



**Occupied Bandwidth and  
Spurious Emissions Measurements  
To Demonstrate Compliance with  
Section 73.317(b) through 73.317(d) of the FCC Rules and Regulations and  
hybrid FM specifications.**

**WMKS– 105.7 Mhz 289C1  
Clemmens NC**

**WTQR-104.1Mhz 281C  
Winston-Salem NC**

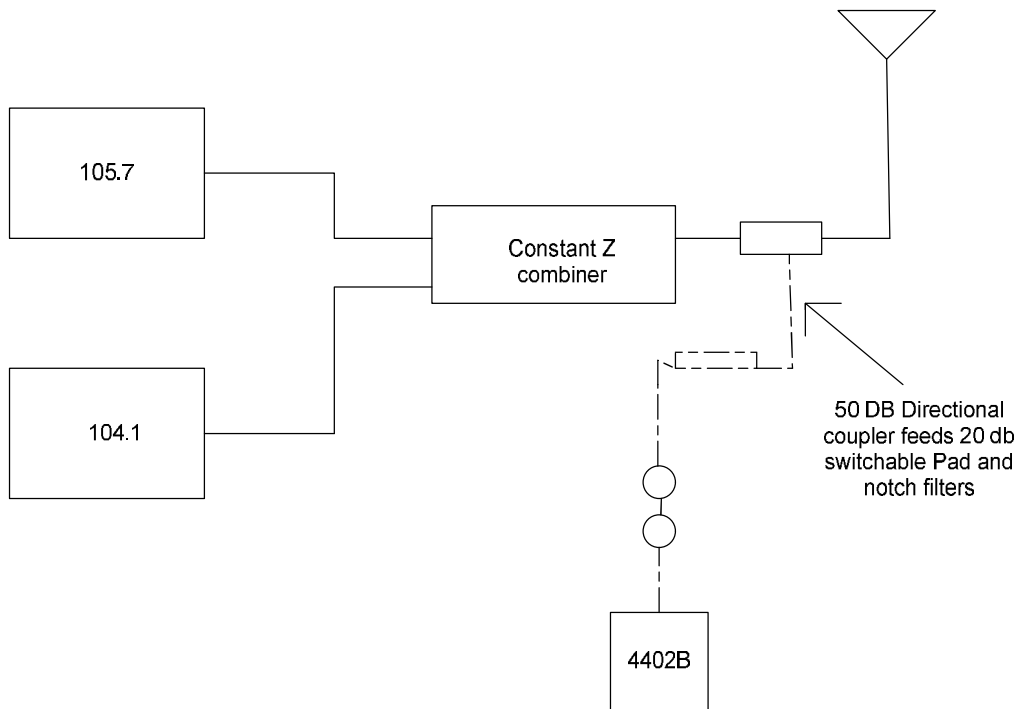
*Benjamin Brinitzer  
Technical Director  
Friday, July 20, 2012*

Measurements were conducted to demonstrate that WMKS, and WTQR operating into a combined antenna system comply with section 73.317(b) through 73.317(d) of the FCC Rules and Regulations. The measurements were conducted on 2/16/2012 by Benjamin H Brinitzer CPBE with Analog carriers of both stations simultaneously utilizing the shared antenna. The spectrum analyzer used for the measurements was an Agilent model 4402B, S/N my44211565 calibrated 10/2011. A sample of WMKS and WTQR Analog signals was derived from the main transmission line at the output of the Constant Z combiner. RF was coupled to the analyzer using a short length of RG-142 50Ω double-shielded coaxial cable. One switchable 20 db pad (Bird model 5-A-MFN-06) was inserted ahead of Notch Filters and the analyzer to avoid overload, increase gain and to provide isolation.

The unmodulated carrier level of WTQR was +20.0 dBm and the unmodulated carrier level of WMKS was +9.23 dBm. Since the WMKS reference level was lower, it was used as the reference for all harmonic, spurious and intermodulation measurements. All measurements were conducted with the transmitters and associated equipment adjusted as used in normal program operation.

For all occupied bandwidth measurements, the spectrum analyzer was placed in the peak hold mode for at least 10 minutes per measurement before the waveforms were observed. Both transmitters were observed to be in full compliance with section 73.317(b) of the FCC Rules with emissions appearing on frequencies removed from the carrier frequencies by between 120 kHz and 240 kHz attenuated by at least 25 dB below the modulated carrier level indicating the occupied bandwidth of each transmitter to be 240 kHz or less. Both transmitters were also observed to be in full compliance with section 73.317(c) of the FCC Rules with emissions appearing on frequencies removed from the carrier frequencies by between 240 kHz and 600 kHz attenuated by at least 35 dB.

Extensive measurement were also conducted to insure that emissions appearing on frequencies removed from the carrier frequencies by more than 600 kHz were attenuated by at least 80 dB as required by section 73.317(d) of the FCC Rules. To facilitate these measurements, notch filters were placed before the switchable 20 dB pad so that the spectrum analyzer gain could be increased by 32 dB. The filters were necessary to avoid the possible generation of false spurious or intermodulation products in the analyzer. The attenuation of the notch filters was 16.3 dB at 105.7 Mhz 289C1 and 29.2 dB at 104.1Mhz 281C.



All harmonic and intermodulation frequencies in the range of frequencies between 3 MHz and 900 MHz through the 3<sup>rd</sup> order that could be produced by the combined operation of WMKS and WTQR were predicted with a computer program, the results of which are shown in Table 1.

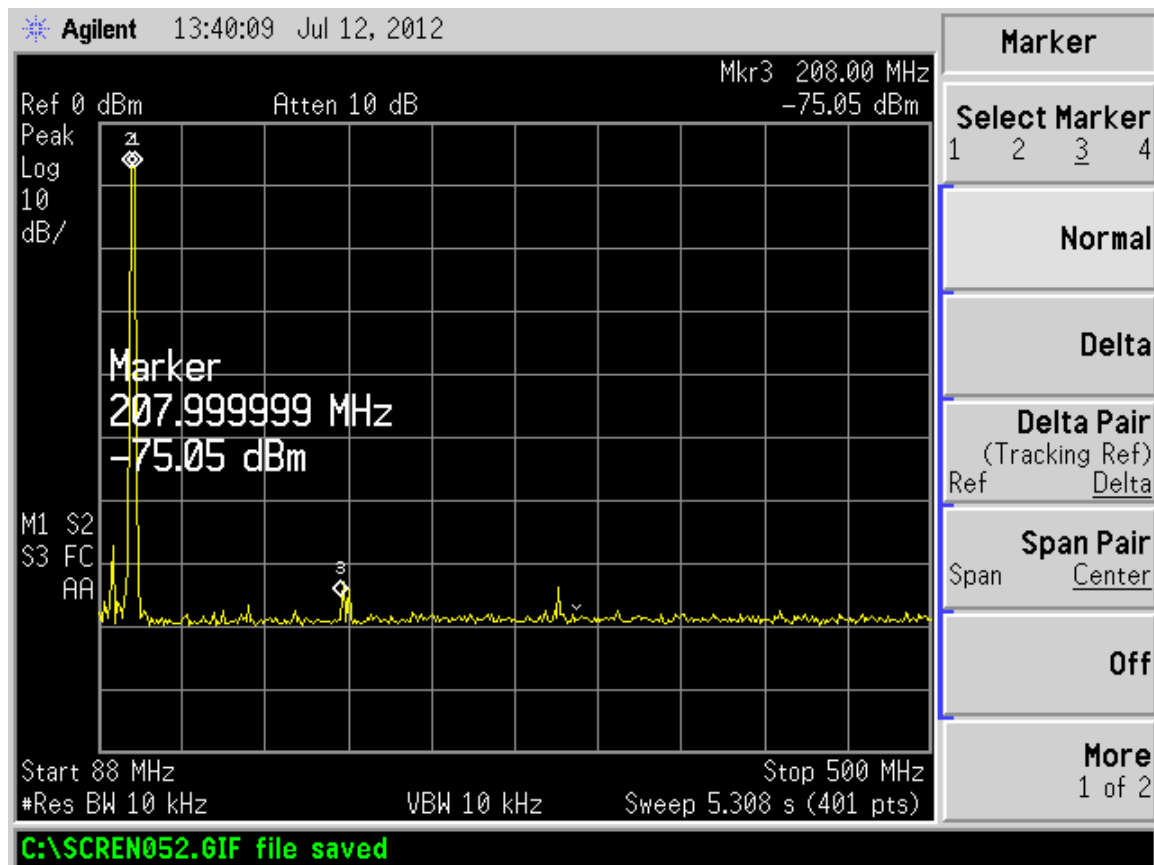
**TABLE 1**

# Mult x Freq. Sum/Dif Mult x Freq. = Product

1.	1	x	105.7	+	1	x	104.1	=	209.8
2.	1	x	104.1	+	1	x	105.7	=	209.8
3.	1	x	105.7	+	2	x	104.1	=	313.9
4.	1	x	104.1	+	2	x	105.7	=	315.5
5.	2	x	105.7	=				=	211.4
6.	2	x	105.7	+	1	x	104.1	=	315.5
7.	2	x	105.7	-	1	x	104.1	=	107.3
8.	2	x	104.1	=				=	208.2
9.	2	x	104.1	+	1	x	105.7	=	313.9
10.	2	x	104.1	-	1	x	105.7	=	102.5
11.	3	x	105.7	=				=	317.1
12.	3	x	105.7	-	1	x	104.1	=	213
13.	3	x	104.1	=				=	312.3
14.	3	x	104.1	-	1	x	105.7	=	206.6
15.	3	x	105.7	-	2	x	104.1	=	108.9
16.	3	x	104.1	-	2	x	105.7	=	100.9

While special attention was given to the “product” frequencies listed in Table 1, measurements were conducted covering the entire range of frequencies between 3 MHz and 900 MHz. The only signals detected at levels attenuated by less than 80 dB below the unmodulated carrier levels and appearing on frequencies removed from the WMKS and WTQR carrier frequencies by more than 600 kHz were the carriers of nearby FM and Television stations. In each case where these signals were observed to be at a level greater than -84 dBm, the WTQR transmitter and WMKS transmitter were turned off alternating between them, while the amplitude of the two signals indicated in the plot were observed to be unchanged, indicating that the signals in the sweep provided below were not the result of the combined operation of WMKS and WTQR. The second Harmonic of WTQR was noted at a level of -84.05 from WMKS fundamental and -95 db from WTQR fundamental.

Table 2



Results of the measurements at the specific frequencies where harmonic or intermodulation products were predicted to possibly occur resulted in levels less than 80 DB under the fundamentals

The results of these measurements confirm that the combined operations of WMKS and WTQR into a shared antenna are in full compliance with section 73.317(b) through 73.317(d) of the FCC Rules and Regulations.

A handwritten signature in blue ink, appearing to read "Benjamin Brinitzer", is written over a light blue grid background.

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Benjamin Brinitzer CPBE #8750  
Regional Vice President of Engineering