

Engineering Report
COMPLIANCE WITH SPURIOUS EMISSIONS REQUIREMENTS
prepared for
WMAL, Inc.
WRQX(FM) Washington, D.C.
Facility ID 73252
Ch. 297B 19.5 kW 246 m

WMAL, Inc. (“*WMAL*”) is the licensee of FM station WRQX(FM), Channel 297B (107.3 MHz), Washington, D.C. *WMAL* is authorized in the construction permit (“CP”), BPH-20030523AEZ, to construct a new facility for WRQX at the currently licensed transmitter site with an effective radiated power (“ERP”) of 19.5 kW at 246 meters antenna height above average terrain (“HAAT”). The CP authorizes WRQX to employ a common, multi-user panel antenna, which is shared with WHUR-FM and WASH(FM), both Washington, D.C. The CP contains a *Special Operating Condition* requiring measurement of spurious emissions to demonstrate compliance with Section 73.317(b)-(d) of the FCC Rules. The instant engineering report presents the results of the measurements.

Background

The common, multi-user panel antenna, a Dielectric model DCBR-03-2FM/6U-1, is located at a developed communications site also employed by WJLA-TV-DT, NTSC Ch. 7, DTV Ch. 39 and WUSA(TV)-DT, NTSC Ch. 9, DTV Ch. 34, both Washington, D.C. Numerous other land mobile and private microwave users also employ this site.

WASH(FM) was originally the sole user of the antenna and was issued a license, BLH-20030326AHB. The licensed facilities for WRQX and WHUR-FM are also side mounted at this site. Adding WRQX and WHUR-FM¹ to the common, multi-user antenna system required a combiner/filter arrangement be installed between each transmitter and the transmission line feeding the antenna. Such a system was constructed by Dielectric and installed.

Construction as authorized in the WRQX(FM) and WHUR-FM construction permits was completed on April 1, 2004. WASH(FM) had already completed its connection to the combiner prior to that date.

¹ WHUR-FM, Ch. 242B (96.3 MHz) is authorized in the construction permit, BMPED-20031215AAF, to employ the common, multi-user antenna system.

Measurements

On April 2, 2004, between the hours of 12 midnight and 2:30 AM, spurious emission measurements were performed by the undersigned on the antenna system with WRQX(FM), WASH(FM), WHUR-FM operating at their authorized power levels into the combiner and antenna system.

A block diagram of the equipment layout employed for the measurements is provided in the attached **Figure 1**. As shown, an RF sample was derived using a Bird 50 dB “sniffer” element inserted into a Bird directional coupler permanently installed in the 6” transmission line at the output of the Dielectric combiner. The output of the Bird “sniffer” was connected directly to the input of a Tektronix 492 spectrum analyzer (SN: B043309). The occupied bandwidths of all three stations were measured.

The resulting measurements are displayed in **Figure 2**, Plots 1-6. For each measurement, the “max-hold” feature of the spectrum analyzer was employed for a 10 second period with the carrier being modulated by normal program material. **Figure 2**, Plot 7 depicts the signals of WRQX(FM), WASH(FM) and WHUR-FM together. As demonstrated in **Figure 2**, all three stations were found to comply with the bandwidth limitations set forth in Sections 73.317(b)² and 73.317(c)³ of the FCC Rules.

Next, to prevent overload of the spectrum analyzer by the stations’ fundamental frequency energy during a spectral sweep, a notch filter arrangement was employed. Three individual tunable notch filters were individually adjusted to 96.3 MHz, 97.1 MHz, and 107.3 MHz. The notch filters were connected in series with each other and then connected between the “sniffer” output and the input of the analyzer. The frequency response⁴ of the notch filter arrangement is provided in **Figure 3**.

² Emissions between 120 and 240 kHz removed from the carrier, must be at least 25 dB below the unmodulated carrier.

³ Emissions between 240 and 600 kHz removed from the carrier, must be at least 35 dB below the unmodulated carrier.

⁴ The loss of the notch filter system at frequencies well removed from the fundamental frequencies was measured for the span of frequencies where spurious emission might be expected. Given the level of signals encountered, no correction to the measurements was deemed necessary.

A scan of the spectrum between 108 MHz and 1.8 GHz was initiated. A series of low level signals was found at approximately 186 MHz, see **Figure 2**, Plot 8. Each of the FM transmitters were cycled on and off. The trace depicted in Plot 8 did not change. Therefore, the signals were attributed to the visual and aural carriers for the co-located NTSC television stations. Plot 9 of **Figure 2** also indicated a low level signal (below the -80 dB level). Again, the FM stations were cycled on and off with no change in the trace. This signal is attributed to the digital TV signal for the WDCA-DT STA facility, Ch. 35, BDSTA-20021115ADF, located on a nearby tower 0.71 km distant. No other spurious emissions were observed during the sweep. Since no spurious emissions from the combined FM operation were observed during the sweep measurement, the combiner and antenna system for WRQX(FM), WHUR-FM, and WASH(FM) was found to comply with Section 73.317(d)⁵ of the FCC Rules.

Conclusion

Therefore, based on the foregoing report and data contained herein, it is believed that the combiner system employed by WRQX(FM), WHUR-FM, and WASH(FM) complies with Sections 73.317(b)-(d) of the FCC Rules and is in compliance with the *Special Operating Conditions* contained in the WRQX(FM) and WHUR-FM construction permits.

⁵ Emissions more than 600 kHz removed from the carrier, must be at least $43+10\text{Log}(\text{Power}_{\text{in watts}})$ dB below the unmodulated carrier or 80 dB, whichever is the lesser.

Certification

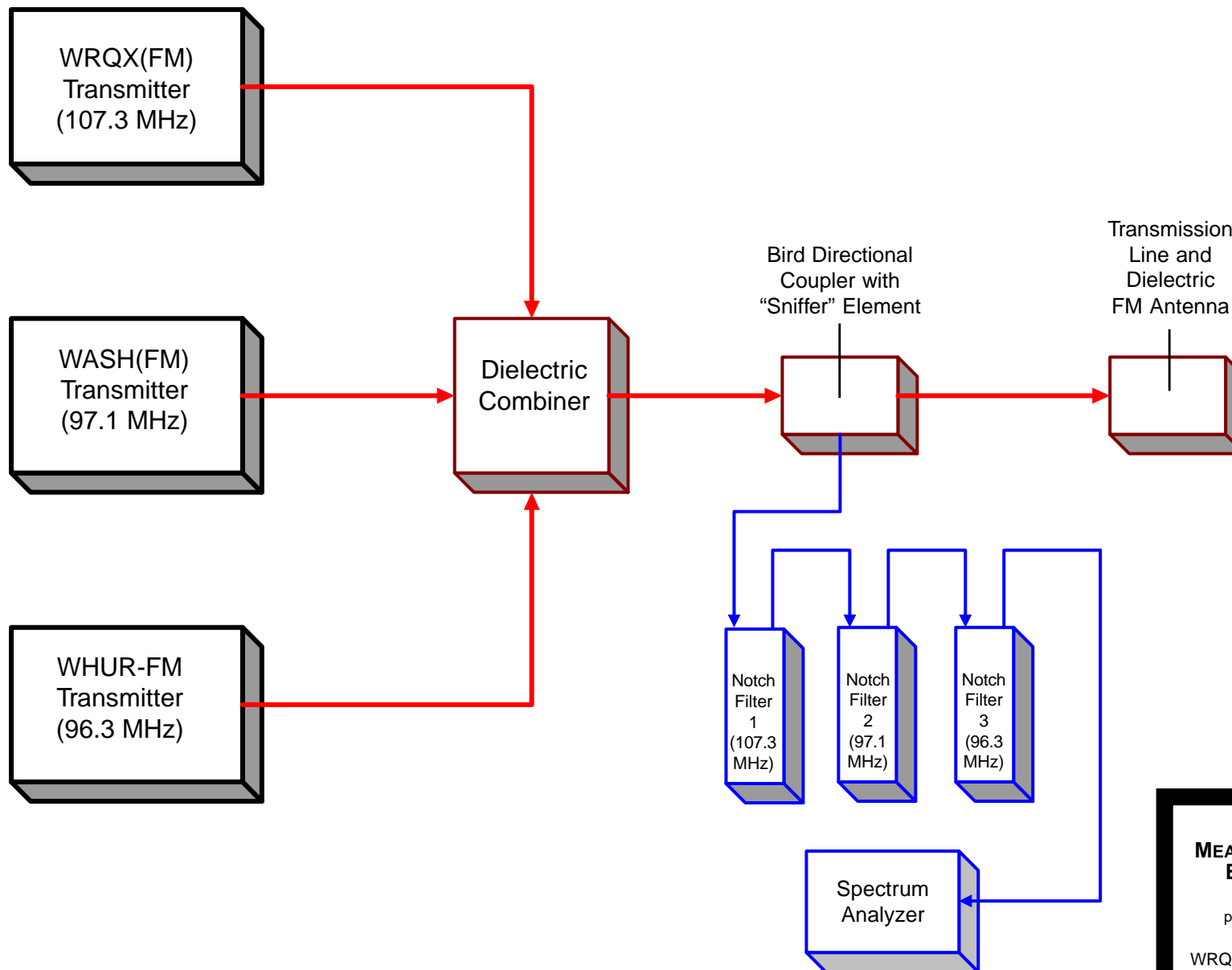
The undersigned hereby certifies that the foregoing statement was prepared by him or under his direction, and that it is true and correct to the best of his knowledge and belief. Mr. Mertz is a principal in the firm of *Cavell, Mertz & Davis, Inc.*, holds a Bachelor of Science degree from Oglethorpe University, and has submitted numerous engineering exhibits to the Federal Communications Commission. His qualifications are a matter of record with that agency.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read "Richard H. Mertz". The signature is fluid and cursive, with the first name "Richard" being the most prominent part.

Richard H. Mertz
April 9, 2004

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**FIGURE 1
MEASUREMENT SYSTEM
BLOCK DIAGRAM**

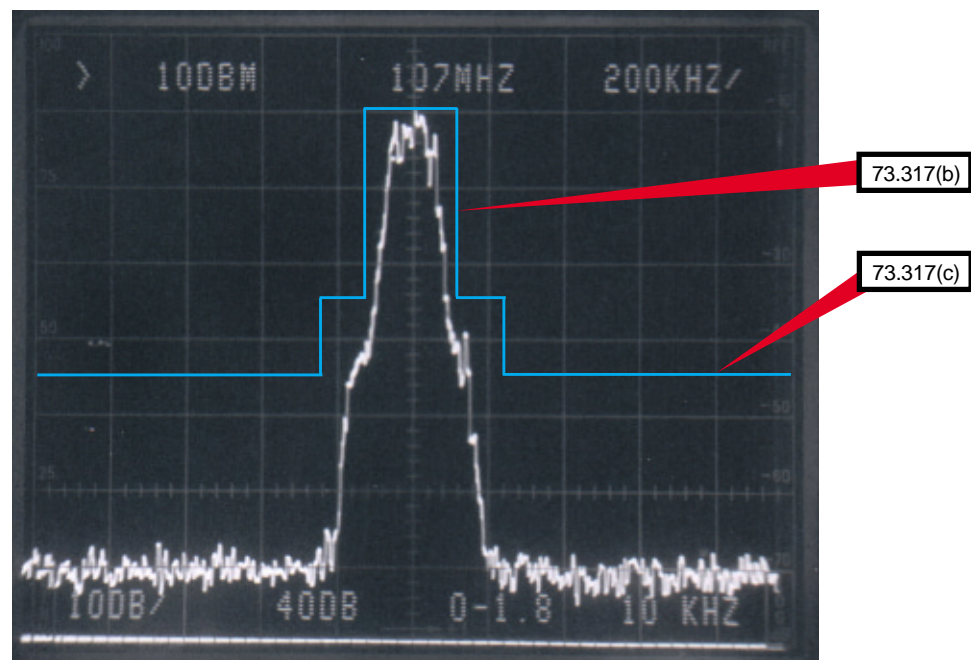
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FIGURE 2
(PAGE 1 OF 5)



Plot 1 WRQX(FM) occupied bandwidth (± 0.5 MHz)



Plot 2 WRQX(FM) occupied bandwidth (± 1 MHz)

FIGURE 2
(PAGE 2 OF 5)

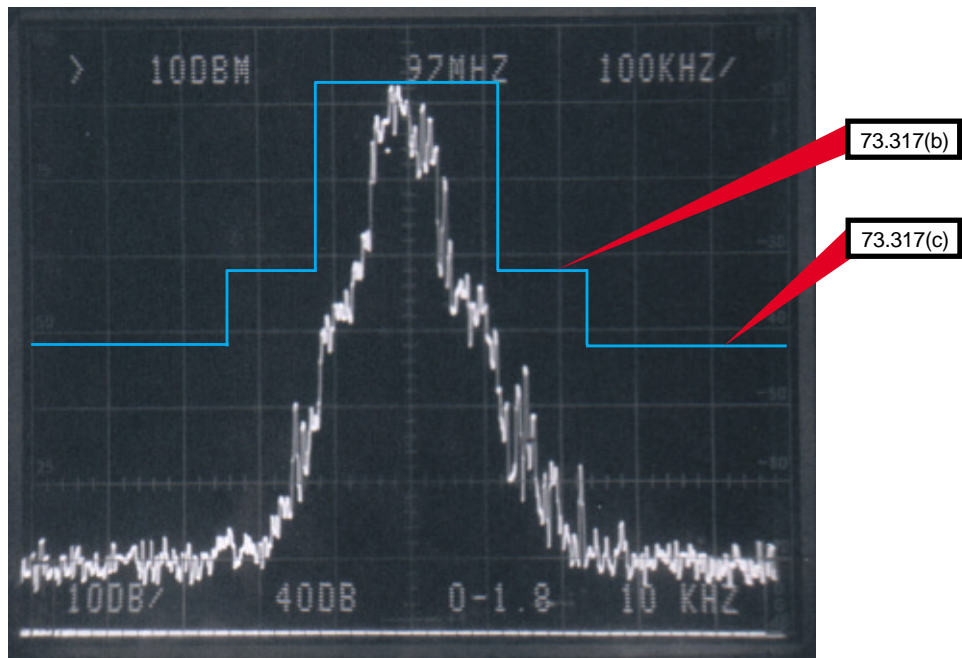


Plot 3 WHUR-FM occupied bandwidth (± 0.5 MHz)



Plot 4 WHUR-FM occupied bandwidth (± 1 MHz)

FIGURE 2
(PAGE 3 OF 5)



Plot 5 WASH(FM) occupied bandwidth (± 0.5 MHz)

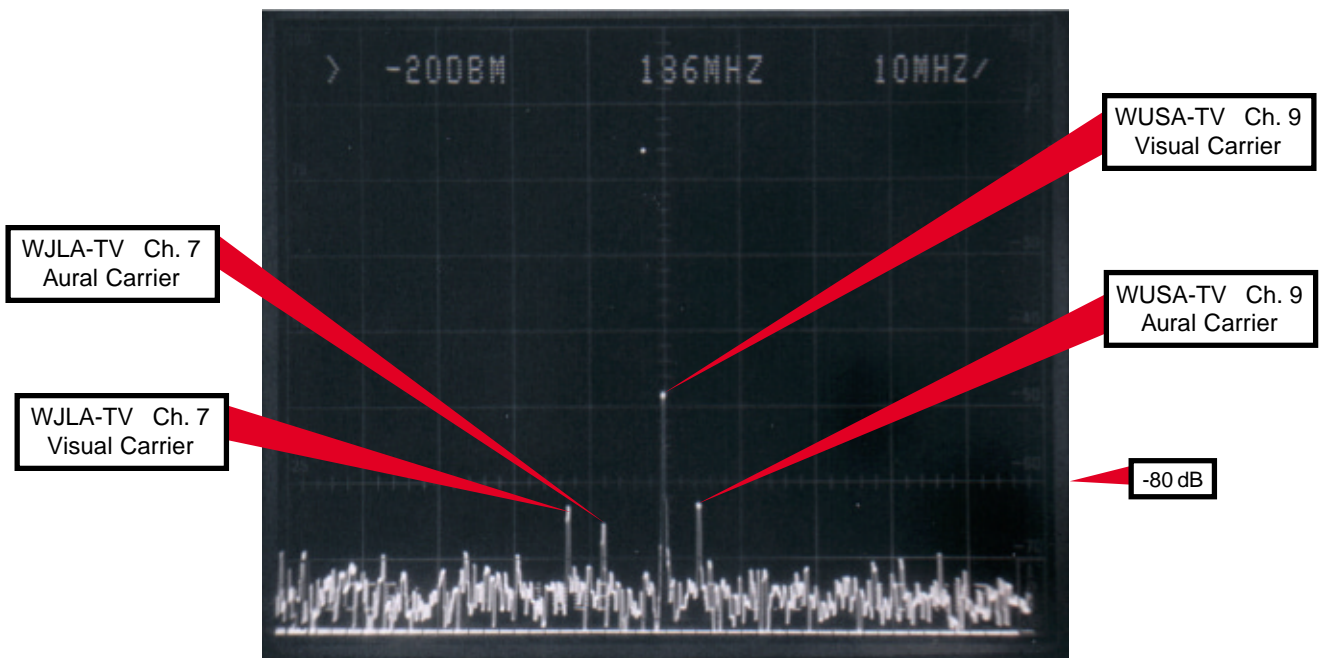


Plot 6 WASH(FM) occupied bandwidth (± 1 MHz)

FIGURE 2
(PAGE 4 OF 5)

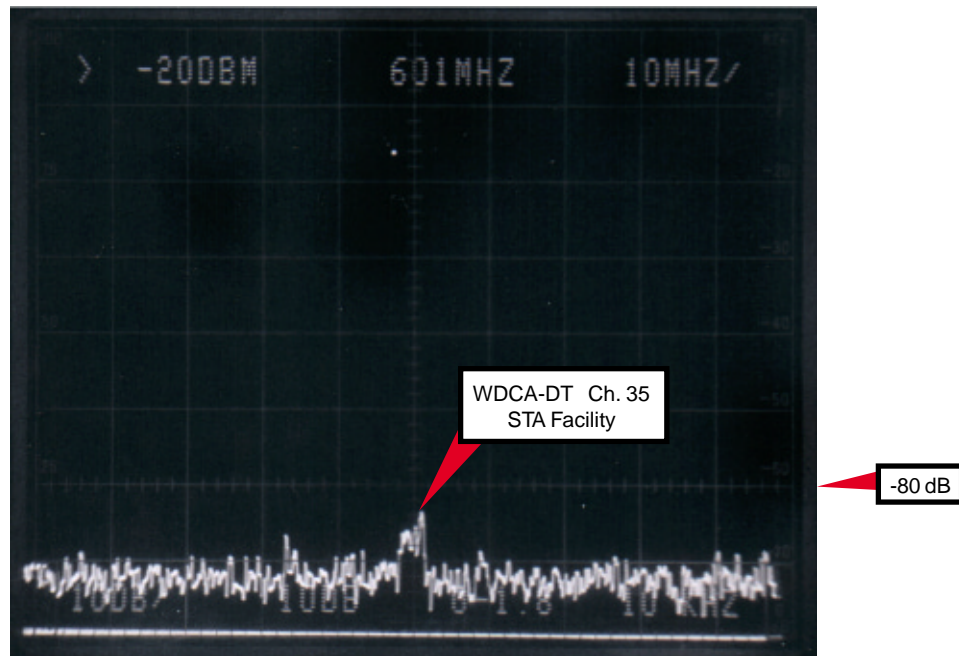


Plot 7 WRQX(FM), WHUR-FM and WASH(FM) at combiner output



Plot 8 Observed signals during sweep

FIGURE 2
(PAGE 5 OF 5)



Plot 9 Observed signals during sweep

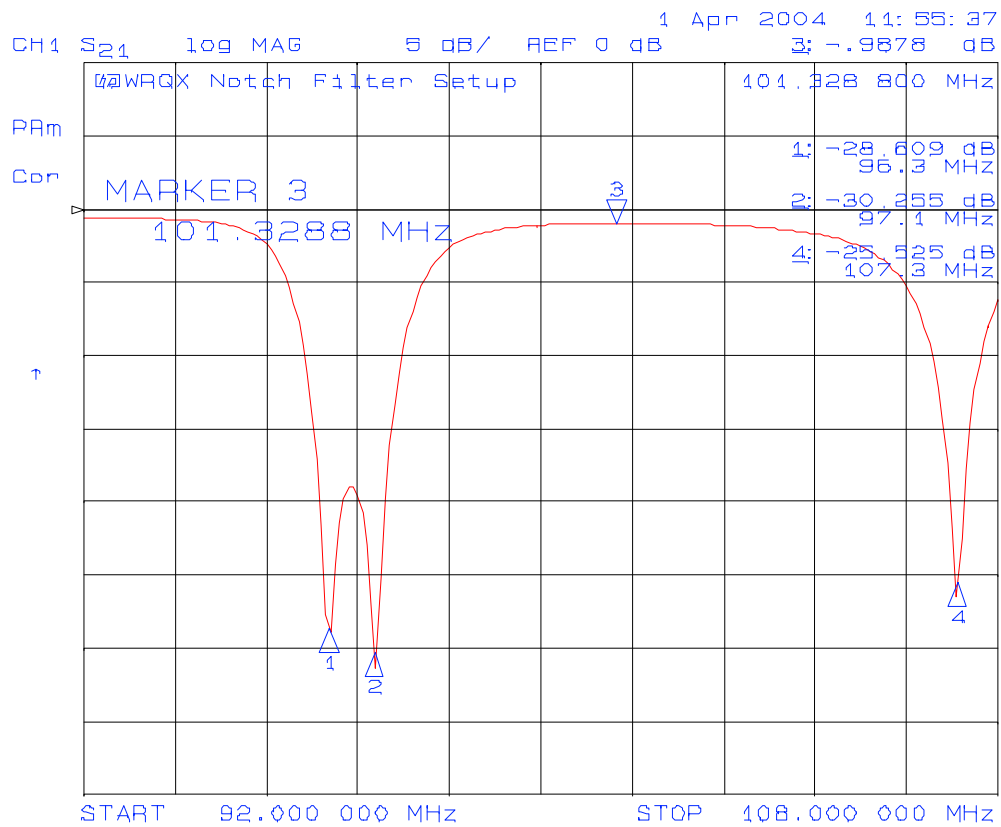


FIGURE 3 NOTCH FILTER RESPONSE

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