

Occupied Bandwidth and Spurious Emissions Measurements

Measurements were conducted to demonstrate that WJBT(FM), Callahan, FL, WNWW(FM), Neptune Beach, FL, WWJK(FM), Green Cove Springs, FL and WQIK-FM, Jacksonville, FL operating into a combined antenna system, comply with section 73.317(b) through 73.317(d) of the FCC Rules and Regulations. Randall L. Mullinax conducted the measurements on June 4, 2012, with all stations simultaneously utilizing the shared antenna. The spectrum analyzer used for the measurements was an Agilent Technologies model E4402B, S/N MY41441731. A sample of the WJBT(FM), WNWW(FM), WWJK(FM) and WQIK-FM signals was derived from the main transmission line at the output of the combiner and was coupled to the analyzer using a short length of RG-223 50Ω double-shielded coaxial cable. Two 6 dB pads (Bird model 5-A-MFN-06 or equivalent) were inserted ahead of the analyzer to avoid overload and to provide isolation.

The unmodulated carrier level of WNWW(FM) was -7 dBm and the unmodulated carrier levels of WJBT(FM), WWJK(FM) and WQIK-FM were +1 dBm. Since the WNWW(FM) 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. As shown in Figures 1, 2, 3 and 4, all 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 unmodulated carrier level indicating the occupied bandwidth of each transmitter to be 240 kHz or less. All 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.

Figure 1
WJBT(FM)

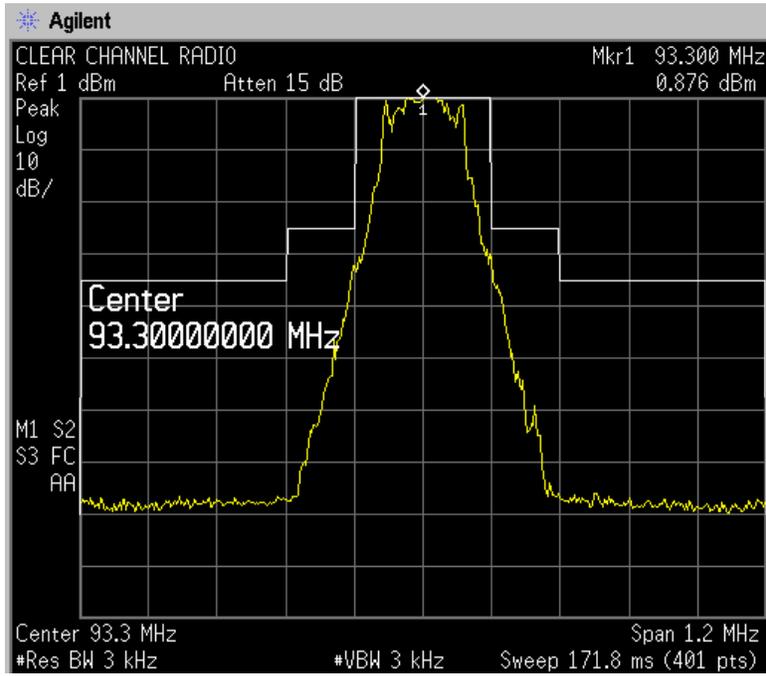


Figure 2
WNWW(FM)

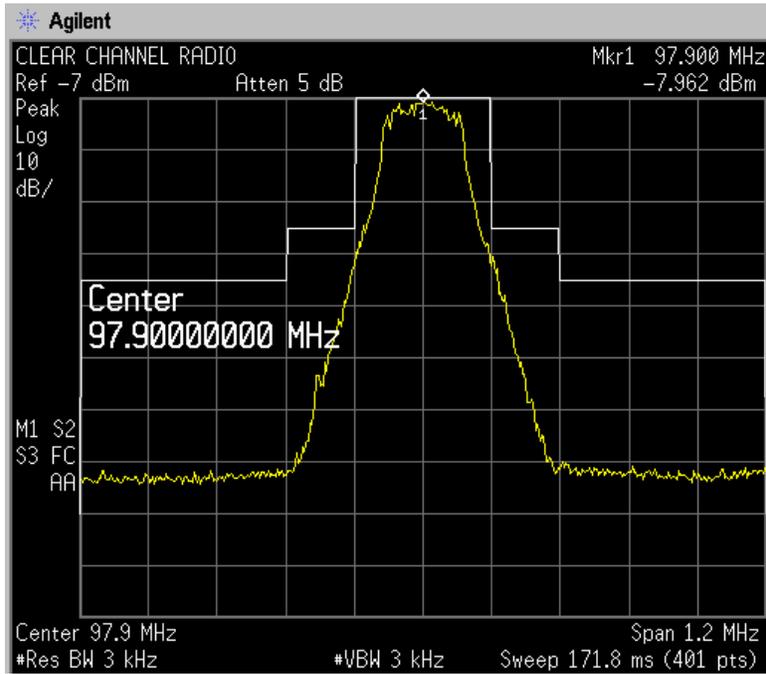


Figure 3
WWJK(FM)

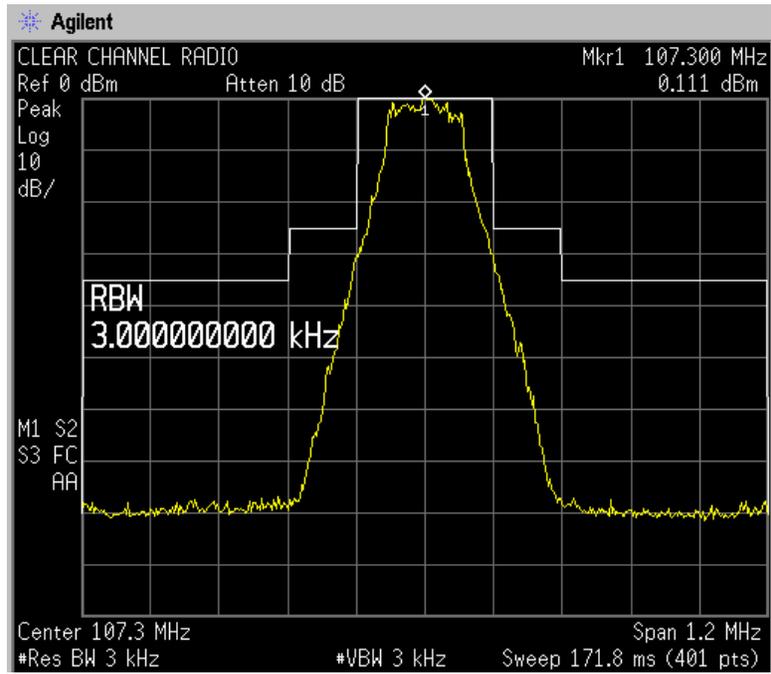
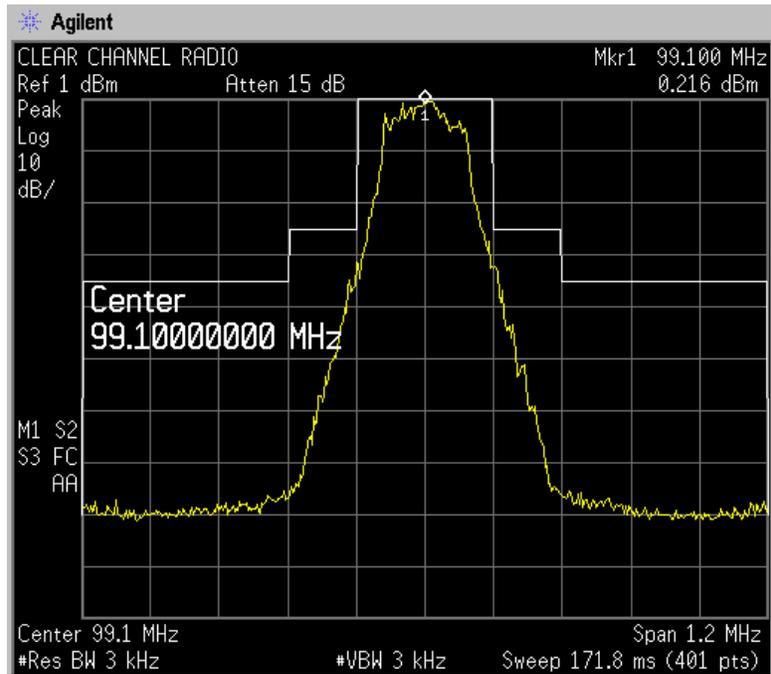


Figure 4
WQIK-FM



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 between the two 6 dB pads so that the spectrum analyzer gain could be increased by up to 20 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 45.0 dB at 93.3 MHz, 49.3 dB at 97.9 MHz, 38.6 dB at 107.3 MHz and 53.4 dB at 99.1 MHz.

The most likely intermodulation frequencies in the range 5 MHz to 550 MHz that could be produced by the combined operation of WJBT(FM), WNWW(FM), WWJK(FM) and WQIK-FM and harmonic frequencies through the 5th harmonic were calculated and the results of the measurements at these frequencies are listed in Table 1.

Table 1

Frequency A	107.3
Frequency B	99.1
Frequency C	97.9
Frequency D	93.3

DESCRIPTION	FREQ. MHZ	ATTENUATION DB	DESCRIPTION	FREQ. MHZ	ATTENUATION DB
A + B	206.4	>100	(3 X A) - (2 X B)	123.7	>100
A - B	8.2	>100	(3 X B) - (2 X A)	82.7	>100
A + (2 X B)	305.5	>100	(3 X A) - (3 X B)	24.6	>100
B + (2 X A)	313.7	>100	A + C	205.2	>100
A + (3 X B)	404.6	>100	A - C	9.4	>100
B + (3 X A)	421	>100	A + (2 X C)	303.1	>100
2 X A	214.6	>100	C + (2 X A)	312.5	>100
(2 X A) - B	115.5	>100	A + (3 X C)	401	>100
2 X B	198.2	>100	C + (3 X A)	419.8	>100
(2 X B) - A	90.9	91	(2 X A) - C	116.7	>100
(2 X A) + (2 X B)	412.8	>100	2 X C	195.8	>100
(2 X A) - (2 X B)	16.4	>100	(2 X C) - A	88.5	>100
(2 X A) + (3 X B)	511.9	>100	(2 X A) + (2 X C)	410.4	>100
(2 X B) + (3 X A)	520.1	>100	(2 X A) - (2 X C)	18.8	>100
3 X A	321.9	>100	(2 X A) + (3 X C)	508.3	>100
(3 X A) - B	222.8	>100	(2 X C) + (3 X A)	517.7	>100
3 X B	297.3	>100	(3 X A) - C	224	>100
(3 X B) - A	190	>100	3 X C	293.7	>100

DESCRIPTION	FREQ. MHZ	ATTENUATION DB	DESCRIPTION	FREQ. MHZ	ATTENUATION DB
(3 X C) - A	186.4	>100	B + (2 X D)	285.7	>100
(3 X A) - (2 X C)	126.1	>100	D + (2 X B)	291.5	>100
(3 X C) - (2 X A)	79.1	>100	B + (3 X D)	379	>100
(3 X A) - (3 X C)	28.2	>100	D + (3 X B)	390.6	>100
A + D	200.6	>100	(2 X B) - D	104.9	>100
A - D	14	>100	(2 X D) - B	87.5	98
A + (2 X D)	293.9	>100	(2 X B) + (2 X D)	384.8	>100
D + (2 X A)	307.9	>100	(2 X B) - (2 X D)	11.6	>100
A + (3 X D)	387.2	>100	(2 X B) + (3 X D)	478.1	>100
D + (3 X A)	415.2	>100	(2 X D) + (3 X B)	483.9	>100
(2 X A) - D	121.3	>100	(3 X B) - D	204	>100
2 X D	186.6	>100	(3 X D) - B	180.8	>100
(2 X D) - A	79.3	>100	(3 X B) - (2 X D)	110.7	>100
(2 X A) + (2 X D)	401.2	>100	(3 X D) - (2 X B)	81.7	>100
(2 X A) - (2 X D)	28	>100	(3 X B) - (3 X D)	17.4	>100
(2 X A) + (3 X D)	494.5	>100	C + D	191.2	>100
(2 X D) + (3 X A)	508.5	>100	C + (2 X D)	284.5	>100
(3 X A) - D	228.6	>100	D + (2 X C)	289.1	>100
3 X D	279.9	>100	C + (3 X D)	377.8	>100
(3 X D) - A	172.6	>100	D + (3 X C)	387	>100
(3 X A) - (2 X D)	135.3	>100	(2 X C) - D	102.5	97
(3 X D) - (2 X A)	65.3	>100	(2 X D) - C	88.7	81*
(3 X A) - (3 X D)	42	>100	(2 X C) + (2 X D)	382.4	>100
B + C	197	>100	(2 X C) - (2 X D)	9.2	>100
B + (2 X C)	294.9	>100	(2 X C) + (3 X D)	475.7	>100
C + (2 X B)	296.1	>100	(2 X D) + (3 X C)	480.3	>100
B + (3 X C)	392.8	>100	(3 X C) - D	200.4	>100
C + (3 X B)	395.2	>100	(3 X D) - C	182	>100
(2 X B) - C	100.3	>100	(3 X C) - (2 X D)	107.1	99**
(2 X C) - B	96.7	>100	(3 X D) - (2 X C)	84.1	>100
(2 X B) + (2 X C)	394	>100	(3 X C) - (3 X D)	13.8	>100
(2 X B) + (3 X C)	491.9	>100	4 X A	429.2	>100
(2 X C) + (3 X B)	493.1	>100	4 X B	396.4	>100
(3 X B) - C	199.4	>100	4 X C	391.6	>100
(3 X C) - B	194.6	>100	4 X D	373.2	>100
(3 X B) - (2 X C)	101.5	93	5 X A	536.5	>100
(3 X C) - (2 X B)	95.5	>100	5 X B	495.5	>100
B + D	192.4	>100	5 X C	489.5	>100
B - D	5.8	>100	5 X D	466.5	>100

* Measured level attributable to WJFR(FM) located at a distance of 13.8 km.

** Notch filter tuned to 107.3 MHz was removed and the WWJK transmitter was turned off to facilitate measurement at this frequency.

While special attention was given to the “product” frequencies listed in Table 1, measurements were conducted covering the entire range of frequencies between 5 MHz and 550 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 WJBT(FM), WNWW(FM), WWJK(FM) and WQIK-FM 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 -87 dBm (80 dB below the unmodulated carrier level of WNWW(FM) which was -7 dBm) the WJBT(FM), WNWW(FM), WWJK(FM) and WQIK-FM transmitters were turned off while the amplitude of the signal was observed to be unchanged, indicating that the signal was not the result of the combined operation of WJBT(FM), WNWW(FM), WWJK(FM) and WQIK-FM.

The results of these measurements confirm that the combined operations of WJBT(FM), WNWW(FM), WWJK(FM) and WQIK-FM into the shared antenna are in full compliance with section 73.317(b) through 73.317(d) of the FCC Rules and Regulations.


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