Occupied Bandwidth and Spurious Emissions Measurements

To Demonstrate Compliance with Section 73.317(b) through 73.317(d) of the FCC Rules and Regulations

Educational Media Foundation
K249DV – 97.7 MHz (Facility ID No: 141228)
and
Captstar TX, LLC
K254DM – 98.7 MHz (Facility ID No: 202555)
March 19, 2020

Occupied Bandwidth and Spurious Emissions Measurements

Measurements were conducted to demonstrate that FM Translators K249DV and K254DM operating into a combined antenna system, comply with section 73.317(b) through 73.317(d) of the FCC Rules and Regulations [section 74.1236(a)(2) requires translators with a power output greater than 10 watts to also meet the requirements of 73.317(b) through (d)]. Randall L. Mullinax conducted the measurements on March 19, 2020, with both translators simultaneously utilizing the shared antenna as specified in the "Special operating conditions or restrictions" of K249DV Construction Permit 0000102343 and K254DM Construction Permit 0000086782. The spectrum analyzer used for the measurements was a Rigol model DSA815, S/N DSA8A163851370. A sample of both 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 (Mini-Circuits model HAT-6+ or equivalent) were inserted ahead of the analyzer to avoid overload and to provide isolation.

The measured unmodulated carrier level of both translators was -8 dBm which was used as the reference level for all harmonic, spurious and intermodulation measurements. With a transmitter power output of 440 Watts, all harmonic, spurious and intermodulation products from both transmitters must be attenuated by 43 + 10(log 440) = 69.4 dB or a maximum level of -8dbm -69.4db = -77.4 dBm. All measurements were conducted with the transmitters and associated equipment adjusted as it will be 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 and 2, 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 unmodulated 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.

Figure 1
K249DV

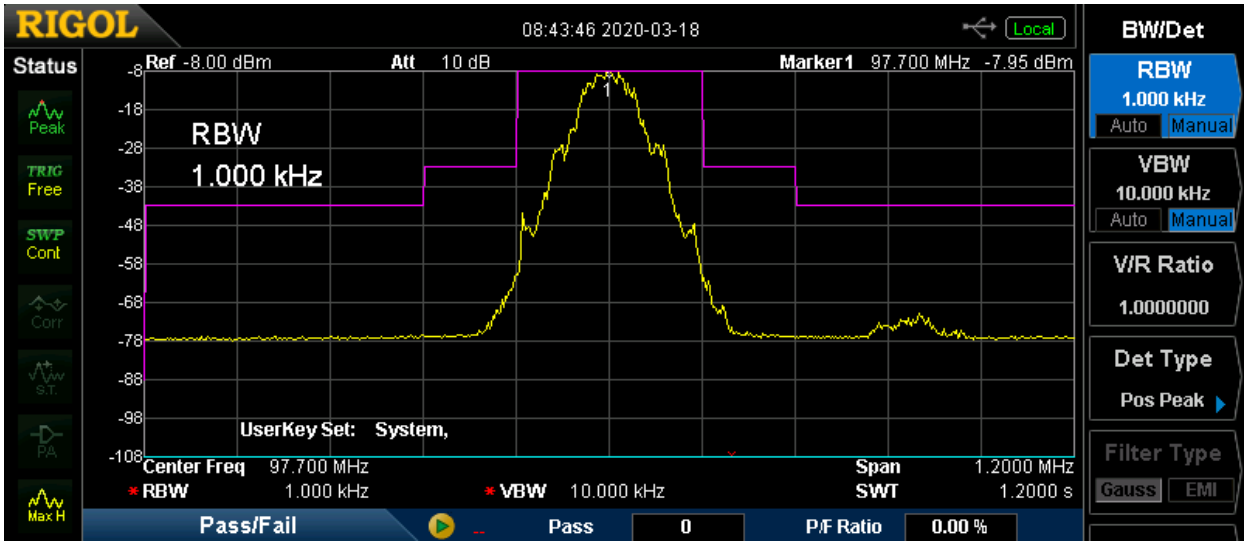
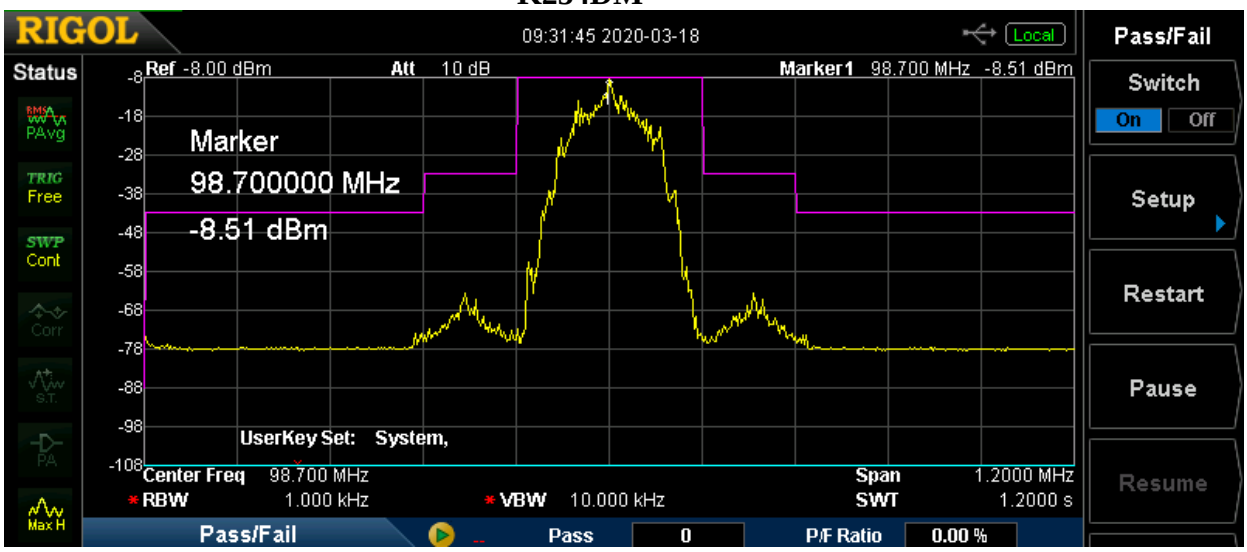


Figure 2
K254DM



Extensive measurements were also conducted to ensure that emissions appearing on frequencies removed from the carrier frequencies by more than 600 kHz were attenuated by at least 69.4 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 56.5 dB at 97.7 MHz and 47.3 dB at 98.7 MHz.

All harmonic and intermodulation frequencies in the range of frequencies between 5 MHz and 500 MHz through the 3rd order that could be produced by the combined operation of K249DV and K254DM were calculated and the results of the measurements at these frequencies are listed in Table 1.

Table 1

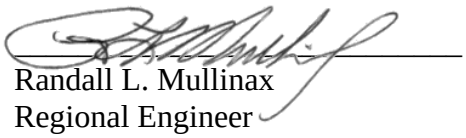
Frequency A	98.7
Frequency B	97.7

DESCRIPTION	FREQ. MHZ	ATTENUATION DB	DESCRIPTION	FREQ. MHZ	ATTENUATION DB
A + B	196.4	>90	(2 X B) + (3 X A)	491.5	>90
A + (2 X B)	294.1	>90	3 X A	296.1	>90
B + (2 X A)	295.1	>90	(3 X A) - B	198.4	>90
A + (3 X B)	391.8	>90	3 X B	293.1	>90
B + (3 X A)	393.8	>90	(3 X B) - A	194.4	>90
2 X A	197.4	>90	(3 X A) - (2 X B)	100.7	80.0
(2 X A) - B	99.7	>90	(3 X B) - (2 X A)	95.7	>90
2 X B	195.4	>90	4 X A	394.8	>90
(2 X B) - A	96.7	>90	4 X B	390.8	>90
(2 X A) + (2 X B)	392.8	>90	5 X A	493.5	>90
(2 X A) + (3 X B)	490.5	>90	5 X B	488.5	>90

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 500 MHz. The only signals detected at levels attenuated by less than 69.4 dB below the unmodulated carrier levels and appearing on frequencies removed from the K249DV and K254DM carrier frequencies by more than 600 kHz were transmissions from nearby FM, TV and LMR stations. In each case where these signals were observed to be at a level greater than –77.4 dBm (69.4 dB below the measured unmodulated carrier level) both the K249DV and K254DM 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 K249DV and K254DM.

The results of these measurements confirm that the combined operations of FM translators K249DV and K254DM into the shared antenna are in full compliance with section 73.317(b) through 73.317(d) and section 74.1236(a)(2) of the FCC Rules and Regulations.

Upon completion of the measurements detailed herein, the K254DM transmitter was turned off pending the filing of FCC Form 350 and operation of K249DV was resumed utilizing the licensed 2-bay antenna at 160m AGL.



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