



Thinking outside the sphere

Equipment Performance Measurement Report – WMVY

September 2, 2015

On September 2, 2015 David Maxson conducted an Equipment Performance Measurement of the new WMVY transmitter and antenna. In addition, a field survey of radio frequency energy exposure potential was performed. Occupied bandwidth, intermodulation and harmonics of WMVY are compliant with 47 CFR 73.317. Potential human exposure to radio frequency energy at the studio/transmitter site of WMVY is also compliant with 47 CFR 1.1307 *et seq* limits for the general population. The tower is secured and appropriately marked for occupational exposure control.

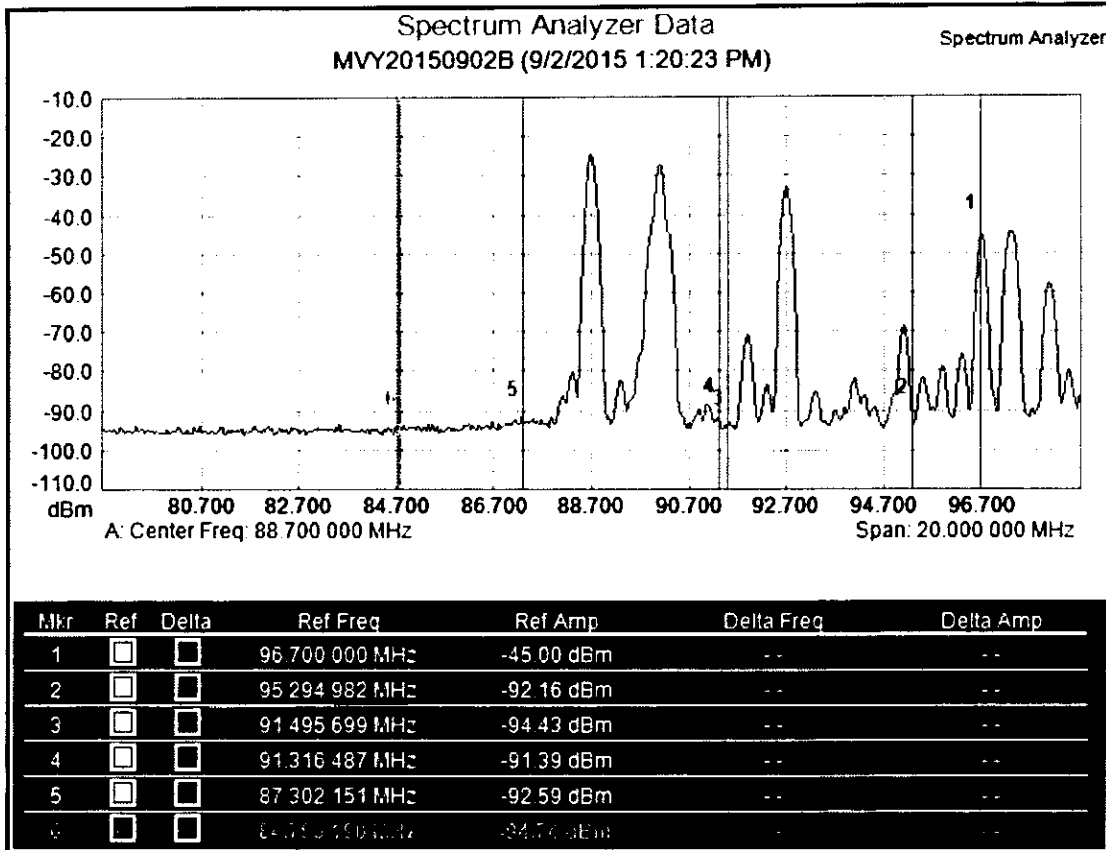
WMVY operates on 88.7 MHz and was recently upgraded to a 13 kW directional antenna 157 feet above ground level. On the same tower, two other FM stations broadcast at 90.1 (12.5 kW dir. @ 135 ft AGL) and at 92.7 (3 kW @ 200 ft AGL). WMVY maintains a bandpass filter on the output of the FM transmitter to reduce the likelihood of unwanted energy feeding back into the WMVY transmitter and causing intermodulation products from the WMVY transmitter.

Third-order IM products possible at site (in or near FM band)								
Key:	6	5		4	3	2		1
86.1	84.7	87.3	87.5	91.3	91.5	94.1	95.3	96.7
Each item above is the sum of the components below it:								
88.7	2*88.7	2*88.7	2*90.1	88.7	-88.7	-88.7	-90.1	-88.7
90.1	-92.7	-92.7	-92.7	-90.1	2*90.1	90.1	2*92.7	2*92.7
-92.7				92.9		92.7		
Stations on the IM3 frequency that might be mistaken for IM3								
						WHJY Prov.		WVYV Tisbury

The table above shows the third-order intermodulation products ("IM3") in the relationship of "2A-B" and "A+B-C" that could appear around the fundamental frequencies of the three stations. In the 2A-B scenario, typically, the station generating the IM3 product will be the one whose position in the equation is as "2A," because the power amplifier stage is most likely to have strong 2nd harmonic components of that station. Thus, for 88.7, both products that would be expected to occur in the WMVY transmitter would be *below the 88.7 fundamental* (highlighted in top row). These figures are highlighted on the table. For completeness, we have



also included the potential IM3 products from the interactions of WBUA and WCAI, without regard for WMVY. The table above is indexed with the six IM3 frequencies involving 88.7. The figure below has markers at the six index points. The figure below is an off-the-air capture¹ of the spectrum straddling 88.7.



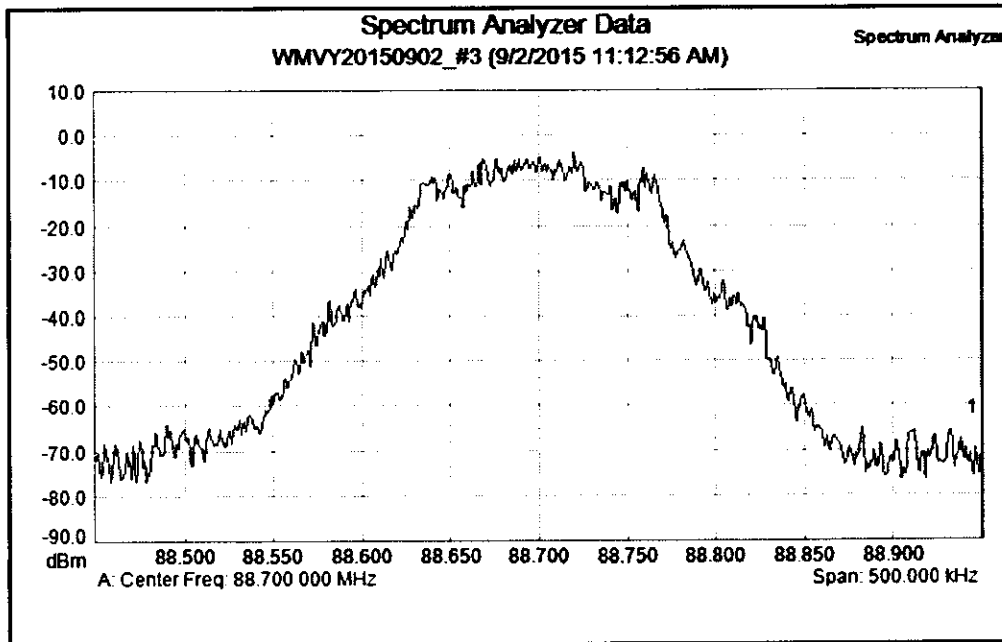
Measurement Parameters			
Trace A data:Trace Average	10	Stop Frequency	98.700 000 MHz
Trace Mode	Average	Frequency Span	20.000 000 MHz
Preamp	OFF	Reference Level	-10.000 dBm
Min Sweep Time	0.001 S	Scale	10.0 dB/div
Reference Level Offset	0 dB	Serial Number	633245
Input Attenuation	0.0 dB	Base Ver.	V4.32
RBW	100.0 kHz	App Ver.	V5.73
VBW	3.0 MHz	Model	MT8222A
Detection	RMS	Options	25, 27, 31, 50
Center Frequency	88.700 000 MHz	Date	9/2/2015 1:20:23 PM
Start Frequency	78.700 000 MHz	Device Name	

¹ On the FM band scan, the analyzer was set to a wider-than normal bandwidth because of the span of the measured spectrum. This captures nearly all the channel power of each signal and each potential IM3 product and is therefore a suitable way to compare in-band energy to the 88.7 fundamental.



As can be seen by looking at the markers, there are no IM3 products at the frequencies of concern. The LPFM signal at 96.7 prevents a reading at that frequency (#1 on the graph).

The spectral occupancy of 88.7 WMVY was observed close to the center frequency (at the conventional 1 kHz resolution bandwidth), and it conforms to the FM mask very well. In the figure below, the reference power level is set to the top of the display (at full channel bandwidth). The power spectral density peaks drop to an average of <-80 dBc as close to the modulated carrier as 250 kHz, which is well within the 600 kHz mask threshold.



Measurement Parameters			
Trace Mode	Max Hold	Stop Frequency	88.950 000 MHz
Preamp	OFF	Frequency Span	500.000 000 kHz
Min Sweep Time	0.001 S	Reference Level	10.000 dBm
Reference Level Offset	0 dB	Scale	10.0 dB/div
Input Attenuation	30.0 dB	Serial Number	633245
RBW	1.0 kHz	Base Ver.	V4.32
VBW	3.0 MHz	App Ver.	V5.73
Detection	RMS	Model	MT8222A
Center Frequency	88.700 000 MHz	Options	25, 27, 31, 50
Start Frequency	88.450 000 MHz	Date	9/2/2015 11:12:56 AM
		Device Name	

The 2nd through 5th harmonics of the WMVY transmitter were observed at the transmitter output sample tap. The tap is located in the transmission line between the transmitter and the filters. The 2nd harmonic power spectral density was the highest of the harmonics sampled, with a maximum value about -55 dBc. Between the bandpass filtering and the antenna system's filtering effect, it is expected that well more than 30 dB of attenuation at harmonic frequencies, is obtained between the transmitter and the air, placing the worst case power spectral density figure more than 80 dB below carrier level. Observation of the signal over the air in the parking



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lot was complicated by environmental factors (noise) but confirmed the assessment that the harmonic emissions are compliant.

A Narda 8718 exposure instrument and 8722 probe were employed to evaluate exposure conditions on site. Within the building, on the grounds and on the approach to the site – 57 Carrolls Way, Vineyard Haven, Massachusetts – the combined emissions from all sources remained below 20% of the maximum permissible exposure for the general population.

David Maxson, CBRE