Broadcast Sciences LLC
1240 Horseshoe Trail
Malvern, PA 19355

610.917.3000
Fax 610.917.3030
www.broadsci.com

FM TRANSLATOR STATION

EMISSIONS MEASUREMENTS

Prepared for

Enrico S. Brancadora

Licensee of

TRANSLATOR STATION W267BP

101.3 MHz / Channel 267

Pleasantville, New Jersey

28 AUG 2017

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INTRODUCTION

At the completion of construction of FM translator station W267BP, equipment performance measurements were made by Broadcast Sciences to verify compliance with applicable Federal Communications regulations contained in 47 CFR §74, Subpart L related to the operation of FM translator stations. Specifically, the measurements made, and the preparation of this report in which the results of those measurements are contained, demonstrate that the station is operating in full compliance with §74.1236 regarding emission and bandwidth (spectral purity), §73.1545(b)(1) as referenced by §74.1261(b) regarding frequency tolerance, and §73.267 as referenced by §74.1235(e) regarding transmitter power output. These on-site measurements were made on August 10, 2017 between 13:00 and 16:00 eastern daylight time.

W267BP transmits using a BW Broadcast model TX300V2 transmitter which is certificated for operation under Parts 73 and 74 of the Commission's Rules at the licensed transmitter power output level of 148 watts. W267BP shares a common antenna with three other translator stations: W230AA, W249CM, and W281BH. The four stations' transmitters are combined using a passive cavity-filter combiner which affords the requisite isolation between the four transmitters to prevent deleterious effects such as the generation of intermodulation products that would otherwise exceed allowable limits.

MEASUREMENT EQUIPMENT

Emissions measurements were made by obtaining a sample of the transmitter output by way of a Bird Electronic model 4274-025 coupling element inserted into a Bird 43 thru-line wattmeter installed in the antenna feedline at the output of the combiner. The coupler provides a nominal coupling level of approximately -50 dB which sufficiently attenuates the signal being measured to avoid overloading the test equipments' inputs. The amplitude response of the coupler is flat to within +/- 0.2 dB across the FM broadcast band referenced to the 98 MHz center frequency, and is flat to within -1.5 dB up to 1 GHz. Details regarding the coupler's measured response are included in Appendix A.

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The primary instrument for emissions measurements was an Agilent Technologies E4402B Spectrum Analyzer, serial number MY45106073. Self-calibration and internal confidence tests were performed prior to taking measurements. Spectrum analyzer traces were saved in the instrument's internal memory and subsequently transferred to a computer workstation for inclusion in this report. The spectrum analyzer was connected to the directional coupler via a 5-meter length of RG400 double-shielded coaxial cable.

A Hewlett-Packard model 8920B Communications Analyzer, serial number US35010108, with the high-stability timebase option (001), was used to verify the frequency of the RF carrier and the demodulated stereophonic pilot. The 8920B's timebase is was verified against a Ball-Efratom rubidium reference oscillator of known accuracy and found to be accurate to less than 1 Hz variation at 10 MHz (0.1 parts per million).

A Bird Electronic model 43 analog wattmeter with integral line section and a 250-watt 50-125 MHz element were utilized for transmitter power measurements.

When necessary to improve the usable dynamic range of the measurement equipment when making measurements at frequencies above the FM broadcast band, a Par Electronics model HPF7(152) 7-pole Chebyshev high-pass filter with a 150 MHz cut-off frequency was installed at the input of the spectrum analyzer to attenuate the fundamental FM broadcast carrier frequencies.

To increase the usable dynamic range of the equipment when making intermodulation product measurements in close spectral proximity to the W267BP fundamental, a Microwave Filter Corp. triple-resonator notch filter (6367 series) was tuned to attenuate the three other stations' fundamental signals. The spectral width of the notches is sufficiently narrow to avoid affecting the measurement of the intermodulation products.

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INITIAL ADJUSTMENTS AND SCALAR ANALOG MEASUREMENTS

With the exception of the pilot frequency measurement, all measurements were made with normal program material modulating the transmitter. The transmitter was adjusted to the authorized TPO of 148 watts via its front-panel metering. A summary of the scalar measurements follows:

Carrier frequency:	101.299856
Carrier frequency error:	-144 Hz (permissible error +/- 200 Hz)
Stereophonic pilot frequency:	18,999.9 Hz
Stereophonic pilot frequency error:	-0.1 Hz (permissible error +/- 2 Hz)
Stereophonic pilot injection:	9.0% (8% to 10% permissible)
Measured Transmitter Power Output:	150W
Transmitter Power Output error:	+1.4% (-10% to +5% permissible)

CARRIER REFERENCE LEVEL

After the analog operating parameters above were measured and verified to be accurate and compliant, a measurement of the sampled signal was made to establish the carrier reference level on the spectrum analyzer for all subsequent spectral measurements, many of which are expressed in values referenced to the carrier power (dBc). The spectrum analyzer was set for 300 kHz resolution bandwidth to encompass the entire modulated signal. **The analog carrier amplitude measured, -0.2 dBm, becomes the reference for all subsequent measurements (see Figure 1).**

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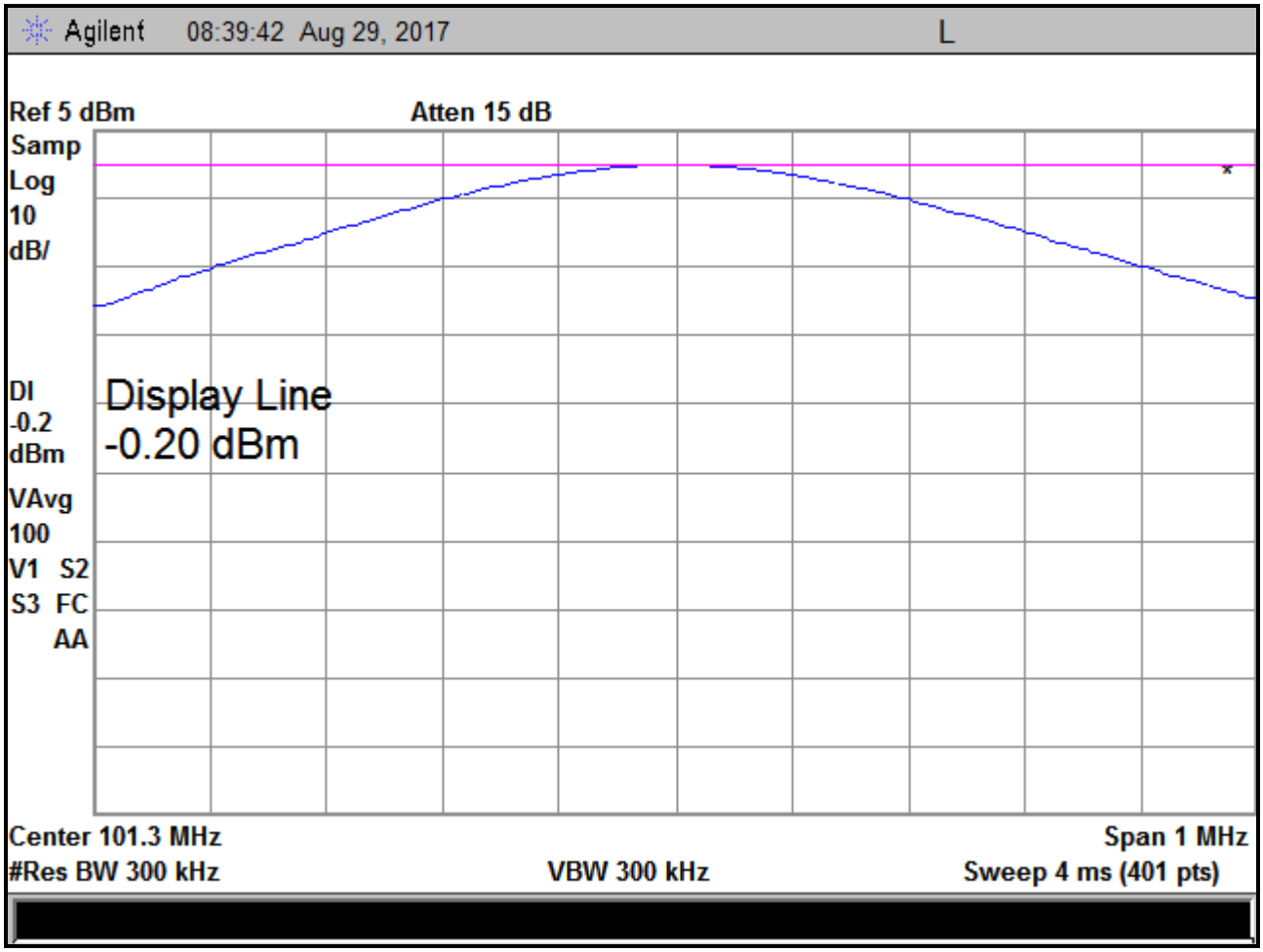

Figure 1 – Analog power reference level established at -0.2 dBm

CHANNEL MASK MEASUREMENT

Once the carrier reference level was established, a measurement demonstrating 47 CFR §73.317 FM channel mask compliance was then made. The trace peak-hold capability of the analyzer was enabled and allowed to record for ten minutes in order to capture any short-duration transients. A resolution bandwidth of 1 kHz was used, with the video bandwidth set to 3 MHz (negligible video filtering). Figure 2 demonstrates that the FM emissions are fully contained within the channel mask which is superimposed on the display for reference.

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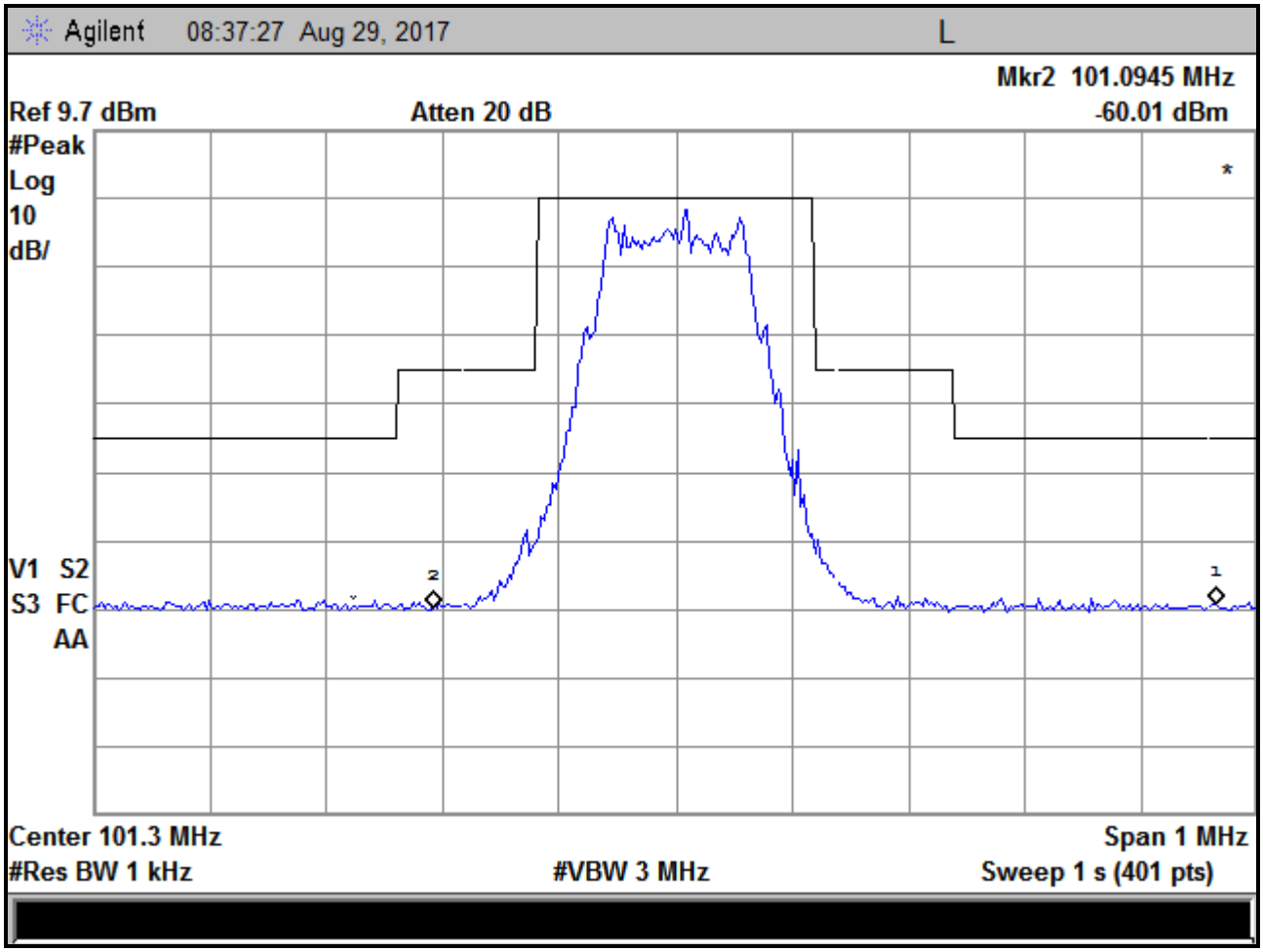

Figure 2 –§73.317 FM channel mask compliance

HARMONIC EMISSIONS

At frequencies removed more than 600 kHz from the licensed channel center, spurious products must be attenuated at least 43 + 10 log (P_{watts}) dB, or 80 dB whichever is less attenuation. At W267BP's licensed power level of 148 watts TPO, the required attenuation is 64.7 dB. When referenced to the -0.2 dBm carrier level established previously, all off-channel emissions must be attenuated to a level no greater than -64.9 dBm.

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The test equipment was configured for measuring harmonic emissions. The high pass filter was installed at the input of the spectrum analyzer. This filter provides approximately 43 dB of attenuation of the W267BP fundamental at 101.3 MHz, while introducing little attenuation at frequencies above approximately 150 MHz. The addition of this filter effectively increases the usable dynamic range of the spectrum analyzer to yield higher instrument sensitivity in the harmonic spectrum. The high-pass filter has some minor, and as will be demonstrated, negligible, insertion loss above its stop band. Appendix B is a plot of the filter's frequency response which depicts a worst-case attenuation of 3.25 dB at 1.1 GHz, which is approximately the 11th harmonic of the 101.3 MHz fundamental, and no more than 1.0 dB at the sixth harmonic (607.8 MHz) and all lower-order harmonics.

As in earlier measurements, the coupler was used to obtain a sample from the antenna transmission line after the combiner. The coupler has minor, and as will be shown, negligible, frequency response aberrations (see Appendix A).

Figure 3 depicts a sweep from 150 MHz to 550 MHz encompassing all harmonic orders through the fifth. The trace was captured using the peak-hold capability of the analyzer over a period of 10 minutes. The magenta display line superimposed on the trace is at the -64.9 dBm out-of-band emissions limit calculated previously. As shown in Figure 3, there are no emissions that exceed the allowable limit, even if corrected for coupler frequency response aberrations.

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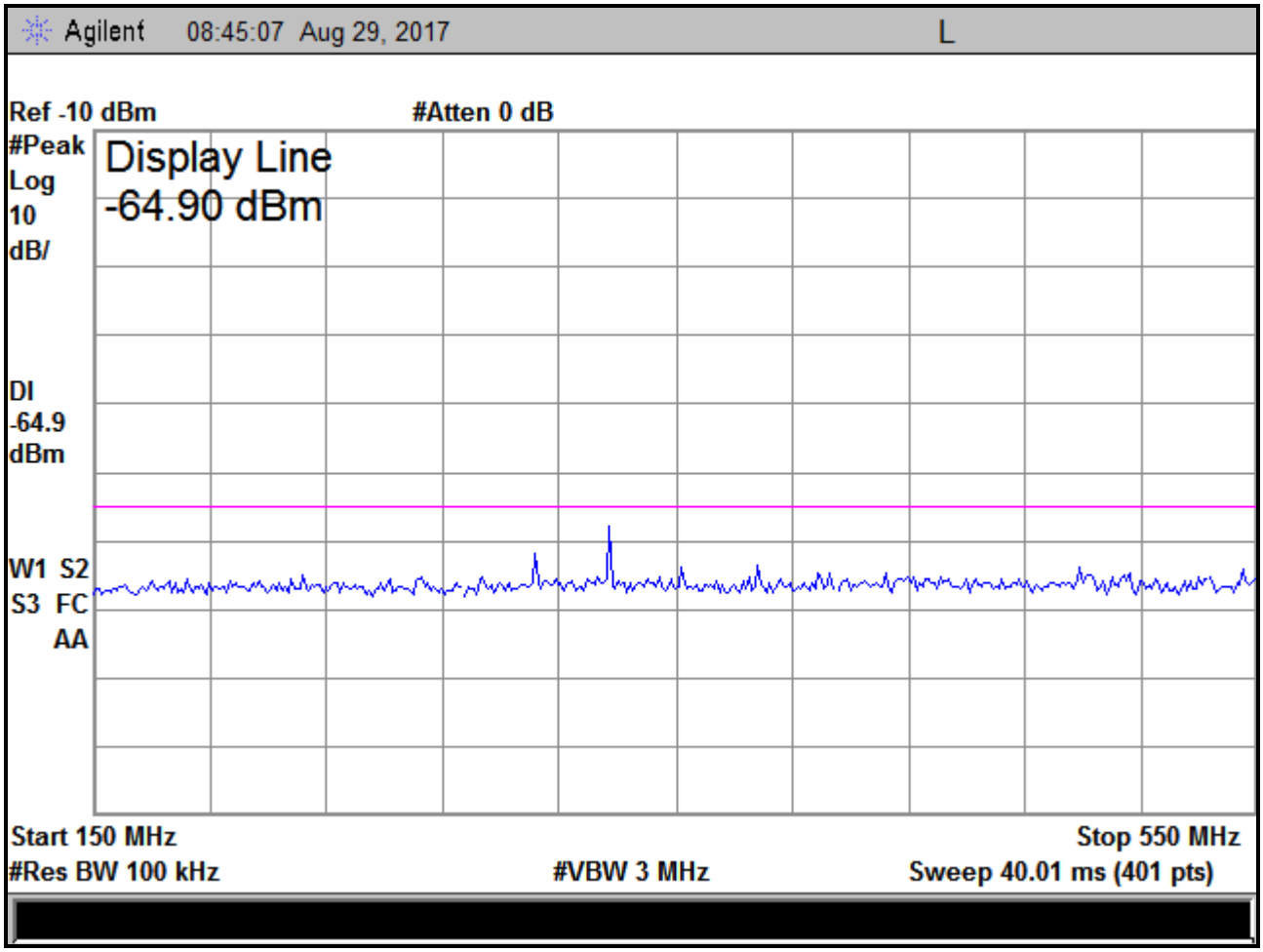

Figure 3 – Wideband sweep including harmonic spectrum

SPURIOUS AND INTERMODULATION EMISSIONS

Following the harmonic measurements, spectral measurements were made across a 25 MHz span centered on the 101.3 MHz fundamental (see Figure 4). This span encompasses the entire FM broadcast band and adjacent spectrum. The goal of this measurement was to identify any intermodulation products involving W267BP and any of the other three combined facilities.

When combining multiple transmitters such as in the instant case, odd-order mix products, and particularly third-order mix products, tend to be the most problematic as they fall "in band" and are

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attenuated less by the cavity filters as compared to even-order products far removed from the passband of the cavity filters.

As seen in Figure 4, aside from the fundamentals of the three other co-located stations on the combiner, there are several emissions which exceed the -64.9 dBm limit line. However, each of those was identified, via the use of the instrument's frequency marker display, as being the fundamental frequencies of another nearby FM broadcast stations, with the four most prominant identified with markers and listed below:

96.1 MHz: WTTH(FM), Margate City, NJ
96.9 MHz: WFPG(FM), Atlantic City, NJ
99.3 MHz: WZBZ(FM), Plesantville, NJ
107.3 MHz: WPUR(FM), Atlantic City, NJ

It should also be noted that none of the discernable frequencies above is a calculated third-order or fifth-order mix product of any of the stations on the combined antenna system.

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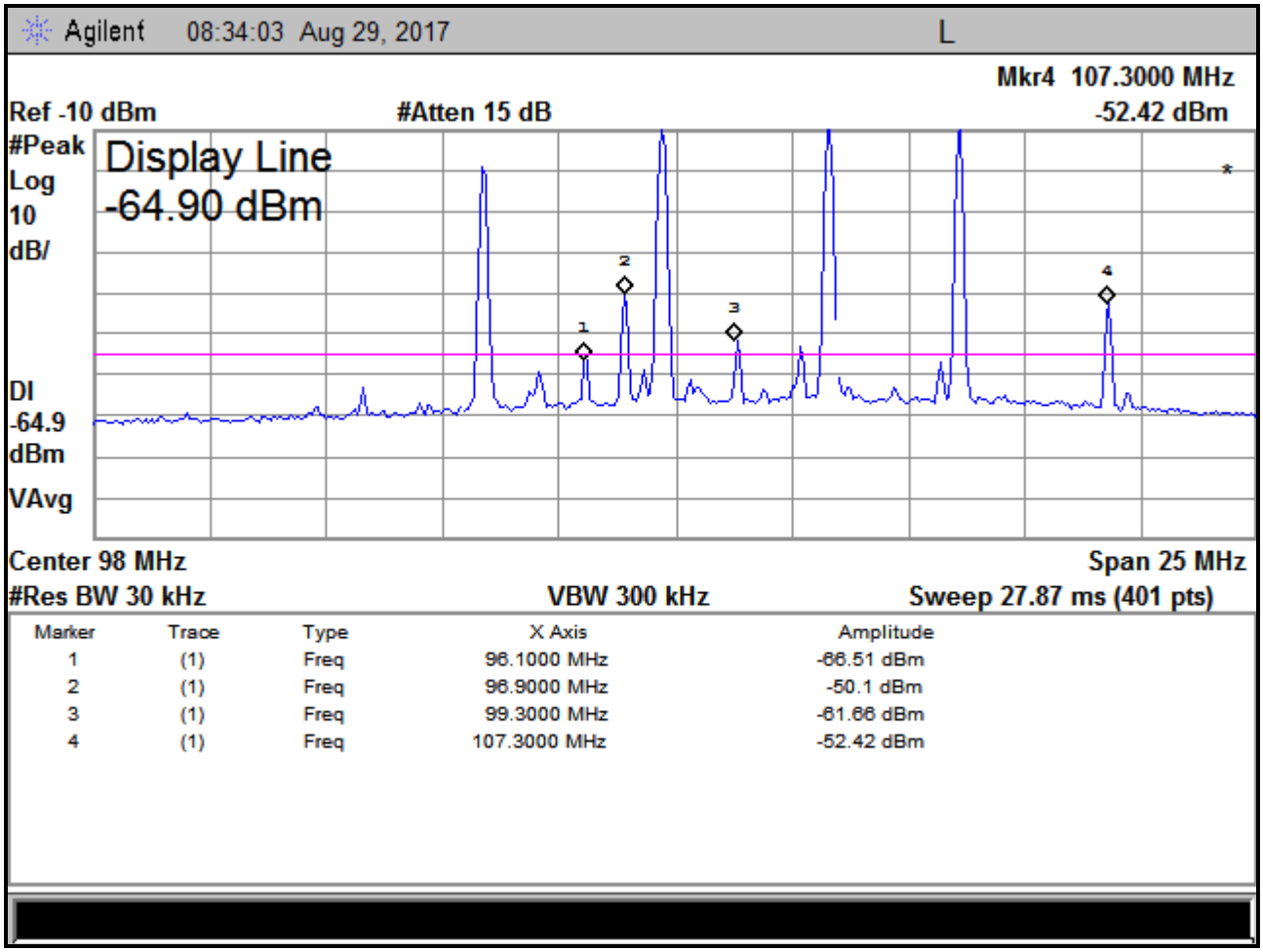

Figure 5 – FM band and adjacent spectrum

CONCLUSION

Based on the measurements, calculations, and analyses herein, it is believed that W267BP is in compliance with all applicable Federal Communication Commission regulations cited herein.

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CERTIFICATION

I, Jeff DePolo, hereby certify that the field measurements and subsequent calculations and analyses contained in the instant report were made or generated by me, or by Broadcast Sciences personnel under my direct supervision. The information, calculations, and analyses provided are true and accurate to the best of my knowledge and belief. I have been employed in the broadcast and wireless communications field for over twenty-three years, during which time I have prepared numerous applications, reports, and analyses deemed acceptable to the Federal Communications Commission. My other qualifications are a matter of record with the Commission.

This report was prepared by Broadcast Sciences LLC at the request of, and on behalf of, the licensee, Enrico S. Brancadora.

Jeff DePolo, Sr. Engineer
Broadcast Sciences LLC
28 August 2017

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APPENDIX A –COUPLER FREQUENCY RESPONSE

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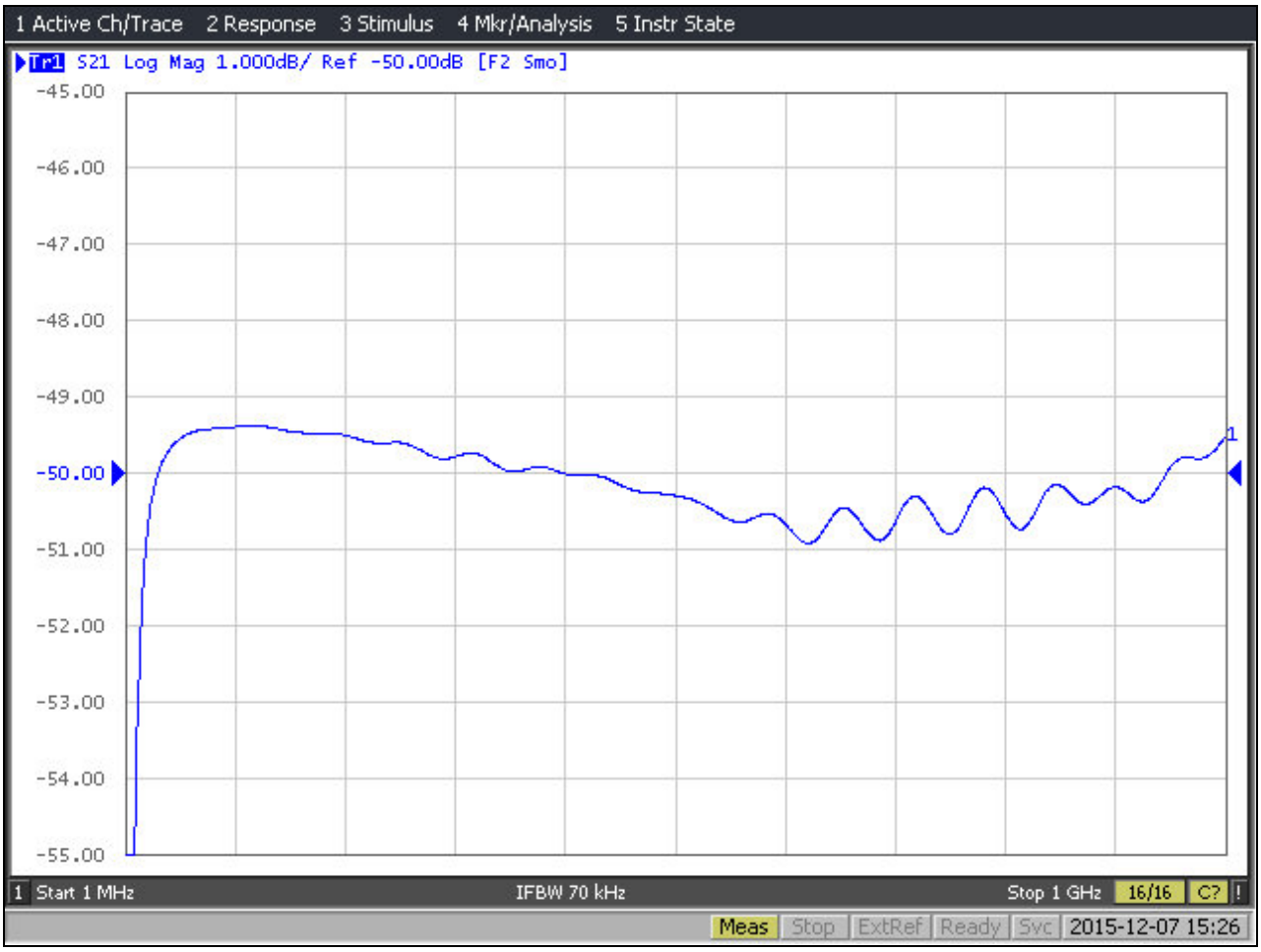
TEST EQUIPMENT CHARACTERIZATION

7/8" LINE SECTION SAMPLING ELEMENT
BIRD ELECTRONIC MODEL #4274-025

COUPLING RESPONSE



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APPENDIX B – HIGH-PASS FILTER FREQUENCY RESPONSE

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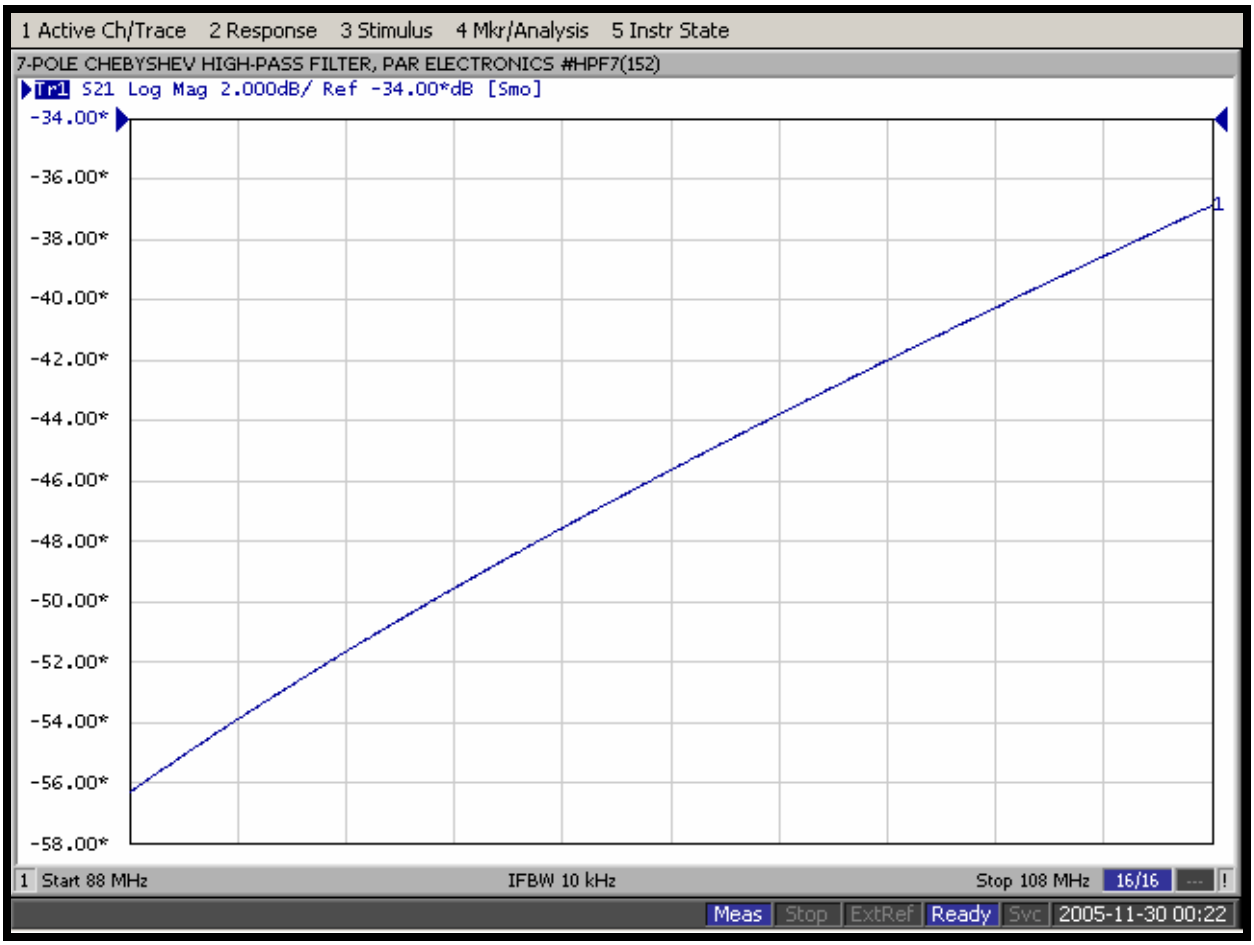
TEST EQUIPMENT CHARACTERIZATION

7-POLE CHEBYSHEV HIGH-PASS FILTER
PAR ELECTRONICS HPF7(152), UNIT #1

FM BROADCAST BAND ATTENUATION



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TEST EQUIPMENT CHARACTERIZATION

7-POLE CHEBYSHEV HIGH-PASS FILTER
PAR ELECTRONICS HPF7(152), UNIT #1

PASSBAND FREQUENCY RESPONSE