Subject: Measurement Technique for Accurately Measuring the HD Radio™ Spectrum of an FM Transmitter

Date: January 23rd, 2007

Purpose of this document

The following document describes the measurement technique for accurately measuring the FM HD Radio™ Spectrum.

FM Spectral Emissions Limits Mask

The following table is the emissions mask for FM HD Radio**™** performance as specified by iBiquity. Note that all measurements are made in a 1 kHz bandwidth and relative to an un-modulated carrier.

FM HD FCC Spectral Mask	
Frequency, F, Offset Relative to Carrier	**Level, dB / kHz**
100 - 200 kHz offset	- 40 dB
200 - 250 kHz offset	[- 61.4 dB – (frequency in kHz – 200 kHz) X 0.260]
250 - 540 kHz offset	- 74.4 dB
540 - 600 kHz offset	[- 74.4 dB – (frequency in kHz – 540 kHz) X 0.093]
> 600 kHz offset	- 80 dB

Figure 1 - FM HD Radio™ Spectral Emissions Limits Mask in Tabular Form

Figure 2 shows the FM spectral emissions limits mask for HD. The limits shown are the implementation of the table in **Figure 1** above.
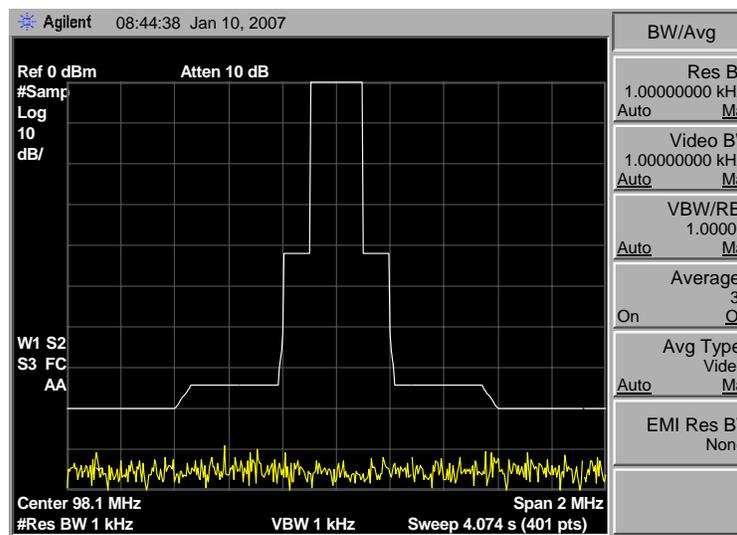

Figure 2 - FM HD Radio™ Spectral Emissions Limits Mask in Graphical Form

Setting up the Spectrum Analyzer

Reference:

Setting the reference for the measurement is critical to taking accurate data and the following steps should be taken. When setting this reference point the analyzer detector **MUST** be set to **peak, Averaging Off,** and no modulation present on the FM carrier.

1) The reference level on the spectrum analyzer should be set at 0dBm. That is the top line on the spectrum is 0dBm. All measurements should be referenced to this point.

2) Apply an un-modulated FM signal to the spectrum analyzer input (external variable and/or fixed attenuation should be in line with the front to avoid overdriving or damage to the spectrum analyzer). Adjust the external variable attenuator until the un-modulated FM carrier is at the 0dBm reference line.

Resolution Bandwidth, Span, Detector, and Averaging:

When measuring an FM HD spectrum the spectrum analyzer must have the **Resolution Bandwidth** (RBW) set to **1 kHz** and **Video Bandwidth** (VBW) set to **1 kHz**. The **Span** setting of **2 MHz** is not required but is a good setting to view performance. The **Detector** should be set to **Sample** and **Averaging** over a minimum time span of 30 seconds and **minimum** of **100 sweeps**.

When measuring the HD signal the FM carrier should have normal program modulation applied. The **Modulated FM Transmitter Spectrum** that is properly aligned should appear as shown in **Figure 3**. The modulated FM carrier will vary depending on program content. The primary sidebands should be ~42dB down from the un-modulated carrier and the secondary sidebands (re-growth) should be a minimum of ~74.4 dB down from the un-modulated carrier. In a good system the re-growth will be ≤ 80 dB down as shown below.

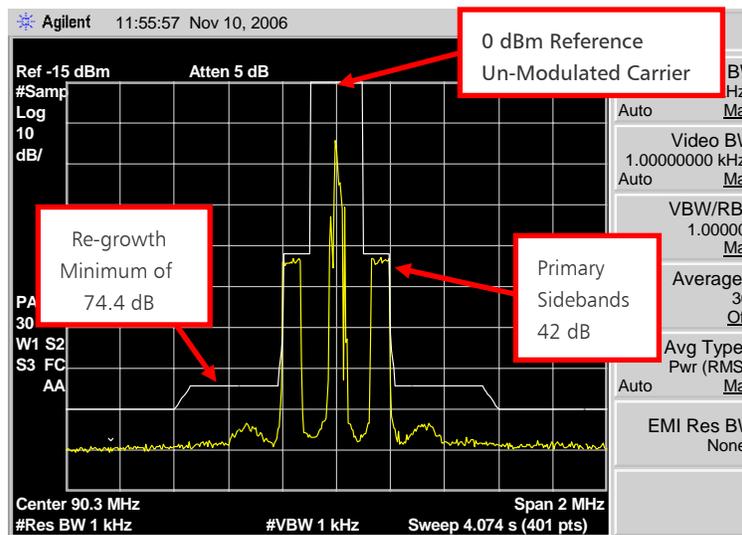All measurements **MUST** be made into a known good 50 ohm load prior to putting Transmitter into antenna.

Figure 3 – Properly Aligned FM HD Radio™ Spectrum