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## TIME-ALIGNING ANALOG AND DIGITAL FM IBOC SIGNALS

Hundreds of FM broadcasters in the U.S. (soon to be thousands!) are now transmitting hybrid in-band/on-channel (IBOC) digital radio signals using technology developed by iBiquity Digital Corporation. These signals consist of two major components—a traditional analog FM signal and a group of orthogonal frequency division multiplex (OFDM) digital carriers—both of which contain the station's main channel audio signal. These two audio signals need to be time-aligned by the broadcaster because IBOC receivers are designed to switch back and forth between these two signals using a process known as "blending."

A useful white paper on how to accomplish this time alignment using a hidden feature of a consumer IBOC receiver is available on the website of engineering service firm Broadcast Signal Lab (BSL, [www.broadcastsignallab.com](http://www.broadcastsignallab.com)). The Kenwood KTC HR100 HD Radio unit has what is called a "broadcaster mode" in which the user can listen to digital and analog reception simultaneously on the left and right audio channels. This receiver needs to be attached to a compatible Kenwood dashboard radio (the "head unit", not shown in photo); Kenwood has many HD Radio™ ready head units from which to choose. Here's how it works:

- Find and depress the RESET button recessed in the front panel of the head unit (note that this will clear all settings and return the radio to its factory default settings);
- Within the next 30 seconds press the SRC (Source) key until HD RADIO appears on the display.
- Wait for the HD RADIO display to convert to a frequency display (at a default frequency)—do not tune in a station yet;
- Some head units have a NEXT key in the upper right hand corner. These models have function keys instead of PRESET keys. Press the NEXT key until the display shows "1 2 3 4 5 6" at the bottom, indicating that the function keys are acting like PRESET keys (if the unit doesn't have a NEXT key on the head unit, skip this step);
- Press PLAY/PAUSE 5 times;
- Press PRESET keys in sequence: 1, 2, 3, 4, 5, 6. Nothing should happen while doing these last 11 presses. If the radio reacts to key presses before finishing the sequence, go back to RESET and try again);
- "Alignment" should now appear on the display. Unit is now in broadcaster mode; stations can now be tuned. Most radio features can be accessed normally;
- Analog/digital audio time alignment mode is engaged by pressing PRESET 5. Right front channel is analog broadcast audio and left front channel is digital broadcast audio.

After executing this procedure, it is possible to determine if the radio station's analog and digital audio signals are time aligned by simultaneously listening to the left and right front channels. Broadcasters can adjust the analog audio delay at transmitter to align this timing, using an oscilloscope for precise alignment. BSL recommends using a mono audio source (e.g., voice) for best time-alignment results.

