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Data Transmission Capabilities for FM Radio

The methods available to broadcasters for sending data over an FM radio signal have evolved in recent years with the advent of HD Radio[tm] technology and the resurgence of the Radio Data System (RDS) FM subcarrier. A session at the upcoming NAB Broadcast Engineering Conference (BEC, April 18-23, 2009, Las Vegas, NV – see below for additional information) entitled "*Radio Engineering Forum Part I*" includes a paper, excerpted here, which discusses the amount of data capacity that is available on different data channels as well as the ability for different data (and audio) systems to coexist on a single FM channel.

INTRODUCTION – engineers should have an understanding of how much data capacity is available on different FM radio-based data services as well as the ability for different data delivery systems to coexist on a single FM channel. To better understand these questions, several tests were run on what could be described as a typical FM radio station that was running RDS and HD Radio data streams. Observations and spectrum analysis was made during various modes of operation (see figure for an example – the full paper includes 9 such figures). Maximum data bandwidth was measured in each mode of operation and cross-compatibility tests were performed. It is likely that future advancements in existing schemes will result in future improvements in performance, but these tests were considered to be similar to what could be expected from a typical FM station of similar configuration at the time of the testing.

RDS – the RDS system utilizes a 57 kHz FM subcarrier and has an overall data rate of 1.187 kbps. Typically, a 5% injection level is standard for this technology. This data stream is allocated to various services that are predefined as part of the RDS (and RBDS) standards. Stations generally use the PS and RT fields to display information related to the station or the content of the audio program being transmitted. Other data services that are relayed through RDS include traffic and emergency information for the broadcast area. These services are capable of reasonable performance at relatively low data rates, unlike real time digital audio delivery or large file transfers. There weren't any noticeable compatibility issues between RDS and any other mode of data transmission. No additional multipath was detected by any of the stations during tests by using RDS although this concern has been raised in the past.

HD RADIO – Plain Old HD Radio (POHDR) is a single 96 kbps channel that is used to duplicate the analog FM audio. If additional equipment (Importer) is purchased and installed, this can be divided into multiple data streams that will make up to 48 kbps available for another audio stream or data channel or a mixture of both. A minimum of 48 kbps is reserved for replicating the main channel FM audio. Extended hybrid mode is also available which adds additional HD carriers to the HD signal resulting in extra capacity (and requiring extra bandwidth).
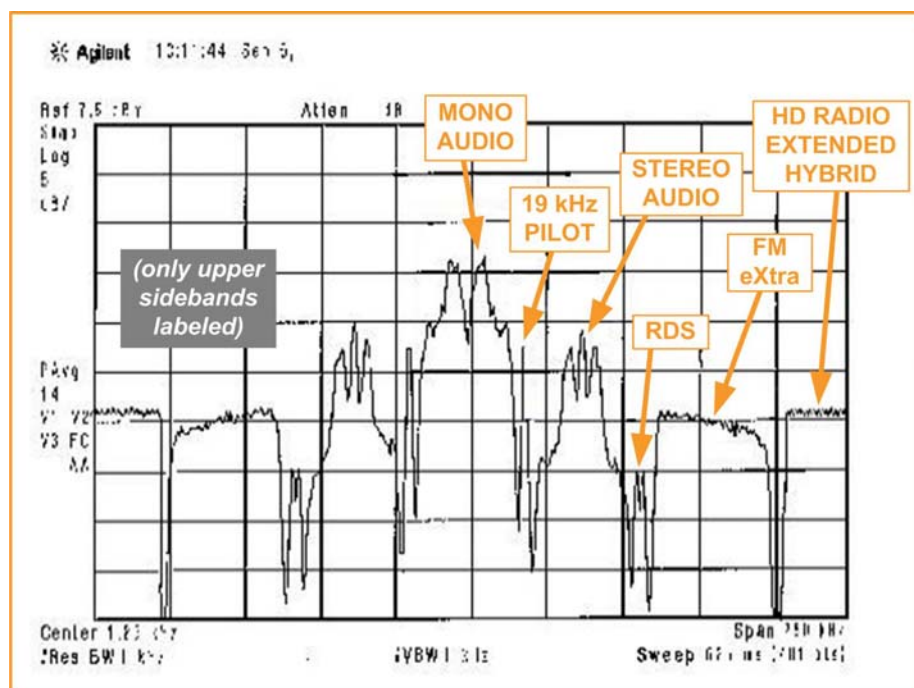
OTHER SCAs – the Subsidiary Communications Authority (SCA) provisions of the FCC's rules allow for a variety of subcarriers to be used. Subcarriers at 67 kHz and 92 kHz systems are typically modulated with an analog signal for traditional SCA applications, but more modern technology supports the use of digital subcarriers for specialized applications. An example of this is the DirectBand system which Microsoft uses for their Smart Personal Objects Technology (SPOT, used with the MSN Direct service – see www.msndirect.com/ for additional information). The data rate on that system is reported to be 12 kbps. Another readily available digital SCA system is the FMeXtra system (see www.dreinc.com/ for additional information). If used with a stereo FM signal, this system typically delivers 64 kbps, and if used with a mono FM signal, the throughput increases to 128 kbps. 67 kHz-based analog SCA's can be employed without harm to hybrid HD Radio signals in any transmission mode. There are cross-compatibility issues using 92 kHz analog SCA services when the extended Hybrid HD Radio mode is activated.

This paper is authored by Roswell Clark, Director of Technical Operations, Cox Radio Tampa. It will be presented on Monday, April 20, 2009 starting at 11:30 a.m. in room S228 of the Las Vegas Convention Center. It will also be included in its entirety in the *2009 NAB Broadcast Engineering Conference Proceedings*, on sale at the 2009 NAB Show Store and available on-line from the NAB Store (www.nabstore.com) after the convention. For a complete list and summaries of each paper that will be presented at the 63rd NAB BEC, April 18 – 23 in Las Vegas click here. For additional conference, housing and registration information visit the NAB Show Web page at www.nabshow.com.