SUMMARY

According to a first aspect of the present invention, there is provided a system comprising:

a transmitter including a transmitter clock, wherein the transmitter is configured to switch between transmission of a digital signal and an analog signal;

a receiver including a receiver clock, wherein the receiver is configured to receive the signal transmitted from the transmitter;

a clock synchronization signal transmitted between the transmitter and the receiver, wherein the clock synchronization signal is configured to synchronize the transmitter clock and the receiver clock;

wherein the clock synchronization signal is embedded in the analog signal so that the clock synchronization signal is transmitted with the analog signal; and

wherein the transmitter clock and the receiver clock are synchronized by the clock synchronization signal without a delay when the transmitter switches from transmitting the analog signal to the digital signal.

According to a second aspect of the present invention, there is provided a method comprising:

embedding a clock synchronization signal in an analog signal wherein the clock synchronization signal is configured to synchronize a transmitter clock and a receiver clock;

transmitting the analog signal and the embedded clock synchronization signal from a transmitter to a receiver;

switching the transmission from the transmitter from the analog signal to a digital signal; and

wherein the transmitter clock and the receiver clock are synchronized by the clock synchronization signal without a delay when the transmitter switches from transmitting the analog signal to the digital signal.

A communication system uses may be used to provide a low latency communication pathway for data between remotely located transmitter and receiver stations, such as located in North America and Europe. Generally speaking, the overall system operates in two modes, a data transmission mode and a broadcast mode. In the data transmission mode, data is transmitted in a digital form between the transmitter and receiver. On off hours when data transmission is not needed, such as when stock exchanges are closed, the transmitter

broadcasts music, news, entertainment, and/or other audio information to the general public, such as via an AM or FM signal, or even a phase modulation (PM) signal. In one form, the digital data signal and the AM signal are transmitted at different frequencies, but in other variations, they can share the same general frequency band.

When in a data transmission mode, the system attempts to communicate the data as fast as physically possible, that is, with the lowest practical latency. Normally, but not always, the data is transmitted using a digital signal which requires clock synchronization between the transmitter and receiver. The clocks at the transmitter and receiver typically set their clocks at least in part based on time data received from a Global Positioning System (GPS). During transmission, the radio data signal is bounced off the ionosphere. Due to changes in ionospheric conditions and other environmental changes, the path length of the digital signal between the transmitter and the receiver changes which in turn leads to signal distortions such as Doppler shifting. So the receiver is able to remove or adjust to these distortions, the transmitted digital signal includes a clock signal that helps synchronize the transmitter and receiver.

As part of the broadcast license, the FCC requires broadcasters to interrupt their normally scheduled programming in order to provide a station identifier (ID) on an hourly basis (or at other intervals). The station ID may be transmitted using the AM broadcast signal. While this is usually not a problem during the broadcast mode as latency is not a concern, during the data transmission mode, the receiver has to switch from the digital signal to the AM signal. During this switch to the AM signal, the clock synchronization signal is lost. Upon switching back to the digital data transmission signal, there is a delay caused by reestablishing the clock synchronization between the transmitter and receiver. This delay can be problematic because the information transmitted via the digital data signal is extremely time sensitive.