The Complete Bluetooth® Audio Picture  
Until now, the industry-best analysis tools have let you examine the pieces of the Bluetooth audio puzzle without ever showing you the complete picture. Frontline’s Bluetooth Audio Expert System completes that picture by clearly depicting, in one intuitive tool, when and how Bluetooth protocol and audio work- and sometimes don’t work- together.

Your Audio Issues Might Be Related to Your Bluetooth Implementation  
Does your Bluetooth-enabled audio device suffer from poor audio quality when streaming A2DP, poor voice quality in telephone calls when using Bluetooth hands-free or a headset, audio disconnects, delays, stutter, or intermittent anomalous noises?  

Many audio quality issues are directly related to Bluetooth protocol implementation and interoperability. Because these protocol-related conflicts and issues are manifested as audio problems, debugging has typically meant hours of often fruitless guesswork and repeated test cycles.

Call In the Audio Expert  
Frontline’s Bluetooth Audio Expert System is the first and only analysis tool on the market to combine audio analysis with Bluetooth protocol analysis, allowing developers to quickly pinpoint the root cause of a wide array of Bluetooth protocol-related audio problems.

How Does it Solve Audio Problems?  
Bluetooth frames containing encoded audio data are captured by the Frontline BPA® 600 Dual Mode Bluetooth Protocol Analyzer and are passed to the Bluetooth Audio Expert System, which displays the audio live in the waveform viewer pane of the Audio Expert System.  
Simultaneously, Bluetooth, codec and audio events and errors are indicated on a timeline which aligns with the displayed waveform. The Bluetooth Audio Expert System time aligns Bluetooth audio and the Bluetooth protocol traces, identifying three specific event types within the trace: Bluetooth, codec and audio events.  
An integrated event detail table links back to the Frontline’s powerful Frontline software, allowing users to quickly drill down to a specific packet or packet range of interest.  
The Bluetooth Audio Expert System’s referenced mode audio testing uses baseline information to significantly improve audio analysis for easier correlation with Bluetooth protocol, codec and bit rate variance data.
Bit Rate Variance Graphs
When audio data is conveyed over the high-latency Bluetooth transport, achieving the correct bit rate becomes difficult and audio quality is impacted. Further affecting latency (which directly affects bit rate) are a wide variety of environmental changes that can impact Bluetooth, including:

- Interference (excessive re-transmissions)
- Bandwidth consumption (simultaneous OBEX and audio transfers)
- Changes in Adaptive Frequency Hopping

By overlaying the expected bit rate against the actual audio bit rate and waveform, the Bluetooth Audio Expert System can help the developer pinpoint and resolve the actual source of the bit rate problem.

Referenced Mode Testing
In a typical unreferenced mode test scenario, audio is captured from a source and is analyzed with no frame of reference. This approach yields information about a limited range of audio characteristics such as clipping, audio drop out, frequency ranges and audio levels.

The Bluetooth Audio Expert System’s referenced mode does much more. In referenced mode testing, the user transmits a “known” audio file (a file which has already been analyzed by the Bluetooth Audio Expert System for number of key parameters and ranges). The transmitted file is compared against the initial baseline data to provide a far more detailed understanding of how the signal has changed from the sending device under test to the receiving DUT. The identification of variances in audio signal characteristics enables the user to make a truly informed and accurate diagnosis of audio issues that can more readily and rapidly be correlated with Bluetooth protocol, codec and bit rate variance data.

Full Workflow Integration
The Audio Expert System is seamlessly integrated with Frontline’s industry-leading Frontline Protocol Analysis System software, allowing for quick and complete Bluetooth audio problem-solving:

- Common timestamping of Bluetooth protocol data, audio events, audio waveform display, codec events and bit rate variance graphs
- Works with existing Frontline hardware
- Bluetooth Audio Expert System data and results are synchronized and coordinated with the existing rich set of Frontline software interfaces for precise and thorough protocol analysis

Files can be exported easily to allow users to conduct tests on encoded raw data using their own codecs, and to further review and analyze .wav files in other audio tools.

The Frontline Modular Approach
Frontline software is at the core of our protocol analysis products, allowing technology-specific hardware interfaces to work individually or in combination with other hardware interfaces. This modular approach gives the developer or analyst the widest possible range of scenarios for debugging complex communications.

The Bluetooth Audio Expert System is a software module of the Frontline Protocol Analysis System software, and analyzes packets captured by the BPA 600 Dual Mode Bluetooth Protocol Analyzer. It utilizes OpenSynergy’s Blue SDK stack (www.opensynergy.com).