CleverCAT

Communications Analysis Tool

The quality of your voice and data communications depends on peak network performance. If your network coverage isn't optimized, your mobile workforce can be left without the ability to communicate effectively. The **CleverCAT** suite is a powerful Communications Analysis Tool (CAT) that evaluates the cellular and LMR RF coverage in a specific area using TSB-88 and ITU107 testing standards to determine the degree of variability of voice and data performance throughout the service.

Evaluating Wireless LMR, Cellular and Wired Networks

Designed to be radio/communications system agnostic, the CleverCAT test tool tests the digital radio

Figure 1

The CleverCAT client is a laptop-based mobile GUI that lets the test operator visually determine the grids that have and have not been tested across the predefined service area.

technologies in both the inbound and outbound direction. The CleverCAT test suite includes a fixed end server that provides data packet logging and replies to test messages sent from the mobile data collection tool (CleverCAT Client). CleverCAT can be configured to send continuous packet streams as well as a pre-defined number of packets. As a result, not only can grid based testing for wireless LMR and cellular networks be accomplished, but wired networks and backhaul can be evaluated for latency, jitter and packet loss as well.

Tile Based Testing Grids

Clever Devices overlays a tile base grid whose boundary is the desired service area to be tested. Grid size can be adjusted from 500ft to 1.25-mile square grids. When the test vehicle enters an untested grid, a random location will be selected, a pre-defined number of messages will be sent to the server, and the server will return the same number of messages to the test vehicle. Upon completion of the test, the grid will be marked as tested and the test vehicle will proceed to the next test grid. Any grids that are deemed inaccessible due to lack of roads, bodies of water or on private/restricted property, can be marked as such and will not be tested.

In addition to automated data testing, test results from subjective DAQ testing by a team can be recorded and saved with the associated geographic coordinates for display and analysis.

Configurable and Versatile

Field tests utilizing the CleverCAT client provide insight into the degree of variability throughout the service area for voice and data performance. The tool can be configured for collecting metrics on many distinct aspects of a wireless network, including wireless technology (HSPA, LTE, EX-DO, 1xRTT), RF frequency band, channel, RSSI, Latency, Jitter, RSRP, RSRQ, adjacencies and SINR.

Requirements

The following measurements must be kept within optimal operating ranges established by a set of best practices guidelines to ensure a quality voice and data communication:

- **RSSI** (Received Signal Strength Indicator) is a common name for the signal strength in a wireless network environment. It is a measure of the power level that a RF client device is receiving from a base station, for example.

- **Latency** – Latency is the time between the transmission of a data packet and the moment it reaches the FES server. CleverCAT calculates the inbound and outbound link latencies for each packet transmitted and received in a test grid. A latency of less than 100ms is desired.

- **Jitter** – the variation in data packet transmission delay caused by queuing, congestion, timing drifts, route changes and serialization effects on the path through the network. A jitter of less than 50ms is desired.

- **Lost packets** - the failure of one or more packets to reach their destination across the network; it is desired that packet loss be kept at less than 1%.

- **R-value** – a score that is used to quantitatively express the subjective quality of speech in communications systems for which VoIP service is under consideration.

- **MOS**- Based on the measured latency, jitter and packet loss, the expected Mean Opinion Score (MOS) is calculated. The value is expressed as a number with a range from 1-5. A MOS of 3.0 equates to speech understandable with occasional requests to repeat. A MOS of 3.4 equates to speech understandable with very occasional request for repeat. A MOS of 4.0 and above is "toll quality" audio.
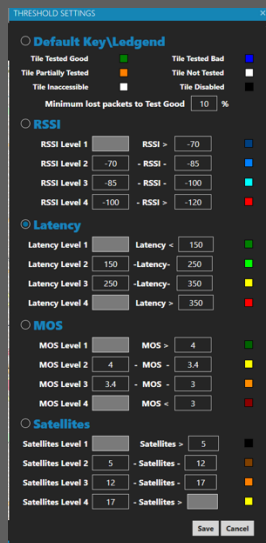

Figure 2 – Tile color and threshold settings

Post Test Correlation and Analysis

Both the server and the CleverCAT client laptop log the transmitted and received data packets. Upon completion of the drive testing, a post-test correlation process is run to determine Latency, Jitter and Lost Packets across the targeted customer service area. Through these measurements, Message Success Rate (MSR), R and ultimately Mean Opinion Score (MOS) can be calculated and estimated VoIP quality can be determined. Then, all data from the CleverCAT client and CleverCAT server are ingested into the CleverCAT Analysis tool. Maps with user defined levels and colors can be generated across the service area as shown in **Figure 2.** In addition to being able to export the data in a Microsoft Excel format, color coded maps are generated and include:

- Grid pass/fail
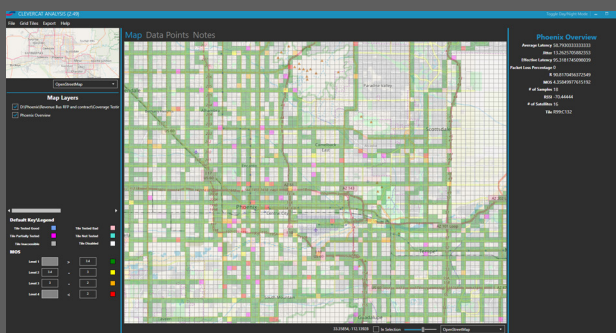- RSSI
- Latency
- MOS
- GPS Satellite count

Figure 3 – Map Analysis

Wired Network and Backhaul Analysis

CleverCAT is also used to validate network and backhaul link quality. By monitoring for latency, jitter and packet loss, unexpected anomalies can be resolved before your communications solution is deployed, or can be used to track down voice degradation in your existing communications solution when trouble transpires.
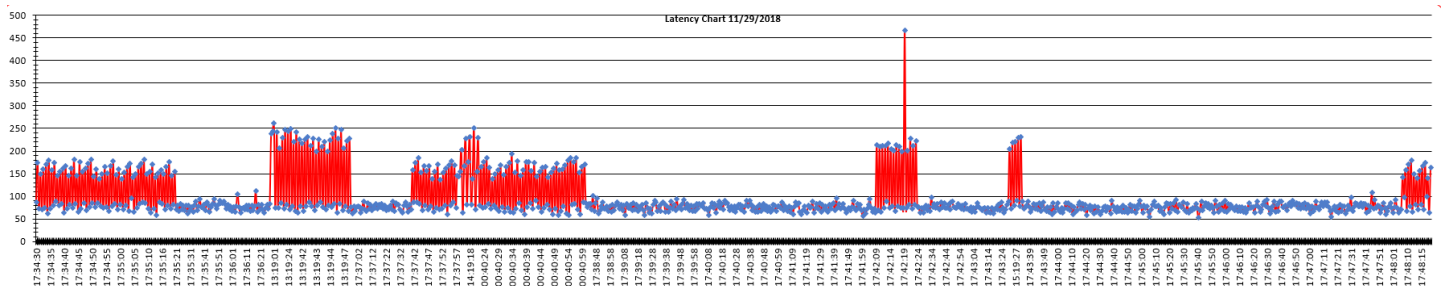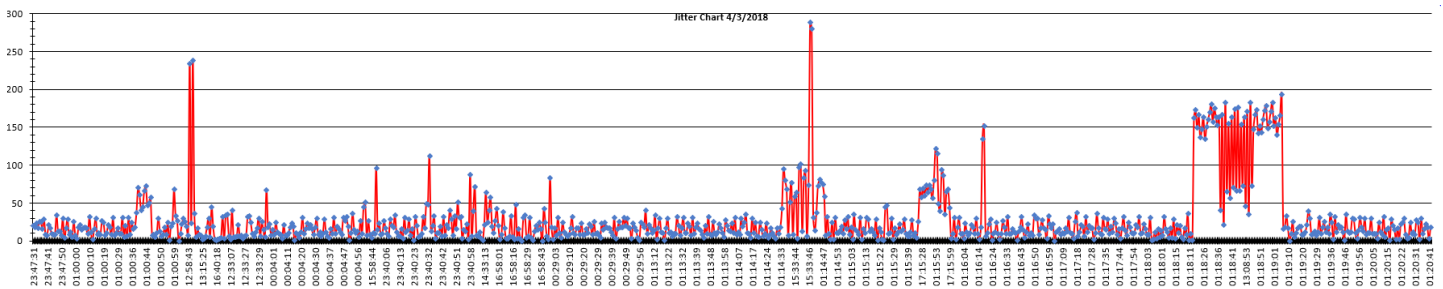

Figure 4 – *Latency Monitoring Chart*

Figure 5 – *Jitter Monitoring Chart*