

DIAGNOSTX

Purpose

This paper provides an overview of Locus DiagnostX, an innovative approach to Over the Air Bench Testing resulting in early detection of potential mobile and portable radio transmission problems, narrowband performance verification and diagnostics in trunked and conventional radio networks.

By way of uplink metrics, downlink control channel tracking, real time signal processing and time based characterization of radio signals; a picture of each radio's health can be attained and reported upon. By pre-identifying radio transmission problems, the organization will experience a higher level of system performance and reduced maintenance costs.

DiagnostX makes these measurements on all radio control channel transmissions i.e. registrations, affiliations and PTT access messaging, while the radios are in service, in the field.



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Patent Pending. DiagnostX Specifications are subject to change without notice.

Introduction

Using measurement and signal intelligence techniques, the DiagnostX platform can evaluate;

- Common Frequency related metrics
- Common FCC conformance measurements
- Statistical analysis of repeat performance

With these metrics, the inner workings and the health of radio can be evaluated. DiagnostX uses the uplink (radio transmit) side of the inbound control channel in performing signal intelligence and therefore relies on a moderate RSSI (received signal strength indication) in making measurements of the incoming waveform. Once the threshold of RSSI is achieved, the parallel DSPs (Digital Signal Processors) go to work at extracting the desired metrics and storing them in a database for further statistical analysis. Signals that do not qualify, or exhibit poor measurement metrics due to poor signal transmissions such as low SNR (signal to noise ratio) and transmissions experiencing fading or interference are discarded. This process is performed without user intervention, on live RF signals, in real time. Once the incoming waveform is captured, evaluated and stored in the database, a second level of statistical analysis, based on past transmissions of the radio and time, are used to verify any anomaly that would identify a poorly operating radio.

A viewing application, DiagnostX Viewer (DV), allows the evaluating staff to review the captured metrics and schedule poorly performing radios for maintenance and alignment.



How it Works

DiagnostX is an Over the Air Diagnostic system. It can be installed in any location where a receive antenna can be mounted or it can coexist at any established radio site.

DiagnostX has an intelligent RF (radio frequency) tuner that scans customer's control channel frequencies to identify the current one in use. Once it identifies the outbound operational control channel, it will tune a secondary receiver to listen on the inbound control channel frequency. For 800MHz radio systems this is 45 MHz lower in frequency than the outbound channel.

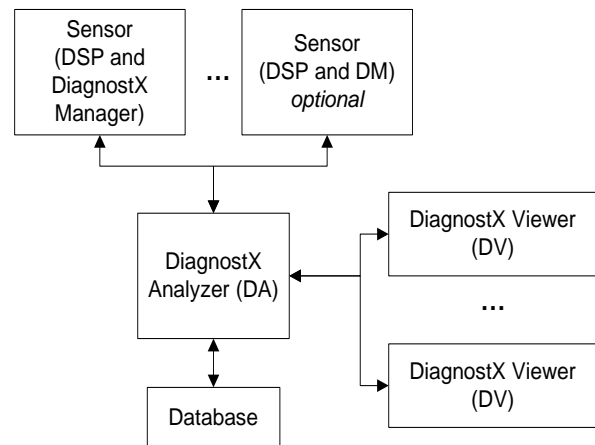
Once DiagnostX auto-tunes, the tuner assigned to the inbound control channel frequency listens and passes RF signals to the DSP (digital signal processing) board for signal analysis and measurement. The DSP board identifies and validates that the signal passing through the system is a radio transmission and has measureable signal components. The radio signal is oversampled, resulting in a more accurate analysis allowing DiagnostX to produce real time signal metrics at bench test equipment accuracy. Once it is established to be a valid signal, the DSP board analyzes the incoming transmission and compares it to:

- Mathematical representations of good signals
- Waveform specifications (FCC and manufacturer's standards)
- Signal intelligence algorithms.

The DiagnostX Analyzer (DA) performs all the calculations related to radio performance and stores historical records in the system database. The analysis of the received waveform provides information and compares it to bench mark measurement to determine the operational aspects of each radio.

This metric information is processed to determine conformance of the radio to customer configured DiagnostX thresholds. These thresholds identify a poorly operating radio or nonconformance to FCC requirements or manufacturers specifications.

The database metrics are interpreted and displayed in real time on an easy to navigate, information rich user interface, DiagnostX Viewer (DV). All logged signal metrics are stored by radio identification and easily retrieved for further analysis.



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Benefits

To insure operational readiness, the radio communication links of the organization need to be continually monitored and maintained.

DiagnostX, is a stand alone, non-intrusive over the air monitoring asset, developed to assist the radio service shop by constantly monitoring your radios while they are operating in the field, ensuring operational readiness.

By pre-identifying radio operational problems the organization will experience a higher level of system performance and reduced maintenance costs.

DiagnostX has been tested in live markets and the results have been compared against bench testing of the same radio. The tests have proven DiagnostX's effectiveness and accuracy in identifying problem radios. DiagnostX's technological advantage and dedicated service allow a constant monitoring and evaluation of your radio network. This constant monitoring and reporting on the performance of your radio resources ensure minimum hardware and personnel downtime and peak operational readiness.

DiagnostX:

- Is not a Bench Service Monitor.
- Does not require the radio to be placed in Test Mode to be analyzed.
- Does not impact the trunked radio system.

Examples of operation problems;

- Frequency Error. Oscillator misaligned. DiagnostX can identify this Over the Air on the live system before the user knows it is an issue.
- Modulation misaligned. DiagnostX can identify this Over the Air on the live system before the user knows it is an issue.
- Power, antenna and other mechanical attributes. Certain RF markers can help to identify installed radios issues versus bench tested issues.

Examples of hard and soft maintenance costs;

- 75-80% of maintenance personnel's time is spent on measuring performance indicators of a radio. Every radio with a problem needs to go through a checkout before returning to the field.
- 'No fault found' conditions on a radio. DiagnostX can analyze the radio in the field to verify it is the radio and not some other anomaly or user error.
- Downtime of agency personnel. Scheduling and transport, to and from radio shop costs fuel and time.

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