SAGE Instruments UCTT 8901 Release Notes

Wednesday May 29, 2013, Sage Instruments is excited to announce a major new release for its wireless base station test tool, model 8901 UCTT.

Release Summary

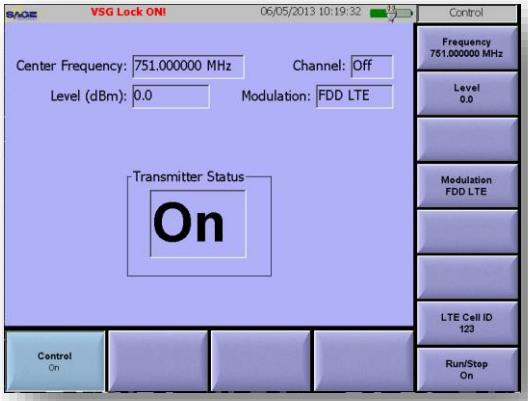
This release serves to extend the UCTT's capabilities to include:

- LTE Signal Generation
- New PBCH Bit Error Metric for LTE Signal Coverage Testing
- Enhancements for Signal Source Location
- Enhancements to LTE Physical Channel Demodulation
- Enhancement to Channel Scanner
- Reduced SEM Measurement Time
- Added autonomous auto-scaling on-entry to demodulation submenus

Release Details

LTE Signal Generation

Under Vector Signal Generator Mode, the UCTT now provides 10 MHz FDD-LTE with on-the-fly settings for
Level: -25.0 dBm to 0.0 dBm (Accuracy +/- 1 dB)
Freq: 698 MHz to 2.7 GHz
PCI: 0-511
Channel Bandwidth: Currently fixed at 10 MHz but expanded in later versions



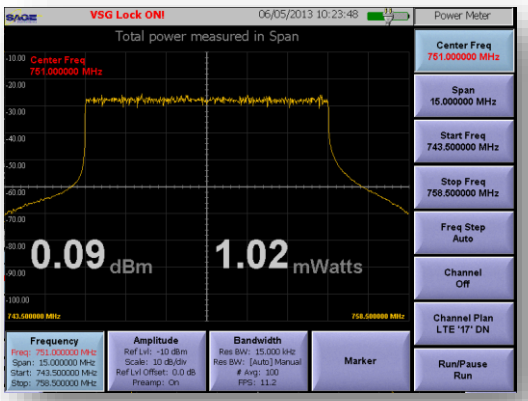


Figure 1 *&* ***Figure 2*** *Show the Vector Generator Mode (VSG) with FDD-LTE SigGen turned "On" [0.0 dBm, 751 MHz, with PCI of "123"]. In* ***Figure 2****, the RFout port was looped to the RFin and Mode was switched to Power Meter to display signal.*

LTE Signal Generator Applications

- LTE transmitter Emulation
- In-building and small cell deployment for both uplink and downlink coverage characterization
- Amplifier gain troubleshooting
  [The UCTT can transmit and receive simultaneously]
- Manual cable assembly insertion loss tests
- With a 2nd UCTT, conduct manual coverage testing by demodulating and decoding Sage generated LTE signal

PBCH Bit Error Detection for LTE Signal Coverage Testing

PBCH Bit Error Detection has been added to the LTE demodulation capabilities and is currently presented in the LTE Demodulation mode under submenu “Modulation” as shown in Figure 3 (circled in red).

A more direct approach to LTE coverage testing is to detect bit errors of the transmit path. This can be accomplished by decoding the PBCH data bits, the measurement instrument has to function like an actual LTE phone or modem. It must synchronize to the PSS (Primary Sync Signal) and decode the PSS and SSS (Secondary Sync Signal) to obtain the cell-ID. From there, it must determine how many TX antenna ports are used and then extract all the RS signals from all the TX antenna ports to form an equalization matrix in order to decouple the signals that have been mixed up via transmit diversity layer mapping and pre-coding [1]. The same process applies to decoding the other control channels such as PDCCH and PDSCH traffic channel. If the decoded PBCH channel does not even come out right, one can be absolutely certain that the PDCCH and PDSCH channels will not work either. Regardless of power and regardless of how many sectors can be seen at a given area, a good bit-error-free PBCH channel is the simplest and also the most decisive way of determining the overall signal coverage quality for an area.

Once the UCTT is locked onto a Cell_ID, the PBCH is continuously decoded and processed for Bit Errors. The bit error detection results are displayed as status conditions: “OK”, “Poor”, or “Bad”.

PBCH BER Results	Definition	Interpretation
OK*	Bit Error Free	Good Service Area Approx Download Data Rate > 25%
Poor	Bit Errors Present but Recoverable	Near Border or compromised location (i.e. in-building). Approx Download Rate: 25% > x > 5%
Bad	Uncorrectable Bit Errors Present (Unrecoverable)	Border area or Beyond. Approx Download Data Rate < 5%

* Indication of “OK” (Error-Free) does not imply maximum data rate.

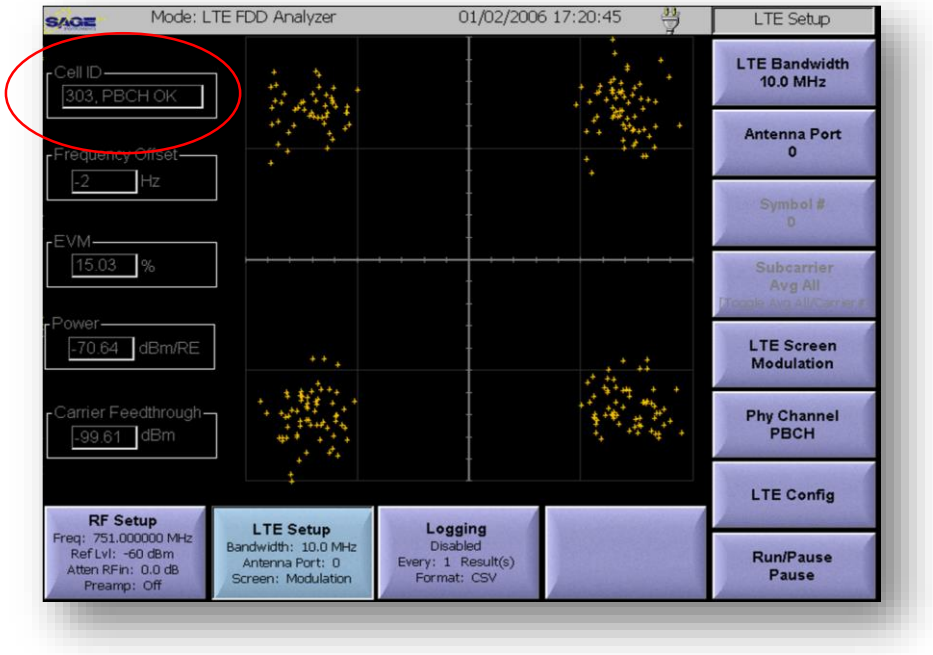


Figure 3 *Shows the PBCH constellation when the PBCH is OK (meaning no bit errors). This signal was obtained using an Omni antenna about one mile from the cell site and roughly in the center of a sector.*

Applications for PBCH Bit Error Detection Test

- LTE Cell Coverage Area Assessment
- In-Building Coverage Quality
- Troubleshooting Poor Coverage Areas

Future Applications

- LTE Bit Error Coverage Mapping utilizing GPS for location capture.
- Indoor LTE Bit Error Coverage Mapping utilizing indoor building maps to capture location.

<u>Enhancements for Signal Source Location</u>

The Signal Location Mode now has 3 new buttons under “Amplitude” setting for audio tracking control as shown in Figure 4

1) Audio Control Button : New Audio on/off toggle soft button and volume adjustment (1-10)
2) Audio Sound Type & Tracking Button: Allows users to toggle between tone or beeps for audio tracking and set Percent of Span for associated with audio tracking [1-100%].
   [Allows users to observe wider active span while independently tracking signal of interest in center of screen. For Span set to 10 MHz, and Audio tracking set to 10% then center 1 MHz will be associated with audible aide]

3) Audio Sense Range Button: Allows users to set Audio tracking sensitivity 10-100 dB.
[If Ref Level is set to -20 dBm and Audio Sense Range is set to 30 dB then audio will be tracked between power range: 0 and -50 dBm.]

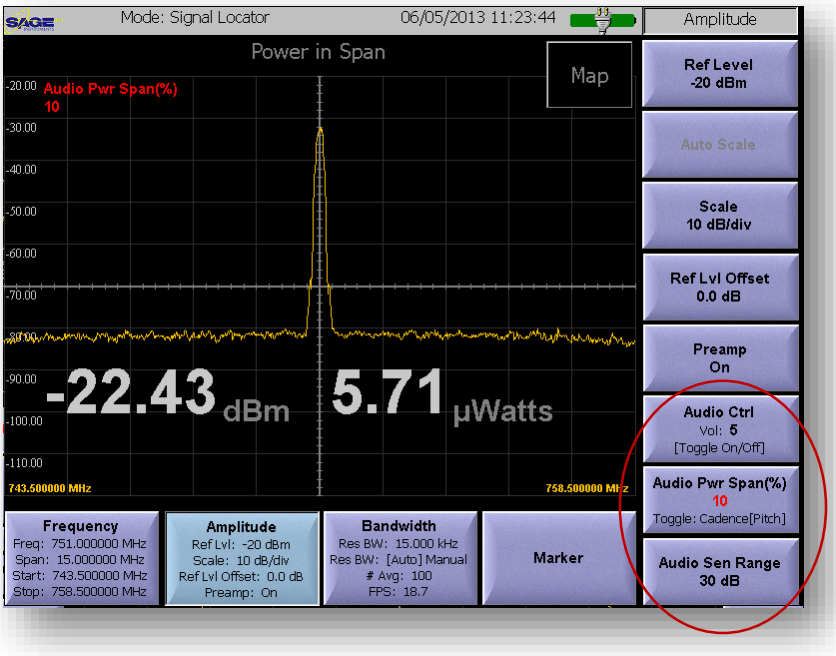


Figure 4 *Shows the Signal Location Mode with the 3 new audio control buttons circled in red.*

Enhancements to LTE Demodulation

For both FDD and TDD-LTE demodulation modes, the following enhancements have been made:

1) Better tracking, grouping and presenting of the PDSCH Channel IQ data when channel contains data for multiple users.
2) More robust detection and discrimination of QPSK, QAM16 and QAM64 modulation patterns, and automatically measures EVM.
3) LTE SNR metric is now derived from the Reference Signal (RS), making it equivalent to the SINR reported by typical UE devices.
4) Better interpolation algorithm for channel estimation via RS
5) When presenting IQ data for PSS and SSS signals, only the stronger instance is presented [It was found that these signals are power-unbalanced between the two instances of them within a 10ms frame. And only one instance is required for a UE to frame-up.

Enhancements to Channel Scanner

The UCTT Channel Scanner mode has been updated with the following improvements (See Figure 5):

1) Added touch selectable channel bars to set channel parameters

2) Allows multiple technologies (i.e. LTE, CDMA, etc…) and channel bandwidths [Measures real integrated Channel Power]
3) Settable Level Offset [helps with transmitter alignment activities]
4) Selectable bar color
5) New user definable label string
6) Added Auto amplitude scaling button
7) Added Geo-tag logging

Some Applications for Channel Scanner

- In-building DAS deployment coverage testing of multiple carriers
- COW deployment activities (including Transmitter alignment)

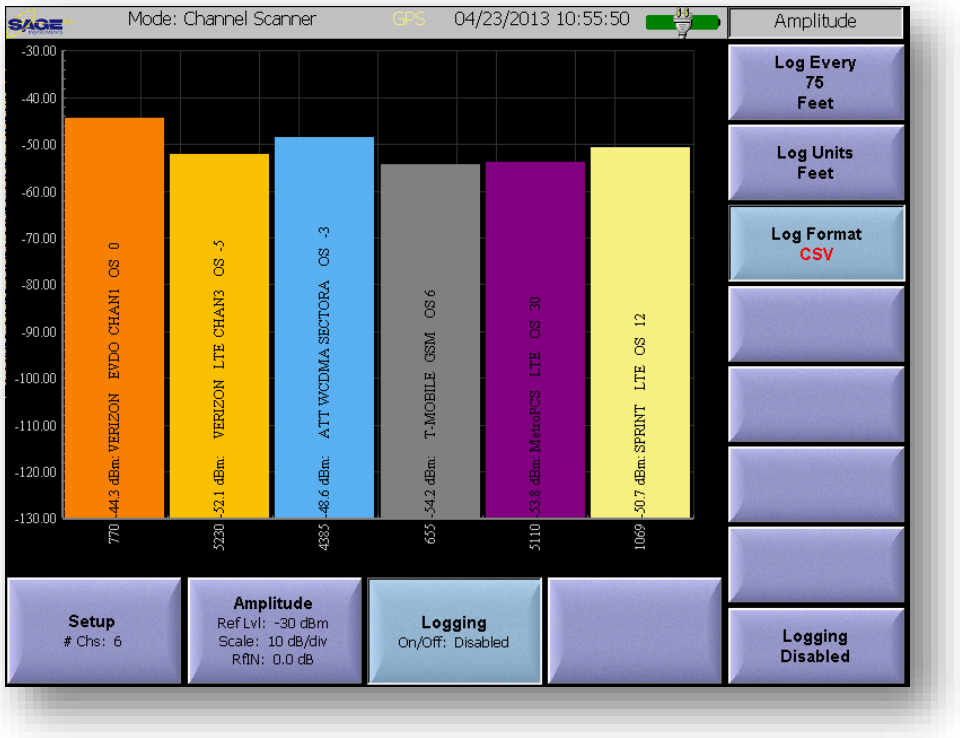


Figure 5 *Shows the Channel Scanner Mode monitoring 6 carriers with different technologies.*

Reduced SEM Measurement Time

All Spectral Emissions Mask measurements have been reduced from 8 seconds to 2 seconds.

Added autonomous auto-scaling on-entry to SA and demodulation submenus

To reduce manual re-adjustment of signal level when changing modes to the Spectrum Analyzer or from one submenu modulation screen to another, auto-scaling is invoked upon entry to new screen.