

# GTT LTE RRU ADD-ON

## USER GUIDE

The image displays two screenshots of the RRH LTE Demo software interface, showing various configuration and measurement parameters.

**Top Screenshot (Configuration and BLER Results):**

- Configuration:**
  - UL Text Model: FRC A1-3
  - TBs to decode: 2500
  - RNTI: 1024
  - RB Offset: 0
  - UL Bandwidth: 10 MHz
  - UL Duplex Mode: FDD
  - Cell ID: 0
  - AvC: 1
  - Target Power (dBm): -91.91
- BLER Results:**
  - Decoding Progress: [Progress Bar]
  - BLER (%): 0
  - Decoded TBs: 2500
  - Test Time (s): 3,259
  - Decoder Error Log: No Error
  - Constellation Diagram: [Plot]

**Bottom Screenshot (Acquisition and Generation):**

- HW:**
  - CPRI Device: e592R
  - Re-establish CPRI Link: Yes
  - Activate CPRI Link: [Button]
  - CPRI Mapping: 16 Bits, IQ Swap: Enabled, Sampling Rate: 15.36MS/s
- Acquisition:**
  - Acquisition Length: 1
  - Acquisition Unit: Radio frames
  - Start IQ Acquisition: [Button]
  - Number of Hyper Frames: 150
  - Target Power: -91.91 dBm
  - Antenna Port: Port 2
  - dBFS-to-dBm Offset: -60.00 dB
  - CPRI Data: [List]
  - CPRI Data Graph: [Plot]
  - Signal Spectrum of Demapped Data: [Plot]
- Generation:**
  - IQ Source: DL Signal Generation
  - Digital Scaling: -18 dB
  - Activate IQ Source: [Button]
  - DL Resource Element Map: [Plot]
  - CCDF Trace: [Plot]
- Status:**
  - CPRI port: On (3): 2457.6 Mbit/s
  - CPRI link state: (F): Operation (active link / C&M channel available)
  - CPRI Link State: [Indicator]
  - Link Failure Detected: [Indicator]
  - CPRI Error Log: No Error
  - CPRI Error Status: [Indicator]

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# 1 Introduction

The GTT LTE RRU Add-on by Gefle Testteknik AB adds support for CPRI based Radio Remote Units (RRU, or RRH) to the GTT LTE RBS Toolkit. The complete solution features all common transmitter measurements according to 3GPP by sending down link data to the RRU over CPRI and analysing transmitted RF using the GTT LTE RBS Toolkit. It also features receiver measurements by sending up link RF to the RRU and through the CPRI interface capture the received data and perform demodulation and BER/BLER measurements.

The included soft front panels enable easy lab measurements and the high-level APIs makes custom sequences or fully customized soft front panels easy to make. This add-on extends the full capabilities of the GTT LTE RBS Toolkit to the RRU product family.

The system is built on the LabVIEW 2014 platform.

## 2 System Requirements

See <http://testteknik.se/content/product> for a list of SW and HW requirements for the product.

## 3 Installation

Start LabVIEW and VIPM with administrator rights and start the installation of the “LTE RRU” using VIPM 2014 or newer.

The installed SFPs are by default located at:  
C:\Program Files (x86)\Gefle Testteknik\LTE RRU

The installed APIs are by default located at:  
...\National Instruments\[LabVIEWInstallDir]\vi.lib\GefleTestteknik\LTERRU\...

**Note:** The system supports Windows 7, 64 bit. For other Windows versions please contact [sales@testteknik.se](mailto:sales@testteknik.se) for latest status.

### 3.1 To activate/deactivate a license

The distributed executables and the GTT LabVIEW libraries (\*.lvlib) are licensed and have an evaluation period of 30 days and must then be activated for continued use. The license is locked to the computer that is used during installation.

We recommend using GTT licensing toolkit for activation of licenses. The built in activation tool in LabVIEW may also be used. Be aware that licenses activated in LabVIEW versions older than 2014 cannot be transferred at a later date, should it be needed.

To transfer a license it must first be deactivated on the system where it is currently active before activation on the new system. When restoring the computer from a backup image deactivation must be performed before deleting the old system.

A product can be manually activated (i.e. offline) by sending an email to [sales@testteknik.se](mailto:sales@testteknik.se) in the following format. NOTE that manually activated licenses cannot be deactivated or transferred:

Company Name:  
 User Name:  
 Executable User Code 1:  
 Executable User Code 2:  
 LabVIEW Library User Code 1:  
 LabVIEW Library User Code 2:

For further information refer to the preferred tool for activation.

## 4 HW Setup

Connect the RRU to the RF-port of the VST

**Note:** Maximum absolute input power VST RF in: **33dBm (peak)**

The CPRI communication is connected to 6592R

## 5 Example

This chapter shows example of how the code can be used.

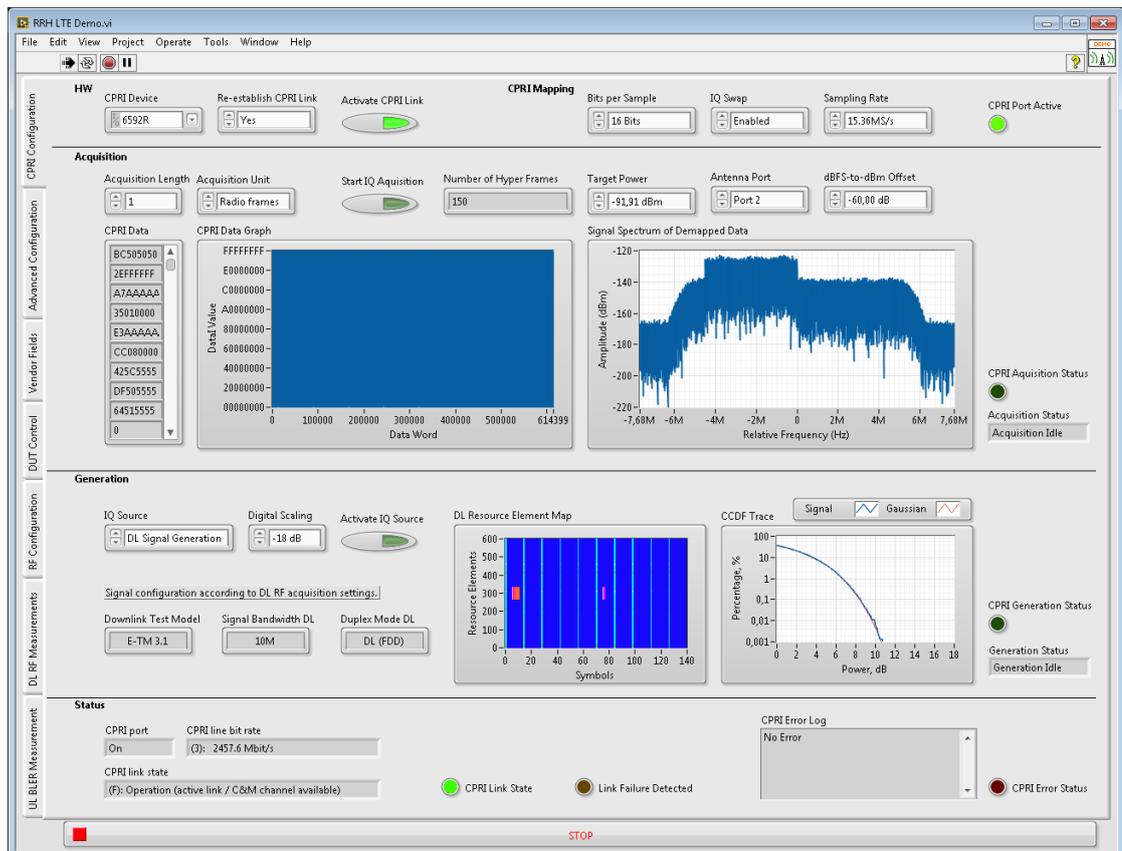


Figure 1 CPRI Configuration

Establish the CPRI link with the “Activate CPRI Link” button

- On first call after powering-up the PXI system the FPGA image for the 6592R will be loaded which takes a few seconds
- Verify that there is no error shown in the CPRI Error Log
- Check that CPRI Port Active and CPRI Link State is showing a green LED
- The Status section also shows the current line bit rate and CPRI link state
- If Re-establishment CPRI Link is set to Yes, the CPRI fiber cable can be removed and re-attached interactively. The current status will be updated in the GUI.

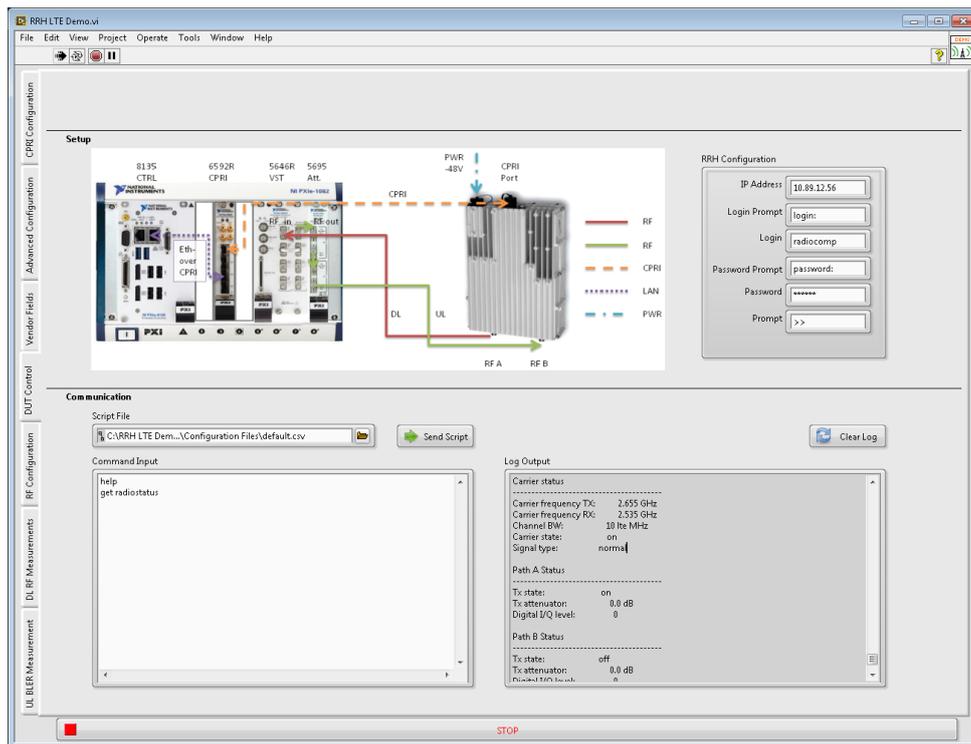


Figure 2 DUT Control

- Check the Ethernet connection to the RRH by issuing the *help* command
- If the connection is valid, send the initialization commands to the RRH by using the Send Script button. This needs to be done only once after powering-up the RRH
- Other commands can be used at any time, e.g.
  - *get radiostatus* to show current RF frequencies and RF bandwidth
  - *get linkstatus* to show status of the CPRI link
- The setup drawing shows an overview of the RRH test setup using the PXI platform
- Do not change the RRH configuration unless you know what you are doing!

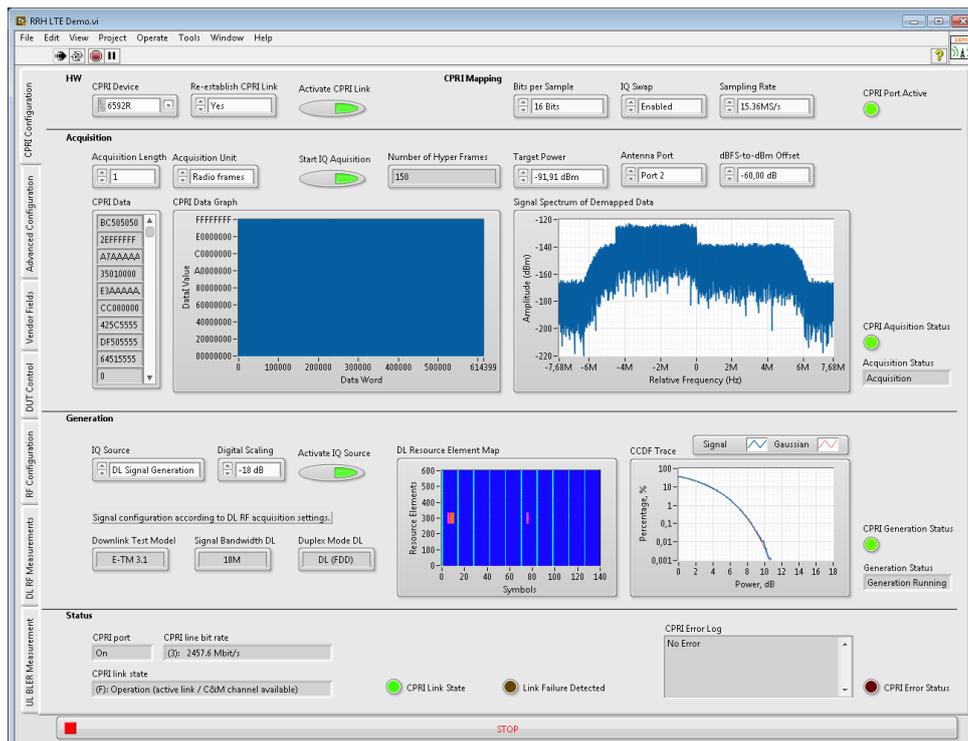


Figure 3 CPRI Signal Generation and Acquisition

- Single acquisition of the CPRI data stream and contained signal can be carried out with the Start IQ Acquisition button. The state of the acquisition is indicated with a LED and a textual display. The CPRI frame data is provided as an array and as a data graph. The spectrum of the de-mapped IQ samples is provided as well. The target power of the received signal at the RRH can be set according to the RF configuration within a range of about 27dB. The acquisition length is limited to 10 radio frames (10 ms) to limit memory consumption.
- For signal generation select the type of signal to be generated. The possibilities are a CPRI frame read from file, a generated DL LTE test signal or a single/multi tone signal. In case of DL LTE test signal, the resource map and the CCDF of the generated signal is shown. The signal generation is started with the Activate IQ source button and remains active until the button is disabled again. The Digital Scaling can be used to adjust the (digital) power of the signal (e.g. for the RadioComp use -18 dB for DL LTE signals and -36 dB for CW signals). Similar to signal acquisitions, the state of the generation is indicated with an LED and a textual display.
- The configuration of the DL LTE signal, e.g. bandwidth, duplex mode, test model, depends on the settings for the DL analysis which can be found on the RF Configuration tab.

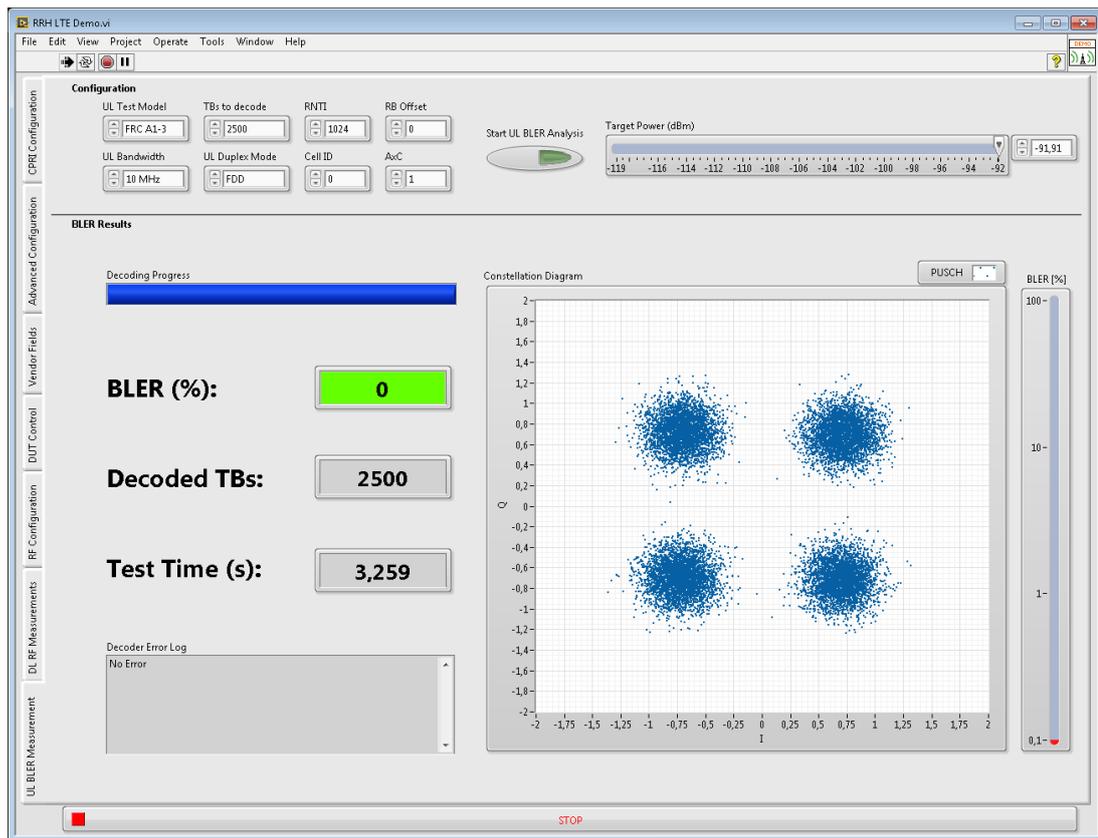


Figure 4 UL Bler Measurements

- This tab is used to carry out UL BLER measurements which involve decoding the actual contents of the received signal from the RRH!
- The default settings are matching the ones from the RF configuration tab and reflect the parameters of an RX sensitivity test according to 3GPP TS36.141 with a target of less than 5% of BLER (more than 95% of data throughput)
- The total test time for 2.5 seconds of the test signal is less than 5 seconds including fetching the data from the RRH and the PXIe-6592R (also includes processing time required for the GUI), the actual decoding is just about 2 seconds.
- BLER, Decoded TBs and the PUSCH constellations are updated on a LTE subframe basis (1ms).
- Select the received power at the RRH with the slider. The range is derived by the programmable RF attenuator, the RF output power at the VST RF out and the external attenuation.

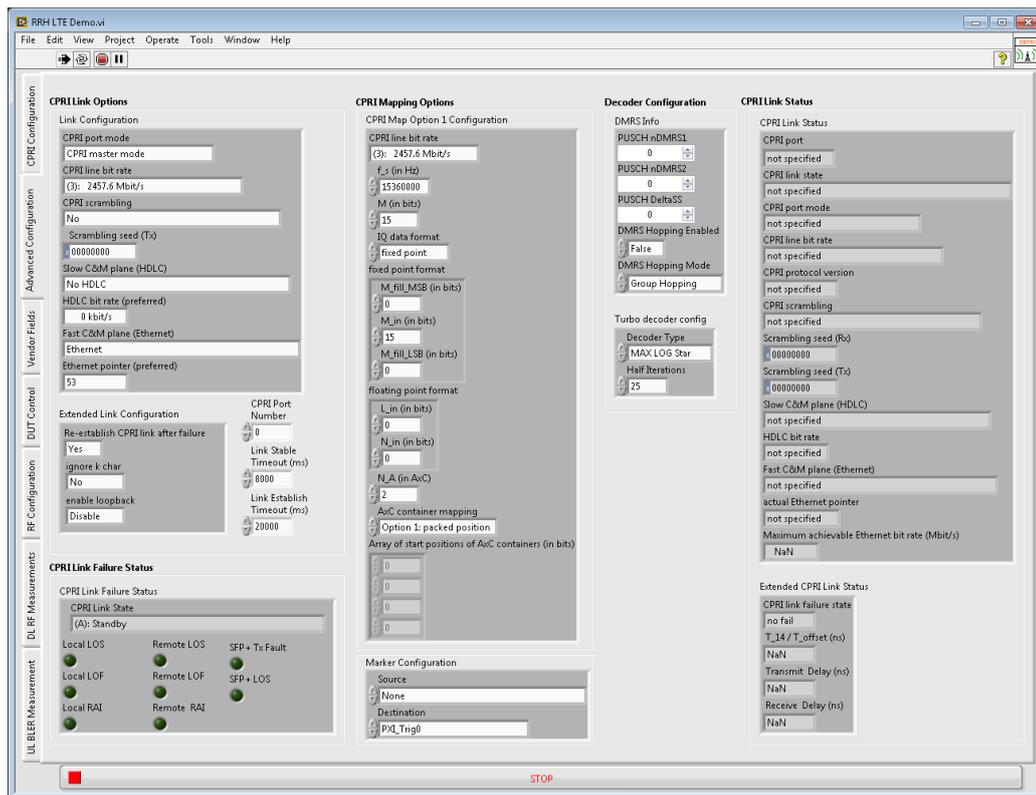
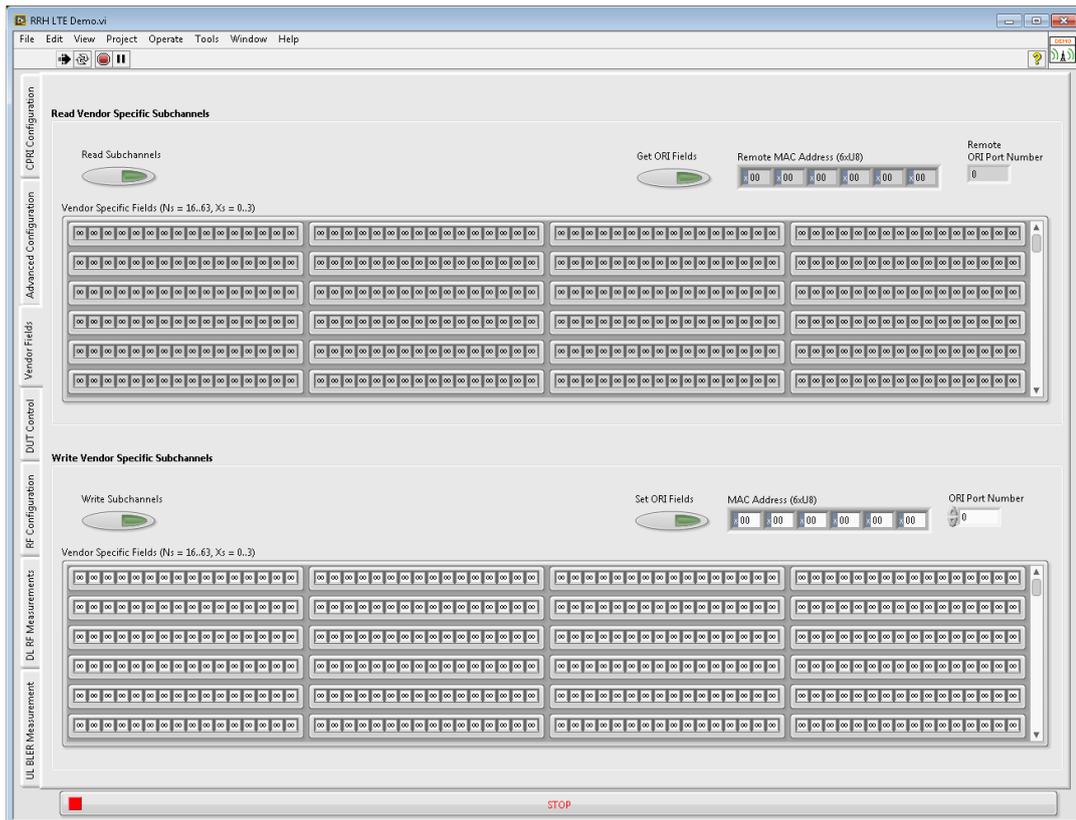


Figure 5 Advanced CPRI Configuration and Status

- This tab offers setting of advanced configuration options
- The “CPRI Link Option” section contains settings for the CPRI link, e.g. master/slave mode, line bit rate, slow/fast C&M plane configuration. Additionally, extended settings like loopback mode and selecting CPRI port are available. Furthermore, certain timeouts for the CPRI link establishment can be changed.
- The “CPRI Mapping Options” contains settings for the mapping (and de-mapping) of IQ data into the CPRI frame format, e.g. bit width, numeric representation, number of AxC, AxC container position.
- The “CPRI Link Status” shows detailed information about the status of the CPRI link, including information about the negotiated line bit rate, C&M plane settings as well as information about certain delays.
- The “CPRI Link Failure Status” displays the last CPRI link status before the link failure was detected. It can give some hints what would have caused the link failure.
- The “Marker Configuration” control can be used to specify an event signal that is exported to a front panel connector or to the PXI backplane.
- The “Decoder Configuration” allows tweaking specific parameters related to the UL decoder. The “DMRS Info” parameters control certain aspects of the demodulation reference signal. The “Turbo Decoder Config” changes the behavior of the turbo decoder.



**Figure 6 Configuration of Vendor Specific Fields**

- This tab can be used to read and write the CPRI subchannels that are defined for vendor specific data. Vendor specific data starts at subchannel 16 and can span up to subchannel 63 depending on whether fast C&M is used and what configuration is used for the fast C&M (Ethernet pointer). Each vendor specific field can use up to 16 bytes (line bit rate 8). For lower line bit rates the number of useable bytes is lower than 16 bytes. Please refer to the CPRI specification for additional details.
- Use the read subchannels button to read in all subchannels defined for vendor specific data. The rows mark the parameter  $N_s$  (16 to 63) while the columns define  $X_s$  (0 to 3). Please note that the upper rows might be used by Ethernet and may not contain useful vendor specific data.
- Use the write subchannels button to write vendor specific data for all subchannels that are defined for vendor specific data. The rows mark the parameter  $N_s$  (16 to 63) while the columns define  $X_s$  (0 to 3). Please note that the upper rows might be used by Ethernet and may not be used for vendor specific data. Each vendor specific field can use up to 16 bytes (line bit rate 8). For lower line bit rates the number of useable bytes is lower than 16 bytes. Vendor specific data can be written as soon as the CPRI session is active such that the data is already available during CPRI link establishment.

## 6 User Interface

Refer to context help for details

## 7 Contact Information

<http://testteknik.se/>

Support contact:

[support@testteknik.se](mailto:support@testteknik.se)

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