Industry's only high-resolution portable TDR

SLIDES ONLY

NO SCRIPT PROVIDED

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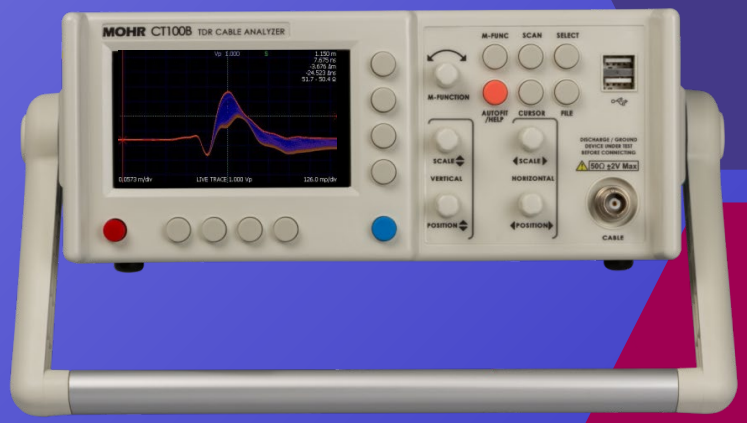
MOHR™ CT100B Technology

Locate & Characterize cable problems in seconds – with millimeter accuracy **01**

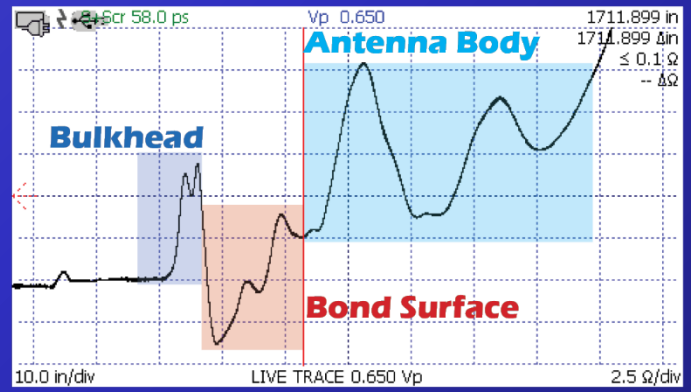
Diagnose any Metallic System, Cable, or Sensor **02**

Locate Intermittent Faults **03**

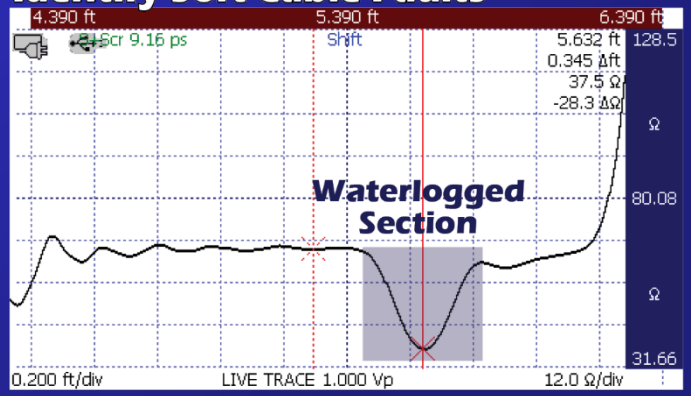
Digitally Record and Archive for Preventative and Predictive Maintenance. **04**



Analyze Antenna Installation



Identify Soft Cable Faults



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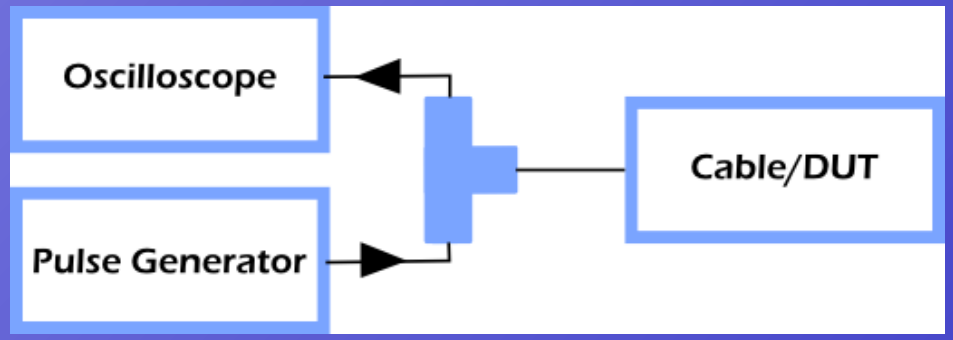


TDR is a specialized form of closed-circuit radar (cable radar) developed for characterizing transmission lines, and is particularly useful for testing coaxial and twisted pair cables and connectors found in modern microwave/RF and digital communications systems.

A TDR can be thought of as a combination of a pulse generator and an oscilloscope.

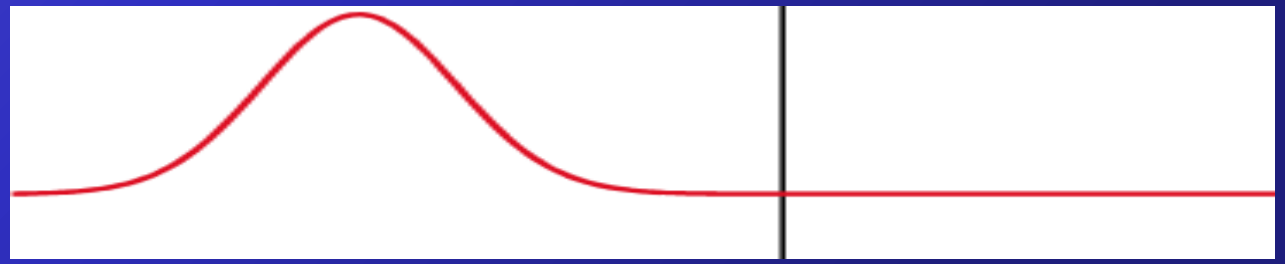
The pulse generator injects a wideband test signal into a cable, and the oscilloscope records the resultant reflections caused by impedance variations along its length.
There are two types of TDR's – Pulse TDR, and Step TDR.

<u>The CT100B is a Step TDR, creating a fast rising edge (60ps) followed by a voltage plateau.</u>

This provides both high spatial resolution and high signal energy for long-rage propagation.

Because Step TDR's use a continuous excitation source, impedance variations along the cable are clearly defined as changes in the reflected voltage.

No impedance limits, continuous live calibration (no warmup)



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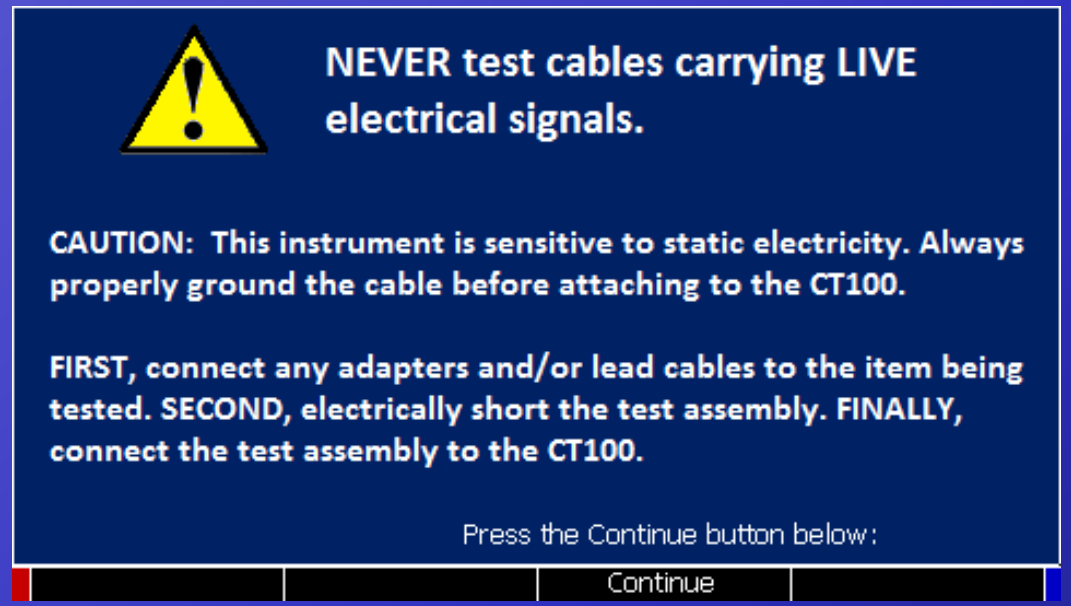
STATIC CHARGE CAUTION

Any wire or cable can carry a significant static electric charge.

It is essential to discharge any cable or device **BEFORE** attaching it to the CT100B.

This is easily done by shorting the DUT conductor to the shield.



Failure to properly discharge a Device Under Test (DUT) prior to testing may cause damage to the CT100 High-Frequency components and void the Warranty.

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Using the CT100B

Basics

- Start-up and Front Buttons
- Distance to Fault Measurements
- Connector-Level Detail

Four Use Cases

- Troubleshooting Antennas
  - Save and Recall Scans – Manual & Automatic Set-up
- Aircraft & Engine Wiring Harness
  - Pin & Socket Set useage
- 1553 Data Busses
- Intermittent Fault
- Instant Pass/Fail Testing

Wrap-up / Questions

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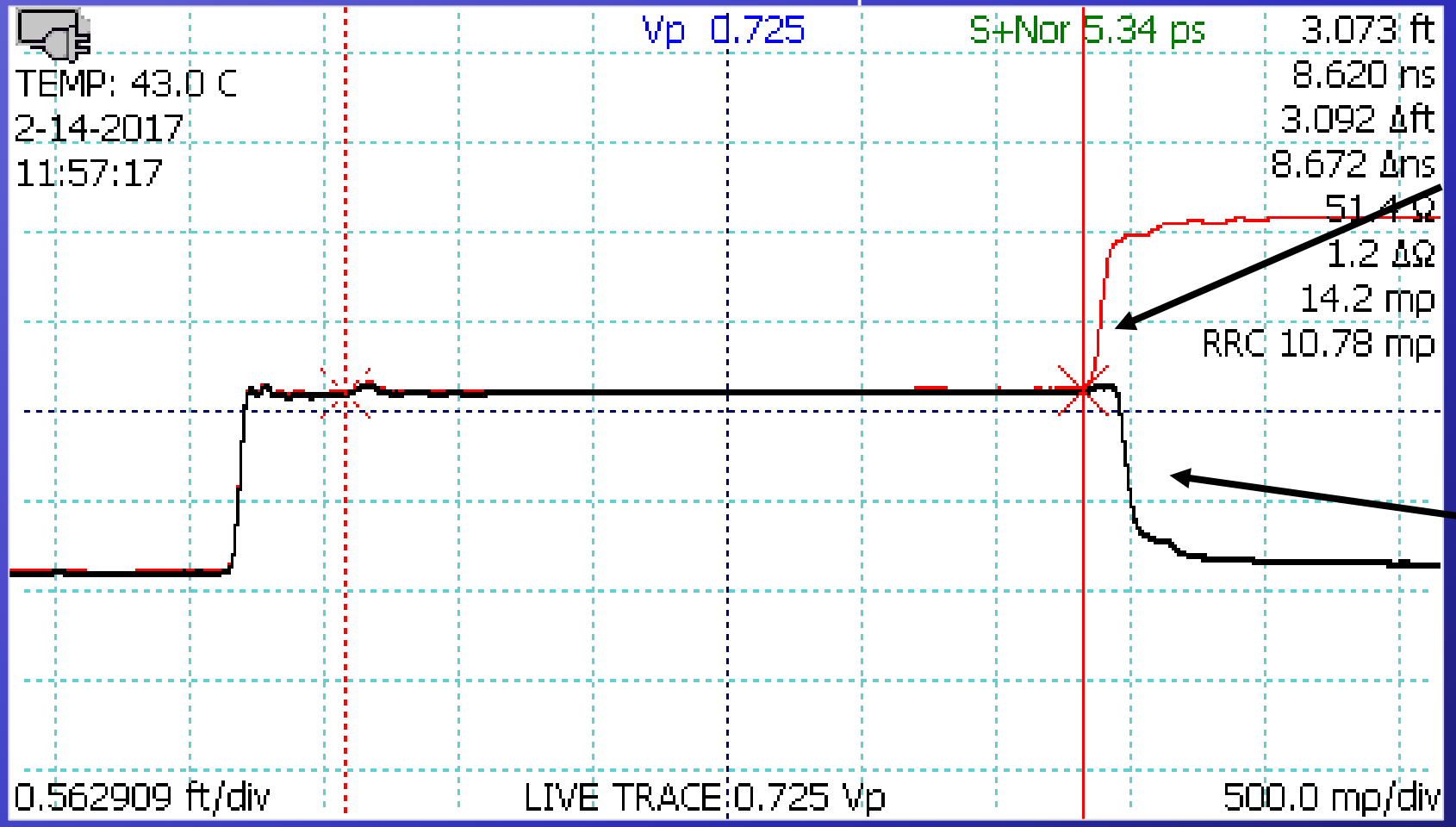
Distance to Fault Measurements
Open/Short & Vp

Three Termination Types – Open, Short, Load

Distance is determined by cable properties – the Velocity of Pulse (Vp)

Distance = V_p x time



Open indicated by sharp rise

Short indicated by sharp fall (note cable is slightly longer because we added a barrel connector and a short)

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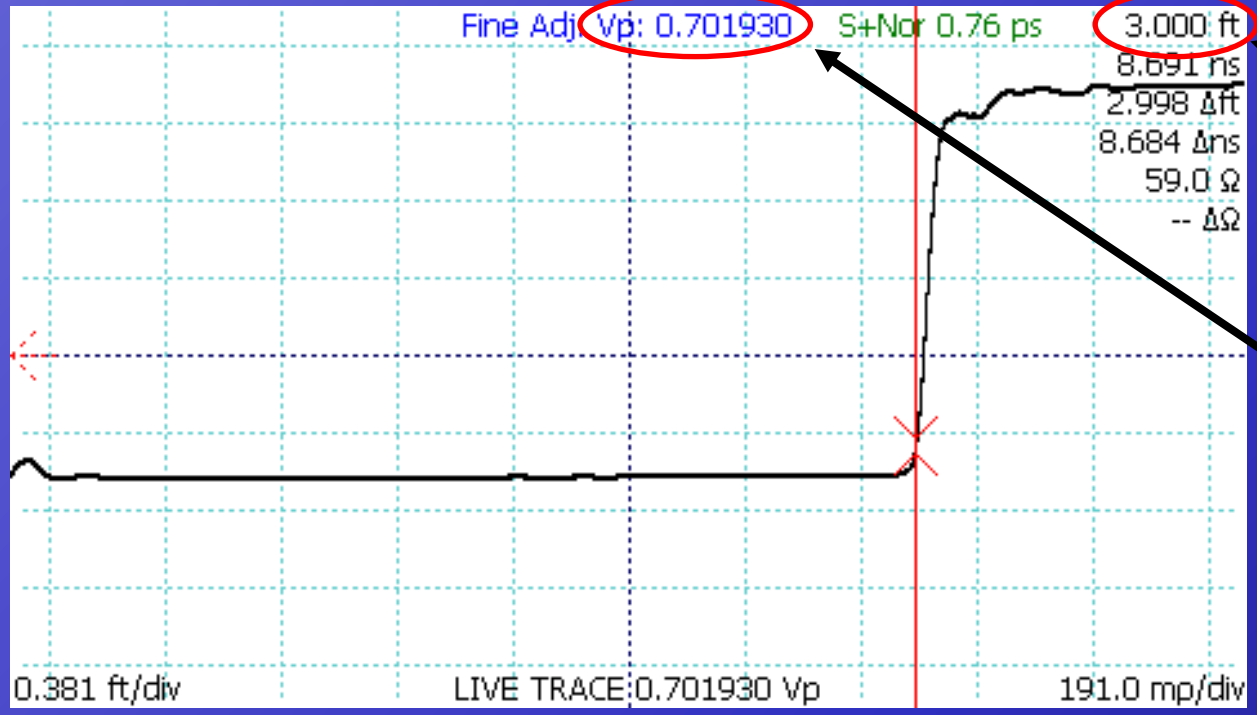
Distance to Fault Measurements

- Localizing a known or suspected fault is often the most important task in field maintenance. TDR's measure Distance to Fault (DTF) natively, and measurements are simple and quick.
- Distance to Fault measurements are performed by transmitting an incident signal onto a cable and measuring reflected voltage. Distance to Fault measurements are made by accurately measuring the time between an incident pulse and its reflections.
- The CT100B TDR's feature an internal clock with 0.76picosecond resolution – equivalent to 0.003in (75 microns)



Length measurement in both time and distance. The value is measured in nanoseconds and converted to distance by multiplying it by the cable velocity factor (V_p).

Vp is a fraction of the Speed of Light, and has a different value for different cable types.

Distance = V_p x time

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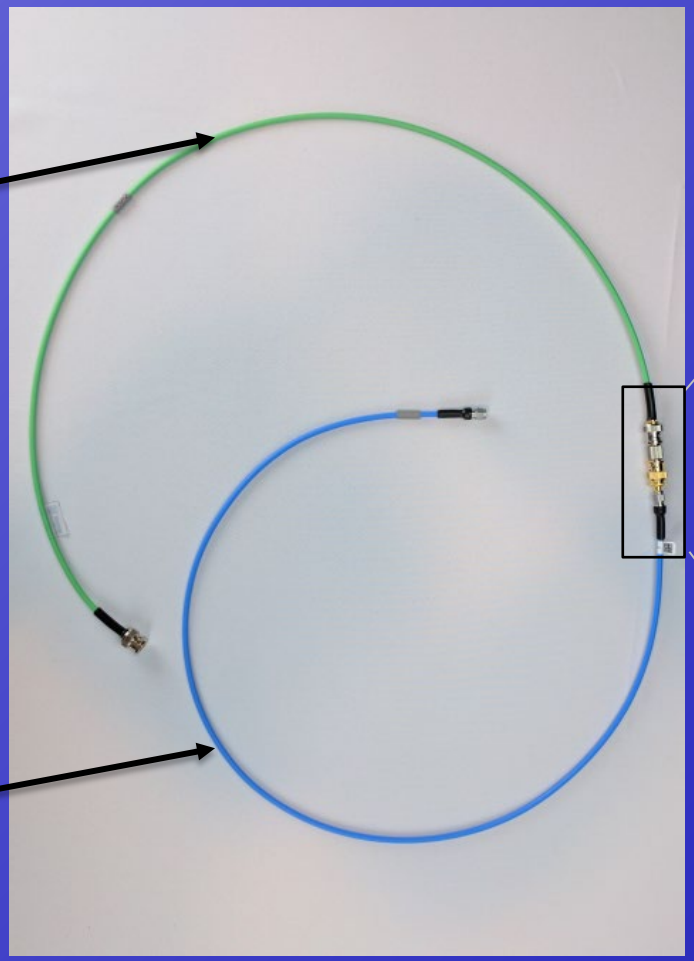
Connector-Level Details

This is a simple example of measuring two cables and a connector to serve as a baseline for the usability and capability of each device.

3 Foot 50Ω BNC Test Cable connected to tester



3 Foot 50Ω SMA Test Cable

3 Foot 50Ω BNC Test Cable

Female BNC to Female BNC Adapter

Male BNC to Female SMA Adapter

3 Foot 50Ω SMA Test Cable

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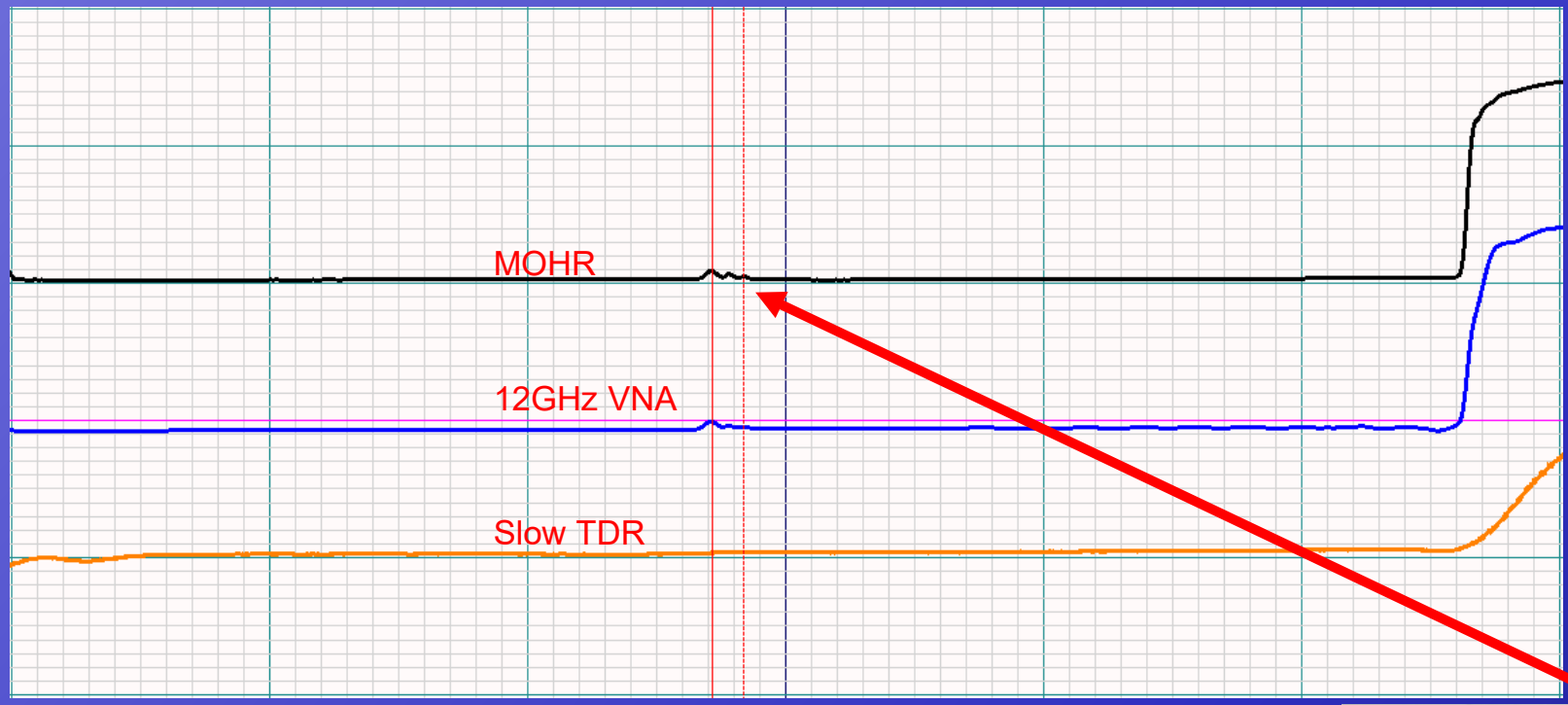
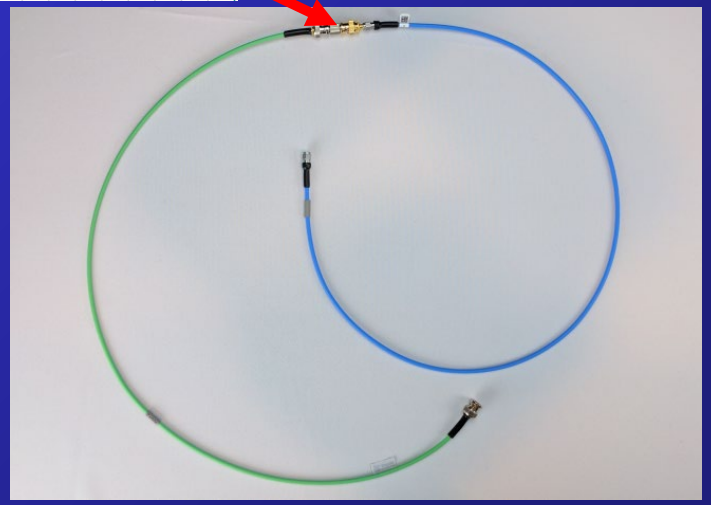
Connector-Level Details



Open at end of cable



- All three devices can find the ends of the cable and display the trace.
- Slower-risetime TDR's are not able to resolve the connectors
- MOHR CT100's and GHz VNA's can both identify the connectors between the two 3 foot test cables

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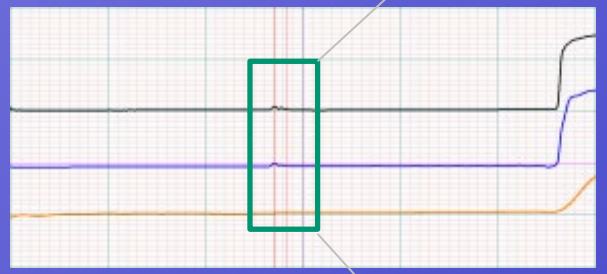
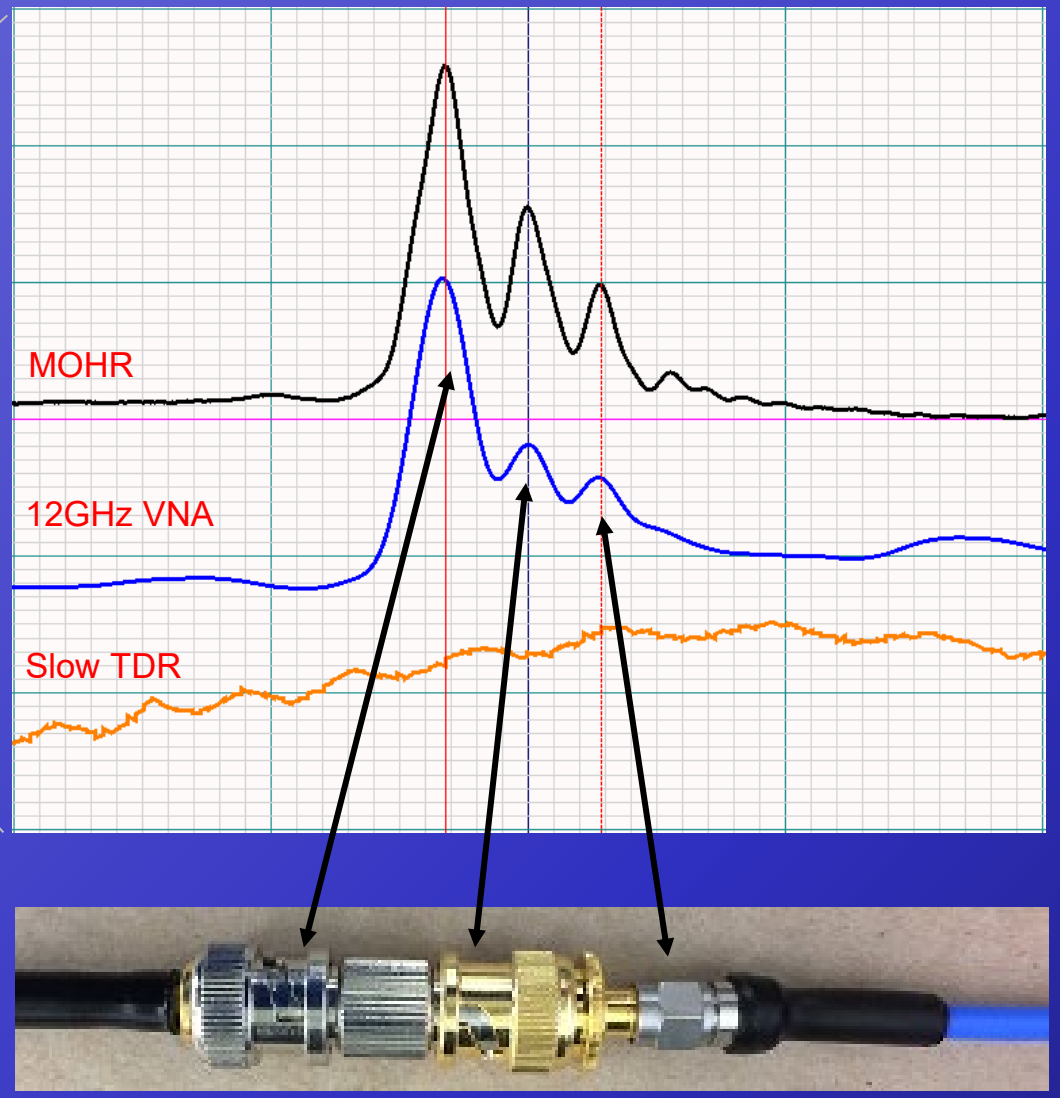
Zoom in to see details of the connector





Large peak is 4Ω higher than cable

- Slow TDR fails to show any connector details
- CT100 and VNA display details of all connectors within the test system

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Use Case 1: Troubleshooting Antennas

Quicklook – CT100B Set-up for Antenna Troubleshooting

CT-100B Set up checklist for Antenna Troubleshooting

- *Step 1: Short Cable for ESD*
- *Step 2 : Connect and torque termination as needed*
- *Step 3: Press Autofit*

- *Using Autofit, the CT100 will automatically capture the entire cable length including the antenna, interconnects, relays, etc.*

- *Step 4: Analyze trace signature to ensure Antenna is connected and waveform meets known pattern*

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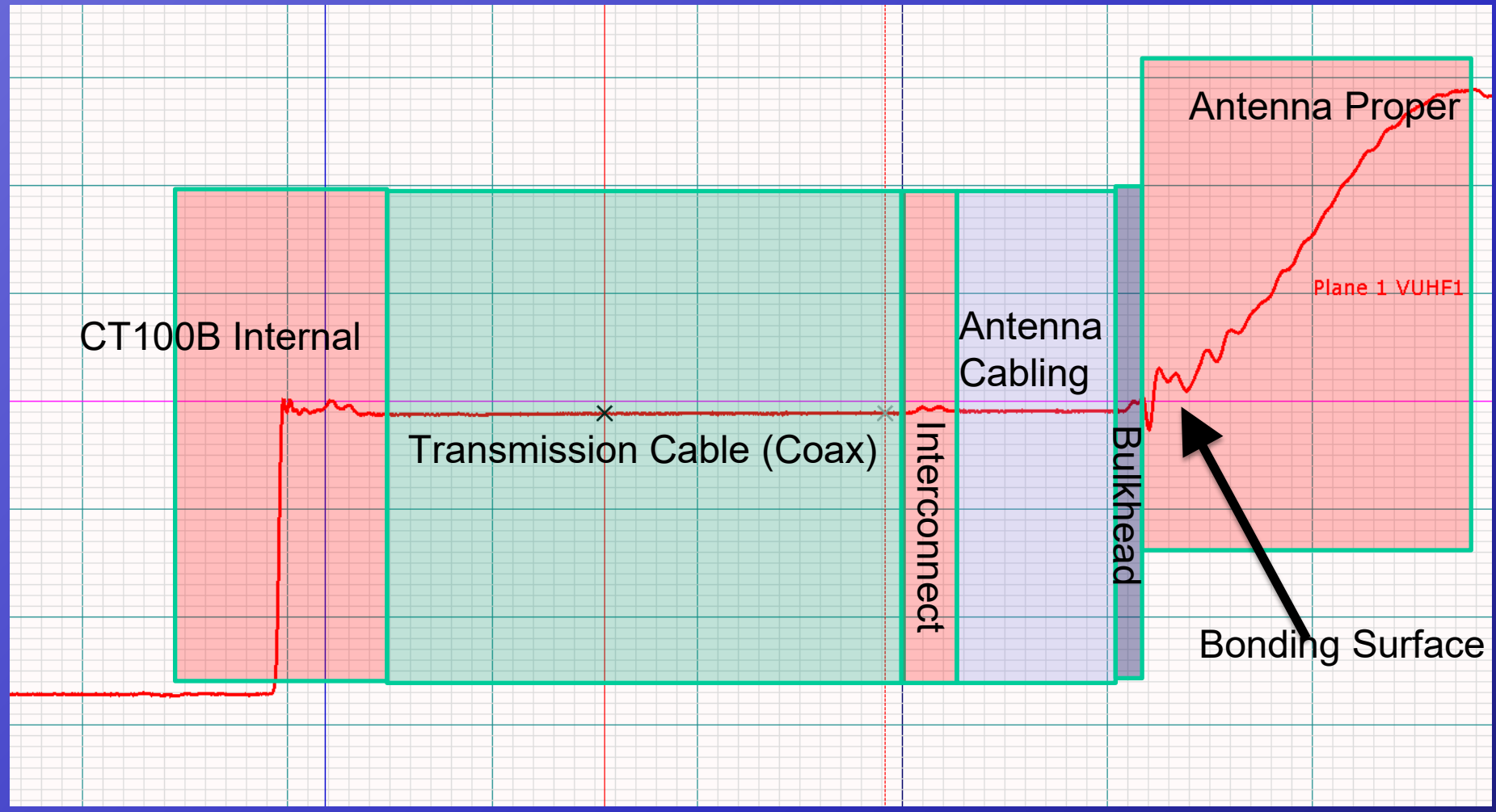
CT100B: Typical Graphic for Good Antenna



Discussion of Next Steps as a result of the Scan

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Manual & Automatic Set-up
Save and Recall Scans

- ✓ Use the same adapter every time
- ✓ When testing loose cables, test them in the same fixed configuration (e.g. flat, coiled, etc.)
- ✓ Use Configurations to minimize operator error if possible
- ✓ Helpful to have “Gold Standard” for untrained technicians.

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Use Case 2: Aircraft and Engine Wiring Harnesses

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Quicklook – CT100B Set-up for Harness Troubleshooting

CT-100B Set up checklist for Harness Troubleshooting

- ***Step 1: Short Conductors and Shield for ESD***
- ***Step 2 : Connect harness using impedance-controlled adapter (such as MOHR CT100-AK–PSP kit or custom interconnect)***
- ***Step 3: Press Autofit***

- ***Using Autofit, the CT100 will automatically capture the entire \ cable length including all connecting harnesses, interconnects, and devices, etc.***
- ***Step 4: Analyze trace signature to ensure Harness is continuous, impedances match, and system is complete.***

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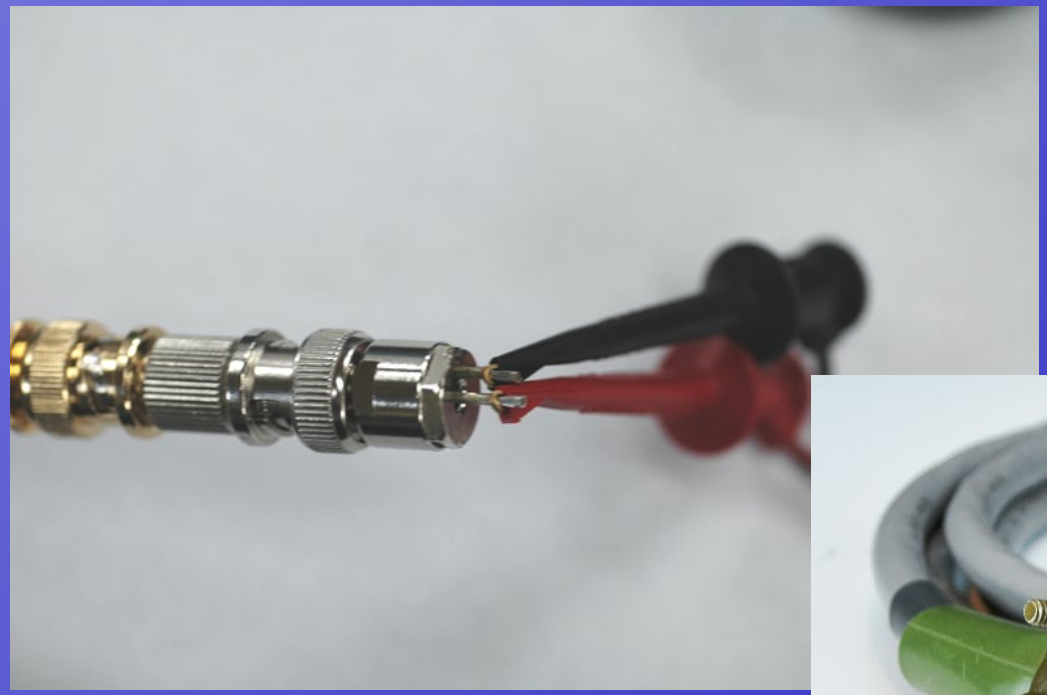
Pin and Socket Kit



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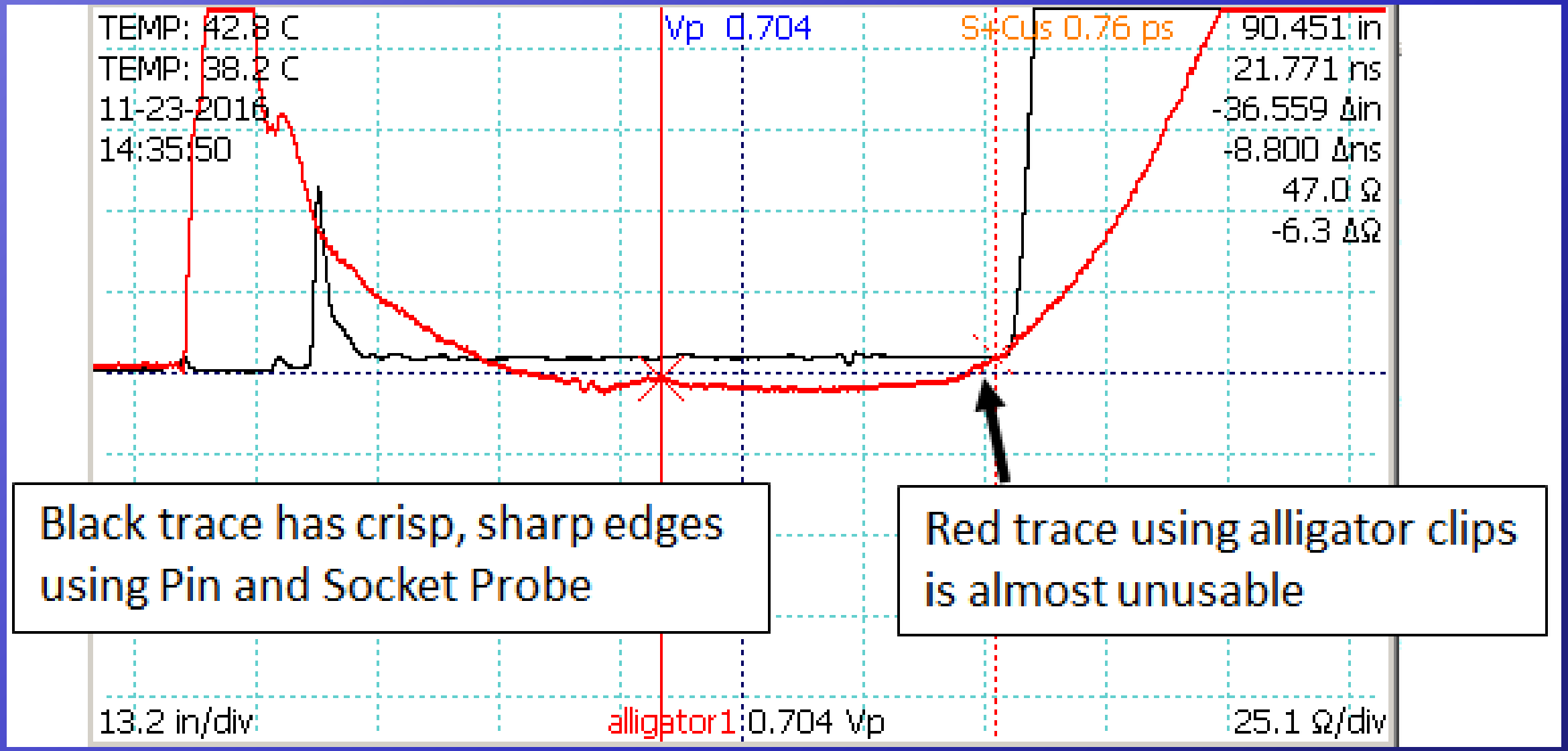
Pin and Socket Kit



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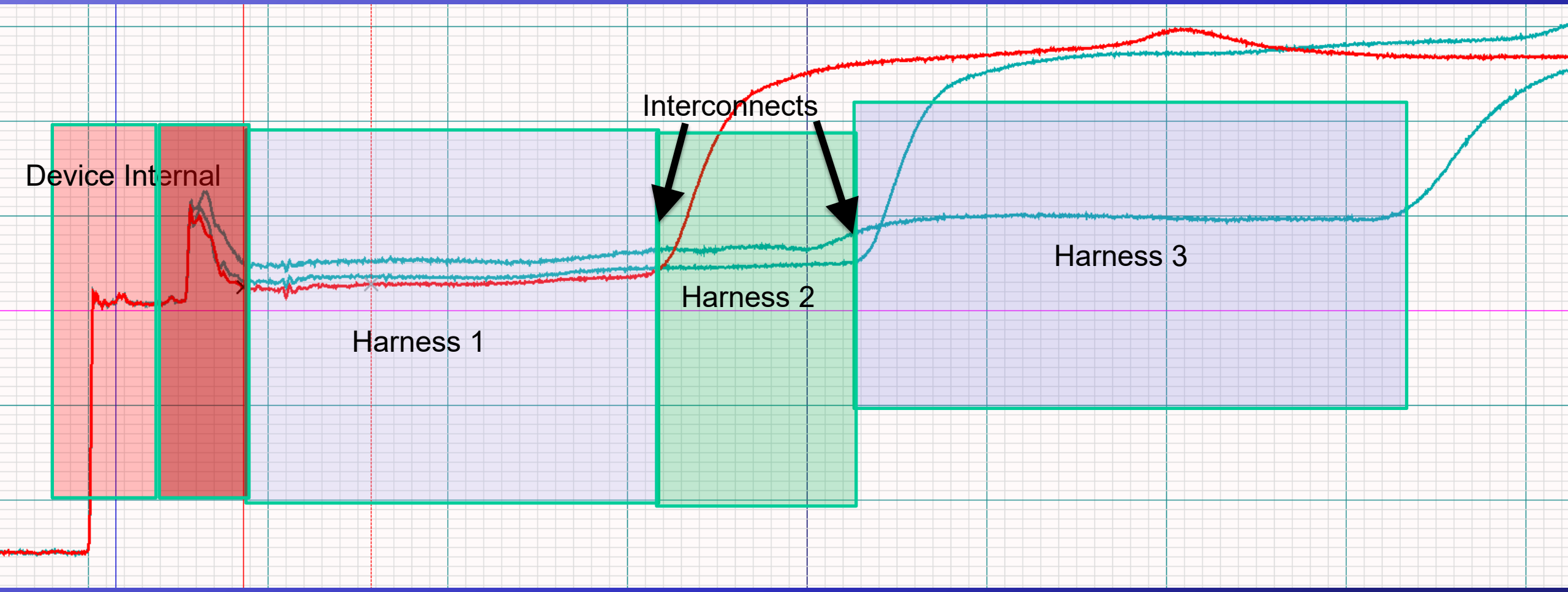
CT-100B: Typical Graphic for Multi-part Harness



Notice that Harness 3 is a different impedance than Harnesses 1 and 2.
This causes an energy loss, which in turn can cause timing delays or phase shifts

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Use Case 3: 1553 Data Bus

Quicklook – CT100B Set-up for 1553 DataBus testing

CT-100B Set up checklist for Databus / ARINC / Other networks

- *Step 1: Short Conductors and Shield for ESD*
- *Step 2: Connect harness using impedance-controlled adapter (such as MOHR 1553-TRB kit)*
- *Step 3: Scale trace manually using knobs/cursors (Autofit will not work)*

- *Step 4: Analyze trace signature to ensure Network is continuous, transformers are visible at stub locations, and system is complete.*

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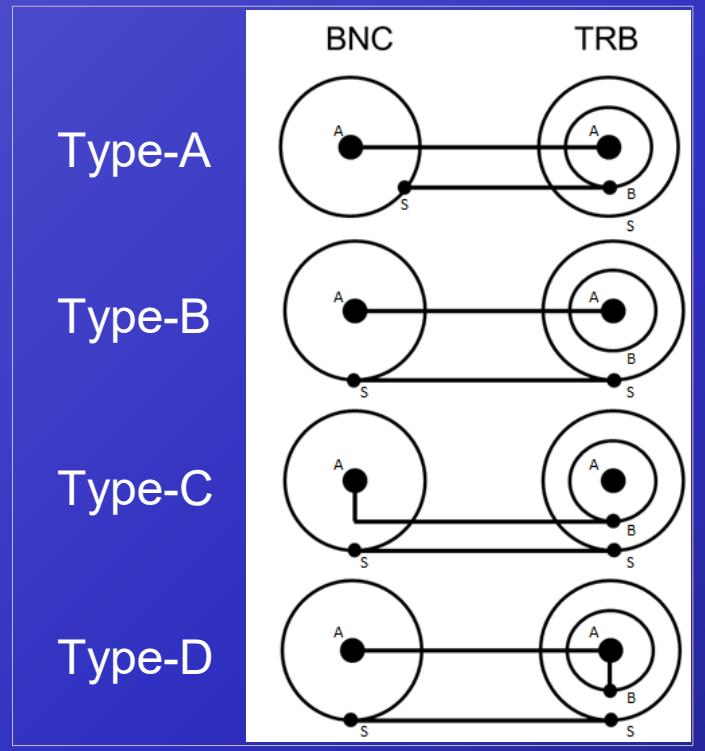
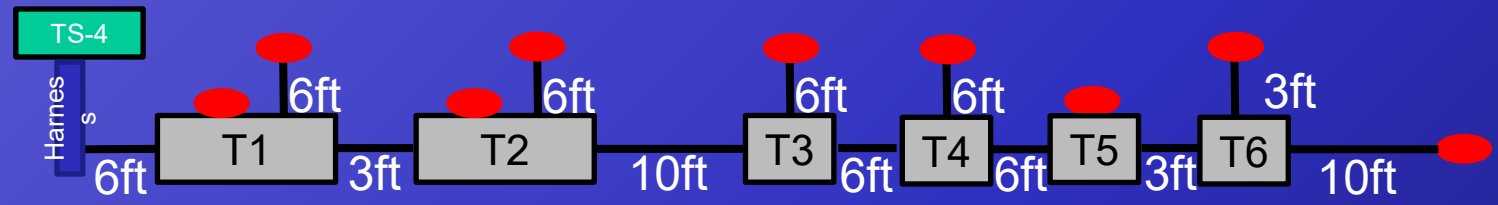
1553B TRB Adapter Kit

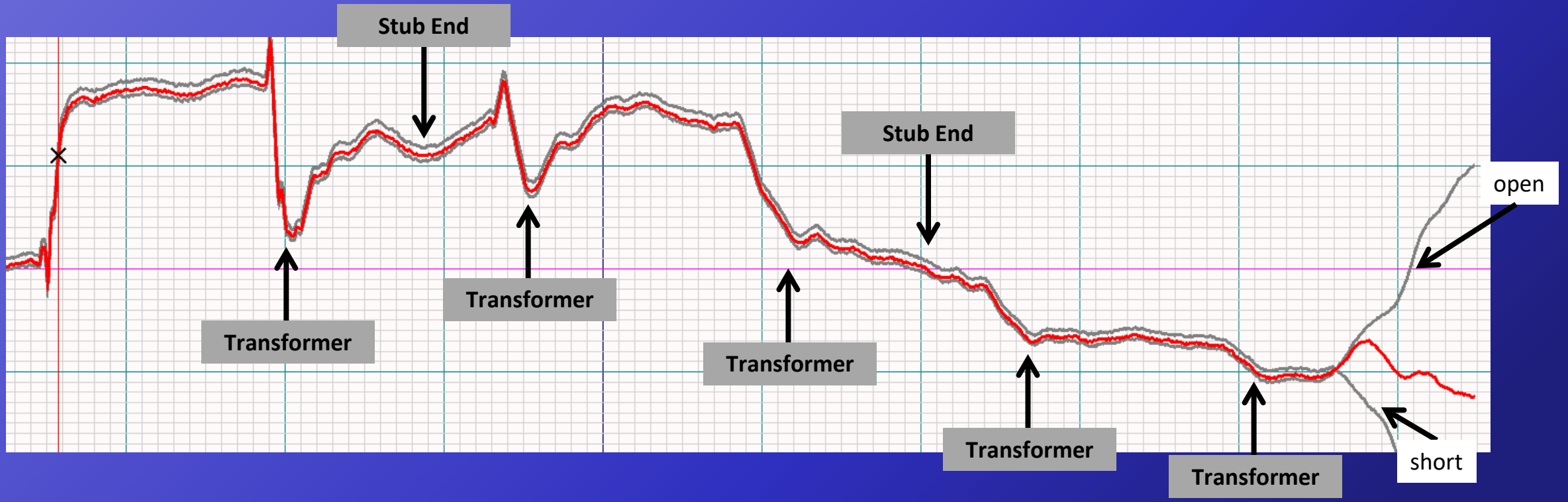


Contains a set of high bandwidth, controlled impedance BNC-TRB adapters.

- Type-A is for open/short and impedance mismatch between conductors.
- Type-B and Type-C are good general purpose and show the clearest signal when identifying system components.
- Type D is for identifying and locating shield damage.

1553B Analysis (Scans, using CT Viewer)





Using the CT100B and a **Type-A adapter** to scan the A vs B conductors. The red trace is the nominal trace that we see with a 78 ohm termination. You can see an open or short on the main bus through six transformers.

Distance to Intermittent Fault

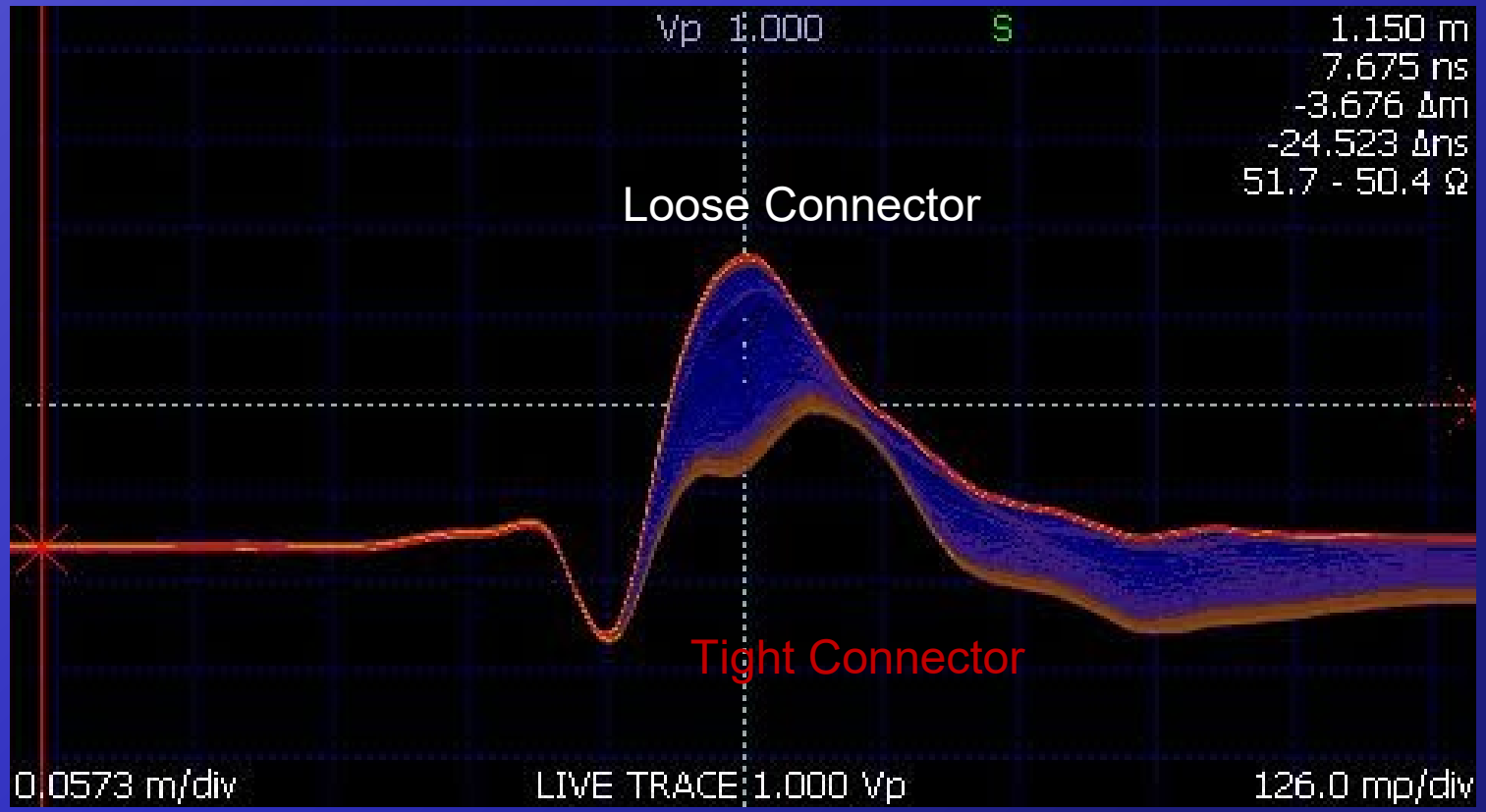
Envelope Plot

In cases where a fault may be intermittent, distance to fault measurements can still be performed, and the effects of the measurement may be evaluated. CT100B samples multiple times per second, and each sample can be displayed through the use of an Envelope Plot.

This allows a CT100B Operator to take Min/Max measurements, as well as determine the effects of the intermittent fault.

An Envelope Plot in Gradient mode will display the time-history of an intermittent fault, allowing the Operator to determine how often a fault occurs.

There is no time limit on Envelope Plots, so very rare events can be captured.



Instant
Pass / Fail Testing

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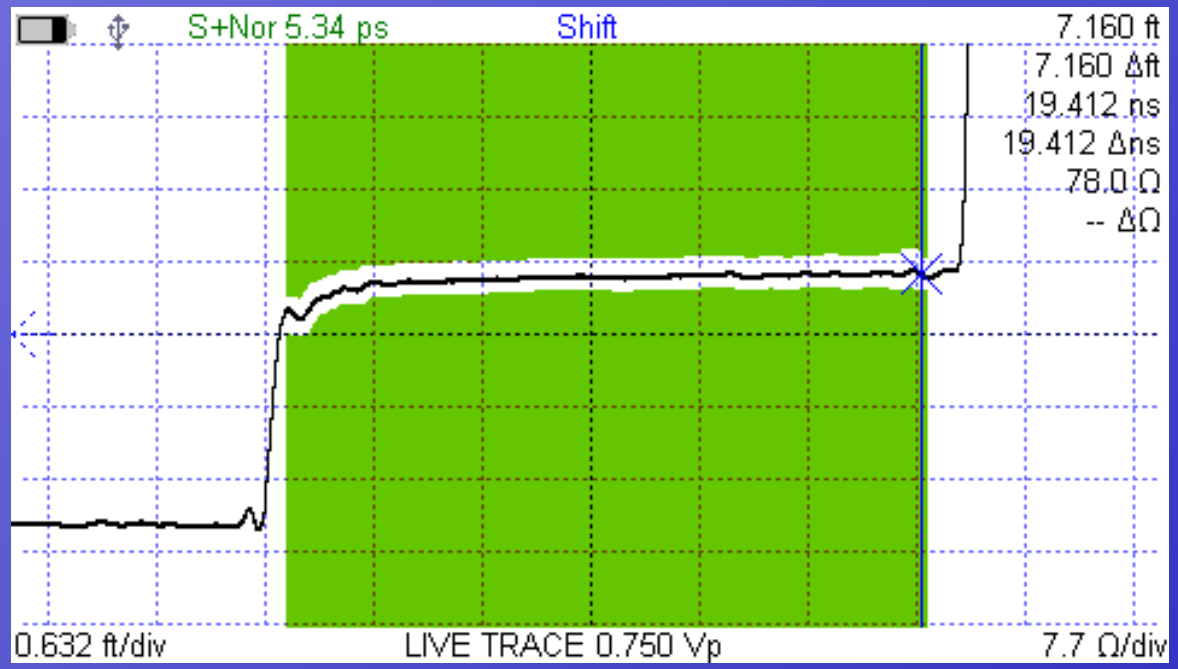
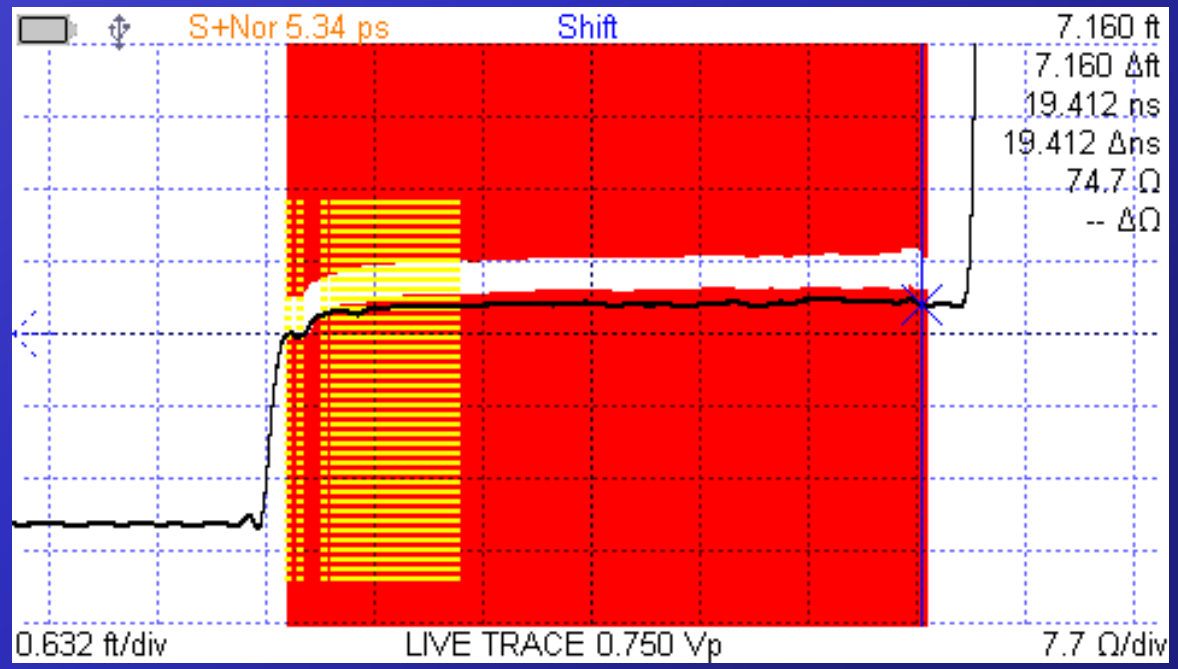
MOHR Instant Pass / Fail



Good impedance, correct length
Green Mask = Good cable

Correct length, Bad Impedance

Bad cable
Red Mask + Yellow fault location



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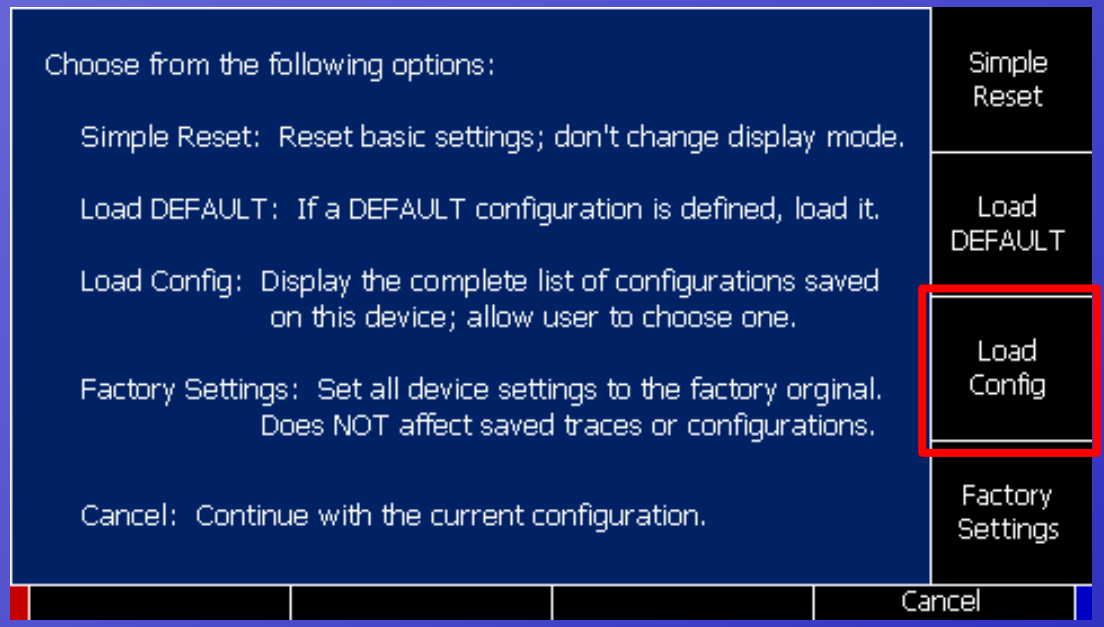
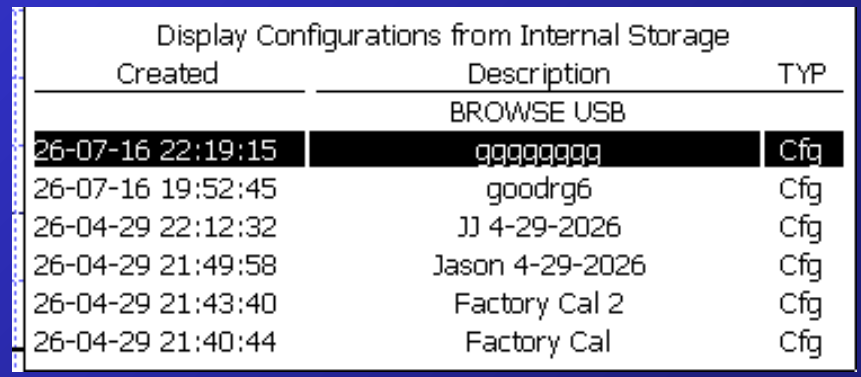
MOHR Impedance Masks

Instantly load test configuration for pass/fail testing, with a single scan, or directly off the device with minimal operator input



Load from the CT100 start screen

Load from Barcode



Just turn it on and Go.

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Wrap-Up

MOHR™ CT100B Technology

TDR is a specialized form of closed-circuit radar (cable radar) developed for characterizing transmission lines, and is particularly useful for testing coaxial and twisted pair cables and connectors found in modern microwave/RF and digital communications systems.

MOHR TDR Technology is uniquely suited to detect minor impedance changes such as interconnects / kinks / splices / mis-twists / waterlogging.

- **No impedance limits (0 to 1.5kohm)**
- **No minimum length – No dead zone, no “soft zone”**
- **Maximum length is over 10km**

The CT100B combines everything MOHR Test & Measurement has learned over the last 20+ years. For the Money, it is he best piece of troubleshooting equipment available

Reduce Component “No-Fault Found” occurrences to zero.
Use the best there is - the MOHR CT100B

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