



Innovation, Quality and Service
MIL-STD-1553 & ARINC-429

1553 Electrical Signals

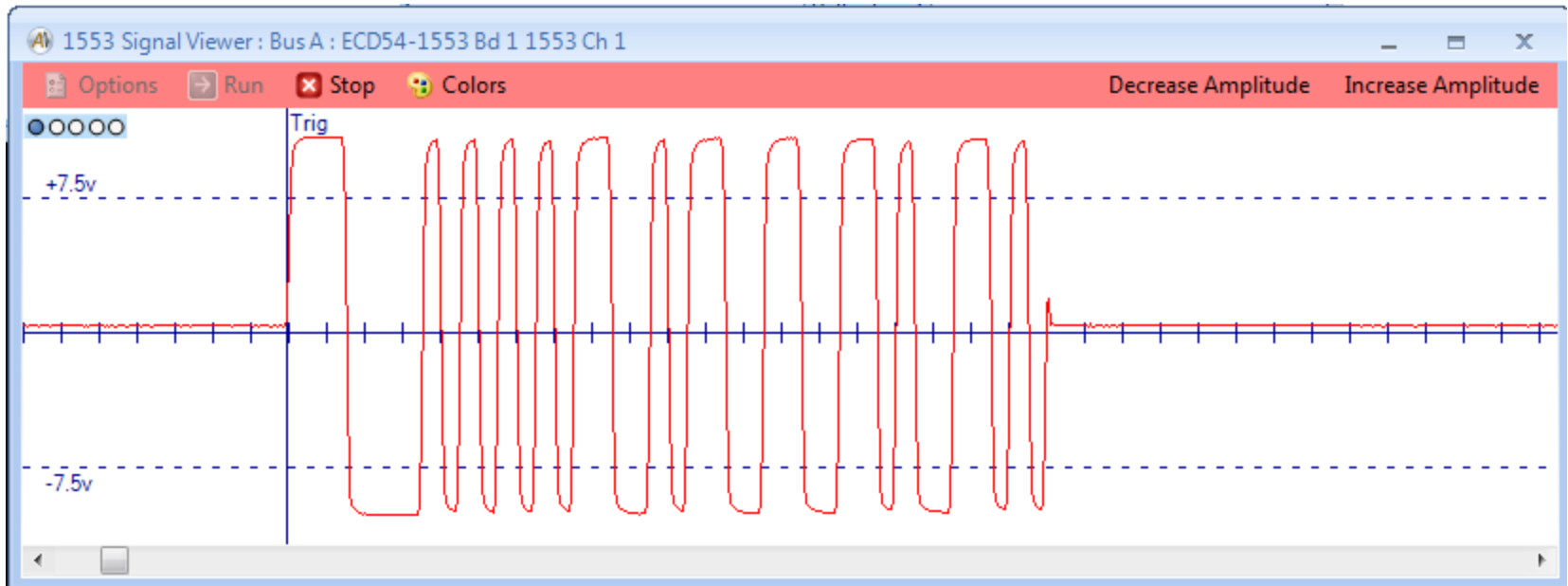
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Introduction

- These slides provide examples of typical 1553 electrical signals and discuss what can distort the signal.
- Reference – MIL-HDBK-1553A, Section 40

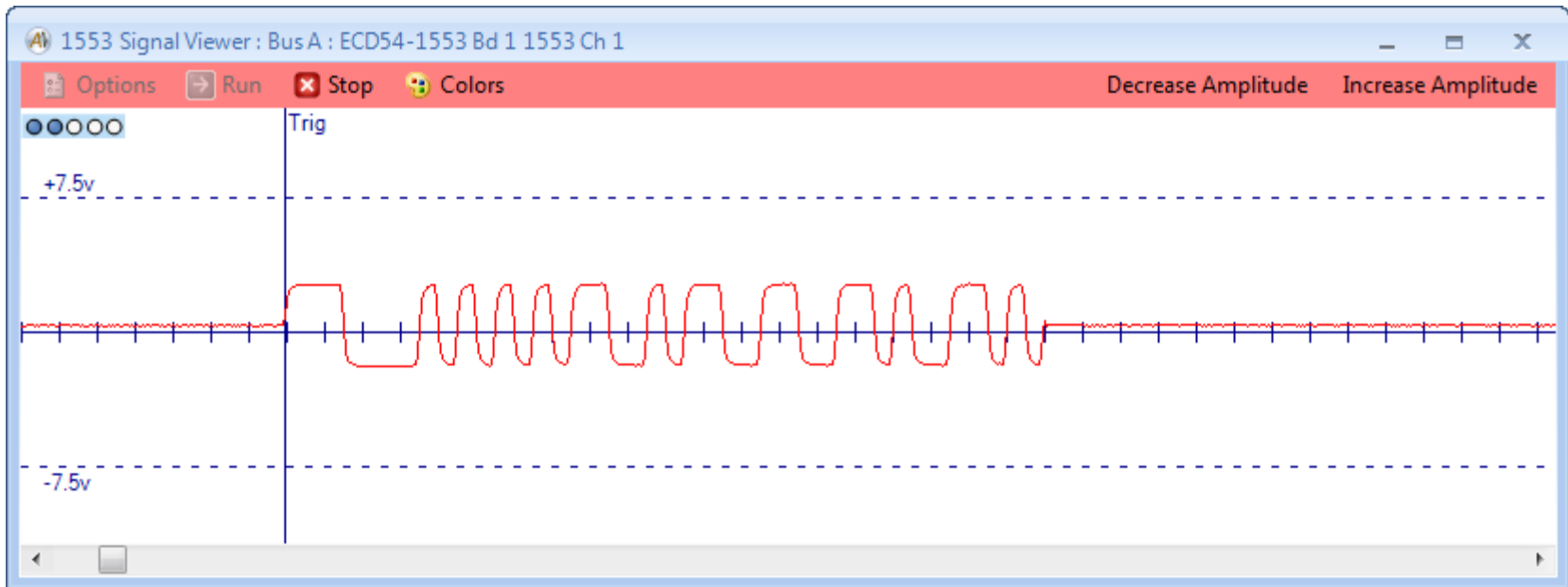
Good Signal – Transmitting Stub



MIL-STD-1553B 4.5.2.1.1.1 - Voltage output from a transformer coupled terminal shall be from **18.0** to **27.0** volts peak to peak.

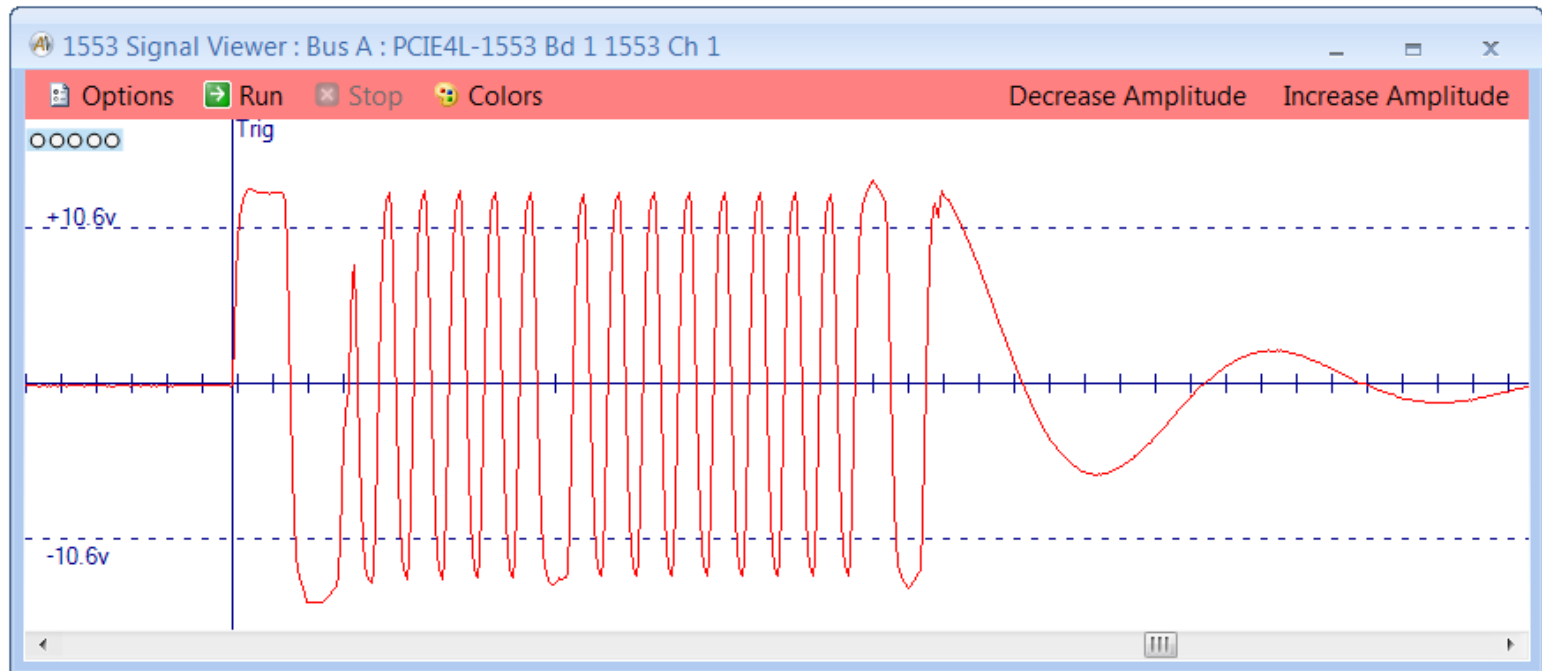
This signal is about 20 Vpp.

Good Signal – Receiving Stub



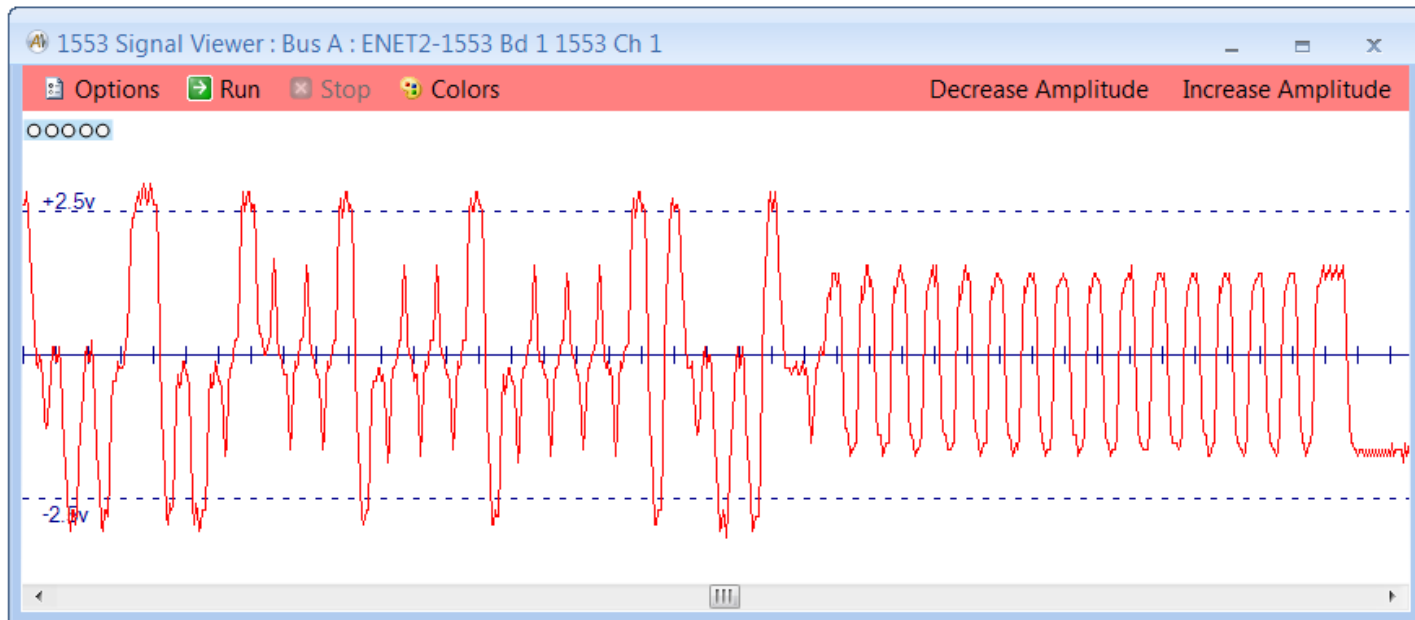
A 1553 signal passing through a transformer coupled bus will see $\frac{1}{4}$ of the transmitted voltage at the other (receiving) stubs. **This is normal.** This signal is about 5 Vpp. A terminal should accept an input signal from 0.86 to 14 Vpp (for a transformer coupled bus).
MIL-HDBK-1553A, 40.4.7.

Unterminated Bus



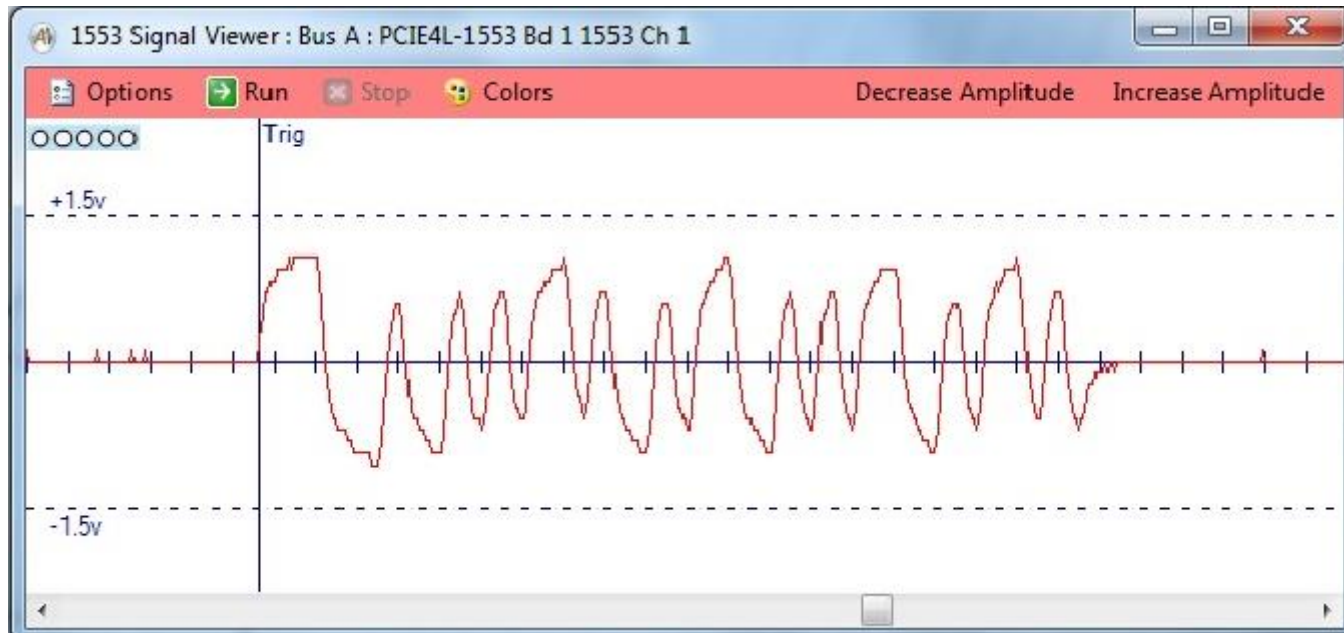
An unterminated bus will have higher amplitude signal with overshoot and ringing in the signal.

Bus Collision



A bus collision occurs when two terminals are transmitting at the same time. For example, this can happen if there are two bus controllers active on the bus.

Distorted Signal - Dispersion



A 1553 signal going through a **very long bus** is distorted by dispersion, where the higher frequency components are attenuated more than the lower frequency components. This can cause zero-crossing distortion.

MIL-HDBK-1553A, 40.6.3, figure 40-14, figure 40-15.

Voltage Effects of Bus Length

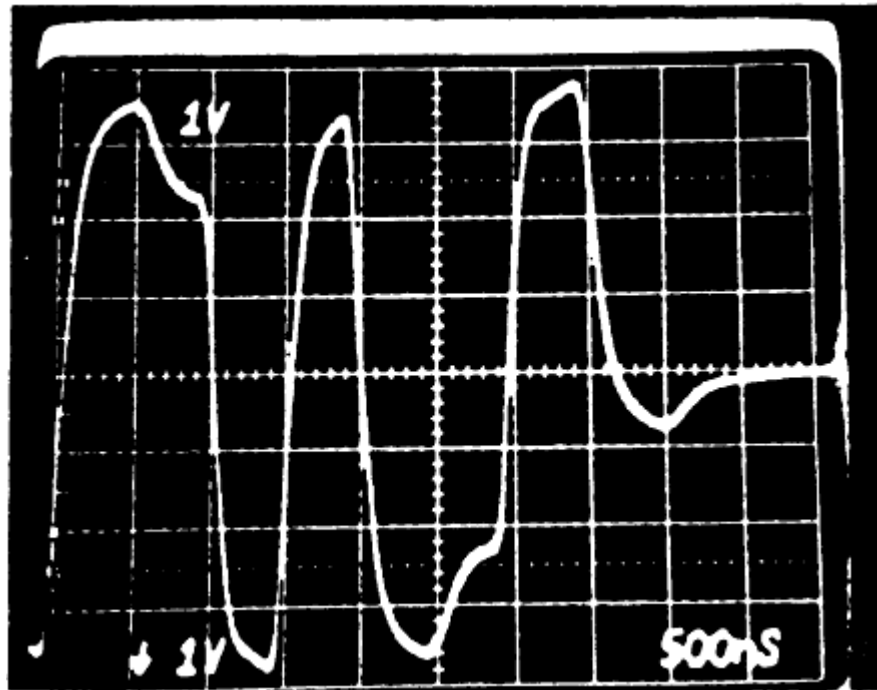
Cable resistive losses will attenuate the 1553 signal. For a 100-ft length of 78-Ohm cable (properly terminated), the resistive attenuation is:

$$78 / (100 * 0.52 + 78) = 0.94 \text{ or } 0.6 \text{ dB}$$

Uniform attenuation from resistive losses is usually not a problem, but should be considered in network design to ensure adequate voltage amplitude at the receiving terminals.

MIL-HDBK-1553A, 40.6.3.

Distorted Signal - Reflections



Every stub on a 1553 bus will reflect signals and can distort the signal seen at different stubs – all reflections change the shape of the wave tops. Reflections can cause zero-crossing distortion, and can be a problem when stubs are more than 156 ft from the receiving stub.

MIL-HDBK-1553A, 40.7, figure 40-19.

Design Guidelines

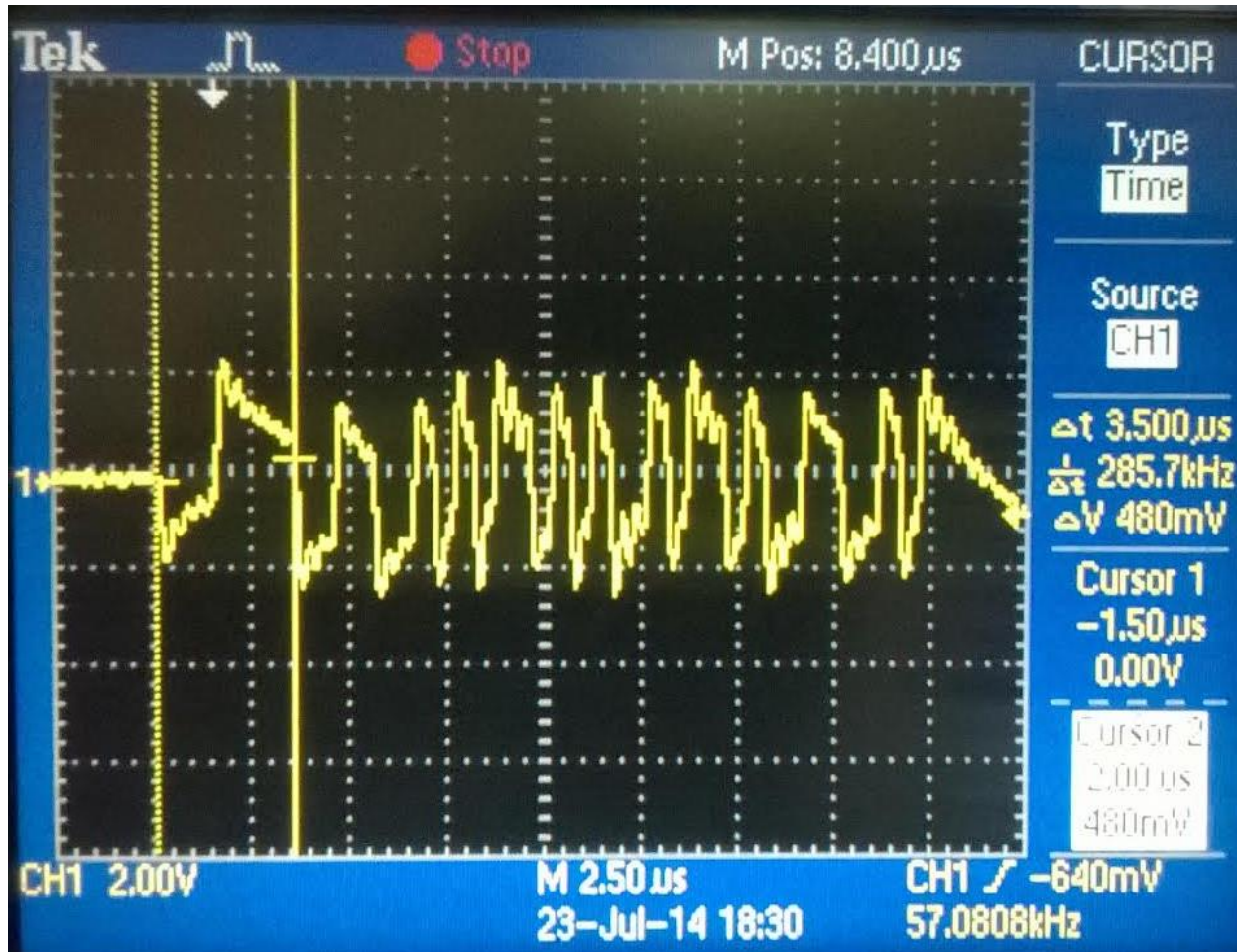
Bus Length – Keep bus length at short as possible. This will minimize zero-crossing distortion and lossy effects from the cable.

Stub Distribution – Spacing of stubs on the bus should be as uniform as possible. Collocating stubs causes an effectively larger mismatch at that point on the bus.

Cable Routing – Route the main bus cable so stubs are as short as possible. Distortion from stub reflections is worse with longer stubs. One coupler with a 15 ft stub causes about the same distortion as two couplers with 1 ft stub lengths.

MIL-HDBK-1553A, 40.10.

Bad Transformer/Transceiver?



(From SLN India, 23 JUL 14, unterminated bus)

They did something on their end and got a good signal - ???