AN216
Coaxial Cable Tee

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Abstract

This application note discusses the reflective events presented on a TDR's trace or plot when the TDR encounters a coax cable Tee with cable connected.

General

Coaxial cable Tee's are often encountered on coax networks whether they are permitted or not. The old Ethernet coaxial network, which ran on RG58 (50 Ohm), used Tees at every PC on the network, but didn't permit cable drops on the Tees. The Thicknet version used Tees at every network access point along the thick coax cable and RG58 drop cables to each PC. Tuning stubs are encountered on antenna systems and when done correctly, improve antenna performance. CATV cable should use splitters and not Tees as Tees cause picture ghosting and signal loss.

Whether a coaxial Tee is acceptable or not, TDR users should be aware of finding them and how they affect the TDR's trace. This is the same as a bridge tap on twisted pair cable or a tuning stub. In Figure 1, a TDR PC Vision view of the 20/20 TDR's plot, the red cursor at 13+ feet shows the distance to the stub/tap. The blue cursor at 25 feet shows the end of the shorter segment. If the stub/tap is shorter than the main line then it ends at 25 feet. However, it is possible that the stub/tap is longer than the remaining cable in which case the main line ends at 25 feet. The longer of the two segments ends at 33 feet, even though the impedance (Z) doesn't go to an open. In between 25 and 44 feet, the readings can be difficult to understand. This occurs because the signal splits between the two segments and they have multiple paths to travel around before returning to the TDR. In the case of a stub, you should have expected distances available to check against. In the case of an unexpected tap, remove the tap and take a new measurement.

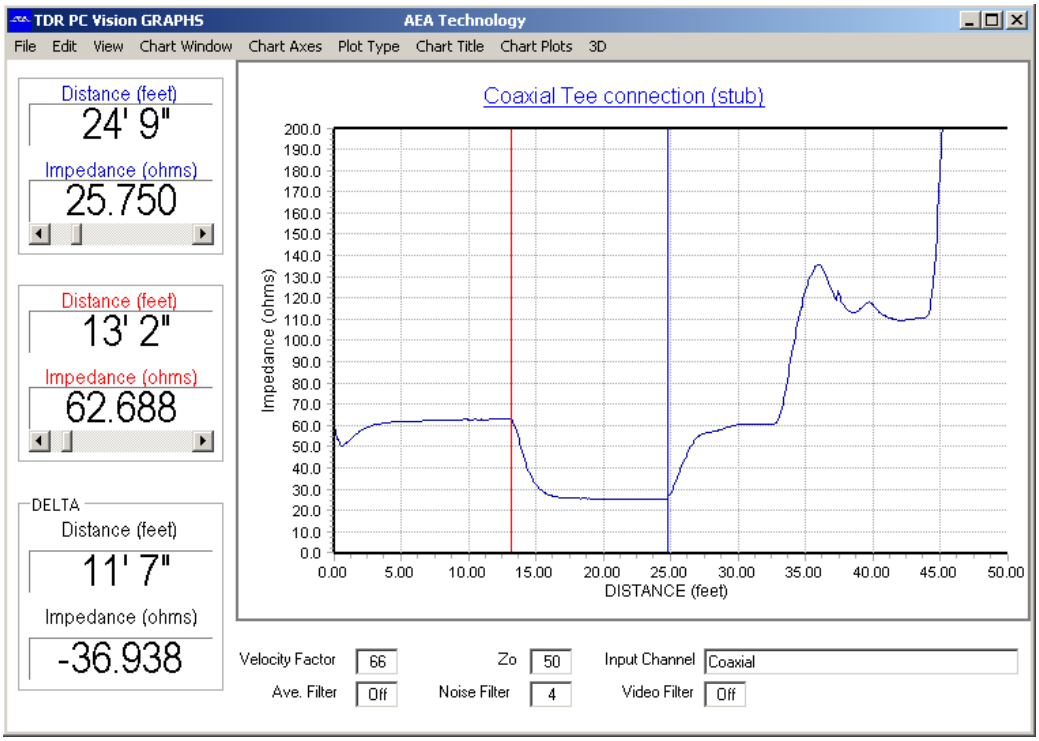

Figure 1

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Why Do Tees Present a Confused Display?

When a TDR is sending energy down a single cable and sending back reflections along a single path its trace is fairly strait forward. However, with a Tee involved there are not only two paths and two sources of reflections, but an issue of multiple energy reflections that are causing secondary and tertiary reflection themselves. Figure 2 relates to Figure 1 to show how the secondary reflections are being generated and why the cable's ends do not show a complete open.

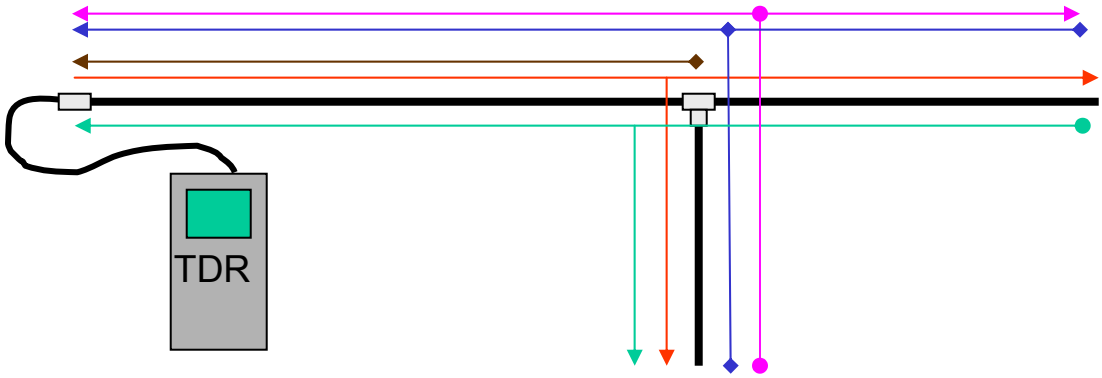

Figure 2

In Figure 2 the lines with arrows represent energy paths as follows:

Red = First pulse sequence from the TDR
Brown = First reflection from the Tee connection point (13+ feet)
Blue = First end reflection from the Tee leg (25 feet). Note it travels not only back to the TDR, but to the other leg's end
Green = Second end reflection from the main leg (~ 33 feet) Note it travels not only back the TDR, but also back down the Tee leg
Magenta = Tertiary reflection from Tee leg end resulting from second end reflection (green)

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