U/FTP vs F/UTP CAT6A LAN Cables

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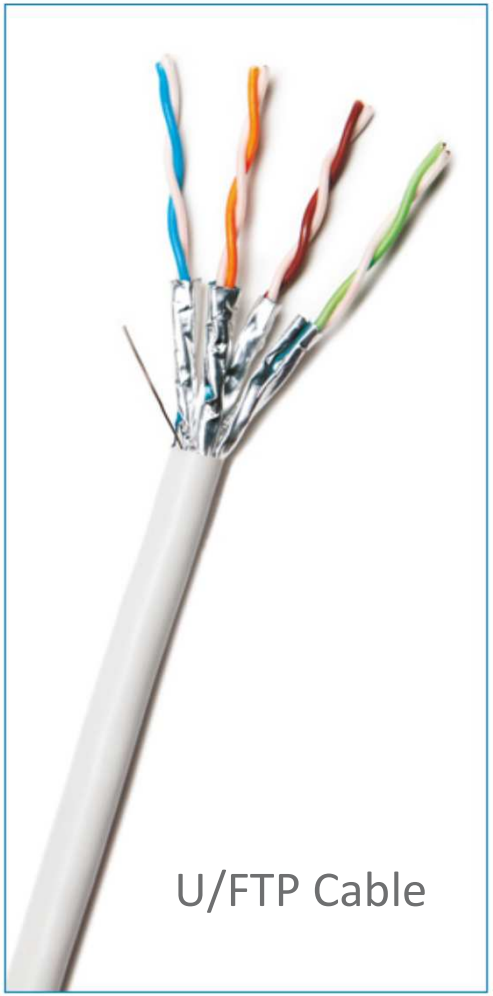
at&t

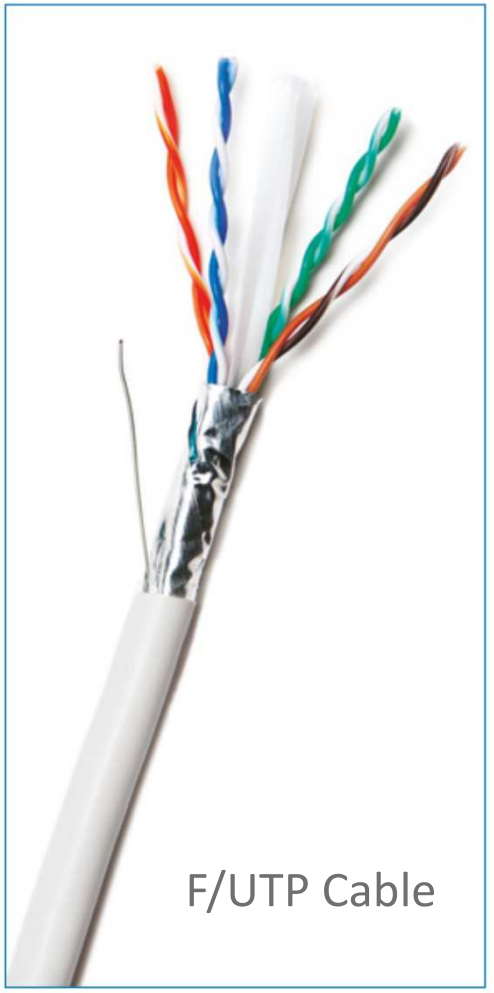
Preface

Shielded cabling systems are strongly recommended for category 6A (Class EA) installations, but the user still has to choose between two optional shielding options: F/UTP or U/FTP.
This presentations shows the inherent benefits of U/FTP cables of F/UTP cables.
The comparison is done for cables containing only a single drain wire.
Cables with an overall copper braid (in various constructions) providing better grounding are available in both configurations, namely SF/UTP and S/FTP, but they do not affect the comparison as they improve the coupling attenuation and transfer impedance of both constructions equally.

U/FTP vs F/UTP



Each pair
individually shielded
with a metal foil



Unshielded pairs
overall shielded with
a metal foil

Pair Lay Length

- In F/UTP cables the NEXT loss and FEXT Loss (crosstalk between the pairs) is controlled by the lay-length. Due to the crosstalk coupling mechanism, higher frequencies require twisting the pairs in shorter lay length, and each pair must have a different lay.
- In U/FTP cables the NEXT loss and FEXT Loss are mainly controlled by the individual foil shields so the pairs can be twisted in relatively long lays, which are quite similar in all 4 pairs.

F/UTP – Short Lays

U/FTP – Long Lays

Long lays benefits:

- ✓ Lower DC resistance per cable length => better PoE support
- ✓ Easier to untwist – shortening termination time

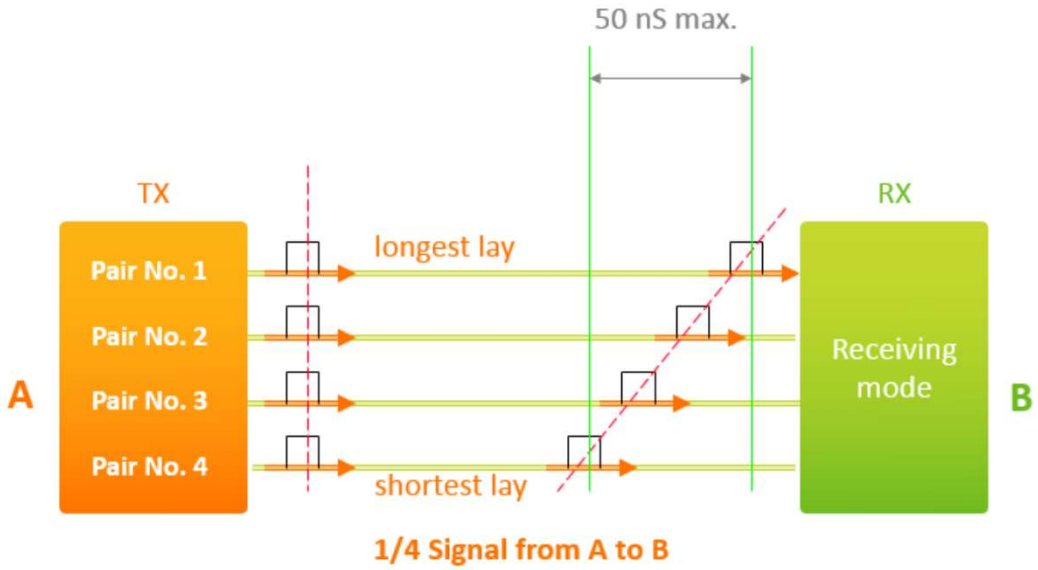
Pair Lay Length (contd.)

Additional U/FTP cable benefits: Low delay skew

As all 4 pairs have very similar lay lengths the propagation delay skew of U/FTP cables is very small: Usually 5~8 ns/100m, compared to the maximum of 45ns/100m allowed by the standard.

F/UTP cable have much higher values, some are close to the maximum of 45 ns/100m (for the bulk cable).

Lower delay skew provides higher margins, which in turn provides lower BER which minimizes the amount of re-transmissions and maximizes the data-rate.



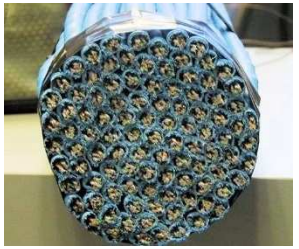
Each pair wrapped with a metal foil

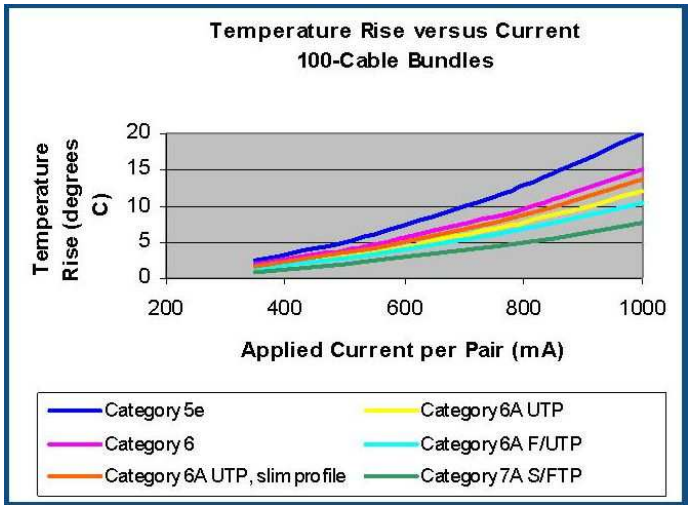
The individual foil wrap provides 3 major benefits:

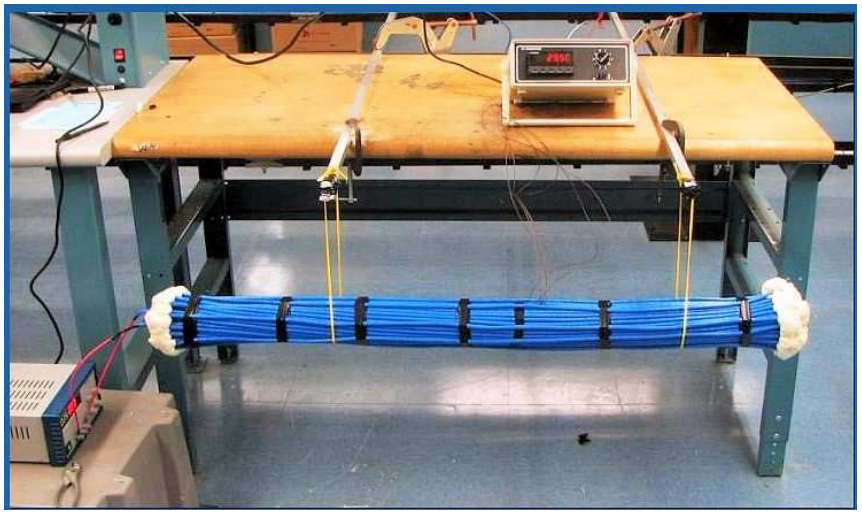
1. Better heat dissipation => better PoE support

Extensive tests have shown that the presence of metal shields in LAN cables improves the heat dissipation and minimizes the temperature increase in PoE energized bundled cables.

Evidently: S/FTP cables have the best heat dissipation, U/FTP cables come second and F/UTP cables come third.



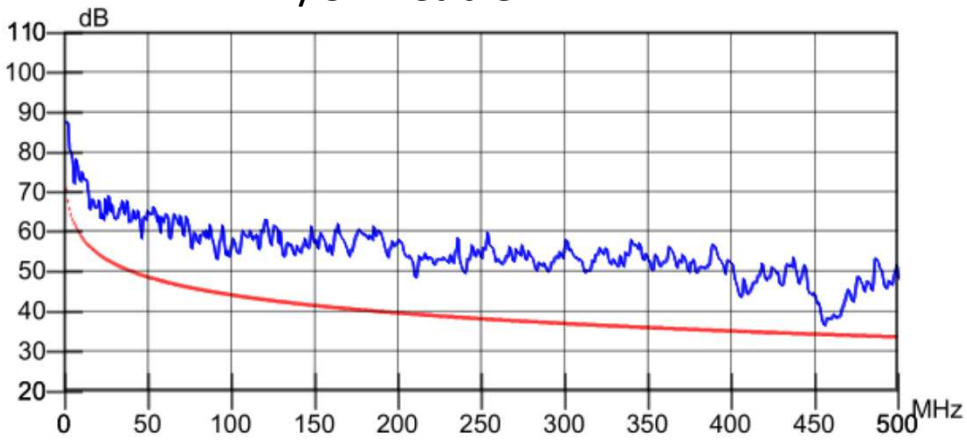




2. Extremely high NEXT loss and FEXT loss

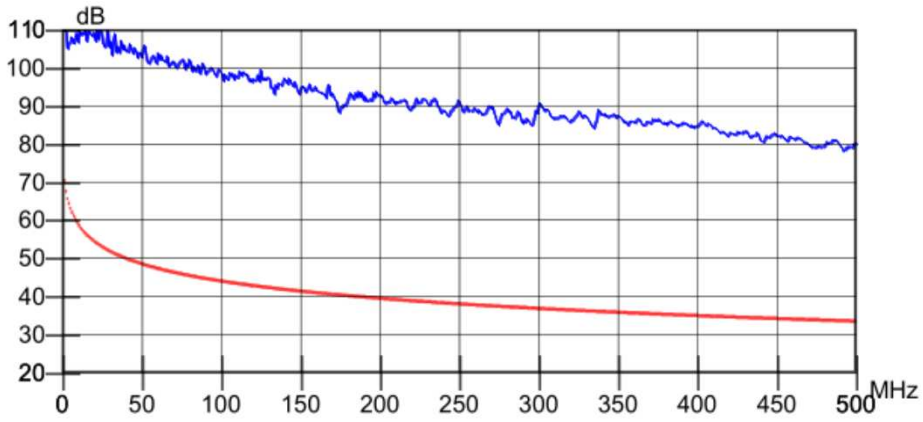
The aluminum foil minimizes the crosstalk between the pairs in U/FTP cables but may increase the crosstalk in F/UTP cables, as the signal is reflected inside the cable.

F/UTP Cable



NEXT Margin: 2 dB

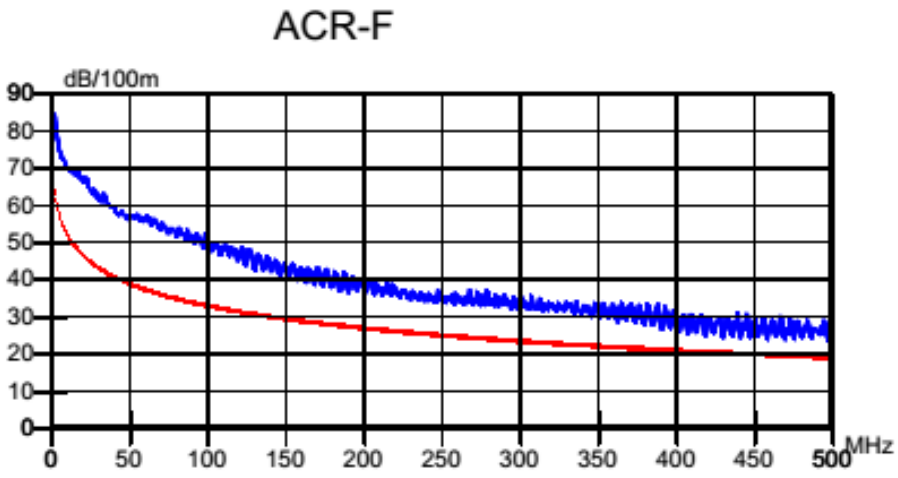
U/FTP Cable



NEXT Margin: 40 dB

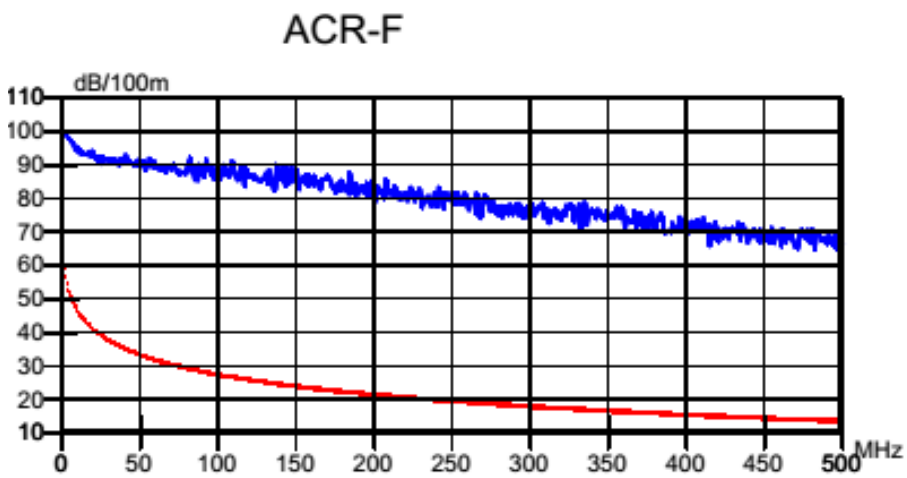
2. Extremely high NEXT loss and FEXT loss (Contd.)

F/UTP Cable



ACR-F Margin: 5 dB

U/FTP Cable



ACR-F Margin: 50 dB

3. High tolerance to cable abuse during installation:

All AT&T cables are routinely tested in S-bend and U-band tests in order to assess the effect which installation abuse will have on the transmission properties.

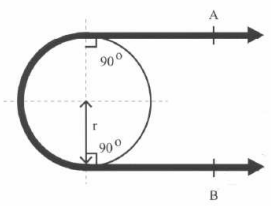


Fig 1: U-bend

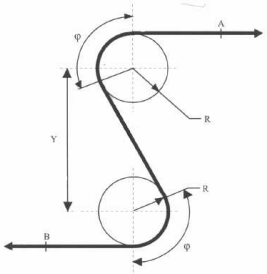


Fig 2: S-bend

Our tests show that the individual foil shield in U/FTP cables maintains the shape and form of the twisted pair, so the distance between each wire and the ground (= the foil shield) is virtually constant thus minimizing the effect of installation.

F/UTP cables are much more vulnerable to installation abuse as the position of the pairs inside the cable may be changed, affecting the proximity of the pairs and their position relative to the overall foil shield, thus changing the transmission properties of the pairs.

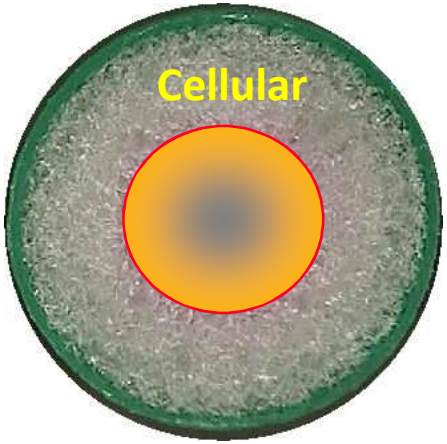
The above, combined with the low margins available in the cable before installation may cause frequent Link and Channel failures.

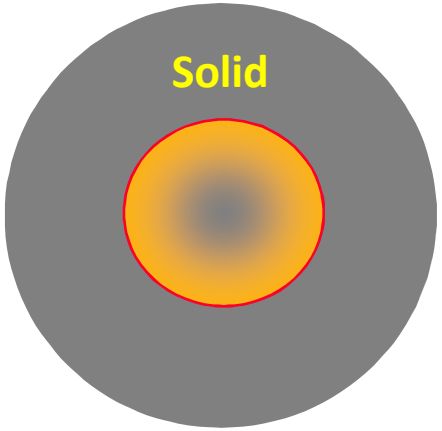
Foamed (cellular) vs solid insulation

Lower dielectric constant => Higher velocity of propagation (Vp)

Most F/UTP CAT6A cables are made with solid (or mostly solid) insulation. This is needed in order to avoid deformation of the insulation during the short-lay twinning process.
AT&T U/FTP cables are insulated with foamed (cellular) material.

U/FTP





F/UTP

- ✓ Lower dielectric constant => Higher velocity of propagation (Vp)
- ✓ Lower dielectric losses => lower attenuation

- ➢ Higher dielectric constant => Lower velocity of propagation (Vp)
- ➢ Higher dielectric losses => Higher attenuation

Summary
Benefits U/FTP cables compared to F/UTP

All pairs twisted in long lay lengths:

- ✓ Easier to untwist – shortening termination time
- ✓ Lower DC resistance per cable length => better PoE support
- ✓ Lower delay skew (8~15 nS/100m)

Each pair wrapped with a metal foil:

- ✓ Better heat dissipation => better PoE support
- ✓ Extremely high NEXT loss and FEXT loss
- ✓ High tolerance to cable abuse during installation

Foamed insulation:

- ✓ Lower dielectric constant => Higher velocity of propagation (Vp)
- ✓ Lower dielectric losses => lower attenuation