



TECHNICAL  
INNOVATION

# SMPTE 292M INFRASTRUCTURES

# SMPTE 292M

The serial digital interface standard that defines a universal medium of interchange for uncompressed High Definition Television between various types of video equipment. It stipulates that the source data be in 10 bit words with a total bit rate of 1.5 Gb/s.



# Transmission Cable

## What is important?

1. Characteristic impedance of 75 ohms must be maintained

2. Minimum Return Loss is 15 db.

The higher the number, the less the return loss



# Impedance

A cable's characteristic impedance is determined by:

- Size of center conductor
- Distance between center conductor and shield
  - Dielectric constant of material in-between



# What is Return Loss?

The ratio, in decibels, of maximum power sent down a transmission line to the power returned toward the source.

Also referred to as reflectance.

20 times the log of the reciprocal of the reflection coefficient

$$20 \cdot \log(U_{\text{ref}}/U_{\text{inc}})$$



# Why is RL important?

An uncompressed hi-def video signal (750 MHz) is more RF signal than video signal.

Wavelength 1.3 ft,  $\frac{1}{4}$  wavelength 4 in.

Third harmonic 2.25 GHz

Wavelength 5.3 inches,  $\frac{1}{4}$  wavelength 1.3 in.



# What causes RL?

- Defects during manufacturing process
- Damage during shipping or handling
  - Being crushed, stepped-on,  
Bent, kinked or twisted



# Return Loss Factors

## Center conductor

- Wrong size
- Size varies
- Not in center

## Dielectric

- Wrong amount of foam
- Incorrect dielectric constant (velocity)
  - Variations in diameter
  - Foam density too soft



# Return Loss Factors

## Shield

- Foil -  
Wrinkling

- Braid -

Helical wrap can create periodic defects  
Jerked by wheels and gears

## Jacket

Problems with print wheels  
Ink jet system used as an alternative



# Periodicity

Small changes happening over and over

- Defects during manufacturing process
  - Open frame ladder trays
  - Over tightened cable ties



# Installation Factors

## Deformation

- Stepping on the cable, running over it
  - Setting equipment on the cable
    - Exceeding pull strength when pulling cable through conduits

## Exceeding Bend Radius

- Crushes low density foam dielectric
  - Stresses the center conductor



# Cable Bend Radius

## Manufacturer's specifications

	Diameter	Min bend radius
Belden 1855A	.159	1.59"
Belden 1505A	.235	2.35"
Belden 1694A	.275	2.75"
Belden 7731A	.400	4.00"



# Pull Strength/Tension

## Pulling

- Elongates center
- The braid creates “Chinese finger trap”  
(Squeezes dielectric)

## Maximum Pulling Tensions

*40% of breaking strength*

- 1855A = 36 lbs
- 1505A = 47 lbs.
- 1694A = 69 lbs.
- 7731A = 145 lbs.



# Cable Transmission Distances

## Maximum run distances

	<b>259M</b>	<b>292M</b>
	<u>270 Mb/s</u>	<u>1 .5Gb/s</u>
Belden 1855A	750'	210'
Belden 1505A	1110'	300'
Belden 1694A	1360'	370'
Belden 7731A	2000'	540'

# Connectorization

- Use correct strippers and crimpers (diameter and spacing is critical)
- Connector dielectric must fit-up to cable dielectric
  - Passive component losses add up



# Summation

- Treat high definition cable like glass.
- Provide supports that will maintain cable weight-load and radius.
- Use Velcro fasteners instead of tie-wraps.
  - Do not over-tighten fasteners.
- Minimize vertical bundle distance & diameters.
- Be mindful of long term conveyance and loading situations.
- Use inner-duct where necessary for difficult routing transitions.
- Secure work area where cable is exposed.



