Connecting the World: Specifying Structured Cabling for International Markets

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Leviton Network Solutions
Agenda

• Global Standards Bodies
• Standards comparison
• Cable constructions
• Fire ratings
• Wallplate choices
• Logistics and Business Challenges
Standards and Codes
What is a Standards Body?

• Primary activities are developing, coordinating, revising, amending, issuing, or otherwise producing technical standards that address the needs of affected adopters

• Driven by the need for interchangeable parts and interoperability (example: standardization of screw thread sizes)

• Made up of committees and subcommittees that formulate standards that serve the industry and end user

• Participants include representatives from manufacturers, service providers, engineers and ends users

• Standards usually formulated through a series of proposed and voting cycles - Roberts Rules of Order
Standards Bodies Authoring Cabling* Standards

* Ethernet standards drive cable criteria
Codes vs. Standards

Codes

- Enforced by law and regulatory powers of the AHJ (Authority Having Jurisdiction)
- Address safety, fire hazards and the minimum quality of construction

Standards

- Ensure a minimum level of system performance
- Essential to a well performing structured cabling system
- Assures interoperability of systems
- Provide consistency of design, installation, and conformance to physical and transmission requirements
- May not be enforced by law (e.g. inspectors)
Code Compliance Agencies
Structured Cabling

- NFPA
- EC
- CSA
- NRC
- UL/ETL

Check your Jurisdiction
- Authority Having Jurisdiction (AHJ)
- Independent Testing Laboratory (ITL)
Let’s take a look at the most current Standards

TIA/ISO/CENLEC Standards
Global Structured Cabling Standards

**ANSI/TIA**
- **568-D** – Series Standards released 2016-2018

**ISO/IEC**
- 11801 Series Standards released Q4 2017

**CENELEC**
- **EN 50173** - Performance, Design and Premise Cabling Standards
ANSI/TIA

Telecommunications Industry Association

- Primary North American Structured Cabling Standards
- Multiple Technical Committees and Working Groups 42.1, 42.2, 42.3......
- 568 Series is primary document set
- TR 42 meets 3 times per year

Committee Website:
http://www.tiaonline.org/all-standards/committees/tr-42
TR-42 Committees
Telecommunications Cabling Standards

• 42.1 – Premises Telecommunications Infrastructure
• 42.3 – Telecommunications Administration, Pathways, Spaces, Bonding and Grounding
• 42.5 – Telecommunications Infrastructure Terms and Symbols
• 42.7 – Telecommunications Copper Cabling Systems
• 42.9 – Industrial Telecommunications Infrastructure
• 42.11 – Optical Fiber Systems
• 42.12 – Optical Fibers and Cables
• 42.13 – Passive Optical Devises and Fiber Optic Metrology
## Published Standards — Q2 2018

### Common Standards
- ANSI/TIA-568.0-D: Generic Premises Cabling
- ANSI/TIA-569-D-1: Pathways and Spaces
- ANSI/TIA-606-C: Administration
- ANSI/TIA-607-C: Grounding and Bonding
- ANSI/TIA-758-B: Outside Plant
- ANSI/TIA-862-B: Intelligent Building Systems
- ANSI/TIA-5017: Security

### Premises Standards
- ANSI/TIA-568.1-D: Commercial Cabling
- ANSI/TIA-570-C: Residential
- ANSI/TIA-942-B: Data Center Cabling
- ANSI/TIA-1005-A: Industrial Cabling
- ANSI/TIA-1179: Healthcare
- ANSI/TIA-4966: Education
- ANSI/TIA-5018: DAS

### Component Standards
- ANSI/TIA-568.2-D: Copper Components
- ANSI/TIA-568.3-D: Fiber Components
- ANSI/TIA-568.4-D: Coaxial Components
- ANSI/TIA-1152-A: Field Test Equipment 2GHz
- ANSI/TIA-1183-A: Lab Test Equipment

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Topology Model — ANSI/TIA-568.0-D

Generic Topology Structure

- Generic cabling System Structure
- Recognized cabling types
- Minimum and Maximum cabling lengths
- Basic Installation Requirements
- Cabling Transmission Performance and Test Requirements
Copper Performance
ANSI/TIA 568.0-D

Category 5e
- 100Mhz

Category 6
- 250Mhz

Category 6A
- 500Mhz

Category 8*
- 2000Mhz
- *30m channel

<table>
<thead>
<tr>
<th>TIA Channel Min. Performance</th>
<th>Cat 5e</th>
<th>Cat 6</th>
<th>Cat 6A</th>
<th>Cat 8*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Defined Frequency</td>
<td>100 MHz</td>
<td>250 MHz</td>
<td>500 MHz</td>
<td>2000 MHz</td>
</tr>
<tr>
<td>Insertion Loss (dB)</td>
<td>24.0</td>
<td>35.9</td>
<td>49.3</td>
<td>32.7</td>
</tr>
<tr>
<td>NEXT Loss (dB)</td>
<td>30.1</td>
<td>33.1</td>
<td>26.1</td>
<td>9.8</td>
</tr>
<tr>
<td>PSNEXT Loss (dB)</td>
<td>27.1</td>
<td>30.2</td>
<td>23.2</td>
<td>7.3</td>
</tr>
<tr>
<td>ACRF (dB)</td>
<td>17.4</td>
<td>15.3</td>
<td>9.3</td>
<td>5.9</td>
</tr>
<tr>
<td>PSACR (dB)</td>
<td>3.1</td>
<td>15.8</td>
<td>15.8</td>
<td>n/s</td>
</tr>
<tr>
<td>PSACRF (dB)</td>
<td>14.4</td>
<td>12.3</td>
<td>6.3</td>
<td>2.9</td>
</tr>
<tr>
<td>PSANEXT Loss (dB)</td>
<td>n/s</td>
<td>n/s</td>
<td>49.5</td>
<td>65.5</td>
</tr>
<tr>
<td>PSAACRF (dB)</td>
<td>n/s</td>
<td>n/s</td>
<td>23.0</td>
<td>35</td>
</tr>
<tr>
<td>Delay Skew (ns)</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>17</td>
</tr>
</tbody>
</table>

*Cat 8 is 30m 2 connector channel
Fiber Performance
ANSI/TIA 568.3-D

**OM3**
- 2000 MHz-Km Bandwidth
- 50 Micron MMF

**OM4**
- 4700 MHz-Km Bandwidth
- 50 Micron MMF

**WBMMF-OM5 reference**
- Defined in TIA-492AAAE
- 4700/2470 MHz-Km Bandwidth

**OS2**
- Single-mode

Relative distance
40GBps SR4/LR4 Technologies
ISO/IEC

- International Organization for Standardization (ISO)
- International Electrotechnical Commission (IEC)
- Headquartered in Geneva Switzerland
- Publish International Structured Cabling Standards
- ISO/IEC Joint Technical Committee 1, Sub Committee 25, Working Group 3, All cabling standards
  - ISO/IEC JTC 1/SC 25/WG 3
- ISO/IEC 11801 is Primary SCS Standard

Committee Website: ISO/IEC JTC1/SC25 Website
Cabling Standards

Premises cabling Standards – ISO/IEC-11801 Series

- 11801-1  Part 1: General requirements
- 11801-2  Part 2: Office premises
- 11801-3  Part 3: Industrial premises
- 11801-4  Part 4: Single-tenant homes
- 11801-5  Part 5: Data Centers
- 11801-6  Part 6: Distributed building services

Published Q4 2017
Published Standards Q4 2018

General Design
- ISO/IEC 11801-1: Generic Cabling Systems

Premises Standards
- ISO/IEC 11801-2: Office Premises Cabling
- ISO/IEC 11801-3: Industrial Cabling
- ISO/IEC 11801-4: Residential Cabling
- ISO/IEC 11801-5: Data Center Cabling
- ISO/IEC 11801-6: Distributed Building Cabling

Technical Reports
- ISO/IEC TR 24704: Cabling for WAP’s
- ISO/IEC TR 29125: Remote DTE Power (POE)
- ISO/IEC TR 11801-9904: 2.5G and 5GBASE-T Cabling

Implementation
- ISO/IEC 14763-2: Planning and Implementation
- ISO/IEC 30129: Grounding and Bonding

Testing and Validation
- ISO/IEC 61935 Series: Testing Copper Cables
- ISO/IEC 14763-3: Testing of Optical Fibre

Component Standards
- IEC 60603-7: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions to 2000 MHz
- IEC 60512-99-001: Testing Connectors used in twisted pair cabling with remote power for arcing
- IEC 61156 – (1-10) Series: Detailed specifications for Twisted Pair cables
- IEC 60793: MM Fiber Specifications
- IEC 60793: Fiber Connector Specifications
- Numerous Others!

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ISO/IEC Topology Model 11801-1

Generic

Source: IEC
Cabling Standards
ISO/IEC 11801-1 Generic

Balanced Cabling Channel Performance Classes Identified — Generic

Class D: up to 100Mhz using category 5e components
Class E: up to 250 MHz using category 6 components
Class EA: up to 500 MHz category 6A components (recommended minimum)
Class F: up to 600 MHz category 7 components
Class FA: up to 1000 MHz category 7A components
Class I: up to 2000MHz using category 8.1 components (RJ-45)
Class II: up to 2000MHz using category 8.2 components (Non RJ45)

Class D/Cat 5e and Class I/II Cat 8 NOT recognized for office premises
Cabling Standards
ISO/IEC 11801-1 Generic

Fiber classes recognized

**OM3**: Multimode fiber type 50 μm core; minimum modal bandwidth of 2000 MHz*km at 850 nm

**OM4**: Multimode fiber type 50 μm core; minimum modal bandwidth of 4700 MHz*km at 850 nm

**OM5**: Multimode fiber identified as applicable for Short Wave Division Multiplexing

**OS1a**: Indoor Singlemode fiber specification 1.0db/km attenuation

**OS2**: Outdoor Singlemode fiber specification .4db/km attenuation
  - OS2 fiber is manufactured in accordance with ITU-T G.652D, and IEC B1.3 SM fiber standards to reduce or eliminate water absorption loss in the 1383 spectral region, (the water peak)
IEC 14763 Standards

Implementation and Operation of Premises Cabling

ISO/IEC 14763-2, Information Technology – Implementation and Operation of customer premises cabling – Part 2 Planning and Installation

• Specifies requirements for the planning, installation and operation of cabling and cabling infrastructures (including cabling, pathways, spaces, earthing and bonding)


• Specifies systems and methods for the inspection and testing of installed optical fibre cabling designed in accordance with premises cabling standards
## IEC Component Standards

Examples, many others available

<table>
<thead>
<tr>
<th>Standard No.</th>
<th>Name</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>60603-7-4</td>
<td>Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz</td>
<td>Cat 6 RJ 45 connectors</td>
<td>Published April 2010</td>
</tr>
<tr>
<td>60603-7-41</td>
<td>Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz</td>
<td>Cat 6A RJ 45 connectors</td>
<td>Published Mar 2010</td>
</tr>
<tr>
<td>60603-7-81</td>
<td>Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 2000 MHz</td>
<td>Cat 8 RJ 45 connectors</td>
<td>Published Dec 2015, Updated 2017</td>
</tr>
<tr>
<td>61156-5</td>
<td>Multicore and symmetrical pair/quad cables for digital communications - Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1000 MHz - Horizontal floor wiring</td>
<td>Cat 5e, 6, 6A, 7 and 7A LAN cable</td>
<td>Published Feb 2009, updated 2012</td>
</tr>
<tr>
<td>61935-2</td>
<td>Specification for the testing of balanced and coaxial information technology cabling - Part 2: Cords as specified in ISO/IEC 11801 and related standards</td>
<td>Cat 5e, 6, 6A, 7 and 7A Patch cords</td>
<td>Published July 2010</td>
</tr>
</tbody>
</table>
CENELEC

- **CENELEC** is the European Committee for Electrotechnical Standardization
- **CLC/TC 215 Committee** - Electrotechnical aspects of telecommunication equipment responsible for structured cabling standards
- **EN 50173** and **EN 50174** series are primary documents
- Normalized to but enhanced versions of **ISO 11801** document

Committee Website: [CENELEC CLC/TC 215 Committee Website](#)
Published Standards

**Performance and Design**
- EN 50173-1: Generic Cabling Requirements
- EN 50310:2016
- EN 50667:2016
- EN 50173-99-1: Remote Powering (POE)

**Component Standards**
- Follow IEC Standards

**Premises Standards**
- EN 50173-2: Commercial Office Premises
- EN 50173-3: Industrial Cabling
- EN 50173-4: Cabling for Homes
- EN 50173-5: Data Center Cabling
- EN 50173-6: Distributed Building Systems

**Implementation**
- EN 50174-1: Installation and QA
- EN 50174-2: Cabling Installation Inside Plant
- EN 50174-3: Cabling Installation Outside Plant

**Testing and Validation**
- EN 50346:2002/A2:2009
- Testing of installed cabling

EU Member States adopt these standards, insert appropriate prefix to indicate country
i.e.: **BS** EN 50173-1, **FR** EN 50174-2…
TIA VS. ISO Differentiators
TIA vs. ISO Differentiator
Topology Nomenclature Generic

**TIA 568.0-D**
- **Distributor** A/B/C
- **EO** - Equipment outlet
- **CP** - Consolidation Point

**ISO 11801-1**
- **Distributor** 1/2/3/4
- **TE Outlet** - Terminal Equipment Outlet
- **CP** - Consolidation Point
TIA vs. ISO Differentiator — Topology
Nomenclature Commercial Premises

**TIA 568.1-D**
- Main Cross Connect (MC)
- Intermediate Cross Connect (IC)
- Horizontal Cross Connect (HC)
- Telecommunications Outlet (TO)

**ISO 11801-2**
- Campus Distributor (CD)
- Building Distributor (BD)
- Floor Distributor (FD)
- Telecommunications Outlet (TO)
TIA vs. ISO Differentiator
Channel Definitions Category/Class

<table>
<thead>
<tr>
<th>Max Frequency</th>
<th>TIA Components</th>
<th>TIA Channel</th>
<th>ISO Component</th>
<th>ISO Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MHz</td>
<td>Category 5e</td>
<td>Category 5e</td>
<td>Category 5e</td>
<td>Class D</td>
</tr>
<tr>
<td>250 MHz</td>
<td>Category 6</td>
<td>Category 6</td>
<td>Category 6</td>
<td>Class E</td>
</tr>
<tr>
<td>500 MHz</td>
<td>Category 6A</td>
<td>Category 6A</td>
<td>Category 6A</td>
<td>Class EA</td>
</tr>
<tr>
<td>600 MHz</td>
<td>n/a</td>
<td>n/a</td>
<td>Category 7</td>
<td>Class F</td>
</tr>
<tr>
<td>1000 MHz</td>
<td>n/a</td>
<td>n/a</td>
<td>Category 7A</td>
<td>Class FA</td>
</tr>
<tr>
<td>2000 MHz</td>
<td>Category 8</td>
<td>Category 8</td>
<td>Category 8.1</td>
<td>Class I</td>
</tr>
<tr>
<td>2000 MHz</td>
<td>n/a</td>
<td>n/a</td>
<td>Category 8.2</td>
<td>Class II</td>
</tr>
</tbody>
</table>

- TIA 568.0-D
  - Components and channels are **both** categories

- ISO 11801 – EN 50173-1
  - Components are **categories**
  - Channels are **classes**
**TIA vs. ISO Differentiator**

**IEEE Base-T Requirements**

- No IEEE Ethernet applications for Category 7/7A – 25/40GBase-T requires Category 8

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Distance</th>
<th>TIA</th>
<th>ISO</th>
<th>Equipment Interface</th>
<th>IEEE 802.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 MHz</td>
<td>100 m</td>
<td>Cat 3</td>
<td>Class C</td>
<td>RJ45</td>
<td>10BASE-T</td>
</tr>
<tr>
<td>100 MHz</td>
<td>100 m</td>
<td>Cat 5</td>
<td>Class C</td>
<td>RJ45</td>
<td>Up to 100BASE-T</td>
</tr>
<tr>
<td>100 MHz</td>
<td>100 m</td>
<td>Category 5e</td>
<td>Class D</td>
<td>RJ45</td>
<td>Up to 1000BASE-T</td>
</tr>
<tr>
<td>250 MHz</td>
<td>100 m</td>
<td>Category 6</td>
<td>Class E</td>
<td>RJ45</td>
<td>Up to 1000BASE-T</td>
</tr>
<tr>
<td>500 MHz</td>
<td>100 m</td>
<td>Category 6A</td>
<td>Class Ea</td>
<td>RJ45</td>
<td>Up to 10GBASE-T</td>
</tr>
<tr>
<td>600 MHz</td>
<td>100 m</td>
<td>Not Recognized</td>
<td>Cat 7/Class F</td>
<td>None</td>
<td>Up to 10GBASE-T</td>
</tr>
<tr>
<td>1 GHz</td>
<td>100 m</td>
<td>Not Recognized</td>
<td>Cat 7A/Class FA</td>
<td>None</td>
<td>Up to 10GBASE-T</td>
</tr>
<tr>
<td>2 GHz</td>
<td>30 m</td>
<td>Cat 8</td>
<td>Cat 8.1/Class I</td>
<td>RJ45</td>
<td>25/40GBASE-T</td>
</tr>
<tr>
<td>2 GHz</td>
<td>n/a</td>
<td>n/a</td>
<td>Cat 8.2/Class II</td>
<td>Non RJ45</td>
<td>25/40GBASE-T</td>
</tr>
</tbody>
</table>
Cat 5e and Cat 6 Performance Benchmarks
Effectively the Same

- ISO and TIA performance requirements are nearly identical for Cat 5e and Cat 6
- Shown limits are at 100MHz for comparison

<table>
<thead>
<tr>
<th>Channel Parameter</th>
<th>TIA Cat 5e (ISO Class D) Channel (dB)</th>
<th>TIA Cat 6 (ISO Class E) Channel (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss</td>
<td>24</td>
<td>21.3 (21.7)</td>
</tr>
<tr>
<td>Return Loss</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>NEXT</td>
<td>30.1</td>
<td>39.9</td>
</tr>
<tr>
<td>PSNEXT</td>
<td>27.1</td>
<td>37.1</td>
</tr>
<tr>
<td>ACRF (ELFEXT)</td>
<td>17.4</td>
<td>23.3</td>
</tr>
<tr>
<td>PSACRF (PSELFEXT)</td>
<td>14.4</td>
<td>20.3</td>
</tr>
</tbody>
</table>
# Key Differentiator

## Component Specs 6A NEXT @ 500MHZ

<table>
<thead>
<tr>
<th>Connecting Hardware Parameter</th>
<th>TIA Cat 6A Component (dB)</th>
<th>ISO Cat 6A Component (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss</td>
<td>.45</td>
<td>.45</td>
</tr>
<tr>
<td>Return Loss</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>NEXT</td>
<td>34</td>
<td>37</td>
</tr>
<tr>
<td>FEXT</td>
<td>29.1</td>
<td>29.1</td>
</tr>
<tr>
<td>TCL/TCTL</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>PSANEXT</td>
<td>56.5</td>
<td>56.5</td>
</tr>
<tr>
<td>PSAACRF (PSAELFEXT)</td>
<td>53</td>
<td>53</td>
</tr>
</tbody>
</table>
## Key Differentiator

Crosstalk Channel Specs for Cat 6A

<table>
<thead>
<tr>
<th>Channel Parameter</th>
<th>TIA Cat 6A Channel (dB)</th>
<th>ISO Class $E_A$ Channel (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss</td>
<td>49.3</td>
<td>49.3</td>
</tr>
<tr>
<td>Return Loss</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>NEXT</td>
<td>26.1</td>
<td>27.9</td>
</tr>
<tr>
<td>PSNEXT</td>
<td>23.2</td>
<td>24.8</td>
</tr>
<tr>
<td>ACRF (ELFEXT)</td>
<td>9.3</td>
<td>11.5</td>
</tr>
<tr>
<td>PSACRF (PSELFEXT)</td>
<td>6.3</td>
<td>8.5</td>
</tr>
<tr>
<td>PSANEXT</td>
<td>49.5</td>
<td>49.5</td>
</tr>
<tr>
<td>PSAACRF (PSAELFEXT)</td>
<td>23</td>
<td>23</td>
</tr>
</tbody>
</table>
Bundle Size Guidance
What do the standards say about bundling?

**ANSI/TIA-184-A**
- Detailed analysis, data, and charts regarding temperature rise in cable bundles
- Testing used bundle size of 100 cables, empirical data on other bundle sizes provided
- Comparison of heat dissipation of different cable categories provided
- Mention of better heat dissipation with cables that have metallic elements (shields, isolation wraps)
- **No hard recommendation of maximum bundle size**
- Guidance on methods to reduce heat generation and minimize heat build up listed

**ISO/IEC 29125**
- Detailed analysis, data, and charts regarding temperature rise in cable bundles
- Testing used bundle size of 37 cables, empirical data on other bundle sizes provided
- Comparison of heat dissipation of different cable categories provided
- Mention of better heat dissipation with cables that have metallic elements (shields, isolation wraps)
- **Maximum bundle size of 24 cables given**
- Guidance on methods to reduce heat generation and minimize heat build up listed
Cable Choices for International Markets
Understanding Cable Constructions

ACRONYM: $\text{XX / YY ZZ}$

- **ELEMENT**
  - **U** = Unscreened
  - **F** = Foil Screened

- **OVERALL CONSTRUCTION**
  - **U** = Unscreened
  - **F** = Foil Screened
  - **S** = Braid Screened
  - **SF** = Braid and Foil Screened

- **PAIR OR QUAD**
  - **TP** = Twisted Pair
  - **TQ** = Twisted Quad

**EXAMPLES:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>U/UTP</td>
<td>Overall unscreened cable with unscreened twisted pairs (often referred to as UTP)</td>
</tr>
<tr>
<td>F/UTP</td>
<td>Overall screened cable with unscreened twisted pairs (often referred to as FTP)</td>
</tr>
<tr>
<td>U/FTP</td>
<td>Overall unscreened cable with individual foil screened twisted pairs (often referred to as PiMF)</td>
</tr>
<tr>
<td>S/FTP</td>
<td>Overall braid screened cable with individual foil screened twisted pairs (often referred to as STP)</td>
</tr>
<tr>
<td>SF/UTP</td>
<td>Overall braid and foil screened cable with unscreened twisted pairs</td>
</tr>
</tbody>
</table>

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U/UTP Dominance in the Market

U/UTP still the dominant choice in global markets

- U/UTP estimated at 95% of total LAN cabling installed
- Shielded LAN cable estimated to grow at a faster pace than U/UTP but still less than 5% of market in the short term (1-2 yrs)
- Acceptance of Category 8 for 25/40GBase-T and 100W POE in future years may drive greater acceptance for Shielded LAN cabling
- Much greater historical market preference for shielded solutions in EU/UK (UK, Germany, France, Switzerland, and Austria)

Copper cable by type trends

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTP</td>
<td>92.5%</td>
<td>95.6%</td>
</tr>
<tr>
<td>FTP</td>
<td>5.3%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Coax</td>
<td>2.2%</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

Source: FTM Consulting, Inc.
What does Shielding do?

Why shield your structured cabling system?

• Reduce Alien Crosstalk (ANEXT)- the introduction of an overall shield (F/UTP) around the 4 balanced pairs will improve ANEXT by approximately 20dB as compared to U/UTP
• Reduce susceptibility to EMI/RFI ingress interference
• Reduce EMI/RFI egress from structured cable into surrounding environment
• Reduced diameter of Cat 6a cable as compared to U/UTP construction that introduce larger cable size to control ANEXT
• Better heat dissipation than U/UTP cables
Where to Shield?

Where to shield your structured cabling system?

• In order to meet market preference in countries such as UK, Germany, France, Switzerland, and Austria where shielded cabling solutions have market dominance

• High noise environments where sources of EMI/RFI interference may be common
  – Radiology department at hospital, industrial locations, testing laboratories, broadcast/recording studios

• Military applications where shielded cable is one method of achieving TEMPEST compliance

• Cabling installed in close proximity to high voltage transformers
  – Elevator machine rooms, transportation tunnels, moveable cranes...
Isolation wrap UTP construction
An alternative to F/UTP shielded cable

NEW CAT 6A UTP recognized Cable

- Better heat dissipation for POE+ than U/UTP
- Uses metallic Isolation Wrap construction- “discontinuous shield”
- 20% smaller than typical CAT 6A UTP cables
- Exceptional Alien Crosstalk performance compared to U/UTP cables
- Reduces installation complexity, time and cost compared to shielded solutions, no extra grounding or testing
- Better heat dissipation than standard UTP cables
Cable Fire Ratings
USA Fire, Smoke, and Toxicity Ratings
NFPA-70, the National Electric Code (NEC)

CMP/OFNP (PLENUM):
• Suitable for use in ducts, plenums, and other spaces used for environmental air

CMR/OFNR (RISER):
• Suitable for use in a vertical run from floor to floor and have fire-resistant characteristics capable of preventing the carrying of fire from floor to floor

CMG/CM (GENERAL PURPOSE):
• Suitable for general-purpose communications use, with the exception of risers and plenums

US Municipalities adopt the NEC, may not all be at same revision
Canadian Fire, Smoke, and Toxicity Ratings

National Building Code of Canada (NBC)
National Fire Code of Canada (NFC)

FT6 (PLENUM): Equivalent to US CMP
- Suitable for use in ducts, plenums, and other spaces used for environmental air

FT4 (General Purpose):
- Suitable for general-purpose communications use
- Most manufacturers submit CMR rated cable for this purpose, CMR exceeds requirements for FT4
Global Fire, Smoke and Toxicity Ratings – LSZH

Known as Low Smoke Zero Halogen (LSZH, LSOH, HFFR-LS)

Different emphasis than North American codes
- More focused on outgassing of smoke and toxins
- Less stringent flame spreading parameters

3 separate tests for communications cables
- Flame retardancy (IEC 60332)* Multiple variants
- Halogen content (IEC 60754)
- Smoke emission (IEC 61034)

Typically required in MEA, APAC and certain LATAM countries
Multiple LSZH ratings for fire retardancy

IEC 60332-2-2 Single vertical cable test (LSZH-1)
  • Most LSZH cables are rated to this test
  • Equivalent to UL VW-1 test

IEC 60332-3-25 Bundled vertical cable test (LSZH-3)
  • More stringent testing of bundled cables
  • Requires additional flame-retardant doping, more expensive to produce

Other IEC burn tests defined (IEC 60332-3-21,22,23,24)
  • May be required by certain local codes

LSZH and CMP are not interchangeable!
EU Fire, Smoke and Toxicity Ratings- CPR

Construction Products Regulation (CPR)
Effective July 2017

- EU law – Compulsory for fixed cable products within buildings
- Member countries responsible for implementing the law
- Defines multiple levels of Fire, Smoke, Toxicity Levels
- Each individual Member State defines the level appropriate for facilities within their Country, not consistent!
- Required level determined by building type, occupancy, safety risks,...
- Compliant products must carry CE mark and appropriate public certification documentation
CPR- Safety in case of fire
How is performance identified?

Euro Classification

- Fire resistant ceramic loaded compounds (out of scope for data cable)
- Self extinguishing product - Higher People Safety

Classes for comms cable

- A<sub>CA</sub>, B<sub>1CA</sub>, B<sub>2CA</sub>, C<sub>CA</sub>, D<sub>CA</sub>, E<sub>CA</sub>, F<sub>CA</sub>

- BEST
- WORST

- No performance determined – external only
- IEC 60332-1 pass
- Increasing bundled cable fire performance replaces IEC 60332-24 requirement (HF3)
Intended Areas of Use for CPR Classifications

CPR tests each of these factors and enforces a hierarchical system of performance and suggested application.

<table>
<thead>
<tr>
<th>Euroclass Level</th>
<th>Descriptions</th>
<th>Example Environments</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2_{ca}</td>
<td>Very High Fire Protection Self Extinguishing</td>
<td>Hospital ward areas, children's nurseries, above fire exits, escape routes in public buildings, airports, metro, train stations</td>
</tr>
<tr>
<td>C_{ca}</td>
<td>High Fire Protection Self Extinguishing</td>
<td>Hospitals, commercial buildings, leisure facilities, hotels, schools, administration and office buildings</td>
</tr>
<tr>
<td>D_{ca}</td>
<td>Moderate Fire Protection Limited Emissions</td>
<td>Used as a basic minimum for general installs in some regions.</td>
</tr>
<tr>
<td>E_{ca}</td>
<td>Basic Fire Protection</td>
<td>Used as a basic minimum for general installs in some regions.</td>
</tr>
</tbody>
</table>
CPR Compliance

- **CPR requires** that all cables marketed in European Economic Area (EEA) carry a **CE mark** and have a **declaration of performance** (DOP)

- The CE mark indicates the **specific fire performance level** that the cable has been verified to provide

- **Starting 1 July 2017**, manufacturers cannot supply cables unless they have been tested, certified, and marked in accordance with the CPR standards

- **Each country** determines the application of the Law

- **Significant variability in application**
  - Which class do I need to use?
Faceplate Choices for International Markets
Outlet Box Footprint

Outlet box dimensions and faceplate choices vary by country, must be properly specified

- **USA NEMA** 4” x 1 ¼” (100mm x 28.5mm) single gang box is used globally but not ubiquitous
- **UK box** is 75mm x 75mm with 60mm screw distance, 83mm square faceplate
- Certain **LATAM** countries and **Italy** will orient USA boxes in **landscape** fashion
Faceplate Compatibility

- **Standard US faceplates** will fit NEMA outlet boxes regardless of region deployed

- Install **landscape faceplates** or install US faceplates sideways in box for LATAM/Italy region

- **UK style faceplates** fit UK outlet box with 60mm screw holes
Outlet Accessories
Accessories to support multitude of applications
Faceplate Compatibility
3rd Party Adapter plates

**LI150** adapters are **50mm x 25mm** and fit 3rd party wallplates with 50mm x 50mm EU openings

**LI145** adapters are **45mm x 22.5mm** and fit 3rd party wallplates with 45mm x 45mm French openings

**LJ6C** adapters are **37m x 22mm** and fit 3rd party LJ6C wallplates
Regional Business Challenges and Logistics
Regional Business Challenges and Logistics

Language Differences
• Is your ability to communicate specifications, concepts and applications hindered by language barriers?
• What is the common technical language used? Strand/Fibre/Core as an example
• Is an interpreter needed
• Document translations, proper dialect, can be expensive

Time Zones / Calendar Issues
• Need to conduct project conference calls on a 24hr open clock
• Holidays are regional, need to be cognizant when scheduling meetings
• Monday-Friday business is not always the norm, Sun-Thurs in Middle East
Regional Business Challenges and Logistics

Tariff / Duty / Excise Taxes / Freight / Customs

- Protective Tariffs/duties need to be calculated if presenting a budget proposal
- Customs issues and delays can hinder productivity
- Are there in country VAT taxes to be considered?
- Need to calculate freight costs into budgets

Cultural / Social Differences

- Pace of business and decision making varies
- Stakeholder roles may be different – Distributors, Integrators, Consultant, VAR...
- How is product purchased and delivered in the sales channel? Multiple sources?
- Who’s Who?
Regional Business Challenges and Logistics

**Code Enforcement / Standards Compliance**
- Adherence to specifications, codes and standards varies
- Should you specify fire rated cables regardless of a lack of code requirement?
- Which standard to reference in a specific region
  - TIA /ISO/CENELEC?
  - Don't mix references

**Warranty**
- Does the manufacturer offer a warranty in all regions?
- How are claims handled?
- “Feet on the Street” support
Regional Business Challenges and Logistics

**Certified Contractors**
- Are there sufficient Manufacturer Certified Contractors to perform the work?
- Is the experience level appropriate for the type and size of project?

**Product availability**
- Is there a viable distribution network in country?
- Multiple distribution sources?
- Local inventory for Day 2 move and change work?
Connecting the World: Specifying Structured Cabling for International Markets

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