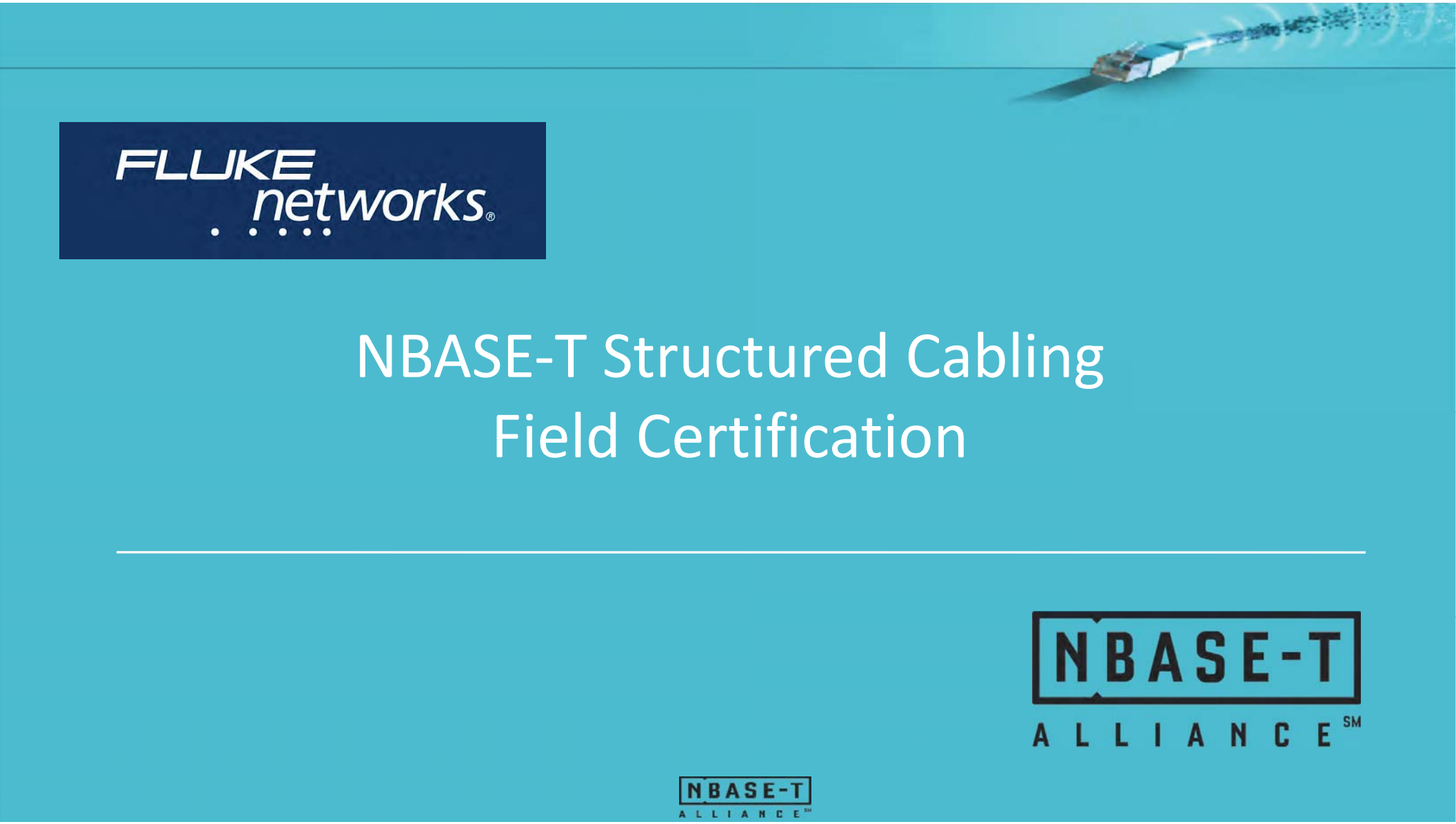

FLUKE networks
NBASE-T Structured Cabling
Field Certification
NBASE-T ALLIANCE SM
NBASE-T ALLIANCE SM

Webinar Speakers

Jim Davis
Regional Marketing Engineer
jim.davis2@flukenetworks.com
@FlukeNetDCI

Peter Jones
Chairman, NBASE-T Alliance
Distinguished Engineer, Cisco
chairman@nbaset.org
@nbasetalliance
@petergjones

Agenda

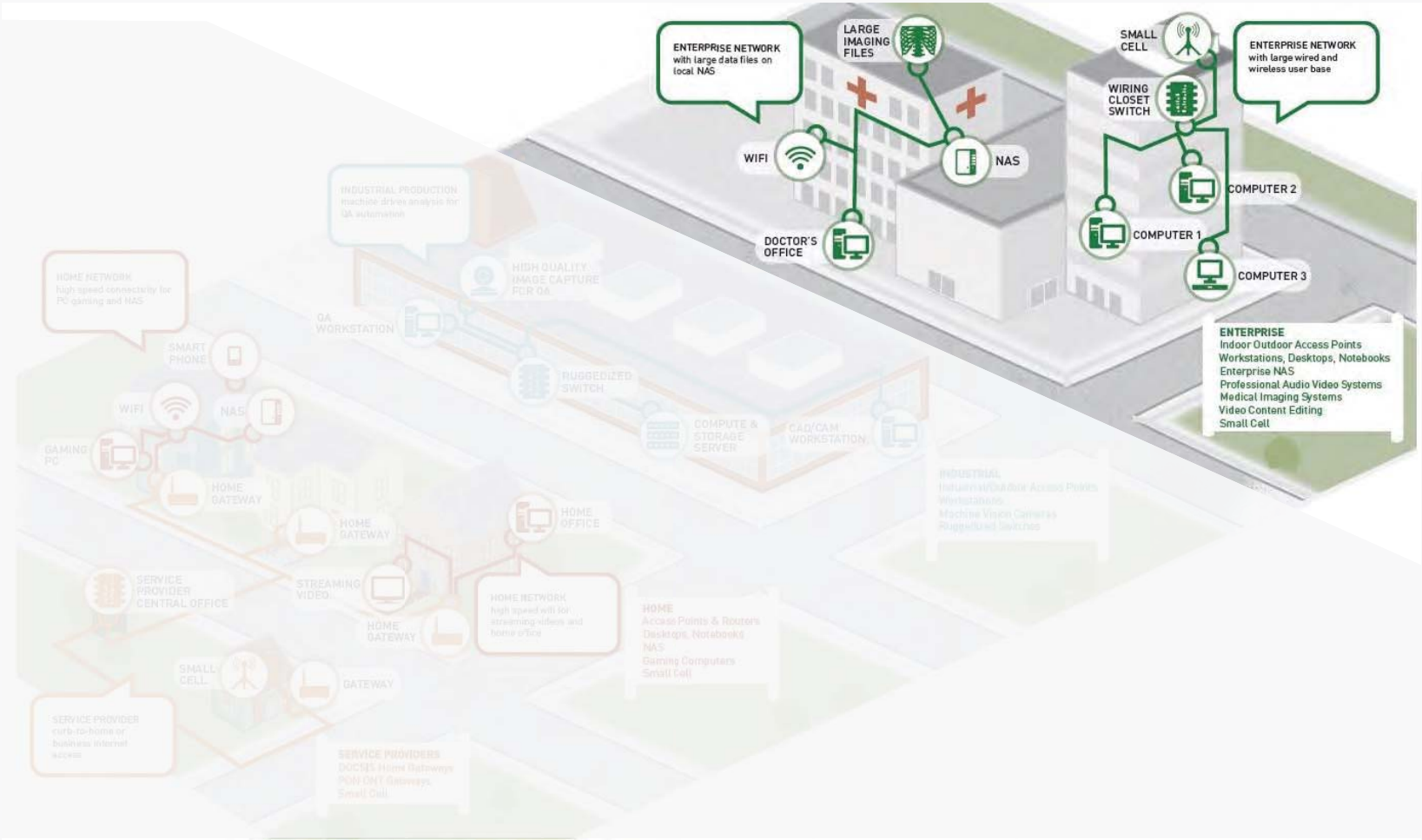
NBASE-T Overview	Peter
Who is Fluke Networks?	Jim
NBASE-T Field Testing	Jim
Old Cabling?	Jim
What About ALSNR?	Jim
Wrap-up & Discussion	Jim/Peter

NBASE-T Alliance

- NBASE-T Alliance (www.nbaset.org/)
  - Vendor alliance for 2.5G/5G BASE-T
- Who are we?
  - Member companies representing all areas of network infrastructure including components, silicon, systems, cabling, testing equipment
- What are we doing?
  - Educate the market about multiple NBASE-T applications, enable widespread deployment, facilitate interoperability and build the market

NBASE-T ALLIANCE℠

NBASE-T Application Areas



Enterprise:
- Switch
- Wireless AP
- Desktop
- Storage
- Small Cell

Industrial:
- Switch
- Wireless AP
- Workstation
- Storage
- Compute
- Machine Vision

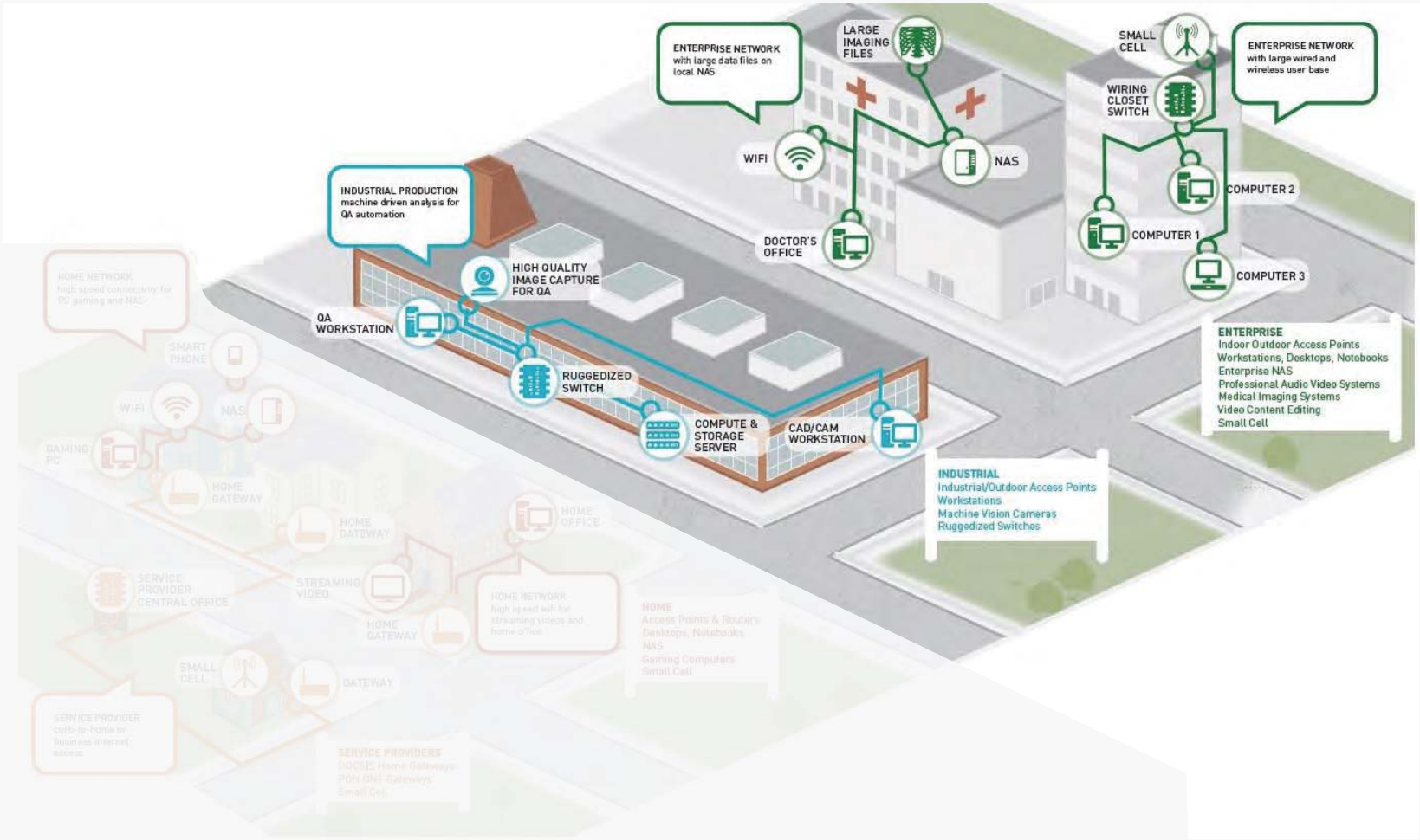
Home:
- Switch
- Wireless AP
- Storage Server
- Home Gateway
- Streaming Media

Service Provider:
- Small Cell
- Home Gateway

http://www.nbaset.org/wp-content/uploads/2017/05/ApplicationsGraphic_051517.pdf

NBASE-T ALLIANCE℠

NBASE-T Application Areas



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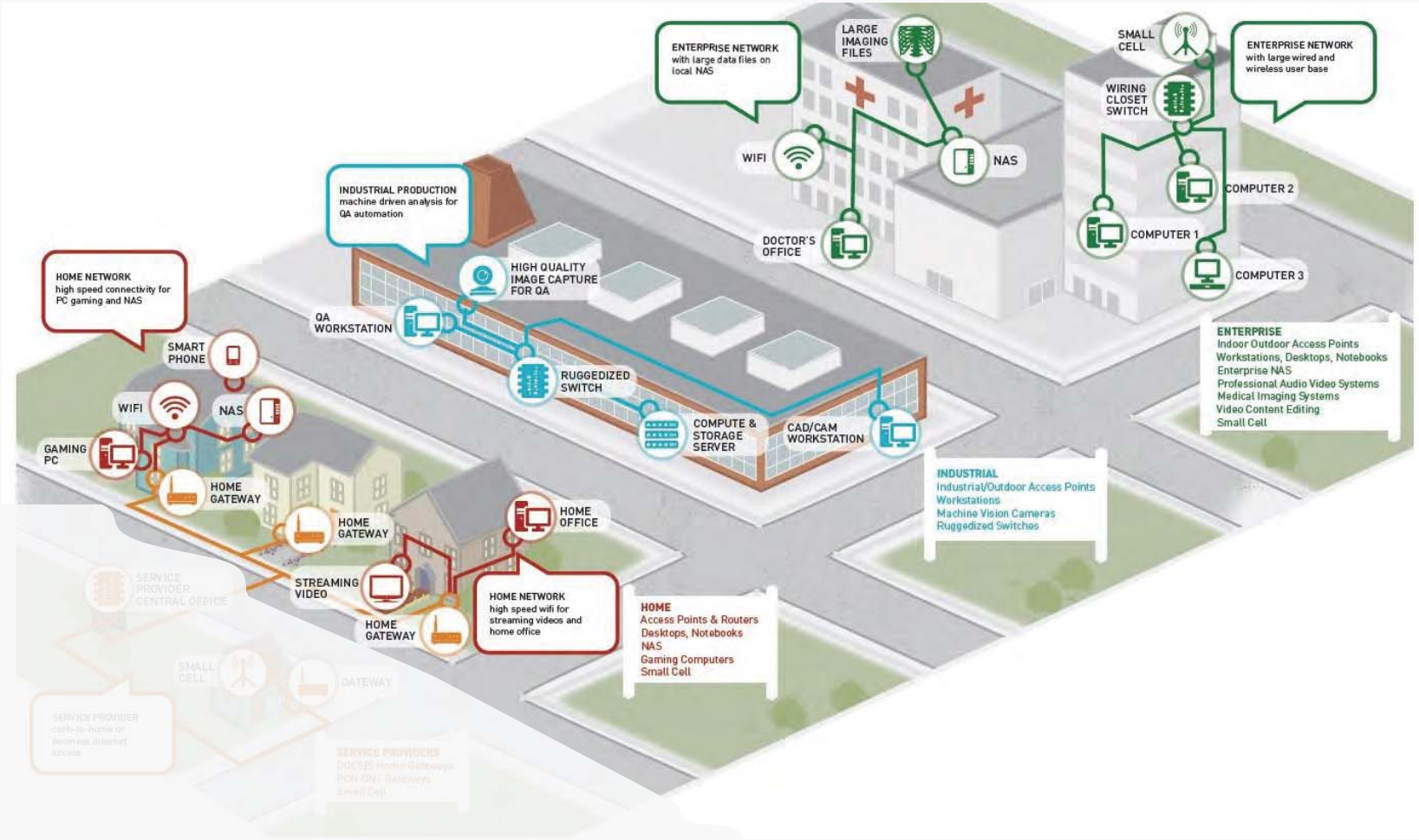

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NBASE-T ALLIANCE℠

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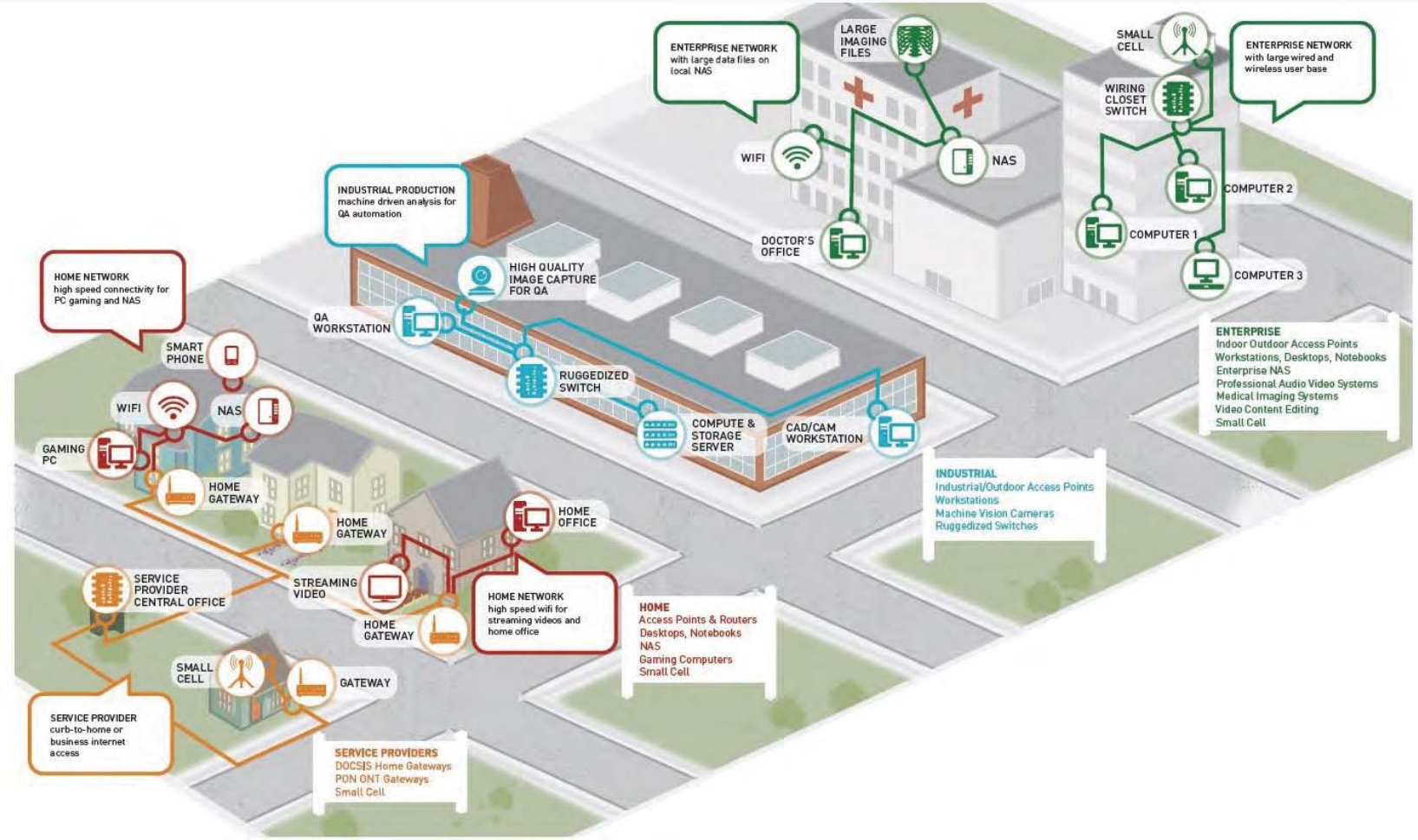

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Companies with NBASE-T Product

NBASE-T Alliance Member Companies

Component
Aquantia
Aruba HPE
Bel Magnetic Solutions
Cisco
GLGNet
Intel
KinnexA
Marvell
NXP

System Level Product
Aquantia
Aruba HPE
Cisco
Microsemi
Netgear
Pleora Technologies
Tehuti Networks
Teledyne e2v

Test Equipment
Aukua Systems
Spirent
Tektronix
Xena Networks

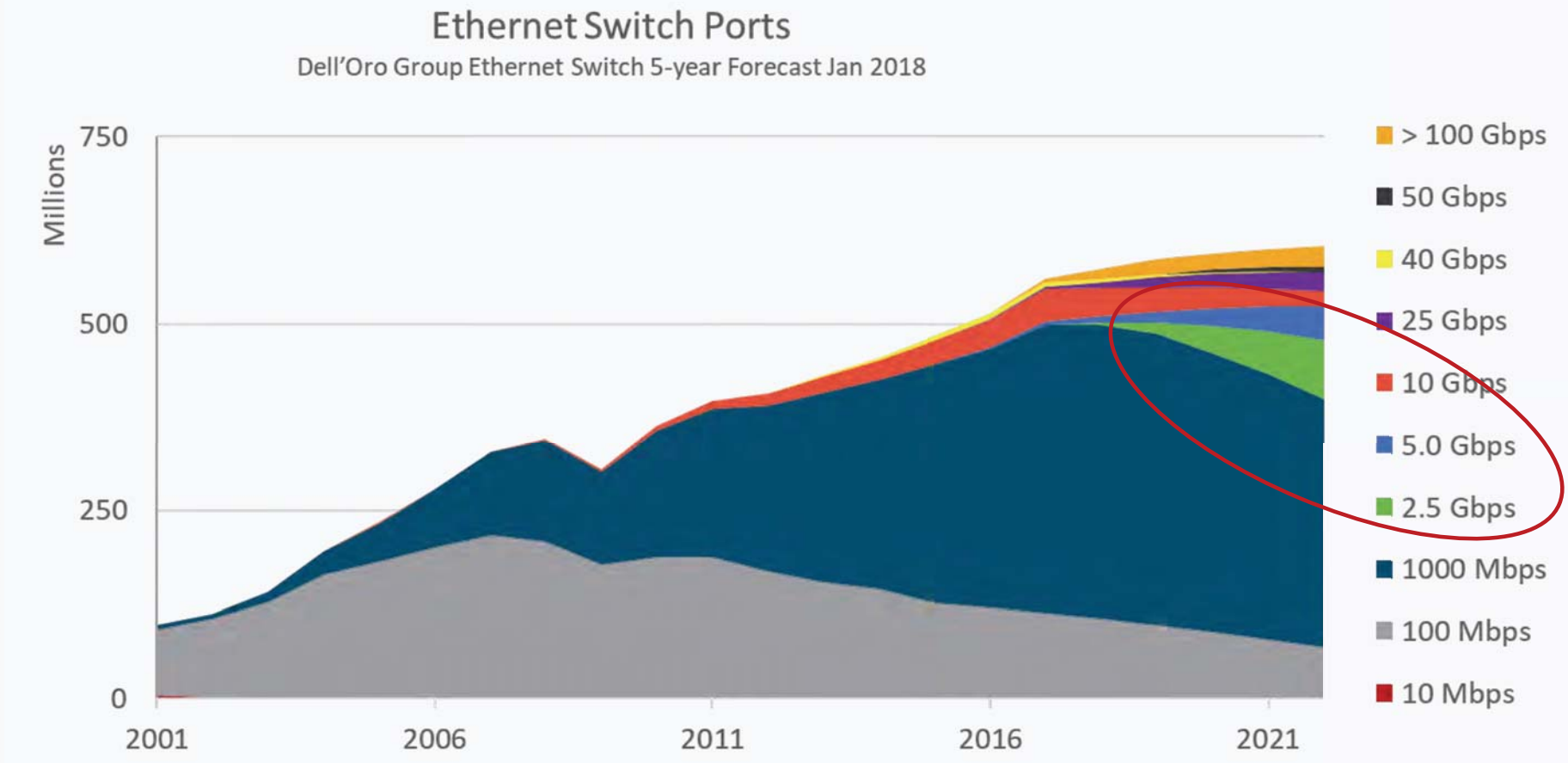
Non-Member Companies

Component
Akitio
Dell
Gigabyte
Promise Technology
QNAP
Sonnet

System Level Product
Accton
Apple
ASRock
ASUS
Brocade
Buffalo
Dell
Dell EMC
Lenovo
MSI
Promise Technology
Sonicwall
Startec
Supermicro

https://www.nbaset.org/technology/nbaset-products/

Momentum



NBASE-T ALLIANCE℠

Value of NBASE-T Technology

Leverages more than 1.3+ billion Cat5e/Cat6 outlets and more than 70 billion meters of Cat5e/Cat6 cables that make up greater than 90% of the current installed base

Enables network evolution by providing up to 10x faster speed without pulling cables or requiring building construction

Supports high-speed links to next generation WiFi access points and high-data rate client PC and workstation systems

An Introduction to Fluke Networks

Who We Are – Fluke Networks

Started 70 years ago as John Fluke Manufacturing

*Fluke Networks is the worldwide leader in **certification, troubleshooting, and installation** tools for professionals who install and maintain critical network cabling infrastructure.*

*We help **network professionals** ensure the **performance and reliability** of our **connected world**.*

Datacom Contractors

Datacenter / Network Managers

Communications Service Technicians

NBASE-T ALLIANCE℠

Fluke Networks Solutions

Certification

- Versiv: DSX2-8000, OptiFiber Pro, CertiFiber Pro, FI-7000
- LinkWare Live / PC
- MultiFiber Pro

Copper Qualification / Verification

- MicroScanner
- CableIQ

Fiber Qualification / Verification

- SimpliFiber
- Inspection and Cleaning

Tools

- Buttsets
- Hand Tools

NBASE-T ALLIANCE

Testing Cabling for NBASE-T

What is Cable Certification?

- Field Test - “to attest as being true or as meeting a standard”
  - ANSI/TIA-568.2-D is for cabling and components
  - ANSI/TIA-1152-A is for Field Testers
  - IEEE 802.3bz/NBASE-T is the standard for the application
- All of these provide expectations for the performance of the cabling
  - Sort of like defining the ‘shape’ of the road, the height of the overpasses
- In Field Testing, we check Signal (actually Insertion Loss) and Noise on the cabling
  - We measure the ‘height’ of the overpasses for your cabling
  - An insurance policy, if you will, to *make sure your installed cabling works*

A Test Result!

The Logo of the Company that did the testing

Cable ID: of the port that was tested

Test Summary: PASS

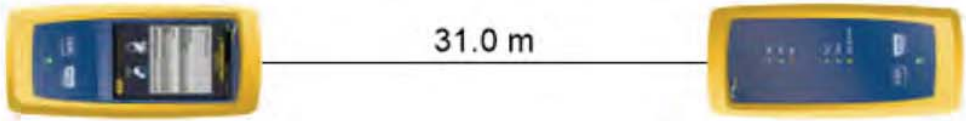
Date / Time:
Headroom 11.9 dB (RL 45)
Test Limit: TIA Cat 6 Perm. Link
Cable Type: affects the NVP
NVP: 69.0%

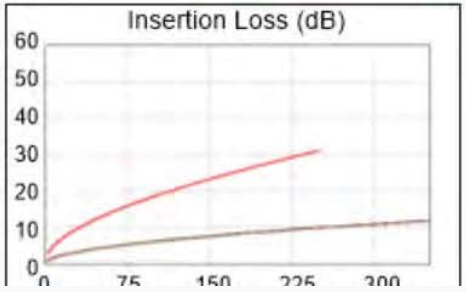
Operator: of the test equipment
Software Version: V5.0 Build 3
Limits Version: V5.0
Calibration Date:
Main (Module): 03/11/2016
Remote (Module): 03/11/2016

Model: DSX-5000
Main S/N:
Remote S/N:
Main Adapter: DSX-PLA004
Remote Adapter: DSX-PLA004

Length (m), Limit 90.0	[Pair 45]	31.0
Prop. Delay (ns), Limit 498	[Pair 36]	161
Delay Skew (ns), Limit 44	[Pair 36]	11
Resistance (ohms)	[Pair 12]	5.08
Insertion Loss Margin (dB)	[Pair 12]	21.3
Frequency (MHz)	[Pair 12]	250.0
Limit (dB)	[Pair 12]	31.1

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR





NBASE-T ALLIANCE

A Test Result! – Did the Test Pass?

The Logo of the Company that did the testing

Cable ID: of the port that was tested

Test Summary: PASS

Date / Time:
Headroom 11.9 dB (RL 45)
Test Limit: TIA Cat 6 Perm. Link
Cable Type: affects the NVP
NVP: 69.0%

Operator: of the test equipment
Software Version: V5.0 Build 3
Limits Version: V5.0
Calibration Date:
Main (Module): 03/11/2016
Remote (Module): 03/11/2016

Model: DSX-5000
Main S/N:
Remote S/N:
Main Adapter: DSX-PLA004
Remote Adapter: DSX-PLA004

Length (m), Limit 90.0	[Pair 45]	31.0
Prop. Delay (ns), Limit 498	[Pair 36]	161
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Resistance (ohms)	[Pair 12]	5.08
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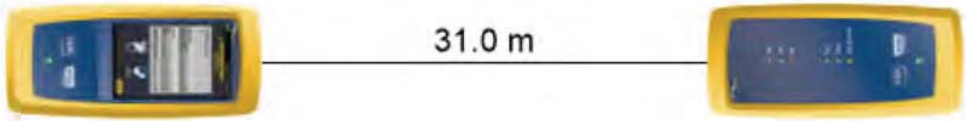
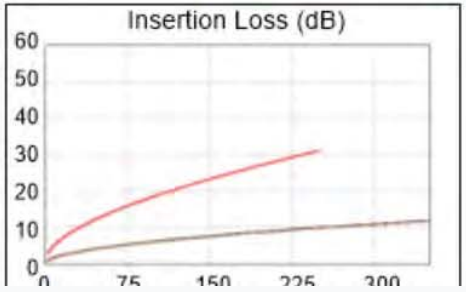
PASS	MAIN	SR	MAIN	SR





NBASE-T ALLIANCE

A Test Result! – Did the Test Pass?

Yes!

The Logo of the Company that did the testing

Cable ID: of the port that was tested

Test Summary: PASS

Date / Time:
Headroom 11.9 dB (RL 45)
Test Limit: TIA Cat 6 Perm. Link
Cable Type: affects the NVP
NVP: 69.0%

Operator: of the test equipment
Software Version: V5.0 Build 3
Limits Version: V5.0
Calibration Date:
Main (Module): 03/11/2016
Remote (Module): 03/11/2016

Model: DSX-5000
Main S/N:
Remote S/N:
Main Adapter: DSX-PLA004
Remote Adapter: DSX-PLA004

Length (m), Limit 90.0	[Pair 45]	31.0
Prop. Delay (ns), Limit 498	[Pair 36]	161
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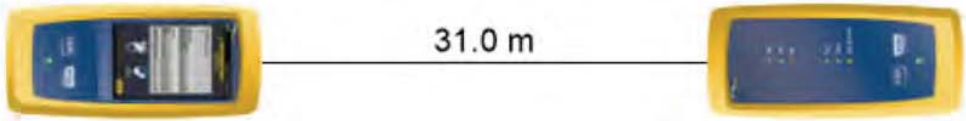
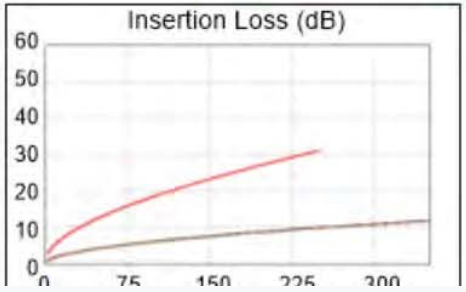
	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR





NBASE-T ALLIANCE

A Test Result! What Test Limit was Passed?

The Logo of the Company that did the testing

Cable ID: of the port that was tested

Test Summary: PASS

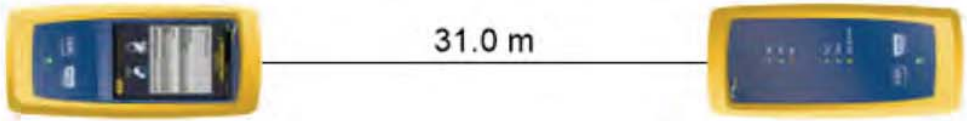
Date / Time:
Headroom 11.9 dB (RL 45)
Test Limit: TIA Cat 6 Perm. Link
Cable Type: affects the NVP
NVP: 69.0%

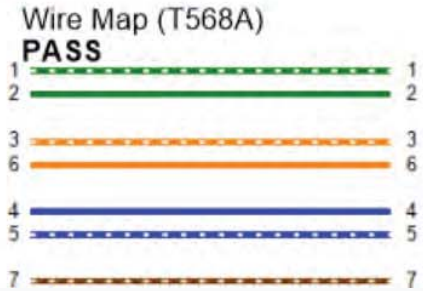
Operator: of the test equipment
Software Version: V5.0 Build 3
Limits Version: V5.0
Calibration Date:
Main (Module): 03/11/2016
Remote (Module): 03/11/2016

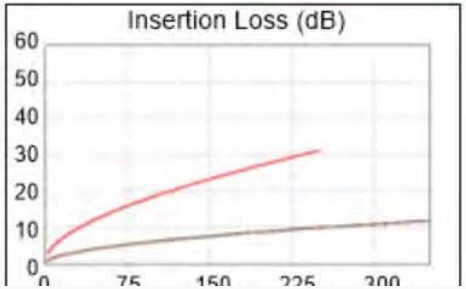
Model: DSX-5000
Main S/N:
Remote S/N:
Main Adapter: DSX-PLA004
Remote Adapter: DSX-PLA004

Length (m), Limit 90.0	[Pair 45]	31.0
Prop. Delay (ns), Limit 498	[Pair 36]	161
Delay Skew (ns), Limit 44	[Pair 36]	11
Resistance (ohms)	[Pair 12]	5.08
Insertion Loss Margin (dB)	[Pair 12]	21.3
Frequency (MHz)	[Pair 12]	250.0
Limit (dB)	[Pair 12]	31.1

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR







NBASE-T ALLIANCE

A Test Result! What Test Limit was Passed?

The Logo of the Company that did the testing

Category 6 – Permanent Link

Cable ID: of the port that was tested

Test Summary: PASS

Date / Time:
~~Headroom 11.9 dB (RL 45)~~
Test Limit: TIA Cat 6 Perm. Link
~~Cable Type: affects the NVP~~
NVP: 69.0%

Operator: of the test equipment
Software Version: V5.0 Build 3
Limits Version: V5.0
Calibration Date:
Main (Module): 03/11/2016
Remote (Module): 03/11/2016

Model: DSX-5000
Main S/N:
Remote S/N:
Main Adapter: DSX-PLA004
Remote Adapter: DSX-PLA004

Length (m), Limit 90.0	[Pair 45]	31.0
Prop. Delay (ns), Limit 498	[Pair 36]	161
Delay Skew (ns), Limit 44	[Pair 36]	11
Resistance (ohms)	[Pair 12]	5.08
Insertion Loss Margin (dB)	[Pair 12]	21.3
Frequency (MHz)	[Pair 12]	250.0
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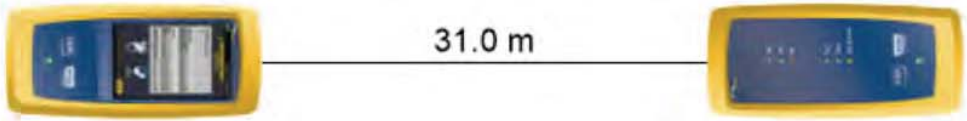
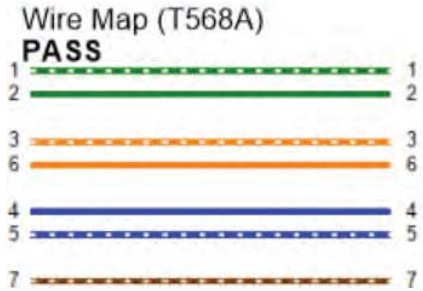
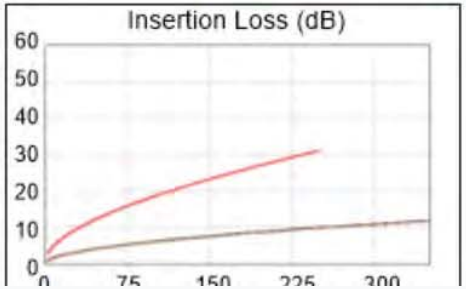
	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR







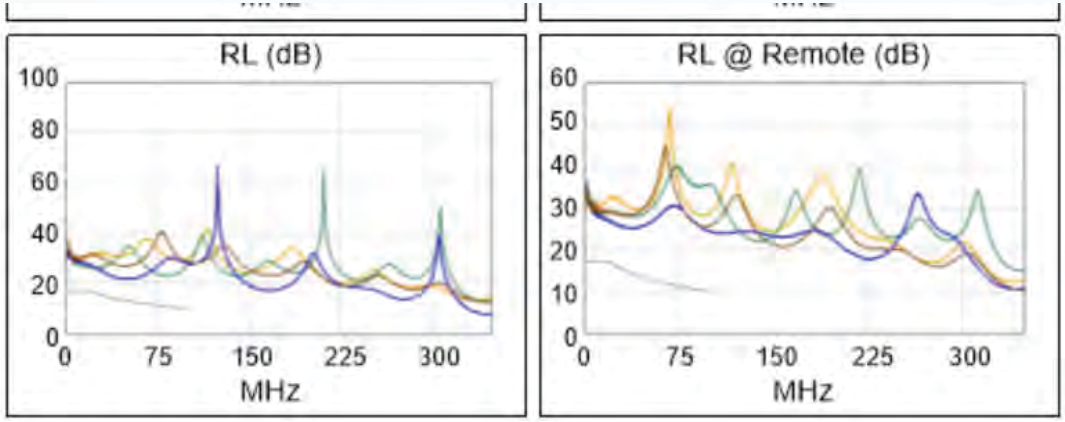
NBASE-T ALLIANCE

Will it support NBASE-T? Yes!

N/A	MAIN	SR	MAIN	SR
Worst Pair	45	45	45	45
RL (dB)	8.4	9.8	9.0	14.4
Freq. (MHz)	44.3	21.1	52.5	100.0
Limit (dB)	13.6	16.8	12.8	10.0

Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	2.5GBASE-T	5GBASE-T
ATM-25	ATM-51	ATM-155
100VG-AnyLan	TR-4	TR-16 Active
TR-16 Passive		



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ATM-25	ATM-51	ATM-155
100VG-AnyLan	TR-4	TR-16 Active
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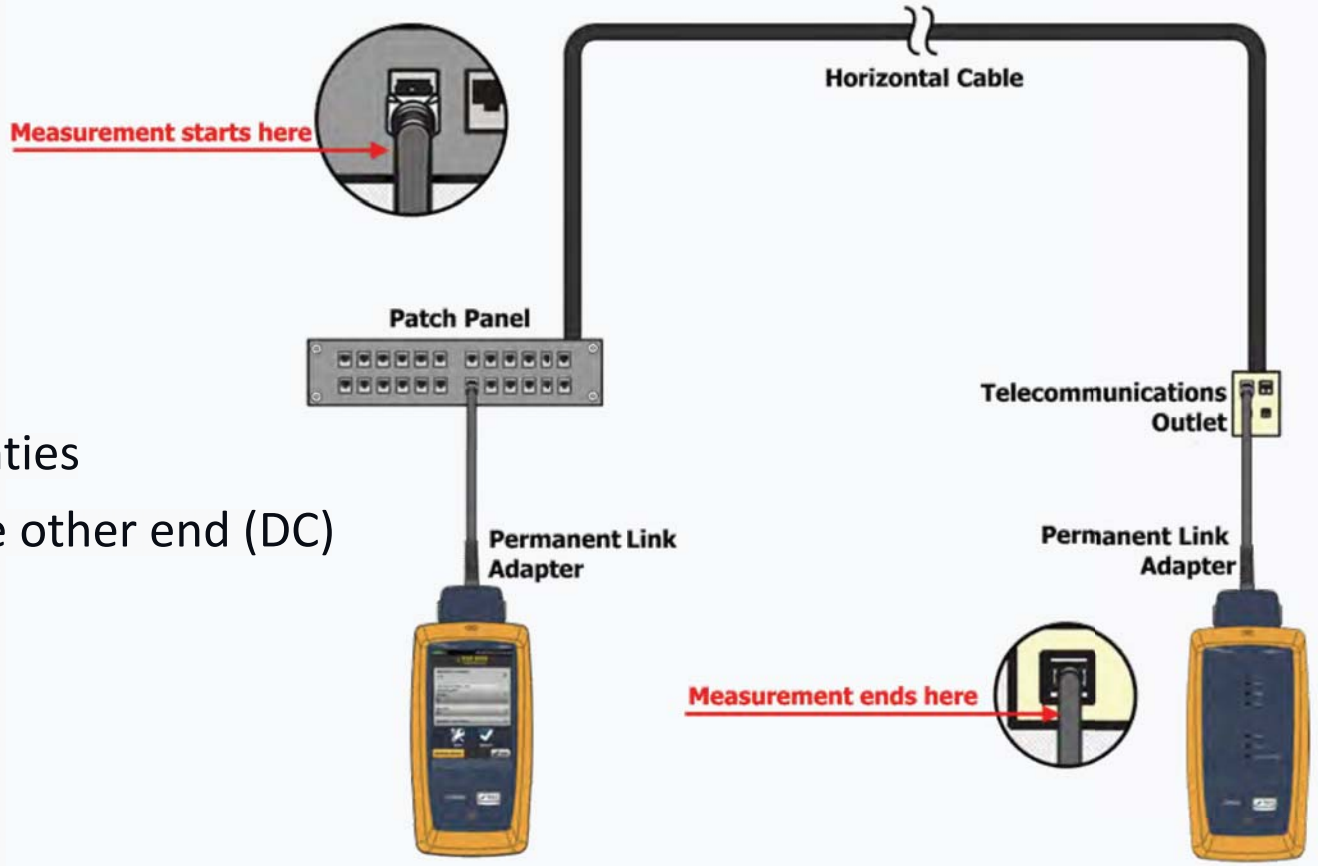
Permanent link

Typically used by installers

Required for cabling warranties

May be a patch panel at the other end (DC)

Max. 90 m (295 ft.)



NBASE-T ALLIANCE

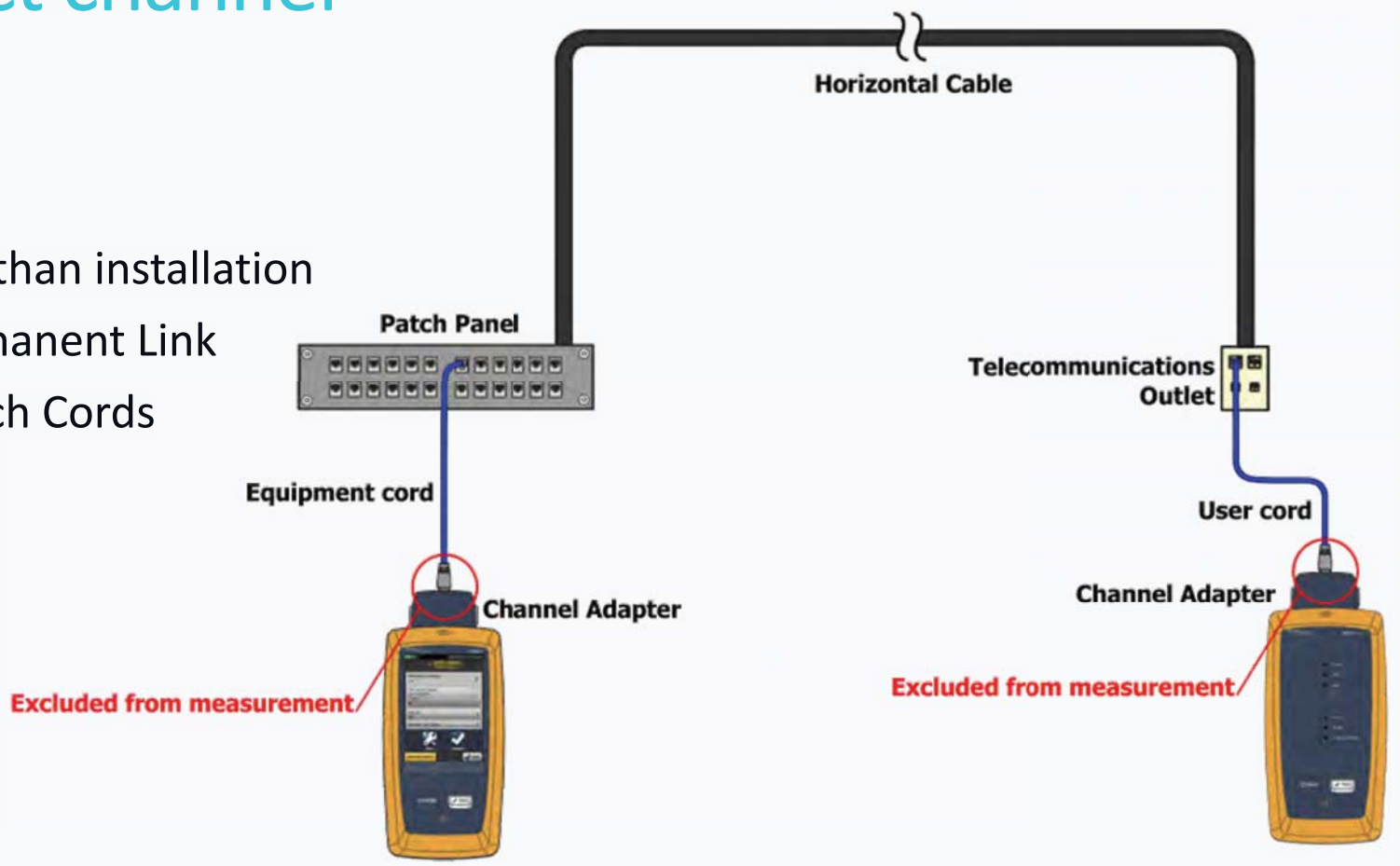
Inter-connect channel

Troubleshooting rather than installation

Easier to Pass than Permanent Link

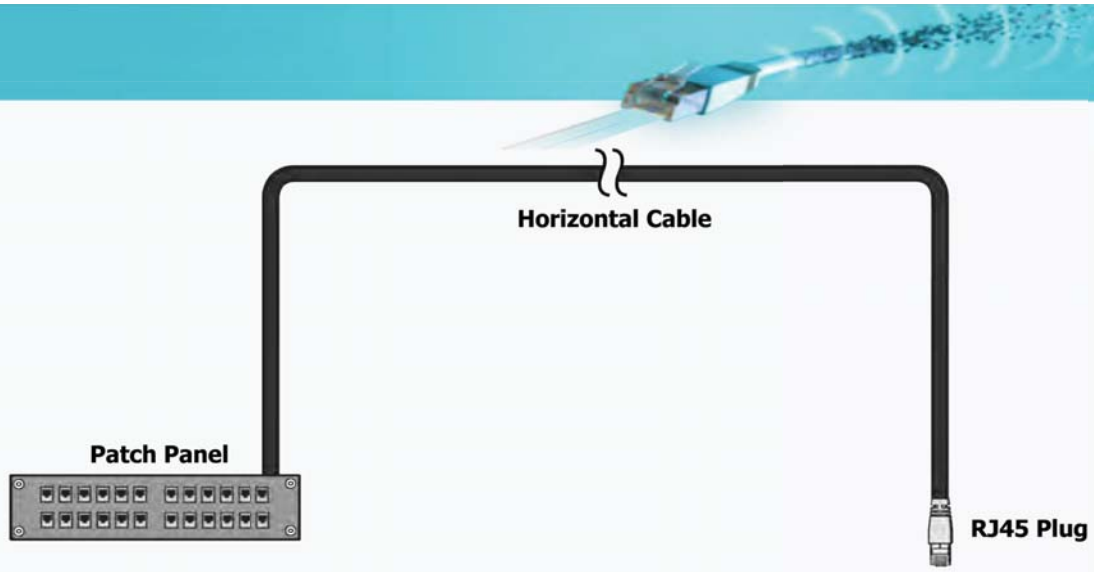
Tested with specific Patch Cords

Max. 100 m (328 ft.)



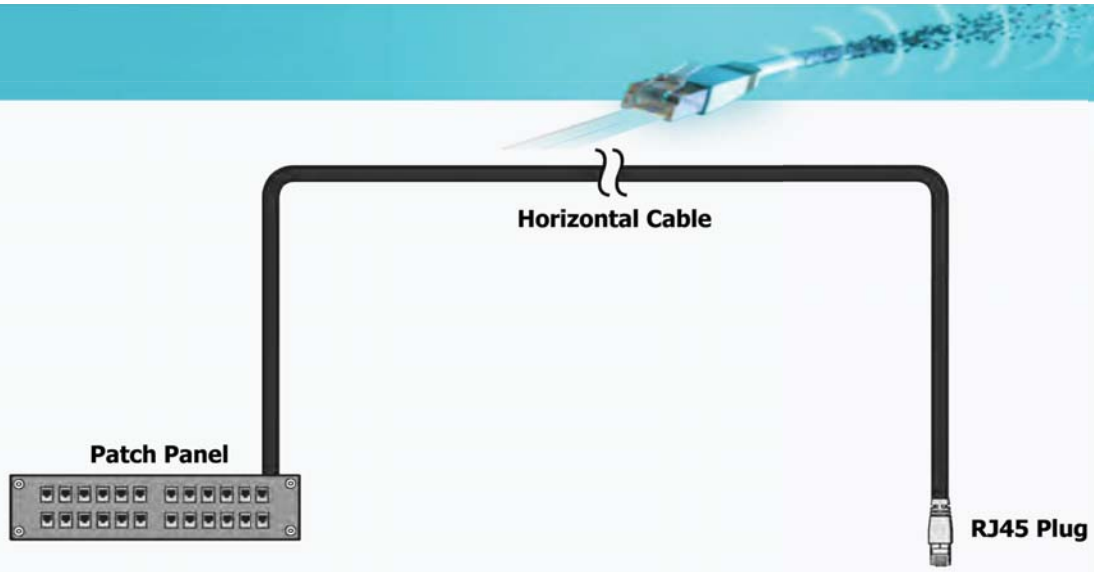
NBASE-T ALLIANCE

WAPs and IP Cameras



- The far end is typically hardwired with an RJ45 plug.
- Used in CCTV and PoE wireless access points

WAPs and IP Cameras



- The far end is typically hardwired with an RJ45 plug.
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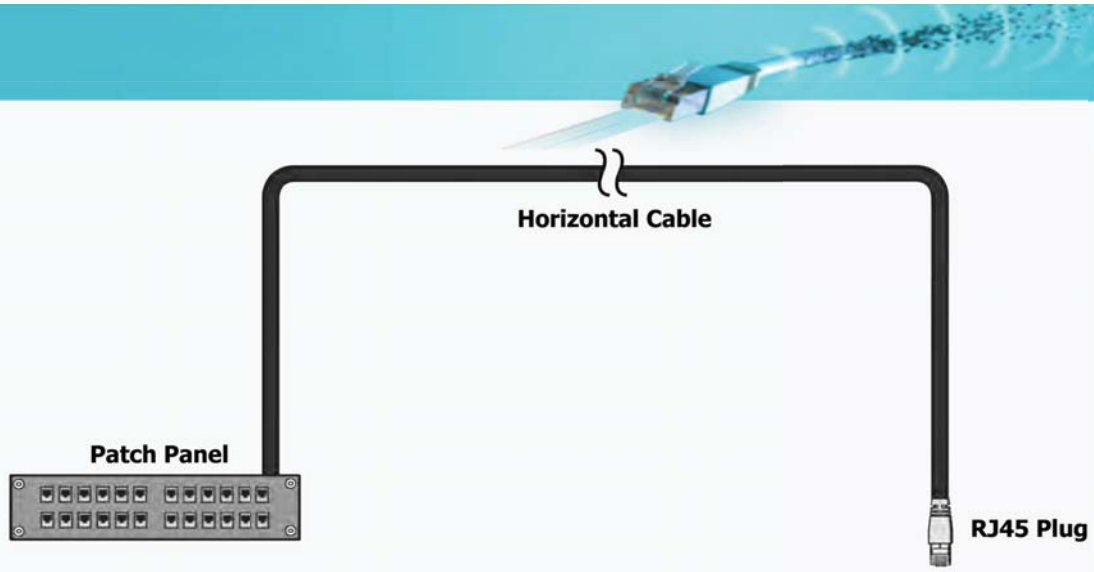
- Is this a Permanent Link or Channel test?

WAPs and IP Cameras



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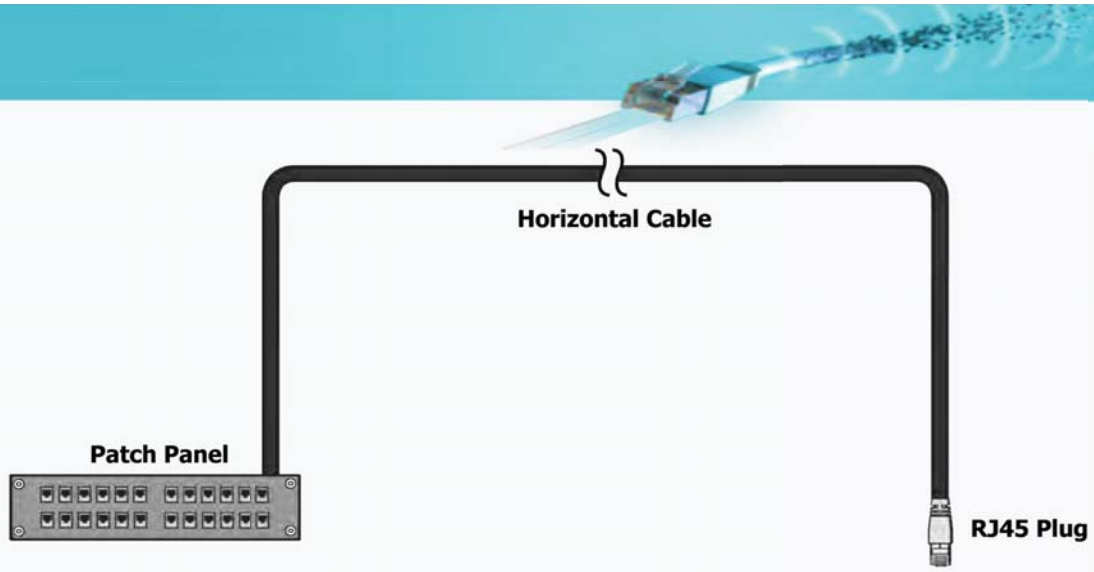
WAPs and IP Cameras



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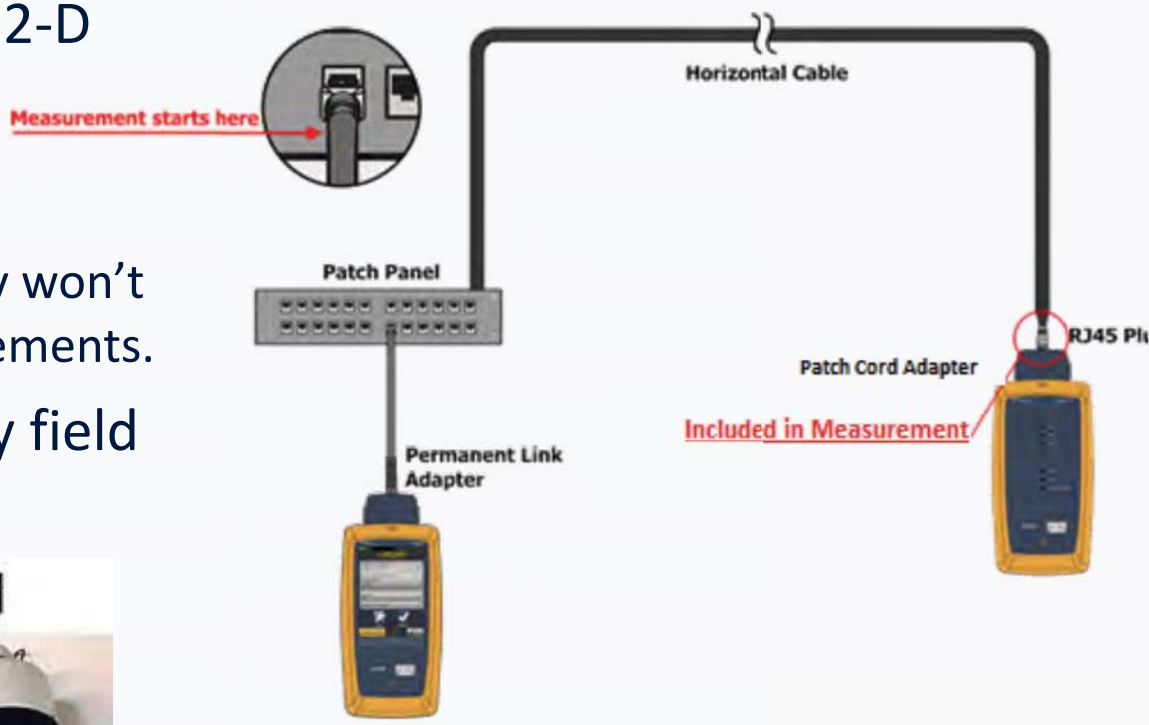
  - ANSI/TIA 568.2-D (published June 2018) includes “Modular Plug Terminated Link” (MPTL) in Annex F
- Will use a Permanent Link limit

NBASE-T ALLIANCE

Modular Plug Terminated Link

- Just introduced in ANSI/TIA-568.2-D
- Limited to 90 meters
- Uses field terminate-able RJ-45
  - A standard “ice cube” plug probably won’t meet Cat 6/6A performance requirements.
- Use patch cord adapter to certify field installed plug performance



Check with the company issuing the warranty

What About My Old Cabling?

Cabling Performance Requirements for NBASE-T

- Category 5e is tested to 100 MHz
- 2.5 G NBASE-T has the same limit lines as Category 5e
- 5 G NBASE-T has the limit lines extrapolated out to 250 MHz

Cabling Performance Requirements for NBASE-T

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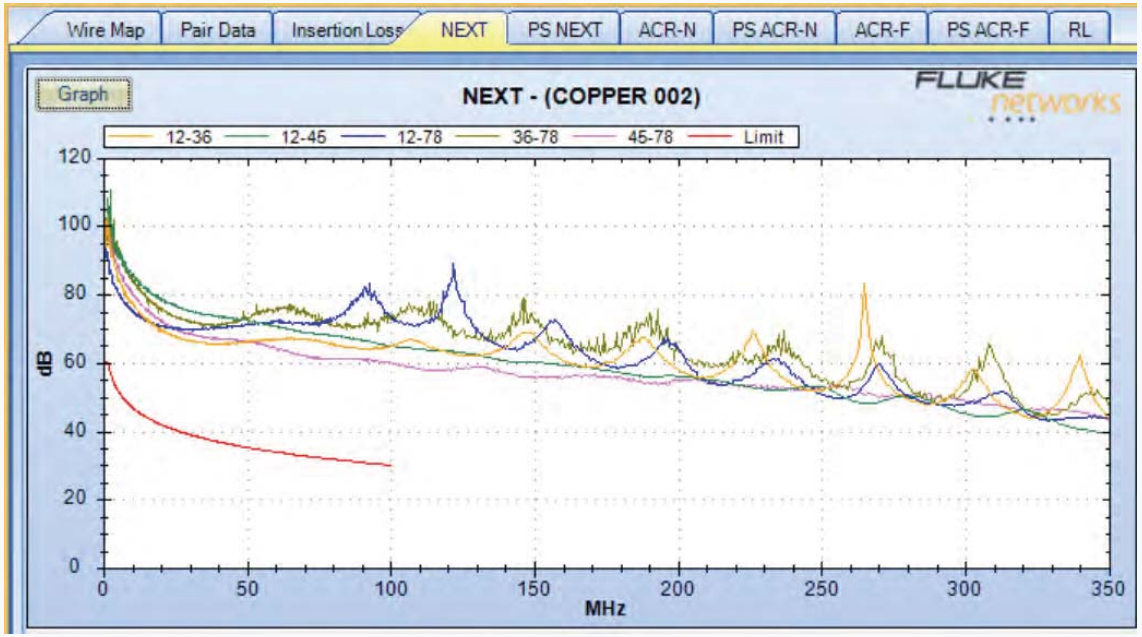

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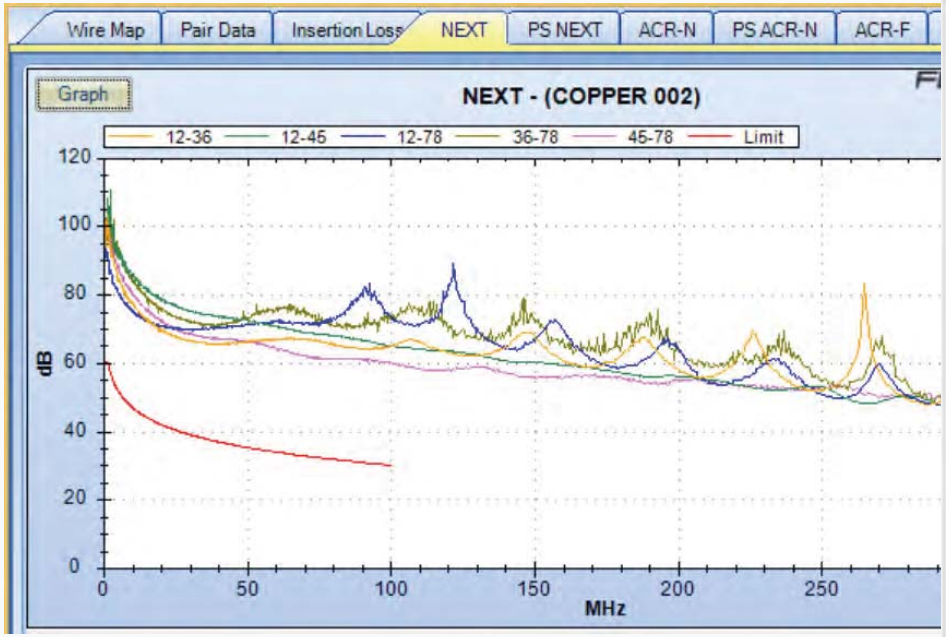
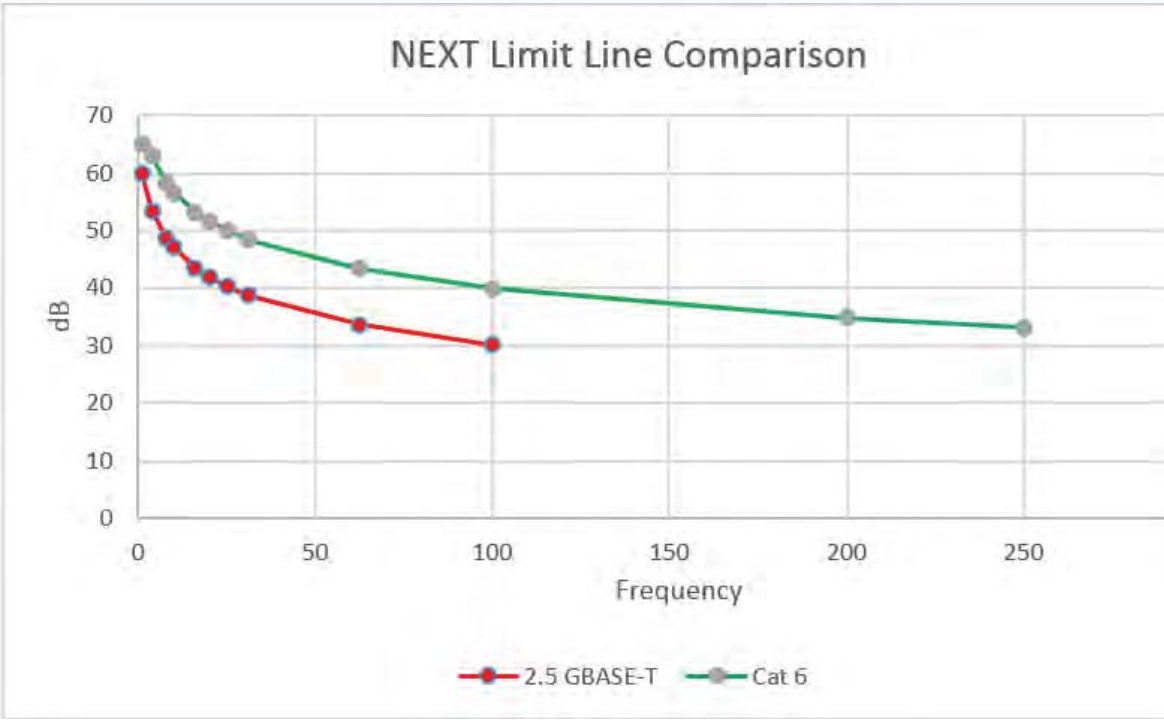
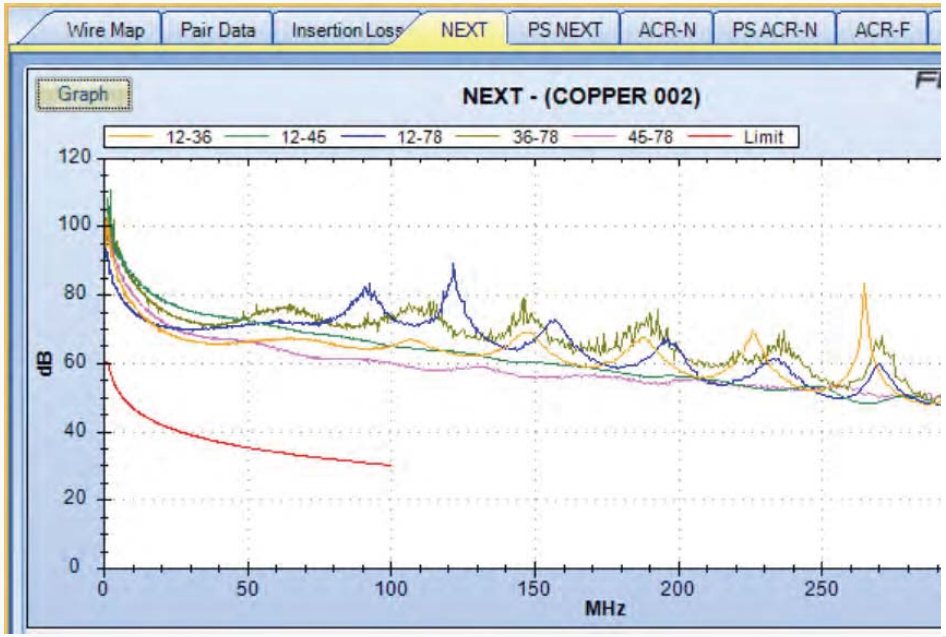
- 5 G NBASE-T has the limit lines extrapolated out to 250 MHz

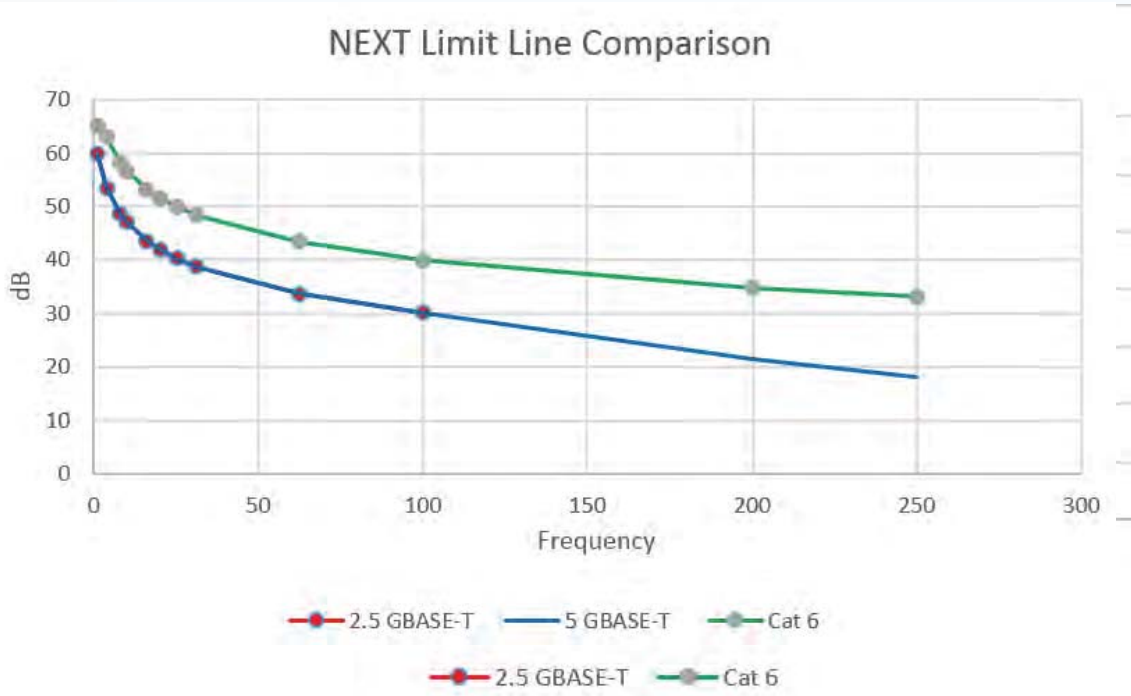




Cabling Performance Requirements for NBASE-T

- Category 5e is tested to 100 MHz
- 2.5 G NBASE-T has the same limit lines as Category 5e
- 5 G NBASE-T has the limit lines extrapolated out to 250 MHz





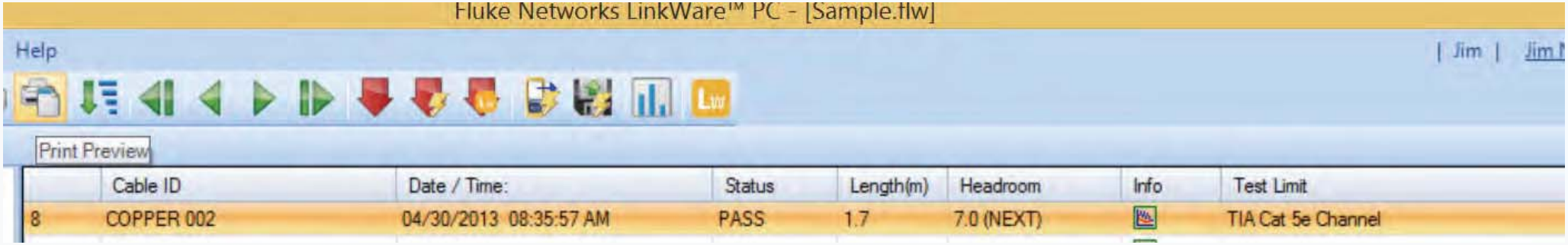
Category 5e Cabling is expected to support NBASE-T

- NBASE-T limits are the same as Category 5e for NEXT and Return Loss
  - However – 5G Gigabit limits are based on Category 5e limits extrapolated out to 250 MHz
- Will your existing cabling will support 2.5G/5G
  - Compare your test results to limits out to 250 MHz
- How was your cabling certified? To What Standard?
  - Not certified?
  - Continuity?
  - Application Test?
  - Did you store your test data?

	2.5G BASE-T	5G BASE-T
Installed Cat 5e	✓	Extended frequencies required
Installed Cat 6	✓	✓
Installed Cat 6A	✓	✓

NBASE-T ALLIANCE™

LinkWare PC Recertification



NBASE-T ALLIANCE

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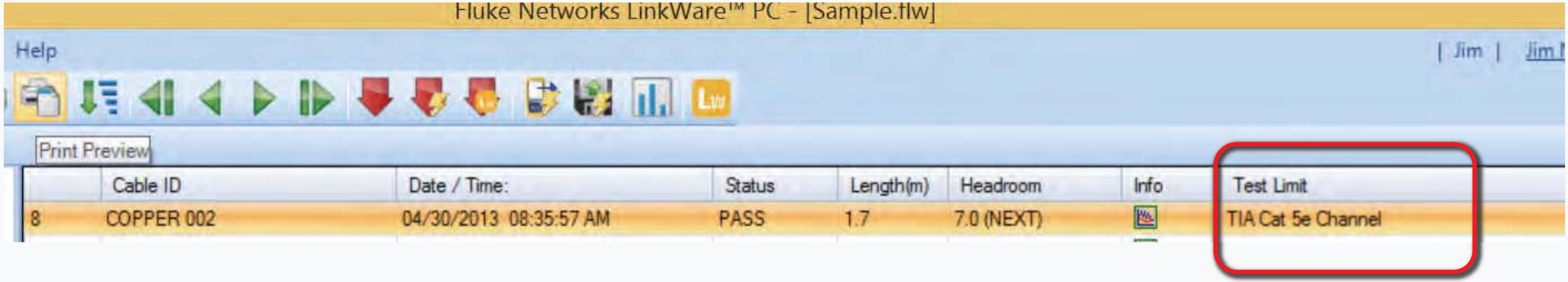

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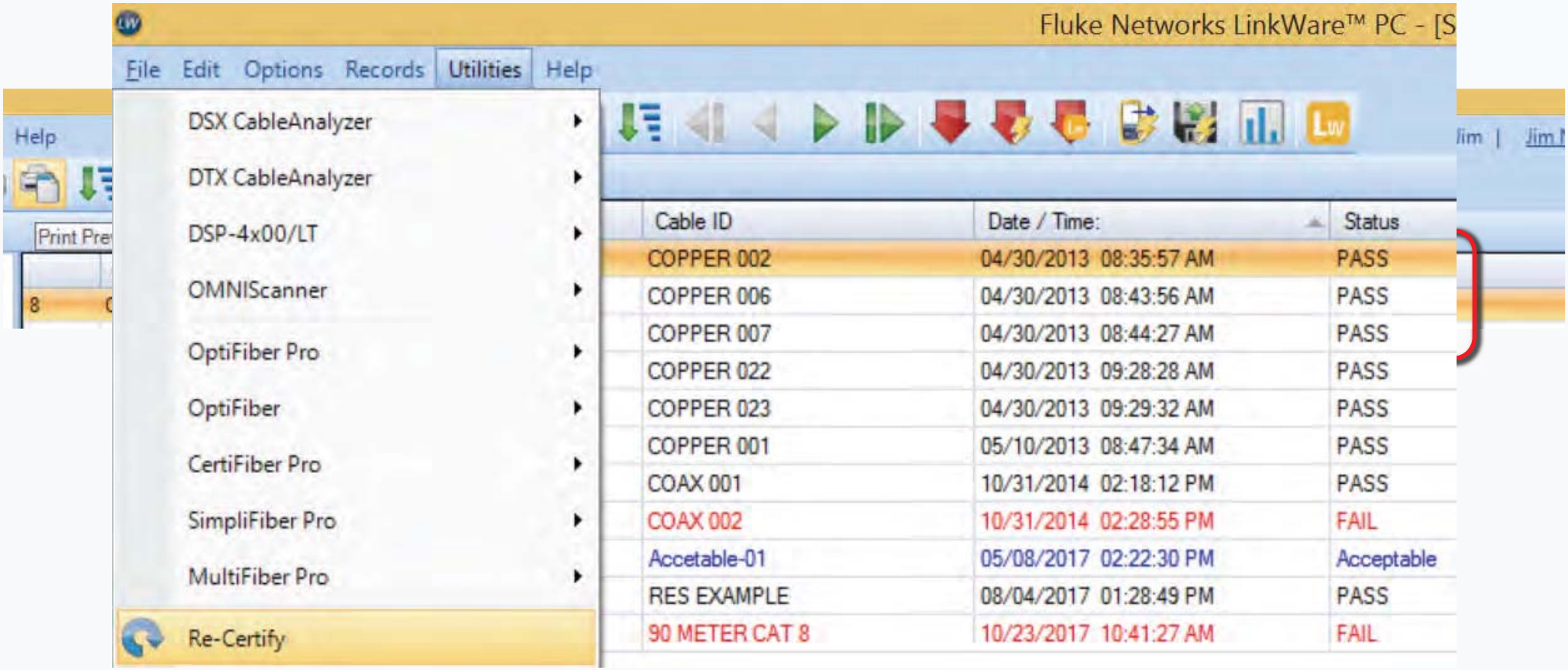

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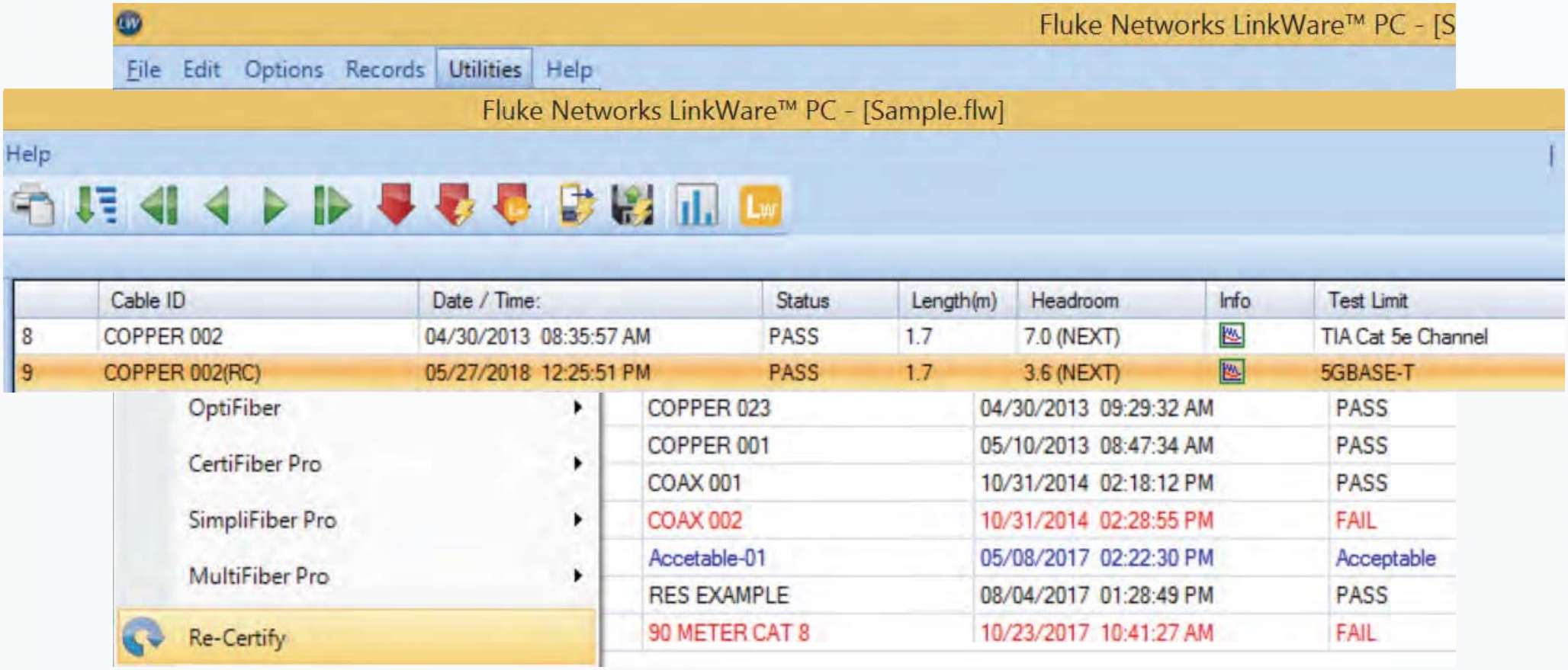

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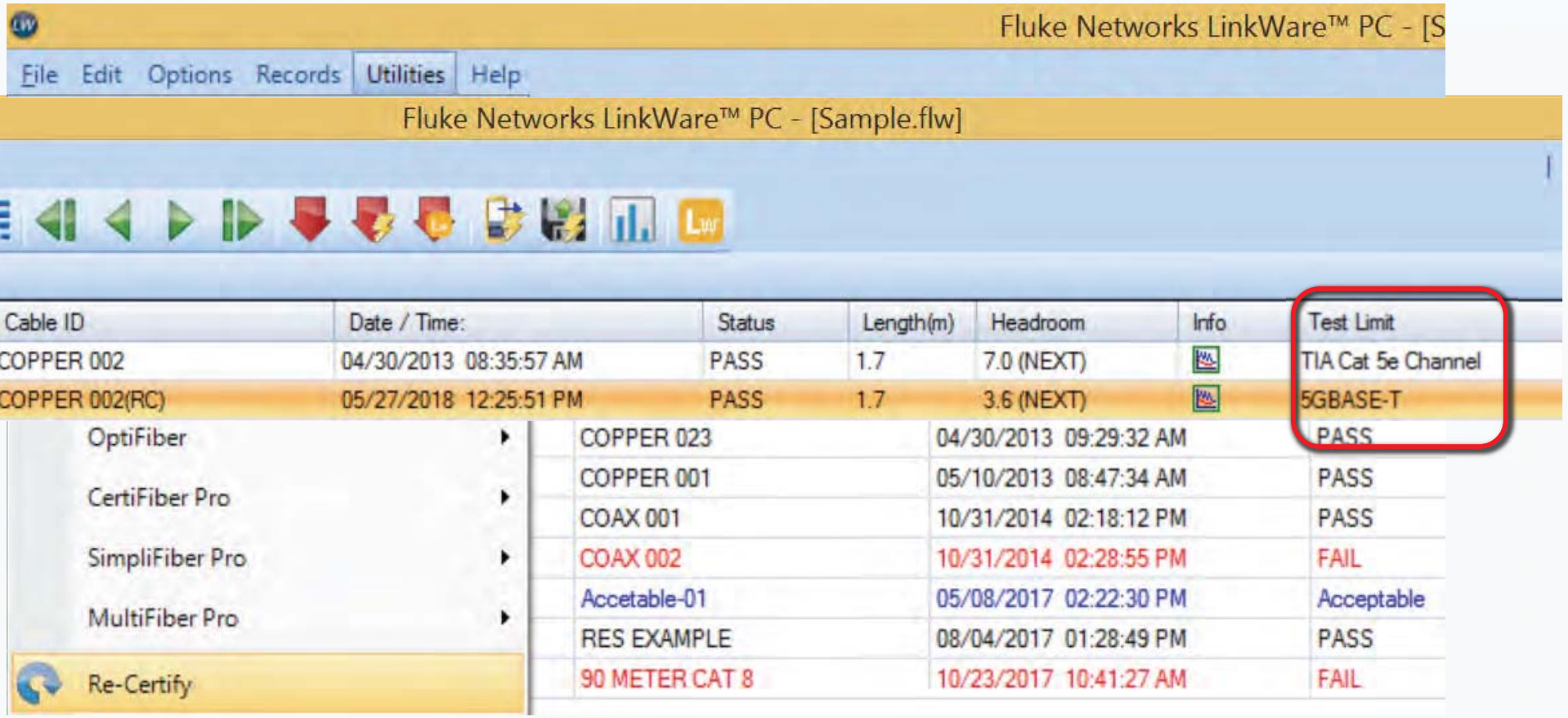

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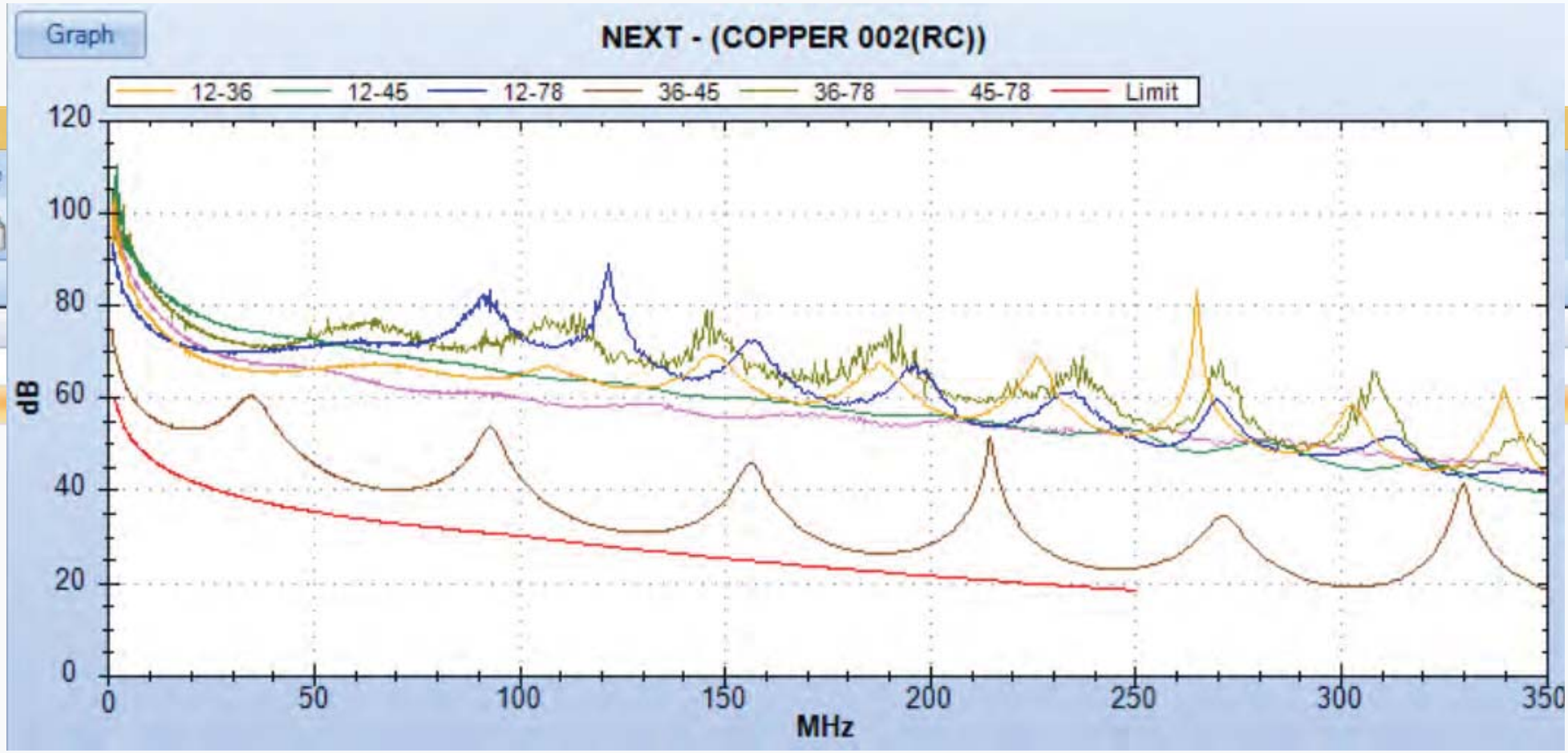

NBASE-T ALLIANCE

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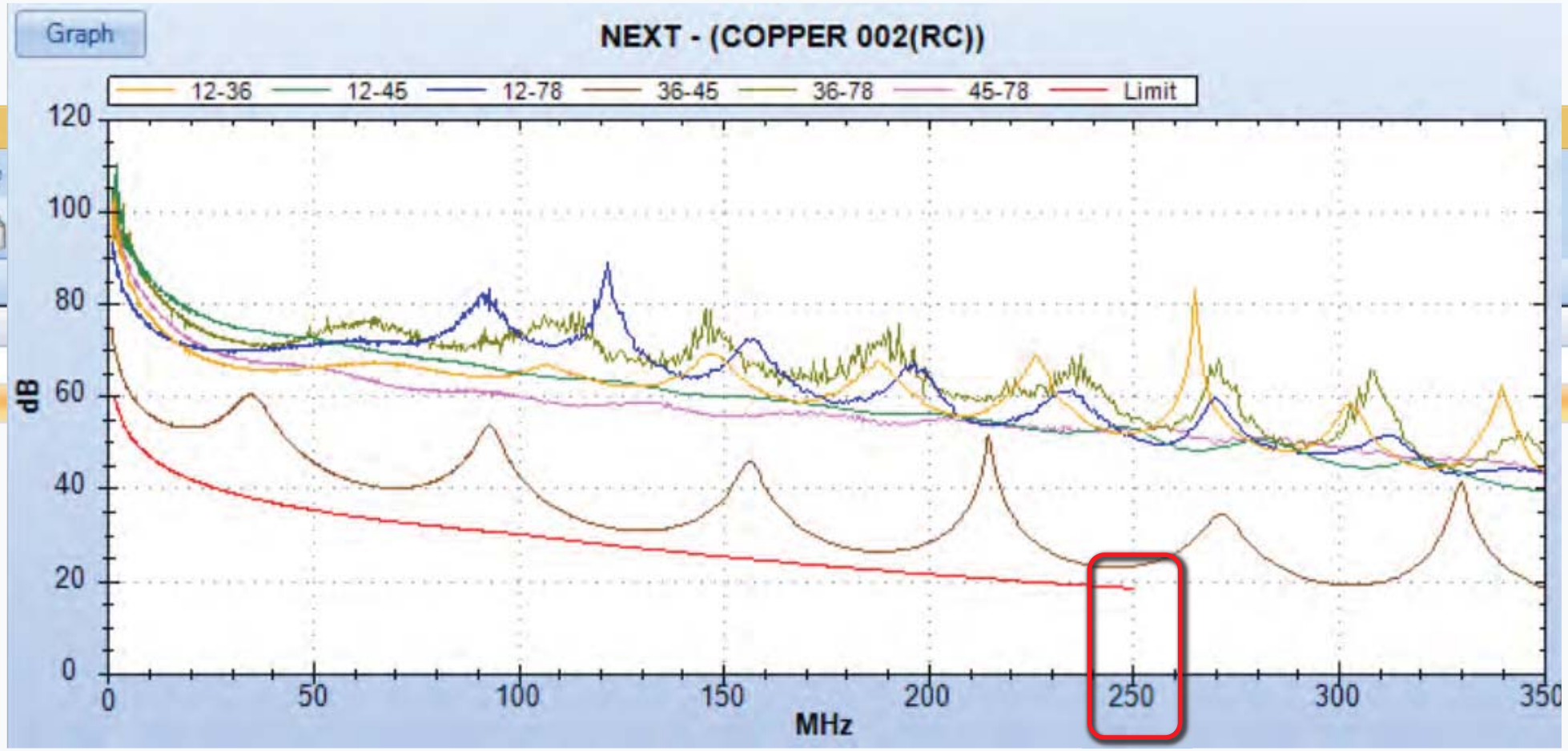


NBASE-T ALLIANCE

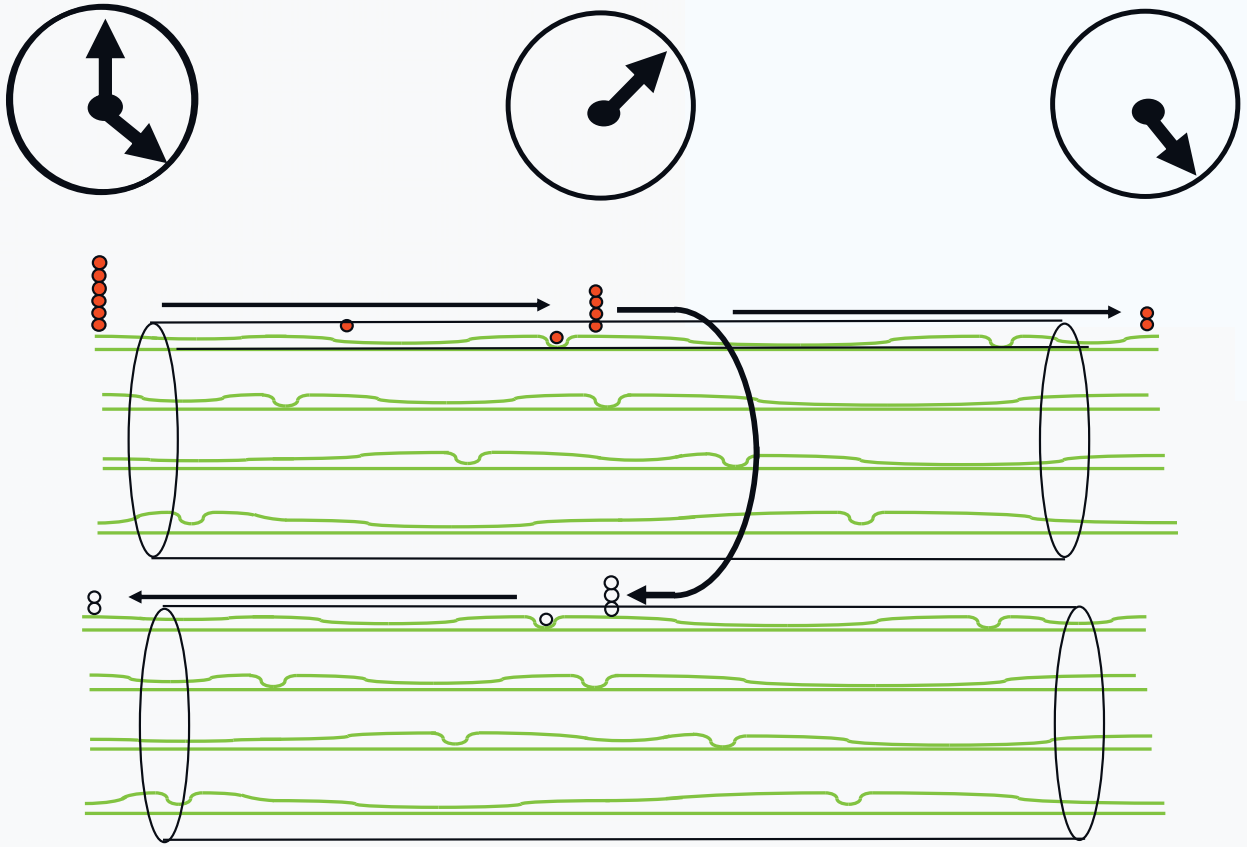
What About ALSNR?

Alien Limited Signal to Noise Ratio ALSNR

(Exogenous Crosstalk)

Alien Crosstalk/ALSNR in NBASE-T

Alien crosstalk occurs between cables



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Field Testing for PS ANEXT

- Power Sum Alien Near-End Crosstalk

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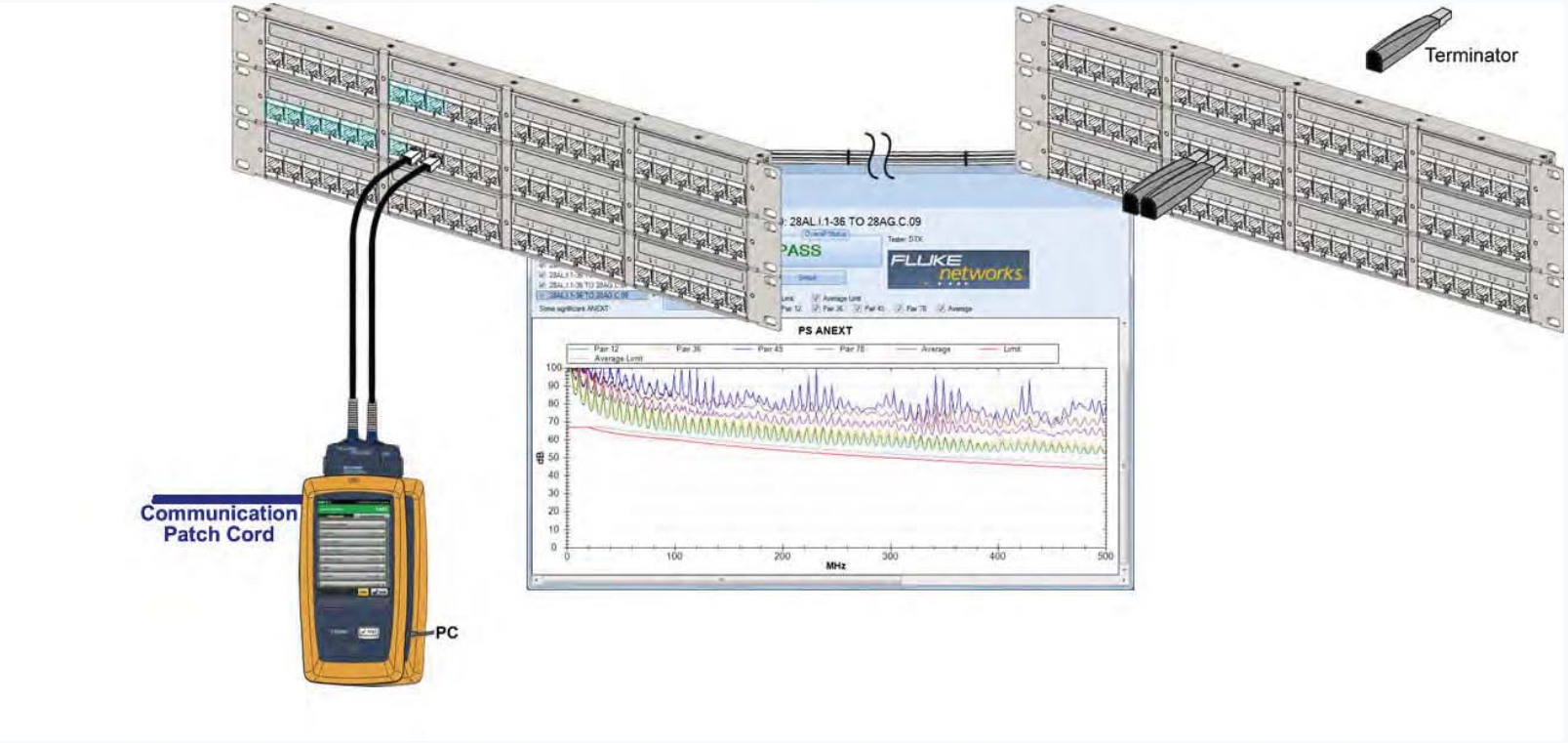

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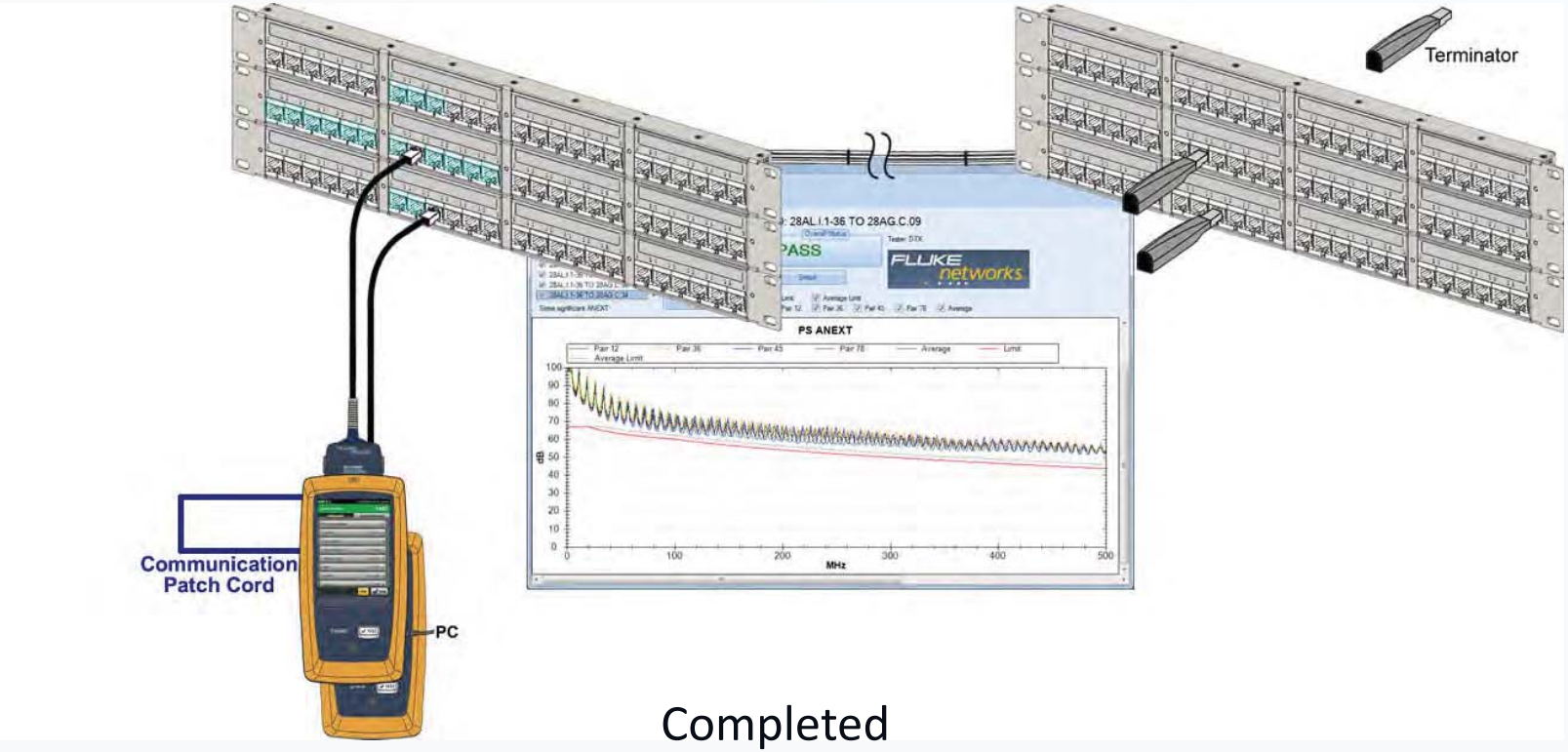

Completed

Field testing for ALSNR

- First, relax, it is a visual inspection
- How long are your cables in a bundle?
  - < 50 meters (164 ft) should be no problem
  - 50 – 75 meters, perhaps some concern for Category 5e
  - > 75 meters, Category 5e may not support 5GBASE-T

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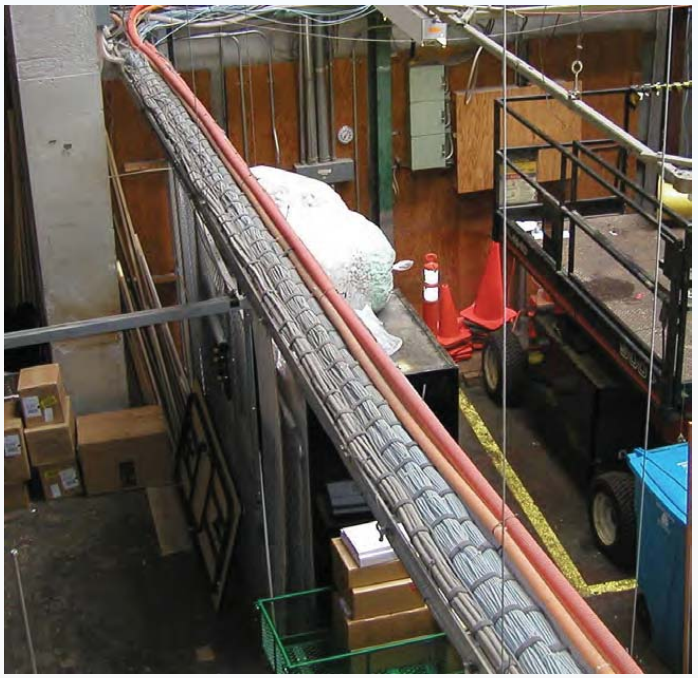

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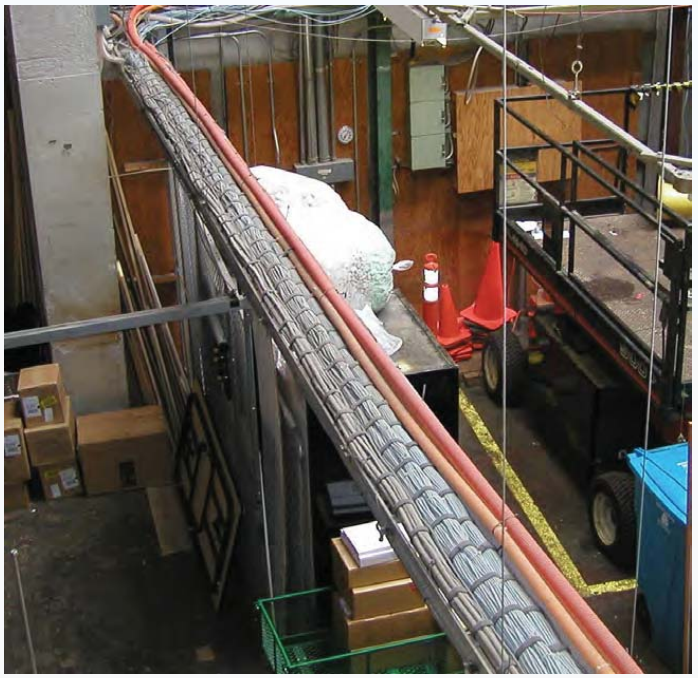

0m <= Bundled cabling length <= 50m	Category 5e	Category 6	Category 6A
2.5GBASE-T			Assured
5GBASE-T Assured			Assured

50m <= Bundled cabling length <= 75m	Category 5e	Category 6	Category 6A
2.5GBASE-T			Assured
5GBASE-T Assured			Assured

75m <= Bundled cabling length <= 100m	Category 5e	Category 6	Category 6A
2.5GBASE-T			Assured
5GBASE-T Assured			Assured

ALSNR Risk	High	Medium	Low

NBASE-T ALLIANCE℠

Wrap-up & Discussion

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NBASE-T is designed to run on installed Category 5e or better cabling

Did you certify your cabling when you installed it?

- Great, you are probably ready to support NBASE-T

MPTL may be an interesting solution for your access points

Certify new cabling to ready for network speed evolution

- Keep bundles short to minimize Alien CrossTalk
- Want more? Review the NBASE-T Performance and Cabling Guidelines whitepaper

Thank you, Gracias, Obrigado
Jim & Peter

Visit www.nbaset.org & www.FlukeNetworks.com for more information