Seattle Archdiocese Office for Catholic Schools
Design for Classroom WiFi Network Modernization
Guidelines for IT Physical Infrastructure Design and Specifications

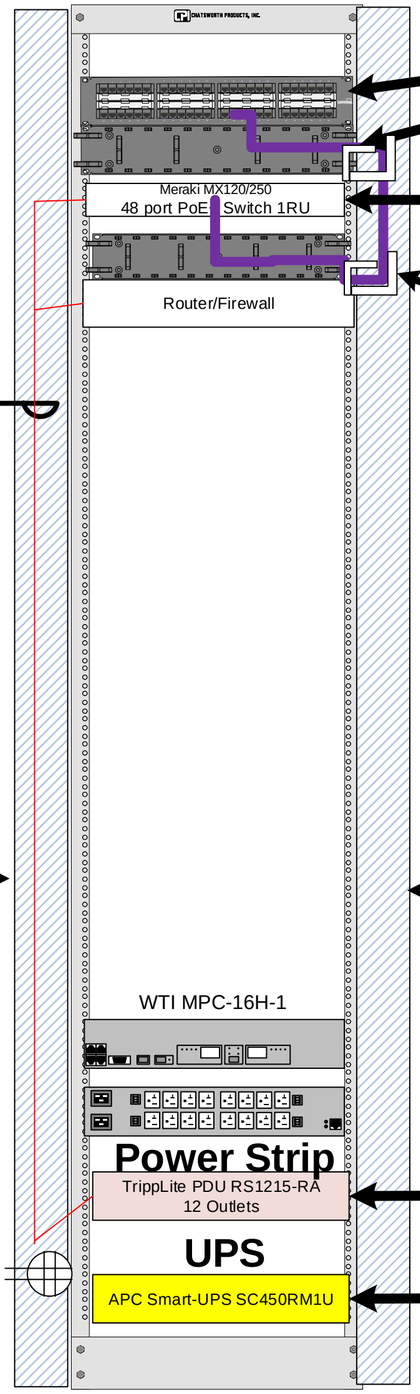
This document provides guidelines to school technology support staff responsible for developing and supervising the design and installation of new classroom computer/network cabling systems.

Contents:

Engineer: T. E. O'Callahan OCS Technology Strategy and Planning March 17, 2018 rev 8/19/19

Classroom WiFi Network Infrastructure Plan

Typical 19 Inch Floor Mount Rack Profile



1. 48 Port copper patch panels label with jack numbers
2. 2U Horizontal wire managers D-Ring Panel 5 rings 558331-1 Leviton Opt-X 500i SDX 5R1UL-CMT
3. 48 port switch
4. Harness cables or patch cords secured with velcro in 6 cable bundles

Cable Mgmt Ring
Part #: CS 558334-1

Power cords routed on back side on vertical wire manager

4 to 6 inch
vertical wire management

1

4 to 6 inch vertical wire management

TrippLite PDU
Part #: RS1215-RA
12 Outlets

120 volt, 20 amp power strips

Engineer's Notes:

1. The switch is the first and closest equipment component to the patch panel.
2. The vertical and horizontal cable management must be place to provide a path to route the patch cords between equipment. The patch cords must be appropriately sized. 3ft Mini Cat6 are optimal. 2ft is the minimum length.

3. The patch cords must not be routed directly down across equipment from the patch panel.

Power redundancy design:
UPS or Power Strip (WTI MPC) with dual power inputs. Two (2) L5-20 power receptacles on separate 120 volt, 20 amp circuits.
Note: These are locking style receptacles.

Best Practice: Use L5-20 cords (locking style preferred) and 5-20R receptacles

Example: CHATSWORTH - 57003-703

REV	REVISION DESCRIPTION
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SHEET SIZE: 11x8.5

Typical Floor Mount Rack Example

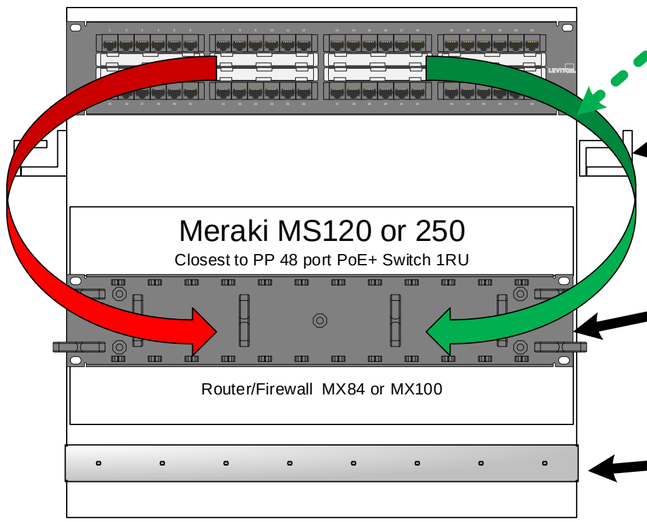
SITE: Typical Rack	BLDG:	Location:
Engineer: Tom O'Callahan	DATE: 3/20/17	Project NAME:
ORIG: T. O'CALLAHAN	DATE: 3/17/15	SHEET: 1 of 1

Wall Mount Rack Examples and Equipment Profiles

Option 1: MDF/central network location
Hoffman Wall Mount Rack 12 RU
Part #: E19FMW12u20

Hoffman Wall Mount Rack
Equipment Position and
Cable Management Example

48 Cat 6 patch cables:
24 to left (red)
24 to right (green)
patch cables organized with velcro
into 6 cable bundles



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Vertical cable management on right and left sides
Allen Tel Products AT55MR-S1
Vertical Cable Management D-Ring, 1 Rack Unit Wide

Allen Tel Products AT55WMP-1
1 Rack Unit mounted directly below
switch

TrippLite PDU RS1215-RA
12 Outlets (6F/6B) 1 Rack Unit 15 ft cord
1800 Watts

REV	REVISION DESCRIPTION
1	August 19, 2019: Add cable management detail
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Hoffman Wall Mount Rack 12 RU	BLDG:	Location:
Engineer: Tom O'Callahan	DATE: 3/17/18	Project NAME:
ORIG: T. O'CALLAHAN	DATE: 3/17/15	SHEET: 1 of 1

End to End Classroom Cable Path

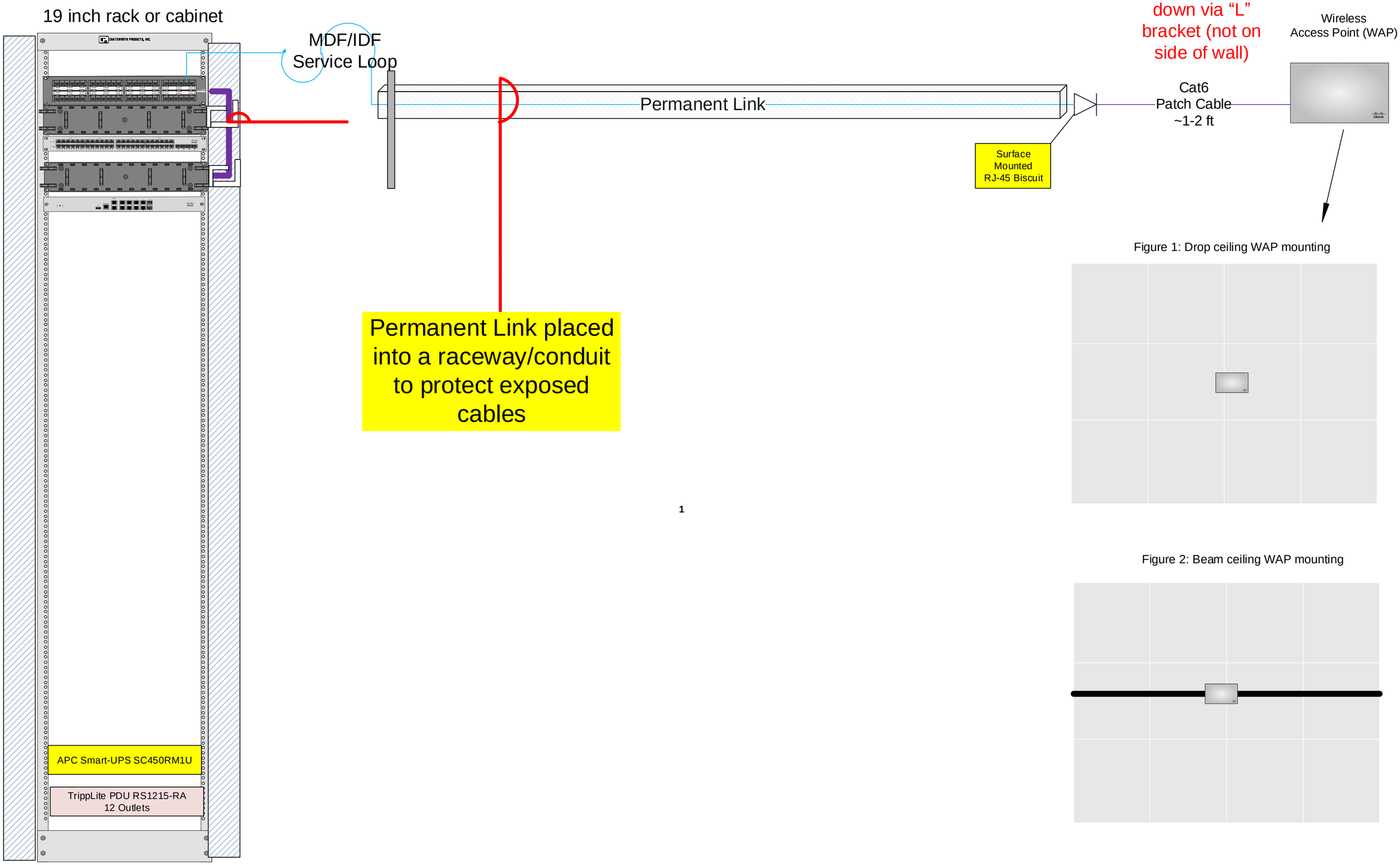

Figure 1: Drop ceiling WAP mounting

Figure 2: Beam ceiling WAP mounting

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Cabling Design for Classroom Wireless Access Points

General Template	BLDG: All	Location:
Engineer: Tom O’Callahan	DATE: 3/17/17	Project NAME:
ORIG: T. O'CALLAHAN	DATE: 3/17/17	SHEET: 1 of 1

1. Bids shall provide detail on type of cabling. Include components necessary for full operation including installation. The attached diagram is guidance for a rack design. The components include: cabling, conduit, cable ways, race way, jacks, ground, busbar, patch panel, racks, cable management.

2. Dual 4 pair station wire will be terminated on an un-keyed 8 pin modular jack and shall conform to the appropriate performance specifications as set forth in EIA/TIA 568B or the equivalent.

3. All jacks shall be labeled with its appropriate assigned room number.

4. The number and location of jacks will be determined during a site visit. The estimated number is 25 jacks.

5. Installed equipment labels on installed items, such as access points and switches and other non-cable items, must include the Funding Request Number (FRN).

6. The wiring for wireless access points shall provide for mounting the access point in the middle of the classroom ceiling using the manufacturer specified mounting brackets.

7. The number of feet of cabling drops is an estimate only and the selected solution may differ from the estimation by a considerable amount.

8. Horizontal wiring shall be plenum rated.

9. Wires should run in a straight line at 90-degree angles to the building structure and be formed properly. Wire clamps/rings shall be placed 4' horizontally or 8' vertically. Cable/wire tie wraps or Velcro straps will be every 6' horizontally or 8' vertically. The installed cable must not be under tension greater than 25 pounds (II kg). This will be visually apparent by the sag of the cables.

10. UTP cable shall be installed per the ANSI/TIA/EIA-569 EMI separation distances.

11. Cables shall not be laid directly on ceiling tiles, HVAC ducts or attach to sprinkler pipes, electrical conduit, ceiling tile hangers or any other structure not specifically intended for communications support.

12. The design/installation shall provide a minimum of 15ft (4m) service loop be provided in the horizontal permanent link to enable future patch panel or drop location move requirements.

13. Wiring/cabling and equipment must be properly installed and tested. Installer shall provide cabling test reports. Note: Cat 5e cabling must meet or exceed Cat 5e specifications at 100Mhz for near end/far end cross talk per IEEE 802.3 1000BASE-T (Gigabit Ethernet) standards. See Appendix A for an example.

14. The design/installation contractor must meet and comply with federal, state, and local codes and regulations including telecommunications industry standards: ANSI/BICSI, TIA, NEC/NFPA, IEEE. This is an example of such standards:

- ANSI/BICSI:
- ANSI/BICSI 002-2014 - Data Center Design & Implementation Best Practices
- ANSI/BICSI 003-2014 - Building Information Modeling (BIM) Practices for Information Technology Systems
- **BICSI:**
- Information Technology Systems Installation Methods Manual - 6th Edition
- Outside Plant Design Reference Manual - 5th Edition
- Telecommunications Distribution Methods Manual - 13th Edition
- **TIA:**
- TIA-568-C.0 - Aug 14, 2012 - Generic Telecommunications Cabling for Customer Premises
- TIA-568-C.1 - May 3, 2012 - Commercial Building Telecommunications Cabling Standard
- TIA-568-C.2 - Nov 7, 2014 - Balanced Twisted-pair Telecommunications Cabling and Components Standards
- TIA-568-C.3 - Oct 13, 2011 - Optical Fiber Cabling Components Standard
- TIA-569 Rev B - Mar 12, 2015 - Telecommunications Pathways and Spaces
- TIA-606 Rev B - Jun 22, 2012 - Administration Standard for Telecommunications Infrastructure
- TIA-607 Rev B - Aug 21, 2013 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- TIA-758 Rev B - Mar 27, 2012 - Customer-owned Outside Plant Telecommunications Infrastructure Standard
- TIA-862 Rev A - Mar 30, 2011 - Building Automation Systems Cabling Standard
- TIA-942 Rev A - Mar 2014 - Telecommunications Infrastructure Standard for Data Centers
- TIA-1005 Rev A - Jan 7, 2015 - Telecommunications Standard for Industrial Premises
- TSB-162 Rev A - Nov 1, 2013 - Telecommunications Cabling Guidelines for Wireless Access Points
- **IEEE:**
- IEEE 802.3af-2003: Power over Ethernet (PoE).
- IEEE 802.3at-2009: Power over Ethernet Plus (PoE Plus)
- IEEE 802.11-2012: Wireless Networking
- IEEE 802.3an-2006: 10GBASE-T 10 Gbps (1250 Mbps) Ethernet over Unshielded Twisted Pair (UTP)
- IEEE 802.3bz: NBASE-T
- **NFPA:**
- NFPA 70 - National Electrical Code - 2014 Edition
- NFPA 70E - Standard for Electrical Safety in the Workplace - 2015 Edition

Post Installation:

Primary Contractor will email cabling test reports in a PDF format (Item 13) to tom.ocallahan@seattlearch.org within 20 days of completion.

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Cabling Specifications and Standards

General Description	BLDG:	Location:
Engineer: Tom O'Callahan	DATE: 3/17/17	Project NAME:
ORIG: T. O'CALLAHAN	DATE: 3/17/17	SHEET: 1 of 1

Appendix A: Copper Certification Report Example

Copper Certification Report

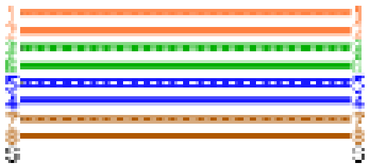
Cable Label: P3 MDF D-01

Overall Result: ✓

Date & Time:	8/3/2016 2:27:28 PM	Building:	Unspecified-Building
Limit Type:	TIA - Cat 5e Permanent Link	Floor:	Unspecified-Floor
Cable Name:	CAT 5e UTP	Room:	Unspecified-Room
Connector Name:	UTP Mod Jack 5E	Rack:	Unspecified-Rack
Site:	Pope john paul H3	Panel:	Unspecified-Panel
Operator Name:	Unspecified		

Local Ser. No.:	jt20311199	Remote Ser. No.:	jt20311200
Local Adapter:	Cat 6A Link	Remote Adapter:	Cat 6A Link
Local Calibration Date:	May 31 2016	Remote Calibration Date:	May 31 2016
Device Software:	7.2	Reporting Software:	Build_#424_7.2_2016 05 25_11 52 05

Wiremap: Pass

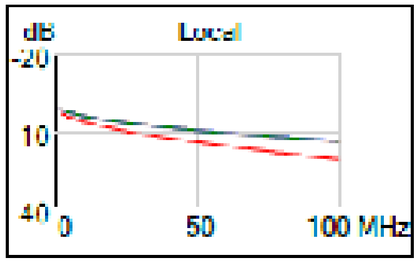


Wiremap: T568B

	Value	Limit	Margin
Length (m):	61.4	90.0	28.6
Cable NVP:	68.0		
Propagation Delay (ns):	322.0	498.0	176.0
Delay Skew (ns):	10.0	44.0	34.0
Resistance (Ohms):	13.2	21.0	7.8

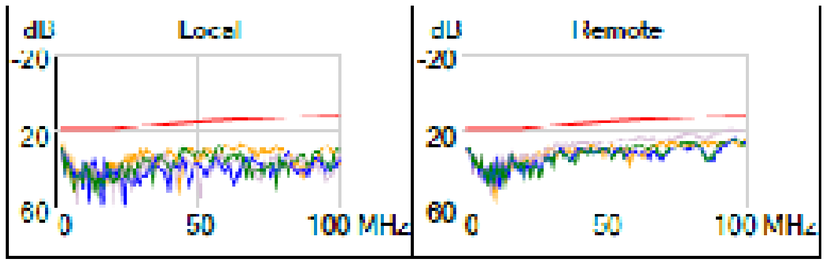
Insertion Loss: Pass

	Worst Margin: Local:	Worst Value: Local:
Pair:	36	12
Value (dB):	1.9	14.2
Limit (dB):	3.1	20.9
Margin (dB):	1.2	6.7
Frequency (MHz):	2.50	99.00



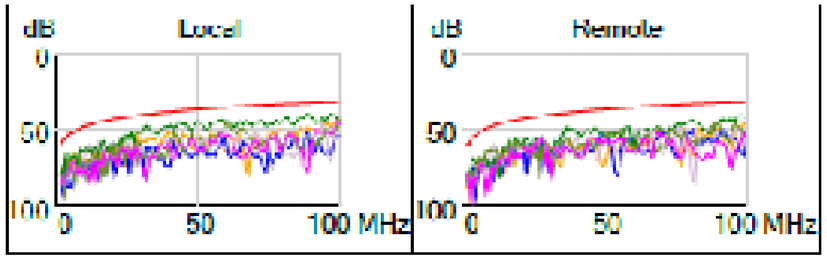
Return Loss: Pass

	Worst Margin: Local	Worst Margin: Remote	Worst Value: Local	Worst Value: Remote
Pair:	12	36	12	36
Value (dB):	29.1	19.2	26.8	19.2
Limit (dB):	17.2	12.3	13.9	12.3
Margin (dB):	11.9	6.9	12.9	6.9
Frequency (MHz):	29.95	93.75	64.50	93.75



NEXT: Pass

	Worst Margin: Local	Worst Margin: Remote	Worst Value: Local	Worst Value: Remote
Pair:	36-45	36-45	36-45	36-45
Value (dB):	40.3	41.0	40.3	41.0
Limit (dB):	33.2	32.5	33.2	32.5
Margin (dB):	7.1	8.5	7.1	8.5
Frequency (MHz):	88.75	97.25	88.75	97.25



ACR-F: Pass

	Worst Margin: Local	Worst Margin: Remote	Worst Value: Local	Worst Value: Remote
Pair:	36 12	45 36	45 36	36 45
Value (dB):	40.1	36.3	32.7	32.9
Limit (dB):	26.6	23.1	18.6	18.6