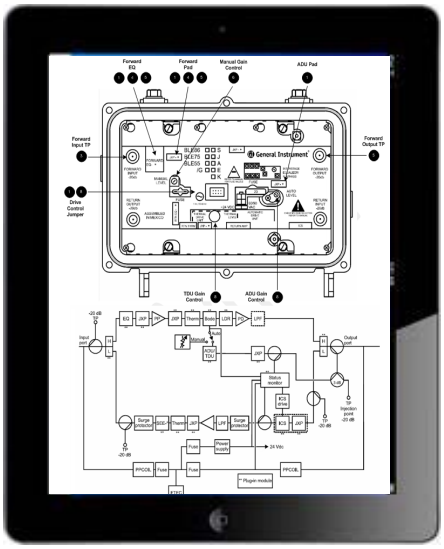
Operational Playbooks
HFC Outside Plant



BENEFITS

- Operational efficiencies from documentation and process standardization across the system and region
- Reduced reliance on limited critical knowledge resources
- Faster on-boarding for new hires or transfers
- Out-of-region emergency response staff know right where to look for system-specific parameters

OVERVIEW

The Outside Plant Hybrid Fiber-Coax (HFC) network is the foundation upon which consumer video and broadband cable services are built. As such, the performance of this network is critical.

- Mergers and acquisitions lead to a diverse collection of legacy plant equipment from a multitude of vendors which may provide minimal or no ongoing technical support
- Third-party manuals have more information than needed which can distract or confuse the technician
- Signal levels are often based on the judgement of the technician that has been doing it the longest and not on an end-to-end plant analysis
- Each technician often has their own way of doing things – making the training of new staff complicated
- Plant and network upgrades require ongoing documentation updates to plant setup procedures

Getting maximum performance from your HFC network is often easier said then done!

ARRIS Global Services Operational HFC Outside Plant Playbooks help minimize operational inefficiencies and ensure maximum performance from your HFC network.

What are Playbooks?

- A single replacement for dozens of third-party manuals
- An operator/plant-specific operations manual
- A single "go-to" resource for all plant equipment (nodes, amplifiers and line extenders) regardless of make or model
- A standard document format from plant to plant and device to device

Key Feature

Operator Specific Procedures

- Relevant content from third-party manuals put into a standard format
- Easy to follow numbered processes
- Operator-specific levels are inline – no separate reference
- ARRIS uses its HFC experience to optimize the process to reflect real world situations
- No unnecessary content

III. Table of Contents

Goal: Achieve 49/44/36 dBmV at 870/750/550/54 MHz (Equivalent Analog Levels).

1. In the event that rough balancing is unnecessary, please skip to step 4. Set the Amplifier to factory-aligned condition by ensuring that the following are installed:
   a. Verify that the designated system design Pad and EQ values are installed in the Forward Pad and Forward EQ locations.
   b. ADU Module (if utilized): Verify that an 11 dB Pad (Motorola Part Number: JXP-11B) is installed in the AGC Pad location.
   c. Set the Drive Control jumper to the MAN position.
   d. Install the distribution accessories as specified by the system design print.
2. Connect a signal level meter (compensated for 20 dB test point loss) to the Forward Input test point. Measure and record input levels at 870, 750, 550 and 54 MHz.
3. Based on the specified RF Input levels for the amplifier and the measurements made at the input test point, calculate and install the required Forward Input EQ and Forward Input Pad value into the amplifier for initial balancing via the steps provided below:
   a. Specified RF Input Levels and Operating Tilt (870/750/550/54 MHz):
      i. Input requirement (all nodes): 12.0/12.0/12.0 dBmV
      ii. Required Input Tilt: 0 dB
   b. Calculate the Forward Input Equalizer Value:

dB	- (	dB	-	dB	) =	dB
Required Input Tilt		Measured 870MHz Input		Measured 54MHz Input		Equalization Required

Equalization Required	Use this EQ	Equalization Required	Use this EQ	Equalization Required	Use this EQ
-10.1 to -11.1	SCS-10	0.0 to 1.4	SFE-100-0	15.2 to 16.6	SFE-100-20
-9.0 to -10.0	SCS-9	1.5 to 2.9	SFE-100-2	16.7 to 17.6	SFE-100-22
-7.9 to -8.9	SCS-8	3.0 to 4.5	SFE-100-4		
-6.8 to -7.8	SCS-7	4.6 to 6.0	SFE-100-6		
-5.6 to -6.7	SCS-6	6.1 to 7.5	SFE-100-8		
-4.5 to -5.5	SCS-5	7.6 to 9.0	SFE-100-10		
-3.4 to -4.4	SCS-4	9.1 to 10.5	SFE-100-12		
-2.3 to -3.3	SCS-3	10.6 to 12.0	SFE-100-14		
-1.2 to -2.2	SCS-2	12.1 to 13.6	SFE-100-16		
-0.1 to -1.1	SCS-1	13.7 to 15.1	SFE-100-18		

Note: Based on 1 GHz Equalizers with 870 MHz losses
See Appendix A for Standard Insertion loss by Equalizer Value/Frequency.

   c. Calculate the Forward Input Pad Value:

dBmV	-	dBmV	=	dB
Measured RF Input Level @ 1GHz		Required RF Input Level @ 1GHz		Forward Input Pad

Key Feature

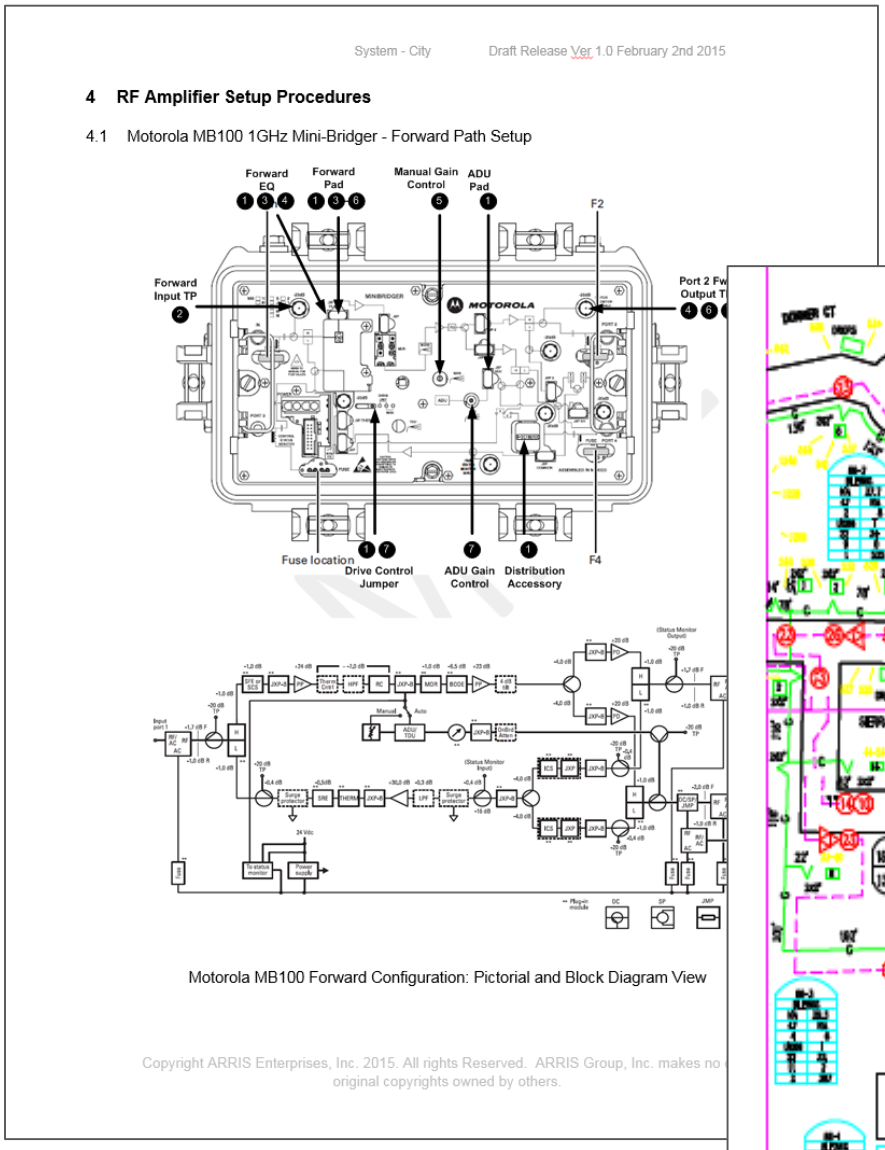
Single Electronic Document

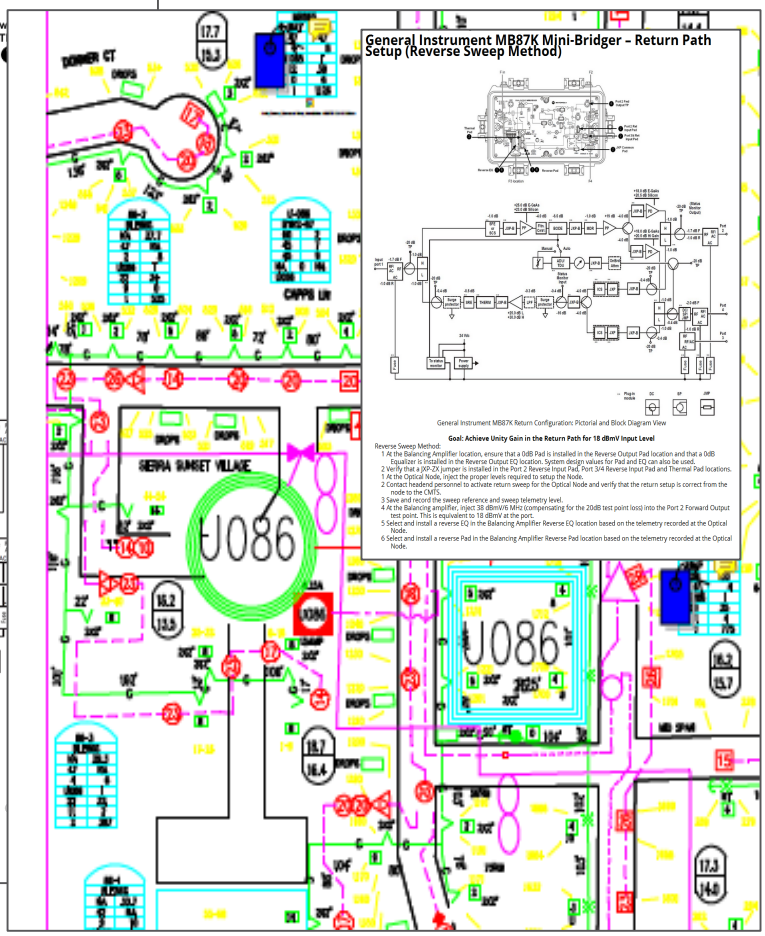
- Procedural steps are referenced on physical and network drawings in the Playbook for easy reference
- Plant architecture overview and additional documents can be added as appendices to assist in diagnostics and training
    - Equipment location maps
    - Site access instructions
    - Plant specific diagnostics procedures
    - Equipment replacement instructions

Key Feature

Integration Into Your Tools

- Playbooks are delivered in PDF format
- Playbooks can also be delivered in HTML5 format that can be easily integrated into your network design tools or technician field tools to enable real time access to the latest procedure and signal level updates
- Playbooks are reviewed in Microsoft Word format to facilitate commenting and revision tracking
- ARRIS Global Services can provide tool integration services on request





Key Feature

Extensive Content and Experience

- ARRIS has forward and return path setup procedure templates for over 80 different types of outside plant amplifiers, line extenders and nodes
- Signal levels in a playbook can be changed without manually editing the procedures resulting in fewer errors and shorter review times
- New procedures are created based on the third-party manual, the operator's plant design and the ARRIS team's experience
- The ARRIS outside plant Playbook team has decades of cumulative field experience in tuning and maintaining HFC networks

Amplifier Procedures

ACI Comm	SDAT TYPE 1A SDAB Type 2A	SDAF Type 2A-TRI
Antec	750 MHz Mini-Bridger 750 MHz Mini-Trunk	870 MHz Mini-Bridger
ARRIS-CCOR	FlexNet Series 900 FlexNet 700 FlexNet 800 FlexNet Series 900	FMB901E Series FNB800 Series FNB800 Series 6-GNA298
General Instruments Motorola	BT275SH BTD75E MB75S MB75SH MB75SX MB750DH	MB86S MB87K MB87S MB100 MBV3 BTD-87E
Phillips	GNA298-43 870 MHz Series Amplifier Setup	
Scientific Atlanta	GainMaker 1 GHz High Gain Balanced Triple (HGBT) GainMaker 1 GHz High Gain Dual (HGD) GainMaker 1 GHz Low Gain Dual (LGD) GainMaker 1 GHz Unbalanced Triple (UBT) GainMaker 870 MHz High Gain Balanced Triple (HGBT) GainMaker 870 MHz High Gain Dual (HGD) GainMaker 870 MHz Low Gain Dual (LGD) GainMaker 870 MHz Unbalanced Triple (UBT) System Amplifier II Balanced Triple Amplifier System Amplifier II High Gain Dual Amplifier System Amplifier II Low Gain Dual Amplifier System Amplifier II Unbalanced Triple Amplifier System Amplifier III Balanced Triple Amplifier System Amplifier III High Gain Dual Amplifier System Amplifier III Low Gain Dual Amplifier System Amplifier III Unbalanced Triple Amplifier	

Line Extenders

ACI Comm	ALX Line Extender SDLE - TYPE 3M
Antec	PAL1 2 750 MHz 870 MHz RF LINK
ARRIS-CCOR	FlexNet 700 FlexNet 900 FM331 6LE98-31 870 MHz
General Instruments Motorola	JLX-7-750 BLE100 1 GHz BLE75SH BLE87S-G 870 MHz BLE87S-H 870 MHz
Phillips	6-LE Series Line 6-LE98-31 870 MHz
Scientific Atlanta	GainMaker 1 GHz GainMaker 870 MHz System Amplifier II

Nodes

ADC	OptiWorx ISX-3040
Antec	750 MHz Gemini LLRX 400 Proteus Optical Node
ARRIS-CCOR	OM1000 OM3100 OM4100 Mini Mux Node G
Aurora	NC4000SG Optical Node NC4000HG Fiber Deep Node
General Instruments Motorola	AM-MBR-750D BTN Node SG2000 SG2440 SG4000 SLW2500
Harmonic	3144 3844 HL3842 Mini-Node
Scientific Atlanta Cisco	GainMaker Node GS7000 6940 6942 6944

HFC Outside Plant Playbooks
ARRIS Global Services

ARRIS Playbook Development Process

Requirements and Specifications Gathering Phase
- Complete Customer Input Document (CID)
- Document Hardware Types and Model Numbers
- Document Operating Levels

Kick-off and Verification Phase
- Verify Plant Configuration
- Review & Gather Operating Manuals not in the ARRIS library
- Document Unique Plant Characteristics

Build and Review Phase
- Build specific operating/configuration parameters per device
- Build Operator Specific Tables
- Publish and Review
- Incorporate feedback

Why Use Outside Help?

Objectivity – An objective, consulting mindset is usually needed to identify operational inefficiencies especially when planning DOCSIS 3.1 upgrades.

Standardization – The data gathering and consulting process can uncover commonalities, leading to greater standardization within a larger region

Focus – Keep local resources focused on build/repair/operate, not documenting

Why ARRIS?

- Industry leader in cable networks, customer and plant knowledge
- Defined process and methodology
- Skilled technical resources across third-party equipment
- Extensive library of procedures

Benefit – Reducing Operational Inefficiencies

- Process and documentation standardization across the plant and region enables staffing flexibility
- Reduced reliance on senior knowledge experts
- Reduced training time for new hires or transfers
- Quicker disaster response – Out of region emergency teams just follow the playbooks

Ordering Information

To better understand how playbooks can reduce your operational costs, contact your sales representative.

365-096-29528 x.1