ANTRONIX®

AIFA-15-61-042-09-SA
AIFA-15-61-085-09-SA
AIFA-15-31-042-09-SA
AIFA-15-31-085-09-SA

Inverse Fiber Amplifier

User Manual

Installation & Operation Guide

Contents

Safety Warning

- The Antronix Inverse Fiber Amplifier (*AIFA*) is equipped with a laser transmitter which emits invisible radiation that can cause permanent eye damage. AVOID DIRECT EXPOSURE TO BEAM.

- Operate the AIFA only with the proper optical fiber installed in the optical connector.

- Never use any Optical Instrument to view the optical connector. “OPTICAL INSTRUMENT” Includes Magnifying Glasses, etc..

- Never look into the bulkhead or optical connector of the AIFA.

- Never look into the output of a fiber connected to an optical transmitter.

- Power to the AIFA must be shut off if the AIFA optical connector and or bulkhead needs to be examined.

- ALWAYS treat the plant extension fiber as active. Often this may be connected to a “*burst mode ONU*” laser and an instantaneous reading of no light may not guarantee ONU is not connected.

- **VOLTAGE –** The power supply section (*bottom section*) of the AIFA contains no user serviceable parts. There is exposed high voltage inside this section. Only factory service technicians should open the power supply section.

- **SHOCK HAZARD –**
  - The AIFA is designed for hardline connectors on all used ports (*RF & Optical*).
  - Do Not insert fiber with a grommet as interior exposure to moisture must be avoided.
  - All connections to the AIFA should be completed prior to energizing the Circuit.
  - The connection to source power (*either direct power or from [RF/AC] CATV Port*) should be made with de-energized circuit as well.

Inverse Fiber Amplifier

Overview

The Antronix Inverse Fiber Amplifier (AIFA) is an innovative cost-effective solution to extend the network and/or broaden its reach by converting the multitap's drop RF signal to an optical signal.

The inverse fiber amplifier is an outdoor, line mountable, rugged device that can provide extra reach and expand the existing HFC infrastructure to add and attract additional subscribers (rural customers) otherwise not serviced by the MSO. The AIFA is designed to leverage an MSO's existing Hybrid Fiber Coaxial (HFC) network to support FTTX, FTTB, FTTH solutions. This implementation allows for improved reliability, lower maintenance costs and significantly increased performance, all while utilizing existing headend equipment. The CMTS and back-office systems already supporting the HFC plant are utilized in the new fiber plant extensions. The Inverse Fiber Amplifier is interoperable regardless of ONU manufacturer but is most frequently paired with either a dedicated High Output MDU Antronix Premise MicroNode or a shared access Antronix RFoG ONU, for new sets of subscribers.

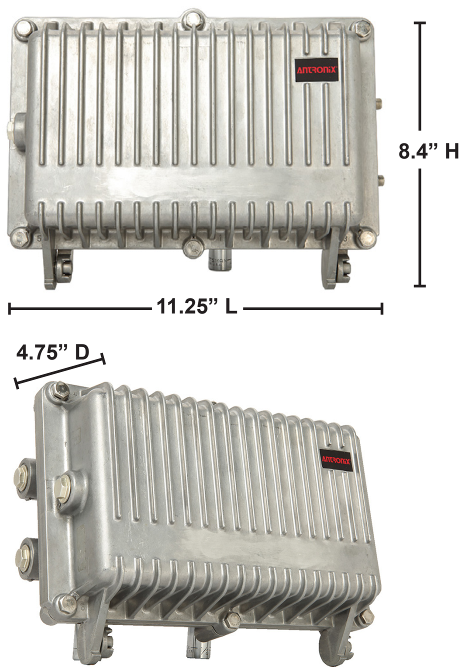
- **Extend Network Reach –** The Antronix Inverse Fiber Amplifier is a high output and low distortion fiber bridge that can extend the network reach by over 10 km via new build fiber extension, with little reengineering of the OSP.
- **Broaden Network Reach –** Add multiple subscribers by onboarding new homes passed to existing service groups.
- **Performance –** 50 MHz - 1.2 GHz bandwidth high powered 1550 nm DFB transmitter and high sensitivity receiver.
- **Simple Installation –** The units can be installed indoors or outdoors; either pedestal or strand mounted.
- **Signal Conditioning –** Full complement of JXP pads, Equalizers (*EQ*) or Cable Simulators (CS) plug ins available enabling signal level optimization for both forward and return, resulting in the ability to maintain proper CPE boundaries.
- **DOCSIS Compliant Operation**
- **Low Power Consumption –** At only 13 watts the AIFA may be placed anywhere in OSP and can be powered with drop cable.
- **Powering –** Local 40-95 VAC
- **Increase Revenue –** Add additional subscriber(s) and/or upgrade existing extensions with failing End of Line performance.

Physical Features of the AIFA

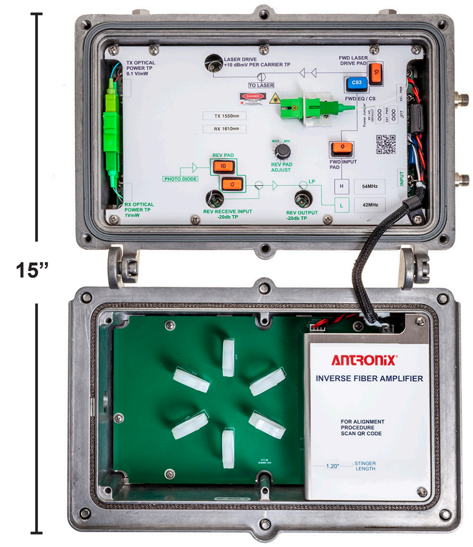
External

Dimensions

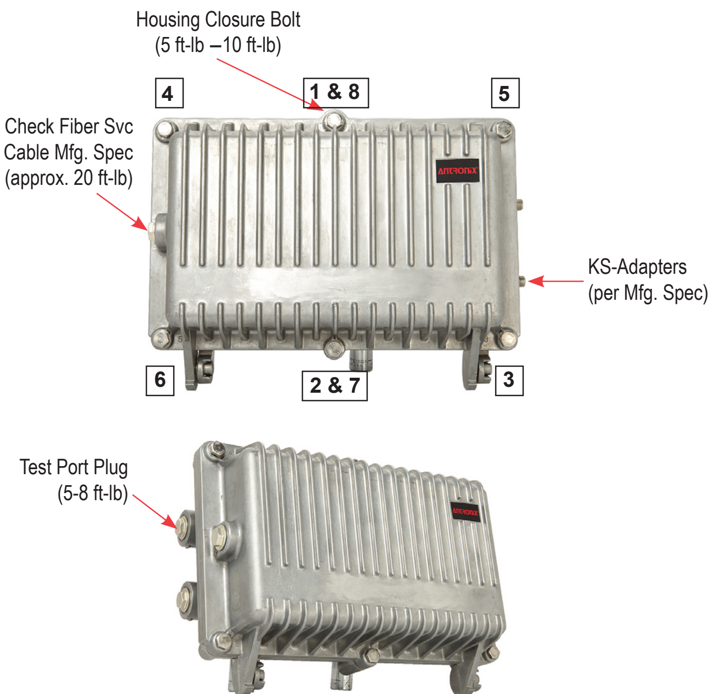
L x H x D



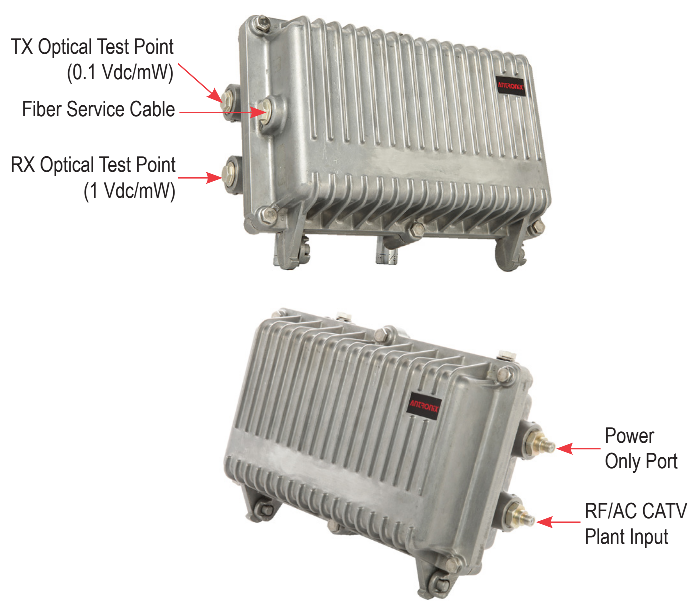
Open Height



Torque & Sequence

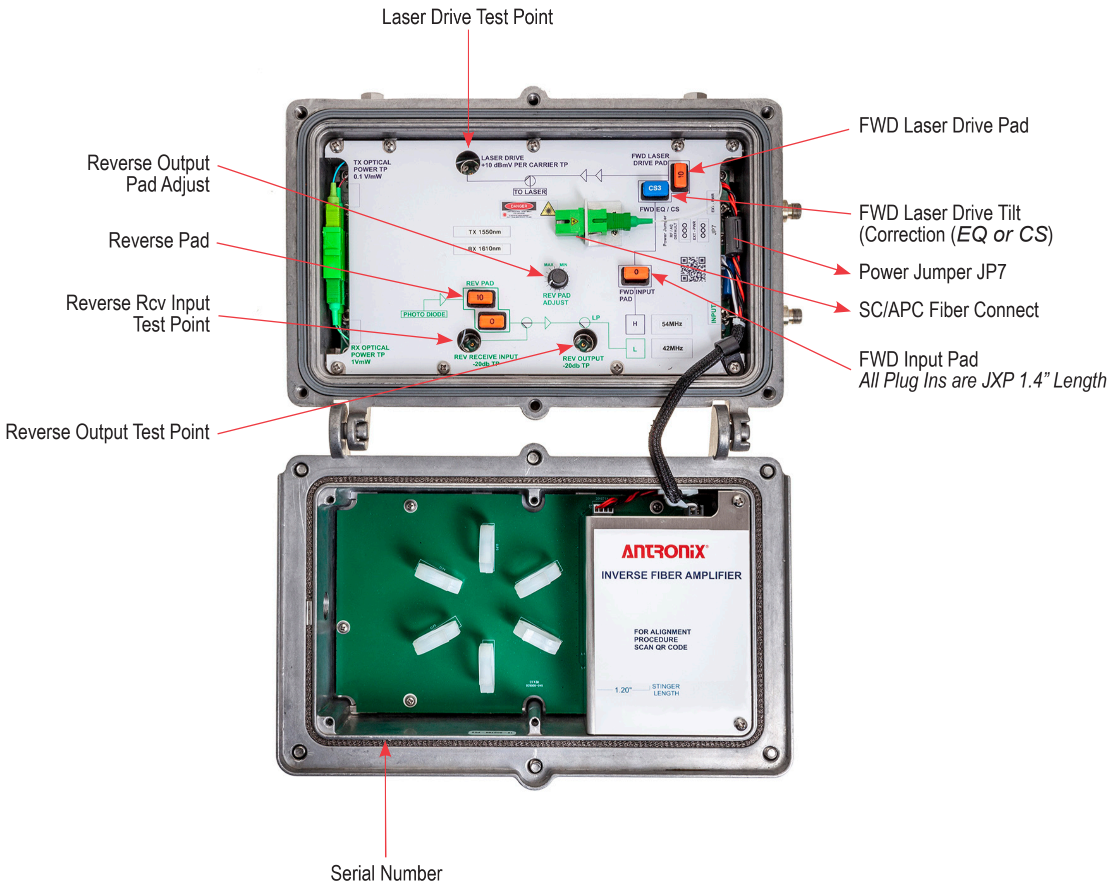


External Ports



Physical Features of the AIFA *cont'd*

Internal



Operation

Introduction

The Antronix Inverse Fiber Amplifier (AIFA) is designed to transition HFC RF Plant to optical signals permitting new build fiber plant extensions, or upgrading long, multi amp, high maintenance extensions feeding minimal locations. This is accomplished via a direct modulated 1550 nm 1.2 GHz forward, low chirp, 9 dBm transmitter. The return receiver is a high sensitivity *(-14 dBm minimum input) and high output of +45 dBmV/ Ch*. receiver. The high quality of both the forward and return design produce excellent performance in analog, SC-QAM, OFDM loading, or any combination thereof. This is all contained in a plant hardened, RFI shielded, strand or pedestal mountable housing.

The AIFA can be field adjusted internally via 1.4" JXP style plug ins to accommodate RF level from any tap providing 10/10 dBmV analog @ 1.2 GHz /55 MHz (*4/4 dBmV digital*).

When pairing with the Antronix RFoG ONU (*R-ONU),* or any ONU with similar Tx/Rcv levels, an optical plant extension may be designed with up to 15 dB link loss. Depending on distance and fusion splices vs pre-connectorized jumpers the AIFA can enable connection of 8 homes via an 8 way splitter. The AIFA may also be paired with one of the Antronix Premise MicroNodes to feed and an even greater number of MDU apartments or higher end niche lines of service.

Operation cont'd

System Requirements to Install the AIFA

The three primary considerations for installation are:

1. RF Input
2. Powering
3. Optical Link the AIFA can support (Link Budget)

RF Input

1. Accepting a full suite of 1.4" JXP style plug-ins the AIFA may be balanced internally to 10/10 dBmV analog *(4 dBmV digital)* @1.2 GHz /55 MHz. It is recommended to launch from whichever tap that satisfies both the minimum input requirement, and which keeps the new fiber plant extension build to a minimum. There is no need for costly overlashing of fiber onto existing HFC plant.

Powering

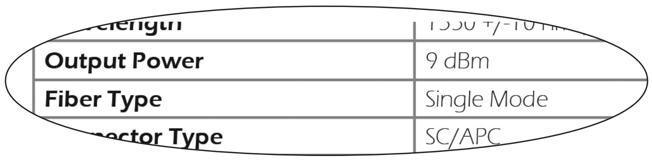
1. The AIFA is extremely flexible with AC powering and can be powered either by a combined RF/AC input (default factory setting) as shown on page 10 or with independent 60-90 VAC power from the HFC plant. For this option the JP7 jumper should be set to the position as indicated on page 11. At only 13 watts, the AIFA may be powered from an Antronix SDPE series Milenium® power passing Tap or a DC coupler which satisfies minimum RF input requirements. When using Antronix Milenium® Series SDPE Taps, one could standardize the first port as power passing, thus enabling a mix of data/video subscribers on the powering Tap, saving time and End of Line level, without having to rebalance downstream of a newly cut in SDPE solely for this purpose.

2. The AIFA can also be powered via Power Only port (*see figure on page 11*). Please note the power jumper JP7 must be shifted upward from the factory default setting.

Operation cont'd

Link Budget

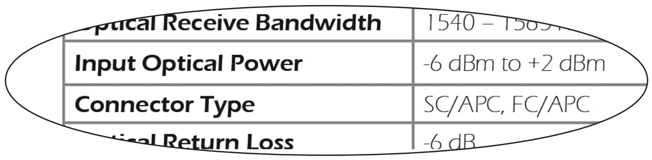
Optical Link – When setting up any optical network, it is imperative to know the transmit and receive power of all devices to be included in that network. The total loss of the fiber design (*Link Loss)* cannot exceed this budget, and the most stringent budget within the network governs the design.



Output Power	9 dBm
Fiber Type	Single Mode

Example: Feeding an Antronix RFoG ONU (R-ONU)

From the specification sheet of the of the AIFA, we note that the transmit level is 9 dBm (see AIFA data sheet) and we see from the ONU's specification sheet that the minimum receive level is -6 dBm.



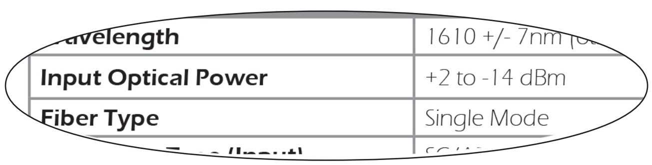
Input Optical Power	-6 dBm to +2 dBm
Connector Type	SC/APC, FC/APC

Note – the AIFA is not proprietary, and the MSO can use edge device of their choosing, just verify Tx/Rcv level to perform this sample calculation.

This results in:

Forward Link Budget = (Source Transmit) + [Customer Premise Equipment (CPE) Rcv]

= 9 dBm + -6 dBm = 15 dBm



Input Optical Power	+2 to -14 dBm
Fiber Type	Single Mode

When calculating the Return Link Budget the specification sheet states the AIFA Minimum Receive Level is -14 dBm. The Antronix RFoG ONU may be ordered with a 3 dBm Transmitter.

Return Link Budget = [CPE Transmit) + [Minimum Source Rcv]

= 3 dBm + -14 dBm = 17 dBm

Note – Fiber distance, quality of fusion splices, connector loss and desired "*cushion*" must also be taken into design criteria.

So from above, the design link budget can be no greater than 15 dB, which can accommodate up to 8 Homes fed by an RFoG ONU under many circumstances.

Setting Up the AIFA

Introduction

Unlike optimizing a standard node or balancing a typical active for forward and return, the AIFA has some unique steps to ensure maximum performance. The forward balancing is straight-forward and follows the standard protocols that many are accustomed to: e.g. First stage - Forward level in, Pad adjustment: Second stage - EQ or CS plus Pad, as can be viewed on meter via output test point (*see figure on page 13*).

The return alignment, however, hinges on the optical level coming back from the customer's premise, which in turn hinges on the optical link design. Additionally, in the case of RFoG deployment, "*burst mode*" lasers will be used, so there will not be an "*always on*" optical return to optimize to. Lastly, often the optical customer premise equipment will be located far away from the AIFA, making side by side adjustments impractical.

From the optical link design, the amount of acceptable optical loss from the optical CPE to the AIFA can be determined. The return laser power of the CPE should also be known in order to adhere to the design for best practices. It is then possible to inject the anticipated return optical level into the AIFA for any design, making the AIFA's alignment possible prior to any actual CPE installation. Upon installing the optical CPE, if slight adjustments are required, the technician only needs to ensure measured values are within the design's acceptable tolerances.

However it is **HIGHLY recommended** to install your first AIFA in a lab/ bench environment until the AIFA and resulting impact on legacy CPE's is well understood. This will have the added benefit of enabling training in a bench environment, and of further evaluating whether standardizing prior alignment is preferable for your organization. Regardless which direction is chosen (*bench or field*), the steps are the same.

It is highly recommended that certain performance levels be recorded upon the receipt of your AIFA on a "Birth certificate". A sample record is included with this manual in Appendix B. Should you require technical support these levels will be helpful in determining a baseline performance. Information will vary from operator to operator.

Your AIFA's Serial Number can be located on the inside cover *(see figure on page 5 for location)*

When Ordering the AIFA from Antronix it will arrive in the following manner:

- The Power Jumper (*JP7*) will be positioned for RF/AC on single port (*page 11*)
- The Forward Balance was set using (*20/12*) dBmV @ (*860/55*) MHz loaded with (*77 NTSC and SC-QAM -6 dBmV below analog*)
- The Return Alignment was set with -7 dBm rcv and 30 dBmV at 25 MHz

The following will explain how to adjust these three parameters for your application(s):

1. Powering
2. Forward Balance
3. Return Alignment

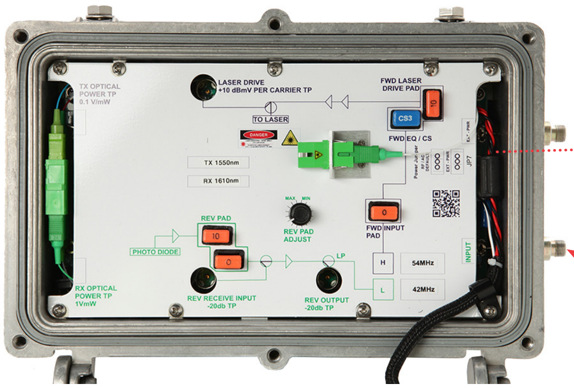
Note – Like any optical link or amplifier optimization, the AIFA should **NOT** be taken out of alignment (*either in the Forward or Return*) in order to bring modems or STB's within a desired MSO's network tolerance window. The AIFA and Link must be optimized as stated and RF padding at the customer's premise must be utilized to accomplish desired ranges for both RF upstream and downstream level.

Setting Up the AIFA *cont'd*

Powering

The Factory Setting for the AIFA has both RF and AC feeding the AIFA on a single drop. As such, the Power Jumper (*JP7*) is set to the bottom as depicted below (*connects middle and bottom pin of three pin power configuration*).

Combined Powering and RF Feed



JP7 bottom two pins

Hint - JP7 points to the leg being powered

RF/AC (*60~90 VAC*)

MGT2000-SDPE-G2

Powering the AIFA via Antronix Milenium Series SDPE Power Passing Multi-Taps

– The Antronix Milenium Series SDPE Power Passing Tap is an excellent option to deliver both RF/AC to the AIFA

– Allows for mixed use applications to service HSD/video subscribers from a single interface for superior total insertion loss

– We recommend always using the first port as "*Power Pass*"
  Standardizing streamlines tech training
  (e.g.: First Port powers AIFA and all others are unpowered and may be used for BAU.)

– The power passing tap may be substituted *(or spliced in solely for the AIFA)* anywhere in the Tap String

– A full compliment of pads, EQ's and Cable Simulators *(JXP style -1.4")* will flatten any input signal to desired level within the AIFA.

– Standard 5/8-24 Hardline Connectors may be used and in this case KS-F. Use strip gauge and Phillips screwdriver to install KS-F

– Antronix Milenium Series MGDCH Series Directional Couplers may also be used

The AIFA may be powered separately via the Power Only port in the following manner:

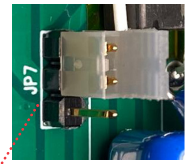
Powering cont'd

Separate Powering and RF Feed

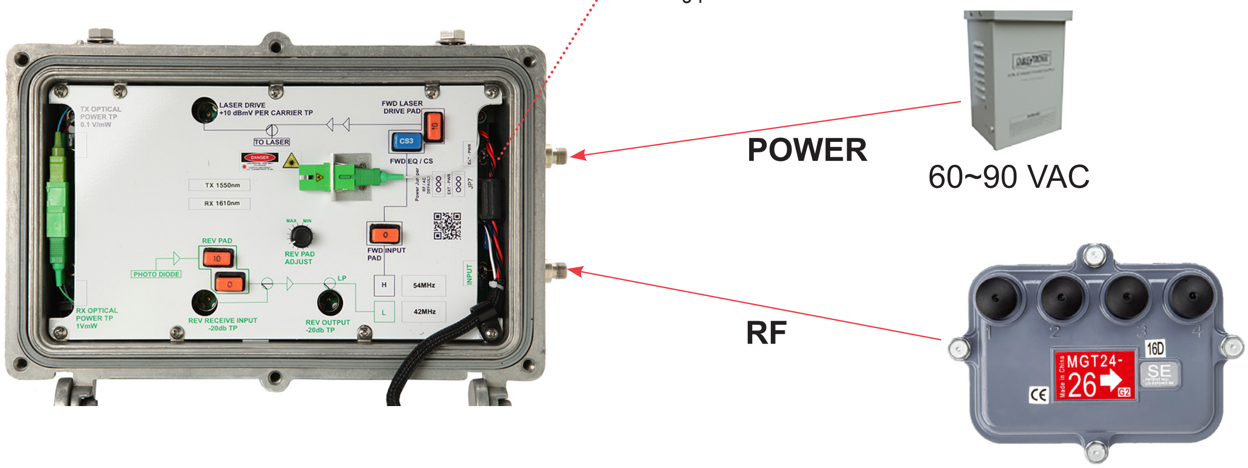
Move Factory Set Power Jumper (*JP7)*
from bottom 2 Pins to Top 2 Pins.

Any standard 5/8" - 24 hardline connector may be used.

JP7 top two pins



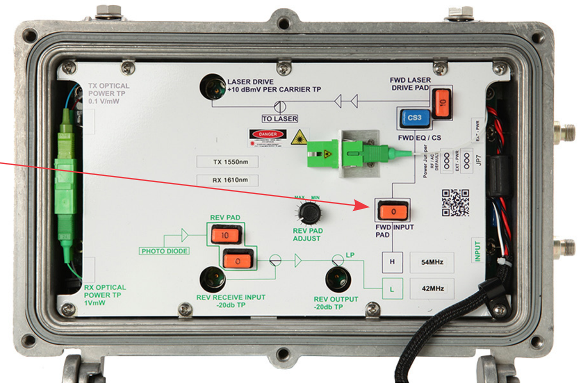
Hint - JP7 points to the leg being powered



Setting Up the AIFA *cont'd*

Forward Alignment

RF Input from HFC Plant (1st Stage)



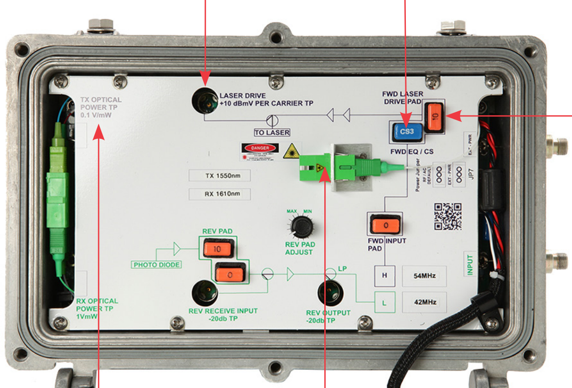
- Measure and record FWD/RTN level on HFC Plant Tap feeding the AIFA to ensure both are as expected
- The Forward Input Pad is used to limit total input power (*TIP*) to the first stage to 20 dBmV analog (*14 dBmV digital*)
- 0 Pad for any TIP of 20 dBmV analog or lower. This can then be raised 1:1 for higher TIP levels. e.g.. 4 Pad for 24 dBmV TIP
- It is possible to feed the AIFA from a Node + X architecture and from any Tap in the string.
- End of Line levels will be based on quality of HFC input
- The HFC input needs to be slightly above compliance to compensate for E/O conversion required to install the AIFA. (*A close approximation is an MER reduction of 1.5- 2 dB*)

Note – For Optimal SNR/MER do not pad here on first stage unless the TIP is > 20 dBmV. For Up Sloped Inputs approximate or calculate Total Composite Power. A few Channels at 22 dBmV at the end of the spectrum with a 12 slope will not require 2 dB Pad.

RF Input from HFC Plant (2nd Stage)

Connect RF meter to Laser Drive Test Point

Flatten input with either a JXP style Equalizer (*reverse tilt*) or a Cable Simulator (*positive tilt)*



Adjust FWD Laser Drive Pad until meter reads **+10 dBmV/Ch Analog** or **+4 dBmV/Ch for Digital** loading

To measure launch TX you can either:
- Verify 1550 nm with a Light Meter
- Use V.O.M. and use 0.1 v/mW

Tech Tip

1. If for some reason you do not have the proper plug ins, remember, additional drop cable from tap to AIFA can act as a predictable Cable Simulator/Attenuation.
2. If a power passing tap is used exclusively for the AIFA, additional conditioning may occur within the tap as well.

Setting Up the AIFA *cont'd*

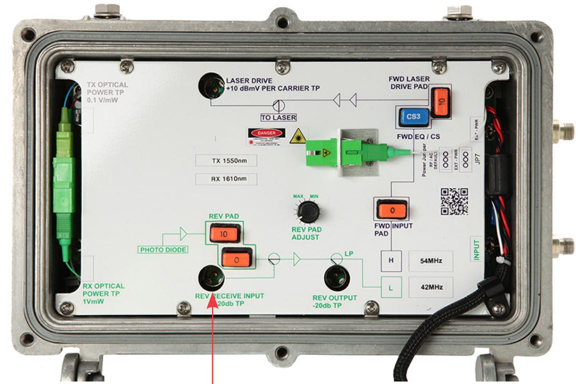
Return Alignment

As stated in the Introduction, bench setup is highly recommended and will be reviewed. The same methodologies may be used in the field.

Aligning Return

For simplicity an end to end solution on bench will be reviewed

1. The light level from the CPE to the AIFA MUST be considered first.
2. It's best to simulate outside optical link loss via splitters, defined jumper lengths, optical pads or a combination of all.
3. For this example we will assume '**Designed Link**' = 1 mile of fiber and an 8-way optical splitter. There are two connectors and 3 fusion splices.
4. Our calculated loss = 0.64 dB *(1 mile*) + 10.8 dB (*8-way*) + 0.8 dB (two connectors) + 0.75 dB (*3 fusion splices*) = **13 dB Link.**
5. If the ONU at the end of this link has a 3 dBm laser, the AIFA will receive -10 dBm (*3 dBm launch –13 dB link = -10 dBm*).
6. This may be replicated on the bench by introducing 13 dB optical loss (splitters, optical pads, known fiber lengths).
7. The next step is to select a return frequency *(in the clear if combining with active node*) or 25 MHz if stand alone.
8. Inject 30 dBmV on frequency determined above. This will force burst mode laser to stay on.
9. Measure 1610 nm before it enters the AIFA with a light meter. This measured value should be close to calculated loss in step 4.
10. While not as accurate as above, if there is no light meter available, connect fiber link to AIFA (*ONU connected to AIFA*).
11. Use V.O.M on RX Optical Power T.P. (*1 V/mW*) to determine RCV optical level (*dBm*).
12. Factory installed 6 dB Pad for all received light levels of -6 dBm to -14 dBm. Replace 6 dB Pad with a 12 dB Pad for received levels of -5 dBm to +2 dBm.



Step #12

Step #8

Setting Up the AIFA *cont'd*

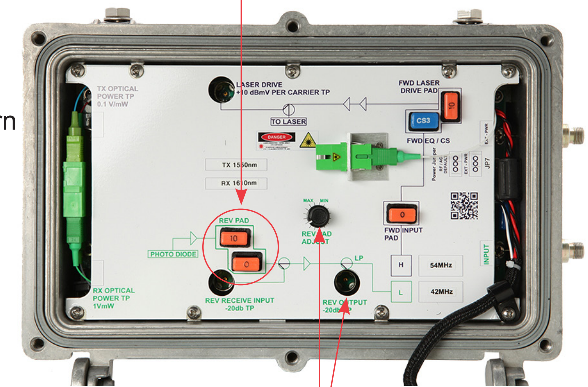
Return Alignment *cont'd*

13. Now that the Ret Pad has been selected, if return equalization is desired there is a JXP place holder for that (*0 dB Pad = Default).*

14. From the previous setup, the ONU should be connected to the AIFA through the simulated Link with 30 dBmV injected on Return Frequency selected.

15. Adjust 'Rev Pad Adjust' POT until the meter reads 25 dBmV.

    Using actual meter reading, +45 dBmV if factoring -20 dB T.P.
    Each click on the POT = 2 dBmV move.



Turn Rev Pad Adjust until Rev Output
(*-20 dB T.P. = 25 dBmV/Ch)*
*Actual Level = 45 dBmV/Ch
(For 5-85 MHz, use 40 dBmV/Ch)

Final Suggestions for Bench Alignment

1. Green RCV light will be visible.

2. The AIFA for all practical purposes is optimized both RF and optical.

3. MSO may elect to slightly adjust either or both paths to maximize performance (*No significant variations should happen in AIFA however).*

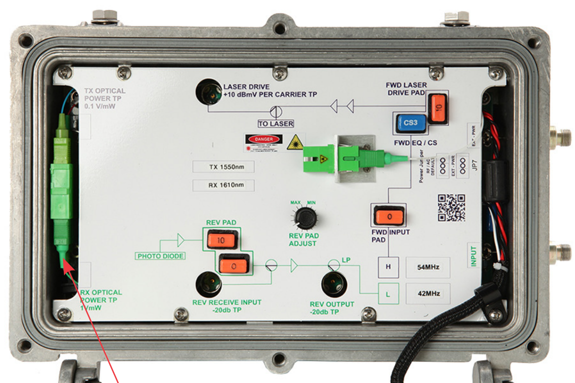
4. The last task will be to ensure Modem Upstream and Downstream Levels are within MSO's tolerance windows.

5. This will PRIMARILY be done with RF Padding on the ONU or adjustments made to the Premise MicroNode, if applicable.

6. Remember to simulate typical home wiring off the ONU to the modem. *e.g. 50' RG-6 to 4-way Splitter with 25' RG-6 to modem. It is best to use cable vs pad as cable will yield true tilt correction.*

7. RF padding can be done on Modem only, on the Input to 4-way splitter, or a combination depending on instructions from your management team. Padding should be selected to satisfy Modem RCV/TX level.

8. Once completed, end of line measurements can be taken to ensure RCV/TX/MER/BER (*pre and post*) /DQI of OFDM block are all within specification.



Green RCV light

Step #14
Inject 30 dBmV
43 MHz factory set

Fiber to Link and to AIFA

Note – It is very important to run a system check on whatever feeds the AIFA. All numbers of interest should be recorded for comparison throughout the AIFA pairing with an ONU or Premise MicroNode.

Final Design Considerations

So far...

It was shown how to connect a single CPE to an AIFA.
It was shown how the AIFA was optimized based on the link budget and launch power of the ONU.

- When designing Fiber Plant to feed multiple ONU's the fiber Link Loss to each should be fairly symmetrical.

- Barring the length of the house fiber drop, if the optical link loss to each ONU is fairly consistent, all modems may be more readily brought into an acceptable forward/return range
  e.g. (*-7 to +7*) dBmV down and (*38 - 48*) dBmV up.

- The House Drop should not be a significant factor in the design.
  e.g. excluding connectors, considering a 0.12 dB loss/ 1000' of drop cable, a difference of 2000' amounts to 0.24 dBm or 0.5 dBmV.

Field Installation

- Please make sure ALL SAFETY MATERIAL has been reviewed before continuation.
- The AIFA should be installed at designed location.
- If desired, and obtainable, the AIFA may be set on the bench if the exact levels of the location designed to feed the AIFA can be replicated. If the exact levels cannot be replicated on the bench, a close simulation may minimize the number of SKUs of plug ins "*on location*".
- When installing in the field, all the methods previously described are applicable.
- Select Powering Method
  The MSO will need to decide on which of the two methods are to be used to power the AIFA and ensure power jumper JP7 is set properly (*Factory Default = RF/AC single port = JP7 to the bottom position*).
- The AIFA should be prepared for both hardline aerial and pedestal installation on the ground with applicable connectors. All connector pin lengths should be cut to length using 1.2" strip gauge and secured using Phillips screwdriver on set screw.
- The MSO can select the various methods of deployment:
  – AIFA hung and optimized without fiber service cable
  – AIFA hung and optimized with service cable un-spliced to hard line optical plant (**Do Not** connect fiber internally if this method selected) and the more complete
  – AIFA final version of simply attaching fiber service cable where splicing and plant extension is completed (*Warning – If selecting last option, you MUST ensure it is ok to connect laser and that the field side termination is secured*)
- Pending option selected above and stage of the process, determine the best time to attach fiber service cable, carefully routing fiber into the AIFA and tightening fiber service cable to manufacturer's recommended torque.
- Pending fiber installation, attach the AIFA to strand if not done so already. Brackets may be used if required *(not included*).
- Verify designed HFC launch port is perfectly balanced for both upstream and downstream. It is STRONGLY recommended that the run be swept prior to AIFA installation.

Note – The AIFA must be tightly sealed for both moisture and RFI… Do Not Insert fiber drop cable with grommet as this will void all warranties and cause service impacting issues.

Field Installation cont'd

- Validate that minimum AC requirements will be met.
- Shut off power that will feed the AIFA until all connections are secured.
- Run drop from validated designed HFC port.
- Power up the AIFA and balance as previously described in bench setup.
- If the MSO has fiber plant extension completed and wishes to validate "*actual*" return at this time, the same method of injecting RF into the ONU on bench setup can be done near customer's home.
- Measure light level on fiber service cable at the proper wavelength e.g. (*1550/1610*) to verify calculated results vs measured results are within your organization's generally accepted tolerances. If not, consult AIFA birth certificate for verification (baseline record of individual AIFA should be common practice).
- Verify return alignment is set.
- Once the AIFA has been aligned **DO NOT CHANGE SETTINGS** to force modem downstream/upstream levels into a particular range. Undoing proper alignment will degrade end of line performance.
- Acceptable Downstream and Upstream levels of Modems and STBs should be obtainable with RF padding either on the ONU and/or STB. (*see your organization's instructions*)

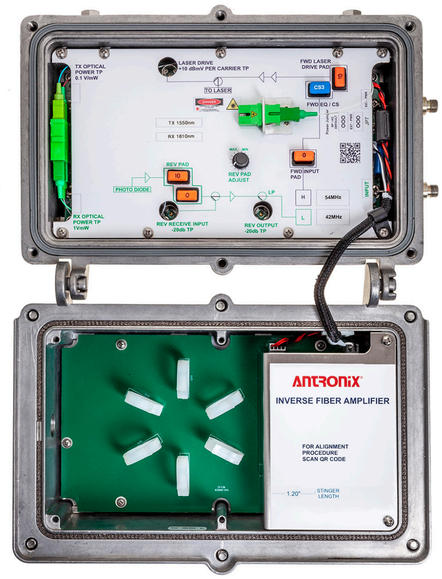
Tech Tip – Remember, just like the bench setup, optical design symmetry is expected and, if desired, longest optical drop can be used. Variances from location to location SHOULD BE MINIMAL for BEST optical alignment.

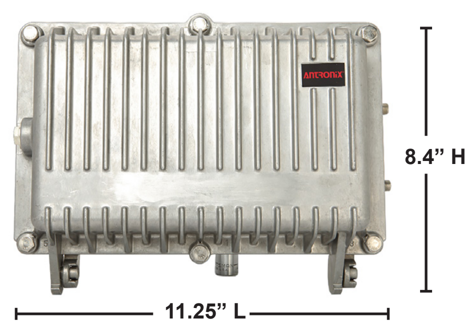
Note – A slight adjustment to simulated return setup is expected, but anything appreciable needs to be thoroughly investigated.

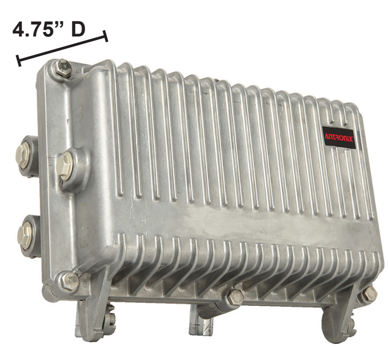
Note – If testing off CPE is to be performed remember you would want to compare those results vs the RF port feeding the AIFA. Some slight degradation to MER is to be expected due to added e/o conversion but aligned properly, all results should be well within specification to support all services.

Specifications

	Specification
Optical Performance Forward TX	
Wavelength	1550+/-10 nm (*other wavelengths available*)
Output Power	9 dBm
Fiber Type	Single Mode
Connector Type	SC/APC
RF Performance Forward TX	
Bandwidth	54 - 1235 MHz
Input Level	6 ~ 20 dBmV/ch Analog CH Manual Gain
Transmitter QMI	3.2 % Modulation Index **(*See Channel Loading Below*)
Flatness	+/- 1.0 dB (*54 - 1220 MHz*)
Input Return Loss	>16 Typical dB
Impedance	75 Ω
Optical and RF Performance Receiver	
Wavelength	1610+/-7 nm (*other wavelengths available*)
Input Optical Power	+2 to -14 dBm
Fiber Type	Single Mode
Connector Type (Input)	SC/APC - Connector located inside the unit
Bandwidth	5 - 42/54 MHz, 5 - 85/102 MHz
Output Level	>45 dBmV/CH (*EQ's available*)
Flatness	+/- 1.0 dB
Output Return Loss	16 dB Typical
Impedance	75 Ω
Link Specification - (9 dB link loss feeding AFN-L)	
CNR	>52 dB
CTB	>66 dBc
CSO	>60 dBc 60 dBc (3 *km, 57 dBc)* (*5 km*), 55 dBc (*10 km*)
Electrical/Physical	
Powering	40 - 95 VAC OSP
Power Consumption	13 W 0.14 A @ 95 VAC / 0.29 A @ 45 VAC
Operating Temperature	-40 to +140 °F
Dimensions	11.25(*L*) x 8.4(*H*) x 4.75(*D*) inches
Weight	7.3 lbs.
Other	
Channel Loading	77 NTSC + 75 digital - 3% OMI digital -6 dB from analog channel **







Maintenance

- The AIFA requires very little to no maintenance

- Good documentation to include all RF levels, Optical Levels and VOM readings (*AC input & TX/RX DC test points*) is strongly advised.

- Forward and Return Ch Loading should be recorded at the time of AIFA setup, along with AIFA Diplex Filter frequencies.

- Installation location, RF Feed and Power Source should be recorded.

- If possible, the AIFA should be entered into AutoCAD for design assistance, as well as creation of unique symbol for design print denotation.

Once edge devices are installed off the AIFA and aligned properly, these readings may be used by MSO to determine when maintenance on AIFA should be performed.

Either of the following WILL require a visit to the AIFA:

- Return bandwidth changes e.g. 42 MHz to 85 MHz return (*AIFA contains Diplex Filter*)

- Channel loading changes in either the Forward, Return or both

Tech Tip – Remember, the AIFA is aligned with total Ch. power considered. This should be reviewed, and in the cases where many are deployed, review at least a few to insure alignment is still optimal.

The following are some suggestions to consider:

- Periodically verify the levels at the Tap feeding the AIFA are within tolerances set by your organization.

- Periodically verify levels on test points (*dcV*) to dBm charts (*no need to open unit*).
    - Can forgo the above if periodical level tests, which can be performed via remote monitoring tools, are acceptable to your organization's management.

Troubleshooting

- Prior to touching ANYTHING on the AIFA the first step should ALWAYS be to confirm if all CPE's fed by AIFA are experiencing the same issue or if only a percentage of the total are.

- It is important to reference the AIFA installation birth certificate when looking to make internal changes to the AIFA *(Please refer to Appendix B for Birth Certificate form).*

- Likewise, the recordings of CATV Plant levels for Forward, Return, Modem Upstream level and any "measured tests" (*e.g. DQI, MER, Pre, Post, CSO, CTB etc.*) should be reviewed.

- Lastly, confirm these levels conform to your organization's standards.

Correct any/all source related issues utilizing Standard Operating Procedures (*SOP*).

If opening the AIFA please refer to the set up procedures and adhere strictly to all safety warnings.

Verify the unit has power and both the optical and RF paths are functioning and aligned properly.

If the AIFA is fully functional and the issue is determined to be fiber related, please follow SOP for fiber troubleshooting.

Tech Tip – When Plant is confirmed to be functioning properly remember there are DC voltage Optical Power Test Points for both the Tx and Rcv. which may be accessed without opening unit. (*Tx = 0.1 V/mW and Rx = 1 V/mW*)

Ordering Information

Part #	Description
AIFA-15-61-042-09-SA	1550/1610 nm, 42/54 MHz rtn, 9 dBm
AIFA-15-61-085-09-SA	1550/1610 nm, 85/102 MHz rtn, 9 dBm
AIFA-15-31-042-09-SA	1550/1310 nm, 42/54 MHz rtn, 9 dBm
AIFA-15-31-085-09-SA	1550/1310 nm, 85/102 MHz rtn, 9 dBm

AIFA-FW-RW-ccc-09-SA

Forward Wavelength
15: Standard 1550

Reverse Wavelength
61: 1610
31: 1310

Connector (SC/APC) std

Optical Output Power (dBm)

Diplex Filter
042: RTN (5-42) FWD (54-1220)
085: RTN (5-85) FWD (102-1220)

Accessories

Plug Ins (JXP Style @ 1.4" Length)					
Cable Simulators		**Cable Equalizers**		**Pads**	
Part #	**Values (dB)**	**Part #**	**Values (dB)**	**Part #**	**Values (dB)**
CSGJX02	2	CEGJX01	1	CPGJX00	0
CSGJX03	3	CEGJX02	2	CPGJX01	1
CSGJX04	4	CEGJX03	3	CPGJX02	2
CSGJX05	5	CEGJX04	4	CPGJX03	3
CSGJX06	6	CEGJX05	5	CPGJX04	4
CSGJX07	7	CEGJX06	6	CPGJX05	5
CSGJX08	8	CEGJX07	7	CPGJX06	6
CSGJX09	9	CEGJX08	8	CPGJX07	7
CSGJX10	10	CEGJX09	9	CPGJX08	8
CSGJX11	11	CEGJX10	10	CPGJX09	9
CSGJX12	12	CEGJX11	11	CPGJX10	10
CSGJX13	13	CEGJX12	12	CPGJX11	11
CSGJX14	14			CPGJX12	12
CSGJX15	15			CPGJX13	13
CSGJX16	16			CPGJX14	14
CSGJX17	17			CPGJX15	15
CSGJX18	18			CPGJX16	16
				CPGJX17	17
				CPGJX18	18

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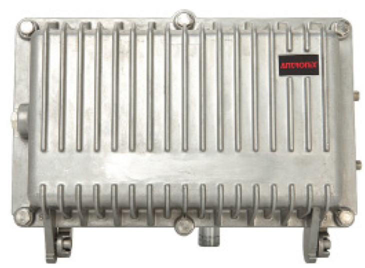
Link QR Code to AIFA Support Page

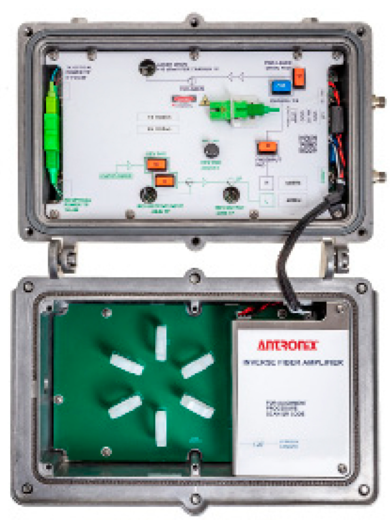
Features and Benefits

Inverse Fiber Amplifier (AIFA)

The Antronix Inverse Fiber Amplifier (AIFA) is an innovative cost-effective solution to extend the network and/or broaden its reach by converting the multitap's drop RF signal to an optical signal. This high performance device operates at an industry leading 9 dBm of output power.



The inverse fiber amplifier is an outdoor, line mountable, rugged device that can provide extra reach and expand the existing HFC infrastructure to add and attract additional subscribers (rural customers) otherwise not serviced by the MSO. The Antronix AIFA is designed to leverage an MSO's existing Hybrid Fiber Coaxial (HFC) network to support DOCSIS data traffic and video channels. This implementation allows for improved reliability, lower maintenance costs and significantly increased performance, all while utilizing existing headend equipment. The headend and back-office systems already supporting the HFC plant are utilized in the new fiber plant extensions. The Inverse Fiber Amplifier is interoperable regardless of manufacturer but is most frequently paired with either a dedicated High Output MDU Antronix Premise MicroNode or a shared access Antronix Mini RFoG ONU, for new sets of subscribers.



- **Extend Network Reach**
  The Antronix Inverse Fiber Amplifier is a high output and low distortion fiber bridge that can extend the network reach by over 10 km. via new build fiber extension, with little reengineering of the OSP.
- **Broaden Network Reach**
  Add multiple subscribers by onboarding new home's passed to existing service group.
- **Performance**
  50 - 1.2 GHz bandwidth high powered 1550 nm DFB transmitter and high sensitivity receiver
- **9 dBm Transmit Power**
- **Simple Installation**
  The units can be installed indoors or outdoors; either pedestal or strand mounted.
- **Signal Conditioning**
  Full complement of JXP pad, eq or cable sim available enabling signal level optimization for both forward and return, resulting in ability to maintain proper cpe boundaries.
- **DOCSIS Compliant Operation**
- **Low Power Consumption**
  At only 13 watts the AIFA may be placed anywhere in OSP and can be powered with drop cable.
- **Powering**
  Local (40-95 VAC)
- **Increase Revenue**
  Add additional subscriber(s) and/or upgrade existing extensions with poor End Of Line performance.

Acquire New Subscribers	
Campgrounds	Rural Broadband
MDU	Hotels / Casinos
Hospitals	College Campuses
Stadiums / Arenas	Airports / Terminals
Data Centers	Corporate Complex

Specifications subject to change without notice

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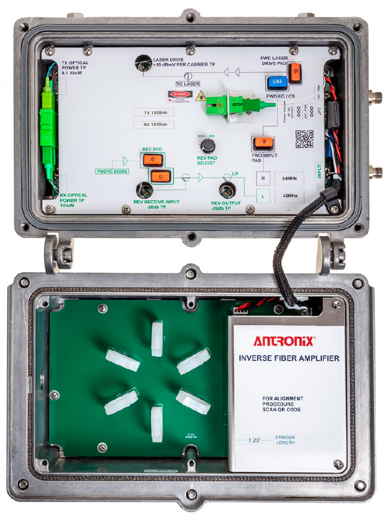
ANTRONIX®

Specifications
Inverse Fiber Amplifier (AIFA)

Optical Performance Forward TX	
Wavelength	1550 +/-10 nm (other wavelengths available)
Output Power	9 dBm
Fiber Type	Single Mode
Connector Type	SC/APC
RF Performance Forward TX	
Bandwidth	54~1235 MHz
Input Level	6~20 dBmV/ch Analog CH, Manual Gain
Transmitter OMI	3.2 % Modulation Index ** (See Channel Loading Below)
Flatness	+/- 1.0 dB (54~1220 MHz)
Input Return Loss	>16 Typical dB
Impedance	75 Ω
Optical and RF Performance Receiver	
Wavelength	1610 +/- 7nm (other wavelengths available)
Input Optical Power	+2 to -14 dBm
Fiber Type	Single Mode
Connector Type (Input)	SC/APC - Connector located inside the unit
Bandwidth	5-42/54, 5-85/102 MHz
Output Level	>+45 dBmV /ch (EQ's Available)
Flatness	+/- 1.0 dB
Output Return Loss	16 dB Typical
Impedance	75 Ω
Link Specification - (9 dB Link Loss feeding AFN-L)	
CNR	>52 dB
CTB	>66 dBC
CSO	[60 dBc (3 Km), 57 dBc (5 Km), 55 dBc (10 Km)]
Electrical/Physical	
Powering	40 - 95 VAC OSP
Power Consumption	< 13 W 0.14 A @ 95 VAC / 0.29 A @ 45 VAC
Operating Temperature	-40 to +140 °F
Dimensions	11.25 (L) x 8.4 (H) x 4.75 (D) (inches)
Weight	7.3 lbs.
Other	
Channel Loading	77 NTSC + 75 digital -- 3 % OMI. Digital -6 dB from analog channel **



Available Configurations*

Part #	Description
AIFA-15-61-042-09-SA	1550/1610 nm, 42/54 MHz rtn, 9 dBm
AIFA-15-61-085-09-SA	1550/1610 nm, 85/102 MHz rtn, 9 dBm
AIFA-15-31-042-09-SA	1550/1310 nm, 42/54 MHz rtn, 9 dBm
AIFA-15-31-085-09-SA	1550/1310 nm, 85/102 MHz rtn, 9 dBm

AIFA-FW-RW-ccc-09-SA

- **SA** — **Connector (SC/APC) std**
- **09** — **Optical Output Power (dBm)**
- **ccc** — **Diplex Filter**
  042: RTN (5-42) FWD (54-1220)
  085: RTN (5-85) FWD (102-1220)
- **RW** — **Reverse Wavelength**
  61: 1610
  31: 1310
- **FW** — **Forward Wavelength**
  15: Standard 1550

*Contact Antronix for other options

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Product Specifications

Features and Benefits

RFoG ONU
R-ONU

The Antronix R-ONU is a compact 1.2 GHz bi-directional mini burst mode RFoG Optical Network Unit, the ideal platform for delivering upstream and downstream, voice, video and high speed data service over FTTB or FTTX applications. It includes Automatic gain control (AGC), Burst Mode Return Lasers, and optional bandwidth splits. It also has an optional PON Pass-through port.

- **Easy SDU and MDU Installation**
- **Standard SC/APC Optical Connector**
- **Patented CamPort® F-connectors**
- **xPON Pass Through**
- **Supports DOCSIS 3.0 and 3.1**
- **Burst Mode Operation - Laser Type; Burst Mode DFB**
- **Optical Input Range -6 to +2 dBm**
- **Optical Automatic Gain Control (AGC)**
- **Input Optical Wavelength: 1550 nm**
- **Output Wavelength Available: 1610 nm or 1310 nm**
- **Downstream Bandwidth: Up to 1250 MHz**
- **Upstream Bandwidth: 5 MHz to 42 MHz, or 5 MHz to 85 MHz**
- **Output RF Signal Level: 17 dBmV/Ch @ 860 MHz (typical) 6 dB Linear Slope 54 -1220 MHz**
- **Input RF Signal Level, 20 to 40 dBmV/Ch**
- **RF Test Point, -20 dB**
- **Supply Power, 12 Volt DC**
- **LED Indicator: Power-on, Optical Link-on**
- **Supports RFoG SCTE 174 Standard**

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Product Specifications cont'd

Specifications
R-ONU

Electrical

Model: R-ONU-FW-RW-ccc-SA-G2	Typical
Optical Receiver RF Performance	
Frequency Range	54-1250 MHz
RF Output Level	17 dBmV/Ch @ 860 (typical) 6 dB linear slope 54 -1220 MHz
Output Return Loss	> 16 dB
Flatness	+/-1.0 dB
Distortion Performance (@ -1dBm input)	
CNR	51 dB
CSO	-60 dBc
CTB	-65 dBc
Optical Receiver Parameters	
Optical Receive Bandwidth	1540 – 1565 nm
Input Optical Power	-6 dBm to +2 dBm
Connector Type	SC/APC
Optical Return Loss	-6 dB
Return Tx RF Parameters	
Frequency	5-42 MHz , 5- 85 MHz
Input Return Loss	16 dB
Return RF Input level	Nominal +33 dBmv/carrier
Flatness	+/- 1.0 dB
Return Tx Optical Parameters	
Laser Type	DFB
Output Power	3 dBm
Connector Type	SC/APC

Ex: **R-ONU-15-61-085-SA-G2**
R-ONU: RFoG Technology
15: FWD 1550 nm
61: RTN 1610 nm
085: 85 MHz Diplex Filter
SA: SA-SC/APC
G2: 1.2 GHz

Ordering Information

R-ONU-FW-RW-ccc-SA-G2

G2: Bandwidth
G2: 1.2 GHz

SA: Connector Type
SA-SC/APC standard

ccc: Diplex Filter
042: RTN (5-42) FWD (54-1220)
085: RTN (5-85) FWD (102-1220)

ONU Technology
R-ONU (RFoG)

Forward Wavelength
15: Standard 1550

RW: Reverse Wavelength
61: 1610 nm
31: 1310 nm

Specifications subject to change without notice

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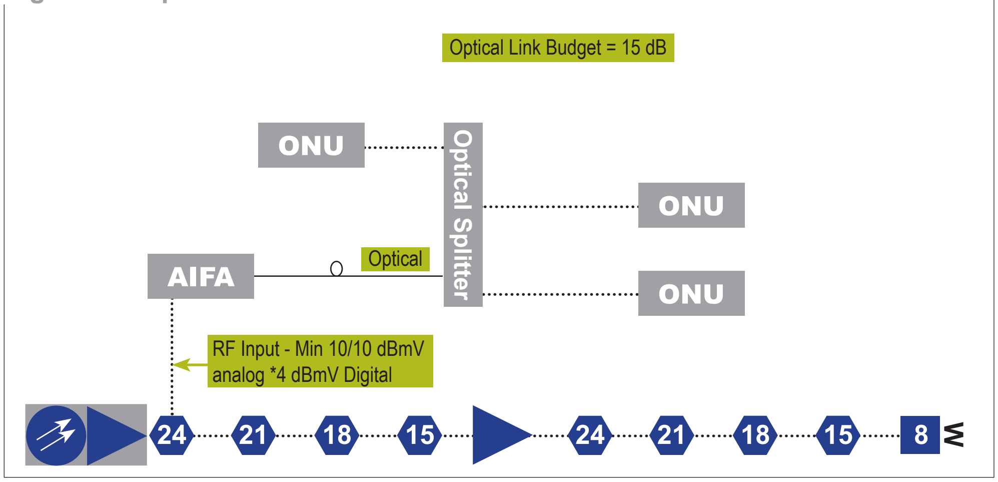
Appendix A Design Example

The AIFA can accommodate a full suite of plug ins allowing it to be placed anywhere in the tap string.

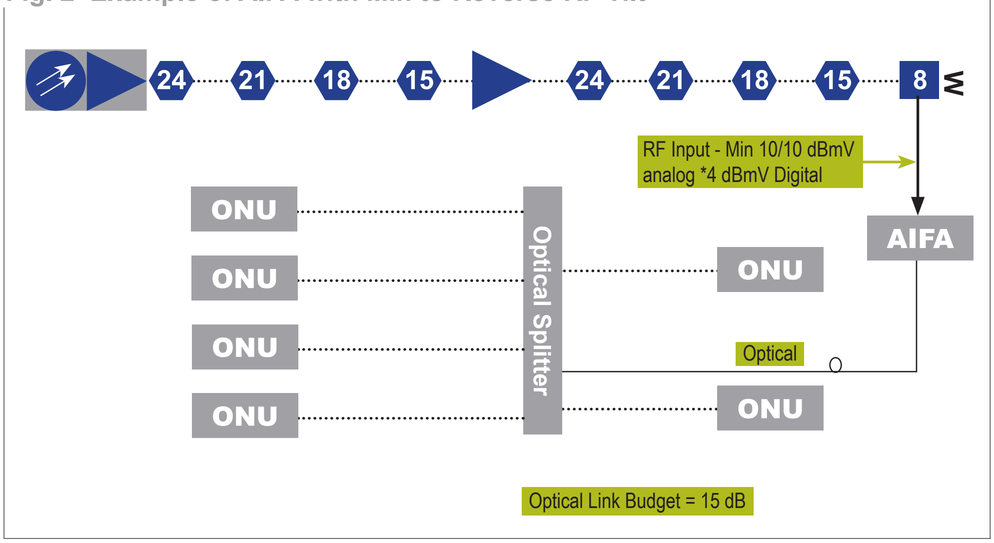
From the First Tap with Maximum Tilt

Fig. 1 Example of AIFA with Max RF Tilt



To the Last Tap

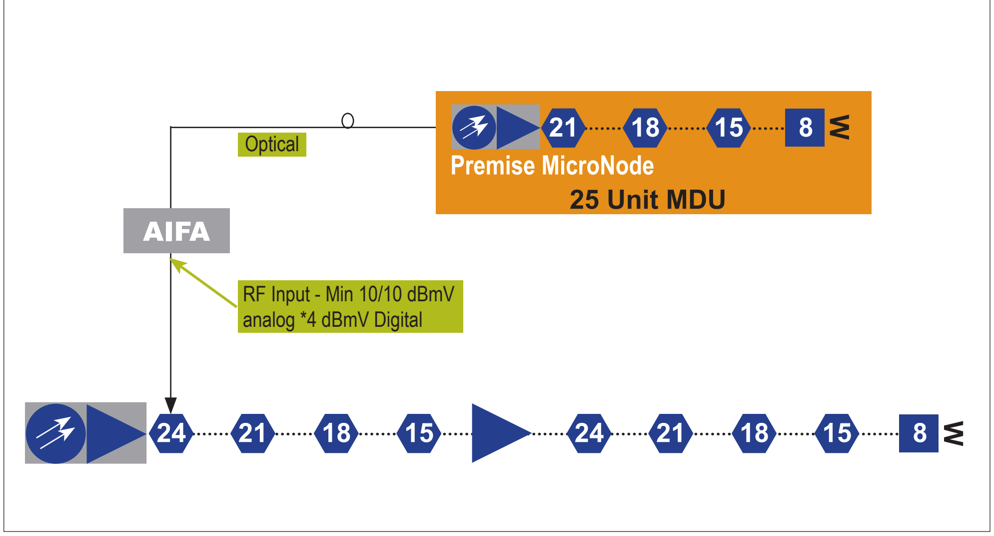
Fig. 2 Example of AIFA with Min to Reverse RF Tilt



Appendix A Design Example cont'd

The AIFA can also drive a Premise MicroNode

Fig. 3 Example of AIFA Driving a Premise MicroNode



Appendix B Birth Certificate

Antronix Inverse Fiber Amplifier (AIFA) Birth Certificate

Tech #		**Pole #**				
Date		**Node #**				
Location		**Amp #**				
Tap Value	**Ports**	**Value**				
Plant Records						
Ch	**Freq.**	**Level**	**Measurements**			
	(MHZ)	(dBmV)	**Mer**	**Pre**	**Post**	**DQI**
Plant Return Level (dBmV)						
Modem Upstream Level (dBmV)						
Powering (DC or Power Tap)	**Power Tap**					
Forward Bandwidth of CATV (Hi/Lo)	(MHz)	(MHz)				
Levels @ end of AIFA Drop (input to AIFA (Hi/Lo)	(dBmV)	(dBmV)				
Antronix AIFA Data						
Serial #						
AC Volt		**Powering - Input or Ext. Power**			**JP7-Up or Down**	
Fwd Input Pad		**Laser Drive Test Point Level**	**Freq.**	**Level**	**Please Circle**	
Fwd EQ/CS			(MHz)	(dBmV)		
Fwd Laser Drive Pad					**Digital**	**Analog**
					Digital	**Analog**
Rev Pad		**Rev Pad Adjust** (# of positions past Min)				
Rev EQ						
AIFA Optical Transmit Level	(nm)	(dBm)	**AIFA Optical Receive Level**		(nm)	(dBm)
	1550				**1610**	
TX Optical Power TP (0.1 V/mW)	**Volt** (dc)	**RX Optical Power TP** (1.0 V/mW)		**Volt** (dc)		
Design Link Loss	**Fwd** (dB)	**Ret** (dB)	**Measured Link Loss**		**Fwd** (dB)	**Ret** (dB)

Additional Complementary Antronix Products

Antronix Milenium SDPE series 1.2 GHz Power Extracting Multi-Tap

Antronix Milenium Series MGDCH series 1.2 GHz MainLine Passives

Antronix RFoG ONU

Antronix AFN series Premise MicroNodes

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