



Radio over fiber manuals
AFB-250 AFR-200 ACH-642 ACH-862



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Lire d'abord:

- Lisez tout d'abord ce manuel.
- L'alimentation RF peut être dangereuse, veuillez toujours utiliser ou porter un Equipement de Protection Individuelle (EPI) approprié.
- Assurez-vous de comprendre le comportement des radiofréquences lorsque vous mesurez la puissance, sinon cela peut détruire les amplificateurs ou les abimer.
- Pour utiliser ces équipements, assurez-vous de comprendre les concepts RF tels que spectre, puissance, bruit, intermodulation, filtrage ...
- Nettoyez l'appareil avec un chiffon légèrement humide.
- Cet appareil ne doit pas être exposé à la pluie, à l'humidité.
- N'installez pas l'appareil à proximité de sources de chaleur.
- Cet appareil doit être réparé par un technicien qualifié.
- Les spécifications peuvent être modifiées sans préavis.
- BSRF n'est pas responsable des blessures, destructions résultant d'une mauvaise utilisation des équipements.

Firmware revision:

-pas de révision du firmware pour les équipements actuels.

Si vous devez faire une mise à jour du firmware, veuillez nous contacter à:
info@aeitech.com, contact@bs-rf.com.

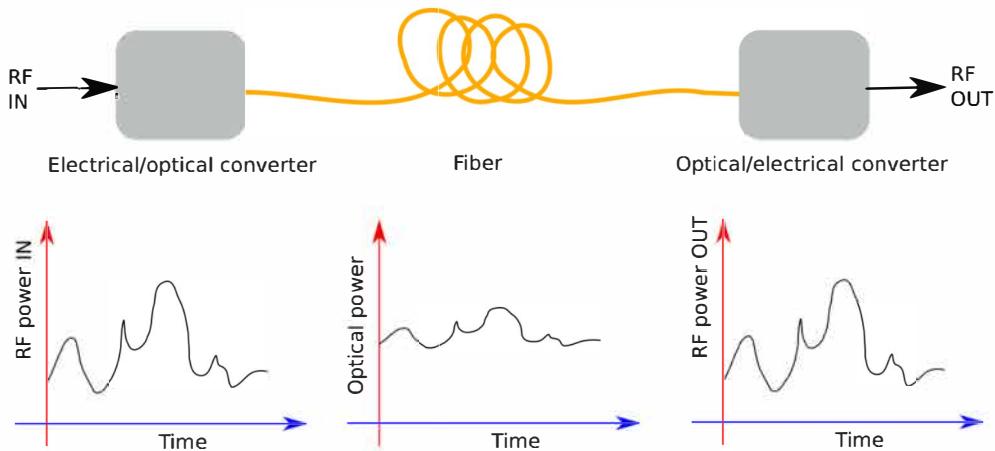
Description:

Tout d'abord merci d'avoir acheté ce produit BSRF, nous espérons qu'il vous servira bien !

Les produits radio sur fibre BSRF sont utilisés pour profiter des avantages de la propagation sur fibre optique. Ces appareils sont utilisés pour convertir le signal électrique RF en signal optique et les reconvertir en électricité. Cette transformation analogique complète n'est pas compatible avec le réseau IP.

Basics about radio over fiber:

Radio over fiber (RoF) is a technique used to transport radio-frequency signal on optical fiber. This technique is analog, they are no digital conversion neither error correction. So frequency of signal are not altered by the RoF link.



- Converters are used to change the propagation medium. From electric lines to optical fiber and from optical fiber to electric lines.
Electric to optic is performed by an optical modulator, the incoming RF signal modulate the power of the LASER diode.
Optic to electric is performed by a photodiode, it demodulates input light to electrical signal.
- Optical fiber offer low loss. At 1310nm loss is 0,5dB/Km.
Fiber is lightweight, signal on fiber is ideally isolated from external signals/electromagnetical fields. It can't rust. Mounted on a drum it can be used on field quickly compared to coax cables.
BSRF equipments must be used with monomode fiber.
- Connectors. Connectors allows to connects equipments. The more connections you have in the path the more loss you'll get in the RF path. It means you need to carefully take this in account to get the best from your equipment. Connectors must be carefully inspected and cleaned if needed.
BSRF equipments must be used with APC connectors when connecting equipments. We can add internal patchcord to make equipments compatible with PC connectors.
- Polishing. Green connectors are APC (Angled Physical Contact) it allows to reduce back reflection from perturbing laser. Blue connectors are PC(Physical Contact) they are less effective to reduce back reflection.

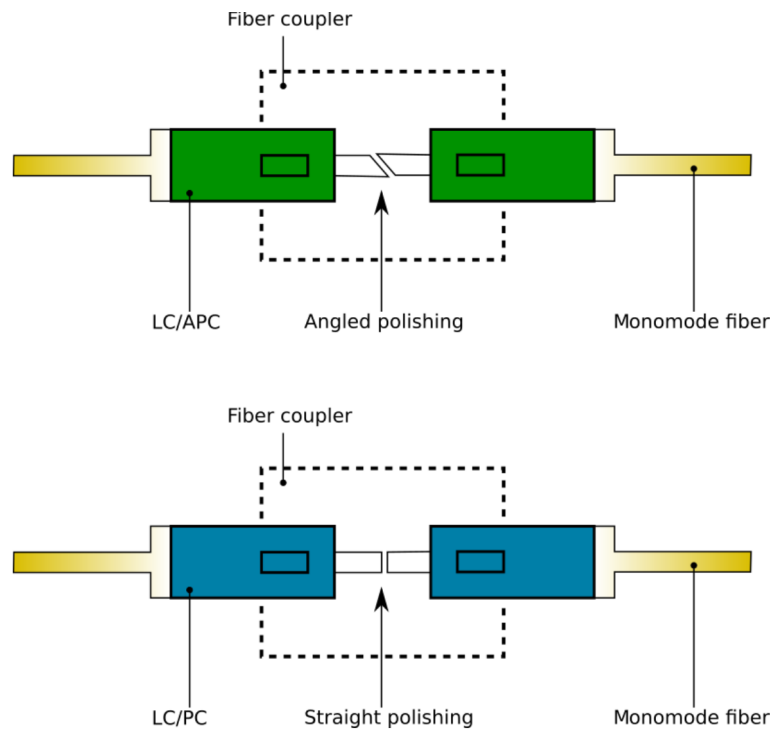


Illustration 1: Mating of fiber connectors (LC/APC and LC/PC)

Question answer about RoF.

1. Does it work like network devices ? NO, it's an analog modulation, you've to pay attention on optical loss. As a rule of thumb every time you loose 1dB on the optical path you'll loose 2dB on RF path.
2. How far can I remote antenna ? If you use just one fiber between equipments, you can put the remote 10km from the base (5dB of optical loss leads to 10dB of RF loss). If you add more connections between equipments or if connectors are dirty this distance will be reduced.
3. How can I get the best from RoF for wireless microphones applications ? Well as usually the way you place antenna is still important, the idea is to avoid too strong signals and too weak signals !! As converter is active device it can be overloaded this lead to intermodulation and rising noise. With a well defined antenna position, clean fiber, sometimes filter on big rig, you will get the best RF coverage.
4. How can I get the best from RoF for IEM application ? Well as usually the way you place antenna is still important. It's never a good idea to put the TX antenna near or in front of a RX antenna. As AFB-350 and AFB-450 have a broadband amplifier onboard, you should consider using an external filter to reduce noise generated by amplifier. If you feel not comfortable with that we are here to help (really!).
5. How to handle wireless microphone multi-zone coverage with RoF ? The best idea is to alternate A and B diversity antenna. Because diversity receivers switch from A to B selecting the best signal. You should avoid the case where two A (or B) antennas are near of each others because you can have drops depending on frequency and position of emitter... If you have to put A antennas (or B) near each others consider using directive

antenna to « select » area of coverage.

6. Can I consider not inspecting fiber before an installation ? It's the same when you wear glasses, generally it's quite hard to clean them when you drive... Seriously it must be done before an installation with proper tools.
7. How can I inspect fiber ? The best way is to use a video inspection tool (ie: VIAVI/JDSU P5000i, USB with free software, is widely used, safe for eyes). But ones can use affordable microscope with a X200/X400 magnification (**WARNING ! Don't use it while equipment is powered as it could lead to permanent damage of your eyes**). You also need the proper microscope tip to adapt to the kind of connector (LC/PC,LC/APC,SC/PC,SC/APC...). Of course we can help you on that topic.

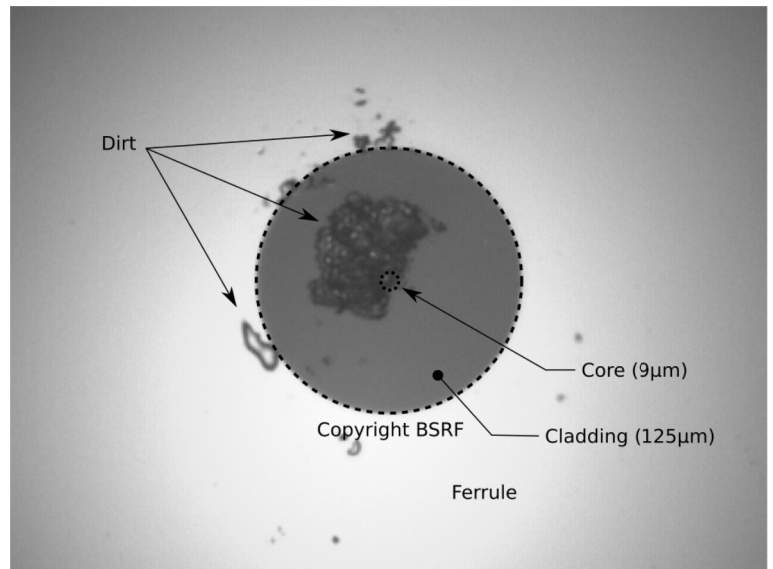
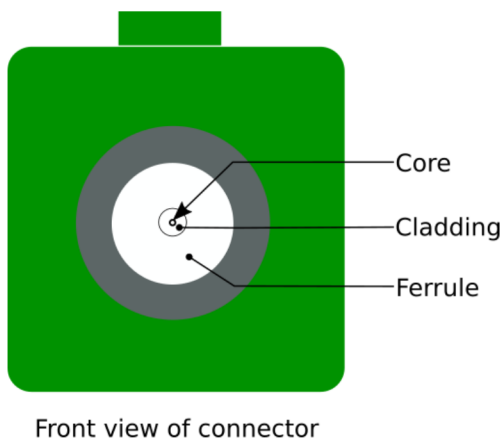


Illustration 2: Fiber inspection (monomode fiber)

8. How can I clean fiber ? We use two technique : the first one if dirt is light we use an automatic pencil to do it (ie :IBC LC, www.usconec.com). If it doesn't work with the pencil we use Clean Wipes and Alcool from Sticklers. It requires a little training.

AFB-250:

WARNING!: DON'T TRY TO INSPECT FIBER WITH YOUR EYES WHEN THE UNIT IS SWITCHED ON, USE PROPER PERSONNAL PROTECTION EQUIPEMENTS.



Illustration 3: Front panel AFB-250

The AFB-250 allows to remote two RX antennas over two momode fibers. Specially made electro-optical components are used in this equipment.

This device must be used with a AFR-200 or ACH642 or ACH-862 base. Its rugged aluminium made enclosure and its connectors are designed for on field operation. A DC-feed 12V supply, protected from short circuits, can be activated on each inputs individually. An « RF peak » indicator shows if the RF input level is too strong. At last a 10dB RF attenuator on each input can be activated in order to reduce sensitivity and intermodulation. This attenuator must be enabled on startup.

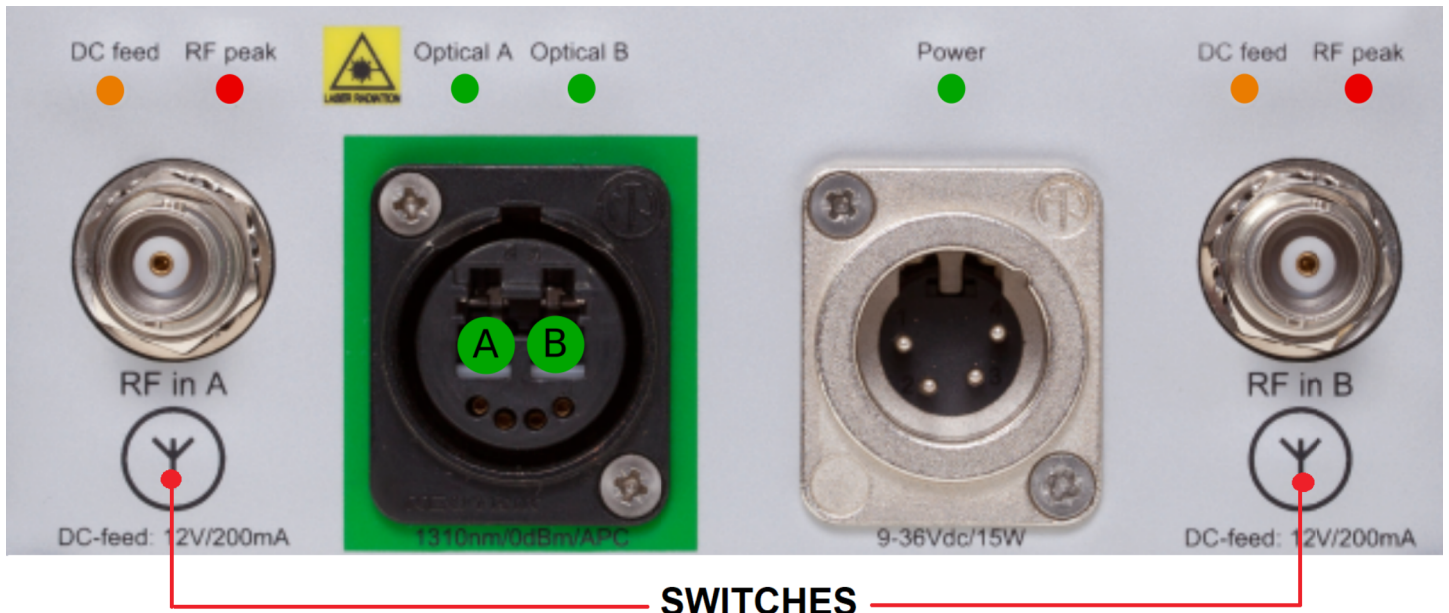


Illustration 4: Front panel close view

LEDS:

- **Power:** Green color lights up when the device is on.
- **DC feed:** Orange color indicates that supply is enabled for active antennas. This orange LED will blink in case of short circuit in cable or connector.
- **Optical:** Green color indicates that optical converter is active.
- **RF peak:** This red LED lights up when RF level is too high. This may come from a wrong antenna booster setting or a transmitter too close from the antenna.

SWITCHES:

- **DC-feed :** Activate 12V/200mA power supply for active antennas. Press on antenna symbol o toggle DC feed state.

POWER:

- 9-36Vdc-15W linear power supply or battery Consumption 500mA - 600mA with 1 active antenna - 750mA with 2 active antennas XLR4 Wiring : 1 - / 4 +

FIBER OPTICS:

- Neutrik OpticalCon Duo APC or LC/APC fiber optics cables linked to fiber receiver AFR / ACF / ACH
- Each channel use a single fiber, when using a connection with LC connector, the corresponding pin out is indicated on the Front panel close view.

RF in:

- Connect Rx Antennas A & B Passive up to 5m with RG58 and 10m with RG213 cable Active up to 35 m with RG58 and 70m with RG213 cable.

Activate/desactivate internal attenuator:

- While switching device ON, press SWITCH RF in A. Optical A and B leds will blink alternatively. From this moment you'll have about 10sec to set attenuation: Pressing DC feed switch (A or B) for having RF peak led ON & DC feed OFF(10dB attenuator activated on corresponding channel) or RF peak OFF & DC feed OFF (no attenuation, default).
- When 10s pass, configuration will be stored in EEPROM.

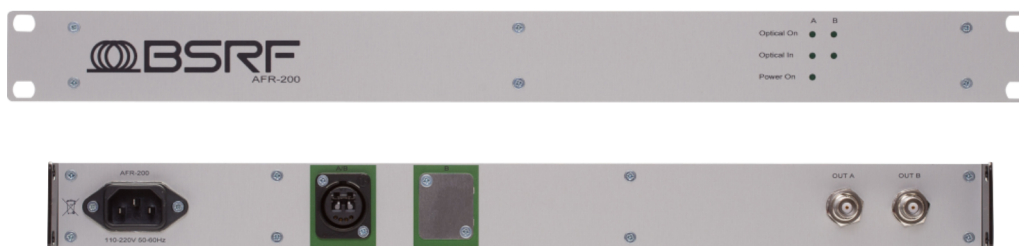
AFB-250 specifications:

Specifications:

RX section	
Bande passante	470-800MHz
Entrée RF	2xBNC 50R
Télé-alim	12V/200mA
Atténuateur RF	0/10dB
Seuil RF peak	-12dBm
Sortie optique	Neutrik Opticalcon, 1310nm, monomode/APC
Consommation	500mA typ.
+1 antenne	600mA typ.
+2antennes	750mA typ.
Alimentation	XLR4, 12W
Dimensions	155x180x70mm
Poids	1,3kg

AFR-200:

WARNING!: DON'T TRY TO INSPECT FIBER WITH YOUR EYES WHEN THE UNIT IS SWITCHED ON, USE PROPER PERSONNAL PROTECTION EQUIPEMENTS.



The AFR-200 allows to remote two RX antennas over two monomode fibers. Specially made electro-optical components are used in this equipment. This device is used with one AFB-250. Two indicators « OPTICAL IN » shows if loss on incoming optical signals occurred (from AFB-250). Leds will blink if loss is between 3 and 6dB. Beyond 6 dB leds turn off.

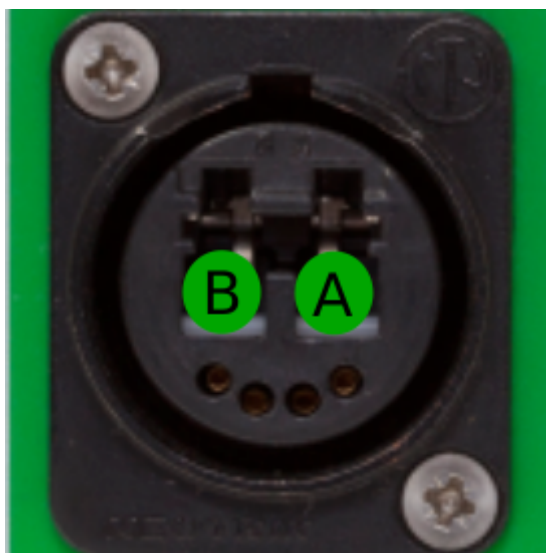


Illustration 5: Optical connection

LEDS:

- **Power:** Green color lights up when the device is on.
- **Optical:** Green color indicates that optical link is active Beyond 3 dB power loss in optical link, this LED will blink.

POWER:

- 110/220V 50-60Hz Max 2A .

FIBER OPTICS:

- Neutrik OpticalCon Duo APC or LC/APC fiber optics cables linked to fiber receiver AFR / ACF / ACH

- Each channel use a single fiber, when using a connection with LC connector, the corresponding pin out is indicated on the Optical connection.

RF out:

- Connected to wireless receiver or splitter/combiner.

AFR-200 specifications:

Specifications:

RX section	
Bandwidth	150-1000MHz
RF output	2xBNC 50 ohms
Optical input	Neutrik Opticalcon, 1310nm, monomode/APC
Supply	AC 110-220V
Dimension	435x250x43mm
Weight	3,1kg

(Subject to change without notice)

ACH-642:

WARNING!: DON'T TRY TO INSPECT FIBER WITH YOUR EYES WHEN THE UNIT IS SWITCHED ON, USE PROPER PERSONNAL PROTECTION EQUIPEMENTS.



The ACH-642 allows to remote up to two pair of RX antennas over 4 monomode fibers and combine their RF signal with a pair of local RX antennas (connected with coaxial cable to the base). Specially made electro-optical components are used in this equipment. This device must be used with one or two or three AFB-250. A 12V DC-feed supply, protected from short circuits, can be activated on each inputs individually (switches inside the ACH). Four indicators « OPTICAL IN » shows if loss on incoming optical signals occurred (from AFB-250). Leds will blink if loss is between 3 and 6dB. Beyond 6 dB leds turn off.



Illustration 6: BNC close view

LEDS:

- **Power:** Green color lights up when the device is on.
- **Optical:** Green color indicates that optical link is active Beyond 3 dB power loss in optical link, this LED will blink.
- **DC Feed:** Orange color indicates that supply is enabled for active antennas. This orange LED will blink in case of short circuit in cable or connector.

POWER:

- 110/220V 50-60Hz Max 2A .

RF IN:

- Connect Rx Antennas A & B Passive up to 5m with RG58 and 10m with RG213 cable Active up to 35 m with RG58 and 70m with RG213 cable.
- To set on/off DC feed on RF in A1 or B1, open cover and set high or low switch 1(A1) or 3(B1). !!!MUST BE DONE BY A QUALIFIED TECHNICIAN!!!

RF out:

- Connected to wireless receiver or splitter/combiner.



Illustration 7: Optical connection

FIBER OPTICS:

- Neutrik OpticalCon Duo APC or LC/APC fiber optics cables linked to fiber receiver AFR / ACF / ACH
- Each channel use a single fiber, when using a connection with LC connector, the corresponding pin out is indicated on the Optical connection.

ACH-642 specifications :

Specifications:

TX section	
Bandwidth	150-850MHz
Input.output coax	4x BNC 50 ohms
Télé-alim	12V/200mA
Gain coax channel	+3dB typ.
Fiber input	Neutrik OpticalCon Duo (<u>fibres monomode APC</u>)
Gain fiber channels	0dB typ.
Supply	110-220V 50-60Hz
Dimension	480x280x44mm
Weight	3,5kg

(Subject to change without notice)

ACH-862:

WARNING!: DON'T TRY TO INSPECT FIBER WITH YOUR EYES WHEN THE UNIT IS SWITCHED ON, USE PROPER PERSONNAL PROTECTION EQUIPEMENTS.



The ACH-862 allows to remote up to three pair of RX antennas over 6 monomode fibers and combine their RF signal with a pair of local RX antennas (connected with coaxial cable to the base). Specially made electro-optical components are used in this equipment. Each antenna can be enabled or disabled with on panel's switches. This device must be used with one or two or three AFB-250.

A 12V DC-feed supply, protected from short circuits, can be activated on each inputs individually (switches inside the ACH). Six indicators « OPTICAL IN » shows if loss on incoming optical signals occurred (from AFB-250). Leds will blink if loss is between 3 and 6dB. Beyond 6 dB leds turn off.

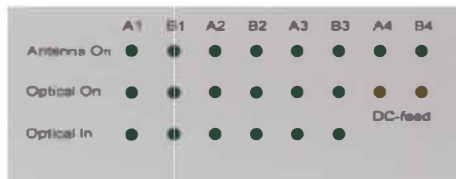


Illustration 8: Led close view

LEDS:

- **Power:** Green color lights up when the device is on.
- **Optical:** Green color indicates that optical link is active Beyond 3 dB power loss in optical link, this LED will blink.
- **DC Feed:** Orange color indicates that supply is enabled for active antennas. This orange LED will blink in case of short circuit in cable or connector.
- **Antenna On:** Green color light up when the corresponding channel is on.

SWITCHES:

- Press switch to toggle state on corresponding channel. RF switches have a 60dB OFF state attenuation.

POWER:

- 110/220V 50-60Hz Max 2A .

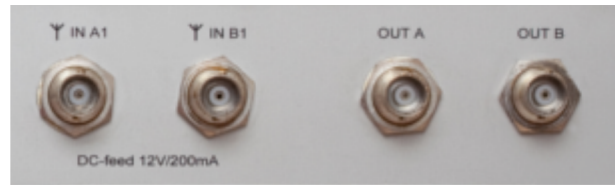


Illustration 9: BNC close view

RF IN:

- Connect Rx Antennas A & B Passive up to 5m with RG58 and 10m with RG213 cable
Active up to 35 m with RG58 and 70m with RG213 cable.

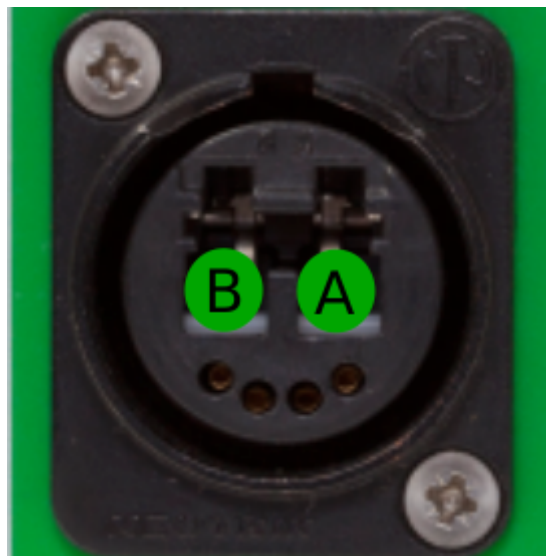


Illustration 10: Optical connection

FIBER OPTICS:

- Neutrik OpticalCon Duo APC or LC/APC fiber optics cables linked to fiber receiver AFR / ACF / ACH
- Each channel use a single fiber, when using a connection with LC connector, the corresponding pin out is indicated on the Optical connection.

RF out:

- Connected to wireless receiver or splitter/combiner.

ACH-862 specifications:

Specifications:

TX section	
Bandwidth	470-790MHz
RF IN/OUT	4x BNC 50 ohms
DC-feed	12V/200mA
Gain on coax	+/-1dB typ.
Optical input	Neutrik OpticalCon Duo (fibre monomode APC)
Gain on fiber (RF)	0dB typ.
Isolation ON/OFF RF	60dB typ.
Supply	110-220V 50-60Hz
Dimension	480x280x44mm
Weigth	3,5kg

(Subject to change without notice)

How to:

1) What is important:

Most important things are:

-Optical loss as it directly induce RF loss: 1dB loss in the the optical path lead to 2dB of RF loss

=> keep fiber interface as clean as possible.

=> as soon as fiber is unplugged protect it.

=> use quality equipments to inspect/clean fibers interface.

-Too strong RF signals: radio over fiber as all active equipments have a limited dynamic. This means above a threshold the more the signal become strong the more it will produce distrortion, noise.

=> RF in ports must be preserved from high signal, on AFB-250 the RF peak led 1 lights up at -12dBm, keep signal under this threshold (specially when using many carriers).

=>Use filter behind passive antennas to reduce outband perturbing signals.

=>Use directive antennas, move antenna to not be in the line of sight of IEMs, TX, walkies

2) When should I need radio over fiber equipments?

If you need to:

-Put antennas far away from receiver (above 100 meters) and low loss coax is not an option (weight/oxydation/on field set up).

-Capture wireless from distant location and you don't want to put one receiver per carrier in every spot... and handle multiple audio source.

-Quickly deploy antennas on field.

3) What about noise?

Radio over fiber equipments use active components that produces noise, specially the laser used as an optical carrier. The noise produced is a broadband noise (AWGN), seen as an increasing noise floor on a spectrum analyzer. Summing multiple ROF link will increase this level.

4) How to set up equipments.

AFR-200:

Simple as following 1).

ACH-642/ ACH-862:

Multiple antenna combining can produce destructive interference, this happens when two out of phase signal sums locally. This produce a quick drop out that every RF tech knows. So the more antenna you sum the more probability you have to get this effect to happens. This effect happens when both signals are phase opposite and of equal magnitude. This magnitude is important, you need to take care of that. Antennas from the same diversity channel (A or B) must not receive the same magnitude coming from the same source (wireless microphone). If you try to put all summed antennas in the same

area (in the line of sight) it won't work! Antennas from the same diversity channel (A or B) must not see each others. Use directive antennas to avoid such event.

5) Recommended tools ?

Decent spectrum analyzer.

Usefull datas:

Insertion loss of usual coaxial cables:

Cable (50ohms) :	Frequency						
	10MHz	100MHz	400MHz	500MHz	600MHz	700MHz	1GHz
RG316	0,1dB	0,3dB	0,6dB	0,6dB	0,7dB	0,8dB	0,9dB
RG58	0,1dB	0,2dB	0,3dB	0,4dB	0,4dB	0,5dB	0,6dB
RG213- RG214- RG8	0,02dB	0,1dB	0,2dB	0,2dB	0,2dB	0,2dB	0,3dB
LMR400	0,04dB	0,1dB	0,1dB	0,1dB	0,2dB	0,2dB	0,2dB
Ecoflex 10	0,012dB	0,04dB	0,08dB	0,1dB	0,1dB	0,1dB	0,14dB

Illustration 11: Insertion loss versus frequency.

Insertion loss of connectors:

A good connector is typically 0,05dB of loss (400MHz-800MHz). You can check the datasheet of the connector to find this value.

Insertion loss of 1:N port passive splitters (min theoretic):

N ports :	Min att (dB)
2	-3
3	-5
4	-6
5	-7
6	-8
7	-8
8	-9
10	-10
16	-12

Illustration 12: Minimum insertion loss of passive splitter

Accessories:

Reference:	Description:	
AFB-250-PSU	AC/DC converter, 12V, XLR4 female/ IEC	



Warranty:

This 2 year limited Warranty covers any defects in material or workmanship under normal use during the Warranty Period. During the Warranty Period, BSRF will repair or replace, at no charge, products or parts of a product that proves defective because of improper material or workmanship, under normal use and maintenance.

Send us an email first at:

contact@bs-rf.com



Société Aeitech - Avenue de la Mauldre, 6 Village d'Entreprises, 78680 Épône
01 45 25 51 00 - info@aeitech.com - www.aeitech.com