fiplex

Dual Band PS700 & PS800 Digital Signal Booster

User & Installation Manual

Document History

Description	Revision	Date Issued
Original version	001	Feb 17th, 2015
General Revision	002	May 14th, 2015
General Revision	003	March 28th, 2018

About this manual

This manual describes installation, commissioning, operation and maintenance of Fiplex **PS700 & PS800 Dual Band Digital Signal Booster, and *Fiplex Control Software (FCS)***. The first part of the manual describes the Signal Booster hardware and the second part describes the software.

Hardware and software mentioned in this manual are subjected to continuous development and improvement. Consequently, there may be minor discrepancies between the information in this manual and the performance and design of the hardware and software. Specifications, dimensions and other statements mentioned in this manual are subject to change without notice.

Abbreviations

AGC	Automatic Gain Control
AMPS	Advanced Mobile Phone Service
ARFCN	Absolute Radio Frequency Channel Number
BCCH	Broadcast Control Channel (GSM broadcast channel time slot)
BS	Base Station, BS antenna = towards the base station
CDMA	Code Division Multiple Access
DC	Direct Current
DCS	Digital Communication System (same as PCN)
DL	Downlink signal direction (from base station via Signal Booster / Master / Remote to mobile station)
DPLX	Duplex filter
EEPROM	Electrical Erasable Programmable Read Only Memory
EGSM	Extended Global System for Mobile communication
ETACS	Extended Total Access Communication System
ETSI	European Telecommunications Standard Institute
FCS	Fiplex Control Software
GSM	Global System for Mobile communication
HW	Hardware
LED	Light Emitting Diode
LNA	Low Noise Amplifier, uplink and downlink
MS	Mobile Station, MS antenna = towards the mobile station
OL	Overload
OMS	Operation and Maintenance System
PA	Power Amplifier
PCN	Personal Communication Network (same as DCS)
PCS	Personal Communication System
pFOMS	Portable Fiplex Operation and Maintenance Software
PS	Power Supply
RF	Radio Frequency
RSSI	Received Signal Strength Indication
SW	Software
UL	Uplink signal direction (from mobile station via Signal Booster / Master / Remote to base station)
WEEE	Waste of Electric and Electronic Equipment

Safety

Caution!

This manual lists a set of rules and warnings to be accomplished when installing, commissioning and operating a Signal Booster / Master / Remote Unit from FIPLEX. Any omission may result in damage and/ or injuries to the System and/or the System Operators or Users.
If an instruction is not clear or you consider is missing, please contact immediately to Fiplex.
See www.fiplex.com for contact information.

Dangerous Voltage Warning

Any personnel involved in installation, operation or service of Fiplex Signal Boosters / Masters / Remotes must understand and obey the following:

The power supply unit supplied from the main power contains dangerous voltage level, which can cause electric shock. Switch the main power off prior to any work in such equipment. Any local regulations are to be followed when servicing Signal Boosters / Masters / Remotes. Authorized service personnel only are allowed to service repeaters while the main is switched on.

Radiation Hazard Warning

Any Signal Booster / Master / Remote, including this unit, will generate radio signals and thereby give rise to electromagnetic fields that may be hazardous to the health of any person who is extensively exposed to the signals at the immediate proximity of the Signal Booster / Master / Remote and the Antennas.

R&TTE Compliance Statement

This equipment complies with the appropriate essential requirements of Article 3 of the R&TTE Directive 1999/5/EC.

Station Ground

BTS chassis, Signal Booster / Master / Remote feeders, donor antenna, service antenna/s and auxiliary equipment (splitters, tabs, .etc) are required to be bonded to protective grounding using the bonding stud or screw provided with each unit.

Electrostatic Discharge

Static electricity means no risk of personal injury but it can severely damage essential parts of the Signal Booster / Master / Remote, if not handled carefully. Parts on the printed circuit boards as well as other parts in the Signal Booster / Master / Remote are sensitive to electrostatic discharge.
Never touch printed circuit boards or uninsulated conductor surfaces unless absolutely necessary.
If you must handle printed circuit boards or uninsulated conductor surfaces, use ESD protective equipment, or first touch the Signal Booster / Master / Remote chassis with your hand and then do not move your feet on the floor.
Never let your clothes touch printed circuit boards or uninsulated conductor surfaces.

Disposal of Electric and Electronic Waste

Pursuant to the WEEE EU Directive electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.

FCC Compliance

This is a 90.219 Class B device.

WARNING. This is a 90.219 Class B device. This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate this device. You **MUST** register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation. The installation procedure must result in the signal booster complying with FCC requirements 90.219(d). In order to meet FCC requirements 90.219(d), it may be necessary for the installer to reduce the UL and/or DL output power for certain installations.

ATTENTION: This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

ATTENTION: FCC regulation mandate that the ERP of type B signal boosters should not exceed 5W. This Signal Booster has a maximum programmable composite output power of 5W (+37dBm, and programmable to +30dBm and +24dBm), therefore the gain of the DL antenna should be of 0dBi or less and maintain a minimum separation of 45 cm from all persons, and the gain of the UL antenna should be 13dBi or less and maintain a minimum separation of 45 cm from all persons.

IC Compliance

As per RSS 131 Issue 2:

- Nominal passband gain: 80dB max
- Nominal bandwidth: 8MHz maximum for Canada market
- Rated mean output power: Up to +37dBm maximum, programmable to +30dBm and +24dBm
- Input and Output impedances: 50 ohms

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

RF Exposure Statement for ISED: “This device complies with Health Canada’s Safety Code. The installer of this device shouldensure that RF radiation is not emitted in excess of the Health Canada’s requirement. Information can be obtained at http://www.hc-sc.gc.ca/ewhsemt/pubs/radiation/radio_guide-lignes_direct/index-eng.php”

The antenna/s used for this transmitter must be installed to provide a separation of at least 45 cm in DL and 45 cm in UL from all persons and must not be collocated or operating in

conjunction with any other antenna or transmitter. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Selon RSS 131 Issue 2:

- *Gain de bande passante nominal: 80dB max*
- *Bande passante nominale: 8MHz maximum pour le marché canadien*
- *Puissance nominale de sortie moyenne: Jusqu'à + 37dBm maximum, programmable à +30dBm et à +24dBm.*
- *Impédances d'entrée et de sortie: 50 ohms*

La puissance de sortie nominale du fabricant de cet équipement est pour le fonctionnement d'une seule porteuse. Pour les situations où plusieurs signaux de porteuse sont présents, la cote devrait être réduite de 3,5 dB, en particulier lorsque le signal de sortie est ré-irradié et peut causer des interférences aux utilisateurs de bande adjacents. Cette réduction de puissance doit se faire au moyen d'une puissance d'entrée ou d'une réduction de gain et non pas par un

atténuateur à la sortie du dispositif.

Déclaration d'exposition RF pour ISED: «Cet appareil est conforme au Code de sécurité de Santé Canada. L'installateur de cet appareil doit s'assurer que les rayonnements RF ne sont pas émis au-delà de l'exigence de Santé Canada. Vous pouvez obtenir de l'information à l'adresse http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-fra.php.

L'antenne utilisée pour cet émetteur doit être installée de manière à assurer une séparation d'au moins 45 cm dans DL et 45 cm dans UL de toutes les personnes et ne doit pas être collocée ni fonctionner avec une autre antenne ou émetteur. Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur d'utiliser l'équipement.

Product Description

The DH7S Signal Booster Series are dual band channel selective Public Safety 700 and Public Safety 800 Dual Band Digital Signal Booster that operates in the PS700 and PS800 bands.

Each band has separate filtering modules, so no interference can be produced between the two systems.

Each band has a separate To Base RF Port, so each band can have its own directional antenna. In the case the PS700 and PS800 donor Base Stations are located in the same donor site, a conventional splitter/combiner can be used to feed both systems with one same donor antenna. The connectors and LED panel in the cabinet are labelled as Band I and Band II, in this case, Band I is PS700 and Band II is PS800.

BAND I → PS700

BAND II → PS800

Each band has a separate intermediate filtering. The intermediate filtering is done using FPGA based Digital Signal Processing that, among many, has the following features:

- High Selectivity vs Low Delay
- AGC per channel and per time slot
- Squelch per channel and per time slot
- Integrated Spectrum Analyzer

This Signal Booster is capable of handling 30 filters in uplink PS700, 30 filters in downlink PS700, 32 filters in uplink PS800 and 32 filters in downlink PS800, making a total count of 124 filters. The center frequency and BW of each one of the filters can be tuned via a software interface.

This Digital Signal Booster is intended to be used in P25Ph1, P25Ph2, TETRA, DMR, Mototrbo and Conventional radio systems.

This Digital Signal Booster has a heavy duty IP67/NEMA4X cabinet for outdoor usage, it is designed to be wall or pole mounted.

For more details refer to the product datasheet.

Mechanical specifications

Product Parts

FCR012 “2 Port” Duplexed Configuration

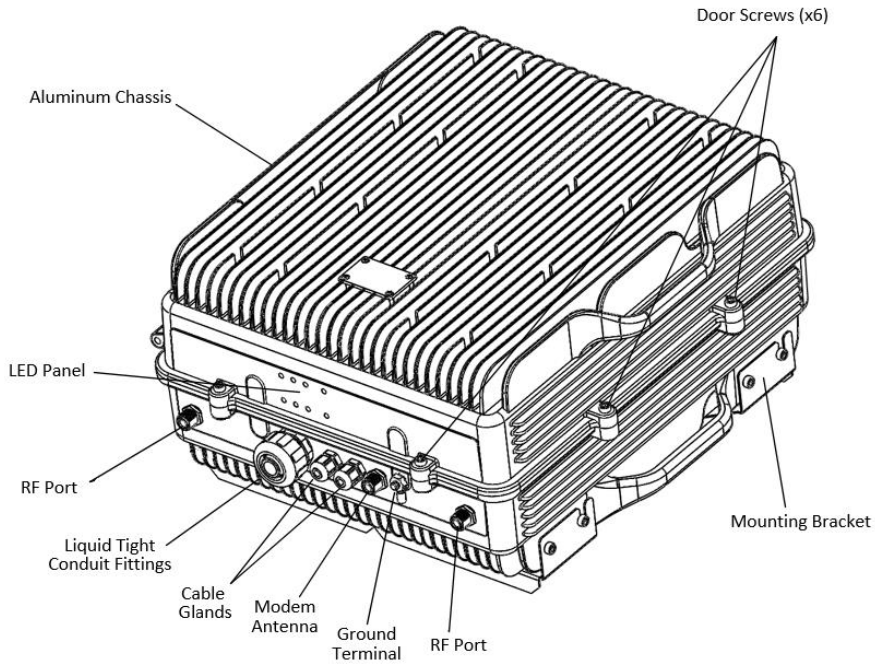

Figure: *FCR012 “2 Port” Duplexed Configuration*

FCR012 “4 Port” Non-Duplexed Configuration

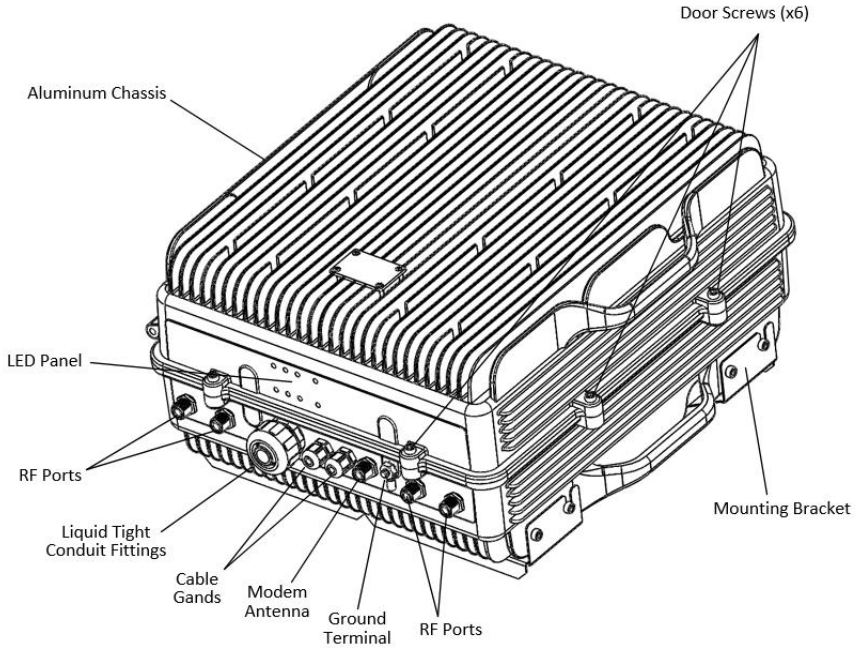

Figure: *FCR012 “4 Port” Non-Duplexed Configuration*

FCR021 Configuration

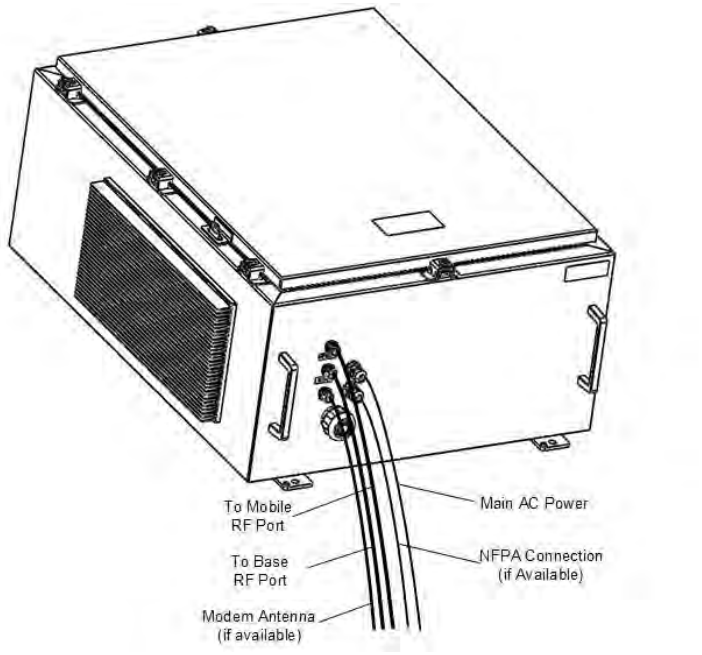

Figure: *FCR021 Configuration*

Product Dimensions

FCR012 Dimensions

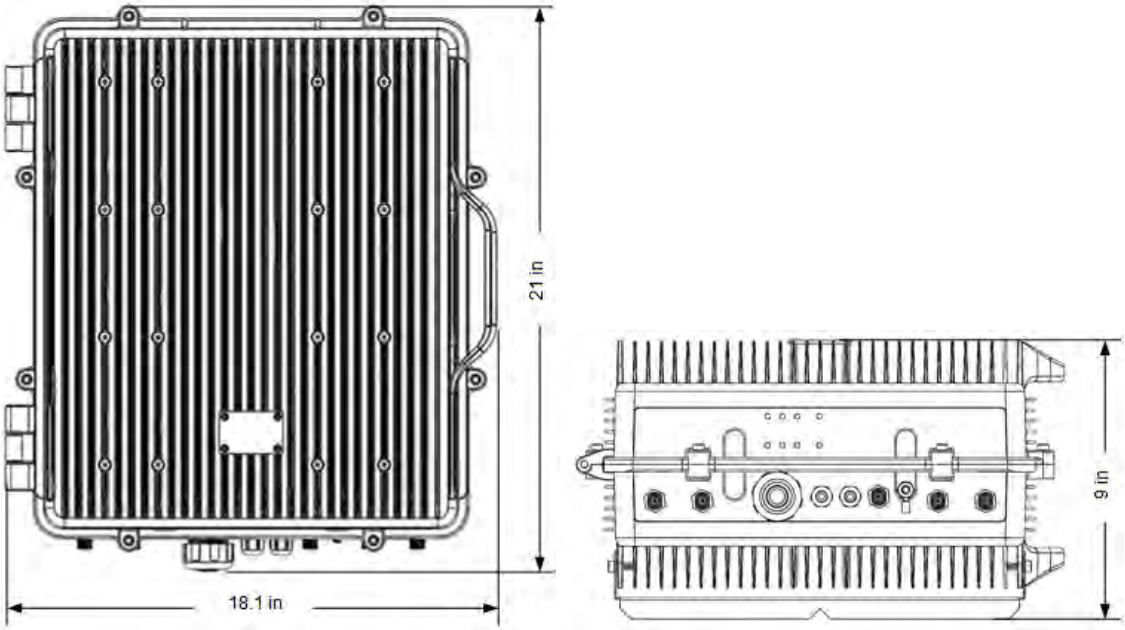

Figure: *FCR012 dimensions*

FCR021 Dimensions

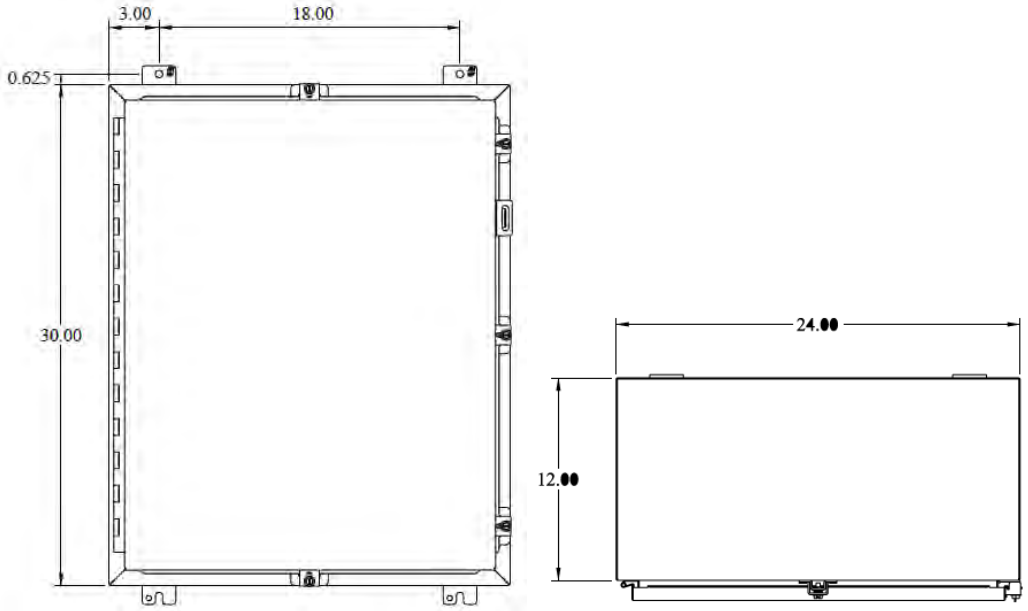

Figure: *FCR021 dimensions*

Installation

Fiplex Signal Boosters / Masters / Remotes are designed for outdoor usage with a weather proof outdoor NEMA4 cabinet that can be mounted without any kind of shelter from rain, snow or hail.

However, to improve reliability, it is recommended to mount the Signal Booster / Master / Remote on a site with shelter from direct exposure to sun, rain, snow and hailing.

It is not recommended to operate the Signal Booster / Master / Remote under bad weather conditions, such as:

- Intense rainfall, snowfall or hail
- Storm or high wind
- Extremely low or high temperature
- High humidity of the air

Mounting

Mounting Cabinet FCR012

A. Mount the bracket

The Signal Booster / Master / Remote can be mounted on a wall or pole. The bracket is provided with the Signal Booster / Master / Remote.

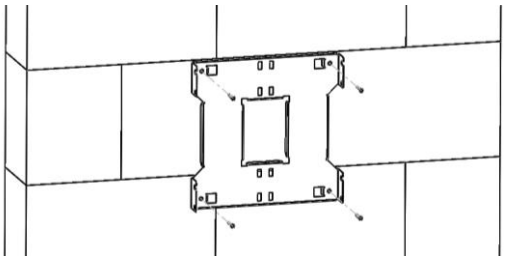

Figure: *Bracket attachment to a wall using three fixing screws*

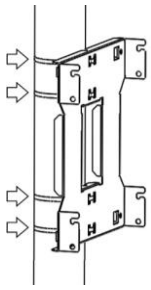

Figure: *Bracket attachment to a pipe using four inox hose clamps*

B. After attaching the bracket hang the Signal Booster / Master / Remote.

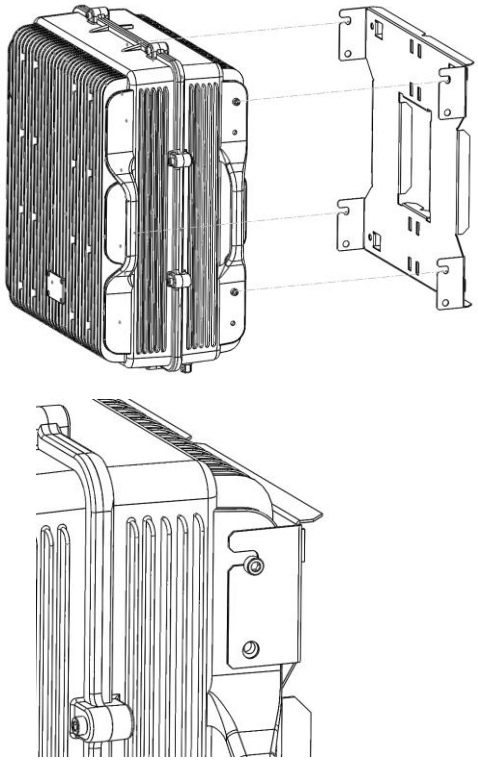

Figure: *Hang the Signal Booster / Master / Remote*

C. Secure the cabinet to the bracket.

To attach the Signal Booster's / Master's / Remote's cabinet to the bracket use the provided four M6 x 1/2" allen screws and follow the indicated steps:

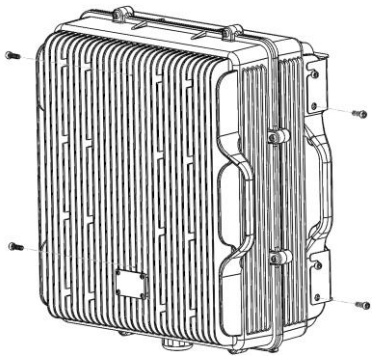

Figure: *Secure the cabinet to the bracket*

D. To open the cabinet, release the 8 door screws using the provided special allen key.

Figure: *Release Signal Booster / Master / Remote cover*

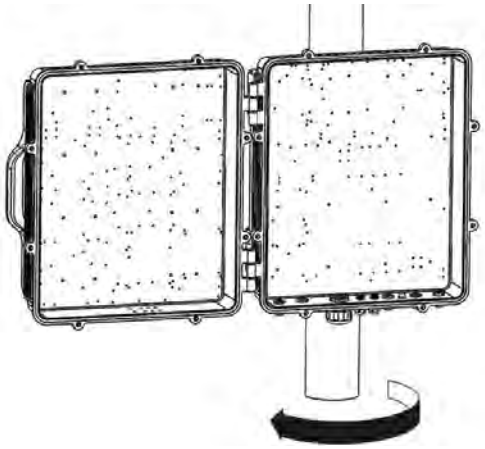

Figure: *Open the Signal Booster / Master / Remote cover*

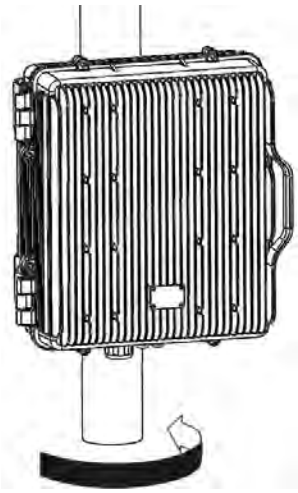

Figure: *Close the Signal Booster / Master / Remote cover*

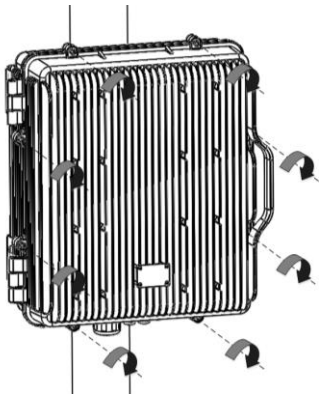

Figure: *Secure Signal Booster / Master / Remote cover*

Mounting Cabinet FCR021

A. This cabinet can be mounted on a wall.

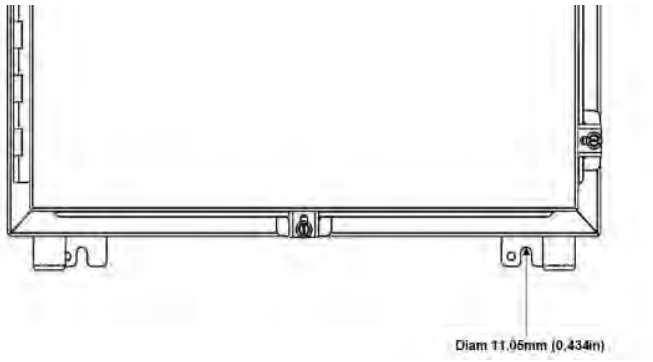

Figure: *Secure Signal Booster / Master / Remote cover*

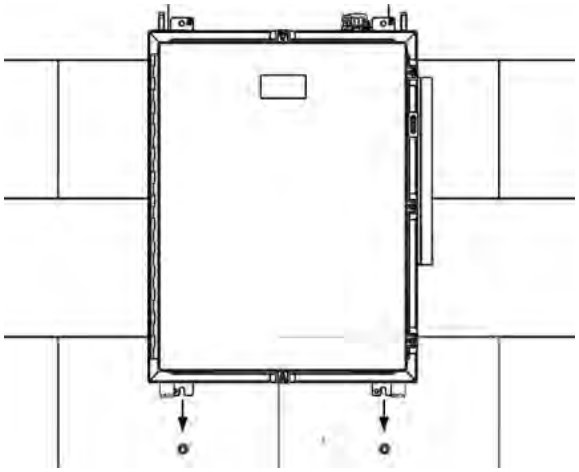

Figure: *Hang the Signal Booster / Master / Remote*

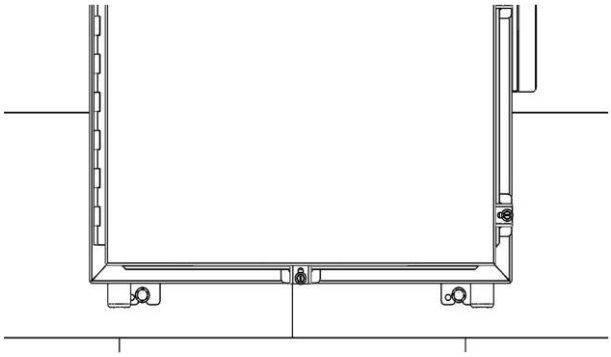

Figure: *Secure Signal Booster / Master / Remote cover*

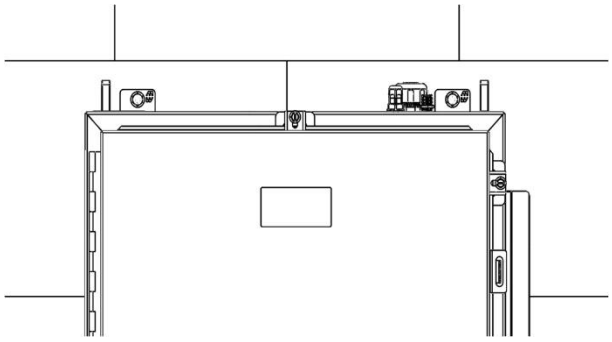

Figure: *Secure Signal Booster / Master / Remote cover*

B. To open the cabinet, release the door screws using a flat screw driver.

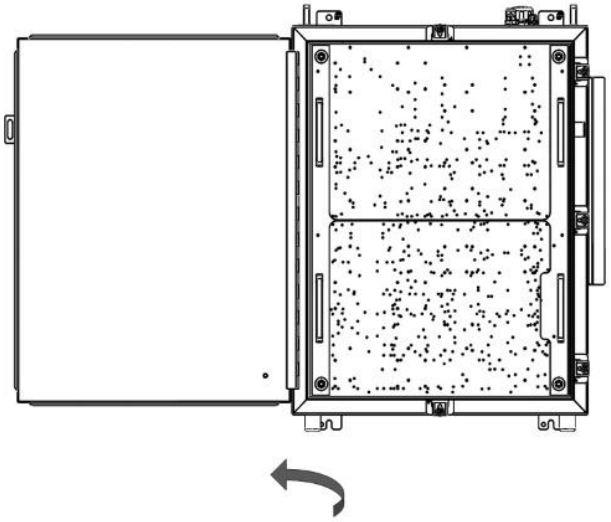

Figure: *Open the Signal Booster / Master / Remote cover*

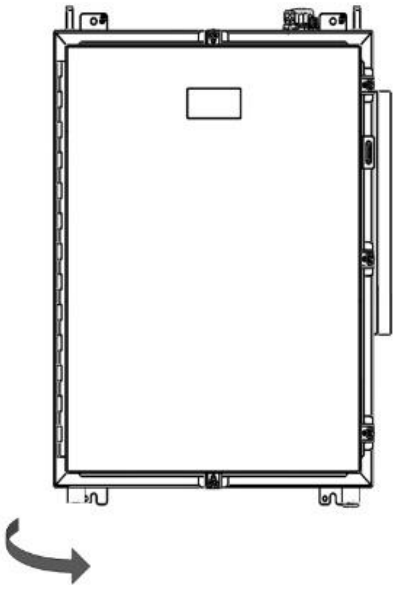

Figure: *Close the Signal Booster / Master / Remote cover*

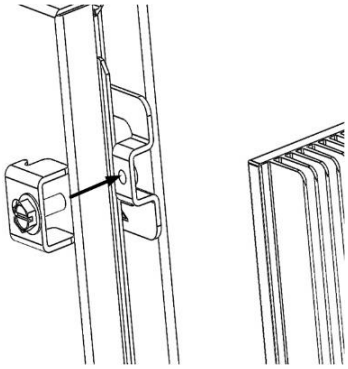

Figure: *Secure Signal Booster / Master / Remote cover*

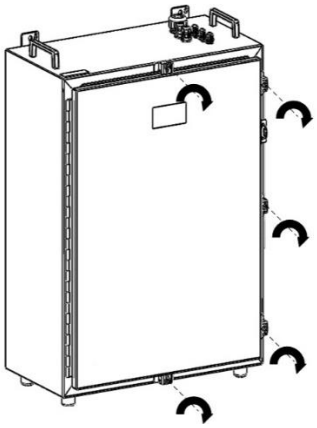

Figure: *Secure Signal Booster / Master / Remote cover*

Use of Liquid Tight Conduit

Mounting Cabinet FCR012

The unit has available a Liquid Tight Conduit Fitting connector for ¾" tubes. The unit as standard has the connector installed, so if the user requires to use this connector, if available, the NFPA cables, Ethernet, DC or AC cables can be routed through this connector.

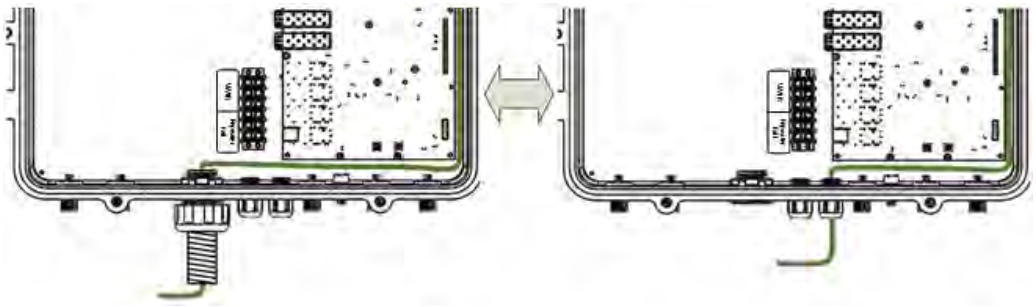

Figure: *AC Routing through cable gland or conduit connector*

If the is not going to use Liquid Tight Conduits, then the connector should be replaced by the provided sealing cup.

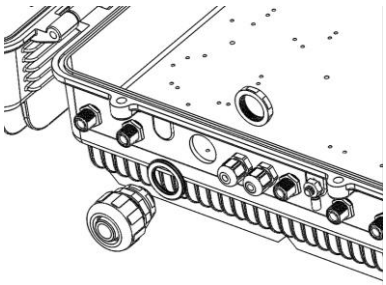

Figure: *Remove the conduit connector*

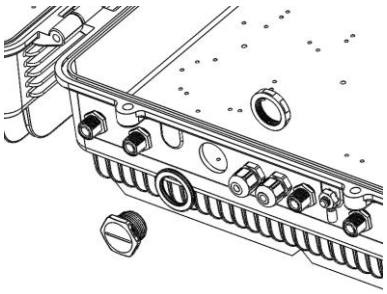

Figure: *Install the sealing cup*

Replacement of Conduit connector to sealing cup

NEMA4 considerations

This device is equipped with a NEMA4 enclosure, however, to ensure the NEMA rating, the user must have the following considerations:

1. Correct use of the Liquid Tight Conduit. In case this interface is not used, it should be replaced with the sealing cup.

2. Sealing cups should be installed in the non-used cable glands.

3. The RF Ports should be perfectly mated.

Mounting Cabinet FCR021

The unit has available a Liquid Tight Conduit Fitting connector for ¾" tubes. The unit as standard has the connector installed, so if the user requires to use this connector, if available, the NFPA cables, Ethernet, DC or AC cables can be routed through this connector.

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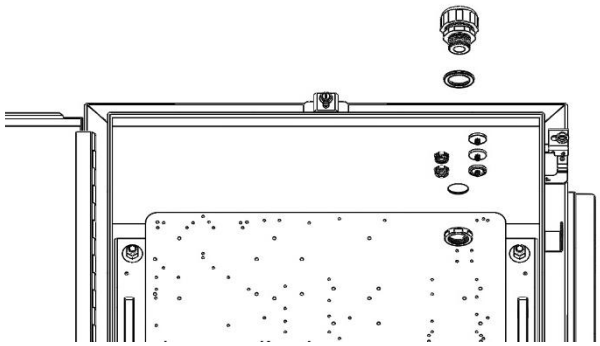


Figure: *Remove the conduit connector*

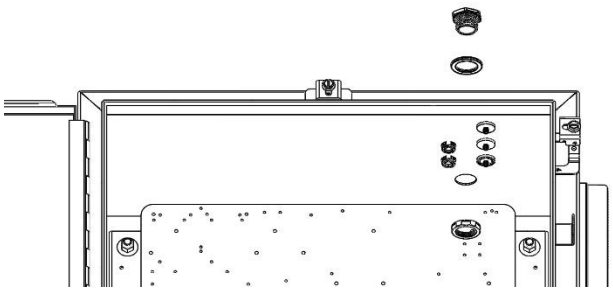


Figure: *Install the sealing cup*

Replacement of Conduit connector to sealing cup

NEMA4 considerations

This device is equipped with a NEMA4 enclosure, however, to ensure the NEMA rating, the user must have the following considerations:

1. Correct use of the Liquid Tight Conduit. In case this interface is not used, it should be replaced with the sealing cup.

2. Sealing cups should be installed in the non-used cable glands.

3. The RF Ports should be perfectly mated.

Mounting clearance

When mounting the cabinet, the clearances around it should be considered to allow a clear open door and heat dissipation.

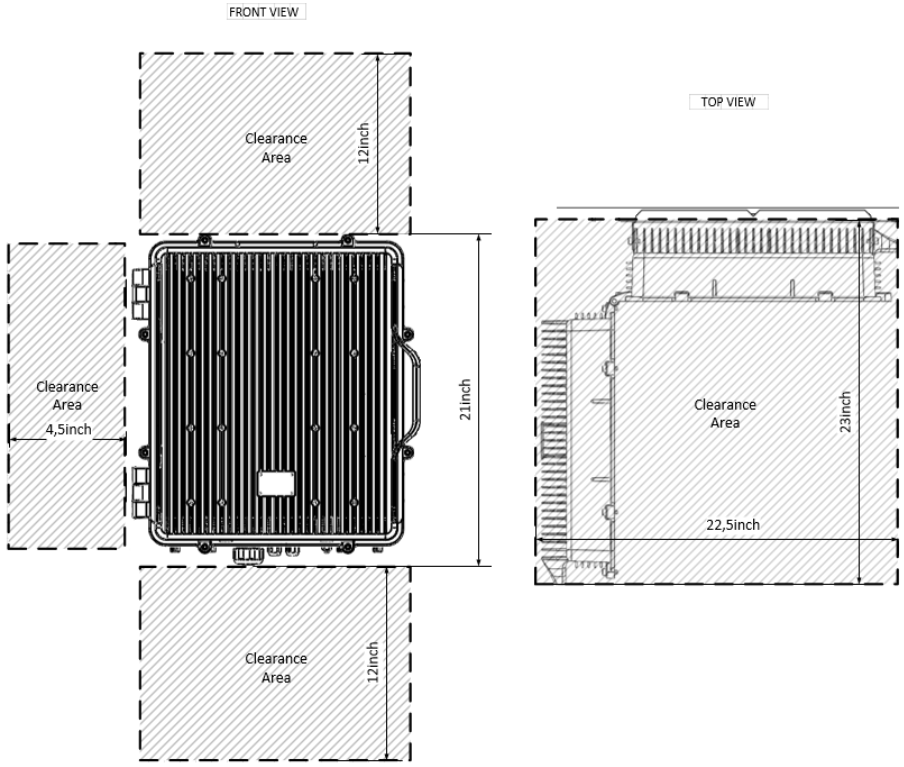


Figure: *Mounting clearance FCR012*

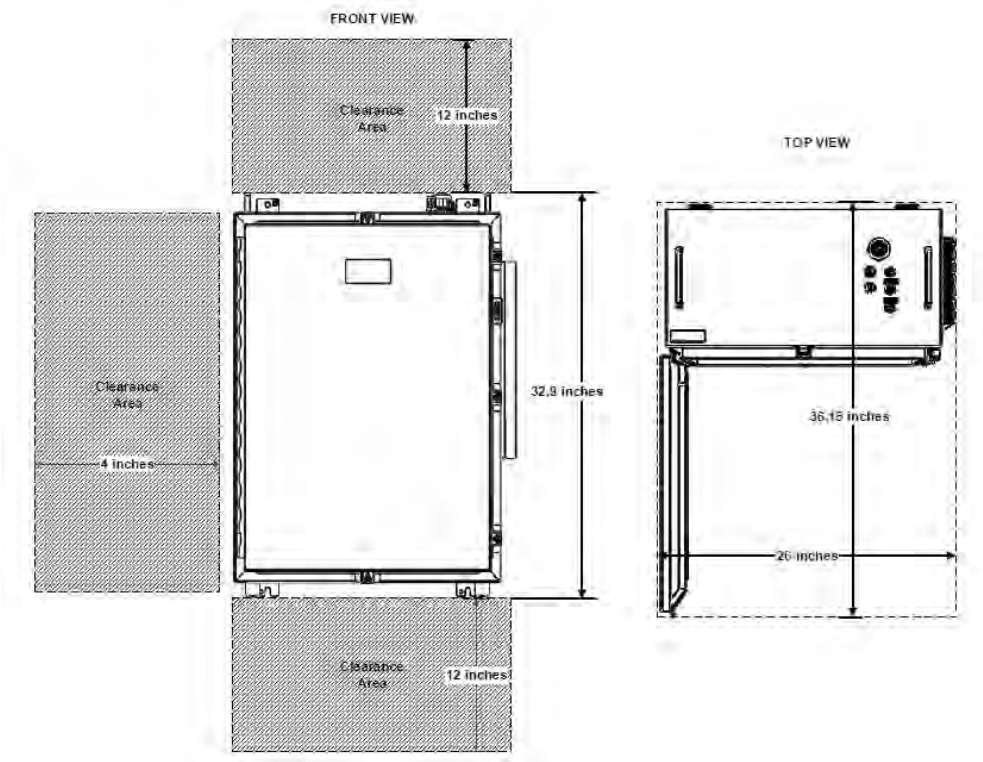


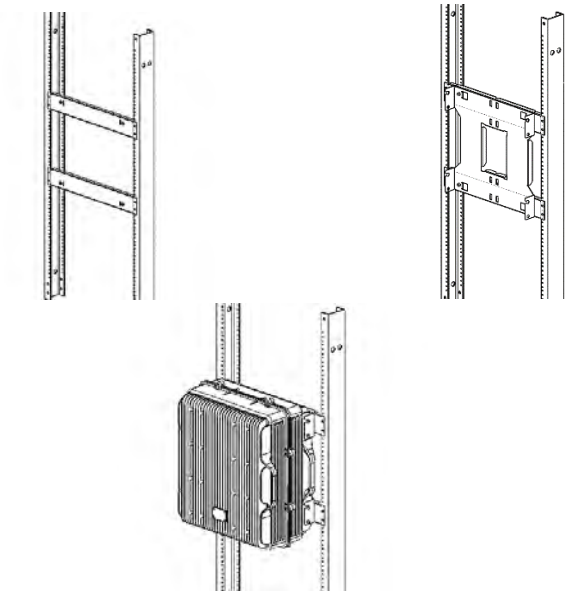
Figure: *Mounting clearance FCR021*

Rack mount option

Even though this cabinet is designed mainly to be wall or pole mounted, it has the option to be installed in a 19” standard rack using the Rack Mount Option.

The Rack Mount Option are adaptors that allow the installation of the cabinet bracket to the 19” rack.

It is recommended to use 2 post racks, this way, using back-to-back installation, 4 cabinets can be installed in a single 2 post RU rack.



Mount the 19” rack adaptors.

Mount the cabinet bracket to the adaptors.

Mount and Fix the Signal Booster / Master / Remote to the bracket.

Figure: *Installation steps for the rack mount option FCR012*

Mounting clearance on rack mount option

When mounting the cabinet in a 19” rack, the clearances around it should be considered to allow a clear open door and heat dissipation.

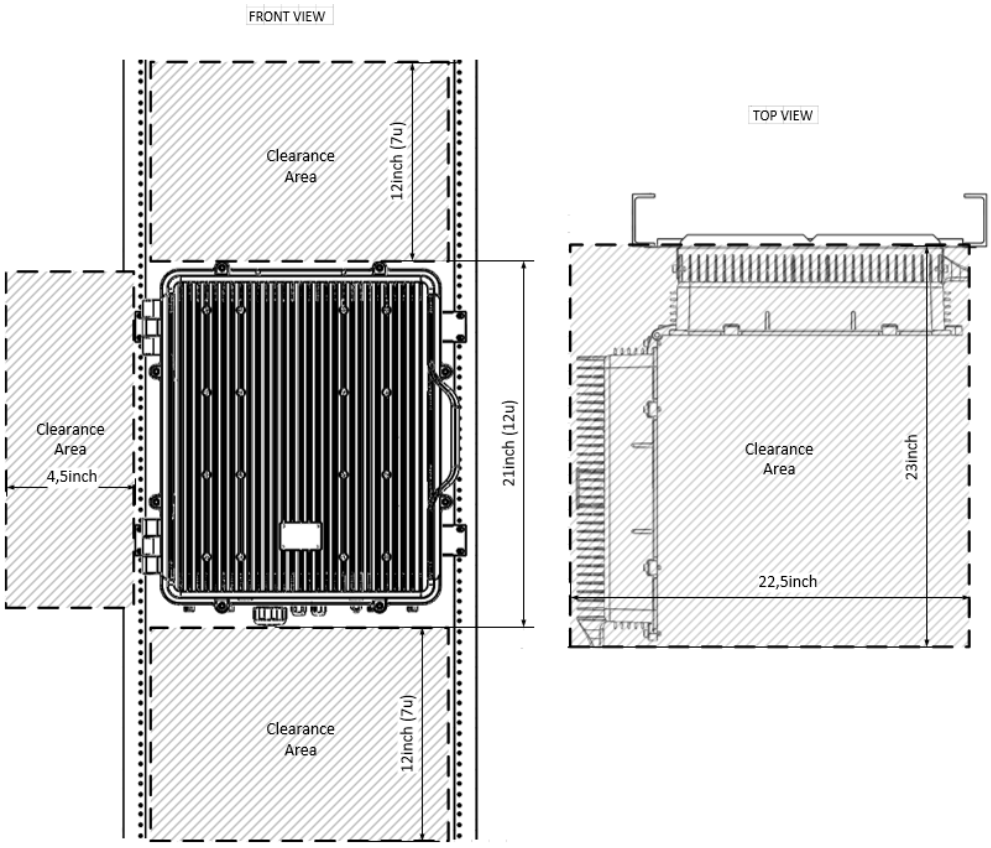


Figure: *Mounting clearance for the rack mount option FCR012*

Commissioning

Commissioning FCR012

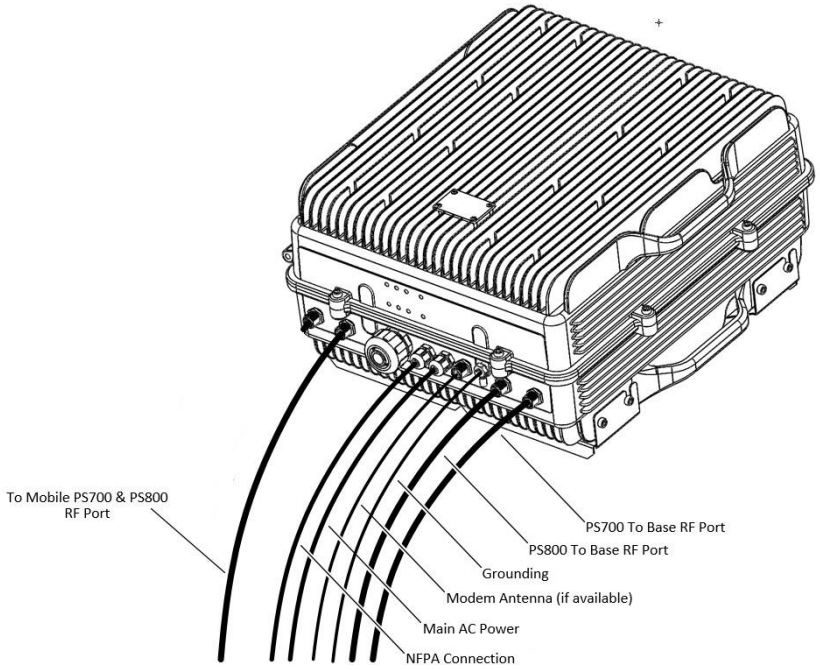


Figure: *RF ports and Power Cable Glands location*

Connection step by step

Connection FCR012

A. RF Ports: Connect the service antennas to the To Mobile Port and each PS700 and PS800 donor antennas to the To Base RF Ports. N type female connectors are used in this Signal Booster.

B. Once the RF ports of the Signal Booster are properly loaded connect the Main AC power. If using the AC model, electrical installation must provide differential and thermo-magnetic breaker elements according to electric safety international regulations.

C. Make sure that not used cable glands are properly sealed. For this, use the seal plug and self-amalgamating tape.

D. Auxiliary DC connection can be provided to the device from an external DC source. There is a dedicated port for this purpose, and a dedicated DC connector labelled “VDC IN” located inside the cabinet. Please check appropriate DC voltage at Signal Booster specification sheet.

E. NFPA Dry Contacts: there is a dedicated cable gland for this purpose. A multi-conductor cable can be used to connect the NFPA dry contacts to the Fire Department Control Box.

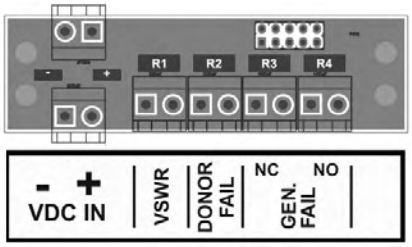


Figure: *NFPA Dry Contact connection location inside the cabinet*

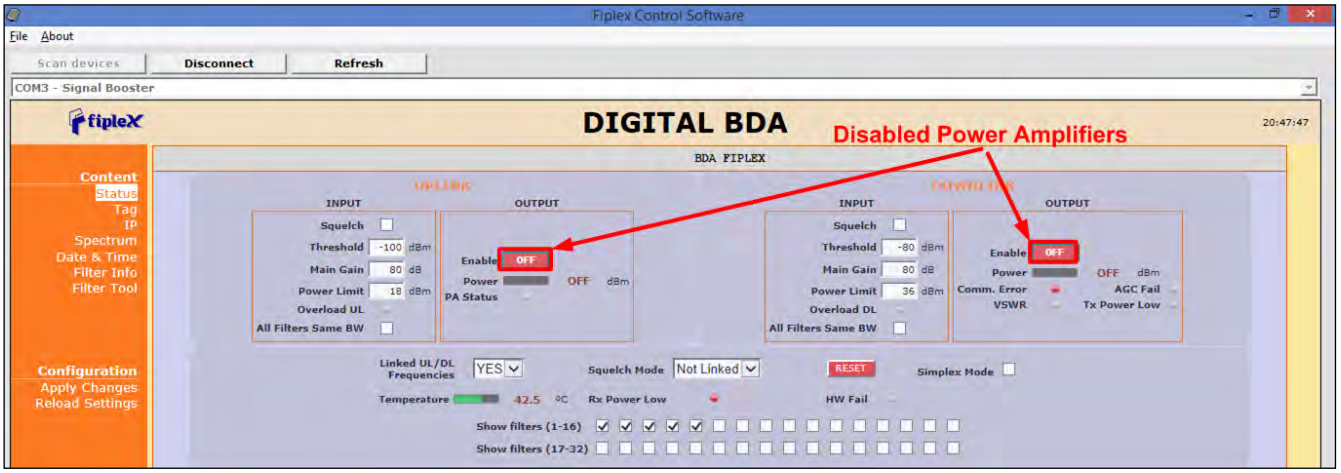
F. Once the Signal Booster is connected to the power source, it takes about 40 seconds to run a booting routine. After that time, the Signal Booster is ready to be connected via USB cable to a computer running Fiplex Control Software (FCS) to be properly configured. The Signal Booster has two USB Ports, one for PS800 and one for PS700.

Starting Operation

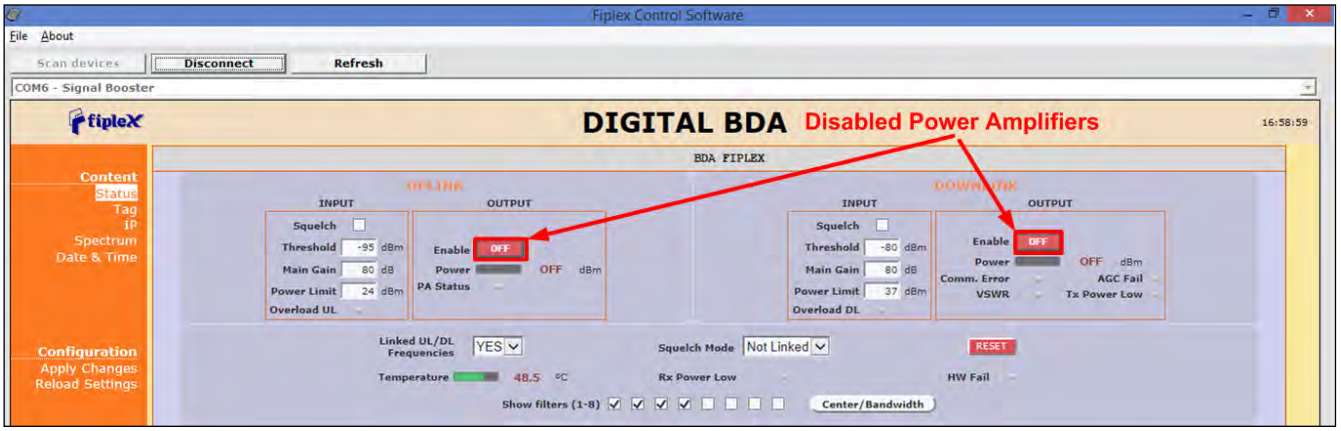
BE SURE THAT “TO MOBILE” AND “TO BASE” PORTS ARE PROPERLY LOADED EITHER WITH 50 OHMS DUMMY LOADS, OR RADIATING SYSTEM.

The Digital Signal Booster may come in one out of two versions: a 32 narrow-band filters version or an up-to-8 adjustable-bandwidth filters version. It is even possible to have both versions in one device so that the user can choose either of them. Depending on which version is actually running, the main screen of the Fiplex Control Software will have a slightly different look.

1. Turn on the Digital Signal Booster, connect computer to Signal Booster through USB cable, and run Fiplex Control Software. It is recommend to turn off the power amplifiers.

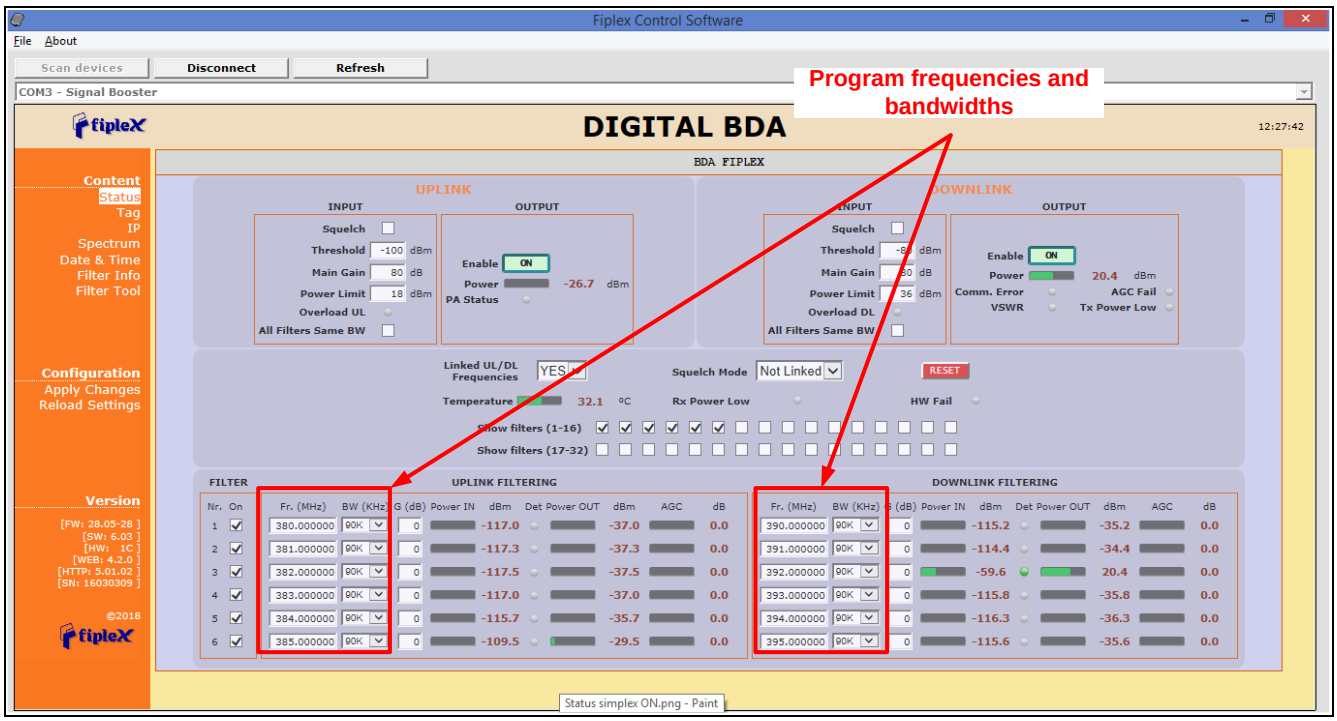


PA OFF in narrow-band version

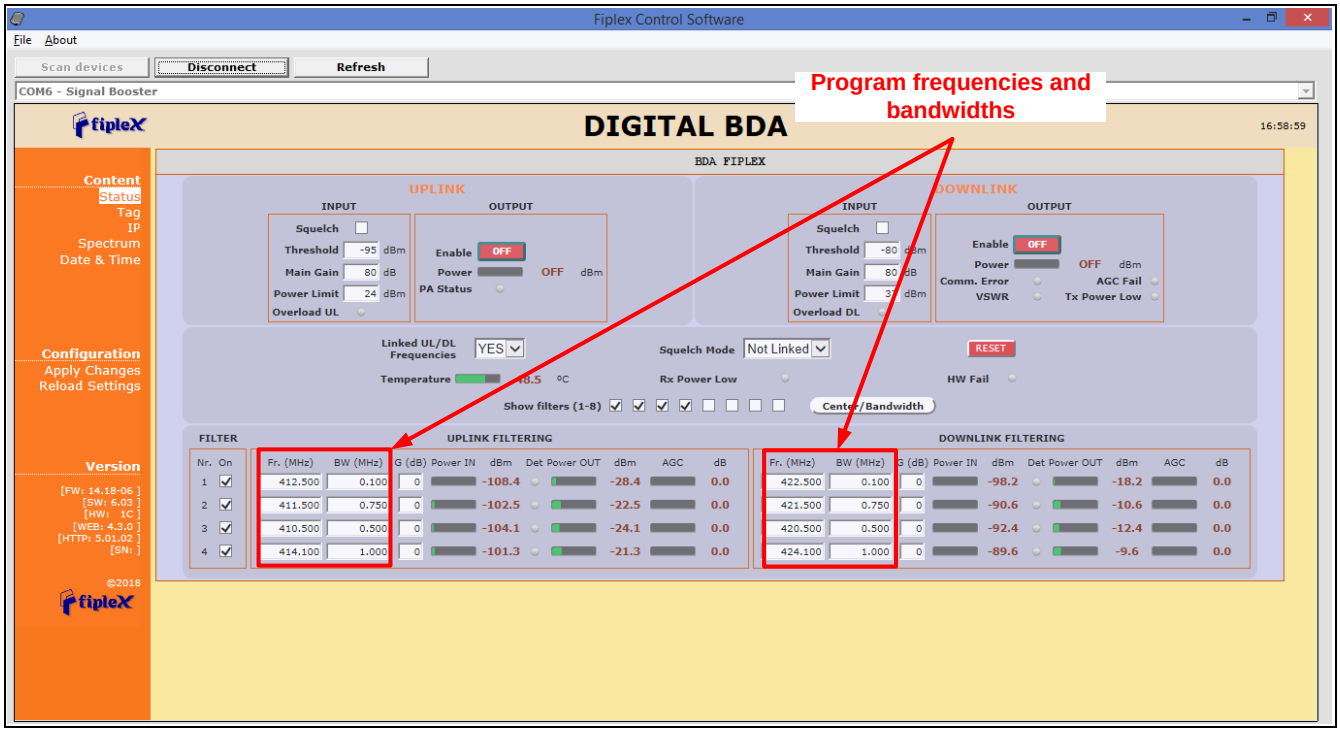


PA OFF in adjustable bandwidth version

2. Setup desired channel frequencies. Since Fiplex Signal Booster is channel selective, user has to know what frequencies are used in base station.

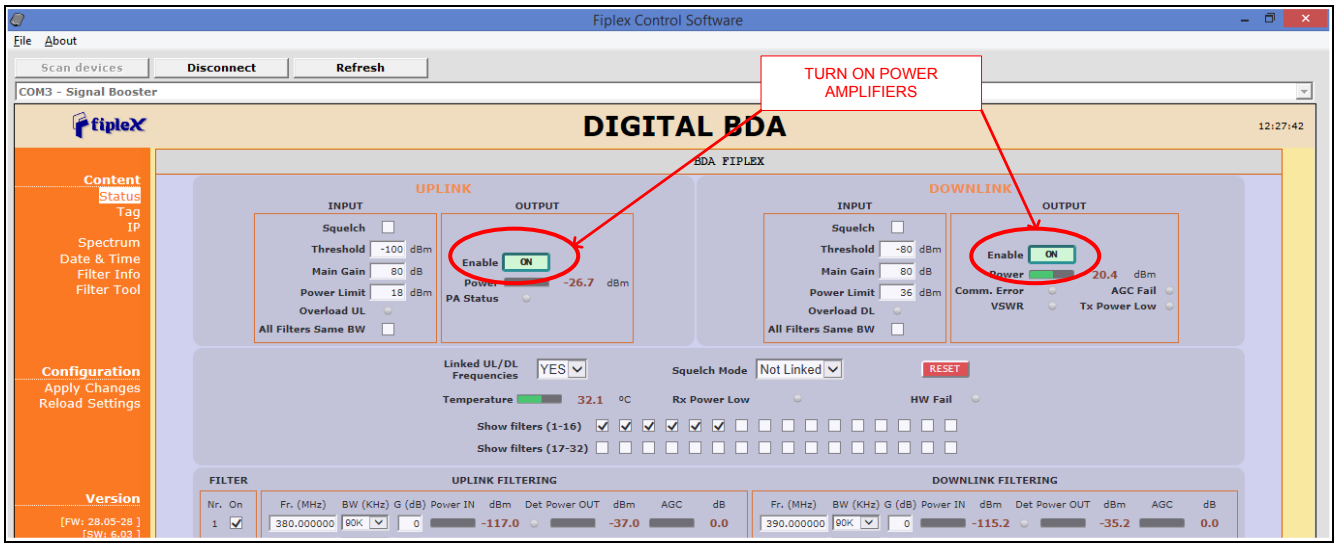


Narrow-band filter frequency settings

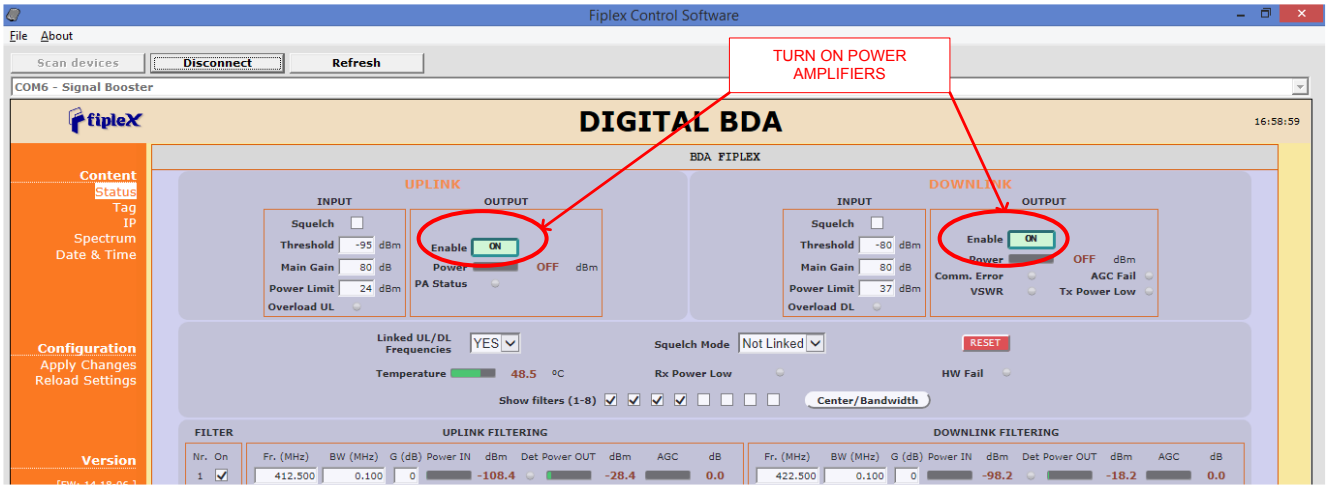


Frequency and Bandwidth settings

3. Turn on UL and DL power amplifiers, and check that any alarm indicator is active.



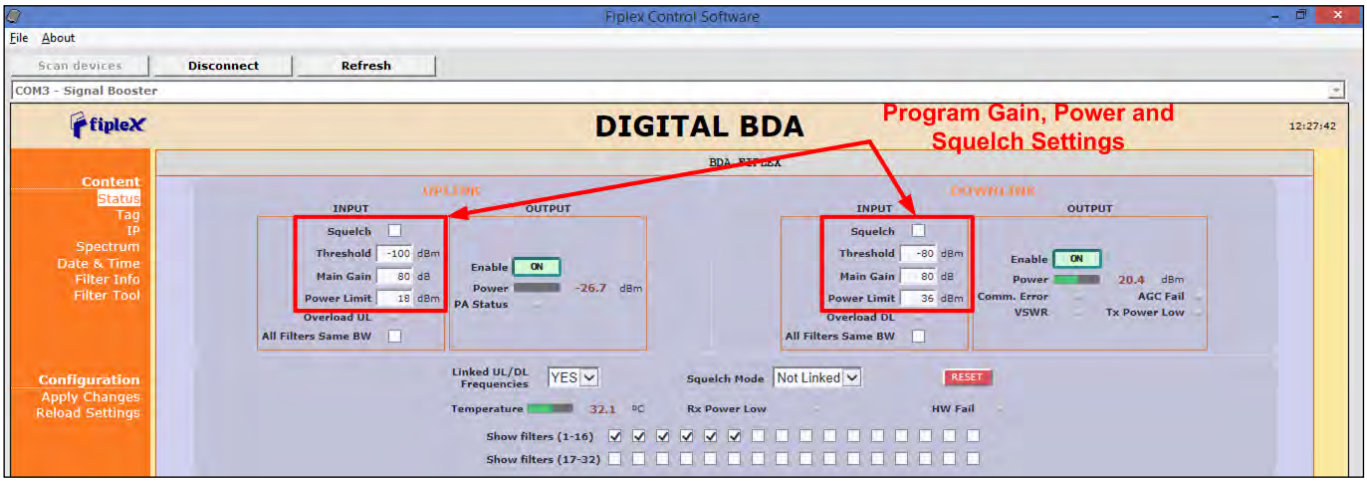
PA ON in narrow band version



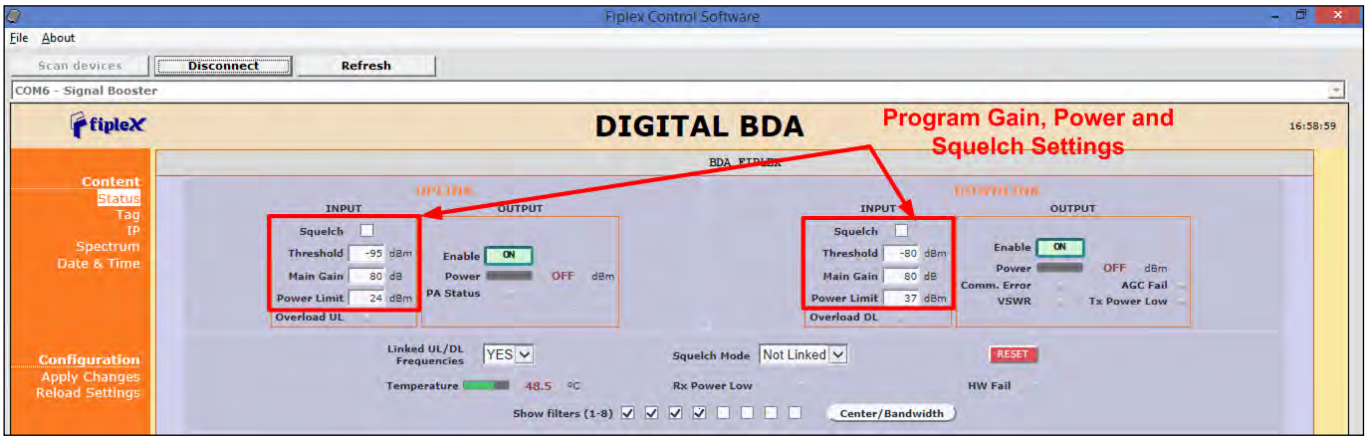
PA ON in adjustable bandwidth version

4. Setup desired operating gain using FCS. UL and DL chain are independent, so both values must be set. To set DL band gain is recommended that AGC works around 3dB in each channel, in this way, maximum output power is achieved.

5. Set up squelch settings. Controls are independent in UL and DL bands. Typical values for UL are -110dBm for squelch threshold. For DL, recommended value for squelch threshold is minimum level received in any active channel minus 10dB.

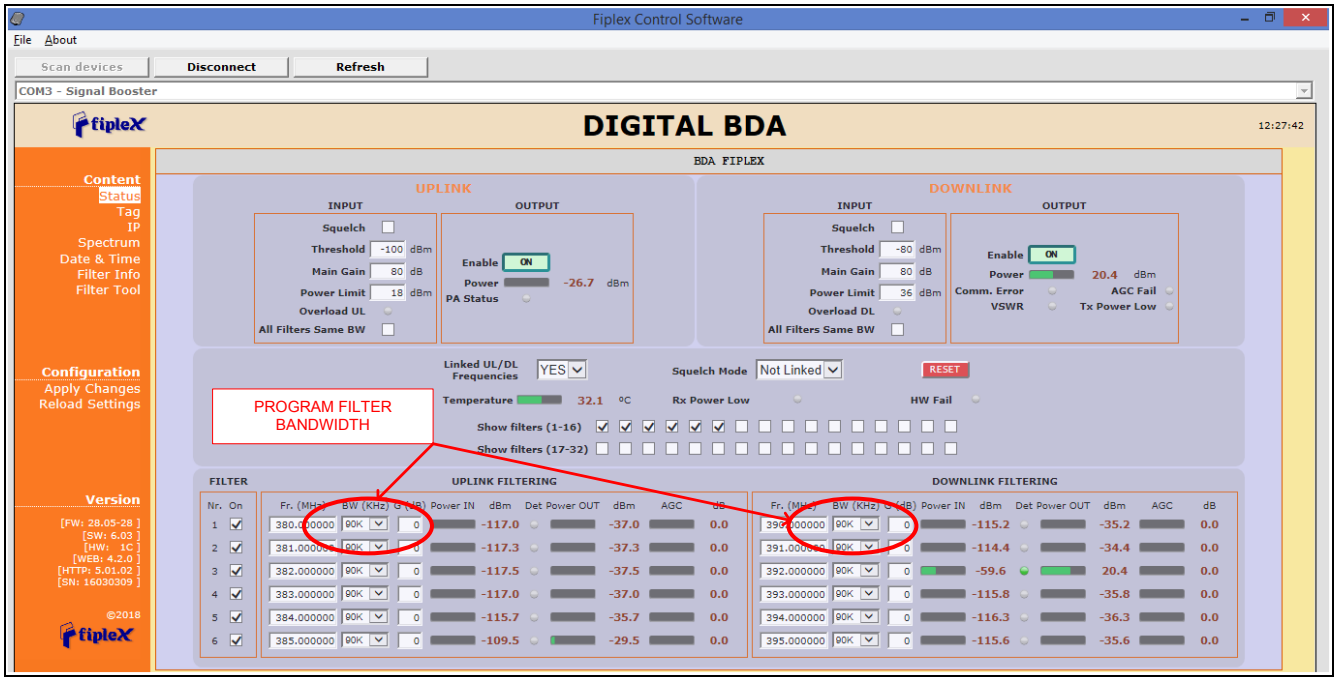


Squelch, gain and power settings: narrow band



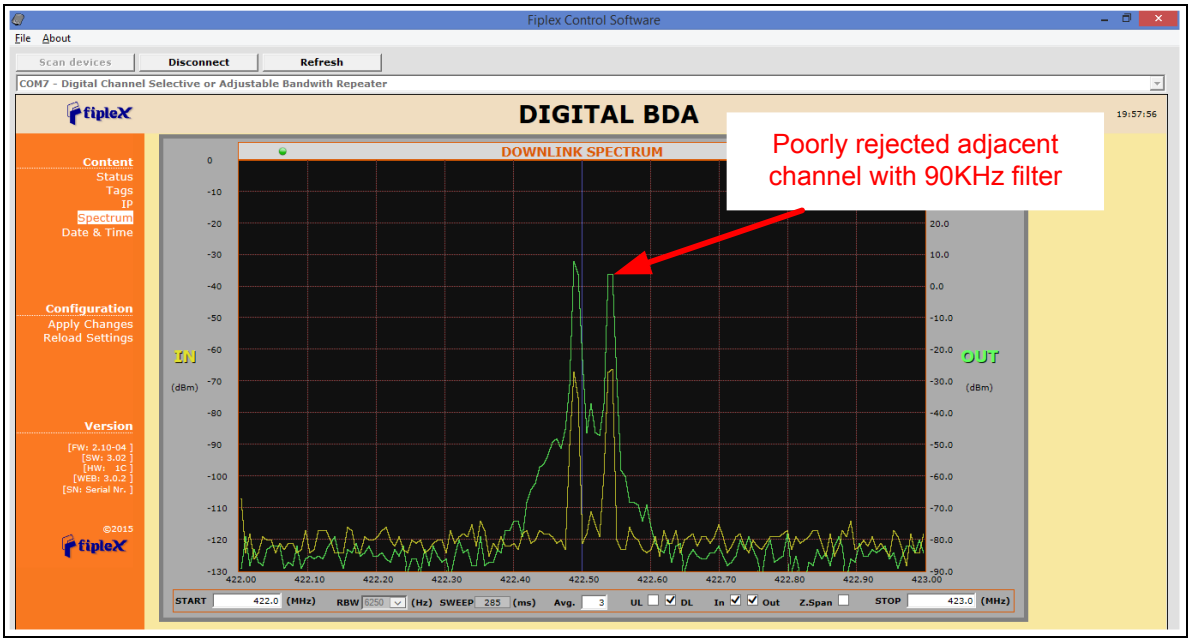
Squelch, gain and power settings: adjustable bandwidth

6. For narrow band filters version, setup desired filter bandwidth, depending on presence of adjacent channels. In principle, recommended bandwidth filter is 90KHz due to its low delay, but if adjacent signal is detected, narrow filters can be used. Spectrum analyzer of FCS can be used to know rejection to undesired signals. It is recommend that adjacent channels output power be, at least, 10dBc lower than useful carrier.

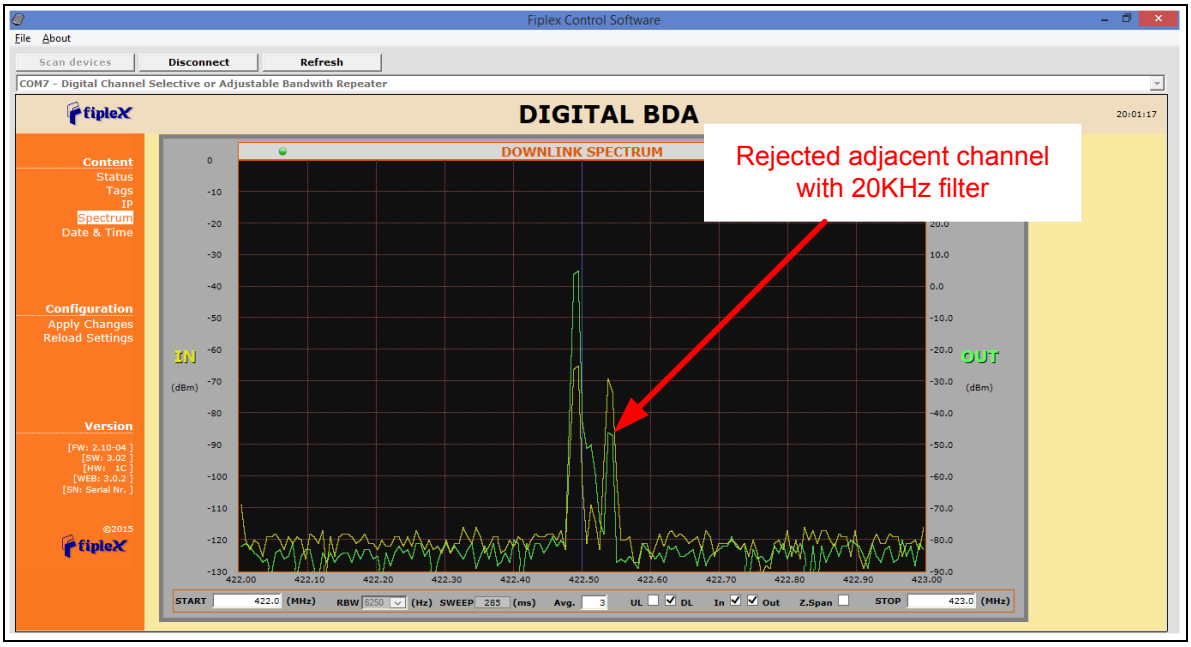


Filter bandwidth selection for narrow band filters version

Next figures, shows how integrated spectrum analyzer can help to select bandwidth filters:



Adjacent channel rejection with 90KHz filter



Adjacent channel rejection with 20KHz filter

Status Indicators

There is an indicator panel located at bottom of the Signal Boosters. This LED panel works as a status monitor, in order indicate warning or alarms of Signal Booster.

The LED panel has four LEDs, the first one the power ON indication led, labelled “PWR”.

The Second LED, labelled “STS” summarizes warnings regarding critical operational conditions of the Signal Booster.

The third and fourth LED summarizes operational conditions for uplink “UL” and downlink “DL” chains.

In general, the LEDs have four states: “off”, “slow blinking”, “fast blinking” and “on”. Next table describes alarm and warning conditions for each led state.

Indicator Panel	*LED indication description*
	Signal Booster is not powered or fail in power supply
	Normal state: Signal Booster is powered on

	Low output power detected at the "To Mobile" RF port (DL)
	Normal State.
	General fail: there is an alarm, whatever the root cause is.
	Normal state: input signal detected in at least one active filter, at "To Base" RF port from base station (DL)
	Base Station Warning: no signal is detected coming from base station
	Normal state: no mismatch detected in "To Mobile" RF output (DL)
	VSWR alarm: high reflected power detected at "To Mobile" RF output DL)
Where:	
	Led OFF
	Led slow blinking with period of 2 seconds approx. WARNING
	Led ON

Table: *LED Indication Description*

Laboratory Measurement

For specific parameters verification and laboratory tests, please contact factory.

Detailed procedures, recommended tests set up, and a knowledge engineering team will bring adequate support to perform this measurements in a comfortable and safely way.

Software

Introduction

Fiplex Signal Booster can be fully configured and monitored in local and remote mode.

- Local mode:
  - USB port with Windows desktop application
- Remote mode:
  - Remote Web server

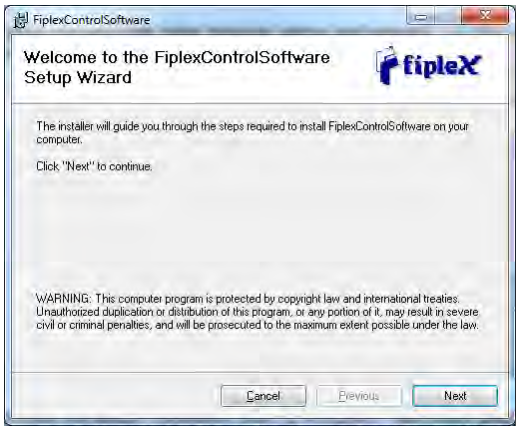
In following section, each control mode (configuration / monitoring) is described.

Local Software. Desktop application through USB port

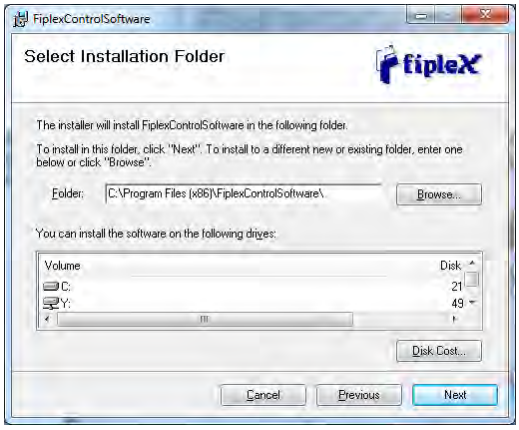
Installation

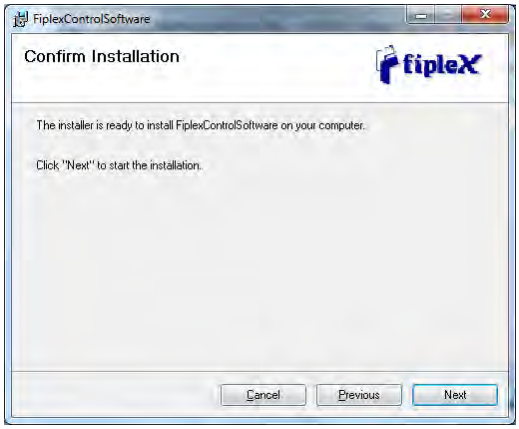
The following section will describe the steps to be followed in order to install and use the Fiplex Control software with your Fiplex Signal Booster.

1. Before connect USB cable between computer and Signal Booster, run the FiplexControlSoftware.msi File. Next screen will appear…

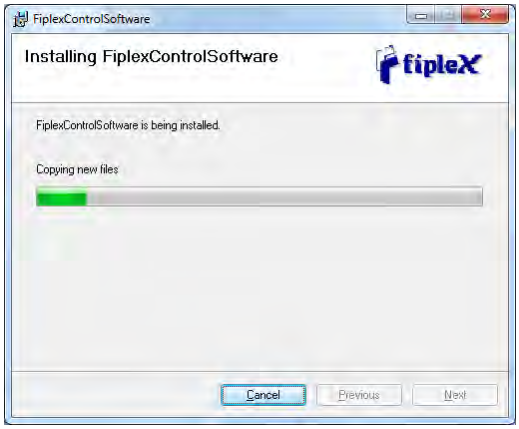


2. Choose the default installation path “C:\Program Files (x86)\FiplexControlSoftware”. Note that this can change according to your system configuration (32bits or 64bits), language and Windows Version.

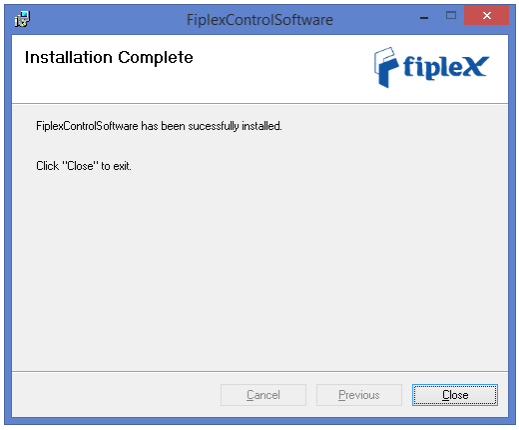


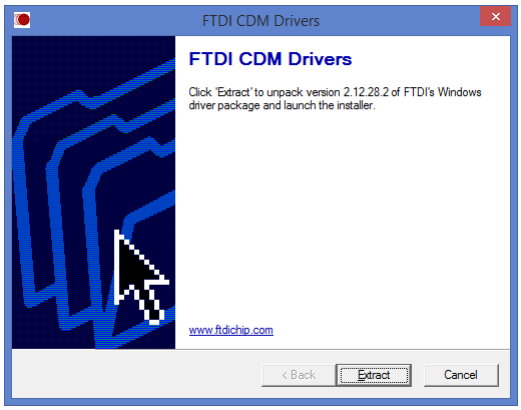


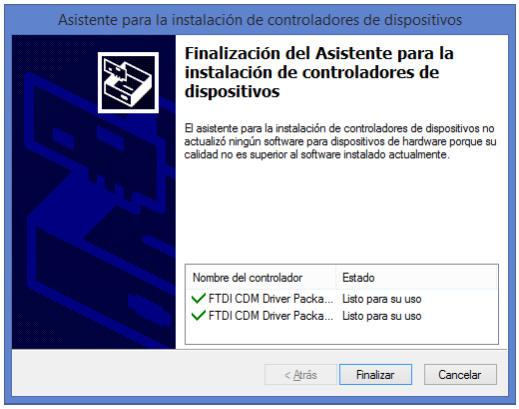
3. The installer will start to copy the necessary files.



4. After installation has completed, a shortcut in user desktop will appear, and new installer windows appears in order to install USB drivers. Follow the installer step-by-step process







5. Connect USB cable between computer and Signal Booster, keeping the Signal Booster powered off. New USB device will be detected

6. Turn on the Signal Booster

BE SURE THAT "TO MOBILE" AND "TO BASE" PORTS ARE PROPERLY LOADED EITHER WITH 50 OHMS DUMMY LOADS, OR RADIATING SYSTEM.

7. Execute the Fiplex Control Software. Next window will appear:

User interface controls:

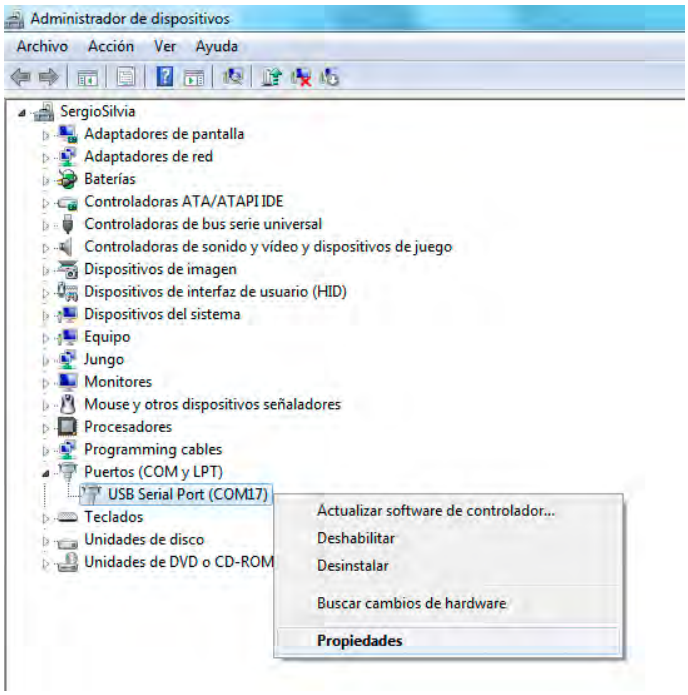
- Scan Devices Button: refresh the available COM ports and identify Fiplex devices
- Connection Button: connect / disconnect software from Signal Booster
- List of available devices: below two buttons, is placed a dropdown list that shows all available COM ports. Available COM ports not related to Fiplex Signal Boosters will be shown with its number and "Unknown device" label. COM ports related to Fiplex Signal Boosters will show a device description.
- Embedded Web browser: graphical area where configuration and monitoring parameters will be shown.
- File menu: contains menus to save Signal Booster configuration to a file and load configuration from file to Signal Booster.

NOTE: if Fiplex Signal Booster is not turned on, related COM port will appear as "Unknown device"

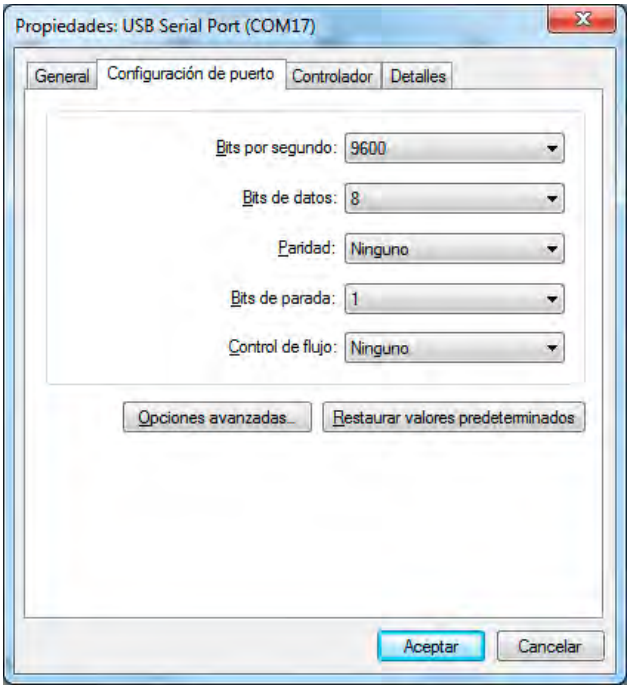
8. Click "Scan Devices"

Now, the Fiplex Digital Signal Booster is shown in the list of available devices, and connection button is enabled.

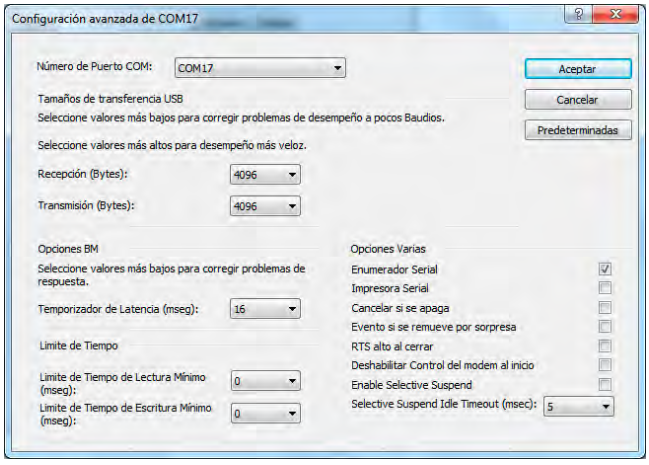
NOTE: Fiplex Signal Booster could not appear in list, if COM port number is higher than COM16, depending on Windows version. COM port number can be forced to arbitrary number (below COM16) through Device Administrator. In order to change COM number, click “Properties” pop-up menu:



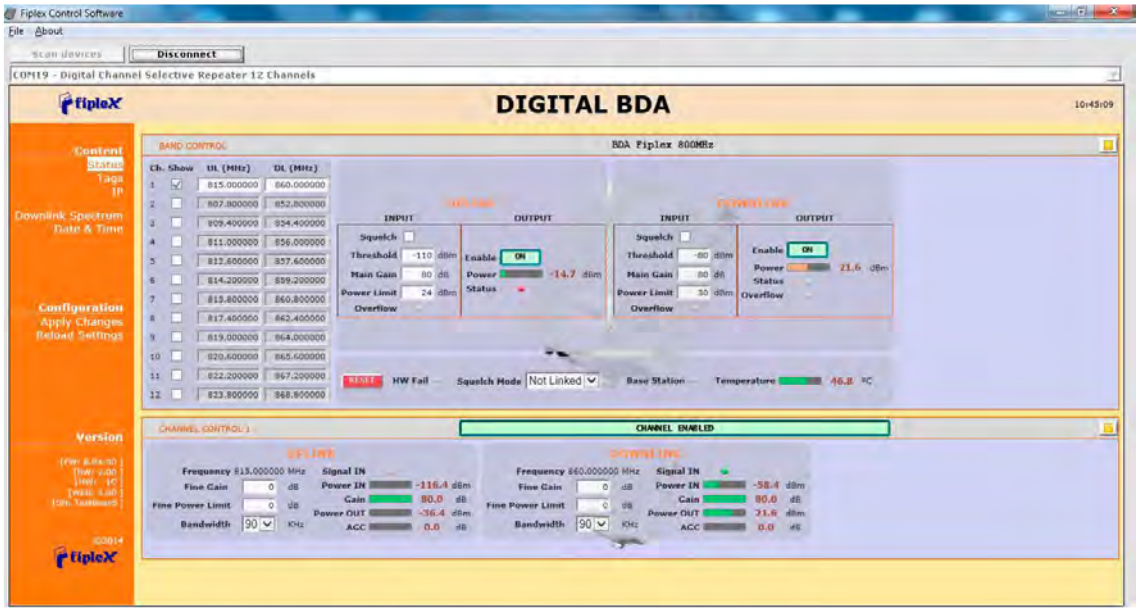
Click “Advanced Options”



Change COM port number

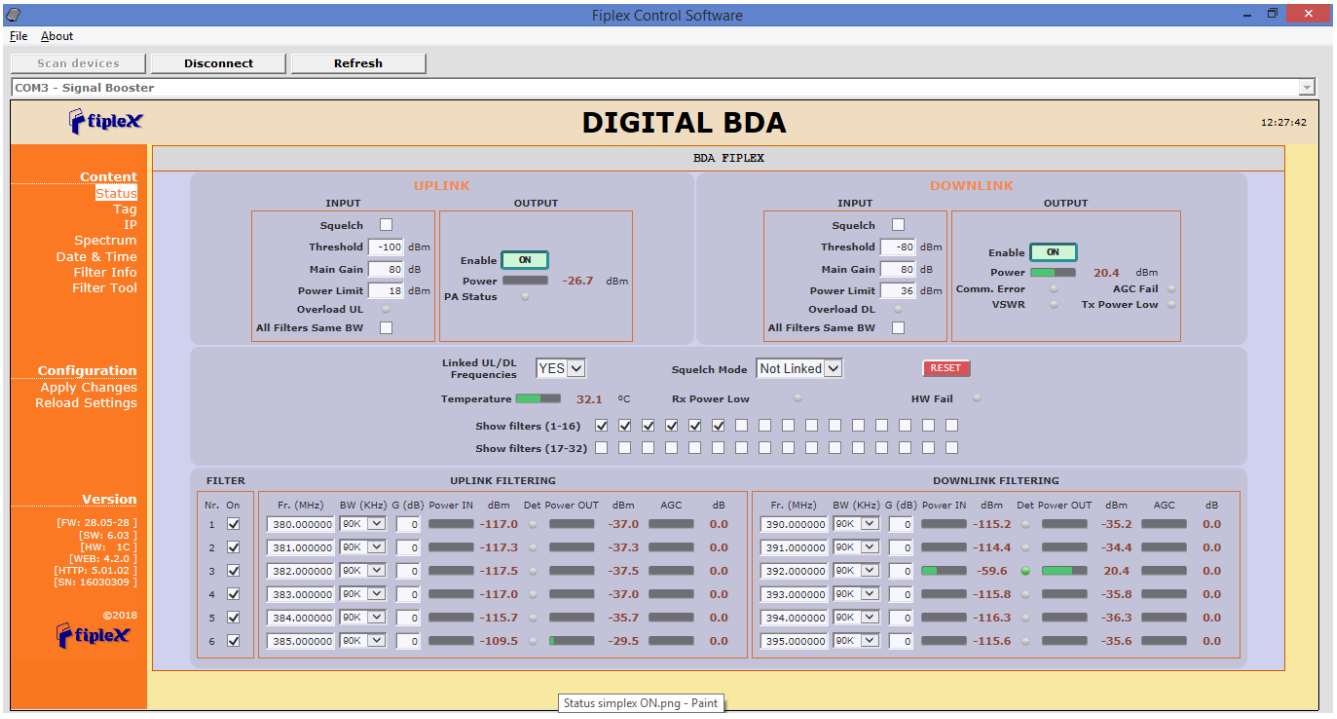


9. Click “Connect”. Fiplex Control Software window will be automatically maximized, and web browser will show the configuration screen. Application screens are described in the next section due to these application screens and web pages (in webserver remote mode) are the same.

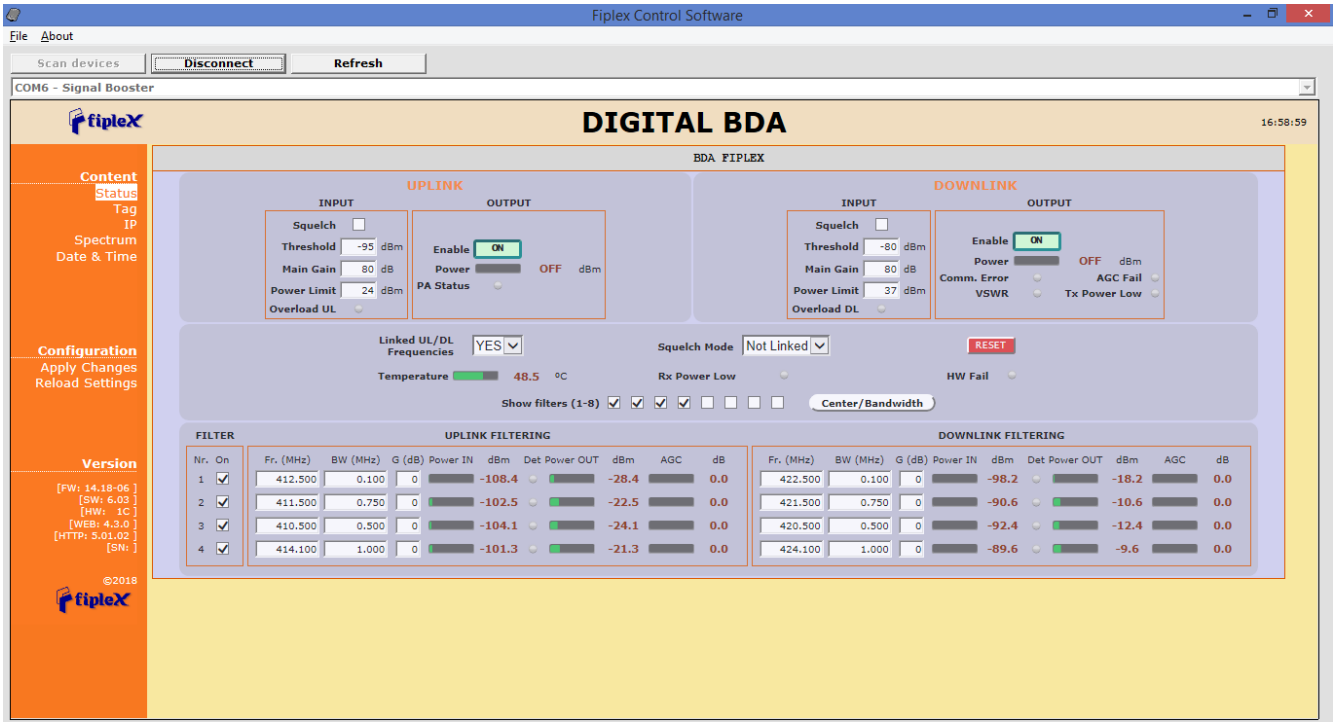


10. Once Signal Booster is configured, user can disconnect software using connection button, now labelled “Disconnect”. Initial window will be shown.

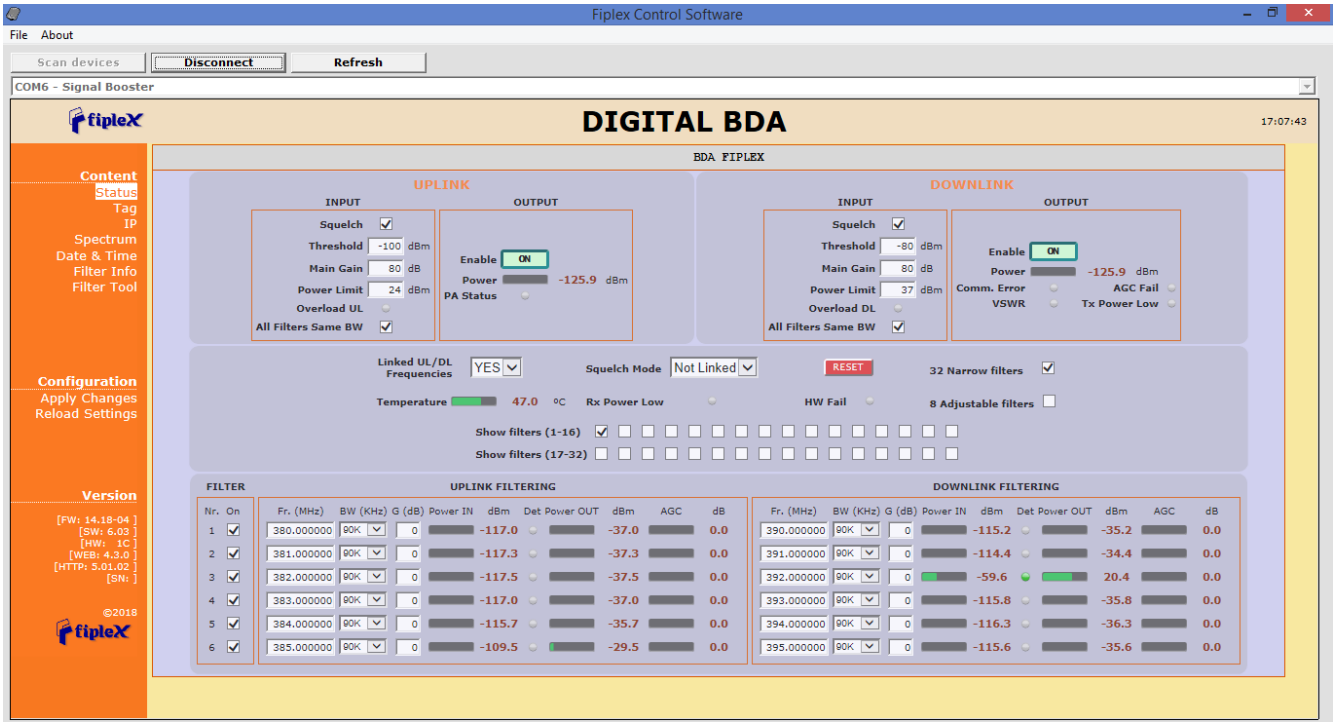
If Signal Booster is disconnected or turned off, while Fiplex Control Software is connected to device, software will go back to initial window. Moreover, if some communication problem occurs while device is monitored, the software will go back to initial state as well.



Initial window for narrow-band filters version



Initial window for adjustable bandwidth filters version



Initial window for dual firmware version

Remote Web Server option

IP Connection

Fiplex Signal Boosters use an Ethernet module and 3G Router to give TCP/IP connectivity (webserver and SNMP Agent). In local mode, user can connect directly a computer to the Ethernet module using the inside Ethernet cable.

In order to access to web browser, default IP addresses of Ethernet module are detailed in the next table:

IP Address	192.168.1.10	IP Address
Network submask	255.255.255.0	Network submask
Gateway	192.168.1.2	Gateway

Computer network adapter configuration needs to be set to same network submask and gateway. IP address can take any value in this IP range (192.168.1.11, for instance). These addresses can be changed by user.

Web pages description

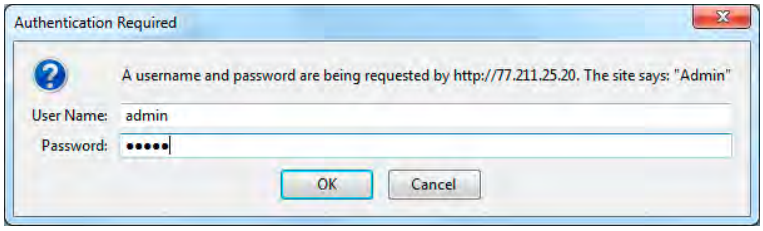
Once the Ethernet module is properly configured, user can connect to the Signal Booster, writing IP address in URL toolbar of any web browser available in its computer. Default URL is http://192.168.1.10.

First screen to appear is Authentication. Default login and password are:

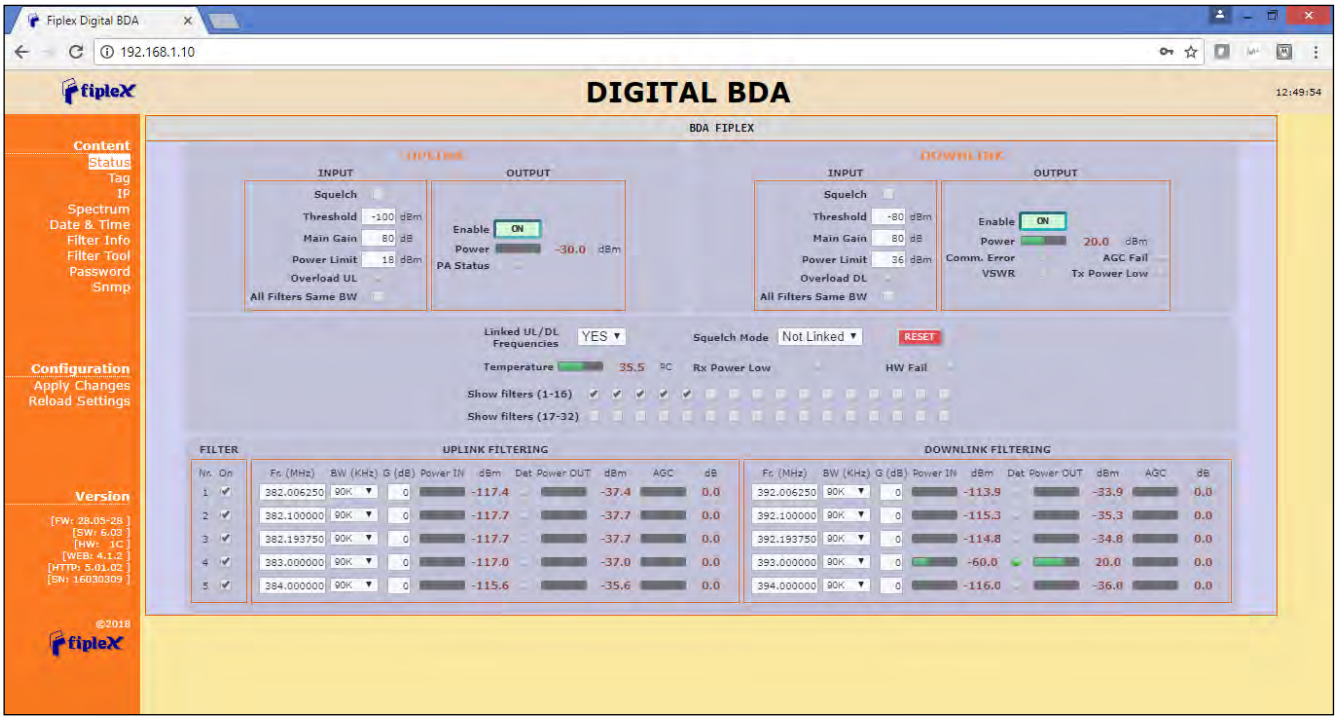
Login	admin	Login
Password	admin	Password

Password can be changed by user, using menu described in next sections.

NOTE: in order to restore password, push the button placed close to USB Connector during 5 seconds.



After authentication, web browser will load the main page of Fiplex Signal Booster showing RF configuration and monitoring parameters.

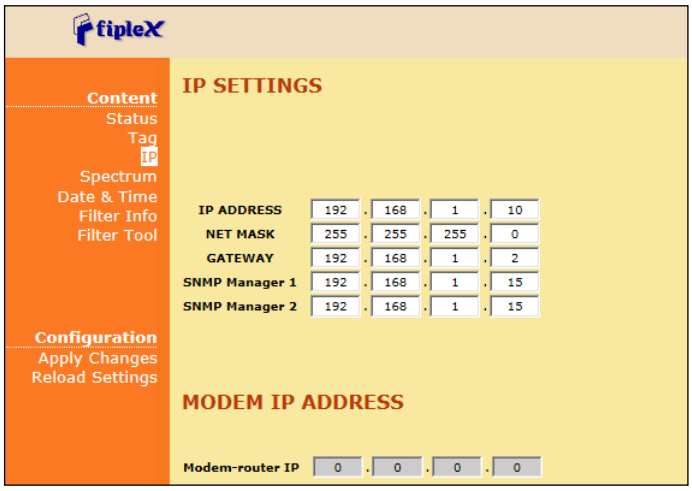


At left side of webpage, configuration menus are shown:

Content

- Status: whole RF configuration and monitoring parameters are shown. These parameters are described in the next section.
- Tag: user can set a tag to ease Signal Booster identification. For modifying the TAG, write a new value in text field and click over Apply Changes link

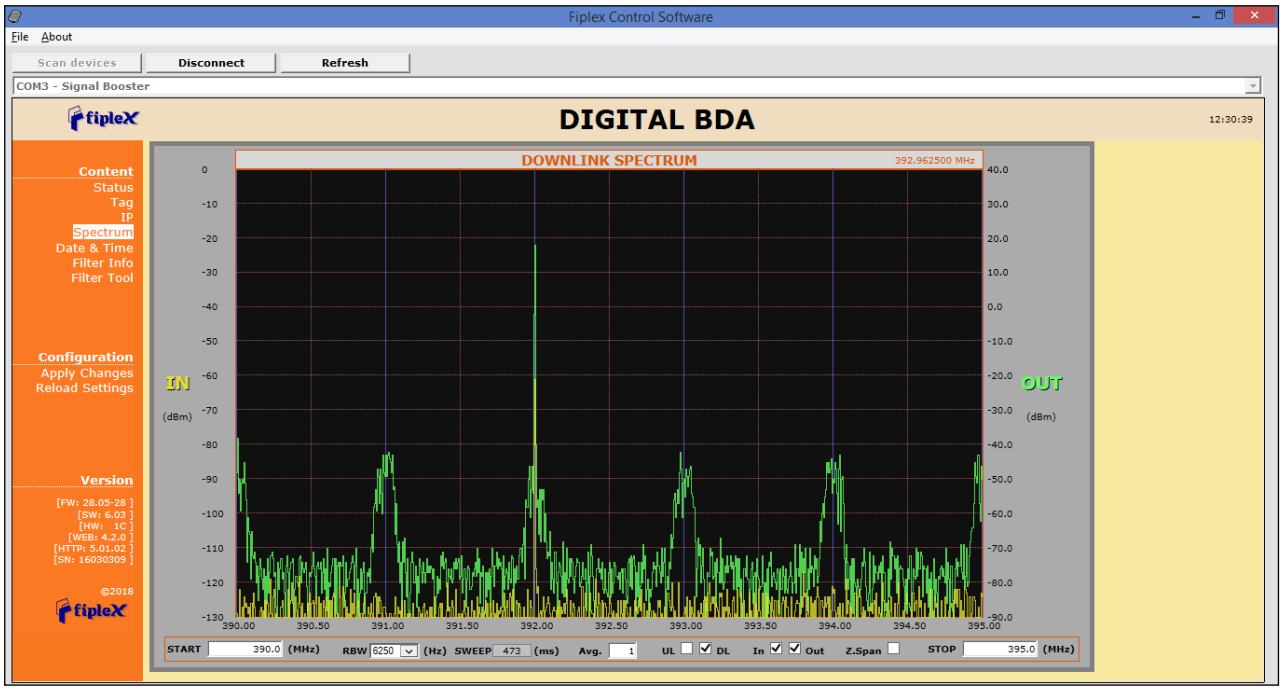
- IP: At this page, Signal Booster IP address, network submask, gateway address and IP addresses of SNMP Managers are shown. User can set addresses of two SNMP Managers (IP where SNMP agent will send TRAP information). To modify, click over Apply Changes link after writing new values on text fields.



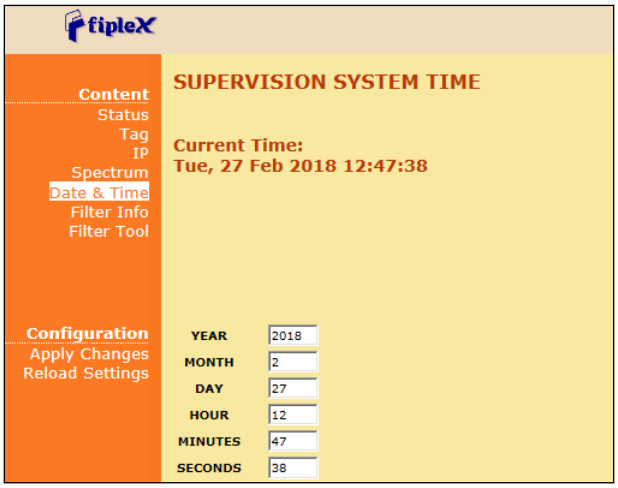
In case the Signal Booster had been fit with an internal modem-router, its own IP address settings would be fixed and the modem's address would be shown in the greyed boxes.

- Spectrum: this page shows estimation for input and output spectrum in either DL or UL, whatever is selected by the user. Estimation for output spectrum takes into account RF input levels, and gain, bandwidth filters and squelch options programmed by the user, and it can be a useful tool for users to know how the undesired signals are rejected by the channel selective Signal Booster.

  The user can change start and stop frequency modifying text fields placed at the page bottom. Minimum span is 200KHz and maximum span is the band covered by the Signal Booster. In case the same frequency is set for both start and stop, then zero-span is set. For user convenience, a zero-span checkbox is available that makes that operation with one click, and chooses the start frequency setting as the measurement frequency. That also disables the stop frequency setting and changes it according to start frequency. And finally, measurements can be averaged up to 32 times.

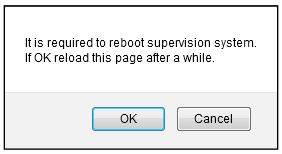


- Date and Time: page to modify real time clock. When the Signal Booster is not powered, this clock runs with a voltage supply provided by a 3V lithium battery, button type of 20mm (CR2032) with 220mA·h. This suffices for at least half year. When the Signal Booster is powered, no current is drained from the battery. So, actual battery life will depend on Signal Booster usage. For battery replacement, please locate battery holder between USB and Ethernet connectors on main board. Battery positive side is UP, i.e. on holder clip.

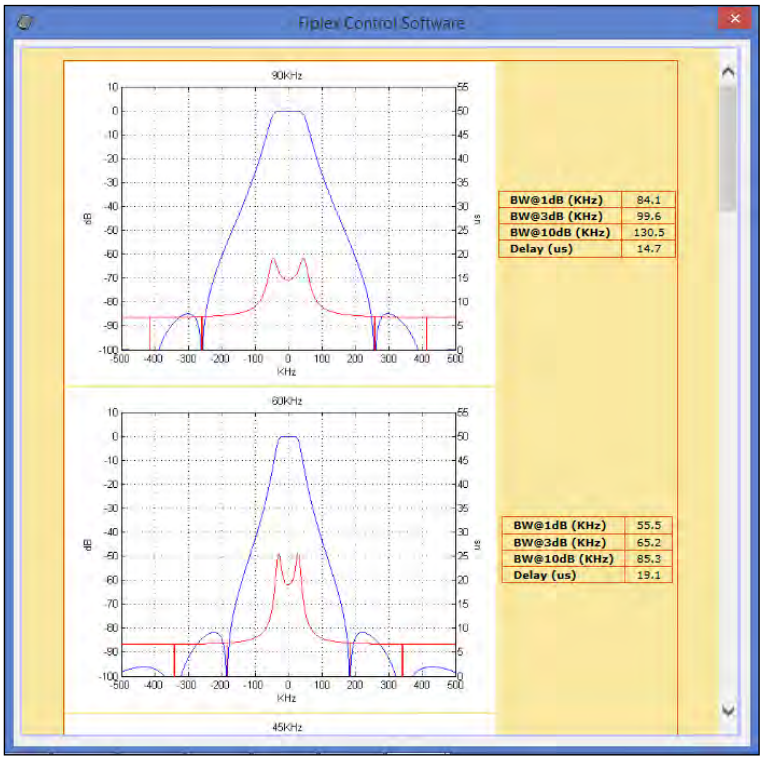


Date and time setting

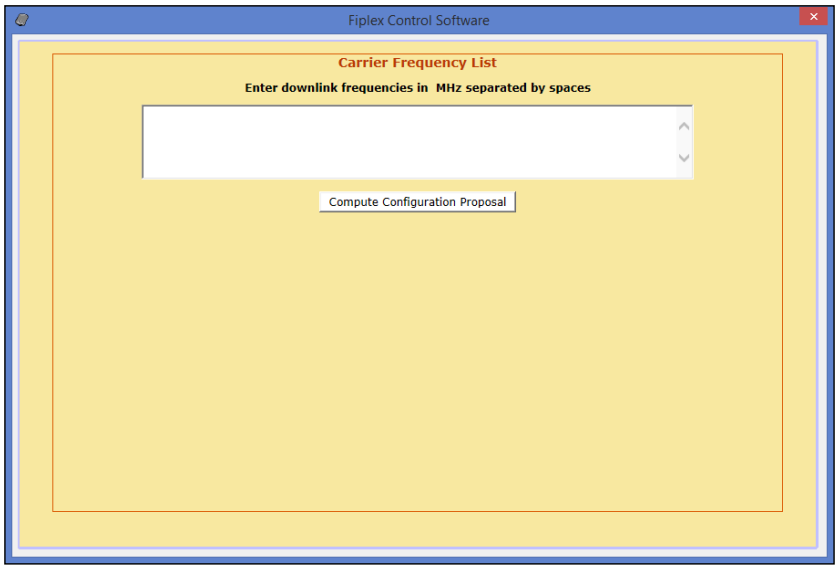
After clicking on “Apply Changes” link, next message will appear, warning the user that system needs to be rebooted.



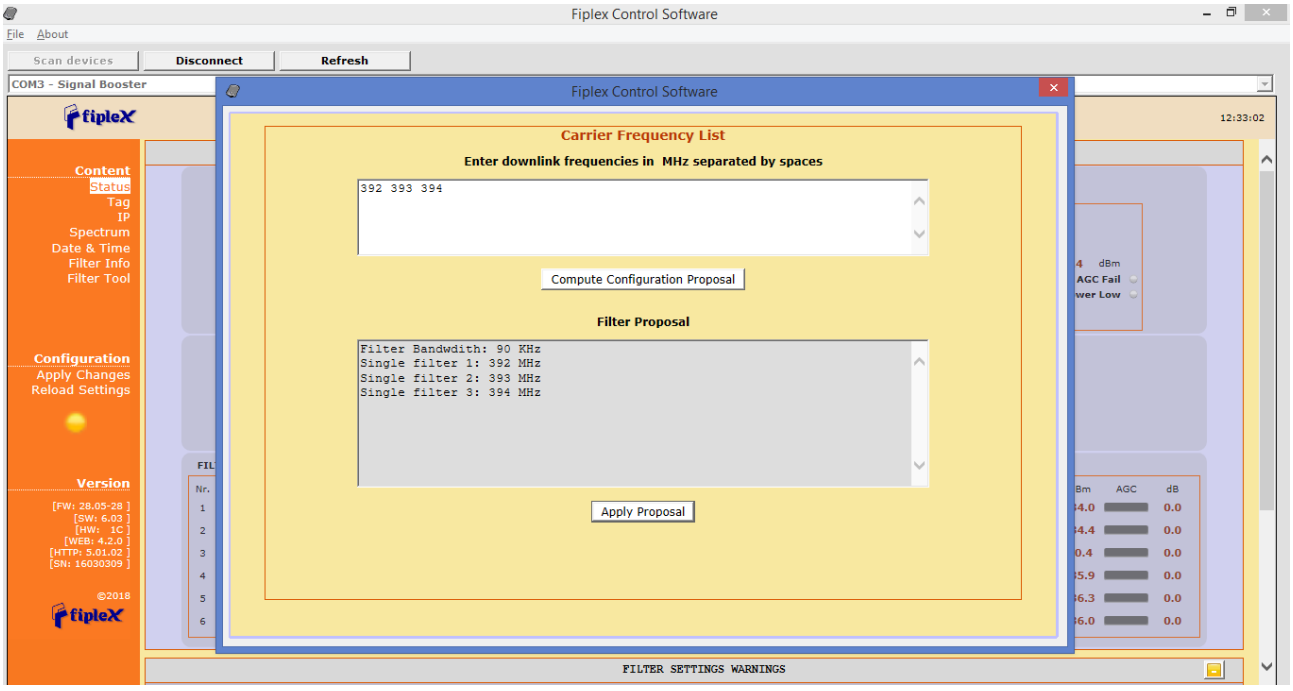
- Filter Info: following this link, a new window appears with detailed information of frequency and delay response of all available filter bandwidths (1dB, 3dB and 10dB bandwidths and delay at center frequency)



- Filter tool: assistant to easily configure signal booster filters with minimum delay response (all filters set to 90KHz bandwidth). It is especially useful if carriers are grouped in “frequency packets” where it is not possible to configure an independent filter for each one. With this tool filtering parameters are automatically set from a desired frequency carriers list. This tool executes in a pop-up window as the image below and is described in next sections:



The desired carrier frequencies of the downlink band, are to be typed in the text area of this window expressed in MHz. The tool will try to enable as many filters of 90KHz bandwidth as necessary for all carriers, using a fine gain of 0dB by default. This is trivial when carrier frequencies are sufficiently separated apart. For instance:



The button "Compute Configuration Proposal" shows the computed filter frequencies in another text area and, if accepted, the button "Apply Proposal" would actually perform the configuration change.

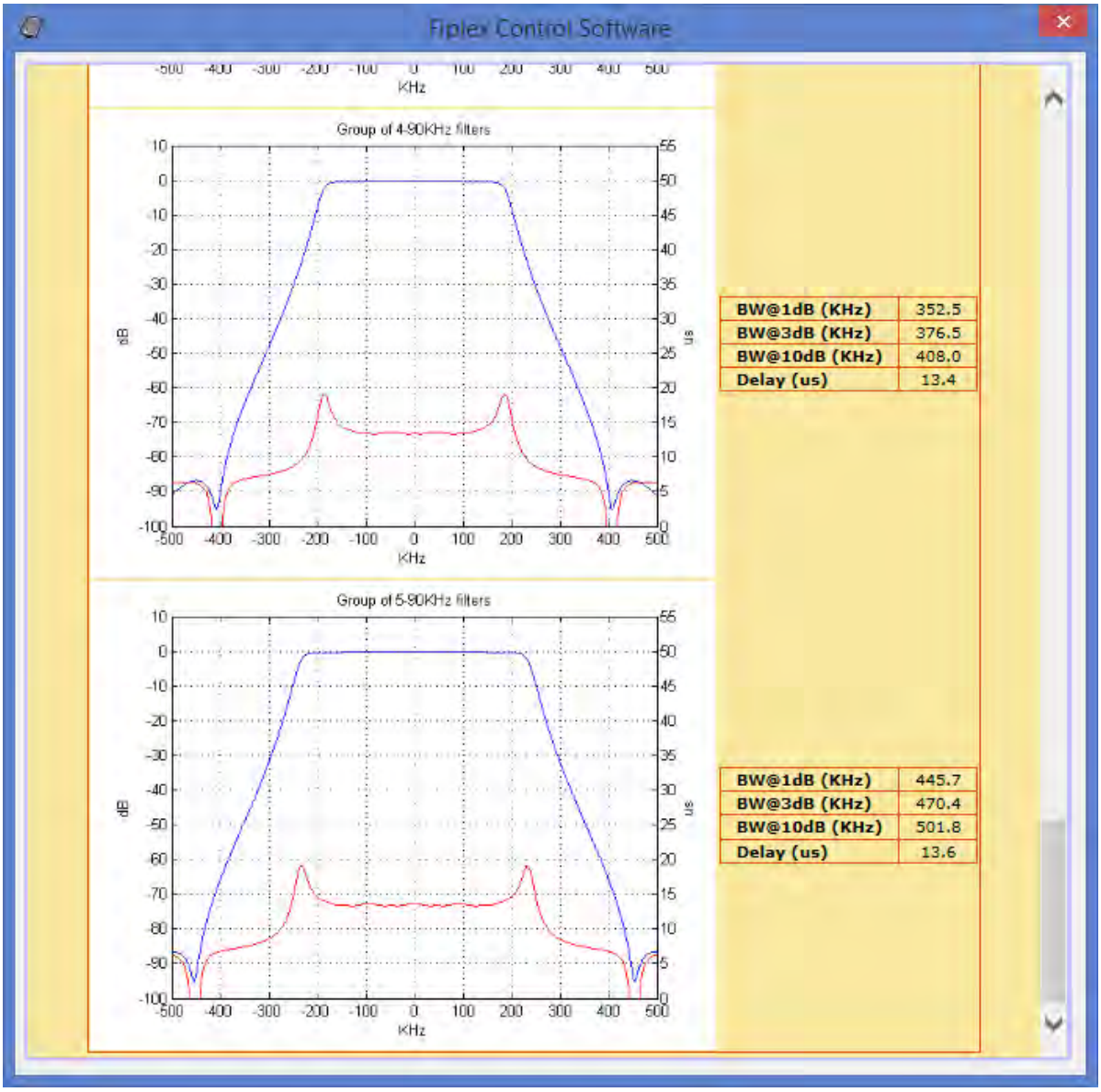
However, for carrier frequencies that come in packets, the filter frequencies should not be set too close because the overall response would be distorted. Depending upon signal modulation, that response distortion might not have any

consequence. But in the case that distortion cannot be tolerated, consider that the minimum frequency separation between two filters to avoid this problem is 1.25 times the semi-sum of their bandwidths. For instance, two filters width bandwidths 90KHz and 30KHz respectively, must be separated apart by 1.25·(90 + 30) / 2 = 75 KHz.

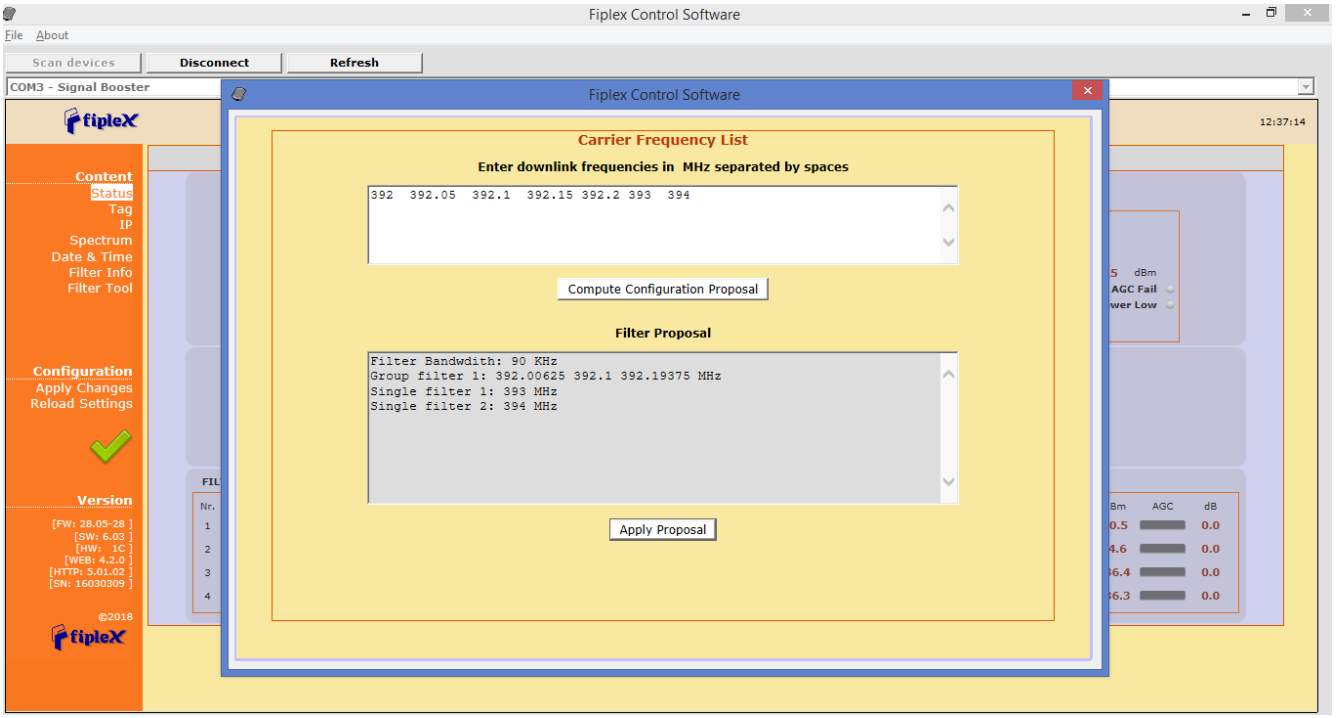
Nevertheless, there are certain conditions under which filters can be set closer to make up a single filter with wider bandwidth:

- The frequency separation must be 93.75 KHz.
- All of them must have the same bandwidth setting of 90 KHz.
- All of them must have the same fine gain setting.

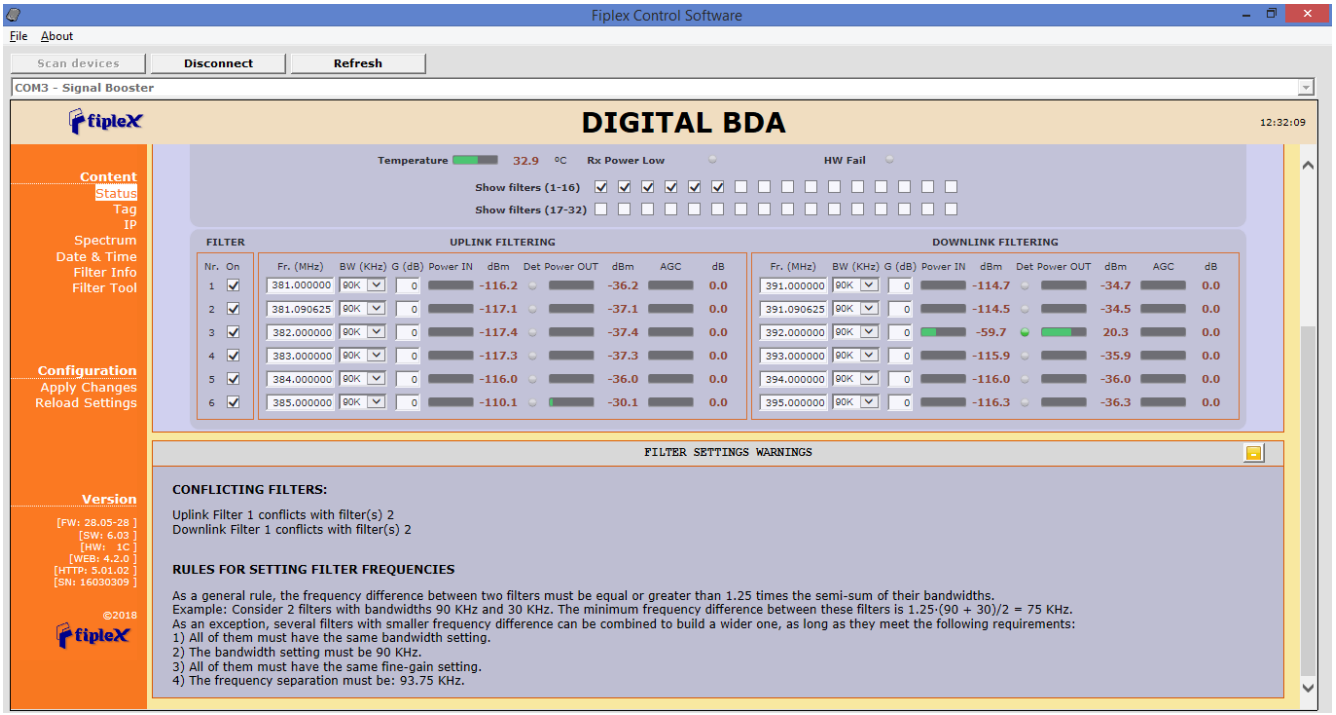
The Filter Info window shows the frequency response of the combination of up to five filters:



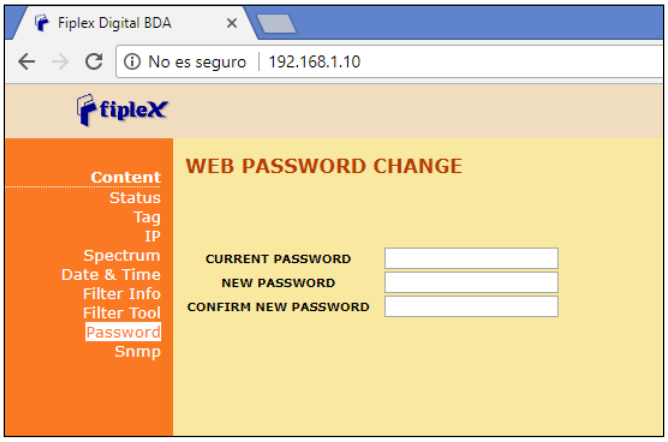
Now, consider for instance a case with the following downlink carrier frequencies: 392.0, 392.05, 392.1, 392.15, 392.2, 393.0 and 394.0 MHz. This is when the Filter Tool comes in handy. It will automatically choose the filters required to cover the range between 392.0 MHz and 392.2 MHz. As shown in next picture, it would set three filters with frequencies 392.00625 MHz, 392.1 MHz and 392.19375 MHz for the four carriers in the packet, and two more filters for the two separated carriers.



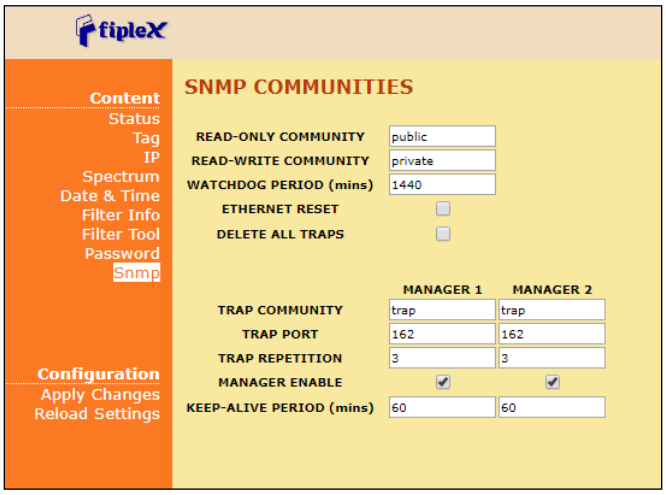
It is certainly possible to do this same operation manually, in the Filter Control Frame, although it would be less convenient. Should the user set filters without keeping these rules, the software would show a warning message, as in the following image:



- Password (only via web connection): to modify webpage password, old password is required, and new password needs to be written two times. After clicking on “Apply Changes” link, new authentication screen appear, where user must write new password.

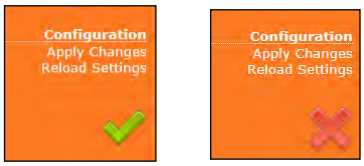


- SNMP (only via web connection): user can configure through webserver some SNMP parameters:



- Read-only community and read-write community: set passwords for SNMP agent (typically "public" / "private")
- Watchdog Period: time in minutes without external IP access to the device (HTTP, SNMP or PING) after which the embedded Ethernet module will reboot just in case it were stuck. It does not affect RF functioning. Default value is 1440 minutes, i.e. one day.
- Ethernet RESET: resets Ethernet module.
- Delete All Traps: clear all alarm conditions and sets trap counter to zero
- Trap community: set trap community for each connection to SNMP Manager
- Trap port: set UDP port for SNMP trap sending. Default standard port is 162. SNMP polling is done through standard port nr. 161.
- Trap repetition: set number of traps that SNMP agent will send every time that alarm conditions vary. Maximum number is five repetitions and the time lapse between them is 10 seconds.
- Manager Enable: enables each connection to SNMP Manager independently. If enabled, traps will be sent to manager IP address set in IP section.
- Keep-Alive period: Keep-Alive traps can be sent periodically with the purpose of letting the SNMP manager know that the agent is working. The time in minutes between these traps is the Keep-Alive period. Default period is 60 minutes. A setting o 0 disables sending these traps. These traps are not affected by the Trap Repetition mentioned before.

- Configuration
  - Apply Changes: as it is said above, this link is used to load changes to the Signal Booster, in configuration, tag, IP, password and date and time menus. After any configuration change, web page will show and icon that allows user to know if configuration has been successfully applied:



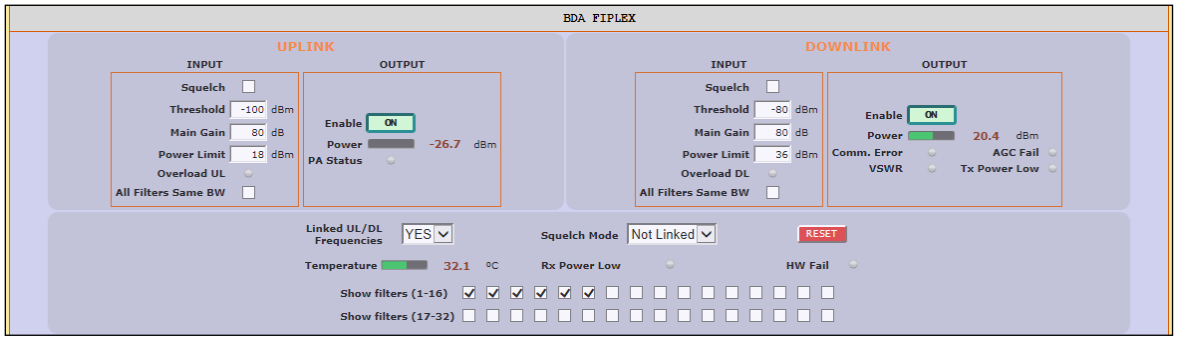
- Reload Settings: clicking this link, Signal Booster configuration data is refreshed.

- Version: shows hardware, firmware and software versions of Signal Booster and serial number.

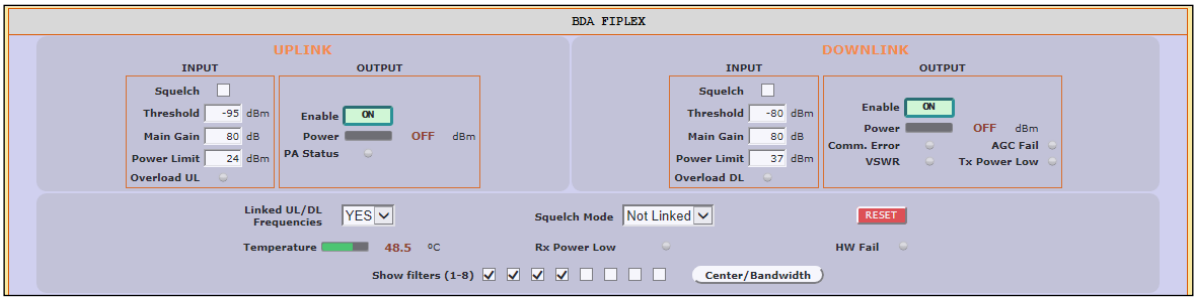
RF parameters description

"Status" menu shows whole RF configuration and monitoring data that are distributed along the webpage.

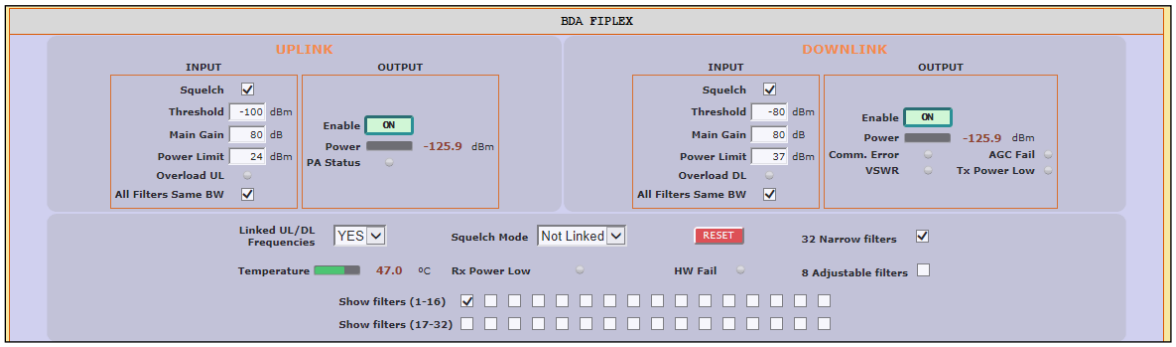
The status window is divided in two main blocks: general control and filtering control. First, general control contains signal booster main configuration parameters, while second block is a list with variable number of rows (according to number of enabled filters) which contains detailed configuration and monitoring parameters of each filter. Maximum number of filters is 32 for narrow filters version and 8 for adjustable bandwidth version



General control frame for narrow-band version

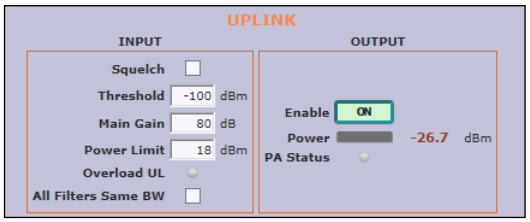


General control frame for adjustable bandwidth version



General control frame for dual version

- General control frame. There are four sub-sections inside this frame:

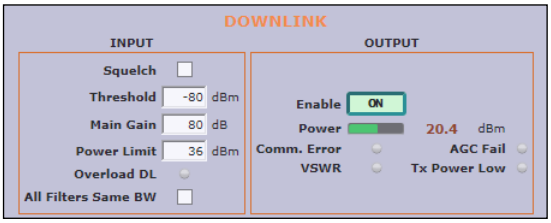


  - Main uplink control: RF main parameters regarding to uplink band are contained in this section: gain, output power limit, squelch threshold, squelch enable, PA enable control, RF output power indicator, and RF input overload, PA status and stability alarms. Next table describes information of this frame:

Uplink frame

Parameter	Description
Main Gain	Set maximum gain of Signal Booster at UL band. Range can vary between models.
Power Limit	Set maximum output power of Signal Booster at UL band. System automatically will apply a correction to share this limit between the active channels. For instance, +18dBm band limit means +12dBm maximum output power per channels for 4 active channels. Range can vary between models depending on rated power.
Squelch Enable	Enabling this control, Signal Booster does not transmit in each channel if RF input power do not exceed the threshold level configured according to next row
Squelch Threshold	If squelch is enabled, input levels below this threshold are not transmitted.

PA Enable	This control enables / disables PA UL: Green button and label “ON” means that PA is enabled, red button and label “OFF” means that PA is disabled
RF Output Power	Shows instantaneous RF output power at UL band
Overload UL	This alarm indicates that Signal Booster is being overloaded at UL band, due to very high RF input level
PA Status	PA status alarm indication based on current consumption
All Filters Same BW	If enabled, any change of bandwidth filter of any enabled filter will be applied to all UL filters

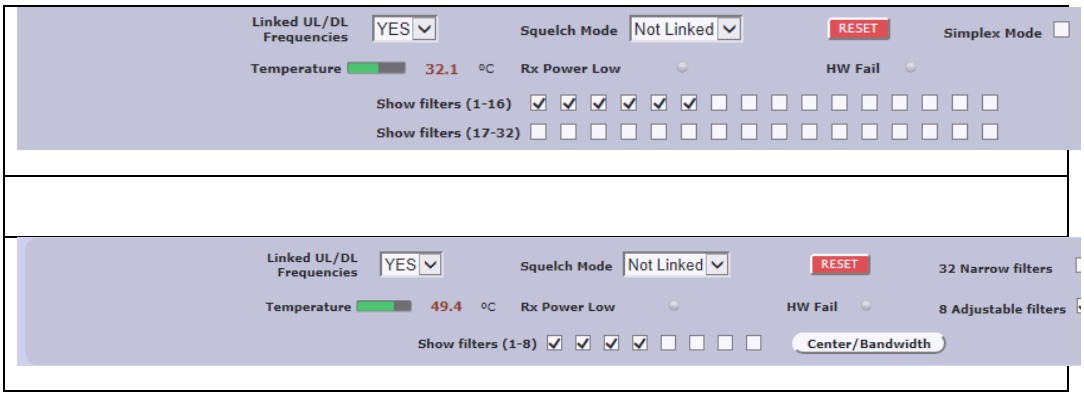


- Main downlink control: parameters regarding to downlink band. They are almost equal to uplink band.

Downlink frame

Parameter	**Description**
Main Gain	Set maximum gain of Signal Booster at DL band. Range can vary between models.
Power Limit	Set maximum output power of Signal Booster at DL band. System automatically will apply a correction to share this limit between the active channels. For instance, +36dBm band limit means +30dBm maximum output power per channels for 4 active channels. Range can vary between models depending on rated power.
Squelch Enable	Enabling this control, Signal Booster does not transmit in each channel if RF input power do not exceed the threshold level configured according to next row.
Squelch Threshold	If squelch is enabled, input levels below this threshold are not transmitted.
PA Enable	This control enables / disables PA DL: Green button and label “ON” means that PA is enabled, red button and label “OFF” means that PA is disabled

RF output power	Shows instantaneous RF output power at DL band
Overload DL	This alarm indicates that Signal Booster is being overloaded at DL band, due to very high RF input level
Comm. Error	Indicates that communication with monitoring PA Board is lost. In this case, following three alarms will not be available
AGC Fail	This alarms appear if output power is higher than maximum output power (typical +37dBm) plus 3dB.
VSWR	Alarm appears if high reflected power is detected in “To mobile” connector
Tx Power Low	Indicates that measured output power at PA output is lower than expected according to RF input levels and configured gains



General control frame for narrow band and dual version

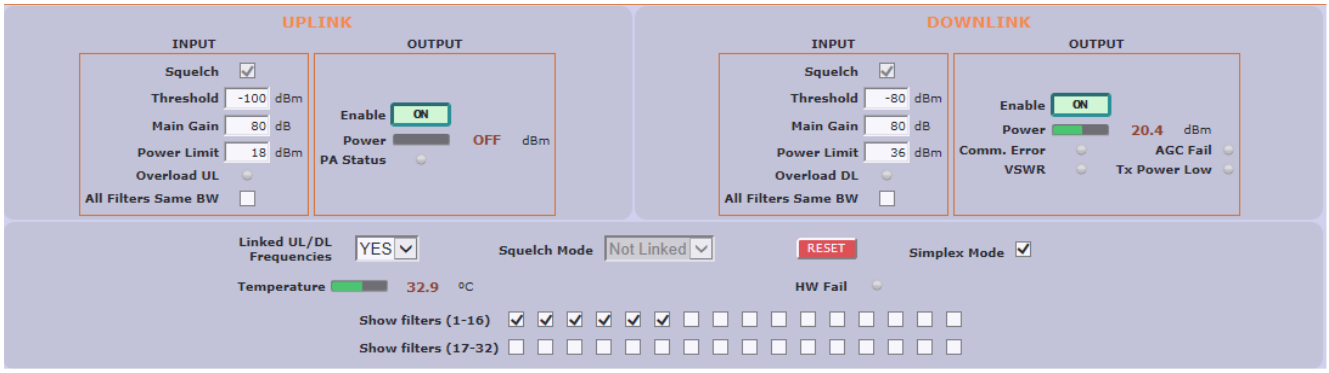
- General control

General control frame

Parameter	Description
Linked UL/DL frequencies	If 'Yes' then frequency setting in DL will also modify UL according to frequency band split preset in factory. If 'No' then filter frequencies can be set independently in UL and DL.
Squelch mode control	If this control is set to “Linked”, DL channels without input signal (according to DL Squelch threshold) automatically squelch related UL channels

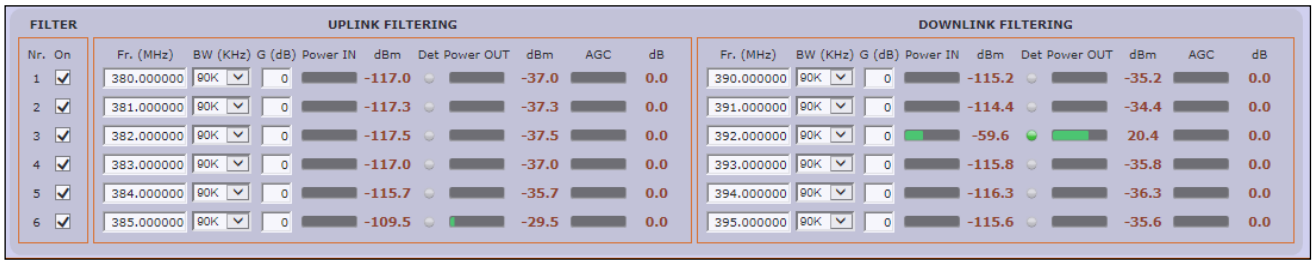
RESET	Reboots digital signal processor
Simplex Mode (only available in some narrow filters versions)	If enabled, signal booster works in simplex mode. This is, any DL signal detected in any DL enabled filter blocks all UL filters and any UL signal detected in any UL enabled filter blocks all DL filters
Temperature	Shows internal Signal Booster temperature
Rx Power Low	Alarm is active, if signal is not detected in any DL channel
Hardware fail alarm	Indicates critical malfunctioning in digital signal processor
Show filters	
Firmware selection (only for dual version)	User can change filtering mode in case of dual version signal booster

Simplex mode checkbox control is only visible in devices with such capability. It allows signal flow only in one direction, either uplink or downlink, at any given time. The chosen direction is made automatically based on signal detection which, in turn, depends on squelch. Therefore, turning on simplex mode automatically turns on squelch, both in uplink and downlink sections, and disables these controls for the user. Besides, it also sets squelch mode to "Not Linked" and disables this control, too. This is necessary since otherwise the lack of RF input signal in downlink would mute the uplink RF input, thus blocking all communication. The look of the general control frame in simplex mode is as in next image:

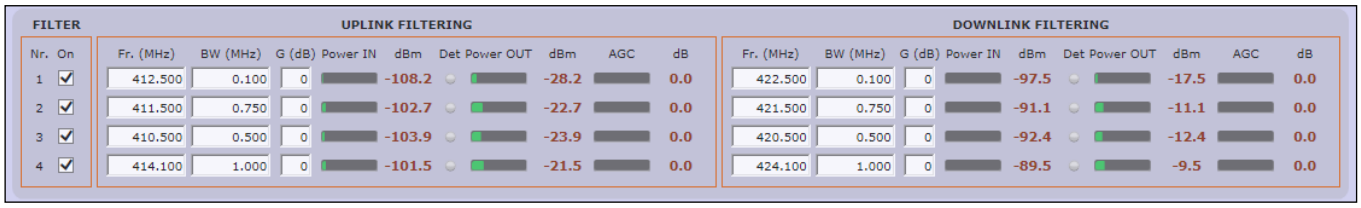


Filter control frame for narrow-band version

- Filtering control frame.



Filter control frame for narrow-band version



Filter control frame for adjustable bandwidth version

- Filter control frame: shows configuration and monitoring information of all filters. The frame is divided in two: uplink and downlink. Data showed in each half is symmetric.

Filter control frame

Parameter	**Description**
On	Allows to enable/disable each filter
Frequency	Configures center frequency of each filter
Bandwidth filter control for narrow-band version only	There are up to five available filters (depending on factory setup) to adjust the trade-off between rejection to undesired signals and delay
Fine gain control	Each channel gain can be fine adjusted
RF input power	Shows RF input level for each channel
Signal detection	With this indicator, system shows if signal is detected at input, according to squelch threshold. Moreover, with Squelch Mode = 'Linked', UL shows no signal if signal is not detected in the same DL channel even if UL signal exceed squelch threshold. Similarly, with simplex mode enabled, if one signal is detected at DL band, all UL filters will show "No signal"
RF output power	Shows estimation for RF output level for each channel, according to programmed gain and AGC control. Shows

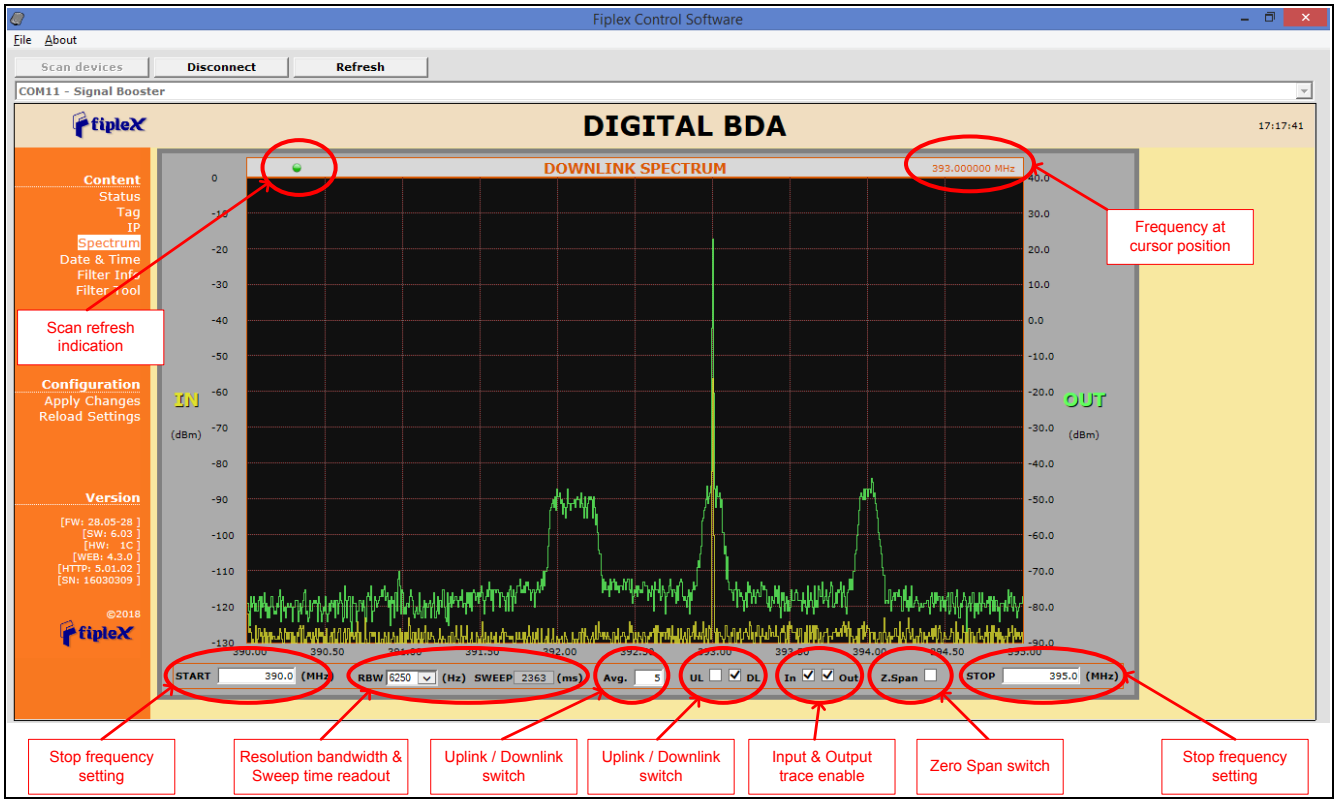
	'OFF' in the same cases that signal detection shows 'No signal'
AGC	Indicates gain reduction due to power limitation control.

In case of adjustable filter version, filter control frame is slightly different. According to entry mode button, frequency and bandwidth parameter configuration can be:

- Center frequency (in 25KHz steps) and bandwidth filters (50KHz steps)
- Start and stop frequencies (in 25KHz steps)

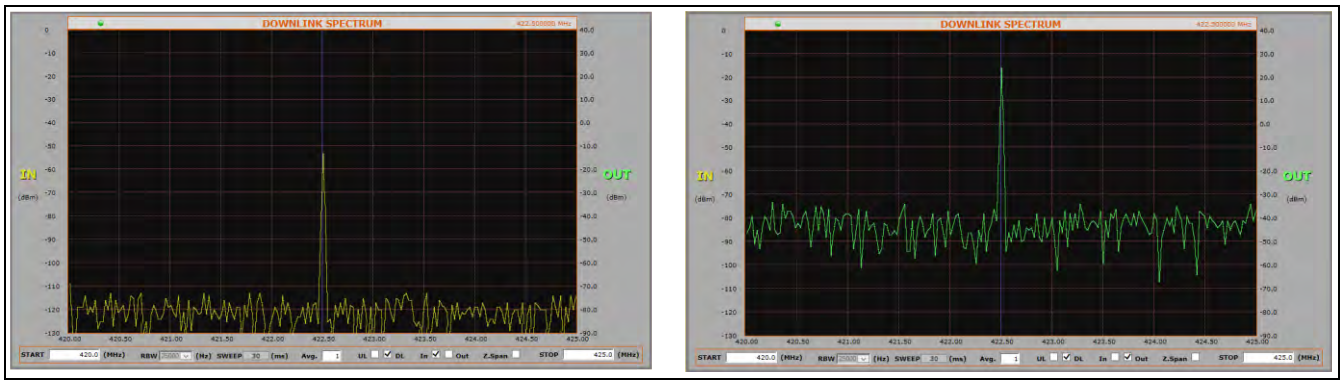
Spectrum Analyzer

The spectrum analyzer feature of the Signal Booster is a useful tool for commissioning and troubleshooting. This section explains how to use it.



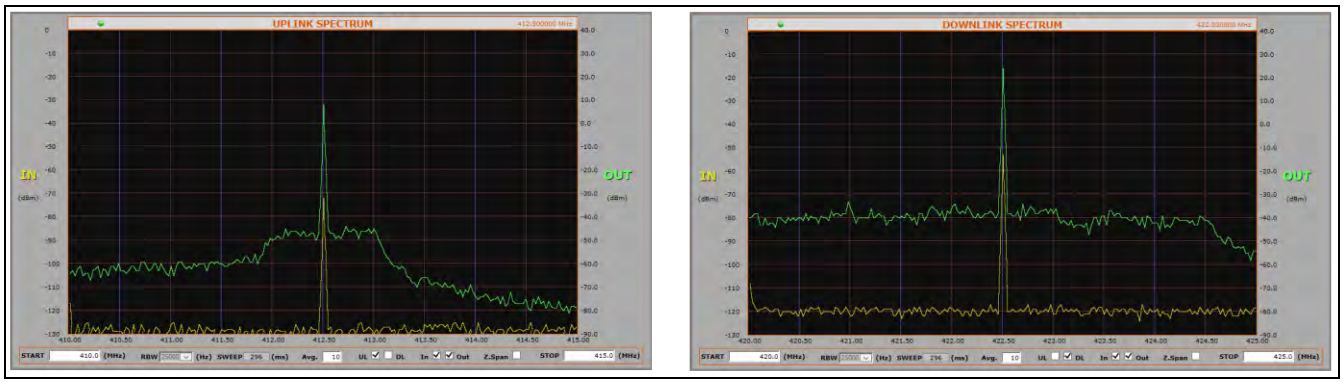
Spectrum analyzer settings

Input and output signals are scanned successively and can be shown or hidden independently:



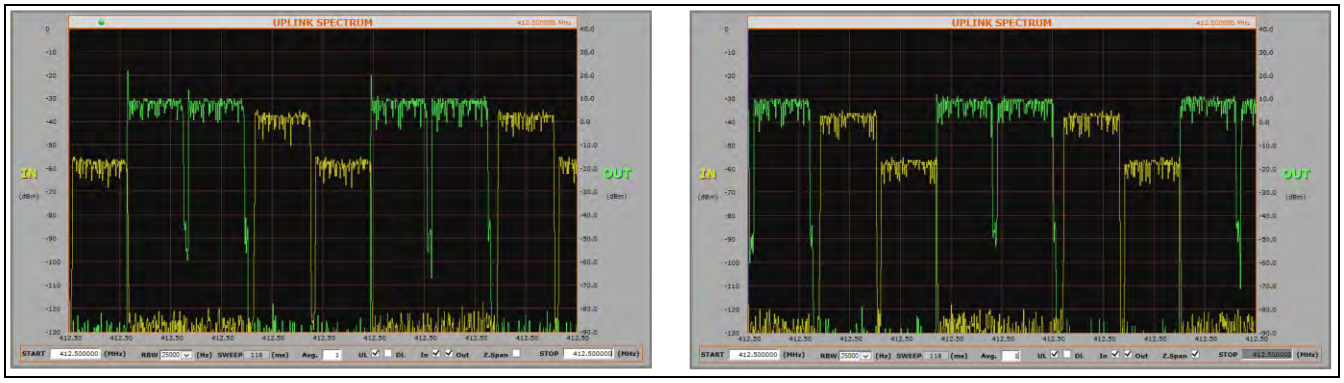
Spectrum input/output selection

Either uplink or downlink signal paths are chosen and average up to 32 can help to clean noise signals. Resolution bandwidth and sweep time are set automatically.



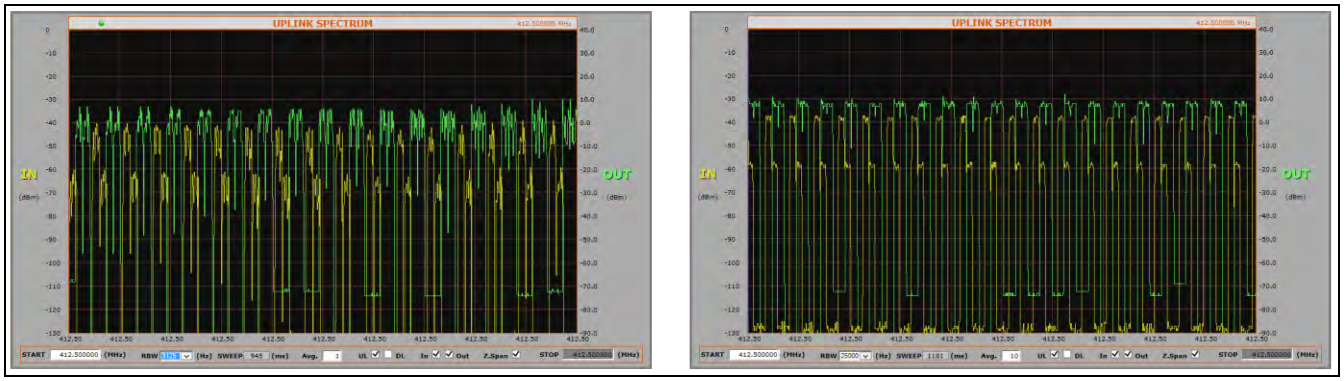
Spectrum UL / DL selection

When start and stop frequencies are set equal, then zero-span mode is activated to show evolution of signals with time, which may be of special interest with pulsed signals. The same thing can be achieved by setting the zero-span checkbox, with the convenience that start frequency change would also change stop frequency accordingly.



Spectrum zero-span mode

Resolution bandwidth becomes enabled in zero-span mode and sweep time is automatically set according to its setting, which is user selectable between 25.000Hz, 12.500Hz, 6.250Hz and 3.125Hz. Average setting will also impact sweep time in a similar way.



Zero span settings

SNMP Agent

Fiplex Signal Booster includes a SNMPv1 agent that allows user to supervise the device by means of 'SET' and 'GET' type commands and, asynchronous traps to notify alarm conditions can be sent. The device is intended to be monitored by a polling NMS but it can send traps to a NMS or Trap Receiver if enabled. Fiplex can provide a NMS system upon request.

The following sections will show the user configurable, relevant information that can be read via SNMP from the device. The tables will describe these values in order to explain how the information has to be read and interpreted.

MIB Description

The associated MIB document is FIPLEX-BDA-SYSTEMv13-MIB.mib. The Fiplex MIB is divided into blocks. Each block describes the characteristics and values of a specific element but not all elements are implemented in this agent. Each MIB block is divided in two segments, named 1T and 2T. Segment 1T contains the information that is fixed & read only. Segment 2T has the information that can vary over time, regardless of it being read/only or read/write.

The following sections will show the user configurable, relevant information that can be read via SNMP from the device.

Manager

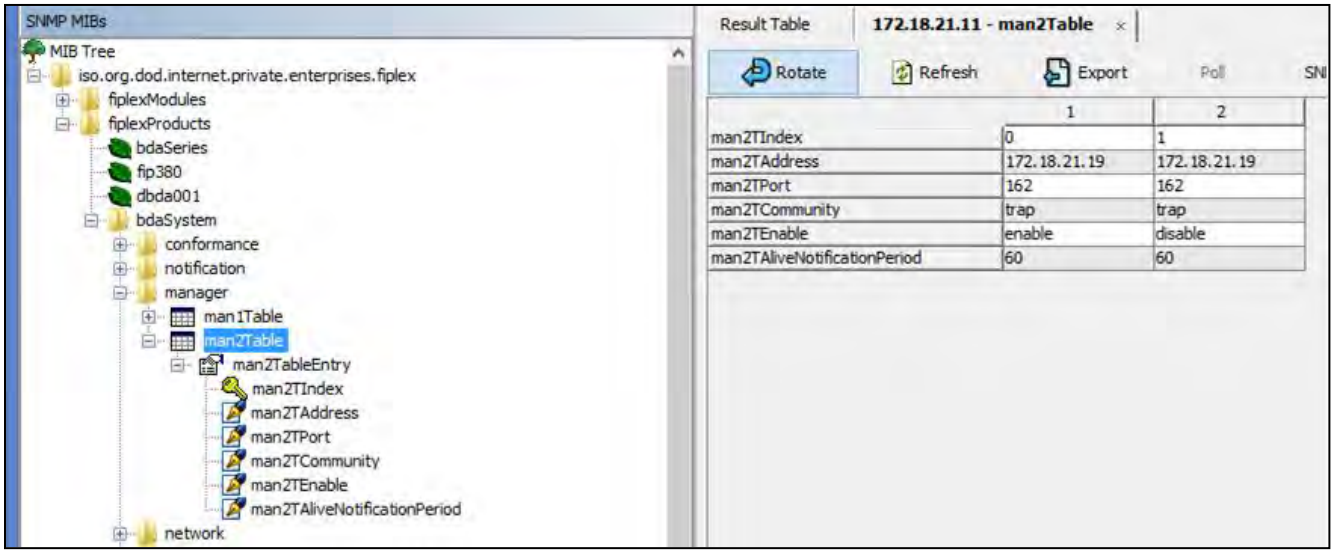
This is a table with 2 consecutive elements, one for each NMS. No checking is done of the validity of the information stored in the table, so extra care must be taken by the user.

SNMP Managers table

Field Name	OID	Description	Type
Man2TAddress[0]	1.3.6.1.4.1.26355.2.50.3.2.1.2.0	First NMS Address	R/W
Man2TAddress[1]	1.3.6.1.4.1.26355.2.50.3.2.1.2.1	Second NMS Address	R/W
Man2TPort[0]	1.3.6.1.4.1.26355.2.50.3.2.1.3.0	First NMS Port where to send traps	R/W
Man2TPort[1]	1.3.6.1.4.1.26355.2.50.3.2.1.3.1	Second NMS Port where to send traps	R/W

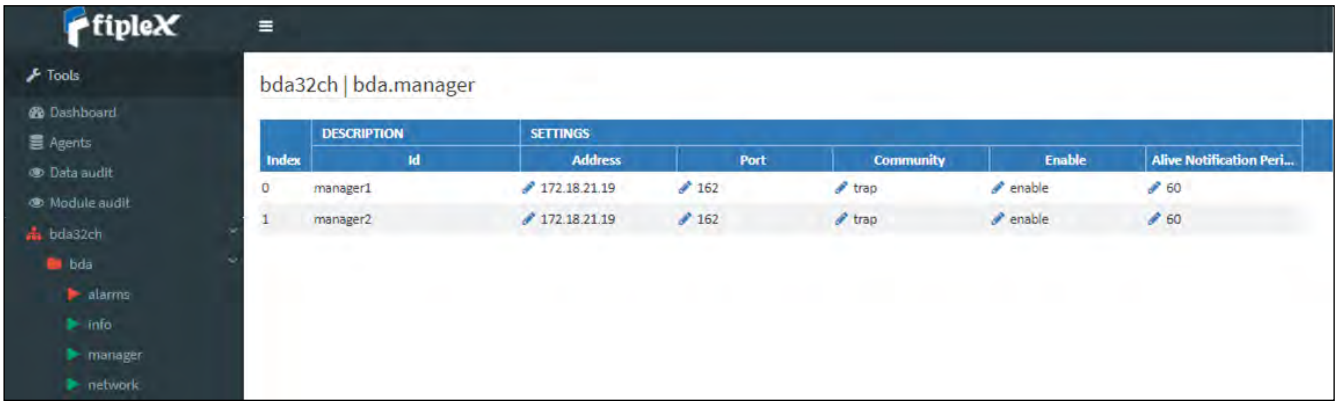
Man2TEnable[0]	1.3.6.1.4.1.26355.2.50.3.2.1.5.0	First NMS. 1= Enabled, 2=Disabled	R/W
Man2TEnable[1]	1.3.6.1.4.1.26355.2.50.3.2.1.5.1	Second NMS. 1= Enabled, 2=Disabled.	R/W
Man2TAliveNotificationPeriod[0]	1.3.6.1.4.1.26355.2.50.3.2.1.6.0	First NMS. If enabled in Man2TEnable, defined time between keep-alive traps.	R/W
Man2TAliveNotificationPeriod[1]	1.3.6.1.4.1.26355.2.50.3.2.1.6.1	Second NMS. If enabled in Man2TEnable, defined time between keep-alive traps.	R/W

The following MIB tree representation shows this table:



SNMP Managers table

The following picture shows the same table as seen by the Fiplex NMS:



NMS: SNMP Managers table

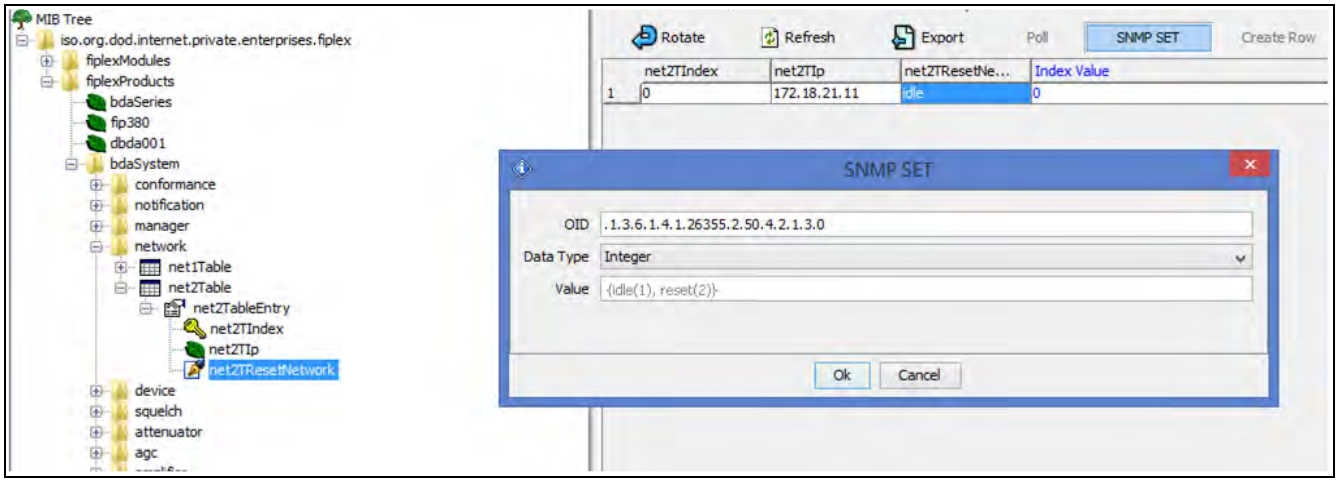
Network

This is a table has just one element with two items. The first one is the device's IP address and it is read-only to avoid unwanted miss-configuration. This can only be changed by means of the embedded web server or locally, through USB, by means of the Fiplex Control Software. The second item is a “kind” of button intended for resetting the embedded Ethernet hardware interface.

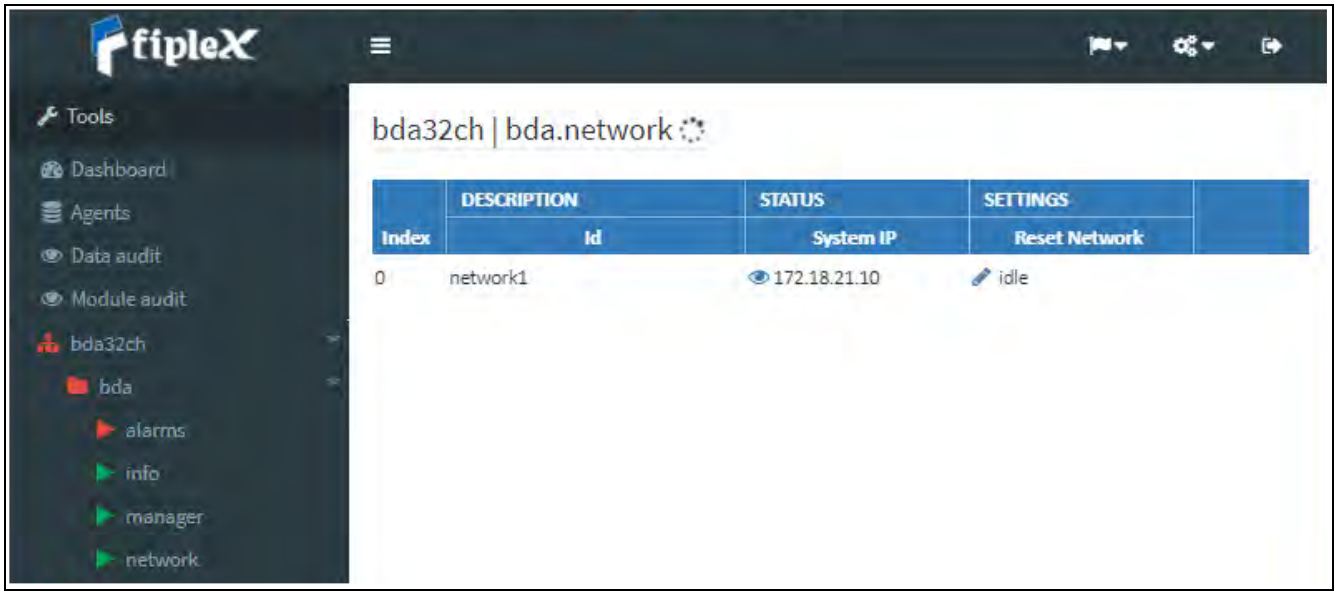
SNMP Network table

Field Name	OID	Description	Type
Net2TIp[0]	1.3.6.1.4.1.26355.2.50.4.2.1.2.0	IP address	R/O
Net2TResetNetwork[0]	1.3.6.1.4.1.26355.2.50.4.2.1.3.0	Network reset: reads as *idle*(1), sets to *reset*(2)	R/W

The following MIB tree representation shows this table and following there is the NMS view:



SNMP Network table



NMS: SNMP Network table

Device

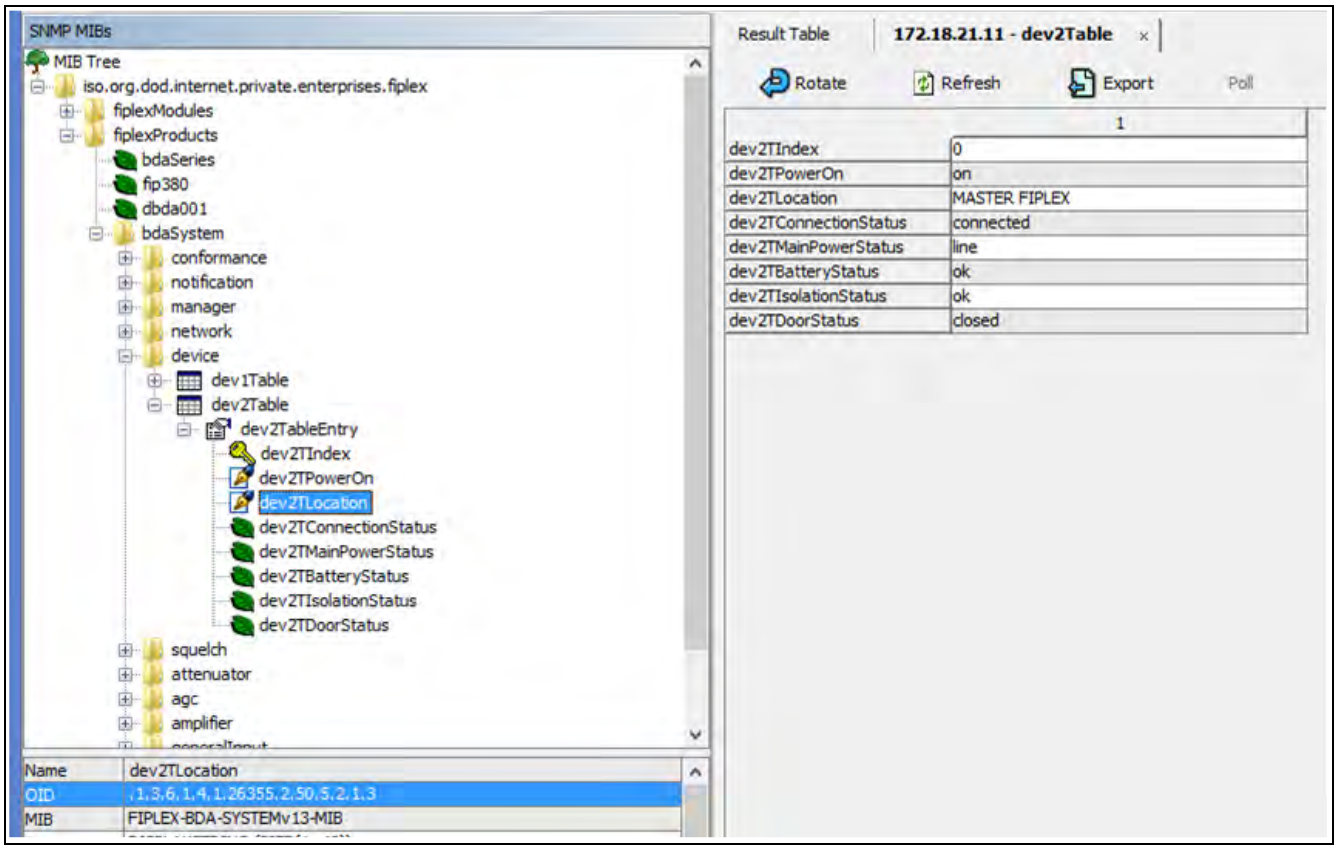
This is also a one element table, providing several informative fields, but only relevant and implemented one is the “Location” field, which allows to easily identify a device by a name provided by the user, usually related to the place where it is located.

SNMP Device table

Field Name	OID	Description	Type
Dev2TPowerOn[0]	1.3.6.1.4.1.26355.2.50.5.2.1.2.0	-	R/W

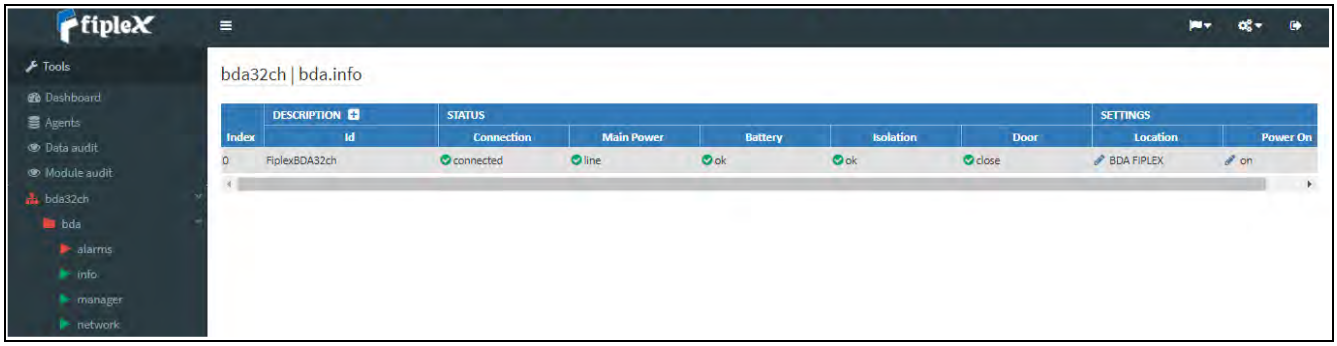
Dev2TLocation[0]	1.3.6.1.4.1.26355.2.50.5.2.1.3.0	String with up to 30 characters	R/W
Dev2TConnectionStatus[0]	1.3.6.1.4.1.26355.2.50.5.2.1.4.0	-	R/O
Dev2TMainPowerStatus[0]	1.3.6.1.4.1.26355.2.50.5.2.1.5.0	-	R/O
Dev2TBatteryStatus[0]	1.3.6.1.4.1.26355.2.50.5.2.1.6.0	-	R/O
Dev2TIsolationStatus[0]	1.3.6.1.4.1.26355.2.50.5.2.1.7.0	-	R/O
Dev2TDoorStatus[0]	1.3.6.1.4.1.26355.2.50.5.2.1.8.0	-	R/O

MIB tree view:



SNMP Device table

The Fiplex NMS view shows this table under the tab named “info”:



NMS: SNMP Device table

Additional information is shown by clicking on the link named “Description”. This extra piece of information comes from the fixed table, Dev1Table. The most relevant items in this table are the following ones:

SNMP Device Group table

Field Name	OID	Description	Type
Dev1TGroup[0]	1.3.6.1.4.1.26355.2.50.5.1.1.3.0	das.info (conformance group)	R/O
Dev1TurlExtern[0]	1.3.6.1.4.1.26355.2.50.5.1.1.19.0	URL of embedded web server	R/O

Alarms

Alarms tables provide information regarding the status of key parts in the system. The fixed table *gralAlarm1Table* provides self-explanatory identifiers, *gralAlarm1TId,* for each relevant subject. The second item in each element of this table is the *gralAlarm1TGroup.* When the device being monitored is a Remote unit, this item just takes the value '*das.alarms* '. However, since the Master unit carries information from all the devices in the whole DAS system, it provides a different value for each device to which the alarm is assigned to, be it the Master unit, any of the Remote units or any of the Expansion units. Therefore, the actual number of elements in this table for the Master unit, depends on how many devices compose the DAS system. The third item of each element, *gralAlarm1TDescription*, is left blank, since the first one suffices for that purpose.

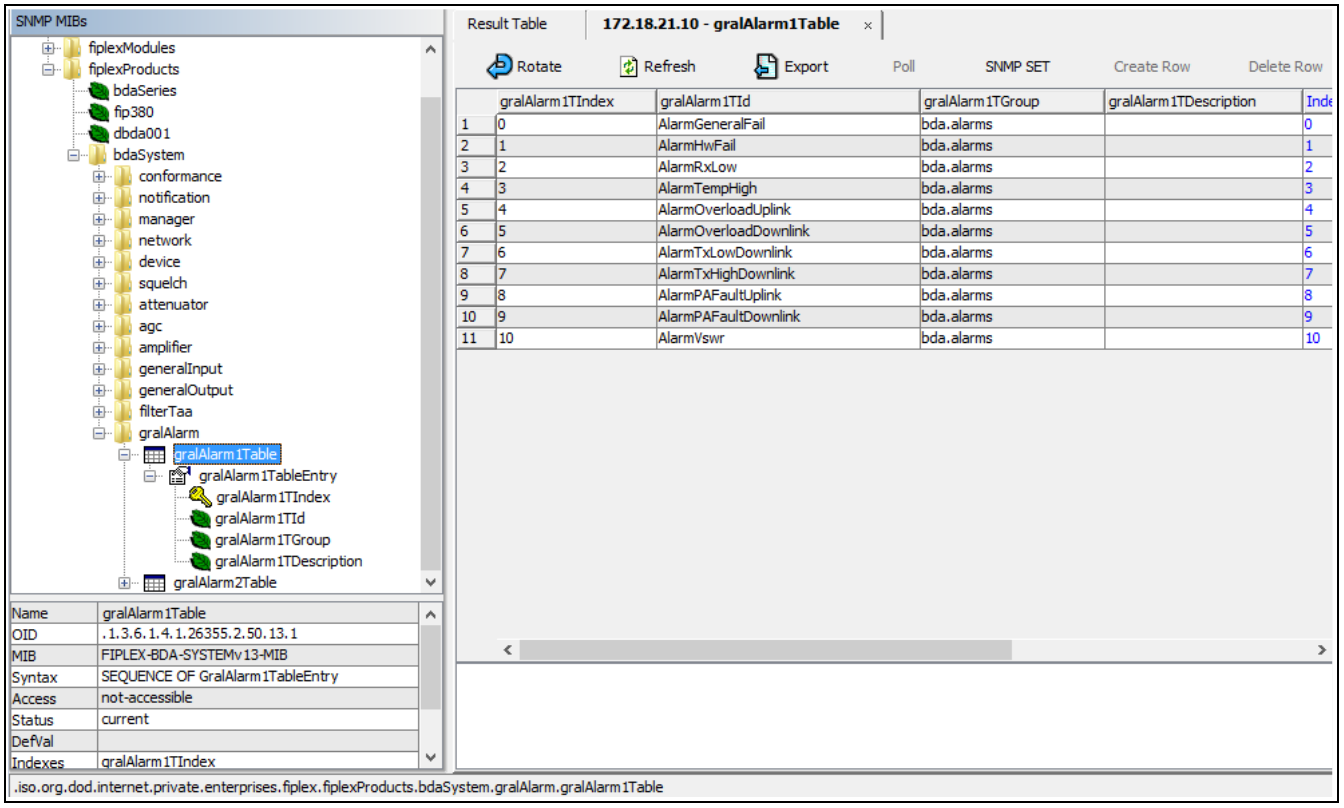
SNMP Alarm Group table

Field Name	OID	Description	Type

GralAlarm1TId[0]	1.3.6.1.4.1.26355.2.50.13.1.1.2.0	Descriptive identifier string	R/O
GralAlarm1TGroup[0]	1.3.6.1.4.1.26355.2.50.13.1.1.3.0	Conformance group for general alarms	R/O
GralAlarm1TDescription[0]	1.3.6.1.4.1.26355.2.50.13.1.1.4.0	-	R/O

The alarm identifiers available are the following ones:

- *AlarmGeneralFail* Board malfunction that cannot be determined.
- *AlarmHwFail* Digital signal processor failure.
- AlarmRxLow No input signal is detected in the downlink direction in any of the activated filters. Aside from a faulty part, as the donor antenna or RF cable, this also might be caused be a problem with the base station or frequency configuration. Notice also that signal detection is dependent on squelch threshold setting. Because of that, this is considered a warning instead of an alarm.
- *AlarmTempHigh* High device temperature (over 85ºC).
- *AlarmOverloadUplink* Excessive RF input signal in UL.
- *AlarmOverloadDownlink* Excessive RF input signal in DL.
- *AlarmTxLowDownlink* Detected RF output power much lower than expected. Since output power measurement is performed by the dedicated monitoring board, a fault in that board would make this item be set as *Unavailable* and *AlarmPAFaultDownlink* set to true.
- *AlarmTxHighDownlink* Excessive RF output power detected (3dB higher than rated). This is most likely due to bad gain settings, since AGC would limit output power otherwise.
- *AlarmPAFaultUplink* Uplink Power Amplifier failure. This alarm is available for certain amplifier types only, and for the rest an 'unavailable' status is set in the next table.
- *AlarmPAFaultDownlink* Downlink Power Amplifier failure. A communication failure with the dedicated monitoring board itself, throws this alarm, too.
- *AlarmVswr* RF mismatch of PA output is detected. Since VSWR measurement is performed by the dedicated monitoring board, a fault in that board would make this item be set as *Unavailable* and *AlarmPAFaultDownlink* set to true.



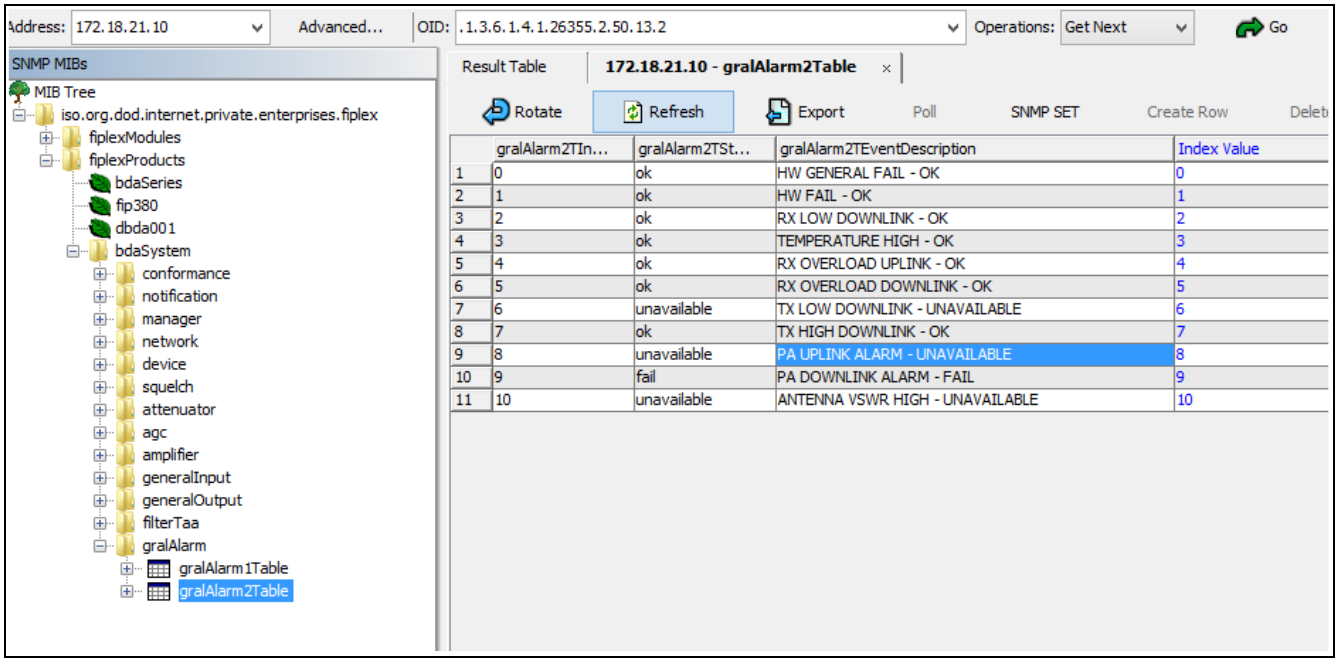
SNMP Alarms Group table

On the other hand, the mutable table *gralAlarm2Table* provides the actual status of each alarm. This table has one element for each element in *gralAlarm1Table*. Each element has two items. The first one is a status identifier, *gralAlarm2TStatus*, be it 'ok', 'warning', 'fail' or 'unavailable'. The second item is a short description of the fault, mainly for human readability.

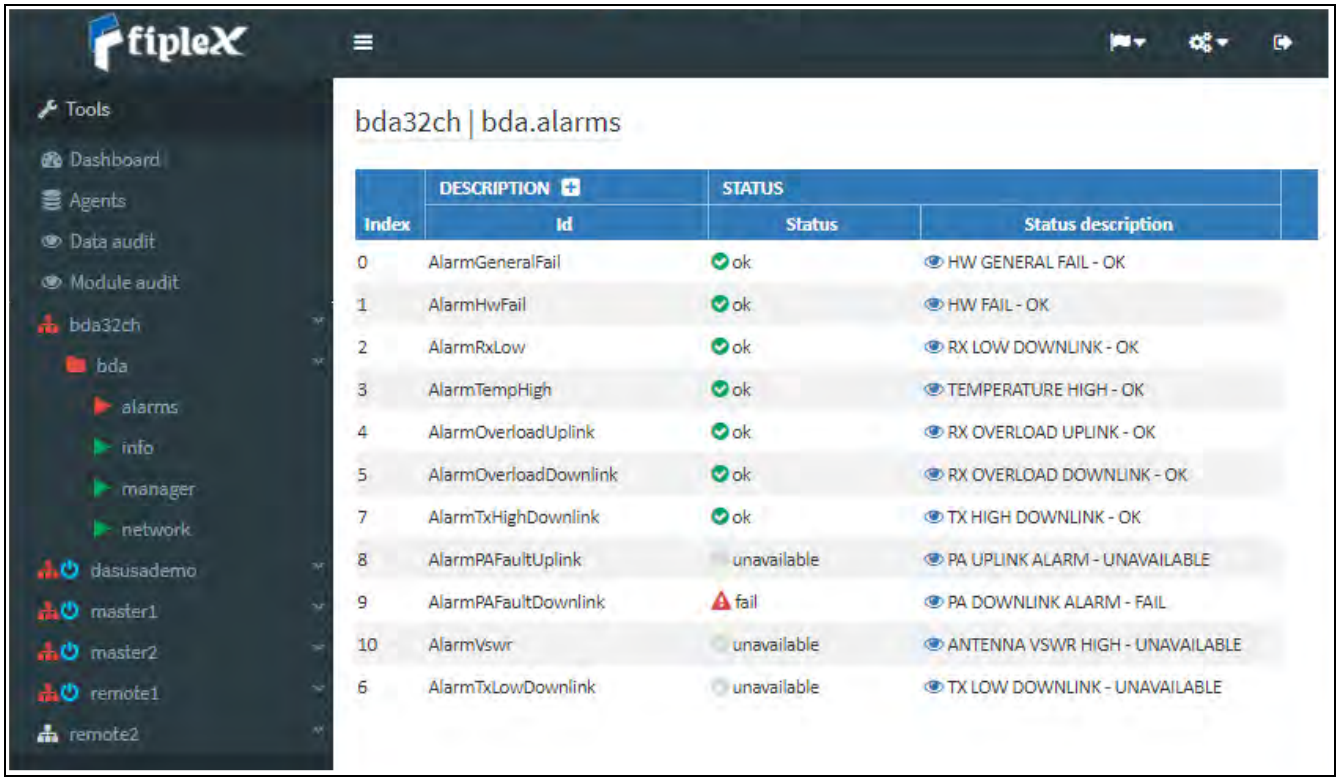
SNMP Alarm table 2

Field Name	**OID**	**Description**	**Type**
GralAlarm2TStatus[0]	1.3.6.1.4.1.26355.2.50.13.2.1.2.0	Status enumeration	R/O
GralAlarm2TEventDescription[0]	1.3.6.1.4.1.26355.2.50.13.2.1.3.0	Short descriptive string	R/O

The next picture is the MIB tree view of this table, and the Fiplex NMS provides a combined view of both tables and groups alarms:



SNMP Alarms table



NMS: SNMP Alarms table

SNMP Traps

General Explanation

For any event that may set or clear an alarm in the *gralAlarm2Table*, there is a SNMP trap that may be sent by the embedded SNMP agent to the manager, if enabled. Therefore, the list of traps closely reassembles the entries in the alarms table. Furthermore, there is also a keep-alive trap for letting the SNMP manager that the agent is working, in case that polling is not being done.

Each trap message has the following fields (except for the *keepAlive* trap, whose only object is the agent's IP address

- An identification number associated to the event being signaled.
- A severity indication number.
- A short string description for human readability.

The following list gathers all the available identifiers:

SNMP Trap descriptions and Enterprise Specific IDs

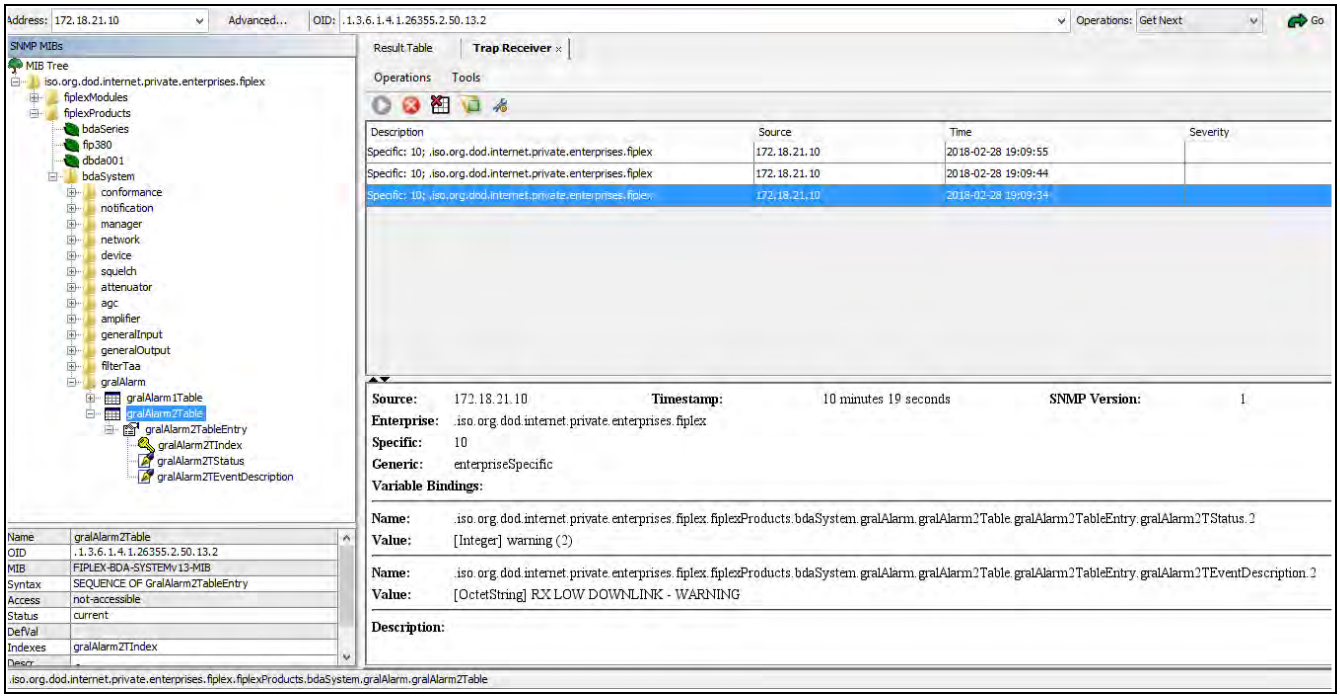
Source event	*Description*	*ID*
Keep-alive	System sends this trap periodically. Period is set with *Keep-Alive Period* setting of the trap manager. When this trap is thrown, the trap counter is not incremented. It is always in *cleared* state.	3
General Failure	This trap indicates that the board controller is not responding to the remote supervision system.	5
Hardware Failure	This trap indicates malfunction related the Digital Signal Processor.	6
Rx Input Low DL	Downlink input signal is not detected in any active filters.	10
Temperature	Internal repeater temperature exceeds +85ºC.	11
Rx Overload UL	Uplink RF input level overload	20
Rx Overload DL	Downlink RF input level overload	21
Tx Low DL	Detected Downlink RF output power is lower than expected.	30
Tx High DL	Downlink RF output power too high	31
PA Fault UL	Alarm for the UL Power Amplifier if available.	40
PA Fault DL	Alarm for the DL Power Amplifier. It may be caused by communication error with PA monitoring module.	41
VSWR	Excessive DL output reflected power: antenna mismatch.	50

As it turns out from this list, there is a one-to-one relationship between events triggering traps and their notification identifiers. But the trap identifier does not tell whether the event was to trigger the alarm state or to cancel it. That is the purpose of the severity identification number in the trap message. The following table lists the severity numbers used:

SNMP Trap status binding

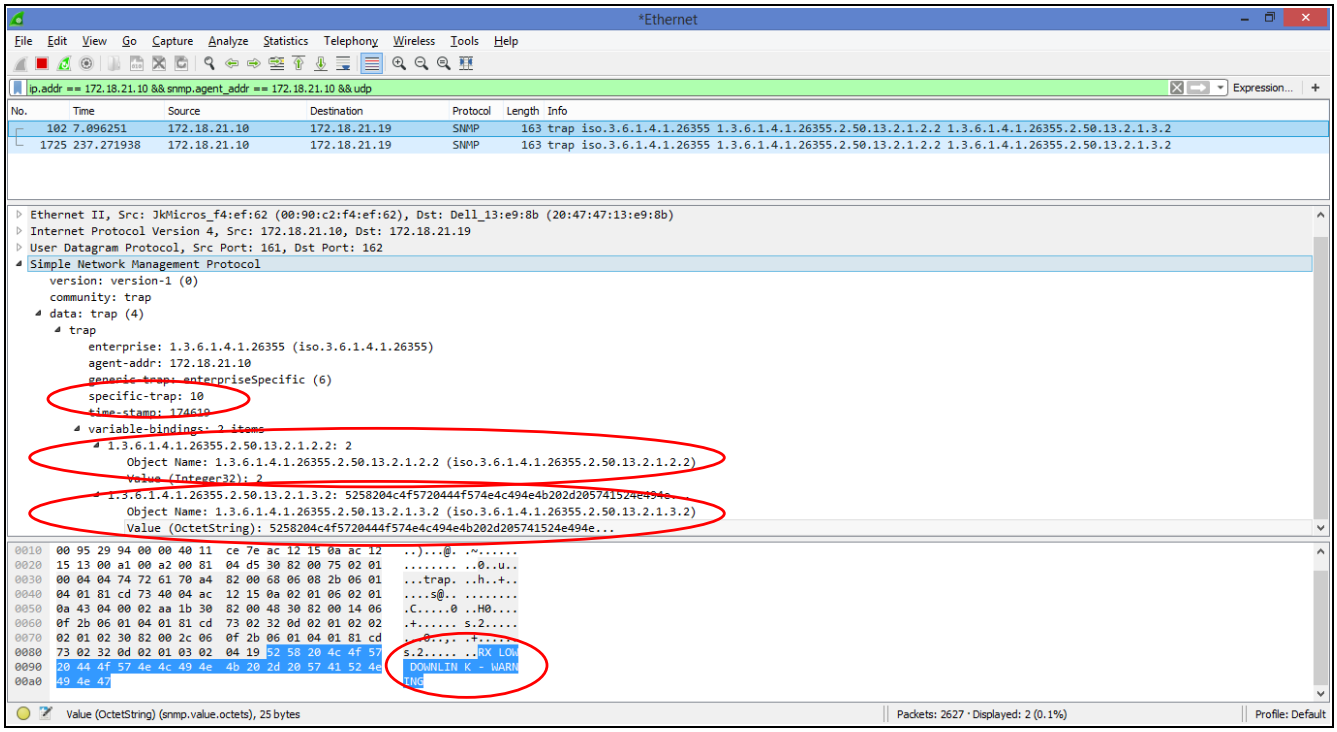
Severity	*Description*	*StatusID*	*Trap status binding*	*Binding string*
CRITICAL	System malfunction comes into effect	1	3	fail
WARNING	System warning comes into effect.	4	2	warning
CLEARED	System malfunction or warning is canceled.	5	1	ok
UNAVAILABLE	System state cannot be determined	6	99	unavailable

The character string attached to each trap message includes both a short event description plus a severity description such as “OK” or “FAIL”. As an example, the following picture shows a snapshot of a trap receiver getting traps from a unit at address 172.18.21.10. The *time-stamp* shows time since system boot and SNMP Version is '1'. The severity is set to 'warning'.



SNMP Trap in trap receiver

Example trap capture



SNMP Trap capture

Trap data explained:

Enterprise: .1.3.6.1.4.1.26355 (Fiplex Inc.)

BDA System MIB: .1.3.6.1.4.1.26355.2.50 (applicable to BDA system)

Enterprise specific trap number: 10 (meaning '*Rx Input Low DL*' according to the table of trap identifiers).

Trap Bindings

1) **gralAlarm2TStatus**. Value: 2 (see table below)

2) **gralAlarm2TEventDescription**: Value: "RX LOW DOWNLINK - WARNING"

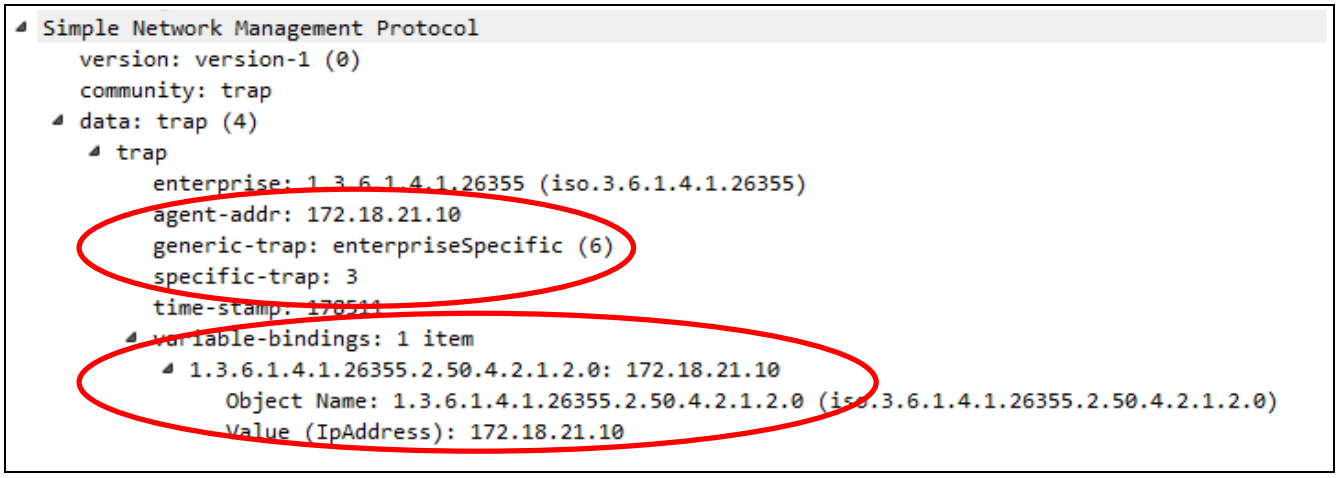
The first binding in the trap is the *gralAlarm2TStatus* of *gralAlarm2T* table in the MIB:

```
gralAlarm2TStatus OBJECT-TYPE
        SYNTAX INTEGER { ok(1), warning(2), fail(3), unavailable(99) }
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION
        "-"
```

::= { gralAlarm2TableEntry 2 }

and its equivalence to the trap severity is explained in the table shown in previous section.

The second binding is the string used to be human-readable. The only different type of trap is the keep-alive one, which as an example is shown in next picture:



SNMP Keep-alive trap capture

and its only binding is the *net2TIp* part of the *net2Table* in the MIB

net2TIp OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"-"
::= { net2TableEntry 2}

List of traps

The following table lists all bindings in each trap for convenience:

SNMP Trap list

Source event	*Specific Trap ID*	*Bindings*	*Value*
Keep-alive	3	1.3.6.1.4.1.26355.2.50.4.2.1.2.0	Ip Address

Source event	*Specific Trap ID*	*Bindings*	*Value*
General Failure	5	1.3.6.1.4.1.26355.2.50.13.2.1.2.0	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.0	String
Hardware Failure	6	1.3.6.1.4.1.26355.2.50.13.2.1.2.1	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.1	String
Rx Input Low DL	10	1.3.6.1.4.1.26355.2.50.13.2.1.2.2	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.2	String
Temperature	11	1.3.6.1.4.1.26355.2.50.13.2.1.2.3	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.3	String
Rx Overload UL	20	1.3.6.1.4.1.26355.2.50.13.2.1.2.4	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.4	String
Rx Overload DL	21	1.3.6.1.4.1.26355.2.50.13.2.1.2.5	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.5	String
Tx Low DL	30	1.3.6.1.4.1.26355.2.50.13.2.1.2.6	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.6	String
Tx High DL	31	1.3.6.1.4.1.26355.2.50.13.2.1.2.7	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.7	String
PA Fault UL	40	1.3.6.1.4.1.26355.2.50.13.2.1.2.8	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.8	String
PA Fault DL	41	1.3.6.1.4.1.26355.2.50.13.2.1.2.9	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.9	String
VSWR	50	1.3.6.1.4.1.26355.2.50.13.2.1.2.10	{1, 2, 3, 99}
		1.3.6.1.4.1.26355.2.50.13.2.1.3.10	String

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