fipleX®

DH1 Series - Digital Signal Booster
User & Installation Manual
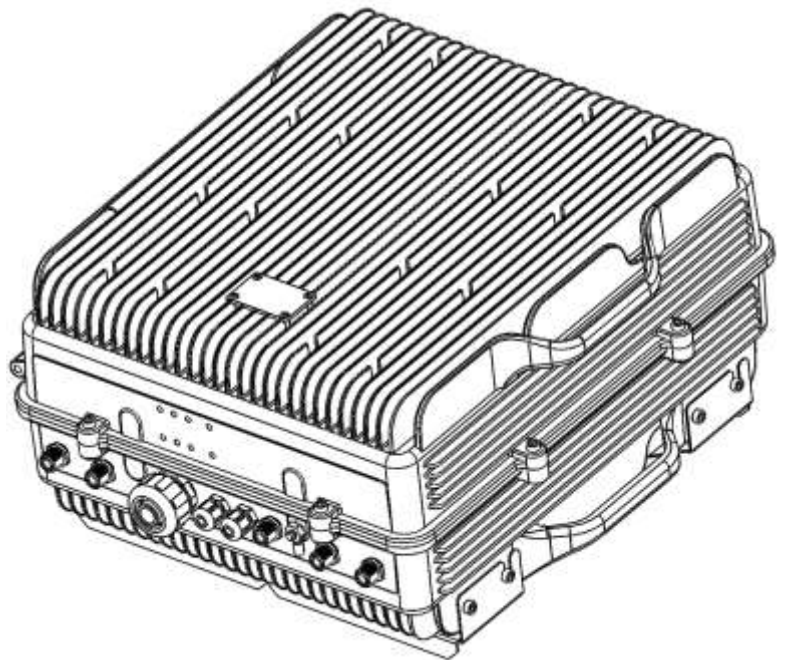
Document History

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

About this manual

This manual describes installation, commissioning, operation and maintenance of Fiplex **DH1 Series 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.

Contents

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 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
OMS	Operation and Maintenance System
OL	Overload
PA	Power Amplifier
PCN	Personal Communication Network (same as DCS)
PCS	Personal Communication System
PS	Power Supply
RF	Radio Frequency
RSSI	Received Signal Strength Indication
SW	Software
UL	Uplink signal direction (from mobile station via Signal Booster to base station)
WEEE	Waste of Electric and Electronic Equipment

Part 1 HARDWARE

1.   Safety

Dangerous Voltage Warning

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

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

Any Signal Booster, including this Signal Booster, 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 and the Signal Booster antennas.

Radiation Hazard Warning

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, 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, if not handled carefully.
Parts on the printed circuit boards as well as other parts in the Signal Booster 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 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 +24dBm, therefore the gain of the DL antenna should be of 0dBi or less and maintain a minimum separation of 25 cm from all persons, and the gain of the UL antenna should be 10dBi or less and maintain a minimum separation of 55 cm from all persons.

IC Compliance

As per RSS 131 Issue 2:

- Nominal passband gain: 80dB max
- Nominal bandwidth: 2MHz maximum
- Rated mean output power: +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 radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Heath Canada's website at www.hc-sc.gc.ca/rpb"

The antenna/s used for this transmitter must be installed to provide a separation of at least 25 cm in DL and 55 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: 2MHz maximum*
- *Puissance nominale de sortie moyenne: +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 25 cm dans DL et 55 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.

2.   Product Description.

The DH1 Signal Booster Series are FPGA based Digital Channel Selective signal boosters that operates in the downlink frequency of 150 - 174MHz and in the uplink frequency of 150 - 174MHz for United States and Canada.

This Signal boosters extends the radio coverage into areas inside the Base Station range where propagation losses prevent reliable communication.

The system receives the DL signal though a Donor antenna to be amplified, filtered and re-radiated through the Service antennas. The UL signal is received by the Service antennas to be amplified, filtered and re-radiated through the Donor antenna back to the Base Station. This way, the system works as a Bidirectional Amplifier.

This signal booster is capable of handling 12 carriers in uplink and 12 carrier in downlink. The center frequency of each one of the 12 filters can be tuned via a software interface.
The intermediate filtering of this equipment is performed by using FPGA based Digital Signal Processing that, among many, has the following features:

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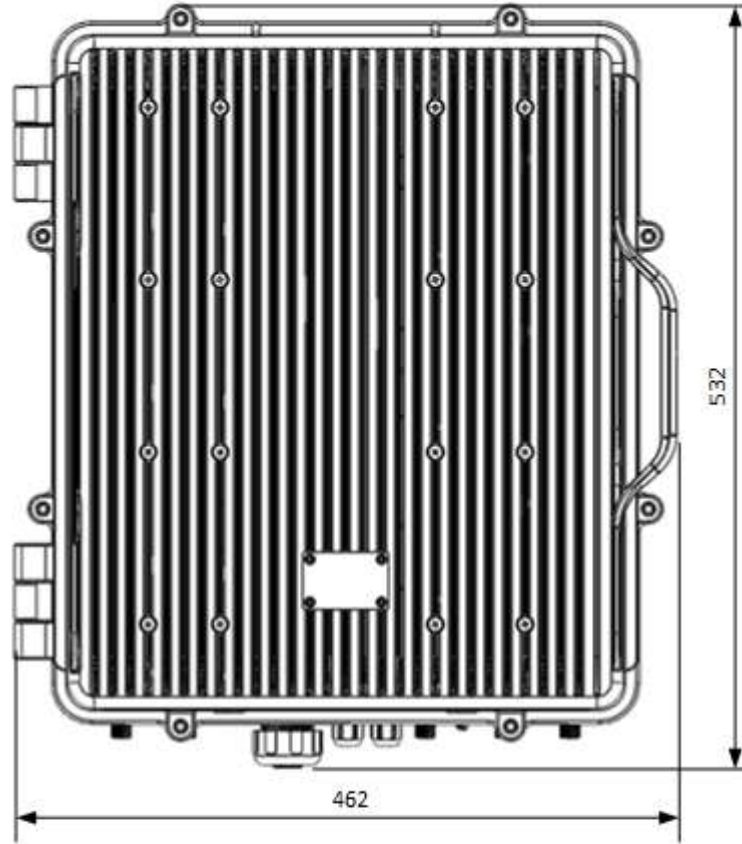- Integrated Spectrum Analyzer.

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

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

2.1. Product Parts.
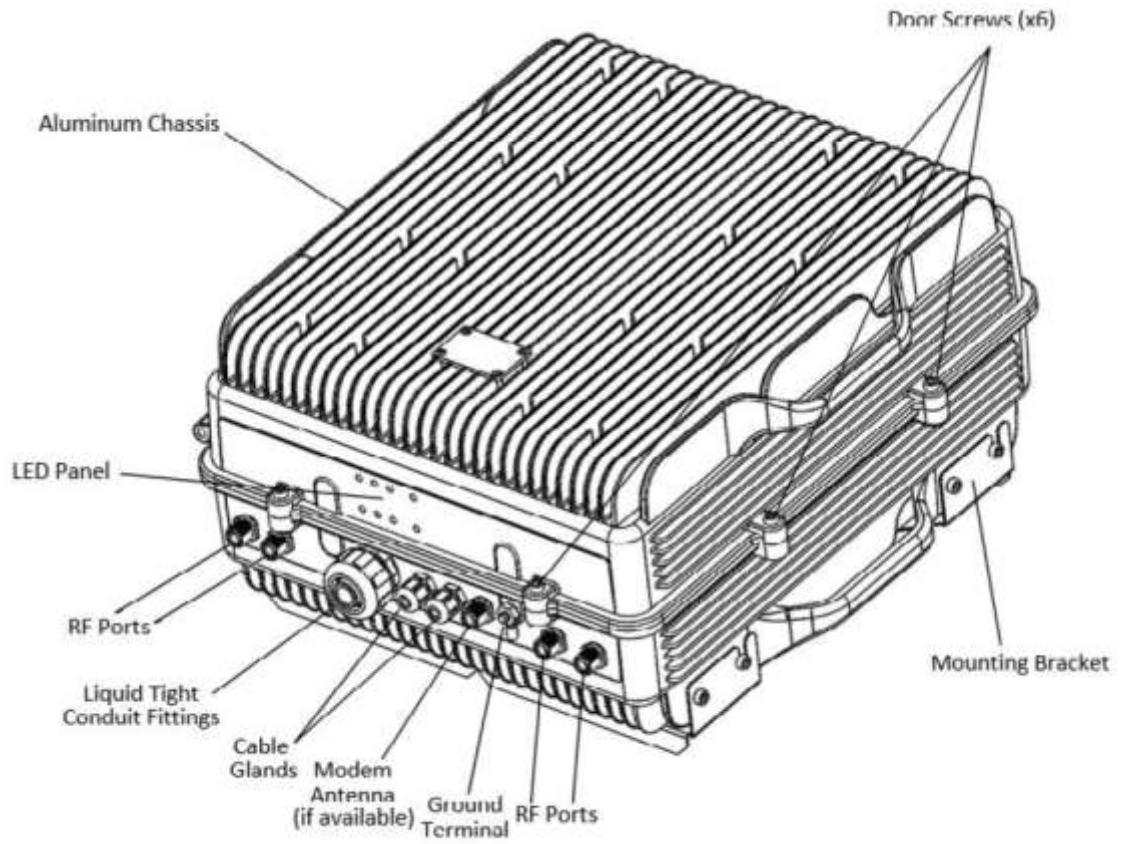
2.2. Dimensions
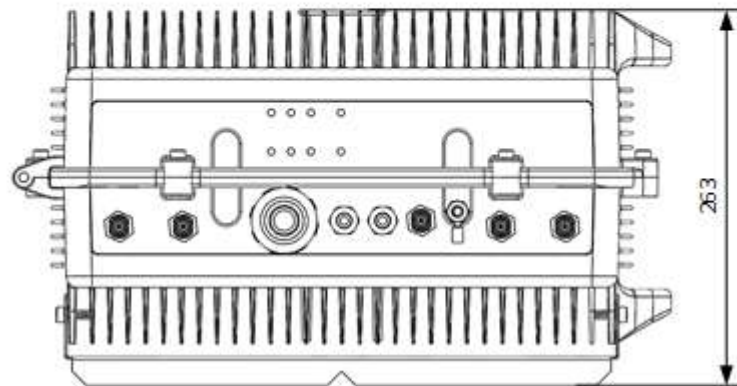
3.   Installation

Mounting the Signal Booster

Fiplex DH7 Signal Booster is 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 Digital Signal Booster on a site with shelter from direct exposure to sun, rain, snow and hailing.

It is not recommended to operate the Signal Booster 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

1. Mount the bracket
The Signal Booster can be mounted on a wall or pole. These mounting cases are shown below in Figure 1 and Figure 2. The bracket is provided with the Signal Booster.
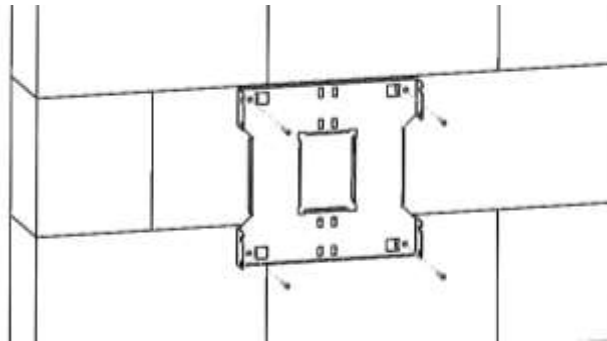
Figure 1

Figure 1 shows a bracket attachment to a wall using three fixing screws.
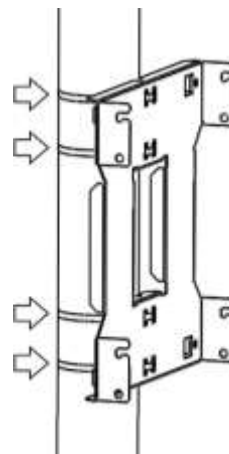
Figure 2

Figure 2 shows a bracket attachment to a pipe using four inox hose clamps (provided with bracket).

2. After attaching the bracket hang the Signal Booster as shown in Figure 3.
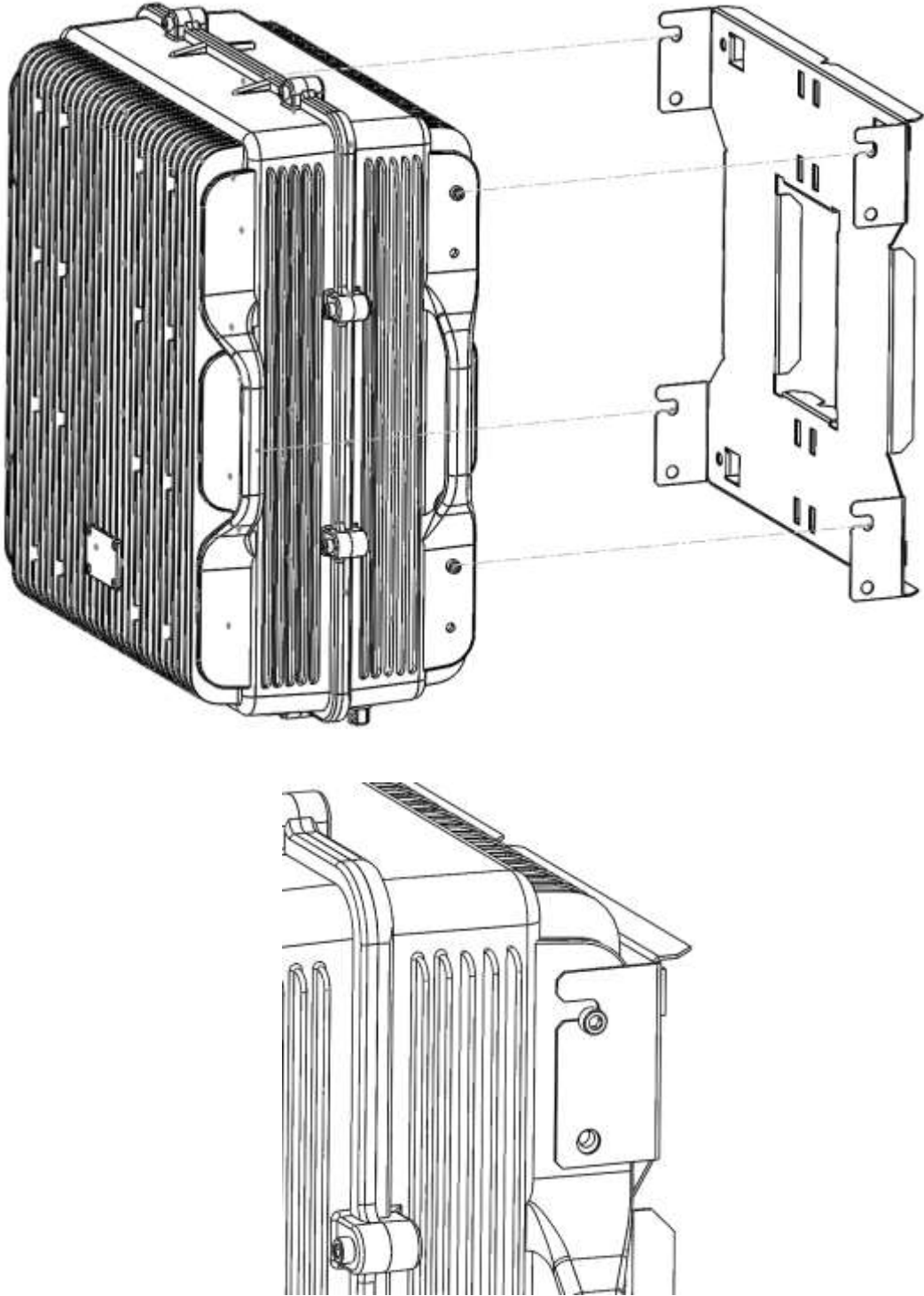
Figure 3

3. Secure the cabinet to the bracket as shown in Figure 4. To attach the Signal Booster's cabinet to the bracket use the provided four M6 x 1/2" allen screws.
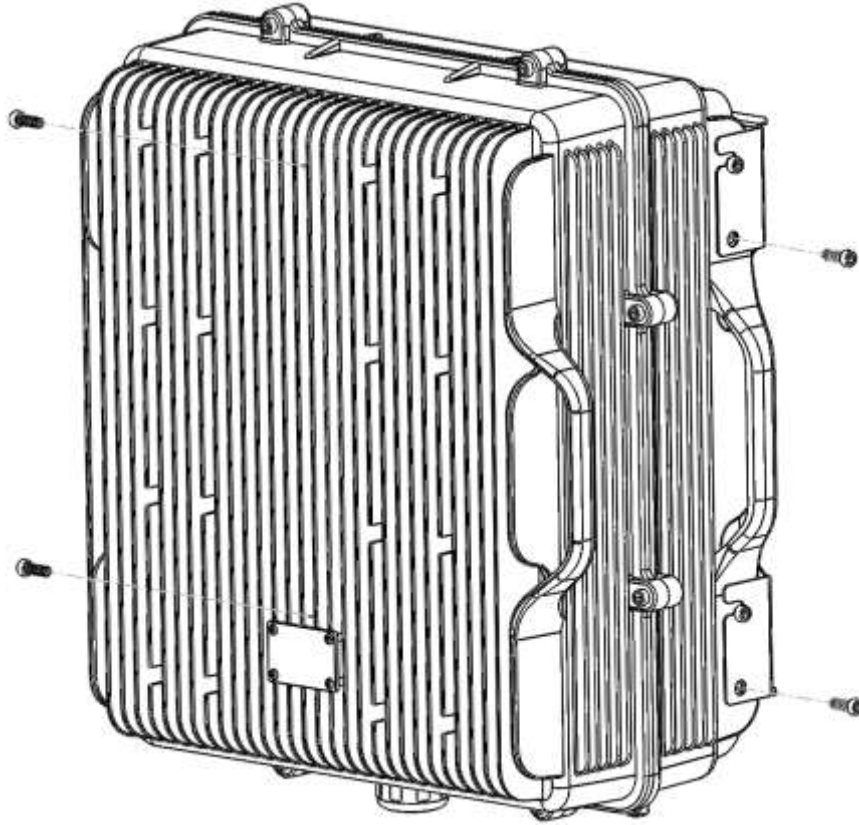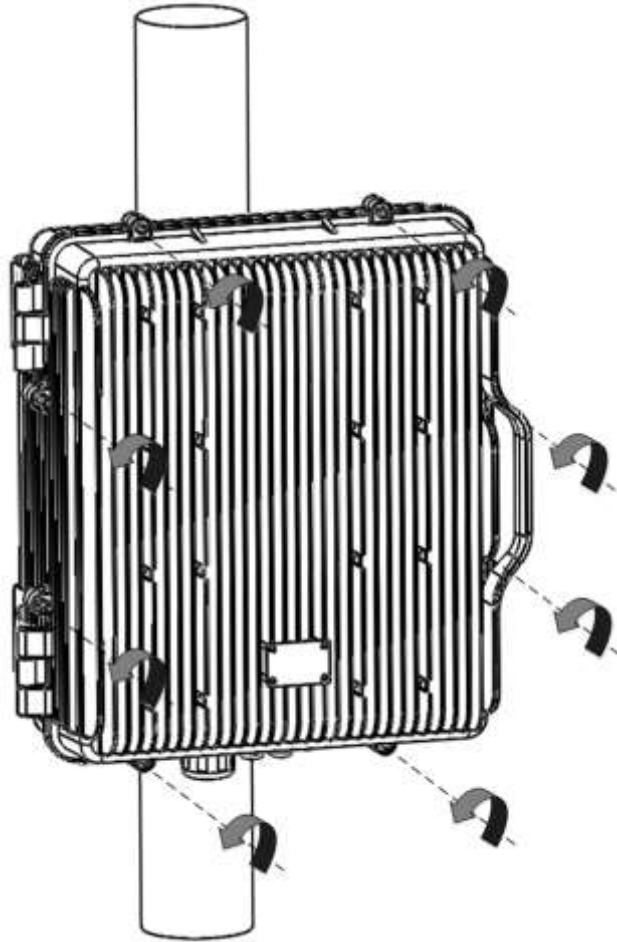

Figure 4

Opening and Closing the Cabinet

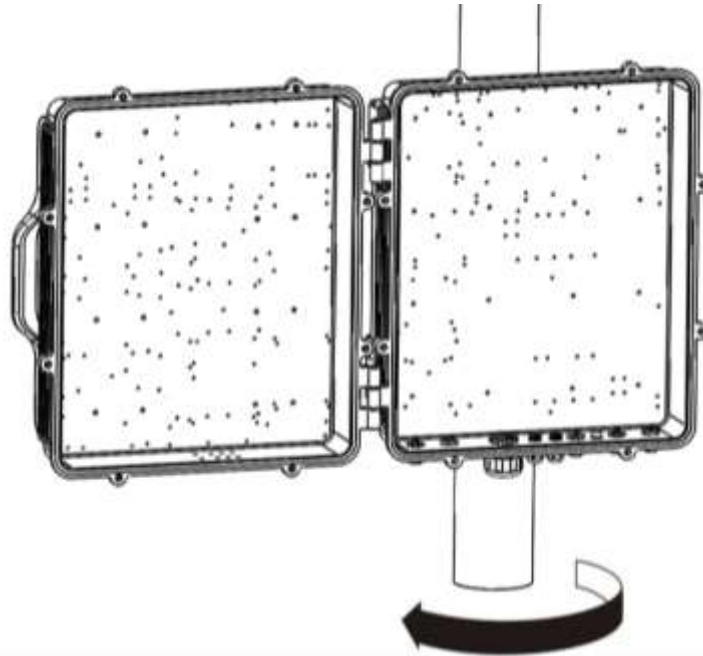To open the cabinet, release the 8 door screws indicated in figure 5 using the provided special allen key.
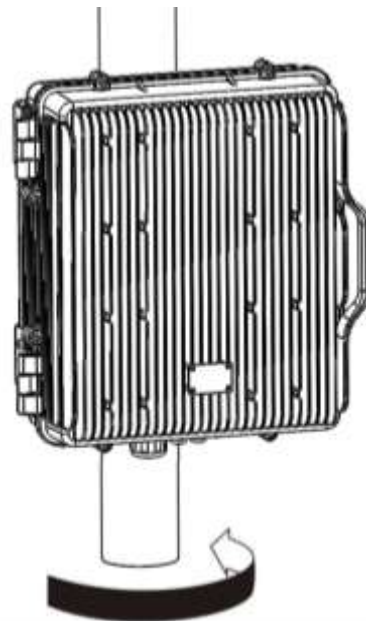
A - Release Signal Booster cover.
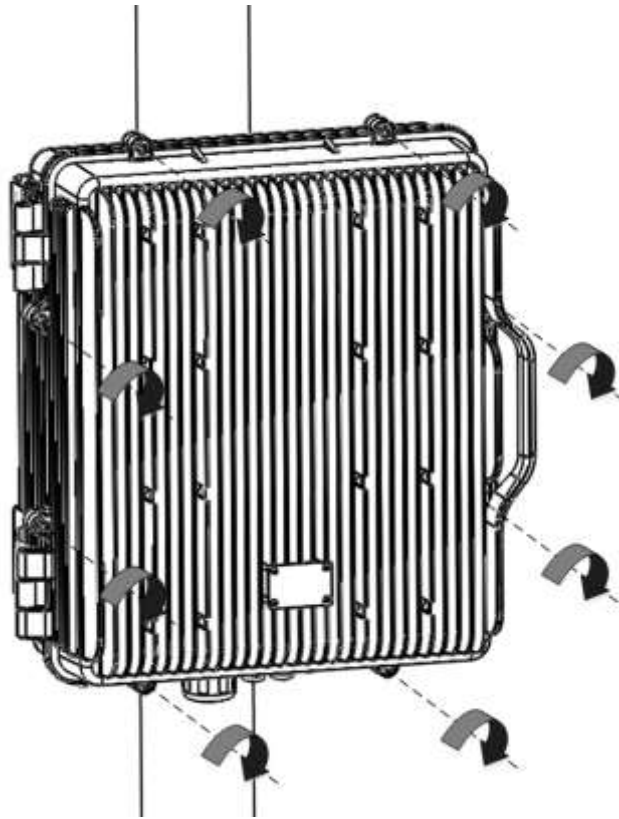
Figure 5

Use the special allen key N°6

B - Open the Signal Booster cover.

Figure 6

C – Close the Signal Booster cover.

Figure 7

D - Secure Signal Booster cover.

Figure 8

Use of Liquid Tight Counduit

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.
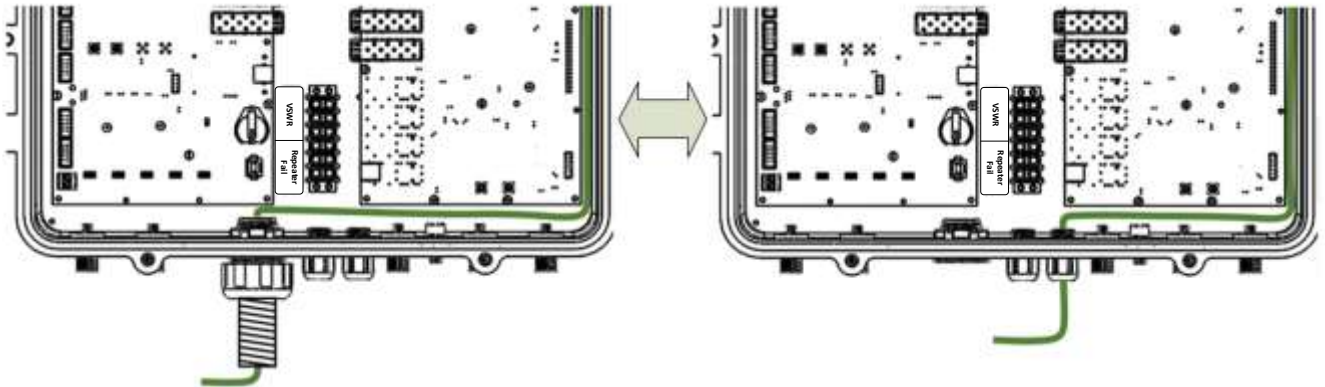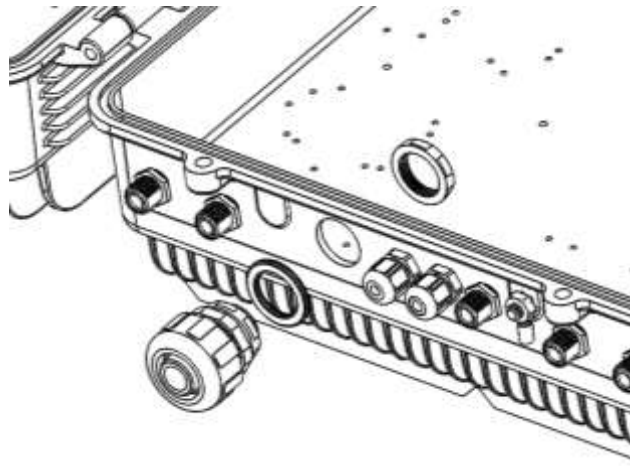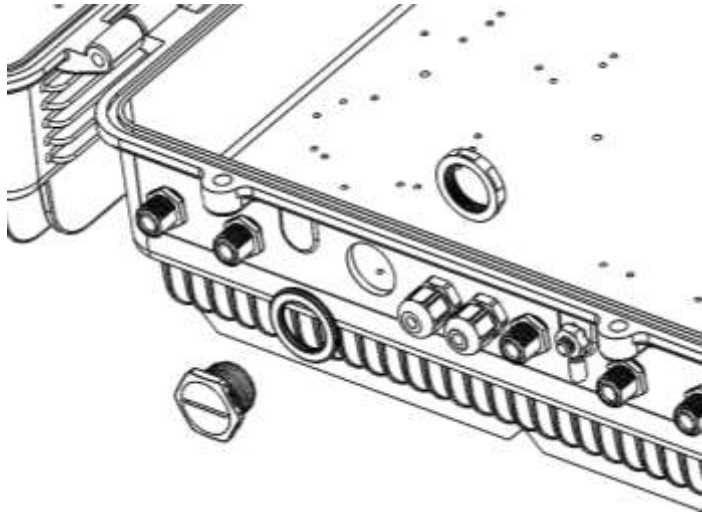

Figure 9; AC Routing through cable gland or conduit connector

If the is not going to use Liquid Tight Conduits, then the connector should be replaced by the provided sealing cup as indicated in Figure 10.

A - Remove the conduit connector

B – Install the sealing cup

Figure 10; Replacement of Conduit connector to sealing cup

4. Commissioning
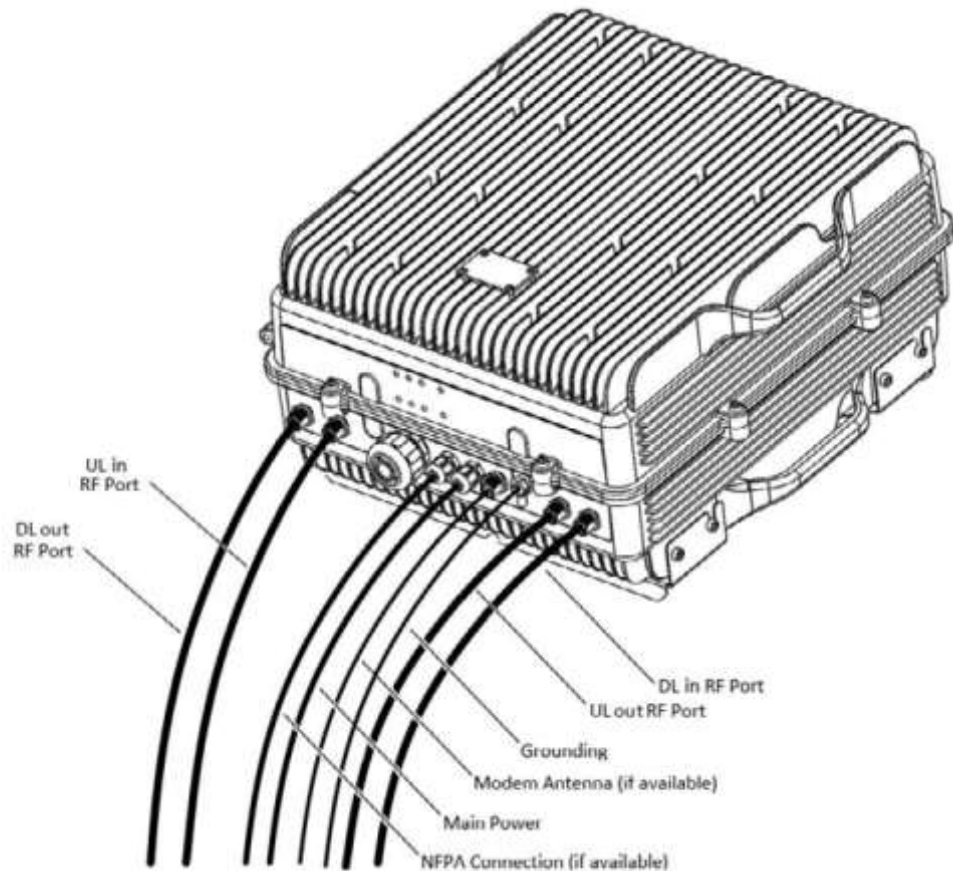
4.1. Connection step by step

Figure 11

Figure 11; RF ports and Power Cable Glands location.

1. Connect service antennas to the To Mobile Port. N type female connectors are used in the Signal Booster.

2. Connect the donor antenna to the To Base RF Port. N type female connectors are used in the Signal Booster.

3. 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.
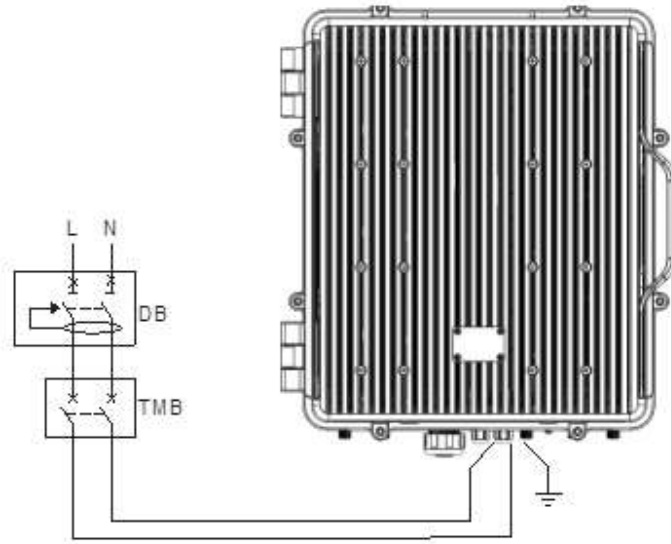
Figure 12

4. If the Signal Booster has the NFPA Option, there is a dedicated cable gland for this purpose ("NFPA" in figure 11). A multi-conductor cable can be used to connect the NFPA dry contacts to the Fire Department Control Box.

Status of contacts (**Alarms Off**)

Pin 1 – 2 = VSWR (normally closed contact)
Pin 2 – 3 = VSWR (normally open contact)
Pin 4 – 5 = Repeater Fail (normally closed contact)
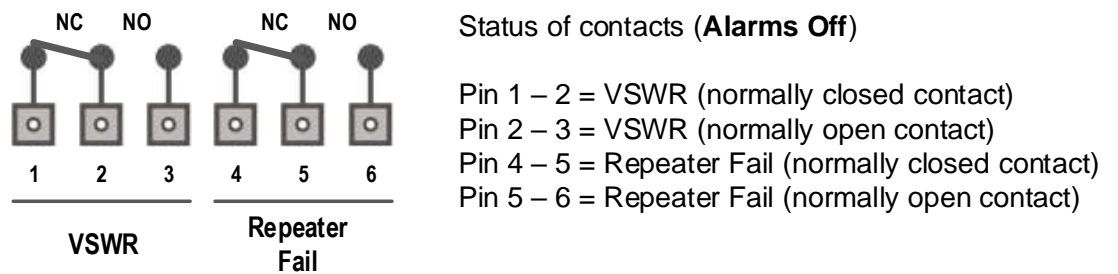Pin 5 – 6 = Repeater Fail (normally open contact)
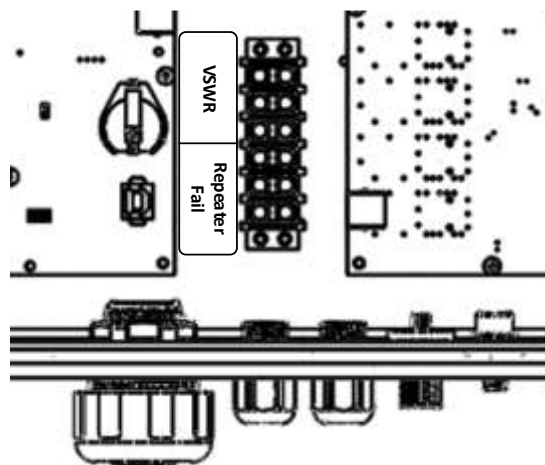
Figure 13; NFPA Dry Contact connection configuration

Figure 14; NFPA Dry Contact connection location inside the cabinet

5. 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.
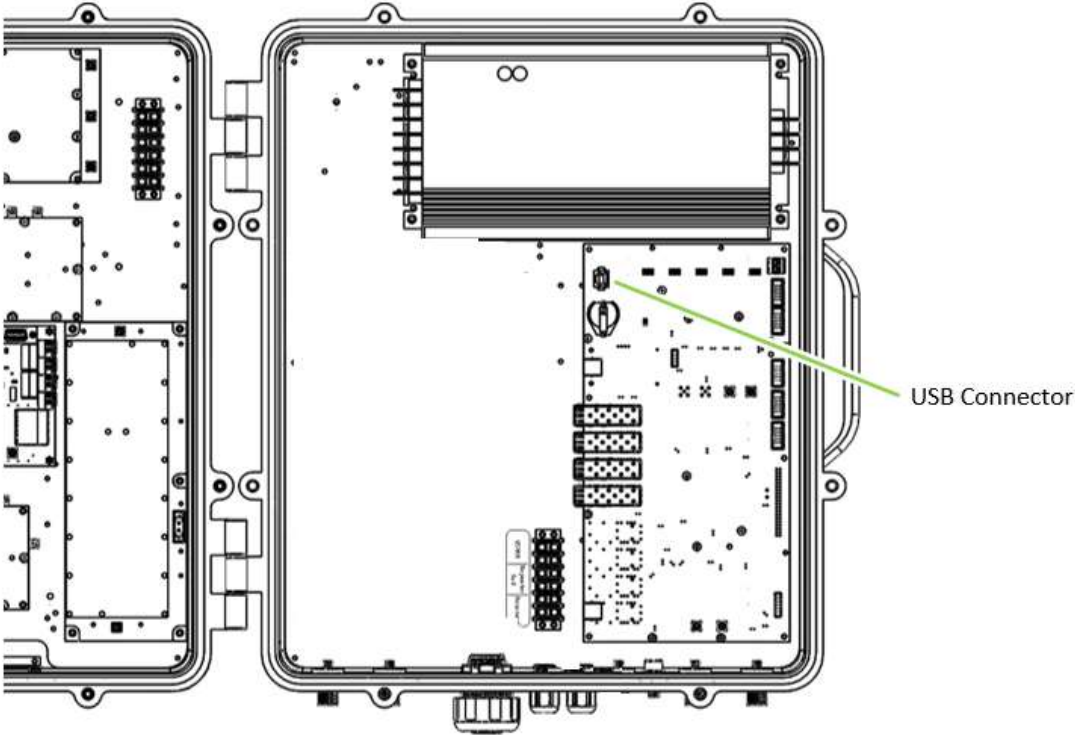

USB Connector

Figure 15; USB port location

5.   Starting Operation

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

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.


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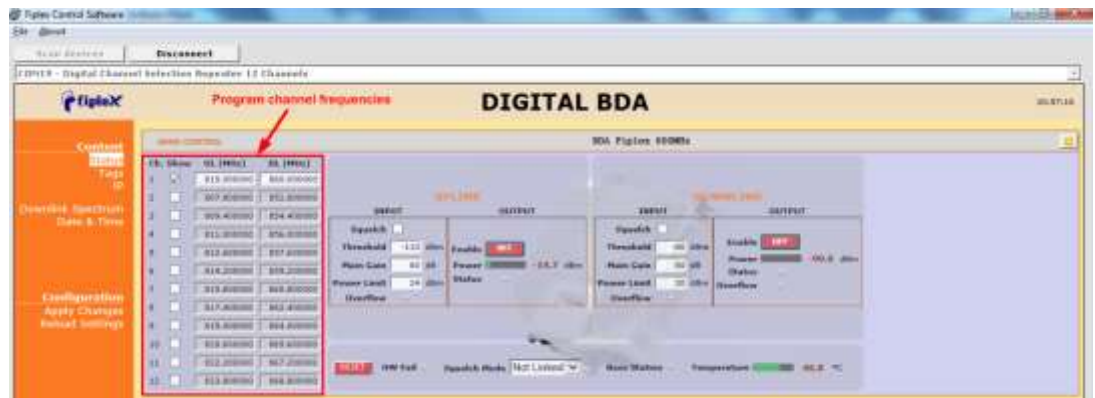

3. Turn on UL and DL power amplifiers, and check that any alarm indicator is active.

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 3 - 6dB 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.
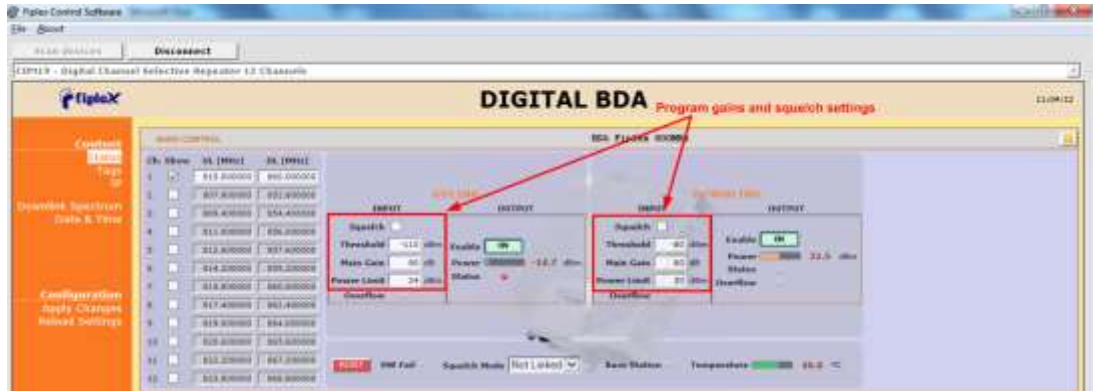

6. Setup desired filter bandwidth, depending on presence of adjacent channels. In principle, recommended bandwidth filter is 90KHz due to its low delay, but if adjacent signal is detected, narrow filters can be used. Spectrum analyzer of FCS can be used to know rejection to undesired signals. It is recommend that adjacent channels output power be, at least, 10dBc lower than useful carrier.
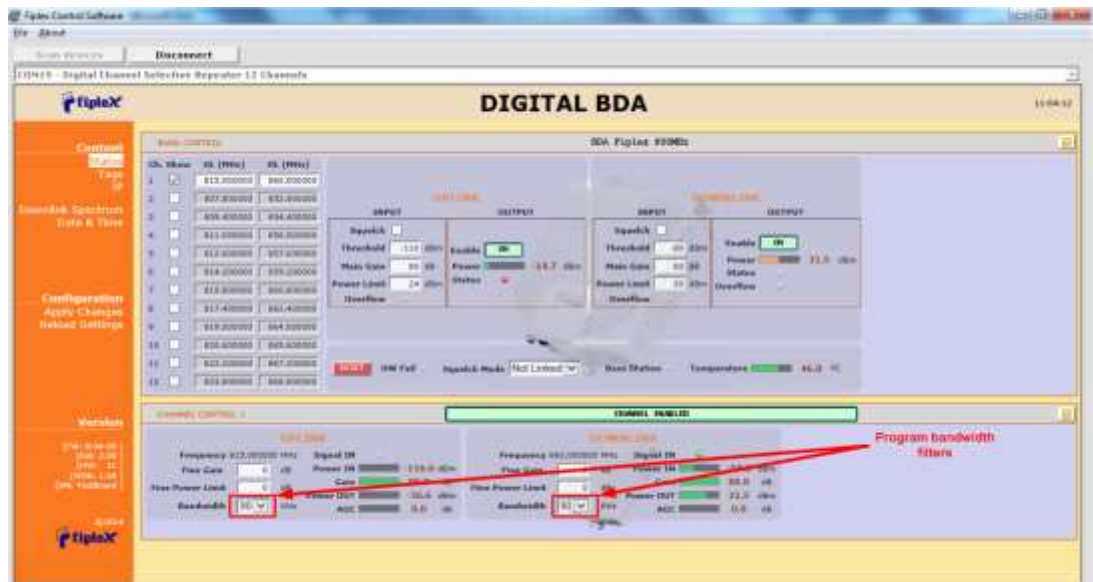
Next figures, shows how integrated spectrum analyzer can help to select bandwidth filters:
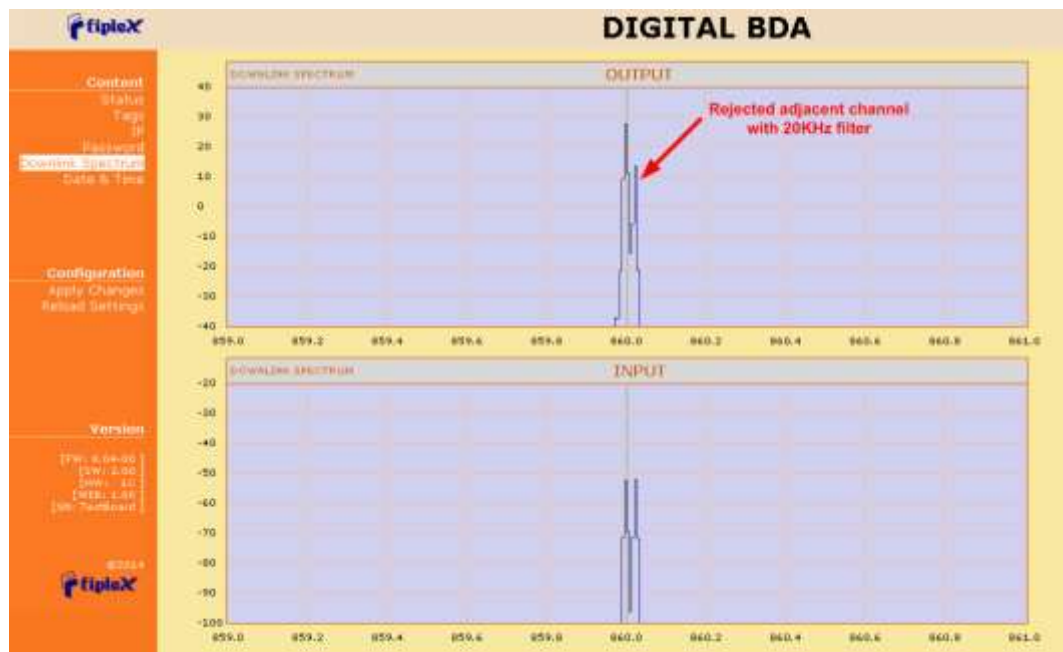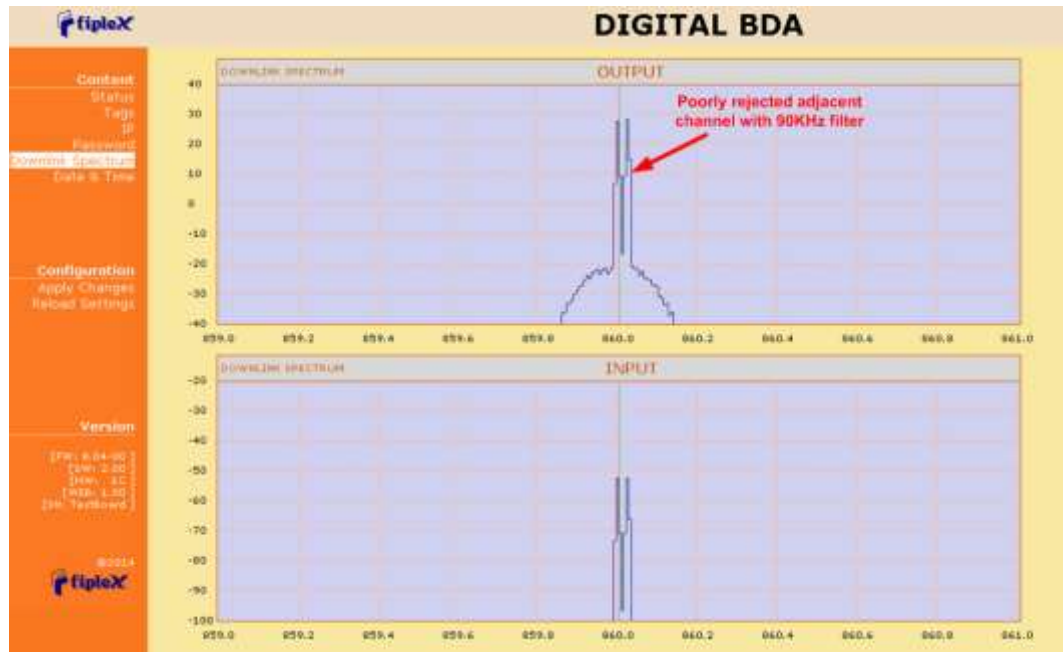
Status Indicators

There is an indicator panel located at bottom of the Signal Boosters door. 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". Table 1 describes alarm and warning conditions for each led state.

Table 1

Indicator Panel	LED indication description
PWR	Signal Booster is not powered or fail in power supply
PWR	Normal state: Signal Booster is powered on
STS	Normal state
STS	HW fail: digital signal processor is not detected Board Temperature: very high internal Signal Booster temperature
STS	Base Station Warning: No signal is detected coming from base station
UL	PA UL Status Alarm: alarm based on PA current consumption RF input overflow: maximum level at RF input is exceeded
UL	Normal state
DL	PA DL Status Alarm: alarm based on PA temperature PA DL Overflow: PA output level is higher than +40dBm RF input overflow: maximum level at RF input is exceeded
DL	PA DL Underflow: PA output level is lower than +25dBm
DL	Normal state
Where:	
	Led OFF
— —	Led slow blinking with period of 2 seconds aprox. WARNING
------	Led fast blinking with period of 0.5 seconds aprox. ALARM
——	Led ON

Laboratory Measurements

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.

Part 2 SOFTWARE

1.   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) are described.

2.   Local Software. Desktop application through USB port

2.1.   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…
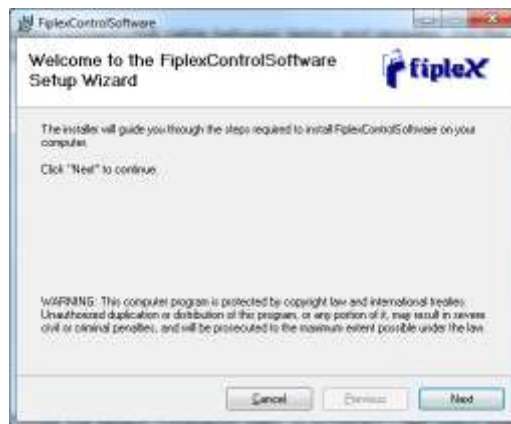
2. Choose the default installation path "C:\Program Files (x86)\FiplexControlSoftware". Note that this can change according to your system configuration (32bits or 64bits), language and Windows Version.

3. The installer will start to copy the necessary files.
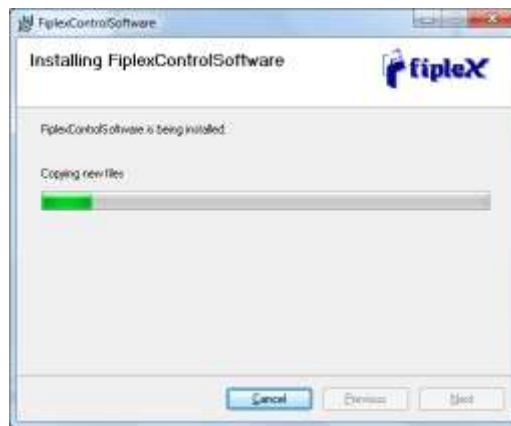
4. After installation has completed, a shortcut in user desktop will appear.
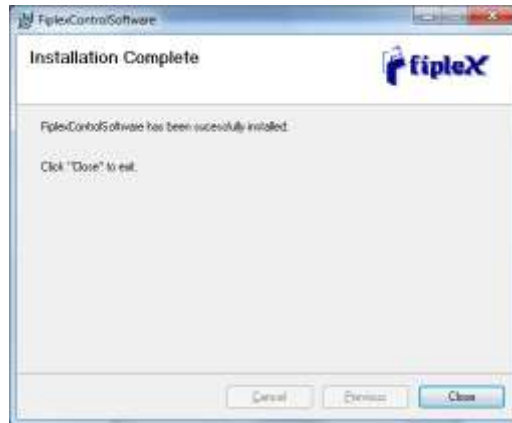
5. Connect USB cable between computer and Signal Booster, keeping the Signal Booster powered off. Usually, drivers will be automatically installed, but depending on Windows version, screen asking for drivers of new device can appear. Drivers can be found in application folder: C:\Program Files (x86)\FiplexControlSoftware\drivers".
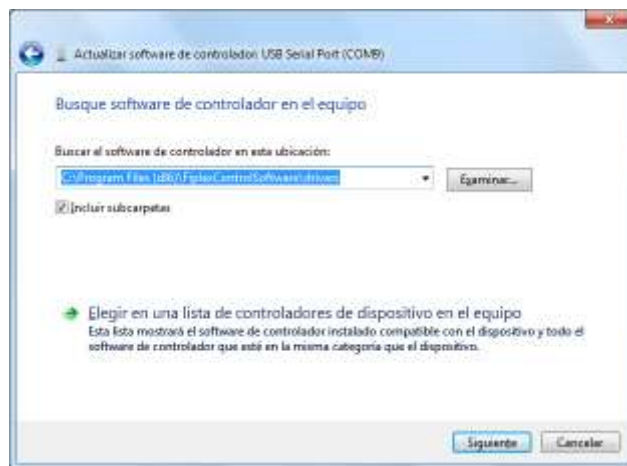
6. Turn on the Signal Booster

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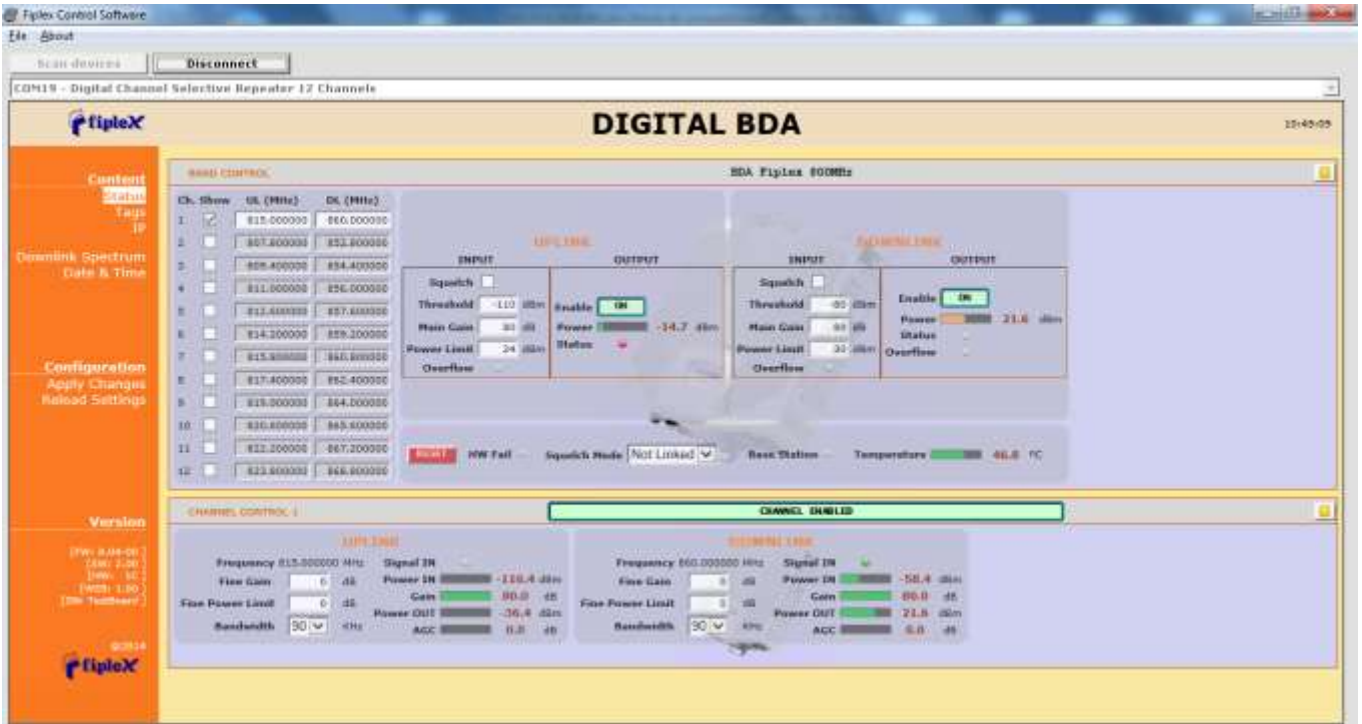
10. Once Signal Booster is configured, user can disconnect software using connection button, now labelled "Disconnect". Initial window will be shown.

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.

3.   Remote Web Server option

3.1.   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
Network submask	255.255.255.0
Gateway	192.168.1.2

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.

3.2.   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
Password	admin

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.
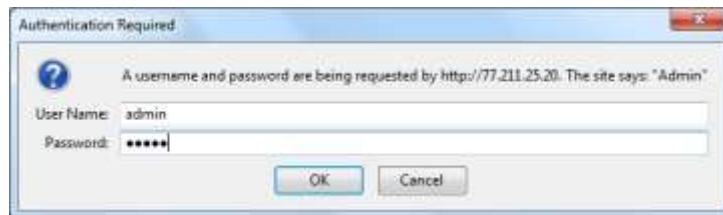
After authentication, web browser will load the main page of Fiplex Signal Booster showing RF configuration and monitoring parameters.
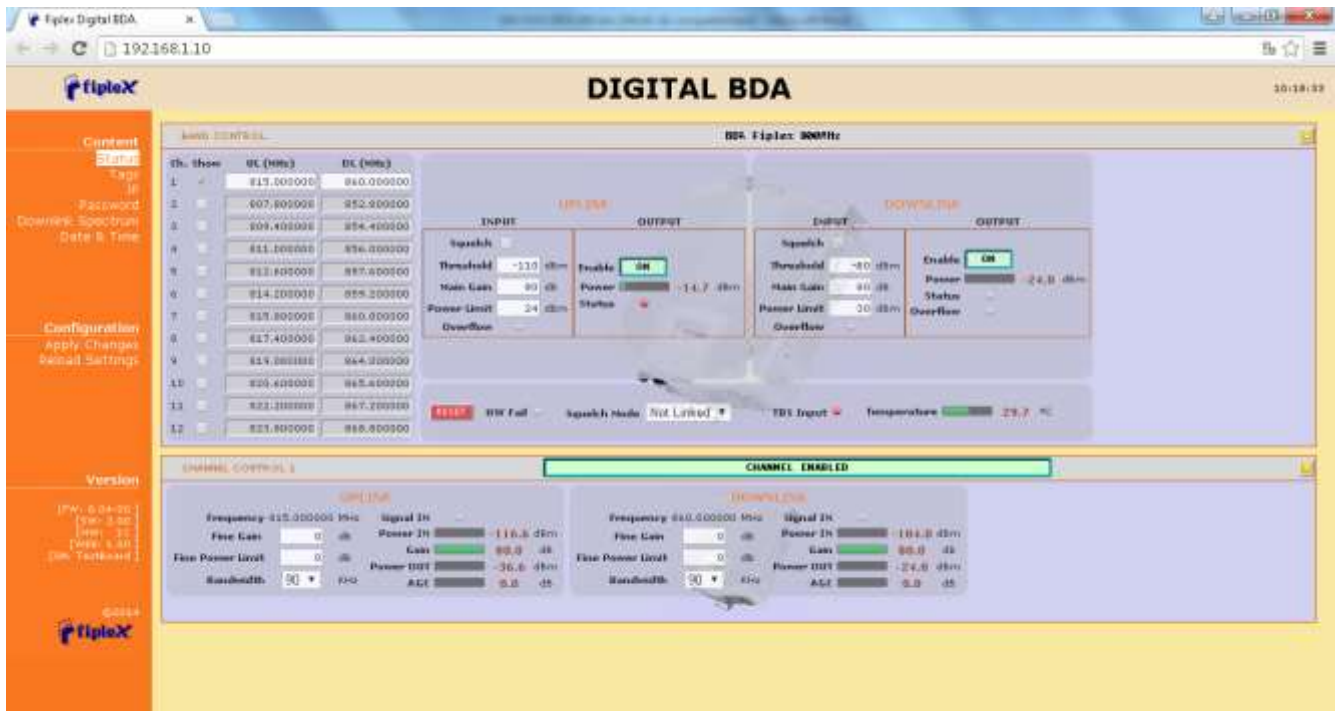
At left side of webpage, configuration menus are shown:
- Content

  - 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.

- Password: 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.

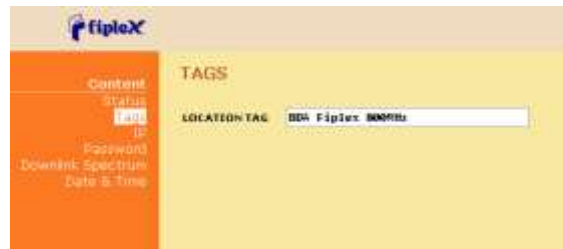- Downlink Spectrum: this page shows estimation for downlink input and output spectrum. Estimation for output spectrum takes into account RF input levels, and gain, bandwidth filters and squelch options programmed by the user, and it can be a useful tool for users to know how the undesired signals are rejected by the channel selective Signal Booster. Available spans are 1,2,3,4 and 5MHz. User can change start and stop frequency modifying text field placed at the page bottom
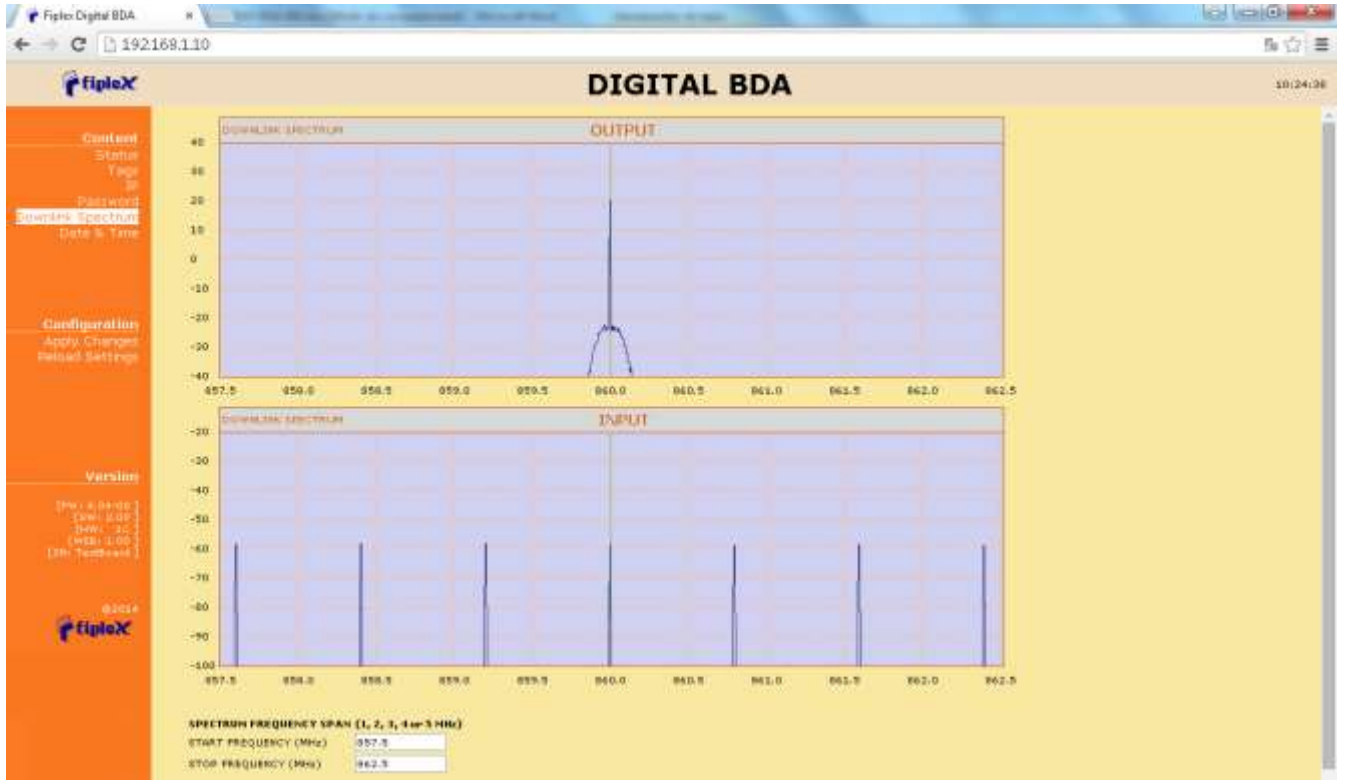
- Date and Time: page to modify real time clock. When the Signal Booster is not powered, this clock runs with a voltage supply provided by a 3V lithium battery, button type of 20mm (CR2032) with 220mA·h. This suffices for at least half year. When the Signal Booster is powered, no current is drained from 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.

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

It is required to reboot supervision system.
If OK reload this page after a while.

OK   Cancel

- 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:
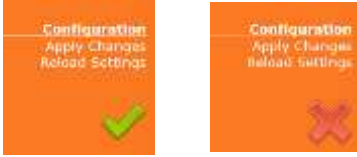
  - Reload Settings: clicking this link, Signal Booster configuration data is refreshed.
- Version: shows hardware, firmware and software versions of Signal Booster and serial number.

3.3. RF parameters description

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

The first frame called "CONTROL" is placed in top of webpage, showing general configuration of Signal Booster. Below this, some frames titled "CHANNEL 1", "CHANNEL 2"... . There is one for each active channel, and configuration and status information related to each channel can be viewed. Next figures show these frames:
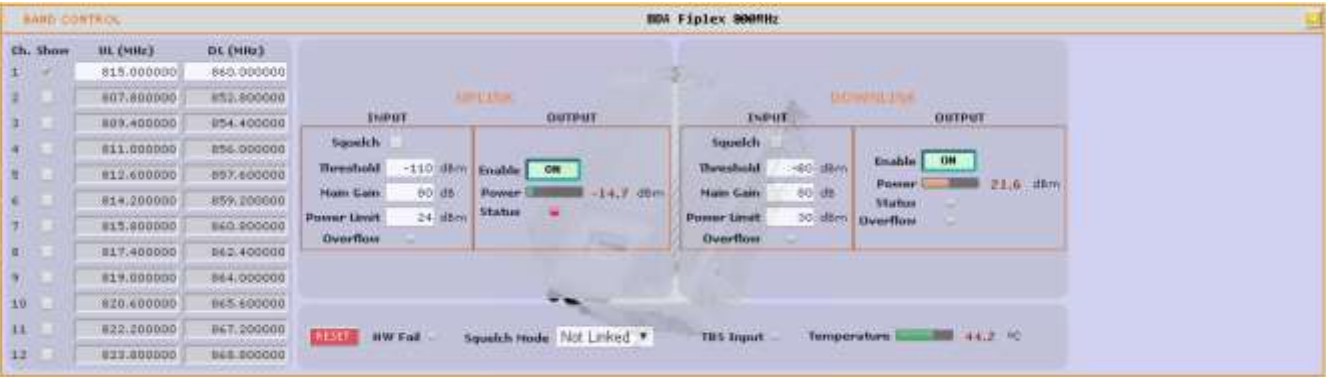
- General control frame. There are four sub-sections inside this frame:

- o Frequency control: this section contains fields to modify channel frequencies. Frequency resolution is 6.25KHz. User can change any channel frequency, taking into account that uplink and downlink frequencies are always separated 45MHz. Display check-boxes column are used to display each channel control frame, by default, only active channels will be displayed.

- o 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 overflow, PA status and stability alarms. Next table describes information of this frame:

Parameter	Range	Description
Gain control	60dB to 85dB	Set maximum gain of Signal Booster at UL band
Power limit control	+14dBm to +24dBm	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
Squelch enable control	Enabled / disabled	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 control	-110dBm to -70dBm	If squelch is enabled, input levels below this threshold are not transmitted.
PA enable control	On / off	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 indicator	---	Shows instantaneous RF output power at UL band
Input overflow alarm	---	This alarm indicates that Signal Booster is being overloaded at UL band, due to very high RF input level
PA status alarm	---	PA status alarm indication based on current consumption

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

Parameter	Range	Description
Gain control	60dB to 85dB	Set maximum gain of Signal Booster at DL band
Power limit control	+20dBm to +30dBm	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
Squelch enable control	Enabled / disabled	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 control	-80dBm to -40dBm	If squelch is enabled, input levels below this threshold are not transmitted.
PA enable control	On / off	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 indicator	---	Shows instantaneous RF output power at DL band
Input overflow alarm	Grey: normal state / Red: alarm state	This alarm indicates that Signal Booster is being overloaded at DL band, due to very high RF input level
PA status alarm	Grey: normal state / Red: alarm state	PA status alarm indication based on temperature
PA overflow	Grey: normal state / Red: alarm state	Alarm active if output level exceeds +40dBm
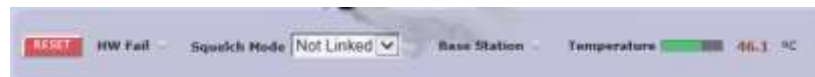
o General control

Parameter	Range	Description
Squelch mode control	Linked / not Linked	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
Temperature	---	Shows internal Signal Booster temperature
Base station alarm	Grey: normal state / Red: alarm state	Alarm is active, if signal is not detected in any DL channel
Hardware fail alarm	Grey: normal state / Red: alarm state	Indicates critical malfunctioning in digital signal processor

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

Parameter	Range	Description
Fine gain control	-10dB to 0dB	Each channel gain can be fine adjusted
Fine power limit control	-10dB to 0dB	Each channel maximum output power can be fine adjusted
Bandwidth filter control	90KHz, 45KHz, 30KHz, 20KHz and 15KHz	There are five available filters to adjust the trade-off between rejection to undesired signals and delay
RF input power indicator	---	Shows RF input level for each channel
RF output power indicator	---	Shows estimation for RF output level for each channels, according to programmed gain and AGC control
Gain indicator	---	Shows effective gain applied to each channel. This value is programmed gain minus the gain reduction due to AGC
AGC indicator	---	Indicates gain reduction due to power limitation control.
Signal detection indicator	Grey: no signal is detected / Green: signal detected	With this indicator, system shows if signal is detected at input, according to squelch threshold