	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*

9 Software

9.1 Introduction

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

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

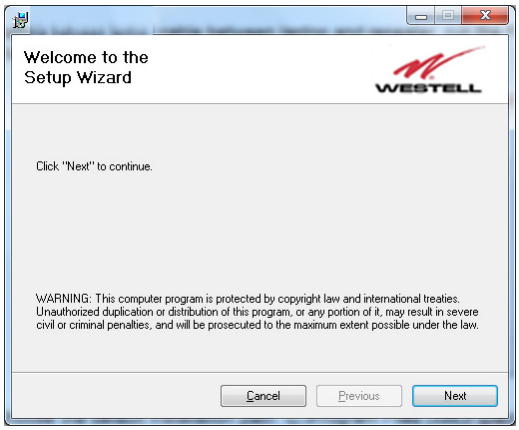
In following section, each control mode (configuration / monitoring) is described.

9.2 Local Software. Desktop application through Ethernet/USB port

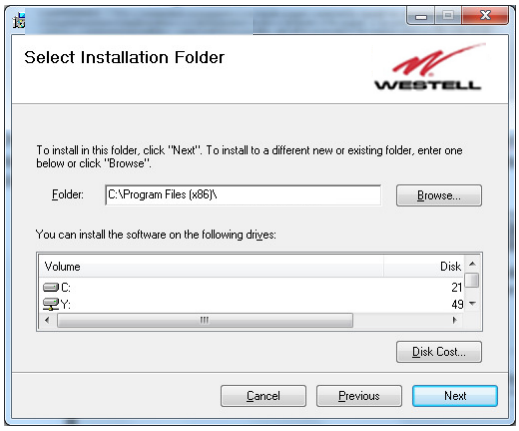
9.2.1 Installation

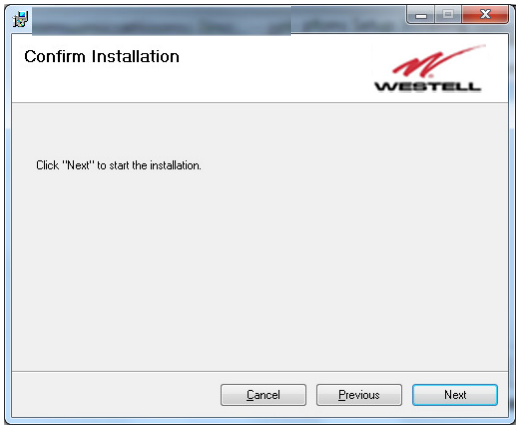
The following section will describe the steps to be followed in order to install and use the Westell Control software with your Westell Signal Booster.

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

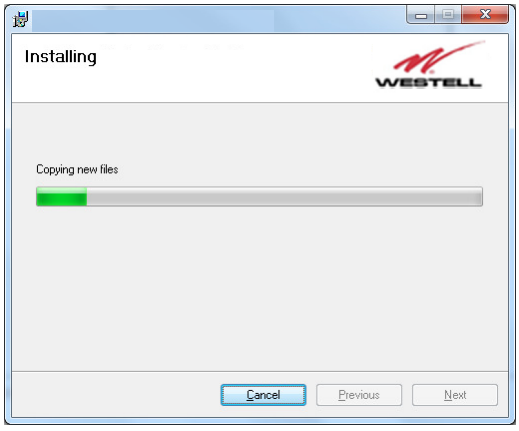


2. Choose the default installation path “C:\Program Files (x86)\WestellControlSoftware”. Note that this can change according to your system configuration (32bits or 64bits), language and Windows Version.

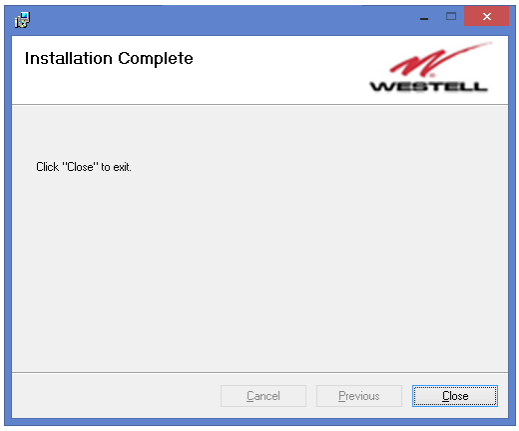


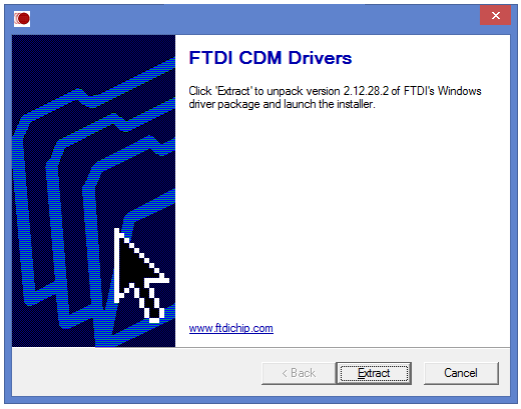


3. The installer will start to copy the necessary files.



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 Ethernet or USB cable between computer and Signal Booster, keeping the Signal Booster powered off. New USB device will be detected
6.
7. 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.

8. Execute the Westell Control Software. Next window will appear:

User interface controls:

- Scan Devices Button: refresh the available COM ports and identify Westell 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 Westell Signal Boosters will be shown with its number and "Unknown device" label. COM ports related to Westell 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 Westell Signal Booster is not turned on, related COM port will appear as "Unknown device"

8. Click "Scan Devices"

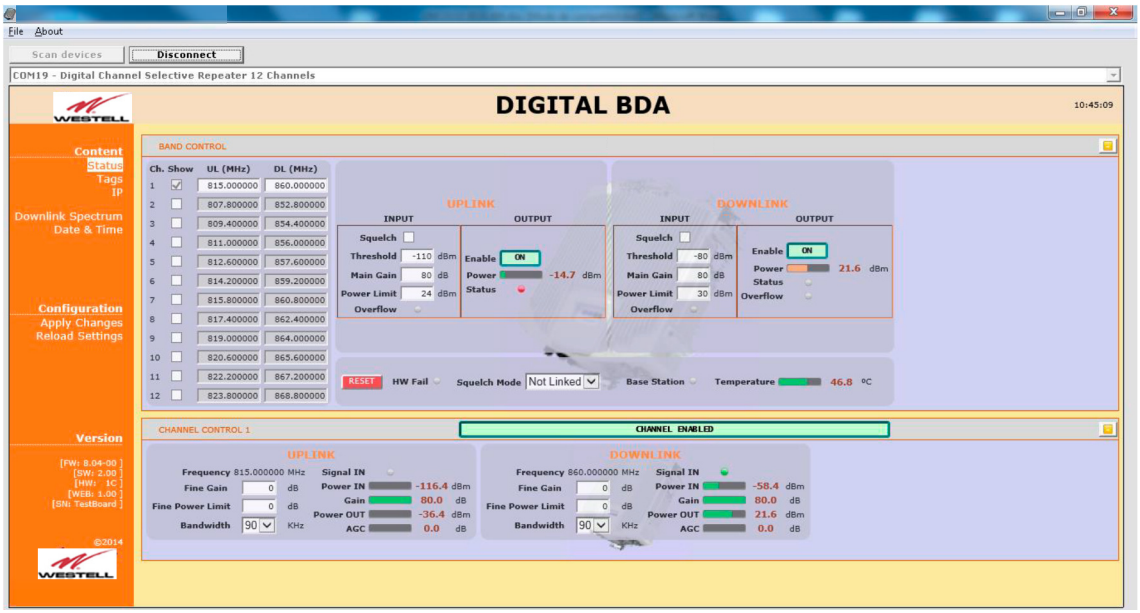
Now, the Westell Digital Signal Booster is shown in the list of available devices, and connection button is enabled.

NOTE: Westell 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”

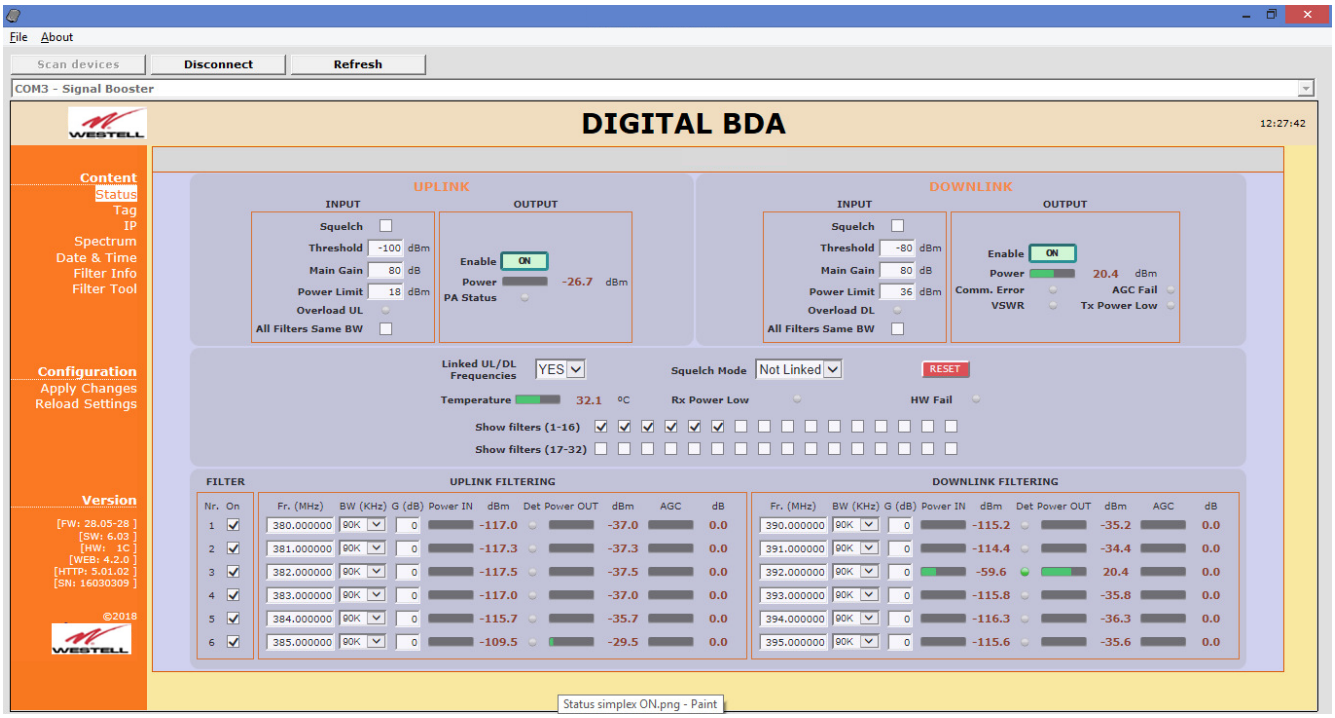
Change COM port number

9. Click “Connect”. Westell 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.

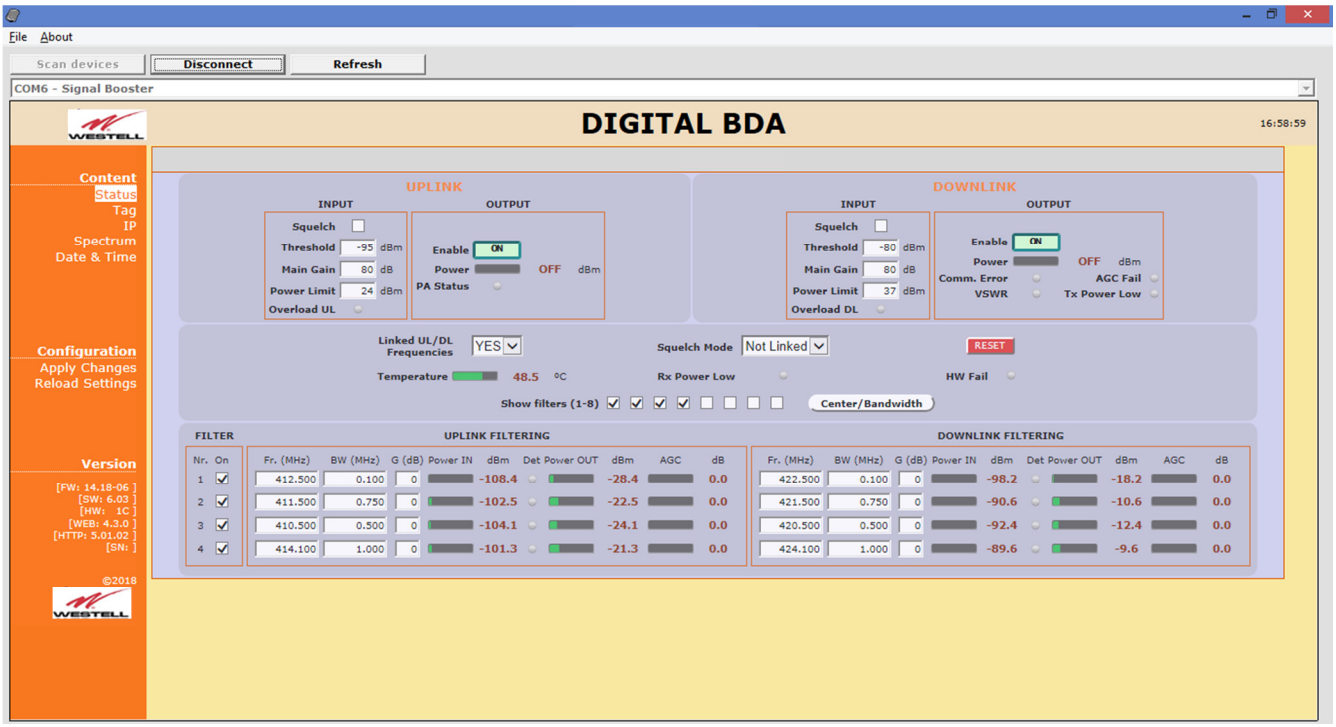


10. Once Signal Booster is configured, user can disconnect software using connection button, now labelled “Disconnect”. Initial window will be shown.

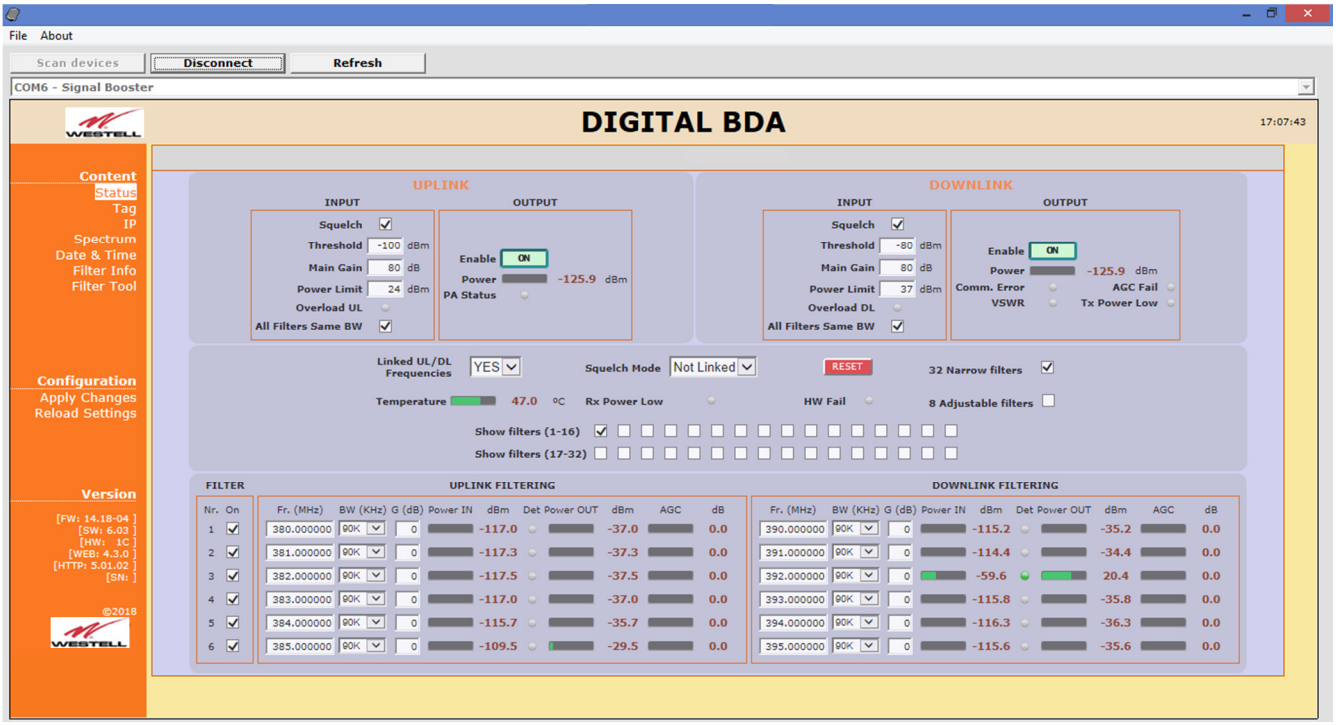
If Signal Booster is disconnected or turned off, while Westell Control Software is connected to device, software will go back to initial window. Moreover, if some communication problem occurs while device is monitored, the software will go back to initial state as well.



Initial window for narrow-band filters version



Initial window for adjustable bandwidth filters version



Initial window for dual firmware version

10 Remote Web Server option

10.1 IP Connection

Westell 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.

10.2 Web pages description

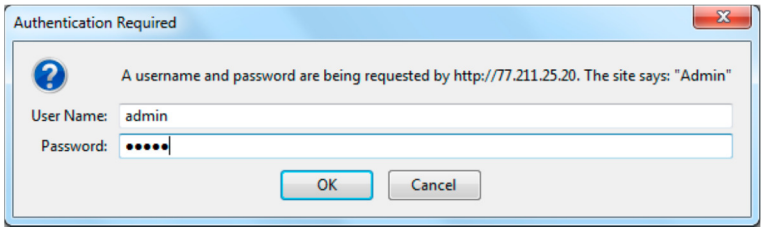
Once the Ethernet module is properly configured, user can connect to the Signal Booster, writing IP address in URL toolbar of any web browser available in its computer. Default URL is http://192.168.1.10.

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

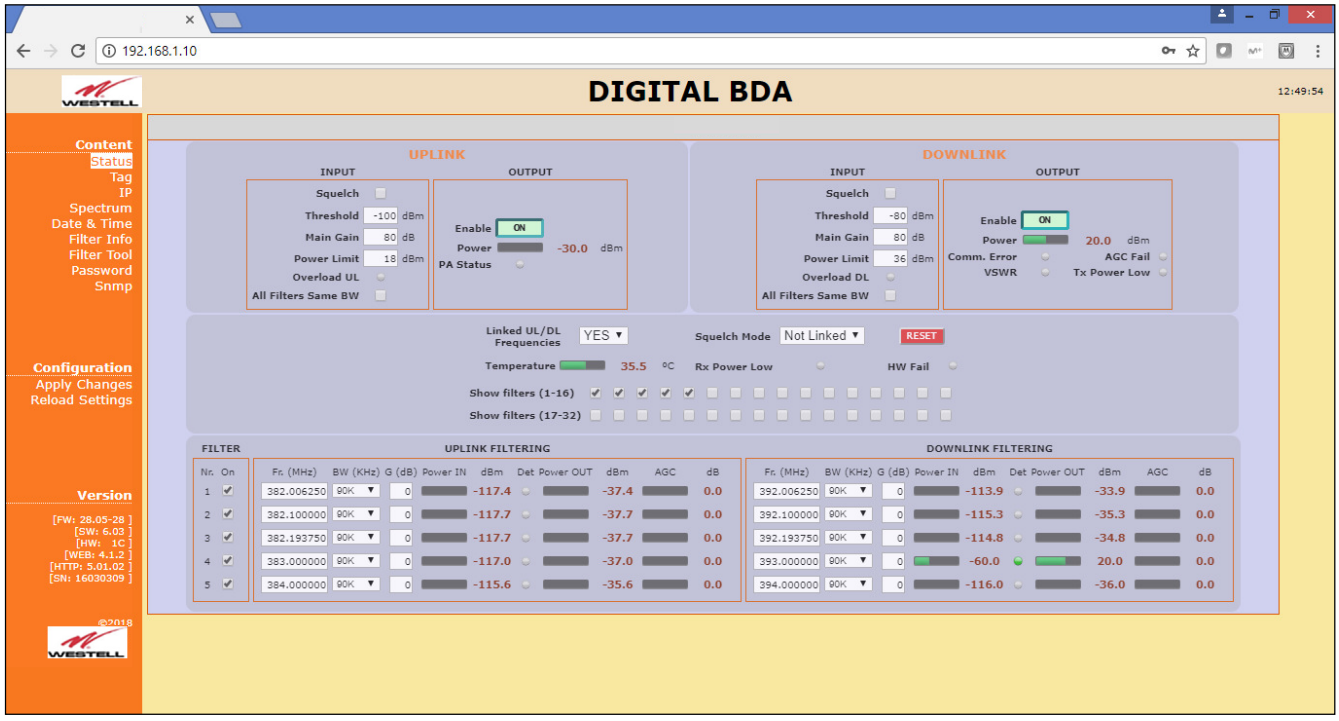
Login	admin	Login
Password	admin	Password

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.



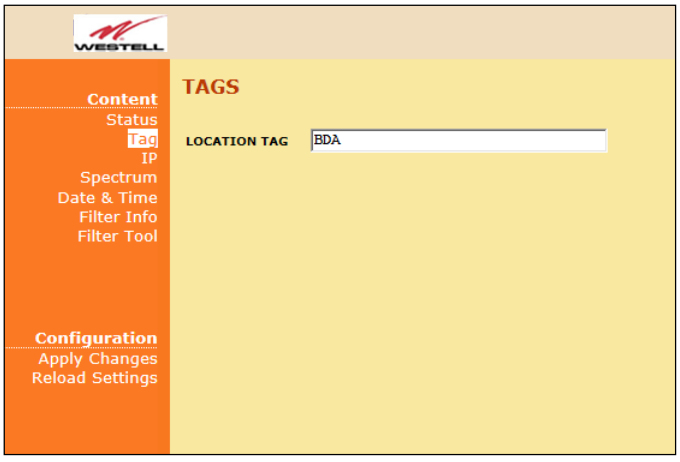
After authentication, web browser will load the main page of Westell Signal Booster showing RF configuration and monitoring parameters.



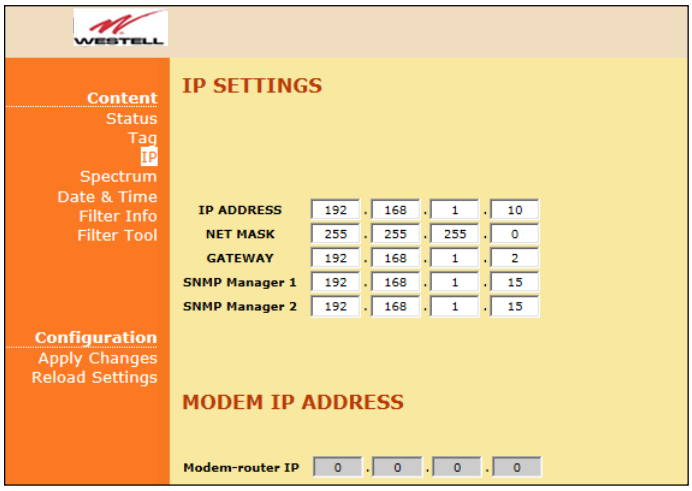
At left side of webpage, configuration menus are shown:

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



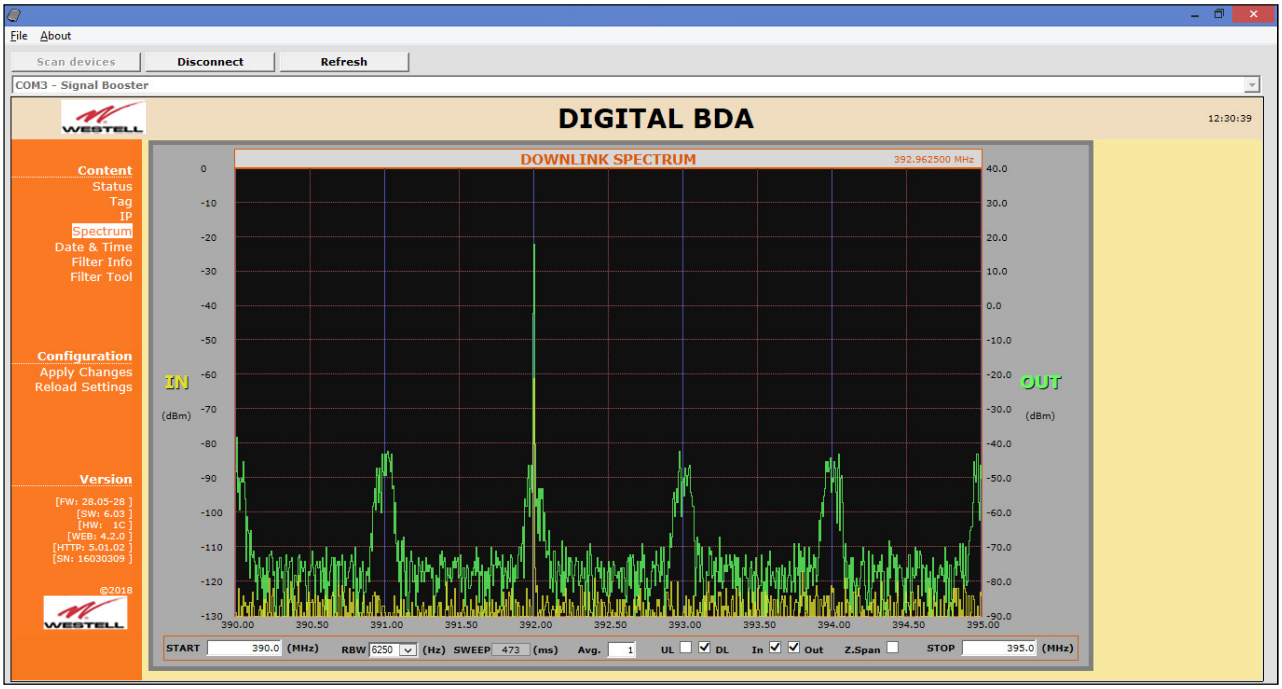
- IP: At this page, Signal Booster IP address, network submask, gateway address and IP addresses of SNMP Managers are shown. User can set addresses of two SNMP Managers (IP where SNMP agent will send TRAP information). To modify, click over Apply Changes link after writing new values on text fields.



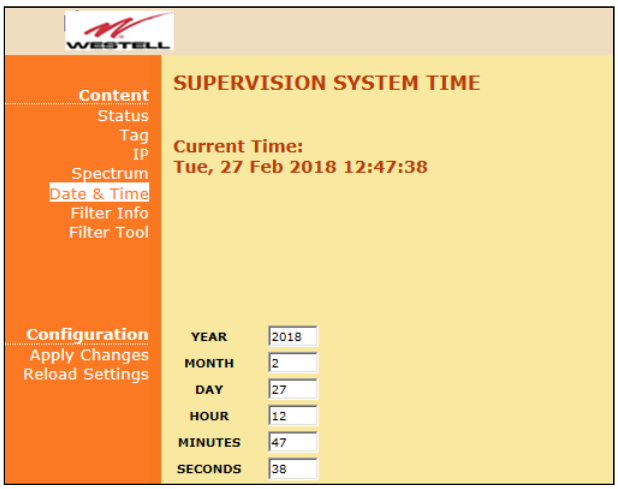
In case the Signal Booster had been fit with an internal modem-router, its own IP address settings would be fixed and the modem's address would be shown in the greyed boxes.

- 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.



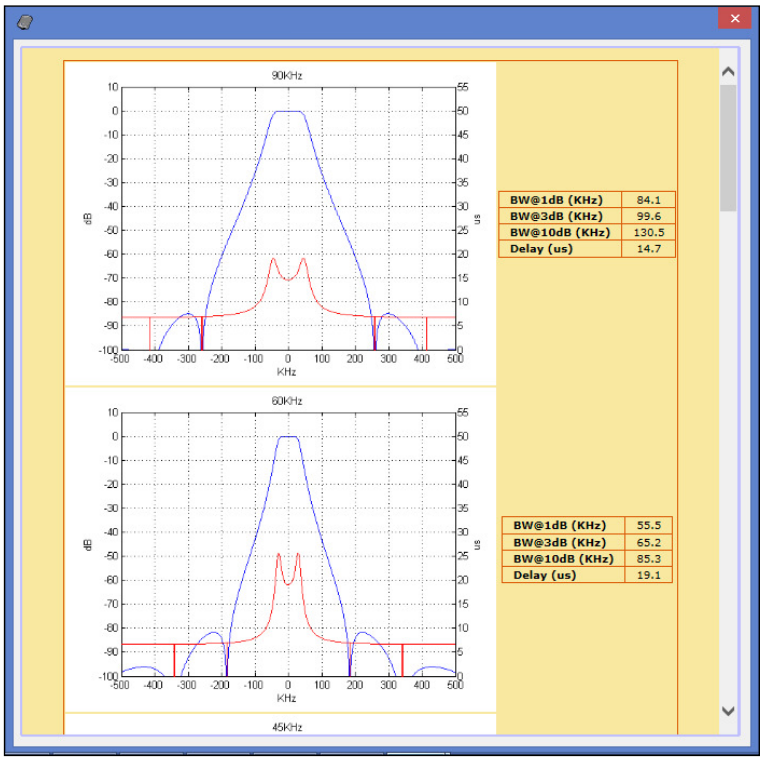
- Date and Time: page to modify real time clock. When the Signal Booster is not powered, this clock runs with a voltage supply provided by a 3V lithium battery, button type of 20mm (CR2032) with 220mA·h. This suffices for at least half year. When the Signal Booster is powered, no current is drained from 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.



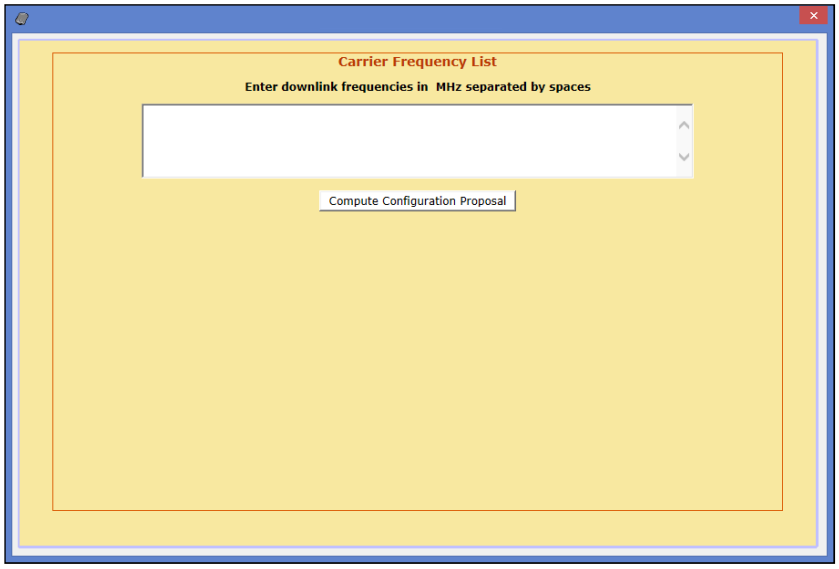
Date and time setting

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

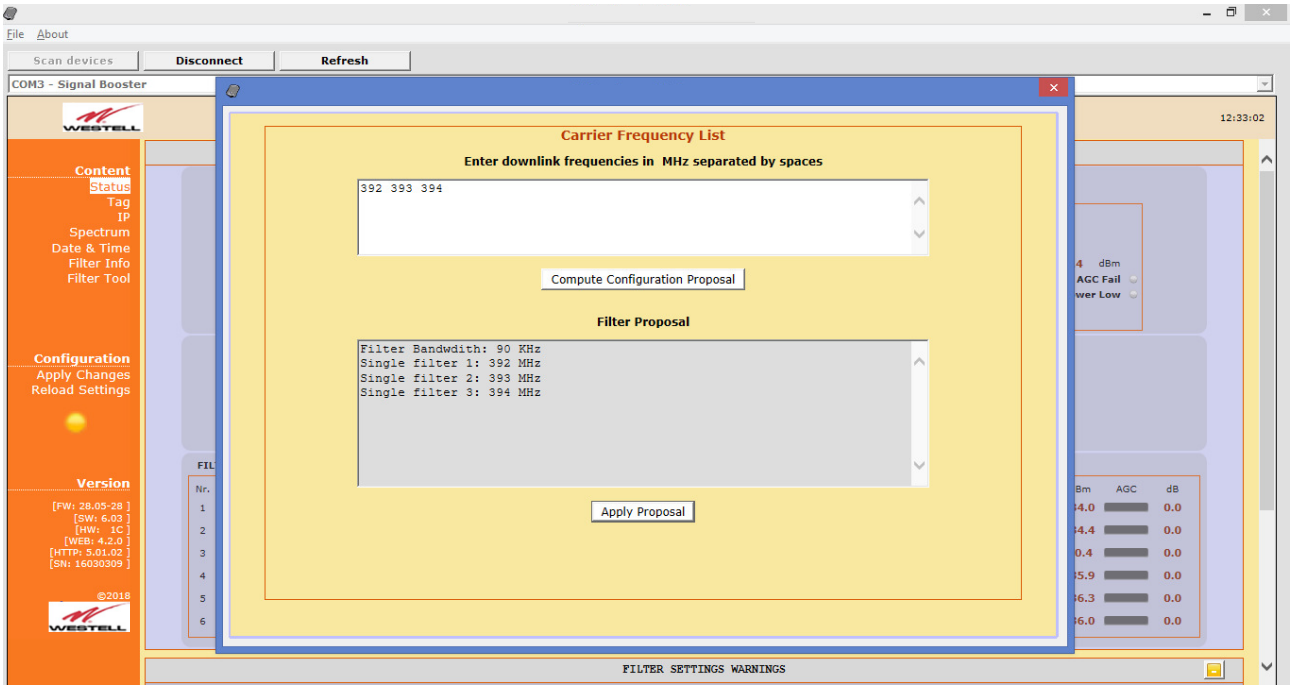
- Filter Info: following this link, a new window appears with detailed information of frequency and delay response of all available filter bandwidths (1dB, 3dB and 10dB bandwidths and delay at center frequency)



- 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:



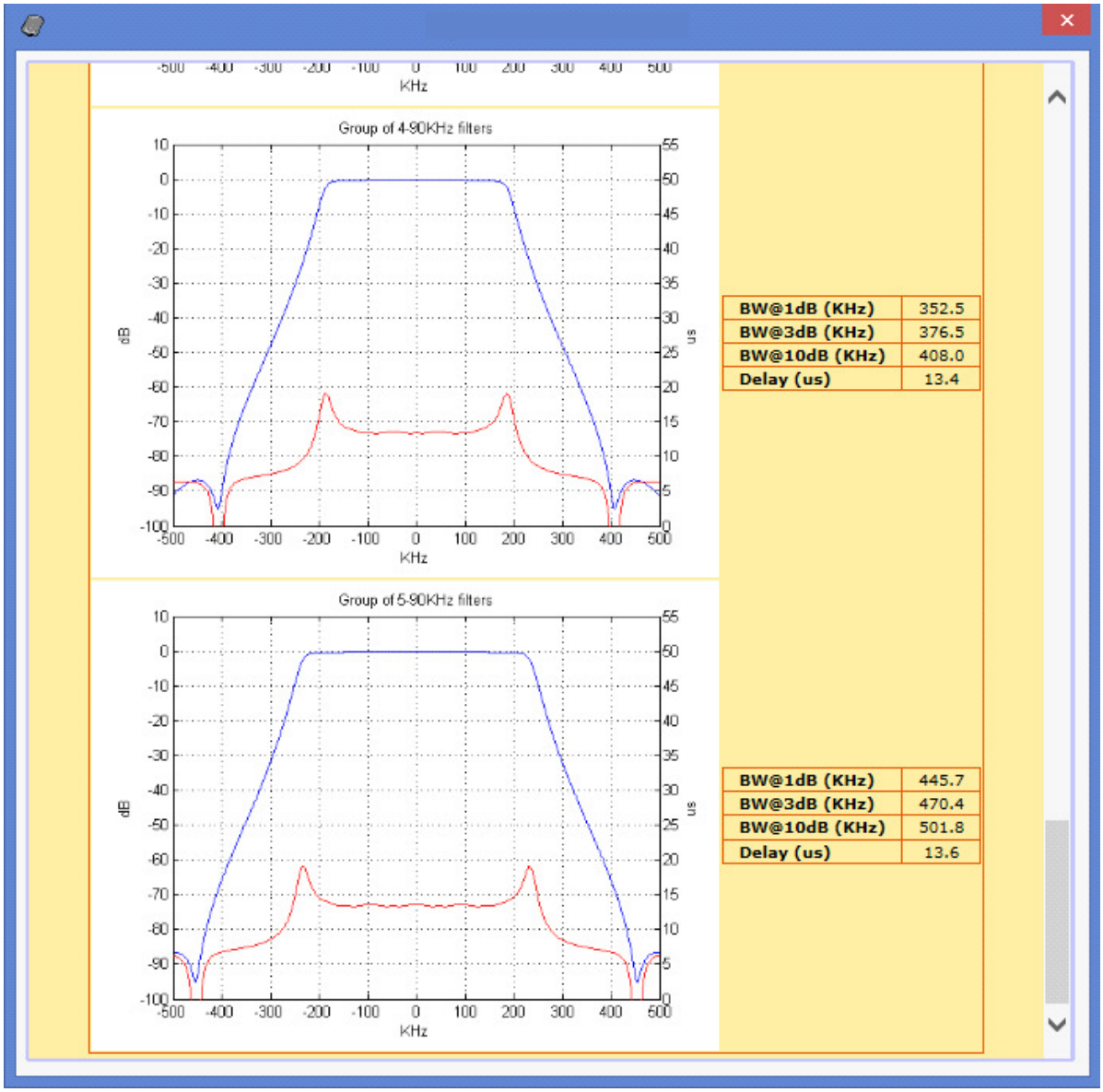
The button "Compute Configuration Proposal" shows the computed filter frequencies in another text area and, if accepted, the button "Apply Proposal" would actually perform the configuration change.

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 $1.25 \cdot (90 + 30) / 2 = 75$ KHz.

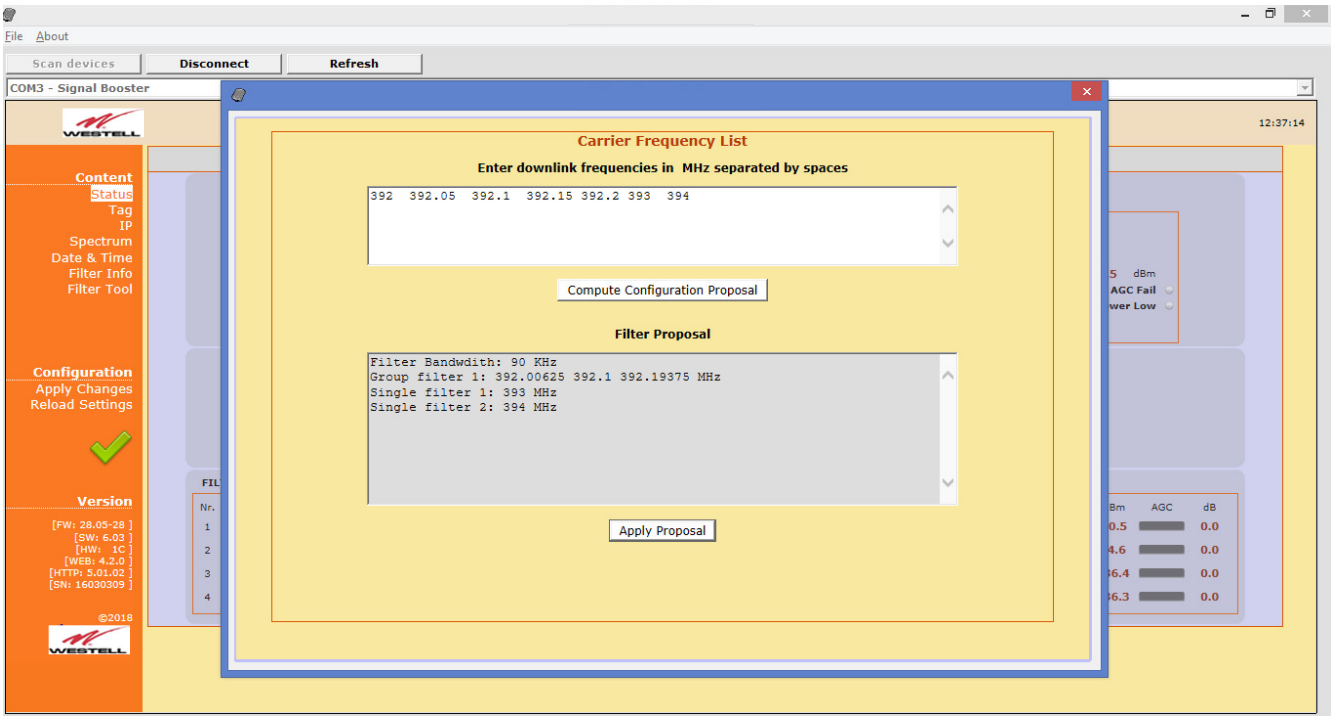
Nevertheless, there are certain conditions under which filters can be set closer to make up a single filter with wider bandwidth:

- 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.

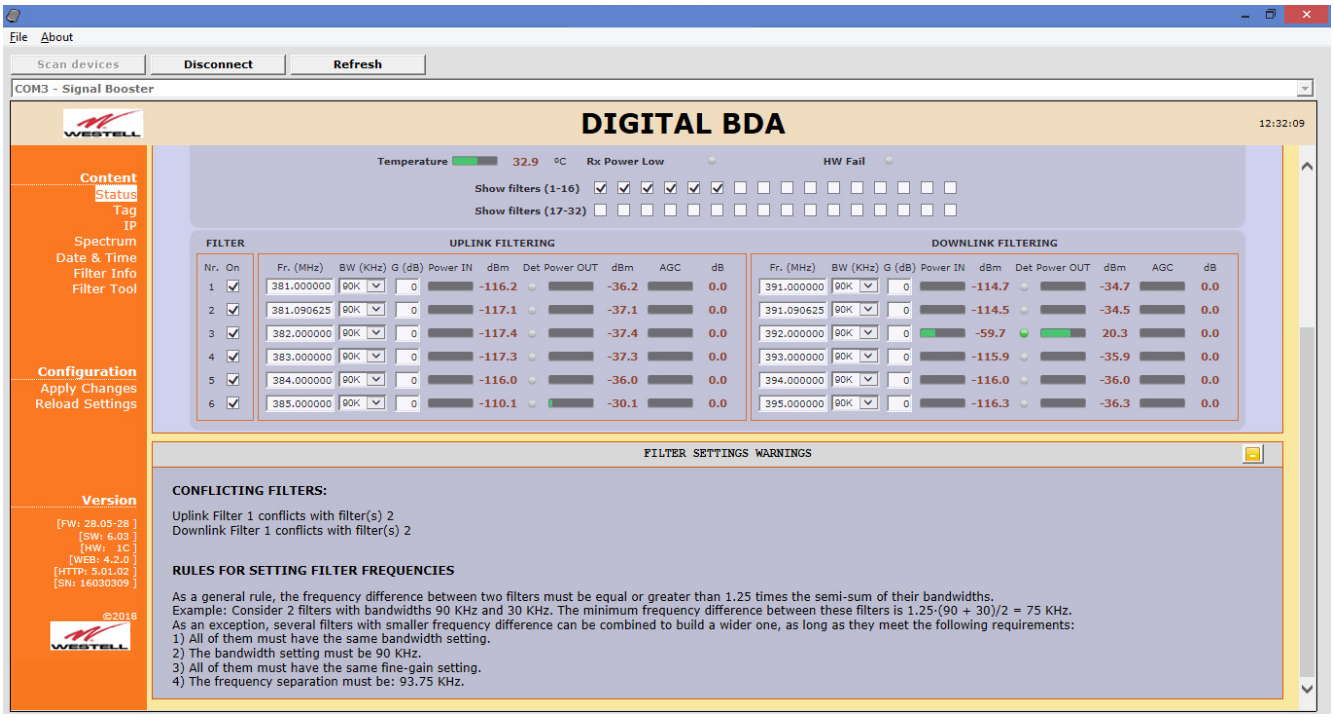
The Filter Info window shows the frequency response of the combination of up to five filters:



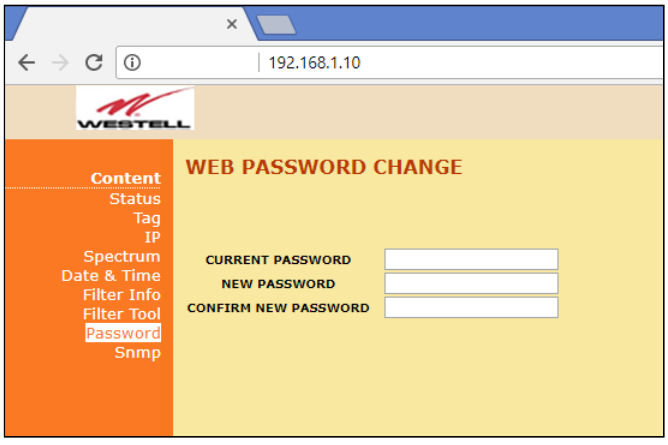
Now, consider for instance a case with the following downlink carrier frequencies: 392.0, 392.05, 392.1, 392.15, 392.2, 393.0 and 394.0 MHz. This is when the Filter Tool comes in handy. It will automatically choose the filters required to cover the range between 392.0 MHz and 392.2 MHz. As shown in next 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:



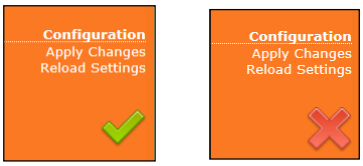
- Password (only via web connection): to modify webpage password, old password is required, and new password needs to be written two times. After clicking on “Apply Changes” link, new authentication screen appear, where user must write new password.



- 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:



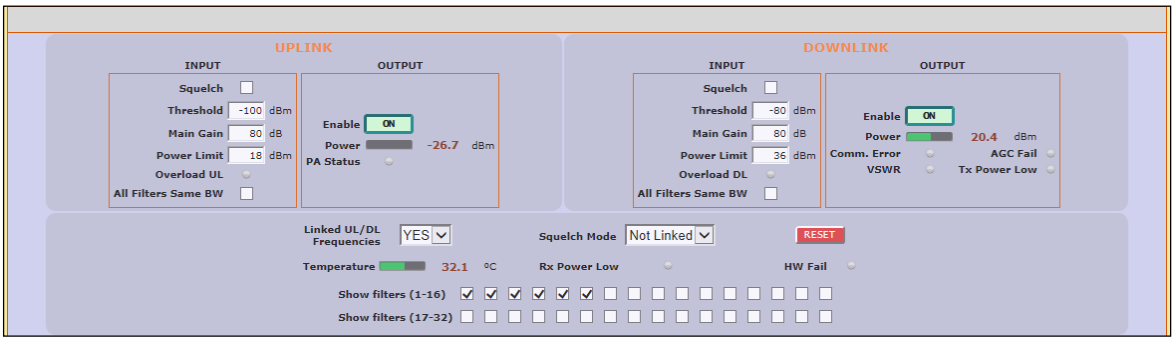
- Reload Settings: clicking this link, Signal Booster configuration data is refreshed.

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

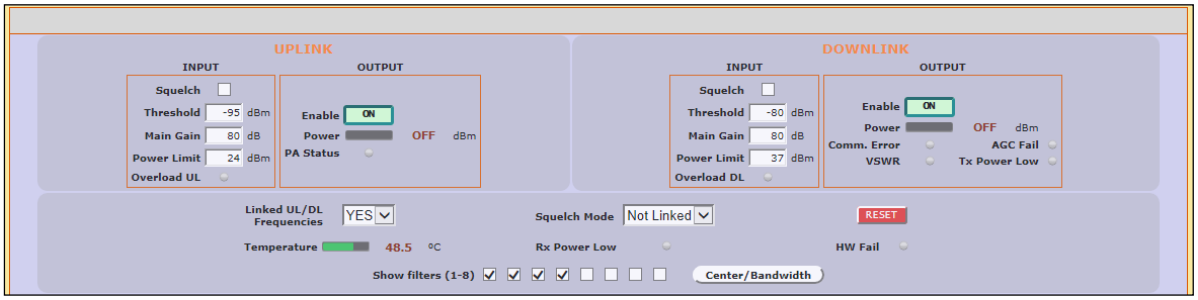
11 RF parameters description

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

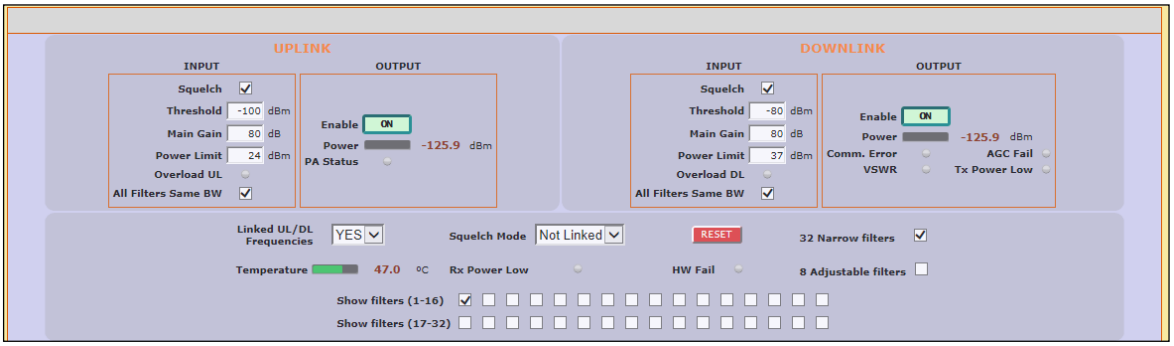
The status window is divided in two main blocks: general control and filtering control. First, general control contains signal booster main configuration parameters, while second block is a list with variable number of rows (according to number of enabled filters) which contains detailed configuration 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

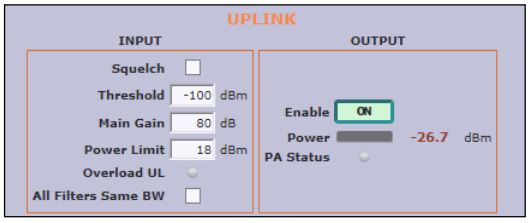


General control frame for adjustable bandwidth version



General control frame for dual version

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

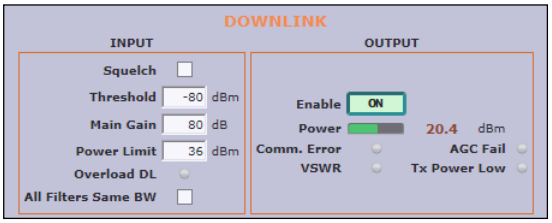


  - Main uplink control: RF main parameters regarding to uplink band are contained in this section: gain, output power limit, squelch threshold, squelch enable, PA enable control, RF output power indicator, and RF input overload, PA status and stability alarms. Next table describes information of this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

Uplink frame

Parameter	Description

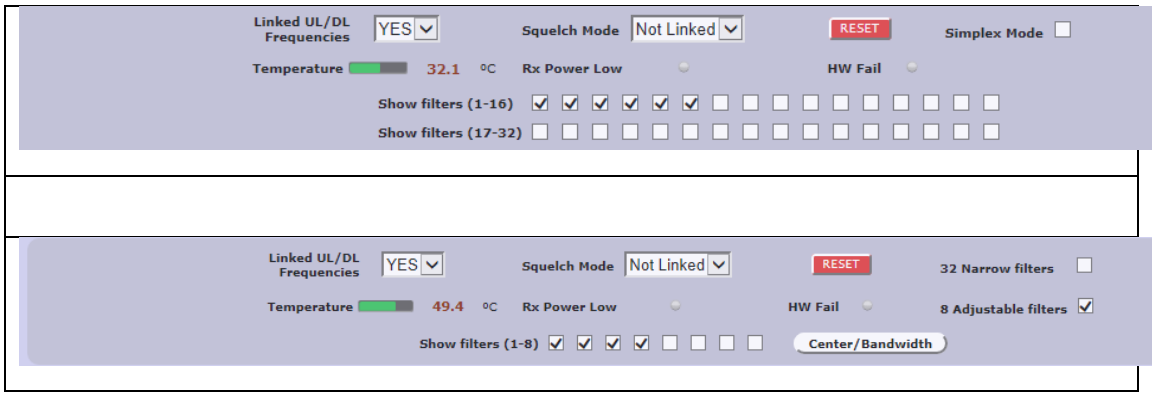
Main Gain	Set maximum gain of Signal Booster at UL band. Range can vary between models.
Power Limit	Set maximum output power of Signal Booster at UL band. System automatically will apply a correction to share this limit between the active channels. For instance, +18dBm band limit means +12dBm maximum 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	