



## *nanoSAW Series Repeater* **User's Manual**

November 2009

## Document History

<b>Description</b>	<b>Revision</b>	<b>Date Issued</b>
Preliminary release for early field trials	0.0	September 10 <sup>th</sup> , 2009
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## About this manual

This manual describes installation, commissioning, usage, function, operation and maintenance of Fiplex **nanoSAW** series repeater and Fiplex **portable Operational and Maintenance Software** (pFOMS). The first part of the manual describes the repeater 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 the 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.

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## 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 repeater 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
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
pFOMS	Portable Fiplex Operation and Maintenance Software
PS	Power Supply
RF	Radio Frequency
RSSI	Received Signal Strength Indication
SW	Software
TDMA	Time Division Multiple Access
UL	Uplink signal direction (from mobile station via repeater to base station)
WEEE	Waste of Electric and Electronic Equipment

## Part 1 HARDWARE

### 1. Safety

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



Any repeater, including this repeater, 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 repeater and the repeater antennas.

#### **FCC Radiation Hazard Warning**

To comply with FCC RF exposure requirements in Section 1.1307 and 2.1091 of FCC Rules, the antenna used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 2 meter from all persons.

#### **R&TTE Compliance Statement**

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



Repeater, 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.



Static electricity means no risk of personal injury but it can severely damage essential parts of the repeater, if not handled carefully.

Parts on the printed circuit boards as well as other parts in the repeater 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 repeater 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.



## 2. Installation

### Sitting the repeater

Fiplex nanoSAW family of repeaters is designed for indoor use. If repeater needs to be mounted outdoors, weather proof cabinet should be provided in order to preserve weather tightness.

### Mounting

nanoSAW is ready for wall mount using four fixing screws.

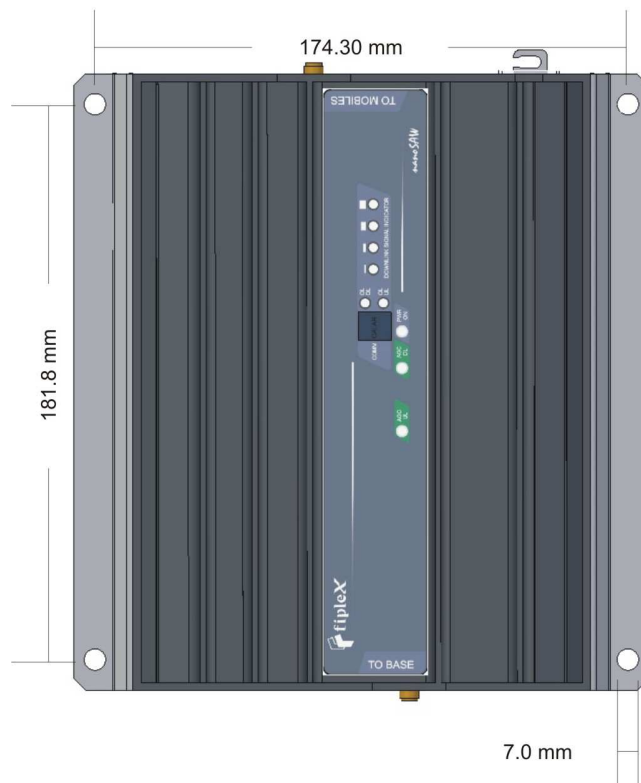


Figure 1

Figure 1 shows holes pattern for fixing screws.

### 3. Commissioning

#### **Connection**

1. Connect service antenna (“TO MOBILE” port) and donor antenna (“TO BASE” port) coaxial cables. SMA type female connectors are used in the repeater.
2. Once RF ports of the repeater are properly loaded connect the DC plug from power supply to nanoSAW DC input.  
The repeater powers on when power supply is connected to the AC line, and nanoSAW is properly feed with DC voltage. Blue led labelled “PWR ON” must be on, under normal power conditions.



Figure 2

Figure 2 shows DC input plug position.



## Starting operation

Prior to the following steps refer to section 2 of this manual in order to properly install pFOMS.

1. Setup desired filter configuration using pFOMS (only for programmable band selective and programmable channel selective models).

In programmable band selective repeaters user must set up start and stop frequency.

In programmable channel selective user must set up center frequency, nanoSAW repeaters are a special case of programmable selective repeater, where number of channels is equal to one.

For both types of repeaters user could set up start, stop or center frequency either using absolute values (in MHz) or using ARFCN.

For fixed bandwidth repeaters this feature will not allow user to make changes, so, skip this step for fixed bandwidth models.

2. Setup desired operating gain using pFOMS. UL and DL chain are independent, so both values must be set.

For nominal gain of the repeater these values must be set to zero.

The screenshot displays the 'Manager Form' software interface. The 'General' tab is active, showing configuration for 'Filter 1'. The filter is set to 'ON' with a model of 'UL=FPGU-02 DL=FPGD-02'. The start channel is 660 and the end channel is 512. The uplink start frequency is 1880,000 MHz and the end frequency is 1850,400 MHz. The downlink start frequency is 1960,000 MHz and the end frequency is 1930,400 MHz. Below the filter settings, there are two spinners for 'Atenuación Uplink' and 'Atenuación Downlink', both set to 0. Two red arrows point to these spinners. To the right, there are buttons for 'ON' and 'PA'. At the bottom, there is a 'Report Status Schedule Time [min]' set to 15, and 'Cancelar' and 'Aceptar' buttons. The status bar at the bottom shows '15:29:50 Variables Information read successfully.' and a 'Salir' button.

Figure 3

Figure 3 shows how to set up manual attenuation values.

## Status Indicators

There is an indicator panel located at the front of the repeater. This led panel works as a status monitor, in order to advice different operational conditions of the repeater.

### 1. Power indicator

Every time the repeater is plugged to DC power supply, and under normal conditions of operation, led labelled PWR ON will be ON.

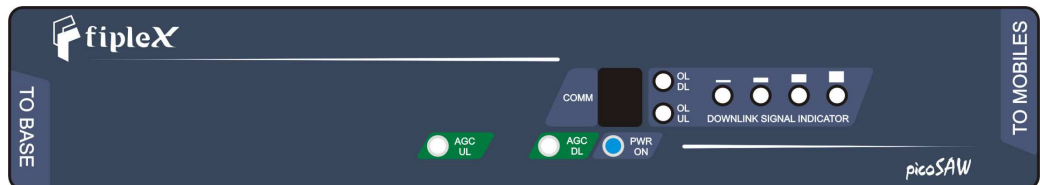


Figure 4

Figure 4 shows PWR ON led location.

### 2. Automatic Gain Control Indicator

When Automatic Gain Control circuitry is active led labelled AGC UL and/or AGC DL will be ON. Please see **Automatic Gain Control** for further functional explanation.

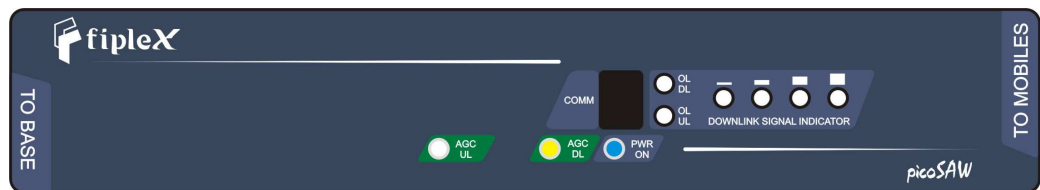


Figure 5

Figure 5 shows AGC DL led active, this is only for example purposes.

### 3. Overload Indicator

When Overload circuitry is active led labelled OV DL or OL UL will be ON. Please see **Overload Protection** for further functional description.

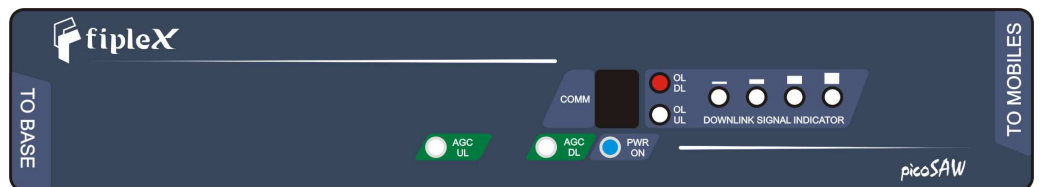


Figure 6

Figure 6 shows OL DL led active, this is only for example purposes.

#### 4. Downlink Signal Indicator

Four leds indicates downlink signal strength

Please see **Downlink Signal Indicator** for further functional description.

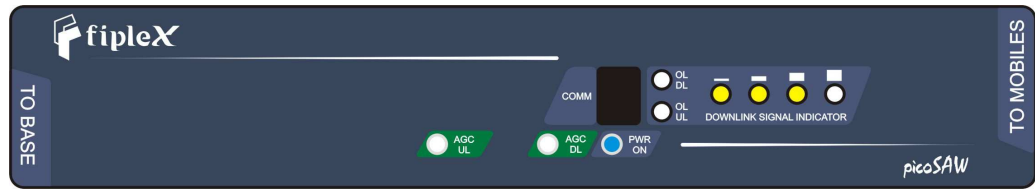


Figure 7

Figure 7 shows Downlink Signal Indicator leds active, this is only for example purposes.

## **Automatic Gain Control (AGC)**

Automatic Gain Control circuitry is intended to keep repeater's output power at a fixed level when input signals exceed maximum values, avoiding quality signal degradation by intermodulation generation.

When AGC is active AGC UL and/or AGC DL leds will be ON, this means that signal level from donor and/or service area site, plus repeater gain produces an output power that is above the maximum composite output power of the repeater. This should not be considered an undesired working condition, far from that; this is the best operating condition because you are getting the maximum composite output power available from the repeater.

Anyway is a good practice to increase attenuation (reducing gain), until AGC led turns off, this operation releases AGC circuitry dynamic range.

Also is a good practice to check signals from donor site to ensure that undesired signals are not being amplified by the repeater, or even desired signal levels are not excessively high taking repeater to an overload condition.

## **Overload Protection**

When AGC circuit reaches its limit, the power amplifier stage is shut down to prevent harmful distortion and potential damage to the repeater. After approximately ten seconds the system checks if overload condition is still present, if this happens, amplifiers will remain off. This cyclic check will continue until condition that makes AGC circuitry reach its limits disappears.

Conditions that can cause AGC to reach its limits include the presence of one or more very strong channels, a strong in-band noise source, or amplifier oscillation due to poor antenna isolation.

## **Downlink Signal Indicator**

Summarizes downlink repeater output. Indicates bad, poor, good, very good and excellent signal levels as follows:

- Bad RSSI, all leds off
- Poor RSSI, first led ON
- Good RSSI, first and second leds ON
- Very Good RSSI, first, second and third leds ON
- Excellent RSSI, all leds 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

### 4. Installation

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

1. Execute the Fiplex Portable Foms installer and choose the default path “C:\program files\fiplex”.

Please do not change this location.

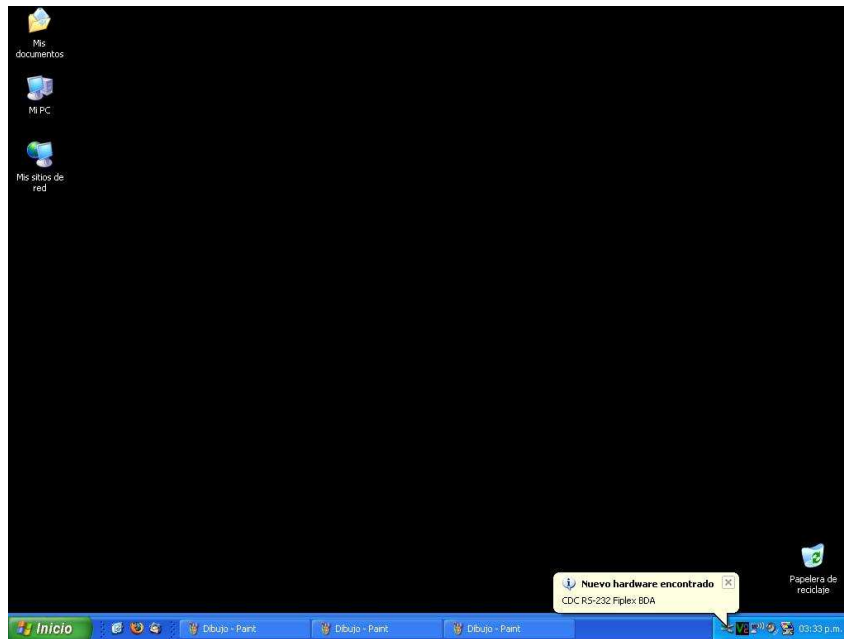


2. Turn on the Repeater

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

3. Plug in USB cable to USB male connector labeled as “COMM”. Repeater HW will trigger the installation of its driver, which is a COM port emulator.

“New hardware found” advice should be noticed.



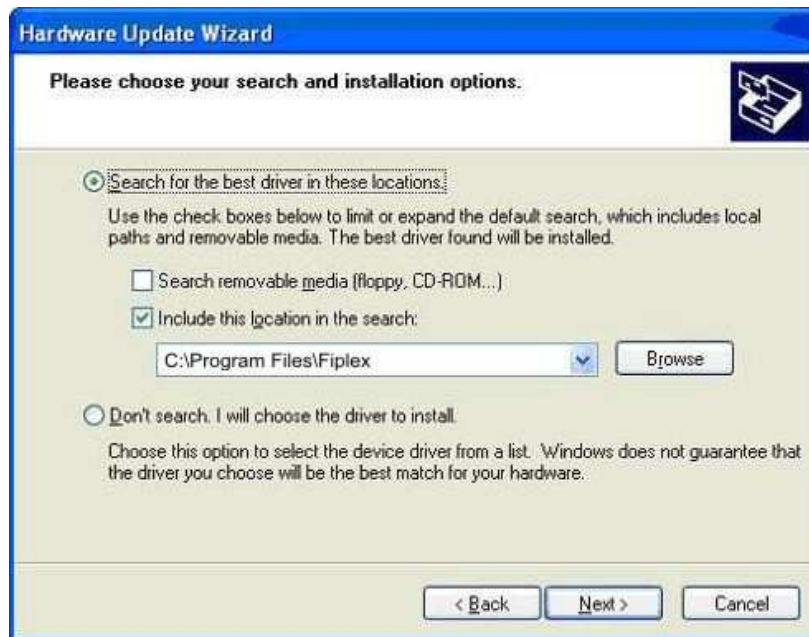
4. Windows will start its hardware installation assistant, follow the steps and indicate the driver location.



Select "No, not this time"



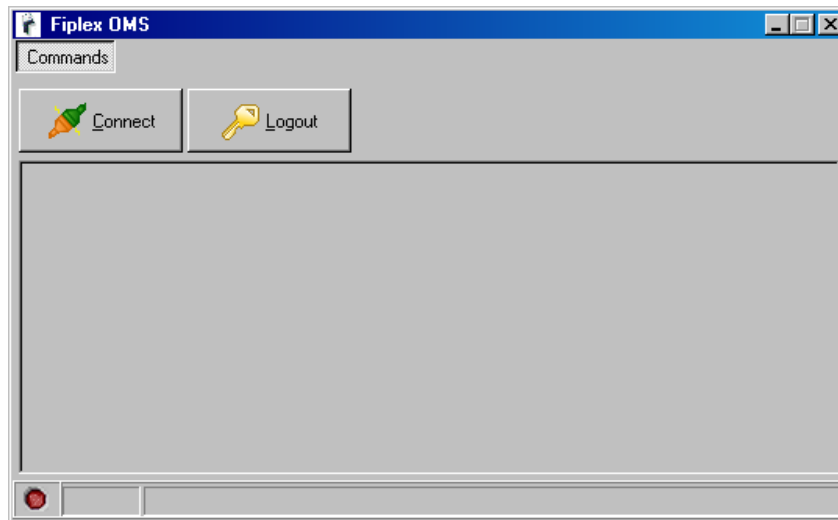
Select "Install from a list or specific location (Advanced)"



Windows probably complains because this is not an official Microsoft Windows driver, click in "Continue Anyway"

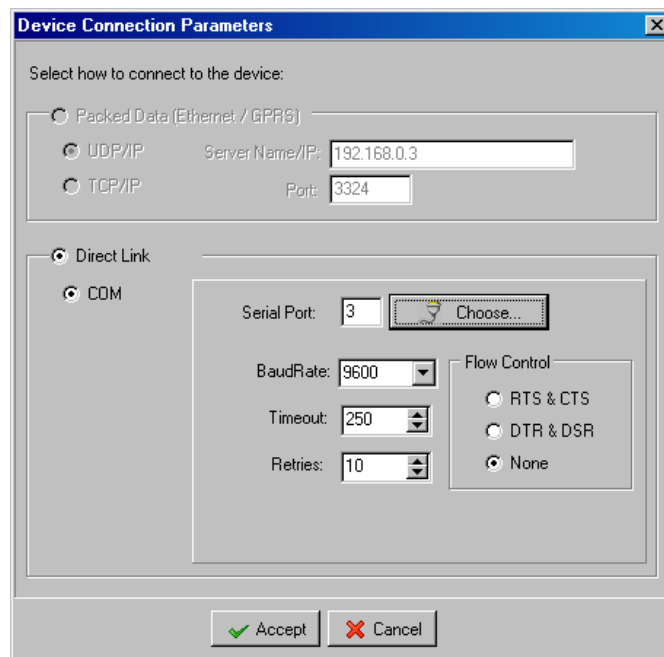


5. After having installed the CDC-RS232 Fiplex driver, run pFOMS Software.

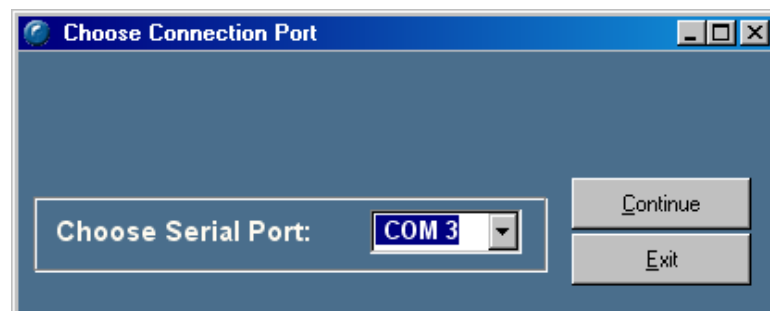


Click "Connect".

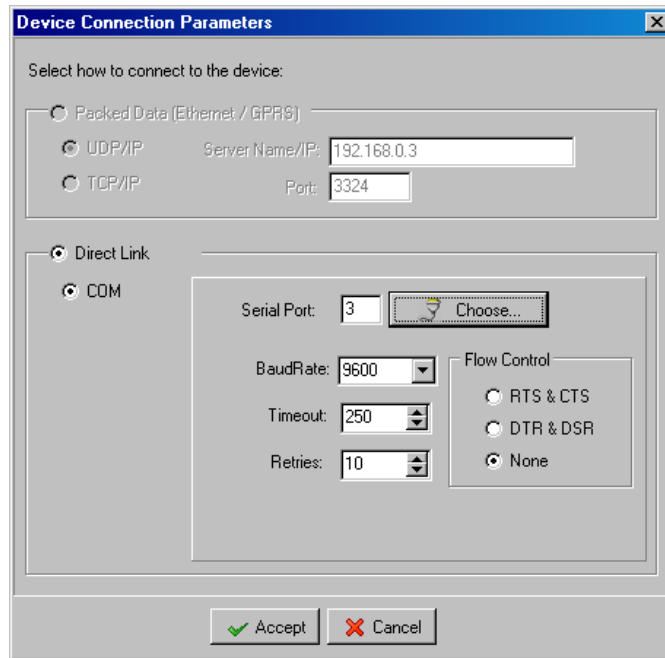




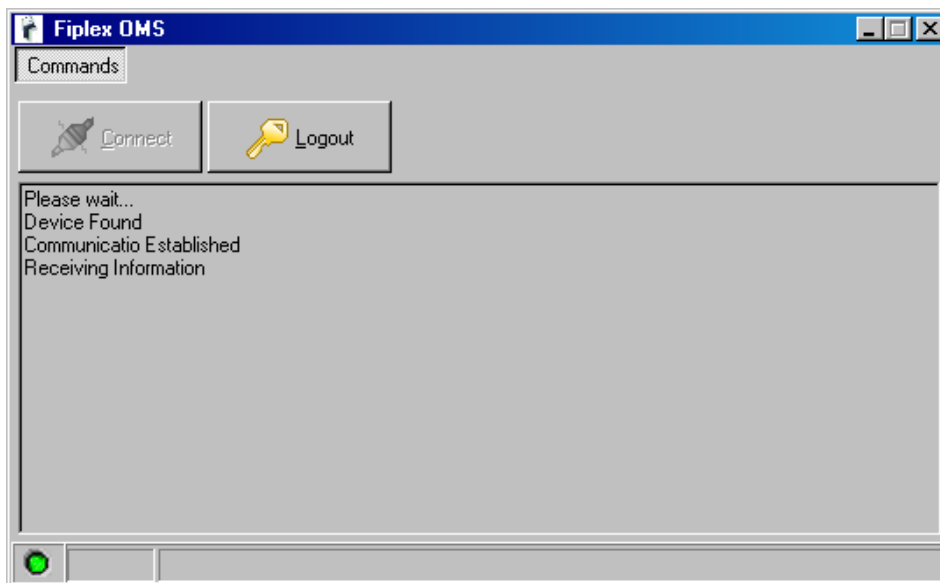
Click "Choose"



Select The Serial Com port that just appeared on your PC. Remember that the BDA driver installs itself as a generic Com Port so if properly installed, you should have a new comport not present before connecting the Repeater. Click "Continue".



Choose Flow Control "None".  
Click "Accept".



This window will be active while Repeater is establishing connection with pFOMS.

## 5. Overview

### General Tabsheet

	Uplink	Downlink
Attenuation Range	18 db	18 db
AGC Range	20 db	20 db
Gain	65 db	65 db
Output Power	10 dbm	10 dbm

	Uplink	Downlink
Manual Attenuation	0 db	0 db
AGC	0 db	0 db
Effective Gain	65 db	65 db

This tab sheet displays general information from repeater.

First eight fields at the upper left corner of the window displays identity information of the repeater, this information is stored at repeater's firmware.

Modem information is displayed at the bottom left corner, these read/write fields allow user to set up wireless connection via modem when available.

Device Information: four fields at the upper right of the window displays static nominal value of the repeater, this information is shown by pFOMS after detecting repeater model.

Gain: these fields allow user to know actual manual attenuation, AGC, and effective gain of repeater, this is dynamic information, constantly and automatically being updated by pFOMS.

## Status tab sheet

The screenshot shows a software window titled "Manager Form" with a "Status" tab selected. The interface is divided into several sections:

- Filter 1:** A section with a green background. It includes a text field with "OK", a "Model" field with "UL=EGSM DL=EGSM", a "Start Channel" dropdown set to "1", and an "End Channel" dropdown set to "61".
- Uplink:** A section with a green background showing "Start Freq." as 880,1000 MHz and "End Freq." as 892,1000 MHz.
- Downlink:** A section with a green background showing "Start Freq." as 925,1000 MHz and "End Freq." as 937,1000 MHz.
- Attenuation:** Two spinners for "Uplink Attenuation" and "Downlink Attenuation", both set to 0.
- PA:** A button with a globe icon, labeled "ON PA".
- Buttons:** "Cancel" and "Edit" buttons at the bottom.

At the bottom of the window, a status bar shows the time "16:35:48" and the message "Status Information read successfully." An "Exit" button is located in the bottom-left corner.

This tab sheet shows configurable parameters of the repeater:

Filters: active filters will appear in green, not installed filters in gray and filters with communication errors will be purple.

Band selective programmable filters shows Start / Stop channel and Start / Stop frequency.

Channel selective programmable filters will only show Start channel, in this case the meaning for start channel is filter center BW channel.

Band selective fixed filters will show start frequency or channel and the meaning is center BW frequency or channel.

Manual attenuation: shows the status of uplink and downlink attenuation.

PA: shows power amplifiers operative status. Some repeater may not have this feature.

## Configuration

In order to setup operative parameters of the repeater such as manual attenuation UL and/or DL, filters and PA, user must click "Edit" button of Status tab sheet.

Now user is free to change configurable values.

The screenshot shows a software window titled "Manager Form" with two tabs: "General" and "Status". The "Status" tab is active. The configuration area includes:

- Filter 1:** A text box containing "OK".
- Model:** A text box containing "UL=EGSM DL=EGSM".
- DN:** A button with a radio button selected.
- Start Channel:** A spinner box set to "1".
- End Channel:** A spinner box set to "61".
- Uplink:** A section with "Start Freq." set to "880,1000 MHz" and "End Freq." set to "892,1000 MHz".
- Downlink:** A section with "Start Freq." set to "925,1000 MHz" and "End Freq." set to "937,1000 MHz".
- Attenuation:** Two spinner boxes for "Uplink Attenuation" and "Downlink Attenuation", both set to "0".
- PA:** A button with a radio button selected.
- Buttons:** "Cancel" and "Accept" buttons at the bottom.

At the bottom of the window, a status bar shows the time "16:36:26" and the message "Status Information read successfully." An "Exit" button is located in the bottom-left corner.

Once configured operational parameters click "Accept", after a few seconds changes will be displayed (once pFOMS refresh the window), with updated information.