cellvine
innovative wireless solutions

USER MANUAL

BDA-AWS21-26-4UT-AB-JXX

OVER-THE –AIR REPEATER

VER. 1.06

Important Notice

No representation or warranties for fitness for any purpose other than what is specifically mentioned in this manual is made either by Cellvine or its agents.

For further information contact Cellvine at the address below or contact your local distributor.

1-YEAR LIMITED HARDWARE AND SOFTWARE WARRANTY

Cellvine Ltd. warrants all Repeater Products against electrical malfunction for a period of One (1) year from shipment of the product to the purchaser. If Cellvine receives notice of defects during the warranty period, Cellvine will either replace or repair the products.

WARRANTY EXCLUSIONS AND LIMITATIONS

The warranty shall not apply to defects resulting from improper operation, inadequate maintenance, or unauthorized use or modification by the customer of the Repeater products or software. The warranty service and service beyond the warranty period described herein are the customer's sole remedies.

OBTAINING SERVICE DURING AND BEYOND WARRANTY PERIOD

To obtain warranty service, the customer shall return the Repeater product to Cellvine Ltd with date and proof of purchase and an explanation of the problem. The customer shall pay for shipping charges and Cellvine shall pay for return shipping. For service beyond the warranty period, contact Cellvine for details of available service.

GETTING HELP

The Repeaters have undergone extensive testing prior to shipment. All of the functions have been thoroughly tested. However, if there are problems that you discover, please call us. We are here to help.

Contacting Cellvine

Headquarter	U.S. Office
Cellvine Ltd. Phone: +972-3634-8881 Fax: +972-3-6348882 Giyora@cellvine.com	55 Madison Ave , Suite 400 Morristown , NJ 07960 Phone : 973-285-3201 Fax : 973-538-0503 Richard@cellvine.com

About this Manual

This User's Manual is intended for experienced installation technicians and engineers.

It contains the following:

- A general description of the BDA-AWS21-26-4UT-AB-JXX Repeater system and system components
- Installation overview
- Repeater system operation

Contents

Figures

Abbreviations

The terms, acronyms and abbreviations used in this manual are detailed in the following list:

Abréviation	Description
AGC	Automatic Gain Control
BDA	Bi Directional amplifier
BL	Bluetooth
Div	Diversity
DU	Donor Antenna Unit
LED	Light Emitting Diode
LNA	Low Noise Amplifier
NMS	Network Management System
PA	Power Amplifier
PSU	Power Supply Unit
REP	Repeater
RF	Radio Frequency
RSSI	Received Signal Strength Indication
RU	Remote Unit
RX	Receiver
SC	Service Channel
TX	Transceiver unit

General Safety Warning

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized personnel should carry out adjustment, maintenance or repairs to the components of this system.

DANGER: ELECTRICAL SHOCK

The power supply unit contains dangerous voltage that can cause electric shock. Disconnect the mains prior to any work in the Repeater. Any local regulations are to be followed when servicing Repeaters.

This equipment is usually installed indoors. Wet conditions increase the potential for receiving an electric shock when installing or using electrically powered equipment. To prevent electrical shock when installing or modifying the system power wiring, disconnect the wiring at the power source before working with insinuated wires or terminals.

Repeaters supplied from the mains must be connected to grounded outlets and in conformity with any local regulations.

CAUTION: HIGH GROUND

When working on a Repeater on high ground, e.g. on a mast or pole, be careful not to drop parts or the entire Repeater. Falling parts can cause serious personal injury.

CAUTION: COAX CABLE BENDING

Allow sufficient coax cable length to permit routing of patch cords or pigtails without severe bends.

CAUTION: RADIATION

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.

CAUTION: STATIC ELECTRICITY

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 board as well as other parts in the Repeater are sensitive to electrostatic discharge.

Never touch the printed circuit board or uninsulated conductor surfaces unless absolutely necessary.

If you must handle the printed circuit board 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.

Always, store printed circuit boards in ESD-safe bags.

FCC STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his expense. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1. Introduction

1.1. GENERAL DESCRIPTION

The goal of the Repeater system is to improve coverage for T-MOBILE AWS (1710-1755MHz, 2110-2155 MHz) in medium size indoor areas of up to 50,000 sq. ft.

Figure 1-1: BDA-AWS21-26-4UT-AB-JXX Repeater

The system implements BDA technology to enhance coverage in urban areas. Repeaters are used to fill out uncovered areas in cellular mobile systems, such as base station fringe areas, road tunnels, business and industrial buildings, etc. A Repeater receives signals from a base station, amplifies the signals and retransmits them to service area. It also receives, amplifies and retransmits signals in the opposite direction. Both directions are served simultaneously.

In order to receive and transmit signals in both directions, the Repeater is connected to a donor antenna directed towards the base station and to a service antenna directed towards the area to be covered.

Control of the Repeaters is performed using a desktop or laptop computer equipped with standard browser (no special software) which can communicate with the Repeaters, either locally or remotely via modem (optional).

2. System components

2.1. BDA-AWS21-26-4UT-AB-JXX REPEATER KIT

1. Power Supply
2. Ethernet CAT5E cable for Operation and Maintenance of the unit using a PC .
3. Repeater unit
4. Wall mounting
5. Power supply optional installation kit
6. This manual

2.2 REPEATER UNIT

Cellvine's indoor **BDA-AWS21-26-4UT-AB-JXX** Repeater has been designed to enhance and extend cellular coverage into small and medium-size buildings, restaurants, underground areas, office buildings and other similar indoor environments. It provides the following functionalities:

- High linearity and low noise amplifiers
- Telco grade reliability
- High gain AWS +80dB
- Advanced AGC
- Oscillation detection and protection
- Output power +26 dBm Downlink, 18dBm Uplink
- Full local and remote control and diagnostics
- Available communication through Ethernet protocol
- cellular modem for remote monitoring and control
- Adjustable filters for various T-MOBILE AWS sub bands

2.3 REPEATER UNIT RF SPECIFICATIONS

Parameters	Specifications
Frequency Range (Down / Up)	See AWS BANDS table below
Output Power	DL: 26 dBm UL: 18 dBm
System Max Gain	80dB +/-2dB
Delay	Less then 5usec
Waveform	EVM<12%
Ripple	+/-2dB
Noise Figure	<7dB
Filter rejection	>-40dBc @1Mhz from corner frequency
Gain tuning range	30dB in 1dB steps
VSWR	1.5:1
Operating Temperature	Standard: -20C to + 60C.
Manual Indicators\Controls	See below
Alarms	See below
Dimension	16X 10.5X 5 (inches)
Power Requirements	10VDC,<80W from external power supply (included)
RF Connector	N Type female

2.4 REPEATER BLOCK DIAGRAM

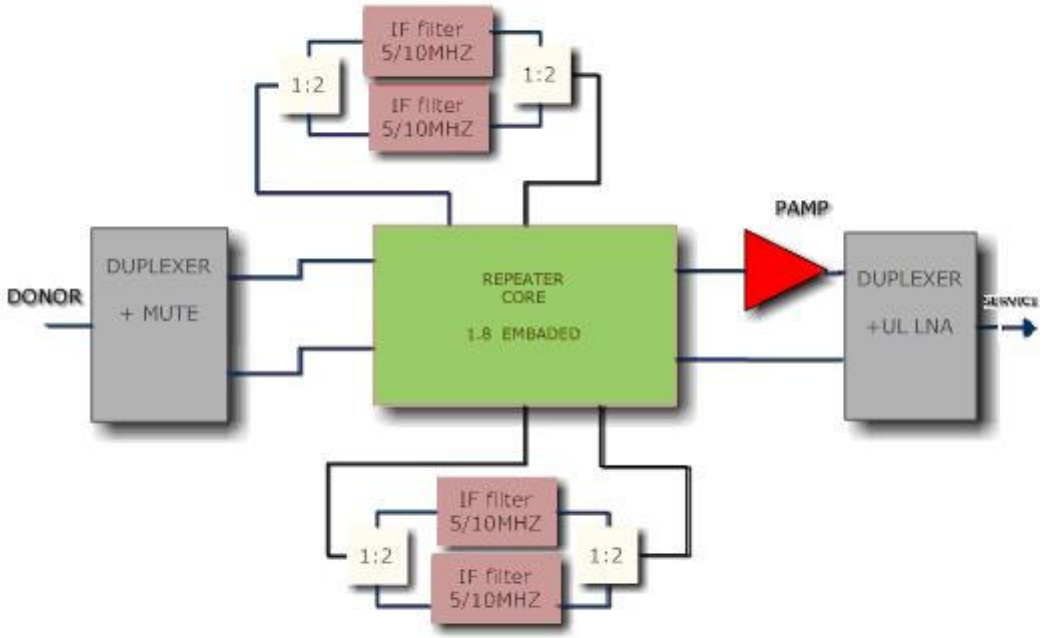


Figure 2-1: System Block Diagram

2.5 REPEATER UNIT PASS-BAND FILTERS

The BDA-AWS21-26-4UT-AB-JXX Repeater unit supports simultaneously and independently, two of the following sub band options:

REPEATER SUB BAND OPTIONS

Configuration	*Uplink [MHz]*	*Downlink [MHz]*
A	1710-1720	2110-2120
B	1720-1730	2120-2130
C	1730-1735	2130-2135
D	1735-1740	2135-2140
E	1740-1745	2140-2145
F	1745-1755	2145-2155
C+D	1730-1740	2130-2140
D+E	1735-1745	2135-2145

NOTE

The system can be configured to one or two sub bands from the above list of BW 5 or 10 MHz. Any filter can be turned off, if needed

2.6 DIMENSIONS AND WEIGHT

The dimension of the Repeater, including the mounting bracket, is shown in Figure2-2.

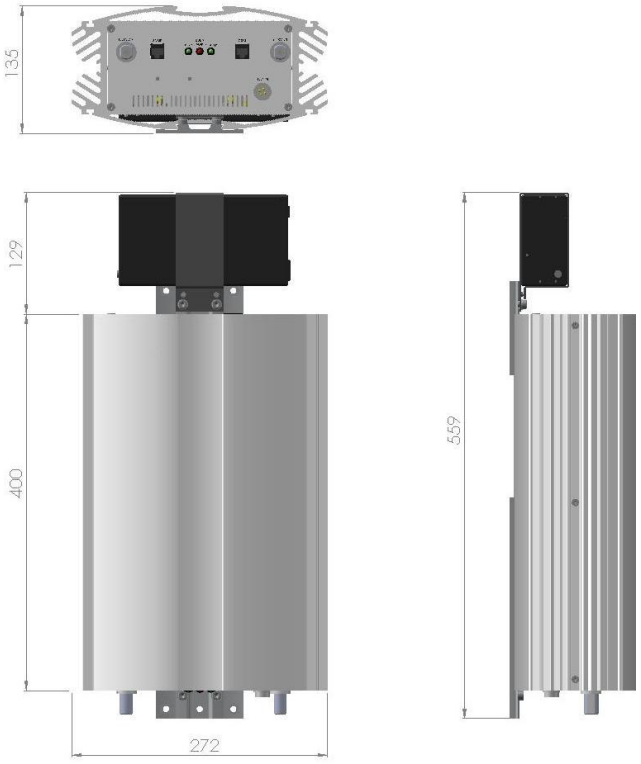


Figure 2-2: Repeater dimensions

Approximate Repeater weight: 12 Kg (26 lbs)

2.7 REPEATER UNIT INTERFACES

The Repeaters interfaces are located at the bottom, op and the side of the Repeater.

Table 2-1：Repeater Interfaces

Name	Type	Function
SERVICE	N-Type female connector	Connect to Service antenna
DONOR	N-Type female connector	Connect to Donor antenna
POWER	PLT DC connector	Connect to Power supply
COM	RJ 45	Ethernet connection to PC
SNMP	RJ 45	Ethernet connection to LAN

3. Installation

This section provides information for the installation and setup of the Cellvine Repeaters.

The information consists of procedures for unpacking, inspection and preparation for the installation, as well as the actual installation and the setup. It is important that the Repeater will be installed correctly at its working location. It is recommended that installation be done by a certified radio technician.

The Repeater installation consists of five basic steps:

(1) Unpacking and inspection

(2) Antenna installation

(3) Repeater installation

(4) Cable installation

(5) Repeater parameters Set-Up and tuning with Control application.

3.1 UNPACKING AND INSPECTION

Examine the shipping package for damage before unpacking the unit. If the shipping package is damaged, try to have the carrier's agent present when the equipment is unpacked. If visual inspection reveals physical damage(s) to the equipment, you should send it back for replacement.

Verify that the equipment includes all components, as listed under packing slip. Contact Cellvine Ltd. if you find missing components.

3.2 OPERATING ENVIRONMENT

Cellvine's indoor Repeaters are intended for installation indoors only.

Do not install them where they might be exposed to direct sunlight and rain\snow conditions as this could be harmful to the unit. For normal operation, the environmental conditions should be as follows:

Ambient temperature range: –20 °C to +60 °C, Maximum Humidity: 90 %.

3.3 PRE-INSTALLATION INSPECTION

Before beginning the Repeater installation determine the following:

- Base station location and receiving power (Tx power in dBm)
- Location where the DONOR/ Service antenna is to be installed
- Location where the Repeater is to be installed
- Length of coaxial cable needed to connect from the Donor antenna to the Repeater unit
- Length of coaxial cable needed to connect from the Repeater unit to the indoor antenna/s.
- Isolation estimation between the donor and the coverage antenna/s.

3.4 ANTENNAS INSTALLATION

3.4.1 Coverage (Service) Antennas

Coverage (service) antennas are facing to the service area. The mostly used Antennas for indoor applications are Omni or panel antennas. When multiple indoor areas need coverage, more than one antenna can be used. The indoor antennas are usually placed near the ceiling with decorative covers, antenna location decisions take into account isolation issues and overcoming interfering signals. For outdoor coverage, panel antennas are commonly used, location of the antenna is defined by coverage and isolation matter.

3.4.2 DONOR Antenna

DONOR antenna is installed outside, facing to the donor BTS. The donor cell site should be chosen by considering capacity, range and signal level in the outdoor antenna location. The location should be chosen so that the donor cell site will be received at a higher level than all other adjacent cell sites. If possible this antenna should be faced directly to the nearest cellular site with a line of sight view. This antenna should also be properly grounded with an appropriate grounding strap and lightning protection if needed. Install the antenna according to antenna manufacturer instructions.

3.5 REPEATER UNIT MECHANICAL INSTALLATION

3.5.1 Repeater Installation

- Use the hardware bracket supplied to mount the Repeater to a solid location as show in Figures 3-1to 3-8.
- Install the Lower (Long) bracket on the wall in vertical position using three fixing screws ÷ M6 (or 1/4 ") socket pan screw, M6 plain washer, M6 spring washer.(Figure 3-1,3-2)

Figure 3-1

Figure 3-2

- Slide the repeater on the lower bracket from top (Figure 3-3, 3-4).

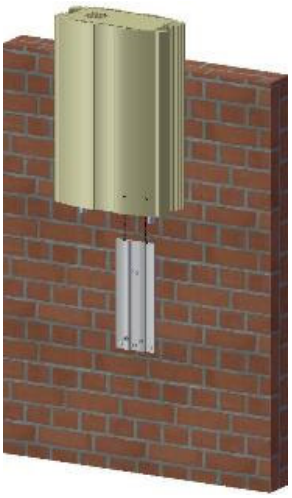


Figure 3-3

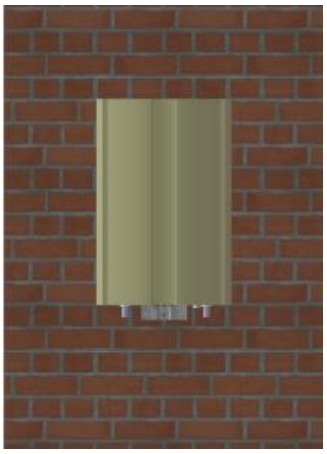


Figure 3-4

- Slide the Upper bracket (Short) and mark the drilling points for the upper bracket (use the black marker on the bracket Figure 3-5,3-6,3-7)

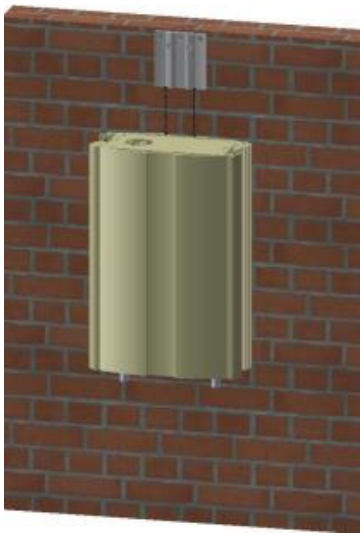


Figure 3-5

Figure 3-6

Figure 3-7

- Take out the Upper bracket and the repeater and drill the needed holes.

- Re slide the repeater and the upper bracket (till the black marker), Connect the two upper screws and fasten the bracket to the wall (Figure 3-7,3-8).

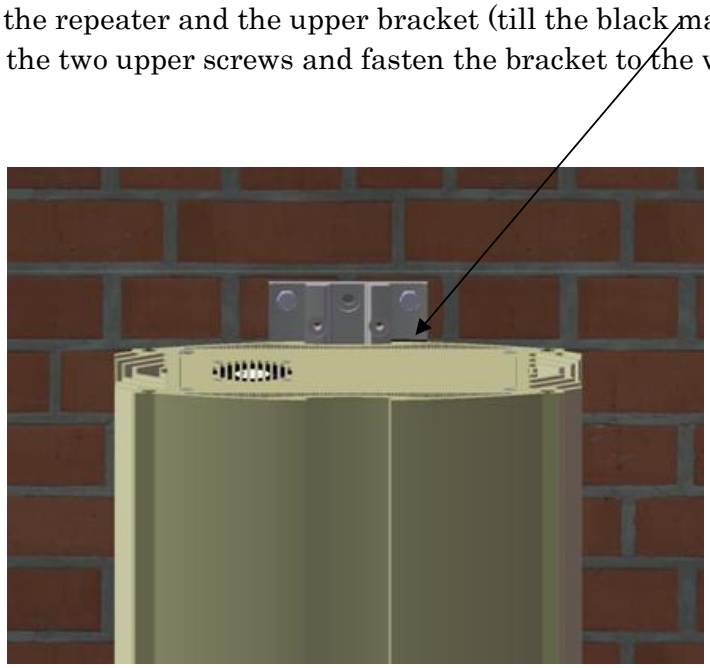


Figure 3-8

- Make sure that the antenna cable connectors and the Repeater connectors are clean and dry.
- Connect the Donor antenna cable to the "DONOR" RF connector.
- The connection should be snug and tight.
- Connect the "service" (coverage) antenna cable to the service RF connector. The connection should be snug and tight.
- Ensure that the antenna cables have not been crimped, kinked, or otherwise damaged in the process.

3.5.2 Power supply Installation

3.5.2.1 Bracket Mounting

- Take out the 2 Allen screws mount the power supply on the bracket
- re insert the screw and the spring lock washers, fasten the screws to the bracket (see figure 3-9)

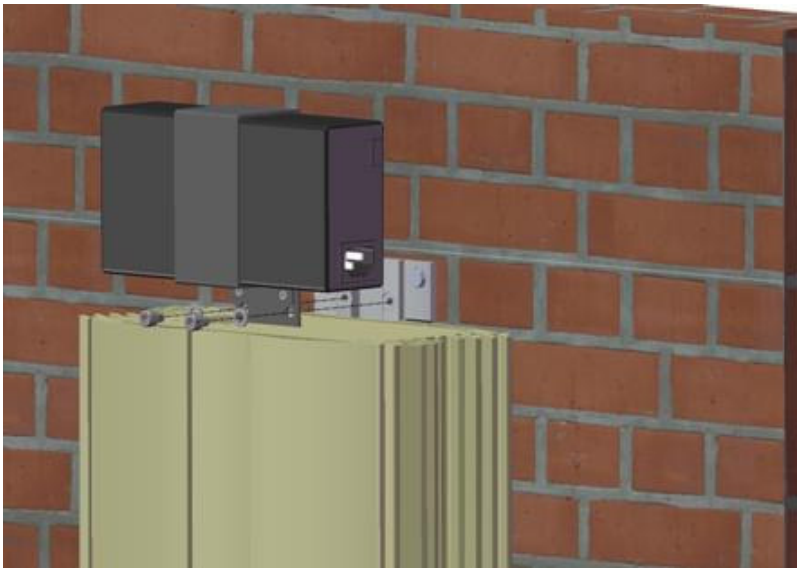


Figure 3-9

- Connect the DC cable to the repeater
- Connect the AC cable to the Power supply and than to the AC outlet.

3.5.2.2 Wall Mounting

Take the power supply kit (Power supply +attached bracket) place it on the wall and mark the holes for drilling.

Drill the 2 holes and than fasten the kit to the wall with 2 screws. (Figure 3-10).

Figure 3-10

- Connect the DC cable to the repeater
- Connect the AC cable to the Power supply and than to the AC outlet.

NOTE: Always connect RF connectors to Repeater before applying electric power!

3.6 REPEATER CABLE CONNECTION

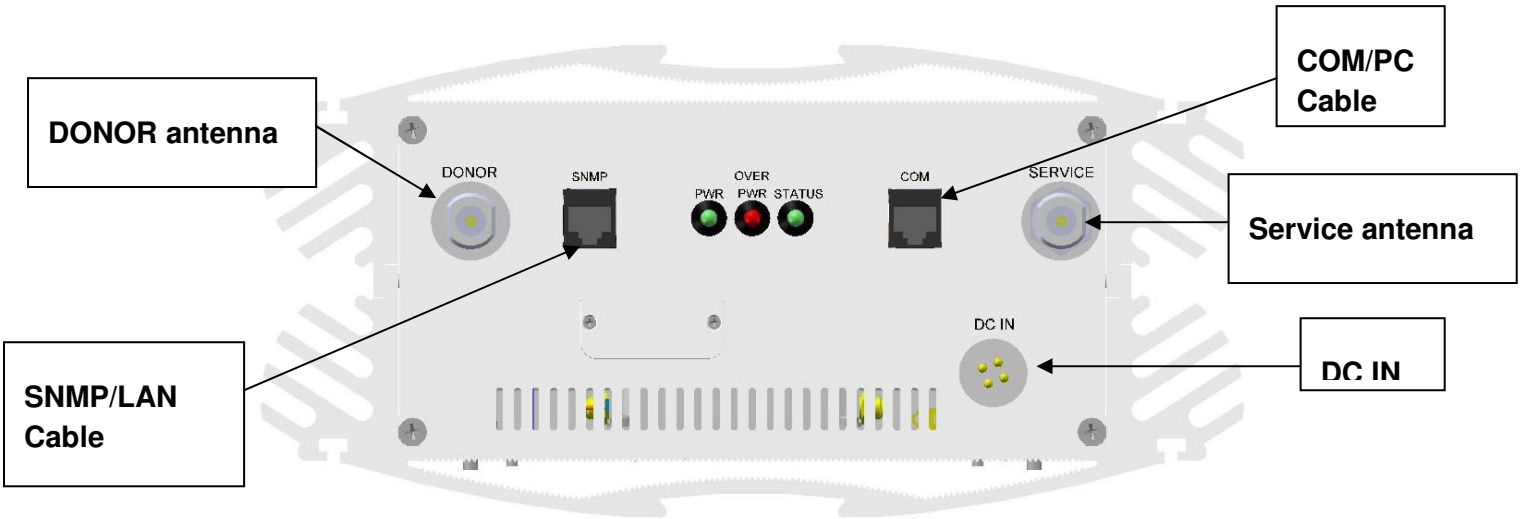


Figure 3-1: Cable Connections

3.7 SYSTEM INDICATIONS

There are three indication LED's on the front panel:

Power, Over Power, Status.

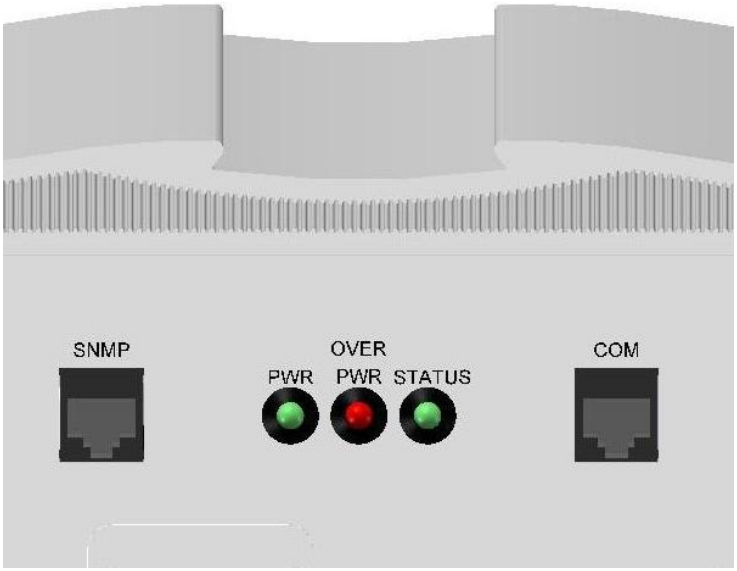


Figure 3-2: Repeater Indications LED's

- PWR: On when the repeater is ON,
- OVER PWR:

  Off in normal operation,

  On when signal is high (27dBm) and Gain is at minimum value.

  Blinking when signal is high (above 27dBm) and the system is shut down for a period of approximately 1 minute.

- STATUS:

  On in normal operation and good DL power

  Blinking when DL power is low

3.8 TUNING DONOR ANTENNA

Locate a potential site for installing the Donor Antenna with an accessible and comfortable working space. If possible locate a place with a line of sight to the Donor BTS.

Deploy a coax cable between the Donor antenna and the Repeater location and connect to the DONOR connector.

In order to achieve the best signal reception quality at the donor antenna, rotate the antenna gently sideways and measure signal strength by an approved test set.

3.9 ANTENNA ISOLATION

To assure proper Repeater operation, the isolation between the indoor (Service) and Donor antennas should be higher than the Repeater's maximal gain (15dB difference is recommended). This parameter can be measured by injecting a pilot signal at the indoor antenna's (DAS) connector and measuring the received signal at the DONOR antenna connector. The isolation measured should be at least 15dB higher then the MAX GAIN of the repeater. It is recommended to perform the test using a sweep signal generator to cover the whole band. It is also recommended, to perform the test in the opposite direction. (Injecting to the donor antenna and measuring at the Service antenna's connector).

4 Repeater Monitoring and Control

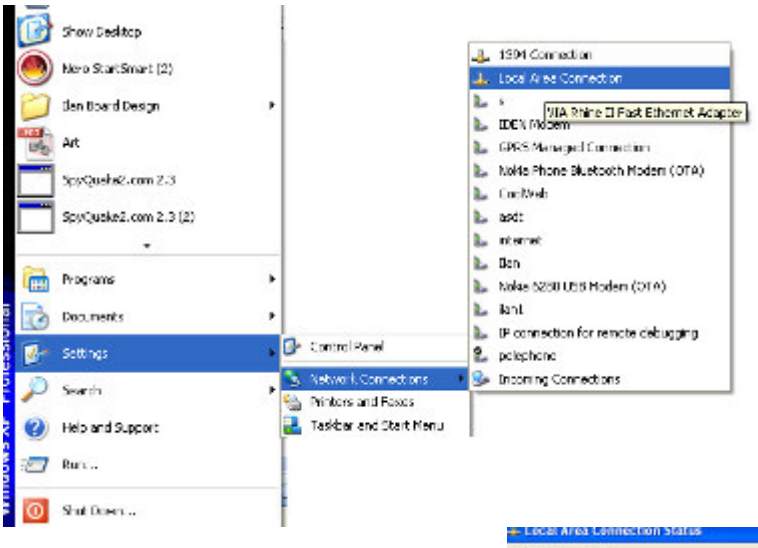
This type of repeater can be accessed in two ways for Monitoring and Control:

- Via Ethernet cable in local, web connection or by
- Internet connection via cellular modem

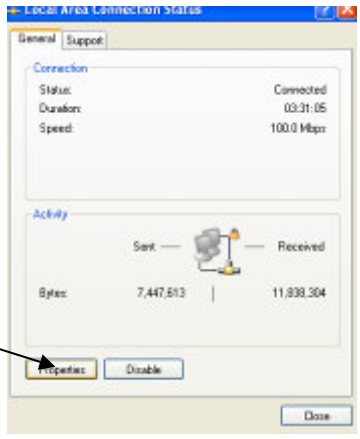
4.1 PREPARING THE REPEATER FOR LOCAL CONNECTION

4.1.1 Define PC internet settings:

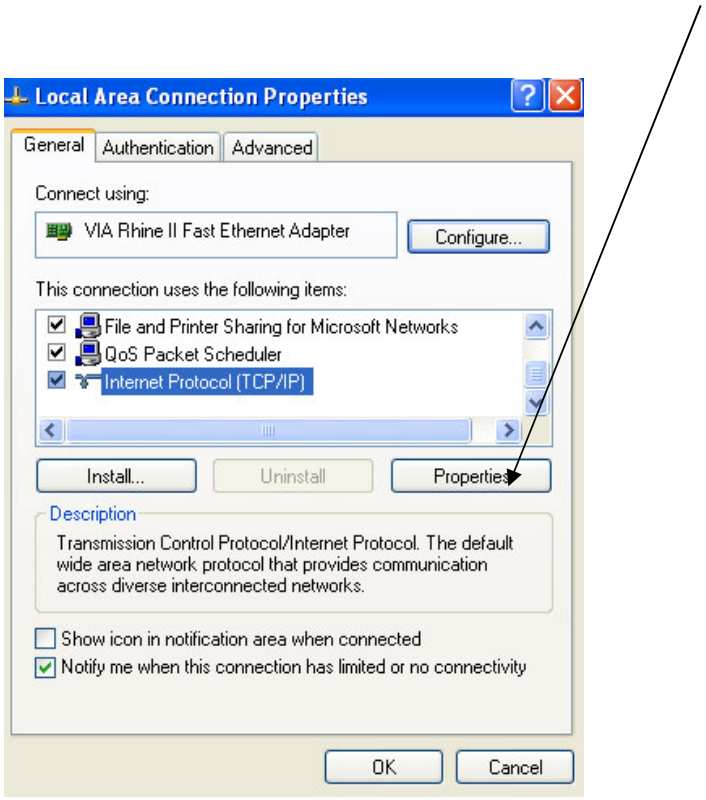
Go to Start→Settings→Network Connections→Local Area Connection



Select "Properties"

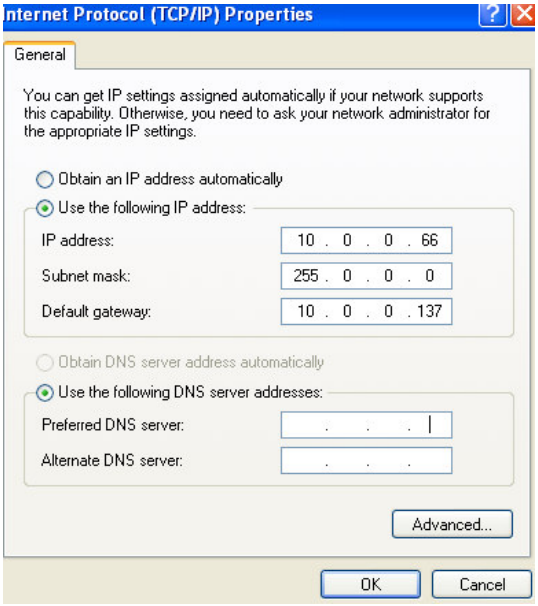


Select "Internet Protocol (TCP/IP), click Properties



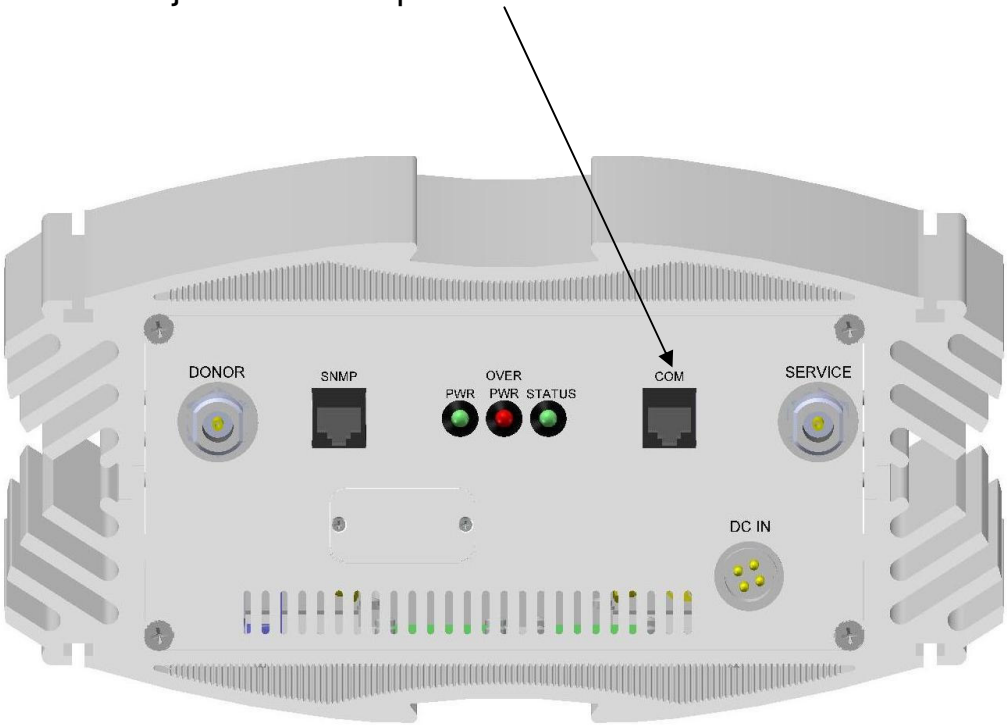
4.1.2 TCP\IP Setting

Define TCP/IP properties as following, then click "OK:



4.1.3 Ethernet cable connection:

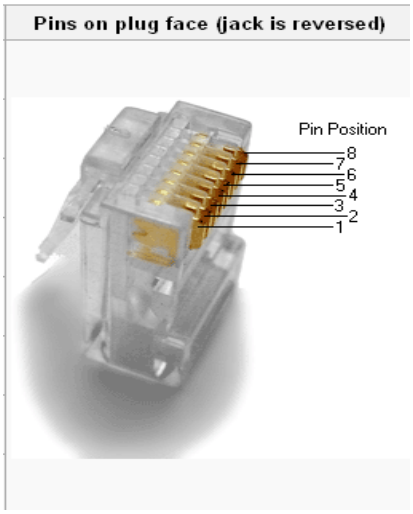
Connect the crossed Ethernet cable (supplied by Cellvine) from the PC\Laptop to the RJ45 jack on the repeater



4.1.4 Standard crossed Ethernet cable description

Pin number	Wire Color
Pin 1 ==>	Orange/White
Pin 2 ==>	Orange
Pin 3 ==>	Green/White
Pin 4 ==>	Blue
Pin 5 ==>	Blue/White
Pin 6 ==>	Green
Pin 7 ==>	Brown/White
Pin 8 ==>	Brown

Crossed-Over	
Wire	Becomes
1	3
2	6
3	1
6	2

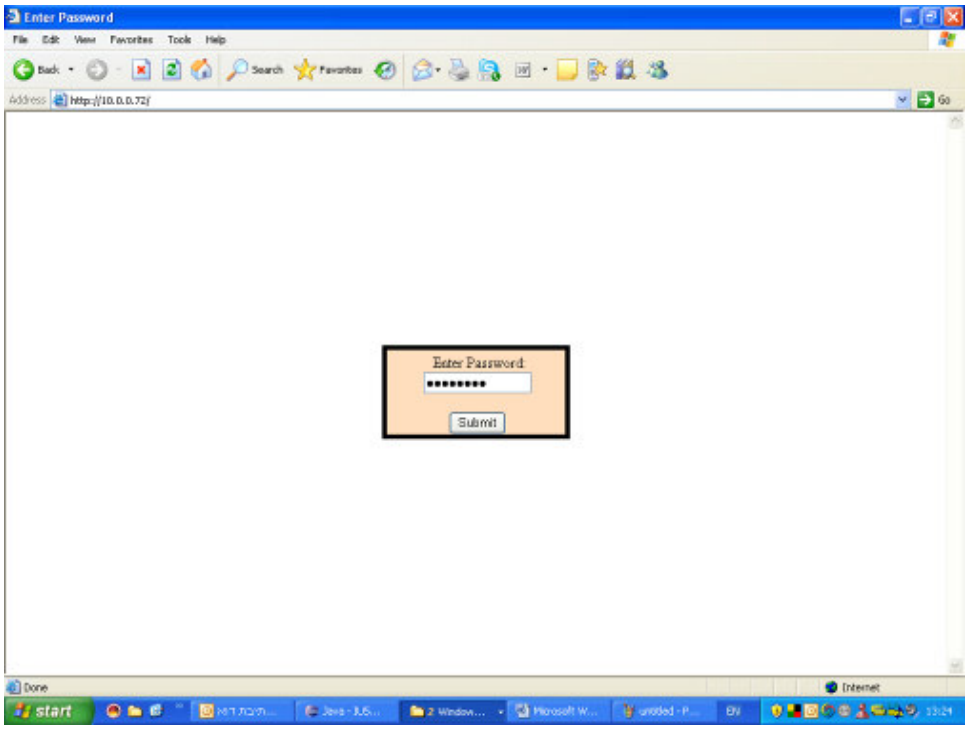


4.1.5 Connection to the repeater Using internet browser:

It is recommended that before connecting to the repeater , delete all history and temporary files from the Internet Browser.

Go to IP address: 10.0.0.72. (Wait for 2 min after repeater turned on)

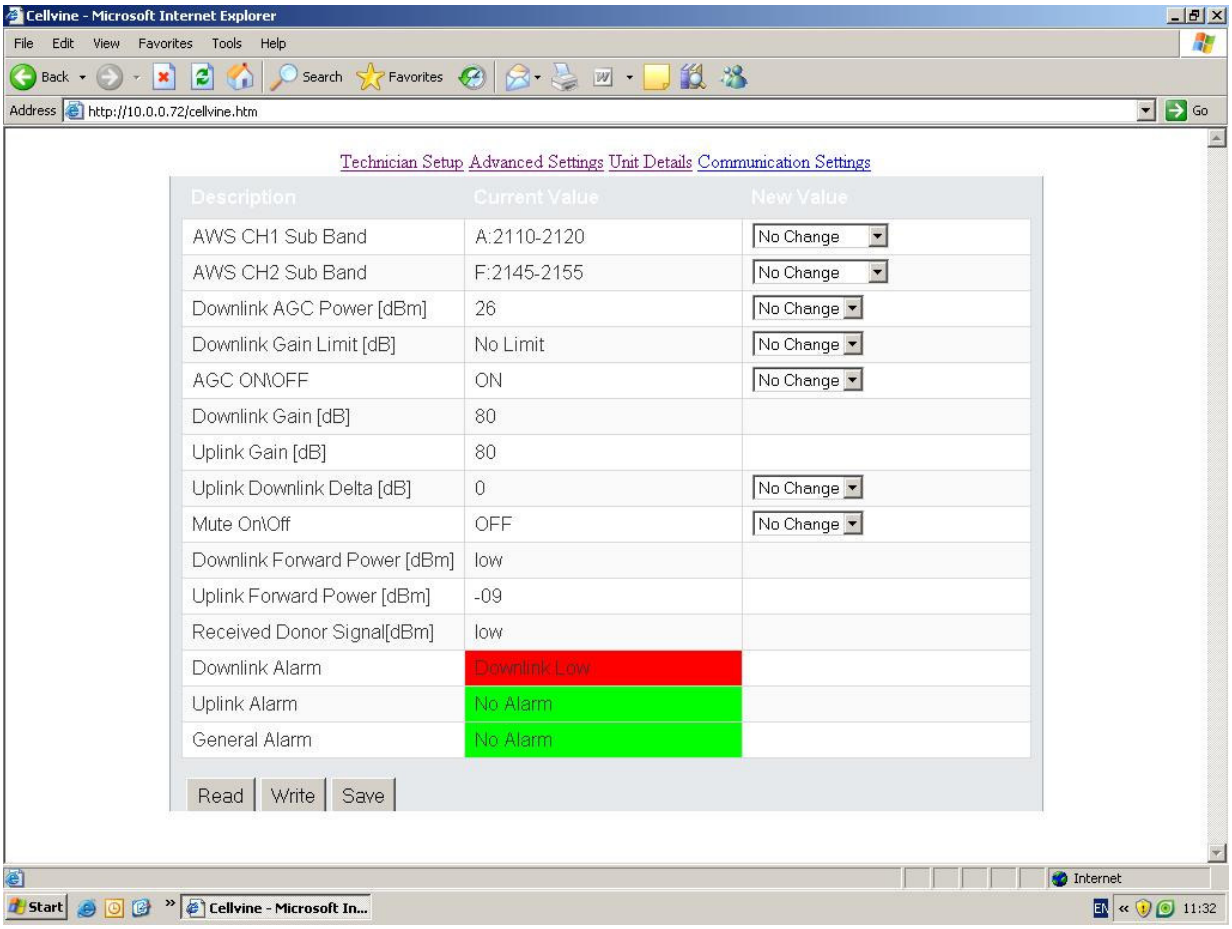
Login screen appears:



- Enter password: Cellvine (all small letters)
- Click "submit"
- The main screen of the repeater will appear.

4.2 REPEATER MONITORING AND CONTROL

The main screen is "Technician Setup". The user can set & read all the important parameters of the repeater following a friendly GUI process.



4.2.1 Reading parameters and readouts

By pressing "read" the user will get readings of all repeater parameters and readouts.

Parameters:

AWS CH1 Sub Band - Channel 1 sub band definition from the dropdown list.

AWS CH2 Sub Band - Channel 2 sub band definition from the dropdown list.

Downlink AGC Power [dBm] - The target power that the repeater will try to go to, will use max gain if needed unless limited by Max Gain Limit.(effective on AGC ON mode).

Downlink Gain limit [dBm] –The Gain limit (effective on AGC ON mode)

AGC ON/OFF – Turning on or off the AGC mechanism. When AGC is ON the repeater will try to set the output power to the value set at the " Downlink AGC Power [dBm]" with the limit of the gain as set on the " Maximum gain Limit [dBm]".

When AGC is OFF the repeater will amplify according to the values set on "Downlink Gain [dBm]" and Uplink gain [dBm] respectively.

Downlink Gain [dB] – The gain value that the repeater will amplify on the Downlink path (effective on AGC OFF mode)

Uplink Gain [dB] – The gain value that the repeater will amplify on the Uplink path (effective on AGC OFF mode)

Uplink Downlink Delta [dB] - The difference in dB between the Downlink gain and the uplink gain. (-) sign mean that the uplink gain is lower than the uplink gain by X dB. Recommended value is -1 to -3.

Mute ON/OFF – Mute is the function of turning off the power amplifiers of both Uplink and Downlink paths. Turning it on will shutdown the amplifiers.

READOUTS:

Downlink Gain [dB] - When in AGC ON mode used as the reading of the current Downlink gain.

Uplink Gain [dB] - When in AGC ON mode used as the reading of the current Uplink gain.

Downlink Forward Power [dBm] – The power measured by the repeater at the service port. (Values between 9 to 27,below 9 will display "LOW")

Uplink Forward Power [dBm] - The power measured by the repeater at the Donor port. (Reading is usually "LOW" since output to the donor is with low power)

Uplink RSSI [dBm] - The measurement of the signal coming to the service port.

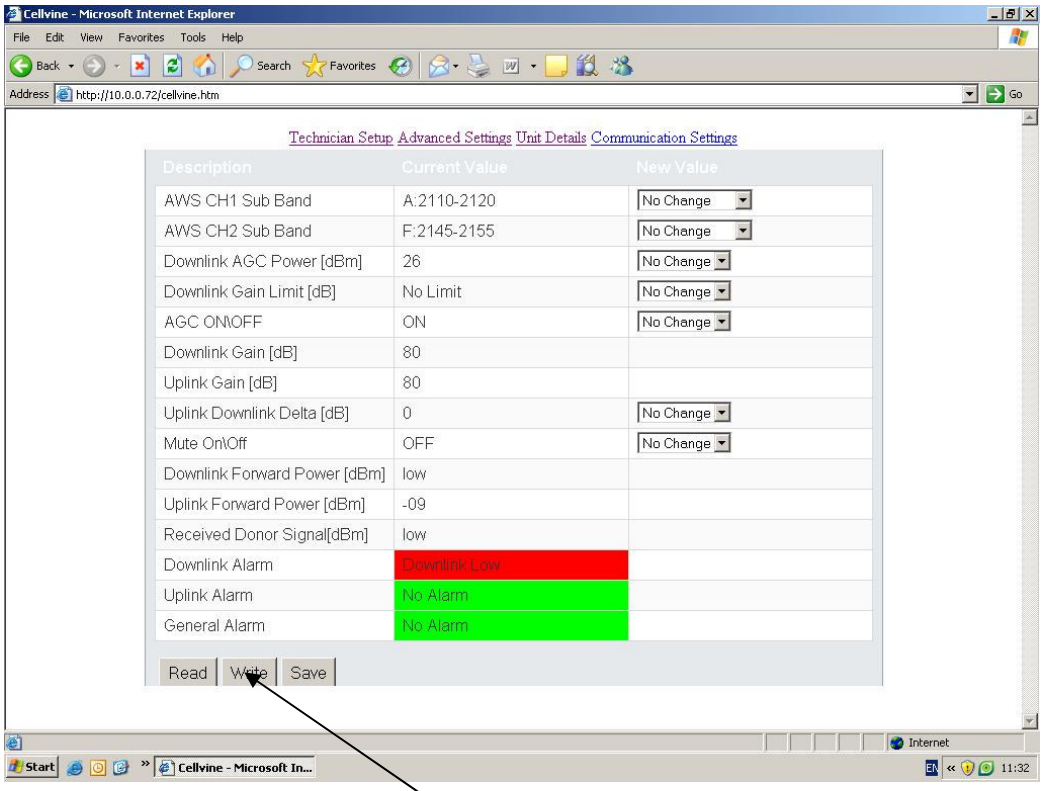
(Equal to " [Uplink Forward Power [dBm]] – [Uplink Gain [dB]],

Downlink Alarm - Display the alarms exist on the Downlink (If there is no alarms will display "No Alarms").

Uplink Alarm - Display the alarms exist on the Uplink (If there is no alarms will display "No Alarms ").

General Alarm - Display general alarms (If there is no alarms will display "No Alarms ").

4.2.2 Writing parameter



The user can select new value for a parameter (in this example "AWS CH1 Sub Band") using the "New Value" drop down window and clicking the required value.

In order to update the value press "Write"

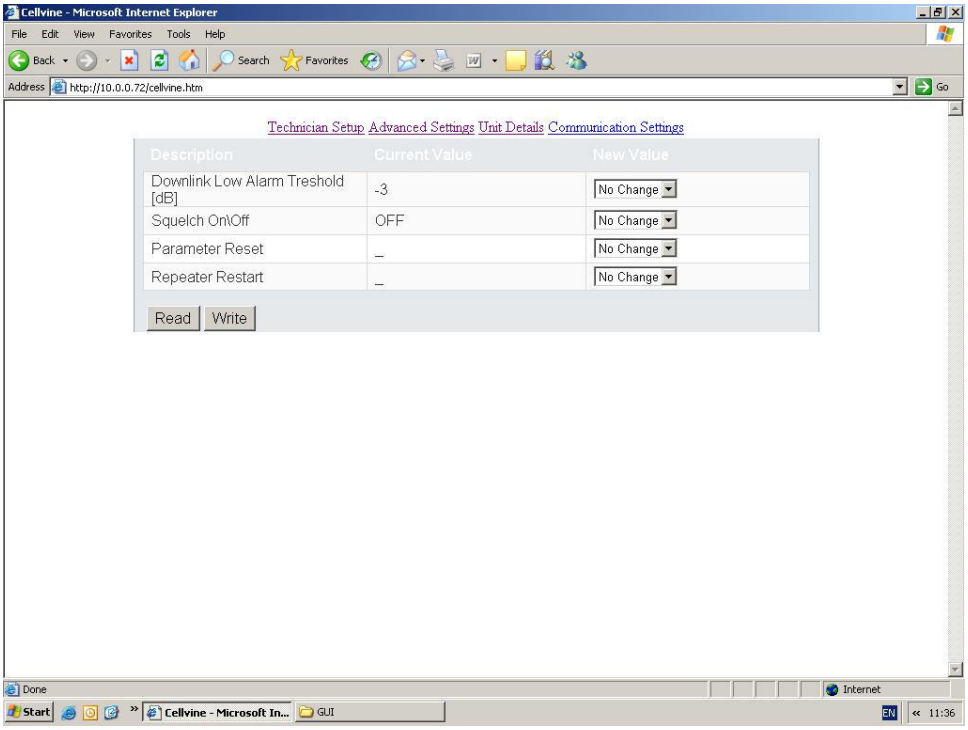
When selecting a new value all other values are blocked, (the selection boxes become pale) unless "write" button is pressed, or "No Change" is selected.

All the parameters that have "New Value" box can be updated in the same way.

4.2.3 Saving parameter

In order to keep the parameters after repeater power shutdown and recover them, the user needs to click "Save", this will save the current values to repeater's non volatile memory.

4.2.4 Advanced settings



In this screen the user sets the general setting of the repeater

Downlink Low Alarm Threshold – this parameter sets the allowed downlink power delta from AGC power before generating an alarm.

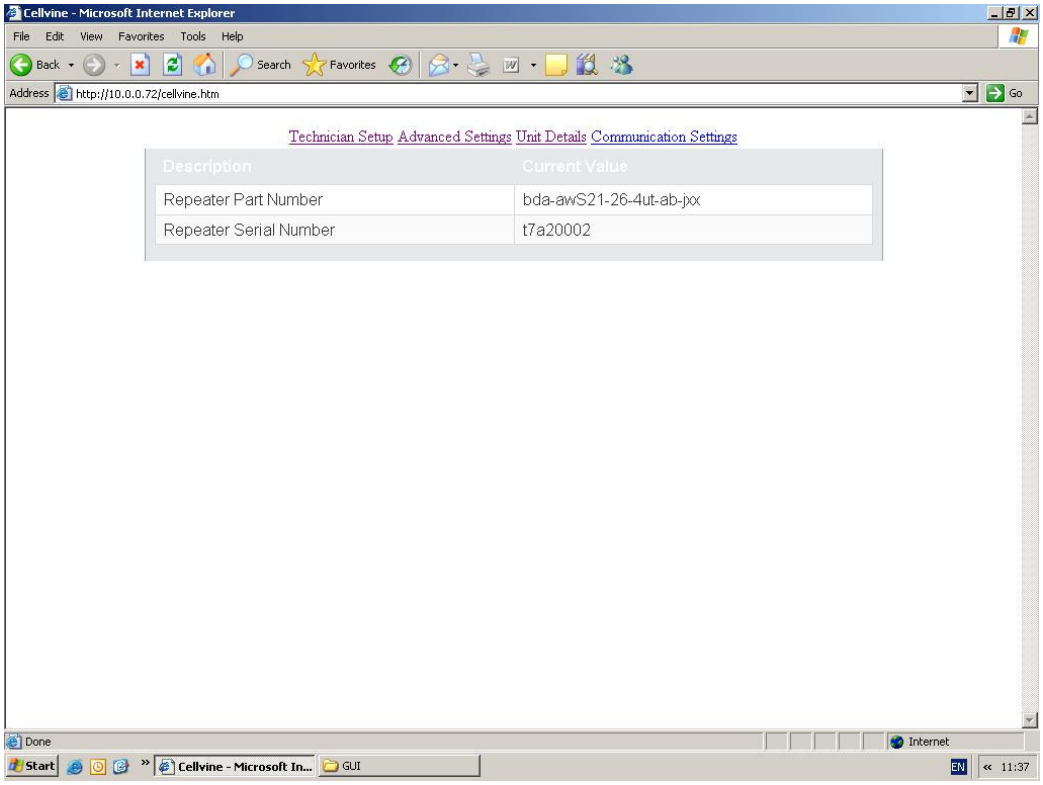
Squelch On/Off – Enable/disable the squelch function

Parameter Reset - Return the repeater parameters to the last known saved.

Repeater Restart – Resume repeater operation after shut down.

(Pressing "save" in "Technician Setup" screen also saves this screen parameters)

4.2.5 Unit Details

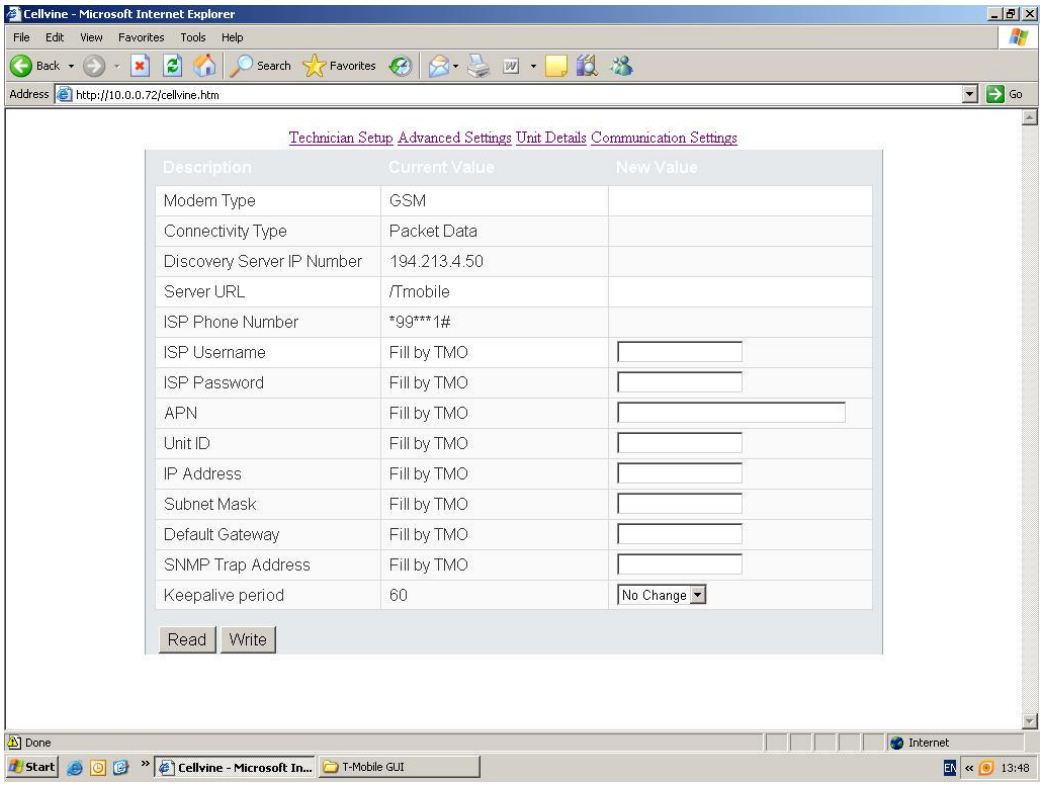


This screen shows the unit part number & serial number

4.2.6 Communication setting

Use this tab for wireless internet connection via modem

This screen shows the IP communication definitions



The parameters can be set by the technician:

Modem type:

Connectivity type:

Discovery Server IP Number: this parameter is supplied as defined by the operator; if the server IP has changed the technician can set it

Server URL: Default value is Cellvine's management server

ISP Phone Number:

ISP Username: the cellular internet provider username (operator defined)

ISP Password: the cellular internet provider password (operator defined)

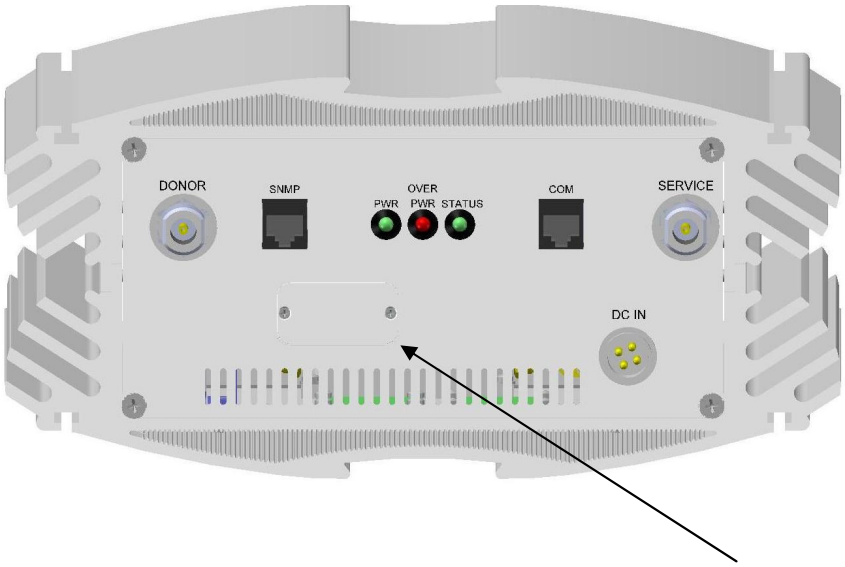
All others fields will be explained on the MOP doc and other T-Mobile documents.

All screen parameters are saved automatically upon pressing "Write"

4.3 PREPARING THE REPEATER FOR REMOTE CONNECTION VIA INTRANET:

4.3.1 Initiating the modem:

- Make sure that the repeater is switched OFF
- Make sure that a modem is installed in the repeater



Insert SIM card into the modem through the SIM card slot:
- Open 2 screws and remove SIM card cover.
- Press the yellow button using a sharp tool (like pen tip) and pull out the SIM card plastic tray.
- Place the SIM card in the tray and insert the tray back into the slot.
- Place the cover and fasten it with the 2 screws.

- Turn the repeater ON.

5 TROUBLESHOOTING

5.1 Connection Failure

Trying to locally connect to the repeater via the internet browser fail

Possible reason:

1. Adress typed is not correct.

2. TCP/IP definitions are not correct.

3. Communication port on the repeater is not ready yet.

4. The Ethernet cable is not the original (Crossed).

Solution:

Check cable and reconnect it, verify configuration according to chapter 4.1, clean all temporary internet files and history on your internet browser, wait 2 min for repeater "warm up" and try to connect.

5.2 GUI Parameters not update correctly

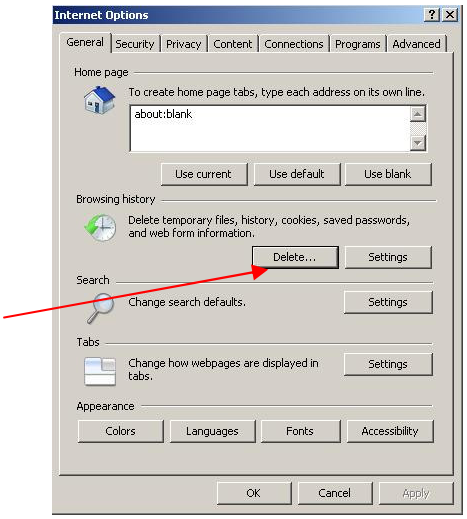
Parameters coming from the repeater not updated as they should.

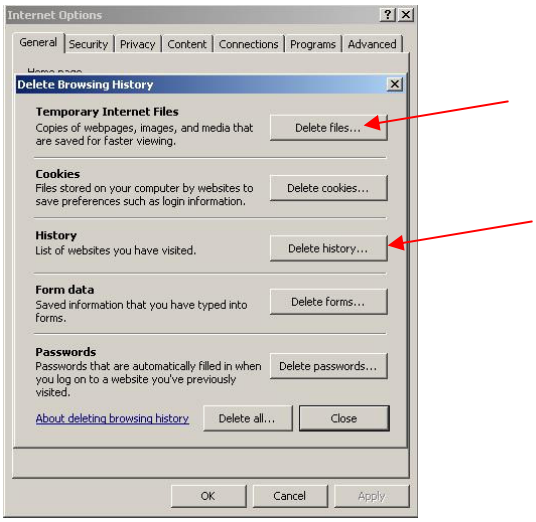
Possible reason:

1. Internet browser cache is full

Solution:

Delete temporary internet files and history on your internet browser





5.3 Modem can't connect to the NMS server

Trying to connect to the server (Via the modem) fail.

Possible reason:

1. SIM is not inserted.
2. SIM is not configured properly (APN, Data services, etc'. e.g.
3. Repeater APN definition is not configured properly.
4. RF Receive level is too low.
5. Network definitions for the SIM are not correct.

Solution:

Verify SIM card inserted correctly (chapter 4.3.1).
Verify all definitions are set to the correct value (at the switch/HLR/SIM card)
Check the reception of the GSM/GPRS signal coming from the donor site.

5.4 Call Fails.

Trying to make calls through the repeater fails although signal strength from the donor is OK and DAS network working properly. (Good indoor coverage).

Possible reason:

1. Cell Range parameter on the donor site not configured to include repeater delay.
2. Other network parameters related to delay are not set properly.

Solution:

Verify that the parameters on the network take into account the delay of the repeater + the extended coverage range of the repeater.