

SBR/RF Series**OPERATION AND INSTALLATION MANUAL****R-20-930 MHz (One Way Paging)
(Indoor Coverage)**

April 2007

Proprietary Information

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Hello,

You will feel immense pleasure that you have acquired a world-class RF repeater for augmentation of RF signals for providing quality connectivity to the outside World from your home, office or any other indoor location. This system has been designed to operate on the latest digital mobile communication technology so as to guarantee you enhanced voice clarity each time, every time. It is, as you will soon find yourself, the ultimate in reliability and quality. This has an elegant design and is one of the products from the comprehensive portfolio of in-building & outdoor solutions from **SHYAM TELECOM**.

As you will find that it is light in weight, easy to handle and install at a suitable place of your interest to match the interior. It is associated with different technical features for optimum performance so as to have minimum maintenance.

Shyam Telecom today, is World leader for providing Outdoor & In-Building RF coverage solutions not only in India but also at different locations around the World, in the rapidly growing mobile communications market. Operating in an industry that has been witnessing rapid technical changes, **Shyam Telecom** strives to keep abreast of the latest technology and industry trends through continuous research and development. Our hard work & dedication in this field, has been recognized by the **Department of Scientific & Industrial Research (DSIR), Government of India** through the best award for R&D in its category.

True to the family to which this system belongs, it is uniquely designed to render clear sound and error free data for a long, very long time. We would request you to go through this easy to understand **R-20-930 (One way paging) RF Repeater** Operation & Installation manual for optimum utilization of this product.

Shyam Telecom assures you after sale service of International standard through its Service Network located around the World.

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1.0 DISCLAIMER

Every attempt has been made to incorporate complete and up-to-date information about the equipment in this document but **Shyam Telecom** reserves the right to make changes without notice as per the requirement and convenience. As such **Shyam Telecom** shall not be responsible for any damages including consequential, caused by reliance of the contents presented in this document.

Product name(s) referenced in this document are trademarks of the company or their companies, and are hereby acknowledged.

Warranty conditions about the product, are given in **clause no.3** of this document and accordingly shall be honored.

2.0 About Shyam Telecom

Shyam Telecom has well-organized infrastructure & facilities for providing RF coverage solutions to cater to the requirements of our valuable customers around the World.

Established in 1974, **Shyam Telecom** initiated the process of manufacturing Radio Communications related products as per the needs of the customers in Domestic & International markets at that time. Our vision has been to grow & keep pace with the continuous development in the telecommunication field and upgrade our facilities accordingly. **Shyam Telecom** made humble switch over to manufacture various products related with enhancement of coverage in Mobile Communications Network in 1996, since then, it has never looked back.

There is comprehensive range of different products to offer solutions for enhancement of RF coverage under all possible situations in building and outdoor.

Head office including Marketing, Research & Development and Manufacturing facilities of Shyam Telecom are located in the Industrial area of Gurgaon in the state of Haryana in India. In order to cater to the requirements of customers, for marketing and after sale service, we have network consisting of branch offices in the Americas & Europe.

Any intervention has to be performed by authorized persons only. If you need technical assistance, please address your queries at any of the Offices/Service Centers as indicated below:

1. **Shyam Telecom Ltd.**
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GURGAON – 122015 (INDIA)
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Frohsinnstrasse 16, 63739 Aschaffenburg, Germany
Tel: + 49-6021-45901-0 Fax: + 49-6021-45901-29

3. **Shyam Telecom Inc.**
6, KILMER ROAD, SUIT D,
EDISON, New Jersey-08817 (USA)
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3.0 WARRANTY

This **Shyam Telecom** product is guaranteed against manufacturing defects of parts and components inside the system for a period as per attached warranty card enclosed in the packing of the product. Should a defect arise in this product during the period of warranty, **Shyam Telecom** as the seller undertakes to get the system repaired free of charge, through its authorized service center. Attention of the customer is drawn to the following with respect to the warranty:

- During the warranty period, **Shyam Telecom** or its authorized service network will carryout the repair or replace the faulty unit/module. No charge will be made to the customer for either parts or labour in repairing or replacing the product. All original units/parts or equipment, which have been replaced, shall become property of Shyam Telecom.
- Any repaired or replaced product will be warranted for the balance of the original warranty period or for 90 (ninety) days from the date of repair, whichever is longer.
- The Customer must provide particulars about the original purchase upon request from **Shyam Telecom** or authorized service dealer.
- Transportation, delivery and handling charges incurred in the transport of the product to & fro **Shyam Telecom** or its authorized service center will be borne by the customer. Any expenses relating

to uninstalling or reinstalling the product are not covered under this warranty.

The warranty shall not be valid in one or more than one of the following event(s) / circumstances:

- The product has been subjected to abnormal use, abnormal condition, improper storage, exposure to excessive moisture, dampness, temperature or such environmental conditions, unauthorized modifications, connections, repair including but not limited to the use of unauthorized spare parts in repairs, misuse, neglect, abuse, accident, alteration, tempering, improper installation, Acts of God, spill of foods or liquids, or acts which are beyond the reasonable control of **Shyam Telecom** and fair wear & tear of the product.
- The product was presented for repair after the applicable warranty period. In such event, **Shyam Telecom's** normal service policies shall apply and the customer will be charged accordingly.
- The product serial number or model number has been defaced, removed or tempered.
- The product was used with or connected to any accessory not supplied by or authorized by **Shyam Telecom** or any accessory not fit for use with the product.
- The warranty is not applicable to second or subsequent buyer.

In case where the product is reported faulty after the expiry of warranty, **Shyam Telecom** shall undertake the job of repair/replacement after confirmation from the customer. **Shyam Telecom** requests the customer to furnish the following information:

1. Name of the Company (Purchaser) with address
2. Contact person
3. Invoice Number & date
4. Delivery Note
5. Name of the product
 - a. Model
 - b. Serial No.
 - c. Lot & year
 - d. Quantity
6. Nature of fault/observation

The team from **Shyam Telecom** shall technically examine the product and on the basis of which the customer shall be intimated about the payment to be levied. Necessary action to repair/replace the unit shall be initiated after the confirmation is received from the customer.

Any disputes arising in connection with warranty clauses mentioned above, will be governed by and construed in accordance with the laws of India. The Courts within Delhi will have jurisdiction.

All warranty information, product features and specifications are subject to change without notice.

4.0 SAFETY REQUIREMENTS

The person(s) who are required to handle/install the product, precautions as detailed below, may be observed:

Skilled person(s) should handle the product.

The manual pertaining to the product should be read & understood carefully. Correct AC mains settings (100-240 V) should be done for the operation of the system to avoid damage to the system and to the person handling it. If required, separate voltage stabilizers should be installed for providing AC input to the equipment.

During the installation, the AC mains input to the equipment should remain disconnected.

Placement of outdoor antenna(s) close to the power lines should be avoided and safe distance has to be maintained.

In the manual, wherever the "CAUTIONS" are indicated, the handling should be carried out as per directions.

WARNING! Installation of antennas near power lines is dangerous. For your safety, follow all installation directions and keep safe distance from any high voltage power lines that could result in shock or loss of life.

WARNING! This equipment complies with FCC & IC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. For mobile or fixed location transmitters, the minimum separation distance is greater than 40 cm, even if calculations indicate that the MPE distance would be less.

5.0 ELECTROSTATIC DISCHARGE (PRECAUTIONS)

Different modules located in the equipment make use of semiconductor devices for better performance provided they are operated with proper cautions. The careless handling of such devices should be strictly avoided. While handling the semiconductor devices, grounded wrist straps, grounded workbench surfaces and grounded floor mats should be used.

6.0 INTRODUCTION

6.1 Objective

The objective of this document is to facilitate the customer to arrange installation, operation and maintenance of the equipment supplied by **Shyam Telecom** without any complication. This document enumerates all the relevant information regarding **R-20-930 (One way paging)** repeater.

6.2 Abbreviations

AC	Alternating Current
AM	Amplitude Modulation
AMPS	Advanced Mobile Phone System (US 800 MHz standard)
BTS	Base Transmission Station (cellular system element)
DC	Direct Current
DCS	Digital communication system (European 1800 MHz standard)
DL	Downlink (Radio path from BTS to subscriber)
EMC	Electro-Magnetic Compatibility
ETACS	Extended Total Access Communication System
GSM	Global system for mobile
IMD	Inter-modulation Distortion
LNA	Low Noise Amplifier
LV	Low Voltage
SMOF	Single Mode Optical Fiber
PCB	Printed Circuit Board
PCS	Personal Communication System (US 1900 MHz standard)
RF	Radio Frequency
UL	Up-link
UMTS	Universal Mobile Telecommunication System

6.3 Conforming To International Standards

The repeater systems, designed, manufactured and supplied by Shyam Telecom conform to international technical standards like ETSI and further conform to the entire international safety requirement for installation, operation and maintenance.

6.4 Repeater Systems-Introduction

Mobile Communications Systems are planned as cellular systems and each cell of the base station is required to provide RF coverage over a certain geographical area as per defined RF power levels. Due to the physics of radio propagation, even using high radiated RF powers or complicated antenna systems, there are zones within the coverage area where the RF signal strength from base station remains inadequate for establishing the desired connectivity to mobile users.

Repeaters traditionally are inducted in the Mobile Communication network to fill in the “Dead Zones” caused by blocking of signals by geographic topologies such as mountains, valleys, dense foliage, high rising urban landscapes and other man-made structures. The distance from the base station also adversely affects the RF signal strength. The user views repeaters as a means to extend base station coverage so as to reduce the number of base stations and thereby accelerate network availability.

Repeater systems are installed after meticulous planning between BTSs and the mobile users to provide RF coverage in the shadowed regions. Repeater systems are available for different applications and **ultimate choice** shall depend on some of the factors mentioned below:

- Area to be provided with coverage.
- Indoor/outdoor coverage.
- Availability of BTSs in the vicinity.
- Antenna isolation to be achieved.

7.0 R-20-930 (One way paging) Repeater

This repeater has been designed to meet the requirement of indoor coverage and is equipped to carry traffic in a **single sub band** of one MHz bandwidth in the frequency band 929 to 930 MHz. Basically traffic carried in this repeater is for transmitting signals in one direction only what can be termed as DL path.

7.1 Salient Features

- It is a band selective device & is equipped to handle signals in a **single sub band** of one MHz bandwidth that is set as per requirement in the frequency band 929 to 930 MHz.
- It has been designed to amplify signals in one direction only i.e. the down link path. It is installed at a suitable site between BTS and the area intended for providing coverage.
- It intercepts signals from the BTS through a **DONOR antenna** (highly directional outdoor antenna) and distributes the signals to the users after amplification through a set of **SERVER antennas** (omni/directional) system in the D/L.
- Design of filters permits high selectivity and excellent out of band signals rejection.
- The indoor antenna is specifically designed to blend into the ceiling of a typical office providing RF signal in all directions downward and outward from the installation point.
- For in-building configurations requiring higher gain or directional RF signal, such as a long hallway or corridor, a medium gain directional antenna may cover the area best by mounting the antenna to the opposing wall, where coverage is required.
- It finds application in multi-storey buildings, basements & car parking areas.

7.2 Typical In-Building Coverage

The R-20-930 (One way paging) repeater is designed to provide optimal coverage for areas of 1000 Sq Meters (10,000 sq. ft) to 2,000 Sq Meters (20,000 sq. ft). However, performance also depends on the amount of in-

building shadowing and the available forward signal level at the donor antenna. Typical coverage is usually planned for relatively small areas such as large conference rooms or several adjacent rooms in smaller office areas. Figure 1 shows application of an indoor repeater in a small building. Coverage is primarily determined by the available forward signal level at the outdoor yagi antenna input, loss due to the RF cable length, type of RF cable installed and achievable isolation for optimum **R-20-930** performance. Indoor coverage varies greatly due to the nature of various building construction techniques and materials. Approximations of signal level/coverage can be determined with the following assumptions:

- i. 12 dBi donor antenna. 7dBi indoor directional antenna.
- ii. Installed total cable and connector loss of approximately 5 dB for 40 Meters (125 feet) of typical 1/4" coaxial foam cable.
- iii. Interior building structure consists of typical vertical stud and drywall composition.
- iv. Isolation should be 15 dB more than the gain set for the repeater.

Indoor Coverage

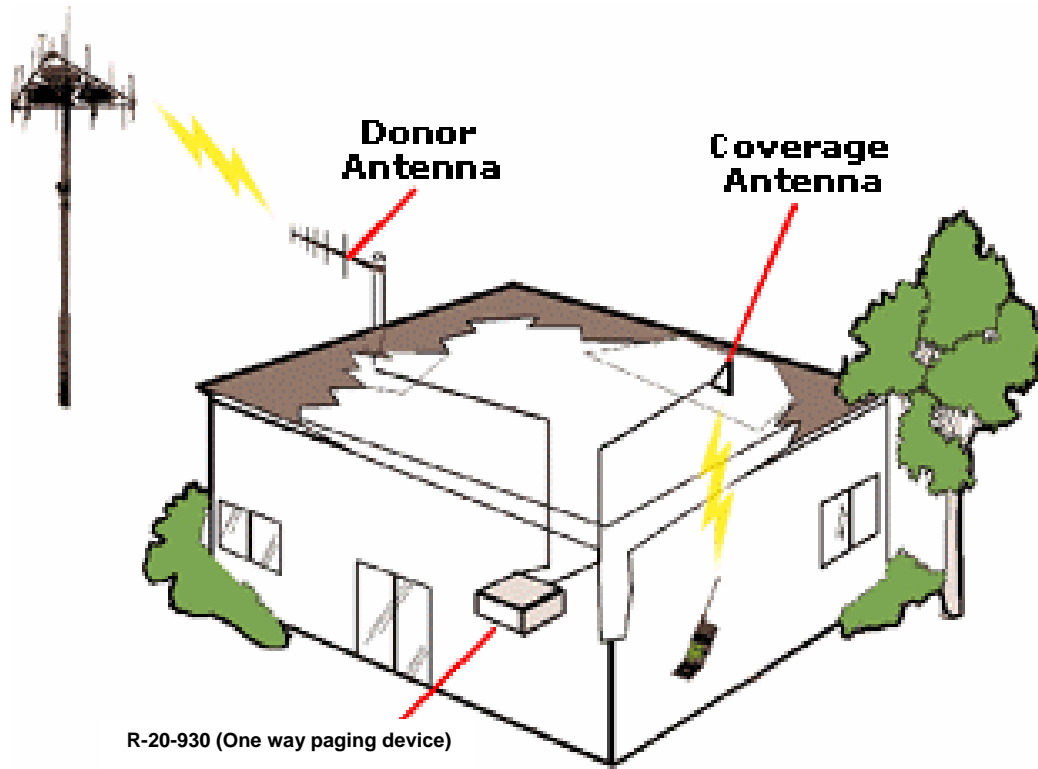


Figure 1: Indoor coverage in a small building

7.3 Description R-20-930 (One way paging) Repeater

The Repeater system comprises of high power amplifiers with automatic power control and highly selective amplification in the DL direction. It is incorporated with a **Donor antenna** (highly directive outdoor yagi antenna) and **Server antenna** (indoor omni directional antenna), specifically designed for interior configurations. The donor antenna must point towards the cell of the base station from where the signals are proposed to be picked up and is usually mounted on the exterior of the building so as to receive the maximum forward signal level from the base station. The indoor antenna is specifically designed to blend into the ceiling of a typical office providing RF signals in all directions downward and outward from the installation point. For in-building configurations requiring higher gain or directional RF signal, such as a long hallway or corridor, a medium gain directional antenna may cover the area best by mounting the antenna to the opposing wall, where coverage is required.

The repeater is envisaged with the following capabilities:

a) Monitoring

Monitoring and control of the repeater is provided through a local USB port, which provides the alarms monitoring & status.

b) Application

The repeater is used for providing indoor coverage for the signals meant for broadcasting.

c) Power Supply

The unit is shipped with a power supply adaptor designed for input of **100-240 V AC, 47/63 Hz**. Power consumption is approximately **20 Watts**.

d) Mechanical

The unit is 312x141x54 mm (12x5x2 inches) wall mount. Mounting setup is provided for Installation.

7.4 Technical Specification: Repeaters R-20-930

Frequency Bandwidth	929 to 930 MHz	
Number of Sub-Bands	one, the bandwidth of 1 MHz is set as per requirement within the band	
Gain	70 dB	
Attenuation Range for power control. (Automatic/manual by GUI or DIP switch)	0-31 dB in steps of 1 dB	
Output power	+19 dBm Composite	
Spurious Emission	$\leq -36\text{dBm}$ @ 9KHz – 1GHz	$\leq -30\text{ dBm}$ @ 1 GHz – 12.75 GHz
Noise Figure	5dB Max.	
V.S.W.R.	1.5 Max.	
Propagation Delay (In one direction only)	5.5 micro secs. max.	
Power Supply (I/p to Adaptor)	AC 100-240 V, 47/63 Hz	
RF Connector	N-female	
Dimensions (L x W x H) approx.	312x141x54 mm (12x5x2 inches)	
Weight (approx.)	Less than 2 Kg.(4.4 lbs.)	
Operation Temperature	-5 ⁰ C to +55 ⁰ C (+23 ⁰ F to +131 ⁰ F)	

8.0 INSTALLATION

8.1 ENGINEERING CONSIDERATION

a. SITE SELECTION

Site selection affects the overall performance of the system hence it requires prime consideration. The system comprises of a unit, which houses all the modules. The unit is installed at the indoor site and the Donor antenna can have directivity to the BTS from where the signals are proposed to be intercepted.

Once the expected coverage area is determined and a site installation plan is established, a pre-installation checklist should be considered and reviewed for the following items:

1. Identify the Service Provider's base station location and measure the available signal strength at the exterior of the installation location.
2. Identify the installation location for the DONOR antenna, and review the antenna manufacturer's installation procedures for additional considerations. Ensure that the DONOR antenna has proper directivity to the service provider's base station. If the directivity is obstructed, determine the azimuth position by using a magnetic compass for approximate alignment of donor antenna with base station antenna.

Following points need consideration:

- The DONOR antenna mounted should have direct line of sight with the donor site (BTS).
- Likewise the set of SERVER antennas should have proper directivity to the areas where coverage is desired to maximize the signal strength.
- Availability of AC mains for energizing the system.
- Shortest route without sharp bends for laying RF cable to the DONOR antenna.
- Shortest route without sharp bends for laying RF cable to SERVER antenna.
- Identify the spot for installing the repeater unit, which is away from other heat generating appliances or equipment. There should not be any direct exposure to direct sunlight or atmosphere consisting of chemical fumes.
- The structural mounting surface is flat.

- Accessibility for the maintenance team.

b. PLACEMENT OF ANTENNAS

Antennas are deployed for intercepting signals from the donor site and distributing signals to the mobile users. Proper selection of both DONOR & SERVER antennas is of prime importance. Following points need to be considered:

- The antennas should have proper frequency band of operation.
- Gain as per requirement for achieving maximum efficiency. It is 10-12 dB for the DONOR antenna.
- Adequate separation from the power lines to avoid damage to the equipment and humans.
- Antenna with proper characteristics to maintain adequate isolation to avoid oscillations. Normally, isolation should be 15 dB more than the gain set for the repeater. It should have good front to back ratio.
- The beam width for the DONOR antenna should be as small as possible.
- The beam width for SERVER antenna is 60 degree to 120 degree.
- There should be adequate separation between the DONOR & SERVER antennas to avoid interference and noise.

8.2 Installation Tools

You will need the following basic tools for installation:

- i. Standard wrenches/screwdrivers/cable stripper/cable cutter/pliers set for installing the **R-20-930** Unit and antennas. (Refer to the manufacturer's recommendations for installing the antennas).
- ii. RF coaxial cable connection tools for installing connectors.
- iii. Multi-meter.
- iv. Mobile handset loaded (e.g. Nokia) with Net engineering software to be used for signal level measurement.
- v. Magnetic compass for measuring the azimuth of the BTS and repeater site.

8.3 Installation Procedure

1. RF coaxial cable installation must comply with local or National Electrical Codes and must be with nominal 50-Ohm impedance. Pull and route the RF coaxial cables as per the site installation plan.
2. Fix the supplied connectors to the RF coaxial cable and verify the following:
 - The center conductor to outer shield of RF coaxial cable indicates an “Open Circuit” condition.
 - Check for any short circuit between center conductor and outer shield.
 - Short one end of the conductor between center conductor and outer shield by piece of wire temporarily and check the other end of conductor for any break in the RF cable.
3. Record the **R-20-930 unit** serial number for use when contacting SHYAM customer service for support.
4. Mount the unit on the intended wall surface using the appropriate screws.
5. Install the indoor coverage antenna according to the antenna manufacturer’s instructions. Connect the RF coaxial cable between the indoor antenna and the “MS” port on the unit.
7. Install the donor antenna (Outdoor Yagi antenna) according to the antenna manufacturer’s instructions. Connect the RF coaxial cable between the donor antenna port and the “BTS ” port on the unit.

Connections as indicated below may be carried out:

- RF cable from Donor antenna to “BTS” port.
- RF cable from Server antenna to “Mobile” port.
- AC mains through power supply adopter.

8.4 Commissioning

1. Plug the AC/DC power adaptor to the Repeater and switch ON the unit.
2. Once the repeater is ON, the LEDs will not glow under normal condition.

3. The UL Align indication LED and DL align indication LEDs will blink for adjusting the DL gain and UL gain automatically.
4. Review the intended coverage area according to the site installation plan. Using a mobile NOKIA handset loaded with NET engineering software and the SIM card of cellular operator, measure and monitor the signal level at various points within and around the perimeter of the coverage area.

- i. **Ensure that antenna connectors and antenna cable connectors are clean and dry.**
- ii. **The RF cables must not be kinked, cut or damaged in any way.**
- iii. **Connect the RF cables to the antennas taking care to avoid cross threading or stripping. The RF connections should be snug and tight.**
- iv. **Seal the antenna and repeater connectors with waterproof sealant or the appropriate weather tight boot.**

8.5 Configuration & Monitoring Console

The repeater system is delivered with software loaded in order to perform configuration as per requirement. It also enables monitoring the status. Configuration of parameters can be carried out locally with the help of laptop / PC connected to the repeater by means of local USB interface. The laptop/PC is to be loaded with CMC software & USB driver software from the CD supplied with the system.

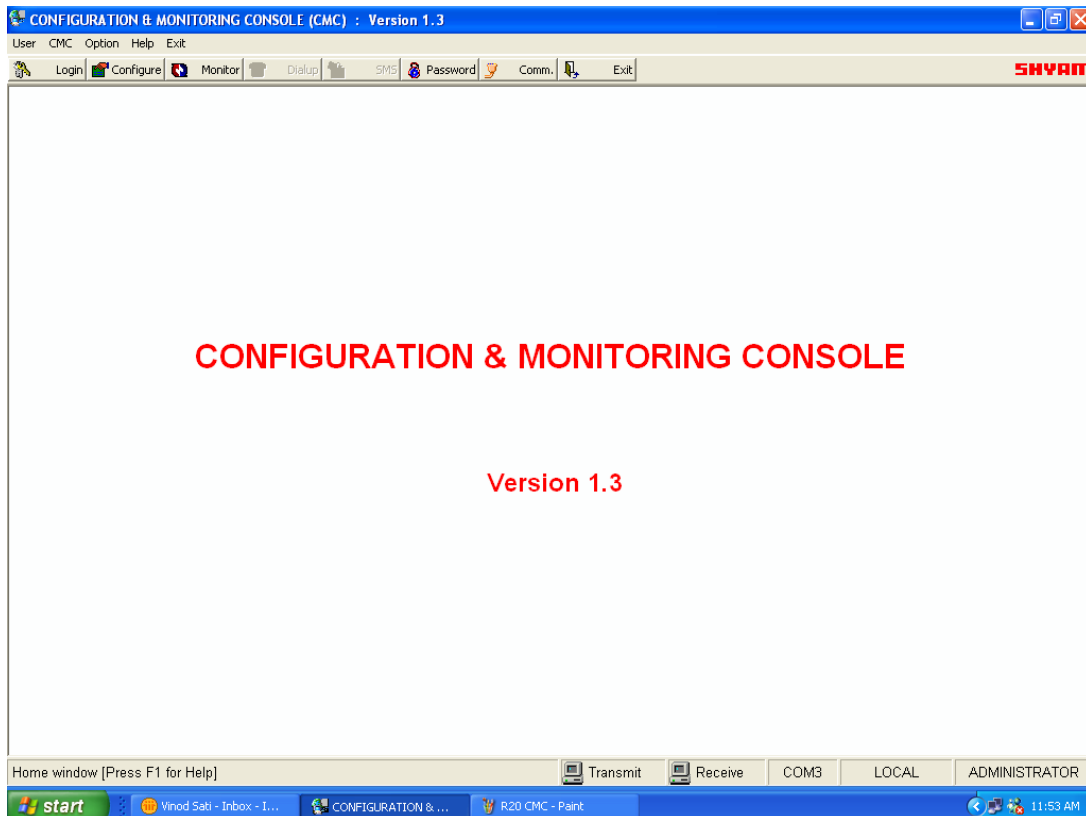


Figure 2: CMC window

1) Login Repeater (Figure 3)

After running the repeater *Configuration & Monitoring Console (CMC)*, user needs to login the repeater. To login the repeater:

- Click the “**Login**” on the command bar.
- Select the user type.
- Enter the password.
- Finally click the “OK”.

After successful login a message “**Logged in successfully**” will be flashed on the screen. Now user can start the operation through CMC. There are two type of user viz. **ADMINISTRATOR** and **SUPERVISOR**. If user logged in as an ADMINISTRATOR, all the operation through the CMC can be carried out. Default password is “**shyam**”.



Figure 3: Login



Administrator can limit the system access authority of the SUPERVISOR.

II) Configuration

Configuration means setting different repeater parameters for proper operation. Configuration of Shyam repeaters can be performed locally with a laptop / PC connected to the repeater by means of local USB serial interface cable.

Clicking the **CONFIGURE** on the command bar, displays configure window. This window allows access to all the configurable repeater parameters.

- **SET** : This is for updating the repeater parameters.
- **READ** : This is for reading configured parameters from repeater.

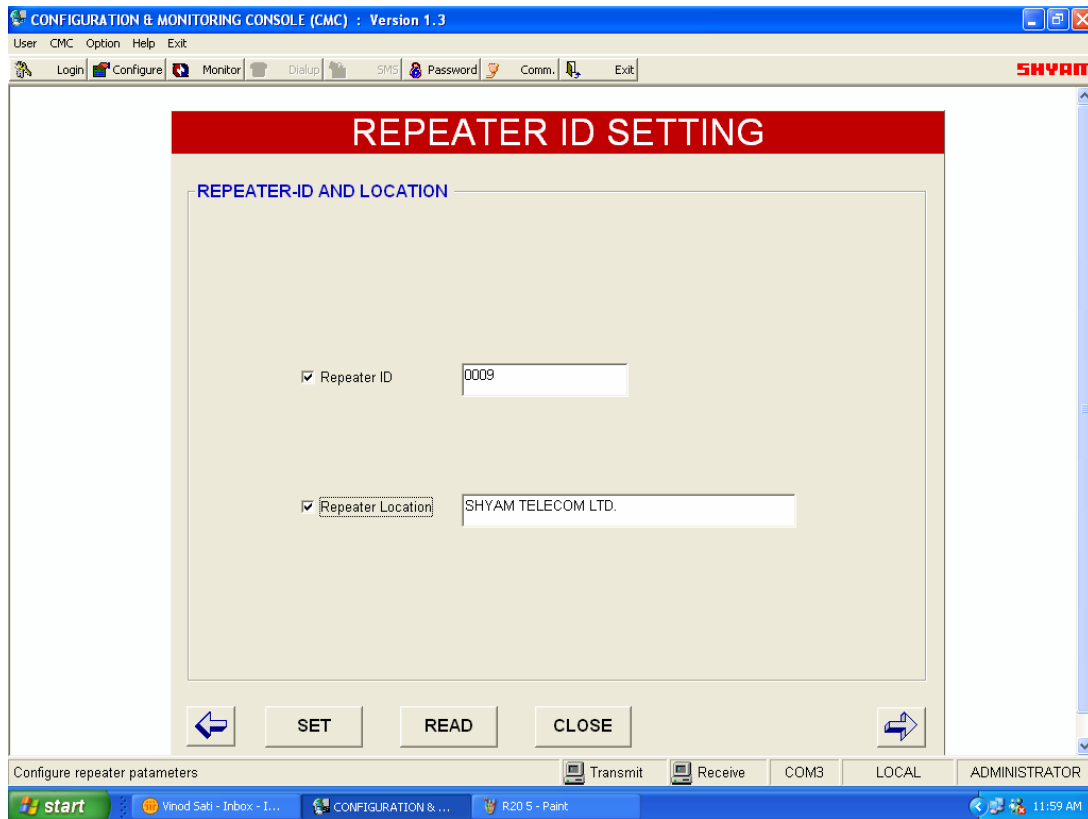


Figure 4: Repeater ID Setting

a) Repeater ID (Figure 4)

User can assign a unique repeater ID to each repeater installed. Up to 10 characters are allowed for this field.

b) Repeater Location (Figure 4)

User can assign the address of location where repeater is installed. Up to 30 characters are allowed for this field.

c) Sub Band ON/OFF Setting (Figure 5)

The sub band equipped can be set as ON others shall remain OFF.

d) Frequency Settings (Figure 6)

The frequency band of the sub band equipped is specified for DL path.

e) PA ON/OFF Settings (Figure 7)

The PA can be put in ON or OFF condition for the purpose of testing.



Figure 5: Sub Band ON/OFF Setting

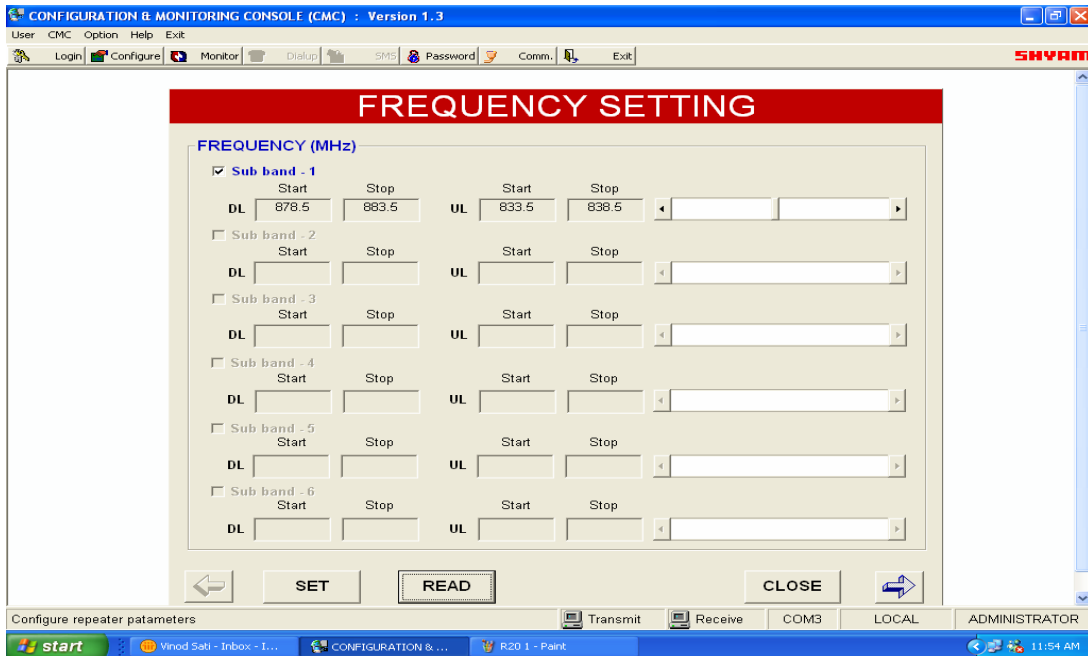


Figure 6: Frequency Settings (Only for DL)

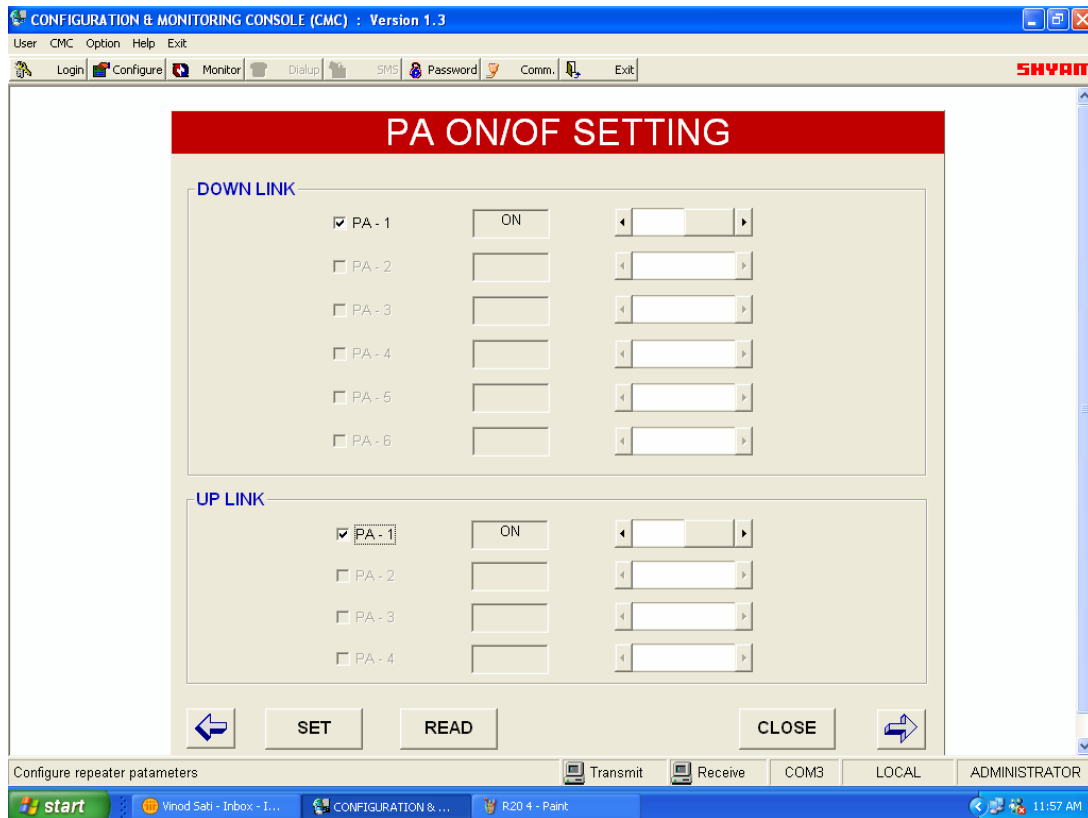


Figure 7: PA ON/OFF Settings (Only for DL)

f) Other Parameters Settings (Figure 8)

Other parameters to be specified are:

- Band set with DL path frequencies.
- Sub band frequency bandwidth.
- Type of attenuation viz. manual, automatic or through DIPswitch.
- Offset PA (DL) shut down.
- Offset RSSI DL.
- Offset DL Power set.
- APC DL
- Set power DL

After configuring the parameters, these are saved by pressing **SAVE**.

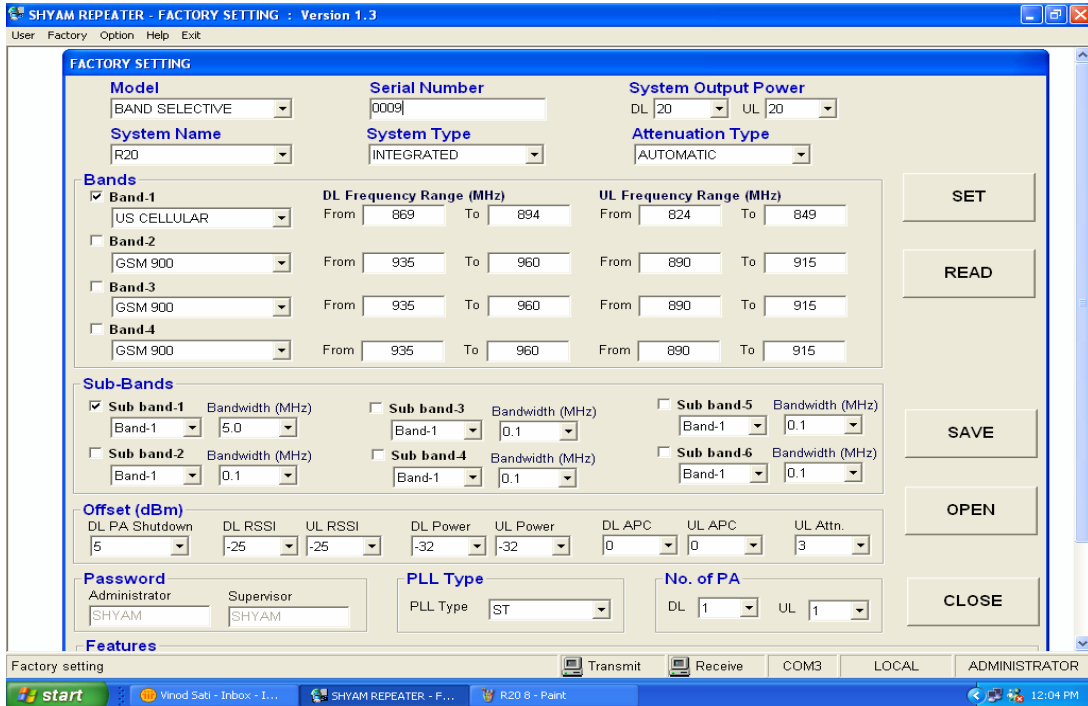


Figure 8: Different Parameters Settings (DL Path only)

g) Attenuation Settings (Figure 9)

If attenuation is to be set manually, that values for DL is specified.

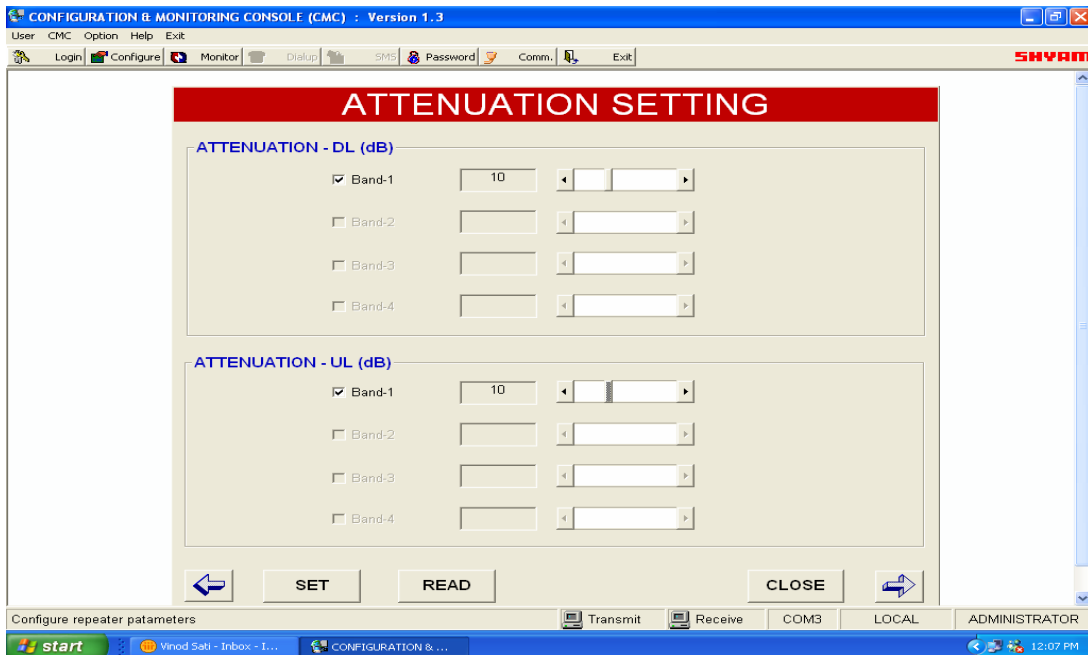


Figure 9: Attenuation Settings (DL path only)

III) Status Monitoring (Figure 10)

Parameter	Remarks
Output power DL	Prevailing RF power in DL path is displayed.
Attenuation DL	Indicates the attenuation provided in the DL path.
RSSI DL	Indicates the prevailing value of RSSI level in DL path.
Power supply 7 V	Displays the value of 7 V derived supply.
System Temperature	Indicates the instant temperature of the system.
Type of attenuation	The type of attenuation introduced is indicted.
Alarm	Indicates the type of alarm i.e. Critical, Major or Minor to enable further analysis.

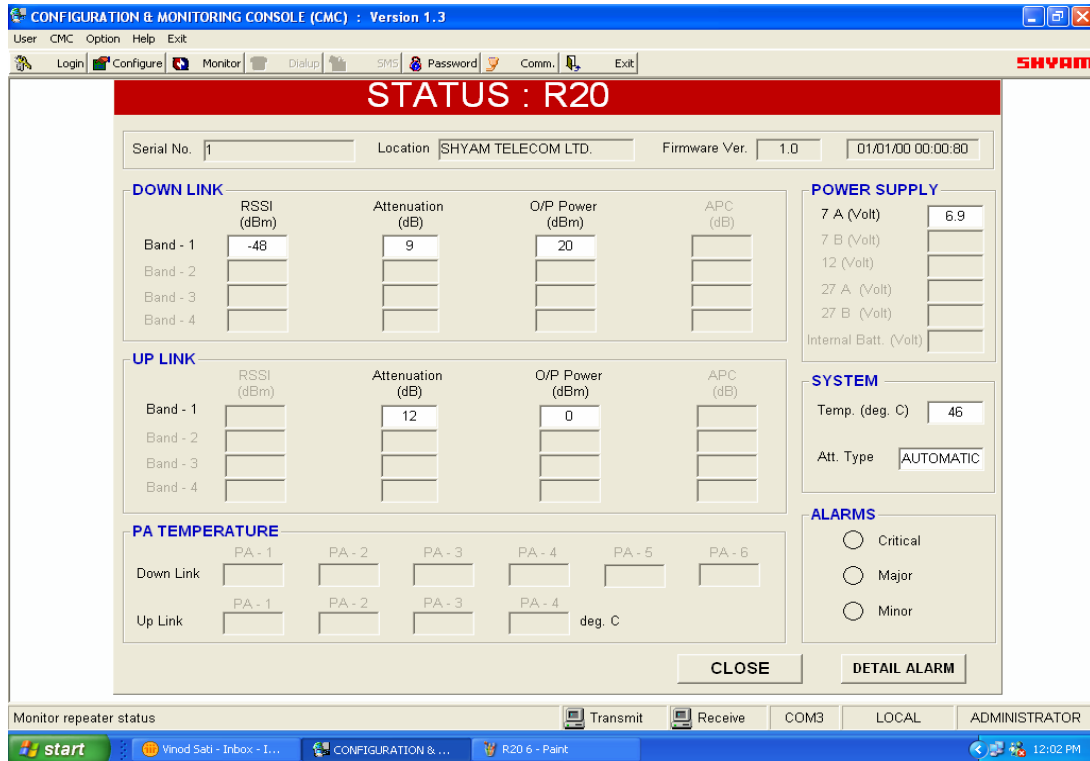


Figure 10: Status Monitoring (Activated for DL path only)

IV) Alarms (Figure 12)

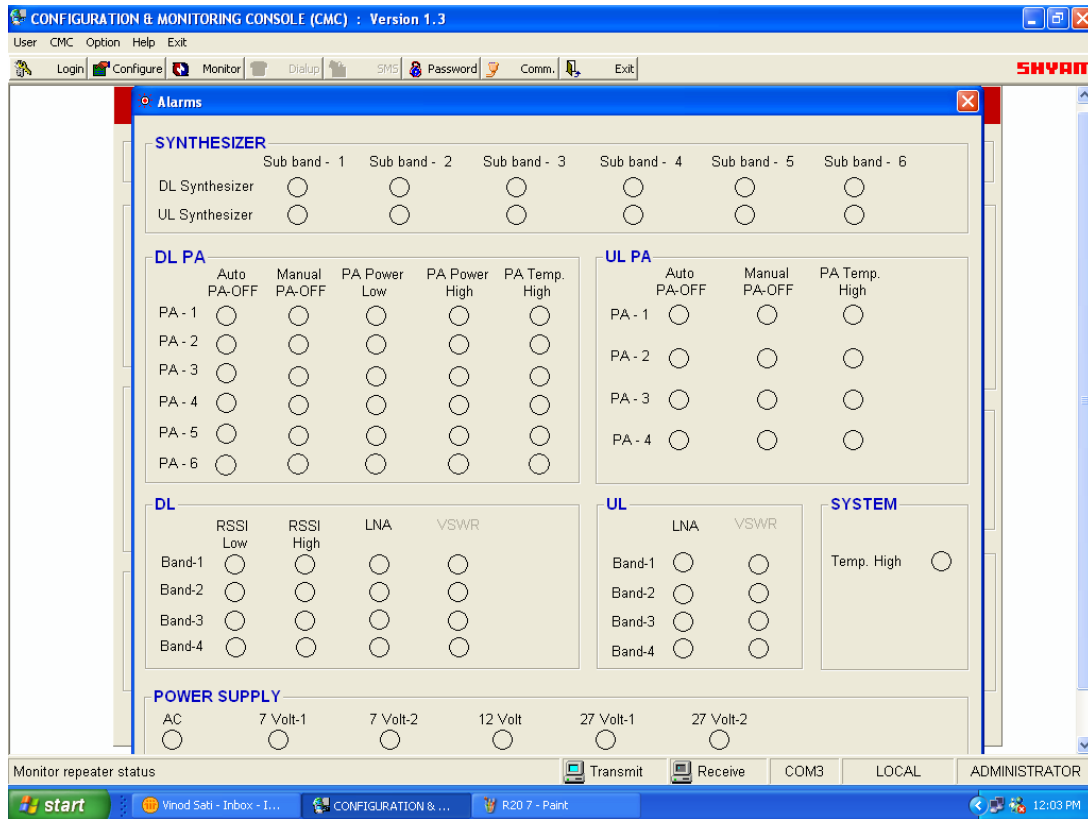




Figure 12: Alarm Window (DL path alarms activated)

Observation	Remarks
DL synthesizer fail	Failure of synthesizer in DL is indicated.
PA Off (Auto) DL	Indication draws the attention about the off condition of PA in DL.
PA Off (Manual) DL	Indication draws the attention about the off condition of PA in DL.
PA Power Low -DL	Indicates the PA power becoming lower than the configured condition in DL.
PA Power High -DL	Indicates the PA power becoming higher than the configured condition in DL.
PA Temperature High-DL	Alarm indication draws that the temperature of PA in DL has exceeded the limit.
RSSI Low-DL	Indication that the RSSI level has gone lower than the pre-set limit in DL.
LNA-DL	Indicates the failure condition of LNA in DL.
System Temperature High	Displays that the temperature of the overall system has gone high.

Monitoring interval is 3 seconds i.e. after every 3 seconds data on the monitoring window will be refreshed.



-  A red indication is for Alarm present.
-  A green indication is for No alarm.

V) Communication (Refer Figure 13)

In COMMUNICATION window user can select serial communication port for communication:

LOCAL CONNECTION

In this type of connection, user computer COM Port and repeater's USB Port is connected directly using cable. Steps as indicated below, are followed:

- Click the "**COMM.**" on the command bar to display the COMMUNICATION window.
- Select the Connection Type as "**LOCAL**"
- Select the computer's Comm. Port where the repeater is connected.
- Click "**OK**".

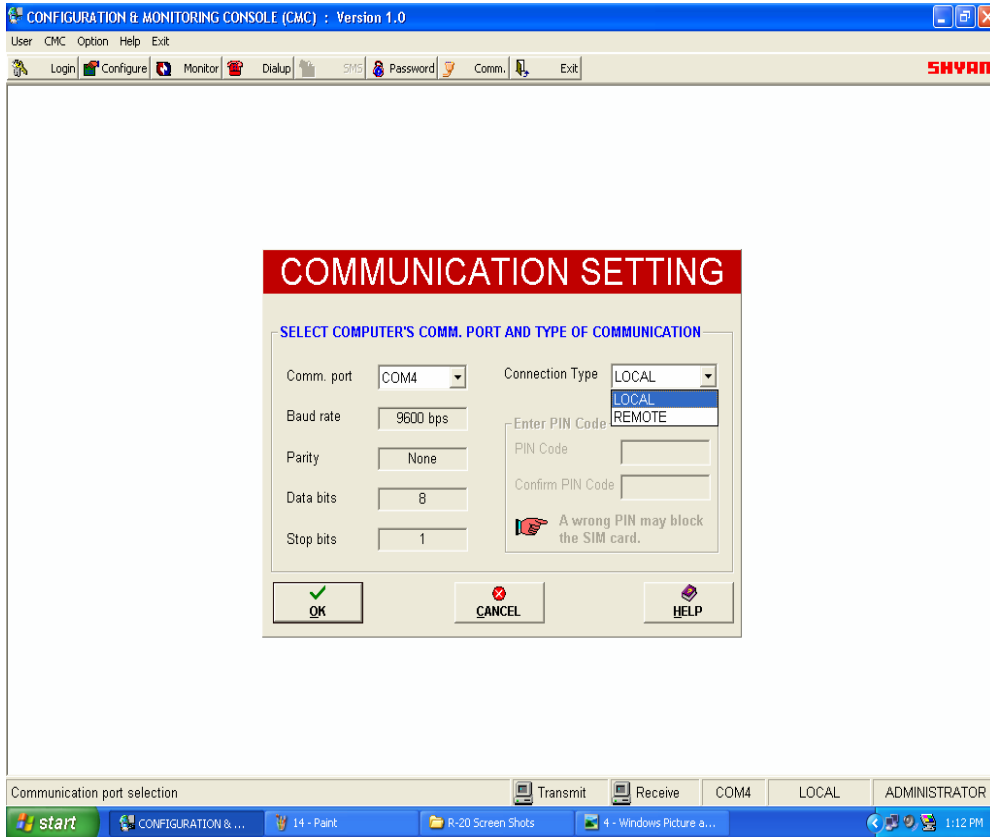


Figure 13: Communication Window

8.6 LED Display On R-20-930 Unit

In order to facilitate the maintenance team, a set of LEDs are provided on the top cover of the unit which display some of the important events in the system, the detail is given below:

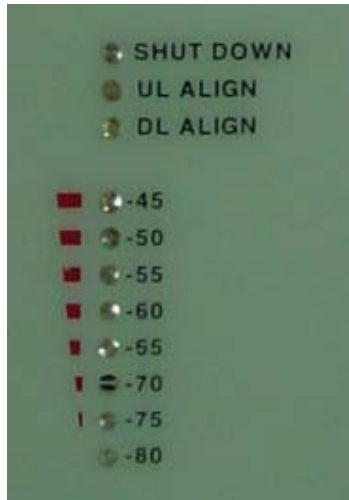


Figure 14: Display Details of R-20-930

- The DL Align LED will blink when system is in Downlink Alignment mode.
- SHUT Down LED will Glow when the system goes out of order due to (poor isolation) or excessive input signal. The system will check for the normal state after 30 seconds continuously. If the system senses the right condition it will be ON automatically and start functioning.
- Downlink RSSI is continuously monitored and level prevailing at a particular instant is displayed through 8 LED's.

Clicking in Alarm window carries out the detail analysis.

9.0 Fault Shooting & Maintenance

9.1 In-building Coverage Problems

After the installation of **R-20-930** unit, sometimes the actual coverage does not conform to the plan, different possibilities are discussed below and action is required to be taken accordingly.

- i. **Physical obstructions degrading the signal level** – Visually inspect the area of weak coverage. If possible, rearrange objects that may be interfering with the signal path. Pay particular attention to large metallic objects that may be reflecting or blocking the signal resulting in weak coverage area. If weak coverage area still persists, check the following:
 - a. Inspect the indoor RF coaxial cable and its connection with connector
 - b. Indoor antenna direction and its tilting
 - c. R-20-930 repeater gain setting
- ii. **Defective indoor coaxial cable or antenna** – Check the RF coaxial cable and antenna. If necessary, replace each individually with a known functional unit, and verify the respective signal level. This can be achieved by observing the signal strength indicator on a mobile handset that has an unobstructed line-of-sight view, 15 – 20 feet from the indoor antenna. If the signal level increases at this test location, re-verify the signal level in the weak coverage area. If the signal level remains marginal, inspect the unit.
- iii. **R-20-930 Defective** – Replace the unit with a known operational unit. Verify the signal level at the unobstructed test location. If the signal level increases, re-verify the weak coverage area. If the weak coverage area remains marginal, an additional indoor antenna or R-20-930 unit may be required to cover the additional area. If the original R-20-930 is defective, contact Technical customer support team at +91-124-4311600 or email at ibs@shyamtelecom.in.

9.2 Signal Quality Problems

Under certain conditions, the signal level on the mobile handset may indicate adequate signal strength, but the quality of the signal is degraded (i.e. distortion). The signal level at the donor antenna is probably too strong. Under these conditions, the service provider's exterior signal level

is adequate, in such condition, reduce the forward path signal using the forward attenuation in the repeater and minimize the forward signal level in step of 1dB until the problem subsides.

But ensure that the In-Building signal level remains adequate for the coverage area.

9.3 Antenna Isolation

Antenna isolation is defined by the path loss or attenuation, between the donor and server antennas. It is important to ensure that the antennas are sufficiently separated, such that the signals transmitted by donor antenna are not intercepted by server antenna and vice versa. For optimal performance, the separation of the two antennas must provide a path loss of at least 15 dB greater than the gain of the R-20-930 unit.

In most cases, isolation will be achieved by properly locating the donor and server antennas, respectively. The optimal location for the donor antenna is high above the roofline, and exterior to the building. The indoor coverage antenna (server) should be installed inside, near or below the ceiling. Following guidelines should ensure adequate isolation between antennas.

- I) Installation of the donor and server antennas near windows is to be avoided from where signals can easily pass through the glass resulting in poor isolation.
- II) Mount the donor antenna as high as physically possible to the exterior of the building, maximizing the vertical separation between the donor and server antennas. The donor antenna should point towards the base station site.
- III) Install the antennas taking advantage of any existing building structure such as brick walls, metal roofs, or multiple wall structures to provide additional attenuation in the possible link path between them.
- IV) Whenever using directional antennas inside the building to provide coverage in the corridors and hallways, point the indoor antenna away from the donor antenna location.
- V) In extreme cases, the building configuration may not allow for such separation and isolation. If additional isolation is required, coaxial attenuator may be inserted between the donor antenna and the repeater or reduce the forward path signal using the attenuator.

9.4 Trouble shooting

During post installation or subsequent period, some of the peculiar situation may be observed, some of them are discussed below:

Conditions	Possible Reasons & Solutions
<p>LED, s do not glow after the Repeater is switched ON.</p>	<ol style="list-style-type: none"> 1 Check the power adaptor and the AC power socket. 2 Please note that the AC mains has to be within the range 100 to 240V. 3 Check for the DC voltage of adaptor.
<p>Signals are not amplified after completing the installation</p>	<ol style="list-style-type: none"> 1. Check the AC power cord and make sure the power switch is ON. 2. Check all the connectors of the repeater system for proper connections. The “BTS” connector has to be connected to donor antenna, and the “MS” connector has to be connected to server antenna. 3. The poor isolation between donor and server antenna will cause system oscillation and it may damage the amplifier of the repeater. It is to note that the repeater gain should be at least 15 dB lower than the antenna isolation.
<p>The system performed well in the beginning but after few days the performance has degraded.</p>	<ol style="list-style-type: none"> 1. The received signal level from the base station might have degraded due to environmental changes such as new building construction and so on. If so: <ol style="list-style-type: none"> a. Try to re-align the donor antenna towards the base station b. Adjust the gain attenuation of Down link direction c. Relocate the donor antenna to solve the problem d. RF Cable problem: Check the RF cable for physical damage by rats etc. Also check for sharp bands or RF cable pressed. Under these conditions, RF signal losses could have increased. If so, replace RF cable. e. Indoor structural change: The signal level will vary according to the interiors. Look for any interior changes subsequent to the repeater installation or site survey. If so, adjust the gain of repeater or re-align the server antenna without affecting the existing coverage.

Shut Down alarm indication LED glowing in red colour.	It indicates that the downlink received signal level is high due to poor isolation between antennas. Change the antenna positions.
DL Align LED is blinking	This is not the fault condition, the LED will blink when system is aligning it self.

9.5 Contents Of Delivery

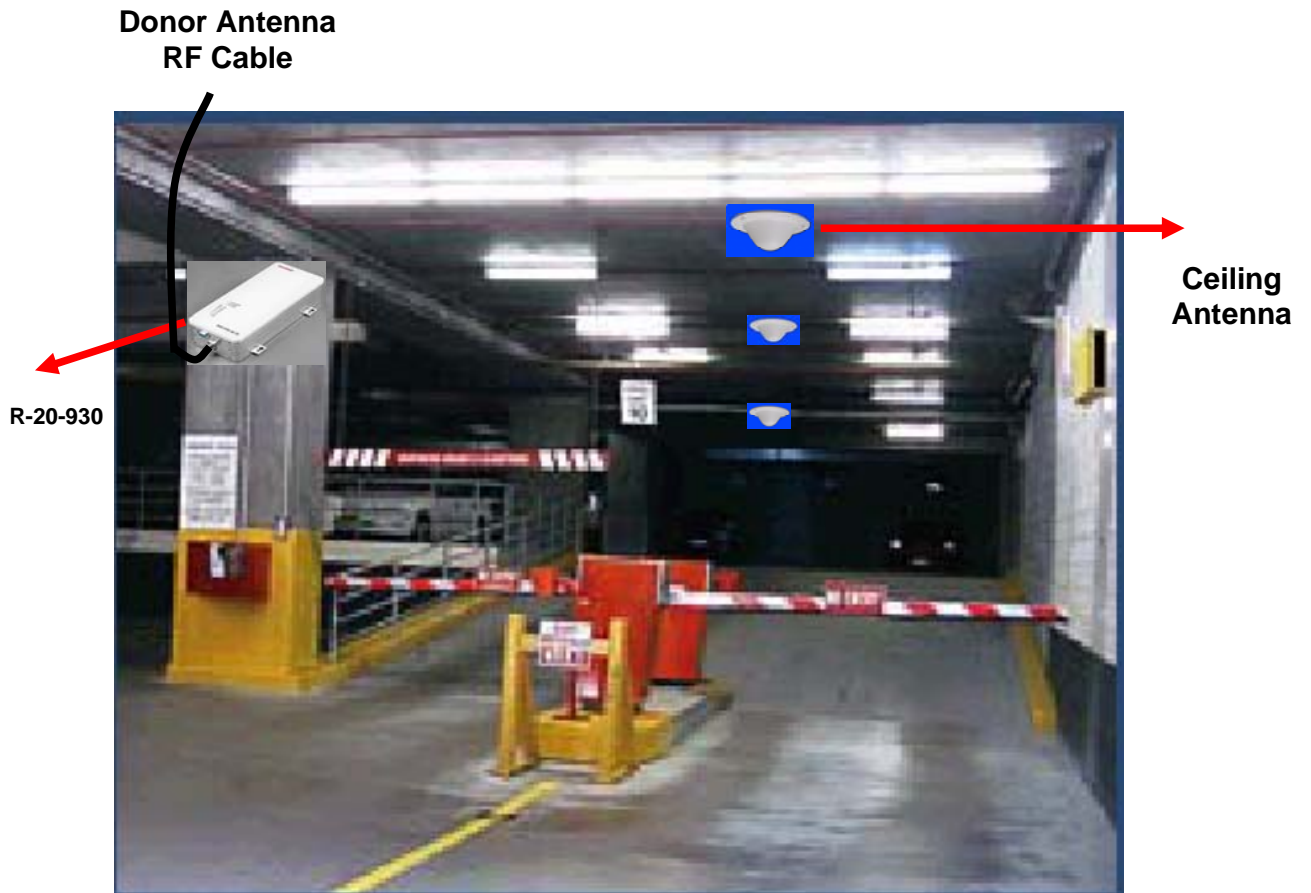
- i. Donor Antenna – 12 dBi Directional antenna
- ii. R-20-930 Unit
- iii. Power Adapter
- iv. Mounting screws
- v. Installation and Operation Manual
- vi. Configuration and Monitoring Software CD.

Additional Parts Which may be needed (Optional)

- RF coaxial cable length and type as per the actual site requirement
- Server antennas: In-Building Coverage Antenna
 - a. 2dbi Omni directional-Ceiling Mount
 - b. 6dbi Directional Antenna
 - c. 7dbi Directional Antenna
- Type N male plug connectors – 4 nos. for establishing connection between coaxial cable & antennas

- Power divider (SPD –n): as per the actual site requirement (n= 2,3,4,& 8)
- Coaxial attenuator

Basement Coverage



For Technical Support, please contact at any of the following addresses:

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