

RF / DBR Series**OPERATION & INSTALLATION MANUAL**

**DB5R (Dual Band)
850 Cellular & 1900 PCS For Outdoor Applications**

October 2007

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1. Document History

Document Number	Document Name	Document date	Author	Edited by	Approved by	Revision
	DB5R Dual Band Repeater	October 2007				

Revision

Revised Section

Date/Sign

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2. Disclaimer

Every attempt has been made to make this material complete, accurate, and up-to-date. Users are cautioned, however, that **Shyam Telecom Limited** reserves the right to make changes without notice and shall not be responsible for any damages including consequential, caused by reliance of the contents presented, including, but not limited to, typographical, arithmetical, or listing errors.

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In areas with unstable power grids (mains) all repeaters must be installed with a voltage regulator ensuring a constant voltage level at the repeater power input. A maximum voltage deviation should remain within the input range to the repeaters for warranty purposes.

All antennas must be installed with lightning protection. Damage to internal modules, as a result of lightning is not covered in the warranty.

3. Safety Instructions and Warnings

3.1. Personnel Safety

Before installing or replacing any equipment, the entire manual should be read and understood. The user needs to supply the appropriate AC power to the Repeater. Incorrect AC power settings can damage the repeater and may cause injury to the user.

Throughout this manual, there are "**Caution**" warnings, "**Caution**" calls attention to a procedure or practice, which, if ignored, may result in injury or damage to the system or system component or even the user. Do not perform any procedure preceded by a "Caution" until the described conditions are fully understood and met.

3.2. Equipment Safety

When installing, replacing or using this product, observe all safety precautions during handling and operation. Failure to comply with the following general safety precautions and with specific precautions described elsewhere in this manual violates the safety standards of the design, manufacture, and intended use of this product. **Shyam Telecom Limited** assumes no liability for the customer's failure to comply with these precautions. This entire manual should be read and understood before operating or maintaining the repeater system.

CAUTION

Calls attention to a procedure or practice which, if not followed, may result in personal injury, damage to the system or damage to individual components. Do not perform any procedure preceded by a **CAUTION** until described conditions are fully understood and met.

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. The unit with server antenna must be installed to provide minimum 110 cm separation distance between the server antenna and the body of user or near by person. The donor antenna used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 1.5 meters from all persons during normal operation.

The RF electric performance of the repeater conforms to FCC requirement of the inter modulation and spurious emission. It avoids interference problems.

3.3. Electrostatic Sensitivity

CAUTION**ESD = ELECTROSTATIC DISCHARGE SENSITIVE DEVICE**

Observe electrostatic precautionary procedures.

Semiconductor transmitters and receivers provide highly reliable performance when operated in conformity with the intentions of their design. However, a semiconductor may be damaged by an electrostatic charge inadvertently imposed by careless handling.

Static electricity can be conducted to the semiconductor chip from the centre pin of the RF input connector, and through the AC connector pins. When unpacking and otherwise handling the Repeater, follow **ESD** precautionary procedures including the use of grounded wrist straps, grounded workbench surfaces, and grounded floor mats.

4. Introduction

4.1. Purpose

The purpose of this document is to describe the electrical and mechanical specifications, operation and maintenance of the **DB5R Dual Band Repeater**.

4.2. Scope

This document is the product description of the Shyam **DB5R Dual Band Repeater** for outdoor application.

4.3. Definitions

AGC	Automatic Gain Control
ALC	Automatic Level Control
APC	Automatic Power Control
BCCH	Broadcast Control Channel
BTS	Base Transceiver Station
BSEL	Band Selective
CDMA	Coded Division Multiple Access
CMC	Configuration & Monitoring Console software
CMB	Combiner Unit
CSEL	Channel Selective
DCS	Digital Communication System
DL	Downlink signal (from base station via repeater to mobile station)
EGSM	Extended Global System for Mobile Communication
ETSI	European Telecommunications Standard Institute
GSM	Global System for Mobile communication
LAC	Location Area Code of the BTS site
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LO	Local Oscillator
MS	Mobile Station
MSC	Mobile Switching Center
NMS	Network Management System
PCN	Personal Communication Network
PCS	Personal Communication System
PSU	Power Supply Unit
RF	Radio Frequency
RMS	Remote Management System
RSSI	Received Signal Strength Indication
RTC	Real Time Clock
TACS	Total Access Communication System
TDMA	Time Division Multiple Access
UL (Uplink)	Uplink signal direction (from mobile station via repeater to base station)

4.4. References

[1] ETS 300 086.

Radio Equipment and Systems Land mobile service Technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech.

[2] ETS 300 609-4.

Digital cellular telecommunications system (phase 2): Base Station Systems (BSS) equipment specification: Part 4: Repeaters.

[3] ETS 300 342-3

Radio Equipment and Systems (RES); Electro-Magnetic Compatibility (EMC) for European Digital Cellular Telecommunications systems. Base Station Radio and ancillary equipment and Repeaters meeting phase 2 GSM requirements.

4.5. General

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 RF propagation properties, 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 deployed 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.

5. Functional Description Of DB5R Dual Band Repeater

5.1. General Description

The **DB5R Dual Band** Repeater System is designed to provide outdoor coverage and can handle signals in up to five sub bands with 3+2 configuration (maximum) in two of the service bands, used around the World by various service operators. It provides highly selective amplification in the pre-set frequency bands. The details of operating service frequency bands are given below:

S.NO.	Service Band	DL Frequency (MHz)	UL Frequency (MHz)
1.	SMR 800	851-866	806-821
2.	Cellular	869-894	824-849
3.	SMR 900	935-941	896-902
4.	EGSM	925-960	880-915
5.	GSM 900	935-960	890-915
6.	DCS	1805-1880	1710-1785
7.	PCS	1930-1990	1850-1910
8.	UMTS	2110-2170	1920-1980

The Customer is requested to refer to the packing list giving the details of frequency band set & the bandwidths of different sub bands equipped in the repeater (FCC & IC applications only apply for Cellular & PCS band operations).

- The DB5R repeater is designed to provide optimal coverage, the area covered shall primarily depend on RF power radiated, manmade structures in the area (high rise buildings), the geographical topologies and availability of reflecting surfaces.
- The ultimate performance & coverage shall depend on the obstructions blocking/absorbing of the RF signals by various objects between the Server antenna of RF repeater and the mobile users.
- The repeater is specifically designed for the Operators who are allocated frequency spectrum in different service bands and non-contiguous sub bands are specified.
- The repeater adopts duplex mode and bi-directional amplification for U/L & D/L signals between the base station and mobile users.
- It receives signals from the BTS through a **DONOR antenna** (highly directional outdoor antenna) and distributes the signals to mobile users after amplification through a set of **SERVER antennas** (omni/patch directional) system in the D/L.

- In the U/L, the signals from the mobile users are picked up by SERVER antenna and retransmitted to the BTS after amplification.
- The repeater finds applications in tunnels, highways, large size airports, and open market areas etc. where traffic requirement is high.
- The system can be incorporated with optional **Remote Management System (RMS)** which can be used for configuration and monitoring the status of the link. It helps not only speedy maintenance but remote configuration also through wireless modem.

The repeater consists of the following modules/units:

- LNA
- Converter modules
- Power amplifiers
- Power supply module
- Duplexer filters for transmit/receive directions
- Supervisory module
- Diplexer Unit for segregating bands
- A metallic case houses the repeater. Arrangement is made for heat dissipation especially for amplifiers, which generate more heat. The choice of suitable metal as the case material gives a lightweight design with good heat conduction and waterproof protection. The housing conforms to IP65 (NEMA 5) standards.

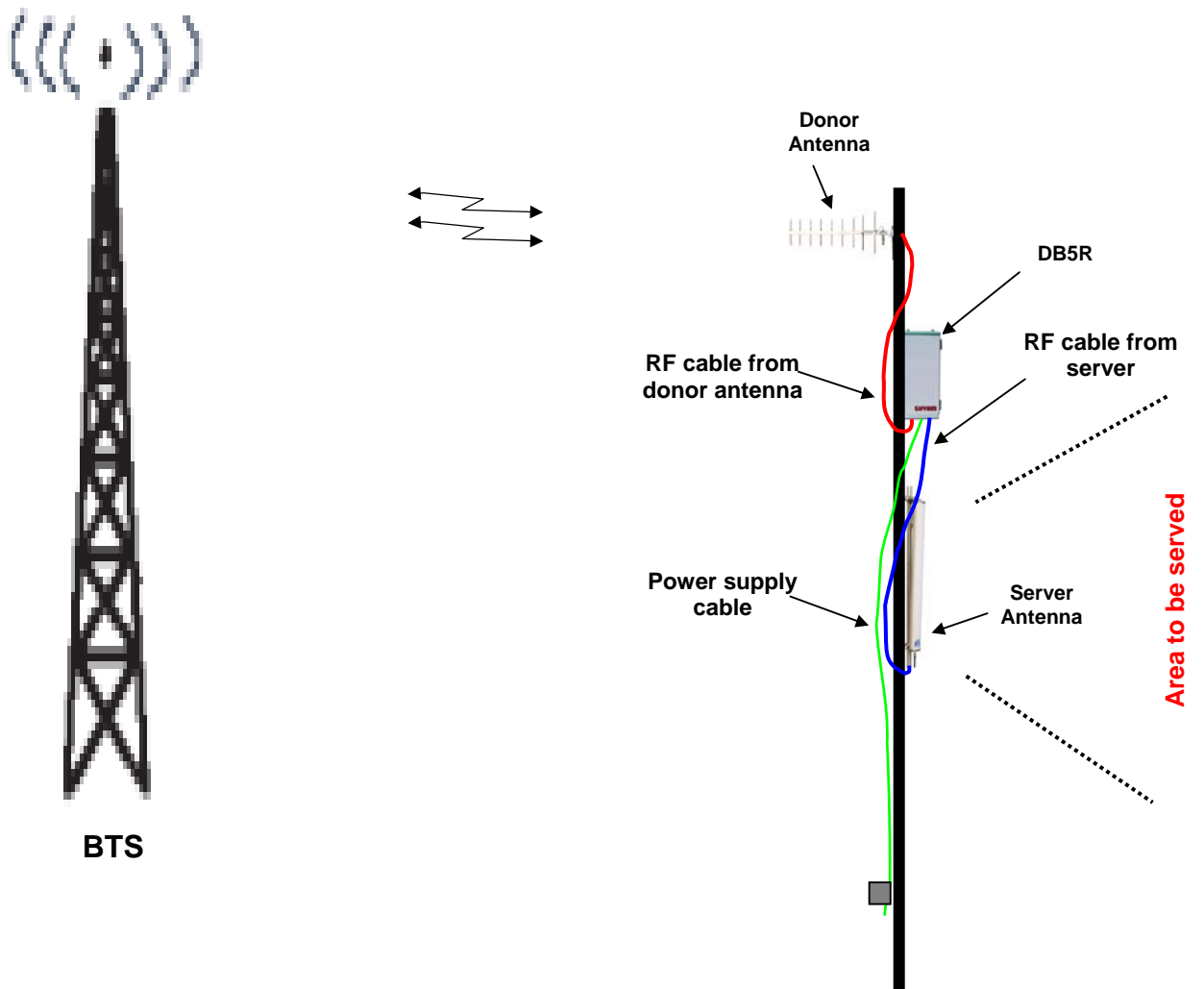


Figure 1: DB5R Repeater-Different Constituents



Figure 2: DB5R Repeater - Application in a Urban Area

6. To Get started-Basic Software Control Of the Repeater

6.1. General

The repeater is equipped with a supervisory module that allows the monitoring and control of various parameters such as RF power, attenuation, temperature, status of door and alarm conditions etc.

The communication interface between the local terminal and the control module can be set up using the Configuration & Monitoring Console software (CMC), which is an easy to use GUI for simple control and monitoring. This way, the parameters can be easily observed and adjusted from the display terminal.

This can be performed either via a terminal (PC/laptop) locally, or via remote login through the wireless modem (Optional) located in the repeater. USB port is provisioned in the equipment for connecting PC/laptop.

6.2. Terminal Set-up

The 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 serial interface or remotely via wireless modem (Optional) mounted inside the repeater. The laptop/PC should be loaded with the CMC software available on the supplied CD along with the USB driver.

I) LOGIN-Repeater (Figure 3)

After running the repeater *Configuration & Monitoring Console* (CMC), user needs to login the repeater, sequence as under, may be followed:

- Click the “**LOGIN**” on the command bar.
- Select the user type (ADMINISTRATOR or SUPERVISOR).
- Enter the password.
- Finally click the “**OK**”.

A message “**Logged in successfully**” will appear on the screen after successful login. There are two types of users viz. **ADMINISTRATOR** and **SUPERVISOR**. If user logged in as an **ADMINISTRATOR**, all the functions can be performed through the CMC. By default, the password for both users is “**SHYAM**”.

SUPERVISOR is allowed to perform monitoring of the status & alarms but no change in configuration is permitted. However, the **SUPERVISOR** can change password if so desired.

II) CONFIGURATION

Configuring repeater means setting the repeater parameters for operation as per the requirement at site.

Click on the command bar to display the configuration window, which allows access to all the configurable repeater parameters. User can login for configuration of repeater parameters.

- **SET** is for updating the repeater parameters.
- **READ** is for confirming the parameters set during the configuration.

Information as detailed below, can be configured after the “**Configuration**” window is activated:

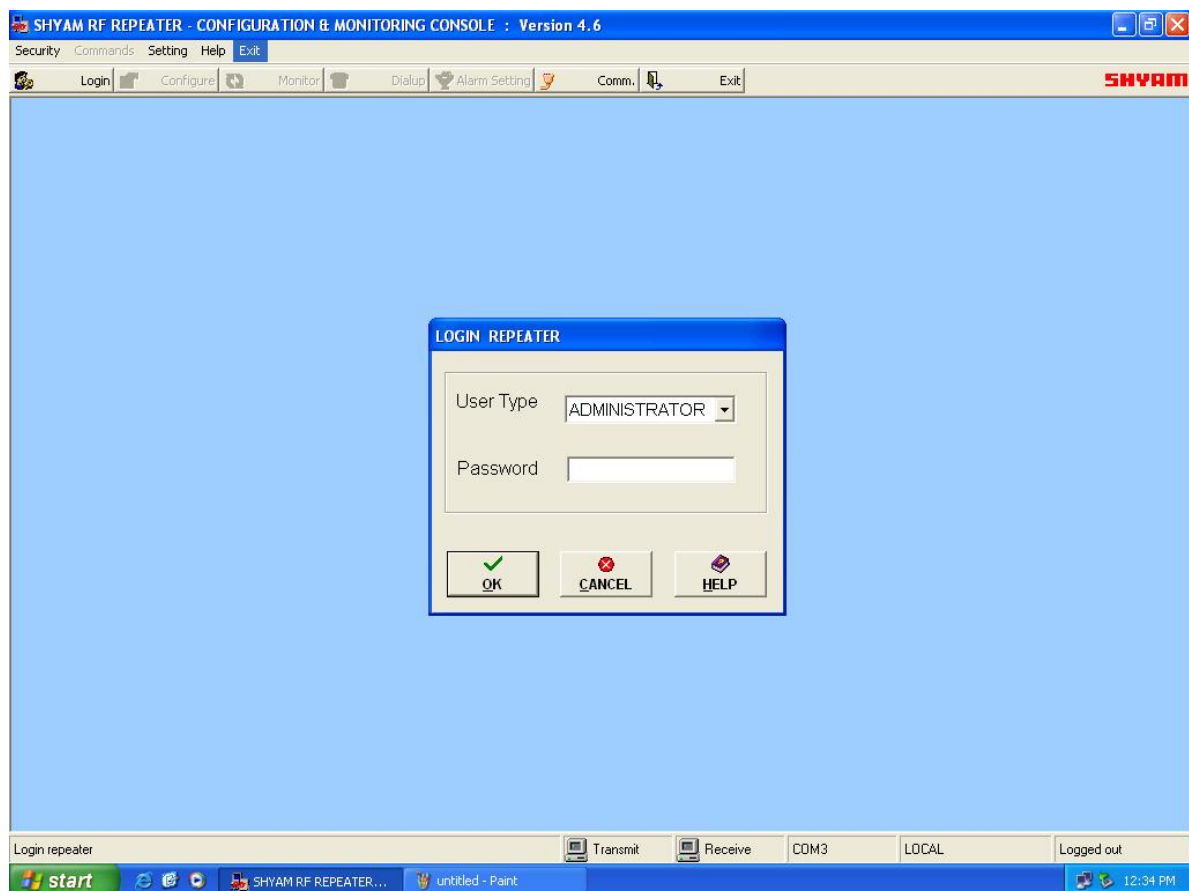


Figure 3: Login Repeater

- Repeater ID:** User can assign a unique repeater ID to each repeater installed. Up to 10 characters are allowed in this field. **(Figure 4)**
- Repeater Location:** User can assign the address of location where repeater is installed. Up to 30 characters are allowed in this field. **(Figure 4)**
- Sub Bands (UL/DL Frequency Bands) Settings:** The frequency bandwidths of all the five sub bands or loaded sub bands in UL & DL are defined. **(Refer Figure 4)**

- d. **Thresholds Output Power:** Maximum Output Power limit in UL & DL for both the bands are set. A “**PA Power high**” alarm will be generated when PA power exceeds the upper limit. (Refer Figure 4)
- e. **Thresholds RSSI Limits:** Lower and Upper RSSI Limits in DL & UL paths for both the bands are set. A RSSI High alarm will be generated when RSSI exceeds the set upper limit, and a RSSI Low alarm will be generated when RSSI goes below the set lower limit set. Upper range that can be set varies from -35 to -55dBm. Lower range that can be set varies from -75 to -95dBm. (Refer Figure 4)

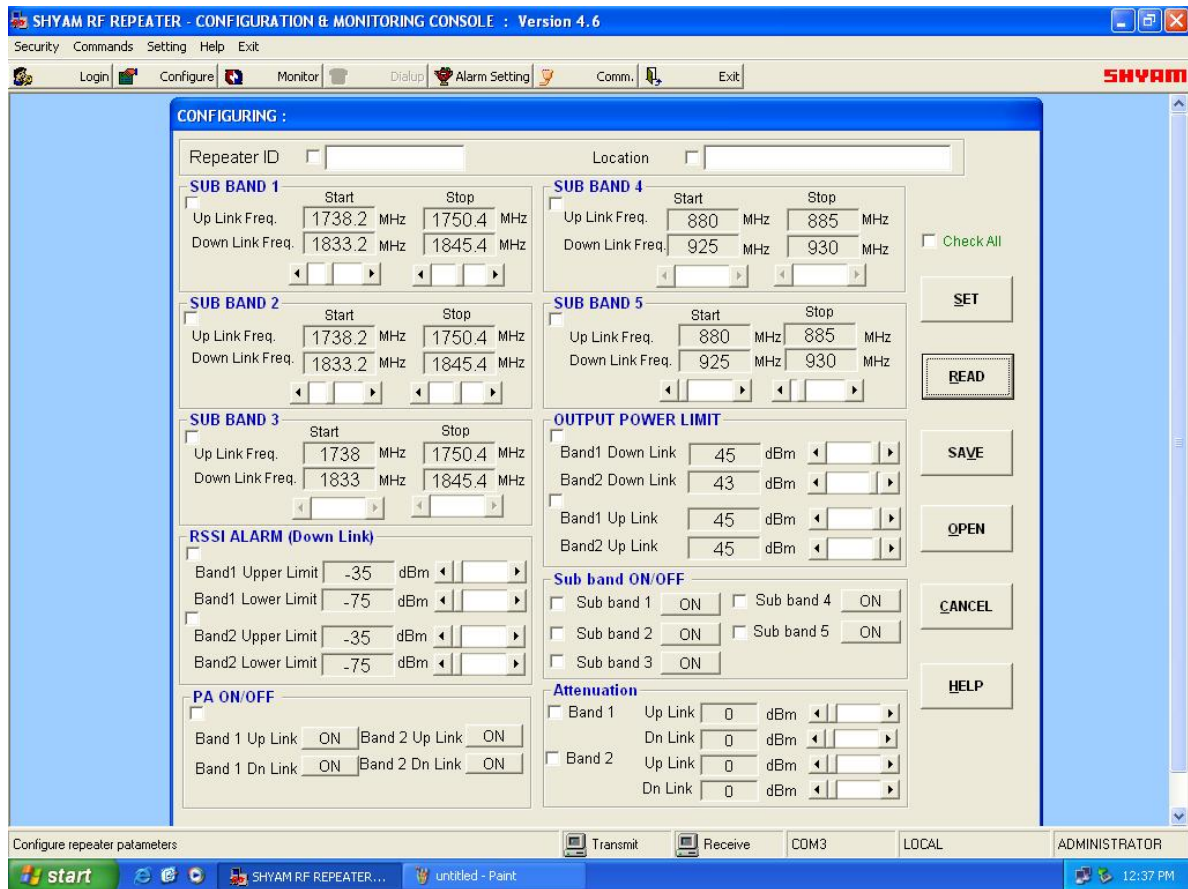


Figure 4: Configuration window

- f. **Sub band ON/OFF:** The equipped sub bands are brought in the ON mode and others are put in OFF condition.
- g. **PA ON/OFF:** User can set uplink and/or downlink PA as ON or OFF independently for testing/maintenance purpose at the time of installation for both the bands. (Please refer to Figure 4)
After completing the installation it must be in ON condition only.
- h. **Attenuation:** The information regarding attenuation inserted in UL & DL for both the bands is displayed.

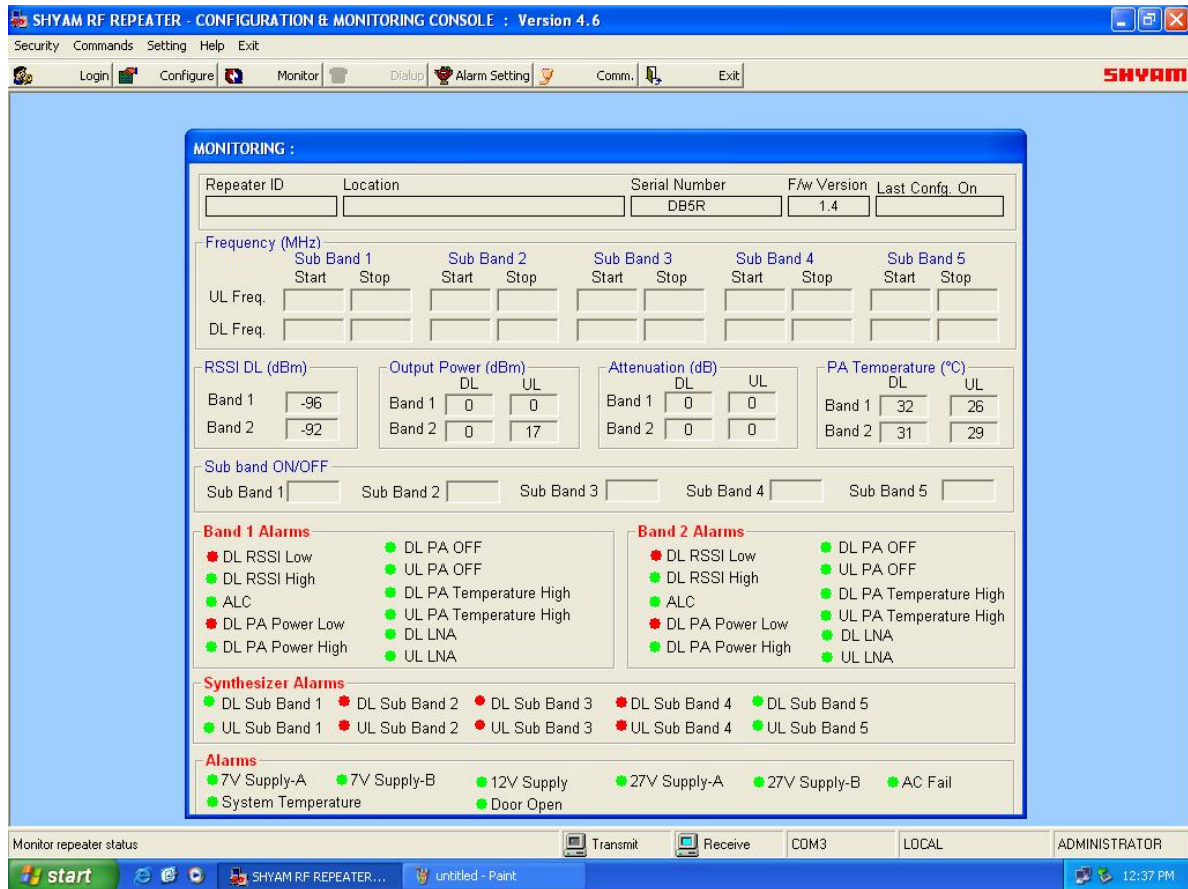


Figure 5: Monitoring & Alarm window

III) Monitoring (Figure 5)

In this window, the status of the system is monitored for the following parameters/conditions:

S.NO.	Parameters/Conditions	Remarks
1.	Frequency Bandwidth for sub bands	It displays the bandwidth in DL & UL of each sub band equipped.
2.	RSSI (DL) Band 1	Real time value of DL signal level for Band 1 is indicated.
3.	RSSI (DL) Band 2	Real time value of DL signal level for Band 2 is indicated.
4.	Attenuation Band 1 (DL)	Indicates attenuation inserted in the system for the band in DL.
5.	Attenuation Band 2 (DL)	Indicates attenuation inserted in the system for the band in DL.
6.	Attenuation Band 1 (UL)	Indicates attenuation inserted in the system for the band in UL.
7.	Attenuation Band 2 (UL)	Indicates attenuation inserted in the system for the band in UL.
8.	Output Power Band 1(DL)	Real time PA output power in dBm.
9.	Output Power Band 2(DL)	Real time PA output power in dBm.

10.	Output Power Band 1(UL)	Real time PA output power in dBm.
11.	Output Power Band 2(UL)	Real time PA output power in dBm.
12.	Sub band ON/OFF	Displays the information about the sub band equipped.
13.	PA (DL) temperature for band 1.	Indicates the temperature of PA.
14.	PA (DL) temperature for band 2.	Indicates the temperature of PA.
15.	PA (UL) temperature for band 1.	Indicates the temperature of PA.
16.	PA (UL) temperature for band 2.	Indicates the temperature of PA.

IV) Alarms (Figure 5)

Details of alarms displayed are detailed below:

S.NO.	Alarm Indication	Remarks
1.	DL RSSI Low (Band 1 & Band 2)	When the low RSSI is detected in any of the two or both bands, limits as set by the user.
2.	DL RSSI High (Band 1 & Band 2)	When RSSI in DL path exceeds the upper limit in any of the two or both bands, as set by the user.
3.	DL PA Power High (Band 1 & Band 2)	When PA Power in DL path exceeds the upper limit in any of the two or both bands, set by user.
4.	DL PA Power Low (Band 1 & Band 2)	When PA Power in DL path exceeds the lower limit in any of the two or both bands, set by user.
5.	DL Auto PA OFF (Band 1 & Band 2)	When PA Auto OFF is detected in any of the two or both bands in DL path.
6.	DL Manual PA OFF (Band 1 & Band 2)	When PA Manual OFF is detected in any of the two or both bands in DL path.
5.	DL PA Temperature High	When PA Temperature in DL path exceeds the upper limit in any of the two or both bands set by user.
6.	UL PA Temperature High	When PA Temperature in UL path exceeds the upper limit in any of the two or both bands set by user.
7.	Synthesizer failure (For equipped sub bands in DL & UL)	When the synthesizer in any of the equipped sub bands fails, relevant alarm is displayed.
8.	LNA failure for Band 1 & 2 in DL	When LNA failure is detected in any of the bands in DL.
9.	LNA failure for Band 1 & 2 in UL	When LNA failure is detected in any of the bands in UL.
10.	ALC band 1`	It indicates that ALC limit is exceeded.
11.	ALC band 2	It indicates that ALC limit is exceeded.
12.	AC fail	Failure of AC mains to the system is indicated by this alarm.
13.	7 V DC (A & B) failure	Indicates the failure of 7 V DC supply.
14.	12 V DC failure	Indicates the failure of 12 V DC supply.
15.	27 V DC (A & B) failure	Indicates the failure of 27 V DC supply.
16.	System Temperature	Indicates the temperature of the system.
17.	Door Open	Indicates that the door has been opened.

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



 *A red indication is for Alarm present.*

 *A green indication is for No alarm.*

V) Communication Window (Figure 6)

In COMMUNICATION window, user can select serial communication port of the computer and type of connection between repeater and computer. There are two types of connections viz. Local and Remote

Local Connection: In this type of connection, User computer COM Port and repeater's USB Port are connected directly using cable. Sequence is given below:

- 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".

Remote Connection: This connection is established through Wireless Modem.

In this type of connection, User communicates from/to remote location with the repeater using wireless Modem / Cell phone.

To connect:

- Click the "**COMM.**" on the command bar to display the COMMUNICATION window.
- Select the Connection Type as "**REMOTE**".
- Select the computer's Comm. Port where the wireless Modem is connected.
- Click "**OK**".
- Now click the **DIALUP** on the command bar to display the **DIALUP** window.
- Enter / Select the repeater phone number.
- Click the "**DIAL**" and wait (maximum 60 seconds) for connection.

A message "**CONNECTED**" will appear on the screen after the GSM Connection is established.



Click the "**DISCONNECT**" on the DIALUP window to disconnect remote communication with the repeater.

Wireless Modem (Optional) is equipped inside the housing of the repeater and it can be easily located through a sticker provided on the same. It has a groove with SIM cardholder in which the SIM card can be inserted for remote communication.

CAUTION

When the communication between repeater & PC/Laptop is in progress through USB:

1. Do not remove cable from the USB port.
2. Do not switch off the repeater.

In case the communication is not required any more, click at **EXIT** before removing cable from USB port to avoid *hanging* of the PC/Laptop. In case the PC/Laptop goes in to *hanging* mode, it has to be restarted after closing/switching OFF & ON the repeater.

VI) Security Settings (Figure 7)

The system has two levels of permitting Log in to the repeater to avoid unauthorized operation. The levels are: **ADMINISTRATOR & SUPERVISOR.**

Each level has a specific password. The password for each level can be changed at intervals. **ADMINISTRATOR** has rights to perform all functions Viz. Configuration, Monitoring etc. Whereas the **SUPERVISOR** is allowed to perform limited functions like monitoring of alarms, establishing communication etc.

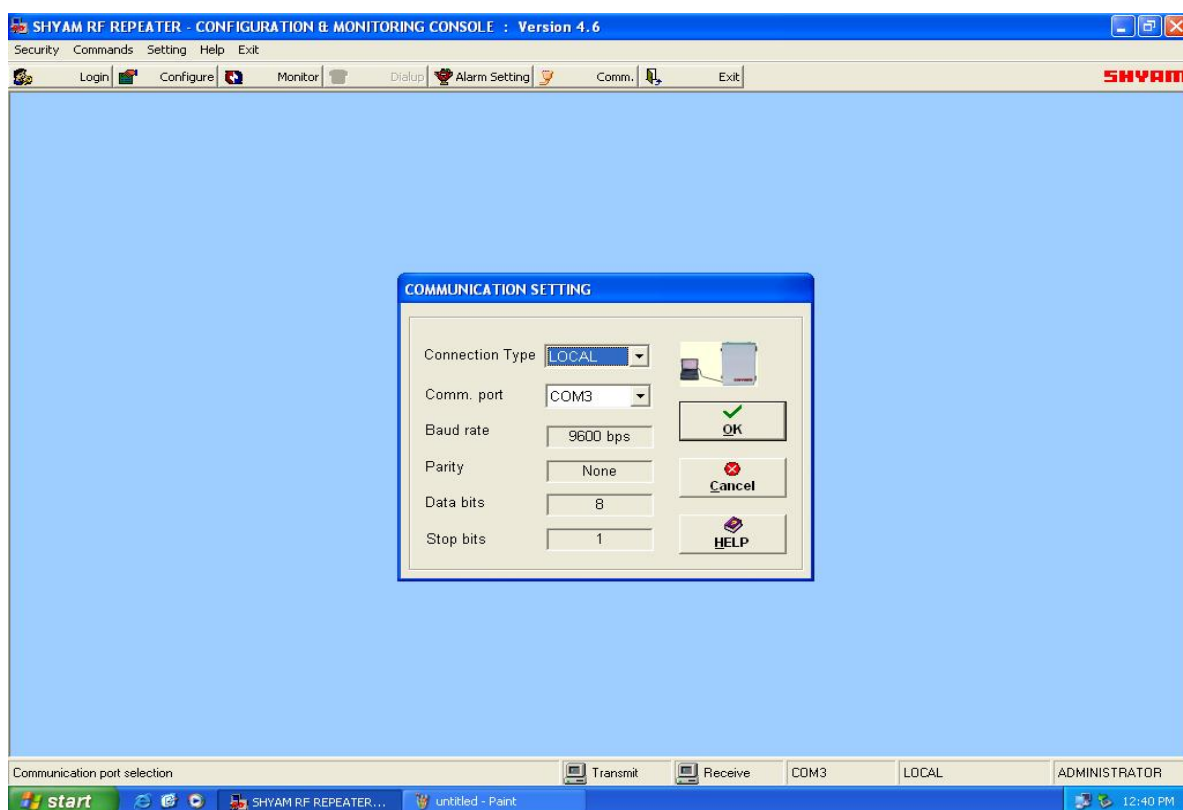


Figure 6: Communication Window

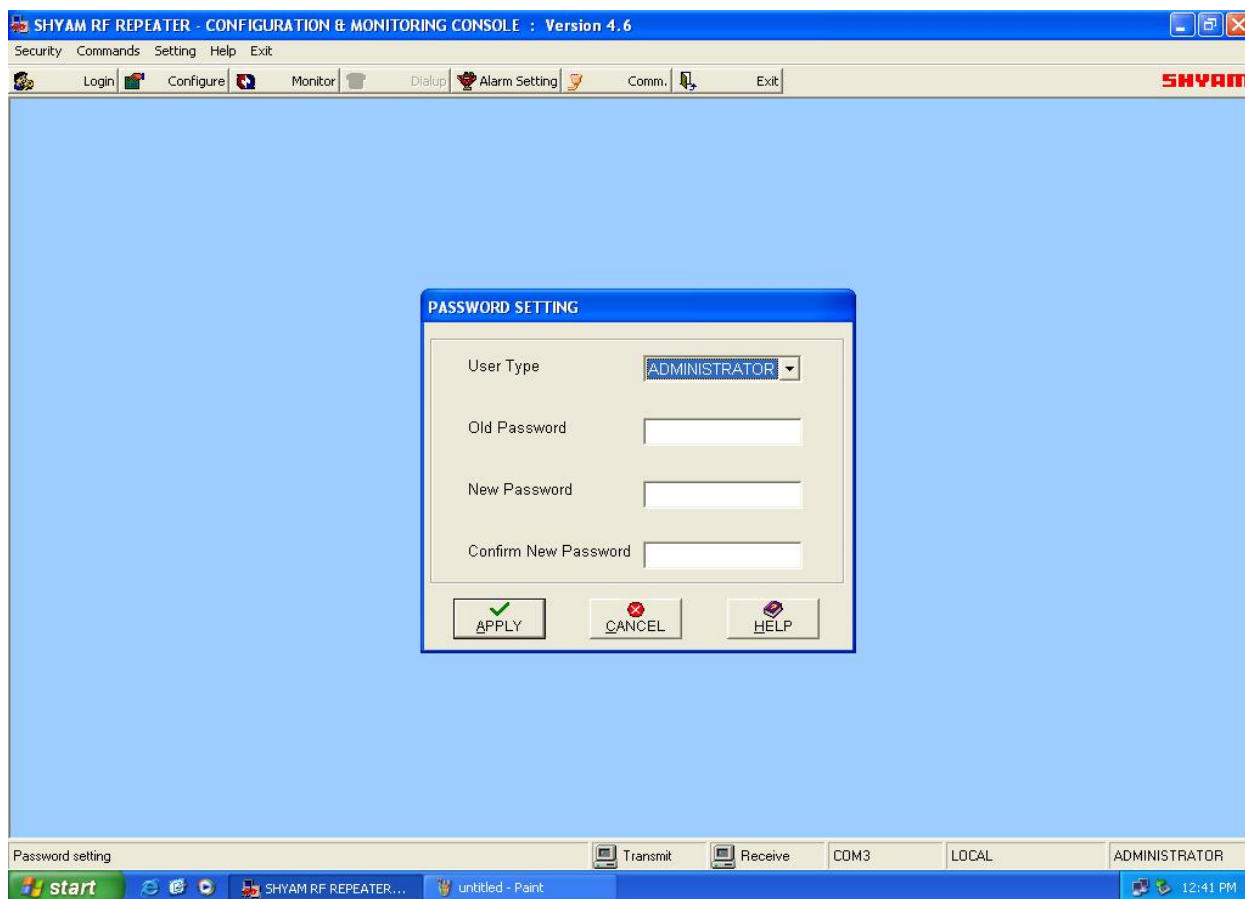


Figure 7: Password Settings

6.3. Modules In DB5R-Description

The signals intercepted through the Donor antenna in the DL pass through different modules/units for further signal processing; the detail explanation is about different modules/units is given below:

a. DONOR Antenna

Donor antenna of appropriate bandwidth & gain interfaces the BTS on one side and repeater system on other side through RF cable. It is used to intercept signals from the base station and switch electromagnetic waves into RF signals in the DL and vice versa in the UL.