

**OPTICAL / MOU Series / BTS LINK****OPERATION & INSTALLATION MANUAL****BTS Link® -104/108****FIBER OPTICAL  
DISTRIBUTED ANTENNA SYSTEM WITH 4/8 SBROUS**FCC ID:S3CBTSLINK1048  
IC: 5751A-BTSLINK1048

5920 0020 100

March 2008

**Proprietary Information**

The information contained herein is proprietary to **Shyam Telecom Limited**. Unauthorized access, copy and replication are prohibited. This document must not be copied in whole or part by any means or it shall not be disclosed or divulged to any third Party without the prior written consent of **Shyam Telecom Limited**.

**INDEX**

<b>1. DOCUMENT HISTORY .....</b>	<b>3</b>
<b>2. DISCLAIMER.....</b>	<b>4</b>
<b>3. SAFETY INSTRUCTIONS AND WARNINGS.....</b>	<b>4</b>
3.1. PERSONNEL SAFETY .....	4
3.2. EQUIPMENT SAFETY .....	4
3.3. ELECTROSTATIC SENSITIVITY .....	5
<b>4. INTRODUCTION .....</b>	<b>6</b>
4.1. PURPOSE .....	6
4.2. SCOPE .....	6
4.3. DEFINITIONS .....	6
4.4. REFERENCES.....	7
4.5. GENERAL .....	7
<b>5. FUNCTIONAL DESCRIPTION OF BTS LINK-104/108 REPEATER .....</b>	<b>8</b>
5.1. GENERAL DESCRIPTION.....	8
5.2. INDOOR/OUTDOOR COVERAGE.....	9
<b>6. TO GET STARTED-BASIC SOFTWARE CONTROL OF THE SYSTEM .....</b>	<b>11</b>
6.1. GENERAL .....	11
6.2. TERMINAL SET-UP.....	11
6.3. BLOCK DESCRIPTION.....	23
<b>7. BTS LINK-104/108 REPEATER SPECIFICATIONS .....</b>	<b>26</b>
7.1. ELECTRICAL SPECIFICATIONS-RF & OPTICAL .....	26
7.2. ELECTRICAL SPECIFICATION POWER REQUIREMENT .....	26
7.3. EXTERNAL ELECTRICAL/OPTICAL INTERFACE.....	26
7.4. MECHANICAL SPECIFICATION .....	27
7.5. ENVIRONMENTAL SPECIFICATION.....	27
7.6. CONTENTS OF DELIVERY .....	27
7.7. SAFETY PRECAUTIONS-HANDLING OPTICAL EQUIPMENT .....	27
<b>8. INSTALLATION .....</b>	<b>29</b>
8.1. PREPARATION SHEET-PRE INSTALLATION .....	29
8.2. MOU INSTALLATION .....	30
8.3. OPTICAL FIBER LAYING.....	32
8.4. INSTALLATION-SBROU .....	33
8.5. DOS & DON'T DOS .....	34
8.6. CHECKLIST-POST INSTALLATION.....	35
<b>9. SYSTEM MAINTENANCE.....</b>	<b>37</b>
9.1. GENERAL .....	37
9.2. PREVENTATIVE MAINTENANCE .....	37

**1. Document History**

<b>Document Number</b>	<b>Document Name</b>	<b>Date</b>	<b>Compiled by</b>	<b>Approved by</b>	<b>Revision</b>
5920 0020 100	BTS Link-104/108 Repeater	March 2008	Inderjit	Rajeev Sarup	

**Revision****Revised Section****Date****Intentionally Left Blank**

## 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.

Product name(s) referenced in this document may be trademarks or registered trademarks of their respective companies, and are hereby acknowledged.

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 by the warranty.

***All specifications are subject to change without prior notice***

## 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**

It 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.

**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 **BTS Link-104/108** Repeater.

### 4.2. Scope

This document is the product description of the Shyam **BTS Link-104/108** Repeater.

### 4.3. Definitions

<b>AGC</b>	Automatic Gain Control
<b>ALC</b>	Automatic Level Control
<b>APC</b>	Automatic Power Control
<b>BTS</b>	Base Transceiver Station
<b>CDMA</b>	Coded Division Multiple Access
<b>CMC</b>	Configuration & Monitoring Console software
<b>DCS</b>	Digital Communication System
<b>DL</b>	Downlink signal (from base station via repeater to mobile station)
<b>EGSM</b>	Extended Global System for Mobile Communication
<b>ETSI</b>	European Telecommunications Standard Institute
<b>FDF</b>	Fiber Distribution Frame
<b>GSM</b>	Global System for Mobile communication
<b>LED</b>	Light Emitting Diode
<b>LNA</b>	Low Noise Amplifier
<b>LO</b>	Local Oscillator
<b>MOU</b>	Master Optical Unit
<b>MS</b>	Mobile Station
<b>PCN</b>	Personal Communication Network
<b>PCS</b>	Personal Communication System
<b>PSU</b>	Power Supply Unit
<b>RF</b>	Radio Frequency
<b>RMS</b>	Remote Management System
<b>ROU</b>	Remote Optical Unit
<b>RSSI</b>	Received Signal Strength Indication
<b>UL (Uplink)</b>	Uplink signal direction (from mobile station via repeater to base station)
<b>UMTS</b>	Universal Mobile Telecommunication System

#### 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] ETS300609-4  
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 rise 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.

## 5. Functional Description of BTS Link-104/108 Repeater

### 5.1. General Description

The **BTS Link-104/108** Repeater System is designed to provide indoor/outdoor coverage (depending on the location of the remote optical unit installed) and is equipped to handle signals in AWS band. It provides highly selective amplification in the pre-set band. The detail of operating AWS service frequency band is given below:

**Frequency Band:**

Down Link: 2110 MHz to 2155 MHz

Up Link : 1710 MHz to 1755 MHz

**The Customer is requested to refer to the sticker on the repeater unit giving the details of frequency band set.**

- The **BTS Link-104/108** repeater system is a single band Distributed Antenna System (DAS) for point to point & point to multi-point coverage.
- It is comprised of a Master Optical Unit (MOU) and Single Band Remote Optical Units (SBROUs), maximum 4 or 8, installed at different sites. **Two versions are available; BTS Link-104 version supports up to 4 SBROUs and BTS Link-108 supports up to 8 SBROUs.** MOU & each of the SBROUs are connected through a pair of optical fibers.
- For providing coverage in a large area, SBROUs with RF power of +40dBm can be installed.
- Master Optical Unit (MOU) is installed at indoor location close to BTS from where the signals are to be received and OFC terminations destined for SBROUs at different sites are available.
- The repeater is deployed in the network where RF coverage is required for large clusters of mobile users at different sites.
- The repeater can be equipped with a RMS (Optional) for speedy maintenance & monitoring.
- The antenna isolation problem is of little consequence since the signals between MOU and SBROUs are propagated as optical signals, which are insensitive to any electrical interference/disturbances.



The system is comprised of two units:

**I) Master Optical Unit (MOU):** The MOU is installed at a suitable indoor location close to the BTS. It receives RF signals from BTS in the DL path and optical signals from different ROUs in the UL path. It consists of modules/units:

- Duplexers
- Optical Transmitter Unit (OTX)
- Optical Splitter (1:4)
- Optical Receiver Unit (ORX)
- Power Supply Unit
- Gain modules
- Supervisory and ASK modem
- A metallic housing (Indoor application) accommodates all the above units/modules. Arrangement is made for dissipation of heat generated in the unit and the unit is not waterproof.

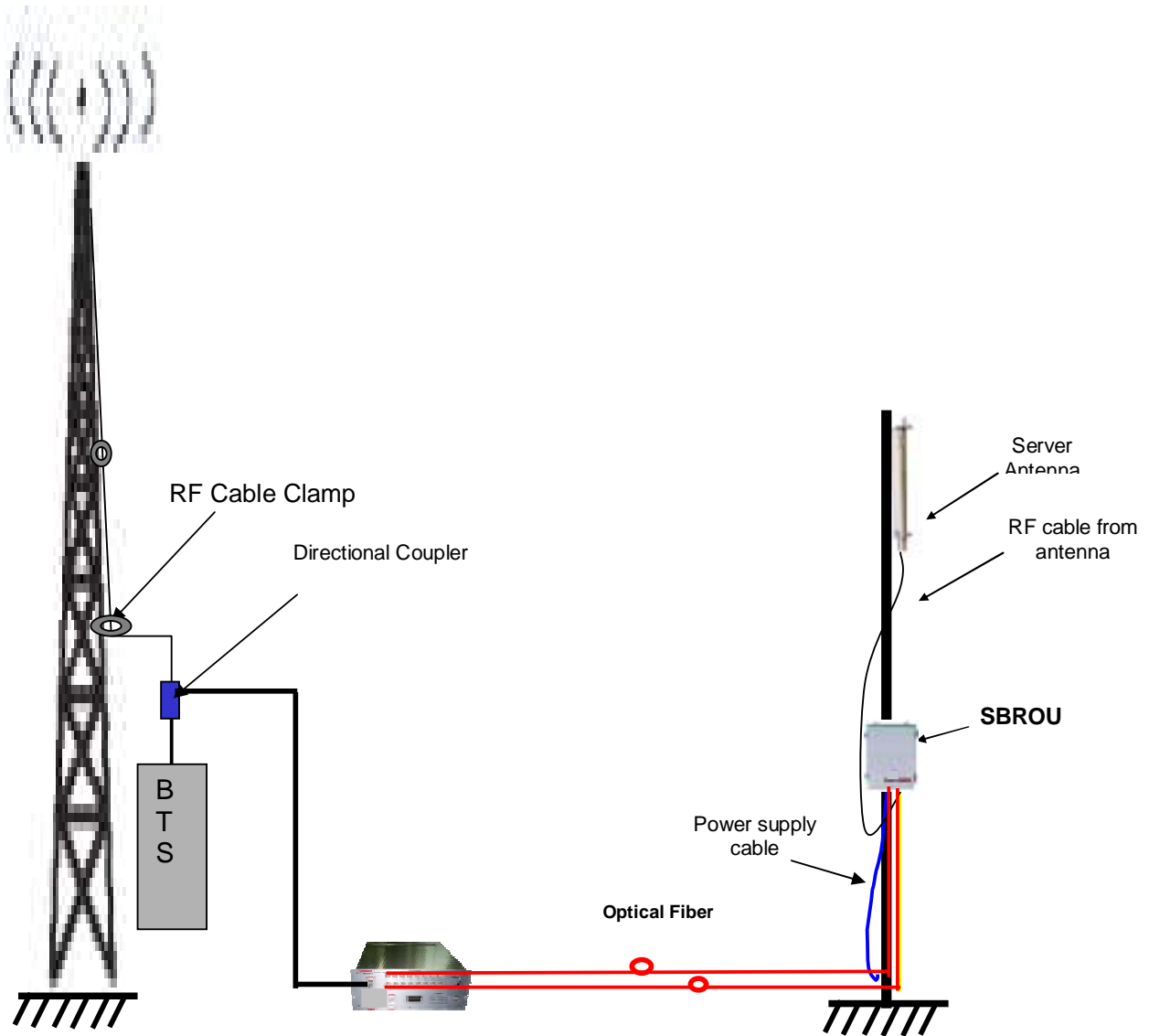
**II) Single Band Remote Optical Unit (SBROU):** Depending on the requirement SBROUs maximum up to 4 or 8 are installed at different locations where coverage is desired. Each of the SBROUs is comprised of modules/units:

- Optical Receiver Unit (ORX)
- Power Amplifier
- Duplexer
- LNA
- Optical Transmitter Unit (OTX)
- Power Supply Unit
- Gain module
- Supervisory & ASK module
- A metallic housing (Indoor application/outdoor application) accommodates all the above units/modules. Arrangement is made for dissipation of heat generated in the unit; the outdoor housing conforms to IP-65.

## 5.2. Indoor/Outdoor Coverage

The indoor or outdoor coverage provided by the system shall depend on the location of SBROU installed at distant site.

When outdoor coverage is desired, SBROU is installed at the particular site. Refer to **Figure 1** where relative positions of MOU & SBROU are indicated for outdoor application.



**MOU Installed inside BTS enclosure**

**Figure 1: Typical Outdoor Application of BTS-Link 104/108**

## 6. To Get started-Basic Software Control of the System

### 6.1. General

The system (MOU & SBROU) 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. It enables monitoring of parameters & subsequent adjustment if required.

This function can be performed either using a terminal (PC/laptop) locally, or through remote login using 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 at MOU & ROU with a laptop / PC connected to the system by means of local USB serial interface or remotely via wireless modem (Optional) mounted inside the MOU. The laptop/PC should be loaded with the CMC software available on the supplied CD along with the USB driver.



Figure 2: Login Repeater

Functions as described below are carried out through CMC software:

### I) Login Repeater (Figure 2)

After running the system *Configuration & Monitoring Console* (CMC), user needs to login. Similar sequence is to be followed at MOU & SBROU. To login:

- 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**”.

**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 & Monitoring

Configuring system means setting the system parameters for operation as per the requirement at site. Configuration & monitoring is carried out at MOU and ROU separately.

#### a) Settings in MOU

To begin with MOU ID settings as per **Figure 3** are carried out, information specified is:

- Repeater ID
- Repeater Location

Configurable parameters as per **Figure 4** are:

- Out put power limit UL
- Laser Diode ON/OFF
- OTX1 ON/OFF and OTX2 ON/OFF

After specifying these parameters, SET is pressed

#### b) MOU Status

Status of MOU as per **Figure 5** is displayed through following set (configurable) parameters:

**Downlink**

- RSSI
- Attenuation inserted

**Uplink**

- Out put Power
- Attenuation inserted

**Optical Power**

- OTX 1 & OTX 2 [Both units are equipped for 8 SBROUs]
- ORX 1 to 8 [As per number of equipped SBROUs]

**Power Supply**

- 5.5 V

**Temperature**

- Displays the system temperature

**Alarms**

- Alarms as per categorization viz. Critical, Major and Minor. Clicking at “detail alarms” can further check the associated detail.

In addition to above it also displays:

- MOU Serial No.
- Location of MOU
- Firmware incorporated in the unit
- Date



**Figure 3: MOU ID Settings**



**Figure 4: MOU Settings**



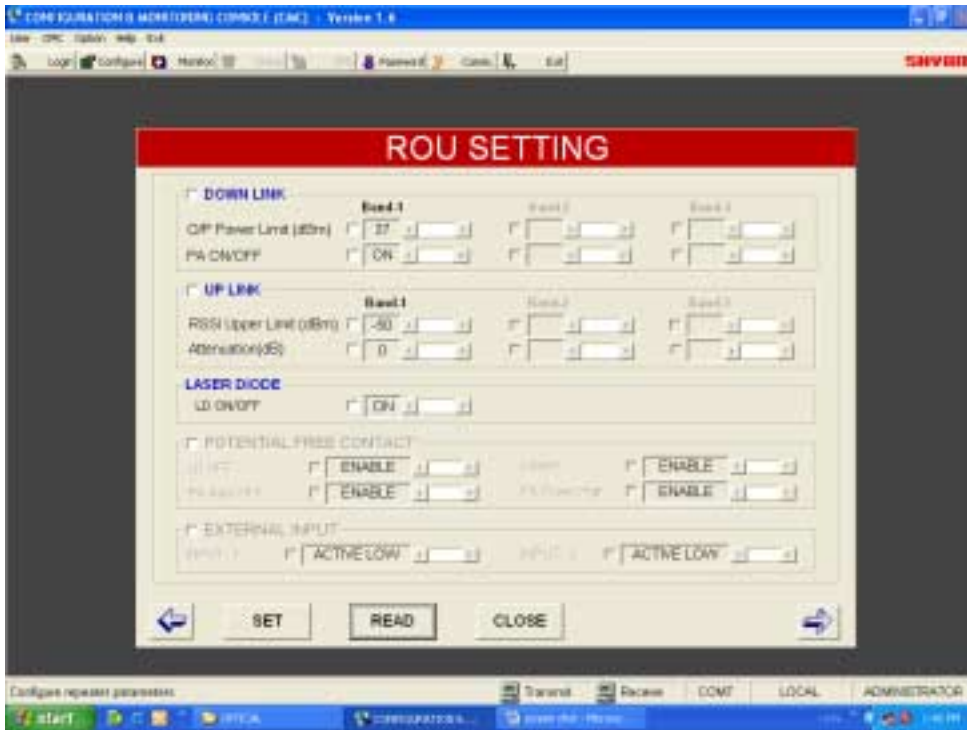
**Figure 5: MOU Status Monitoring**

**C) Alarms-MOU (Refer Figure 6)**

Alarm Observed	Detail
DL RSSI low	It indicates that the RSSI has gone below the set limit.
DL RSSI High	It indicates that the RSSI has exceeded the higher limit set.
UL Power High	When the high power than the set limit is detected, it is indicated.
LD off [OTX-1 & OTX-2]	It indicates the OFF status of LD corresponding to OTX-1/OTX-2.
LD Power Low [OTX-1 & OTX-2]	It indicates the detection of low optical power in LD corresponding to OTX-1/OTX-2.
LD Power High [OTX-1 & OTX-2]	It indicates the detection of high optical power in LD corresponding to OTX-1/OTX-2.
Photo Diode Power Low [ORX-1 to ORX-8]	It indicates the detection of low optical power in PD corresponding to ORX-1 to ORX-8.
Photo Diode Power High [ORX-1 to ORX-8]	It indicates the detection of high optical power in PD corresponding to ORX-1 to ORX-8.
Power Supply	Failure of derived DC voltage is indicated.
System Temperature High	When the system temperature exceeds the set limit, alarm will be generated.



**Figure 6: MOU Alarm Monitoring**



**Figure 7: SBROU Settings**

**d) Settings in SBROU [Figure 7]**

After login, following setting is carried out:



### Downlink

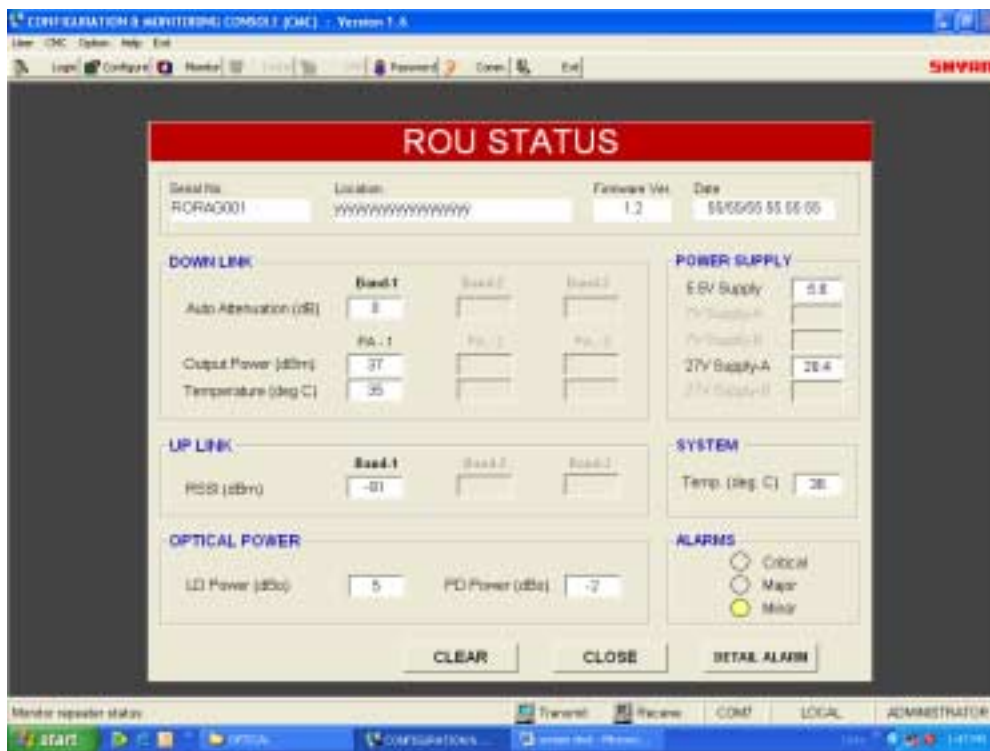
- Output power limit
- PA ON/OFF

### Uplink

- RSSI upper limit
- Attenuation inserted

### Optical

- Laser Diode ON/OFF



**Figure 8: ROU Status Monitoring**

### e) SBROU Status (Refer Figure 8)

Status of SBROU as per **Figure 8** is displayed through following set of (configurable) parameters:

#### Downlink

- Auto attenuation insertion
- Output power
- Temperature

#### Uplink

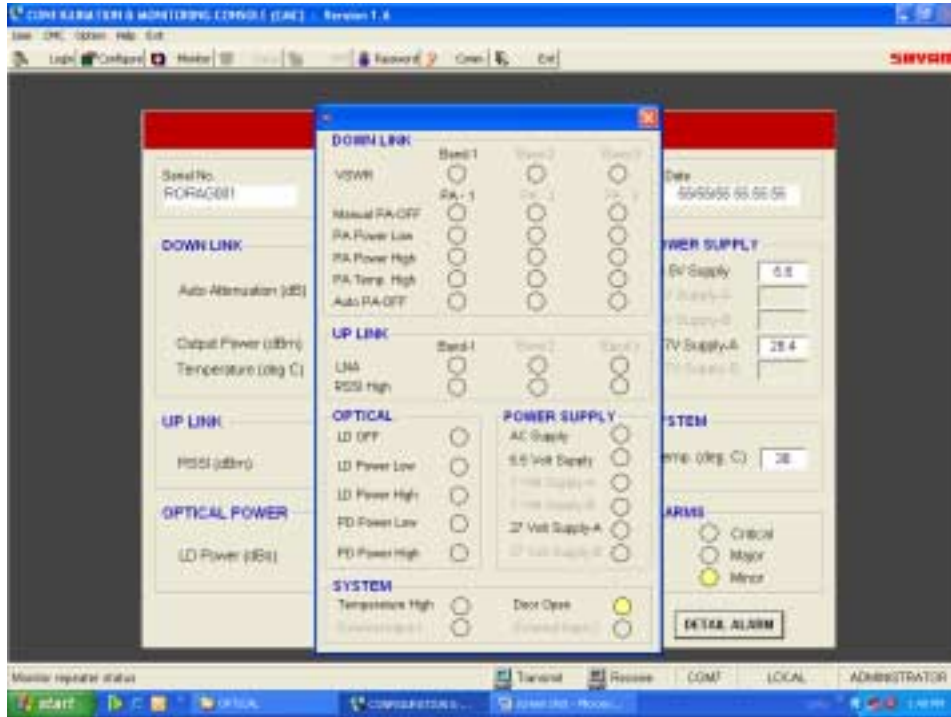
- RSSI

## Optical Power

- LD power
- PD power

In addition to above parameters, following parameters are also displayed:

- Derived DC voltages
- System temperature
- Alarms – Category [Detail can be seen on Alarm window]



**Figure 9: SBROU Alarms Monitoring**

### f) Alarms-SBOU (Refer Figure 9)

Alarm Observed	Detail
PA OFF DL (Manual)	When the user sets PA ON / OFF command as OFF, alarm will be generated.
PA OFF DL (Auto)	When the system sets the PA OFF, alarm will be generated.
PA Power High DL	When PA power exceeds the limit set by the user, alarm will be generated.
PA Power Low DL	When PA power goes lower than the limit set by the user, alarm will be generated.
PA Temperature High	It indicates that the temperature has exceeded the limits.
LNA UL	LNA failure is indicated.
Laser Diode OFF	Failure of Laser Tx power is indicated.

<b>LD Power Low</b>	It indicates that the LD power has gone below the set limit.
<b>LD Power High</b>	It indicates that the LD power has exceeded the set limit.
<b>PD Power Low</b>	It indicates that the PD power has gone below the set limit.
<b>PD Power High</b>	It indicates that the PD power exceeded the set limit.
<b>Power Supply</b>	Failure of AC mains, 5.5 V DC & 27 VDC are indicated through separate LEDs.
<b>VSWR Alarm</b>	When antenna port is open or mismatch, alarm will be generated.
<b>Door Open</b>	When the door of the outdoor system is open, alarm will be generated. It is applicable to SBROU for outdoor application.

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

*For Alarm*



 *A red indication is present.*

 *A green indication is for No alarm.*

It is possible to have access to any of the SBROUs (**Refer Figure 10**) from MOU through ASK modem and all the functions like, configuration, monitoring Status & alarms can be carried out. MOU can be accessed through remote external modem (optional) for above functions.

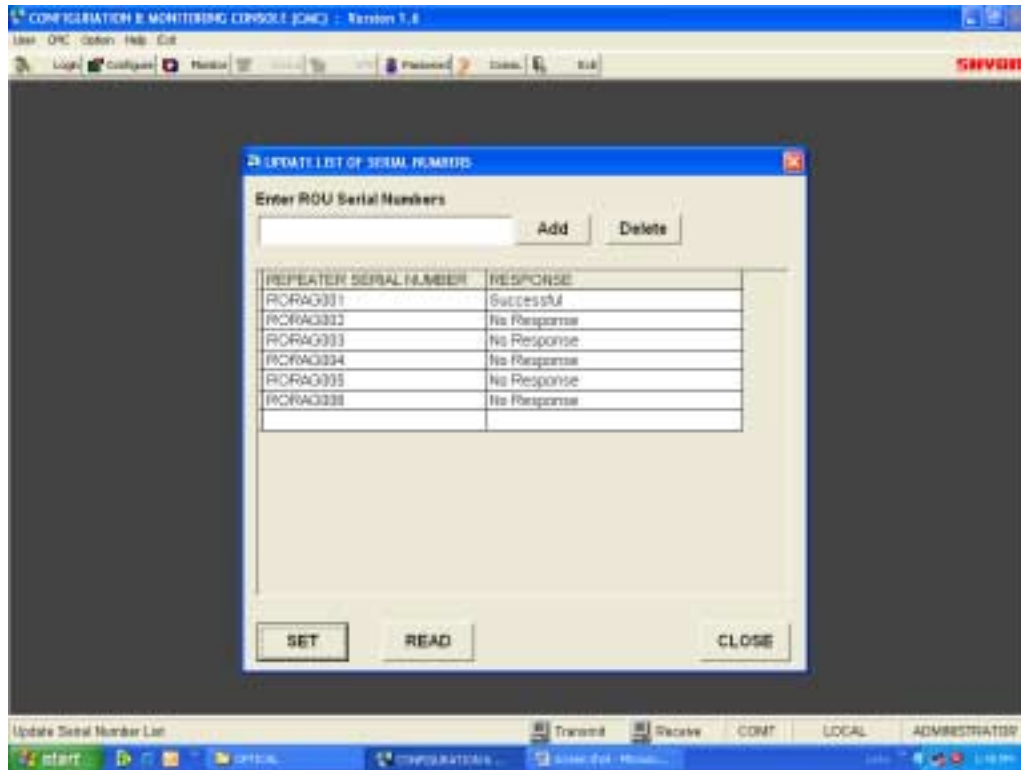


Figure 10: Selection of SBROU for Status & Alarm Monitoring

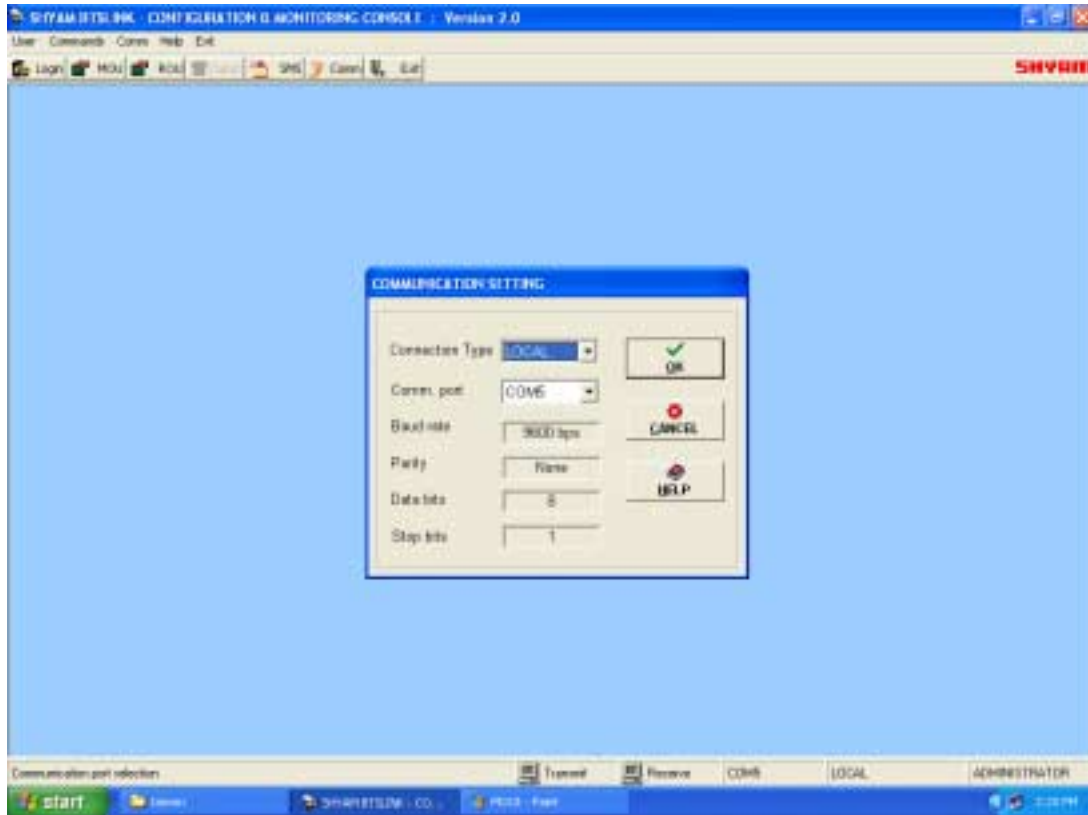
### III) Communication Setting [Figure 11]

It is possible to establish communication with MOU & ROU through the software incorporated in the system.

#### i. Local Connection

In this type of connection, user computer COM Port and system's USB port are connected directly using cable. Proceed as under:

- 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 11: Communication Settings**

**ii. Remote Connection**

In this type of connection, User communicates from/to remote location with the system using wireless External Modem.

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 GSM 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 wireless Connection is established.



Click the “**DISCONNECT**” on the DIALUP window to disconnect remote communication with the system.

#### CAUTION

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

- Do not remove cable from the USB port.
- 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.

#### IV) SECURITY [Figure 12]

##### Password Setting

Select Password setting from Security menu to change the existing Password. If logged in user is SUPERVISOR, the password for SUPERVISOR only, can be changed.

The ADMINISTRATOR can perform all the functions including change of the password for ADMINISTRATOR & SUPERVISOR.

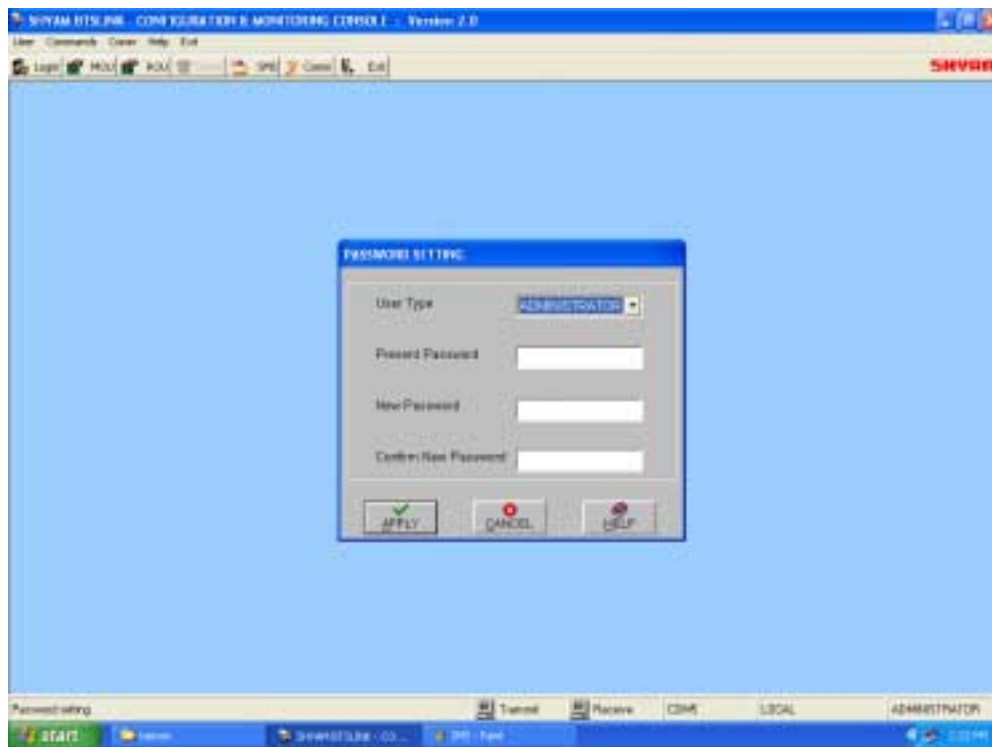


Figure 12: Password Setting

### 6.3. Block Description

Main constituents of the system are:

#### I) Master Optical Unit (MOU)- Figures 13 & 14

The MOU is installed at the indoor location close to the BTS. In the DL path, the received RF signals from the BTS are fed to the MOU, which converts the RF signals to a stream of optical signals to be applied to the optical fiber for transmission to SBROUs installed at different locations. The optical signals between MOU & each of the SBROUs are propagated on two single mode fibers.

In the UL path, the optical signals received from each of the SBROUs are converted back to the RF signals in the preset frequency band for application to the BTS.

The connectivity between the MOU and the BTS is through low loss RF cable via a directional coupler.

#### Modules in the MOU

- a) **Duplexer:** It is provided in the RF path interfacing BTS for providing isolation between the DL & UL frequency bands (1710 MHz to 1755 MHz & 2110 MHz to 2155 MHz).
- b) **Optical Transmitter Unit (OTX):** It receives RF signals in the preset frequency band in the DL path & converts the same to the optical signals in 1310 nm wavelength at a level of  $-1.5\text{dBm}\pm 1\text{dBm}$  for application to the optical fiber. One OTX unit is equipped in MOU for **BTS Link-104** & two OTX units are equipped for **BTS Link-108**.
- c) **Optical Splitter 1:4 Unit:** As indicated earlier, one MOU supports 4 SBROUs or 8 SBROUs at different locations, the optical signals from each OTX are split in this unit in to 4 in case of **BTS Link-104**. Two splitters shall be equipped in case of **BTS Link-108**.
- d) **Optical Receiver Unit (ORX):** 4 ORX or 8 ORX (depending on the version) units are equipped in the MOU and each of them receives optical signals in 1550 nm wavelength from the SBROU in the UL path. Stream of out put optical signals from each ORX unit is converted in to RF signals for application to BTS at the desired power.
- e) **Power Supply Unit (PSU):** The unit gets input of  $-48\text{ V DC}$  or 100 to 240 V AC (depending on option) for deriving different DC voltages required for other active units in the MOU.
- f) **Gain Module:** It is available after ORX in the UL path for making RF signals available for application to the BTS.

- g) Supervisory & ASK Modem:** Supervisory and ASK modem enable the monitoring the status of MOU & SBROUs at different locations and the information can be extracted through USB port interface available in the front panel.
- II) Optical Fiber & Patch Cords:** It is very important part of the system, which connects MOU with SBROU through two fibers. Two single mode optical fibers are needed between the MOU and each SBROU. Fiber carrying signals from the specific SBROU is terminated at the corresponding ORX in the MOU likewise; fiber carrying signals for specific SBROU is terminated at one of the splitter ports.



**III) Single Band Remote Optical Unit (SBROU):** It houses the following modules:

- a) Optical Receiver Unit (ORX):** One such unit is provided in the SBROU, which receives the optical signals in the 1310 nm wavelength in the DL path from MOU and converts the same to RF signals in the preset frequency band.
  - b) Power Amplifier (PA):** The PA unit is responsible for generating the desired RF power for application to the server antennas. It is provided in the DL path and the gain of the amplifier is set in accordance with RF power required.
  - c) Duplexer:** It is provided to isolate the DL & UL RF signals. It interfaces with the server antenna.
  - d) Low Noise Amplifier (LNA):** It is provided in the UL path after the Duplexer to provide the amplification to the RF signals.
  - e) Optical Transmitter Unit (OTX):** It receives RF signals in the preset frequency band in the UL path & converts the same to the optical signals in 1550 nm wavelength at a level of  $+4\pm 1$  dBm for application to the optical fiber. One OTX unit is equipped in ROU.
  - f) Power Supply Unit (PSU):** One PSU is equipped in the ROU for deriving DC voltages required for operation of different devices, it gets AC in the range of 140-270 V, 47/63 Hz.
  - g) Supervisory & ASK Modem:** Supervisory and ASK modem enable the monitoring the status of MOU & SBROUs at different locations and the information can be extracted through USB interface.
  - h) Gain Modules:** One is provided between ORX and PA in the DL path for enabling generation of the desired RF band. Another one is provided with the OTX unit.
- iv) Server Antenna:** The RF signals from SBROU are distributed to the mobile users through server antenna mounted at the appropriate spot from where the intended area can be provided with coverage. For indoor coverage, a set of server antennas at different spots at indoor locations is installed. For outdoor coverage, omni antenna is mounted at outdoor location. In both cases, antenna should be of appropriate gain & required frequency band.

## 7. BTS LinK-104/108 Repeater Specifications

### 7.1. Electrical Specifications-RF & Optical

S.NO.	Parameter	Specifications for MOU	Specifications for SBROU
1.	Optical Wavelength (TX)	1310 nm	1550 nm
2.	Optical Wavelength (RX)	1550 nm	1310 nm
3.	Frequency Band	2110 MHz to 2155 MHz (DL) 1710 MHz to 1755 MHz (UL)	2110 MHz to 2155 MHz (DL) 1710 MHz to 1755 MHz (UL)
4.	Optical Power TX	-1.5dBm±1dBm	+4dBm±1dBm
5.	RF power options in DL path	-	+40dBm±1dBm
6.	Impedance at RF ports	50 Ohms	50 Ohms
7.	Spurious Emission	< -36dBm @ 9 KHz to 1 GHz, <-30dBm @ 1 GHz to 12.75 GHz	< -36dBm @ 9 KHz to 1 GHz, <-30dBm @ 1 GHz to 12.75 GHz
8.	System Noise figure	-----5dB max. ---	-----
9.	Group delay without fiber	---< 0.5 microseconds---	-----

### 7.2. Electrical Specification Power Requirement

S.NO.	Parameter	Specifications for MOU	Specifications for ROU
1.	Power Supply	-48 V DC	140-270 V AC, 47/63 Hz
2.	Power consumption (Approx.)	60 watts (Fully equipped)	200 watts

### 7.3. External Electrical/Optical Interface

S.NO.	Parameter	Specifications for MOU	Specifications for ROU
1.	RF Port	N-type	N-type
2.	Optical Port	FC-PC	FC-PC

## 7.4. Mechanical Specification

S.NO.	Parameter	Specifications for MOU	Specifications for ROU
1.	<b>Dimensions (w x h x d)</b>	485x400x135 mm (19x16x5 inches)	700x385x210 mm (27x15.2x8inches)
2.	<b>Weight (Approx.)</b>	12 Kg. (26 lbs.)	25 Kg. (55 lbs.) +37dBm
3.	<b>Housing</b>	Metal Housing for Indoor application	Metal Housing for outdoor application
4.	<b>Grounding Connection</b>	-	Bolt (Outdoor Housing)
5.	<b>Housing Color</b>	Grey	Grey
6.	<b>Cooling</b>	Convection	Convection

## 7.5. Environmental Specification

Conditions	Specification
<b>Operating Temperature</b>	-20°C to +55°C (-4°F to +131°F)
<b>Storage Temperature</b>	-30°C to +80°C (-22°F to +176°F)
<b>Enclosure</b>	Outdoor application requirement

## 7.6. Contents of Delivery

ITEMS	QUANTITY
<b>Repeater BTS Link-104/108 MOU</b>	1
<b>Repeater BTS Link-104/108 SBROU</b>	As per requirement
<b>PC interface cable for USB port</b>	As per requirement
<b>Power cable with 3 pin pug</b>	As per requirement
<b>Operation &amp; Installation manual</b>	As per requirement
<b>CD containing the application software</b>	As per requirement
<b>Wireless Modem (Optional)</b>	As per requirement
<b>Mounting Clamps with Nuts-bolts</b>	As per requirement

## 7.7. Safety Precautions-Handling Optical Equipment

Special care has to be taken while handling the optical equipment to avoid damage not only to the equipment but also to the technicians/Engineers who are handling the equipment. MOU and SBROU are equipped with Lasers; direct exposure to the human eyes must be avoided. Though the Lasers used in the equipment are of low power and are classified as class III B (norm EN60825) even then enough care needs to be taken to avoid exposure.

Optical connectors for single mode fibers are designed for sub micron tolerances.

Even a small particle of dust shall cause excessive loss & adversely affect the performance:

For safety reasons & optimum performance, following points need attention:

- The optical connectors should never be left in open condition to avoid entry of dust/moisture etc.
- When working with the optical connectors or the optical fiber, check at each end that both optical transmitters are switched off.
- The connectors should be cleaned regularly with ethyl alcohol and tissue paper; the tip should not be touched with bare hands.
- The connectors are very delicate in nature therefore proper aligning without applying excessive force should carry out removal & insertion.

## 8. Installation

### 8.1. Preparation Sheet-Pre Installation

#### 1. General

Application: Outdoor  
 Service Band: AWS  
 Frequency Band DL: 2110 MHz to 2155 MHz  
 Frequency Band UL: 1710 MHz to 1755 MHz

Number of SBROUs installed at different sites:

#### 2. Master Unit

Parameter	Remarks
BTS power	
Estimated Feeder Loss between BTS & Coupler	
Estimated Coupling loss (in coupler)	
Estimated Feeder loss between coupler & Master unit	
Estimated Input RF power in DL to Master unit	
Arrangement for termination of optical fibers	
Optical power in link path (DL)	
Estimated RF power in UL	

#### 3. Optical Path

Parameter	Remarks
Optical Fiber length between MOU-ROU 1.....4/8	
Estimated optical loss between MOU-ROU 1.....4/8	
Estimated optical signal level at each ROU input in DL	
Estimated optical signal level at MOU from each of the SBROUs	

#### 4. Remote Unit (s)

Parameter	Remarks
Proposed attenuation in DL	
Proposed attenuation in UL	
Arrangement for termination of optical fibers	
Desired power at server antenna in DL	
Proposed gain setting in DL	

Date: ..... Prepared by.....

Site Address: .....

## 8.2. MOU Installation

As mentioned earlier in this document, the MOU is placed at indoor location, which is close to the BTS from where the signals are to be fed through directional coupler.

Following points need consideration:

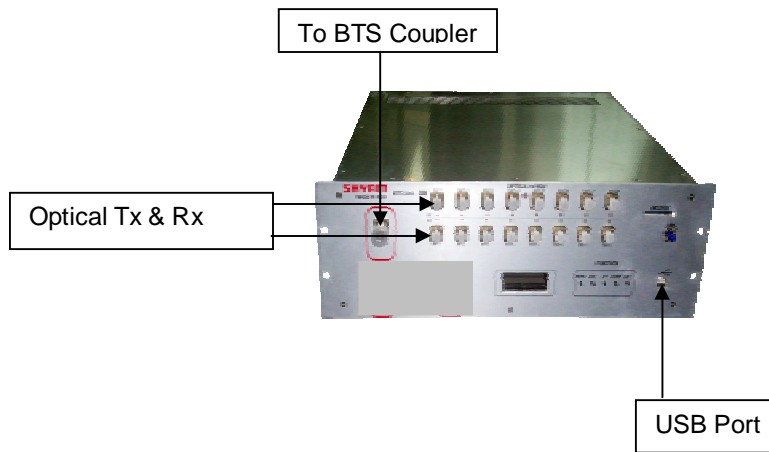
- The MOU should be installed at the spot where optical fiber ends are terminated and is a secured place where unauthorized access is avoided.
- The length of RF coaxial cable route from MOU to the BTS via directional coupler should also not be excessive & sharp bends are to be avoided to minimize losses.
- MOU is operated from –48 V DC, this supply either from battery or from a separate power pack operated through AC should be available.
- The site should be easily accessible by the maintenance staff.
- The environment should be free from excessive moisture, chemical fumes and ultra-violet radiations.
- The environment is not subjected to any Automobile Ignition noise, Generator noise etc.

### Installation Tools

- a. Standard wrenches/screwdrivers/cable stripper/cable cutter/pliers set for installing the system and antennas. (Refer to the manufacturer's recommendations for installing the antennas).
- b. RF cable connecting tool for fixing connectors.
- c. Multi-meter.
- d. Optical power Meter.

**Termination/Connections at MOU:** Connections as detailed below need to be carried out:

- Optical fibers for connectivity to SBROUs at different locations are required to be terminated on MOU. Two fibers are needed for each of the SBROUs.
- RF connection for transfer of signals from/to BTS.
- Power connection for extending –48 V DC to MOU.



**Figure 16: Termination at MOU**

**Important:**

- Continuity/short circuiting of RF coaxial wherever used should be checked before making connections.
- Continuity of each fiber to the respective ROU should be ensured.
- The system should not be switched ON till the installation is completed and settings in the system are made.
- No optical connector should be left open.

**Commissioning MOU:**

Preliminary verify the correct operation of MOU:

- Visual inspection of MOU cards before use, for any mechanical or component damage.
- Insert the cards in the designated slot only.
- Switch-ON the MOU sub rack.
- Measure the optical power at each of the optical ports in DL.
- Verify the LED status through CMC software.

**Important:**

- a. Continuity/short circuiting of RF wherever used should be checked before making connections.
- b. Continuity of each fiber to the respective SBROU should be ensured.
- c. The system should not be switched ON till the installation is completed and certain settings for the system is made.
- d. No optical connector should be left open.

### 8.3. Optical Fiber Laying

The connectivity between the MOU and SBROUs at different sites is through optical fibers. In case the fibers are not available, the laying of optical fiber cable has to be undertaken. Single mode fibers are used for which two fibers are required between the MOU and each of the SBROUs.

Depending on the situation, the type of optical fiber cable could be of **aerial** type or of **buried** type. In aerial type, the OFC is firmly fixed/clamped on the poles/pillars in the open atmosphere and such cables are normally armored to provide adequate protection/strength. The advantage of using such cable is that the installation job can be completed in less time. However, the cost of the cable is higher. Whereas the buried type, the OFC is placed in pipes which are laid underground.

A variety of cable designs are available to meet the requirements of different installations. Some of the designs are given below:

- **Loose tube construction:** The fiber lies loosely inside a surrounding plastic tube so that it can adjust itself when the cable is bent; micro bending is almost completely eliminated by this technique. Loose tube cables are preferred for long distance links and for almost all outdoor applications.
- **Tight buffer construction:** The buffered fiber is completely enclosed in a cushioning material (secondary coating up to an external diameter of 900 micro meters) to improve crush resistance and vibration isolation, minimizing micro bending. Tight buffer cables are usually adopted for outdoor applications because they offer small cross-section dimensions and small bending radius.

#### Termination of fibers on MOU and SBROU

Under the normal circumstances, two fibers are utilized for connecting MOU to a particular SBROU, one for the UL & other for the DL path. Every fiber must be labeled in order to indicate the connection particulars & route.

Sharp bends on the pigtails are to be avoided while making connections. The optical connectors must be cleaned thoroughly to avoid entry of dust and obstructions to the optical signals.

#### The guidelines for OFC laying are:

- The exact route may be decided before starting the laying work.
- Extra length of OFC may be kept for future use at each end.
- The OFC should be free from all optical connectors and should be sealed at both the ends at the time of laying.
- Sharp bends, extra pressure and pull should be avoided during laying to avoid damage to the fibers.
- Proper splicing should be carried out for minimum splice losses.



- All technical specifications from the OFC supplier should be followed.
- The termination of OFC at each end should be done at FDFs, which should be located close to the equipment.
- Connection between the OFC (terminated at FDF) and the equipment should be carried out through optical jumpers with FC-PC connectors.

#### 8.4. Installation-SBROU

**Outdoor Coverage:** Following points need to be considered

- Availability of AC mains in the range 140-270V 47/63 Hz for energizing the SBROU
- It is installed at outdoor site, so it should be in the secured area where unauthorized access is avoided.
- The site should be close to the fiber termination point.
- It is mounted either on pole or on the wall; enough space should be available for opening the unit door for testing & maintenance staff.
- Outdoor antenna with proper frequency band & gain is installed outside preferable at a height for distribution of signals to the mobile users.

**Termination/Connections at SBROU:** Connections as detailed below need to be carried out:

- Optical fibers for connectivity to MOU. Two fibers are needed for each of the SBROUs.
- RF connection for transfer of signals from/to antennas.
- Power connection to the AC mains.
- Grounding of the unit.

**Commissioning SBROU:**

- After making the desired connections, Switch "ON" The power supply.
- Check the LED status at ROU.
- Measure the Optical Output Power. It should be  $+4\pm 1$ dBm.
- If any Parameter is not within the specified limits, check the connections and observe for the alarm.

**8.5. Dos & Don't Dos**

1. The BTS-104/108 system is comprised of two independent units viz. Master Optical unit & Single Band Remote Optical Unit; the site selection should be made with great care for maximum efficiency.
2. The site(s) should be accessible for maintenance purposes.
3. Arrangement is to be made to avoid unauthorized access to the system.
4. Proper grounding of the outdoor units is required to be done to avoid damage to the system.
5. The housings for outdoor applications must be waterproof.
6. Stable power supply for all units should be ensured.
7. The route of Cables to/from antennas should be short to limit the cable losses and should be free from sharp bends & kinks.
8. Local standard of cabling should be followed.
9. Route of cable from antenna to the system should be secured to avoid damage and connections have to be made water tight to prevent the entry of water in the equipment.
10. There should be adequate separation between the antenna system and power lines.
11. The Master unit draws RF input from BTS; its level should not be excessively high for satisfactory performance.
12. The optical fiber termination should be carried out with care and no optical port left open when the system is ON.
13. Bending of optical fiber cable at acute angles must be avoided
14. The estimation of coverage area should be confirmed.
15. The system should be configured for normal traffic after actual measurement of:
  - a) RF power in the DL
  - b) RF power in the UL
16. Feedback regarding performance of the system must be obtained from the user.

## 8.6. Checklist-Post Installation

### Service Band: AWS

Frequency Band DL: 2110 MHz to 2155 MHz

Frequency Band UL: 1710 MHz to 1755 MHz

### A. Coupler Installation

S.NO.	Point(s) To Be Verified	Remarks
1.	30 dB coupler installed on BTS main antenna feeder	
2.	Type N connector closer to antenna terminated with 50 Ohms	
3.	Type N connector closer to BTS connected to donor cable	
4.	BTS operating normally with coupler installed	
5.	Coupler weatherproof	

### B. Master Unit Installation

S.NO.	Point(s) To Be Verified	Remarks
1.	Grounding of the unit	
2.	Cable from coupler terminated at donor (BTS) port	
3.	Termination of optical fibers for different ROUs & no optical fiber port is left open. Two fibers are provided for each ROU.	
4.	-48 V DC cable connected to the Master unit	
5.	RF Cable protection ensured and outdoor connections are waterproof	
6.	Precautions against excessive bending of optical cable.	
7.	Labels showing cautions displayed	

### C. Master Unit Setup

S.NO.	Point(s) To Be Verified	Remarks
1.	Master unit switched ON	
2.	Any error/alarm observed	
3.	RF signal strength in DL	
4.	Transmitting optical signal strength at relevant optical port for each ROU	
5.	Received optical signal strength at relevant optical port from each ROU	
6.	Loss for optical signals between MOU and each of the ROUs is within limits.	
7.	RF power set in UL.	
8.	Attenuation inserted in UL.	

### D. Remote Unit Installation

S.NO.	Point(s) to be verified	Remarks
1.	Ensure termination of optical fibers at optical Tx & RX ports.	
2.	Grounding of the unit	
3.	RF cable connected between RF port and server antenna.	

4.	Cable to server antenna connected to server antenna port	
5.	Mains cable connected to the Remote unit	
6.	RF Cable protection ensured and outdoor connections are waterproof	

**E. Remote Unit Setup**

S.NO.	Point(s) To Be Verified	Remarks
1.	Remote unit switched ON	
2.	Any error/alarm observed	
3.	Received optical signals at RX port	
4.	Attenuator inserted for desired RF power	
5.	RF power set	
6.	Optical signal strength at TX port	
7.	Remote unit secured.	

Any Other Remark/Comment:

Date Of Installation: ----- Repeater ID: -----

Site Address: -----

Name of the Installer: -----

## 9. System Maintenance

### 9.1. General

The system normally operates without any operator intervention or maintenance. If, in the unlikely event of a unit failure, the field replaceable units (antenna unit, cables) should be checked for faults and the system restored. The faulty unit can be removed and replaced with a spare while the rest of the system is still operating. Soldering or local repair of the modules should be avoided from better maintenance point of view. Faulty module/unit should be replaced with genuine spares from Shyam Telecom Limited only.

The power supply of the faulty unit should be isolated from AC mains and DC power before any module is replaced. In the event of a system malfunction, the status of the antenna systems should be checked as well as the continuity of the cabling before replacing any modules within the unit.

### 9.2. Preventative Maintenance

The **BTS Link-104/108** does not require any preventative maintenance. However, some of the common observations as tabulated below are possible:

Observation	Remark
No communication between MOU & ROUs	a) Check if the MOU is ON. If it is not ON, check the availability of –48 V DC for MOU. Make sure that –48 V is available. b) Check the alarms, if Laser diode/photo diode failure is indicated. Verify functioning of OTX unit by replacing with working unit. Also clean the optical connectors wherever provided. c) Check the optical power at each port connected to the SBROUs. If it is available at each of the ports, check the optical connectivity between MOU and SBROUs.
RF power high in DL at ROU	Check for the indication for alarm and insert an additional attenuator to reduce the RF power.
RF power low in DL at SBROU	Check for the indication for alarm and adjust the attenuator to enhance the RF power.
Power high UL at MOU	Reduce the level by inserting additional attenuator.
RSSI LOW/HIGH DL at MOU	Adjust the attenuator in order to get rid off the alarm. Also check the RF cable between the antenna and the MOU.
Photo-diode failure at MOU	It indicates a problem in the ORX unit. Check & verify the ORX unit, if required replace it.

**FCC Statement:**

FCC ID:S3CBTSLINK1048

This device complies with Part 2, 27 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

**IC Statement:**

Trade Name: SHYAM BTS Link-104/108 Repeater

Model No.: 104/108

IC: 5751A-BTSLINK1048

This device complies with RSS-131, RSS-102 of the IC Rules.

**Warning**

Changes of modifications not expressly approved by the manufacturer could void the user's authority to operate the equipments.

**Antenna Information:**

This device has been designed to operate with the antennas listed below, and having a maximum gain of 16dB. Antennas not included in this list or having a gain greater than 16dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Antenna (or equivalent) list:

- 1) Patch Panel Antenna ,16 dbi for outdoor installation
- 2) Yagi Antenna 12 dbi for outdoor installation
- 3) Patch Panel Antenna 9 dbi for indoor IBS installations
- 4) Omni Antenna 2 dbi for indoor IBS installations

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

**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 120 cm (indoor server antenna) and 260cm (outdoor server antenna), even if calculations that the MPE distance would be less.**

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

**For Americas**

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

**For Europe**

**Shyam Telecom GmbH.**  
Frohsinnstrasse 16, 63739 Aschaffenburg, Germany  
**Tel: + 49-6021-45901-0 Fax: + 49-6021-45901-29**

**For ASEAN & Others**

**Shyam Telecom Ltd.**  
246, Phase IV, UDYOG VIHAR,  
GURGAON – 122015 (INDIA)  
**Tel: +91-124-4311600 FAX: +91-124-4018117**

**Email: [contact@shyamtelecom.com](mailto:contact@shyamtelecom.com)**