BEAMER®

PCS FLEXBEAMER® RF Repeater System

Assembly & Operation Manual

Document No. 913002500

Rev. 0.0

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Celletra

Cellular Transmission Solutions

FCC Part 15A Compliance Statement

> **This device complies with part 15 of the FCC rule.**
>
> **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**

Caution

> **Changes or Modifications not expressly approved by Celletra Ltd.**
>
> **could void the user's authority to operate the equipment"**

NOTE

> **This equipment has been tested and found to comply with the limits**
> **for a Class A digital device, pursuant to part 15 of the FCC rules.**
> **These limits are designed to provide reasonable protection against**
> **harmful interference when the equipment is operated in a**
> **commercial environment. This equipment generates, uses, and can**
> **radiate Radio Frequency energy and, if not installed and used in**
> **accordance with the instructions manual, may cause harmful**
> **interference to radio communication. Operation of this equipment in**
> **a residential area is likely to cause harmful interference in which**
> **case the user will be required to correct the interference at his own**
> **expense.**

For Customer and Technical Support contact

WWW.CELLETRA.COM   or Email to   Support@CELLETRA.COM

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Revision	Description	Date
0	Release	May, 2002
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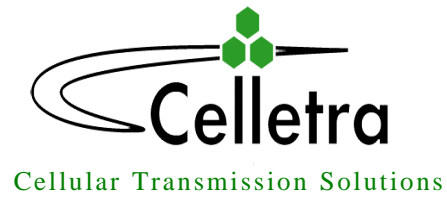
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Celletra Ltd. reserves the right to change specifications without notice.

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Applicable Documents

Celletra Internal documents

1. C&M channel description dated 06.08.2000.

2. Micro Active Rx Bias-T Spec. Doc. No. 953000500

3. Micro Active Tx Bias-T Spec Doc. No. 953000400

4. Micro Active Diversity Unit for PCS Tx band Spec Doc. No. 811001300

5. PCS 1x4x4 Array Specifications, Doc. No. 953003200

6. PCS RF Channel Selective repeater system specifications, Doc. No. 952004100

7. PCS Beamer Rev. 2

8. PCS Beamer Rev. 2M

9. IS97D, IS95B

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Acronyms and Abbreviations

ACPR	Adjacent Channel Power Ratio
BEAMER$^{®}$	Active Radiating Module
ATP	Acceptance Tests Procedure
BAU	BEAMER$^{®}$ Antenna Unit
BFN	Beam Forming Network
BSM	BEAMER$^{®}$ System Manager
BPF	Band Pass Filter
BTS	Base Transceiver Station
BW	Band Width
CDMA	Code Division Multiple Access
DCA	Digitally Controlled Attenuator
DL	Down Link
EMI	Electro Magnetic Interference
FSK	Frequency Shift Keying
RAC	Interface & Control Unit
IM	Inter Modulation
LED	Light Emitting Diode
LSB	Least Significant Bit
M&C	Monitoring and Control
MSB	Most Significant Bit
MTBF	Mean Time Between Failures
MS	Mobile Subscriber Unit
PCB	Printed Circuit Board
RACC	Remote antenna Converter Controller
RF	Radio Frequency
RFI	Radio Frequency Interference
RF RAC	Radio Frequency Remote Antenna Controller
Rx	Receiver
TBD	To Be Defined
TDMA	Time Division Multiple Access

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Tx	Transmitter
VSWR	Voltage Standing Wave Ratio
UL	Up Link

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1. PCS BEAMER® FLEXBEAMER® RF REPEATER SYSTEM DESCRIPTION

This document is a guide to the Installation, operation and maintenance of the PCS RF FLEXBEAMER® System. This first chapter brings a brief description of the RF Repeater System overview . PCS RF Channel Selective Repeater System consists of these Three parts:

- BAU (Beamer Antenna Unit) - the interface between the BTS (Base Transceiver Station) Via the Donor Antenna and the RAC .

- RAC (Remote Antenna Controller)- Up link and Down link amplifiers with programmable attenuators. Control card for C&M of the whole FLEXBEAMER® system.

- PCS FLEXBEAMER® (Coverage Enlightener BEAMER - The main amplifier unit includes two Beamers, dividers, combiners and a duplexer. This unit is connected to the sector antenna.
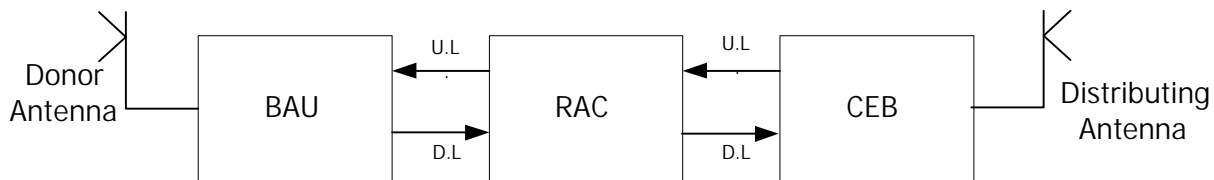
Figure 1: Repeater Simplified Block Diagram

1.1. BEAMER® Module Concept

The BEAMER® is an integrated active antenna for wireless communications. It incorporates a transmission amplifier, Remote Controlled Gain, transmission band filter and the respective receive chain: band filter, and Gain controlled LNA.

The Tx amplifier is linear. The Rx amplifier has an exceptional linear dynamic range. The integral unit contains its own power conditioner and a monitoring and control circuit that communicates with the RAC and from there on through the Wireless Modem to any remote PC (**The Wireless Modem feature is an option**) . The whole unit is sealed and built as a plug-in replaceable unit. The design and production techniques offer low price and high reliability.

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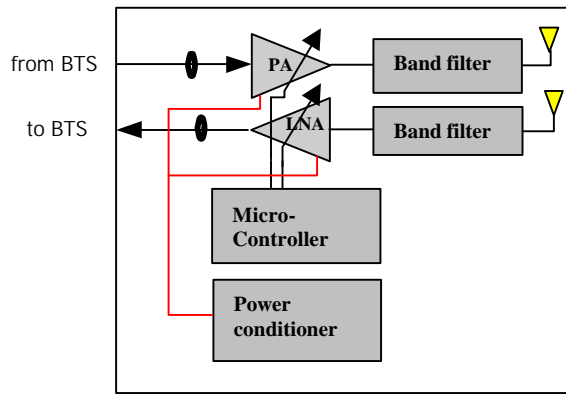
Figure 2: BEAMER$^{®}$ block diagram

The band pass filters (BPF) supply enough Tx/Rx channel isolation to ensure that the small amount of Tx signal power and Tx wide band noise power leaking into the sensitive receive channel will not degrade the Rx channel performance. In the FLEXBEAMER® System the BPF are replaced by a duplexer and the Beamer antenna by a separate sector antenna.

The Rx amplifier is a low noise amplifier with a high enough intercept point that several PCS channels received simultaneously should not degrade each other's performance. The low noise and high gain performance of this amplifier compensate for the high losses of the coaxial cable going down from the Rx BEAMER$^{®}$ front-end to the RAC and BAU and transmitted to the base station. The Tx Amplifier is a power amplifier that enables up to 10 Watts average at the Tx antenna port. while compensating for gain and power losses in the coaxial cable coming up from the BAU received from the base station.

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1.2. PCS RF FLEXBEAMER® Repeater System Overview

The PCS RF FLEXBEAMER® Repeater System is a transmit and receiving amplifiers repeater-System.

All system modules are hermetically sealed outdoors units to be mounted on tower top.

The PCS RF FLEXBEAMER® System contains the following units:

- BAU- Beamer Antenna Unit.
- RAC- remote Antenna Controller
- FLEXBEAMER®- PCS Enlightener Beamer.

BAU   RAC   FlexB

Figure 3: PCS FLEXBEAMER® RF Repeater units

1.3. FLEXBEAMER® Repeater Overview

The FLEXBEAMER® Repeater System is installed outdoors on remote site tower top, close to the Donor Side Antenna. The FLEXBEAMER® System contains the following units:

- BAU- Beamer Antenna Unit
- RAC- Remote Antenna Controller
- FLEXBEAMER®- Coverage Enlightener Beamer

1.3.1. BAU

Including:

- Duplexer
- Linear P.A (p/o Beamer$^®$)
- LNA. (p/o Beamer$^®$)

1.3.2. RAC

Including:

- RF band selective Filtration
- Rx ACBTs - Programmable gain UP LINK amplifiers, Bias-T
- Tx ACBTs - Programmable gain DOWN LINK amplifiers and Bias-T
- Control and Monitor (C&M) board for:
    - Local PC connection by RS-485 interface to supports software download and system configuration via a PC and Software (S/W) packages (such as the BSM S/W for local interface)
    - Remote interface options include Dial-up wireless modem (as an option).
- Internal 110-220AC power supply and power conditioning

The RAC is the RF interface between the FLEXBEAMER® unit and the BAU, provides the BEAMER$^®$ units in the BAU and the FLEXBEAMER® with the DC power, and control each individual BEAMER$^®$. It consists of a set of Bias T connections for multiplexing the RF, DC power and the C&M communication on the RF cables to the BEAMER$^®$ units in the BAU and FLEXBEAMER® units, a modem for communicating with each of the BEAMER   units, and a digital processor/controller.

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unit and dedicated computer, via the RAC. The BEAMER® modules are constantly monitored and controlled by the RAC unit.

Bi-directional communication with the BEAMER® is established through an FSK modulated communication channel multiplexed on the Rx coaxial cable connecting the individual BEAMER® to the RAC. The coaxial cable can be as long as 100 meters and have losses of up to 8db at 1850 to 1945MHz band.

The Uplink signal at 1850-1865 MHz runs on the same coaxial (Rx)cable with DC and the M&C from the FLEXBEAMER®, but an isolation between the DC, M&C, and Uplink signals is high due to Bias-T isolation.

The Down Link signal at 1930-1945 MHz runs on the same coaxial (Tx) cable together with the DC voltage, but isolation between the DC voltage and Tx signals is high due to Bias-T isolation.

1.3.3. FLEXBEAMER®

Including:

- Linear P.A and LNA (Beamer®)
- Duplexer
- Combiners and Dividers
- Active Diversity Units for Up link or Down link or both Diversities (Optional).
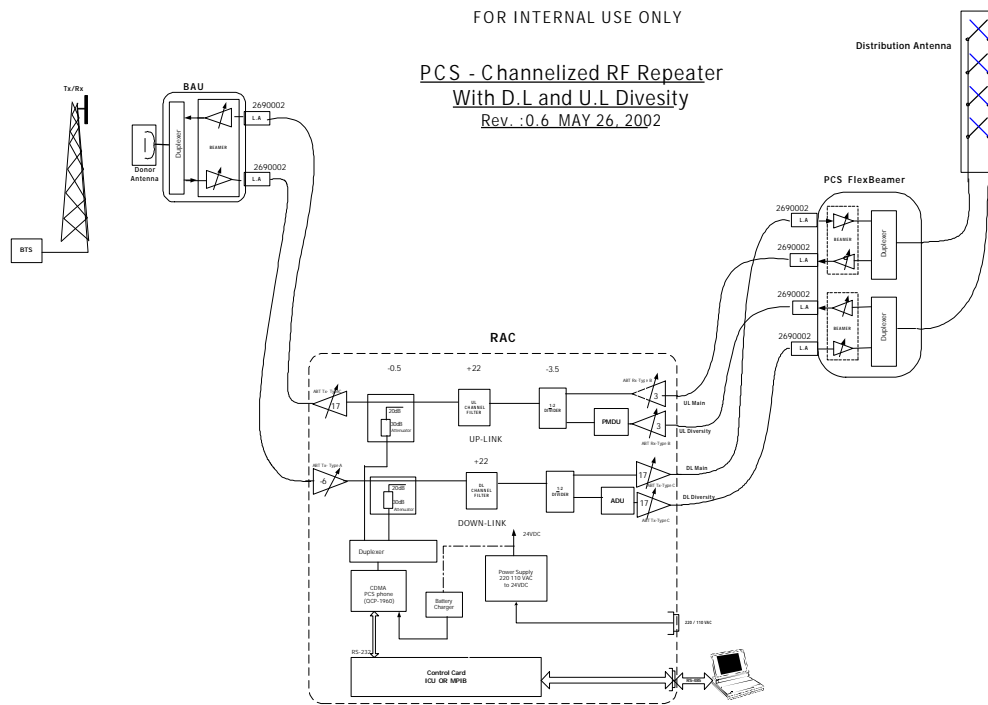
Figure 4: 2x4W RF FLEXBEAMER® Repeater Block Diagram

(*L.A.- Lightning Arresters are an option)

The RF channels of the FLEXBEAMER® Repeater are built of Separate Down and Up links built of Tx and Rx ABT and a BEAMER® module. The RAC is equipped with Four to Six Micro Rx ABTs and Micro Tx ABTs. Each of the Micro ABTs can be one of several types, which differ in the available gain from –4 db to +30db. In the above block diagram a full 95db Max. Gain on both channels Repeater is presented.

The Bias-Ts serve Three purposes:

1. Supply DC voltage to the BEAMER® modules within the FLEXBEAMER® and the BAU.

2. Provide Gain controlled RF amplification stage for setting up the levels and compensate for the cables losses possible RF losses and to maintain the necessary level of the transmitted or received output power per sub-array.

3. Connect the BEAMER® modules Telemetry to the RAC controller via the superimposed FSK link.

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The gain of the Bias-Ts is defined according to the system design.

The Active Bias-T comprised of a boost amplifier and a digital controlled attenuator in order to adjust the gain and enable a convenient interface to the Control features. The gain of the ABT assemblies is Temperature Compensated.

The Rx ABTs are transparent to the FSK communication channel which enables the M&C communication with the BEAMER$^®$ units in the FLEXBEAMER® and the BAU.

In this manual, Bias-Ts are also termed 'sub-array', since each Bias-T can serves an independent portion of an array (i.e., Tx sub-array or Rx1 and Rx2 sub-arrays, which are all physically part of the same array, but are logically independent entities).

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1.4. BEAMER® RF Repeater Modular Concept

The BEAMER® RF REPEATER product family is built in a modular way, enabling Celletra to optimize the RF repeater performance /price to the specific needs of each customer and application. This document specifies a unique PCS RF REPEATER BEAMER® system with the following properties:

- Single , Vertically Polarized high gain Donor Antenna
- High power Donor Uplink Amplifier for far remote RF Repeater applications.
- Up to 95db gain on each link with 60 db remotely controlled Gain Control
- Single CDMA Channelizing narrow band filter on both the Up and Down links
- RF Band Selective Filters on both the Donor Side and Distribution side.
- Active Beamer BAU module on the Donor Side with :
  - o +23dbm Average Composite Up Link Power
  - o 30dB gain.
  - o >+17 dBi Donor Antenna.
  - o +46dbm EIRP (Effective isotropic Radiated Power)
- Active Beamer® FLEXBEAMER® on the Distribution Side with :
  - o 2x+35dBm Output power at the antenna port for one channel.
  - o 40dB gain
  - o CDMA ACPR as per IS-95.
  - o Lightning Arrester on Coaxial Cables.(option)
- +24VDC to supply the whole system or 110/220V AC to +24VDC Power Supply (Optional).
- Wireless CDMA dialup Modem for remote M&C Capabilities.

1.5. Telemetry and M&C of the Repeater System

1.5.1. Network Architecture and Capacity

The RAC is the master in a star configured network .The Telemetry network enables data transmission along the following data transmission paths:

1. RAC to each BEAMER$^{®}$ unit of any 2 BEAMER$^{®}$ FLEXBEAMER® and BAU BEAMER$^{®}$.

2. RAC to PC Locally Connected (or via Wireless Modem as an option)

3. BEAMER$^{®}$ to RAC

The maximum capacity of the network is 16 BEAMER$^{®}$ modules in a FLEXBEAMER® and BAU. The actual communication with the RAC and BEAMER$^{®}$ FLEXBEAMER® or BAU is done by the BSM SW Package running on local or remote PC.

1.5.2. Communication Procedure

The communication mode between the RAC, the BEAMER$^{®}$, and the PC is half-duplex. The communication procedure is described in the following figure:
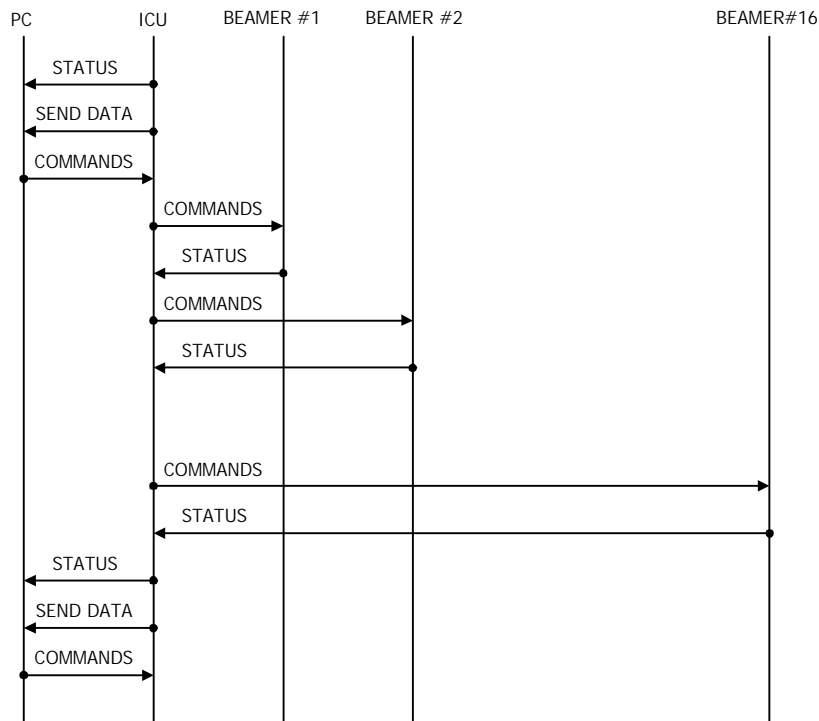
Figure 5: Telemetry Communication procedure

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1.5.3. BEAMER® Monitoring and Control

Monitoring and control (M&C) of the whole RF Repeater is performed from the RAC by the internal Control Card. The Control card of the RAC has several internal communication channels and some external channels.

Internal Communication Channels:
- FSK modulated signal to control the Beamer FLEXBEAMER® or BAU Beamer units.
- Parallel TTL Level lines to control the ABTs of the RAC.

External Communication Channels:
- RS485 through an external connector to BSM operated Local PC
- RS232 through the Wireless Modem to the CDMA network and remote BSM operated PC.

The M&C system will monitor and control the following functions, when the Failure definitions are fully programmable via MMI and NMS.:
- C&M functions for the BEAMER® module in FLEXBEAMER® or BAU via FSK channel includes continuous detection of each BEAMER module status and Query of selected BEAMER® module selected parameters . These include:

  - ➢ For the P.A half of the BEAMER® module:

    - Input power measurement -
    - Output Power measurement
    - Temperature measurement
    - Tx current consumption
    - Tx return power alarm
    - Input voltage
    - Tx gain control
    - Tx Phase control
    - Automatic shut down

  - ➢ For the LNA half of the BEAMER® module:

    - Rx current consumption
    - Rx gain control.

- Rx Phase control

- CTRLR status

- Manual control of selected BEAMER$^{®}$ PA ON/OFF state and DCA
  Attenuation values.

- Control ABTs Gain states

- Monitor ABTs amplifiers well being by monitoring the ABTs currents.

- Checks the +24V internal Supply.

- Software upgrade Download into a selected BEAMER$^{®}$ module and the
  Control Card Remotely

- Faults indication Register which saves the Fault Indications History to be read
  remotely when required.

1.6. Power Distribution

The Repeater System is powered by connecting the AC power supply line to the AC connections in the panel of the RAC. DC voltage is supplied via the Tx and Rx coaxial cable coming up from the RAC to the FLEXBEAMER® and BAU for system operation.

Power Source	110/220VAC or +24VDC up to 400Watt
ACBT Max. Current Consumption	Up to 200mA @ +24VDC with no FLEXBEAMER® or BAU connected (DC)
Max. Current per BEAMER$^{®}$ Ver.3.2 (in FLEXBEAMER®)	Up to 3Amp. @ +24VDC
Max. Current per BEAMER$^{®}$ Ver.3.2 M (in BAU)	Up to 1Amp. @ +24VDC

RAC Connectors

Tx Connector to FLEXBEAMER® unit	N-type connector, female
Tx/Rx Connection to BAU	N-type connector, female
Rx Connector to FLEXBEAMER® unit	N-type connector, female
RS-485 connector	Amphenol 7 pins female sealed connector
AC/DC Connector	Amphenol 7 pins male sealed connector
Grounding Connection	By physically Wiring the RAC to pole grounding

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2. RF REPEATER SYSTEM INSTALLATION GUIDE

2.1. Scope

This chapter describes the installation of the PCS FLEXBEAMER® RF Repeater System and its integration into the PCS Network by properly setting up the Repeater parameters .

The FLEXBEAMER® RF Repeater System is basically a modular tower top Repeater with the FLEXBEAMER® Sector Active unit at the Distribution side of the Repeater and the BAU and RAC, being assembled near the Donor Antenna , includes the Donor Side LNA , Donor Side Power amplifier and all the Telemetry , Monitoring and Control (Including the Wireless Modem as an option). The FLEXBEAMER® RF Repeater is equipped with programming and modularity features that are uncommon with other, comparable systems.

The chapter details the instructions for field installation of the FLEXBEAMER® RF Repeater system. It is intended to be used by customer technical personnel, who are trained to install and service the FLEXBEAMER® RF Repeater system.

2.2. Important Safety Precautions

The system is supplied following extensive acceptance production line tests. Usually, lab tests will not be required before installing the unit at the customer's location. One should always be aware of the necessary safety precautions, assuring that the FLEXBEAMER® Repeater system will be fully functional after the installation.

Read this instruction guide thoroughly before starting with the installation. In case of doubt, do not hesitate to call Celletra Customer Support engineering. Celletra Customer Support contact points are given at :

WWW.CELLETRA.COM   or Email to   Support@CELLETRA.COM

2.2.1. Handling and Moving the FLEXBEAMER® System Units

The FLEXBEAMER®, BAU and the RAC are delicate and accurate electrical apparatus.

- Use extreme caution when handling the units. Always use the original box, with proper padding, when delivering or moving the FLEXBEAMER® system units.

- The FLEXBEAMER® overall unit weight is ~12kg. If necessary, each unit should be carefully carried by one person. When there is a need to hang a unit to bring it up the tower, use the hangers for that purpose. (Shown in the mechanical drawings).

- The RAC module overall weight is 12 Kg. The RAC can be carried by one person . For lifting it up the RAC up tower, use the clamps mechanical base units.

- The RAC Module is Hermetically sealed in controlled environment. Do not open any of the covers or disassemble the BEAMER$^{®}$ units attached to it. This should be done only in a controlled environment by Celletra authorized Personnel.

- The FLEXBEAMER® module overall weight is 8 Kg FLEXBEAMER® hardware is hermetically sealed in controlled environment. Do not open or try to disassemble a BEAMER$^{®}$ module. This should be done only by Celletra authorized personnel. BEAMER$^{®}$ modules can be replaced by authorized personnel only following the instruction herein.

- Use extra caution when installing the unit on tower top. Use proper winch or pulley to lift the unit up the tower. Watch carefully for possible obstacles when lifting the units. Pad the units, if needed, to avoid possible damage during lift-up.

- Always shut down the AC or DC supply to the RAC before replacing or removing the FLEXBEAMER® or BAU from the tower.

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2.2.2. System Measurement and Testing Conditions

- Live +24VDC with high current capability exists on the FLEXBEAMER® and BAU Coaxial connections of the RAC. (These are the Tx ABT output and the Rx ABT input N-type connectors at the RAC). Disconnect the AC or DC power to the RAC before any cable is disconnected from the RAC, FLEXBEAMER® or BAU.

- Always use a DC block device connected to the measuring equipment input or output ports (spectrum analyzer, power meter, or RF signal source), when measuring RAC performance.

- *Do not apply more than +10dBm of RF input power to any RF port of the FLEXBEAMER® Repeater system, or irreversible damage may occur.*

- When measuring high power outputs, always verify that the equipment input port is capable for handling the expected output power.

- *When testing the units in lab or during field installation, always practice RF radiation safety rules. It is not recommended for service or lab personnel to work closer then 2 meters away from the FLEXBEAMER® Antenna surface when operated at full RF power.*

- During lab tests, with AC voltage applied to the RAC, do not use any PCS mobile transmitter in a range of less than 10 meters from the FLEXBEAMER® unit. An unexpectedly high RF power might appear at the output ports, which might in turn damage the measuring equipment connected to that port.

2.3. BAU RAC and FLEXBEAMER® Installation Instructions

2.3.1. **Sector Antenna Mounting**

The Sector Antenna should be mounted on the top of the tower in order to achive best coverage. The Customer should refer to existing Network Planning Tools or Celletra Technical Support.

2.3.2. **Donor Antenna Mounting**

1. The mounting of the Donor antenna is pending the application and the location specific parameters. The following guide lines for the Donor antenna mounting are recommendations and the Customer should refer to existing Network Planning Tools or Celletra Technical Support.:

- The Donor Antenna and the distribution antenna have Isolation in between them of at least 10 db higher then the overall Repeater Gain. Since Gain is 35 to 95db , the isolation should be 45 to 105 db. The Isolation is achieved by mounting the two Antennas and the FLEXBEAMER® on opposite walls of a building or by mounting both on the same tower but up to 10 meters vertically separation (Isolation dependent).

- For Maximum Repeater Coverage the Distribution FLEXBEAMER® antenna will be mounted on Tower top while the Donor antenna will be mounted up to 10 meters below the FLEXBEAMER® antenna.

2. The Donor antenna is a high Gain, high directivity, low side lobes Antenna and can be one of several types and different vendors. Mount the Donor antenna following strictly the manufacturer instructions.

3. Trim the Donor antenna Azimuth towards the Donor Base Station ,as per the process of paragraph 3.2.1. Tighten and secure all screws per the Antenna Vendor instructions.

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2.4.   FLEXBEAMER® Installation Instructions

2.4.1.   General Array Installation Instructions

We recommend using a 3"-4.5" diameter pole for the FLEXBEAMER® System installation. The figures later in this section illustrate the installed FLEXBEAMER® units, showing the Tx and Rx cables connections.

The RF coaxial cables connecting the BAU FLEXBEAMER® and the RAC can be of any 3/8" or ½" diameter low loss type. These cables carry DC Current and RF signals from the RAC to the BAU and FLEXBEAMER®. Since the FLEXBEAMER® include the Power amplifier and the LNA, the losses on these cables can be high without affecting the overall performance. Thus , these cables can be as long as 100 meters .

Sealing and weatherproofing of RF connector is of prime importance to assure good electrical contact for many years, minimizing DC loss and passive RF inter-modulation effects. Thus, special care should be taken with the RF connectors sealing and weatherproofing especially at the FLEXBEAMER® input connectors that are exposed to extreme environmental conditions. Common sealing practice should be used.

For sealing instructions, refer, for example, to Andrews weatherproofing recommendations with 3M^{TM} Cold Shrink^{TM} Weatherproofing Kit, or an equivalent sealing method.

Before installing the FLEXBEAMER® unit, note that each FLEXBEAMER® and BAU has a Tag attached to it. After installation remove the tag keep it and log this info in the system manual book. This tag carries the BEAMER$^{®}$ modules address.(This address is the serial number of each BEAMER$^{®}$ unit as appears on the module label nearby the Rx connector).You will need these IDs later, for system configuration setup.

2.4.2.   Unpacking

Unpack the units and verify that there are no mechanical damages to any of the parts of the FLEXBEAMER® units.

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2.4.3. Installing the FLEXBEAMER® Unit on the Pole :

1. Position the FLEXBEAMER® unit on the pole so that it is aligned to the desired direction according to network management instructions. Tighten the 4 nuts use flat and spring washers (3/8"-16 UNC) using a 9/16" wrench.
2. Connect the Sector Antenna cables coming from the top tower antenna.
3. Install the Lightning protectors if needed and Connect the Tx and Rx cables going down to the RAC unit.

Caution - Do not over tighten the nuts, use a 5"-8" length wrench applying 234-259 LbxIn" max moment
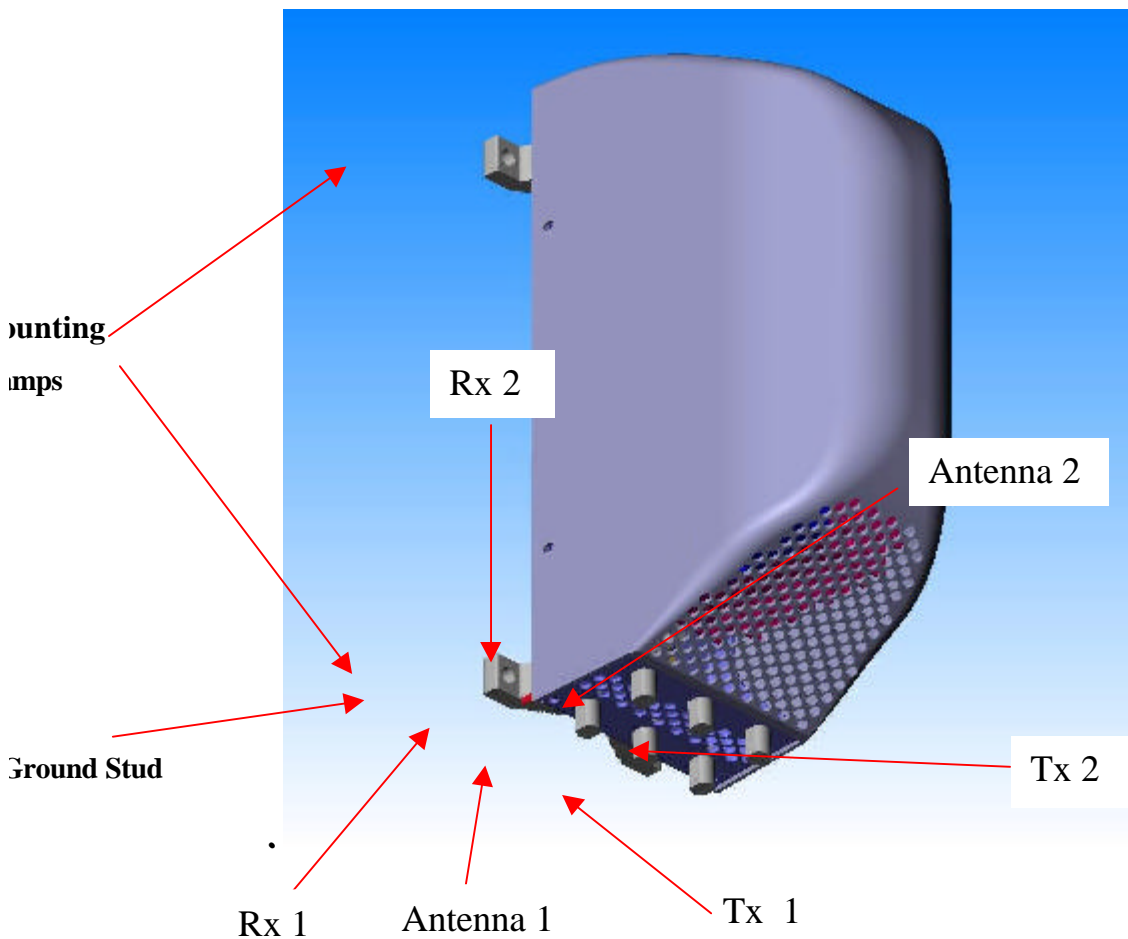
Figure 6: **FLEXBEAMER® Installation**

2.4.4. BAU Mounting

1. The BAU should be mounted near the Donor antenna on the mast. The cable connecting between the BAU and the Donor antenna is preset to 2.5 meters max. in order to achieve an overall lowest Noise Figure possible on the Down link .

2. Install the BAU unit on the Pole verify that the distance between the BAU and the RAC will be greater then 10 meters in order to provide good isolation between input and output of the repeater.

3. Mount the BAU assembly on the pole and secure the two rear clamps with 4 threaded screws and 4 nuts(3/8"-16 UNC), flat and spring washers . Tighten

4. Connect the grounding cable connected to the BAU stud (1/4" dia. located at the bottom of the BAU) to the Tower ground stud. Tighten the grounding bolt properly

Caution Do not over tighten the nuts, use a 5"-8" length wrench applying 234-259LbxIn" max moment.

Mounting

Clamps

und Stud

Rx

Tx

Antenna
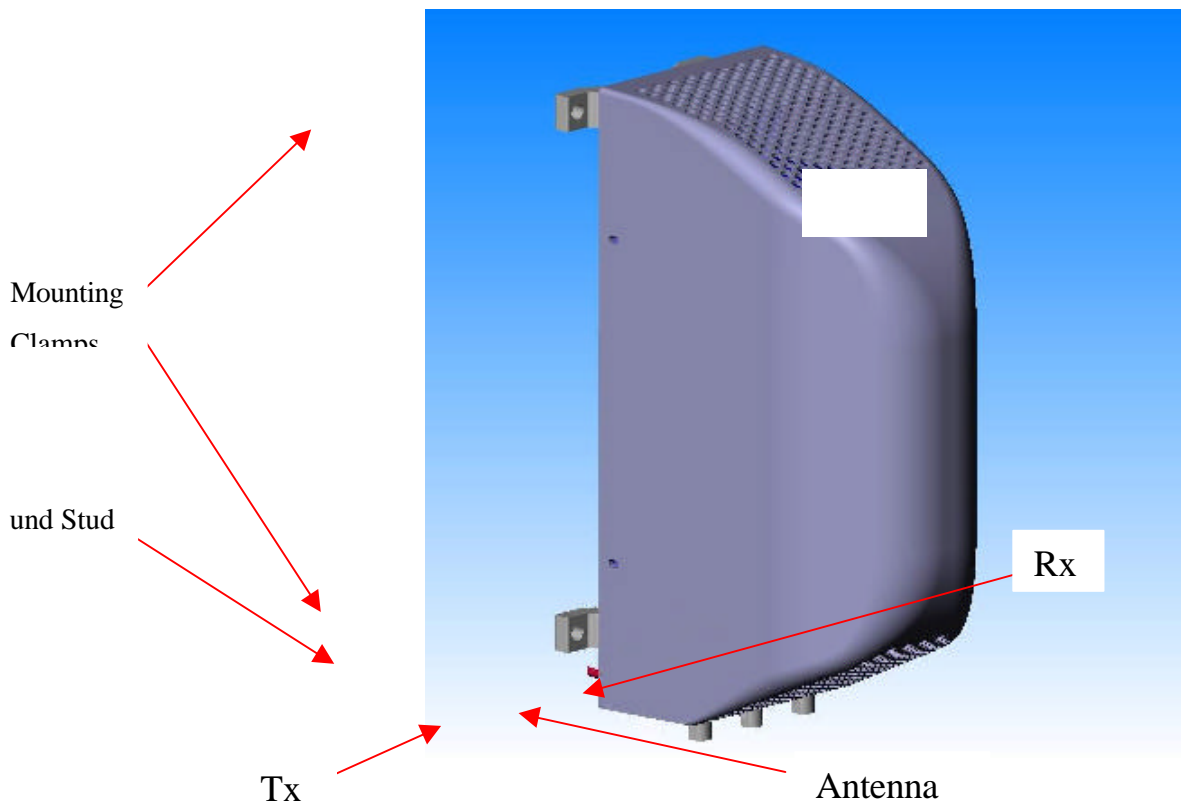
Figure 7: BAU Installation

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2.4.5. Installing the RAC on the Pole

1. Mount the RAC assembly on the pole and secure the two rear clamps with 4 threaded screws use 4 nuts(3/8"-16 UNC) flat and spring washers . Tighten the nuts

Caution Do not over tighten the nuts, use a 5"-8" length wrench applying 234-259LbxIn" max moment.

2. Connect the Rx and Tx cables coming from the FLEXBEAMER® unit to the proper connectors at the bottom of the RAC.

3. Connect the Rx and Tx cables going down to the BAU to the proper connectors on the bottom of the RAC.

4. Seal the connectors , after tightening them manually, with proper sealing accessories as explained above.

5. Connect the grounding cable connected to the RAC stud (1/4" dia. located at the bottom of the RAC) to the Tower ground stud. Tighten the grounding bolt properly.
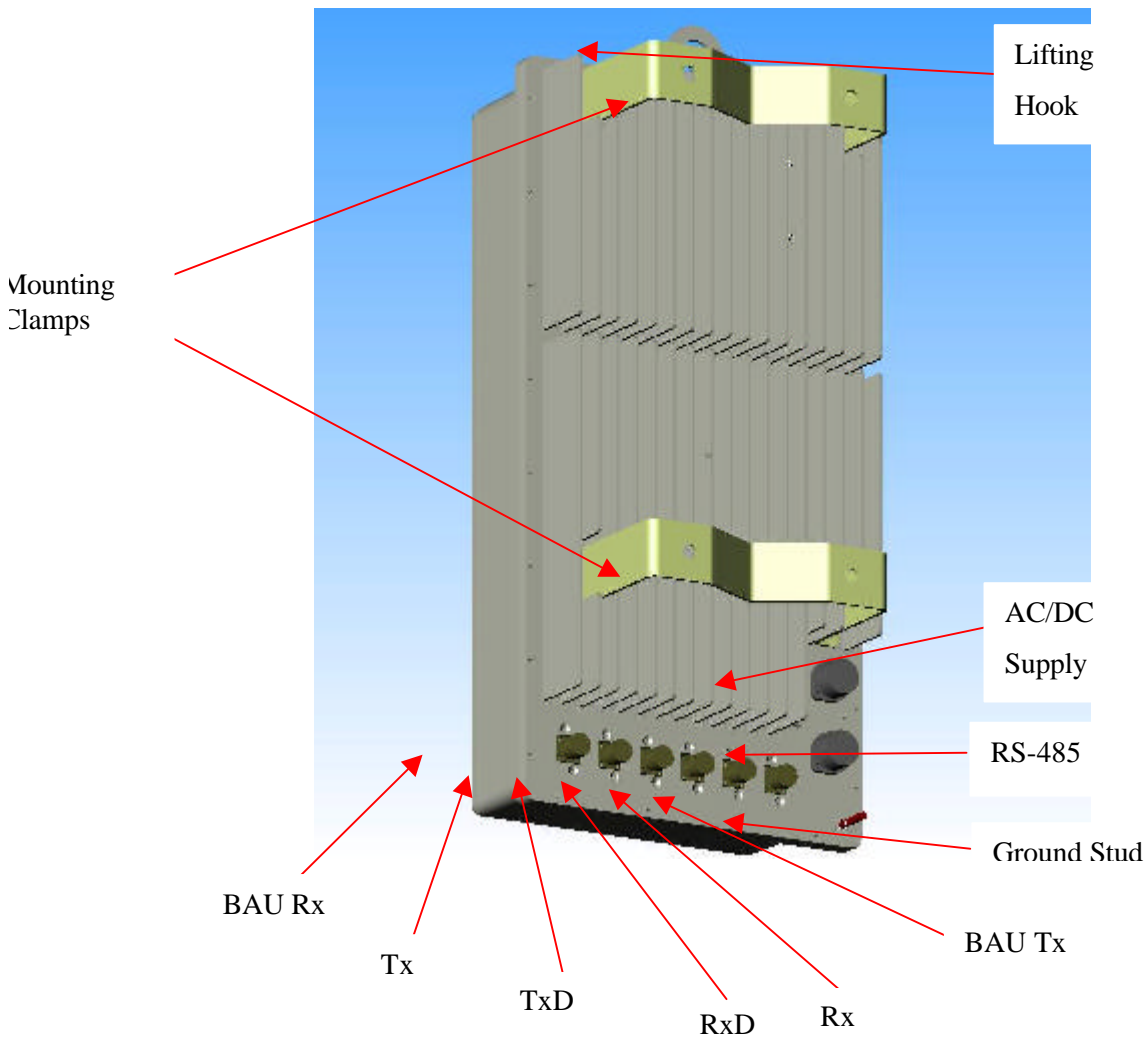
Figure 8: RAC Installation

2.4.6.   Dismounting the FLEXBEAMER® System units

1.   Use the Mounting procedure in reverse order to dismount the FLEXBEAMER® units.

2.   Care should be taken to tie the units by the lifting hooks **Before** un-tightening the mounting screws.

3. Verify that the dismounted unit is being saved in the original box.

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3. FLEXBEAMER® RF REPEATER SYSTEM SET-UP AND TUNING

3.1. FLEXBEAMER® RF Repeater System Set Up

The following set of procedures will guide you through the proper and full system set-up. Please follow these steps in the order given herein.

3.1.1. AC Wiring

➢ The RAC should be connected to 24VDC power supply or to 115/220 VAC(as an option). A cable with a minimum of 16 AWG inner wires gage should be used.

➢ The AC or DC power will be connected to the 7 pin Amphenol sealed connector on the RAC bottom panel.

➢ Please use an UL cable to connect the RAC to AC outlet.

➢ The RAC included resettable Fuses located inside the box. In order to reset the fuses it is needed to turn **OFF** and back **ON** the mains power.

Remember to disconnect the RF drive (or to turn the RF drive OFF) before turning the AC power ON.

3.1.2. Local or Remote PC Connection

Connect the PC either by Local connection or Remote via Wireless Modem (IF option exist), following the steps as noted herein:

3.1.2.1. Operation system in Local PC Mode

In order to operate the BSM S/W , the PC should be equipped with windows 95/98 or Windows 2000 with service pack 1.

3.1.2.2. Serial Communication Connector

Local communication with RAC is obtained through the RS-485 connector located on the RAC panel. This is a 7-pin female Amphenol sealed connector.

Table 1: RS485 communication connector

Pin #	RS485
1	Rx+
2	Tx+
3	NC
4	NC
5	Tx-
6	Rx-
7	GND

3.1.2.3. Communication Mode

The communication mode at the RAC controller board is enabled for RS-232 via wireless modem or RS-485 via a local PC.

The connection from PC is via a RS-232/RS-485 adapter like ADAM-4520 by Advantech.

3.1.3. System Configuration and Logical Setting

Some of the RAC setup items are already configured for the needed system configuration. This setup is saved on the RAC's Flash memory. Use the BSM(Beamer System Manager) in order to confirm and change the configuration when required.

The following sections will guide you through the process of RAC setup verification. You can modify the setup to match your configuration at any time.

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Before setting up the system, **avoid connecting RF cables between the RAC BAU and the FLEXBEAMER®**. Since the Tx and Rx gain are not calibrated yet, this is done to protect the BAU and FLEXBEAMER® from overdrive conditions.

The following table can be used as a reference for the RAC and FLEXBEAMER® setting. The table specifies the pre-set default values.

Note: Many values are not pre-set. The following sections will instruct you how to set these values, tailored to the specific on-site installation.

Caution: some values (such as RS-232/RS-485 switch ,Time out and codes are factory set and should not be changed on site. In particular, these values relate to the FLEXBEAMER® calibration and operation modes. Modification of these values, without coordination and specific authorization from Celletra engineering, can cause invalid FLEXBEAMER® performance and should be avoided. The changes are possible by the highest password authorization only.

Parameter	Required for RAC
Operation Mode	Auto (manufacturer pre defined).
Control Mode	Main, Local
RAC configuration (jumper positions) (manufacturer pre defined).	1. Operation "ON" 2. I/O not installed "OFF" 3. MODEM installed(option depend) "ON" 4. RS-232/RS485 enabled "ON"
System Features	# of arrays – 03 Main-1 Diversity-2 BAU-3 arrays type BEAMER® Tx/Rx PCS3.2 The BAU is PCS3.2M
Time out	Do not change. Cannot be accessed in operation mode.
Real time clock	Set to location time zone
BEAMER® failure conditions	See Table No. 5
Shut-down conditions	All ON.

Table 2: RAC - BEAMER® default values and quick reference

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arrays).

Use this command to set the number of installed arrays to 3

Sub Array No. 2,5 for Main

Sub Arrays No. 3,4 for Diversity

Sub Arrays No. 1,6 for BAU

Note: Issuing the 'save system features' command will erase the previous BEAMER$^®$ configuration. Previous definitions of arrays and Bias-T assignments must be reprogrammed, following this command.

3.1.3.3. Bias-T Definitions and type

Once the arrays are configured, a Bias-T must be assigned for each array. The "Settings/Array setting/Sub array setting" is used for assigning the Bias-T for the arrays. For example, Array without Rx diversity will need Rx and Tx Sub arrays.

3.1.4. Setting the Bias-T Attenuation

Bias-T attenuation, for either Rx or Tx Bias-T, can be modified by entering to the desired Array from the main screen and entering to one of the sub arrays and by hitting pause and changing attenuation value and apply.

3.1.5. Coaxial Cables Connection

➢ Connect the Four coaxial cables connecting the RAC and the FLEXBEAMER®. Use cables with N-Type connected for that purpose.

➢ Be aware to connect the Tx marked connector on the RAC to the Tx Marked connector on the FLEXBEAMER®. The same is true for the Rx marked cables.

➢ Be aware the FLEXBEAMER® and the RAC might have already other connectors on the same panel marked "Diversity Tx" or "Diversity Rx".

3.1.6. FLEXBEAMER® Configuration

3.1.6.1. FLEXBEAMER® Module Registration

The Beamer registration is done by entering to "settings/Array setting/beamer setting and let the S/W scan all beamer addresses and find the existing Beamers in the system.

After the S/W will find the Beamers hit apply and than go to array address and register the Beamer in the array by marking an X in Beamer location column.

3.1.6.2. Configuring the Array

After registration the FLEXBEAMER® and BAU in the system you will have a complete array configuration.

3.1.6.3. BAU configuration

The BAU configuration will be similar to the FLEXBEAMER® configuration.

3.1.7. Setting Limits, Failures and Shut-Down Conditions

3.1.7.1. Setting the BEAMER® Limits

Setting the Beamer limits will be done under "Setting/CTRL setting/Beamer limits.

In the following table you will find the recommended numbers.

Note that the limits setting corresponds to the " Failure Alarms"

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Table 3: BEAMER® limits recommended settings

Description	Meaning
Temperature min	-20°C
Temperature max	+75°C
Input power min	-18dBm
Input power max	-4dBm
Output power min	20dBm
Output power max	37dBm
Tx attenuator min	0dB
Tx attenuator max	15.5dB
Main Rx attenuator min	0dB
Main Rx attenuator max	15.5dB
Div Rx attenuator min	0dB
Div Rx attenuator max	15.5dB
BEAMER® supply voltage min	18VDC
BEAMER® supply voltage max	28VDC

3.1.7.2. Setting RAC Limits

Similar to the limits for the BEAMER® you can put limits for the RAC (ICU Limits) the recommended limits are in the following table.

These limits can be changed to the customer preference (up to a given, reasonable range). The following table sets the recommended limits for the RAC and the Bias-T.

Table 4: RAC limits setting

Description	Meaning
RAC supply voltage min	18VDC
RAC supply voltage max	28VDC
Fan current min	0mA
Fan current max	180mA
Bias T supply voltage min	18VDC
Bias T supply voltage max	28VDC
Tx bias T current min	0mA
Tx bias T current max	500mA

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Description	Meaning
Rx bias T current min	0mA
Rx bias T current max	500mA

3.1.7.3. Setting the BEAMER® Shut-Down Conditions

It is recommended to operate all Shut down conditions.

3.1.7.4. Defining System Failure Conditions

Command 'save alarm conditions' (code 26) defines the conditions for failures. These conditions can be set to the customer's preferences. The following table describes the command conditions and the suggested failure conditions.

Table 5: Failure conditions

Failure Description	Recommended Value
Temperature out of range	minor
Input power	minor
Output power out of range	minor
Tx attenuator	no condition
Main Rx attenuator	no condition
Div Rx attenuator	no condition
BEAMER® supply voltage	minor
Tx current	major
Main Rx current	minor
Div Rx current	minor
Return power	minor
Power amplifier	major
Linearizer	N/A for this model
Bias T voltage	major
RAC voltage	major
Rx bias T current	minor
Tx bias T current	major
BEAMER® CTRLR	minor
RAC CTRLR	minor

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Failure Description	Recommended Value
Fan current	no condition

3.1.8. Changing the Real Time Clock

The real time clock correct timing is important for log files time stamp. To change the RTC timing: enter from the main screen to ICU, mark with your mouse the wrong date or hour, delete it and hit apply twice.

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3.1.9. FLEXBEAMER® System Sector Installation Record

After setting the FLEXBEAMER® RF Repeater system, it is recommended to write down the site information for remote control records.

Repeater #..

RAC address.................................... RAC ID number   (from unit label)

FLEXBEAMER® (Array) Number .... BAU (Array) Number………………..

3.1.9.1. Installed BEAMER® Modules

Unit#1 ID(from unit label).................. system address   …………

Unit#2 ID (from unit label)................. system address   …………

Unit#3 ID (from unit label)................. system address   ………….

RAC BEAMER® Unit # (from label)_….. ,   System Address ……………..

3.1.9.2. Estimated RF Cable Loss

Tx RAC to FLEXBEAMER® (main). dB

Tx RAC to FLEXBEAMER® (diversity)   dB

Rx FLEXBEAMER® to RAC (main). dB

Rx FLEXBEAMER® to RAC (diversity)   dB

Tx BAU to RAC .... dB

Rx FLEXBEAMER® to BAU .... dB

Donor Ant. to BAU .... dB

FLEXBEAMER® Main to Ant. .... dB

FLEXBEAMER® Div. to Ant............ dB

3.1.9.3. Down Link Channel parameters

Ec power level at Donor Antenna........ dBm …………

RAC Down Link gain........................ dB…………..

BAU Down Link gain........................ dB …………..

FLEXBEAMER® BEAMER® measured output power:

> Beamer 1 .... dBm
>
> Beamer 2.. dBm
>
> Average .... dBm

3.1.9.4. Up Link Channel Parameters

Up Link LNA gain setting for the FLEXBEAMER®…………..dB

Up Link LNA gain setting for the FLEXBEAMER®…………..dB

Up link RAC Gain Setting: (main)………………dB

Up link RAC Gain Setting: (diversity)..…………dB

Up link BAU Gain Setting:.…………………………dB

3.2. RF Repeater Tuning Procedure

This paragraph summarizes the Procedures for tuning of the Celletra FLEXBEAMER® Repeaters for optimum operation within the PCS network of which the repeater is part of.

The following Figure shows the system block diagram which defines the terminology used hereinafter.
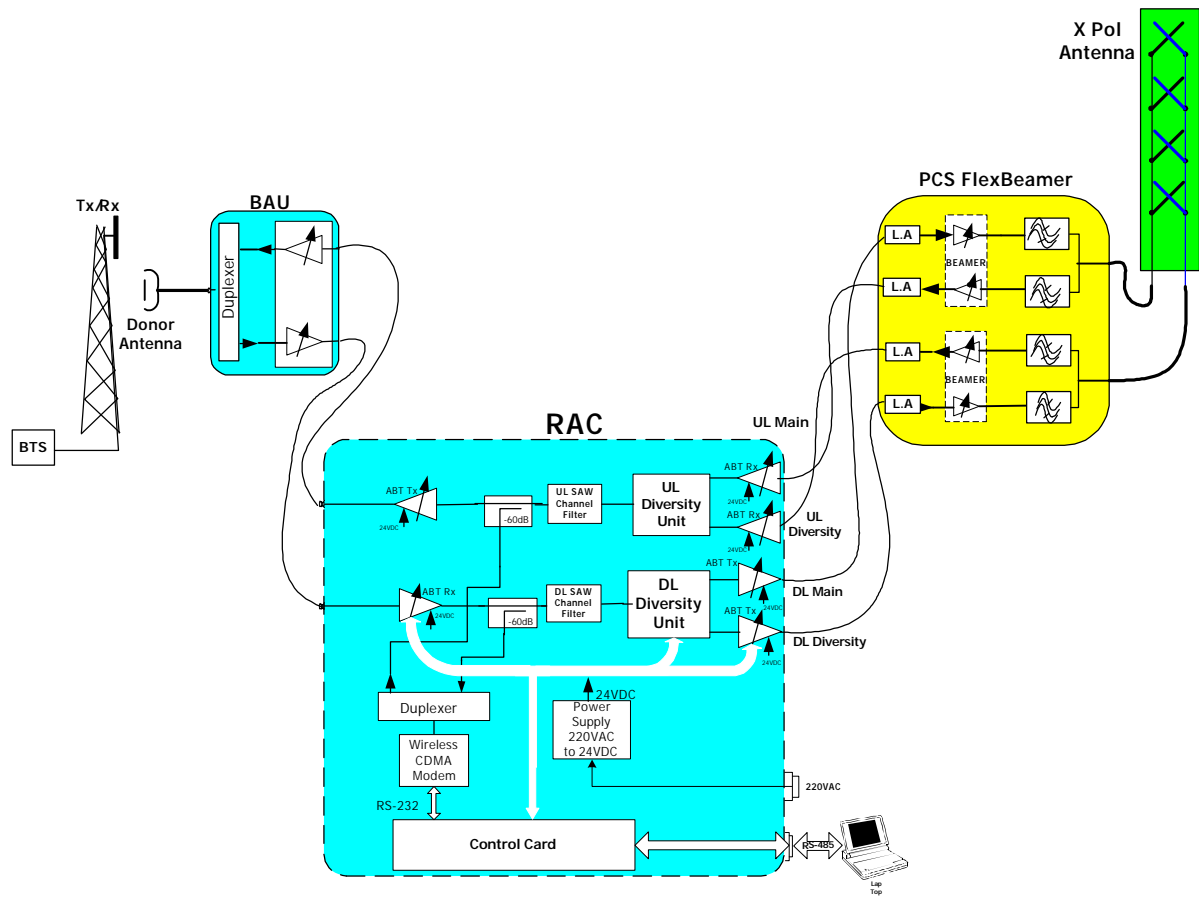

Figure 9: PCS RF Repeater Block Diagram

3.2.1. Donor Antenna Setting

1. Install the Repeater Donor Antenna and direct it optimally towards the Donor Sector.
2. Connect a Pilot Scanner to the Donor Antenna port for verifying that the requested sector is relayed.

3. Record the maximum pilot signal level at the Donor Antenna terminal:

   - Pilot PN Sequence Offset: _____

   - Pilot power Pp _____[dBm]

   - Pilot quality Ec/Io: _____[db]

3.2.2. Repeater Down Link (DL) Gain Setting

The overall DL gain is settable in the rang of : 35dB to 95 dB by using the Remotely controlled Attenuators of the BAU, FLEXBEAMER® and RAC. The following procedure will define the optimum DL gain setting.

1. FLEXBEAMER® Gain Setting

Calculate the required Pilot Power according to the normal Site Planning Procedure to be transmitted by the Repeater Array, according to the required coverage area, using the Network planning tools. Since the maximum FLEXBEAMER® total power is 8 (2x4) watts, the maximum allocated Pilot Power is 0.8 Watts (+29dBm) (20% of total power).
The FLEXBEAMER® Gain is settable over a 15.5 dB range , in 0.5 dB steps.

Denoting the required Pilot Power P_P (2x0.8Watt) , the FLEXBEAMER® amplifier attenuator should be set to:

$$\text{FLEXBEAMER® Attenuation setting} = 10 \log_{10}(P_{T\,max}/10) = 10 \log_{10}(P_P/\ \cdot10)[dB]$$

……(1)

When $P_{T\,max}$ Watt

Example: Assume your Network Planning tool requires the Max. Pilot Power from the Distribution Array to be 1W. The FLEXBEAMER® attenuation should be set according to (1) to the following Value:

FLEXBEAMER® Att. Value= $10 \log_{10}(1/2.0)$= -3.01 db (rounded to 3db)

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2. DL Low Power Chain Gain Setting

2.1 **Calculating the Gain of the DL FLEXBEAMER® units:** The Max. gain of the DL amplifiers in the RAC is 95 db. This gain amplification is composed of 4 successive amplifiers- The BAU LNA, DL Rx ABT, the DL Tx ABT and the FLEXBEAMER® Beamer each contributes approximately 15dB of the total FLEXBEAMER® adjustable DL gain.
The total gain of the DL Amplifiers of the RAC should be set to the value which will bring the Pilot Ec received at the Donor Antenna to the required value at the FLEXBEAMER® input. Thus the DL Gain of the Repeater System should be set to the following value:

Total Gain of DL in Repeater = +Pp–P'p [dB]……………..(2)

Where Pp denotes the DL signal input to the Donor Antenna ………….(3.1.1).

Example:

If the Pp measured at the Donor antenna is –60dbm, the total required gain of the DL amplifiers of the RAC is   +27-(-60)=+87db ………..(2.1)

2.2 **Dividing the Gain between the FLEXBEAMER® Repeater stages**: After calculating the total DL gain of the FLEXBEAMER® Repeater per equation (2), the gain should be divided between the 4 stages of the DL FLEXBEAMER® Repeater chain. following are the recommendations for doing that:

 a. Start the process by setting all the DCA attenuation in the BAU and RAC to 15.5dB.

 b. Start reducing the Attenuation from max. at the BAU first(which is the first amplifier in the chain.

 c. The second DCA to reduce the attenuation is the Rx ABT(second amplifier in the chain).

 d. The third DCA to be reduced it's attenuation will be the Tx ABT.

Example:

According to the process in example (2.1) , one needs to have +71db gain out of the +95 db available. Following the steps a-c, the DL Tx ABT attenuator is set to 14dB attenuation, and the Rx ABT set to –10dB.

Note

The DL Main and Diversity EIRP's should be equal in order to achieve the maximum diversity gain.

Check by reducing the DL Diversity TX gain by –15.5 dB and check the power (actual or through the BSM indication) of the Main channel.

Repeat the same procedure for the Diversity channel by reducing the Main TX channel.

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3.2.3. Repeater Up-Link (UL) Gain Setting

The overall UL gain is settable in the range of : 35dB to 95dB.

1. Set the FLEXBEAMER® LNA's gain to +30 db (DCA set to 0db attenuation).

2. Set the repeater UL RAC and BAU amplifiers (UL Rx ABT, UL Tx ABT, BAU P.A) gain to minimum. This corresponds to a total UL gain of 50dB, including the FLEXBEAMER® amplifiers

3. Drive with a MS to the far – out border of the Repeater coverage area, and observe the Mobile Tx Power (in test mode). Operate the repeater Remote Control SW to remotely control the RAC UL amplifiers gain.

> 3.1 If the Mobile Tx Power is maximum (+23dBm), increase BAU UL PA Amplifier gain in 1dB steps until the Mobile Tx Power drops 2 dB bellow its maximum. If required , increase the gain of the UL Rx ABT and than the gain of the UL Tx ABT.

> 3.2 If the Mobile Tx Power is less than 2db below its maximum (+23dBm), decrease the FLEXBEAMER® Rx Gain in 1dB steps, Until the MS reaches the maximum of +21dbm Mobile Tx Power.

*Note: This procedure guarantees a fade margin for UL of 2 db. In practice, the Operator should utilize the required fade , according to the Site Planning rules. More margins are possible by further increasing the UL repeater gain and observing the lower MS Tx Power. This should be tested in a drive tests along the distribution side coverage border.

<p align="center">NOTE</p>

<p align="center">The UL main and Diversity should be equalized: Measure power out of the BAU while attenuating the main or diversity gain by –15.5 dB.</p>

3.2.4. Repeater DL gain Fine Tuning

For optimum DL and UL balancing it is recommended to have additional fine tuning procedure performed on the DL, after going through the previous processes.

1. Drive with a MS to the outskirt bounderies area of the Repeater coverage area (the same coverage border you have set for the UL) and observe the Mobile Ec/Io (in test mode).

2. Operate the repeater Remote Control SW to control the FLEXBEAMER® System DL amplifiers Chain.

3. If the Mobile Ec/Io is low or marginal (Ec/Io   -14db) increase RAC DL Amplifiers (DL Rx ABT, DL Tx ABT) gain in 1dB steps until the Mobile Ec/Io is set to the Operator's network design desirable values.

4. If the Mobile Ec/Io is high at the Coverage border, decrease the RAC DL amplifiers (DL Rx ABT, DL Tx ABT) Gain in 1dB steps, Until the MS Ec/Io reaches the Operator's Network Design desirable values.
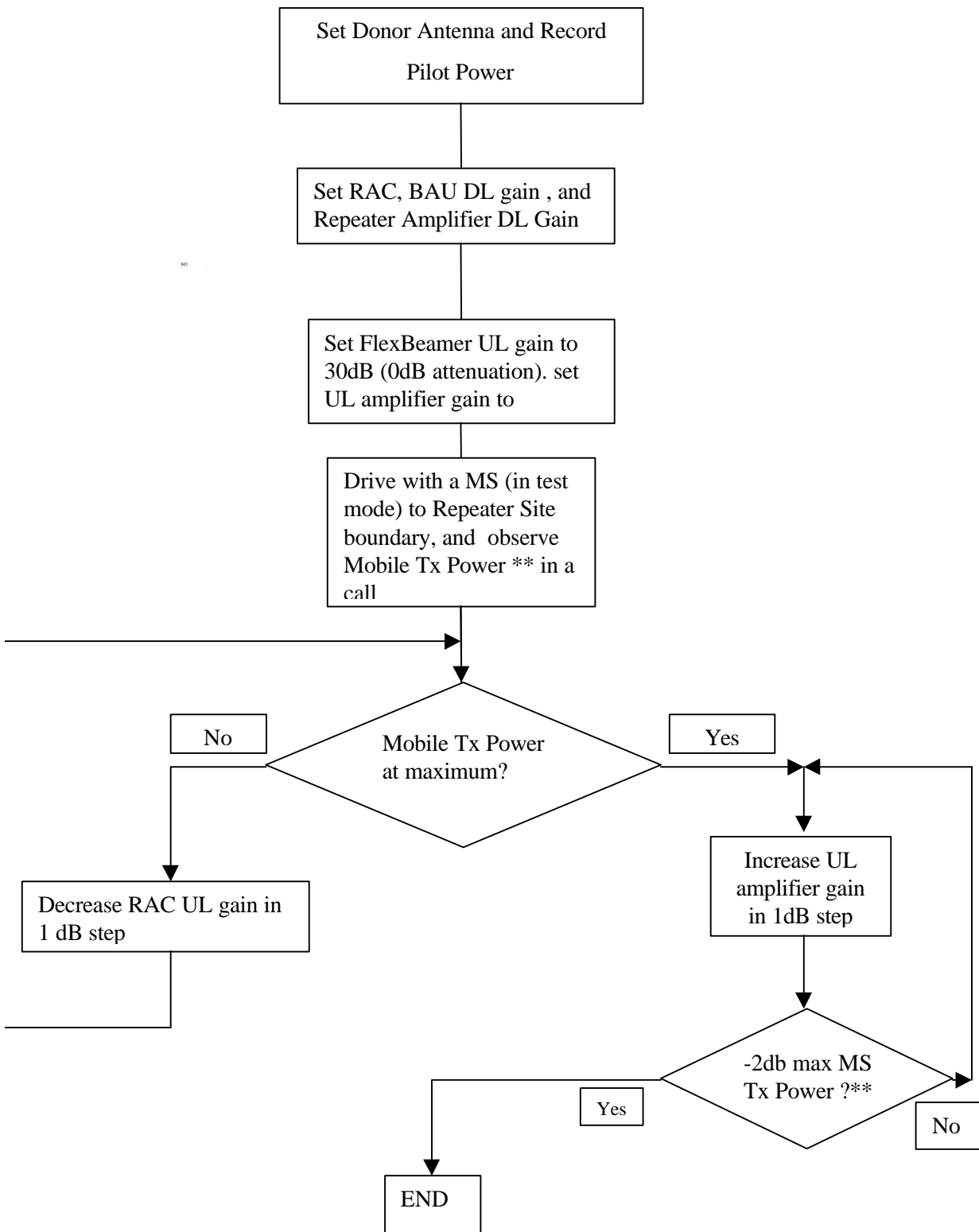
This Concludes the Repeater Optimal gain Setting..

```
                    ┌──────────────────────────┐
                    │  Set Donor Antenna and   │
                    │  Record Pilot Power      │
                    └──────────────────────────┘
                                │
                    ┌──────────────────────────┐
                    │ Set RAC, BAU DL gain,    │
                    │ and Repeater Amplifier   │
                    │ DL Gain                  │
                    └──────────────────────────┘
                                │
                    ┌──────────────────────────┐
                    │ Set FlexBeamer UL gain   │
                    │ to 30dB (0dB             │
                    │ attenuation). set UL     │
                    │ amplifier gain to        │
                    └──────────────────────────┘
                                │
                    ┌──────────────────────────┐
                    │ Drive with a MS (in test │
                    │ mode) to Repeater Site   │
                    │ boundary, and observe    │
                    │ Mobile Tx Power ** in a  │
                    │ call                     │
                    └──────────────────────────┘
```

Set Donor Antenna and Record Pilot Power

Set RAC, BAU DL gain , and Repeater Amplifier DL Gain

Set FlexBeamer UL gain to 30dB (0dB attenuation). set UL amplifier gain to

Drive with a MS (in test mode) to Repeater Site boundary, and observe Mobile Tx Power ** in a call

No — Mobile Tx Power at maximum? — Yes

Decrease RAC UL gain in 1 dB step

Increase UL amplifier gain in 1dB step

-2db max MS Tx Power ?**

Yes

No

END

Figure 10: PCS RF Repeater Block Diagram

** Note: This Value is determined by each Operator using the required fade margin and performed at several areas along the distribution side border in drive tests.

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4. BSM (BEAMER® SYSTEM MANAGER) SOFWARE PROGRAM

The BSM program enables monitoring and control of the BEAMER® units of both the FLEXBEAMER® and the BEAMER® unit of the RAC, from a local or remote PC based host computer.

Its main functions are:

Control of system capacity and configuration

Control of each BEAMER®

Setting the Active Bias-T amplifiers gains for Up and Down links.
Status report for each Array

Status report for each BEAMER®

Monitoring & Control of the RAC functions and Active Bias-Ts (ABTs)
Set RF channel in channelized repeater.

4.1. Requirements for Operation

4.1.1. PC Hardware and operating System

- A Pentium™ based PC and a serial port on the PC

- Window 95/98/NT operating system

4.2. User Interface Description

4.2.1. Main Menu - BEAMER® (Active Radiating Module) System Manager

The BEAMER® System Manager enables:

Display of systems status report such as:

Status of each Array and Sub-array
Real time date and clock
Authorized level for changes

Access to the following operating menus and functions:

System
Password

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BEAMER® monitoring and control

4.2.2. System Menu List

The SYSTEM menu list provides the functions to set system parameters. It consists of four menus:

Definition, Configuration, Array Control and Com port

4.2.2.1. System definition Menu

The Capacity menu enables definition of the number of arrays in the system and type of array.

4.2.2.2. Configuration Menu

The Configuration menu enables:

> Registration of new BEAMER® units in the system..
>
> Display the ID number of each BEAMER® unit in the system.
> Definition of the conditions for failure messages.
> Definition of the shutdown conditions for the Power Amplifiers.
> Definition of status limits for failure messages (displayed by the RAC , the user
>
> interface and sent to the BEAMER® concentrating unit).

4.2.2.3. Com Menu

The Com menu enables selection of an available serial port

4.2.2.4. Array Control

The Array Control menu enables setting the gain for each Active Bias T (ABT) in the system.

4.2.2.5. Password Menu List

The Password menu list enables entering the password to apply changes in system configuration.

Four levels of security password are available:

1. "Guest" level can only observe indications.

2. "Operator" level can apply changes to System configuration setting menu and BEAMER® setting menu in addition to "Guest" abilities.

3. "Supervisor" level can apply changes to the system settings, such as Capacity/Failure conditions and Limit/Shutdown conditions, in addition to the "Operator" abilities.

4. "Administrator" can change the passwords in addition to "Supervisor" abilities.

4.3. Status Reports

4.3.1. Report by Monitoring

Either a PC or remote- connected PC (Via Modem or Wireless Modem) can be used for Monitoring and Control of the BEAMER® RF Repeater System. The communication standard between the RAC and the local or remote PC is by a standard RS-232/RS485 bus at a baud rate of 9.6 Kbps.

4.3.2. BEAMER® RF Repeater System Control

Either a PC or remote- connected PC can be used for Control each individual BEAMER® and each of the BEAMER® RF Repeater ABT amplifiers. Local or remote PC can obtain control functions but not both simultaneously.

4.4. BSM S/W

The BSM Software enables system configuration and monitoring functionality of each unit in the system.

The Operation of the software will be described in the following paragraphs.

4.4.1. S/W Installation

The BSM software installation is from a diskette which is supplied with the product by Celletra .

- Put disk no.1 in the floppy drive and run "Setup".
- Follow the instructions on the screen until completion of installation.

4.4.2. S/W Operation

From the "Program files" in the Windows operating system select the BEAMER® icon and double click to operate the BSM software.

Follow the next steps in order to establish a correct system installation.

Note: The ICU (Interface and Control Unit) is the Control Board located within the RAC module of the BEAMER® RF Repeater. When ever the ICU is referenced in the following BSM slide show the interpretation should be the RAC Module Control Board.

4.5. BSM Main Screen

From the **Setting** menu select the Comm port.

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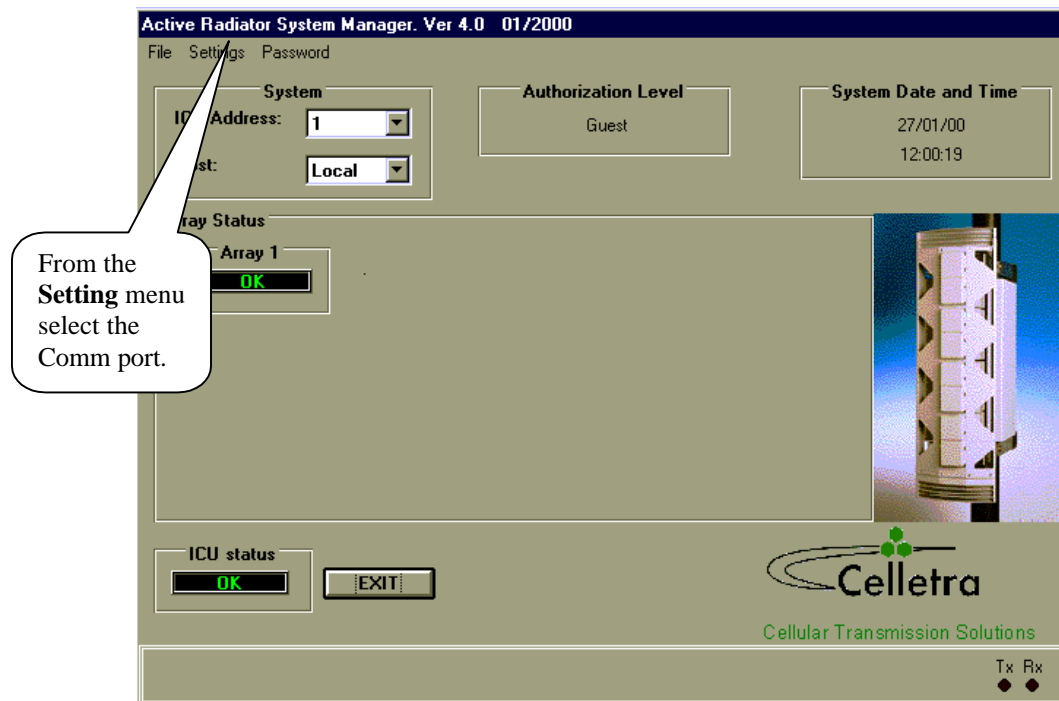
4.6. Comm Port Selection

Connect RS-232 or RS-485 cable to the ICU.

Run the cable to a Comm port on your PC.

Comm Setting

Com Number
- ○ Comm 1
- ● Comm 2

Connection:
- ● RS - 232
- ○ Modem

OK

Cancel
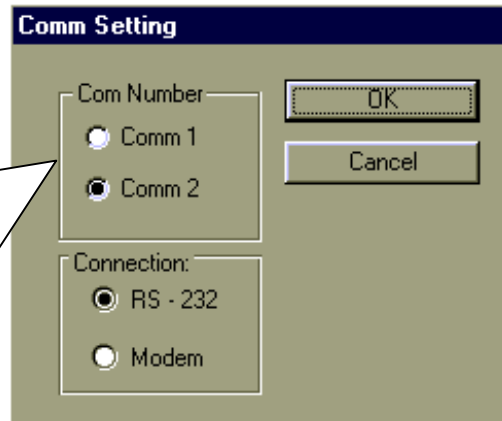
4.7. Password Entering

In order to create or modify a configuration, you will need "Administrator" password level.

Enter Password

Level   Guest

Enter password   ****

OK

Cancel

4.8. Host Selection

Main Host

Host: Local
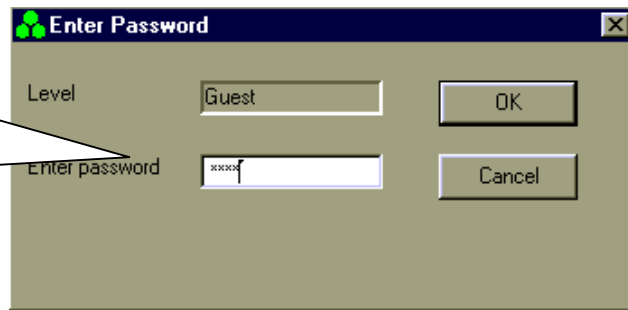
From the **Setting** menu select **Main Host** and then select either **Local** or **Remote Host**.

OK   Cancel   Apply

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Title: **PCS FlexBeamer ® RF Repeater**	913002500		**80**NUMPAGES
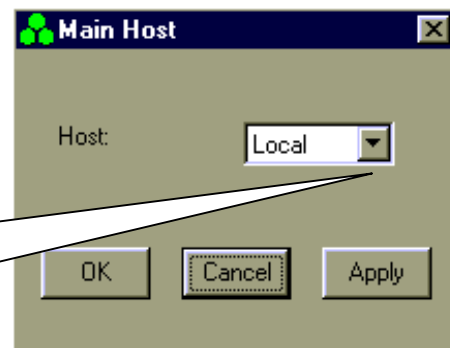
4.9. Installation of RAC in System

Operate ICU 24VDC Power Supply .

Read **ICU ID** and **ICU addresses**.

ICU Setting

ICU Address: ICU ID:

9

2   Not installed

3   Not installed

4   Not installed

OK   Cancel

4.10. Failure Conditions Selection

Control Setting

Failure cond | Beamer limits | ShutDown Conditions | ICU limits

Select **Major** or **Minor Fail** according to operator application

Condition	Minor Fail	Major fail	Condition	Minor Fail	Major fail
Temperature	☒	☐	PA	☐	☒
Input power	☒	☐	Beamer input V.	☒	☐
Output power	☒	☐	Return power	☒	☐
Tx current	☐	☒	Linearizer	☐	☒
current	☒	☐	ICU CTRLR	☒	☐
RX - 2 current	☒	☐	SA input V.	☐	☒
Tx attenuator	☐	☐	Tx SA current	☐	☒
RX - 1 attenuator	☐	☐	Rx SA current	☒	☐
RX - 2 attenuator	☐	☐	ICU input V.	☐	☒
Beamer CTRLR:	☐	☒	ICU fan current:	☐	☐

OK   Cancel   Apply

4.11. BEAMER® Limits Definition

Select **limits** according to operator application
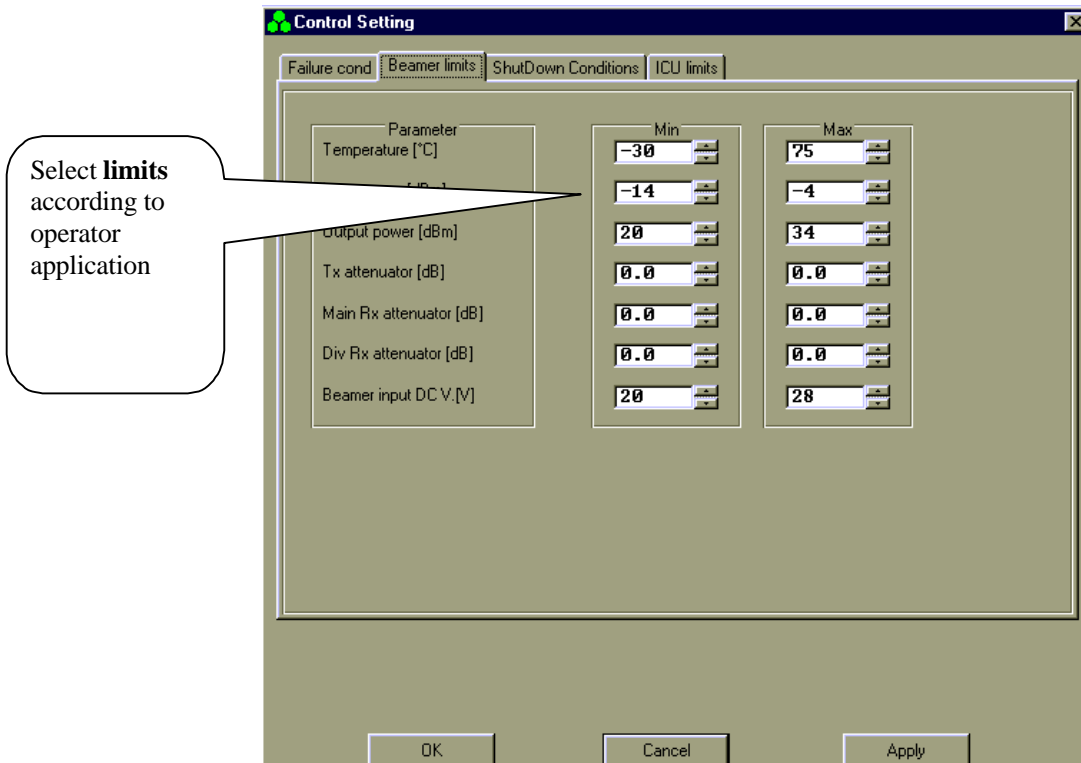
4.12. Shut Down Conditions Enable/Disable

Enable or disable **Shut Down conditions** according to operator aplication.
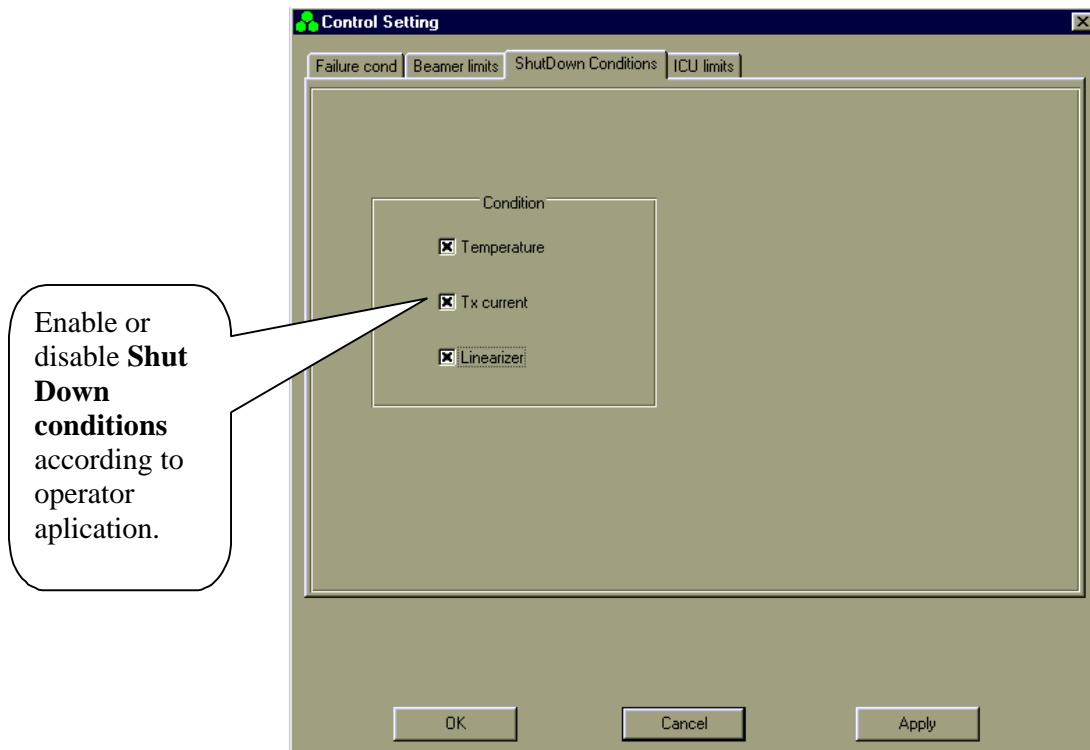
The "Shut Down Conditions" should be saved only after BEAMER installation paragraph 4.18

4.13. RAC Limits Definition

Select **ICU limits** according to operator application

4.14. System Definition

Define the **Number of Arrays** and the **Type of Arrays** in your system.

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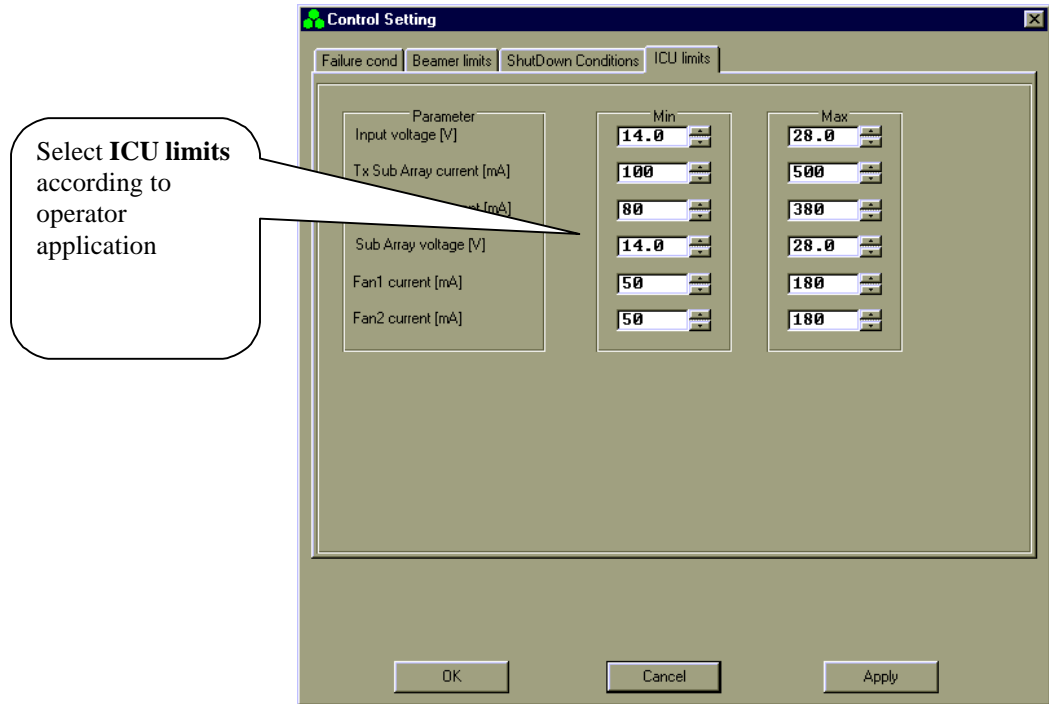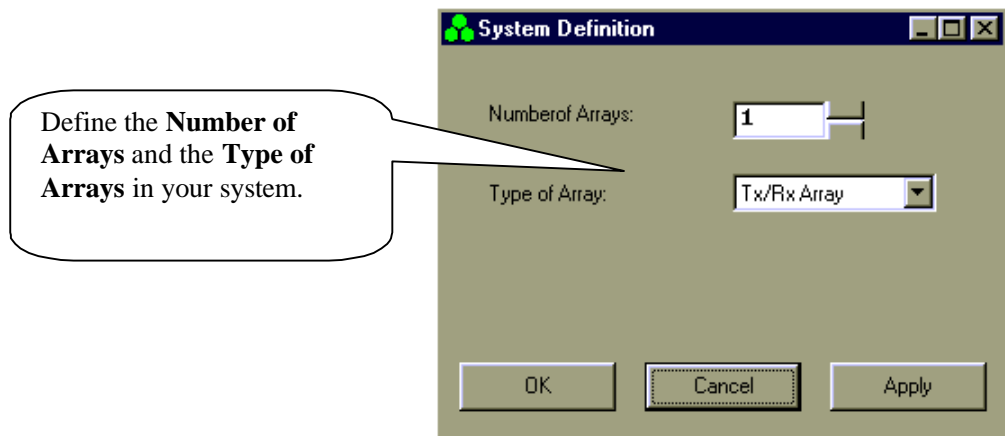
4.15. Sub-Array and BEAMER® Setting
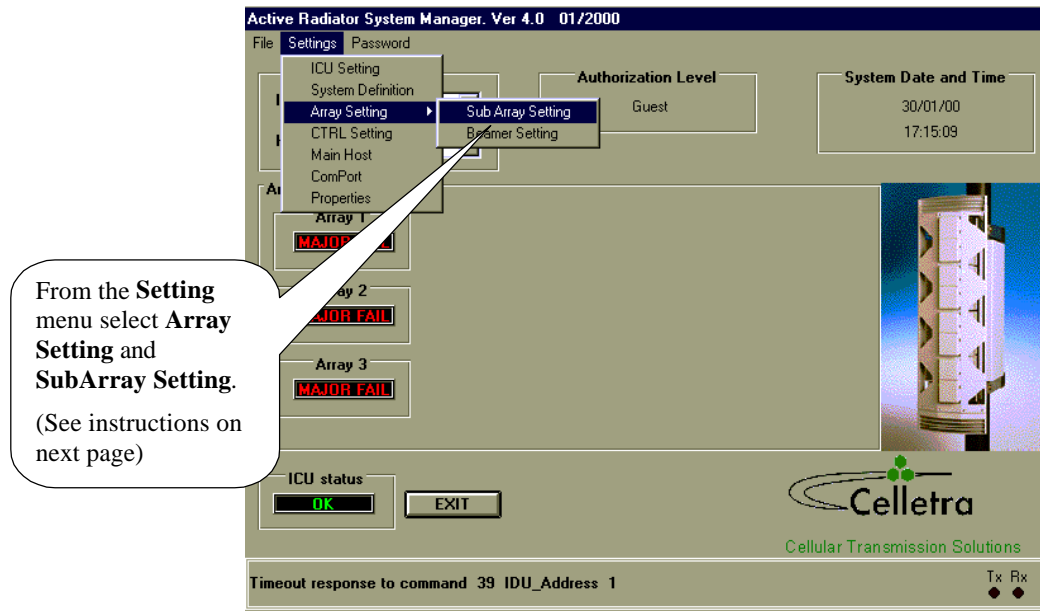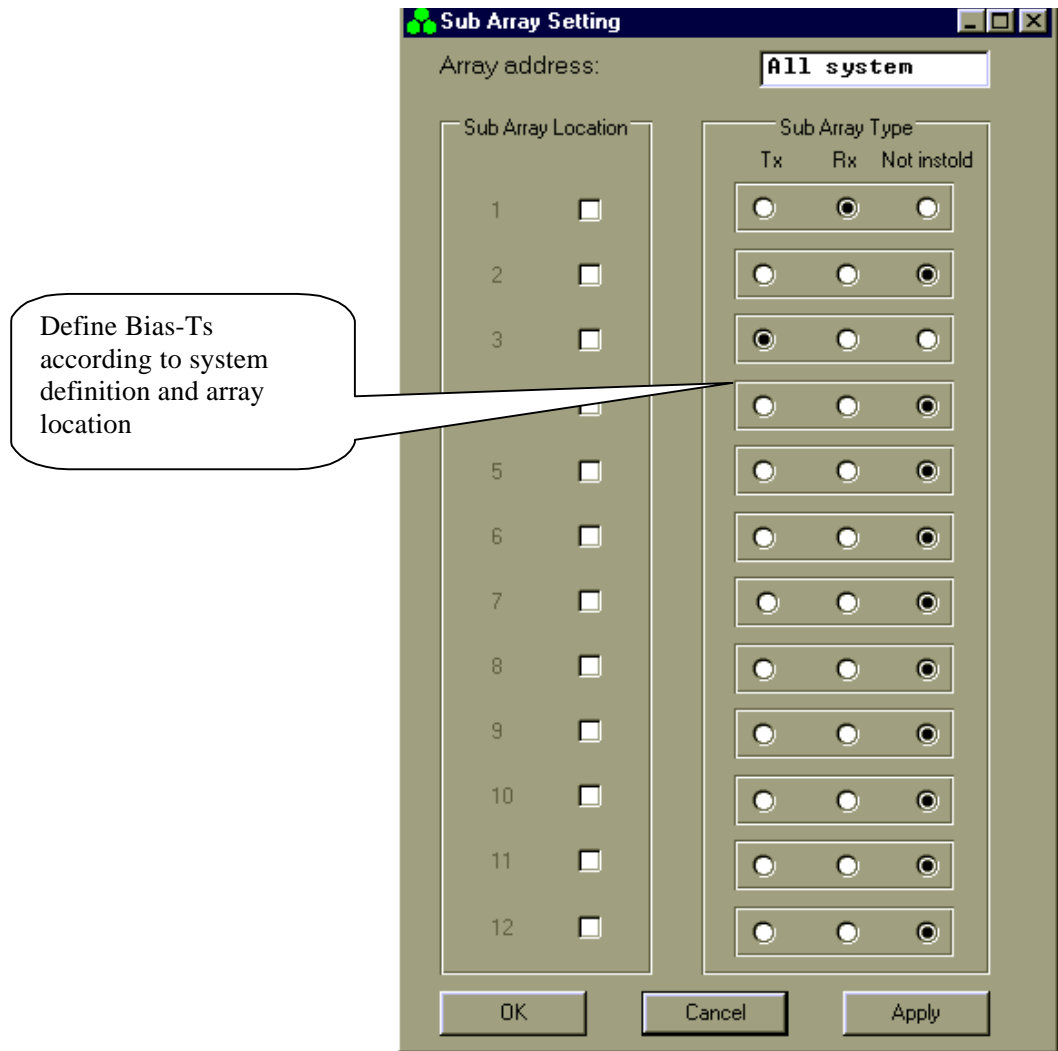
From the **Setting** menu select **Array Setting** and **SubArray Setting**.

(See instructions on next page)

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4.16. Sub Array Setting

Define Bias-Ts according to system definition and array location

4.17. BEAMER® Installation

Beamer Setting

Array address: All system

Col	Row	Beamer Location	Beamer ID
1	1	1 ☐	4
1	1	2 ☐	20
1	1	3 ☐	21
	1	☐	6
		☐	Not installed
		6 ☐	Not installed
		7 ☐	Not installed
	1	8 ☐	Not installed
	1	9 ☐	Not installed
	1	10 ☐	Not installed
	1	11 ☐	Not installed
	1	12 ☐	Not installed
	1	13 ☐	Not installed
	1	14 ☐	Not installed
	1	15 ☐	Not installed
	1	16 ☐	Not installed

OK   Cancel   Apply

From **BEAMER** Setting select **BEAMER**.

The S/W starts looking for installed BEAMERs.

Wait until **Apply** button becomes available.

Add missing BEAMERs or make changes according to existing installation by adding BEAMER ID numbers.

Confirm by clicking **Apply** button.

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4.18. Column and Row Definition

In the **Array address** combo box, select the Array number.

Check the **Beamer Location.**

Enter the **Col** and **Row** for the Beamer.

Repeat for each Beamer in the Array.

Click **Apply** when you have completed an Array of BEAMERs.

Repeat this procedure for all the Arrays.

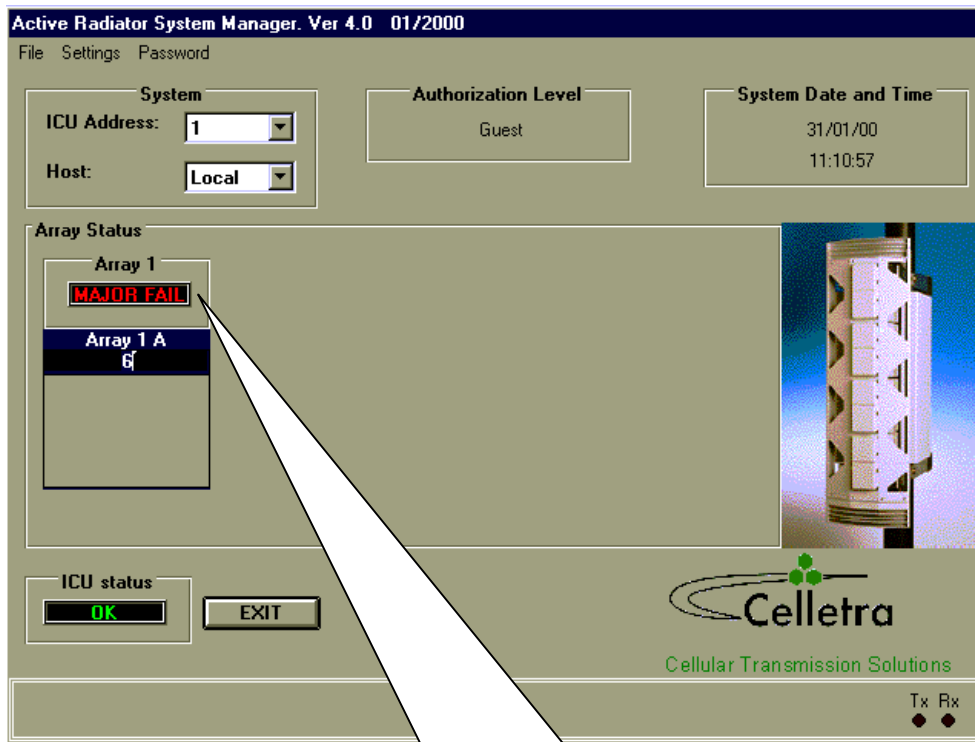Click **OK**.

4.19. Sub-Array Status and Attenuator Setting

Select from **Array Status** window an Array and select **Sub-Array** option.

Click **Pause Updating Window** and adjust the attenuator value between 0 and 15.5 dB.

Click **Apply** in order to save your selection.
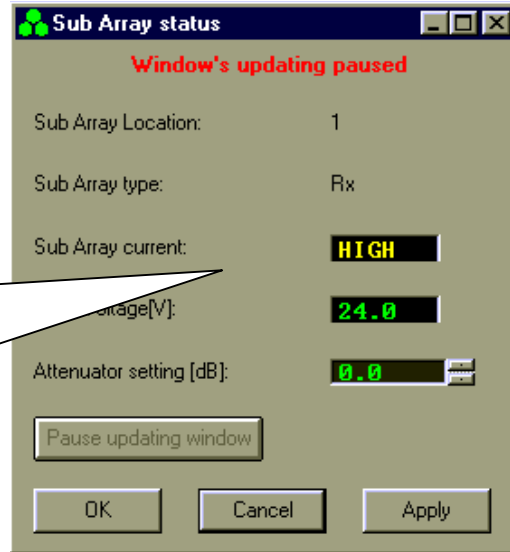
4.20. Control & BEAMER® Setting

Point cursor at an Array window.

Click to view all BEAMER addresses in selected Array.

Double click to see BEAMER **Control** screen.

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4.21. BEAMER® Control

Click **Pause Updating Window** and select attenuator value for Tx and Rx according to your system definition.

Click **Apply** to save your selection.

Click **OK** to return to Main screen.

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4.22. RAC Status

Click on **ICU** window to see ICU status.

In case of a failure, double click on it to display details

ICU status

Fan1 current:	OK
Fan2 current:	HIGH
Input Voltage[V]:	22.0
CTRLR	OK
ICU Date	31/01/10
ICU Time	10:03:54

OK   Cancel   Applay
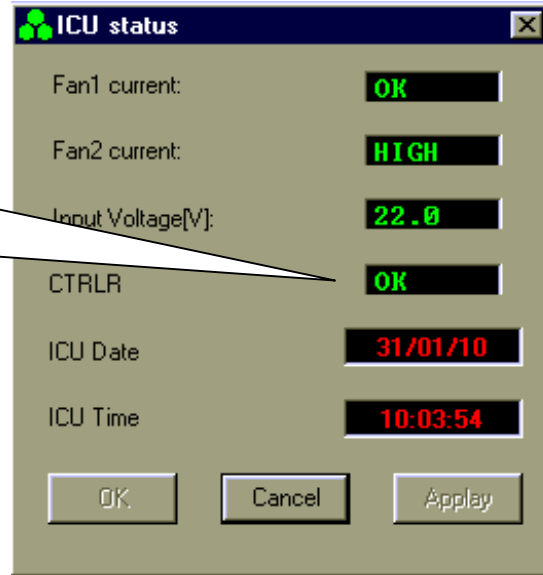
4.23. RAC CTRLR Status

Double click on the CTRLR window to view this box, which shows the CTRLR parameters in detail.

ICU CTRLR status

Memory:	OK
I/O Facilities:	OK
Real Time CLOCK:	OK
A/D:	OK
FSK modem:	OK
Tel. modem:	OK
Battery status:	OK
Parameters:	OK

OK

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Title: PCS FlexBeamer® RF Repeater	913002500		**80**NUMPAGES
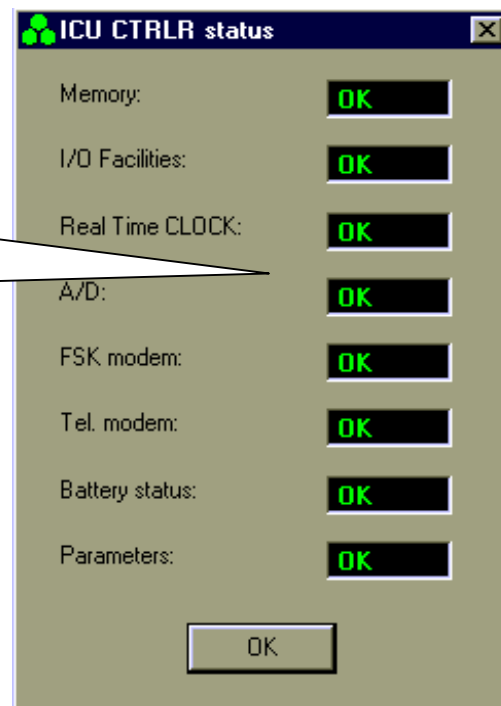
4.24. RAC Properties

From **Setting** you can select **ICU Properties** to view the SW versions of the ICU CTRLR card
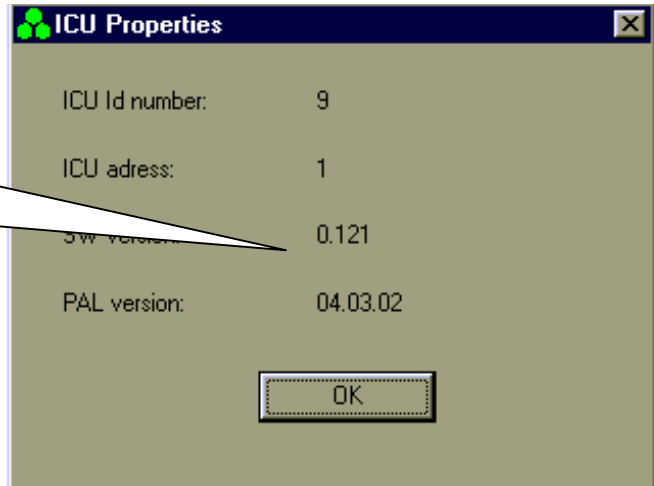
ICU Properties

ICU Id number:	9
ICU adress:	1
SW version:	0.121
PAL version:	04.03.02

OK

5. NEW SOFTWARE DOWNLOAD GUIDE

5.1. Introduction

This chapter is a guide to loading program files to the RAC and BEAMER® via their Monitoring and Control communication channels. This enables program upgrades in the field without dismantling the equipment for that purpose.

The program loading is done from a PC when using the *CELLETRA SOFTWARE DOWNLOADING SYSTEM* program, which is supplied by CELLETRA.

This chapter describes the loading process to the RAC and the BEAMER® using the *CELLETRA SOFTWARE DOWNLOADING SYSTEM.*

5.2. Overview

5.2.1. Downloading Software to the RAC

In the software download process a new application program file is loaded to the RAC via the serial communication channel or Wireless Modem and saved to the FLASH memory.

5.2.1.1. RAC Memory Configuration

The RAC controller includes two types of memories a FLASH memory and a RAM. The FLASH memory includes the configuration parameters of the RAC (such as ID number, number of arrays, failure conditions etc.) and the application program, which enables all the features of the RAC and which is upgradeable.

The RAM is used for logging events into the log file during regular operation of the RAC, and for receiving the new application program for the RAC during the download process. A third memory is

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located in the CPU component and includes the basic I/O program of the controller. This program enables operation of the basic functions of the controller (such as serial communication and application program loading) and cannot be modified. The memory size allocated for the application is 64 Kbytes. Programming a new application program into the FLASH memory does not affect the RAC configuration parameters.

5.2.1.2. RAC Download Operation Mode

Loading a program file to the RAC is enabled while the RAC operates in Download mode. The operation mode of the RAC is changed by a command through the serial communication channel. When the RAC operates in Download mode, no operational function is performed. (That means that it does not provide monitoring and control of the BEAMER$^{®}$ s). The baud rate of the serial port increases to 56K baud. That enables faster transmission of data packets to the RAC during the download process. The RAC returns to operational mode (Auto) at the end of the loading process or if there was no data transmission from the PC within a predefined time period .

5.2.1.3. File Transmission From PC to RAC

5.2.1.3.1. File Transmission

The program file is a HEX type file and the data is ASCII format. While loading the file to the RAC the PC sends the file content line by line. The RAC reports TO the PC about reception quality. If errors were detected the transmission will be stopped and an error message will be displayed. The PC then restarts the transmission. The program is contained in files of 64 Kbytes. That is, if the program size is greater than 64 Kbytes it will be packed in two files that are distinguished by their names.

5.2.1.3.2. File Name Format

The file name has the following format: IDUxxTVVV.Hyy

IDU	RAC application header
Xx	Not relevant for loader
T	Application type (0,2,3=Celletra ICU/1=Micro ICU)
VVV	Application version
Hyyy	HEX: The program is packed in one HEX file
	H00 and H01: The program is packed in two HEX files

Example: IDUck0102.h01

    IDUck: Software application

    0: Celletra version

    102: Software version number

    h01: High package of the hex file

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5.2.2. Downloading Software to the BEAMER®

The Software download process enables loading of a new application program file for the BEAMER® host processor and the DSP via the serial communication channel and saving it to the FLASH memory in the BEAMER® .

5.2.2.1. BEAMER® Memory Configuration

The BEAMER® includes two processors a DSP and a HOST. The HOST processor is a general purpose processor that is used for reporting BEAMER® status to the RAC via a FSK channel and for initialization of the DSP.

The BEAMER® controller includes a FLASH memory that contains:

1. The configuration parameters of the BEAMER® (such as ID number, calibration tables etc.). These parameters are not affected during the loading process.

2. The application program that enables all the features of the BEAMER® that can be replaced by a new version.

3. The program and data files of the DSP that can be replaced by a new version.

The FLASH size contains two files of each program (two of HOST application, two program files for the DSP, and two data files for the DSP). The required program files for operation are selected by the user. The memory is arranged by pages (each page includes 128 bytes).

5.2.2.2. File transmission from PC to the BEAMER®

5.2.2.2.1. File Transmission

The new file is transmitted page by page from the PC to the RAC and from the RAC to the BEAMER® . All files to be loaded are text files. The files contain a Header block, which is the properties block, and the software to be loaded. When the load process is enabled, the baud rate of the serial port (from PC to the RAC) increases up to 56K Baud. That enables faster transmission of data packets to the RAC during the download process. The RAC reports the PC about reception quality and if errors occurred, the transmission will be stopped and an error message will be displayed.

The RAC sends the data packets received from the PC to the BEAMER® and the BEAMER® reports the RAC about reception quality. If errors were detected the transmission will be stopped and an error message will be displayed

5.2.2.2.2. File Name Format for HOST

Files will be identified by the following suffix: name.hst

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5.2.2.3. File Name Format for DSP

Files will be identified by the following suffixes:

- DSP Program file: name.dpm
- DSP Data file: name.ddm

5.3. User Interface for SW Download

5.3.1. Functions

The Software download program enables download program files to the RAC and the BEAMER$^{®}$ module from a local PC-based host computer.

Its main functions are:

- Selection of the target for downloading (BEAMER$^{®}$ or RAC)
- Selection of files to be loaded
- Transmission of files from the PC to the selected target (BEAMER$^{®}$ or RAC).
- Monitoring of transmission process

5.3.2. Requirements for Operation

5.3.2.1. Hardware

- Pentium^{TM}-based PC
- Free serial port from the PC
- At least 4 Mb free RAM

5.3.2.2. Software

Window 95/98/NT operating system

5.3.3. User Interface Installation

The software is installed from a diskette supplied by Celletra.

1. Put disk no.1 in the floppy drive and run "Setup".
2. Follow the instructions on the screen until completion of installation.

The program will be installed in the "Program files" subdirectory of the "Windows" directory.

5.3.4. User Interface Operation

The program can be operated from the program menu in the start menu. Another option is to create a shortcut for the program from the "Program files" subdirectory in the Windows directory and operate the program by clicking the icon

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5.4. User Interface Description

When operating the program the following window will be displayed:
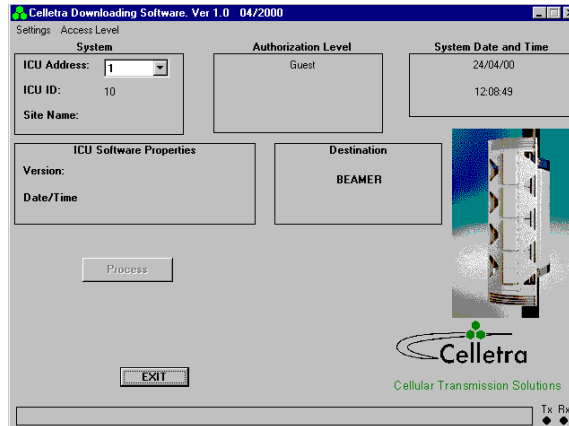
5.4.1. System Field

The System field displays the address of the RAC and its ID number that is controlled by the operated program. In case that the system includes few RACs the required RAC can be selected by its address from the address bar.

When the program is operated it scans the addresses (1 to 4) and displays the address of the existing RACs in the System filed . In case that no RAC was connected or the RAC was not configured the address bar will remain blank.

5.4.2. Authorization Field

Authorization field displays the actual authorization level. Two levels of authorization are available:

1. "Guest" level can only observe indications.

2. "Administrator" which enables the application of the loading process and change the passwords in addition to "Supervisor" abilities.

5.4.3. System Date and Time Field

System date and time function displays the PC's actual date and time. That time will be registered as one of the properties of the loaded file.

5.4.4. RAC SW Properties Field

RAC SW properties field is enabled when the loading process is enabled. It displays the properties of the program file that exists in the RAC. The RAC property information includes the version number and file loading date and time.

5.4.5. Destination Field

Destination field displays the destination for the file loading – BEAMER   or RAC.

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number).

5.4.6.2.   Software Loading Code

This function enables saving to the BEAMER$^®$ details about present loading. Software loading code is an alphanumeric expression up to 20 characters.
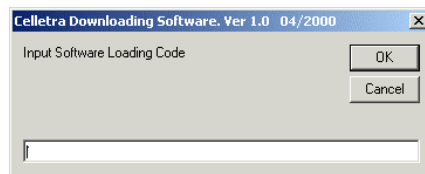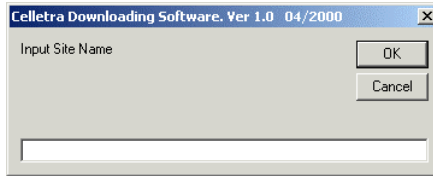

5.4.6.3.   Software Remote Loader

This function enables saving of the program loader name into the BEAMER$^®$. Software remote loader is an alphanumeric expression up to 20 characters.
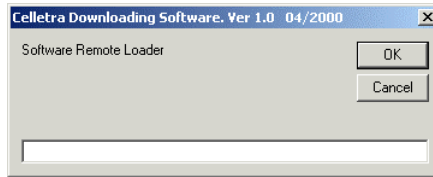
5.4.6.4. Site Name

This function enables saving to the BEAMER$^{®}$ the name of the site where a program was recently loaded to that BEAMER$^{®}$. Site name is an alphanumeric expression up to 20 characters.

5.4.6.5. Destination

This function enables selecting the required destination for the SW download: BEAMER$^{®}$ or RAC

5.4.6.6. ComPort

This function enables selecting the required communication path from the PC to the RAC. Selection of ComPort function will display the Comm. setting window

Connecting the RAC is possible directly via RS232 interface for local connection or via telephone or Wireless modem for remote connection. The remote connection is enabled in RAC versions that include internal telephone or Wireless modem. The Comm. setting window enables selecting the required path: RS-232 interface or modem. It displays all the available serial ports in the PC and enables selecting a free port in the case where the RS-232 interface is selected.
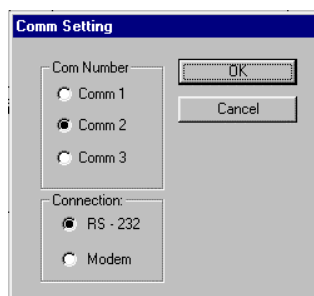
5.4.7. Password Menu

Password menu enables the inclusion of the following functions:

1. Enter password and user name

2. Low level

3. Change the Administrator password

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5.4.7.1. Enter Password

Clicking on the Enter password function will display the following window:
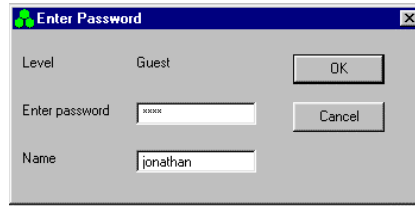
The displayed window enables entering the required password, which enables the loading process.

5.4.7.2. Low Level

Clicking on Low Level sets the Guest level authorization.

5.4.7.3. Change Password

This function is enabled when the Administrator authorization is enabled and enables changing the password for authorization.

5.5. Program Loading Procedure

5.5.1. Procedure for Loading Program to the RAC

To load a new version of application program file to the RAC controller, follow the following instructions:

1. Connect the PC that includes the Celletra program loader program to the RAC via the serial port or wire or Wireless Modem.

2. If you wish to keep the log file then save it, otherwise the log file will be erased during the new file loading.

3. Operate Celletra program loader program and wait until the address of the RAC appears at the RAC address bar. If the system includes few RACs, select the address of the required RAC from the address bar.

4. From the Setting menu select Comport and select the required communication path to the RAC.

   - If the PC is connected via the serial port of the PC then check the RS-232 and define the COMM port in the PC that is used.
   - If the PC is connected via the a telephone line by a modem, then check the MODEM and dial the telephone number of the destination modem.

5. From the Setting menu, click on Destination and select RAC as the destination for loading. The following warning message will appear to warn that the log file will be erased:
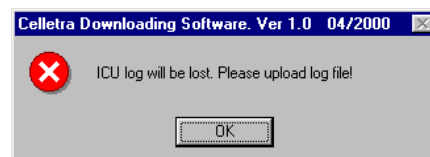


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6. Exit to save the log file or Click O.K to continue. The properties of the existing file will be displayed on RAC Software properties field.

7. Click on the Password menu then on Enter to enter the password that enables loading of a new program. After you enter the correct password and your name the Start download command key will be enabled.

8. Click the Start download command key to start the loading process. The following window will be displayed:
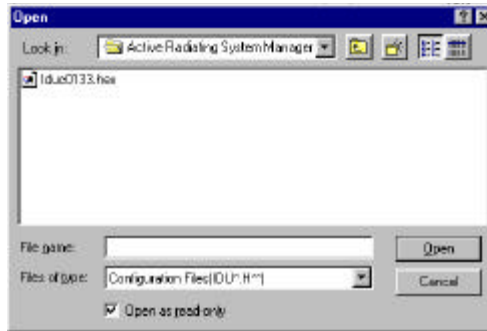
9. Select the required file and click on the Open button. If the selected file is similar to the existing (operational) file then following notice will be displayed:
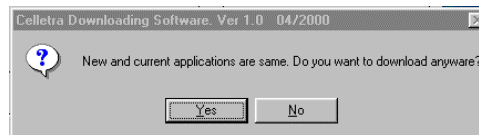
10. If you wish to load the same file anyway then click Yes to continue, otherwise click No and select other file.

11. During the loading process a status bar will be displayed:
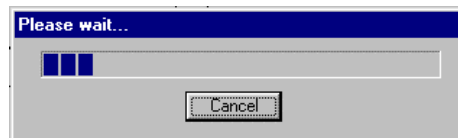
12. Wait about 3 minutes until the process is completed. If you wish to stop loading the file then click on the Cancel button.

13. After the file has been loaded into the RAM successfully the RAC will program the FLASH memory. During the FLASH programming the following message will be displayed:

FLASH PROGRAMMING IN PROGRESS

14. The new program version will operate at the end of this process and the RAC is operational again.

FILE DOWNLOAD TIME OUT ERROR!

15. If the loading process has been failed the following warning message will be displayed:

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5.6. Procedure for Loading Program to the BEAMER®

To load a new file (application, DSP prog. file and DSP data file) to the BEAMER® controller follow the following instructions:

1. Connect the PC that includes the Celletra PROGRAM LOADER program to the RAC via the serial port.

2. If you wish to keep the log file then save it, otherwise the log file will be erased during the new file loading.

3. Operate Celletra program loader program and wait until the address of the RAC appears at the RAC address bar. If the system includes few RACs (ICUs), select the address of the required RAC from the address bar.

4. From the Setting menu select Comport and select the required communication path to the RAC.

5. If the PC is connected via the serial port of the PC then check the RS-232 and define the COMM port in t he PC that is used.

6. If the PC is connected via a telephone line by a modem then check the MODEM and dial the telephone number of the destination modem.

7. From the Setting menu click on Destination and select BEAMER® as the destination for loading.

8. Click on the Password menu then on Enter to enter the password that enables loading of a new program. After you enter the correct password and your name the Start download command key will be enabled.

9. Click the Start Download command key to start the loading process. Clicking the start download button will display a window to enter the required BEAMER® ID number.

10. Enter the ID number of the required BEAMER® and click O.K to continue. In case that the particular RAC ID number does not exist in the system the following warning message will be displayed:

ERROR : BEAM ER NUMBR 51 IS NOT RESPONDING
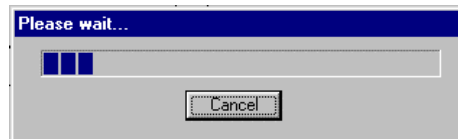
Otherwise the following window will be displayed:
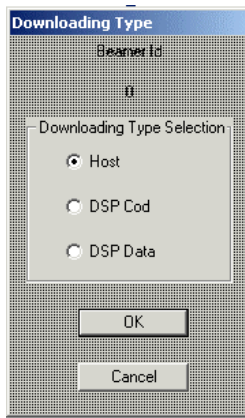
11. Check the required file type for loading and click OK to continue. The following window will enable the selection of the particular file to be loaded:

12. Select the required file from the file list and click OPEN for loading

    During the loading process a status bar will be displayed:

13. Wait until the process is completed. If you wish to stop loading the file then click on the Cancel button.

14. After the file was loaded into the BEAMER$^{®}$ successfully the following message will be displayed:

    FILE LOAD WAS COMPLETED SUCCESSFULLY

15. The new program version will operate at the end of this process and the BEAMER$^{®}$ is operational again.

6. SERVICING AND TROUBLE SHOOTING THE BEAMER® RF REPEATER

6.1. servicing the RF Repeater

6.1.1. Back-up battery replacement

The back up battery is valid for about 10 years of normally use of the system.

Despite the above, it is recommended to replace back-up battery when opening the system for maintenance activities.

6.2. Trouble Shooting

The following table detailed the common problems and recommended solutions.

Remark! In case of problems or dificulties, it is recommended to contact "Celletra Technical Support".

Error/Fault	Check
System don't start	• Verify proper installation and power connections.
Monitoring and control problems	• Check power to RS-232/485 adapter, verify comm port definition on the BSM S/W.
Low/No Power	• Operate BSM S/W and check the following parameters: • Check DC power level in the BAU RAC and FLEXBEAMER® using BSM S/W. • Check damage to coax cables in case of bad results in previous check. • Verify system setup parameters. • Check In/Out power parameters using BSM S/W. • Replace faulty unit in case of "good input" and "bad output" • In case of unit replacement start system setup from the beginning.

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System Alarms	1. Enter to the Beamer status screen and verify PA is "ON"
	2. Look for alarms in one of the two defined arrays.
	3. If PA is "OFF" try to turn it "ON".
	4. If you can not do so go to the Sub-array (ABT) "Attenuator settings and increase the attenuation to avoid possible over drive power to the Beamers.
	5. If PA can be turned "ON" start system setup from the beginning.
	• If PA does not go "ON" replace the faulty unit.

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6.2.1.   Troubleshooting the system using ICU log file.

6.2.1.1.   Getting ICU Log File

For getting the ICU Log File follow the instructions:

1.   Select <FILE> option in the main menu.

2.   Select <Get Log file> option. A small window, named "Save In" will be displayed. Set the name of the Log file (or use the default name) and press <save>.

3.   A 'progress window' will be displayed while reading the data from the ICU.

6.2.1.2.   The Log file structure

The log file is a text file with a line of 26 fields

Field No.	Field Name	Description
1	Failure type	
2	Date	
3	Time	
4 – 20	**Beamer Status**	(relevant only for Beamer failure)
4	BEAMER address	
5	Controller status	0 - OK; other - Fail
6	Temperature Indication	checked within Beamer limits
7	Input Power Indication ,	Checked within Beamer limits
8	Output Power Indication	Checked within Beamer limits
9	Tx Attenuator Indication	Checked within Beamer limits
10	Main Rx Attenuator Indication,	Checked within Beamer limits
11	Div Rx Attenuator Indication	Checked within Beamer limits
12	Tx Current Indication	Low - 0 Norm - 1 High - 2
13	Main Rx Current Indication	Low - 0 Norm - 1 High - 2
14	Div Rx Current Indication	Low - 0 Norm - 1 High - 2
15	Return Power Indication	0 - OK;1 - Fail

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16	Tx Amplifier Status	0 - OFF;1 - ON
17	Correction Amplifier Status	0 - OFF;1 - ON
18	Linearizer Status	0 - OK;1 - Fail
19	Beamer Voltage Indication;	Checked within Beamer limits
20	Communication Error	Timeout or corrupted data
21-26	**ICU Status**	(relevant only for ICU failure)
21	ICU Status	
22	Fan1 Status	
23	Fan2 Status	
24	Voltage Status	
25	Controller Status Num1	
26	Controller Status Num1	

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The following is just to inform you that:

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Exclusions

The above warranty shall not apply to defects resulting from: improper or inadequate use, unauthorized modifications or misuse.

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