

BreezeCELL - In-building Cellular Solution for Commercial Buildings



Installation, Operation & Maintenance and Testing Procedures



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1 Introduction

Indoor wireless coverage is one of the most challenging areas in the wireless industry. Alvarion develops innovative communications equipment, infrastructure and products – enabling wireless operators and property owners to deliver high quality indoor wireless services using a Distributed Antenna System (DAS).

Alvarion developed a unique DAS solution for improving in-building wireless coverage in commercial buildings such as airports, stadiums, shopping malls, hotels, office buildings and residential areas. Such locations suffer from wireless coverage problems such as interference, attenuation, and multi-path due to their height and build. The solution is installed using a hybrid fiber and TV type coaxial cables. BreezeCELL's unique flat architecture makes it extremely cost effective.

The solution can also be installed using existing coax cables infrastructure, used to distribute TV signals within the building. Alvarion believes that utilizing the already installed TV infrastructure is the most cost effective means of providing these services.

Value proposition

- Affordable active Distributed Antenna System
- Very low installation cost
- Unique MIMO on a single cable solution
- Plug and Play - very fast and flexible installation process
- Multi-Operator, Multi service
- Easy design and fine tuning
- Fast ROI

2 The Concept

Indoor wireless coverage is traditionally done via external macro cells. In many cases coverage is problematic due to interference, attenuation, multi-path and other issues.

BreezeCELL distributes the cellular signal throughout the property over a combination of fiber and 75 ohm coax to active remote units and antennas located throughout the building area.

On the other hand, almost all buildings are equipped with coax cables infrastructure, used to distribute TV signals within the building. Alvarion's solution can use this existing cabling infrastructure through unutilized bandwidth on the coax cables to bring wireless services into the indoors environment.

Alvarion's technology enables servicing multiple operators and technologies (i.e GSM, UMTS, CDMA, WiMAX, iDEN) over the same infrastructure in order to increase the utilization of the cable infrastructure. BreezeCELL is a forward compatible system and fits current and future protocols (LTE, etc) and has a unique MIMO solution on a single cable support.



3 BreezeCELL Architecture

3.1 Typical Network

A wireless signal source (BTS/Node B/, Micro, Pico, Femto, Repeater) is installed in a central point in the building. Cabling infrastructure (fiber and coax) is installed according to a pre-designed RF coverage plan.

The wireless signal is shifted in frequency to the Alvarion intermediate band and then combined in the RF level. The combined RF signal is then converted to an optical signal which is being transmitted via the fiber link. At the coverage area the optical signal is being converted back to RF and propagated along the coaxial network down to the remote units. If required and in order to overcome the coax cable attenuation, a wire amplifier is used to boost the signal. Remote units are connected to the cable and transmit via a built-in antenna (or an external antenna) the wireless signals indoors at their original licensed frequency.

In the case of TDD transmissions such as WiMAX and LTE, the BreezeCELL equipment converts the TDD signal to FDD at both ends of the system (Headend and Remote). TDD synchronization is run over the system.

It is important to note that there is no modification to the original signal generated by the Wireless equipment. BreezeCELL is an active DAS, carrying the signal to the remote small antenna (Remote unit) where it radiates in its original form.

The following diagram illustrates the BreezeCELL network:

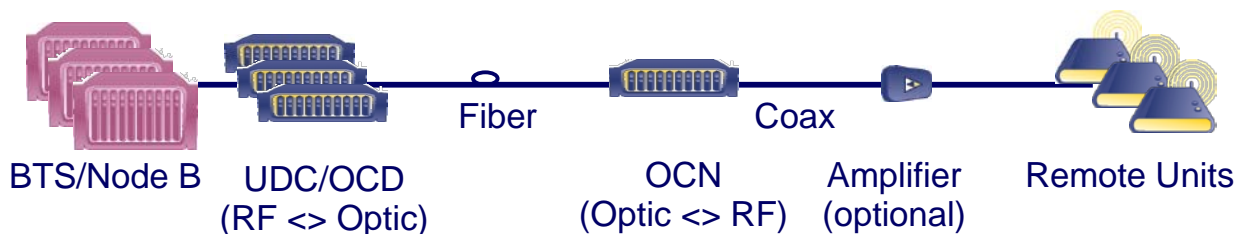


Figure 1: BreezeCELL Architecture

3.2 Existing Cable TV Network

A typical in building TV coax network is built as a tree and branch architecture. TV signals are delivered from a common source (which can be a terrestrial antenna, CATV or satellite dish/receiver) to TV outlets within the building. In order to compensate for losses in the coaxial cables a set of amplifiers are installed at various locations throughout the network to increase the signal gain. The signal is distributed to branches using taps and to the outlets using power dividers. Amplifiers can also be found in the branches.

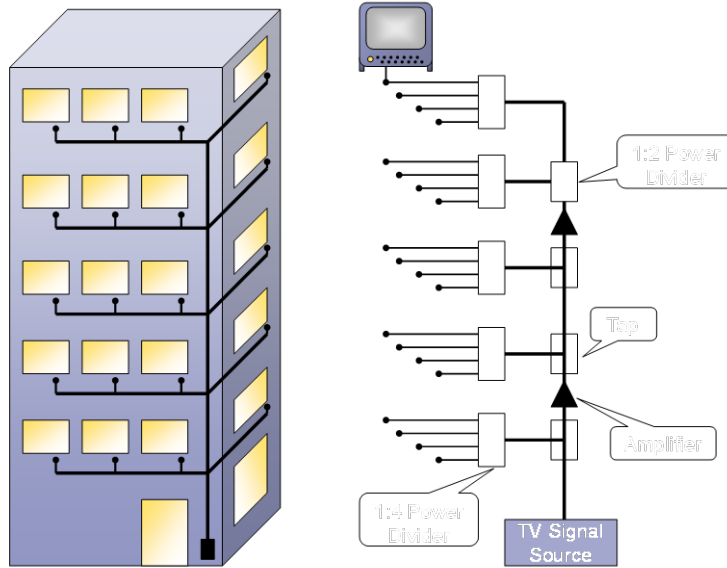


Figure 2: Typical Cable Network

3.2.1 Frequency Limitations

In order to pass through frequencies of 960 to 1155 MHz we need to examine the frequency limitations of the coax network elements. The only limiting element in the coax network is the amplifier used to boost the signal which is bypassed by the DAS system. All other elements namely coax cables, connectors, taps, power dividers and outlets are capable of handling the required frequencies.

3.2.2 BreezeCELL Solution

Wireless equipment is installed at the entry point of the TV signals to the building. The TV signals entry point may be a terrestrial antenna, a satellite dish or CATV feed. In some cases, like hotels, the source of the TV signals may be a stack of CATV or satellite receivers and a VOD/PPV system. The wireless equipment may be a microcell, a picocell or a wireless repeater.

The wireless signal is shifted in frequency to the Alvarion band and then combined with the TV signals. Since the Alvarion band is above the TV signal band, there is no interference between the two signals. The combined signal is propagated along the coaxial network down to the TV outlets. In order to overcome the frequency limitation of the cable amplifier a bypass circuit is used to separate the wireless signal, amplify it and then recombine the frequencies. At the end user's TV outlet a small CPE called Remote is connected which transmits the wireless signals indoors at their original licensed frequency.

In the case of TDD transmissions such as WiMAX, the BreezeCELL equipment converts the TDD signal to FDD at both ends of the system (Headend and Remote). TDD synchronization is run over the system.

It is important to note that there is no modification to the original signal generated by the Wireless equipment. BreezeCELL is an active DAS, carrying the signal to the remote small antenna (Remote) where it radiates in its original form.

The following diagram illustrates the BreezeCELL network overlaying the cable TV infrastructure:

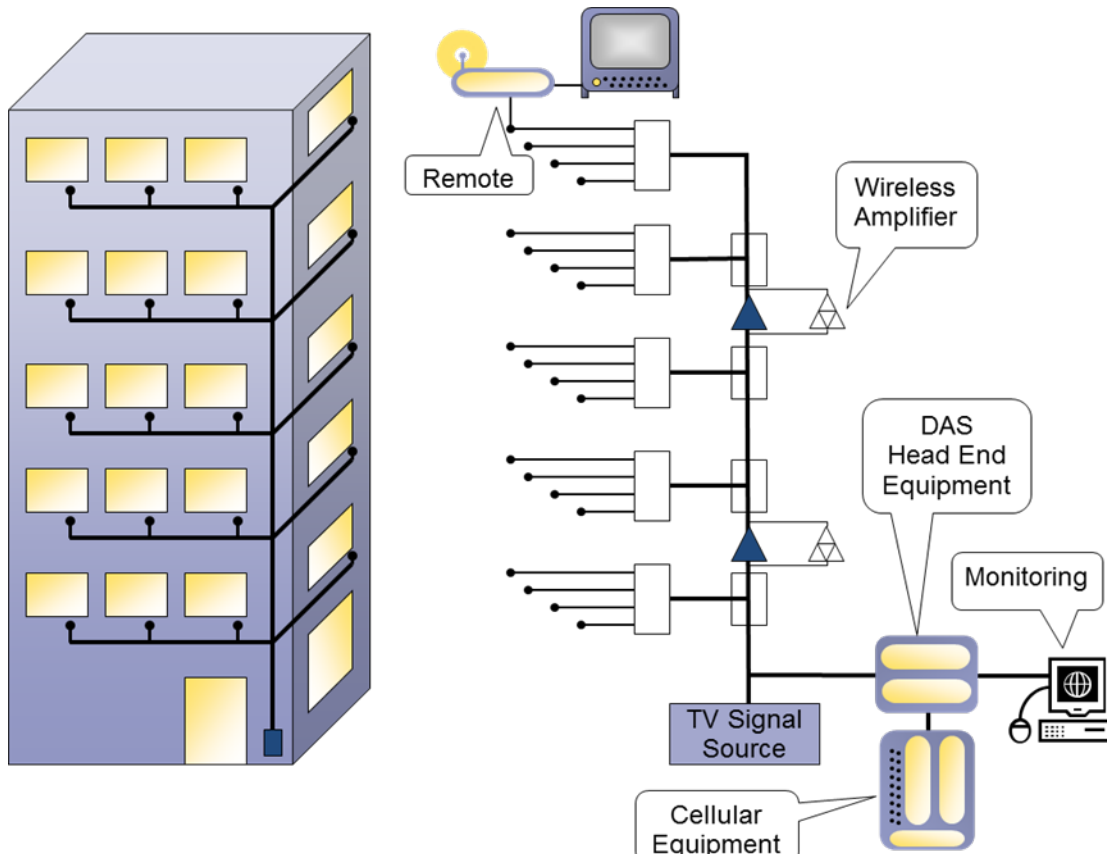


Figure 3: BreezeCELL Architecture

4 BreezeCELL Network Elements

The BreezeCELL network is composed of three parts: BreezeCELL Head end equipment, Coaxial Network equipment and Customer Premises (or end user) Equipment.

4.1 BreezeCELL Head End Equipment

The BreezeCELL head end equipment is co-located with the TV signal source of the building. The purpose of BreezeCELL's Head end equipment is aggregating wireless services signals, converting them into the correct frequency range and combining them on the coaxial network. Remote monitoring and control of the Remotes is performed using the monitoring system in the headend. The wireless equipment (microcell or repeater) is also installed at the same location.

4.1.1 UDC – Up Down Converter

The wireless native RF signal is inserted into Alvarion Up/Down Converter (UDC). The UDC converts the original wireless signal into the 960 – 1155 range. In TDD networks (WiMAX) the UDC also converts TDD signals to FDD. The output of several UDCs can be aggregated together by the CCD (see 4.1.2 below) in order to combine several operators and technologies or aggregate traffic.



4.1.2 CCD – Coax Cable Distribution

The CCD combines the RF inputs and outputs of several UDCs into a single coaxial connection. The CCD also provides a reference clock for all UDCs by supplying them an accurate 10 MHz clock signal. Through the CCD the system monitoring signals are sent to the network elements. A single CCD can support up-to 8 UDCs.

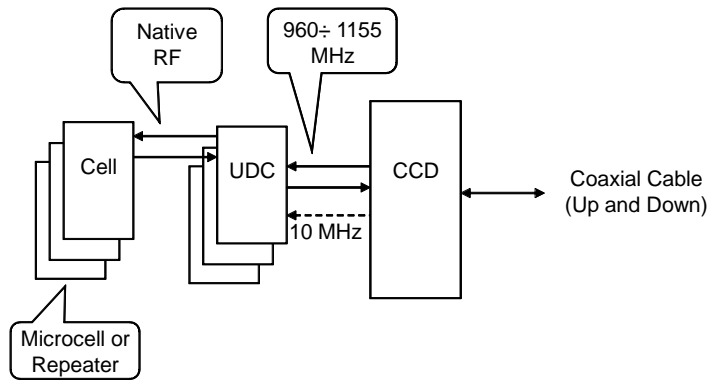


Figure 4: Head End Equipment

4.1.3 Monitoring & Control

A communication link exists between the Monitoring software residing on a PC at the headend and the remotes. The monitoring & control systems enables the user to remotely configure the Remotes operating frequencies, turn a Remote on/off and monitor various Remote parameters. Alarms generated at the Remotes will be communicated to Monitoring and be displayed for the user.

4.2 Optical Network Equipment

4.2.1 OCD – Optical Cable Distribution

The OCD has the same functionality of the CCD. OCD combines the RF inputs and outputs of several UDCs into a single fiber connection.

4.2.2 OCN – Optical Cable Node

A fiber is pulled in between the BTS location and the main coverage area, where coax is being laid. The optical signal is converted to RF signal using the OCN which is an RF optic transceiver.

4.3 Coaxial Network Equipment

The purpose of the bypass infrastructure is enabling the transfer of the 960 -1155 MHz frequency band over the standard cable TV Coax amplifiers. The cable TV amplifiers are the only element in the network which does not handle this frequency range and therefore the higher frequency signal should bypass those amplifiers and be amplified separately. The amplifiers are bi-directional and carry both the forward and return wireless signals.



BreezeCELL's coaxial bypass has very low power consumption and can be fed from the electrical grid or from AC voltage sent over the coax plant.

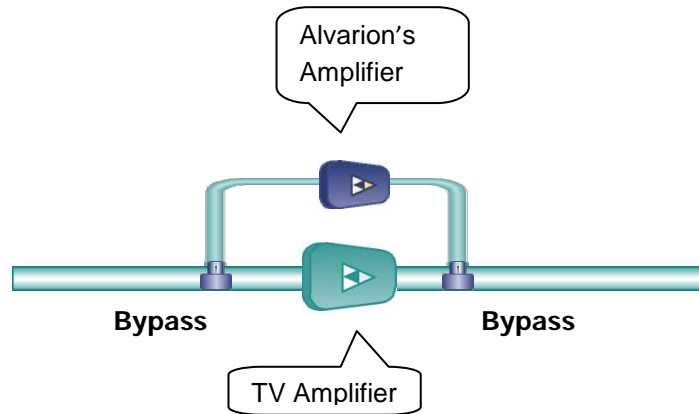


Figure 5: Bypass Infrastructure

4.3.1 Bypass Filter - Diplexer

The Bypass filter is a passive element that separates the lower frequency cable TV signals 5-860 MHz and the higher Alvarion's frequencies of 960- 1155 MHz. The design of the bypass filter is based on a diplexer which passes the standard cable TV signals with low attenuation and provides the required separation between them and the Alvarion signals. For self powering systems the diplexer also samples the AC signal that runs on the coax and uses it to power the Alvarion amplifier. A bypass filter is used for splitting the signals before amplification and for combining the wireless and cable signals after amplification.

4.3.2 Bi-directional Amplifier

This element compensates for the wireless signal losses that result from coax cable attenuation. The amplifier is a low power amplifier in order to draw minimal current from the cable network.

4.4 Remote Unit

The Remote is an active unit. The purpose of the Remote is to take the RF signals that are propagated via the cables, convert it to the native wireless frequency and transmit it in the air inside the building. The Remote contains a miniature UDC for frequency conversion, a transmitter and an internal antenna (external antenna connection is available as well). The Remote receives power through the cable and can be installed as a self contained unit.

The Remote units can be single or dual band

The Remote can operate in MIMO configuration for 4G networks.

5 Frequency Allocations

The up and down links of 75 MHz can be split and shared between several operators and technologies. A typical GSM operator requires 10 MHz and a typical UMTS operator 5 MHz. Frequency allocation planning is done based on the required services and technologies. A typical example is a combination of GSM and UMTS on a single network. Together they occupy 15MHz out of the available 75 MHz. Other operators and technologies can be added

6 MIMO Support

The system supports SISO or 2x2 MIMO (A and B). MIMO is supported using a **single cable**.

MIMO channels are frequency duplexed within the BreezeCELL band and sent across the infrastructure to the remote units. At the remote each channel is separated and transmitted from a dedicated antenna.



Figure 6: MIMO Utilization

7 Monitoring & Control

Monitoring provides the network operator with the ability to remotely monitor and if required configure the BreezeCELL Remotes. The Monitoring System comprises monitoring agents in the Remotes and a web based server co-located with the cable headend equipment. The agents are responsible for monitoring the status and configuring the Remotes while the server is responsible for displaying the data and interfacing to the user in a friendly manner.

The traffic between the monitoring system and the agents is carried over a proprietary communication modem channel that is established between the Remote agents and the server via the CCD. This channel is carried over the CATV network using dedicated bandwidth within the Alvarion band (960 MHz to 1155MHz). The physical layer of the channel is implemented by a two-way modem, an integral part of the agent. The MAC (Media Access Control) layer of the communication channel controls the access scheme over the shared CATV medium. A proprietary protocol is used over this communication channel in order to minimize the CPU performance and memory requirements of the agents.

During normal operation, the monitoring system receives failure messages from the Remotes and triggers a visual alarm on the screen with identification of the faulty Remote.



The monitoring system provides the user with a user friendly GUI. Using the GUI, the user is able to send commands to the Remotes (e.g. turning the Remote on and off), query for the status, and remotely configure (e.g. setting frequencies).

7.1 Monitoring Elements

A proprietary modem is located in the CCD which is able to communicate with all the Remotes. A similar modem resides in the controller of every Remote which enables the monitoring and configuration of the Remote.

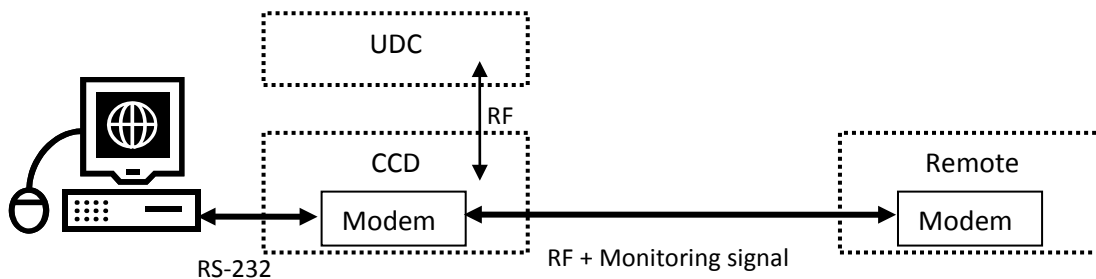


Figure 7: Monitoring Architecture

The Monitoring PC serial port is connected via an RS-232 cable to the CCD. The user has a Web based GUI and the PC translates the user operations into a set of commands transmitted by the modems between the PC and Remotes.

The PC polls all the Remotes at regular intervals to check their operational status and updates the database with the changes. The Remotes constantly monitor their internal status. In case of a fault the Remote will transmit a message to the PC to indicate the fault. The PC will update the database and GUI.

8 Installation Requirements and Procedures

8.1 CATV System (if applicable)

- Coax TV plant supporting 750/860MHz transmissions

8.2 Headend (Equipment Room)

- Equipment room 19" rack space for the following:
 - CCD – 2 U
 - UDC – 1 U (for each UDC)
 - monitoring PC – 1 U
- Available power outlets for CCD, UDCs,
- Socket outlets should be installed near the equipment and shall be easily accessible



- Additional two pole disconnect device (disconnect all poles simultaneously) should be provided in the building installation
- Monitoring system comprise of a Pizza box rack mounted PC. In case remote access is required, a TCP/IP link should be available as well.
- It is advisable that the BreezeCELL equipment will be co-located with the cellular BTS/Repeater and the TV headend. Otherwise connecting cables should be prepared.
- Equipment should be used in a RESTRICTED ACCESS LOCATION only

8.3 Coax Plant (if applicable)

- Available power outlet next to each TV amplifier
- Socket outlets should be installed near the equipment and shall be easily accessible
- Additional two pole disconnect device (disconnect all poles simultaneously) should be provided in the building installation
- Available space for 2 diplexers and 1 amplifier next to each TV amplifier
- Equipment should be used in a RESTRICTED ACCESS LOCATION only

8.4 Rooms (in case of CATV plant)

- TV outlet
- Available power outlet next to each TV outlet

9 Headend Equipment Installation

9.1 Connector Information

9.1.1 UDC

BTS/Node B: SMA female

10 MHz input: BNC female

Alarm output: D-type, 9 pin

9.1.2 CCD

UDC Up link: SMA female

UDC Down link: SMA female

10 MHz output: BNC female

RF output: F type female

9.2 Rack Installation

- The CCD is a non-configurable unit and therefore should be installed as the bottom unit.
- The UDCs are configurable units (Gain and Attenuation controls). In general UDCs will be shipped pre-configured from the factory. In case a configuration is needed the box's top cover needs to be opened. Configuration can be done externally, however it is advisable to leave room above the UDCs to allow for cover opening.

9.3 Connecting the BreezeCELL Equipment

1. Connect the DL port of the UDC to the CCD Down Link port using a SMA/SMA cable. (Figure 11-1)
2. Connect the UL port of the UDC to the CCD Up Link port using a SMA/SMA cable. (Figure 11-2)
3. Connect the 10 MHz in port of the UDC to the 10 MHz output port in the CCD using a BNC/BNC cable. (Figure 11-3)
4. Repeat steps 1 – 3 for all UDCs
5. After power up, all LEDs should be green.



Figure 8: Headend Equipment Connections

9.4 Connecting the Monitoring System

1. Connect the PC to the monitor and both to the power outlet
2. Connect the Dry contacts interface Advantech USB-4761 to the USB port at the back of the PC
3. Connect the PC to the CCD serial port (on the back) using a DB9 serial cable (male to female)
4. Connect the female side of the DB9 cable to the PC serial port (light blue colored with the symbol IOIOI)
5. Connect the male side of the DB9 cable to the serial port on the back of the CCD



9.5 Connecting External Alarms

9.5.1 UDCs

Each UDC is equipped with an external alarm output at the back of the unit. Any UDC failure will light the Alarm LED on the front panel and trigger the dry contact whose output is at the back. The alarm is normally closed and will open once triggered or when there is no power to the UDC. Alarm output is at pins 2 and 3 of the 9 pin D-type connector. Connect an appropriate cable between the alarm output and the BTS alarm input (or other input source).



Figure 9: UDC Alarm Output

9.5.2 Monitoring

The system uses an Advantech USB dry contacts adaptor for alarm indications.

Relay #0 – provides alarm for a single remote unit failure

Relay #1 – provides alarm for a multiple remote units failure

Single remote unit alarm: For a Normally closed operation connect NC0 and COM0 to the relevant BTS alarm port

Multiple remote units alarm: For a Normally closed operation connect NC1 and COM1 to the relevant BTS alarm port

9.6 Connecting the Base Stations

UDC input power range is +10 dBm to +33 dBm. The BTS/Node B output power should be adjusted to meet this requirement. In case BTS power exceeds the requirement an external attenuator should be connected

Note: Only the downlink path should be attenuated!

In case of a combined up/down links, it is advisable to split between uplink and downlink paths, and place the attenuator on the downlink path only.

Connect the output of the BTS/Node B to the appropriate BTS/Node B connector in the relevant UDC (An N-to-SMA or other adaptor might be required according to the BTS output connector).

9.7 UDC Configuration

UDCs are pre-configured at the factory. In case a change of configuration is required the units are capable of configuring the BTS attenuation and the gain control. Setting requires removal of the UDC cover.



9.7.1 BTS Attenuation Setting

The UDC input power is limited. An internal attenuator allows inputs of +10 dBm to +33 dBm. In case the output is larger a separate attenuator on the downlink only is required.

Switches represent values of: 1, 2, 4, 8, 16 dB.

The left most switch has the highest attenuation – 16 dB. The right most switch represents the least attenuation – 1 dB.

The output level of the downlink cellular signal in the Alvarion band should be 0 ± 1 dBm.

The following figure demonstrates the location of the attenuator:

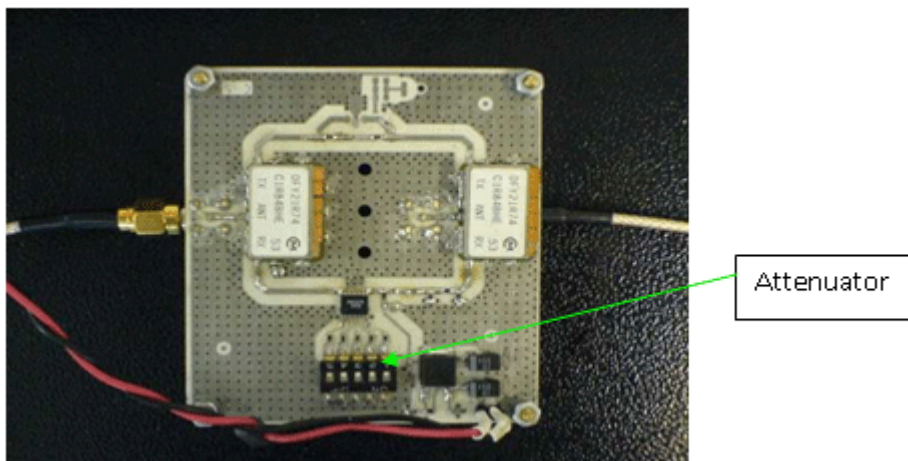


Figure 10: BTS Attenuator

9.7.2 Gain Configuration

The UDC has internal attenuators that allow you to control the Pilot signal level and up link and down link gains

Switches represent values of: 1, 2, 4, 8, 16 dB.

The left most switch has the highest attenuation – 16 dB. The right most switch represents the least attenuation – 1 dB.

All signals are pre-configured according to network parameters.

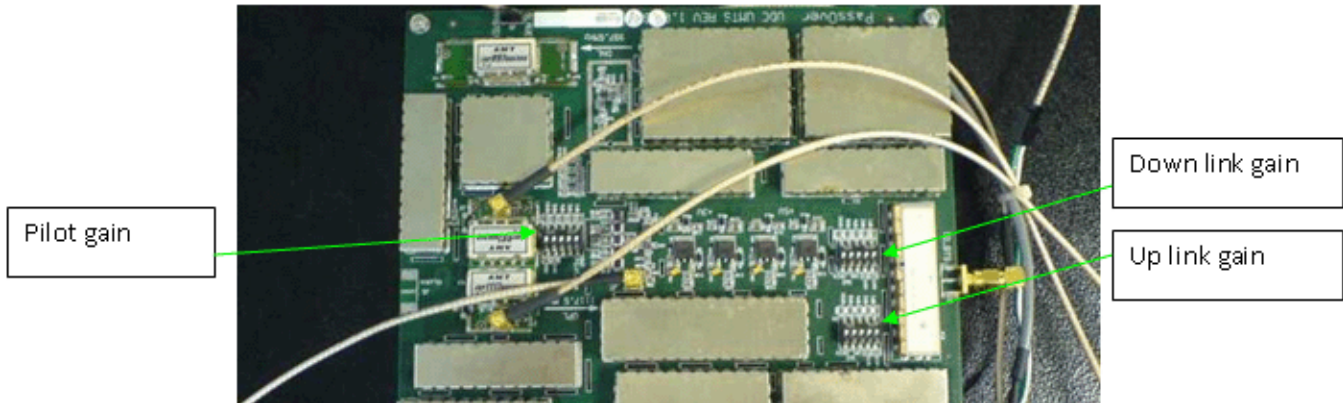


Figure 11: Gain Configuration

If configuration is required:

1. Measure the signal at the UDC DL out port and configure the Pilot signal (962 MHz) to be 0 ± 1 dBm.
2. Measure the cellular downlink signal at the UDC DL out port and adjust it to be 0 ± 1 dBm.
3. Measure the signal at the UDC UL in port and adjust the uplink cellular signal so there is a 0 ± 5 dB end-to-end Gain (Remote Unit to UDC).

9.7.3 Frequency Configuration

UDC frequency configuration is required in the event the UDC is not pre-configured with the correct operating frequencies. Using the configuration software is described in appendix A.

9.8 Pilot Master/Slave Configuration

When working with multiple UDCs only one pilot signal should be generated. Therefore one UDC should be configured as Master and the rest as Slaves.

Note: The power to the UDC and CCD units should be disconnected before performing the following procedure.

Locate the Master/Slave jumper on the further left corner of the main UDC circuit board. There are three pins. Place the jumper (J9) on the left and middle pins for Master. Place the jumper (J9) on the right and middle pins for Slave.

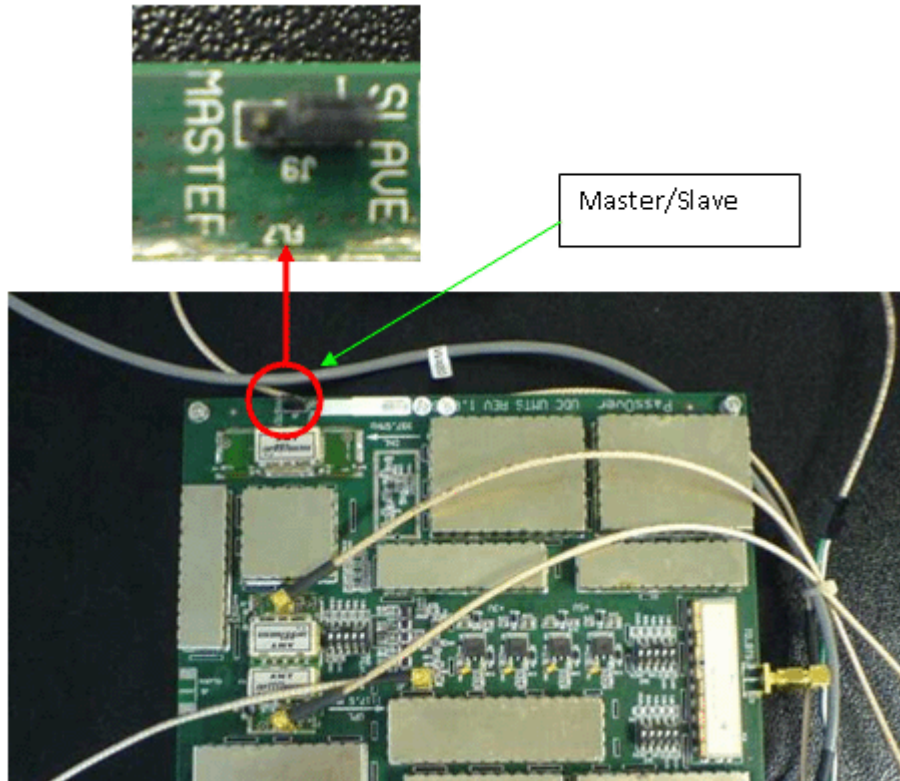


Figure 12: Master/Slave Configuration

9.9 Measurements

Required test equipment is a spectrum analyzer (capable of measuring both the cable and wireless frequencies).

In case a BTS/Node B is not available, a signal generator can be used to simulate the signal.

Connect the spectrum analyzer to the DL OUT port of the UDC and verify:

1. Pilot signal at 962 MHz at a 0 ± 1 dBm level.
2. Cellular signal is at the correct frequency (as was configured in the UDC) and at a 0 ± 1 dBm level.

9.10 Connecting to the Coax TV Networks

1. Identify the source of the TV signal.
2. Identify the most convenient point of connection before the first branch.
3. Measure and record the TV signals level with a spectrum analyzer
4. Disconnect the TV source and the building network input.
5. Install a BreezeCELL input diplexer to combine the wireless signal from the BreezeCELL network to the coax TV network:
6. Connect the diplexer AMPLIFIER port to the coax TV source
7. Connect the diplexer RPT port to the CCD RF OUTPUT port



- The diplexer CABLE port now carries the combined TV and wireless signal. Connect the CABLE port the to the building coax network input

Note: The diplexer AC port will be in use only when the coax network is self powered by a 60 VAC source.

9.11 Measurements

Use a spectrum analyzer to verify that the CABLE output of the diplexer includes the cellular, pilot and TV signals at their respective power levels as measured in sections 7.9 and 7.10.

9.12 Localized Testing Port

The CCD is equipped with an ability to locally test the BTS connectivity and proper remote unit operation. The RF Output Monitoring connector in the front of the CCD is a output that is similar to the CCD RF Output with a -40 dB attenuation. A remote unit can be directly connected to this output to test the BTS output without the need to disrupt the coax plant.

9.13 Determining BTS Output Power VS. Remote Unit Output Power

BreezeCELL remote units are offered with two output power settings: 0 dBm and 10 dBm. The remote unit output power setting is per carrier. The system maintains constant linear gain between the BTS and the remote unit, thus enabling the BTS/MS power control mechanism to operate normally. The BTS power output should be configured not to exceed the UDC input power specification.

Example:

- GSM BTS with a 46 dBm output power.
- External downlink attenuation between BTS and UDC (Attenuation at UDC input)
- UDC internal attenuation set at 20 dB
- Remote unit output power 10 dBm (per carrier)
- GSM BCCH is measured at 0 dBm at the output of the UDC

Number of Carriers	Attenuation at UDC Input [dB]	UDC Output [dBm]	Remote Unit Output Power [dBm]
1	26	0	10
2	23	3	13
4	20	6	16
8	17	9	19

10 Coax Network Amplifier Installation (if applicable)

The coax plant includes amplifiers that compensate the TV signal for the cable loss. A wireless amplifier should be installed in parallel to each TV amplifier. A set of two diplexers (bypass filters) and an amplifier is required for every TV amplifier.

10.1 Connections

All connection are done using an F-male to F-male cable

1. Disconnect the input of the TV amplifier and connect it to the CABLE port of diplexer 1. (Fig. 15-1)
2. Connect the AMPLIFIER port diplexer 1 to the input port of the TV amplifier. (Fig. 15-2)
3. Connect the RPT port to the BreezeCELL amplifier DL IN port. (Fig. 15-3)
4. Disconnect the coax network cable from the output port of the TV amplifier and connect it to diplexer 2 CABLE port. (Fig. 15-4)
5. Connect the output port of the TV amplifier to the AMPLIFIER port of diplexer 2. (Fig. 15-5)
6. Connect the RPT port of diplexer 2 to the UL IN port of the BreezeCELL amplifier. (Fig 15-6)
7. Connect the BreezeCELL amplifier to the power grid using the 7.5 VDC power supply. (Fig. 15-7)

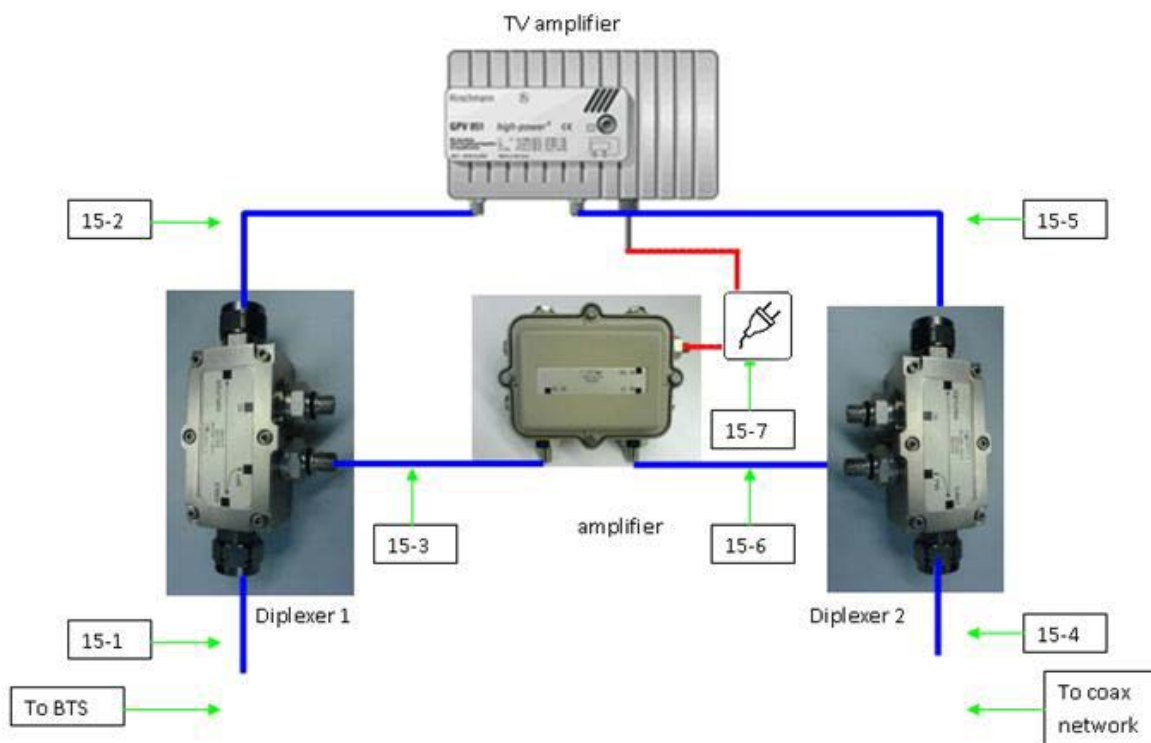


Figure 13: BreezeCELL Amplifier and Diplexer Connection



10.2 Testing and Measurements

1. Measure the cellular downlink signal at the UL IN port of the amplifier (The amplified downlink signal). Verify existence of the pilot signal at 962 MHz and of the cellular signal. Both signals should be at a 0 ± 3 dBm level
2. Verify that there is no degradation to the TV signal at the output of diplexer 2.

11 Remote Unit Installation

11.1 Remote Unit Registration

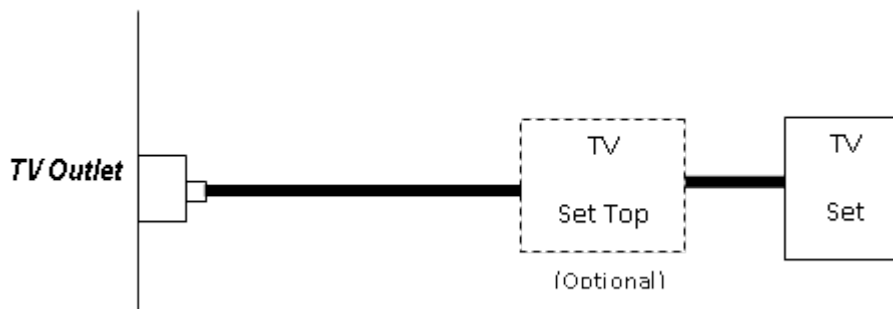
Each new remote unit should be registered in the monitoring system data base (See chapter 10) PRIOR to installation.

11.2 Remote Unit Connection (if Applicable)

The remote unit is installed in series to the TV, between the TV (or Set Top box) and the wall outlet.

The remote unit should be installed according to the following diagram:

Standard TV connection (before remote unit installation):



Remote unit connection:

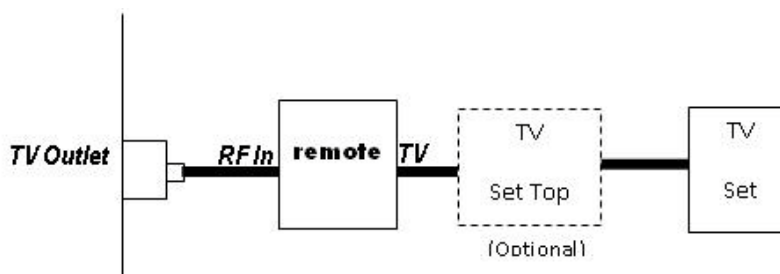


Figure 14: Remote Unit Connection

11.3 Remote Unit Installation Kit

- Remote unit
- AC/DC Power Supply: AC Input - 100-240V, 50/60Hz; DC Output – 5.7 VDC, 3.5 A



- Coaxial Cable (F-Type Connectors)
- Power Supply (provided separately), complying with the following specifications:
 - Certified to the EU market:
 - According to EN/IEC 60950-1 (LPS evaluated)
 - Rated Input: 100-240VAC, 0.5-0.17 A, 50 or 60 Hz
 - Rated Output: 5.7 ± 0.5 VDC, 2.7 A

**CAUTION**

Use only the power supply provided with the installation kit

11.4 Installation and Testing Procedure

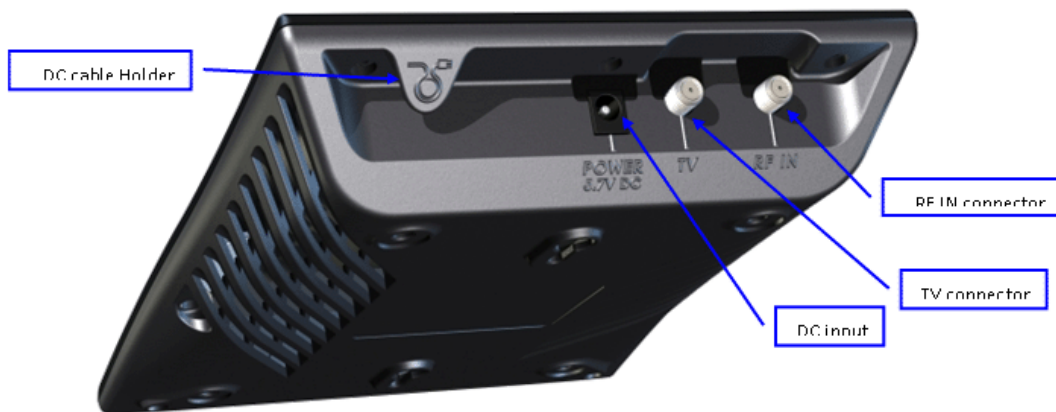


Figure 15: Remote Unit Rear View

1. Turn off the TV and the TV Set Top Box (if exists)
2. Identify the Coaxial Cable that is connected between the Cable TV Outlet and the TV or the Set Top Box. Disconnect this cable from the TV or Set Top Box and connect it to the RF IN connector of the remote unit.
3. Connect the TV connector of the remote unit to the TV or the Set Top Box with a Coaxial cable (included in the Installation Kit). Turn on the TV (and the TV Set Top Box).
4. Connect the Power Supply (included in the Installation Kit) to the DC Input of the remote unit. Secure the DC cable using the DC cable holder. Connect the Power Supply to the electrical socket.
5. Verify that the LED on the remote unit's front illuminate. The LED should turn orange and after a few seconds turn green.
6. Verify that the reception of TV programs is in order.



11.5 Remote Unit Configuration

The remote unit will automatically receive all the configuration data from the monitoring system. The remote unit will not start transmitting before receiving acknowledgment from the monitoring system that the parameters loaded into its memory are valid.

In the case of a power down, once power restored the remote unit will wait 1 minute before starting to transmit with its initial configuration parameters.

11.6 Normal Operation

The remote unit LED should be green.

11.7 Recommended Measurements

11.7.1 Testing the First Remote Units

It is advised to perform the following measurements for the first few remote units installed in the network to verify proper operation:

1. Measure signal levels at the coax cable connection between the wall outlet and the remote unit. The pilot and the cellular signals should be visible at levels between -20 dBm to -50 dBm (dependant of the coax length in this specific network branch)
2. In case a remote unit with external RF outputs is available, measure that the output power is 10 dBm (as specified) and the RF output is at the correct cellular frequency

11.7.2 Standard Remote Unit Testing

For all remote units perform the following:

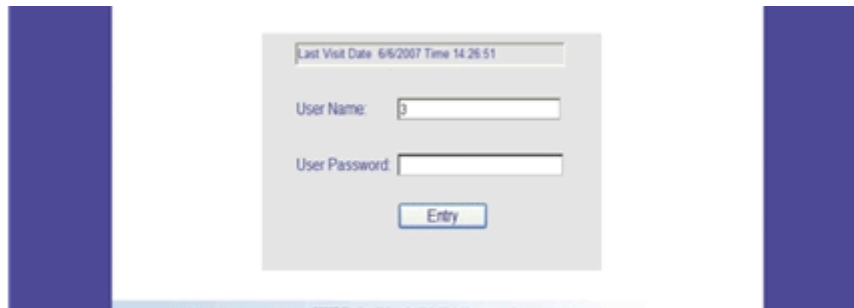
1. After installing the remote unit, verify the LED is green
Using dedicated cellular test equipment (Handset with test mode or specialized h/w)
2. Measure the cellular downlink signal.
3. Generate a call and test: coverage quality (walk test), call quality and uplink transmit power
4. In case there is a problem perform the measurements in section 9.7.1 for further troubleshooting

12 Preparing for Remote Unit Installation

All operation and maintenance actions are done through the monitoring system. The monitoring system is a web based application residing on a local PC which serves as a web server.

12.1 Logging into the Monitoring System

Upon activation of the system, the user will be directed to the entry screen and prompted to enter User Name and User Password. Enter the login information to enter the system.



After logging in, the main screen will be the Alarms Log.

12.2 Configuring a Global Parameter Set (GPS)

A group of remote units with the same frequency requirements should be allocated a common parameter set called GPS. Each GPS include:

- Cellular (Air) Up Link Frequency
- Cellular (Air) Down Link Frequency
- CATV Up Link Frequency
- CATV Down Link Frequency

A change in the GPS will generate a change in each remote unit using this GPS.

Note: You can't edit the GPS name, as this is used by its associated remote units

	Name	Description	Technology	Bandwidth	Air Up Freq	Air Down Freq	CATV Up Freq	CATV Down Freq
<input type="button" value="Edit"/>	PCS 1900	STL	PCS	10	1900000	1980000	1100000	990000
<input type="button" value="Edit"/>	UMTS 1	Operator	UMTS	10	1945000	2135000	1120000	980000
<input type="button" value="Edit"/>	GSM 1800 1	Operator	GSM 1800	10	1735000	1830000	1100000	1020000

12.2.1 Adding a GPS

1. From the menu GPS MAINTENANCE choose Add Group Parameters
2. Press the ADD GPS button on the top left side of the screen. The GPS configuration table will appear.
3. Enter a Name and Description of the GPS. The name should be unique.
4. Choose the technology from the list: GSM 900, GSM 1800, UMTS, PCS, iDEN, US Cellular
5. Choose the channel Bandwidth of the remote unit (factory hardware preset)
6. Fill in the Cellular and CATV frequencies according to your frequency plan so that there is a match with the channel bandwidth and the technology. The frequency units are [KHz]
7. Press Save to update the database
8. Repeat steps b to g for each GPS required in the network



In the case of a dual technology remote unit, two separate GPSs are required for the remote unit to be fully operational.

Name	<input type="text"/>
Description	<input type="text"/>
Technology	GSM 1800
Bandwidth	5
Air Up Freq	<input type="text"/>
Air Down Freq	<input type="text"/>
CATV Up Freq	<input type="text"/>
CATV Down Freq	<input type="text"/>
<input type="button" value="Close"/> <input type="button" value="Save"/>	

12.2.2 Deleting a GPS

Note: You should delete a GPS only if there are no remote units that belong to this GPS!

1. From the menu GPS MAINTENANCE choose View Group Parameters
2. Press the EDIT button of the relevant GPS
3. Press the DELETE button
4. Press the confirmation button

Name	GSM 1800 Mid
Description	Mid Bandwidth
Technology	GSM 1800
Bandwidth	10
Air Up Freq	1715000
Air Down Freq	1810000
CATV Up Freq	1090000
CATV Down Freq	970000
<input type="button" value="Close"/> <input type="button" value="Delete"/> <input type="button" value="Save"/>	
<input type="button" value="Press to confirm"/>	

12.3 Adding and Registering a New Remote Unit

Each remote unit installed in the network should be defined and registered prior to installation.

1. From the remote unit MAINTENANCE menu choose Edit/Add remote unit
2. Press the Add remote unit button on the top left side of the screen. The remote unit configuration table will appear.
3. Input all remote unit parameters:
 - Remote unit ID = serial number
 - Location [Free text]
 - Information [Free text]



- Number of instances - single [1] or dual technology [2]
 - GPS1 & GPS2 – choose from defined GPS list
4. Press the Save button to input the remote unit into the database

The screenshot shows a software interface with a table and a configuration form. The table has columns for PINDU ID, Location, Information, # Instances, GPS 1, and GPS 2. A row is visible with PINDU ID 12321, Location ROOM 102, Information Test Unit, # Instances 1, and GPS 1 GSM 1800 Max. To the right of the table is a configuration form with fields for PINDU ID, Location, Information, # Instances (set to 1), GPS 1 Name (set to GSM 1800 Max), and GPS 2 Name. There are 'Close' and 'Save' buttons at the bottom of the form.

12.4 Installing a Remote Unit

Once a remote unit is installed in the field, it will communicate with the monitoring system and will receive operational configuration parameters. There are two possible scenarios:

- Uninstalled remote unit – a remote unit which is defined in the database
- Undefined remote unit – a remote unit which was not previously defined in the database

12.4.1 Uninstalled Remote Unit

Adding a new remote unit into the database will generate an uninstalled remote unit entry. This refers to a remote unit that was properly defined in the system and should be installed in the field. At the moment the remote unit is physically installed, it communicates with the monitoring system, all parameters are verified and downloaded to the remote unit, after that the remote unit receives a permission to radiate.

12.4.2 Undefined Remote Unit

A remote unit that was physically installed in the field, but was not entered into the database prior to installation. Such a remote unit will be transferred to the undefined remote unit s list and requires operator configuration of the relevant parameters in the monitoring system to become operational.

12.4.3 Adding an Undefined Remote Unit into the Database

1. From the remote units Lists menu choose Undefined remote units
2. Choose the relevant remote unit from the list and press the EDIT button on the left side of the remote unit entry. A configuration screen will appear.
3. Enter the remote unit information
 - Location [Free text]
 - Information [Free text]
 - Number of instances - single [1] or dual technology [2]



- GPS1 & GPS2 – choose from defined GPS list
4. Press the Save button to input the remote unit into the database.

	PINDU ID	Location	Information	# Instances	GPS 1	GPS 2
<input type="button" value="Edit"/>	14807195			1		

PINDU ID	<input type="text" value="14807195"/>
Location	<input type="text"/>
Information	<input type="text"/>
# Instances	<input type="text" value="1"/>
GPS 1 Name	<input type="text"/>
<input type="button" value="Close"/>	
<input type="button" value="Save"/>	

12.4.4 Deleting an Undefined Remote Unit from the List

1. From the remote units Lists menu choose Undefined remote units
2. Choose the relevant remote unit from the list and press the EDIT button on the left side of the remote unit entry. A configuration screen will appear.
3. Press the Delete button
4. Press the Confirmation button to confirm

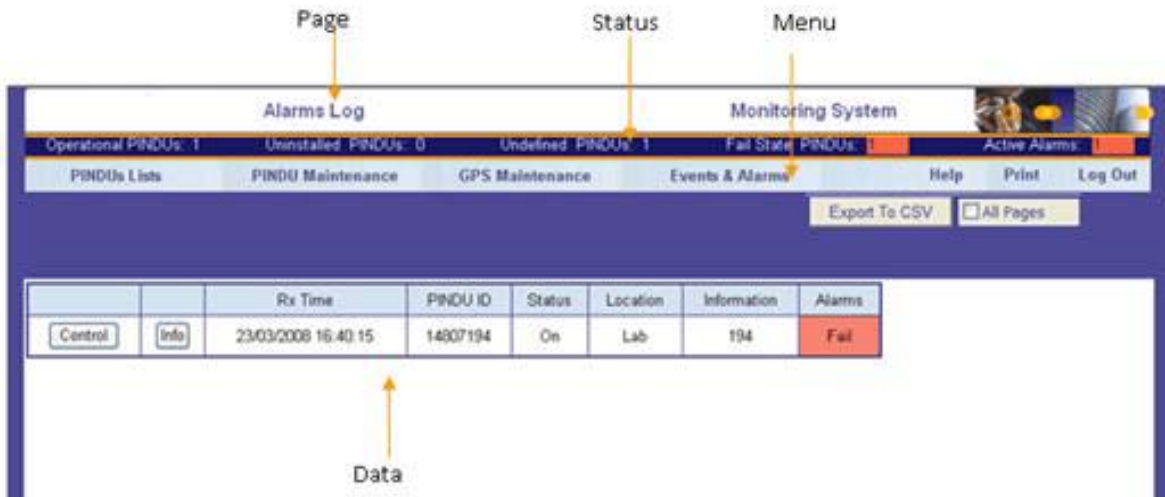
13 Normal Operations

To start the program, perform the following steps:

- Turn the PC on and log in if necessary
- The S.N.A.P monitor software will start-up automatically. In case the monitor software has been manually closed it can be activated again using the monitor short cut on the desktop.
- Start the Internet explorer application by double clicking on the desktop icon

The system enables the operator to perform the following tasks

- View the network current status (Alarms, Events, remote unit status)
- Perform commands on a specific remote unit
- Perform commands on all the remote units in the network simultaneously



13.1 Logging into the Monitoring System



Upon activation of the system, the user will be directed to the entry screen and prompted to enter User Name and User Password. Enter the login information to enter the system.

After logging in the main screen will be the Alarms Log

13.2 The Status Bar

On the top of the screen there is a status bar which remains visible in all the screens. The Status Bar provides immediately available information for the operator regarding:

- Number of Operational remote units
- Number of Uninstalled remote units
- Number of Undefined remote units
- Number of Failed remote units
- Number of Active Alarms

13.3 Viewing Remote Units Status

The operator can view a list of all operational remote units status and configuration or alternatively look at a single remote unit.



13.3.1 Viewing the Operational Remote Units Status

- From the remote units Lists menu choose Operational remote units.
- The screen will display a list of all operational remote units with the following parameters for each one:
 - Status of communication with remote unit
 - Time and date of last status update
 - Remote unit ID – remote unit serial number
 - General Status – remote unit On/Off
 - Pilot Lock – System Pilot signal reception OK/Fail
 - Gain – Input to output gain setting
 - Instances – Single or Dual band
 - Instance 1 Status – On/Off
 - Instance 1 Synthesizer Lock Status – OK/Fail
 - Instance 1 Technology – GSM 900/GSM 1800/UMTS/PCS/iDEN/US Cellular
 - Instance 2 Status – On/Off
 - Instance 2 Synthesizer Lock Status – OK/Fail
 - Instance 2 Technology – GSM 900/GSM 1800/UMTS/PCS/iDEN/US Cellular
- On the left side of each remote unit entry there is an INFO button. Pressing the view button will show the full detail list for the chosen remote unit.

Show PINDUs Configuration													
	Comm Status	Rx Time	PINDU ID	Status	PINDU Pilot	Gain	# Inst	Instance Status 1	Synth Lock Status 1	Technology 1	Instance Status 2	Synth Lock Status 2	Technology 2
Info	O.K.	23/03/2008 17:15:00	14807194	On	O.K.	34	2	On	O.K.	GSM 1800	On	O.K.	UMTS

13.3.2 Viewing the Operational Remote Units Configuration

- In the Operation remote unit status screen press the button: Show remote units Configuration
- The screen will display a list of all operational remote units with the following parameters for each one:
 - Status of communication with remote unit
 - Time and date of last status update
 - Remote unit ID – remote unit serial number
 - Location – Operator entered free text
 - Information – Operator entered free text



- Hardware version
 - Software version
 - Communication protocol version
 - Output power type – 0 dBm or 10 dBm
 - Instances – Single or Dual band
 - GPS 1 – Global Parameter Set for instance 1
 - GPS 2 – Global Parameter Set for instance 2
3. On the left side of each remote unit entry there is an INFO button. Pressing the view button will show the full detail list for the chosen remote unit.

Show PINDUs Status												
	Comm Status	Rx Time	PINDU ID	Location	Information	HW Version	SW Version	Protocol Version	OutputPowerType	# Instances	GPS 1	GPS 2
Info	O.K.	23/03/2008 17:20:16	14807194	Lab	194	005-00-1	S1.00.01	P1.00.01	0	2	GSM 1800 1	UMTS 1

13.3.3 Viewing the Complete Information of a Single Remote Unit

1. From the Operational remote unit screens, press the info button
2. Alternatively, from the remote unit Maintenance menu choose remote unit Information
3. Search for the relevant remote unit according to the remote unit ID/Location/Information
4. The chosen remote unit will be displayed with complete information
5. The remote unit info can be refreshed by pressing the GET STATUS button
6. The remote unit can be controlled by pressing the SEND CONTROL button. This action will link to the remote units commands page with the chosen remote unit

Search By ID
Search By Location
Search By Information
Search

General Info	Instance 1	Instance 2				
PINDU Last RX	23/03/2008 17:21:06	GPS Name	GSM 1800 1	GPS Name	UMTS 1	Send Control
PINDU ID	14807194	Air Up Frequency	1735000	Air Up Frequency	1945000	
PINDU Definition		Air Down Frequency	1830000	Air Down Frequency	2135000	Get Status
PINDU Status	On	CATV Up Frequency	1100000	CATV Up Frequency	1120000	
PINDU Location	Lab	CATV Down Frequency	1020000	CATV Down Frequency	980000	
Information	194	Technology	GSM 1800	Technology	UMTS	
HW Version	005-00-1	Bandwidth	10	Bandwidth	10	
SW Version	S1.00.01	Instance Status	On	Instance Status	On	
Protocol Version	P1.00.01	Synthesizer Lock Status	O.K.	Synthesizer lock status	O.K.	
Pilot Lock Status	O.K.	Synthesizer Unlock Counter	0	Synthesizer Unlock Counter	0	
Pilot Unlock Counter	0					
Monitor Off Counter	0					
PINDU Gain	35	PINDU Alarm		PINDU Communication		
Number of instances	2					
Output Power Type	0					

The following information is available for each remote unit:



- Time and date of last status update
- Remote unit ID – remote unit serial number
- Remote unit Definition – Operational/Uninstalled/Undefined
- General Status – remote unit On/Off
- Location – Operator entered free text
- Information – Operator entered free text
- Hardware version
- Software version
- Communication protocol version
- Pilot Lock – System Pilot signal reception OK/Fail
- Pilot Unlock counter – the number of Pilot unlock occurrences since last counter reset
- Monitor off counter – the number of monitor unlock occurrences since last counter reset
- Remote unit Gain – Input to output gain setting
- Instances – Single or Dual band
- Output power type – 0 dBm or 10 dBm

For each instance the following parameters:

- GPS name – Global Parameter Set for instance
- Air Up Frequency – Wireless uplink frequency
- Air Down Frequency – Wireless downlink frequency
- CATV Up Frequency – Cable allocation uplink frequency
- CATV Down Frequency – Cable allocation downlink frequency
- Instance Technology – GSM 900/GSM 1800/UMTS/PCS/iDEN/US Cellular/WiMAX
- Instance Status – On/Off
- Instance Synthesizer Lock Status – OK/Fail
- Instance Synthesizer unlock counter – the number of synthesizer unlock occurrences since last counter reset

Global alarms:

- Remote unit ALARM – a sum of all remote unit alarms
- Remote unit Communication – status of communication between PC and remote unit



13.4 Controlling Remote Units

13.4.1 Controlling a Single Remote Unit

1. From the INFO page press SEND CONTROL
2. Alternatively, from the remote unit Maintenance menu choose remote unit Commands
3. Search for the relevant remote unit according to the remote unit ID/Location/Information
4. The chosen remote unit will be displayed with configuration information
5. Press the CONTROL button on the left side of the row. A window will open.
6. Choose the required Command
 - OUTPUT - remote unit RF Output Enable – On/Off
 - Counters – Reset all unlock counters (Pilot/Synthesizers/monitor)
 - Remote unit Reset – Reset the remote unit software
 - Instance 1 – Turn instance 1 output RF off
 - Instance 2 Reset – Turn instance 2 output RF off
7. Press the SEND button

Note: Only a single command can be issued!

	PINDU ID	Location	Information	# Instances	GPS 1	GPS 2
<input type="button" value="Control"/>	12321	ROOM 102	Test Unit	1	GSM 1800 Max	

Unit ID: 12321

Location: ROOM 102

Output:

Counters:

PINDU Reset:

Instance 1:

Instance 2:

13.4.2 Issuing a Global Command

A global command affects all the remote units in the network.

1. From the remote unit Maintenance menu choose Global Commands
2. Choose the required Command
 - Remote unit RF Output Enable – On/Off
 - Counters Reset– Reset all unlock counters (Pilot/Synthesizers)
 - Remote unit Reset – Reset the remote unit software
 - Instance 1– Turn instance 1 output RF off



- Instance 2 – Turn instance 2 output RF off
3. Press the SEND button
 4. Press the CONFIRMATION button

Note: Global Command may be Service effecting and generate a service down time. Sending a Global Command will generate a process of communication between all remote units and the Monitoring system. When performing a Global Command such as RESET, sufficient time should be allowed for all elements in the system to respond and stabilize. Do not perform any operations for 2 minutes.

Note: Only a single command can be issued!

The screenshot shows a configuration window with the following elements:

- Output: Off (dropdown menu)
- Counters: (dropdown menu)
- PINDU Reset: (dropdown menu)
- Instance 1: (dropdown menu)
- Instance 2: (dropdown menu)
- Send: (button)
- Press to confirm: (button)

13.4.3 Editing Remote Unit Configuration

1. From the remote unit Maintenance menu choose Edit/Add remote unit
2. Choose the relevant remote unit from the list
3. Press the EDIT button on the left side of the row
4. An information screen will appear on the right side
5. Modify the required parameters:
 - Remote unit Location – Free Text
 - Remote unit Information – Free Text
 - Number of Instances – Choose the correct option for the remote unit
 - GPS 1 – Choose the relevant GPS for instance 1
 - GPS 2 – Choose the relevant GPS for instance 2
6. Press the SAVE button will generate communication to update the remote unit in the field



The screenshot shows the 'Add PINDU' interface. At the top, there are search filters: 'Search By ID', 'Search By Location', and 'Search By Information', each with a text input field and a 'Search' button. Below this is a table with the following columns: PINDU ID, Location, Information, # Instances, GPS 1, and GPS 2. The table contains one row with the following data: PINDU ID: 14807194, Location: Lab, Information: 194, # Instances: 2, GPS 1: GSM 1800 1, and GPS 2: UMTS 1. To the left of the table is an 'Edit' button. To the right is a detailed view form with the following fields: PINDU ID (14807194), Location (Lab), Information (194), # Instances (2), GPS 1 Name (GSM 1800 1), and GPS 2 Name (UMTS 1). At the bottom right of the detailed view are buttons for 'Close', 'Delete', and 'Save'.

Note: GPS changes will take place only after resetting the remote unit (see section 3.4 controlling remote units)

13.4.4 Deleting a Remote Unit from the Database

1. From the remote unit Maintenance menu choose Edit/Add remote unit
2. Choose the relevant remote unit from the list
3. Press the EDIT button on the left side of the row
4. An information screen will appear on the right side
5. Press the DELETE button
6. Press the CONFIRMATION button to delete

The screenshot shows a 'Delete Confirmation' dialog box. It contains the following fields: PINDU ID (12321), Location (ROOM 102), Information (Test Unit), # Instances (1), and GPS 1 Name (GSM 1800 Max). At the bottom are buttons for 'Close', 'Delete', and 'Save'. Below the dialog box is a red bar with the text 'Delete Confirmation'.

Note: Always leave at least one remote unit in the database. The database shouldn't be empty

13.5 GPS Maintenance

13.5.1 Editing a GPS

1. From the GPS Maintenance menu choose View Global Parameters
2. Choose the relevant GPS from the list
3. Press the EDIT button on the left side of the row
4. An information screen will appear on the right side
5. Modify the required parameters:



- GPS NAME – Free Text
 - GPS Description – Free Text
 - Technology – Choose between GSM 900/GSM 1800/UMTS/PCS/iDEN/US Cellular/WiMAX 2.5 GHz
 - Bandwidth – Choose between 5/10/15 MHz
 - Air Up Frequency – Cellular Receive (middle frequency of band in KHz)
 - Air Down Frequency – Cellular Transmit (middle frequency of band in KHz)
 - CATV Up Frequency – Cable Receive (middle frequency of band in KHz)
 - CATV Down Frequency – Cable Transmit (middle frequency of band in KHz)
6. Press the SAVE button

Name	GSM 1800 Mid
Description	Mid Bandwidth
Technology	GSM 1800
Bandwidth	10
Air Up Freq	1715000
Air Down Freq	1810000
CATV Up Freq	1090000
CATV Down Freq	970000

Close Delete Save

Note: GPS changes will take place only after resetting the associated remote units (see section 3.4 controlling remote units)

13.5.2 Deleting a GPS from the Database

Note: You should delete a GPS only if there are no remote units that use this GPS!

1. From the GPS Maintenance menu choose View Global Parameters
2. Choose the relevant GPS from the list
3. Press the EDIT button on the left side of the row
4. An information screen will appear on the right side
5. Press the DELETE button
6. Press the CONFIRMATION button to delete



Name	GSM 1800 Mid
Description	Mid Bandwidth
Technology	GSM 1800
Bandwidth	10
Air Up Freq	1715000
Air Down Freq	1810000
CATV Up Freq	1090000
CATV Down Freq	970000
<input type="button" value="Close"/> <input type="button" value="Delete"/> <input type="button" value="Save"/>	

13.6 Events Log

All actions performed in the system are documented in the Event Log

Search By ID	<input type="text"/>	Search By Location	<input type="text"/>	Search By User	<input type="text"/>	<input type="button" value="Search"/>
1 2 3 4 5 6 7 8 9						
PINDU ID	Location	Time	User	Event Name	Event Parameter	
14807194	Lab	23/03/2008 17:42:00	3	Control On/Off PINDU	On	
14807194	Lab	23/03/2008 17:41:54	3	Control On/Off PINDU	Off	
14807194	Lab	23/03/2008 17:41:42	3	Control Reset Counters	Reset	

13.7 Alarms Log

The main screen after logging in, is the Alarm Log.

A list of all active alarms is displayed on the screen. According to the amount and details of concurrent alarms, the operators can analyze the alarm to determine whether the cause is a specific remote unit or a network problem.

A single remote unit alarm will cause the dry contacts output #0 to change position (from Normally Closed to Normally Open)

<input type="button" value="Control"/>	<input type="button" value="Info"/>	Rx Time	PINDU ID	Status	Location	Information	Alarms
		23/03/2008 17:45:31	14807085	On	CL	085	Fail

In case of a multiple remote units failure that have crossed the multiple alarm threshold (see section 3.8) a message will appear on the top of the alarm window to indicate Multiple units failure.

Multiple units failure							
1 2							
<input type="button" value="Control"/>	<input type="button" value="Info"/>	Rx Time	PINDU ID	Status	Location	Information	Alarms
		9/16/2008 12:06:46 PM	14807179	On	CL	179	Fail
<input type="button" value="Control"/>	<input type="button" value="Info"/>	9/16/2008 12:00:35 PM	11608045	On	CL	045	Fail

A Multiple remote unit alarm will cause the dry contacts output #1 to change position (from Normally Closed to Normally Open)



The operator can control the faulty remote unit by pressing the CONTROL button on the left side of the alarm row. A window will open.

1. Choose the required Command
 - Remote unit RF Output Enable – On/Off
 - Counters Reset– Reset all unlock counters (Pilot/Synthesizers)
 - Remote unit Reset – Reset the remote unit software
 - Instance 1– Turn instance 1 output RF off
 - Instance 2– Turn instance 2 output RF off
2. Press the SEND button
3. Go to specific remote unit information screen or check the Operational remote units status to verify current status.

Note: Only a single command can be issued!

		Rx Time	PINDU ID	Status	Location	Information	Alarms
<input type="button" value="Control"/>	<input type="button" value="Info"/>	23/03/2008 17:45:31	14807085	On	CL	085	Fail

Unit ID:

Location:

PINDU:

Counters:

PINDU Reset:

Instance 1:

Instance 2:

13.8 Alarms Thresholds

Each remote unit periodically transmits its current status to the monitoring system. An alarm is generated in a case where one of the remote unit status parameters exceeds a threshold defined in the system. The operator can configure the alarm thresholds to fit the local requirements.

The following parameters can be configured from the Alarm Thresholds screen:

Minimum Gain – Generates an alarm when the remote unit gain is lower than the threshold

Maximum Gain – Generates an alarm when the remote unit gain is higher than the threshold

Multiple Units Failure (Quantity>) – Generates a multiple units alarm whenever the number of failed units exceeds the threshold

Minimum Gain

Maximum Gain

Multiple Units Failure (Quantity>)



13.9 Exporting the Database

Database can be exported to a CSV (Comma Separated Value) file. This file can be used with programs such as Microsoft Excel and Access for further analysis and display.

The following information screens can be exported to CSV format:

- Operational remote units status and configuration screens
- Undefined remote units
- Uninstalled remote units
- View/Add Group Parameters Set (GPS)
- Events log
- Alarms log

There are two options for the export:

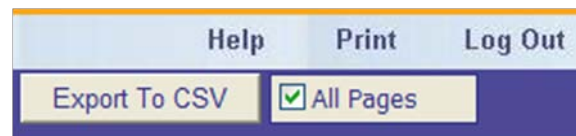
- Export the displayed page
- Export all pages in the data base

To export the displayed screen

1. Press the Export To CSV button at the top of the data screen

To export all pages in the data base

2. Mark the check box All Pages
3. Press the Export To CSV button



13.10 Database Backup

The application automatically saves a backup of the database every day at midnight (00:00). The backup files are saved with a date tag attached to their name for indication.

A corrupted database file can be replaced with the backup database. For further details please contact your local support office.

Note: replacing a database file with a backup file will result in the loss of all changes made to the database and all collected database information in between the last backup and the time of replacement.



14 Acceptance Testing

14.1 Headend Equipment Testing

14.1.1 BTS Output Measurement

The BTS/Node B output power should be adjusted so that the UDC output port will have a 0 dBm per carrier.

The UDC is factory configured to have 20 dB attenuation, therefore the BTS/Node B output should be the following.

Example for GSM – BCCH should be 20 dBm, BTS has 46 dBm composite power.

Number of Carriers	Attenuation at BTS Output (downlink only)	Measured Composite (after attenuator)
1	26 dB	20 dBm
2	23 dB	23 dBm
4	20 dB	26 dBm
8	17 dB	29 dBm

No.	Test Operations	Test Requirement	Results	
			Pass	Fail
1	Measure BTS/Node B output	See 1.1		

14.1.2 UDC Testing

1. For each UDC verify that all three LEDs are green
2. Measure the Pilot signal (962 MHz) at the UDC DL out port. The signal should be 0 ± 1 dBm.
3. Measure the cellular downlink signal at the UDC DL out port. The signal should be 0 ± 1 dBm.

No.	Test Operations	Test Requirement	Results	
			Pass	Fail
1	Examine UDC LEDs	All LEDs are Green		
2	Measure Pilot signal (962 MHz)	0 ± 1 dBm		
3	Measure Cellular signal	0 ± 1 dBm		



14.2 Coax Network Amplifier Testing

14.2.1 Amplifier Downlink Signal Measurement

Measure the cellular downlink signal at the UL IN port of the amplifier (The amplified downlink signal). Verify existence of the pilot signal at 962 MHz and of the cellular signal. Both signals should be at a 0 ± 3 dBm level.

No.	Test Operations	Test Requirement	Results	
			Pass	Fail
1	Measure Pilot signal (962 MHz)	0 ± 3 dBm		
2	Measure Cellular signal	0 ± 3 dBm		

14.3 Remote Unit Testing

14.3.1 Remote Unit LEDs

Verify that the LED on the remote unit's front illuminate. After power up the LED should turn orange and after a few seconds turn green. In Normal operations LED should be green

14.4 Remote Unit Measurements

14.4.1 Testing the First Remote Units

1. Measure signal levels at the coax cable connection between the wall outlet and the remote unit. The pilot and the cellular signals should be visible at levels between -20 dBm to - 50 dBm (dependant of the coax length in this specific network branch)
2. In case a remote unit with external RF outputs is available, measure that the output power is 0 or 10 dBm (according to remote unit type) and the RF output is at the correct cellular frequency

Number of carriers	Remote unit output power (0 dBm model)	Remote unit output power (10 dBm model)
1	0 dB	10 dB
2	3 dB	13 dB
4	6 dB	16 dB
8	9 dB	19 dB

14.4.2 Standard Remote Unit Testing

For all remote units perform the following:

Using dedicated cellular test equipment (Handset with test mode or specialized h/w)



1. Measure the cellular downlink signal (walk test)
2. Generate a call and test: coverage quality (walk test), call quality and uplink transmit power

No.	Test Operations	Test Requirement	Results	
			Pass	Fail
1	Verify remote unit LED illuminate	Green		
2	Measure wall outlet cellular signal *	-20 dBm to -50 dBm		
3	Measure direct remote unit output power*	See 3.2.1		
4	Outgoing voice call			
5	Incoming voice call			
6	Data session			

14.4.3 Global Walk Test

Using dedicated test equipment such as TEMS perform a complete premises walk test.



Appendix A. UDC Software Configuration Tool

UDC frequency plans are configurable using configuration software and a Alvarion supplied programmer. The same programmer can also configure 1st generation remote units.

A.1. Requirements

- PC/Laptop with a serial port
- ICP-01 Programmer
- Alvarion configuration software

A.2. Connecting the Programmer

The programmer is supplied with two cables:

- Serial 9 pin to Serial 9 pin (or USB)
- Serial 15 pin to RJ – 11



Figure 16: Programmer Connection

1. Connect the 9 pin serial cable between the programmer serial 9 pin port and a PC serial port
2. Connect the serial 15 to RJ-11 cable. The serial side connects to the programmer data port and the other side to the programmed device such as the UDC or remote unit.
3. Plug the power supply to the programmer and into the AC mains.
4. The green POWER LED should be lit
5. Note: the programmer uses COM1 on the PC. In case of a conflict with other software please contact Alvarion for support.



A.3. Configurator Software

- The Configurator software does not require special installation. Simply copy all the software files into a specific folder.
 - The software includes a help file with further details
1. To run the configuration software double click the Alvarion Network Configurator icon
 2. The configuration screen below will appear

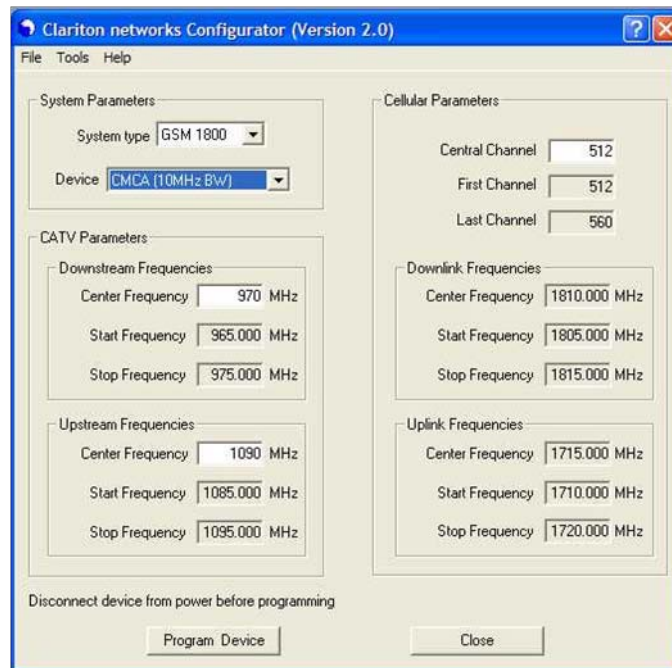


Figure 17: Configuration Screen

3. The RS-232 green LED on the programmer will be turned on to indicate proper connectivity
4. Choose the technology and frequency band (i.e. UMTS, GSM 1800, etc)
5. Choose the device to be configured (UDC)
6. Cable band downstream - enter the center frequency (between 965 MHz to 1035 MHz)
7. Cable band upstream - enter the center frequency (between 1080 MHz to 1155 MHz)

8. Cellular band – enter the downlink band

(in GSM = central channel number, in UMTS = first downlink channel number, in PCS = Block, in iDEN = center frequency in MHz)

9. Verify all inputs

Note:

- Make sure the programmed device is DISCONNECTED from power
- In case none of the parameters was changed a warning will be displayed before programming takes place.



10. Press Program Device
11. The red VPP and VDD LEDs on the programmer will be turned on and a status window will be displayed.

A.4. Tools

On the main menu press Tools

A.4.1. Recall Configuration from a Device

The configuration of a UDC can be recalled from a pre-configured device.

1. Connect the device to the programmer
2. Press the Read Device button
3. The red VPP and VDD LEDs on the programmer will be turned on and a status window will be displayed.
4. The device parameters will be displayed in the Read Device window.

A.4.2. Use Device Configuration

The recalled parameters can be used to configure a new device

1. Press the Use Frequencies button.
2. The device parameters will be transferred to the main configuration template.
3. Verify all inputs
4. Press Program Device.

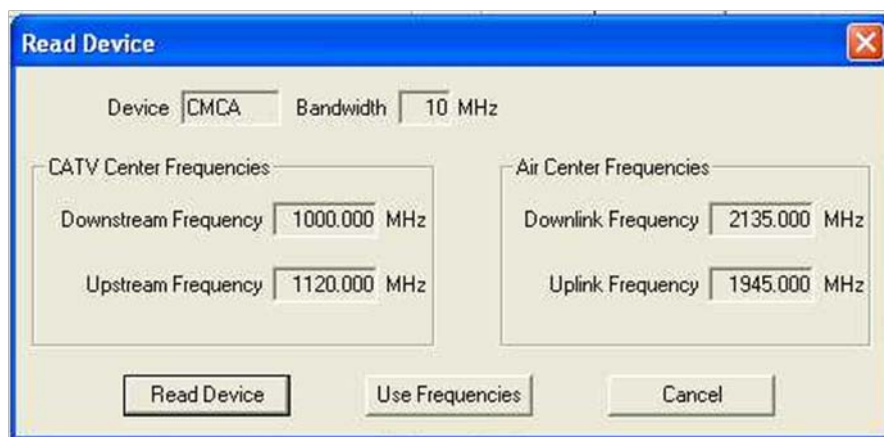


Figure 18: Tools Screen

A.5. Configuration Management

Configurations can be saved and restored from a database. Up to 1,000 different configurations can be loaded and displayed using the File menu.



A.5.1. Saving a Configuration

You can save your current configuration in the following way:

1. Press File from top menu
2. Choose Save Configuration
3. Enter at the bottom the Configuration Name and Comment
4. Press the Save button

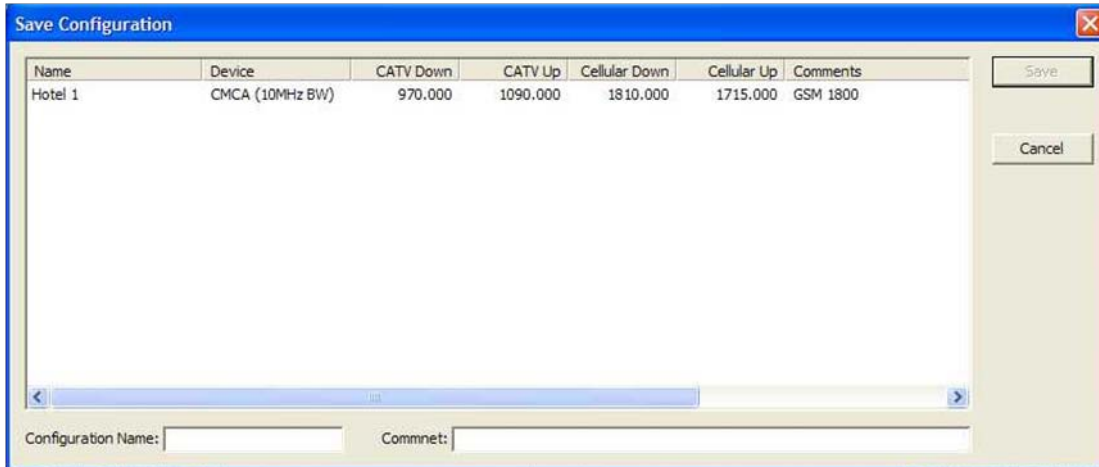


Figure 19: Save Configuration

A.5.2. Loading a Configuration

You can load past configurations from the database in the following way:

1. Press File from top menu
2. Choose Load Configuration
3. Click on the chosen configuration
4. Press the Load button

A.5.3. Deleting a Configuration

You can delete a configuration from the database in the following way:

1. Press File from top menu
2. Choose Delete Configuration
3. Click on the chosen configuration
4. Press the Delete button



Appendix B. Power Ratings

Device	Input Voltage [Volts DC]	Current [Amperes DC]
UDC	9	1
CCD	110/230 Volts AC (50/60Hz)	0.05 Amperes AC
Amplifier	7.5	0.3
Remote unit	5.7	2.7