DELOS200
USER MANUAL

Version 1.1

Version 1.1 (Released March 25, 2008)

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Revision History

Version	Author	Description	Date
1.0	Peter Son		June 24, 2006
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1. Introduction of Delos200

    1.1 Overview

    Delos200 series repeaters enhance in-building wireless coverage in the most effective and cost efficient way. For its intelligent design and versatility, Delos200 series repeaters are the ideal choice for wireless coverage problems indoors.   Delos200 series repeaters can be used as a stand-alone repeater with passive antennas connected to it or it can also be used as a feeder repeater to a DAS (Distributed Antenna System).

    1.1.1   Highlights

    · 23 dBm Composite Output Power
    · 80 dB gain
    · 25 dB AGC Range @ 0.5 dB Step
    · Can Set AGC Output Power Level
    · Auto Level Control Feature
    · Band/Channel Selectable via Software/Button
    · Three Sliding Filters Built-In (5, 10 & 15 MHz)
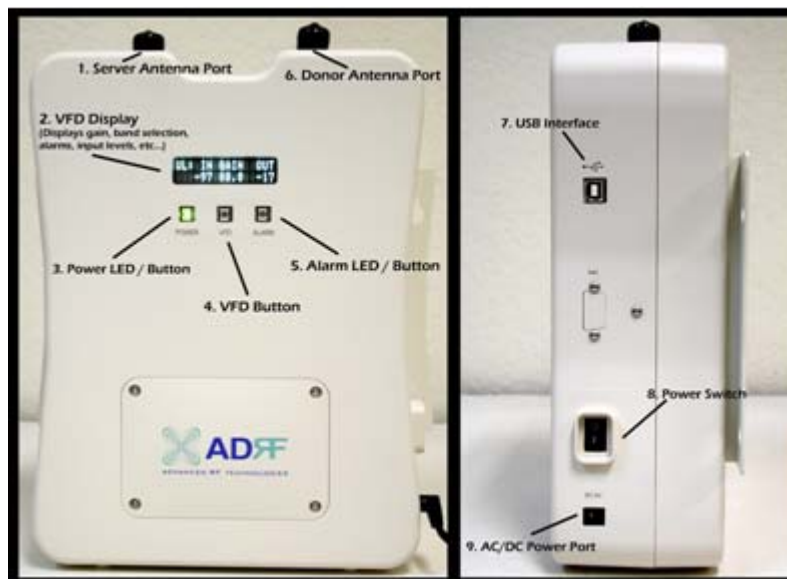
    1.1.2   Special Features

Figure 1 – Front & Right Side Views of the Repeater

1. Server Antenna Port

One end of the coax cable will connect to the "Server Antenna Port" of Delos200 while the other end of the cable will connect to the server antenna which is pointing towards the intended coverage area.

2. VFD Display

In this display, you are able to view the repeater vitals in each link (e.g. RSS, Gain, Output Power & Alarms).

*** Please refer to Appendix B for more detailed information on how the VFD button operates.*

3. Power LED / Button

The Power LED will be lit Green if the power is turned on and will be not lit if the power is turned off.

At the same time, by pressing the "Power LED" button, you can choose the desired filer (5, 10 or 15 MHz).

*** Please refer to Appendix B for more detailed information on how the Power LED button operates.*

4. VFD Button

By pressing the VFD button, you can see the repeater vitals on the VFD display. The VFD display will be lit for 30 minutes and will then turn off. It needs to be pressed again to display the repeater parameters on the VFD display.

5. Alarm LED / Button

If there's an alarm, the Alarm LED will be lit Red and will not be lit if there isn't any alarm.

At the same time, by pressing the "Alarm LED" button, you can choose the desired operating band(s). By clicking on the "ALARM LED" button each time, you will be sliding the filter (5, 10 or 15 MHz) to the right side of the spectrum by an increment of 5 MHz bandwidth.

*** Please refer to Appendix B for more detailed information on how the Alarm LED button operates.*

6. Donor Antenna Port

One end of the coax cable will connect to the "Donor Antenna Port" of Delos200 while the other end of the cable will connect to the donor antenna which is pointing towards the BTS.

The coax cable coming in from the donor antenna (pointing towards the BTS)

7. USB Interface

For management and troubleshooting purposes, you can connect your PC to Delos200 Manager via USB cable.

8. Power Switch

To turn the Delos200, you need to turn the power switch on.

9. AC/DC Power Port

To power the repeater, you need to connect the power supply to this port.

1.1.3   Available Models

Delos200 is available in all 1900 MHz PCS band combinations. The following table illustrates the two standard models:

Product ID	Description
Delos201	RF repeater with built-in sliding filters (5, 10 & 15 MHz) @ 5 MHz increments across the first 45 MHz PCS spectrum (DL: 1930-1975 / UL: 1850-1895)
Delos202	RF repeater with built-in sliding filters (5, 10 & 15 MHz) @ 5 MHz increments across the last 45 MHz PCS spectrum (DL: 1945-1990 / UL: 1865-1910)

Table 1 – Delos200 Models

1.2 Warnings and Hazards

WARNING! ELECTRIC SHOCK

Opening the Delos200 could result in electric shock and may cause severe injury.
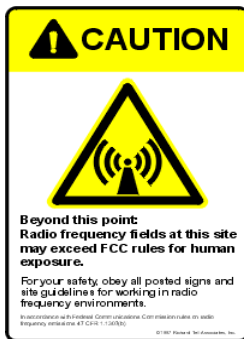
WARNING! EXPOSURE TO RF

Working with the repeater while in operation, may expose the technician to RF electromagnetic fields that exceed FCC rules for human exposure. Visit the FCC website at www.fcc.gov/oet/rfsafety to learn more about the effects of exposure to RF electromagnetic fields.
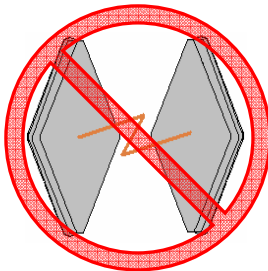
WARNING! DAMAGE TO REPEATER

Operating the Delos200 with antennas in very close proximity facing each other could lead to severe damage to the repeater.

RF EXPOSURE & ANTENNA PLACEMENT Guidelines

Please maintain a safe distance of 20 cm while operating near the donor and the server antennas.   Also, the donor antenna needs to be mounted outdoors on a permanent structure.

WARRANTY

Opening or tampering the Delos200 will void all warranties.

FCC Part 15 Class A

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 instruction manual, may cause harmful interference to radio communications. 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.

Delos200 Parts List

The Delos200 repeater system includes:

	PART ID	QUANTITY
a. Delos200 Repeater	Delos20X	1
b. Screws	SC01	4
c. **CD	Delos200 Manager	1
d. USB Cable	USB01	1
e. Power Cable	PWRC01	1

** CD includes: (1) GUI Software; (2) User Manual; (3) Delos200 Quick Start Guide; & (4) Software & USB Driver Setup Guide.

1.3 Delos200 Software Installation and Requirements

1.4.1 Minimum PCS Requirements
CPU: 200 MHz
Memory: 32 MB
Hard Disk: 10 MB (Free Space)
USB Port: 1 USB Port
CD-ROM Drive

Compatible Operating System:
Microsoft Windows 2000 / XP

1.4.2 Delos200 Software Installation

** *Refer to the Software & USB Driver Setup Guide*

1.4.3 Initial Startup of Delos200 Software

a. Using the USB cable (USB01) that is provided, connect one end of the cable to the USB port to the PC and the other end to the repeater's USB port located on the right side of the repeater.
b. Launch the Delos200 Software.

** *Refer to the Software & USB Driver Setup Guide*

1.4 Pre-Installation using Delos200 Software

Prior to the Delos200 installation, ensure that:

a. The USB cable has been connected and proper communication has been established.

b. The donor and server antennas are in place.

c. The TX and RX communication status LEDs are lit green and blinking periodically on the Status Menu.

*** The TX and RX LEDs should blink every 1 second only in the Status Menu. In the Status Menu, a blinking green RX LED indicates that the PC is retrieving data from the repeater (Delos200).   Similarly, a blinking green TX LED indicates that the PC is transmitting data to the Delos200.*

1.5 Step by Step Instructions for Installation

1.5.1   Repeater Setup

Figure 2 – Front & Right Side Views of the Repeater

1. Connect the Power Source

Make sure that the power switch on the right side of the repeater is turned off before connecting the power cable. Connect the power cable to the AC/DC Power Port as shown in Figure 3. Make sure not to turn the power on

*** Before connecting the power cable to the power source, make sure that the voltage source is 110 V.*

2. Connect the Donor Antenna
Connect one end of the RF coaxial cable to the donor antenna and the other end to the repeater Donor Antenna Port located on the top of the Delos200 as shown in Figure 2.

3. Connect the Server Antenna
Connect one end of the RF coaxial cable to the server antenna and connect the other end to the repeater Server Antenna Port located on the top of the Delos200 as shown in Figure 2.

4. Connect the USB Cable
Using the USB cable (included in the box), connect one end of the cable to the Delos200's USB port located on the right side of the repeater and the other end to the PC's USB port as shown in Figure 2.

** Install the USB driver and the Delos200 Manager Software prior to installation.

5. Turn On the Power for Delos200
Make sure that the donor and server antennas and the power cable are securely connected to the correct ports. Turn the power switch on, located on the right side of the repeater.

6. Launch the Delos200 Software
Open the Delos200 Software. You will see the Status Menu.

** For more detailed information on the Delos200 Software, please refer to Section 2 on page 15.

** If only one or both of the LEDs on the Status Window are not blinking: (1) check the physical USB cable connection or (2) check if the repeater power is turned on.

7. Go to the Control Menu

Now with the blinking TX and RX status LEDs on the Status Window, go to the Control Window. You will see the following:
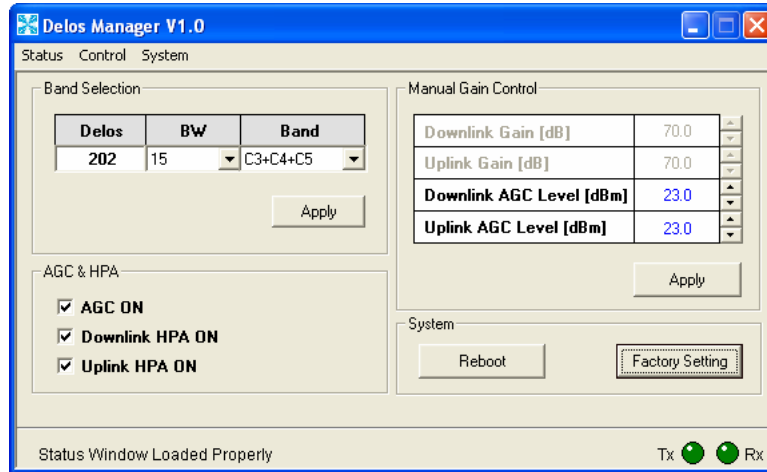

Figure 3 - Control Window of the Delos200 Software

8. Select the Desired Band(s)

In the Band Selection section of the Control Window (Figure 3), click on the pull down arrows labeled "BW" and "Band."

You can choose your desired bandwidth (5, 10 or 15 MHz) by clicking on the pull down arrow labeled "BW." After selecting your desired filter, click on the pull down arrow labeled *Band* and choose your desired operating band.

The following table illustrates the three bandwidths you can choose from and the corresponding bands which can be selected:

Bandwidth	Band Options
5 MHz	A1, A2, A3, D, B1, B2, B3, E, F, C3, C4 or C5
10 MHz	A1+A2, A2+A3, A3+D, D+B1, B1+B2, B2+B3, B3+E, E+F, F+C3, C3+C4 or C4+C5
15 MHz	A1+A2+A3, A3+D+B1, B1+B2+B3, B3+E+F, F+C3+C4 or C3+C4+C5

Table 2 – Band Combinations

*** Depending on which model of Delos200 is being used, the band options will vary. Delos201 doesn't support the C band while the Delos202 model doesn't support the A band.*

9. Check the Front LED Panel
Check that the Power LED is on (Green) and the Alarm LED (Red) is off.

*** If the Alarm LED is on, refer to Section 2.3 on page 25.*

*** You can go to the Status Menu of the Delos200 Software to view the basic parameters of the repeater once the repeater has installed successfully.*

CONGRATULATIONS!!
The Delos200 Installation Process is Complete.

2   User Manual V1.0 using Delos200 Software
2.1 Menu Structure
2.1.1   Window Overview

Status

The Status Window allows you to monitor the current settings and status of the Delos200.

Control

The Control Window enables you to select the operating band and change or adjust the Delos200's parameters and settings.
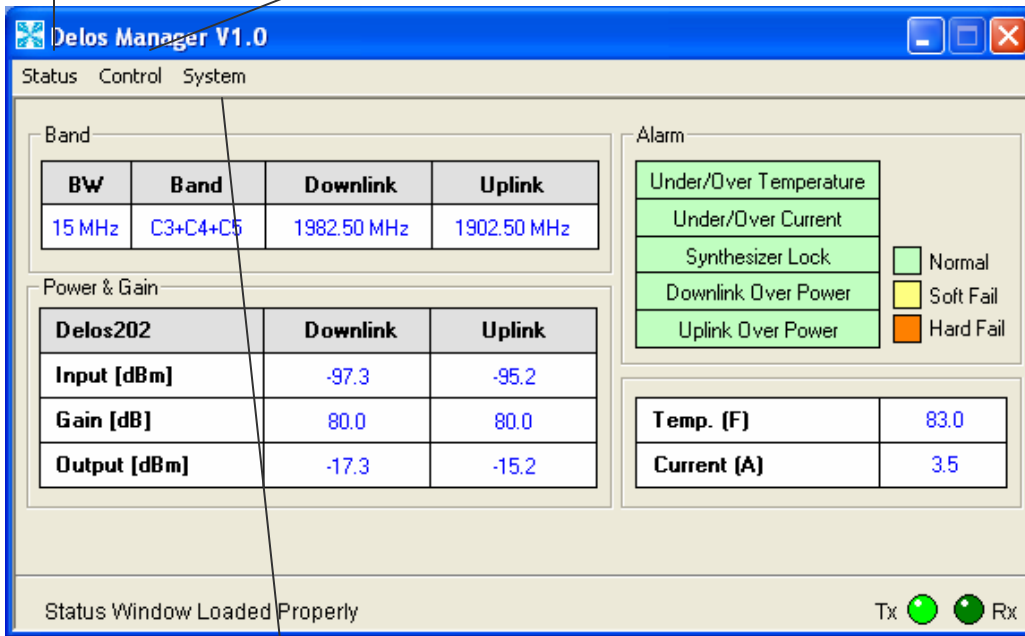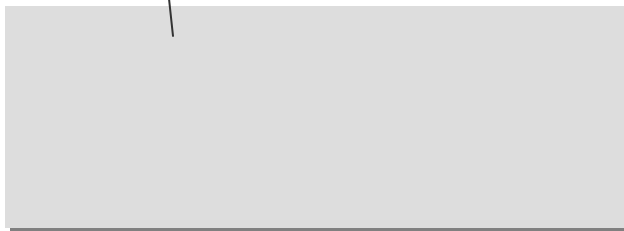

Figure 4 – Status Window of the Delos200 Software

2.1.2   Status Menu

The Status Window is the monitoring window of the Delos200 Software. This window enables the user to monitor the status and settings of the Delos200. In other words, no parameters can be changed in the Status Window.   To change parameters, you will need to go to the Control Window.

Bandwidth
Indicates the bandwidth of the selected filter.

Bands
Currently selected band(s) are highlighted.

Downlink/Uplink
Indicates currently selected operating frequencies.

Alarm
Indicates what type of alarm the repeater currently is in.

Repeater Input
Indicates input signal strength of the repeater after the donor antenna [in dBm].

Repeater Gain
Indicates the gain of the repeater [in dB].

Temp. & Current
Indicates what the temperature is inside the repeater and how much current is being drawn.
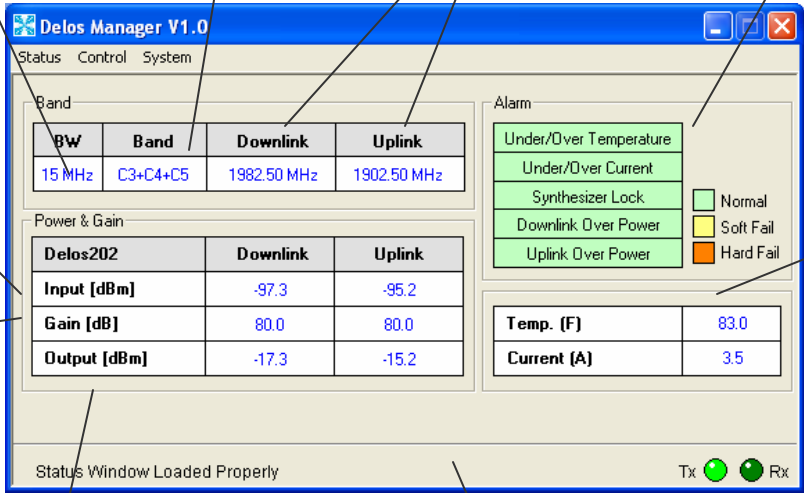

Figure 5 – Status Window of the Delos200 Software

Repeater Output
The output of the repeater [in dBm] before being radiated by the server antenna.

Status Bar
Displays the status of the repeater (e.g. Status Window Loaded Properly, etc.), transmit (TX) and receive (RX) communication LEDs.

2.1.3 Control Menu

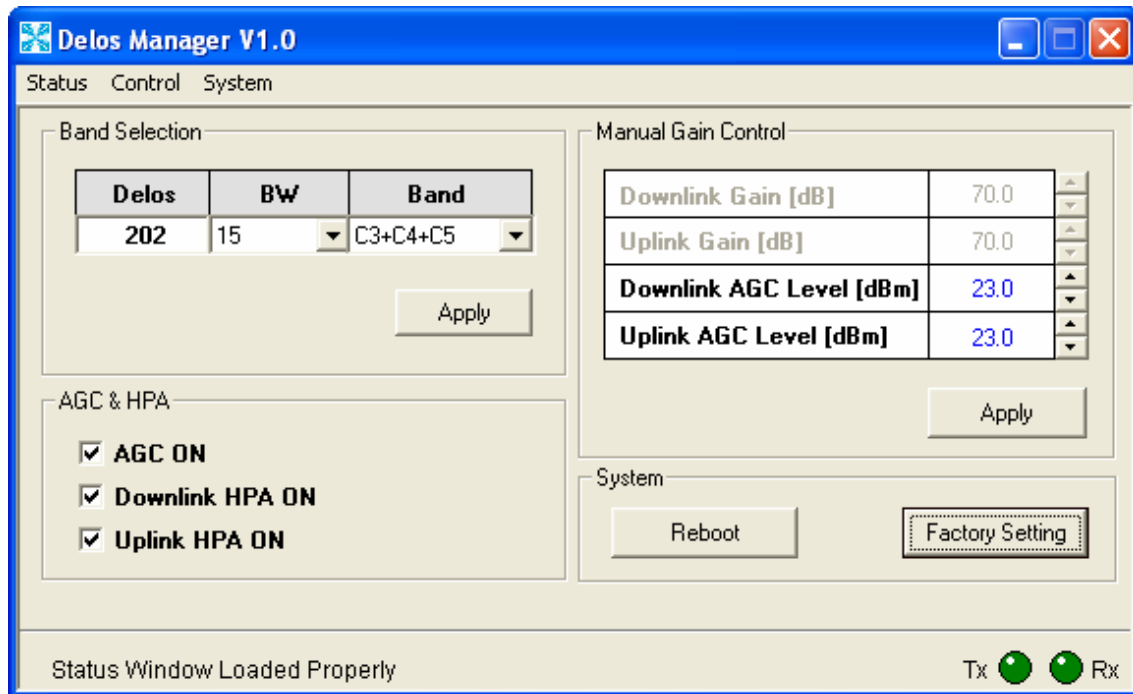The Control Window lets the user to change parameters of the repeater.

Figure 6 – Control Window of the Delos200 Software

Band Selection

Depending on which model of the Delos200 you have, you can choose the desired filter from the drop down menu by clicking on *BW* and the corresponding band options can be viewed by clicking on *Band*. Please refer to Table 2 on page 12 for all the possible band combinations.

AGC Mode

AGC (Auto Gain Control) adjusts the variable gain of the repeater to ensure a constant specified output power of 23 dBm. The functionality of the AGC feature is assured under the condition that the input BTS signal is within the specified AGC range (–57 to –32 dBm => assuming AGC Level is set to 23 dBm) and that sufficient isolation exists between antennas ($\geq$ 93 dB).   By default, the *AGC ON* box is checked. To manually change the gains in both the links, *AGC ON* must be unchecked.

The user can specify the AGC level in the downlink and in the uplink respectively @ 0.5 dB step (0 to 23 dBm). By default, the AGC Level is set to 23 dBm in each link.

Downlink/Uplink HPA Mode
The HPA mode enables the user to turn the HPA on or off. If the HPA is turned off on either link, the Delos200 will not operate properly. Both HPAs needs to be turned on for the RF portion of the repeater to work in both directions (downlink and uplink). By default, the *Downlink/Uplink HPA ON* box are checked.

Either or both HPAs can be turned off for troubleshooting purposes during an installation process.

Downlink/Uplink Gain
The gain of the Delos200 is the ratio of the input signal to the output signal. The gain may be set in both links.

*** The manual gain option is disabled when the AGC ON box is checked.*

Reboot
By clicking the "Reboot" button, similar to how the operation works in a PC, the control board of the repeater will restart itself.

Factory Setting
Clicking on the "Factory Setting" button resets the settings of the repeater to the original default factory settings as noted in the "Default Control Settings" in Section 2.4 on page 28.

*** You will lose your current saved settings once you click on Factory Setting.*

2.1.4   System Menu

2.1.4.1 Info. Window

The Info. Window displays the Model Number, Serial Number and Firmware Version of the Delos200 repeater. Contact information is included along with a link to Advanced RF Technologies, Inc.'s URL.

Figure 7 – Info. Window of the Delos200 Software

2.1.4.2 Upgrade Window

In order to download the latest repeater firmware, click on the Upgrade Window. The firmware file will be provided by the technical support group from Advanced RF Technologies, Inc. Once the firmware file has been saved on the PC, you would connect the Delos200 repeater to the PC via the USB cable provided. Click on "Open" and locate the firmware file and click on 'Download."
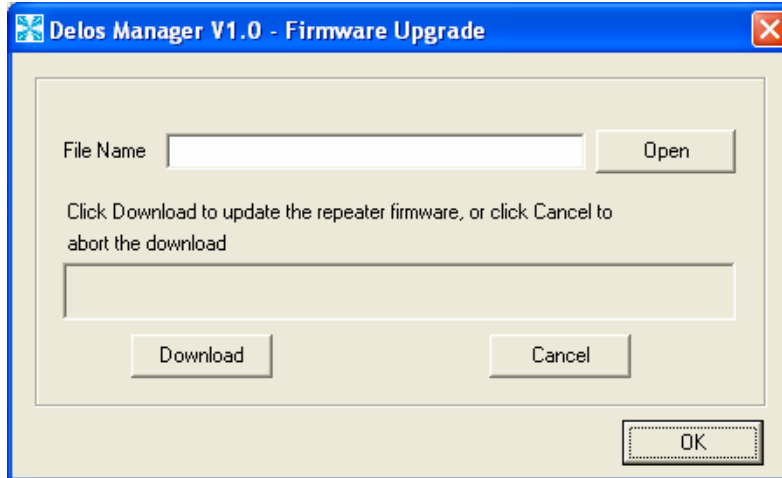
Figure 8 – Upgrade Window of the Delos200 Software

Once the firmware has been downloaded successfully, the following pop-up window will appear.
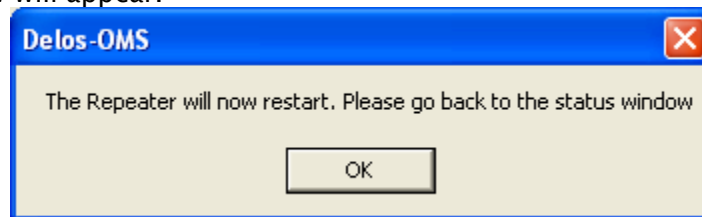
2.2 Default Control Settings

Control Item	Setting Value
AGC Mode	ON
Downlink/Uplink HPA Mode	ON
Uplink Tracking Mode	ON
Downlink/Uplink Gain	70 dB
Downlink/Uplink AGC Level	23 dBm

Table 3 – Default Repeater Settings

** When *AGC ON* mode is enabled, by default, the *Downlink/Uplink AGC Level* is set to 23 dBm.

3   Maintenance Guide for Delos200

3.1 Periodic Inspection Checklist

☐ a.   Check for loose connections to the repeater and antennas. If connections are loose, make sure that all connections are tightly fastened properly.

☐ b.   Cables and connectors are in good condition.

☐ c.   Ensure that the repeater brackets are in good condition and that the repeater is securely fastened.

3.2 Preventive Measures for Optimal Operation

3.2.1   Recommendations

• Perform the *Periodic Inspection Checklist* quarterly or semiannually.

3.2.2   Precautions

• Do not operate the repeater with the antennas in extremely close proximity as this may cause damage to the repeater.

• Do not change parameters unless instructed to do so by an authorized supervisor.

• Do not move the repeater unless instructed to do so by an authorized supervisor.

• Do not detach any cables to the repeater unless repair of respective components are necessary.

4   Troubleshooting
   4.1 Tx & Rx LEDs

Tx	Rx	Explanation
Blinking GREEN	Blinking GREEN	Successful Connection. The Delos200 Software and the repeater are communicating successfully.
Blinking GREEN	Solid GREEN	The repeater is not receiving any commands from the software. In this state, the repeater is either processing or executing a command. Wait for a few seconds for the Rx LED to blink periodically.
Blinking GREEN	RED	The repeater is not receiving any commands from the software. Ensure that the repeater is tuned on and check for proper USB port connection.
RED	RED	The USB port can not send or receive data. Check if the USB driver has been installed and also verify if the physical connection on both ends of the USB cable is secure. Ensure that the repeater is turned on.

Table 4 – Tx and Rx LEDs

** The Tx/Rx LEDs will blink periodically only on the Status Window.

4.2 Common Installation Problems

Problem	Possible Solution
USB port is not being recognized	You would need to install the driver for the USB cable which can be found with the CD that comes with the repeater.
The power green LED on the front panel is not lit.	Check if the power switch is turned on. Also verify if the power cord is securely connected to the repeater. Make sure there's no power outage.
GUI Software & Laptop – No Communication	The very first time during installation, once you connect the USB cable to the repeater and the laptop, the PC will automatically detect a new hardware has been added in the system and will prompt you to install the driver which can be found in the CD. The driver needs to be installed only once.
Status Window – Weak Signal or Donor RSS	Check that the donor and server antennas are connected to the proper antenna ports on the repeater. Reposition or rotate the donor antenna around until a stronger signal is received.
Downlink/Uplink Over Power Alarm	Add an attenuator after the donor/server antenna to reduce the strong donor/server signal coming into the repeater. An oscillation in the system could cause this alarm. Check if there is sufficient separation between the donor and the server antennas.

Table 5 – Troubleshooting Tips

5   Warranty and Repair Policy

5.1 General Warranty

The Delos200 carries a Standard Warranty period of two (2) years unless indicated otherwise on the package or in the acknowledgment of the purchase order.

5.2 Limitations of Warranty

Your exclusive remedy for any defective product is limited to the repair or replacement of the defective product. Advanced RF Technologies, Inc. may elect which remedy or combination of remedies to provide in its sole discretion. Advanced RF Technologies, Inc. shall have a reasonable time after determining that a defective product exists to repair or replace the problem unit.   Advanced RF Technologies, Inc. warranty applies to repaired or replaced products for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced product, whichever is longer.

5.3 Limitation of Damages

The liability for any defective product shall in no event exceed the purchase price for the defective product.

5.4 No Consequential Damages

Advanced RF Technologies, Inc. has no liability for general, consequential, incidental or special damages.

5.5 Additional Limitation on Warranty

Advanced RF Technologies, Inc. standard warranty does not cover products which have been received improperly packaged, altered, or physically damaged. For example, broken warranty seal, labels exhibiting tampering, physically abused enclosure, broken pins on connectors, any modifications made without Advanced RF Technologies, Inc. authorization, will void all warranty.

5.6 Return Material Authorization (RMA)

No product may be returned directly to Advanced RF Technologies, Inc. without first getting an approval from Advanced RF Technologies, Inc. If it is determined that the product may be defective, you will be given an RMA number and instructions in how to return the product. An unauthorized return, i.e., one for which an RMA number has not been issued, will be returned to you at your expense. Authorized returns are to be shipped to the address on the RMA in an approved shipping container. You will be given our courier information. It is suggested that the original box and packaging materials should be kept if an occasion arises where a defective product needs to be shipped back to Advanced RF Technologies, Inc. To request an RMA, please call (323) 254-8131 or send an email to techsupport@adrftech.com.

Appendix A: Specifications

ELECTRICAL SPECIFICATIONS

PARAMETERS		SPECIFICATIONS	COMMENTS
Frequency Range	DL	1930 to 1990 MHz	
	UL	1850 to 1910 MHz	
Sub Band Filtering		5/10/15 MHz Sliding Filter	Model 1 DL: 1930–1975 MHZ / UL: 1850–1895 MHZ
Sub Band Filtering		5/10/15 MHz Sliding Filter	Model 2 DL: 1945–1990 MHZ / UL: 1865–1910 MHZ
Operating Frequency		Programmable	Freq. Step: 10 KHz
Frequency Error		≤ +/– 0.1 ppm	
Delay		≤ 5 usec	Each Direction
Input Dynamic Range		–32 to –57 dBm	
Repeater Gain		55 to 80 dB	
Maximum DL&UL Output Power		+23 dBm	Composite
DL AGC Range		25 dB / 1 dB Step	
UL AGC Range		25 dB / 1 dB Step	
Gain Flatness		+/– 2.5 dB	
In Band Noise		≤ –45 dBc	@ Fc +/– 885 KHz
		≤ –50 dBc	@ Fc +/– 1.98 MHz
Spurious Emission		< –13 dBm	@ Fc +/– 2.25 MHz
Rho Factor		≥ 0.912	
Noise Figure		≤ 5 dB	
VSWR		≤ 1.5:1	

MECHANICAL SPECIFICATIONS

PARAMETERS		SPECIFICATIONS	COMMENTS
Housing (W x H x D)		8.27 x 11.03 x 3.57 inches	
Housing Material		Aluminum & Plastic	
Weight		≤ 11 lbs	
Connector Type	Antenna	N-Type (Female)	
	Software Interface	USB	
Cooling		External Convection	

POWER SPECIFICATIONS

PARAMETERS	SPECIFICATIONS	COMMENTS
Main AC Power	100 to 240 VAC	Power Adapter complies with UL & CE
AC Frequency	50 to 60 Hz	
Adaptor Voltage & Current	6 VDC / 4.5 A	
Power Consumption	≤ 30 Watts	

ENVIRONMENTAL SPECIFICATIONS

PARAMETERS	SPECIFICATIONS	COMMENTS
Operating Temperature	+41 ˚F to +113 ˚F	
Storage Temperature	+23 ˚F to +176 ˚F	
Humidity	10 to 85%, RH	
MTBF	75,000 hours	

Appendix B: Button Operation

Normal Operation

Soft Fail Alarm Operation

Soft Alarm Operation

Power Off

Power On

16 sec
Booting Time

POWER (off)   VFD   ALARM (off)

Delos201 Initializing...

6 sec

POWER (Green)   VFD   ALARM (Red)

Display Cycle*

4 sec

POWER (Green)   VFD   ALARM (Red)

4 sec
Until the condition cleared

SOFT FAIL ALARM DOWNLINK RSSI

POWER (Green)   VFD   ALARM (Red)

The VFD display will be disappeared 30 minutes later since the VFD button is touched.

If the VFD button is clicked, the display will be come up again.

POWER (Green)   VFD   ALARM (Red)

Hard Fail Alarm Operation

Hard Alarm Operation

Filter and Operating Band