We Extend Your Coverage

Pisces Digital

ICS Repeater

Product Manual

Edition

Edition 1.2, December 22, 2012.

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1. About This Manual

This product manual is produced for the use of Coiler's Pisces (PS) Digital ICS Repeater by Coiler personnel, licensees and customers.

The Pisces Digital ICS Repeater has the most innovative technologies to simplify the installation process. **Please first refer to the single sheet installation guide**. This manual covers the functions of the Pisces (PS) in detail with OMT instructions (Section 8) and is needed only when the information on the single sheet installation is insufficient.

Due to the continued progress in methodology, design and manufacturing of our products, the contents of this document are subject to revision without any notice. Coiler assumes no legal responsibility for any error or damage resulting from the use of this document.

Your comments can assist us in improving our products and services. Please address them to Coiler at any time.

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2. Table of Contents

3. Safety Instructions

Any personnel involved in an installation, operation or service of the Coiler PS Digital ICS Repeater must understand and obey the following:

1. Coiler PS Digital ICS Repeaters must be used exclusively for its application described in this guide's product introduction and nothing else.

2. For your safety, please be aware of power lines at all times during installation and use. Please make sure to take appropriate safety measures for protection. Contact with high-voltage power lines can cause serious injury or death.

3. Please handle the equipment with care. Mechanical shock due to the dropping or mishandling of the repeater can permanently damage sensitive RF components.

4. The PS Digital ICS Repeater is designed for indoor applications and should be kept away from water and humidity.

5. The primary AC power range for the repeater is AC100-240V. It is possible to damage the repeater if the primary AC power is outside this range.

6. Conducted emissions can only be carried out when the DC cable is less than 3m long. Please operate the repeater with DC power cable included in the package and not cables longer than 3m.

7. An external lightning protector is recommended when the antenna is installed outdoors.

8. The operating temperature of this product should be between 0°C ~ 40°C.

9. Any repeater, including Coiler's PS Digital ICS Repeater, will generate radio signals and thereby give rise to electromagnetic fields that may be hazardous to the health of any person who is extensively exposed to the signals, and is in the immediate proximity of a repeater or repeater antennas. Therefore, the minimum distance between the user and/or any bystander and the radiating structure (antenna) of the transmitter is 50cm.

   *Coiler's PS Digital ICS Repeater complies with or exceeds EMC safety and RF requirements, as per 1995/5/EC Directive.

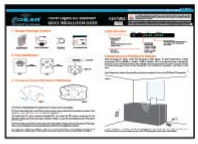
4. Package Contents & Parts Identification

Standard Package:


Main Repeater Unit
with Built-in Antennas


Power Supply Adaptor


USB Cable for
OMT Access

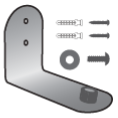

Quick Installation Guide

Accessories Information		
AC Adaptor	Model Name	EA10521B-060
	Power Rating	I/P: 100-240V~1.8A, 50-60Hz; O/P: 6V 6A
	DC Power Cord	120cm

Optional Package Additions:

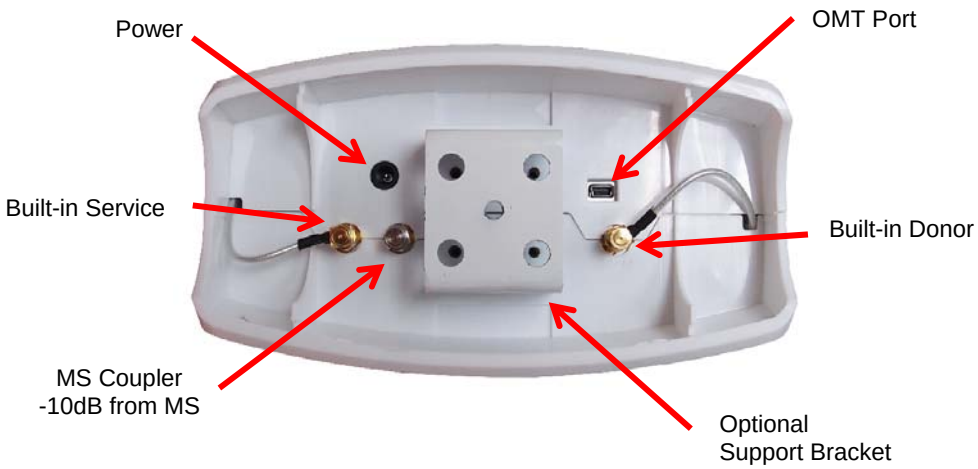

3m Coaxial Cable
with 90° Connector


7dBi Antenna with
2 Mounting Options


L-shape Wall
Mount Bracket


Wrench Tool

Base Connections & Components:



5. Product Introduction

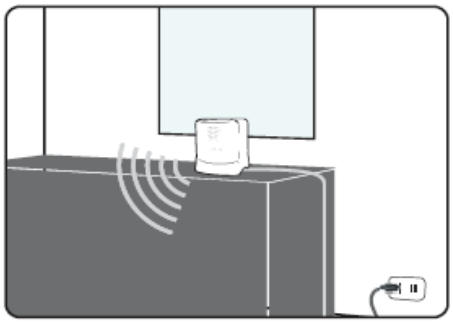
Pisces, or PS-2200 is Coiler's Pico level ICS (Isolation Cancellation System) repeater. ICS is a breakthrough technology that cancels isolation up to 25dB and enables the Pisces to be equipped with built in donor and service antenna. With intuitive LED indicators, an average mobile phone user can simply plug in the power and place the PS-2200 at the best signal window location for optimal performance.

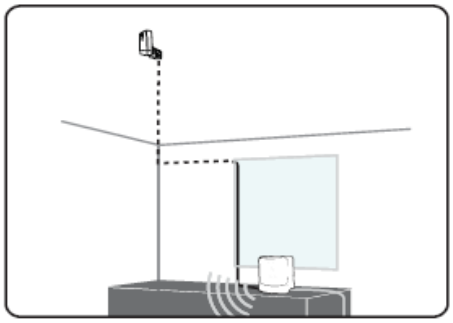
In addition to ICS technology, the PS also has Auto Gain Adjustment (AGA) up to 25dB should the environment requires attenuation of gain - no action is required by the user. Standard safety features such as Auto Gain Control (AGC), Auto Shutdown (ASD), and Auto Turn-on (ATO) are all packaged into the PS to ensure network and product safety.

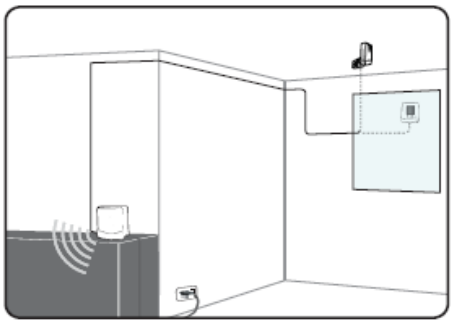
When signal is weak by the window or when PS would not be place beside a window, external donor antenna could be used to ensure the receptiono of quality signal. When multiple areas requires service, the PS also has ability to connect external service antenna(s). Whenever external antennas are used, wall mount brackets is an option for better placement and unit stability.

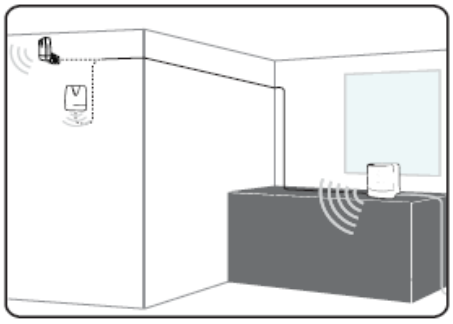
The PS is not only flexible in unit deployment but also with service frequencies. Coiler's OMT software provides the ability for the configuration of 3G service channels to ensure the PS would be amplifying the signal of a particular operator.

Simple, complete, and versitile, the PS-2200 digital ICS repeater is an unique offering for carriers to solve the 3G coverage problems of their clients instantly.









5.1 Product Features

The PS Digital ICS Repeater represents some of the most innovative technologies from Coiler. The key technology that defines the PS is the Isolation Cancellation System (ICS). In addition, the Pisces also feature technologies such as Automatic Gain Adjustment (AGA), Automatic Gain Control (AGC), Auto Shut Down (ASD) and Auto Turn On (ATO). Each feature is described in details below.

A. Isolation Cancellation System

Isolation Cancellation System (ICS) is a complex technology. However, the over function can be simply to the following definition:
All RF signal has three parameters: amplitude (A), phase (Ø), and time delay (T). ICS repeater has a digital engine that differentiates the real input and feedback signal, then controls and reduces the amplitude, phase and time delay of feedback signal. Hence echo is cancelled and antennas can be much closer than repeaters without ICS technology. The formulas below illustrate a **25dB isolation improvement** comparing repeaters without ICS technology and Pisces Digital ICS Repeater.

Repeater without ICS technology: **Isolation ≥ Gain + 15dB**
Pisces Digital ICS Repeater: **Isolation ≥ Gain – 10dB**

B. Automatic Gain Adjustment

Working hand in hand with the ICS technology within the Pisces is the Automatic Gain Adjustment (AGA) with 25dB range. This is a dynamic function that adjusts the gain of the Pisces whenever isolation becomes insufficient. The full gain of Pisces repeater is 70dB when isolation is 60dB or higher. When a situation causes the isolation to be lower than 60dB, AGA would reduce the gain immediately to avoid oscillation. For example, if an object is placed directly in front Pisces repeater on the service side, this would cause the service signal to feedback to donor and reduce the isolation value. In this case if isolation becomes 50dB, then AGA would reduce the gain of the repeater by 10dB to avoid oscillation. Maximum attenuation of AGA is 25dB, which means the Pisces repeater would adjust automatically for best performance as long as isolation is high than 35dB.

C. Automatic Gain Control

Automatic Gain Control (AGC) is also a dynamic gain adjustment feature with 25dB of range. AGC adjust the gain of Pisces whenever the input power is higher than -60dBm. Since the maximum gain of Pisces is 70dB and the maximum output power +10dBm on the DL, whenever input RSSI is higher than -60dBm, AGC would make the appropriate attenuation to keep the output power consistent at the max output power level of +10dBm. Maximum attenuation of AGC is 25dB, which means Pisces repeater can adjust to any circumstance with RSSI of -35dBm or lower. Pisces would shut down when input power is -35dBm or higher. The use of repeater should not be required when signal level is that strong.

D. Auto Shut Down and Auto Turn On

When the input power exceeds AGC range on the DL or UL by 3dB, Pisces would activate its advanced set safety mechanism: Auto Shut Down (ASD) and Auto Turn On (ATO). ASD is a stage that temporarily stops the RF function of PS. On the UL it will continuously detect the input power and resume RF function as soon as the input power reduces to a safe range. For the DL, it will make three attempts to detect the input power in this temporary stage. If the input power reduces to a safe range for the PS to operate, the ATO feature would power the repeater back on and restore all functions promptly. However, if the input power remains too great and dangerous for the network, it will then shut down completely. In such the signal is too strong for the usage of Pisces repeater.

Note: shutdown level of Pisces is at +13dBm (3dB higher than maximum output power), which translates to an input power of -32dBm after full AGC attenuation).

5.2 LED Indications

The Pisces Digital ICS Repeater is designed with built-in LED indicators to simplify the installation process. Details indications can be found below. In general, the more green LEDs the better when it comes to the two sets of LEDs for RSSI and Isolation.

Label	Status	Indication
POWER	On	Calls are being made through the repeater.
	Blinking	3 seconds after no calls are being made, repeater would go into sleep mode.
ALARM	On	Overpower; Over temperature; Isolation; Unit faulty. Alarm could be caused by any one of the conditions above. Please check with OMT for exact cause of alarm.
	Off	Normal.
RSSI	0 on	**<-95dBm** – basically no signal detected. External donor recommended.
	1 on	**-94~-89dBm** – signal is weak. Although repeater can work, service area may be limited due to weak input signal.
	2 on	**-88~-83dBm** – signal is sufficient. Service area still limited.
	3 on	**-82~-77dBm** – recommended minimum input is -80dBm. Therefore with 3 LED on, the repeater is functioning well.
	4 on	**-76~-71dBm** – signal is good. Coverage area can be around 250m^2 with this input signal.
	5 on	**>-70dBm** – signal is strong. PS has can perform well under most conditions with 5 LEDs on. However, to achieve maximum output power of 10dBm, input should be at -60dBm. This value can be checked with OMT. See section 7.5 for OMT monitor information.
Only need to check then Isolation LED when external donor or service antenna is in use.		
ISOLATION	0 on	**<39dB** – donor and service are too close. Isolation alarm would be triggered when isolation value reaches 35dB.
	1 on	**40~44dB**
	2 on	**45~49dB**
	3 on	**50~54dB**
	4 on	**55~59dB**
		Isolation not ideal. Whenever isolation is below 60dB, AGA would reduce according to isolation value to avoid oscillation. For maximum gain, ensure that all 5 isolation LED are on.
	5 on	**>60dB** – isolation is good. PS can perform with maximum gain.

***** UL Stand-By Mode would be activated when UL signal is <-90dBm for over 3 seconds. 90dBm). UL Stand-By Mode deactivates when UL signal is >-85dBm. When UL Stand-By Mode is activated, **green power LED will be blinking until UL transmission resumes**.

5.3 Available Optional Accessories

Standard package of the Pisces Digital ICS Repeater is for one service area plug and play installation. Optional package includes one three meter cable, one 7dBi panel antenna (could be used as donor or service) and a wall mount bracket. With the optional packages, the user can easily use the external antenna to either locate a better signal location or use the antenna to service a second area.

Should there be a need to service more than two rooms/areas, optional cabling and antennas can be purchased through a Coiler sales representative. Below is a list of available accessories to maximize the use of your Pisces Digital ICS repeater.

8521 9dBi Directional
Panel Outdoor/Indoor Antenna

918 2dBi Omnidirectional
Outdoor Antenna

3dBi Omnidirectional
Indoor Antenna

2dBi Omnidirectional
Patch Indoor Antenna

2, 3 and 4-Way
Power Splitters

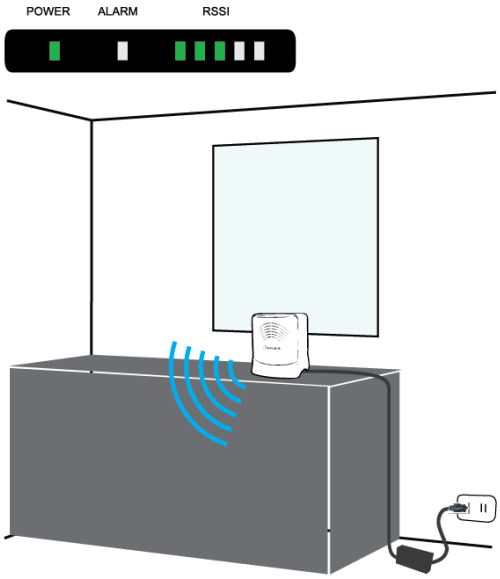
6. Installation

The installation of Pisces Digital ICS repeater without external antenna(s) is really just placing the unit next to the window and plugging in the power. However due to natural or manmade obstacles and the direction of the source signal, signal may not be sufficient for the Pisces to work properly. This section provides instruction on how to identify the best placement location and the application of Pisces with external antenna(s).

6.1 Standard Package Installation

Be sure to review the Quick Installation Guide for instructions on removing the base cover. Review Section 4 for connections at the base.

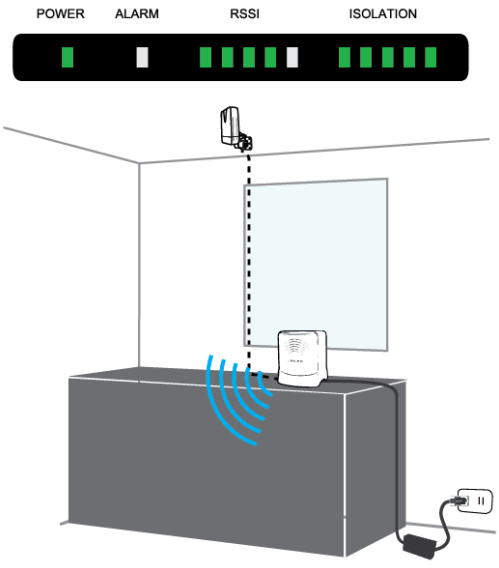
- Locate a window location where you would like to place the repeater main unit. The back of repeater should be at least partially higher than the bottom of the window to ensure receiving of signal.
- Power on the repeater connecting the main unit with AC power supply unit and plugging into a wall socket.
- Check the RSSI LED. Coiler recommend minimum of 3 RSSI LED for quality performance.
- When RSSI LED is less than 3, please locate a different window or refer to the 6.2 for external antenna utilization.



6.2 Utilizing External Donor Antenna

This section refers to using components from the optional package.

- Disconnect the built-in donor port (refer to Section 4 for base connections) and connect the 90° end of the 3 meter cable instead.
- Connect the 7dBi panel antenna to the other end of the 3 meter cable (should you need a longer cable or different antenna, please speak to a Coiler representative).
- Search for a better signal location by checking the RSSI LED. Be sure to have 3 RSSI LED or more.
- When external antenna is used, be sure to check the Isolation LED. Best to have all 5 Isolation LED lid.
- Mount the external donor antenna once an ideal location is found.



Note: when not all of the Isolation LED's are lid, the gain of the repeater maybe less than 70dB.

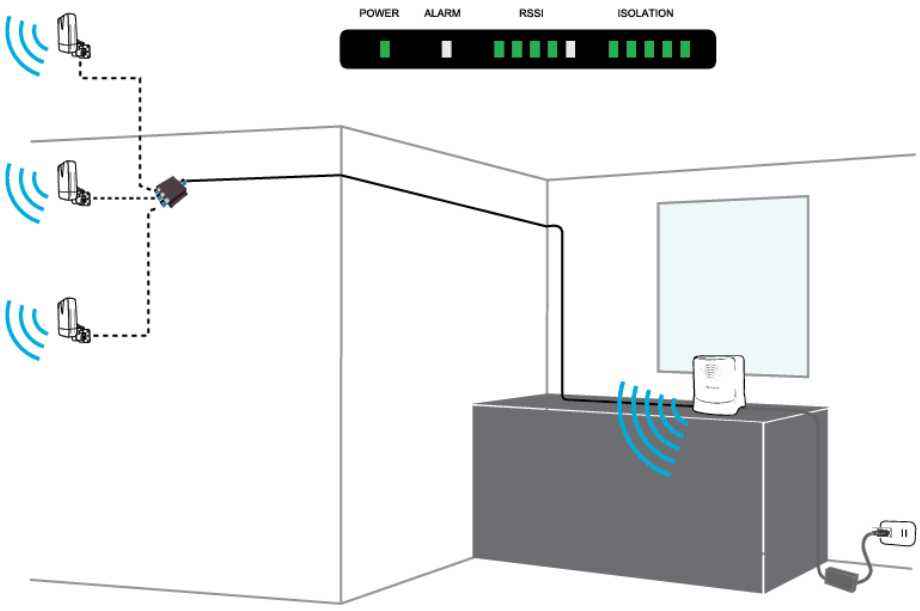
6.3 Utilizing External Service Antenna

This section refers to using components from the optional package.

- Remove the dummy load on MS CPL port (refer to Section 4 for base connections) and connect the 90° end of the 3 meter cable instead.
- Connect the 7dBi panel antenna to the other end of the 3 meter cable.
- Please make sure that all 5 Isolation LED are lid.
- Determine best location to mount the donor antenna to service a second area/room.

Speak to a Coiler representative for additional components for multiple service antenna application.

- The built-in service port has a +10dB difference from the MS CPL port. When multiple antennas would be used, it is recommended that the built-in antenna to be connected to MS CPL port and external antennas to the original service port to compensate for the cable and splitter loss.
- Due to the difference of 10dB output, whenever built in service antenna would not be in use, it is recommended that the original service port be used instead of the MS CPL port.



7. Testing

Test the repeater's performance by making phone calls using a mobile phone of the appropriate operator in various locations in the installation site. Ensure that the signal is available in the locations most distant from the service antennas and in the corners of the facility. In case there are any problems with these tests, please refer to the Troubleshooting section (Section 9) of this manual.

For RF testing of various parameters, please download and install OMT for PS-2200. The ICS function generates interference signal to the testing equipment and would distort the testing result. The PS OMT has different test mode for the testing of different parameters to ensure accurate readings, please refer to section 10.5 under **B – Operator Screenshot** for test mode settings.

Note: With the ICS function on, the Pisces Digital ICS repeater meets all 3GPP and has been certified by the responsible authorities.

8. Accessing the PS with Coiler OMT

The Pisces Digital ICS repeater is designed to be a simply Plug & Connect DIY solution. The use of OMT would be strictly for changing of service frequency or to switch the unit into different test modes. To download the PS OMT, please visit Coiler's FTP site below:

ftp://ftp.coiler.com.tw/_ftp_/coilerclient/OMT/PS2200/

You will find the OMT file itself as well as the driver for the mini USB cable under this folder.

This FTP site is password protected. Please contact your Coiler representative for login user name and password.

8.1 .NET Framework 3.5 Installation

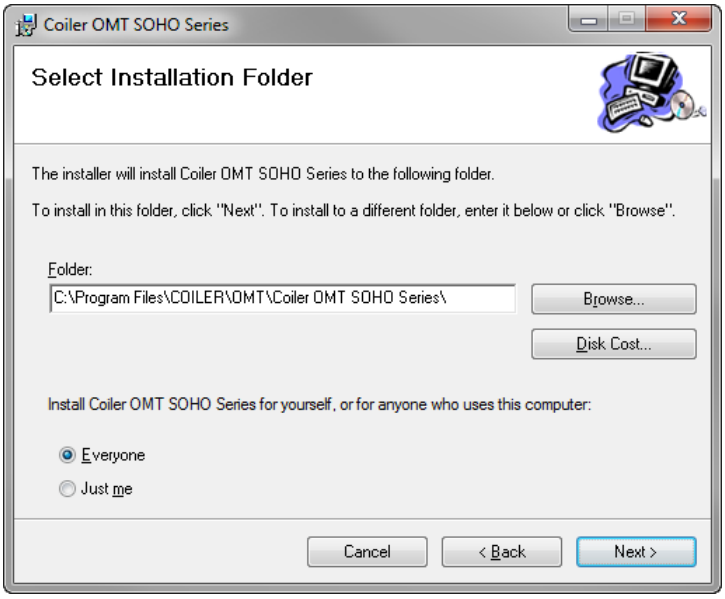
If you are using Windows XP, please install .NET Framework 3.5. It can be downloaded from Microsoft website or from Coiler ftp site. The full download for the file is around 231MB. Please follow the installation instruction once the file is downloaded and launched.

Windows 7 user does not need to install this software addition since it is already built in.

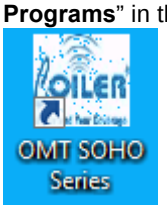
8.2 OMT Installation

- The file downloaded from the FTP site is a zip file. You need to unzip the file before launching the installation.
- You must install both the OMT software and the USB Driver before accessing the PS via the USB port.
- Double click on the OMT SOHO Series installation file to start the installation.

- A welcome screen will appear. Simply click "Next" to continue. You can specify where to install the software in your hard drive as well as who would have access to the Coiler OMT.



- Once the OMT finishes the installation, you can locate it either in the "**Start**" menu under "**All Programs**" in the "**Coiler**" folder or you can find it on your desktop labeled "**OMT**".



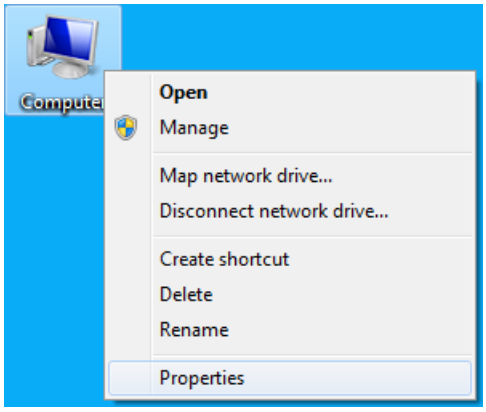
- **You will NOT be able to access the PS with OMT at this point. Please continue to the next section before attempting launching OMT.**

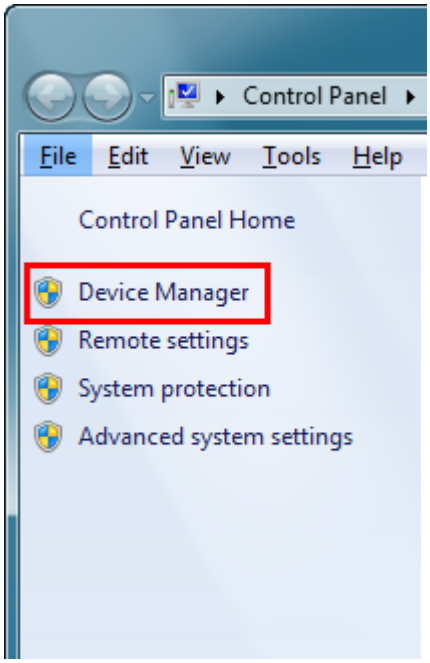
8.3 USB Driver Installation

- Unzip and run the “PreInstaller” file of the USB driver.
- Follow the on screen installation instruction to complete the driver installation.
- At this stage, the three part software/driver installation is complete.

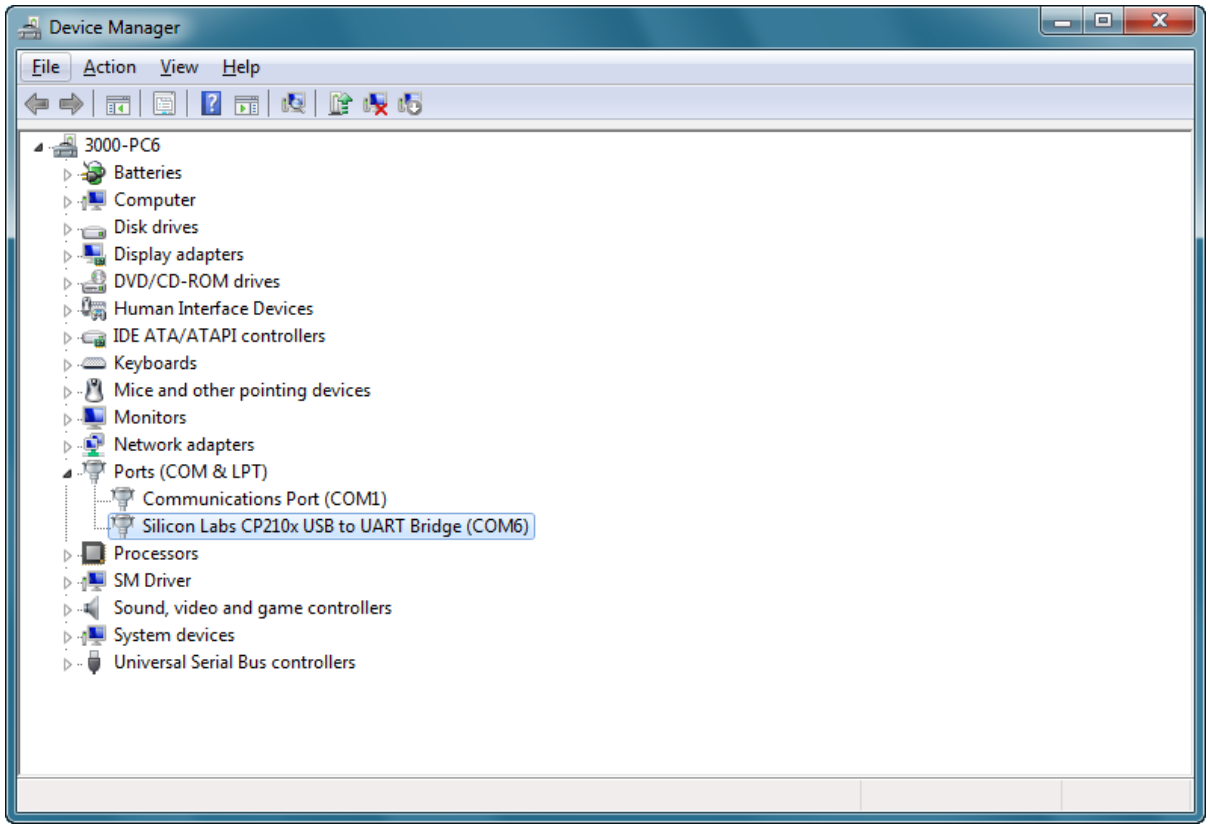
Before launching the OMT, you will need to find out which COM port the PS repeater uses. To find out which COM port to use, **you would need to connect the PS to your computer in order to find out the exact COM port number.**

- Once the PS and the computer are connected. Right click on “My Computer” and select “Properties”. Once inside properties, select the “Device Manager”.



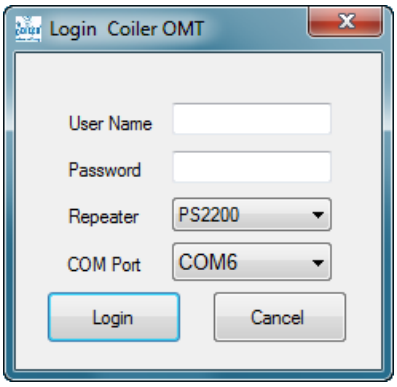


- Next you would need to find “Ports (COM & LPT)” in the hardware hierarchy chart. Expand “Ports (COM & LPT)” and locate “USB Serial Port” and note down the COM number (in the example below it is COM3, your setting may be different). You are now ready to launch the Coiler OMT.



8.4 OMT Login

Now that you have all the software installed and know the COM port number, double click on the OMT software icon on your desktop or under coiler folder from the Start Menu. You will see the following screen.



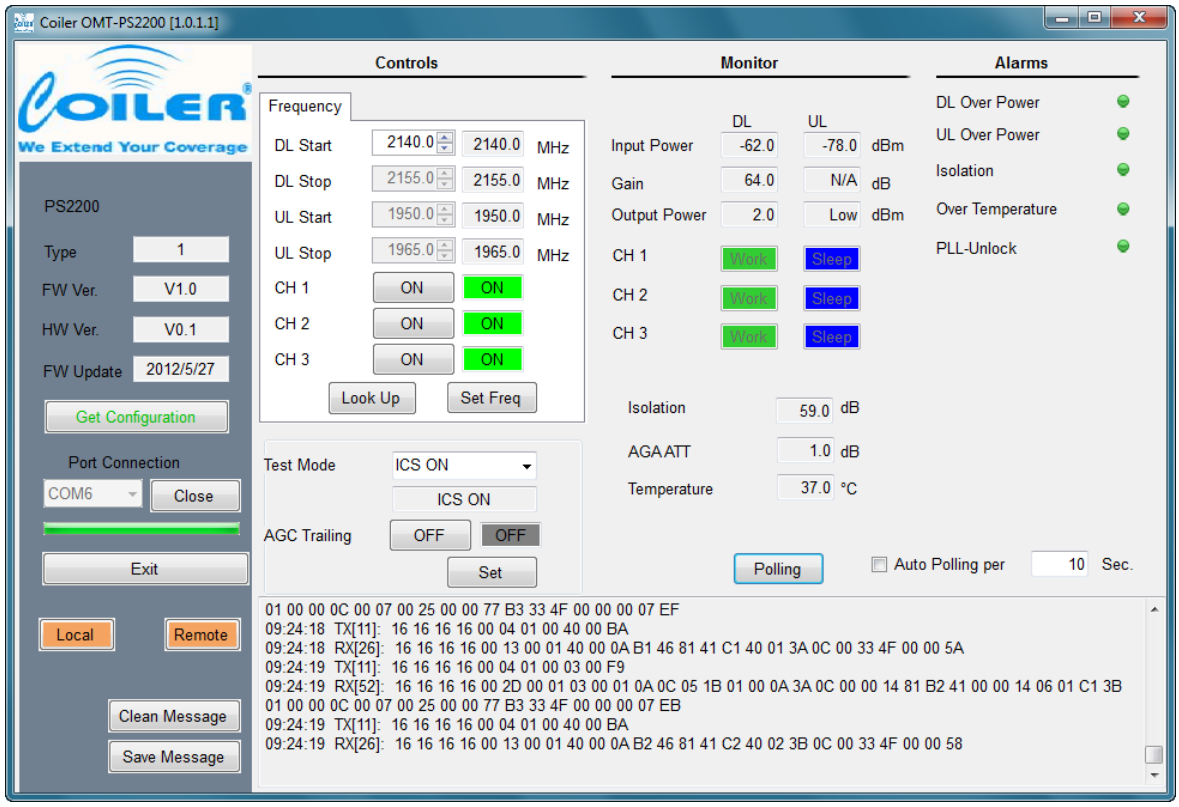
User Accounts	Password	Privilege
user	test	Only view status
operator	coiler	Set different test mode
admin	Contact Coiler Representative	Set different test mode Frequency adjustment Log information for troubleshoot

8.5 Control, Monitor and Alarms

This section indicates the working description of each function.

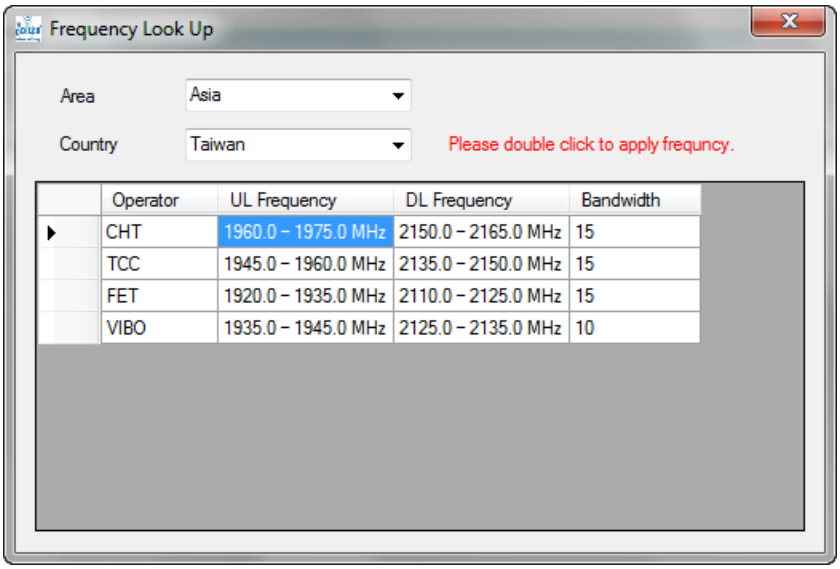
A. Admin Screenshot

- The administrator can press "**Ctrl + F12**" to see the detail polling information and save the information.
- Press "Polling" if you with to get the most updated repeater status. You may also set automatic polling by checking the "Auto Polling" box and indicate the interval in seconds.



Control Descriptions:

DL Start	Adjustable by 0.1MHz. Use the up and down arrow to adjust or simply type the frequency you wish in.
DL Stop	Always 15MHz difference from the DL Start Frequency.
UL Start	Will automatically be calculated base on DL Start Freq.
UL Stop	Will automatically be calculated base on DL Stop Freq.
CH 1	Digital On/Off switch of the first 5MHz of your 15MHz selection.
CH 2	Digital On/Off switch of the middle 5MHz of your 15MHz selection.
CH 3	Digital On/Off switch of the last 5MHz of your 15MHz selection.
Look UP	Opens separate window for frequency selection by region and operator. Double click to change frequency to intended operator's frequency.
Set Freq	Applies the adjusted frequency to the repeater.
Test Mode	Select the mode to test for particular parameter.
AGC Trailing	Default off. When AGC trailing is on,



Monitor Descriptions:

Input Power	Indicating the input power of both DL and UL detected by the repeater.
Gain	Indicating the DL and UL gain of repeater. UL gain will display as N/A during UL standby mode (blue sleep button).
Output Power	Displays the DL and UL output power of the repeater. UL output power will display as Low during UL standby mode (blue sleep button).
CH1	Displays the DL and UL working status of first 5MHz of your 15MHz selection. DL will show sleep when channel is switched off or when no signal of this channel is detected.
CH2	Displays the DL and UL working status of middle 5MHz of your 15MHz selection. DL will show sleep when channel is switched off or when no signal of this channel is detected.
CH3	Displays the DL and UL working status of last 5MHz of your 15MHz selection. DL will show sleep when channel is switched off or when no signal of this channel is detected.
Isolation	Displays the isolation value detected by repeater.
AGA ATT	Adjustment made by AGA when isolation is insufficient.
Temperature	Operating temperature of the repeater.

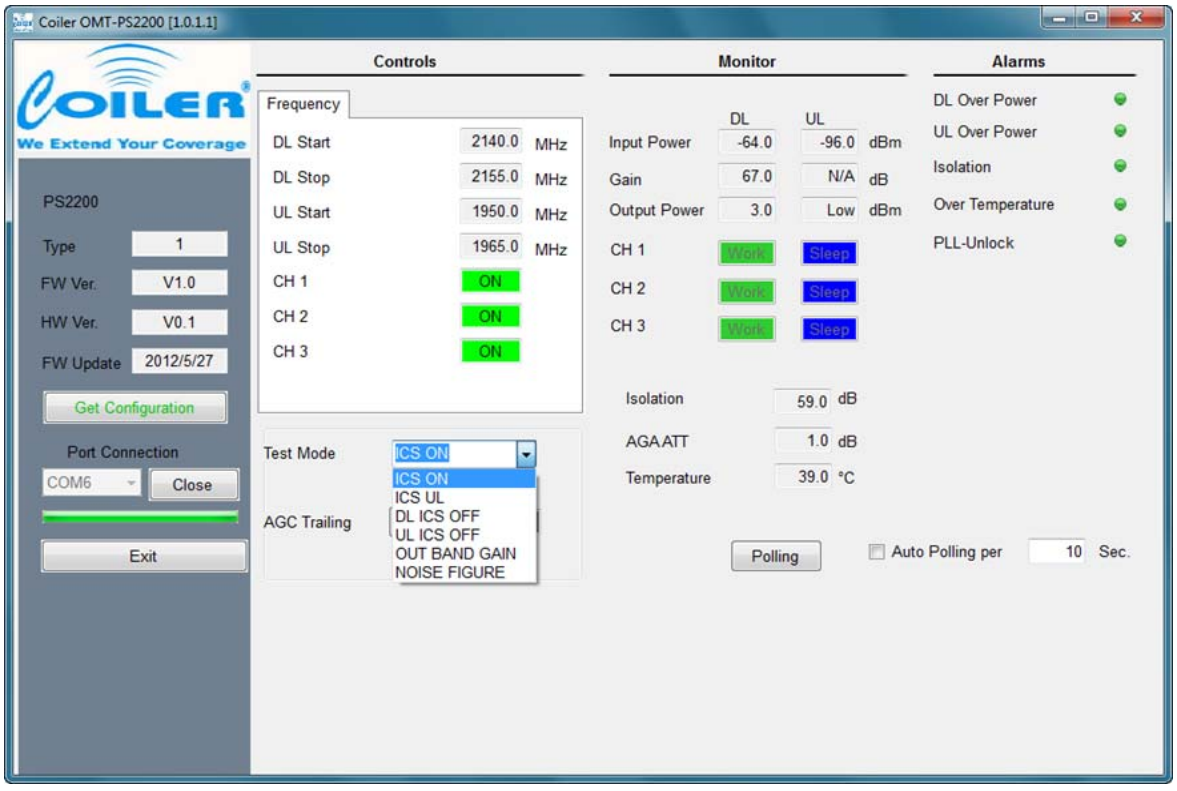
Alarm Descriptions:

DL Over Power	This can happen when DL input power reaches -32dBm or higher.
UL Over Power	This can happen when too many people are using the repeat simultaneously.
Isolation	Triggers when isolation value is <35dB.
Over Temperature	Triggers when temperature is over 75°C. Repeater will recover at 65°C.
PLL-Unlock	Triggered when repeater hardware fails. If alarm persist, contact Coiler for warranty information.

B. Operator Screenshot

The ICS function generates interference signal to the testing equipment and would distort the testing result. Hence a list of different test modes can be found under “admin” and “operator” account. Please select the appropriate test mode according to the testing parameters to ensure accurate result.

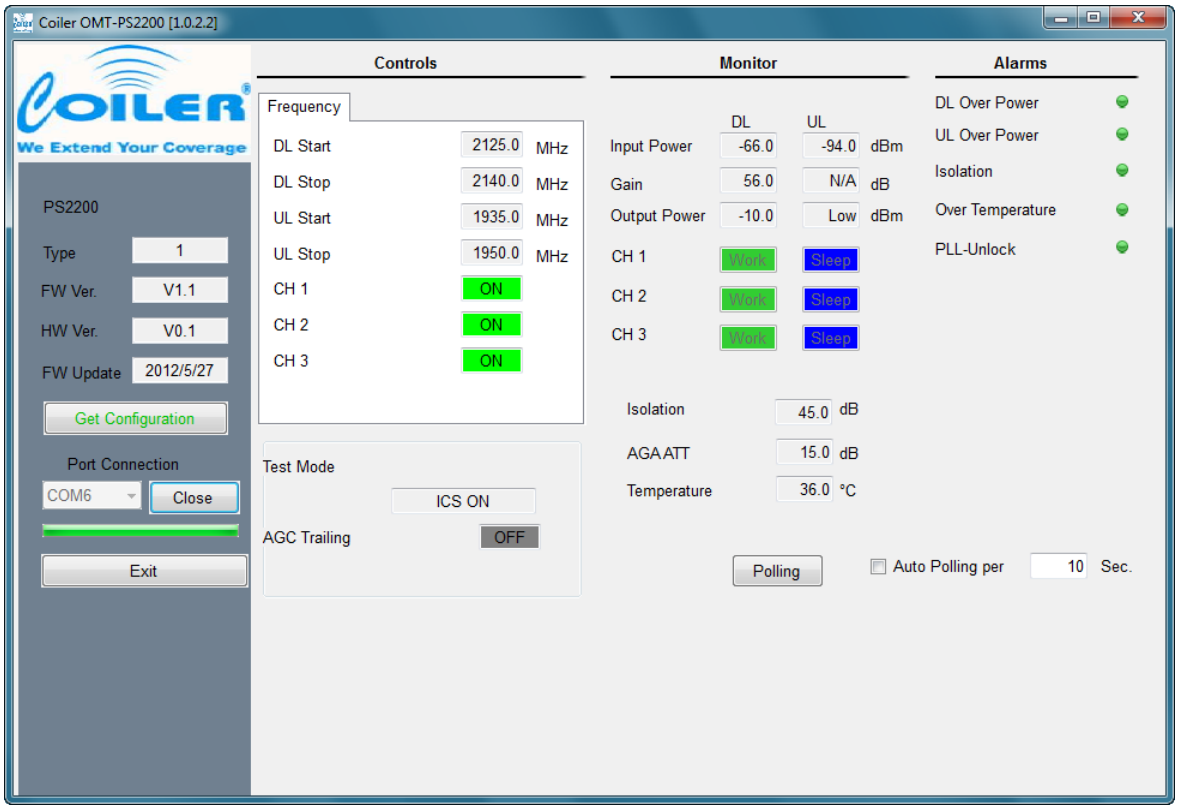
Test Mode	Purpose
ICS ON	Default setting. **Always** select this option to ensure proper functioning of PS.
ICS UL	Select this option to test UL standby mode.
DL ICS OFF	UL PA would be off and DL signal would become analog with this test mode.
UL ICS OFF	DL PA would be off and UL signal would become analog with this test mode.
OUT BAND GAIN	Select this test mode to test out of band gain.
NOISE FIGURE	Select this test mode to test noise figure.



Both “admin” and “operator” also has the ability to switch AGC Trailing on/off. When AGC trailing is on, UL AGC will follow DL AGC. By default, AGC trailing is off so UL and DL AGC would work independently.

C. User Screenshot

User mode does not have ability to modify any setting. Only viewing of status is available.



9. Troubleshooting

Please first refer to troubleshooting section of the Quick Installation Guide.

Situation	Solution
There is still no signal after the installation of the equipment.	• Ensure that the output power of the Adaptor is DC 6V / 6A and that green power LED is illuminated. • Ensure that all connections are tightly fastened. • Ensure that the outdoor signal level (RSSI) is sufficient. (Coiler recommends a signal strength greater than -80dBm, or three green RSSI LED). • If external donor antenna is used, ensure that all connections are tightly fastened. • Reconnect the power cable.
The signal strength is too weak in the corner.	• Ensure a strong donor signal level (RSSI) of -80dBm or better is achieved (three green RSSI LED). • Adjust the placement location of the PS repeater or consider using external donor antenna. • Use the coupler port to install additional service
The repeater's signal is not stable.	• Ensure that the outdoor signal is stable. • If external donor/service antenna is used, ensure that the Isolation LED has five green LED. • Consider changing location of PS repeater or connect
The red Alarm LED is lit.	• Ensure that input RSSI is not -32dBm or higher. • If alarm persist even though RSSI is less than -32dBm, Log into OMT to review the alarms list for exact alarm description. • For PLL-Unlock alarm, contact a Coiler representative.