Generation 5 Documentation

Manual: Beta version 1
Software version 5014
Date: 5/2/2013

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ATTACHMENTS

FCC-OET TDWR NOTICE 10/14/2010 for 5470-5725 MHz w/ DFS

Logging into a repeater

1. **How to login to relay point locally**

First, hard set a local area connection to a IP address in the range of 172.16.0.X e.g. 172.16.0.50 with a subnet mask of 255.255.255.0 with no gateway.
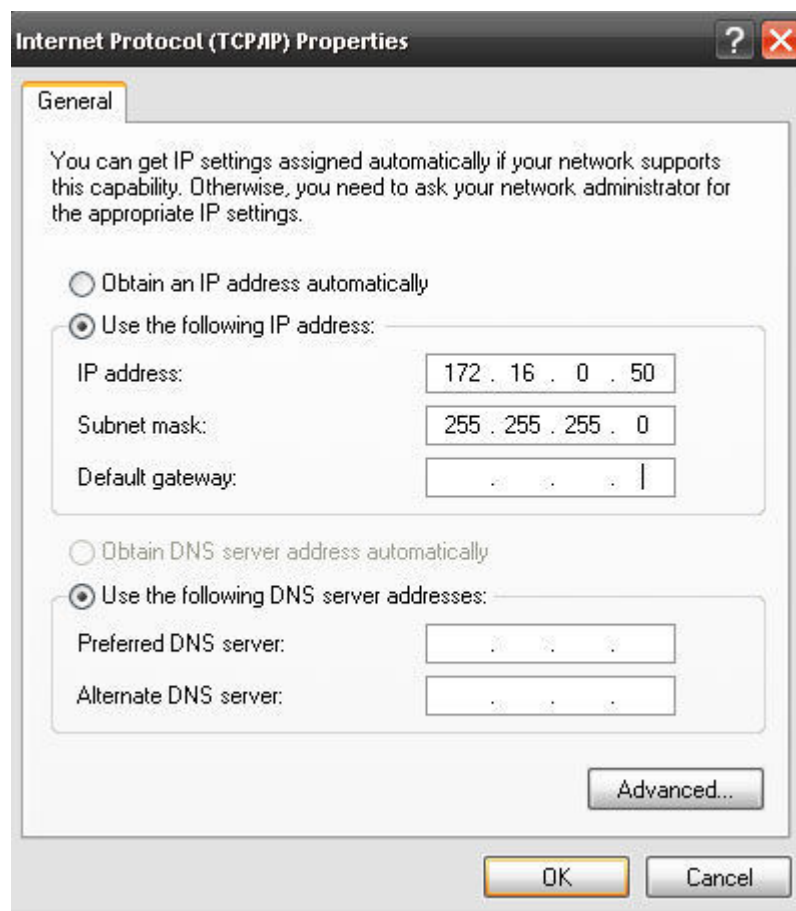
- Plug in a power-supply to an electrical outlet and then, run a patch cable from the pigtail to the middle port (eth0) on the repeater. You will then see a green light on in the water box. You can also use eth1 to program repeaters.

- After, plug the other end of the pigtail (the 4-inch black cable) into the Ethernet port we earlier set to the 172 hard set IP address.

- Open a web browser and try to login to https://172.16.0.1:8000
  a. Troubleshooting logging in

- If you can't get into the device open a command prompt window Ping the 172.16.0.1. If you can't ping the 172.16.0.1 try pinging the 172.168.0.x address we assigned to the local area connection. If you can ping the local area connection than locally it is correct.

```
Command Prompt                                                    _ □ ×
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\bmaletsky>ping 172.16.0.1 -t_
```
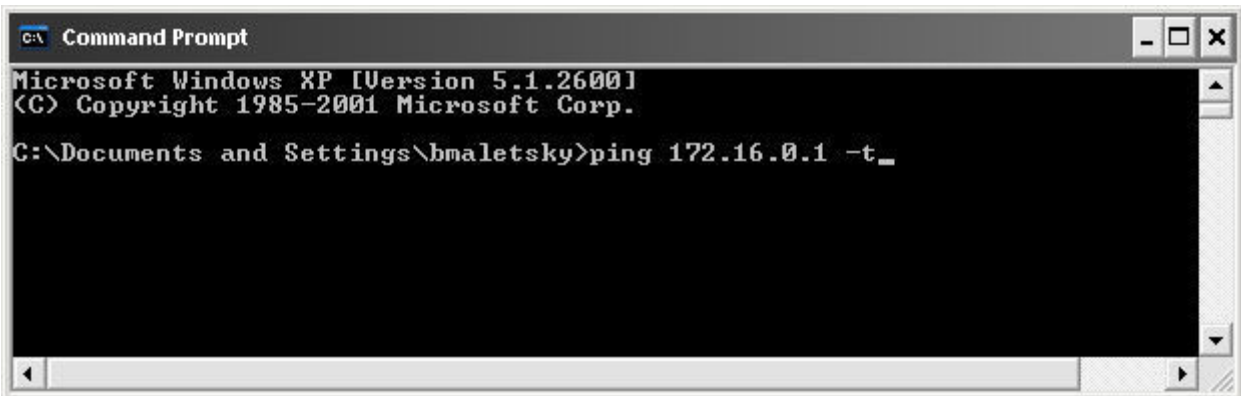
- Then go to your local area connection and right-click and go to repair. After it repairs attempt to ping the 172.16.0.1. If you can't go back to the local area connection and disable and then enable it again. Then attempt to ping the 172.16.0.1. You should be able to ping the address and login to the device. If not start back at the beginning step 1.

  If the device is new out of manufacturing you can use the 10.0.201.250 address to login to the repeater. You may have to follow the above steps but change your local area connection IP address to 10.0.201.50.

Types of Gen 5 Repeaters

PRODUCT CODE	DESCRIPTION
G5RL10	5GHz Panel (18dBi) w/ integrated 10dBi Omni Directional Antenna
G5RL10E	5GHz Panel w/ external connectors
G5RL10G	5GHz Panel (18dBi) w/ integrated 10dBi Omni Directional Antenna w/ GPS
G5RL10EG	5GHz Panel w/ external connectors w/ GPS
G5RL10T	5GHz Tri-Sector (17dBi)
G5RL10TG	5GHz Tri-Sector (17dBi) w/ GPS
G5RL10TH	5GHz Tri-Sector (17dBi) w/ 48v Heater
G5RL10THG	5GHz Tri-Sector (17dBi) w/ GPS and 48v Heater
G5RL10TS	5GHz Tri-Sector (17dBi) w/ shims
G5RL10TGS	5GHz Tri-Sector (17dBi) w/ GPS and shims
G5RL10THS	5GHz Tri-Sector (17dBi) w/ 48v heater / shims
G5RL10TGHS	5GHz Tri-Sector (17dBi) w/ GPS / 48v heater / shims
G5RL102XG	5GHz Duo-Sector (17dBi) w/ GPS and aluminum case
G5RL102X	5GHz Duo-Sector (17dBi) w/ aluminum case

*Determining what type of repeater you are using at the bottom of the repeater there is a sticker that will list the following information.

- Product Code:
- Date Created:
- FCC ID:

Generation 5 Device Modes

1. Uplink Router

An Uplink Router will connect the site and start a new routed subnet.

2. Downlink Router

Downlink router mode will feed other relays and or connect customers on external devices or an Omni-directional antenna. It will also start a new routed subnet.

3. Downlink Bridge

Downlink Bridge will be bridged off the sites current subnet and feed another relay and or connect customers on external devices or an Omni directional antenna.

4. Uplink Bridge

Uplink Bridge will connect the site and be in the same bridge 1group as the downlink that feeds it.

Configuring a Uplink Router

1. After logging into the relay go to Configure > Mode. Next, choose 2cardUrouter (client + AP router)

Current Mode	Description
2cardUrouter (client + AP router)	client and access point that starts a subnet
Switch Mode	
2cardDbridge (dual AP bridge)	dual access points
2cardDrouter (dual AP router)	dual access points that start a subnet
2cardUbridge (client + AP bridge)	client and access point
2cardUbridge-bonded (client uplink full-duplex)	full-duplex client uplink
2cardDbridge-bonded (AP bridge full-duplex)	full-duplex access point
2cardUrouter-bonded (client + AP full-duplex router)	full-duplex client and access point that starts a subnet
2cardDrouter-bonded (Dual AP full-duplex router)	full-duplex dual access points that start a subnet
2cardUbridge-ospfbonded (Dual client OSPF full-duplex)	OSPF FDX Uplink implementation
2cardDbridge-ospfbonded (Dual AP bridge OSPF full-duplex)	OSPF FDX Downlink implementation

2. After choosing the mode of the device to 2cardUrouter (client + AP router) it will redirect you to the Configure > Settings page. The first part of configuring a router is knowing what your IP address is.
3. Backhaul – Card1. The three fields at the top of the configuration page are the bridged information for the repeater. This is what the repeater will talk on to connect to the downlink that feeds it e.g. if the parent device feeding the repeater is 10.10.21.1 then the Client IP address (or eth0 IP address) will be 10.10.21.x (2-65 240-254).

Configuring The Backhaul – (Card 1)

Backhaul - card 1

Client IP	
Client Netmask	
Gateway	10.0.201.1

Client IP: The bridged IP address connecting the two sites on the br1 bridge group.

Client Netmask: This field represents the subnet that the br1 bridge group contains.

Gateway: This field represents your gateway from this device. In a router mode it will be the gateway of the router in your br1 bridge group IP address.

Configuring the Router – (Card 0, eth0, eth1)

Router - card 0, eth0, eth1

Router IP	10.0.201.76
Router Netmask	255.255.255.0

Router IP: This is the routing IP address that will feed all wireless customers off of the device and wired repeaters on eth1. This will normally be a ".1" e.g. 10.10.21.1.

Router Netmask: This is the subnet mask for the routing IP address. This will normally be a /24 class C Netmask (255.255.255.0).

Configuring Card 1 (5 GHz directional uplink client)

Next, to connect the site we will need to do a survey from card 1 (5 GHz directional uplink client). Scroll down to the site survey column and click extended. This will survey for all available wireless device in the 5 GHz band.

5ghz directional downlink AP - card 1

Downlink Radio Mode	N mixed ▾
Downlink Frequency	5.8ghz ▾
Downlink Channel	151 - 5.755 GHz ▾
Downlink SSID	bradmimoDL
Downlink Power	13 ▾ dB
Downlink Distance	10 ▾ miles
Downlink AutoAck	No ▾
Downlink Channel Width	10 mhz ▾
Downlink MAC	90:A4:DE:AA:3F:74
Site Survey	click to survey

After finding the appropriate downlink to connect to simply press the red link labeled >select. This will enter the upstream Mac address, uplink frequency, and uplink channel.

MAC	SSID	IP	Chan	Signal	Noise	
00:1B:B1:04:FD:23	AnitaDL	10.10.20.1	56	-81 dB	-96 dB	Select
00:1B:B1:04:FD:0A	EsplanadeDL	10.0.170.1	60	-90 dB	-96 dB	Select
00:1B:B1:04:FB:8C	HicksDL	10.11.56.31	64	-86 dB	-96 dB	Select
00:0B:6B:34:9F:82	AIRPARKDLV1	10.0.188.1	64	-86 dB	-96 dB	Select

You will have to put in a SSID of the sites name followed by UL. Set the correct txpower and mileage. More information on the fields is listed below.

Upstream MAC: This is the MAC address of the device the uplink will be connecting to.

Uplink frequency: The current frequency band the radio will broadcast in. 5.3 GHz A only 5.5 GHz A only and 5.8 GHz A only.

Uplink channel: This will be dependent upon the uplink frequency field.

Uplink SSID: It is helpful to set this field to something related to the location of the device. There can be no spaces in the SSID.

Uplink Power: This is the transmit power the radio will broadcast at.

Uplink Distance: This is the ack time-out setting that calculates how far to send the data. Setting the distance to 10% longer than the actual distance between repeaters is recommended.

Uplink AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate it-self to the correct ack time out settings with the least errors.
Only use this on far shots that are affected by speeds or duplicate packets due to a fluctuating ack value.

Uplink Channel Width: Channel width can be set to 20 MHz or 10 MHz. This is the channel space the current frequency will broadcast at. 20 MHz will give you more throughput and is recommended for infill, backhaul repeaters and uplinks. 10 MHz is recommended for point to multi-point connections.

Uplink Mac: The uplink mac is one mac address that is associated to the card1 br1 bridge group. This mac will never have to be cloned when replacing devices.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Configuring Card 0 (5 GHz Omni AP)

5ghz omni AP - card 0

Omni Radio Mode	N mixed ▾
Omni Frequency	5.3ghz ▾
Omni Channel	60 - 5.3 GHz ▾
Omni SSID	bradmimoAP
Omni Power	13 ▾ dB
Omni Distance	10 ▾ miles
Omni AutoAck	No ▾
Omni Channel Width	10 mhz ▾
Omni MAC	90:A4:DE:AA:3E:75
Site Survey	click to survey

Power Status	No powerbox detected
Power Child IP	
Description	gen5_repeater_test

Save

Card 0 is normally where Point to multi point subscribers will connect
through. Now we will need to configure the 5 GHz Omni.
If you are replacing the device the channel, channel width and mac are very important.
All three values connect CPEs to the 5 GHz Omni. More information on the fields is
listed below.

Omni frequency: This is the wireless mode that the radio will run at.

Omni Channel: This is the wireless channel the radio will run at.

Omni SSID: This is the SSID that will be seen when associating to this radio.

Omni Power: This is the transmit power the radio will broadcast at.

Omni Distance: This is the Ack time out settings.

Omni AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate it-self to the correct ack time out settings with the least errors.

Omni Channel Width: 10 MHz or 20 MHz is recommended.

Omni Mac: The Omni mac address is the mac address CPEs will connect to. This may need to be cloned if you are replacing a device.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Power Child IP: This is used for devices that are daisy chained off of each other. This field is normally not filled out. Nothing is affected if not filled out it is just for reference.

Description: This is the site location.

Saving and Rebooting

After configuring the device you will need to save the settings and reboot the repeater. This is done by clicking save at the bottom of the page. You will then get a prompt at the top of the page to go to Administration > Reboot.

You completed the following actions:
Saved the new configuration (please reboot via the Administration menu to activate your changes)

Configuring a Downlink Router

1. After logging into the relay go to Configure > Mode. Next, choose 2cardDrouter (dual AP router)

Current Mode	Description
2cardUrouter (client + AP router)	client and access point that starts a subnet
Switch Mode	
2cardDbridge (dual AP bridge)	dual access points
2cardDrouter (dual AP router)	dual access points that start a subnet
2cardUbridge (client + AP bridge)	client and access point
2cardUbridge-bonded (client uplink full-duplex)	full-duplex client uplink
2cardDbridge-bonded (AP bridge full-duplex)	full-duplex access point
2cardUrouter-bonded (client + AP full-duplex router)	full-duplex client and access point that starts a subnet
2cardDrouter-bonded (Dual AP full-duplex router)	full-duplex dual access points that start a subnet
2cardUbridge-ospfbonded (Dual client OSPF full-duplex)	OSPF FDX Uplink implementation
2cardDbridge-ospfbonded (Dual AP bridge OSPF full-duplex)	OSPF FDX Downlink implementation

2. After choosing the mode of the device to 2cardUrouter (dual AP router) it will redirect you to the Configure > Settings page. The first part of configuring a router is to know your IP addresses. If replacing a device simply pull the configuration data off the device. If you are configuring a new Downlink Router please see the section on **Creating Routers and what to check**

Configuring The Backhaul – eth0:

The four fields at the top of the configuration page are the bridged information for the repeater. This information is for connecting the downlink to an existing sites uplink or switch.

Backhaul - eth0

Ethernet IP	
Ethernet Netmask	
Gateway	10.0.201.1
Parent IP	10.0.201.1

Ethernet IP: This is the bridged IP address on the local subnet on the site the repeater is being installed on.

*It is important that the data cable be plugged into eth0 on the repeater or it will not come online as a router.

Ethernet Netmask: This is the local bridge groups subnet mask either being announced on the switch or the uplink at the location.

Gateway: This is the Gateway of the local bridge group at the location.

Parent IP: This will either be the managed switch at the location or the uplink at the site. This is important since the parent ping watchdog will ping this address.

Configuring the Router – (Card 0, Card 1, eth1)

Router IP: This is the routing IP address that will feed all wireless customers off of the device and wired repeaters on eth1. This will usually be a ".1" e.g. 10.10.21.1.

Router Netmask: This is the subnet mask for the routing IP address. The majority of repeaters normally use a /24 class C Netmask (255.255.255.0).

Router - card 0, card 1, eth1

Router IP	10.0.201.76
Router Netmask	255.255.255.0

Configuring Card 1 (directional downlink AP- card 1)

> Next, If replacing a device simply pull the configuration data from the device being replaced. If it is a new device label the device appropriately e.g. if it feeds 701 Main St. label the SSID as 701mainstDL).

```
5ghz directional downlink AP - card 1

Downlink Frequency        [ 5.3ghz A only ▼ ]
Downlink Channel          [ Not Set        ▼ ]
Downlink SSID             [                  ]
Downlink Power            [ 20    ▼ ] dB
Downlink Distance         [ 6     ▼ ] miles
Downlink AutoAck          [ No ▼ ]
Downlink Channel Width    [ 20 mhz (default) ▼ ]
Downlink MAC              [ 00:1B:B1:02:BC:91 ]
Site Survey               normal survey extended
```

> **Downlink Frequency:** This is the frequency band the radio will broadcast in.

> **Downlink Channel:** This will be a downlink channel that will feed either a relay or Point to multi point customers. When choosing a channel use a channel that is not used on the site and is at least 4 channels away from any frequency used on the site.

> **Downlink SSID:** Use a SSID that is appropriately labeled. E. G. if the downlink is feeding a relay such as 701 Main St. use 701mainDL. There should be no spaces in the SSID.

Downlink Power: This is the transmit power the radio will broadcast at. Please talk to your supervisor about appropriate transmit power settings.

Downlink Distance: This is the Ack time out settings that calculate how far to send the data. Setting the distance to 10% longer than the actual distance between repeaters is recommended. If it is an internal panel antenna the longest distance it can broadcast is 10miles.

Downlink AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate itself to the correct ack time out settings with the least errors.

Only use this on far shots that are affected by speeds or duplicate packets due to a fluctuating ack value.

Downlink Channel Width: Chanel width can be set to 20 MHz or 10 MHz. This is the channel space the current frequency will broadcast at. 20 MHz will give you more throughput and is recommended for infill, backhaul repeaters and uplinks.

Downlink Mac: The downlink mac is the mac address either relays or CPEs will connect to. If replacing the device this mac address will need to be cloned.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Configuring Card 0 (5 GHz Omni AP –Card 0)

```
5ghz omni AP - card 0

Omni Frequency              5.8ghz A only ▼
Omni Channel                Not Set        ▼
Omni SSID                   [            ]
Omni Power                  16        ▼ dB
Omni Distance               6  ▼ miles
Omni AutoAck                No  ▼
Omni Channel Width          10 mhz         ▼
Omni MAC                    00:0F:A2:00:04:98
Site Survey                 normal survey extended

Power Status                No powerbox detected
Power Child IP              [            ]
Description                 [            ]

[ Save ]
```

Card 0 is normally where Point to multi point customers will connect through. Now we will need to configure the 5 GHz Omni. If you are replacing the device the channel, channel width and mac are very important. All three values connect CPEs to the 5 GHz Omni. More information on the fields is listed below.

Omni frequency: This is the wireless mode that the 5 GHz Omni will run on. This can be either 5.3 GHz A only , 5.5 GHz A only or 5.8 A only.
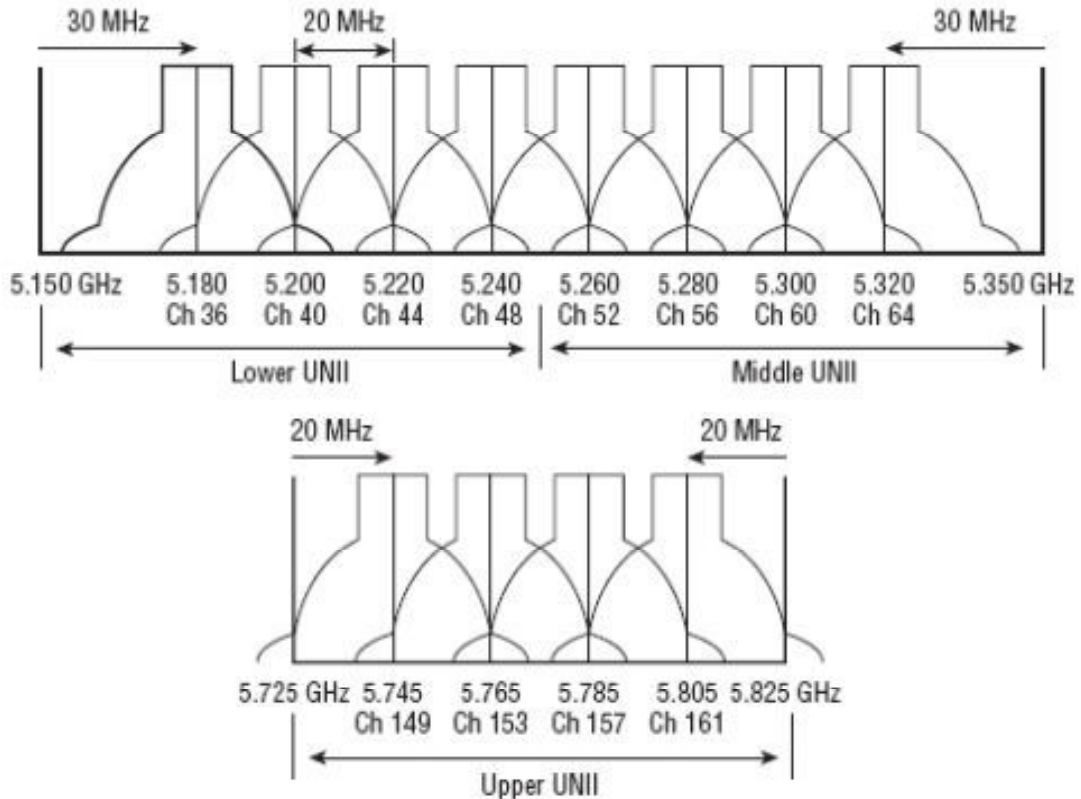
Omni Channel: This is the wireless channel the radio will broadcast on. See graph below for overlapping channels.

Omni SSID: The Omni SSID should contain a short description of the unit.

Omni Power: This is the transmit power the radio will broadcast at. Please see the transmit power table located in the FCC section of this document for the proper self-installation transmit power for your antenna/device.

Omni Distance: This is the Ack time out settings. This should be an approximation of the mileage of the link.

Omni AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate it-self to the correct ack time out settings with the least errors.

Omni Channel Width: uses 10 and 20 MHz transmit channel widths.

Omni Mac: The Omni mac address is the mac address CPEs will connect to. This may need to be cloned if you are replacing a device.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Description: This is the site location.

Identifying Types of Repeaters and Antennas

Digitalpath uses many different types of repeater and antenna combinations here are some examples**.**

G5RL10 Repeater	Trisector
5 GHZ omni (10dBi) 5GHZ Panel (18dBi) Optional External Connectors instead of omni (G5RL10E)	5 GHZ omni 5GHZ Panel 2 TX, 3 RX Antennas

Duo-Sector
Dual 5GHz 17dBi antenna

PRODUCT CODE	DESCRIPTION
G5RL10	5GHz Panel (18dBi) w/ integrated 10dBi Omni Directional Antenna
G5RL10E	5GHz Panel w/ external connectors
G5RL10G	5GHz Panel (18dBi) w/ integrated 10dBi Omni Directional Antenna w/ GPS
G5RL10EG	5GHz Panel w/ external connectors w/ GPS
G5RL10T	5GHz Tri-Sector (17dBi)
G5RL10TG	5GHz Tri-Sector (17dBi) w/ GPS
G5RL10TH	5GHz Tri-Sector (17dBi) w/ 48v Heater
G5RL10THG	5GHz Tri-Sector (17dBi) w/ GPS and 48v Heater
G5RL10TS	5GHz Tri-Sector (17dBi) w/ shims
G5RL10TGS	5GHz Tri-Sector (17dBi) w/ GPS and shims
G5RL10THS	5GHz Tri-Sector (17dBi) w/ 48v heater / shims
G5RL10TGHS	5GHz Tri-Sector (17dBi) w/ GPS / 48v heater / shims
G5RL102XG	5GHz Duo-Sector (17dBi) w/ GPS and aluminum case
G5RL102X	5GHz Duo-Sector (17dBi) w/ aluminum case

External Antennas

There are a couple different types of external antennas Digitalpath uses. Here are some examples**.**

5GHZ 20dBi Dual Polarity Sector - These are dual polarity sectors. Uses a RP-SMA cable listed in the parts list at the end of this document.

5GHZ 23dBi External Diamond –These can be used to improve signal or create another downlink device. Should be used on PTP links.

5GHZ Sector Dual Polarity 20dbi Gain	**5ghz External Diamond** Single Polarity Vertical 23dbi Gain	**5ghz External Dish** Single polarity Vertical 2 ft 29dbi Gain Optional 33dbi Dish

5GHZ 2ft 29db Dish – Dishes are used for longer distance links. They give you a 15 degree beam width. Dishes can be installed on any external 5 GHz port. Point to Point links only.

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Understanding the Status Page

The Gen 5 Repeater's status page has some general useful information. Here are the definitions and examples of the status page.

Configuration		
Product Type	AP 5GHz TriSector, int ants	
Description	gen5_test76	
Bridge IP	10.0.201.76	255.255.255.0
Mode	dual AP bridge	
Device Type	gen5	
Board Type	geode233	
Software Version	5009	

Interfaces	Status	MAC
5ghz AP - card 1	up	00:0E:8E:39:38:4B
5ghz AP - card 0	up	00:1B:B1:58:F6:EA
eth0	link ok, negotiated 100baseTx-FD flow-control	00:0D:B9:1B:8A:C4
eth1	no link	00:0D:B9:1B:8A:C5
Serial port	No powerbox detected	

Understanding the General Tab

Description: This is the description entered at the bottom of the settings page. Usually will be the site locations address.

Router IP: This is the Routing IP address for the AP router

Client IP: This is the Bridged IP on an AP router

Mode: This is the current Mode the repeater is running in.

Device Type: Displays the Generation of the Repeater.

Software version: Shows current software version. Installers need to take note of this when replacing repeaters; firmware needs to be on the newest current version.

Interfaces: Shows current software version. Installers need to take note of this when replacing repeaters; firmware needs to be on the newest current version.

Understanding and using the Stations tab

The stations tab displays current wireless information and tools for troubleshooting. Pages such as Stations, Survey, Change channel, and radio check.

Stations- Displays all current local and associated hosts. It will display its own Downlink, local interfaces, and stations connected on what interface. Also shows signal strengths and noise floors.

Stations

Interface	MAC	IP	Type	Beacon	Signal	Noise
ath1wds0	00:1B:B1:04:FD:21	10.10.21.1	Downlink	0	-73dBm	-96dBm
ath1	00:1B:B1:03:61:3D	10.10.21.4	Local	0	N/A	N/A
ath0	D8:B3:77:F4:0A:E7	Unknown	Station	10	-45dBm	-96dBm
ath0	00:1B:B1:03:61:53	10.10.25.1	Local	0	N/A	N/A

Survey - The Survey tap gives you the option from surveying in each radio and in different channel widths. This can also be completed in Configure > Settings page.

Survey

Interface	Chan Width	
5ghz directional downlink AP - card 1	10 mhz ▾	click to survey
5ghz omni AP - card 0	10 mhz ▾	click to survey

Change Channel - To change channel properly it needs to be done in the change channel section of the Stations tab. By doing the channel change there the repeater sends out a beacon to its children that it is going to change the channel. After the repeater sends out the beacon to its children it goes forward with its channel change. This is important when changing

channels because without the beacon you can find CPEs and repeaters not following frequency changes.

Change Channel			
Interface	**Current**	**New**	
5ghz directional downlink AP - card 1	113	113 - 5.565 GHz ▼	Change
5ghz omni AP - card 0	62	62 - 5.31 GHz ▼	Change

Radio Check - Radio Check is a simply program that checks to see if the radio working properly. Just press click to check, and it will come up with your radio results. If no signal is determined the radio is bad.

Radio Check		
Interface	**Frequency**	
5ghz directional downlink AP - card 1	5ghz ▼	click to check
5ghz omni AP - card 0	5ghz ▼	click to check

Radio check complete
Tested card 0 transmitting in A mode
Card 0: 5ghz directional
Card 1: 5ghz directional
Signal: -24 Noise: -96 Ratio: 72

DHCP- Displays the leases on the 10.x.x.x Network to its CPEs and how long until their lease expires.

Speed Test- This feature is not functional in the GUI. Please refer to the SSH section of this manual.

Configuring a Uplink Bridge

1. After logging into the relay go to Configure > Mode. Next, choose 2cardUbridge(client + AP Bridge)

Current Mode	Description
2cardUbridge (client + AP bridge)	client and access point
Switch Mode	
2cardDbridge (dual AP bridge)	dual access points
2cardDrouter (dual AP router)	dual access points that start a subnet
2cardUrouter (client + AP router)	client and access point that starts a subnet
2cardUbridge-bonded (client uplink full-duplex)	full-duplex client uplink
2cardDbridge-bonded (AP bridge full-duplex)	full-duplex access point
2cardUrouter-bonded (client + AP full-duplex router)	full-duplex client and access point that starts a subnet
2cardDrouter-bonded (Dual AP full-duplex router)	full-duplex dual access points that start a subnet
2cardUbridge-ospfbonded (Dual client OSPF full-duplex)	OSPF FDX Uplink implementation
2cardDbridge-ospfbonded (Dual AP bridge OSPF full-duplex)	OSPF FDX Downlink implementation

2. After choosing the mode of the device to 2cardUBridge (client + AP Bridge) it will redirect you to the Configure > Settings page. The first part of configuring a bridge is finding a unused bridged IP in the subnet you are connect to.

2cardUbridge (client + AP bridge) Settings

IP Address	
Netmask	
Gateway	

IP Address: The bridged IP address connecting the two sites on the br1 bridge group.

Netmask: This field represents the subnet that the br1 bridge group contains.

Gateway: This field represents your gateway from this device. In a router mode it will be the gateway of the router in your br1 bridge group IP address.

Configuring Card 1 (5 GHz directional uplink client –card 1)

Next, to connect the site we will need to do a survey from card 1 (5 GHz directional uplink client). Scroll down to the site survey column and press extended. This will survey for all available wireless device in the 5 GHz band. After finding the appropriate downlink to connect to simply press the red link labeled >select. This will enter the upstream Mac address, uplink frequency, and uplink channel. You will have to put in a SSID of the sites name followed by UL. Set the correct txpower and mileage. More information on the fields is listed below.

5ghz directional uplink client - card 1	
Upstream MAC	
Uplink Frequency	5.8ghz A only
Uplink Channel	Not Set
Uplink SSID	
Uplink Power	18 dB
Uplink Distance	6 miles
Uplink AutoAck	No
Uplink Channel Width	20 mhz (default)
Uplink MAC	00:1B:B1:03:61:3D
Site Survey	normal survey extended

Upstream MAC: This is the MAC address of the device the uplink will be connecting to.

Uplink frequency: The current frequency band the radio will broadcast in. 5.3 GHz A only and 5.8 GHz A only.

Uplink channel: This will be dependent upon the uplink frequency field

Uplink SSID: It is helpful to set this field to something related to the location of the device. There can be no spaces in the SSID (**Example**: 701MainstUL)

Uplink Power: This is the transmit power the radio will broadcast at. Please talk to your supervisor about appropriate transmit power settings to abide by FCC regulations.

Uplink Distance: This is the Ack time out setting that calculates how far to send the data. Setting the distance to 10% longer than the actual distance between repeaters is recommended.

Uplink AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate it-self to the correct ack time out settings with the least errors.
*Only use this on far shots that are affected by speeds or duplicate packets due to a fluctuating ack value.

Uplink Channel Width: Channel width can be set to 20 MHz or 10 MHz. This is the channel space the current frequency will broadcast at. 20 MHz will give you more throughput and is recommended for infill, backhaul repeaters and uplinks. 10 MHz is recommended for Point to multi point connections.

Uplink Mac: The uplink mac is one mac address that is associated to the card1 br1 bridge group. This mac will never have to be cloned when replacing devices.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Configuring Card 0 (5 GHz Omni AP –Card 0)

Card 0 is normally where Point to multi point customers will connect through. Now we will need to configure the 5 GHz Omni. If you are replacing the device the channel, channel width and mac are very important. All three values connect CPEs to the 5 GHz Omni. More information on the fields is listed below.

5ghz omni AP - card 0

Omni Radio Mode	N mixed ▾
Omni Frequency	5.3ghz ▾
Omni Channel	60 - 5.3 GHz ▾
Omni SSID	bradmimoAP
Omni Power	13 ▾ dB
Omni Distance	10 ▾ miles
Omni AutoAck	No ▾
Omni Channel Width	10 mhz ▾
Omni MAC	90:A4:DE:AA:3E:75
Site Survey	click to survey

Power Status	No powerbox detected
Power Child IP	
Description	gen5_repeater_test

Save

Omni frequency: This is the wireless mode that the 5 GHz Omni radio will run at. This can only be in B only mode.

Omni Channel: This is the wireless channel.

Omni SSID: This is the MAC address of the device the uplink will be connecting to.

Omni Power: This is the transmit power the radio will broadcast at. See the FCC section of this document for transmit power settings per antenna.

Omni Distance: This is the Ack time out settings.

Omni AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate it to the correct ack time out settings with the least errors.

Omni Channel Width: 20 MHz and 10MHz channel widths are recommended

Omni Mac: The Omni mac address is the mac address CPEs will connect to. This may need to be cloned if you are replacing a device.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Power Child IP: This is used for devices that are daisy chained off of each other. This field is normally not filled out. Nothing is affected if not filled out it is just for reference.

Description: This is the site location.
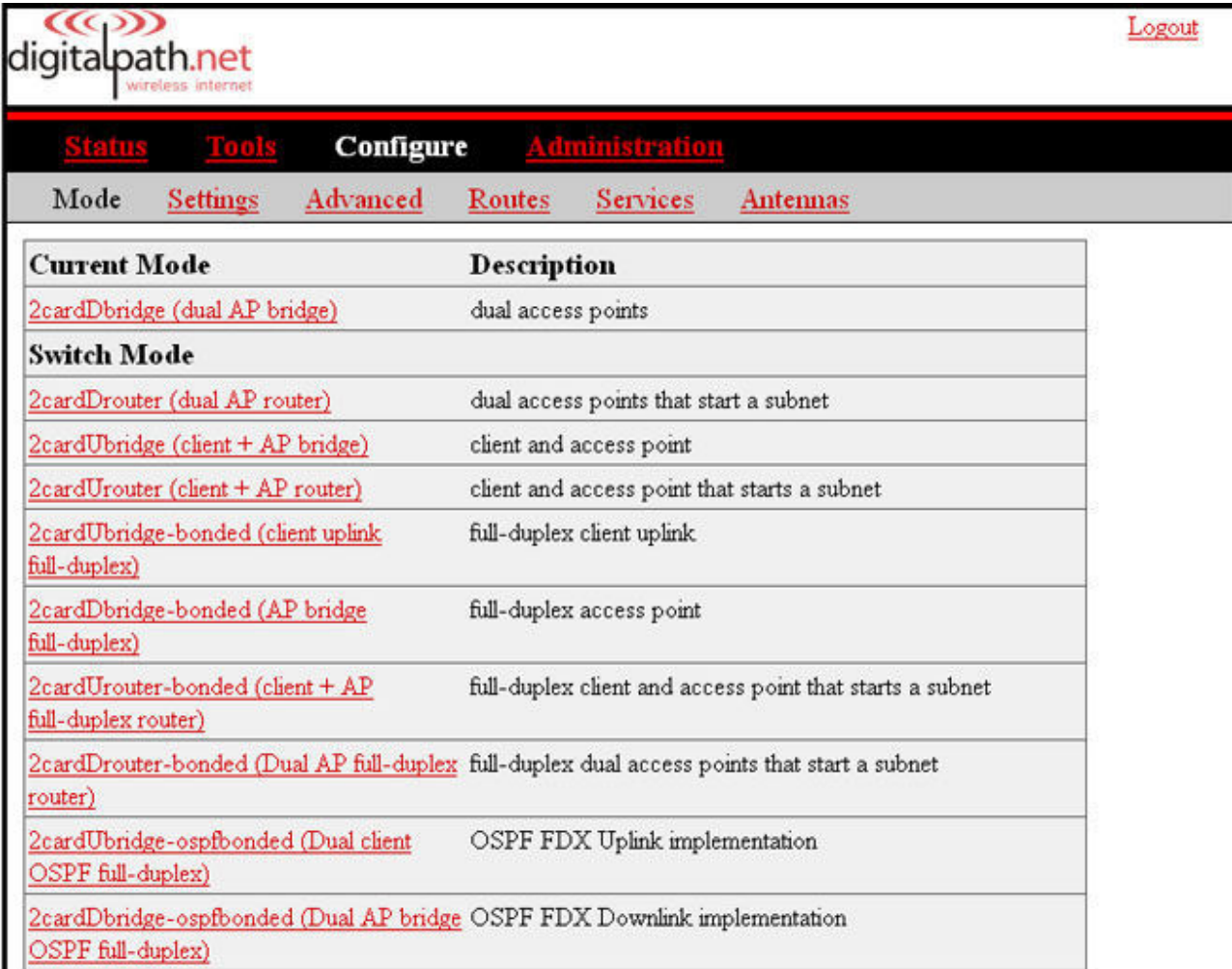
Saving and Rebooting

After configuring the device you will need to save the settings and reboot the repeater. This is done by clicking save at the bottom of the page. You will then get a prompt at the top of the page to go to Administration > Reboot.

You completed the following actions:
Saved the new configuration (please reboot via the Administration menu to activate your changes)

Configuring a Downlink Bridge

After logging into the relay go to Configure > Mode then choose 2cardDBridge (dual AP Bridge)

After choosing the mode of the device to 2cardDBridge (dual AP Bridge) it will redirect you to the Configure > Settings page. The first part of configuring a bridge is to know your IP address.

IP Address: This is the bridged IP address on the local subnet on the site the repeater is being installed on.

*It is important that the data cable be plugged into eth0 on the repeater or it will not come online as a router.

Netmask: This is the local bridge groups subnet mask either being announced on the switch or the uplink at the location.

Gateway: This is the Gateway of the local bridge group at the location.

Parent IP: this will either be the managed switch at the location or the uplink at the site. This is important since the parent ping watchdog will ping this address.

Configuring Card 1 (directional downlink AP- card 1)

```
5ghz directional downlink AP - card 1
Downlink Frequency          5.3ghz A only  ▼
Downlink Channel            Not Set        ▼
Downlink SSID               [            ]
Downlink Power              20     ▼  dB
Downlink Distance           6      ▼  miles
Downlink AutoAck            No  ▼
Downlink Channel Width      20 mhz (default) ▼
Downlink MAC                00:1B:B1:02:BC:91
Site Survey                 normal survey extended
```

Downlink Frequency: This is the frequency band the radio will broadcast in.

Downlink Channel: This will be a downlink channel that will feed either a relay or Point to multi point customers. When choosing a channel use a channel that is not used on the site and is at least 4 channels away from any frequency used on the site.

Downlink SSID: Use a SSID that is appropriately labeled.

Downlink Power: This is the transmit power the radio will broadcast at. Please talk to your supervisor about appropriate transmit power settings.

Downlink Distance: This is the Ack time out settings that calculate how far to send the data. Setting the distance to 10% longer than the actual distance between repeaters is recommended. If it is an internal panel antenna the longest distance it can broadcast is 10mi.

Downlink AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate itself to the correct ack time out settings with the least errors.

Only use this on far shots that are affected by speeds or duplicate packets due to a fluctuating ack value.

Downlink Channel Width: Chanel width can be set to 20 MHz or 10 MHz. This is the channel space the current frequency will broadcast at.

Downlink Mac: The downlink mac is the mac address either relays or CPEs will connect to. If replacing the device this mac address will need to be cloned.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Configuring Card 0 (5 GHz Omni AP –Card 0)

Card 0 is normally where Point to multi point customers will connect through. Now we will need to configure the 5 GHz Omni. If you are replacing the device the channel, channel width and mac are very important. All three values connect CPEs to the 5 GHz Omni. More information on the fields is listed below.

```
5ghz omni AP - card 0

Omni Frequency        [5.8ghz A only ▼]
Omni Channel          [Not Set        ▼]
Omni SSID             [                ]
Omni Power            [16     ▼] dB
Omni Distance         [6  ▼] miles
Omni AutoAck          [No ▼]
Omni Channel Width    [10 mhz         ▼]
Omni MAC              [00:0F:A2:00:04:98]
Site Survey           normal survey extended

Power Status          No powerbox detected
Power Child IP        [                ]
Description           [                ]

[ Save ]
```

Omni frequency: This is the wireless mode that the 5 GHz Omni will run on. This can be either 5.3 GHz A only or 5.8 A only.

Omni Channel: This is the wireless channel the radio will broadcast on. See graph below for overlapping channels.

Omni SSID: pick a name for this repeater to broadcast. No spaces.

Omni Power: This is the transmit power the radio will broadcast at. Please talk to your supervisor about appropriate transmit power settings.
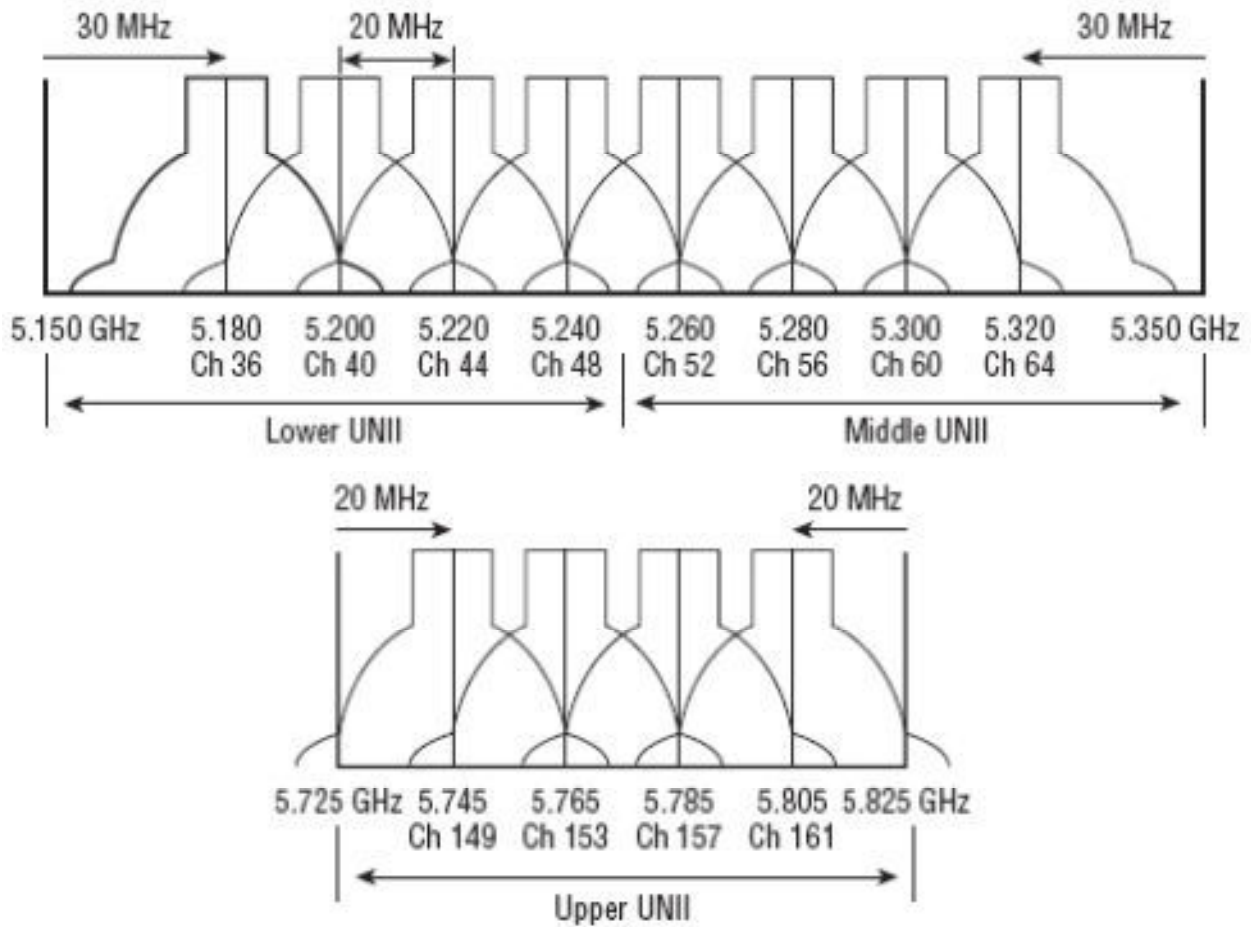
Omni Distance: This is the Ack time out settings. All 5 GHz Omnis are set to 6 miles. If it is a 5 GHz sector it needs to be set to 20mi. If it is a 5 GHz diamond it can go up to 13- 15mi depending on the gain of the receiving antenna.

Omni AutoAck: Is a program that tests how many errors on each acktmout settings occurs and will manipulate it-self to the correct ack time out settings with the least errors.

Omni Channel Width: 10 to 20 MHz channel widths are recommended.

Omni Mac: The Omni mac address is the mac address CPEs will connect to. This may need to be cloned if you are replacing a device.

Site Survey: Will survey all available wireless devices in the area. An extended survey will show you more devices and will survey longer. An extended survey is recommended when trying to find wireless devices.

Description: This is the site location.

Understanding the Configure Page

Understanding the Advanced Tab

The advanced tab has a couple of features that can be used when having issues with wireless noise or Ethernet related issues.

Automatic Noise Immunity (ANI): ANI turns off fy error reporting. If errors are too great on a radio is will spike cpuload, which in turn will lower the performance of the radio. With ANI on the radio will ignore errors and make it more sensitive to rx packets. This can be turned on a per radio basis.

RTS Threshold: RTS (Request To Send) controls what size data packets the RF protocol issue to a RTS packet. The default is 2346.

Fragmentation Threshold: The maximum frame size that can be sent without fragmenting the frame.

Aggregation: Defines how frames are aggregated together, either by frames or amount of bytes. Whatever comes first.

Rx Chain Mask: Standard Rx Chain Mask is 5 for all devices except Tri-Sector configuration.

Tx Chain Mask: Standard Tx Chain Mask is 5.

Ethernet: The Ethernet setting allows you to manipulate the negotiation of Ethernet. When set to Auto Ethernet will auto-negotiate. Normally in most situations this is the recommended value. If problems occur where packet loss is happening between Ethernet ports through cabling, modifying these settings can confirm a Ethernet related issue.

Ethernet

eth0 Media Type	Auto
eth1 Media Type	Auto

Understanding the Routes Tab

The routes tab is for manually configuring static routes.

#	Destination Subnet	Netmask	Gateway
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Save

Understanding the Antennas Tab

The antennas tab is for configuring external devices and the frequency is runs on.

WARNING: Changes to active antenna port take effect immediately. Frequency changes require a reboot

downlink AP - card 1

Description	
Active Antenna	internal
Internal Frequency	5ghz
Turbo Mode	disabled ▾

omni AP - card 0

Description	
Active Antenna	internal
Internal Frequency	5ghz
Turbo Mode	disabled ▾

Save

Description: This needs to be labeled on what is connected to the external port. If on card 1 you install a 23db external diamond, type in external diamond in the description field. This will give installers and technicians the information on what is installed on each repeater.

Active Antenna: Either set this to internal for an internal radio source or external for an external radio source (external diamond).

Internal Frequency– This is the internal frequency on the radio.

Turbo Mode – (DISABLED) and not available on gen5 repeaters. May be available in a future version of software pending FCC certification.

Understanding the Administration Page

The administration page is where management of the repeaters configuration and initial setup are applied.

Reload Config: The reload config feature is disabled on Generation 5 repeaters.

Reboot: This will reboot the repeater. After rebooting the repeater you will get a "device is rebooting prompt". The screen will never change and you will have to refresh the page to re-login to the device.

Reason: Choose either reconfigure, fix problem, or other. This will be listed in the log as the type of reboot.

Description: The description is why you rebooted the devices e.g. Card 0 locked up.

Reset Config: The reset config tab will reset the device to its default configuration. This should never be done remotely, only if an tech is at the location.

Initial Setup: Manufacturing uses this to configure the settings for each repeater type, configuration, and optional features. This may need to be modified if any errors are made when setting up the device.

Hardware Details: Details what specific device the repeater is. Please see *Types of Repeaters* section above for more information.

5 GHz directional uplink client – card 1: Displays the mac address, internal frequency setting and the ability to use either internal or external antennae.

*If you need to set an external device on a radio and this setting only displays internal you will need to edit the initial setup.

5 GHz Omni AP: Similar information as card 1.

*If you need to set an external device on a radio and these setting only displays as internal you will need to edit the initial setup.

Eth0 Mac Address: displays the eth0 mac address. This mac address cannot be edited or cloned.

FCC Compliance & Installation Statement

Definitions

15.3(h) **Class A digital device**. A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

15.3(i) **Class B digital device**. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- — Reorient or relocate the receiving antenna.
- — Increase the separation between the equipment and receiver.
- — Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- — Consult the dealer or an experienced radio/TV technician for help.

Attention

This device is intended for outdoor use only.

FCC statement 15.21(a)

Modifications not expressly approved by Digital Path, Inc could void your authority to operate the equipment. Do not make modifications to the equipment unless authorized by Digital Path, Inc.
FCC ID

Relay Point: RHK-G5RL10

Professional Installation

FCC statement 15.27(b)

This device should be professionally installed by a trained technician. The installer shall be responsible for ensuring that the proper antenna is employed to comply with FCC requirements.   The equipment described herein may only be used in accordance with accessories listed in below for FCC ID numbers RHK-G5RL10.

Parts List & Tune-Up Information

External RF Cables for Connection to Modularized Connector Ports

<u>This equipment must be professionally installed when utilizing modularized connector ports.</u>
SMA to RP-SMA Connector Cable PN # Hana Wireless CA-195 (3') –HW-CA195-SMAM-SMAM

- Used for Connecting to UBNT external sectors and Arc Wireless Directional Panel

SMA to N-Connector Cable PN # Hana Wireless CA-185 (3') - CA195-NM-SMAM-3

- Used for Connecting to High Gain Arc Wireless 29 dBi and 33 dBi antennas for 15.247 ISM

Ethernet Surge Suppression

Optional Ethernet/Power Surge Suppressor – Part # H-LS-001.01 – DigitalPath, Inc
    UL # 3VEO – Model DPISURG5E

Power Supply

Condor Electronics
Model: STD-2427P
Ferrites on power lead (QTY 2) – Steward 28A2024-0A0

Antenna

Each repeater has a combination of 1 or 2 antenna(s) present depending on the configuration.

5GHz
UNII - 5250-5350 – 5500-5725 and ISM 5725-5850

Panel

ARCWireless Panel	**23.0dBi**
DPI – Internal	**18.0dBi**

Omni-Directional

UBNT (360 degree)	**10.0 dBi**

Sector

DPI (90 degree)	**17.0 dBi**
UBNT (90 degree)	**17.0 dBi**
UBNT (90-120 degree)	**20.0 dBi**

ISM 5.725-5850 MHz only

Dish

ARCWireless Dish	**33.0 dBi**
ARCWireless Dish	**29.0 dBi**

This equipment must be professionally installed when utilizing modularized connector ports.

SMA to RP-SMA Connector Cable PN # Hana Wireless CA-195 (3') –HW-CA195-SMAM-SMAM

SMA to N-Connector Cable PN # Hana Wireless CA-185 (3') - CA195-NM-SMAM-3

Channels

Channel Width	Lowest Channel (MHz)	Highest Channel (MHz)
15.247 5.725-5.85GHz Band		
10MHz	5735 (147)	5840 (168)
20MHz	5740 (148)	5835 (167)
U-NII 5.25-5.35GHz Band		
10MHz	5275 (55)	5325 (65)
20MHz	5280 (56)	5320 (64)
U-NII 5.47-5.725GHz Band ** SEE BELOW FOR EXCLUSIONS		
10MHz	5495 (99)	5705 (141)
20MHz	5500 (100)	5700 (140)

UNII 5.47-5.725 GHz Band Edge Channels

U-NII 5.47-5.595GHz		
10MHz	5495 (99)	5595 (119)
20MHz	5500 (100)	5590 (118)

UNII 5.47-5.725 GHz Band Edge Channels

U-NII 5.655-5.725GHz		
10MHz	5655 (131)	5705 (141)
20MHz	5660 (132)	5700 (140)

Note: channels 5600-5650 (120-130) are excluded from the channel list.

All other antennas tested for FCC certification come manufactured with the directional panel antenna and Omni directional antennas within the enclosure.

Notice of FCC power compliance for transmit power settings

Below is information related to dynamic frequency selection and power settings per band specific to the antenna(s) you are using.

DFS and TDWR

Terminal Dopper Weather Radar uses the 5600-5650 MHz band for generating high definition severe thunderstorm warnings. There are several of these sites throughout the United States. If you are within 35 kilometers of a TDWR station you must be at least 30 MHz center-to-center from the TDWR operating frequency for both client and base station equipment. Table of the current TDWR can be found in the FCC document " 443999 Do1 Approval of DFS UNII Devices v01" from OET located at the URL below.

https://apps.fcc.gov/kdb/GetAttachment.html?id=dV24P2kaxB%2BkKzIPZxHxHg%3D%3D

The original bulletin is also attached to the end of this manual for reference.

Professional Installation Transmit Power Settings Tables

Antenna type, channel width and frequency band specified. On two card radio devices, each radio must be in a different band (e.g. 5.3, 5.5, 5.8 GHz). DFS (Dynamic Frequency Selection) is enabled for the 5250-5350, 5470-5725. The 5725-5850 band is ISM 15.247 and does not require DFS.

For the frequencies/antennas and channel widths listed below, it is advised that you utilize the lowest transmit power for the particular band/modulation/channel width if you are unsure about what modulation scheme you want to run.

5GHz Omni (10 dBi) – UBNT AMO-5G10

5250 MHz – 5350 MHz
Freq: 5275 MHz (low), 5300MHz (mid), 5325MHz (high)
Channel Bandwidth: 10MHz
802.11a: TX power setting = 17.5, 17.5, 17.5
802.11n: TX power setting = 17.5, 17.5, 17.5

Freq: 5280MHz (low), 5300MHz (mid), 5320MHz (high)
Channel Bandwidth: 20MHz
802.11a: TX power setting = 19, 19, 18
802.11n: TX power setting = 19, 19, 18

5470 MHz – 5725 MHz
5495MHz, 5590MHz, 5705MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 17.5, 18.5, 18.5
802.11n: TX power setting = 17, 18.5, 17.5

5500MHz, 5590MHz, 5700MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 17.5, 19, 16.5
802.11n: TX power setting = 16.5, 19, 16.5

5725 MHz - -5850 MHz
5735MHz, 5785MHz, 5840MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 16,16,16
802.11n: TX power setting = 16,16,16

5740MHz, 5785MHz, 5835MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 16,16,16
802.11n: TX power setting = 16,16,16

5GHz Panel (18 dBi)

5250 MHz – 5350 MHz
Freq: 5275 MHz (low), 5300MHz (mid), 5325MHz (high)
Channel Bandwidth: 10MHz
802.11a: TX power setting = 10,10,10
802.11n: TX power setting = 10,10,10

Freq: 5280MHz (low), 5300MHz (mid), 5320MHz (high)
Channel Bandwidth: 20MHz
802.11a: TX power setting = 12.5,12.5,12.5
802.11n: TX power setting = 12.5,12.5,12.5

5470 MHz – 5725 MHz
5495MHz, 5590MHz, 5705MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 11,11,11
802.11n: TX power setting = 11,11,11

5500MHz, 5590MHz, 5700MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 13.5,13.5,12.5
802.11n: TX power setting = 13.5,13.5,11

5725 MHz - -5850 MHz
5735MHz, 5785MHz, 5840MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 14.5,14.5,14.5
802.11n: TX power setting = 14.5,14.5,14.5

5740MHz, 5785MHz, 5835MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 14.5,14.5,14.5
802.11n: TX power setting = 14.5,14.5,14.5

5GHz Sector (20 dBi)

5250 MHz – 5350 MHz
Freq: 5275 MHz (low), 5300MHz (mid), 5325MHz (high)
Channel Bandwidth: 10MHz
802.11a: TX power setting = 10.5,10.5,10.5
802.11n: TX power setting = 10.5,10.5,10.5

Freq: 5280MHz (low), 5300MHz (mid), 5320MHz (high)
Channel Bandwidth: 20MHz
802.11a: TX power setting = 10.5,10.5,10.5
802.11n: TX power setting = 10.5,10.5,10.5

5470 MHz – 5725 MHz
5495MHz, 5590MHz, 5705MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 11.5,11.5,11.5
802.11n: TX power setting = 11.5,11.5,11.5

5500MHz, 5590MHz, 5700MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 10.5,14,10.5
802.11n: TX power setting = 12,14,8.5

5725 MHz - -5850 MHz
5735MHz, 5785MHz, 5840MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 15,15,15
802.11n: TX power setting = 15,15,15

5740MHz, 5785MHz, 5835MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 15,15,15
802.11n: TX power setting = 15,15,15

5GHz Sector (17 dBi)

5250 MHz – 5350 MHz
Freq: 5275 MHz (low), 5300MHz (mid), 5325MHz
(high)
Channel Bandwidth: 10MHz
802.11a: TX power setting = 11,11,11
802.11n: TX power setting = 11,11,11

Freq: 5280MHz (low), 5300MHz (mid), 5320MHz
(high)
Channel Bandwidth: 20MHz
802.11a: TX power setting = 12.5,13.5,13.5
802.11n: TX power setting = 12,13.5,12

5470 MHz – 5725 MHz
5495MHz, 5590MHz, 5705MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 12,12,12
802.11n: TX power setting = 12,12,12

5500MHz, 5590MHz, 5700MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 14.5,14.5,14.5
802.11n: TX power setting = 14.5,14.5,14.5

5725 MHz - -5850 MHz
5735MHz, 5785MHz, 5840MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 15.5,15.5,15.5
802.11n: TX power setting = 15.5,15.5,15.5

5740MHz, 5785MHz, 5835MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 15.5,15.5,15.5
802.11n: TX power setting = 15.5,15.5,15.5

5GHz Panel (23 dBi)

5725 MHz - -5850 MHz
5735MHz, 5785MHz, 5840MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 15.5,15.5,15.5
802.11n: TX power setting = 15.5,15.5,15.5

5740MHz, 5785MHz, 5835MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 15.5,15.5,15.5
802.11n: TX power setting = 15.5,15.5,15.5

5GHz Parabolic Dish (33 dBi)

5725 MHz - -5850 MHz
5735MHz, 5785MHz, 5840MHz
Channel Bandwidth: 10MHz
802.11a: TX power setting = 20.5,20.5,18
802.11n: TX power setting = 20.5,20.5,18

5740MHz, 5785MHz, 5835MHz
Channel Bandwidth: 20MHz
802.11a: TX power setting = 18,20.5,18
802.11n: TX power setting = 18,20.5,18

Version 5 Power

User's Manual

Version 5 Power User's Manual

The *Version 5 Power System* is composed of 3 parts.

a. The Gen5 repeater

b. The power box (CHMONv5.10)

c. The network monitoring system (NMS)

These 3 elements create a *SMART* Un-Interruptible Power System (UPS). In addition to normal functions such as battery charging and automatic battery back-up it utilizes hardware and software to achieve remote status indication, remote command initiation, and Heart-Beat monitoring. Commands can be sent and status can be read by using the *Network Monitoring System NMS.*

System Diagram

Power system installation for a gen 5 repeater
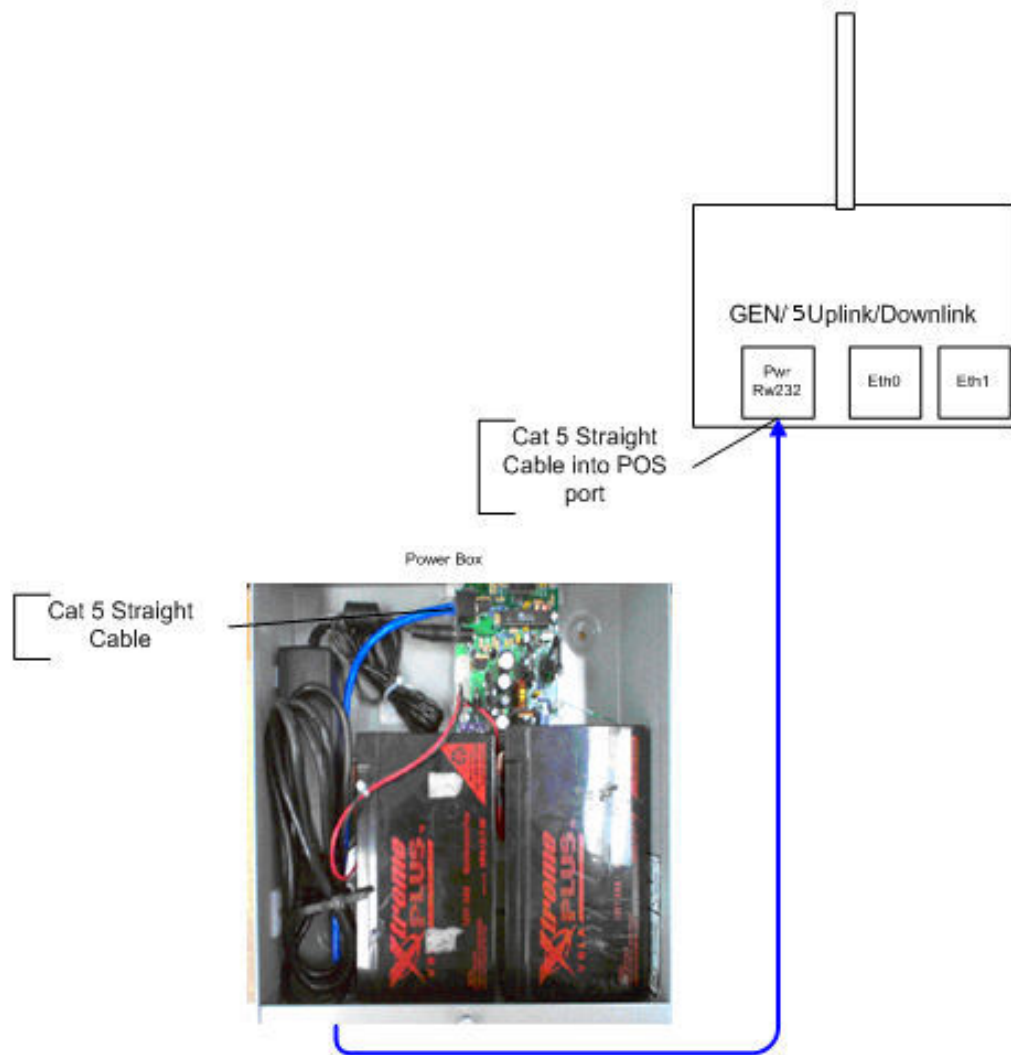
This will be performed multiple times at a tower location. Digitalpath prefers to have a battery backup system on every gen5 repeater. Listed below is a diagram of a one repeater site.

Power system installation for a 2 repeater site.

Power system installation for a 2 repeater site.

Powering two repeaters off
of one Version 5
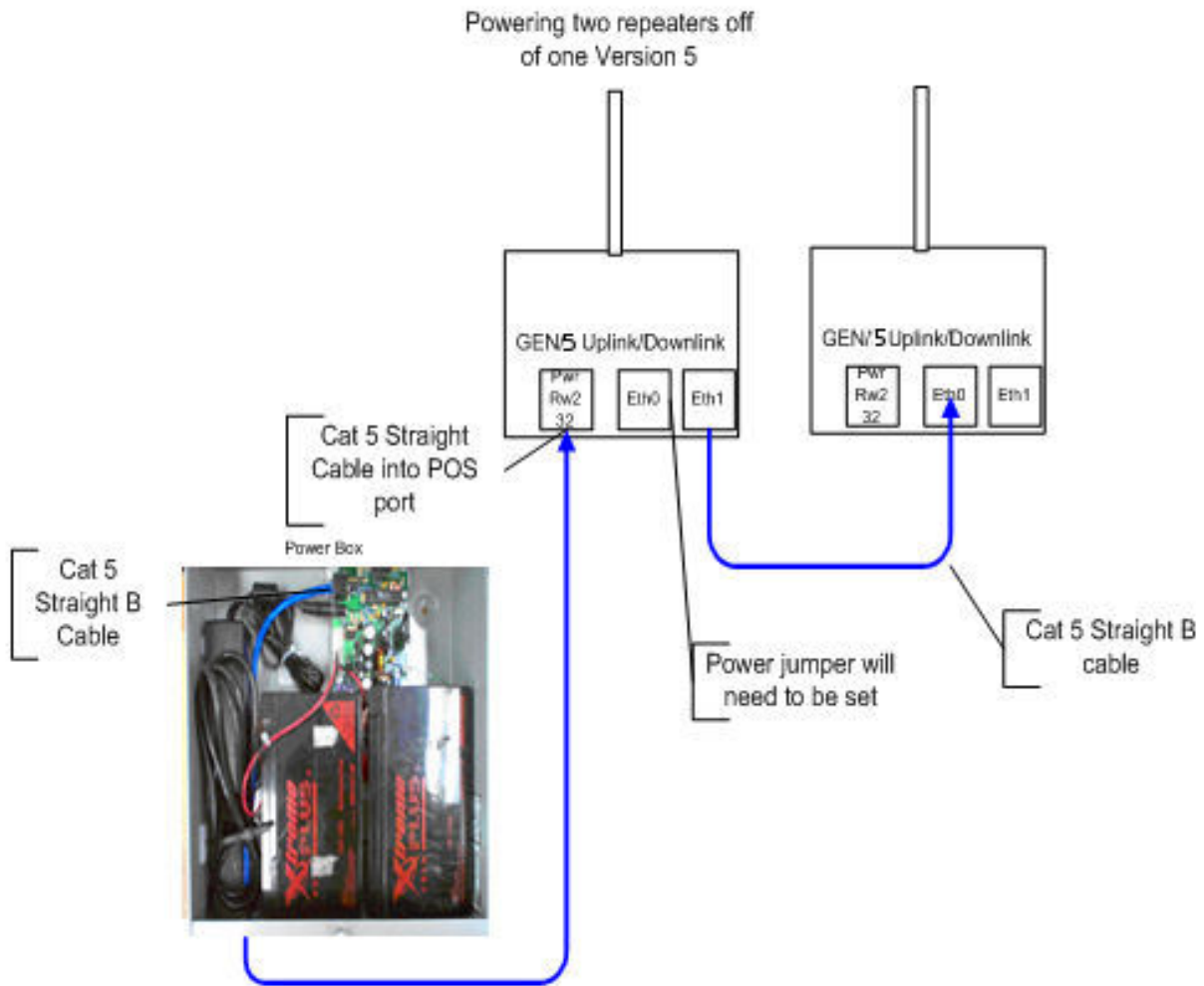
Power Box Connections Power System is connected as shown. Refer to next section (Operation) for power up sequence and status checking.
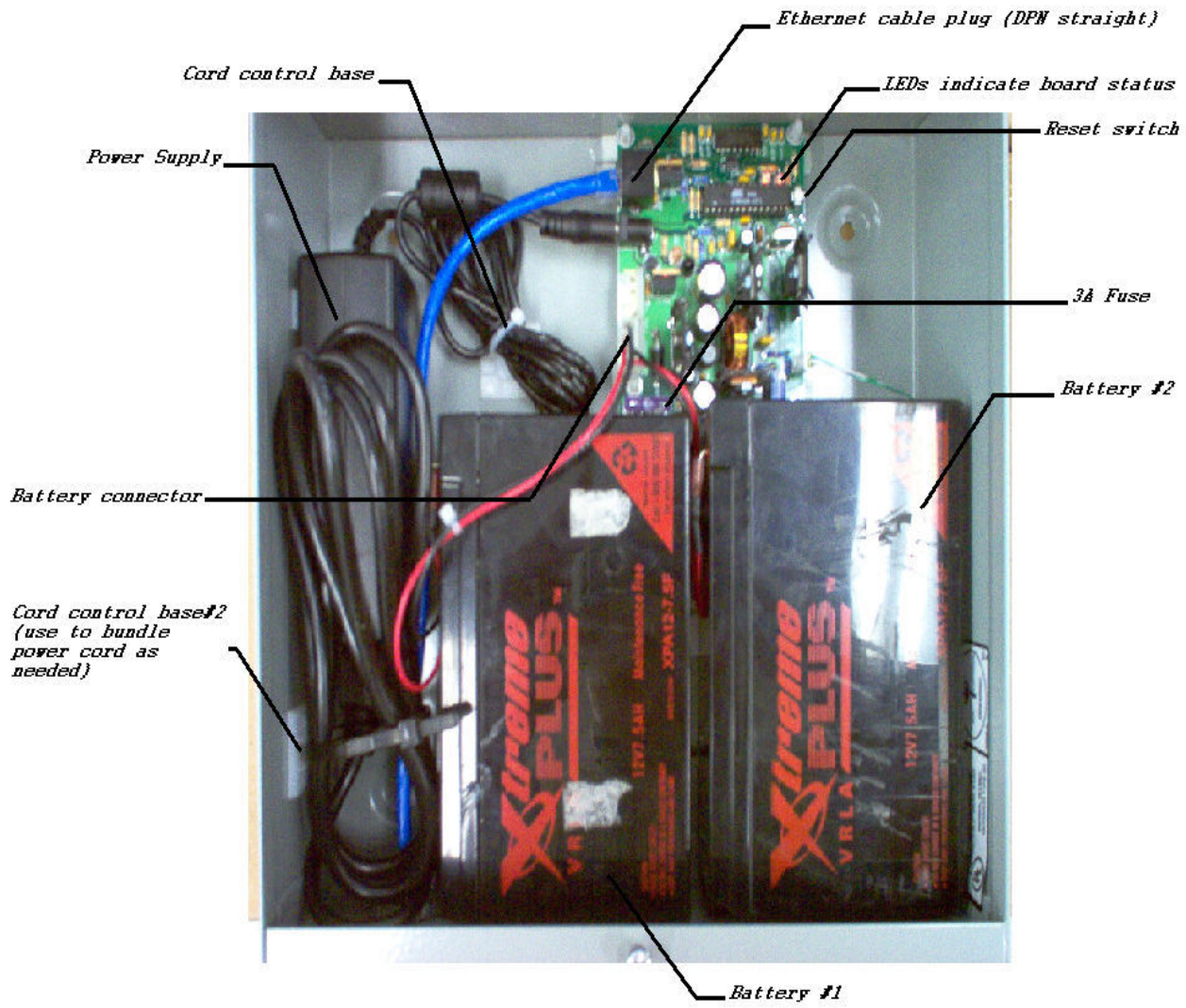
Figure 1: version 5 Power Box layout

CHMONv5 Board

Operation

CHMONv5 Board

RJ 45 Output Jack

Lid Sensors

L1
1. AC Status
2. HB Status

DC Input Jack

Control Button
Power Cycle
MCu Reset

External Batt. Connector

Internal Batt. Connector

Fuse ATO 3 Amp
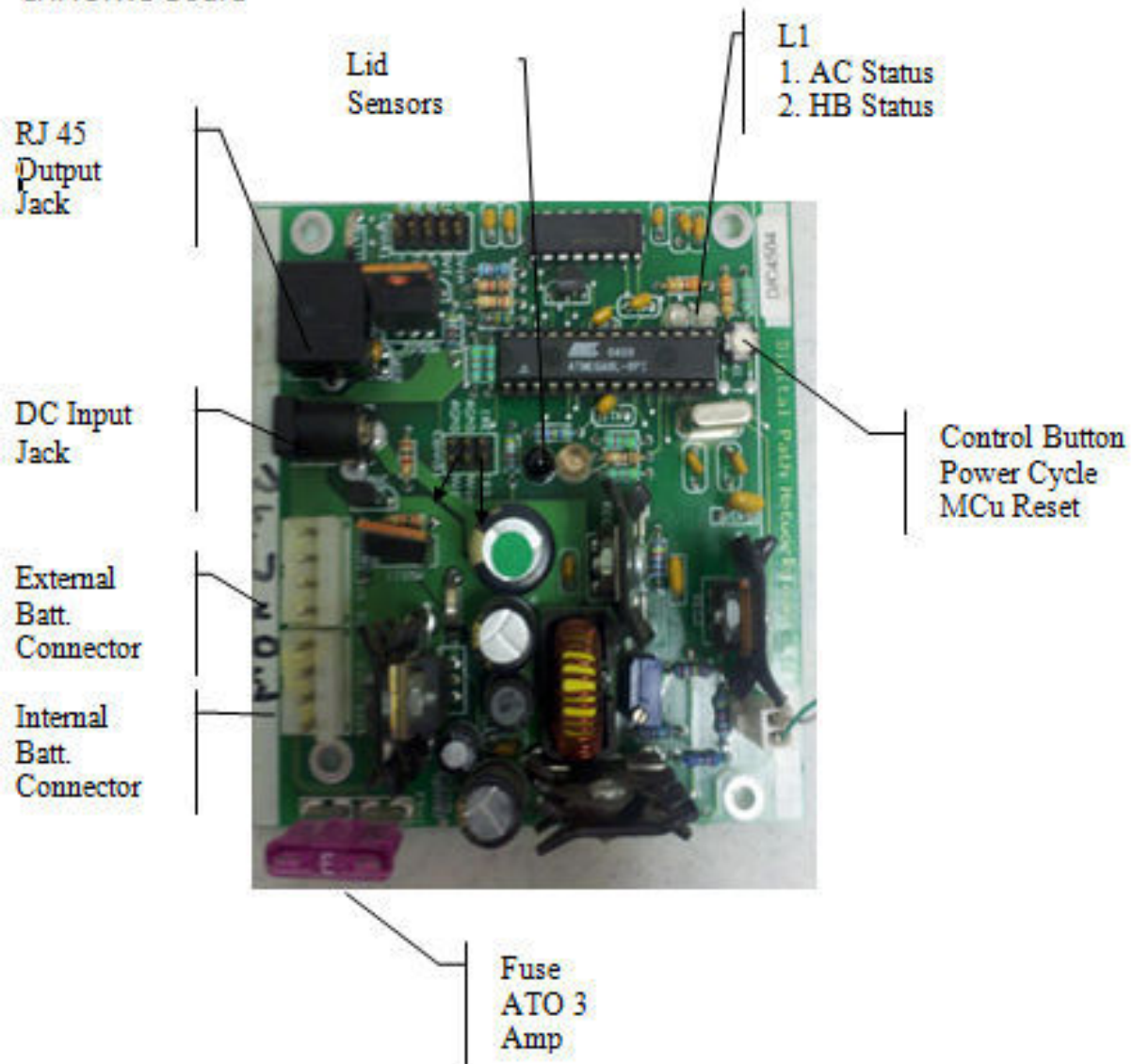
Operation

Powering Up a Version 5

1. Un-plug RJ45 and batteries form the CHMONv5 board
2. Plug-in and connect AC/DC power supply
3. Plug-in and connect Batteries
4. Reset the MCu
5. Verify that Both LEDs are solid green within 5 seconds
6. Plug-in the RJ45 connector
7. Verify serial data is being received (see figure 2c.1)

> *This is recommended for power cycling a repeater, also known as a hard reset.*

LED Indicators

There are 2 LEDs located left of center of the board. Each LED can be either red or green and they are used to indicate the current status and mode of CHMONv5.

NOTE: When the Lid is on LEDs will go off to save power. If the LEDs do not come on make there are no cords or obstructions in front of the IR sensor

LED KEY

SOLID ON

Battery OK
A:C OK

Battery LOW
A:C OK

Battery OK
A:C OFF

Battery LOW
A:C OFF

FLASHING

Data—Receiving

Data—Sending

Heartbeat
Active

START/ RESET (2 Seconds)

BLOWN FUSE (slow flash)
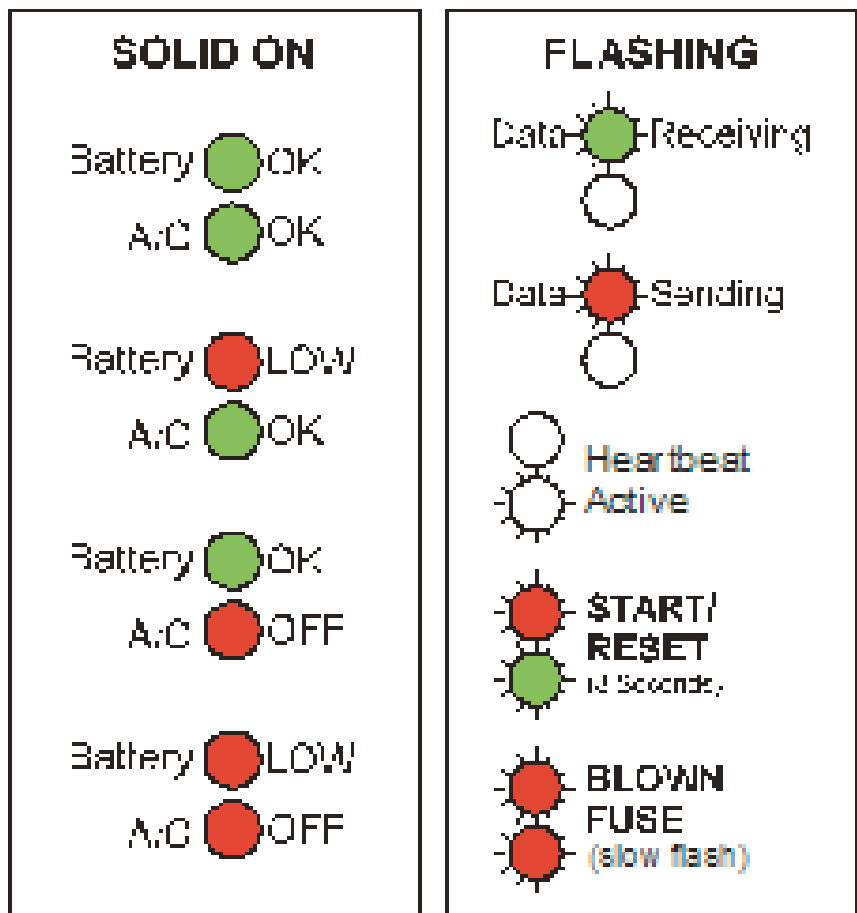
Button Operation

   Power Cycle the repeater
Give the button a short push until both LEDs turn red. Power to the repeater(s) will go **off** for 5 seconds then back on. The LEDs will slowly alternate red / red while the power is off.

   2c.2. Reset the MCu on CHMONv5
Hold the button down for over 2 seconds until you see the flashing **Start-Up/Reset**   sequence.

Lid Sensor

CHMONv5 is equipped with an Infrared (IR) lid sensor. The sensor works by sending and receiving pulses of IR energy every second. It is extremely important the area immediately above the sensors is kept free of cords or other obstructions. The lid must also have the reflective tape properly applied or the sensor will malfunction.

When the Lid is on the LEDs go out to save power. When the lid is removed it may take up to 2 seconds or (1 minute on older boards) before the LEDs turn on.

Fuse Replacement

CHMONv5 can sense when it has a blown fuse or a problem with the battery circuit. If a blown fuse or improperly connected battery is detected CHMONv5 will not check for a fuse again. The MCu must be reset after the fuse is replaced

CHMONv5 Fuse: ATO 32V 3Amp (Purple)

NOTE:

Using a Fuse other than the one specified may result in permanent damage to CHMONv5

1. Locate the Fuse in Figure 2a.1
2. Pull the Fuse out by rocking it up and down
3. Insert another fuse with the same ratings
4. Reset the MCu (see 2b.2)
5. Verify the LEDs indicate a good fuse

Heart-Beat Monitoring

Introduction:

CHMONv5 has the ability to monitor if the repeater that is connected via POS (Power Over Serial) is operating in a stable state. If the repeater software locks up CHMONv5 will detect it and initiate a power cycle after 3 minutes. If the repeater is not able to boot up properly and begin Heart-Beat Monitoring CHMONv5 will leave the power on and un-interrupted. This is useful for connecting equipment other than DPN Gen5 repeaters

The Heat-Beat (HB) function utilizes the following items:

Serial RS323 POS (Power Over Serial) link
Service Daemon (PmonD) on the Gen5 repeater
Logic Firmware on the CHMONv5 board

PmonD sends a Heart Beat (HB) signal every 30 seconds. When CHMONv5 receives a HB signal it begins a countdown of 3 minutes. If another signal is not sent within 3 minutes or 5 HBs CHMONv5 will cycle the power to the repeaters. CHMONv5 will never enter into monitoring mode if a HB signal is never sent. CHMONv5 will also only cycle the power ounce if the repeater fails to come back online.

NOTE:
If CHMONv5 is in Monitoring Mode and it is logged into or processes are killed that contribute to the Heart-Beat. You will be at risk of CHMONv5 initiating a power cycle 3 minutes from the time the system was interrupted.

ATTACHMENTS

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

Interim Plans to Approve UNII Devices Operating in the 5470 - 5725 MHz Band with Radar Detection and DFS Capabilities

The FCC, NTIA, FAA and industry are working to resolve interference to Terminal Doppler Weather Radar (TDWR) systems used near airports that has occurred from some outdoor wireless systems operating in the 5470 MHz – 5725 MHz band. These wireless devices are subject to Section 15.407 of our rules and when operating as a master device they are required to implement radar detection and DFS functions. We are continuing our work to develop long-term equipment authorization test procedures that will ensure that the devices comply with our rules that include protecting the TDWR operations. In the interim, the Commission will now allow certification of wireless master devices with radar detection function and with DFS capability, if they meet the following conditions:

- Devices will not transmit on channels which overlap the 5600 – 5650 MHz band.[1]

- Devices intended for outdoor use will be further restricted, as follows:

  o Devices must be professionally installed when operating in the 5470 – 5725 MHz band,[2]
  o Grantees must provide owners, operators and all such installers with specific instructions in their user's manual on requirements to avoid interference to TDWRs and information that meets the following instructions:
    - Any installation of either a master or a client device within 35 km of a TDWR location shall be separated by at least 30 MHz (center-to-center) from the TDWR operating frequency (as shown in the attached table)[3, 4, 5], and

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[1] The devices subject to the requirements in this KDB can select the initial channel for operation to avoid TDWRs and apply the Uniform Channel Spreading requirements (see FCC 06-96 in ET Docket 03-122 released June 30, 2006) on the remaining available frequency band of operation. All the other test procedures including the test radar patterns remain the same at the present time. A revision to the measurement procedure with modification to the Uniform Channel Spreading requirement and other changes will be released in the future. The Commission will also address the issue of any field upgrade option at that time.

[2] The grantee must identify the specific expertise and the training required by the installers for installing these types of devices.

[3] In some instances it is possible that a device may be within 35 km of multiple TDWRs. In this case the device must ensure that it avoids operation within 30 MHz for each of the TDWRs. This requirement applies even if the master is outside the 35 km radius but communicates with outdoor clients which may be within the 35 km radius of the TDWRs.

[4] The requirement for ensuring 30 MHz frequency separation is based on the best information available to date. If interference is not eliminated, a distance limitation based on line-of-sight from TDWR will need to be used. In addition, devices with bandwidths greater than 20 MHz may require greater frequency separation.

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- Procedures for the installers and the operators on how to register the devices in the industry-sponsored database with the appropriate information regarding the location and operation of the device and installer information is included.[6]

- Devices must meet all of the other requirements specified in Section 15.407, and it is prohibited to include configuration controls (e.g. country code settings or other options to modify DFS functions) to change the frequency of operations to any frequency other than those specified on the grant of certification for US operation.[7]

- All applications for equipment authorization must clearly show compliance with all of the technical requirements under worst case parameters, under user or operator control, based on frame rates, listen/talk ratios and user data transfer conditions.

All the devices subject to the DFS requirements must be submitted to the Commission's Laboratory Division for pre-grant testing and equipment authorization.[8] The applicant must ensure that all equipment authorization applications subject to this interim procedure include appropriate attestations that the device has no option to change the DFS parameters and that transmissions are disabled at least in the 5600 – 5650 MHz band. The application must include the user's manual with the appropriate installation and operations requirements for the installers and operators.

We are continuing to evaluate additional measures that may need to be taken to further ensure against interference caused by 5 GHz outdoor wireless systems located near airports. While manufacturers have an obligation to ensure that their equipment complies with FCC rules, and must take steps to ensure their devices are unlikely to cause harmful interference, Section 15.5 of the Commission's rules also places an obligation on users of devices to avoid causing interference and to correct any interference that may occur. We encourage the manufacturers to include information for the users, including the operators and installers, to ensure that they understand that it is incumbent on them to cooperate with manufacturers to implement any changes necessary to facilitate compliance.[9]

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[5] Devices may be optionally designed not to transmit on channels which overlap 5570 – 5680 MHz instead of requiring installers to perform site-by-site adjustments. In that case it is still required that the devices should be installed professionally and the procedures for registering the device in the industry database should be included in the Users Manual.

[6] A voluntary WISPA sponsored database has been developed that allows operators and installers to register the location information of the UNII devices operating outdoors in the 5470 – 5725 MHz band within 35 km of any TDWR location (see http://www.spectrumbridge.com/udia/home.aspx). This database may be used by government agencies in order to expedite resolution of any interference to TDWRs.

[7] For example, device software must not have any country code options or software configuration settings which allow an end user to modify the DFS operation or impact the performance of DFS. See KDB 594280.

[8] The TCBs are not permitted to approve transmitters with radar detection capabilities. See KDB 628591.

[9] The manufacturers may consider taking steps providing clear instructions to operators and installers of devices as to the need to comply with rules for use of the band, guidance on registration of devices and any other processes that are designed to avoid interference. They may use methods that include, but are not limited to, instructions in manuals, notification on product web pages and service bulletins issued for products in the field.

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TDWR Location Information*

STATE	CITY	LONGITUDE	LATITUDE	FREQUENCY	TERRAIN ELEVATION (MSL) [ft]	ANTENNA HEIGHT ABOVE TERRAIN [ft]
AZ	PHOENIX	W 112 09 46	N 33 25 14	5610 MHz	1024	64
CO	DENVER	W 104 31 35	N 39 43 39	5615 MHz	5643	64
FL	FT LAUDERDALE	W 080 20 39	N 26 08 36	5645 MHz	7	113
FL	MIAMI	W 080 29 28	N 25 45 27	5605 MHz	10	113
FL	ORLANDO	W 081 19 33	N 28 20 37	5640 MHz	72	97
FL	TAMPA	W 082 31 04	N 27 51 35	5620 MHz	14	80
FL	WEST PALM BEACH	W 080 16 23	N 26 41 17	5615 MHz	20	113
GA	ATLANTA	W 084 15 44	N 33 38 48	5615 MHz	962	113
IL	MCCOOK	W 087 51 31	N 41 47 50	5615 MHz	646	97
IL	CRESTWOOD	W 087 43 47	N 41 39 05	5645 MHz	663	113
IN	INDIANAPOLIS	W 086 26 08	N 39 38 14	5605 MHz	751	97
KS	WICHITA	W 097 26 13	N 37 30 26	5603 MHz	1270	80
KY	COVINGTON CINCINNATI	W 084 34 48	N 38 53 53	5610 MHz	942	97
KY	LOUISVILLE	W 085 36 38	N 38 02 45	5646 MHz	617	113
LA	NEW ORLEANS	W 090 24 11	N 30 01 18	5645 MHz	2	97
MA	BOSTON	W 070 56 01	N 42 09 30	5610 MHz	151	113
MD	BRANDYWINE	W 076 50 42	N 38 41 43	5635 MHz	233	113
MD	BENFIELD	W 076 37 48	N 39 05 23	5645 MHz	184	113
MD	CLINTON	W 076 57 43	N 38 45 32	5615 MHz	249	97
MI	DETROIT	W 083 30 54	N 42 06 40	5615 MHz	656	113
MN	MINNEAPOLIS	W 092 55 58	N 44 52 17	5610 MHz	1040	80
MO	KANSAS CITY	W 094 44 31	N 39 29 55	5605 MHz	1040	64
MO	SAINT LOUIS	W 090 29 21	N 38 48 20	5610 MHz	551	97
MS	DESOTO COUNTY	W 089 59 33	N 34 53 45	5610 MHz	371	113
NC	CHARLOTTE	W 080 53 06	N 35 20 14	5608 MHz	757	113
NC	RALEIGH DURHAM	W 078 41 50	N 36 00 07	5647 MHz	400	113
NJ	WOODBRIDGE	W 074 16 13	N 40 35 37	5620 MHz	19	113
NJ	PENNSAUKEN	W 075 04 12	N 39 56 57	5610 MHz	39	113
NV	LAS VEGAS	W 115 00 26	N 36 08 37	5645 MHz	1995	64
NY	FLOYD BENNETT FIELD	W 073 52 49	N 40 35 20	5647 MHz	8	97
OH	DAYTON	W 084 07 23	N 40 01 19	5640 MHz	922	97
OH	CLEVELAND	W 082 00 28	N 41 17 23	5645 MHz	817	113
OH	COLUMBUS	W 082 42 55	N 40 00 20	5605 MHz	1037	113
OK	AERO. CTR TDWR #1	W 097 37 31	N 35 24 19	5610 MHz	1285	80
OK	AERO. CTR TDWR #2	W 097 37 43	N 35 23 34	5620 MHz	1293	97
OK	TULSA	W 095 49 34	N 36 04 14	5605 MHz	712	113
OK	OKLAHOMA CITY	W 097 30 36	N 35 16 34	5603 MHz	1195	64
PA	HANOVER	W 080 29 10	N 40 30 05	5615 MHz	1266	113
PR	SAN JUAN	W 066 10 46	N 18 28 26	5610 MHz	59	113
TN	NASHVILLE	W 086 39 42	N 35 58 47	5605 MHz	722	97
TX	HOUSTON INTERCONTL	W 095 34 01	N 30 03 54	5605 MHz	154	97
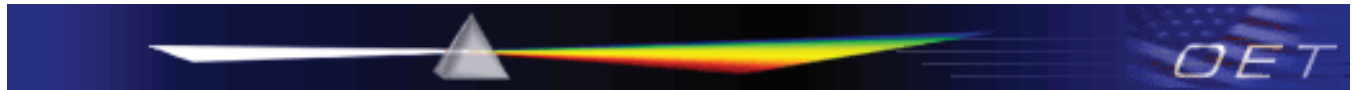
TX	PEARLAND	W 095 14 30	N 29 30 59	5645 MHz	36	80
TX	DALLAS LOVE FIELD	W 096 58 06	N 32 55 33	5608 MHz	541	80
TX	LEWISVILLE DFW	W 096 55 05	N 33 03 53	5640 MHz	554	31
UT	SALT LAKE CITY	W 111 55 47	N 40 58 02	5610 MHz	4219	80
VA	LEESBURG	W 077 31 46	N 39 05 02	5605 MHz	361	113
WI	MILWAUKEE	W 088 02 47	N 42 49 10	5603 MHz	820	113

* Latitude and Longitude are specified in NAD 83

- Last updated July 30, 2010
- Rev. Note (July 30, 2010) – Adjusted coordinates and Elevation Information for Charlotte, NC