Preparations

The minimum of preparations necessary are to have the system documentation which should include the following items at least:

- The system layout and block schematic
- A connection diagram for the head-end Master Unit
- The type of connectors and tappers used to interface to the base station ports
- The number of carriers for each of the BIU that the base stations connects via
- Maximum output power for each service from the base stations
- Fiber losses should be documented beforehand so that you can compare what the system actually measures
- Sectorization information, which sectors should go to which remotes
- DAS calculator sheets showing the expected settings for each of the RF chains in uplink and downlink.
- Information about Ethernet connection if the system should be monitored by remote. How to connect it to the Internet for remote viewing unless you are using a modem.

Necessary tools

The tools necessary to commission the system includes:

- One laptop for changing the system settings, checking any alarms and status. Only software needed is a web browser. Operating system can be Windows, Linux or Mac as you prefer.
- Spectrum analyzer to measure the uplink. The system relies on test tone measurements in the uplink and therefore it is important to have equipment to measure them.
- SMA tool to be able to connect or disconnect BTS cables from the BIU.
- QMA adapter so you can measure signals directly on the head-end units such as the FOI, BIU, ICU and so on.

Software

No particular software is necessary except a modern graphical based web browser.

System Commissioning

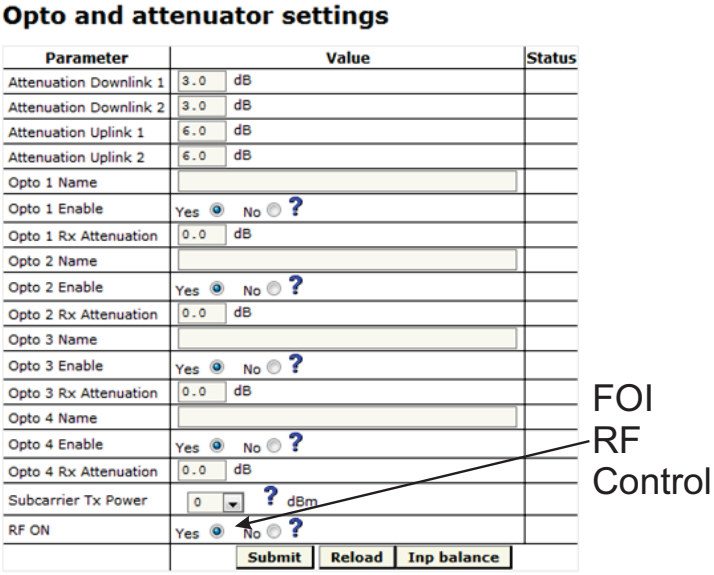
Pre-requisites

- Establish Ethernet connection between the BGW and all cards
- Power up all equipment
- Ensure IP addresses have been assigned
  Cards will briefly flash green. Solid green indicates waiting for IP assignment
- Verify remote unit fibers are connected to correct FOI ports
- Set names for all components and add components to the system - See "Naming Components" on page 92.
- Connect BTS to the BIU ensuring proper attenuation for the BIU card being used

Commissioning Process

1. Once the fiber is connected and verified, turn FOI RF power on.
   Connect only one fiber port at a time and complete naming of remote. Otherwise, a second person will be needed at the remotes to identify the remote when “Locate Me” is enabled. This can be eliminated with good project management and labeling during the installation process.

Figure 109 FOI RF On



2. Enable the appropriate optical ports on the 4-port FOI
   Only enable the optical ports that are being used. Otherwise, the system will alarm with low optical levels on the unused ports.

Figure 110 Enable FOI Optical Ports

Opto and attenuator settings

Parameter	Value	Status
Attenuation Downlink 1	3.0 dB	
Attenuation Downlink 2	3.0 dB	
Attenuation Uplink 1	6.0 dB	
Attenuation Uplink 2	6.0 dB	
Opto 1 Name		
Opto 1 Enable	Yes ◉ No ○ ?	
Opto 1 Rx Attenuation	0.0 dB	
Opto 2 Name		
Opto 2 Enable	Yes ◉ No ○ ?	
Opto 2 Rx Attenuation	0.0 dB	
Opto 3 Name		
Opto 3 Enable	Yes ◉ No ○ ?	
Opto 3 Rx Attenuation	0.0 dB	
Opto 4 Name		
Opto 4 Enable	Yes ◉ No ○ ?	
Opto 4 Rx Attenuation	0.0 dB	
Subcarrier Tx Power	0 ? dBm	
RF ON	Yes ◉ No ○ ?	
	Submit Reload Inp balance	

Enable FOI Optical Ports

3. Go to FOI status and note RX Opto power UL.
   The laser transmits at 5000 uW. The difference between the 5000 uW transmit level and the receive level is the loss on the fiber.

Figure 111 RX Optical Power

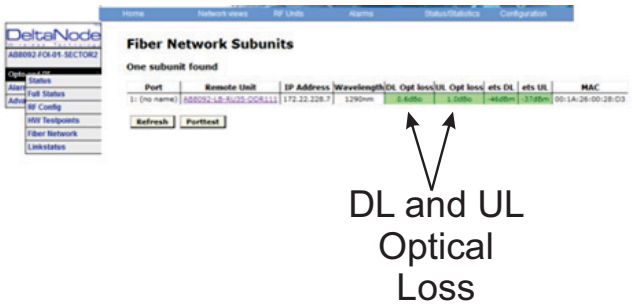
FOI4 Opto Status

Variable	Value
RF State	On
Temperature	36 degC
Tx Opto Power Downlink	-1.9 dBm
Opto 1 Name	
Opto 1 Enable	On
Opto 1 Uplink Opto Power	2075 uW
Opto 1 Uplink Opto Power	3.7 dBm
Opto 2 Name	
Opto 2 Enable	Off
Opto 2 Uplink Opto Power	0 uW
Opto 2 Uplink Opto Power	< dBm
Opto 3 Name	
Opto 3 Enable	Off
Opto 3 Uplink Opto Power	0 uW
Opto 3 Uplink Opto Power	< dBm
Opto 4 Name	
Opto 4 Enable	Off

RX Optical Power

   a. Starting with software release 3.9, there is an option to have the GUI calculate the fiber loss.

Figure 112 Calculated Optical Loss, Software version 3.9



Uplink

1. Set all values at default (factor setting may vary due to individual testing before shipping) for all bands
    a. BIU: -10dB
    b. FOI: -6, -6, -6
    c. FOR: +12
    d. Amp: +35 for low loss fiber, +45 for high loss fiber
2. Start with adjusting the high frequency band.
3. Turn RF on at the BIU. Ensure that only the RF strips being used have RF turned on.
4. Go to the FOR and turn the UL test tone on. Note the level being transmitted and the frequency. The level is set at the factory to compensate for losses between the RU output port and the amplifier. Levels will vary unit by unit.
5. Connect spectrum analyzer to the BIU BTS port and tune to the UL test tone frequency.
6. Measure the test tone level. Initial goal should be to set the UL test tone at the BIU BTS port to the same level as being transmitted at the RU (zero dB system gain).
    a. To reduce gain, it is recommended to adjust the attenuators in the BIU UL path. This will further reduce UL noise.
    b. To increase gain, it is recommended to adjust the gain in the RU UL path.

    Note: *Do not drive the FOR UL laser with more than 0dBm RF input. Recommended FOR UL input level is approximately -5dBm.*

    c. The BIU UL input will be permanently damaged with signals stronger than +13dBm.
7. Record UL test tone level received in the spectrum analyzer. After all remote units on the sector have UL levels set, the remotes will need to be balanced against each other (all are hitting the BTS UL at the same level). Levels should be within about 1dB of each other.

Downlink

1. Set all values at default (factor setting may vary due to individual testing before shipping)
    a. BIU: -15dB
    b. FOI: -3, -3
    c. FOR: +10
    d. Amp: To be set based on actual input
2. Suggestion: Set FOR DL ALC level to one dB less than amp rating if unit alarms on DL.
    a. A 43dB amplifier would have an ALC level set to +42.
3. Set BIU DL level to compensate for ICU interconnection loss. Do not exceed +10dB output of the BIU in the DL path (will cause IM).
    a. Suggest setting at maximum of +5dB output of the BUI.
    b. Note there is 13 dB of inherent loss in the BIU. With 0dB settings in the BIU DL attenuators a 30dB input signal will have an output of +17dB (30dB input minus 13dB inherent loss = 17dB). Adjust attenuators so that BIU is approximately +5dB as a start.
    c. Variations in the BTS input levels for loading must be taking into consideration. Full load and no load power levels differ greatly. Do not allow the BTS to overdrive the BIU.
4. Adjust FOI attenuator levels in the DL path so that the RF input into the DL laser is approximately -5dB.
    a. Note that the 0dB max into the laser is a composite level for all bands. By setting each band at -5dB then total composite should not exceed 0dB.
    b. Take into consideration that each BIU has two RF strips/paths. These must be taken into consideration when setting the FOI levels.
    c. Calculate full load conditions for all bands being fed into the FOI. Incorrectly setting the levels will impact the system during times of most usage.
5. Set the desired gain in the remote.

6. Apply RF signal to the BIU BTS port.
7. Check Remote Unit FOR status "Set Gain", "Gain" and "Output Power".
8. Adjust "Set Gain" so that desired output power is achieved.
    d. If "Gain" level is lower than "Set Gain" level in the status screen then the system is being over driven and ALC is limiting the gain of the system. Reduce gain setting to the level displayed in "Set Gain". Submit change and the review status screen. "Set Gain" and "Gain" levels should now be identical.

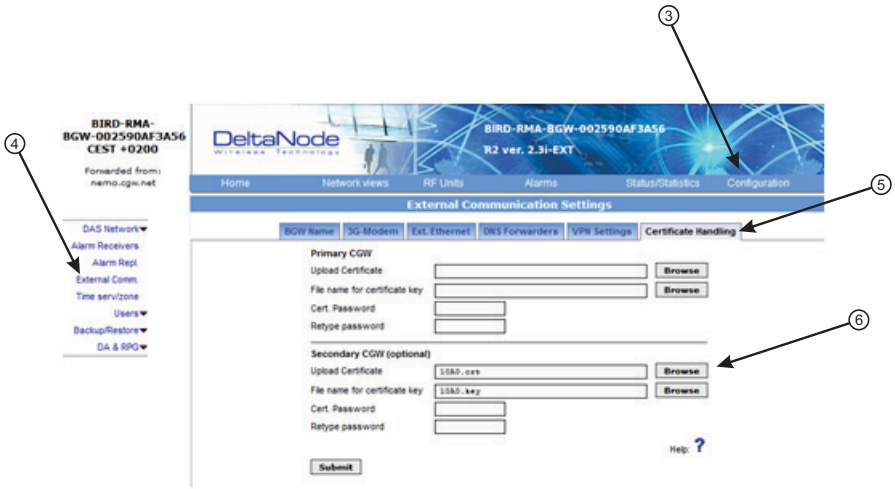
Bird VPN Access

Establishing secure VPN access for Bird/DeltaNode will allow for remote monitoring and advanced technical support. The BGW is designed to communicate directly with the Bird/DeltaNode NOC via cloud access.

VPN Settings

1. Connect laptop to an open port on the DAS switch. Do not connect to the Console port.
2. Log into the BGW at 172.22.0.1.
    Login Name: “extend”
    Password: “admin”
3. Click “Configuration,” see Figure 113.
4. Click “External Comm.”

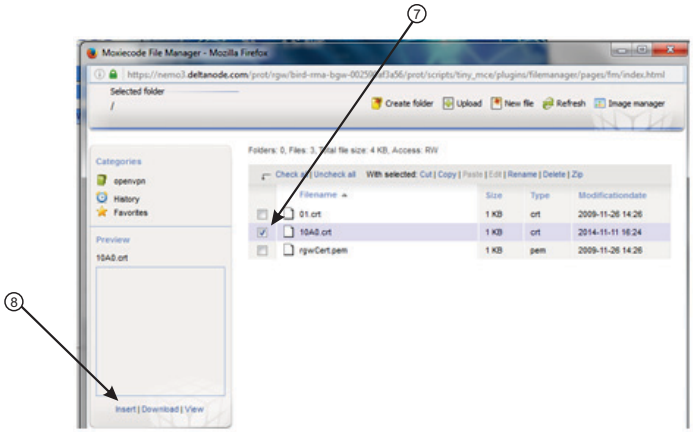
Figure 113 Certificate Entry



5. Click “Certificate Handling.”
6. Click “Browse” next to upload Certificate for Secondary CGW.
    Only make setting changes to the Secondary CGW. The Primary CGW is reserved for customer CGW access.

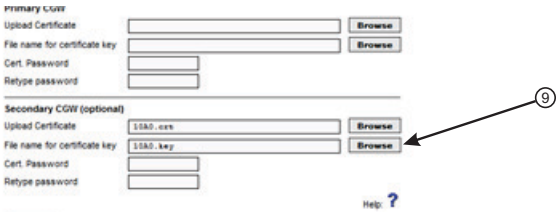
7. Select the check box next to the 10##.crt file. See Figure 114.
8. Click"Insert"

Figure 114 Certificate Selection



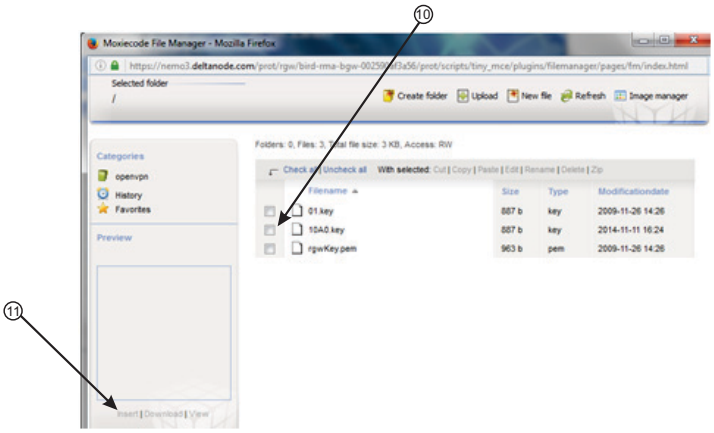
9. Select "Browse" for the File name for certificate key. SeeFigure 115.

Figure 115 Key Entry



10. Select the check box next to the "10##.key" file. See Figure 116.
11. Select "Insert"

Figure 116 Key Selection



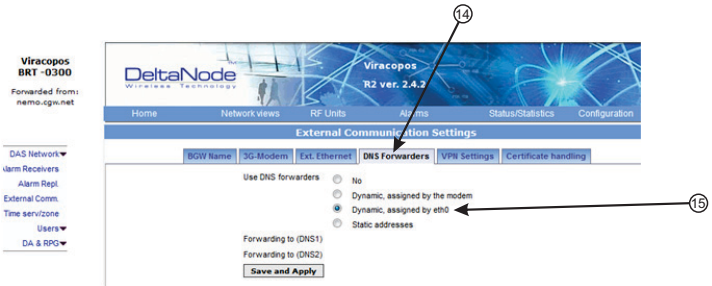
12. Select Ext. Ethernet Tab
13. Select the check box for “Use eth0 for Internet (WAN).”
    This ensures external Ethernet connections are allowed.

Figure 117 External Ethernet

14. Select DNS Forwarders tab.
15. Select radio button for “Dynamic, assigned by eth0.”

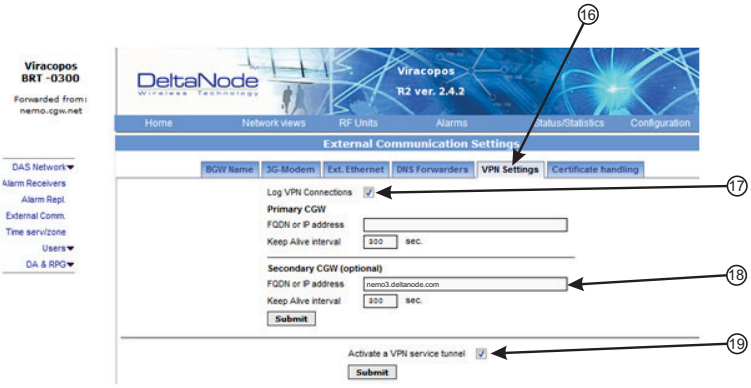
Note: *The Bird maintained CGW is not able to hostname check a DNS2 IP address of 8.8.2.2, 4.2.2.4 or 4.2.25. Please change to something like Google's 8.8.4.4 or 8.8.8.8*

Figure 118 DNS Forwarders



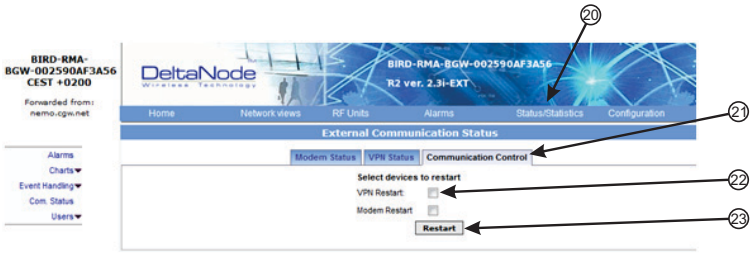
16. Select VPN Settings tab to verify that the VPN settings are correctly set.
17. Select check box “Log VPN Connections”
18. Type “nemo3.deltanode.com” into the Secondary CGW setting for FQON or IP address.
19. Select check box “Activate a VPN service tunnel.” This selection is only on available on older software versions.

Figure 119 VPN Settings



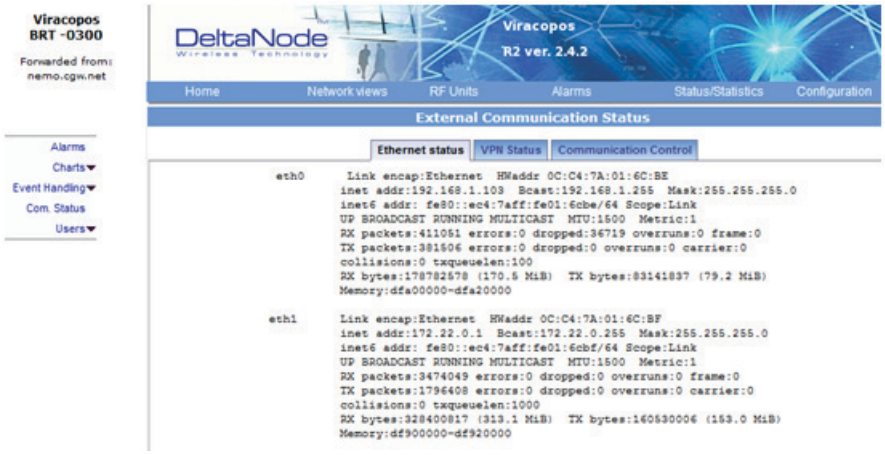
20. Click on “Status/Statistics.”
21. Select the “Communication Control” tab.
22. Select the check box next to “VPN Restart.”
23. Click “Restart.”

Figure 120 VPN Restart



24. After about 10 minutes, the BGW should start communicating with the Bird/DeltaNode CGW.
25. Click on Status/Statistics
26. Select the Ethernet Status tab.
    Both "eth0" and "eth1" should show connectivity. Figure 121 shows good communications in "eth0" between the BGW and a 3G modem. "eth1" shows good communications between the 3G modem and the Bird/DeltaNode CGW.

Figure 121 Ethernet Status



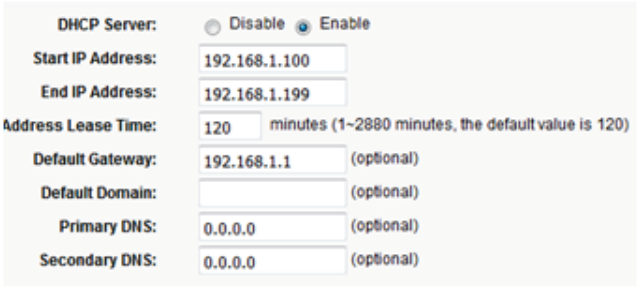
Wireless Modem Setup

Due to variances with different wireless modem manufacturers, settings may vary from modem to modem. A general understanding of network settings is required. Below are a few typical settings that will need to be configured.

Modem DHCP

DHCP will need to be enabled so that the wireless modem can assign an IP address to the BGW. Be sure to enter the start and end IP address as seen in the image.

Figure 122 Modem DHCP Configuration



Modem VPN Tunnels

The BGW communicates back to the CGW via a VPN tunnel. The wireless modem must enable VPN pass through.

Figure 123 Modem VPN Settings

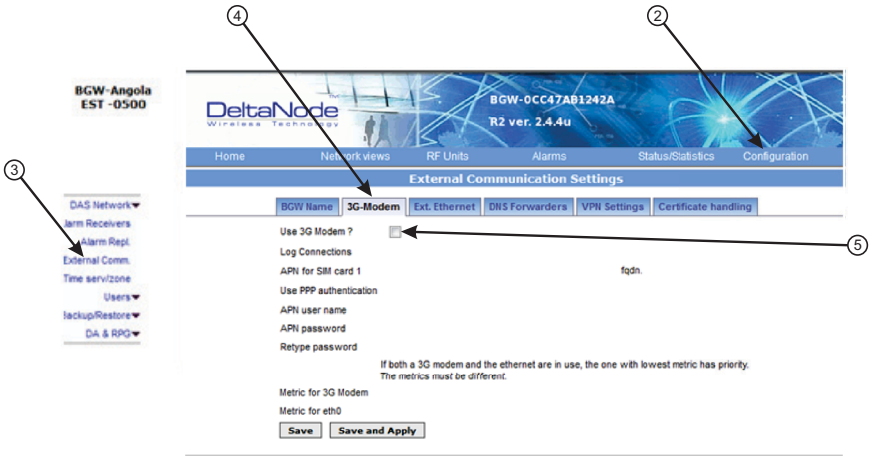
Modem Port Forwarding

Set up the modem so that it forwards TCP port 443.

BGW Configuration

1. Connect IP modem to the External WAN port on the BGW.
2. Click Configuration. See Figure 124.
3. Click External Comm.
4. Select 3G-Modem tab.
5. Select the “Use 3G Modem” check box.

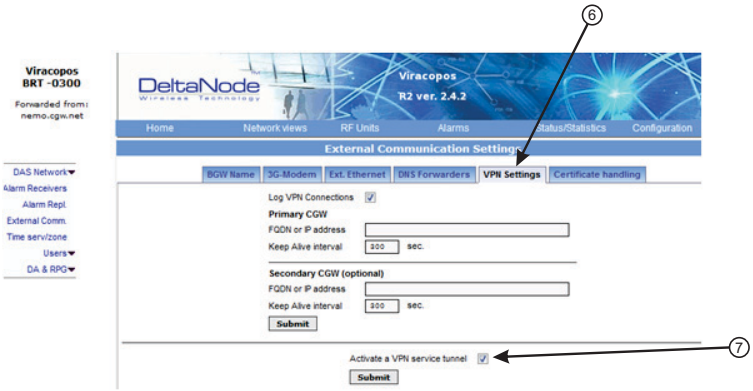
Figure 124 BGW Configuration - 3G Modem Setup



6. Select the VPN Settings tab.
7. Select the “Activate a VPN service tunnel” check box, if not already selected.

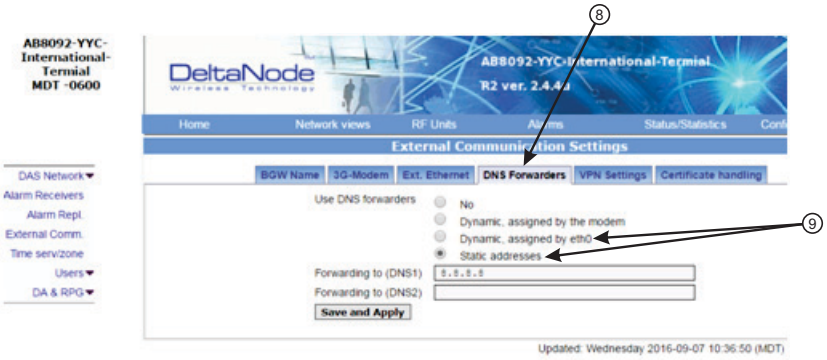
Note: *Older software versions of the BGW do not offer VPN service tunnels. Contact Bird to order a replacement BGW.*

Figure 125 BGW Configuration - VPN Setting



8. Select the DNS Forwarders tab. See Figure 126 on page 106.
9. Select either:
   - "Dynamic, assigned by eth0" or
   - "Static addresses". Enter 8.8.8.8 in the Forwarding to (DNS1).

Figure 126 BGW Configuration - DNS Forwarders Setting



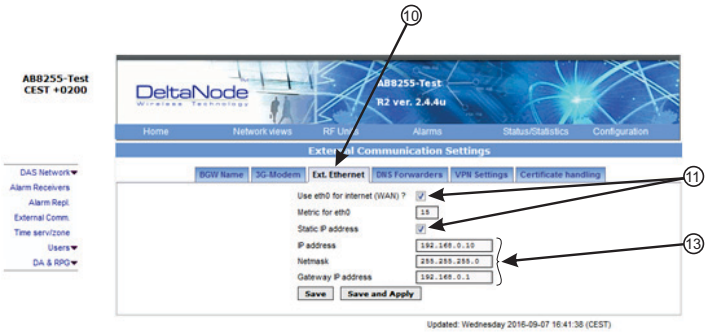
10. Select the Ext. Ethernet tab
11. Select "Use eth0 for internet" and "Static IP address" check boxes.
12. Record the existing IP setting in case rolling back to original settings is required.
13. Enter the IP addresses information:

    IP Address: 192.168.0.10

    Netmask: 255.255.255.0

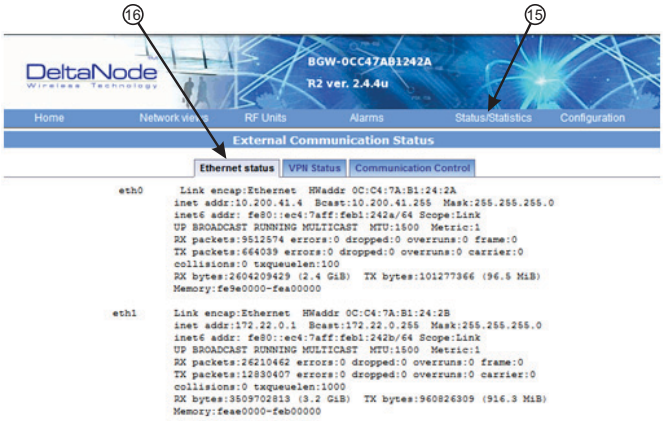
    Gateway IP Address: 192.168.0.1

Figure 127 BGW Configuration - External Ethernet Setting



14. After all the settings have been configured, power cycle the wireless modem.
15. Click on "Status/Statistics." See Figure 128 on page 107.
16. Select the "Ethernet Status" tab.
    Verifiy that "etho" has been assigned a valid IP address.

Figure 128 BGW Configuration - Ethernet Status

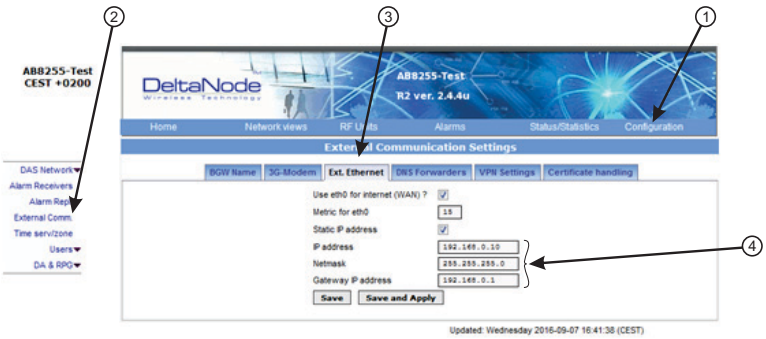


Rolling Back Modem Configuration

If the external modem is no longer required the configuration can quickly be rolled back.

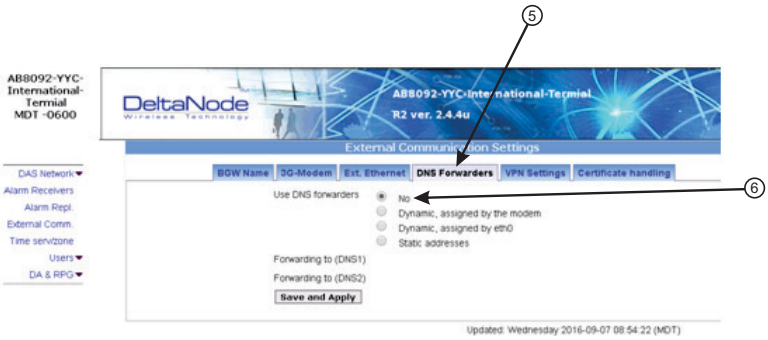
1. Click on Configuration. See Figure 129.
2. Click on External Comm.
3. Select the Ext Ethernet tab.
4. Enter original IP addresses that used prior to installing the modem.

Figure 129 Rollback Modem IP Addresses



5. Select the DNS Forwarders tab. See Figure 130 on page 107.
6. Select the "No" radio button.

Figure 130 Stop DNS Forwarding



Setup local Network UDP Ports for CGW Access

In order for the Bird/DeltaNode CGW to be able to make contact with the BGW ensure that the customer IT department has OpenVPN with UPD ports 1194 to 1199. This allows Bird/DeltaNode static IP address to access the BGW.

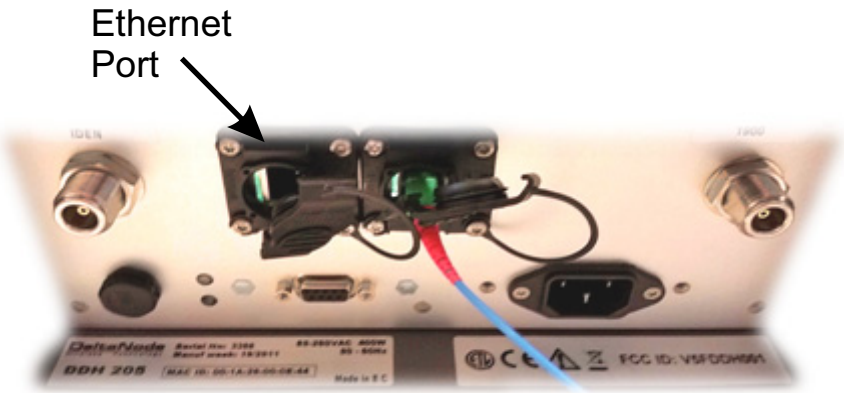
Local Connection to Remote Unit

A technician can directly connect a laptop to the remote unit. This is useful when the technician is at the remote unit troubleshooting. The direct connection is also very useful when there is no fiber connectivity to the remote unit and the installer needs to test and program the remote unit during the installation process.

> **Note:** *By directly logging in the remote unit and programming the name of the remote there is less chance of confusion when all the remotes are connecting to the Master Unit.*

1. Set laptop to a static IP address; something along the lines of
   - IP address 169.254.48.11
   - Subnet Mask 255.255.0.0
   - Gateway 169.254.0.1
2. Connect RJ45 Ethernet cable to the laptop and the Ethernet port on the remote.

Figure 131 Remote Unit Ethernet Port



3. Use any web browser to connect to the remote unit starting with https://169.254.48.1.
   The remote unit has a default IP address of 169.254.48.1 to .10. If the login menu does not appear try the next sequential IP address (https://169.254.48.2). Continue trying the next IP address until the login menu appears.

Figure 132 Remote Unit Login Screen

4. When the login menu appears type in the default credentials:
   - Username: “extended”
   - Password: “admin”
5. The GUI menus will be the same as when connecting to the remote through the BGW.

Local Connection to Remote Unit with Two FOR's

Some remote units are built with 2 FOR boards. This would occur in applications where one chassis contains: MIMO paths, multiple amplifiers of the same band, amplifiers fed from different FOI cards or other special applications. The 2 FOR boards share the one Ethernet connector on the remote unit. A standard Ethernet cable will only access FOR [0]. A custom cable is required to access FOR [1] board.

To build a cable to access both FOR units you will need the following items.

- Wire cutters
- Wire strippers
- Electrical tape
- Two Ethernet cables with RJ-45 Connectors

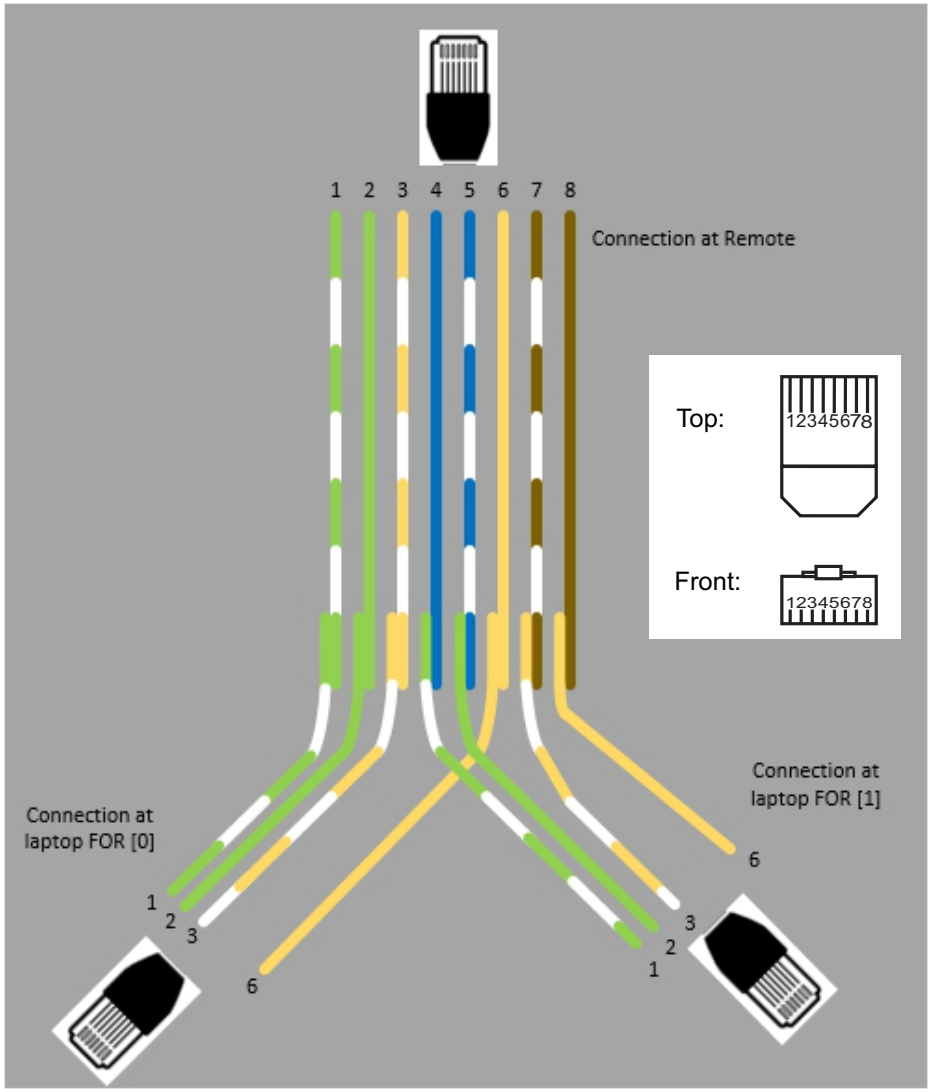
Build a Custom Cable

1. Cut both Ethernet cables in half.

   Three sections will be needed.
2. Strip back the insulation on each wire about 0.5 inch/13mm.
3. Twist the color pairs together as shown in Figure 133 on page 110.
4. Use electrical tape to cover the connections so bare wire do not touch.

   Unused cable strands can be cut.
5. Secure the splice with electrical tape so that stress does not pull the wire pairs apart.
6. Clearly mark each connector to distinguish which connector is attached to the remote and which connector plugs into the laptop for FOR [0] and FOR [1].

Figure 133 Custom Cable for Connecting to two FOR systems



Connection to BGW from Remote Unit

The technician has the ability to connect to the BGW from the remote unit. This eases troubleshooting and programming by not having to return to the BGW location for direct access.

1. Enable the laptop DHCP settings.
2. Connect RJ45 Ethernet cable to the Ethernet port on the remote.

   The FOI will detect that a device has connected to the FOR and will assign an IP address to the the laptop in the range of 172.22.108.49-62.

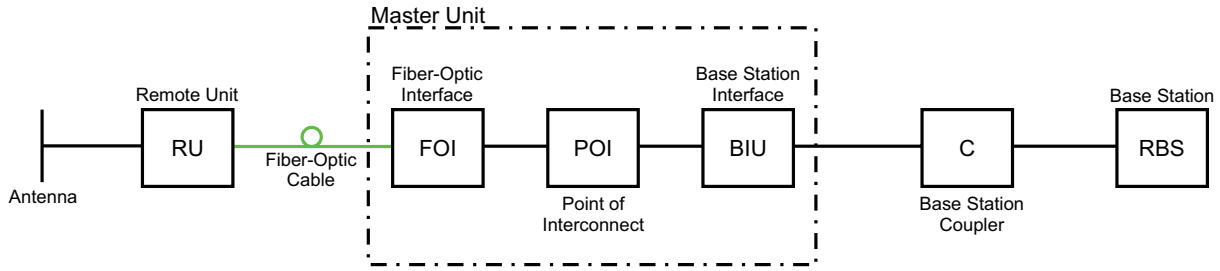
   Note: *It may take up to 15 minutes for the FOI to assign an IP address to the laptop.*
3. Using an Internet browser connect to 172.22.0.1
4. When the login menu appears type in the default credentials:
   - Username: "extended"
   - Password: "admin".

In order to make the process more clear for this part of the manual we will consider setting up a fictitious system, but based on a standard approach at doing Fiber-DAS. The system that we are considering will have two frequency bands, let's assume GSM 900 MHz and UMTS 2100 MHz. The example will have 2 sectors with two remotes in each sector. Of course your system may look different, be more or less complex but in order to make it clear how the system is set up this should provide you with a starting point.

Setting up the uplink

Setting up the uplink means to adjust the system for an optimal working point from the antenna port of the Remote Unit to the actual input on the Radio Base Station. This can be done in different ways depending on how the system is designed. We will here discuss a standard set-up starting with a small block schematic showing how the system is connected.

Figure 134 System Interconnect Diagram



The main parameter that we will be discussing is the "net gain" of the system. This means the total change in signal from the Remote Unit antenna port to the receiver port on the base station. There are different ways of setting this system up but we will look at a 0 dB net gain system which is a good starting point for most systems.

The system gain can be calculated as the gain in the Remote Unit – Loss on fiber + FOI gain – ICU loss + BIU gain – coupler loss. Basically this takes form of a link budget and here is an example:

Table 70 Example Link Budget

Unit/Component	Gain/Loss (dB)	Accumulated Gain/Loss (dB)
Remote Unit (RU)	40	40
Fiber-Optic Cable	-10	30
FOI	20	50
ICU	-35	15
BIU	0	15
Coupler	-15	0

Basically this means that whatever is input at the antenna will also be seen at the same level for the Radio Base Station receiver. This is not a bad starting point but does not take into account the noise load on the base station which will increase somewhat with this setup.

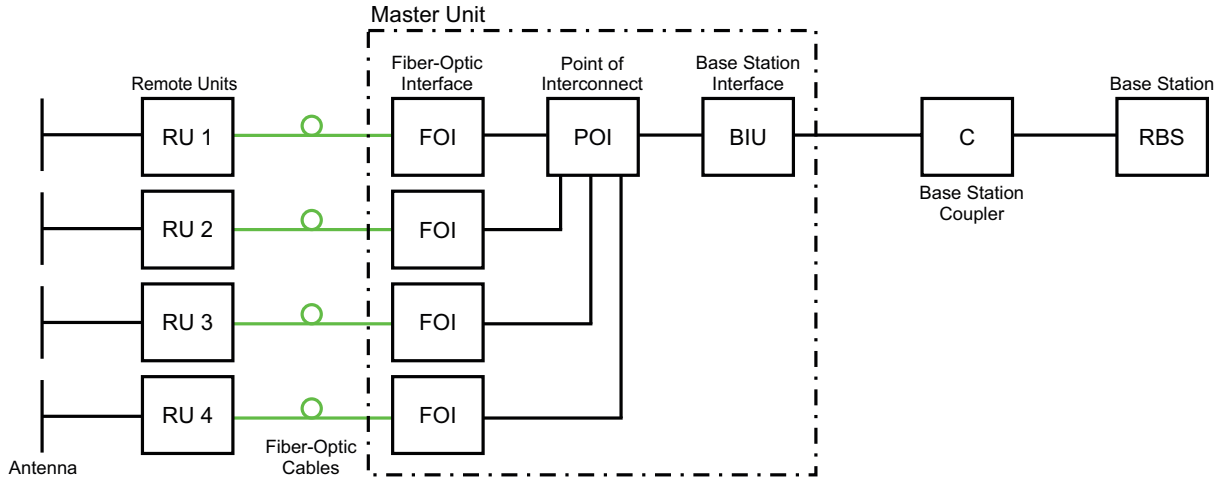
Noise load on Radio Base Station

The system will inevitably add some noise to the receiver. When properly set up the noise figure in a system like this will be better than 3 dB. However, if the gain is improperly set up (i.e. not enough gain in the remote, too much gain in the head-end) it is possible to create a very bad noise figure. In order to avoid this the Fiber-DAS Calculator should be used to calculate the noise figure of the system in the uplink.

If you have not familiarized yourself with the Fiber-DAS Calculator, do so before moving on in this manual. The figures in the Fiber-DAS calculator relate to the settings of all steps in the chain. By using the calculator, you can determine the proper settings once you know the fiber loss between the Remote Unit and the headend.

Let us assume you've arrived at a Noise Figure (NF) of 3 dB for this chain. However your system may contain more remotes, perhaps connected like the system in Figure 135.

Figure 135 Multiple RU Connection Diagram



Now the noise load can be calculated by adding the noise contribution from each step of the chain. Below is an example of noise figures from each of the remotes:

Table 71 Noise Load

Chain	NF	Gain	Noise Load
RU 1	2.8	0.0	2.8
RU 2	3.2	1.0	4.2
RU 3	3.8	-2.0	1.8
RU 4	2.6	-1.0	1.6
Sum of Noise Load			8.7

Base Station	4.0
Fiber-DAS Noise Load	8.0
Total Noise into BTS	9.5
Desensitization	-5.5

Add your figures to the sheet in the Fiber-DAS calculator and it will calculate it for you.

What we see here is that if we set the system up in this fashion we will desensitize the base station with about 5,5 dB. This can be okay if the base station coverage is only through the Fiber-DAS system but if the base station is also being used for outdoor coverage it is not good. We need to change the net gain to reflect this. In general we should lower the gain so that we desensitize the BTS only about 3 dB. This value is a good compromise and similar to adding a second antenna to the same receiver port (which is kind of what we are doing with the Fiber-DAS).

Here are the new values:

Table 72 Adjusted Noise Load

Chain	NF	Gain	Noise Load
RU 1	2.8	-5.5	-2.2
RU 2	3.2	-5.5	-1.8
RU 3	3.8	-5.5	-1.2
RU 4	2.6	-5.5	-2.4
Sum of Noise Load			4.1

Base Station	4.0
Fiber-DAS Noise Load	4.1
Total Noise into BTS	7.1
Desensitization	-3.1

As you can see we should set the system up with a net gain of about -5 dB. Going back to the settings we had before which was:

Table 73 Example Link Budget

Unit/Component	Gain/Loss (dB)	Accumulated Gain/Loss (dB)
Remote Unit (RU)	40	40
Fiber-Optic Cable	-10	30
FOI	20	50
ICU	-35	15
BIU	0	15
Coupler	-15	0

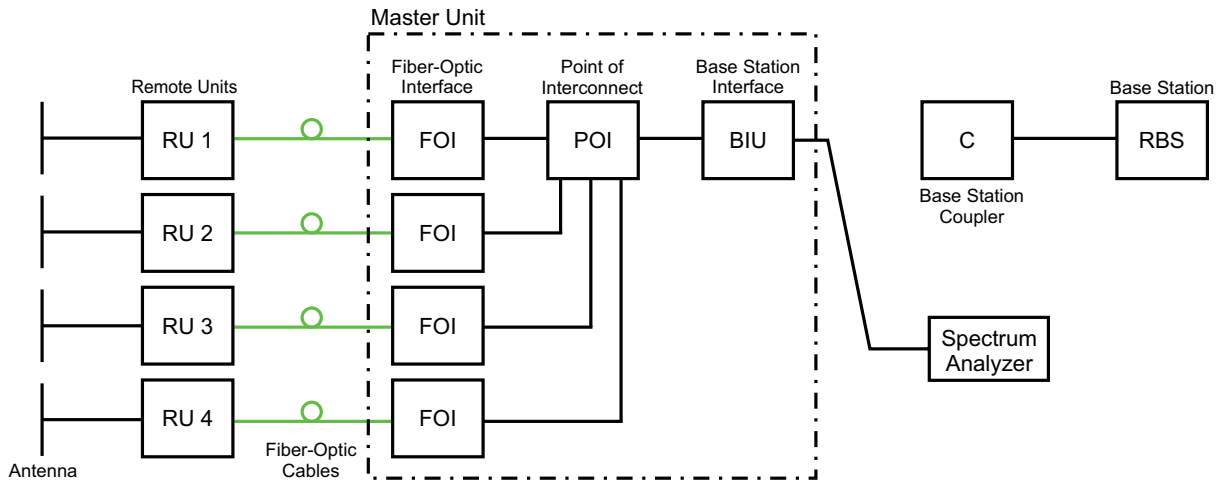
We only need to change the BIU setting using the attenuators in the BIU to lower the gain with 5 dB. This will accomplish what we need to do and the uplink should then be commissioned.

Practical approach

Now that we know what we should have we can easily set the system up. You need a spectrum analyzer to do this and it is easiest to connect it into the BIU port. Remember that when you measure here, the signal should also go through the BTS coupler before it reaches the base station receiver port. Therefore you should expect to read a value that is:

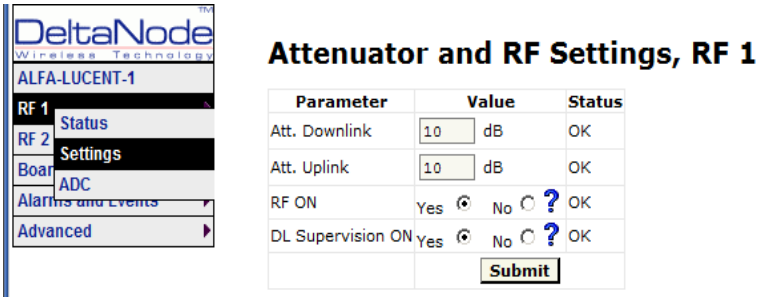
Your expected gain + the loss in your coupler.

If you want a net gain of -5 dB and you have a 15 dB coupler, you should read a net gain of +10 on the BIU port. This is now what we are going to use in the following example.



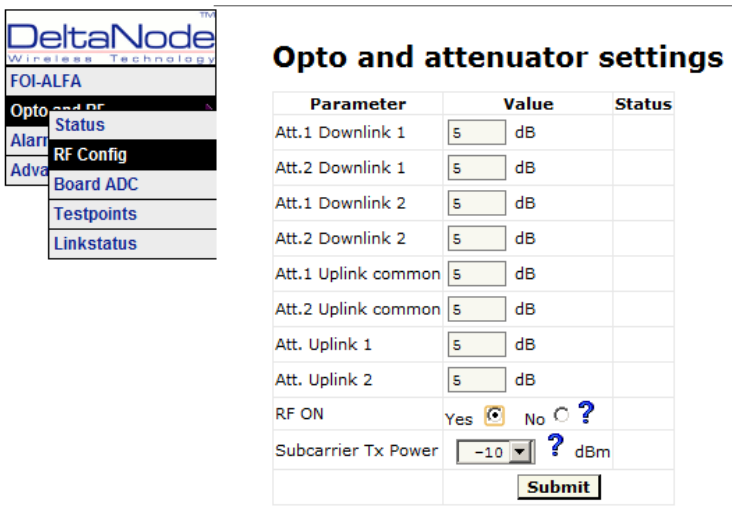
Turn on the RF

Connect to the BIU and turn on the RF. Set the attenuator in the medium range for the uplink that you are measuring. This allows you later to adjust it up and down as necessary to get the correct gain for the uplink chain.

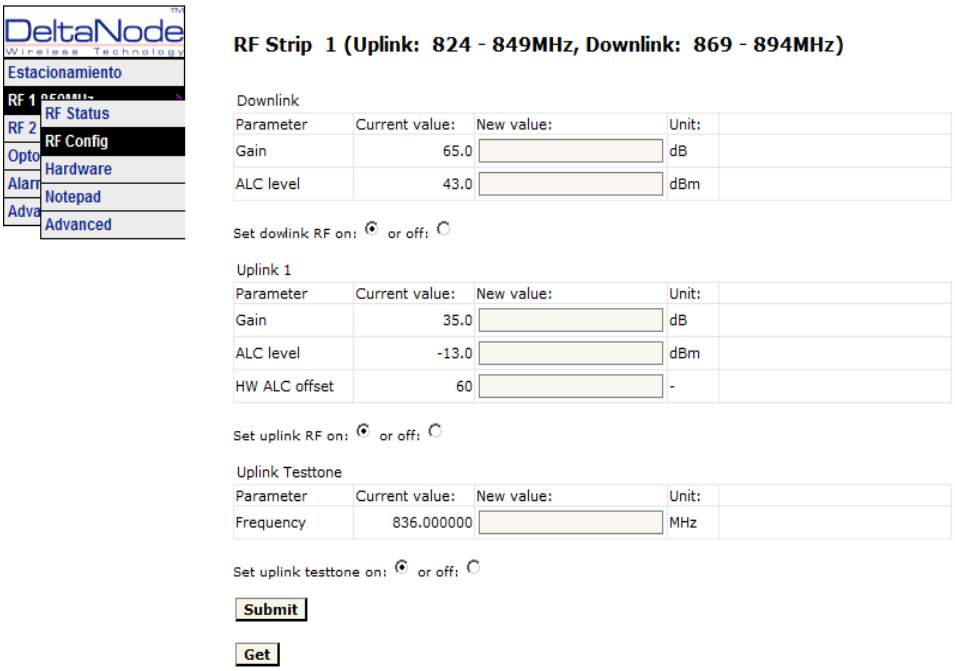


Setting them to 10 dB is a good idea. DL supervision can be left as is for now and also DL attenuation which we will set up later.

Connect to the FOI card and select Opto and RF – RF Config and set it up according to your Fiber-DAS calculator settings. Do not forget to turn RF on.



Next step is to connect to the remote unit and set it up for test measurement in the uplink.



In this screen you should also turn RF on, set the gain to about 35 dB as a starting point and then turn on the uplink test tone. Note the frequency of the test tone, this is the frequency you should be measuring on your spectrum analyzer.

Turn on the spectrum analyzer, make sure it is connected to the right port on the right BIU and then find the frequency. A reasonable span is 1 MHz and the receiver band width can be set to 30 kHz or similar. Use the marker to measure the peak of the signal. Then go to the next screen on the remote unit, the RF Status screen.

RF Strip 1 (Uplink: 824 - 849MHz, Downlink: 869 - 894MHz)

RF Status

Downlink	**Current value:**	**Unit:**
Start frequency	869.000000	MHz
Stop frequency	894.000000	MHz
RF link	on	
ALC threshold	43.0	dBm
Set gain	65.0	dB
Max gain	65.0	dB
Gain	63.6	dB
Output power	43.1	dBm
Uplink 1	**Current value:**	**Unit:**
Start frequency	824.000000	MHz
Stop frequency	849.000000	MHz
RF link	on	
Testtone state	on locked	
Testtone frequency	836.000000	MHz
Testtone level	-62.6	dBm
ALC threshold	-13.0	dBm
Set gain	35.0	dB
Max gain	35.0	dB
Gain	35.0	dB
Output power	-27.5	dBm

Reload

Periodic

What we are looking for here is the Test tone Level. Note this down as well, next to the frequency of the test tone you noted earlier.

Then check your spectrum analyzer. Assuming your test tone level is -62.6 dBm as in this example your spectrum analyzer may show -58.2 dBm. Calculating the net gain between the RU and the BIU will then yield -58.2 - -62.5 = 4.3 dB. Subtract the coupler between the BIU and the radio base station which in this example was 15 dB and we get -19.3 dB as our net gain.

We wanted -10 dB so we have 9.3 dB too low gain. We should then increase the gain and the best place to do this would be in the remote unit by setting the gain at 35 + 9.3 = 44.3 which we will round to 44 dB.

CAUTION

Turn Off Test Tone

Do not forget to turn off the test tone when you are done with your uplink. Better check one extra time. They will otherwise interfere with the normal operation of the system by causing noise to the base station.

Note: *If the test tone is not manually turned off, the system will automatically turn off test tone after a 60 minute time limit has elapsed.*

That uplink is now finished and we will repeat the settings for all of our uplink, one at a time.

The operation the Fiber-DAS components are monitored, any operation outside of acceptable limits will generate an alarm. The alarms are described within the following paragraphs along with recommended actions at the Network Operations Center (NOC) and field maintenance levels.

Alarms

Alarms in the following paragraphs are grouped by the unit generating the abnormal condition. The alarms are listed in numerical order by the alarm ID.

Base Station Gateway (BGW) Alarms

ID	Name	Class	Severity	Unit
16	Lost Node	0x0001	Critical	BGW
	Description	The supervisor has lost connection with a node. Communication over the fiber between the BMU and the RU is down. The two major reasons for this alarms would be a fiber disconnect or a power outage. RF may still be working if only the communication link is affected.		
	NOC Actions	From NOC Check if there are other alarms related such as low optical level. Check optical light on the corresponding FOI		
	Field Actions	Check power, check fiber, check remote unit.		

ID	Name	Class	Severity	Unit
17	Lost Supervision	0x0001	Critical	BGW
	Description	Supervisor is not functional in the BGW system. Likely a software issue.		
	NOC Actions	Try to restart the BGW. This may require a root login and issuing the command "shutdown -r now" from the console.		
	Field Actions	Reboot the BGW computer. If alarm does not clear or comes back, replace the BGW computer. Contact Bird for replacement or software upgrades.		

Fiber Optic Remote (FOR) Alarms

ID	Name	Class	Severity	Unit
46	Temperature Alarm	0x0010	Warning	FOR
	Description	Temperature is above **85° C** (185° F) for the FOR. High power units may start reducing their output power to protect itself from overheating.		
	NOC Actions	Check temperature for other remotes. Dispatch field techs to check the environment.		
	Field Actions	Check the reason for overheating. Arrange for ventilation if insufficient. For outdoor units, deploy the sun shield that is available for the Bird remote unit.		

ID	Name	Class	Severity	Unit
46	Temperature Alarm	0x0010	Error	FOR
	Description	Temperature is above **90° C** (194° F) for the FOR. High power units may start reducing their output power to protect itself from overheating.		
	NOC Actions	N/A		
	Field Actions	Check the reason for overheating. Arrange for ventilation if insufficient. For outdoor units, deploy the sun shield that is available for the Bird remote unit.		

ID	Name	Class	Severity	Unit
51	RF Voltage low	0x0010	Error	FOR
	Description	The measured RF voltage is below threshold.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
52	RF Voltage high	0x0010	Error	FOR
	Description	The measured RF voltage is above threshold.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
53	Analog voltage	0x0010	Error	FOR
	Description	The 3 V supply voltage is not within the specified range. This is a hardware fault.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
54	Negative Voltage	0x0010	Error	FOR
	Description	The measured negative voltage is above threshold. This is a hardware fault.		
	NOC Actions	Check the output power of the unit if it is still functioning. Dispatch field tech to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
55	RF overload UL	0x0010	Warning	FOR
	Description	The RF power on the laser in the remote unit is too high. Alarm is triggered when UL ALC hits 10 dB above set level.		
	NOC Actions	Check the uplink gain settings. Check the settings of the ALC. The ALC settings is set so that it should correspond to the negative FOR gain in the uplink minus 1 dB. If the FOR gain is set to 12 dB the ALC should be -13 dBm. If the FOR gain is 20 dB the ALC should be -21 dBm		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
56	Received optical power low	0x0010	Warning	FOR
	Description	The received optical power on the fiber optic remote board (FOR) is less than **60 µW**. This corresponds to 17 dB fiber optical loss.		
	NOC Actions	Investigate the loss from both ends, if there is communication with the remotes. If the system is multi drop then the problem is likely to be before the split to the different units.		
	Field Actions	Investigate the loss on the fiber from both ends. Using optical test equipment, measure wave length 1550 nm downlink and 1310 nm uplink. In multi-drop systems, the issue would likely be fiber. On point-to-point systems the remote may be down.		

ID	Name	Class	Severity	Unit
56	Received optical power low	0x0010	Error	FOR
	Description	The received optical power on the fiber optic remote board (FOR) is less than **30 µW**. This corresponds to 20 dB fiber optical loss.		
	NOC Actions	Investigate the loss from both ends if there is communication with the remotes. If the system is multi drop then the problem is likely to be before the split to the different units.		
	Field Actions	Investigate the loss on the fiber from both ends. Using optical test equipment, measure wave length 1550 nm downlink and 1310 nm uplink. In multi-drop systems, the issue would likely be fiber. On point-to-point systems the remote may be down.		

ID	Name	Class	Severity	Unit
56	Received optical power low	0x0010	Critical	FOR
	Description	The received optical power on the fiber optic remote board (FOR) is less than **20 µW**. This corresponds to 22 dB fiber optical loss.		
	NOC Actions	Investigate the loss from both ends if there is communication with the remotes. If the system is multi drop then the problem is likely to be before the split to the different units.		
	Field Actions	Investigate the loss on the fiber from both ends. Using optical test equipment, measure wave length 1550 nm downlink and 1310 nm uplink. In multi-drop systems, the issue would likely be fiber. On point-to-point systems the remote may be down.		

ID	Name	Class	Severity	Unit
61	Communication Failure	0x0010	Error	FOR
	Description	The driver for the sub-carrier Ethernet communication could not be loaded. This is a hardware or software failure.		
	NOC Actions	Dispatch field techs to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
62	Laser Current	0x0010	Warning	FOR
	Description	The measured laser current is above the threshold of **150 mA**. This is a hardware fault.		
	NOC Actions	Dispatch field techs to replace remote unit with spare.		
	Field Actions	Replace remote units with spare.		

ID	Name	Class	Severity	Unit
62	Laser Current	0x0010	Error	FOR
	Description	The measured laser current is above the threshold of **160 mA**. This is a hardware fault.		
	NOC Actions	Dispatch field techs to replace remote unit with spare. Check optical levels on corresponding FOI board. Check output power.		
	Field Actions	Replace remote units with spare.		

ID	Name	Class	Severity	Unit
62	Laser Current	0x0010	Critical	FOR
	Description	The measured laser current is above the threshold of **200 mA**. This is a hardware fault.		
	NOC Actions	Dispatch field techs to replace remote unit immediately. To prevent problems with the System, disable RF to the remote unit on all bands or power down the remote unit.		
	Field Actions	Replace remote units with spare.		

ID	Name	Class	Severity	Unit
63	Board supply voltage low	0x0010	Error	FOR
	Description	The supply voltage is dropped below **4.5 V**. This is a hardware fault. Unit should be replaced.		
	NOC Actions	Dispatch team to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
64	Board supply voltage high	0x0010	Error	FOR
	Description	Board voltage above **5.5 V**. This is a hardware fault.		
	NOC Actions	Dispatch team to replace unit.		
	Field Actions	Replace unit.		

Remote Unit (RU) Alarms

ID	Name	Class	Severity	Unit
0	No alarm board	0x0011	Error	RU
	Description	Alarm board for external alarms could not be found. This is a hardware or software fault.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
1	Loss of main AC power	0x0011	Error	RU
	Description	This is an external alarm and only valid if it is wired up. External alarm 1 triggered.		
	NOC Actions	Depends what is connected to external alarm 1. If used with UPS this should be the loss of AC power alarm. The unit will run on UPS until batteries are depleted or AC power is restored.		
	Field Actions	See actions at NOC		

ID	Name	Class	Severity	Unit
2	Battery voltage low	0x0011	Critical	RU
	Description	This is an external alarm and only valid if it is wired up. External alarm 2 triggered.		
	NOC Actions	Depends what is connected to external alarm 2. If used with UPS this should be the battery low alarm. The unit will shut down soon.		
	Field Actions	See actions at NOC		

ID	Name	Class	Severity	Unit
3	Ext. alarm 3	0x0011	Error	RU
	Description	This is an external alarm and only valid if it is wired up. External alarm 3 triggered.		
	NOC Actions	Depends what is connected to external alarm 3.		
	Field Actions	See actions at NOC		

ID	Name	Class	Severity	Unit
4	Ext. alarm 4	0x0011	Warning	RU
	Description	This is an external alarm and only valid if it is wired up. External alarm 4 triggered.		
	NOC Actions	Depends what is connected to external alarm 4.		
	Field Actions	See actions at NOC		

ID	Name	Class	Severity	Unit
5	Slave FOR-1	0x0011	Warning	RU
	Description	Slave FOR-1 lost or alarm from slave FOR. This is used when a unit is equipped with dual fiber optic remote boards. More information on what is going on can be found at the redundant connection to the unit.		
	NOC Actions	Check the alarms on the redundant connection and take action depending on what they are.		
	Field Actions	See actions at NOC		

ID	Name	Class	Severity	Unit
8	PSU2 lost	0x0011	Error	RU
	Description	Alarm indicates a problem with the second PSU in the unit. This is likely a hardware fault and it is recommended to replace the unit.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
41	Lost RF instance	0x0011	Critical	RU
	Description	The unit's supervisor has detected a loss of the RF instance, i.e. an amplifier chain. This is a hardware fault and replacing the unit is recommended.		
	NOC Actions	Reset the unit. If problem reappears later (check the alarm logs a couple of hours later) dispatch field tech to replace unit.		
	Field Actions	Replace the unit.		

ID	Name	Class	Severity	Unit
70	Downlink TX power low	0x0011	Warning	RU
	Description	The downlink transmitted power is low. This can happen for a number of reasons: 1) The base station at the BMU may be down and the signal is lost, 2) The BIU card may have been disconnected. 3) Loss of RF over the fiber while communication is still working or 4) The gain setting in the DL is insufficient for the signal level required.		
	NOC Actions	Check RF input source. Check other units in the same sector if they have power. Check fiber optical power. Check the gain setting in the DL corresponds to what was recorded at commissioning time. If the unit is connected to a system that has an intermittent RF downlink, such as some analog systems or paging systems, then this may be a false alarm triggered when the base station is not transmitting. If that is the case then turn off this alarm from the RF configuration page on the remote.		
	Field Actions	Check the RF signal levels in the downlink path. Confirm the connection from the BMU to the BIU is correct. Confirm the FOI is patched to the correct sector. Confirm the DL gain settings are correct. If the DL gain is increased is the problem solved? If so, re-commission the unit. If the unit is connected to a system that has an intermittent downlink, such as some analog systems or paging systems, then this may be a false alarm triggered when the base station is not transmitted. If that is the case then turn off this alarm from the RF configuration page on the remote.		

ID	Name	Class	Severity	Unit
70	Downlink TX power low	0x0011	Critical	RU
	Description	The downlink transmitted power is low. This can happen for a number of reasons: 1) The base station at the BMU may be down and the signal is lost, 2) The BIU card may have been disconnected. 3) Loss of RF over the fiber while communication is still working or 4) The gain setting in the DL is insufficient for the signal level required. Most of the time this is a configuration error, system error on the BTS side or connection problem on the BMU		
	NOC Actions	Check RF input source. Check other units in the same sector if they have power. Check fiber optical power. Check the gain setting in the DL corresponds to what was recorded at commissioning time. If the unit is connected to a system that has an intermittent RF downlink, such as some analog systems or paging systems, then this may be a false alarm triggered when the base station is not transmitting. If that is the case then turn off this alarm from the RF configuration page on the remote.		
	Field Actions	Check the RF signal levels in the downlink path. Confirm the connection from the BMU to the BIU is correct. Confirm the FOI is patched to the correct sector. Confirm the DL gain settings are correct. If the DL gain is increased is the problem solved? If so, re-commission the unit. If the unit is connected to a system that has an intermittent downlink, such as some analog systems or paging systems, then this may be a false alarm triggered when the base station is not transmitted. If that is the case then turn off this alarm from the RF configuration page on the remote.		

ID	Name	Class	Severity	Unit
71	AGC	0x0011	Warning	RU
	Description	The automatic level control in the remote unit has reduced the gain more than **10 dB** for some time. This is normally configuration error.		
	NOC Actions	Reduce the gain wit 10 dB and put the unit under observation. Check the output power from the RF Status page.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
71	AGC	0x0011	Error	RU
	Description	The automatic level control in the remote unit has reduced the gain more than **30 dB** for some time. This is normally configuration error.		
	NOC Actions	Reduce the gain wit 10 dB and put the unit under observation. Check the output power from the RF Status page.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
72	Power supply voltage low	0x0011	Error	RU
	Description	The measured power supply voltage is below the limit. This is a hardware fault.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace failed unit.		

ID	Name	Class	Severity	Unit
73	Power supply voltage high	0x0011	Error	RU
	Description	The measured power supply voltage is above the limit. This is a hardware fault.		
	NOC Actions	Dispatch field tech to replace unit.		
	Field Actions	Replace failed unit.		

Fiber optic Interface (FOI) Alarms

ID	Name	Class	Severity	Unit
41	Lost RF instance	0x0020	Critical	FOI
	Description	The supervisor in the FOI has detected loss of an RF instance, i.e. amplifier chain. This is likely a hardware fault.		
	NOC Actions	Dispatch field tech to replace FOI board.		
	Field Actions	Note the current settings on the FOI board. Replace with new FOI, configure the new board with the same settings as the old board.		

ID	Name	Class	Severity	Unit
44	Fan speed to low	0x0020	Error	FOI
	Description	This alarm is not actually emanating from the FOI but comes from the back plane in the Master Frame Unit (MFU) . This alarm indicates there is a problem with the cooling fans in the MFU .		
	NOC Actions	Dispatch field tech to replace fan tray.		
	Field Actions	Replace the fan tray by removing the old one and installing a new unit.		

ID	Name	Class	Severity	Unit
45	Fan speed to high	0x0020	Error	FOI
	Description	This alarm is not actually emanating from the FOI but comes from the back plane in the Master Frame Unit (MFU). This alarm indicates there is a problem with the cooling fans in the MFU .		
	NOC Actions	Dispatch field tech to replace fan tray.		
	Field Actions	Replace the fan tray by removing the old one and installing a new unit.		

ID	Name	Class	Severity	Unit
46	Temperature alarm	0x0020	Warning	FOI
	Description	The temperature is high in the FOI board and has reached **85° C** (185° F).		
	NOC Actions	Check if there are alarms from the fan tray. If there are no alarms check the other modules reported temperature in the unit. If several boards have temperature problems it is likely to be an environmental problem. If it is only one card then this card may be the failure. Dispatch field tech to check the ambient temperature/ventilation or replace board.		
	Field Actions	Arrange for better ventilation if that is the problem or replace failing board.		

ID	Name	Class	Severity	Unit
46	Temperature alarm	0x0020	Error	FOI
	Description	The temperature is high in the FOI board and has reached **90° C** (194° F).		
	NOC Actions	Check if there are alarms from the fan tray. If there are no alarms check the other modules reported temperature in the unit. If several boards have temperature problems it is likely to be an environmental problem. If it is only one card then this card may be the failure. Dispatch field tech to check the ambient temperature/ventilation or replace board.		
	Field Actions	Arrange for better ventilation if that is the problem or replace failing board.		

ID	Name	Class	Severity	Unit
47	Input voltage V1A low	0x0020	Error	FOI
	Description	Measured input voltage from backplane power connector A is too low. This is a hardware fault either on FOI or DMF or a PSU.		
	NOC Actions	Check if any other cards in the same rack produce the same errors. If not this may be just the FOI that has a problem. If other cards are reporting the same issue then this is likely to be a PSU or backplane fault.		
	Field Actions	If just one board is alarming try to replace that board. If several boards are alarming, attempt to replace the PSU. If that does not help replace the DMF transferring all cards to the new DMF.		

ID	Name	Class	Severity	Unit
48	Input voltage V1B low	0x0020	Error	FOI
	Description	Measured input voltage from backplane power connector B is too low. This is a hardware fault either on FOI or DMF or a PSU.		
	NOC Actions	Check if any other cards in the same rack produce the same errors. If not this may be just the FOI that has a problem. If other cards are reporting the same issue then this is likely to be a PSU or backplane fault.		
	Field Actions	If just one board is alarming try to replace that board. If several boards are alarming, attempt to replace the PSU. If that does not help replace the DMF transferring all cards to the new DMF.		

ID	Name	Class	Severity	Unit
49	Input voltage V1A high	0x0020	Error	FOI
	Description	Measured input voltage from backplane power connector A is too high. This is a hardware fault either on FOI or DMF or a PSU.		
	NOC Actions	Check if any other cards in the same rack produce the same errors. If not this may be just the FOI that has a problem. If other cards are reporting the same issue then this is likely to be a PSU or backplane fault.		
	Field Actions	If just one board is alarming try to replace that board. If several boards are alarming, attempt to replace the PSU. If that does not help replace the DMF transferring all cards to the new DMF.		

ID	Name	Class	Severity	Unit
50	Input voltage V1B high	0x0020	Error	FOI
	Description	Measured input voltage from backplane power connector B is too high. This is a hardware fault either on FOI or DMF or a PSU.		
	NOC Actions	Check if any other cards in the same rack produce the same errors. If not this may be just the FOI that has a problem. If other cards are reporting the same issue then this is likely to be a PSU or backplane fault.		
	Field Actions	If just one board is alarming try to replace that board. If several boards are alarming, attempt to replace the PSU. If that does not help replace the DMF transferring all cards to the new DMF.		

ID	Name	Class	Severity	Unit
51	Downlink 5V low	0x0020	Error	FOI
	Description	The measured 5 V to RF parts on the board is below acceptable level. This is a hardware fault.		
	NOC Actions	Dispatch tech to replace board.		
	Field Actions	Replace FOI card. Commission new card with the same settings as the old.		

ID	Name	Class	Severity	Unit
54	Negative voltage	0x0020	Error	FOI
	Description	The measured negative voltage is too high. Hardware failure.		
	NOC Actions	Dispatch tech to replace FOI.		
	Field Actions	Replace FOI.		

ID	Name	Class	Severity	Unit
55	RX uplink RF power overload	0x0020	Warning	FOI
	Description	The measured RF power in the uplink is above threshold. Alarm is triggered at **+20 dBm** something that should never come off the FOI. If this alarm is triggered it is likely to be a hardware fault.		
	NOC Actions	Dispatch field tech to replace FOI.		
	Field Actions	Replace FOI. Set new FOI to same settings as the old.		

ID	Name	Class	Severity	Unit
56	Received optical power low	0x0020	Warning	FOI
	Description	Alarm is triggered when the optical power received on the fiber is **< 60 µW**. This is likely to happen if the RU is powered off or there is a problem with the fiber connection.		
	NOC Actions	Check if there is a power problem. If that is not the case dispatch field tech to check the fibers.		
	Field Actions	Go to remote connected to the FOI and check for power problems. At the remote you may connect locally and check received optical levels. If they are also low, then fiber is the likely cause of the problem.		

ID	Name	Class	Severity	Unit
56	Received optical power low	0x0020	Error	FOI
	Description	Alarm is triggered when the optical power received on the fiber is **< 30 µW**. This is likely to happen if the RU is powered off or there is a problem with the fiber connection.		
	NOC Actions	Check if there is a power problem. If that is not the case dispatch field tech to check the fibers.		
	Field Actions	Go to remote connected to the FOI and check for power problems. At the remote you may connect locally and check received optical levels. If they are also low, then fiber is the likely cause of the problem.		

ID	Name	Class	Severity	Unit
56	Received optical power lost	0x0020	Critical	FOI
	Description	Alarm is triggered when the optical power received on the fiber is **< 20 µW**. This is likely to happen if the RU is powered off or there is a problem with the fiber connection.		
	NOC Actions	Check if there is a power problem. If that is not the case dispatch field tech to check the fibers.		
	Field Actions	Go to remote connected to the FOI and check for power problems. At the remote you may connect locally and check received optical levels. If they are also low, then fiber is the likely cause of the problem.		

ID	Name	Class	Severity	Unit
57	Low downlink RF power	0x0020	Warning	FOI
	Description	The input RF signal is too low to the FOI.		
	NOC Actions	Check inputs on BIU cards. Check attenuator settings from commissioning protocols. Dispatch field tech to check connections and settings.		
	Field Actions	Check the settings of the system. If all seems fine there could be a problem with the FOI card.		

ID	Name	Class	Severity	Unit
58	Downlink RF power overload	0x0020	Warning	FOI
	Description	The downlink RF power in to the laser is too high.		
	NOC Actions	Check the input levels on the FOI board. It is possible to readjust this on from remote by increasing attenuation on the FOI board. Also check the output power on the remote units as this adjustment will lower their output power. Recommended also a field tech checks the system out.		
	Field Actions	Check the settings of the FOI card. The input is too high. Adjust as needed and then reset levels on the affected RUs in the DL.		

ID	Name	Class	Severity	Unit
59	Uplink 5V low	0x0020	Error	FOI
	Description	The measured 5 V to RF parts on the board is below acceptable level. This is a hardware fault.		
	NOC Actions	Dispatch tech to replace board.		
	Field Actions	Replace FOI card. Commission new card with the same settings as the old.		

ID	Name	Class	Severity	Unit
60	Uplink 5V high	0x0020	Error	FOI
	Description	The measured 5 V to RF parts on the board is above acceptable level. This is a hardware fault.		
	NOC Actions	Dispatch tech to replace board.		
	Field Actions	Replace FOI card. Commission new card with the same settings as the old.		

ID	Name	Class	Severity	Unit
61	Communication Failure	0x0020	Error	FOI
	Description	The driver for the sub-carrier Ethernet communication could not be loaded. This is a hardware or software failure.		
	NOC Actions	Dispatch field techs to replace the FOI.		
	Field Actions	Replace FOI with spare.		

ID	Name	Class	Severity	Unit
62	Downlink 5V high	0x0020	Error	FOI
	Description	The measured 5 V to RF parts on the board is above acceptable level. This is a hardware fault.		
	NOC Actions	Dispatch tech to replace board.		
	Field Actions	Replace FOI card. Commission new card with the same settings as the old.		

ID	Name	Class	Severity	Unit
72	Laser TX current	0x0020	Warning	FOI
	Description	The measured laser current is too high **> 150 mA**. Hardware fault.		
	NOC Actions	Dispatch tech to replace FOI.		
	Field Actions	Replace FOI card.		

ID	Name	Class	Severity	Unit
72	Laser TX current	0x0020	Error	FOI
	Description	The measured laser current is too high **> 160 mA**. Hardware fault.		
	NOC Actions	Dispatch tech to replace FOI.		
	Field Actions	Replace FOI card.		

ID	Name	Class	Severity	Unit
72	Laser TX current	0x0020	Critical	FOI
	Description	The measured laser current is too high **> 200 mA**. Hardware fault.		
	NOC Actions	Dispatch tech to replace FOI.		
	Field Actions	Replace FOI card.		

Base Station Interface (BIU) Alarms

ID	Name	Class	Severity	Unit
41	Lost RF instance	0x0030	Critical	BIU
	Description	The supervisor in the BIU has detected a loss of an RF instance, i.e. amplifier chain. Hardware or software fault.		
	NOC Actions	Dispatch tech to replace BIU.		
	Field Actions	Replace BIU card.		

ID	Name	Class	Severity	Unit
42	Received power from BTS low	0x0030	Warning	BIU
	Description	The received power input from the BTS is measured below the set alarm threshold. This could be due to settings if the card has not been properly commissioned yet or it could be because the BTS is down or the RF transmission between BTS and BIU is broken.		
	NOC Actions	Check the base station operation feeding the card. If no fault found and the system was properly commissioned then dispatch a field tech.		
	Field Actions	Check the level from the base station. Check the transmission line from BTS to the BIU card. If everything is OK then check the SMA connector is OK on the BIU card itself. If that still checks out, replace the BIU card and arrange a RMA for the faulty card.		

ID	Name	Class	Severity	Unit
43	Received power from BTS low	0x0030	Critical	BIU
	Description	The received power input from the BTS is measured below the second alarm threshold. This could be due to settings if the card has not been properly commissioned yet or it could be because the BTS is down or the RF transmission between BTS and BIU is broken.		
	NOC Actions	Check the base station operation feeding the card. If no fault found and the system was properly commissioned then dispatch a field tech.		
	Field Actions	Check the level from the base station. Check the transmission line from BTS to the BIU card. If everything is OK then check the SMA connector is OK on the BIU card itself. If that still checks out, replace the BIU card and arrange a RMA for the faulty card.		

ID	Name	Class	Severity	Unit
44	Fan speed low	0x0030	Error	BIU
	Description	The card has detected a malfunction on the DAS rack backplane that the fans are not working properly. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the fan tray.		
	Field Actions	Replace the fan tray on the DMF unit containing the card giving the alarm.		

ID	Name	Class	Severity	Unit
45	Fan speed high	0x0030	Error	BIU
	Description	The card has detected a malfunction on the DAS rack backplane that the fans are not working properly. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the fan tray.		
	Field Actions	Replace the fan tray on the DMF unit containing the card giving the alarm.		

ID	Name	Class	Severity	Unit
46	Temperature alarm	0x0030	Error	BIU
	Description	Temperature is above allowed temperature interval > **90° C** (194° F) .		
	NOC Actions	Check if there are other cards that give high temperature alarms. If there is, then it is likely an environmental problem with very high environment temperatures in the room. If only this card is alarming there might be a failure on the temperature sensor. In both cases dispatch a field tech to trouble shoot.		
	Field Actions	Check the ambient temperature. Arrange for ventilation as needed. If ambient temperature is fine, then check the other boards. If only one board is alarming replace the board which likely has a failed temperature sensor.		

ID	Name	Class	Severity	Unit
47	Input voltage V1A low	0x0030	Error	BIU
	Description	Input voltage A is detected below a threshold. Likely a PSU failure.		
	NOC Actions	Dispatch field tech to replace PSU. If there are other cards in the same rack they should also give similar alarms.		
	Field Actions	Check the output on the PSU should be 27 VDC nominally. Replace if not working properly.		

ID	Name	Class	Severity	Unit
48	Input voltage V1B low	0x0030	Error	BIU
	Description	Input voltage B is detected below a threshold. Likely a PSU failure.		
	NOC Actions	Dispatch field tech to replace PSU. If there are other cards in the same rack they should also give similar alarms.		
	Field Actions	Check the output on the PSU should be 27 VDC nominally. Replace if not working properly.		

ID	Name	Class	Severity	Unit
49	Input voltage V1A high	0x0030	Error	BIU
	Description	Input voltage A is detected above a threshold. Likely a PSU failure.		
	NOC Actions	Dispatch field tech to replace PSU. If there are other cards in the same rack they should also give similar alarms.		
	Field Actions	Check the output on the PSU should be 27 VDC nominally. Replace if not working properly.		

ID	Name	Class	Severity	Unit
50	Input voltage V1B high	0x0030	Error	BIU
	Description	Input voltage B is detected above a threshold. Likely a PSU failure.		
	NOC Actions	Dispatch field tech to replace PSU. If there are other cards in the same rack they should also give similar alarms.		
	Field Actions	Check the output on the PSU should be 27 VDC nominally. Replace if not working properly.		

ID	Name	Class	Severity	Unit
51	RF voltage low	0x0030	Error	BIU
	Description	Measured 5 V to RF parts is below a certain threshold.		
	NOC Actions	Dispatch field tech to replace card.		
	Field Actions	Replace card.		

ID	Name	Class	Severity	Unit
52	RF voltage high	0x0030	Error	BIU
	Description	Measured 5 V to RF parts is above a certain threshold.		
	NOC Actions	Dispatch field tech to replace card.		
	Field Actions	Replace card.		

ID	Name	Class	Severity	Unit
53	Analog voltage	0x0030	Error	BIU
	Description	3 V supply for analog parts are not within the acceptable range.		
	NOC Actions	Dispatch field tech to replace card.		
	Field Actions	Replace card.		

ID	Name	Class	Severity	Unit
54	High BTS signal	0x0030	Error	BIU
	Description	The received RF signal from the BTS is above the alarm threshold. The alarm threshold can be set at commissioning time.		
	NOC Actions	Check with engineers and adjust by remote to proper levels in BIU card. If input is too high for the card to handle, dispatch field tech to insert attenuator between BTS and BIU card.		
	Field Actions	Readjust or attenuate the BTS signal properly. Readjust the DL and UL for the sector when done with the attenuation.		

ID	Name	Class	Severity	Unit
55	High BTS signal	0x0030	Config	BIU
	Description	Measured output from the BIU is above a certain threshold. Alarm can be configured on, off, level and criticality by the tech.		
	NOC Actions	Check with engineers and adjust by remote to proper levels in BIU card. If input is too high for the card to handle, dispatch field tech to insert attenuator between BTS and BIU card.		
	Field Actions	Readjust or attenuate the BTS signal properly. Readjust the DL and UL for the sector when done with the attenuation.		

Medium Power Amplifier (PA) Alarms

ID	Name	Class	Severity	Unit
1	AD Converter fault	0x0100/0x0101	Error	PA
	Description	The AD converter on the board is malfunctioning. This is a hardware failure. There is a risk the RF output is not working.		
	NOC Actions	Dispatch field tech to replace the unit as soon as possible.		
	Field Actions	Replace failed unit.		

ID	Name	Class	Severity	Unit
2	EEPROM fault	0x0100/0x0101	Error	PA
	Description	The memory chip on the board is malfunctioning. This is a hardware failure. There is a risk the RF output is not working.		
	NOC Actions	Dispatch field tech to replace the unit as soon as possible.		
	Field Actions	Replace failed unit.		

ID	Name	Class	Severity	Unit
3	Calibration database corrupt	0x0100/0x0101	Warning	PA
	Description	The calibration database has been corrupted on the board. It is likely there is a hardware problem.		
	NOC Actions	Dispatch field tech to replace the unit as soon as possible.		
	Field Actions	Replace failed unit.		

ID	Name	Class	Severity	Unit
11	Temperature high	0x0100/0x0101	Warning	PA
	Description	The PA has detected a temperature above **95° C** (203° F) internally.		
	NOC Actions	Turn unit RF off to prevent overheating if alarm persists. Dispatch field tech to examine environment.		
	Field Actions	Examine environment, arrange for better air circulation. If outdoor consider adding the sun shield that goes over the cooler.		

ID	Name	Class	Severity	Unit
11	Temperature high	0x0100/0x0101	Error	PA
	Description	The PA has detected a temperature above **95° C** (203° F) internally.		
	NOC Actions	Turn unit RF off to prevent overheating if alarm persists. Dispatch field tech to examine environment.		
	Field Actions	Examine environment, arrange for better air circulation. If outdoor consider adding the sun shield that goes over the cooler.		

ID	Name	Class	Severity	Unit
12	Temperature low	0x0100/0x0101	Warning	PA
	Description	Measured temperature is low. Generally this may happen after a power failure in a very cold location.		
	NOC Actions	Give the unit an hour to warm up after power returns, if alarm is not clearing of its own give the unit a reset.		
	Field Actions	Same as for NOC.		

ID	Name	Class	Severity	Unit
21	Board supply voltage high	0x0100/0x0101	Error	PA
	Description	The board 14 V supply is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
22	Board supply voltage low	0x0100/0x0101	Warning	PA
	Description	The board 14 V supply is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
101	supply voltage high	0x0100/0x0101	Error	PA
	Description	The board supply voltage is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
102	supply voltage low	0x0100/0x0101	Warning	PA
	Description	The board supply voltage is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
103	Driver voltage high	0x0100/0x0101	Error	PA
	Description	The amplifier driver voltage is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
104	Driver voltage low	0x0100/0x0101	Error	PA
	Description	The amplifier driver voltage is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
105	Bias voltage missing	0x0100/0x0101	Error	PA
	Description	The amplifier bias voltage is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
111	PA current high	0x0100/0x0101	Error	PA
	Description	The amplifier current is outside acceptable limits. Hardware failure.		
	NOC Actions	Dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
112	PA current low	0x0100/0x0101	Warning	PA
	Description	The amplifier current is outside acceptable limits. Hardware failure.		
	NOC Actions	Reset the unit and see if the alarm clears. If it comes back then dispatch tech to replace unit.		
	Field Actions	Replace failing unit.		

ID	Name	Class	Severity	Unit
122	RF output power high	0x0100/0x0101	Warning	PA
	Description	RF output power is above preset threshold and the AGC can't reduce gain more.		
	NOC Actions	Forward to site engineer to check the settings on the unit.		
	Field Actions	Check the downlink gain and adjust accordingly.		

Variable Gain Amplifier (VGA) Alarms

ID	Name	Class	Severity	Unit
1	AD Converter Fault	0x0102	Error	VGA
	Description	The analog to digital converter has failed. This is a hardware error.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
2	EEPROM fault	0x0102	Error	VGA
	Description	Reading from or writing to the EEPROM memory failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
3	Calibration fault	0x0102	Warning	VGA
	Description	The database holding the calibration data for the unit is corrupt. The unit may need to be replaced but will work of default parameters.		
	NOC Actions	Schedule unit for replacement. Not imminent since the unit will work on default parameters.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
11	Temperature high	0x0102	Warning	VGA
	Description	Measured temperature is above threshold.		
	NOC Actions	For indoor units dispatch field tech to check the ambient temperature in the room and arrange for ventilation as needed. For outdoor units arrange for sun shield to be mounted.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
11	Temperature high	0x0102	Error	VGA
	Description	Measured temperature is above threshold.		
	NOC Actions	For indoor units dispatch field tech to check the ambient temperature in the room and arrange for ventilation as needed. For outdoor units arrange for sun shield to be mounted.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
12	Temperature low	0x0102	Warning	VGA
	Description	Measured temperature is below threshold.		
	NOC Actions	No action normally needed. This alarm generally happens if the unit has been out of power for a time in cold environment. It will generate enough heat to get back in order in an hour or so.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
21	Board supply voltage high	0x0102	Error	VGA
	Description	The measured voltage on the board is outside the limits. This is a hardware fault.		
	NOC Actions	Dispatch tech to replace remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
22	Board supply voltage low	0x0102	Warning	VGA
	Description	The measured voltage on the board is outside the limits. This is a hardware fault.		
	NOC Actions	Dispatch tech to replace remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
201	PLL data fault	0x0102	Error	VGA
	Description	PLL is supplied with invalid data. This is either a hardware or software fault.		
	NOC Actions	Dispatch field tech to change the remote unit when convenient. As long as the alarm remains a warning it is likely the unit will continue to operate.		
	Field Actions	Replace unit.		

ID	Name	Class	Severity	Unit
202	PLL lock fault	0x0102	Error	VGA
	Description	PLL is supplied with invalid data and/or unable to lock to frequency. This is either a hardware or software fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

Analog Pre-distortion (APD) Amplifier Alarms

ID	Name	Class	Severity	Unit
1	AD Converter Fault	0x0104	Error	APD
	Description	The analog to digital converter has failed. This is a hardware error.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
2	EEPROM read or write fault	0x0104	Error	APD
	Description	Reading from or writing to the EEPROM memory failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
3	Calibration fault	0x0104	Warning	APD
	Description	The database holding the calibration data for the unit is corrupt. The unit may need to be replaced but will work of default parameters.		
	NOC Actions	Schedule unit for replacement. Not imminent since the unit will work on default parameters.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
4	DAC Fault	0x0104	Warning	APD
	Description	The digital to analog converter has failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
5	I/O port	0x0104	Warning	APD
	Description	The communications port may have failed on the board.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
6	5VA	0x0104	Warning	APD
	Description	5 V Analog power has failed.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
7	Table missing	0x0104	Warning	APD
	Description	Calibration or configuration table in database missing. This is a software fault but the easiest way to fix it is to replace the unit.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
11	Temperature alarm	0x0104	Warning	APD
	Description	Temperature is above the threshold (95° C(203° F) in the unit.		
	NOC Actions	For indoor units dispatch field tech to check the ambient temperature in the room and arrange for ventilation as needed. For outdoor units arrange for sun shield to be mounted.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
11	Temperature alarm	0x0104	Error	APD
	Description	Temperature is above the threshold (105° C(221° F) in the unit.		
	NOC Actions	For indoor units dispatch field tech to check the ambient temperature in the room and arrange for ventilation as needed. For outdoor units arrange for sun shield to be mounted.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
12	Temperature alarm low	0x0104	Error	APD
	Description	Temperature is below the limit.		
	NOC Actions	No action normally needed. This alarm generally happens if the unit has been out of power for a time in cold environment. It will generate enough heat to get back in order in an hour or so.		
	Field Actions	See actions at NOC.		

ID	Name	Class	Severity	Unit
21	Board supply voltage high	0x0104	Error	APD
	Description	The board voltage is too high. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
22	Board supply voltage low	0x0104	Error	APD
	Description	The board voltage is too low. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
101	Supply voltage high	0x0104	Error	APD
	Description	The supplied voltage is too high. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
102	Supply voltage low	0x0104	Warning	APD
	Description	The supplied voltage is too low. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
103	Driver voltage high	0x0104	Error	APD
	Description	The driver voltage is too high. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
104	Driver voltage low	0x0104	Error	APD
	Description	The driver voltage is too low. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
105	VBIAS missing	0x0104	Error	APD
	Description	The bias voltage is missing.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
106	5V RF missing	0x0104	Error	APD
	Description	The 5V supplying the RF chain is missing.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
107	8V over voltage	0x0104	Error	APD
	Description	Bias voltage is too high on the board.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
108	8V under voltage	0x0104	Error	APD
	Description	Bias voltage is too low on the board.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
109	1.8V over voltage	0x0104	Error	APD
	Description	The 1.8 V is out of bounds on the board, this is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
110	1.8V under voltage	0x0104	Error	APD
	Description	The 1.8 V is out of bounds on the board, this is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
111	Over current	0x0104	Error	APD
	Description	The PA current is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
112	Under current	0x0104	Warning	APD
	Description	The PA current is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
121	Return loss	0x0104	Error	APD
	Description	The VSWR return loss measurement failed. Generally this indicates a problem with the antenna network.		
	NOC Actions	Dispatch field tech to check the antenna network and do VSWR testing on the passive distribution net.		
	Field Actions	Check VSWR using a TDR or FDR instrument. Find the problem and replace cable, connector, splitter, combiner etc.		

ID	Name	Class	Severity	Unit
122	High output power	0x0104	Error	APD
	Description	The output power is too high.		
	NOC Actions	Contact the systems engineer to check the settings.		
	Field Actions	Readjust the downlink gain to attain nominal output power.		

ID	Name	Class	Severity	Unit
123	APD Over current	0x0104	Error	APD
	Description	APD has detected an over current situation. Usually a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
124	APD reverse power	0x0104	Error	APD
	Description	The VSWR return loss measurement failed. Generally this indicates a problem with the antenna network.		
	NOC Actions	Dispatch field tech to check the antenna network and do VSWR testing on the passive distribution net..		
	Field Actions	Check VSWR using a TDR or FDR instrument. Find the problem and replace cable, connector, splitter, combiner etc.		

ID	Name	Class	Severity	Unit
125	APD linearizer lost	0x0104	Error	APD
	Description	The APD has lost the linearizer circuit and is malfunctioning. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
126	APD linearizer failure	0x0104	Error	APD
	Description	The APD linearizer is failing. This may be due to BW too high, check that all signals are within what can be handled by the APD (15 MHz).		
	NOC Actions	Forward the problem to the engineers to check the signals that are fed to the APD.		
	Field Actions	Check that all signals to the RU that contains the APD has a total BW less than 15 MHz. If not, change BTS settings to make the signal fit within the 15 MHz window. If that is not the problem then it is likely to be a hardware fault.		

ID	Name	Class	Severity	Unit
127	APD linearizer alarm	0x0104	Error	APD
	Description	The APD linearizer is failing. This may be due to BW too high, check that all signals are within what can be handled by the APD (15 MHz).		
	NOC Actions	Forward the problem to the engineers to check the signals that are fed to the APD.		
	Field Actions	Check that all signals to the RU that contains the APD has a total BW less than 15 MHz. If not, change BTS settings to make the signal fit within the 15 MHz window. If that is not the problem then it is likely to be a hardware fault.		

Multi-carrier Power Amplifier Interface (MPI) alarms

ID	Name	Class	Severity	Unit
1	AD Converter fault	0x0103	Error	MPI
	Description	The AD converter on the board has failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit, commission the replacement and arrange RMA for the failed unit.		

ID	Name	Class	Severity	Unit
2	EEPROM fault	0x0103	Error	MPI
	Description	Read or write operation to EEPROM failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit, commission the replacement and arrange RMA for the failed unit.		

ID	Name	Class	Severity	Unit
3	Calibration data	0x0103	Warning	MPI
	Description	The calibration database is corrupt. This is a software error.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit, commission the replacement and arrange RMA for the failed unit.		

ID	Name	Class	Severity	Unit
4	DAC fault	0x0103	Warning	MPI
	Description	The DAC has failed on the board. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
5	IO port	0x0103	Warning	MPI
	Description	The IO port has failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
6	5V Analog	0x0103	Warning	MPI
	Description	The 5 V analog voltage has failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
7	Table missing	0x0103	Warning	MPI
	Description	Configuration or calibration database error. This is a software error.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
11	Temperature alarm	0x0103	Error	MPI
	Description	The temperature in the unit is too high.		
	NOC Actions	Dispatch field tech to check environmental conditions.		
	Field Actions	Check ventilation and arrange for good air flow. If outdoor unit mount sun screen.		

ID	Name	Class	Severity	Unit
11	Temperature alarm	0x0103	Warning	MPI
	Description	The temperature in the unit is too high.		
	NOC Actions	Dispatch field tech to check environmental conditions.		
	Field Actions	Check ventilation and arrange for good air flow. If outdoor unit mount sun screen.		

ID	Name	Class	Severity	Unit
12	Temperature alarm low	0x0103	Warning	MPI
	Description	The unit is very cold.		
	NOC Actions	Generally this happens if it has been powered down in a cold location for a long time. Unit will warm up and come back to operation when it has heated itself for a while. Wait an hour and check temperature.		
	Field Actions	Generally this happens if it has been powered down in a cold location for a long time. Unit will warm up and come back to operation when it has heated itself for a while. Wait an hour and check temperature.		

ID	Name	Class	Severity	Unit
21	Board supply voltage high	0x0103	Error	MPI
	Description	The supplied voltage is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
22	Board supply voltage low	0x0103	Error	MPI
	Description	The supplied voltage is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
101	supply voltage high	0x0103	Error	MPI
	Description	PA supplied voltage is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
102	supply voltage low	0x0103	Warning	MPI
	Description	PA supplied voltage is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
103	Driver voltage low	0x0103	Error	MPI
	Description	PA driver voltage is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
104	Driver voltage high	0x0103	Error	MPI
	Description	PA driver voltage is out of bounds. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
105	VBIAS missing	0x0103	Error	MPI
	Description	The BIAS voltage is missing. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
111	Over Current	0x0103	Error	MPI
	Description	The PA has an over current alarm. This is generally a hardware fault but may also be caused by overdriving.		
	NOC Actions	Consult systems engineer if the system is overdriven or not. Otherwise the unit should be replaced by field tech.		
	Field Actions	See NOC actions.		

ID	Name	Class	Severity	Unit
112	Under Current	0x0103	Warning	MPI
	Description	The PA has an undercurrent alarm. This is generally a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
121	Return Loss	0x0103	Error	MPI
	Description	VSWR alarm. Generally this indicates a problem with the antenna network.		
	NOC Actions	Dispatch field tech to check the VSWR on the line from the remote unit.		
	Field Actions	See actions ad NOC.		

ID	Name	Class	Severity	Unit
122	High output power	0x0103	Error	MPI
	Description	The PA is being overdriven. This is a settings problem.		
	NOC Actions	Consult with systems engineer to have the system readjusted.		
	Field Actions	Re-commission the downlink on affected unit.		

ID	Name	Class	Severity	Unit
131	LPA lost	0x0103	Error	MPI
	Description	The MPI board is not able to talk to the MCPA. This is generally a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
132	LPA low gain	0x0103	Error	MPI
	Description	The gain in the MCPA is not what it is supposed to be. This is generally a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
133	Loop fail	0x0103	Error	MPI
	Description	This alarm indicates a failure of the LPA in to properly lock on to the input signals and linearize them. This could be due to configuration parameters that need to be changed. This alarm may appear from time to time when BTS signals are lost etc.		
	NOC Actions	If the alarm happens frequently on a unit or stays on for a long time, attempt to reset the unit and see if it clears. If it comes back notify a systems engineer.		
	Field Actions	Re-commission the downlink to check if the settings are right. Observe the reactions of the unit. If the LPA loop fail alarm reoccurs immediately or frequently consider replacing the unit.		

ID	Name	Class	Severity	Unit
134	LPA DC Fail	0x0103	Error	MPI
	Description	DC feed in MCPA has failed. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
135	LPA return loss	0x0103	Error	MPI
	Description	The gain in the MCPA is not what it is supposed to be. This is generally a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
136	LPA high output power	0x0103	Error	MPI
	Description	Output power is too high on the LPA. Settings problem.		
	NOC Actions	Consult a systems engineer. The gain may need to be readjusted in the downlink for this unit.		
	Field Actions	Readjust the gain in the downlink to bring the unit back to nominal power.		

ID	Name	Class	Severity	Unit
137	LPA link lost	0x0103	Error	MPI
	Description	Communication link lost. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
138	LPA link init error	0x0103	Error	MPI
	Description	Communication link lost. This is a hardware fault.		
	NOC Actions	Dispatch field tech to change the remote unit.		
	Field Actions	Replace remote unit.		

ID	Name	Class	Severity	Unit
139	LPA over current	0x0103	Error	MPI
	Description	This can happen if the LPA is overdriven or it could be a hardware fault.		
	NOC Actions	Consult systems engineer to have the unit readjusted regarding downlink gain. If that is not solving the problem, dispatch field tech to have it replaced.		
	Field Actions	Readjust systems gain in DL. If that does not solve the problem then replace remote unit.		

ID	Name	Class	Severity	Unit
140	LPA overpower	0x0103	Error	MPI
	Description	This can happen if the LPA is overdriven.		
	NOC Actions	Consult systems engineer to have the unit readjusted regarding downlink gain.		
	Field Actions	Readjust systems gain in DL. If that does not solve the problem then replace remote unit.		

ID	Name	Class	Severity	Unit
141	LPA over temp	0x0103	Error	MPI
	Description	The temperature in the unit is too high.		
	NOC Actions	Dispatch field tech to check environmental conditions.		
	Field Actions	Check ventilation and arrange for good air flow. If outdoor unit mount sun screen.		

System Model Numbers

Product Family		Sub-family	Number of Bands		Frequency	Duplexed	Frequency	Duplexed		Frequency	Duplexed	Frequency	Duplexed		Voltage	Connectors	WDM		Wavelength FOR 1	FOR 1 Band 1	FOR 1 Band 2		Wavelength FOR 2	FOR 2 Band 1	Wavelength FOR 3	FOR 3 Band 1		CWDM				Optical Split
D	D	R	4	-	G	0	C	0	-	G	0	C	0	-	A	D	W	-	B	1	2	-	C	3	H	3	-	W	U	B	C	S

Family:
DDU - 46 dBm Full Band
DDH - 43 dBm Full Band
DDS - 41 dBm Single Carrier
DDR - 33 dBm Full Band
DDL - 23 dBm Full Band
DDX - Mixed Power Levels

Number of Bands:
1
2
3
4

Frequency:
R - FM Radio
V - VHF (136-174)
T - Tetra (380-400)
M - Gov (406-420)
B - Tetra (410-415/420-425)
O - Tetra (415-420/425-430)
X - CDMA450 (453-457.5/463-467.5)
U - UHF (450-470)
Q - 500MHz T-Band (470-512)
L - Lower 700
H - Higher 700
G - 700 Full Band
F - PS 700 (793-805) FirstNet & NB
S - 800 SMR
J - DD 800
C - Cell 850
N - 900 PS
Y - GSMR
Z - EGSM900
D - DCS (1800)
P - PCS
I - UMTS (1900/2100)
A - AWS (1700/2100)
K - AWS & AWS3
E - IMT-E (2600)

Duplexed or DDX Pwr Lvl:
0 - Non-duplexed
1 - Duplexed
For DDX use:
For DDX Pwr Lvl 0 - 9:
0 - Non-duplexed (DDU)
1 - Duplexed (DDU)
2 - Non-duplexed (DDL)
3 - Duplexed (DDL)
4 - Non-Duplexed (DDH)
5 - Duplexed (DDH)
6 - Non-duplexed (DDS)
7 - Duplexed (DDS)
8 - Non-duplexed (DDR)
9 - Duplexed (DDR)

Voltage:
A - Universal AC (86-264 AC/DC)
D - 48 VDC

Connectors:
N - N-type Connectors
D - 7/16 DIN
M - Mini DIN

WDM:
W - Duplexed (UL and DL on the same fiber)

Wavelength of Uplink:
(FOR2 and FOR3 are optional to support multiple fiber links)
A - 1270
B - 1290
C - 1310 (default C if omitted)
D - 1330
E - 1350
F - 1370
G - 1390
H - 1410
I - 1430
J - 1450
K - 1470
L - 1490
M - 1510
N - 1530
O - 1550
P - 1570

FOR Bands:
(if omitted than all bands on one FOR)
Bands for that fiber link (in order as appear in model #) i.e. C123 would be standard FOI driving bands 1, 2, and 3
1
2
3
4

CWDM (option):
WUxxxx - combine multiple uplink fiber interfaces onto one fiber - each x denotes a wavelength (absence of xxxx implies all UL wavelengths)
WDxxxx - split to multiple downlink fiber interfaces from one fiber - each x denotes a wavelength (absence of xxxx implies all DL wavelengths)

Optical Split (option):
Sx - split the fiber at entry - to daisy chain other remotes - x is dB split (3dB equal split if absent)

Examples:

DDR4-GC0-PA1-AD — 4 band, 33dBm power output per band, Full band 700 combined with Cell 850 non duplexed, PCS combined with AWS duplexed, AC powered, 7/16 DIN, 1310nm uplink

DDR4-GC0-PA1-AD-B12-C34-WUBCS — 4 band, 33dBm power output per band, Full band 700 combined with Cell 850 non duplexed, PCS combined with AWS duplexed, AC powered, 7/16 DIN, Bands 1 and 2 (700 and 850) 1290nm uplink, Bands 2 and 3 (PCS & AWS) 1310nm uplink, CWDM, fiber split (3dB) for daisy chained remotes

Remote End Unit Part Numbers

Note: *The remote end units are completely integrated at the factory, there is no field assembly other than mounting and cable connection. Modules should not be altered once deployed.*

Public Safety DDR Module Numbers

Part Number	Frequency Band	IC Certification Number
MOD-DDR-V	VHF - 136-174MHz	110141A-DDR1V
MOD-DDR-U	UHF - 450-470MHz	110141A-DDR1U
MOD-DDR-Q	T-Band - 470-512MHz	110141A-DDR1Q
MOD-DDR-F	700Mhz PS	110141A-DDR1F
MOD-DDR-S	800MHz PS	110141A-DDR1S

Cellular DDR Module Numbers

Part Number	Frequency Band	IC Certification Number
MOD-DDR-G	700 cell full band	110141A-DDR700FB
MOD-DDR-C	850 cell band	110141A-DDR850
MOD-DDR-P	1900 PCS	110141A-DDR1900
MOD-DDR-A	2100AWS	110141A-DDR2100
MOD-DDR-E	2600	110141A-DDR2600