

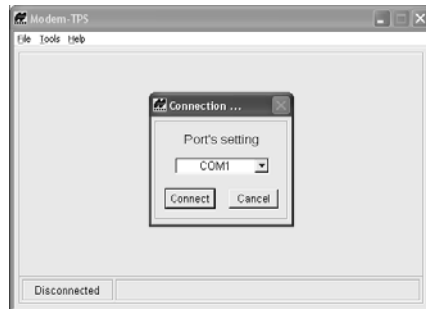
GR-3 MANUAL ADDENDUM FOR DIGITAL UHF RADIO

A. Configuring a Base Station's Digital UHF radio modem in PDL Mode

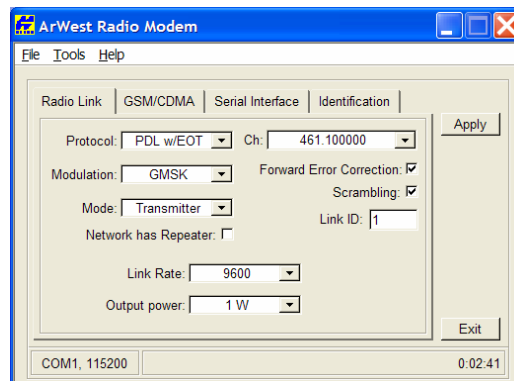
Note: To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

For the GR-3 Digital UHF, the integrated radio modem provides TX/RX UHF communications between a Base Station and Rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98 or later
 - Modem-TPS 2.1p0 or later
 - Serial cable or Bluetooth connectivity with PC
1. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.
 2. Turn on the receiver.
 3. Open Modem-TPS and select the COM Port the receiver is connected to.
 4. Click on **Connect**.



5. On the *Radio Link tab*, set the following parameters for the base station's radio modem in **PDL protocol**:

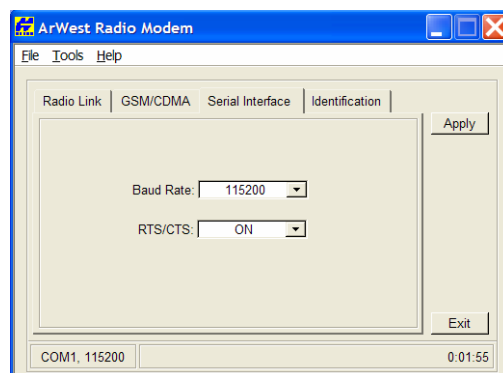


- **Protocol** – Select PDL w/EOT.
- **Modulation Type** – the modulation for PDL protocol is GMSK.
Link Rate – the default link rate for GMSK is 9600 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.
- **Mode** – The Radio Operation mode. The GR-3 Digital UHF can be set to Transmit and Receive in PDL Mode.
- **Scrambling** – Enable to provide more robust data communication over high interference areas
- **Forward Error Correction (FEC)** – enable to maximize data communication. With this parameter enabled, the rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream.

NOTE: FEC reduces data throughput by adding redundant check bits to the data stream. If using FEC with a differential messages format that produces a great deal of data, select a link rate of 19200 and a modulation type of 4-level FSK to ensure reliable radio communication between receivers.

- **Channel** – The current Transmit/Receive frequency channel in MHz
- **Output power** – Select the level of power for RF transmissions ranging from 10 mW to 1W.

6. After completing steps 1-5 in “Configuring a Base Station’s UHF Radio modem”, click on the *Serial Interface tab*.



7. On the *Serial Interface tab*, select a baud rate for the modem’s serial port. The same rate must be used for both the receiver and the transmitter. The recommended baud rate is **115200**.
8. On the *Serial Interface tab*, select the Ready to Send/Command to Send (RTS/CTS) to be **ON**.

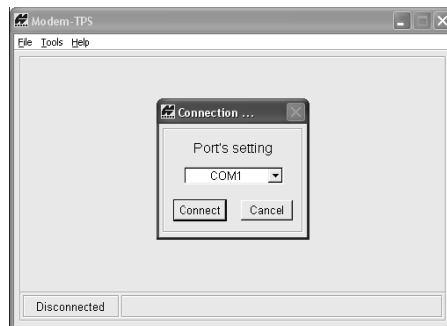
9. Click **Apply**, and then click on **File-Disconnect**. To close Modem-TPS, choose **File-Exit**.
10. Launch PCCDU and setup the receiver to run as an RTK Base station.

B. Configuring a Rover's Digital UHF radio modem in PDL Mode

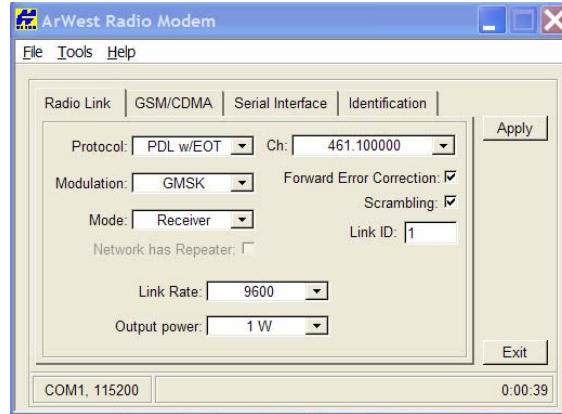
Note: To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

For the GR-3 Digital UHF, the integrated radio modem provides TX/RX UHF communications between a Base Station and Rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98 or later
 - Modem-TPS 2.1 or later
 - Serial cable or Bluetooth connectivity with PC
1. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.
 2. Turn on the receiver.
 3. Open Modem-TPS and select the COM Port the receiver is connected to.
 4. Click on **Connect**.



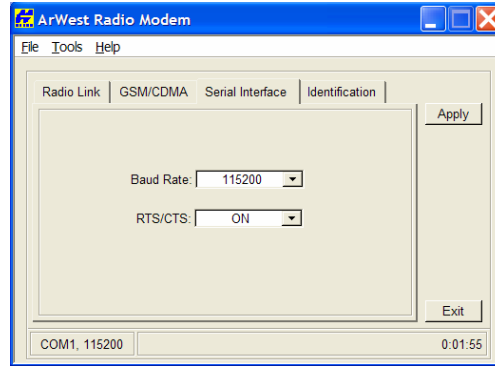
5. On the *Radio Link tab*, set the following parameters for the base station's radio modem in **PDL Mode**:



- **Protocol** – Select PDL w/EOT.
- **Modulation Type** – the modulation for PDL protocol is GMSK and is recommended for most applications.
- **Link Rate** – the default link rate for GMSK is 9600 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.
- **Mode** – The radio operation mode. To set the radio as a base modem, select Transmitter. The GR-3 Digital UHF can be set to Transmit, and Receive in PDL Mode.
- **Scrambling** – Enable to provide more robust data communication over high interference areas.
- **Forward Error Correction (FEC)** – enable to maximize data communication. With this parameter enabled, the rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream.

NOTE: FEC reduces data throughput by adding redundant check bits to the data stream. If using FEC with a differential messages format that produces a great deal of data, select a link rate of 19200 and a modulation type of 4-level FSK to ensure reliable radio communication between receivers.

- **Channel** – The current Transmit/Receive frequency channel in MHz
6. After completing steps 1-5 in “Configuring a Base Station’s UHF Radio modem”, click on the *Serial Interface* tab.



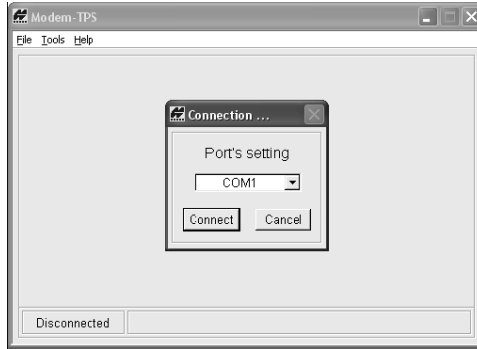
7. On the *Serial Interface* tab, select a baud rate for the modem's serial port. The same rate must be used for both the receiver and the transmitter. The recommended baud rate is **115200**.
8. On the *Serial Interface* tab, select the Ready to Send/Command to Send (RTS/CTS) to be **ON**.
9. Click **Apply**, and then click on **File-Disconnect**. To close Modem-TPS, choose **File-Exit**.
10. Launch PCCDU and setup the receiver to run as an RTK Rover.

C. Configuring a Base Station's Digital UHF radio modem in Simplex Mode

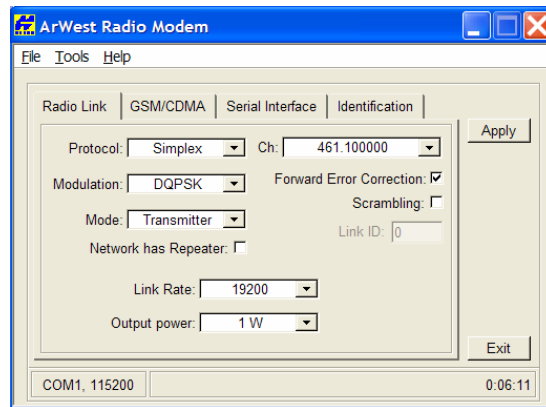
Note: To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

For the GR-3 Digital UHF, the integrated radio modem provides TX/RX UHF communications between a Base Station and Rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98 or later
 - Modem-TPS 2.1 or later
 - Serial cable or Bluetooth connectivity with PC
1. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.
 2. Turn on the receiver.
 3. Open Modem-TPS and select the COM Port the receiver is connected to.
 4. Click on **Connect**.



5. On the *Radio Link* tab, set the following parameters for the base station's radio modem in **Simplex Mode**:

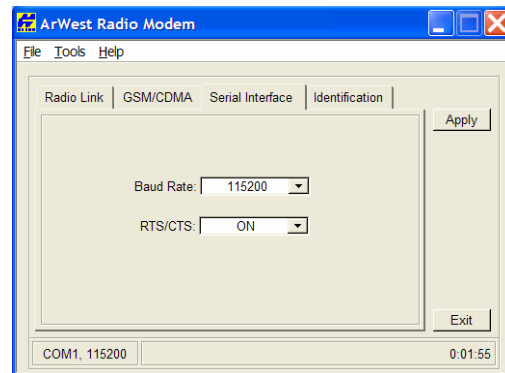


- **Protocol** – Select Simplex as the protocol. This is the default setting for the GR-3 Digital UHF.
- **Modulation Type** – the default modulation for Simplex protocol is DQPSK and is recommended for most applications.
- **Link Rate** – the default for DQPSK is 19200 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.

For this Link Rate	Use this Modulation Type
4800 baud	DBPSK
9600 baud	DBPSK or DQPSK
19200 baud (default; recommended)	DQPSK

- **Mode** – To set the radio as a base modem, select Transmitter. The GR-3 Digital UHF can be set in Simplex protocol as a Transmit, and Receive radio.
- **Scrambling** – For Simplex protocol, uncheck the Scrambling in Modem-TPS.

- **Forward Error Correction (FEC)** – Forward Error Correction should be checked for Simplex protocol.
 - **Channel** – The current Transmit/Receive frequency channel in MHz.
 - **Output power** – Select the level of power for RF transmissions from 10 mW to 1W.
6. After completing steps 1-5 in “Configuring a Base Station’s UHF Radio modem”, click on the *Serial Interface tab*.



7. On the *Serial Interface tab*, select a baud rate for the modem’s serial port. The same rate must be used for both the receiver and the transmitter and the recommended baud rate is **115200**.
8. On the *Serial Interface tab*, select the Ready to Send/Command to Send (RTS/CTS) to be **ON**.
9. Click **Apply**, and then click on **File-Disconnect**. To close Modem-TPS, choose **File-Exit**.
10. Launch PCCDU and setup the receiver to run as an RTK Base station

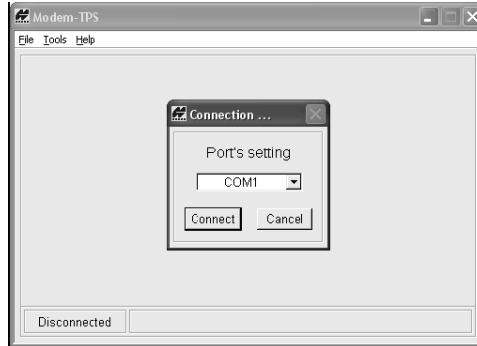
D. Configuring a Rover’s Digital UHF radio modem in Simplex Mode

Note: To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

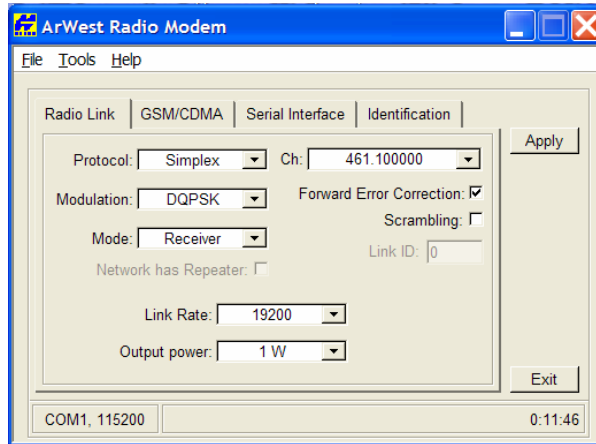
For the GR-3 Digital UHF, the integrated radio modem provides TX/RX UHF communications between a Base Station and Rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98 or later
- Modem-TPS 2.1 or later
- Serial cable or Bluetooth connectivity with PC

1. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.
2. Turn on the receiver.
3. Open Modem-TPS and select the COM Port the receiver is connected to.
4. Click on **Connect**.



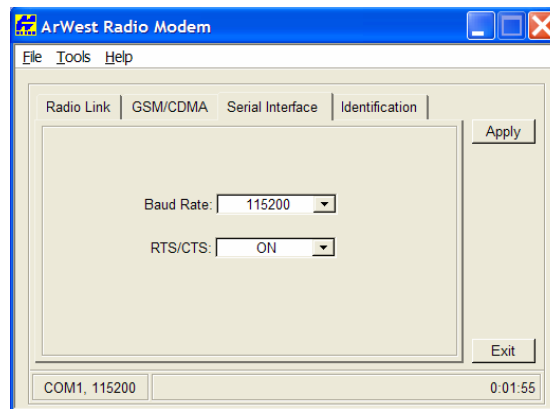
5. On the *Radio Link* tab, set the following parameters for the base station's radio modem in **Simplex Mode**:



- **Protocol** – Select Simplex. This is the default setting for the GR-3 Digital UHF.
- **Modulation Type** – the default modulation is DQPSK and is recommended for most applications.
- **Link Rate** – the default link rate for DQPSK is 19200 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.

For this Link Rate	Use this Modulation Type
4800 baud	DBPSK
9600 baud	DBPSK or DQPSK
19200 baud (default; recommended)	DQPSK

- **Mode** – To set the radio as a base modem, select Transmitter. The GR-3 Digital UHF in Simplex mode can be set as a Transmitter and Receiver.
 - **Scrambling** – For Simplex protocol, disable the scrambling in Modem-TPS.
Forward Error Correction (FEC) – For Simplex protocol, enable FEC in Modem-TPS.
 - **Channel** – The current Transmit/Receive frequency channel in MHz
6. After completing steps 1-5 in “Configuring a Base Station’s UHF Radio modem”, click on the *Serial Interface* tab.



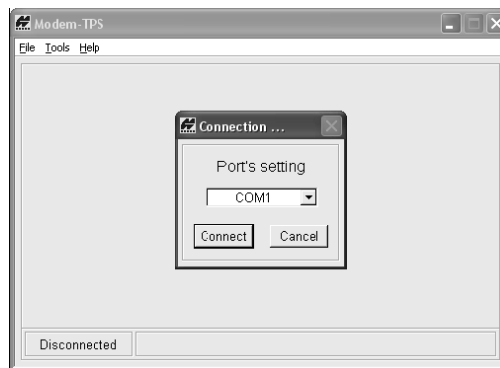
7. On the *Serial Interface* tab, select a baud rate for the modem’s serial port. The same rate must be used for both the receiver and the transmitter and the recommended baud rate is **115200**.
8. On the *Serial Interface* tab, select the Ready to Send/Command to Send (RTS/CTS) to be **ON**.
9. Click **Apply**, then click on **File-Disconnect**. To close Modem-TPS, choose **File-Exit**.
10. Launch PCCDU and setup the receiver to run as an RTK Rover.

E. Configuring a GSM Radio Modem

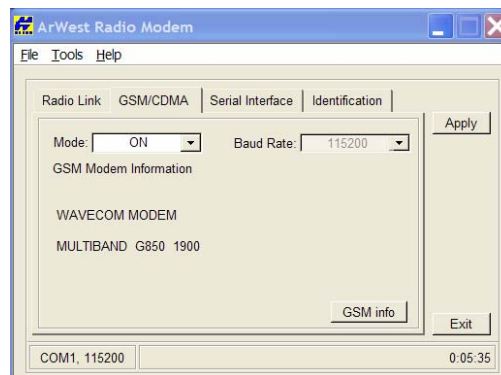
Note: To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

For the GR-3 Digital UHF, the integrated radio modem with a Wavecom GSM Module provides TX/RX GSM communications between a Base Station and Rover, or communications with a GPS network using IP based connections. To configure the GSM modems, have the following ready:

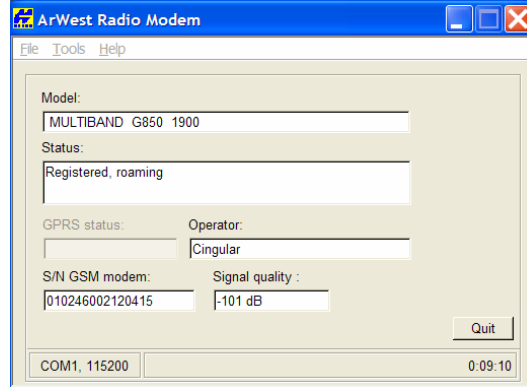
- PC running Windows 98 or later
 - Modem-TPS 2.1 or later
 - Serial cable or Bluetooth connectivity with PC
1. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.
 2. Turn on the receiver.
 3. Open Modem-TPS and select the COM Port the receiver is connected to.
 4. Click on **Connect**.



5. Once connected select the *GSM/CDMA* tab in Modem-TPS.
6. Select the Mode as **ON** and click **Apply** to enable the GSM Module.



7. The Wavecom GSM modem can either be in the US GSM band (GSM 850/1900 MHz as in the image above) or the European GSM band (900/1800 MHz). To view the GSM modem information, click on **GSM Info**. Click on **Quit** to return to the *GSM* tab.



- Signal quality is a reading of the strength of the GSM signal. The lower the number – the closer to zero 0 – the better the signal quality. The minimum signal cutoff is -111 dB.
- The Operator is the service provider on the SIM card inserted into the GR-3 Digital UHF
- The Model shows the model of the Wavecom module and the GSM band that it uses.
- The S/N GSM modem reports the electronic serial number of the Wavecom GSM module inside the GR-3 Digital UHF.
- The status shows whether the SIM card inserted into the GR-3 is registered on the service provider’s network. It will report one of three things.
 - Registered, home network
 - Registered, roaming
 - Not registered

Note: As long as the SIM card is registered, it will work even though it may be roaming.

8. On the *Serial Interface tab*, select a baud rate for the modem’s serial port. For the Wavecom GSM modem in the GR-3 digital UHF, this must be set to **115200**.
9. Click **Apply**, and then click **File-Disconnect**.
10. If needed, launch PC-CDU and setup the receiver to run as an RTK Base station.

F. Troubleshooting Guide

Receiver Problems

Problem	Solution
The RX/TX LED is flashing green on my	<ul style="list-style-type: none"> • The base has been set into Receiver

base receiver	<p>mode, not transmit mode. Change this using the data collector software or Modem-TPS.</p> <ul style="list-style-type: none"> The base is set into GSM mode. Change this using data collector software or Modem-TPS.
I have no radio link between base and rover and the Rx/TX LED is flashing green on the rover.	<ul style="list-style-type: none"> The LED indicates that the receiver is set into Receive mode; however no radio link has been established Check to make sure that the base receiver is powered on Check to make sure that the base and rover receivers are on the same channel. Check to make sure the rover is not set into GSM mode.
I have no radio link between base and rover and the rover RX/TX LED is solid green	<ul style="list-style-type: none"> The LED indicates that the rover has established radio link with the base receiver, however it is not receiving RTK Corrections. Check to make sure that the base is tracking enough satellites. Check to make sure that the base is transmitting via a radio scanner or by setting up the base receiver with PC-CDU or application software.
The RX/TX LED is flashing red on my receiver	<ul style="list-style-type: none"> A fault condition has been detected. Check the radio modem's antenna to see if it is undamaged. Check to see if the radio antenna is connected properly and securely

Internal Digital UHF Modem Specifications

General Specifications

Parameter	Specification
Operating Frequency Range country/region/purpose dependent	410-470 MHz
Modulation Techniques	GMSK, 4-level FSK, DBPSK, DQPSK, D8PSK, and 16QAM
Channel Spacing	12.5 kHz/25 kHz
Transmission Rates at 25 kHz spacing	<ul style="list-style-type: none"> DBPSK/GMSK – 9600 bps DQPSK/4FSK – 19200 bps D8PSK – 28800 bps

Transmission Rates at 12.5 kHz spacing	<ul style="list-style-type: none"> • D16QAM – 38400 bps • DBPSK/GMSK – 4800 bps • DQPSK/4FSK – 9600 bps • D8PSK – 14400 bps • D16QAM – 19200 bps
Data Speed of Serial Interface	Max 115200 bps
Forward Error Correction	Available
Scrambling	Available
Communication Mode	Half-Duplex

Digital UHF Transmitter Specifications

Parameter	Specification
Output Power	0.01 W (+10dBm), 0.02 W (+13 dBm), 0.05 W (+17 dBm), 0.1 W (+20 dBm), 0.25W (+24 dBm), 0.5 W (+27 dBm), 1W (+30 dBm)
Nominal Output Impedance	50 Ohms 2.0:1 VSWR
Output Power Control Accuracy	+ 1dB (at normal test condition) +2.0 dB and -3.0 dB (under extreme test condition)

Digital UHF Receiver Specifications

Parameter	Specification
Receiver Sensitivity for DBPSK (@ BER $<1 \times 10^{-4}$, over temperature -30°C to +60°C)	-115 dBm for 25 kHz Channel Spacing -116 dBm for 12.5 kHz Channel Spacing
Adjacent Channel Selectivity	-70 dB for 25 kHz Channel Spacing -60 dB for 12.5 kHz Channel Spacing
Nominal Output Impedance	50 Ohms 2.0:1 VSWR
Output Power Control Accuracy	+ 1dB (at normal test condition) +2.0 dB and -3.0 dB (under extreme test condition)