

## BASIC SPECIFICATIONS

Operating Frequency Bands (xmit/rec or rec/xmit; 1 MHz resolution):

	<u>Model 2200/2201</u>	<u>Model 2240/2241</u>
Band 1:	1.8–2.5 GHz;	1.8–2.5 GHz;
Band 2:	5.8–6.6 GHz;	3.5–5.0 GHz & 5.8–6.6 GHz;
Band 3:	11.0–12.0 GHz;	7.5–10.0 GHz & 11.0–12.0 GHz;
Band 4:	18.1–19.4 GHz.	18.1–19.4 GHz & 22.0–23.5 GHz.

Transmitter Output Power: 0 dBm, nominal.

Receiver Sensitivity: -100 dBm, nom./1.8–2.5 GHz;  
-95 dBm nom./5.8–12 GHz;  
-90 dBm nom./18.1–23.5 GHz.

Receiver Overload point: -30 dBm (signals <30 dB path loss will read 30 dB on meter).

Operating Temperature: -10°C to 40°C (14°F to 104°F).

Battery: 12 V, 2.3 Ah, rechargeable sealed Lead-Acid camcorder battery.

Operation Time (approx.): 4 to 5 hours continuous. Low Battery indicator, within LCD display, ON when approx. 15 min. operating time remains.

Charge Time (approx.): 3 hours.

### Record-R™ (model 2201/2241 only)

Data Recorded: Path Loss, Frequency, Model No., Serial No., and (if GPS Locked): Latitude, Longitude and UTC Date & Time.

Data Record Time: Approx. 20 milliseconds.

Max. No. of Records: 250 (stored in instrument's memory).

### GPS:

Frequency: L1 (1575.42 MHz), C/A code (SPS), 8-channel cont. tracking, 32 correlators.

Position Accuracy: ±2 meters.

Timing Accuracy: ±95 nano-seconds.

Position Fix Update: 1 second.

Time to Lock: Cold Start: <130 seconds (90%);  
Warm Start: <45 seconds (90%);  
Hot Start: <20 seconds (90%).

Reacquisition Time: <2 seconds (90%) after loss of signal.

### Warning

To insure the integrity of the backpack to instrument connection, a stainless steel safety wire and quick-link connection have been provided between the Path Align-R™ and the backpack's 'D' ring. This safety wire connection is designed to prevent the possibility of the instrument separating from the backpack and possibly falling, injuring the instrument or tower/ground personnel. The safety wire is looped thru the instrument's right-hand front panel handle and the quick-link connects the other end of the wire to the backpack's 'D' ring. **This safety wire connection should never be removed or defeated when the unit is being used in the field.**

Further, whenever the Path Align-R™ is taken up a tower, the unit should always be attached to the tower's superstructure. The recommended attachment method is with a carabiner through the backpack's 'D' ring and a nylon runner looped around the superstructure, with the free end attached to the carabiner.

## Path Align-R™

models 2200/2201/2240/2241 Microwave Antenna Path Alignment Test Sets

### User Information Card

The following information is provided to aid the user in the operation of the Path Align-R™ Test Set. For more in-depth information, as well as service and repair information, consult the Operation Manual included with each instrument.

**NOTE: This instrument is not waterproof. To minimize weather related problems, keep instrument within its Weather-resistant Back-pack.**

**Pre-Climb Check List and Set-up.** This check list is in addition to any safety issues regarding personnel and equipment that may be relevant. Safety issues regarding personnel and equipment are beyond the scope of this User Card.

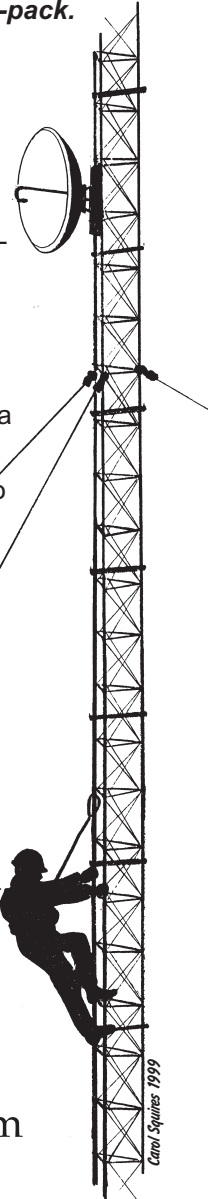
1. Review the Engineering Profile to determine the expected RSL (received signal level, or path loss) for the link under test (this should include the free space path loss and the gain of the antennas). *Note:* The loss exhibited by the installed cable or waveguide transmission lines should be included in this figure if you are connecting the Path Align-R™ through these lines. When connecting the Path Align-R™ directly to the back of the antenna with a short coax cable the insertion loss is minimal.

2. Both tower technicians should go over their check lists, prior to climbing the tower, to assure that, included with the Path Align-R™, they have:

- **A charged battery installed!** (possibly a spare if you are planning to be up for over 4–5 hours);
- The proper waveguide-to-coax adapter for the antenna;
- A coax cable (SMA to appropriate coax connector on the waveguide adapter);
- The supplied headset; and,
- A carabiner and a nylon runner of appropriate length to attach the bag strap to the tower.

3. Set one Path Align-R™ unit to 'Master' and the other Path Align-R™ unit to 'Slave' (it doesn't matter which is which, as long as they're different).

4. Using the front panel thumbwheel switches, select the proper link frequency (*Note:* both units must be set to the same frequency, e.g. 6.200 GHz).



Pendulum Instruments, Inc  
(incorporating XL Microwave)

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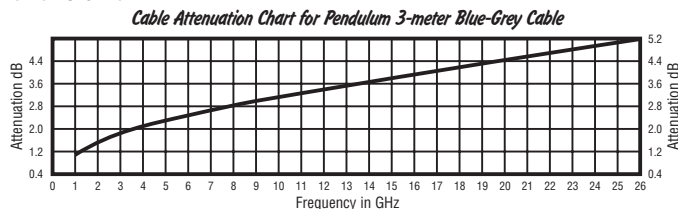
Incorporating XL Microwave

## Alignment Procedure

1. After reaching the antenna, check that the antenna polarization is properly setup (polarization should be the same for both transmitting and receiving antennas).
2. Locate each *Align-R™* unit near the back of the antenna.
3. Attach the coax-to-waveguide adapter at the back of the antenna's waveguide flange.
4. Connect the coax cable from the appropriate output connector on the *Path Align-R™* to the adapter.
5. Connect the headset to the *Path Align-R™*.
6. Turn the Power Switch ON. An LED will indicate which output connector is active (make sure the cable is connected to that connector) and begin talking. Typically, the antennas can be off alignment by as much as several beamwidths and the voice channel will still operate.
7. While one technician simply observes the reading of the path loss meter at his/her site, the other site commences Azimuth (horizontal) adjustment. As the voice channel is full duplex (FM), each technician can communicate with the other during the alignment process. Check for both side lobes as well as the main lobe response to ensure that the antenna is being aligned to the main lobe and not one of the side lobes. The *Path Align-R™* test sets have enough sensitivity (to -100 dB) and update speed (300 ms) to quickly check for side lobe and main lobe response.
8. To use the '**Alignment Tone**' function, the technician who will adjust his antenna first, sets his front panel 'AUDIO' switch to the 'Alignment Tone' position. He now adjusts his antenna's azimuth using the alignment tone as an indicator of the resultant path loss (the front panel meters of both units are always operational). When he gets the highest tone possible, he then uses the *Path Align-R™*'s meter reading to fine tune the adjustment. One-way voice communication from his unit to the second *Path Align-R™* is still operational, but to carry on a two-way conversation he would need to switch to 'voice' position on his 'Audio' switch. The second technician sets his front panel 'AUDIO' switch to the 'Voice' position. This provides the ability to hear the first technician's voice while he waits his turn to align.
9. Once Azimuth has been optimized, the Elevation adjustment is performed.
10. When steps 7 & 8 have been completed at the first site, the technicians switch roles and steps 7 & 8 are repeated by the other technician at the second site.
11. Once step 9 is completed, for both Azimuth and Elevation, the link is aligned. As a record, note the final path loss value displayed on the meter.

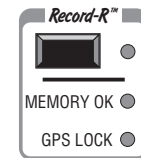
**Frequencies outside the *Path Align-R™*'s Band range.** An antenna system whose link frequency is designed outside the frequency band edge of the *Path Align-R™* (e.g. 6.800 GHz) can still have its path alignment correctly adjusted, as long as the antenna system (antenna, waveguide, etc.) can operate at both the link frequency (6.800 GHz) and a nearby frequency covered by the *Path Align-R™* (e.g. 6.600 GHz). This applies equally to all four bands of the *Path Align-R™*.

Here is a chart showing Cable attenuation verses frequency for the coax cables supplied with this unit.



## *Record-R™* Data Logging Information (*models 2201 & 2241 only*)

The *Record-R™* allows the results of antenna alignment, done with the *Path Align-R™*, to be logged into internal memory. The *Record-R™* also contains an embedded GPS receiver, which provides accurate UTC date/time and position information to be added to the above data. This logged data is saved in non-volatile memory (it is not affected by turning the instrument off) for later transfer (download) to a PC computer. Up to 250 separate data records can be saved in the field.



When the [*Record-R™*] pushbutton is pressed, an individual data record is created and stored in the instrument's memory, provided the MEMORY OK LED is continuously illuminated. The memory used for this storage is non-volatile; it is not affected by turning the instrument off. The *Record-R™* LED illuminates for 1–2 seconds when a data record is being recorded. When logging a data record, the data recorded will be identical to the data displayed on the instrument the moment the *Record-R™* pushbutton is pressed.

**Recording data without GPS Lock.** If the GPS LOCK is flashing (no lock), position is not known and cannot be recorded. If the [*Record-R™*] button is pressed *and held for three seconds*, until the *Record-R™* LED illuminates, a data record *will* be recorded along with frequency, path loss, date and time. The data recorded is the information displayed at the instant the *Record-R™* LED illuminates.

**'MEMORY OK'** LED illuminates to indicate that there is room in the instrument's memory to store additional records. If this LED is not illuminated, internal memory is full and records must be downloaded, via the instrument's USB or RS-232 ports, a PC and the *Log View-R™* software utility, before further data records can be recorded.

**'GPS LOCK'** LED has two 'ON' states. (1) The LED illuminates *continuously* when the internal GPS receiver is locked to three or more satellites, giving a two-dimensional solution: latitude and longitude with UTC date/time (this could take 2–3 minutes from a 'cold' start) and indicates that UTC date/time and position will be added to the recorded data. (2) The LED *flashes briefly once every 4 seconds* when the GPS receiver is attempting to acquire satellites, indicating that there are not enough satellites locked onto to provide a fix. Data may be recorded without GPS lock but will lack position information. If this LED is not illuminated in one of the previously described ways it indicates a failure of the GPS receiver.

**Note 1:** The GPS antenna, the small plastic block located on the front panel of the instrument, should face up to the sky for best signal acquisition and GPS lock.

**Note 2:** Date and Time recorded are UTC values. The date and time values displayed in *Log View-R™* on your PC are the UTC recorded values converted to the local time zone setting in your computer, through the Windows operating system settings. Coordinated Universal Time (UTC) is the international time standard. It is the current term for what was commonly referred to as Greenwich Meridian Time (GMT). Zero (0) hours UTC is midnight in Greenwich England, which lies on the zero longitudinal meridian. Universal time is based on a 24 hour clock, therefore, afternoon hours such as 4 pm UTC are expressed as 16:00 UTC (sixteen hours, zero minutes).

The latest version of the *Log View-R™* software utility is available for free download from our website at: [www.pendulum-instruments.com](http://www.pendulum-instruments.com)