TRACER 2210/3202
System Manual

1280012L1 TRACER 2210/3202 System

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About this Manual

This manual provides a complete description of the TRACER 2210/3202 system and system software. The purpose of this manual is to provide the technician, system administrator, and manager with general and specific information related to the planning, installation, operation, and maintenance of the TRACER 2210/3202. This manual is arranged so that needed information can be quickly and easily found. The following is an overview of the contents.

Section 1 **System Description**

Provides managers with an overview of the TRACER 2210/3202 system.

Section 2 **Microwave Path Engineering Basics**

Explains the basics of analyzing a wireless microwave link, or path. The significant parameters are defined, and several recommendations are offered.

Section 3 **Engineering Guidelines**

Provides information to assist network designers with incorporating the TRACER 2210/3202 system into their networks.

Section 4 **Network Turnup Procedure**

Provides step-by-step instructions on how to install the TRACER 2210/3202 unit, determine the parameters for the system, install the network and option modules, and power up the system.

Section 5 **User Interface Guide**

Explains the terminal interface and provides a description for each of the menus available for the TRACER 2210/3202 system.

Section 6 **Trouble Shooting Guide**

Provides helpful information for troubleshooting common configuration problems for the TRACER 2210/3202 system.

Section 7 **Menu Trees**

Provides a detailed listing of all available menus for the TRACER 2210/3202 system.

Revision History

This is the 2nd revision of this manual. It includes Channel Plan selection updates to the menu tree and the User Interface Guide.

NOTE *Notes provide additional useful information.*

CAUTION *Cautions signify information that could prevent service interruption.*

WARNING *Warnings provide information that could prevent damage to the equipment or endangerment to human life.*

Safety Instructions

When using your telephone equipment, please follow these basic safety precautions to reduce the risk of fire, electrical shock, or personal injury:

1. Do not use this product near water, such as a bathtub, wash bowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.
2. Avoid using a telephone (other than a cordless-type) during an electrical storm. There is a remote risk of shock from lightning.
3. Do not use the telephone to report a gas leak in the vicinity of the leak.
4. Use only the power cord, power supply, and/or batteries indicated in the manual. Do not dispose of batteries in a fire. They may explode. Check with local codes for special disposal instructions.

Save These Important Safety Instructions

Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio frequencies. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTE *Shielded cables must be used with this unit to ensure compliance with Class A FCC limits.*

WARNING *Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

CAUTION *Use suitably sized (22 or 24 AWG) copper conductors only.*

Warranty and Customer Service

ADTRAN will replace or repair this product within five years from the date of shipment if it does not meet its published specifications or fails while in service. For detailed warranty, repair, and return information refer to the ADTRAN Equipment Warranty and Repair and Return Policy Procedure.

Return Material Authorization (RMA) is required prior to returning equipment to ADTRAN.

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ADTRAN warrants that for five (5) years from the date of shipment to Customer, all products manufactured by ADTRAN will be free from defects in materials and workmanship. ADTRAN also warrants that products will conform to the applicable specifications and drawings for such products, as contained in the Product Manual or in ADTRAN's internal specifications and drawings for such products (which may or may not be reflected in the Product Manual). This warranty only applies if Customer gives ADTRAN written notice of defects during the warranty period. Upon such notice, ADTRAN will, at its option, either repair or replace the defective item. If ADTRAN is unable, in a reasonable time, to repair or replace any equipment to a condition as warranted, Customer is entitled to a full refund of the purchase price upon return of the equipment to ADTRAN. This warranty applies only to the original purchaser and is not transferable without ADTRAN's express written permission. This warranty becomes null and void if Customer modifies or alters the equipment in any way, other than as specifically authorized by ADTRAN.

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ADTRAN will replace or repair this product within five years from the date of shipment if the product does not meet its published specification, or if it fails while in service.

A return material authorization (RMA) is required prior to returning equipment to ADTRAN. For service, RMA requests, training, or more information, see the toll-free contact numbers given below.

Presales Inquiries and Applications Support

Please contact your local distributor, ADTRAN Applications Engineering, or ADTRAN Sales:

Applications Engineering	(800) 615-1176
Sales	(800) 827-0807

Post-Sale Support

Please contact your local distributor first. If your local distributor cannot help, please contact ADTRAN Technical Support and have the unit serial number available.

Technical Support	(888) 4ADTRAN

The Custom Extended Services (ACES) program offers multiple types and levels of service plans which allow you to choose the kind of assistance you need. For questions, call the ACES Help Desk.

ACES Help Desk	(888) 874-2237

Repair and Return

If ADTRAN Technical Support determines that a repair is needed, Technical Support will coordinate with the Custom and Product Service (CAPS) department to issue an RMA number. For information regarding equipment currently in house or possible fees associated with repair, contact CAPS directly at the following number:

CAPS Department	(256) 963-8722

Identify the RMA number clearly on the package (below address), and return to the following address:

ADTRAN Customer and Product Service
901 Explorer Blvd.
Huntsville, Alabama 35806

RMA # _____________

Training

The Enterprise Network (EN) Technical Training offers training on our most popular products. These courses include overviews on product features and functions while covering applications of ADTRAN's product lines. ADTRAN provides a variety of training options, including customized training and courses taught at our facilities or at your site. For more information about training, please contact your Territory Manager or the Enterprise Training Coordinator.

Training Phone	(800) 615-1176, ext. 7500
Training Fax	(256) 963-6700
Training Email	training@adtran.com

Radio Frequency Interface Statement

This equipment has been tested and found to comply with the limits for an intentional radiator, pursuant to Part 15, Subpart C of the FCC Rules. This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause interference to radio communications.

The limits are designed to provide reasonable protection against such interference in a residential situation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna of the affected radio or television.
- Increase the separation between the equipment and the affected receiver.
- Connect the equipment and the affected receiver to power outlets on separate circuits.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING Changes or modifications not expressly approved by ADTRAN could void the user's authority to operate the equipment.

FCC Output Power Restrictions

The FCC does not require licensing to implement this device. However, the FCC has established restrictions regarding maximum output power and the adjustments required when employing directional gain antennas. (Refer to “Setting the Transmitter Power” in Section 2 of this manual). These restrictions are detailed in FCC Part 15.247 (b)(1), (b)(3)(i), and (3)(iii). It is the responsibility of the individuals designing and implementing the radio system to assure compliance with these and any other pertinent FCC Rules and Regulations. **This device must be professionally installed**.

Exposure to Radio Frequency Fields

The TRACER 2210/3202 is designed to operate at 5.8 GHz with 100 mW maximum transmit power.

This level of RF energy is below the Maximum Permissible Exposure (MPE) levels specified in FCC OET 65:97-01. The installation of high gain antenna equipment in the system configuration may create the opportunity for exposure to levels higher than recommended for the general population at a distance less than 16.5 feet (5 meters) from the center of the antenna. **The following precautions must be taken during installation of this equipment**:

- The installed antenna must not be located in a manner that allows exposure of the general population to the direct beam path of the antenna at a distance less than 15 feet (4.6 meters). Installation on towers, masts, or rooftops not accessible to the general population is recommended; or
- Mount the antenna in a manner that prevents any personnel from entering the area within 15 feet (4.6 meter) from the front of the antenna.
- It is recommended that the installer place radio frequency hazard warnings signs on the barrier that prevents access to the antenna.
- Prior to installing the antenna to the RIU output, make sure the power is adjusted to the settings specified in section 2 of this manual.
- During antenna installation, be sure that power to the TRACER equipment is turned off in order to prevent any energy presence on the coaxial connector.
- During installation and alignment of the antenna, do not stand in front of the antenna assembly.
- During installation and alignment of the antenna, do not handle or touch the front of the antenna.

These simple precautions must be taken to prevent general population and installation personnel from exposure to RF energy in excess of specified MPE levels.

SYSTEM DESCRIPTION

This section of ADTRAN's TRACER 2210/3202 System Manual is designed for use by network engineers, planners, and designers for overview information about the TRACER 2210/3202.

It contains general information and describes physical and operational concepts, network relationships, provisioning, testing, alarm status, and system monitoring. This section should be used in conjunction with Section 3, *Engineering Guidelines*, of the system manual.

CONTENTS

1. SYSTEM OVERVIEW

The ADTRAN TRACER® 2210/3202 wireless data system provides low-cost point-to-point connectivity between the end user's Data Terminal Equipment (DTE) for applications such as LAN to LAN bridging and Videoconferencing. TRACER 2210/3202 is capable of achieving distances up to 30 miles. As authorized under Part 15.247 of the FCC Rules, the TRACER 2210/3202 operates license-free in the 5.725 to 5.850 GHz industrial, scientific and medical (ISM) band.

The TRACER 2210/3202 system is composed of two primary hardware elements: The 2210 Data Interface Unit (DIU) and The 3202 Radio Interface Unit (RIU). The 2210 DIU is contained in a compact plastic housing and supports synchronous data rates from 56 kbps to 1.536 Mbps in 56 or 64 kbps increments. A single V.35 physical interface provides a connection to the end user's DTE equipment. The weatherproof RIU may be mast mounted up to 700 ft. from the DIU using 22 AWG twisted pair wires. All signaling and power functions between the DIU and RIU are provided over this simple four-wire connection. The TRACER 2210/3202 design locates the radio at the antenna to maximize signal efficiency, while eliminating the requirement of expensive coax to link the DIU and RIU.

For configuration and testing, the TRACER 2210/3202 provides the capability to control the remote TRACER 2210/3202 through a separate maintenance channel. The TRACER 2210/3202 has several built-in test capabilities including remote loopback and 511 BERT test patterns. Complete configuration and performance data is available from the front panel keypad and from the two-line by 16-character LCD display on the 2210 data interface. For additional configuration and monitoring options, the TRACER 2210/3202 supports a VT-100 terminal configuration and control mode, which is available through the control port.

2. FEATURES AND BENEFITS

The following is a brief list of TRACER 2210/3202 features and benefits:

Configuration and Management

- Easy to use front-panel keypad for configuration and monitoring
- Remote configuration

Data Interface Unit

- Tabletop or wall-mounted housing
- Single V.35 DTE interface
- Nx56 or Nx64 operation for data rates to 1.536 Mbps
- Local and remote loopback capability

Radio Interface Unit

- Digital microwave radio
- No license required per FCC Rules Part 15.247
- Direct-sequence spread spectrum
- Frequency: 5.725 to 5.850 GHz
- Point-to-point, up to 30 miles

- Mast mounted RIU for maximum signal efficiency
- 700 feet of 22 AWG or 600 feet of 24 AWG wire between DIU and RIU

MICROWAVE PATH ENGINEERING BASICS

CONTENTS

FIGURES

1. LINE-OF-SITE

The TRACER 2210/3202 system is designed for operation in the 5725 MHz to 5850 MHz unlicensed Industrial, Scientific, and Medical (ISM) frequency band, which is near the middle of what is traditionally referred to as the C-band portion of X-band. Radio wave propagation in this band exhibits microwave characteristics, which are ideally suited for point-to-point, line-of-sight communications. Line-of-sight essentially requires that the transmitting antenna and receiving antenna are able to "see" each other, and that the straight-line path between the two antennas is free of any obstructions, such as buildings, trees, mountains, and, in longer paths, even the curvature of the earth.

Point-to-Point	Wireless communication from a single site to another individual site. Contrast with point-to-multipoint
Line-of-Sight	An unobstructed, direct path exists between the transmitting and the receiving antennas.

2. DECIBELS

The received signal power equation is often expressed in a decibel (dB) format, which turns the power multiplication and division operations into addition and subtraction operations. In general, any quantity can be expressed in decibels. If the quantity (x) is a power level, the decibel equivalent is defined as

$$x_{dB} = 10 \cdot log_{10}(x) \qquad \text{(dB)}$$

If the quantity x is referenced to a milliwatt (mW), then the decibel-milliwatt (dBm) is used instead of a generic decibel.

$$x_{dBm} = 10 \cdot log_{10}\left(\frac{x}{1mW}\right) \qquad \text{(dBm)}$$

3. RECEIVER POWER

The radio frequency (RF) signal power that is available at the input to the receiving TRACER 2210/3202 system is the next parameter of interest in analyzing a wireless path. Per FCC 15.247 rules, the TRACER 3202 RIU is allowed to output a maximum power level of 100 mW, which is equivalent to 20 dBm. This output signal will be attenuated and distorted by various factors, all of which will degrade the original signal and affect the signal strength and quality as sensed by the receiving unit. A simplified power budget analysis is beneficial to perform after verifying a suitable line-of-sight path to determine if the microwave path is suitable, even for ideal, non-distorted signals.

The equation relating received signal power to the other microwave parameters is

$$P_R = \frac{P_T G_T G_R \lambda^2}{(4\pi)^2 d^2 L} \quad \text{(watts, W)}$$

where the variables in the equation are defined as

P_R	received power (Watts)
P_T	transmitted power (100 mW for TRACER 2210/3202)
G_T	transmit antenna gain
G_R	receive antenna gain
λ	carrier wavelength (c / f) (meters)
d	path distance (meters)
L	other losses (RF coaxial cable, etc.)

As previously mentioned, the transmitted power is limited for the 5.8 GHz ISM band to a maximum of 20 dBm. The actual transmit and receive antenna gain values are strictly dependent upon the physical characteristics of the antennas installed for each link. Typical gains are between 20 and 40 dB. For example, a 4-foot diameter parabolic dish has 34.2 dB of gain at 5.8 GHz. The carrier wavelength is the physical wavelength of the main RF carrier being used for communication, and is usually approximated at the center frequency of the band, which is 5787.5 MHz. This gives a wavelength of 5.18 cm.

The path distance is simply the physical distance between the transmit and receive antennas. For the TRACER 2210/3202 these distances can range up to 30 miles. The final parameter L incorporates all other signal power losses in the microwave link, most of which are caused by antenna feed, or coaxial cables used to connect the TRACER 3202 N-type connector to the antenna connector. Since the TRACER 3202 is a mast-mounted device, the antenna feed losses are minimized by requiring only short runs of coaxial cable.

4. PATH LOSS

The expression

$$L_P = \left(\frac{4\pi d}{\lambda}\right)^2 = \left(\frac{4\pi df}{c}\right)^2 \qquad \text{(decibels, dB)}$$

where

f carrier frequency (Hz)
λ carrier wavelength (c / f) (meters)
d path distance (meters)
c speed of light, free-space (meters)

is called the path loss, and increases rapidly as either path length increases or carrier wavelength decreases (which happens as the carrier frequency increases). So, longer microwave paths will naturally experience more path loss than shorter paths. Likewise, higher frequency microwave communication will experience more path loss than lower frequency microwave communication.

Table 1 tabulates path loss values for various path lengths for the TRACER 2210/3202 system. Values not listed in the table can be interpolated from those listed.

Table 1. Path Loss for Given Path Lengths

Path Length (miles)	Path Loss (dB)
1	112
2	118
3	121
4	124
5	126
10	132
15	135
20	138
25	140
30	141
35	143

When using decibel notation, the received power equation becomes

$$P_R = P_T + G_T + G_R - L - 20 \cdot log_{10}\left(\frac{4\pi df}{c}\right) \quad \text{(dBm)}$$

or

$$P_R = P_T + G_T + G_R - L - L_P \quad \text{(dBm)}$$

Where, in the second equation the path loss has been lumped into a single quantity, L_P, as discussed previously. When using decibel notation, it is necessary that all quantities are individually converted to decibels prior to performing addition and subtraction.

When d is expressed in miles and f in GHz, the path loss expression in decibels becomes

$$L_P = 96.6 + 20 \cdot log_{10}(d) + 20 \cdot log_{10}(f) \quad \text{(dB)}$$

Figure 1 illustrates a wireless link containing all of the parameters previously discussed.

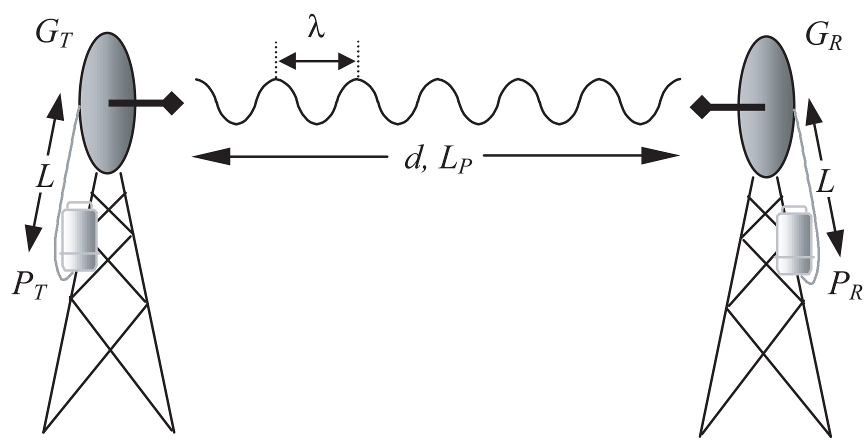

Figure 1. Example Microwave Path with Parameters

5. ANTENNA ALIGNMENT

With line-of-sight microwave communications, optimum system performance requires that the transmitting and receiving antennas are properly aligned. This will ensure maximum received signal power at each receiver. Antenna alignment must be achieved in both azimuth (along a horizontal plane) and elevation (along a vertical plane). A received signal strength indicator (RSSI) is used to aid the equipment installer in determining when alignment is maximized, by simply ensuring maximum RSSI. The RSSI indicator for the TRACER 2210/3202 system is provided on the LCD display of the 2210 unit, and is presented as a series of asterisks. More asterisks means more RSSI, which ensures more received signal strength and better link performance.

Using the 2210 keypad, look at the menu option

STATUS ⇒ RADIO STATUS ⇒ RSSI

RSSI [■■■■]

to examine the RSSI value of the local TRACER 2210/3202 system.

If the remote system has acquired a useful signal from the local system, then the remote TRACER 2210/3202 RSSI can also be viewed from the local 2210 unit menu, via the keypad menu sequence:

STATUS ⇒ FAR RADIO STATUS ⇒ RSSI

FAR RSSI [■■■■]

Antenna Beam Patterns

Directly related to the subject of antenna alignment is the topic of antenna beam patterns. Antennas being used with the TRACER 2210/3202 system will have a particular beam shape determined in part by the physical construction and geometry of the antenna. The antenna beam patterns are characterized by a dominant main lobe, which is the preferred lobe to use for point-to-point communications, and several side lobes, as shown in Figure 2. The antenna alignment step to setting up a microwave link is in fact steering the main lobes of both antennas until the main lobe of one transmitter is centered on the receiving element of the receiving antenna.

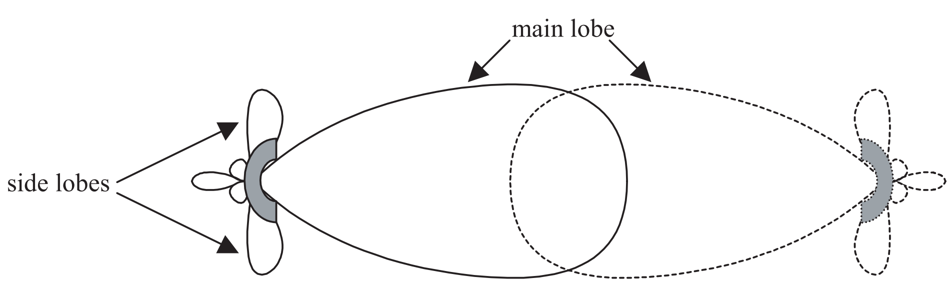

Figure 2. Typical Antenna Beam Pattern

Antennas are also designed to radiate RF energy efficiently for a specific range of frequencies. Please consult the data sheet for your particular antenna make and model to ensure that it is specified to operate in the 5725 MHz to 5850 MHz frequency band.

Fresnel Zones, Earth Curvature, & Antenna Heights

The Fresnel zones correspond to regions in the microwave path where reflections of the intended signal occur and combine in both constructive and destructive manners with the main signal, thereby either enhancing or reducing the net power at the receiver.

In general, the odd numbered Fresnel zones (1, 3, 5, ...) add constructively at the receiver, while the even numbered Fresnel zones (2, 4, 6, ...) add destructively at the receiver.

The first Fresnel zone corresponds to the main lobe, and must be at least 60% free of physical obstructions for the path calculations to be valid. Since the main lobe contains the vast majority of the microwave energy, this zone is typically used to determine proper antenna heights when placing antennas on towers or buildings.

The curvature of the Earth becomes a legitimate obstruction for path lengths of 7 miles or greater, and must also be accounted for when determining minimum antenna heights.

The aggregate expression for minimum antenna height that incorporates both the 60% first Fresnel zone and the Earth curvature is given by

$$h = 72.1\sqrt{\frac{d}{4f}} + 0.125d^2 \qquad \text{(feet)}$$

where f is in GHz and d is in miles.

Table 2 tabulates minimum antenna heights for given path lengths.

Table 2. Minimum Antenna Height for Given Path Lengths

Path Length (miles)	Min. Antenna Height (ft)
2	22
4	32
6	41
8	50
10	60
12	70
14	81
16	92
18	104
20	117
22	131
24	145
26	161
28	177
30	194
32	213
34	232
36	252

6. COAXIAL CABLE

Coaxial cable will be required to attach the TRACER 3202 mast unit to the antenna. The length of the cable will vary from a few feet to several feet, depending upon your application and the proximity of the TRACER 3202 to the antenna. Since the data/power cable attaching the TRACER 2210 indoor unit to the TRACER 3202 mast unit can operate at lengths of up to 700 feet, it is recommended that this cable absorb as much of the distance between the 2210 unit and the antenna as possible. This will also decrease coaxial cable losses in the overall power budget for the link, which was described previously.

Various grades of coaxial cable will work sufficiently well for connecting the TRACER 3202 unit to the antenna. A low-loss coaxial cable is suggested to minimize cable losses. One end of the cable will require an N-type male connector (plug) to mate with the TRACER 3202 unit. The other end of the coax will require a connector compatible with the antenna chosen for the installation, which is normally an N-type male connector (plug). Additionally, it is recommended that both connectors on the coaxial cable be weatherproofed from the elements to prevent corrosion and electrical shorting.

Table 3 gives typical loss figures for some of the more common coaxial cable types, per foot

Table 3. Typical Coaxial Loss for Common Cable Types, per Foot

Cable Type	Cable Loss (dB/ft)
RG-213, RG-214, RG-393	0.2
RG-142	0.3
RG-58, RG-223	0.4
RG-174, RG-316	0.7

In certain areas where lightning strikes are frequent, a lightning arrestor can be installed directly on the antenna. This will help protect the RF electronics in the downstream path from damaging voltages and currents, including the TRACER 3202 unit.

7. RECEIVER SENSITIVITY

Receiver sensitivity is a value expressed in decibels referenced to one milliwatt (dBm) that corresponds to the minimum amount of signal power needed at the receiver to achieve a given bit error rate (BER). Receiver sensitivity is usually a negative number of decibels, and as such smaller receiver sensitivity is better for a given BER. Several factors affect receiver sensitivity, including the data bandwidth of the wireless link, and the amount of additional signal degradation introduced in the receiver electronics. The receiver sensitivity of the TRACER 3202 is -86 dBm at 10^{-6} BER.

8. FADE MARGIN

Fade margin is a value indicating the amount of extra signal power available to the receiver to operate at a maximum bit error rate (BER). Higher levels of fade margin are better, and will protect the viability of the microwave link against signal fading. Fade margin is simply the difference between the available signal power at the receiver and the receiver sensitivity, discussed previously:

$$F = P_R - P_{sens} = P_R + G_T + G_R - L - L_P - P_{sens} \qquad \text{(dB)}$$

9. PATH AVAILABILITY

The path availability of a wireless link is a metric that expresses the fractional amount of time a link is available over some fixed amount of time, and depends on several factors. Path availability is expressed as

$$A = [1 - (2.5 \times 10^{-6}) abfd^3 (10^{-F/10})] \times 100\% \qquad \text{(dB)}$$

where the parameters are

a	terrain factor
b	climate factor
f	carrier frequency (GHz)
d	path length (miles)
F	fade margin (dB)

The terrain factor is a quantity that compensates the link availability for different types of terrain. Generally speaking, the more smooth an area's terrain is, the less availability a wireless link running over that terrain will have, primarily due to multipath reflections. In contrast, secondary microwave signals will be randomly dispersed over rough terrain, and will not interfere with the main signal lobe as badly as in the smooth terrain case. The terrain factor values normally used are listed below:

Terrain	Terrain Factor	Description
Smooth	4	water, flat desert
Average	1	moderate roughness
Mountainous	1/4	very rough, mountainous

The climate factor is a quantity that compensates the link availability for different types of climates (weather). In general, microwave links operating in areas with high humidity will have less availability than those in arid areas, primarily because water is a dispersive mechanism to microwave energy, and causes the main signal lobe to refract and disperse away from the receiver location. The climate factor values normally used are listed below.

Climate	Climate Factor	Description
Very Dry	1/8	desert regions
Temperate	1/4	mainland, interior region
Humid	1/2	humid and coastal regions

ENGINEERING GUIDELINES

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FIGURES

TABLES

1. EQUIPMENT DIMENSIONS

TRACER 2210 DIU

The TRACER 2210 unit is 9.0” W, 6.25” D, and 1.5” H, weighs 2 pounds, and can be used in tabletop or wall-mount configurations.

TRACER 3202 RIU

The TRACER 3202 RIU is a cylinder 6.0” D and 12.0” H, weighs 10 pounds, and is intended for mast mount configuration only.

2. POWER REQUIREMENTS

The TRACER 2210/3202 system has a maximum power consumption of 14W and a maximum current draw of 0.5A.

3. CABLE REQUIREMENTS

The cable used to connect the TRACER 2210 to the TRACER 3202 unit should be a 4 conductor, 22 or 24 AWG, UV-resistant cable, maximum length 700 ft or 600 ft, respectively.

4. REVIEWING THE FRONT PANEL DESIGN

The front panel contains the display LCD, the scroll selection buttons, the enter and cancel buttons and status LEDs. The LEDs provide visual information about the TRACER 2210/3202 system. Figure 1 identifies the LCD, the various buttons, and the LEDs.

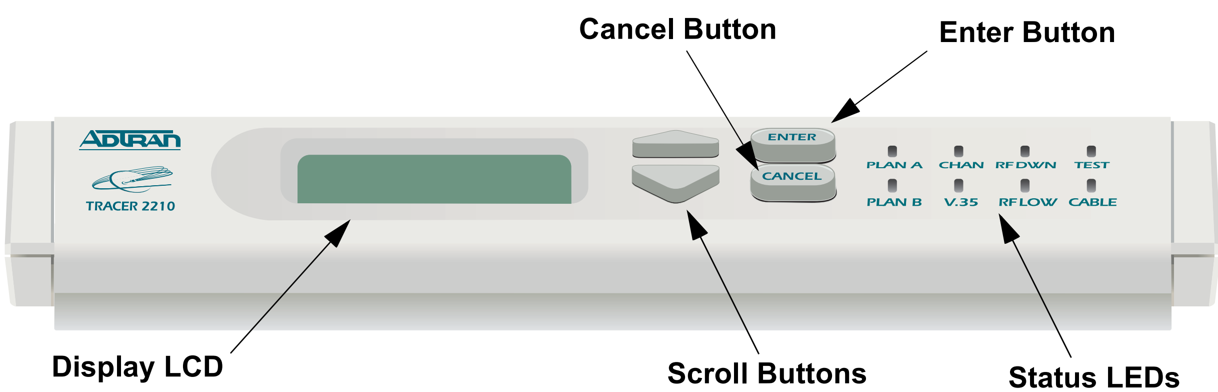

Figure 1. TRACER 2210/3202 Front Panel Layout

Front Panel LEDs

With the TRACER 2210/3202 powered-on, the front panel LEDs provide visual information about the status of the TRACER 2210/3202 system. Table 1 provides a brief description of the front panel features, and Table 2 on page 27 provides detailed information about the LEDs.

Table 1. TRACER 2210/3202 Front Panel Description

Feature	Description
Display LCD	Displays all menu operations and data
Scroll Buttons	Use the Up and Down arrows to traverse through menu items
Enter Button	Use the Enter button to select the highlighted menu
Cancel Button	Use the Cancel button to escape to the previous menu
Status LEDs	Provides status information about the system

Table 2. TRACER 2210/3202 LEDs

For these LEDs...	This color light...	Indicates that...
PLAN A	Green (solid)	the TRACER 3202 RIU is transmitting on Frequency Plan A.
	Off	the TRACER 3202 RIU is not transmitting on Frequency Plan A.
PLAN B	Green (solid)	the TRACER 3202 RIU is transmitting on Frequency Plan B.
	Off	the TRACER 3202 RIU is not transmitting on Frequency Plan B.
CHAN	Green (solid)	the TRACER 3202 RIU is transmitting on Frequency Channel 1.
	Amber (solid)	the TRACER 3202 RIU is transmitting on Frequency Channel 2.
V.35	Green (blinking)	there is activity on the V.35 data port.
RF DWN	Red (solid)	there is a communication problem between the local and remote 2210 and 3202 systems.
RF LOW	Red (solid)	the RSSI level is below suggested minimum threshold.
TEST	Amber (solid)	there is an active test being performed by the system or there is an active loopback.
CABLE	Green (solid)	the cable between the TRACER 2210 and 3202 units is good.
	Off	there is a problem with the cable connecting the TRACER 2210 and 3202 units.

5. REVIEWING THE TRACER 2210 REAR PANEL DESIGN

The TRACER 2210 rear panel contains a terminal block labeled, **RADIO**, for connecting to the TRACER 3202 unit, an RS-232 port for accessing the unit via a terminal menu, a V.35 interface for connecting DTE equipment, and a four pin power connector.

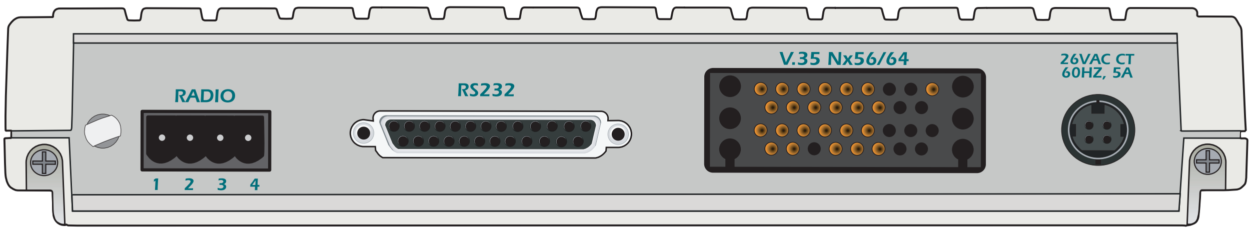

Figure 2. TRACER 2210/3202 Rear Panel Layout

RADIO Connector

The **RADIO** connector (terminal block) connects to the TRACER 3202 RIU using the custom cable assembly (see Figure 1 on page 33). The **RADIO** connection follows, and Table 3 shows the pinout.

Connector type Terminal Block

Table 3. RADIO Connector Pinout

PIN	NAME	DESCRIPTION
1	RX +	RECEIVE DATA - POSITIVE POLARITY, +VDC SPAN POWER
2	RX –	RECEIVE DATA - NEGATIVE POLARITY, +VDC SPAN POWER
3	TX +	TRANSMIT DATA - POSITIVE POLARITY, -VDC SPAN POWER
4	TX –	TRANSMIT DATA - NEGATIVE POLARITY, -VDC SPAN POWER

RS-232 Connection

The RS-232 connector provides a female DB-25 terminal connection, which is used for terminal access to the TRACER 2210/3202 system. The RS-232 port provides the following functions:

- Accepts EIA-232 input from a PC or terminal for controlling the TRACER 2210/3202 system.
- Operates at 9600 bps
- Parity scheme - 8 databits, no parity, 1 stopbit

Table 4 on page 29 shows the pinout.

Connector type (USOC) DB-25

Table 4. RS-232 Connection Pinout

PIN	NAME	DESCRIPTION
1, 7	GND	GROUND
2	TX	TRANSMIT
3	RX	RECEIVE
4	RTS	REQUEST TO SEND
5	CTS	CLEAR TO SEND
6	—	UNUSED
8	CD	CARRIER DETECT
9-19	—	UNUSED
20	DTR	DATA TERMINAL READY
21	—	UNUSED
22	RI	RING INDICATOR
23-25	—	UNUSED

V.35 Nx56/64 Connection

The V.35 Nx56/64 connector provides a female V.35 connection, which is used when connecting DTE equipment to the TRACER 2210/3202 system. The V.35 port provides the following functions:

- Operates at data rates from 56 kbps (1, 56k DS0) to 1.536 Mbps (24, 64k DS0s).

Table 5 on page 30 shows the pinout.

Connector type V.35 Winchester

Table 5. V.35 Connector Pinout

Pin	CCITT	Signal Description	Pin	CCITT	Signal Description
A	101	Shield (Ground)	T	104	Transmit Clock (B)
B	102	Transmit Data (A)	V	115	Clear to Send (B)
C	105	Received Data (A)	X	115	Transmit Data (B)
D	106	Request to Send (A)	P	103	Transmit Clock (A)
E	107	Clear to Send (A)	S	103	Received Data (B)
F	109	DCE Ready (A)	Y	114	Receive Clock (A)
H	—	Signal Ground	AA	114	Local Loopback
J	—	Carrier Detect (A)	U	113	Request to Send (B)
L	—	Received Clock (B)	W	113	DTE Ready (A)
N	—	Carrier Detect (B)	NN & K	—	Remote Loopback
R	104	Ext. Transmit Clock (B)			

6. REVIEWING THE TRACER 3202 DESIGN

The TRACER 3202 RIU is a mast mount, cylindrical unit which serves as an environmentally controlled housing for the RF receiver and RF transmitter. Figure 3 shows the TRACER 3202 base.

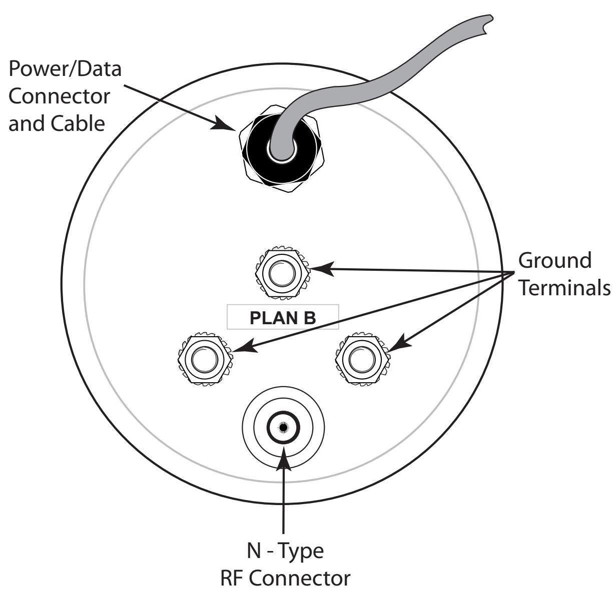

Figure 3. TRACER 3202 Base

NETWORK TURNUP PROCEDURE

CONTENTS

FIGURES

1. INTRODUCTION

This section discusses the installation process of the TRACER 2210/3202 system.

WARNING *Changes or modifications not expressly approved by ADTRAN could void the user's authority to operate the equipment.*

2. TOOLS REQUIRED

The tools required for the installation of the TRACER 2210/3202 are:

- Wire stripper (for cable assembly)
- Wire cutter (for cable assembly)
- Crimping tool (for cable assembly)
- #2 Phillips screwdriver (for cable assembly)

CAUTION *To prevent electrical shock, do not install equipment in a wet location or during a lightning storm.*

3. UNPACK AND INSPECT THE SYSTEM

Each TRACER 2210/3202 is shipped in its own cardboard shipping carton. Open each carton carefully and avoid deep penetration into the carton with sharp objects.

After unpacking the unit, inspect it for possible shipping damage. If the equipment has been damaged in transit, immediately file a claim with the carrier, then contact ADTRAN Customer Service (see *Warranty and Customer Service* information in the front of this manual).

Contents of ADTRAN Shipment

Your ADTRAN shipment includes the following items:

- (1) TRACER 2210 Data Interface Unit (DIU)
- (1) 6' Wallmount power supply (for DIU)
- (1) TRACER 3202 Radio Interface Unit (RIU)
- (1) Pre-threaded mast unit bracket
- (2) Bracket clamps
- (4) CPC crimping pins
- (1) Terminal block for custom cable assembly - inside TRACER 2210 box
- (1) The TRACER 2210/3202 System CD including the User Manual and Quick Start Guide - inside TRACER 2210 box

Customer Provides

The following items are necessary for the installation of the TRACER 2210/3202 system and are not provided by ADTRAN:

- 4-Conductor, 22 or 24 AWG twisted pair, UV-resistant cable (maximum length 700 ft or 600 ft, respectively)

4. CABLE ASSEMBLY

The following provides pictorial instructions for assembling the cable between the TRACER 2210 and 3202 units. The cable length and material should be customized to suit the needs of the application. All of the necessary connector pieces are supplied by ADTRAN in your TRACER 2210/3202 shipment.

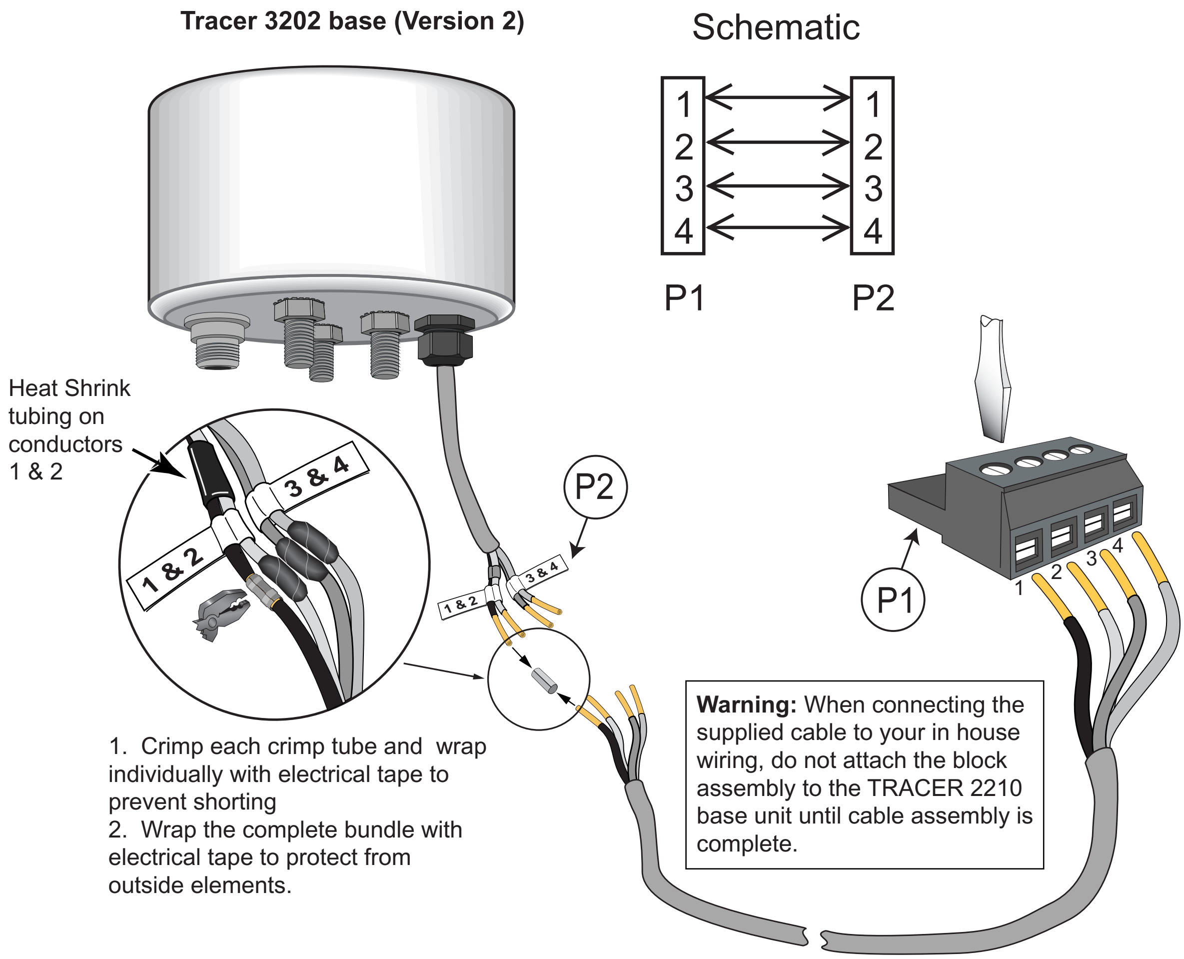

Figure 1. Cable Assembly Instructions

5. CHANNEL SELECTION

The FCC has allocated 125 MHz of spectrum in the band in which the TRACER 2210/3202 operates. Figure 2 illustrates the bandwidth division.

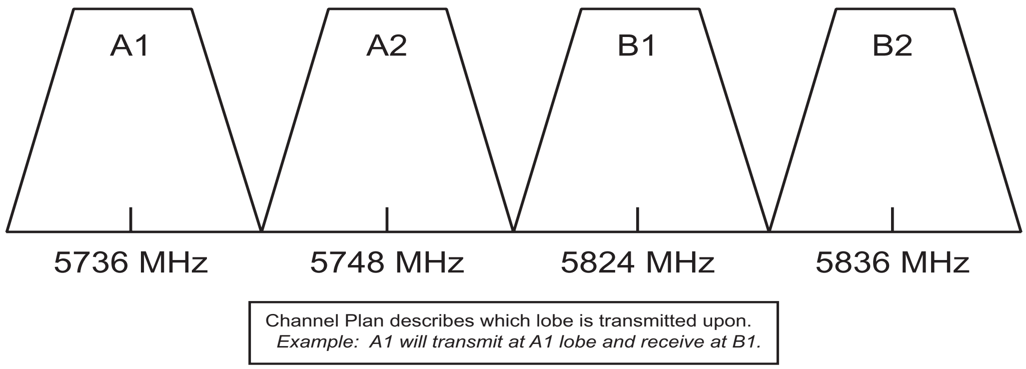

Figure 2. Bandwidth Division

To designate the utilization of the ISM bandwidth, there are four different channel plans, labeled A1, B1, A2 and B2. The letter of each channel plan setting is preset by the factory and refers to the physical configuration of the diplexer filter inside the environmental housing. The second portion or letter of the channel plan refers to the receive and transmit oscillator frequencies in the radio. Numbering the lobes in Figure 2 from left to right, a channel plan of A1 or B1 refers to transmitting and receiving on the first and third lobes. Likewise a channel plan of A2 or B2 refers to the transmitting and receiving of the second and fourth lobes of Figure 2. There are two rules for successful 3202 configuration.

1. The letter of the channel plan must be different on both ends.
2. The frequency number must match.

An A1 Radio must have a B1 Radio on the other end and a B2 Radio must have an A2 Radio on the other end.

6. GROUNDING INSTRUCTIONS

The following provides grounding instruction information from the Underwriters' Laboratory UL 60950, Third Edition, Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.

An equipment grounding conductor that is not smaller in size than the ungrounded branch-circuit supply conductors is to be installed as part of the circuit that supplies the product or system. Bare, covered, or insulated grounding conductors are acceptable. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes. The equipment grounding conductor is to be connected to ground at the service equipment.

The attachment-plug receptacles in the vicinity of the product or system are all to be of a grounding type, and the equipment grounding conductors serving these receptacles are to be connected to earth ground at the service equipment.

A supplementary equipment grounding conductor shall be installed between the product or system and ground that is in addition to the equipment grounding conductor in the power supply cord.

The supplementary equipment grounding conductor shall not be smaller in size than the ungrounded branch-circuit supply conductors. The supplementary equipment grounding conductor shall be connected to the product at the terminal provided, and shall be connected to ground in a manner that will retain the ground connection when the product is unplugged from the receptacle. The connection to ground of the supplementary equipment grounding conductor shall be in compliance with the rules for terminating bonding jumpers at Part K or Article 250 of the National Electrical Code, ANSI/NFPA 70. Termination of the supplementary equipment grounding conductor is permitted to be made to building steel, to a metal electrical raceway system, or to any grounded item that is permanently and reliably connected to the electrical service equipment ground.

The supplemental grounding conductor shall be connected to the equipment using a number 8 ring terminal and should be fastened to the grounding lug provided on the rear panel of the equipment. The ring terminal should be installed using the appropriate crimping tool (AMP P/N 59250 T-EAD Crimping Tool or equivalent.)

NOTE

Grounding terminals for the TRACER 2210/3202 are located on the bottom of the TRACER 3202 mast unit.

7. SUPPLYING POWER TO THE UNIT

TRACER 2210 DIU

The TRACER 2210 comes equipped with an AC adapter with a 2 prong plug for connecting to a properly grounded power receptacle. As shipped, the TRACER 2210 is set to factory default settings. To power-up the unit, ensure that the TRACER 2210 is connected to an appropriate power source. There is no On/Off switch on the TRACER 2210 unit.

CAUTION

- *This unit shall be installed in accordance with Article 400 and 364.8 of the NEC NFPA 70 when installed outside of a Restricted Access Location (i.e., central office, behind a locked door, service personnel only area).*
- *Power to the TRACER 2210 AC system must be from a grounded 90-130 VAC, 50/60 Hz source.*
- *The power receptacle uses double-pole, neutral fusing.*
- *Maximum recommended ambient operating temperature is 50 ºC.*

TRACER 3202 RIU

Power for the TRACER 3202 RIU is provided by the TRACER 2210 DIU over a twisted pair. To power-up the TRACER 3202, properly connect the RIU to the DIU using the custom cable assembly (see *Cable Assembly* on page 33).

WARNING	*Disconnect power from the TRACER 2210 before connecting to the TRACER 3202 RIU. Power-up the TRACER 2210 after the cable assembly has been properly created and connected to both units.*

8. MOUNTING OPTIONS

TRACER 2210 DIU

The TRACER 2210 DIU may be installed for tabletop or wall-mount configuration. Use the 4 mounting slots on the base of the TRACER 2210 housing for wall-mount configurations.

TRACER 3202 RIU

The TRACER 3202 RIU is provided for mast mount installation. Use the provided mounting bracket when installing the unit on the external pole or tower.

CAUTION	*Connect the provided wire rope tethers around the L-shaped cutout on the mounting bracket to protect the housing clamp and housing cover from falling during installation and maintenance (see Figure 3).*

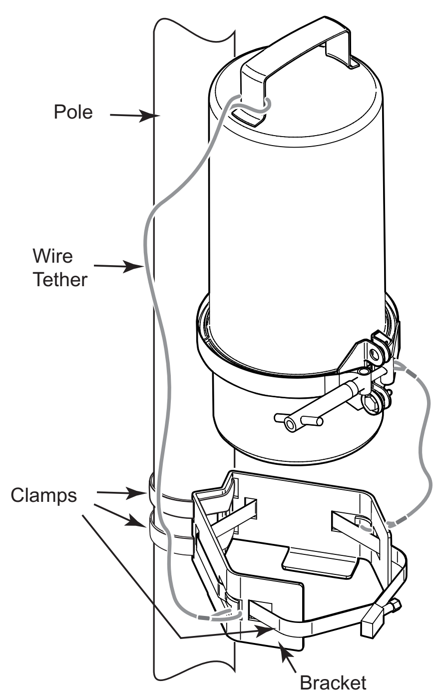

Figure 3. Connecting the TRACER 3202 Rope Tethers

USER INTERFACE GUIDE

CONTENTS

FIGURES

1. NAVIGATING THE TERMINAL MENU

The TRACER 2210/3202 menu system can be accessed via the front panel or through terminal menus when connected to the DB-25 terminal interface located on the rear panel of the TRACER 2210 unit. The menu listings and descriptions found in this section refer to the menus as listed when connected through the terminal interface.

> Minor differences in the menu listings will occur when viewing the menus through the front panel.

Terminal Menu Window

The TRACER 2210/3202 uses hierarchical menus to access its many features. The main menu level (see **Figure 1**) leads to submenus. All menu operations can be displayed in either a terminal window or in the LCD window on the front panel of the TRACER 2210 unit.

> After connecting a VT100 terminal to the 2210, press the spacebar to redraw the current screen. VT 100 access will not be possible until this step is performed.

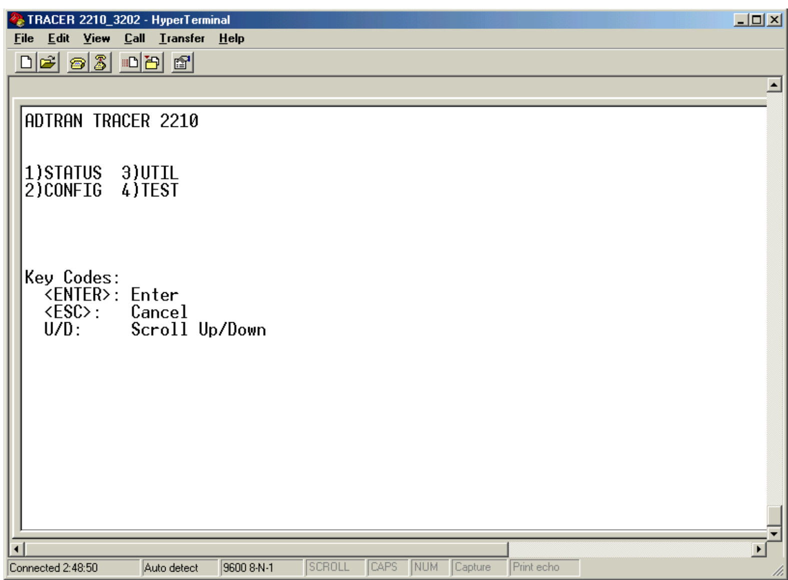

Figure 1. Top-Level Terminal Menu Window

Navigating using the Keyboard Keys

You can use various keystrokes to move through the terminal menu, to manage a terminal menu session, and to configure the system.

Moving through the Menus

To do this..	Press this key...
Move up to select items	U
Move down to select items	D
Edit a selected menu item	Enter
Cancel an edit	Escape
Ascend one menu level	Escape

Session Management Keystrokes

To do this..	Press this key...
Log into a session	Spacebar
Refresh the screen	Spacebar

2. TERMINAL MENU AND SYSTEM CONTROL

Selecting the Appropriate Menu

The terminal menu is the access point to all other operations. Each terminal menu item has several functions and submenus that identify and provide access to specific operations and parameters. Use the chart below to help select the appropriate terminal menu.

To do this..	Go to this menu...
View the current status of the V.35, radio, or alarms	**STATUS**
Configure the network parameters including clocking and V.35 data rate	**CONFIG**
View the current software revision of the unit and set the passcode for front panel access	**UTIL**
Initiate a V.35 test and review the current status	**TEST**

3. MENU DESCRIPTIONS

The remainder of this section describes the TRACER 2210/3202 menus and submenus. Menu trees for the TRACER 2210/3202 can be found on the documentation CD.

NOTE

The hierarchical menu structure of the TRACER 2210/3202 system is depicted below as follows:

> **MAIN MENU**
> **MAIN MENU** > **SUBMENU**
> **MAIN MENU** > **SUBMENU** > **SUB-SUBMENU**

>STATUS

Provides status information for the TRACER 3202 RIU as well as performance statistics for the V.35.

STATUS > RSSI

RSSI (Received Signal Strength Indicator) is an acronym referring to the relative strength of the signal currently received at the antenna. A high RSSI is desirable for good system performance. RSSI is displayed on the front panel LCD and the terminal menus as a solid bar extending between two brackets. When the bar fully covers the space between the brackets, a maximum RSSI level is conveyed. When the space between the brackets is empty, a minimum RSSI is conveyed. This menu item refers to the near TRACER 3202.

STATUS > FAR RSSI

RSSI (Received Signal Strength Indicator) is an acronym referring to the relative strength of the signal currently received at the antenna. A high RSSI is desirable for good system performance. RSSI is displayed on the front panel LCD and the terminal menus as a solid bar extending between two brackets. When the bar fully covers the space between the brackets, a maximum RSSI level is conveyed. When the space between the brackets is empty, a minimum RSSI is conveyed. This menu refers to the TRACER 3202 on far-end of the system.

STATUS > PERFRM REPORTS

Provides performance data for the 2210 to 3202 connection. The data displayed is data accumulated over the last 15 minutes and over the last 24 hours of operation.

STATUS > PERFRM REPORTS > SES

Displays the number of severely errored seconds occurring in the last 15 minutes and 24 hours. A severely errored second is defined as any second that contains more than 2.5 code violations.

STATUS > PERFRM REPORTS > ES

Displays the number of errored seconds occurring in the last 15 minutes and 24 hours. An errored second is defined as any second that contains a code violation.

STATUS > PERFRM REPORTS > %AV

Displays the percentage of available seconds in the last 15 minutes and 24 hours of operation. An available second is defined as any second of operation that the unit is not in an alarm condition.

STATUS > PERFRM REPORTS > %EF

Displays the percentage of error free seconds in the last 15 minutes and 24 hours of operation. An error free second is defined as any available second that does not contain a code violation.

STATUS > PERFRM REPORTS > RESET PERF CNTRS

Resets the display for the performance report counters. Clearing the counter display does not affect the 15 minute or 24 hour counter totals.

>CONFIG

The Configuration menu is used to set the TRACER 2210/3202 operational configuration, including all of the network interface parameters, the allocation of the DS0s, and the V.35 port parameters.

CONFIG > 2210

Contains configuration parameters for the TRACER 2210 DIU.

CONFIG > 2210 > CLOCK SOURCE

Configures the clock source for transmission toward the network. The TRACER 2210 is operable from various clock sources permitting it to perform properly in many different applications.

Choices: INTERNAL, FAR END, AUTO, DTE

The clocking option selected always designates the clock source for transmission. Clocking necessary for receiving data is always recovered from incoming data.

CONFIG > V.35

Contains configuration and operational parameters for the TRACER 2210 DIU V.35 interface.

CONFIG > V.35 > V.35 STEPSIZE

Configures the data rate step size for the TRACER 2210 DIU V.35 interface. The available step sizes for the V.35 interface are 56 kbps or 64 kbps.

Choices: 56 or **64**

CONFIG > V.35 > V.35 RATE NX56/64

Configures the data rate for the TRACER 2210 DIU V.35 interface. The data rate for the TRACER 2210 DIU V.35 interface is the value of N (1 to 24) multiplied by the step size of the interface (see above). Thus the available data rates range from 56 kbps (N = 1, step size = 56kps) to 1.536 Mbps (N=24, step size = 64kbps).

Choices: 1 to **24**

CONFIG > V.35 > V.35 TX CLK

Controls the clock used by the TRACER 2210 DIU to accept the transmit (TX) data from the DTE. Most applications will allow for this to be set to **INTERNAL**. If the cable between the TRACER 2210 DIU and the DTE equipment is long (causing a phase shift in the data) the clock can be selected as **INT-INV** (Internal/Inverted). This switches the phase of the clock which should compensate for a long cable. The **AUTO** setting will allow the TRACER 2210 DIU to automatically detect the delay from the DTE device to the V.35 interface of the DIU and set the proper phase of the clock. This feature will automatically select between the **INTERNAL** and **INT-INV** settings. If the DTE provides a clock with TX data, the clock selection should be set to **EXTERNAL**. When set to **EXTERNAL**, the TRACER 2210 DIU will require an externally supplied clock to accept TX data

Choices: AUTO, INT-INV, EXTERNAL, INTERNAL

CONFIG > V.35 > DATA

Used to control the inverting of the DTE data. Inverting data can be useful when operating with an HDLC protocol (due to excessive zeros). Enabling data inversion helps ensure ones (1s) density.

Choices: **NORMAL**, **INVERT**

> **NOTE** CSU/DSU equipment on both ends must be configured for data inversion if it is required.

CONFIG > V.35 > CTS

Used to control the characteristics of the Clear To Send (CTS) signal on the V.35 interface. In normal operation CTS follows Request To Send (RTS) and is only asserted after RTS. Selecting the **FORCE ON** setting configures the TRACER 2210 DIU to permanently assert the CTS signal on the V.35 interface.

Choices: **NORMAL**, **FORCE ON**

CONFIG > V.35 > DCD

Used to control the characteristics of the Data Carrier Detect (DCD) signal on the V.35 interface. In normal operation DCD is turned off when a TRACER 2210 DIU self test is active, when no DS0s are mapped to the V.35 interface, or when the radio interface is unavailable. Selecting the **FORCE ON** setting configures the TRACER 2210 DIU to permanently assert the DCD signal on the V.35 interface

Choices: **NORMAL**, **FORCE ON**

CONFIG > V.35 > DSR

Used to control the characteristics of the Data Set Ready (DSR) signal on the V.35 interface. In normal operation DSR is turned off during all testing and when no DS0s are mapped to the V.35 interface. Selecting the **FORCE ON** setting configures the TRACER 2210 DIU to permanently assert the DSR signal on the V.35 interface.

Choices: **NORMAL**, **FORCE ON**

CONFIG > RADIO

Provides operational parameters for the TRACER 3202 RIU.

CONFIG > RADIO > TRANSMIT POWER

Controls the power the TRACER 3202 transmits through the antenna. A solid bar extends between two brackets in lengths corresponding to the selected transmit power. When the transmit power is set so that the bar fully covers the space between the brackets, a maximum transmit power level has be selected. When the transmit power is set so that the space between the brackets is empty, a minimum transmit power. This menu refers to the near TRACER 3202.

CONFIG > RADIO > FAR TRANSMIT PWR

Controls the power the TRACER 3202 transmits through the antenna. A solid bar extends between two brackets in lengths corresponding to the selected transmit power. When the transmit power is set so that the bar fully covers the space between the brackets, a maximum transmit power level has be selected. When the transmit power is set so that the space between the brackets is empty, a minimum transmit power. This menu refers to the TRACER 3202 on far-end of the system.

CONFIG > RADIO > CHANNEL PLAN

Displays the current channel settings on the near (local) and far (remote) end TRACER 3202.

Displays: NEAR (A OR B), FAR (A OR B)

CONFIG > RADIO > CHANGE CHANNEL PLAN

Controls the near and far end TRACER 3202 unit channel plan as either A1, A2, B1, or B2. The TRACER 3202 RIU comes pre-configured as either channel plan A or B. These are the four possible valid channel plan settings:

NEAR: A1	FAR: B1
NEAR: A2	FAR: B2
NEAR: B1	FAR: A1
NEAR: B2	FAR: A2

Their frequencies are listed below.

A1: Transmit 5.736 Ghz	Receive 5.824 Ghz
A2: Transmit 5.748 Ghz	Receive 5.836 Ghz
B1: Transmit 5.824 Ghz	Receive 5.736 Ghz
B2: Transmit 5.836 Ghz	Receive 5.748 Ghz

Choices: YES, <u>NO</u>

>UTIL

The Utility menu contains display information for the TRACER 2210/3202 system as well as configuration parameters for system settings.

UTIL > SOFTWARE REV

Displays the current software revision level and the software checksum of the TRACER 2210 DIU. This information will be needed when requesting assistance from ADTRAN Customer Service or when updates are needed.

UTIL > RADIO SW REV

Displays the current software revision level and the software checksum of the TRACER 3202. This information will be needed when requesting assistance from ADTRAN Customer Service or when updates are needed.

UTIL > REINIT UNIT

Reinitializes the unit and performs a system self-test. Using the **REINIT UNIT** setting is the same as power cycling the unit.

> **NOTE** This menu item is not used to restore the factory default settings for all parameters.

UTIL > SET PASSCODE

Allows the user to add, change, or delete a passcode for the TRACER 2210 DIU front panel.

UTIL > KEY PAD LOCK

Allows the user to lock the front panel keypad access. Locking the keypad will require a terminal session to access the TRACER 2210 DIU.

Choices: UNLOCKED, LOCKED

UTIL > FACT RESTORE

Restores all unit parameters to the factory default settings.

UTIL > ALL PIXELS ON

Allows the user to verify that none of the pixels are “stuck off”.

UTIL > ALL PIXELS OFF

Allows the user to verify that none of the pixels are “stuck on”.

UTIL > LED TEST

Allows the user to verify that the LEDs function correctly by illuminating them all simultaneously. Reselect the test to return the LEDs back to their previous setting.

>TEST

The Test menu is used to initiate different types of tests for the unit and view the results. Test results can be viewed via the LCD display on the front panel of the unit or the terminal menu.

TEST > LOOPBACKS

Configures the TRACER 2210 DIU to initiate a particular loopback. Selecting a Far 2210 loopback configures the DIU to loop the far end unit. This will constitute a full system test. Selecting a 2210 To Radio loopback configures the DIU to loop the data stream at the unit back towards the 3202 RIU. This can be used to verify the entire system when the pattern is sent from the far end through the local loopback. Selecting the 2210 To V.35 loopback configures the DIU to loop the data stream from the 2210 back towards the V.35 interface. This can be used to verify the cable between the DIU and the DTE equipment.

Selecting the Radio Cable loopback provides a loop in the data stream at the data framer in the TRACER 3202 RIU back to the TRACER 2210 radio interface. Sending the pattern from the TRACER 2210 DIU through the Radio Cable loopback will verify the integrity of the cable connecting the two units.

Choices: NO LOOPBACK, FAR 2210, 2210 TO RADIO, 2210 TO DTE, AND RADIO CABLE

TEST > TEST PATTERN

Sets the pattern for the active test and initiates the transmission of the pattern. Selecting the 511 Pattern will generate the standard DTE 511 data pattern from the TRACER 2210. This will activate the 511 error counter but not reset the value. Selecting the QRSS pattern will generate a quasi-random signal source data pattern from the TRACER 2210. The 1:8 pattern will generate a binary one followed by eight binary zeros.

CHOICES: NO PATTERN, 1:8 PATTERN, QRSS PATTERN, AND 511 PATTERN

TEST > CLR PATTN ERRORS

Displays the count of the pattern errors. This counter is initiated when a pattern is selected in the Test Pattern field. To clear the pattern error counter press <Enter>.

TEST > INSERT PATTN ERRORS

Inserts an intentional pattern error in the data stream which can be tracked using the pattern error counter. Press <Enter> to insert the error.

TEST > CLEAR TESTS

Clears all active tests (loopbacks and patterns) in the TRACER 2210/3202 system.

TROUBLE SHOOTING GUIDE

Contents

Figures

1. OVERVIEW

In general, system configuration errors fall into 1 of 4 categories:

(1) 2210-to-3202 cabling errors

(2) Invalid 2210 settings

(3) DTE configuration errors

(4) RF errors

2. 2210-TO-3202 CABLING ERRORS

Ensure that the electrical connection between the cable splices and the terminal block plug on the 2210 is correct, using an ohmmeter. If all 4 conductors are intact, ensure that the pin-out is correct for each connector, i.e. pin 1 on the terminal block is attached to conductor 1 on the spliced cable, etc.

3. INVALID 2210 SETTINGS

Several V.35 interface options are available for the TRACER 2210 for connecting to DTE equipment (e.g.. router, bridge), and its interface with the radio link.

Timing Settings

Timing settings determine how the TRACER 2210 synchronizes itself to external equipment, including the DTE hardware attached to the V.35 port, and the remote 2210 unit on the opposite end of the radio link. A fully synchronized and operational TRACER 2210/3202 system requires that one and only one piece of communications equipment control timing throughout the system. The TRACER 2210 has been flexibly designed so that either the 2210 or the attached DTE equipment can mandate timing.

Most DTE equipment will expect timing to originate from the 2210 unit. In these common applications the factory default, or AUTO, settings stored in the 2210 will synchronize the DTE and TRACER 2210/3202 circuits together. For those DTE devices that require self-regulated system timing, the TRACER 2210 timing settings will need to be changed via the 2210 menu.

V.35 Settings

Interface-related errors may also occur if the number of 56/64 kHz sub-channels is incompatible with the DTE hardware. To remedy this problem, set the 2210 V.35 rate within the limits of the DTE bandwidth.

There are two distinct clock circuits in the 2210. One clock circuit interfaces with the V.35 port, and the other clock circuit interfaces with the radio channel (network). The V.35 clock setting determines whether the V.35 port accepts (sinks) or provides (sources) the clock used to synchronize data transmission between the DTE unit and the 2210. The 2210 internal clock setting determines whether the internal 2210 oscillator, DTE received clock, or radio interface clock is used as the internal clock source for the 2210 unit. In most applications, the default (AUTO) timing settings for these two clocks will be correct.

The TRACER 2210 is factory-configured to network timing, and so acts as standard DCE hardware when connected via a V.35 cable to DTE hardware. When using the 2210 in non-standard applications, please consult both the DTE hardware user’s manual and TRACER 2210 user’s manual for proper settings information.

4. INVALID DTE SETTINGS

It may be necessary to change certain options on the DTE hardware. Please consult the user's manual for your particular DTE hardware to ensure proper setup.

5. RF ERRORS

RF errors can range anywhere from a non-viable microwave path to loose RF connectors.

Non-viable path conditions could be caused by physical obstructions such as buildings, mountainous terrain, trees, etc., as well as other physical limitations such as excessive path distances and in-band RF interference. These types of errors are remedied by performing a detailed line-of-sight microwave path study to determine whether or not a microwave link is feasible for the terrain and environment under consideration.

If after performing a microwave path study the system is still not operational, ensure that the antennas are properly aligned. Note that alignment must be achieved in both elevation and azimuth for optimal link performance. The TRACER 2210 can be used to aid in antenna alignment by looking at the RSSI submenu. Optimal antenna alignment will correspond to the maximum number of RSSI asterisks (or bars) on the 2210 RSSI display.

6. LOOPBACK OPTIONS

The TRACER 2210/3202 has several data path loopback options available to assist in piece-wise verification of data path integrity throughout the circuit. Each loopback option can be turned on/off from the keypad menu on the 2210 unit. Enter the following menu selection to access the Loopback submenu.

4) TEST → 1) LOOPBACKS

The available loopback points are RADIO CABLE, 2210 TO DTE, 2210 TO RADIO, and FAR 2210. (Figure 1 on page 49) shows the loopback locations and directions graphically.

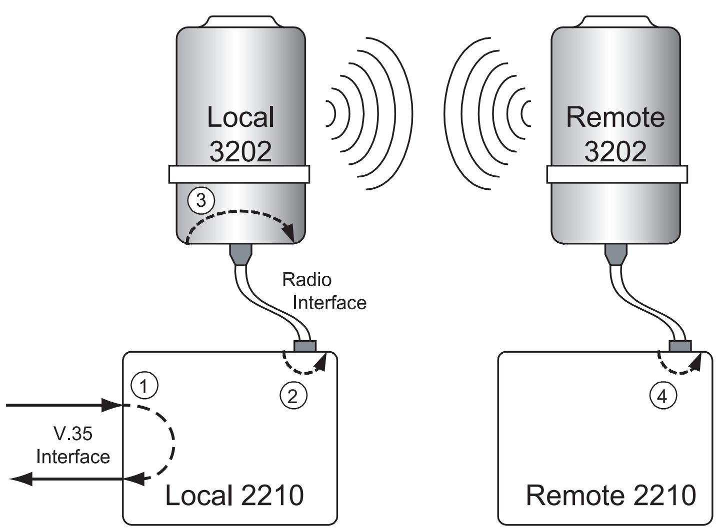

Figure 1. TRACER 2210/3202 Loopback Diagram

2210 to DTE (V.35) Loopback

Performs a loopback at the V.35 DTE data interface. All received V.35 data is looped back in the transmit direction toward the DTE equipment. This loopback is useful for diagnosing DTE device configuration and setup.

2210-to-Radio Loopback

Performs a loopback at the line interface inside the TRACER 2210 unit directed back toward the host 3202 unit. This loopback is useful for diagnosing problems in the TRACER 3202 radio units.

Radio Cable Loopback

Performs a loopback at the line interface inside the TRACER 3202 radio unit directed back toward the host 2210 unit. This loopback is useful for diagnosing the radio cable connecting the 2210 and 3202 units, in addition to differentiating between radio link errors on the remote or local ends of the link.

Far 2210 Loopback

Effectively performs a 2210-to-Radio loopback on the remote TRACER 2210 unit. This loopback exercises the majority of the system circuitry and is useful for verifying end-to-end operation from a single location.

7. TEST PATTERNS

The TRACER 2210/3202 has several data test patterns available to test bit integrity throughout the system. Typically these patterns are used in conjunction with a loopback option to determine which system device is demonstrating faulty behavior. The available patterns are a 511 pattern, a QRSS pattern, and a 1-in-8 pattern (1:8). Additionally, most third party test equipment will recognize and can operate with these three standard patterns.

1-in-8 Pattern

The 1-in-8 (1:8) pattern is simply a repetition of the binary data sequence 10000000. The 1:8 pattern is useful when needing to identify a regular data stream through the system.

511 Pattern

The 511 pattern is a pseudo-random data sequence that repeats every 511 bits. It is a relatively short periodic sequence that can be used to simulate live data. The 511 pattern is generated by a length-9 shift register with the logical exclusive-or of registers 9 and 5 being fed back to register 1.

QRSS Pattern

The QRSS pattern, or quasi-random signal sequence, is a test sequence designed to simulate live data traffic. It is based on a length-20 shift register with the logical exclusive-or of registers 17 and 20 being fed back to register 1. The shift register contents are monitored for runs of 14 consecutive zeros, in which case the QRSS generator will force the output to logic-1 to proceed the run of zeros. The QRSS pattern is designed to have a 1-to-0 ratio of 1:1.

8. STEP-BY-STEP TROUBLESHOOTING

The logical troubleshooting flow presented in this section can be used to set up your TRACER 2210/3202 system, and also to diagnose a previously installed system. Please contact Adtran Technical support at any stage during installation and/or troubleshooting if you require assistance.

9. INSTALLING/TROUBLESHOOTING THE TRACER HARDWARE

1. Perform a detailed path profile for each TRACER 2210/3202 microwave link. A thorough path study can be used to estimate signal power budgets, fade margins at each receiver, identity potential line-of-site obstacles, properly size antenna dishes, and determine minimum antenna dish heights above the earth.
2. Setup all of the TRACER hardware on a work bench. This includes both 2210 units, both 3202 units, and RF attenuators or antennas. It is also recommended that the actual cables to be used in the permanent installation be used in the work bench setup. A rigorous work bench "simulation" of the link will help you alleviate and avoid time-consuming errors.
3. After applying power to the 2210 units, examine the CABLE light on the front panel of each 2210. If this light is illuminated (green), then the 2210 is delivering power and data to the 3202 unit. If the CABLE light is not illuminated, then the 3202 is not connected properly to the 2210 unit. Normally this means that there is a physical problem with the cable attaching the 2210 to the 3202. Any of several cabling errors could be present, including disconnected cable splices, severed wire, or improper conductor ordering of the 4-wire cable to the back of the 2210 unit.
4. Resolve all 2210/3202 cabling errors using an ohmmeter before proceeding.
5. Command a RADIO CABLE loopback on each individual 2210/3202 pair, and run either a 511 or QRSS test pattern to verify proper attachment of the 2210/3202 units. You should not see any pattern errors during the test. Clear all test patterns after verification is finished.
6. Examine the PLAN A, PLAN B, and CHAN lights on the front panel of each 2210 unit. These LEDs indicate the frequency plan and frequency channel for each 2210/3202 unit. The factory default setting for the frequency channel is channel 1, while the frequency plan will be prefixed to plan A for one 3202 unit, and plan B for the other 3202 unit. The color of the frequency channel (CHAN) LED on both 2210 units should be the same. The frequency plan (PLAN A, PLAN B) LED should be the opposite on both 2210 units. Unless you have verified that changing the frequency channel is necessary for a particular link, there is no need to manually change the channel setting on either unit. Possible conditions that could benefit by changing the frequency channel include co-channel interference from a third party, or co-location applications.
7. Attach the RF coaxial cables to be used in the permanent installation to the N-type connectors on the base of the 3202 unit. Attach the other end of the coaxial cable(s) to an RF power meter or spectrum analyzer if either is available. The power measured by the meter/analyzer will be the RF power available at the input of the antenna. The 3202 unit is programmed at the factory to output approximately 100 mW (20 dBm) of 5.8 GHz RF power. The actual power level measured by the meter/analyzer will be less than 100 mW due to RF losses through the coaxial cable, and is a function of cable type and length of cable being used. In any event, the power level at the output of the coaxial cable should be a significant fraction of 100 mW. A power meter/analyzer reading that is not on the order of at least tens-of-milliwatts could be an indication of any combination of either unsuitable RF, faulty, or unreasonably long coaxial cable.

8. Resolve all RF coaxial cabling errors before proceeding.
9. Attach the RF coaxial cables to a 5.8 GHz attenuator, if possible. If you do not have an attenuator, attach the coaxial cables to the antennas to be used in the permanent installation. If the installation antennas are not available, small, inexpensive dipole or patch antennas can be used for verification purposes. If an adjustable attenuator is being used, dial in the amount of attenuation that corresponds to the path loss value expected for the microwave link in which the TRACER hardware will be installed. The path loss value can be calculated from a knowledge of the path length, or provided by a path study. Remember to subtract both antenna gain values from the attenuator level if these values have not already be accounted for.
10. After setting up the RF pieces, examine the RFDWN light on the front panel of each 2210 unit. If the RFDWN light is illuminated (red), the corresponding 2210/3202 is not receiving a suitable RF signal from the other 2210/3202 pair. In this case, the receiving 2210/3202 is either receiving a very weak signal, or no signal at all. If the RFDWN light is not illuminated, then the 2210/3202 units are receiving a suitable RF signal. Suitable RF power levels for low error rate communication will range from -30 dBm to -87 dBm measured at the N-type connector input at the base of the receiving 3202 unit.
11. Resolve any signal level issues before proceeding.
12. Examine the RFLOW light on the front panel of each 2210 unit. If this light is illuminated, then the 2210/3202 is receiving a relatively weak signal, however if the RFDWN light is not illuminated, the received signal is being suitably processed by the TRACER system. If you are receiving a weak signal (RFLOW is lit), please verify that the weak signal is not being caused by a faulty cable, an insufficiently tightened cable, or some other installation-related problem. Also, make sure an unreasonably large attenuation value has not been selected if you are using an attenuator on a work bench setup.
    You can use the table in the Microwave Path Engineering section of this manual to select the proper free-space attenuation value (in dB) based on the estimated length of the microwave path. Remember to subtract out both antenna gains (local and remote) from the attenuator setting.
13. Command a FAR 2210 loopback on both 2210 units to verify end-to-end link integrity. Set TEST PATTERN to 511 or QRSS and verify that no errors are occurring. This step will ensure that the hardware being used in the TRACER link is adequately passing data and will be a viable wireless data path for your DTE equipment.

Installing/Configuring DTE Hardware

1. If possible, attach any or all of the intended DTE hardware to the 2210 units using the same work bench setup. This step offers the perfect opportunity to configure your DTE hardware for proper functioning with the TRACER hardware.
2. Determine the required data rate for the DTE hardware. Be sure to match this rate in the 2210 unit using the CONFIG > V.35 menu selections. In nearly all applications, only the V.35 RATE setting will need to be adjusted to match the DTE data rate, and not the V.35 TX CLK setting, which should be set to AUTO.
3. Resolve any remaining DTE-to-2210 configuration issues before field installation, if possible. This will significantly reduce the probability of unsuccessful field installation.

MENU TREES

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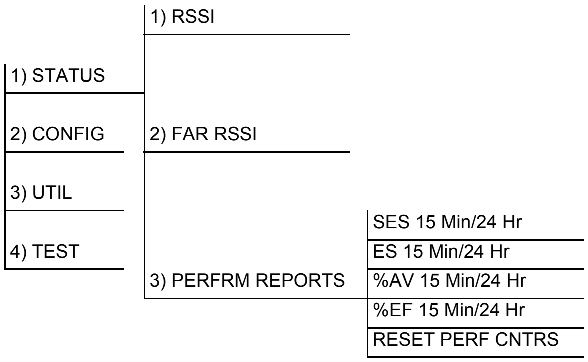
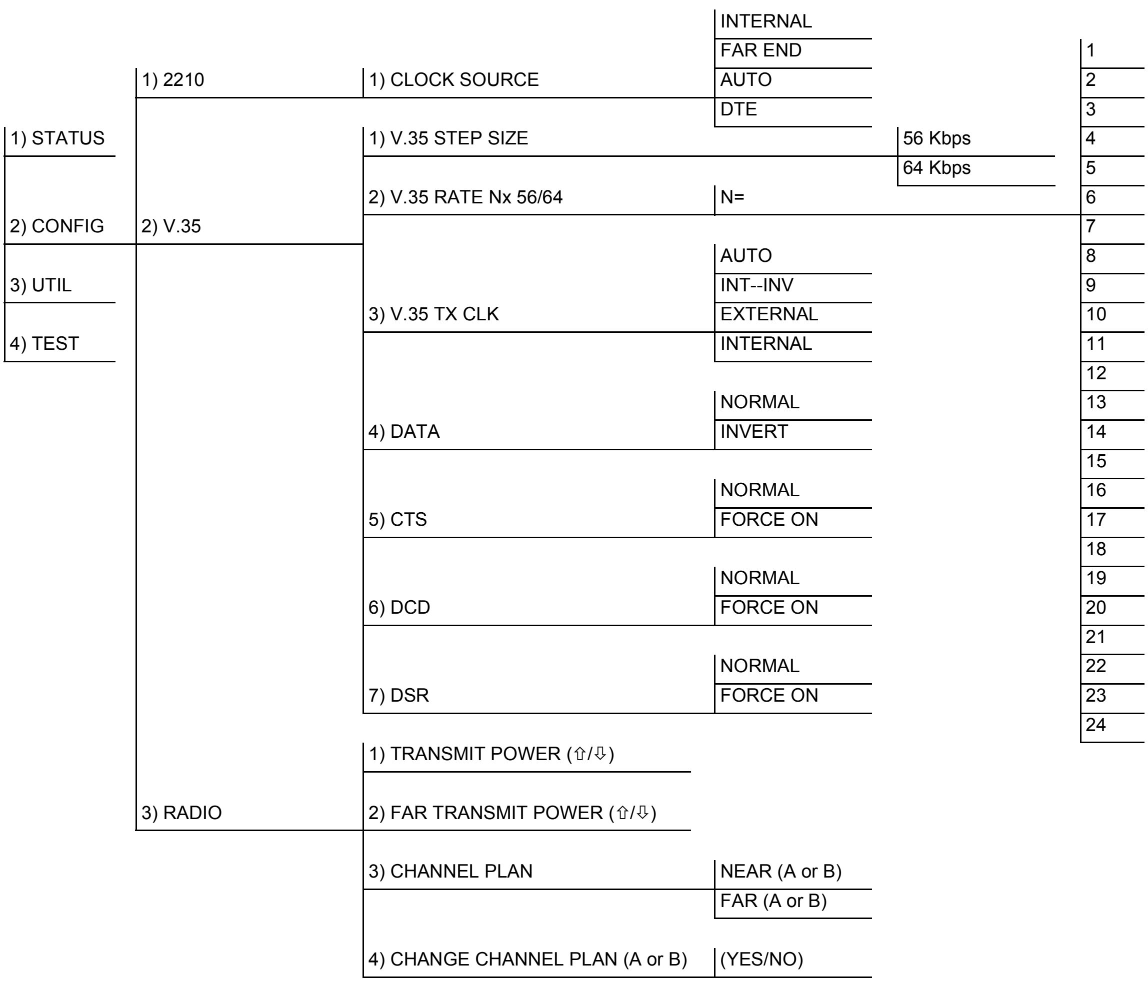
TRACER 2210/3202 Status Menu Tree



TRACER 2210/3202 Config Menu Tree



TRACER 2210/3202 Util Menu Tree

- 1) STATUS
- 2) CONFIG
- 3) UTIL
  - 1) SOFTWARE REV
    - REVISION
    - CHECKSUM
  - 2) RADIO SW REV
    - REVISION
    - CHECKSUM
  - 3) REINIT UNIT
  - 4) SET PASSCODE (valid range 0000-9999)
  - 5) KEYPAD LOCK
    - UNLOCKED
    - LOCKED
  - 6) FACT RESTORE
  - 7) ALL PIXELS ON
  - 8) ALL PIXELS OFF
  - 9) LED TEST
- 4) TEST

TRACER 2210/3202 Test Menu Tree

- 1) STATUS
- 2) CONFIG
- 3) UTIL
- 4) TEST
  - 1) LOOPBACKS
    - NO LOOPBACK
    - FAR 2210
    - 2210 TO RADIO
    - 2210 TO DTE
    - RADIO CABLE
  - 2) TEST PATTERN
    - NO PATTERN
    - QRSS PATTERN
    - 511 PATTERN
    - 1:8 PATTERN
  - 3) CLR PATTN ERRORS
  - 4) INSERT PATTN ERR
  - 5) CLEAR TESTS