



**Model 2351S Series
Millimeter Wave
10 Mb/s Ethernet
Radio Link**

**Installation and Operation
Manual**

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TELENETICS, INC.
Model 2351S Millimeterwave 10 Mb/s Ethernet Radio Link

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TELENETICS, INC.
Model 2351S Millimeterwave 10 Mb/s Ethernet Radio Link

SECTION I

TECHNICAL DESCRIPTION

The 2351S 10 Mb/s Ethernet radio link operates in a full-duplex mode, simultaneously transmitting and receiving Ethernet 10 base T signals. The radio link consists of two identical indoor control units and a pair of outdoor RF Head units tuned to a pair of frequencies within the 21.2 to 23.6-frequency band.

The 2351S is available in two configurations: (1) with RF Heads that include integral 12 inch parabolic antennas, and (2) with the RF Heads housed in a separate box for use with larger external antennas. In the integral antennas configuration, no separate antennas or flexible wave-guide sections are required. In the external antenna configuration, the customer must furnish the separate antennas and the sections of WR42 flexible wave-guide to interconnect the RF Head wave-guide interface and the antenna feed mechanism.

The Control Unit contains an AC (optional DC) power supply, Ethernet transceiver, and a baseband interface/demodulator for simultaneous duplex operation.

Two (customer furnished) 50 Ohm Type N Male to Type N Male coaxial cables are required (one at each end of the link) for installation and operation of the radio link. The cable should be 100% shielded and of the highest quality, such as Belden 9913 (ore equivalent). The cable runs between the Indoor Control Unit and the outdoor RF Head and carries the Tx baseband signal to the Head from the Control Unit, the AGC voltage and the 70 MHz IF signal from the RF Head to the Control Unit, and all of the alarm, diagnostic, and control information.

Each Control Unit provides the following diagnostic indicators:

Power On	Green LED
AGC Voltage	Meter (0-10 Volts)
Ethernet Data into Radio from Network	Green LED
Ethernet Data from other end of Link.	Green LED
Link Continuity, Head to Control Unit	Green LED
AGC Alarm	Red LED
Rx Alarm	Red LED
Tx Alarm	Red LED

TELENETICS, INC.

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System Interface to Radio

10 Base T Ethernet Interface:

Radio connects directly to Data Terminal Equipment (DTE) via one of two switch selectable interface connectors:

- (1) DB15/AUI
- (2) RJ45/UTP

Power

The radio link requires 93-265 VAC via attached 6-foot long power cord. (DC power is an extra cost option)

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SECTION II

UNPACKING AND INSPECTION

Your Sierra Digital Series Millimeter Wave Link has been carefully inspected and packed at the factory. Each end of the Link is shipped in a single box. Please check the packing list carefully to ensure that all pieces have been received undamaged. If anything is missing, contact Telenetics.

TRANSIT DAMAGE

Although the factory has carefully packed the units, check for possible transit damage. If any damage has occurred in shipping, leave the entire units and packing carton intact and contact your carrier. Telenetics is not responsible for transit damage.

RETURN AUTHORIZATION NUMBER

If necessary to return the equipment, first obtain a return authorization number (RMA number) from Telenetics. Please contact the Telenetics Customer Service organization at (916) 624-7313 to obtain a RMA number. When contacting Customer Service, you will need your Model number, Serial number, a responsible technical contact, and a description of the problem. Please have all of this available when you make your call.

SECTION III

PATH REQUIREMENTS

The microwave path must be clear “line of sight”. That is, it must have no obstructions of any kind between the two antennas. Ensure that the path is not obstructed by buildings, trees (allow for growth), billboards, telephone poles, light poles, and/ or any other objects either man-made or natural. A strobe light is often used to verify “line of sight”.

The microwave “beam” does not travel along the path in a parallel fashion, it actually spreads out in the middle of the path and it is possible that a portion of this “spread-out” beam may hit an obstruction. In some cases this may cause multi-path interference.

After the path has been checked, and the antenna height verified, attention should be given to the mounting structures for the RF head units. Sierra Digital Communications millimeterwave radios are designed for easy installation. They will mount to pipes varying in diameter from 2.5 to 4.5 inches. This will accommodate almost all mounting structures available. The structure must be relatively rigid to prevent antenna movement when it is windy. The structure must not vibrate, twist, or sway. If necessary, guy wires may be used to stabilize the structure. The rigidity required is a function of the antenna size, which determines the RF signal beam width. The larger the antenna, the narrower the beam width, and the tighter the control over vibration, twist, and sway must be.

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SECTION IV
SPECIFICATIONS

The following two pages contain a set of specifications for the Sierra Digital Communications, Inc. Model 2351S 10 Mb/s Ethernet Radio Link

Microwave: Sierra Digital Series

Applications

- ▲ Point to Point medium haul, light density LAN extensions.
- ▲ Extending communications service, including local area network and PBX extensions in a single radio link.

**MODEL 2351S
(SYNTHESIZED)**
21.2-23.6 GHz MILLIMETER
WAVE RADIO LINK
*10 Mbps: Ethernet, Ethernet
plus 1 or 2 T1 or E1*



Features & Benefits

- ▲ Flexible - Can be configured for ETHERNET only, ETHERNET+T1/E1, or ETHERNET+2T1/2E1.
- ▲ Operating frequency tunable at the Interface Unit with thumbwheel switches.
- ▲ Optional Output Power Control at the Interface Unit with thumbwheel switch.
- ▲ One year warranty - Low parts count, highly derated solid state devices make for extremely high MTBF.
- ▲ Easy installation - special mounts enable simplified, rapid installation.

Description

The 2351S series synthesized digital millimeter wave radio is a simple, low cost, 10 Mb/s, alternative to burying fiber.

For all your ETHERNET needs, the 2351S millimeter wave link affords a low cost full 10 Mb/s radio solution. The 2351S digital radio, with its included switch selectable AUI/DB15 or UTP/RJ45 interface, will connect directly into your computer or 802.3 device such as a Router, Bridge, or Repeater, because the transceiver unit is built into the radio itself. The UTP interface facilitates full duplex operation. Optional separate T1/E1 capability (1T1, 1E1, 2T1, or 2E1) is available to add low cost voice service to the same radio link.

Three units make up the 2351S system:

- A weatherproof outdoor transmitter/receiver unit including integral 12" antennas.
- Also available in separate box for use with external antennas.
- An Indoor Interface unit containing power supplies, ETHERNET transceiver, and optional T1/E1 circuitry.

Technical Specifications

TECHNICAL SUMMARY

Frequency Range	21.2 to 23.6 GHz
Standard TX/RX spacing	1200 MHz
Allocated R.F. Channel Bandwidth	50 MHz
Occupied Bandwidth	28 MHz
Modulation type	2-level FSK (FM)

STATUS AND DIAGNOSTICS

LED Status Indicators	Primary power, Link continuity
LED Alarm indicators	AGC Alarm, Tx Alarm, Rx Alarm, Frequency command error
Alignment Aids	Outdoor Unit: AGC Test Points Indoor Unit: AGC Level Meter



ORDERING INFORMATION

Synthesized LAN Radio
Model 2351S

OPTIONS (Consult the Factory)

Note that standard models will accept input voltages from 93 to 265 VAC, 50/60 Hz.

1. Add T1 Capability (LAN+T1)
2. Add E1 Capability (LAN+E1)
6. + or - 24 VDC
7. + or - 48 VDC
10. 24" External Antennas
11. Flex guide Sections to connect Antennas to RF Heads
12. Output Power Control
17. Arctic Mod to Operate Down to -45 C (Increases Power Consumption)
18. Add 2T1 Capability (LAN+2T1)
19. Add 2E1 Capability (LAN+2E1)

** In the US, operation with 12 Inch antennas is restricted to Pair numbers
D (21.825/23.025),
T (21.875/23.075),
G (21.925/23.125),
and
E (21.975/23.175).

More Specifications for 2351S*

TRANSMITTER CHARACTERISTICS

RF Source	Oscillator/ Multiplier/ Amplifier Type
Guaranteed Power Output	+17 dBm (minimum)
Power Control Option	7 steps down from max power out
Frequency Stability (-30° to +70° C)	± 0.001%
Tuning Range	Covers full band with Two (2) sets of units (One set covers upper half, one set covers lower half)
	In response to interference, radios may be tuned in 5 MHz increments at the Control Unit.

RECEIVER CHARACTERISTICS

Type - Dual Conversion Superhetrodyne	2500 & 70 MHz
Noise Figure (System)	5.5 dB (typical)
<i>Sensitivity</i>	
For 10-6 BER operating point (LAN Only)	-75 dBm
For 10-3 BER operating point (LAN + T1/E1)	-78 dBm
Maximum receiver input	-15 dBm
	(Damage will occur at +5 dBm)

12" ANTENNA CHARACTERISTICS

Type	Parabolic
Diameter	12.5 inches (31.8 cm)
Polarization	Linear
Gain (22.4 GHz)	35 dB
Front to back ratio	42 dB
Beamwidth (3 dB)	3.2°

INTERFACE PARAMETERS

Ethernet Specification (direct)	IEEE 802.3
Protocols passed	IEEE 802.3

ENVIRONMENTAL CHARACTERISTICS

	OUTDOOR UNIT	INDOOR UNIT
Ambient temperature range	-30° to +70° C	0° to +50° C
Storage & transportation	-40° to +80° C	-40° to +60° C
Humidity	up to 100% (non-condensing)	up to 95% at +50° (non-condensing)

INPUT VOLTAGE REQUIREMENTS

Power input	93 - 265 VAC
Brown-out voltage	90 VAC
Line frequency	50/60 Hz
	A six foot long power cord with a 3-prong plug is provided with the indoor unit.

TRANSMISSION DATA

System Gain	
Guaranteed for 10 ⁻⁶ BER operating point	92 dB (LAN Only)
Unfaded BER	10 ⁻¹²

POWER CONSUMPTION

Total power required per Terminal	50 Watts Maximum (100 Watts Maximum for both ends of the link)
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FCC INFORMATION

FCC rules part number	101
Frequency range	21.2 - 23.6 GHz**
Emission Designator	42M0F7D
Frequency tolerance	± 0.001%
FCC Maximum power output	0.10 watts

SIZE AND WEIGHT

	High	Deep	Wide	Wt
Outdoor RF Unit with Integrated 12" antennas (excluding mount)	15"	12"	15"	15 lb.
Outdoor RF Unit for use with external antennas (excluding mount)	10"	4.5"	8"	15 lb.
Indoor Interface Unit	19" Rack, 2U mounting space (3.5" high)			

INTERCONNECT CABLES & CONNECTORS

Cabling Between RF Head and Interface Unit

0' to 1000'	One single 50 Ohm coaxial cable (Belden 9913 or equivalent.)
Coaxial connectors	Type N
Waveguide Flange	UG 595/U (for connection to external antennas)
Ethernet conn (switch selectable)	RJ45 (UTP) or DB15 (AUI)
T1 Connectors	RJ45
E1 Connectors	BNC

FREQUENCIES

The lower half of the band is covered by one pair of units and the upper half of the band is covered by a second pair of units. Therefore, to spare all possible frequencies would require four (4) different RF Heads.

Specifications are subject to change without notice.

For more information on Telenetics' 2351 Series and other wireless products and services, contact us at:

949-455-4000 or visit
www.telenetics.com

SECTION V

PRELIMINARY INSTALLATION CONSIDERATIONS

Prior to receiving the radio equipment, there are a number of preliminary tasks, which should be completed. Proper site preparation will significantly expedite the final installation process.

1. Determine the exact sites where the radio equipment will be located.
2. Ensure that the tower or mounting structure is adequate to support the RF head unit (and the external antenna if that configuration is used), and that line of sight exists between the antenna points, please refer to Section III, Path Requirements. Note that the mounting point must be stiff enough to hold the pointing within +/- 3.2 degrees when utilizing the integral 12 Inch parabolic antennas and correspondingly tighter tolerances when using larger antennas.
3. Perform the path survey.
4. Obtain the necessary ancillary equipment (interconnect cable, connectors, etc.), and determine any special installation requirements.
5. Ensure that appropriate power is available.
6. Install the interconnect cable runs between the Outdoor RF Heads, and the Indoor Control Units, and the data network.

SECTION VI

INSTALLATION INSTRUCTIONS

General:

The Sierra Digital Series 2351S Ethernet radio link includes two terminals, each consisting of two units ...the Outdoor RF Head and the Indoor Control Unit. The 2351S RF Head is pole mounted and consists of the microwave transmitter/receiver, and, in the integral antenna version, the 12-inch parabolic antenna. In the configuration for use with external antennas, the transmitter/receiver is housed in a small box with a waveguide connection to the external antenna via a short flexible waveguide section. The Control Unit is mounted in an indoor enclosure at street level and contains the data network interface circuitry and power supplies, which power both the Control Unit and the RF Head. Input power to the link is 96-265 VAC applied at the Control Unit or, as options 24 or 48 VDC.

The RF Head is connected to the Control Unit by a single 50-Ohm coaxial cable, which may be up to 1000 feet long with Type N connectors at each end. The data input and output connections to the radio are switch selectable between a DB15, AUI interface connector, or an RJ45 UTP interface connector.

Items Required for Installation:

Tools/Test Equipment:

- 2 ea $\frac{3}{4}$ " wrench to adjust antenna elevation angle
- 2 ea Wrench sized for customer supplied U-clamp
- 2 ea Tool to install cable connectors
- 2 ea Fluke 73 series II multimeter or equivalent
- 2 ea Ethernet Packet Gen's, Netcom Syst. Model ET-1000 or equiv.
- OR** 2 ea *Laptop or Handheld Computers with appropriate software*
- 1 ea 100 MHz Oscilloscope, desirable but normally not required.
- 2 ea Handheld high intensity strobe lights to facilitate antenna pointing, desirable but not always required.

Customer Furnished items:

- 4 ea U-Clamps (2.5" to 4.5" diameter) for pole mount (2 for each RF Head with matching saddle clamps)
- As required 50-Ohm Interconnect cable and Type N connectors
- As required Cable ties

SECTION VI

INSTALLATION INSTRUCTIONS (continued)

SDC furnished items:

1 ea	“A” RF Head Unit	(Lower Freq. Transmitter)
1 ea	“B” RF Head Unit	(Higher Freq. Transmitter)
2 ea	Indoor Control Units	
2 ea	Mounting brackets (p/n 380-00062-0001)	(For integral antenna configuration)
2 ea	Mounting brackets (p/n _____)	(For external antenna configuration)

Radio Installation

1. Install 50 Ohm coaxial cables, with Male Type N connectors attached, between the RF Head locations and the Control Unit locations.
2. Proceed to install the 2351S RF Heads and Control Units. The RF head **must** be mounted the heat sink fins running vertically. Also, the screws **must** be removed from the downward-facing water drain holes. **If this is not done the unit may fill with water, and the warranty will be voided.**
 - A. In the integral antenna configuration, determine desired 2351S RF head orientation for correct antenna polarization at both ends of the link. Make sure the feed polarization is the same at both ends. In the external antenna configuration, mount the antenna separately to provide the proper antenna polarization.
 - B. In the integral antenna configuration, mount RF head so both horizontal and vertical-mounting angles can be easily adjusted during the antenna alignment process. In the external antenna configuration, make sure the antenna mounting brackets allow sufficient azimuth and elevation movement.
 - C. Connect interconnect cables to the RF Head Unit at each end of link. Apply power to the RF Head Units through the Control Units at both ends of the radio link. Open the RF head unit. LED indicators should be on. If no LED's are on, check the connections for AC (or DC) power.

SECTION VI

INSTALLATION INSTRUCTIONS (continued)

- D. Antenna alignment requires a person with a communication device (Cellular Phone, Walkie Talkie, etc.) at each end of the link. Visually align antennas at each other. Hold one antenna still. In the integral antenna configuration, or the external antenna configuration, place the ground lead of the multimeter into the black tip jack on the RF head and the red lead of the multimeter into the red tip jack on the RF head. Monitor the AGC voltage at the far end and move the near end antenna very very slowly from side to side to find the maximum AGC voltage. There may be more than one peak, (but only one large one) so make sure the arc is large enough to ensure that the maximum voltage is achieved. Tilt the antenna a little up or down with each horizontal sweep. After an AGC of +4 volts or more is established at each end; adjust antennas very slightly left to right and up to down to find the maximum AGC voltage at both ends.
3. Attach test equipment and test the Ethernet data channels in both directions. The Link should operate correctly. If not, check wiring between test equipment and radio and switch settings and level adjustments on test equipment.
4. The installation is complete and the radio link may be inserted into the customer's data network.

TELENETICS, INC.
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Frequency Select Switch Settings for Various Operating Frequencies

LOWER HALF OF THE FULL 23 GHZ BAND

Frequency Pair	"B" Head		"A" Head	
	Higher Frequency of Pair	Lower Frequency of Pair	Higher Frequency of Pair	Lower Frequency of Pair
Frequency Pair	Frequency Start at 22.405 GHz	Switch Setting 500s - 50s - 5s	Frequency Start at 21.205 GHz	Switch setting 500s - 50s - 5s
H	22.425	0 - 0 - 4	21.225	0 - 0 - 4
I	22.475	0 - 1 - 4	21.275	0 - 1 - 4
J	22.525	0 - 2 - 4	21.325	0 - 2 - 4
K	22.575	0 - 3 - 4	21.375	0 - 3 - 4
L	22.625	0 - 4 - 4	21.425	0 - 4 - 4
M	22.675	0 - 5 - 4	21.475	0 - 5 - 4
N	22.725	0 - 6 - 4	21.525	0 - 6 - 4
O	22.775	0 - 7 - 4	21.575	0 - 7 - 4
P	22.825	0 - 8 - 4	21.625	0 - 8 - 4
Q	22.875	0 - 9 - 4	21.675	0 - 9 - 4
R	22.925	1 - 0 - 4	21.725	1 - 0 - 4
S	22.975	1 - 1 - 4	21.775	1 - 1 - 4

UPPER HALF OF THE FULL 23 GHZ BAND

Frequency Pair	"B" Head		"A" Head	
	Higher Frequency of Pair	Lower Frequency of Pair	Higher Frequency of Pair	Lower Frequency of Pair
Frequency Pair	Frequency Start at 23.005 GHz	Switch Setting 500s - 50s - 5s	Frequency Start at 21.805 GHz	Switch setting 500s - 50s - 5s
D	23.025	0 - 0 - 4	21.825	0 - 0 - 4
T	23.075	0 - 1 - 4	21.875	0 - 1 - 4
G	23.125	0 - 2 - 4	21.925	0 - 2 - 4
E	23.175	0 - 3 - 4	21.975	0 - 3 - 4
C	23.225	0 - 4 - 4	22.025	0 - 4 - 4
U	23.275	0 - 5 - 4	22.075	0 - 5 - 4
V	23.325	0 - 6 - 4	22.125	0 - 6 - 4
B	23.375	0 - 7 - 4	22.175	0 - 7 - 4
X	23.425	0 - 8 - 4	22.225	0 - 8 - 4
Y	23.475	0 - 9 - 4	22.275	0 - 9 - 4
F	23.525	1 - 0 - 4	22.325	1 - 0 - 4
A	23.575	1 - 1 - 4	22.375	1 - 1 - 4

TELENETICS, INC.
Model 2351S Millimeterwave 10 Mb/s Ethernet Radio Link

Frequency Select Switch Settings for the Operating Frequencies in Australia

		"B" Head		"A" Head	
		Higher Frequency of Pair		Lower Frequency of Pair	
Frequency Pair	Frequency Start at 23.2435 GHz	Switch Setting 350s - 35s - 3.5s	Frequency Start at 22.0115 GHz	Switch Setting 350s - 35s - 3.5s	
W1	23.254	0 - 0 - 3	22.022	0 - 0 - 3	
W2	23.282	0 - 1 - 1	22.050	0 - 1 - 1	
W3	23.310	0 - 1 - 9	22.078	0 - 1 - 9	
W4	23.338	0 - 2 - 7	22.106	0 - 2 - 7	

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Line Build-Out Switch Settings for Various RF Head to Control Unit Separations

Head to Control Unit Separation	Switch # 1	Switch # 2
0 to 250 Feet	OFF	OFF
250 to 500 Feet	ON	OFF
500 to 750 Feet	OFF	ON
750 to 1,000 Feet	ON	ON

TELENETICS, INC.
Model 2351S Millimeterwave 10 Mb/s Ethernet Radio Link

Transmit Power Control Switch Settings for Various RF Radiated Power Settings

Three-gang switch located between the
Frequency Select Switches and the Line Build Out Switch

Transmit Power (Steps are approx. 3 db)	Switch # 1 (On left) (Four steps)	Switch # 2 (In center) (Two steps)	Switch # 3 (On right) (One step)
Maximum Power	On – Up	On – Up	On – Up
Max less 3 db	On – Up	On – Up	Off – Down
Max less 6 db	On – Up	Off – Down	On – Up
Max less 9 db	On – Up	Off – Down	Off – Down
Max less 12 db	Off – Down	On – Up	On – Up
Max less 15 db	Off – Down	On – Up	Off – Down
Max less 18 db	Off – Down	Off – Down	On – Up
Minimum Power	Off – Down	Off – Down	Off – Down

Frequency Select Switch Settings for Various Operating Frequencies

For BORDERCOM PO # 25050

LOWER HALF OF THE FULL 23 GHZ BAND

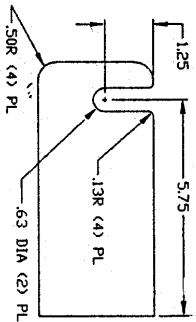
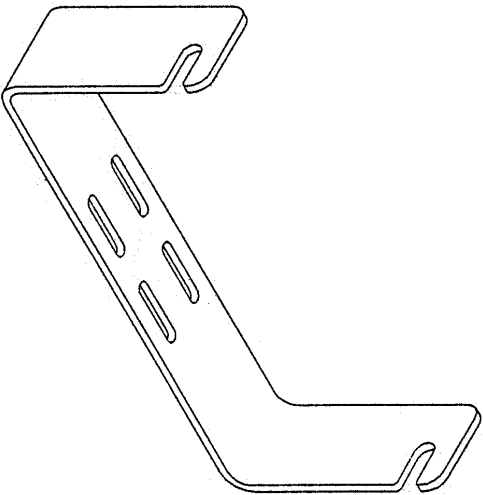
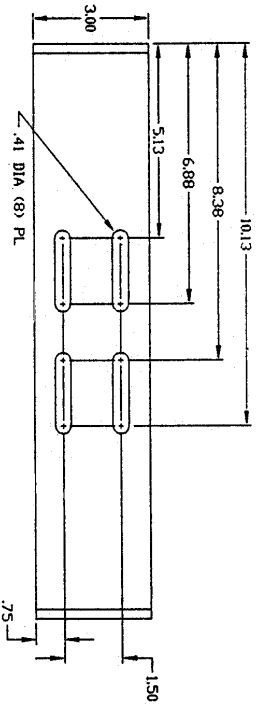
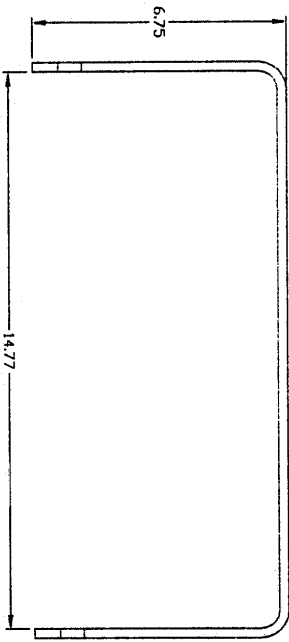
Authorized Frequency Pair	"B" Head		"A" Head	
	Frequency Start at 22.440 GHz	Switch Setting 500s - 50s - 5s	Frequency Start at 21.205 GHz	Switch setting 500s - 50s - 5s
Between 22.7955 and 22.8235	22.795	0 - 7 - 1		
	22.800	0 - 7 - 2		
	22.805	0 - 7 - 3		
	22.810	0 - 7 - 4	← Factory Setting	
	22.815	0 - 7 - 5		
	22.820	0 - 7 - 6		
Between 21.5635 and 21.5915			21.560	0 - 7 - 1
			21.565	0 - 7 - 2
			21.570	0 - 7 - 3
		Factory Setting →	21.575	0 - 7 - 4
			21.580	0 - 7 - 5
			21.585	0 - 7 - 6
			21.590	0 - 7 - 7

IMPORTANT NOTE: Switch Settings at both ends of the link must be exactly the same . . . for example: the link shipped with "B" Head set to 0-7-4 and "A" Head set to 0-7-4 (approximately the center of the authorized band). This ensures that the Transmitter at one end and the Receiver at the other end are tuned to the same frequency.

TELENETICS, INC.
Model 2351S Millimeterwave 10 Mb/s Ethernet Radio Link

SECTION VII
INSTALLATION DRAWINGS

REVISIONS			
LTR	ECO	DESCRIPTION	DATE
D	00293	CHG THK	DAS
E		CHG THK	3-14-94



- NOTES (UNLESS OTHERWISE SPECIFIED)
1. MATERIAL - AL 5052-H32, .25 THK
 2. ALL DIMENSIONS IN INCHES
 3. TOLERANCE - XXXX.XX
 4. MINIMUM BEND RADIUS: BREAK ALL SHARP EDGES
 5. FINISH - CHEMICAL FILM PER MIL-C-5541 TYPE I, GRADE C, CLASS S, CLEAR

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	REV: E	FILE: 00062E.DWG	SCALE: 1/2
			SHEET 1

TELENETICS, INC.
Model 2351S Millimeterwave 10 Mb/s Ethernet Radio Link

SECTION VIII

LIMITED WARRANTY

Seller warrants to the Buyer that all Seller goods (equipment and component parts) when sold are free from defects in materials and workmanship under normal use and service for a period of one year from the date of shipment, as evidenced by Seller's or its agent's packing list or transportation receipt. Seller's obligation under this warranty shall be limited to the repair or replacement of goods. No person, including any dealer, agent or representative of Seller, is authorized to assume for Seller any other liability on its behalf.

Seller has no obligation or responsibility for goods, which have been repaired or altered by other than Sellers employees.

This warranty is the only warranty made by seller and is expressly in lieu of all other warranties express or implied, and warranties of merchantability and fitness for any particular purpose are specifically excluded.

WARRANTY CLAIM PROCEDURES

Defective goods must be returned, transportation charges prepaid, to seller for correction. Seller will pay return transportation charges for warranty repair. Upon redelivery of goods corrected under this warranty, the repaired or replaced portions shall be subject to this warranty for a period of 90 days or until expiration of the original warranty, whichever is later. All claims of failed or defective goods must be in writing and received by Seller within the specified warranty period. Seller will provide Buyer a return authorization number as authority to return the goods and for use in monitoring repair status.

Repair or replacement of defective goods will be at Seller's discretion and for the Buyer's account when the cause of failure is determined by Seller's examination to be misuse, mishandling or abnormal conditions of operation. In such event a firm price quotation for correction of the goods may be submitted to the Buyer. No repair or replacement work will be initiated prior to receipt of the Buyer's written authorization to proceed and approval of price, except as may be necessary to complete Seller's examination of the goods. If returned goods are determined not to be defective or if the Buyer elects not to authorize correction at its expense of goods not covered by its warranty, the Seller may charge a reasonable amount for such evaluation. Any amounts due Seller under these conditions will be subject to the same payment terms as the original sale. The Buyer will not recover from Seller by offset, deduction or otherwise, the price of any goods returned to Seller under this warranty.

REPAIR AND RETURN PROCEDURE

A return authorization number must be obtained from Telenetics before any items will be accepted for repair or return. Please contact the Telenetics Customer Service organization at (916) 624-7313 to obtain this authorization number. When contacting Customer Service, you will need your Model number, Serial number, a Purchase Order number (if out of warranty), a responsible technical contact, and a description of the problem. Please have this information available prior to calling.

SECTION IX

GLOSSARY OF MICROWAVE RADIO TERMS

This glossary of microwave radio terms is offered in the belief that it will aid in the understanding of the application of Telenetics microwave radios.

A.G.C.

Automatic Gain Control voltage, which indicates the relative signal strength of the microwave carrier, used to align the RF head during installation; also useful in determining the status of the microwave link.

A.U.I.

Attachment Unit Interface: The connector (DB-15) on an Ethernet router or bridge that provides the interconnection point for the SDC Ethernet radio system.

ALARM

An indication of an error condition.

AUXILIARY SUBCARRIER

An extra carrier for a specialized circuit.

BANDWIDTH

The portion of the frequency spectrum, expressed in Hertz, required for the transmission of one or more signals.

BASEBAND (BB)

The band of frequencies occupied by the signal before it modulates the carrier (or subcarrier) frequency.

BIT ERROR RATE (BER)

The ration of erroneous bits to total bits received in a specified measurement interval;
Equivalently, the bit errors per second divided by the data rate in bits per second.

CARRIER

A high frequency signal, which may be varied from a known reference by modulation.

C.C.I.R. (International Radio Consultative Committee)

International Standards Committee covering the radio transmission of information; a committee of the International Telecommunications Union (ITU) Geneva Switzerland.

CHANNEL

The pair fo frequencies used by the two RF heads within a link to transmit data between them.

CHANNEL BANK

In PCM voice equipment, the channel bank performs six operations on the voice channels.

- a) Transmit direction
 1. Sampling Time Division Multiplexing
 2. Compressing
 3. Encoding into binary numbers
- b) Receive direction
 1. Decoding
 2. Expanding
 3. Gating

The Channel Bank must also detect and transmit signaling information for each channel, transmit framing information to the receiving terminal so that the time slots allocated to each channel can be identified, and transmit alarm signals to the far terminal during alarm conditions.

E1 SIGNAL

European CCIT standard for 2.048 Mb/s digital signal carrying 30 PCM voice channels or data.

ETHERNET

Was co-developed by Digital Equipment Corp. (DEC), Intel and Xerox more than twenty years ago. In 1983, the IEEE committee adopted the original specification. Creating the 802.3 standard. It is by far the most widely installed and support network to date.

GUNN DIODE

The high frequency device that generates the signal in an SDC radio.

IEEE 802.3

This standard defines how a device accesses the Ethernet network and the speed at which the network operates. The accessing scheme dictated by the IEEE 802.3 is the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) method.

INTERFACE UNIT

The ground level equipment used interface between the users equipment and the RF head; contains a power supply and interface board(s).

LED

Light Emitting Diode; a solid state lamp used to indicate status.

LINK

Two RF heads or antennas, separated by some distance, which communicate with each other.

T1 SIGNAL (DS-1)

Bell System terminology for the 1.544 Mb/s digital signal carrying 24 PCM voice channels or data. A T1 line carries DS-1 signal.

MODEM

A contraction of modulator-demodulator

MULTIPLEXING

The subdivision of a transmission facility into two or more channels.

PATH

The physical airspace between the two antennas.

PULSE CODE MODULATION (PCM)

An encoding rather than a modulation technique in which quantized samples of analog information are buffered and retimed. Digital data are transmitted in the form of binary words, each consisting of a fixed number of bits. These PCM data words are arranged in a single serial bit stream by the data source and fed to the communications channel in continuous uniformly timed fashion. Normally word identification bits and synchronization bits are mixed with the data words in a regular and predetermined pattern.

R.F. HEAD (HEAD)

In the case of the 31 GHz unit, a pole mounted transmitter/ receiver/ antenna assembly. In the case of the 23 GHz and 18 GHz units, the antenna is not supplied.

SUMMARY ALARM

A single alarm that indicates that one of several alarms has occurred may be tied to a common office alarm.

TRUNK

A channel that connects switching centers or exchanges.

2351S +T1/ E1/ 2T1 Application Notes

LAN LAN can be either AUI Half Duplex or Full Duplex 10 Base T by using the selector switch on the back of the Indoor Unit. Move the switch toward the desired connector. DB 15 for AUI, RJ45 for 10 Base T.

T1/ E1 The connectors for T1/ E1 are located on the back of the Indoor Unit. Standard RJ45 for T1, BNC for E1. Coding and equalization are set with S1, located on the back of the Indoor Unit, lower right. ON=DOWN. Use the settings on Table 12 for best performance.
S1#1 Controls AMI/ B8ZS Coding.
ON=AMI
OFF=B8ZS/ HDB3 (E1)
The factory setting are as follows:

S1#1---- OFF
S1#2---- OFF
S1#3---- OFF
S1#4---- ON
S1#5---- OFF

Note that these settings denote a system using **B8ZS** Coding Short Haul.

2351S +T1/ E1/ 2T1 APPLICATION NOTES

LED EXPLANATION

Power	Green --- Indoor Unit AC Power Present
LAN Link	Green --- MUX to LAN Connection OK
LAN TX	Green --- LAN Packets are being sent
LAN RX	Green --- LAN packets are being received
Link	Green --- Indoor and outdoor units are communicating
FSE	Red --- Improper Frequency selected. Check Freq. Settings
MUX Sync	Red --- MUX not communicating
AGC	Red --- Signal level below -75 db
AMI	Green --- On when AMI Selected
B8ZS/ HDB3	Green --- On when B8ZS/ HDB3 Selected
RX Alarm	Red --- RX Synthesizer/ Receiver Fault
TX Alarm	Red --- TX Synthesizer/ Transmitter Fault
Data 1	Green --- On when T1 / E1 signal present
Data 2	Green --- On when T1 / E1 signal present

LED INDICATORS

Power	LAN Link	LAN TX	LAN RX
Link	FSE	MUX Sync	AGC
AMI	B8ZS	RX Alarm	TX Alarm
CH 1 Data	CH 2 Data		

T-1 Switch Settings

See Table 12

	S1#1	S1#2	S1#3	S1#4	S1#5
	ON=	ON=	ON=	ON=	ON=
	AMI	“0”	“0”	“0”	“0”
	B8Zs/	EC#	EC#2	EC#3	EC#4
		1			
	AMI				

Table 12: Equalizer Control Input Settings

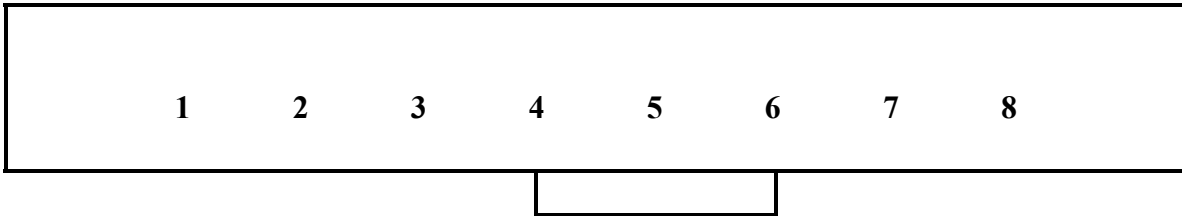
EC4	EC3	EC2	EC1	Function	Pulse	Cable	Gain	Coding
0	0	0	0	T1 Long Haul	0.0 db pulse	100 ohm TP	36 db	B8ZS
0	0	1	0	T1 Long Haul	-7.5 db pulse	100 ohm TP	36 db	B8ZS
0	1	0	0	T1 Long Haul	-15 db pulse	100 ohm TP	36 db	B8ZS
0	1	1	0	T1 Long Haul	-22.5 db pulse	100 ohm TP	36 db	B8ZS
0	0	0	1	T1 Long Haul	0.0 db pulse	100 ohm TP	26 db	B8ZS
0	0	1	1	T1 Long Haul	-7.5 db pulse	100 ohm TP	26 db	B8ZS
0	1	0	1	T1 Long Haul	-15 db pulse	100 ohm TP	26 db	B8ZS
0	1	1	1	T1 Long Haul	-22.5 db pulse	100 ohm TP	26 db	B8ZS
1	0	0	0	E1 Short Haul	ITU G. 703	120 ohm TP/ 75 ohm Coax	12 db	HDB3
1	0	0	1	E1 Long Haul	ITU G. 703	120 ohm TP	43 db	HDB3
1	0	1	0	E1 Long Haul	ITU G. 703	120 ohm TP/ 75 ohm Coax	43 db	HDB3
1	0	1	1	T1 Short Haul	0-133 ft/ 0.6 db	100 ohm TP	12 db	B8ZS
1	1	0	0	T1 Short Haul	133-266 ft/ 1.2 db	100 ohm TP	12 db	B8ZS
1	1	0	1	T1 Short Haul	266-399 ft/ 1.8 db	100 ohm TP	12 db	B8ZS
1	1	1	0	T1 Short Haul	399-533 ft/ 2.4 db	100 ohm TP	12 db	B8ZS
1	1	1	1	T1 Short Haul	533-655 ft/ 3.0 db	100 ohm TP	12 db	B8ZS

1. ECI sets the receive equalizer gain (EGL) during T1 long haul operation.
2. When enabled

2351S +T1 Application Notes

T1 Connector Pin Out

Front View



1. Data Into Radio Ring
2. Data Into Radio Tip
3. Not Used
4. Data out of Radio Ring
5. Data Out of Radio Tip
6. Not Used
7. Not Used
8. Not Used