

411- 1333 -203

Reunion

CTR 28 GHz

Sub-Bands 28-01P1, 28-01P2 and 28-07P

Outdoor Microwave Transceiver

Installation Guide

Release 1.2 March 1999



NORTEL
NETWORKS

Reunion

CTR 2800

Outdoor Microwave Transceiver Installation Guide

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- Subject to change without notice

About this guide

Purpose

This guide provides the information required to install and operate the CTR 28 GHz outdoor microwave transceiver.

The CTR 28 GHz is one of the Radio Frequency (RF) products that constitute a Nortel Reunion product line. The associated products include the following types of cell site equipment:

- broadband transmitters
- broadband receivers
- broadband repeaters
- broadband transceivers

Audience

The audience for this document are those who install and operate the CTR 28 GHz. To take full advantage of this guide, you should have a basic understanding of microwave fundamentals and know how to use microwave test equipment.

Organization

This Guide is divided into seven sections:

- *Product Overview* describes the CTR 2800's components and theory of operation.
- *Pre-Installation* describes the basics of handling the equipment upon arrival.
- *Reunion Safety Standards* provide a quick review of general safety guidelines.
- *Installing the CTR 2800* explains how to physically install the transceiver.
- *CTR 2800 Maintenance* describes basic maintenance procedures to ensure that the transceiver is operating correctly.
- *CTR 2800 Diagnostic Reference Chart* provides a quick troubleshooting guide.
- *Grounding and Surge Protection* explains basic grounding and lightening protection requirements and methods for the Reunion equipment.
- *List of terms* provides a quick reference to terms and acronyms found in the guide.

Documentation Suite

This Reunion Release has a suite of fifteen documents:

Reunion System Overview, 411- 1343 - 010

Reunion Network Node Equipment Installation Guide, 411- 1313 - 200

Reunion NIU 6054 Network Interface Unit Installation Guide,
Release 1.2, 411- 1323 - 201

Reunion NIU 6154 Network Interface Unit Installation Guide,
Release 1.2, 411- 1323 - 202

Reunion NIU 5008 Network Interface Unit Installation Guide,
Release 1.2, 411- 1323 - 203

Reunion BTR 28 GHz Outdoor Microwave Transceiver Installation Guide,
Release 1.2, 411- 1333 - 202

Reunion CTR 28 GHz Outdoor Microwave Transceiver Installation Guide,
Release 1.2, 411- 1333 - 203

Reunion BTR 38 GHz Outdoor Microwave Transceiver Installation Guide,
Release 1.2, 411- 1333 - 204

Reunion CTR 38 GHz Outdoor Microwave Transceiver Installation Guide,
Release 1.2, 411- 1333 - 205

Reunion Redundancy Switching Matrix Installation Guide, Release 1.2,
411- 1313 - 201

Reunion Procedures Reference Manual, 411-1343-400

DSS for the NNE User Guide, 411-1343-501

Reunion DSS 1000 for the NIU 6054 User Guide, 411-1343-502

Reunion DSS 1000 for the NIU 6154 User Guide, 411-1343-503

Reunion DSS 1000 for the NIU 5008 User Guide, 411-1343-504

Customer Support

In addition, Nortel Networks Broadband Wireless Access (BWA) provides 24-hour customer service and technical support to ensure your service operation is trouble-free. If you have questions or need technical support, contact Nortel Networks Broadband Wireless Access at the following telephone numbers:

- In the USA and Canada, call 972-BWA-ETAS/972-292-3827
- Fax (204) 631-2475

Write Nortel Networks at:

- Nortel Networks
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CTR 28 GHz Release 1.2

Product Overview

The CTR 28 GHz outdoor transceiver is a customer premise transceiver designed to operate in the Receiver (RX) 27.5485 to 27.7485 GHz and Transmitter (TX) 28.5565 to 28.7565 GHz frequency bands. It is a Nortel Reunion product which operates in conjunction with base station products. It is compatible with Reunion's Release 1.2 equipment.

The CTR 28 GHz transceiver is mounted on a pole or a building. It features a small size and low noise characteristics. The combination of digital modulation and low-loss mounting results in an efficient and low-cost installation. It has a high-stability reference oscillator.

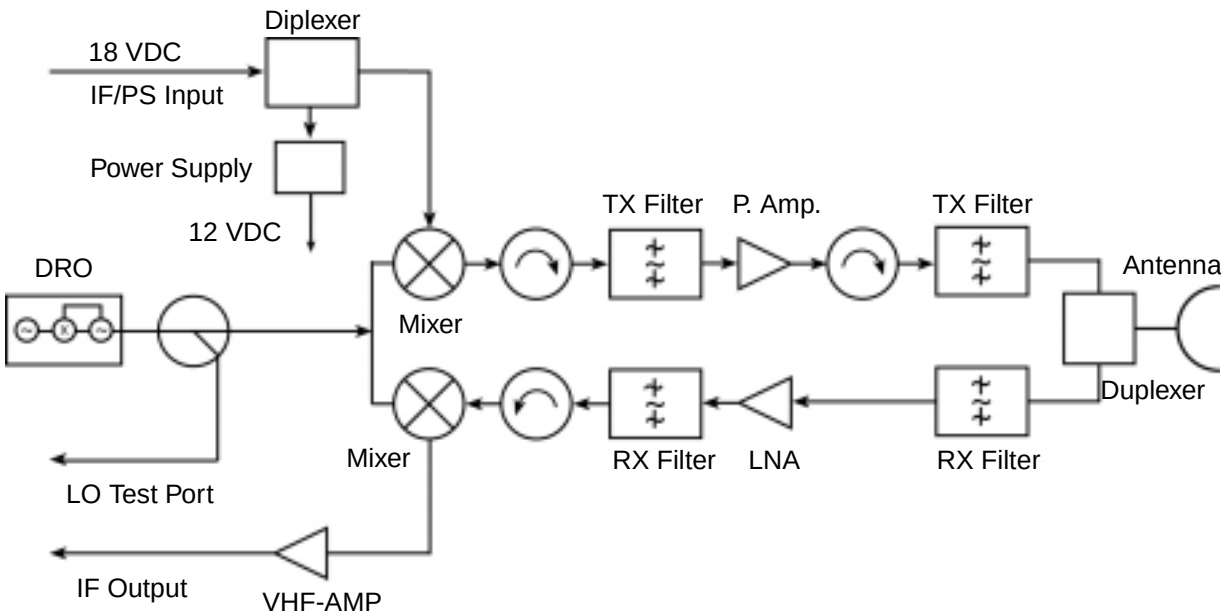
The CTR 28 GHz features the following attributes:

- light-weight and compact packaging designed for mounting outdoors
- solid-state upconverter and downconverter designs
- high frequency stability over a wide temperature range
- standard 18 VDC input for use around the world

The transceiver comprises the following components:

- diplexer
- power supply
- mixers
- local oscillator
- isolators
- bandpass filters
- low noise amplifier (LNA)
- power amplifier
- duplexer
- antenna

Figure 1-1
CTR 28 GHz Block Diagram



How the CTR 28 GHz Works

This section provides an overview of the theory of operation for the CTR 28 GHz outdoor transceiver.

Its installation on a pole or building enhances transmitting and receiving capabilities by avoiding the need for long expensive waveguide runs. This technique minimizes the power loss from waveguide attenuation, which results in a highly efficient, compact and cost-effective installation. Minimum maintenance is required.

The high-stability reference oscillator ensures that the transmitter and receiver remain on frequency over a wide operating range.

The radio uses a common input cable to carry the 18 VDC and transmit intermediate frequency (IF) signals. The DC power supply and the IF signals are separated by the diplexer in the radio. The radio uses a common antenna for both the transmit and receive microwave signals.

1. The CTR transceiver's input coaxial cable carries the IF signals and the 18 VDC power supply to the diplexer. The diplexer distributes the DC power to the power supply unit and interfaces with the mixer for the IF signals.
2. The 450-650 MHz transmit IF signals enter the mixer which upconverts the signals to the 28.5565-28.7565 GHz band for the transmit path. The received 27.5485-27.7485 RF band is downconverted to a receive signal in the 358-558 MHz range.
3. The local oscillator (LO) provides local oscillator signal to the mixer. The LO uses a phase-locked dielectric resonance oscillator (DRO) with an oven controlled crystal oscillator (OCXO).
4. The bandpass filters remove the undesired sideband signals, in both the transmit and receive paths.
5. The upconverted signal is fed into the power amplifier which provides the required gain to the microwave signals. The power amplifier output is connected to the antenna through the filter and duplexer.
6. The received RF simultaneously passes through the antenna, the band pass filter, the Low Noise Amplifier (LNA), and enters the downconverter mixer.

There are three connectors on the outside of the transceiver case:

- The IF (TX) and power supply input uses a Type N female jack
- The IF (RX) output uses a Type N female jack
- Test Port uses SMA jack

CTR 28 GHz Specification

Table 1: CTR 28 GHz Specifications

TX	IF Input	RF Output
Frequency Range 28-01P1	538-650 MHz	28.5565-28.6685 GHz
28-01P2		28.6405-28.7525 GHz
28-07P		28.2-28.35 GHz
Output Level (P1dB)		≥ 21 dBm, -40° to $+30^{\circ}\text{C}$ ≥ 20.7 dBm, $+31^{\circ}$ to $+50^{\circ}\text{C}$ ≥ 20.2 dBm, $+51^{\circ}$ to $+55^{\circ}\text{C}$
Output Level (IP3)		> 28 dBm, min.
Input Impedance	50 Ohms	
Input/Output Connector	N Type Female	WR-28 Cover Flange
Input VSWR	1.8:1, max	1.6:1, max (or 13 dB)
Gain (not including antenna)		22 dB
Gain Stability		± 2.0 dB over temperature
Gain Flatness		± 1 dB over bandwidth
Frequency Stability		± 2 ppm, $(-40^{\circ}$ to $+55^{\circ}\text{C})$
RX	RF Input	IF Output
Frequency Range 28-01P1	27.5485-27.6605 GHz	358-470 MHz
28-01P2	27.6325-27.7445	
Nominal Input Level	- 26 dBm	
Output Impedance		50 Ohms
Input/Output Connector	WR-28	N Type Female
Output VSWR	1.6:1, max (or 13 dB)	1.8:1, max
Gain (not including antenna)		34 dB, minimum
Gain Stability		$< \pm 3.0$ dB over temperature
Gain Flatness		$< \pm 1.5$ dB over bandwidth
Noise Figure		< 8 dB, -40° to $+30^{\circ}\text{C}$ < 8.3 dB, $+31^{\circ}$ to $+50^{\circ}\text{C}$ < 8.7 dB, $+51^{\circ}$ to $+55^{\circ}\text{C}$
Frequency Stability		$< \pm 2.7$ ppm, $(-40^{\circ}$ to $+55^{\circ}\text{C})$
Test Port		-20 SMA

Antenna	CTR
Frequency	27.5-29.5 GHz
Gain	35 dBi, minimum
TX / RX wave polarity	linear, single pole
Beam Width (3dB)	2.6°
Diameter	1' (30.5 cm)
Power Supply	CTR
Input Voltage	18 VDC, 3A, max diplexed with TX cable
Input Current	<3 Amp
Input Power	54 Watts, maximum
Environmental	CTR
Humidity	100% condensing
Altitude	10,000 feet
Operating Temperature	-40° to +55°C
Storage Temperature Range	-45° to +85°C
Mechanical	CTR
Size (Height x Diameter)	15.2" x 12.4" (38.5 x 31.5 cm)
Weight without brackets	7 lbs. (3.2 KG)

Note: Use the following formula to calculate the converted frequency:

$$\text{TX: } f_{\text{RF OUT}} (\text{GHz}) = f_{\text{IF IN}} (\text{GHz}) + 28.1065$$

$$\text{RX: } f_{\text{IF OUT}} (\text{GHz}) = 28.1065 - f_{\text{RF IN}} (\text{GHz})$$

CTR 28 GHz Component Descriptions

Diplexer / Power Supply

The diplexer separates the IF input signals and the DC power supply. The isolation between the IF path and the power supply path is more than 45 dB. A transient voltage protector on the board helps to protect the transceiver from possible lightning damage.

The 18 VDC power from the diplexer is first regulated to 12 VDC for all the modules.

Mixer

The CTR 28 GHz uses a third harmonic mixer. The mixer uses a 9.368833 GHz local oscillator (LO) signal to convert the IF input signals to the 27.5485-27.7485 GHz microwave frequency band. The same LO is used to downconvert the incoming microwave signals to the receive IF frequency band.

Dielectric Resonance Oscillator (DRO)

The Dielectric Resonance Oscillator is equipped with a OCXO reference oscillator. When the DRO is phase-locked, it provides a 9.368833 GHz microwave frequency stability derived from the reference crystal.

When the DRO is phase-locked, the phase-locked voltage at the test port on the DRO can vary from 3 VDC to 10 VDC. The voltage at the alarm test port is approximately 5 VDC.

When the DRO is unlocked, the phase-locked voltage becomes an oscillating ramp wave. The voltage at the alarm test port goes down to 0 VDC.

Isolator

Three isolators provide adequate return loss in the CTR 28 GHz. Each isolator's maximum forward insertion loss is 0.5 dB, and its return loss is greater than 18 dB.

Bandpass Filter

The bandpass filter removes the undesired sideband elements and LO leakage, and passes the required sideband signals.

Low Noise Amplifier

The low noise amplifier (LNA) provides gain in the receive path and amplifies the received microwave signals to the mixer. The gain and noise figure of the LNA are chosen to maximize the overall dynamic range and noise performance of the CTR 28 GHz receiver section.

Power Amplifier

The power amplifier provides gain in the transmit path. It boosts the signals in the 28.5565-28.7565 GHz frequency range to the required level. The amplifier is a solid state amplifier that has high linearity within a high output power range.

Duplexer

The CTR 28 GHz uses the duplexer to combine and separate the transmit and receive RF signals, allowing use of a common antenna for receiver and transmitter.

Antenna

The CTR 28 GHz uses a reflector antenna to transmit and receive RF signals. The transmitting signal polarity is defined as the direction of CTR 28 GHz polarity.

Note: V= vertical TX wave polarization

H= horizontal TX wave polarization

Note: Lightning arrestors are not supplied with the CTR transceiver.

Pre-Installation

Prevention of Access

Allow only authorized personnel to access the equipment. Install the equipment in a restricted-access location or similar environment. Failure to prevent unauthorized user access invalidates the equipment warranty.

Unpacking Shipment

Use the following steps to unpack and inspect the shipment of Nortel Broadband Wireless Access equipment:

1. Copy adequate Inventory Forms
2. Check each package against the order form and packing slip to ensure that all components are received
3. Check each package for signs of damage
4. Open the package and closely inspect all components for obvious signs of damage
5. Know exactly where you are going to place the equipment, before removing them from the package
6. Carefully remove the equipment from the packaging
7. Save packing material for future use
8. Be aware of electrostatic discharge devices (ESD) requirements when handling BWA equipment



Note: For more information, refer to the Electronic Industries Association (EIA) standard, *Requirements for Handling Electrostatic-Discharge-Sensitive Devices (ESDS)*, EIA-625, as well as local and national standards.

Reunion Safety Standards

Safety and safety considerations are important while using Nortel Broadband Wireless Access equipment.

Safety Disclaimer

The safety standards discussed in this guide cannot address all safety problems associated with their use or all applicable regulatory requirements. The customers are responsible for establishing appropriate safety and health practices and for determining the applicability of regulatory limitations before their use.

General Safety

Ensure that installation personnel are trained on CPR (Cardio Pulmonary Resuscitation), as well as on local, regional and national safety standards.

When working on Nortel Broadband Wireless Access equipment, follow these guidelines:

- Keep your work site clean and free of clutter.
- Wear close fitting clothing.
- Remove jewelry such as rings, bracelets, or watches.
- Where it is possible to dislodge small pieces, wear eye protection.
- Place equipment or cabinets on level surfaces.
- Wear a safety belt when climbing a tower and installing equipment on a tower.
- Work in pairs so that you have someone to help in case of an emergency.

Electrical Safety

Locate the main power shut-off switch controlling the equipment you are working on. This is important in the event of an accident, so you can quickly cut the power.

Disconnect all power when working on power supplies.

In an emergency (electrocution):

- shut the power off.
- have someone call for emergency medical assistance
- start CPR



Warning

Do not move in front of the antenna, nor look directly into the face of the antenna when the CTR 28 GHz is running.

Installing the CTR 28 GHz

Installation involves three separate operations:

- mounting bracket assembly
- installing the tower equipment
- installing the indoor equipment

For information about installing the antenna(s) and such aspects as line of sight, antenna mast spacing, coverage angle, etc., refer to the Network Engineering Package and the Design Document.

Mounting Bracket Assembly

It is recommended that you assemble the mounting brackets on the ground prior to mounting them on the pole. See Figures 1-7, 1-8, and 1-9.

Tools

You require the following tools to assemble the brackets:

- i. Allen Key
- ii. two open ended wrenches or a wrench and a socket

Steps

- i Bolt the two side supports onto either side of the 'U bracket support.'
- ii Align the holes in the U bracket with the holes in the 'base support. Ensure that the flat surface of the base support is in the upward position, while the curved/concave surface faces downward.
- iii Bolt the assembled U bracket support to the narrow end of the 'base support.'
- iv Position the assembled pole mounting hardware on the mounting pole at the point you want to mount the CTR.
- v Bolt the assembled mounting hardware to the two saddle brackets using the supplied 6" threaded bolts. Ensure that the bracket is securely tighten and correctly positioned on the mounting pole before attaching the radio.

Installing the Tower Equipment

Install the CTR 28 GHz microwave transceiver as follows:

1. Mount the CTR 28 GHz to a stable pole using the supplied mounting brackets. See Figures 1-7, 1-8, and 1-9.

The mounting brackets accommodate poles with outside diameters from 2" to 4.5". See Figures 1-5 and 1-6.

The CTR 28 GHz requires 18 VDC (3A) power supply unit.

2. Connect the IF/power supply input cable to the CTR's N-type IF IN 18 VDC port. See Figures 1-3 and 1-4.
3. Connect the RX cable from the CTR's N-type IF OUT port to the RMM RX port. See Figures 1-3 and 1-4.
4. Seal all connections using Coax-Seal® or equivalent, cold shrink or hot shrink tubing.
5. Ground all RF cables at the recommended spacing intervals. (Refer to tower and cable manufacturers' specifications).
6. Ensure that all feed lines are securely attached to the support structure. Plan for drip (service) loops on all cables.



Caution

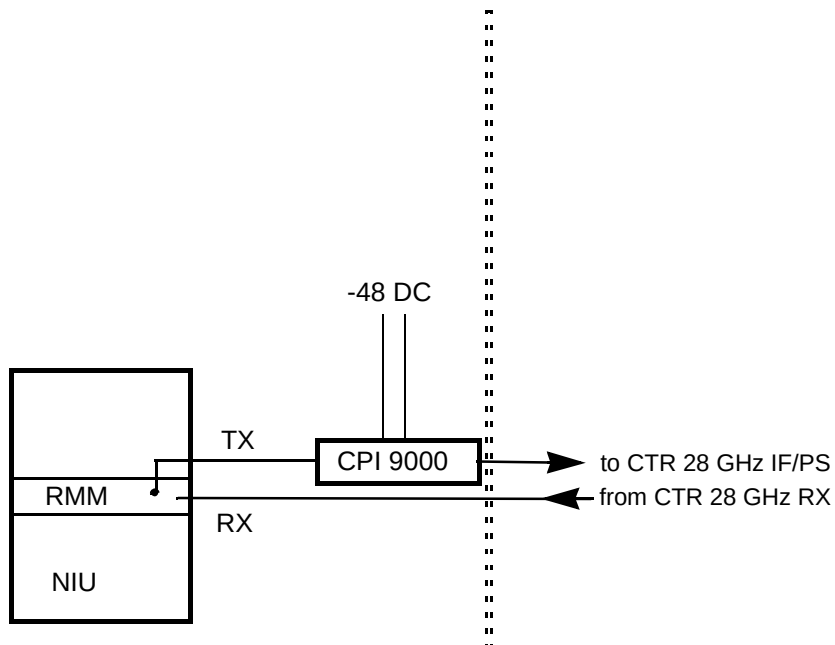
Do not turn on the power supply until the installation is complete. After you install the equipment, check the cable connections.

Installing Indoor Equipment (NIU 5008 only)

Install the NIU 5008 equipment associated with the CTR 28 GHz microwave transceiver as follows:

1. Connect the CPI 9000 (power inserter) to -48 VDC power source.
2. Adjust voltage out of CPI 9000. It is adjustable from 17V to 21V, depending on cable length and type.
3. Connect power inserter unit's IF IN port (N-type connector) to the NIU's IF OUT N-type (bulkhead) connector as shown in Figure 1-2.
4. Connect CTR 28 GHz IF/PS cable to the CPI 9000 output (PS/IF) port (N-type connector).
5. Connect CTR 28 GHz RX cable to NIU IF IN N-type (bulkhead) connector.
6. Refer to *Reunion NIU 5008 Network Interface Unit Installation Guide*, Release 1.2, 411- 1323 - 203, and the *Network Engineering Package*.

Figure 1-2
Diagram showing CTR 28 GHz indoor set-up



Installing Indoor Equipment (NIU 6054 only)

Install the NIU 6054 equipment associated with the CTR 28 GHz microwave transceiver as follows:

1. Adjust voltage out of NIU 6054. It is adjustable from 17V to 21 V, depending on cable length and type.
2. Connect CTR 28 GHz IF/PS cable to the NIU 6054's output (PS/IF) port (N-type connector).
3. Connect CTR 28 GHz RX cable to NIU N-type (bulkhead) connector.
4. Refer to *Reunion NIU 6054 Network Interface Unit Installation Guide*, Release 1.1, 411- 1323 - 201, and the *Network Engineering Package*.

Figure 1-3

Block Diagram showing CTR 38 GHz indoor set-up with NIU 6054

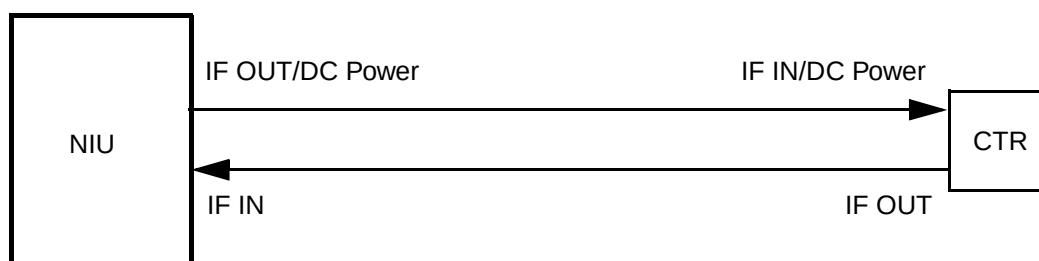




Figure 1-5
CTR 28 GHz Mounted to a Pole-Back View

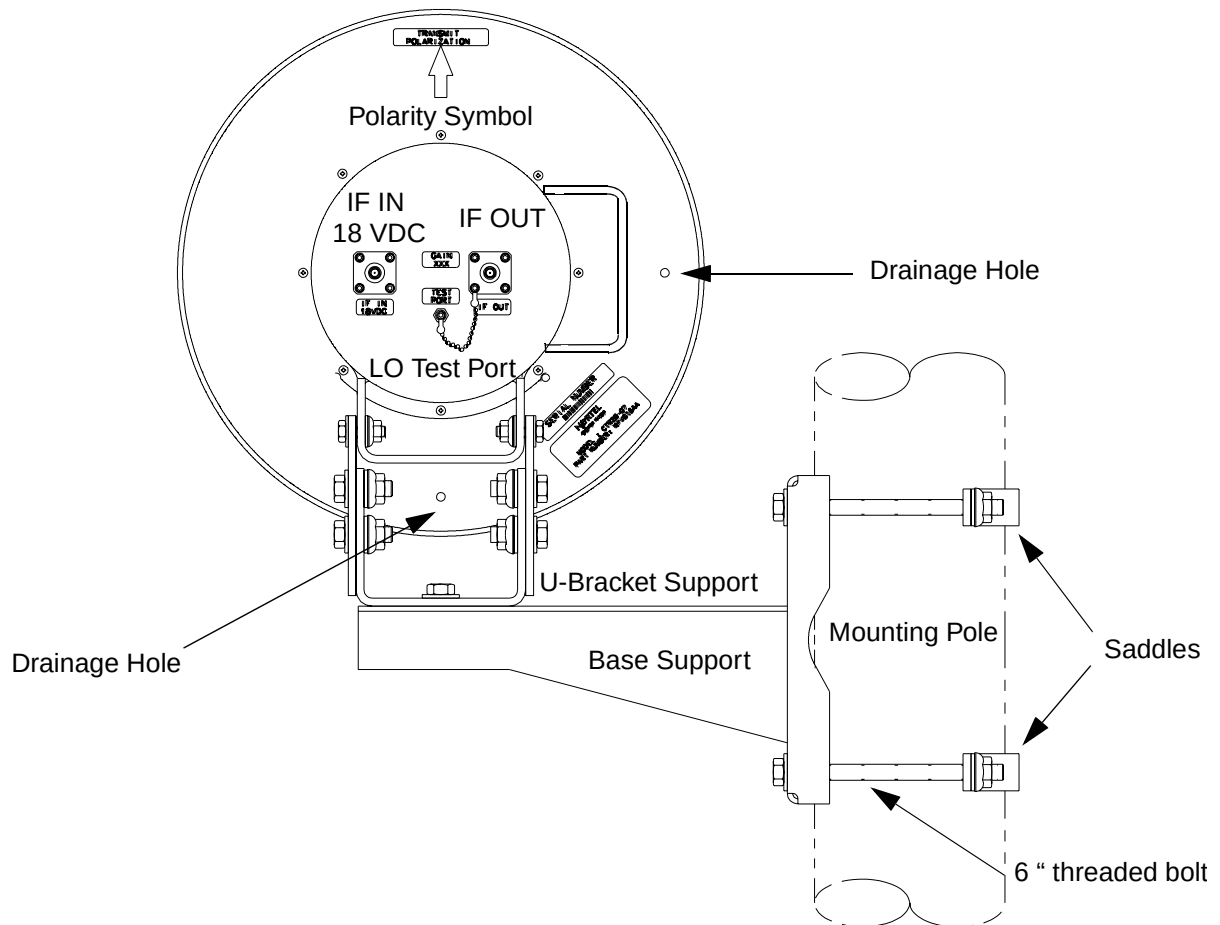


Figure 1-6
CTR 28 GHz Mounted on a Pole - Side View

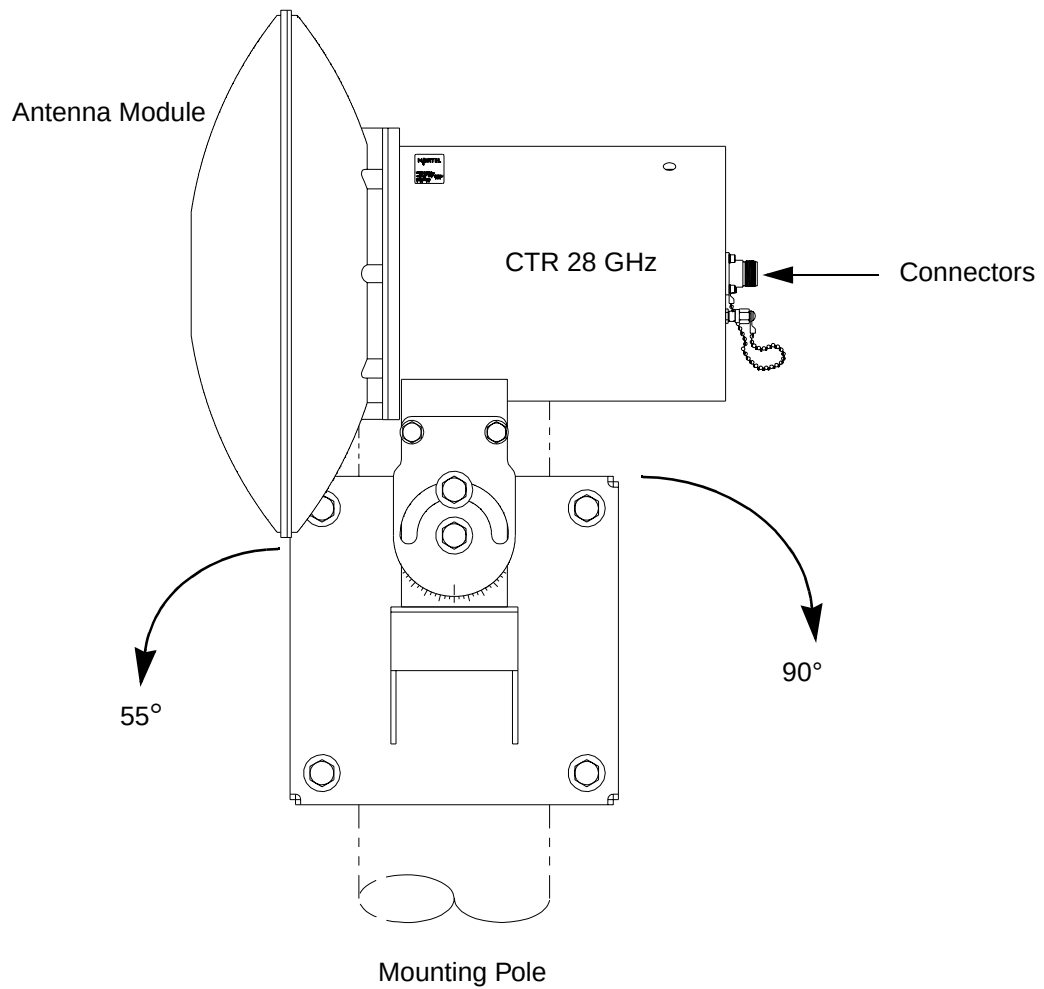


Figure 1-7
Bracket Components



Figure 1-8
Bracket Mounted on the Pole

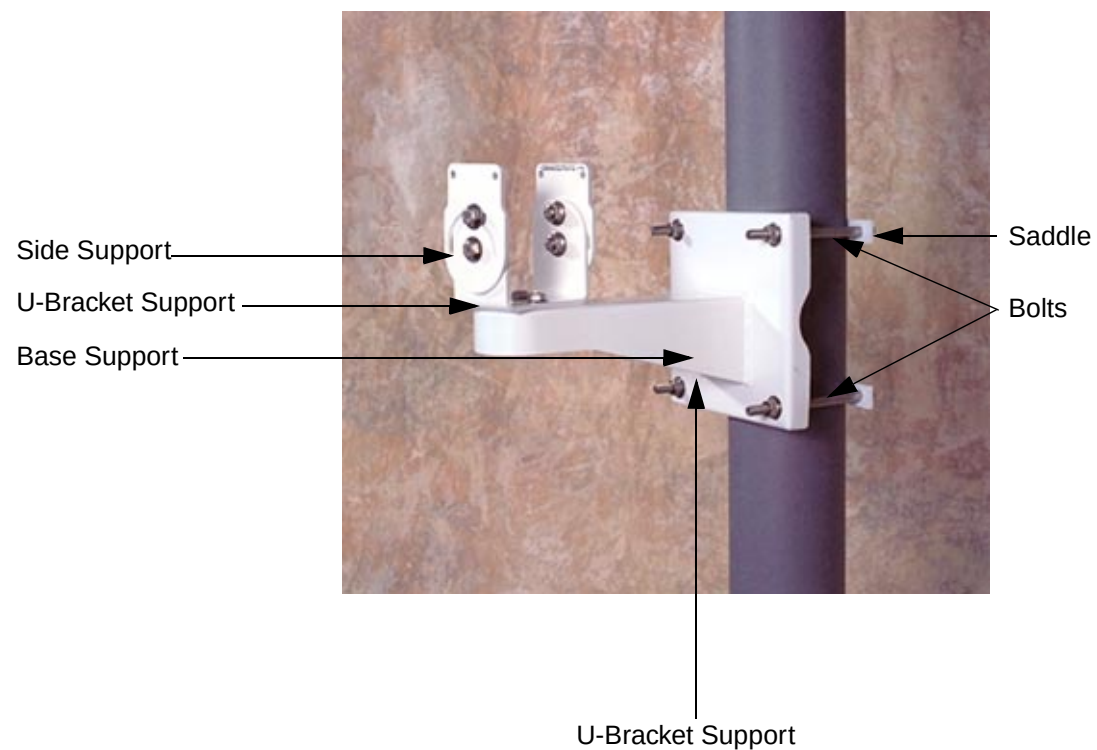


Figure 1-9
CTR mounted to a Pole

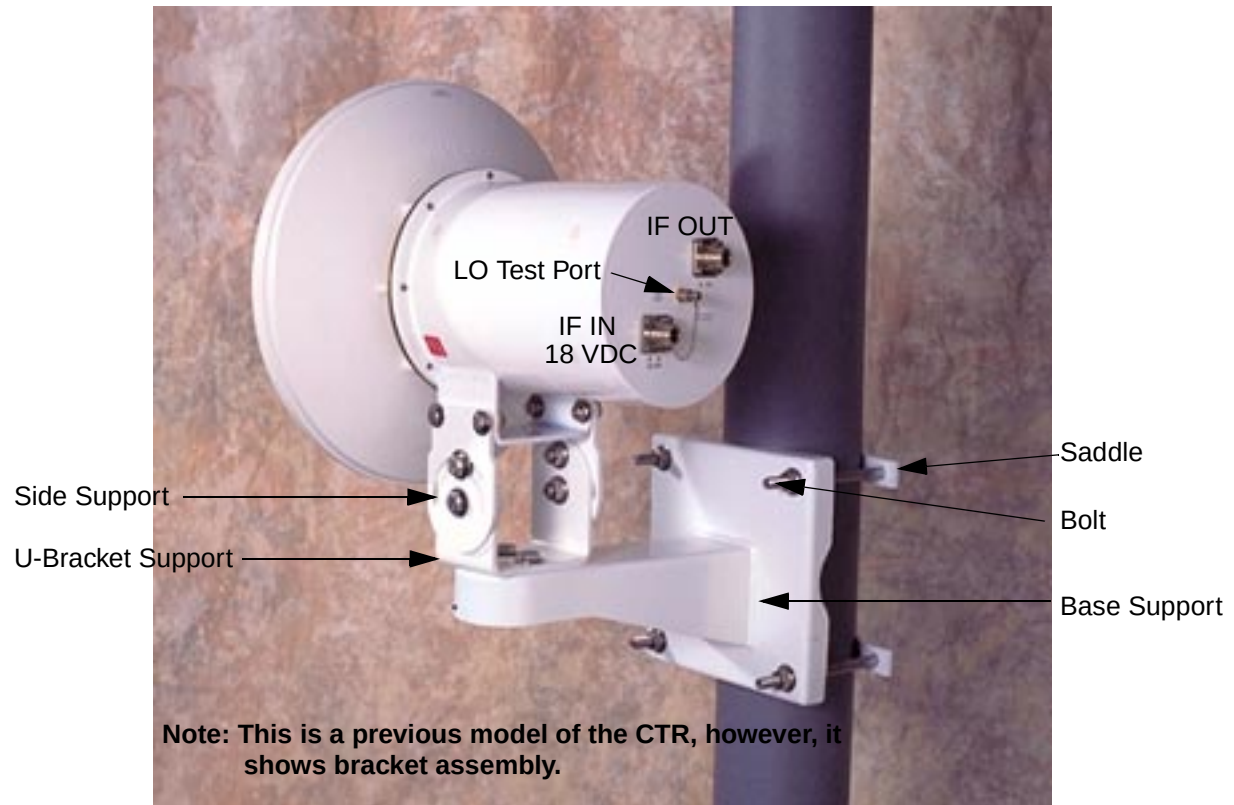


Figure 1-10
CTR 28 GHz with Connectors



Figure 1-11
CTR 28 GHz Side View with Brackets



Figure 1-12
CTR 28 GHz Side View with Brackets



CTR 28 GHz Maintenance

Establish a regular check procedure. This quickly identifies any problem which might develop. There are no repairable internal components in the CTR 28 GHz. Therefore, the checks focus on the exterior features of the transceiver unit.

Mechanical Checks

Check the following mechanical areas to prevent problems.

1. Check the bolts and fasteners which hold the transceiver, waveguides, and antenna. Vibrations due to wind can cause bolts and fasteners to loosen. Verify that equipment is secure and properly mounted. If the bolts or fasteners are loose, tighten them carefully. Use lock and spring washers.
2. Check to ensure that all connections between the transceiver and antenna remain watertight. If water enters the waveguide or coaxial connections, it can cause attenuation of the microwave signals. If water is detected, call Nortel Broadband Wireless Access.
3. Visually inspect all equipment for signs of external damage. If signs of damage are detected, call Nortel Broadband Wireless Access.

Note: If you detect an unsolvable problem during the electrical and mechanical inspections, contact Nortel Networks Broadband Wireless Access so that action can be taken to rectify the problem.

CTR 28 GHz Diagnostic Reference Chart

Symptom	Possible Cause	Check Procedure
Output power low	1. VHF input signal level low.	a. Check VHF signal level. b. Check coaxial cable. c. Check cable connectors. d. Check antenna for blockage (e.g. guano)
No power		a. check main fuse power b. check cable connections

If you detect any problem during the electrical and mechanical checks, contact Nortel Networks Broadband Wireless Access so that action can be taken to rectify the problem.



Caution

Warranty void if seal is opened. This means do not attempt to remove cover.



Caution

Warranty void if CTR is not equipped with lightening arrestor.

Grounding and Surge Protection

Grounding/Lightning Protection

Scope

This chapter presents guidelines for the grounding and electrical protection of Reunion equipment in typical buildings, assuming

1. indoor equipment is installed in an appropriate equipment room and
2. outdoor equipment is installed on rooftops using a pole mount.

Further, Nortel Networks assumes building electrical systems comply with the appropriate national and local regulations.

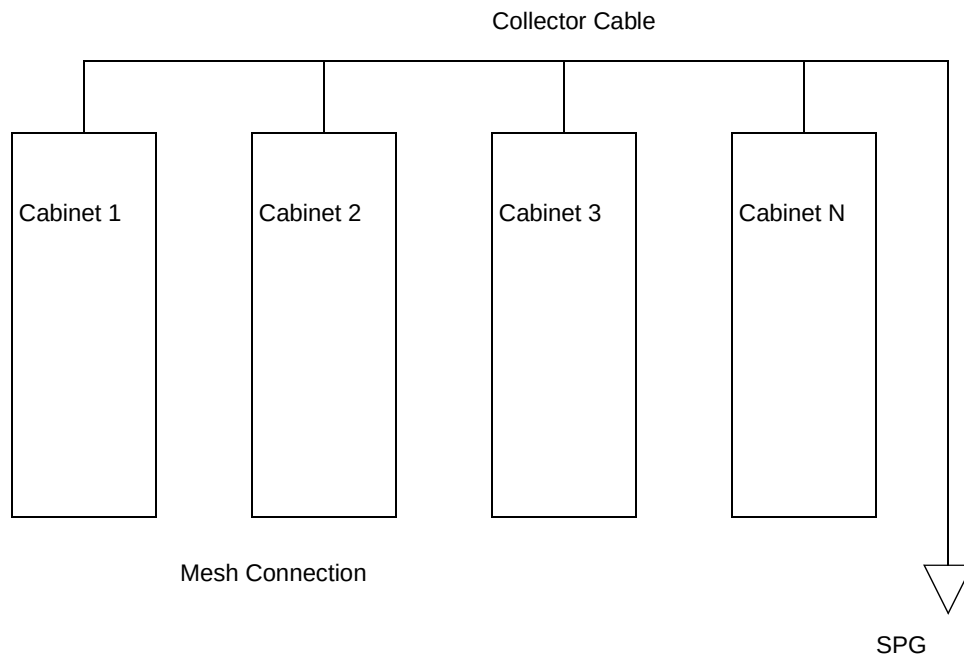
Grounding Methods/Indoor Equipment

Components of a communications system can be grounded together using an isolated bonding network (IBN). The IBN can be configured in several different ways:

1. Mesh
2. Mesh – IBN with bonding mat
3. Star or sparse-mesh

In turn, the IBN is bonded at a single point to the Common Bonding Network (CBN) that forms the principal bonding network in a building. Figure 2-1 shows a typical installation:

Figure 2-1
Typical Grounding configuration for Indoor Equipment



The single point ground (SPG) represents the connection of IBN to the building grounding system.

Wire Gauge Guidelines

Main bonding conductors

All main bonding conductors in the equipment room shall be No. 2 AWG or larger copper wires.

Other bonding conductors

All other bonding conductors in the room, including

- bonding individual frames/cabinets to the collector cable, supplementary conductor or BPG
- bonding conductors of other metallic objects such as cable trays and building utility equipment

are No. 6 AWG or larger insulated copper conductors.

Outdoor Equipment: the need for surge (lightning) protection

Apart from the need to provide good grounding for safety, outdoor equipment is subject to more environmental hazards than is indoor equipment. Radio communication equipment, with antennas mounted well above ground level, have conductive parts exposed to lightning.

Safety needs are met by grounding practices and protection needs are met by a combination of grounding and protective devices. Many protective devices are available:

- air terminals,
- solid state OVPs,
- filters,
- zeners,
- MoVs,
- isolators
- capacitors,
- resistors,
- QWS and more.

The application of these devices is beyond the scope of this document. The equipment designer needs to consider both the protection requirements and the geographic region where the equipment is installed.

Grounding and Lightning Protection

In general, all exposed metallic equipment must be grounded. Besides the need for lightning protection, it is desirable to conduct induced current to ground through as low a resistance as possible, along as short a path as possible.

In practice this means multiple ground connections and multiple conductors. Figure 2-2 shows a typical rooftop installation of Reunion customer premise equipment. Figure 2-3 shows a typical rooftop installation of Reunion base station transceiver (BTR).

The radio equipment should, where possible, be grounded through the ground lug using a 6AWG bonding wire to the building common bonding network. Alternatively, the equipment can be grounded through the mounting bracket. Provision must be made to prevent corrosion on the metallic contact surfaces. Similarly, the installer shall ensure that there is a good metallic connection to the building CBN.

If a common mounting plate is used for the two redundant BTRs and the radio power extractor (RPE), the installer shall insure that ground continuity to the CBN is maintained and corrosion protection is applied. The common

2-4 Grounding and Surge Protection

mounting plate should be considered as an alternative bonding to the preferred technique of separately bonding each BTR and RPE. The size of the bonding wire should be #6 AWG.

The coaxial cable shall be bonded at least at the RPE/BTR/CTR and at the building entry. For a tower higher than 30 meters (98 ft), the cable shall be bonded at 30 meter intervals. The size of the bonding conductor shall be #6 AWG or larger.

Mount the radio in an area protected from lightning strikes. If local conditions require an air terminal, install it in accordance with ANSI/NFPA 780. The air terminals are shown schematically in Figures 1-2 and 1-3. The air terminal (lightning rod) if used, is at least 1 meter (3.3 ft) above the highest object being protected and within 2 meters (6.6 ft) $\pm$ 30 cm (1.0 ft) of the object.



Caution

Do not install Reunion equipment on lightning protection air terminals.

Figure 2-2
Rooftop Installation of Reunion Base Radio Equipment

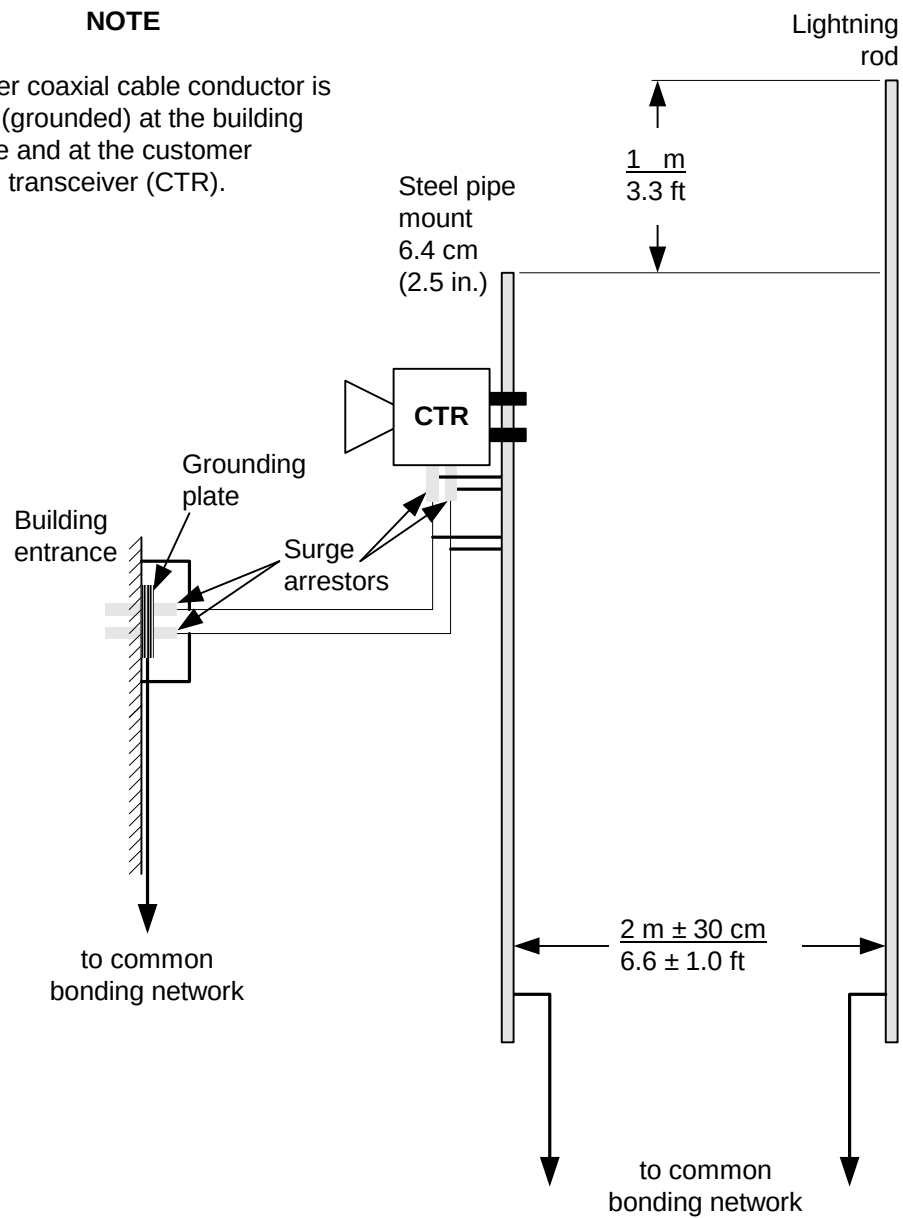
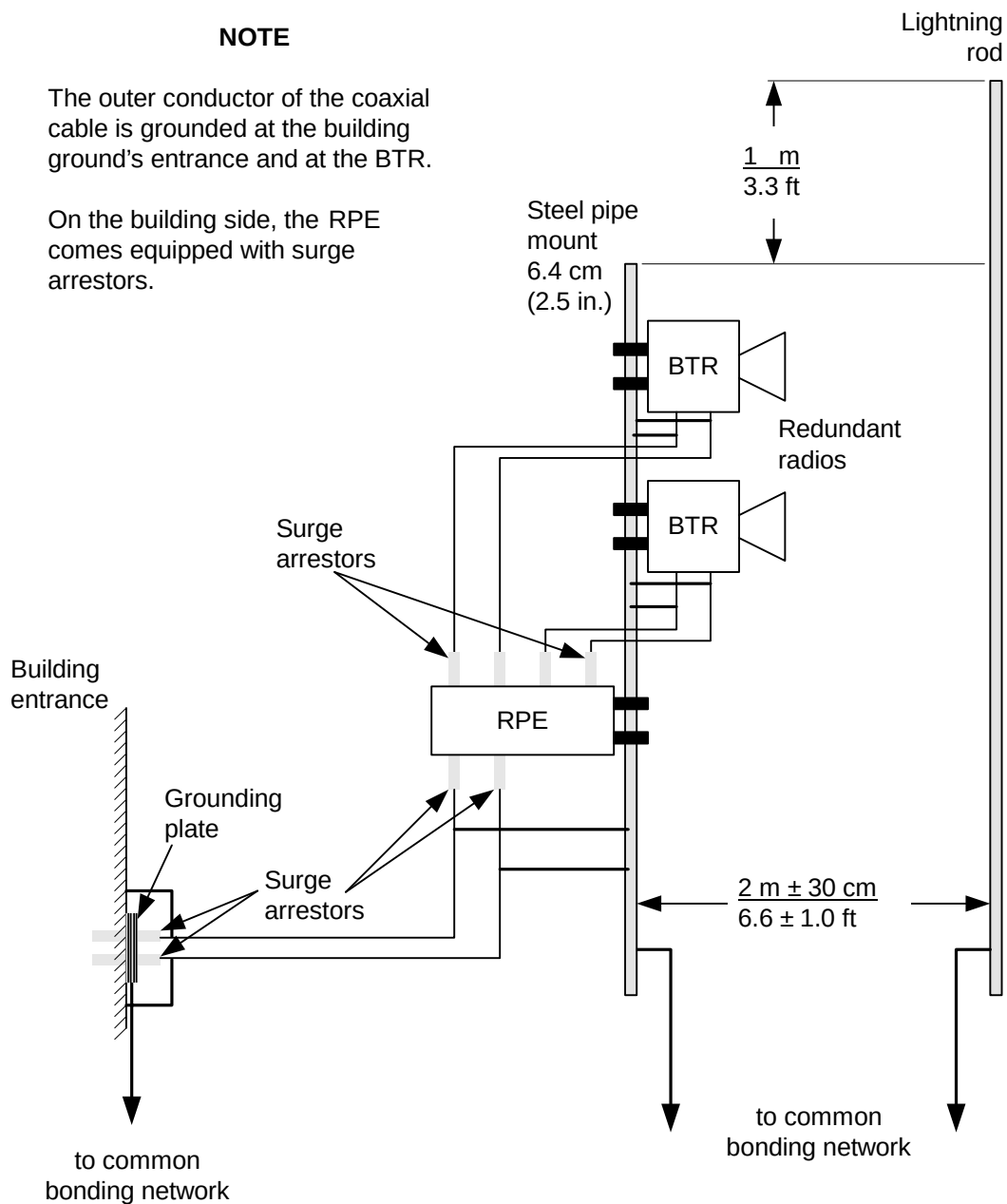


Figure 2-3
Rooftop Installation of Reunion Base Radio Equipment



Ground connections to outdoor equipment

The grounding lug is supplied with all current releases of outdoor brackets. In addition, a 6 AWG braided ground wire connected to the common bonding network is required to complete the ground connection for all microwave products.

Note: There is no grounding lug supplied with previously-released microwave products. To retrofit these installations, order one retrofit kit for each sector and use the following procedures.

Retrofit procedure for grounding the base station equipment (BTR and RPE)

You will need an NTVG15BA BTR and RPE grounding retrofit kit for every base station sector to be retrofitted, containing the following parts:

Item	Qty	Vendor part no.	Description	CPC no.
1	2	LCA6-38	6 AWG, 3/8" compression terminal (Panduit) for BTR	A0297956
2	1	LCA6-14	6 AWG, 1/4" compression terminal (Panduit) for RPE	A0315080
3	2	W-2064	1/4" Stainless steel internal tooth lock washer (Spaenaur) for RPE	TBD
4	2	W-2069	3/8" Stainless steel internal tooth lock washer (Spaenaur) for BTR	TBD

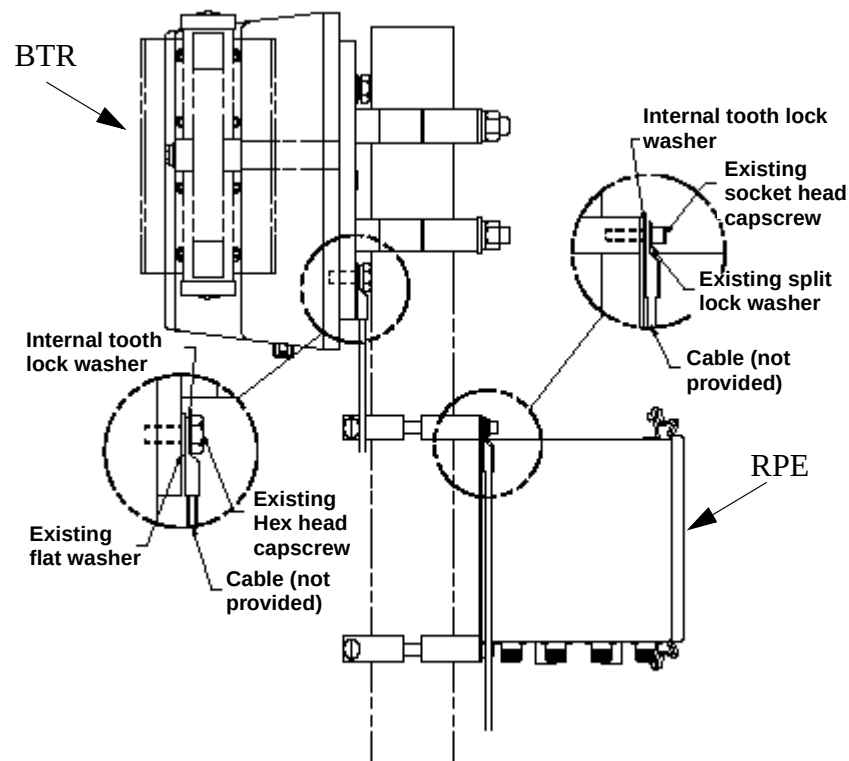
Use the following method to install the kit on the BTR, referring to Figure 2-4:

- 1 Remove the 3/8" mounting bolt, two flat washers and the mounting washer from the BTR. Discard one flat washer and the locking washer.
- 2 Crimp the 3/8 terminal (A0297956) onto the grounding wire.
- 3 Install the existing bolt, flat washer, new internal tooth washer, and the complete ground cable as shown in Figure 2-4.

Use the following method to install the kit on the RPE, referring to Figure 2-4:

- 1 Remove the 1/4" mounting bolt and split lock washer as shown in Figure 2-4.
- 2 Crimp the 1/4 terminal (A0315080) onto the grounding wire.
- 3 Install the 1/4" original mounting bolt and a stainless steel internal tooth washer.
- 4 Repeatedly tighten and loosen the fastener assembly, rotating the internal tooth lock washer, until the powder coating is scraped off and the bare metal is exposed. Repeat this procedure if required.
- 5 Discard the internal tooth washer used to remove the powder coating.
- 6 Using new stainless steel internal tooth washers, assemble the complete ground cable connection, as per Figure 2-4.

Figure 2-4
Grounding the BTR and RPE



Retrofit procedure for grounding the customer premise equipment (CTR)

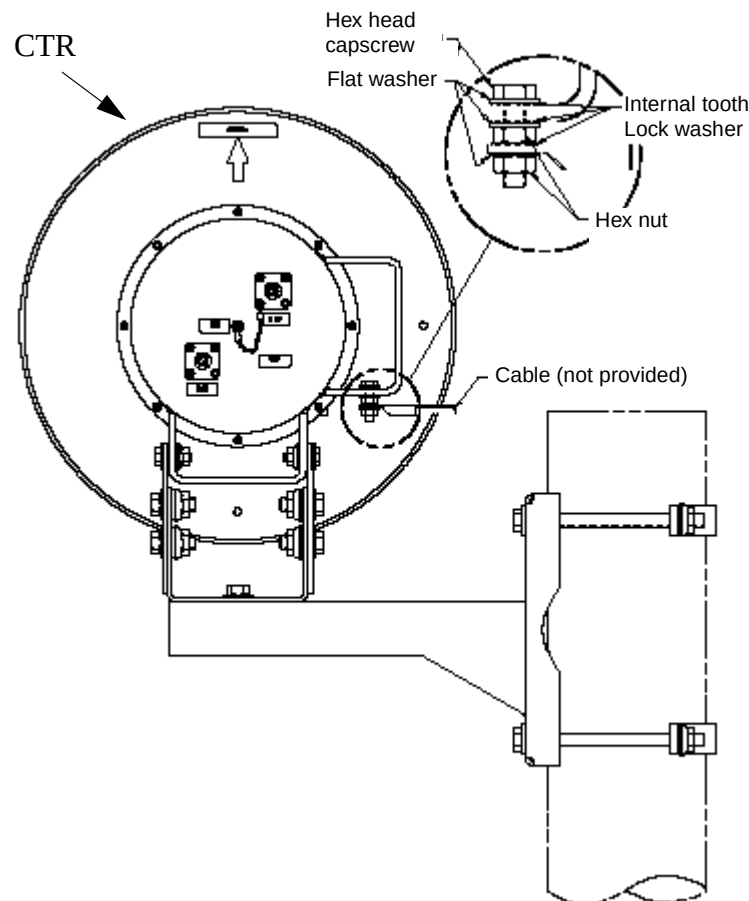
You will need an NTVG15CA CTR grounding retrofit kit for every CTR to be retrofitted, containing the following parts:

Item	Qty	Vendor part no.	Description	CPC no.
1	5	LCA6-38	1/4" Stainless steel internal tooth lock washer (Spaenaur)	TBD
2	1	LCA6-14	6 AWG, 1/4" compression terminal (Burndy) for CTR	A0315080
3	3		1/4" stainless steel flat washer	P0883797
4	1		1/4" x 1" Stainless steel hex head bolt	P0888501
5	2	MS35649-2254	1/4" Stainless steel nut	P0860421

Use the following method to install the kit on the CTR, referring to Figure 2-5:

- 1 Install the 1/4" stainless steel hex bolt, stainless steel flat washer and the stainless steel internal tooth washer through one of the four holes in the CTR. (Refer to Figure 2-5 for the hole location.)
- 2 Install a stainless steel internal tooth washer, stainless steel flatwasher and the 1/4" nut onto the assembly installed in Step 1.
- 3 Repeatedly tighten and loosen the fastener assembly, rotating the internal tooth lock washer, until the powder coating is scraped off and the bare metal is exposed. Repeat this procedure if required.
- 4 Discard the internal tooth washer used to remove the powder coating.
- 5 Using new stainless steel internal tooth washers, assemble the complete ground cable connection, as per Figure 2-5.

Figure 2-5
Grounding the CTR



Regulatory Considerations

Electrical

1. UL1950/IEC950

Lightning protection

1. UL1492
2. IEC 65
3. IEEE/ANSI C62.41
4. Bellcore GR-1089-CORE
5. ANSI/NFPA 780 Lightning Protection Code

Grounding

1. CCITT Rec K.27
2. Corporate Standard 4122, Grounding of Communication Systems

It is assumed that building construction complies with NEC Article 250 (US) or CEC Section 10 (Canada). In the US the recommended ground resistance is 5 ohms and the maximum for a single electrode is 25 ohms.

List of terms

AC

Alternating Current

Air Terminal

Another name for lightning rod

AWG

American Wire Gauge

DBMS

Digital Broadband Microwave System

DC

Direct Current

DRO

Dielectric Resonance Oscillator

Earthing

Another term for grounding used by safety agencies. Earthing is the term often seen in safety standards.

EIA

Electronic Industries Association

ESD

Electrostatic Discharge

FCC

Federal Communications Commission

IBN

Isolated Bonding Network

IC

Industry Canada

IF

Intermediate Frequency

kHz

kilohertz, one thousand hertz or cycles per second

LO

Local Oscillator

LNA

Low Noise Amplifier

LNB

Low Noise Block Downconverter

MHz

MegaHertz, one million hertz or cycles per second

NIU

Network Interface Unit

OCXO

Oven-Controlled Crystal Oscillator

PA

Power Amplifier

PI

Power Inserter

PS

Power Supply

QAM

Quadrature Amplitude Modulation, which entails modulating frequency

RF

Radio Frequency

RMM

Radio Modem Module

SPG

Single Point Ground

VAC

Voltage Alternating Current

VDC

Voltage Direct Current (Volts Direct Current)

VHF

Very High Frequency

Reunion

CTR 28 GHz Installation Guide

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