

Alcatel 7390 (Ex 9900)

Multiservice broadband wireless access solution

Base Station - release 2.2b

X - Polarized version

User Manual



DRAFT

Status Draft

Change Note

Short Title A7390 Base Station – release 2.2b

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1 – Foreword

1.1 – Structure of the manual

This manual is for users with a sound knowledge of how to operate and install **point-multipoint microwave systems** and how to use a **PC-based craft terminal** running the Windows operating system.

With it, you should quickly be able to operate the equipment. It is not intended to replace the training services that we can provide for your particular needs.

The manual is divided into seven sections followed by appendixes:

- Foreword
- Equipment overview
- Installation of the Base Station
- 7390LT Software overview
- Commissioning the Base Station (7390BS)
- Operation and maintenance
- Changes of configuration
- Appendixes

1.2 – Using the manual

With this manual, you should be able to commission and operate the described equipment to a basic level.

You should always read this manual in conjunction with the attached "**Update**" document (if provided) so that you are aware of the latest equipment upgrades.

Manual updates

This edition of the manual describes hardware and software releases whose revision indexes are greater than or equal to those given below:

Hardware revision: 01

In cases where an equipment upgrade affects the content of the manual, the relevant modification should be inserted in the "**Update**" document, with the same reference number, but with code type VE (instead of TQ).

When the number or extent of the changes justifies it, they should be incorporated in the body of the manual and the manual's revision index should be incremented. Revision bars will show the differences from the previous version.

Note: MS-DOS, MICROSOFT and WINDOWS are registered trademarks of Microsoft Corporation.

1.3 – Safety instructions

1.3.1 – General rules

The following general safety precautions must be observed by the installer and the operator. ALCATEL assumes no liability for the customer's failure to comply with these requirements.

- **Ground the equipment:** for Safety Class 1 equipment, always connect the earth conductor of the power cable to an appropriate earthing device.
- **DO NOT operate the product in an explosive atmosphere or in presence of flammable gases or fumes.**
- **For protection against fire:** replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type.
- **Dangerous voltages:** users must not remove equipment covers or shields. The installation and maintenance procedures described in this manual are for use by service-trained personnel only.
- **Protection against short circuits:** the mains equipment should ensure protection against short circuits according to the current domestic standards (residual current differential protection recommended).
- Observe the standards in force for all activities carried out on the roofs.
- For any on-site intervention, observe the precautions against lightning.
- **DO NOT operate equipment which may be damaged: its protection level could be affected.**
- Whenever it is possible that the safety protection features built into this equipment have been impaired, ISOLATE FROM THE POWER SUPPLY and do not use the equipment until safe operation can be verified by service-trained personnel. If necessary, return the equipment to Alcatel After Sales for service and repair.
- **DO NOT OPEN THE EQUIPMENT.**
- Return the product to Alcatel Customer Service for servicing and repair.
- **Recommendation to installers and maintenance operators:** before carrying out any operations, check the equipotential bonding of the earthing devices to which our measurement equipment and instruments are connected. If necessary, during installation, ensure the equipotential bonding by electrical connection of these devices.

Local regulations

All BS and CPE installations must adhere to all local, national and civil electrical/safety regulations of the area where they are installed.

Wireless safety compliance in the United States of America

It is the responsibility of the wireless licence holder to ensure that the requirements of OET Bulletin 65 are met in the USA.

Wireless safety compliance in Canada

It is the responsibility of the wireless licence holder to ensure that the requirements of Safety Code 6 are met in Canada.

Placement of transmitting equipment

To prevent exposure to non-ionizing radiation, the X-Pol RT should always be mounted at a minimum of 3m (10 ft) above ground level or roof-top level. An X-Pol RT that is mounted on a wall should be mounted at least 3m (10 ft) away from any point of exposure such as windows, balconies or doors.

X-Pol RT service and repair safety precautions

Only authorized personnel should service X-Pol RT units.



Danger - Never touch the X-Pol RT antennas while they are in operation. Do not stand in front of X-Pol RT antennas, and never pass closer than 1m (3 ft) in front of an operating or X-Pol RT.

Power to X-Pol RTs must be disconnected prior to installation or servicing.

Service and repair preparation activities should be made as close as possible to the base of an elevated X-Pol RT, as the risk of exposure to non-ionizing radiation increases as you move further from the base toward the area that is serviced by the transmitter.

Equipment interconnection points

All card faceplate connectors are SELV.

Connect SELV circuits on this equipment only to other circuits that comply with the requirements of SELV circuits as defined in EN60950.

Restriction of unauthorized access

Only authorized personnel should have access to the equipment. Install the equipment in a restricted-access location or similar environment, and post appropriate warning signs to indicate safety concerns. Failure to prevent unauthorized user access will invalidate any approvals given to this equipment.

Regulatory symbols

The following sections show examples of regulatory approval symbols generally used. They may be used on product markings such as approval labels. These symbols are described in IEC417.

Power on



This symbol indicates the on position of the main on/off switch.

Power off



This symbol indicates the off (O) position of the main on/off switch.

Protective grounding terminal

These symbols indicate a terminal that must be connected to earth ground prior to making any other connections to the equipment.



Supply wire protective earth



Protective earth

Dangerous voltage

This symbol indicates the presence of uninsulated “dangerous voltage” within the product's enclosure that could cause electric shock. Labels bearing this symbol are installed on the outside of the product enclosure.



Dangerous voltage symbol

Instructions

This symbol indicates the existence of important operating and maintenance (servicing) instructions in the product documentation.



Important instructions symbol

Elevated non-ionizing radiation levels

This symbol identifies equipment that emits elevated levels of non-ionizing radiation. Do not approach equipment that is marked with this symbol unless power to the device is disconnected.

Labels bearing this symbol are installed on the outside casing of transmitter devices.



Elevated non-ionizing radiation levels symbol

International EMC compliance

The EMC compliance of these products relies on the user following the installation processes correctly. Failure to follow the correct installation processes may result in non-compliance to the EMC standards against which these products have been assessed.

Appropriate shielded cables must be used to connect NT to telecommunications equipment.

NT EMC compliance

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

DBS card EMC compliance

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Industry Canada regulations

The Industry Canada (formerly known as the Department of Communications) label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements as prescribed in the Terminal Equipment Technical Requirements document(s). Industry Canada does not guarantee that the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or any equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

For their own protection, users should ensure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.



Caution - Users should not attempt to make electrical ground connections, but should contact the appropriate electrical inspection authority or electrician.

The Ringer Equivalence Number (formerly known as Load Number) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five (5).

The Ringer Equivalence Number regulations do not apply to the MainStreet NIUs.

Safety approval for dc systems

The dc source for the Alcatel Broadband Wireless system must meet the requirements of a SELV source in accordance with CSA C22.2 No. 950. These systems are intended for use with a SELV secondary source that is electrically isolated from the ac source, and that is reliably connected to ground.

United States Federal Communications Commission regulations

This equipment has been approved to the Federal Communications Commission Part 68 Rules as not being harmful to the telephone network when connected directly to telephone lines. Customers must, upon request from the telephone company, provide the following information:

- FCC Registration Numbers
- USOC: RJ48C
- FIC: 04DU9-BN/DN/1KN/1SN
- SOC: 6.0Y

The FCC identification number can be found on the product label located on the product chassis.

The REN determines the number of devices that users can connect to their telephone line and still have the assurance that these devices will ring properly when their number is called. In most, but not all areas, the sum of the RENs for all devices should not exceed five (5.0). To determine the maximum number of devices users can connect to their line, as specified by the REN, users must contact the local telephone company and request the information on the maximum REN for their calling area.

If the user equipment causes harm to the telephone network, the telephone company may temporarily discontinue service to the line. If possible and practical, the company will notify the user in advance. If not, the company will notify the user as soon as possible. Included in the notification, the users will be advised of their right to file a complaint with the FCC.

The telephone company may make changes to its facilities, equipment, operations and procedures that could affect the operation of user's equipment. Before these changes are made, the telephone company will provide advance notice that service will be interrupted.

FCC regulations prohibit the connection of customer-provided equipment to coin service (central office implemented systems). Connection to party lines is subject to tariffs; contact the state public utility commission, public service commission or corporation commission for information. In the event that repairs are needed to this equipment, contact:

Alcatel Inc.
810 Commerce Park Drive,
Ogdensburg, NY 13669
1-315-393-9981

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 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 communications. 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 their own expense.

Food and Drug Administration




This product complies with 21 CFR 1040.10 and 1040.11 regulations, which govern the safe use of lasers. Only qualified service personnel, thoroughly familiar with laser radiation hazards, should install or remove the fiber optic cables used in this system. Information regarding the safe use of lasers can be found in ANSI Z 136.1: Safe Use of Lasers and ANSI Z 136.2: Safe Use of Lasers in Optical Fiber Communications Systems. These documents and other instructional material can be obtained from:

Laser Institute of America
 12424 Research Parkway, Suite 125
 Orlando, FL 32826-3274

CSA NRTL

This equipment is certified by the Canadian Standards Association as meeting the requirements of UL1950, Safety of Information Technology Equipment (or UL1459, Safety of Telephone Equipment). CSA is listed by the American Federal Occupational Safety and Health Administration as equivalent to Underwriters Laboratories and other American safety testing laboratories under the Nationally Recognized Testing Laboratories program.

Safety precautions for installing TNV devices

- 
Danger 1 - Never install telephone wiring during a lightning storm. Use caution when installing or modifying telephone lines.
- 
Danger 2 - Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the telephone network interface. Never install telephone jacks in wet locations, unless the jack is specifically designed for wet locations.
- 
Caution - Always disconnect the MainStreet NT from the telephone system when installing or removing covers from connected equipment.

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2 – Equipment overview

2.1 – Overview of the A7390 system

The **Alcatel 7390** is a multi-service **broadband wireless** local loop system designed to provide telecom services to small and medium-sized enterprises.

Broad band WLL (Wireless Local Loop) system, Alcatel 7390 allows **operators** to offer rapid provision - to a large number of client sites - of a comprehensive range of telephone and data transmission **services**.

For **cellular phone network** operators, Alcatel 7390 offers the possibility of linking **base stations** to base station **controllers**. This makes Alcatel 7390 an economical transmission solution, for the implementation or extension of high traffic density areas coverage.

For **mixed network** operators (fixed and mobile), Alcatel 7390 enables to connect, with the same system, fixed professional end user as well as **base stations of cellular telephony**.

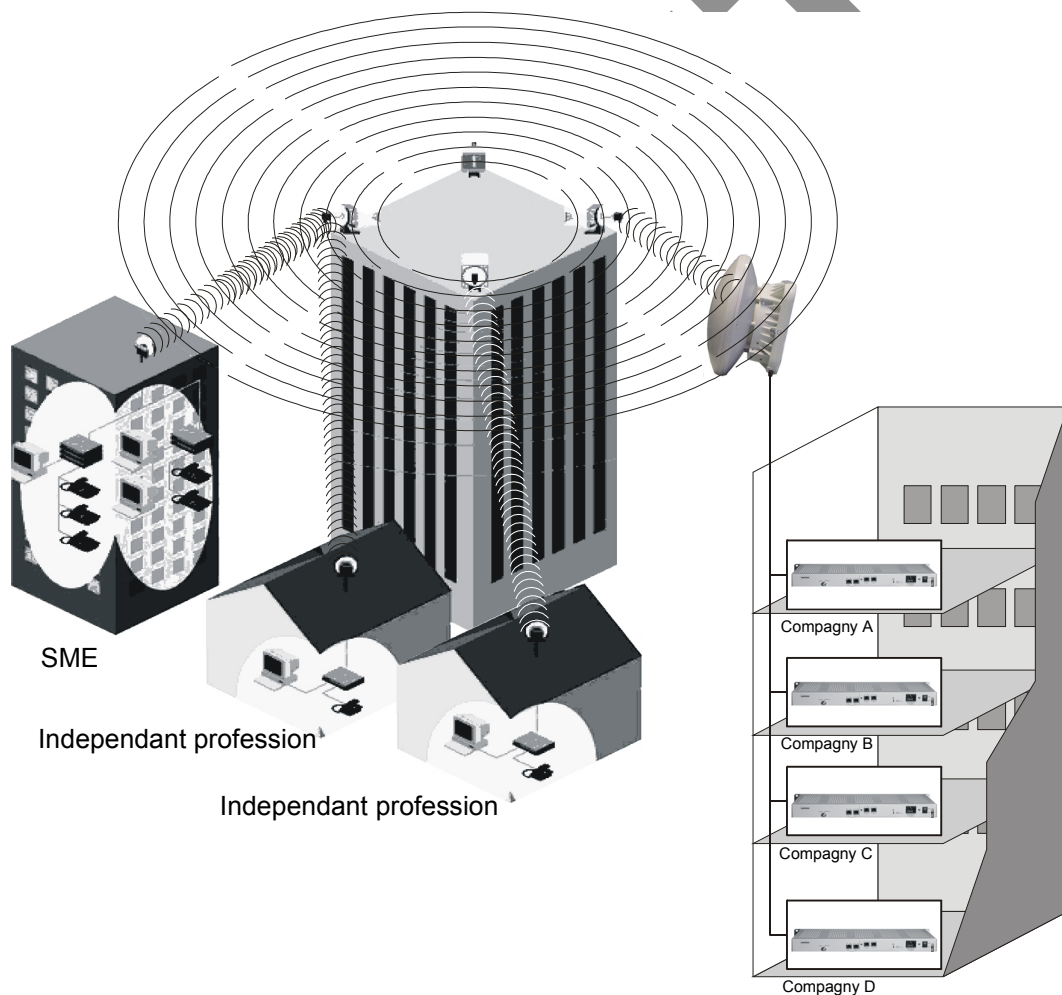


Figure 1 – A7390 System - Local point - multipoint service distribution -

2.2 – Composition of the A7390 system

An A7390 network cell consists of the following:

- a common **base station** designated 7390BS;
- and several **terminal stations** distributed across the user sites, and designated **7390TS**.

Cross-polarized Radio Base Station
"X-Pol RBS"

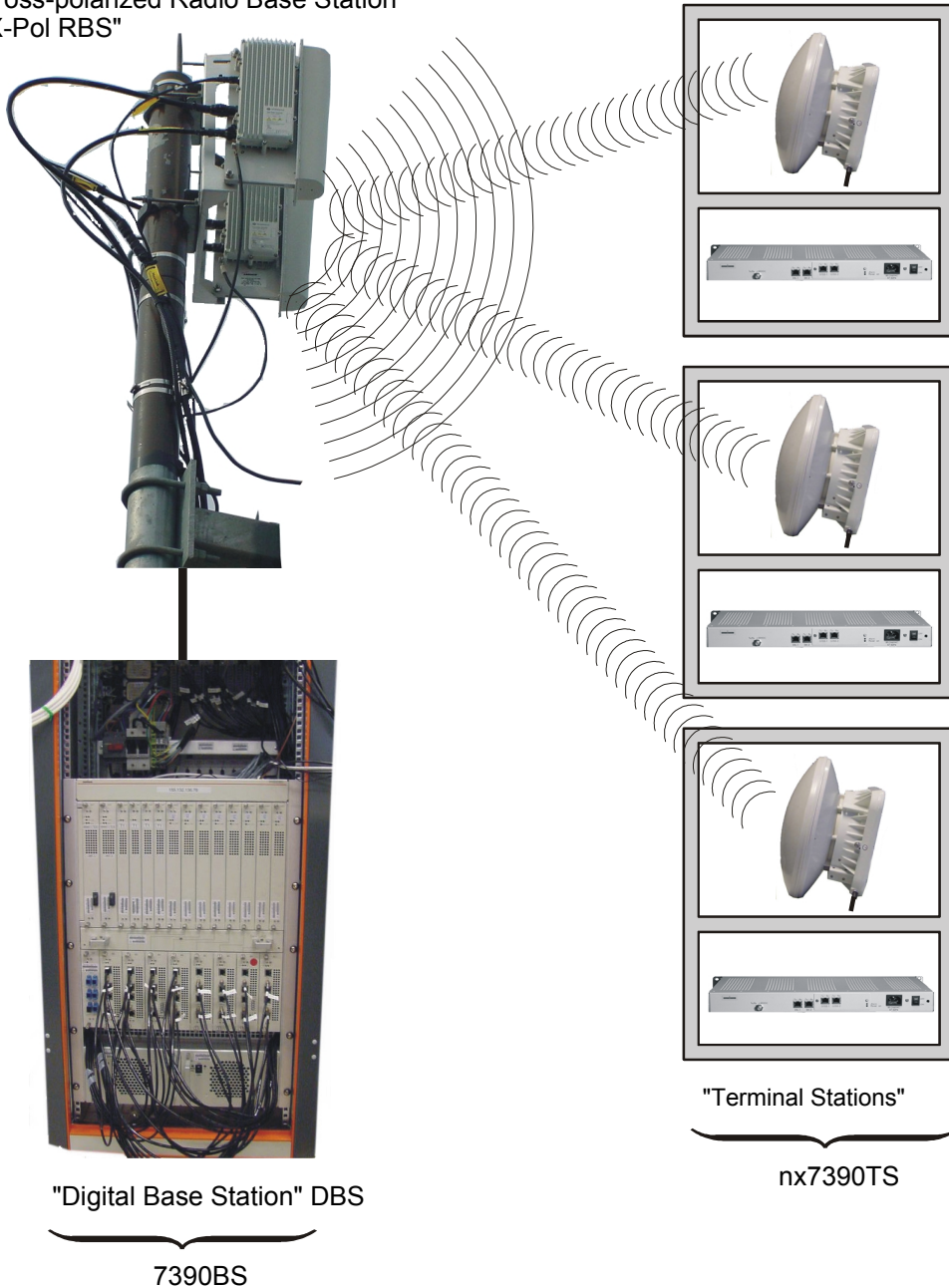


Figure 2 – Base Station and Terminal Stations

2.3 – A7390 system specifications

2.3.1 – Frequency bands used

Cross-polarized radio	Down-link	Up-link
LMCS/AB	27 850 — 28 350	27 350 — 27 650
LMCS/F	25 600 — 25 850	25 350 — 25 600
LMCS/C	27 100 — 27 350	26 850 — 27 100
LMDS/A	27 500 — 28 350	31.075 — 31 225
LMDS/B	31 225 — 31 300	31 000 — 31 075
38/700/1	39 700 — 40 000	39 000 — 39 300

2.3.2 – Radio transmission specifications (typical values)

The following table gives the main characteristics of the A7390 wireless system.

A downstream (BS to TS) carrier is combined with up four upstream (TS to BS) carriers.

Channel bandwidth	Downstream							
	14 MHz				28 MHz			
Occupied bandwidth	13.63 MHz				27.25 MHz			
Roll-off factor	35%				35%			
Modulation	QPSK				QPSK			
Gross bit rate	20.19 Mbit/s				40.37 Mbit/s			
Inner Code	Convol. 7/8 (k=7)				Convol.7/8 (k=7)			
Interleaving	depth 12				depth 12			
Outer Code	Reed-Solomon (204,188,8)				Reed-Solomon (204,188,8)			
Bit rate before coding	16.19 Mbit/s				32.38 Mbit/s			
Radio	25 GHz	28 GHz	31 GHz	39 GHz	25 GHz	28 GHz	31 GHz	39 GHz
X-Pol RBS output power (antenna port)	17 dBm	17 dBm	17 dBm	17 dBm	17 dBm	17 dBm	17 dBm	17 dBm
Transmit antenna gain	21 dB	21 dB	21 dB	21 dB	21 dB	21 dB	21 dB	21 dB
Receive antenna gain (with radome)	36 dB	34.5 dB	35 dB	34.5 dB	36 dB	34.5 dB	35 dB	34.5 dB

Channel bandwidth	Upstream			
	3.5 MHz		7 MHz	
Occupied bandwidth	3.36 MHz		6.72 MHz	
Roll-off factor	25%		25%	
Modulation	D-QPSK		D-QPSK	
Gross bit rate	5.38 Mbit/s		10.75 Mbit/s	
Outer Code	Reed-Solomon (63,53,5)		Reed-Solomon (63,53,5)	
Bit rate before coding	4.19 Mbit/s		8.38 Mbit/s	
Radio	25 GHz	28 GHz	25 GHz	28 GHz
TS output power (antenna port)	14 dBm	14 dBm	14 dBm	14 dBm
Transmit antenna gain	35 dB	34.5 dB	35 dB	34.5 dB
Receive antenna gain (with radome)	15 dB	15 dB	15 dB	15 dB

2.3.3 – Capacity

The system capacity depends on the **traffic** mix between data services (transported on ATM cells) and leased lines or telephony services (transported on TDM circuits).

It also depends on the **channeling** and the number **of upstream channels**.

Figures are given in the following tables for three mix examples: **minimum**, **medium** and **maximum** circuit capacity but any intermediate mix is possible.

28 / 7 MHz channeling:

Downlink: 28 MHz Uplink: 1 x 7 MHz	Traffic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	60	120
ATM uplink capacity (cells/s)	18.823	9.412	0
ATM downlink capacity (cells/s)	75.512	66.530	57.399

Downlink : 28 MHz Uplink : 2 x 7 MHz	Traffic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	120	240
ATM uplink capacity (cells/s)	37.647	18.823	0
ATM downlink capacity (cells/s)	75.512	57.548	39.286

Downlink: 28 MHz Uplink: 3 x 7 MHz	Trafic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	180	360
ATM uplink capacity (cells/s)	56.471	28.235	0
ATM downlink capacity (cells/s)	75.512	48.566	21.173

Downlink: 28 MHz Uplink: 4 x 7 MHz	Trafic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	240	480
ATM uplink capacity (cells/s)	75.294	37.647	0
ATM downlink capacity (cells/s)	75.512	39.585	3.084

14/3.5 MHz channeling:

Downlink: 14 MHz Uplink: 1 x 3.5 MHz	Trafic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	30	60
ATM uplink capacity (cells/s)	9.412	4.706	0
ATM downlink capacity (cells/s)	38.047	33.519	28.990

Downlink: 14 MHz Uplink: 2 x 3.5 MHz	Trafic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	60	120
ATM uplink capacity (cells/s)	18.824	9.412	0
ATM downlink capacity (cells/s)	38.047	28.990	19.934

Downlink: 14 MHz Uplink: 3 x 3.5 MHz	Trafic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	90	180
ATM uplink capacity (cells/s)	28.235	14.118	0
ATM downlink capacity (cells/s)	38.047	24.462	10.877

Downlink: 14 MHz Uplink: 4 x 3.5 MHz	Traffic MIX: circuit capacity		
	Minimum	Medium	Maximum
Nb of circuits: 64 kbit/s	0	120	240
ATM uplink capacity (cells/s)	37.647	18.824	0
ATM downlink capacity (cells/s)	38.047	19.934	1.821

2.3.4 – X-Pol RBS Tx and X-Pol RBS Rx

The X-Pol RBS Tx is a transmitter radio that connects to an antenna. The X-Pol RBS Tx receives an IF channel from each of one or more IBS-TLX cards, upconverts the IF signal to RF, and sends the RF signal to the transmit antenna.

The X-Pol RBS Rx is a receiver radio that connects to an antenna. The X-Pol RBS Rx receives an RF signal from one or more NIUs through the connected antenna, downconverts the RF signal to IF, and sends the IF signal to the IBS-TLX card.

Figure 3 shows the X-Pol RBS Tx and X-Pol RBS Rx connected to antennas.

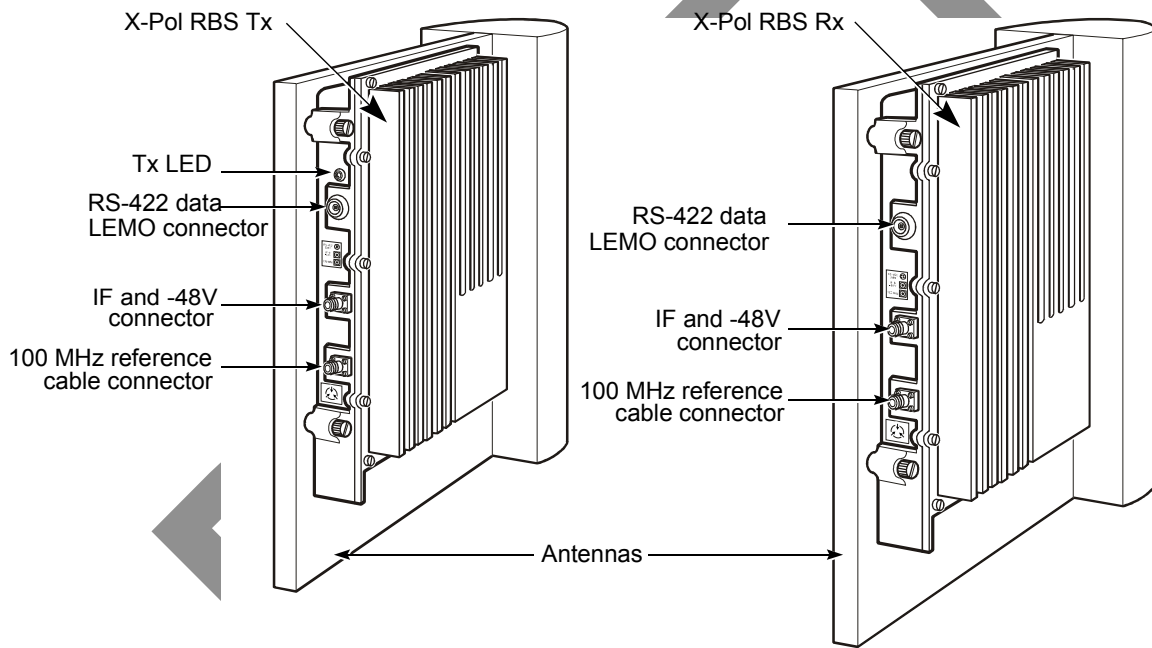


Figure 3 – X-Pol RBS Tx, X-Pol RBS Rx and antennas

X-Pol RBS Txs and X-Pol RBS Rxs are supplied with mounting hardware that is used to install the equipment on mounting poles. Table 1 lists the environmental requirements for an X-Pol RBS Tx or X-Pol RBS Rx. These specifications are met by using mounting brackets provided by Alcatel; however, the mounting brackets must be attached to mounting poles that are designed and fastened to a building or tower in such a way that these requirements are met.

Specification	Requirement
Operating	
Ambient temperature	-40 to +50°C (-40 to +122°F)
Humidity	0 to 100% condensing
Wind loading	0 to 180 km/h (112 mph)
Vibration	1 g random, at 5 to 2000 Hz
Physical shock (three axis)	11 ms half-sine pulses at 0 to 10 g
Altitude	4572 m (15 000 ft)
Seismic	NEBs, California zone 4
Elevation positioning relative to prescribed downtilt	< 0.1°
Azimuthal positioning relative to the prescribed bearing line	< 1.0°
Allowable elevation rotation motion	< 0.25°
Allowable azimuthal rotation motion	< 0.5°
Survival	
Wind loading	0 to 217 km/h (135 mph)

Table 1: X-Pol RBS Tx and X-Pol RBS Rx environmental requirements

Connectors

Table 2 describes the X-Pol RBS Tx and X-Pol RBS Rx connectors.

Connector	Type	Purpose
RS-422 Data	RS-422 LEMO	Connects to the IBS-TLX via an RS-422 cable
IF and -48V	N(F) coaxial	Connects to Tx IF coaxial cable (X-Pol RBS Tx) Connects to Rx IF coaxial cable (X-Pol RBS Rx)
100 MHz REF ⁽¹⁾	N(F) coaxial	Connects to a synchronization reference cable that synchronizes the X-Pol RBS Tx with the X-Pol RBS Rx

Table 2: X-Pol RBS Tx and X-Pol RBS Rx connectors

Note: ⁽¹⁾ This port has a dc blocking capacitor that protects the X-Pol RBS Tx/X-Pol RBS Rx from damage if -48 V dc is accidentally applied.



Warning - The RS-422 Data connector must be protected by a dust cap or tape if the X-Pol RBS Tx/X-Pol RBS Rx is installed before its cables are attached. The RS-422 Data connector is waterproof only when it is mated with the RS-422 data cable connector.

2.3.5 – Bias-T

The Bias-T mounts directly onto the 12:2 Combiner/Splitter and provides -48 V to the X-Pol RBS Tx and X-Pol RBS Rx at the BS site. *Figure 4* shows the Bias-T. *Table 3* describes the connectors on the Bias-T.

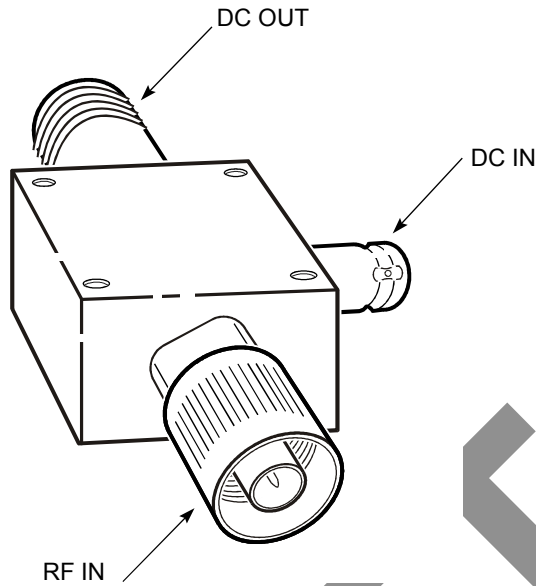


Figure 4 – Bias-T

Connector	Type	Purpose
DC OUT	N(F)	Connects to the X-Pol RBS Tx or X-Pol RBS Rx to provide both –48 V and RF signal connection
DC IN	BNC(F)	Connects to the Bias-T power cable via an intermediate surge protector to provide a –48 V power input
RF IN	N(M)	Connects to the Primary radio or Redundant radio connector on the 12:2 Combiner/Splitter

Table 3: Bias-T connectors

2.3.6 – Surge protectors

Surge protectors protect the system power supply from damaging power surges that may occur during a lightning strike to the outdoor equipment or IF cables. Surge protectors connect directly to each Bias-T via a BNC connector, and contain a gas discharge tube that must be replaced regularly. Figure 5 shows a surge protector. Table 4 lists the connectors.

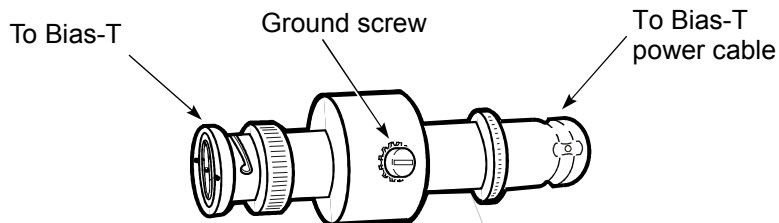


Figure 5 – Surge protector

Connector	Type	Purpose
Bias-T	BNC(M)	Connects to the Bias-T DC IN connector
Ground screw	Slot-head screw	Connects the surge protector body to a ground source
Bias-T power cable	BNC(F)	Connects to the Bias-T power cable, which connects to the -48 V power source to provide power to the X-Pol RBS Tx/ X-Pol RBS Rx

Table 4: Surge protector connectors

2.3.7 – Cables

There are four types of cables used in the BS:

- SMA cables
- Bias-T power cable
- IF cable
- RS-422 data cables

SMA cables

SMA cables connect the Tx and Rx connectors on the IBS-TLX card faceplate to the Tx and Rx 12:2 Combiner/Splitters. *Table 5* lists the SMA cable specifications.

Specification	Measure
Part numbers	2 m (6.6 ft): 90-6656-04 3 m (10 ft): 90-6656-01 6 m (20 ft): 90-6656-02
Impedance	50 Ω \pm 1 Ω
Frequency band	400 to 2050 MHz
Maximum VSWR	1.35:1
Maximum connector insertion loss	0.05 dB at 400 MHz 0.075 dB at 2 GHz
Average power rating (based on 150 m at 2 A dc)	< 1W
Maximum loss over IF band	2 m (6.6 ft) cable: 0.8 dB 3 m (10 ft) cable: 1.0 dB 6 m (20 ft) cable: 2.0 dB
Minimum shielding (dB)	-100 dB
Connector type	SMA(M)
Minimum bend radius	25 mm
Maximum phase change vs. bending radius	\pm 1°/GHz/mm
Operating temperature range	-5 to +55°C (+23 to +131°F)
Relative humidity	5 to 95%, non-condensing

Table 5: SMA cable specifications

Bias-T power cable

A Bias-T power cable is used to provide power to each Bias-T, by connecting the surge arrester to a –48 V dc power supply. [Table 6](#) lists the Bias-T power cable specifications.

Specification	Description
Part number	90-6518-01
Maximum bias port current	2 A
Maximum operating voltage	–72 V dc
Power supply connectors	–48 V power: #12 ring lug ⁽¹⁾ 0VR: #12 ring lug
Surge arrester connector	BNC (F)

Table 6: Bias-T power cable specifications

Note: ⁽¹⁾ The –48 V lead is attached to the center conductor of the cable.

BS IF cables

BS IF cables run between the 12:2 Combiner/Splitter and the X-Pol RBS Tx and X-Pol RBS Rx radios. Each BS IF cable requires a lightning arrester to be installed on the cable at the indoor equipment shelter grounded entry point, and a 1 m (3 ft) outdoor jumper cable to make the final connection to the X-Pol RBS Tx/X-Pol RBS Rx. [Table 7](#) lists the general requirements for BS IF cables. [Tables 8, 9, 10 and 11](#) list the specifications of Alcatel-recommended Andrew, CommScope and Times Microwave IF cables. The outdoor jumper cable is a finished assembly available from Times Microwave (part number FT-400DB/3/NM/NF).

Specification	Description
Impedance	50 Ω \pm 1 W
Frequency band	400 to 2050 MHz
Maximum VSWR	1.2:1
Average power rating (based on 300 m at 2 A dc)	< 5 W
Jacket spark	5000 VRMS
Maximum connector insertion loss	0.2 dB
Minimum shielding	–100 dB
Jacket flammability rating	CATVP, CATVR, CATVX, CATV (according to the environment where the cable is installed)
Outdoor cable temperature range	–40 to +50°C (–40 to +122°F)
Wind loading	200 km/h (125 mph)
Maximum phase change vs. temperature	\pm 1°/GHz/°C

Table 7: BS IF cable specifications

Specification	FSJ1-50A	FSJ2-50	FSJ4-50B
Minimum bending radius	25 mm (1 in.)	25 mm (1 in.)	32 mm (1.25 in.)
N(M) connector	F1PNM-H	F2PNM-H	F4PNM-C
Bending moment	1.1 Nm (0.8 ft-lb)	2.3 Nm (1.7 ft-lb)	2.7 Nm (2.0 ft-lb)
Cable weight	0.067 kg/m (0.045 lb/ft)	0.12 kg/m (0.078 lb/ft)	0.21 kg/m (0.14 lb/ft)
Diameter over cable jacket	7.4 mm (0.29 in.)	10.8 mm (0.425 in.)	13.5 mm (0.53 in.)
Temperature range	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾
Available jacket flammability rating	CATVX (FSJ1RN-50A) CATVR (FSJ1RN-50A)	CATVX (FSJ2RN-50) CATVR (FSJ2RN-50)	CATVX (FSJ4RN-50B) CATVR (FSJ2RN-50B)

Table 8: Andrew HELIAX FSJ cable specifications

Note: Standard outdoor jacket: -40° to 85°C (-40° to 185°F)
 CATVX, CATVR jackets: -30° to 80°C (-22° to 176°F)
 CATVP jackets, except LDF6-50A: -20° to 150°C (-4° to 302°F)
 CATVP jacket, LDF6-50A cable: 0° to 150°C (32° to 302°F)

Specification	LDF2-50	LDF4-50	LDF5-50	LDF6-50	HL4RP-50	HJ5-50
Minimum bending radius	11 mm (0.44 in.)	125 mm (5 in.)	250 mm (10 in.)	380 mm (15 in.)	125 mm (5 in.)	250 mm (10 in.)
N(M) connector	L2PNM	L4PNM	L5PNM	L6PNM	L4PNM	H5PNM
Bending moment	1.9 Nm (1.4 ft-lb)	3.8 Nm (2.8 ft-lb)	16.3 Nm (12 ft-lb)	53 Nm (39 ft-lb)	4.1 Nm (3 ft-lb)	34 Nm (25 ft-lb)
Cable weight	0.12 kg/m (0.08 lb/ft)	0.22 kg/m (0.15 lb/ft)	0.49 kg/m (0.33 lb/ft)	0.98 kg/m (0.66 lb/ft)	0.27 kg/m (0.18 lb/ft)	0.80 kg/m (0.54 lb/ft)
Diameter over cable jacket	11 mm (0.44 in.)	16 mm (0.63 in.)	28 mm (1.09 in.)	39.4 mm (1.55 in.)	15.5 mm (0.61 in.)	28.2 mm (1.11 in.)
Temperature range	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾	Cable jacket and type dependant ⁽¹⁾
Available jacket flammability rating	CATVX (LDF2RN-50) CATVR (LDF2RN-50)	CATVX (LDF4RN-50A) CATVR (LDF4RN-50A)	CATVR (LDF5RN-50A)	CATVR (LDF6RN-50A)	CATVP (HL4RP-50)	CATVP (HJ5RP-50) CATVR (HJ5RN-50)

Table 9: Andrew HELIAX LDF, HL and HJ cable specifications

Note: Standard outdoor jacket: -40° to 85°C (-40° to 185°F)
 CATVX, CATVR jackets: -30° to 80°C (-22° to 176°F)
 CATVP jackets, except LDF6-50A: -20° to 150°C (-4° to 302°F)
 CATVP jacket, LDF6-50A cable: 0° to 150°C (32° to 302°F)

Specification	CR50-540-PE	CR50-1070-PE
Minimum bending radius	102 mm (4 in.)	203 mm (8 in.)
Connectors	CR540NM	CR1070NM
Bending moment	10.6 Nm (7.8 ft-lb)	34 Nm (25 ft-lb)
Cable weight	0.22 kg/m (0.15 lb/ft)	0.41 kg/m (0.28 lb/ft)
Maximum diameter over cable jacket	13 mm (1/2 in.)	22 mm (7/8 in.)
Jacket flammability rating	See manufacturer	See manufacturer
Cable temperature range	-40 to +50°C (-40 to +122°F)	-40 to +50°C (-40 to +122°F)

Table 10: CommScope CellReach cable specifications

Specification	LMR-400 UltraFlex	LMR-600-LLPL	LMR-900-FR
Minimum bending radius	25.4 mm (1 in.)	38.1 mm (1.5 in.)	76.2 mm (3 in.)
Connectors	TC-400-NMH	TC-600-NMH	EZ-900-NMH
Bending moment	0.68 Nm (0.5 ft-lb)	3.73 Nm (2.75 ft-lb)	12.20 Nm (9 ft-lb)
Cable weight	0.10 kg/m (0.068 lb/ft)	0.20 kg/m (0.131 lb/ft)	0.40 kg/m (0.266 lb/ft)
Maximum diameter over cable jacket	See manufacturer	See manufacturer	See manufacturer
Jacket flammability rating	See manufacturer	CATVP	CATVR
Cable temperature range	See manufacturer	See manufacturer	See manufacturer

Table 11: Times Microwave cable specifications

RS-422 cables

RS-422 cables run from the X-Pol RBS Tx and X-Pol RBS Rx radios to the IBS-TLX connector on the front of the DBS. RS-422 cables are composed of two separate lengths of RS-422 cable: an outdoor-rated cable and an indoor-rated cable. The two cables are joined by the BS RS-422 lightning protector in the indoor equipment shelter room. *Table 12* lists the specifications for the RS-422 data cable.

Specification	Description
Cable supplier and part number	Indoor cable: Delco - 398087P Outdoor cable: Delco - 398087
Impedance	120 Ω
Maximum length	1000 m (3000 ft)
Connectors and supplier part number	Indoor/outdoor cable RJ45 connector: Stewart 943-SP-370808 SM2 Outdoor LEMO connector: LEMO USA FGG.1K.304.CLCC.60Z (strain relief: LEMO USA GMA.1B.065.DN)
Conductor	(7/34) 26 AWG or (7/32) 24 AWG Tinned annealed copper
Conductor resistance	141.4 Ω /1000 m (43.1 Ω per 1000 ft)
Shielding	Double shielded Shield #1 = aluminum/mylar tape Shield #2 = 36 AWG tinned copper braid
Shielding conductor resistance	12.5 Ω per 1000 ft
Weight	Indoor cable: 24.5 lb per 1000 ft Outdoor cable: 25 lb per 1000 ft
Operating temperature	Indoor cable: -5 to +55°C (+23 to +131°F) Outdoor cable: -40 to +50°C (-40 to +122°F)
Fire rating	Indoor cable: CSA FT-6, NEC 800, UL 910 Outdoor cable: CSA FT-4

Table 12: RS-422 data cable specifications

2.4 – Installing the base station components

2.4.1 – BS site requirements

BS X-Pol RBS TxS and X-Pol RBS RxS are mounted on elevated sites such as building rooftops or towers. General site requirements apply to the building or tower as a whole. Rooftop/tower requirements apply to the outside equipment environment. Equipment room requirements apply to the indoor environment that houses the LMDS, power utility hook-ups, and passive components such as 12:2 Combiner/Splitters, Bias-Ts and lightning arresters.

General site requirements

The following general requirements apply.

Access to power

The equipment room must be provided with a power utility hook-up capable of supplying power to the BS equipment.

Access to building or tower

Access to the rooftop or tower and equipment room must be available day or night, 24 hours each day for emergency repair or configuration.

Arranging access with the appropriate partner (facility security personnel, or the building/tower owner or lease-holder) is the responsibility of the wireless equipment owner.

Access to telecommunications services

Where access to telecommunications services or to back-bone network attachments are required by network design, permission to route fiber or cable to the equipment room must be arranged by the wireless equipment owner.

Rooftop/tower requirements

The following rooftop/tower requirements apply.

Rooftop/tower modification

Depending on international, national, territorial, regional or municipal regulations, rooftop/tower equipment may be affected by one or more of the following:

- allowable maximum height of mounting poles allowed on the rooftop or tower,
- color of exposed outdoor equipment and cable,
- aircraft glide slope (as governed by ICAO/IATA standards),
- equipment wind loading and structural impact of equipment added to a rooftop or tower.

These issues must be considered, and resolved with appropriate national, territorial, regional or municipal authorities, as well as with the owner and lease-holder of the property.

Safety

Equipment must be installed in such a way that installers and maintenance personnel are not at risk. Elevated installations must have accessible places for the proper connection of safety straps, to prevent accidental injury due to falls.

Equipment must be installed in such a way that public safety is not at risk due to falling equipment or tools during installation and long term operation.

Third-party equipment

Rooftops may contain third-party equipment that interferes with the RF or line-of-sight requirements of the system. If such conditions exist, this information must be provided to network design staff for contingency planning or alternate site selection.

Rooftop or tower access

Rooftop or tower access should be limited to authorized personnel only. All entry points to the rooftop or tower must be clearly marked with RF hazard signs.

Equipment room requirements

The following equipment room requirements apply.

Proximity to the X-Pol RBS Tx and X-Pol RBS Rx radios

The equipment room should be located in an area that is central to each sector pair of X-Pol RBS Tx's and X-Pol RBS Rx's, to provide convenient cable access. The equipment room should be located as close to the rooftop level as possible, to reduce cable length requirements.

Shelf space

Each equipment rack requires 0.652 m² (7.02 ft²), in accordance with Bellcore GR-63-CORE. This space requirement includes wiring and maintenance space.

Power

The MainStreetXpress 36170 shelf consumes a maximum of 1050 W of power. Each –48 V power supply used to power an X-Pol RBS Tx or X-Pol RBS Rx radios consumes 50W of power.

Electrical ground access

The equipment room must provide access to a ground source that fulfils all international, national, territorial, regional and municipal regulations for absorbing energy discharge from lightning arresters.

Temperature and environmental control

The air temperature in the equipment room must be maintained in the range of –5 to +55°C (+23 to +131°F). This may require installing an air conditioning system, and a back-up air venting system. Additionally, the equipment room must provide protection from precipitation, seeping water and humidity.

Cables must enter the equipment room through feed-through, weatherproof rubber cable portals capable of handling the BS configuration and growth plans.

Fire suppression

The equipment room must be equipped with a chemical fire suppression system that complies with all international, national, territorial, regional and municipal fire safety codes.

Cable guides

Cable guides and ladders should be used appropriately to route cable both inside and outside the equipment room.

Controlled access

Only authorized personnel should have access to the equipment room.

2.4.2 – BS installation overview



Note 1 - BS components and cables must be installed and serviced by trained personnel who are experienced in the local, national and civil electrical and safety regulations of the area where the equipment is being installed.

Some areas require that only licensed individuals may install and service equipment. Consult appropriate local authorities prior to installation.

Note 2 - All IF cabling must meet local safety and building code requirements.

Customer-supplied equipment

Customers installing a BS need to supply:

- attenuators,
- IF cable,
- a grounded entry point,
- ground wires and connectors,
- weatherproof cable entry panel(s),
- poles or towers for mounting X-Pol RBS Rxs and X-Pol RBS TxS,
- miscellaneous supplies and connector tools (such as butyl electrical tape, cold-shrink tubing, cable cutter, wire stripper and crimping tool),

- cable guides and ladders,
- cable hangers and cable grounding kits,
- antenna heaters (to prevent antenna icing).

Grounded entry point

Each BS requires a grounded entry point in order to ground BS components and cables. Refer to local electrical code requirements when choosing a grounded entry point for the BS.

Lightning protection

BS site lightning protection requires:

- installing lightning arresters on IF and RS-422 cables,
- grounding X-Pol RBS Tx, X-Pol RBS Rx and mounting poles,
- grounding IF cables,
- lightning rods.

Lightning arresters

The installation of both IF and RS-422 cable lightning arresters is strongly recommended. If lightning arresters are not used, equipment is not covered by the warranty agreement.

Lightning arresters should be installed as close to the rooftop IF cable entry point as possible. Lightning arresters must be grounded according to international, national, territorial, regional and municipal safety codes.

Lightning rods

Equipment that may be subject to lightning strikes must be protected by a lightning protection system that is installed in accordance with all applicable international, national, territorial and local regulations and practices.

This may require the installation of lightning rods, a rooftop ground loop, and a main building ground.

X-Pol RBS Tx and X-Pol RBS Rx

The X-Pol RBS Tx and X-Pol RBS Rx cases, mounting bracket and mounting pole must be grounded to the building power utility ground.

IF cable

IF cables must be grounded at the cable entry point, every 50 m (164 ft) between the cable entry point and the X-Pol RBS Tx or X-Pol RBS Rx, and at the base of a tower.

Use a standard cable grounding kit available from the recommended cable manufacturer.

IF cable installation

IF cables provide a signal path for data, and power for the X-Pol RBS Tx and X-Pol RBS Rx. IF cables should be approved by Alcatel, and rated for the particular environment where they are installed (indoor, outdoor, riser or plenum).

Cable run requirements for the inside and outside of the equipment room vary from site to site. Alcatel currently recommends only certain cable types, connectors and manufacturers. However, customers can contact Alcatel to inquire about using alternate cable solutions if the currently approved cables do not suit a specific application.

Because there are many factors associated with choosing a suitable IF cable, customers are advised by Alcatel of the manufacturers and part numbers recommended for these cable assemblies.



Caution - When installing IF cable, use the connectors and connector tools recommended in Appendix A. Failure to do so could damage the connectors or result in poor signal quality.

Weatherproofing

IF cable connectors and cable entry points must be weatherproofed.

IF cable connectors

Moisture in IF cables causes an increase in VSWR that increases signal loss beyond the specifications of the system. All IF cable connections should be weather-proofed using butyl tape, or cold-shrink kits available from the cable or connector manufacturer.

RS-422 data cable LEMO connectors

The RS-422 data cable LEMO connector is a waterproof connector when properly assembled. Additional weatherproofing is not required.

X-Pol RBS Tx, X-Pol RBS Rx and antennas

If an X-Pol RBS Tx/X-Pol RBS Rx is removed from an antenna, care must be taken to ensure the O-ring that seals the RF channel between the X-Pol RBS Tx/X-Pol RBS Rx and antenna is correctly installed when the X-Pol RBS Tx/X-Pol RBS Rx is reconnected to an antenna.

Cable entry point

In order to keep moisture from entering the building, cable entry points should be weatherproofed using a feed-through weatherproof rubber cable portal.

Where a cable runs down a wall to enter a building, a drip-loop or bend in the cable is required to ensure that rainwater does not follow the cable into the building. The drip-loop or bend causes rain water to drip from the cable before it reaches the cable entry point.

X-Pol RBS Tx and X-Pol RBS Rx installation

The X-Pol RBS Tx and X-Pol RBS Rx must be connected to antennas before being mounted on towers, masts, building rooftops or other appropriate fixtures.

BS antennas connect to mounting hardware that is attached to 11.43 cm (4 1/2 in.) outer diameter steel mounting poles at preselected locations on a rooftop.



Note - The required inner diameter (wall thickness) of a mounting pole must be determined by professional engineering staff, taking into consideration the torsional and vibrational forces caused by the wind loading on the pole and on the equipment mounted on the pole, as well as the distribution of these forces on the supported and unsupported parts of the pole.

Vertical and horizontal spacing between X-Pol RBS Txs and X-Pol RBS Rxs is provided by cell planning activities, and must be adhered to.

Power for each X-Pol RBS Tx and X-Pol RBS Rx is delivered by the IF cable. No additional power delivery is required for the radios.

2.4.3 – Equipment and cable connection for non-redundant and redundant X-Pol RBS Tx/X-Pol RBS Rx configurations

Figure 6 shows a typical non-redundant X-Pol RBS Tx/X-Pol RBS Rx BS configuration. Figure 7 shows a redundant X-Pol RBS Tx/X-Pol RBS Rx BS configuration. Grounding, surge protection and power connection for non-redundant and redundant systems are similar. Attenuators, if required, are installed between the 12:2 Combiner/Splitter and the Bias-T. Table 13 lists the BS components and part numbers.

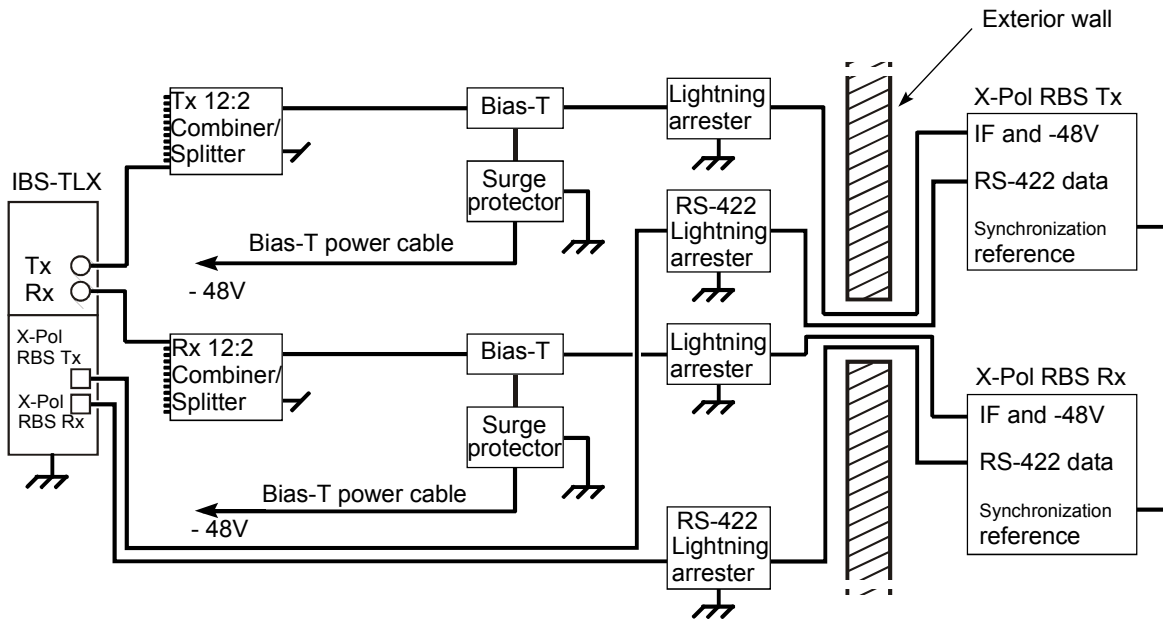


Figure 6 – Non-redundant X-Pol RBS Tx/X-Pol RBS Rx BS components and cables

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Item	Number for non-redundant X-Pol RBS Tx/ X-Pol RBS Rx system	Number for redundant X-Pol RBS Tx/ X-Pol RBS Rx system	Part number	Commercial Code
12:2 Combiner/Splitter	2	2	90-6659-01	
2:1 Combiner/Splitter	0	2	90-6734-01	
Type N lightning arrester	2	4	90-6517-01	
X-Pol RBS Tx	1	2	See § 2.3	
X-Pol RBS Rx	1	2	See § 2.3	
Antennas	1 1	2 2	290-4563-xx (horizontal polarization) 90-4564-xx (vertical polarization)	
RS-422 lightning arrester	2	4	90-6519-01	
Surge protector	2	4	90-6739-01	
Bias-T	2	4	90-6516-01	
Bias-T power cable	2	4	90-6518-01	

Table 13: BS equipment summary per sector

2.4.4 – BS installation tasks

The following installation tasks apply to the installation of a BS.

Task	Chapter
Install the IBS	
Attach the X-Pol RBS Tx/X-Pol RBS Rx to an antenna	
Attach the antenna to the pole assembly, ground the X-Pol RBS Tx/X-Pol RBS Rx and adjust the downtilt	
Connect the surge protectors to the Bias-Ts	
Connect the Bias-Ts to the 12:2 Combiner/Splitter	
Mount the Type N lightning arresters	
Connect the BS cables	
Calibrate IF cable upstream and downstream losses	

2.5 – Installing BS X-Pol RBS Tx, X-Pol RBS Rx and antennas

2.5.1 – Overview

This chapter describes how to:

- attach an X-Pol RBS Tx or X-Pol RBS Rx to an antenna,
- attach antenna mounting plates to a pole,

- attach antennas to mounting plates,
- ground the X-Pol RBS Tx and X-Pol RBS Rx,
- adjust antenna downtilt,
- replace a X-Pol RBS Tx, X-Pol RBS Rx or antenna.



Note - X-Pol RBS Txs, X-Pol RBS Rxs and antennas must be installed and serviced by trained personnel who are experienced in the local, national and civil electrical and safety regulations of the area where the equipment is being installed. Some areas require that only licensed individuals may install and service equipment. Consult appropriate local authorities prior to installation.

BS antennas connect to mounting hardware that is attached to 11.43 cm (4 1/2 in.) outer diameter steel mounting poles at preselected locations on a rooftop.



Note - The required inner diameter of a mounting pole must be determined by professional engineering staff, taking into consideration the torsional and vibrational forces caused by the wind loading on the pole and on the equipment mounted on the pole, as well as the distribution of these forces on the supported and unsupported parts of the pole.

The location of the mounting poles, the distance between X-Pol RBS Txs and X-Pol RBS Rxs, the height of the X-Pol RBS Txs and X-Pol RBS Rxs on the mounting poles, and the polarization of the X-Pol RBS Tx and X-Pol RBS Rx antennas are determined as part of cell planning. The distance required between X-Pol RBS Tx and X-Pol RBS Rx antennas is either a horizontal or vertical distance, as shown in *Figure 8*.

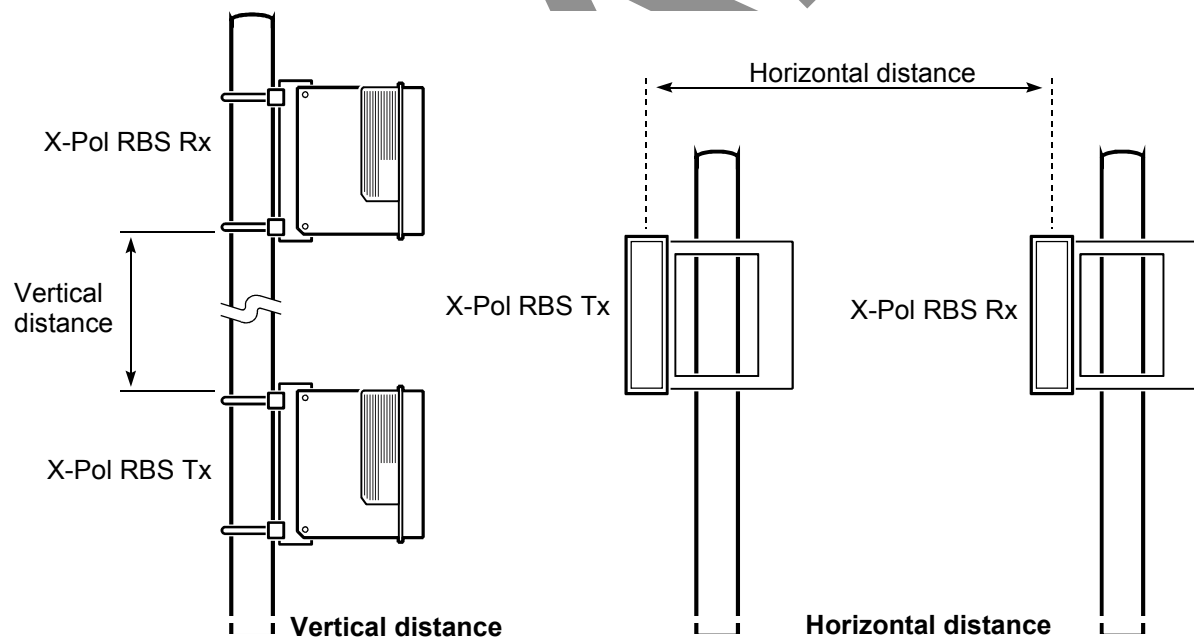


Figure 8 – Distance between X-Pol RBS Tx and X-Pol RBS Rx antennas

2.5.2 – Attaching an X-Pol RBS Tx or X-Pol RBS Rx to an antenna

Each X-Pol RBS Tx and X-Pol RBS Rx must be connected to an antenna in a clean indoor environment, on a surface that is suitable for electronic assembly, before the antenna is mounted on the BS pole assembly.

To install an X-Pol RBS Tx or X-Pol RBS Rx on an antenna that is already attached to a mounting plate, the antenna must be removed from the mounting plate without disturbing the antenna downtilt. See procedure 6-6 for information on removing an antenna from a mounting bracket.



Note 1 - Do not remove the shipping caps from the coaxial and RS-442 connectors on the X-Pol RBS Tx and X-Pol RBS Rx until the BS cables are ready for attachment.

Note 2 - Antenna polarization is specified in cell planning, and cannot be changed without affecting network performance. Use the appropriate Tx and Rx antenna polarization for X-Pol RBS Tx's and X-Pol RBS Rx's in a given sector, as specified by cell planning activities.

To attach an X-Pol RBS Tx or X-Pol RBS Rx to an antenna

1. Remove the RF wave guide cover from the X-Pol RBS Tx or X-Pol RBS Rx, and remove the RF wave guide plug from the antenna. *Figure 9* shows the location of the cover and the plug.

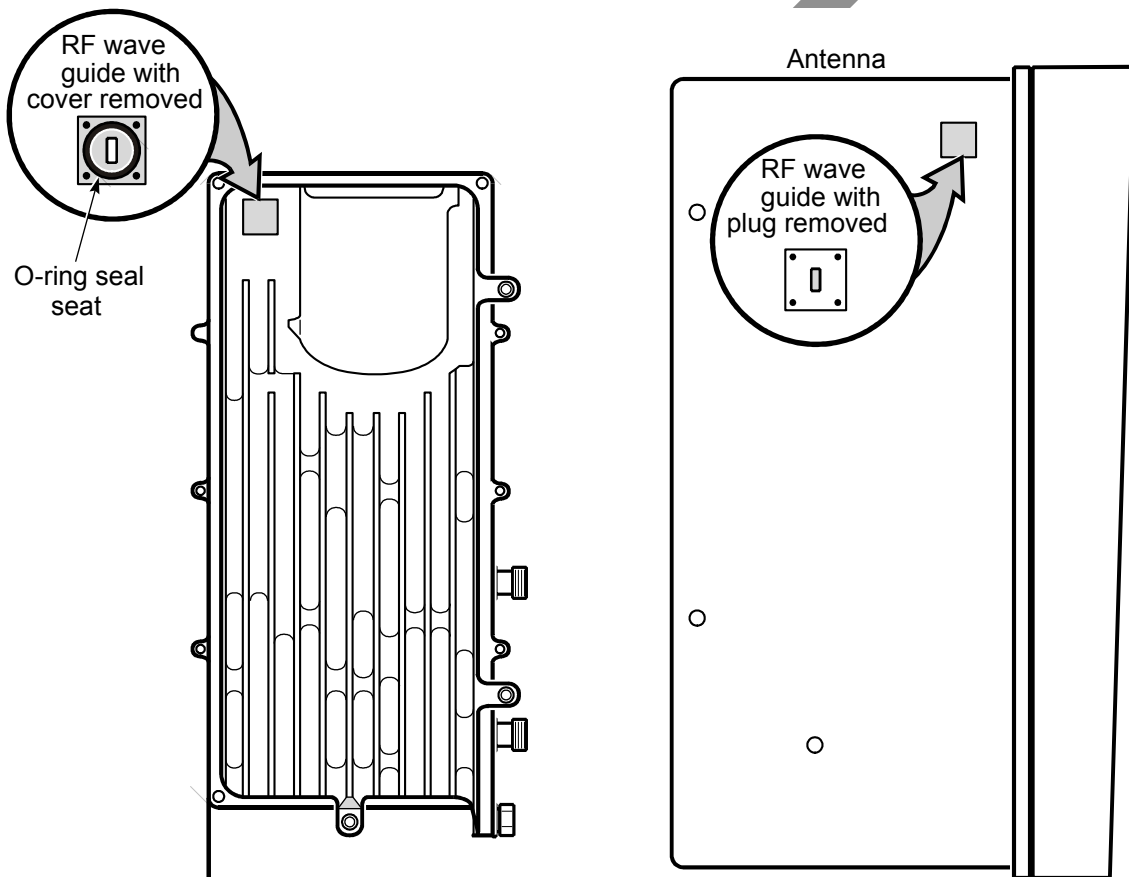


Figure 9 – Location of the wave guide plugs and covers

2. Place the radio on a flat surface, with the wave guide facing up.
3. Place the provided O-ring on the O-ring seal seat around the X-Pol RBS Tx or X-Pol RBS Rx RF wave guide. Ensure that the O-ring remains in place during the remainder of the procedure.
4. Place the antenna on the radio as shown in *Figure 10*, ensuring that the captive bolts align with their threaded standoffs. Tighten each of the three captive Hex bolts to 2.37 Nm (21 in.-lb) torque.