WAVEXpress/BTS

Installation and Commissioning Guide

Release 3.3

interWAVE COMMUNICATIONS
Part Number 680075-00
1/99 Revision A

Release 3.3, Revision A (January 1999)

This document applies to the interWAVE Communications International, Inc. system release 3.3 of the WAVEXpress/BTS and to all subsequent versions and releases of the hardware or software unless otherwise indicated in a new version or an update package for this edition.

Publications are stocked at the address given below. Requests should be addressed to:

Technical Publications Department

656 Bair Island Road, Suite 108

Redwood City, CA 94063

Fax: 650.261.6220

United States Federal Communications Commission Required User Information

This equipment complies with Part 68 of the FCC rules. Located on the equipment is a label that contains, among other information, the FCC registration number. If requested, this information must be provided to the telephone company.

This equipment cannot be used on the telephone company-provided coin service. Connection to Party Line Service is subject to State Tariffs.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, of procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

If trouble is experienced with this equipment, please contact:

interWAVE Communications, Inc.
656 Bair Island Road, Suite 108
Redwood City, CA 94063
Phone: 650.482.2100

If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved.

It is recommended that the customer install an AC surge arrester in the AC outlet to which that device is connected. This is to avoid damaging the equipment caused by local lightening strikes and other electrical surges.

This equipment uses the following USOC jacks and codes:

Model Name	Facility Interface Code	Service Order Code	Jack Type
340122	04DU9-BN	6.ON	RJ-48C
340122	04DU9-DN	6.ON	RJ-48C
340122	04DU9-1KN	6.ON	RJ-48C
340122	04DU9-1SN	6.ON	RJ-48C
340122	04DU9-1zN	6.ON	RJ-48C

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio 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 his own expense.

Changes of modifications not expressly approved by interWAVE Communications, Inc. can void the user's authority to operate the equipment.

The 1900MHz WAVEXpress Series M50 complies with Part 24 of the FCC Rules.

Industry Canada Required User Information

CP-O1, Issue 8, Part 1, Section 14.1

NOTICE: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee 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 equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection 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 such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The standard connecting arrangement (telephone jack type) for this equipment is CA81A.

CP-01, Issue 8, Part 1, Section 14.2

NOTICE: The **Ringer Equivalence Number** (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination of 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 5.

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

Cet appareil numerique de la classe A est conforme a la norme NMB-003 du Canada.

This device complies with Industry Canada RSS-133 and SRSP-510.

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Preface

Assumptions, Purpose, and Audience

interWAVE assumes that pre-installation project planning has occurred, and is documented via a site survey report. This site survey should include items such as the location of antennas, chassis, power connections and other interface accesses and temperature control equipment.

This document is intended for an interWAVE trained field service engineer (FSE) or operator who performs local installation and commissioning at the customer's site. The FSE or operator should be equipped with the necessary tools for installation and commissioning, and a basic understanding of the GSM cellular network. The FSE or Operator should also be familiar with the use of Craft PC and procedures conducted using the Craft PC.

Related Documentation

While this guide focuses mainly on how to operate the WAVEXpress/BTS, it may be necessary to refer to other publications for more specific information.

Documents and Part Numbers

The following is a list of all related documentation. All manuals are bundled on a single documentation CD-ROM. Print versions of individual manuals are also available. To order documentation, please contact interWAVE Communications, Inc. at +1.650.482.2100.

Document Title	Part Number
Documentation, CD-ROM Version, Release 3.3	D640233CD
Documentation, CD-ROM Version, Release 4.0	D640189CD

The following table lists all the manuals included in the documentation package (CD or print) and includes individual part numbers.

Table 1: Related publications

Document Title	Part Number
WAVEXpress/BTS Product Guide	680043-00
WAVEXpress/BSC Product Guide	680044-00
WAVEXchange Product Guide	680047-00
BSS Field Maintenance Guide	680081-00
Field Maintenance Guide	680051-00
BSS Craft PC Guide	680053-00
interWAVE's BSS Network Implementation Guide	680054-00
WAVEXchange Installation and Commissioning Guide	680055-00
WAVEXpress/BTS Installation and Commissioning Guide	680075-00
WAVEXpress/BSC Installation and Commissioning Guide	680074-00
interWAVE BSS Parameter Dictionary	680058-00
interWAVE Parameter Dictionary	680059-00
interWAVE Glossary of Terms	680060-00
WAVEView OMC-R Setup and System Administration Guide	680061-00
WAVEView OMC Setup and System Administration Guide	680062-00
Craft PC Guide	680063-00
interWAVE's Network Implementation Guide	680064-00
WAVEView OMC-R Operations and Maintenance Guide	680077-00
WAVEView OMC Operations and Maintenance Guide	680066-00

Documentation Structure

This section lists and describes all documentation related to the 3.3 system release.

WAVEXpress/BTS Product Guide

Scope

The WAVEXpress/BTS Product Guide is a technical reference that provides a description of the WAVEXpress/BTS functionality, capacities, operational features, and specifications.

Audience

This guide is intended for network operators and planners who require the knowledge to plan and setup network architecture and cells. It is also used by installation and maintenance technicians who may be interested in understanding the network architecture and fault locating capabilities.

WAVEXpress/BSC Product Guide

Scope

The WAVEXpress/BSC Product Guide is a technical reference that provides a description of the WAVEXpress/BSC functionality, capacities, operational features, and specifications.

Audience

This guide is intended for network operators and planners who require the knowledge to plan and setup network architecture and cells. It is also used by installation and maintenance technicians who may be interested in understanding the network architecture and fault locating capabilities.

WAVEXchange Product Guide

Scope

The WAVEXchange Product Guide is a technical reference that provides a description of the WAVEXchange functionality, capacities, operational features, and specifications.

Audience

This guide is intended for network operators and planners who require the knowledge to plan and setup network architecture and cells. It is also used by installation and maintenance technicians who may be interested in understanding the network architecture and fault locating capabilities.

Field Maintenance Guide

Scope

This guide describes the basic BSS and NSS maintenance and troubleshooting procedures used on-site.

Audience

This guide is intended for the maintenance technician who will maintain and troubleshoot the WAVEXchange, WAVEXpress/BSC, WAVEXpress/BTS and MicroXpress/BTS.

WAVEXchange Installation and Commissioning Guide

Scope

This guide includes step-by-step installation and off-line and on-line commissioning procedures for the WAVEXchange. The final goal is a network element ready for commercial use in a GSM or DCS network.

Audience

This guide is intended for on-site technicians responsible for installing and commissioning these network elements. It assumes knowledge of telecommunications equipment used for installation.

WAVEXpress/BTS Installation and Commissioning Guide

Scope

This guide includes step-by-step installation and off-line and on-line commissioning procedures for the WAVEXpress/BTS. The final goal is a network element ready for commercial use in a GSM or DCS network.

Audience

This guide is intended for on-site technicians responsible for installing and commissioning these network elements. It assumes knowledge of telecommunications equipment used for installation and basic radio frequency (RF) knowledge.

WAVEXpress/BSC Installation and Commissioning Guide

Scope

This guide includes step-by-step installation and off-line and on-line commissioning procedures for the WAVEXpress/BSC. The final goal is a network element ready for commercial use in a GSM or DCS network.

Audience

This guide is intended for on-site technicians responsible for installing and commissioning these network elements. It assumes knowledge of telecommunications equipment used for installation.

interWAVE Parameter Dictionary

Scope

This dictionary is a reference guide that describes all objects and attributes used in WAVEView and in NMI, which is the command line proprietary language used to manage interWAVE objects from the interWAVE Craft PC. For each object, it includes a list of definitions, accepted ranges of values, default values, and comments that describe correlations of attributes between the WAVEView and NMI.

Audience

This guide is intended for all personnel using interWAVE equipment.

interWAVE Glossary of Terms

Scope

The interWAVE Glossary of Terms includes an alphabetical glossary of terms and lists the acronyms used by the interWAVE products and documents.

Audience

This glossary allows an interWAVE trained field service engineer (FSE), the local operator, or other customer to look up the technical terms used by interWAVE and GSM.

WAVEView Setup and System Administration Guide

Scope

The WAVEView hardware platform is delivered to a customer site with all appropriate software installed and with factory set default values entered for all configurable parameters. Upon receipt of the system, the system administrator must configure these parameters to correspond with those used in the network. The system administrator also must perform basic routine maintenance at the operating system level to ensure that WAVEView is functioning optimally, and that all data and databases are backed up in the event of system failure. The WAVEView Setup and System Administration Guide details the routine tasks performed by a system administrator in a UNIX environment.

This guide also describes the 'behind-the scenes' procedures that can be performed in-house if the software must be re-installed or if the WAVEView OMC platform needs to be re-commissioned before integration into a pre-existing network.

Audience

This guide is intended for the UNIX system administrator who will initially commission and maintain the WAVEView software and will configure the WAVEView server and clients.

Craft PC Guide

Scope

This guide describes the procedures for using the Craft PC for software installation and maintenance of the WAVEXchange, WAVEXpress and MicroXpress.

Audience

This guide is intended for on-site technicians responsible for the commissioning and maintenance of these network elements.

interWAVE's Network Implementation Guide

Scope

This guide is a tool to lead technicians through the processes of implementing and integrating an interWAVE network. It defines all activities of the implementation and integration phases and clearly separates the site surveys, installations, commissioning, and integration activities. The final goal is a micro-cellular network ready for commercial use in a GSM or DCS network.

Audience

This guide is intended for network designers and planners who are tasked with implementation of a network. It is also used by the WAVEView user and maintenance technician who may be interested in understanding the global picture of a network deployment.

WAVEView Operations and Maintenance Guide

Scope

This guide describes how to use WAVEView: interWAVE's graphical user interface (GUI) based network management system (NMS) to manage the interWAVE product line. The first chapter contains an introduction and a brief overview of WAVEView. Subsequent chapters contain details on the WAVEView conventions and step-by-step instructions on how to use it in managing a network.

Audience

This guide is intended for the following types of users:

- The general operator who will have access privileges to control or monitor the whole or only parts of the network.
- The network planner or designer tasked with the implementation of a network who will use this guide as a reference.
- The WAVEView administrator who will have access to all parts of the NMS.

Customer Support Services

interWAVE has regional service and support centers to handle day-to-day customer issues. Each center is staffed with a local technical support group. The exact services to be performed by interWAVE's Technical Support Department are specified in a support contract. Below is an example of the types of services available:

- telephone support
- site surveys
- installations
- off-line and on-line commissioning
- network integration activities
- troubleshooting and fault isolation
- escalation of problems to appropriate interWAVE technical departments

interWAVE can physically perform all or a portion of these processes for the operator, as specified in the support contract. The Technical Support Department can also provide documentation outlining corrective and preventive maintenance procedures and troubleshooting guides for fault isolation.

Technical Support may be reached at +1.650.482.2100.

If possible, please have the following information available when making a call:

- site number
- full description of product(s) (e.g., model and part number)
- serial number of product(s)
- purchase order number if a non-warranty repair is necessary
- original sales order number if product is under warranty

Return Materials Authorization

In the event that a depot repair or hardware replacement is required, please contact interWAVE Communications for return authorization. The following information is required by interWAVE:

- full description of the product(s): model and part number
- serial number of the product(s)
- purchase order number if a non-warranty repair is necessary
- original sales order number if the product is under warranty
- quantity that needs to be returned to interWAVE, if applicable

All interWAVE products carry a one year manufacturing warranty from the date of installation. At the time of a request for a return authorization, if the product has exceeded the warranty period, interWAVE will require a new purchase order number to cover the cost of non-warranty repair.

Training

interWAVE Communications has developed an extensive series of training courses designed to teach you how to use our products. The courses are developed by a combination of subject matter experts and training specialists in order to create highly technical materials in modern training format. Each of our course offerings are designed around specific learning objectives that keep our classes on track to learning specific job skills related to interWAVE's products.

interWAVE's training catalog contains a listing of the interWAVE training services available along with descriptions of each course. Our training materials are divided into specific sub system training series, depending upon the topic and job requirements. To obtain more information, contact the Training Department in Redwood City, CA at +1.650.482-2115 or by email at training@iwv.com.

Conventions Used in this Manual

The following type and style conventions are used in this manual:

Table 2: Conventions used in this manual

Convention	Meaning
Body text	Used for regular body text
Bold	Indicates a menu or button choice
`Command`	Indicates computer generated text
`User Input`	Indicates user input
`<hostname>`	In command syntax, indicates user-specified command line parameters
`Italic`	Represents prompt string
`[BRACKETS]`	Indicates a key on the keyboard or instrument
NOTE 	Provides relevant additional information
	Provides important warning information that may affect operation of or may be a potential threat to the system
	USED TO STRESS THAT THE READER **STOP** WHAT THEY ARE DOING TO READ IMPORTANT INSTRUCTIONS THAT ARE VITAL TO PREVENT DAMAGE OF EQUIPMENT OR SOFTWARE

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Installation

One

Unpacking the WAVEXpress/BTS

The WAVEXpress/BTS was packed with great care, and all containers were inspected prior to shipment. Upon receipt of these packages, immediately inspect the outside of the shipping containers. If there is any visible damage, insist that a representative of the carrier be present when unpacking the contents.

Carefully inspect the system as it is unpacked. If any damage such as dents or broken connections is noticeable, immediately notify the carrier as well as the interWAVE Communications Solution Center.

Store the shipping containers for future use. If the unit has to be returned for upgrade or service, the specially designed shipping containers assure adequate protection for the equipment. If for some reason the containers are not reusable or if they are misplaced, please contact interWAVE to order new containers.

1-1Configuration Labels

There are four configuration labels which placed on the front of each of the WAVEXpress modules as well as the chassis to help identify the system's current configuration. The four labels identify the part's:

- Identity
- Part number
- Revision number
- Serial number

An example of a configuration label is shown in the following figure:

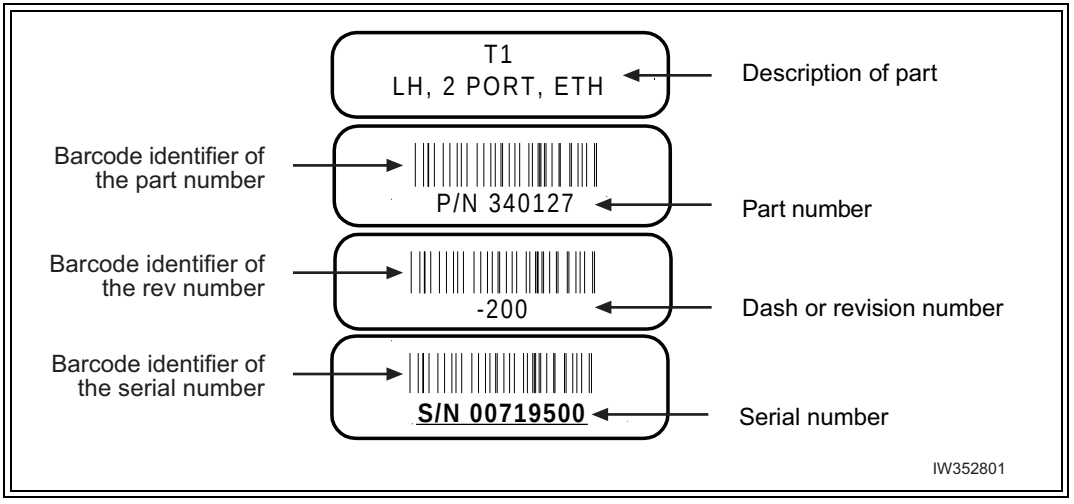


Figure 1-1: Example of the four configuration labels

NOTE

The TRX cards have 4 configuration labels affixed to their front face. They are:

- TRX Module 1900MHz
- PWR AMP 1900MHz
- DSP/TRX
- RF/TRX

The first two labels identify the operating frequency band of the TRX. The RF/TRX label identifies the RF characteristics of the TRX.

Note that each descriptive label is followed by a part number, revision number and serial number label.

1-1.1 Module Identification Numbers

The part number, revision number and serial number of each module needs to be logged. This information is needed for technical support, warranty situations or product updates. Use the WAVEXpress/BTS Installation Checklist located in the appendix to log this information.

NOTE

Note only the serial number of the TRX card in the checklist. Do not note the serial numbers of the power amp, DSP and RF boards. This is because the serial number of the TRX module is the only number visible from the OMC.

1-2 WAVEXpress/BTS Modules

The WAVEXpress is shipped with all cards and modules installed in the chassis, according to the ordered configuration. Upon opening the front door, several basic parts to the unit are visible:

- The power supply module
- Fan assemblies
- The clock module
- Card cage
- All installed cabling.

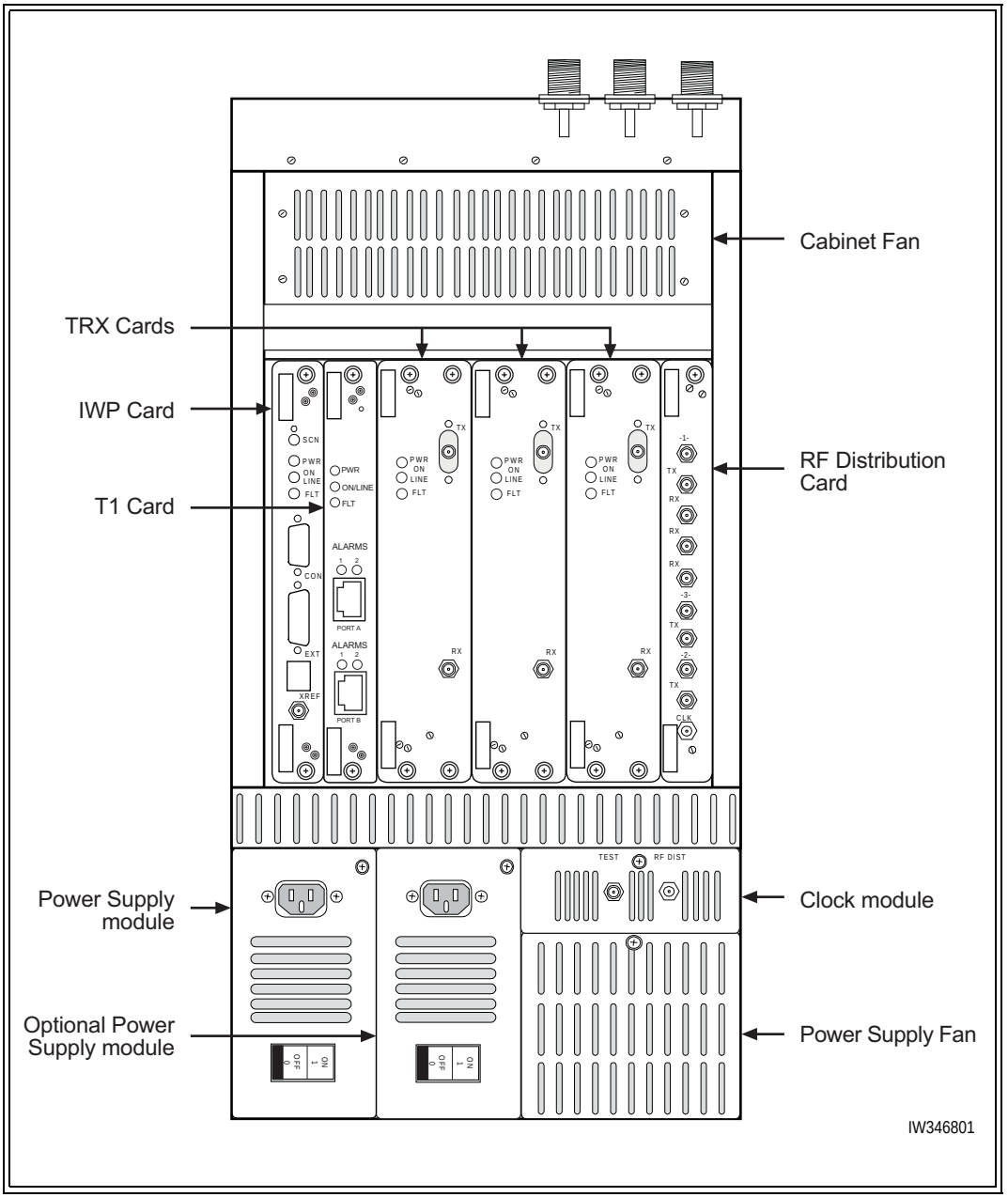


Figure 1-2: A WAVEXpress/BTS (front view, door open, no cabling, maximum configuration - loaded with 1 IWP, 1 T1, 1 RF Distribution Card and 3 TRX cards)

The chassis of the WAVEXpress/BTS can accept up to 9 cards. Card slots are labeled from left to right, starting at 0. The IWP card must always be placed in slot 0 while the RF Dist card must always be placed in slot 8. It is usual to place the T1 card in slot 1, and the TRX cards, each occupying 2 slots, in slots numbered 2-7. The left side of the TRX card must be placed in an even-numbered slot; either in slots numbered 2,4 or 6. TRX cards are placed from right to left. If the BTS is a 1 TRX BTS, the TRX is placed in slot 6-7. A second TRX is placed in slot 4-5 and a third TRX is placed in slot 2-3.

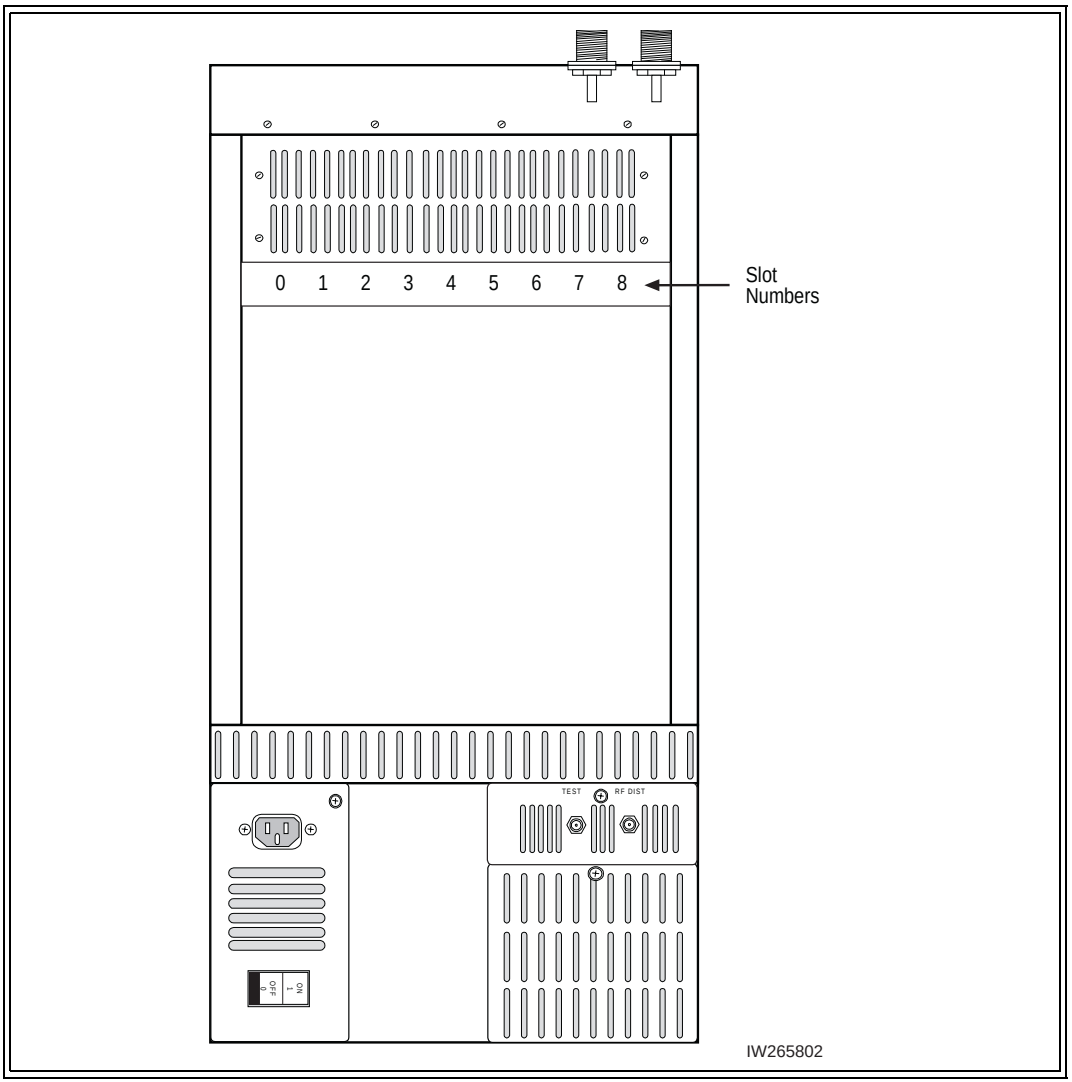
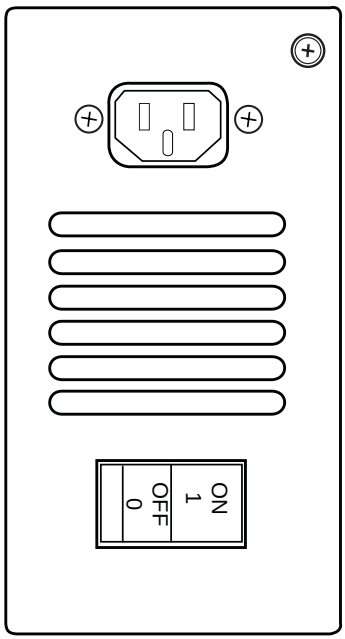


Figure 1-3: WAVEXpress chassis (front view, door open containing one power supply and one clock module)

1-3 Modules, Connections and Indicators

The following section describes all the BTS modules, their connectors and indicator lights.

1-3.1 AC Power Supply Module



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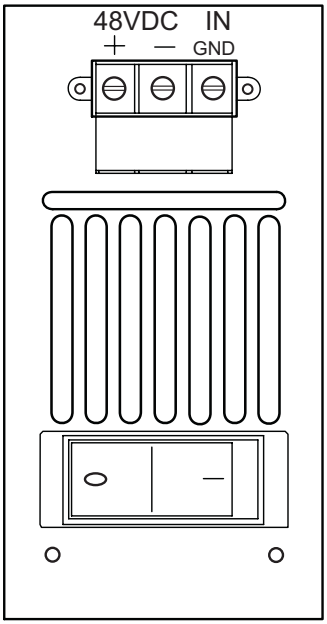
The following table describes the function of the connectors and indicators on a WAVEXpress/BTS AC power supply module.

Table 1-1: AC power supply module's connectors and indicators

Connector or Indicator	Function
ON/OFF switch	Turns power on or off to the unit Circuit breaker for the unit.
Power connector	A standard IEC 110/220V 50/60Hz AC power cord for AC operation

1-3.2 DC Power Supply Module



IW352804

The following table describes the function of the connectors and indicators on a WAVEXpress/BTS DC power supply module.

Table 1-2: DC power supply module's connectors and indicators

Connector or Indicator	Function
ON/OFF switch	Turns power on or off to the unit Circuit breaker for the unit.
Power connector	A screw clamping type barrier terminal for DC operation

1-3.3 Clock Module

The following table describes the function of the connectors and indicators on a WAVEXpress/BTS clock module.

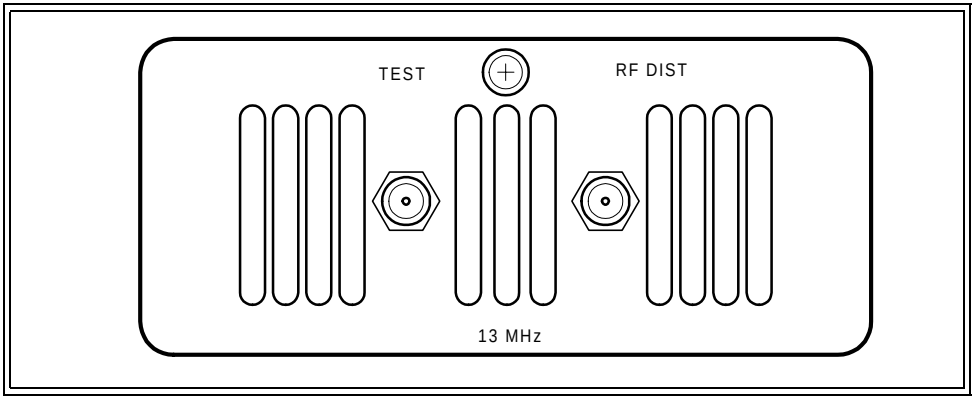
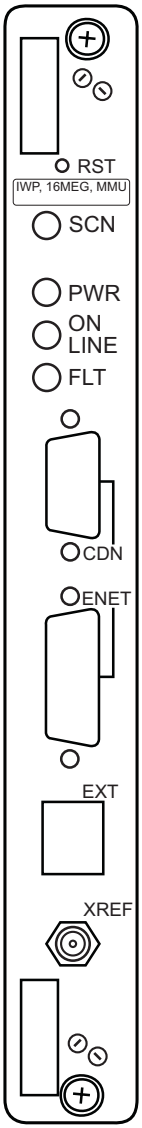


Figure 1-4: Front view of the clock module

Table 1-3: Clock module's connectors and indicators

Connector or Indicator	Function
RF Dist	Connects the internal clock via a semi-rigid coaxial cable to the CLK port on the RF Dist card
TEST	SMA connector, allowing access to the 13MHz signal for test purposes

1-3.4 interWAVE Processor (IWP) Card



IW352802

The following table describes the function of the connectors and indicators on a WAVEXpress/BTS IWP card. Refer to the illustration on the left for the position of connectors and indicators.

Table 1-4: WAVEXpress/BTS IWP card's connectors and indicators

Connector or Indicator	Function
RST	This button resets the card.
SCN	When lit, the system controller LED indicates the IWP is operational.
PWR	Green LED, lit when card has power supplied.
ONLINE	Green LED, lit when card is on-line, downloaded, and card boot process has been performed successfully.
FLT	Red LED, lit when the card detects a fault or the card has not downloaded successfully.
CON	9-pin, RS232 connector for serial connection to the Craft PC.
ENET	15-pin, DB-15 connector for Ethernet connection to the Craft PC.
EXT	RJ45 for external alarm connection.
XREF	SMA connector for input from external clock for system synchronization.

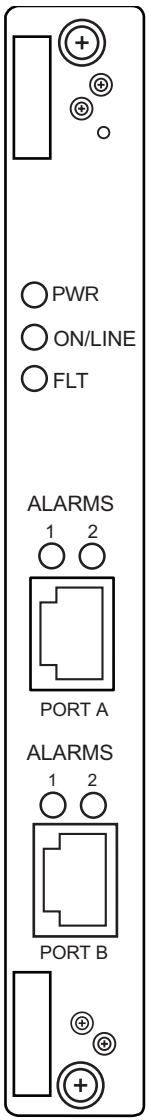
NOTE

A BTS 16Mb IWP card has the part number 340123. This part numbers is visible on the front face of the IWP card.

1-3.5 Dual Port T1 Card

The dual port T1 card accommodates two T1 lines connected to its shielded RJ-48 jacks. The front panel of the card accomodates both a local and remote alarm LED for each T1 port. The T1 card also features a dip switch selector located on the side of the card to match the impedence of the T1 cable connected to each port.

T1 100-Ohm card



IW352805

The following table describes the function of the connectors and indicators on a WAVEXpress/BTS T1 card (RJ-48). Refer to the illustration on the left for the position of connectors and indicators.

Table 1-5: WAVEXpress/BTS T1 card's connectors and indicators

Connector/ Indicator	Function
PWR	Green LED, lit when card has power supplied.
ONLINE	Green LED, lit when card is on-line, downloaded, and card boot process has been performed successfully.
FLT	Red LED, lit when the card detects a fault or the card has not downloaded successfully.
PORT A	Port A, RJ-48 shielded jack for T1 data interface, 100 Ohm
PORT B	Port B, RJ-48 shielded jack for T1 data interface, 100 Ohm
ALARM 1	Local alarm, Port A and Port B for LOS and LOF
ALARM 2	Remote Alarm, Port A and Port B

Table 1-6: 100 Ohm T1 Cards

Part Number	Description
M340122	Card, T1, 100 Ohm

The impedance level of the card may be chosen by configuring the DIP switch according Figure 1-7 which provides the T1 DIP switch settings for both Port A and Port B given the length of a shielded twisted pair cable. Refer to Figure 1-5 for T1 DIP switch location and pin identification.

NOTE

The T1 card DIP switch is set according to DSX cable length or line build out. The proper DIP switch settings should be identified during the initial system installation .

Table 1-7: T1 dip switch settings

Port A Switch Setting 1-2-3-4	**Port B Switch Setting 5-6-7-8**	**DSX-1 Cable Distance Feet (Meters)**	**CSU Line Build-Out**
O-C-C-C	O-C-C-C	0-133 (0-	N/A
O-O-C-C	O-O-C-C	133-266	N/A
O-C-O-C	O-C-O-C	266-399	N/A
O-O-O-C	O-O-O-C	399-533	N/A
O-C-C-O	O-C-C-O	533-655	N/A
O-O-C-O	O-O-C-O	N/A	0dB
O-C-O-O	O-C-O-O	N/A	-7.5dB
O-O-O-O	O-O-O-O	N/A	-15dB
C-O-X-X	C-O-X-X	N/A	-22.5dB
O = Open, C = Closed, X = Either			

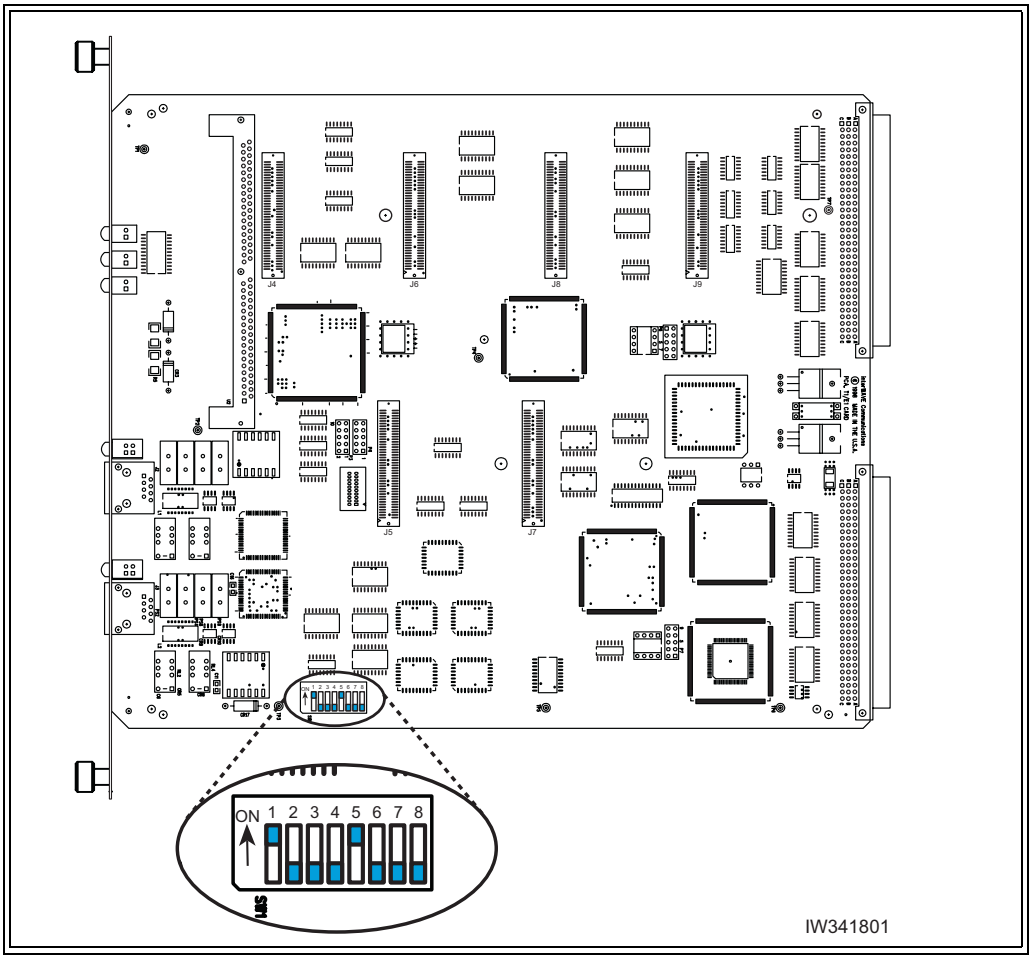


Figure 1-5: T1 card DIP switch (set at DSX cable length of 0-133ft)

When connecting a shielded twisted pair T1 cable between two WAVEXpress systems, the routing of the pins needs to comply with the cable mapping shown in the following illustration:

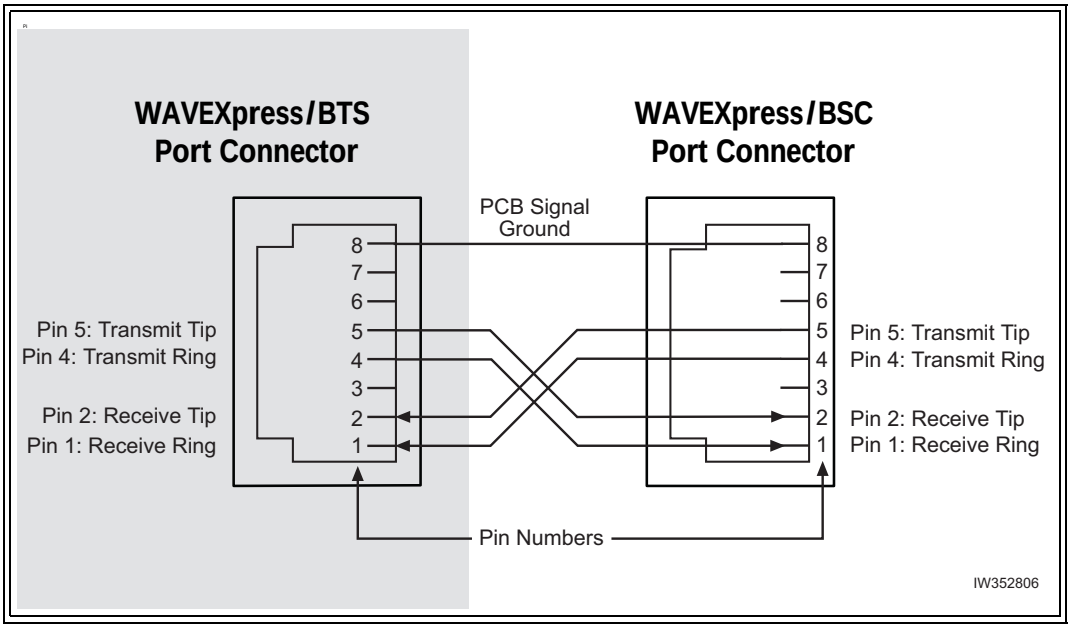


Figure 1-6: Cable mapping of pin assignments of port connectors when connecting two WAVEXpress systems using RJ-45 connectors

The RJ-45 cable connector may be of the conventional plastic body type with the shield and drain wires of the cable connected to a pigtail to pin 8, which is internally grounded to the card. However, a shielded cable plug may also be used, terminating the cable shield to an integral metal shell of the RJ-48 jack which then makes an electrical connection to the front panel when installed. Table 1-8 provides the pin assignments for the T1 RJ-48 jacks.

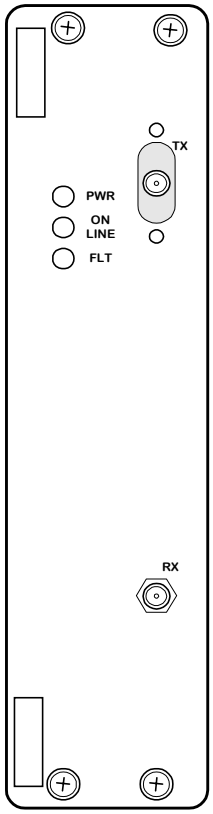
Table 1-8: RJ-48 Pin outs

RJ-48 Pin Number	Signal
1	Rx Ring
2	Rx Tip
3	nc
4	Tx Ring
5	Tx Tip
6	nc

Table 1-8: RJ-48 Pin outs

RJ-48 Pin Number	Signal
7	nc
8	PCB Signal Ground
Shell	Chassis Ground

1-3.6 Transceiver (TRX) Card



The following table describes the function of the connectors and indicators on a WAVEXpress/BTS TRX card. Refer to the illustration on the left for the position of connectors and indicators.

Table 1-9: WAVEXpress/BTS TRX card's connectors and indicators

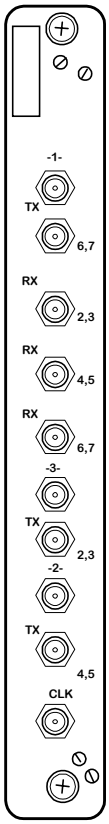
Connector or Indicator	Function
Tx	Signal transmission port, connected to the RF dist card using a semi-rigid SMA cable
PWR	Green LED, lit when card has power supplied
ONLINE	Green LED, lit when card is on-line, downloaded, and card boot process has been performed successfully
FLT	Red LED, lit when the card detects a fault or the card has not downloaded successfully
Rx	Signal reception port, connected to the RF dist card through a semi-rigid SMA cable

There are two types of TRX cards available.

Table 1-10: Available TRX modules

Part Number	Description
M640116	900 MHz, GSM
M640117	1800 MHz, DCS 1800 MHz Full Band

1-3.7 RF Distribution Card



The following table describes the function of the connectors and indicators on a WAVEXpress/BTS RF Distribution card. Refer to the illustration on the left for the position of connectors and indicators.

Table 1-11: WAVEXpress/BTS RF Distribution card's connectors and indicators

Connector or Indicator	Function
-1-	SMA connector for antenna connection 1
Tx 6,7	Signal transmission port, connected to the TRX card 1, located in slots 6 and 7
Rx 2,3	Signal reception port, connected to the TRX card 3, located in slots 2 and 3
Rx 4,5	Signal reception port, connected to the TRX card 2, located in slots 4 and 5
Rx 6,7	Signal reception port, connected to the TRX card 1, located in slots 6 and 7
-3-	SMA connector for antenna connection 3
Tx 2,3	Signal transmission port, connected to the TRX card 3, located in slots 2 and 3
-2-	SMA connector for antenna connection 2
Tx 4,5	Signal transmission port, connected to the TRX card 2, located in slots 4 and 5
CLK	Receives external clock signal at 13MHz from clock module

There are two RF Distribution cards. The RF Distribution card used must be compatible to the appropriate TRX card being used.

Table 1-12: Correlation of RF Distribution and TRX card part numbers

System Description	TRX Part Number	RF Distribution Part Number
900 MHz,	M640116	M340103
1800 MHz, Rev 7	M640117	M340088

Two

Internal BTS Cabling and Jumpering

This chapter describes all internal cabling connections needed to be made for the BTS to operate. This cabling needs to be connected and checked before the WAVEXpress/BTS is installed.

2-1 Cabling Specifications

Listed below is the internal cabling supplied with the WAVEXpress/BTS:

Table 2-13: Supplied cabling

Cable Identity	Quantity	Required Cables for an Indoor BTS	Required Cables for an Outdoor BTS
Power	up to 2*	IEC 320	IEC 320
Antenna- RF Dist • -1- • -2- • -3-	1-3*	Two cable sets shipped: • SMA semi-rigid to female N-type • SMA semi-rigid to male N-type	SMA semi-rigid to female N-type
TRX • Tx 2,3 cable • Tx 4,5 cable • Tx 6,7 cable • Rx 2,3 cable • Rx 4,5 cable • Rx 6,7 cable	2-6*	SMA semi-rigid to SMA semi-rigid	SMA semi-rigid to SMA semi-rigid
Internal clock	1	SMA semi-rigid to SMA semi-rigid	SMA semi-rigid to SMA semi-rigid
External alarm	1	RJ45 to terminal block	RJ45 to terminal block

NOTE

* The number of cables shipped depend on the configuration of the system ordered.

The specifications of the power cable shipped with the BTS are:

- BS-1363/ IEC-320 type
- 8’2” long (245 cm)

which is suitable for countries such as the United Kingdom, Ireland, Hong Kong, Singapore and Malaysia

Table 2-14 provides a description of cables required for installation and connection to the T1 network, but not supplied with the WAVEXpress/BTS:

NOTE

Prior to connection of T1 lines to the WAVEXpress/BTS, it is assumed that the quality of the lines has been verified. It is recommended that running bit error rate tests be completed to ensure that the BER is less than 10^{-8}. Recommended BER tests may be found in Appendix 1.

Table 2-14: Required cabling (not supplied)

Cable Identity	Cable Type	Corresponding Cable Plug
T1, 100 Ohm	Shielded, Twisted, 2-Pair	RJ-48
Antenna (external)	Coaxial	N-type, Female

NOTE

The number of required cables depends on the ordered configuration of the BTS.

2-2 Connection of Cables within the BTS

There are multiple connections between cards which must be made within the WAVEXpress/BTS. The cards are connected using semi-rigid, shielded cabling, supplied with the system, which usually terminate with SMA connectors. Each cable supplied is identified with an eight digit part number and a label, as shown in section Figure 2-7 : "Cable identification". Their shape determines the only possible orientation in which they can be connected.

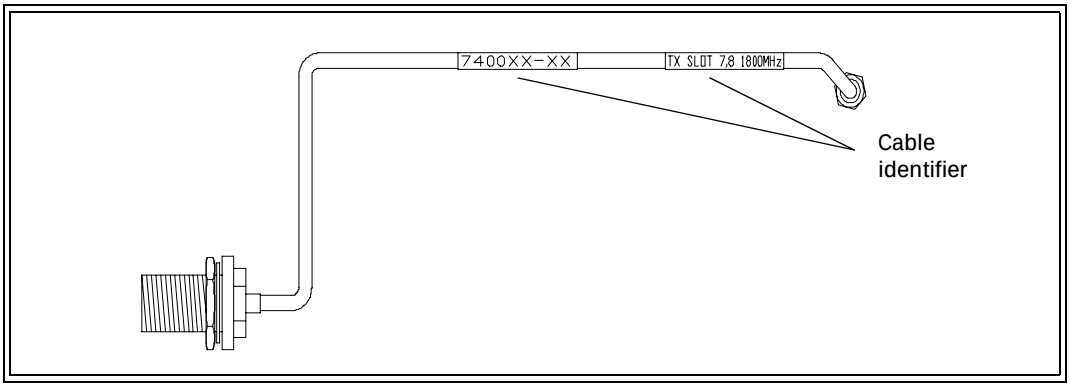


Figure 2-7: Cable identification

There are two types of SMA cables, distinguished by the type of their end-fitting, which are shipped with the WAVEXpress/BTS. The first type has a captive nut, held in place on the end of the cable with a small c-clamp. The second type of cable has a loose fitting which can slide down the cable's body.

NOTE

All cable connections are installed prior to shipment of the WAVEXpress/BTS.

Extreme care should be used when connecting SMA cables, as misalignment of the cable with the connectors can damage both parts and degrade the cable's performance. Follow these steps when connecting SMA cables:

Cable Connection

1. Before tightening the SMA cable, carefully position the SMA male connector of the RF or clock cable in line with the SMA female connector of the module, with minimal bending of the cable. The connector has to be perfectly centered and perpendicular with respect to the plane of the module.
2. At this point, start to tighten the connector by hand. If it becomes too tight, it means that the connector is not correctly centered. Loosen the connector and carefully try again as described in step 1.
3. When the connector has been tightened by hand, finish tightening with an SMA torque wrench to 7 to 10 in/lbs. (80 to 115 N cm)

Cable Disconnection

1. Initially loosen the connector with a wrench. Finish loosening the connector by hand.
2. Carefully remove the cable and the male connector from the female connector of the module, making sure that there is minimal bending of the cable.

This section describes the cabling for a standard BTS.

NOTE

In the following sections, cables are identified by their descriptor and their part number which consists of a six digit number. An example of this would be the receive cable Rx 6,7 with part number 740047. The revision number of the cable, which is for example the -02 in the part number 740047-02, is not called out in the document.

2-2.1 Clock Cable Connection

Step 1 Locate the clock cable, labeled with the descriptor CLK and part number 740049.

Step 2 Ensure that one end of the cable is connected to the SMA connector labeled CLK on the RF Dist module, and the other end is connected to the SMA connector labeled RF DIST on the clock module.

Step 3 Using a SMA torque wrench, check that the SMA connectors on either end of the cable are tightened to 7-10 in/lbs. (80-115 N cm).

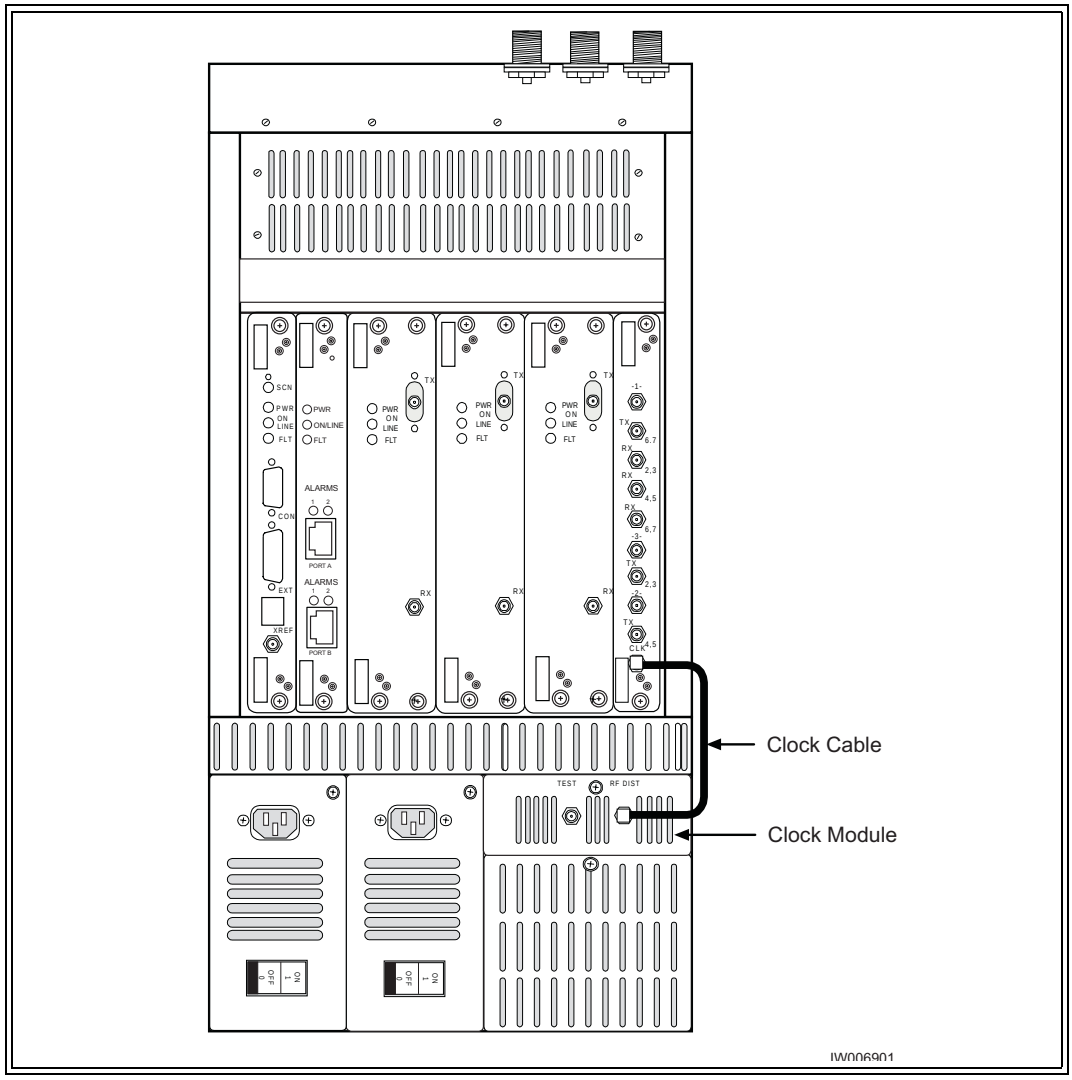


Figure 2-8: Routing of the clock cable

2-2.2 Cable Connection for a 1 TRX system

Step 1 Locate the receive cable labeled with the descriptor Rx slot 6,7 and part number 740047.

Step 2 Ensure that one end of this cable is connected to the port labeled Rx 6,7 on the RF Dist card, and the other end is connected to the Rx port on the TRX card located in slots 6 and 7 of the chassis.

Step 3 Locate the transmit cable labeled with the descriptor Tx slot 6,7 and part number 740048.

Step 4 Ensure that one end of this cable is connected to the port labeled Tx 6,7 on the RF Dist card, and the other end is connected to the Tx port on the TRX card located in slots 6 and 7 of the chassis.

Step 5 Using a SMA torque wrench, check that the SMA connectors on either end of the cables are tightened to 7-10 in/lbs (80-115 N cm).

For indoor mounting only (rack or wall)

Step 6 Ensure that the first antenna cable part number, 740079 for female and 740050 for male, is connected to the SMA connector labeled -1- on the RF Dist card.

Step 7 Ensure that the second antenna cable part number, 740080 for female and 740051 for male, is connected to the SMA connector labeled -2- on the RF Dist card.

Step 8 Using a SMA torque wrench, check that the SMA connectors on either end of the antenna cables are tightened to 7-10 in/lbs. (80-115 N cm)

NOTE

Refer to Chapter 3 for instruction on connecting cables when mounting a WAVEXpress/BTS in an outdoor enclosure.

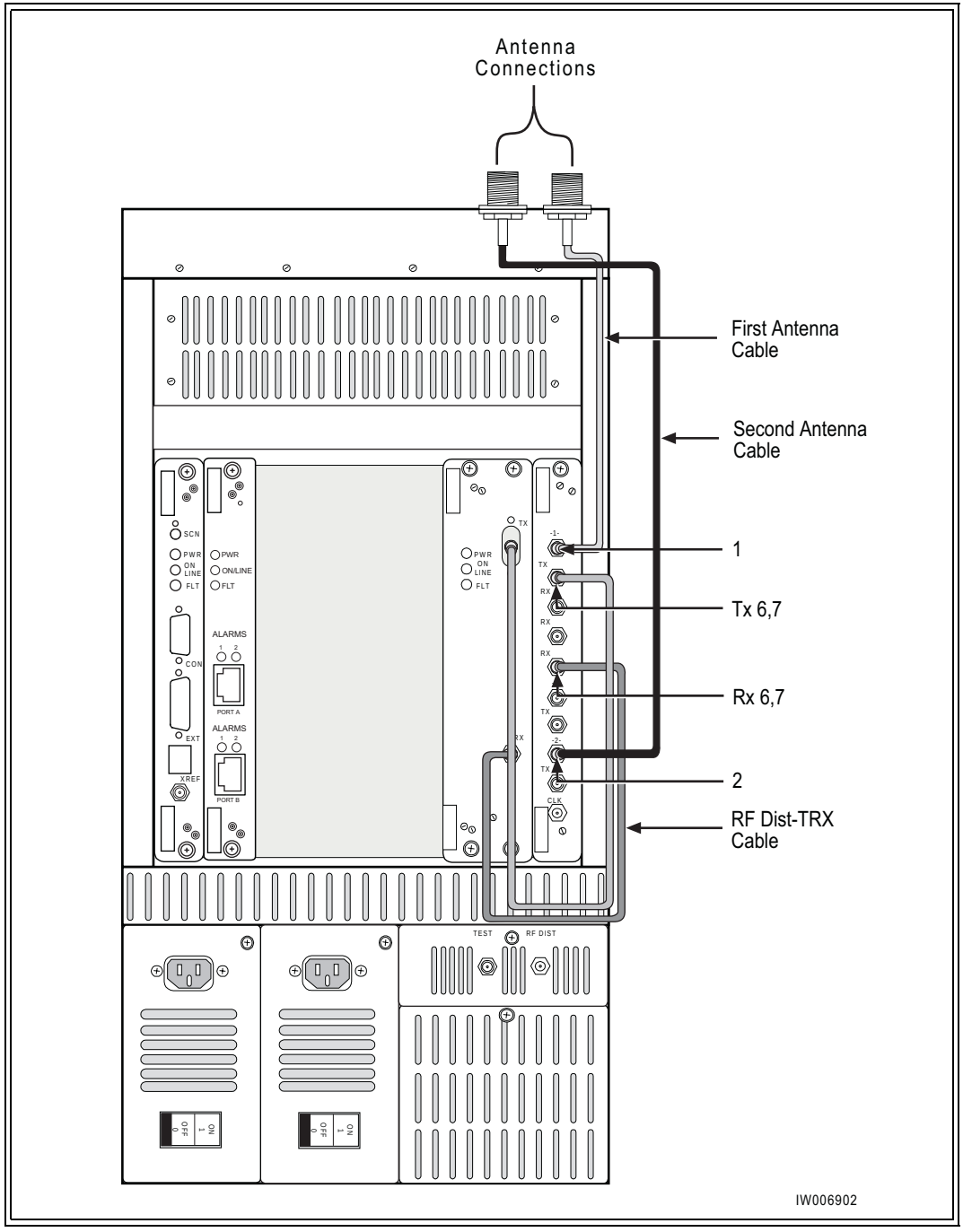


Figure 2-9: Routing of cables for a 1 WAVEXpress/BTS TRX system (for clarity, no clock cable is shown)

2-2.3 Cable Connection for a 2 TRX WAVEXpress/BTS system

Check the following cables in addition to those already checked for a 1 TRX WAVEXpress/BTS system:

Step 1 Locate the receive cable labeled with the descriptor Rx slot 4,5 and part number 740045.

Step 2 Ensure that one end of this cable is connected to the port labeled Rx 4,5 on the RF Dist card, and the other end is connected to the Rx port on the TRX card located in slots 4 and 5 of the chassis.

Step 3 Locate the transmit cable labeled with the descriptor Tx slot 4,5 and part number 740046.

Step 4 Ensure that this cable is connected to one end to the port labeled Tx 4,5 on the RF Dist card, and the other end is connected to the Tx port on the TRX card located in slots 4 and 5 of the chassis.

Step 5 Using a SMA torque wrench, check that the SMA connectors on either end of the cables are tightened to 7-10 in/lbs. (80-115 N cm).

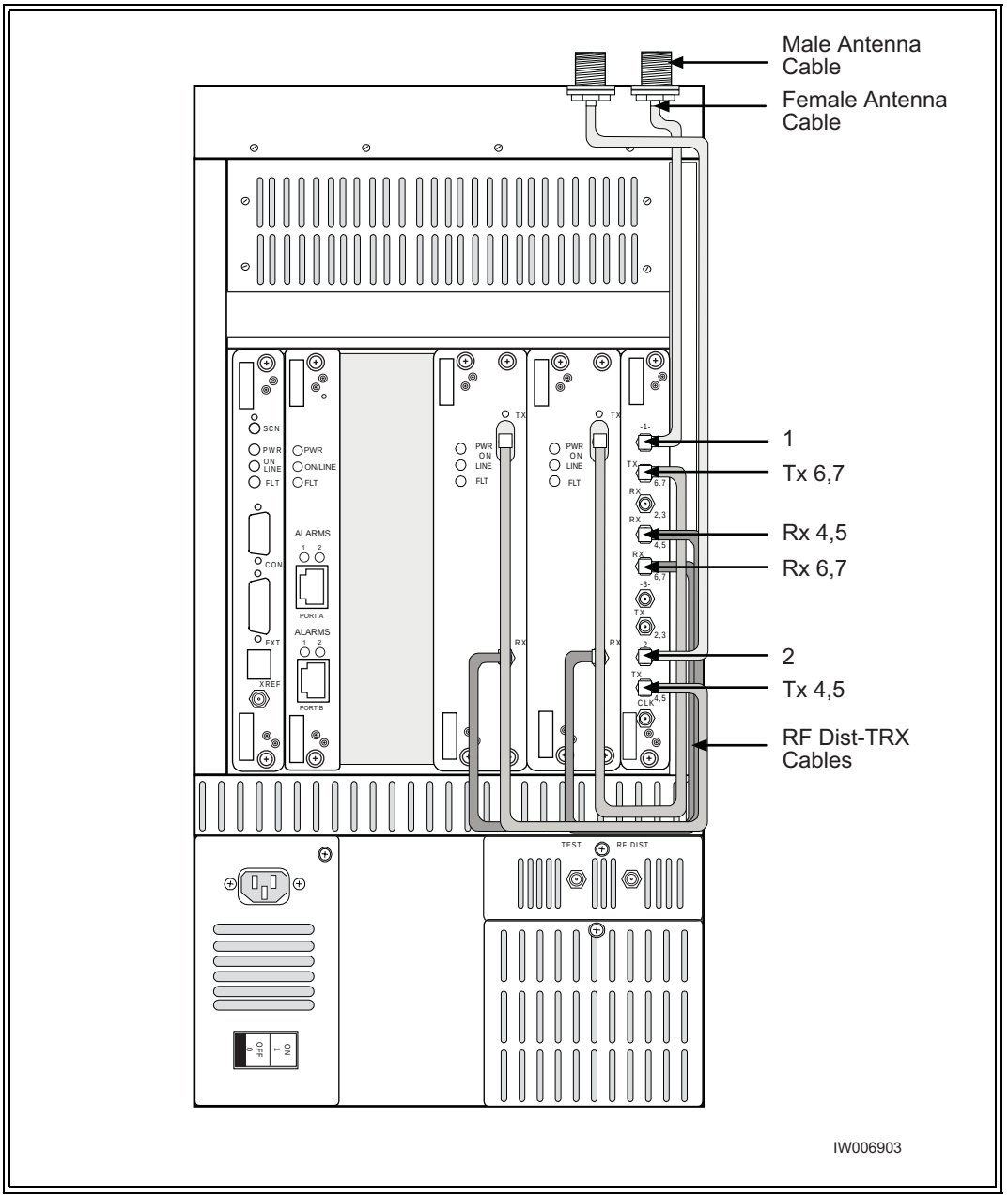


Figure 2-10: Routing of cables for a 2 WAVEXpress/BTS TRX system (For clarity, no clock cable is shown.)

2-2.4 Cable Connection for a 3 TRX WAVEXpress/BTS system

Check the following cables in addition to those already checked for a 2 TRX WAVEXpress/BTS system.

Step 1 Locate the receive cable labeled with the descriptor Rx slot 2,3 and part number 740043.

Step 2 Ensure that one end of this cable is connected to the port labeled Rx 2,3 on the RF Dist card, and the other end is connected to the Rx port on the TRX card located in slots 2 and 3 of the chassis.

Step 3 Locate the transmit cable labeled with the descriptor Tx slot 2,3 and part number 740044.

Step 4 Ensure that one end of this cable is connected to the port labeled Tx 2,3 on the RF Dist card, and the other end is connected to the Tx port on the TRX card located in slots 2 and 3 of the chassis.

Step 5 Using a SMA torque wrench, check that the SMA connectors on either end of the cables are tightened to 7-10 in/lbs. (80-115 N cm)

For indoor mounting only (rack or wall)

Step 6 Ensure that the third antenna cable, part number 740052 for male and 740081 for female, is connected to the SMA connector labeled -3- on the RF Dist Module.

Step 7 Using a SMA torque wrench, check that the SMA connectors on either end of the antenna cables are tightened to 7-10 in/lbs. (80-115 N cm)

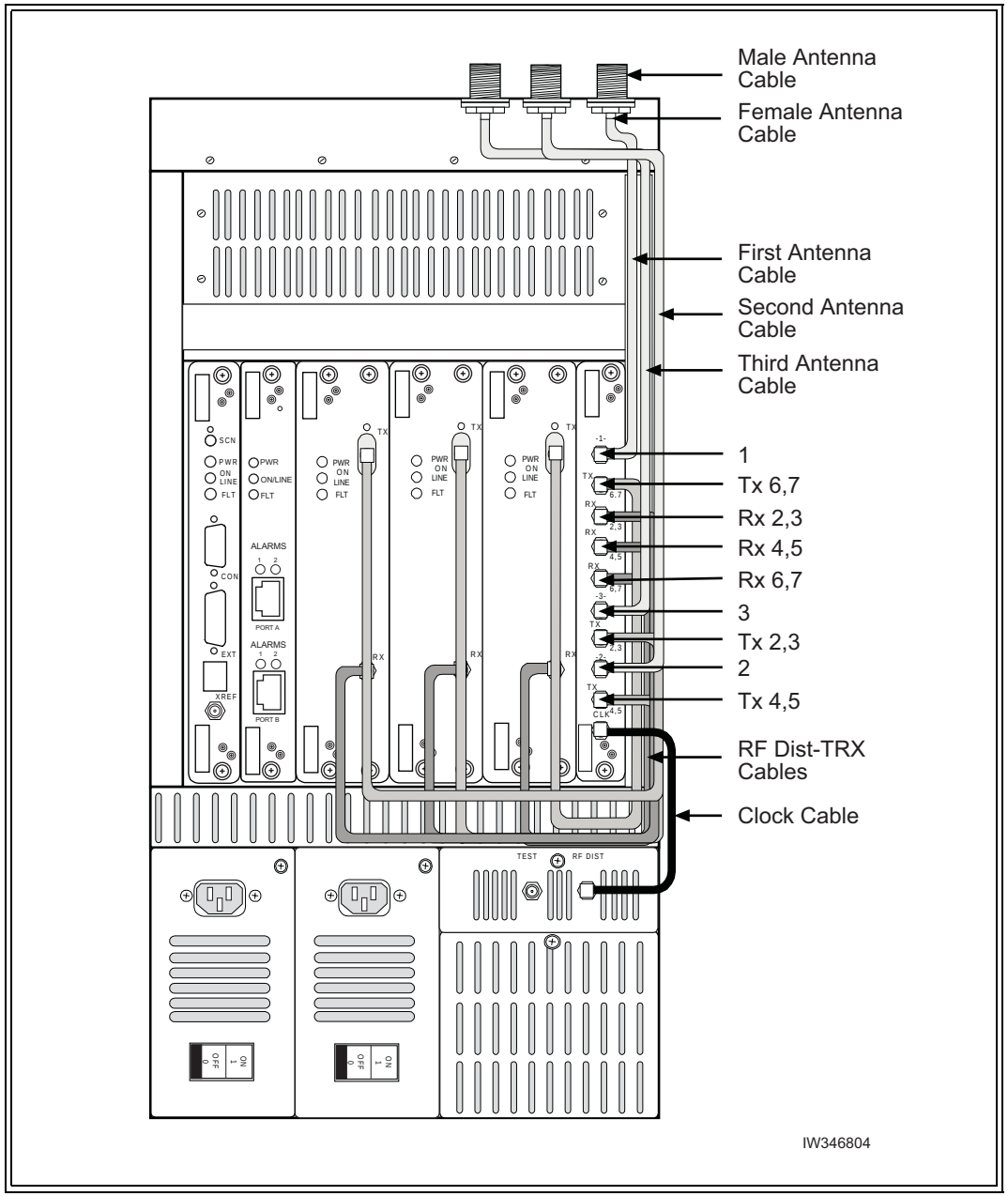


Figure 2-11: Routing of cables for a 3 TRX WAVEXpress/BTS system

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Three

Installation

The WAVEXpress/BTS can be mounted in four different manners: directly to a wall, on a table mount stand, into a 19" rack, and in an outdoor enclosure which is then itself mounted to an outdoor structure. Upon ordering the BTS, the desired type of mounting must be specified as a separate mounting kit is supplied for each of these options.

This chapter describes all the necessary steps for the installation of a WAVEXpress/BTS. It is divided into five sections. They are:

- section 3-1 "Wall Installation"
- section 3-2 "Table Mount"
- section 3.3 “19” Rack Installation”
- section 3-4 "Common Final Installation Procedures"
- section 3-5 "Outdoor Installation"

Each of these sections contain complete instructions on how to install the WAVEXpress/BTS in the different manners. Please only refer to the section which is appropriate.

3-1Wall Installation

Required Materials

The WAVEXpress/BTS is shipped with the following materials for wall mounting:

- a lightweight wall attachment plate, 25.4cm x 48.3cm x 2.5cm (10” x 19” x 1”)
- 2 keyhole plates
- 4 No. 10-32 x 3/4” machine screws/washers
- 4 No. 10-32 shoulder bolts (attached to the wall-plate)

NOTE

These materials are provided in the indoor wall mounting kit, part number M640055.

The chassis is fitted with captive nuts on its right side, left side and back surface, allowing it to be installed either parallel or perpendicular to the wall.

Note on Mounting to Sheet Rock or Dry Walls

Required Tools

- Phillips screwdriver
- 5/16” Allen key

The mounting plate supplied with the system is intended to be attached to wooden or metal studs used to support the wall board. The following procedures explain how to mount a WAVEXpress/BTS unit on a sheet rock or a dry wall using the mounting plate:

Step 1 Install a 3/4” (2cm) thick plywood sheet 24" (61cm) high to span the distance between two or three studs where the WAVEXpress is to be mounted. To accomplish this, use four No. 8 x 1.5" screws for each stud (either eight or twelve screws).

Step 2 Using 6 No. 12 x 1" wood screws, mount and secure the wall plate to the plywood sheet at the desired position. Be sure to use under the heads of the screws.

3-1.1 Installation Instructions

Step 1 Mount the attachment plate to the wall, in the desired location, using customer-provided screws suitable for the wall material (wood, concrete, plaster, sheet metal).

> **!** The flat side of the back of the attachment plate must be flush with the wall surface.

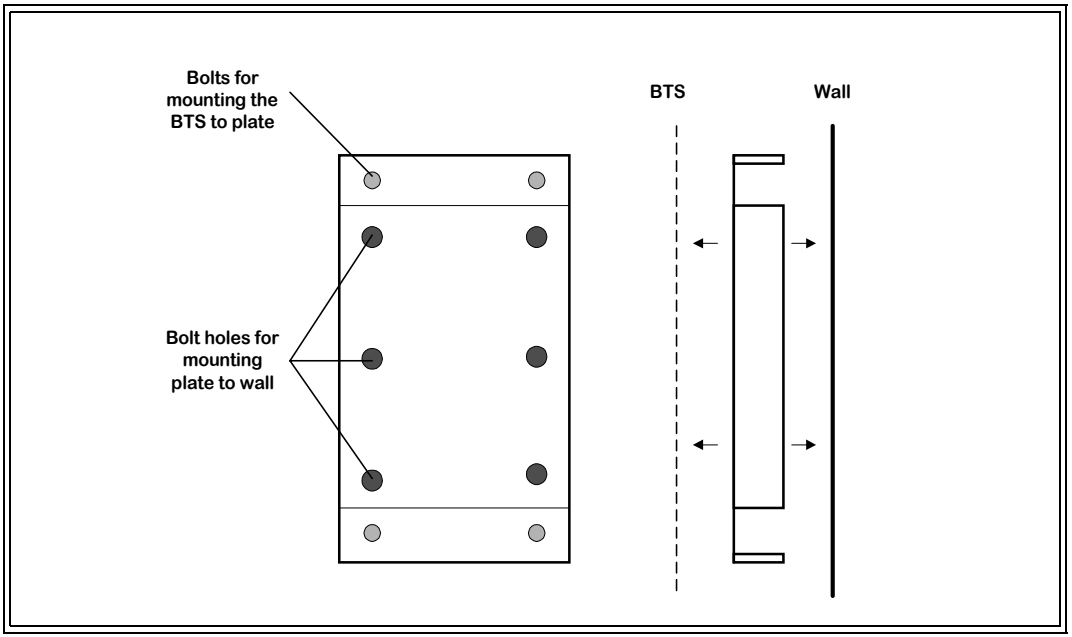

Figure 3-1: Front view of the attachment plate

Step 2 Position the keyhole plate on the side of the WAVEXpress/BTS which will be mounted to the wall. Ensure that the narrow end of the keyhole points upwards.

Step 3 Attach the keyhole plates (shown in Figure 3-2 : "View of the side mounted keyhole plates" on page 30) to the chassis in the desired location using two 10-32 machine screws and washers per keyhole plate. These keyhole plates can be mounted in three locations on the chassis, namely:

- to the back of the BTS chassis
- to the left side of the BTS chassis
- to the right side of the BTS chassis

Step 4 Hang the keyhole plates attached to the WAVEXpress/BTS from the top, then bottom shoulder bolts of the back wall plate.

Step 5 Tighten the locking screws using a 5/16" Allen key located on the side of the keyhole plate.

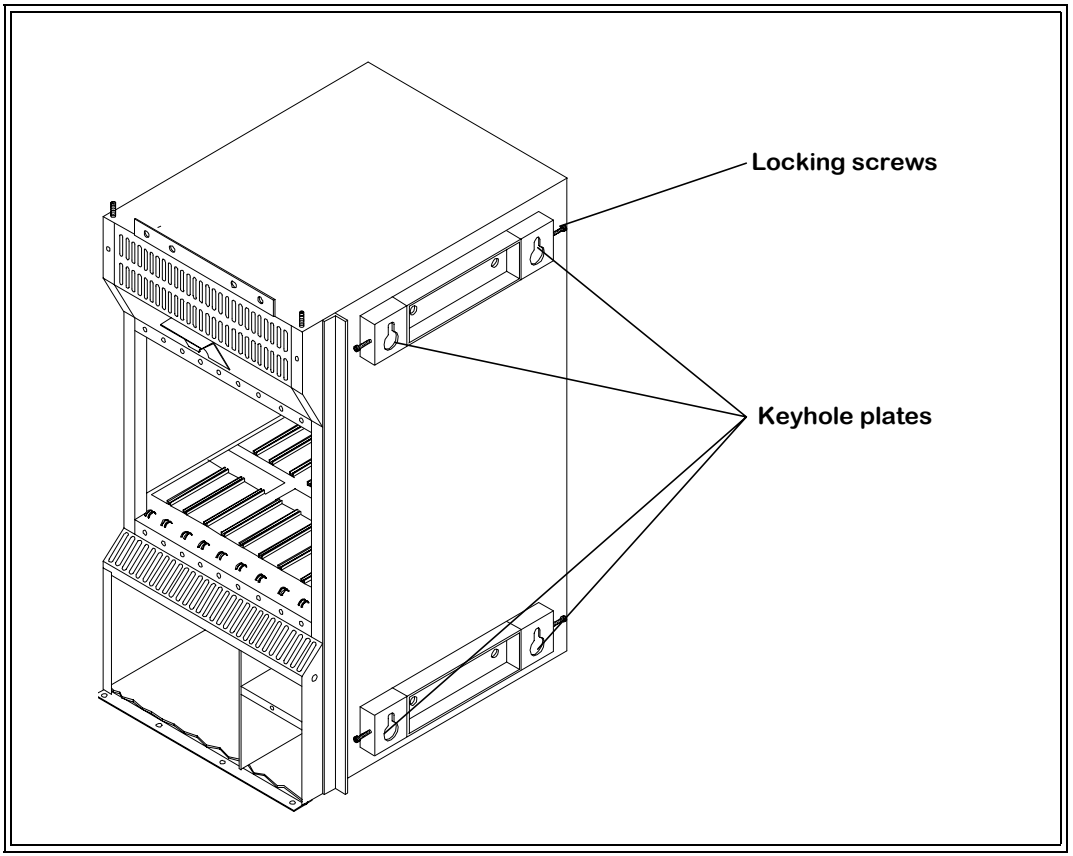

Figure 3-2: View of the side mounted keyhole plates

NOTE

Keyhole plates can also be mounted to the back of the chassis

Step 6 Note that there are no minimum distances which must be adhered to when mounting the WAVEXpress/BTS to the wall. The cooling fans are located in the front of the chassis, allowing the WAVEXpress/BTS to be mounted into corners, and tight places. The only consideration that must be taken into account is to mount the WAVEXpress/BTS in such a way that there is ample clearing room for the antenna cables feeding into the bulkhead connector and for the WAVEXpress/BTS door to be opened.

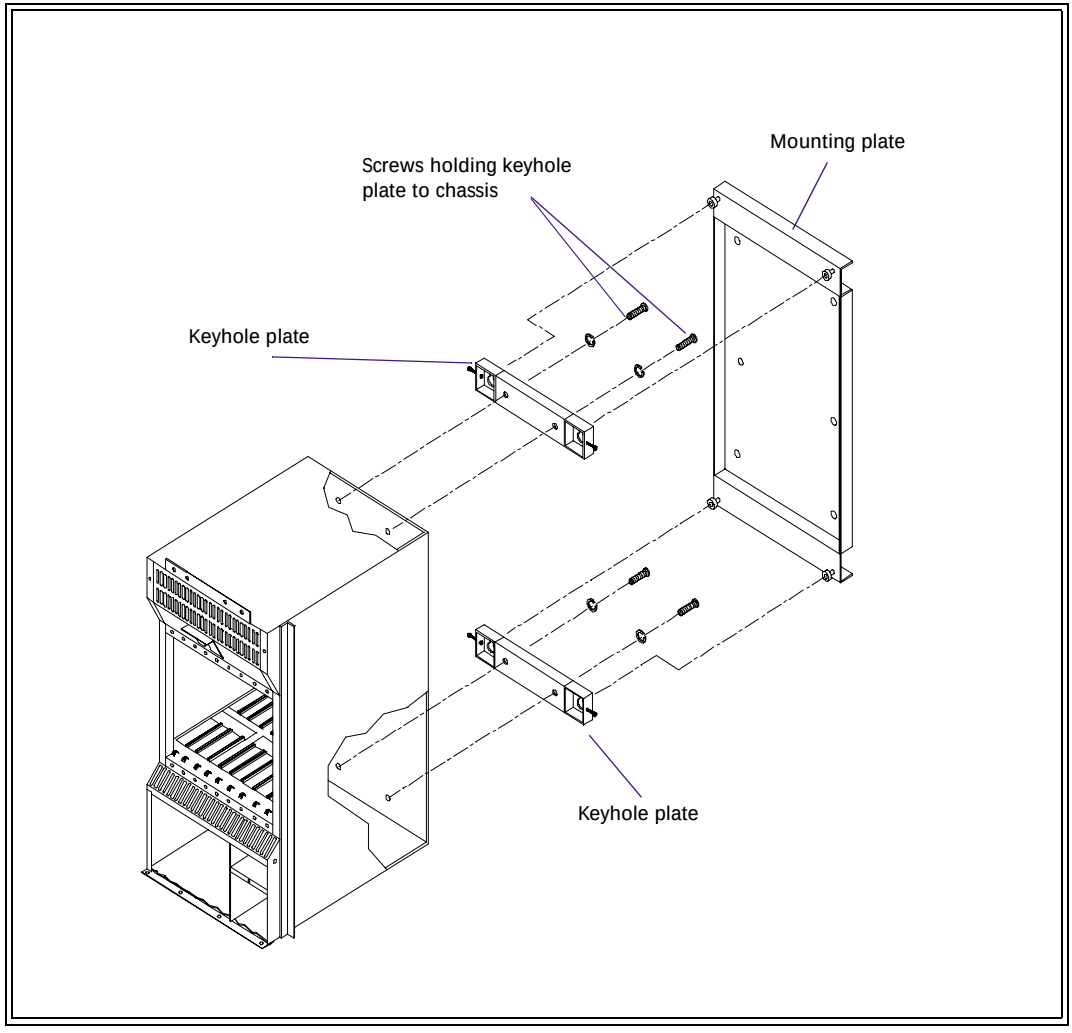

Figure 3-3: Mounting the WAVEXpress/BTS (back mounting of keyhole plates shown)

3-2 Table Mount

Required Materials

- 1 lightweight table stand
- 4 No. 10-32 x 3/4” machine screws

> **NOTE**
>
> These materials are provided in the table mounting kit, part number M640065

Required Tools

- Phillips screwdriver

Note on The Table Stand

The table stand is a lightweight steel stand upon which the BTS sits. This stand raises the BTS 4.5" (11.4cm) off the table, allowing the BTS's door to be opened without hindrance. The BTS is held in position on this stand using 4 10-32 screws. The table stand must be bolted to the table to increase the assembly's stability.

3-2.1 Installation Instructions

Step 1 Place the table stand on the table with the opening under the stand facing forwards.

Step 2 Bolt this stand to the table with customer-provided screws. There are 6 holes; three on each side of the stand, that can accommodate screws up to 9/16” (1.2cm) in diameter.

Step 3 Place the BTS on the stand, with the door of the BTS facing forwards, as shown in Figure 3-4 : "Placing the BTS in the table stand" on page 33.

Step 4 There are two tapped holes on each of the BTS's sides. Line these tapped holes up with the clearance holes of the stand.

Step 5 Thread a 10-32 screw with a washer through each of the stand's clearance holes and into the tapped holes of the BTS. Tighten the screws down as shown in Figure 3-5 : "Attaching the BTS to the table stand" on page 34.

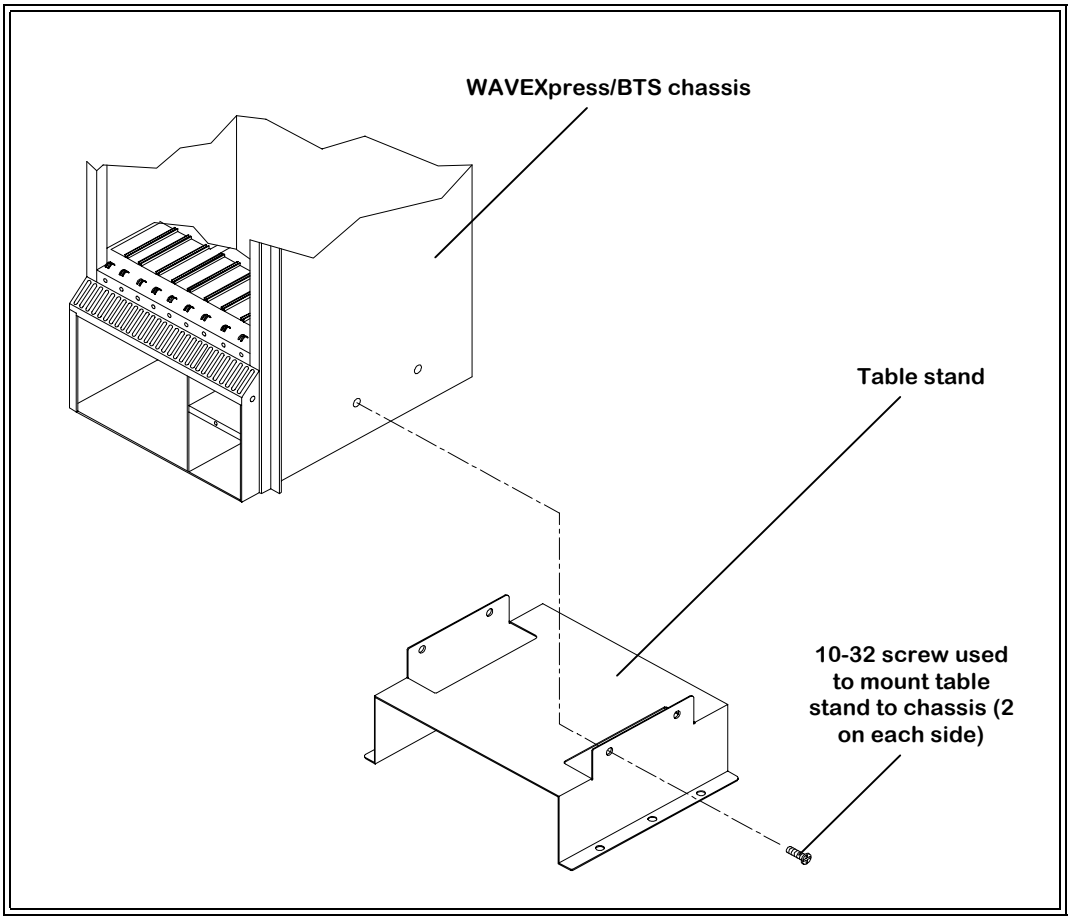

Figure 3-4: Placing the BTS in the table stand

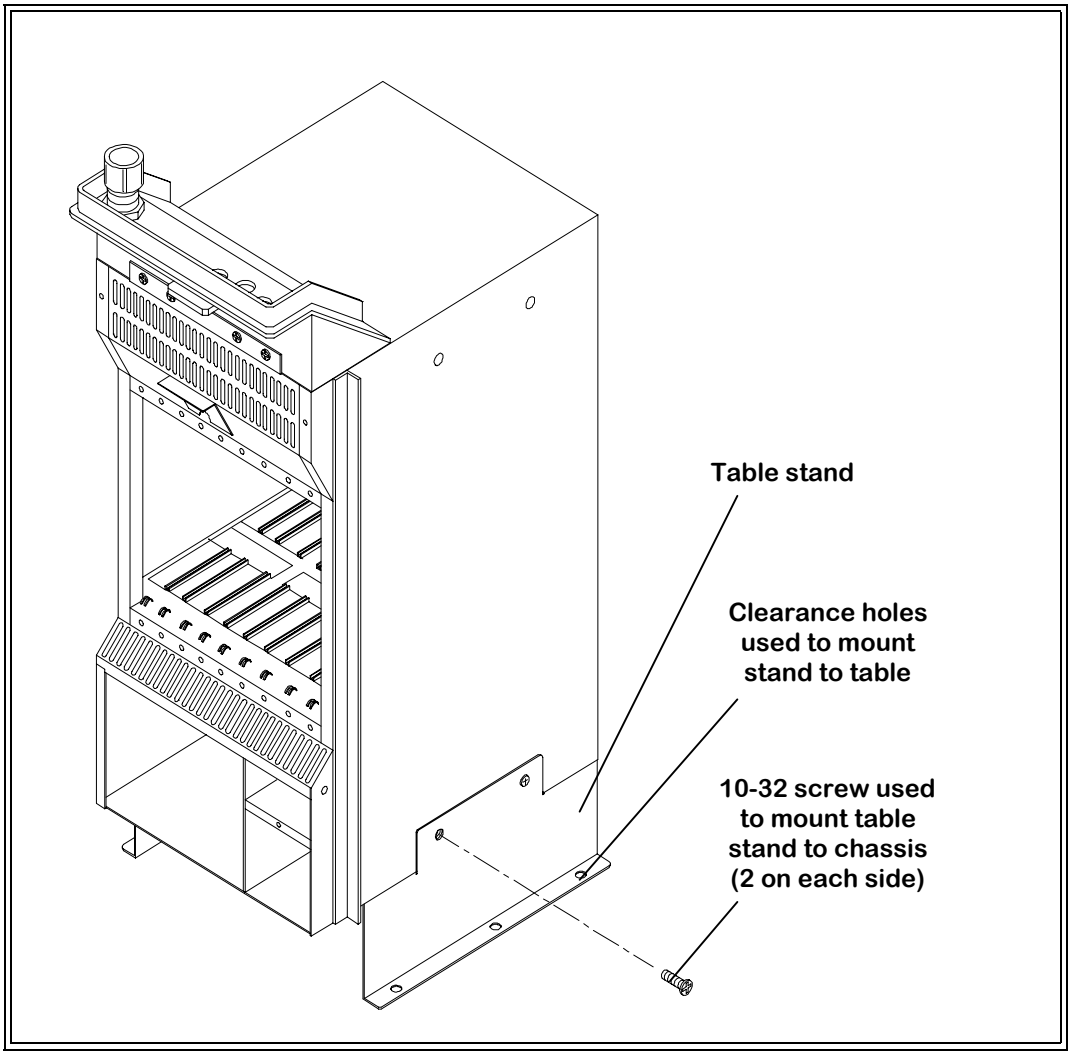

Figure 3-5: Attaching the BTS to the table stand

3-3 Rack Installation

Required Materials

- 2 rack-mount brackets
- 4 No. 10-32 machine screws

> **NOTE**
>
> These materials are provided in the rack mounting kit, part number M640050

Required Tools

- Phillips screwdriver

3-3.1 Installation Instructions

Step 1 Two rack mount brackets are supplied with the chassis, one left bracket and one right bracket. Mount the two brackets to the appropriate side of the chassis using 2 10-32 screws for each side, as shown in Figure 3-6 : "Attaching the rack mount plates to the WAVEXpress/BTS chassis" on page 36 using the supplied machine screws.

Step 2 The rack mount brackets have cutouts to accommodate the 19" rack screws. Mount the chassis in the rack using customer provided screws.

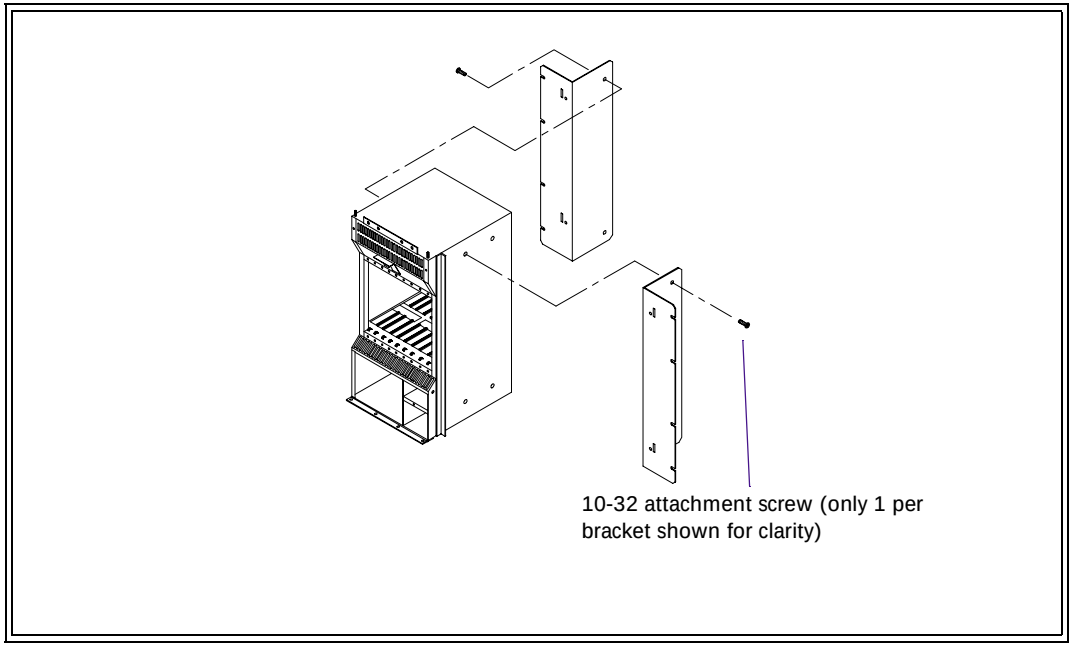

Figure 3-6: Attaching the rack mount plates to the WAVEXpress/BTS chassis

3-4 Common Final Installation Procedures

The following section describes the cable connections which must be made for a wall, table or rack mounted BTS so that the unit is ready for commissioning. As these cable connections are the same for these three mounting options, they have been detailed in a separate section. This section is divided into the following sub-sections:

- section 3-4.1 "Connection of the Cable Gland"
- section 3-4.2 "Connection of the Grounding Cable"
- section 3-4.3 "Connection of the Antennas to the Bulkhead Plate"
- section 3-4.4 "Connection of the Optional Combiner Assembly"
- section 3-4.5 "Connection of the Power Supply"
- section 3-4.6 "Connection of the T1 Lines"
- section 3-4.8 "Optional Voltage Standing Wave Ratio (VSWR) Check"
- section 3-4.9 "Post Installation Checks"

3-4.1 Connection of the Cable Gland

The cable gland is a 1.5" wide connector which must be mounted on the BTS's antenna bracket. All power and T1 cables connected to the BTS are routed through this gland.

Step 1 Locate the cable gland. Unscrew the bottommost ring on the gland by turning it counterclockwise.

Step 2 Thread the cable gland through the leftmost opening in the BTS' antenna bracket.

Step 3 Place the removed ring back on the gland, and tighten it into position.

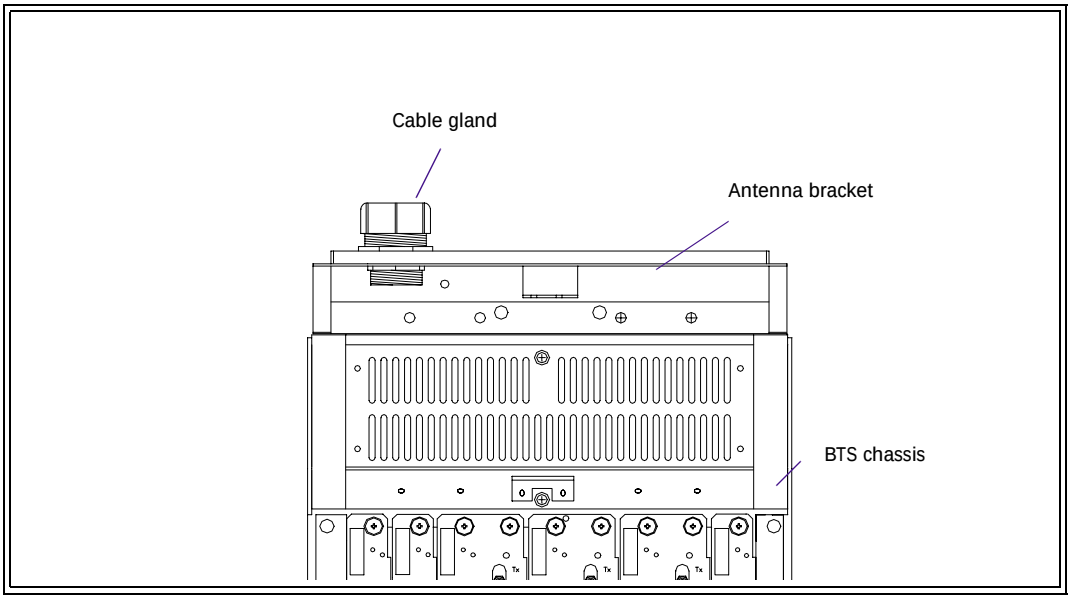

Figure 3-7: Placement of the cable gland

3-4.2 Connection of the Grounding Cable

The indoor mounted BTS is equipped with one No. 10-32 x 1" ground stud located on the antenna bracket. To properly ground the WAVEXpress/BTS:

Step 1 Route a No.10 AWG stranded copper lead through the cable gland on the top, left side of the chassis.

Step 2 Connect the copper lead to the grounding stud on the antenna bracket of the chassis.

Step 3 Connect the other end of the lead stud to the closest grounding bus.

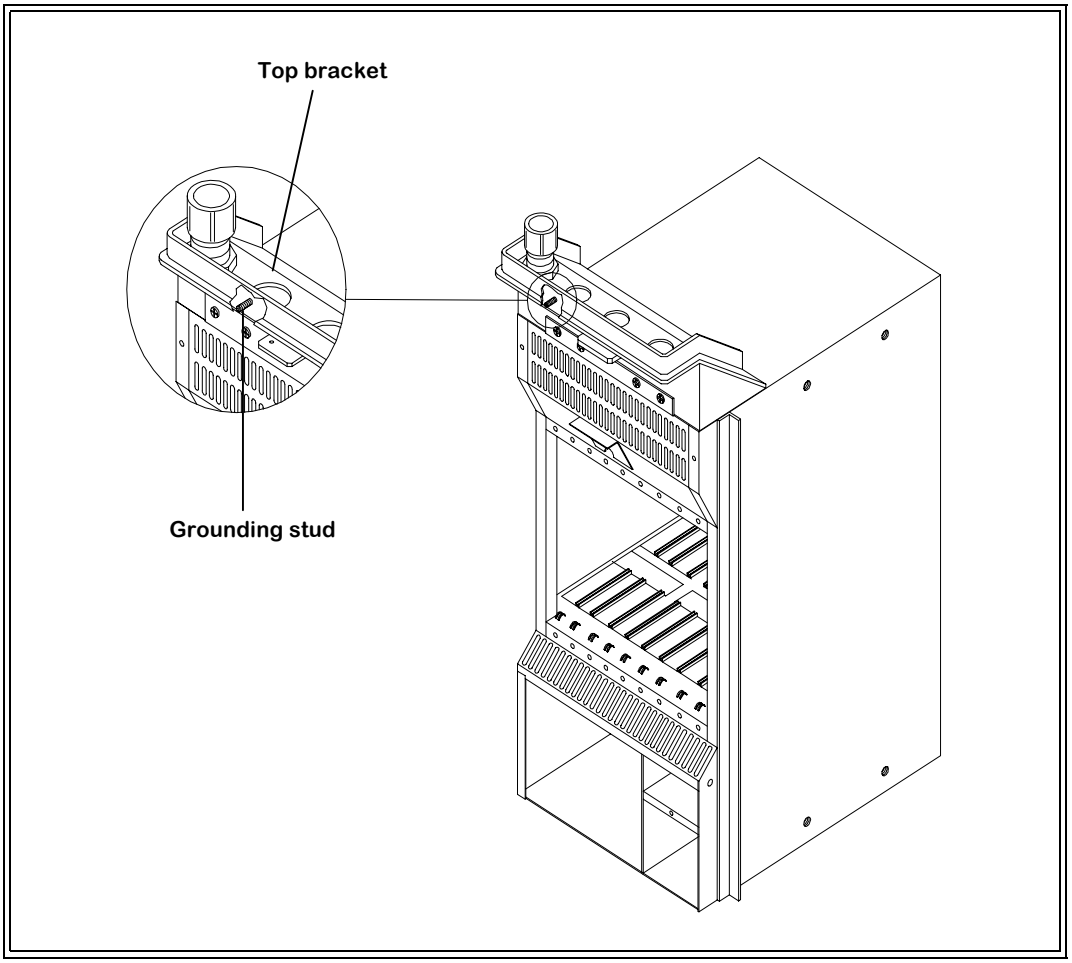

Figure 3-8: Grounding of the WAVEXpress

3-4.3 Connection of the Antennas to the Bulkhead Plate

Verify that the external antennas are connected to the bulkhead plate:

Step 1 A bulkhead feedthrough plate located at the top right of the WAVEXpress/BTS chassis holds three bulkhead connectors. Two of these connectors are exposed while one is plugged, only to be used for a three TRX system. Route each external antenna cable to these connectors.

Step 2 For a 1 TRX system, the SMA cable connecting the port marked -1- and -2- on the RF Dist to the N-type adapter located on the bottom of the feedthrough plate should already be installed. If this is not the case, connect this cable now.

Step 3 For a 2 TRX system, the SMA cables connecting the ports marked -1- and -2- on the RF Dist to the N-type adapter located on the bottom of the feedthrough plate should already be installed. If this is not the case, connect these cables now.

Step 4 For a 3 TRX system, the SMA cables connecting the ports marked -1-, -2- and -3- on the RF Dist to the N-type adapter located on the bottom of the feedthrough plate should already be installed. If this is not the case, connect these cables now.

NOTE

Note that T1 and power cables should be routed through the cable gland

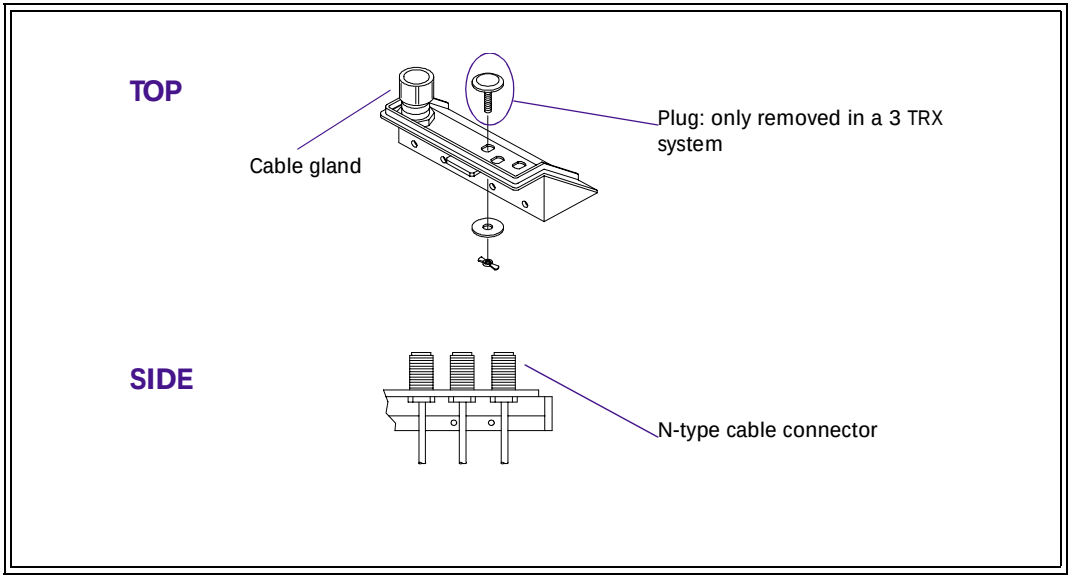

Figure 3-9: Top and side view of the antenna bulkhead plate

3-4.4 Connection of the Optional Combiner Assembly

The combiner assembly kit is intended to enable a single antenna to serve two TRXs in one of the following configurations:

- Transmitter signals from two power amplifiers may be combined to drive a single antenna.
- The receive band from a single antenna may be split to serve two separate base stations at different locations.
- Antenna ports Ant1 and Ant2 on the BTS RF distribution card may be combined to use a single antenna in both receive and transmit mode to serve two different TRXs operating on different channels.

The combiner kit may be either factory installed or installed in the field. If the combiner kit is factory installed, proceed with the instructions in this chapter. If the combiner kit must be installed in the field, refer to the instructions outlined in Appendix 1, then return to this chapter, starting at section 3-4.5 "Connection of the Power Supply"

This option is not available for a TurboWAVE - a high powered BTS.

3-4.5 Connection of the Power Supply

For AC operation

Step 1 Make sure that the circuit breaker located at the bottom of the power supply module is in the 0 (OFF) position.

Step 2 Route the power cable through the feedthrough on the antenna bracket to the power supply module.

Step 3 Plug in the power cable (No. 128 3-conductor AWG cable with IEC 320 up angle connector) into the power module.

Step 4 Plug the power cable into the electrical mains.

For -48 DC operation

> The power main must be a Safe Extra-Low Voltage (SELV), -48V supply as defined in IEC950 and EN60950.

Step 1 Make sure that the circuit breaker, located at the bottom of the power supply module is in the 0 (OFF) position.

Step 2 Route the power cable through the feedthrough on the antenna bracket to the power supply module.

Step 3 A clamping type barrier terminal is provided for -48V DC power input. Lift the plastic cover of the terminal in order to expose three lugs, labeled (-), (+), GND.

Step 4 Making sure that the DC power is off, strip about 1/4" of the insulation off the ends of the DC wire. A No. 12 AWG stranded copper wire is recommended.

Step 5 Slide the exposed ends into the proper terminal, and screw down the lug until each wire is tightly clamped.

Step 6 Flip the plastic cover back into position, in order to cover the exposed terminals. Failure to do so could result in electrical shock.

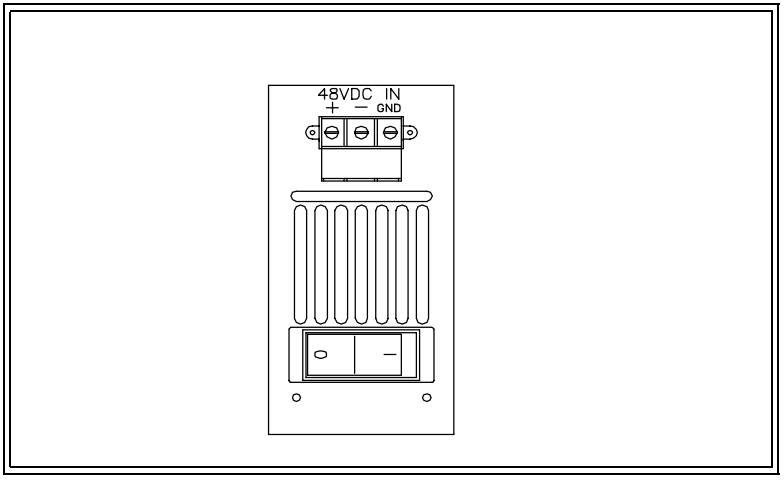

Figure 3-10: DC power supply - terminal strip cover open

3-4.6 Connection of the T1 Lines

Step 1 Route the T1 lines through the feedthrough gland so that they are in place for connection.

Step 2 Connect the Abis interface T1 cables to the local T1 provider.

3-4.7 Connection to External Alarms

In Release 3.3 the OMC supports several alarms for the WAVEXpress/BTS, these alarms are reflected at the OMC operator station and include an open door, tilt and battery back-up alarm. There also exists the capacity to support up to 3 external customer definable alarms through connection to the terminal block identified in Figure 3-11.

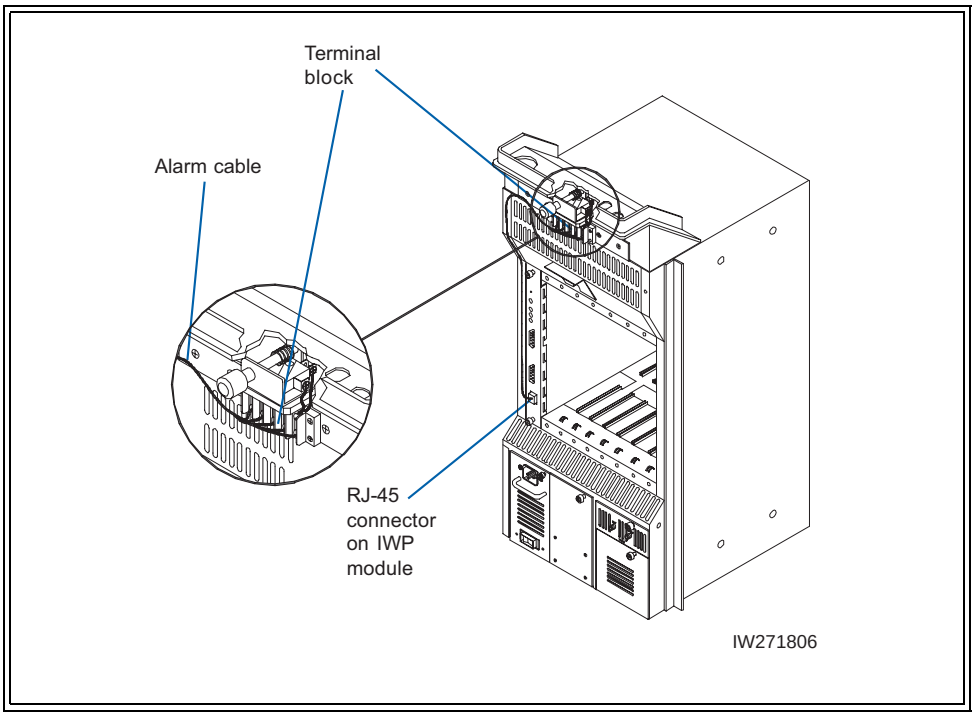

Figure 3-11: WAVEXpress/BTS External Alarm Connections

This terminal block is linked to the RJ-45 pin on the IWP module via the connections illustrated in Figure 3-12. The WAVEXpress/BTS comes shipped with the alarm cable connected from the IWP to the terminal block.
See Table 3-3 for Terminal Block pin assignments.

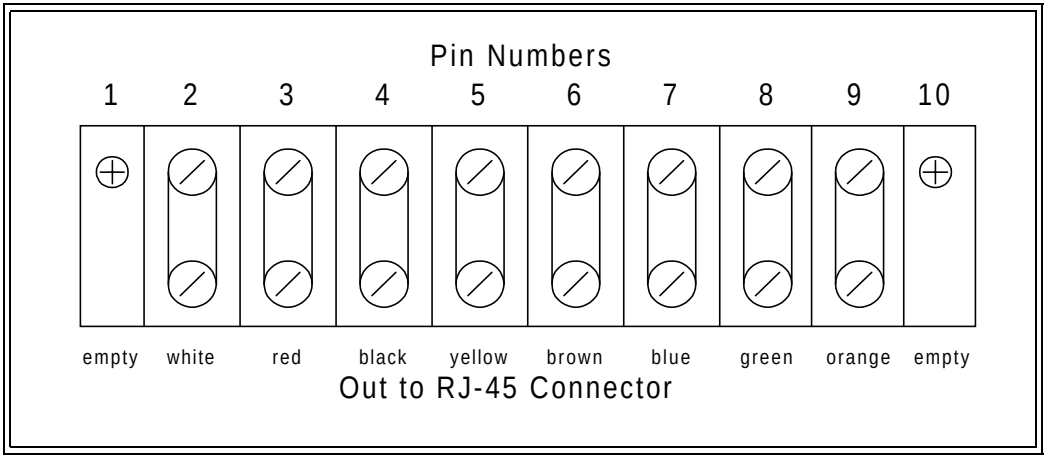

Figure 3-12: Terminal Block

Table 3-3: Terminal Block Pin Assignment

Terminal Block Pin	Assignment
1	Shelter Line
2	Tilting Angle
3	UPS Switched to Battery
4	Door opened
5	Ground
6	Customer definable 1
7	Customer definable 2
8	interWAVE reserved
9	Customer definable 3
10	empty

3-4.8 Optional Voltage Standing Wave Ratio (VSWR) Check

The VSWR check should be performed by the organization responsible for the antenna installation. The purpose of the check is to ensure the integrity of the antenna and the antenna connection by determining whether the reflected power reading is higher than the recommended value. The reflected power is defined as a ratio of the power output versus the reflected power return. This value is determined by two key factors: the power output from the WAVEXpress/BTS (approximately 2 watt 33dBm) and the loss due the length and type of the cable.

The recommended test approach is to use an in-line, forward/reverse power meter (ex. NAS model by Roche and Schwarz) installed between the BTS and the antenna cable. This approach validates that the antenna and cable are good. It also verifies that the transmit power from the BTS is within tolerance limits. The VSWR ratio should be less than or equal to 1.5:1.

Listed below are threshold values assuming a VSWR of 1.5 at different levels of cable loss (due to length or cable type). The estimated return loss should be greater than or equal to the values below.

Table 3-1: Total acceptable return loss for cable loss (dB), assuming an antenna VSWR of 1.5

End-to-end cable Loss (dB)	1	2	3	4	5	6
Return Cable loss (dB)	-14	-16	-18	-20	-22	-24

NOTE

Antenna types are site specific. Cable types in Asia tend to be either 7/8 inch foam connection dielectric or RG214.

3-4.9 Post Installation Checks

BTS Connection

Prior to commissioning the WAVEXpress/BTS, make sure that:

- The Abis interface T1 cables are routed to the T1 provider.
- Ensure that the T1 dual port is properly set for DSX cable length.
- The BTS' power is turned off.

BTS-BSC Link Verification

- It is the operator's responsibility to verify that all BTS-BSC T1 links are ordered, installed and certified by the T1 provider according to ITU G.703 specifications before on-line commissioning is performed.
- The operator should also perform end-to-end bit error rate tests over a 20 minute period on the T1 Abis interface link.

3-5 Outdoor Installation

The WAVEXpress/BTS can also be mounted in an enclosure for outdoor use. The outdoor enclosure for the WAVEXpress conforms to the NEMA-4 environmental rating and completely seals the WAVEXpress from environmental influences. The enclosure consists of a steel enclosure box, a heat exchanger, and sun shield. The welded steel enclosure is provided with a door which seals with a molded in-place gasket. The enclosure's heat exchanger is an integrated air-to-air type, mounted on the top of the enclosure. The sun shield mounts over the enclosure in order to deflect direct sunlight and protect the heat exchanger. A UPS is also offered with the enclosure and provides up to seven minutes of backup time.

NOTE

The interWAVE outdoor enclosure is rated as compliant with the requirements of IEC529, Class IP66 for sand, dust and water penetration.

This enclosure is also rated as compliant with the requirements of UL 1332, which states that when a painted metal sample is scribed with a point and subjected to salt spray exposure for 600 hours (3.5 weeks), the resulting corrosion should not have spread by more than approximately 4mm.

Required Materials

The complete WAVEXpress/BTS outdoor enclosure mounting kit consists of the following materials for mounting. The tools required during installation are also listed.

- Bottom steel plate assembly
- UPS/power strip mounting bracket
- Optional UPS
- Sun shield
- Power strip
- L-bracket
- E1 modem bracket**
- Transmit filter
- Receive filter
- Transmit filter bracket
- Hybrid combiner
- Mounting brackets
- Mounting plate
- Swing frame
- Tie plates
- Necessary bolts, nuts

Required Tools

- A full set of Phillips screwdrivers
- A full set of metric and imperial lug wrenches

NOTE

The following components must be specified as separate line items while ordering this option:

- Outdoor enclosure. Part number: M640052
- UPS kit 230V. Part number: M640045
- RF filter kit. Part number: M640053
- Heat exchanger 230V. Part number: M640042
- 2 TRX cable kit. Part number: M640062
- 3 TRX cable kit. Part number: M640063

Note on The Outdoor Enclosure

The enclosure should have the following components assembled:

- The UPS plate, and power strip should be installed inside the base of the enclosure.
- The sun shield and heat exchanger should be mounted on top of the heat exchanger.
- The power and UPS cables should be routed.
- The swing frame should be installed in the enclosure.
- The optional filter and combiner assembly should be mounted on the swing frame.
- The cables connecting the filters and combiners should be routed.
- The supporting L-bracket should be mounted to the swing frame.

If this is not the case, contact interWAVE Communications for instructions.

3-5.1 Installation Instructions

The enclosure comes supplied with two hanging brackets mounted at the top and bottom of the backside of the enclosure. The wall mounting plate also comes attached to the enclosure by means of one 1/4-20 screw. The following procedures must be used to attach the enclosure to the wall.

Note that the enclosure can be attached to the wall either before or after mounting the WAVEXpress inside the enclosure.

The brackets supplied for mounting the interWAVE enclosure are made of stainless steel. Each bracket is rated at 450 pounds, normal load when mounted to the enclosure and to a suitably strong wall with 8mm (5/16”) diameter stainless steel machine screws and nuts, or other fasteners suitable for the wall material, such as lag screws for wood, or lag screws in concrete anchor sleeves for solid concrete or masonry walls. For more information on a suitable mounting wall, refer to Chapter 2.

Step 1 Open the enclosure door, and move the swing frame to expose the single 1/4-20 bolt which is used to attach the mounting plate to the back wall of the enclosure for shipping purposes.

Step 2 Unscrew the 1/4-20 bolt to free the wall mounting plate from the enclosure. Refer to Figure 3-13 : "Outdoor enclosure wall mount" on page 50 for an indication of the position of this bolt.

Step 3 Mount the wall plate to a suitable wall, as detailed in the following note. The plate should be mounted so that the tabs on the top and bottom of the plate face outwards, away from the wall. A sketch detailing hole placement is shown in Figure 3-14 : "Hole placement for the wall mount plate" on page 51.

No mounting hardware is supplied with the plate as the type of hardware used is determined by the material of the wall to which the enclosure is mounted. However, the six mounting holes of the wall plate can accommodate up to 5/16” diameter hardware.

The mounting location should be selected so that it is capable of supporting 160lbs from four 8mm (5/16”) screws. Examples of typical materials include:

- Poured concrete aggregate walls, 6" or greater in thickness. Holes may be drilled of a diameter and depth sufficient to accept the lead concrete expansion. Anchors typically are used with hex-head coarse thread lag screws. The lag screws should penetrate the wall by at least 2", requiring a sleeve hole of at least 2.5" deep.

- Wood timber framed wall with upright members 4" square cross-section or greater, with spacing equal to the mounting dimensions of the box. Lag screws should penetrate the wood by at least 3", and be screwed into pilot holes of diameter 1/32” greater than the minor diameter of the thread. Soap may be applied to the screw threads to ease the screwing operation.

Step 4 Hang the enclosure form the top and bottom of the mounting plate's lip. This is accomplished by raising the enclosure slightly higher than the mounting plate and sliding it in position over the two plate's lips.

Step 5 Bolt the enclosure in position using the 1/4-20 screw which was initially removed form the backside of the enclosure

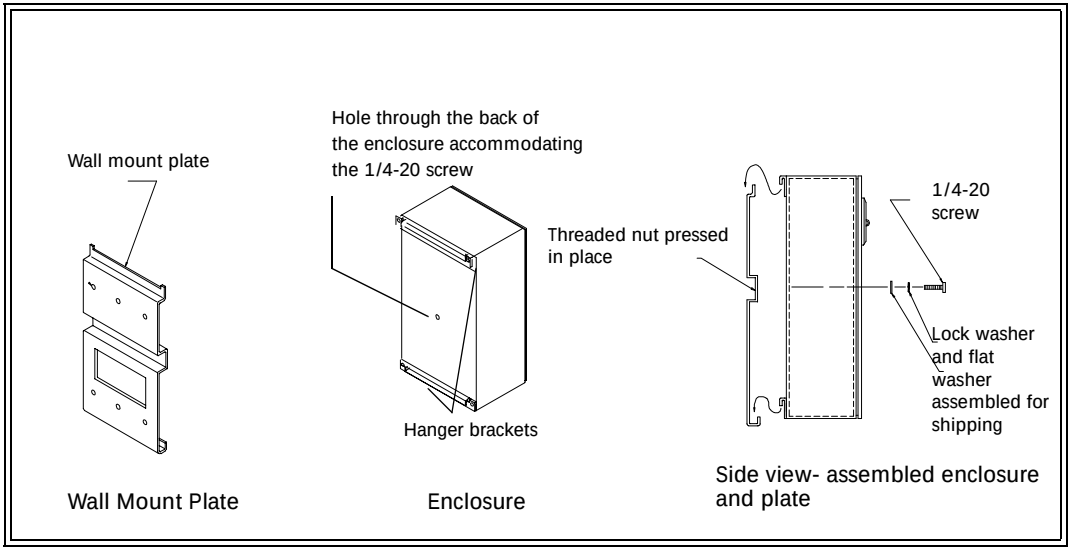

Figure 3-13: Outdoor enclosure wall mount

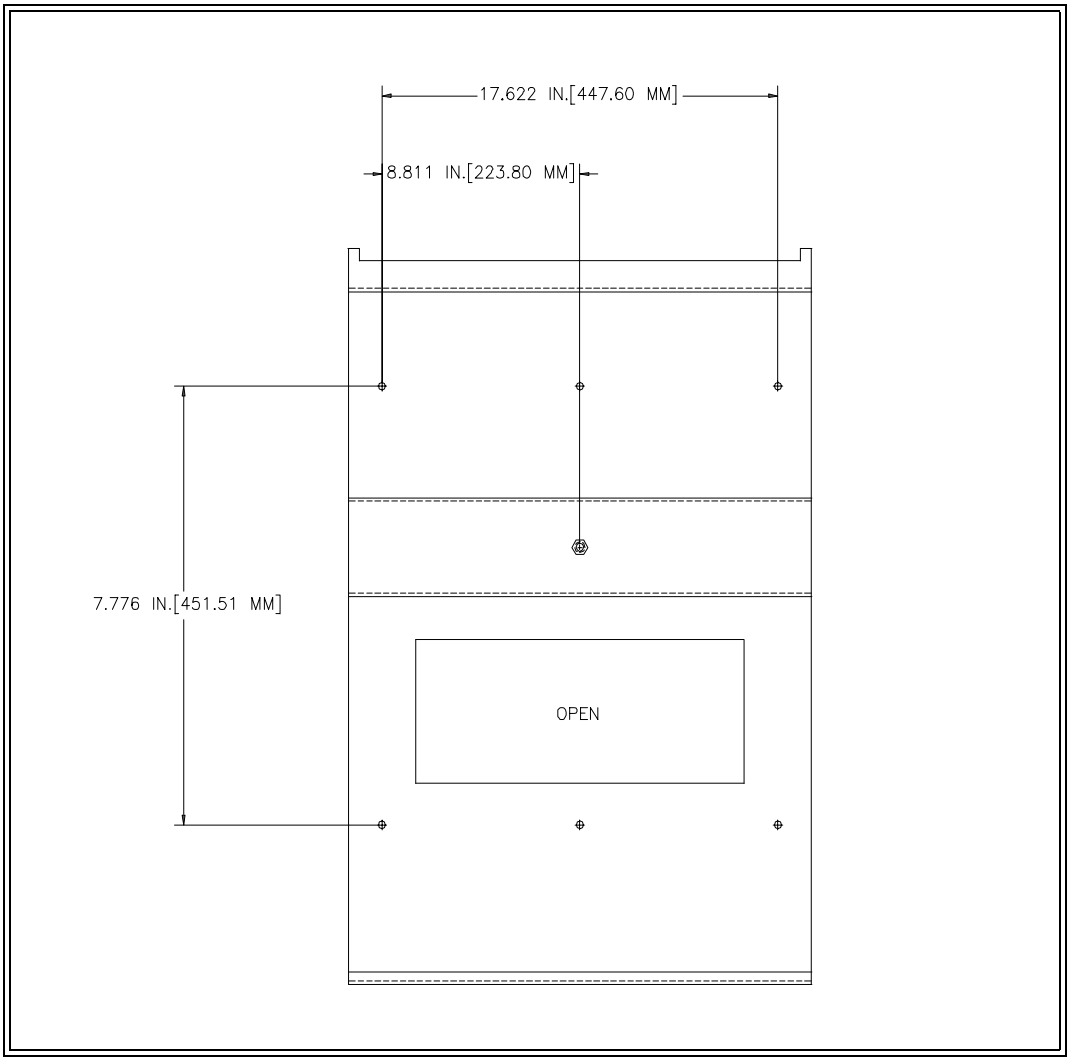

Figure 3-14: Hole placement for the wall mount plate

3-5.2 Mounting of the WAVEXpress/BTS Within the Enclosure

Step 1 Opening the door of the enclosure reveals a swing frame. Opening the swing frame exposes a plate to which an L-bracket is mounted. This L-bracket is used to hold the WAVEXpress/BTS in position within the enclosure.

Step 2 Before mounting the WAVEXpress/BTS, ensure that the door of the WAVEXpress/BTS is removed and that the intra-module cabling within the unit has already been installed. If this is not the case, please refer to Chapter 2 for a description on how to install the intra-module cabling.

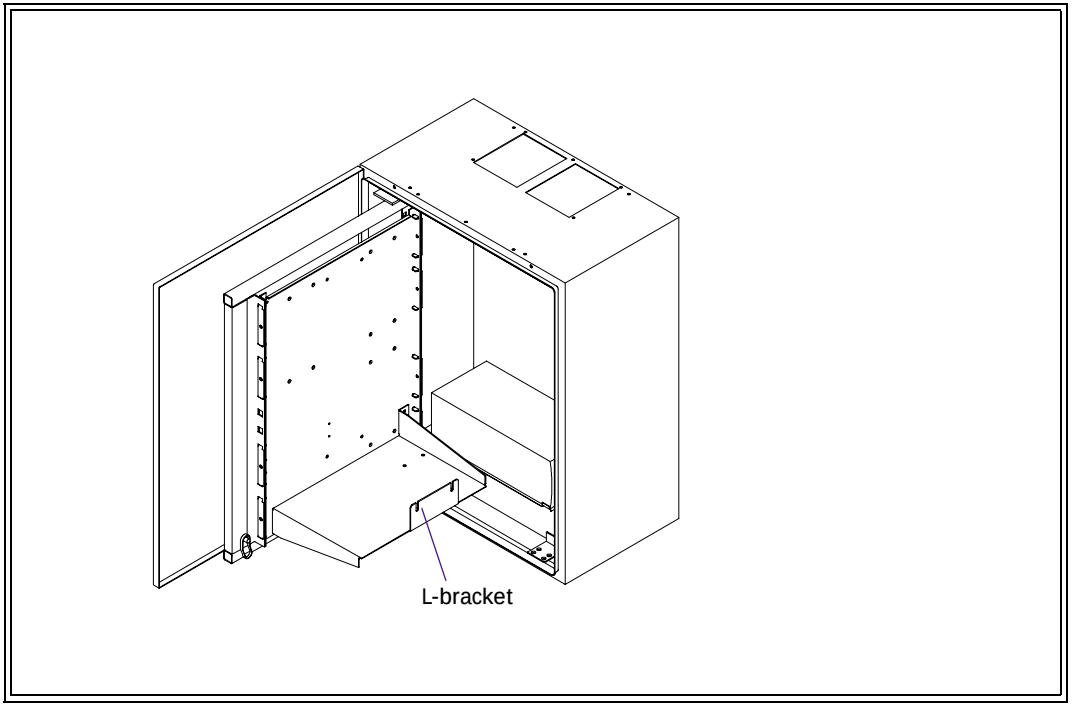

Figure 3-15: Mounting of the WAVEXpress/BTS L-bracket

Step 3 Spacers must be added to the WAVEXpress for it to sit flush against the mounting frame. To do this, mount the two 3/8" thick spacers to the left side of the WAVEXpress using two 10-32 screws for each plate, as shown in Figure 3-16 : "Mounting of the spacers to the WAVEXpress (only 1 spacer shown for clarity)" on page 53.

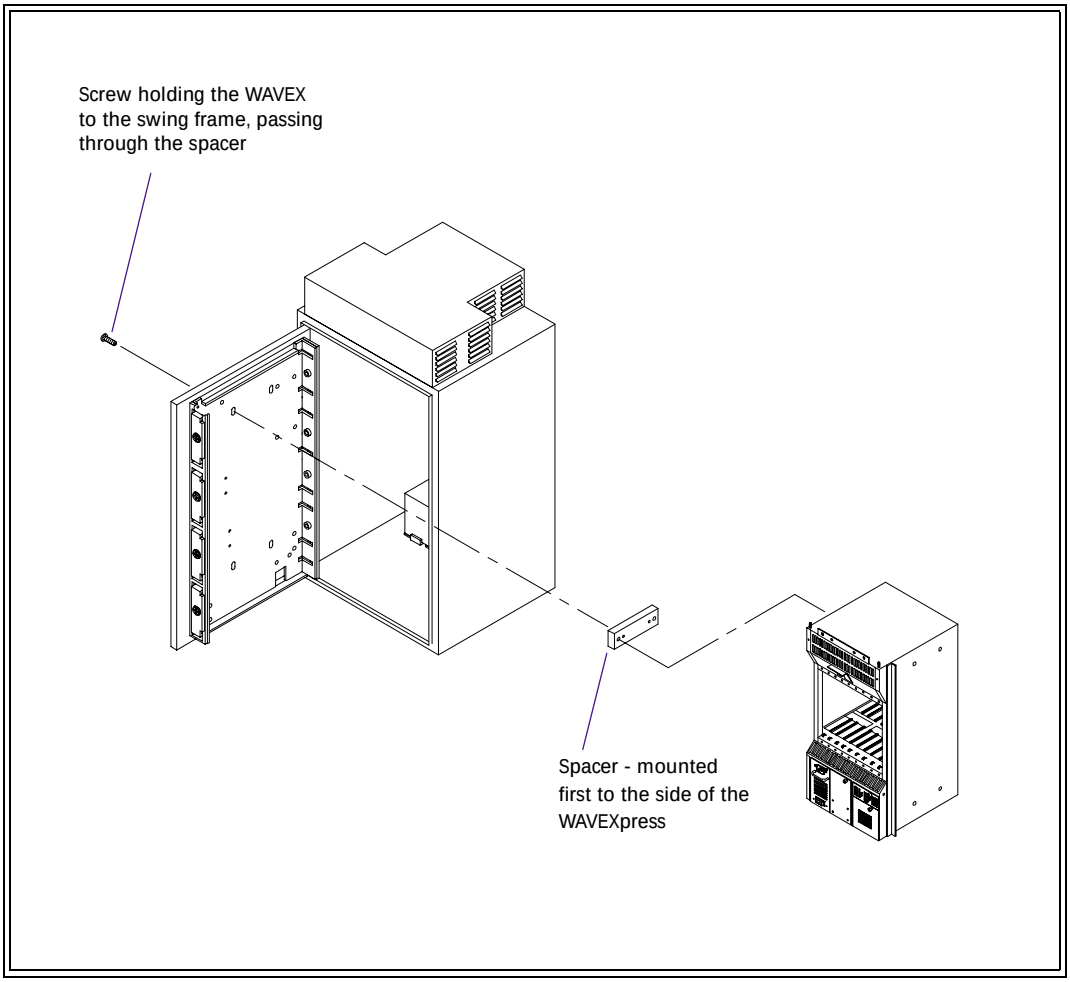

Figure 3-16: Mounting of the spacers to the WAVEXpress (only 1 spacer shown for clarity)

Step 4 Place the WAVEXpress on the L-shaped bracket. The front of the WAVEXpress should be parallel to the swing frame, and the card cage should face the installer.

Step 5 Fasten the WAVEXpress to the L-bracket using two 10-32 screws.

Step 6 Tighten the WAVEXpress down using four 10-32 screws with washers which are threaded through the mounting frame and into the tapped holed of the spacers.

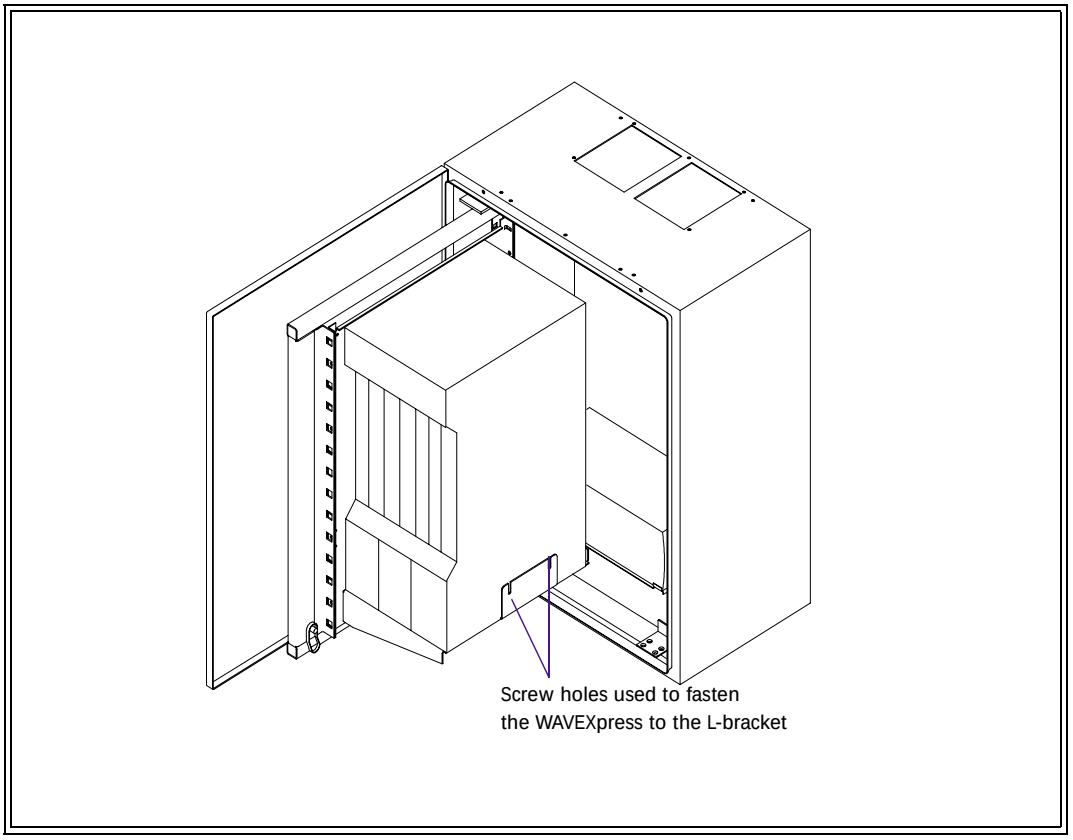

Figure 3-17: Mounting of the WAVEXpress/BTS

3-5.3 Routing of Cables

Use Figure 3-18 : "WAVEXpress/BTS cabling - FRONT VIEW" on page 56 and Figure 3-19 : "WAVEXpress cabling - BACK VIEW" on page 57 to help you with these instructions. Figure 3-18 displays the front view of the WAVEXpress showing all its cabling while Figure 3-19 displays the back view of the swing frame assembly, highlighting the filter and combiner connections.

TRX and RF Dist Cables

Step 1 Locate the two cables marked with part numbers 740060, and having SMA connectors on each end.

Step 2 Attach one end of one of these cables (part numbers 740060) to the Transmit port labeled Tx on the TRX card in slot 6 and 7 of the WAVEXpress/BTS chassis. (Cable labeled as #1 in Figure 3-18)

Step 3 Thread the cable over the top of the swing frame, and attach the other end of this cable to the top SMA connector of the hybrid combiner. (Cable labeled as #1 in Figure 3-19)

Step 4 Attach one end of the second cable (part numbers 740060) to the Transmit port labeled Tx on the TRX card in slot 4 and 5 of the WAVEXpress/BTS chassis. (Cable labeled as #2 in Figure 3-18)

Step 5 Thread the cable over the top of the swing frame, and attach the other end of this cable to the bottom SMA connector of the hybrid combiner. (Cable labeled as #2 in Figure 3-18)

Step 6 Locate the two cables marked with part numbers 740054, and having a SMA connector at one end and a N-type connector at the other end. (Cable labeled as #3 in Figure 3-18)

Step 7 Attach the SMA connector of one of these cables (part numbers 740054) to the antenna port labeled -1- on the RF Distribution card.

Step 8 Thread the cable over the top of the swing frame, and attach the other end of this cable to the N-type connector of the first receive filter. (Cable labeled as #3 in Figure 3-18)

Step 9 Attach the SMA connector of one of these cables (part numbers 740054) to the antenna port labeled -2- on the RF Distribution card. (Cable labeled as #4 in Figure 3-19)

Step 10 Thread the cable over the top of the swing frame, and attach the other end of this cable to the N-type connector of the second receive filter. (Cable labeled as #4 in Figure 3-18)

Step 11 Thread the customer supplied antenna cables through the conduit located at the bottom of the enclosure.

Step 12 Connect each of the customer supplied antenna cables to the two receive filters. (Cable labeled as #5 in Figure 3-18)

Step 13 Connect the third antenna cable to the transmit filter. (Cable labeled as #6 in Figure 3-18).

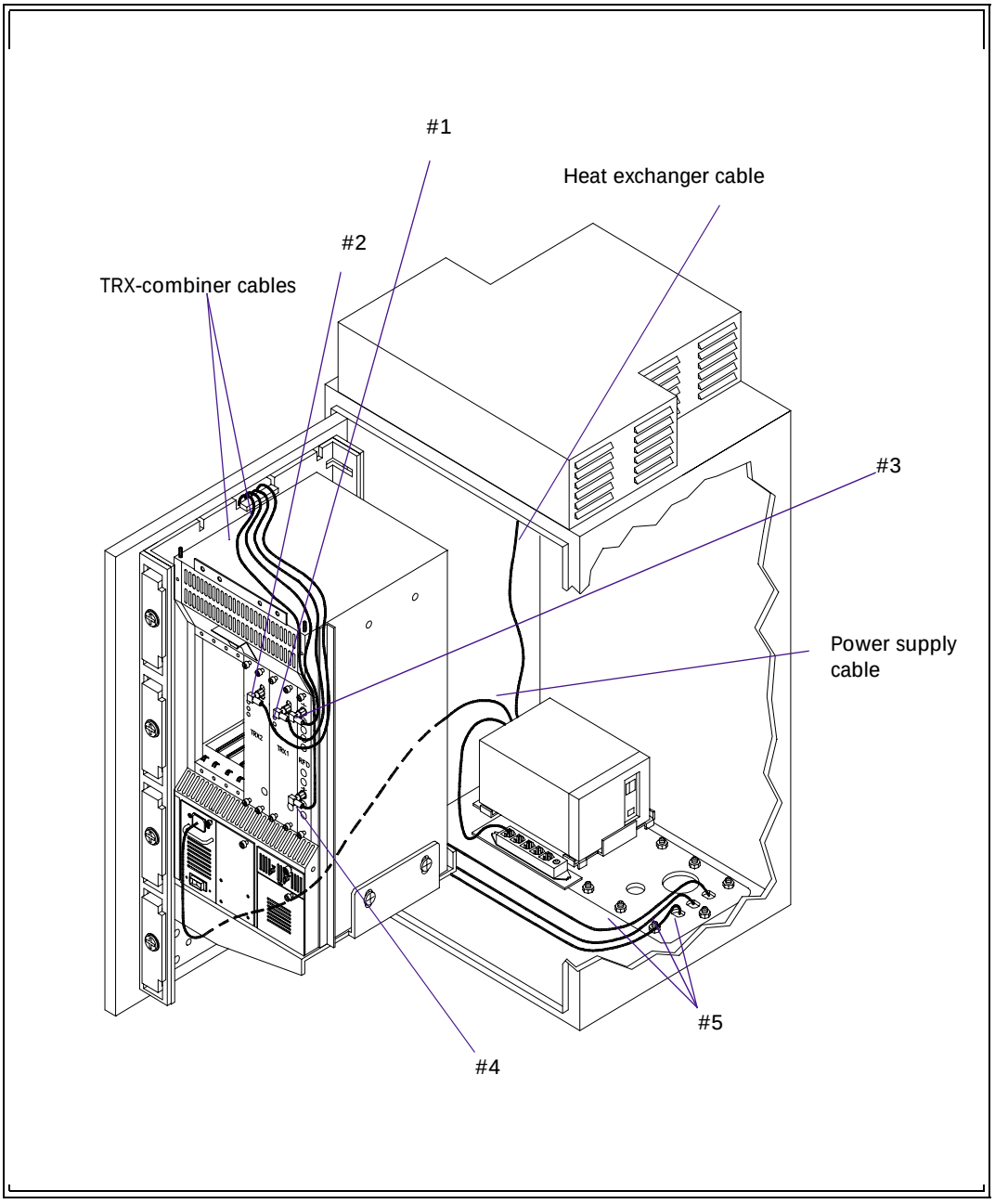

Figure 3-18: WAVEXpress/BTS cabling - FRONT VIEW

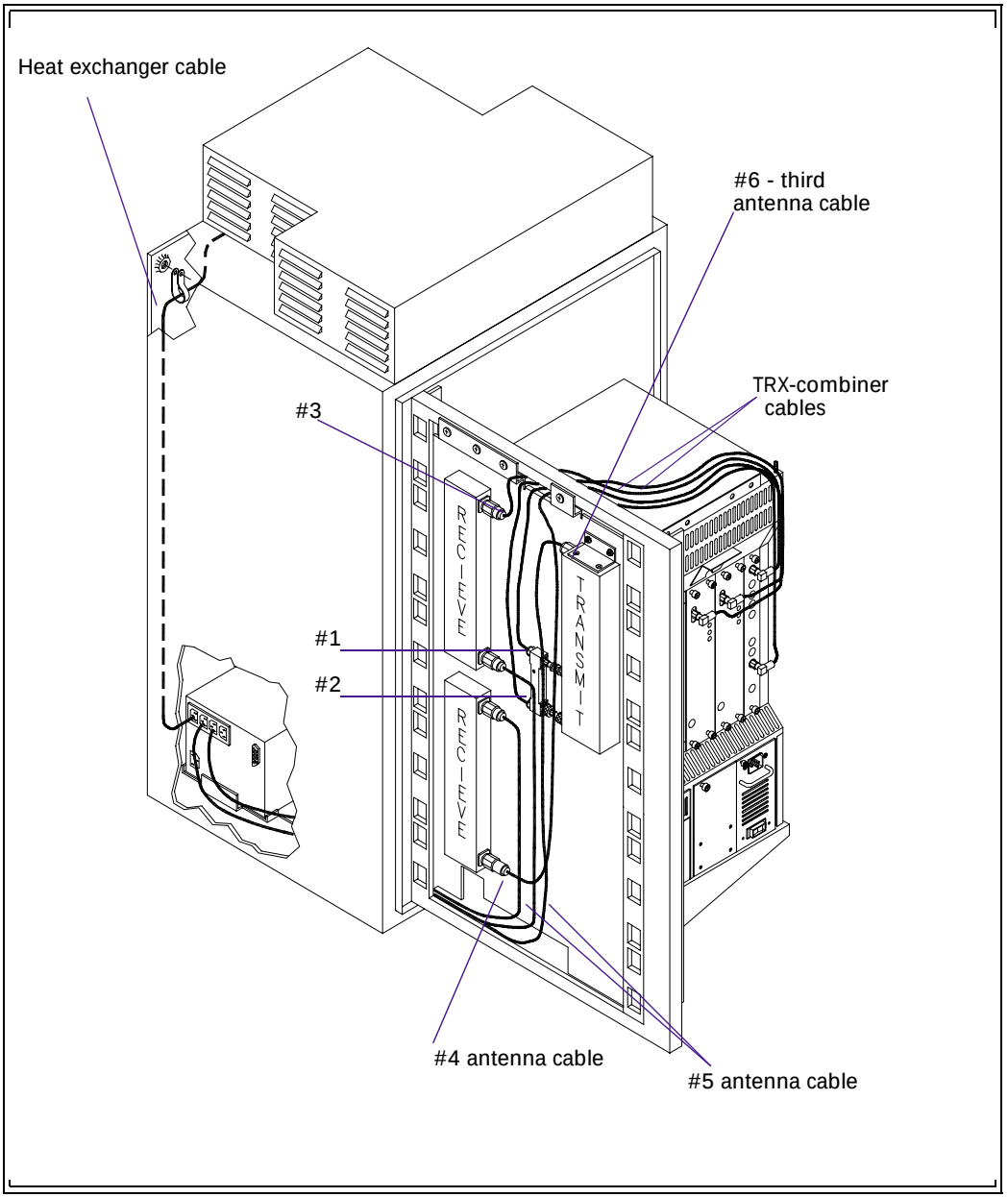

Figure 3-19: WAVEXpress cabling - BACK VIEW

Other Cable Connections

Antenna Connections

Step 1 Connect the external antenna cables to their appropriate port on the RF Distribution card.

Step 2 Route the cables over the top of the swing frame and through the three conduits at the bottom of the enclosure.

T1 Cable Connections

Step 1 Thread the T1 cables through the opening at the bottom of the swing frame.

Step 2 Connect each T1 cable directly to the RJ-48C jack on the dual port T1 card:

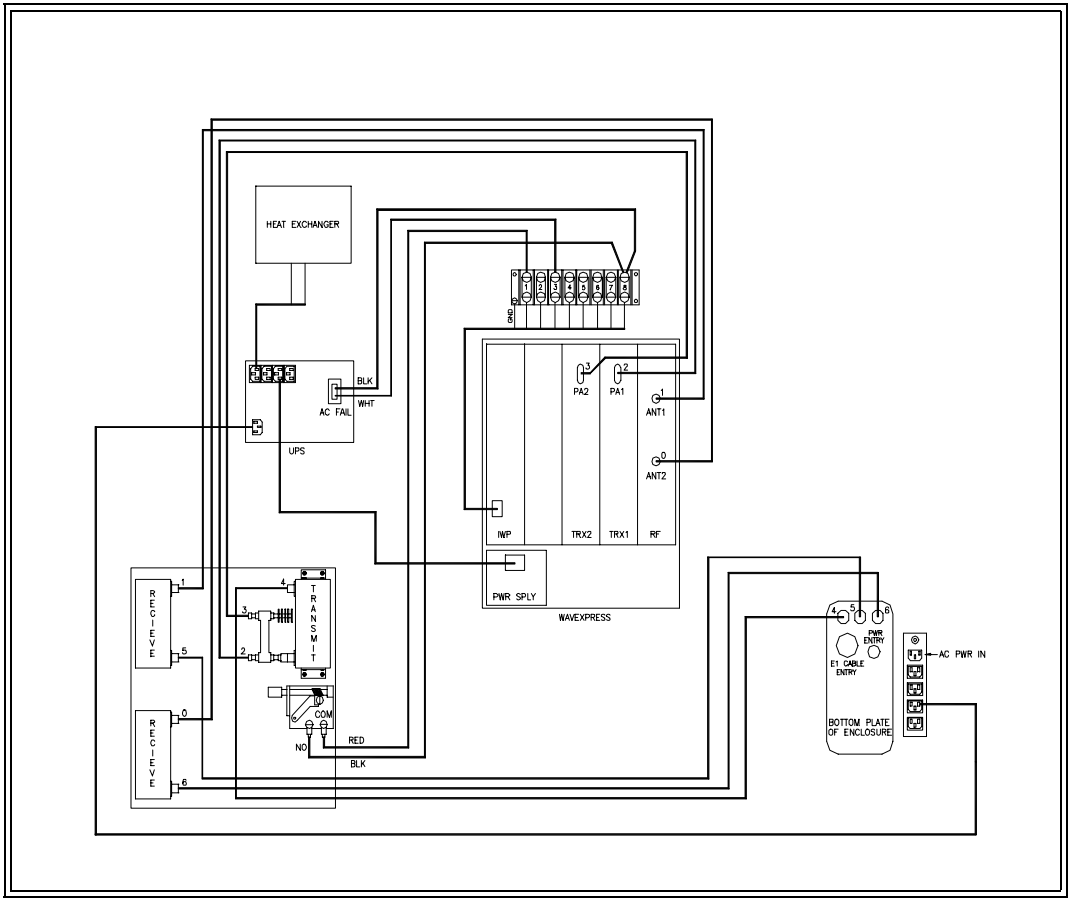

Figure 3-20: Cabling scheme of the outdoor enclosure showing all cabling connections

3-5.4 Optional Voltage Standing Wave Ratio (VSWR) Check

The optional VSWR check should be performed by the organization responsible for the antenna installation. The purpose of the check is to ensure the integrity of the antenna and the antenna connection by determining whether the reflected power reading is higher than the recommended value. The reflected power is defined as a ratio of the power output versus the reflected power return. This value is determined by two key factors: the power output from the WAVEXpress/BTS (approximately 2 watt 33dBm) and the loss due the length and type of the cable.

The recommended test approach is to use an in-line, forward/reverse power meter (ex. NAS model by Roche and Schwarz) installed between the BTS and the antenna cable. This approach validates that the antenna and cable are good. It also verifies that the transmit power from the BTS is within tolerance limits. The VSWR ratio should be less than or equal to 1.5:1.

Listed below are threshold values assuming a VSWR of 1.5 at different levels of cable loss (due to length or cable type). The estimated return loss should be greater than or equal to the values below.

Table 3-2: Total acceptable return loss for cable loss (dB), assuming an antenna VSWR of 1.5

End-to-end cable Loss (dB)	1	2	3	4	5	6
Return Cable loss (dB)	-14	-16	-18	-20	-22	-24

NOTE

Antenna types are site specific. Cable types in Asia tend to be either 7/8 inch foam connection dielectric or RG214.

3-5.5 Post Installation Checks

BTS Connection

Prior to commissioning the WAVEXpress/BTS, make sure that:

- The Abis interface T1 dual port cables are routed to the local T1 provider.
- Ensure that the DIP switch setting on the T1 card is set correctly. The length of T1 cables should be taken into account and the proper impedence set on the T1 card using the T1 dip switch. Refer to Section 2.3 T1 dip switch settings.
- The BTS' power is turned off.

BTS-BSC Link Verification

- It is the operator's responsibility to verify that all BTS-BSC T1 links are ordered, installed and certified according to ANSI T1.403 specifications before on-line commissioning is performed.
- The operator should also perform end-to-end bit error rate tests over a 20 minute period on the T1 Abis interface link.

Off-Line Commissioning

Four

Off-Line Commissioning

4-1 Pre Off-Line Commissioning Checks

The off-line commissioning of the BTS can take place either off-site at a staging area prior to installation or on-site after its installation depending on the operator's preference. These tests are optional procedures used to:

- Verify that the BTS has not been accidentally damaged during shipment or installation
- Verify that the BTS is properly working in its final environment.

The off-line commissioning process is split into two consecutive steps:

Step 1 Pre-commissioning visual checks, where the field technician verifies that the BTS is in an appropriate working state for off-line commissioning.

Step 2 Off-line commissioning, where the BTS proper operation is verified in a stand-alone mode via the Craft PC and the appropriate test equipment.

NOTE

The necessary steps for off-line commissioning are summarized in Checklist 2.

4-1.1 Pre Off-Line Commissioning Visual Checks

Off-line commissioning activity will only begin after the following checks have been made. Utilize the appropriate list depending on where the off-line commissioning is being performed.

Visual Checks for Depot Pre-Commissioning

1. The power to the WAVEXpress is OFF.
2. The WAVEXpress is connected to a suitable power source.
3. The WAVEXpress is correctly grounded.
4. All cables are available and secured in their correct positions.
5. All modules are securely seated and populated according to the original purchase order.

Visual Checks for On-Site Pre-Commissioning

1. The WAVEXpress/BTS has been securely installed at the appropriate site.
2. The power to the WAVEXpress/BTS is OFF.
3. The WAVEXpress/BTS is connected to a suitable power source.
4. The WAVEXpress/BTS is correctly grounded.
5. All cables are available and secured in their correct positions.
6. All modules are correctly seated and populated according to the original purchase order.
7. Transmission cables are available and labeled.

Compliance Checks

1. Verify that the test equipment used has a current calibration certificate. Note its current reference number in Checklist #2 in the Appendix.

Power Requirements

1. Verify that the voltage for the installation site match those of the WAVEXpress modules (either 230V, 115V, -48V, as specified in product manual.)
2. In the case of the outdoor enclosure only, verify that the battery backup option is enabled. This is done by turning on, then switching off the AC power to the unit and verifying that the LEDs on the IWP, T1 and TRX modules remain green as the battery backup is enabled.

4-2 Off-Line Commissioning Set-up

This section describes the procedures which must be followed in order to set up the WAVEXpress/BTS for off-line commissioning.

4-2.1 T1 Lines and Power Configuration

In order to prepare the WAVEXpress/BTS for off-line commissioning tests, the following steps must be performed:

Step 1 Verify that any T1 cables connected to the BTS are properly labeled.

Step 2 Disconnect the T1 cables form the dual port T1 card if there are any cables connected.

Step 3 Turn the power to the BTS on.

Step 4 Verify that the LEDs flash in the sequence shown in the following diagram.

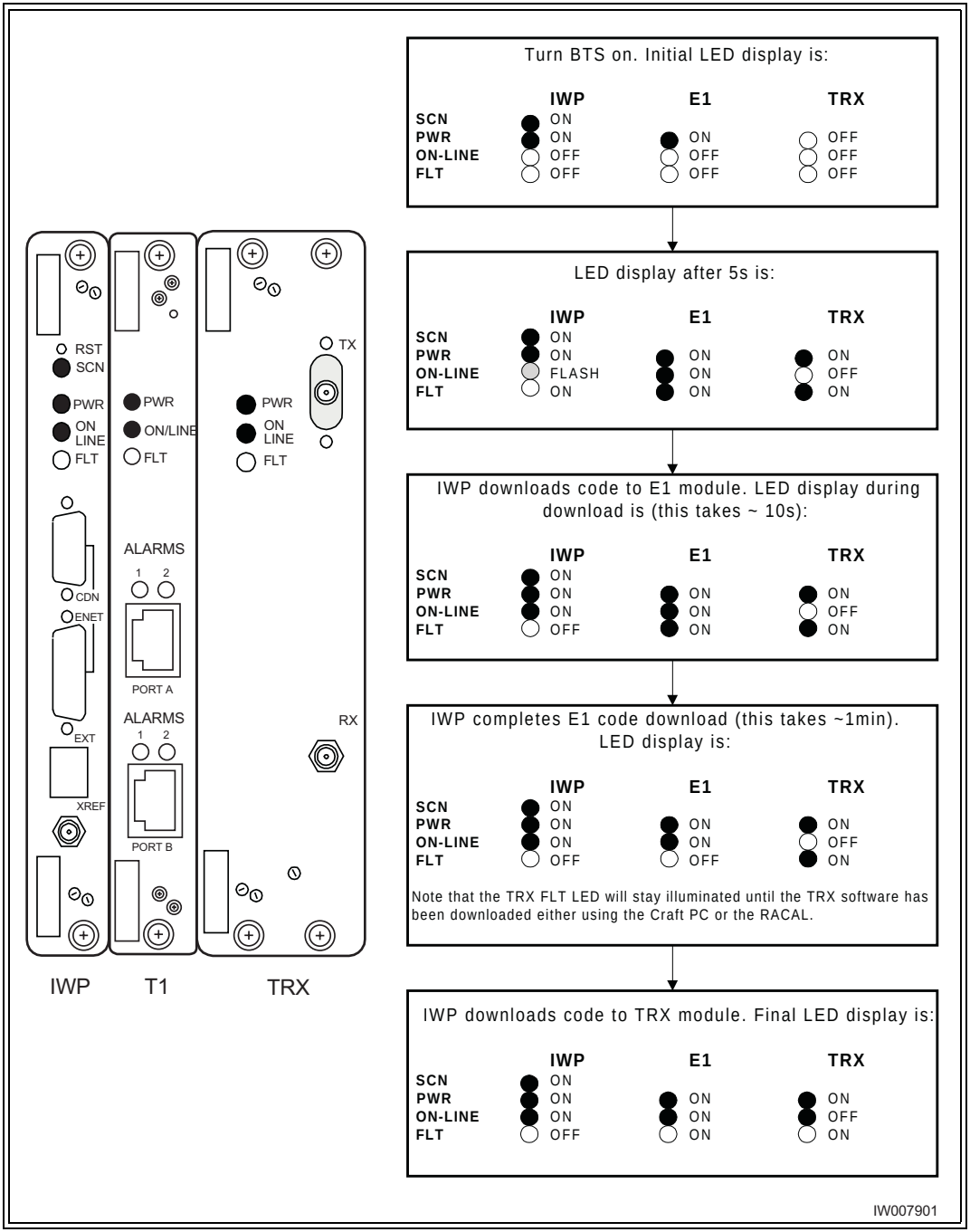

Figure 4-1: LEDs which should be lit after the BTS' power is turned on

The final LED sequence should be:

Table 4-1: WAVEXpress/BTS LED indications

LED	DESCRIPTION
SCN	Green LED, lit when IWP is operational (only present on the IWP card)
PWR	Green LED, lit when card has power supplied. The PWR LED of the IWP, T1 and TRX card will be lit after all cards have completed the boot-up process.
On-Line	Green LED, lit when card is on-line, and module BOOT process has been performed successfully. The On-Line LED of the IWP, T1 and TRX cards will be lit after all cards have completed the boot-up process.
Flt	Red LED, lit when card detects a fault or is not downloaded. No FLT LEDs should be lit if the boot-up process is successful.

If your display is different than what is shown, refer to the BSS Maintenance Guide.

4-2.2 Power On Self Test (POST) Diagnostics

Power-on self tests (POST) are optional diagnostics designed to exercise the hardware cards and modules, to the component level, in order to detect and report any problems.

POST diagnostics are currently run upon start-up on the T1 card, and can be invoked off-line for both the T1 and TRX cards. The following section describes the recommended sequence of steps which should be performed in order to check that the Craft PC can be connected to the BTS over an Ethernet connection, that the correct version of code is loaded from the Craft PC to the BTS and that the POST diagnostics are run successfully.

Connection of the Craft PC to the BTS

Required Hardware

The following hardware is needed to connect the Craft PC to the WAVEXpress/BTS through an Ethernet and a serial connection. Note that this hardware is supplied with the Craft PC:

- 1 RG-58 coaxial cable terminating in BNC connectors
- 2 50-Ohm terminators with BNC connectors
- 2 BNC T-connectors
- 1 3Com Combo transceiver
- 1 AUI-BNC transceiver.
- 1 DB9 cable (male to female)

Procedure to Set Up an Ethernet Connection

Step 1 Connect a T-connector to each end of the RG-58 coaxial cable.

Step 2 Connect a 50-Ohm terminator to the T-connector on each end of the RG-58 coaxial cable.

Step 3 If an AUI-BNC transceiver is not already connected to the IWP's Ethernet port labelled "ENET," then attach one now.

Step 4 Attach one end of the cable with the T-connector to the AUI-BNC transceiver on the IWP.

Step 5 Connect the other end of the cable to the 3Com Combo transceiver's BNC transceiver.

Step 6 Insert the 3Com Combo transceiver firmly into the PCMCIA card slot on the left side of the Craft PC.

The following illustration shows a completed physical connection between the Craft PC and a WAVEXpress:

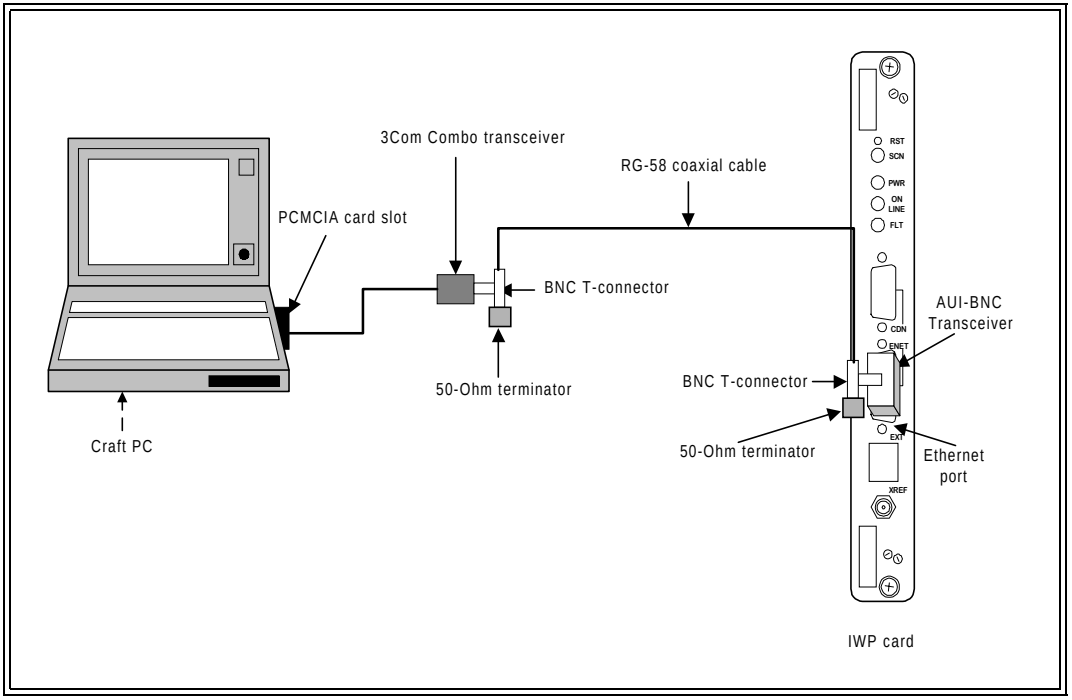

Figure 4-2: Connection to the Craft PC via the Ethernet port

Procedure to Set Up a Serial Connection

Step 1 Connect the female end of the DB9 cable to the serial port on the back of the Craft PC, and the male end of the cable to the DB9 connector labeled CON.

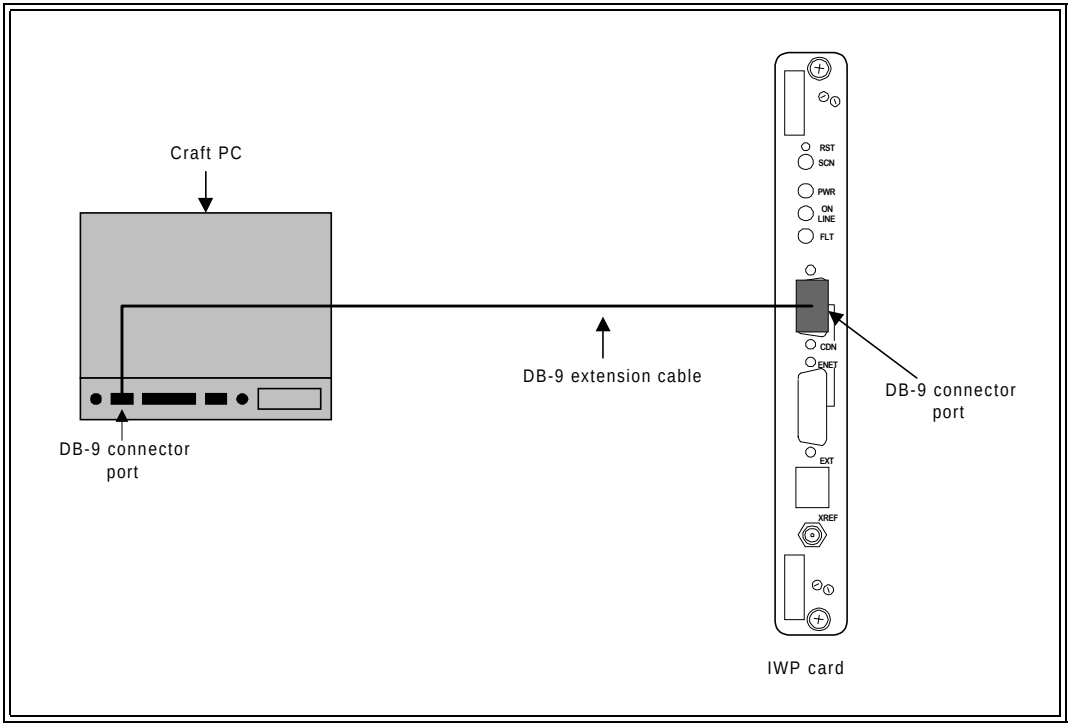

Figure 4-3: Connection to the Craft PC via the serial port

Starting XWindows Using the Craft PC

> **NOTE**
>
> The following sections describe procedures performed using the Craft PC. For more information pertaining to the use of the Craft PC, please refer to the Craft PC Guide. Note that all commands in bold are those entered by the user.

Starting the Craft PC

Step 1 Power up the Craft PC.

Step 2 At the *LILO* prompt, press [ALT]

Step 3 Start the UNIX operating system by pressing the [ENTER] key.

> **NOTE**
>
> At the *LILO* prompt, waiting for 30 seconds (with no user input) will automatically start the Linux operating system bootup.

Starting XWindows

Step 1 Login as "build" by typing:

craftpc login: **build** [ENTER]

Step 2 Start XWindows by typing:

build@craftpc:~> **startx** [ENTER]

Establishing a Serial Connection with the BTS

In an XTerm window, type:

```
build@craftpc:~>cu -l ttyS0 -s 9600 [ENTER]
Connected.
```

Step 3 After the returned message Connected appears, press the [ENTER] key. The prompt now changes to the following:

bts:A->

Verifying/Changing Boot Parameters

Step 1 Ensure that a serial connection is established between the BTS and the Craft PC. After the WAVEXpress/BTS boots normally, type:

bts:A-> **bootChange** [ENTER]

Step 2 A list of boot parameters appears. Edit the parameter values with the following commands:

Table 4-2: Changing Boot Parameters

Command	Action
[ENTER]	Accepts the current parameter value and proceeds to the next parameter.
. [ENTER]	Erases the current parameter value and proceeds to the next parameter.
- [ENTER]	Returns to the previous parameter.
[CTRL][D]	Aborts all changes to the boot parameter and revert to the current value.

```
'.' = clear field;  '-' = go to previous field;  ^D =
quit

boot device          : qu
processor number     : 0
host name            : craftpc
file name            : /home/target/vxWorks
inet on ethernet (e) : 172.16.80.42:fffff000
inet on backplane (b):
host inet (h)        : 172.16.80.43
gateway inet (g)     :
user (u)             : target
ftp password (pw) (blank = use rsh):
flags (f)            : 0xa
target name (tn)     : bts
startup script (s)   : /home/target/bsxstart
other (o)            :
```

Figure 4-4: Verifying/changing WAVEXpress/BTS boot parameters

NOTE

You must edit the boot parameters to contain the EXACT values shown in bold in the above display, or the WAVEXpress will not bootup properly.

Step 3 For the new parameters to take effect, reboot the WAVEXpress/BTS by pressing the key combination [CTRL][x].

NOTE

Refer to the Craft PC Guide for instructions if the V2R4 kernel is not loaded on the WAVEXpress/BTS (i.e. V2R3).

Checking the IWP Flash Version Number

In order to verify that the correct software build is loaded into flash memory, go to an XTerm window by placing your cursor in it and type:

```
bts:A-> printConfigBlocks
```

The following screen containing information relating to the two flash images (labeled Primary Config Block and Secondary Config Block) is displayed:

```
PR I M A R Y   C O N F I G   B L O C K:
1 (t3)idString          :PrimarYFlasHConfiGSectoR
2 (t3) version        :3
3 (t3) sequenceNumber :2
4 (t3) imageCRC       :0xa18h (valid)
5 (t3) imageLength    :440
6 (t3) creationTime   :THU JAN 01 00:00:16 1970
7 (t3) imageCurrent   :image A (0x80000) iw03_00.101
8 (t3) imagePrevious  :image B (0x140000) iw03_00.101
9 (t3) imageA startup file: none
10 (t3) imageB startup file:none
11 (t3) Abis signalling chno:0
12 (t3) bootLine      :qu(0,0)craftpc:/home/target/vxWorks
                        e=172.16.80.42
13 (t3)              :fffff000 h=172.16.80.43 u=target f=0xa tn=bts s=/
14 (t3)                       home/target/bsxstart
15 (t3)
16 (t3) S E C O N D A R Y   C O N F I G   B L O C K:
17 (t3)idString     :SecondarYFlasHConfiGSectoR
18 (t3)version        :3
19 (t3)sequenceNumber :2
20 (t3)imageCRC       :0xa18h (valid)
21 (t3) imageLength   :440
22 (t3) creationTime  :THU JAN 01 00:00:16 1970
23 (t3)imageCurrent   :image A (0x80000) iw03_00.101
24 (t3)imagePrevious  :image B (0x140000) iw03_00.101
25 (t3) Abis signalling chno:0
26 (t3) imageA startup file:none
27 (t3) imageB startup file:none
28 (t3)bootLine       :qu(0,0)craftpc:/home/target/vxWorks
                         e=172.16.80.42
29 (t3)             :fffff000 h=172.16.80.43 u=target f=0xa tn=bts s=1
30 (t3)                       home/target/bsxstart
```

Figure 4-5: Determining the IWP flash version

Locate the line labeled *Image Current* in the primary and secondary config block which are highlighted above. These lines have the format:

```
iwxx_yy.zzz
```

where iwxx_yy.zzz indicates the IWP flash version.

The flash version number should be 01_00.101 or higher for WAVEXpress/BTS TRX POST diagnostics to be able to run. If it is not, the flash version number will have to be changed and the BTS rebooted. To do this, refer to Chapter 8, BTS Management, located in the Craft PC Guide.

Running POST Diagnostics

T1 Diagnostics

Step 1 Disconnect any T1 lines from the BTS. This ensures that no Abis connection exists. If an Abis connection did exist, the TRX POST may not run properly.

Step 2 At the *bts*:A-> prompt, type:

```
bts:A-> nfsMountAll "craftpc"
```

Step 3 In an XTerm window, type: **reboot**

Step 4 This action reboots the BTS. The VxWorks kernel is started, and the 7 T1 tests run sequentially and the results of each test will be listed as PASSED/FAILED. Only if all 7 tests passed successfully will the T1 POST diagnostics be considered successful. The E1 POST results will be displayed after the boot process has been completed:

```
bts:A-> 0 (defunct) INTERWAVE PROCESSOR CARD (IWP) INITIALIZED
1(defunct) STARTING BTS CODE (version: iw03_00.000)...
2(e1diag)      E1 CARD in SLOT 1:STARTING POST/OFFLINE Test
3(e1diag)      E1(1)TID01:        Init Peripheral Registers : PASSED
4(e1diag)      E1(1)TID02:         Peripheral Register test : PASSED
5(e1diag)      E1(1)TID03:             Framer Register Test : PASSED
6(e1diag)      E1(1)TID04:        VME to CPU FIFO Flag Test : PASSED
7(e1diag)      E1(1)TID05:    Initialize Time/Space sw chip : PASSED
8(e1diag)      E1(1)TID06:           Software Download Test : PASSED
9(e1diag)      E1(1)TID07:                      Memory Test : PASSED
10(e1diag) E1 CARD in SLOT 1 :  COMPLETED POST/OFFLINE Test : PASSED
11(E1Mgrboot)  E1 LAPD IS OPERATIONAL
12(E1Mgrboot)  E1 LAPD IS ATTEMPTING TO ESTABLISH ABIS CONNECTION
WITH BSC.
```

Figure 4-6: T1 POST results

Step 5 The above display shows the T1 POST results that would appear if the T1 POST diagnostics ran successfully on the T1 card in slot 1. The format for each diagnostic line is:

[line number][action][T1 number][test number][test description][test result]

In the case of an error, a FAILED message would appear following the test that failed. In addition, the following message will be displayed in line 10:

```
T1 CARD in SLOT 1: COMPLETED POST/OFFLINE Test: FAILED
```

NOTE

If a particular T1 card fails the POST diagnostics, remove the failed card and return it to interWAVE Communications, Inc. along with its test results file. The defective module needs to be replaced by a new one, and POST diagnostics should be run again on the new card.

TRX Diagnostics

This section explains how to use the Craft PC to run the TRX POST diagnostics on the WAVEXpress/BTS locally.

Step 1 After the WAVEXpress/BTS has bootup and the T1 POST has run during the boot process, the TRX POST diagnostics can be initiated. Type:

```
bts:A-> runtrxpost [ENTER]
```

Step 2 A set of 40 TRX POST diagnostics will run sequentially and the results of each test will be listed as PASSED/FAILED. Only if all 40 tests passed successfully will the TRX POST diagnostics be considered successful. The TRX POST results will be displayed after the boot process have been completed:

> **NOTE**
>
> The TRX on-line LED flashes continuously when TRX POST diagnostics are being run and does not stop flashing until the WAVEXpress/BTS is rebooted. The flashing LED can be used as a reminder to reboot the system after successfully completing the TRX POST diagnostics.

The following example shows the TRX POST results of a 2 TRX BTS. The format for each diagnostic line is:

[line number][action][TRX number][test number][description of the test][test result].

For example:

```
19 (Diag)   TRX(4) TF22: Test Basic op of VME/RTP FIFOs: PASSED
```

where:

Table 4-3: Description of the TRX POST results

Line Entry	Description
19	Line number
Diag	Diagnostic test being run
TRX 4	TRX4 being tested
TF22	Test number
Test Basic op of VME/RTP FIFOs	Test description
PASSED	Indicates that the TRX passed this test.

```
iwbox:A-> runtrxpost
value = 0 = 0x0
iwbox:A-> 13 (t1) LOADING BTS FUNCTIONAL CODE
14 (txpostf) STARTING BTS FUNCTIONAL CODE...
15 (Diag) TRX CARD IN SLOT 6 : STARTING  TRX POST OFFLINE Test
16 (Diag)   TRX(6) TF85:               Download BDIO FPGA   : PASSED
17 (Diag)   TRX(6) TF14:           Test RTP  RAM Section 1  : PASSED
18 (Diag)   TRX(6) TF60:                 Verify BDIO FPGA  : PASSED
19 (Diag)   TRX(6) TF22:    Test Basic op of VME/RTP FIFOs  : PASSED
20 (Diag)   TRX(6) TF23:    Test Fast  op of VME/RTP FIFO.  : PASSED
21 (Diag)   TRX(6) TF24:    Test Fast  op of RTP/VME FIFO.  : PASSED
22 (Diag)   TRX(6) TF21:         All VME/RTP FIFO tests     : PASSED
23 (Diag)   TRX(6) TF14:          Test RTP  RAM Section 1   : PASSED
24 (Diag)   TRX(6) TF16:         Test DSP1 DATA & CODE RAM  : PASSED
25 (Diag)   TRX(6) TF17:         Test DSP2 DATA & CODE RAM  : PASSED
26 (Diag)   TRX(6) TF18:         Test DSP3 DATA & CODE RAM  : PASSED
27 (Diag)   TRX(6) TF19:         Test DSP4 DATA & CODE RAM  : PASSED
28 (Diag)   TRX(6) TF13: Test RTP RAM, DSP RAM, VME EEPROM  : PASSED
29 (Diag)   TRX(6) TF26:               Test RTP-DSP1 FIFO  : PASSED
30 (Diag)   TRX(6) TF27:               Test RTP-DSP2 FIFO  : PASSED
31 (Diag)   TRX(6) TF28:               Test RTP-DSP3 FIFO  : PASSED
32 (Diag)   TRX(6) TF29:               Test RTP-DSP4 FIFO  : PASSED
33 (Diag)   TRX(6) TF25:                All RTP-DSP FIFOs  : PASSED
34 (Diag)   TRX(6) TF86:               Download TDM  FPGA  : PASSED
35 (Diag)   TRX(6) TF62:          Verify TDM FPGA download  : PASSED
36 (Diag)   TRX(6) TF63:             TDM control store RAM  : PASSED
37 (Diag)   TRX(6) TF66:          TDM clocks and interface  : PASSED
38 (Diag)   TRX(6) TF87:               Download RXTDMA FPGA  : PASSED
39 (Diag)   TRX(6) TF65:       Verify RXTDMA FPGA download  : PASSED
40 (Diag)   TRX(6) TF88:               Download TXTDMA FPGA  : PASSED
41 (Diag)   TRX(6) TF64:       Verify TXTDMA FPGA download  : PASSED
42 (Diag)   TRX(6) TF40:            Test DSP3 to DSP1 FIFO  : PASSED
43 (Diag)   TRX(6) TF41:            Test DSP4 to DSP2 FIFO  : PASSED
44 (Diag)   TRX(6) TF42:Test DSP1-TXTDMA FIFO via RTP access: PASSED
45 (Diag)   TRX(6) TF43:Test DSP2-TXTDMA FIFO via RTP access: PASSED
```

Figure 4-7: TRX POST results (Page 1)

```
46 (Diag)   TRX(6) TF44:Test DSP3-RXTDMA FIFO via RTP access: PASSED
47 (Diag)   TRX(6) TF45:Test DSP4-RXTDMA FIFO via RTP access: PASSED
48 (Diag)   TRX(6) TF31:    Load & verify start-up of DSP1  : PASSED
49 (Diag)   TRX(6) TF32:    Load & verify start-up of DSP2  : PASSED
50 (Diag)   TRX(6) TF33:    Load & verify start-up of DSP3  : PASSED
51 (Diag)   TRX(6) TF34:    Load & verify start-up of DSP4  : PASSED
52 (Diag)   TRX(6) TF30:   Load & verify startup of DSP1-4  : PASSED
53 (Diag)   TRX(6) TF36:                    DSP1 ping test  : PASSED
54 (Diag)   TRX(6) TF37:                    DSP2 ping test  : PASSED
55 (Diag)   TRX(6) TF38:                    DSP3 ping test  : PASSED
56 (Diag)   TRX(6) TF39:                    DSP4 ping test  : PASSED
57 (Diag)   TRX(6) TF35:                  Ping-test DSP1-4  : PASSED
58 (Diag)   TRX(6) TF58:   DSP test of DSP1 to DSP3's FIFO  : PASSED
59 (Diag)   TRX(6) TF59:   DSP test of DSP2 to DSP4's FIFO  : PASSED
60 (Diag)   TRX(6) TF46: Test DSP1 to TDM Serial Loop Test  : PASSED
61 (Diag)   TRX(6) TF47: Test DSP2 to TDM Serial Loop Test  : PASSED
62 (Diag)   TRX(6) TF48: Test DSP3 to TDM Serial Loop Test  : PASSED
63 (Diag)   TRX(6) TF54:  DSP fill test of DSP1-TXTDMA FIFO : PASSED
64 (Diag)   TRX(6) TF55: DSP fill test of DSP2-TXTDMA FIFO  : PASSED
65 (Diag)   TRX(6) TF56: DSP read test of DSP3-RXTDMA FIFO  : PASSED
66 (Diag)   TRX(6) TF57: DSP read test of DSP4-RXTDMA FIFO  : PASSED
67 (Diag)   TRX(6) TF71:          Disable all IRQs to VME   : PASSED
68 (Diag)   TRX(6) TF78:     Clear all DSP/RTP to VME IRQs  : PASSED
69 (Diag)   TRX(6) TF11:Fast Test Suite (all but VME EEPROM): PASSED
70 (Diag)   TRX CARDIN SLOT 6:COMPLETED TRX POST OFFLINETest: PASSED
71 (Diag)   TRX CARD IN SLOT 4 : STARTING TRX POST OFFLINE Test
72 (Diag)   TRX(4) TF85:                Download BDIO FPGA  : PASSED
73 (Diag)   TRX(4) TF14:           Test RTP  RAM Section 1  : PASSED
74 (Diag)   TRX(4) TF60:                  Verify BDIO FPGA  : PASSED
75 (Diag)   TRX(4) TF22:   Test Basic op of VME/RTP FIFOs   : PASSED
76 (Diag)   TRX(4) TF23:    Test Fast  op of VME/RTP FIFO.  : PASSED
77 (Diag)   TRX(4) TF24:    Test Fast  op of RTP/VME FIFO.  : PASSED
78 (Diag)   TRX(4) TF21:            All VME/RTP FIFO tests  : PASSED
79 (Diag)   TRX(4) TF14:           Test RTP  RAM Section 1  : PASSED
80 (Diag)   TRX(4) TF16:         Test DSP1 DATA & CODE RAM  : PASSED
81 (Diag)   TRX(4) TF17:          Test DSP2 DATA & CODE RAM : PASSED
82 (Diag)   TRX(4) TF18:          Test DSP3 DATA & CODE RAM : PASSED
83 (Diag)   TRX(4) TF19:          Test DSP4 DATA & CODE RAM : PASSED
84 (Diag)   TRX(4) TF13:  Test RTP RAM, DSP RAM, VME EEPROM : PASSED
85 (Diag)   TRX(4) TF26:                Test RTP-DSP1 FIFO : PASSED
86 (Diag)   TRX(4) TF27:                Test RTP-DSP2 FIFO : PASSED
87 (Diag)   TRX(4) TF28:                Test RTP-DSP3 FIFO : PASSED
88 (Diag)   TRX(4) TF29:                Test RTP-DSP4 FIFO : PASSED
89 (Diag)   TRX(4) TF25:                All RTP-DSP FIFOs  : PASSED
90 (Diag)   TRX(4) TF86:               Download TDM  FPGA  : PASSED
```

Figure 4-8: TRX POST results (Page 2)

```
 91 (Diag)   TRX(4) TF62:          Verify TDM FPGA download  : PASSED
 92 (Diag)   TRX(4) TF63:             TDM control store RAM  : PASSED
 93 (Diag)   TRX(4) TF66:          TDM clocks and interface  : PASSED
 94 (Diag)  TRX(4) TF87:            Download RXTDMA FPGA     : PASSED
 95 (Diag)  TRX(4) TF65:     Verify RXTDMA FPGA download     : PASSED
 96 (Diag)  TRX(4) TF88:           Download TXTDMA FPGA      : PASSED
 97 (Diag)  TRX(4) TF64:         Verify TXTDMA FPGA download : PASSED
 98 (Diag)  TRX(4) TF40:              Test DSP3 to DSP1 FIFO : PASSED
 99 (Diag)  TRX(4) TF41:              Test DSP4 to DSP2 FIFO : PASSED
100 (Diag)  TRX(4) TF42:Test DSP1-TXTDMA FIFO via RTP access: PASSED
101 (Diag)  TRX(4) TF43:Test DSP2-TXTDMA FIFO via RTP access: PASSED
102 (Diag)  TRX(4) TF44:Test DSP3-RXTDMA FIFO via RTP access: PASSED
103 (Diag)  TRX(4) TF45:Test DSP4-RXTDMA FIFO via RTP access: PASSED
104 (Diag)  TRX(4) TF31:     Load & verify start-up of DSP1 : PASSED
105 (Diag)  TRX(4) TF32:     Load & verify start-up of DSP2 : PASSED
106 (Diag)  TRX(4) TF33:     Load & verify start-up of DSP3 : PASSED
107 (Diag)  TRX(4) TF34:     Load & verify start-up of DSP4 : PASSED
108 (Diag)  TRX(4) TF30:    Load & verify startup of DSP1-4 : PASSED
109 (Diag)  TRX(4) TF36:                    DSP1 ping test : PASSED
110 (Diag)  TRX(4) TF37:                    DSP2 ping test : PASSED
111 (Diag)  TRX(4) TF38:                    DSP3 ping test : PASSED
112 (Diag)  TRX(4) TF39:                    DSP4 ping test : PASSED
113 (Diag)  TRX(4) TF35:                  Ping-test DSP1-4 : PASSED
114 (Diag)  TRX(4) TF58:    DSP test of DSP1 to DSP3's FIFO : PASSED
115 (Diag)  TRX(4) TF59:    DSP test of DSP2 to DSP4's FIFO : PASSED
116 (Diag)  TRX(4) TF46:  Test DSP1 to TDM Serial Loop Test : PASSED
117 (Diag)  TRX(4) TF47:  Test DSP2 to TDM Serial Loop Test : PASSED
118 (Diag)  TRX(4) TF48:  Test DSP3 to TDM Serial Loop Test : PASSED
119 (Diag)  TRX(4) TF54:  DSP fill test of DSP1-TXTDMA FIFO : PASSED
120 (Diag)  TRX(4) TF55:  DSP fill test of DSP2-TXTDMA FIFO : PASSED
121 (Diag)  TRX(4) TF56:  DSP read test of DSP3-RXTDMA FIFO : PASSED
122 (Diag)  TRX(4) TF57:  DSP read test of DSP4-RXTDMA FIFO : PASSED
123 (Diag)  TRX(4) TF71:            Disable all IRQs to VME : FAILED
124 (Diag)  TRX(4) TF78:      Clear all DSP/RTP to VME IRQs : FAILED
125 (Diag)  TRX(4) TF11:Fast Test Suite (all but VME EEPROM): FAILED
126 (Diag) TRX CARD IN SLOT 4:COMPLETED TRX POST OFFLINETest: FAILED
```

Figure 4-9: TRX POST results (Page 3)

Step 3 The above display shows that the TRX POST diagnostics ran successfully on the TRX card in slot 6 but failed on the TRX card in slot 4. The final results of the TRX POST for both cards are highlighted in grey in the illustration above.

Step 4 If the TRX card(s) passed the POST diagnostics successfully, then reboot the WAVEXpress/BTS to place the TRX card(s) in an on-line and operational status by typing:

bts:A-> **reboot** [ENTER]

NOTE

If a particular TRX card fails the POST diagnostics, remove the failed card and return it to interWAVE Communications, Inc. along with its test results file. The defective module needs to be replaced by a new one, and POST diagnostics should be run again on the new card.

Reviewing POST Results

This section explains how to review T1 POST and TRX POST diagnostics results after POST has been completed on the WAVEXpress/BTS.

NOTE

The following procedure assumes that T1 and TRX POST have just been completed on the selected WAVEXpress/BTS and a serial connection is still active between the Craft PC and the BTS. If this is not the case, reboot the BTS and run POST again.

Step 1 To display the most current T1 and TRX POST results after POST has been completed, type:

bts:A-> **postReportE1Trx** [ENTER]

A summary of the T1 and TRX POST results will be displayed (note that some tests may not run):

```
bts:A-> postReportE1Trx
******************* E1 DIAGNOSTICS REPORT *******************
************************************************************
Slot:1
E1(1)TID01:         Init Peripheral Registers : PASS
E1(1)TID02:          Peripheral Register test : PASS
E1(1)TID03:              Framer Register Test : PASS
E1(1)TID04:         VME to CPU FIFO Flag Test : PASS
E1(1)TID05:     Initialize Time/Space sw Chip : PASS
E1(1)TID06:            Software Download Test : PASS
E1(1)TID07:                      Memory Test : PASS
E1(1)TID08:                 CPM download Test : Not-Run
E1(1)TID09:                      Ping Test : Not-Run
E1(1)TID10:                Cross Connect Test : Not-Run
************************************************************
******************* TRX DIAGNOSTICS REPORT *******************
************************************************************
Slot 6
------------------------------------------------------------
All Tests PASSED
************************************************************
value=58=0x3a='="
bts:A->
```

Figure 4-10: Reviewing T1 and TRX POST results

NOTE

There are three additional tests which are not run but show up in the results section when the user manually retrieves the POST results. These tests are not displayed when running POST by rebooting the BTS. They are:

- T1(1) TID08: CPM Download Test : Not-Run
- T1(1) TID09: Ping Test: Not-Run
- T1(1) TID10: Cross Connect Test: Not-Run

Rebooting the BTS after Running POST

Step 1 Type:

```
bts:A-> reboot
```

This action places the TRX in an on-line and operational state.

Step 2 Reconnect all T1 lines to the BTS.

Disconnecting the Serial Connection

Step 1 This completes the running of the POST diagnostics. If the Racal tests described in the BSS Field Maintenance Guide are going to be performed at this point, ensure that you have rebooted the BTS. In addition, leave the Craft PC connected to the BTS and a serial connection open.

Step 2 If the Racal tests are not performed at this point, end the serial connection. To do this, place your cursor in the XTerm window which was used to establish a serial connection, and press the [~] key and the [.] key at the same time. This terminates the serial connection between the Craft PC and the BTS.

Step 3 After a few seconds the returned message should read Disconnected, and the prompt should revert to:

```
build@craftPC:->
```

Five

Off-Line Commissioning of a Daisy Chain

Up to four WAVEXpresses can be incorporated into a daisy chain. If this configuration is adopted, each WAVEXpress/BTS must be installed separately, and if needed, off-line commissioning procedures performed on each unit independently. Once each unit is installed and commissioned, the WAVEXpresses can be daisy chained together.

NOTE

WAVEXpresses and MicroXpresses can be included in the same daisy chain.

5-1 Setting the Abis Timeslot

This procedure sets the Abis timeslot for the WAVEXpress/BTS. If the Abis timeslot is not set, it automatically defaults to 16.

This procedure is optional for a star configured WAVEXpress/BTS but is required for all WAVEXpresses which will be connected in a daisy chain. In this case, each WAVEXpress/BTS must have its Abis timeslot set to a unique number in the chain. This information will be used by the OMC operator to configure the daisy chain.

This procedure must be performed after the WAVEXpress' are tested using a Racal testset. Refer to the BSS Field Maintenance Guide for further instructions.

Step 1 Ensure that the Craft PC is connected to the BTS over a serial line, and that a serial connection is established. Refer to Chapter 4 for instructions on how to do this.

Step 2 In an XTerm window, type:

```
bts:A->getFlashE1Chan
```

This displays the timeslot reserved for the Abis timeslot, which is by default set to 16. To change this value, type at the prompt:

```
bts:A->setFlashE1Chan <number>
```

where <number> is a number between 1 and 31 and is the reserved Abis signaling timeslot for the WAVEXpress to be daisy chained.

Step 3 To double-check that the timeslot was changed, type again:

```
bts:A->getFlashE1Chan
```

The new Abis timeslot number should be displayed.

Step 4 If the Abis timeslot was changed, the WAVEXpress must be rebooted. Type:

```
bts:A->reboot
```

> **NOTE**
>
> In the case of daisy chained WAVEXpresses, the Abis timeslot for each unit in the daisy chain must be set to a different number. For example:
>
> - BTS 1 in the chain = Set timeslot 16 as the Abis timeslot
> - BTS 2 in the chain = Set timeslot 17 as the Abis timeslot
> - BTS 3 in the chain = Set timeslot 18 as the Abis timeslot
> - BTS 4 in the chain = Set timeslot 19 as the Abis timeslot
>
> Make sure that this information is communicated to the OMC operator.

5-2 Prerequisites to Daisy Chaining

Step 1 Ensure that all WAVEXpresses comprising the daisy chain are installed and off-line commissioned.

Step 2 Ensure that the Abis Manager timeslot has been set for each WAVEXpress/BTS in the daisy chain as outlined in Section 10-1. Each BTS within this daisy chain MUST be allocated a different Abis timeslot number.

Step 3 Turn the power off to all units.

Step 4 Verify that all T1 lines are in place and commissioned by the operator from the BSC to the first BTS, and between all successive BTS comprising the daisy chain.

> **NOTE**
>
> For daisy chained WAVEXpresses, the T1 card(s) of the WAVEXpress machine automatically enters a by-pass mode in the event of a power loss. The card is equpped with a relay in the signal path which provides continuity between the A-port and the B-port connector pins. In the event of a power outage, the A-port Rx signal from a remote destination is presented at the B-port Tx pins; the A-port Tx signal is driven from the B-port Rx pins by the remote source.

5-3 Cabling of the Units in a Daisy Chain

Step 1 Connect a T1 cable from the port of the BSC's T1 card labeled Port B to the port of the first BTS' T1 card labeled Port A.

> **NOTE** The pin-out of the cables connecting BTS #1 to BTS #2 is the same as the cable connecting the BSC to BTS #1. The connector pin assignments and DIP switch settings must adhere to information detailed in Section 1-3.5 "Dual Port T1 Card" on page 9.

Step 2 Connect a second T1 cable from the first BTS' T1 card labeled Port B to the second BTS' T1 card labeled Port A. This connects two BTS' in a single daisy chain.

Step 3 Up to four BTS' can be connected in this manner. Note that port Port B of the final BTS in the chain remains unconnected. See Figure 5-1 "Daisy chain configuration for a BTS consisting of 100 Ohm T1 cards"

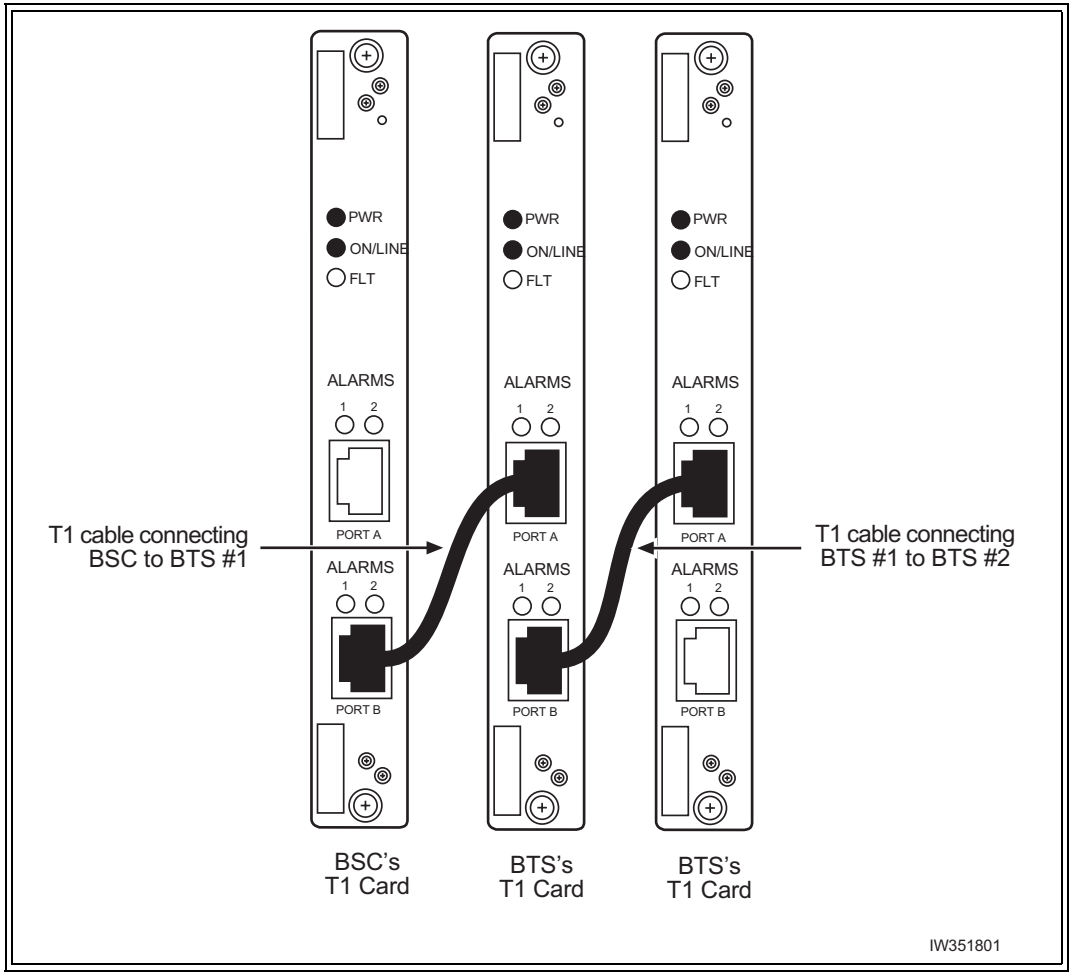

Figure 5-1: Daisy chain configuration for a BTS consisting of 100 Ohm T1 cards

Six

Post Off-Line Commissioning

6-1 Post Off-Line Commissioning

The following post off-line commissioning procedures need to be followed. In the case of off-line commissioning at a staging area, these procedures ensure that the WAVEXpress/BTS is ready for installation. In the case of off-line commissioning after installation, these procedures ensure that the WAVEXpress/BTS is ready for on-line commissioning.

6-1.1 Post Off-Line Commissioning Procedures at the Staging Area

Step 1 Repack the WAVEXpress/BTS in its original shipping containers and make sure that it is shipped to the site where the BTS will be installed.

Step 2 Once the BTS is installed, as described in the first section of the Guide:

- Connect the dual port T1 module cables to the T1 provider
- Power the BTS on. Verify that all PWR and On-Line LEDs are green.
- Leave the power to the BTS on
- Inform the OMC operator that the BTS is ready for on-line commissioning tests.

6-1.2 Post Off-Line Commissioning Procedures On-Site

Step 1 Reconnect the T1 cables to the digital distribution frame.

Step 2 Power the BTS on if it is not already on. Verify that all PWR and On-Line LEDs are green.

Step 3 Inform the OMC operator that the BTS is ready for on-line commissioning tests.

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On-Line Commissioning

Seven

On-Line Commissioning

7-1 Introduction

The on-line commissioning of the BTS takes place on-site in conjunction with the OMC operator, after installation and off-line commissioning. The aim of commissioning is to verify that the WAVEXpress/BTS is operational and can be integrated into a telecommunications network.

The on-line commissioning process is split into two consecutive steps:

Step 1 Pre-commissioning visual checks, where the field technician verifies that the BTS is still in an appropriate working state for on-line commissioning.

Step 2 On-line commissioning, where the BTS' proper operation is verified via the OMC.

NOTE

The necessary steps for on-line commissioning are summarized in Checklist 2.

7-1.1 Pre On-Line Commissioning Requirements

On-line commissioning activity will only begin after the following checks have been made by either the field technician or the OMC operator.

The prerequisites for on-line commissioning are:

- The BSC is fully commissioned, in service and connected to the BTS.
- The OMC is in service and connected to the BSC via the MSC as defined in the *i*nterWAVE BSS Network Implementation Guide.
- The database questionnaire is completed, with all necessary BTS parameters listed, as defined in the interWAVE BSS Network Implementation Guide.
- A planned cell is created in the OMC's database which corresponds to the field-installed BTS.
- The BSC is connected to the MSC.
- The OMC has downloaded the BTS' configuration with the correct software version and operational parameters as defined in the WAVEView Operations and Maintenance Guide and the interWAVE BSS Network Implementation Guide.
- The RF frequencies are cleared to transmit.
- The BSC-BTS T1 link is properly installed:
  - The BTS' dual port T1 cables are connected to the T1 provider.
  - The BSC's dual port T1 cables connected to the T1 provider are assigned to the BTS.
- The BSC-BTS T1 link is properly certified. Note that the certification should state length of testing and BER results.

It is the operator's responsibility to verify that all BSC-BTS T1 Abis links are ordered, installed and certified by the local T1 provider. Certification should include a BER test of at least 20 minutes on the Abis interface.

7-1.2 Prerequisites for Network Integration

In order to integrate the BTS in a pre-existing network, several procedures must be followed at the OMC. These procedures include:

- Creating a planned cell in the OMC's database that corresponds to the BTS physically installed. This planned cell must be identified by the appropriate Cell ID and Location Area Code (LAC) for the installed BTS. Optional information about which templates apply to the installed BTS can also be defined at this stage.
- Defining neighbor relationships for this planned cell.
- Creating a managed cell from the planned cell.
- Setting BTS parameters which include defining its base station identity code.
- Setting Abis parameters. This involves defining which BSC's T1 card and slot number is connected to which BTS and defining which T1 channel of the T1 link is dedicated to signaling (The default timelsot is 16).
- Defining which TRX of the BTS is the beacon TRX and assigning ARFCN for each TRX.
- In the case of a daisy chained BTS, setting the “T1 use type”, “previous BTS node”, “next BTS node” in the BTS Manager view, and the “T1 Chan” as the Abis channel in the Abis Manager view as described in the chapter “Configuring Network Elements” of the WAVEView Operations and Maintenance Guide.

Procedures on how to perform these tasks are outlined in the section “Network Configuration” of the WAVEView Operations and Maintenance Guide.

7-2 On-Line Commissioning

The network integration procedures listed below must be performed at the OMC to complete the BTS integration. Refer to the WAVEView Operation and Maintenance Guide for detailed procedures. This section contains the procedures for on-line commissioning of the WAVEXpress/BTS.

In order to complete the on-line commissioning of the WAVEXpress/BTS successfully, a BSS field technician needs to be on-site at the BTS and an OMC operator needs to be at the OMC in order to carry out the necessary procedures. The BSS field technician must have all relevant information found in Checklist #1 of the Appendix ready for verification by the OMC operator. The following flowchart contains the sequential procedures that are required to complete the on-line commissioning. Step numbers contained in the boxes are elaborated in the corresponding steps following the flowchart.

NOTE

Before starting any of the following procedures, the BSS maintenance technician needs to ensure that anti-static precautions are taken.

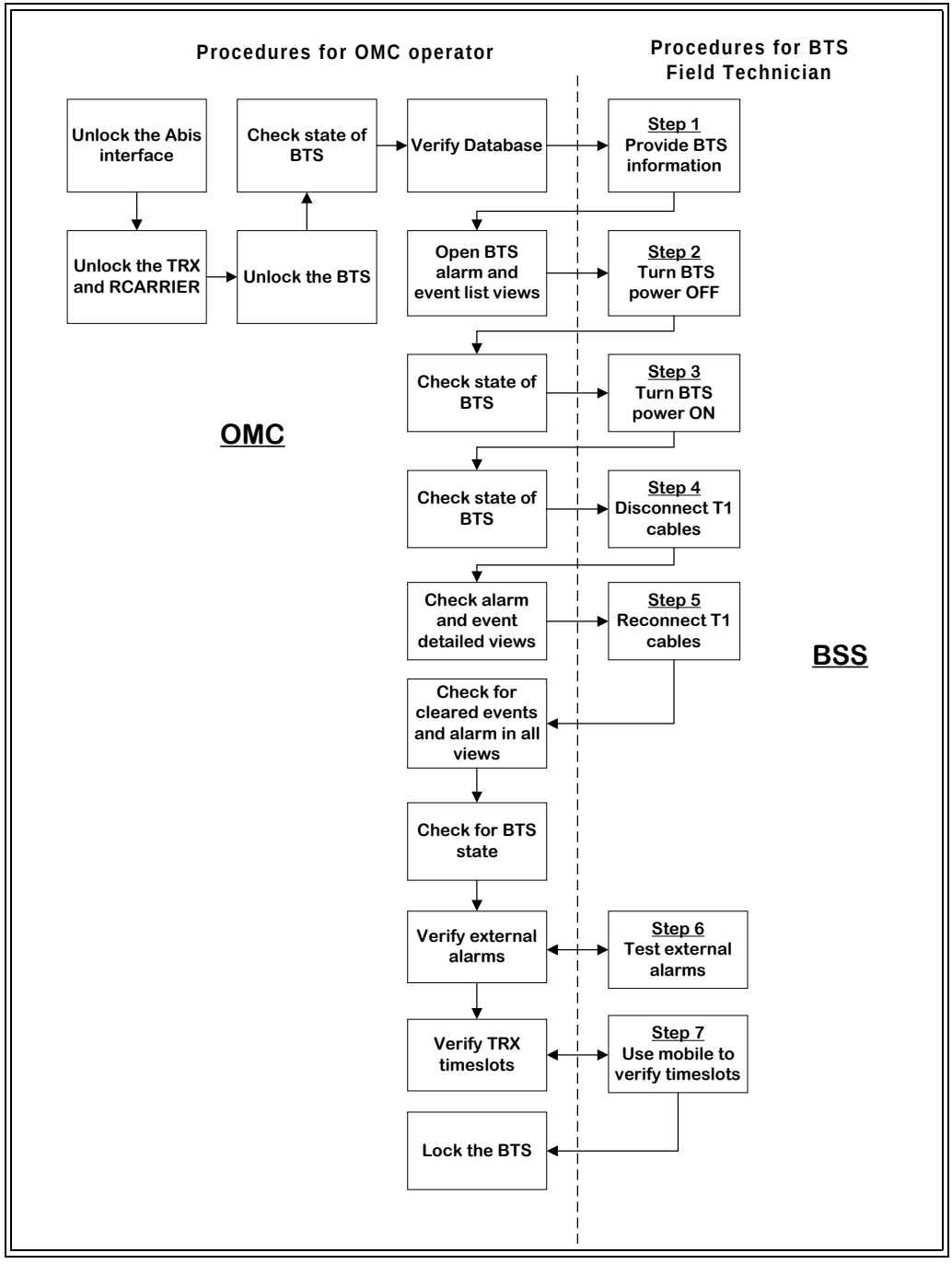

Figure 7-1: On-Line Commissioning Procedures

Step 1 Provide the OMC operator with all part, revision and serial numbers for the WAVEXpress / BTS cards and modules. This information was gathered during the physical installation and is available in Checklist #1 of the Appendix.

Step 2 Power off the BTS.

Step 3 Power on the BTS. Monitor the LED sequence of the BTS.

Step 4 At the BTS, disconnect both T1 cables. Monitor the LED sequence of the BTS as described in Chapter 4.

Step 5 Reconnect both T1 cables to the BTS' dual port T1 card. Monitor the LED sequence of the BTS as described in Chapter 4.

Step 6 Text external alarms as per the following procedures:

Test #1

1. Open the door of the BTS.
2. After a certain delay, the OMC operator must observe an NMI event.
3. Close the door.
4. After a certain delay, the alarm state changes from open to closed.

Test #2

1. If the first external alarm is used, close the alarm relay (i.e. trigger the first customer-defined alarm).
2. After a certain delay, the OMC operator must observe an NMI event.
3. Close the alarm relay by opening the alarm contact.
4. After a certain delay, the alarm state changes from open to closed.

Test #3

1. If the second external alarm is used, close the alarm relay (i.e. trigger the second customer-defined alarm).
2. After a certain delay, the OMC operator must observe an NMI event.
3. Close the alarm relay by opening the alarm contact.
4. After a certain delay, the alarm state changes from open to closed.

Step 7 At the BTS site, the commissioner should set the module handset in use into its debug mode. Refer to the documentation provided by the module handset manufacturer for the proper procedures. Examine the display of the handset in order to verify that the timeslot being used corresponds to the timeslot that was unlocked on the BTS by the OMC operator. Place a mobile-to-mobile call using the handset and the TRX under test. Verify that a two way call can be made on this timeslot with good audio quality, power and low interference. End the call.

NOTE

This test checks the performance of each timeslot contained within each TRX present in the WAVEXpress/BTS. The same test will be performed sequentially on all TCH timeslots outlined in Table 1 on page 121 to Table 7-3 on page 97. The number of timeslots which are tested are different for a 1 TRX BTS and a 2 or 3 TRX BTS.

Table 7-1: Timeslots needing testing in a 1 TRX BTS

TRX Number	Timeslot Number	Channel Type	Testing Necessary
First TRX - TRX #6	0	BCCH Combined	No
	1	TCH	Yes
	2	TCH	Yes
	3	TCH	Yes
	4	TCH	Yes
	5	TCH	Yes
	6	TCH	Yes
	7	TCH	Yes

NOTE

An abbreviated version of this test can also be run. It is sufficient to test any one of timeslots 0-3 and any one of timeslots 4-7 on a single TRX using the procedures outlined above. This procedure must then be repeated for all TRX's within the BTS.

Table 7-2: Timeslots needing testing in a 2 TRX BTS

TRX Number	Timeslot Number	Channel Type	Testing Necessary
First TRX*	0	BCCH	No
	1	SDCCH	No
	2	TCH	Yes
	3	TCH	Yes
	4	TCH	Yes
	5	TCH	Yes
	6	TCH	Yes
	7	TCH	Yes
Second TRX*	0	TCH	Yes
	1	TCH	Yes
	2	TCH	Yes
	3	TCH	Yes
	4	TCH	Yes
	5	TCH	Yes
	6	TCH	Yes
	7	TCH	Yes

Table 7-3: Timeslots needing testing in a 3 TRX BTS

TRX Number	Timeslot Number	Channel Type	Testing Necessary
First TRX*	0	BCCH	No
	1	SDCCH	No
	2	TCH	Yes
	3	TCH	Yes
	4	TCH	Yes
	5	TCH	Yes
	6	TCH	Yes
	7	TCH	Yes
Second TRX*	0	TCH	Yes
	1	TCH	Yes
	2	TCH	Yes
	3	TCH	Yes
	4	TCH	Yes
	5	TCH	Yes
	6	TCH	Yes
	7	TCH	Yes
Third TRX*	0	TCH	Yes
	1	TCH	Yes
	2	TCH	Yes
	3	TCH	Yes
	4	TCH	Yes
	5	TCH	Yes
	6	TCH	Yes
	7	TCH	Yes

NOTE

The BCCH can be assigned to any TRX within the BTS. The label “First TRX” applies to the TRX to which is assigned the BCCH. The OMC operator may determine which physical TRX is the “1st, 2nd or 3rd”.

7-2.1 Post On-Line Commissioning Procedures

Step 1 Leave the power to the BTS on.

Step 2 Check that all T1 and power cable connections to the BTS are tight.

Step 3 Close and lock the BTS door.

Step 4 Ensure that the BTS' site is left in a tidy state.

At this point, the commissioner can leave the BTS’ site.

Appendices

Appendix 1
Connection of the Combiner Assembly

A1-1 Introduction

The combiner assembly kit is intended to enable a single antenna to serve two TRXs in one of the following configurations:

1. Transmitter signals from two power amplifiers may be combined to drive a single antenna.

2. The receive band from a single antenna may be split to serve two separate base stations at different locations.

3. Antenna ports Ant1 and Ant2 on the BTS RF distribution card may be combined to use a single antenna in both receive and transmit mode to serve two different TRXs operating on different channels.

A performance penalty is experienced in all three of these applications because the division of power by two results in a 3dB loss in both directions of operation (to which must be added the internal losses of the coupler, approximately 1dB, for a total of 4dB). The receiver sensitivity will be impaired by this amount, while the transmitted power will be reduced by this amount.

The combiner assembly can be used for a two-TRX BTS. In this configuration, the combiner assembly is used to combine the outputs of the two power amplifiers into a single feed. This allows a two-TRX BTS to operate with a single antenna for both transmission and reception. This configuration offers full receiver sensitivity for each of two channels, but reduced power output by 4dB in each channel, and no capability for receiver diversity.

The combiner assembly can also be used for a three TRX BTS, in which the third transmitter output is combined with one of the others to feed an existing antenna. In this case, two duplexed antennas offer full receive sensitivity for all three channels, switched antenna receive diversity for all three channels, full transmitter power on TRX No.1, and 4dB reduced tranmsitter power on TRX No. 2 and No.3.

Two combiner kits are available:

- Part number M640104 is used for 900MHz BTSs
- Part number M640133 is used for 1800MHz BTSs

A1-2 Equipment Description

Each combiner kit consists of the following components:

- modified antenna bracket
- hybrid combiner (either for 900MHz operation or 1800MHz operation)
- 50 ohm terminator
- N-type connector
- combiner clamping bracket
- 2 modified SMA cables

The combiner kit may be either factory installed or installed in the field. The access to the combiner kit is at the Type-N female adapter located on the top of the antenna bracket. The 50-ohm terminator is located at the adjacent connector, and must be in place for proper operation.

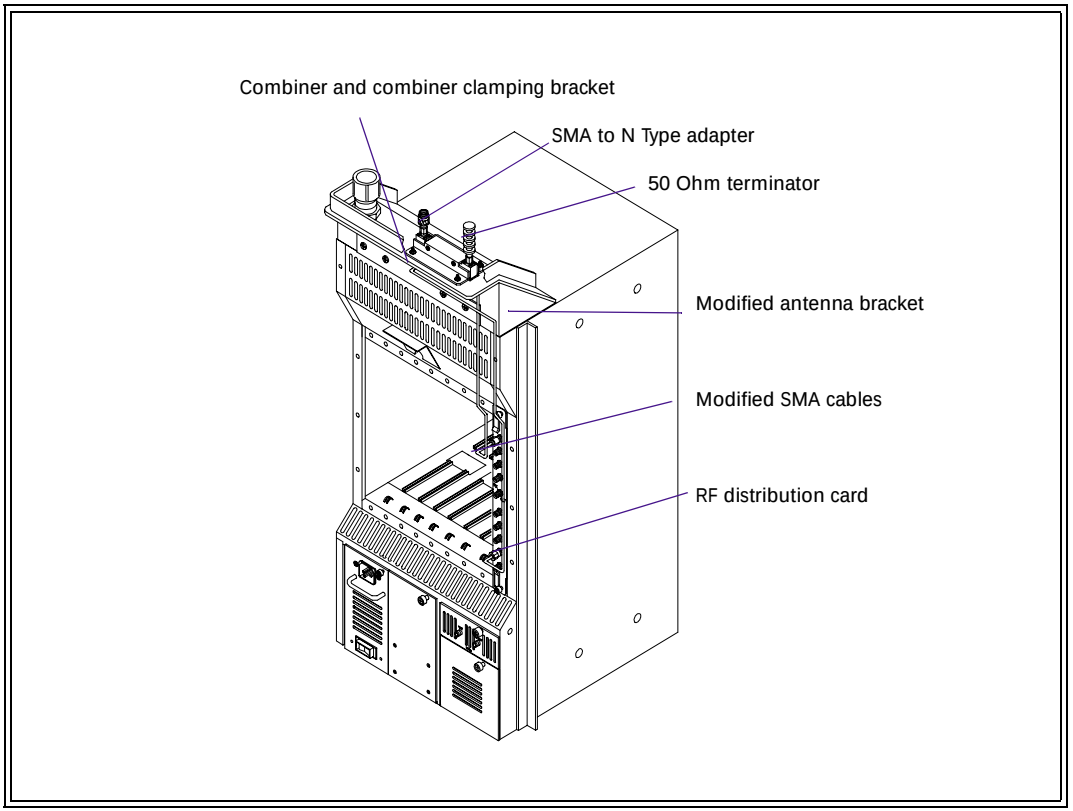

Figure A1-1: Combiner assembly option

Follow these steps and refer to the figures below to install the combiner assembly and new antenna bracket on a standard WAVEXpress.

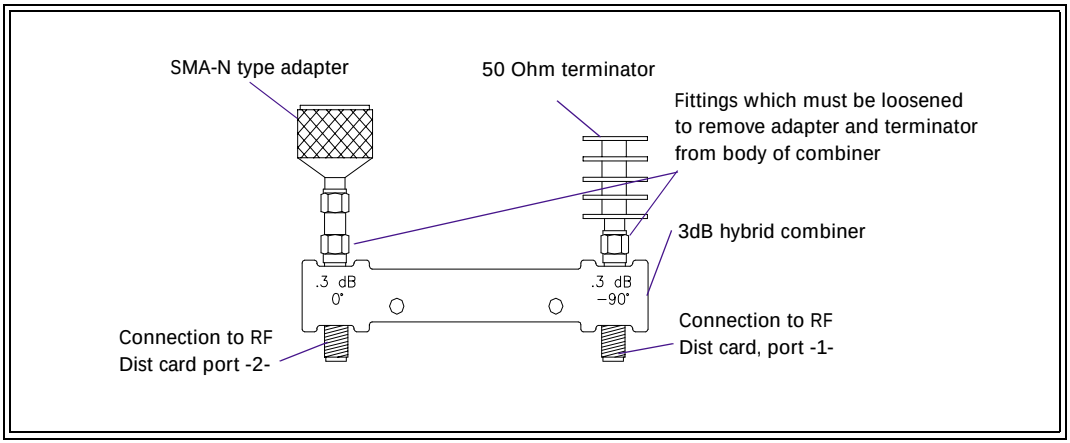

Figure A1-2: Side view of the combiner assembly

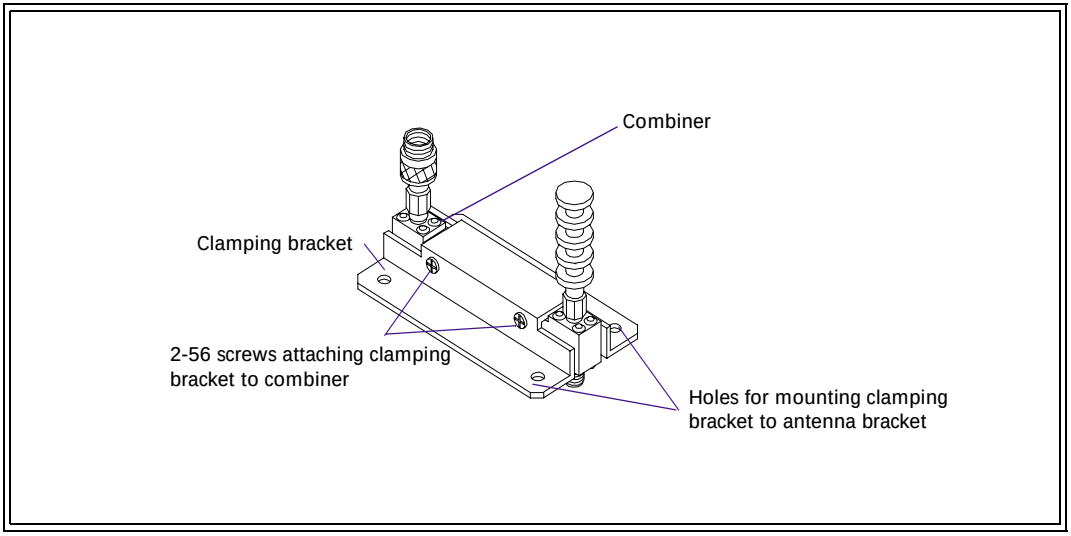

Figure A1-3: Combiner assembly and clamping bracket

If the combiner assembly is to be installed in the field, all that needs to be done is to swap out the standard antenna bracket and replace it with the combiner antenna bracket. Note that this modified bracket is shipped with the combiner assembly already mounted on the bracket. Instructions on how to swap antenna brackets are as follows:

Removing the cable gland and standard SMA cables

Step 1 Remove the cable gland from the antenna bracket.

Step 2 Remove the 2 SMA cables from the antenna bracket to the RF distribution card using a Torx wrench.

- Remove cable 1 connected from port labeled -1- on the RF Dist module to the right-hand antenna connector when the WAVEXpress is viewed from the front.
- Remove cable 2 connected from port labeled -2- on the RF Dist module to the middle antenna connector when the WAVEXpress is viewed from the front.

Removing the standard antenna bracket

The antenna bracket is placed over two threaded studs located on the top of the WAVEXpress, locked in position using nuts threaded over these studs and attached to the front of the WAVEXpress using 4 10-32 screws.

Step 1 To remove the original antenna bracket, unscrew the 4 10-32 screws holding the antenna bracket to the front of the WAVEXpress.

Step 2 Using a 3/8î wrench, unscrew the two 10-32 nuts holding the antenna bracket in place over the threaded studs located on the top of the WAVEXpress.

Step 3 Lift the antenna bracket off the threaded studs.

Attaching the combiner antenna bracket

Step 1 Place the new antenna bracket over the two threaded studs on the top side of the WAVEXpress. Move the antenna bracket in position so that the four screw holes on the front of the antenna bracket and the front of the WAVEXpress are lined up.

Step 2 Using a 3/8 wrench, thread the 2 10-32 nuts with washers over the threaded studs and tighten them down.

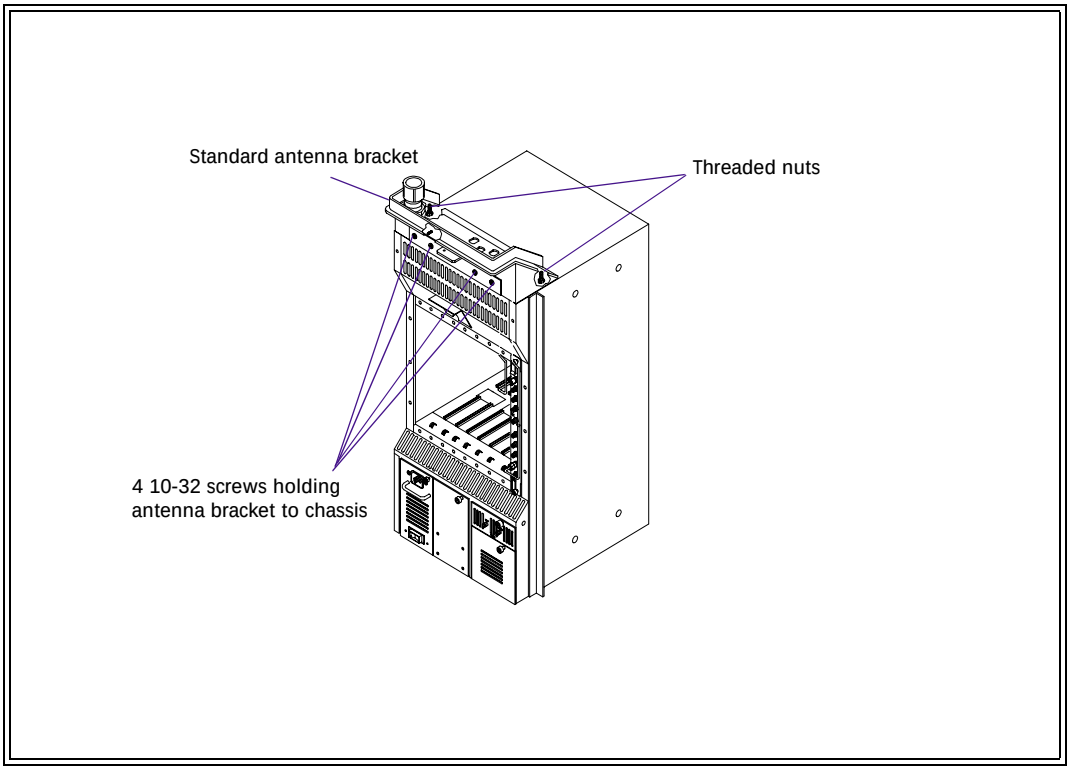

Figure A1-4: Hardware used to fasten the standard antenna bracket to the WAVEXpress

Step 3 Screw the 4 10-32 screws with washers through the four threaded holes in the front of the antenna bracket.

Connecting the modified SMA cables

Step 1 Connect the 2 modified SMA cables to the combiner using a Torx wrench and tightening the cables to 8 in. lbs.

- Connect cable 1 from port labeled -1- on the RF Dist module to the right-hand, lower port of the combiner when the WAVEXpress is viewed from the front.
- Connect cable 2 from port labeled -2- on the RF Dist module to the left-hand, lower port of the combiner when the WAVEXpress is viewed from the front.

Step 2 Connect the cable gland to the modified antenna bracket

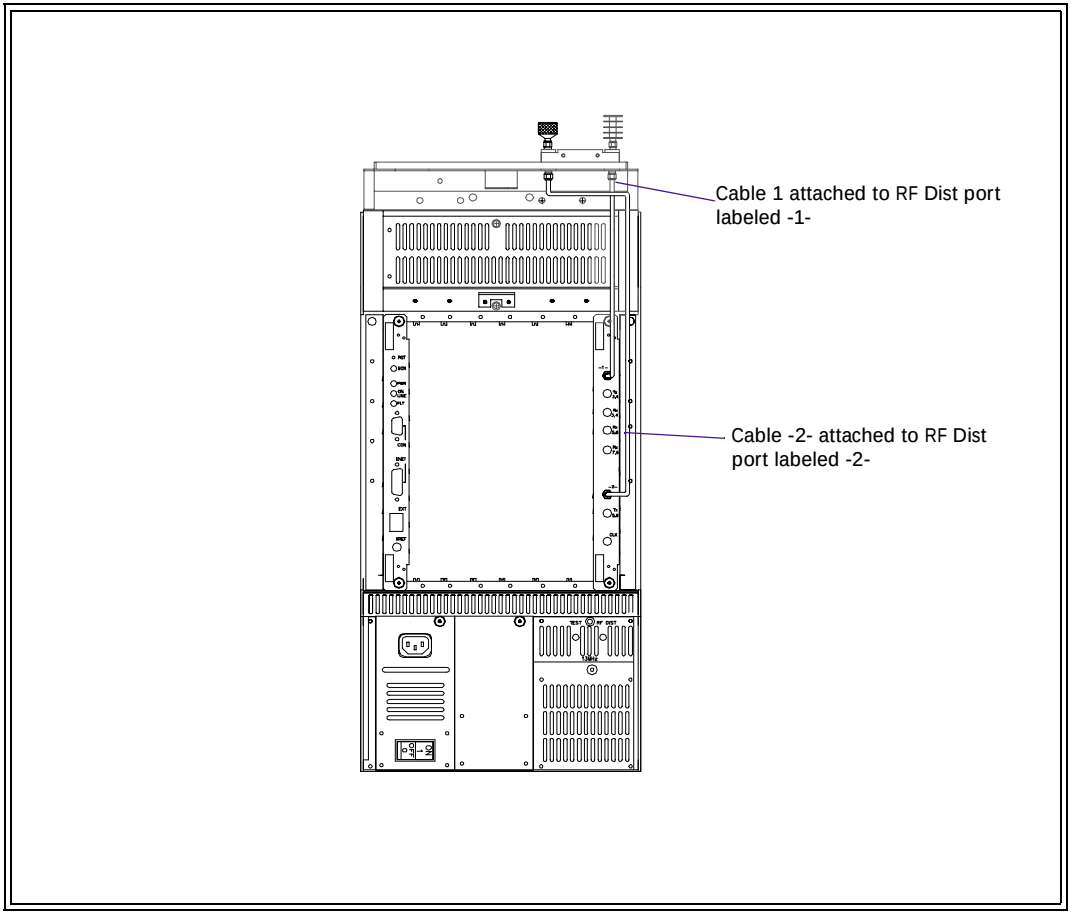

Figure A1-5: Connecting the specialized SMA cables to the combiner

NOTE

Other than the antenna cabling from the RF Dist card to the combiner assembly, all other WAVEXpress cabling for this option is identical to what is described in other chapters in this Guide.

Appendix 2

BTS Field Maintenance

A2-1WAVEXpress/BTS Field Replacement Maintenance

This section contains the BSS field replacement maintenance procedures for the WAVEXpress/BTS. WAVEXpress/BTS field replacement maintenance includes the field replacement actions of the following cards and modules:

- IWP card
- T1 card
- TRX card
- RF Distribution card
- clock module
- power supply units
- fan assemblies
- filters
- combiner assembly.

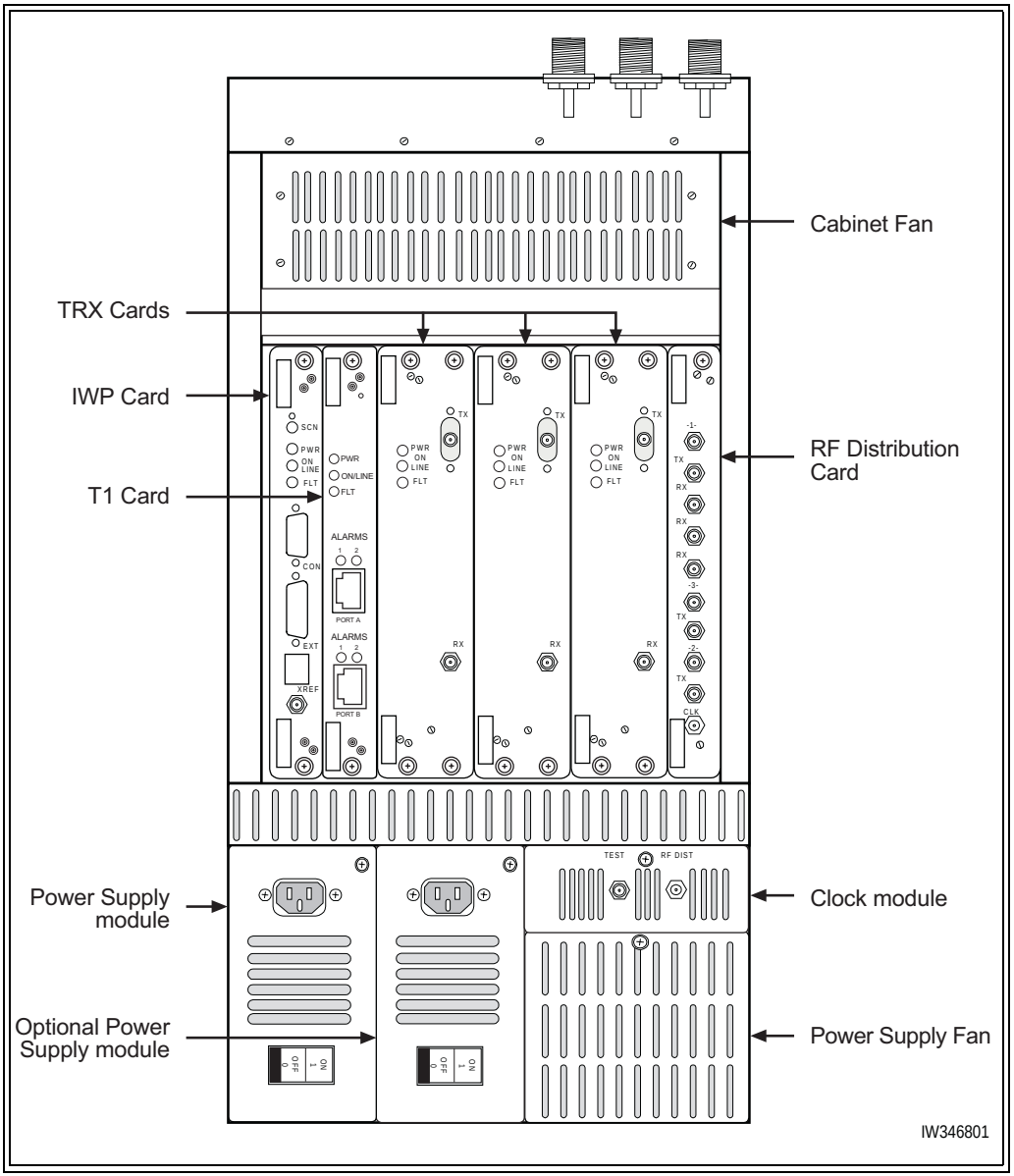

Figure A2-1: WAVEXpress/BTS field replaceable units

The previous illustration shows how each card and module can be replaced on a WAVEXpress/BTS. The procedures for completing these actions are covered in the following sections.

BEFORE PERFORMING ANY FIELD REPLACEMENT PROCEDURES, **AN ANTI-STATIC WRISTBAND MUST BE WORN**. MAKE SURE THAT THE WRISTBAND IS PROPERLY GROUNDED BEFORE HANDLING THE EQUIPMENT.

A2-1.1 Replacing the WAVEXpress/BTS IWP card

This section contains the procedures for replacing the IWP card on a WAVEXpress/BTS. Refer to Figure A2-1 "WAVEXpress/BTS field replaceable units" on page 108 for an illustration of the replacement position.

WHEN REMOVING THE IWP CARD, POWER TO THE BTS MUST BE SHUTDOWN, AND SERVICE WILL BE INTERRUPTED.

Step 1 Inform the OMC operator to shutdown the WAVEXpress/BTS using the OMC.

Step 2 Power off the WAVEXpress/BTS by switching the power switch to the OFF position.

Step 3 Ensure that anti-static precautions are taken.

Step 4 Using a Phillips screwdriver, unscrew the two screws located at the top and bottom of the IWP card.

Step 5 Remove the IWP card by firmly pulling the two white tabs located at the top and bottom of the IWP card.

Step 6 Place the new IWP card into the slot and slide in the card until it completely rests inside the slot. Push the card firmly into place.

Step 7 Using a Phillips screwdriver, screw in the two removed screws onto the IWP card.

Step 8 Power on the WAVEXpress/BTS by switching the power switch to the ON position.

Step 9 Monitor the bootup process, refer to the maintenance manual for procedures.

Step 10 Using the Craft PC, verify the boot parameters on the WAVEXpress/BTS after the bootup process is completed. Refer to the Craft PC guide for the necessary procedures.

Step 11 Using the Craft PC, verify the current Flash boot image and upgrade if necessary. Refer to the Craft PC guide for the necessary procedures.

Step 12 If the WAVEXpress/BTS fails to bootup properly, refer to the maintenance manual for the necessary procedures to bootup the WAVEXpress/BTS.

Step 13 Inform the OMC operator to unlock the WAVEXpress/BTS using the OMC after the communication alarm to the BTS has cleared.

Step 14 Conduct test calls on all TRX channels contained in the WAVEXpress/BTS.

A2-1.2 Replacing the WAVEXpress/BTS T1 card

This section contains the procedures for replacing the T1 card on a WAVEXpress/BTS. Refer to Figure A2-1 "WAVEXpress/BTS field replaceable units" on page 108 for an illustration of the replacement position.

When removing the T1 card, power to the BTS must be shutdown. Service will be interrupted.

Step 1 Inform the OMC operator to shutdown the WAVEXpress/BTS using the OMC.

Step 2 Power off the WAVEXpress/BTS by switching the power switch to the OFF position.

Step 3 Ensure that anti-static precautions are taken.

Step 4 Disconnect any T1 cables connected to the selected T1 card. Make note of the orientation of the cables.

Step 5 Using a Phillips screwdriver, unscrew the two screws located at the top and bottom of the T1 card.

Step 6 Remove the T1 card by firmly pulling the two white tabs located at the top and bottom of the T1 card.

Step 7 When replacing the T1 board, examine the existing board dip switch settings. Refer to the following illustration. Ensure the new T1 board dip switch settings are identical to the settings on the T1 card being replaced. Table A2-1 on page 111 provides the T1 dip switch settings for both Port A and Port B given DSX cable length or line build out. Refer to Figure A2-2 for T1 dip switch identification.

NOTE

The T1 card dip switch is set according to DSX cable length or line build out. The proper dip switch settings should have been identified during the initial system installation and need only be replicated on the new T1card for replacement purposes.

Table A2-1: T1 dip switch settings

Port A Switch Setting 1-2-3-4	**Port B Switch Setting 5-6-7-8**	**DSX-1 Cable Distance Feet (Meters)**	**CSU Line Build-Out**
O-C-C-C	O-C-C-C	0-133 (0-	N/A
O-O-C-C	O-O-C-C	133-266	N/A
O-C-O-C	O-C-O-C	266-399	N/A
O-O-O-C	O-O-O-C	399-533	N/A
O-C-C-O	O-C-C-O	533-655	N/A
O-O-C-O	O-O-C-O	N/A	0dB
O-C-O-O	O-C-O-O	N/A	-7.5dB
O-O-O-O	O-O-O-O	N/A	-15dB
C-O-X-X	C-O-X-X	N/A	-22.5dB
O = Open, C = Closed, X = Either			

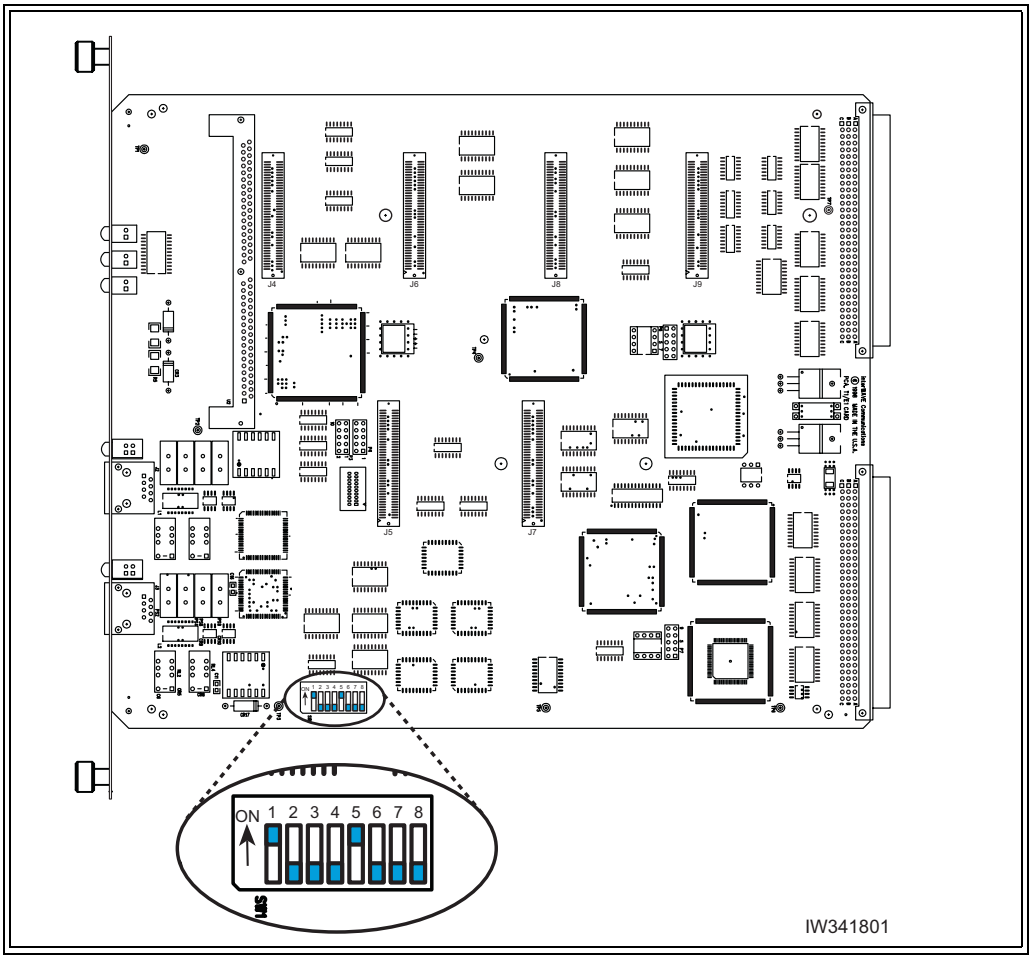

Figure A2-2: T1 card dip switch (set at DSX cable length of 0-133ft)

Step 8 Place the new T1 card into the slot (refer to Figure A2-1 "WAVEXpress/BTS field replaceable units" on page 108) and slide in the card until it completely rests inside the slot. Push the card firmly into place.

Step 9 Using a Phillips screwdriver, screw in the two removed screws onto the T1 card.

Step 10 Reconnect the disconnected T1 cables to the new T1 card.

Step 11 Power on the WAVEXpress/BTS by switching the power switch to the ON position.

Step 12 Monitor the bootup process, refer to Chapter 4 for procedures.

Step 13 Inform the OMC operator to unlock the BTS object using the OMC and verify that the WAVEXpress/BTS has been returned to its on-line status: operational, unlocked, online.

Step 14 Conduct test calls on all TRX channels contained in the WAVEXpress/BTS.

A2-1.3 Replacing the WAVEXpress/BTS TRX card

This section contains the procedures for replacing the TRX card on a WAVEXpress/BTS. Refer to Figure A2-1 "WAVEXpress/BTS field replaceable units" on page 108 for an illustration of the replacement position.

WHEN REPLACING A TRX CARD ON A ONE TRX WAVEXPRESS/BTS SYSTEM, **SERVICE WILL BE INTERRUPTED AND NEW CALLS WILL NOT BE PROCESSED UNTIL A NEW TRX CARD IS REPLACED**.

TRX cards can be replaced without powering off the WAVEXpress/BTS. If the WAVEXpress/BTS contains multiple TRX cards, replacing one TRX card will not effect existing calls when calls do not exceed the capacity of the remaining TRX card(s). New calls will also be processed if the capacity of the remaining TRX card(s) has not been exceeded.

NOTE

TRX cards take up two card slots and are placed from right to left starting with slots 6 and 7 on the WAVEXpress/BTS chassis.

Step 1 Inform the OMC operator to lock the faulty TRX card from the OMC.

Step 2 Ensure that anti-static precautions are taken.

Step 3 Using a torque wrench (set to 8 in. lbs.), disconnect the RF semi-rigid cables connecting the TRX card to the RF distribution card. Refer to the following illustration for the appropriate cables to disconnect:

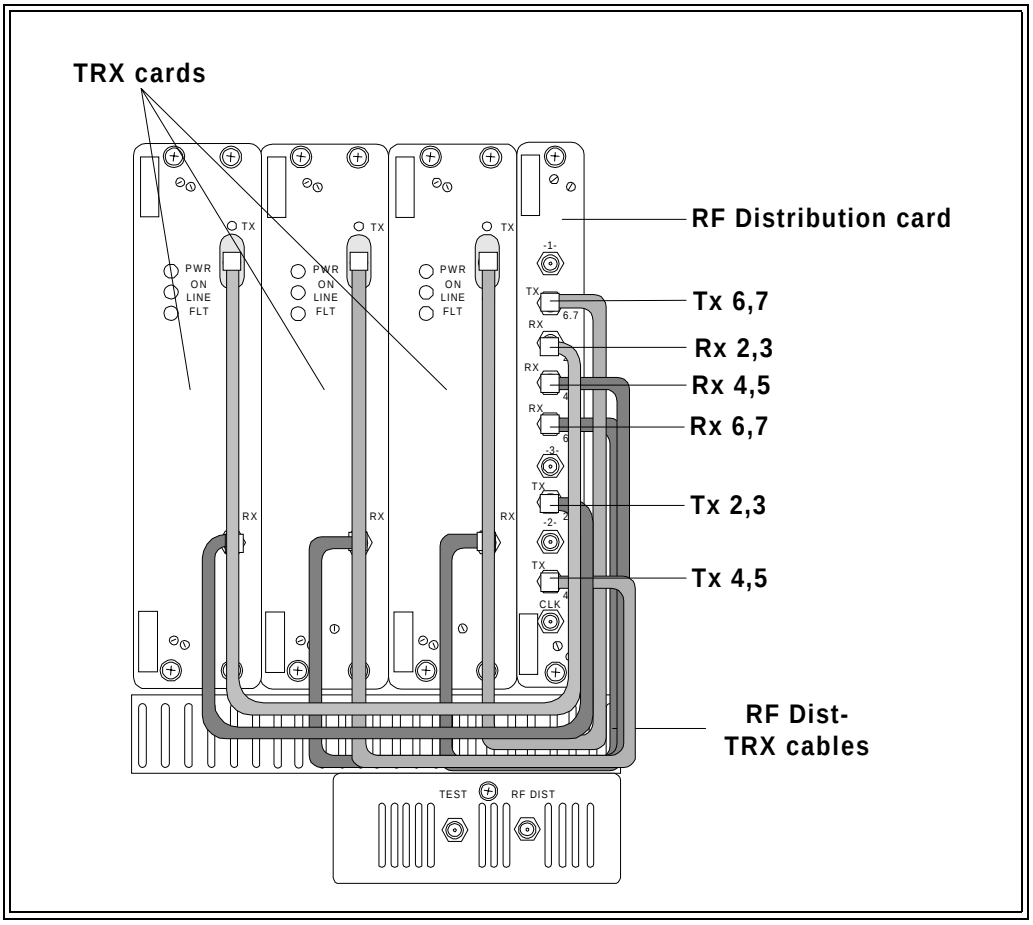

Figure A2-3: TRX card semi-rigid cables layout (only TRX to RF cables are shown above)

Step 4 Using a Phillips screwdriver, unscrew the four screws located on the TRX card (two at the top and two at the bottom).

Step 5 Remove the TRX card by firmly pulling the two white tabs located at the top and bottom of the TRX card.

Step 6 Place the new TRX card into the slot and slide in the card until it completely rests inside the slot. Push the card firmly into place.

Step 7 Using a Phillips screwdriver, screw in the four removed screws onto the TRX card.

Step 8 Using a torque wrench (set to 8 in. lbs.), reconnect all disconnected RF cables to the new TRX card.

Step 9 The replacement TRX card should begin to download automatically.

Step 10 Inform the OMC operator to unlock the replacement TRX card.

Step 11 Inform the OMC operator to verify the status of the replacement TRX card. The following table contains a list of the status values of an operational TRX card. The status of the replacement TRX card should contain the values listed below.

Table A2-2: Operational TRX card status

Attribute	Status
AdminState	ADMIN_UNLOCKED
OperStatus	OPERATION_ENABLED
AvailStatus	ON_LINE

Step 12 Once the TRX card is replaced and is operational, TRX POST diagnostics will run automatically. Inform the OMC operator to verify if the replacement TRX card passed POST successfully.

Step 13 Conduct test calls on all TRX channels contained in the WAVEXpress/BTS.

A2-1.4 Replacing the WAVEXpress/BTS RF distribution card

This section contains the procedures for replacing the RF distribution card on a WAVEXpress/BTS. Refer to Figure A3-1 for an illustration of the replacement position.

WHEN REMOVING THE RF DISTRIBUTION CARD, POWER TO THE BTS WILL BE SHUTDOWN, AND SERVICE WILL BE INTERRUPTED.

Step 1 Inform the OMC operator to shutdown the WAVEXpress/BTS using the OMC.

Step 2 Power off the WAVEXpress/BTS by switching the power switch to the OFF position.

Step 3 Ensure that anti-static precautions are taken.

Step 4 Using a torque wrench (set to 8 in. lbs.), disconnect the RF semi-rigid cables connecting the RF distribution card to the TRX card(s), antenna and clock module. Refer to the following illustration for the appropriate cables to disconnect:

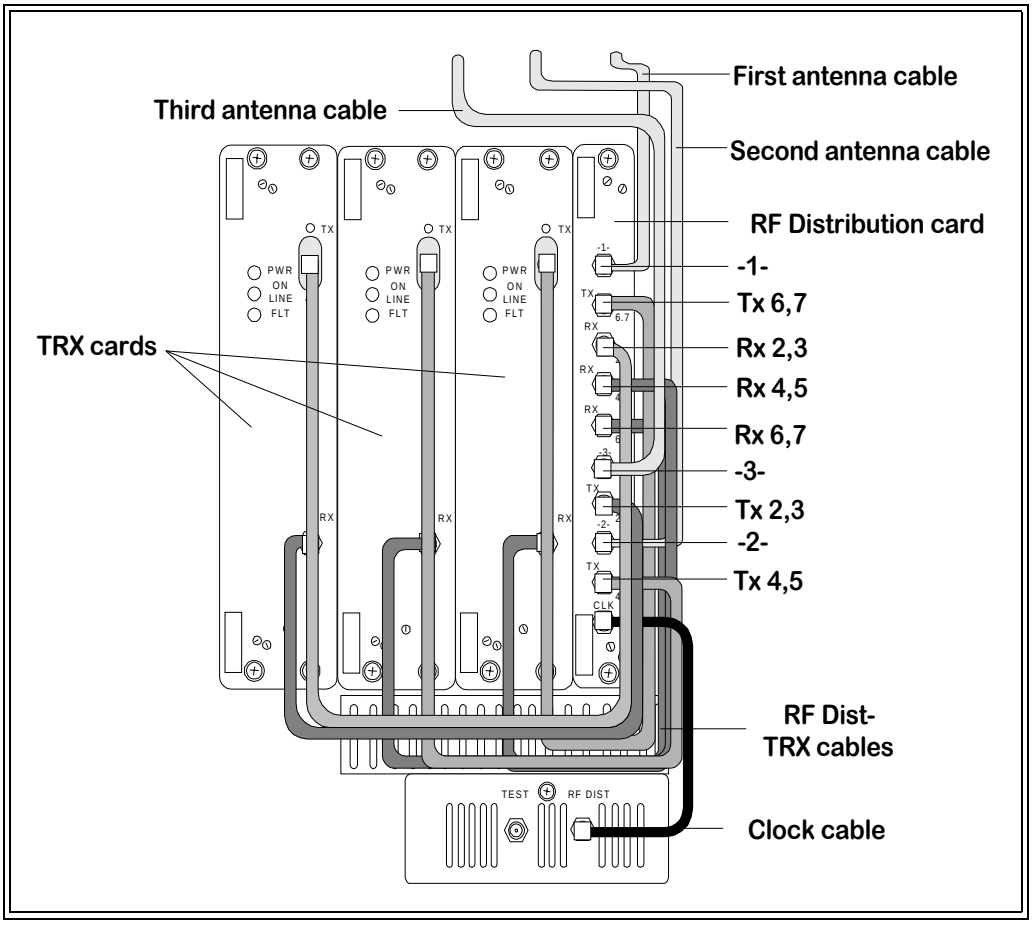

Figure A2-4: RF distribution card semi-rigid cables layout (all RF semi-rigid cables are shown above)

Step 5 Using a Phillips screwdriver, unscrew the two screws located at the top and bottom of the RF distribution card.

Step 6 Remove the RF distribution card by firmly pulling the two white tabs located at the top and bottom of the RF distribution card.

Step 7 Place the new RF distribution card into the slot (refer to Figure A3-1) and slide in the card until it completely rests inside the slot. Push the card firmly into place.

Step 8 Using a Phillips screwdriver, screw in the two removed screws onto the RF distribution card.

Step 9 Using a torque wrench (set to 8 in. lbs.), reconnect all disconnected RF cables to the new RF distribution card.

Step 10 Power on the WAVEXpress/BTS by switching the power switch to the ON position.

Step 11 Inform the OMC operator to unlock the WAVEXpress/BTS using the OMC.

Step 12 Monitor the bootup process, refer to Chapter 4 for procedures.

Step 13 Conduct test calls on all TRX channels contained in the WAVEXpress/BTS.

A2-1.5 Replacing the clock module

This section contains the procedures for replacing the clock module on the WAVEXpress/BTS. Refer to Figure A3-1 for an illustration of the replacement position.

IN ORDER TO COMPLETE THIS PROCEDURE, THE WAVEXPRESS/BTS MUST BE POWERED OFF AND **SERVICE WILL BE INTERRUPTED**.

Step 1 Inform the OMC operator to lock the WAVEXpress/BTS using the OMC.

Step 2 Power off the WAVEXpress/BTS by switching the power switch to the OFF position.

Step 3 Ensure that anti-static precautions are taken.

Step 4 Using a torque wrench (set to 8 in. lbs.), disconnect the RF semi-rigid cable connecting the RF distribution card to the clock module. Refer to the following illustration for the appropriate cable to disconnect:

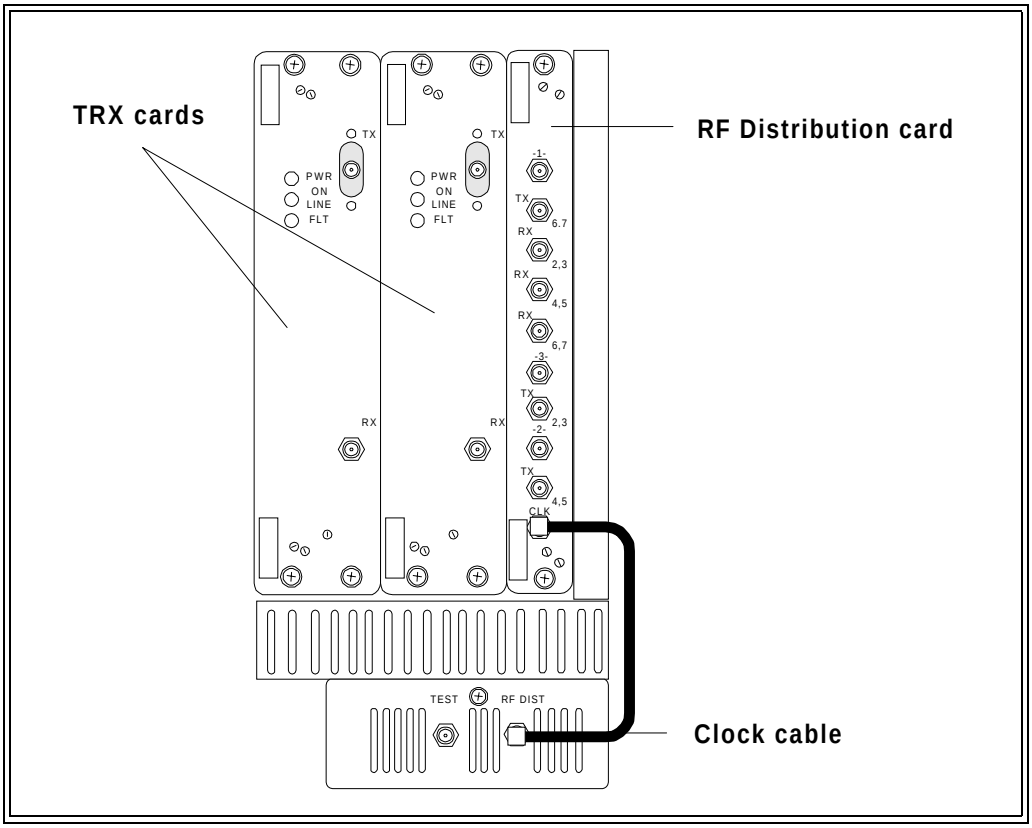

Figure A2-5: Clock module semi-rigid cable layout (only the clock cable is shown above)

Step 5 Using a Phillips screwdriver, unscrew the screw located at the top of the clock module.

Step 6 Pull out the clock module.

Step 7 Place the new clock module into the appropriate slot in the chassis (refer to Figure A3-1) and slide in the module until it completely rests inside the slot. Push the module firmly into place.

Step 8 Using a Phillips screwdriver, screw in the removed screw onto the clock module.

Step 9 Using a torque wrench (set to 8 in. lbs.), reconnect the RF semi-rigid cable to the new clock module

Step 10 Power on the WAVEXpress/BTS by switching the power switch to the ON position.

Step 11 Monitor the bootup process, refer to the maintenance manual for procedures.

Step 12 Conduct the clock check procedure on the clock module. Refer to Craft PC guide for procedures.

Step 13 Inform the OMC operator to verify that all relevant alarms have cleared.

A2-1.6 Replacing power supply units

This section contains the procedures for replacing power supply units on the WAVEXpress/BTS. Refer to Figure A3-1 for an illustration of the replacement position.

A WAVEXpress/BTS can have either one or two power supply units installed in the chassis. If there are two power supply units installed, generally one of these units is used as the primary power supply and the other a backup power supply that can assume the power load if the first power supply fails. The failed power supply unit can thus be replaced without powering off the WAVEXpress/BTS and calls will not be dropped. If there is only one power supply unit, a BTS failure indication will be sent to the OMC and calls will dropped. In either case, the procedures for replacing power supply units are identical whether there are one or two units installed on the WAVEXpress/BTS.

NOTE

In the case of a power supply unit failure in a WAVEXpress system that contains two power supply units, the OMC currently will not display an alarm. Therefore both power supply units would have to fail before the OMC displays an alarm and replacement is necessary.

Step 1 Power off the failed power supply unit by switching the power switch to the OFF position.

Step 2 Unplug the power cord from the AC outlet.

Step 3 Ensure that anti-static precautions are taken.

Step 4 Using a Phillips screwdriver, unscrew the screw located at the top-right corner of the power supply unit.

Step 5 Pull out the power supply unit.

Step 6 Place the new power supply unit into the appropriate slot in the chassis (refer to Figure A3-1) and slide in the unit until it completely rests inside the slot. Push the unit firmly into place.

Step 7 Using a Phillips screwdriver, screw in the removed screw onto the power supply unit.

Step 8 Plug the power cord into the AC outlet.

Step 9 Power on the WAVEXpress/BTS by switching the power switch to the ON position.

Step 10 Monitor the bootup process, refer to the maintenance manual for procedures.

Step 11 Inform the OMC operator to verify that all relevant alarms have cleared.

A2-1.7 Replacing fan assemblies

This section contains the procedures for replacing fan assembly units on the WAVEXpress/BTS. Refer to Figure A3-1 for an illustration of the replacement position.

There are two types of fan assemblies on the WAVEXpress/BTS: power supply fan and cabinet fan. The power supply fan provides air flow to the power supply units and is located in the bottom-right-hand corner of the chassis, next to the optional power supply unit and below the clock module. The cabinet fan provides air flow to the cards and modules enclosed in the chassis and is located at the top of the chassis above the card slots.

If there is a fan failure, the OMC will display a “Shelf Fan Failure” alarm but will not distinguish whether the failure is at the power supply fan or the cabinet fan. The BSS maintenance engineer thus need to check both fans in order to find out which fan is not rotating properly.

NOTE

Only one of the following procedures should be completed if a “Shelf Fan Failure” alarm is displayed at the OMC. These procedures can be completed while the WAVEXpress/BTS is on-line and operational. Calls will not be interrupted or dropped during the process.

Replacing the power supply fan

Step 1 Ensure that anti-static precautions are taken.

Step 2 Using a Phillips screwdriver, unscrew the screw located at the top of the power supply fan.

Step 3 Pull out the power supply fan.

Step 4 Place the new power supply fan into the appropriate slot in the chassis (refer to Figure A3-1) and slide in the unit until it completely rests inside the slot. Push the fan firmly into place and make sure that the end connectors meet.

Step 5 Using a Phillips screwdriver, screw in the removed screw onto the power supply fan.

Step 6 Verify that the fan is rotating properly.

Step 7 Inform the OMC operator to verify that all relevant alarms have cleared.

Replacing the cabinet fan

Step 1 Ensure that anti-static precautions are taken.

Step 2 Using a Phillips screwdriver, unscrew the two screws located at the top and bottom of the cabinet fan.

Step 3 Pull out the cabinet fan. Verify that the complete fan assembly is removed.

Step 4 Place the new power cabinet fan into the appropriate slot in the chassis (refer to Figure A2-1 "WAVEXpress/BTS field replaceable units" on page 108). Insert the fan by sliding the base plated over the tabs on the chassis. Push the fan firmly into place and make sure that the end connectors meet.

Step 5 Using a Phillips screwdriver, screw in the two removed screws onto the cabinet fan.

Step 6 Verify that the fan is rotating properly.

Step 7 Inform the OMC operator to verify that all relevant alarms have cleared.

A2-1.8 Replacing filters (p/n 520081-01)

This section contains the procedures for replacing the filters on the WAVEXpress/BTS outdoor enclosure. When setup as an outdoor system, the WAVEXpress/BTS chassis is enclosed in a cabinet containing a filter that needs to be cleaned or replaced regularly.

Step 1 Unlock and open the cabinet door containing the WAVEXpress/BTS chassis.

Step 2 Pull the tab in order to remove the filter from the cabinet door.

Step 3 Clean the filter using a soft cloth or replace with a new filter.

Step 4 Fit the filter into the cabinet door, making sure that the door closes properly.

Step 5 Lock the cabinet door.

A2-1.9 Replacing the antenna bracket with a combiner assembly

This section contains the procedures for replacing the antenna bracket with a combiner assembly kit on the WAVEXpress/BTS. The combiner assembly kit can be used to enable a single antenna to serve two TRXs on the WAVEXpress/BTS by combining the outputs of the two TRX cards into a single feed. This configuration offers full transmission and receiver sensitivity, but reduces power output by 4dB per channel and has no capability for receiver diversity.

To replace the antenna bracket with a combiner assembly, the standard antenna bracket needs to removed and replaced with the combiner antenna bracket by completing the following steps:

If the combiner assembly is to be installed in the field, all that needs to be done is to swap out the standard antenna bracket and replace it with the combiner antenna bracket. Note that this modified bracket is shipped with the combiner assembly already mounted on the bracket. Instructions on how to swap antenna brackets are as follows:

Removing the WAVEXpress/BTS antenna bracket

Step 1 Remove the cable gland from the antenna bracket.

Step 2 Using a torque wrench, remove the two SMA cables leading from the antenna bracket to the RF distribution card.

- Remove cable 1 connected from the port labeled "-1-" on the RF Dist module to the right-hand antenna connector on the antenna bracket (front view).
- Remove cable 2 connected from the port labeled "-2-" on the RF Dist module to the middle antenna connector on the antenna bracket (front view).

Step 3 The antenna bracket is placed over two threaded studs located on the top of the WAVEXpress/BTS. The bracket is locked in position using nuts threaded over these studs and attached to the front of the WAVEXpress/BTS using 4 10-32 screws. To remove the antenna bracket, unscrew the 4 10-32 screws holding the antenna bracket to the front of the WAVEXpress (refer to the following illustration):

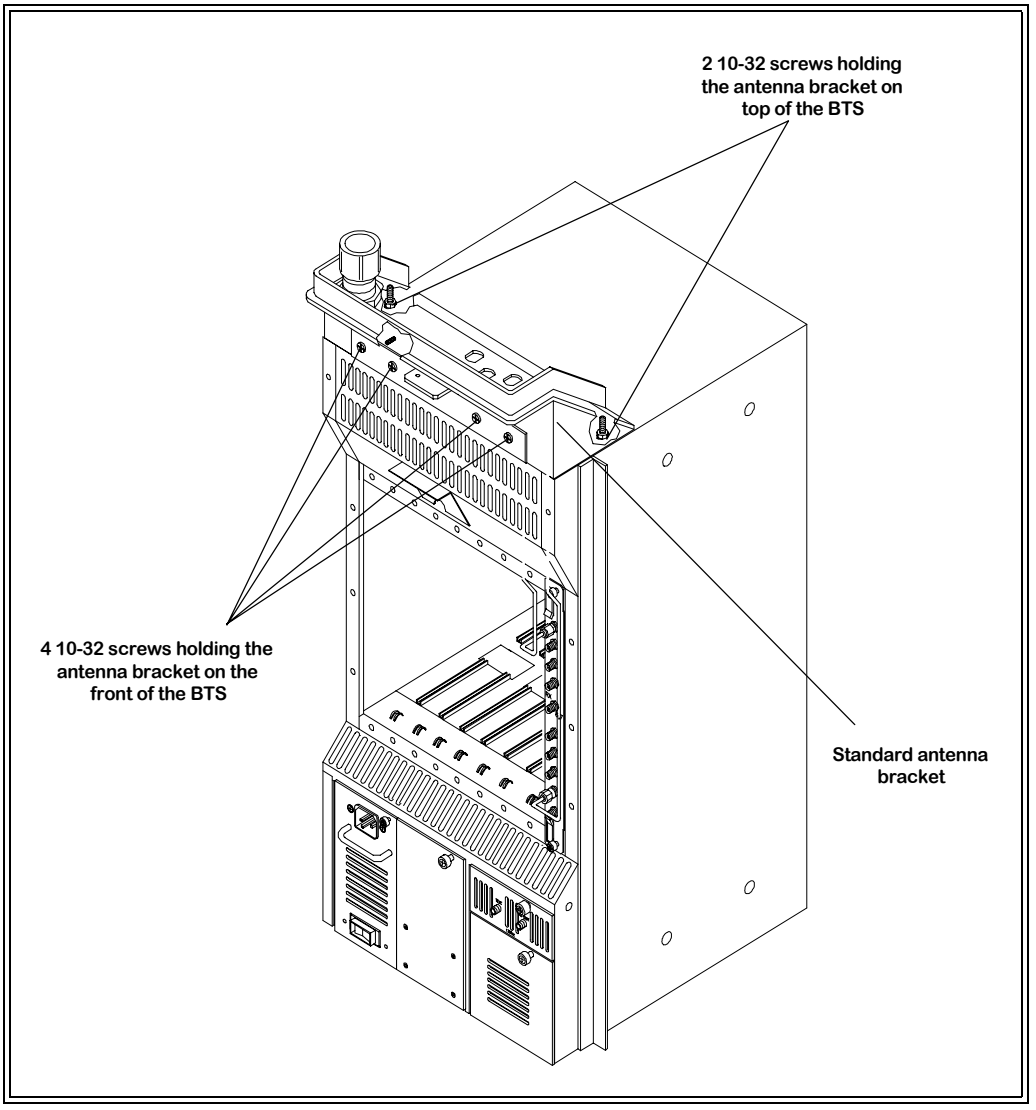

Figure A2-6: WAVEXpress/BTS standard antenna bracket

Step 4 Using a 3/8" wrench, unscrew the two 10-32 nuts holding the antenna bracket in place located on top of the WAVEXpress/BTS (refer to the previous illustration).

Step 5 Lift the antenna bracket off the threaded studs.

Installing the WAVEXpress/BTS combiner assembly

Step 1 Place the combiner antenna bracket over the two threaded studs on the top side of the WAVEXpress/BTS. Move the combiner antenna bracket in position so that the four screw holes on the front of the antenna bracket and the front of the WAVEXpress/BTS are lined up.

Step 2 Using a 3/8" wrench, thread the 2 10-32 nuts with washers over the threaded studs on top of the WAVEXpress/BTS and tighten (refer to the following illustration):

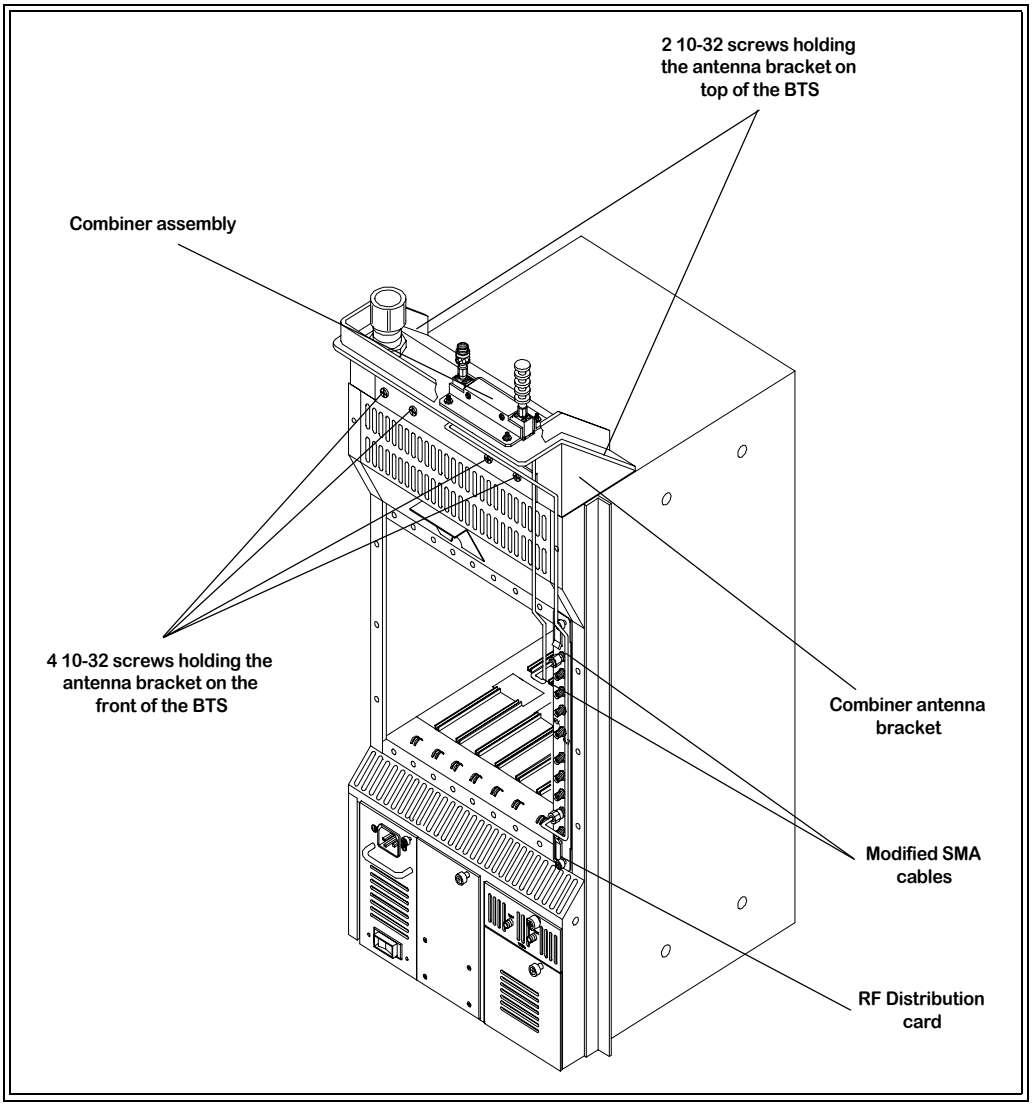

Figure A2-7: WAVEXpress/BTS combiner assembly

Step 3 Screw the 4 10-32 screws with washers through the four threaded holes in the front of the combiner antenna bracket (refer to the previous illustration).

Step 4 Connect the 2 modified SMA cables to the combiner and tighten using a torque wrench (set to 8 in. lbs.).

- Connect cable 1 from the port labeled "-1-" on the RF Dist module to the right-hand, lower port on the combiner assembly (front view).
- Connect cable 2 from the port labeled "-2-" on the RF Dist module to the left-hand, lower port on the combiner assembly (front view).

Refer to the following illustration for cable connections:

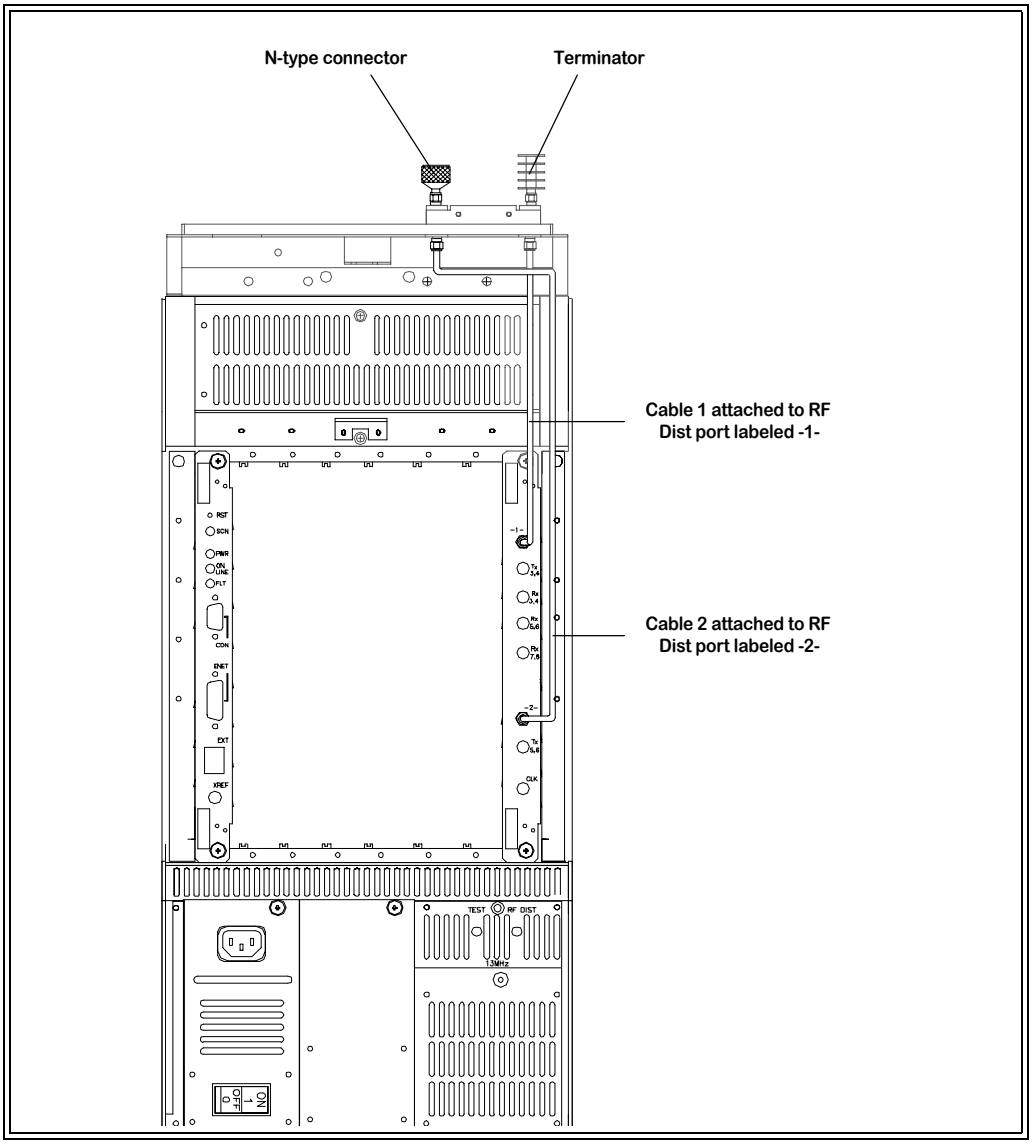

Figure A2-8: WAVEXpress/BTS combiner assembly SMA cable connections

Step 5 Connect the cable gland to the combiner antenna bracket.

Checklists

Checklist 1

Installation Checklist

Site name	
Address	
BSC name	
MSC name	
Site/Access phone number	

Card type	Slot number	Part number	Revision number	Serial number
Chassis	-			
IWP	0			
t1	1			
TRX	2-3			
TRX	4-5			
TRX	6-7			
RF Dist	8			
TurboWAVE RF Dist	6-8			
Power supply	-			
Power supply	-			
Clock	-			

Unpacking the WAVEXpress/BTS

Contact interWAVE Solutions Center if any visible damage is found.

1 __ No visible damage to shipping materials
2 __ All parts included per shipping invoice
3 __ Cross check with site specific data to ensure BTS is correctly configured with all modules

Wall mount (if applicable)

1 __ Mount wall attachment plate
2 __ Mount chassis to wall attachment plate
3 __ Attach chassis door (if detached)
4 __ Ground chassis
5 __ Connect power supply: 115V, 230V, -48V

Table mount (if applicable)

1 __ Mount chassis in table mount
2 __ Ground chassis
3 __ Connect power supply: 115V, 230V, -48V

Rack mount (if applicable)

1 __ Attach mounting brackets to chassis
2 __ Mount chassis in rack
3 __ Ground chassis
4 __ Connect power supply: 115V 230V -48V

Outdoor enclosure mount (if applicable)

1 __ Mount enclosure to surface
2 __ Install all internal cabling
3 __ Connect power supply: 115V 230V -48V
4 __ Install mounting plate into the swing frame
5 __ Install BTS into swing frame
6 __ Connect and route data and antenna cables

VSWR Check

VSWR measurements are performed by the operator to verify the installation of external antennas.

1 __ VSWR measurement on TX antenna #1
2 __ VSWR measurement on TX antenna #2 (if applicable)
3 __ VSWR measurement on TX antenna #3 (if applicable)

BTS connection

1 __ Connect “Abis Interface” T1 dual port cables to local T1 Provider demarcation
2 __ Configure dual port T1 card DIP switch settings
3 __ Ensure power to BTS is **off**.

BTS-BSC link verification

It is the operator’s responsibility to verify that all BTS-BSC T1 links are ordered, installed and certified by the local TELCO facilities/operator.

1 __ Verify bit error rates on a nominal 20 minute soak test on the E1 Abis-interface (end-to-end BER test to include dual port T1 cables)

Checklist 2

Commissioning Checklist

Site name	
Address	
BSC name	
MSC name	
Site/Access phone number	

Off-Line Commissioning

Pre-commissioning visual checks

At the Depot

2 __ Power to BTS is off
3 __ BTS connected to power source
4 __ BTS grounded
5 __ Equipment cables labeled and secured
6 __ Cards seated securely

On-Site

1 __ Installation secure
2 __ Power to BTS is off
3 __ BTS connected to power source
4 __ BTS grounded
5 __ Equipment cables labeled and secured
6 __ Cards seated securely
7 __ Transmission cables available and labeled

Compliance check

1 __ Cross check with site specific data to ensure BTS is correctly configured with all cards
2 __ Serial number of all cards recorded
3 __ Verify correct operating voltage supplied: 230V 115V -48V

Power on

1 __ Disconnect all T1 cables from BTS (if connected)
2 __ Turn power to BTS on
3 __ All card power LEDs and IWP and E1 on-line LEDs are green

BTS off-line software checks

1 __ Connect the Craft PC to the BTS using a serial and Ethernet cable
2 __ Establish a serial connection
3 __ Check BTS boot parameters
4 __ Check the IWP flash version number

POST tests

1 __ Verify T1 POST tests successfully passed
2 __ Verify TRX POST tests successfully passed for each module

TRX Commissioning

1 __ Connect the BTS to the Craft PC and the Racal testset
2 __ Start the Racal
3 __ Load the sequence files on to the PCMCIA card from the CD-ROM
4 __ Setup the test results presentation on the Racal
5 __ Set the offset values for RF cable loss
6 __ Run the automated test sequence

TRX 1 Pass ____ Fail ____
TRX 2 Pass ____ Fail ____
TRX 3 Pass ____ Fail ____

Post Racal Procedures

1 __ Disconnect the BTS from the Racal testset
2 __ Reboot the BTS using the Craft PC
3 __ Disconnect the BTS from the Craft PC

Post off-line commissioning

At the Depot

1 __ Physically install BTS on-site
2 __ Connect T1 lines to T1 Provider demarcation point
3 __ Leave power to BTS on
4 __ Inform OMC operator that BTS is ready for on-line commissioning

On-Site

1 __ Connect T1 lines to T1 Provider demarcation point
2 __ Leave power to BTS on
3 __ Inform OMC operator that BTS is ready for on-line commissioning

On-Line Commissioning

BTS on-line commissioning pre-requisites

1 __ BSC in service and connected to BTS
2 __ OMC in service and connected to BSC

3 __ Database questionnaire completed with BTS parameters defined
4 __ OMC downloaded BTS configuration with correct operational parameters
5 __ RF frequencies cleared to transmit
6 __ BTS T1 module's cables connected to the local T1 Provider demarcation
7 __ BSC T1 module's cables connected to the local T1 Provider demarcation assigned to the BTS

Note: Operator's responsibility to verify all E1 links properly installed and certified by local T1 Provider facilities. Certification must rate: Length of testing and BER results

BTS-BSC Network Integration

1 __ Unlock the Abis interface
2 __ Unlock the BTS
3 __ Verify the BTS' operational state

Recovery

1 __ Perform a BTS cold start and verify that the BTS fully recovers
2 __ Confirm Abis interface re-establishes communications to BSC after T1 disconnects

Operational tests

1 __ Unlock TRX
2 __ Perform test calls on each timeslot
3 __ Perform test calls on each TRX

Final commissioning, on-line tests

1 __ Leave power to BTS on
2 __ Inform the OMC operator that commissioning is complete

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