

Ripwave™ Base Station

User Manual

Part Number 40-00197-00
Revision C (1.20), Version 1.0
September 26, 2003

Proprietary

All information disclosed by this document is the proprietary property of Navini Networks, Inc. and is protected by copyright, trademark, and/or trade secret laws. All rights therein are expressly reserved.

About This Document

Purpose

This manual provides an overview for the Navini Networks Base Station. Topics included are installation of the Base Transceiver Station (BTS), Radio Frequency Subsystem (RFS), and cabling; and testing and commissioning the Base Station.

Revision History

Date	Revision / Version	Author	Editor	Comments
Sept 17, 2003	A / 1.0	P. Prudhomme	S. Redfoot	Release of Base Station user manual for FCC submission.
Sept 18, 2003	B / 1.0	P. Prudhomme	S. Redfoot	Edit specifications.
Sept 26, 2003	C / 1.0	P. Prudhomme	S. Redfoot	Add output power information

Contacts

Contact Navini Networks Technical Support during normal business hours: Monday through Friday 8:30 a.m. to 5:30 p.m. Central Time. You can also submit questions or comments by web or email at any time.

Corporate Headquarters: (972) 852-4200
Technical Support: 1-866-RIPWAVE
Web Address: www.navini.com / select Technical Support
E-mail: techsupport@navini.com

Navini Networks, Inc.
2240 Campbell Creek Blvd.
Suite 110
Richardson, Texas 75082
USA

Permissions, Trademarks & Distribution

Copyright© September 2003, Navini Networks, Inc. All information contained herein and disclosed by this document is the proprietary property of Navini Networks, Inc. and all rights therein are expressly reserved. Acceptance of this material signifies agreement by the recipient that the information contained in this document is confidential and that it will be used solely for the purposes set forth herein. Acceptance of this material signifies agreement by the recipient that it will not be used, reproduced in whole or in part, disclosed, distributed, or conveyed to others in any manner or by any means – graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems – without the express written permission of Navini Networks, Inc.

Navini Networks, Internet at the Speed of Thought, zero-install, unwired by Navini, the Navini Networks logo, and Ripwave are trademarks of Navini Networks, Inc. Other product and company names mentioned herein may be trademarks and/or service marks of their respective owners.

Nothing herein constitutes any representation, warranty, assurance, or guaranty of any kind.

Because of continuing developments and improvements in design, manufacturing, and deployment, material in this document is subject to change without notification and does not represent any commitment or obligation on the part of Navini Networks, Inc.

Navini Networks, Inc. shall have no liability for any error or damages resulting from the use of this document. Any unauthorized usage is strictly prohibited without the express written permission of Navini Networks, Inc.



Copyright © 2003 Navini Networks, Inc. All rights reserved.

Navini Networks, Inc.
2240 Campbell Creek Boulevard
Suite 110
Richardson, Texas 75082
USA

TABLE OF CONTENTS

ABOUT THIS DOCUMENT	2
PERMISSIONS, TRADEMARKS & DISTRIBUTION	3
SAFETY	5
REGULATORY INFORMATION	7
BATTERY CAUTION & PROCEDURES.....	8
GLOSSARY OF TERMS & ABBREVIATIONS	9
OVERVIEW	17
RIPWAVE DESCRIPTION.....	17
PROCEDURAL DOCUMENTS & FORMS.....	18
HIGH-LEVEL I&C PROCESS.....	19
BASE STATION COMPONENTS	30
BASE TRANSCEIVER STATION (BTS)	30
RADIO FREQUENCY SUBSYSTEM (RFS)	31
GLOBAL POSITIONING SYSTEM (GPS)	32
MOUNTING RACKS & ENCLOSURES.....	33
GENERAL SPECIFICATIONS.....	34
BASE STATION SPECIFICATIONS.....	35
MATERIALS SPECIFICATIONS	37
APPENDIX A: RFS IDENTIFICATION LABEL	39
2.3 GHZ RFS – OMNI HIGH BAND	39
2.3 GHZ RFS – OMNI LOW BAND	40
2.3 GHZ RFS – SECTOR	41
APPENDIX B: 2.3 GHZ BTS IDENTIFICATION LABEL.....	43

Safety

To optimize safety and expedite installation and service, read this document thoroughly. Follow all warnings, cautions, and instructions marked on the equipment and included in this document.

To aid in the prevention of injury and damage to property, cautionary symbols have been placed in this document to alert the reader to known potentially hazardous situations, or hazards to equipment or procedures. The symbols are placed before the information to which they apply. However, any situation that involves heavy equipment and electricity can become hazardous, and caution and safety should be practiced at all times when installing, servicing, or operating the equipment.



Caution Symbol - possible equipment or property damage



Warning Symbol - could cause personal injury or otherwise be hazardous to your health

Navini Networks, Inc., expressly requires that when using Navini electronic equipment always follow the basic safety precautions to reduce the risk of electrical shock, fire, and injury to people and/or property.

1. Follow all warnings and instructions that come with the equipment.
2. Do not use the equipment while you are in a bathtub, shower, pool, or spa. Exposure of the equipment to water could cause severe electrical shock or serious damage to the equipment.
3. Do not allow any type of liquid to come in contact with the equipment. Unplug the equipment from the power source before cleaning. Use a damp cloth for cleaning. Do not use any soaps or liquid cleaners.
4. Follow all airport and FAA regulations when using the equipment on or near aircraft.
5. Only operate the equipment from the type of power source(s) indicated in this manual (110 VAC or Navini supplied battery). Any other type of input power source may cause damage to the equipment.
6. Power the equipment using only the battery or the AC adapter cable provided, and in accordance with the instructions specified in the User Guide.
7. Do not use a frayed or damaged power cord. Do not place the power cord where it can be stepped on or tripped over.
8. Do not touch wires where the insulation is frayed or worn unless the equipment has been

disconnected from its power source.

9. Do not overload wall outlets, power strips, or extension cords. This can cause serious electrical shock or fire.
10. Do not place the equipment on an unstable surface. It can fall and cause injury or damage to the equipment.
11. Do not disassemble the equipment. Removing covers exposes dangerous voltages or other risks and also voids the warranty. Incorrect reassembly can cause equipment damage or electrical shock. Only an authorized repair technician should service this product.
12. Do not expose the equipment to extreme hot or cold temperatures.
13. Do not use the equipment under the following conditions:
 - When the equipment has been exposed to water or moisture.
 - When the equipment has been damaged.
 - When the power cord is damaged or frayed.
 - When the equipment does not operate properly or shows a distinct change in performance.

Regulatory Information

FCC Notice



WARNING! This device is a Radio Frequency transmitter. It is required to comply with FCC RF exposure requirements for transmitting devices. A minimum separation distance of one meter or more must be maintained between the antenna and all persons during device operations to ensure compliance with the FCC's rules for Radio Frequency Exposure. If this minimum distance cannot be maintained, exposure to RF levels that exceed the FCC's limits may result.

INFORMATION TO USER

This device has been authorized as a radio frequency transmitter under the appropriate rules of the Federal Communications Commission. Any changes or modifications not expressly approved by Navini Networks could void the user's authority to operate the equipment.

Battery Caution & Procedures



WARNING! To reduce risk of injury or fire, follow these instructions when handling the battery.

1. Risk of explosion is possible if the battery is replaced with one not supplied by Navini Networks.
2. Do not dispose of the battery in a fire. It may explode. Check with the local codes for battery disposal guidelines.
3. Do not open or mutilate the battery. The battery contains substances that are toxic, corrosive, or harmful to humans. If battery substances come in contact with the skin, seek medical help immediately.
4. Do not attempt to recharge the battery by any means except per the instructions in this manual.
5. Remove the battery from the equipment if the equipment is not going to be used for a long period of time. The battery could leak and cause damage to the equipment.
6. Exercise care when handling the battery to prevent shorting the battery with conducting materials such as bracelets, rings, and keys.
7. Store the battery pack in a dry place, 0 to +40 degrees Celsius.
8. Dispose of used batteries according to environmental guidelines.

Glossary of Terms & Abbreviations

Term	Stands For....	Meaning
ACC	Access Channel or Access Code Channel	AKA, Paging Channel. The signal path that tells a mobile to prepare for an incoming call.
ACK	Acknowledge	Positive message sent by a protocol to acknowledge reception of a transmitted packet
AP	Access Point	Wireless LAN transceiver that acts as a center point of an all-wireless network or as a connection point between wireless and wired networks.
ARP	Address Resolution Protocol	The function of the ARP is to match higher-level network IP addresses with the physical hardware address of a piece of equipment.
ASYNCH	Asynchronous	Not occurring at regular intervals, as in data piped over a network
ATM	Asynchronous Transfer Mode	Transporting a broad range of user data at irregular intervals over network facilities
BB	Broadband	RF system with constant data rate of 1.5 Mbps or higher.
BCC	Broadcast Code (or Control) Channel	A channel of data transmitted by one entity and received by many devices.
BS	Base Station	Network Access equipment and software that transmits and receives, as well as processes, voice or data calls from mobile units to network connections. A Ripwave Base Station consists of the Base Transceiver Station (BTS) and the Radio Frequency Subsystem (RFS), or antenna, plus a Global Positioning System (GPS) antenna for timing.
BTS	Base Transceiver Station	The Ripwave BTS is a two-shelf rack that holds the RF modules and digital circuit cards that interpret radio signals into computer language and sends messages to and from the local or wide area network. It functions between the RFS and the EMS to handle the signaling.
BW	Bandwidth	Frequency spectrum usable for data transfers. It describes the maximum data rate that a signal can attain on the medium without encountering significant loss of power. Usually expressed in bits per second (digital) or Hertz (analog).
BYTE	Byte	8 bits
CAM	Configuration & Alarm Manager	An EMS functionality that is handled through a Graphical User Interface for purposes of configuring elements in the system and handling other OAM requirements.
CC	¹ Communications Controller or ² Cross-check	¹ A type of circuit card that resides in the Digital shelf of the Ripwave BTS. It handles all interfaces between BTS and network. ² An EMS functionality that allows the system to perform an automated sanity check of the datafill.
CD	¹ Compact Disk or ² Change Directory	¹ An optical disk capable of storing large amounts of data (700x floppy disk). It can be inserted into most pc's and "read" to load files onto a computer ² A software programming term in "C" language that tells the computer to go to a different location in the computer's memory.

Term	Stands For....	Meaning
CDMA	Code Division Multiple Access	Digital cellular technology that uses a spread-spectrum technique where individual conversations are encoded with a random digital sequence. Increases capacity and speed of communications messages between mobile units over other types of wireless networks.
CD-ROM	Compact Disk - Read Only Memory	See "CD." If a CD is not Read Only, computers can write data to it with that capability.
CHP	Channel Processor Card	A card in the digital shelf of the BTS that performs the first stage of signal processing for up to 4 antennae. One Navini 2.4 GHz BTS has 8 antennae. The card performs digital-to-analog conversion (DAC) and analog-to-digital conversion (ADC) for up to 10 carriers.
CLEC	Competitive Local Exchange Carrier	A telephone company that competes with an incumbent Local Exchange Carrier (LEC).
CLI	Command Line Interface	A text-based programming language through which a user communicates with an operating system or an application.
CORBA	Common Object Request Broker Agent	A standard for Network Management Systems that allows integration with NMS regardless of programming language or Operating System.
CPE	Customer Premise Equipment	Communications equipment that resides at the customer's location.
dB	Decibel	Unit of measurement for sound.
dBd	Decibel/Dipole	A ratio, measured in decibels, of the effective gain of an antenna compared to a dipole antenna (2 horizontal rods in line with each other). The greater the dBd value the higher the gain and therefore the more acute the angle of coverage.
dBi	Decibel/Isotropic	A ratio, measured in decibels, of the effective gain of an antenna compared to an isotropic antenna (measured along axes in all directions). The greater the dBi value the higher the gain and therefore the more acute the angle of coverage.
DHCP	Dynamic Host Configuration Protocol	A protocol for dynamically assigning IP addresses to devices on a network.
DiffServ	Differentiated Service	Different Quality of Service (QoS) descriptions for different types of traffic, i.e., voice, video, email. The DiffServ table is where each level of QoS is defined. Equivalent to Class of Service (COS) in POTS.
DIR	Directory	A special kind of file used to organize other files into a hierarchical structure.
DL	DownLink	In this case, data messages transmitted from the BTS to the CPE.
DNS	Domain Name Server	TCP/IP networking term that is a protocol for matching objects to network (IP) addresses.
DS-1	Digital Signal - 1	Also "T1" or "E1". Digital transmission equipment that can handle up to 1.544 Mbps.
DSL	Digital Subscriber Line	A type of service whereby users gain access to the Internet through high-speed data networks.

Term	Stands For....	Meaning
DSP	Digital Signal Processor	Compressing or manipulating analog signals to digital signals and vice-versa.
EID	Equipment Identifier	Field in EMS for assigning IP address or name to individual pieces of equipment for purposes of configuring the system.
EMS	Element Management System	An application that allows the user to define and manipulate managed objects as a system within an overall network.
ERP	Effective Radiated Power	The actual power in Watts radiated from a transmitter's antenna.
FCC	Federal Communications Commission	United States government regulatory agency that supervises, licenses and otherwise controls electronic and electromagnetic transmission standards.
FE	Far End	A relative term that refers to the receiving element in a network, as opposed to the near-end element that is transmitting data.
FTP	File Transfer Protocol	A TCP/IP method consisting of a client and server and used to transfer files between two or more sites or elements in a network.
Gain	Gain	Ratio of the output amplitude of a signal to the input amplitude of a signal, expressed in decibels (dB).
Gb	Gigabit	One billion (1,000,000,000) bits.
GB	Gigabyte	One billion (1,000,000,000) bytes.
GHz	Gigahertz	One billion (1,000,000,000) hertz - cycles per second. Ultra high frequency (UHF) signals, including microwave signals.
GPS	Global Positioning System	A constellation of 24 well-spaced satellites that orbit the earth and enable users with GPS antennas to pinpoint their exact geographical position.
GUI	Graphical User Interface	A graphic rather than purely text based user interface to a computer or computing system.
HW	Hardware	Physical, tangible equipment
Hz	Hertz	1 cycle per second.
I&C	Installation & Commissioning	Term used to describe the procedures of physically installing technical equipment then powering up the equipment to make sure it will operate (to put it "into commission").
IEC	Inter-exchange Carrier	Also IXC. Public switching network service provider (carrier) that connects across and between local exchange carriers (LEC).
IF	Interface Card	Card on the digital shelf of the Ripwave BTS that takes the analog signal from the Channel Processor card (CHP) and converts it to a baseband signal before sending it on to the RF modules for transmission (forward link), and vice-versa (reverse link).
IMA	Inverse Multiplexing over ATM	A method of building dynamic routes of 2 or more T1's to increase bandwidth so that PVC's can share the IMA resources, as needed, for data transmissions.
IP	Internet Protocol	A TCP/IP protocol used to route data from its source to its destination.
ISP	Internet Service Provider	A company that provides access to the Internet.
Kb	Kilobit	1,024 bits
KB	Kilobyte	1,024 bytes
KHz	Kilohertz	1,000 hertz.

Term	Stands For....	Meaning
L1	Layer 1	Physical Layer. Part of the OSI rules and standards for network management. L1 describes the physical layer, or electrical and mechanical port-to-port connections, in the network.
L2	Layer 2	Data Link Layer. Part of the OSI rules and standards for network management. L2 describes the data link layer where data is set up and torn down in a specific format (frames), through the overall network. Also responsible for detecting and correcting errors by requesting retransmission.
L3	Layer 3	Network Layer. Part of the OSI rules and standards for network management. L3 describes the network addressing that gets data to its destination within the network, i.e., IP addressing.
LAN	Local Area Network	A data network of interconnected computers, servers, printers, and other peripherals that communicate at high speeds over short distances, usually within the same building. Also allows for sharing of resources.
LCP	Link Control Protocol	Basis of the Point-to-Point Protocol (PPP) scheme for negotiating and establishing connections.
LED	Light-emitting Diode	An electronic device that lights up when electricity passes through it. Often used to indicate equipment or system state.
LLC	Logical Link Controller	A protocol that governs the transition of frames between data stations regardless of how the medium is shared. It's the upper sub-layer that further defines the Media Access Control (MAC) protocol. It provides the basis for an unacknowledged connectionless service on a LAN - i.e., error correction, multiplexing, broadcasting.
LOS	Line-of-sight	Describes laser, microwave, RF, and infrared transmission systems that require no obstruction in a direct path between the transmitter and the receiver.
MAC	Media Access Control	Protocol that governs access to a network in order to transmit data between nodes. In a wireless LAN, the MAC is the radio controller protocol (L2).
Mb	Megabit	One million (1,000,000) bits.
MB	Megabyte	One million bytes. Literally - 1,048,576 bytes.
Mbps	Megabits Per Second	Transmission speed at rate of one million bytes per second.
MDM	Modem Card	A card in the Navini BTS that converts digital signals into analog so the signals can be transmitted over telephone lines, and vice-versa. Modem stands for modulator/demodulator.
MHz	Megahertz	One million (1,000,000) hertz - cycles per second. Normally used to refer to how fast a microprocessor can execute instructions.
MIB	Management Information Base	A collection of managed objects used in SNMP-based networks. MIBs carry information in a standard format so external tools can analyze network management and performance.
MMDS	Multipoint Multi-channel Distribution Service	Fixed wireless, high-speed local service that operates at 2.1 - 2.7 GHz. Speed 10 Mbps. Originally conceived for cable TV service.
NE	¹ Near-end or ² Network Element	¹ The transmitting end, versus the receiving end, of a signal transmission. ² A router, switch, or hub in an ISDN network.
NLOS	Non Line-of-site	Describes laser, microwave, RF, and infrared transmission systems that can penetrate obstructions in the path between the transmitter and the receiver.

Term	Stands For....	Meaning
NMS	Network Management System	A product that helps manage a network generally hosted on a well-equipped computer such as an engineering workstation. The system tracks network statistics and resources.
NOC	Network Operations Center	A centralized point, much like a traffic control tower, where technicians or engineers can monitor network activity, alarms, and statistics, as well as make network configuration and other changes dynamically. For Internet, the NOC is often a hub for ISP services.
OAM	Operation, Administration, Maintenance	A set of network management functions. Also describes the human-machine interface tasks - i.e., to operate the system, to administer the system, and to maintain the system.
OS	Operating System	A software program that manages the basic operation of a computer. Most Operating Systems are either based on
OSI	Open Systems Interconnection	An ISO model for worldwide communications that defines 7 layers of network protocol: L1 Physical Layer; L2 Data Link Layer; L3 Network Layer; L4 Transport Layer; L5 Session Layer; L6 Presentation Layer; L7 Application Layer.
PC	Personal Computer	Any IBM-compatible computer, so named because IBM's first commercial end user computer was called a PC.
PCB	Printed Circuit Board	A hardware module that holds electronic circuitry and usually fits into a larger frame where the various PCB's are interconnected electronically.
PDU	Packet Data Unit or Protocol Data Unit	A data packet. Refers to that which is exchanged between peer-layer entities. Contains header, data, and trailer information.
Ping	Ping	Generalized term from sonar science, where a short sound burst is sent out and an echo or "ping" is received. Used to determine if signals or packets have been dropped, duplicated, or reordered.
PPPoE	Point-to-point Protocol Over Ethernet	A protocol that allows dial-up Internet connections. Includes the Link Control Protocol as well as Network Control Protocols.
Propagation	Propagation	To spread out and affect a greater area; travel through space, as in radio waves.
PSK	Phase Shift Keying	Digital transmission term that means an angle modulation where the phase of the carrier varies in relation to a reference or former phase. An encoded shift. Each change of phase carries one bit of information, where the bit rate equals the modulation rate.
PSN	Packet Switched Network	A network in which data is transferred in units called packets. Packets can be routed individually and reassembled to form a complete message at the destination.
PSTN	Public Switched Telephone Network	Typically used in the same context as POTS. Analogous to a network of major highways originally built by a single organization but added to and expanded by multiple organizations. AKA, backbone networks.
QAM	Quadrature Amplitude Modulation	A bandwidth conservation process routinely used in modems. Creates higher throughput but decreased coverage area.
QoS	Quality of Service	A guaranteed throughput for critical network applications, such as Voice over IP. Term primarily used in an ATM environment. Five classes of service: Class 1 Video; Class 2 Audio; Class 3 Data Connection.

Term	Stands For....	Meaning
RAM	Random Access Memory	Computer memory that can be accessed randomly.
RF	Radio Frequency	A portion of the electromagnetic spectrum in the frequency range between audio and infrared: 100 KHz to 20 GHz. RF measurements are expressed in Hz (unit for measuring frequency); MHz = 1 Million Hz; GHz = 1 Billion Hz.
RFS	Radio Frequency Subsystem	A term for the antenna portion of the base station.
RSSI	Receiver Signal Strength Indicator	A term that describes the measure of the signal strength in kilohertz or gigahertz between the transmission and the receiving end.
Rx	Receive	An abbreviated way of expressing the term, receive, as in to receive a transmission.
S-CDMA	Synchronous Code Division Multiple Access	Wireless technology based on data being transferred at a fixed rate using Code Division Multiple Access algorithms.
SMDS	Switched Multi-megabit Data Service	Connectionless service for MAN/WAN based on 53-byte packets that target the interconnection of different LAN's into a public switched network at speeds higher than T1.
SMS	¹ Short Message Service or ² Systems Management Server or ³ Subscriber Management System	¹ A protocol that allows mobile users to send text-based messages from one device to another. The text appears on a device's screen and may be a maximum 160 characters in length. ² A Windows NT process that allows a network administrator to inventory all hardware and software on the network, then perform software distribution over the LAN. ³ Network element that provides AAA functionality: Authentication, Authorization, & Accounting.
SNMP	Simple Network Management Protocol	Standard management request-reply protocol for managing TCP/IP networks. A device is said to be SNMP compatible if it can be monitored or controlled using SNMP messages.
SNR	Signal-to-noise Ratio	Related to RSSI, a measurement of the intended signal being transmitted against the other entities that can interfere with the signal.
SSI	Signal Strength Indicator	See "RSSI".
SW	Software	Computer instructions or data.
SYN	Synthesizer Card	A circuit card in the Navini BTS digital shelf that provides a local oscillator and system clock with a single calibration transceiver. The card is used to calibrate the Base Station so that no external spectrum analyzer or signal generator is required.
SYNCH	Synchronous	Digital packets or signals that are sent at the same, precisely clocked fixed rate of speed.
TCC	¹ Traffic Channel or ² Transmission Control Code	¹ A portion of a radio channel used to enable transmission of one direction of a digitized voice conversation (as opposed to the Voice Channel). ² A way of segregating traffic in order to define controlled communities of interest among subscribers.
TCP	Transport Control Protocol	A standardized transport protocol between IP-based network nodes that allows two hosts to establish a connection and exchange streams of data. TCP operates on top of Internet Protocols and handles the multiplexing of sessions, error recovery, reliability and flow; it guarantees packets are delivered in the same order in which they were sent.
TCP/IP	Transport Control Protocol/Internet Protocol	A set of protocols that allows cooperating computers to share resources across the network. TCP provides the reliability in the transmission, while IP provides connectionless packet service.

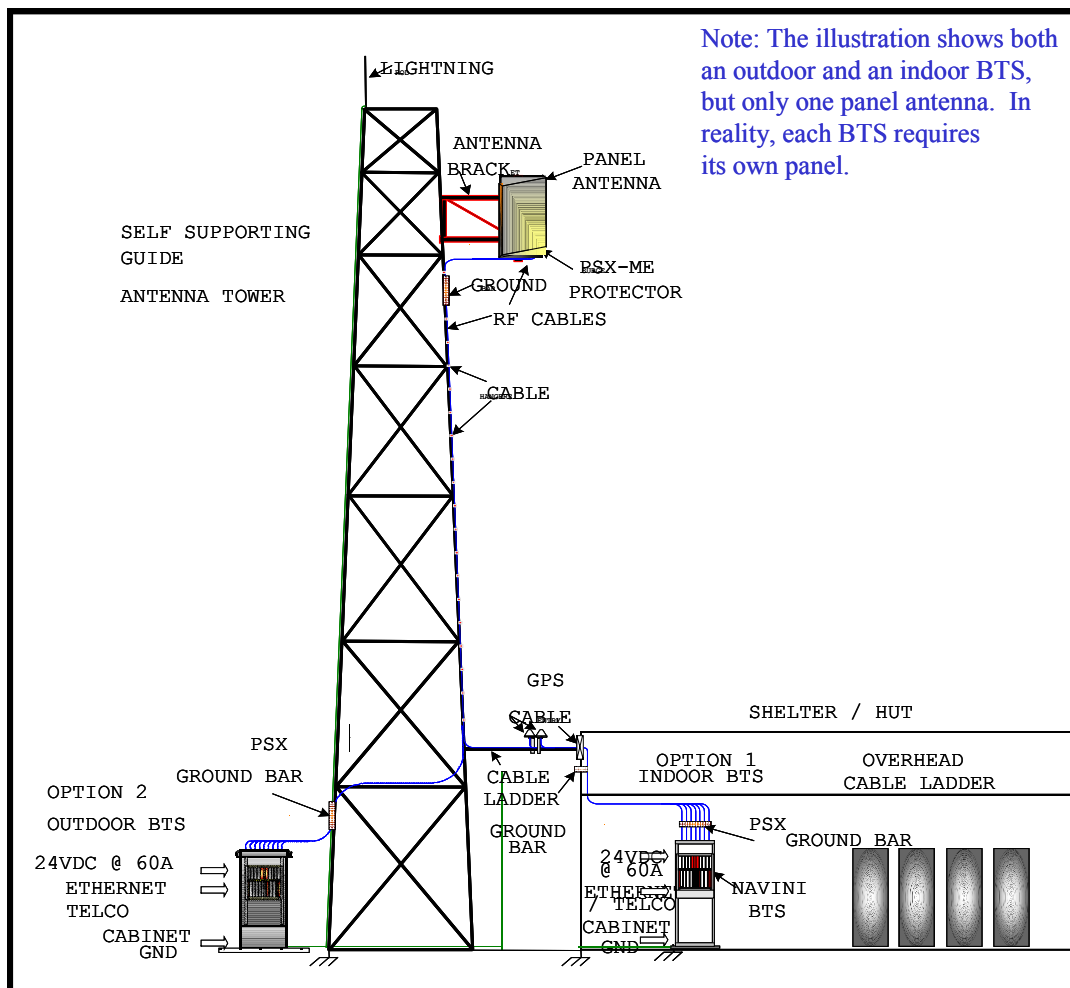
Term	Stands For....	Meaning
TDD	Time Division Duplex	A digital transmission method that combines signals from multiple sources and allows a single channel to alternately carry data in each direction of a link.
TFFS	True Flash File System	Memory in a computing device that does not lose its information when powered off. Available as a SIMM or PCMCIA card, it usually stores router Operating System (OS) software. Can be easily updated.
TTL	Time-to-live	A field in the Internet Protocol that specifies how many more hops a packet can travel before being discarded or returned.
Tx	Transmit	To send by wire or other medium electronically or through air via electromagnetic waves to a receiving communications device.
UL	UpLink	Describes the direction of signal flow being sent from a subscriber to a network system, as in from a mobile device (CPE) to a base station.
USB	Universal Serial Bus	An external bus standard for plug-and-play interfaces between a computer and add-on devices, such as a mouse, modem, keyboard, etc. One USB port can connect up to 127 devices.
VCC	Virtual Channel Circuit	AKA, Virtual Channel Connection or Virtual Circuit Connection. A logical circuit made up of Virtual Channel Links, which carry data between two end points in an ATM network.
VCI	Virtual Channel Identifier	A 16-bit value in the ATM cell header that provides a unique identifier for the Virtual Channel that carries that particular cell.
VCL	Virtual Channel Link	A connection between two ATM devices.
Vector	Vector	A quantity representative of both magnitude and direction (energy + orientation in space)
VPC	Virtual Private Channel	AKA, Virtual Path Connection. A grouping of Virtual Channel Connectors, which share one or more contiguous VPL's.
VP	Virtual Path	A set of Virtual Channels grouped together between cross-points (i.e., switches).
VPI	Virtual Path Identifier	An 8-bit value in the cell header that identifies the VP as well as the VC to which the cell belongs. The VPI + VCI identify the next destination of a cell as it passes through a series of ATM switches.
VPL	Virtual Path Link	A group of unidirectional VCL's with the same end points in a Virtual Path. Grouping VCL's into VPL's reduces the number of connections to be managed. One or more VPL's makes up a VPC.
WAN	¹ Wide Area Network or ² Wireless Access Network	¹ A communications network that spans geographically separate areas and which provide long-haul services. Examples of inter-networked connections are frame relay, SMDS, and X.25 protocols. ² General term for any product primarily used to gain access to the Internet, as opposed to being part of the actual Internet devices or software.

Overview

Ripwave Description

A Ripwave system has three main components: the Customer Premise Equipment (CPE); the Base Station; and the Element Management System (EMS). The Base Station performs the CPE registration and call processing, and provides the interface between the backhaul network and the EMS. It is made up of the Base Transceiver Station (BTS) and the Radio Frequency Subsystem (RFS) (Figure 1).

Figure 1: Base Station Installation With Panel Antenna



Procedural Documents & Forms

You will refer to other Ripwave documents, procedures, and forms in the process of installing and commissioning the Base Station. The product documentation is provided on the Ripwave Standard Documentation CD (Table 1). As well, the EMS manuals can be viewed on-line through the EMS Server and Client applications.

Table 1: Ripwave Standard Documentation CD

Order Number 95-00116-00	Component or Part Number	Format
EMS Overview Manual	40-00016-03	MSWord/.pdf
EMS Software Installation Guide	40-00017-00	MS Word/.pdf
EMS-OSS Integration Guide	40-00147-00	MS Word/.pdf
EMS Administration Guide	40-00031-00	MS Word/.pdf
Ripwave Configuration Guide	40-00016-01	MS Word/.pdf
EMS CLI Reference Manual	40-00016-02	MS Word/.pdf
Ripwave Alarm Resolution Reference Manual	40-00033-00	MS Word/.pdf
System Operations, Maintenance & Troubleshooting Guide*	00-00046-00	MS Word/.pdf
EMS Diagnostic Tools Guide	40-00032-00	MS Word/.pdf
Ripwave Modem Quick Installation Guide	40-00112-00	MS Word/.pdf
English	40-00098-00	MS Word/.pdf
Spanish	40-00096-00	MS Word/.pdf
Ripwave Modem User Guide	40-00111-00	MS Word/.pdf
English	40-00097-00	MS Word/.pdf
Spanish	40-00099-00	MS Word/.pdf
Customer Release Notes	Varies w/each release	MS Word/.pdf

*Available 4Q03

A separate CD specifically created for personnel involved with installation and commissioning of the Ripwave system, called “VAR Documentation CD”, may be ordered by authorized VARS, and business partners. The CD includes detailed procedures and electronic forms that Navini uses during the I&C process. Table 2 contains a partial listing of the files on this CD. The I&C forms found on the CD are referenced throughout this manual.

Table 2: VAR Documentation CD

Order Number 95-00017-00	Part Number	Format
Site Candidate Evaluation Form	40-00091-00	Excel Spreadsheet
RFS System Test Form	40-00093-00	Excel Spreadsheet
Base Station Calibration Verification Form	40-00059-00	Excel Spreadsheet
Drive Study Survey Form	40-00076-00	Excel Spreadsheet
Location (FTP) Test Form	40-00077-00	Excel Spreadsheet
Customer Acceptance Form	40-00117-00	MS Word Document
BTS Outdoor Selection Guide	44-00035-00	MS Word/.pdf
Rectifier/Battery Backup Specification	44-00036-00	MS Word/.pdf

High-level I&C Process

To put the I&C activities in the context of overall system deployment, Figure 2 provides a ‘flow’ of the key activities that are performed prior to and during the installation and commissioning of the Ripwave Base Station. Post-I&C, the system that has been installed and commissioned goes through Acceptance Testing against the customer’s objectives for that site. Once customer sign-off on the site is achieved, the customer becomes fully responsible for operating the system.

Different job holders may perform various portions of these activities and not necessarily all of the activities. In fact, Marketing and Engineering personnel typically handle the earlier tasks, while installation may be a stand-alone function. Commissioning may or may not be handled by the same people who designed or installed the site. Regardless of who does them, these key activities have to be accomplished for successful deployment:

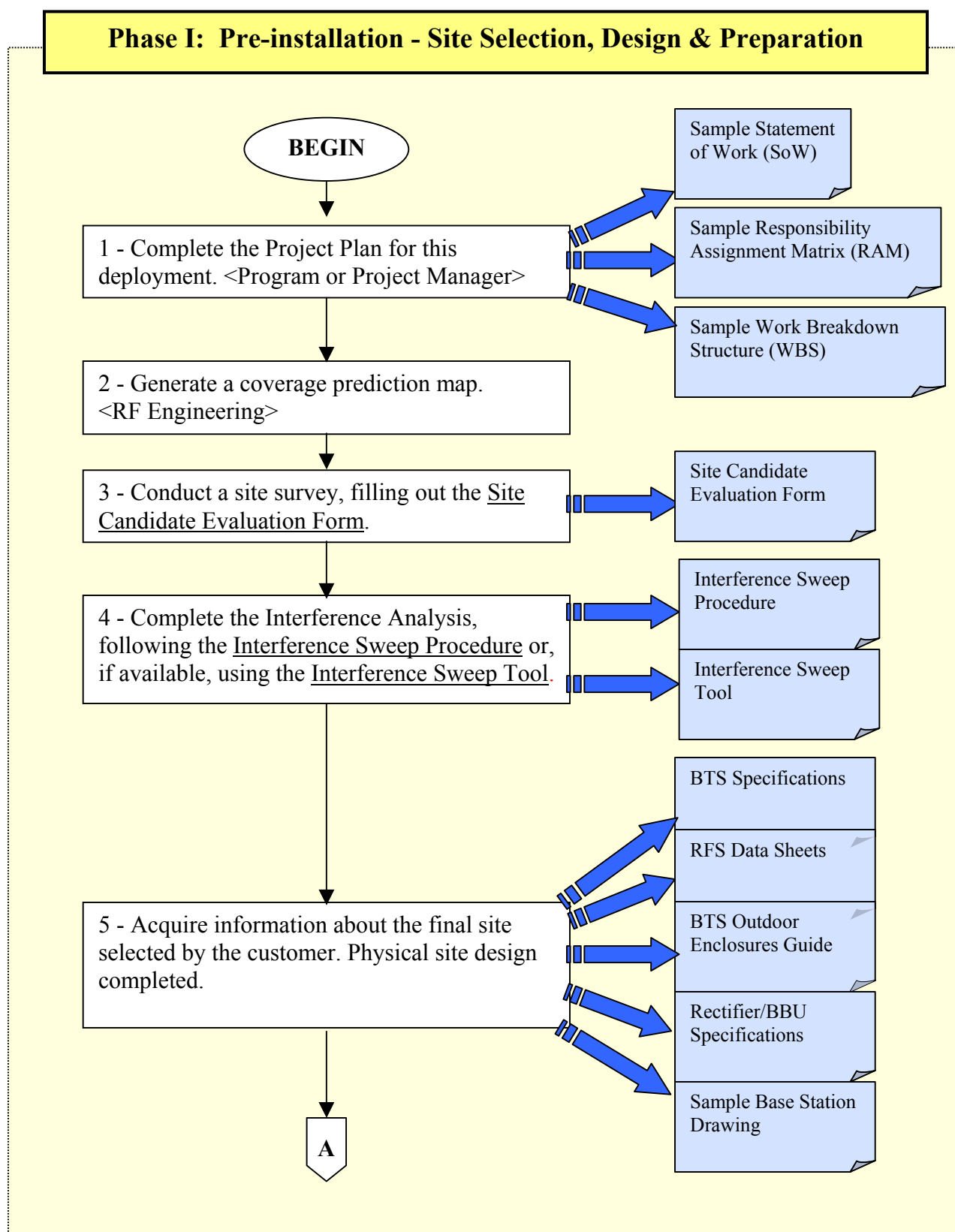
- Site Selection, Design, and Preparation
- Physical Installation
- Commissioning, with Acceptance Testing and Sign-off

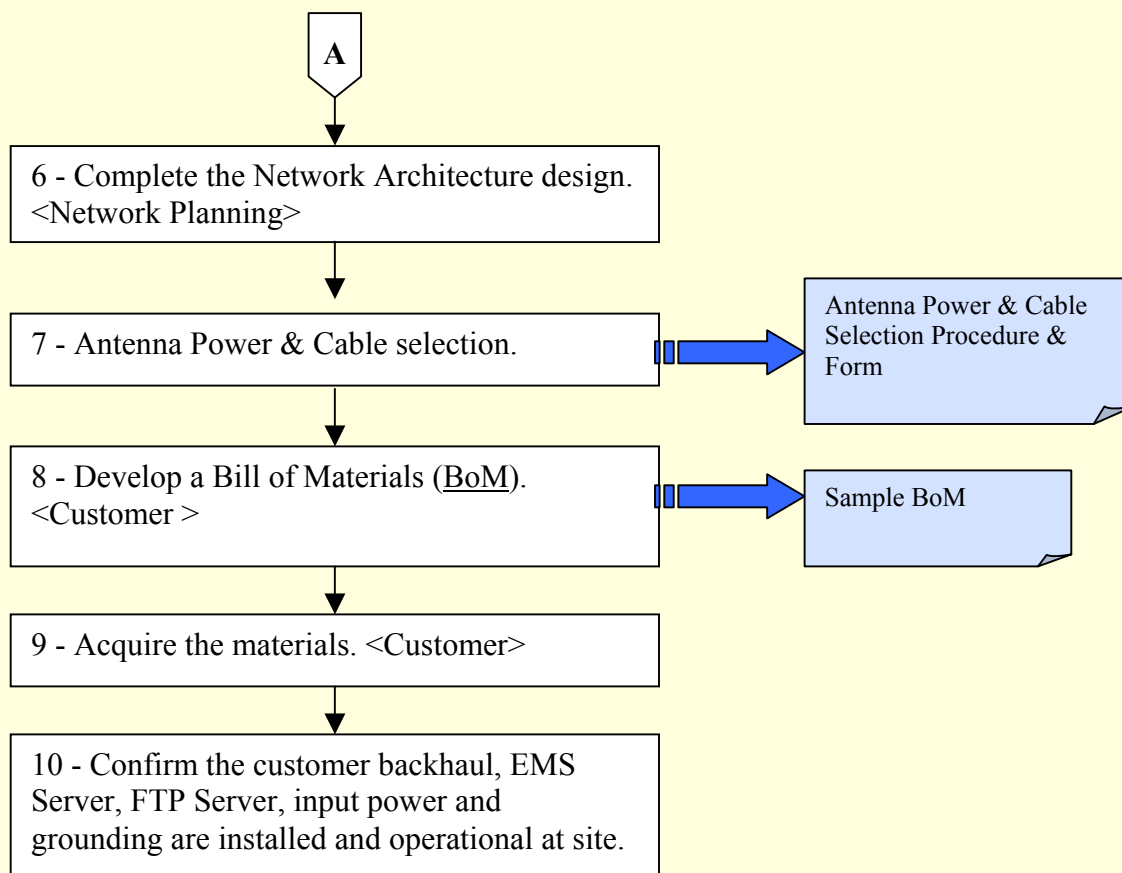
Prior to installation, Navini and the customer formulate a Project Plan and Responsibility Assignment Matrix (RAM) to clarify who will do what to complete the I&C activities. If requested by the customer, Navini may provide personnel, procedures, forms, and/or tools required to install and commission the Base Station equipment. They may also provide special commissioning software programs, computers, and any other special test equipment required.

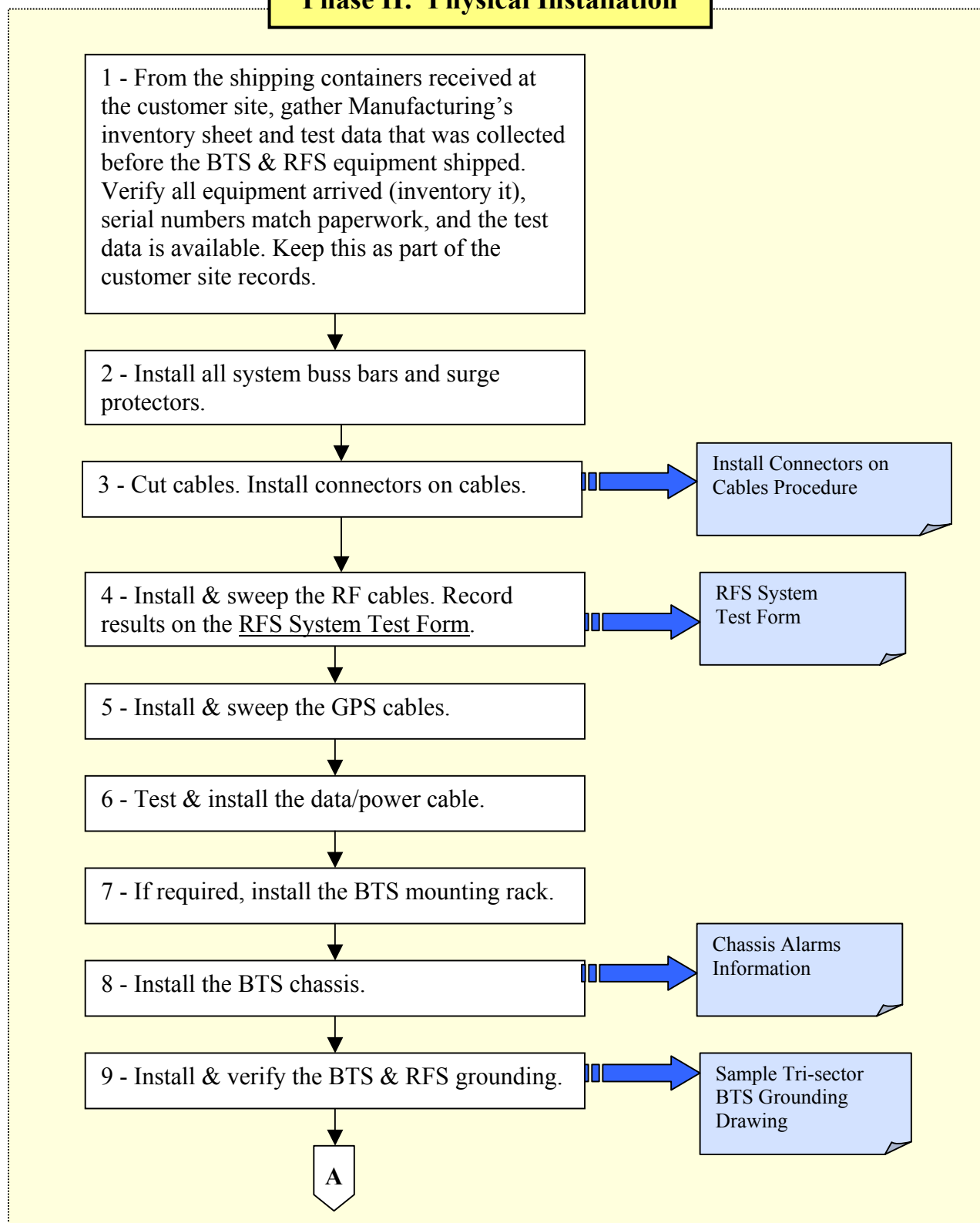
As part of the I&C duties, all testing results are recorded and kept for the customer to review and approve. These test results include the cable sweeps, the BTS Calibration Verification, RF System Tests, Drive Study, Line-of-Sight (LOS) FTP tests, and Non-Line-of-Sight (NLOS) FTP test results. The I&C Supervisor provides site tracking and weekly status reports. All of these tasks can be negotiated with the customer.

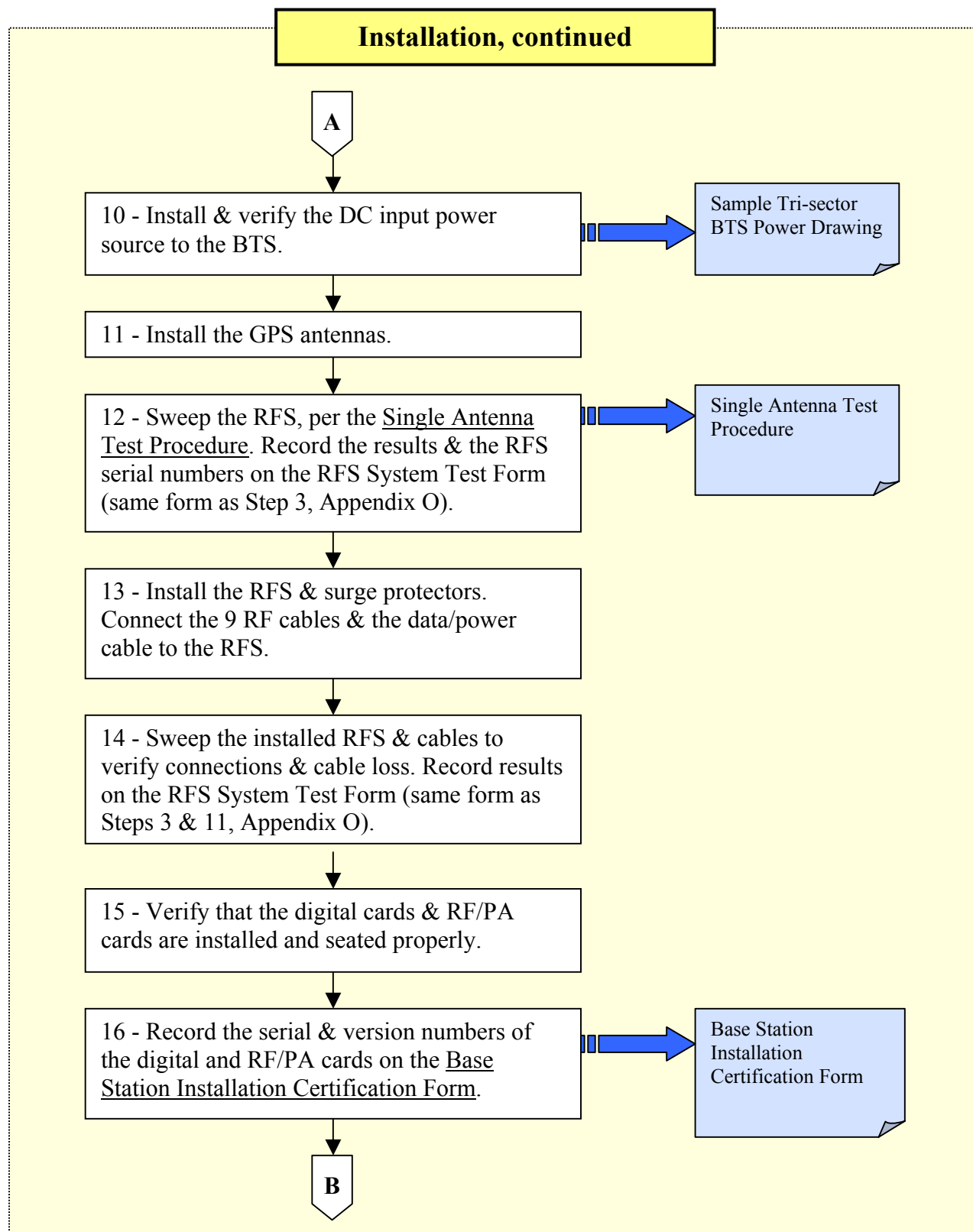
If Navini Networks is hired by a customer to provide Installation & Commissioning Services, involvement and some actual deliverables are still required by the customer. For example, the customer will need to review or perhaps even explain their Site Design Specifications, approve Logistics Plans, provide shipping information, approve the Network Architecture Plan, etc.

As part of a successful hand-off from Navini to the customer, it is usually necessary for Navini to provide some product training to customer personnel who will support the Base Station operation on-going. Customers may opt to take on a Train-the-Trainer program, in which case Navini certifies the customer’s instructors who then provide staff training thereafter.

Figure 2: High Level I&C Process Flowchart

Phase I: Pre-installation - Site Selection, Design & Preparation, continued

Phase II: Physical Installation

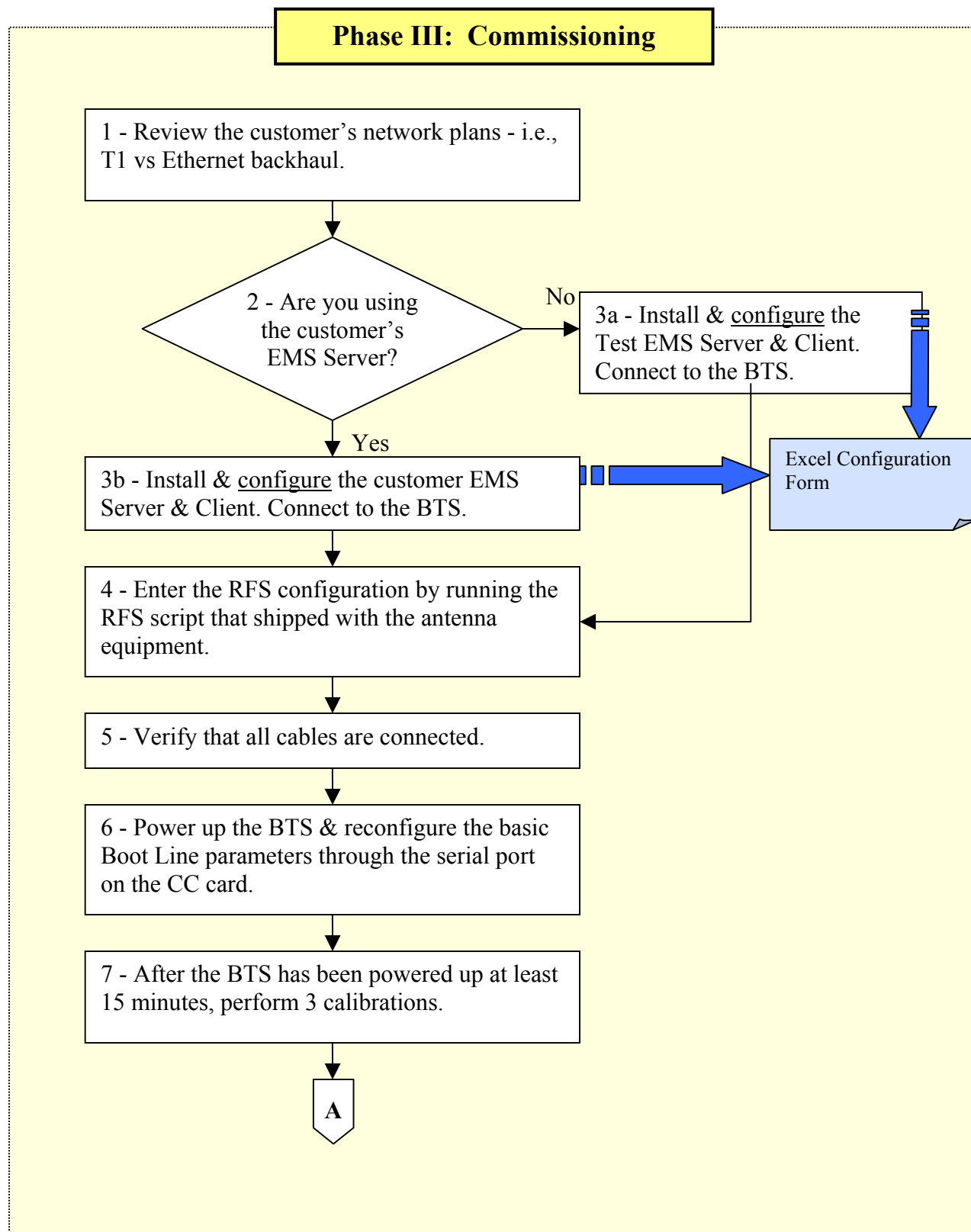


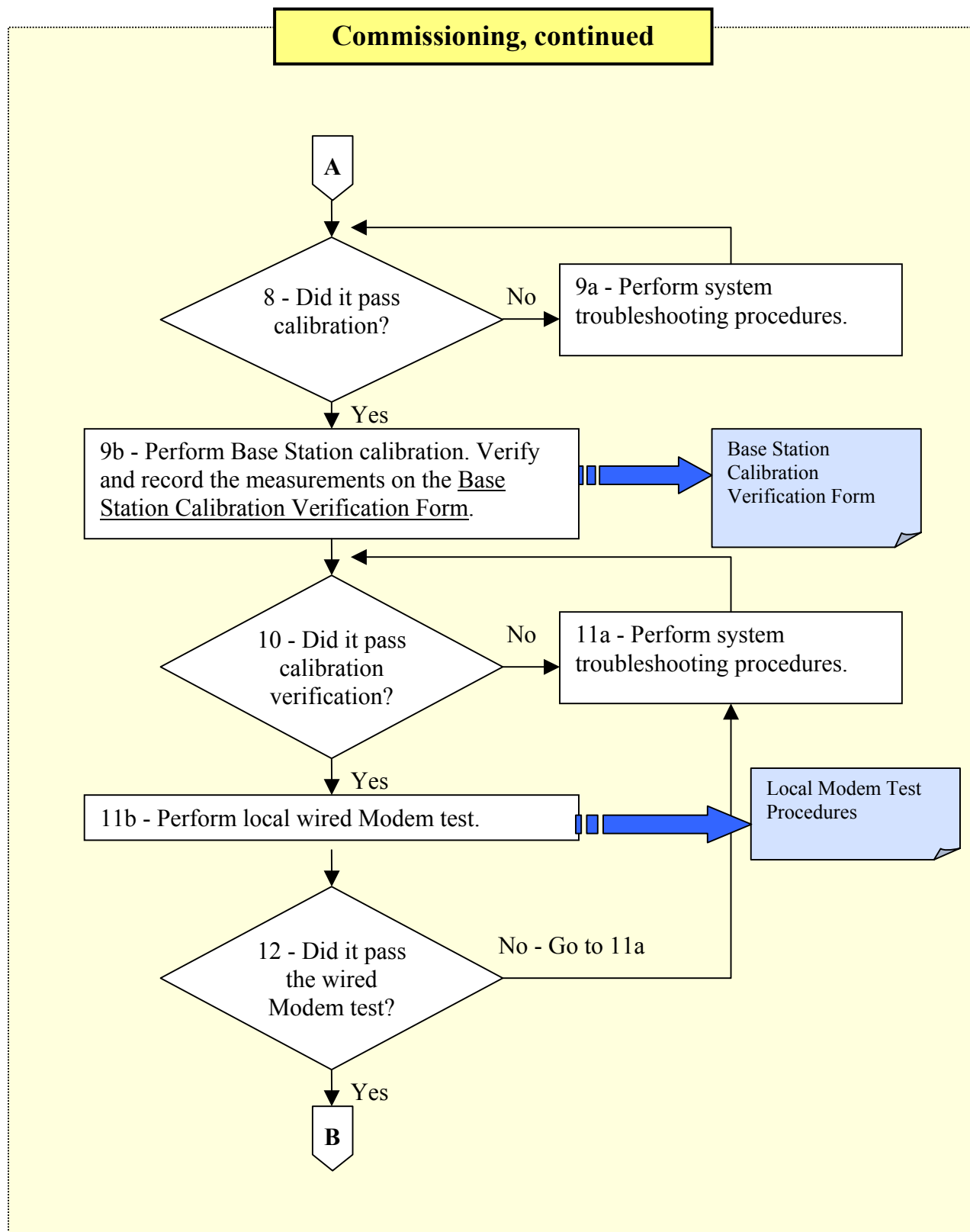
Installation, continued**B**

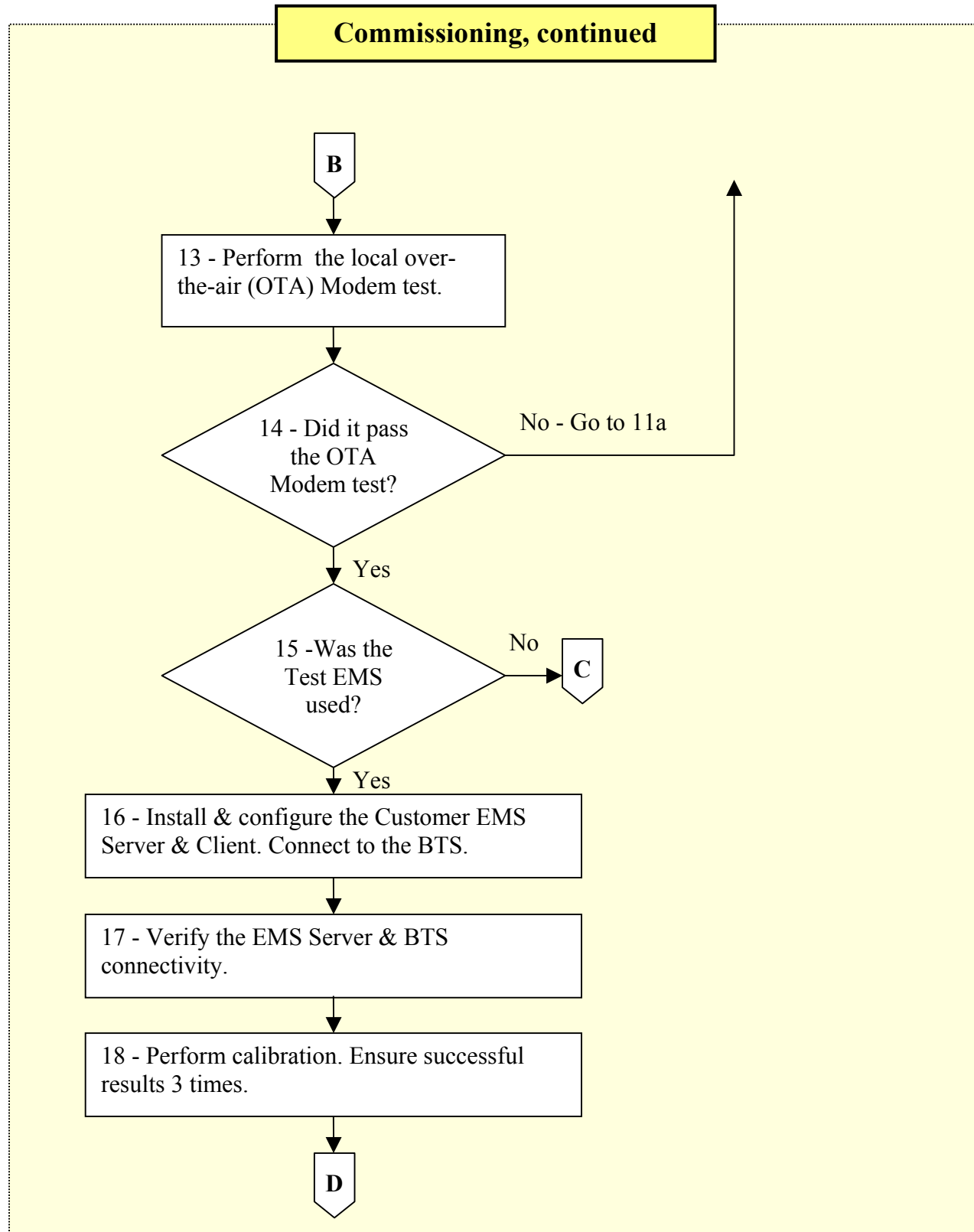
17 - If required in the Responsibility Assignment Matrix (RAM) portion of the Project Plan, test the backhaul to the customer demarcation point.

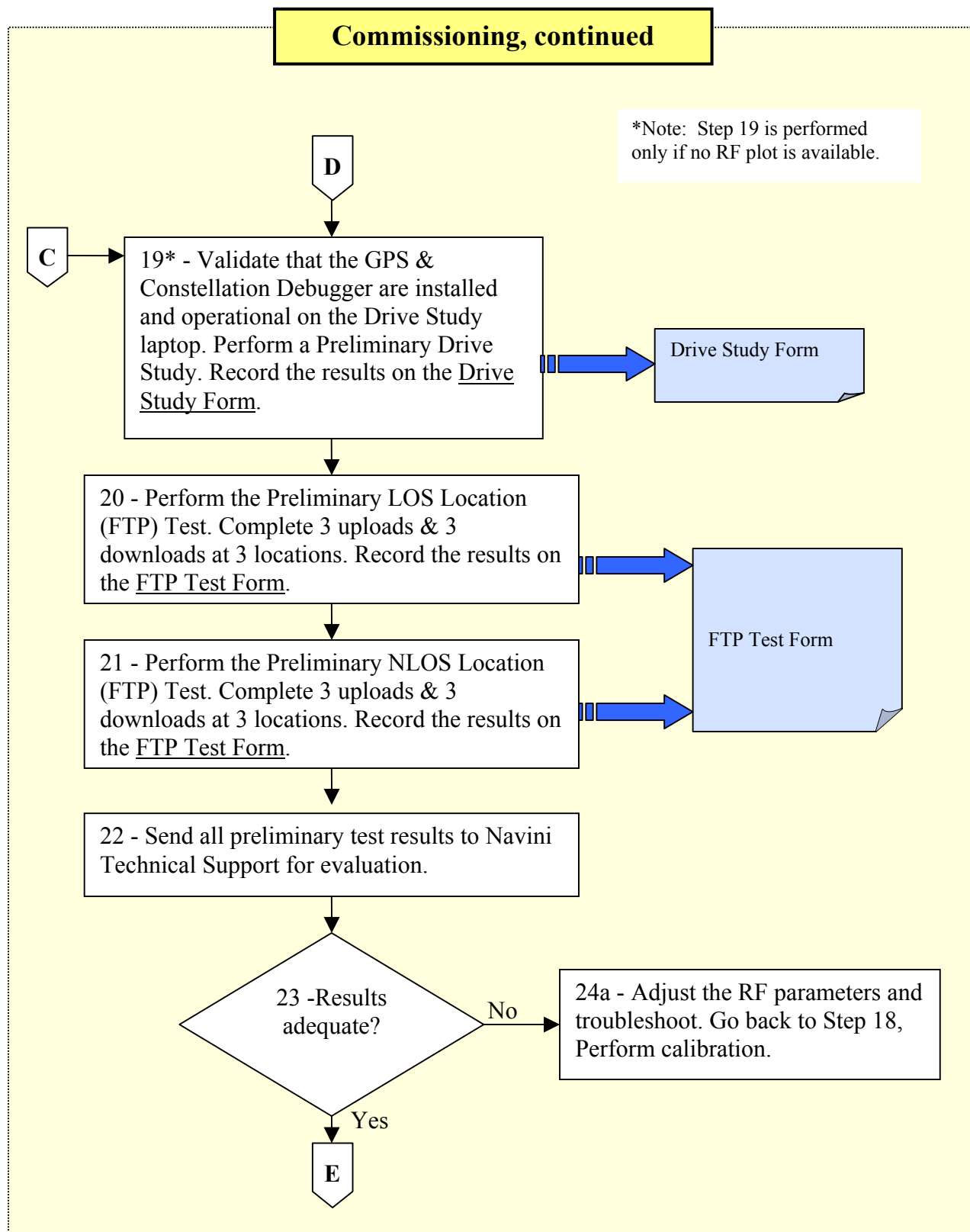
18 - Provide a printed package of the measured results and equipment inventory to the customer on-site.

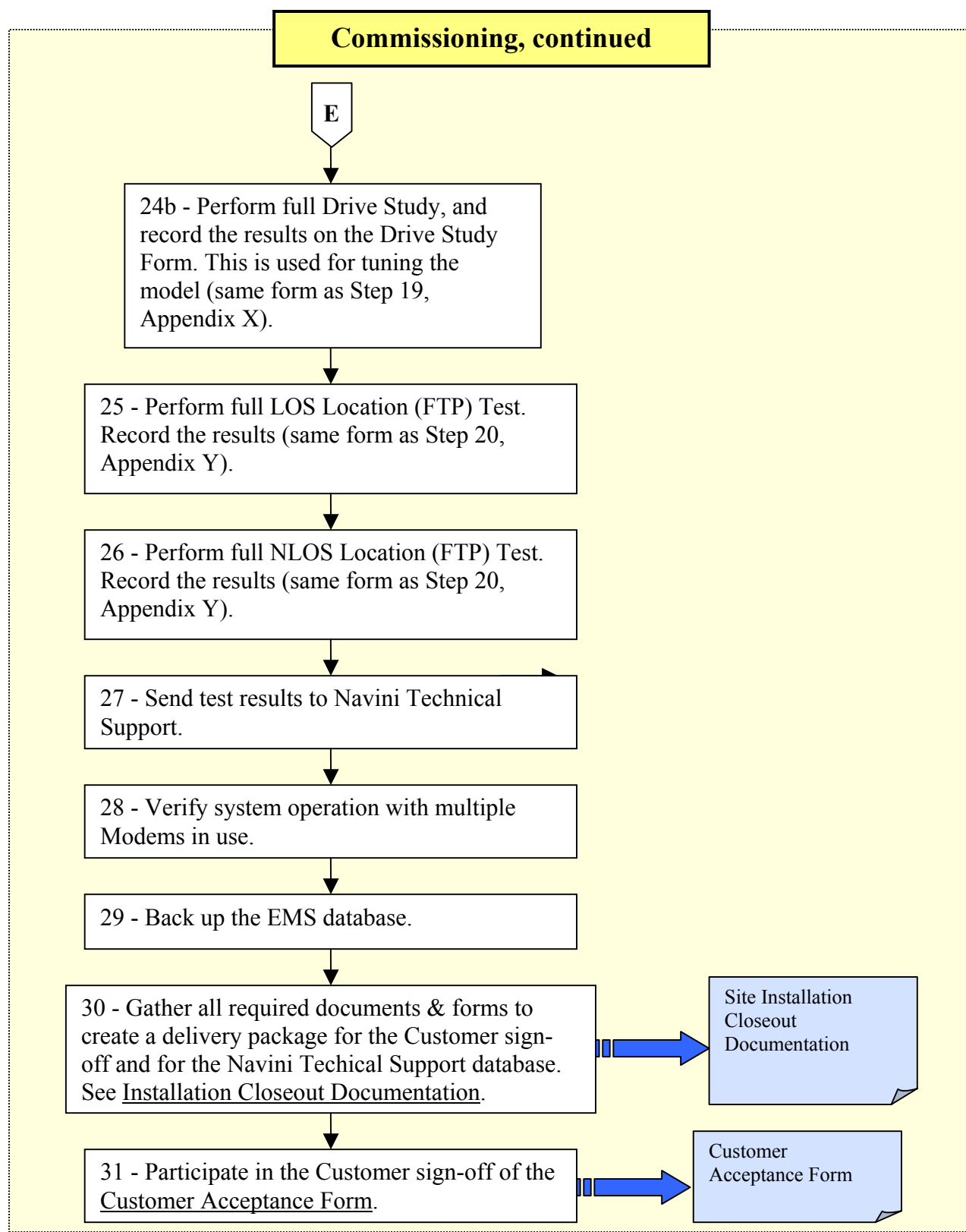
19 - Go over the results using the printed package and obtain customer sign-off on the completion of the Installation portion of the work. Use the Base Station Installation Certification Form for sign-off (same form as Step 15, Appendix T).











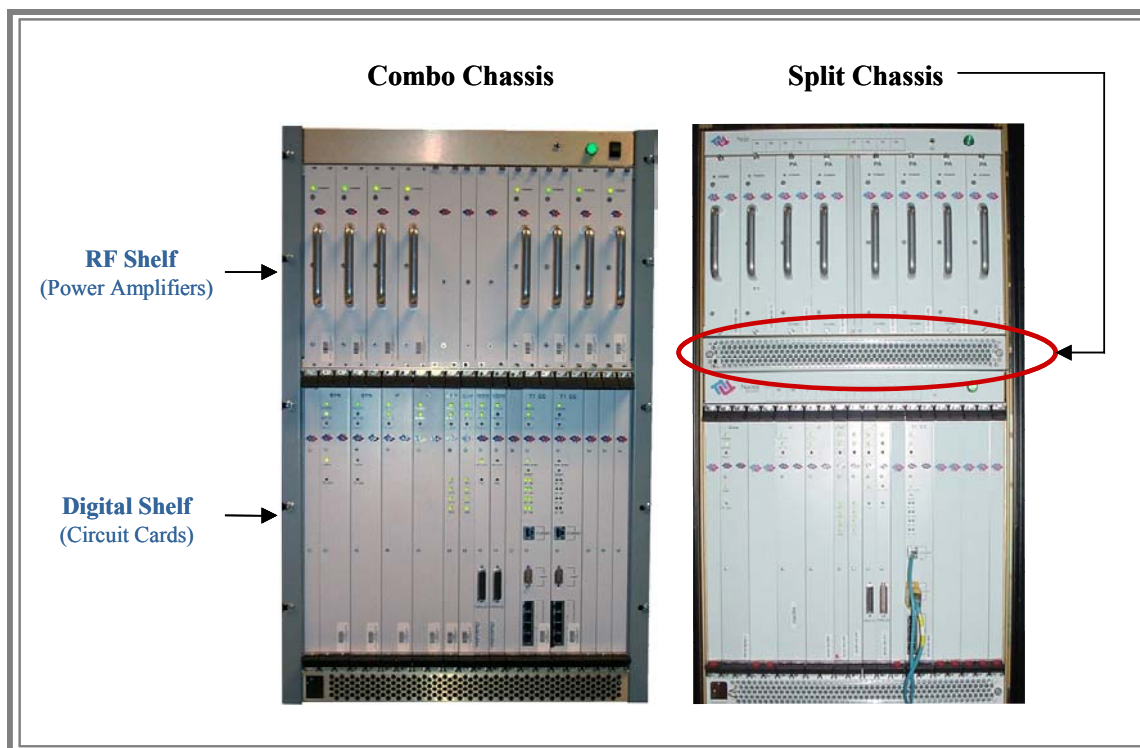
Base Station Components

Base Transceiver Station (BTS)

The BTS consists of the RF Power Amplifiers (PA's), the digital circuit cards, the backplane, and the mechanical enclosure or housing. It performs the signal processing and RF transmission for the system. There are two types of chassis: Combo and Split. The Combo Chassis is used primarily with 2.4 GHz systems. The Split Chassis is used for all other (2.3, 2.5, 2.6 GHz) systems (Figure 3).

The chassis is compartmentalized into two sections - the RF shelf and the Digital shelf. The BTS connects to the network using a 10/100 Base-T Ethernet connection or up to 8 T1 interfaces. Up to three BTS assemblies can be installed per system, depending on the configuration. The BTS specifications are provided later in this document.

Figure 3: BTS Chassis



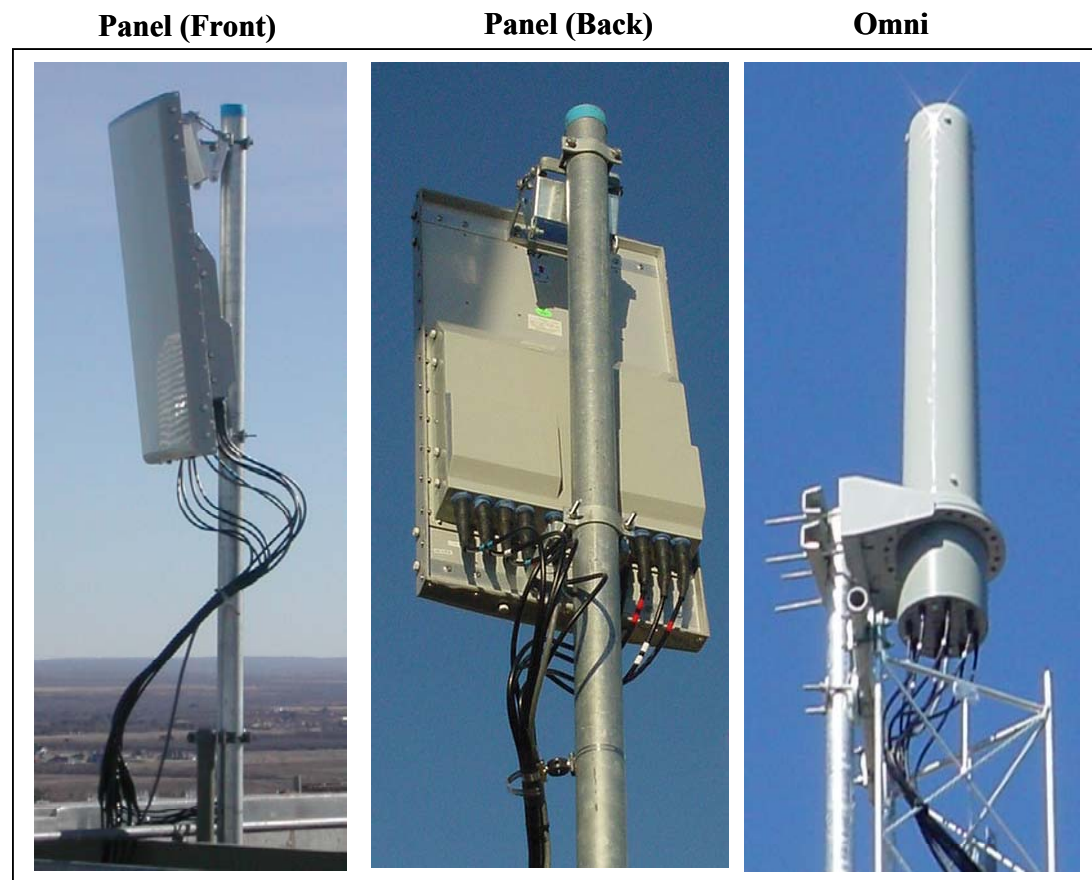
Radio Frequency Subsystem (RFS)

The Radio Frequency Subsystem (RFS) is mounted on a transmission tower or building rooftop. It transmits and receives data to and from the Ripwave Customer Premise Equipment (CPE) using a digital beamforming transmission technique. The RFS may be either a panel antenna or an omni antenna (Figure 4).

An RFS panel transmits in a directional mode, covering a transmit angle of 120 degrees. The antenna can be used as a single mode antenna, or it can be used in a group of two or three sectorized antennas, covering 240 and 360 degrees respectively. Each panel requires a BTS to operate. For example, in a tri-sectorized cell with 3 panels, you would need 3 BTS's. The omni antenna provides omni-directional coverage of 360 degrees.

An RFS panel or omni contains eight (8) antenna elements, cavity filters, and, optionally, low noise amplifiers (LNA). For downtilt, the omni must be situated as it comes from the factory. A panel's downtilt can be adjusted at the site. The higher up the antenna is placed, the more downtilt it typically requires.

Figure 4: RFS



Global Positioning System (GPS)

One or two Global Positioning System (GPS) antennas are used with each Base Station. A GPS antenna works with a constellation of satellites that orbit the earth, and it provides the ability to pinpoint geographical locations. The two types of GPS antennas that may be ordered with a Ripwave Base Station are the VIC 100 and the Motorola Timing 2000 (Figure 5).

Figure 5: GPS Antennas

VIC 100 GPS



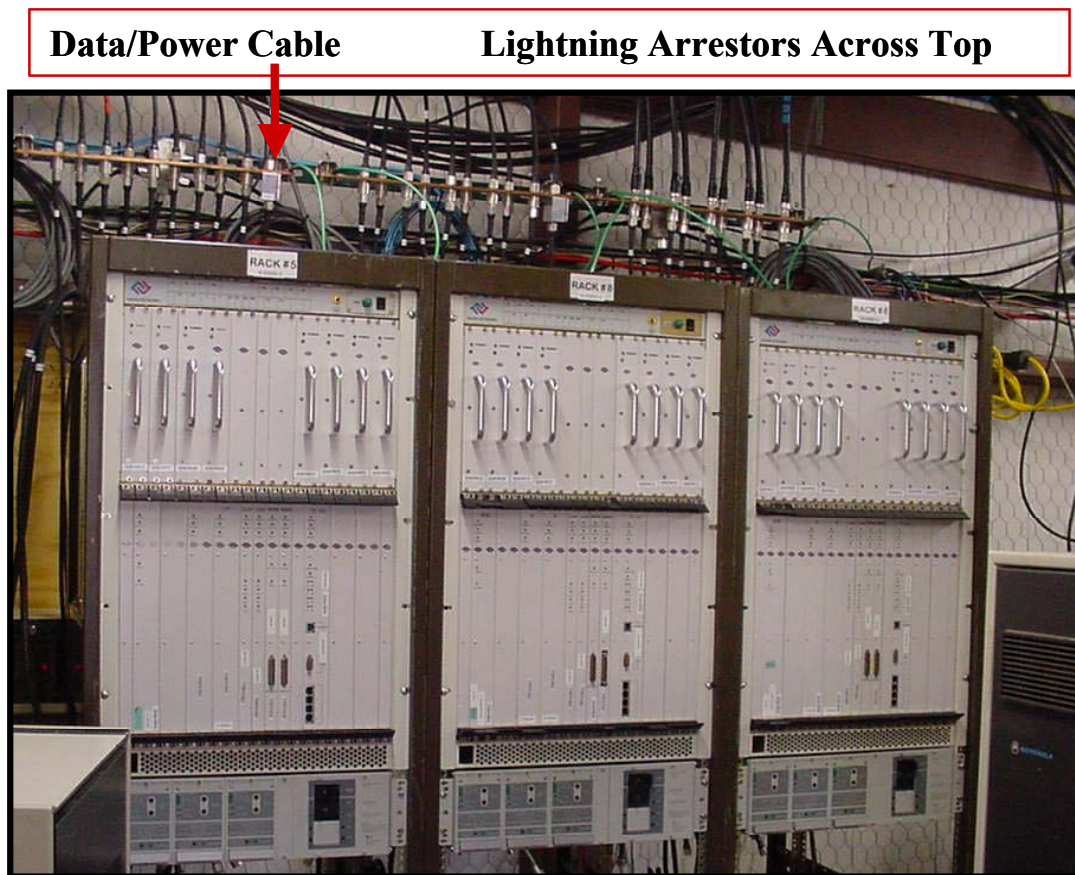
**Motorola Timing
2000 GPS**



Mounting Racks & Enclosures

The BTS can be installed indoors or outdoors in industry standard 19- or 23-inch racks. Rack adapters are needed to mount the equipment in a standard 23-inch rack. For outdoor BTS's, the customer can supply any standard enclosure from a multitude of vendors. Figure 6 shows 3 BTS's installed indoors.

Figure 6: Indoor BTS



General Specifications

Input Power

The BTS requires +21 to 28 VDC power supply rated at 60 amps (combo chassis) and at 50 (RF shelf) and 20 (Digital shelf) for the split chassis. Installers are referred to industry standards for power supply installations.

Humidity

The operating environment of the BTS must control relative humidity to 5% to 95% RH, non-condensing.

Heat Dissipation

The combo BTS chassis, under normal operating conditions, will dissipate a maximum of 1000 Watts or 3415 BTU's. The split chassis will dissipate a maximum of 1500 watts.

Airflow

Fresh air intake for the BTS chassis is along the lower front vertical panel. Exhaust is out of the upper rear of the chassis. The I&C crew must ensure there are no obstacles to airflow present in these areas. Exhaust air from other equipment should not mix with the BTS fresh air intake.

Accessibility

The BTS is intended for installation and use only in a restricted access location.

Base Station Specifications

Current Ripwave operating frequencies include those shown in Table 3. Testing on other frequencies is underway and soon will be commercially available. The specifications are shown in Table 4.

Table 3: Operating Frequencies

Model	Frequency Range	Operating Band	Chassis
2.3 GHz	2.305 GHz to 2.360 GHz	WCS	Split

Table 4: Split Chassis System (WCS Systems)

Antenna Downtilt:	2 & 4 degree options for Omni-directional; Mechanical for 120 degree Sector
Antenna Gain:	12dBi Omni-directional, 17 dBi for 120-degree Sector
Antenna Options:	Omni-directional or 120-degree Sector
Backhaul Interfaces:	10/100 BaseT Ethernet or ATM over T1; up to (8) T1's with or without IMA, long haul support
Bandwidth Allocation:	Dynamic
Baseband Modulation:	Uplink QAM4
Beamforming Gain:	18dB
Configurations:	RFS Omni-directional or Sector. 1 BTS per antenna.
DC Power Consumption:	+21VDC to +28VDC; 50 amps RF shelf, 20 amps Digital shelf; 1353 Watts typical, 1500 Watts maximum
DC Power Interface:	2 - ¼" lugs for +24V DC and 24V return.
Duplex Format:	Time Division Duplexing (TDD)
Humidity:	0 to 95% non-condensing
Mechanical Dimensions:	Digital: H19.2" X W19.0" X D12.9" (add ~1.3" to D with modules installed). RF: H14.0" X W19.0" X D15.2" (add ~1.5" to D with modules installed).
Multiple Access Schemes:	Multi-carrier Beamforming Synchronized (MCBS) CDMA
Operational Frequency Band:	See Table 3
Operational Temperature:	0 to +50 degrees C (indoor); -40 to +50 degrees C (outdoor)
Polarization:	Vertical
Power Control:	Forward & reverse, open & closed loop
Regulatory:	UL 1950, FCC part 27
Reliability/Availability:	Load-sharing
RF Channel Bandwidth:	6MHz
RF Output Power (per channel):	5 watts max
Sensitivity:	-114 dBm/single channel (NF of 5dB)
Serviceability:	Field replaceable cards, EMS remote reset; Front and rear access required
Spreading Spectrum Scheme:	Direct Sequence Spreading (DSS)
Storage Temperature:	-40 to +70 degrees C
System Features:	Reed Soloman forward error correction (FEC), congestion control, automatic repeat request (ARQ), extensive GoS/QoS mechanisms
System Throughput:	12 Mbps (fully loaded max raw data rate downstream + upstream)

Up/down Link Duplex:	Symmetrical or Asymmetrical TDD with a maximum of 3:1 ratio for down/up allocations
Upgradeability:	Software downloads
Weight:	Digital Shelf 35 lbs + RF Shelf 82 lbs.

Materials Specifications

The Base Station installation requires general materials and parts for installation. In Table 5 is a partial list of the items that may be used for a typical installation of the Ripwave Base Station. The quantity and use of materials will vary depending on the specific installation. The lists in Table 5 are based on a 150-foot site.

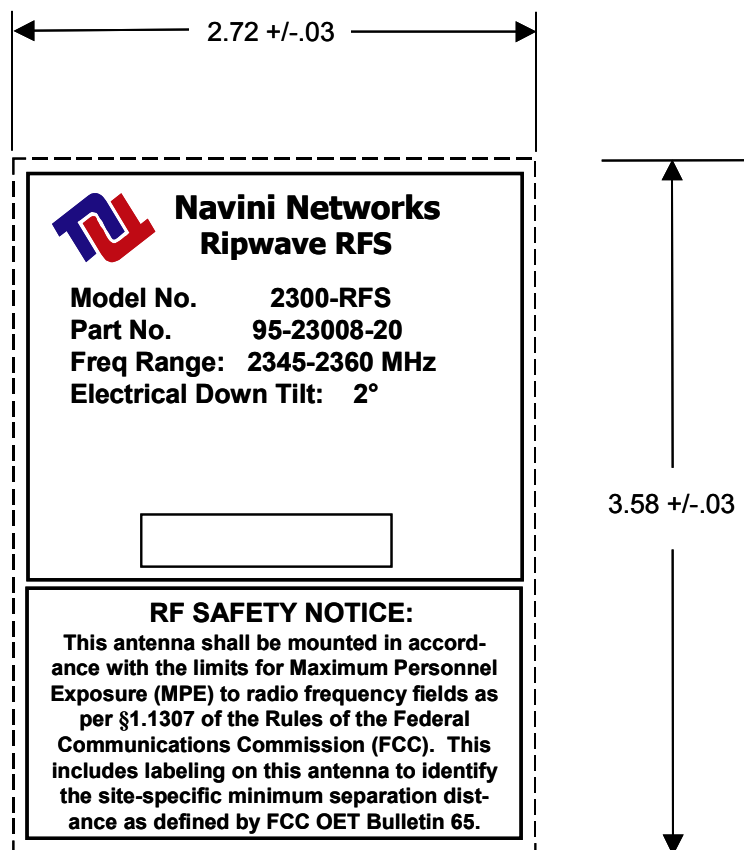
Table 5: Materials Specifications

Base Station General Materials Requirements List			
BTS Install Kit 96-05000-00	Description	Supplier	Rqd Qty
GROUNDING			
Lightning Rod	Lightning Rod - 8'	MTS	
Ground Rod	Tinned copper ground rod, 5/8" x 8'	MTS	
Ground Wire	# 2 Stranded green ground wire	MTS	50 Ft
Ground Wire	# 6 AWG Stranded Green Wire	LOCKE	50 Ft
Ground Buss Bar (Tower)	Ground buss bar kit, 1/4" x 2-1/2" x 12-1/2"	MTS	1 Kit
Ground Buss Bar (Shelter)	Copper Gnd buss bar, 1/4" x 4", drilled to 5/8"	ALT	1 Kit
Ground Lug	#6, One Hole	T&B	3 Pcs
Ground Lug	#6, Two Hole	T&B	6 Pcs
Ground Lug	#2, Two Hole	T&B	2 Pcs
Grounding Kit (1/2"), LMR600	STD Ground kit, LMR-600, 5' x 3/8" 2 hole lug	MTS	27 Kits
Grounding Kit (3/8"), LMR400	STD Ground kit, LMR-400, 5' x 3/8" 2 hole lug	MTS	2 Kits
Grounding Kit (1/2"), RF-1/2"	Ground Kit, RF-1/2", 2 hole lug	NK Cables	
Universal Grounding kits	Universal grounding kit, 3' with 3/8" 2 hole lug	MTS	
ANTENNA SYSTEM			
RFS Antenna	Omni Antenna	Navini	
RFS Surge Protector	RFS surge protector	POLYPHASER	9 Pcs
RFS Antenna Mount	Omni Antenna Mount	MTS	1 Kit
Weatherproofing kits	Universal weatherproofing kit, Large	MTS	2 Kits
RFS Antenna Power Cable	RFFE Power/Data Main Cable assembly	Probity	1 Kit
RFS Antenna Jumper Cable	RFFE Power/Data Jumper cable, 10 Feet.	Probity	1 Kit
Mounting Clamps	Crossover Clamp, 1.5" x 3.5" OD	MTS	1 Kit
Mounting Clamps	Pipe to pipe clamps, kit of 2	MTS	1 Kit
MAIN FEEDER			
RFS Cable	LMR 600, 1/2" coaxial cable	HUTTON/TIMES	1350 Ft
RFS Type N Male Connectors	EZ600 N type, Male connectors	HUTTON/TIMES	36 Pcs
Hoisting Grips	Pre-laced Hoisting Grip, 1/2"	MTS	10 Pcs
Cushion Hangers 1/2"	Cushion hanger assembly, 5H, 1/2", kit of 5	MTS	12 kits
Cushion Hangers 3/8"	Cushion hanger assembly, 6H, 3/8" for LMR400	MTS	
Angle Adapter	Adapter, Galvanized, Angle kit of 10	MTS	
Cross Cushion Hanger Mounts	Cross cushion hanger mount, kit of 5	MTS	6 Kits
Universal Hanger 1/2"	Hanger, Universal, Snap-In, 1/2", kit of 10	NK Cables	
Support Blocks	Mini Coax Support Blocks, kit of 10	MTS	2 Kits
RFS Connector	MALE, N TYPE, 3/8 INCH	NK Cables	
RFS Connector	MALE, N TYPE, 5/8 INCH	NK Cables	
RFS Connector	MALE, N TYPE, 1/2 INCH	NK Cables	
RFS Connector	MALE, N TYPE, 7/8 INCH	NK Cables	
RFS Connector	FEMALE, N TYPE, 5/8 INCH	NK Cables	

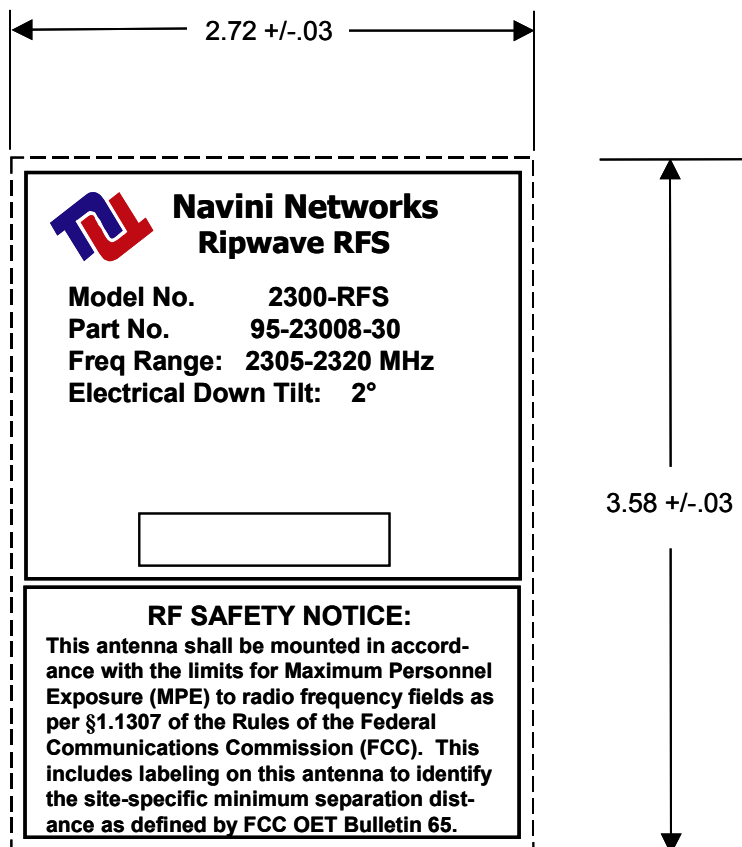
RFS Connector	FEMALE, N TYPE, 7/8 INCH	NK Cables	
RFS Connector	N STRAIGHT PLUG, EZ PIN, FEMALE (LMR400)	HUTTON/TIMES	
RFS Connector	N RIGHT ANGLE, EZ PIN, MALE (LMR400)	HUTTON/TIMES	
RFS Connector	N RIGHT ANGLE, SOLDER PIN, MALE (LMR400)	HUTTON/TIMES	
RFS Connector	N STRAIGHT, SOLDER PIN, MALE (LMR400)	HUTTON/TIMES	
Weatherproofing	Sealing Compound, Coax Cable Connector	NK Cables	
RFS Cable	CABLE, COAX, RF, CORRUGATED, 3/8 INCH	NK Cables	
RFS Cable	CABLE, COAX, RF, CORRUGATED, 5/8 INCH	NK Cables	
RFS Cable	CABLE, COAX, RF, CORRUGATED, 1/2 INCH	NK Cables	
RFS Cable	CABLE, COAX, RF, CORRUGATED, 7/8 INCH	NK Cables	
GPS SYSTEM			
GPS Antenna	GPS Antenna, N-type Female	Motorola	2 Pcs
GPS Surge Protector	GPS surge protector, Redundant	POLYPHASER	2 Pcs
GPS Surge Protector	GPS surge protector, Non-redundant	POLYPHASER	1 Pc
GPS Cable	LMR400, 3/8" coaxial cable	HUTTON/TIMES	200 Ft
GPS Type N Male Connectors	EZ400 N type, Male connectors	HUTTON/TIMES	8 Pcs
ENTRY PORT SYSTEM			
Goose Neck - J type Hood entry		TBD	
Feed Thru Entry Panel		TBD	
Boot Assembly Kits	Boot Assembly Kit, 4" w/ 4 holes (LMR 600)	MTS	4 Kits
BTS SYSTEM			
Ripwave 2400 BTS		Navini	
BTS Surge Protector	BTS surge protector	POLYPHASER	9 Pcs
24 VDC Power Supply		Argus	1 Unit
DC Power Wire	# 6 AWG, Stranded, RED Wire		
DC Power Wire	# 6 AWG, Stranded, BLACK Wire		
BREAKER	24 VDC, 60A Distribution Breaker	Argus	
ROUTER	CISCO 2600 Dual 10/100 ENET, WIC/NM Slots	CISCO	
SERIAL WAN	Serial Interface WAN Card, One Port	CISCO	
T1-IMA MODULE	Multiport T1/E1 Network Module with IMA	CISCO	
Air conditioning		TBD	
110 VAC Power Outlets		TBD	
Telco / Ethernet Connectors RJ45		TBD	
MISCELLANEOUS			
Expanding Foam Sealer		TBD	
Bolts (Ground)	Bolt, Hex, 1/4-20 x 1.000 LG, SSPA	QUESTRON	
Nuts (Ground)	Nut, Reg, Hex, Cres, 1/4-20UNC	QUESTRON	
Flat Washer (Ground)	Wash, Flat, Cres, #6 T-B-Reg .156x.438x.040	QUESTRON	
Lock Washer (Ground)	Wash, Lock. Split, Cres 1/4, Reg .252x.487x.062	QUESTRON	
Star Washer (Ground)	Wash, Star, 1/4	QUESTRON	
Star Washer (BTS Chassis Ground)	Wash, Star, #10	QUESTRON	
Nut (BTS, Power/Data Surge P)	Nut, Hex, #10-24	QUESTRON	
Equipment Open Rack	Rack, 19" x 72" with 1/4" x 1" holes	CHATSWORTH	
Tie wraps		TBD	
Split Bolt #2/0		TBD	
Uni-Struts		TBD	
Anchor/Expansion Bolts		TBD	
Cable Ladder		TBD	

APPENDIX A: RFS IDENTIFICATION LABEL

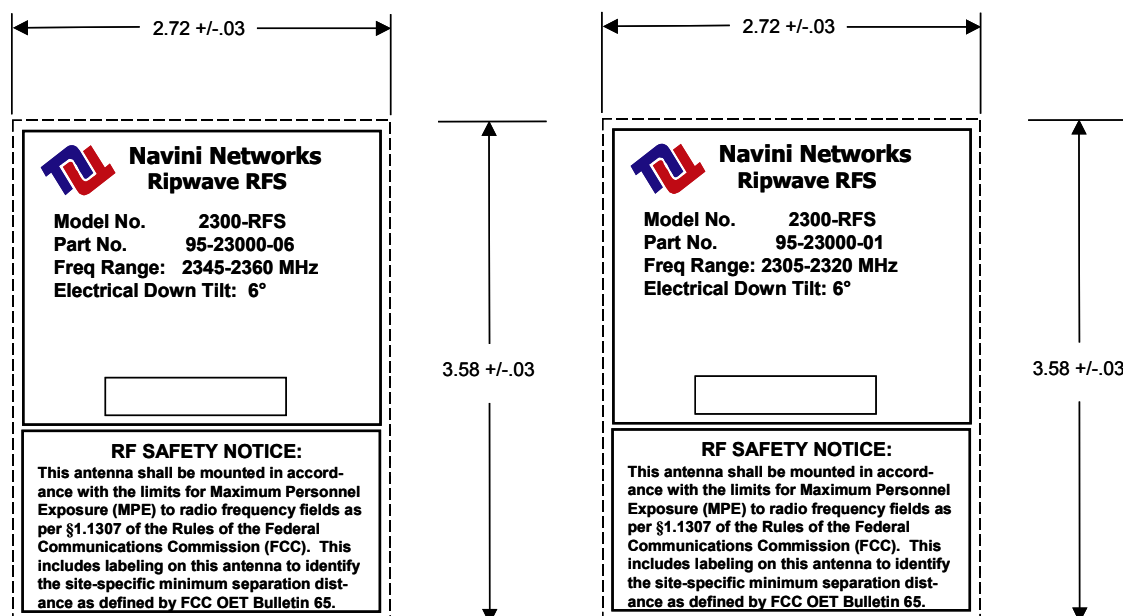
2.3 GHz RFS – Omni High Band



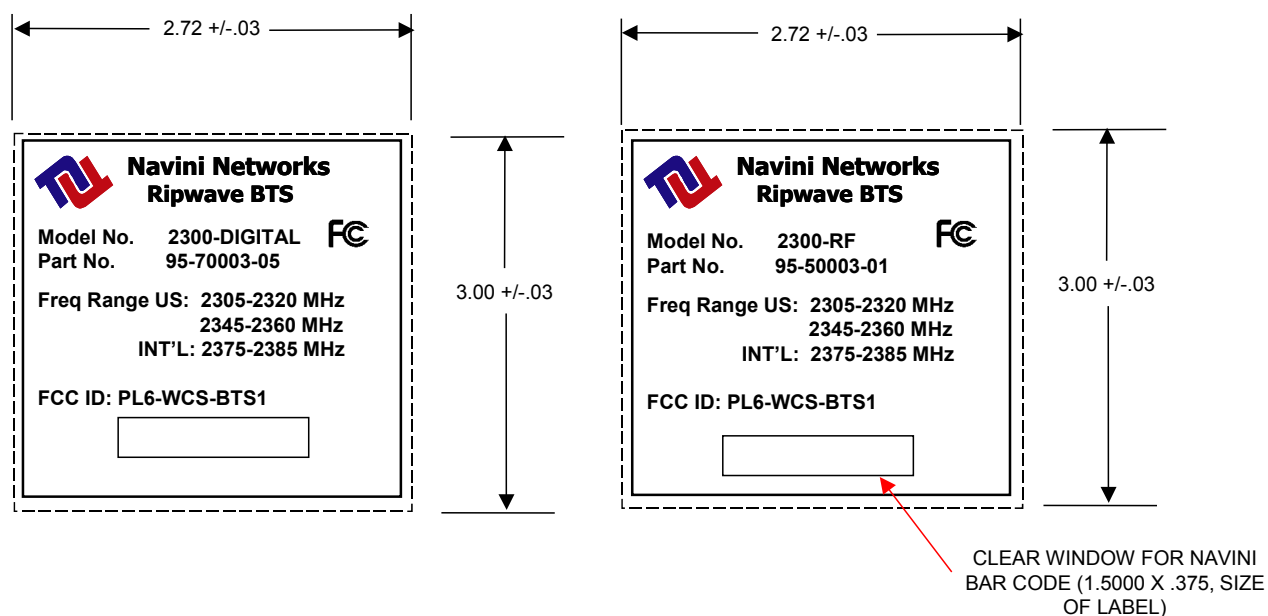
2.3 GHz RFS – Omni Low Band



2.3 GHz RFS – Sector



APPENDIX B: 2.3 GHZ BTS IDENTIFICATION LABEL



NOTE: This device has not (yet) been authorized by the FCC. Therefore, the FCC ID number is not valid and could possibly change.