SAMSUNG ELECTRONICS

MINIBTS
INSTALLATION & METHODS

Wireless Systems Lab
ID: _____
Rev: _____

CHRISTOPHER WHITTLE

Revision History

Revision No.	Revision Date	Reason for Change	Changed By
01	12.03.97	Updates from department	C Whittle
02	12.17.97	Updates from department	C Whittle
03	1-11-98	Edit	S Logan
04		Updates	C Whittle
05	2-12-98	Edit/format	S Logan
		Updates	P Sohn
06	2-18-98	Edit	S Logan
06c	2-24-99	Format draft	S Logan
	2-25-99	Send draft to KTL	

RELEASE APPROVALS

ENGINEER	MANAGER
TITLE	TITLE
DATE	DATE

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1 INTRODUCTION

1.1 Purpose

The document is the recommended installation procedures for the Samsung Base Transceiver Subsystem (BTS). The document provides a complete reference for multiple configurations of the BTS System. Individual customer documentation should be followed during installation. Information within is reference for individual customer documentation.

1.2 Scope

The BTS installation document covers the complete installation of a BTS System from the hardware prospective. Procedures include unpacking, mounting, power, cabling, and initial startup. The document begins after the site preparation and ends at the power-up procedure.

Note: *Samsung disclaims any liability or responsibility for the results of improper or unsafe installation practices.*

1.3 Responsibility

WSL Field Deployment
1130 E. Arapaho Rd.
Richardson, TX 75081
phone 972-761-7000 fax 972-761-7909

1.4 Warnings

1.4.1 Electrostatic Discharge

Proper procedures and precautions can prevent damage by ESD. Grounding, storage/transportation materials, and labeling reduce the effects of ESD. All ESD-sensitive materials must be shipped in ESD-approved bags. ESD-sensitive materials should not be removed from storage bags unless the unit is being tested or utilized for service. Ground straps and anti-static surfaces must be used while the ESD materials are exposed. Samsung is not responsible for the damages caused by improper ESD procedures.

1.4.2 High Voltage Warning

All work areas containing high voltage must be marked. Any circuits being serviced must display a work tag in areas where the circuit is accessible. Proper grounding is the responsibility of the service technician. Service Technicians should wear appropriate attire and refrain from wearing jewelry or polyester materials. Samsung is not responsible for death and/or injury resulting to you and/or coworkers due to improper safety procedures.

1.4.3 Laser Warning

Laser radiation may or may not be visible. Avoid eye or skin contact with laser radiation. Never look directly into a laser. Use proper protection or some type or refraction material to view the laser. Samsung is not responsible for improper safety procedures.

1.5 Precautions

Use correct cables, connectors, and power cords as specified in this method. Inspect all electrical equipment (cables, connectors, wires, plugs) carefully for any damage.

Observe the general safety rules listed below when in contact with the BTS.

a. Ensure that the job site is clean, properly temperature controlled, and without excessive humidity.
b. Pay attention to all hazard and warning signs.
c. Exposed parts such as connection part, ceiling, floor, etc. shall be covered with a safety guard or protected with an enclosure.
d. Mark potentially dangerous areas with appropriate signs to restrict access.
e. Wear safety gloves and glasses when drilling.
f. Make sure that the site has ample illumination.
g. Do not step on the cables nor use excessive force during handling.
h. To reduce the risk of shorting, take off all metallic jewelry such as rings or watches etc. when working with electrical equipment.
i. Do not work around bare wires or exposed terminals unless the power has been disconnected.
j. The BTS cabinet must be grounded properly to protect against equipment damage and personnel injury. **The ground wire must be attached before any power is turned on in the cabinet.**
k. Installers should wear anti-static wrist straps while proceeding with the installation.
l. Do not work in wet areas. The BTS must be permanently situated in a dry and well-ventilated area.
m. Do not install the BTS during a lightning storm.
n. The power source should be a dedicated line to minimize disruptions from power surges, and to prevent service disruptions from overloads on a shared line.
o. Check all supplied material for damage and ensure replacement to avoid disruptions.

1.6 Applicable Standards

FCC part 68, ANSI T1 (applicable sections), NEC (applicable sections), Bellcore.

1.7 Design Change Procedure

Design change and acceptance form (ref. xxxx).

Changes require the use of form xxxx. Individuals requesting the change must complete the form to the best of their ability. Forms are forwarded to Samsung engineering. Changes forms are reviewed immediately upon receipt. Questions may be necessary for approval. Approval time is based upon the complexity of a change.

Change approval/decline are documented on the same form as the original request. New drawings, specs, budgets, and schedules may accompany the approval. Should the change be declined, a documented response will accompany with the form.

Customer acceptance is supplied by signing the approval form and returning a copy to Samsung engineering. All design change request and approval forms are copied and stored in the individual project folder. The changes are issued to field personnel as an update to the current installation document. Each design change does not constitute a new revision level. Field personnel should refer to engineering for the latest documentation and design changes.

2 BTS SYSTEM OVERVIEW / OPERATING CONFIGURATIONS

The Samsung's BTS (mini-Base Transceiver Subsystem) provides radio interface between the mobile PCS users and the Base Station Controller (BSC). The BTS is made up of transmitting/receiving antenna for each sector, the BTS Main Unit, BTS Radio Remote Unit, and unchannelized T1/E1 trunk (packet transmission) used for sending traffic information and control signals to BSC. In addition, it is equipped with the GPS receiver for the network synchronization of CDMA System.

Figure 2.1 Samsung CDMA BTS

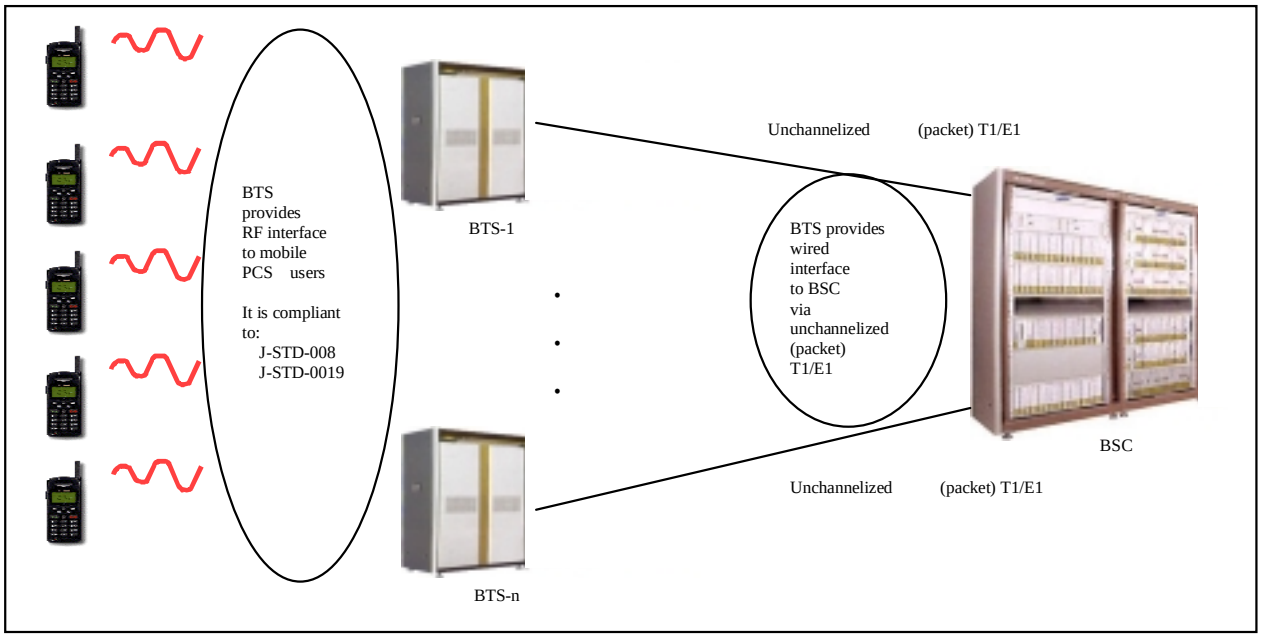


Figure 2.2 Samsung BTS System Architecture

2.1.1 BTS Major Features

2.1.1.1 RF (Radio Frequency) Interface to/from Mobile PCS Users Function

The radio transmission characteristics include a radio channel interval, a modulation method, output power characteristics, spurious emission power, and receiving band emission power that meet the requirements of J-STD-008, and J-STD-0019.

2.1.1.2 BSC WIRED INTERFACE FUNCTION

BSC/BTS interfaces send/receive the packet information on the traffic information and control signals between BSC and BTS. The BSC/BTS interface supports either E1/T1 (copper or μ wave backhaul). The unchannelized method suitable for the packet data transmission is utilized as a frame structure, thus utilizing the full bandwidth offered by the T1/E1.

2.1.1.3 SAMSUNG BTS RESOURCE MANAGEMENT AND OPERATION/MAINTENANCE FUNCTION

Samsung's BTS provides the following functions for operation and maintenance functions:

- Detects system error and reports the results to the BSC
- Collects statistics information related to call processing and reports it to the BSC
- Has self diagnostic capability
- Performs a forward/reverse link performance test
- Supports test mobile, RF loop-back, Markov test, and other measurements

2.1.1.4 GPS RECEIVING FUNCTION

This function receives the time information and clocks of the GPS, and generates a reference signal, system clock, and Even_sec for output.

2.1.2 BTS Characteristics

Table 2.1 BTS Characteristics

	Mini-BTS (indoor)	Mini-BTS (outdoor)
Rack frame height including cover	71"+/-1"	77"+/-1"
Rack frame width	29.5"	34"
Rack frame depth	28.5"	38"
Min. work area for front (doors)	24"	48"
Min. work area for back (doors)	24"	48"
Min. dimensions for doorways	32”	36”
Width	35"	36"
Height	84"	84"
Weight (approx.)	770 lbs.	990 lbs.
Power Requirements Minimum/Optimum	+27Vdc(+21~+29Vdc) @ 50 amps / 100 amps	+27Vdc(+21~+29Vdc) @ 50 amps/ 100 amps
Operating temperature range	0°C ~ +50°C	-40°C ~ 80°C
Operating humidity range	20% ~ 80%	20% ~ 80%

Note: The Rack Dimensions will change. When final design is completed dimensions will be updated.

2.1.3 Transmitter Specifications

Table 2.2 Transmitter Specifications

Tx. Freq.	1930.00 – 1990.00 MHz
Output Power	17.4 watts/CDMA carrier +2 – 4 dB at the antenna port
Blossom/Wilting Attenuator Range	Min. 60 dB (blossoming, wilting, breathing)

2.1.4 Receiver Specifications

Table 2.3 Receiver Specifications

Rx. Freq.	1850.00-1910.00 MHz
Noise Figure	Max. 5 dB (Max. AGC Gain and min. Attenuation)
Input Signal Power	Max. Operating Power: Max. –65.9 dBm Max. Allowable Power: Max. 0.0 dBm
C/N Decrease	Min. 60 dB (blossoming, wilting, breathing)

2.1.5 BTS Power Consumption

The power rectifier used for supplying the indoor/outdoor BTS will have a dc voltage of +27Vdc nominal (+21 ~ +29 Vdc adjustable). A battery interworking is possible. The minimum current draw for a three-sector system will be 50.0 amps. A 50-amp supply is used for A- and B-side of internal power distribution. Optimum current supply should be 100 amps.

2.1.6 BTS Battery Backup System

The BTS battery backup (BBU) provides the emergency operating power in case of ac power loss. Under normal conditions, the BBU is charged by an internal charger. If ac power loss occurs, the BBU automatically comes on-line and this condition is reported to the status and control module. The BBU will power the BTS System for approximately five (5) minutes. The BBU has been sized for back-up capability over the full -40°C to +50°C temperature range.

2.1.7 BTS Environmental Characteristics

The indoor BTS will be installed in a building of such construction that the equipment is not exposed to extreme temperatures and humidity normally experienced in the country concerned. The building should contain air conditioning in order to guarantee the environmental conditions listed in the Table 2.1.

The outdoor BTS needs a stable platform for installation. The outdoor BTS has a self-contained AC or heat exchanger unit to maintain a consistent internal environment.

2.2 Operations Configurations

2.2.1 BTS System Operating Configurations

The BTS System hardware and software is designed to support the following system operating configurations.

- Omni
- Two Sector
- Three Sector

Below are the recommended installation procedures for the different system operating configurations.

2.2.2 BTS Omni and Sector Configuration

When installing the BTS in the Omni configuration, the system will consist of one (1) BTS Main Unit, two (2) GPS antennas, and TX/RX ports along with a diversity RX port.

The Omni configuration is capable of being upgraded to a sector configuration if the necessary channel cards are installed. When upgrading the Omni configuration to a sector configuration the installation time should not exceed the installation time of a newly configured sector site.

When installing the BTS in the sector configuration, the system will consist of one (1) BTS, two (2) GPS antennas, and up to six sector TX/RX ports along with a diversity RX port. Below is the recommended procedure for installing the BTS System in the sector and omni configuration.

2.2.3 Rack Configuration

Samsung's BTS supports both omni and three sector configurations. Each deployment location has unique characteristics that drive specific configuration requirements. Samsung's BTS is designed with maximum configuration flexibility. The following are some configuration examples:

- A three-sector cell uses one basic rack for one CDMA carrier and can accommodate a maximum of seven CDMA carriers with five racks.
- An omni cell uses one basic rack for three CDMA carriers and can accommodate a maximum of seven CDMA carriers with two racks.
- Table 2.4 summarizes the Samsung BTS configuration examples discussed above.
- Figures 2.3 and 2.4 show the maximum rack configuration for Samsung omni and three sector BTSs.

Table 2.4 Configuration Examples

Configuration	# of CDMA Carriers	# of Racks Needed	# of CDMA Carriers	# of Racks Needed
Three Sector Cell	1	1	7	5
Omni Cell	3	1	7	2

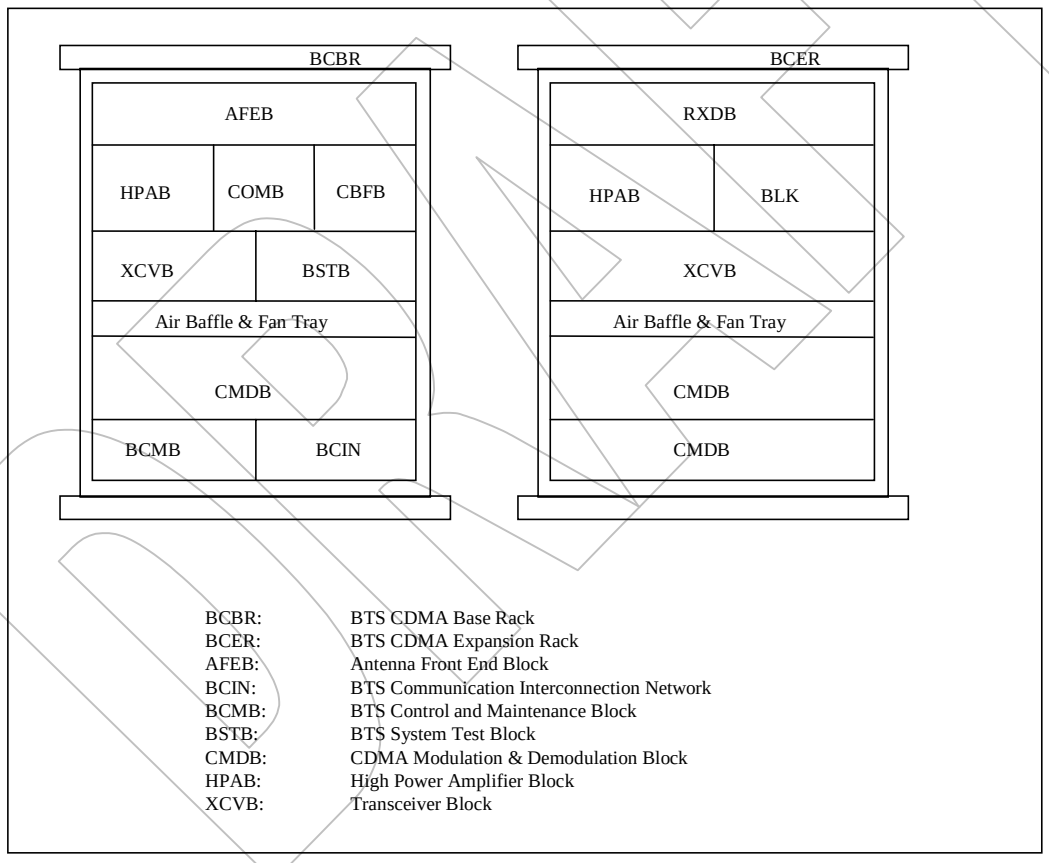


Figure 2.3 Maximum Rack Configuration for Samsung Omni BTS

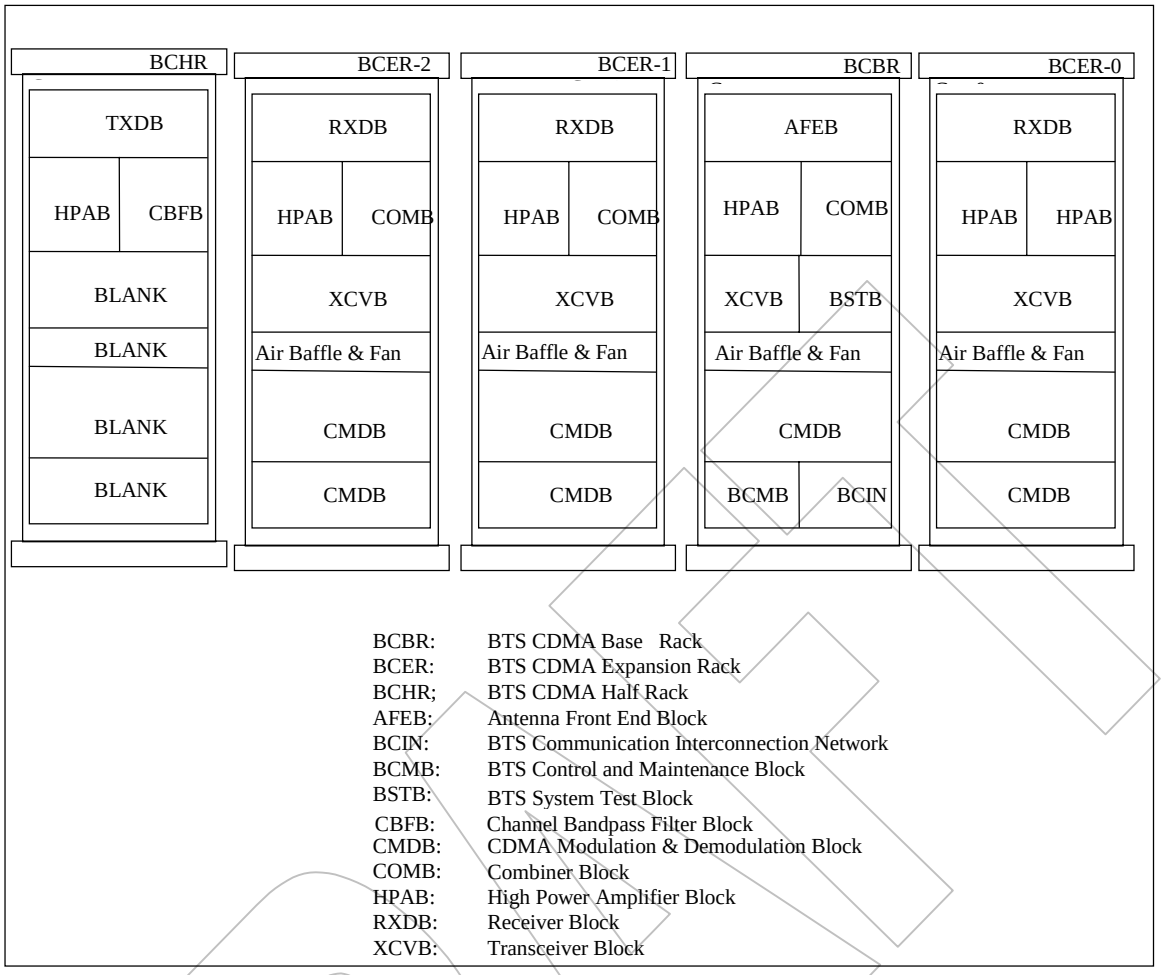


Figure 2.4 Maximum Rack Configuration for Samsung Three Sector BTS

2.3 Block Descriptions

Please refer to the rack configuration figures above. Each of the hardware blocks mentioned are described below:

2.3.1 AFEB

The AFEB (Antenna Front End Block) includes the AFEU (Antenna Front End Unit), the RXDU (Receive Divider Unit), and the TFEU (Transmit Front End Unit). The RXDU and TFEU are only employed for base stations with multiple carriers.

2.3.2 BCIN

The BCIN (BTS Communication Interconnection Network) includes the HIPA (High Speed IPC Processor Board Assembly), the HINA (High Speed IPC Node Board Assembly), and the LITA/LIEA (Link Interface IPC T1/E1 Assembly-D). The BCIN provides the BTS to BSC interface and performs packet routing for the Inter Processor Communications (IPC) in the BTS.

2.3.3 BCMB

The BCMB (BTS Control and Maintenance Block) includes the SCPA (Subsystem Control Processor Board Assembly), the CSAA (Cell Site Alarm Assembly), the GPSR (Global Positioning System Receiver), and the PCU-B (Power Converter Unit in the BCIN block). The BCMB performs the following major functions:

- It generates and distributes system clock and TOD from the signals received from the GPS antenna.
- It compensates the clocks for network synchronization.
- It manages the hardware and software of the BTS.
- It monitors and reports hardware alarms.

2.3.4 BSTB

The BSTB (BTS System Test Block) performs diagnosis and maintenance of the receive and transmit antennas.

2.3.5 CBFB

The CBFB (CDMA Band-pass Filter Block)

2.3.6 CMDB

The CMDB (CDMA Modulator and Demodulator Block) includes the CCEA (CDMA Channel Element Assembly), the CATA (Control and Transmit Assembly), the CABA (Clock distribution/AGC Bank Assembly), the SICA-A (Sector Interface Card Assembly-A), and the PCU-F (Power Converter Unit-F). The CMDB performs the following major functions:

- It performs baseband to IF upconverting.
- It performs IF to baseband downconverting.
- It handles the receive IF Automatic Gain Control (AGC).
- It performs the CDMA Modulation and Demodulation.

2.3.7 COMB

The COMB (COMbiner Block) combines the output signals from each HPAB into the input signal for each AFEB. It acts as a 3-way power combiner.

2.3.8 HPAB

The HPAB (High Power Amplifier Block) receives signals from the upconverter of the transceiver unit, amplifies the signals by 46dB, and sends then to the AFEB. The HPAU (High Power Amplifier Unit) is a linear amplifier and can amplify one CDMA carrier

2.3.9 RXDB

The RXDB (Receiver Distribution Block) transfers signals received from the AFEB to the XCVB of each rack.

2.3.10 XCVB

The XCVB (Transceiver Block) includes the XMCU-A (Transceiver Master Control Unit-A), the XSCB (Transceiver Slave Control Board), the TUCB (Transmit Up-Converter Board), the DCRB (Diversity Cell Receiver Board), and the TPSU (Transceiver Power Supply Unit).

3 INSTALLATION PLANS AND PROCEDURAL GUIDELINES

The installation, deployment, and maintenance of the BTS System by Samsung requires qualified, experienced personnel. The following installation instructions have been written for such personnel.

The BTS provides the air interface transmission and reception of the CDMA signal. The BTS is physically mounted near the antenna and may operate indoors or outdoors. The installation of the BTS Main Unit is estimated to take less than five days to install, provided that the ac/dc power and T1/E1 lines are available on-site. The below procedures should be followed where there is no superseding documentation.

3.1 Entrance Criteria

Prior to the BTS System installation start date, the project scope of work, RF performance data, and the site configuration installation specifications should be thoroughly reviewed by all key personnel. All phases of the project will be completely understood to ensure the end results meet all the customer's desired objectives.

The following guidelines shall be completed before installation of the BTS System begins:

a. Verify that the site survey and structural analysis is complete. (see appendix B)
b. Determine the mounting location for the BTS.
c. Determine the location of the ac/dc power connection.
d. Review all required safety requirements prior to commencement of work.
e. Remove the units from the shipping containers. Save the packaging material and shipping container for reshipment of the units if necessary. Compare the part numbers indicated on the BTS units to the purchase documentation to be sure that all material is received.
f. Upon receiving the BTS System, verify that the units are not damaged. Notify the carrier promptly if any damage is noted.

3.2 Required Materials

It is recommended that a thorough and complete check of the BTS equipment and installation list of materials is performed to determine the system breakdown and contents. A determination of the system staging requirements shall be made prior to shipping equipment to site.

Note: *This list is preliminary, a final list will be developed once the BTS design is complete.*

3.2.1 Recommended Tools

A thorough understanding of all system installation requirements is necessary to determine the required tools to complete the BTS installation.

Table 3.1 Recommended Tools

Digital multimeter	1
# 2 Philips screwdriver 4" and 1"	1
Straight edge screwdriver	1
Cable cutters	1
Crimp tools for RF cable	1
Crimp tool for power cable	1
Heat gun	1
Shrink-wrap	TBD
Solder iron	1
Solder	10ft
Crowbar	2
GPS antenna	2min/14max
RF cable for GPS antenna	< 170 feet
RF splitter for each unit (GPS)	5
Two RF cable for each unit after splitter for GPS	10
May need eight-way splitter for GPS antenna	1
Cable for power feed	TBD
Cable for grounding plane	TBD
Cable for RF feed from GPS antenna	TBD
Cable for T1 connections	10
Tie wraps 3" and 6"	50each
Wire wrap tools	16-24 gauge
Adjustable wrench 4"	1

5/16 wrench	1
Soft grip pliers	1
Insulated tape	2 rolls
Crimp connectors for power cable (brown)	30
Crimp connectors for grounding cable	30
3/8" drill	1
Drill bits	1 set
Knife	1

Note: A preliminary tool list is developed, however a tool list can change per a customer's needs.

3.3 Assemble, Inventory, and Stage

Upon arrival at the site, the installation team shall inventory all equipment and materials on hand. Upon completion of the inventory, the installation team leader shall notify the field program manager of missing items required for completing the installation. See appendix A for list of cards.

3.4 ANCHORING BTS PROCEDURE

3.4.1 BTS Mounting

When the BTS System is installed indoors several scenarios for installation are possible. The interior floor construction will vary from building to building, however a complete mounting procedure for a variety of floor conditions is listed in Appendix H.

3.5 GROUNDING BTS PROCEDURE

Build cable that is able to connect the ground plane from the backplanes to the central grounding point of the BTS.

Connect ground to backplanes using terminal lugs and green cable to code.

Verify ground connections using a digital multimeter. Ground should be less than 5 Ohms to ground.

3.6 RF/Power/Data Cable Installation

It is extremely important to inspect the cable for any possible damage not only while it is on the reel, but also as it is being installed. This includes unpacking and checking all cables shipped in cartons. If possible, perform any electrical testing on the cable prior to installation to avoid costly rework time. Also, this minimizes the possibility of damage to other cables caused by removal of the defective cable.

When bulk cable is used, field attachment of connectors at the antenna end must be completed before hoisting. Remove the protective cap just prior to use. Attach the connector to end of bulk cable in accordance with connector manufacturers' instructions. If an adapter is needed to match the cable connector with the antenna input, ensure that the adapter and connector are mated with the recommended torque.

3.6.1 Hook Up Power

a. Select the correct lug for cable. Butt and strip the installation the length of the lug barrel.
b. The wire surface shall be clean.
c. Place lug in tool with wire side toward smaller movable indent of crimping tool.
d. Select the correct crimper and crimp the lug on the cable. (Only one crimp is required on insulated lugs.)
e. Route a 2AWG cable from the rectifiers to the top of the BTS rack. (Cable size is dependent upon the load.)

f. Connect the two-hole power lug to the positive and negative bar and screw the bolt in tight. (See figure below for correct install.)

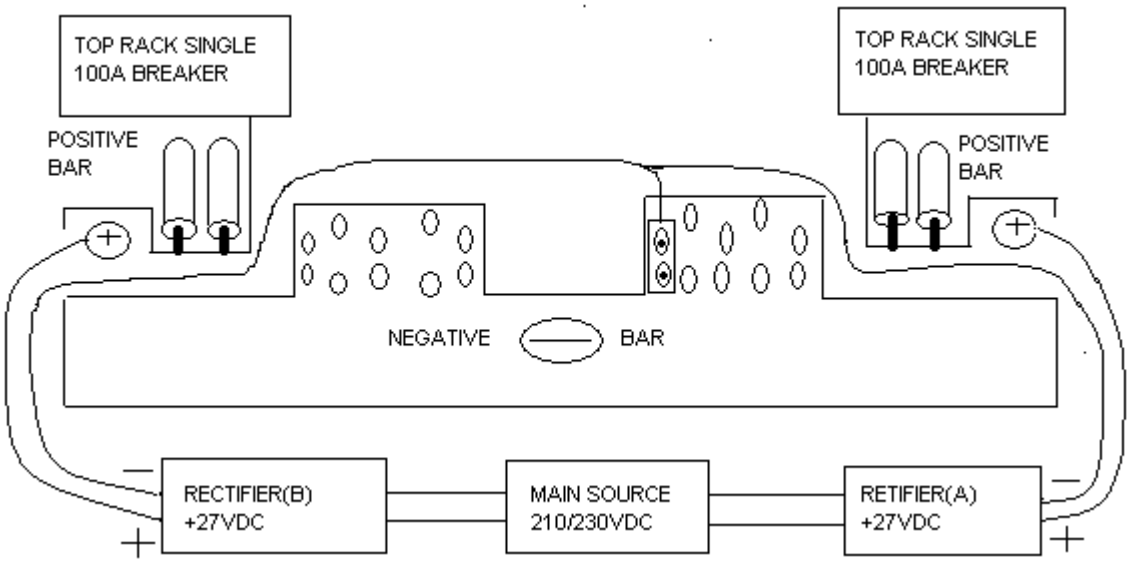


Figure 3.1 Power Bus Bar

3.7 T1/E1 I/O Cabling Installation

When installing the T1/E1 cable to the BTS, use CO-type shielded cable provided by the local telephone utility. The following procedure should be followed to connect the T1/E1 interface cable to the BTS. Figure 3.2 below shows the T1/E1 I/O Cable installation diagram.

3.7.1 Make T1 Connectors

a. Two 24 pins male connectors.

b. 24AWG solder type cables.

c. Two twisted pairs for a T1 connections. One pair for Tx and another pair for Rx.

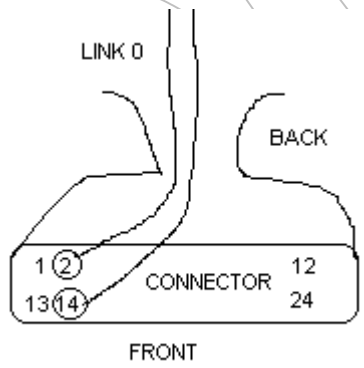


Figure 3.2 T1 Connector

(For the BTS to operate you need only link 0, but the max number of links you can use are 4.)

Table 3.2 T1 Connector Table

T1 Twisted Pair TX Connector Table				T1 Twisted Pair RX Connector Table			
Pin Out		T1 Links	Cable Color Codes	Pin Out		T1 Links	Cable Color Codes
1	13	Not Use		1	13	Not Use	
2	14	LINK 0	WH/BL	2	14	LINK 0	WH/BL
3	15	LINK 1	WH/GR	3	15	LINK 1	WH/GR
4	16	LINK 2	WH/SL	4	16	LINK 2	WH/SL
5	17	LINK 3	RD/OR	5	17	LINK 3	RD/OR
6	18	Not Use		6	18	Not Use	
7	19	Not Use		7	19	Not Use	
8	20	Not Use		8	20	Not Use	
9	21	Not Use		9	21	Not Use	
10	22	Not Use		10	22	Not Use	
11	23	Not Use		11	23	Not Use	
12	24	Not Use		12	24	Not Use	

3.7.2 Hook Up T1 Connections

Bottom shelf on the back, left side of the PC Board. (See picture below for correct install.)

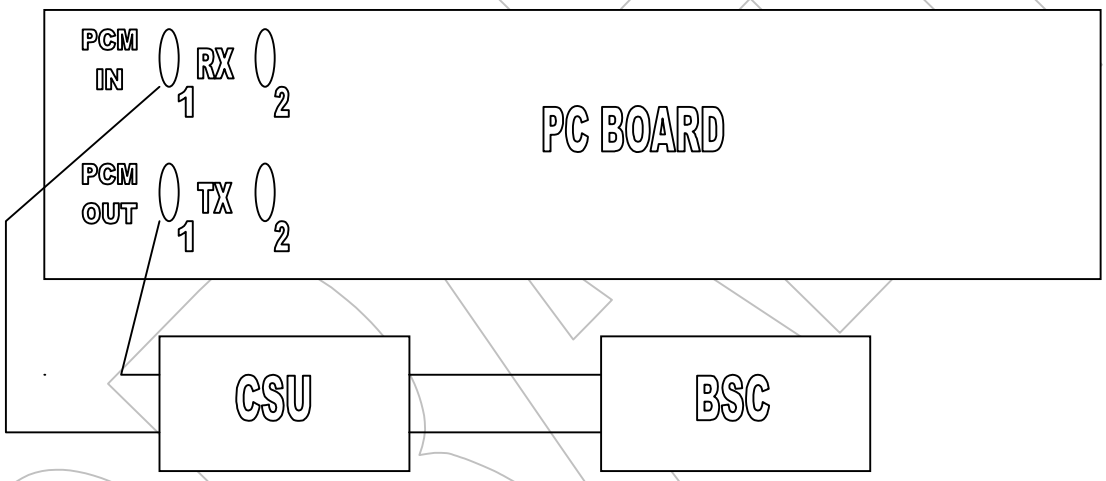


Figure 3.3 T1 Connection Backplane

T1 connection, which is defined as, the American standard for 1.544M bits PCM connection carrying 24 independent 64k bits channels.

The transmission cable connecting the T1 interface to the BTS, is terminated at the PCM terminal PC board installed in the BTS. (See picture above.)

CSU connector on primary PCM cable should be of a RJ45 type modular jack.

Pin configuration as shown in table below.

Table 3.3 T1 Pin Configuration

1	In +	R1	From Transmission Network
2	In _	T1	
3	Out +	R	To Transmission Network
4	Out -	T	

3.8 Card Insertion Procedure

Note: When handling cards have clean dry hands and wear an approved grounding wrist strap that has been tested to code. Ensure the strap is properly grounded to the equipment ground plane. Do not touch the face of cards; handle cards by the edges or handles when available.

Note: This procedure is to be performed during the **POWER ON PROCEDURE**. During the Power On Procedure you will be inserting and testing cards in a systematic process.

- Check cards for proper pins. Check for any bent, missing, or broken pins.
- Check pins on backplane for any bent, missing, or broken pins.
- Verify that connector on cards and backplanes are compatible.
- Confirm that the rails are aligned properly on the top and bottom of rack. Some rails may have moved during shipment and need to be reseated into the proper groove.
- Align card with rails in top and bottom and push card half way into the rack.

With Locking Lever: With the locking lever in the 'unlock' position (down position) slowly push card in until the lever makes contact with the rack. When lever makes contact with the rack, lock tabs into groove on rack. Raise lever into the upright 'locked' position. The lever will insert the card into the backplane. Do not attempt to push cards into the backplane.

Without Locking Lever: Follow the same procedure as the first five steps. Proceed to push the card with thumb and forefinger until faceplate is flush with the rack. Be sure to not use excessive force on the card. Hand tighten the locking screws into the rack. A straight edge screwdriver may be used to tighten the screws. Caution should be use to not strip the screws with the screwdriver.

3.9 Power On Procedure

a. Using a #2 Phillips screwdriver verify the tightness/looseness of **ALL** the screws on the cabinet and backplane boards due to vibration during shipping. Screws should be gently hand tightened with screwdriver.

b. Connect grounding to central ground plane. See section 7.3.1.

c. Racks should be empty of all cards.

d. With the power off and with circuit breakers off, check the voltage going to the circuit breakers located at the top of the cabinet. 0Vdc should be present at the circuit breakers.

e. Check for a short between the two bus bars, by ohming out the two bus bars with the DMM. The reading should be an open.

f. With circuit breakers off, turn on power rectifiers to the BTS. Check the voltage with tge DMM to the circuit breakers, verifying that +27 Vdc +/- 3 Vdc is present at the circuit breakers. Current draw should be <5 amps.

g. Turn on one circuit breaker and check the voltage at the power bus bars. The two bus bars should be isolated and voltage (+27Vdc +/- 3Vdc) should be indicated for the side that the circuit breaker was activated, no voltage should be present for the other bus bar. If voltage is present check for a short between the two bus bars. Turn off the circuit breaker and repeat for other circuit breakers.

h. With circuit breakers in the off position, install the PCU-B power supplies. No lights should be illuminated at this time. Note: refer to proper procedure for installing cards.

i. Turn on the circuit breakers; the red **fail** light should be lit.

j. Turn on the PCU-B's on the front of the panel switch. Notice the red **fail** light is extinguished and the green **power on** light is lit.

k. On the backplane of the rack, measure the voltage with a DMM at PWR1A and PWR2A. S1-4 is +5Vdc +/- 1Vdc. Note: Caution should be used in measuring high current voltage. Personnel injury and equipment damage may occur.

l. On the backplane of the rack, measure the voltage with a DMM at PWR1B and PWR2B for –12Vdc +/- 1Vdc. Pin S2 is –12Vdc +/- 1Vdc.

m. Turn off the PCU-B's and turn off the circuit breakers.

n. Install the PCU-F; notice that the red **fail** light is not lit.

o. Turn on the circuit breakers for the system and notice that the red **fail** lights are lit for the PCU-F and the PCU-B's.

p. Turn on the PCU-Fs by the front panel switch. Notice that the red **fail** light is extinguished and the green **power on** light is lit.

q. On the backplane of the rack, measure the voltage with a DMM at PA1A and PA2A. On S1 should be +12Vdc +/- 1Vdc and S3 should be –12Vdc +/- 1Vdc. Next, check PA1B and PA2B, looking for +5Vdc +/- 1Vdc on S1 and S2.

r. Turn off the PCU-F's and turn off circuit breakers.

s. Install the TPSU; notice that all lights are extinguished.

t. Turn on the circuit breakers for the system and notice only the red **fail** lights are lit for the PCU-F, PCU-B's. The TPSU's **power on** lights are extinguished.

u. Turn on the TPSU's by the front panel switch. Notice that the red **fail** light is extinguished and the green power light is lit.

v. On the backplane of the rack, measure the voltage with a DMM at P110 for +8Vdc +/- 1Vdc on pins S15 and S16.

w. On the backplane of the rack, measure the voltage with a DMM at P101 for +8Vdc +/- 1Vdc on pins S7 and S8.

x. Turn off the TPSU's.

y. Turn off the circuit breakers.

z. Install the GPSR-A and notice no lights are illuminated on the card.

aa. Turn on the circuit breakers, notice that the GPSR-A turns on. Wait 15 minutes for the GPSR-A to lock on and receive a satellite signal.

bb. Turn on the PCU-B's.

cc. Install cards one at a time into the rack powered by the PCU-B. Notice that a red **fail** light is lit on the SCPA-A card. There is no other red alarm light lit.

dd. Turn on the PCU-F's.

ee. Install cards one at a time into the rack powered by the PCU-F. Notice that on the CATA card the red CRCF and HINA lights are illuminated. Notice that on the CCEA the red DRST light is illuminated.

ff. Turn on the TPSU's and notice the that the XMCU-A **fail** light is illuminated.

gg. Do not turn on the HPAU-P until the system software has been loaded.

3.10 Exit Criteria

Installation sign off completion form. (see Appendix)

After the completion of the BTS installation, perform the system operational tests (refer to the BTS System Operational Test Procedure).

4 BTS ACRONYMS

ACRONYM	FULL NAME
A/D	**A**nalog to **D**igital
AIF	**A**ntenna **I**nter**F**ace
ASIC	**A**pplication-**S**pecific **I**ntegrated **C**ircuit
BOM	**B**ill of **M**aterial
BBU	**B**attery **B**ackup **U**nit
BSC	**B**ase **S**tation **C**ontroller
BSM	**B**ase **S**tation **M**anager
BTS	**B**ase **T**ransceiver **S**ubsystem
CCEA	**C**DMA **C**hannel **E**lement **A**ssembly
CDG	**C**ellular **D**evelopment **G**roup
CDMA	**C**ode **D**ivision **M**ultiple **A**ccess
CE-BIT	**C**hannel **E**lement **B**uilt-**I**n **T**est
CP	**C**ommunication **P**rocessor
CPM	**C**ommunication **P**rocessor **M**odule
D/A	**D**igital to **A**nalog
DC/DC	**D**irect **C**urrent to **D**irect **C**urrent
DCP	**D**ata **C**ollection **P**C
DSP	**D**igital **S**ignal **P**rocessor
EEPROM	**E**lectrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory
EPROM	**E**lectrically **P**rogrammable **R**ead **O**nly **M**emory
FOA	**F**irst **O**ffice **A**pplication
FCC	**F**ederal **C**ommunication **C**ommission
FIFO	**F**irst **I**n **F**irst **O**ut
FPGA	**F**ield **P**rogrammable **G**ate **A**rray
GPS	**G**lobal **P**ositioning **S**ystem
HDLC	**H**igh-level **D**ata **L**ink **C**ontrol
HMS	**H**eat **M**anagement **S**ystem
IEEE	**I**nstitute of **E**lectrical and **E**lectronic **E**ngineers
JTAG	**J**oint **T**est **A**ction **G**roup (IEEE 1149.1)
LED	**L**ight **E**mitting **D**iode
LIFO	**L**ast **I**n **F**irst **O**ut
LVTTL	**L**ow **V**oltage **TTL**
MAP	**M**aintenance and **A**dministration **P**C
MCU	**M**icro-**C**ontroller **U**nit
MIPS	**M**illion **I**nstruction **P**er **S**econd
MPU	**M**icro-**P**rocessor **U**nit
MSC	**M**obile **S**witching **C**enter
MTBF	**M**ean **T**ime **B**etween **F**ailure
MTTF	**M**ean **T**ime **T**o **F**ailure
MTTR	**M**ean **T**ime **T**o **R**epair
PA	**P**ower **A**mplifier
BTS	**m**ini-**B**ase **T**ransceiver **S**ubsystem
PI	**P**roduct **I**ntegrity
PLD	**P**rogram **L**oad **D**ata
PMCC	**BTS M**ain **C**ontroller **C**ard
PMU	**BTS M**ain **U**nit
POR	**P**ower **O**n **R**eset
PPM	**BTS P**erformance **M**anagement
PRU	**BTS R**adio **U**nit
PSA	**P**ower **S**upply **A**ssembly
RCVR	Receiver
RFU	**R**adio **F**requency **U**nit
RISC	**R**educed **I**n**S**truction **C**ount

SCC	**S**erial **C**ommunications **C**ontroller
SIT	**S**ystem **I**ntegration **T**est
SRAM	**S**tatic **R**andom **A**ccess **M**emory
TAP	**T**est **A**ccess **P**ort
TBD	**T**o **B**e **D**etermined
TBR	**T**o **B**e **R**efined
TBSL	**T**o **B**e **S**pecified **L**ater
TFC	**T**ime and **F**requency **C**ard
TFU	**T**ime **F**requency **U**nit
TRIC	**T**ransmit and **R**eceive **I**nterface **C**ard
TTL	**T**ransistor/**T**ransistor **L**ogic
UART	**U**niversal **A**synchronous **R**eceiver **T**ransceiver
UL	**U**nderwriters **L**aboratories
XCVR	Transceiver
XMTR	Transmitter

Appendix A Inventory for Each Type of Configuration

	Level			SEC Code	Omni				Sector				Definition
	L1	L2	L3	L4	1FA	2FA	3FA	4FA	1FA	2FA	3FA	4FA	
	ASS'Y			125-408101 AAAA	1	I	I	I	1	1	1	1	Master Control Unit Rack
	SIS	SIBB	-	650-754107 AAAA	1	1	2	2	1	1	2	2	Sector Interface T1board
		TFCA	-	650-754102 AAAA	2	2	2	2	2	2	2	2	Tin & Frequency Control Assembly
		SICA	-	650-754103 MAA	2	4	6	8	2	4	6	8	Sector Interface Assembly
M		PCU-S	-	953-140043 CE	2	2	4	4	2	2	4	4	Power Control Unit-Sis
	BIS	RBBP	-	&50-754904 AAAA	I	I	I	1	1	1	1	1	Router & BTS IPC Processor Backboard
		HIPA	-	650-754932 AAAA	2	2	2	2	2	2	2	2	High Capacity IPC Node Assembly N
		HINA	-	650-754933 AAM	4	4	4	4	6	6	6	6	High Capacity PC Processor Assembly
C		LITA	-	650-754934 AAAA	2	2	2	2	2	2	2	2	Link Interface T1 Assembly
		LIEA	-	650-754935 AAAA	2	2	2	2	2	2	2	2	Link Interface El Assembly
		PCU-B	-	953-140043 CC	2	2	2	2	2	2	2	2	Power Control Unit-Sis
	BCS	BCBB	-	650-754108 AAAA	1	1	1	1	1	1	1	1	BTS Control Backboard
U		CSAA	-	650-754105 AAAA	2	2	2	2	2	2	2	2	Cell Site Alarm Assembly
		SCPA	-	650-190008 AAAA	2	2	2	2	2	2	2	2	Subcontrol Processor Assembly
		PCU_B	-	953-140043 CC	2	2	2	2	2	2	2	2	Power Control Unit-BCS
	BTUS	ASS'Y	-	125-406700 AAAA	I	I	I	I	I	I	I	I	Basestation Test Unit Shelf
		BTBB	-	650-754670 AAAA	I	I	1	1	1	1	1	1	BTU Backplane Backboard
		RSWU	ASS'Y	125-406710 AAAA	3	3	3	3	3	3	3	3	RF Switch Unit

Appendix B Site Survey

Customer_____ Date_____

Comment_____

Site_____ State_____

Site Physical Address_____ Phone# _____

Site Point of Contact_____

Site License Information

Tower Hgt.	
Latitude	
Longitude	
County	
City	
State	

GPS Reading

Latitude	
Longitude	

	Existing Radio	Freq.	AZ	Pol	Antenna Ht	Rx Site
1						
2						
3						
4						
5						

Customer File Information

_____

_____

_____

_____

Property/ Site Requirements (if applicable)

Yes	No	Description	Comments:
		Site acquisition	
		P&Z support	
		Legal survey	
		Soil test	
		Site drawing package	

Tower Information

New_____ or Existing_____

Type: Guy_____ or Self Support_____ or Monopole_____Tower Height_____

Comments_____

Design Load: EIA/TIA_____ or Other_____

Wind_____ Ice_____ Applied Simultaneous? Yes___No____

Guy Ratio: 80%_____ or Other_____

Tower Orientation: Magnetic_____ or True North (if known)_____

Tower Light? Yes_____No____ Tower Painted? Yes___No____

Strobe / Beacon Mfg_____

Antenna Loading: Existing (visual

Item	Qty.	Size/ Type	AGL	AZ	W/G- Coax

Comments_____

_____

_____

_____

Tower

Yes	No	Description	Comment
		Existing tower- analysis	
		Tower mod. material	
		Antenna pipe mounts (4 ½"x 10')	Are they long pipes?
		Vertical W/G ladder	
		W/G bridge	
		EF&I new tower	
		Light kit-strobe Red Beacon	
		Paint	
		Safety climb device	
		Freight	
		Tower foundation	
		Tower erection	

Antenna System

Yes	No	Description	Comment
		F&I antennas	
		F&I transmission lines	
		Antenna system testing	
		Freight	
		F&I GPS antenna	

Shelter

Yes	No	Description	Comment
		Existing- size & type	
		New- size & type	
		Foundation- slab or piers	
		Freight- *	
		* Is special handling required for delivery to the site (off highway)	
		Off-load & set up	
		Electrical hook-up	

Comments_____

Building Layout

Yes	No	Description	Comment
		Existing cable tray	
		Floor to ceiling (height)	
		Floor (type)	
		Equipment position	
		Equipment anchoring	
		* Is special handling required for delivery to the site	
		Off-load & set up	
		Electrical hook-up	
		Cable installation	
		DC power system	
		Charger installation	
		Battery installation	
		Telco installation	
		Existing ac system	

Comments_____

Site Grounding

Yes	No	Description	Comment
		Tower existing or new?	
		Shelter existing or new?	
		Upgrade?	
		Soil type (rock, normal etc..)	
		Meg test (5ohm min.) required?	
		Isolated ground plane	
		Connecting method	
		Grounding installation requirements	

Site Electrical

Yes	No	Description	Comment
		Existing (100amp or 200amp?)	
		F&I service pole	
		Distance to shelter	
		F&I generator (size)	
		F&I fuel system (type)	
		Tank Required (Size 250/ 500gal?)	

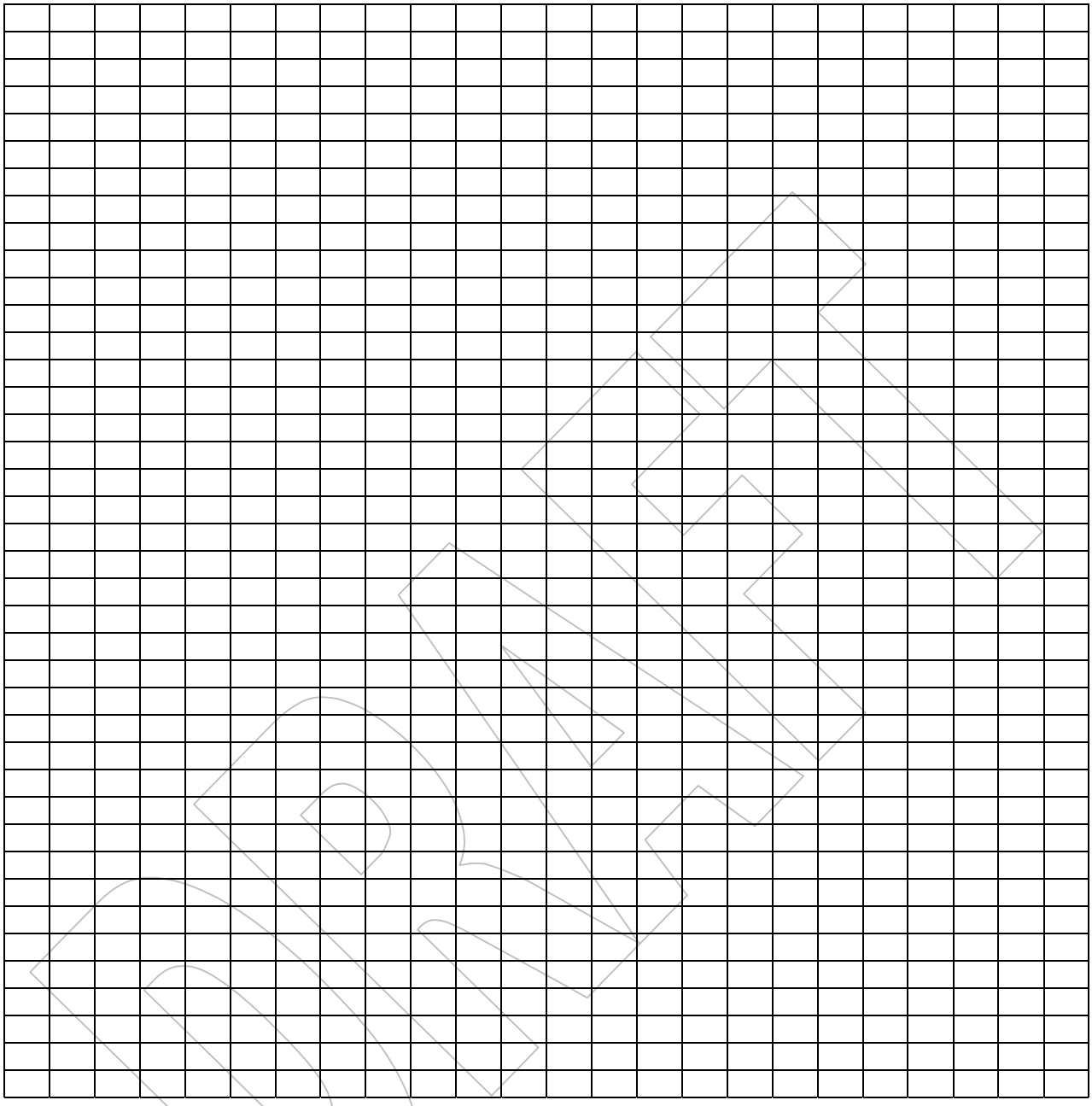
Commercial Power Company

Site & Civil

Yes	No	Description	Comment
		Clear & Grub Site Area	
		Access Road (width & length)	
		Regrade road?	
		Site Fencing (height)	
		Anchor Fencing (type, walk gate ?)	
		Site Gravel & Weed Barrier	
		Site Clean-up	

Comments_____

Site Sketch: indicate North arrow



Appendix C Antenna Installation

1 ANTENNA INSTALLATION

Selection of an antenna is made after determining the application, performance requirements, and location of the proposed system. Criteria for selecting an antenna and transmission system include operating frequency, radiation pattern, gain, polarization, and windload.

Typical antennas used in the PCS band are Omni and directional. Directional antennas must be aimed properly for the communication system to perform to the desire specifications. Some antenna manufacturers indicate the direction of the main lobe with a dot, arrow, or external marker on the side or base of the antenna. It is imperative that the antenna is mounted vertically (plumb) or as designed to achieve the correct radiation pattern.

When installing an antenna it is essential to follow the Manufacturer Installation Instructions provided with the antenna. Read the instructions thoroughly before assembly. Follow sequences for the proper assembly and operation of the antenna.

Carefully remove all parts from shipping boxes. The contents should correspond with the parts list. Any damage or shortage will prevent satisfactory assembly, installation, and operation of the antenna.

Antenna mounts and sidearms shall be either welded or bolted in place and shall be plumb. A corrosion-resistant material shall be used for the mounting devices.

Commonly, sidearms extend the antenna either three to six feet away from tower. By moving the antenna at least one wavelength away from the tower mast, the mast becomes less of an influence on the radiation pattern.

An Omni-directional antenna should be mounted as far away from the tower as possible to minimize the effects on the radiation pattern.

1.1 Roof-Top

Where the BTS antenna supports are attached to a building or located on a rooftop, the support, if made of metal, and all guy wires should be bonded together and connected to the metal frame of the building by a # 6, or larger, copper conductor. The grounded BTS Units and the antenna supports or their grounding conductors should have either at least 2-m (6-ft) separation from other grounded structures or should be bonded to them by a # 6 copper conductor.

The following procedures shall be followed when installing the BTS System:

a. Upon receiving the BTS System, verify that the units are not damaged. Notify the carrier promptly if any damage is noted.
b. Remove the units from the shipping containers. Save the packaging material and shipping container for reshipment of the units if necessary. Compare the part numbers indicated on the BTS units to the purchase documentation to be sure that all material is received.
c. Verify that the site survey and structural analysis is complete.
d. Determine the mounting location for the BTS antenna rooftop-mounting platform.
e. Determine the location of the ac/dc power connection.
f. Review all required safety requirements prior to commencement of work.
g. When installing the BTS antenna mounting platform, ensure that the platform is set level on the roof's surface. Secure the platform to the roof's surface using the manufacturer's recommended installation material and procedures. Ground the antenna-mounting platform per EIA-RS-222 (Latest Revision).

h. After securing the antenna-mounting platform to the rooftop, install the antenna using the manufacturer's recommended installation material and procedures.

i. Install the antenna-mounting bracket using the mounting hardware provided in the antenna mounting kit.

j. Mount the transmit and receive antennas to the antenna mounting brackets. Torque the nuts and bolts to the manufacturer's recommended specifications.

k. Install the RF cables between the BTS and antenna assemblies.

l. Secure all the system interconnect cables with the manufacturer's recommended cable hanger kits every three feet. Verify that the proper cable hanger spacing and torque specifications are followed.

m. The system interconnect cables should be grounded to the antenna mounting structure along the vertical run near the top, middle, and bottom near the interface connector to the BTS using a standard coaxial cable grounding kit such as Andrew Grounding Kit 241088-1 or equivalent.

n. After the completion of the BTS installation perform the system operational tests refer to the BTS System Operational Test Procedure.

1.2 Monopole Tower

The BTS antennas in most cases will be installed on a monopole tower. If the site is an existing tower several areas should be reviewed prior to beginning the installation of the BTS System.

Review the site and tower construction drawings to ensure that the tower is installed and grounded in accordance with EIA/TIA-222 Standards (latest revision).

1.3 Guyed/Self-Supporting Tower

When using a Guyed tower the two vertical supporting legs of a tower should be grounded to the individual ground system of the tower. Tower grounds should be tied together at the base and a ground wire installed between the nearest tower base ground and the outside cabinet perimeter grounding system. Guyed towers with guy wires anchored in concrete should have one or more ground rods at each anchor in order to equalize earth potentials around the anchor. The guys should be bonded together at the anchor with # 6, or larger, copper wire and connected to the anchor ground rods.

All Self-supporting towers should have a 5/8 in. (16mm) ground rod driven not less than 8 ft. (2.5 m) into the ground at the base of each footing and bonded to the tower leg with a # 6, or larger, copper conductor. Interconnection of the tower and building grounding system is made external to the building. Where wires connecting to the ground crosses, they should be bonded together to avoid arcing. Also, care should be taken in placing grounding conductors to maintain an appreciable [2 m (6 ft) or more] separation from other grounded metal parts that may be hidden within the building structure, such as structural members; steam, gas, or water pipes, etc. Where such members are accessible, numerous bonds to the systems grounding conductors are desirable to prevent arcing.

Review the site and tower construction drawings to ensure that the tower is installed and grounded in accordance with EIA/TIA-222 Standards (latest revision).

When installing the BTS System units on a Self- Supporting or Guyed Tower, care must be taken when attaching the mounting kits to the tower members.

Position the BTS mounts on the tower mounting pipes on the tower at the height required as per the site Engineering Drawings. Attach the mounts to the tower with the manufacturer recommended hardware.

Raise the BTS units and carefully position them so that the appropriate mounting brackets rest on the BTS mounting supports attached to the tower. Secure the units to the support mounts following the manufacturer recommended procedures and torque specifications.

1.4 Cable Hoisting

Obtain suitable hoist line that will adequately support weight of the cable. Refer to cable Manufacturers Installation Instructions for approximate weights per 100-foot (30m) length of various size cables.

Use a cable pulley high on the tower to allow cable connection to antenna, and another pulley at the bottom of tower. Most lengths can be hoisted manually; however, a winch is recommended for heavy lifts.

Support the reel on an axle to permit free rotation as the cable is hoisted. Cable paying off the top is the safest method for heavily loaded reels. For lighter loads, which can be broken by hand, reels can be positioned 180 degrees opposite so cable pays from bottom of reel. Uncoil short length not on reels along ground and away from tower.

Place protective covering over the connector to prevent damage during hoisting. Attach a rope sling or cable grip near the end of the cable allowing sufficient length to reach the antenna input from hoisted cable position. Tie the end of cable to the hoist line to keep from dangling. The rope sling may be in lieu of cable grips for very short lengths. When installing lengths more than 150 feet, additional cable grips at 100 to 150 feet are required. Additional tying is done above and below the cable grips to keep weight on the hoist line and not on the cable. Make certain to allow slack in the cable when tying and that slack is maintained in the cable while hoisting. Use fiber-reinforced tape or similar material at 50 intervals for tying as the cable is raised.

Note: Never use hoisting grips at intervals more than 200 feet.

Hoist cable slowly. To prevent kinking, rotation of reel must be retarded to control payout of cable. Avoid snags when hoisting or routing cable through and around tower members. Careless handling can cause kinks, dents, and scrapes. Do not make bends shorter than the cable minimum bend radius. Care must be taken to apply an even pressure when forming cable. When routing is confined and shorter bends are required, a jumper assembly with a greater bending radius should be used.

Note: The following warnings are presented to alert you to possible dangers in misusing Hoisting Grips. Failure to adhere to a warning may result in injury or death to you or to others.

Do not use one hoisting grip for hoisting two or more cables. This can cause the hoisting grip to break or the cables to fall.

Never use hoisting grips for lowering cable. Snapping of the cable may loosen the grip and possibly cause the cable to sway or fall.

Do not reuse hoisting grips. Used grips may have lost elasticity, stretched, or become weakened. Reusing hoisting grips can cause the cable to slip, break, or fall.

Make sure the size of the hoisting grip matches the size of the cable. Slippage can occur with a larger hoisting grip and insufficient gripping strength can result with a smaller grip.

Maintain tension on the hoisting grip during hoisting. Loss of tension can cause dangerous movement of the cable and result in injury or death to you or others on or near the tower. Also, do not release tension on the grip until after the cable has been fastened to the tower members.

1.5 Cable Anchoring

The main feeder line in an antenna system may be from ¼" to 2 ¼" or up to several inches in diameter. The antenna lines should be secured using corrosion-resistant hardware. Attachment to the tower can be accomplished using beam clamps, butterflies, donuts, and snap-in clamps, etc. The method of securing the line is dependent on the type of tower and the unique requirements of each customer. However, below are some standard guidelines to follow when anchoring antenna transmission lines.

After the cable has been raised to the correct height, anchor it to a tower leg beginning near the antenna or masthead electronics. Attachment to lighting conduit or vertical angle iron is recommended for installation where tower members do not provide adequate or convenient hanger support.

Space hangers one foot apart for the first three at the top of vertical run and three feet apart thereafter. Allow enough cable at the antenna end to accommodate changes at the antenna position and to prevent strain at antenna input connection. If distance from feed termination to the first hanger is more than three feet, the cable must be supported. Maintain hoist line tension until anchoring is completed.

1.6 Cable System Grounding

The transmission line system is probably the most likely path for surges to enter the site. It is critical, therefore, that this system be thoroughly grounded. All transmission lines cellular and non-cellular must be properly grounded. The transmission line outer conductors shall be grounded at the following places:

- Top of the vertical run on the tower
- Bottom of the vertical run on the tower
- Point of entry to the radio equipment

If the tower is greater than 200 feet, additional grounding kits must be installed. These additional kits are installed to ensure there is no more than 200 feet of transmission line between ground kits. Grounding of transmission lines is to be accomplished with the use of appropriate kits supplied by the transmission line manufacturer. These kits are to be installed as follows:

On top of the tower, each ground kit is to run from the transmission line to the tower or a steel bar attached to the tower (thereby establishing a good electrical connection with the tower). The tower then becomes the main conductor of any surges to ground. The same type of connection is used at any mid-tower grounding points.

At the bottom of the vertical run, the ground kits are run either to the tower or a steel bar attached to the tower. The tower again becomes the main conductor of any surges through the transmission lines. It is not required to run a separate lead from the steel bar to ground, as the tower is a good conductor.

At the point of entrance to the radio equipment, the ground kits are connected to the External Ground Bar. The EGB should be equipped with either a 2-inch copper strap or two #2 AWG tinned, solid, copper wire, positioned at opposite ends of the EGB. The straps or wire are to be exothermically bonded to the EGB and the EGR (External Ground Ring). All connections form the EGB to the EGR will pass through an insulating pipe such as PVC, extending from several inches above the ground to at least 12 inches below ground. This will greatly reduce the step voltage hazard.

1.7 Horizontal Cable Runs

Route all cables from the base of the tower to the radio equipment. Cables can be buried or supported. Attach above ground cables to horizontal support members using the same type of hangers at three feet intervals as in the vertical runs. Exposed horizontal runs should be protected from the weight of accumulated ice and damage from falling ice or other objects.

Buried cable should be below the frost line and at least three feet deep for protection against damage from heavy vehicles and objects. A 4-inch layer of sand under and over buried cable is adequate to protect the jacket from stones or other sharp objects. Splices on buried cables must be thoroughly covered with plastic cement and tape. Markers should be placed at convenient intervals over buried cables especially splices.

All inter-connecting cabling between the BTS, antenna system, power system, and central office shall be checked for continuity and proper installation.

Appendix D GPS Antenna Installation

The GPS antenna with an N-Type connector, is typically a 3" diameter circularly polarized antenna with an integrated preamplifier. A +5 volt dc bias is required via the center conductor to provide dc power for the integrated low-noise preamplifier. Two GPS antennas are used for redundancy, the system will work with only one antenna with the signal being split to the two receivers.

Install the GPS antenna using the following recommended procedures. Where the below procedures are different from the GPS Antenna Manufacturer Installation Procedures, the manufacturer's procedures should be followed.

a. Mount the GPS antenna mounting pipe mast per your site requirements. If suitable stainless steel attachment hardware is not provided with the GPS antenna by the manufacturer, then it must be procured locally.
b. Attach the GPS antenna/mount assembly to the top portion of the pipe mast with a stainless steel pipe clamp and two (2) #10-32 screws.
c. Position the coaxial cable connector (male-end towards antenna) against the mast with the connector at underside of the GPS antenna. DO NOT connect the coaxial cable to the antenna at this time.
d. When using round member adapters, attach two cable hangers with cable supports installed to the pipe mast; one hanger 8" – 10" below the GPS antenna and the other positioned to adequately secure the remainder of the cable run to the pipe mast. Loosely secure cable in hangers.
e. Install the GPS antenna manufacturer-recommended weather proofing kits to the antenna and cable interface.
f. Install grounding kits to coaxial cable per the manufacturer's recommend procedures.