PRODUCT SPECIFICATION
(DOC. NO:A9.20.0001.PS.EXT)

AND

PICO BTS INSTALLATION AND COMMISSION PROCEDURE
(DOC. NO.:A9.10.0004.CMM)

COMPLIANCE CERTIFICATION SERVICES DOCUMENT NO:CCSUP4031A
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

AVALCOM

Aval Communications Inc.
IS-136 Picocell BTS

Product Specification
(A9.20.0001.PS.EXT)

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Author(s): Mahesh Narayanaswamy
Steve Fielding

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- Power supply - to provide regulated DC voltages to the other BTS modules
- RF Branching - to combine the RF output of the radios and connect them to antennas

The Radio and Vocoder functions reside on the Radio Card. The Scanning Receiver functions reside on a separate card. The BTS Controller and Network Interface functions are provided in the controller card. The radio cards and the controller card are connected using the backplane. The Power supply and Master Oscillator reside on a single board next to the backplane, and the RF Branching and combining functions are located on the branching board. The top level functional description of each of these functions is included in this document.

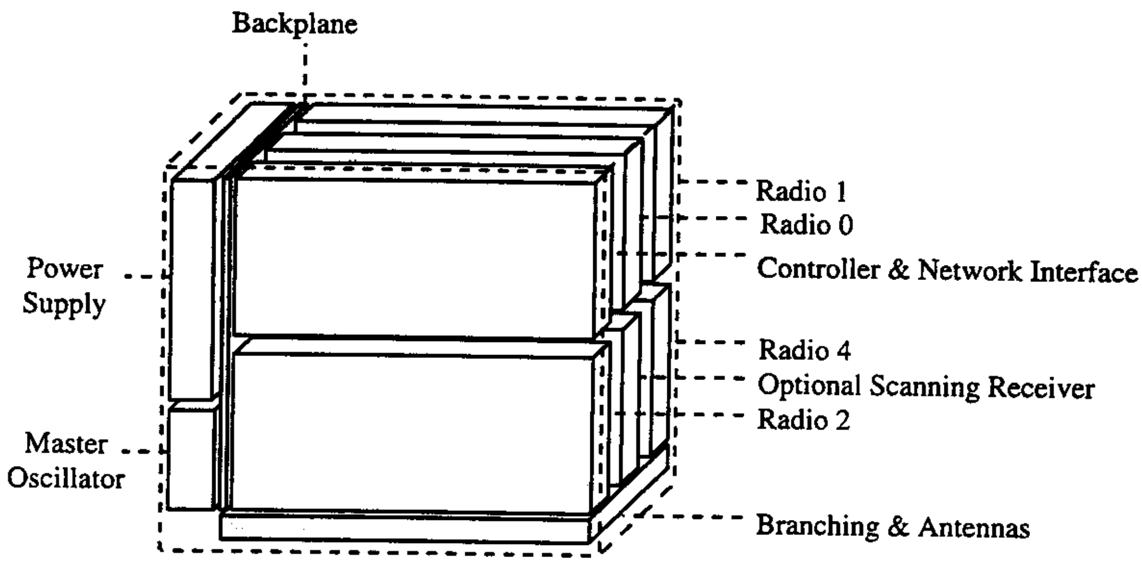

Figure 1 - Packaging of WBSU (approximately 12x12x5 inches)

2. Reference

[1] TIA/EIA/IS-136.1, TDMA Cellular - Radio Interface - Mobile Station - Base Station Compatibility - Digital Control Channel
T1A/EIA/IS-136.2, TDMA Cellular - Radio Interface - Mobile Station - Base Station Compatibility - Traffic Channel and FSK Control Channel
[2] EIA/TIA/IS-138, TDMA Cellular - Radio Interface - Minimum Performance Standards for Base Station
[3] IS-130, TDMA Wireless System - Radio Interface - Radio Link Protocol 1

4. Picocell System Overview

The picocell system block diagram is shown in Figure-3. It shows the connections between the Picocell BTS and the rest of a typical wireless office system. The T1 connection provides the line interface between the Picocell BTS and the Wireless Office Service Controller (WOSC). The T1 connection can be daisy-chained to serve multiple Picocell BTSs from one T1 port on the WOSC. Each time slot on the T1 interface transports a single DTC. The connectivity between T1 time slots and radios is dynamic, in that any T1 time slot in the pool of traffic time slots can be assigned to any call. The first T1 time slot is reserved for broadcast messages to all BTSs.

The Picocell BTS also supports compressed voice so that 6 DTCs can be supported on a single T1 time slot. This capability allows many Picocell BTSs to be daisy-chained on a single T1 from the WOSC.

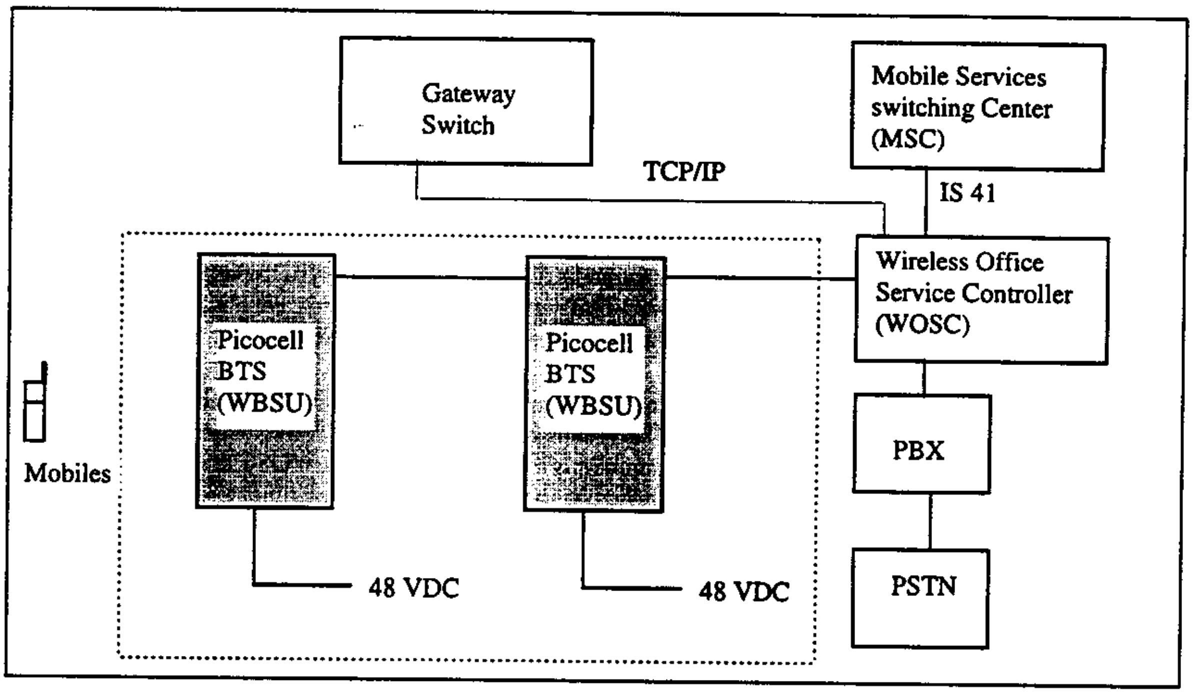

Figure-2 Wireless Office System (WOS)

The WBSU functional block diagram is shown in Figure-4. Within the Picocell BTS, the BTS controller communicates with other modules using the back-plane bus.

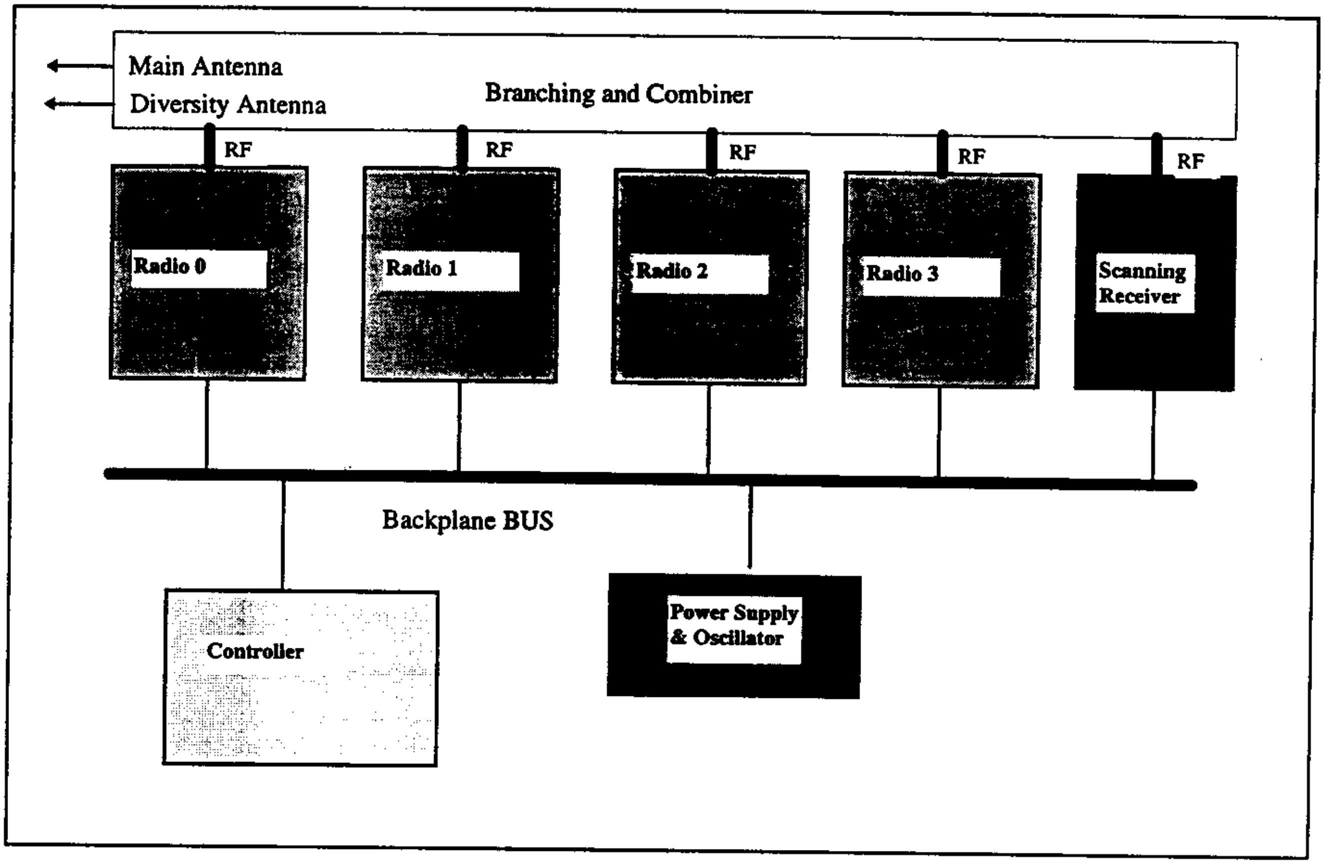

Figure-4. WBSU Functional Block Diagram

- Boot ROM to store the boot load code for booting up the controller.
- Flash ROM for file storage.
- DRAM to be used as program and data memory.
- Three optional bi-color LEDs, which are used to indicate the current state of the controller card.
- Two T1/E1 transceivers. One to provide voice/control connectivity between the WBSU and the WOSC, and a second T1/E1 transceiver to provide a daisy chain connection to the next WBSU.
- A clock generation unit to provide all the system clocks for the WSBU operation.

5.2.1.1 Control Links External to WBSU

There is one external control link between the WBSU and the WOSC (HDLC over the T1), one local serial link for maintenance purposes (RS232 maintenance port), one optional serial port for test purposes (RS232 PPP port), and finally one control link between the WBSU, and the next WBSU in the chain (HDLC over T1).

The control link from the WOSC to the WBSU units, consist of between one and three full duplex DS0 channels per WBSU, this allows for a communications bandwidth of between 64 and 192kbps per WBSU. These DS0 channels are carried by the T1 link from the WOSC to the WBSU, where the complete T1 span is extracted by the T1 transceiver 0, converted to the back-plane bus format , and output from the transceiver to the switch. The switch extracts the HDLC channels that are intended for the current WBSU and routes them to the message DSP where they encoded and decoded, and made available to the RISC processor through the shared memory interface. HDLC channels that are intended for the next WBSU in the chain are routed by the switch onto the back-plane bus, which connects from the switch to T1 transceiver 1.

Maintenance support is provided by a local RS232 port connected directly to the RISC processor, and accessible through an RJ45 connector on the front panel of the controller card. In addition there is an optional RS232 connection for a PPP port, which is also available through a front panel RJ45 connector.

5.2.1.1 Voice Connection

Voice connection from the WBSU is provided by the same T1 link as used for the HDLC control link. The DS0 channels that contain voice information are routed by the switch to the message DSP in the case of compressed voice, where they are repackaged between two different formats (6 voice per DS0 on the T1, and 3 voice per ST slot on the back-plane bus link to the radios), and routed on the back-plane bus which connects to the radios. In the case of 64kbps PCM voice, the switch routes the voice directly to the radios via the back-plane bus.

Voice channels intended for down-stream WBSU are routed by the switch from transceiver0 to transceiver1, via the back-plane bus.

5.2.1.1 Radio Control

All the radio control and status information between the RISC processor, and the radios is carried over the back-plane bus. Since the RISC processor has no means of directly accessing the back-plane bus, it communicates indirectly via the message DSP. Most of the radios have a single DS0 connection for general control purposes (i.e. configuring the radio, reporting radio status), but the radio that carries the digital control channel (DCCH), has an additional DS0 devoted entirely to DCCH processing.

The controller card can reset the radio cards, and detect their presence via five dual function back-plane control lines. These lines are connected directly to the RISC processor, so these lines can be configured as both inputs, or outputs. When used as inputs they can be used to detect the presence of a radio card. When used as outputs they can be used to drive a card into reset, either momentarily, or in the case of a failed card, permanently.

5.2.1.1 Clock Generation and Control

The controller board is responsible for supplying clocks for the entire system. This includes clocks internal to the controller board, and clocks required by the radios.

RS232 Maintenance port: RJ45 connector

Pin	Function
1	NC
2	Signal Ground
3	20mS Test Pulse
4	Signal Ground
5	Signal Ground
6	Transmit Data
7	Receive Data
8	RTS
9	CTS
10	NC

Optional RS232 PPP port: RJ45 connector

Pin	Function
1	NC
2	NC
3	NC
4	NC
5	Signal Ground
6	Transmit Data
7	Receive Data
8	RTS
9	CTS
10	NC

5.1.1 WBSU Controller Software

The controller software is downloaded from the WOSC when the power is turned on for the first time. The software can be loaded from the FLASH file system.

The BTS controller software provides the following functions.

- Configuration of radios
- DCCH messages encode and decode (layer 1 and layer 2 only)
- DTC messages encode and decode (layer 1 and layer 2 only)
- Abis protocol handling
- OAM&P messages encode and decode
- Message interface with Modem/Vocoder DSP
- BOOTP and TFTP for software download
- Initialization of the controller hardware and drivers
- Power-On Self Test (POST).
- Trace and other built-in diagnostic software.

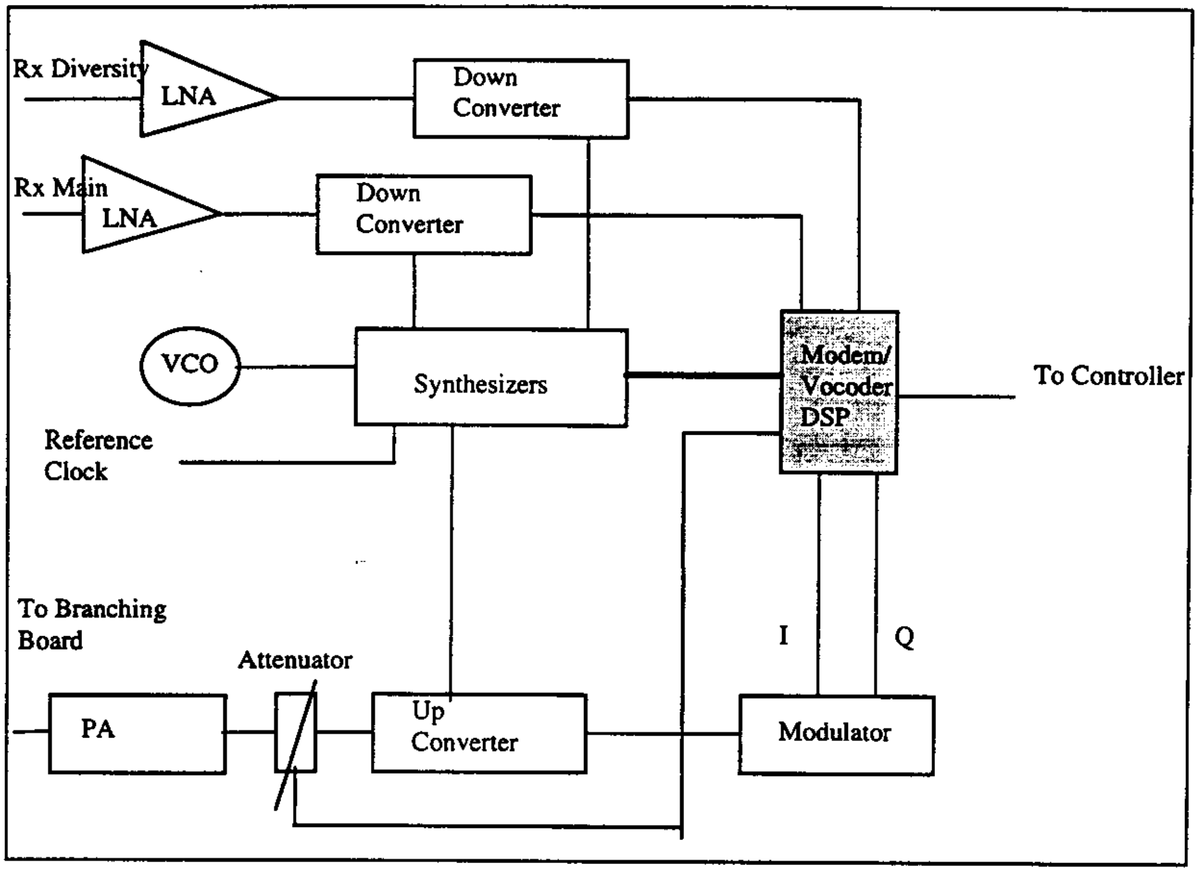

Figure-5 Transceiver Functional Block Diagram

5.2.2 Enhanced Modem

5.2.2.1 Enhanced Modem Hardware

The high level block diagram of Enhanced Modem DSP hardware is shown in Figure-6.

The Modem portion of the DSP card has three DSPs, several A/D devices, one D/A, and a CPLD to write the data received from the radio to the IDMA memory in DSP1 via a parallel bus. Although these two DSPs split functions between each other, DSP1 is the master. DSP1 controls DSP2 by writing commands or data to the IDMA memory of DSP2. The DSP1 communicates with the controller module using the assigned bus.

The Picocell BTS supports voice privacy, using Shared Secret Data calculated by the WOSC using the CAVE algorithm. (The BTS does not contain the CAVE algorithm.) Compressors and expanders, which are optional under IS-130A, are not included due to both processing hardware limitations and the fixed bandwidth of the T1 link.

5.3 Scanning Receiver

Physically, the scanning receiver is similar to the radio, except its transmitter is not present (shown in Figure-7). Also, the diversity receiver is configured for reception on the downlink (Base Station transmit) band and uplink band (Mobile Station transmit). The main receive path of the antenna is connected to the Uplink and the Diversity Receive path is connected to the downlink for the scanner. The scanning receiver can also be ordered by the WOSC to measure the RSSI on any specific uplink or downlink frequency. The WOSC uses these results to assist its handoff operation and selection of usable frequencies at installation time.

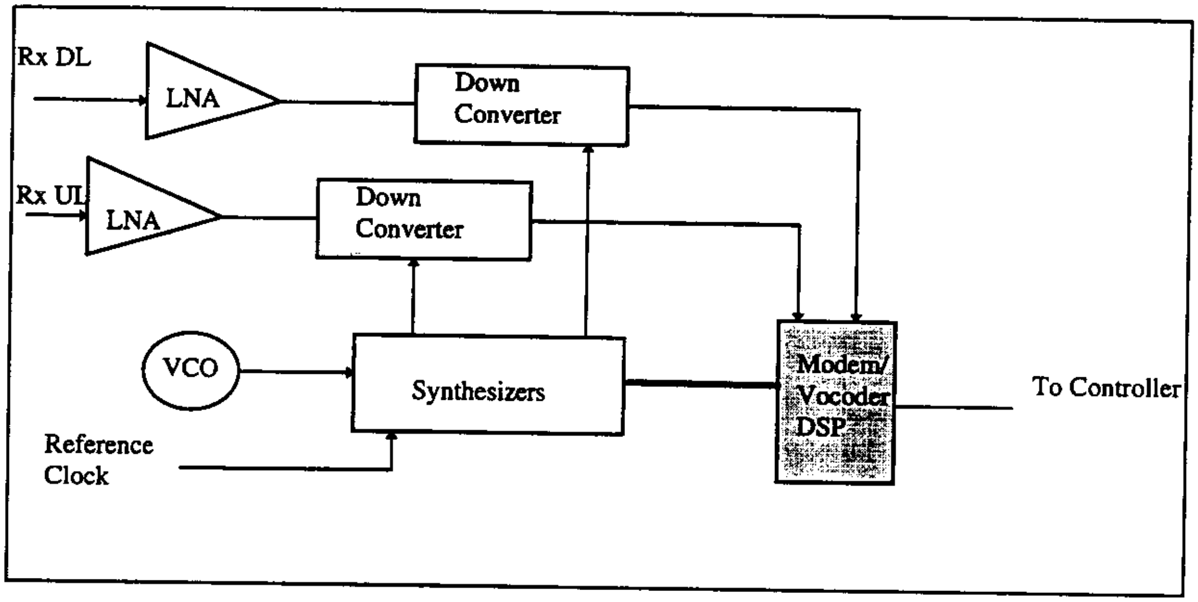

Figure-7 Scanning Receiver Functional Block Diagram

6. Back Plane

The back plane contains the connectors, serial buses, and parallel communication buses required to tie the whole system together. The serial bus has 32 time slots, which are used for communication between modules, mainly between the BTS controller and radios.