Company Name	Samsung Telecommunication America
FCC ID :	NP8-SCBS-319L
Work Order Number	

APPENDIX J:

USER'S MANUSAL

SCBS-319L

BTS SYSTEM DESCRIPTION

EPBD-000776

ED 00

1999. 11.

SAMSUNG

ELECTRONICS

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INTRODUCTION

Document Overview

This description provides an overview of SCBS-319L that functions as a Base station Transceiver System in the CDMA network and a general description of hardware and software architecture, functions and specifications.

Intended Audience

This document is focussed on system operators and technical personnel who deal with SCBS-319L.

Document Content & Organization

This document is organized as follows:

CHAPTER 1. System Overview

This chapter provides a brief description of the topology of Samsung CDMA network, specifications, features, reliability, system configuration and overall functional flow of SCBS-319L.

CHAPTER 2. System Architecture

This chapter describes hardware and software of SCBS-319L.
It deals with the following.

- Basic structure, functions by block, capacity and structure of hardware
- Basic structure, block configuration and performance of software
- System configuration, interworking by hardware and software block

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CHAPTER 1

System Overview

1 CDMA Network

The main objective of the CDMA network is to provide service for roaming Mobile Station(MS) and to meet the requirements of CDMA subscribers by interconnecting the subsystems of the network.

The CDMA Network consists of the following subsystems.

- Mobile Switching Center(MSC)
- Base Station Controller(BSC)
- Base station Transceiver System(BTS)
- Home Location Register(HLR)
- Inter-working Function(IWF)
- Base Station Manager(BSM)

Mobile Switching Center (MSC)

MSC is the core subsystem in the CDMA network, which communicates signal and voice data and interfaces the CDMA network to other networks.
In addition, MSC supports the Visitor Location Register (VLR) that stores and manages subscriber information necessary for call processing by exchanging data with the related HLR.

Base Station Controller (BSC)

BSC controls BTS, and performs call processing by operating with MSC for a voice call or to IWF for a data call. Several BSCs connected to the MSC are interconnected via the router. The CDMA Base Station Manager (BSM) provides network management services for the CDMA network. It provides graphical user interface (GUI) which supports the configuration, fault, and performance management and makes it easier for the operator to understand the system operation and maintenance.

Base station Transceiver System (BTS)

BTS is controlled by BSC, which is supported through the microwave or wire-line communication. An area covered by the power of BTS is called a cell, and BTS processes CDMA calls by communicating with MS in the cell through air interface.

Home Location Register (HLR)

HLR is a database that stores and manages information of all subscribers in the CDMA system and location information of all mobile stations. It is a perfect fault-tolerant system that provides real-time database system and that services by interworking with MSC, SMS center, NMC and the customer center.

Interworking Function (IWF)

IWF system provides the data communication services such as personal computer communication, Internet communication and facsimile service. To realize this, IWF interworks with BSC. It connects packet data calls like Internet access to Internet server, and circuit data calls like PC communication and fax service to PSTN through MSC.

Base Station Manager (BSM)

BSM is connected to BSC and is responsible for operation and maintenance of BSC and BTS. BSM functions are implemented graphically, so that the user can easily determine the system status and give instructions.

The Subsystems in CDMA network are interconnected through the interface protocol standardized by ITU/ANSI, which ensures efficient setup and operation of the CDMA network and easily adopt new services by adding new functions or components to systems without remarkable changes to the previous network architectures.

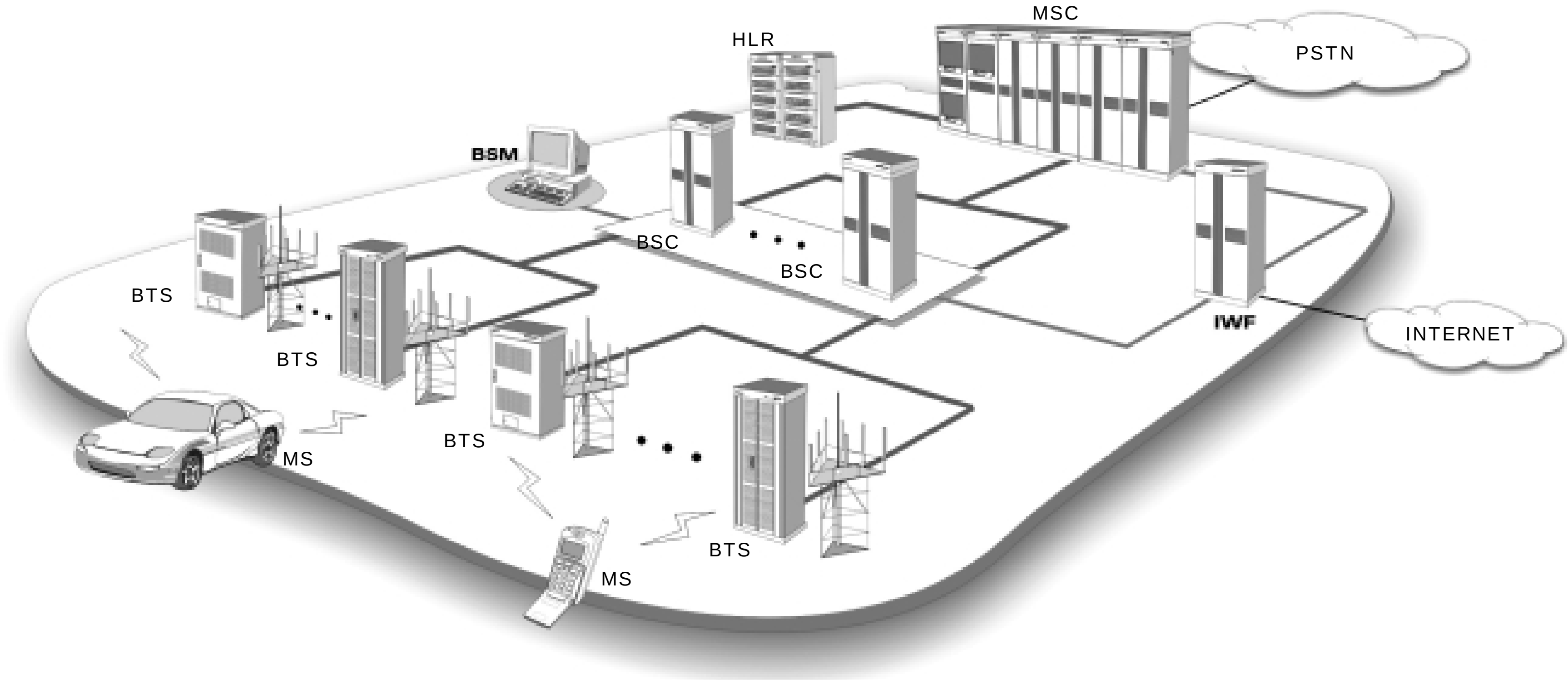


Figure 1.1 Samsung CDMA Network

2 Specification of SCBS-319L

SCBS-319L is a high-capacity BTS that services CDMA calls at the 1900MHz band. Frequency sector can be divided into maximum three, where, each section can use maximum eight frequency bands. Also, as it provides the service to use three sectors and two frequecy allocation(FA) as the basic configuration, it is suitable for small-capacity area. SCBS-319L is installed indoors.

2.1 Capacity

The following are SCBS-319L capacity and specifications

System Capacity

Classification		System Capacity	
The number of Channel		About 20 Channels per FA/sector, max. 480 Channels (Physically, a maximum of 768 channels available)	
The number of Sectors		Omni(single sector), 3 sectors	
The number of frequency band	Basic Rack	Omni type	6 FA
		3 sector type	2 FA
	Basic Rack + 1 Expansion Rack	Omni type	8 FA
		3 sector type	6 FA
	Basic Rack + 2 Expansion Racks	3 sector type	8 FA

Transmitter/Receiver Specifications

Classification		Specifications
Transmitter	Transmitting Frequency	1930 ~ 1990MHz
	Channel Bandwidth	1.25MHz
	Output Power	Average power per channel below 20W, +2dB ~ -4dB
	Pilot Channel Power	Configured Power ± 0.5dB
	Modulation mode	QPSK
Receiver	Receiving Frequency	1850 ~ 1910MHz
	Channel Bandwidth	1.25MHz
	Receiving Sensitivity	Less than 1% FER when the power is under -117dBm

2.2 Interface Specifications

SCBS-319L is basically connected with BSC and Mobile Station. Besides, SCBS-319L can be supported with Base Station Management (BSM) by telephone line for maintenance. And it can interface with additional equipment such as optical repeater and Maintenance and Administration Processor (MAP).

Interface with BSC

SCBS-319L transmits 13K QCELP DATA to BSC through T1 or E1 link. For T1, it provides a transmission speed of 1.544Mbps, and for E1, at 2.048Mbps. Internal IPC specifications of Samsung is observed for the transmission.

Interface with Mobile Station

Mobile Station is connected to SCBS-319L through air interface with IS-95B Standard. There are pilot channel, synchronization channel, paging channel, traffic channel for transmission from BTS to Mobile Station, and accesses channel and traffic channel for transmission from Mobile station to BTS. It transmits various control signals through pilot channel, synchronization channel, paging channel and access channel and transmits data through traffic channel.

Interface with BSM

Basically, BTS is designed to communicate with BSM through BSC. Physically, it is connected through 16550A UART-compatible port, and transfers data at a speed of 56Kbps.

Interface with additional equipment

The RF block is installed in the existing network with the support of optical repeater to extend the coverage area of the BTS and to resolve the radio shadow area. SCBS-319L and optical repeaters are interconnected on optical cable. Consequently, when you connect to an optical repeater, you should install a separate optical combiner unit.

MAP is a maintenance program that is used by connecting PC directly to BTS. PC and SCBS-319L are inter-connected by RS-232C mode.

2.3 System Specifications

The system specifications of SCBS-319L are as follows.

Power

Classification	Specifications
System DC supply Voltage	+24V ~ +28V
AC Input Voltage	Single Phase 220V, 3Phase 380V ± 10% (Designate upon the purchase)
AC Input Frequency	50/60 Hz
DC current	Maximum 60ADC
Efficiency	> 0.85

Mechanical

Classification	Specifications
Size of Rack	1800 × 600 × 680 (mm)
Weight of Rack	350Kg

Note) H (Height), W (Width), D(Depth)

Environmental

Items	Range	Specifications Applicable
Operation Temperature	0 ~ 50	TA-NWT-000487 4.1
Idle Temperature	-40 ~ 70	
Humidity	5 ~ 95% (Moisture in air should not exceed 0.024Kg.)	TA-NWT-000487 4.1
Height	-200 ~ 13,000 ft	
Noise Level	Less than 60dBA per 1.5m	
Airborne Particle	0 ~ 90 /∞	GR-63-CORE 4.5
Vibration	Satisfies the specification	GR-63-CORE 4.4
Electromagnetic interference(EMI)	Satisfies the specification	GR-1089-CORE Section 3

3 Features of SCBS-319L

The features of SCBS-319L are as follows:

Diverse Services

SCBS-319L provides various services of IS-95B except basic call processing. SCBS-319L provides services making changes to software and without extending any modifications on hardware.

High Speed Data Services

SCBS-319L provides high-speed data services of maximum 115.2Kbps by connecting with IWF through BSC. And hence, it is possible to use fax and access commercial networking systems including other supplementary Internet services.

Soft Hand-off

SCBS-319L soft hand-off provides increased reliability and fewer dropped calls as users move from one service area to another and it simultaneously connects to other base stations producing no influence during hand-offs, whereas the hard hand off disconnects momentarily from the existing connection before transferring to another BTS.

Access Hand-off

SCBS-319L provides access hand-off. Access hand-off is the new solution that provides increased reliability and fewer dropped calls as users move from one
Service area to another while transferring signals to BTS and keeps the call alive.

Hard Hand-off

SCBS-319L hard hands off MS to a frequency band found enhanced to the current one serving MS then the frequency hard hand-off is performed when MS is idle, this ensures the best call quality.

Location Service

SCBS-319L provides location service interworking with BSC. Location service is to locate a certain mobile station upon the request of an operator or a subscriber.

Priority Access and Channel Assignment (PACA) Service

SCBS-319L supports the PACA service. A call is not connected because BTS is congested, the PACA service holds the call and connects it to a subscriber based on the subscriber priority when BTS is free.

Capacity and Expansion

The board accommodates 32 channels on SCBS-319L. The channels are not assigned for sector or frequency bandwidth and thus allowing highly scalable capacity and greater utilization efficiency. Also, SCBS-319L capacity can be increased by adding racks. And the capacity can be modified by selecting omni mode or sector mode within the same hardware specifications. Accordingly, an operator can choose the mode based on characteristic of service area.

Service Area Expansion(Option)

SCBS-319L can connect remote RF optical unit when optical conbiner unit is installed inside BTS. The RF (Radio Frequency) module in the remote optical unit, offers the widest possible solutions to increase the capacity of the service areas. And hence, enhances to secure maximum service area at a minimum cost. Maximum 9 remote optical unit can be installed for one BTS at maximum 10Km away from BTS.

Flexible System Operation

An operator can easily control SCBS-319L through BSM in the station building. BSM displays system status in GUI, so that an operator can conveniently check the system status and take necessary actions.

Also, it provides MAP as an option so that it can take various tests under the conditions when trunk is disconnected. MAP is used by directly connecting to the test panel. It provides BTS local loading, normal status of hardware, fault module, and origin of faults.

4 Reliability

The system reliability is defined by the Failure Rate(FR) and the Mean Time Between Failure (MTBF).

If SCBS-319L services 3 frequency bands with 3 sertors, FR and MTBF are as follows:

FR	MTBF
19.60 times	51020.24 hours(about 5.82 years)

Note) 1. Failure Rate is figured on the basis on 10^6 hours.

2. MTBF = 1/FR $\times 10^6$

3. Reliability calculation on the basis of :

Engineering Reliability Fundamentals and Applications, R.Ramakumar, 1993

Reliability Design Handbook, R.T. Anderson, March 1976

LATA switching system generic requirements (LSSGR), section 12: reliability, Bellcore TR-TSY-000512, Issue 2, July 1987 plus TA-TSY-000512, Issue 1, October 1988

Reliability Prediction Procedure for electronic equipment, Bellcore Technical Reference TR-TSY-000332, Issue 5, December 1995

Reliability Engineering, Samsung Electronics, May 1988

Engineering Reliability (MIL-HDBK-217) by the Department of Defense (the Pentagon) in U.S.

5 System Configuration

5.1 Basic Configuration

SCBS-319L can provide basic services with a base rack and the racks can be extended to enlarge capacity.

SCBS-319L is configured as below.

- BSBR (BTS Standard Base Rack)
- BSER (BTS Standard Expansion Rack)

BSBR (BTS Standard Base Rack)

BSBR is the base rack to configure BTS. It communicates with BSC or controls BSER by common control block. The channel processing and RF blocks are used for call processing. BSBR channel processing block can accommodate physically maximum 192 channels.

Classification	Channel Capacity	Functional Block
BSBR	Maximum 192 Channels	Common control block, channel processing block (1), RF block

BSER (BTS Standard Expansion Rack)

BSER is an expansion rack installed to expand BTS capacity, with two BSERs installable per BSBR.
BSER #1 equips up to 2 channel processing blocks, while BSER #2 equips only one channel pocessing block. Consequently, when BSBR and two BSERs are all installed, the maximum physical capacity of SCBS-319L is about 768 channels.

Classification	Channel Capacity	Functional Block
BSER #1	Maximum 384 Channels	Channel processing block(2), RF block
BSER #2	Maximum 192 Channels	Channel processing block(1), RF block

Note) 1. Details of blocks are provided in Chapter 2, section ‘1. Hardware’.
2. Calculation of channel capacity takes into account even channels used for N(Narrow band)-WLL.

5.2 SCBS-319L Configuration

The configuration diagrams of SCBS-319L is as follows.

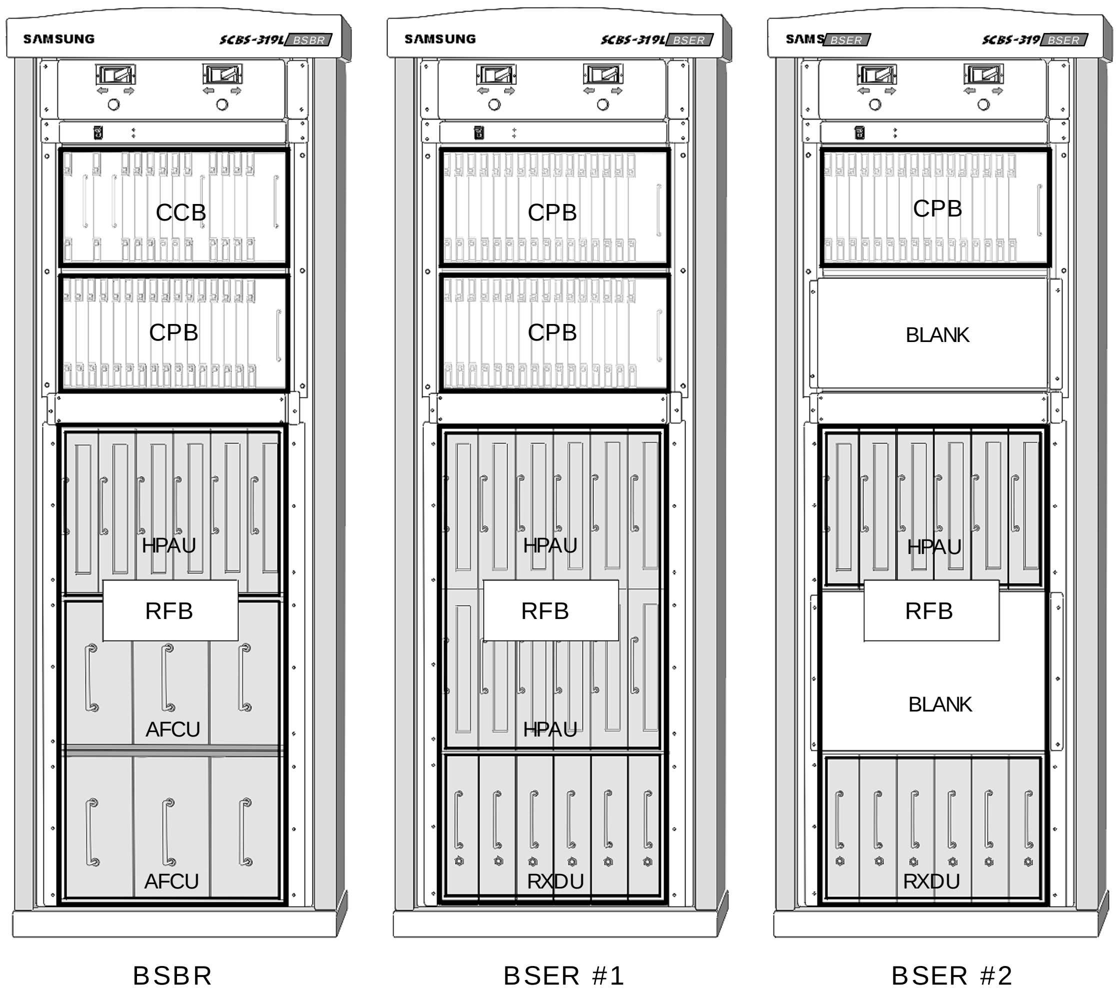
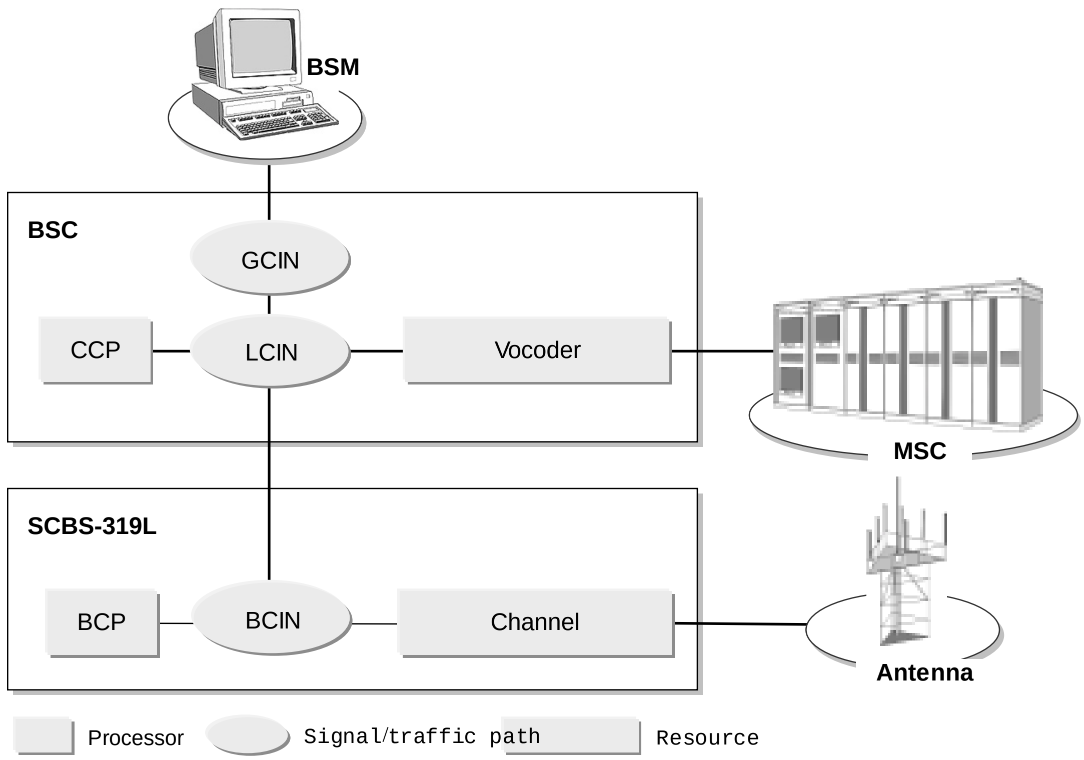


Figure 1.2 SCBS-319L Rack Configuration

6 Functional Blocks

The basic functional flow of SCBS-319L is as follows.



BSM : Base Station Manager
CMP : Common channel MTP Processor
BCP : BTS Control and Maintenance Processor
LCIN : Local Communication Interconnection Network
CCP : Call Control Processor
SIP : Selector Interface Processor
GCIN : Gateway Communication Interconnection Network
BCIN : Base station Communication Interconnection Network

Figure 1.3 Functional structure

CCP and BCP sends/receives various control signals to BSM and controls the system.
Vocoder and channel is the resource for communication, and BCIN, LCIN, GCIN are paths of various control signals and traffic.

Initialization Procedure

SCBS-319L initializes system by loading various software from CCP of BSC.

General initialization flow:

✂ BSM initializes CCP as passing by GCIN, LCIN.

✁ CCP initialize sub processors with downloaded software from BSM, and it downloads required software for SCBS-319L from BCIN to BCP.

👓 BCP initialized sub processors with downloaded software from CCP

Operation and Maintenance

SCBS-319L provides the operator various static data that is gathered while it is under operation, and controls configuration information of system. Also, it regularly diagnoses system status, gathers and transfers related information to BSC. It provides irregular system test upon the request of the operator for resolution.

The control flow is as follows.

✂ Operator input commands through BSM.

✁ BSM transfers command to CCP as passing by GCIN and LCIN.

👓 CCP transfers command after interpretation as passing by BCIN.

🔔 BCP processes command after interpretation by driving sub-processor or relevant software.

The flow of providing operation and maintenance information is as follows.

✂ Various events (command processing result, statistics, status, fault etc.) originated from SCBS-319L are gathered into BCP through BCIN.

✁ BCP reports gathered information to CCP.

👓 CCP reports information to be gathered from BSC and reported from BCP to BSM.

Statistic events are gathered and reported regularly by 5 min., hourly, daily etc., and operation and maintenance events are reported in real-time.

Call Processing

The traffic channel setup route for an originating call is as follows.

✂ Mobile station requests BCP for call setup through control channels.

✁ BCP transfers call setup request to CCP.

👓 CCP transfers call setup request to MSC.

🔔 MSC directs CCP set up calls after checking validity of subscribers and call resources.

🕮 CCP directs vocoder resource assignment and order BCP for channel assignment.

🕯 BCP instructs channel assignment of SCBS-319L upon instruction of CCP.

☎ It has finally provided speech route to be connected like mobile station – channel – (trunk) – vocoder – (trunk) – MSC.

Note -> Repeat steps 🔔 🕮 🕯 ☎ for the terminating call setup.

After traffice channel is set up, SCBS-319L processes various transmitting signals and receiving signals as below.

Transmitting signal processing

SCBS-319L modifies QCELP packets transferred from BSC to baseband CDMA signals. These signal are converted into analog waveform (D/A conversion) and amplified to transmitting frequency of 1900MHz band.
If it has more than two-frequency band, it is filtering to other signal except 1.25MHz band to merge signals and eradicate noise. Signals, which all process is done, are transferred to antenna cable through connection port on upper part of SCBS-319L.

Receiving signal processing

Received signal through antenna comes into SCBS-319L as passing by connection port on the top of BTS. SCBS-319L filters signals except 1.25MHz band, and amplifies necessary signals only to baseband signal of digital waveform. This signal is packetized through channel processing, and is transferred to BSC through E1 or T1.

CHAPTER 2

System Architecture

1 Hardware Architecture

1.1 Basic Architecture

The functional Hardware of SCBS-319L is of 3 modules.

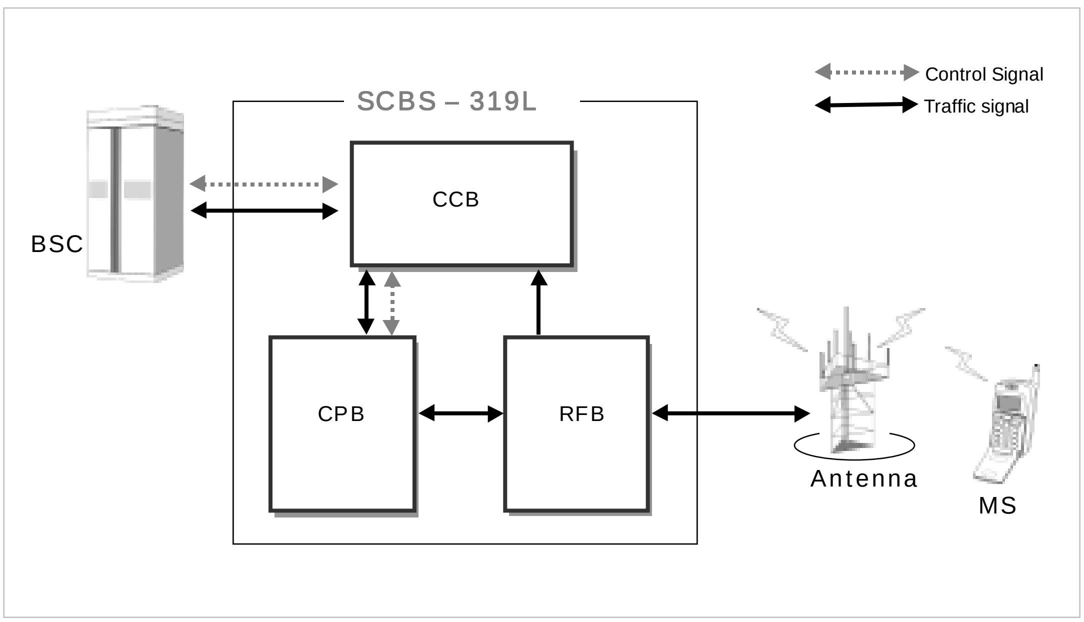


Figure 2.1 Basic Structure of Hardware

Common Control Block (CCB)

Common control block(CCB) operates and maintains BTS. Also, it connects BTS and BSC, and provides communication path among each processor of BTS. It generates system clocks and distributes them to the other blocks.

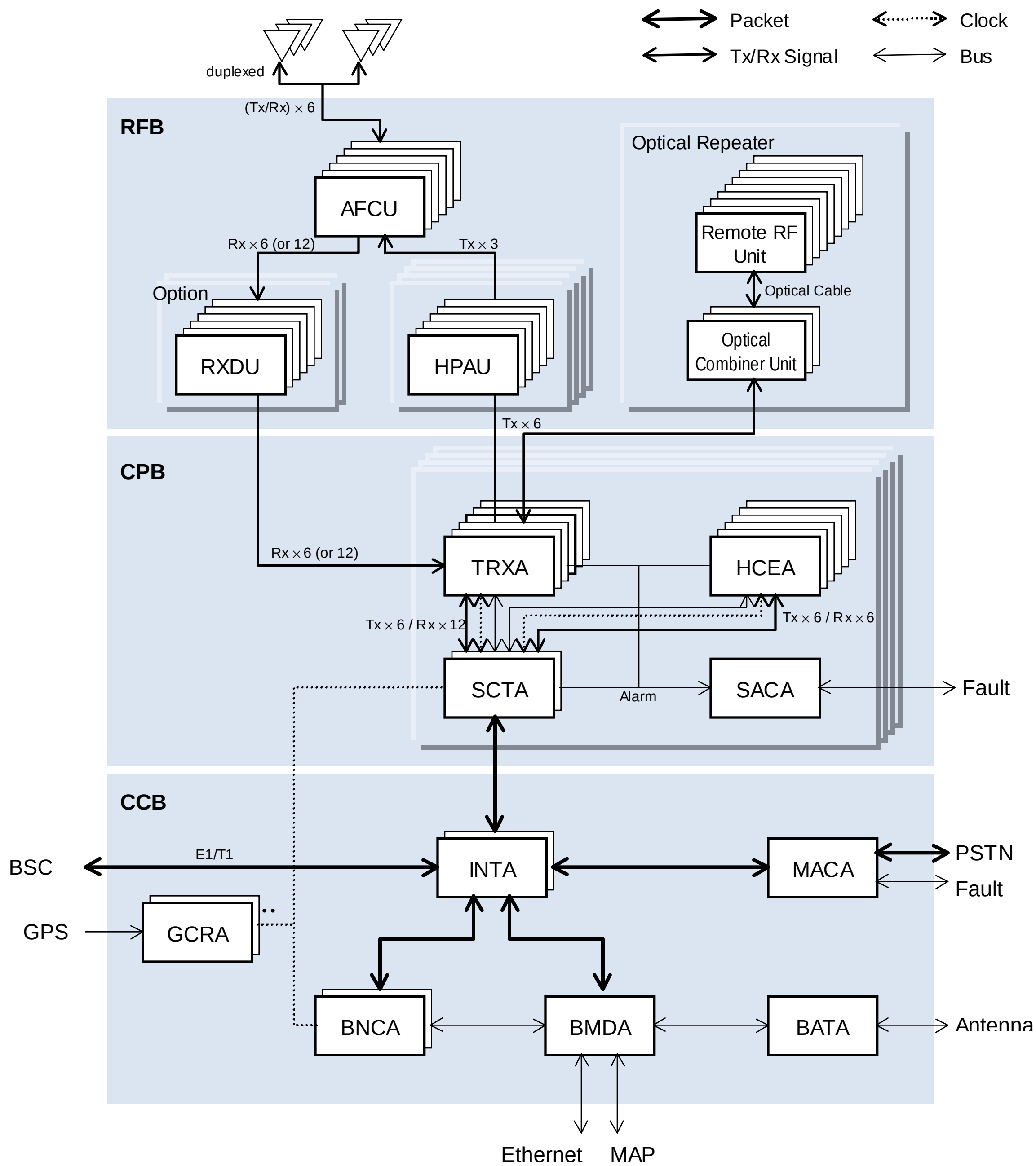
Channel Processing Block (CPB)

Channel processing block(CPB) modifies receiving/transmitting signals between BSC and RF block. Voice and control signal to be received by CPB is modifies to CDMA signal in 1900MHz frequency band and transfers to RF block. Conversely, CDMA signals to be received by RF block are packetized then transferred to BSC through CCB.

RF Block (RFB)

RF block (RFB) filters receiving/transmitting signal band between antenna and CPB, and amplifies signals. It filters required bands from signals transmitted from CPB, and merge frequencies then sends them to antenna. It filters required bands from signals received by antenna, and distributes signals to CPB after amplifying them.

Besides, SCBS-319L interfaces with additional devices to enlarge its coverage or support operation and maintenance function. Optical repeater, Tower-mounted Front-end Module (TFM) and Maintenance and Administration Processor (MAP) are additional devices.



BNCA	BTS and Node Control Assembly	INTA	Interconnection Node and Trunk Assembly
MACA	Master Alarm Control Assembly	BMDA	BTS Maintenance and Diagnostic Assembly
GCRA	GPS Clock Receiver Assembly	BATA	BTS Antenna Test Assembly
HCEA	High-density Channel Elements Assembly	TRXA	Transceiver Assembly
SCTA	Shelf Controller and Transceiver control Assembly	SACA	Slave Alarm Control Assembly
HPAU	High Power Amplifier Unit	AFCU	Antenna Front end and Combiner Unit
RXDU	Receiver Distribution Unit		

Figure 2.2 Hardware Structure

1.2 Common Control Block

1.2.1 Functions

Main functions and features of CCB are as follows.

- It provides communication path between BTS and BSC by connecting to LCIN.
- It provides communication path between each processor within BTS.
- It assigns BTS resource and manages the status.
- It detects fault within BTS and reports it to BSC.
- It tests BTS.
- It generates system clocks with time and location information received from GPS, and distributes them.

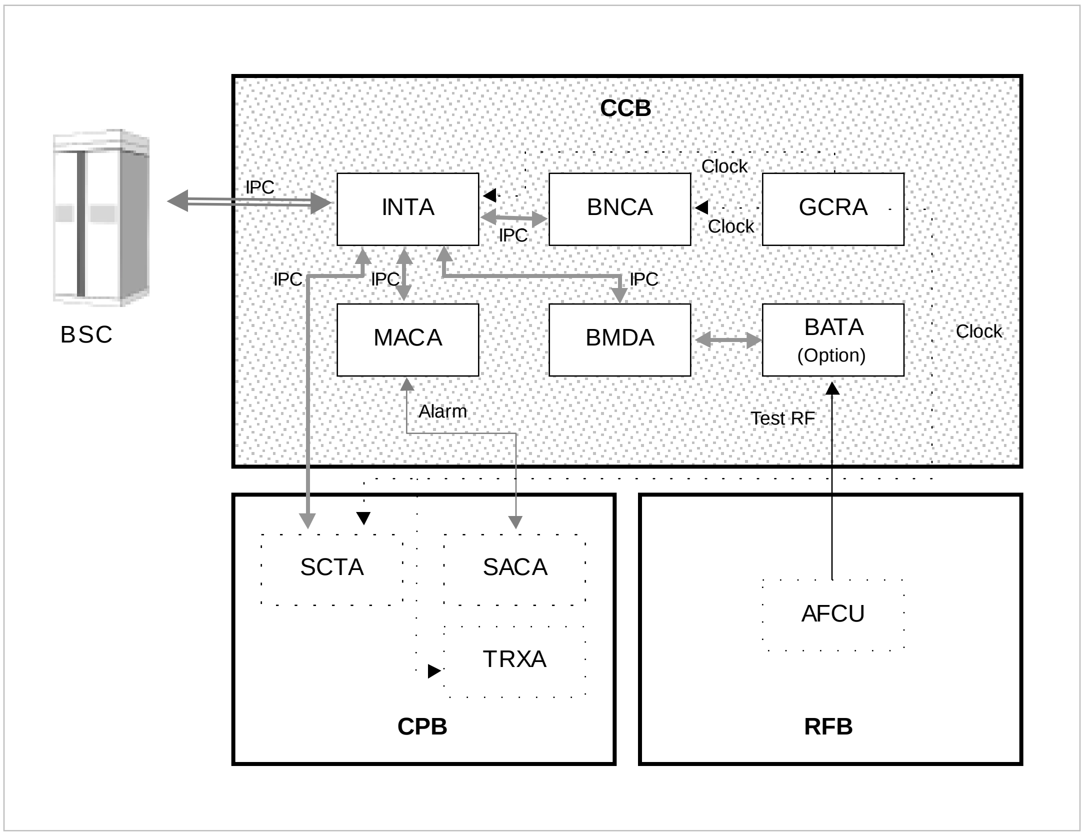


Figure 2.3 Interworking of CCB

1.2.2 Architecture

CCB is shown below.

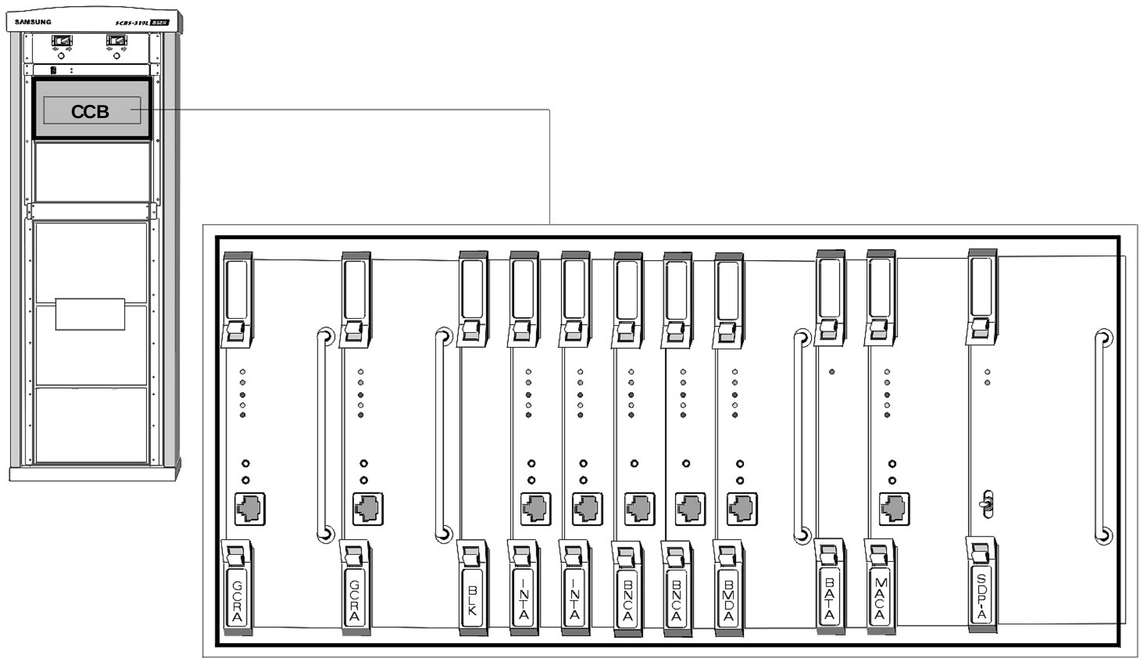


Figure 2.4 Board Configuration of CCB

Board Name	Quantity	Functions
BNCA	2	Basic call processing, Controls operation and status
INTA	2	Interconnects BSC and BTS, and provides communication path between the blocks in BTS.
MACA	1	Collects and controls fault of BTS.
BMDA	1	Diagnostic, BTS maintenance through MAP
GCRA	2	Generation and distribution of clock
BATA	(1)	Optional specifications Provides maintenance path by connecting BMDA and AFCU
SDP-A	1	Power supply

BNCA, INTA and GCRA are duplicated for reliability, SDP-A is duplicated with SDP-A to be mounted in CPB.

Below is the detailed description of BNCA, INTA, MACA, BMDA and GCRA boards.

BTS and Node Control Assembly (BNCA)

BNCA is the main processor that controls status of overall hardware and software of BTS. Then it reports them to BSM. Also, it assigns and controls resources of BTS and processes calls originated from BTS.
BNCA is duplicated in operation/waiting status to secure reliability. As two boards are connected in serial, the standby BNCA takes over when active BNCA fails.

Items	Detailed Specifications
Interface	RS232C, TTL, RS-422/485

Interconnection Node and Trunk Assembly (INTA)

INTA performs as BCIN and it interfaces BTS and BSC. And it takes charge for communication between internal processors.
One INTA board provides 12 nodes. Among them 4 nodes are connected to BSC and rest of 8 nodes are used within BTS. Maximum transmission speed of node is 400Mbps, it merges with block to be communicated in serial. INTA controls status of 12 nodes and reports relevant information to BNCA.
INTA uses network synchronization clock to be received from GCRA to synchronize with BSC for communication.

Items	Detailed Specifications
Interface	E1/T1, Pseudo-ECL, RS-422/485, TTL

Master Alarm Control Assembly (MACA)

MACA has reports of status and fault of each rack from SACA mounted in CPB, then reports them to BNCA. Also MACA powers on/off or the basis of environment information reported from SACA by controlling the rectifier.
MACA connects to BSM through telephone line as mounting modem unit. BSM can breaks rectifier remotely or instruct to perform trunk test through telephone line.
Additionally, it manages fault of optical repeater or TFM, which are additional devices.

Items	Detailed Specifications
Modem	V.34 ISA Bus
Interface	RS-232C, RS-422/485, U-Link, TTL

BTS Maintenance and Diagnostic Assembly (BMDA)

BMDA tests operation status of SCBS-319L. This test is performed regularly within BTS or irregularly upon the request of the operator. Also BMDA performs BTS control test such as checking transmitting/receiving antenna and receiving path transmitting output measure function etc.

If you connect PC to BMDA, you can use MAP. MAP provides interface so that an operator can load BTS to off-line or maintain it.

Flash memory of 4Mbytes to be mounted on BMDA stores software loading information. If it is required to re-start processors, it performs self-restarting within BTS by using loading information without passing by trunk.

Items	Detailed Specifications
Interface	RS-422, RS-232, Ethernet

GPS Clock Receiver Assembly (GCRA)

GCRA generates 10MHz for a three-dimensional location information and time information from GPS. GCRA generates system clock (19.6608MHz), even second (0.5Hz), reference clock (10MHz) and network synchronization clock (4.096MHz, 1.544MHz, 8KHz) with generated 10MHz.

TOD, time information provided by GPS, is supplied to BNCA. System clock and even second is supplied to HCEA via SCTA, and the reference clock is supplied to TRXA so that it could be referred to frequency generation. Network synchronization clock maintains synchronization with BSC by provision of INTA. It holds over clock within board itself for 24 hours providing that BTS cannot receive signals from GPS.

GCRA is duplicated in state of operation/wait. Clock provision is also duplicated to provide against inaccurate clock provision in case of system restart or fault.

Items	Detailed Specifications
Input Signal	1PPS, TOD
Output Signal	10 MHz, 4.096 MHz, 1.544 MHz, 8KHz 19.6608MHz, even second, 1PPS
Interface	RS-232, Pseudo-ECL, RS-485, TTL

BTS Antenna Test Assembly (BATA)

BATA is an option and it connects AFCU mounted in RFB and BMDA. It transfers CDMA signals received from AFCU to BMDA, and diagnostic control signal recevied from BMDA to AFCU.

In other words, if BATA is installed, BMDA can perform BTS test such as check of antenna and receiving path, and measurement transmitting power.

1.3 Channel Processing Block

1.3.1 Functions

CPB performs forward traffic as shown below.

- It receives packet signals from BSC through INTA mounted in CCB
- It modulates CDMA and processes channels.
- It modulates a digital signal into an analog signal.
- It modulates QPSK and upconverts frequency.
- It transfers CDMA signal to HPAU of the RFB.

It performs the following in the reverse traffic.

- It receives CDMA signal from AFCU mounted in RFB.
- It demodulates QPSK and down-converts frequency.
- It demodulates an analog signal into a digital signal.
- It demodulates CDMA and processes channels.
- It transfers baseband packet signals to BSC via INTA mounted in CCB.

In addition, the CPB collects hardware fault and environment fault and reports it to MACA of CCB.

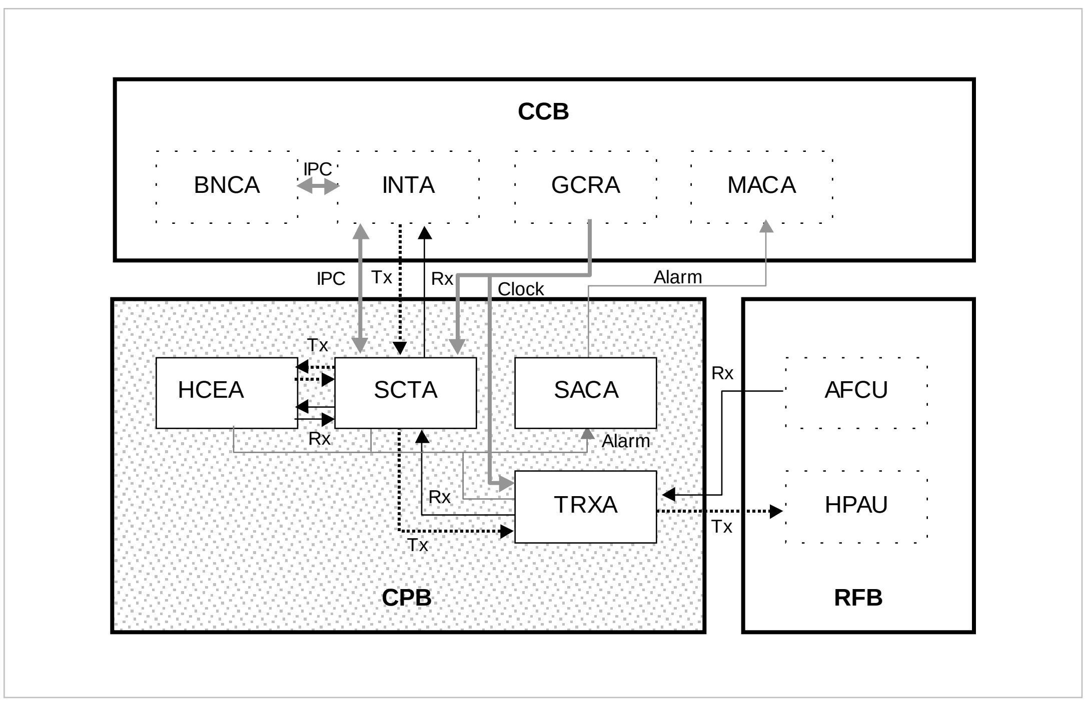


Figure 2.5 Interworking of CPB

Call processing flow of CPB is as follows.

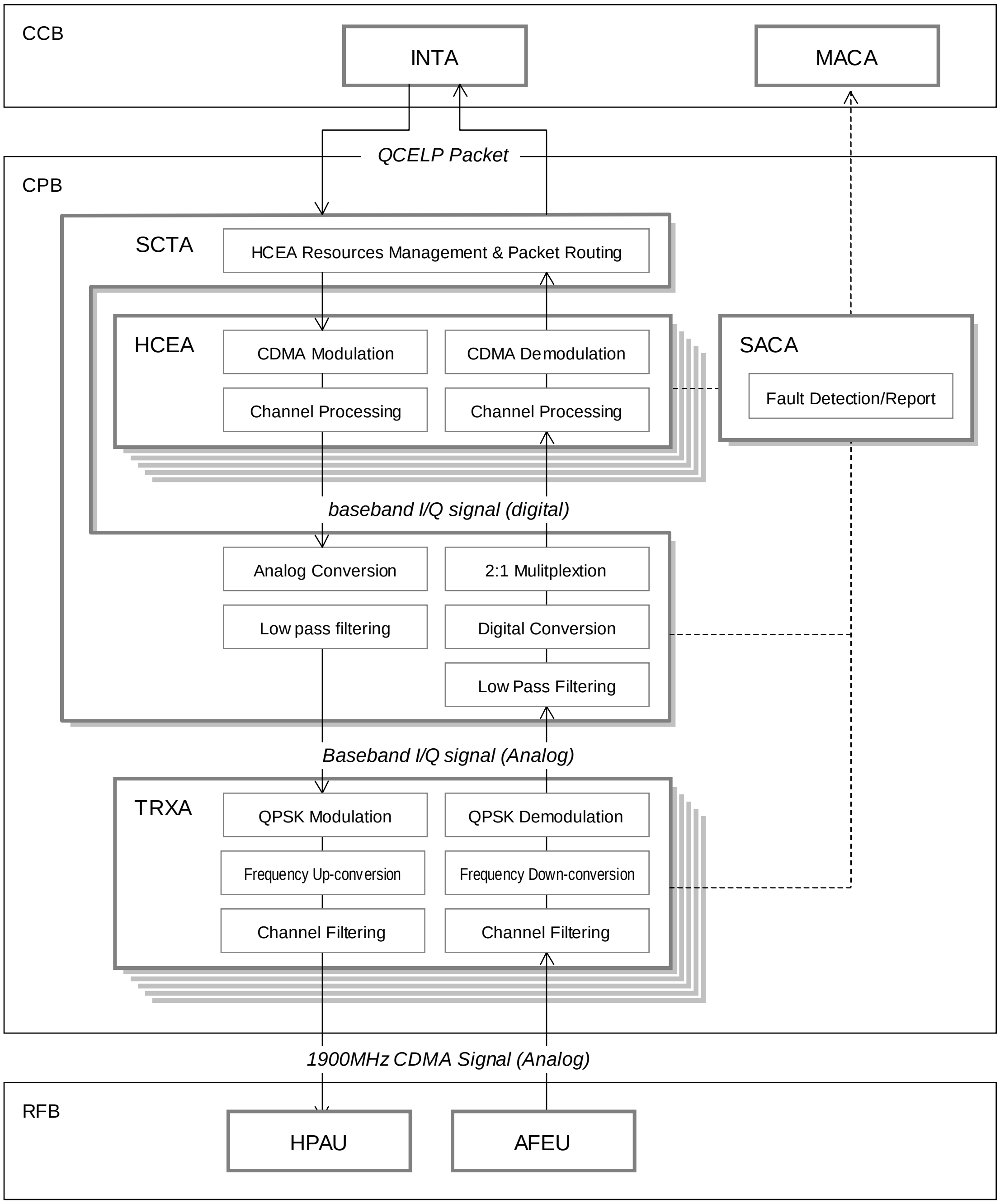


Figure 2.6 Call processing flow of CPB

1.3.2 Architecture

CPB is shown below.

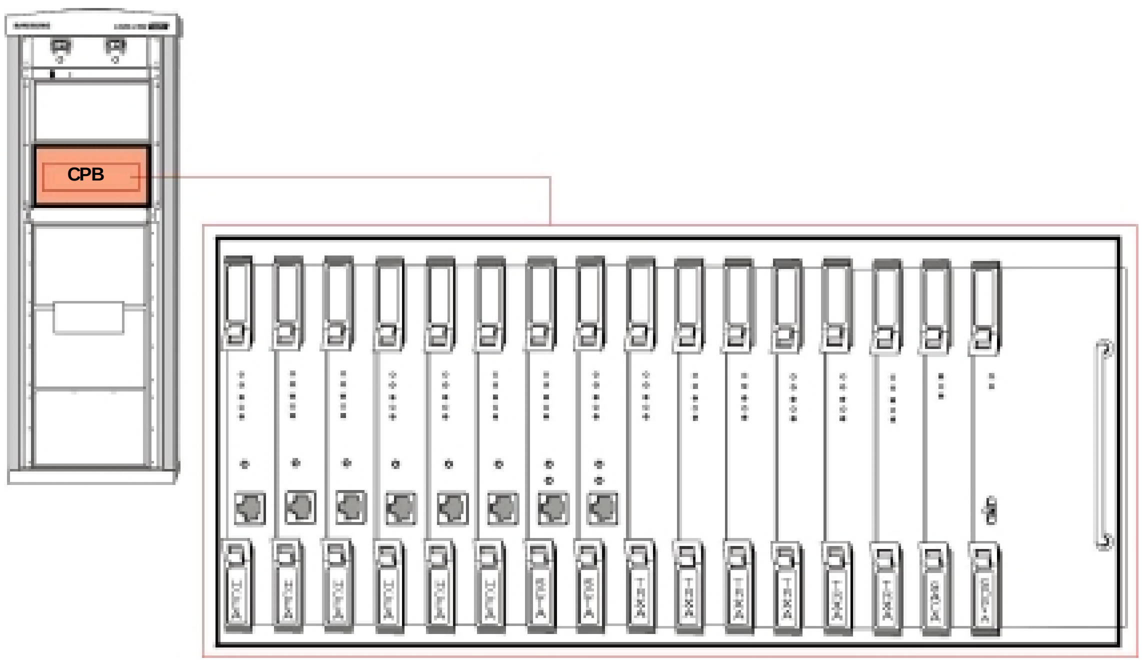


Figure 2.7 Board configuration of CPB

Board Name	Quantity	Functions
HCEA	6	Modulation/demodulation of data, accommodate 32 channels
TRXA	6	Convert baseband signal and RF band signal
SCTA	2	Change analog and digital, control HCEA and TRXA
SACA	1	Collect faults and report to MACA
SDP-A	1	Power supply

HCEA and TRXA can be mounted maximum 6 when it includes capacity for W-CDMA WLL. SCTA is duplicated for reliability, and SCP-A is duplicated with SDP-A mounted in CCB.

This is detailed description for HCEA, SCTA, TRXA and SACA board.

High-density Channel Elements Assembly (HCEA)

HCEA performs CDMA signal modulation/demodulation and channel processing between SCTA and INTA. In other words, HCEA modulates QCELP packet signals coming through INTA and SCTA to baseband I/Q signal then transfers them to SCTA. Conversely, it processes received signal coming through SCTA as a packet, then transfers to BSC via SCTA and INTA.
HCEA provides 32 channels. Each channel performs different functions according to loaded program. It processes pilot channel, synchronization channel, paging channel and forward traffic channel while it transfers data to mobile station. But it processes access channel and backward channel while receiving data from mobile station.
It shares control information related to call origination, disconnection or hand-off. for call processing with SCTA.

Items	Detailed Specifications
Interface	TTL, RS-232, Pseudo-ECL

Shelf Controller and Transceiver control Assembly (SCTA)

SCTA converts digital signals sent by HCEA to analog signals by I/Q channel, then transfers them to TRXA after low pass filtering.
The two received signals transferred from TRXA due to antenna diversity. SCTA converts these signals to digital signal after low pass filtering, and transfers to HCEA after making them into single signal through 2:1 Mux.
SCTA takes charge of loading and control of HCEA and TRXA, and it distribute clocks to be received from GCRA mounted in CCB to HCEA and TRXA.

Items	Detailed Specifications
Interface	Ethernet, RS-485, RS-232, TTL, SENSOR I/F, Pseudo-ECL

Transceiver Assembly (TRXA)

TRXA performs QPSK modulation on baseband I/Q signal to be received through SCTA then upconverts 1900MHz band. After eliminating noise excpt 1.25MHz band from this signal, it transfers it to HPAU mounted in RFB.
The two received signals transferred from TRXA due to antenna diversity. TRXA eliminates unnecessary bands from this signal, downconverts baseband signal via IF signal, then transfers each to SCTA after QPSK demodulation.
Additionally, TRXA performs cell coverage coordination function through power control.
A board of TRXA provides one sector at one frequency band.

Items	Detailed Specifications
Flower Attenuation Range	30dB
Interface	Analog, TTL, Pseudo-ECL
Max. Output	+3dBm
Range of Input	-40 ~ -100dBm

Slave Alarm Control Assembly (SACA)

SACA collects faults of various boards, FAN, LNA, HPA and sensor of various environmental fault detection, and reports them to MACA. And it controls above devices as getting control signals from MACA.

Items	Detailed Specifications
Interface	TTL, RS-422/485

1.4 RF Block

1.4.1 Functions

Performances of RFB are as follows.

- Power amplification of RF signal
- RF signal combination
- Automatic Gain Control(AGC) of receiving RF signal
- De-multiplexing of RF signal for performance diagnostic

Optical combiner unit replaces parts of RFB so that it can combine with optical repeater in SCBS-319L. Optical repeater is used to enlarge the coverage of BTS and to resolve radio shadow area.

TFM can be connected to the bottom of the antenna for receiving. TFM transfers merely received signals after low-noise amplification. Accordingly, general receive sensitivity of BTS is improved.

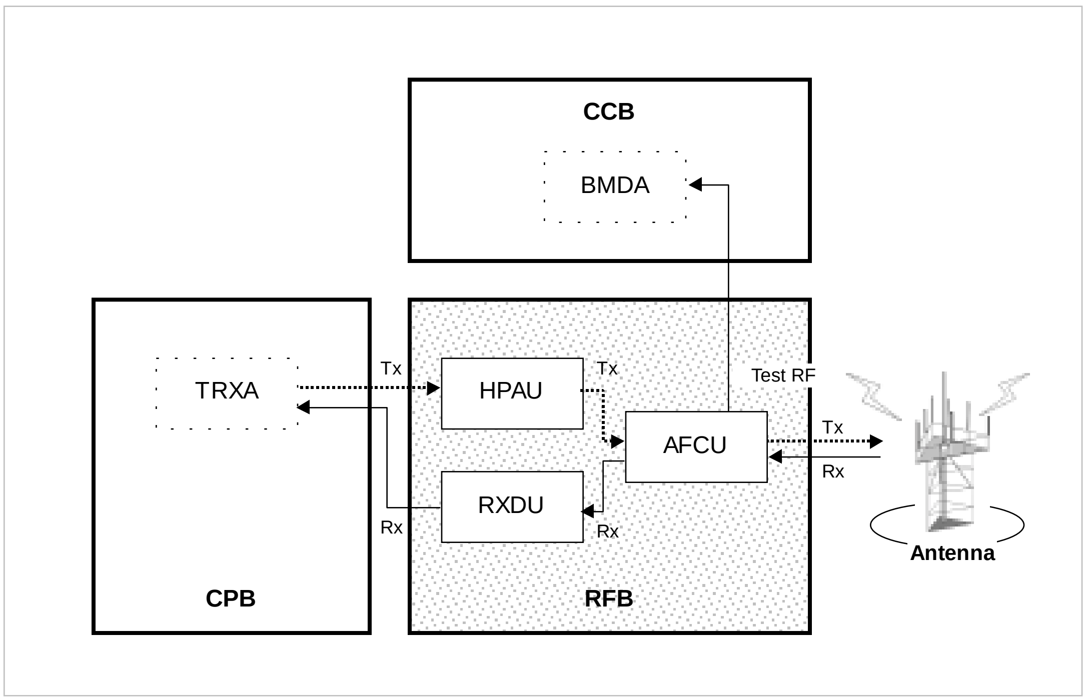


Figure 2.8 Interworking of RFB

Call processing flow of RFB is as below.

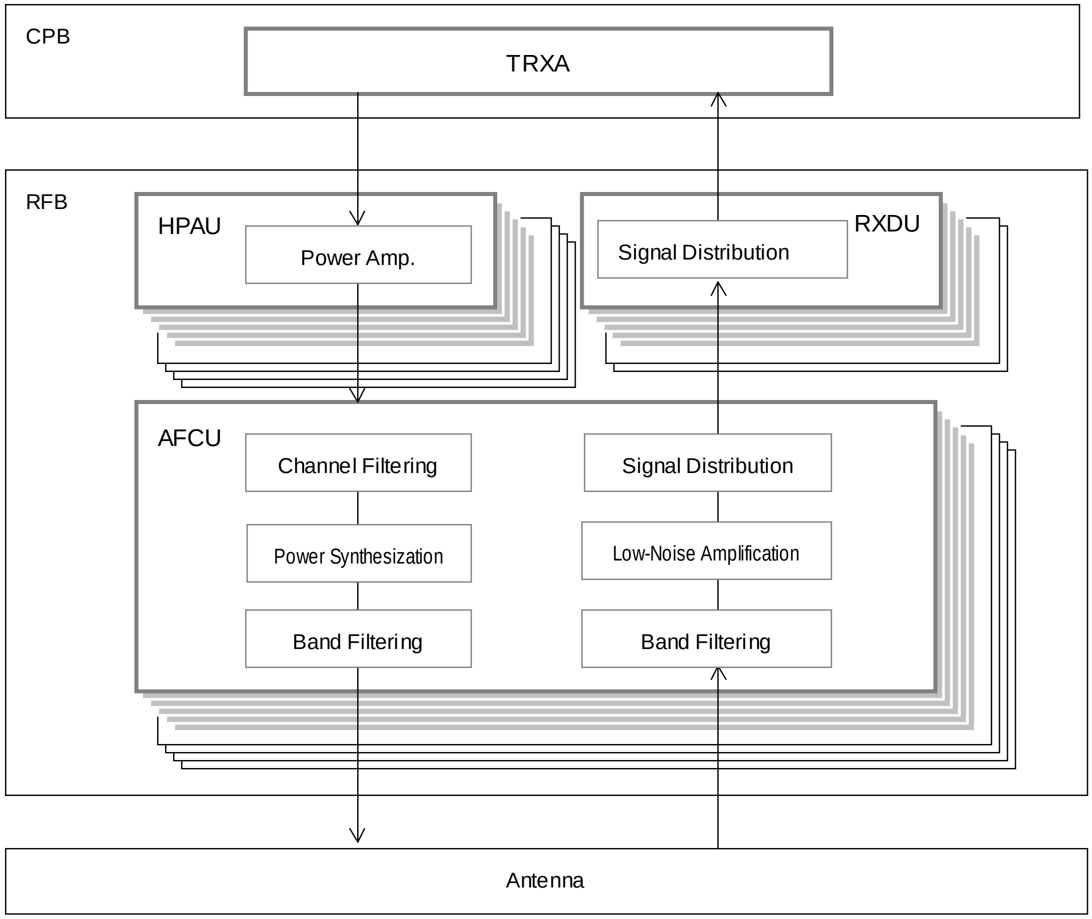


Figure 2.9 Call processing flow of RFB

1.4.2 Architecture

RFB is inserted in diferent format for different configurations.

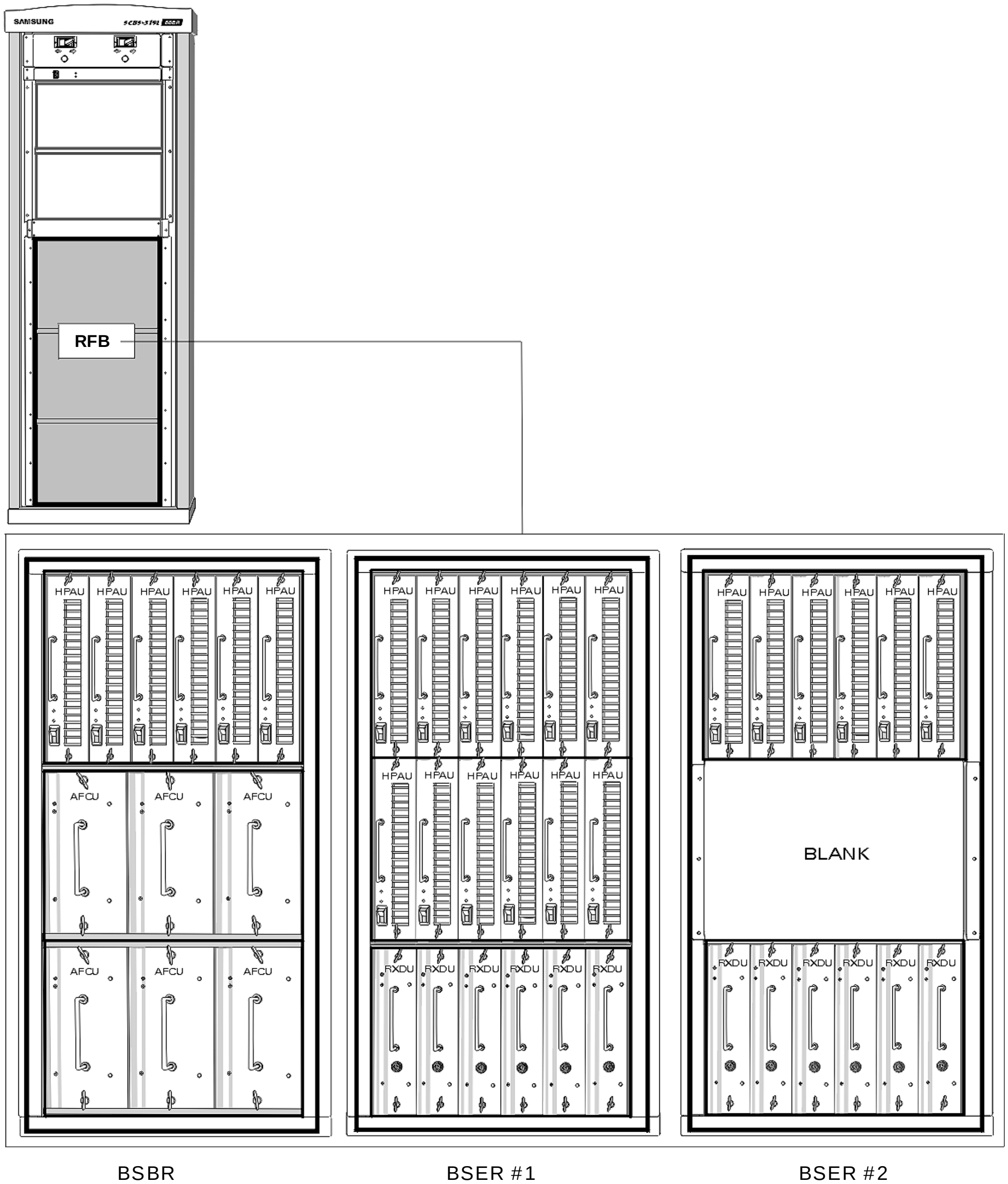


Figure 2.10 Board configuration of RFB

Board Name	Quantity			Functions
	BSBR	BSER#1	BSER#2	
HPAU	6	12	6	Power amplification of Rx signal
AFCU	6	-	-	Tx Signal : channel filtering, power synthesization, band filtering Rx Signal : band filtering, low-noise amplification, signal distribution
RXDU	-	6	6	Distribution of Rx signal to TRXA

The quantity of HPAU is the same as that of HCEA and TRXA in the CPB.
AFCU is connected right under the antenna, and equipped only I the base rack. As RXDU is necessary only when BTS services 4 or more frequency bands, it is necessary to equipp only for capacity expansion.

When SCBS-319L interfaces with optical repeater, optical combiner unit is mounted instead of HPAU. Below is detail description of HPAU, AFCU and RXDU boards.

High Power Amplifier Unit (HPAU)

One HPAU unit is mounted per each sector, and it amplifies transmitting signal to be transferred from TRXA.
Over current protection circuit and over-output protection circuit is mounted in HPAU. If over current or problem on the power route is placed, over current protection circuit automatically powers off and protects the internal circuits. When output is over than standard of HPAU, over-output protection circuit keeps the output to be 1dB higher than standard one (35W) and protects damage on power transistor. If output gets back to normal, over-output protection circuit is not operated any more.

Items	Detailed Specifications
Gain	46.5±0.5dB (27V, +25)
Output	Average 45.5dBm(35W) (27V, +25)
Gain variables according to temperature change	±1.0dB (45.5dBm(35W), 27V, +25)
Interface and Impedence	TTL, Analog, 50∧

AFCU (Antenna Front end and Combiner Unit)

AFCU removes unnencessary signals other than 1.25MHz bandwidth from signals transferred by HPAU, and junctions signals. From a junctioned signal, it re-filters a frequency band allocated to the carrier and transfers it to the antenna via the connection port plate on top of BTS.

It filters a frequency band to the carrier first from the received signal on the antenna. After low-noise amplification of the filtered signal, it removes signals other than 1.25MHz bandwidth used by the relevant channel. When the base rack only is installed, AFCU distributes th signal immediately to TRXA of the channel pocessing block, while when an expansion rack is installed, RXDU receives the signal to distribute to TRXA.

SCBS-319L has two antennae per sector to give diversity effects to Rx signal. AFCU also has two antennae per sector to processs Tx signals.
In addition, AFCU interfaces to BMDU to support BTS performace test.

Items	Detailed Specifications
Filter	Tx 5MHz/Rx 15MHz Bandwidth
Input Loss	0.4dB
LNA Gain	30.5dB±1.5dB
I/O Impedance	50∧

RXDU (Receiver Distribution Unit)

RXDU is equipped when BTS services 4 or more frequency bands, and receives signals from AFCU to distribute TRXA of the CPB.

Items	Detailed Specifications
Power DIV. loss	7dB(4-WAY)

1.5 Additional Devices

1.5.1 Optical Repeater

Optical repeater is used for enlarging BTS coverage and to resolve the power loss in radio shadow area. It is configured with optical combiner unit and remote RF unit. And optical combiner unit and remote RF unit are connected by optical fiber cables.
MACA controls fault of optical repeater.

Optical Repeater specifications

Items	SCBS-319L → Optical repeater	Optical repeater → SCBS-319L
Link Gain	41dB	Average 30dB
Noise Figure	-	Maximum10dB
Max. Transmit Power	8W per frequency band	-

Detailed description of the units in optical repeater is as follows.

Optical Combiner Unit

If an optical combiner unit replaces HPAU, SCBS-308L and optical repeater is interfaced. Up to 3 optical combiner unit can be mounted in each rack. Each unit can connect up to 3 remote RF unit, and it provides 3 sectors capacity in one frequency band and single sector capacity in three frequency bands.

Optical combiner unit modulates transmitting signals from TRXA of channel processing block and transfers to remote RF unit. Conversely, it demodulates receiving signal transferred from remote RF unit to RF signal and transfers to TRXA.

Remote RF Unit

Remote RF unit can be attached on the wall or pole in maximum 10Km away from BTS.
Remote RF unit demodulates optical signal transferred from optical combiner unit to RF signal amplifies and sends them to the antenna. The low-noise amplifies RF signal received through antenna and transfers it to optical combiner unit after modifying them to optical signals. Also, Two remote RF unit antennas are installed per sector for diversity effect. Remote RF unit transfers the signal to optical combiner unit through two routes.

1.5.2 Maintenance and Administration Processor (MAP)

MAP is a maintenance program installed on PC, and is directed to BMDA to CCB. Because MAP supports off-line functions unless BSM, it is easy to use for various tests during BTS installation or maintenance on BTS under operation. All functions of MAP are displayed in GUI.

MAP supports the performances stated below when BTS is in normal condition.

- BTS local loading
- Configuration information output and modification
- State and alert output
- Test and diagnostic
- Statistic measure and statistic data output (It corresponds to regular tests under operation)

MAP supports the performances stated below when faults occur on BTS.

- Test call request and result output
- BTS link disconnection and restoration
- Channel element disconnection and restoration
- Subcell service disconnection and restoration
- Various test control for BTS hardware

Environment for MAP installation is as follows.

Items	Detailed Specification
Software Environment	Microsoft Window 95, 98
H/W Environment	IBM Compatible PC above 386 Connection Cable between PC and BTS 8Mbytes Main Memory above
Interface	RS-232C

1.5.3 Tower-mounted Front-end Module (TFM)

TFM is installed on the bottom of receiving antenna and amplifies in low-noise merely received signal. Therefore, receiving signal gain increases about 12dB and general receive sensitivity is improved. Also, the BTS coverage area is enlarged and rate of call success is excellent if TFM is installed. Also, it improves life cycle of battery of the mobile station. Fault of TFM is controlled by MACA of CCB.

The major specifications of TFM are as follows.

Items	Detailed Specifications
Link Gain	12±1dB
Bypass Path Loss	Max. 2dB
VSWR In,Out	1.3 : 1
Noise Figure	Max. 2dB
Insertion Loss	Max. 0.7dB

2 Software Architecture

2.1 Basic Architecture

The software structure of SCBS-319L is shown below.

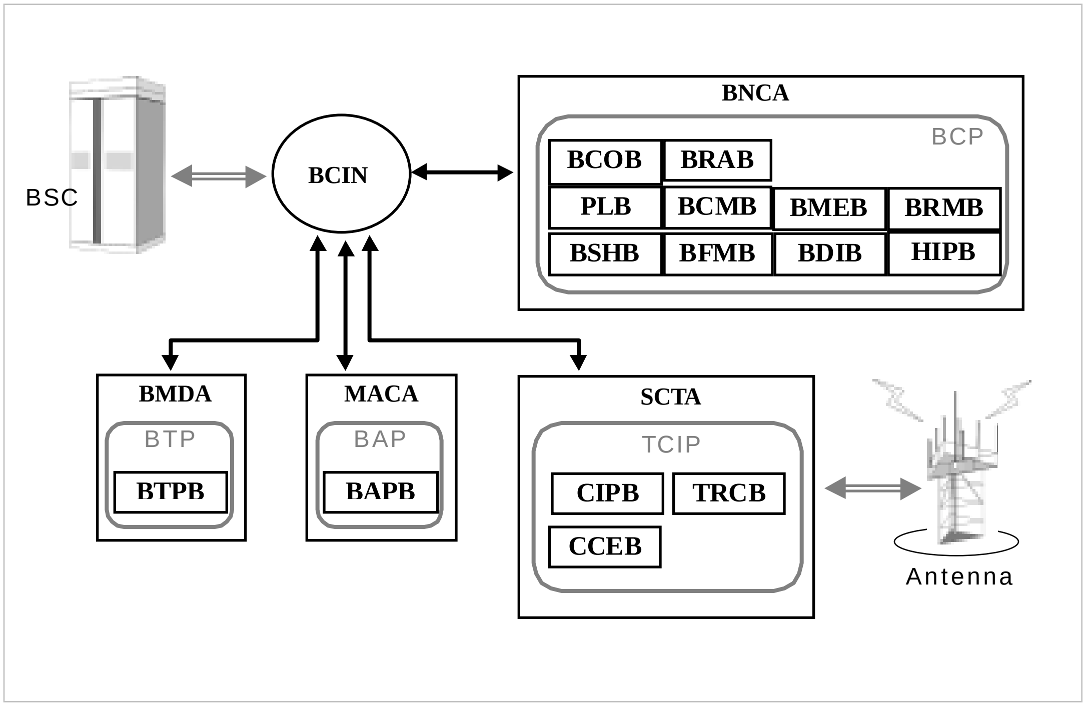


Figure 2.11 Software structure of SCBS-319L

2.1.1 Processor Configuration

There are different processors as mentioned below according to software requirements loaded on–board.

BTS Control and Maintenance Processor (BCP)

BCP is most significant processor of BTS and driven by BNCA. BCP performs system initialization, communication path set between BSC and mobile station, system operation and maintenance. For this, BCP receives/sends various IPC messages with CCP, which is the most significant processor of BSC through LCIN and BCIN.

BTS Test Processor (BTP)

BTP is a processor driven by BMDA.
BTP performs various tests to diagnose state of BSC and provides the result to the operator.

BTS Alarm control Processor (BAP)

BAP is a processor driven by MACA of CCB.
BAP collects various faults information that is detected in BSC and reports to the operator.

Transceiver and Channel element Interface Processor (TCIP)

TCIP is a processor to be driven by SCTA.
TCIP takes charge of operation and maintenance of HCEA and TRXA, and controls channel element. Also, it takes charges of data communication between CCB and CPB.

2.1.1 Software Configuration

Software run on each processor is as follows.

BCP Call Control (BCOB)

BCOB is operated in BCP and performs the following functions.

- Call set-up, maintenance and disconnection as interworking with CCOB of BSC
- Management of various resources within BCP to provide quality service efficiently
- Subscriber location registration processing
- Various additional service provision

BCP Resource Allocation (BRAB)

BRAB is operated in BCP and performs the following functions.

- Assignment and restoration of various resources for call processing
- Centralized control of BTS resources

Processor Loader Block (PLB)

PLB is the system-loading block operated in BCP and performs the following functions.

- Get software block of BCP and sub processor downloaded from BSC
- Download software block to sub processor
- Process related command upon the request of operator for re-starting of processor

BTS Configuration Management Block (BCMB)

BCMB is configuration management block operated in BCP and performs the following functions.

- Channel processing block initialization and BTS configuration management
- Provides frequency band information, which is serving relevant BTS to mobile station so that mobile station can have accurate frequency service.
- In case alert is placed on control channel, transfers relevant channel to normal traffic channel to keep service.

BTS Resource Management Block (BRMB)

BRMB is a configuration management block operated in BCP and performs the following functions.

- Correct, delete and add resources data according to command
- Transfer modified resources data information to state, loading, fault and call processing related software
- Perform system addition and reduction on on-line

BRMB is the only software to change resource data within BTS, but other software could just read them.

BTS Measurement Block (BMEB)

BMEB is a statistic management block operated in BCP and performs the following functions.

- Collect statistic information by each function of BTS
- Report collected data to BSC
- Transfer collected data to MAP upon the request of MAP

BCP Status Handling Block (BSHB)

BSHB is a state management block operated in BCP and performs the following functions.

- Manage state of processor and device of BTS
- Transfer state management information to BSM or MAP
- Isolate available resources from garbage to increase the call success rate

BTS Fault Management Block (BFMB)

BFMB is a fault management block operated in BCP and performs the following functions.

- Report fault to CFMB of BTS as being notified from BSHB, which is a state management block
- Reports hardware fault information that is received from BAPB to CFMB after filtering them

BTS Diagnostic Block (BDIB)

BDIB is a test and diagnostic block operated in BCP and performs the following functions.

- Request BTPB for various state test regularly according to PLD information
- Request BTPB for a temporary state test upon getting instruction of BSM or MAP

High capacity IPC Processor Block (HIPB)

HIPB is a INTA control block operated in BCP and performs the following functions.

- Download INTA node address
- Node state management
- Report fault information to BCP upon fault detected on INTA.

BTS Test Processor Block (BTPB)

BTPB is a test and diagnostic block operated in BTP, it performs the following functions upon request of BDIB.

- Channel element built-in test
- Diagnose RF path
- Call test by using TM(Test Mobile)

BTS Alarm Processor Block (BAPB)

BAPB is a fault-processing block operated in BAP and performs the following functions

- Collect hardware fault from SACA mounted on each rack
- Transfer collected fault information to BFMB
- Takes the roll as an environmental monitor for interior temperature management of BTS, disconnection of rectification etc.
- RF block control

BTS Channel Element Block (CCEB)

CCEB is operated in TCIP and performs the following functions.

- Assign and operate channel element under the control of BCP
- Modify packet data from BTS to CDMA signal to transfer it to mobile station
- Modify CDMA signal to be received from antenna to packet data to transfers it to BTS

Channel Card Interface Block (CIPB)

CIPB is operated in TCIP and performs the following functions.

- Data receiving/transmitting between TRXA, HCEA and INTA
- Initialization and control of HCEA
- Report fault information to BCP upon fault placement on HCEA

TRXA Control Block (TRCB)

TRCB is a TRXA control block to be operated in TCIP and performs the following functions.

- Initialization and control of TRXA
- Report fault information to BCP upon fault placement on TRXA
- TCIP data backup

2.2 Functions of Software

The functions of software are as follows.

- Call processing
- System Operation
- System Maintenance

2.2.1 Call Processing

Call processing software provides various call services to mobile subscribers as interworking software of BTS and MSC.
The major functions of call processing are as follows.

Originating call

When SCBS-319L receives originating call message of mobile station, call processing software assigns channel by synchronizing with BTS after MS authorization. It provides mobile subscriber with call path by connecting channel element of SCBS-319L, vocoder of BTS and MSC.

Incoming call

When SCBS-319L receives incoming call message from BTS, call processing software sends paging signal to mobile station, and when it has response from mobile station, it reports to BTS. Accordingly, as BTS assigns vocoder and call path for incoming call processing is provided.

Test call

Call processing software sets test calls upon the request of an operator. Test call is made regardless switching exchange, and call is set as assigning traffic channel upon the request of BTS.

Supplementary call

SCBS-319L processes non-voice call such as SMS and data service. SMS can be proceeded by using paging channel without call setup or by using traffic channel after call setup. In case of data, it is possible to set up the circuit mode data call to be connected by fax or modem and packet data call to be connected on Internet.

Hand-off

Call processing software proceeds hand-off to be originated according to the mobility station. SCBS-319L provides softer hand-off, soft hand-off, hard hand-off and access hand off.

Others

Call processing software provides power control, Priority Access channel Assignment (PACA), location service etc. Also, it provides various statistics data related to call processing to operation subsystem.

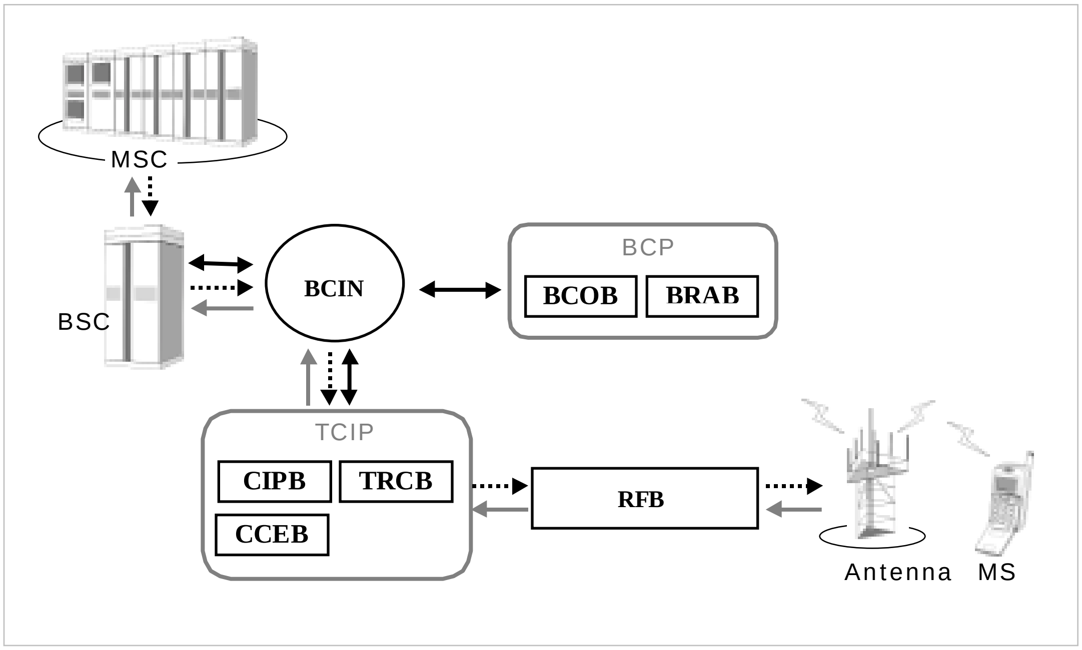


Figure 2.12 Software interworking for call processing

2.2.2 Operation Software

Operation software of SCBS-319L initializes system processor data and manages system configuration and resources for normal system operation.
The major functions related to system operation are as follows.

System Loading

System loading software initialize system by downloading various software from CCP of BTS. Also, it loads required software to relevant processor upon the request of sub-processor, and restarts certain processor of system upon the request of the operator. Additionally, it reloads certain software or takes load of files required for system extension/removal.

Statistic Management

Statistic management software measures meaningful events originated from BTS periodically, and reports them to BSM through BSC. It also transacts the requests of MAP for statistic data collection.

Configuration Management

Operation subsystem controls configuration information of SCBS-319L. When an operator wants to modify data, configuration management software changes relevant Program Load Data (PLD) according to data characteristics, and transfers this information to other software blocks, which indicates this modification. Also, configuration management software provides relevant information upon the request of BSM or MAP for system configuration information.

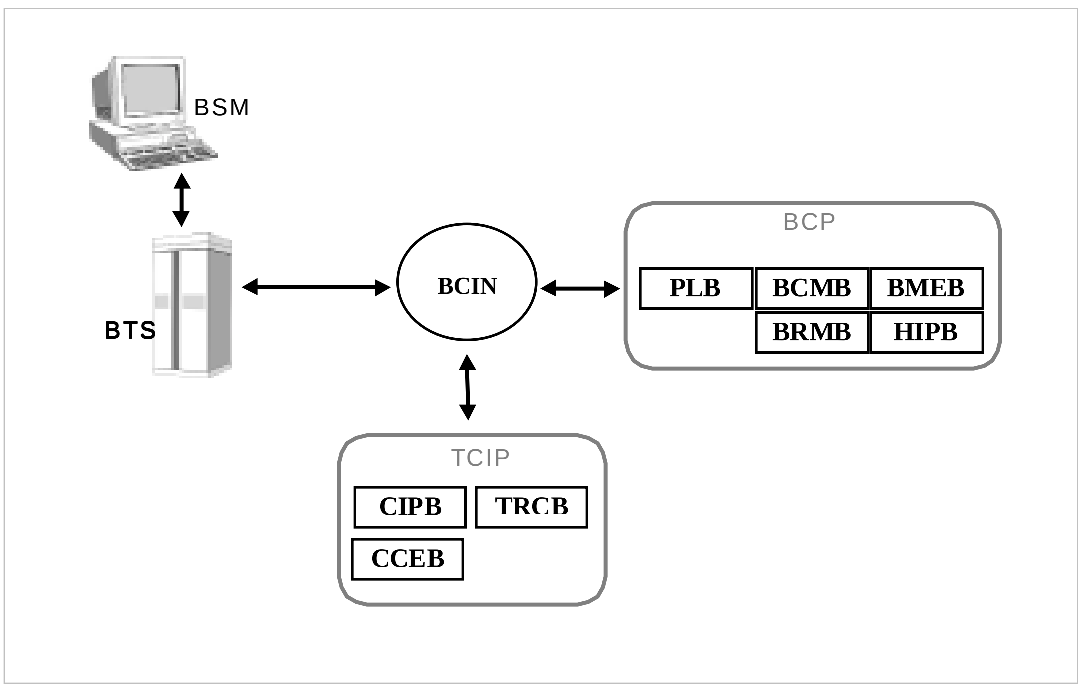


Figure 2.13 Software interworking for system operation

2.2.3 Maintenance Software

Maintenance Software of SCBS-319L manages system state and fault and transfers relevant information to BTS.
The major functions related to system operation are as follows.

State Management

State management software manages states of various processors, links, devices and call processing resources of BTS. Also, it provides information of various states to BSM or MAP.

Fault Management

Fault management software detects faults on various system components, links devices and power boards of BSC, and reports to BSC.

Test and Diagnostics

Test and diagnostics software diagnoses System State as testing various processors, links, call processing resources. Test can be made regularly according to PLD information or irregularly upon the request of an operator.

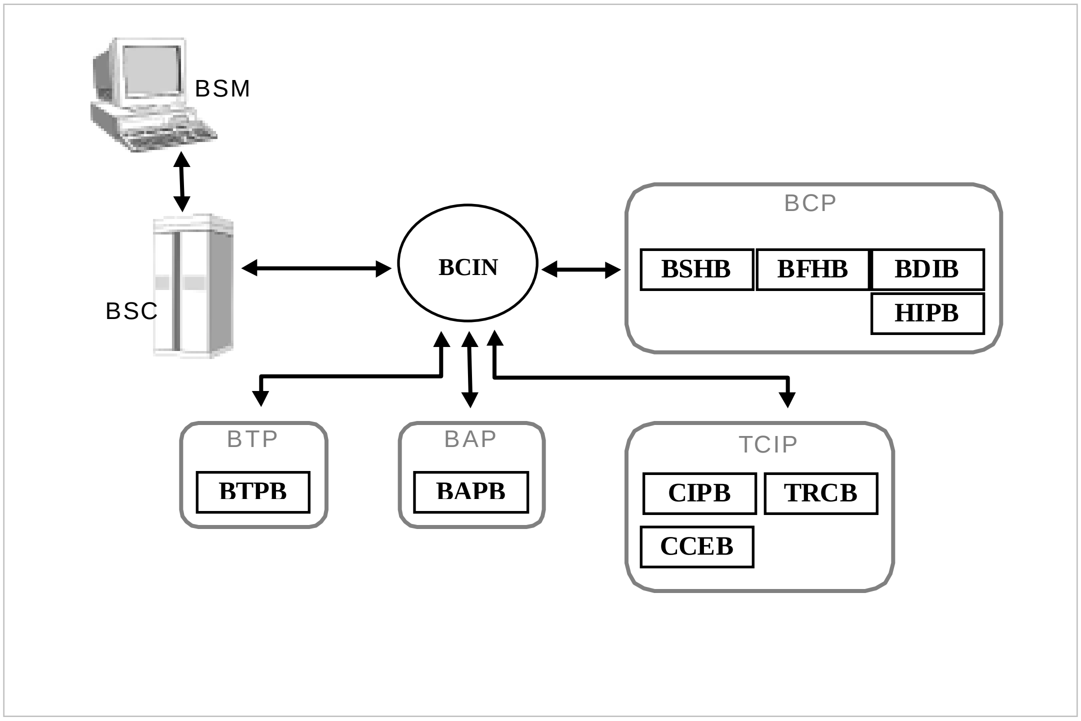


Figure 2.14 Software interworking for system maintenance

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ACRONYMS GLOSSARY

A

ADC	Analog-to-Digital Converter
AFCU	Antenna Front end & Combiner Unit

B

BAP	BTS Alarm control Processor
BAPB	BTS Alarm Processor Block
BATA	BTS Antenna Test Assembly
BCOB	BCP Call Control
BCMB	BTS Configuration Management Block
BCP	BTS Control and Maintenance Processor
BCPB	BTS Control Processor Block
BDIB	BTS Diagnostic Block
BFMB	BTS Fault Management Block
BMDA	BTS Maintenance and Diagnostic Assembly
BMEB	BTS Measurement Block
BNCA	BTS and Node Controller Assembly
BSC	Base Station Controller
BSM	Base Station Manager
BRAB	BCP Resource Allocation
BRMB	BTS Resource Management Block
BSHB	BCP Status Handling Block
BTP	BTS Test Processor
BTS	Base station Transceiver System

C

CCEB	BTS Channel Element Block
CDMA	Code Division Multiple Access
CDSP	Control Digital Signal Processor
CIPB	Channel Card Interface Block
CPU	Central Processing Unit

D

DC	Directional Coupler
DDSP	Demodulator Digital Signal Processor
DPRAM	Dual Port RAM

E

EMI	Electro Magnetic Interference
EVRC	Enhanced Variable Rate Coding

F

FR	Failure Rate

G

GPS	Global Positioning System
GCRA	GPS Clock Receive Board Assembly

H

HCEA	High-density Channel Elements Assembly
HIPB	High capacity IPC Processor Block
HLR	Home Location Register
HPAU	High Power Amplifier Unit

I

INTA	Interconnection Node and Trunk Assembly
ITU-T	International Telecommunication Union-Telecommunication Standardization Sector
IWF	Inter Working Function

L

LNA	Low Noise Amplifier

M

MACA	Master Alarm Control Assembly
MAP	Maintenance and Administration Processor
MSC	Mobile Switching Center
MTBF	Mean Time Between Failure

P

PACA	Priority Access and Channel Assignment
PC	Personal Computer
PLB	Processor Loader Block
PLD	Program Load Data

Q

QCELP	Qualcomm Code Excited Linear Prediction
QPSK	Quadrature Phase Shift Keying

R

RBPF	Receive Band Pass Filter
RFB	Radio Frequency Block
RLNA	Receive Low Noise amplifier

S

SACA	Slave Alarm Control Assembly
SCTA	Shelf Controller and Transceiver control Assembly
SDP-A	Samsung DC/DC Power-Advanced
SMS	Short Message Service
SWP	Switching Processor

T

TBPF	Transmit Band Pass Filter
TCIP	Transceiver and Channel element Interface Processor
TFM	Tower-mounted Front-end Module
TOD	Time Of Day
TRXA	Transceiver Assembly
TTL	Transistor-Transistor Logic

SCBS-319L

BTS SYSTEM DESCRIPTION

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ELECTRONICS

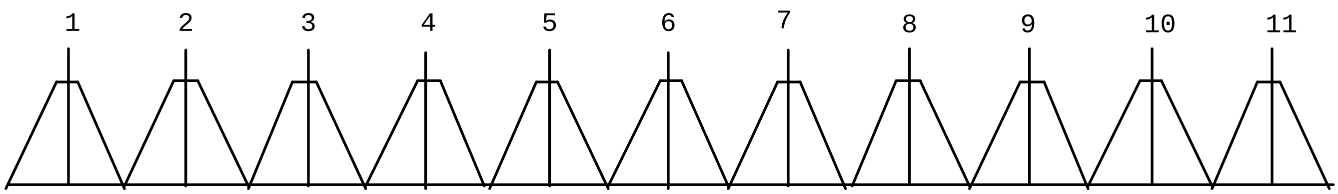
●An Appendix

- Operation Frequency

- RF_block diagram

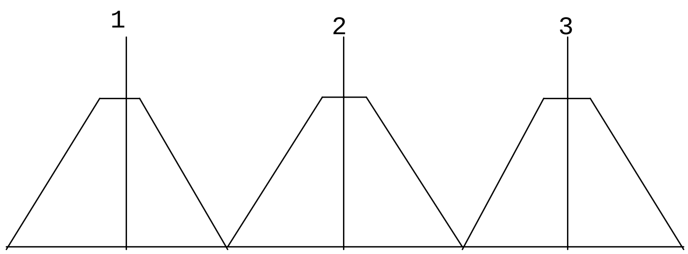
* Operation Frequency

A Band CDMA Channel Numbers and Corresponding Frequencies



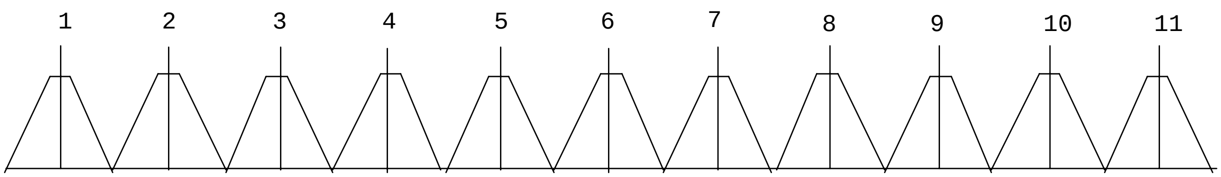
	Tx. Frequency	CH num.		Tx. Frequency	CH num.
1	1931.25	25	7	1938.75	175
2	1932.5	50	8	1940	200
3	1933.75	75	9	1941.25	225
4	1935	100	10	1942.5	250
5	1936.25	125	11	1943.75	275
6	1937.5	150			

D Band CDMA Channel Numbers and Corresponding Frequencies



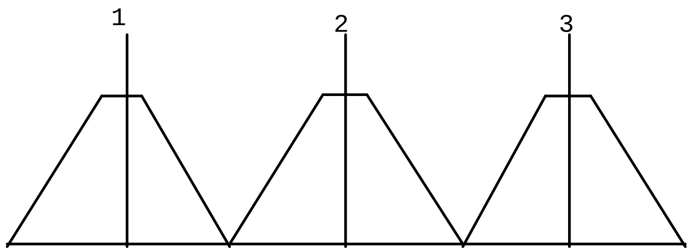
	Tx. Frequency	CH num.
1	1946.25	325
2	1947.5	350
3	1948.75	375

B Band CDMA Channel Numbers and Corresponding Frequencies



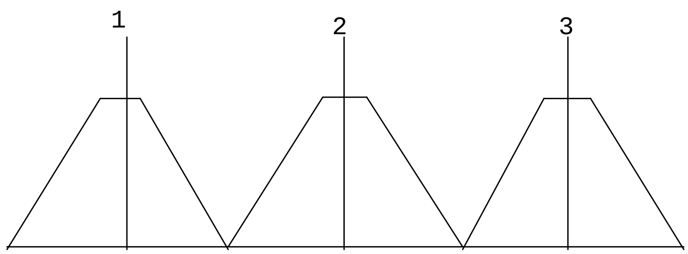
	Tx. Frequency	CH num.		Tx. Frequency	CH num.
1	1951.25	425	7	1958.75	575
2	1952.5	450	8	1960	600
3	1953.75	475	9	1961.25	625
4	1955	500	10	1962.5	650
5	1956.25	525	11	1963.75	675
6	1957.5	550			

E Band CDMA Channel Numbers and Corresponding Frequencies



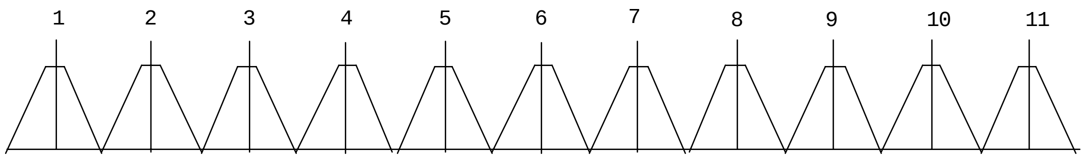
	Tx. Frequency	CH num.
1	1966.25	725
2	1967.5	750
3	1968.75	775

F Band CDMA Channel Numbers and Corresponding Frequencies



	Tx. Frequency	CH num.
1	1971.25	825
2	1972.5	850
3	1973.75	875

F Band CDMA Channel Numbers and Corresponding Frequencies

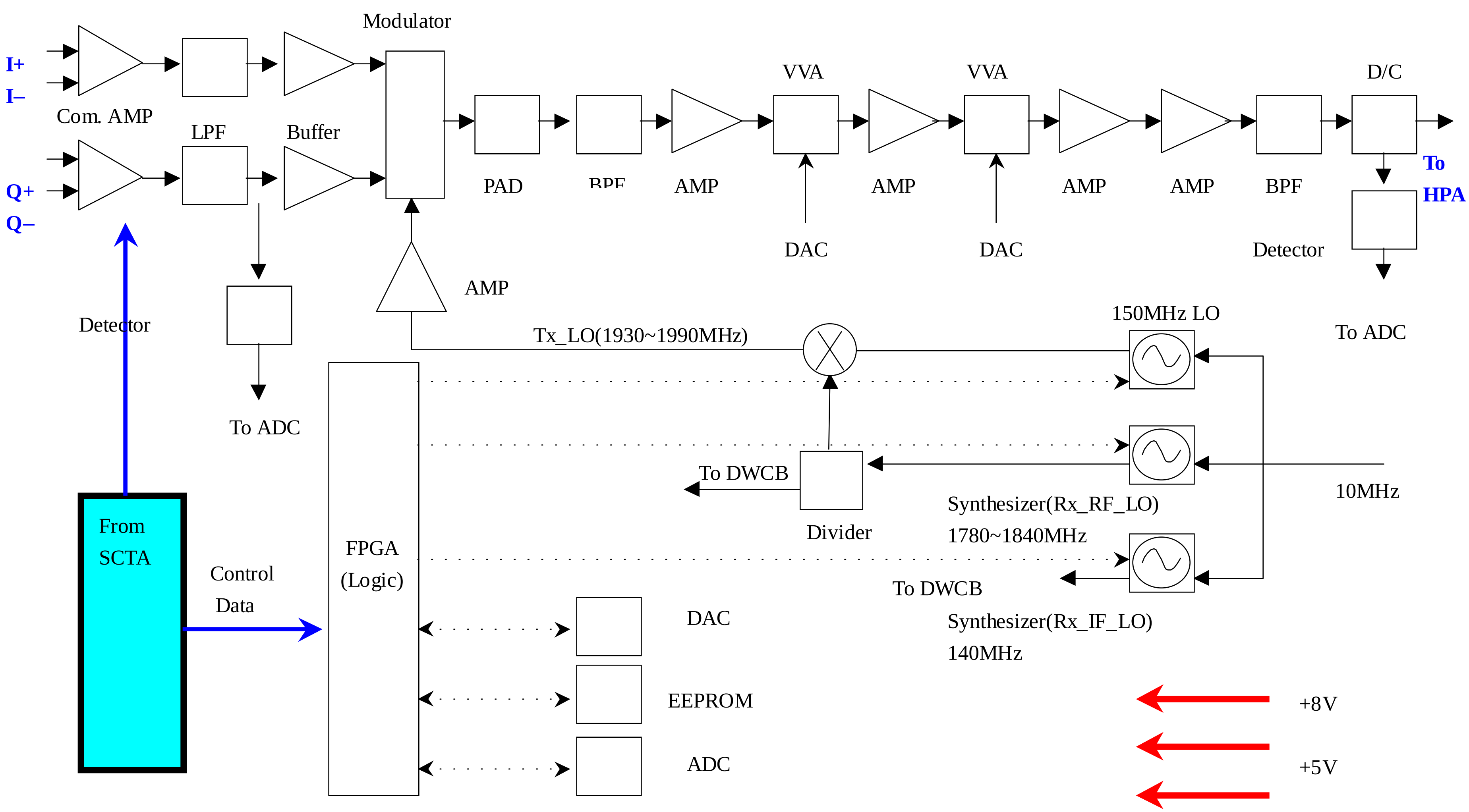


	Tx. Frequency	CH num.		Tx. Frequency	CH num.
1	1976.25	925	7	1983.75	1075
2	1977.5	950	8	1985	1100
3	1978.75	975	9	1986.25	1125
4	1980	1000	10	1987.5	1150
5	1981.25	1025	11	1988.75	1175
6	1982.5	1050			

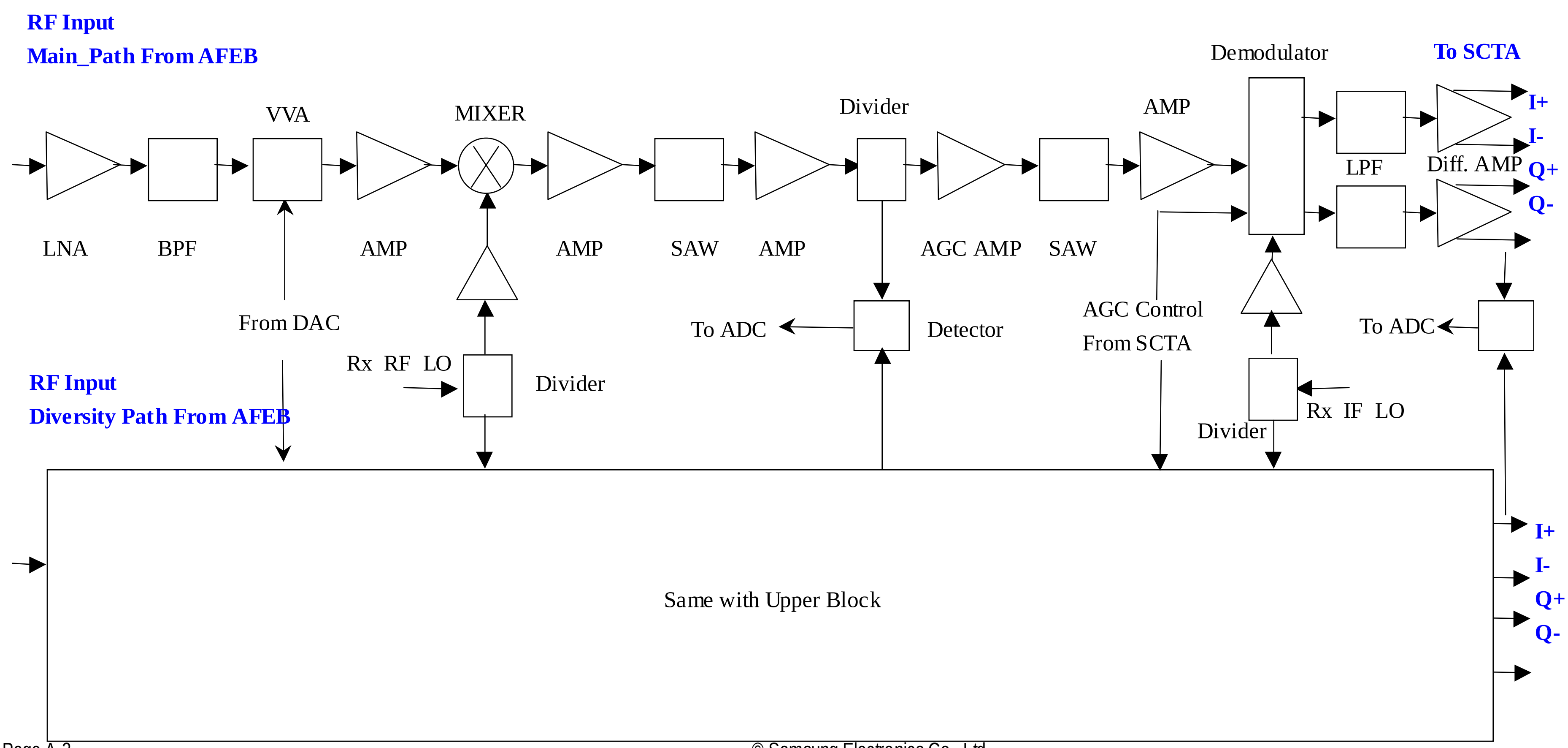
* RF_block diagram

1. TRXA Block Diagram

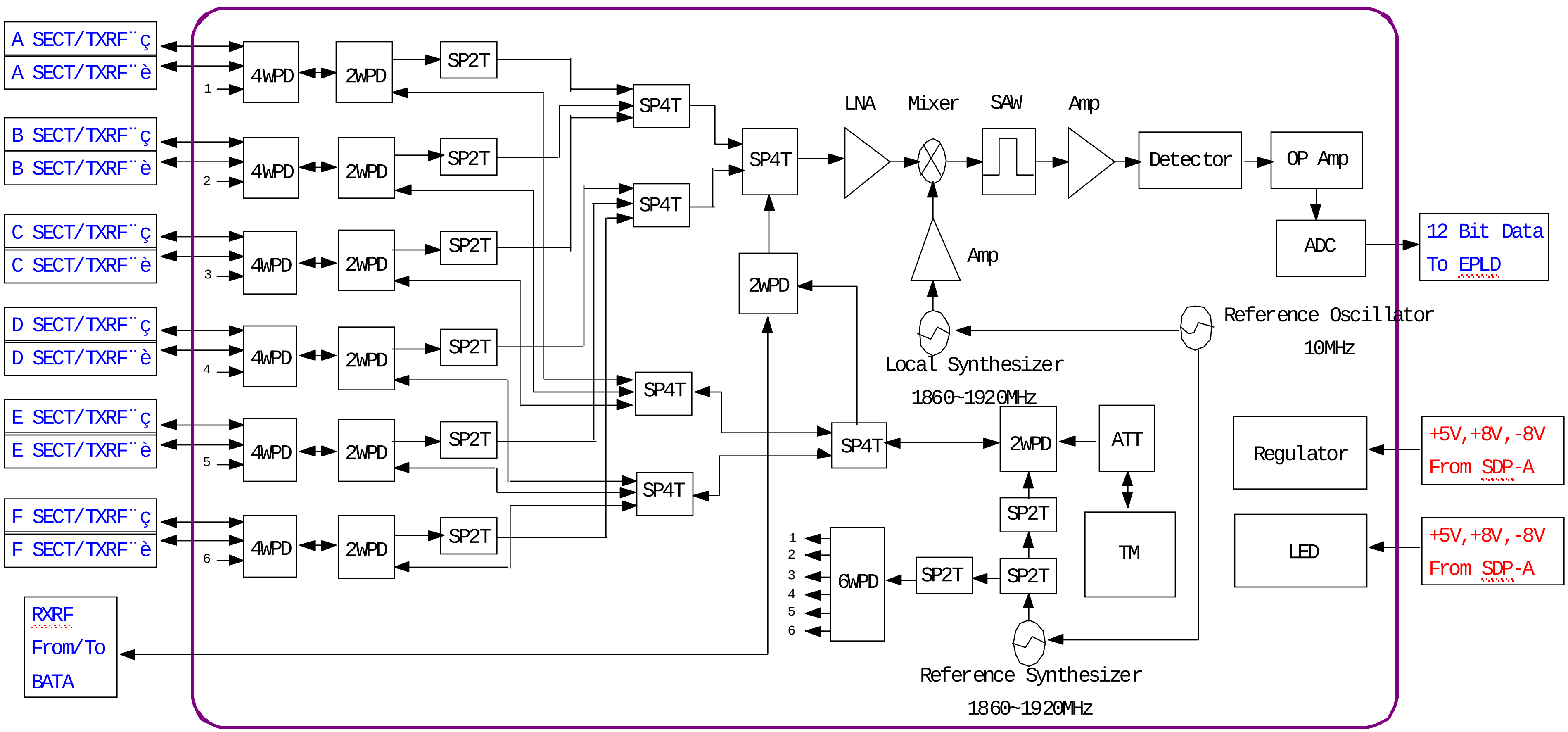
1) UPCB BLOCK Diagram



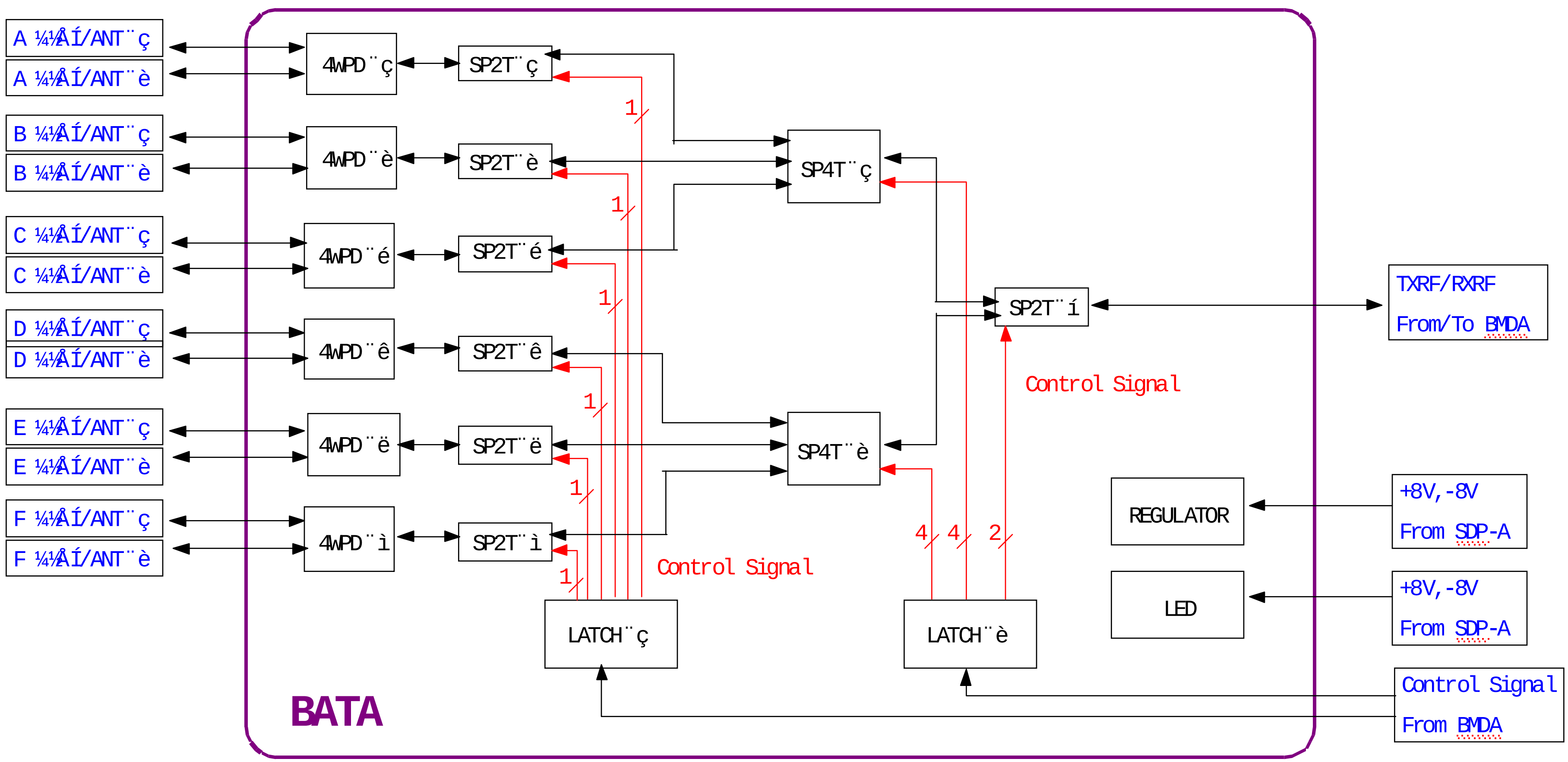
2)DWCB BLOCK Diagram



2. BMDA Block Diagram



3. BATA Block Diagram



<±×¸²1> BATA Block Diagram

4. HPAU Block Diagram

This Block Diagrm describes the High Power Amplifier Unit (HPAU) circuit used for PCS (1900MHz)