行政院及所屬各機關出國報告
（出國類別：考察）

參訪金星(L.G.)公司心得報告

服務機關：中山科學研究院
出國人職稱：上校技正　中校技士　少校技士
姓　　名：王昌國　鄭張權　胡榮富

出國地區：韓國漢城
出國期間：89年10月30日至89年11月7日
報告日期：90年3月23日

中山科學研究所出國公差人員心得報告目錄

壹、出國目的及緣由

因本組負責經濟部「寬頻無線通訊系統發展五年計畫」之寬頻分碼多重進接無線通訊(WB-CDMA)系統開發，由於對國際WB-CDMA(Wide Band-Code Division Multiple Access)大廠之先進系統實際應用情形認為應更加深入了解與學習，期能透過此次派員赴韓國金星 (LG) 公司參訪寬頻無線通訊系統發展設計技術，蒐集WB-CDMA/WLL 系統發展之最新相關資料。

因此與金星公司研討及觀摩其寬頻無線通訊系統的基本細部架構，使本所能對本計畫執行寬頻無線通訊系統計畫有所助益，另外用戶台、基地台、管控台間測試驗證方式，做為國內未來寬頻無線通訊驗證技術參考。

貳、公差心得

一、前言

行動通訊從第一代 AMPS 系統，第二代行動通訊系統如 GSM/ DCS-1800 /PCS1900、IS-54/136、PDC 及 IS-95，第二代半系統如 GPRS、EDGE，第三代行動通訊系統如 W-CDMA、CDMA2000 等。因此國內為了在無線通訊領域發展，經濟部委由本院研發寬頻分碼多重進接無線通訊(WB-CDMA)系統，以其能為國內通訊業創造生機。

為了能了解先進大廠之發展現況級系統驗證相關技術，赴韓國金星(LG)公司參訪寬頻無線通訊系統發展設計技術，蒐集對本所 WB-CDMA/WLL 系統發展之最新相關資料，並以此機會與金星公司研討及觀摩寬頻無線通訊系統細部架構，包括用戶台、基地台、管控台間模擬驗證、測試平台及系統整合等。

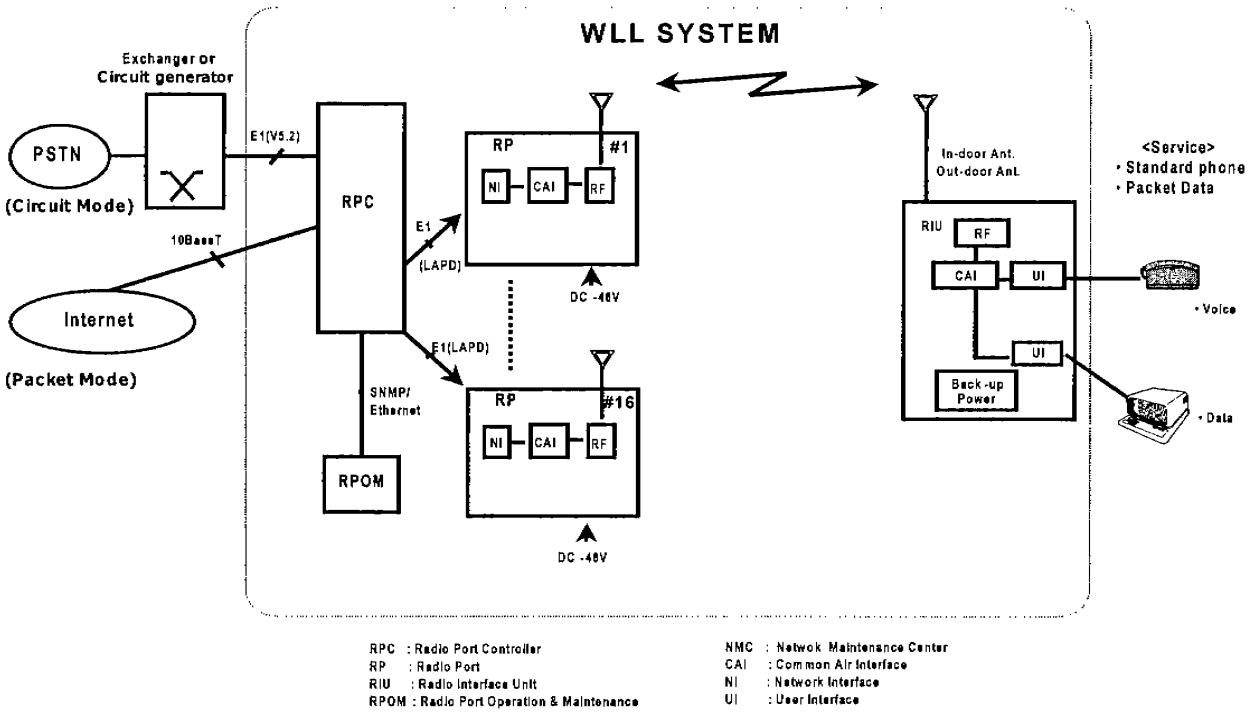
二、說明

金星(L.G.)公司利用其發展寬頻分碼多重進接無線通訊之用戶迴路系統(簡稱 WB-CDMA/WLL)解說系統架構及其測試平台，令此次觀摩及研討有實品展示，對此行有很大的幫助，更容易瞭解其架構、操作及加深印像。

1. 系統架構及組態

系統包含用戶台(RIU：Radio Interface Unit)、基地台(RP：Radio Port)、管控台(RPC：Radio Port Controller)、操作及維護工作站(RPOM：Radio Port Operation & Maintenance)、數據分封交換伺服器(IP-Server)，其架構如圖一 WB-CDMA /WLL 系統架構圖。

管控台可與本地交換機(Local Exchange)連接，並以 E1 連接基地台，而基地台以無線方式與眾多用戶台連接；用戶台提供語音及數據介面供用戶使用；操作及維護工作站提供人機介面可監管本系統通連及裝備狀況。



圖一： WB-CDMA/WLL 系統架構圖

1.1 基地台(RP：Radio Port)

基地台以 E1 介面與管控台介接，並以無線的方式採 WB-CDMA 技術與用戶台介接，作為管控台與用戶台間傳遞資料的橋樑。

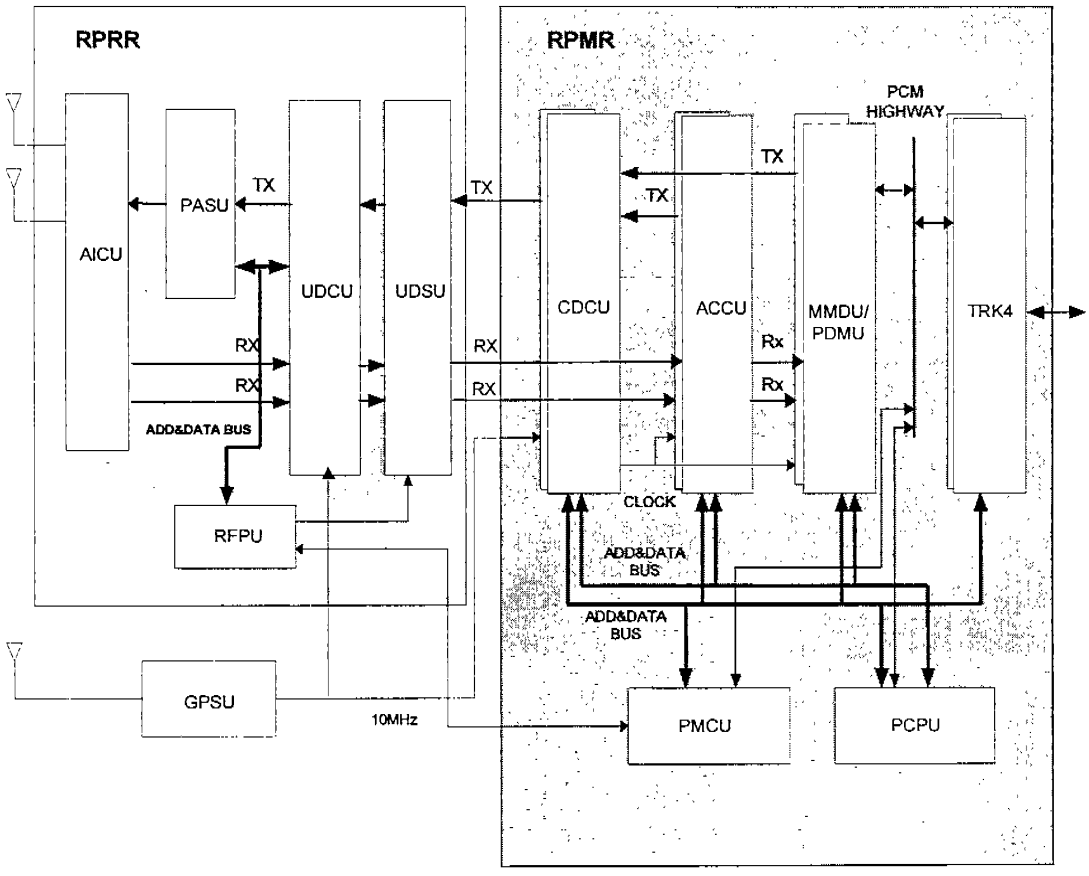


圖 1.1-1 基地台(RP)架構圖

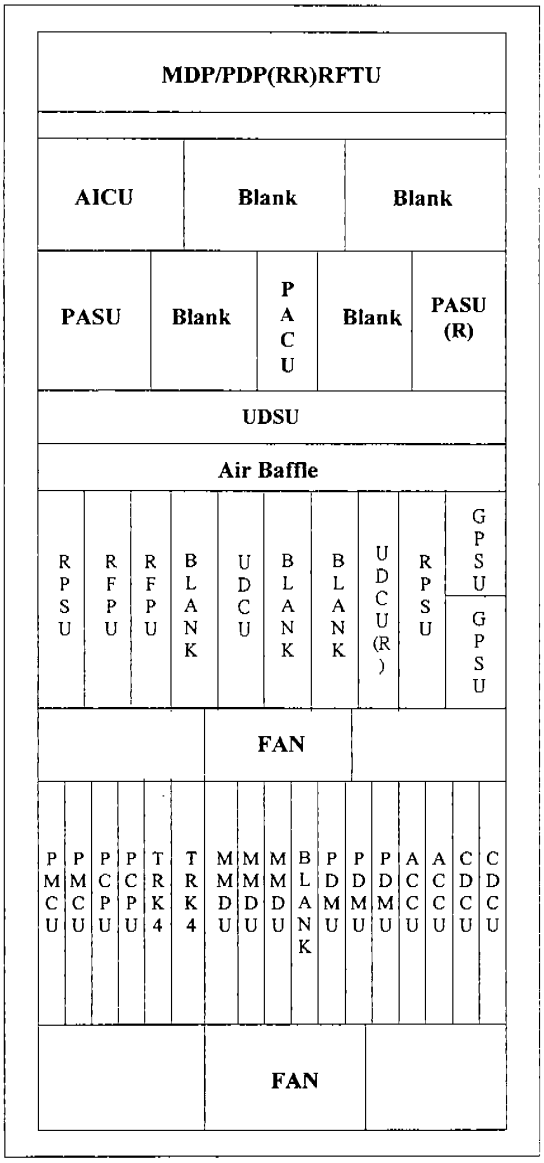


圖 1.1-2 基地台(RP)正面實體圖

基地台(如圖 1.1-1 基地台(RP)架構圖及圖 1.1-2 基地台(RP)正面實體圖)主要功能有：

(1)提供用戶台(RIU)與管控台(RPC)之間連結介面

(2)處理無線射頻部分之通訊協定、RF(高頻)與 IF(中頻)至基頻之轉換、基頻訊號處理

(3)提供功率放大功能

(4)提供語音及數據頻道，可以擴充卡板方式增加用戶數。

(5)皆具備備份容量。

1.1.1 基地台單體功能介紹

1.1.1.1 rP 主要控制單元(PMCU)

PMCU 初始化所有裝配在 RP 系統的卡板硬體。而在初始化硬體之後，PMCU 初始化已經初始化硬體上的軟體。其亦會報告錯誤狀態與警告到 RPOM(經由 NMS 通道和 RPC)，也提供 RFPU 和 RPC 間的通訊路徑(為了監測每一塊 RP 卡板上的狀態)。PMCU 主要是執行下列功能：

(1)初始化卡板及管理卡板狀態。

(2)管理錯誤訊息並取透過管控台送至 RPOM 後，儲存錯誤狀態。

(3)透過 E1 介面與 NMS(網路管理伺服器)及管控台連接，回報卡板狀態至 RPOM。

(4)儲存每一片卡板軟體及下載軟體。

(5)處理及控制中央警告面板之警告訊號。

(6) 提供與 RP 溝通所需的 NMS 通道功能(E1 的每一個時槽)。

1.1.1.2 rP 通話處理單元(PCPU)

PCPU 透過 PMCU 間接地管理 MMDU、ACCU、CDCU 處理語音和資料通話，再反應管理結果給系統資源管理伺服器。其亦設定和更改 RP 無線參數，也負責通話處理控制和透過無線通話處理通訊協定來處理統計資料。PCPU 主要是執行下列功能：

(1) PCPU 透過共享記憶體來分享 刪除(或新增)資訊和與 PMCU 相關的卡板備用資訊，另外一個作用是定期地監控資訊。

(2) PCPU 透過 LAPD 通訊協定與 RPC 做溝通，也處理無線語音呼叫和資料呼叫。

(3) 所有無線呼叫處理都是以無線存取規格作為基礎(CAI 通訊協定)。

(4) PCPU 控制和設定 RP 和使用者終端機之間的無線參數 (SYNC, PAGING, PILOT, BASEPNSEED 等等)。

(5) PCPU 管理 Modem 通道卡板(MMDU)通道狀態，且提供呼叫處理統計資料和回報，其中包含啟動呼叫/呼叫成功/呼叫失敗。

(6) 軟體下載功能。

(7) 備用切換功能。

1.1.1.3 四通道的主幹(TRK4)

TRK4 會將從多調變解調單元(MMDU)單元來的單極資料(unipolar data)轉換成多極脈波(multipolar pulse)，然後傳送脈波到 RPC；相反地亦然，會將從 RPC 來的多極脈波轉換成單極資料再送至 MMDU。TRK4 會監控每一個主幹線的狀態，當狀態發生不正常時，會啟動警告且回報狀態給系統。在主幹和單體測試方面，TRK4 在本地端和遠端是使用迴路測試方式(loopback)再傳送給遠端站警告訊息。

(1) 提供 E1 通道。

(2) 支援 HDB3 或 AMI 線碼(line code)。

(3) G.704 2048Kbit/s E1 框架介面(frame interface)。

(4) CRC, HDB3, 框架字錯誤監督(frame word error monitoring)。

(5) 在PMCU與透過DPRAM和緩衝器的本地端處理器做介面處理。

(6) 將E1封包框架或是解框架。

1.1.1.4 多調變解調單元(MMDU)

多調變解調單元(Multi MoDem Unit ：MMDU)處理相對應每一 W-CDMA 碼通道(code channel)的實體層信號，還有無線存取通信協定。

MMDU 包含下列方塊：W-CDMA modem ASIC(W-CDMA調變解調ASIC)、負責與高階處理器PMCU做溝通的Peripheral Control(周邊控制器)、全部卡板控制、內板(inner-board)周邊裝置控制、負責處理器和記憶體控制的Processor Controller(處理器控制器)、Interrupt Control(中斷控制器)、負責順向鏈路平行資料結合(forward link parallel data combine)的TX-combiner(發射信號結合器)、反向鏈路(reverse link)資料驅動器、負責 E1 資料 PCM 高速介面的 timeslot selector(時槽選擇器)與 trunk selector(主幹選擇器)、MFC Timing Check(Multi Frequency

Control Timing Check，多頻率控制時序檢查)、timing distribution(時序分配)。

其架構如下圖，1.1.1.4-1 多調變解調單元(MMDU)示意圖。

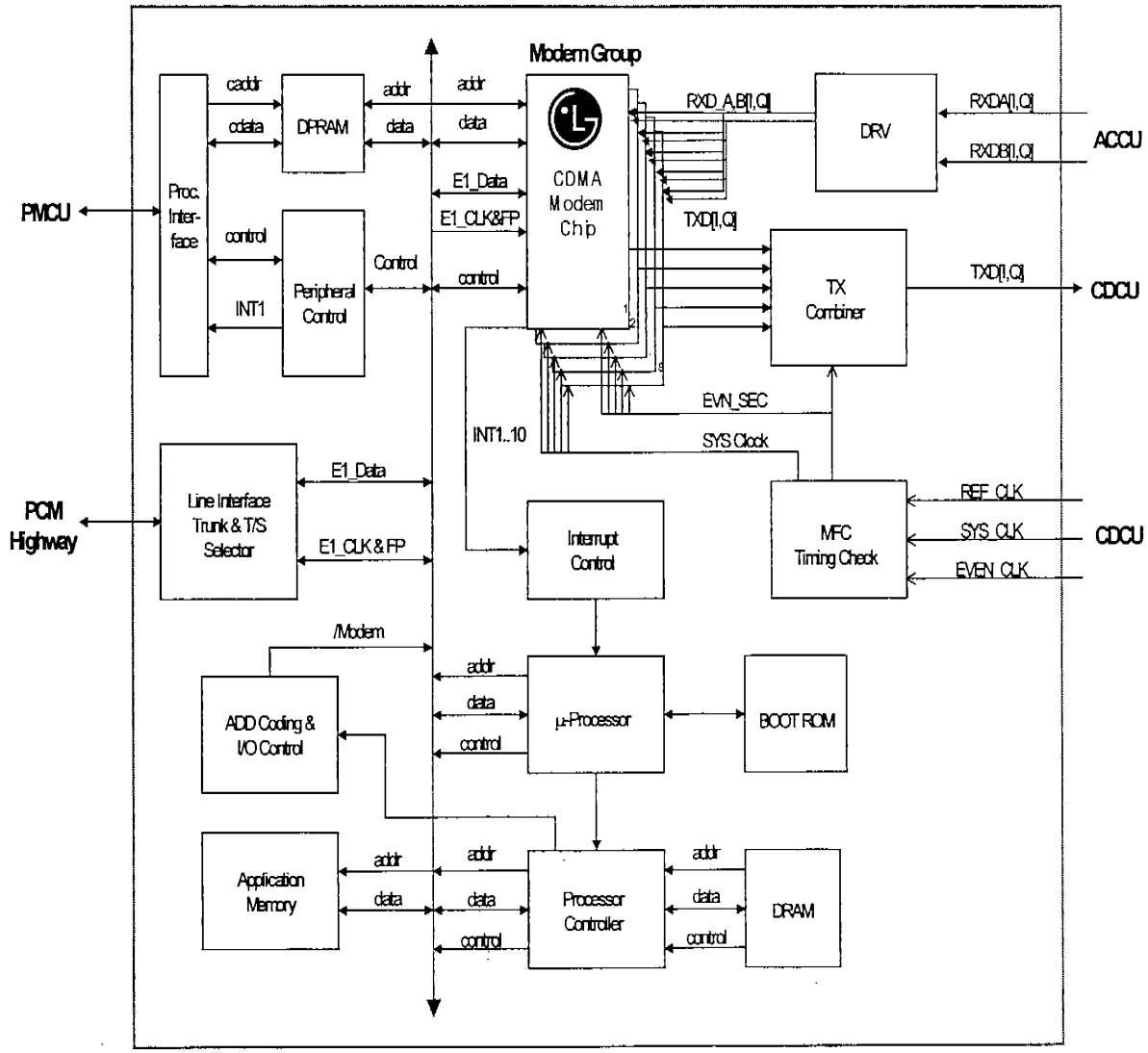


圖 1.1.1.4-1 多調變解調單元(MMDU)示意圖

1.1.1.5 封包資料調變解調單元(PDMU)

封包資料調變解調單元(Packet Data MoDem Unit：PDMU)處理在 WLL 規格中相對應每一 W-CDMA 碼通道的實體層信號和無線通訊協定。

PDMU 包含下列方塊：W-CDMA modem ASIC(三個通道)、偵測存取信號的 Matched Filter(匹配濾波器)、負責與高階處理器 PMCU 做溝通的 Peripheral Control(周邊控制器)、全部卡板控制、內板(inner-board)周邊裝置控制、負責處理器和記憶體控制的 Processor Controller(處理器控制器)、Interrupt Control(中斷控制器)、負責順向鏈路平行資料結合(forward link parallel data combine)的 TX-combiner(發射信號結合器)、反向鏈路(reverse link)資料驅動器、負責 E1 資料 PCM 高速介面的 timeslot selector(時槽選擇器)與 trunk selector(主幹選擇器)、MFC Timing Check(Multi Frequency Control Timing Check，多頻率控制時序檢查)、timing distribution(時序分配)。

其架構如下圖，1.1.1.5-1 封包資料調變解調單元(PDMU)示意圖。

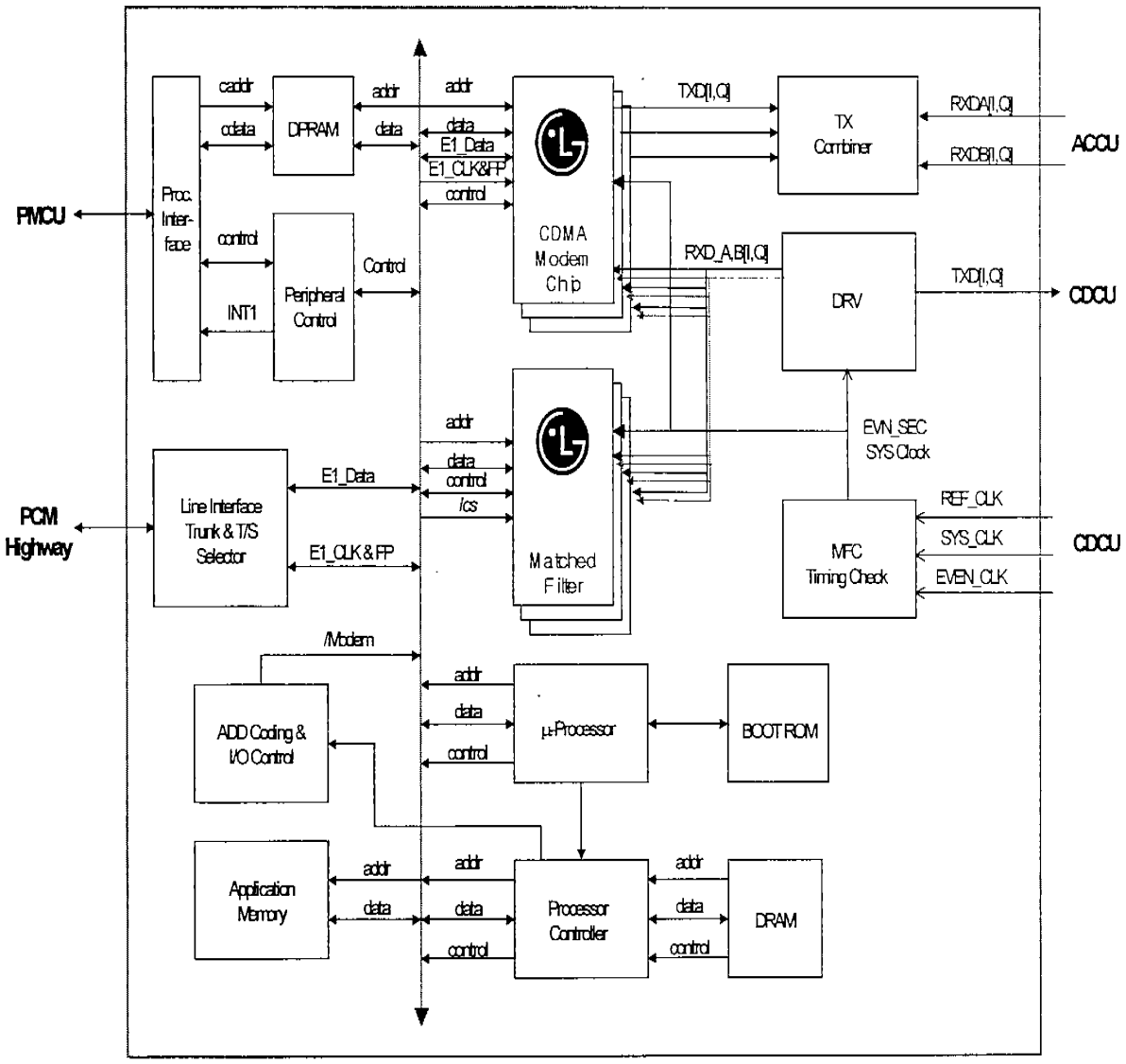


圖 1.1.1.5-1 封包資料調變解調單元(PDMU)示意圖

1.1.1.6 存取通道單元(ACCU)

存取通道單元(Access Channel Unit：ACCU)轉換基頻類比信號，以及解調後送至每一 MMDU 的接收信號。同時在解調和傳送至 PCPU 之前，也將使用者存取資料（隨機接收到）做同步。

其架構如下圖，1.1.1.6-1 存取通道單元(ACCU)示意圖。

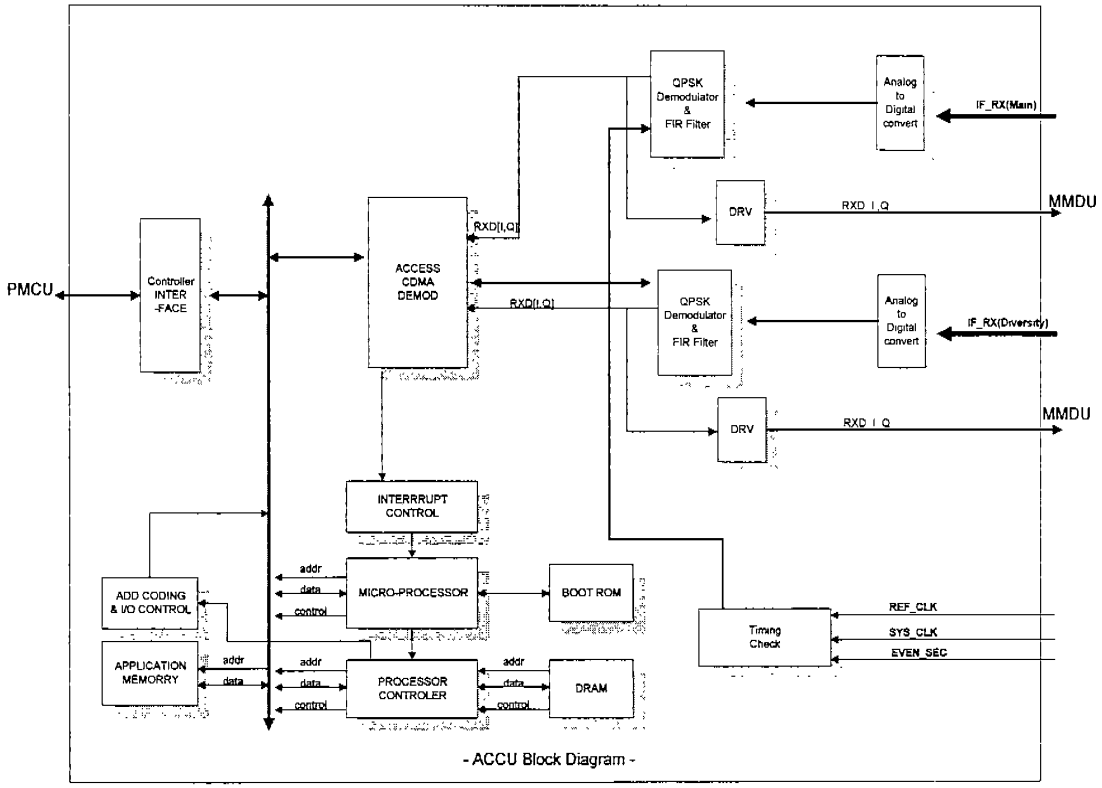


圖 1.1.1.6-1 存取通道單元(ACCU)示意圖

1.1.1.7 時脈分派與結合單元(CDCU)

時脈分派與結合單元(Clock Distribution & Combine Unit：CDCU)從 GPSU 接收 10 MHz 的時脈，然後產生和提供系統時脈。而且其會將 PILOT 通道、SYNC 通道、PAGING 通道、RP 無線通道和 TRAFFIC 通道結合在傳送出去，這樣備份的原因是為了較高的可靠度。

CDCU 功能特性如下：

(1) 接收 GPSU 來的 10 MHz 時脈且產生及分配 RP 所需的時脈。

(2) Combiner 將從 MMDU 來的順向鏈路基頻數位信號分成 I & Q 兩個通道，然後將做結合和 saturate 動作。

(3) 產生 RP 的標準 RF 信號用的 Pilot 通道、PN 碼的同步信號、Sync 通道[傳送 RP 辨識資訊和從 RP 來的可視資訊(visual information)]、Paging 通道[提供現今 RP 的系統資訊，例如隔壁 RP 資訊(neighboring RP)、可使用服務型態、註冊週期數、終端機辨識數目、存取參數、功率控制資訊、RP 本地資訊]。

(4) 將結合後的順向鏈路數位信號經由數位濾波器將相對應的頻率要求濾波做濾波，再做調變。

(5) 將已調變的數位信號轉換成基頻類比信號。

其架構如下圖，1.1.1.7-1 時脈分派與結合單元(CDCU)示意圖。

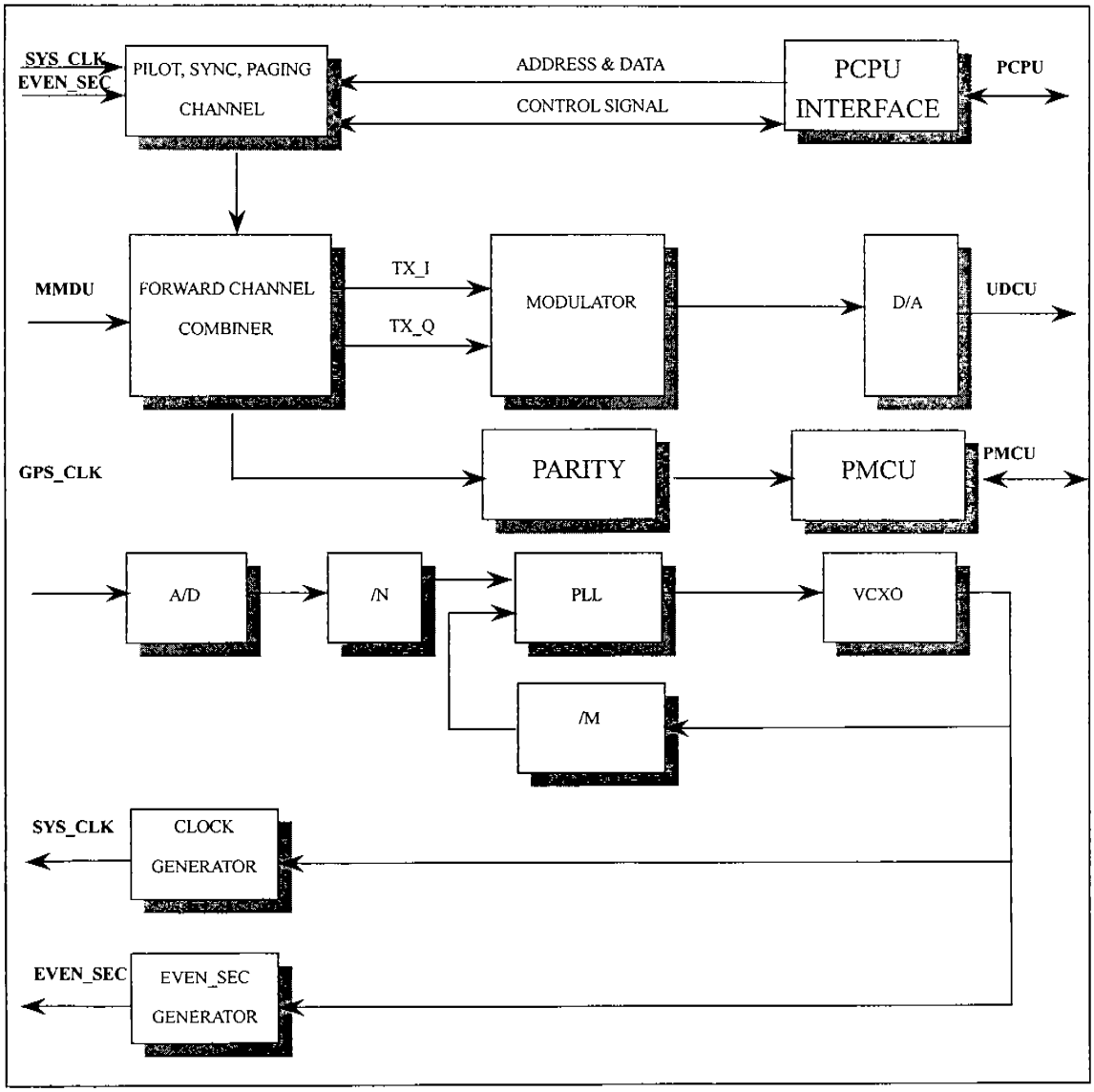


圖 1.1.1.7-1 存取通道單元(CDCU)示意圖

1.1.1.8 射頻電源供應單元(RPSU)

射頻電源供應單元(RF Power Supply Unit：RPSU)提供以下單元所需電力：位於 RFS 的四個 UDCU 模組、兩個 RFPU 單元、AICU 和 UDSU。對於穩定電源供應而言此單元是預備角色，除此之外，此單元產生錯誤信號和回報給 RFPU。

1.1.1.9 射頻處理器單元(RFPU)

射頻處理器單元(Radio Frequency Processor Unit：RFPU)監測和控制 RF 機架中的每一個模組的狀態，另外收集 RP 機架的告警狀態，最後回報給 RPOM。

RFPU 包含下列部分：

(1)CPU and control part(CPU 和控制部分)。

(2)Interface part(介面部分)。

(3)Alarm collection and processing part(告警收集和處理部分)。

(4)Redundancy part(預備部分)。

其架構如下圖，1.1.1.9-1 射頻處理器單元(RFPU)示意圖。

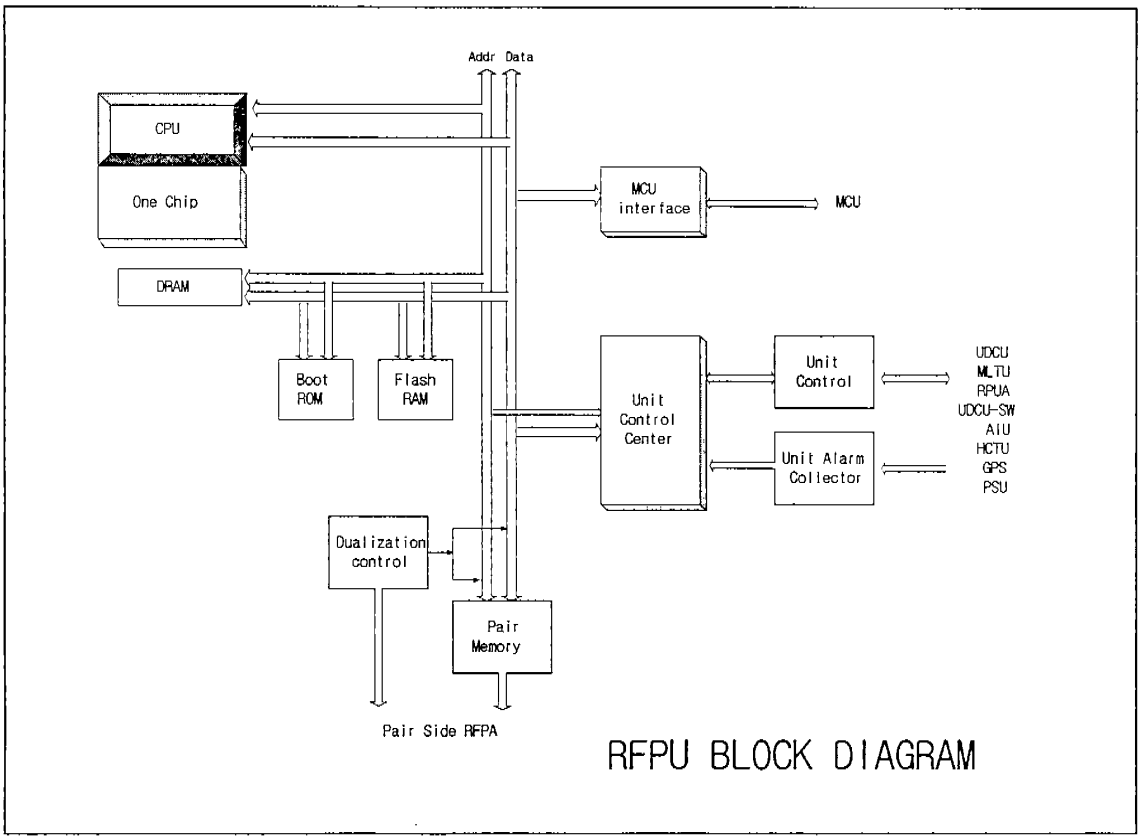


圖 1.1.1.9-1 射頻處理器單元(RFPU)示意圖

1.1.1.10 昇頻與降頻單元(UDCU)

昇頻與降頻單元(Up-Down Converter Unit：UDCU)分成傳送路徑和接收路徑兩個部分。

傳送路徑的主要功能是轉換 8.192 MHz IF 信號到 140

MHz 或是 RF 信號的昇頻動作，和有可變 30 dB 衰減的增益調整。

接收路徑的主要功能是轉換 RF 信號到 70 MHz 和 8.192 MHz IF 信號的降頻動作，和維持 8.192 MHz IF 信號位準的 AGC 功能，其包含空間全向性功能(space diversity function)的 A 路徑和 B 路徑。

其架構如下圖，1.1.1.10-1 昇頻與降頻單元(UDCU)示意圖。

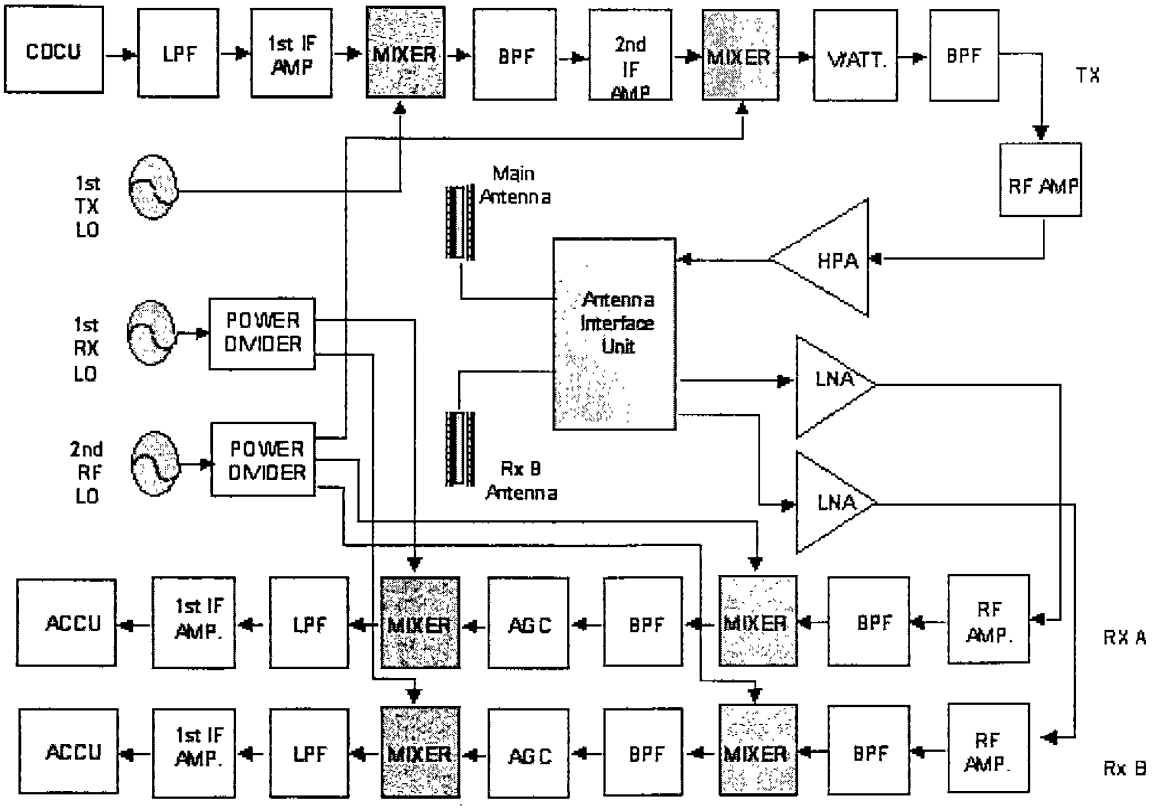


圖 1.1.1.10-1 昇頻與降頻單元(UDCU)示意圖

1.1.1.11 全球定位系統單元(GPSU)

全球定位系統單元(Global Positioning System Unit：GPSU)使用大約 10^{-12} 頻率精確度的 GPS 接收器來接收 L1 頻率，這是為了符合頻率規範 (Frequency stability = 0.05 ppm)，和產生 10 MHz 信號(亦即系統參考頻率)。

有個備用的 GPSU，由天線抓取的 L 頻段(band)信號由 GPSU 內的 GPS 引擎產生十個 10 MHz 信號、一個 PPS 信號、一個 TOD 信號。

其架構如下圖，1.1.1.11-1 全球定位系統單元(GPSU)示意圖。

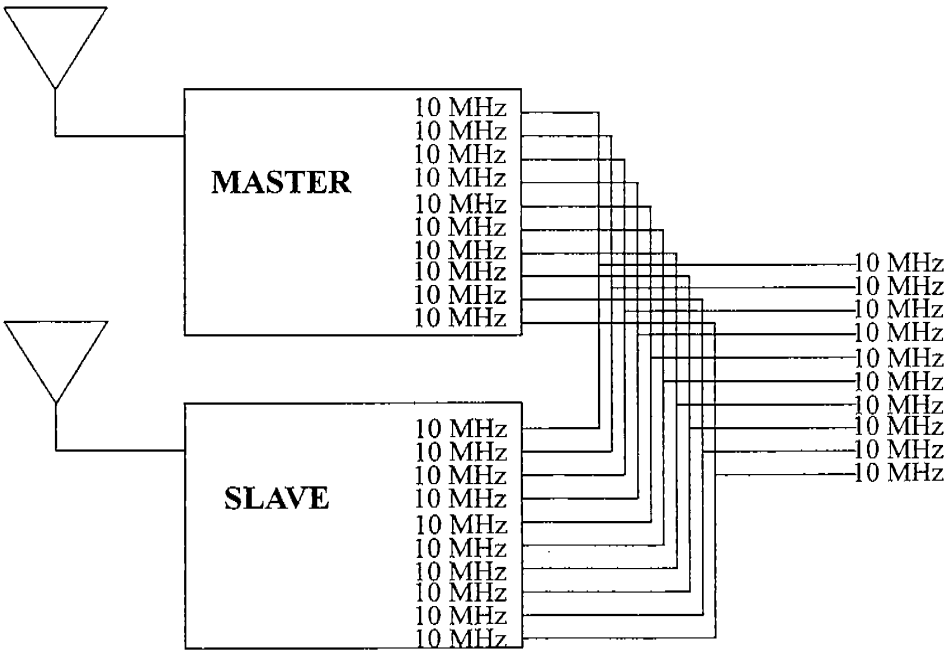


圖 1.1.1.11-1 全球定位系統單元(GPSU)示意圖

1.1.1.12 功率放大器 S 頻段單元(PASU)

功率放大器 S 頻段單元(Power Amplifier S-band Unit：PASU)放大從 RP 來的信號至固定位準。

在每一個部分(Alpha,Beta,Gamma)都配置一個 PASU 且具有 N:1 備用架構。

PASU 放大 RF 信號至 PASU 所要求的固定位準，其 RF 頻率是透過 UDCU 中的 UDCT 轉換過來的，然後提供信號給 AICU。

由 PASU 產生的 RF 信號頻寬是由 AICS(Antenna Interface & Coupling System，天線介面與耦合系統)中的 AICU 通道濾波器決定，然後透過天線傳送。

其架構如下圖，1.1.1.12-1 功率放大器 S 頻段單元(PASU)示意圖。

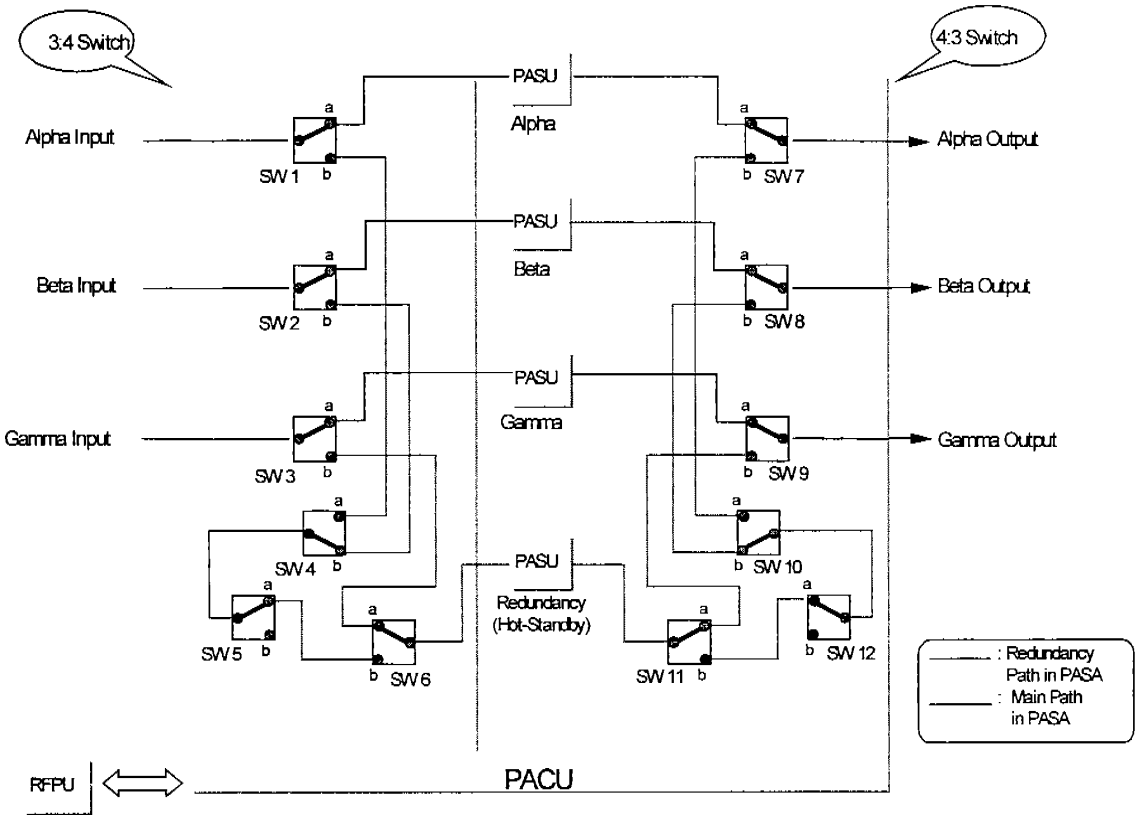


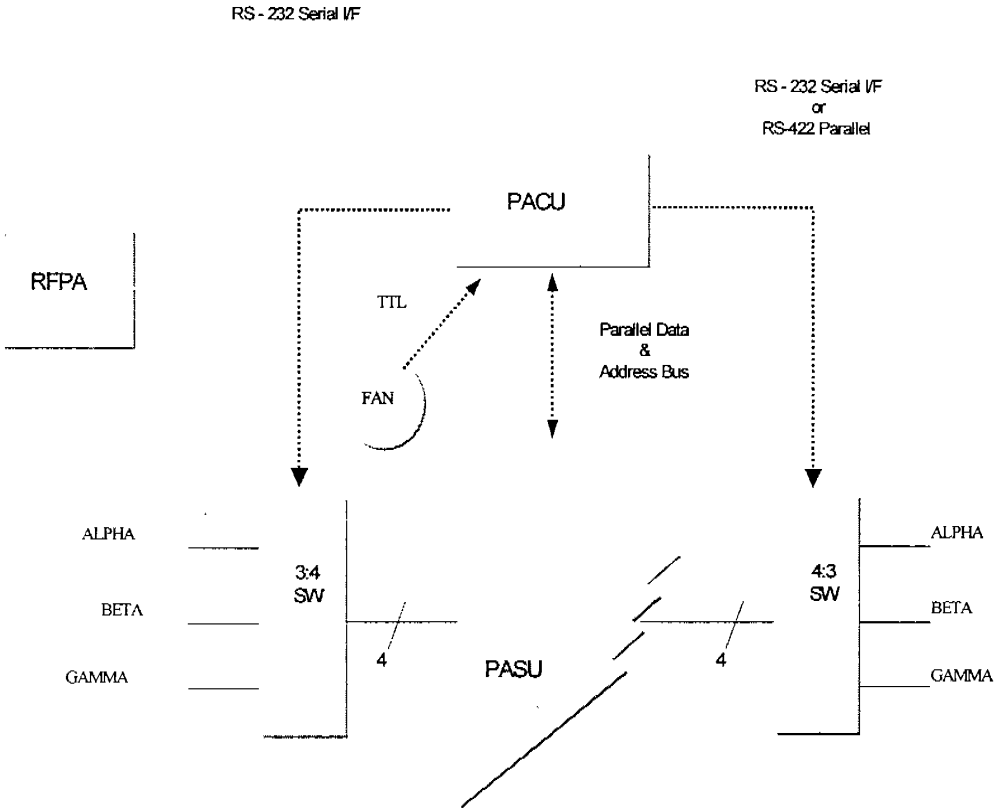
圖 1.1.1.12-1 功率放大器 S 頻段單元(PASU)示意圖

1.1.1.13 功率放大器控制單元(PACU)

功率放大器控制單元(Power Amplifier Control Unit：PACU)監測和控制配置至 PASU。當錯誤發生時，會執行切換到另一備用卡板。確認哪一個 FAN 是正常和傳送 PASU 狀態到 RFPU。

PACU 執行致能/禁能功能、VSWR 告警、IN/OUT 信號位準偵測、強迫式備用(forced redundancy)、切換、依據 RFPU 命令所做的溫度告警恢復和 PASU 恢復。

其架構如下圖，1.1.1.13-1 功率放大器控制單元(PACU)示意圖。



1.1.1.13-1 功率放大器控制單元(PACU)示意圖

1.1.1.14 天線介面與耦合單元(AICU)

天線介面與耦合單元(Antenna Interface & Coupling Unit：AICU)是 RP 公用鏈路存取部分(public link access part)。包含透過天線來發射和接收信號的主路徑、透過天線接收信號的 Rx B 路徑。每一個 AICU 會指定一個部分方向天線。

發射路徑是讓發射信號通過多工器(duplexer)使得信號有固定頻寬。其中發射信號會透過 POWER AMPLIFIER SUB SYSTEM (PASS)放大成固定位準。然後傳送路徑傳送信號到天線。

發射路徑的監視埠監視 RP 發射信號的位準，這樣可看出從連接至發射天線輸出 40 dB 低位準信號。

接收路徑包含全向性的兩個路徑 (主要路徑和 Rx B 路徑(空間全向性))，每一個路徑都有相同的電子特性。接收路徑包含傳送頻段濾波器、低雜訊放大器、監測信號、測試路徑的雙向耦合器。會以帶通濾波器來濾從每一個接收天線(Rx 天線和 SD 天線)來的信號，然後再將他們利用低雜訊放大器放大後傳送信號到 UDSU。

每一個接收路徑的低雜訊放大器都是 1:1 備用架構的平衡式放大器，其會接收透過低雜訊放大器輸出端的雙向耦合器來的中繼器(repeater)信號，然後透過 UDSU 傳送信號至位於 UDCU 的 UDCR。

其架構如下圖，1.1.1.14-1 天線介面與耦合單元(AICU)示意圖。

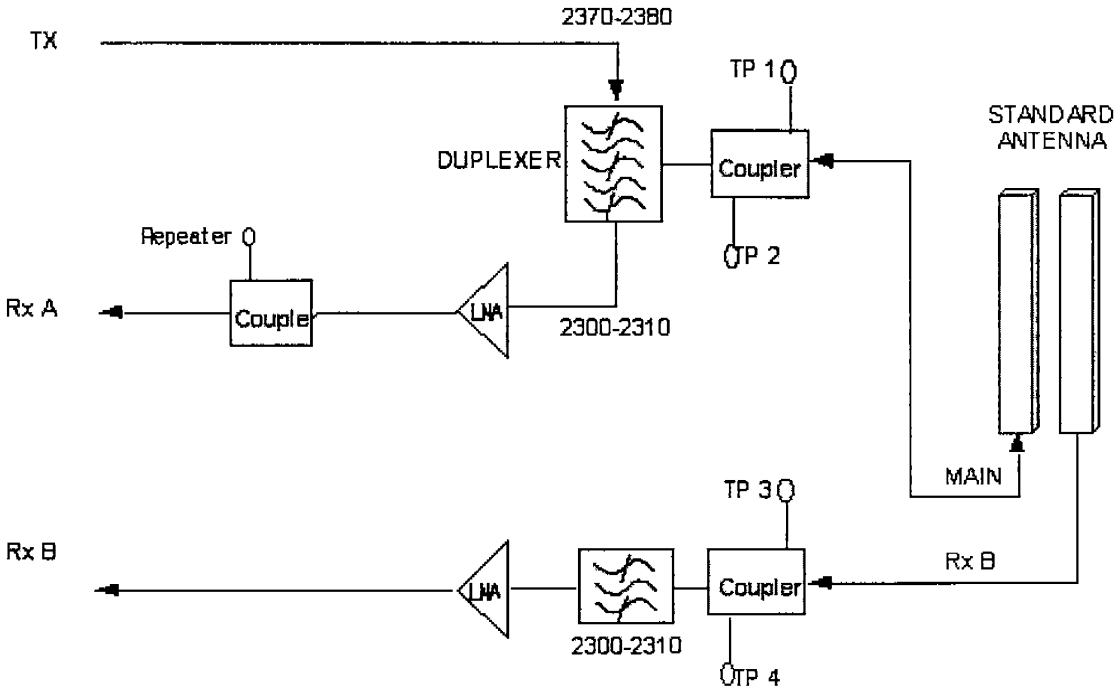


圖 1.1.1.14-1 天線介面與耦合單元(AICU)示意圖

1.2 管控台(RPC：Radio Port Controller)

RPC 透過 V5.2 協定存取 WLL 本地回路交換和利用語音壓縮技術處理用戶的語音呼叫然後再將它們傳送至對應的 RP 端。RP 藉由無線方式經由 RIU 來傳送(或接收)語音信號。如果是封包資料的話，某一端的 PPP 封包會經由 RP 傳送至 RPC，接下來 RPC 將封包資料轉換成乙太網路框格式 (Ethernet frame)後傳送至終端資料服務的網路中。

除了上面的所述以外，RPC 執行 RP 的管理、語音呼叫處理，另外也透過乙太網路作為與 RPOM 連結的介面。

其架構如圖 1.2 管控台結構圖。

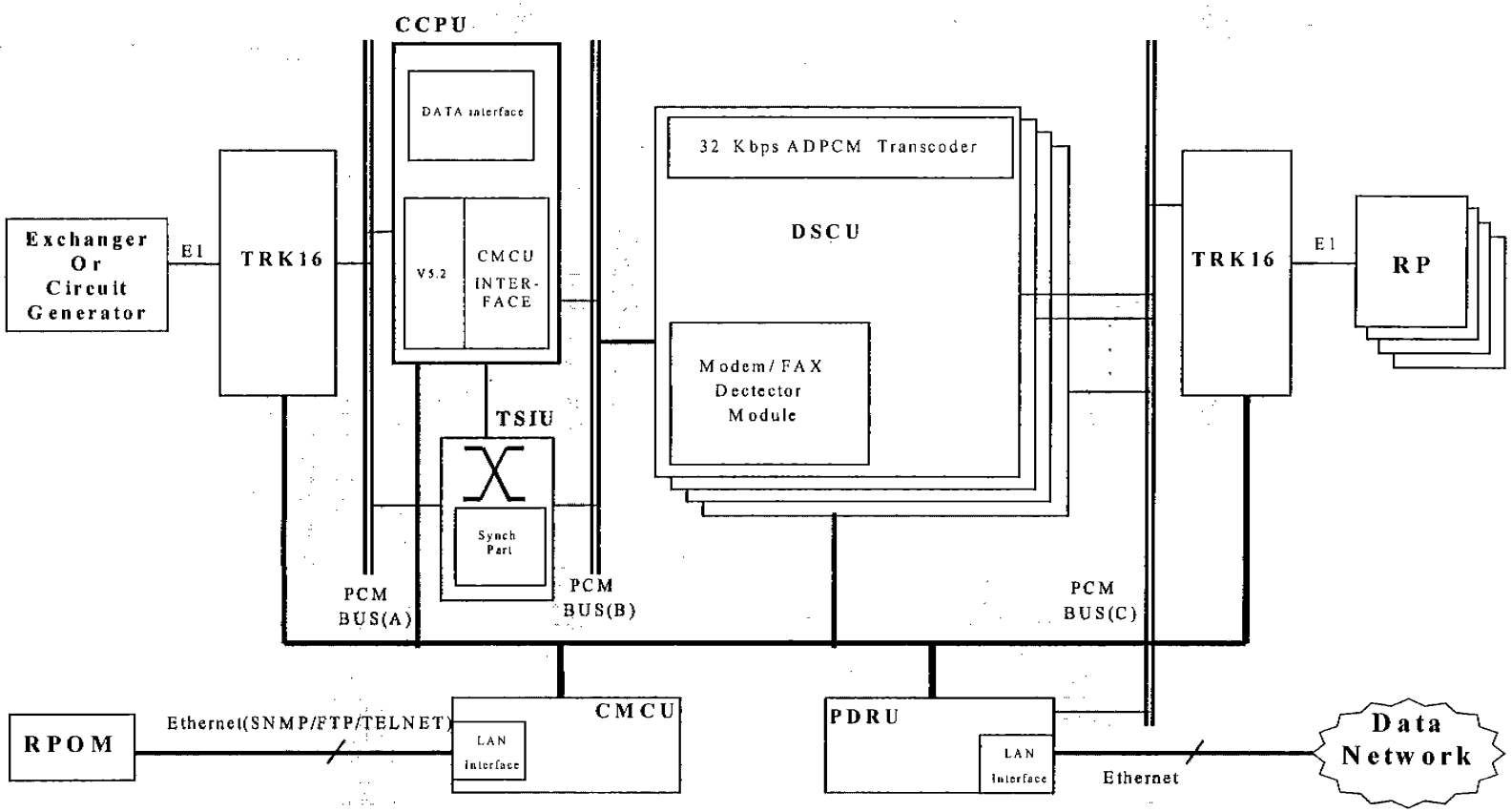


圖 1.2-1 管控台(RPC)結構圖

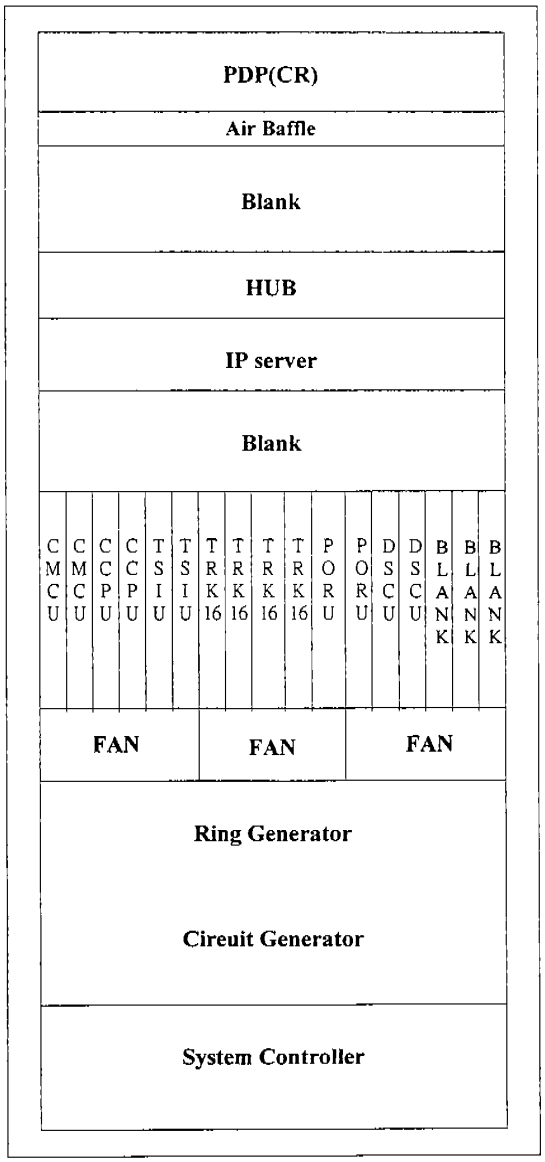


圖 1.2-2 管控台(RPC)安裝圖

1.2.1 RPC 硬體功能介紹

1.2.1.1 rpC 主要控制單元(CMCU)

rpC 主要控制單元(rpC Main Control Unit：CMCU)啟動系統並且初始化所有裝配卡板的硬體。而在初始化硬體之後，CMCU 初始化軟體去管理錯誤和狀態；也會報告錯誤狀態到 RPOM(經由 Ethernet 存取)。CMCU 也切換語音呼叫並且控制語音壓縮。CMCU 主要是執行下列功能：

(1)初始化卡板及管理卡板狀態。

(2)管理錯誤訊息並且儲存後送至 RPOM。

(3)使用 RPOM 來控制系統(經由存取 Ethernet)。

(4)執行語音切換和語音壓縮控制。

(5)儲存每一個卡板軟體及下載軟體。

(6)處理及控制中央警告面板的警告信號。

(7)設定設備系統時脈。

(8)提供額外的交換器(switchover)。

(9)提供與 RP 溝通所需的 NMS 通道功能(E1 的每一個時槽)。

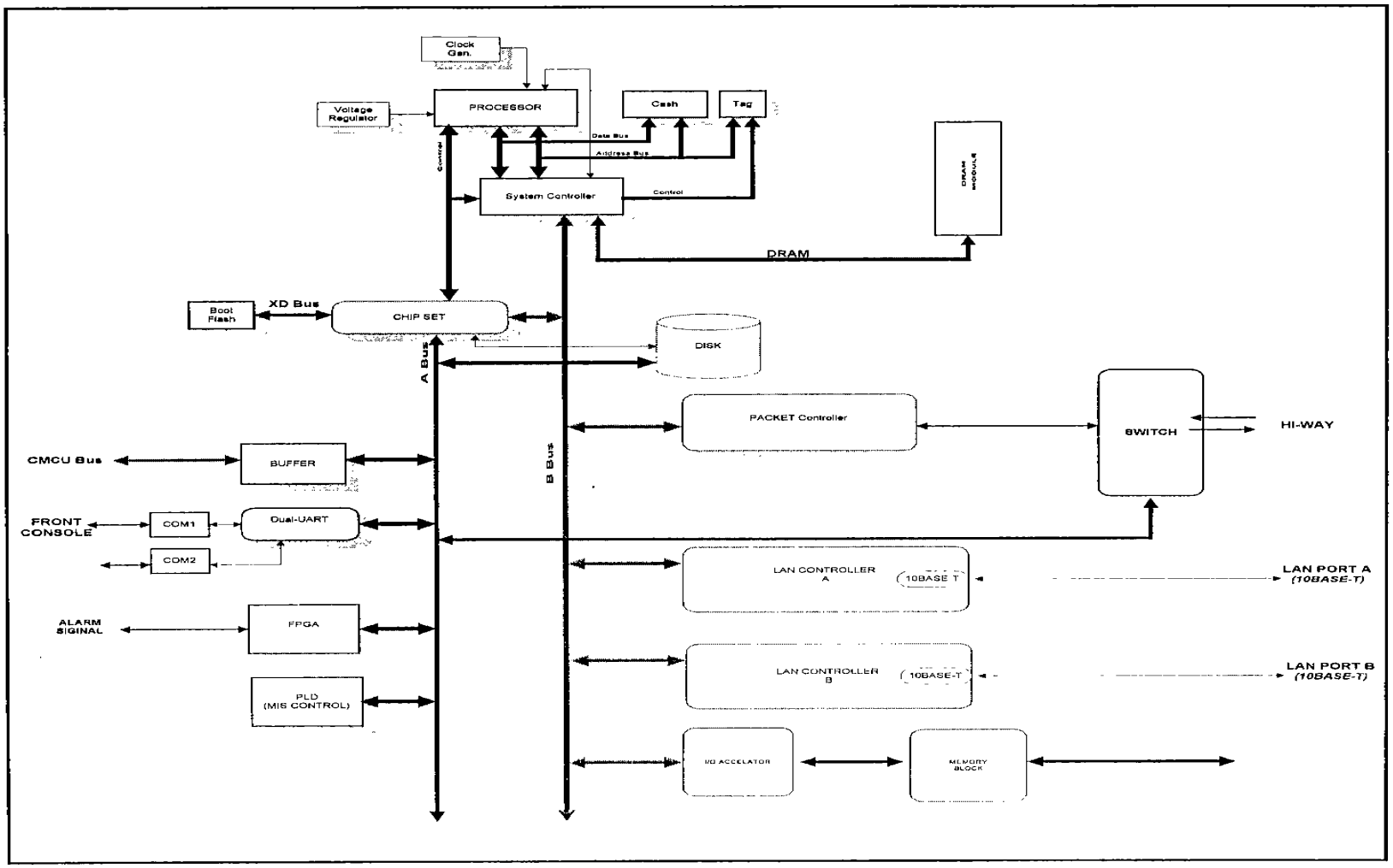


圖 1.2.1.1-1 rpC 主要控制單元(CMCU)示意圖

1.2.1.2 rpC 通話處理單元(CCPU)

rpC 通話處理單元(rpC Call Processing Unit：CCPU)處理語音通話和資料通話，也經由 CMCU 間接地管理 TRK、TSIU、DSCU，之後反應管理結果給系統資源管理。

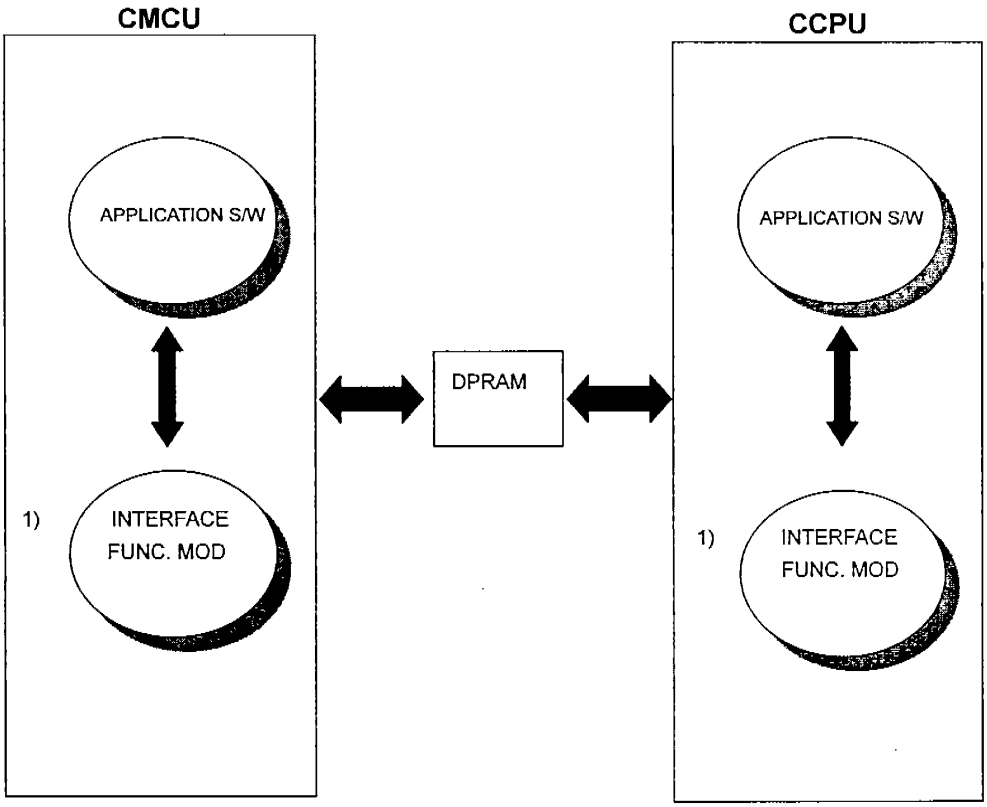


圖 1.2.1.2-1 rpC 通話處理單元(CCPU)示意圖

1.2.1.3 時槽交換單元(TSIU)

時槽交換單元(Time-Slot Interchange Unit： TSIU)為CMCU所控制的卡板，主要是將從WLL本地回路交換端來的用戶資料分配到相對應的RP。除了執行RPC時脈的同步動作外，也提供系統時脈。

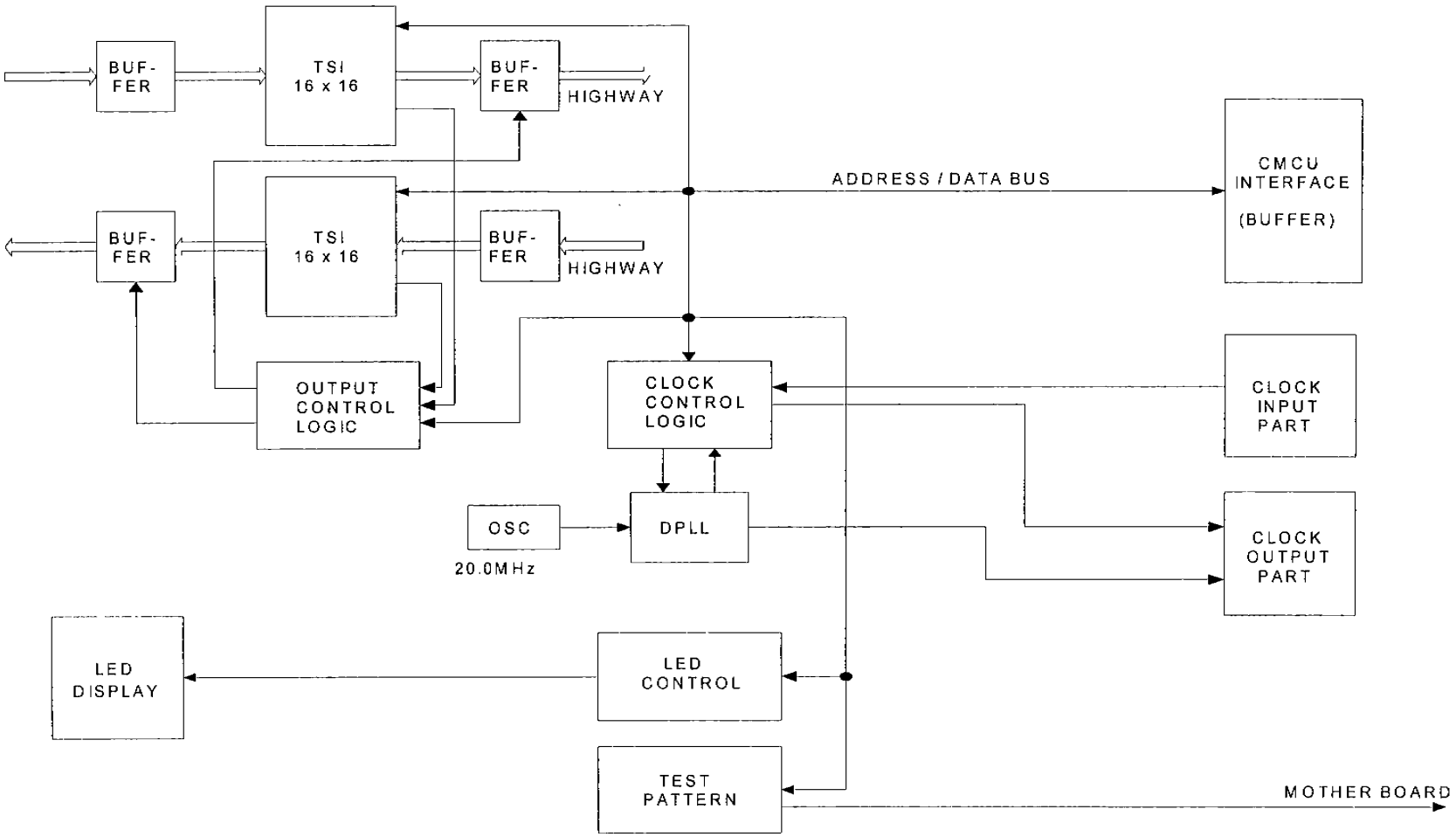


圖 1.2.1.3 時槽交換單元(TSIU)示意圖

1.2.1.4 十六通道的主幹 (TRK16)

十六通道的主幹(Trunk 16-channel：TRK16)會將從 DSCU 單元來的單極資料(unipolar data)轉換成多極脈波(multipolar pulse)，然後傳送脈波到遠端站；相反地亦然，會將從遠端站來的多極脈波轉換成單極資料。然後，TRK16 單體產生時脈給 TSIU 用，再傳送接收到的資料給 DSCU。TRK16 會監控每一個主幹線的狀態，當狀態發生不正常時，會啟動警告且回報狀態給系統。在主幹和單體測試方面，TRK16 是使用迴路測試方式(loopback)再傳送給遠端站警告訊息。

1.2.1.5 數位信號壓縮單元(DSCU)

數位信號壓縮單元(Digital Signal Compression Unit：DSCU)藉由壓縮和回存 32 kbps ADPCM 信號的方式來轉換編碼為 64 kbps A-law PCM 的語音信號，這樣是為了提供 64 kbps A-law PCM 或是 32 kbps ADPCM 兩種服務模式。DSCU 也藉由偵測傳真或數據機的 tone 信號來執行 Bearer Channel Modification(BCM)，然後將 32 kbps 通道頻寬轉換成 64 kbps 通道頻寬。

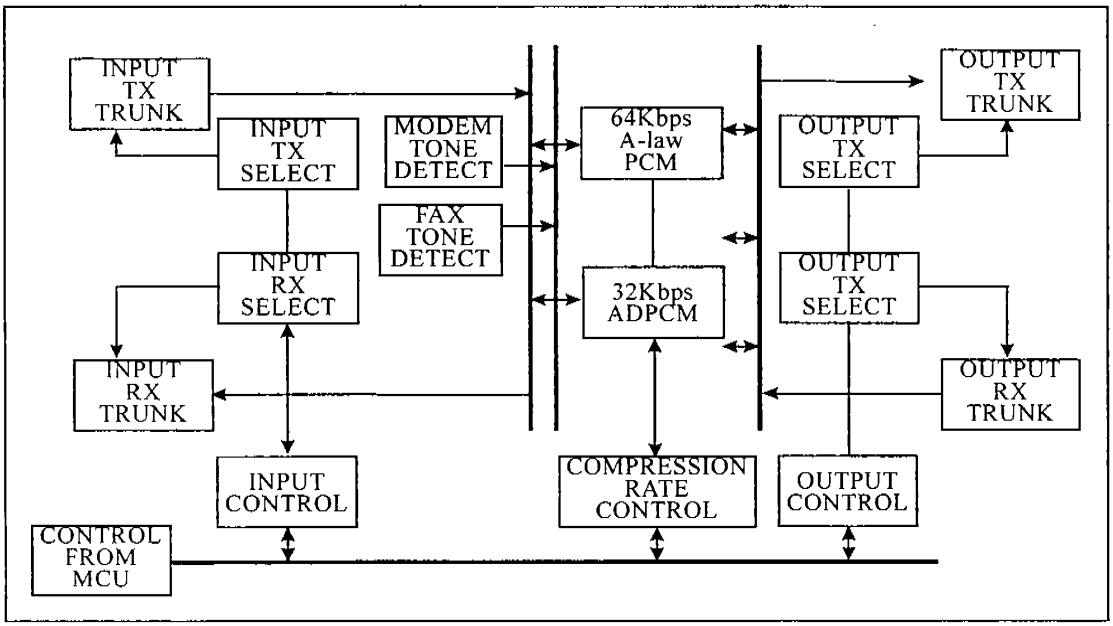


圖 1.2.1.5-1 數位信號壓縮單元(DSCU)結構圖

1.2.1.6 封包資料路由單元(PDRU)

在 RP 中與 PDMU 連接的封包資料路由單元(Packet Data Routing Unit，以後本文簡稱為 PDRU)將來自於終端機的封包資料分送(route)至網際網路。PDRU 可以處理傳送/接收從十六個 RP 來的資料。

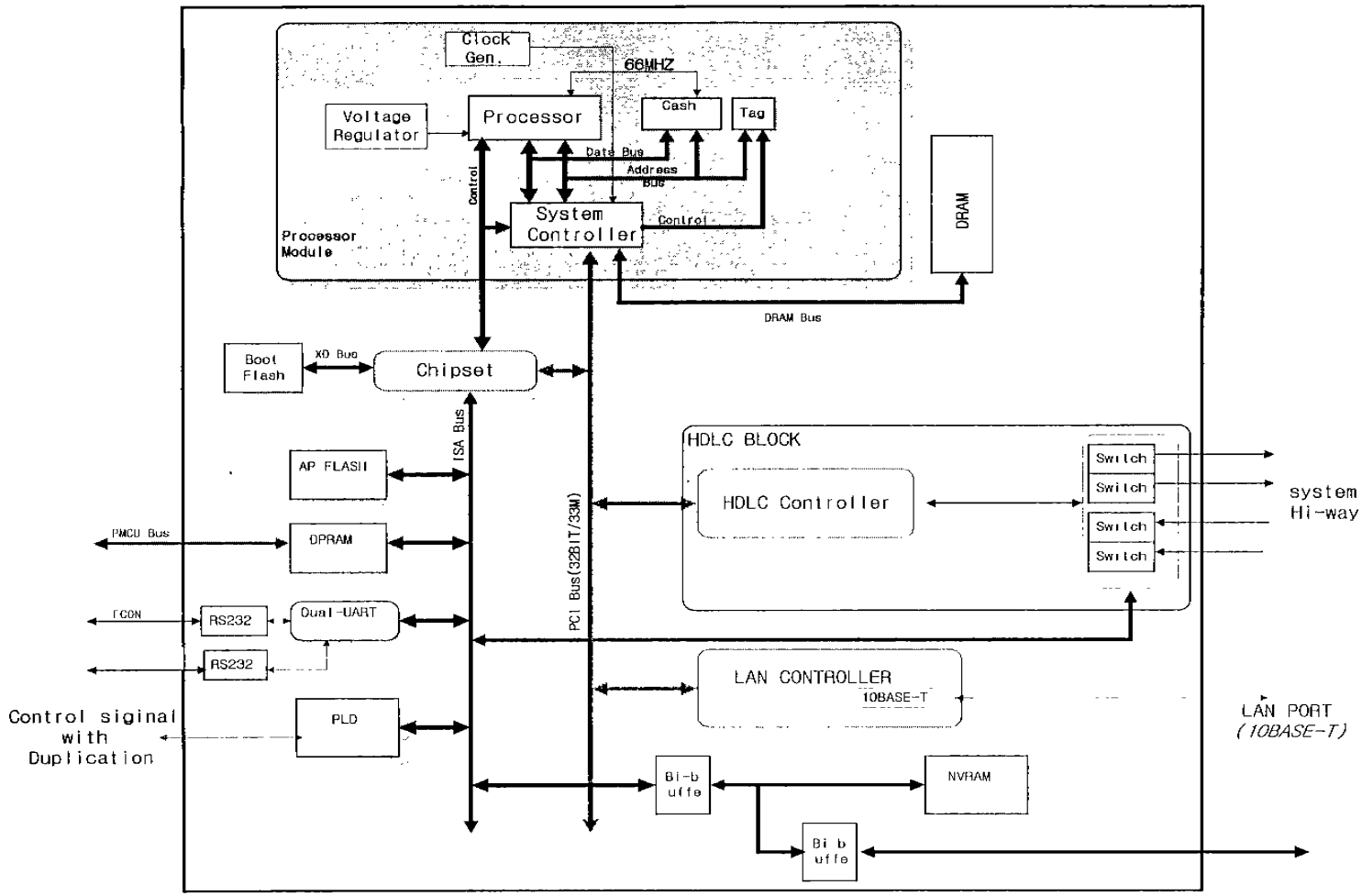


圖 1.2.1.6-1 封包資料路由單元(PDRU)結構圖

1.3 操作及維護工作站(RPOM：Radio Port Operation & Maintenance)

RPOM 是針對 RP 操作和管理方面的一台工作站，RPOM 在 Unix 作業系統下執行而且預設值是提供圖形使用者介面(GUI)。由於 RPOM 容易操作和提供各種資訊的特性使得系統維護變得相當有用。

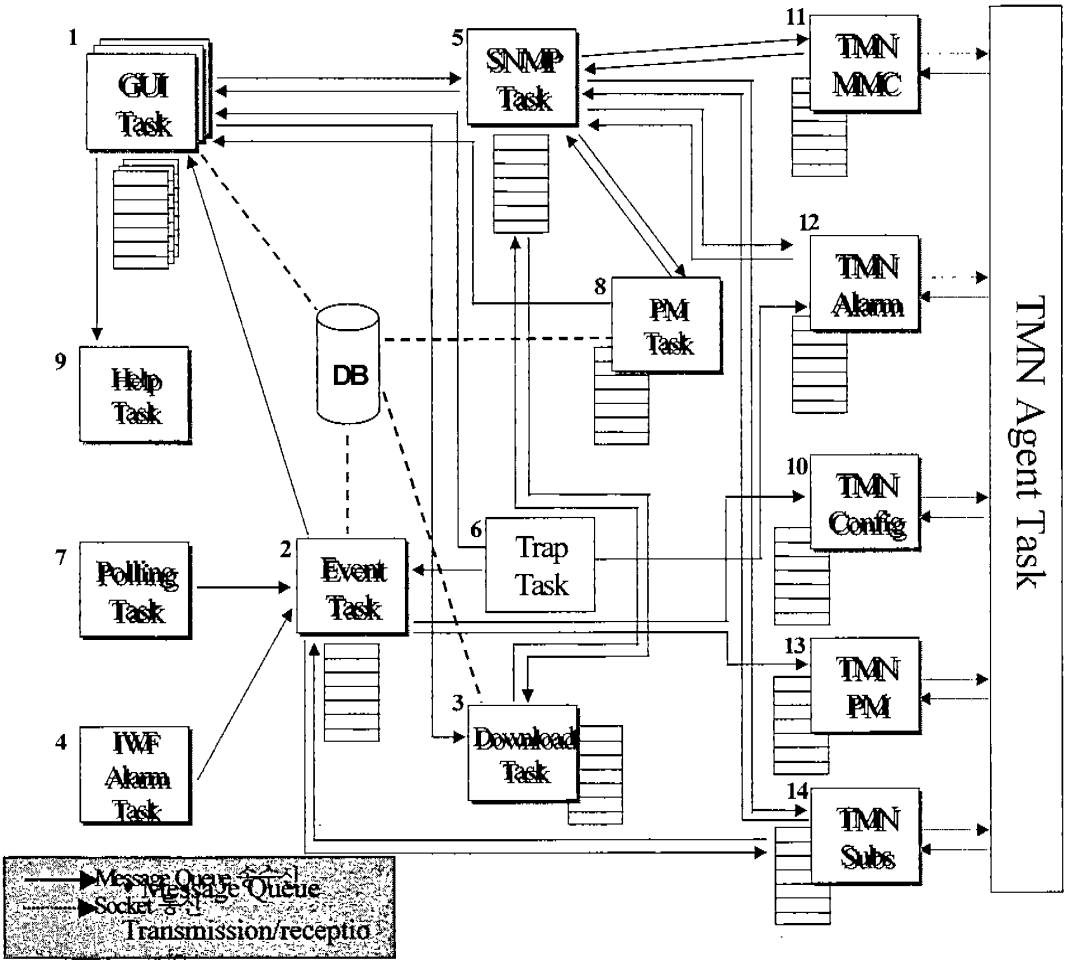


圖 1.3-1 操作及維護工作站(RPOM)軟體架構圖

1.4 用戶台(RIU：Radio Interface Unit)

此用戶介面是使用來自 LG 電子公司的先進技術 WB-CDMA 的無線區域網路介面。韓國國內 CDMA 用戶所使用之語音及數據通訊介面，語音介面連接家用電話機，透過無線介面單元即可撥號通話，而數據介面連接一般電腦，透過無線介面單元即可上網路，其數據傳輸可達 128Kbps。

用戶台將用戶的訊息，經無線傳遞與基地台構連，語音方面以點對點方式通訊，而數據方面以封包方式通訊，所有通訊控制由管控台來達成，因此本系統有清楚的語音通話品質外，另提供高速度的數據通訊服務。

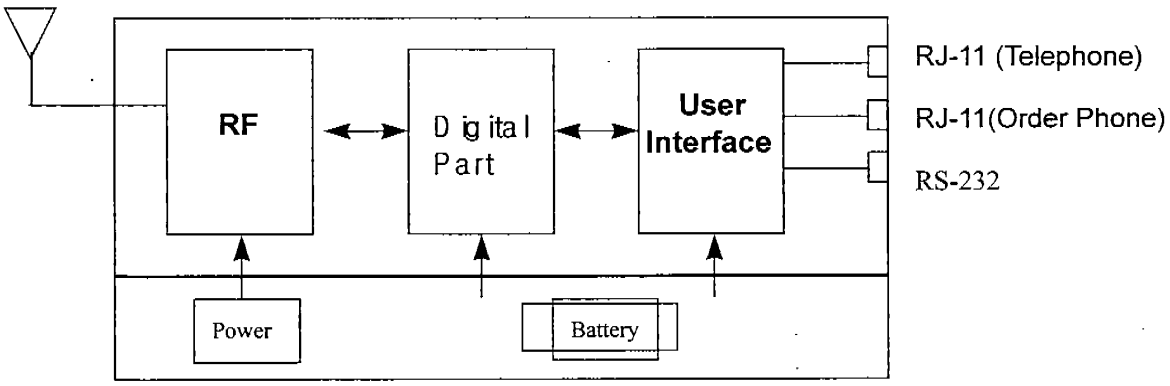


圖 1.4-1 用戶台(RIU)架構圖

2 系統測試

此次測試包含語音及數據實際通連測試外，尚包含射頻、頻寬、靈敏度等功能測試。

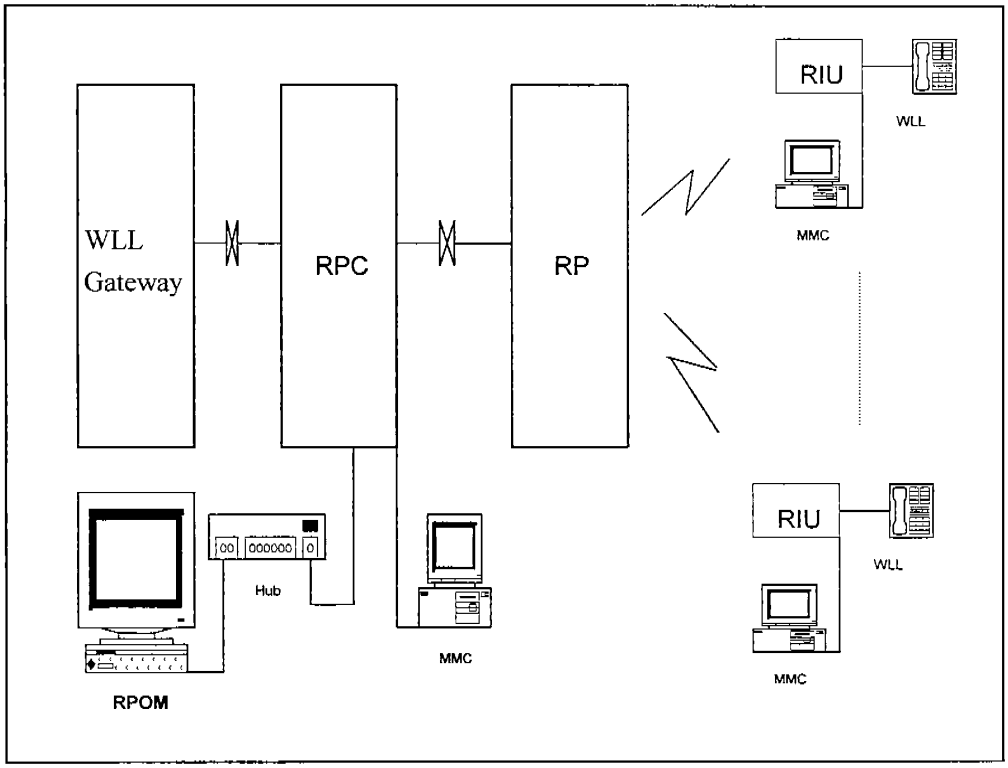


圖 2-1 全系統測試架構

2.1 用戶台功率測試

2.1.1 目的

驗證用戶台 effective isotropic radiation power (EIRP) 傳輸功率。

2.1.2 裝備項目

1. 用戶台 RIU。
2. 增益 11dBi 天線
3. 量測儀表

Spectrum Analyzer : HP 8566B

Power Meter : HP 438A

2.1.3 測試架構

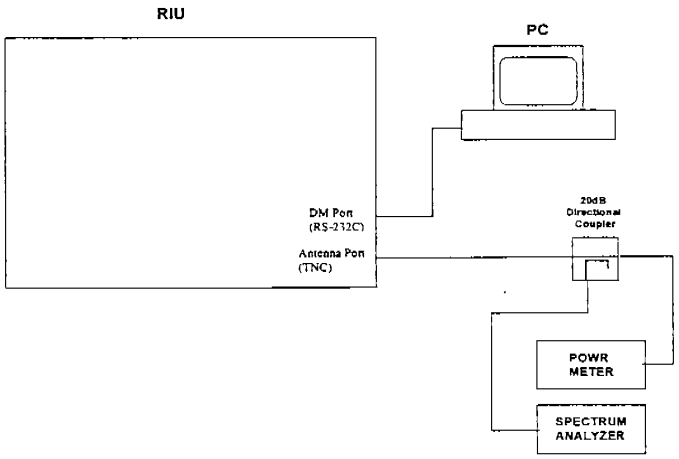


圖 2.1.3-1 用戶台功率測試架構圖

2.2 基地台功率測試

2.2.1 目的

驗證基地台 effective isotropic radiation power (EIRP) 傳輸功率。

2.2.2 裝備項目

1. 基地台 RP。
2. 增益 11dBi 天線
3. 量測儀表

Spectrum Analyzer : HP 8566B

Power Meter : HP 438A

2.2.3 測試架構

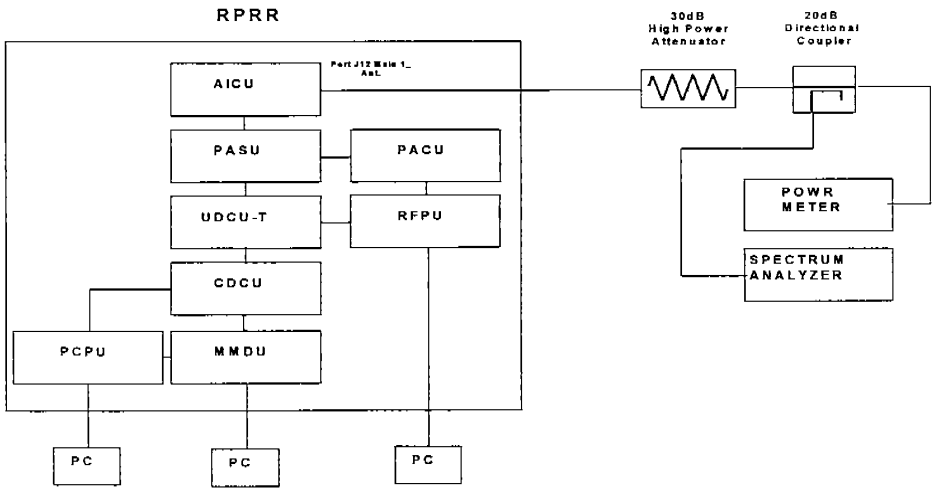


圖 2.2.3-1 基地台功率測試架構圖

2.4 接收靈敏度測試

2.2.1 目的

驗證基地台接收端靈敏度。

2.2.2 裝備項目

1. 基地台 RP。
2. 量測儀表

Power Meter: HP 438A

BER Test Set: FIREBIRD 6000A

AWGN: TAS 2500A or better

2.2.3 測試架構

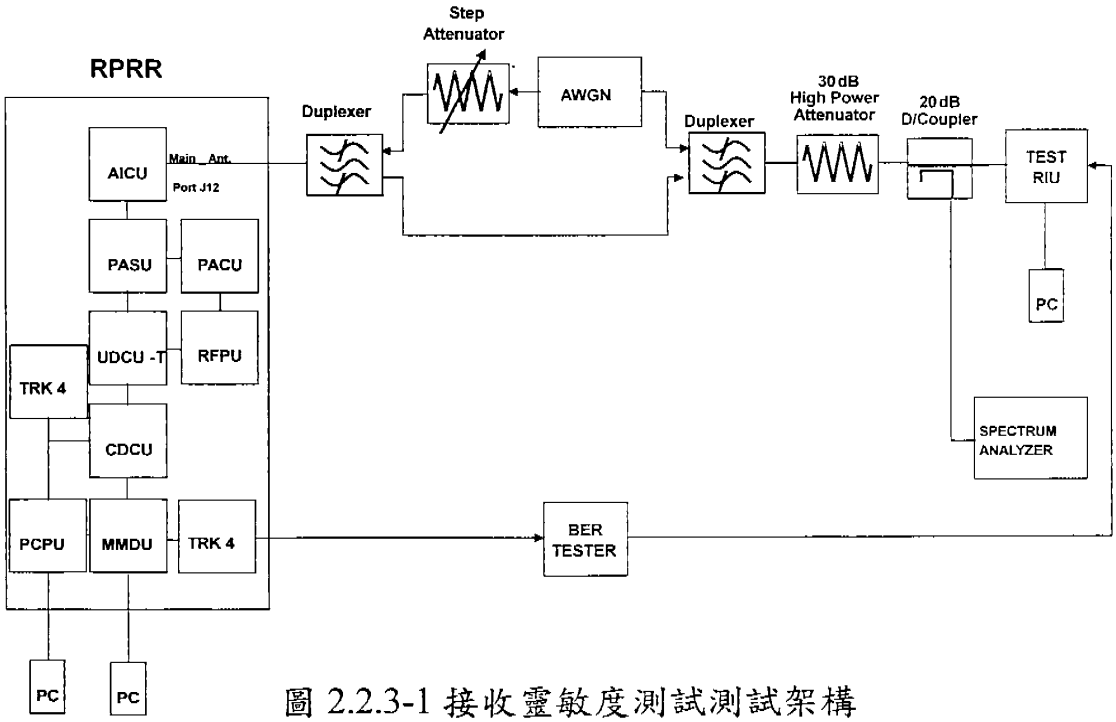


圖 2.2.3-1 接收靈敏度測試測試架構

2.4 傳輸頻寬

2.4.1 目的

測試基地台之傳輸頻寬

2.4.2 裝備項目

Spectrum Analyzer : HP 8562A

Power Meter : HP 438A

2.4.3 測試架構

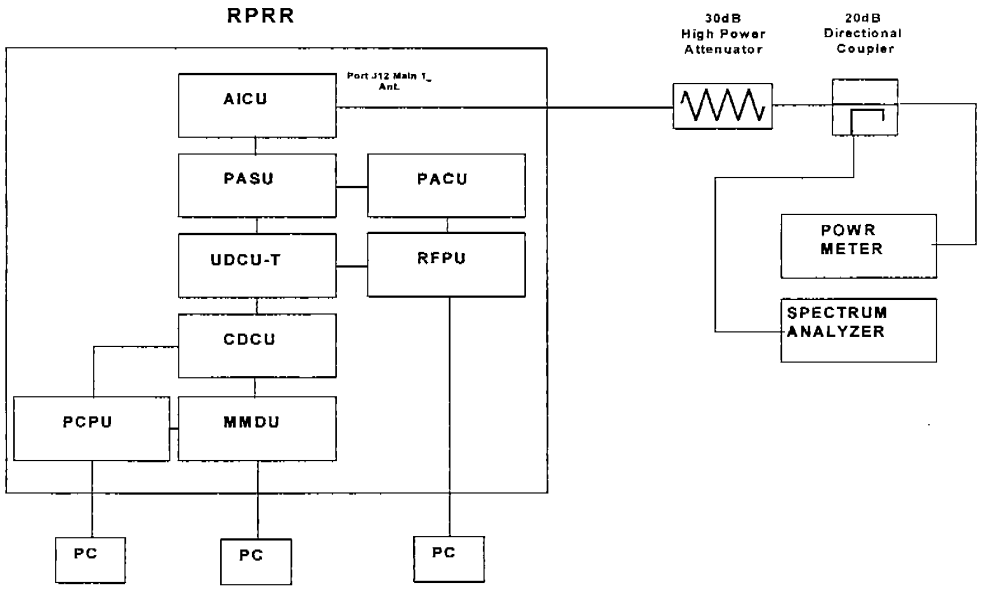


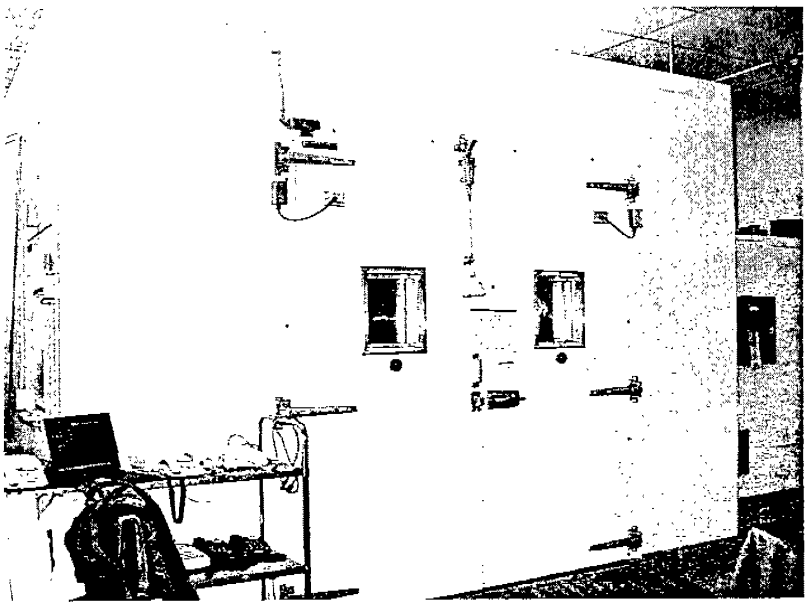
圖 2.4.3-1 傳輸頻寬測試架構

2.5 研討狀況

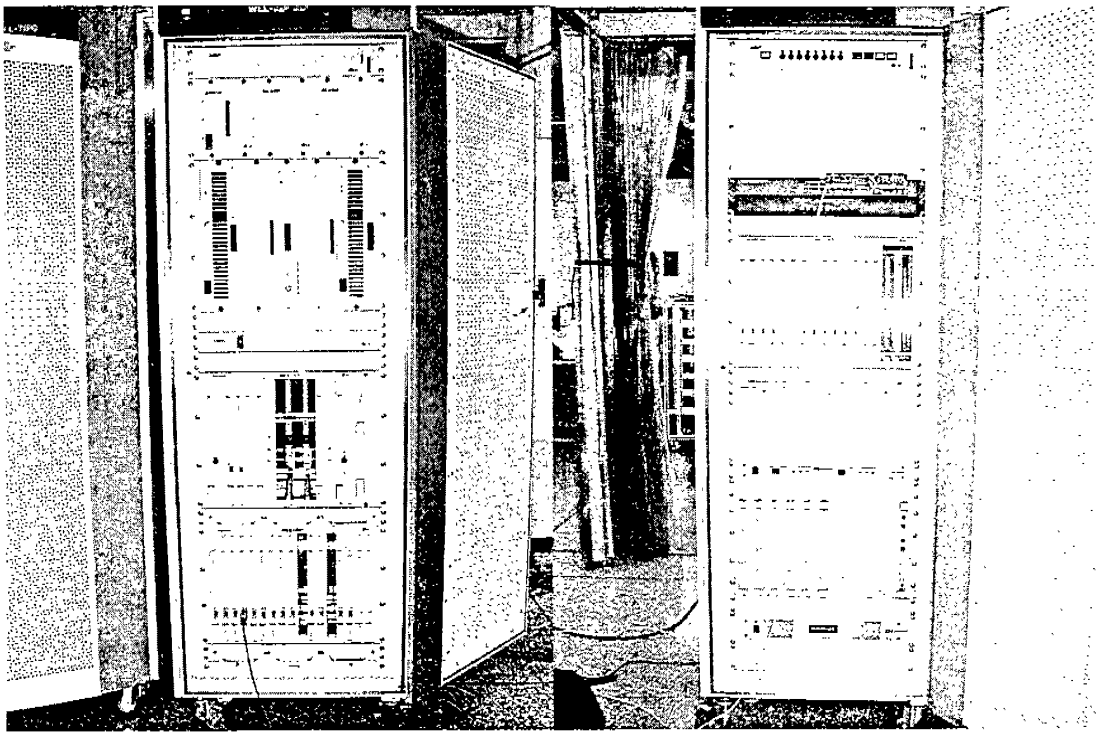
在金星公司期間，觀摩整個實驗室、測試機房，並與研發團隊研討其系統架構及測試內容，以下是在金星公司內活動情形。

2.5.1 研討實景

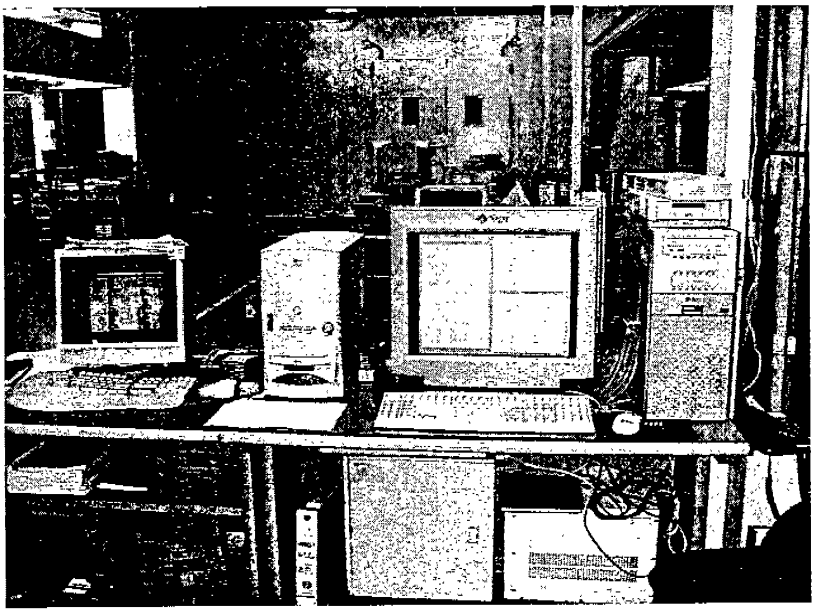
2.5.2 測試實景



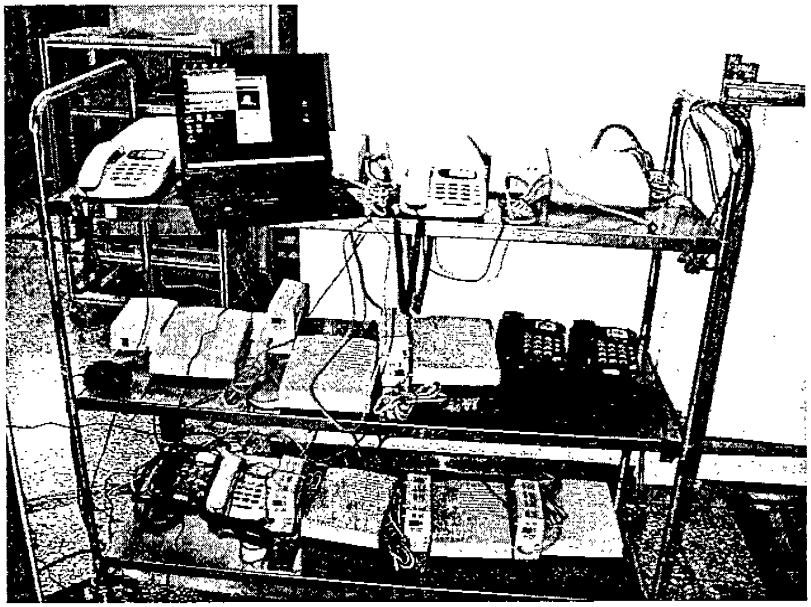
體積龐大測試溫箱



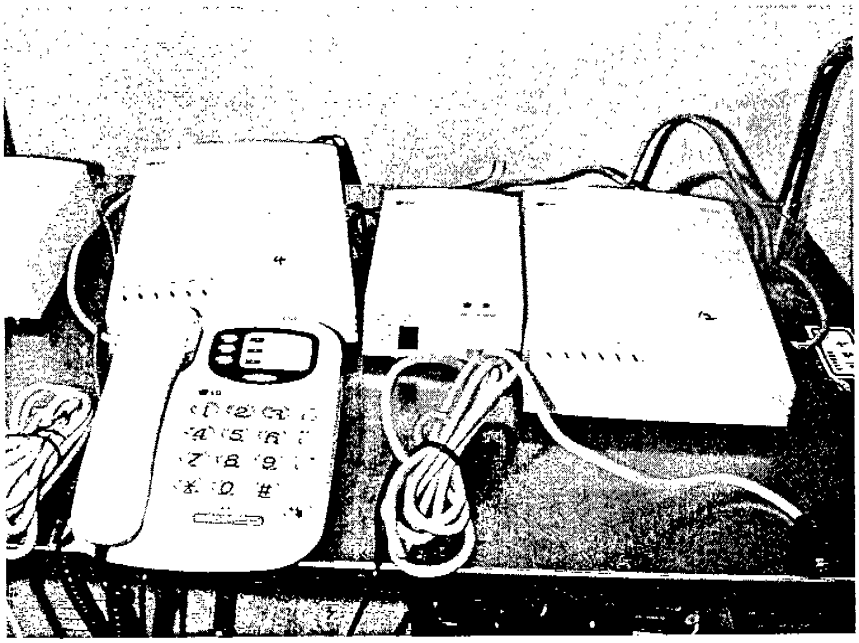
RPC 外觀　　RP 外觀



RPOM 外觀

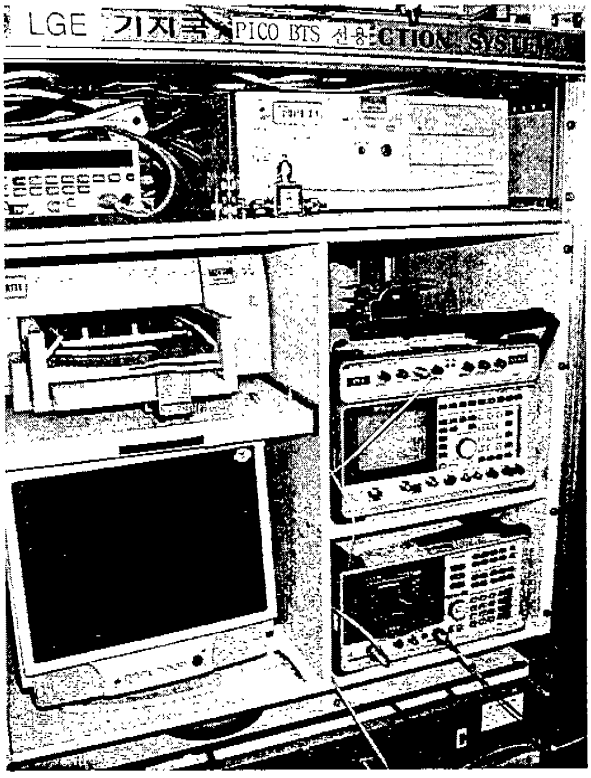


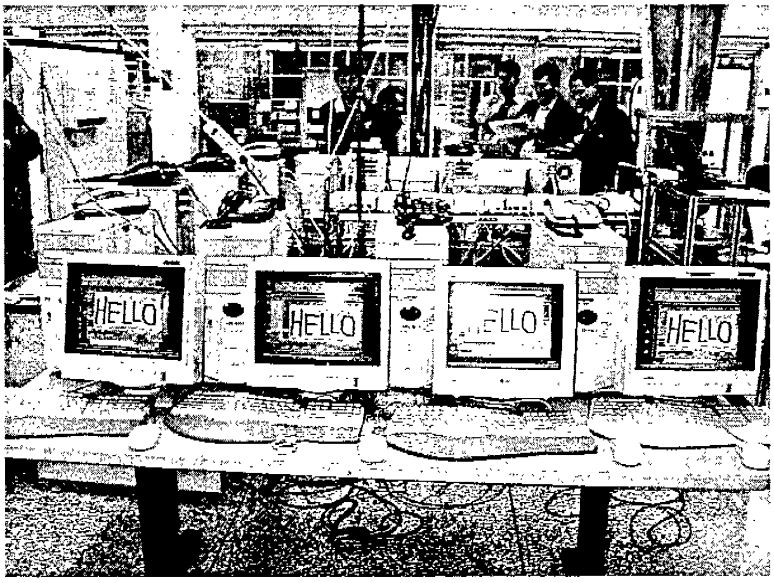
用戶台外觀一



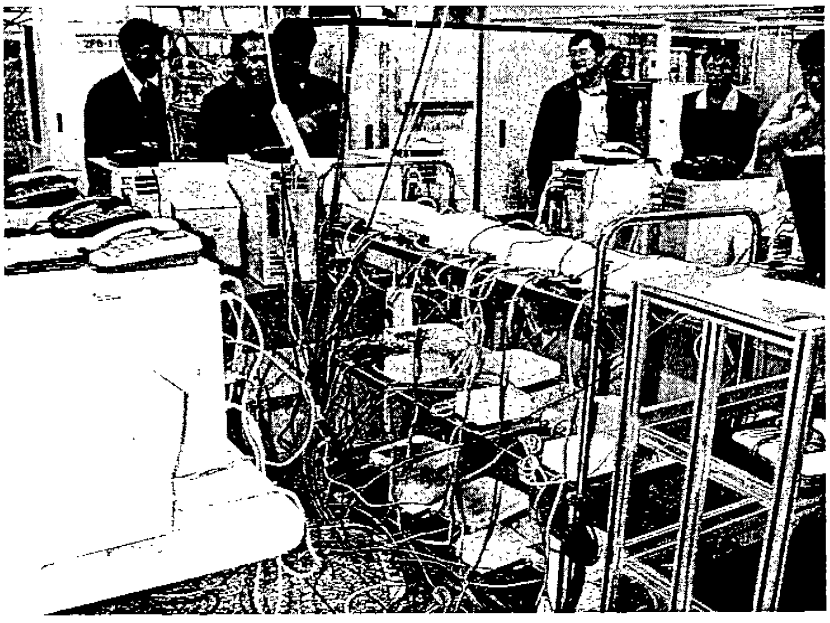
用戶台外觀二

用戶台數據測試

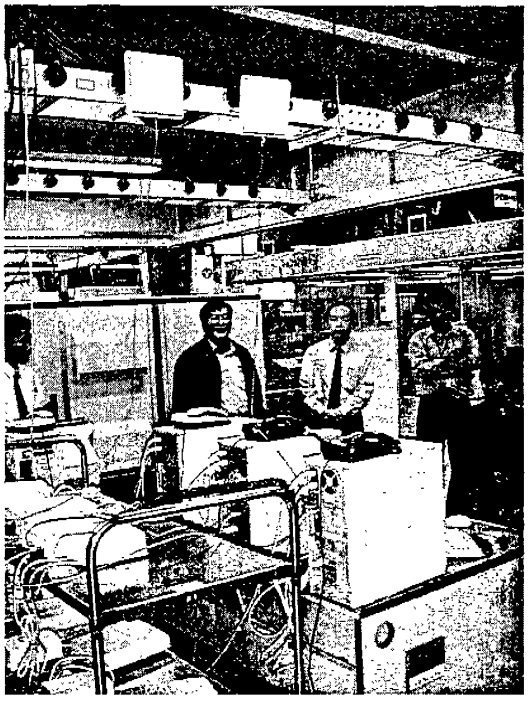




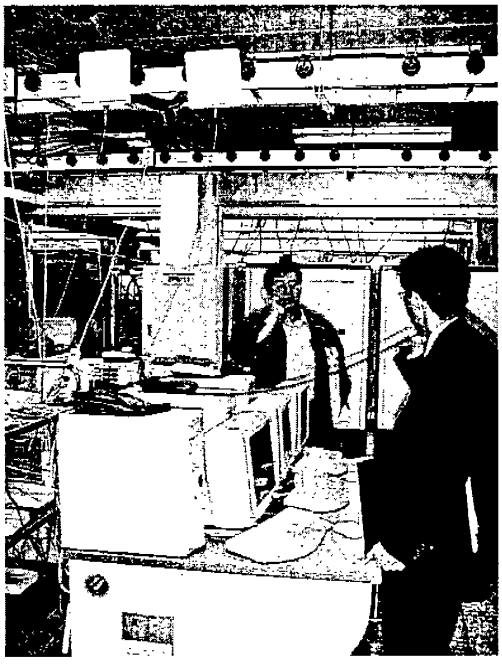
實驗及測試場一



實驗及測試場二



實驗及測試場三



實驗及測試場四

參、效益分析

這次參訪韓國金星(LG)公司，參觀金星公司的 WB-CDMA 產品，進而實地了解其架構，並在廠房中實際驗證及操作系統。此行中感受韓國的通訊技術比國內進步，其韓國工業集團為了佔有市場及提昇本身技術，以引進外國先進技術為手段，奠定韓國國內通訊技術，在國際佔有一席之地，反觀國內企業對通訊行業並沒有完整發展計畫，目前(89)國內宏碁集團旗下明碁電通與工研院 W-CDMA 研發團隊共同成立達宙通訊，以開發第三代行動通訊(3G)之行動電話基地台設備為主。

經濟部「寬頻無線通訊系統發展五年計畫」為增進國內 3G 的技術，委由本院以分年分階段方式研發相關技術，為使本計畫研發順利及在最短時間內有最佳成效，並尋求合作夥伴，因此到韓國參觀金星公司的產品，並進而研討其硬品架構及測試模式，除了本文所述基本架構外，尚帶回詳細的參考資料，以利本院參考使用。而此次公差，可以有以下效益價值：

1. WB-CDMA 發展現況及應用情形

CDMA 是由 CDG (CDMA Development Group) 所提出的行動電話協定。目前 CDMA 已經開始拓展寬頻技術，從 1995 年的 IS-95A 標準所能夠提供的 13kbps，到 1997 年 IS-95B 完成時將

CDMA 的極速理論值提升到 64kbps，到目前 2000 年第一階段完成時，頻寬將會增加到 1.25Mbps，而到第二階段的更新完成之後，頻寬就會達到 2Mbps。

使用 CDMA 的地區包含整個北美、南美洲的 90% 國家，中歐、北亞以及澳洲等地均有電信業者使用這個系統。而金星公司採用 IS-95 的標準所衍生出自有產品，其數據頻寬目前只有 128kbps，但以一個數據卡板為其最大容量，該公司據稱於下階段將提昇至 384kbps/每一個數據卡板，亦即每一個用戶最大數據傳輸量可達 384kbps。

2. 硬品基本架構

金星公司將現有產品之基本架構於本次研討中公開討論，令本院在研發階段有參考及學習的對象，其詳細文件如附件。

3. 驗證程序

金星公司將現有產品在工廠內安排實地驗證，測試其分系統及全系統細部功能，有助於在本院發展 WB-CDMA 之初，能考量系統驗證測試時之架構及系統設計時之監測能力。金星公司之驗證及監管程序如附件。

此次公差所蒐集資訊(如附件)，提供本院發展 WB-CDMA 之參考，並將此資訊已分送本組相關人員研參。

肆、國外工作日程表

日期	行程
十月三十日	由台灣出發，抵達韓國漢城。
十月三十一日	赴金星(L.G.)公司參訪及研討 WB-CDMA 系統架構
十一月一日	赴金星(L.G.)公司參訪及研討 W-CDMA/WLL 終端維護裝備 (Radio Port & Operation Maintenance Center)及基地台(Radio Port)間應用會議
十一月二日	赴金星(LG)公司研討管控台(Radio Port Control)與終端維護裝備(RPOM)及基地台(RP)間之系統測試模擬平台，參與模擬平台測試，並接受實務經驗交流。
十一月三日	赴金星(LG)公司研討用戶台(RIU)及基地台(RP)間之系統測試模擬平台，參與模擬平台測試，並接受實務經驗交流。
十一月四日	假日整理資料。
十一月五日	假日整理資料。
十一月六日	赴金星(LG)公司觀摩 W-CDMA/WLL 產品實地運用於韓國國內站台，並了解其使用狀況。
十一月七日	由韓國回國

伍、社交活動

因時間短絀，且人生地不熟，大部時間皆在參加研討及觀摩，僅利用空檔參觀韓國漢城市區。

陸、建議事項

1.金星公司(L.G..)在韓國為三大通訊系統業者(另兩家為現代及三松)，其通訊技術超越國內約 3~5 年，為加速本國通訊產業提昇，或許可考量引進韓國通訊技術，謀求與韓國通訊大廠技術合作，以縮短國內研發時程，令國內除了半導體科技及本世紀發著重發展生物科技外，通訊科技能成為國內三大高科技產業之一。雖然此技術引進需付出龐大支出但為謀求通訊技術生根、往後龐大商機及延伸技術為考量，此方式是值得投資的。

2.本院執行經濟部科專案，此案不僅是為國內通訊技術生根，且本院為三軍建構未來通訊裝備的大好時機，由此次觀摩金星公司發展 WB-CDMA 產品的研發人員約 120 人至 200 人，而本院投資之人力及物力相形之下低於金星公司。而本院科技人員平時忙碌於研發、修改外，尚需執行一些文件撰寫及行政公文等，佔據研發時間，因此本案之執行除了增加人力(專時之研發人員)外，需界定其工作內容，並以強力主導方式，督導各個分系統進度，以免本案無法完成任務，對經濟部無法交代，影響本院形象。

柒、附件

1. WB-CDMA 硬品說明一份

2. 測試資料一份。

LG Electronics Inc.	Device Name		CODE Name	
	Preparation Date 2000-09-25	Title No.	Main Title Name	Page 1/1
Title Name Data Call Connection Time Test			Subtitle Name	

1. Objective

1.1 Verify whether the data call is connected within the given period of time after the data call connection is attempted, under the wire or wireless test environment.

2. Evaluation Criteria

2.1 The period of time should be within 20 seconds until the connection screen is displayed after connection start button of the data call is clicked.

2.2 Verify that the communication of the data call is normal after the data call connection.

3. Reference

3.1 Perform the test after configuring the base station and terminal in wire or wireless mode.

3.2 Prepare one notebook PC or desktop PC in which Windows is installed.

3.3 Prepare one stopwatch.

4 Testing Method and Result

4.1 Connect to the data port of RIU and RS232 port of the notebook and the desktop PC.

4.2 Perform the telephone connection network of Windows to connect data call.

4.3 Measure the time to be taken until the connection screen is displayed from the moment of pressing the connection button with starting up the stopwatch at the same time. In this case, the time should be within 20 seconds.

4.4 Verify whether the data is transmitted and received after the connection is made normally.

4.5 When the verification is complete, end the data call.

1. Objective

1.1 Verify effective isotropic radiation power (EIRP) transmitted out from RIU.

2. Evaluation Criteria

2.1 Total effective isotropic radiation power allocated to the transmit channel from the RIU antenna should be 2.5W or higher.

3 Reference

3.1 Compensation of loss generated from cable, connector, and attenuator.

3.2 Compensation of antenna gain after the measurement from RF output terminal or terminal corresponding to this.

3.3 Gain of RIU antenna should be 11dBi

3.4 Measuring Instruments

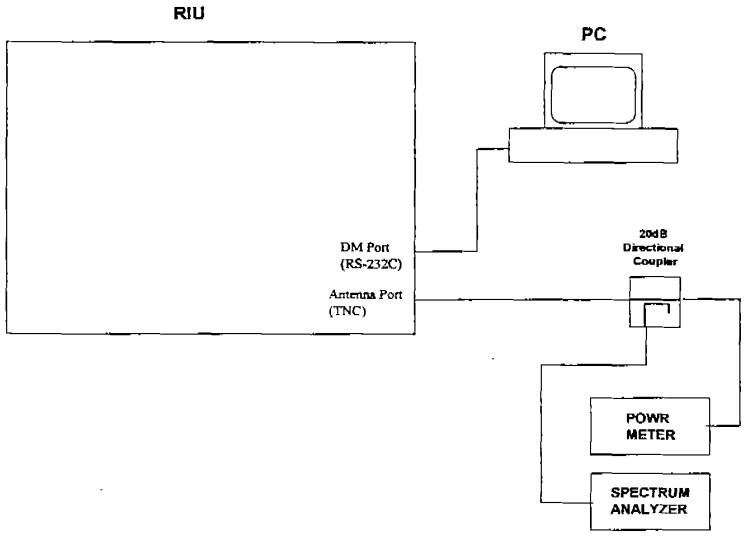
Spectrum Analyzer : HP 8566B

Power Meter : HP 438A or above

4. Testing Method and Result

4.1 Equipment configuration diagram

Total Power Measurement



4.2 Set up the equipment as in the above.

4.3 Spectrum Analyzer Setting

4.4 Set up RIU in order to measure the channel power of RIU.

DM SETTING Order

1) Execute Mirror and set SP 384. Then, input "go lo" and press the <Enter> key.
2) Turn on the power of RIU and then, press <Ctrl>+<C>.
3) Load DM on Sector 2 as follows when "RIU-MON12>" is displayed on the monitor.
   (1) Enter "ls2" and then, press the Enter Key.
   (2) Enter " go" and then, press the Enter Key.
4) The menu is displayed on the monitor as follows.

```
[ ================================================ ]
[ v2.1  04/24  CDMA ASIC DIAGNOSTIC MONITOR v4.0.1 ]
[ ================================================ ]
[ [0] INIT MODEM.          [m] MEM/REG DUMP          ]
[ SUB BLOCK SETUP MENU ---------------------------- ]
[ [1] SHOW Para.  (ENC, SRCH, Fn, DMOD, COMB)       ]
[ [2] ENCODER   Setup.  [3] RF/ANALOG Setup.        ]
[ [4] SEARCHER  Setup.  [5] FINGER    Setup.        ]
[ [6] DMOD.     Setup.  [7] COMB.     Setup.]
[ DIAGNOSTIC MENU                   ---------------- ]
[ [8] DIAG RSSI.           [9] DIAG Eb/Io.          ]
[ [a] DIAG INT STAT.     [e] SHOW FIR AGC STS.      ]
[ TEST MENU ------------------------------------- ]
[ [b] SUB BLOCK TEST.    [r] RF MODULE TEST.        ]
[ [c] CHANNEL TEST.      [z] ACC MASS-PROD.         ]
[ [d] BER TEST.          [f] TPG BER TEST.          ]
[ PRODUCTION MENU ------------------------------- ]
[ [p] Prod TEST.                                    ]
[ ------------------------------------------------ ]
Select number or Press Enter to quit
```

5) Set up RIU in the following order.

```
[ ================================================ ]
[ v2.1  04/24  CDMA ASIC DIAGNOSTIC MONITOR v4.0.1 ]
[ ================================================ ]
[ [0] INIT MODEM.          [m] MEM/REG DUMP          ]
[ SUB BLOCK SETUP MENU ---------------------------- ]
[ [1] SHOW Para.  (ENC, SRCH, Fn, DMOD, COMB)       ]
[ [2] ENCODER   Setup.  [3] RF/ANALOG Setup.        ]
[ [4] SEARCHER  Setup.  [5] FINGER    Setup.        ]
```

```
[ [6] DMOD.      Setup.  [7] COMB.      Setup.                ]
[ DIAGNOSTIC MENU ----------------------------------------- ]
[ [8] DIAG RSSI.          [9] DIAG Eb/Io.                    ]
[ [a] DIAG INT STAT.      [e] SHOW FIR AGC STS.              ]
[ TEST MENU ----------------------------------------------- ]
[ [b] SUB BLOCK TEST.     [r] RF MODULE TEST.                ]
[ [c] CHANNEL TEST.       [z] ACC MASS-PROD.                 ]
[ [d] BER TEST.           [f] TPG BER TEST.                  ]
[ PRODUCTION MENU ----------------------------------------- ]
[ [p] Prod TEST.                                             ]
[ ---------------------------------------------------------- ]
```

Select number or Press Enter to quit ?

(1) Select modem initialization menu "[0] INIT MODEM ".

```
==============================================
[ [0] SELECT PLL VERSION.                     ]
[ [1] Init all Modem to   NULL state.         ]
[ [2] Activate Modem to open traffic.         ]
[ [3] Deactivate Modem.                       ]
==============================================
    Select one :
```

(2) Select "[0]SELECT PLL VERSION" in order to set PLL.
Select PLL Version (3,4,5,6,7) ? :

(3) Select desired PLL version.

```
[L1-RFDRV] Hanaro RF PLL version 23.
==============================================
[ [0] SELECT PLL VERSION.                     ]
[ [1] Init all Modem to   NULL state.         ]
[ [2] Activate Modem to open traffic.         ]
[ [3] Deactivate Modem.                       ]
==============================================
Select one :
```

(4) Select "[1] Init all Modem to NULL state ".
Initializing Modulator
Initializing RF sub-system
Initializing Searcher/Demodulator
Initializing Interrupt Trampoline Service

Initializing FIR driver
Initializing Rx AGC Threshold/Speed

```
==============================================
[ [0] SELECT PLL VERSION.                     ]
[ [1] Init all Modem to  NULL state.          ]
[ [2] Activate Modem to open traffic.         ]
[ [3] Deactivate Modem.                       ]
==============================================
```

Select one :

(5) Select "[2] Activate Modem to open traffic".

```
==============================================
[ [1] Select CDMA CH.          ----------[ 0] ]
[ [2] Select CDMA PORT.        ----------[ 0] ]
[ [3] Select DATA RATE.        ----------[ 0] ]
[ [4] Select Fn CS.            ----------[ 0] ]
[ [5] Make it Effects.                        ]
==============================================
```

Select one :

(6) Select "[2] Select CDMA PORT".
Select CDMA port [0,1] :1

(7) Select the desired CDMA Port and then, input the enter key.
CDMA PORT 1 selected

```
==============================================
[ [1] Select CDMA CH.          ----------[ 0] ]
[ [2] Select CDMA PORT.        ----------[ 1] ]
[ [3] Select DATA RATE.        ----------[ 0] ]
[ [4] Select Fn CS.            ----------[ 0] ]
[ [5] Make it Effects.                        ]
==============================================
```

Select one :

(8) Enter "q".

```
==============================================
[ [0] SELECT PLL VERSION.                     ]
[ [1] Init all Modem to  NULL state.          ]
[ [2] Activate Modem to open traffic.         ]
[ [3] Deactivate Modem.                       ]
```

```
==========================================
Select one :
```

(9) Enter "q".

```
[ ========================================== ]
[ v2.1  04/24  CDMA ASIC DIAGNOSTIC MONITOR v4.0.1  ]
[ ========================================== ]
[ [0] INIT MODEM.          [m] MEM/REG DUMP          ]
[ SUB BLOCK SETUP MENU ---------------------------- ]
[ [1] SHOW Para.  (ENC, SRCH, Fn, DMOD, COMB)        ]
[ [2] ENCODER   Setup.  [3] RF/ANALOG Setup.         ]
[ [4] SEARCHER  Setup.  [5] FINGER    Setup.         ]
[ [6] DMOD.     Setup.  [7] COMB.     Setup.         ]
[ DIAGNOSTIC MENU ---------------------------------- ]
[ [8] DIAG RSSI.           [9] DIAG Eb/Io.           ]
[ [a] DIAG INT STAT.       [e] SHOW FIR AGC STS.     ]
[ TEST MENU ---------------------------------------- ]
[ [b] SUB BLOCK TEST.      [r] RF MODULE TEST.       ]
[ [c] CHANNEL TEST.        [z] ACC MASS-PROD.        ]
[ [d] BER TEST.            [f] TPG BER TEST.         ]
[ PRODUCTION MENU ---------------------------------- ]
[ [p] Prod TEST.                                     ]
[ ---------------------------------------------------- ]
Select number or Press Enter to quit ?
```

(10) Select "[3] RF/ANALOG Setup".

```
==========================================
[ [0] SET CDMA PORT.                [      0] ]
[ [1] RX AGC SPEED.                 [      2] ]
[ [2] RX AGC THRESHOLD.             [    600] ]
[ [3] TX AGC PDM.                   [0x8001] ]
[ [4] TX AGC PDM1.                  [0x0000] ]
[ [5] TURN ON/OFF PA.                        ]
[ [6] FIR SETUP.                             ]
[ [7] SELECT FA.                             ]
==========================================
Select one or 'q' to quit : ?
```

(11) Select "[3] TX AGC PDM".
Enter Tx AGC PDM value in Hex : 7fff

(12) Enter "7fff" and then, press the enter key.
Set to 0x00007fff

```
==========================================
[ [0] SET CDMA PORT.                [     0] ]
[ [1] RX AGC SPEED.                 [     2] ]
[ [2] RX AGC THRESHOLD.             [   600] ]
[ [3] TX AGC PDM.                   [0x7fff] ]
[ [4] TX AGC PDM1.                  [0x0000] ]
[ [5] TURN ON/OFF PA.                        ]
[ [6] FIR SETUP.                             ]
[ [7] SELECT FA.                             ]
==========================================
Select one or 'q' to quit : ?
```

(13) Select "[5] TURN ON/OFF PA".
Turn On or Off PA [1:On, 0:Off] : 1

(14) Select "1:On" and then, press the enter key.
Set to 0x00000001

```
==========================================
[ [0] SET CDMA PORT.                [     0] ]
[ [1] RX AGC SPEED.                 [     2] ]
[ [2] RX AGC THRESHOLD.             [   600] ]
[ [3] TX AGC PDM.                   [0x7fff] ]
[ [4] TX AGC PDM1.                  [0x0000] ]
[ [5] TURN ON/OFF PA.                        ]
[ [6] FIR SETUP.                             ]
[ [7] SELECT FA.                             ]
==========================================
Select one or 'q' to quit : ?
```

6) Verify whether channel power is 22dBm or greater with the use of power meter or spectrum analyzer.

1. Objective

1.1 Verify effective isotropic radiation power (EIRP) transmitted out from the base station.

2. Evaluation

2.1 Total effective isotropic radiation power allocated to the transmit channel from the base station antenna should be +50.969 dBm(125W) or greater.

3. Reference

3.1 Compensation of loss generated in cable, connector, and attenuator.

3.2 Antenna gain compensation after performing the measurement from the output terminal or terminal corresponding to this.

3.3 Gain of base station antenna should be 11dBi.

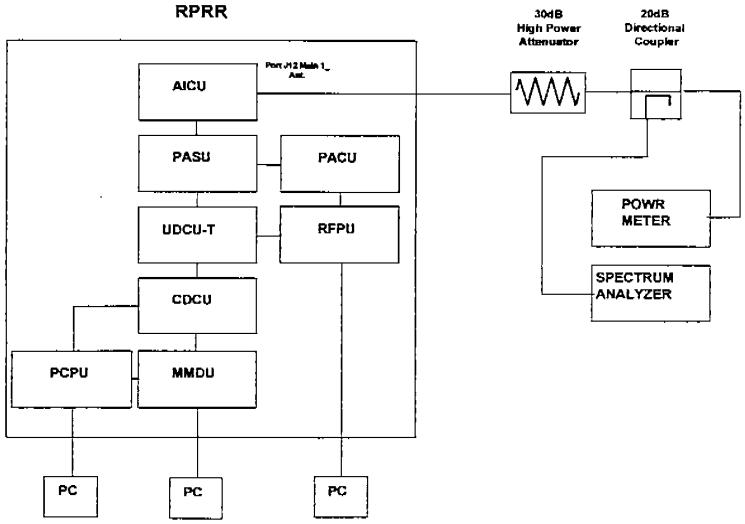
3.4 Measuring Instruments

Spectrum Analyzer: HP 8566B

Power Meter: HP 438A or above.

4. Testing Method and Result

4.1 Equipment configuration diagram



Total Power Measurement

4.2 Set up the equipment as in the above..

4.3 Age the measuring instrument for 30 minutes or longer.

4.4 Set up the base station in order to transmit modulated signal loaded with pilot, sync, paging, traffic, and PPCS channel as in the ratio of Table 103.1.

DM SETTING Order

1) Execute Mirror and set SP 384. Then, input b"go lo" and press the return key.
2) Press the RESET Button on the front side of PCPU and then, press the UG Button.
3) Connect the console to the PCPU Board and then, press the "return key" when "WLL-RP/CAI> is displayed.
4) Enter items in the following order.
   First, check the status of current PCPU.
   WLL-RP/CAI> show-cai-db:::rp; ↵

```
==========================================================
   RP-4 DATABASE
==========================================================
      RPC-RP Primary Trunk : 0
      RPC-RP Trunk Usage   : 0xf
      LAPD state           : BROKEN
      Subscriber Number    : 0
      ----------------------------------------------
            Base Seed (I)        : 0x8be4d33e
      Base Seed (Q)        : 0x81493f93
      LAI                  : [02f0010104]
      Pilot Ch Gain        : 445          → Pilot channel gain value
      Sync Ch Gain         : 87           → Sync channel gain value
      Paging Ch Gain       : 174          → Paging channel gain
value
      ----------------------------------------------
      Active PKT Slot      : 1
      Active ACC Slot      : 1
      Active CDC Slot      : 1
      Modem Board Equip.   : 0x0202
           Modem Board Status   : 0x0202
----------------------------------------------
-- more --
   Available CDMA Ch(s) : 40
```

Next Alloc CDMA Ch : 0
Available HADAMARD(s): 116
Total In-Svc Call(s) : 0
MMU Ch Seize Factor : [0] [0] [0] [0] [0] [0] [0]

RIU Application Ver : NONE

==========

Set up the gain of channel as follows when the above is displayed.

WLL-RP/CAI> *set-pipwr:::371;* ↵
RPT:004:2400-01-01 04:24:05:M:COMMAND EXECUTED;

WLL-RP/CAI> *set-pgpwr:::345;* ↵
RPT:004:2400-01-01 04:24:13:M:COMMAND EXECUTED;

WLL-RP/CAI> *set-sypwr:::173;* ↵
RPT:004:2400-01-01 04:24:20:M:COMMAND EXECUTED;

Check the status of PCPU again.
WLL-RP/CAI> *show-cai-db:::rp;*

==========

RP-4 DATABASE

==========

RPC-RP Primary Trunk : 0
RPC-RP Trunk Usage : 0xf
LAPD state : BROKEN
Subscriber Number : 0

Base Seed (I) : 0x8be4d33e
Base Seed (Q) : 0x81493f93
LAI : [02f0010104]
Pilot Ch Gain : 371
Sync Ch Gain : 173
Paging Ch Gain : 345

Active PKT Slot : 1

```
Active ACC Slot          : 1
Active CDC Slot          : 1
Modem Board Equip.       : 0x0202
Modem Board Status       : 0x0202
-------------------------------------------------

-- more --

Available CDMA Ch(s) : 40
Next Alloc CDMA Ch   : 0
Available HADAMARD(s): 116
Total In-Svc Call(s) : 0
MMU Ch Seize Factor  : [0] [0] [0] [0] [0] [0] [0]
-------------------------------------------------
RIU Application Ver  : NONE
=================================================
```

5) Verify whether the gain of pilot, sync, and paging channel has been entered properly. Then, record the base seed number or value (base seed is different for each equipment).

6) Connect the console to the MMDU board and press enter. Then, the initialization screen is displayed as follows. Data rate can be entered if 0 is selected.

```
[================================================]
[    M M D U   R E V I S I O N   D M Ver2.3 [04/21]   ]
[================================================]
[  0. Auto Initialize modem.                    ]
[  1. SEARCHER.                                  ]
[  2. FINGER.                                   ]
[  3. COMBINER.                                  ]
[  4. MODULATOR.                                 ]
[  5. Viterbi Decoder.                          ]
[  6. Parameter Status.                          ]
[  7. Clear Register.                           ]
[  8. Access Channel Test.                       ]
[  9. Signal channel test.                      ]
[  a. Power Control.                             ]
```

```
[  b. BER Test.                                    ]
[  c. Memory Write.                                ]
[  d. Memory Read.                                 ]
[  e. Auto Test.                                   ]
[  f. General Board Test.                          ]
[  g. RP Tx Test.                                  ]
[ ----------------------------------------------- ]
[  Press any key to return menu from running.      ]
[ ----------------------------------------------- ]
Enter data rate[32,64,128k(default=64k)] : 32
Set to 32k
Auto Initialization Completed!!
```

7) Press enter again.

```
[================================================]
  [    M M D U   R E V I S I O N   D M Ver2.3 [04/21]   ]
  [================================================]
  [  0. Auto Initialize modem.                       ]
  [  1. SEARCHER.                                    ]
  [  2. FINGER.                                      ]
  [  3. COMBINER.                                    ]
  [  4. MODULATOR.                                   ]
  [  5. Viterbi Decoder.                             ]
  [  6. Parameter Status.                            ]
  [  7. Clear Register.                              ]
  [  8. Access Channel Test.                         ]
  [  9. Signal channel test.                         ]
  [  a. Power Control.                               ]
  [  b. BER Test.                                    ]
  [  c. Memory Write.                                ]
  [  d. Memory Read.                                 ]
  [  e. Auto Test.                                   ]
  [  f. General Board Test.                          ]
  [  g. RP Tx Test.                                  ]
  [ ----------------------------------------------- ]
  [  Press any key to return menu from running.      ]
```

[----------]

8) Select g from the above screen in order to generate test.ch model for transmit test.

Enter Channel number[1-8] : 6

6 Channel Selected

Enter PCS channel gain(default=0) : 86

Set to 210

Enter Traffic channel gain(default=0) : 244

Set to 49

Enter Mod. PCS channel walsh0(default=7) : 7

Set to 7

Enter Mod. Traffic channel walsh1(default=8) : 8

Set to 8

Enter Scramble seed(default=0) : 100

Set to 100

Enter PNseed Number[0-511]

9) As the number of PN seed, the PN seed number of PCPU should be entered.
[Manual Input:512] : 2

Set to ccbb6a6c

Set to db527007

==========

PnI	: ccbb6a6c	PnQ	: db527007
SigGain	: 86	TrafGain	: 244
Ch	: 0	Scramble	: 100
PCS Walsh	: 7	Traf Walsh	: 8
Ch	: 1	Scramble	: 200
PCS Walsh	: 9	Traf Walsh	: 10
Ch	: 2	Scramble	: 300
PCS Walsh	: 11	Traf Walsh	: 12
Ch	: 3	Scramble	: 400
PCS Walsh	: 13	Traf Walsh	: 14
Ch	: 4	Scramble	: 500
PCS Walsh	: 15	Traf Walsh	: 16
Ch	: 5	Scramble	: 600
PCS Walsh	: 17	Traf Walsh	: 18

4.5 Verify whether the desired value has been entered on the above screen.

4.6 In the above measurement configuration diagram, measure insertion loss at frequency bandwidth used by RF that connects the RF output port and power meter sensor (measured value).

4.7 Connect the power meter to the AICU Tx out port using a calibrated directional coupler and RF cable.

4.8 Measure total power output from the RF output port using a power meter.

4.9 In case the power of base station is not within the specification of +43dBm ±1dB, adjust the power of UDCT of UDCU through RFPU as follows in order to set the output of base station to the specification.

Setting of Base Station Output

1. Connect the console to RFPU and then, press enter to display rfpu-act>.
   rfpu-act.> *show-udcu-volt;*
2. When entering as in the above, voltage value of UDCU of sector to be measured can be known.
   rfpu-act.> *set-udcu-tx:::a,3;* ↵
   (If sector is alpha, it is a. If beta, it is b and if gamma , it is g. The voltage value can be adjusted up to the second decimal point.
   rfpu-act.> *set-udcu-tx:::a,3.1;* rfpu-act.> *set-udcu-tx:::a,3.2*; rfpu-act.> *set-udcu-tx:::a,3.3;*

• • • •

4.10 Adjust the voltage value of Item 4.9 so that the base station power becomes +43dBm ±1dB.

4.11 Measure total power outputted from the RF output port using a power meter (measured value: B).

4.12 Calculate total transmit power at the base station. Total power = (A+B)dBm

4.13 Check whether the value obtained by adding gain11dBi to the total power of base station meets the specification (if the base station equipment power is 20watts (antenna feed line not included) and the antenna gain is 11dBiB, the effective isotropic radiation power at the base station antenna is 251 Watts (+54dBm).

Table 103.1 Base Station Test Model

Type	No. of Channels	Power Ratio (linear)	Power Radio (dB)	Remarks
Pilot	1	0.2000	-7	Channel Code 0
Sync	1	0.0437	-13.6	Channel Code 1
Paging	1	0.1738	-7.6	Channel Code 2 – 5
Traffic	6	0.0871	-10.6	Variable Channel Code
PC	6	0.0120	-19.6	Variable Channel Code

LG Electronics	Device Name		Code Name	
	Prepared by 2000-10-06	Title No	Main Title Name	Page 1/1
Title Name One-to-multi Packet Transmission			Subtitle Name	

1 Objective

1.1 Verify whether one-to-multi packet transmission is possible in the WLL system.

2 Evaluation Criteria

2.1 Verify whether a file can be sent out from one PC to N PCs without errors.

3 Reference

3.1 For file transmission among PCs, Microsoft's NetMeeting program is used.

3.2 The IP address of server system should be assumed to be known.

3.3 N PCs are designated randomly as A, B, C,.....

4 Testing Method and Result

4.1 Provide PPP connection through telephone connection networking at N number of PCs for Internet accessing.

4.2 Run the NetMeeting program in the server system.

4.3 Run the NetMeeting program in all the PCs

4.4 Attempt a connection through NetMeeting from PC A with the use of ID address of server system.

4.5 Connection request from PC A is displayed on the server system and when this is accepted at the server system, a connection through NetMeeting is set up between the server system and PC A.

4.6 When a connection through NetMeeting is attempted from PC B with the use of IP address of server system, connection request from PC B is displayed on the server system and PC A. When the server system and PC A accept the connection request, a connection through NetMeeting is set up among the server system, PC A and PC B.

4.7 All the remaining PCs can be connected through NetMeeting using the above method.

4.8 A file transmission window is created when the file transmission button is pressed from a certain PC.

4.9 When starting the file transmission by selecting a file to be sent out from the created file transmission window, the selected file is sent out to all the PCs connected through NetMeeting.

4.10 Once the file transmission is completed, the file received from each PC is compared with the file before the sending. If they match with each other, one to multi packet transmission has been performed.

LG Electronics	Device Name		Code Name	
	Prepared by 2000-10-06	Title No	Main Title Name	Page 1/1
Title Name One-to-one Packet Transmission			Subtitle Name	

1 Objective

1.1 Verify whether one-to-one packet transmission is possible in the WLL system.

2 Evaluation Criteria

2.1 Verify whether files are sent from one PC to another PC without errors.

3 Reference

3.1 For file transmission between two PCs, Microsoft's NetMeeting program is used.

3.2 The IP address of service should be assumed to be known.

4 Testing Method and Result

4.1 Provide PPP connection through telephone connection networking at PC connected to two WLL terminals for Internet accessing.

4.2 Run the NetMeeting program in the server system.

4.3 Run the NetMeeting program in two PCs (PCA, PC B).

4.4 Attempt a connection through NetMeeting from PC A with the use of ID address of server system.

4.5 When a connection through NetMeeting from PC A is attempted, the message indicating that connection request has arrived is displayed on the screen of server system. The connection through NetMeeting is set up between PCA and server system when the accept button is pressed this time.

4.6 Attempt a connection through NetMeeting from PC B with the use of IP address of server system.

4.7 When a connection through NetMeeting from PC B is attempted, the message indicating that connection request has arrived is displayed on the screen of server system. In addition, the message indicating that connection request has arrived is displayed on the screen of PC A as well. A connection through NetMeeting is set up among PC B, server system, and PC A when the accept button is pressed in the server system and PC A.

4.8 A file transmission window is created when the file transmission button is pressed

from one PC between two PCs.

4.9 A file to be sent out is selected from the created file transmission window and then, it is sent out to the PC of opposite side.

4.10 Once file transmission is completed, the file sent out to the other PC and the file before the sending are compared. If the two files match with each other, one-to-one packet transmission is possible.

1 Objective

1.1 Verify whether BER of 32Kbps voice service call channel meets the requirements of minimum receive power not exceeding a preset value when the measurement is carried out at the receive input terminal of base station.

2 Evaluation Criteria

2.1 Receive power should be –117dBm or below when BER of backward 32Kbps voice call channel is 10^{-3} or below at the receive RF input terminal (the test should be performed by generating specific test pattern).

* Reference) Table 101.1 Test Parameters for Receive Sensitivity

Parameter	Unit	Value
I^or	dBm/8.2MHz	-117
PPCS Ec / Ior	dB	-7
Traffic Ec / Ior	dB	-1
Data rate	kbps	32

3 Reference

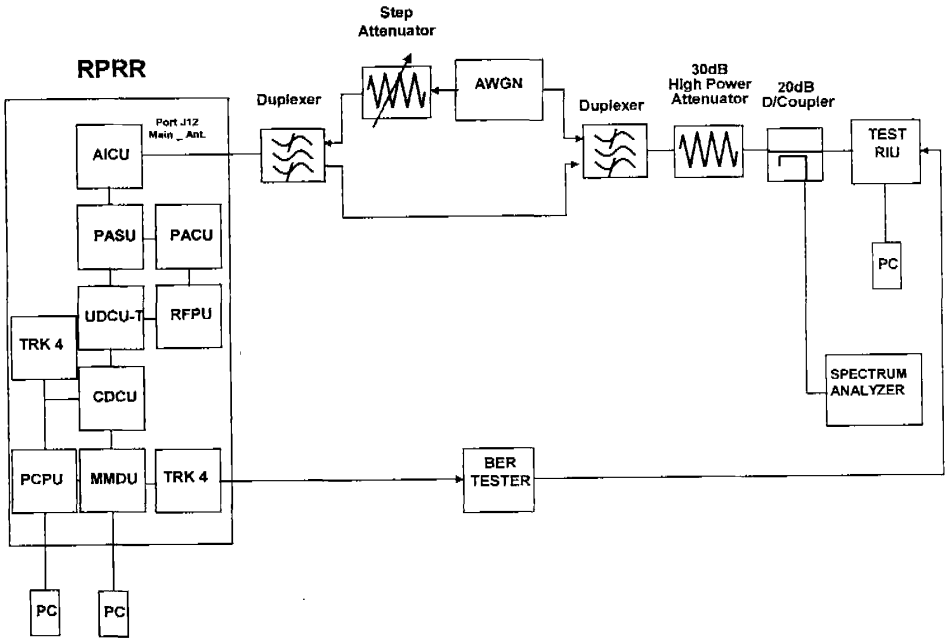
3.1 Measuring Instruments

Power Meter: HP 438A

BER Test Set: FIREBIRD 6000A

AWGN: TAS 2500A or better

3.2 Test configuration diagram



4. Testing Method and Result

4.1 Set up the equipment as in the above figure.

4.2 The RIU should be set up as follows in order for the base station to receive signals.

1) Connect the console to the IWF port.
2) Execute Mirror and set SP 384. Then, input "go lo" and press the return key.
3) Press the Reset Button on the front panel and then, press the UG Button.
4) Execute "LS2" (sector 2 Loading) when "MON>" is displayed. Then, the following diagnostic monitor screen is displayed.
5) Select d from the RIU initial menu and press 1. Then, the item for selecting TFCH of RIU and PPCH GAIN is displayed on No.3 item.
6) Change PPCH GAIN to 0 on that item.
7) Measure the level of signal coming out from the RF output port of RIU using AWGN (Value A).
8) Re-execute 7 and 8 of Item 4.2 in order to set up GAIN value of PPCS to 150.
9) Measure the level of signal coming out from the RF output port of RIU using AWGN (Value B).

10) Calculate the difference between Value A and Value B (Value B – Value A= Value C).
11) Return to the initial menu.

RIU DM Setting

```
[ ============================================== ]
[ RIU-T 04/21   CDMA ASIC DIAGNOSTIC MONITOR v4.0.0 ]
[ ============================================== ]
[ [0] INIT MODEM.          [m] MEM/REG DUMP                ]
[ SUB BLOCK SETUP MENU ---------------------------------- ]
[ [1] SHOW Para.  (ENC, SRCH, Fn, DMOD, COMB)              ]
[ [2] ENCODER     Setup.  [3] RF/ANALOG Setup.             ]
[ [4] SEARCHER    Setup.  [5] FINGER      Setup.           ]
[ [6] DMOD.       Setup.  [7] COMB.       Setup.           ]
[ DIAGNOSTIC MENU ------------------------------------------ ]
[ [8] DIAG RSSI.           [9] DIAG Eb/Io.                 ]
[ [a] DIAG INT STAT.       [e] SHOW FIR AGC STS.           ]
[ TEST MENU ------------------------------------------------ ]
[ [b] SUB BLOCK TEST.      [r] RF MODULE TEST.             ]
[ [c] CHANNEL TEST.        [z] ACC MASS-PROD.              ]
[ [d] BER TEST.            [f] TPG BER TEST.               ]
[ PRODUCTION MENU ------------------------------------------ ]
[ [p] Prod TEST.                                           ]
[ ------------------------------------------------------------ ]
```

12) The menu is displayed along with the following sentences if d is selected from the above screen.

```
Select number or Press Enter to quit ?
Initializing Modulator
Initializing RF sub-system
Initializing Searcher/Demodulator
Initializing Interrupt Trampoline Service
Initializing FIR driver
Initializing Rx AGC Threshold/Speed
PORT[0] PILOT GAIN = 170, TFCH GAIN = 0
PORT[1] PILOT GAIN = 0, TFCH GAIN = 340
[============================================]
```

```
[                    BER TEST                                    ]
[------------------------------------------------------------]
[                                                                ]
[  [1] RIU -> RP    ( UPLINK    SETUP )                          ]
[  [2] RP   -> RIU  ( DOWNLINK SETUP )                           ]
[                                                                ]
[================================================================]
Select one or 'q' to quit : Select 1

[================================================================]
[  RIU -> RP    ( UPLINK    SETUP )                              ]
[------------------------------------------------------------]
[                                                                ]
[  [1] BER TEST START                                            ]
[  [2] CHANGE SEARCHER/FINGER PN SEED                            ]
[  [3] CHANGE PPCS/TRAF GAIN                                     ]
[  [4] CHANGE TX AGC PDM                                         ]
[                                                                ]
[================================================================]
```

Select one or 'q' to quit : The following sentences are displayed when 2 is pressed.

enter pn index [0-511] : **Select** 2.

received value = [2]

```
[================================================================]
[  RIU -> RP    ( UPLINK    SETUP )                              ]
[------------------------------------------------------------]
[                                                                ]
[  [1] BER TEST START                                            ]
[  [2] CHANGE SEARCHER/FINGER PN SEED                            ]
[  [3] CHANGE PPCS/TRAF GAIN                                     ]
[  [4] CHANGE TX AGC PDM                                         ]
[                                                                ]
[================================================================]
```

Select one or 'q' to quit : Select 1.

SELECT BER RATE (0: 32K, 1:64K, 2:128K) : ? Select 0.

set to [0].

PORT[0] PILOT GAIN = 170, TFCH GAIN = 0
PORT[1] PILOT GAIN = 0, TFCH GAIN = 340

!!!!!! PLEASE WAIT UNTIL RIU IS LOCKED !!!!!!
---- AFTER LOCKED, press any key ----

13) Press any key when Sync of BER TESTER is captured.
[RIU -> RP] UPLINK BER TEST STARTED!
14) Connect the console to the PMCU board and press the esc key on the mirror window. Then, input do ber-32cts on the command line and then, press enter. Then, the batch file is executed as follows and the trk board is set up.

PMCU>set-ber-off::trk0;
M:COMMAND EXECUTED;

PMCU>set-test-cfg::trk0-0:riu,1,32k,none,0;
M:COMMAND EXECUTED;

PMCU>set-ber-on::trk0;
M:COMMAND EXECUTED;

15) Connect the console to the ACCU board and then, set up the agc value as follows.

ACCU>set-agc:::0,500,0,500;
== MAIN ==
AGC Speed: 0 AGC Threshold : 500
== SUB ==
AGC Speed: 0 AGC Threshold : 500
M:COMMAND EXECUTED;

4.3 Connect the console to RP MMDU B/D and then, execute 2 of Item 4.2.
4.4 Press the Reset Button of MMDU and then, press UG Button.
4.5 Enter "5" when Select Number and Press Enter is displayed in the "System Administration Mode".
4.6 Enter "2" at "select Flash Zone(1-3).

4.7 The following screen is displayed when "4.start Application" is selected.

MMDU DM setting

```
[==============================================]
[    M M D U   R E V I S I O N   D M Ver2.1 [04/19]      ]
[==============================================]
[  0. Auto Initialize modem.                    ]
[  1. SEARCHER.                                 ]
[  2. FINGER.                                   ]
[  3. COMBINER.                                 ]
[  4. MODULATOR.                                ]
[  5. Viterbi Decoder.                          ]
[  6. Parameter Status.                         ]
[  7. Clear Register.                           ]
[  8. Access Channel Test.                      ]
[  9. Signal channel test.                      ]
[  a. Power Control.                            ]
[  b. BER Test.                                 ]
[  c. Memory Write.                             ]
[  d. Memory Read.                              ]
[  e. Auto Test.                                ]
[  f. General Board Test.                       ]
[ ----------------------------------------------]
[  Press any key to return menu from running.   ]
[ ----------------------------------------------]
```

1) Select 0 from the above screen.

Enter data rate[32,64/128,144(default=64k)] ***: Select 32***

Set to 32k

Auto Initialization Completed!!

```
[==============================================]
[    M M D U   R E V I S I O N   D M Ver2.1 [04/19]      ]
[==============================================]
[  0. Auto Initialize modem.                    ]
[  1. SEARCHER.                                 ]
```

```
[  2. FINGER.                                                    ]
[  3. COMBINER.                                                  ]
[  4. MODULATOR.                                                 ]
[  5. Viterbi Decoder.                                           ]
[  6. Parameter Status.                                          ]
[  7. Clear Register.                                            ]
[  8. Access Channel Test.                                       ]
[  9. Signal channel test.                                       ]
[  a. Power Control.                                             ]
[  b. BER Test.                                                  ]
[  c. Memory Write.                                              ]
[  d. Memory Read.                                               ]
[  e. Auto Test.                                                 ]
[  f. General Board Test.                                        ]
[ ---------------------------------------------------------------]
[  Press any key to return menu from running.                    ]
[ ---------------------------------------------------------------]
```

2) The following screen is displayed when No. b is selected again in the initial screen.

Select Channel number(0,1,2,3,4,5,6,7) -- Select ***0***

Channel 0 Selected

```
[================================================]
[                BER Test Menu                     ]
[================================================]
[  0. RP Tx Mode                                   ]
[  1. RP Rx Mode                                   ]
[ -----------------------------------------------]
```

[Select number or Press Enter to quit Select ***1***

```
[================================================]
[       R P  Demod  Parameter setting              ]
[================================================]
[  0. Finger Energy & Position Display             ]
[  1. Finger EPOCH.                                ]
[  2. Lower Threshold.                             ]
```

```
[  3. Walsh code Set.                                          ]
[  4. DataRate Set.                                            ]
[  5. Deinterleaver Set                                        ]
[  6. Rx Parameter Status                                      ]
[ ---------------------------------------------------------------]
[  Press any key to return menu from running.                  ]
[ ---------------------------------------------------------------]
```

Select No. 4.
Enter data rate [32,64k,128k,144kbps(default=64k)] : ***32***
Set to 32k

```
[================================================]
[        R P   Demod   Parameter setting           ]
[================================================]
[  0. Finger Energy & Position Display             ]
[  1. Finger EPOCH.                                ]
[  2. Lower Threshold.                             ]
[  3. Walsh code Set.                              ]
[  4. DataRate Set.                                ]
[  5. Deinterleaver Set                            ]
[  6. Rx Parameter Status                          ]
[ ---------------------------------------------------------------]
[  Press any key to return menu from running.                  ]
[ ---------------------------------------------------------------]
```

Select ***0***
Finger Energy & Position Display
Enter Display Time(every(1)/twice(2)....) Select ***10***
Scale Set to 10
Pos : 76802 , Erg : 57232
Pos : 81602 , Erg : 6352
Pos : 86402 , Erg : 8528

3) Type enter when failing to capture lock (Position value is changed sequentially or the energy value is not constant)

```
[==========================================]
[        R P   Demod   Parameter setting    ]
[==========================================]
[  0. Finger Energy & Position Display      ]
[  1. Finger EPOCH.                         ]
[  2. Lower Threshold.                      ]
[  3. Walsh code Set.                       ]
[  4. DataRate Set.                         ]
[  5. Deinterleaver Set                     ]
[  6. Rx Parameter Status                   ]
[ ------------------------------------------]
[  Press any key to return menu from running.]
[ ------------------------------------------]
[==========================================]
[              BER Test Menu                ]
[==========================================]
[  0. RP Tx Mode                            ]
[  1. RP Rx Mode                            ]
[ ------------------------------------------]

[ Select number or Press Enter to quit Select No.1
[==========================================]
[        R P   Demod   Parameter setting    ]
[==========================================]
[  0. Finger Energy & Position Display      ]
[  1. Finger EPOCH.                         ]
[  2. Lower Threshold.                      ]
[  3. Walsh code Set.                       ]
[  4. DataRate Set.                         ]
[  5. Deinterleaver Set                     ]
[  6. Rx Parameter Status                   ]
[ ------------------------------------------]
[  Press any key to return menu from running.]
```

[----------]

Select No. 1

TT_FN_CTL Slew Lock Set

Enter Slew Number(default=0) : Input 480

Set to 480

Finger Epoch

[==========]

[R P Demod Parameter setting]

[==========]

[0. Finger Energy & Position Display]

[1. Finger EPOCH.]

[2. Lower Threshold.]

[3. Walsh code Set.]

[4. DataRate Set.]

[5. Deinterleaver Set]

[6. Rx Parameter Status]

[----------]

[Press any key to return menu from running.]

[----------]

Select 0

Finger Energy & Position Display

Enter Display Time(every(1)/twice(2)....) Input 10

Scale Set to 10

Pos : 498 , Erg : 150560

Pos : 499 , Erg : 150560

Pos : 499 , Erg : 150560

Pos : 499 , Erg : 150560

4) Press enter when capturing Lock.
5) Select 2 from the above screen and input 0. Then, press enter.

4.8 During this time, mount a fixed attenuator so that the level of signal inputted becomes 30~-35dBM in the perspective of power meter mode of AWGN Generator.

4.9 Adjust the Step Attenuator so that the level of signal inputted to the RF Main Port of RP becomes –116dBm.

4.10 For RIU, the closed loop power control function of backward traffic channel should not be operated.

4.11 Receive certain data from the BER measurement equipment at 32Kbps and then, send them to RP.

4.12 Measure BER to evaluate whether the receive power that includes C value meets the standard of Table 101.1.

1. Objective

1.1 Measure and verify the occupied frequency bandwidth (OBW) of transmit channel sent out from the base station.

2. Evaluation Criteria

2.1 In case total power allocated to the base station transmit channel is 43dBm (20W) ±1dB, the seizure frequency bandwidth of allocated channel should be within 10MHz of allocated frequency.

3 Reference

3.1 Compensation of loss generated from the cable, connector, and attenuator.

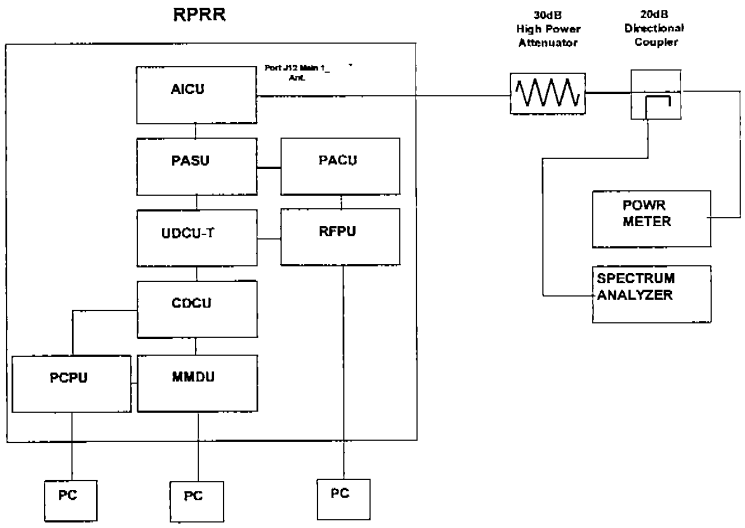
3.2 Measuring Instruments

Spectrum Analyzer: HP 8562A

Power Meter: HP 438A or better

4. Testing Method and Result

4.1 Equipment configuration diagram



Occupied Frequency Bandwidth Measurement

4.2 Set up the equipment as in the above.

4.3 Age the measuring instrument for 30 minutes or longer.

4.4 Set up the base station in order to send out a modulated signal loaded with pilot, sync, paging, traffic, and PPCS channel as in the case of ratio of Table 103.1.

DM SETTING Order

1) Execute Mirror and set SP384. Then, enter "go lo" and press the return key.
2) Press the Reset Button on the front panel of PCPU and then, press the UG Button.
3) Connect the console to the PCPU Board and then, press the return key when "WLL-RP/CAI> is displayed.
4) Enter items in the following order.
   First, check the status of current PCPU.

```
WLL-RP/CAI>  show-cai-db:::rp; ↵
==========================================================
   RP-4 DATABASE
==========================================================
      RPC-RP Primary Trunk : 0
      RPC-RP Trunk Usage   : 0xf
      LAPD state           : BROKEN
      Subscriber Number    : 0
      ----------------------------------------
            Base Seed (I)        : 0x8be4d33e
      Base Seed (Q)        : 0x81493f93
      LAI                  : [02f0010104]
      Pilot Ch Gain        : 445          → Pilot channel gain value
      Sync Ch Gain         : 87           → Sync channel gain value
      Paging Ch Gain       : 174          → Paging channel gain
value
      ----------------------------------------
      Active PKT Slot      : 1
      Active ACC Slot      : 1
      Active CDC Slot      : 1
      Modem Board Equip.   : 0x0202
      Modem Board Status   : 0x0202
---------------------------------------------
-- more --
```

```
   Available CDMA Ch(s) : 40
   Next Alloc CDMA Ch    : 0
   Available HADAMARD(s): 116
   Total In-Svc Call(s) : 0
   MMU Ch Seize Factor   : [0] [0] [0] [0] [0] [0] [0]
-------------------------------------------------
   RIU Application Ver   : NONE
=================================================================
```

Set the gain of channel as follows when the above screen is displayed.

```
WLL-RP/CAI> set-pipwr:::371; ↵
RPT:004:2400-01-01 04:24:05:M:COMMAND EXECUTED;

WLL-RP/CAI> set-pgpwr:::345; ↵
RPT:004:2400-01-01 04:24:13:M:COMMAND EXECUTED;

WLL-RP/CAI> set-sypwr:::173; ↵
RPT:004:2400-01-01 04:24:20:M:COMMAND EXECUTED;
```

Check again the status of PCPU.

```
WLL-RP/CAI> show-cai-db:::rp;
=================================================================
   RP-4 DATABASE
=================================================================
   RPC-RP Primary Trunk : 0
   RPC-RP Trunk Usage    : 0xf
   LAPD state            : BROKEN
   Subscriber Number     : 0
-----------------------------------------------
   Base Seed (I)         : 0x8be4d33e
   Base Seed (Q)         : 0x81493f93
   LAI                   : [02f0010104]
   Pilot Ch Gain         : 371
   Sync Ch Gain          : 173
   Paging Ch Gain        : 345
```

```
-------------------------------------------------------
  Active PKT Slot          : 1
  Active ACC Slot          : 1
  Active CDC Slot          : 1
  Modem Board Equip.       : 0x0202
  Modem Board Status       : 0x0202
-------------------------------------------------------
-- more --

  Available CDMA Ch(s) : 40
  Next Alloc CDMA Ch   : 0
  Available HADAMARD(s): 116
  Total In-Svc Call(s) : 0
  MMU Ch Seize Factor  : [0] [0] [0] [0] [0] [0] [0]
-------------------------------------------------------
  RIU Application Ver  : NONE
=======================================================
```

5) Verify whether the gain of pilot, sync, and paging channel is entered accurately.
Then, record the base seed number or value (base seed for each equipment is different).

6) Connect the console to the MMDU Board and then, press enter in order to display the following initial screen. Date rate can be entered when 0 is selected.

```
[=================================================]
 [    MMDU  REVISION  DM Ver2.3 [04/21]    ]
 [=================================================]
 [  0. Auto Initialize modem.                    ]
 [  1. SEARCHER.                                 ]
 [  2. FINGER.                                   ]
 [  3. COMBINER.                                 ]
 [  4. MODULATOR.                                ]
 [  5. Viterbi Decoder.                          ]
 [  6. Parameter Status.                         ]
 [  7. Clear Register.                           ]
 [  8. Access Channel Test.                      ]
```

```
[  9. Signal channel test.                    ]
[  a. Power Control.                           ]
[  b. BER Test.                                ]
[  c. Memory Write.                            ]
[  d. Memory Read.                             ]
[  e. Auto Test.                               ]
[  f. General Board Test.                      ]
[  g. RP Tx Test.                              ]
[ ---------------------------------------------]
[  Press any key to return menu from running.  ]
[ ---------------------------------------------]
 Enter data rate[32,64,128k(default=64k)] : 32
 Set to 32k
Auto Initialization Completed!!
```

7) Press enter again.

```
[================================================]
[    M M D U   R E V I S I O N   D M Ver2.3 [04/21]   ]
[================================================]
[  0. Auto Initialize modem.                   ]
[  1. SEARCHER.                                 ]
[  2. FINGER.                                  ]
[  3. COMBINER.                                 ]
[  4. MODULATOR.                                ]
[  5. Viterbi Decoder.                         ]
[  6. Parameter Status.                         ]
[  7. Clear Register.                          ]
[  8. Access Channel Test.                      ]
[  9. Signal channel test.                     ]
[  a. Power Control.                            ]
[  b. BER Test.                                 ]
[  c. Memory Write.                             ]
[  d. Memory Read.                              ]
[  e. Auto Test.                               ]
[  f. General Board Test.                      ]
[  g. RP Tx Test.                               ]
```

[----------]
[Press any key to return menu from running.]
[----------]

8) Select g from the above screen in order to generate test.ch model for transmission test.
Enter Channel number[1-8] : 6
6 Channel Selected
Enter PCS channel gain(default=0) : 86
Set to 210
Enter Traffic channel gain(default=0) : 244
Set to 49
Enter Mod. PCS channel walsh0(default=7) : 7
Set to 7
Enter Mod. Traffic channel walsh1(default=8) : 8
Set to 8
Enter Scramble seed(default=0) : 100
Set to 100
Enter PNseed Number[0-511]

9) As the number of PN seed, the number which is the same as the PN seed number of PCPU should be entered.
[Manual Input:512] : 2
Set to ccbb6a6c
Set to db527007

==========

PnI	: ccbb6a6c	PnQ	: db527007
SigGain	: 86	TrafGain	: 244
Ch	: 0	Scramble	: 100
PCS Walsh	: 7	Traf Walsh	: 8
Ch	: 1	Scramble	: 200
PCS Walsh	: 9	Traf Walsh	: 10
Ch	: 2	Scramble	: 300
PCS Walsh	: 11	Traf Walsh	: 12
Ch	: 3	Scramble	: 400
PCS Walsh	: 13	Traf Walsh	: 14

Ch	: 4	Scramble	: 500
PCS Walsh	: 15	Traf Walsh	: 16
Ch	: 5	Scramble	: 600
PCS Walsh	: 17	Traf Walsh	: 18

==========

4.5 Verify whether the desired value is entered in the above screen.

4.6 In the above measurement configuration diagram, measure insertion loss at the frequency bandwidth used by the RF path that connects the RF output port and power meter sensor (measured value: A).

4.7 Connect the power meter to the AICU Tx out port of RP using a directional coupler that has been calibrated and RF cable.

4.8 Measure total power outputted from the RF output port using a power meter.

4.9 In case the output of base station is not within the specification of +43dBm ±1dB, adjust the output of UDCT of UDCU through RFPU so that the base station output is within the specification.

Base Station Output setting

1. Connect the console to RFPU and press enter. Then, rfpu-act> is displayed.
   rfpu-act.> *show-udcu-volt;*
2. When entering as in the above, the voltage value of UDCU of sector to be measured can be known.
   rfpu-act.> *set-udcu-tx:::a,3;* ↵
   (If sector is alpha, it is a. If beta, it is b. If gamma, it is g. The voltage value can be adjusted up to second decimal point.)
   rfpu-act.> *set-udcu-tx:::a,3.1;* rfpu-act.> *set-udcu-tx:::a,3.2;* rfpu-act.> *set-udcu-tx:::a,3.3;*

• • • •

4.10 Adjust the voltage value of Item 4.9 so that the output of base station becomes 43dBm ±1dB.

4.11 Measure total power outputted from the RF output port using a power meter (measured value:B).

4.12 Calculate total transmit power from the base station. Total power = (A+B)dBm

4.13 In case the item of 4.12 meets the specification of total power, measure the seizure frequency bandwidth of actual transmit channel using the measuring function of the seizure frequency bandwidth of spectrum analyzer in order to find out whether it meets the specification.

Table 103.1 Base Station Test Model

Type	No. of Channels	Power Ratio (linear)	Power Ratio (dB)	Remarks
Pilot	1	0.2000	-7	Channel code 0
Sync	1	0.0437	-13.6	Channel code 1
Paging	1	0.1738	-7.6	Channel code 2 – 5
Traffic	6	0.0871	-10.6	Variable channel code
PC	6	0.0120	-19.6	Variable channel code

1. Objective

1.1 Set up a test environment in the wire/wireless mode and check the number of RIUs that can be called at the same time.

1.2 Check whether voice call between subscribers can be made when voice broadcasting is not performed.

1.3 Check whether ring is activated in the RIU of terminating side.

1.4 Check whether the voice call is originated or terminated with 2 digits during the dialing.

2. Evaluation Criteria

2.1 Set up a test environment in the wire/wireless mode. All the calls should be connected normally to the traffic channel of base station at certain interval.

2.2 Check whether the voice call is originated or terminated with 2 digits during the dialing.

2.3 Check whether ring is activated in the RIU of terminating side.

2.4 All the calls connected should be disconnected normally when the lastly connected call completes the call for a certain time (5 minutes).

2.5 At least 10 or more RIUs should be called simultaneously after the last call is connected.

3. Reference

3.1 The test should be executed after connecting the base station and terminal in the wire or wireless mode.

3.2 Set up an originating and terminating call in the WLL to WLL mode.

3.3 10 or more telephones should be available for use.

3.4 Set up RIU in such a way that 10 or more channels can be used and then, execute the test.

4. Testing Method and Result

4.1 For two RIUs, set up two originating/terminating voice call paths in the WLL to WLL mode. Then, for the remaining RIUs, set up voice call paths the same way. Then, increase the number of calls made sequentially.

4.2 Check the normal call status. The connected call should be maintained.

4.3 Check the number of RIUs connected after making the last call for five minutes.

4.4 Check the normally completed calls.

1. Objective

1.1 Verify whether voice call and data call can be made simultaneously under the wire or wireless test environment.

1.2 Verify whether the WLL system has one or more voice channel and data channel for RIU.

2. Evaluation Criteria

2.1 A voice call should be connected between two RIUs under the wire or wireless test environment.

2.2 The data call should be connected normally by using the data port of the same RIU that the voice call is connected.

2.3 Verify whether the file is transmitted from one PC (RIU#1) to the other PC (RIU#2) without errors. And verify whether the voice call is made normally, at this moment.

3. Reference

3.1 Perform the test after the configuration of the base station and terminal in wire or wireless mode.

3.2 Set up the originating /terminating call from WLL to WLL between RIU.

3.3 Prepare two telephone sets, and two PCs or notebook PCs.

3.4 For the data test, NetMeeting program of Microsoft used for the file transmission between the two PCs. And suppose that the IP address of the PC to which the file will be transmitted is known already.

4 Testing Method and Result

4.1 Set up two originating and terminating voice call paths with WLL to WLL between two RIUs, and verify whether the communication is normal. At this point, keep the call connected.

4.2 Enable the interface to Internet by setting up PPP connection through the telephone interface networking which is connected to two WLL terminals.

4.3 Execute NetMeeting program on both PCs.

4.4 Perform the connection through Net Meeting on one PC with the IP address of the other PC.

When the connection is tried through Net Meeting on one PC, the message that the connection request is arrived from that PC is displayed on the screen of the other PC. Then, click accept button in order to establish the connection between the two PCs through Net Meeting.

4.5 Click the file transmission button one PC, then the file transmission window is created.

4.6 On the created file transmission window, select the file to transmit it to other PC.

4.7 When the file transmission is completed, compare the file, which is transmitted to the other PC with the original file. In case the two files are the same, it means that one-to-one packet transmission is available.

4.8 Complete the voice call and the data call normally.

Wideband – WLL

Hardware Manual

SMD-010-HWA210
01(01)/200010/1.0

Contents

Wideband – WLL

Hardware Manual

WLL System
(PART Ⅰ)

01(01)/200010/1.0

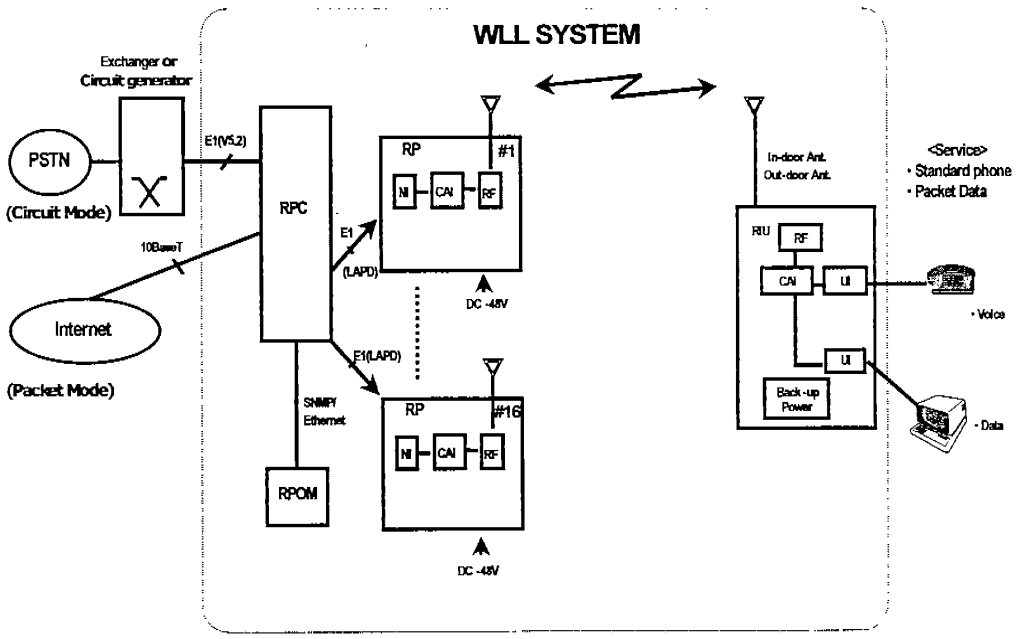
PART I WLL System

1. System Overview

WLL system consists of Radio Port Controller (RPC) that accesses WLL local exchange (or equivalent circuit generator) and controls up to 16 Radio Ports (RP), RP that provides wireless connection between subscribers, Radio Port Operation and Management (RPOM) that manages the entire network, and Radio Interface Unit (RIU) that provides voice and data service according to subscribers' selection.

The design of the system is such that major functions have been duplicated for higher service stability and reliability. In addition, the system can be expanded easily to accommodate increased number of subscribers and system changes for function improvement. In addition, the operation terminals provide graphic user interface for operator's convenience for system fault repairing and maintenance.

1.1 System configuration diagram



1.2 WLL system configuration

- Radio Port Controller (RPC)
- Radio Port (RP)
- Radio Interface Unit (RIU)
- Radio Port Operation & Maintenance (RPOM)

Wideband – WLL

Hardware Manual

RPOM
(PART Ⅱ)

SMD-010-HWA210
01(01)/200010/1.0

PART II RPOM

1. RPOM Overview

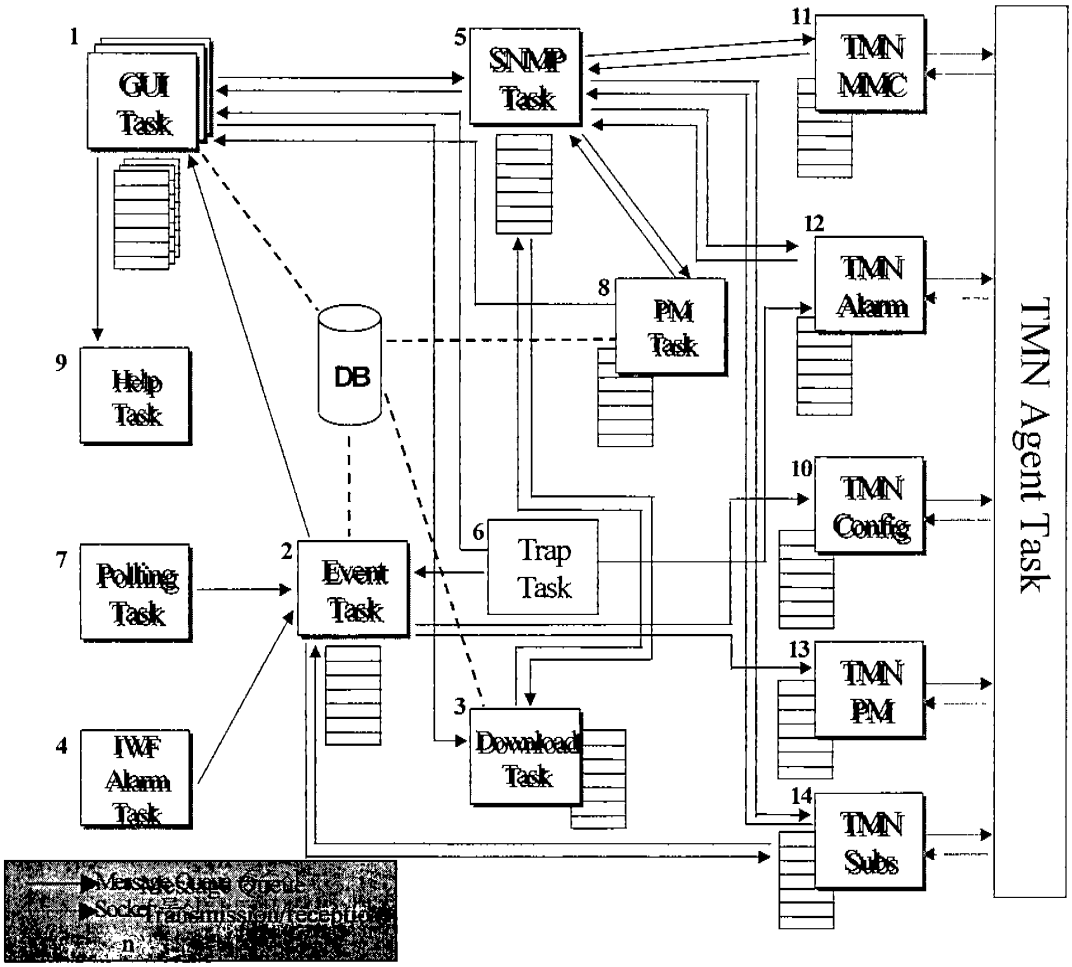
WLL consists of local exchange, Radio Port Controller (RPC), Radio Port (RP), Radio Interface Unit (RIU). RPOM is a workstation for the operation and management of RP. RPOM runs on UNIX system and provides Graphic User Interface (GUI) for users by default. Since RPOM is easy to use and provides various information, it is very useful for the system maintenance.

2. RPOM Specification

2.1 Hardware specification

Model name	Items and specification	Quantity
A14-UEC1-9L-512AH	- SUN ULTRA 2 Workstation Model 1300 - Two 300MHz ULTRASPARC-II Processor - 2MB External Cache/CPU - 1GB Main Memory & 32KB Cache - 9GB 7200RPM Internal F/W SCSI-2 DISK - 4 SBUS (64BIT, 25MHZ)SLOTS & 1 UPA SLOT - Two RS-232C/RS-423 Serial Ports - One Centronics-Compatible Parallel - 10/100Mbps Fast Ethernet - Creator 3D Series 3 Graphics Card	1
X3518A	- Keyboard & Mouse	1
X7121A-K	- 21"Color Monitor	1
SG-XDSK010B-18G	- 18.2GB/7200RPM Disk Unipack	1
X6003A	- 3.5Inch 1.44MB INT FDD ULTRA2 with Cable	1
X6166A	- Internal SUNCD 32X	1
SG-XTAP4MM-011A	- Tape 12GB 4mm DDS-3 UniPack	1
X3856	- Cable 68/68 Pin	2
X1049A	- OPT QUAD FastEthernet W/SW	1
HUB	- 3COM 24Port Ethernet Hub 100Mbps	2
SOLD-2.5.1-45	- Korean SOLARIS 2.5.1 DT	1
ORACLE (Runtime)	ORACLE7.3.3 RDBMS (8 Named User) - SERVER - SQL*PLUS - SQL*NETSERVER	1
OSI-8.1.1-S	- SUNLINK OSI 8.1.1	1
HP OPENVIEW	- HP OpenView DM 4.23 (Runtime)	1
STYLUS-1500H	InkJet Printer - A4, B4 Size, a leaf, continuous paper, 720DPI	1

2.2 Software configuration



❑ Task description

Classification	No.	Task name	Description
System-related (EMS functions)		taskmgr	Start and management of EMS software
	1	main-c	GUI function
	2	wllevent	Event processing
	3	wlldown	Downloading function
	4	wlliwfal	Collection of billing faults
	5	wllsnmp	RPOM-RPC communication
	6	wlltrap	Trap data reception
	7	wllpoll	Monitoring the links between RPOM-RPC
	8	wllpm	Collection of performance data
	9	wllhelp	Help function
TMN Agent Interface		Tmnmgr	Start and management of TMN agent interface software
	10	tmnconf	System configuration
	11	tmnmmc	Control
	12	tmnalarm	Fault management
	13	tmnpm	Link configuration
	14	tmnsub	Registration/deletion/change of subscribers

Wideband – WLL

Hardware Manual

RPC
(PART Ⅲ)

SMD-010-HWA210
01(01)/200010/1.0

PART III RPC

1. RPC Overview

RPC accesses WLL local exchange (Or other equivalent unit) through V5.2 protocol and processes the calls of voice subscribers by compressing voice data and transmitting them to corresponding RP. RP transmits/receives voice data to/from Radio Interface Unit (RIU) by wireless. As for packet data, PPP packet of a terminal is transmitted to RPC via RP and RPC converts the packet data into Ethernet frame and transmits them to the data network for the terminal data service.

Besides the above, RPC performs RP management and call processing and interfaces with RPOM through Ethernet.

2. RPC Specification

Basically, one rack accommodates two RPC shelves.

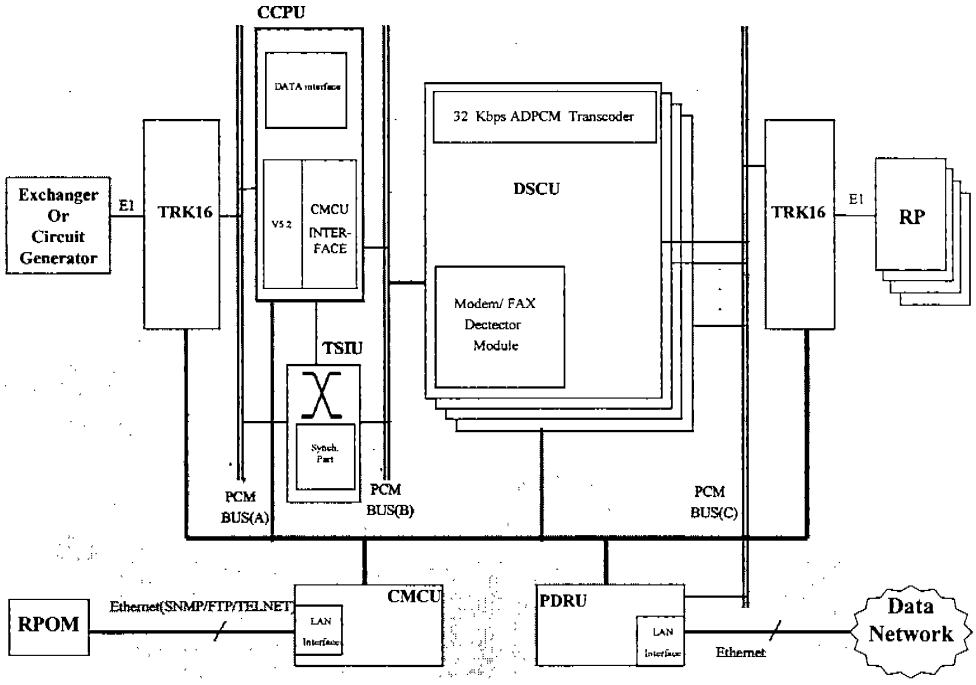
One rack can be extended to have four RPC shelves and the specification of each configuration is as follows.

Configuration	1 Shelf	2 Shelf	3 Shelf	4 Shelf
RP accommodation capacity	16 RP	32 RP	48 RP	64 RP
Number of trunks between RPC-LE	16 E1	32 E1	48 E1	64 E1
Number of trunks between RPC-RP	16 E1	32 E1	48 E1	64 E1
Number of accommodated V5.2	1	2	3	4
Maximum call processing capacity	About 20,000 BHCA	About 40,000 BHCA	About 60,000 BHCA	About 80,000 BHCA
Maximum subscribers	5446 subs	10,933 subs	16,379 subs	21,825 subs

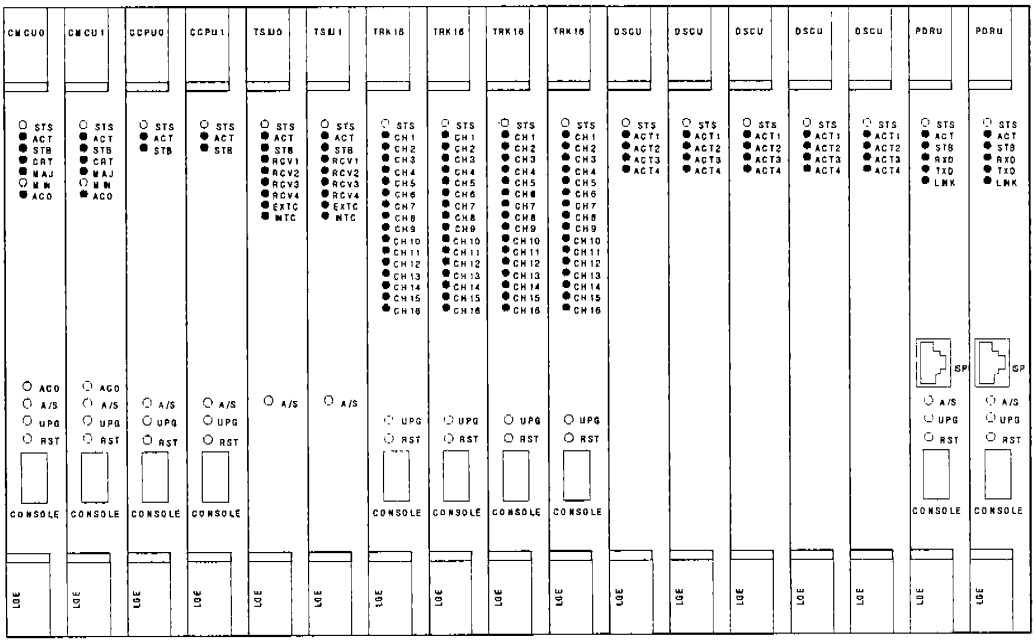
[Calculation standard: 0.09 Erlang per one subscriber]

3. RPC Configuration

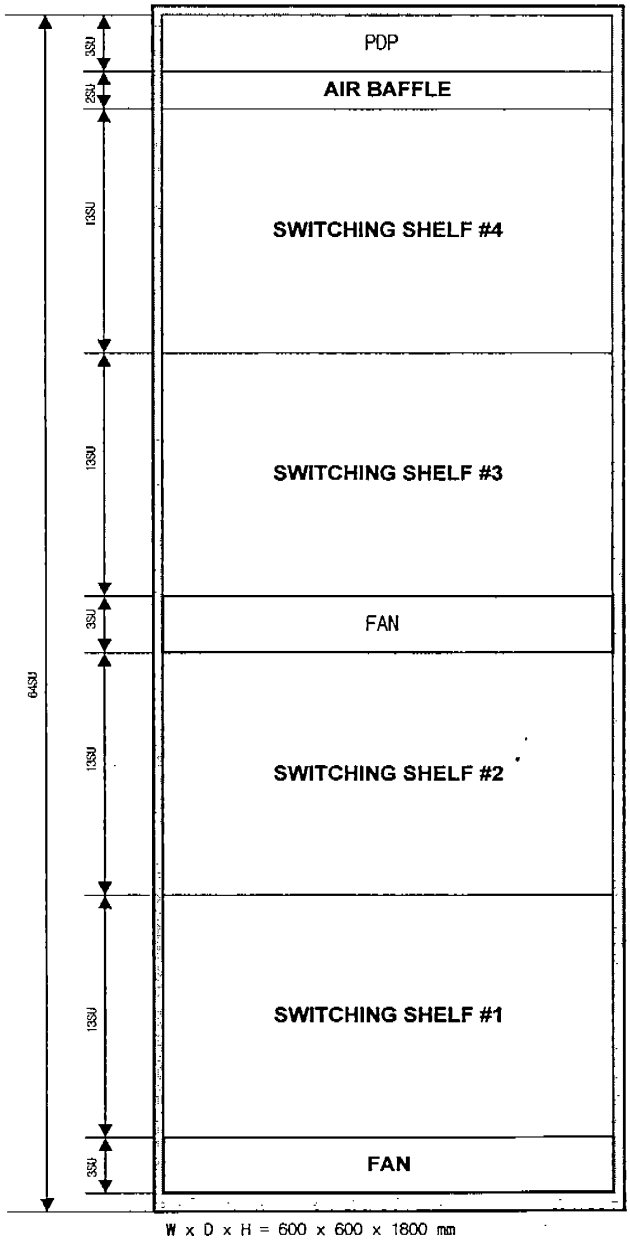
3.1 Total configuration block diagram (1 Shelf)



3.2 Basic configuration by the unit of shelf



3.3 RPC installation diagram

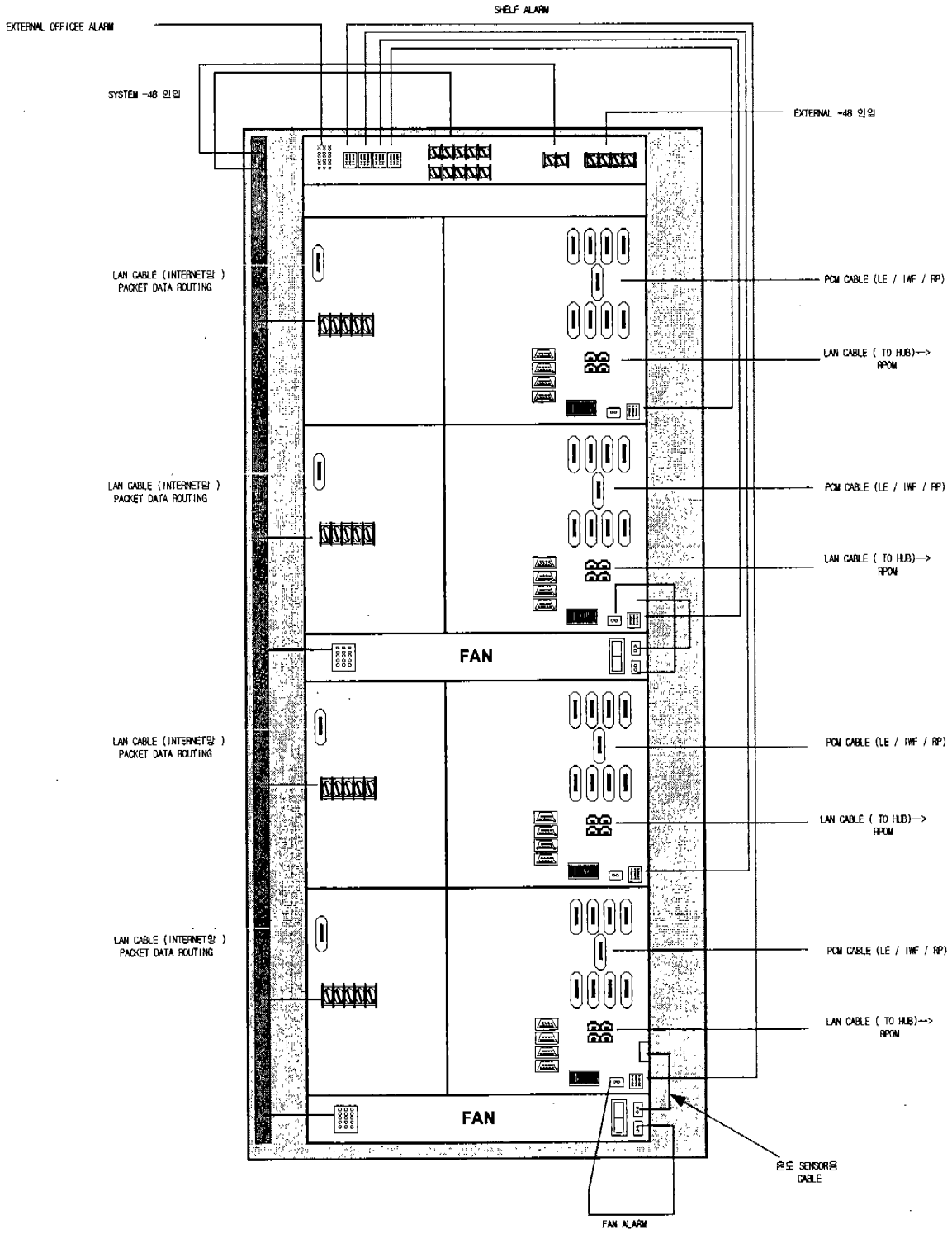


3.4 RPC extension unit

The basic rack configuration in B can be extended based on V5.2 interface or the accommodated subscriber for each shelf.

For each shelf, the basic rack configuration can be extended for each V5.2 or each 5,000 subscribers.

3.5 RPC wiring diagram



4. Functions of Each RPC Hardware Block

4.1 rpC Main Control Unit (CMCU)

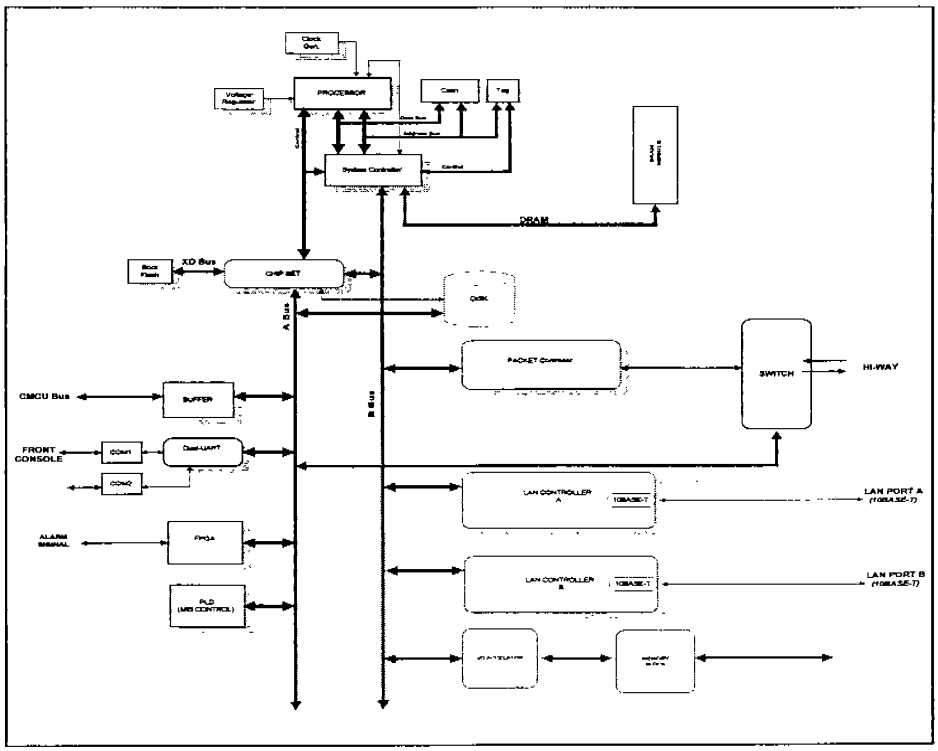
(1) CMCU overview

CMCU starts up the system and initializes all the hardware of the equipped cards. After the hardware initialization, CMCU initializes software to hardware and manages faults and status and reports the fault status to RPOM by accessing Ethernet. CMCU also switches calls and controls the voice compression and performs the following major functions.

- **Initializes cards and manages card status.**
- **Manages faults and stores the status report to RPOM.**
- **Controls the system with RPOM by accessing Ethernet.**
- **Performs call switching and voice compression control.**
- **Stores each card software and downloads software.**
- **Processes and controls alarms of the centralized alarm panel.**
- **Sets up the equipment system clock.**
- **Provides the redundancy switchover.**
- **Provides NMS channel function (one time slot of E1) for the communication with RP.**

(2) CMCU configuration

The detailed configuration diagram of CMCU is as follows.



(3) CMCU description

- **Processor and DRAM part**
  : It is the main control processor of CMCU and it uses DRAM as memory and controls peripheral devices.
- **Cache and tag**
  : They support the processor in order to enhance the system performance.
- **System controller**
  : It is a peripheral device of the processor. It supports the functions of CPU and controls other peripheral devices.
- **Ship set**
  : It bridges A bus to B bus so that the input/output can be connected to B bus and it controls the hard disk.
- **Disk**
  : In this medium, all firmware of CMCU, software of low-level units, and RPC status management and configuration information are stored.
- **Packet controller**
  : It provides the path for the communication with PMCU of RP in relation to the operation and maintenance of RP.
- **LAN controller A/B**
  : It provides the Ethernet interface for the communication with RPOM. It is redundant with active CMCU 2 port and standby CMCU 2 port per RPC.
- **I/O accelerator and memory block**
  : It is a memory block shared between active CMCU and standby CMCU for the redundancy of CMCU.
- **FPGA and PLD**
  : FPGA provides the interface with the alarm panel of CMCU and RPC and PLD generates the controlling signals between the processor and the I/O devices in CMCU unit.

(4) Description on LED on CMCU front side

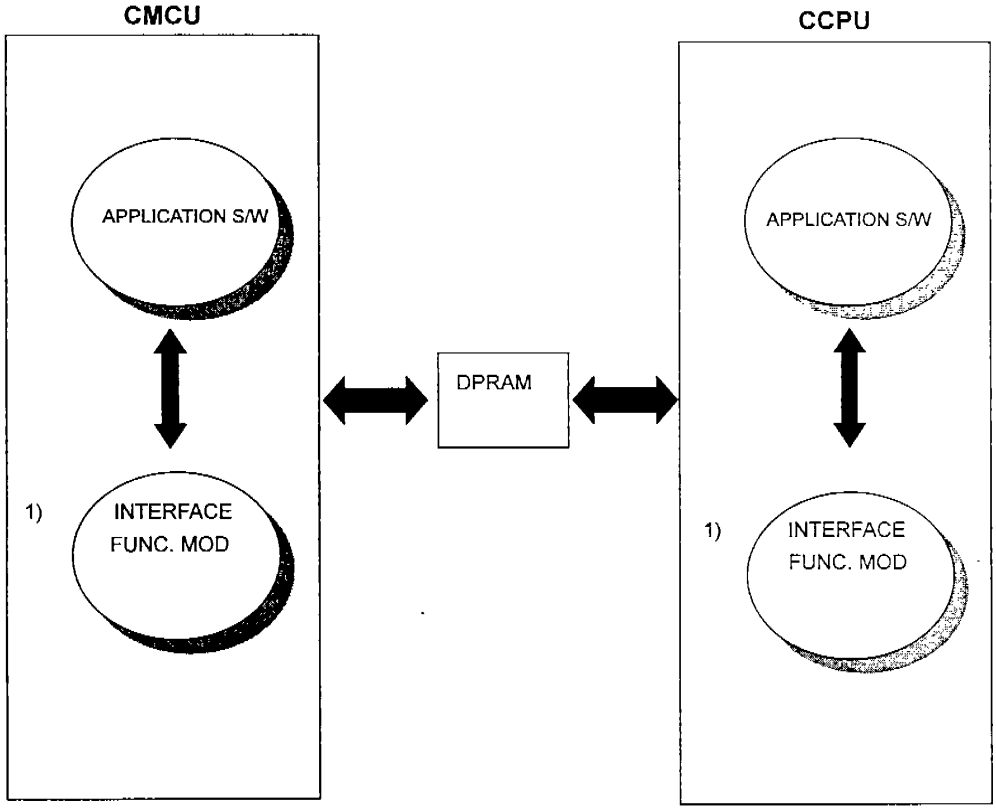
Name	Color	Status
STS	Green	The board is enabled.
	Red	The board is disabled.
ACT	Green	The board is active.
STB	Green	The board is standby.
CRT	Red	When an alarm affecting the system seriously occurs,
MAJ	Red	When an alarm affecting the system occurs,
MIN	Yellow	When an alarm not affecting the system and when the service is maintained despite the alarm,
ACO	Green	When audible alarms are blocked

4.2 rpC Call Processing Unit (CCPU)

(1) CCPU overview

CCPU processes voice calls and data calls and manages TRK, TSIU, and DSCU indirectly through CMCU and reflects the management result for the system resource management.

(2) CCPU configuration



(3) CCPU description

- **Shared card status**
  CCPU shares the board deletion/insertion information and the board redundancy information with CMCU through the shared memory and monitors the information periodically.

- **Voice call and data call processing**
  CCPU interfaces with the local exchange through V5.2 protocol and processes voice calls. It also processes data calls through PDRU communication.

- **Call processing statistics and storage**
  CCPU accumulates and stores the statistics related to all the calls processed through RPC and reports the statistics to RPOM through CMCU.

- **Redundancy switchover function**
  When a fault occurs in CCPU during the operation, CCPU switchovers without stopping the call service.

- **LAPD communication with RP**

- **Software downloading function**

(4) Description on LED on CCPU front side

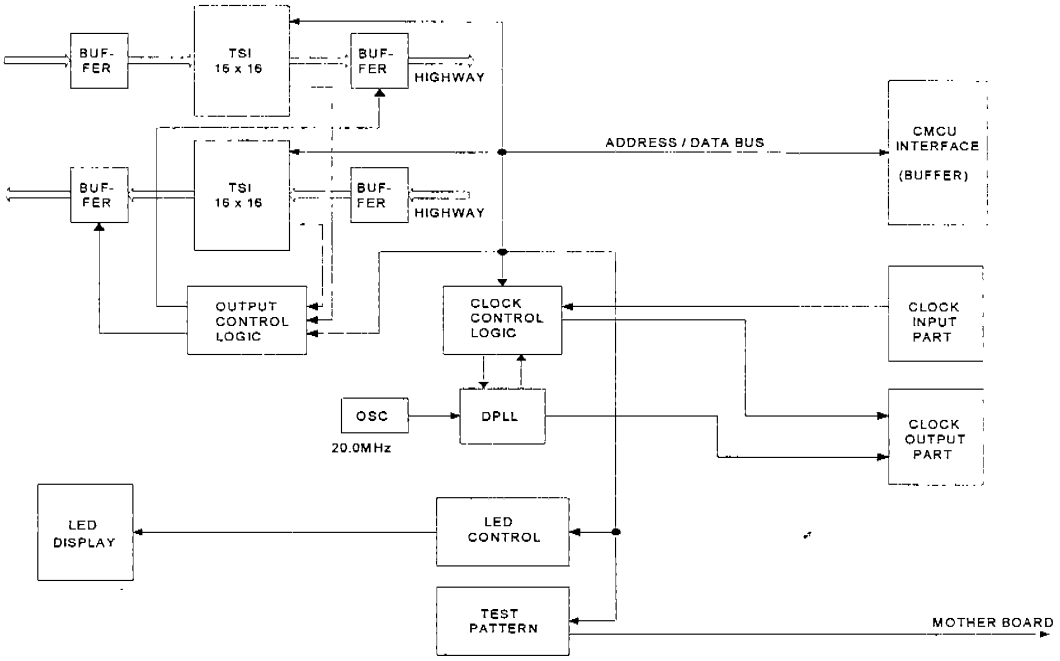
Name	Color	Status
STS	RED	The board is disabled.
	GREEN	The board is enabled.
ACT	GREEN	The board is active.
STB	GREEN	The board is standby.

4.3 Time-Slot Interchange Unit (TSIU)

(1) TSIU overview

Controlled by CMCU, TSIU distributes the subscriber data allocated from WLL local exchange (or other equivalent unit) to the corresponding RP. It also synchronizes the RPC clock and provides the system clock. TSIU is redundant.

(2) TSIU configuration



(3) TSIU description

- **DPLL**
  : It is a digital PLL circuit that generates synchronization clock with the clock received from the external network.
- **Output control logic**
  : It is the logic part that controls the output by the unit of time slot. It enables the time slot multiplexing at 2Mbps.
- **Clock control logic**
  : It selects an external network clock or E1 trunk and controls it to use as the system synchronization clock. When the clock fails, the next clock (RCV) is automatically selected based on its priority.
- **OSC**
  : It is a 20 MHz oscillator input to DPLL.
- **Local exchange capacity**
  : 16E1 X 16E1: Voice class (Default)
  2E1 X 2E1: Data class (Default) * Variable

- **Clock input part**
  : It is the logic circuit part where the external tributary clock or the receive tributary clock is selected.
- **Clock output part**
  : It is the logic circuit part that divides and outputs 4MHz and 8KHz clock that are synchronized to DPLL.
- **Controlled by CMCU, TSIU switches the time slots from 16 E1 input/output trunks in order to rearrange the subscriber data (time slot) allocated from WLL local exchange (or other equivalent unit) to each corresponding RP.**
- **CMCU interface**
  : It provides the address, data, control bus interface part for CMCU to control TSIU.
- **LED control part**
  : This control part indicates the unit status and the clock status on the front side of the unit with LED.
- **LED indication part**
  : This part consists of two-color LED and single color LED and indicates the unit status and the clock status by lights.

(4) Description on LED on TSIU front side

Name	Color	Status
STS	GREEN on	Normal card
	RED On	Abnormal card
ACT	GREEN On	Active status
STB	GREEN On	Standby status
RCV0	GREEN blinks	The green light blinks when RCV0 is used as the system clock.
	GREEN On	When the receive tributary clock is normally received.
RCV1	GREEN blinks	The green light blinks when RCV1 is used as the system clock.
	GREEN On	When the receive tributary clock is normally received.
RCV2	GREEN blinks	The green light blinks when RCV2 is used as the system clock.
	GREEN On	When the receive tributary clock is normally received.
RCV3	GREEN blinks	The green light blinks when RCV3 is used as the system clock.
	GREEN On	When the receive tributary clock is normally received.
EXTO	GREEN blinks	The green light blinks when EXT0 is used as the system clock.
	GREEN On	When the external tributary clock is normally received.
EXT1	GREEN blinks	The green light blinks when EXT0 is used as the system clock.
	GREEN On	When the external tributary clock is normally received.
INTC	GREEN blinks	The green light blinks when INTC is used as the system clock.
	GREEN On	When the internal tributary clock is normally received.

4.4 Trunk 16-channel (TRK16)

(1) TRK16 overview

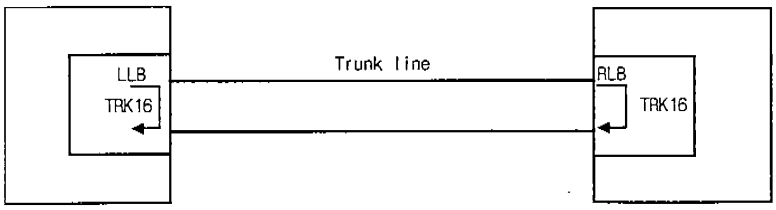
TRK16 unit converts unipolar data from DSCU unit into multipolar pulse and transmits the pulse to the remote station and converts the multi-polar pulse from the remote station into the unipolar data. Then TRK16 unit generates the clock and provides the clock for TSIU and transmits the received data to DSCU. TRK 16 monitors the status of each trunk in units and when a trunk status is not normal, it issues alarms and reports the status to the system For the trunk and unit test, TRK16 performs loopback for local and remote stations and transmits remote station alarms.

- **Provides 16 E1 channels for each unit.**
- **Supports HDB3 or AMI line code.**
- **Recovers the reception clock**
  - It converts the multipolar pulse from the remote station into the unipolar pulse and provides the clock extracted from the received data as the system reference clock. (TSIU receives the clock.)

- **G.704 2048Kbit/s E1 frame interface**
- **CRC, HDB3, frame word error monitoring**
- **Line monitoring and alarms**
  - If there are too many 0 in the data received from the remote station or if there are no received data due to the line snapping, the regeneration of the clock is not possible. Therefore, TRK16 detects NO DATA and issues alarms and turns on red LED of the related channel.

- **Remote station Alarm Interface (RAI)**
- **CCS Signaling support**

- **LoopBack (LLB, RLB)**
  - TRK16 can perform Local LoopBack (LLB) and Remote LoopBack (RLB) for the digital terminal for the test of each line and unit.

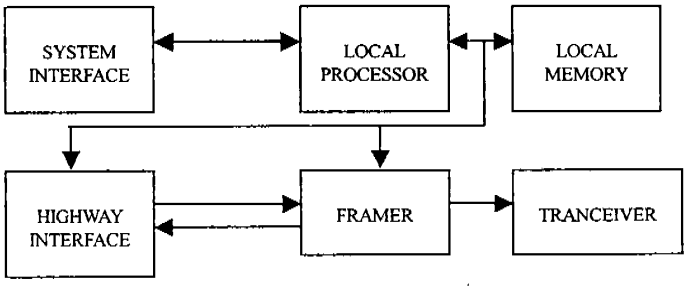


<TRK16 loopback configuration diagram>

- **Channel LoopBack**

(2) TRK16 configuration

The configuration of TRK16 is as follows.



(3) TRK16 description

- **System interface**
  : It interfaces between CMCU and the local processor through DPRAM and the buffer.
- **Highway interface**
  : It connects the system highway to the framer.
- **Local processor**
  : It is the main control processor of TRK16. It processes alarms and controls the framer and transceiver.
- **Framer**
  : It frames or deframes E1.
- **Local memory**
  : This memory consists of the flash memory and SRAM where the boot program and application programs are stored.
- **Transceiver**
  : It performs the line interface function.

(4) Descriptions on TRK16 front LED

Name	Color	Status
STS	RED	The internal TRK16 is initialized or disabled.
	GREEN	TRK16 is enabled
CH0 ~ CH15	OFF	Channel is standby.
	RED	No data or loss of sync
	GREEN	Channel is active.
	GREEN blinks	The remote station alarm is received.

4.5 Digital Signal Compression Unit (DSCU)

(1) DSCU overview

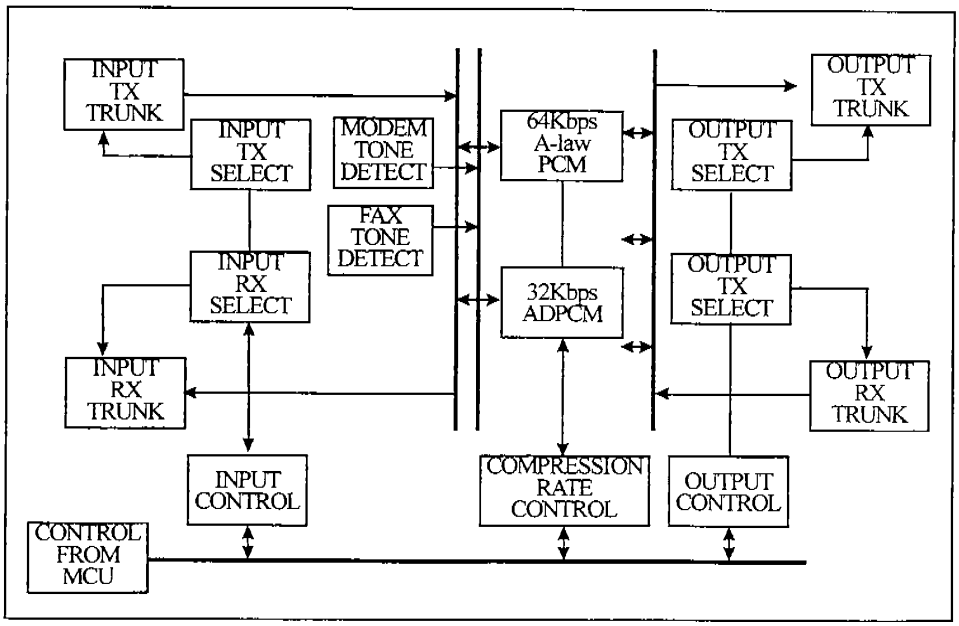
DSCU transcodes 64 kbps A-law PCM signals in the voice band by compressing and restoring to 32 kbps ADPCM signals in order to provide the voice service in 64 kbps A-law PCM or 32 kbps ADPCM mode. It also performs Barer Channel Modification (BCM) by detecting the tone signal of facsimile or modem and converting 32 kbps channel bandwidth to 64 kbps bandwidth.

- **It accommodates four E1 trunks per unit.**

- **Input trunk interface**
  - It selects and controls maximum four E1 trunks among the 16 E1 trunks from WLL local exchange (or other equivalent unit).
- **Output Trunk Interface**
  - It selects and controls E1 trunks of RP.
- **It compresses and restores voice signals.**
  - It compresses and restores voice between 64 kbps A-law PCM mode and 32 kbps ADPCM mode and controls the voice data.
- **Tone Detection**
  - It detects facsimile and model signals and requests the channel modification.

(2) DSCU configuration

The detailed configuration diagram of DSCU is as follows.



(3) DSCU description

- **Input TX/RX selector**
  : It receives the input trunk allocation information from CMCU and selects a corresponding trunk.
- **Output TX/TX selector**
  : It receives the output trunk allocation information from CMCU and selects a corresponding trunk.
- **Modem/facsimile tone detector**
  : It detects whether a subscriber uses the modem or facsimile and reports the result to CMCU.
- **Voice compression part**
  : It receives the compression rate control information from CMCU and compresses voice in the voice encoding method at the rate. (64 kbps A-law PCM, 32 kbps ADPCM)

(4) Description on DSCU front LED

Name	Color	Status
STS	RED	Internal DSCU is initialized or disabled. (The trunk is not yet allocated.)
	GREEN	DSCU is enabled.
ACT0 ~ ACT3	OFF	The corresponding trunk is not yet allocated.
	GREEN On	The corresponding trunk is active.

4.6 Packet Data Routing Unit (PDRU)

(1) PDRU overview
(2) PDRU configuration
(3) PDRU description
(4) PDRU front description

5. RPC Software

5.1 RPC-CMCU

(1) RPC Main Control Unit (CMCU) software

This software is the main process that manages RPC system. It manages and controls the RPC status, faults, downloading, restarting, redundancy, and RP system path.

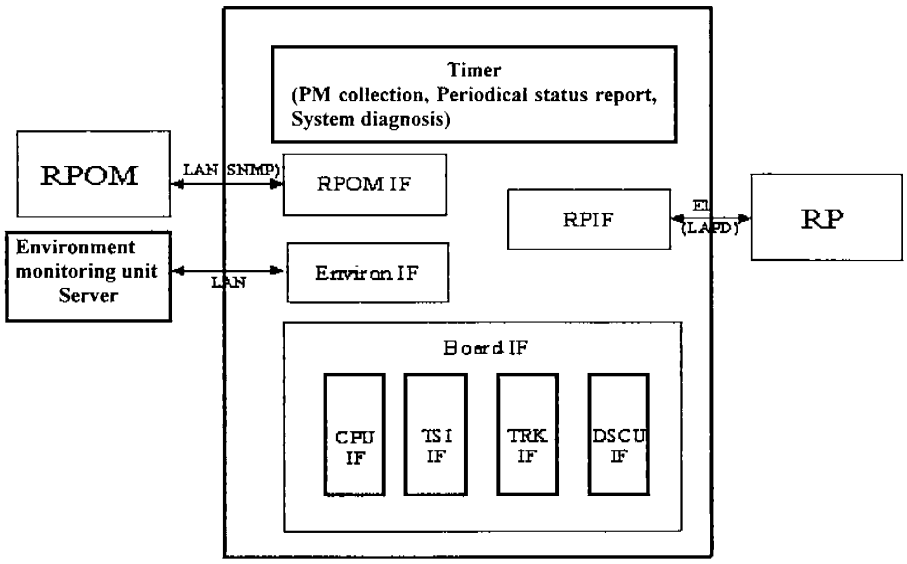


Figure 3-1. CMCU software configuration diagram

(2) CMCU execution module loading structure

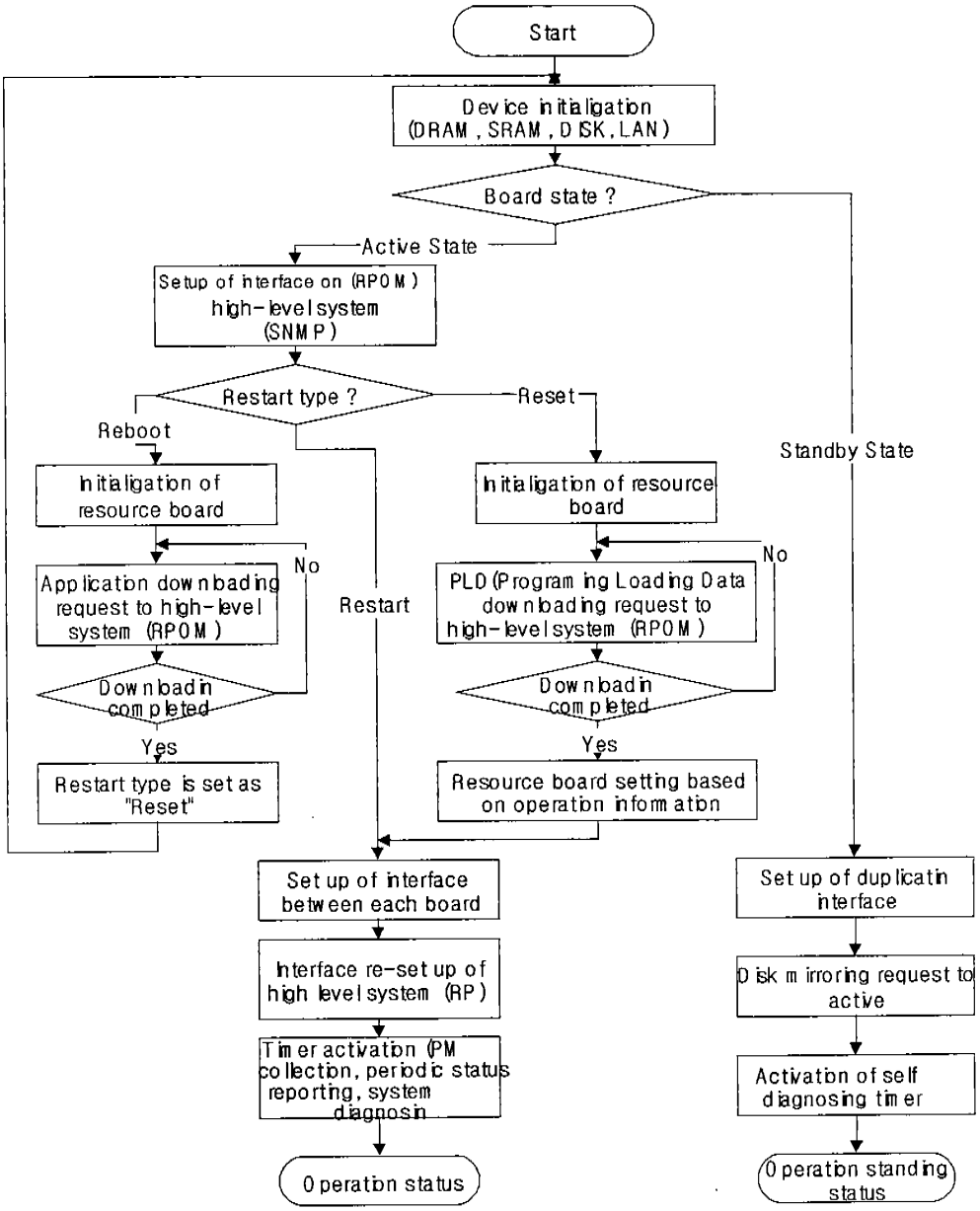


Figure 3-2. CMCU execution module loading system

(3) Function of each CMCU module

A. CPU interface module

This module interfaces with rpC Call Processing Unit (CCPU).

The main functions of this module are as follows.

- It controls the redundancy.
- It processes the board fault notifications.
- It notifies RP configuration information and resource (Trunk & Vocoder) setup information.
- It requests V5.2 interface information and processes the responses.
- It requests to inquire the subscriber information and processes the responses.
- It processes the subscriber operation notification.
- It processes and responds to the requests to set the call processing resources. (It sets the input/output port of TimeSlot Interchange and Vocoder to Enable/Disable.)
- It requests PM and processes the response.

B. TSI interface module

This module interfaces with Time-Slot Interchange Unit (TSIU).

The main functions of this module are as follows.

- It manages and controls the redundancy.
- It processes the board fault notifications.
- It controls TimeSlot interchange.
- It sets up and controls the receiving clock source.

C. TRK16 interface module

This module interfaces with Trunk 16-channel (TRK16).

The main functions of this module are as follows.

- It manages and controls the channel redundancy.
- It processes the board and link fault notifications.
- It sets up and controls Loopback tests and BER measurement requests.
- It requests link PM and processes the responses.

D. DSCU interface module

This module interfaces with Digital Signal Compression Unit (DSCU).

The main functions of this module are as follows.

- It processes the board fault notifications
- It sets up and controls in-out trunks on channels.
- Control enable/disable for TimeSlot resources.
- It processes the tone detection notification

E. Status management module

This module manages the status based on the status system of WLL system and when there are changes in the status, it reports the changes to the high-level system.

Status type	Pro-cessor	De-vice	Re-source	Link	Description
NORM_ACT	√	√		√	Redundant or single processor or device is active normally.
NORM_STB	√	√			Redundant or single processor or device is standby.
NORM_BUSY			√		The resources are allocated and the call is being processed.
NORM_IDLE			√		The resource is idle and performs no call processing.
NORM_SDWN		√	√	√	Normal device, or resource, or link is stopped and standby on request of operators. No additional service is provided and when the current service is completed, this status transits to NORM_MBLK.
NORM-MBLK		√	√	√	All the operation of normal device, or resource, or link is stopped on request of operators. (No fault or no status change message is generated.)
ABNO-MBLK		√	√	√	Abnormal device, or resource, or link is stopped on request of operators. (No fault or no status change message is generated.)
ABNO_OBLK		√	√	√	The operation is automatically stopped temporarily by the main processor of each system. Or when a fault occurs in the device including a resource or link and the devices fails to operate normally, the resource and the link enters into UNBLOCK status.
ABNO_INIT	√	√			When a processor fails to operate normally for downloading, or when a device is initialized for restart.
TEST		√	√	√	A device, or a resource, or a link is tested for the detection of its performance
ABNO_EJT	√	√			The card is ejected.
ABNO_FLT	√	√	√	√	Abnormal operation because of a bad card or resource
NEQ_RDY		√		√	As for a device or a link including a resource, it is not configured but installed.
NEQ_EJT		√	√	√	As for a device or a link including a resource, it is neither configured nor installed. (Blank status)

Table 3-1. WLL system status list

You can inquire the following status with MCU console command.

a. Inquiry of software version

Command: **show-ver;**

```
PMCU>show-ver;
BSP : v1.01, 15:44:36 Feb 14 2000

RPT:0051:2000-02-25 11:36:51:VER:1.64c (Feb 18 2000 09:17:54);
```

Figure 3. Execution example – Inquiry of software version

b. Inquiry of the current system status

Command : **show-sys;**

```
CMCU>show-sys;

    ..........   WLL  SYSTEM  STATUS   ..........
SL CNAME : CTYPE - ETYPE[HWVER-SWVER]   STATUS     bSTS[mSTS]    ALARM
=============================================================================
00 CMCU0 : CMCU  - CMCU [1.01c-1.63c]  NORM_ACT     ACT[ACT]    NOR
01 CMCU1 : CMCU  - CMCU [1.01c-1.63c]  NORM_STB     STB[STB]    NOR
02 CCPU0 : CCPU  - CCPU [1.01c-9.75d]  NORM_ACT     ACT[ACT]    NOR
03 CCPU1 : CCPU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    MAJ
04 TSIU0 : TSIU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    MAJ
05 TSIU1 : TSIU  - TSIU [1.00c-0.000]  NORM_ACT     ACT[ACT]    NOR
06 TRK0  : TRK16 - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[ENA]    CRT
07 TRK1  : TRK16 - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[ENA]    CRT
08 TRK2  : TRK16 - TRK16[f.f85-1.18b]  ABNO_FAULT   ENA[ENA]    MAJ
09 TRK3  : TRK16 - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[ENA]    MAJ
10 SSL0  : DSCU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[DIS]    MAJ
11 SSL1  : DSCU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[DIS]    MAJ
12 SSL2  : DSCU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[DIS]    MAJ
13 SSL3  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
14 SSL4  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
15 SSL5  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
16 SSL6  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
```

Figure 3-4. Execution example – Inquiry of the current system status

- CNAME : Shelf slot name label
- CTYPE : Configuration unit type
- BLANK : The slot is not yet configured.
- ETYPE : The equipped unit type
- HWVER,SWVER : Hardware and software version
- STATUS : The unit status based on the system status list.
- bSTS[mSTS] : Display for debugging, the actual board status and management status
- ALARM : It shows the top class alarm that occurred in the unit. Alarm class is classified into CRT/MAJ/MIN/NOR (normal).

c. Inquiry of RP configuration information and link connection status

Command : **show-rp-link;**

```
CMCU>show-rp-link;
========================  RP System Infomation  ============================
No. RPID  Pri  Rpc-Rp LinkInfo    Rpc-Rp InmuxLinkOfOutTrk  LID HDLC Conn-State
-------------------------------------------------------------------------------
00  0051  00  10000000-00000000  00-00  00000000-00000000  01  00  RELEASED
-------------------------------------------------------------------------------
```

Figure 3-5. Execution example – Inquiry of RP configuration information and link connection status

- RPID : ID of the configured RP (16bit HEX)
- Pri : The number of primary link connected to RP (0-15)
- Rpc-Rp LinkInfo: Among the 16 links, the information of the link (1) allocated to the RP
- Rpc-Rp : RPC link number and its corresponding RP link number
- InmuxLinkOfOutTrk : DSCU output link indication (1) corresponding to PRC link] number
- LID : LAPD Protocol Logical ID, It is used as RP identifier.
- HDLC : It indicates HDLC channel number.
- Conn-State : It shows the connection status of the RP and LAPD protocol interface. ESTABLISHED (connected)/RELEASED (disconnected)

d. Inquiry of TRK and DSCU channel status

Command: **show-sts-ch;**

```
CMCU>show-sts-ch;

TRKU0 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
TRKU1 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
TRKU2 : ABNO_FAULT  NORM_STB    NORM_STB    NORM_STB    NORM_STB    NORM_STB
      : NORM_STB    NORM_STB    NORM_STB    NORM_STB    NORM_STB    NORM_STB
      : NORM_STB    NORM_STB    NORM_STB    NORM_STB
TRKU3 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT

DSCU0 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
DSCU1 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
DSCU2 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
DSCU3 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
DSCU4 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
DSCU5 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
DSCU6 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
```

Figure 3-6. Execution example – Inquiry of TRK and DSCU channel status

This command shows the status of TRK16 – 16 Channel and DSCU – 4 Channel.

e. Inquiry of LE/RP link resource status

Command : **show-trk-sts;**

```
CMCU>show-trk-sts;

                    WLL   RPC   TRUNK  USAGE  DISPLAY      [ T:BUSY   -:IDLE    ]
                   ======================================  [ .:ABNO_EJT/NEQ_EJT ]
         [  D:SDWN, B:NORM_MBLK, b:ABNO_MBLK, x:ABNO_OBLK, F:ABNO_FLT   ]
    TIME  : 0 0 0 0 0 0 0 0  0 0 1 1 1 1 1 1  1 1 1 1 2 2 2 2  2 2 2 2 2 2 3 3
    SLOT  : 0 1 2 3 4 5 6 7  8 9 0 1 2 3 4 5  6 7 8 9 0 1 2 3  4 5 6 7 8 9 0 1

LE 0 [0] : . - - - - - - -  - - - - - - - -  s - - - - - - -  - - - - - - - -
LE 1 [0] : . - - - - - - -  - - - - - - - -  s - - - - - - -  - - - - - - - -
LE 2 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 3 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 4 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 5 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 6 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 7 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 8 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE 9 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE10 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE11 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE12 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE13 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE14 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
LE15 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .

                    WLL   RPC   TRUNK  USAGE  DISPLAY      [ T:BUSY   -:IDLE    ]
                   ======================================  [ .:ABNO_EJT/NEQ_EJT ]
         [  D:SDWN, B:NORM_MBLK, b:ABNO_MBLK, x:ABNO_OBLK, F:ABNO_FLT   ]
    TIME  : 0 0 0 0 0 0 0 0  0 0 1 1 1 1 1 1  1 1 1 1 2 2 2 2  2 2 2 2 2 2 3 3
    SLOT  : 0 1 2 3 4 5 6 7  8 9 0 1 2 3 4 5  6 7 8 9 0 1 2 3  4 5 6 7 8 9 0 1

RP 0 [2] : . x x x x x x x  x x x x x x x x  s x x x x x x x  x x x x x x x m
RP 1 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 2 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 3 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 4 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 5 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 6 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 7 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 8 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP 9 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP10 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP11 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP12 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP13 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP14 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
RP15 [x] : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
```

Figure 3-7. Execution example – Inquiry of LE/RP link resource status

The status of each resource is indicated as follows.

'.':	Not Used	's' :	Signal Path
'm':	Manager Path (Timeslot 31 - RPTRK)	'-' :	NORM_IDLE
'B':	NORM_MBLK	'S' :	NORM_SDWN
'X':	ABNO_MBLK	'T' :	NORM_BUSY (ASYNC USE)
'x':	ABNO_OBLK		
'V':	NORM_BUSY (PSTN 32K front+rear used)		
'f':	NORM_BUSY (PSTN 32K front used)		
'r':	NORM_BUSY (PSTN 32K rear used)		

f. Inquiry of DSCU resource status

Command : **show-vcu-trk;**

```
CMCU>show_vcu_trk;

              WLL   RPC   VCU  TRUNK  USAGE  DISPLAY  [ 3:32K, -:IDLE  e   ]
              ======================================  [ 6:64K, .:NEQ_EJT   ]
      [  D:SDWN, B:NORM_MBLK, b:ABNO_MBLK, x:ABNO_OBLK, F:ABNO_FLT   ]
TIME SLOT : 0 0 0 0 0 0 0 0  0 0 1 1 1 1 1 1  1 1 1 1 2 2 2 2  2 2 2 2 2 2 3 3
I-O SL-CH : 0 1 2 3 4 5 6 7  8 9 0 1 2 3 4 5  6 7 8 9 0 1 2 3  4 5 6 7 8 9 0 1

00-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
01-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
02-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
03-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
04-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
05-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
06-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
07-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
08-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
09-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
10-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
11-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
12-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
13-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
14-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
15-xx:x-x : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
```

Figure 3-8. Execution example – Inquiry of DSCU resource status

The status of each resource is indicated as follows.

'.' :	Not Used	's' :	Signal Path (TimeSlot 16)
'm' :	Manager Path (Timeslot 31 - RPTRK)	' ' :	NORM_IDLE
'B' :	NORM_MBLK	'S' :	NORM_SDWN
'x' :	ABNO_OBLK	'X' :	ABNO_MBLK
'3' :	NORM_BUSY (32K USE) '	'6' :	NORM_BUSY (64K USE)

g. Inquiry of files stored in the disk

Command : **dir;**

```
PMCU>dir

9.0.1/BITMAP.SYS          25600 bytes
9.0.1/FLIST.SYS           13312 bytes
9.0.1/HDIAG.DAT              16 bytes
9.0.1/SYSINI.SYS            842 bytes
9.0.1/SYSCFG.SYS           4118 bytes
9.0.1/pmcu.hex          2007440 bytes
9.0.1/mcfg0051.dat         1976 bytes
9.0.1/pcpu668d.hex      2141014 bytes
9.0.1/acca105b.hex       756378 bytes
            9 file(s)      4960696 bytes
                          99896904 bytes free
```

Figure 3-9. Execution example – Inquiry of files

F. Fault management module

This module manages faults based on WLL system fault list. When a fault occurs or a fault is released, it reports the status to the high-level system. As for the redundant boards, when a fault occurs in the active board, if the fault class of the active board is higher than that of the standby board, this module automatically switchovers the boards. As for single resource boards, this module isolates the resource where a fault occurs.

The fault list of RPC system is as table 2.

Board	ALARM	Slot	Channel	Remarks
CMCU	Extract	0 / 1		Board is extracted
	Lan Module Extract	0 / 1		Lan module is extracted
	HDLC Controller Fault	0 / 1		
	SRAM Fault	0 / 1		
	DRAM Fault	0 / 1		
	HARD DISK Access Fault	0 / 1		
	Standby Software Fault			Standby Interface fault
CCPU	Extract	0 / 1		Board is extracted.
	Type Mismatch	0 / 1		
	HDLC Controller Fault	0 / 1		
	SRAM Fault	0 / 1		
	DRAM Fault	0 / 1		
	HARD DISK Access Fault	0 / 1		
	Standby Software Fault			Standby Interface fault
	Active not Found			Both CCPU0 and CCPU1 are extracted.
TSIU	Extract	0 / 1		
	Type Mismatch	0 / 1		
	Internal Clock Fault	0 / 1		
	Active not Found			Both TSIU0/1 are extracted
TRK16	Extract	0/1/2/3		
	Type Mismatch	0/1/2/3		
	FPGA Fault	0/1/2/3		
	Framer Chip Fault	0/1/2/3		
	Transceiver Fault	0/1/2/3		
	Software Fault	0/1/2/3		Interface Fault
	LE Active not Found			Both TRK16_0 and TRK16_1 are extracted.
	RP Active not Found			Both TRK16_2 and TRK16_3 are extracted.
DSCU	Extract	0/1/2/3/4/5/6		
	Type Mismatch	0/1/2/3/4/5/6		
	Channel n Fault	0/1/2/3/4/5/6	Ch0-3	
LINK	AIS (Blue Alarm)	LE/RP	Link0-15	
	YELLOW (RAI) Alarm	LE/RP	Link0-15	Remote station alarm
	Loss of Signal	LE/RP	Link0-15	
	Loss of Synchronization	LE/RP	Link0-15	
LAN	LAN Connection Fault	A/B		
PDP	PDP Control or Cable Fault			ALMU is extracted or cable fault occurs.
	PDP Power Switch OFF	A/B		Power Switch OFF
	-48V Power Fault	A/B		
	FAN Fault			FAN Power OFF

Table 3-2. RPC system fault list

a. Inquiry of the current faults

Command : **show-alarm;**

```
CMCU>show-alarm;

[ALARM-MAJ] CCPU1 Board Extracted
[ALARM-MAJ] TSIU0 Board Extracted
[ALARM-MAJ] CTRK0 Board Extracted
[ALARM-MAJ] CTRK1 Board Extracted
[ALARM-MAJ] CTRK3 Board Extracted
[ALARM-CRT] LETRK Active Board not Found
[ALARM-MAJ] DSCU0 Board Extracted
[ALARM-MAJ] DSCU1 Board Extracted
[ALARM-MAJ] DSCU2 Board Extracted
[ALARM-MIN] PDP Control Board or Cable Fault
[ALARM-MIN] FAN Fault
[ALARM-MAJ] RP LINK 0  Loss of Synchronization
[ALARM-MAJ] RP LINK 0  Channel Loss of Signal
[ALARM-MAJ] LAN B Connection Cable Fault
```

Figure 3-10. Execution example – Inquiry of the current fault

The fault classes are CRT/MAJ/MIN/NOR and they have following meanings.
CRT: Critical fault MAJ: Major fault MIN: Minor fault NOR: Normal status

G. Downloading management module

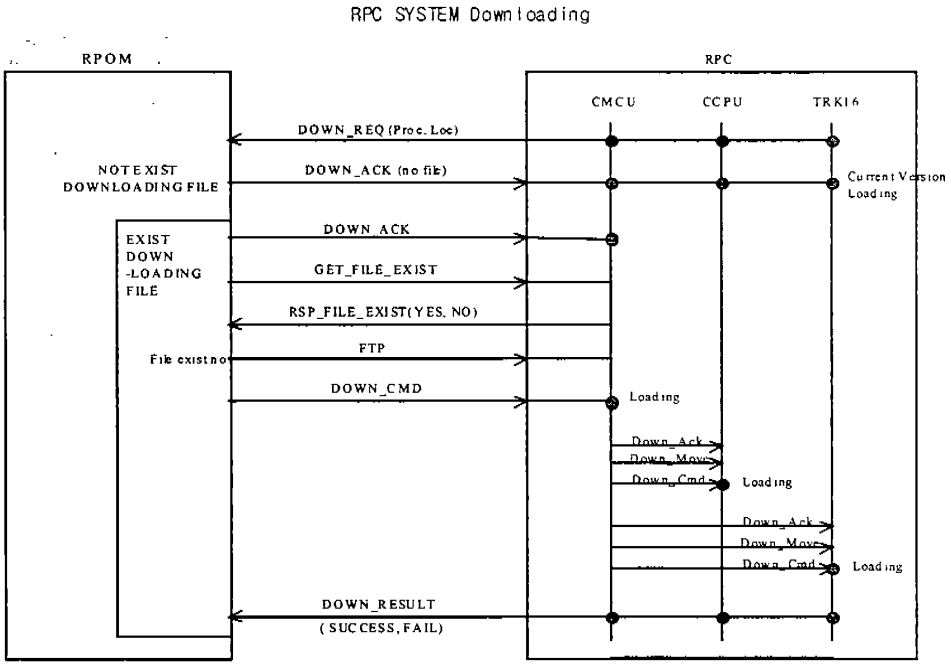


Figure 3-11. Downloading management module

Downloading is divided into the downloading on request of the system and that on request of operators.

The downloading on request of the system is performed at the time of the first initialization or when the operator commands 'Reboot' and the downloading is repeated until it is successfully completed. The downloading on request of the operator is the flow in the following figure except the system request (DOWN_REQ) and the response to the request (DOWN_ACK) and the downloading result (Success/failure) is reported after one downloading is performed.

5.2 RPC-CCPU

(1) CCPU software

The CCPU software that processes the calls and of Radio Port Controller (RPC) and manages the subscribers consists of the following six blocks.

- **LAPD interface block**
- **MMI and CMCU interface block**
- **V52 interface block**
- **Timer block**
- **System Application block**

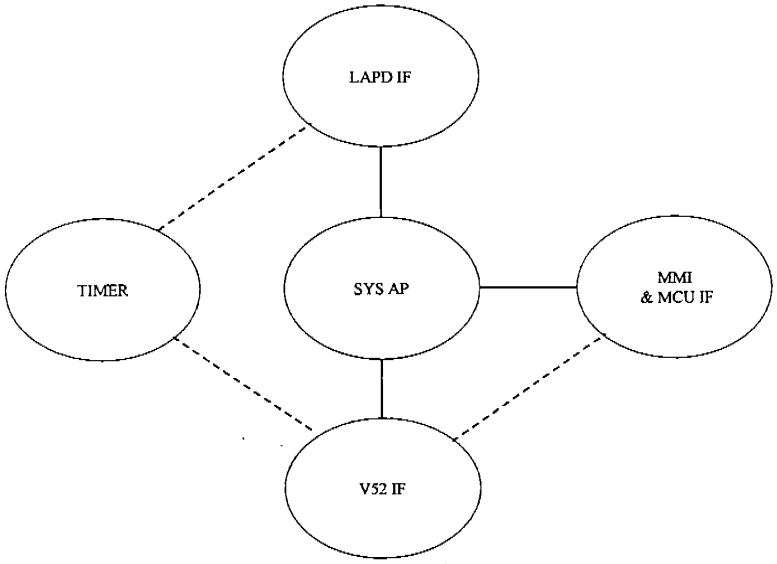


Figure 3-12. CCPU software block diagram

(2) CCPU software execution module loading system

CCPU software is executed in the root, which is the basic task of OS. The execution module loading system of the board is classified into the following four procedures.

A. Active board start procedure

① CCPU generates tasks, queue and semaphores used for the interface between tasks.
② CCPU initializes DPRAM, which is the communication path to CMCU that controls boards.
③ CCPU initializes SRAM, the shared memory of redundant boards.
④ CCPU starts the tasks that perform independent operations.
⑤ CCPU mirrors the information in the active board disk to the standby board.
⑥ CCPU notifies CMCU that the board is restarted.
⑦ CCPU sets the board status as active in the status register.
⑧ CCPU enables the hardware device.
⑨ CCPU receives RP setup information from CMCU.
⑩ When there is no PLD file in the hard disk, CCPU requests PLD from RPOM.
⑪ CCPU loads PLD data to SRAM, the shared memory.
⑫ CCPU performs the V5.2 start procedure.

B. Standby board start procedure

① CCPU generates tasks, queue and semaphores used for the interface between tasks.
② CCPU initializes DPRAM, which is the communication path to CMCU that controls boards.
③ CCPU starts the tasks that perform independent operations.
④ CCPU requests the hard disk mirroring from the active board.
⑤ CCPU notifies CMCU that the board is restarted.
⑥ CCPU sets the board status as active in the status register.
⑦ CCPU waits for the switchover in WAIT mode.

C. Deactivation procedure during the switchover

① CCPU copies the information of SRAM, the shared memory.
② CCPU disables the hardware device.
③ CCPU resisters the board status as standby in the status register.
④ CCPU restarts the board.

D. Activation procedure during the switchover

① CCPU enables the hardware device.
② CCPU resisters the board status as active in the status register.
③ CCPU checks the normal operation of the timer block.
④ CCPU sets up HDLC channel for V5.2 and RPC-RP interface.

(3) Functions of each CCPU software module

A. LAPD interface block

RPC-RP interface is performed through LAPD (ITU-T Q.920/921) that guarantees the reliability of data transmitting/receiving. The followings are the main transmission/reception data.

- LAPD setup and release message
  RP is newly set up or deleted.
- Subscriber management message
  Subscribers are managed through the registration, cancellation, and change procedures.
- Call-processing-related message
  Call connection and release message of POTS and data subscribers

B. MMI and CMCU interface block

a. Man Machine Interface (MMI) block

This block takes charge of the status inquiry and the operator commands in CCPU console.

b. CMCU interface block

CMCU interface block transmits and receives the following information.

- Board status change information
- Application downloading
- Programming loading data downloading
- V5.2 operator command of ROPM and the status inquiry information
- The addition, change, or deletion of LAPD interface
- Call setup and release information
- RPOM call processing statistic data collection

C. Timer block

This block manages the timer required for LAPD interface and V5.2 interface.

- Timer generation
- Timer deletion
- When time out occurs, this block reports it to the related task.

D. System application block

This block supports the protocol area (LAPD, V5.2) to operate smoothly. This block is classified as follows.

- Subscriber management module (Addition, Change, Deletion, Registration, Location registration)
- RP management module (Addition, change, deletion, logical link setup, logical link release)
- Traffic resource management module (Traffic channel setup and release)

E. V5.2 software block[1]

This block provides the interface between the control units of the exchange and RP.

a. Software module configuration

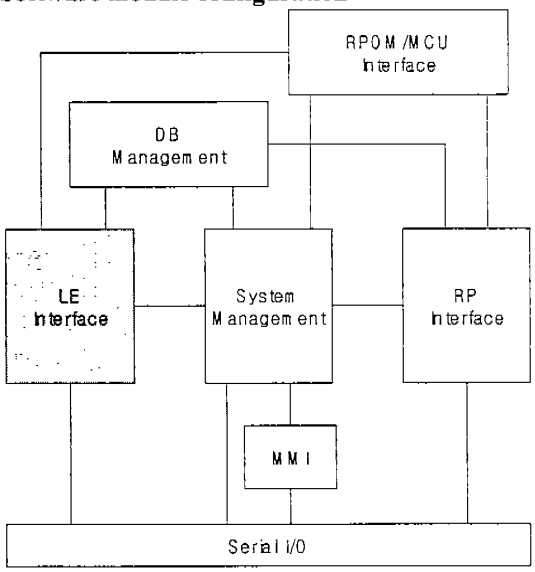


Figure 3-13. CCPU software module outline diagram – Entire

Figure 13 simply illustrates the inter-relation of CCPU software module. The following describes each module in the figure.

- LE Interface
- Provide the interface with LE.
- RP Interface: Provide the interface with RP.
- Man-Machine Interface (MMI): Process the user commands.
- Database management: Manage all the databases defined in CCPU.
- RPOM/MCU interface: Provide the interface with RPOM and MCU.
- System management: Manage the entire CCPU system.
- Serial I/O: Input/Output through serial port

[1] ITU-T G.964/965, ETSI ETS 300 324-1/347-1

Figure 14 shows more detailed LE interface among the software modules in Figure 13. As the figure shows, the LE interface consists of the following two modules.

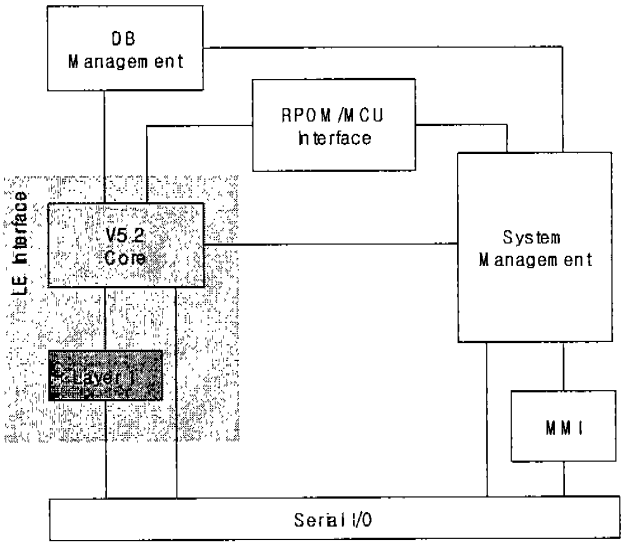


Figure 3-14. CCPU software module outline diagram – LE Interface

- V5.2 Core: Implement V5.2 interface for the interworking with LE.
- Layer 1: The module for the physical transmitting/receiving of data

Figure 15 shows the configuration of V5.2 core module in Figure 14.

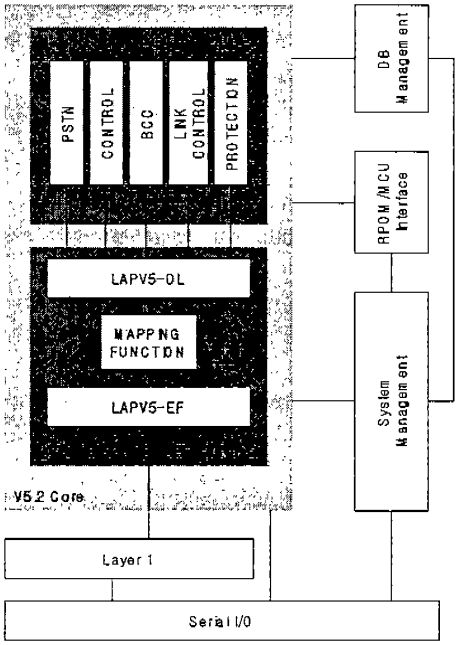


Figure 3-15. CCPU software module outline diagram – V5.2 Core

- Link Access Protocol for V5-Envelope Function sublayer (LAPV5-EF)
- Mapping function
- Link Access Protocol for V5 Interface-Data Link sublayer (LAPV5-DL)
- PSTN: Manage the subscriber line status.
- Control: Manage the subscriber port and the V5.2 interface status.
- BCC: Allocate or release dynamic channels and manage channels.
- Link control: Control and manage links.
- Protection: Provide a function that keeps the service available despite a link fault.

The next PART will describe each module comprising V5.2 core module in detail.

b. V5.2 interface

❑ **V5.2 interface definition and objective**

V5.2 interface is one of the interface types between AN and LE. It aims to provide the following access types[2].

Analog telephone access

ISDN basic access with a line transmission system conforming to Recommendation G.960 for the case with a NT1 separate from the AN

ISDN basic access with a user network interface according to Recommendation I.430 at the user side of the AN (i.e. the interface at the T reference point)

ISDN primary rate access with a line transmission system conforming to Recommendation G.962 for the case with a NT1 separate from the AN

ISDN primary rate access with a user network interface according to Recommendation I.431 at the user side of the AN (i.e. the interface at the T reference point)

Other analogue or digital accesses for semi-permanent connections without associated out-band signaling information

❑ **Features of V5.2 interface**

- Traffic channel: E1 link (2.048 Mbps)
- Multi-link support: Maximum 16 E1 links are available per interface.
- Multi-slot support
- Dynamic channel allocation
- Line collection

[2] ITU-T G.964/965, ETSI ETS 300 324-1/347-1

❑ Abbreviation and glossary

I. Abbreviation

AI	Activate Indication	**AIS**	Alarm Indication Signal
AN	Access Network	**AN-FR**	AN Frame Relay Function
BCC	Bearer Channel Connection	**BECN**	Backward Explicit Congestion Notification
C/R	Command/Response	**C-channel**	Communication channel
C-path	Communication path	**C64**	Communication channel 64 kbps
CRC	Cyclic Redundancy Check	**CTRL**	Control protocol message
Cx	Communication channel with index	**D16**	D-channel 16 kbps
DDI	Direct Dialing In	**DE**	Discard Eligibility indicator
DI	Deactivate Indication	**DISC**	Disconnect
DL	Primitive between layer 2 and layer 3	**DLCI**	Data Link Connection Identifier
DM	Disconnect Mode	**Ds**	D-channel signaling
DS	Access Digital Section	**DTMF**	Dual Tone Multiple Frequency
EA	Address Extension	**EF**	Envelope Function
Efaddr	EF address	**EI**	Error Indication
ET	Exchange Terminator	**FCS**	Frame Check Sequence
FE	Function Element	**FECN**	Forward Explicit congestion Notification
FRI	Frame Relaying Information	**FRMR**	Frame Reset
FSM	Finite State Machine	**ID**	Identifier
ISDN	Integrated Services Digital Network	**L1**	Layer 1
L2	Layer 2	**L3**	Layer 3
L3addr	L3 address	**LAPB**	Link Access Protocol Balanced for X.25
LAPD	Link Access Protocol for ISDN D-channel	**LAPF**	Link Access Protocol for Frame mode
LAPV5	Link Access Protocol for V5 interface	**LAPV5-DL**	LAPV5 Data Link sublayer
LAPV5-EF	LAPV5 Envelope Function sublayer	**LC**	Line Circuit
LE	Local Exchange	**LOF**	Loss Of Frame alignment
LOS	Loss Of Signal	**LT**	Line Termination
MCID	Malicious Call Identification	**MDL**	Primitive between layer 2 and layer 3 Management
MDU	Management Data Unit	**MF**	Mapping Function
MPH	Primitive between layer 1 and layer 2 Management	**NT1**	Network Termination 1
NT2	Network Termination 2	**P/F**	Poll/Final
PABX	Private Automatic Branch exchange	**PCM**	Pulse Code Modulation
PH	Primitive between layer 1 and layer 2	**PICS**	Protocol Implementation Conformance Statement
PL	Permanent Line	**PSTN**	Public Switched Telephone Network
Q_{AN}	Q interface at the AN	**Q_{LE}**	Q interface at the LE
RAI	Remote Alarm Indication	**REJ**	Reject
RNR	Receive Not Ready	**RR**	Receive Ready
SABM	Set Asynchronous Balanced Mode	**SABME**	SABM Extended
SAPI	Service Access Point Identifier	**SDL**	Specification and Description Language
TE	Terminal Equipment(ISDN or PSTN)	**TEI**	Terminal Equipment Identifier
TMN	Telecommunication Management Network	**UA**	Unnumbered Acknowledgement
UI	Unnumbered Information	**V5DLaddr**	V5 Data Link address

II.Glossary

Access Network (AN)
: Local line distribution network implemented between LE and users
Local Exchange (LE)
: Exchange
V5-interface
: General term for V-interface group for the interworking between AN and LE
V5 data link address (V5DLaddr)
: The address used in LAPV5-DL
Envelope Function address (EFaddr)
: The address used in LAPV5-EF
Layer 3 address (L3addr)
: The address used in the protocol message of the layer 3
Time slot number
: The ID for the identification of 64 kbps time slot in 2048 kbps E1 link
B-channel number
: The ID for the identification of B-channel of ISDN
LAPV5-frame
: The frame format used in V5.2 interface to transmit and receive the signaling and control information.
Provisioning
: The activity that sets the values of each parameter used for the operation of V5.2 interface.
Interface ID
: The ID for the identification of V5.2 interface
Variant
: The group of the parameters used for the operation of V5.2 interface
Variant ID
: The ID for the identification of variant
Control
: The layer 3 protocol related to the control of user port status and to the management of V5.2 interface
AN Frame Relay function
: The sub-layer of layer 2 that takes care of mux/demux of ISDN D-channel frame
Active C-channel
: The physical channel through which the signaling frame of V5.2 interface is currently transmitted/received.
Standby C-channel
: The physical C-channel through which the signaling frame of V5.2 interface is not currently transmitted/received but that will be used as the active C-channel when the current active C-channel switchovers.
Bearer channel
: The physical channel used for the transmitting/receiving of general voice and data.

Bearer Channel Connection (BCC) protocol
: The layer 3 protocol related to the management of bearer channel
Communication channel (C-channel)
: 64 kbps timeslot set up to provide the communication path

Communication path (C-path)
: One of the following information types
- Layer 2 data link that transmits control protocol signals
- Layer 2 data link that transmits PSTN protocol signals
- Layer 2 data link that transmits BCC protocol signals
- Layer 2 data link that transmits link control protocol signals
- Layer 2 data link that transmits protection protocol signals
- All ISDN Ds-type data for more than one user port
- All ISDN f-type data for more than one user port
- All ISDN p-type data for more than one user port

Physical C-channel
: 64 kbps timeslot allocated for the transmitting and receiving of logical C-channel in V5.2 interface
Logical C-channel
: Group of more than one C-paths
Primary link
: 2.048Mbps link where the physical C-channel of the timeslot 16, which allocates C-path for the protection, control, BCC, and link control protocols, is allocated
Secondary link
: 2.048Mbps link where the C-path for the protection protocol is allocated and the physical C-channel of the timeslot 16 that plays the role of a standby channel for the control, BCC, and link control protocols.
Protection group
: A group of logical C-channels and their standby C-channels

❑ Architecture and functions of each layer

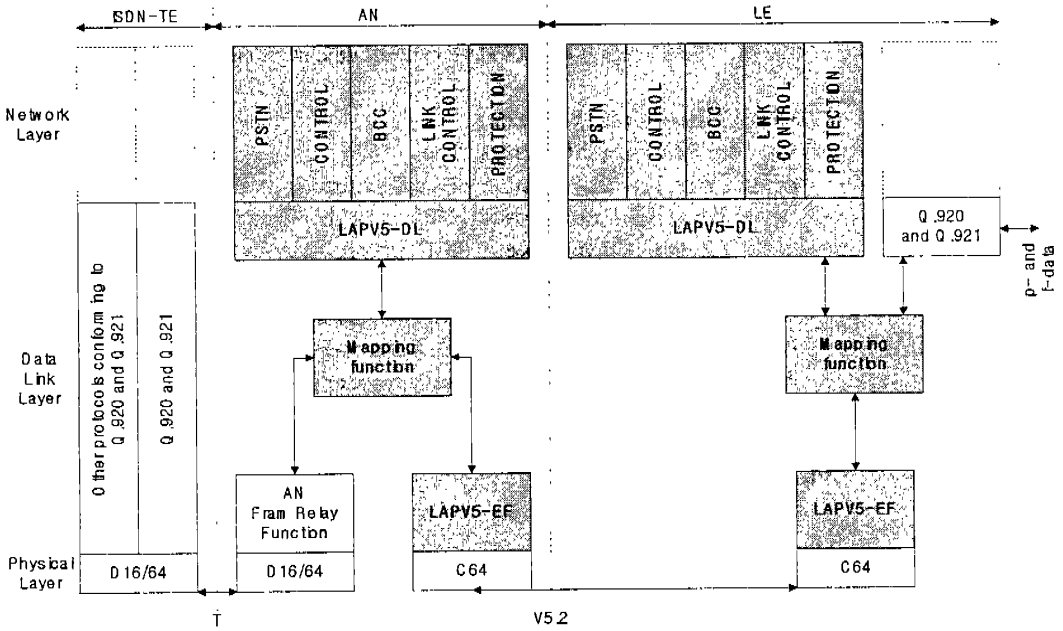


Figure 3-16. V5.2 protocol architecture[3]

Figure 16 shows the architecture of V5.2 protocol. The colored parts in the figure are the functions to be described in the following.

I. Layer 2

Layer 2 corresponds to Layer 2 data link layer of OSI 7 layer and it consists of the following four functional parts.

- LAPV5-EF
- LAPV5-DL
- Mapping Function
- AN Frame Relay Function

The main purpose of layer 2 is to set data links for the transmitting/receiving of the signals of Layer 3.

[3] ITU-T G.965

LAPV5-EF

Interworking with the mapping function, LAPV5-EF makes EF-frame with the exchange information from the mapping function or extracts the exchange information from the received EF-frame and transmits the information to the mapping function.

The following shows the architecture of EF-frame.

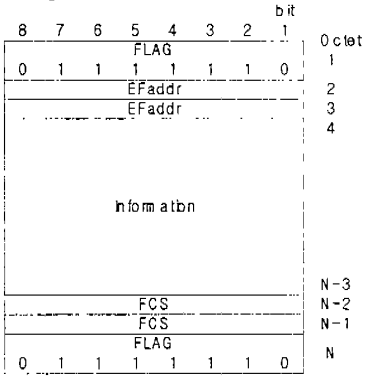


Figure 3-17. LAPV5-EF frame architecture

i. Envelope function address field

This field consists of two octets and the architecture is as in figure 18.

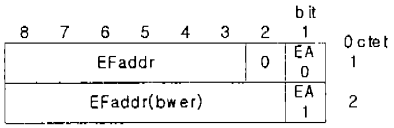


Figure 3-18. EF address field format

The range of available address is 0 ~ 8180 and the addresses between 0 ~ 8175 are allocated to ISDN and those of 8176 ~ 8180 are used for POTS service.

bits								
8	7	6	5	4	3	2	1	
1	1	1	1	1	1	0	EA	Octet 1
								Octet 2
1	1	1	0	0	0	0	EA	PSTN
1	1	1	0	0	0	1	EA	Control
1	1	1	0	0	1	0	EA	BCC
1	1	1	0	0	1	1	EA	Protection
1	1	1	0	1	0	0	EA	Link Control

Table 3-3. Coding of Efaddr values

ii. Envelope Information field

This field has the information to transmit/receive. The allowable size of this field is minimum three octets to maximum 533 octets.

LAPV5-DL

LAPV5-DL sets up the data link for the information exchange between AN and LE.

As Figure 19 shows, there are two types of frame formats. Format A has no information field and Format B has a information field.

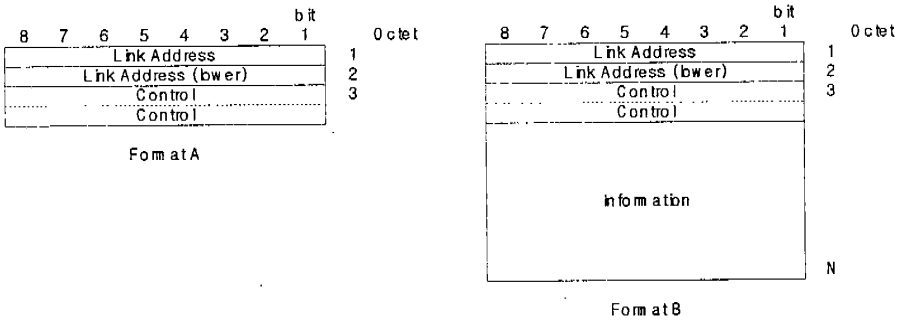


Figure 3-19. LAPV5-DL frame format

The control field is one or two octet long and it is classified into three types as follows.

- **Information (I) format**
  Used for the information exchange between entities of Layer 3
- **Supervisory (S) format**
  It monitors and controls the data link including the functions of I frame acknowledgement, requests of the retransmission of I frame, and the temporary delay of I frame transmission.
- **Unnumbered (U) format**
  It is used for the transmission of unnumbered information for the transmission of additional data link control signals and unverified information.

The frame type and the encoding for each format are as Table 5.

Application	Frame Format	Frame Type	Encoding 8	7	6	5	4	3	2	1	Oct.
Unacknowledged and Multiple Frame Acknowledge Information Transfer	Information transfer	I	N(S)							O	3
			N(R)							P	4
	Supervisory	RR	0	0	0	0	0	0	0	1	3
			N(R)							P/F	4
		RNR	0	0	0	0	0	1	0	1	3
			N(R)							P/F	4
		REJ	0	0	0	0	1	0	0	1	3
			N(R)							P/F	4
	Unnumbered	SABME	0	1	1	P	1	1	1	1	3
		DM	0	0	0	F	1	1	1	1	3
		UI	0	0	0	P	0	0	1	1	3
		DISC	0	1	0	P	0	0	1	1	3
		UA	0	1	1	F	0	0	1	1	3
		FRMR	1	0	0	F	0	1	1	1	3
Connection Management		XID	1	0	1	P/F	1	1	1	1	3

I	**Information**	**RR**	**Recevie Ready**
RNR	**Receive Not Ready**	**REJ**	**REJect**
SABME	**Set Asynchronous Balanced Mode Extended**	**DM**	**Disconnected Mode**
		DISC	**DISConnect**
UI	**Unnumbered Information**	**FRMR**	**FraMe Reject**
UA	**Unnumbered Acknowledge**	**XID**	**EXchange IDentification**
P	**Poll bit**	**F**	**Final bit**
N(S)	**Transmitter send sequence number**	**N(R)**	**Transmitter receive sequence number**

Table 3-4. Control format and encoding[4]

[4] ITU-T Q.921

Mapping function

i. LAPV5-EF to LAPV5-DL communications

This functions to EFaddr in LAPV5-EF frame received from LE. If Efaddr is a value between 8176 ~ 8180, it transmits the information field to LAPV5-DL sublayer.

ii. LAPV5-DL to LAPV5-EF communications

This function refers to V5Daddr in the frame received from LAPV5-DL and sets EFaddr to the same value as V5Dladdr and transmits V5DL-frame and EFaddr to LAPV5-EF sublayer.

iii. AN-FR to LAPV5-EF communications

When D-channel frame transmitted from ISDN user port is processed in AN frame relay function and transmitted to this function, this function sets EFaddr and transmits the frames generated and processed in AN frame relay function and EFaddr to LAPV5-EF sublayer.

iv. LAPV5-EF to AN-FR communications

This function refers to EFaddr in LAPV5-EF frame received from LE. If Efaddr is a value between 0 ~ 8175, it transmits EFaddr and the information field to send to ISDN user port to AN frame relay function.

AN frame relay

The main functions of AN frame relay is to process ISDN protocol. The following figure 20 shows what tasks are performed in AN frame relay.

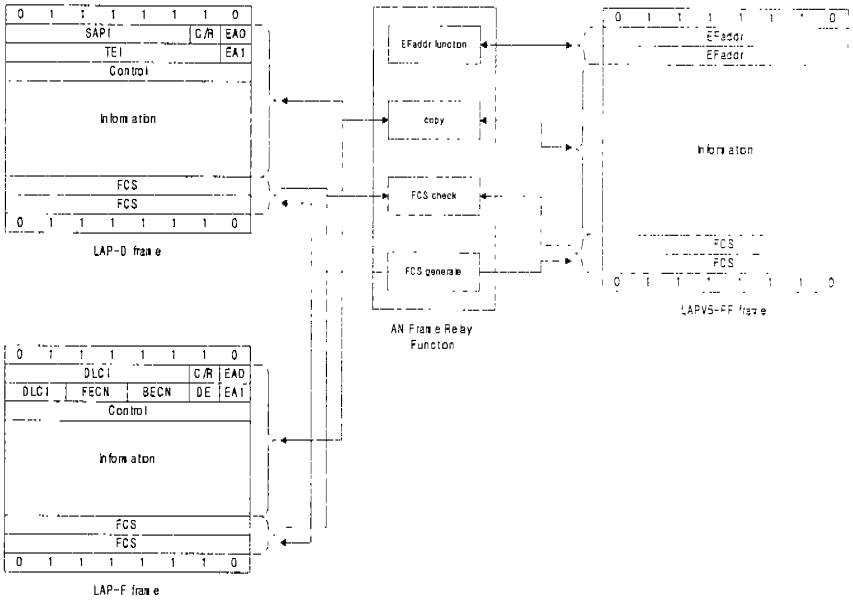


Figure 3-20. AN frame relay function

i. Processing of the frames received from LE

- AN frame relay verifies if the frames are normal.
- It receives EFaddr and the envelope information field from the mapping function.
- It decides which ISDN user port will receive the information from EFaddr.
- It copies the envelope information.
- It generates FCS.
- It composes ISDN protocol frame through the above processes.

ii. Processing of the frames received from ISDN user port

- AN frame relay verifies if the frames are normal.
- It removes Flag and FCS.
- It decides EFaddr.
- It transmits EFaddr and the processed frames to the mapping function.

II.Layer 3

The message frame architecture of Layer 3 is as the figure 21.

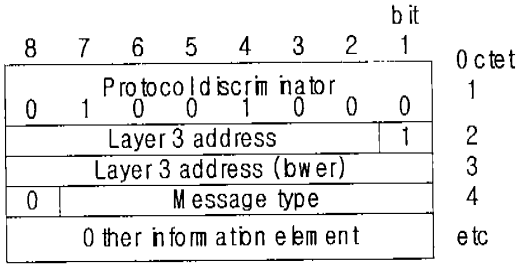


Figure 3-21. Layer 3 message frame architecture

- **Protocol discriminator**
  It is the flag that discriminates the messages used in V5.2 interface from those used in other interfaces. It is fixed to 0x48.
- **Layer 3 address**
  The address of Layer 3 where the messages are applied
- **Message type**
  The messages of each protocol entity
- **Other information element**
  Additional information to apply beside the messages

Layer 3 consists of five protocol entities including PSTN, Control, BCC, Link Control, and Protection protocol entities.

III.PSTN

PSTN protocol has the purpose to transmit the status (off-hook or on-hook) of the subscriber line rather than to control call processes.
L3 message and additional information elements used in PSTN protocol are encoded as Table 5 and 6.

Bits 7	6	5	4	3	2	1	Message type
0	0	0	0	–	–	–	Path establishment messages
0	0	0	0	0	0	0	ESTABLISH
0	0	0	0	0	0	1	ESTABLISH ACK
0	0	0	0	0	1	0	SIGNAL
0	0	0	0	0	1	1	SIGNAL ACK
0	0	0	1	0	–	–	Path clearing messages
0	0	0	1	0	0	0	DISCONNECT
0	0	0	1	0	0	1	DISCONNECT COMPLETE
0	0	0	1	1	–	–	Other messages
0	0	0	1	1	0	0	STATUS ENQUIRY
0	0	0	1	1	0	1	STATUS
0	0	0	1	1	1	0	PROTOCOL PARAMETER

Table 3-5. PSTN protocol message types

Bits 8	7	6	5	4	3	2	1	Name	Length
1	–	–	–	X	X	X	X	SINGLE OCTET	
1	1	0	0	0	0	0	0	Pulse-notification	1
1	0	0	0	X	X	X	X	Line-information	1
1	0	0	1	X	X	X	X	State	1
1	0	1	0	X	X	X	X	Autonomous-signaling-sequence	1
1	0	1	1	X	X	X	X	Sequence-response	1
0	–	–	–	–	–	–	–	VARIABLE LENGTH	
0	0	0	0	0	0		0	Sequence-number	3
0	0	0	0	0	0	0	1	Cadenced-ringing	3
0	0	0	0	0	0	1	0	Pulsed-signal	3 to 5
0	0	0	0	0	0	1	1	Steady-signal	3
0	0	0	0	0	1	0	0	Digit-signal	3
0	0	0	1	0	0	0	0	Recognition-time	4
0	0	0	1	0	0	0	1	Enable-autonomous-acknowledge	4 to 6
0	0	0	1	0	0	1	0	Disable-autonomous-acknowledge	3
0	0	0	1	0	0	1	1	Cause	3 to 5
0	0	0	1	0	1	0	0	Resource-unavailable	3 to 8

Table 3-6. Information element identifier coding

Control

This protocol performs the functions for the subscriber port operation and V5.2 interface maintenance such as subscriber port blocking/unblocking, change of variant in operation, and verification of the ID of variant in operation.

i. Port control

It is defined for the block/unblock of subscriber port.

ii. Common control

It is defined for the control for general purposes of V5.2 interface maintenance except the subscriber port control.

Bits							Message type
7	6	5	4	3	2	1	
0	0	1	0	0	0	0	PORT CONTROL
0	0	1	0	0	0	1	PORT CONTROL ACK
0	0	1	0	0	1	0	COMMON CONTROL
0	0	1	0	0	1	1	COMMON CONTROL ACK

Table 3-7. Control protocol message types

Bits								Name	Length
8	7	6	5	4	3	2	1		
1	–	–	–	x	x	x	x	SINGLE OCTET	–
1	1	1	0	x	x	x	x	Performance grading	1
1	1	1	1	x	x	x	x	Rejection cause	1
0	–	–	–	–	–	–	–	VARIABLE LENGTH	
0	0	1	0	0	0	0	0	Control function element	3
0	0	1	0	0	0	0	1	Control function ID	3
0	0	1	0	0	0	1	0	Variant	3
0	0	1	0	0	0	1	1	Interface ID	5

Table 3-8. Information element identifier coding

Bits (octet 3)							Control function element
7	6	5	4	3	2	1	
0	0	0	0	0	0	1	FE101 (activate access)
0	0	0	0	0	1	0	FE102 (activation initiated by user)
0	0	0	0	0	1	1	FE103 (DS activated)
0	0	0	0	1	0	0	FE104 (access activated)
0	0	0	0	1	0	1	FE105 (deactivate access)
0	0	0	0	1	1	0	FE106 (access deactivated)
0	0	1	0	0	0	1	FE201/202 (unblock)
0	0	1	0	0	1	1	FE203/204 (block)
0	0	1	0	1	0	1	FE205 (block request)
0	0	1	0	1	1	0	FE206 (performance grading)
0	0	1	0	1	1	1	FE207 (D-channel block)
0	0	1	1	0	0	0	FE208 (D-channel unblock)

Table 3-9. Coding of control function element

Bits (octet 3) 7	6	5	4	3	2	1	Control function ID	Optional information element considered mandatory
0	0	0	0	0	0	0	Verify re-provisioning	Variant
0	0	0	0	0	0	1	Ready for re-provisioning	Variant
0	0	0	0	0	1	0	Not ready for re-provisioning	Variant, Rejection cause
0	0	0	0	0	1	1	Switch-over to new variant	Variant
0	0	0	0	1	0	0	Re-provisioning started	Variant
0	0	0	0	1	0	1	Cannot re-provision	Variant, Rejection cause
0	0	0	0	1	1	0	Request variant and interface ID	–
0	0	0	0	1	1	1	Variant and interface ID	Variant, interface ID
0	0	0	1	0	0	0	Blocking started	–
0	0	1	0	0	0	0	Restart request	–
0	0	1	0	0	0	1	Restart complete	–

Table 3-10. Coding of control function ID

8	7	6	5	4	3	2	1	Octet
L3 address						0	0	1
L3 address (lower)							1	2

NOTE - The L3 address value shall be either:
- A copy of the EFaddr used for the D-channel signaling data of an ISDN user port for which the control information applies; or
- The address for the common control function which shall be as for the V5DLaddr for the control protocol and thus shall have the value 8177.

Figure 3-22. L3 address information element for ISDN port or common V5-control function identification

8	7	6	5	4	3	2	1	Octet
L3 address							1	1
L3 address (lower)								2

NOTE – The L3 address value is a copy of the L3 address for the PSTN protocol data of the PSTN user port for which the control information applies.

Figure 3-23. L3 address information element for PSTN port identification

BCC

This protocol is defined for the allocation/release of dynamic channel. When an AN subscriber attempts a call, it allocates the bearer channel for the call. When a call is ended, it releases the allocated bearer channel.

Bits 7	6	5	4	3	2	1	Messages of the BCC protocol
0	1	0	0	0	0	0	ALLOCATION
0	1	0	0	0	0	1	ALLOCATION COMPLETE
0	1	0	0	0	1	0	ALLOCATION REJECT
0	1	0	0	0	1	1	DE-ALLOCATION
0	1	0	0	1	0	0	DE-ALLOCATION COMPLETE
0	1	0	0	1	0	1	DE-ALLOCATION REJECT
0	1	0	0	1	1	0	AUDIT
0	1	0	0	1	1	1	AUDIT COMPLETE
0	1	0	1	0	0	0	AN FAULT
0	1	0	1	0	0	1	AN FAULT ACKNOWLEDGE
0	1	0	1	0	1	0	PROTOCOL ERROR

Table 3-11. Set of the BCC protocol messages

Bits 8	7	6	5	4	3	2	1	Information element
								VARIABLE LENGTH INFORMATION ELEMENTS
0	1	0	0	0	0	0	0	User port identification
0	1	0	0	0	0	0	1	ISDN port channel identification
0	1	0	0	0	0	1	0	V5-time slot identification
0	1	0	0	0	0	1	1	Multi-slot map
0	1	0	0	0	1	0	0	Reject cause
0	1	0	0	0	1	0	1	Protocol error cause
0	1	0	0	0	1	1	0	Connection incomplete

Table 3-12. BCC protocol specific information elements

8	7	6	5	4	3	2	1	
Source ID[5]	BCC reference number value							Octet 1
0	0	BCC reference number value (low)						Octet 2

Figure 3-24. BCC reference number information element

[5] Source ID = 0 : LE generates the reference number. 1 : AN generates the reference number.

Link control

This protocol is defined for the management of E1 links used by V5.2 interface and its main functions are as follows.

- It manages the status of Layer 1 of E1 link and identifies links.
- It blocks and unblocks links.
- It verifies the integrity of links through the link identification.

Bits 7	6	5	4	3	2	1	Message types
0	1	1	0	0	0	0	LINK CONTROL
0	1	1	0	0	0	1	LINK CONTROL ACK

Table 3-13. Messages for V5.2-link control protocol

8	7	6	5	4	3	2	1	
0	0	1	0	0	0	0	1	Octet 1
Length of link control function content								Octet 2
1 ext.	Link control function							Octet 3

Figure 3-25. Information element identifier coding

Bits (octet 3) 7	6	5	4	3	2	1	Link control function
0	0	0	0	0	0	0	FE-IDReq
0	0	0	0	0	0	1	FE-IDAck
0	0	0	0	0	1	0	FE-IDRel
0	0	0	0	0	1	1	FE-IDRej
0	0	0	0	1	0	0	FE301/302 (link unblock)
0	0	0	0	1	0	1	FE303/304 (link block)
0	0	0	0	1	1	0	FE305 (differed link block request)
0	0	0	0	1	1	1	FE306 (non-differed link block request)

Table 3-14. Coding of link control function

8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Octet 1
L3 address field (low)								Octet 2

Figure 3-26. The layer 3 address information element for 2048 kbit/s link identification

Protection

This protocol is defined for the switchover of C-channel so that the service is provided continuously.

Protection protocol does not protect general bearer channels but only protects C-channels.

The causes of switchover are classified into two types as follows.

- E1 link fault: Physical fault, link blocking
- Switchover requested by operators: Switchover for a certain signaling channel

C-paths belong to the protection group 1 or the protection group 2. C-paths for the control, link control, and BCC protocols should belong to the protection group 1. It makes no difference whether C-paths for PSTN protocol belong to the protection group 1 or 2.

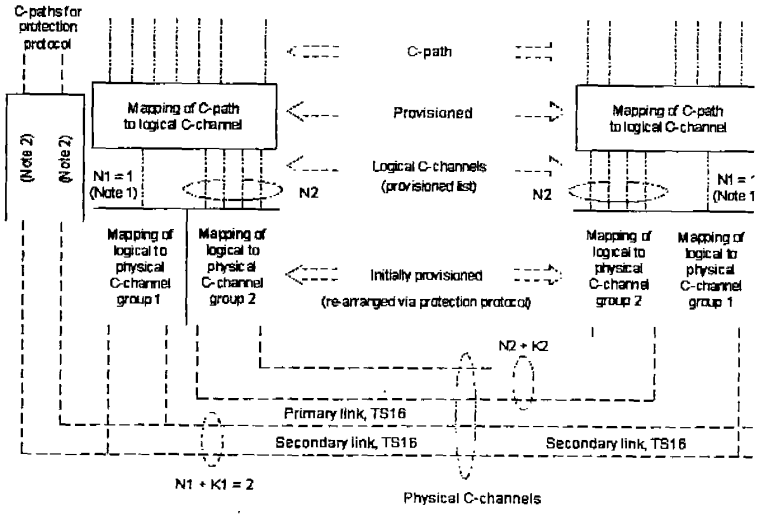
The C-paths belonging to the protection group 1 has the time slot 16 of the primary link as the active C-channel and has the timeslot 16 of the secondary link as the standby C-channel. Therefore the following formula is derived from the above.

$N1 = 1\ K1 = 1$

$1 \leq K2 \leq 3$

$1 \leq N2 \leq (3 \times L - 2 - K2)$

N1 : The number of active logial C-channels of the protection group 1
K2 : The number of standby logicals C-channels of the protection group 1
N2 : The active logical C-channels of the protection group 2
K2 : The standby logical C-channels of the protection group 2
L : Number of E1 links



NOTES

1 Control protocol, link control and BCC protocol C-paths plus optionally other C-paths.

2 Allocation of C-path to physical C-channel.

Figure 3-27. Mapping of C-paths to logical C-channels and hence to physical C-channels

Bits 7	6	5	4	3	2	1	Messages of the protection protocol
0	0	1	1	0	0	0	SWITCH-OVER REQ
0	0	1	1	0	0	1	SWITCH-OVER COM
0	0	1	1	0	1	0	OS-SWITCH-OVER COM
0	0	1	1	0	1	1	SWITCH-OVER ACK
0	0	1	1	1	0	0	SWITCH-OVER REJECT
0	0	1	1	1	0	1	PROTOCOL ERROR
0	0	1	1	1	1	0	RESET SN COM
0	0	1	1	1	1	1	RESET SN ACK

Table 3-5. Set of protection protocol messages

Information element coding 8	7	6	5	4	3	2	1	Messages of the protection protocol
0	–	–	–	–	–	–	–	VARIABLE LENGTH
0	1	0	1	0	0	0	0	Sequence number
0	1	0	1	0	0	0	1	Physical C-channel identification
0	1	0	1	0	0	1	0	Rejection cause
0	1	0	1	0	0	1	1	Protocol error cause

Table 3-6. Protection protocol specific information elements

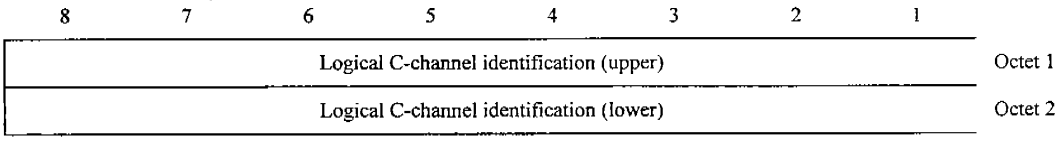


Figure 3-28. logical C-channel identification

❑ **Arrow diagram**

I. Startup procedure

This procedure activates V5.2 interface from Out-Of-Service (OOS) status to In Service (INS) status.

The following procedures are performed for the transition of V5.2 interface to INS status.

- Data link setup for each layer 3 protocol
- Verification of the IDs of variants and interfaces in operation or to apply
- Link ID identification
- PSTN port restart
- Quick port arrangement

After the above procedures, V5.2 interface enters into INS status and from now the service through V5.2 interface becomes available.

Data link setup
The data link are set up for each layer 3 protocol to enable the peer-to-peer communication between layer 3 protocols.

Verification of variant ID and interface ID
The IDs of variants and interfaces currently in operation or to apply to the startup procedures are verified. In this procedure, whether the configuration information used for AN and LE is the same or not is verified.

Link ID identification
In this procedure, the integrity of E1 link is verified.

PSTN restart
The status of PSTN FSM at the initial stage is Out Of Service status (OOS). In this procedure, PSTN FSM status changes to NULL status and now PSTN FSM can accommodate the service.

Quick port arrangement
In this procedure, all the subscriber ports are unblocked.

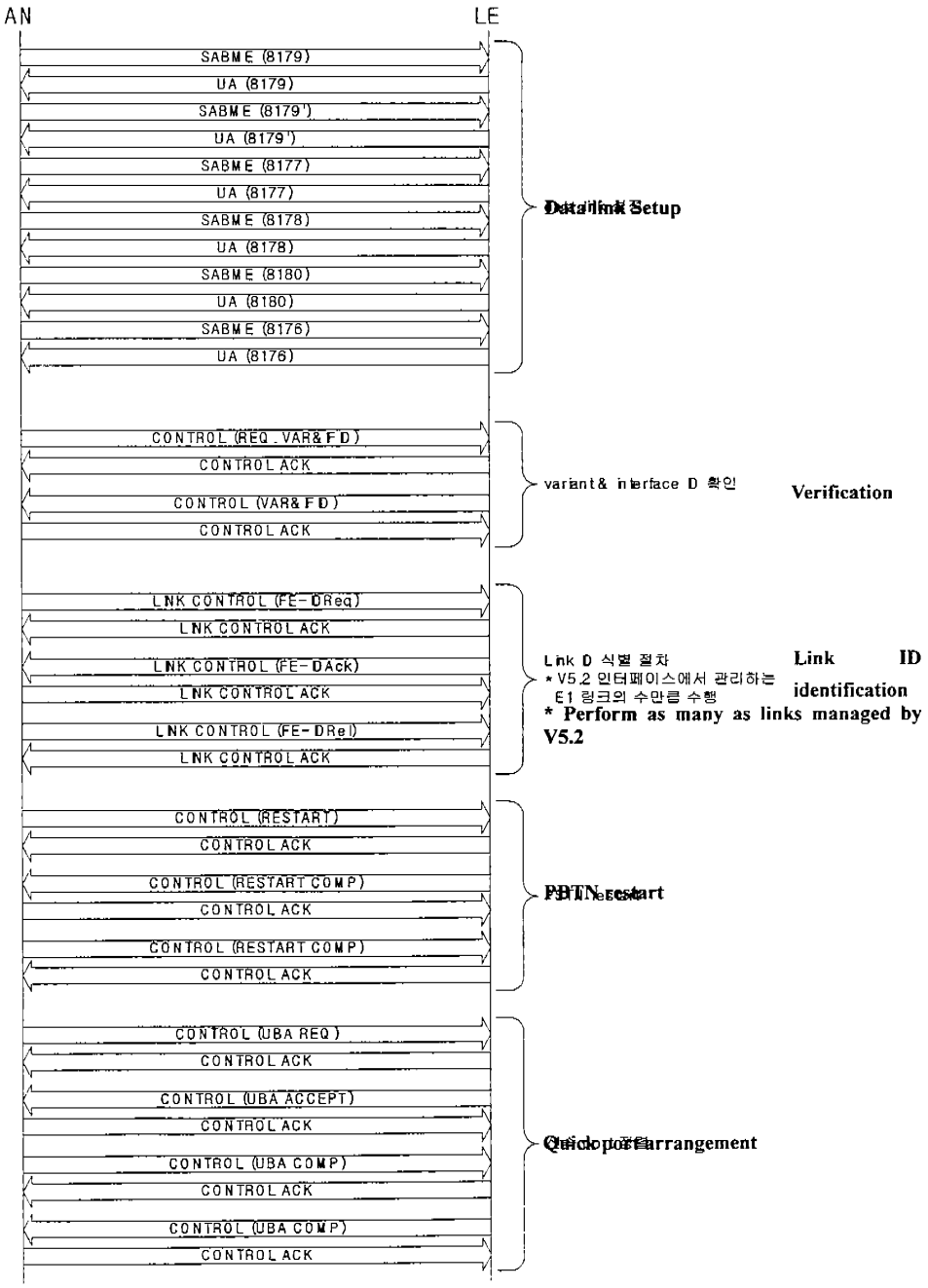


Figure 3-29. Startup procedure started by AN

II.Call attempt procedure

Originating call

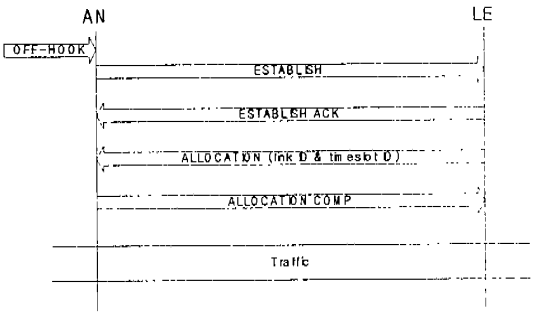


Figure 3-30. Originating call

Terminating call

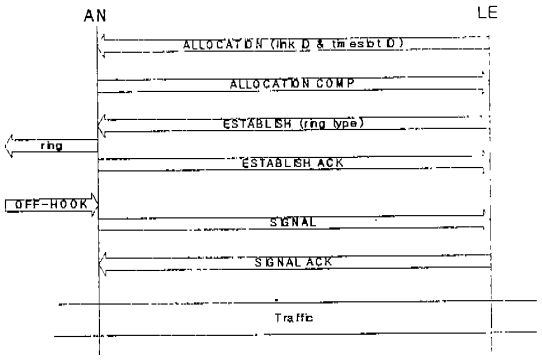


Figure 3-31. Terminating call

III.Call release procedure

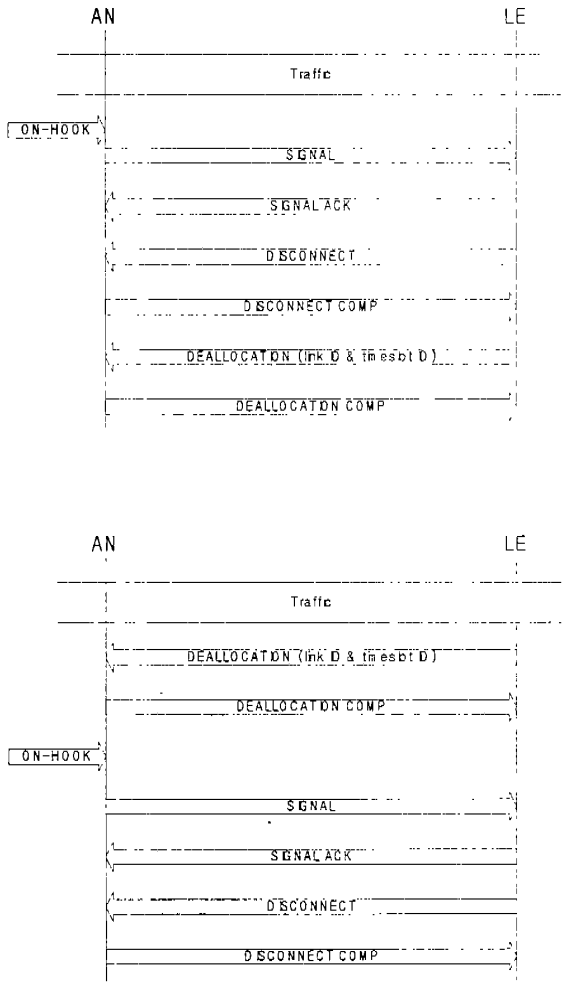


Figure 3-32. Call release

B. Inquiry command

a. Version inquiry command

Display the version of the software of CCPU board.

Command : **show-ver;**

Display example)

Display the version 4.00d status on March 2, 1999

RPT:001:1998-01-01 11:51:09:VER:4.00d (02 MAR 1999) [IPC-INT; NEW RPC-RP IF; NEW MCU IF];

b. V5.2 status inquiry command

Display whether V5.2 interface is in service or out of service with the variant in use.

Command : **show-v52-sys;**

Display example)

If V 5.2 interface is In Service with No. 4 variant

V52 INTERFACE CURRENT STATUS

Current Variant : 4
Service Status : In Service

RPT:001:2000-03-22 17:46:10:M:COMMAND EXECUTED;

c. RP LAPD inquiry command

Display the connection information between RP and RP controller.

Command : **show-rp-sys;**

Display example)

RPC-32940 RP SYSTEM REVIEW

RP ID	SYS ID	FA ID	SECTOR	SAPI	PRI TRK	PRI HDLC	LAPD STATE
0x00000008	1	0	A	1	0	11	ESTABLISHED
0x00000009	1	0	B	2	2	12	ESTABLISHED
0x0000000A	1	0	C	3	3	13	ESTABLISHED
0x00000018	3	0	A	4	14	14	ESTABLISHED

RPC ID : RPC shelf number given by RPOM (RPC ID is displayed in a decimal number.)
RP ID : The number that RPOM gives when organizing RP
SYS ID : RPC discriminates a RP with this number.
FA ID : FA number in RP
SECTOR : The sector number in RP (A : alpha, B : beta, C : gamma)
SAPI : SAPI number of the related RP in LAPD interface
PRI TRK : The physical link number of TRK 16 that takes charge of RP interface
PRI HDLC : HDLC channel number used in RP interface
LAPD STATE: LAPD setup status (Setup: ESTABLISHED, Release: RELEASED)

d. WLL subscriber inquiry command

Display the status of WLL subscriber.

Command : **show-wll-subs:::[iwui];**

Example)

To inquire the subscriber whose IWUI is 0000000072c10061, show-wll-subs:::0000000072c10061;

Display example 1)

Phone service subscriber

[WLL Subscriber Information] USER = [0000000072c10061]

User Type	=	PSTN	Phone service subscriber
Subscription	=	YES	Registration status (Registered: YES, Not registered: NO)
Operational	=	YES	Terminal power On/Off status (Power On : YES, Power Off : NO)
Service Rate	=	32K	Service rate (32K)
L3 Address	=	0x10b (0011)	V5.2 PSTN Layer 3 address (Hex : formatted Layer3 address) (Number) : unformatted layer3 address
RP ID	=	120	RP number (SAPI | FA | SEC)
RIU ID	=	5	RIU number
PORT ID	=	0	PORT number
IWEI	=	[980531a001010061]	International WLL Equipment Identifier (16 digits)
IWUI	=	[0000000072c10061]	International WLL User Identifier (16 digits)
TWUI	=	[00000015]	Temporary WLL User Identifier (8 digits)
WSI	=	4d010061	WLL Subscription Identifier (8 digits)
WASK	=	7f010061	WLL Access Secret Key (8 digits)
HOOK FLASH	=	NO	Whether the subscriber uses additional services (Use: YES, Not use: NO)
BCC State	=	IDLE	Resource status (Seized: ACTIVE, Not seized: IDLE)
Using A-Trunk	=	0	Exchange Interface E1 link number (When the resource is seized)
Using A-Timeslot	=	0	Timeslot number of exchange interface E1 link (When the resource is seized)
Using C-Trunk	=	0	RP interface E1 link number (When the resource is seized)
Using C-Timeslot	=	0	Timeslot number of RP interface E1 link (When the resource is seized)
Using start-bit	=	0	Start bit of sub-timeslot (0: 4 bit in the former part, 4: 4 bits in the latter part)
PSTN Port State	=	[IDLE]	Subscriber call status (IDLE: Initial, CALL IN SVC: Connected)

Display example 2)
Data service subscriber

[WLL Subscriber Information] USER = [0000000072c10062]

User Type	=	ASYNC	Data service subscriber
Subscription	=	YES	Registration status (Registered: YES, Not registered: NO)
Operational	=	YES	Terminal power On/Off status (Power On : YES, Power Off : NO)
Service Rate	=	144K	Service rate (1B subscriber: 64K, 2B subscriber: 144K)
RP ID	=	120	RP number (SAPI | FA | SEC)
RIU ID	=	5	RIU number
PORT ID	=	1	PORT number
IWEI	=	[980531a001010062]	International WLL Equipment Identifier (16 digits)
IWUI	=	[0000000072c10062]	International WLL User Identifier (16 digits)
TWUI	=	[00000016]	Temporary WLL User Identifier (8 digits)
WSI	=	4d010062	WLL Subscription Identifier (8 digits)
WASK	=	7f010062	WLL Access Secret Key (8 digits)
BCC State	=	IDLE	Resource status (Seized: ACTIVE, Not seized: IDLE)
Using C-Trunk	=	0	RP interface E1 link number (When the resource is seized)
Using C-Timeslot	=	0,0	Timeslot number of RP interface E1 link (When the resource is seized)
ASYNC Port State	=	[IDLE]	Subscriber call status (IDLE: Initial, CALL IN SVC: Connected)

e. LE resource inquiry command

Display the status of the timeslot seized by V5.2 interface.

Command : **show-v52-bcc:::abus;**

WLL RPC A-BUS USAGE DISPLAY

'TIM E	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3
SLOT	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
LE 0	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 1	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 2	X	O	O	.	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 3	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 4	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 5	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 6	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 7	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 8	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE 9	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE10	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE11	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE12	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE13	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE14	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LE15	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

X : Resource Unavailable / . : Idle / O : Busy / B : Block

But, the location of the signaling channel is not indicated (Example: V5.2 interface signaling channel)

f. Transcoder resource inquiry command

Display the status of the transcoder seized by the phone service.

Command : **show-v52-bcc:::bbus;**

WLL RPC B-BUS USAGE DISPLAY

TIME	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3
SLOT	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
XV 0	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
XV 1	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
XV 2	X	O	O	.	B	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
XV 3	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
XV 4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV 5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV 6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV 9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
XV15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X : Resource Unavailable / . : Idle / O : Busy / B : Block

g. RP TRK16 link resource inquiry command

Display the status of the timeslot seized by RPC-RP interface.

Command : **show-v52-bcc:::cbus;**

WLL RPC C-BUS USAGE DISPLAY

TIME	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3
SLOT	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
RP 0	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 1	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 2	X	O	O	.	B	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 3	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 4	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 5	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 6	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 7	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 8	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP 9	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP10	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP11	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP12	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP13	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP14	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
RP15	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X

X : Resource Unavailable / . : Idle / O : Busy / B : Block

The seizure of the sub-timeslot is not displayed. (When only four bits are used, it is indicated as Busy (O).)

h. V5.2 PSTN subscriber inquiry command

Display the port information of DV5.2 PSTN subscriber.

Command : **show-v52-db ::: pstn, [port id], info;**

Display example)

PSTN user port 1 information

Layer 3 Address	->	257
Physical Address	->	1
User Port Type	->	PUT_NORMAL
Port Usage	->	S_ACT
Port Status	->	ACTIVE
Call Status	->	NORMAL
Channel Information	->	NOT USED

Note) Port Status->Active Normal port status
P_BLOCKED PORT blocking standby
M_BLOCKED Port blocking by AN
R_BLOCKED Port blocking by the exchange

i. V5.2 E1 link status inquiry command

Display the status of V5.2 E1 link.

Command : **show-v52-db:::lnk;**

Display example)

Interface 0 Variant 0 E1 Link Information

Log. E1	Phy. E1	TYPE	Status	Block State
0	0	PRIMARY	NORMAL	NORMAL
1	1	SECONDARY	NORMAL	NORMAL

j. Inquiry of active/standby status of V5.2 signal channel

Display the E1 link number where a signal channel is allocated, the timeslot number and active/standby status of each protection group.

Command : **show-v52-db:::prtc,0,cch;**

Display example)

SWITCH-OVER C-CHANNEL INFORMATION

GROUP	LINK ID	TS	STATE
PG1	0	16	ACTIVE
PG1	1	16	STANDBY

c. Inquiry of C-path of V5.2 signal channel

Display the logical signal map allocated to each signal channel.

Command : **show-v52-db:::prtc,1,cch;**

Display example)

C-CHANNEL INFORMATION

LINK ID	TS	PG	LOGC	CPATH
0 16	1	1 PSTN CONTROL	LINK-CONTROL	BCC
1 16	1	-1		

<Note 1> Protection Group1 (PG1) has protection c-path
<Note 2> -1 means standby-by c-channel

l. Inquiry of V5.2 variant information

Display the status information for the related variant.

Command : **show-var-d b:::[vairanr id], ifid;**

Display example)

```
RPC/V52> show-var-db:::0,ifid;
  Interface ID                : 0
================================================================
Current Variant ID            : 0
Status                        : ACTIVE
Primary Link ID               : 0
Secondary Link ID             : 1
Interface Type                : V5.2
Protection Type               : GROUP1
Number of E1 Link             : 2
Number of PCCH                : 2
Number of LCCH                : 1
ISDN User Port                : NOT ASSIGNED
PSTN User Port                : 0 <---> 59
Variant ID of Interface 0
[   0]
================================================================
```

m. Inquiry of E1 link information of variant

Display the status information of E1 link allocated to variant.
(1: Signal channel, s: No. 0 synchronization timeslot, 0: Traffic channel)

Command : **show-var-d b:::[variant id], link;**

Display example)

```
E1 LINK | Total : 2
----------------------------------------------------------------
   0| Physical E1 ID : 0  Logical E1 ID : 0  PCCH Num : 1
    | Channel Type : s0000000000000001000000000000000
    | Link Type : PRIMARY
----------------------------------------------------------------
   1| Physical E1 ID : 1  Logical E1 ID : 1  PCCH Num : 1
    | Channel Type : s0000000000000001000000000000000
    | Link Type : SECONDARY
================================================================
```

n. Inquiry of the logical channel of variant

Display the information of logical channel set up in the variant.

Command : **show-var-db:::[variant id]. lcch;**

Display example)

```
RPC/V52> show-var-db:::0,lcch;
LCCH | Total : 1
-------------------------------------------------------------------------
  0                          | Logical C-CH ID    : 1
                             | Logical Link ID    : 0
                             | Time Slot Number   : 16
                             | C-Path Map Flag    : PSTN CONTROL
LINK-CONTROL BCC
                             | C-Path Number      : 4
                             | Protection Group   : 1
=========================================================================
```

o. Inquiry of physical channel status of the variant

Display the status of the physical signal channel set up in the related variant.

Command : **show-var-db:::[variant id], pcch;**

Display example)

```
RPC/V52> show-var-db:::0,pcch;
PCCH | Total : 2
-------------------------------------------------------------
0| Usage : ACTIVE
| Physical Link ID : 0  Logical Link ID : 0  Timeslot : 16
| lcch ID : 1   Protection Group : 1
-------------------------------------------------------------
1| Usage : STANDBY
| Physical Link ID : 1  Logical Link ID : 1  Timeslot : 16
| lcch ID : -1  Protection Group : 1
=============================================================
```

5.3 RPC-TRK16

(1) TRK16 software

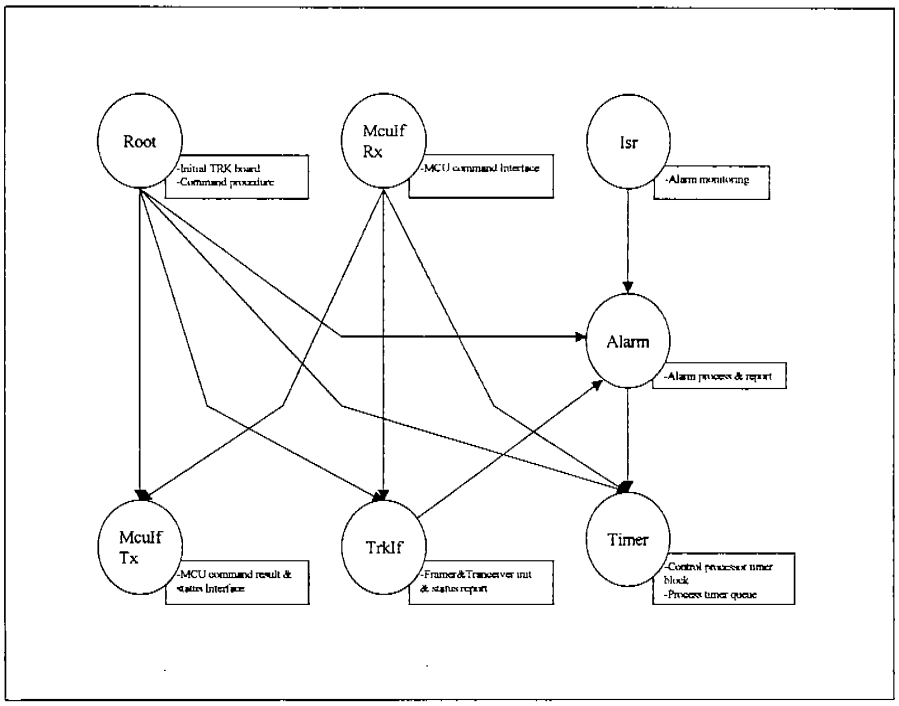


Figure 3-33. TRK16 software configuration diagram

A. Root task
- TRK16 board Initial.
- Load Initial Param.
- User Command Process.

B. MCU If Rx task
- MCU Command Interface.

C. MCU If Tx task
- MCU Command Interface.
- TRK16 Status Report to MCU.

D. Trk If task
- Framer/Transceiver Device Init.
- Physical Status Monitor.

E. Alarm task
- Physical Status Report to MCU

F. Timer task
- Control Processor Timer block.
- Process Timer Queue.

G. ISR
- Interrupt Service.
- Alarm Monitoring.

(2) RPC-TRK16 execution module loading system
① RPC-TRK16 execution module is downloaded to the application flash ROM through the Rpom or the front panel console.
② It is loaded to SRAM according to the control of Root Program.
③ When the execution module is downloaded through the front panel console, TRK16 board is started from the restart mode.

(3) Functions of each RPC-TRK16 module

A. Basic functions
- Verify and report the physical connection of E1 trunk with the exchange and the physical status of E1 trunk.
- Verify and report the physical connection of E1 trunk with RP and the physical status of E1 trunk.

B. Status verification

a. Front panel LED

❑ **STS Led**
- Green in the normal status
- Red in the abnormal status.

❑ **Channel Led**
- Trunk ACT: Green
- Trunk STB: Off
- Trunk Loss: Red
- When the trunk remote alarm indicate is being received: Green blinks
- When the trunk AIS is being received: Red blinks

b. Front panel console

❑ **"show-trk;"**
Verify the current trunk ACT/STB status and LED status.

❑ **"show-alarm;"**
Verify the status of the alarm displayed in the E1 interface device.
- OOCMF/OOF : Loss of Sync
- RED : Loss of Data
- AIS : Blue alarm
- RRA : Yellow alarm
- LOS : Loss of Data
- RAIS : RAI Send (Ch LED indicates normal. No alarm report)

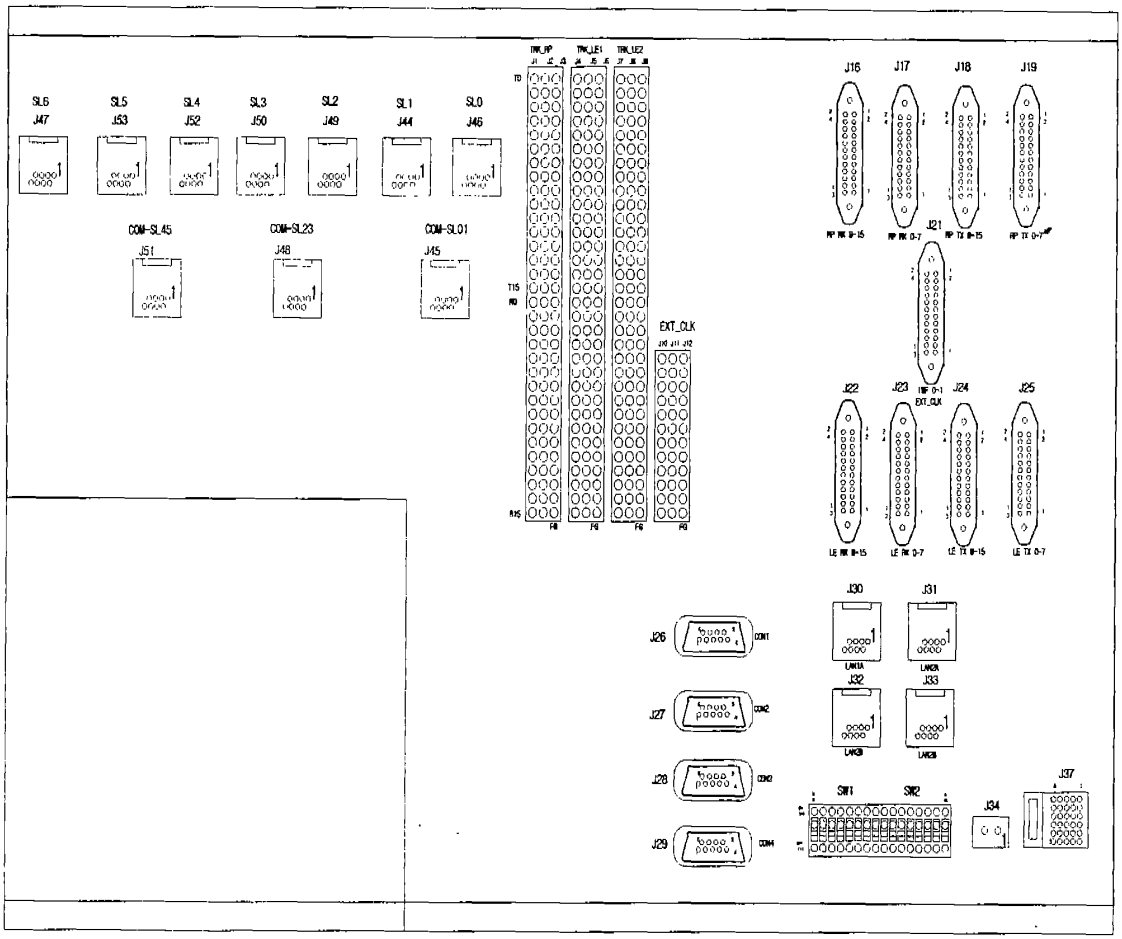
❑ **"show-pm;"**
The current status of performance monitor of each trunk

❑ **"show-lpbk;"**
The current loopback status of each trunk: LL/RL

5.4 RPC-PDRU

(1) PDRU software
(2) RPC-PDRU execution module loading system
(3) Functions of each RPC-PDRU module

6. Switching Shelf Backside



6.1 Description on the backside connector

(1) E1 trunk connection connector between the exchange and RP (25 PIN CHAMP CONNECTOR)

J19 →Interface CONN between RPC and RP (RPC transmission 0-7 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	RIUT-T0 /*transmit0*/	14	RIUT-T4
3	RIUT-R0 /*transmit0*/	15	RIUT-R4
4	RIUT-T1	16	RIUT-T5
5	RIUT-R1	17	RIUT-R5
6	RIUT-T2	18	RIUT-T6
7	RIUT-R2	19	RIUT-R6
8	RIUT-T3	20	RIUT-T7
9	RIUT-T3	21	RIUT-T7
10		22	
11		23	
12	FGND	24	FGND

J18 →Interface CONN between RPC and PR (RPC transmit 8-15 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	RIUT-T8 /*Receive0*/	14	RIUT-T12
3	RIUT-R8 /*Receive0*/	15	RIUT-R12
4	RIUT-T9	16	RIUT-T13
5	RIUT-R9	17	RIUT-R13
6	RIUT-T10	18	RIUT-T14
7	RIUT-R10	19	RIUT-R14
8	RIUT-T11	20	RIUT-T15
9	RIUT-T11	21	RIUT-T15
10		22	
11		23	
12	FGND	24	FGND

J17 → Interface CONN between RPC and RP (RPC receive 0-7 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	RIUR-T0	14	RIUR-T4
3	RIUR-R0	15	RIUR-R4
4	RIUR-T1	16	RIUR-T5
5	RIUR-R1	17	RIUR-R5
6	RIUR-T2	18	RIUR-T6
7	RIUR-R2	19	RIUR-R6
8	RIUR-T3	20	RIUR-T7
9	RIUR-T3	21	RIUR-T7
10		22	
11		23	
12	FGND	24	FGND

J16 → Interface CONN between RPC and RP (RPC receive 8-15 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	RIUR-T8	14	RIUR-T12
3	RIUR-R8	15	RIUR-R12
4	RIUR-T9	16	RIUR-T13
5	RIUR-R9	17	RIUR-R13
6	RIUR-T10	18	RIUR-T14
7	RIUR-R10	19	RIUR-R14
8	RIUR-T11	20	RIUR-T15
9	RIUR-T11	21	RIUR-T15
10		22	
11		23	
12	FGND	24	FGND

J25 → Interface CONN between RPC and LE (RPC transmit 0-7 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	EIUT-T0	14	EIUT-T4
3	EIUT-R0	15	EIUT-R4
4	EIUT-T1	16	EIUT-T5
5	EIUT-R1	17	EIUT-R5
6	EIUT-T2	18	EIUT-T6
7	EIUT-R2	19	EIUT-R6
8	EIUT-T3	20	EIUT-T7
9	EIUT-T3	21	EIUT-T7
10		22	
11		23	
12	FGND	24	FGND

J24 → Interface CONN between RPC and LE (RPC transmit 8-15 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	EIUT-T8	14	EIUT-T12
3	EIUT-R8	15	EIUT-R12
4	EIUT-T9	16	EIUT-T13
5	EIUT-R9	17	EIUT-R13
6	EIUT-T10	18	EIUT-T14
7	EIUT-R10	19	EIUT-R14
8	EIUT-T11	20	EIUT-T15
9	EIUT-T11	21	EIUT-T15
10		22	
11		23	
12	FGND	24	FGND

J23 → Interface CONN between RPC and LE (RPC receive 0-7 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	EIUR-T0	14	EIUR-T4
3	EIUR-R0	15	EIUR-R4
4	EIUR-T1	16	EIUR-T5
5	EIUR-R1	17	EIUR-R5
6	EIUR-T2	18	EIUR-T6
7	EIUR-R2	19	EIUR-R6
8	EIUR-T3	20	EIUR-T7
9	EIUR-T3	21	EIUR-T7
10		22	
11		23	
12	FGND	24	FGND

J22 → Interface CONN between RPC and LE (RPC receive 8-15 LINE)

Pin Num	Signal Name	Pin Num	Signal Name
1	FGND	13	FGND
2	EIUR-T8	14	EIUR-T12
3	EIUR-R8	15	EIUR-R12
4	EIUR-T9	16	EIUR-T13
5	EIUR-R9	17	EIUR-R13
6	EIUR-T10	18	EIUR-T14
7	EIUR-R10	19	EIUR-R14
8	EIUR-T11	20	EIUR-T15
9	EIUR-T11	21	EIUR-T15
10		22	
11		23	
12	FGND	24	FGND

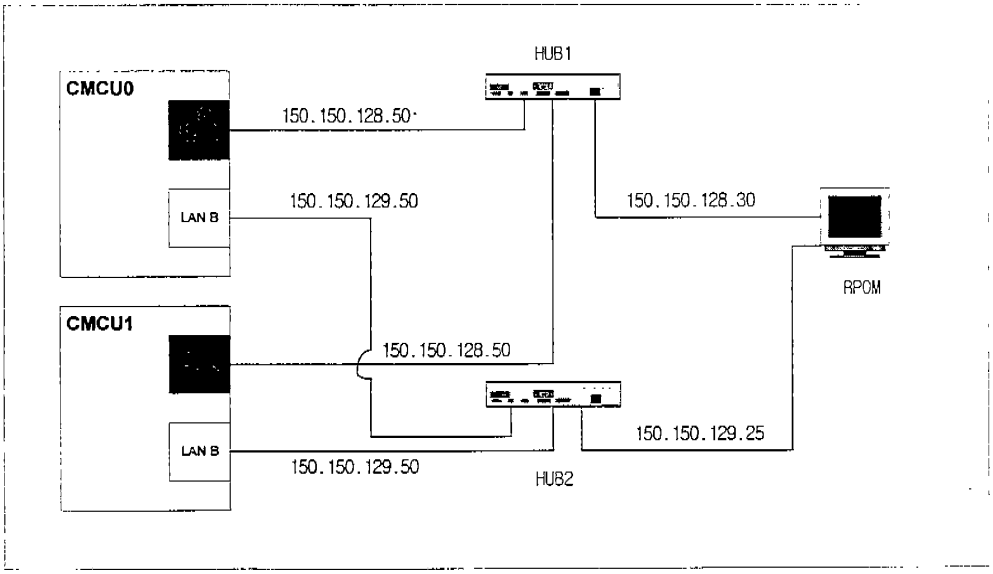
(2) LAN connection connector between CMCU and RPOM

Reference	Name	Description
J30	LAN1A	A side LAN signal output from CMCU0 Slot
J31	LAN1B	B side LAN signal output from CMCU0 Slot
J32	LAN2A	A side LAN signal output from CMCU1 Slot
J33	LAN2B	B side LAN signal output from CMCU1 Slot

- **RJ45 Connector pin description**

Pin	Name	Description
1	TXDP	Transmission positive
2	TXDN	Transmission negative
3	RXDP	Receive positive
4		
5		
6	RXDN	Receive negative
7		
8		

- **Example of the configuration with RPOM**



As the figure shows, A/B two ports are out from the redundant CMCU0/1 and the two ports use two HUBs and configure each independent network connected to RPOM.

(3) PDP alarm connector (J37) description

NO	Net name	IN/OUT	Description
1 pin of A column	ACO_IN	IN	Signals incoming when ACO operates in PDP
2 pin of A column	BUZZ	OUT	Signals outgoing to PDP in order to operate the buzzer
3 pin of A column	MAJ_LED	OUT	Signals to switch on MAJ LED in the shelf
4 pin of A column	-48VA_FLT	IN	PGND input when PDP input –48 A power is off
6 pin of A column	++COMMON	IN	+5V power supplied from PDP to shelf
4 pin of B column	-48VB_FLT	IN	PGND input when PDP input –48 B power is off.
6 pin of B column	++COMMON	IN	+5V power supplied from PDP to shelf
1 pin of D column	ACO_OUT	OUT	Signals to operate ACO in the shelf
2 pin of D column	MIN_LED	OUT	Signals to switch on MIN LED in the shelf
3 pin of D column	CRI_LED	OUT	Signals to switch on CRI LED in the shelf
4 pin of D column	CBA_LED	IN	PGND input when CB A of SYS is off
4 pin of E column	CBB_LED	IN	PGND input when CB B of SYS is off
5 pin of E column	UNIT_DET	IN	PGND input when ALMU is deleted.

(4) FAN alarm connector (J34) description

NO	Net name	IN/OUT	Description
1	VCC	IN	+5V power supplied from FAN
2	FAN_FLT	IN	PGND input in case of FAN fault

(5) RPC shelf ID setting switch (SW1, SW2)

From the backside, the far-left part of SW array is D0. When the switch is up, the switch is ON (0). When the switch is down, it is OFF (1).

The following describes each bit.

BIT	Description
D0~1	SHELF ID: When many shelves are inserted in RPC rack, the very bottom shelf is given its ID first.
D2~7	ID given for each RPC that RPOM manages
D8~15	Reserved

RPC IP address based on the above switch setting is as follows.

LANA	150.150.128.d0~7 : HEX value
LANB	150.150.130.d0~7 : HEX value

(6) RS232 connector (J26~29)

- **It is a reserved connector that is not in use now.**

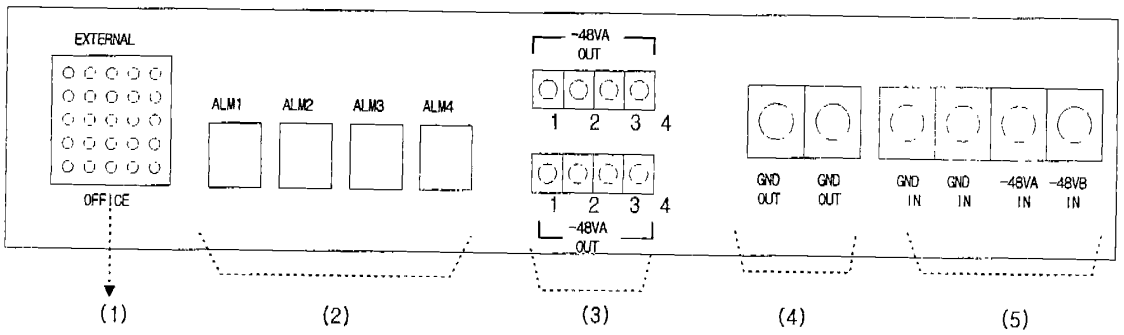
(7) Description of LAN connector for PDRU

Sign	Description	
J46	LAN signal incoming when PDRU is configured as SINGLE in SSL0.	
J44	LAN signal incoming when PDRU is configured as SINGLE in SSL1.	
J49	LAN signal incoming when PDRU is configured as SINGLE in SSL2.	
J50	LAN signal incoming when PDRU is configured as SINGLE in SSL3.	
J52	LAN signal incoming when PDRU is configured as SINGLE in SSL4.	
J53	LAN signal incoming when PDRU is configured as SINGLE in SSL5.	
J47	LAN signal incoming when PDRU is configured as SINGLE in SSL6.	
J45	Signals incoming to two slots when PDRU is configured as redundant in SSL0 and SSL1.	
J48	Signals incoming to two slots when PDRU is configured as redundant in SSL2 and SSL3.	
J51	Signals incoming to two slots when PDRU is configured as redundant in SSL4 and SSL5.	

PDRU can be inserted to all the slots from SSL0 to SSL6 and the operators can configure each slot as single or redundant.

7. Power Distribution and Alarm Panel (PDP)

7.1 PDP front configuration



(1) Front configuration description

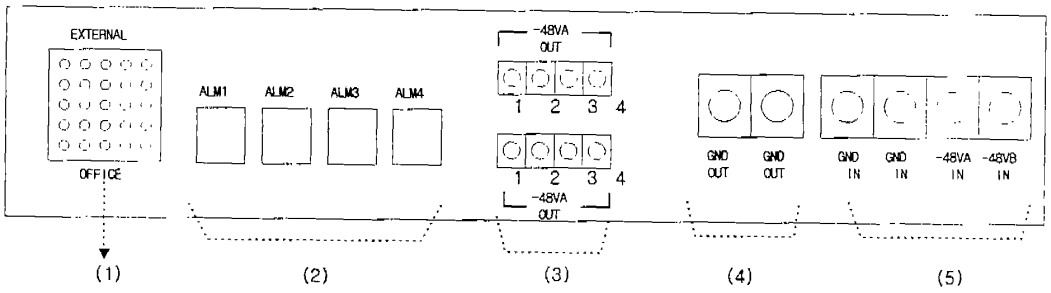
A. Green light is turned on when MAIN –48 A/B power that leads in to the backside of PDP is supplied normally.

B. SYS1/2/3/4 are the circuit breakers that can switch on and off –48 power for the four RPC shelves equipped in RPC rack. If it is upward, the switch is on. If it is downward, the switch is off. The switch is automatically turned off in case of overcurrent.
SYS1 corresponds to the very bottom shelf of the rack.
There are two A/B breakers and each one of MAIN A/B can be switched on/off.

C. CRI/MAJ/MIM→This lamp provides visible information on the alarms generated in the entire RPC rack for the operators.
ACO → With this switch, the operators can cut off the alarm sound of audible alarms.

D. ALMU → This unit controls the entire PDP. It can be inserted or deleted.

7.2 PDP backside configuration



(1) Backside configuration description

A. It is the rapping terminal connected to the external alarm office.

B. Connected to the alarm terminal of RPC switch shelf (J103), this connector concentrates the alarms from each shelf and exchanges the signals required to generate visible and audible alarms. ALM1 is connected to the very bottom shelf of the rack.

❑ Pin description

NO	Net name	IN/OUT	Description
1 pin of A column	ACO_OUT	OUT	PGND output when ACO operates in PDP
2 pin of A column	BUZZ	IN	Signals incoming from the shelf that operates the buzzer
3 pin of A column	MAJ_LED	IN	Signals to switch on MAJ LED in the shelf
4 pin of A column	-48VA_FLT	OUT	PGND output when PDP input –48 A power is off
6 pin of A column	++COMMON	OUT	+5V power supplied from PDP to shelf
4 pin of B column	-48VB_FLT	OUT	PGND output when PDP input –48 B power is off.
6 pin of B column	++COMMON	OUT	+5V power supplied from PDP to shelf
1 pin of D column	ACO_IN	IN	Signals to operate ACO in the shelf
2 pin of D column	MIN_LED	IN	Signals to switch on MIN LED in the shelf
3 pin of D column	CRI_LED	IN	Signals to switch on CRI LED in the shelf
4 pin of D column	CBA_LED	OUT	PGND output when CB A of SYS is off
4 pin of E column	CBB_LED	OUT	PGND output when CB B of SYS is off
5 pin of E column	UNIT_DET	OUT	PGND output when ALMU is deleted.

C. It supplies the power from MAIN –48 A/B to each shelf. It is redundant with A and B. No.1 is provided to the very bottom shelf of the rack. And the rack is supplied to the BUS BAR.

D. It is GND (-48V) supplied to each shelf and connected to the bus bar of the rack.

E. It is MAIN –48V A/B supplied from the outside.

Wideband – WLL

Hardware Manual

Radio Port
(PART Ⅳ)

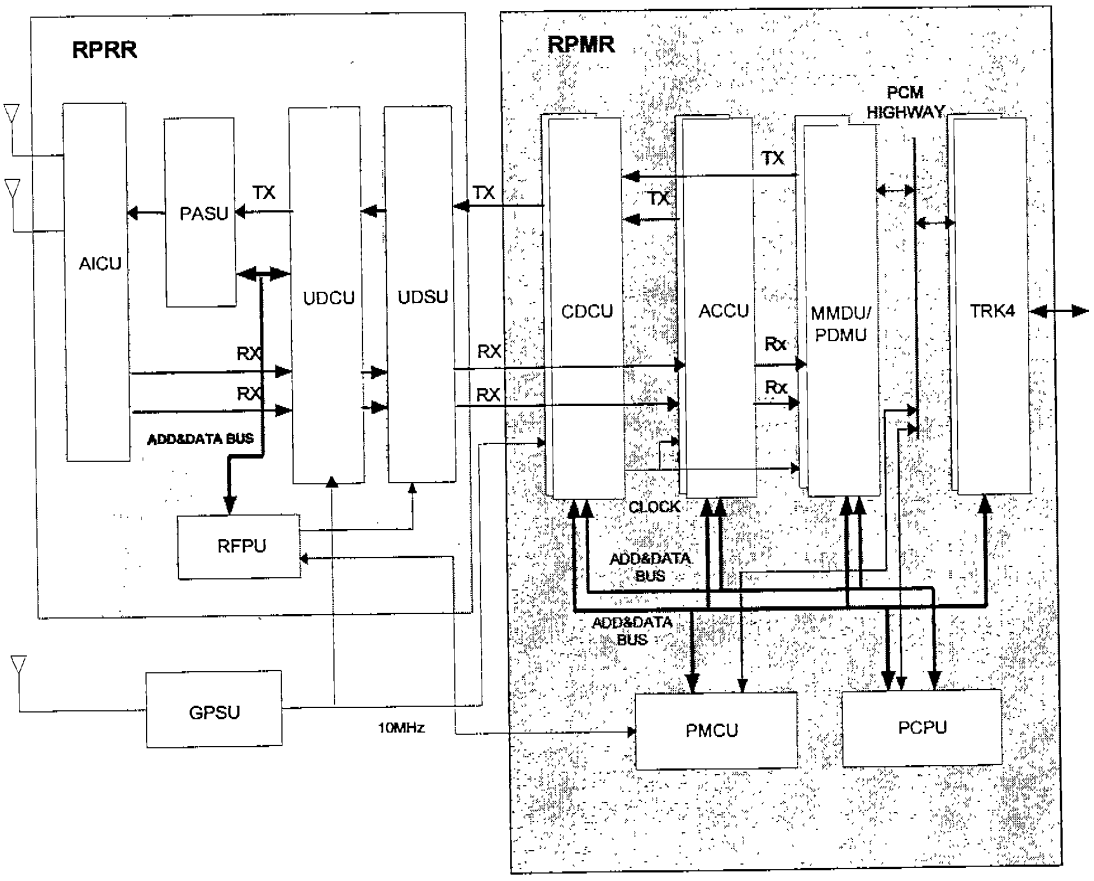
SMD-010-HWA210
01(01)/200010/1.0

PART IV Radio Port

1. RP Introduction

RP interfaces with Radio Port Controller (RPC) and interfaces with the subscriber terminal by using the Wideband Code Division Multiple Access (W-CDMA) technology and finally forms the subscriber data path from the terminal to RPC.

2. RP Configuration

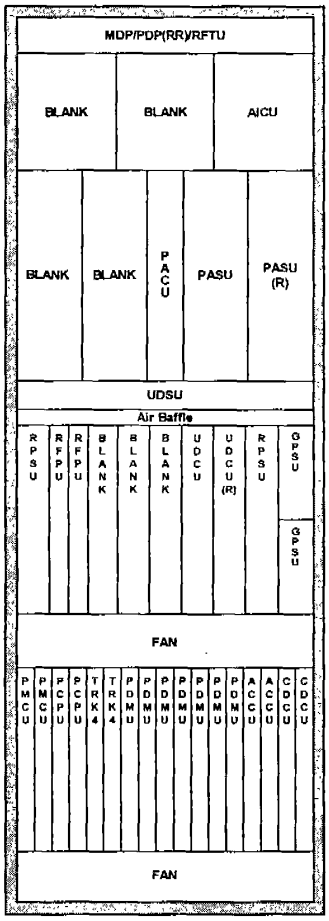


3. RP Specification

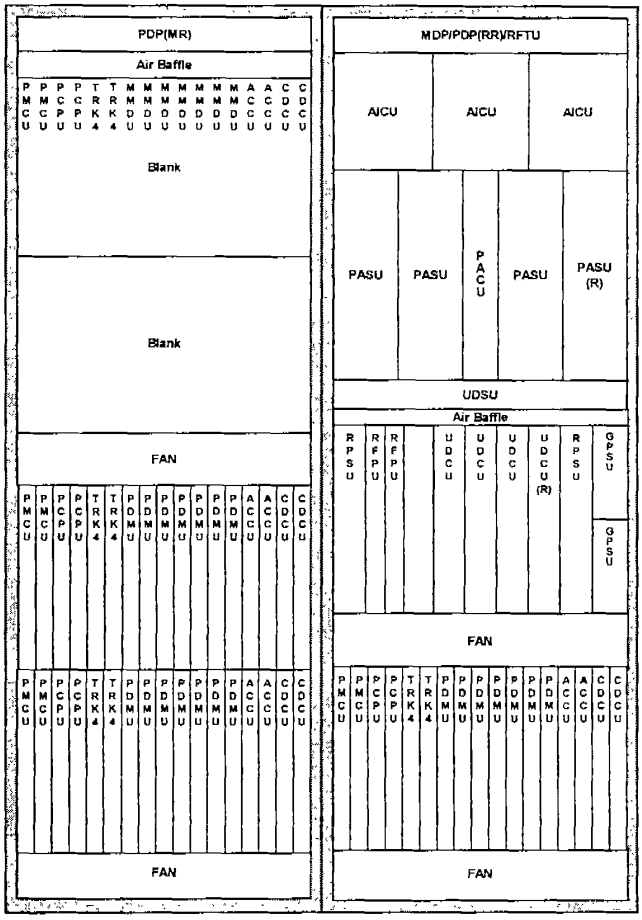
- Receive frequency : 2.30 GHz ~ 2.33 GHz
- Transmit frequency : 2.37 GHz ~ 2.40 GHz
- Range of frequency separation : 250 KHz
- Maximum power output : ≤20W/Sector/FA
- Maximum valid isotropic emitting power : ≥125W
- Channel bandwidth : 10 MHz / 1FA
- Channel interval : 10 MHz / 1FA
- Frequency stability : ± 0.1 ppm
- Tx/Rx duplex mode : FDD
- Tx/Rx difference frequency : 70 MHz
- Multiple access : DS-CDMA (W-CDMA)
- Demodulation/modulation : QPSK
- Receive sensitivity : -117 dBm
- Gain attenuation range : Minimum 60 dB
- Receiver noise figure : ≤4 dB
- Channel capacity : 56 channel /1FA/1Sector(32 kbps, ADPCM)
- Number of FAs : 2FA / sector, Omni
- Number of trunks : 3E1 / sector, Omni

4. RP Hardware Configuration

4.1 1FA/1Sector and 2FA/3Sector installation diagram

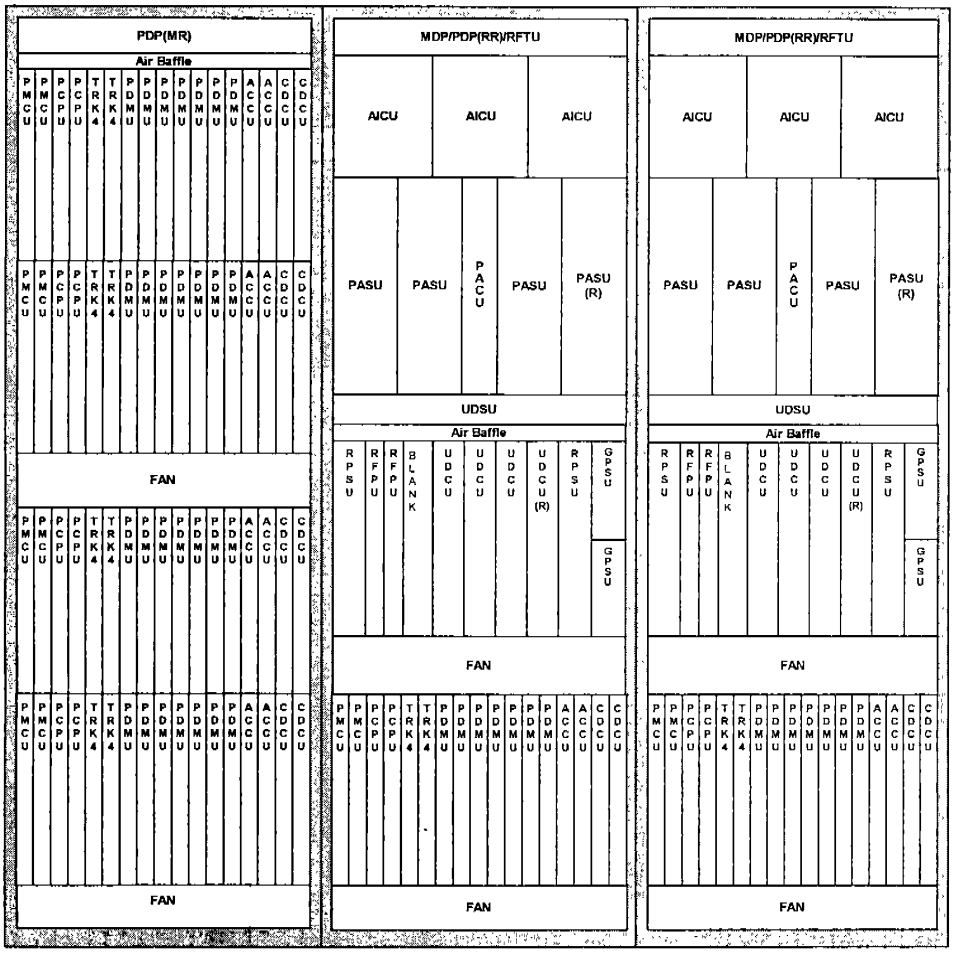


<1FA/1Sector



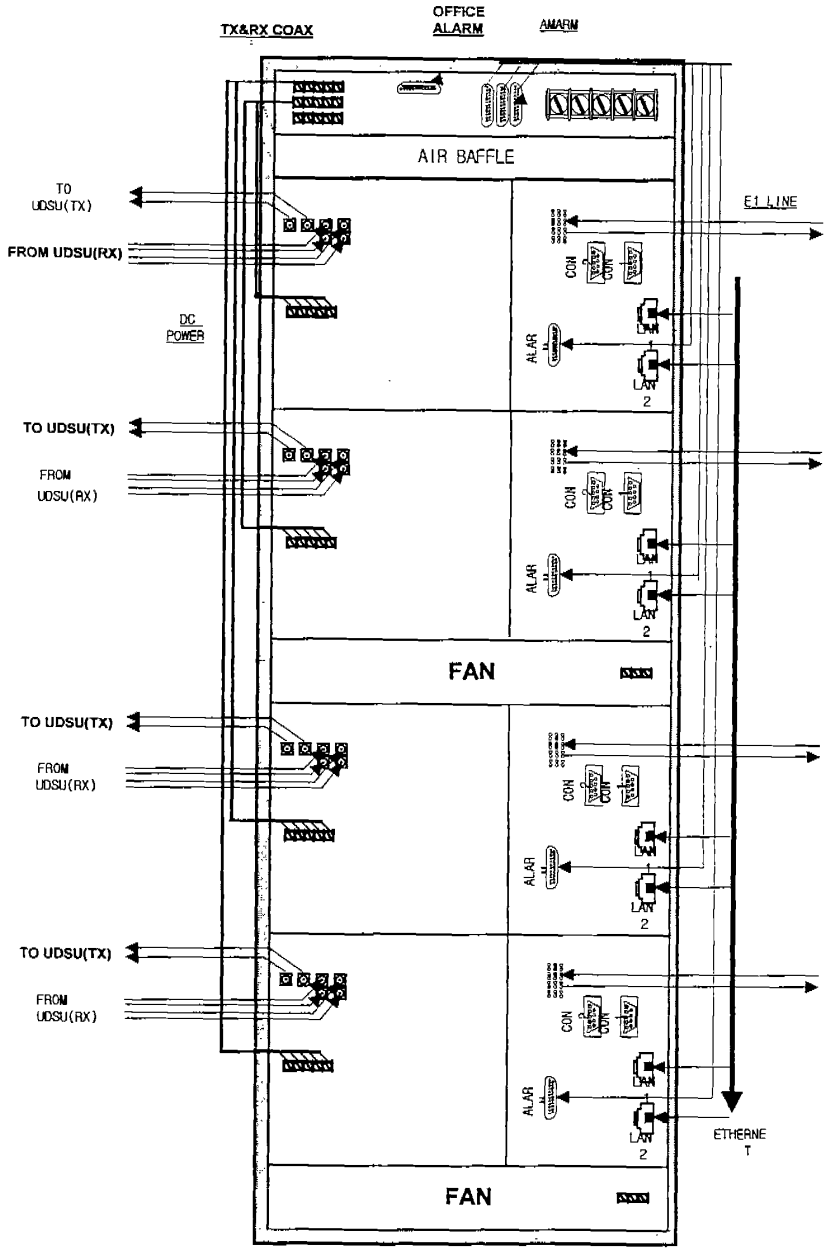
<1FA/

4.2 2FA/3Sector installation diagram

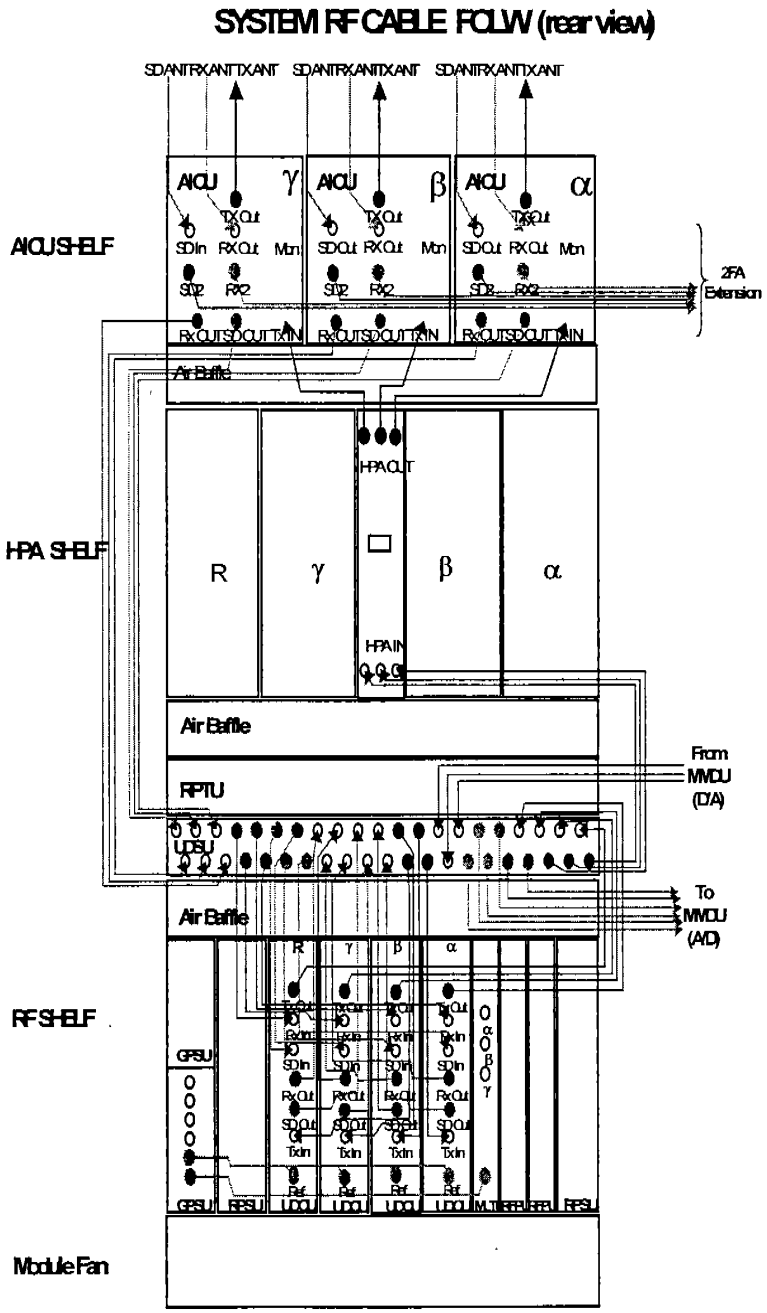


4.3 RP wiring diagram

(1) Modem rack



(2) RF rack wiring diagram



5. Functions of Each RP Hardware

5.1 rP Main Control Unit (PMCU)

(1) PMCU overview

PMCU initializes the hardware of all cards mounted in the RP system and after that, it initializes the software to the initialized hardware. It also reports faults and alarms to RPOM through NMS channel and RPC and provides the communication path between RFPU and RPC in order to monitor the status of each RP card.

- **Initializes cards and manages the card status.**
- **Manages faults and reports them to RPOM through RPC and stores the fault status.**
- **Connects to NMS and RPC through E1 link and reports card status to the system RPOM.**
- **Stores the software of each card and downloads the software.**
- **Manages and controls the alarms of the centralized alarm panel.**
- **Provides the redundancy switchover.**
- **Provides RPC and NMS channel (one timeslot of E1) for communication.**

- **Interfaces with RPC**

  PMCU interfaces with RPC through E1 line. PMCU reports various faults of the system and the status changes and responds to the request for the system operation information.

- **Interface with RFPU**

  PMCU receives the data on faults and status changes from the RF module and transmits the data to RPC. It also receives the request for the operation status information from RPC and transmits it to RF module.

- **Interface with the environment monitoring unit**

  PMCU receives the data from the environment monitoring unit and transmits it to the high-level network element.

(2) Description on PMCU front LED

Name	Color	Status
TS	RED	The board is disabled.
	GREEN	The board is enabled.
ACT	GREEN	The board is active.
STB	GREEN	The board is standby.
CRT	RED	It is turned on when there are alarms affecting the system seriously.
MAJ	RED	It is turned on when there are alarms affecting the system.
MIN	YELLOW	It is turned on when services are maintained in spite of alarms.
ACO	GREEN	It is turned on when the audible alarms are blocked.

5.2 rP Call Processing Unit (PCPU)

(1) PCPU overview

PCPU manages indirectly MMDU, ACCU, and CDCU through PMCU and reflects the management to the system resource management. It also sets up and changes RP wireless parameters and takes charge of call processing control and statistics through the wireless call processing protocol.

- **Card status sharing**
  PCPU shares the board insertion/deletion information and the board redundancy status information with PMCU through the shared memory, and it monitors the board status periodically.

- **Voice call and data call processing**
  PCPU interfaces with RPC through LAPD and processes wireless voice calls and data calls.

- **Wireless call processing protocol**
  All wireless calls are processed based on the wireless access specification (CAI protocol).

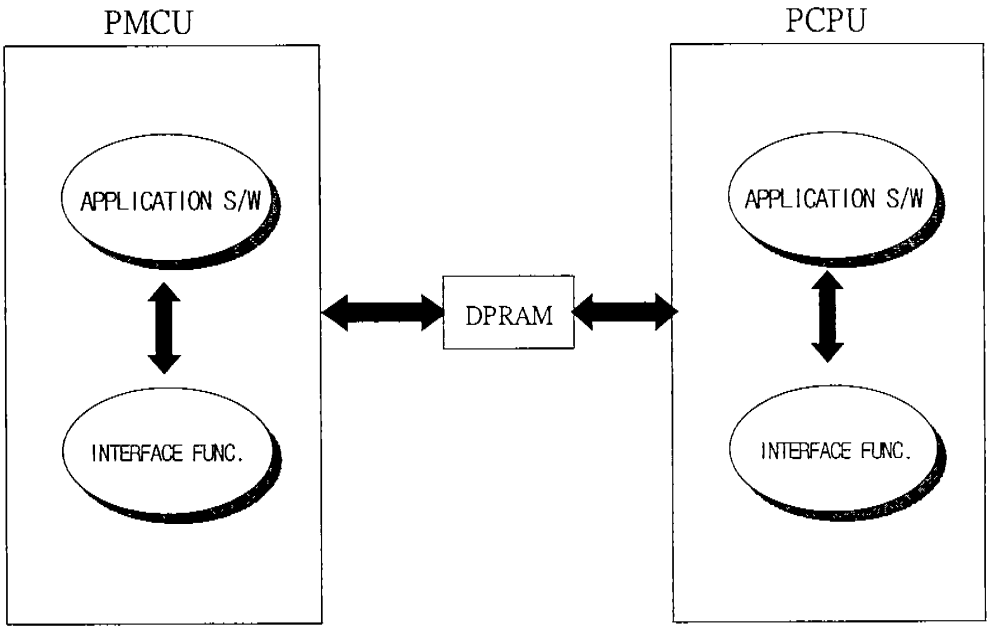
- **RP wireless parameter control and setup**
  PCPU controls and sets up the wireless parameters (SYNC, PAGING, PILOT, BASEPNSEED, etc) between RP and the subscriber terminals.

- **Modem channel management and call processing statistics**
  PCPU manages the channel status of the modem channel board (MMDU) and provides call processing statistics and reports including call attempts/success/failures.

- **Software downloading**

- **Redundancy switchover**

(2) PCPU configuration



(3) Description on PCPU front LED

Name	Color	Status
STS	RED	The board is disabled.
	GREEN	The board is enabled.
ACT	GREEN	The board is active.
STB	GREEN	The board is standby.

5.3 Trunk 4-channel (TRK4)

(1) TRK4 overview

TRK4 unit converts unipolar data from MMDU unit into multipolar pulse and transmits the pulse to RPC and converts the multipolar pulse from RPC into the unipolar data to send to MMDU. TRK4 monitors the status of each trunk in units and when a trunk status is not normal, it issues alarms and reports the status to the system. For the trunk and unit tests, TRK4 performs loopback for local and remote stations and transmits remote station alarms.

- **Provides for E1 channels for each unit**
- **Supports HDB3 or AMI line code**
- **G.704 2048Kbit/s E1 frame interface**
- **Monitors the errors of CRC, HDB3, and frame word.**

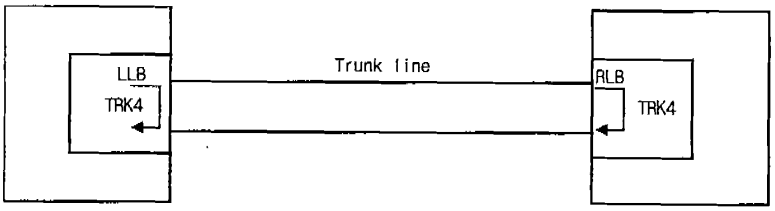
- **Line monitoring and alarms**

  If there are too many 0 in the data received from the remote station or if there are no received data due to the line snapping, the regeneration of the clock is not possible. Therefore, when TRK4 detects NO DATA, it issues alarms and turns on red LED of the related channel.

- **Remote station Alarm Interface (RAI)**
- **CCS Signaling support**

- **Loopback (LLB, RLB)**

  TRK4 can perform Local LoopBack (LLB) and Remote LoopBack (RLB) for the digital terminals for the testing of each line and unit.



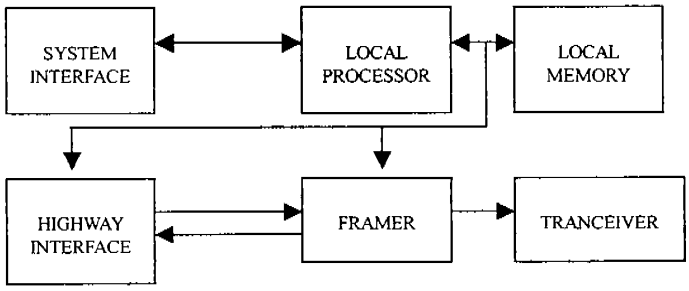
<TRK4 loopback configuration diagram >

- **Channel Loopback**

- **Software downloading**

(2) TRK4 configuration

The configuration of TRK4 is as follows.



(3) TRK4 description

- **System interface:**
  : It interfaces between PMCU and the local processor through DPRAM and the buffer.
- **Highway interface**
  : It connects the system highway to the framer.
- **Local processor**
  : It is the main control processor of TRK4. It processes alarms and controls the framer and the transceiver.
- **Framer**
  : It frames or deframes E1.
- **Local memory**
  : This memory consists of the flash memory and SRAM where the boot program and application programs are stored.
- **Transceiver**
  : It performs the line interface function

(4) Descriptions on TRK4 front LED

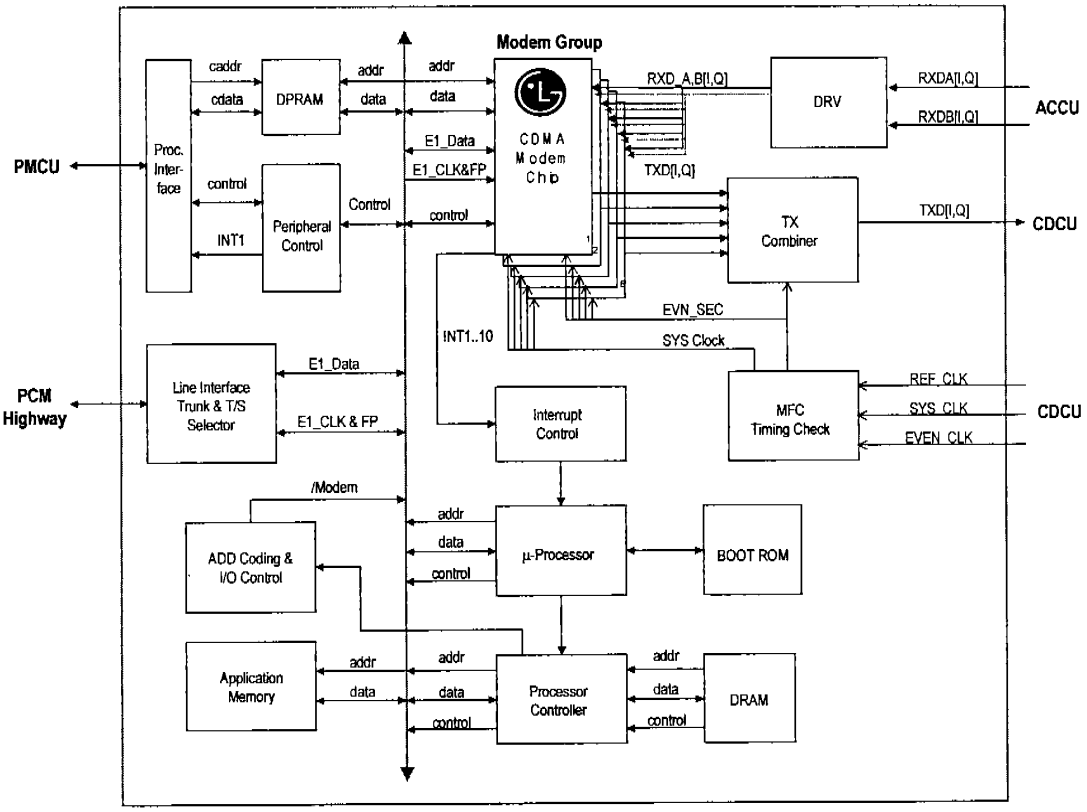
Name	Color	Status
STS	RED	The internal TRK4 is initialized or disabled.
	GREEN	TRK4 is enabled
CH0 ~ CH3	OFF	Channel is standby.
	RED	No data or loss of sync is received
	GREEN	Channel is active.
	GREEN blinks	The remote station alarm is received.

5.4 Multi MoDem Unit (MMDU)

(1) MMDU overview

MMDU processes the signals of the physical layer corresponding to each W-CDMA code channel and the wireless access protocol.

(2) MMDU configuration



(3) MMDU description

MMDU consists of the followings. W-CDMA modem ASIC, the peripheral controller in charge of the interface with the high-level processor PMCU, the entire board control, and the inner-board peripheral device control, the processor controller responsible for the processor and memory control, the interrupt controller, the TX-combiner responsible for the combiner of the forward link parallel data, the reverse link data driver, the timeslot and trunk select responsible for the PCM highway interface of E1 data, the Multi Frequency Control (MFC) timing check, and the timing distribution

- **Input voltage: –48VDC (± 20%, 60W)**
- **Output voltage: +5V, +3.3V**

- **Functions of the modem ASIC group**
  - It processes the signals of the physical layer and the wireless access protocol.
  - Functions of the forward link hardware
    . Traffic channel generation
    . Signal channel generation
    . Power control signal generation
    . Reverse TX signal generation
    . E1 data Interface
  - Functions of the reverse link hardware
    . Detection of the initial pilot synchronization
    . Detection of neighboring cell synchronization in case of channel change
    . Detection of the terminal transmission access channel
    . Detection of the terminal transmission PPCS
    . Detection of the terminal transmission traffic channel
    . Synchronization tracking based on the terminal movement and the wireless channel characteristics
    . Multi-path signal division based on the wireless channel characteristics
    . Multi-path signal combining
    . Antenna diversity

- **Functions of TX Combiner**
  The digital Combiner divides the forward link baseband digital signals from W-CDMA modem ASIC into I & Q and combines and saturates them.

- **Functions of Multi Frequency Control (MFC) and Timing Check Block**
  Timing Generation Logic is allocated with Reference_Clock, System_Clock, and Even_Clock from CDCU and generates the clock signals necessary for W-CDMA ASIC by using PLL function and distributes the signals to each ASIC.

- **Functions of Line Interface Trunk & Time-Slot Selector**
  It selects a timeslot of a highway among PCM highways and transmits its data through the highway.

- **Interface with other units**
  - CDCU interface
    . Clock receiving: System Clock 8.192 MHz, 16.384 MHz
    Even Sec two seconds,
    GPS Clock 10 MHz
    E1 Clock 4 MHz
    Frame Pulse 8K
    . CDMA Forward Link Parallel transmit 8.192M Data

  - ACCU interface
    . CDMA Reverse Link receive 32.768M ECL Data
  - TRK4 interface
    . PCM Highway Data of E1 data
  - PCPU, PMCU interface
    . DPRAM

(4) Description on MMDU front LED

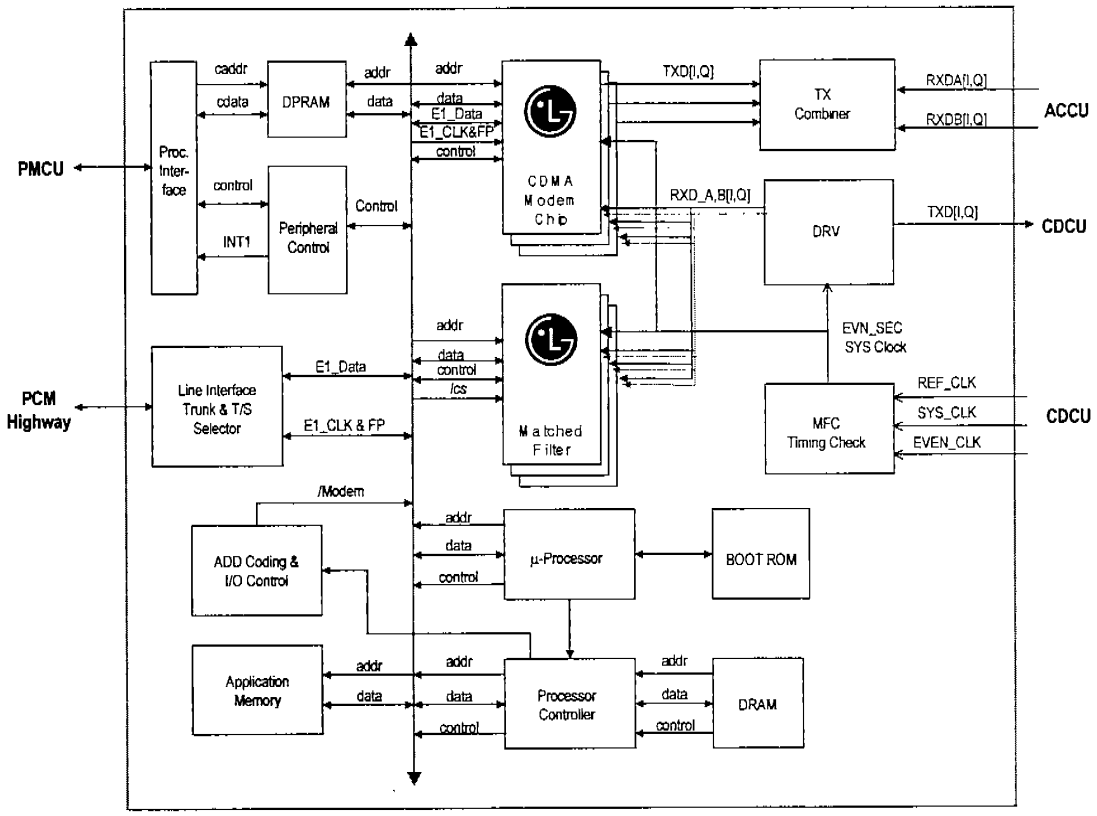
Name	Color	Status description
STS (bicolor)	Green	MMDU operates normally.
	Red	MMDU operates abnormally
CH 0	Green	Channel-1 reception lock is normal.
CH 1	Green	Channel-2 reception lock is normal.
CH 2	Green	Channel-3 reception lock is normal.
CH 3	Green	Channel-4 reception lock is normal.
CH 4	Green	Channel-5 reception lock is normal.
CH 5	Green	Channel-6 reception lock is normal.
CH 6	Green	Channel-7 reception lock is normal.
CH 7	Green	Channel-8 reception lock is normal.

5.5 Packet Data MoDem Unit (PDMU)

(1) PDMU overview

PDMU processes the signals of the physical layer of each W-CDMA code channel and the wireless access protocol.

(2) PDMU configuration



(3) PDMU description

PDMU processes the signals of the physical layer in the specification for the wireless local loop corresponding to each W-CDMA code channel and processes the wireless access protocol. It consists of three W-CDMA modem ASIC (3 channels), the matched filter that detects the access signals, the peripheral controller responsible for the interface with the high-level processor PMCU, the entire board control, and the inner-board peripheral device control, the processor controller responsible for the processor and memory control, the interrupt controller, the TX-combiner responsible for the combiner of the forward link parallel data, the reverse link data driver, the timeslot and trunk select responsible for the PCM highway interface of E1 data, the Multi Frequency Control (MFC) timing check, and the timing distribution.

- **Input voltage: –48 VDC (± 20%, 60 W)**
- **Output voltage: +5 V, +3.3 V**

- **Functions of W-CDMA modem ASIC group**
  - It processes the signals of the physical layer and the wireless access protocol.
  - Functions of the forward link hardware
    . Traffic channel generation
    . Signal channel generation
    . Power control signal generation
    . Reverse TX signal generation
    . E1 data Interface
  - Functions of the reverse link hardware
    . Detection of the initial pilot synchronization
    . Detection of neighboring cell synchronization in case of channel change
    . Detection of the terminal transmission access channel
    . Detection of the terminal transmission PPCS
    . Detection of the terminal transmission traffic channel
    . Synchronization tracking based on the terminal movement and the wireless channel characteristics
    . Multi-path signal division based on the wireless channel characteristics
    . Multi-path signal combining
    . Antenna diversity

- **Functions of TX Combiner**
  The digital Combiner divides the forward link baseband digital signals from W-CDMA modem ASIC into I & Q and combines and saturates them.

- **Functions of Multi Frequency Control (MFC) and Timing Check Block**
  Timing Generation Logic is allocated with Reference_Clock, System_Clock, and Even_Clock from CDCU and generates the clock signals necessary for W-CDMA ASIC by using PLL function and distributes the signals to each ASIC.

- **Functions of Line Interface Trunk & Time-Slot Selector**
  It selects a timeslot of a highway among PCM highways and transmits its data through the highway.

- **Functions of access CDMA demodulator**
  - Receive 32M data
  - Matched Filter
  - Extracts the synchronization signals and access data.

- **Interface with other units**
  - CDCU interface
    . Clock receiving: System Clock 8.192 MHz, 16.384 MHz
    Even Sec two seconds
    E1 Clock 4 MHz
    Frame Pulse 8K
    . CDMA Forward Link Parallel transmit 8.192M Data
  - ACCU interface
    . CDMA Reverse Link receive 32.768 M ECL Data
  - TRK4 interface
    . PCM Highway Data of E1 data
  - PCPU, PMCU interface
    . DPRAM

(4) Description on PDMU front LED

Name	Color	Status description
STS	Green	PDMU operates normally.
(bicolor)	Red	PDMU operates abnormally
LCK	Green	Packet receive lock is normal.
COK	Green	CRC is normal.

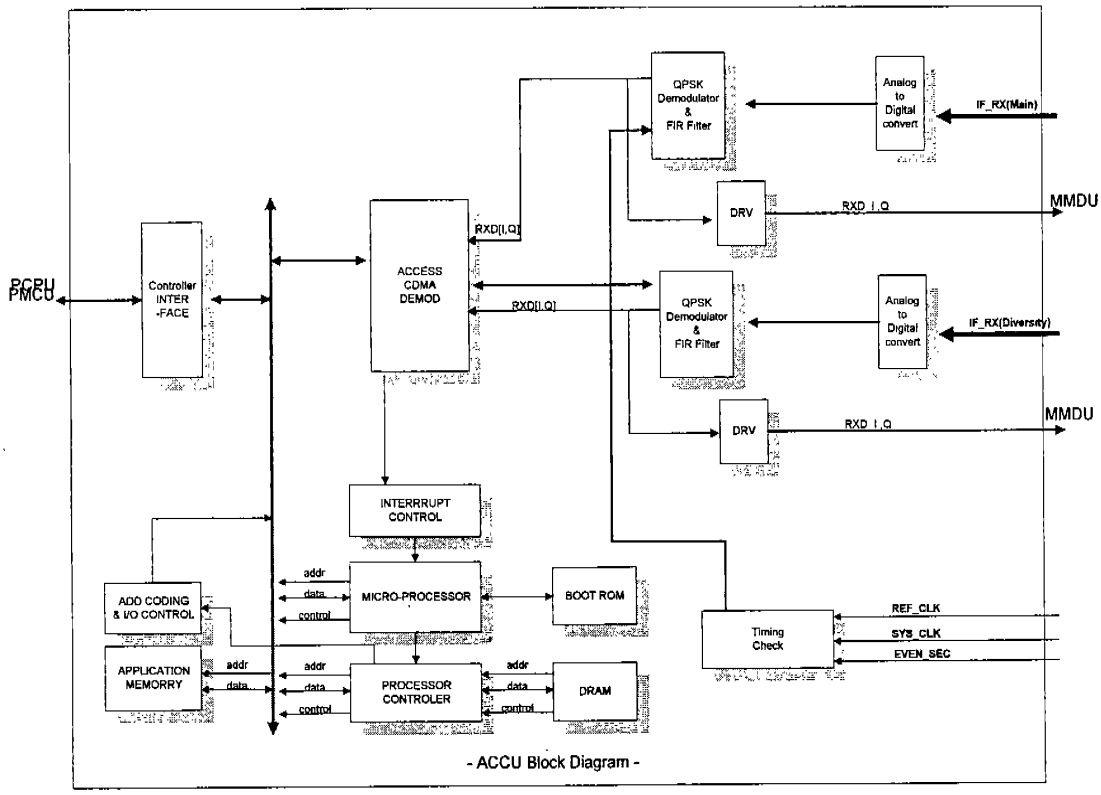
5.6 Access Channel Unit (ACCU)

(1) ACCU overview

ACCU converts the analog signals of the baseband and demodulates them to transmit the received signals to each MMDU. It also synchronizes the subscriber access data that are received randomly before demodulating them and transmitting them to PCPU.

(2) ACCU configuration

The detailed configuration diagram of ACCU is as follows.



- ACCU Block Diagram -

(3) ACCU description

- **Analog to digital Convert**
  - It receives the main and diversity analog signals that have 8M carrier element.
  - It converts analog to digital with 32M clock.

- **QPSK demodulator & FIR filter**
  - Digital QPSK demodulator
  - FIR filter
  - 32M data function

- **DRV (Driver I.C)**
  - It converts 32M data into ECL data and transmits the data to MMDU.

- **Timing Check**
  - It receives 2S, 8M, and 16M clock from CDCU through ECL.
  - It generates 32M and 65M clock with 16M.

- **Access CDMA demodulator**
  - It receives 32M data.
  - Matched Filter
  - It extracts the synchronization signals and access data.

- **Controller Interface**
  - It interfaces with PMCU and PCPU through DPRAM.

- **Input voltage: –48VDC(± 20%)**
- **Output voltage: +5V, +3.3V, +12V, -12V**
- **Receive coaxial cable impedance: 50Ω**
- **Analog receiving: 50Ω coaxial cable**
- **Clock receiving: 8.192 MHz, 16.384 MHz, 2 seconds**
- **PCPU and PMCU interface: DPRAM**
- **MMDU data: 32M ECL data**

(4) Description of ACCU front LED

Name	Color	Status description
STS	Green	ACCU unit operates normally.
	Red	Processor error of no analog data reception
ACT	Green	ACCU unit is active.
STB	Green	ACCU unit is standby.
RXD	Green	There are analog data received.
ACL	Green	The access data are locked.

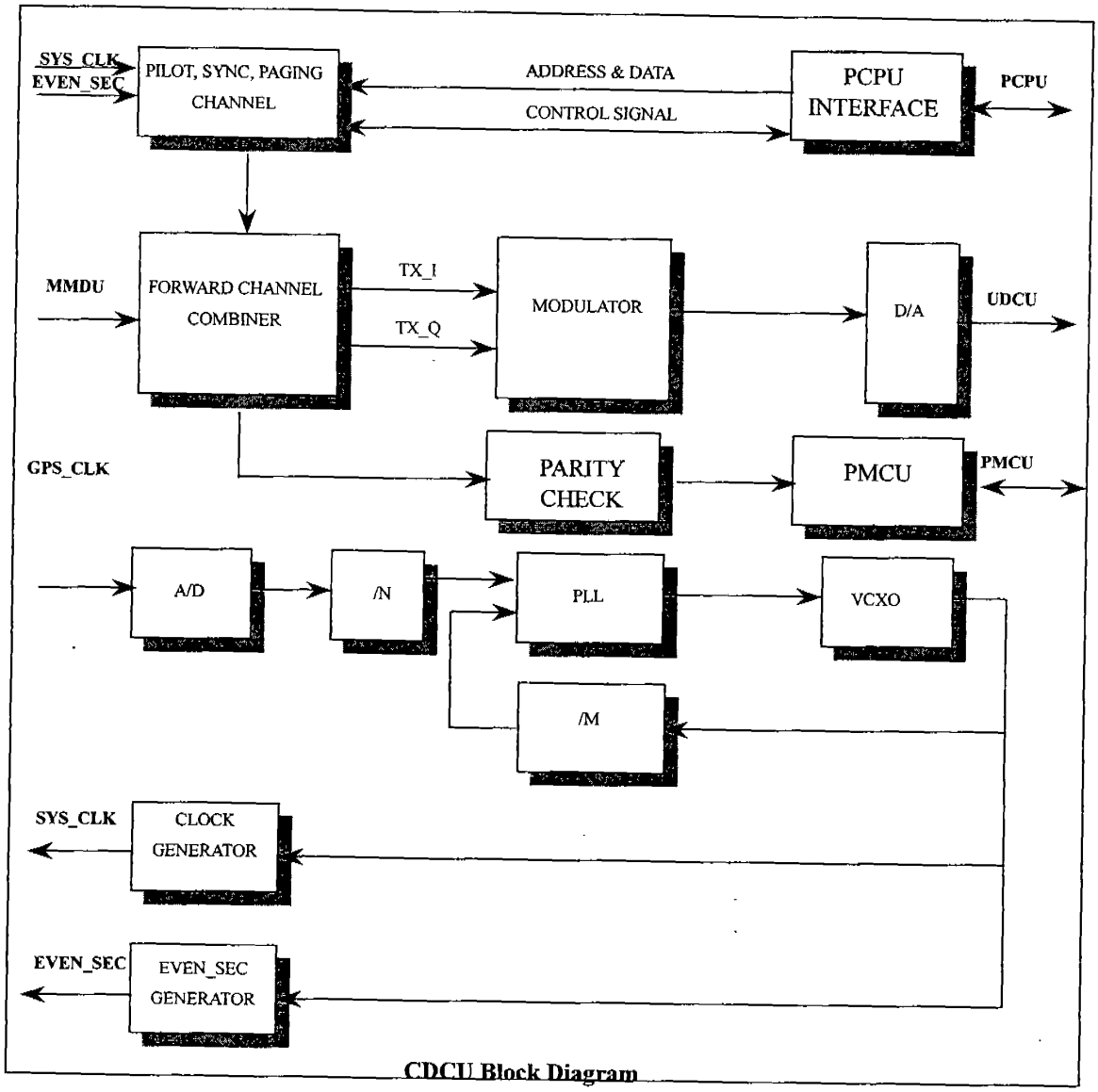
5.7 Clock Distribution & Combine Unit (CDCU)

(1) CDCU overview

CDCU receives 10 MHz clock from GPSU and generates and provides the system clocks. And it combines PILOT, SYNC, and PAGING channels, the RP wireless channels, with TRAFFIC channels and transmits them. It is redundant for higher reliability.

(2) CDCU configuration

The detailed configuration of CDCU is as follows.



CDCU Block Diagram

(3) CDCU description

- **System clock generation part**
  : It receives 10 MHz clock from GPSU and generates and distributes the clocks required for RP.
- **Forward Channel Combiner**
  : The combiner divides the forward link baseband digital signal from MMDU into I and Q and then combines and saturates them.
- **Pilot, Sync, and Paging channel generation part**
  : It generates the pilot channel for the standard RF signal of RP and the synchronization signal of PN code, the sync channel that transmits RP identification information and the visual information from RP to the terminals, and the paging channel that provides the system information of the current RP, such as the neighboring RP information, the available service type, the registration cycle, the terminal identification number, the access parameter, the power control information, and RP local information.
- **Modulation part**
  : It modulates the combined forward sink baseband digital signals in accordance with the requirements of each frequency bandwidth by filtering them with the digital filter.
- **D/A conversion part**
  : It converts the modulated digital signals to the baseband analog signals.

(4) Description on CDCU front LED

Name	Color	Status description
STS	Red	Error
	Green	Normal
ACT	Green	Active
STB	Green	Standby
TXD	Green	Normal TX data transmit
GCLK	Green	Normal GPS operation
SCLK	Green	Normal operation of local oscillator

5.8 RF Power Supply Unit (RPSU)

(1) RPSU overview

RPSU supplies power for the four UDCU modules in RFS and for the two RFPU units and also supplies power for AICU and UDSU. It is redundant for stable power supply. In addition, it generates its own fault signals and reports them to RFPU.

(2) RPSU specification

- **Input voltage range**

Minimum input voltage	Rated input voltage	Maximum input voltage
- 42 V DC	-48 V DC	- 56 V DC

- **Output voltage and output current**

Voltage	Rate	+12 V DC	+5V DC	-12V DC	-5V DC
Current	Min [A]	2.8	0.8	0.2	0.2
	Max [A]	28	8	2	2
Output voltage tolerance [%]		2.5	2.5	2.5	2.5

- **Temperature and humidity for operation**

Temperature	-10 ~+65 °C
Humidity	10~95%

(3) Description on RPSU front LED and switches

On the front side of RPSU, there are Green LED PWR and Red LED FAIL. Green LED indicates the normal operation and Red LED indicates the short status or the overload status. The status of RPSU is reported to RFPU through the rear connector. The circuit breaker on the front side of RPSU plays the role of a toggle switch and fuse for the input power.

5.9 Radio Frequency Processor Unit (RFPU)

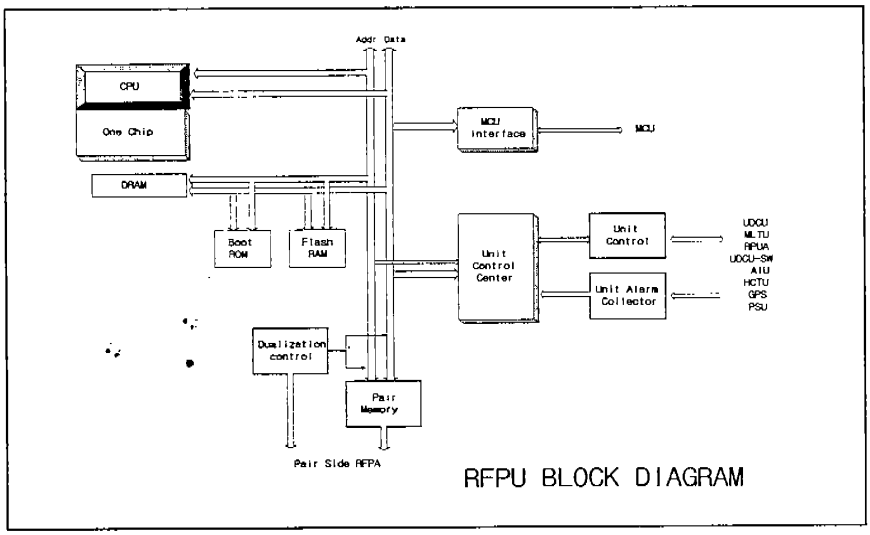
(1) RFPU overview

RFPU monitors and controls the status of each module of RF shelf and collects the alarm status of RF shelf and reports the status finally to RPOM.

It consists of the followings.

- **CPU and control part**
- **Interface part**
- **Alarm collection and processing part**
- **Redundancy part**

(2) RFPU configuration



(3) RFPU description

- **CPU and control part**

  : This parts consists of 386EX processor with the built-in Intel battery, DRAM controller, flash ROM, flash file, and 16 Mbyte DRAM. This part processes all the interrupts of the interface part and takes detailed actions when an alarm signal is generated. Then it reports the interrupt and alarm signal information to RPOM through PMCU. It also stores important information in CMOS in order to use the information for rebooting or switchover.

- **Interface part**

  : It has total of eight RS-233 ports including the two ports for PACU, GPSU and RPTU and the ports for PMCU-ALPHA, PMCU-BETA, PMCU-GAMMA, and the environment monitoring. CPU processes the data from each port and monitors the port status.

  - Interface with PACU

    RFPU converts the ENABLE and DISABLE status of each sector PASU through RS-232 interface with PACU and monitors the power status of each PASU, the ENABLE status, the internal temperature, the input power value, VSWR value of each sector, and others and it performs switchover or restoration when necessary.

  - Interface with GPSU

    Through RS-232 interface with GPSU, RFPU monitors the online/standby status of GPSU, the status of oscillator, the master/slave status, and GPS antenna status and reports all the information to RPOM.

  - Interface with RPTU

    RFPU is connected to RPTU through two RS-232s and one of them is connected to RTU and the other is connected to RIU in RPTU.

    Through the port connected to RTU, RFPU enters the TX attenuator value of each sector and reads the value to diagnose each antenna.

    And RFPU sets the wireless parameter in RPTUER and sets up calls in order to collect the performance data of each sector and report the data to RPOM.

  - Interface with PMCU

    RFPU has PMCU and RS-232 interface of each sector, which provide the physical path for the report of the RP rack information to RPOM.

  - Interface with AICU

    RFPU receives alarm signals from each sector AICU at TTL level. AICU checks AICU installation, DC power, and LNA and reports the result to RFPU. RFPU collects the information and reports it to RPOM.

  - Interface with UDSU

    UDSU is the RF switch unit that takes charge of 4:1 switchover of UDCU. It performs the switchover for OPEN or FAIL of UDCU and RFPU controls all these operations of UDSU.

    RFPU converts the switch status with UDSU at TTL level and monitors the internal UDSU status by reading the converted status information from UDSU and reports the current internal UDSU status to RPOM.

  - Interface with PDP

    RFPU collects RP rack information except MS information and generates critical, major, minor alarms and sends the information to PDP.

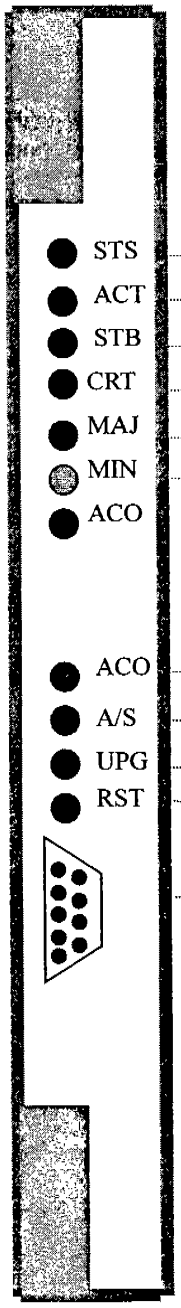
  - Other interface

    . Besides the above interfaces, RFPU has RS-232 interface for environment monitoring and FAN interface.

    . Alarm collection and processing part: RFPU collects the alarms of all the boards in RP rack and reports the information to RPOM.

    . Redundancy part: The redundancy part monitors the status of the other side with the signals between the active and standby boards. And it takes actions for the reset of the other side, the status of active and standby switches and the insertion/deletion status.

(4) Description on RFPU front LED



- STS → It indicates whether the board status is normal or abnormal.(BI-COLOR)
- ACT → It indicates that the current status is ACTIVE. (GREEN)
- STB → It indicates that the current status is STAND-BY. (GREEN)
- CRT → It indicates that a critical alarm occurs. (RED)
- MAJ → It indicates that a major alarm occurs. (RED)
- MIN → It indicates that a minor alarm occurs. (YELLOW)
- ACO → It means ACO status input. (GREEN)
- A/S → ACO input switch
- UPG → ACTIVE/STAND-BY switchover conversion switch
- RST → Application program upgrade switch
- Board reset switch
- 9-pin that connects the board and PC through RS-232 D-SUB female connector

5.10 Up-Down Converter Unit (UDCU)

(1) UDCU overview

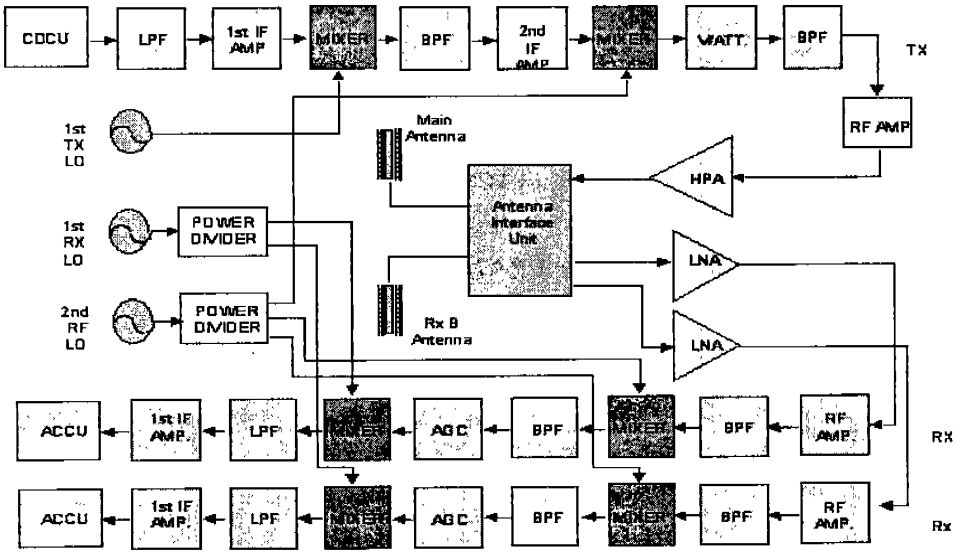
UDCU is divided into the transmit path and the receive path.

The main functions of the transmit path is the up conversion that converts the 8.192 MHz IF signals into 140 MHz or 2380-2400 MHz signals and the gain adjustment that has about 30 dB of variable attenuation.

The main functions of the receive path is the down conversion that converts 2310-2330 MHz RF signals to 70 MHz and 8.192 MHz IF signals and AGC function that maintains the 8.192 MHz IF signal level. It consists of path A and path B for the space diversity function.

(2) UDCU configuration

The detailed configuration diagram of UDCU is as follows.



(3) UDCU description

- **UDCT**
  : It receives 8.192 MHz signals from the modem shelf (CDCU) and up-converts them to 2380-2400 MHz RF signals.
- **UDCR**
  : It receives 2310-2330 MHz receive signals from AICU and down-converts them to IF (8.192 MHz) signals and transmits a certain level of output signals to the modem shelf (ACCU) through AGC circuit.
- **UDCS**
  : UDCU status monitoring, PLL data generation and UDCT RF attenuation voltage supply
- **IPLL-1**
  : It provides 78.192 MHz of CW signals for UDCR.
- **IPLL-2**
  : It provides 148.192 MHz of CW signals to UDCT.
- **RPLL**
  : It provides 2245 MHz of CW signals to the up-down mixer of UDCU RF part.
- **Power**
  : From ±12 Vdc input, + 5V_1, +5V_2, +5V_3, AGC_ Bias_R1(+10V), and AGC_Bias_R2(+10V) power are supplied by using the regulator.
- **78.192 MHz PLL synthesizer (IPLL-1)**
  : It receives the control signal from RFPU and makes 78.192 MHz local signals in order to down-convert 70 MHz signals of the receive path into 8.192 MHz IF signals.
- **148.192 MHz PLL Synthesizer (IPLL-2)**
  : It receives the control signal from RFPU and makes 148.192 MHz local signals in order to up-convert 8.192 MHz signals of the transmit path into 140 MHz signals.
- **2240-2260 MHz PLL Synthesizer (RPLL)**
  : It receives the control signal from RFPU and makes 2240-2260 MHz local signals in order to down-convert 2310-2330 MHz signals of the receive path into 70 MHz signals and to up-convert 140 MHz of the transmit path into 2380-2400 MHz signals.
- **Reference signal detection circuit**
  : It verifies whether the reference signal 10 MHz is permitted for PLL synthesizer.
- **Frequency UP Conversion (UDCT)**
  : It performs the second frequency up conversion that converts the 8.192 MHz IF input signals into 140 MHz and 2380-2400 MHz signals.
- **Gain adjustment terminal**
  : It is configured to have about 30 dB of variable range by using the voltage variable attenuator in order to adjust the output of UDCT.
- **Output level adjustment circuit**
  : It locates the voltage variable attenuator on 140 MHz path in order to compensate the gain variation for each board and adjusts the variable resistance of ADJ port of the front panel to compensate the gain variation.
- **Input signal monitoring**
  : It monitors the input signals of UDCU through 10 dB coupling.

- **Output signal monitoring**
  : It monitors the output signals of UDCU through 20~30 dB coupling.
- **Frequency down conversion (UDCR)**
  : It performs the second frequency down conversion that converts the received 2310-2300 MHz RF signals into 70 MHz and 8.192 MHz IF signals.
- **Automatic Gain Control (AGC) circuit**
  : It uses three PIN diode attenuator on 70 MHz path of UDCR in order to maintain 8.192 MHz IF signals at a certain level.
- **Space Diversity**
  : UDCR consists of two paths, that is path A (main) and path B (SD) for the space diversity.

(4) Description on UDCU front LED

Name	Color	Status description
STS	GREEN	REF (10 MHz), SYN (PLL), RXS (UDCR output), TXS (UDCT output) are all normal.
	RED	One of REF, SYN, RXS, or TXS is abnormal.
REF	GREEN	Normal level of 10 MHz reference signal
	OFF	Abnormal level of 10 MHz reference signal
SYN	GREEN	The lockings of IPLL-1, IPLL-2, and RPLL are all normal.
	OFF	One of IPLL-1, IPLL-2, or RPLL locking is abnormal.
RXS	GREEN	UDCR Main/SD output signals are all normal.
	OFF	One of or both of UDCR Main/SD are abnormal.
TXS	GREEN	UDCT output signal is normal.
	OFF	UDCT output signal is not normal.

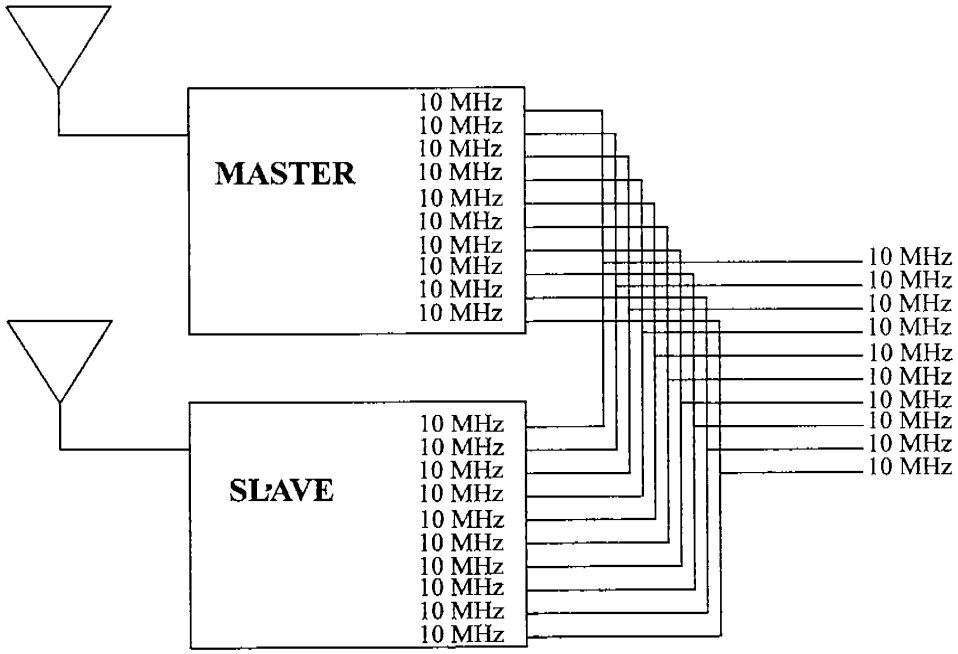
5.11 Global Positioning System Unit (GPSU)

(1) GPSU overview

GPSU receives L1 frequency by using the GPS receiver of about 10^{-12} frequency precision in order to satisfy the frequency specification (Frequency stability = 0.05 ppm) and generates 10 MHz signals, that is, the system reference frequency. This unit has a single or redundant structure to meet the customers' requirements and it has to have a built-in high precision oscillator regardless of its structure in order to prepare for the interruption in receiving satellite signals.

(2) GPSU configuration

The diagram of GPSU is as follows.



(3) GPSU description

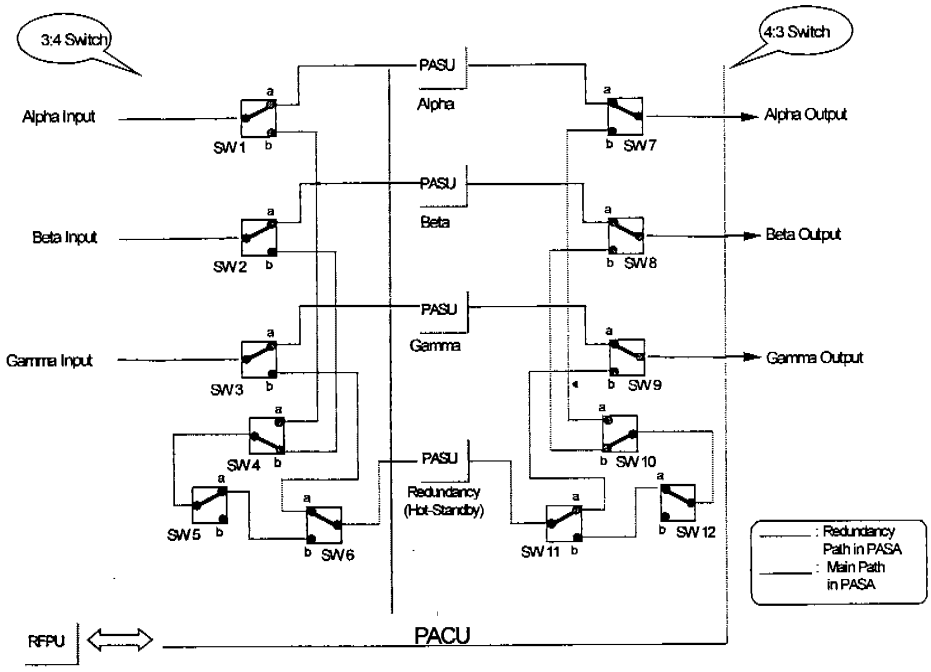
The above figure shows the redundant GPSU. The signals of L band captured by the antenna are generated as ten 10 MHz signals and one 1 PPS signal and one TOD signal by the GPS engine in GPSU. Since this WLL system does not give the mobility, the 1 PPS and TOL signals are not used.

5.12 Power Amplifier S-band Unit (PASU)

(1) PASU overview

- PASU amplifies the level of the signals from RP up to a certain level.
- PASU is allocated to each sector and it has the N:1 redundancy structure.
- PASU amplifies the RF signals whose frequency is converted through the Up Down Converter Transmitter (UDCT) of Up Down Converter Unit (UDCU) of UDCT (Up Down Converter Transmitter) up to a certain power level requested by PASU and then provides the signals to Antenna Interface & Coupling Unit (AICU).
- The RF signals generated through PASU have a bandwidth determined by the channel filter of AICU of Antenna Interface & Coupling System (AICS) and they are transmitted through antennas.

(2) PASU configuration



PASU block diagram

(3) PASU configuration

- **RF Interface**
  PASU have the maximum 0 dBm input signal level from UDCT in UDCU and have the maximum 20dB dynamic range. The output of PASU have linearity to the input and the maximum RP transmission output is 43 dBm ±1 dB.

- **Controller interface**
  PASU is controlled by Power Amplifier Control Unit (PACU), which controls the switch for the redundancy and monitoring of PASU.

  PASU has RS-232 or RS-422 interface with PACU and PASU can be monitored and controlled through PACU.

(4) Description on PASU front LED

Name	Color	Status
DC ON LED	Green	DC switch of the front panel is on.
	Off	DC switch of the front panel is off.
Enable LED	Green	PASU is enabled through PACU. (Normal operation)
	Off	PASU is disabled through PACU or a switchover module with faults
Alarm LED	Red	PASU has faults.
	Off	PASU has no faults

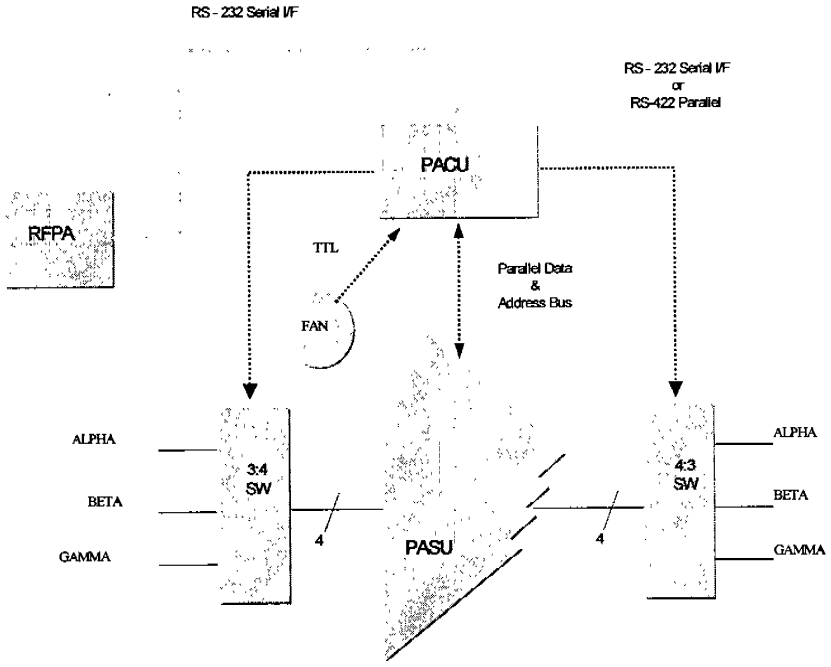
5.13 Power Amplifier Control Unit (PACU)

(1) PACU overview

- PACU monitors and controls PASU that is allocated to each sector. When a fault occurs, it operates switches and switchovers to one redundancy path.
- It also verifies whether FAN is normal and transmits the PASU status to Radio Frequency Process Unit (RFPU).
- PACU performs enable/disable function, VSWR Alarm, IN/OUT signal level detecting, and the forced redundancy and switchover and the recovery of temperature alarms and PASU according to the commands of RFPU.
- The firmware of PACU can be upgraded or modified by using the 9-pin D-sub maintenance port on the front panel.

(2) PACU configuration

PACU control interface diagram



(3) PACU description

- PACU has RS-232 or RS-422 interface with PASU and RACU can be controlled and monitored through RFPU.
- PACU has RS-232 interface with RFPU and reports the status of PASU and PACU on request of RFPU.
- When the redundancy switchover required for the faults in PASU, there is a report sequence after the switchover.

(4) Description on PACU front LED

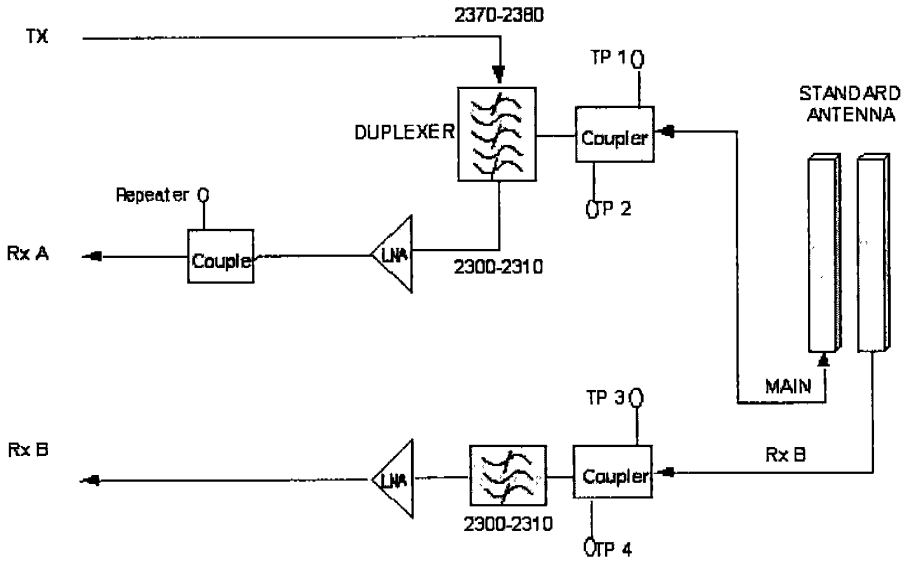
Name	Color	Status
DC ON	Green	DC switch of the front panel is on.
	Off	DC switch of the front panel is off.
Alarm	Red	PACU is abnormal or fan is abnormal
	Off	Normal

5.14 Antenna Interface & Coupling Unit (AICU)

(1) AICU overview

- AICU is the public link access part of RP. It consists of one main path that can transmit and receive signals through the antenna and the Rx B path that receives signals through the antenna. One AICU is assigned to each sector.
- The transmit path makes the transmit signals that are amplified to a fixed level through POWER AMPLIFIER SUB SYSTEM (PASS) pass through the duplexer so that the signals have a fixed bandwidth. Then the transmit path transmits the signals to the antenna.
- The monitor port of the transmit path monitors the level of RP transmit signal that is transmitted to the transmit antenna. It shows a low level output of 40 dB for the output signal level from the port connected to the transmit antenna.
- The receive path consists of two paths (Main path and Rx B (Space diversity) for the diversity and each path has equivalent electrical characteristics. The receive path has the transit band filter, the low noise amplifier, and the bi-directional coupler that monitors signals and tests paths. It filters the signals from each receive antenna (Rx Ant and SD Ant) with the band filter and amplifies them with the low noise amplifier and transmits them to Up Down Switch Unit (UDSU).
- The low noise amplifier of each receive path is the balance type amplifier with 1:1 redundancy structure. It receives the signals from the repeater through the directional coupler of the low noise amplifier output terminal. Then it transmits the signals to Up Down Converter Receiver (UDCR) in Up Down Converter Unit (UDCU) through UDSU.

(2) AICU configuration diagram



(3) AICU description

- RF of the low noise amplifier at each receive path, DC alarm and the unit insert alarm reports the status of AICU.
- RF and DC alarm reports the open collector type of high/low impedance to Radio Frequency Process Unit (RFPU).
- RF alarm occurs when the gain of the low noise amplifier drops or when a path of the balance type of low noise amplifier is abnormal.
- DC alarm occurs when the power input is +9V or lower.
- Unit insert alarm occurs when the unit is not inserted, regardless of power input.

(4) Description on AICU front LED

Name	Color	Status
Front LED	Green	DC switch is on.
	Off	DC switch is off

6. Functions of Each RP Software Module

6.1 RP Main Control Unit (PMCU) software

(1) PMCU functions and configuration

This software is the main process that manages the RP system. It manages and controls status, fault, downloading, restarting, and redundancy, and manages RF system path.

- Starts the system up and initializes the hardware.
- Initializes the software after the hardware initialization.
- Monitors faults and stores fault information in the fault status buffer. This process is divided into the interrupt mode and the polling mode.
- When a fault occurs in the equipment, PMCU processes the fault and stores the fault status and then reports it to the operator. This process is divided into the alarm generating part, the alarm releasing part, and the alarm notifying part.
- Shows the information currently generated in the equipment on request of the operator.
- Generates interrupt when a unit is inserted/deleted.
- When a unit is reinstalled after deletion, PMCU initializes the unit after some delay time.
- Enables the operator to provision the slots in the equipment.

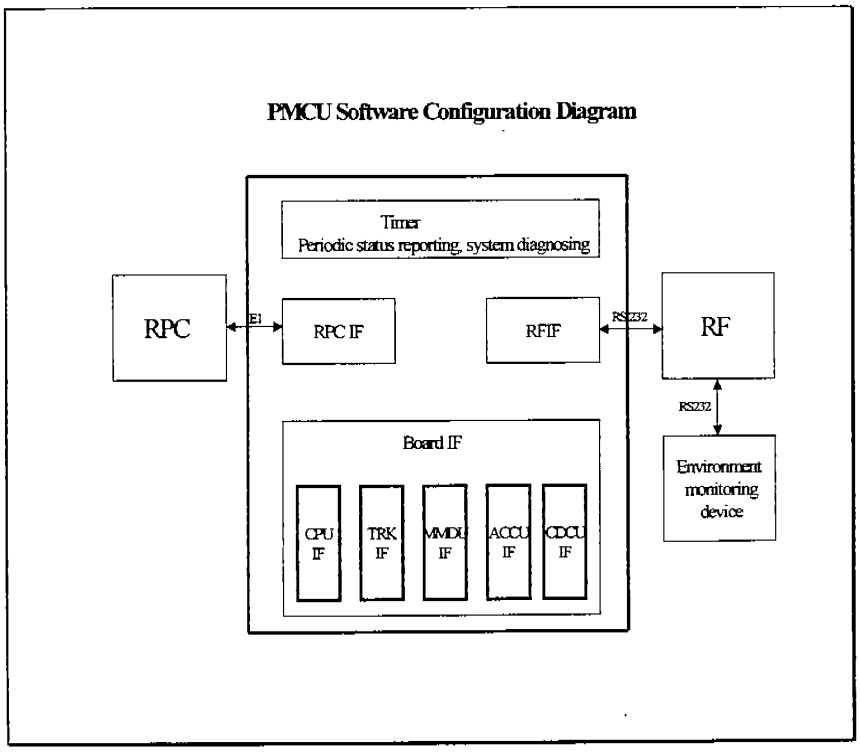


Figure 4-1. PMCU software configuration diagram

(2) PMCU software execution module loading system

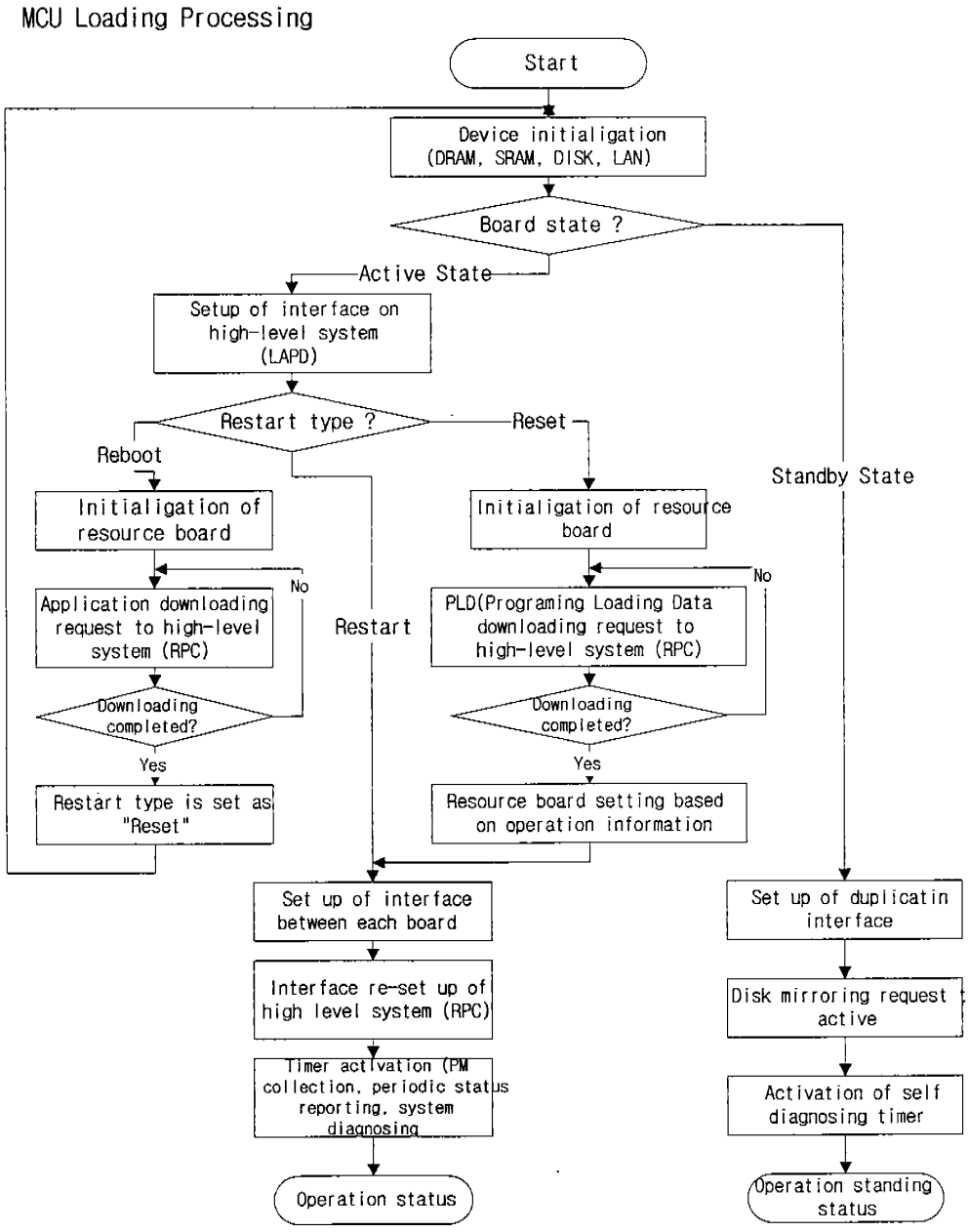


Figure 4-2. PMCU loading process flow chart

(3) Functions of each PMCU software module

A. CPU interface module

This module interfaces with RP Call Processing Unit (PCPU).

The main functions of this module are as follows.

- It controls the redundancy.
- It processes the board fault notifications.
- It notifies the link and system resource information.
- It processes the notification of call processing resource assignment status.
- It requests the wireless resource assignment set and processes the responses.
- It requests to inquire the RIU status and processes the responses.
- It requests PM and processes the responses.

B. TRK interface module

This module interfaces with Trunk 4-channel (TRK4).

The main functions of this module are as follows.

- It manages and controls the channel redundancy.
- It processes the board and link fault notifications.
- It sets up and controls loopback test and BER measurement requests.
- It requests link PM and processes the responses.

C. MMDU interface module

This module interfaces with Multi MoDem Unit (MMDU).

The main functions of this module are as follows.

- It manages and controls the configuration.
- It processes the board fault notifications.
- It requests the channel diagnosis and processes the responses
- It processes the notification of the wireless resource assignment.
- It requests the wireless resource assignment set and processes the responses.
- It requests to inquire the RIU status and processes the responses.
- It requests PM and processes the responses.

D. ACCU interface module

This module interfaces with Access Channel Unit (ACCU).

The main functions of this module are as follows.

- It manages and controls the redundancy.
- It processes the board fault notifications.

E. CDCU interface module

This module interfaces with Clock Distribution & Combine Unit (CDCU).

- It manages and controls the redundancy.
- It processes the board fault notifications.

F. RF interface module

This module interfaces with RF Process Unit (PFPU).

- It requests the RF status and processes the responses.
- It processes RF fault notifications.
- It transmits the environment monitoring equipment data.

G. Status managing module

This module manages the system status based on the WLL system status scheme. When the system status changes, this module reports the change to the high-level system.

a. Inquiry of software version

Inquiry command : **show-ver;**

```
PMCU>show-ver;
BSP : v1.01, 15:44:36 Feb 14 2000

RPT:0051:2000-02-25 11:36:51:VER:1.64c (Feb 18 2000 09:17:54);
```

b. Inquiry of the current system status

Inquiry command : **show-sys;**

```
PMCU>show-sys;

    ..........   WLL  SYSTEM  STATUS   ..........
SL CNAME : CTYPE - ETYPE[HWVER-SWVER]   STATUS     bSTS[mSTS]   ALARM
=============================================================================
00 PMCU0 : PMCU  - PMCU [0.32a-1.64c]  NORM_ACT     ACT[ACT]    NOR
01 PMCU1 : PMCU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    MAJ
02 PCPU0 : PCPU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    CRT
03 PCPU1 : PCPU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    CRT
04 TRK0  : TRK4  - TRK4 [1.00c-1.21d]  NORM_STB     ENA[ENA]    NOR
05 TRK1  : TRK4  - TRK4 [1.00c-1.21d]  NORM_IDLE    ENA[ENA]    NOR
06 MSL0  : MMDU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[ENA]    MAJ
07 MSL1  : MMDU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[ENA]    MAJ
08 MSL2  : MMDU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   DIS[ENA]    MAJ
09 MSL3  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
10 MSL4  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
11 MSL5  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
12 MSL6  : BLANK - BLANK[xxxxx-xxxxx]  NEQ_EJECT    DIS[DIS]    NOR
13 ACCU0 : ACCU  - ACCU [0.000-0.000]  ABNO_ACT     ACT[ACT]    MAJ
14 ACCU1 : ACCU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    MAJ
15 CDCU0 : CDCU  - BLANK[xxxxx-xxxxx]  ABNO_EJECT   STB[STB]    MAJ
16 CDCU1 : CDCU  - CDCU [f.f00-0.000]  ABNO_ACT     ACT[ACT]    MAJ

PMCU>
```

CNAME : Shelf Slot Name Label
CTYPE : Configuration unit type
BLANK : The slot is not yet configured.
ETYPE : The equipped unit type
BLANK : The slot is not yet configured.
HWVER,SWVER : Hardware, Software Version
STATUS : The unit status based on the system status scheme.
bSTS[mSTS] : Display for debugging, the actual board status and management
ALARM : It shows the top class alarm that occurred in the unit.
Alarm classes are classified into CRT/MAJ/MIN/NOR (normal)..

c. Inquiry of primary trunk

Inquiry command : **show-primary-trk;**

```
PMCU>show-primary-trk;

RPT:0051:2000-02-25 11:44:11:PRIMARY TRUNK:0;
```

d. Inquiry of RPC link connection status

Inquiry command : **show-rpc-link;**

```
PMCU>show-rpc-link;
============== LAPD INFO ====================
 TRUNK-TS    Active    HDLC-CH   LID    LinkState
  0 - 31     TRUE         0       1     ESTABLISH
  - - --     FALSE       ---     ---    RELEASE
  - - --     FALSE       ---     ---    RELEASE
  - - --     FALSE       ---     ---    RELEASE
=============================================
```

TRUNK-TS : It indicates LAPD setup link number and TimeSlot number.
Active : It indicates LAPD status of the related link.
TRUE (setup)/FALSE (release)
HDLC-CH : It indicates HDLC channel number.
LID : LAPD Protocol Logical ID, It is used as RP identifier.
LinkState : It shows the connection status of the RP and LAPD protocol interface.
ESTABLISHED (connected)/RELEASED (disconnected)

e. Inquiry of TRK and MMDU channel status

Inquiry command : **show-sts-ch;**

```
PMCU>show-sts-ch;

TRKU0 : NORM_STB     NORM_STB     NORM_STB     NORM_STB
TRKU1 : NORM_IDLE    NORM_STB     NORM_STB     NORM_STB

MMDU0 : ABNO_EJECT   ABNO_EJECT   ABNO_EJECT   ABNO_EJECT
      : ABNO_EJECT   ABNO_EJECT   ABNO_EJECT   ABNO_EJECT
MMDU1 : ABNO_EJECT   ABNO_EJECT   ABNO_EJECT   ABNO_EJECT
      : ABNO_EJECT   ABNO_EJECT   ABNO_EJECT   ABNO_EJECT
MMDU2 : ABNO_EJECT   ABNO_EJECT   ABNO_EJECT   ABNO_EJECT
      : ABNO_EJECT   ABNO_EJECT   ABNO_EJECT   ABNO_EJECT
MMDU3 : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
      : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
MMDU4 : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
      : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
MMDU5 : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
      : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
MMDU6 : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT
      : NEQ_EJECT    NEQ_EJECT    NEQ_EJECT    NEQ_EJECT

PMCU>
```

f. Inquiry of link resource status

Inquiry command : **s; show-trk-sts;**

```
PMCU>show-trk-sts;

              WLL   RP   TRUNK  USAGE  DISPLAY          [ T:BUSY   -:IDLE
                                                        [ .:ABNO_EJT/NEQ_EJT
      [  D:SDWN, B:NORM_MBLK, b:ABNO_MBLK, x:ABNO_OBLK, F:ABNO_FLT   ]
  TIME  : 0 0 0 0 0 0 0 0  0 0 1 1 1 1 1 1  1 1 1 1 2 2 2 2  2 2 2 2 2 2 3 3
  SLOT  : 0 1 2 3 4 5 6 7  8 9 0 1 2 3 4 5  6 7 8 9 0 1 2 3  4 5 6 7 8 9 0 1

  0 [1]P : . - - - - - - -  - - - - - - - -  s - - - - - - -  - - - - - - - - m
  1 [x]  : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
  2 [x]  : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
  3 [x]  : . . . . . . . .  . . . . . . . .  . . . . . . . .  . . . . . . . .
```

The status of each resource is indicated as follows.

'.' : not Used
's' : Signal Path
'm' : Manager Path (Timeslot 31 - RPTRK)
'-' : NORM_IDLE
'x' : ABNO_OBLK
'T' : NORM_BUSY (ASYNC USE)
'V' : NORM_BUSY (PSTN 32K front+rear used)
'f' : NORM_BUSY (PSTN 32K front used)
'r' : NORM_BUSY (PSTN 32K rear used)

g. Inquiry of MMDU resource status

Inquiry command : **m; show-mmdu-sts;**

```
PMCU>show-mmdu-sts;

MMDU0 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
MMDU1 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
MMDU2 : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
      : ABNO_EJECT  ABNO_EJECT  ABNO_EJECT  ABNO_EJECT
MMDU3 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
      : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
MMDU4 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
      : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
MMDU5 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
      : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
MMDU6 : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
      : NEQ_EJECT   NEQ_EJECT   NEQ_EJECT   NEQ_EJECT
```

h. Inquiry of files stored in the disk

Inquiry command : **dir;**

```
PMCU>dir

9.0.1/BITMAP.SYS          25600 bytes
9.0.1/FLIST.SYS           13312 bytes
9.0.1/HDIAG.DAT              16 bytes
9.0.1/SYSINI.SYS            842 bytes
9.0.1/SYSCFG.SYS           4118 bytes
9.0.1/pmcu.hex          2007440 bytes
9.0.1/mcfg0051.dat         1976 bytes
9.0.1/pcpu668d.hex      2141014 bytes
9.0.1/acca105b.hex       766378 bytes
            9 file(s)      4960696 bytes
                          99896904 bytes free
```

H. Fault management module

This module manages faults based on the fault system of WLL system. When a fault occurs or a fault is released, it reports the status to the high-level system. As for the redundant boards, when a fault occurs in the active board, if the fault class of the active board is higher that that of the standby board, this module automatically switchovers the boards. As for single resource boards, this module isolates the resource where a fault occurs.

The fault list of RPC system is as follows.

Board	ALARM Extract	Slot 0 / 1	Channel	Remarks Board is extracted.
PMCU	Lan Module Extract	0 / 1		Lan module is extracted
	HDLC Controller Fault	0 / 1		
	SRAM Fault	0 / 1		
	DRAM Fault	0 / 1		
	HARD DISK Access Fault	0 / 1		
	Standby Software Fault			Standby Interface fault
PCPU	Extract	0 / 1		Board is extracted.
	Type Mismatch	0 / 1		
	HDLC Controller Fault	0 / 1		
	SRAM Fault	0 / 1		
	DRAM Fault	0 / 1		
	HARD DISK Access Fault	0 / 1		
	Standby Software Fault			Standby Interface fault
	Active not Found			Both PCPU0 and PCPU1 are extracted.
TRK4	Extract	0 / 1		
	Type Mismatch	0 / 1		
	FPGA Fault	0 / 1		
	Framer Chip Fault	0 / 1		
	Transceiver Fault	0 / 1		
	Software Fault	0 / 1		Interface Fault
	Active not Found			Both TRK4_0 and TRK4_1 are extracted.
MMDU	Extract	0/1/2/3/4/5/6		
	Type Mismatch	0/1/2/3/4/5/6		
	Sub Board Extract	0/1/2/3/4/5/6		
	FPGA Fault	0/1/2/3/4/5/6		
	Software Fault	0/1/2/3/4/5/6		
	Channel n Fault	0/1/2/3/4/5/6	Ch0-7	Check by the operator diagnosis during the operation
ACCU	Extract	0 / 1		
	Type Mismatch	0 / 1		
	Analog Receive Fault	0 / 1		
	Software Fault	0 / 1		
	Active not Found			Both ACCU0 and ACCU1 are extracted.
CDCU	Extract	0 / 1		
	Type Mismatch	0 / 1		
	FPGA Fault	0 / 1		
	Clock pll Fault	0 / 1		
	TX Data Detect Fault	0 / 1		
	System Clock Fault	0 / 1		
	I-Ch Parity Fault	0 / 1	Ch0-7	
	Q-ch Parity Fault	0 / 1	Ch0-7	
	Active not Found			Both CDCU0 and CDCU1 are extracted.
LINK	AIS (Blue Alarm)		Link0-3	
	YELLOW (RAI) Alarm		Link0-3	Remote station alarm
	Loss of Signal		Link0-3	
	Loss of Synchronization		Link0-3	
PDP	PDP Control or Cable Fault			ALMU is extracted or cable fault occurs.
	PDP Power Switch OFF	A/B		Power switch off
	-48V Power Fault	A/B		
	FAN Fault			FAN power off

Table 4-1. RP system fault list

❑ **Inquiry of the current faults**

Inquiry command : **show-alarm;**

```
PMCU>show-alarm;

[ALARM-MAJ] PMCU1 Board Extracted
[ALARM-MAJ] PCPU0 Board Extracted
[ALARM-MAJ] PCPU1 Board Extracted
[ALARM-CRT] PCPU Active Board not Found
[ALARM-MAJ] MMDU0 Board Extracted
[ALARM-MAJ] MMDU1 Board Extracted
[ALARM-MAJ] MMDU2 Board Extracted
[ALARM-MAJ] ACCU0 Software Fault
[ALARM-MAJ] ACCU1 Board Extracted
[ALARM-MAJ] CDCU0 Board Extracted
[ALARM-MAJ] CDCU1 TX DATA Detect Fault
[ALARM-MIN] PDP Control Board or Cable Fault
[ALARM-MIN] FAN Fault
```

The fault classes are CRT/MAJ/MIN/NOR and they have following meanings.

CRT : Critical fault

MAJ : Major fault

MIN : Minor fault

NOR : Normal status

I. Downloading managing module

Downloading is divided into the downloading on request of the system and that on request of operators.

The downloading on request of the system is performed at the time of the first initialization or when the operator commands 'Reboot' and the downloading is repeated until it is successfully completed. The downloading on request of the operator is the flow in the following figure except the system request (DOWN_REQ) and the response to the request (DOWN_ACK) and the downloading result (Success/failure) is reported after one downloading is performed.

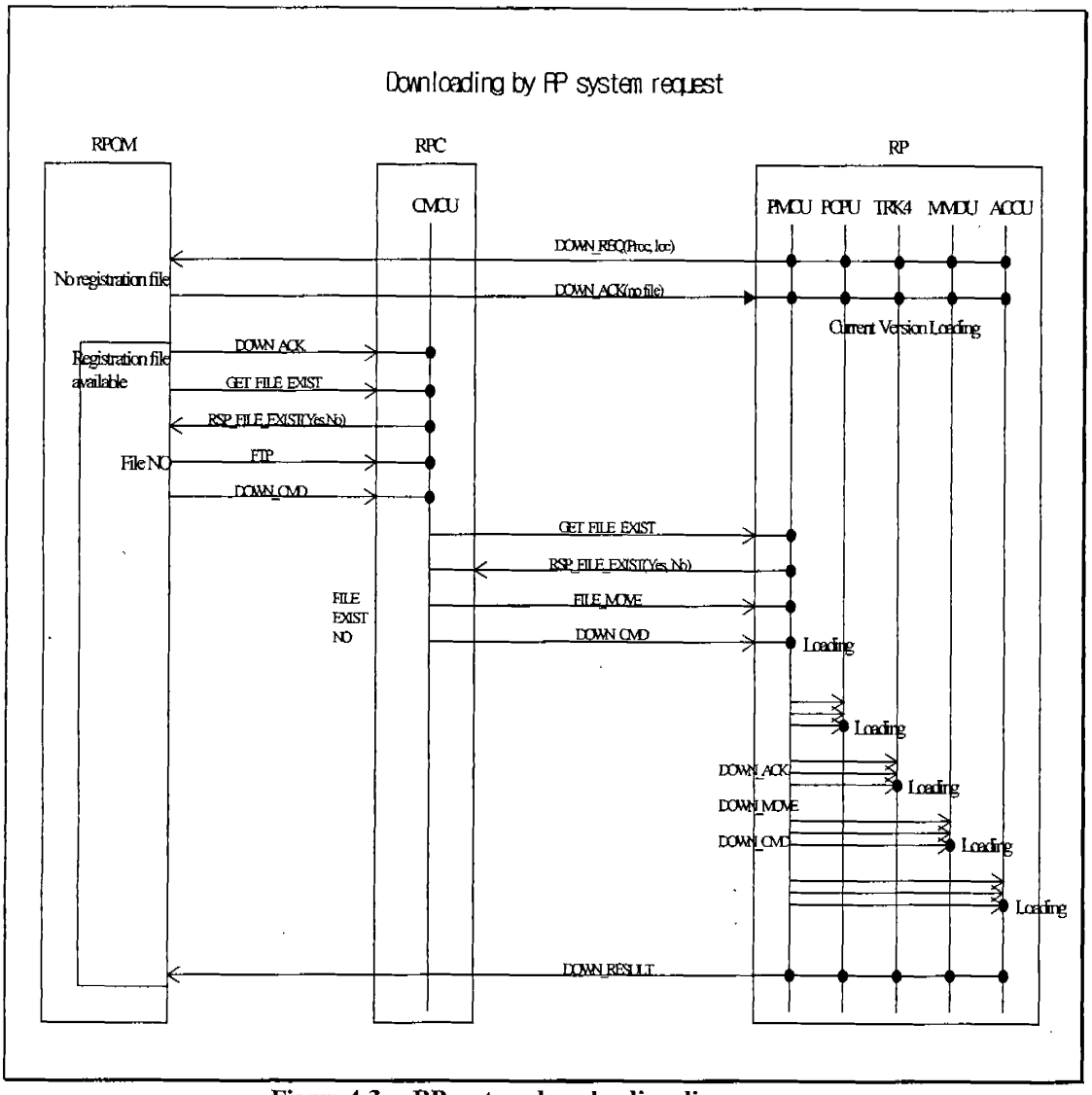


Figure 4-3. RP system downloading diagram

6.2 RP Call Processing Unit (PCPU) software

(1) PCPU software configuration

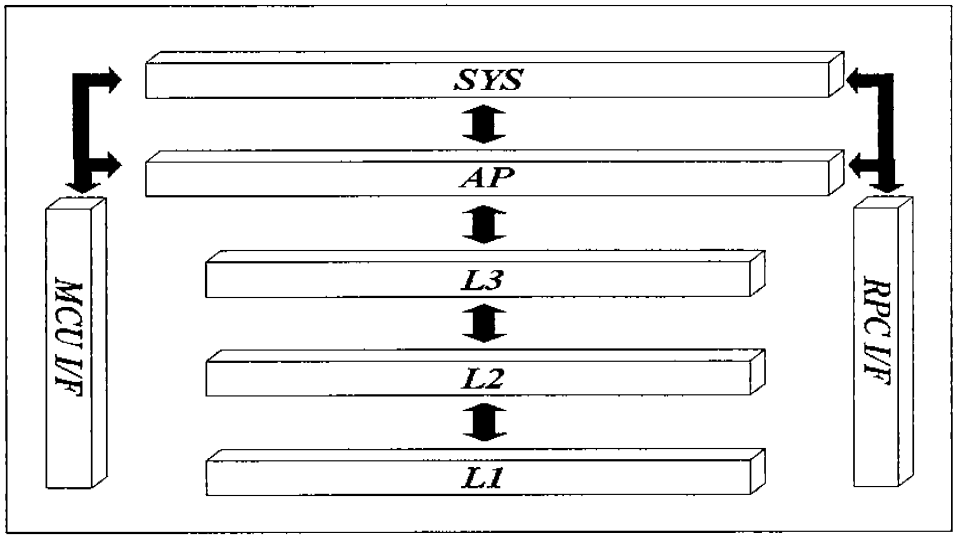


Figure 4-4. PCPU software block diagram

A. AP block

It is a high level part for call processing. It manages the status of each RIU and processes the events occurring all through the call processing.

B. L3 block

It performs wireless resources assignment, connection status control, mobility management, and maintenance. It processes the messages transmitted/received to/from terminals.

C. L2 block

It manages the messages transmitted on the wireless section and manages the link status and retransmits messages.

D. L1 block

It manages SGCH data and AXCH data that PCPU and MMDU/ACCU exchange.

E. SYS block

This block performs RIU/PCPU downloading and maintenance and statistics.

F. RPC interface block

This block processes calls between RPC and RP and various messages.

G. MCU interface block

This block processes the messages between PCPU and PMCU and manages the status of each board.

(2) PCPU MMC command

- **SHOW-CAI-DB:::RP;**

  Display various setup status of RP.

```
==========RP-01 (STANDBY) DATABASE==========
RPC-RP Primary Trunk        : 0  // Main trunk number between RPC-RP
   RPC-RP Trunk Usage       : 0x3
   Assigned LAPD SAPI       : 0  // SAPI assigned by RPC
   Assigned LAPD LID        : 0  // LID assigned by RPC
   LAPD state               : BROKEN  // LAPD setup status BROKEN/ACTIVE
   Subscriber Number        :0// Number of subscribers currently accommodated in RP
------------------------------------------------------
   Base Seed (I)            : 0x237cd7fa// RP PN Seed
   Base Seed (Q)            : 0xd0d57fd8
   LAI                      : [02f0010101]// RP LAI
   Pilot Ch Gain            : 445  // Overhead ch gain value
   Sync Ch Gain             : 87
   Paging Ch Gain           : 174
------------------------------------------------------
   Active PKT Slot          : 1  // Active slot in modem shelf
   Active ACC Slot          : 1 Active CDC Slot   : 1 Modem Board Equip.
: 0x0208  // Unit installation status in modem shelf
   Modem Board Status       : 0x0208 // Unit activation status in modem shelf
------------------------------------------------------
   Available CDMA Ch(s)     : 56  // Number of available channels
   Next Alloc CDMA Ch       : 0  // Channel number to allocate next
   Available F-HADAMARD(s)  : 108  // Number of available HADAMARDs
   Available R-HADAMARD(s)  : 120
   Total In-Svc Call(s)     : 0  // Number of in-service calls
------------------------------------------------------
   RIU Application Ver      : None
```

- **SHOW-CAI-DB::[riu]:RIU;**
  Display the setup status of the related RIU.

```
=========================== RIU-1 DATABASE ===========================
Port Number                 : 0  // Total number of RIU ports   In-service Ports    : 0  //
Number of in-use ports
Operational ?               : OFF  // Current RIU status
   IWEI                     : 0x[00 00 00 00 00 00 00 00]
----------------------------------------------------------------------
   Logical CDMA Ch          : NONE // Logical CDMA channel number
```

- **SHOW-CAI-DB:: [riu-port]:PORT;**
  Display the setup status of the related port.

```
=======================================================================
   RIU-0 PORT-0 DATABASE
=======================================================================
   Available ?              : YES  // Is the port available ?
   Subscripted ?            : YES  // Is the port is subscribed ?
   Signal Mode              : SINGLE  // Currently assigned SGCH mode
   Service Rate             : 32K  // Service rate of the port
   Service Type             : POTS  // Service type of the port
   IWUI                     : 0000000072c10101// Key value of the port
   TWUI                     : 00000000
   WSI                      : 7f010101
   WASK                     : 4d010101
-----------------------------------------------------------------------
   Port State               : ON-HOOK  // Current port status
   Hook Flash mode          : USE  // Hook-Flash mode
   CDMA Channel No.         : NONE  // The channel allocated to the port
   PGCH Index               : 0  // PGCH slot index
```

- **SHOW-CAI-DB:::MMU;**
  Display the status of the call set up in MMDU and the wireless resource information.

PCN	LCN	SL-CH OpMode	Usage	RIU-PT TR-SL	TERM-PN	RATE
008 ---	02-01	UNBLOCK IDLE	000-00	00-00	--------	----
009 ---	02-02	UNBLOCK IDLE	000-00	00-00	--------	----
010 ---	02-03	UNBLOCK IDLE	000-00	00-00	--------	----
011 ---	02-04	UNBLOCK IDLE	000-00	00-00	--------	----
012 ---	02-05	UNBLOCK IDLE	000-00	00-00	--------	----
013 ---	02-06	UNBLOCK IDLE	000-00	00-00	--------	----
014 ---	02-07	UNBLOCK IDLE	000-00	00-00	--------	----
015 ---	02-08	UNBLOCK IDLE	000-00	00-00	--------	----

PCN: Physical channel number, LCN : logical channel number, OpMode : Block/Unblock

- **SHOW-CAI-DB:: [ch no]:RADIO;;**
  Display the allocation information for the corresponding channel number.

CDMA Channel-10 Configuration

```
Operational State          : ACTIVE  // Channel operational status
MMU Equip State            : EXTRACT // Channel card status
Channel Usage              : NONE  // Single channel or multi channel mode
Logical Channel ID         : NONE  // Logical channel number
MMU Slot ID                : 2  // Channel slot number
MMU Channel ID             : 3  // Channel number in the channel unit
Assigned RIU               : 0  // Assigned RIU number
Assigned PORT              : 0  // Assigned port number
Call Information           : ????(8K    ) // Call service information
E1 Traffic Link            : 0  // Trunk number of the assigned call
E1 Traffic TS Number       : 0  // Timeslot figure of the assigned call
E1 Traffic TS              :  // Timeslot number of the assigned call
Power Control Path         : A // Detailed information on the allocated channel
Power Monitor Ch           : TFCH
Interleave Usage           : YES
Traffic Ch Exist           : NO
Channel Usage              : SINGLE
RVS_TRAFFIC_STRENGTH_RATIO      = 0x2
FWD_TRAFFIC_CH_HADAMARD_INDEX   = 0x0
FWD_PCS_CH_CH_HADAMARD_INDEX    = 0x0
SCRAMBLING_CODE_SEED            = 0x0
```

- **SHOW-CAI-AXPARAM;**

  Display the detailed information of the current established access parameter.

```
RADIO ACCESS PARAMETER

T1200          : 20   // The timer used for terminating calls or location registration
SPEC_PWR    : 2   // Output power decided at the timer of access
   MIN_PWR          : 1   // Minimum output power at the point of access
   MAX_PWR          : 3   // Maximum output power at the point of access
   PWR_INC          : 1   // Power increase at the point of access
   PWR_DEC          : 1   // Power decrease at the point of access
   PWR_CLB          : 0   // Power measurement information
   SPEC_DIST        : 4   // Distance information
   FIRST_RD         : 6   // First random delay
   SECOND_RD        : 9   // Second random delay
   RD               : 7   // Random delay
   RPT_RD           : 8   // Repeated random delay
   ACCESS_ACQ_FRAMES   : 2  // Preamble frame count
   ACCESS_MSG_FRAMES   : 1  // Message frame count
   ACC_STRENGTH_RATIO  : 1  // Power ratio of AXCH
   COMMON AXCH PN      : [2f dd 76 4e] // PN seed of AXCH
-------------------------------------------------------------------
   * Current system info sequence number : [1]
```

- **SHOW-CAI-SERCAPA;**

  Display the available service information.

```
SERVICE CAPABILITY

TERMINAL_MODE             : MULTI // Available signal mode
MAX_SERVICE_RATE          : 144K // Maximum service rate available
MAX_ERROR_RATE            : 10^(-6) // Error rate available
   DTX_MODE                  : USED  // DTX mode is used?
   PACKET_MODE               : UNUSED  // Packet mode is used?
   POWER_CONTROL_STEP        : 0x1  // Power control strength
   FWD_RESERVATION_USAGE  : POWER CONTROL // Usage of forward signal channel
   RVS_RESERVATION_USAGE  : POWER CONTROL // Usage of reverse signal channel
   CALL_TYPE                 : 0x4  // Available call type
   CODEC_TYPE                : 0x2  // Available CODEC type
   BELL_MODE                 : 0x1  // Selected bell mode
   REGISTRAION PERIOD        : 0xff // Selected location registration cycle
```

- **SHOW-CAI-RPLIST;**
  Display PN information of neighboring RP that is currently set up.

- **SHOW-CAI-PGCHINFO;**
  Display currently setup PGCH information (Slot paging).

```
PAGE CHANNEL INFORMATION

PAGE_CH              : 7  // PGCH count
MIN_SLOT_CYCLE       : 7  // Minimum slot cycle
MIN_SLOT_CYCLE_NO    : 7  // Minimum slot cycle number
SLOT_CYCLE_INDEX     : 7  // Slot cycle index
```

- **SHOW-CAI-SUBS;**
  Display the information on all current subscribers subscribed to RP.

```
RIU-PT OPR  STATE  TYPE  RATE      IWUI              WASK      WSI       TWUI
000-00 ON   IDLE   POTS  32K   0000000072c10101  4d010101  7f010101  00000000
000-01 ON   IDLE   PKT   64K   0000000072c10102  4d010102  7f010102  00000001
001-00 ON   IDLE   POTS  32K   0000000072c10201  4d010201  7f010201  00000002
001-01 ON   IDLE   PKT   64K   0000000072c10202  4d010202  7f010202  00000003
```

- **SHOW-CALL-PM::: [PSTN/ASYNC];**
  Display PM information related to the calls collected in the system.

- **SHOW-TFCH-PM::: [PSTN/ASYNC];**
  Display PM information related to TFCH collected in the system.

- **SHOW-MISC-PM::: [PAGE/REG/SUBS/TERM/AUTH];**
  Display the PM information related to location registration/subscription/subscription cancellation/authentication collected in the system.

6.3 Trunk unit (TRK4)

(1) TRK4 software configuration

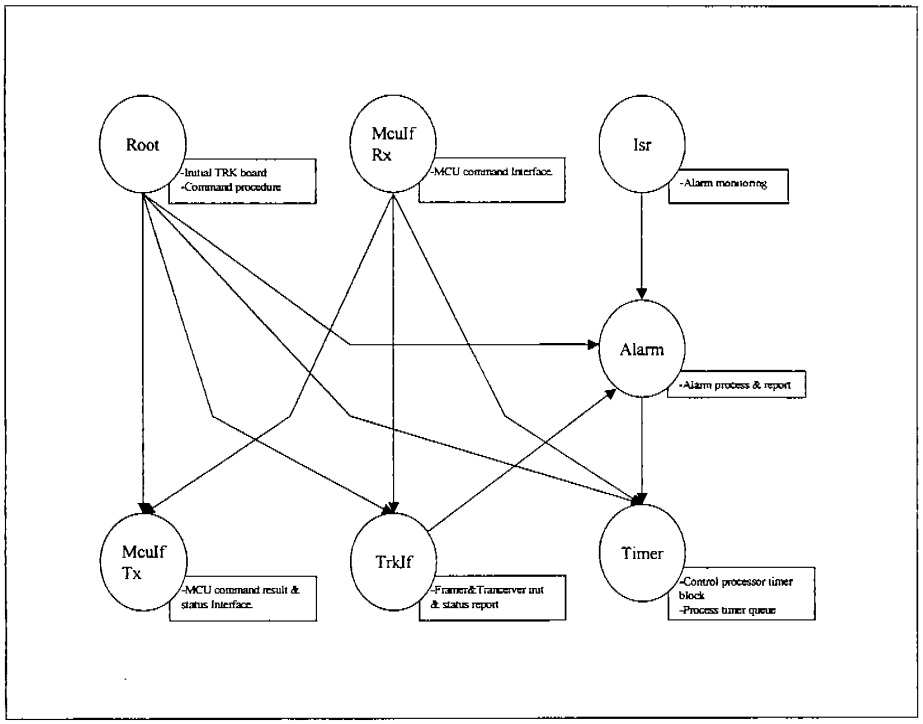


Figure 4-5. TR K4 software configuration diagram

A. Root task
- TRK4 board initialization
- Load initial parameter
- User command process

B. MCU If Rx task
- MCU command interface.

C. MCU If Tx task
- MCU command interface.
- TRK4 status report to MCU

D. Trk If task
- Framer/Transceiver device init.
- Physical status monitor

E. Alarm task
- Physical status report to MCU

F. Timer task
- Control processor timer block.
- Process timer queue.

G. Isr
- Interrupt service.
- Alarm monitoring.

(2) TRK4 software execution module loading system
a. It is downloaded to the application flash ROM through RPOM or the front console.
b. It is loaded on SRAM according to the control of the root program.
c. When the execution module is downloaded by using the front console, TRK4 board is used in the restart mode.

(3) Functions of each TRK4 software module

A. Basic functions

Verifies and reports the physical connection of E1 trunk with RPC and the physical status of E1 trunk.

B. Status verification

C. Front LED status

a. STS Led
- Green in the normal status
- Read in the abnormal status

b. Channel Led
- Trunk ACT : Green
- Trunk STB : Off
- Trunk Loss : Red
- When the trunk remote alarm indicate is being received: Green blinks.
- When the trunk AIS is being received: Red blinks

D. Front console

a. "show-trk;"
Verify the current trunk ACT/STB status and LED status.

b. "show-alarm;"
Verify the status of the alarm displayed in the E1 interface device.

- OOCMF/OOF: Loss of Sync
- RED : Loss of Data
- AIS : Blue alarm
- RRA : Yellow alarm
- LOS : Loss of Data
- RAIS : RAI Send (Ch LED indicates normal. No alarm report)

c. "show-pm;"
The current status of performance monitor of each trunk

d. "show-lpbk;"
The current loopback status of each trunk: LL/RL

e. "show-ber;"
Verify the current BER status

- BER sw : On if BER works, otherwise off
- BER pattern : 511 or 2047
- BER speed : 8k ~ 144k
- Test Direction : Test direction. RPC / RIU, LL/RL is available.
- Trunk : Trunk number with BER
- Time Slot : Timeslot number with BER
- TPD status : Test pattern detector status. In sync / Out of sync.
- Elapsed Time : Total BER time.
- Errored Second: Second when an error occurs
- UAS : UnaVailable Second.
- SES : Severely Errored Second.
- Bit Error Rate
- Blk Error Rate
- Bit Error Cnt
- Blk Error Cnt
- Overflow timer : Elapsed Time Counter overflow alarm.
- Overflow Bit cnt : Bit Error Counter overflow alarm.
- Overflow Blk cnt : Block Error Counter overflow alarm.

6.4 Multi-MoDem Unit (MMDU)

(1) MMDU software configuration

A. MMDU software architecture

a. System-related software
- System software
- Man Machine Language (MML)

b. CAI-related software
- Software related to modem chip drive
- Software related to CAI interface

B. MMDU software description

a. System software

The system software is responsible for main functions for the overall system operation. Its functions include MMDU board initialization routine, interface routine with other boards such as PCPU/PMCU, and the performance monitoring routine.
- Board initial process (Also related to modem chip drive)
- Performance monitoring process (Related to call processing block)
- Board status management process (Related to PCPU/PMCU board interface)
- Downloading process (Related to PMCU board interface)

b. Man Machine Language (MML)

The system operation method in which the operator accesses directly to the system and operates the system with commands is called "Man Machine Interface (MMI). The commands, parsing, grammatical analysis of the commands, and the command execution are generally called "MML"
Typically, MML can be divided into the command analysis pat and the command execution part.
- Command parsing & grammatical analysis (Related to command processing block)
- Command execution (Related to command processing block)

c. Software related to modem chip drive

The software related to modem chip drive can be classified as follows.

❑ **Modem chip initial-related software (Related to call processing routine)**

The software initializes all the chip registers related to modem chip to default.
The software initializes all the variables required for modem chip setting.
The software sets the modem chip data downloaded from PCPU during call setup or call release.

❑ **Demodulator – related software (Finger, Searcher, Combiner)**

Demodulator software is related to the reception of modem chip. It is also related to the demodulation of signals, traffic signals. and pilot signals from RIU.

❑ **Modulator-software (Related to power control)**

This software is related to the transmission of modem chip. It is related to the transmission of signals, traffic signals, and power control information from RP to RIU.

d. CAI interface-related software

CAI Interface-related software includes all the actual call processing routines, for example, the wireless resource allocating and processing routing between PCPU and RIU.

❑ **Interface with PCPU (Call processing related interface)**

MMDU is just a physical path between RP and RIU. MMDU allocates the wireless resources as PCPU does and MMDU sets the related parameters so that calls are processed as the high-level layer intended. In other words, PCPU control MMDU. MMDU plays the role of the ends of RP transmission and reception.

❑ **Interface with PMCU (Status management interface)**

PMCU needs an interface for the routines and the software downloading for board status management tests (LED test, hardware reset, software reset, loopback, channel test) and the result report.

When MMDU board has problems during the service, MMDU sends a fault signal to PMCU and the moment PMCU receives the signal, it generates alarms and takes actions for the fault.

❑ **Call processing software**

The ultimate objective of the interface with PCPU is to make call processing smooth. When RIU attempts subscription, location registration, or a call, MMDU, as a physical path, demodulates various signals of RIU and transmits them to PCPU and relays the signals from PCPU to RIU. For higher quality in call processing, power control information is transmitted to RIU.

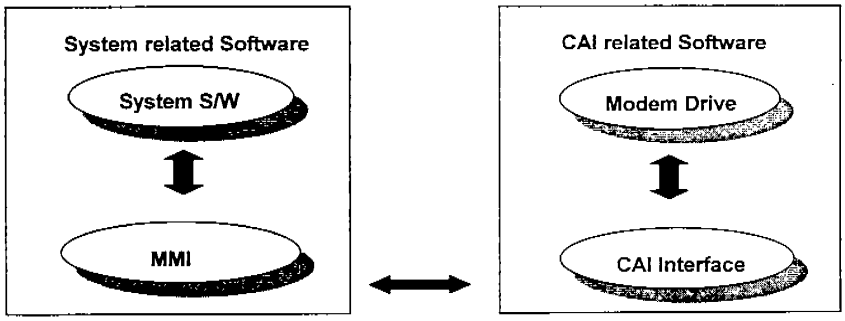


Figure 5-6. MMDU software diagram (System & CAI related architecture)

C. MMDU software execution module loading system.

a. Maximum three executable software are stored in flash ROM.

b. When MMDU board is inserted in the rack, boot ROM sets up 386EX, the main processor, and R380, DRAM controller and loads the programs in a part of flash ROM to load to DRAM.

c The programs loaded to DRAM initializes the modem chip-related registers and initial parameters according to the software execution procedure.

D. Functions of each MMDU software module (Status inquiry command included)

a. Modem chip initial

MMDU software module performs this function when MMDU board is inserted first, or
When MMDU board hardware is reset, or
When MMDU board software is reset, or
When waiting for next call after a call processing.
This function sets the register of modem chip to default.

b. Modem chip setting

When setting up a call, MMDU software module sets the modem chip by downloading call processing parameters (terminal seed, Walsh value, timeslot information and trunk information) from PCPU.
After a call processing, MMDU software module initializes the modem chip setting to wait for next call.

c. Call processing routine

When setting up a call, MMDU board downloads call processing parameters from PCPU board and sets up the call and mediates the exchange of signal data between RIU and PCPU for smoother call setup. After a call is set up, MMDU board plays the role of a path for signal data exchange between PCPU board and RIU and controls power for better call quality. MMDU controls power control based on the demodulation value of the traffic energy from RIU and MMDU adjusts the transmission of RIU by sending adjusting signals to RIU so that the demodulated traffic energy can keep a certain level.

d. Software downloading

MMDU software module performs software downloading through the interface with PMCU board.
When MMDU board requests to download new software or when an operator attempts to download software in RPOM, MMDU software module performs software downloading. At this time, there should be no seized channel in MMDU board.

MMDU software module downloads software as follows.
- Moves the data to download to RAM memory.
- Deletes all the data in the existing flash memory area.
- Programs new data in the flash memory area.

e. Various board tests

This module is related to the interface with PMCU and it performs its functions on requests of the operator in RPOM. The module can perform loopback test, channel test, LED test, software reset, hardware reset, and other tests. These testes are performed only when the channel is not seized.

f. WatchDog-related routine

When a program in execution becomes abnormal and fails to operate normally, this function resets the program software and returns it to normal standby status.

g. Status inquiry command

- All commands are alphabet small letters.
- [enter] means enter key.

❑ **ve [enter]**

Command for software version inquiry

Example] MMDU> ve [enter]
MMDU S/W Version 239a (2000.01.20)

❑ **ste [enter]**

Command to display the current value of each MMDU board parameter

Example] MMDU> ste [enter]

Base Seed I	: 80000000	Base Seed Q	: 80000000
Null traffic	: OFF	ASIC trace	: OFF
MMU trace	: OFF	SYS trace	: OFF
Message level trace	: OFF	ERROR trace	: OFF
RX(ASIC) check trace	: OFF	Time trace	: OFF
Led trace	: pctl	Trace level	: 0
AvgAmpChkLimit	: 19222	DeactCnfThres	: 4000
Master RevChipDly	: 2070	Slave RevChipDly	: 2070
Master Chiplimit	: 3 8	Slave Chiplimit	: 3 8
Deact dly	: 100ms	df Arssi ref 32k	: 25629
df Arssi ref 64k	: 12814	df Arssi ref 128k	: 6407
Mute Ref.	: 12814	Dll-Length	: 1023
Chipdelay period	: 1000ms	Default Toggle Ref.	: 4000
Signal Min value	: 10	Signal Max value	: 57

❑ **st [para1:channel(0-7)] [enter]**
Command for the inquiry of MMDU board channel status

Example] MMDU> st 1 [enter]

ASIC CH : 1

----------Asic State : Ena Ch usage

: Single

Cai state	: Deact		
Trf pwr	: 0	Pcs pwr	: 0
Term seed	: 0x237cd7fa		
Walsh0(PCS)	: 99	Walsh1(TRF)	: 100
RevTRF I	: 2	RevTRF Q	: 1027
Pctl sw	: ON		
E1_trunk	: 0	E1_timeslot	: Dis
Call Rate	: 32k	Deint Status	: ON

❑ **trc [enter]**
Various trace on/off command

Example] MMDU> trc [enter]

1.Asic trace ON/OFF	: off [enter]
2.MMDU trace ON/OFF	: on [enter]
3.System trace ON/OFF	: off [enter]
4.Error trace ON/OFF	: off [enter]
5.Message level trace ON/OFF	: off [enter]
6.Rx(ASIC) check trace ON/OFF	: off[enter]
7.Time trace ON/OFF	: off[enter]
8.WatchDog trace ON/OFF	: off[enter]

ase Seed I	: 80000000	Base Seed Q	: 80000000
Null traffic	: OFF	ASIC trace	: OFF
MMU trace	: ON	SYS trace	: OFF
Message level trace	: OFF	ERROR trace	: OFF
RX(ASIC) check trace	: OFF	Time trace	: OFF
Led trace	: pctl	Trace level	: 0
AvgAmpChkLimit	: 19222	DeactCnfThres	: 4000
Master RevChipDly	: 2070	lave RevChipDly	: 2070
Master Chiplimit	: 3 8	Slave Chiplimit	: 3 8
Deact dly	: 100ms	df Arssi ref 32k	: 25629
df Arssi ref 64k	: 12814	df Arssi ref 128k	: 6407
Mute Ref.	: 12814	Dll-Length	: 1023
Chipdelay period	: 1000ms	Default Toggle Ref.	: 4000
Signal Min value	: 10	Signal Max value	: 57

- **dp [para1: on/off] [enter]**
  Display on/off command related to power control

  Example] MMDU> dp on [enter]
  Display power control reference value mode ON
  MMDU>
  [Rx 0] [25353] Pos 494 / Ref 24453 [0] [24453]
  [Rx 0] [23200] Pos 494 / Ref 24453 [0] [24453]

- **srchfnon [para1: channel(0-7,10)] [para2:srcher on/off] [para3: finger on/off] [enter]**
  Command to display the position and the energy value of each channel finger

  Example] MMDU> srchfnon 1 0 1 [enter]
  Ch 1 Srcher display off
  Finger display on
  MMDU>
  [Ch 1] [490] [23850] [1]
  [Ch 1] [485] [7609] [0] [24699]

6.5 Access Unit (ACCU)

(1) ACCU software configuration

Access software detects the terminal access and sends the information to the high-level layer. It consists of the searcher control part that monitors the pilot channel and searches PN position with energy higher than the threshold and the finger control part that demodulates exact access data in the searched position.

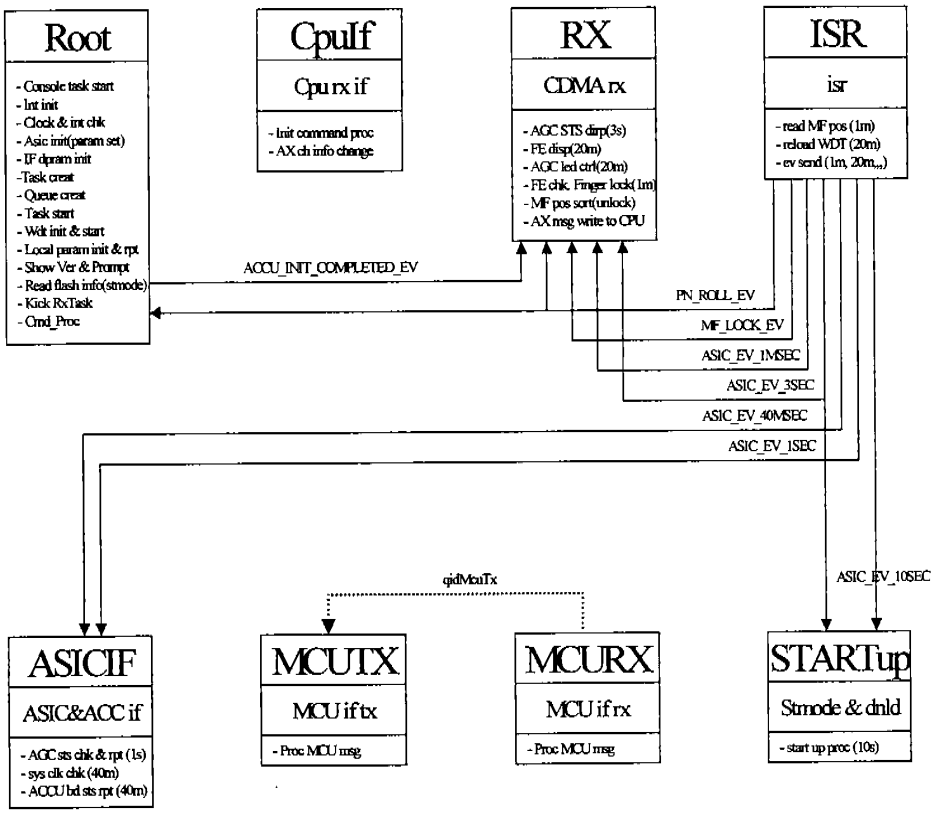


Figure 4-7. ACCU software configuration diagram

A. Root task

- Console task start
- Int init
- Clock & int chk
- Asic init (param set)
- IF dpram init
- Task creat
- Queue creat

- Task start
- Wdt init & start
- Local param init & rpt
- Show Ver & Prompt
- Read flash info (stmode)
- Kick RxTask
- Cmd_Proc

B. MCU If Rx task
- MCU command interface.

C. MCU If Tx task
- MCU command interface.

D. Asic If task
- AGC sts chk & rpt (1s)
- sys clk chk (40m)
- ACCU bd sts rpt (40m)

E. Rx task
- AGC STS dirp (3s)
- FE disp (20m)
- AGC led ctrl (20m)
- FE chk. Finger lock (1m)
- MF pos sort (unlock)
- AX msg write to CPU

F. StartUp task
- start up proc (10s)

G. Cpu If task
- Init command proc
- AX ch info change

H. Isr
- read MF pos (1m)
- reload WDT (20m)
- ev send (1m, 20m,,,)

(2) ACCU software execution module loading system

A. It is downloaded to the application flash ROM through RPOM or the front console.

B. It is loaded on SRAM according to the control of the root program.

C. When the execution module is downloaded through the front console, ACCU board is used in the restart mode.

(3) Functions of each ACCU software module

A. Basic functions

It receives the access attempt of the terminal and transmits the attempt to PCPU.

B. Status verification

a. Front LED status

❑ **STS LED**
- Normal: Green.
- Abnormal: Red.

❑ **RXD Led**
- Normal Rx AGC: Green blinks
- Bad Rx AGC: Off

❑ **ACL LED**
- Terminal Access signal is received: Green
- Normal: Off

❑ **ACT LED**
- Board ACT : Green
- Board STB : Off

❑ **STB Led**
- Board ACT : Off
- Board STB : Green

b. Front console

❑ **"show-fault;"**

Verify the fault of current ACCU board

❑ **"disp-agc-on;, disp-agc-off;"**

Display the current Rx AGC value every one second.

6.6 Radio Frequency Processor Unit (RFPU)

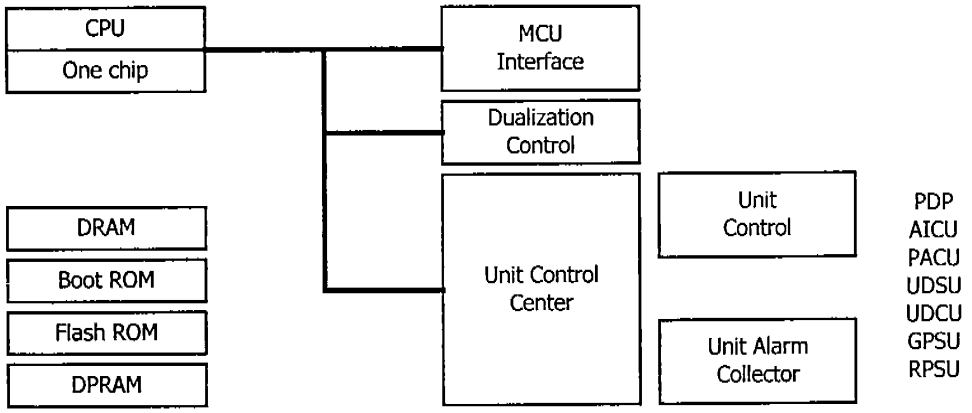
(1) RFPU overview

RFPU monitors and controls the status of each module of RF shelf and collects the alarm status of RF shelf and reports the status finally to RPOM through PMCU.

It consists of the followings.

- **CPU and control part**
- **Interface part**
- **Alarm collection and processing part**
- **Redundancy part**

(2) RFPU configuration



(3) RFPU description

- **CPU and control part**

  : This parts consists of 386 EX processor with the built-in Intel battery, DRAM controller, flash ROM, flash file, and 16 Mbyte DRAM. This part processes all the interrupts of the interface part and takes detailed actions when an alarm signal is generated. Then it reports the interrupt and alarm signal information to RPOM through PMCU. It also stores important information in Flash ROM or DPRAM in order to use the information for rebooting or switchover.

- **Interface part**
  : It has total eight RS-233 ports for PACU, GPSU, RFTU, PMCU(α), PMCU(β), PMCU(γ), and the environment monitoring. CPU processes the data from each port and monitors the port status.

  - PACU interface
    RFPU converts the ENABLE and DISABLE status of each sector PASU through RS-232 interface with PACU and monitors the power status of each PASU, the ENABLE status, the internal temperature, the input power value, VSWR value of each sector, and others and it performs switchover or restoration when necessary.

  - GPSU interface
    Through RS-232 interface, RFPU monitors the online/standby status of GPSU, the status of oscillator, the master/slave status, and GPS antenna status and reports all the information to RPOM.

  - RFTU interface
    Through RS-232 interface, RFPU sets TX attenuator value of each sector and measures the output power and diagnoses VSWR of each antenna.

  - PMCU interface
    RFPU has PMCU and RS-232 interface of each sector, which provide the physical path for the report of the RP rack information to RPOM.

  - AICU interface
    RFPU receives alarm signals from each sector AICU at TTL level and checks AICU installation, DC power, and LNA status.

  - UDSU interface
    UDSU is the RF switch unit that takes charge of 4:1 switchover of UDCU. It performs the switchover for OPEN or FAIL of UDCU.

    RFPU converts the switch status with UDSU at TTL level and monitors the internal UDSU status by reading the converted status information from UDSU.

  - Interface with PDP
    RFPU collects RP rack information and generates critical, major, minor alarms and sends the information to PDP.

  - Other interfaces
    Besides the above interfaces, RFPU has RS-232 interface for environment monitoring and FAN interface.

- **Alarm collection and processing part: RFPU collects the alarms of all the boards in RP rack and reports the information to RPOM.**

- **Redundancy part: The redundancy part monitors the status of the other side with the signals between the active and standby boards. And it performs the redundancy tasks in accordance with the reset of the other side, the status of active and standby switches and the insertion/deletion status.**