No. 10A REMOTE SWITCHING SYSTEM

1.0 Introduction

The RSS is a new member of the ESS family being developed to replace, or to introduce, switching entities that are primarily in the 150 to 1500 (2048 max.) line size. RSS will have application as: a replacement vehicle for small CDOs, a new wire center vehicle and a large pair gain system. There may also be some application for RSS as a vehicle to provide ESS features in No. 5XB offices or to postpone an equipment or building growth addition in a No. 5XB office.

The basic concept incorporated in the RSS design is to control a switch remotely from a host ESS (Figure 1). The RSS remote terminal operates as an extension of the host system and receives command information over a dedicated control link. A single host ESS can control multiple RSSs (31 maximum for No. 1/1A ESS) which may be as far as 75 to 175 miles away, depending on the type of transmission facilities. Some of the major advantages of the RSS system are:

1) Low getting started cost for small switching entities.

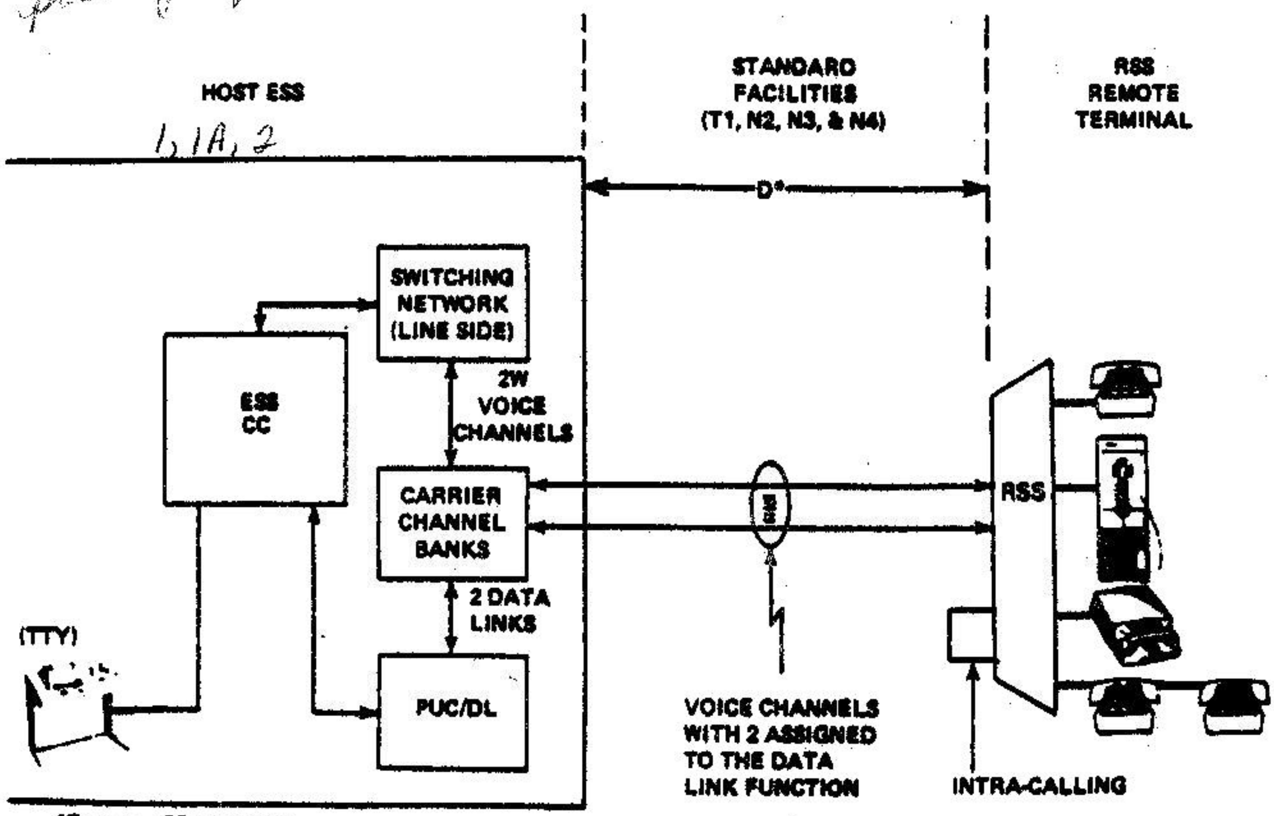
2) Availability of the full range of central office features including: Touch-Tone®, ANI, Zone 16 loop operation, single, 2, 4, and 8 party lines and a complete complement of coin phone operations.

3) Availability of the host ESS features for small switching entities. These features include custom calling as well as all of the administrative aids normally associated with ESS (automatic traffic measurements, automated billing features, remote service order entry etc.).

4) ESS maintenance and reliability including: duplication of essential components, automatic and regularly scheduled diagnostics, automatic error recovery and removal from service of defective units, and centralized maintenance with direct interfaces to the SCC via the host ESS.

5) Intracalling: if a call originates and terminates within the RSS remote terminal, it will be switched on an intra-remote terminal basis and will only use facilities back to the host ESS during call set-up. This is particularly advantageous for the CDO applications where intra-calling typically accounts for a high percentage of the office traffic.

6) Stand-alone operation (optionally provided): in the event the duplicated data link fails between the RSS and its host, the remote terminal will be able to autonomously process intra-RSS calls. The stand-alone mode will provide only basic POTS service for intra-office calls. Coin calls will be handled, but all coins are returned. Custom calling, billing, normal traffic measurements and similar services provided by the host ESS are not available while in this state. (Stand-alone must be used for all CDO applications but is not a requirement for



*Dmax = 175 miles (T1)
= 150 miles (N2)
= 75 miles (N3, N4)

RSS System Block Diagram

FIGURE 1

the pair gain application where the intra-unit calling is typically a low percentage of the total calls handled and complete community isolation will not normally occur.)

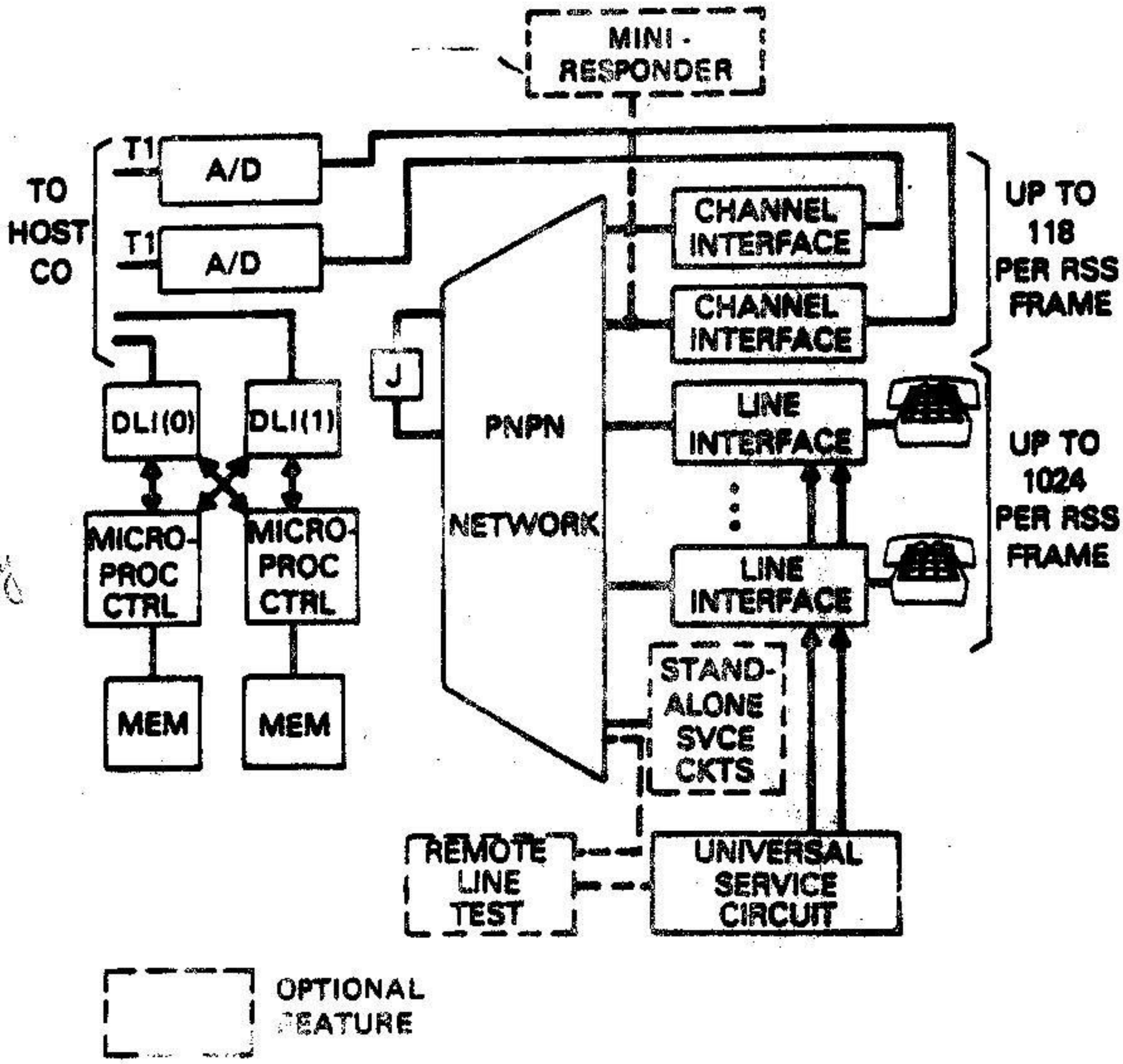
7) As new program features are provided in the host ESSs, these features will become available to the RSSs controlled by these hosts; for example, Voice Storage Services (VSS) can be provided to RSS lines. VSS (GL 77-05-051) will be available in the 1E6 generic for No. 1 ESS lines and the 1E7 generic for RSS lines. The only feature that this does not apply to at this time is Centrex. (See Section 1.1)

Another major advantage of the RSS system is its small size. A single 7' by 3'3" frame will contain equipment for 1024 lines. A maximum size system will contain 2 frames or 2048 lines. A 2 frame RSS configuration will operate as a single entity, controlled by a single microprocessor control and data link complex (located in the first frame - the "home" frame), using a single channel group to the host and providing stand-alone service for all lines within the 2 frame system. (Note that for the larger line sizes, the RSS may be limited by its Busy Hour Calling (BHC) capacity which is estimated at 4000 BHC peak load.) The second RSS frame, in addition to providing more line terminal capacity, will also allow more channels (an additional 120) to be added to the RSS channel group. No junctor reassignments are necessary for this growth frame.

A block diagram of the RSS remote terminal is shown in Figure 2 and a physical layout of this hardware is shown in Figure 3. The remote terminal frame contains a PNPN semiconductor network, a duplicated microprocessor controller and its associated semiconductor memory, line interface circuitry, universal service control circuits (to provide such functions as ringing, coin signaling and line testing), facilities interface hardware, the appropriate DC power supplies, and converters to convert the -48 volt central office battery to the voltage levels required by the remote terminal. The small size of the RSS together with its ability to reuse the existing central office battery plant (typically with less current drain) and the main distributing frame will be particularly attractive in CDOs which are in need of more building space.

The remote terminal is controlled by a host ESS central office over a normal facilities group. The maximum distance between the host ESS and the remote terminal is 75 to 175 miles away, depending on the type of facilities involved. The facilities group can be either T carrier or N (N2, N3 or N4) carrier. Radio facilities are also technically feasible although the specific types of, and restrictions on, compatible radio systems have yet to be identified.

The RSS will be classified in the network hierarchy as part of the class 5 electronic central office that controls it. It is part of that class 5 office because in its normal mode of operation (the emergency stand-alone state being the exception), it is totally dependent upon the host office for its basic call processing functions (i.e. digit reception, digit analysis, routing and call completion). In addition, the RSS



RSS Remote Terminal Block Diagram

FIGURE 2

folded network

provides transparency relative to a subscriber served by the RSS remote terminal versus a subscriber served directly from the host ESS. This transparency is in terms of: access to the DDD network and grade of service for such functions as dial tone delay, probability of network blocking, transmission performance and other service attributes.

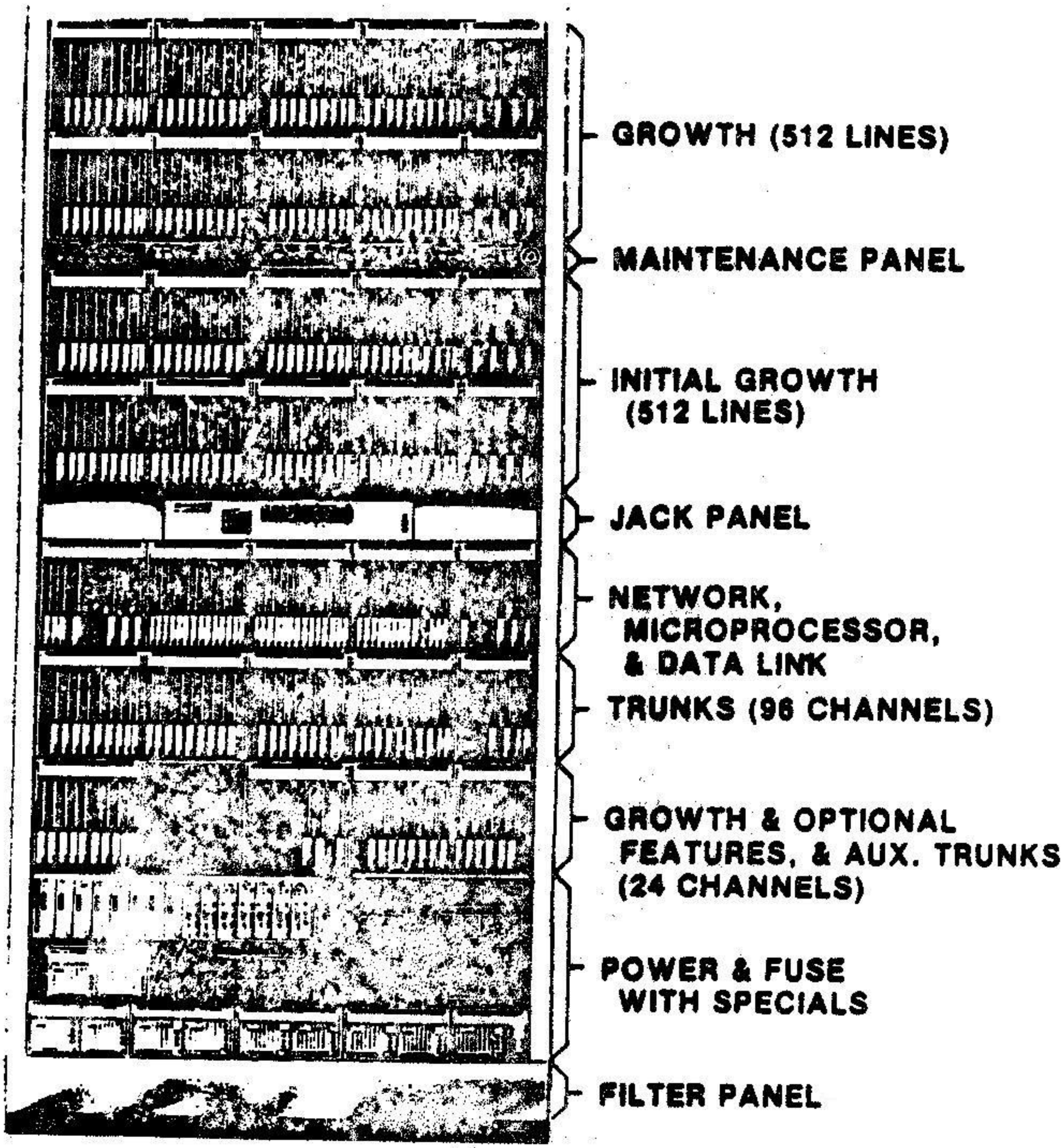
1.1 RSS Features

Important Basic Features Inherent in All RSS Applications

Single, 2, 4 and 8 party Services
Touch-Tone®
Custom Calling Features
911 Emergency Service
Coin: Prepaid Coin
    Dial Tone First
    Coin First
  Non-operator controlled local coin overtime
  Coin Zone Operator
Small business features
  WATS
  Multline hunt group
  Series Completion
  PBX Trunk Interfaces (See Optional Features)
Large business features
  CO Centrex will not be available to RSS lines
Zone 16 Service
Automatic Number Identification
LAMA
Measured Service Capability
TSPS Operation
International Direct Distance Dialing
SCC Maintenance Administration
Remote Channel Maintenance
Automated Traffic Measurements
Call Tracing
Compatibility with: Existing CDO Power Plants
  Group Alerting Circuits
  Loop Electronic Equipment including:
    REGs
    Ringing Extenders and Isolators
    Pair Gain Devices (SLC-40); other Pair Gain Devices are being studied
(See section 6.3.6 for details on Loop Electronics compatibility)

Optional Features

Stand-Alone Capability
Automatic Remote Channel Maintenance
Remote Subscriber Line Testing
PBX Trunk Interfaces (AIOD & DID not available)
Special Service Terminations on Carrier Channels (T1 carrier only)



No.10A Remote Switching System

1,024 Lines/120 Channels

FIGURE 3

Stand-Alone Features

Simple POTS Intraoffice Switching
Provision for recorded message to interoffice call attempts (optional)

Switched Emergency Line providing access to an emergency service circuit(s) not normally served by the RSS switch (e.g., 911 Bureau) in the event of office isolation
Rudimentary Traffic Measurements

Maintenance Features

SCC Maintenance Interface (via the host ESS)
Automatic Trouble Sectionalization
Channel Testing (Manual or CAROT)
Standard T1 Carrier Maintenance and Administration
Remote Subscriber Line Testing (Local Test Desk)

Traffic Features and Measurements

Automatic Overload Control
Line Load Control/Dynamic Service Protection
Engineering and Administrative Data Acquisition System (EADAS) Interface (via the host)

Special Services

Provision for eight built-in standard Special Service D4 Channel Bank plug-ins per RSS frame, if required, for the following:

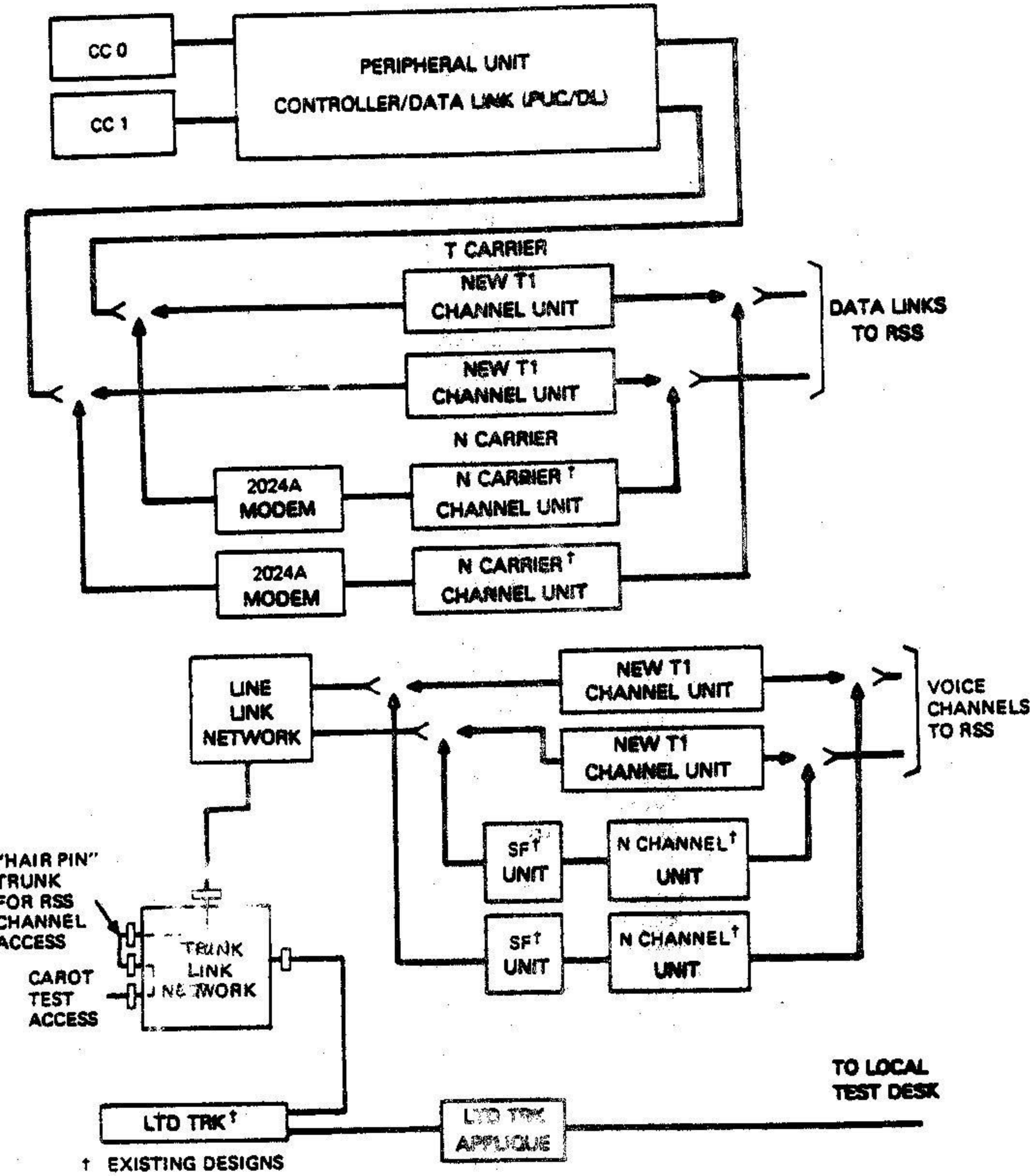
- Off-Premise Extensions
- Foreign Exchange Lines
- Private Lines
- Tie Trunks

An RSS and its host may also be assigned to different Numbering Plan Areas (NPA)*. The No. 1/1A ESS and No. 2B ESS hosts can serve up to six different NPA codes. The initial offering of RSS will require distinct NXX codes for an RSS and host ESS in different NPAs and for any two RSS units served by the same host and located in different NPAs. Until a significant need is established for a single host and associated RSSs to serve offices with the same NXX in different NPAs, such capability will be deferred.

2.0 System Overview

The RSS consists of 3 major components: 1) the remote terminal, 2) the data link and the interconnecting facilities and 3) the controlling ESS. The remote terminal operates primarily as an extension of the host ESS. (Figures 1 and 2) Commands are issued to the remote terminal via a data link. At the remote terminal a microprocessor controller interprets these commands and performs the requested function. In addition, the

* This feature capability was scheduled for the 1E6 generic but has recently been rescheduled to the 1E7 generic.



RSS Host Office Block Diagram

FIGURE 4

controller scans the network and line appearances in the remote terminal for changes of state and reports these changes, via the data link, to the host ESS.

The remote terminal can only interface with the single channel group that interconnects the remote terminal to the host. In the CDO replacement application, this characteristic requires all EAS trunk groups or similar direct trunks to or from the former CDO entity to be routed via the host to any adjacent class 5 central offices. This may create a trunking penalty if the host is not in the same EAS group as the adjacent offices. In other instances where EAS trunking does not dominate, the use of a single high occupancy group between the RSS and its host may reduce trunking facilities by replacing a number of smaller and independent dedicated trunk groups (i.e, operator, coin, non-coin, CAMA, etc.)

The trunk group that interconnects the remote terminal to the host has a number of important characteristics:

1) It is a single high occupancy group. That is, there are no other trunk groups between the remote terminal and the host such as operator trunks, CAMA trunks, etc. This group will be sized using extreme value engineering methods. The use of extreme value criteria with more readily available ABS data is discussed in Section 5.3.

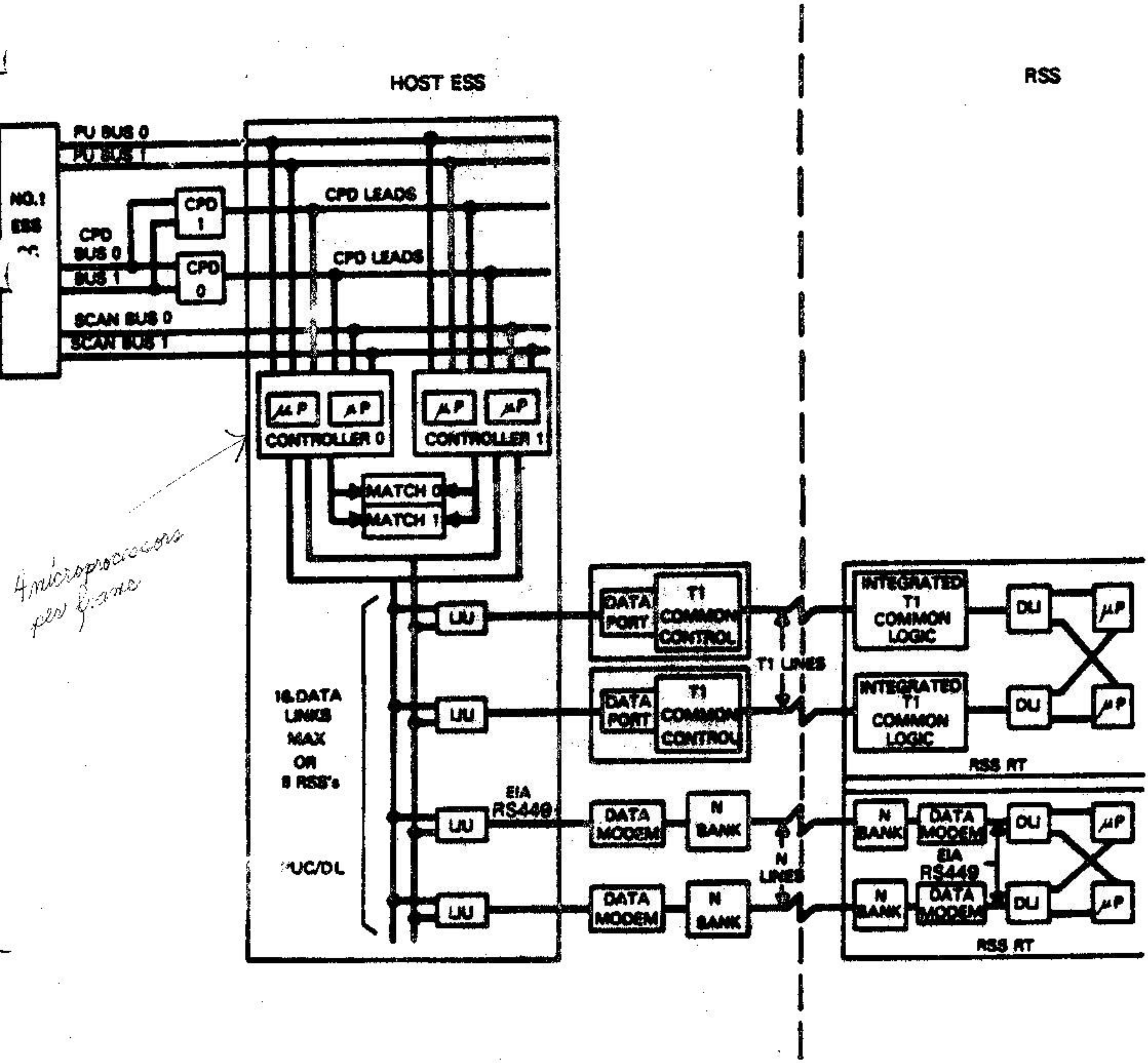
2) It carries both local interoffice and toll traffic as well as the set up portion of each intra-RSS call.

3) It terminates on the line side of the host ESS office. For this reason, the circuits in this facilities group are normally referred to as "channels" to distinguish them from other interswitch trunks. See section 5.4 for common language identification.

4) A duplicated data link to control the remote terminal is included in this group. Two voice frequency channels are required for this function.

The host ESS is the controlling entity for all operations in the remote terminal (with the exception of emergency stand-alone operation). Thus, the host ESS must provide the necessary program store for both the call processing code and the line translation information so that RSS lines can receive service from the host. The termination of the RSS channels on the line side of the host ESS permits much of the existing call processing software in the host to be reused for RSS lines. The channels are, therefore, like heavy usage lines (e.g., like PBX trunks) that terminate on the line link network in the case of No. 1/1A ESS.

A call that originates in the RSS begins with the normal station transition to the off-hook state which is detected by the microprocessor controller in the remote terminal. This off-hook information is sent to the host ESS via the data link. The host central control (CC) then searches for an idle path in the remote network by looking



RSS Data Links

FIGURE 5

through a network map stored in the host ESS memory. When an idle path is found, the host issues a data link order to set up a path from the RSS line through the remote terminal to one of the channels terminating on the line side of the ESS network. Functions such as dial tone, digit reception, audible ringing and on-hook timing are then handled similar to those for the local lines that terminate on the host directly. (Note that for stand-alone separate service circuits are provided at the RSS remote terminal.)

Calls that originate outside the RSS and terminate in the remote terminal are handled in a similar manner. If a call originates and terminates within the remote unit, an RSS connection is established so that, during the talking state, no channels in the RSS channel group are required. Exceptions to this are coin, revertive and other call types requiring a conference bridge circuit such as 3-way calls or call waiting.

3.0 Application Areas

3.1 CDO Replacement

There are presently about 3000 small CDOs in the Bell System below 1500 lines in size. The RSS will serve as an economically attractive modernization vehicle for these small CDOs because of its low getting started cost, its small size, and its capability to reuse the existing battery plant, the main distributing frame, existing facilities and the building. Furthermore, RSS will provide all of the feature enhancements of ESS to small CDOs and will offer a cost effective vehicle with which to provide ANI, LAMA, TSPS interfaces, remote line testing, remote trunk testing, ESS office administration and ESS maintenance and reliability.

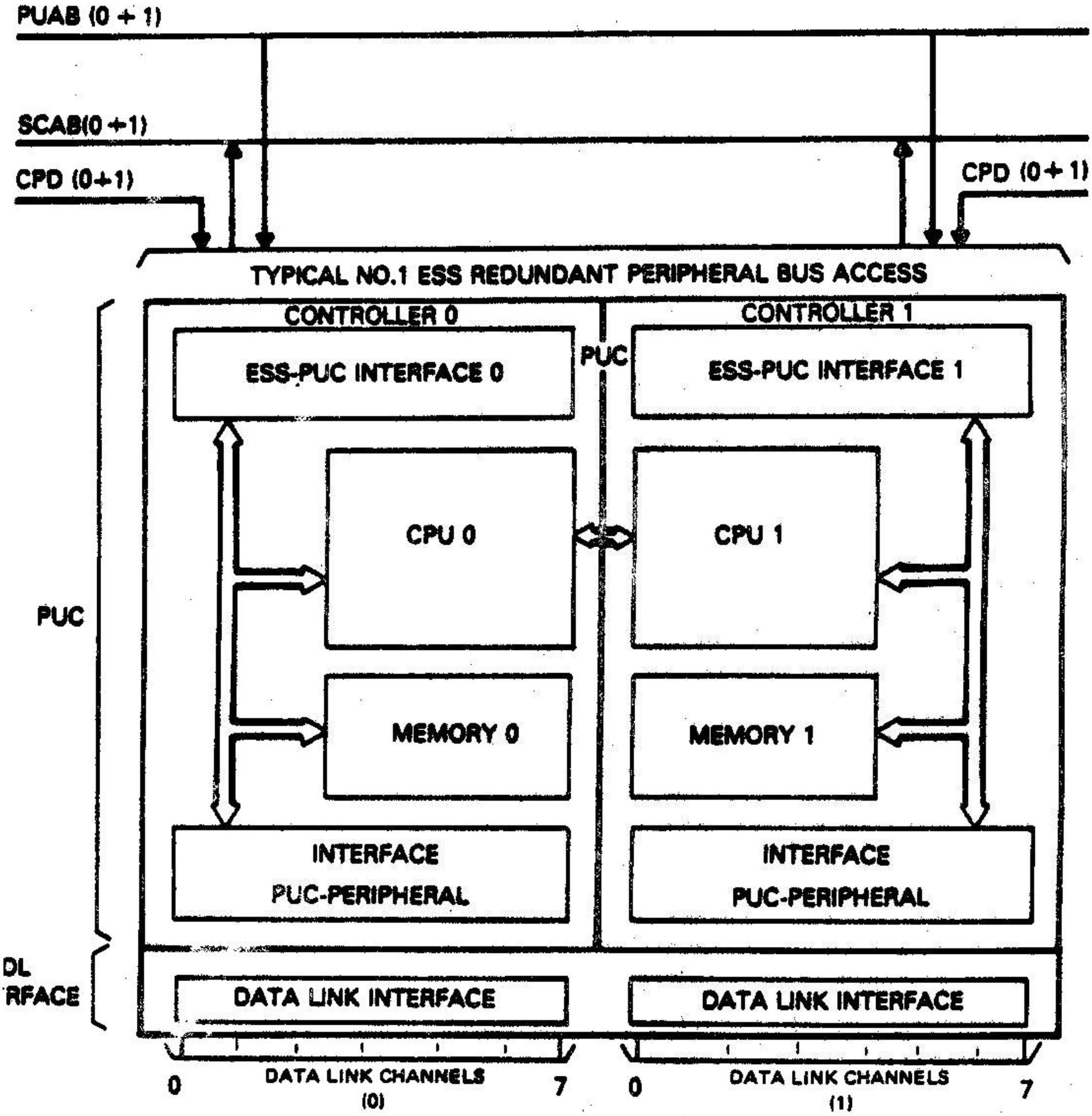
3.2 New Wire Centers

RSS, because of cost and service features which make it attractive economically as a CDO modernization vehicle, affords a potentially desirable method of establishing new wire centers. In addition, application of RSS to new wire centers is enhanced by the fact that the RSS can share the NXX designation of the host ESS (provided the two wire centers are within the same rate area).

Thus, RSS can be utilized to bring electronic switching technology economically to new wire centers at a smaller initial line size than is the case with existing ESS vehicles. This will preclude the establishment of significant amounts of long loop plant in many cases. If the new wire center is expected to remain small for the duration of the planning horizon, RSS, because of its NXX-sharing feature, can be the long term solution to a particular wire center problem. RSS may, of course, be only an interim solution, requiring replacement with a larger vehicle as demand grows. In this case, the RSS can then be readily moved to another location and be reused.

The RSS entity, when used as a new wire center, will have the following characteristics:

1) A separate administrative entity in the network with its own traffic measurements and alarms.



PUC/DL Block Diagram

FIGURE 6

2) A zero resistance point for the loop plant.

3) Intra-switching of local RSS calls.

4) A stand-alone capability to provide an autonomous switching entity in the event that the facilities to the host fail.

5) Single route access via the host ESS to the toll network as well as to other class 5 offices.

6) A dedicated NXX, if required.

7) A well defined geographical boundary serving all customer demands in that area.

3.3 Pair Gain

Pair gain refers to the use of electronics in the loop plant to reduce the number of physical cable pairs required. Traditionally, pair gain systems have tended to be relatively small and used mainly in slowly growing, long feeder routes in rural areas. Recent studies, however, indicate a potential for a pair gain market in suburban wire centers. In particular, because the cost of cable and conduit has continued to rise and the cost of electronics has continued to decrease, the opportunities to deploy pair gain devices in the larger cross-section cable routes has increased. This is especially evident where significant growth exists on a cable route at moderate distances from the wire center. The RSS will provide a vehicle to serve this pair gain function in wire centers served by an ESS.

In pair gain applications, the RSS remote terminal equipment will be installed in a small building or hut rather than in the typical cabinet arrangement usually associated with present day pair gain systems. Because of the relatively large size - typically 500 to 1000 lines - expected for the RSS pair gain installation, site designs, right-of-way and craft access considerations indicate the hut to be a more desirable arrangement than a cabinet.

The RSS entity, when used in a pair gain application, will have the following characteristics:

1) Administered as part of the cable plant. Pairs beyond the remote terminal are considered as derived cable pairs.

2) Can be a zero resistance point*.

---

*For initial pair gain planning, the loop plant beyond the remote terminal will not be regauged because of administrative considerations.

Peripheral Unit Controller/Data Link

(PUC/DL)

SD1A478 - 01, J1A099A - 1

LIST NO.	*DESCRIPTION*	*QUANTITY*
1	BASIC FRAME; INCLUDES MICROPROCESSOR EQUIPS 1ST 8 DATA LINKS FOR I/O	1/4 per RSS
2	PLUG-INS FOR RSS OPERATION CONTAINS RSS WIRED LOGIC	4 per RSS
3	LINE INTERFACE UNIT	2 per RSS
6	EQUIPS 2ND 8 DATA LINKS FOR I/O	1/4 per RSS

SCAN POINTS (PER PUC/DL): 20 DIRECTED MASTER
4 SUPERVISORY

PULSE DISTRIBUTORS (PER PUC/DL): 40 UNIPOLAR
10 BIPOLAR

FIGURE 7

3) Optional stand-alone capability.

4) Single route access via the host ESS.

5) Non-dedicated NXX code.

6) May not serve all pairs in a given area but may serve customer demand in conjunction with other physical wire pairs.

An SL providing information for pair gain applications is in preparation and should be available in 1Q 1979.

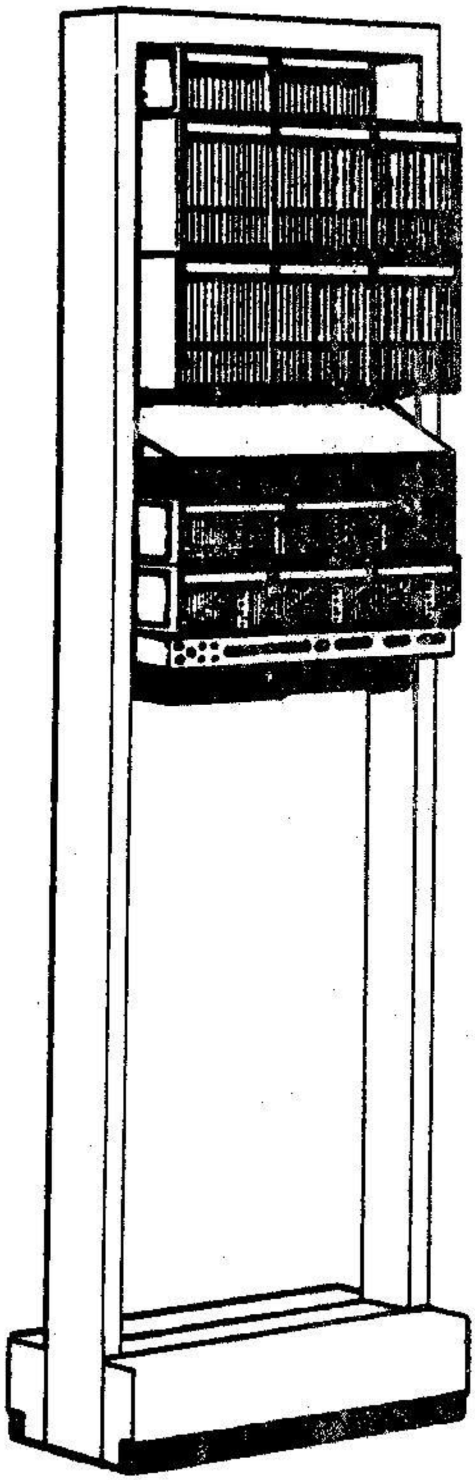
3.4 Feature Extension

In a feature extension application, the RSS is colocated with an electromechanical entity, typically a No. 5XB office, to provide ESS services, such as custom calling or other modern features for which the electromechanical office may not be equipped. The RSS could thus provide these features or services, if the customer is willing to take a number change. Feature extension with RSS provides the capability to implement ESS features throughout a given geographical area. In addition to feature extension, the RSS, with its small size and its potentially short installation interval, may permit the postponement of a building or an equipment addition in No. 5XB offices.

At the present time, this application is not being recommended for widespread use. In special circumstances where there is a clear economic advantage, it may be applicable. Studies are in progress to assess the economic impact of this application. In addition, there is a transmission consideration which may limit the serving range of RSS in this application. That is, in this application a transmission path can result in the presence of undesirable loss (2-5dB) between two switching systems within the same wire center. Note that calls between the RSS entity and the No. 5XB system that is being provided with feature extension must be connected via the host ESS. Although the RSS to host link will be 0 dB, the host to No. 5XB direct trunk group will typically have 3 dB of loss. To compensate for this loss a restriction on the length of the loops connected, either to the RSS or the No. 5XB, may be required. The direct trunk group loss should not exceed 3dB to minimize contrast effects, especially for calls within communities of interest.

4.0 RSS Area Planning

The planning for RSS deployment in its various applications will require considerable analysis, a broad perspective of the planning function and interdisciplinary cooperation. RSS and its host ESS is a distributed switching system and many variables must be accounted for and analyzed. In general, the planning for an RSS must take place on an area basis where the area may be defined as: (1) a wire center (i.e., for pair gain application), (2) wire centers with substantial growth at their adjacent boundaries (i.e., for pair gain/new wire center applications), (3) a cluster of wire centers where a cluster consists of the subtending offices to a class 4 toll office, and (4) and NPA region (or multi NPA region) consisting of several clusters of toll centers in which rural toll consolidations are possible and the resulting economics are impacted by RSS CDO replacement.



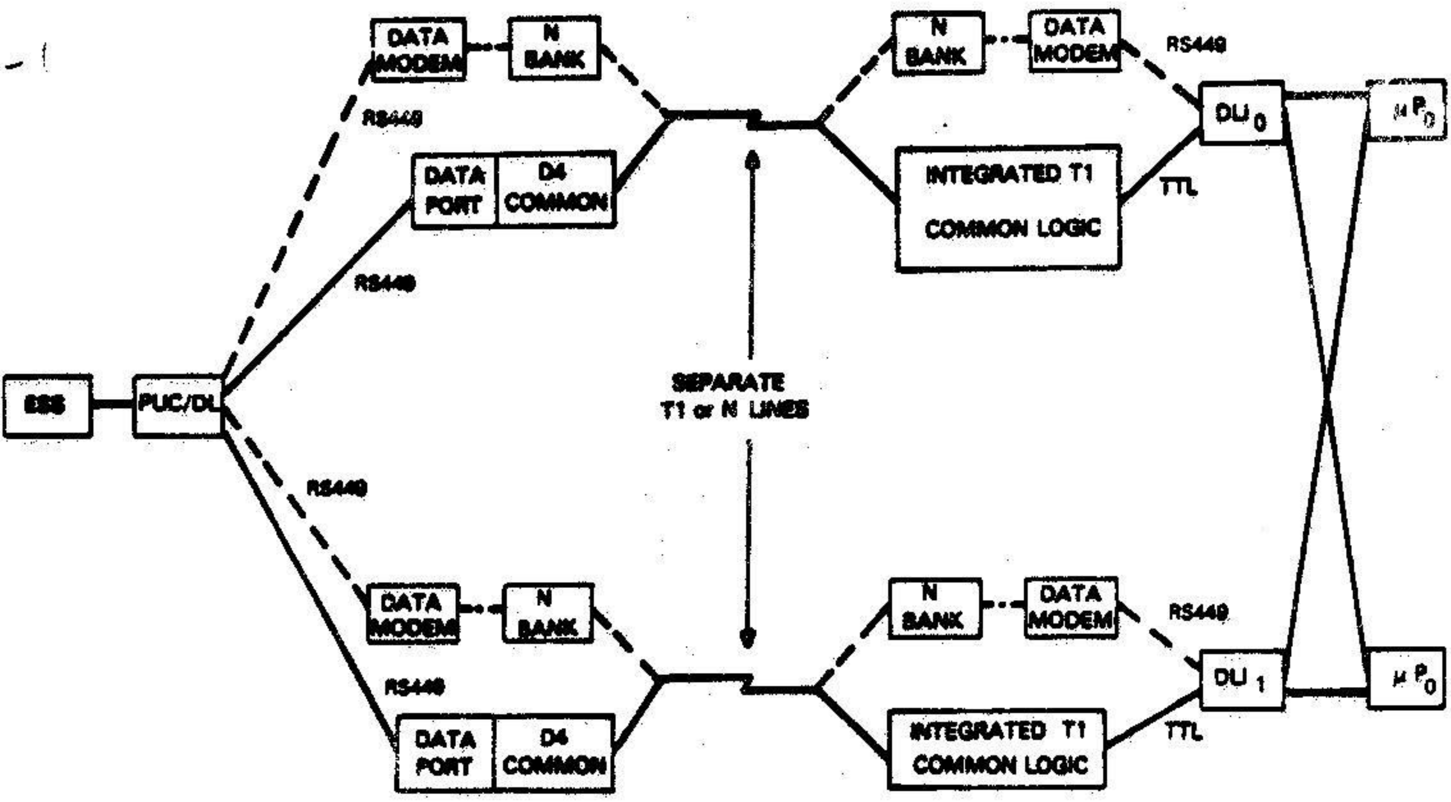
PERIPHERAL UNIT CONTROLLER/DATA LINK(PUC/DL)FRAME
FIGURE 8

In rural area modernization, it will no longer be appropriate to study CDO replacements on an office by office basis. In this regards it is very important to evaluate the economics of replacement taking the area as a whole into consideration. For example, in a cluster of CDOs (assume 5 to 10) homing on a class 4 ESS toll office, or possibly a class 4 electromechanical office that is a candidate for an ESS replacement, it is necessary to evaluate not only the costs of individual RSS CDO replacements but also the facility impact of the RSS-to-host links, the facility impact of new toll connecting trunking arrangements, and changes in toll switching requirements on the class 4 office. Remote switching deployment can radically change the traffic and facility network configuration and the resulting economics are important in determining the overall network modernization alternatives. The impact on equipment for operator services is another important consideration. RSS deployment can affect the location of RTAs and their resulting exhaust dates. In addition, the real time effect and the network CCS demands on the host ESS must all be addressed in an RSS rural area modernization plan.

Area planning studies conducted by AT&T, BTL, and Operating Company study teams have indicated the need for an area planning study procedure to identify when the above aspects must be evaluated in detail. Based on these experiences, study guidelines, methods, and tools are now becoming available to address the local switching CDO modernization decision in conjunction with an interoffice facility analysis. These guidelines are being prepared in a separate planning letter on CDO replacement planning methodology to be issued later this year. In addition, a training course on this subject is available through the Bell System Center for Technical Education (as discussed in Section 6.8).

The pair gain and new wire center applications will also require a new planning perspective to examine the opportunity for saving potentially large investments in outside plant facilities. RSS will serve as a large (150-1500 lines) pair gain vehicle for ESS wire centers that require substantial outside plant facilities relief. The RSS will be particularly attractive in suburban wire centers experiencing growth rates where the relief of a subscriber feeder cable structure or other large, cable-associated costs can be economically deferred. In wire centers served by electromechanical switching systems, the savings in outside plant facilities by an RSS alternative may provide a significant economic trigger to justify the early replacement of the electromechanical central office. If a pair gain alternative is economically attractive, such factors as sizing, placement, timing and annual maintenance and administrative cost will need to be addressed in detail. The interaction with the local switch modernization will also add another planning dimension.

Thus, planning for RSS deployment either on a wire center cluster basis for CDO replacement, or within an exchange boundary as a pair gain vehicle or new wire center, will require a thorough analysis of the engineering tradeoffs and a new emphasis on interdisciplinary planning.



RSS Data Link
FIGURE 9

Two particular studies are relevant in this area. First, a description of a new wire center applications study performed by Cincinnati Bell will be issued in the first quarter of 1979. Second, a description of suburban loop electronics studies and a methodology for permanent application of pair gain systems in suburban areas will also be issued in the first quarter of 1979 and the second quarter of 1979 respectively.

In the longer term, AT&T and Bell Laboratories have recognized the need for the integration of central office modernization planning, outside plant relief planning via remote switching or loop electronics, and interoffice facility planning affected by switching load transfers. Representatives from the Network Planning, Exchange Systems Design and Network Programming and Analysis organizations at both AT&T and BTL are addressing these interdisciplinary planning situations. The methodology for such planning, together with recommendations on how to use the existing tools, and possible recommendations for new planning tool developments will be forthcoming and more detailed planning methodology will be issued in 1979.

5.0 System Description

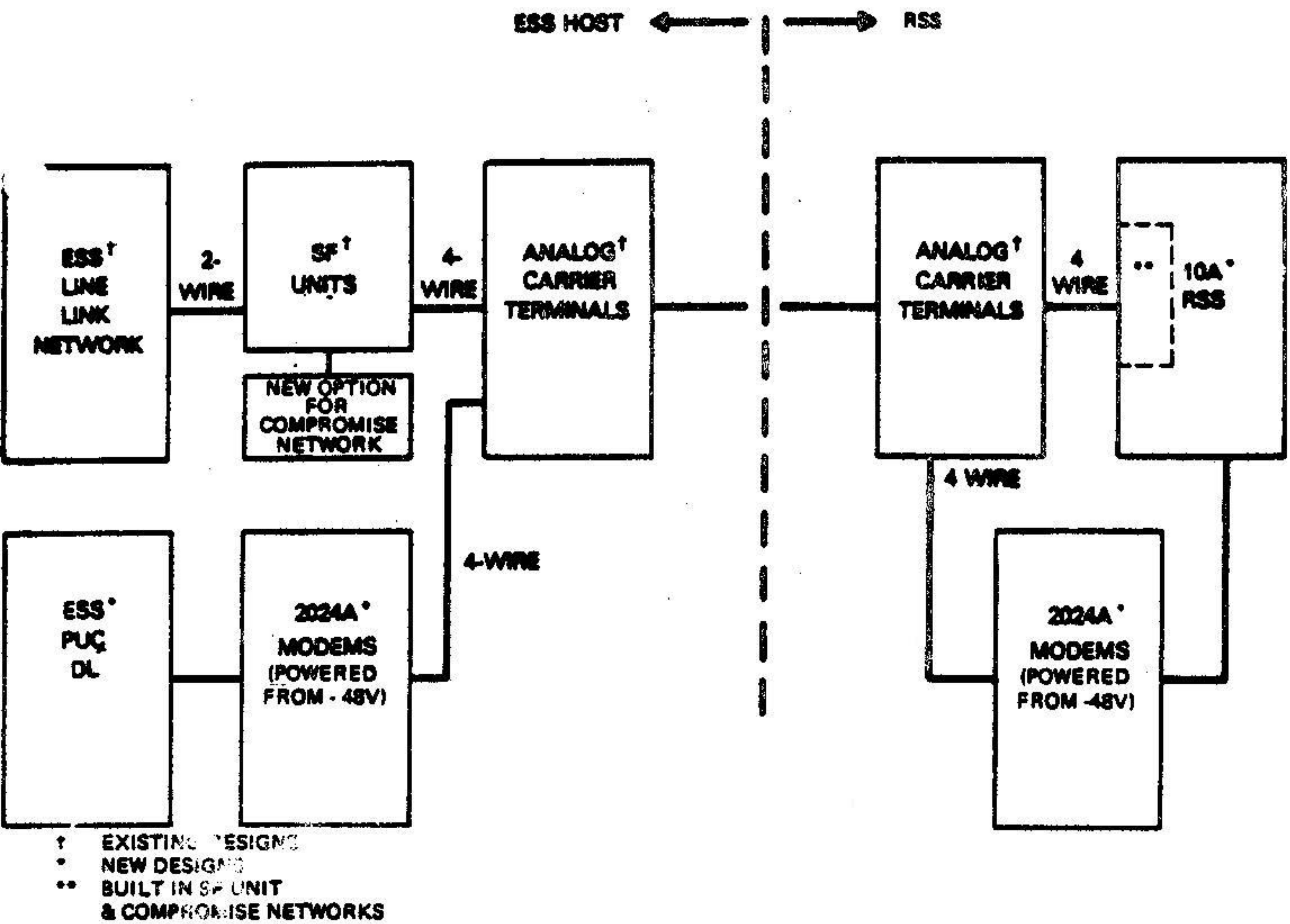
5.1 Remote Terminal

5.1.1 General

The RSS remote terminal frame (as shown in Figure 3) contains all of the necessary hardware to serve 1024 lines (with the exceptions noted below). If T carrier is used, an integrated D bank within the remote terminal frame can provide up to 120 T channels for 1024 lines. An additional RSS remote terminal frame can be added for growth beyond 1024 lines. Although the second frame does provide an additional 120 channels as well as 1024 lines, the two frames serve as a single entity with a single group of facilities back to the host. No junctor rearrangements are necessary for growth within a frame or when a second frame is added.

The basic getting started hardware for the remote terminal is the frame, the power supplies, the data link and the associated channel hardware to interface with the facilities. The main growth items within the remote terminal frame are the line interface circuit packs, the universal service circuits (USCs) and the facility channels. As the line size of the remote terminal grows, channel packs, USCs, line packs and power converters are added. Thus, growth on RSS is straightforward and shorter growth intervals than presently experienced with ESS offices should be expected.

The only major items the RSS frame will not include are: the -48 volt central office battery plant plus its commercial AC power interface (including emergency power if provided), the main distributing frame and any miscellaneous circuits such as specials (for T carrier only, 8 plug-in positions for specials are provided for within a single RSS frame), group alerting or emergency reporting and any miscellaneous alarm circuits. If announcement capability is provided for the stand-alone state (in the normal mode, announcements are given by the host



N Carrier Interface

FIGURE 10

equipment) 7A announcement equipment or its equivalent must also be provided independent of the RSS frame. In addition, for the T carrier application, if back-powering for the T repeaters is required from the RSS remote terminal, this must be separately provided. Where N carrier is used, the N Carrier channel banks must be provided.

5.1.2 Functional Operational

Overview

The host ESS provides the overall call control for all connections (except for the stand-alone mode) involving the RSS remote terminal. Such items as the RSS line translations, the remote terminal network path memory, RSS to host channel assignments, and the data link status information are all maintained within the host ESS central control (CC). Thus, it is the host CC that determines the channel assignments for each RSS connection and executes the network path hunts for the RSS remote terminal. The function of the RSS controller is to interpret and then execute orders issued by the host ESS CC.

Control orders are issued by the host CC to the remote terminal via data link messages. These orders are received by the remote terminal, checked for integrity, and then executed. A single data link order will typically translate into a complex sequence of control operations to be performed. The important aspect of this operation is that the sequence is initiated by a stimulus from the host ESS. The stimulus by the host ESS contains only the type of function requested (no detailed sequencing information) and, if required, the corresponding line, network path and junctor assignment involved. The remote terminal controller is then responsible for the sequencing and control operations necessary to perform the function requested. For a typical call this includes: setting up the PNPN network connections for the voice path, establishing metallic access network paths, controlling the universal service circuits and scanning the network and subscriber lines for changes in supervision.

In many respects the operation of the RSS remote terminal is analogous to the operation of a typical peripheral frame within the host ESS. That is, a peripheral order is issued by the CC, the order is then executed autonomously, and supervision and order acknowledgement information is returned to the CC. The major differences with the RSS operation are: the distances involved between the peripheral frame and the host CC, the degree of complexity of the remote terminal controller, and the number of functions that are contained within the single RSS remote terminal frame. It is this analogous operation that allows the host ESS to reuse much of its existing software for RSS and provide ESS line features to the RSS. For example, in a call terminating in an RSS, a ringing voltage must be applied to the subscriber's line. The call processing sequence for this function is performed with the same host ESS code that performs this function for a call terminating in the ESS. However, once the termination is recognized as an RSS line, a data link message is sent to the remote terminal to apply ringing rather than providing ringing from the host to a subscriber line. Therefore, there are decision points in the host ESS call processing sequence that determine how a particular function is to be carried out. That is, a normal host ESS office peripheral order or a data link order to an RSS remote terminal.

The stand-alone state is invoked when the duplicated data links have both failed and control stimuli have stopped arriving from the host ESS. Upon waiting a short interval (in the order of 30 seconds) to allow for an intermittent failure or "hit" on the facilities between the RSS remote terminal and its host ESS to clear, the remote terminal controller will initiate its own call control sequences. The ability to perform in this stand-alone state requires:

1) A call processing control capability for emergency POTS capability. Thus the controller needs additional control memory to perform this function relative to its normal state.

2) Up-to-date line translations stored within the remote terminal. Since these normally reside in the host ESS, their contents must be periodically copied to the remote terminal. This updating is performed automatically during off peak traffic periods.

3) Service circuits must be provided at the remote terminal to serve the stand-alone traffic. Therefore, dial tone, digit receivers and audible ring that are normally provided at the host ESS must also be located at the remote terminal for the stand-alone state. (Note: ROH tones are always provided at the remote terminal.)

Functional Components

The RSS remote terminal can be partitioned into a number of individual functional entities as shown in Figure 2. An overview of each of the major entities is outlined below. For a detailed description of the RSS remote terminal, see a companion letter (EL 6211).

The microprocessor controller is the controlling entity for the entire frame. It consists of a duplicated MAC 8 microprocessor (with added control logic) and associated microprogram memory.

The Data Link Interface (DLI) provides the electrical and signal interfaces to connect the two voice channels that are assigned to perform the data link operation directly with the dual microprocessor controllers. The input(output) to(from) this interface on the facility side of the remote terminal is a normal T or N voice channel. The DLI also allows either microprocessor controller to access either data link. The necessary hardware to implement the signal protocol, error detection for transmission checks, and the appropriate message formats is also contained in the DLI function.

The RSS switch matrix is an analog, space division, two wire, two stage, folded network. That is, both the lines and the channels appear on the same side of the network. The network fabric is constructed using a semiconductor device called a PNPN. This is a miniaturized solid state crosspoint. In addition to its very compact size, it requires a low level signal to activate a change in its open or closed state. These attributes make the PNPN network and its solid state logic control very compact and low cost.

In the PNPN network, the junctor circuits are also electronic (contain no relays) and as a result are integrated onto the same circuit packs as the network fabric. The entire PNPN network, apart from the first stage of switching, together with the junctor circuits for a 1024 lines, is contained on 32 circuit packs mounted in about 1/2 an equipment mounting unit as indicated in Figure 3. The first stage of switching for the network is actually implemented on the Line Interface (LI) circuit pack (also on the channel interface circuits and on the stand-alone service circuit interfaces provided at the remote terminal); and, as such, the network grows with the basic growth increment of the RSS remote terminal, the LI circuit pack.

The LI circuit pack provides the hardware interface between the tip and ring of the subscriber loop and the PNPN network. Eight subscriber loops can be accommodated on a single LI circuit pack. In addition, since the PNPN semiconductor network cannot transmit the high level signals needed to ring the station set or to control coin phone operations, a special metallic access is provided to the tip and ring leads via the LI circuit pack for the Universal/Service Circuit (USC).

The USC is essentially a programable voltage source, controlled by the RSS microprocessor controller. It can provide voltages that range from +150 v to -150 v in a number of different timing sequences. It is the USC that provides the different voltages for ringing single, 2-party, 4-party and 8-party lines. This includes both AC/DC ringing as well as superimposed ringing. The USC also generates the coin control voltage needed in the variety of different coin phone operations. In addition, it provides important testing and diagnostic capability. For loop testing, the USC, via the metallic access network on the LI circuit pack, can test both the DC as well as the AC impedance of the loop. Another important feature the USC and its access circuits provide is the ability to test backward into the network. This is a very valuable feature since the network path integrity, including the correct operation of the network control functions, the junctors and the LI circuit pack can be verified under program control via the USC.

The Channel Interface (CI) provides the circuitry necessary to interface the channels between the RSS and its host ESS. For T carrier this includes most of the functions normally performed in the D channel banks to convert 24 voice channels to one T1 line. Thus, multiplex-demultiplex, signal conversion, alarm monitoring and the analog to digital conversion are performed in this interface. In addition, compromise networks, a 2 db pad and the switching logic needed to insert the appropriate termination into the hybrid connection between the 4-wire facility path and the 2-wire subscriber loop are contained on this pack. (See Section 5.5 on the RSS transmission plan.) For N carrier, the multiplex-demultiplexing is not performed within the RSS remote terminal. It is assumed that the normal N carrier channel bank equipment, typically already present, will be used. The remaining functions, however, will be performed in the CI interface within the RSS remote terminal frame.