TASS

39. The United Kingdom Telegraph Automatic Switching System (UK TASS) is a Telex type of network connecting most RAF and ARMY stations in the UK. The equipment is hired from BT, and stations are able to dial each other and pass traffic. Interfaces between TASS and the central message switch network are situated at LINDHOLME and RUDLOE MANOR.

TELEX

40. The UK TELEX network is a telegraph network owned by BT where subscribers pay rental for their equipment and facilities. Most Commcens have TELEX Terminals and the System is cleared for the transmission in plain language of UK National and NATO UNCLASSIFIED and RESTRICTED messages. No other classified traffic is permitted on the TELEX network. The most common use of the system is the connection of MARISAT fitted ships working with civilian satellite terminals with military Commcens. Occasionally the system is employed for System Engineering. TELEX must never be used for the transmission of a message when a military circuit exists. TELEX fitted RN Stations are listed in RNCP 6.

BROADCAST MONITORING

41. As a broadcast is a one-way communications system it is difficult to provide adequate quality control. MEP generated broadcasts have their own method of quality control and this will be discussed in the section on the MEP.

42. All non-MEP generated broadcasts are monitored in some way off the air in order to provide a check of:

(1) The TARE output.

(2) The correctness of the on-line encryption process.

(3) The correct delivery of the telegraph signal to the transmitter station.

(4) The Radio Path.

Normally the LF component of a broadcast is monitored off the air (OTA) at the originating Commcen. The traffic is routed to a bay where operators check off the signals as they are transmitted. If the broadcast is manually generated the OTA Receiver drives the teleprinter backroll on the bay where the broadcast is transmitted.

43. Should local reception be impossible, a receiver at the receive site is employed, sending down the signal by landline to the Commcen. This is known as Secondary Monitoring. Exceptionally HF components of the broadcast are monitored, should ships complain of broadcast reception.

44. Satellite broadcasts are also provided with a monitor, known as the 'Integrity Monitor'. This takes the form of an OTA monitor at the SGT, fed back to the Commcen, and is therefore a true monitor of satellite output. Once again this is normally applied to a bay (Non-MEP).

45. A bay associated with a manually generated broadcast is also fitted with a TAA70 for generating the traffic. A typical OTA LF broadcast monitor is shown in Fig 4.11.

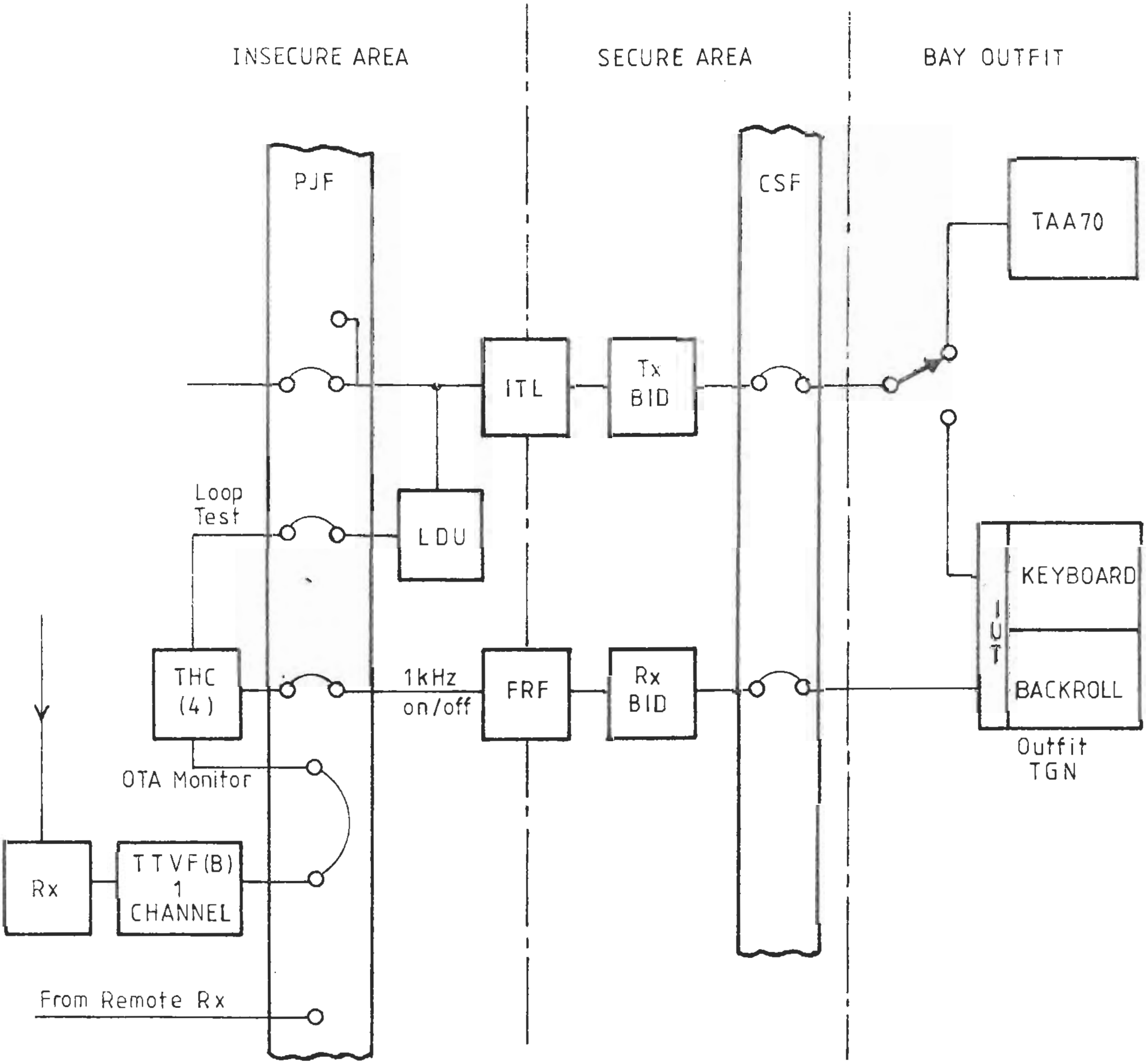

Figure 4.11 - OTA Monitor for Manually Generated Broadcast

46. The LOOP TEST facility is purely for a back-to-back verification of the transmit and receive cryptographic equipment. This circuit includes a Line Delay Unit, which imposes a similar delay to that occurring over the Radio Path. Front patching is required to utilise the Secondary Monitoring System.

AUTOMATION OF FLEET COMMUNICATIONS

47. Whitehall TARE was designed to be able to provide a number of straightforward Fleet Broadcasts. Until recently B11A and the satellite broadcasts were TARE controlled. Satellite Ship-Ship was automated by the Front End Processor (FEP), a small message switch (SPERRY 'SCAMP') which interfaced with

TARE. TARE could also operate a few MRLs. Expanding traffic levels, and the requirement for more ship-shore channels and scheduling of certain broadcasts brought the need for a new system. Part of NSR 7345 specified a system to meet the new requirements with additional benefit of automating Ship-Shore.

48. So the primary task of the system is to provide computer-automated control of Fleet communications:

(1) HF Ship-Shore - 10 channels available.

(2) Satellite Ship-Shore - 14 channels plus receipt channel.

(3) HF MRL - four available.

(4) Satellite MRL - four available.

(5) HF Broadcasts - five, with schedules available.

(6) Satellite Broadcasts - four available.

49. The computer systems are identified as follows:

(1) Message Processor (MEP) - Outfit PRA(1) (WHITEHALL).

(2) Management Processor (MAP) - Outfit PRB(1) (FOREST MOOR).

(3) Cryptographic Switching Unit (CSU) - Outfit PRC(1) (WHITEHALL).

50. Tasks allocated to computer control are:

(1) Administration of channel availability broadcasts for HF Ship-Shore, and channel receipt information for Satellite Ship-Shore.

(2) Message handling for Broadcast channels.

(3) Reception and choice of decryption of National and NATO messages on HF Ship-Shore channels.

(4) Reception of decrypted messages on HF and Satellite MRLs, and Satellite Ship-Shore channels.

(5) Transmission of plain language messages in priority structured sequences to TARE.

51. The Channel Availability and Receipt Broadcast (CARB) and HF Ship-Shore reception tasks are provided by the MAP at HMS FOREST MOOR. The decryption task for HF Ship-Shore messages is provided by the CSU and associated cryptographic equipment at Whitehall. The PL message distribution task and message broadcast task are handled by the MEP. Message encryption and decryption (other than HF Ship-Shore) are handled by direct connection to cryptographic equipment at Whitehall. The MEP is connected to TARE by seven MEP-TARE links and five TARE-MEP links, at present set to 75 Bds link with the capability of software increasing to 4.8 kBds.

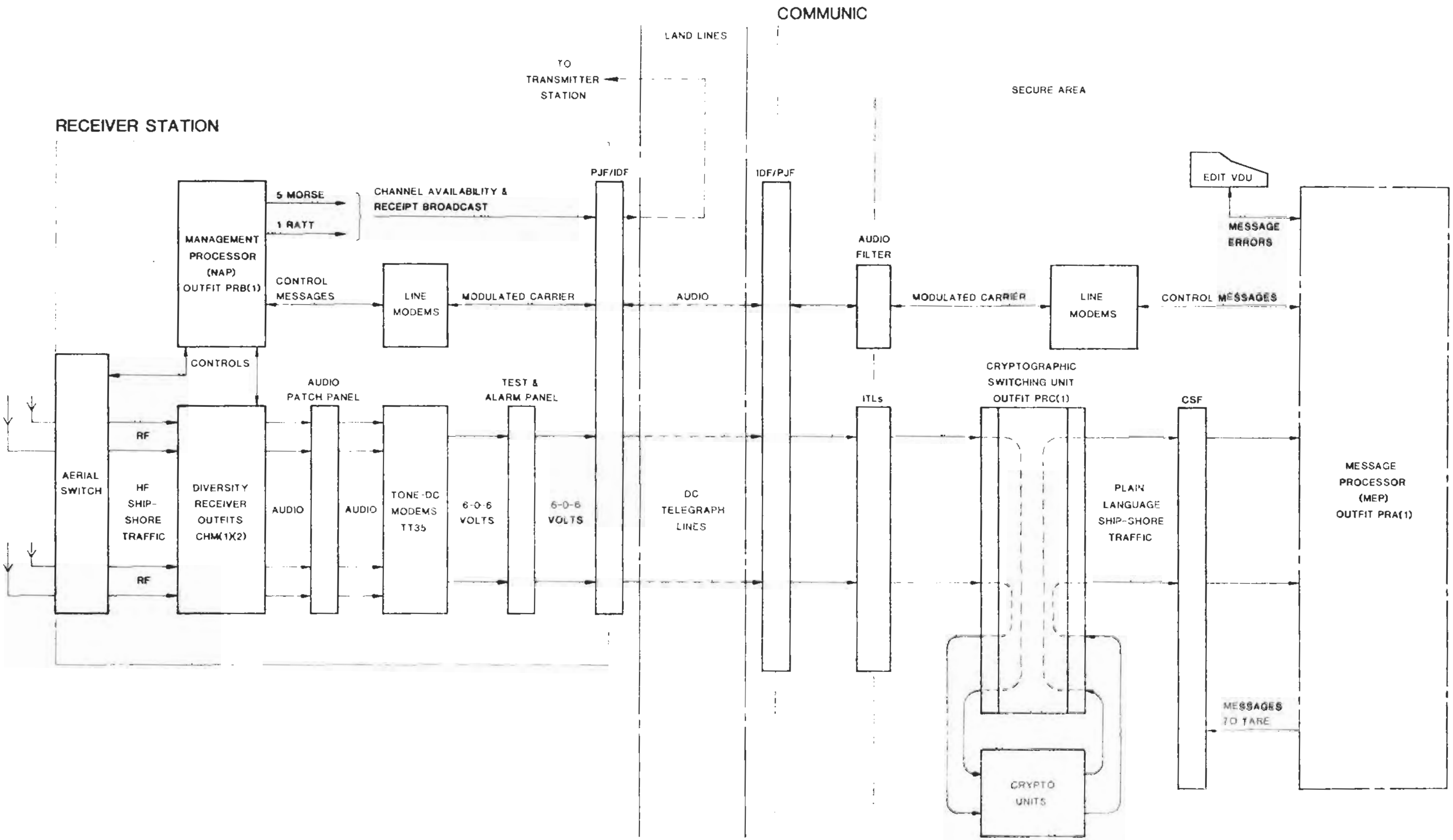

Figure 4.12 - MEP/MAP/CSU Switching System Block Diagram

HF AND SATELLITE BROADCASTS

52. Broadcasts are generated in a similar manner to that when they were run from TARE except that scheduling is now available for B41A, as well as automatic PMI sequence before each message is sent. Tote information is gathered from Satcom Ship-Shore inputs and transmitted on all Satcom broadcasts on the hour and at 30 minutes past the hour. Messages on some HF broadcasts are re-run after one hour. Where a re-run has not taken place after 12 hours, the information is added to a traffic list which is available for transmission as a message when required.

53. Quality control is by OTA monitor receivers in the Commcen monitoring the LF component of a broadcast, or the integrity monitor in the case of a satellite broadcast, feeding back to the MEP via crypto equipment. The MEP then does a bit-by-bit comparison with what was transmitted and subject to preset margins will alarm if comparison is incorrect.

MARITIME REAR LINKS

54. HF and Satellite MRLs are conducted in exactly the same manner as before, and their engineering is covered in Chapter 6.

Satellite Ship-Shore

55. Satellite Ship-Shore is also conducted in a similar manner to before, except that more channels are available. The CARB is still generated, time division multiplexed with engineering information. The receipt function is generated on reception of a message and TOTES of all messages received are produced on all satellite broadcasts on the hour and half hour.

HF Ship-Shore

56. The automated 10-channel UK HF RATT Ship-Shore System (UK RSS) is automatically controlled by the MEP which is directly connected to a Crypto Switching Unit (CSU) at Commcen Whitehall and to the Management Processor (MAP) at FOREST MOOR.

57. The system provides for 10 (working) channels in nine frequency bands covering 2-25 MHz with up to five (A to E) frequencies in each band. A channel designator consists of the frequency band (two figures) and the channel (A to E).

58. The CSU controls 18 crypto equipments and is capable of automatically decrypting a received message and passing the decrypted streams to the Message Processor (MEP) for assessing and processing.

59. The MEP receives the decrypted streams and assesses each System Access Message (SAM) for Directional Aerial Selection, Quality of Message and Indefinite Identity. The MEP then instructs the MAP to select the required aerial and to reject the access if the quality is unacceptable.

60. The MAP is based on a dual processor configuration and controls (via the MEP) all the UK RSS control and reception facilities and also a single off-line CARB. Local control for the MAP is available at FOREST MOOR.

61. The CARB (Channel Availability and Receipt Broadcast) is an off-line RATT broadcast output for ships indicating Access Channel Designators available for use, condition code indications, free text and time.

Ship-Shore Access

62. All receivers are initially connected to omni-directional aerials. A ship monitors the CARB and decides which channel to access and transmits a system access message (SAM) commencing with a PMI. This message is as follows:

VZCZC 2CR 1LF
AAA AAA (62 SPACE CHARACTERS) 2CR 1LF
DE GP GP GP 2CR 1LF
PP 2CR 1LF
NNNN

where ZCZC	is	SOM Function
AAA AAA	is	Aerial Sector Letter (ASL)
62 Spaces	is	quality of signal checking requirement
GP	is	indefinite callsign (G = National, K = NATO)
PP	is	Priority Precedence callsign

63. The MEP analyses the ASL and instructs the MAP to select the correct directional aerial via the Aerial Switch. The MEP also analyses the 62 space characters and assesses the printability of the signal. It then instructs the MAP to update the CARB with the correct code (KP, P, UPA).

64. In its path to the MEP the SAM is presented to the Crypto Selection Unit (CSU). This may be on any of its 10 input lines. The CSU notes the line (from the PMI) and presents the signal to a number of crypto equipments, sending a message to the Plain Language Switching Processor (PLSP) indicating which input line and crypto equipments are in use. Only one crypto will produce plain language, the others will produce garble. The PLSP selects the correct crypto and informs the CSP which lines are producing garble and they are released. The SAM is thus passed to the MEP for analysis.

65. On completion of the SAM analyses and suitable modification of the CARB, the ship transmits its traffic. Manual intervention by MEP or MAP Supervision is possible at all times. Flash messages are applied to the MEP Supervision VDU for receipt.

CONNECTIVITY

66. Line connections to and from COMMCENS, TRANSMIT and RECEIVE sites have to be made as flexible as possible to allow for line defects, and site failures. Any important service (eg a Primary Ship Broadcast) will have more than one injection point and more than one transmitter site, both HF and LF. Primary and Secondary keying routes are employed, backed-up for very important services by a tertiary route.

67. Fig 4.13 illustrates a hypothetical Primary Ship Broadcast with its keying lines. All designated lines will have the keying present on them for instant change over.

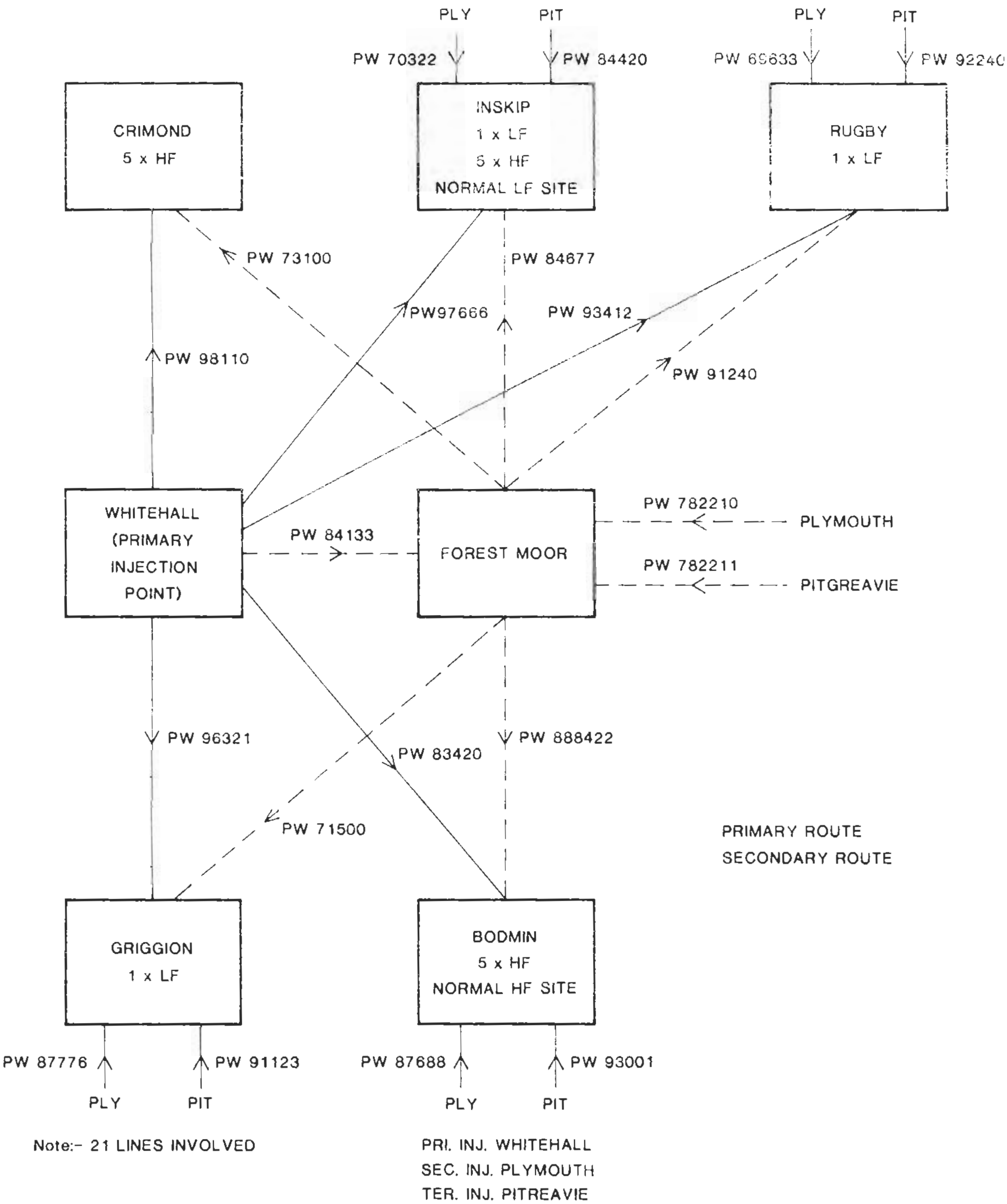

Figure 4.13 - Typical Connectivity for Primary Broadcast

68. Important Services will have LINE VOTING UNITS fitted, having two or three diversely routed keying lines as inputs. The unit monitors the keying on the line and normally selects the primary route. Should this keystream fail, it will switch to secondary with no interruption in keying and alarm. Similarly it will select tertiary should the secondary fail. Line delay unit may have to be fitted should the three routes be of unequal length to align the keystreams.

69. This system allows for most cases of failure. However in some cases it is necessary for one Commcen to take control of a broadcast should the primary Commcen fail with no other intervention. This is sometimes achieved by using MODEMS and audio lines:

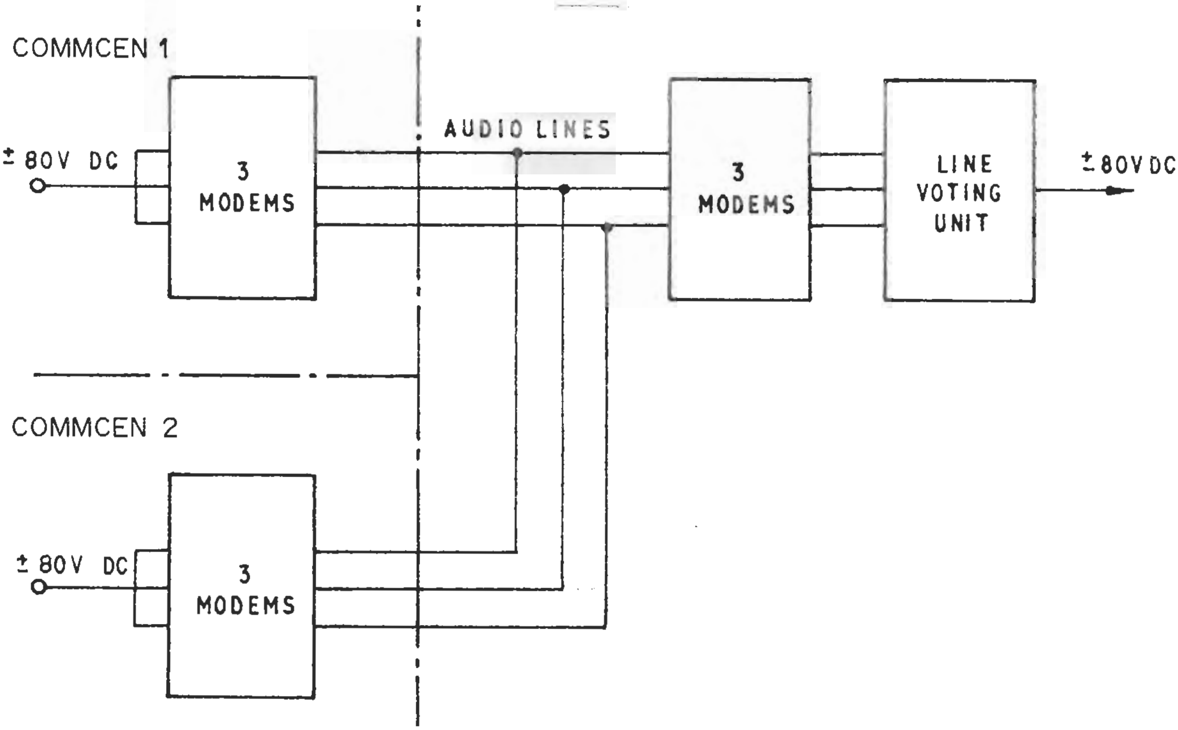

Figure 4.14 - Alternative Control of a Service by MODEM

70. Normally Commcen 1 produces the keystream and MODEMS at Commcen 2 are switched OFF. In the event of failure of Commcen 1, the alternative Commcen 2 can take control of the service just by switching the MODEMS ON.

<u>EMERGENCY LINE CONNECTIONS</u>

71. In the event of massive line failures it is still necessary to ensure that important services are keyed. As a last ditch line connection, certain Commcens and transmitter sites are fitted with special exchange telephones and line MODEMS. In emergency the Commcen would telephone the TRANSMIT site over the BT telephone network and once communication was established switch to MODEM and pass the keystream over the BT telephone network. The connection by this system is exercised regularly.

72. Should all lines fail other facilities are provided for passing important keystream to transmit sites.

Typical Classified Telegraph Circuit connecting two DCN Relay Stations. Each Station responsible for monitoring and quality control of its receive leg. Emergency Manual Tape Relay Centre facilities are provided for important circuits, patched at the CSF.

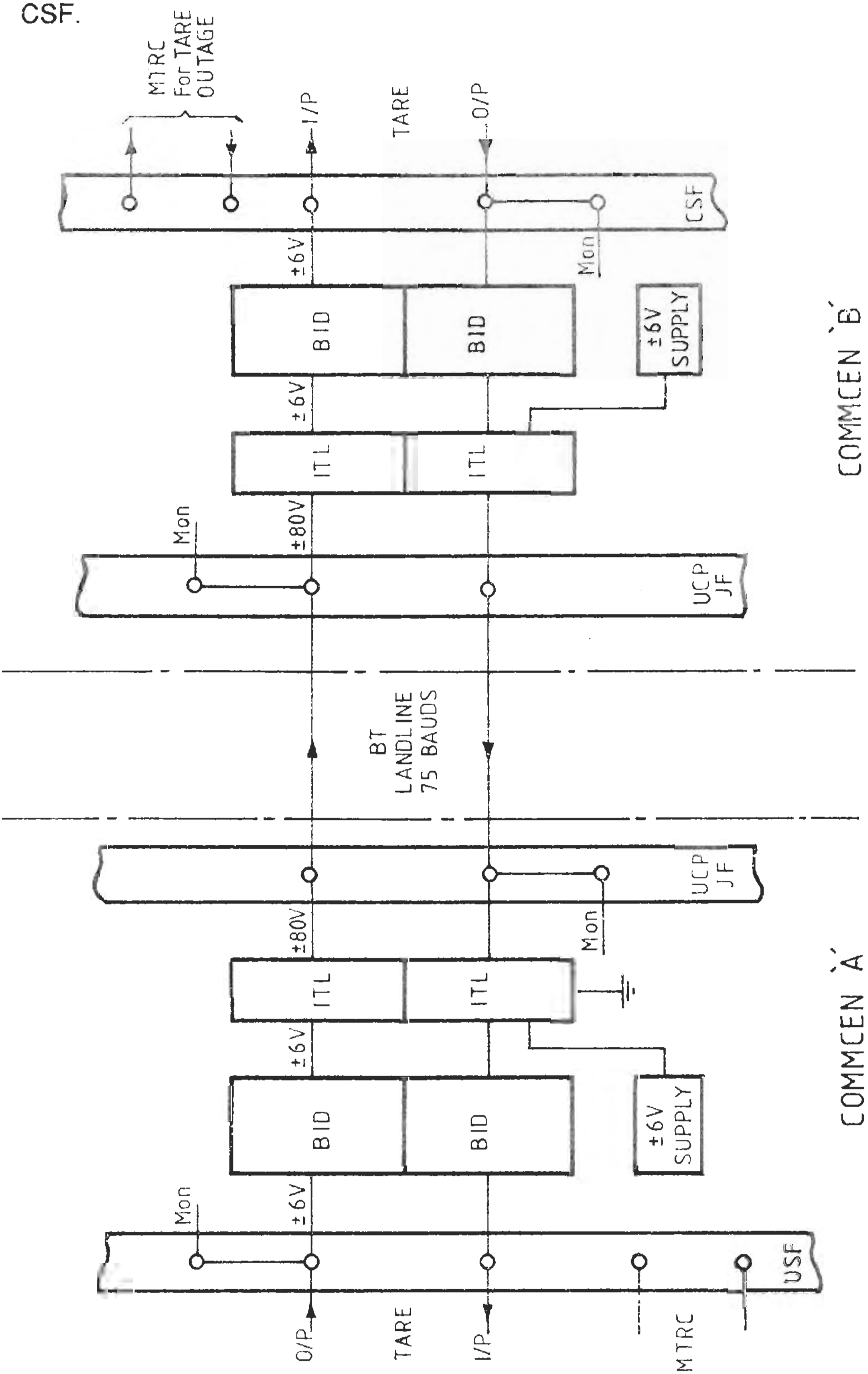

Figure 4A.1 - Classified Telegraph Circuit

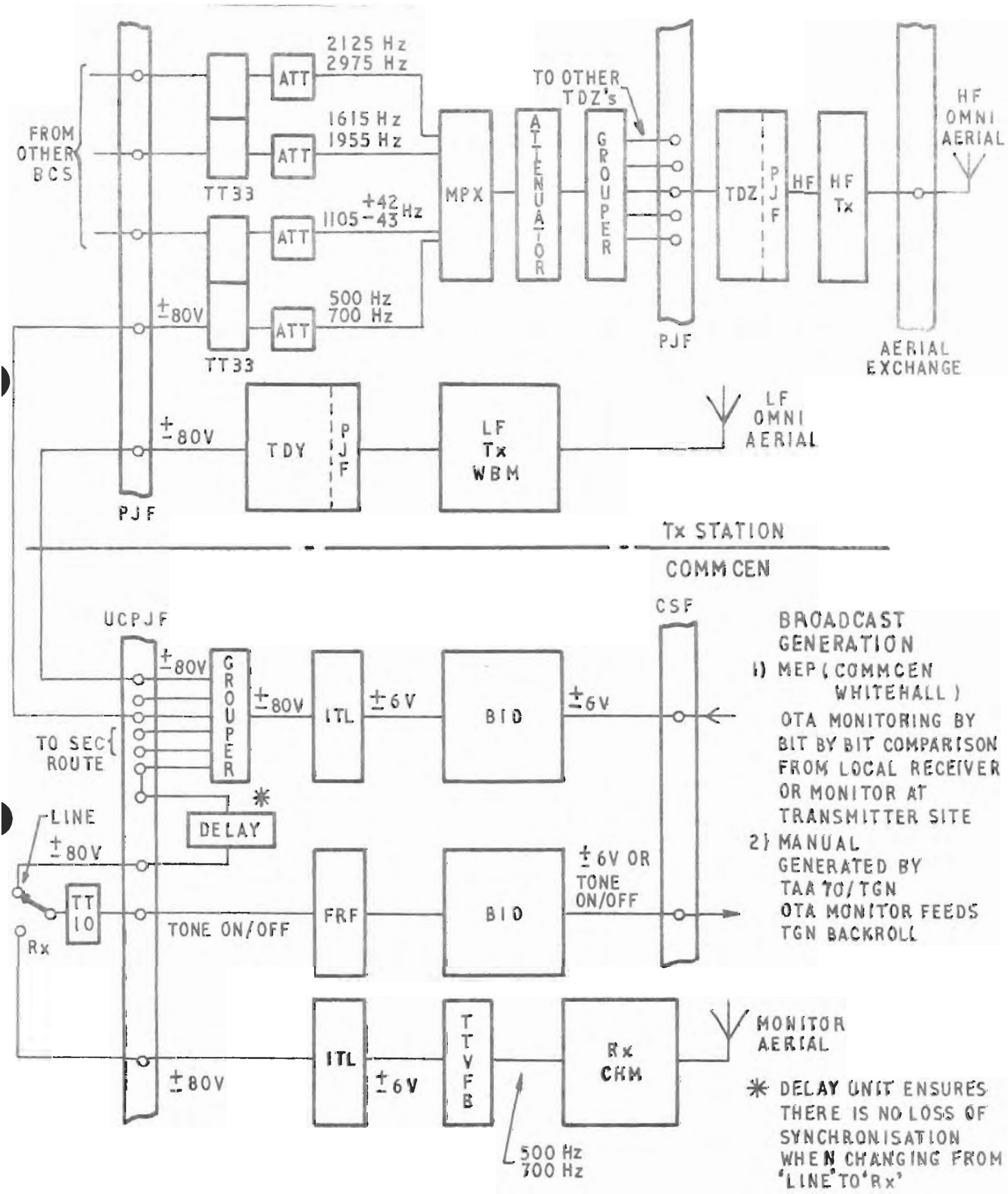

Figure 4B.1 - Multi-Channel Secure Broadcast

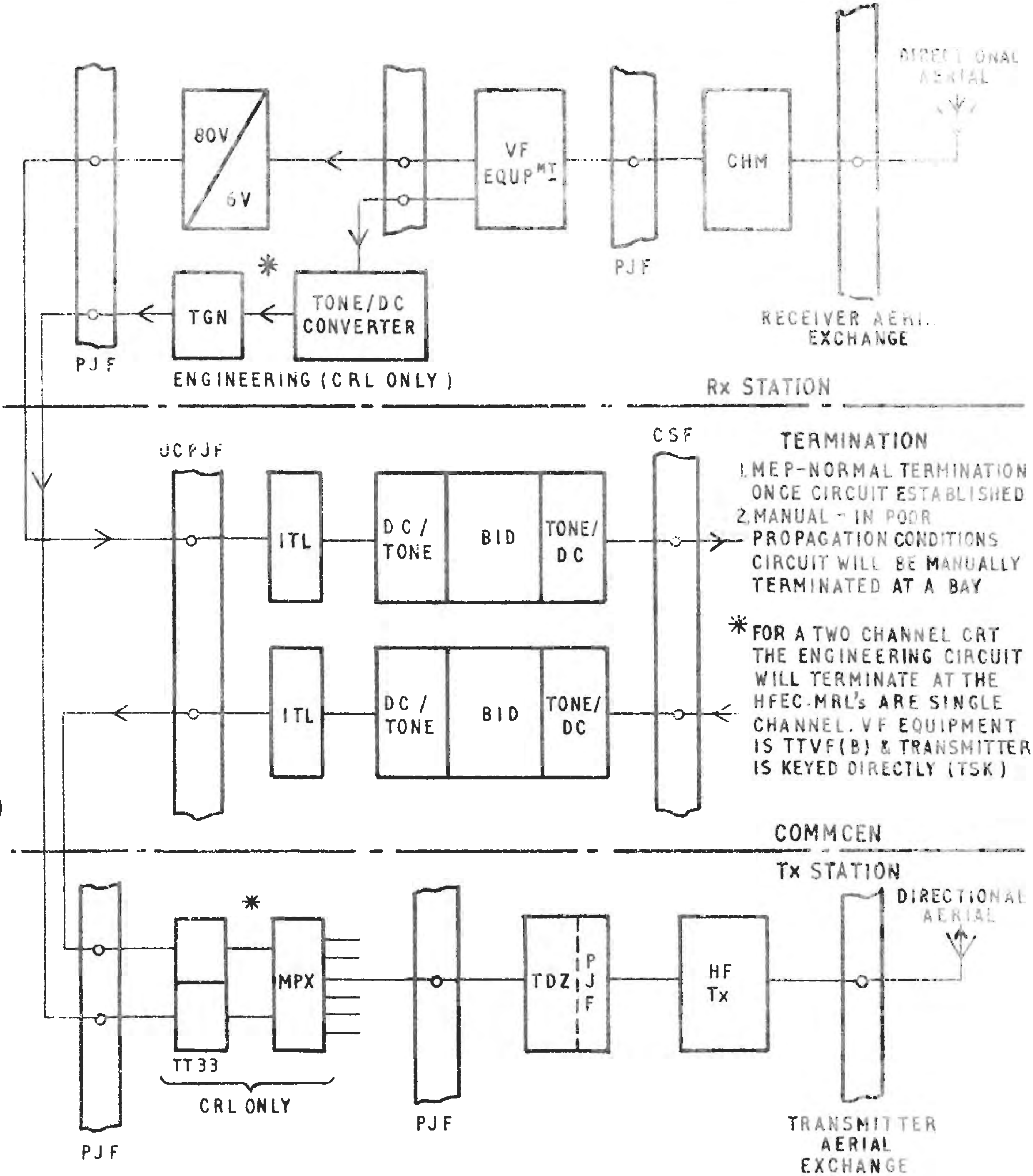

Figure 4C.1 - MRL/CRL Circuit

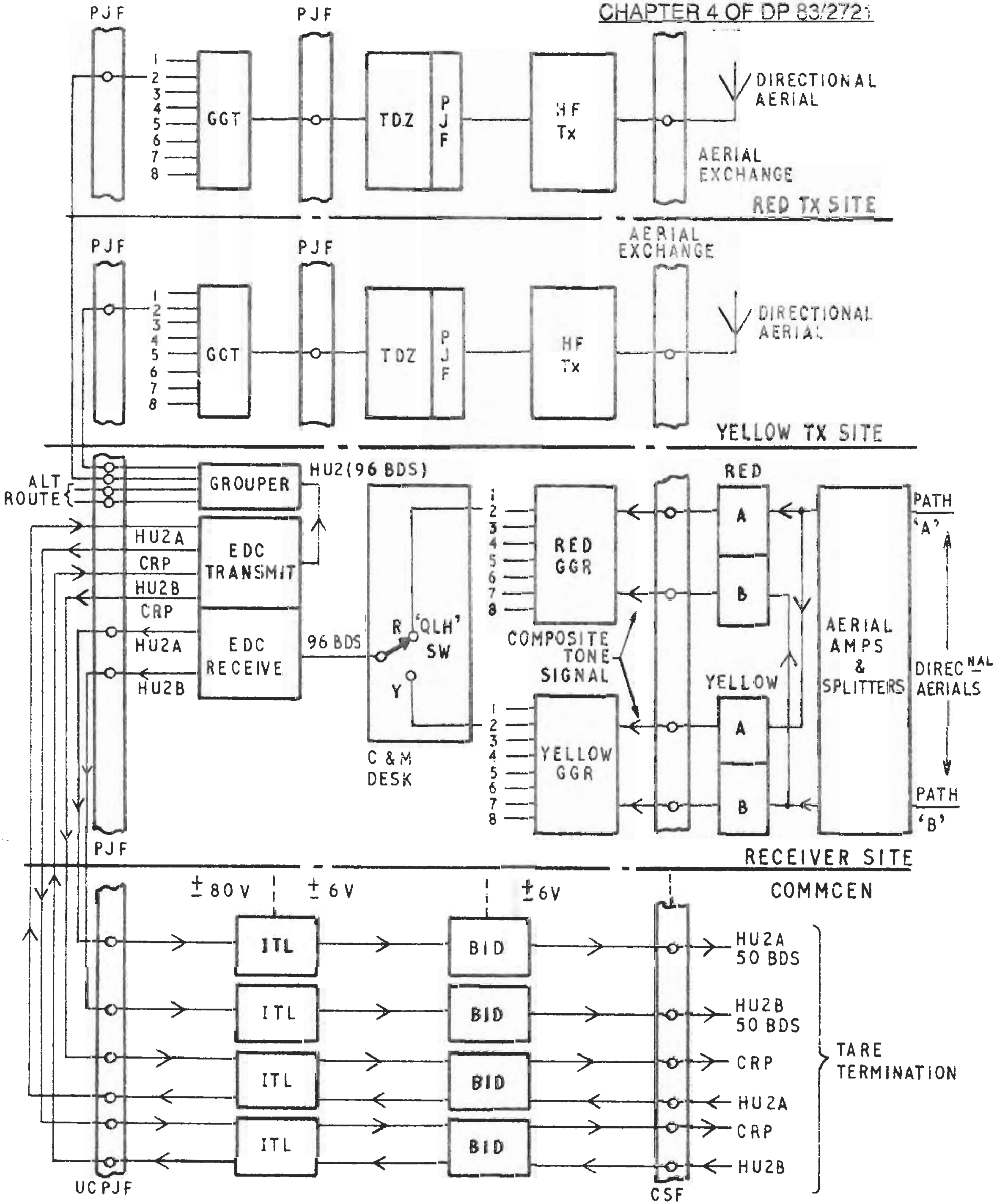

Figure 4D.1 - DCN HF Trunk with DPE & EDC (HU2 'A' & 'B')

Dual Path Emission

1. Most DCN HF fixed trunk services have thresholds in excess of 2315 hours (see Chapter 6). In order to meet this figure HF trunks employ Dual Path Emission to combat poor propagation conditions.

2. Two transmitters transmit the same signal on different frequencies (QLH). Also where possible the transmitters are spaced some distance apart. This gives both frequency and space diversity to combat fading.

3. Two directional aerials at the receiver site pass the signal to two CHM(2) receivers. The two transmission frequencies are known as Red and Yellow. The Red and Yellow CHMs feed two UK GGR MCVF equipments, in each of which a comparator selects the strongest signal, ie selecting from the Space Diversity aspect. The GGR also filters the composite signal, re-converting it to eight channels.

4. These eight channels are then fed to eight "QLH" switches on the Control and Monitoring Desk, on the other pole of which appears the output of the other GGR. The "QLH" switches are thus able to select from Red or Yellow frequency, for each channel individually. The two signals are monitored regularly and the best signal selected. Once all the channels are selected on one frequency, the other frequency will be changed to one more suitable. In this way there are no gaps when frequencies are changed, and if well managed virtually 24 hours a day availability is possible.

Error Detection and Correction

5. A high accuracy is required on FDM Common User channels, so Error Detection and Correction equipment is used. It was stated previously that Start/Stop signals from the terminal equipment are converted into Van Duuran code to enable error-checking.

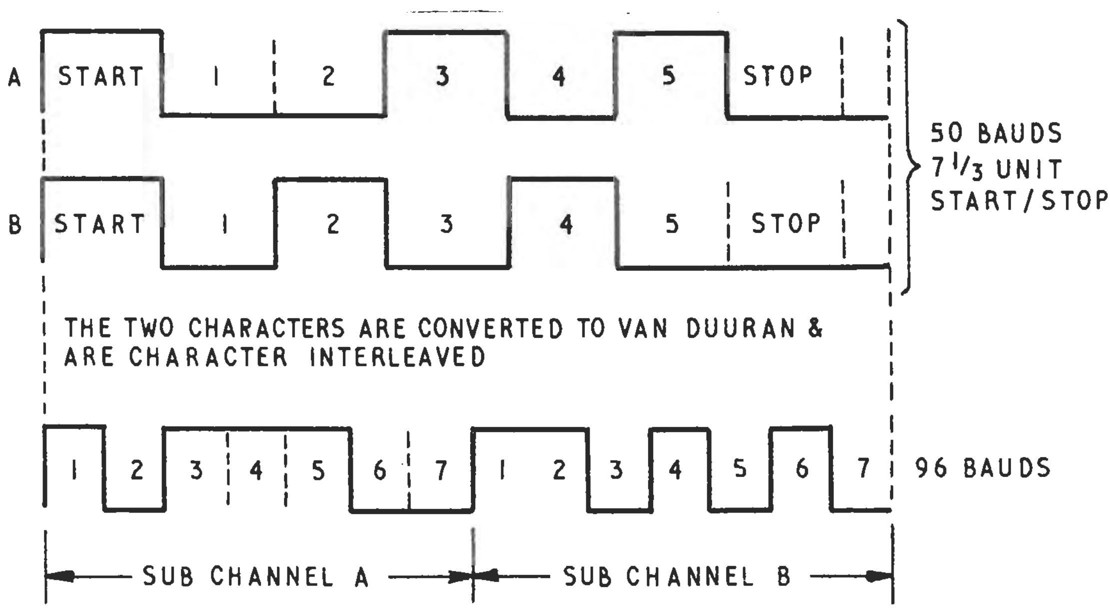

Figure 4D.2 - 50 BD To 96 BD Conversion

6. In EDC equipment, TWO inputs are combined (MULTIPLEXED) so that two characters (one from each) are transmitted in the time normally occupied by one.

7. This system is called Time Division Multiplex (TDM). A $7^{1/3}$ unit Start/Stop code results due to the SEND terminal equipment operating in response to pulses from the EDC. Each pulse releases one character, hence the name Character Release Pulse (CRP). When the conversion is reversed at the receive terminal, $7^{1/3}$ unit Start/Stop is fed to two TPs/Reperforators. The machines will not be affected by the shortened STOP element.

8. Two separate tape readers A and B have information 'called forward' by Character Release Pulses. The $7^{1/3}$ Start/Stop signals are converted into Van Duuran synchronous and are character interleaved to form a 96 Baud aggregate signal. The characters from each channel are also fed to a shift register store; this retains the last few characters transmitted.

9. On the receive side the 96 Baud signal is separated by gating and timing circuits, into two 7 unit channels. A Z element count is carried out on each channel; if there are three, the code is converted to Start/Stop and fed to the receiving terminal equipment.

10. If the Z element count is incorrect, the output is inhibited and a request for repeat (RQ) signal is generated and sent on the return leg.

<u>The RQ Cycle</u>

11. A character in sub-channel A is mutilated over the radio path X-Y. When examined at the receive end the Z/A relationship is incorrect. The RQ signal is generated and the A TP at station Y is disconnected.

(1) Station Y tape reader A is inhibited (no CRP) and RQ is sent to station X. At X, reception of RQ causes TP A to be disconnected and tape reader A to be inhibited.

(2) The stored characters on the outgoing leg are then transmitted, preceded by RQ. The first from store will be the original mutilated character.

(3) Station Y receives RQ and, if the following character is perfect, releases it to TP A. Tape reader A receives CRP and traffic resumes in both directions.

During the whole process, sub-channel B continues normal operation.

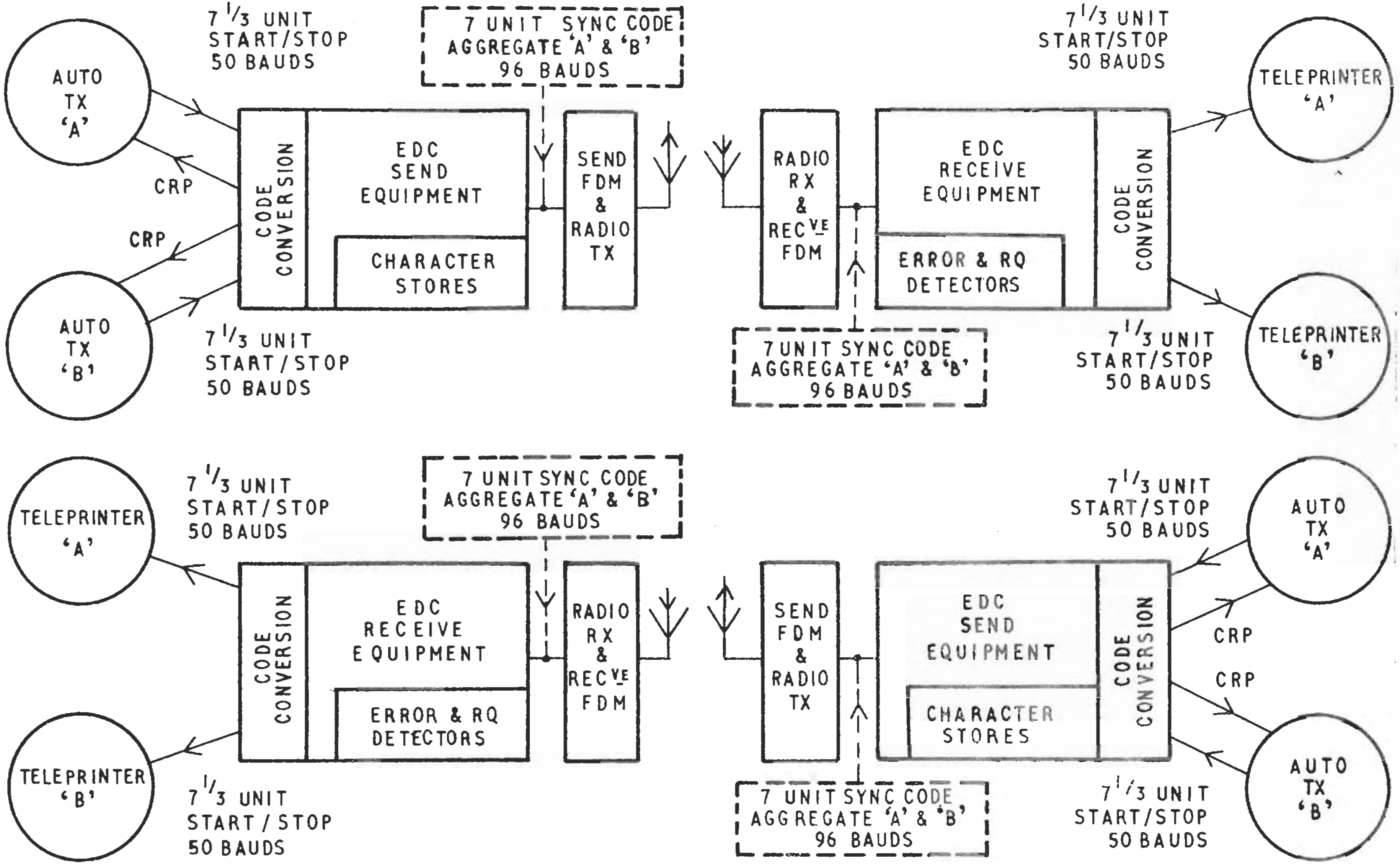

Figure 4D.3 - EDC Duplex Working (Both Sub-channels Passing Traffic)