

## GROUPBAND DATA SYSTEMS (RESTORED POLAR)

### 2-POINT PRIVATE LINE

#### DESCRIPTION

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#### 1. GENERAL

**1.01** This section describes the operating principles and equipment arrangements of a groupband data channel in 2-point private line service.

**1.02** The Groupband Data System described in this section is designed to provide 2-way transmission of data between data stations located within exchange area distances of each other and interconnected through a single office or separated by long distances and interconnected through two or more toll offices. When confined to an exchange area, the transmission facilities are generally repeated wire line loops. Longer station lines may contain N or T carrier facilities. Interexchange facilities may consist of either N or T carrier facilities (short haul) or L-type multiplex systems (long haul). A simplified example of a groupband data channel is shown in Fig. 1.

**Note:** For some special services, it may not be feasible to interconnect the data station through an office. In this case, a wideband

test line is usually provided between an office and the data circuit. This test line may be connected to the data circuit by means of patches or switches so that an office may have test access to the data circuit.

**1.03** Full duplex operation is provided over 4-wire facilities. Data station interface arrangements permit the stations to be connected to a variety of customer-provided business machines. The circuit can handle 2-level data with a minimum signal element width of 20 microseconds when operating in the nonsynchronous mode, or at fixed speeds of 40.8 or 50 kilobits per second when operating in the synchronous mode. Typical connections from a data station over a station line, to a central office, are shown in Fig. 2.

**1.04** In addition to the wideband data channel, a separate voice frequency coordination channel is provided. This channel is made available to the customer so that service activities can be coordinated. The channel can also be used for test coordination. Some types of data transmission may use the voice frequency coordination channel for low-speed control data when required by the customer.

**1.05** One office, through which the 2-point private line passes, is designated the circuit control office for the private line. This office is responsible for coordination of all testing and maintenance activity on the private line. The office to which each data station is connected, over a station line, is designated the serving test center for that data station. This office is responsible for tests of the station line and local and remote tests of the data station.

#### 2. SIGNAL TREATMENT

**2.01** The baseband data signal, transmitted from and delivered to the data sets, requires a frequency band extending from approximately 100

Hz to 50 kHz. This baseband signal, represented in Fig. 3, has been modified so that the lowest frequencies are attenuated in the transmitting data set and then restored in the receiving data set. This process, called the restored polar technique, permits satisfactory transmission of data without transmitting the dc component and the very lowest frequencies. The signal, as modified, suffers minimum impairment from the low-frequency distortions encountered in the transmission facilities; and the attenuation of low frequencies prevents interference with the carrier recovery operations of the vestigial sideband modems used in the carrier facilities.

**2.02** The vestigial sideband modems used in an L-type multiplex facility translate the baseband data signal to the 60- to 104-kHz range of the group allocation of the multiplex equipment. The data signal spectra into and out of the modem is shown in Fig. 3. The modem also translates the 4-kHz voice frequency channel to and from the 104- to 108-kHz range of the group allocation.

**2.03** Since it is important to avoid concentration of signal power in single-frequency components, scrambling of the data signal is provided in synchronous data sets to produce quasi-random pulse sequences, regardless of the content of the customer's data train. This function spreads the signal energy more evenly over the data channel frequency band and reduces the problem of crosstalk from single tones that may be created in the carrier facilities by repetitive data sequences (such as idle codes) from the customer's equipment.

**2.04** The groupband data channel is designed for zero net loss. Each wideband service bay through which the data channel passes and each data auxiliary set at the data station is a 0-dB wideband system level point (SLP).

### **3. 303-TYPE DATA STATIONS**

**3.01** The 303-type data station is used to couple any one of several types of business machines to transmission facilities. 303C-( ) and 303G-( ) data sets are available for groupband data transmission. The letter *C* identifies the 50-kilobits-per-second speed capability and the code

letter *G* identifies the 40.8-kilobits-per-second speed capability. The remainder of the code designation identifies the customer interface arrangements and the mode of operation.

**3.02** Two interface arrangements are available.

For general commercial purposes, cable drivers and terminators are provided for operation into and from unbalanced coaxial cable having a characteristic impedance from 90 to 120 ohms. For special purposes, an arrangement is available for operation into and from a balanced 135-ohm circuit. When a synchronous data set is used with the balanced interface, sync recovery and signal regeneration can be provided in both directions of transmission.

**3.03** In addition to the 303-type data set, the wideband data station usually includes a data auxiliary set 806B( ) which provides test access to the customer loop facilities and capability for remote testing of the data station. Where it is necessary to send low-speed control data over the voice frequency coordination channel, the data auxiliary set 404B( ) may be provided. Voice communication over the voice frequency coordination channel and control of data station operations are provided by a data auxiliary set 804A( ). Generally, a data station which operates with synchronous business machine equipment only, will not be equipped with a data auxiliary set 404B( ).

## **4. TRANSMISSION FACILITIES**

### **A. Station Lines**

**4.01** Wire line repeaters are generally used between the data station and the central office for distances up to about 20 miles. WLR-5 (pilot regulated) or WLR-3 or WLR-5 (nonregulated) wideband loop repeaters are used. The repeaters include adjustable equalization.

**4.02** At distances up to about 100 miles, the T1 Carrier System may be used over cable facilities. This is a digital, regenerative system, well suited for data transmission, since it does not pass the impairments accumulated in interexchange analog carrier systems. T1WM-1 wideband modems or T1WB-( ) wideband banks are required.

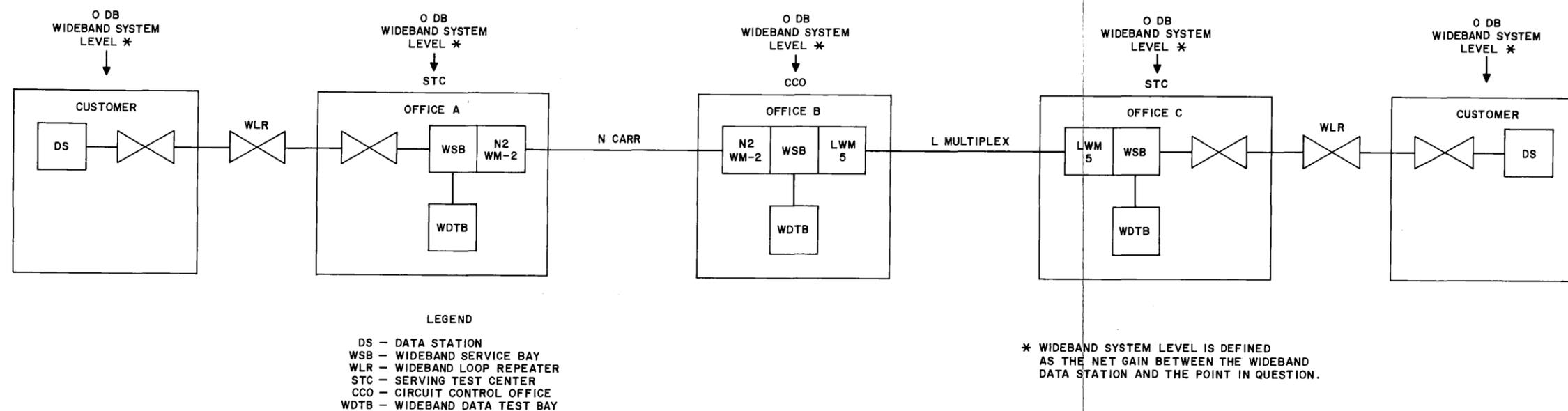
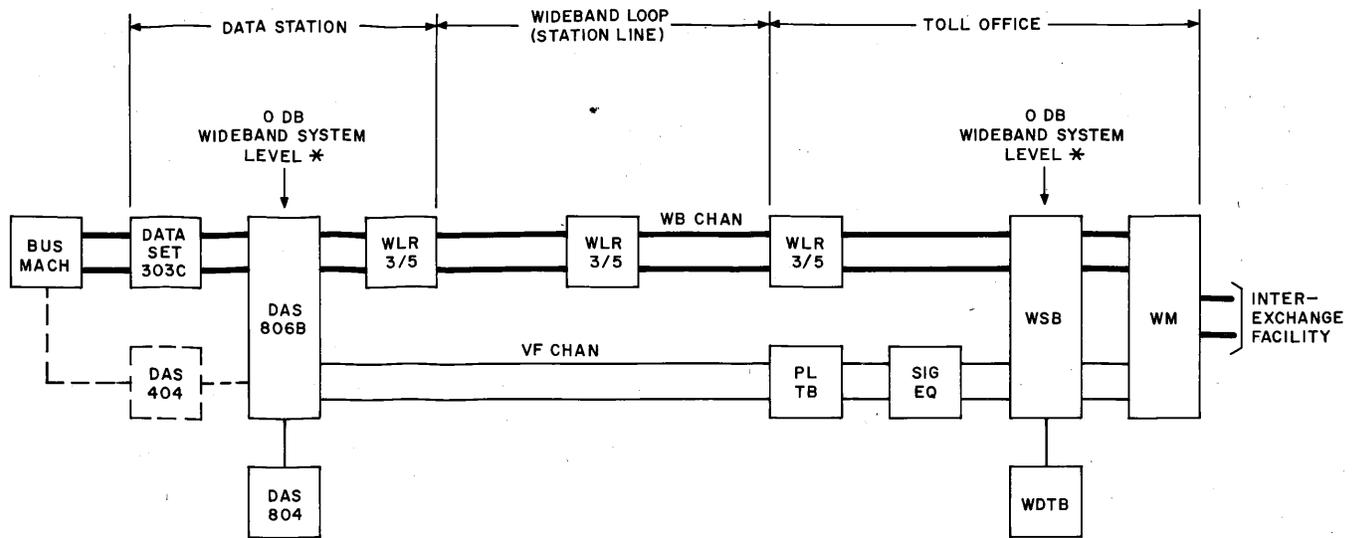


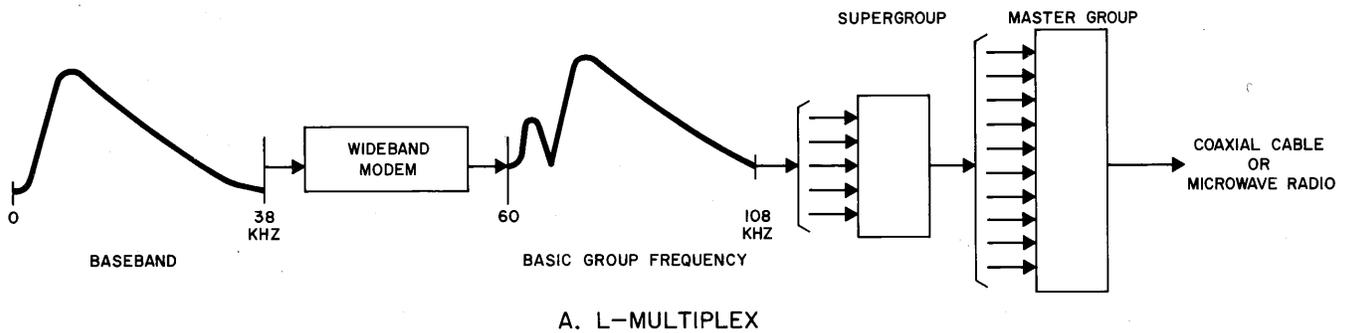
Fig. 1—Groupband Data Circuit, Wideband Channel, 2-Point Private Line—Block Diagram



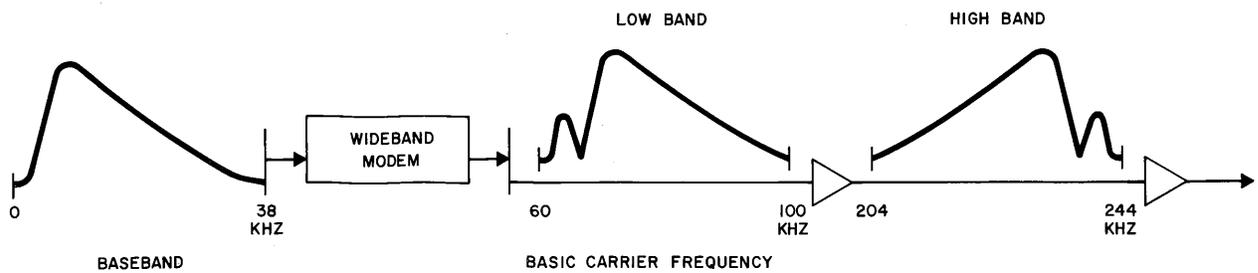
**LEGEND**  
 DAS - DATA AUXILIARY SET  
 WLR - WIDEBAND LOOP REPEATER  
 PL TB - PRIVATE LINE TESTBOARD  
 WSB - WIDEBAND SERVICE BAY  
 WDTB - WIDEBAND DATA TEST BAY  
 WM - WIDEBAND MODEM  
 SIG EQ - SIGNALING EQUIPMENT

\* WIDEBAND SYSTEM LEVEL IS DEFINED AS THE NET GAIN BETWEEN THE WIDEBAND DATA STATION AND THE POINT IN QUESTION.

Fig. 2—Typical Connection, 303-Type Data Station to Toll Office 2-Point Private Line



A. L-MULTIPLEX



B. N CARRIER

Fig. 3—Groupband Data System, Signal Structure on Carrier Facilities

## SECTION 314-609-100

**4.03** Other long station lines may require the use of the analog, frequency-division N Carrier System. This system may be used over cable for distances up to about 100 miles. N2WM-2 wideband modems and N2WT-1 wideband data terminals are required.

### B. Interexchange Facilities

**4.04** If offices are separated by relatively short distances (in the region up to 100 miles), interexchange facilities may use the N Carrier System or the T1 Carrier System. Generally, these systems are not used for distances over 100 miles. The wideband modem and wideband data terminal mentioned in 4.02 and 4.03 are used.

**4.05** Over the longest distances, long-haul L-type multiplex group facilities are used. This is an analog, frequency-division system of transmission using LWM-5 or LWM-6 wideband modems.

**4.06** Certain group and supergroup assignments in L-type multiplex facilities are not presently recommended for data transmission because of slope in envelope delay distortion in group and supergroup connectors. The assignment details are given in engineering guide lines.

### 5. TESTING AND MAINTENANCE ARRANGEMENTS

**5.01** Because signal transmission over different kinds of facilities must necessarily be different, connections between unlike facilities are made at baseband frequencies. Maintenance access is provided at baseband frequencies in offices at wideband service bays (and wideband data test bays) located between transmission facilities. Since the baseband frequencies, or a 25-kHz test signal, pass through the wideband service bays at 0 dBm in each direction of transmission, the circuit may be looped (by patching) in either or both directions

from the wide-band service bay for testing. The jack arrangements in the J70168( ) wideband service bay differ in offices according to the testing flexibility required.

**5.02** Access jacks for the voice frequency coordination channel appear in the wideband service bay and may also appear in a private line testboard.

**5.03** The J79915A data test bay may be associated with the WSB. This bay contains a 912A data test set, a data set used for testing, and other test equipment. Normally, the data test bay is located adjacent to or close by the wideband service bay so that interbay patching is possible. The bays may also be interconnected by tie trunks.

### 6. REFERENCES

**6.01** The sections listed below give more complete descriptive information on equipment mentioned in this section.

SECTION	TITLE
314-601-100	Wideband Service Bay
314-641-100	WLR-3 Wideband Loop Repeater
314-643-100	WLR-5 Wideband Loop Repeater
356-401-100	LWM-5 Wideband Modem
362-812-100	N2WT-1 Wideband Data Terminal and N2WM-2 Wideband Modem
356-119-100	T1WM-1 Wideband Modem
593-012-100	303-Type Data Sets
593-800-100	303-Type Data Stations