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COMMUNICATIONS

Equipment Planning Guide

1. PURPOSE.

a. This guide provides information on specific items of communications equipment to assist in planning and development of Class IV Projects as defined in AR 105-22.

b. This document supplements published literature on existing equipment and provides data on new equipment planned for future use in the USASTRATCOM system.

2. GENERAL. This planning guide is published in loose-leaf form to permit changes as new equipment and systems become a reality. This guide is divided into eight chapters according to specific categories of equipment. Chapters 1 through 7 describe equipment presently available and/or being introduced into USASTRATCOM facilities. Chapter 8 provides descriptive data on equipment under development or being procured for feasibility test purposes only. Items appearing in Chapter 8 are not to be used in development of Class IV Projects.

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CO, HHD, 37th Signal Battalion	(1)
CO, HHC, 41st Signal Battalion	(1)
CO, HHD, 43d Signal Battalion	(1)
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CO, HHD, 509th Signal Battalion	(1)
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EQUIPMENT PLANNING GUIDE

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CHAPTER 2: TELEGRAPH TERMINAL EQUIPMENT

CHAPTER 3: HF RADIO EQUIPMENT

CHAPTER 4: VOICE FREQUENCY EQUIPMENT

CHAPTER 5: TRANSPORTABLE COMMUNICATIONS

CHAPTER 6: DATA EQUIPMENT

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CHAPTER 1

TELETYPEWRITER EQUIPMENT

1-1. TELETYPEWRITER SET AN/FGC-64( )

Purpose.

To provide a teletypewriter set that sends, receives, and monitors messages using five unit start-stop code impulses.

Employment.

This equipment can be used to transmit, monitor, and receive messages over dc wire lines, carrier, or radio systems.

Description.

AN/FGC-64( ) is similar to the AN/FGC-21( ). Unlike the latter, it has a series-governed motor; it only transmits 8.00 unit code signals; and it includes Teletypewriter TT-293/FG instead of the TT-99/FG.

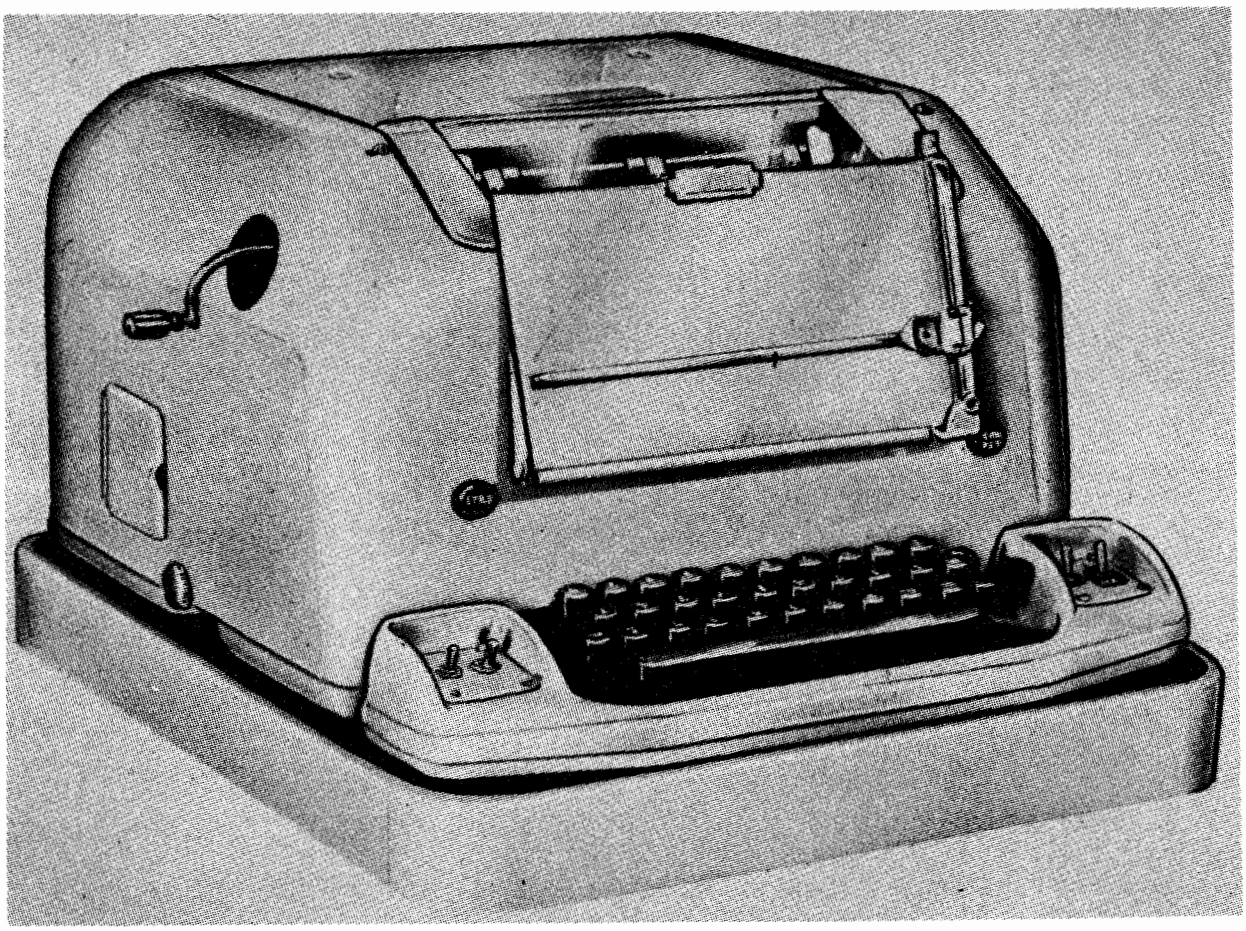
This equipment comes equipped with 45.5 baud rate (368.1 opm) gears; however, 50 baud rate (404 opm) and 75 baud (600 opm) gears are supplied as accessory gears.

Technical Characteristics.

Type of Installation	Strategic send and receive by direct wire, carrier, or radio teletype.
Keyboard Symbols	1. Type of characters: English. 2. Characters per line: Standard, 72; Weather, 76.

Availability Data.

This equipment is available for Class IV projects.



TELETYPEWRITER SET
AN/FGC-64( )

1-2. TELETYPEWRITER SET AN/FGC-66( )

Purpose.

To provide a teletypewriter set that sends, receives, and monitors messages using five unit start-stop code impulses.

Employment.

This equipment can be used to transmit, monitor, and receive messages over dc wire lines, carrier, or radio systems.

Description.

AN/FGC-66( ) is physically and electrically similar to Teletypewriter Set, AN/UGS-4( ). It contains an interchangeable type basket, however, that is easy to remove and that make it different than the AN/UGC-4( ).

Technical Characteristics.

Type of Installation	Fixed station; send and receive by direct wire, carrier, or radio teletype.
Keyboard Symbols	1. Type of characters: English. 2. Characters per line: Standard, 72; Weather, 76. 3. Type of paper feed; friction or sprocket. 4. Signaling code: Five unit start-stop. 5. Type of signals: (a) Neutral: 20 or 60 ma. (b) Polar: 20 or 30 ma.
Speed	1. Operations per minute (send and receive): 368.1, 404, 460, and 600. 2. Words per minute (send and receive): 60, 66, 75, or 100.
Power Requirements	Approximately 150 watts.
Motor Type	Series governed.
Motor Speed	3,600 rpm.
Motor Voltage Requirements	105 to 125 volts, regulated or unregulated.
Paper Capacity	Adjustable to accommodate standard one through six copy, roll, fanfold paper, or sprocket fed forms 8 1/2 inches wide.

Total Weight	Approximately 80 lbs.
Miscellaneous	The equipment withstands high humidity and moisture as encountered in the tropics; it is fungi proofed and resistant to corrosion.

Availability Data.

This item is available for Class IV projects.

1-3. TELETYPEWRITER SET AN/FGC-80

Purpose.

To provide a page printer that is capable of preselected switchable speeds up to 200 wpm (approximately 150 baud) in high-speed communications or data processing systems, or the transmission or reception of 5 level code.

Employment.

This equipment is used in message centers as terminal equipment and in technical control centers for monitoring and control.

Description.

AN/FGC-80 is an electronic teleprinter with a rotary drum that has 64 characters around the periphery for horizontally printing lines of 72 characters. The teleprinter, designed for keyboard sending and page copy receiving, consists of a keyboard, printer, electronic logic module, a power supply, and table. It is capable of transmission speeds of 45.5, 75, and 150 baud.

A speed selection switch is located under the printer cover.

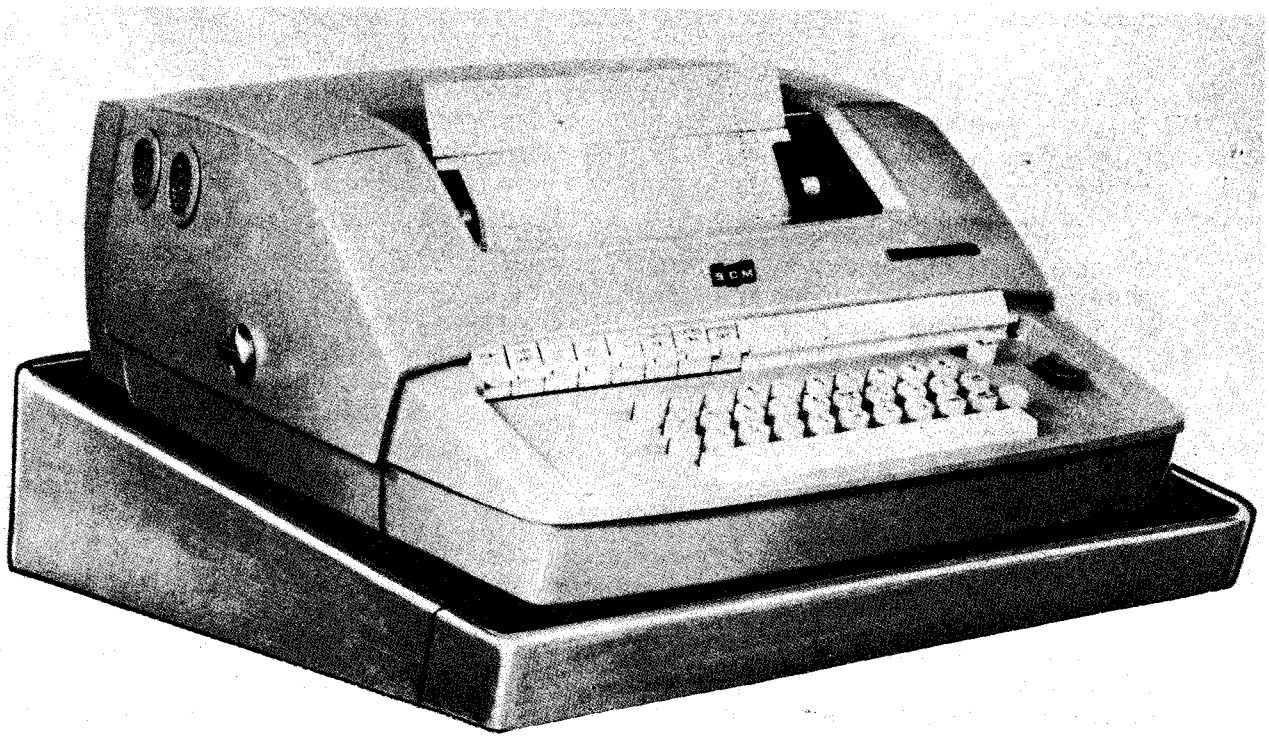
Technical Characteristics.

Type of characters	English.
Keyboard	Three rows, standard symbols.
Paper size (roll)	Five-inch diameter by 8½ inches wide.
Paper feed	Friction or sprocket.
Line feed	Single or double (six lines per inch, single.)
Type style	Murray style.
Weight	Approximately 109 lbs.
Operating voltage	115 vac, ±10%, 60 cycle.
Maximum power	200 watts.
Transmit Signaling Code	Baudot, start-stop, stop pulse equals start pulse, 7.00 Unit.
Receive Signaling Code	Baudot, 7.00 7.42, or 8.00 Unit.
Types of Signals:	
Transmit	20 or 60 ma neutral or 20 ma polar.
Receive	20 or 60 ma neutral or 20 ma polar.

Temperature Range	1. Operating: +32° to 132° F. 2. Non-operating: -80° to +160° F.

Availability Data.

This equipment is being procured and is available for Class IV projects.



ELECTRONIC PAGE PRINTER
AN/FGC-80

1-4. TELETYPEWRITER SET AN/TGC-15

Purpose.

To provide the Army element of the DCS a miniaturized teletypewriter set that requires a minimum of maintenance.

Employment.

This equipment will be used in fixed and transportable communication systems.

Description.

AN/TGC-15 is a transportable automatic teletypewriter set with a standard, three row, 64-character keyboard with facilities for tape reperforation printing and reading as well as multipage hard copy. The unit transmits and receives neutral signals in Baudot code. The signal circuit can be simplex, full duplex, or combinations of the two. For simplex operation, a keyboard disabling switch prevents the inadvertent transmission of the unit during reception.

Solid state line sensors function with dc signal loops operating in two ranges: 2.5 to 10 (or 1 to 5) ma., 5 volts, maximum; and 20 to 80 ma., 150 volts, maximum. A single adjustment selects range. Line sensors are protected from overload and they are not polarity sensitive.

The equipment is capable of on line, off line, or any combination of the two. It can be used, for example, for tape operation, tape proofing, regeneration, or tape correction while simultaneously receiving page copy from an external signal line. A prime consideration, however, has been the reduction of radio interference.

In the off line condition, indicator lights show how the external signal lines would appear to the page printer and reperforator line sensors. This allows the operator to determine if the lines are open, closed, or handling traffic.

a. Reperforator. The printing reperforator converts encoded electrical signals on a coded paper tape 6 1/2 spaces behind the feed holes or on the lower portion of the tape. This allows the tape to be read visible or be read by a mechanical or photo-optical device. Corrections are made by notching the tape with a variable positioned notcher. When the reader senses a notch it automatically stops the unit. The operator then can add, delete, or change characters until he has a

perfect tape. A locally or remote controlled electrical back space is also supplied. A low paper tape supply indication warns the operator when the tape spool is near exhaustion.

b. Page Printer. The page printer provides 72 or 76 standard communications character per line on paper 8 1/2 inches wide, from a 5-inch diameter roll contained within the unit. A mechanical brake prevents the paper from unrolling under vibration. To eliminate the need for cleaning the printing type faces, the mechanism is arranged so that the faces never come in direct contact with the inked ribbon when the paper is in position.

The printing reperforator and page printer are equipped with automatic motor stops that turn off the individual motors 60 seconds after the last space-to-mark transition. These motors are automatically restarted when the first mark-to-space transition is received.

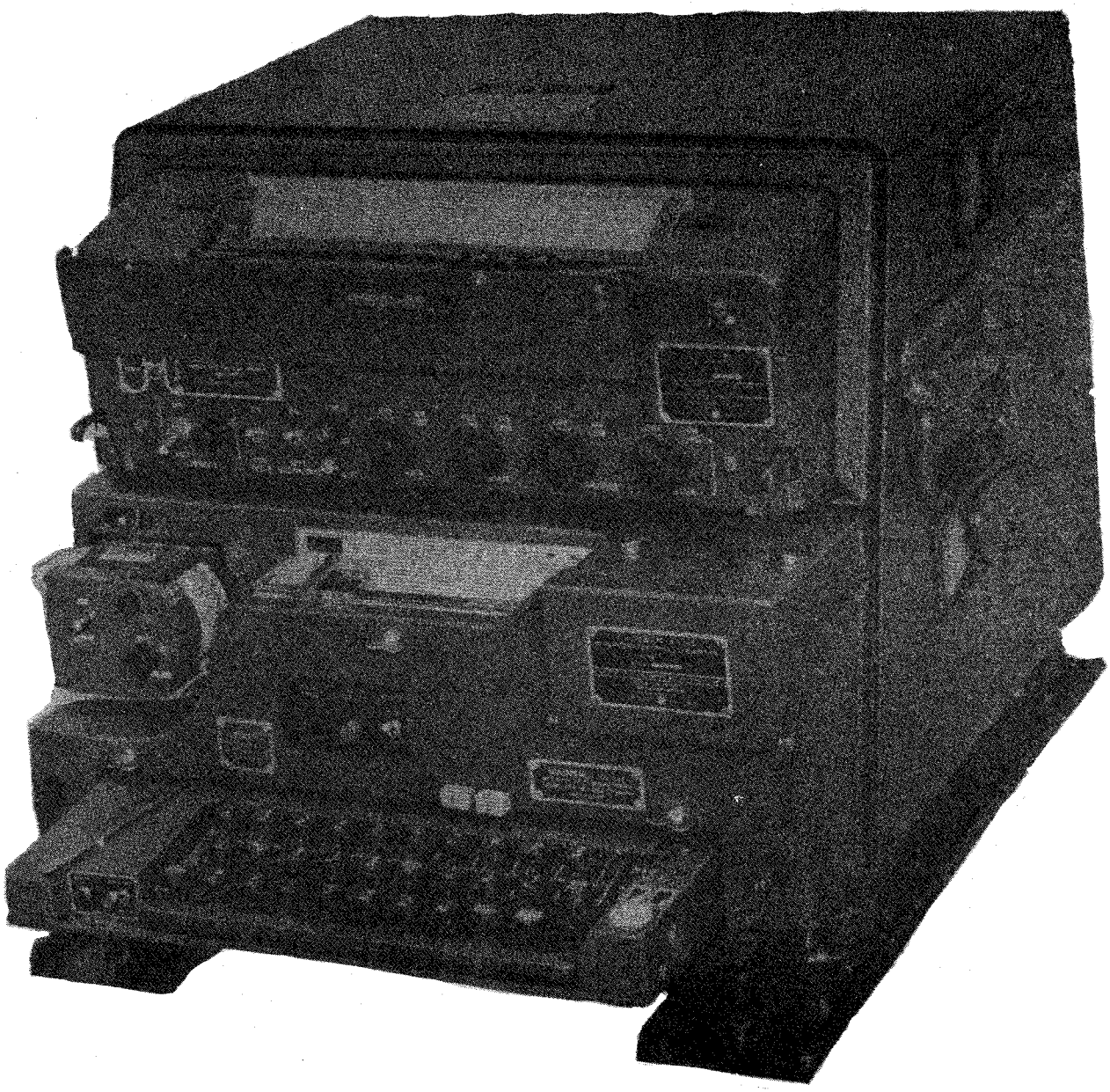
Technical Characteristics.

Receiving Signal Requirements	High range: 20 to 80 am., 150 volts, maximum; input impedance (at 60 ma.) 125 ohms. Low range: 2.5 to 10 ma. (or 1.5 ma.), 5 volts, maximum; input impedance (at 1.0 ma.) 4.7 kilohms (at 5 ma.), 2.5 kilohms. Range changeover by a simple adjustment. The equipment can be supplied for 7.0 unit Baudot code operation, or alternately 7.42 unit code.
Transmitting Signal	7.0 unit, 5 level sequential Baudot code; 7.42 unit available as an alternate.
Operating Speeds	With 7.42 unit operation: 60, 66, 75, and 100 wpm; with 7.0 unit operation: 45.45, 50, 56, and 75 baud. Speed change by a simple exchange of self contained gears by non-technical personnel.
Operating Options	Simple option patching permits selecting combinations of the four major components, page printer, keyboard, distributor-transmitter, and printing perforator for simplex of full duplex operation; internal or external signal line power; or on line or off line operation. In addition, the keyboard, printer, printing reperforator, transmitter-distributor and signal line power supplies may be brought out individually.
Keyboard Features	Standard three row communications keyboard with repeat key, plus break and bell keys. Send receive switch provided to electrically lock out the keyboard. Depressing one key physically prevents another key to be depressed until the first key is released. Standard 1/4 inch bank on keys. When the keyboard is

	placed in storage position or completely removed from the machine, signal lines are automatically shorted. Operator adjustable character counter is standard equipment.
Printing Reperforator	Simultaneously perforates intelligence and prints in standard communications characters (6 1/2 spaces behind corresponding perforation), on 11/16 inches, 7/8 inches, or 1 inch paper tape, either between the feed holes or on the lower portion of the tape. Incorporated variable position notcher notches tape for correction sensing. Paper tape in 8-inch diameter roll is internally mounted. Low paper tape supply indicator included.
Page Printer	Accepts pressure feed paper that is 5 inches in diameter and 8 1/2 inches wide; prints 64 standard communication characters per line, adjustable to 72 or 76.
Transmitter-Distributor	Will accept either 11/16 inch, 7/8 inch, or 1 inch paper tape chad or chadless. The feeder clutch can be operated free running or pulsed from a remote clock. Sixth pin and tight tape stops provided. Built-in test message generator. Manual tape step control included.
Dimensions	15 inches high, 15 1/2 inches wide, and 19 inches deep (21 inches high, 22 1/2 inches wide, and 25 inches deep in the transient case).
Volume	2 1/2 cubic feet.
Mounting	Direct, by 4 1/2 20 screws, or with vehicular or aircraft type shock mounts.
Weight	80 pounds.
Voltage	115 vac.
Frequency	50, 60, or 400 Hz (with appropriate motor).
Operating Power	175 watts.
Heater Power	400 watts.

Availability Data.

One model of this equipment is being procured for test purposes.



TELETYPEWRITER SET
AN/TGC-15

1-5. CONTROL-MONITOR GROUP, TELETYPEWRITER AN/FGA-10( )

Purpose.

To provide a solid state device that prevents the transmission of clear test classified messages over telegraph circuits that have not been approved for classified transmissions.

Employment.

This device is used in relay and strategic communications centers that process classified and unclassified messages; operate partially in the on-line encryption mode; and have one or more telegraph circuits that are not approved for clear text insertion of classified traffic. This unit replaces the Control, Teletypewriter, C-3772/FGC and C-3853/FGC.

Description.

The AN/FGA-10( ) consists of one each Alarm Unit, MX-3945( )/FG and one each Control, Teletypewriter Transmitter, C-4007( )/FG. The units are mounted in standard 19-inch racks and are interconnected via a multiconductor cable of the user's cable system.

Basically the AN/FGA-10( ) is bridged across the teletypewriter send loop. It recognizes the start of message and interrupts the message if any of several conditions associated with classified messages are recognized or if any of several conditions associated with unclassified messages are not recognized.

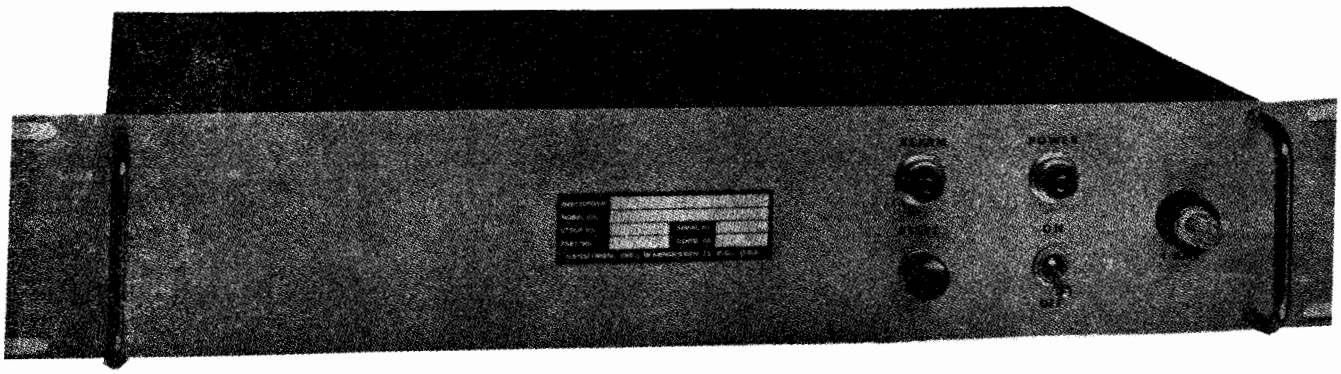
Technical Characteristics.

Input Signal	Any approved high and low level signals.
Input Speed	Baudot code, 6 or 100 wpm, 7.42 or 7.0 unit start-stop.
Recognition:	Each sequence recognizes any programmed character code group of one through seven characters in length. The sequence is recognized even when it is preceded by a multiple first character.
Alarm Output	Contains a front panel alarm light on both units and three sets of one ampere Form C dry contacts.
Operating Temperature	0° to 50° C.

Power	115 Volts ±10% 50 to 60 Hz.
Mounting	Standard 19-inch wide relay rack.

Availability Data.

This equipment is available for Class IV projects.



CONTROL MONITOR GROUP
AN/FGA-10

1-6. AUTOMATIC MULTIPLE ADDRESS ROUTING SYSTEM, MODEL 6702A.

Purpose.

To provide a means of expediting the processing and handling of multiple-address messages at the tape relay station level.

Description.

The Automatic Multiple Address Routing System (AMARS) is an automatic reperforating and address segregation center, designed to expedite the processing and handling of multiple-address messages at the tape relay station level. Tape messages received or originated at the tape relay station, containing multiple addresses, are processed through the AMARS Routing Console. Each address is routed to a particular reperforator, programmed to receive up to eight addresses. When the common portion of the message heading and all the addresses have been routed to the respective programmed reperforators, the remainder of the message is routed to each addressed reperforator and in turn punched on tape. Thus, each reperforator tape contains the common portion of the message heading, the addresses routed to that reperforator, and the entire text of the original tape. These tapes are then available for retransmittal by the tape relay station. The Monitor Console prints all message headings and the designated reperforator position for each routing instruction, plus the Julian date and file time.

The AMARS is housed in standard 19-inch cabinets. The system is logically divided into two Routing Consoles, a Monitor Console, and eleven Reperforator Cabinets. The Routing and Monitor Consoles are 22.5 inches wide, 33 inches deep, and 80 inches high. The Reperforator cabinets are 22.5 inches wide, 29 inches deep, and 80 inches high.

Some of the major features of the AMARS are:

a. Optional manual end-of-message generator.

b. Test pattern and character generator.

c. Incomplete format detection.

d. Cancel transmission generator.

e. Replacement of space with CRCRLF following every 9th RI in the output message heading for each reperforator.

f. Precedence identification and high precedence alarm.

g. SOM detection.

h. Input-output parity check.

i. Tape-in-motion detection.

j. Monitor printer.

k. Automatic message numbering.

l. Time-of-entry recording.

m. Output channel identification.

n. Remote positioning of reperforator cabinets.

o. Unrecognized RI's and low-tape positions to overflow.

p. Accepts either ACP 127 or JANAP 128 formats.

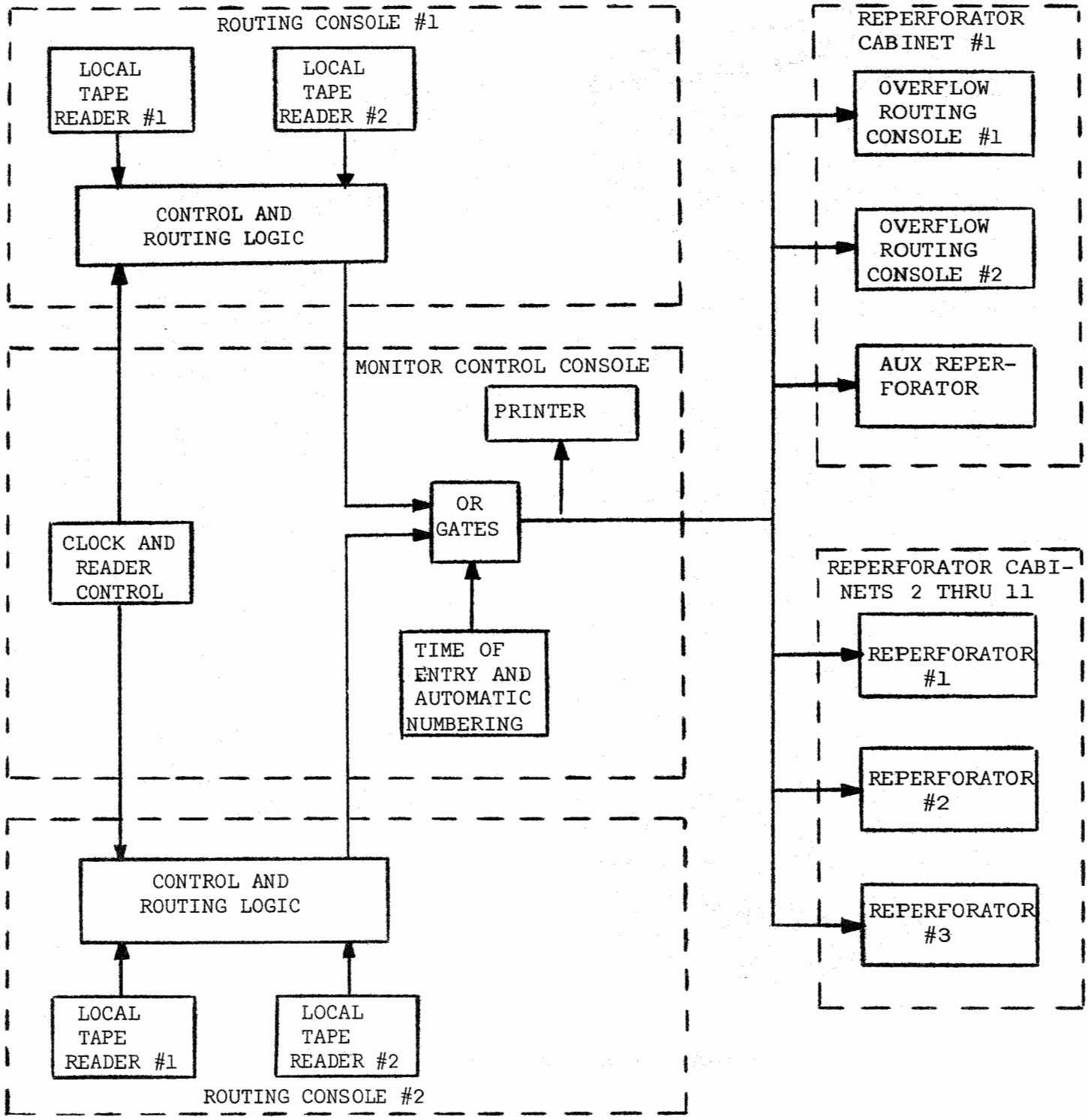
In addition to the above features, the system will activate an alarm and cease to operate upon receipt of more than one SOM without receipt of an EOM.

Technical Characteristics.

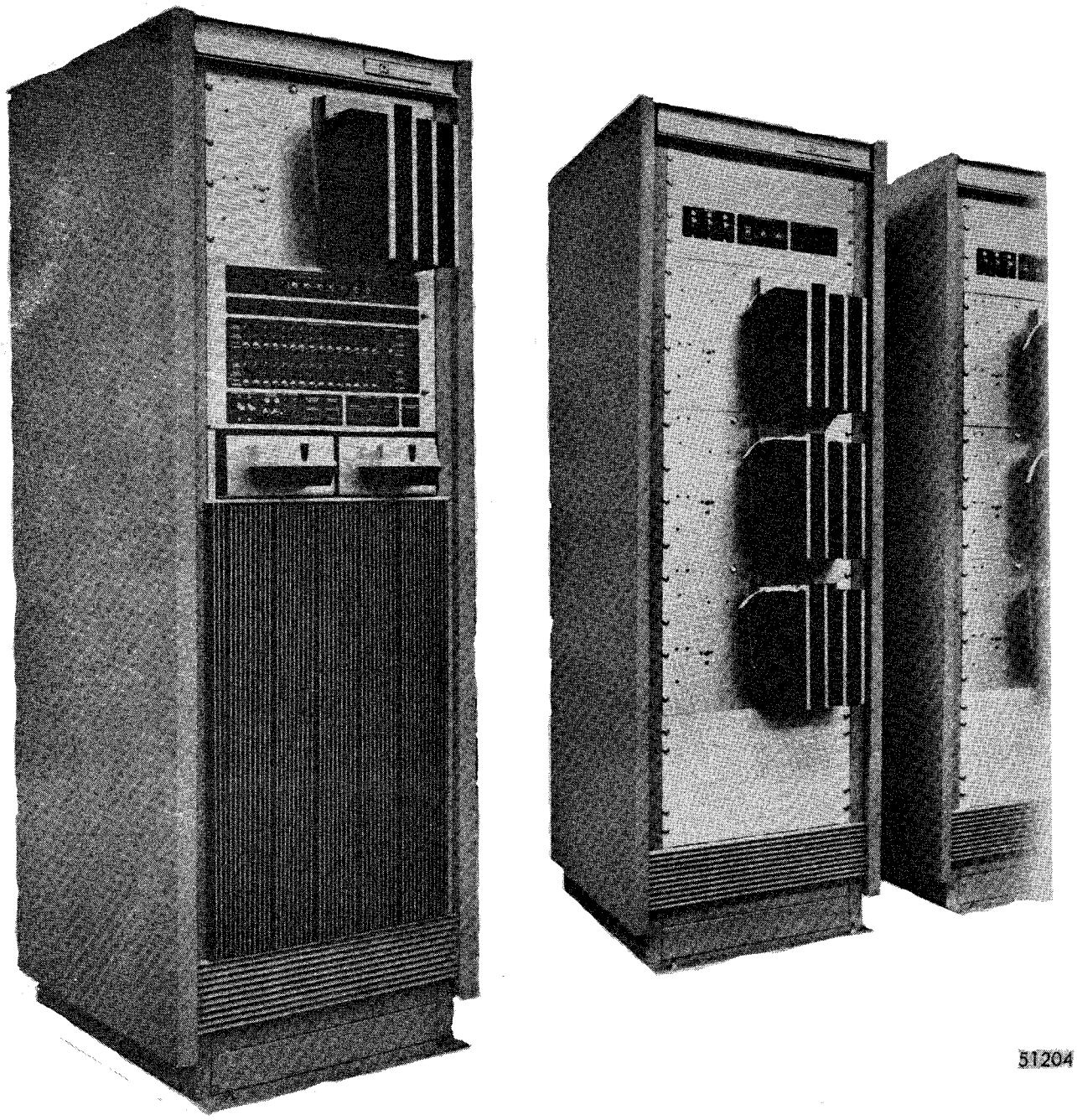
Input Power Requirements	115 vac ±10%, 60 Hz ±5%.
Tape Input	Standard 11/16 or 7/8 inch wide 5-level, chad or chadless.
Tape Output	Standard 11/16 or 7/8 inch wide 5-level, chad.
Routing Indicators	100 each expandable to 200 each 8 character routing indicator.
Speed of Operation	1200 wpm (120 characters per second).

Availability Data.

Only a limited number of the AMARS equipment have been procured to satisfy special requirements.



AMARS General Block Diagram



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AUTOMATIC MULTIPLE ADDRESS ROUTING SYSTEM

CHAPTER 2

TELEGRAPH TERMINAL EQUIPMENT

2-1. TERMINAL, TELEGRAPH AN/FCC-19

Purpose.

To provide 16 full duplex FSK telegraph channels for operation over nominal 3 kHz landline, microwave, forward scatter, or other transmission circuits where diversity is not required.

Employment.

This equipment was designed primarily for strategic fixed plant installations. However, it can also be used in transportable applications.

Description.

AN/FCC-19 is a solid state, modularized, 16-channel voice frequency terminal (FSK) capable of full duplex operation over 3 kHz microwave or metallic (non-diversity) voice circuits. This equipment, which utilizes frequency shift keying and frequency division multiplex, has 8 channel compatibility with the AN/FCC-3 and AN/FCC-7.

All transmit and receive modules are self-contained and adaptable for independent use. This provides the capability of starting with one channel and adding channels as the traffic load increases. The basic 16-channel system equipment modules are housed in one cabinet in such a manner as to allow the installation of an additional 16-channel group, in which case the nomenclature would become the AN/FCC-25.

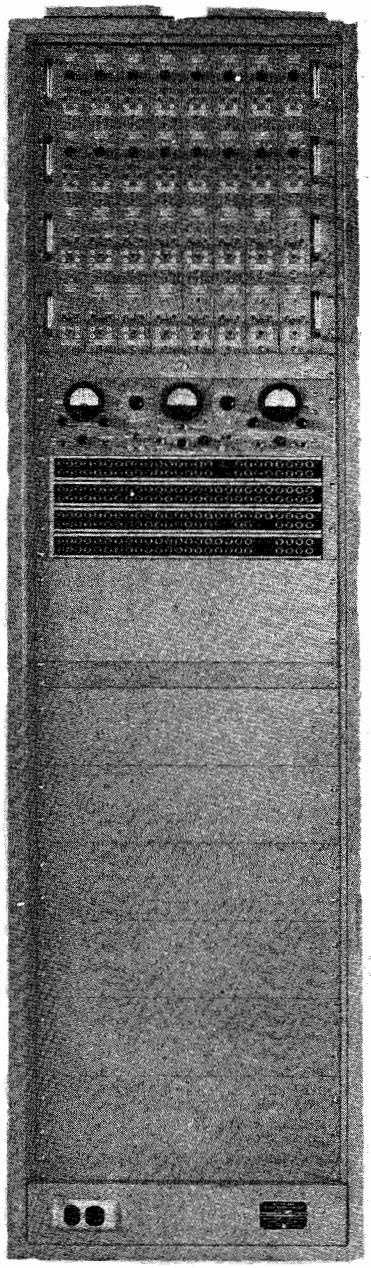
The AN/FCC-19 consists of the following basic modules installed in cabinet, Relay Rack CY-597A/G: 1 each Signal Distribution Panel Model 321A; 16 each Keyer, Frequency Shift CV-1692(P)/UGC; 1 each Panel, Meter SB-2198/UGC; 1 each Patchfield Assembly Type JF139; 1 each Patchfield Assembly Type JF149; 1 each Terminal Block Assembly TE115; 1 each Switch Panel Assembly SA-238/G; and 1 each Equipment Shelf Model 239. Module Extender Model 231 is also provided.

Technical Characteristics.

Voice Frequency Input and Output Impedance	600 ohms isolated from ground.
Voice Frequency Transmit Level	0 dbm to -30 dbm, adjustable.
Voice Frequency Receive Level	+5 to -45 dbm.
Telegraph Loop Characteristics	Keying options are 20 ma polar or 60 ma neutral. Loop terminals are isolated from ground. Loop voltages are 60 volts polar: 120 volts neutral.
Telegraph Loop Power Supplies	External loop power source is required.
Keying Sense	Keying sense is reversible.
Channel Frequencies	382.5 through 3017.5 Hz.
Channel Center Frequencies	425 through 2,975 Hz.
Channel Spacing	170 Hz.
Channel Frequency Shift	42.5 Hz from center frequency.
Channel Keying Speed	90 baud maximum.
Channel Keying Characteristics	The terminal will not insert more than 5% total distortion at a 90 baud modulation rate. Bias distortion correction is adjustable from 0 to ±10%.
Delay Characteristics	Adjustment is provided to compensate for up to 5 milliseconds delay between channels.
Frequency Stability	Less than 1 Hz change for ±10% line voltage variation. Less than 1 Hz change over temperature range from 0^{o} to 125^{o} F.
Primary Power Requirement	115 or 230 volts ±10%, 47 through 63 Hz, 120 watts.
Weight	550 pounds.
Dimensions	22" W, 22 5/8" D, 84" H.

Availability Data.

Available for Class IV Projects.



TELEGRAPH TERMINAL
AN/FCC-19

2-2. TERMINAL, TELEGRAPH AN/FCC-25

Purpose.

To provide 32 full duplex FSK telegraph channels for operation over nominal 3 kHz landline, microwave, forward scatter, or other transmission media where diversity is not required.

Employment.

This equipment was designed primarily for strategic fixed plant installations. However, it can also be used in transportable applications.

Description.

AN/FCC-25 is a solid state, modularized, dual 16-channel voice frequency telegraph terminal (FSK). It consists of two complete sets of channel equipment each equal to the AN/FCC-19 in design, technical characteristics, number of channels, and channel frequency assignments. Both sets are mounted in one equipment cabinet. Each set of channel equipment is designed to operate independently as a separate 16-channel full duplex terminal over 3 kc microwave or metallic (non-diversity) voice circuits. The independent terminals can be combined through use of Multiplexer-Demultiplexer equipment, equivalent to the AN/GCA-12 and AN/GCA-13, to form a single 32-channel system for operation over stable 6 kc transmission facilities (non-diversity).

Each terminal, when operating independently, is fully compatible with the AN/FCC-19 and provides 8-channel compatibility with the AN/FCC-7 and AN/FCC-3.

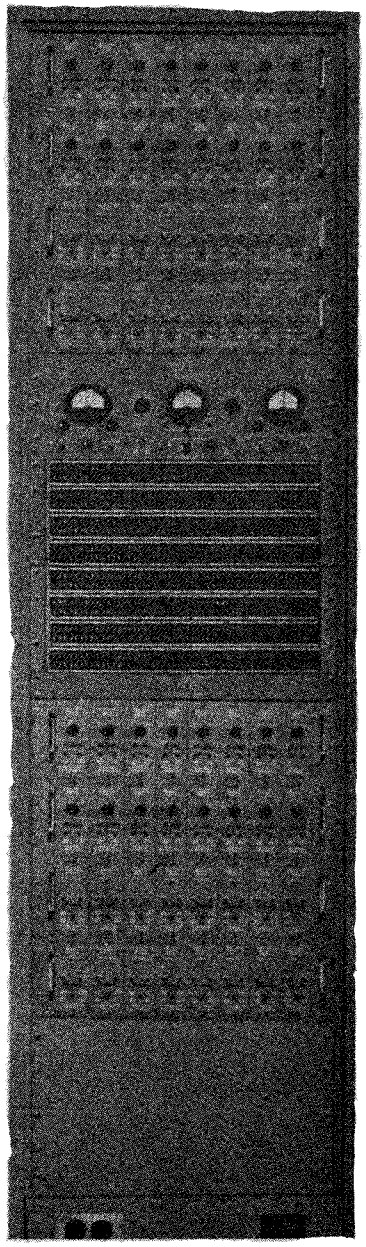
Technical Characteristics.

Voice Frequency Input and Output Impedance	600 ohms isolated from ground.
Voice Frequency Transmit Level	0 dbm to -30 dbm, adjustable.
Voice Frequency Receive Level	+5 to -45 dbm.
Telegraph Loop Characteristics	Keying options are 20 ma polar or 60 ma neutral.
Telegraph Loop Power Supplies	External loop power source is required.
Keying Sense	Keying sense is reversible.
Channel Frequencies	382.5 through 3,017.5 Hz (each 16-channel increments.)

Channel Center Frequencies	425 through 2,975 Hz (each 16-channel increments.)
Channel Spacing	170 Hz.
Channel Frequency Shift	±42.5 Hz from center frequency.
Channel Keying Speed.	90 baud maximum.
Channel Keying Characteristics	The terminal will not insert more than 5% total distortion at a 90 baud modulation rate. Bias distortion correction is adjustable from 0 to ±10%.
Delay Characteristics	Adjustment is provided to compensate for up to 5 milliseconds delay between channels.
Frequency Stability	Less than 1 Hz change for ±10% line voltage variation. Less than 1 Hz change over temperature range from 0° to 125° F.
Primary Power Requirements	115 or 230 volts ±10%, 47 through 63 Hz, 120 watts.
Weight	740 pounds.
Dimensions	22" W, 22 5/8" D, 84" H.

Availability Data.

Only a limited number of FCC-25's have been procured to meet specific requirements.



TELEGRAPH TERMINAL
AN/FCC-25

2-3. TERMINAL, TELEGRAPH
AN/FCC-31 ( )

Purpose.

To provide a transistorized 16 channel, frequency shift keyed, voice frequency telegraph carrier terminal for general use in STARCOM and the DCS.

Employment.

The AN/FCC-31( ) will be used over long haul HF circuits throughout the STARCOM and DCS and is intended as a replacement for the AN/FGC-29, -60, -61, and AN/UCC-1 telegraph terminals.

Description.

The AN/FCC-31( ) provides for transmission of 16 telegraph signals in one nominal 3 kHz voice frequency channel over HF radio, microwave, or metallic circuits, and for reception of 16 similar signals in two nominal 3 kHz voice frequency channels using space diversity, frequency diversity, or a combination of space and frequency diversity techniques. The modular design concept of the AN/FCC-31( ) permits maximum operational flexibility. Although it is considered a 16-channel diversity system, the AN/FCC-31( ) may, at the user's option, utilize any number and combination of channels up to a maximum of 16, without degradation of system performance.

The AN/FCC-31( ) is compatible with AN/FCC-3, -7, and -8; AN/FGC-29, -60, and -61; and AN/UCC-1 telegraph terminal equipment.

Components of the AN/FCC-31( ) include:

a. Two Keyer Group OA-7048( )/FCC-31, each consisting of:

(1) One equipment shelf.

(2) Eight Keyer, Frequency Shift KY-540( )/FCC-31.

b. Four Electronic Frequency Converter Group OA-7049( )/FCC-31, each consisting of:

(1) One equipment shelf.

(2) Eight Converter, Electronic Frequency CV-1810( )/FCC-31.

c. Two Diversity Combiner Group OA-7050( )/FCC-31, each consisting of:

(1) One equipment shelf.

(2) Eight Diversity Combiner MX-6628( )/FCC-31.

d. One Amplifier-Power Supply Group AN/FCA-5( ), consisting of:

(1) One Drawer, Electrical Equipment Cabinet CH-572/FCA-5( ).

(2) Four Amplifier, Audio Frequency AM-4190( )/F.

(3) One Power Supply PP-4185( )/F.

e. One patchfield.

f. One meter and test panel.

g. One signal distribution panel.

h. One module extender.

i. One standard 19-inch cabinet.

j. One alternating current power distribution panel.

k. Two combiner panel.

l. One fuse and alarm panel.

m. One remote combining panel.

Technical Characteristics.

Frequency	The lowest center frequency is 425 Hz in the full 16-channel terminal.
Channel Separation	Adjacent channel separation is 170 Hz.
Frequency Shift	Frequency keying deviation is ±42.5 Hz from center frequency.
Tone Transmission Level	The difference in level between the mark and the space tones of each transmitter does not exceed 2 db.

Frequency Stability	The frequency stability is ±2 Hz from the adjusted values when the line voltage is varied by ±10%, or ±3 Hz under all other environmental conditions.
Output Impedance	The output impedance of the transmitter is 600 ohms ±10% at the center frequency.
Loop Characteristics	The input circuits will accept polar or neutral keying, at the users option, on signal loops from 10 to 100 ma and voltages as high as 150 volts, or polar ±6 V milliampere.

Availability Data.

Production units to be available second quarter FY-69.

CHAPTER 3

HF RADIO EQUIPMENT

3-1. FREQUENCY STABILIZED RADIO RECEIVING SET AN/FRR-41

Purpose.

To provide a radio receiver that is capable of frequency stabilized operation.

Employment.

This equipment will provide stations in the Army element of DCS frequency stabilities of one part in 10^8 per day and tuning steps of 100 Hz throughout the tuning range. This receiver will be used for the reception of analog and data transmission over STARCOM HF single sideband radio circuits.

Description.

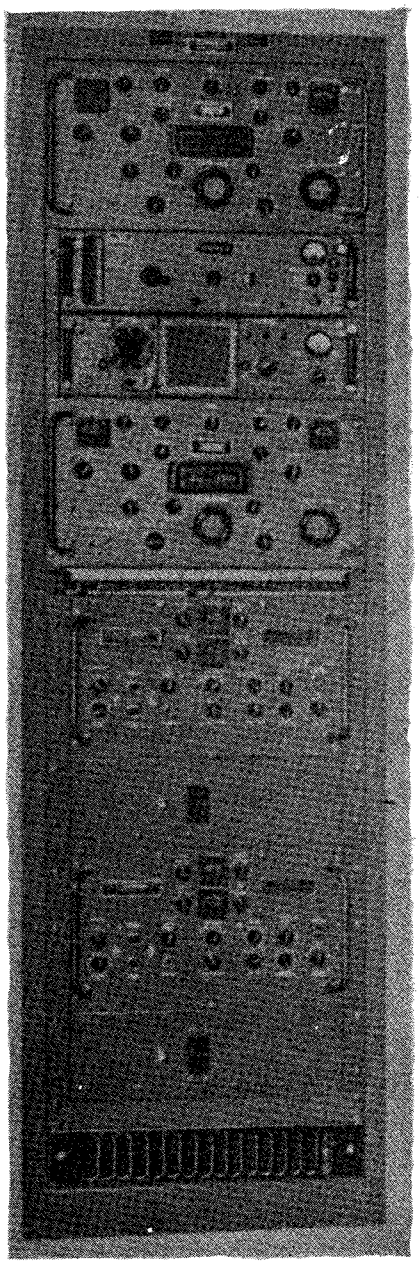
This stabilized radio receiving set involves a modification to the AN/FRR-41 Radio Set which includes the use of multiple frequency stabilizers installed as an integral part of the sets. A stabilizer operates with two R-390A/URR (Receivers) and two CV-157/URR (Converters) to enable the receivers to be tuned through the tuning range in 100 Hz increments. Performance characteristics other than stability and tuning increments, are the same as the unstabilized AN/FRR-41.

Technical Characteristics.

Internal Standard	1 MHz thermostatic temperature control.
Frequency Stability	1 part in 10^8 per day.
External Standard	100 kHz or 1.0 MHz.
Calibration Frequency	100 kHz, 1.0 MHz, or in 1.0 kHz increments from 100 kHz to 5.0 MHz.
Input Power	115 AC ±10%, 48 to 62 Hz.
Signal Input Frequency	0.5 to 32 MHz.
Dimensions	22" W, 20½" D, and 76" H.
Weight	445 pounds.
Operating Temperature Range	10^o to 60^o C. (18^o to 140^o F.)

Availability Data.

The AN/FRR-41 Receiver Stabilization Kits are available for stabilizing existing receivers where required.



STABILIZED RECEIVER
AN/FRR-41

3-2. RADIO TRANSMITTER AN/FRT-52

Purpose.

To provide a medium power (10 kw PEP) transmitter for STARCOM application.

Employment.

This equipment is used in fixed plant and transportable systems.

Description.

AN/FRT-52 is a 10 kw (PEP) transmitter that operates on a frequency between 4.0 and 28.0 MHz. It is manually tuned and aircooled. A spectrum analyzer is included to facilitate tuning and alignment.

Technical Characteristics.

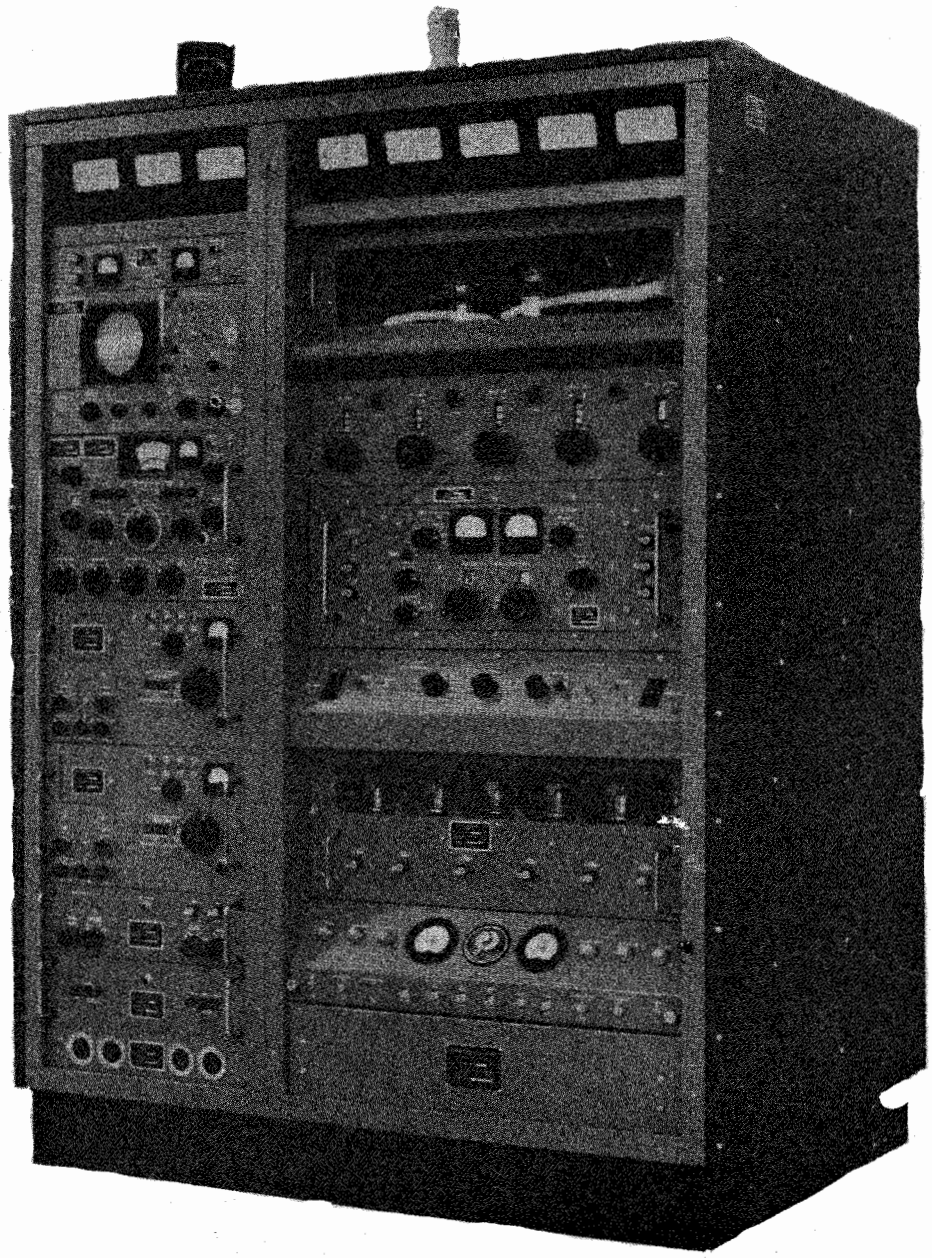
Frequency Range	4.0 to 28.0 MHz band switched.
Output Power	10,000 watts; 2 tone PEP. 5,000 CW or FS.
Operating Modes	CW, MCW, SSB, ISB, DSB, FS.
Tuning	All tuning and band switching controls are located on the front panels (no plug-in components.)
Output Impedance	72 ohms unbalanced; 600 ohms balanced; Pi-L network.
Frequency Control	Built-in stable master oscillator for CW and FS operation. Ten oven-controlled crystal positions plus external oscillator position.
Intermodulation Distortion Products	At least 40 db down relative to PEP output, including third order.
Unwanted Sideband Rejection	1,000 Hz, single tone, 60 db down.
Harmonic Distortion	Second harmonic at least 50 db below the PEP output; third harmonic at least 65 db below the PEP output.
Carrier Insertion	-55 db to full output.
ALDC	An automatic load and drive control is provided to limit distortion at high drive peaks or load changes.
Audio Inputs	600 ohm balanced, -20 to +10 dbm continuously adjustable for full RF output.

Audio Response (each sideband)	Flat, within ±1.5 db, 350 to 3,300 Hz.* Flat within ±1.5 db, 350 to 7,500 Hz.*
VOX Operation	Voice control with anti-trip features. Adjustable gain and squelch.
Metering	Large size illuminated meters accurately indicating readings.
Distortion Measuring	Built-in analyzer.
Primary Power Requirements	208/230 AC, 50 to 60 Hz, three-phase, 13 kw.
Safety Features	Overload and bias protection with automatic recycling and alarm. Safety interlocks at all high voltage points.
Cooling	Filtered, forced air cooling, semi-pressurized cabinet.
Temperature and Humidity	Designed to operate in any ambient temperature between 0^{o} to 50^{o}C. for any relative humidity up to 90%.
Dimensions	56 x 43½ x 84 inches.
Weight	2,800 pounds.
Components and Construction	The equipment is manufactured in accordance with JAN/MIL specifications, wherever practicable.

Availability Data.

This equipment is classified Standard A and is available for Class IV Projects.

* Depends on filter ordered with sideband exciter.



RADIO TRANSMITTER
AN/FRT-52

3-3. RADIO TRANSMITTER AN/FRT-54

Purpose.

To provide a general purpose 40 kw (PEP) transmitter for STARCOM application.

Employment.

This equipment will be used as an interim high-power transmitter pending availability of the automatically tuned HF transmitter (50 kw average) presently under procurement.

Description.

AN/FRT-54 is a general purpose transmitter that transmits four 3 kHz channels of intelligence between 2.0 and 28.0 MHz in a multiplexed communications system. Used as a CW or AM transmitter it provides an average output of 20 kw; used as a sideband transmitter, it provides an output of 40 kw (PEP). Although designed primarily for single sideband, it can also be used for CW (keyed carrier); frequency shift telegraphy and facsimile; single sideband suppressed carrier; independent sideband suppressed carrier (separate intelligence); and single or double sideband AM or MCW.

This transmitter is a completely self-contained unit, with its components housed in four modular assemblies. The first two modules comprise the AN/FRT-52 radio transmitter; and the remaining modules contain the power amplifier section, the antenna tuner section, and the control circuits.

The exciter section has a spectrum analyzer, a two-tone generator, and an extremely sensitive oscillator. The units, in conjunction with a specially designed coaxial switch panel, allow all vital operating points to be quickly monitored and tested.

To provide complete operational flexibility, 1 kw and 10 kw outputs are readily available for reduced power or emergency operation. ALDC (automatic load and drive control) and inverse feedback are used to improve linearity and to suppress unwanted transmission products. The band switching circuitry allows frequency changes to be accomplished in a minimum of time.

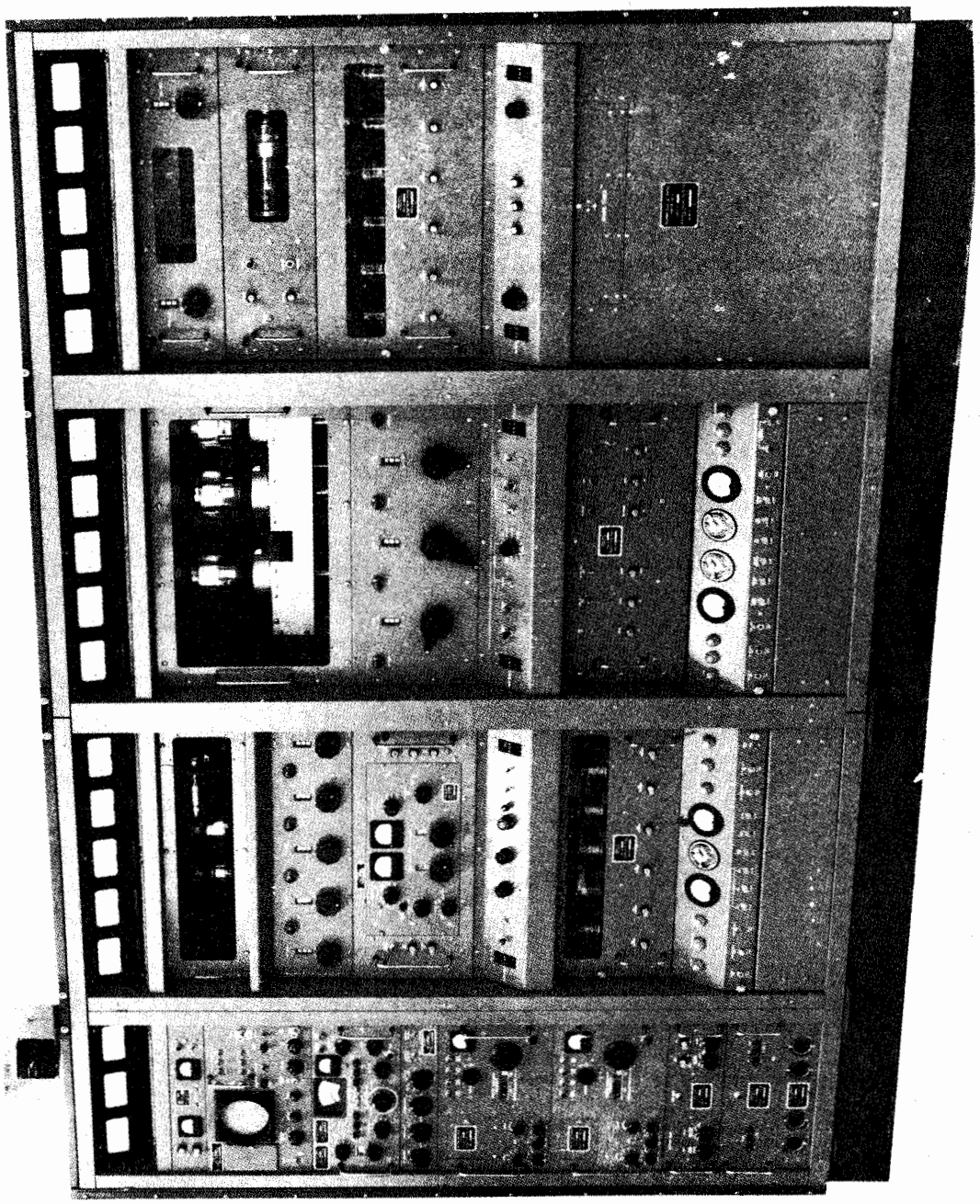
Technical Characteristics.

Frequency Range	2.0 to 28.0 MHz, band-switched.
Output Power	40 kw two-tone PEP, with 35 db signal to distortion ratio; 20 kw two-tone PEP, with 40 db signal to distortion ratio.
Operating Modes	CW, MCW, SSB, ISB, DSB, FSK, FAX.
Output Impedance	72 ohms unbalanced, 600 ohms balanced, with a 2 to 1 VSWR maximum.
Tuning	All tuning and band switching controls are on the front panels.
Stability	VFO better than 20 parts in 10^6 for 30^o change in ambient temperature; sideband exciter: crystal controlled, one part in 10^6; synthesizer control available with stability of one part in 10^8 per day.
Frequency Control	Continuously tunable, direct reading variable frequency oscillator; 10 oven-controlled crystal positions in the sideband exciter and 3 oven-controlled crystal positions in the frequency shift exciter.
Unwanted Sideband Rejection	1 kHz single tone, 60 db down.
Harmonic Distortion	Second harmonic at least 30 db, and third harmonic at least 65 db, below the PEP output.
Carrier Insertion	-55 db to full output.
ALDC	An automatic load and drive control is provided to limit distortion during high drive peaks or load changes.
Audio Response (Each Sideband)	Flat ±1.5 db, 350 to 7,500 Hz.
Metering	Large size illuminated meters that accurately indicate the operation of all circuits.
Primary Power Requirements	230 AC, 50 to 60 Hz three-phase.
Safety	Overload and bias protection with automatic recycling and alarm. Safety interlocks are used throughout to protect personnel.
Cooling	Filtered forced air cooling, semi-pressurized cabinet.
Temperature and Humidity	Operation between 0^o to 50^oC. with any value of relative humidity up to 90%.

Weight	7,000 pounds.
Construction	Equipment is manufactured in accordance with JAN and MIL specifications wherever practicable.

Availability Data.

The equipment was modified and the nomenclature changed from AN/FRT-40 to AN/FRT-54 for usage in transportable systems. Item currently available for Class IV Projects.



RADIO TRANSMITTER
AN/FRT-54

3-4. RADIO TRANSMITTER AN/FRT-57

Purpose.

To provide a low power, general purpose transmitter featuring building block versatility and ease of installation, operation, and maintenance.

Employment.

This equipment is intended for selected STARCOM and CONUS stations that require lower power SSB, ISB, AM, and CW operations.

Description.

AN/FRT-57 is a compact, multi-purpose transmitter that is capable of SSB, ISB, DSB, AM, CW, and FSK operation between 2.0 and 32.0 MHz. Basically, the transmitter consists of a standing wave ratio indicator; transmitting mode selector; variable frequency oscillator; linear RF amplifier; and an auxiliary power panel. The auxiliary power units are band switched by front panel tuning while a filtered, forced air system dissipates radiated heat. To simplify maintenance the transmitter has drawers that slide out and tilt.

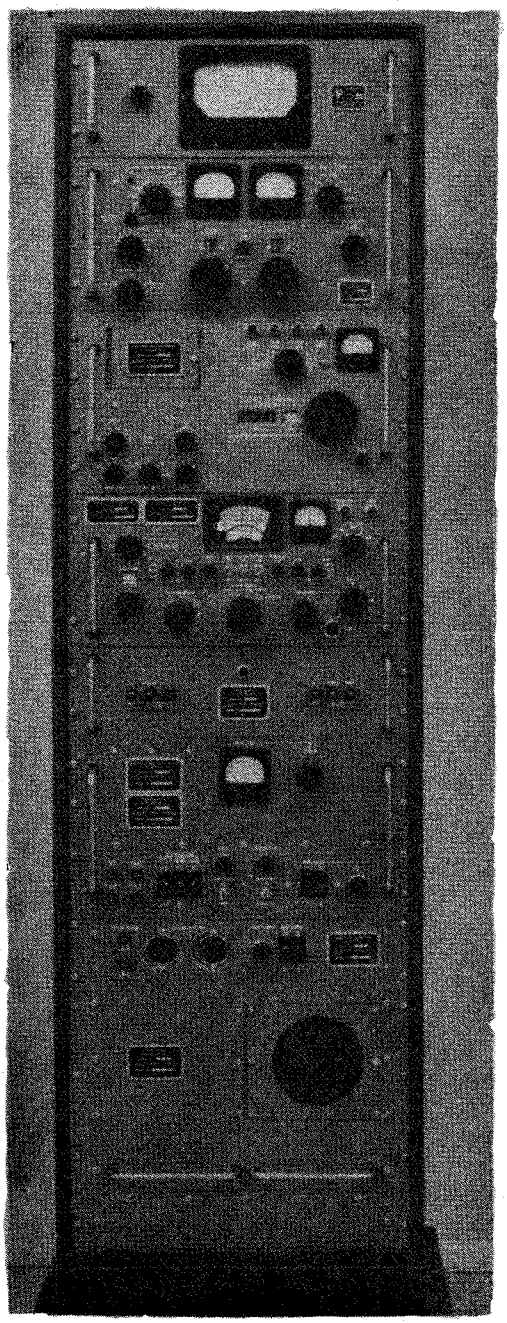
Technical Characteristics.

Output Power	1,000 watts PEP, SSB, CW, FSK.
Frequency range	2.0 to 32.0 MHz.
Modes of Operation	SSB, ISB, DSB, AM, CW, and FSK.
Output Impedance	50 or 70 ohms unbalanced.
Harmonic Distortion	1. 2nd harmonic at least 40 db below PEP. 2. 3rd harmonic at least 50 db below PEP.
Signal/Distortion Ratio	1. Distortion at least 40 db below either tone of a standard two-tone test 2 to 22 MHz. 2. Distortion at least 35 db below either tone of a standard two-tone test 2.0 to 32 MHz.
Frequency Stability	1. Crystal--1 part in 10^6 per day. 2. Synthesizer--1 part in 10^8 per day.
Unwanted Sideband	1,000 Hz tone at least 60 db down.
Carrier Insertion	-50 db to full output.

Audio Input	1. Two 600 ohm channels, balanced or unbalanced. 2. One 500,000 ohm input for crystal or dynamic.
Tuning	All tuning and band switching controls on front panels.
Metering	Front panel meters indicate operation of all critical circuits.
ALDC	An automatic load and drive control is furnished to limit distortion during high drive peaks or load changes.
T/R Function	A coaxial antenna relay and receiver muting circuit is provided to facilitate half duplex operation.
Cooling	Pressured cabinet filtered air for maximum heat dissipation.
Safety Features	1. Full interlock protection. 2. Full overload and fuse protection.
Temperature and Humidity	Any ambient temperature between 0° and 50°C., and humidity up to 90%.
Size	72½ inches high, 20 5/8 inches wide, and 22½ inches deep.
Weight	610 pounds.
Power Requirements	115/230 vac. 50/60 Hz single phase 1,900 watts.
Volume	73 cu. ft.
Bands	4.
Channels	2.
Connections	1. Input: Type UHF Coaxial. 2. Output: Type ODS Coaxial.

Availability Data.

Currently available as a Class IV Project item.



RADIO TRANSMITTER
AN/FRT-57

3-5. HF RECEIVER MULTICOUPLER

Purpose.

To provide an electronic multicoupler capable of coupling six HF radio receivers to a single antenna.

Employment.

This multicoupler is intended for use in all STARCOM receiver facilities.

Description.

The HF receiver multicoupler is designed for fixed plant use and provides optimum coupling between a single antenna and six receivers in a communication system. This equipment provides a low VSWR, a wide frequency range (2 to 30 MHz), a high attenuation of out of band frequencies, a low noise figure, low intermodulation distortion, and a high degree of isolation between individual outputs. The basic circuitry consists of filters, a wideband amplifier, and six output stages. It is equipped with two pull handles for insertion and removing the equipment, ON-OFF power switch, indicator light, fuses, test meter, and test meter switch mounted on front of panel.

Technical Characteristics.

Power Requirements	115/230 volts, AC, 47 to 63 Hz single phase.
Frequency Range	2 to 30 MHz.
Input Impedance	50 ohms.
VSWR	2.0:1.
Number of Outputs	Separate outputs for connecting to 6 receivers.
Output Impedance	50 ohms unbalanced.
Noise Figure	6 db.
Intermodulation	60 db below the level of each tone.
Output Isolation	At least 40 db between any two outputs.
Overload	Gain reduction to overcome overload is better than 3 db with a 1.4 volt signal.

Unused Outputs	Unused outputs are internally terminated.
Mounting	Suitable for mounting in a standard 19-inch rack.

Availability Data.

Available for Class IV Projects.

3-6. VLF RECEIVER/COMPARATOR (Fluke Model 207)

Purpose.

To provide a means to compare local frequency standards to received very low-frequency (VLF) and low frequency (lf) standard frequency broadcasts.

Employment.

This equipment will be used in STARCOM HF facilities.

Description.

This VLF Receiver/Comparator compares local frequency standards to received very low-frequency standard frequency broadcasts. Frequency coverage is from 8.0 to 31.9 kHz in steps of 100 Hz with an additional channel at 60.0 kHz. Thus, local frequency standards may be calibrated by comparing them to frequencies based on both UT2 and A1 time scales.

This equipment is a completely electronic phase tracking receiver. A 1.1 kHz signal derived from the local frequency standard is phase corrected to a 1.1 kHz signal derived from the received vlf or lf transmission signal by means of an electronic phase shifter.

If the local frequency standard is at exactly the right frequency, there will be a constant phase shift. However, if the local frequency standard is high or low in frequency, the phase shift produced by the electronic phase shifter will change with time. This changing phase shift is used to produce a time-internal error which is recorded on a strip chart recorder. In addition, a cumulative total of the error to the nearest tenth of a microsecond is maintained on a counter called the digital error accumulator. The fractional error of the local frequency standard is calculated by dividing the time-internal error by the observation period.

The Model 207 receiver/comparator is equipped with specially designed antenna. A field effect transistor circuit in the base of the antenna provided impedance matching from the antenna to a 50-ohm transmission line. In addition, this circuit provides rf amplification making the antenna about 15 db more sensitive than comparable antenna systems. Operating power for the field effect transistor is supplied through the center conductor of the coaxial cable from the receiver. This antenna is 102 inches long and is supplied with 100 feet of RG-58A/U coaxial cable.

Technical Characteristics.

Input Signal Frequency	1 MHz, 100 kHz or any integral multiple 100 kHz between these two frequencies.
Voltage	0.5 to 14.0 volts peak-to-peak, sine wave, square wave or pulse.
Impedance	Greater than 1000 ohms.
Connector	Front panel BNC.
Controls	Completely automatic changeover from VLF receiver mode to comparison mode.

Availability Data.

Forty vlf receivers have been procured to meet specific STARCOM requirements.

3-7. TRANSMITTING SET, RADIO (1 KILOWATT) AN/FRT-76( )

Purpose.

To provide a general purpose, low power, high frequency radio transmitter for fixed station and transportable use.

Employment.

This transmitter is intended for use in STARCOM fixed station and transportable communications systems.

Description.

The Transmitting Set, Radio AN/FRT-76( ) is a high frequency, frequency-stabilized, air-cooled transmitter suitable for fixed plant and transportable strategic communications applications. The transmitter will be primarily designed for 12A9b operation but will also have self-contained capabilities for A1 and F1 modes.

Design of the transmitter will be based on standard 19-inch panels inclosed in a cabinet scheme which will permit installation, operation, and maintenance entirely from the front of the equipment.

The exciter furnished as part of this equipment will employ solid state electronics where practical and will include all output frequency and modulation determining elements. It will provide terminations for the audio input lines and will furnish to the amplifier a modulated radio frequency excitation signal. The exciter will be of a high reliability, continuous duty, high stability, frequency synthesized type and will include self-contained provisions for accepting from one to four 3 kHz audio input channels.

The amplifier will derive tuning information from the exciter for automatically tuning all amplifier circuits, including the transmitter output circuit, to the desired operating frequency.

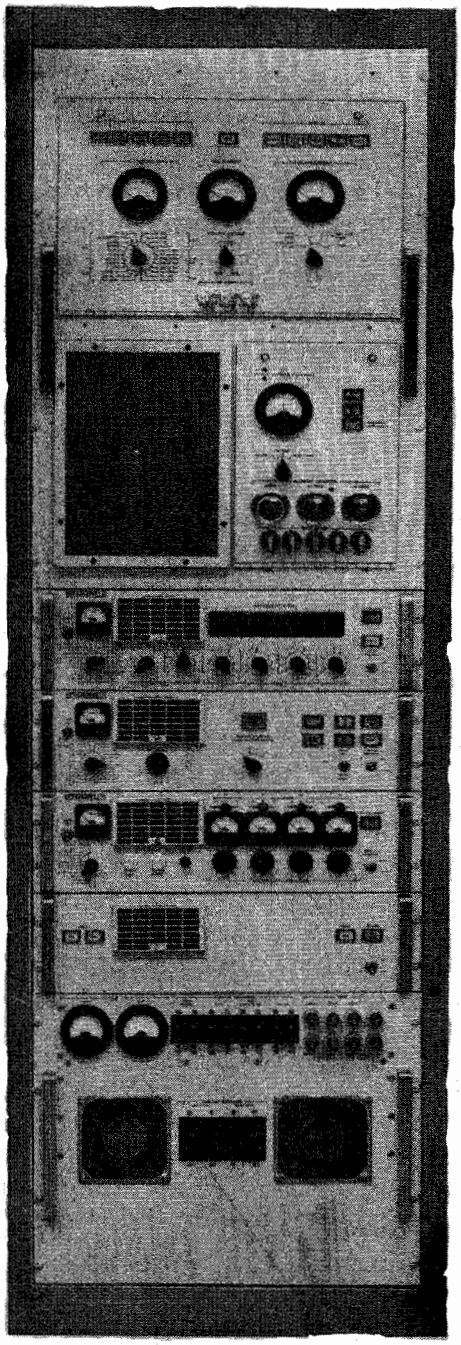
Technical Characteristics.

Power Requirements	115/230 volts ac, 47 to 63 Hz, single phase.
Frequency Range	Continuous from 2 to 30 MHz in increments of 100 Hz. 600 ohms balanced.
Frequency Stability	One part in 10^8 per 24 hours.

Input Impedance	600 ohms balanced.
Power Output	One kilowatt minimum.
Output Impedance	50 ohms unbalanced.
VSWR	Not to exceed 2:1.

Availability Data.

This equipment is being obtained through a two-step multi-year procurement. Production models are expected in FY-69.



TRANSMITTING SET, RADIO
AN/FRT-76( )

3-8. TRANSMITTING SET, RADIO (10 KW) AN/FRT-77( )

Purpose.

To provide a high stability, medium power radio transmitter of 10 kilowatts peak envelope power output for general STARCOM use.

Employment.

This transmitter is intended for general STARCOM use in fixed and transportable communications systems.

Description.

Radio Transmitter AN/FRT-( ) is a 10 kw PEP frequency synthesized, independent sideband (isb) air cooled, local and remote controlled high frequency (HF) radio transmitter for general purpose fixed station or transportable use. It consists of an exciter unit which determines the frequency of the output signal, provides the modulation process, determines the frequency of the output signal, provides the modulation process, determines the output frequency stability, and furnishes an output signal of at least 200 milliwatts (mw) PEP to the succeeding units of the transmitter, which consists of one or more amplifier units.

The entire transmitter will be housed in a maximum of three separable cabinets whose combined installed maximum overall dimensions will not exceed 60 inches in width (across the face), 39 inches in depth (front to back), and 78 inches in height (bottom to top). It will be possible to perform all operations and maintenance functions from the front of the cabinets, so that they may be mounted against wall bulkheads, etc.

Modulator-Oscillator Group: Modulator-Oscillator Group OA-( )/FRT (also called the exciter) will include all of the output frequency determining elements and all of the elements determining the output modulation characteristics. It will provide the terminations for the audio input lines and will furnish to Amplifier-Power Supply Group OA-( )/FRT (also called the amplifier) a modulated radio frequency (RF) excitation signal of not less than 200 mw PEP. It will provide, to the amplifier, any required tuning and/or conditioning information. It will contain all of the input audio line terminations and input signal processing devices. It will be of high reliability, continuous duty, high stability, independent sideband, frequency synthesized type having self-contained provisions for accepting from one to four 3 KHz bandwidth audio input channels. The exciter output will be not less than 20 mw PEP RF power in a 3A9B to 12A9B characteristic depending upon the number of audio

frequency (af) inputs utilized. It will be possible to locate the exciter at least 200 feet from the amplifier without derating or degradation of performance.

Amplifier-Power Supply: Amplifier-Power Supply Group OA-( )/FRT uses of the RF signal from the exciter as a reference for automatically tuning all circuits including the antenna circuit to the most efficient operating conditions for the frequency being used, within a time frame of 10 seconds or less. Any required coarse tuning and/or conditioning information will be provided to the amplifier in not more than six single conductors and the supplied information will not exceed 150 volts AC or ±100 volts DC. Provision will be made to disable the automatic tuning system of the amplifier during normal operation. Those portions of the automatic tuning system concerned with output loading and/or matching will not be disabled by these provisions but will have their sensitivity reduced to the point that they do not operate until a threshold of approximately 10% change of the controlled parameter has been exceeded. At this point they will operate at normal sensitivity until the proper condition of tuning or loading has been reached. At this condition they will revert to the less sensitive condition. This automatic tuning system will be provided with local tuning controls with which the transmitter may be completely tuned manually.

Technical Characteristics.

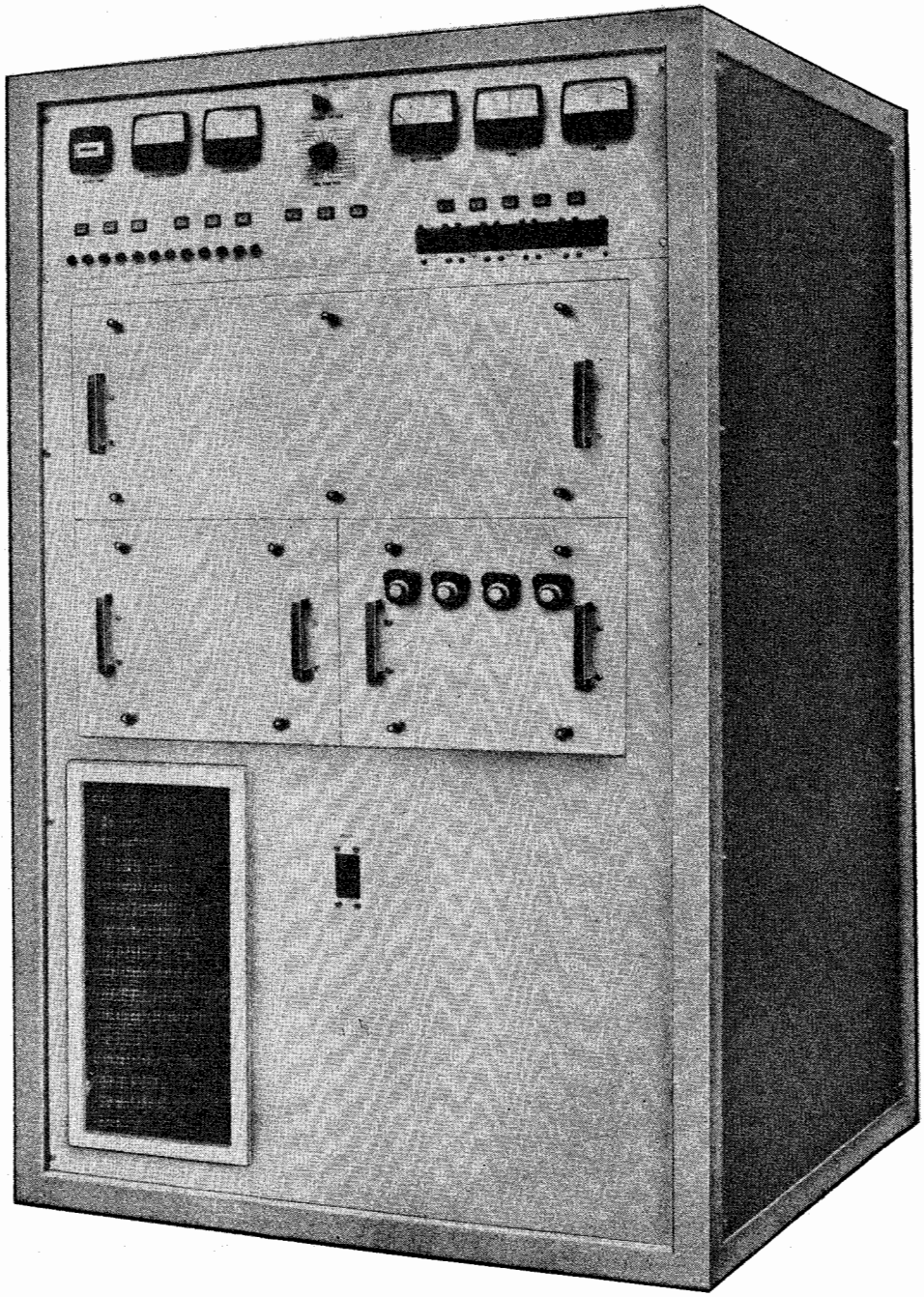
Frequency Range	Exciter: The frequency range of the exciter will be incrementally continuous from 2.0 MHz to 30.0 MHz in increments of not greater than 0.1 kHz each. Amplifier: The frequency range of the amplifier will equal that of the exciter.
Frequency Stability	One part in 10^8 per 24 hours.
Input Impedance	The audio input impedance will be 600 ohms balanced with a minimum of 26 db return loss from 200 to 3,100 Hz.
Output Impedance	The active output impedance of the transmitter will be 50 ohms nominal. No degradation of the specified performance occurs when the external load impedance is such that it produces up to 2.0 to 1 VSWR at the output fitting, and no damage will occur to any component of the transmitter when the external VSWR is as high as 3.5:1.

CCP 105-4

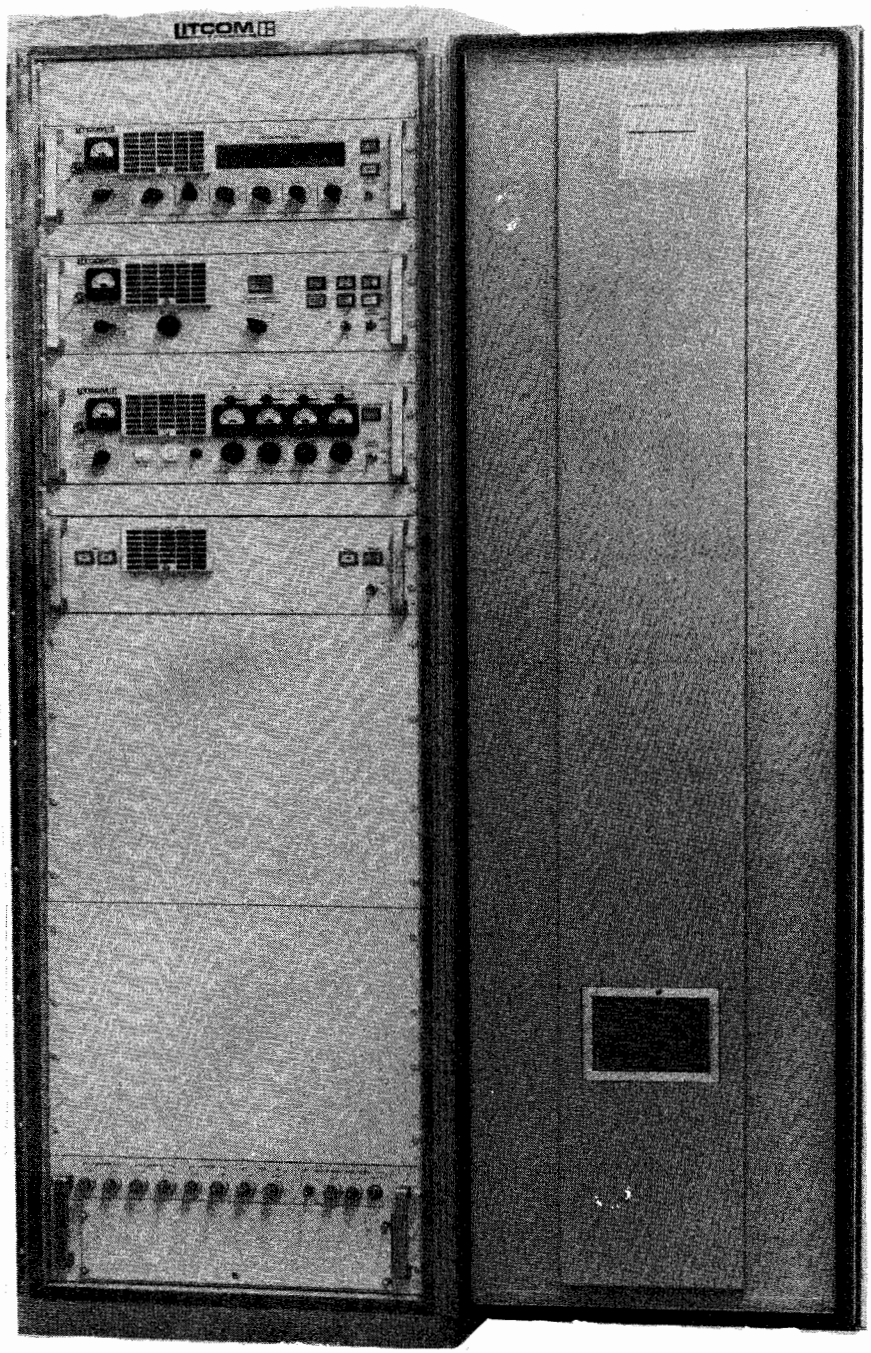
Power Requirements	Transmitter: Prime power for the transmitter will be derived from a single source. This will be a 3-phase (Ø), 4-wire source with 200- to 240-volt, 47.5 to 63 Hz service. Exciter: There will be a second power source for portions of the exciter. This second source will be 1 Ø, 2-wire with 115/230 volt, 47.5 to 63 Hz service. This source will be used for those elements of the exciter which must remain energized when the exciter is in standby condition.

Availability Data.

This equipment is being obtained through a two-step multi-year procurement. Production models are expected to be available in FY-69.



TRANSMITTING SET, RADIO
AN/FRT-77( )



OSCILLATOR-MODULATOR GROUP
P/O AN/FRT-77

CHAPTER IV

VOICE FREQUENCY EQUIPMENT

4-1. AMPLIFIER-POWER SUPPLY GROUP AN/FCA-5( )

Purpose.

To provide amplification of audio frequency signals.

Employment.

This equipment is intended for use in the Army element of the DCS to replace Amplifier, Audio Frequency AM-911/FG, and Line Amplifier Group AN/GGA-14.

Description.

The AN/FCA-5( ) consists of four each Amplifier, Audio Frequency AM-4190( )/F and one each Power Supply PP-4185( )/F installed in Drawer, Electrical Equipment Cabinet CH-572/FCA-5( ). The amplifiers can be used to amplify telegraph, data, or facsimile tones, or voice signals. Input attenuation and 600-ohm balanced inputs and outputs are provided. Jacks are provided for monitoring. The AN/FCA-5( ) is a component of Terminal, Telegraph AN/FCC-31( ).

Technical Characteristics.

Input and Output Impedance	600 ohms ±10% balanced.
Gain	50 db.
Input Level	-40 to +10 vu for rated output of +10 vu.
Frequency Response	±1.0 db, 300 to 10,000 Hz.
Controls	Input level control.
Noise level	7 vu below output level of +10 vu.

Availability Data.

This equipment is available for Class IV Projects.

4-2. MULTIPLEXER SET AN/FCC-18

Purpose.

To provide up to 600 four kc frequency channels for voice, teletype, data, or graphic services.

Employment.

This equipment is designed for microwave relay tropospheric scatter, or cable. Between one and 600 channels are obtained for strategic communication applications.

Description.

AN/FCC-18 is a solid state, frequency division multiplex equipment utilizing a 60 to 2,540 kc spectrum. It is arranged to stack 4 kc single sideband suppressed carrier channels into super groups of 60 channels; and finally, into a line group of 600 channels. Tightly spaced frequency allocations conforming to CCITT recommendations have been employed.

The AN/FCC-18 carrier system requires one third to one tenth less space than similar tube type equipment because the 60, four-wire channels and signaling units can be mounted in an eight-foot rack. 600 channels will fit in the same space previously required for 60 channels of most tube type carrier equipment.

All units plug into the mounting frame and can be quickly removed for inspection or maintenance. The equipment will operate directly from 48 vdc, station battery, or a 115 Hz supply. All switching is performed by power transistors or silicon controlled rectifiers.

A complete 600 channel system may contain a common equipment rack, channel rack, jack field rack, and, other optional equipment racks. Each rack is 8 feet high and has standard 19-inch rack mounting. Only one common equipment rack is required in a 600 channel system, and it contains all the frequency generating equipment. The number of other racks used with group and super group systems, however, depends on the system arrangement. The channel racks may contain up to 60 channels with termination equipment, or 120 channels without terminating equipment. The systems arrangement determines if jack field racks will be employed in a 600 channel system. This rack provides patching facilities at the channel level and the basic group level.

AN/FCC-18 has been designed for maximum flexibility. It utilizes the building block principle, and only the shelves and units necessary for particular requirements are installed. Additional units can be easily added with a minimum of effort.

The carrier system is comprised of two basic systems. The frequency generating system derives and supplies the channel group, and super group carrier frequencies to the transmission system where, through successive modulation and sideband selection, twelve 4 kc voice channels are combined into a supergroup, and ten super groups are combined into a single wideband signal containing 600 voice channels and occupying a spectrum of 60 to 2,540 kc.

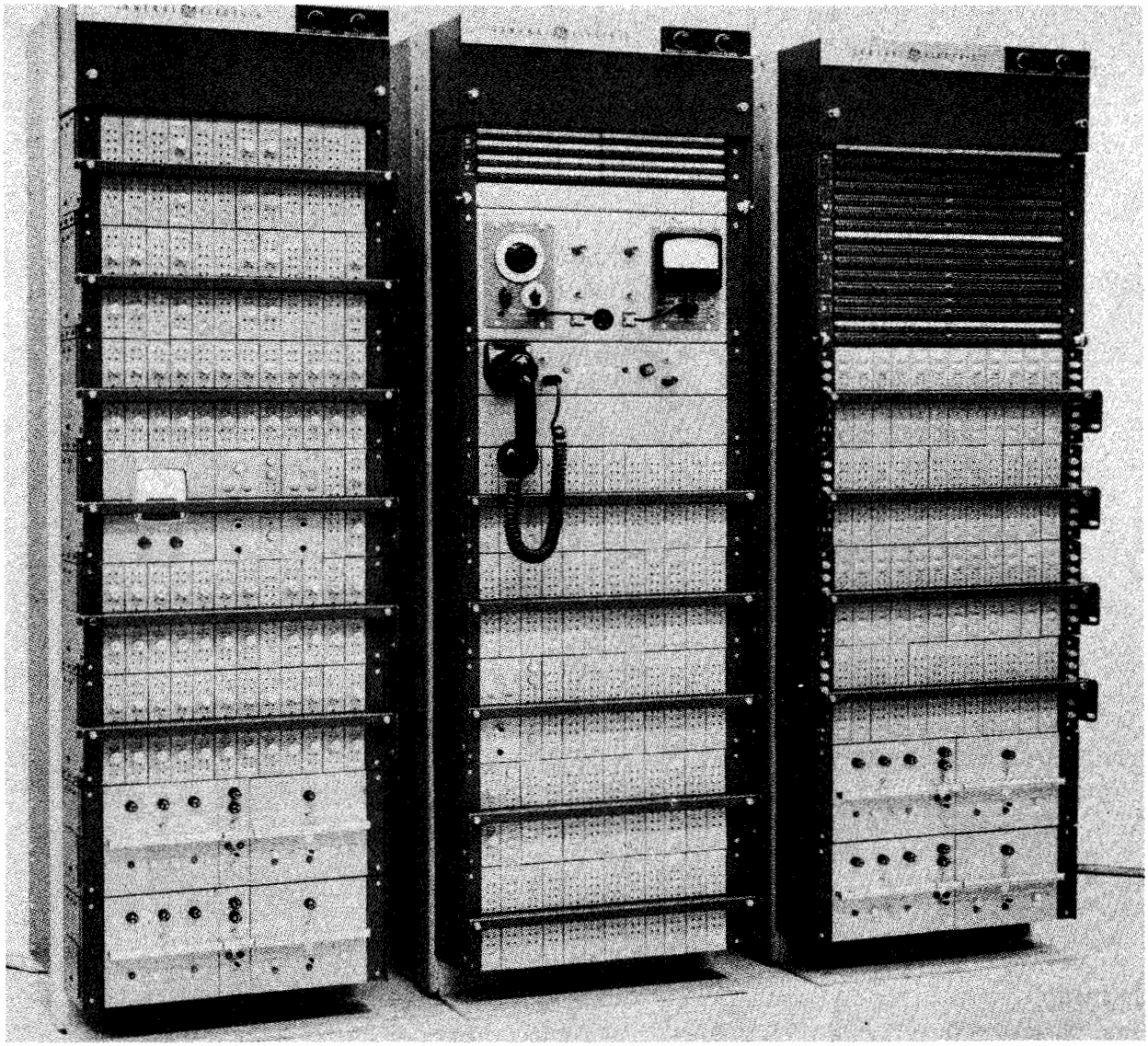
Technical Characteristics.

Channel Capacity	From 1 to 600 full duplex voice channels.
Type of Modulation	Single sideband suppressed carrier.
Type of Multiplexing	Frequency division.
Typical Output Frequencies	Group Plan B: 1. 60 to 108 kc for 12 channel system. 2. 312 to 552 kc for 60 channel system. 3. 60 to 552 kc for 120 channel system. 4. 60 to 1,052 kc for 240 channel system. 5. 60 to 2,540 kc for 600 channel system. Group Plan A: 1. 12 to 6 kc for 12 channel system. 2. 12 to 252 kc for 60 channel system.
Voice Channel Characteristics	1. Frequency Response. Relative to 1 kc from 300 to 3,600 Hz with in-band signaling or no signaling. (300 to 3,450 Hz with out-of-band signaling. 2. Idle Noise Condition. Less than 12 dba on a back-to-back basis. 3. Loaded Noise Condition. Not greater than 23 dba back-to-back. 4. Harmonic Distortion. At least 4 db down (one percent) from any fundamental frequency within the pass band.
Primary AC Power Requirements	1. Type: 120/230 volts 50 to 60 Hz single phase. 2. Source: Furnished by the using activity.
Power Consumption	Less than 750 watts for a 240 channel assembly, complete with signaling units from a 48-volt positive ground station battery. Less than 500 watts without signaling.

Service Condition	1. Temperature: -20° to +50° C. 2. Humidity: 95%. 3. Altitude: To 14,000 feet.
Size	600 channels without signaling, or 300 with signaling, are contained in five 8-foot racks plus a common equipment rack.

Availability Data.

This equipment has been classified type Standard A for Army use.



MULTIPLEXER SET
AN/FCC-18( )

4-3. TELEPHONE TERMINAL AN/FTA-15A

Purpose.

To provide a radio telephone terminal capable of connecting a four-wire full duplex radio or landline voice circuit into a two-wire or four-wire telephone either directly or through manual or automatic telephone switching facilities.

Employment.

This equipment is to be used in all elements of the DCS that require radio telephone circuit interconnection.

Description.

AN/FTA-15A is a replacement for the AN/FTA-6 and -7. As a modularized solid state device, it can be mounted in a standard 19-inch relay rack. All action controls and monitor jacks are mounted on the front panel while the terminals are located at the rear of the unit. Other controls, located within the unit, can be adjusted with a screwdriver. Amplification and signaling circuit components are mounted on plug-in printed circuit cards. The power supply and passive components are mounted on a chassis that slides into the cabinet.

The AN/FTA-15A will terminate a 4-wire full duplex radio or landline voice circuit of 200 to 3,000 Hz bandwidth and provides facilities for extending the circuit to a telephone, manual, automatic switching central either 2-wire or 4-wire on a fully optional basis. An extremely wide range of local signaling options are provided to insure compatibility with existing switchboards and automatic telephone exchanges.

The equipment has been specifically designed to prevent singing, to compensate for the effects of fading, and to reduce noise between speech components. Singing is prevented by directional switching controlled by a frequency shifted inband tone that is generated by voice activated circuitry in each terminal. An inband frequency tone, activated through any of a wide variety of local signaling options provided, also positively controls signaling on the radio channel or long distance landline.

Intended as a replacement for similar equipments, such as the AN/FTA-6, the AN/FTA-15A is incompatible with equipments presently in service.

Technical Characteristics.

Frequency Response Referred to 1,000 Hz	Flat within ±1 db over the band from 300 to 3,000 Hz, except for a notch between 1,100 and 1,400 Hz, which is reserved for inband control tones.
Input and Output Impedances	600 ohms isolated from ground.
Input Levels	-45 VU to +10 VU.
Output Levels	Adjustable from -15 VU to +3 VU maintained constant at ±1 db at the level selected.
Control Tones	1,225 and 1,310 Hz.
Signaling Tones	2,150 to 2,450 shifted at 60 Hz for AC ringing, and at 240 Hz for dial signaling.
Modes of Operation	1. Directly to telephone instrument (point-to-point.) 2. To telephone instrument via switchboard or automatic exchange (normal.) 3. As an intermediate terminal interconnecting through circuits via a switchboard (tandem.)
Local Signaling Options	1. E and M dial. 2. AC ringdown (15 to 75 Hz.) Ring in on any line and ring out on any line on switchboard side. 3. DC.
Line Terminations--Radio Side	1. 4-wire send. 4-wire receive.
Line Terminations--Switchboard Side	1. 2-wire A (used as 2-wire line and as send line in 4-wire operation.) 2. 2-wire B (used as 4-wire receive line in 4-wire operations.) 3. Two separate AC ring lines.
Remote Features	All features required for operation via a switchboard can be remoted.
Primary Power Requirements	115 or 230 volts ±10%, single phase, 50, 60, or 440 Hz, 30 watts.
Dimensions	19 inches long by 8 3/4 inches high by 22 inches deep.
Weight	Approximately 35 pounds.

Note: Several emergency procurements have been made for the AN/FTA-15A and equipments in the field may vary with respect to optional features.

Availability Data.

The AN/FTA-15A has been accepted for STARCOM use. However, future requirements for this type voice terminal equipment will be satisfied by the AN/FTA-28, which is compatible with the AN/FTA-15A.

4-4. ENVELOPE DELAY EQUALIZER CN-1234( )/GCC

Purpose.

To provide a means to provide compensation for envelope delay and amplitude distortion existing in voice frequency lines and channels.

Employment.

This equipment is intended to use in STARCOM and DCS voice frequency communications facilities to improve the quality of facsimile and data transmissions.

Description.

This delay equalizer is designed to provide delay and amplitude compensation in a pass band of 300 to 3400 Hz. This equipment is of solid state design and has a balanced input and output impedance of 600 ohms ±10%.

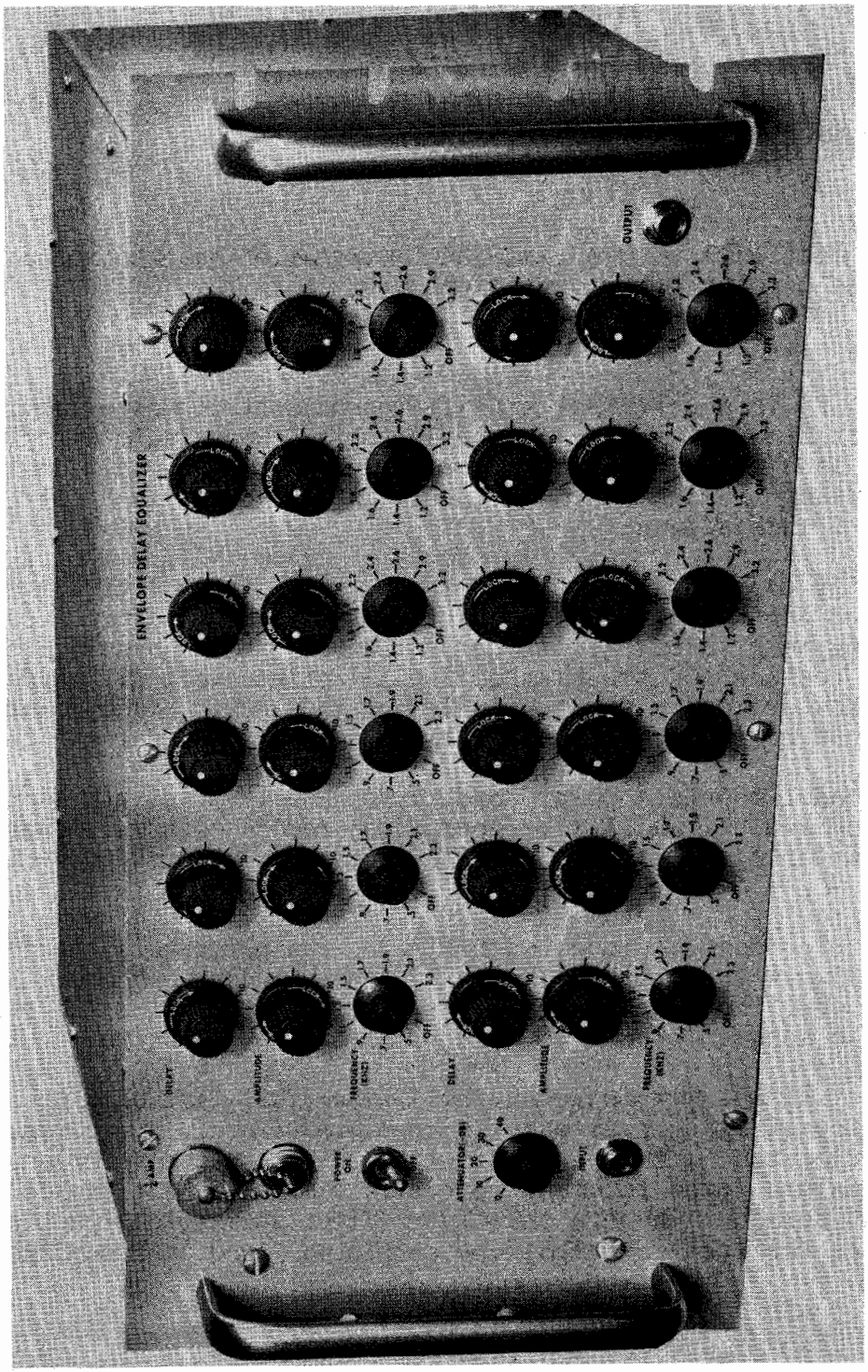
Technical Characteristics.

Power Requirements	115 or 230 vac ±10%, 47 to 63 Hz single phase.
Input Impedance	600 ohms balanced ±10%.
Frequency Range	300 to 3400 Hz.
Delay Distortion:	
Equalization:	The delay equalizer provides manually continuous variable compensation over the frequency range of 300 to 3400 Hz at input/output levels in the range of -25 to +10 decibels.
Amplitude Distortion:	
Compensation:	Manually continuously variable compensation over the 300 to 3400 Hz frequency range at input/output levels in the range of -25 to +10 decibels for any input amplitude distortion of up to 9 db, such that the output amplitude is not greater than 2 db.
Level	This equalizer is designed for nominal unity gain of a 1000 Hz test tone. It is capable of operation with the input/output level anywhere in the range of -25 to +10 decibels referenced to one milliwatt (dbm).

Output Impedance	600 ohms balanced ±10%.
Mounting	Suitable for rack mounting.

Availability Data.

Limited procurement has been effected. Action is being taken to type classify the CN-1234 as Standard A for STARCOM use.



ENVELOPE DELAY EQUALIZER
CN-1234( )/GCC

4-5. TELEPHONE TERMINAL AN/FTA-28

Purpose.

To provide a telephone terminal that offers a significant improvement over the AN/FTA-15A.

Employment.

This equipment will be used in STARCOM installations that require radio telephone circuit interconnection.

Description.

The AN/FTA-28 is a universal amplifying and control voice terminal used to connect 2- or 4-wire telephone lines to 4-wire radio circuits. This terminal is a self-contained, completely solid-state unit designed for slide mounting in a standard 19-inch relay rack. It is 8 3/4 inches high and 15 1/8 inches deep.

All operator controls and indicators, as well as auxiliary time connectors, are on the front panel which swings down to permit access to all the plug-in printed-circuit cards. An extension cord is provided to facilitate testing and troubleshooting all printed-circuit cards from the front without removing the terminal from the rack. Slide mounting permits the unit to be extended from its rack and tilted for maintenance.

The rear panel mounts a power cord, fuse, and terminal strips for connecting ringdown, 2- and 4-wire operation, remote control. There are two basic modes of operation for the FTA-28 carrier control and voice control.

In the carrier control mode, each FTA-28 of a point-to-point communications link always transmits either a 1225 Hz standby tone or a 1310 Hz function tone over the radio path to its opposite terminal. The standby tone causes the send and receive voice paths of the FTA-28 to be blocked.

When voice signals originate on the 2-wire (2WA) line of either terminal, the originating send path is completed (receive path remains blocked) and the standby tone automatically shifts to the function tone. The voice signals and the function tone are transmitted simultaneously to the distant terminal where a selective filter senses the function tone and causes the receive path to be completed (send path remains blocked).

These conditions remain as long as the voice signals persist. When the voice signals at the local terminal cease, the remote terminal may send and the same conditions will exist in the new direction. If both terminals cease talking, the standby condition prevails.

In the voice control mode, there are two ways in which voice control can be implemented: from the 4-wire (4WR) receive path or from the 2-wire (2WA) send path. When voice control from the 4WR path is used, both send and receive voice paths of the FTA-28 are blocked in the absence of voice signals. The start of speech on the 2-wire send line completes the send path (receive path remains blocked). Receipt of speech on the 4WR line operates syllabic detection circuits which complete the receive path. Thus, when one path is operated the other path is blocked.

During voice control from the 2WA path the FTA-28 is in the receive state (4-wire receive line connected through to switchboard) and the 2WA send path is blocked. When speech starts on the 2WA send line, the send path is completed and the receive path is blocked.

Technical Characteristics.

Frequency Response	Within ±2 db from 200 to 3000 Hz referenced to 1000 Hz (except for control signal slot centered at 1275 Hz).
2-Wire Line Input and Output Signals (FTA-28 and Switchboard Interface):	
Voice Input/Output	200 to 3000 Hz (control signal slot
Frequency Range Ringdown	centered at 1275 Hz). AC ring 20 Hz (2- or 4-wire option). Manual (front-panel pushbutton). 1600 Hz 1000/20 Hz AM (to switchboard only). 2-wire or single-wire E&M options.
Dialing	E & M closures.
Maximum Dialing Rate	14 pulses per second.

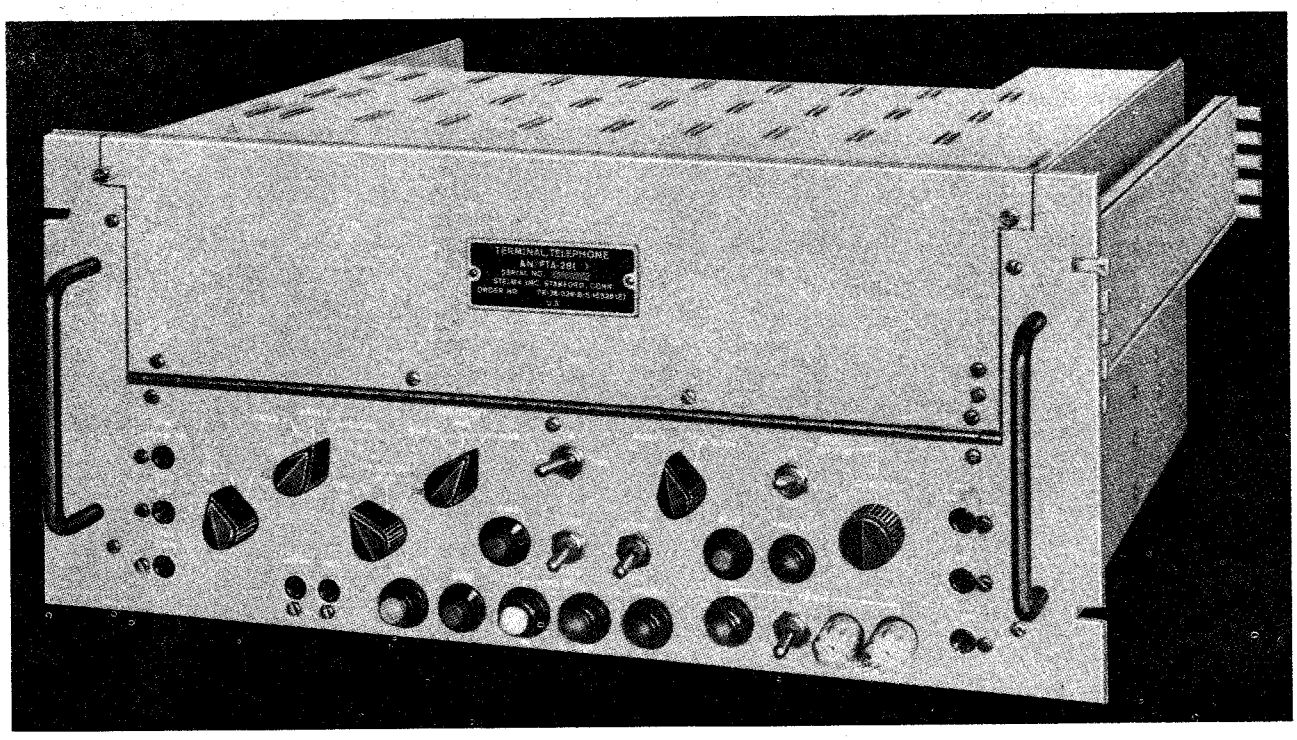
4-Wire Line Input and Output Signals (FTA-28 and Radio Interface):

Voice Input/Output Frequency Range	200 to 3000 Hz (control signal slot centered at 1275 Hz).
Control Signal	Frequency-shift modulation. Function Tone - 1310 Hz. Standby Tone - 1225 Hz.
Ringdown	2150 to 2450 Hz frequency shifted at a 69 Hz rate. 1000/20 Hz AM. 1600 Hz. Manual (front-panel pushbuttom).
Dialing	2150 to 2450 Hz, frequency-shifted at a 240 Hz rate.
Maximum Dialing Rate	14 pulses per second.
Voice Input Level	-40 to +10 dbm, or -25 to +10 dbm jumper selected.
Input/Output Impedance	600 ohms ±10%, ungrounded and balanced.
Anti-sing Provision	4-wire receive isolated from 4-wire send by automatic switch action.
Automatic Gain Response	Fast attack on signal increase; slow retreat on signal decrease.
Output Distortion	Less than 3%.
Ringdown and Dialing Input Sensitivity	-38 dbm.
Ringdown and Dialing Output Level	0 dbm (adjustable).
Control Signal Input Sensitivity	-50 dbm.
Control Signal Output Level	-5 to -15 dbm adjustable.
Noise Suppression	0 to 30 db, adjustable by front-panel control.
Tandem Operation	Accomplished on 2-wire or 4-wire basis. May be remotely controlled.
Telephone Connection	Front-panel double jack receptacle. Local telephone provides communications to radio circuit on a 4-wire basis and to switchboard line on a 2- or 4-wire basis. Party line operation on 2-wire basis.
VOX Operations	Closure is provided to radio equipment during transmit condition of terminal (used only during voice control operation.)

Data Bypass	Remote control of the unit is provided to allow data signal to be bypassed through the unit on a 4-wire basis. Voice operating characteristics of the unit will not interfere in any way with data signals under these conditions.
Power Requirements	115/230 vac ±10%, 47 to 400 Hz (or 48 vdc).
Size	8 3/4" H x 19" W x 15 1/8" D.
Weight	60 lbs.

Availability Data.

The AN/FTA-28 Telephone Terminal is available for Class IV Projects.



TERMINAL TELEPHONE
AN/FTA-28

CHAPTER 5

TRANSPORTABLE COMMUNICATIONS

This section under development. To be issued later.

CHAPTER 6

DATA EQUIPMENT

6-1. TELEGRAPH MODEM MD-700(P)/G

Purpose.

To provide a means of transmitting and/or receiving telegraph data over single-sideband or twin-sideband radio circuits, voice-frequency wire lines, or microwave radio circuits.

Employment.

This modem is used in conjunction with the AUTODIN system.

Description.

The MD-700(P)/G is a single-channel, voice-frequency (VF), frequency-shift keyed (FSK), carrier telegraph modulator-demodulator (modem). The transmitter (modulator) and receiver (demodulator) sections are functionally independent. The modem is capable of simultaneous transmission and reception with the transmitter and receiver at the same carrier frequency (any one of 16 standard carrier telegraph frequencies) or at different carrier frequencies, depending upon the requirements of the installation. The operating frequency of the modem depends upon the frequency determining kit installed in it. The frequency determining kit consists of a mark frequency crystal, a space frequency crystal, a transmitter bandpass filter, a receiver bandpass filter, and a receiver discriminator.

The transmitter and receiver have separate telephone jacks on the front panel for order-wire operation. They can be used for service and maintenance message transmission. The jacks accept a WECO type 289A and B plug and, when actuated, interrupt the normal input signal flow and apply the input and output of the MD-700(P)/G to the front panel connections.

The monitor circuitry senses troubles and provides individual remote-voltage indications denoting the area of operation in which the trouble occurs. A common alarm status indicator on the front panel is energized whenever a trouble occurs.

The transmitter, receiver, monitor and alarm circuit, and power supply are all included as part of the modem.

Technical Characteristics.

a. General characteristics:

Number of channels	1 telegraph channel.
Type of carrier modulation	Frequency-shift keying.
Keying rate	90-baud maximum.
Carrier frequency range	382.5 to 3017.5 Hz.
Frequency shift	±42.5 Hz.
Channel spacing	170 Hz.

b. Transmitter:

Impedance	Input: 6,800 ohms ±10%. Output: Switchable, 600 ohms to 9600 ohms.
Output Level	Adjustable: +3 dbm to -40 dbm.
Harmonic suppression	Second and higher down 60 db below normal tone output.
Input Sensitivity	±0.5 volt for mark-space transition.

c. Receiver:

Impedance	Input: Switchable 600 ohms to 9600 ohms. Output: 100 ohms maximum.
Input Level	-45 to +7 dbm.
Output Level	±6 volts ±1 volt.

d. Power Supply:

AC input voltage	120 vac +10%, -20%, or 230 vac ±10%.
AC power consumption	30 watts maximum.

e. Special Features:

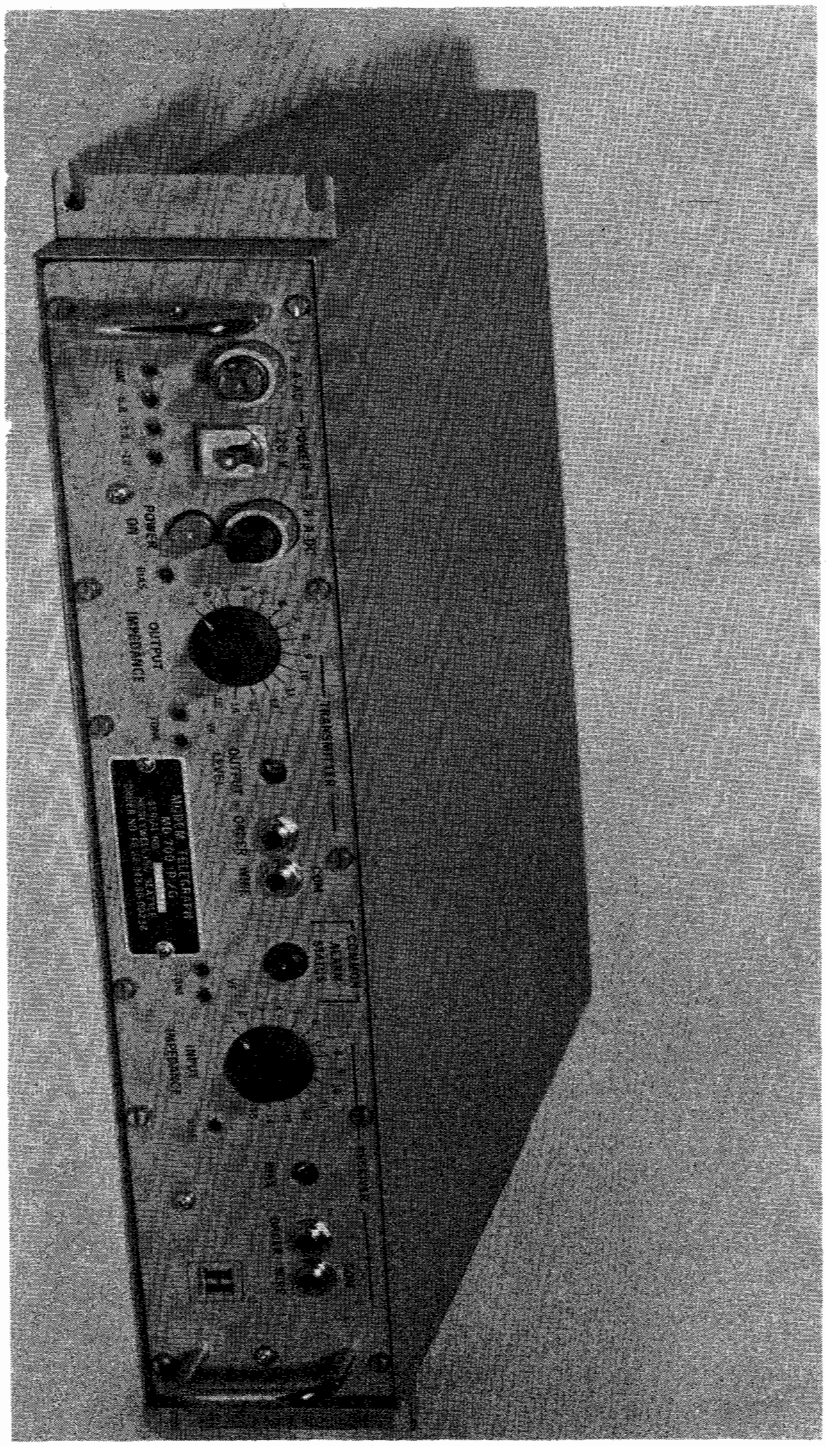
Method of channel frequency selection	Plug-in components listed below: (1) Transmitter filter. (2) Transmitter space crystal. (3) Transmitter mark crystal. (4) Receiver filter. (5) Receiver discriminator.
Monitor and alarm circuit inputs	Conditions: (1) Transmitted carrier, a 10-db drop in level from normal for more than 2 seconds; resets when level returns within 5 db of normal. (2) Received carrier, a 20-db drop below normal for more than 2 seconds; resets when level returns within 10 db of normal.

	(3) Transmitter transitions, a loss of data transitions to transmitter for more than 5 seconds; resets upon return of transitions.
	(4) Receiver transitions, a loss of data transitions from receiver for more than 5 seconds; resets upon return of transitions.
Monitor and alarm circuit outputs	(1) Lights COMMON ALARM STATUS indicator on front panel when input condition exists.
	(2) Provides a separate output voltage for each alarm condition (may be used for remote alarm indications.)

Availability Data.

The MD-700(P)/G was procured for use in AUTODIN and is available for Class IV projects.

MODEM TELEGRAPH
MD-700



CHAPTER 7

TEST EQUIPMENT

7-1. RADIO TEST SET AN/GRM-33A

Purpose.

To provide a means to visually examine the RF output spectrum of radio transmitters for analysis of quality intermodulation distortion products, hum, and noise.

Employment.

This equipment is intended to augment existing test facilities in transmitting stations containing independent sideband equipment.

Description.

AN/GRM-33 consists of three basic units: Spectrum Analyzer, AN/URM-116, Variable Frequency Oscillator, O-330A/FR, and Two Tone Generator, C-279/URT.

The tone generator supplies two AF and two RF tones. Audio tones are selected so that the 3rd, 5th, and 7th order products can be visually analyzed. The RF tones are generated for checking the operation of the spectrum analyzer.

The AN/GRM-33 is contained in a sloped front cabinet equipped with casters which permits the analyzer to be moved to the equipment to be tested. All controls and test connections are made on the front panels. The system is supplied with all cables and connections necessary for operation and each unit may be used independently of the other units.

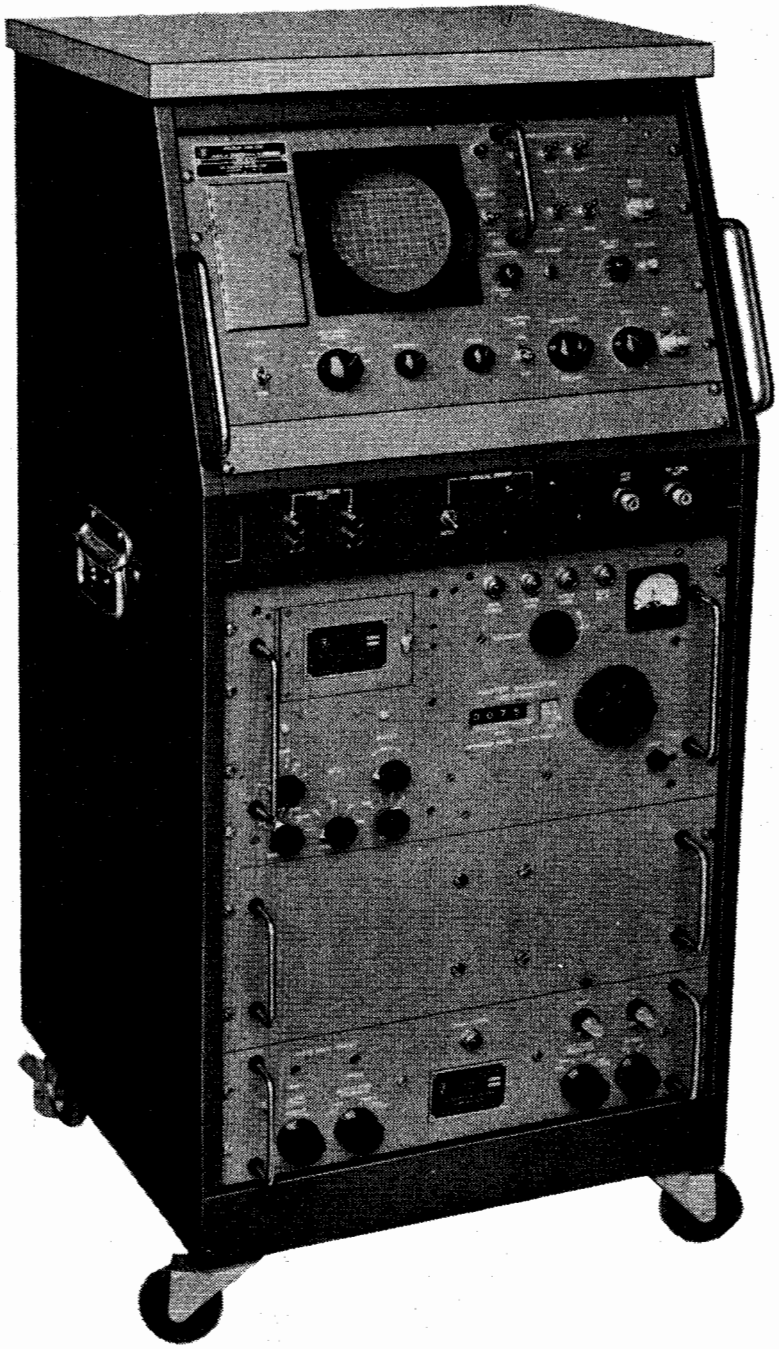
Technical Characteristics.

Sweep Widths	1. Fixed: 150, 500 Hz. 2. Continuously Variable: 0-100 kHz, 0-2 kHz.
Input Center Frequency	500 kHz.
Bandpass Region (After Input Mixer)	450 to 550 kHz.
Image Rejection	Better than 130/1 at input center frequency.
Input Impedance	50 ohms at each of the two terminals.
Input Attenuator	0 to 65 attenuation of the input signal in 5db steps. Accuracy ±2% to 30 MHz.

Amplitude Scales	Linear and 2 decade log selectable by front panel switch. A front panel 20 db IF attenuation may be used to extend calibrated range to 60 db.
Two-Tone Set	All in-band residual (odd order) intermodulation products better than 60 db below level of the two equal reference signals deflected 20 db above full scale log.
Frequency Range	2 to 64 MHz continuously tuned.
AF Test Tones	935 Hz, 2,805 Hz.
RF Test Tones	1,999 kHz crystal controlled, 2,001 kHz crystal controlled.
Harmonic Distortion Test Tone	AF: more than 65 db down. RF: more than 60 db down.
AF Output Impedance	600 ohms unbalanced.
AF Output Level	0 to 0.5 volts continuously variable.
Power Requirement	115/230 ac, 50/60 Hz, single phase.
Power Consumption	Approximately 315 watts peak depending upon cycling of oven heating element. Line regulator supplied. Special regulators available for 230 volts.
Shipping Weight	500 lbs.
Components and Construction	Equipment manufactured in accordance with JAN/MIL specifications wherever practicable.
Size	23½" x 24" x 51".

Availability Data.

This equipment is classified as Standard A and is available for Class IV projects.



RADIO TEST SET
AN/GRM-33

7-2. ELECTRICAL COUNTER CP-612/GG

Purpose.

To provide an inexpensive device capable of counting transmitted or received teletypewriter words for traffic engineering data.

Employment.

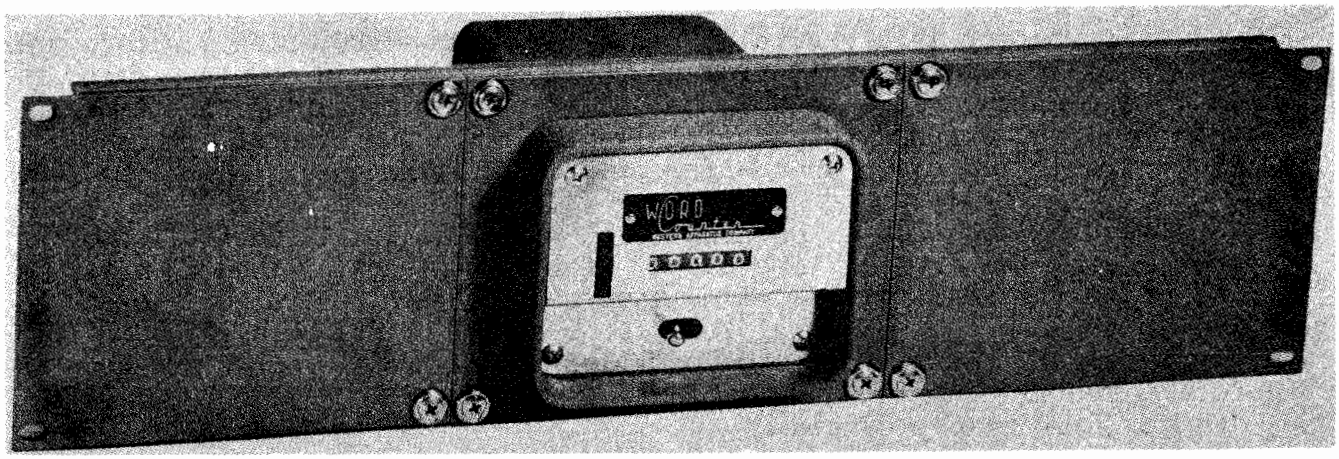
This equipment is intended for automatic and semiautomatic teletypewriter relay centers. It can also be used in mobile communications centers that have a requirement for traffic engineering studies.

Technical Characteristics.

Input Requirement	105 to 125 volts, 60 Hz.
Power Consumption	15 watts.
Counting Speed	100 wpm with blue (30-tooth gear), 75 wpm with red (40-tooth gear), 60 wpm with white (50-tooth gear).
Counting Gear Teeth	20.
Average Characters per word	6.
Maximum Count Displayed	99,999.
Type of Signals	Neutral (20 to 60 ma) or polar.
Unit Codes	1. 7.42 at 100 and 60 wpm. 2. 7.00 and 7.42 at 75 wpm.
Size	4 inches x 4½ inches x 6 5/8 inches.
Installation	Table or rack mounted.
Cost	$79.50 table mounted, $86.00 rack mounted.

Availability Data.

This equipment has been type classified Standard A for Army use.



ELECTRICAL COUNTER
CP-612/GG

7-3. ELECTRONIC COUNTER (HP Model 5245L)

Purpose.

To provide a highly accurate measurement of frequency, period, multiple period average, ratio, and multiples of ratio.

This equipment is intended for use in strategic and transportable facilities.

Description.

This counter is a general purpose, transistorized, electronic counter with a basic counting rate from dc to 50 MHz. Plug-in modules extend the maximum counting range to 5.2 MHz, which permits measuring the time interval, and extends the sensitivity to 1 mv. The counter offers eight digit resolution using an in-line display of rectangular indicating tubes.

Improved accuracy is obtained with a proportionally controlled oven that houses the crystal time base. Stability of better than ±3 parts in 10^9 per day is maintained. Time base and function controls are a standard voltage so that external transistor switching may be used where it is preferred. Display storage provides a continuous display of the most recent measurement for a "non-blanking" readout. Four line BCD output devices, are also provided.

Technical Characteristics.

Frequency Measurements:	
Range	0 to 50 MHz.
Gate Time	1 microsecond to 10 seconds in decade steps.
Accuracy	±1 count ±time base accuracy (one count is 1/ft, where f is frequency counted, t is gate time.)
Reads In	kHz or MHz with positioned decimal point; units enunciator in line with digital display.
Self Check	Counts 10 MHz for the gate time chosen by the time base selector switch.

Period Average Measurements:

Periods Averaged	1 period to 10^5 periods in decade steps.
Accuracy	$\frac{\text{+1 count} \pm \text{time base accuracy} \pm \text{trigger error}}{\text{periods averaged}}$
Frequency Counted	1. Single Period: 10^7 to 1 Hz in decade steps. 2. Multiple Period: 10^7 to one-tenth the number periods averaged, Hz in decade steps.
Reads In	Sec, milliseconds, microseconds, with positioned decimal point; unit enunciator in line with digital display.
Self Check	Gate time is 10 microseconds to 1 second (periods averaged of 100 kHz); counts at 100 kHz rate.

Ratio Measurements:

Displays	(f_1/f_2) times period multiplier.
Range	1. f_1: -0 to 50 MHz. 2. f_2: -0 to 1 MHz in single period, 0 to 300 kHz in multiple periods; periods averaged 1 to 10^5 in decade steps.
Accuracy	±1 count of f_1 ± trigger error* of f_2 divided by number of periods averaged. One count of f_1 is f_2/nf_1 where n is number of periods averaged, f_1 is frequency applied to counting binaries (enters Time Base Ext. Jack), f_2 is frequency applied to decade dividers (enters Signal Input Jack.)
Reads In	Dimensionless positioned decimal point for number or periods averaged.
Self Check	Period Average Self Check above applies.

*Trigger error for sine wave input is ±0.3% for signals with 40 db signal-to-noise ratio.

Scaling:

Frequency Range	0 to 50 MHz.
Factor	By decades up to 10^9; switch selected on rear panel.
Input	Front panel, signal input.
Output	Rear panel, in place of time base output frequencies.

Time Base:

Frequency (internal)	1 mc.
Stability	Aging rate less than ±3 parts in 10^9 per 24 hours. As a function of temperature--less than ±2 parts in 10^{10} per °C. from--20° to +55°C. As a function of line voltage--less than ±5 parts in 10^{10} for ±10% change in line voltage, from 115 to 230 v rms. Short term, less than ±5 parts in 10^{10} peak-to-peak with measurement averaging time of one second (constant environment and line voltage.)
Adjustment	Fine frequency adjustments covering a range of approximately 4 parts in 10^8 and medium frequency adjustments covering a range of approximately 1 part in 10^6 are available from the front panel through the plug-in hole. Coarse frequency adjustment covering a range of approximately 1 part in 10^5 is available at the rear of the instrument.
Output Frequencies (1) (rear panel)	0.1 Hz to 10 MHz in decade steps; switch selected on rear panel; all frequencies available in manual function without interruption at reset; 10 kHz to 10 MHz available continuously in all functions; 1 kHz available continuously for all functions except 100-k period average; stability same as internal time base; 5 volt p-p rectangular wave with 1,000 ohm source impedance at 1 MHz and lower; 1 volt rms sine wave with 1,000 ohm source impedance only at 10 MHz.

Output Frequency (2) (front panel)	0.1 Hz to 1 MHz in decade steps; selected by Time Base Switch; availability as defined under Output Frequencies (1) above; stability same as internal time base; 1 volt peak-to-peak.
External Standard Frequency	1 MHz 1 volt rms into 1,000 ohms required at rear panel BNC connector.

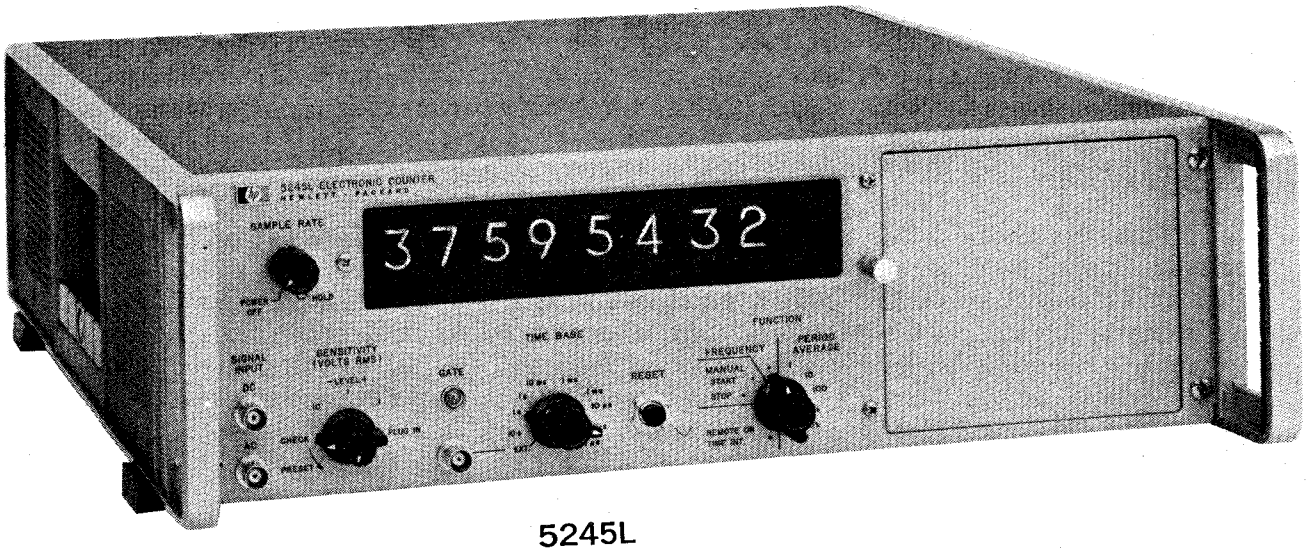
General:

Registration	8 digits in-line with Nixie tubes and display storage; 99,999,999 maximum display; total width of 8 digit display including illuminated units enunciator and autopositioned decimal point indication does not exceed 7 inches.
Sample Rate	Time following a gate closing during which the gate may not be reopened is continuously variable from approximately 0.1 to 5 seconds, for any gate time; display of a single measurement can be held indefinitely.
Input	1. Maximum Sensitivity, 100 mv, rms. 2. Coupling: AC or DC, separate. 3. Attenuation: Step attenuator provides ranges of 0.1, 1, and 10 volts. 4. Impedance: 100k ohms-volt (10k ohms at 100 mv); approximately 40 pf on 0.1-volt range, 15 pf on 1- and 10-volt ranges. 5. Overload: -50 volts rms, signal on 0.1 volt range tolerable; 150 volts rms on 1-volt range; 500 volts rms on 10-volt range; ac coupling capacitance, 1 microfarad, 600 volts.
Operating Temperature Range	-20° to +65°C.
Connector	BNC type except for remote programming and BCD output.
BCD Output	1. Four-line BCD code output with assigned weights of 1-2-2-4 ("1" state positive with respect to "0" state.) This output includes decimal point position and measurement units, suitable for systems use or for output devices.

	Impedance is 100k each line with "0" state level approximately -8v, "1" state level approximately +18v. 2. Reference levels: approximately +17.6v, 350 ohm source: approximately -6.9 volts, 1,000 ohm source; print command step, +13v to 0v dc coupled; hold-off requirements from 1,000 ohm source, chassis ground to +15v. (min) +25v. (max).
Remote Operation	All functions which may be programmed from panel controls (in normal use) may be programmed from a remote location except for the "Sample Rate" (as defined above) and the sensitivity control setting. The instrument provides (through rear panel connectors) all voltages necessary for remote control. The programming voltages for digital display are low level, ±15 volts dc maximum with approximately 5k ohms looking into counter on signal control leads. Control may also be achieved by using an external -15 volts cd supply. The position of the decimal point and measurements unit may be correctly illuminated from the remote location, at +170 volts dc, in like manner, using the internal or an external supply.
Dimensions	16 3/4 inches wide, 5¼ inches high including plug-in, 16½ inches deep. Hardware furnished converts unit to a 19-inch wide by 5¼-inch high rack mount.
Weight	Net: 32 lbs with blank plug-in; shipping: 48 lbs.
Power Supply	115 or 230 volts ±10%, 50 to 60 Hz approximately 80 watts.

Availability Data.

This equipment was tested and found suitable for STARCOM use. Action is being initiated to type classify this counter as Standard A.



5245L

ELECTRONIC COUNTER
5245L

7-4. TEST SET, TELETYPEWRITER TS-2320( )/GG

Purpose.

To provide a portable test set that measures telegraph signal distortion.

Employment.

This equipment is intended to be used by teletypewriter maintenance personnel to measure start-stop and synchronous signal distortion. The principle application would be in servicing of tributary stations.

Description.

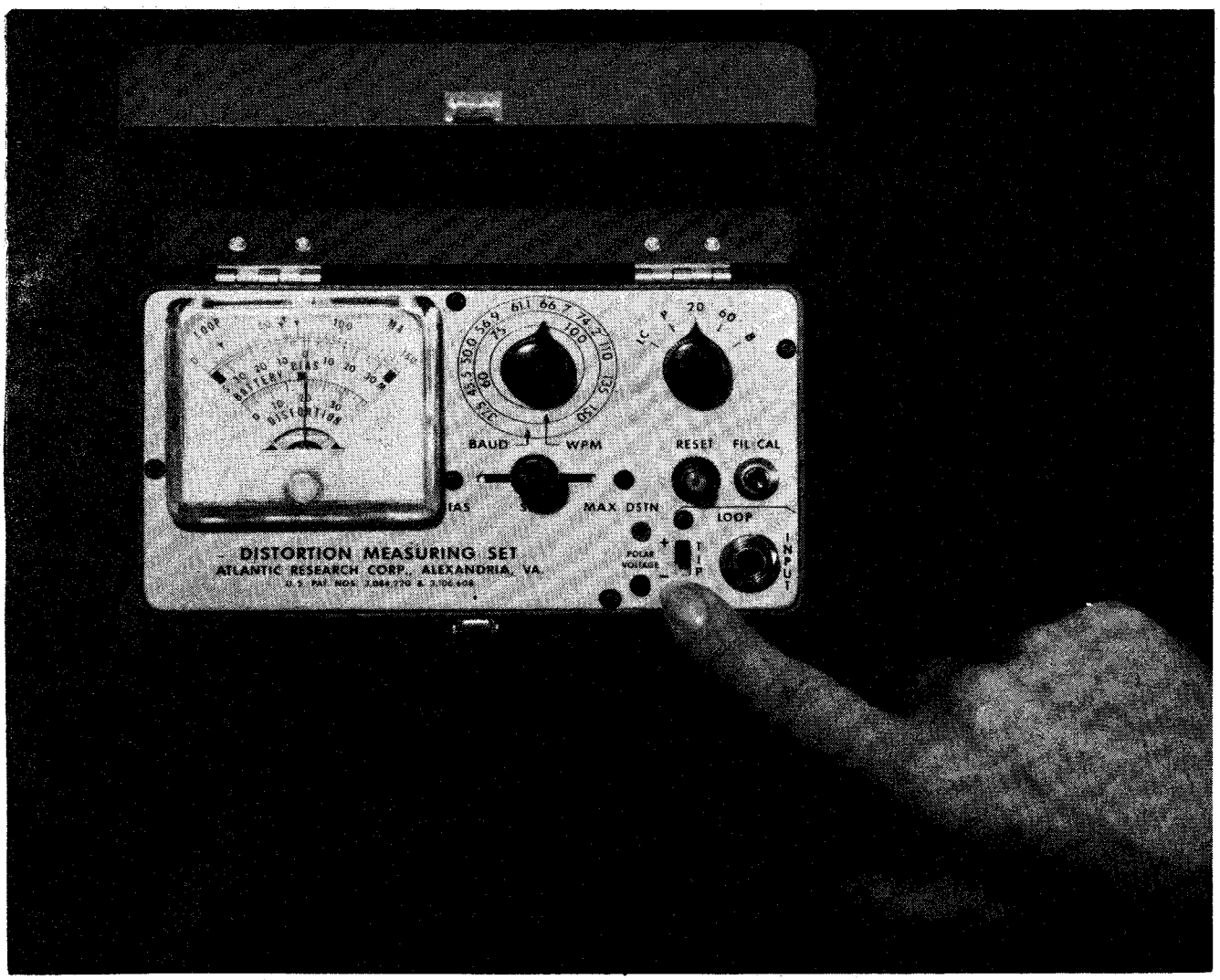
The TS-2320( )/GG is a small battery powered, transistorized, telegraph distortion measuring set. It contains a 22½ volt battery and 1.4 volt mercury cell. This equipment operates on the shortest pulse principle, i.e., it measures unit element marks and spaces, ignoring signal elements longer than 1½ unit length. Input may be low-level or high-level polar, or 20 or 60 ma neutral. A direct reading meter is provided for measuring peak distortion, bias distortion, and line current. An internal reference adjustment and an external calibrating control are provided. No other equipment is required for calibration.

Technical Characteristics.

Telegraph Speeds	37.5, 45.5, 50, 56.9, 61.14, 66.7, 74.2, 110, 135, and 150 bauds.
Accuracy	±2½% distortion.
Input Impedance	60 ohms non-inductive (series connected to telegraph circuit.)
Direct Reading Dial	35% distortion maximum.
Loop Current	0 to 150 ma loop current.
Meter Size	2½ inch dial.
Batteries	1.4 volts, 250 hour life.
Weight	2 pounds.
Dimensions	3½ x 6¼ x 3 5/8 inches (including protective panel cover).
Code Formats Accepted	All--including 6.0, 7.0, 7.28, 7.42, 7.5 and 10.42 unit--element characters (start-stop or isochronous).
Inputs	Low-level and high-level.

Availability Data.

This equipment will be classified as Standard A as a replacement for the TS-2222( )/GG.



TELEGRAPH DISTORTION MEASURING SET
TS-2320/GG

7-5. DELAY DISTORTION MEASURING SET TS-2669/GCM.

Purpose.

To provide a test instrument for use in measurement of envelope delay characteristics of voice frequency communication networks in the frequency range of 100 to 50,000 cycles per second.

Employment.

This equipment is used as a test instrument at any communications installation where voice frequency transmission facilities are terminated. It is used to determine if corrective action is required and to observe the effectiveness of equalizing network adjustments.

Description.

The TS-2669 delay distortion measuring set is a single rack mounted unit consisting of a transmitter and receiver designed to measure envelope delay characteristics of voice frequency communication networks in the frequency range from 100 to 50,000 Hz. This set is of solid state design and has a balanced input and output impedance of 600 ohms ±10%.

Technical Characteristics.

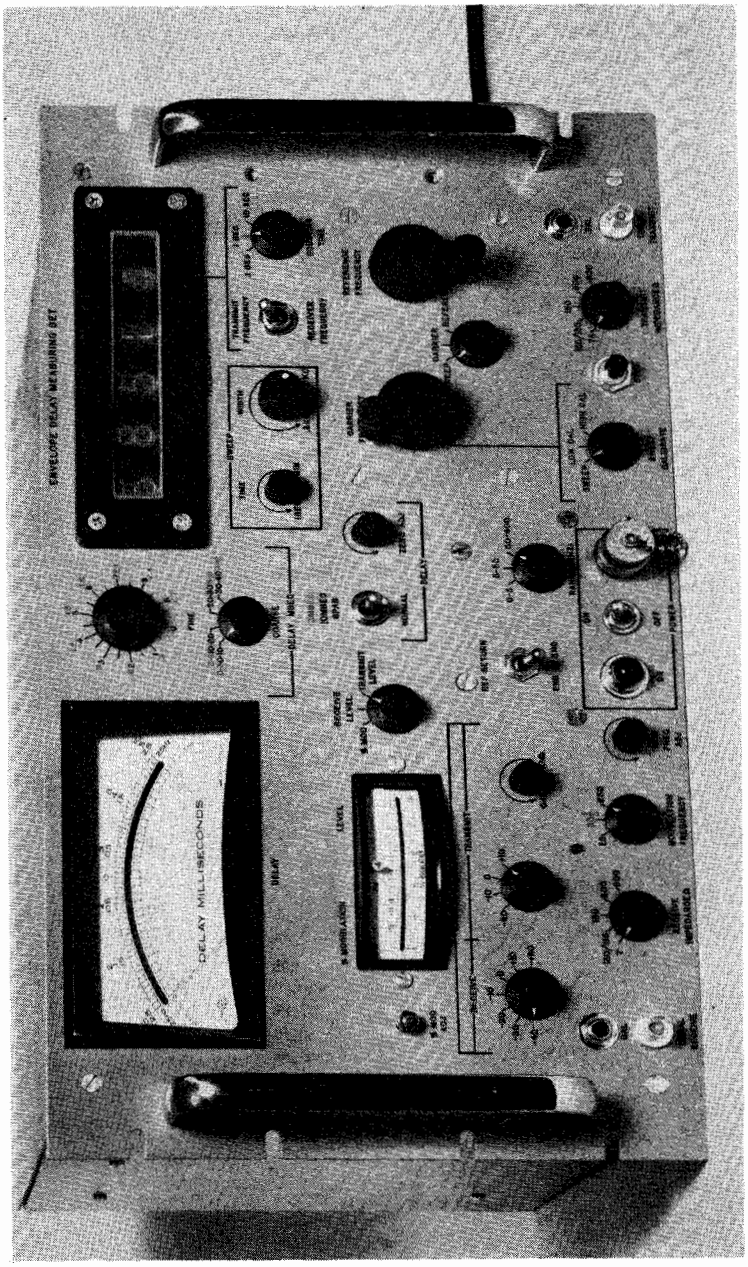
Power Requirements	Operates on 115 or 230 volts ±10%, 47 to 63 Hz, single phase, AC.
Input Signals	The measuring set will operate with input signals -45 db referenced to one milliwatt (dbm) minimum to +20 dbm maximum.
Input Impedance	Balanced input impedance of 600 ohms ±10%.
Carrier Frequency	The carrier frequency is derived from an internal oscillator and has a range from 100 to 50,000 Hz.
Stability	The carrier frequency has a stability of five parts in 10^5 per day.
Meter	The carrier frequency is continuously indicated by a direct reading meter with an accuracy of ±2%.
Modulation Frequency	The measuring set contains an internal oscillator that provides a modulation frequency of 25 Hz.

CCP 105-4

Stability	The modulation frequency oscillator will have a medium term stability of five parts in 10^9 per five minutes, and a long term stability on one part in 10^3 per day.
Delay Meter	Multirange direct reading delay meter.
Delay Range	The delay measuring range is zero to 40 milliseconds.
Accuracy	The delay measuring accuracy is ±1%.
Output Level	Adjustable from -20 dbm to +10 dbm in one decibel steps. The output level is accurate to ±0.5 db.
Output Impedance	600 ohms ±10%.
Mounting	Suitable for mounting in a standard 19-inch rack.
Weight	Does not exceed 35 lbs.

Availability Data.

A limited number have been procured for special requirements. Action being initiated to type classify as Standard A.



DELAY DISTORTION MEASURING SET
TS-2669( )/GCM

CHAPTER 8

DEVELOPMENTAL AND FEASIBILITY EQUIPMENT

8-1. MULTIPLEXER SET AN/UCC-5(V)1

Purpose.

To provide an efficient small lightweight and reliable frequency-division multiplexer set for use with either microwave radio or line carrier systems.

Description.

This equipment is a solid state 60-voice channel frequency-division multiplex carrier equipment for use with either microwave radio or line carrier systems. This set is designed for continuous operation with a minimum of maintenance or adjustment. The design features use of transistors and integrated circuits with ninety-six percent of all components mounted on plug-in printed circuit boards for ease of maintenance and system expansion.

The system consists of a two-step modulation process from voice frequencies to a 12-channel, 60 - 180 kHz, base group. The formation of this channel group is either inverted sideband (CCITT basic group B) or twin sideband. Five 12-channel groups are further modulated to give a standard 60-channel supergroup from 312 to 552 kHz (CCITT supergroup 2). The 60-channel standard supergroups are then remodulated in the supergroup translation equipment to form the baseband of 60 - 300 kHz.

All channel modems are identical and completely interchangeable, resulting in greater maintenance flexibility as well as a reduction in the number of spare modules required. Carrier frequencies of the different modulation stages are phase-locked to the 1024 kHz master oscillator which has a long term stability of $\pm$ 1 part per million for 30 days.

A built-in test facility is included as part of the equipment. A switch is provided so that the operator may talk or listen on any channel during traffic conditions with no degradation in channel performance. This same switching system is used in conjunction with the built-in test set to measure signal-to-noise on each channel. Indicator lights give the status of operational conditions and malfunctions are indicated by both lights and audible alarms. Mounted on the front panel of each channel translating drawer is a bank of 96 bantan jacks which may be used to cross-patch any of the 24 channels as well as to make available all channel input and output circuits for external test purposes. A similar jack arrangement is mounted on the front panel of the carrier supply drawer and is used to handle the input and output of each of the five basic 60 - 108 kHz 12-channel groups as well as the 60-channel supergroup and 60-channel baseband spectrum for either patching or test purposes.

The power supply handles the complete 60-channel system and operates on an AC frequency power source between 47 and 420 Hz. The equipment is protected by means of a circuit breaker on the AC side of the power supply, circuit breakers are in the unregulated DC voltage supply, and a short circuit protector circuit is in each of the regulated DC voltage supplies. This protector circuit drops the output current to a minimal value in the presence of a short circuit. Upon elimination of the short circuit condition, the circuit automatically resets to a "go" condition.

This multiplexer set utilizes three basic drawer types to implement system capacities from 24 to 600 channels. A 60-channel system utilizes 45.5 inches of rack height with standard 19-inch panels and weighs 390 pounds.

Technical Characteristics.

Channel Capacity	60 4 kHz channels (expandable in 12-channel increments from 60 to 300 kHz).
Type of Modulation	a. Amplitude, inverted sideband suppressed carrier. b. Amplitude, twin sideband suppressed carrier.
Frequency Levels	Input: -16 to 0 dbm. Output: -4 to +7 dbm.
Channel Characteristics	
Channel:	300 to 3500 Hz.
Attenuation vs Frequency:	±1.5 db variation from 325 to 3450 Hz.
Envelope Phase Delay:	180 ms 600 - 3200 Hz.
Idle Noise:	15 dba0 psophometrically weighted.
Loaded Noise:	20 dba0 psophometrically weighted.
Harmonic Distortion:	40 dbm0.
Crosstalk:	Intelligible: 14 dba0 psophometrically weighted. Non-intelligible: 24 dba0 psophometrically weighted.
Frequency Synchronization	Slave terminal synchronized to a line pilot from the master terminal.
Frequency Stability	Master Terminal ± 1 part per million for 30 days.
Load Handling	100% data loading, -5 dbm0 per channel.
Signaling	Optional.

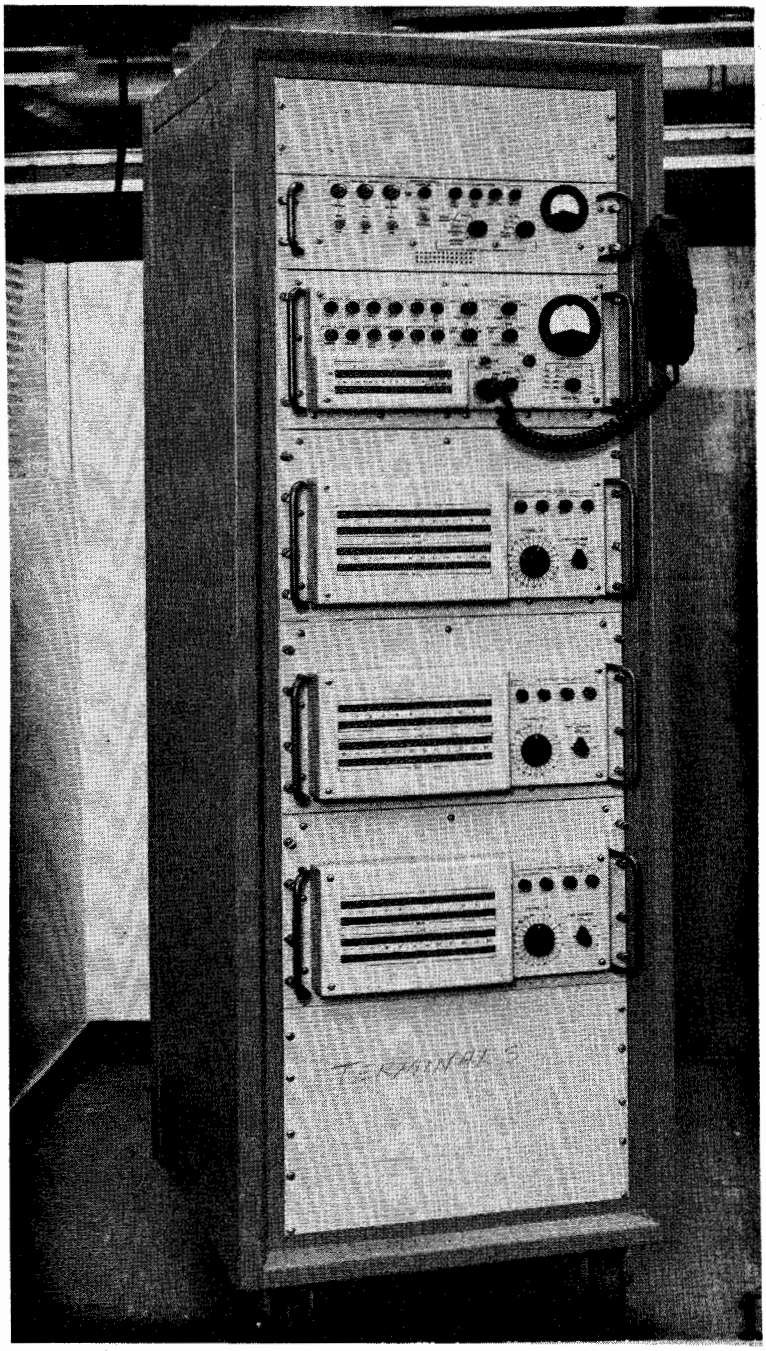
Power Requirements

	Single Phase	Three Phase	DC
Voltage	120 volts AC	120/208 Volts AC	24/48 volts
Frequency	47-420 Hz	47-420 Hz	DC
Regulation	± 10%	± 10%	-3, +4/-6, +8 Volts
Consumption	700 watts	350 watts	335 watts

Weight 390 pounds.

Availability Data.

One model of this equipment has been procured from RCA for feasibility testing. Tests will be conducted for conformance to DCS E&I Standards and will be completed during first quarter FY-69. Future procurement is dependent upon results of test.



MULTIPLEXER SET
AN/UCC-5

8-2. DATA CHANNEL MONITOR.

Purpose.

To provide a means of measuring channel characteristics and evaluating channel quality.

Description.

The data channel monitor provides a means of continuously monitoring a communications channel, measuring channel characteristics, and evaluating channel quality.

The data channel monitor uses a spread-spectrum method for placing a monitoring signal in the channel, and correlation processing for extracting the monitoring signal from the user signal. This low-level, monitoring signal appears to the user as normal background noise. At the receiving terminal, a correlation receiver processes the spread-spectrum signal out of the main intelligence signal and background noise to make useful measurements on channel quality.

The data channel monitor consists of a transmitter unit with channel indicators, necessary metering and adjustments, and alternate manual controls, and a receiver unit with channel and fault indicators and adjustment controls. Each unit is mounted in a standard 19-inch relay rack with its own self-contained power supply.

A full duplex data channel monitor system is being procured for test and is composed of two each data channel monitors and two scanners. The scanners will scan up to 50 data channels at a rate of one channel every two minutes and will identify the channel and record the time of each scanning, thus allowing an operator a means of checking the results at any time.

Some of the special features of the data channel monitor are:

Non-interfering and non-interrupting channel-quality observation.

Automatic readout of pertinent channel-transfer parameters on a non-interfering basis.

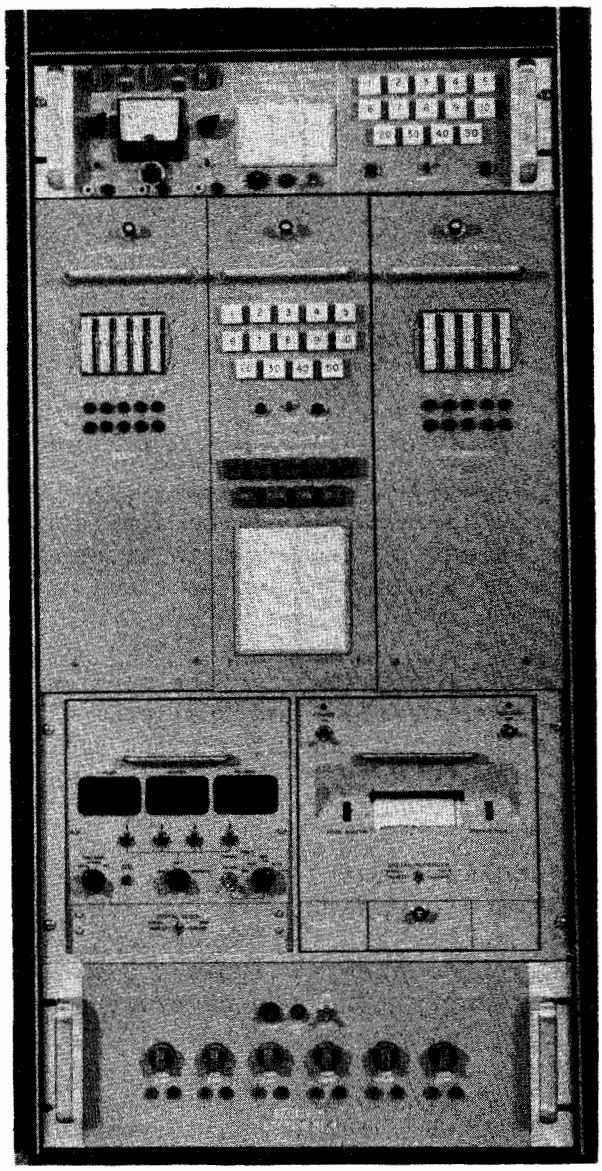
CCP 105-4

Technical Characteristics.

Parameters Measured	Channel continuity. Amplitude distortion. Delay distortion. Frequency translation. Impulse noise.
Probe (monitoring signal) level:	22 db below data signal level.
Power Source	105 to 125 vac, 60 Hz.
Size	19" W x 27" D x 51" H.

Availability Data.

Two terminals will be tested in first quarter FY-69. Future procurement depends on test results.



DATA CHANNEL MONITOR

8-3. QUICK ERECT TOWER MW-P6-100M

Purpose.

To provide a transportable 100 ft trailer-mounted tower that can be moved, erected, and in operation within a few hours.

Employment.

This equipment can be used in transportable or recoverable strategic microwave communications systems.

Description.

The quick erect tower, MW-P6-100M, is a commercial trailer-mounted microwave antenna system. It is being procured for feasibility evaluation to determine whether it can be employed in transportable military applications. Factors such as mobility, set up time, operating crew, and other interrelated factors will be evaluated.

The tower, which consists of six twenty-foot sections, is transported and erected on a twenty-three foot flat bed trailer. The tower is telescopic and the sections are elevated one at a time, locked in position, and guyed. The tower can be raised in 3-foot increments up to a maximum of approximately 100 feet.

Two six-foot antenna dishes, flexible elliptical waveguide, and all ancillary antenna equipment are supplied with the item. The antenna equipment, operating in the 4.4 to 5.0 GHz frequency, is mounted on the trailer during transit. The item also includes a power auger, a hand- or power-driven winch, spare parts, and the necessary tools.

Technical Characteristics.

Type of Installation	Strategic transportable microwave communications.
Antennas	6-ft plane polarized 4.4 - 5.0 GHz type P6-44.
Waveguide	Flexible elliptical type EW-44.
Guy Anchors	6,000 lb, 6-inch, expansion.

Availability Data.

One tower will be tested during last quarter FY-68. Future procurement is dependent upon results of test.

8-4. BROADBAND ERROR DETECTION AND CORRECTION SYSTEM

Purpose.

To provide a solid state multiple user broadband forward error detection and correction system for use in tropospheric scatter systems.

Description.

The broadband multiple user forward error detection and correction system is a broadband duplex digital terminal that will provide the benefits of forward error detection and correction to many simultaneous digital users of a single voice channel over a troposcatter circuit. The terminal contains a full duplex 16-channel, 1200 bit per second multiplexer, a full duplex forward error detection and correction unit, and full duplex 1200, 2400, 4800, and 9600 bps modem. A channel combiner is provided with each terminal which can accept additional 1200 bps multiplexers or 1200/2400 bps inputs. This combiner will also accommodate additional 2400 bps or higher speed modems. This combiner will be used to gate the several multiplexers and modems through the forward error detection and correction unit. In this way the channel combiner will provide an expansion capability such that a group of 12 voice channels could share the single forward error detection and correction unit.

Technical Characteristics.

Multiplexer:

Input/Output

The multiplexer/demultiplexer equipment will provide 16 full duplex channels to the users. Each and every channel will be capable of accepting any of the following inputs by an appropriate selection switch.

a. KW-26 crypto units at 100 wpm in either the 6/6 mode, the 5/7 mode, or the start-stop mode.
b. KW-7 crypto units at 75 baud.
c. Standard teletype units at 100 wpm.
d. Synchronous 75 bps data.

By appropriate switch selection, it will be possible to use the 75 bps channels in parallel so that the multiplex unit will have the capability to handle up to eight channels of 150 bps data, or up to

four channels of 300 bps data or up to two channels of 600 bps data. Each 150 bps channel will require two 75 bps channels. Each 300 bps channel will require four 75 bps channels. Each 600 bps channel will require eight 75 bps channels.

Interface — All digital input/output interfaces will be designed in accordance with the requirements of Standard Interface, MIL-STD-188B, except that the minimum input resistance of the receiver device will be 6,800 ohms and the input capacitance of the receiver device will not exceed 1,500 picofarads.

Automatic Mode Change — Each of the 16 input/output channels of the multiplexer/demultiplexer unit will have the capability of adapting the mode of transmission when normal traffic of a KW-26 crypto unit is interrupted for unencrypted transmission from a teletype keyboard at the same effective transmission rate. Similarly, the resumption of transmission from the KW-26 crypto unit will be automatically detected and the data transmitted over the channel.

Input Flexibility — Selection of the type of input/output on any channel will be made by manual switch and will not interfere with other channels.

Forward Error Detection and Correction System (FEDC):

Input/Output — The FEDC input and output will be capable of being routed through the combiner or being routed directly to a suitable tropo or wire line modem operating at any rate up to 40,000 bps. When operating without the combiner, all inputs and outputs will be a binary serial data stream at half-rate code. Timing for the encoder output and decoder input will be supplied by the modem. Timing for the encoder input and decoder output will be supplied by the FEDC unit. When operating with the

combiner, the FEDC unit will be able to operate with either a half-rate code or a three-fourths rate code by a switch selection. With the half rate code, the encoder input and decoder output will be one-half of the channel rate. With the three-fourths rate code, the encoder input and decoder output will be at three-fourths of the channel rate.

Interface

The encoder input and output at 1200 and 2400 bps respectively and the decoder input and output at 2400 and 1200 bps respectively between the modem and the multiplex channel will conform to Standard Interface, MIL-STD-188B except when the FEDC is operating without the combiner.

FEDC Delays

The delay of data between the encoder input and the encoder output will not exceed two channel bit times. The delay of data in the decoder will not be more than four channel bit times in excess of the constraint length.

Error Detection and Correction System Capability

The FEDC unit will have both a burst correction and random correction capability. The FEDC decoder will sense the presence of either burst or random errors and adapt the decoding procedure to apply the more suitable error correction techniques. If a burst of errors occur, and the corresponding guard space is minimally error free, burst correction will be used, unless the error density of the burst is low enough for reliable random error correction. When an error burst is not correctable by the burst correction mode, then the random correction mode will be used in order to correct as many errors as possible. The constraint length and the corresponding correctable burst length will be variable by switching a set of pluggable cards. A capability for selecting ten correctable burst lengths will be included.

Error Detection and Correction Code Capability	The correctable burst length will be selectable up to 10,000 bits. The required guard space will be no more than 1.4 times the correctable burst length. The random error correction capability will be three bits in twenty four with 100 percent reliability. The random error detection capability will be four bits in twenty four with 100 percent reliability. The total system delay will be approximately 2.4 times the correctable burst length.
Quarter-Rate Coding -	The correctable burst length will be selectable up to 3400 bits. The required guard space will be no more than 3.8 times the correctable burst length. The random error correction capability will be two bits in forty-eight with 100 percent reliability. The random error detection capability will be three bits in forty-eight with 100 percent reliability. The total system delay will be approximately 7.2 times the correctable burst length.
System Synchronization	Synchronization of the system will be achieved by sensing the coded structure of the data and parity bits. No additional bits other than those used for error detection and correction will be required. Resynchronization will be automatic when and if required. The system design will be such that KW-26 crypto units with clock offset of no worse than 1 part in 10^5 will not require resynchronization more often than once in 24 hours. Data transmission interruptions of up to 27 minutes' duration will not require resynchronization of the crypto unit.
External Timing	The FEDC will have the capability of external timing. External timing interface will meet the requirements of Standard Interface, MIL-STD-188B.

Modem:

Rate	The modem supplied with each terminal will operate at 1200/2400/4800 and 9600 bps on a single tropospheric scatter voice channel.
Interface	The modem will have a serial binary interface.
Clock	The modem supplies the clock for data from the encoder and for data to the decoder. The modem clock will maintain a stability of at least one part in 10^8 per day even in the presence of voice channel dropouts as long as three hours. The modem will be capable of accepting external clock timing in accordance with the requirements of Standard Interface, MIL-STD-188B.
Receiver Selection	a. Delay Distortion. The terminal will contain delay distortion equalizers capable of compensating for up to 3 milliseconds of differential phase delay between the frequencies of 600-2800 cps. b. Amplitude Distortion. The terminal will contain amplitude distortion equalizers capable of compensating for up to 25 db of amplitude distortion.

Channel Combiner

Input/Output	Each channel combiner will be capable of interfacing with up to 12 modems at a binary serial rate of 1200 or 2400 bps, or up to 8 modems at a binary serial rate of 4800 bps, or up to 4 modems at a binary serial rate of 9600 bps. Each channel combiner will be capable of interfacing with up to 18 terminal channels. Terminal interfaces will provide for binary serial rate of 600 bps, 1200 bps, 2400 bps, and 4800 bps.
Timing	Timing for each of the modem channels input and output will be supplied by the modem and will have a stability of no less than one part in 10^8 per day. Timing for each of the terminal channels will be supplied by the channel combiner and will reflect the stability of the modem channels from which it is derived.

Synchronization	Interchannel synchronization will be derived and automatically maintained by the channel combiner in conjunction with the FEDC unit.

Electrical Characteristics.

Power Source:	The system will be designed with a selectable capability to operate from a power source of either 115 volts or 208 volts plus or minus 10 percent, 47 to 63 cycles per second, single phase, alternating current.

Dimensions.

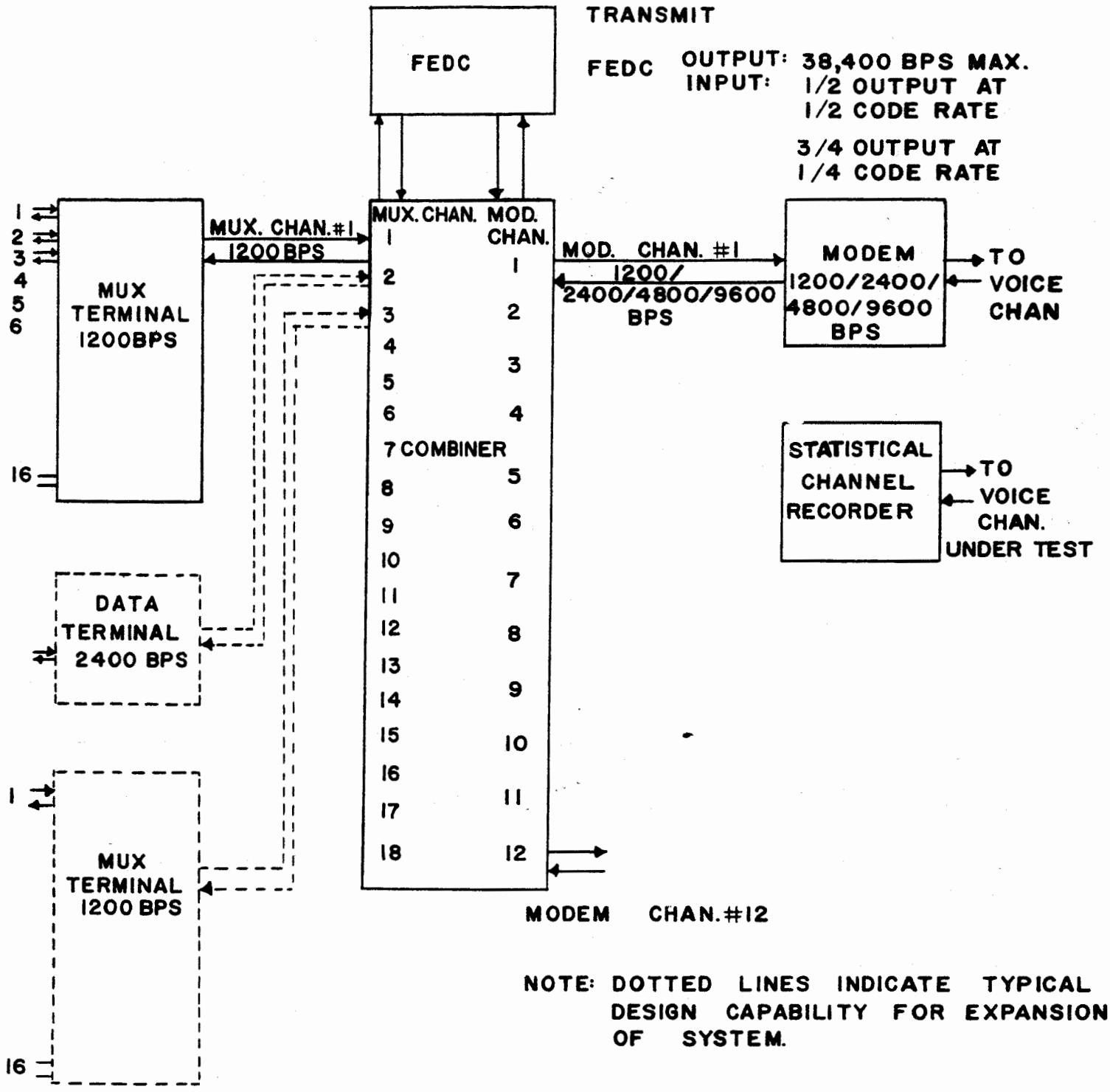
Each terminal will be mounted in standard 19-inch racks not to exceed 7 feet in height nor 2 1/2 feet in depth.

Weight.

Weight of each of the terminals will not exceed 1500 pounds.

Availability Data.

One system is being procured for feasibility test. The equipment is not expected to be available for test until FY-69.



NOTE: DOTTED LINES INDICATE TYPICAL DESIGN CAPABILITY FOR EXPANSION OF SYSTEM.

BLOCK DIAGRAM OF BROADBAND MULTIPLE USER FORWARD ERROR DETECTION CORRECTION TERMINAL

8-5. HIGH SPEED MESSAGE ENTRY EQUIPMENT (Page Reader).

Purpose.

To provide a means of rapidly and automatically reading typed messages in United States of America Standards Institute (USASI) Standard Character Set for Optical Character Recognition, and converting the information into ASCII Code in ACP-127 and/or JANAP 128 format for introduction into the DCS.

Description.

This is a page reader that will provide a means of rapidly and automatically reading typed messages, in USASI standard character set for optical character recognition, and converting the information into United States of America Standard Code for Information Interchange (USASCII) in ACP-127 or JANAP 128 format, to provide high-speed automatic input compatible with the DCS. This equipment may be used for high-speed message entry entry, directly on line or for the operation of conventional and high-speed printers, reperforators, and teletype systems. The equipment will be installed in the fixed-stations of the Army element of the DCS, with the expectation of full-time operation, except for such periods of routine maintenance as may be required. It will accomplish the handling of typed messages automatically and at high speed, and will provide a quick reaction, high traffic density message handling capability.

Employment of this equipment is expected to offer the following advantages:

a. Increased message traffic handling rate.

b. An increase in accuracy of message entry due to elimination of the human errors likely in present day message transcription.

c. A marked increase in message traffic handling capability will result.

d. Reduction of number of teletypewriters and operator personnel in a central office.

e. Automatic addressee-routing indicator conversion.

General Characteristics.

Message Reading	The equipment shall read entire message forms typed on page 7" to 10½" margins, and up to 14" long with the information to be read appearing between ½" margins. The characters to be read will be the upper and lower case alphanumerics and the symbols of four fonts as follows: a. ASA Standards Institute OCR-A (upper case.) b. USASI lower case (when standardized.) Characters to be read will be spaced ten to the inch and three lines to the inch.
Reading Speed	The equipment will read a typed page at the speed necessary to maintain an output of 120, 240, and 480 characters per second (approximately 1200, 2400, and 4800 baud.) (This will be compatible with MIL-STD-188B speeds.)
Automatic Addressee-to-Indicator Conversion	The addressee routing-indicator conversion will accommodate up to 3,000 addressees.
Output	This equipment will be capable of communicating with, and interface with, standard developmental type terminal equipment and computers using the USASCII code in a serial basis.

Availability Data.

This is a continuation of previous research and developmental efforts. Present schedule calls for service test of an engineering development model during fourth quarter of FY-70.

8-6. LOW-LEVEL TELEGRAPH TEST SWITCHBOARD.

Purpose.

To provide a small switchboard for low-level direct current and/or voice frequency manual patching, conferencing in accordance with FED-STD-222.

Employment.

This equipment will be used in small communication centers or terminals to patch low-level circuits and provide DC low-level conferencing capabilities.

Description.

The low-level test switchboard is designed to accommodate five polar, low-level, full duplex, DC circuits and five full duplex tone circuits plus one conference network for up to five conferees. The level of the DC circuits will be plus or minus five to seven volts, 14 volts peak-to-peak, at a maximum of .001 amperes. The tone circuits will have an impedance of 600 ohms, plus or minus 10%, within the frequency band of 300 to 3500 Hz. Tone power output will be zero dbm.

The send and receive side of both the DC and tone circuits consists of line, equipment, and monitor jacks.

A full duplex solid state facility is provided whereby the output of any combination of the five low-level DC circuits may be patch-connected to the input of the conference network. The output of the conference network may be patched to any or all of the low-level DC outputs. Fault detection is incorporated as a part of the conference network to switch out all defective input or output circuits on an open circuit or steady space condition which exists in excess of two seconds. The fault detector will automatically restore to normal within two seconds after fault is removed. A means of indicating faults and identifying faulted circuits is provided at the conference patch jack positions.

Technical Characteristics.

Ten solid-state DC converters are provided to connect 5 each polar or neutral 60-260 volts 150 milliampere (maximum) circuits to low-level and 5 low-level circuits to polar or neutral 60-260 volt 150 milliampere.

Ten solid-state converters are provided to convert 5 each high-level dc 60-260 volt 150 milliampere (maximum) to a FSK tone output and 5 each FSK tone circuits to high-level dc 60-260 volts, 150 milliampere (maximum).

A power supply is provided for ten low-level dc circuits. Power input requirements 95-125 volts, 45 to 65 Hertz, at 5 amperes.

Availability Data.

A feasibility test model will be tested during first quarter FY-69.

8-7. TELEGRAPH ERROR CORRECTOR
Codex Model TD-12

Purpose.

To provide an error correction capability for use on telegraph circuits having high error rate characteristics.

Description.

The TD-12 telegraph error correctors are forward acting error correcting encoders and decoders which correct transmission errors in standard single channel telegraph circuits. They are specifically designed to operate over noisy telegraph circuits where the natural channel error rate is too high to permit satisfactory telegraph transmission. Since the code used is forward acting, the TD-12 telegraph error correctors eliminate the need for retransmission. The TD-12 correctors are compatible with standard VFTG equipment.

Error Correcting Code: The TD-12 error correctors use a diffuse half rate, convolutional error correcting code, capable of correcting both random errors and error bursts. The encoder computes from the input telegraph signals a parity bit stream which is transmitted simultaneously with the information signals. The decoder uses the information contained in the parity bits to detect and correct errors in the information signals. The code action is one way and does not require a return path to correct errors. There is no system delay introduced by the encoder. However, the decoder introduces a delay of 3.67 information characters or 22 information bits.

Asynch/Synch Conversion: The TD-12 error correctors are synchronous transmission devices. The encoder contains an asynchronous/synchronous converter which accepts a start-stop telegraph character and converts it to, a 6 bit synchronous character. Similarly the decoder contains a synchronous/asynchronous converter which converts the synchronous character to a start-stop character. When synchronous telegraph signals are transmitted, provision is made in the TD-12 telegraph error correctors to bypass these converters. Since the TD-12 encoder generates a set of parity bits, it always transmits over the channel at a faster rate than its input.

Transmission speed and synchronous or start-stop mode are selectable from a pair of front panel switches. The encoder contains a neutral type solid state input relay and two neutral solid state output relays. The outputs are transmitted in two telegraph channels each keyed at half the channel transmission rate.

Technical Characteristics.

Power Requirements	Power line voltage 85 to 140 v. Power line frequency 57 to 63 Hz. Approx power consumption 50 watts.

Standard Transmission Speeds:

Input Signal:	Channel Rate:
100 wpm	122.24 bps
67 wpm	83.33 bps
60 wpm	75.00 bps

Signal Levels	Standard: Neutral keying up to 260 v. at 60 ma. Optional: Polar keying up to ±130 v. to 60 ma. or Mil Std 188B ±6 v. 10 ma. polar.

Availability Data.

Four TD-12's have been procured for test. Future procurement depends upon results of test.

TELEGRAPH ERROR.CORRECTOR
CODEX MODEL TD-12

8-8. MULTIPLE LINE ENCRYPTION SYSTEM (MLES).

Purpose.

To provide reliable secure and relatively maintenance free communications and at the same time reduce power requirements to one-tenth or less, space to less than one-tenth, personnel to one-third, and overall cost to less than one-half.

Employment.

The system is to be employed in a fixed plant environment and will be of such configuration to allow use in transportables.

Description.

The MLES will be designed for full duplex digital link encryption and will consist of basic microminiaturized line units controlled and used in conjunction with a centralized computerized processing switch. The MLES will be capable of connecting from switch to switch, switch to subscriber, and subscriber to subscriber.

Technical Characteristics.

Classified.

Availability Data.

One MLES test bed consisting of 50 full duplex line units is under development by the NSA in conjunction with industry. Feasibility testing is expected to commence in Dec 68. Availability of production models is expected in FY-71-72 depending upon a favorable test evaluation.

8-9. VISUAL COMMUNICATION SYSTEM (VIDICODER).

Purpose.

To provide a system that makes it possible to transmit secure video monochrome signals over 3 KC lines from conventional TV cameras to conventional facilities presently utilized by secure data/voice networks. Wideband transmission can also be accommodated.

Employment.

The system is primarily designed for fixed plant use and is capable of providing fixed secure communication service. At the transmit terminal, the TV camera can be located in a conference room, private office, TV studio, operational command center, communications center or operational intelligence center to communicate live briefing scenes, imagery, maps, documents, and/or other information to receiver locations. A zoom lens provides for flexibility to accommodate imagery of any size or resolution.

Description.

The system consists of a TV camera and monitor, analog/digital-digital/analog converters and frame storage devices. With the exception of the TV camera and monitor all components are housed in two cabinets (transmit and receive) approximately 2' D x 4' H x 4' W.

The equipment is capable of processing at slow or fast rates of scan. The composite signals employed in this system are based on a scanning roster of 525 lines at a frame rate of 30 frames per second; however, after video/digital conversion the speed of processing is determined by appropriate timing consistent with the transmission rate. For narrowband transmission, the rate is 2400 bits/second.

With use of appropriate equipment at the receive terminal, the VIDICODER System is flexible to accommodate recording on hard copy, tape, or film for playback purposes.

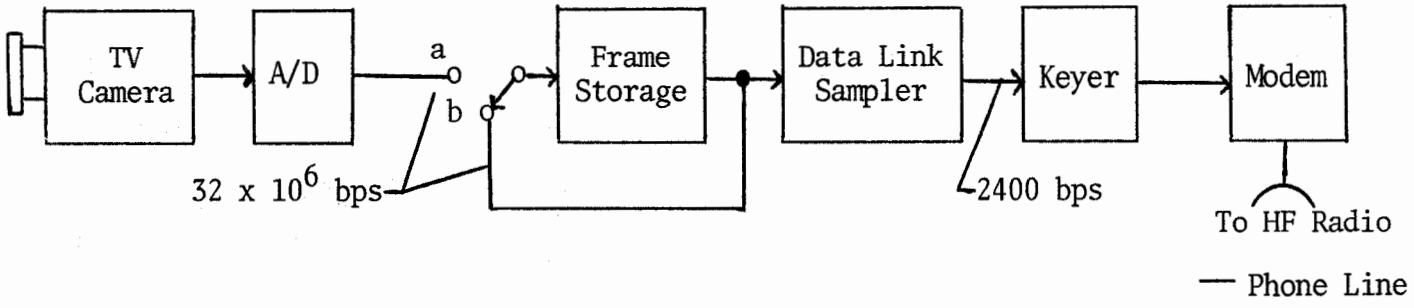
The VIDICODER System is compatible with existing government-furnished security devices and conventional wire line modems. For narrowband application, the TSEC/KG-13 is used. For wideband transmission the TSEC/KG-24 is used.

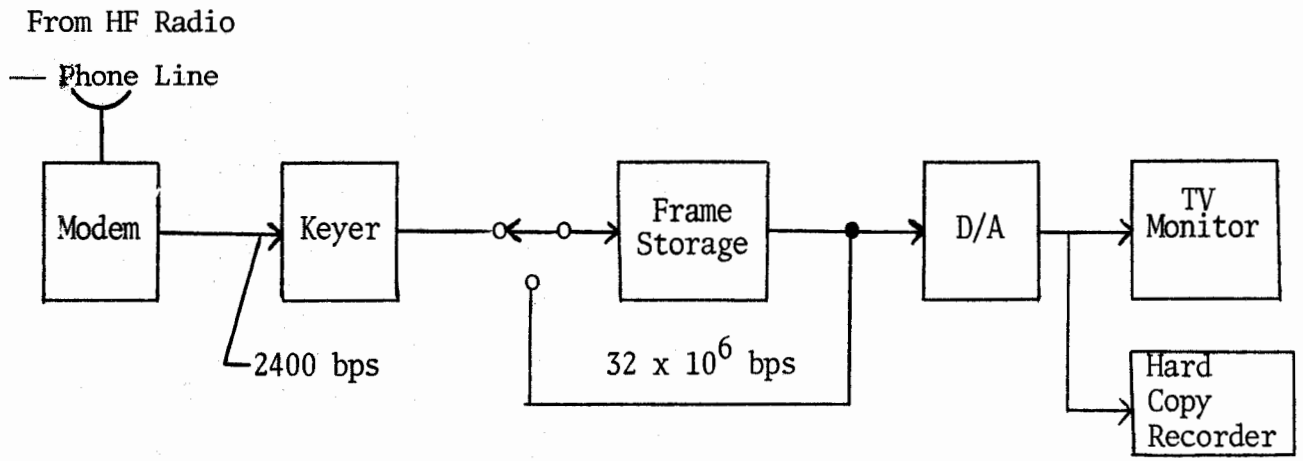
Technical Characteristics.

TV Camera TV Monitor	Video BW, 4.0 Mc. Frame Rate, 30 frames per second. Scan Lines: 525. Camera, Conventional Vidicon. Monitor, Conventional.
A/D Converter D/A Converter	Technique: Pulse Code Modulation with Pseudo-Random Noise. Bit Rate: 32×10^6 bits per second.
Frame Storage	Capacity: 10^6 bits. Recirculation Rate: 32×10^6 bits per second. Technique: Magnetostrictive Delay Lines.
MIL-STD-188B	
Power	115 volts, 15 amps max 50-60 Hz.

Availability Data.

One VIDICODER System has been procured for test and evaluation in 4th Qtr FY-68. Production models could be available in FY-70 depending upon a favorable evaluation.





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VIDICODER System

8-10. MODIFICATION KIT
AN/FCC-19

Purpose.

To provide a means of passing 150 baud data over the AN/FCC-19 telegraph terminal.

Description.

This modification kit is a full duplex 150 baud conversion kit, type 15W16, manufactured by TeleSignal Corp for the AN/FCC-19. This kit is composed of filter networks and components which replace the components of #15 narrowband channel of the AN/FCC-19. (Channel #16 is disabled for this modification.)

Employment.

This kit will be used in conjunction with the AN/FCC-19 as required.

Availability Data.

Two AN/FCC-19 modification kits will be tested during first quarter FY-69. Results of test will determine future procurement.

8-11. MULTI-FUNCTION METER. (HP Model H22-427A-01)

Purpose.

To provide a multi-function meter suitable for replacing presently used multimeters used in transportable communication terminals.

Employment.

This equipment will be used to replace the TS-352 and TS-505 multimeters presently being used in the AN/TSC-18, 19, 20, and 25 communications terminals.

Description.

The Hewlett-Packard Model H22-427A-01 Multi-Function Meter is a portable, AC or battery operated, solid-state unit for making AC-DC voltage and resistance measurements. The unit has a "zero" center scale on the 100 millivolt DC range such as required for adjustment of the combiner portion of the AN/FGC-61 type telegraph terminal equipment.

Technical Characteristics.

DC Voltmeter

Voltage ranges:	±100 mV to ±1000 V full scale in a 1, 3, 10 sequence (9 ranges).
Accuracy:	±2% of full scale on any range (0°C to 50°C.)
Input resistance:	10 megohms on all ranges.
AC rejection:	Superimposed peak AC voltages 100 times greater than full scale affects reading less than 1% for 60 Hz and above. 450 volts peak maximum.
Overload:	1200 V dc on any range.

AC Voltmeter

Voltage ranges:	10 mV to 300 V rms full scale in a 1, 3, 10 sequence (10 ranges.)
Frequency range:	10 Hz to 1 MHz.
Accuracy:	(0°C to 50°C.)
Frequency response:	(10 mV to 30 V ranges.)
Input impedance:	10 megohms shunted by 40 pF on 10 mV to 1 V ranges; 20 pF on 3 V to 300 V ranges.

Response:	Responds to the average value of the input; calibrated in rms volts for a sine wave input.
Overload:	300 V/rms momentarily, 1 V range and below. 425 V/rms maximum above 1 V range.

Ohmmeter

Resistance ranges:	10 ohms center scale to 10 megohms center scale (7 ranges).
Accuracy:	±5% of reading at midscale (0°C to +50°C.)
Power	Battery operation and AC line operation (selectable on rear panel.) 115 or 230 V ±20%, 50 Hz to 1000 Hz, ½ W.
Weight	Net, 5 ¼ lbs; shipping: 7 lbs.
Dimensions	5 1/8" wide, 6 3/32" high, 8" deep.

Availability Data.

Two units are being procured for test during first quarter FY-69.

8-12. DIGITAL ERROR CORRECTION HF COMMUNICATIONS TERMINAL AN/FYC-4 (Codex Model CT-3)

Purpose.

To provide a forward acting error correction terminal for transmission and reception of data over high frequency radio circuits.

Employment.

This unit will be used to test the feasibility of correcting error bursts of up to one second in duration at data speeds up to 1200 baud (2400 baud coding and data bits) on a high frequency radio system.

Description.

The CT-3 Digital Error Correcting HF Communications Terminal is a full duplex system designed to transmit digital information over a standard voice circuit of a high frequency radio system which has a random error rate of at least 10^{-3} at an information rate of either 600 or 1200 bps with an error rate of 10^{-5} or better. The coding technique used does not require a return channel such as ARQ systems which are error detection and retransmission systems. The principal components of the terminal are a data modem, a Codex TD-1000 Encoder and Decoder, and a channel synchronization system. The modem transmits 2400 bps over eight different frequency tones with four phases on each tone. The modem is capable of dual diversity reception. The TD-1000 uses a convolutional encoder with a threshold decoding procedure which will correct random errors and error bursts. Five different error burst correction settings are provided from a front panel switch, so that the terminal may be adapted to a variety of channel burst conditions. The longest error burst which can be theoretically corrected is 2400 successive channel errors, or 1000 milliseconds at 2400 bps transmission rate provided the guard space*1 is relatively error free. The channel synchronization system includes a highly stable clock as well as circuitry necessary to maintain terminal synchronization on highly perturbed HF paths. All terminal inputs and outputs are in accordance with Mil Std 188B. The terminal accepts as an input a serial binary stream at either 600 or 1200 bps from a synchronous source. The output of the terminal is a serial synchronous 600 or 1200 bps binary stream.

*1 The guard space for each correctable burst length is approximately three times that burst length.

Technical Characteristics.

Power Line Voltages	115 or 230 volts single phase.
Power Line Frequency	47-63 cycles/second.
Consumption	Approximately 1000 watts.
Input Signals	Serial polar 6 volt signals into an impedance of approximately 600 ohms at a rate of 600 or 1200 bps.
Clock Signals	Neutral signal presented as a square wave with an amplitude of 6-12 volts peak-to-peak into 600 ohms.
Output Signals	Serial Polar 6 volt signals into an impedance of approximately 600 ohms at a rate of 600 or 1200 bps.
Audio Signals	Input and output signal impedances shall be a nominal 600 ohms with provisions for adjusting to desired audio level.
Terminal Clock Stability	Better than 1 part in 10^{-7} per day.
Error Burst Correction	Five maximum correctable error burst lengths are selectable from a front panel switch: 1000, 500, 250, 125 and 62.5 milliseconds. The guard space for each correctable burst length is approximately three times that burst length.

Availability Data.

Two terminals of this equipment have been procured for feasibility testing. Future procurement depends upon results of test.

8-13. RADIO FREQUENCY MEASURING DEVICE RS-6550 (RACAL)

Purpose.

To provide a radio frequency measuring device to replace the AN/URM-18.

Employment.

This frequency measuring equipment will be used in STARCOM fixed and transportable HF radio facilities.

Description.

The RS-6550 radio frequency measuring equipment is developed by RACAL Communications, Inc., and consists of the following major components:

RA-6217 Radio Receiver.
MA-6314 Synthesizer, including frequency standard with accuracy of 2×10^{9} with operation in 10 cycle steps.
RA-6360 Comparator.
RA-6336 Frequency Display Unit.

In operation of this system, the signal to be measured is tuned by the operator by manipulation of knobs located on the front panel of the synthesizer. These knobs read digitally in terms of received frequency. The operator observes a Lissajou pattern and sets the knobs to the point where the observed pattern is almost stationery. Further interpolation to render the pattern completely stationery is achieved by the fine tune control of the synthesizer. When this is achieved, the receiver is exactly tuned to the receiver signal and received frequency is determined by reading of the synthesizer dials. The comparison which is made is accomplished by comparing the IF output of the receiver which is centered at 100 kc to a locally generated 100 kc output derived from the 1 mc standard. Accuracy of this measurement will be better than 5 parts in 10^{8} for ground-wave signals with an observation time on the order of several seconds.

The RA-6336 display unit is used as an aid in determining the characteristic of the received signal. This unit allows several modes of operation. The first of these is to observe the entire 1 mc interval to which the receiver is tuned. In its second mode of operation the display unit is used to indicate the sideband structure associated with the received signal. This device is useful to the operator in that it allows him to make some judgment as to the nature of the received signal not normally available to him merely by the observation of the Lissajou pattern.

The receiver for this system has been modified and all functions not associated with the measurement of frequency were removed to minimize the number of knobs on the front panel. The audio portion of the receiver is retained to aid the operator in signal identification.

The complete system is housed in a 15 3/4 inch rack.

Technical Characteristics.

RA-6217 Receiver:

Frequency Range	980 kc-30 mc (3 kc-30 mc with low frequency adapter, RA-6337).
Input Impedance	75 ohms wideband or tuned.
Input VSWR	2/1 or better.
Modes of Reception	AM, MCW, CW, SSB, FM. Panoramic with RA-6336 I.S.B. with RA-6298 Adapter.
Sensitivity (3 kc bandwidth)	CW, SSB, 0.5 microvolt for 15 db S/N Ratio. MCW, AM (30% mod) 1.5 mv for 15 db A/N Ratio. FM (10 kc deviation) 1 mv input for 10 mw AF output, 13 kc bandwidth.
Tuning	Digital presentation in kilocycles with interpolation calibration at 200 Hz intervals.
Frequency Setting Accuracy	Within 250 Hz (oscillator output available for counter.)
Tunability	Easily set to within 15 Hz.
Calibration	Internal calibration oscillator provides markers at 100 kc intervals.
Selectivity	13, 6.0, 3.0, 1.0 kc and 200 Hz, 3 db points ±15% center frequency.
Shape Factor (6-60 db)	1:4 or better, 1:10 or better for 200 Hz bandwidth.
IF Outputs	a. 2-3 mc spectrum output for panoramic display unit. b. 1.6 mc: 100 mv nominal to 75 ohms, after IF selectivity. c. 455 kc, 200 mv nominal to 50 ohms, center frequency or 100 kc to customer order.
Noise Figure	Less than 10 db throughout.
AF Output	a. 10 milliwatts to headphone jack and rear terminals, 600 ohms. b. Independent 1.0 milliwatt output to rear terminals, 600 ohms.

RF Input Attenuator	0 to 40 db nominal in 10 db steps.
Spurious Response to External Signal	Better than 70 db down for signals less than 5% off tune--better than 80 db for signals more than 5% off tune.
Image Rejection	80 db or better.
Inband Intermodulation Distortion Products	40 db below two desired--15 dbm input signals within the receiver passband.

Frequency Synthesizer:

Input Frequency	1 MHz at 0.5 to 2.0 volts rms into 50 ohm load. (Optional internal standard available.)
Fixed Output Frequency	1.7 MHz, 1-2 volts rms into 93 ohm load.
Variable Output Frequency	3.6 - 4.6 MHz, 1 volt rms ±3 db into 93 ohm load. Output is inverted in final mixer to provide the complement of the indicated frequency as required for normal operation of the receiver.
Frequency Increments	10 Hz, 100 Hz or 1 kHz on customer order. (All chassis are identical, permitting later field installation of additional modules to expand to 10 Hz increments those instruments ordered initially for 100 Hz or 1kHz increments.)
Harmonics	All harmonics of the selected frequency are at least 80 db below the level of the fundamental.
Spurious Signals	Discrete spurious frequencies are at least 100 db below the level of the fundamental.
Noise	Total noise measured in a 100 Hz bandwidth is at least 100 db below the level of the fundamental.
Switching Speed	Less than 1 millisecond.
Search	A search oscillator may be switched into any of the low order decades up through the 10 kHz/step decade, giving a total search range from ±100 Hz to ±100 kHz in four steps. Search is above and below the synthesized output frequency. Solid-state switching permits remote selection of the search

	range desired, as well as remote electrical control of the search oscillator. A calibrated front panel control adjusts the frequency of the search oscillator when front panel frequency selection is used.
Remote Control	Frequency control from a remote location is by means of contact closures in decimal notation.

Frequency Display Unit:

Mode of Operation	a. Used in conjunction with the RA 6217 to provide a panoramic display of signals in a spectrum up to 1 mc wide. b. To provide spectrum analysis facilities in a 75 kc band centered on the receiver tuned frequency.
Input Frequencies	Mode 1: 2 - 3 mc. Mode 2: 1.6 mc ±37.5 Kc.
Swept Frequency Range	Mode 1: Adjustable from 100 kc or less to 1 mc or more with the ability to sweep any particular portion of the discrete 1 mc band. Mode 2: Adjustable from 7.5 kc or less to 75 kc or more with the ability to sweep any particular portion of the discrete 75 kc band.
Resolution	Mode 1: Capable of resolving two equal amplitude signals spaced by 10 kc. Mode 2: Capable of resolving two equal amplitude signals spaced by 1.0 kc.
Deflection Amplifiers	Linear with manual gain control facilities.
Sweep Rate	4 Hz.
Frequency Markers	Mode 1: a. 100 kc intervals across spectrum. b. Marker indicating receiver tuned frequency. Mode 2: Center frequency marker.
Sensitivity	Such as to enable the resolution of a 1 microvolt signal at the receiver input over the range 3 kc to 30 mc.

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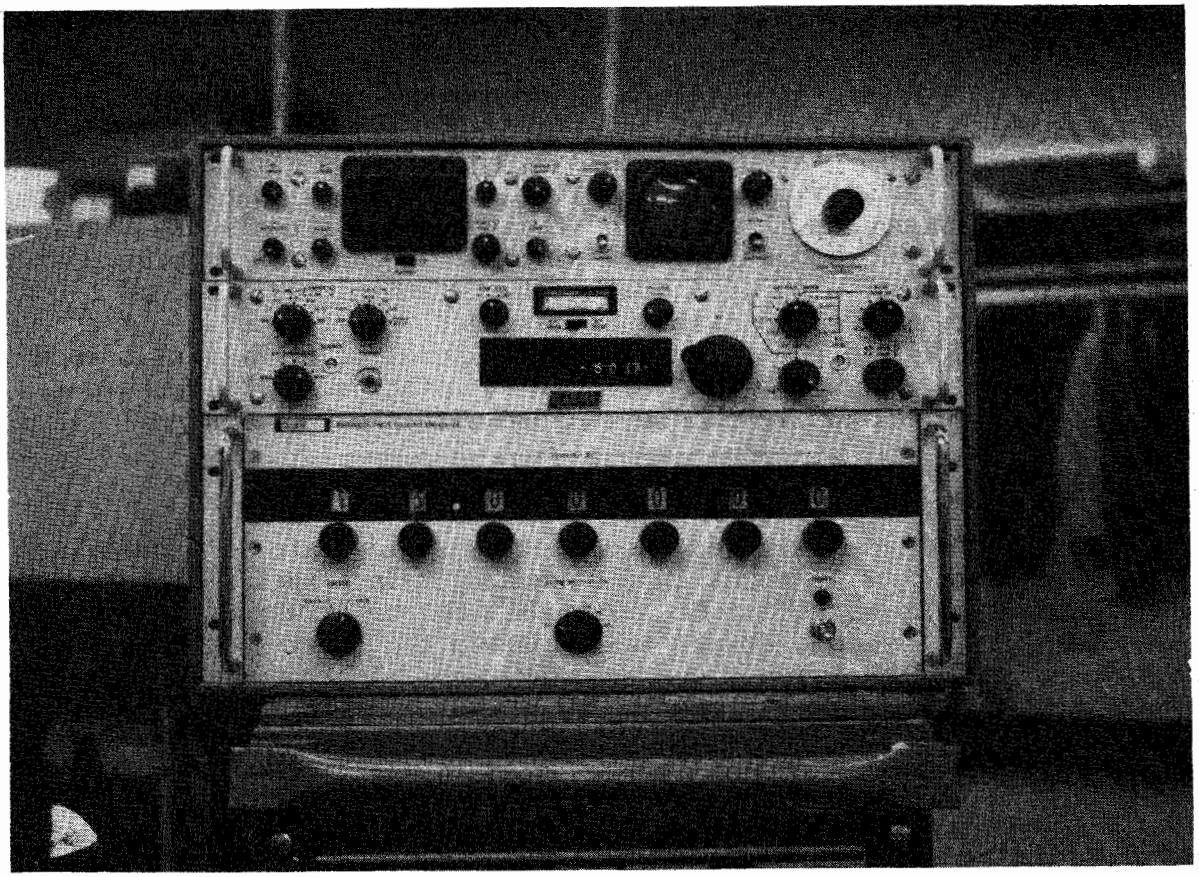
Controls	Sweepwidth-center-frequency, focus, gain, intensity-power off, marker on/off, RF/IF display selector switch.

Availability Data.

One system is scheduled for test during 1st quarter FY-69.



RADIO FREQUENCY MEASURING DEVICE
RACAL MODEL RS-6560

8-14. AUDIO COMBINER

Purpose.

The Audio Combiner will electrically combine the signals from two dispersive time-varying 3 kHz diversity radio signals into one improved 3 kHz output circuit.

Employment.

The Audio Combiner is intended to be installed at radio receiver stations, where it will accept as inputs and then combine two diversity 3 kHz voice frequency circuits into one 3 kHz output circuit. This is accomplished by the correction of selective frequency fades and fine grain phase differences, between the two diversity signals and then combining them with ratio-squaring techniques. In addition to providing an output signal that is improved over either input signal, the Audio Combiner will also reduce the number of circuits required between the receiver location and the primary technical control. Existing methods use two separate circuits from the receiver station to the technical control and there manually choose the one with the better signal.

Description.

The Audio Combiner will be a completely solid-state self-contained unit, two of which will mount in a standard 19-inch rack six feet high. It will be made up with four drawers. The bottom drawer will have the power supply, the second drawer will contain the forty special filters and the top two, the circuit boards, and other electronic components. The control panel will have the VU meter and controls. Controls that will only be adjusted occasionally will be of the locking type and will be readily accessible but not located on the front panel.

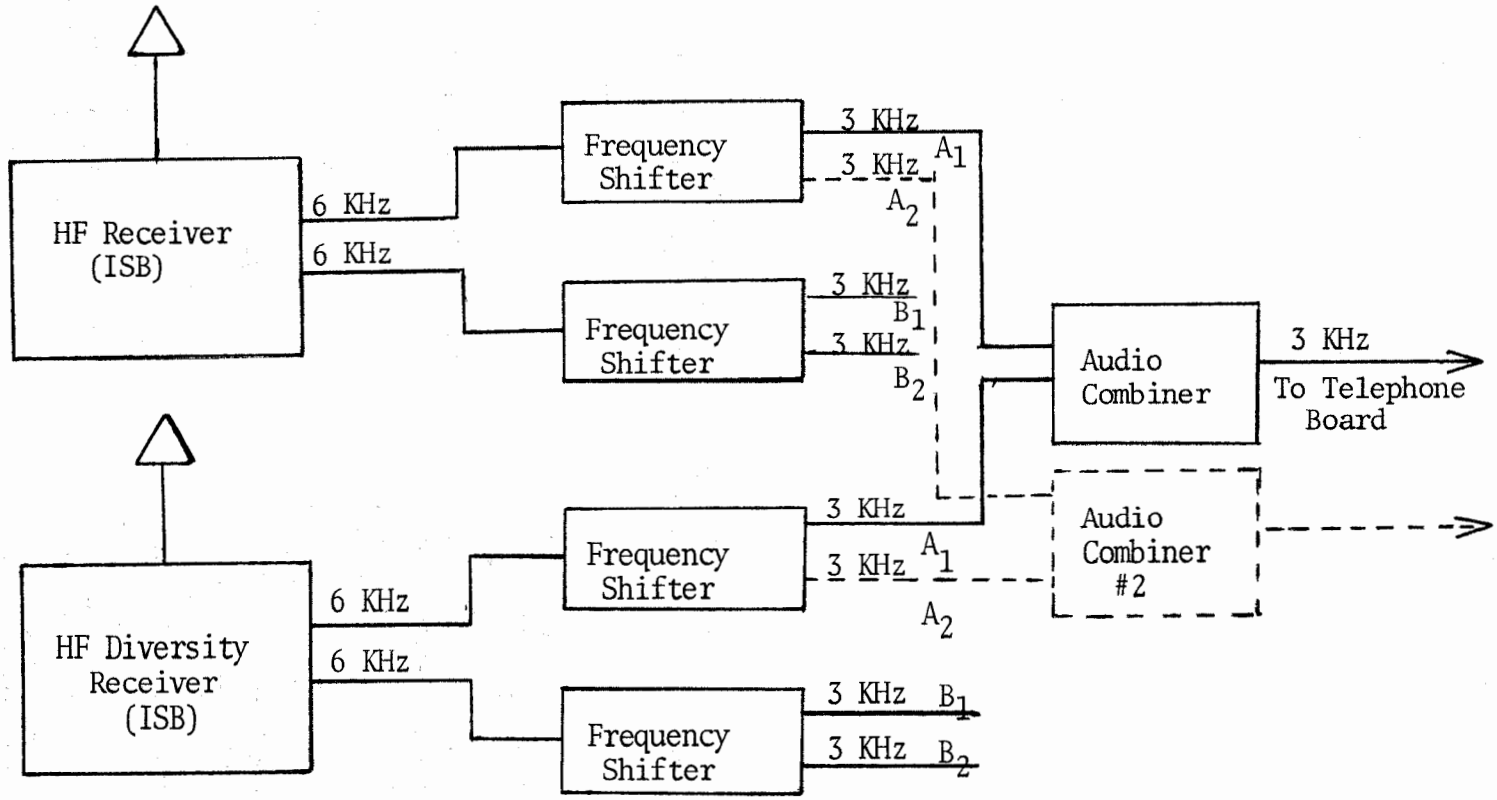
Technical Characteristics.

Input circuits	Two (2), diversity.
Input bandwidth	3 kHz.
Input Impedance	600 ohms ±10% balanced.
Input Return Loss	26 db (min) from 370 to 3040 Hz.
Output circuit	One.
Output Bandwidth	3 kHz.
Output Impedance	600 ohms +10% balanced.
Output Return Loss	26 db (min) from 370 to 3040 Hz.
Input & Output Longitudinal Current Suppression	40 db (min) below prevailing metallic currents.

Harmonic Distortion	Less than 3% with 1000 Hz signal inserted simultaneously to each input with input levels set at 0 db.
Signal-to-Noise	60 db without level at ±10 dbm.
Input Levels	0-30 dbm.
Output Levels	Adjustable from -20 to +10 dbm in increments of not more than 1 db.
AUTOVON Performance	MF 2/6 and DTMF signalling and switch supervisory requirements as specified in DCAC 370-V130-1 for 35 db selective frequency fades.
Power Requirements	115/230 ±10%, V, 47 to 440 Hz single phase AC.
Dimensions	Not firm - to fit in standard 19" rack.
Duty	Continuous, unattended.
Climatic Operating Conditions	Temperature - 0 to +50°C. Humidity - 0 to 95% relative. Altitude - 0 to 15,000 ft above mean sea level.

Availability Data.

Two prototype models will be tested in first quarter FY-69. Future procurement is dependent upon results of test.



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AUDIO COMBINER

Block Diagram

8-15. DATA MODEM (4800 BPS)

Purpose.

To provide a means of transmitting digital data at a rate of 4800 bits per second over standard voice channels.

Employment.

This modem will be employed on STARCOM HF radio, troposcatter, and line-of-sight propagation paths.

Description.

This is a research and development task for development of an advanced development model of a modem equipment which will provide a means for transmitting digital data at a 4800 bits per second rate over standard voice channels. The modem shall employ coherent, synchronous detection and be used over HF radio, troposcatter, and line-of-sight propagation paths.

The data modem will be developed to accept up to 64 data inputs of varying modulation rates of 75 bits per second or less. It will accept synchronous and asynchronous signals simultaneously at any modulation rate up to 75 bps. The modem also will be capable of accepting serial isochronous bit streams up to 75 bps, 150 bps, 300 bps, 600 bps, 1200 bps, 2400 bps, and 4800 bps without altering the incoming phase relationships. At all rates other than 4800 bps the other channels will be usable for random keying up to 75 bps. The modem will consist of necessary code converters, modulators, demodulators, and timing for a full duplex terminal. It will have the capability of accepting external timing.

This modem will provide a high degree of flexibility with respect to circuit utilization by enabling the intermixing of signals having different modulation rates as well as synchronous and asynchronous signals for transmission over a single channel.

Technical Characteristics. Undetermined.

Availability Data.

This modem is being developed to support the "Army 85" concept.

8-16. SPACE DIVERSITY COMMUNICATIONS EQUIPMENT

Purpose.

To provide a means to compensate for the effects of fading of high frequency radio signals.

Employment.

This equipment will be used on STARCOM HF radio circuits.

Description.

This is a research and development task to provide diversity communications equipment for HF circuits. R&D efforts will include studies of the relative and combined effectiveness of the space, time, polarization and angular diversity techniques, and development of equipments for combining diversified signals, including a predetection combiner.

The equipments developed will consist of items at a transmitter site and complementary items at a receiver site. One concept is that the message will be divided into increments at the transmitter site and each increment transmitted a number of times with discrete known delays inserted between each repetitive transmission. At the receiver site the diversified increments would be recombined by corresponding delays so that repetitive transmissions re-enforce each other.

Technical Characteristics. Undetermined.

Availability Data.

This equipment is being developed to support the "Army 85" concept.

8-17. ADVANCED SPEECH COMPRESSION EQUIPMENT.

Purpose.

To provide voice digitizing equipment.

Employment.

Capable of providing voice intelligibility under all propagation conditions. This equipment will be used over existing STARCOM voice circuits.

Description.

This is a research and development task for development of voice digitizing equipment to operate at bit rates not to exceed 2400 bits per second. This equipment will provide improved voice recognition over presently available voice digitizing equipments. This digitizing equipment will be intelligible under all propagation conditions and will result in an increased information transmission capacity eliminating the need for repetition, and will also increase the accuracy of speech transmission.

Technical Characteristics. Undetermined.

Availability Data.

This equipment is being developed to support the "Army 85" concept.

8-18. CALLER IDENTIFICATION EQUIPMENT.

Purpose.

To provide a means for positive voice identification.

Employment.

This equipment will be employed at high level command and control centers.

Description.

This is a research and development effort for development of an equipment or group of equipments which will provide a voice message with positive identification of the particular individual making the call and the particular individual to whom the call is being made. The equipment developed from these efforts will be used for high level command functions to prevent unauthorized commands of a critical nature from being inserted into the command and control system. This equipment could also be used by commanders of major field units in connection with control of dispersed units. This caller identification equipment will be compatible with existing security systems.

Technical Characteristics. Undetermined.

Availability Data.

This equipment will be available to support the "Army 85" concept.

8-19. ULTRA-HIGH SPEED RECORD COMMUNICATIONS FACILITY

Purpose.

To provide a means of automating the process of reading and converting typed matter into ASCII Code for transmission over the STARCOM System.

Employment.

This equipment will be used in STARCOM fixed station message centers.

Description.

This is a research and development effort for development of a group of equipments which will read typed or printed messages at ultra-high speeds; read tape at ultra-high speed to transmit at 14,400 characters per second and/or punch tape at 3,600 characters per second; and print the message at ultra-high speed at a receiving location. This group of equipments will provide a quick-reaction, high traffic density capability for automatically handling typed or printed messages for dissemination over the Strategic Army Communications System. The equipments, using the ASCII Code, will interface with standard terminal equipment including computers and will be compatible with existing and developmental type on-line cryptographic devices.

This group of equipments will be used in each fixed station message center of the STARCOM System or other strategic communications systems to automate the process of reading and converting typed matter into ASCII Code for transmission over the system.

These equipments will enable realization of the following:

a. A very large increase in rate of message traffic handling at input.

b. An improvement in accuracy of message entry resulting from elimination of the human error inherent in present methods of message transcription.

c. An increase in message handling capability of at least one order of magnitude.

d. Reduction in the number of teletypewriters needed in central office or message center.

e. Reduction in the number of operator personnel.

Technical Characteristics. Undetermined.

Availability Data.

This equipment will be available to support the "Army 85" concept.

8-20. ULTRA-HIGH SPEED PAGE PRINTER AND DISTRIBUTOR TRANSMITTER

Purpose.

To provide high speed message and data input/output compatible with STARCOM and ADP systems.

Employment.

This equipment will be used in STARCOM switching centers and high speed subscriber stations.

Description.

This is a research and development program for development of fixed station teletypewriter equipment capable of producing page copy and transmission from a punched tape using the ASCII Code--at data rates up to 2400 bits per second. This equipment will provide high speed message and data input/output compatible with the strategic army communications and automatic data processing systems.

This receiving-only page printer and distributor transmitter will be utilized on a worldwide basis, in both peacetime and wartime, under fixed station conditions. These equipments will be used in conjunction with existing systems and will be capable of printing and transmitting messates as high speed over the STARCOM system. It is envisioned that at least one page printer will be used at each message switching center and high speed subscriber station. Several distributor transmitters will be used at each message center and at least one at each subscriber station.

The following advantages should be realized through employment of this equipment:

Increased message traffic handling rate.
Reduction of operator personnel.
Decrease in overall equipment cost per system.
Increased system capability.
Conformance with Federal Standard 222.

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Technical Characteristics.

Power Requirements	115/230 volts ±10%, 50/60 cycles sources, single phase.
Transmission Rates	600, 1200, and 2400 bps.
Printing	80 characters per horizontal line. 6 lines per vertical inch.
Installation	19" rack or bench mountable.

Availability Data.

Production units are expected to be available in FY-75.

8-21. STANDARDIZED MICROWAVE EQUIPMENT.

Purpose.

To provide a standard family of microwave equipment to replace a variety of non-standard microwave equipments presently in use.

Employment.

This equipment will be employed on a worldwide basis.

Description.

This is a proposed research and development program for development of a family of broadband microwave equipments to military and DCA specifications which can be assembled in different configurations as required to provide line-of-sight, tropospheric scatter, and satellite communication for worldwide application. The equipment will be solid state, except for final amplifiers, modularized and designed for maximum adaptability to various modes of operation to be usable on all microwave bands allocated for military use. A building-block concept will be stressed with the modules to be utilized in a manner to provide maximum flexibility of application, commonality of circuits, and adaptability for the incorporation of foreseeable state-of-the-art devices and technique developments.

The microwave equipment developed will be used in installations of the Army component of the DCS. The basic concept is to permit the engineering of microwave line-of-sight, troposcatter, and satellite systems from a developed inventory of electronic blocks, by using a minimum of interchangeable building blocks. Different configurations and packaging of the module and module drawer building blocks will provide the various operational modes and variable channel capacities required, depending on the type of communications installation. Equipment developed would be capable of being incorporated into present systems, to gradually replace present equipment, or to

provide for new capabilities, as applicable. Logistic and procurement requirements will be significantly reduced by application of standardized microwave communications equipment for all strategic needs.

Technical Characteristics. To be determined.

Availability Data.

Availability of this equipment cannot be determined until program approval and initiation of an R&D task.

8-22. MICRO-MINIATURIZED TEST EQUIPMENT.

Purpose.

To provide a means for rapid and simple testing of equipment and circuits to insure their compliance with DCA, military, and federal standards.

Employment.

This test equipment will be used on a STARCOM worldwide basis.

Description.

A proposed research and development task for advanced development studies and model development of a family of micro-miniaturized test equipment to permit rapid and reliable testing of equipment and circuits to determine their compliance with military and government standards. The work will include development of test equipment that will be of extreme simplicity to operate, high in reliability and accuracy, and be capable of determining circuit quality and equipment performance of high speed information rates in addition to performing all tests currently being performed by existing test equipment. Design considerations will reflect precision and stability by which the performance, for example, of transmission and reception equipment can be evaluated. Advanced design will offer features of integrated, high efficiency circuits requiring relatively few components, immunity to extreme high temperatures and humidity, versatility to maximize usability, negligible maintainability and ease of portability by emphasis on reduction of size and weight.

The micro-miniaturized test equipment will be utilized and adaptable for testing and analysis of all communication type equipment/systems and circuits (digital and analog) employed by Army strategic communications without circuit degradation. Design features of this equipment by reduction of size, weight, and quantities needed, will enable a major reduction in the logistical support now required by existing test equipment.

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Technical Characteristics. Undetermined.

Availability Data.

Availability of this equipment cannot be determined until after initiation of a research and development program.

8-23. IDENTIFICATION OF USER COMMUNICATION SYSTEM.

Purpose.

To provide a system capable of providing a positive means of verification of user location and authentication and protection against spoofing and deception.

Employment.

This equipment will be used by selected STARCOM subscribers.

Description.

This is a proposed research and development program for research studies and model equipment development of a communication system comprised of a number of equipments to provide secure voice (digital or analog) communications between selected users regardless of their geographical location and to furnish automatically in real time for display, the identification, status authentication and location of the user. The work will include research to determine, one, the feasibility of transmitting in real time, regardless of location, information regarding user status through electronic switching centers for continuous display; and, two, the feasibility of furnishing continuous secure voice communications between users. Further, the work will include development of communication equipment of micro-miniature design causing minimum possible physical constraint to the selected user. The system will be capable of providing a positive means of verification of user location and authentication and protection against spoofing and deception.

The basic operational concept of this system, to be comprised of equipment, small in size, light in weight, low in power consumption and capable of operation over any appropriate 3 KC commercially supplied or military transmission system, is to provide selected users regardless of location a means of continuous contact between each other and to provide a means for transmitting their identity and location to a command and control center for automatic display. Communication by the users will be by entry anywhere within the realm of DCS electronic switching systems, utilizing existing landlines and/or radio facilities. The system will be

capable of determining the status of the users (status defined as alive or dead, identity and location) for automatic display on a real-time basis. Further, this system will be capable of providing secure voice transmission between users via entry in to the DCS switching system, will be capable of providing a coded authentication of the user, will be spoofproof, tamperproof and be resistent to jamming.

Technical Characteristics.

Undetermined.

Availability Data.

Availability of this equipment cannot be determined until after approval and initiation of a Research and Development program.

8-24. USER-TO-USER RECORD COMMUNICATIONS.

Purpose.

To provide a printed record of user-to-user voice communications.

Employment.

This equipment will be used at high echelons of STARCOM.

Description.

A proposed research and development program for development of a group of equipment which will accept analog messages (e. g., telephone), convert to digital signals, and provide a typed copy of the message at the originator and at the addressee(s). This group of equipment will provide a rapid means of voice to printed record communications on a user-to-user basis. This group of equipment will be used by high level users to transmit high precedence messages on a user-to-user basis and provide a record thereof for reference purposes.

Utilization of these equipments at the user's office will reduce the number of operators required and will improve the delivery time of information from the originator to the addressees.

Technical Characteristics. Undetermined.

Availability Data.

Availability of equipment cannot be determined until after approval and initiation of a research and development project.

8-25. AUTOMATIC CIRCUIT QUALITY MONITOR AND CONTROL

Purpose.

To provide a means to automatically monitor digital and analog signals transmitted by various media.

Employment.

This equipment will be used in STARCOM technical control centers.

Description.

This is a proposed research and development program for development of a group of equipments which will automatically monitor digital and analog signals transmitted via cable, line-of-sight, troposcatter, high frequency, or satellite facilities. Upon detection of preset adjustable thresholds such as distortion, envelope delay, amplitude, frequency translators, etc., a suitable output will be provided to a manual or automatic circuit control. This group of equipment will be used to automatically detect circuit parameters which fall within certain preset thresholds and permit a full time automatic monitoring of all digital and analog circuits. When a particular circuit parameter is outside the threshold limits, an alarm signal will be provided to manually controlled circuits and a correction signal will be provided to automatic controlled circuits.

Utilization of these equipments at technical control centers will reduce the number of technical control personnel and reduce the time required to detect potential circuit troubles.

Technical Characteristics.

Undetermined.

Availability Data.

Availability of this equipment cannot be determined until after approval and initiation of a research and development project.

8-26. INTEGRATED ANTENNA SYSTEM.

Purpose.

To provide an integrated system of antennas in an effort to improve the reliability of propagation of HF signals.

Employment.

This antenna system will be employed as transmitting and receiving antennas or long range (2500 miles and over) strategic communications circuits.

Description.

This is a research and development task which will consist of research studies and model development to determine the feasibility of achieving design of an antenna or an integrated system of antennas which will improve the reliability of propagation of HF signals by at least one order of magnitude and concurrently reduce installation requirements with respect to needed ground area, time, and cost. This R&D effort will include development of a "low take-off" antenna which will reduce the number of hops over long ranges and a study of the modes of propagation utilized by such antenna. Initial design features will include controllable azimuthal and vertical directivity. Advanced design will incorporate the feature of automatic electronic selection by the antenna of the existing optimum mode of propagation. The antenna or antenna system will be a fixed installation with maintenance requirements only as determined by exposure to the meteorological elements prevalent at the particular installation.

The antenna or antenna system developed will be employed as transmitting and receiving antennas on long range (2500 miles and over) strategic communication circuits. No logistic support beyond original installation and regular preventive maintenance for exposure to the elements will be needed.

Technical Characteristics. Undetermined.

Availability Data.

This antenna system is being developed to support the "Army 85" concepts.

8-27. TELETYPEWRITER, KSR
TTY Corporation Model 37

Purpose.

To provide a keyboard send-receive teletypewriter set capable of operating at 150 wpm ASCII Code.

Employment.

The Model 37 will be used in conjunction with computers in data processing systems.

Description.

The Model 37 KSR Teletypewriter Set operates at the rate of 15 characters per second (150 wpm). It is designed to use 8-level code including "even" parity and can be equipped to operate on any 5, 6, 7, or 8-level code including "odd" parity if desired. The Model 37 keyboard generates codes for both upper and lower case letters. All non-code generating keys have been removed from the keyboard and placed on the printer. Two SHIFT keys and two CONTROL keys have been provided for greater ease in touch typing. The SHIFT keys can be locked in place by the SHIFT LOCK key to type all upper case characters. CONTROL codes can be generated from either the upper or lower case shift. The REPEAT key is no longer required. Characters may be repeated by depressing the key below the normal "down" position. The keyboard provides parallel output, and like the printer, can be adapted to meet most code arrangements up to eight levels. The keyboard output is serialized by an electronic distributor.

Technical Characteristics.

Typing Unit

Signal Input	Serial.
Code Levels	Eight.
Operating Speed	100 and 150 wpm.
Paper Type	Friction Feed Platen: Maximum width - 8½ in. Maximum Diameter - 5 in. Sprocket Feed Platen: Maximum width - 9½ in. Width between hole centerlines - 9 in.

CCP 105-4

Keyboard Unit

Signaling Code

Levels	Eight.
Mark	48 V dc, ma.
Space	OPEN.
Parity	EVEN.

Availability Data.

Two each Model 37 KSR's will be tested during 1st Qtr FY-69.

TELETYPEWRITER, MODEL 37

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