

COMSAT

RESPONSES TO QUESTIONS

Q1. How do you propose to transmit the 300 KHz wideband FM signal via the Quantico to Key Building Microwave System?

A. It is COMSAT's understanding that the 300 KHz signal referred to above consists of a baseband signal with frequencies ranging from 60 KHz to 128 KHz (300 KHz refers to nominal carrier deviation). This signal will be applied to channel 3 of the service channel converter (see paragraph 3.9.2 of COMSAT International's proposal). Channel 3 has a baseband bandwidth of 16 KHz to 130 KHz. The output of the service channel converter will be a single sideband suppressed carrier signal at a nominal frequency of 9.023 MHz. This signal will be combined with the video and program audio carriers and will then be frequency modulated directly onto the terrestrial microwave link carrier and transported over the microwave facilities to the Quantico earth station. At the Quantico earth station all signals will be demodulated to baseband frequencies before being remodulated onto their assigned earth station SCPC carriers. Similarly, the SCPC carriers from the satellite are demodulated to baseband at Quantico and remodulated onto the terrestrial microwave link carrier for transmission to Rosslyn.

Q2. The RFP calls for one each 300 KHz wideband FM/SCPC channel. Your proposal talks about 60 KHz modulators and demodulators (pg. 250). How do you explain this? On page 3-22, the technical characteristics of the FM/SCPC exciter appears to satisfy the 300 KHz requirement. Please clarify.

A. As explained in question one above, it is COMSAT International's understanding that the 300 KHz wideband FM/SCPC signal actually refers to a baseband signal of 60 KHz to 128 KHz with a nominal RMS test tone deviation of 300 KHz. This carrier has been referred to alternately as a 60 KHz or a 300 KHz wideband FM/SCPC carrier. Therefore, the 60 KHz modulators/demodulators imply the 300 KHz RMS deviated carrier.

The technical specifications provided on page 3-22 of the COMSAT International proposal are the specifications of the exciter which COMSAT International proposes to use for the above referenced wideband FM carrier. The modulator will accept a baseband signal in the range of 4 KHz to 156 KHz. The deviation will be set so that a nominal test tone level will provide a carrier deviation of 300 KHz RMS.

-2-

Q3. It is mandatory to know who manufactures the proposed antenna and equipment along with copies of their data sheets (specifications). For example, page 3-21 states that the wideband SCPC receiver is tunable by front panel thumbwheel switches over 3.7 to 4.2 GHz while table 3-7 makes no mention of the receiver being tunable.

A. Attachment 1 provides the manufacturers and model numbers of the proposed equipment and copies of all currently available manufacturer's data sheets.

Q4. RFP says dedicated to FBIS. Introductory letter says otherwise, please clarify.

A. COMSAT International proposes an earth station dedicated to FBIS service, and the rate for FBIS service does not assume additional traffic. However, we would like to point out that it may be advantageous for FBIS to share this earth station with circuits of such other users as are acceptable to FBIS.

Q5. Is microwave hot standby?

A. Since the proposed microwave system consists of high quality, highly reliable equipment, COMSAT International has concluded that hot standby equipment will not be required in the basic proposal in order to maintain the 99% overall system availability specified in the RFP. COMSAT International has, however, proposed hot standby microwave equipment as an option.

Q6. Are there subcarriers other than 6.6 or 6.65?

A. Audio subcarrier frequencies of 6.60 and 6.65 MHz are standard TV audio subcarrier frequencies used in the Intelsat system for the transmission of 525 and 625 line television signals of NTSC, PAL and SECAM formats. The modulator and demodulator which COMSAT International has selected for the FBIS television transmission may be operated at audio subcarrier frequencies anywhere from 5.8 to 8.3 MHz. As the INTERNET television signals are carried in a dedicated transponder, the audio subcarriers need not adhere to standard Intelsat practices, and the frequency selected for INTERNET service will assure the proper transmission of the NTSC, PAL and SECAM television signals. The audio and video interface at Rosslyn will be for all television standards at baseband (video: 1 volt p-p, 75 ohms; audio: 0 dBm, 600 ohms balanced). See also Table 3-8 of our proposal.

-3-

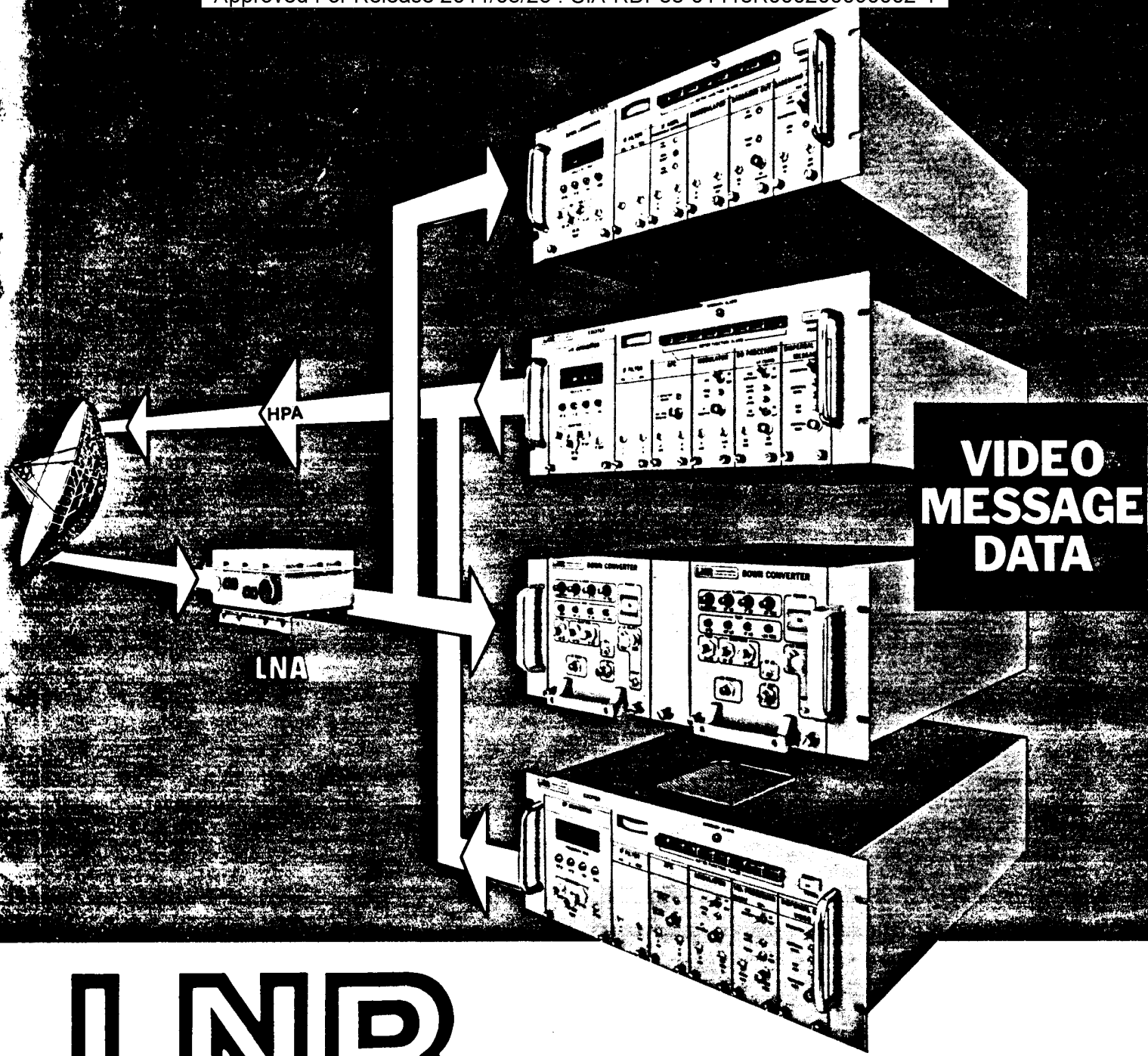
Q7. Unattended operation? Define meaning per RFP.

A. As described in Section 5.1 of the COMSAT International proposal, we propose 24-hour per day, 7 days per week manning of the Quantico earth station during the first year of operation. Toward the end of the first year, the need for 24-hour manning should be reevaluated by FBIS and COMSAT International. Thus, Section 5.7 of our proposal applies to possible operation in later years if the station is not manned. It is under this type of operation that a technician would be dispatched periodically (Section 5.7.2) to perform preventive maintenance routines and to conduct operational checks. We regret the lack of clarity regarding this in Section 5.7.2 and the error in the Cost proposal regarding the proposed O&M approach.

Equipment List and Copies of Manufacturer's Data Sheets of Major Items (Basic Proposal)

<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
<u>Earth Station</u>		
a. Antenna, 15 meter, C-band	Vertex	5265
b. LNA, 35K	LNR	NC4335
c. Klystron, 3.35K	LNR	YZU-27006/GEN II
d. Upconverter	LNR	p/o UEV6
e. Downconverter	LNR	p/o DRV4
f. Modulator/Demodulator 15 KHz	Coastcom	412
g. Modulator/Demodulator 8 KHz	Coastcom	412
h. Modulator, 4-156 KHz	STS	Mod 700
i. Demodulator, 4-156 KHz	STS	DEM 700
j. Modulator, TV	LNR	p/o UEV6
k. Demodulator, TV	LNR	p/o DRV4
l. Upconverter, C-band	STS	UC 6010
m. Downconverter, C-band	STS	DC 4010
n. Group Delay Equalizer	STS	DEQ 700
<u>Terrestrial Microwave Equipment</u>		
a. Microwave Transceiver Unit 2 CH	MACOM	MA23VFM
b. Microwave Transceiver Unit, 2 CH	MACOM	MA-6G
c. Program Channel Modulator	MACOM	PAC10
d. Program Channel Demodulator	MACOM	PAC12
e. Service Channel Converter 130 KHz	MACOM	SC1
f. Antenna, Microwave*	Andrew	---
g. Dehydrator*	Andrew	4025A

* Data sheets not available at present.



LNR

COMMUNICATIONS  INC.

UPLINK/DOWNLINK

GROUND COMMUNICATIONS EQUIPMENT

FOR SATELLITE EARTH STATIONS

LNR MODULAR SATELLITE FM RECEIVERS**Series DRM4 FM/FDM Message Receiver****Series DRV 4 Intelsat Video Receiver****MONITOR AND ALARM FUNCTIONS**

The following status facilities are standard:

PERFORMANCE PARAMETER	MONITORS AND TEST POINTS		ALARMS	
	LOCAL	REMOTE	LOCAL	REMOTE
Downconverter Local Oscillator (RF)	Meter & TP BNC	Analog	Light	—
Phase Lock Voltage		—	—	—
RF Output				
Downconverter Local Oscillator (IF)	Meter & TP BNC	Analog	Light	—
Phase Lock Voltage		—	—	—
RF Output				
RF Input Test	Dir Coupler-BNC	—	—	—
Synthesizer Voltage	TP	—	—	—
IF AGC (IF Level)	Meter	Analog	Light	Form C Contact
IF Spectrum	BNC	—	—	—
Baseband Pilot*	Meter	Analog	Light	Form C Contact
Out-Of-Band Noise (OBN)*	Meter	Analog	Light	Form C Contact
Baseband/Video	BNC	—	—	—
Main Frame ±15 VDC	Meter	Analog	Light	—
+ 5 VDC	Meter	Analog	Light	—
+24 VDC	Meter	Analog	Light	—
SUMMARY			Light	Form C Contact

*Optional

PERFORMANCE SPECIFICATIONS**Input**

Frequency Range 3.7 to 4.2 GHz
 Impedance 50 Ohms
 Return Loss 23 dB (typ) 21 dB (min)
 Carrier Type 12 to 1872 Channels, FM/FDM 525/625 Line Video (Switchable)
 Signal Level Range -75 to -35 dBm Typical

RF/IF

Noise Figure 12 dB (typ) 15 dB (max)
 First IF Frequency Above 1 GHz
 Tuning (Dual Conversion) Synthesized, thumbwheel-tunable (Model DRM4-D3)
 Step Size: 125 KHz (other increments available)
 Optional: Fixed Freq. (—D1) or agile multifreq. (—D2), crystal controlled.
 Local Oscillator Stability 5×10^{-7} /day
 IF Filter Bandwidths 1.25 to 36.0 MHz (Message)
 36, 30 and 17.5 MHz (Video)
 AGC Amplifiers 40 dB Dynamic Range
 Image Rejection 75 dB (typ) 70 dB (min)

Output (DRM Message Receiver)

Baseband Frequency ±0.25 dB, 12 KHz to 6 MHz; ±0.5 dB, 4 KHz to 10 MHz
 Baseband Level (Test Tone) Adjustable, -15 to -30 dBm/channel
 Level Stability ±0.2 dB/day
 Deemphasis CCIR Rec. 464
 Impedance 75 Ohms (unbal.)
 Return Loss 26 dB (min)
 Baseband Squelch Activated by Summary Alarm (with bypass for test)

Output (DRV Video Receiver)

Video Format 525 or 625 lines
 Baseband ±0.25 dB, 20 Hz to 4.2 MHz; ±0.4 dB to 8 MHz
 Deemphasis CCIR Rec. 405-1
 Baseband Level (composite video) Adjustable, 1 V p-p
 Impedance 75 Ohms (unbal.)
 Return Loss 26 dB (min)
 Clamp Rejection 30 dB (min)
 Differential Phase and Gain Exceeds ICSC and EIA RS-250B requirements
 Baseband Squelch Activated by Summary Alarm (with bypass for test)

General

Prime Voltage 115 VAC or 230 VAC ±10% (other voltages available)
 Line Frequency 47-63 Hz
 Power 120 Watts
 Dimensions/Weight 7.0 x 19 x 22 inches (17.8 x 48.3 x 56 mm), 52 lbs. (24 kg.)
 Connectors (RF In/Baseband Out) Type N female/type BNC female

LNR MODULAR SATELLITE FM EXCITERS
Series UEM6 FM/FDM Message Exciter
Series UEV 6 Intelsat Video Exciter

MONITOR AND ALARM FUNCTIONS

The following status facilities are standard:

PERFORMANCE PARAMETER	MONITORS AND TEST POINTS		ALARMS	
	LOCAL	REMOTE	LOCAL	REMOTE
Upconverter Local Oscillator (RF)	Meter & TP BNC	Analog	Light	—
Phase Lock Voltage		—	—	—
RF Output				
Upconverter Local Oscillator (IF)	Meter & TP BNC	Analog	Light	—
Phase Lock Voltage		—	—	—
RF Output				
RF Input Test	Dir Coupler-BNC	—	—	—
Synthesizer Voltage	TP	—	—	—
IF Level	Meter	Analog	Light	Form C Contact
IF Spectrum	BNC	—	—	—
Baseband Level	Meter	Analog	Light	Form C Contact
AFC	Meter	Analog	Light	Form C Contact
Dispersal Monitor	BNC	—	—	—
Baseband/Video	BNC	—	—	—
Main Frame ± 15 VDC	Meter	Analog	Light	—
+ 5 VDC	Meter	Analog	Light	—
+ 24 VDC	Meter	Analog	Light	—
SUMMARY			Light	Form C Contact

PERFORMANCE SPECIFICATIONS

Output
 Frequency 5.925 – 6.425 GHz
 Impedance 50 Ohms
 Return Loss 23 dB (typ) 21 dB (min)
 Carrier Type 12 to 1872 Channels, FM/FDM 525/625 Line Video (Switch Selectable)
 Signal Level (1dB compression) – 5 dBm (Standard)
 optional output level up to + 10 dBm available.
 Muting Activated by Summary Alarm (with bypass for test)

RF/IF
 Tuning (Dual Conversion) Synthesized, thumbwheel-tunable (Model UEM6-D3).
 Step Size: 125 KHz (other values available).
 Optional: Fixed Freq. (—D1) or agile multifreq. (—D2), crystal controlled.

First IF Frequency Above 1 GHz
 Local Oscillator Stability 2.5 x 10⁻⁷/day (Higher stabilities available)
 IF Filter Bandwidths 1.25 to 36.0 MHz (Message) 36, 30, and 17.5 MHz (Video)
 IF Level Control 15 dB range (min)

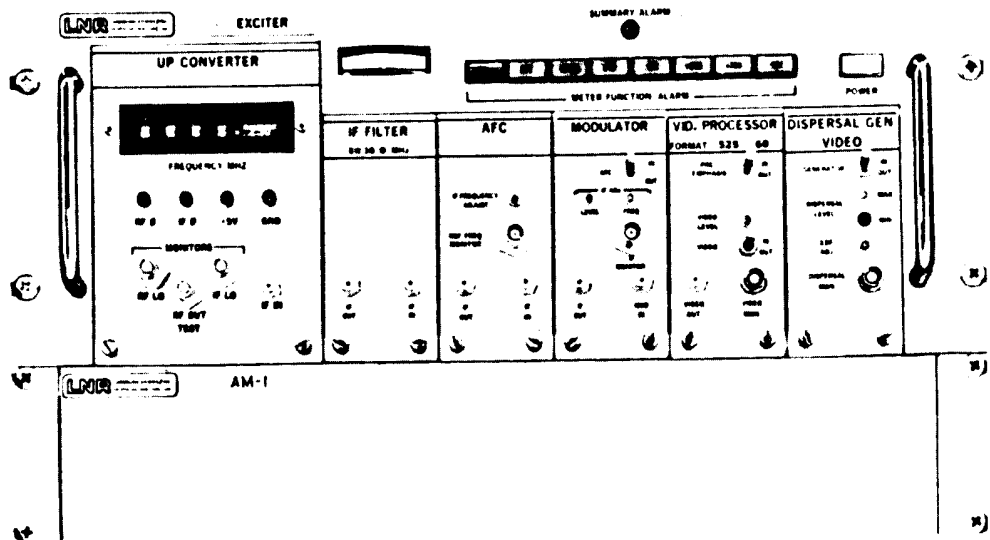
Input (Model UEM6 Message Exciter)
 Baseband Frequency* ±0.25 dB, 12 KHz to 6 MHz ±0.5 dB, 4 KHz to 10 MHz
 Baseband Level Fixed Level Between – 20 to – 40 dBm/channel
 Level Stability ±0.2 dB/day
 Preemphasis CCIR Rec. 464
 Pilot Level – 20 dBm0
 Pilot Frequency 60 KHz (above baseband optional)
 Impedance 75 ohms (unbal)
 Return Loss 26 dB (min)
 Energy Dispersal Frequency 20 to 150 Hz continuously variable
 Energy Dispersal Stability ±1 Hz
*Roofing filter limits response to fmax

Input (Model UEV Video Exciter)
 Baseband Frequency ±0.25 dB, 20 Hz to 4.2 MHz ±0.4 dB, to 8 MHz
 Preemphasis CCIR Rec. 405-1
 Level 1 V p-p composite video
 Level Stability ±0.2 dB/day
 Impedance 75 ohms unbalanced
 Return Loss 26 dB (min)
 Differential Phase and Gain Exceeds ICSC and EIA RS-250B requirements
 Peak Deviation Up to 12 MHz
 Energy Dispersal Frequency 25/30 Hz synchronized to frame rate (525/625 video)
 Energy Dispersal Deviation 1 MHz p-p with video; 2 MHz p-p without video

General
 Prime Voltage 115 VAC or 230 VAC ± 10% (Other Voltages Available)
 Line Frequency 47-63 Hz
 Prime Power 120 Watts
 Dimensions/Weight 7.0 x 19 x 22 inches (17.8 x 48.3 x 56 mm); 52 lbs. (24 kg)
 Connectors (Baseband in/RF out) Type BNC female/Type N female

AUDIO SUBCARRIER VIDEO EQUIPMENT

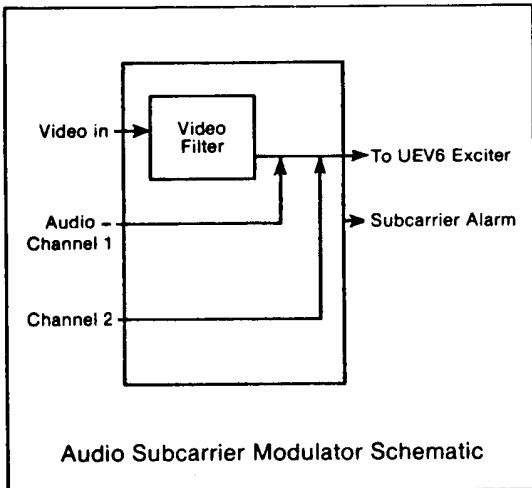
LNR offers Audio Subcarrier Modulators and Demodulators as part of its line of Video Exciters and Receivers. The audio subcarrier equipment will diplex one or two FM subcarriers with the normal video baseband signal to transmit TV-Associated Audio as a composite signal. The TV-Associated Audio may include sound programs, cue or commentary channels, or coordination circuits.



LNR Model		Application	FM Subcarrier Frequency (MHz)	Remarks
Exciter UEV6-D3 (xxx)	Receiver DRV4-D3 (xxx)			
AM-1	AD-1	INTELSAT	6.60 or 6.65 (Switchable)	Meets INTELSAT Spec BG-35-78E
AM-D1	AD-D1	Domsat (Single Channel)	6.8	Meet Telesat and Similar Domsat Specs.
AM-D2	AD-D2	Domsat (Dual Channel)	6.17 and 6.8	

SPECIFICATIONS

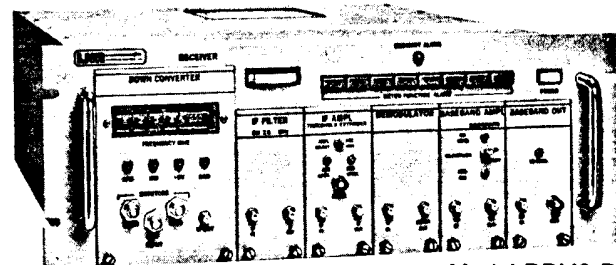
- Audio Gain—Frequency Response ±0.5 dB, 50 Hz to 15 KHz
- Input Impedance 600 Ohm (bal)
- Audio Test Tone Level (400 Hz) +8 dBm
- Audio Peak Program Level +18 dBm
- Audio Pre-emphasis 75 usec
- Audio Subcarrier Frequency 6.2 MHz (typ), other frequencies between 5.8 and 8.3 per customer request. Dual subcarrier option available.
- Audio Signal-to-noise ratio Meets INTELSAT ICSC and Domsat EIA RS-250B requirements
- Harmonic Distortion (400 Hz test tone) 1% Max at +8 dBm
- Test Audio Deviation of subcarrier 75 KHz peak (typ)
- Subcarrier Deviation of 70 MHz IF Carrier 1.5 MHz peak (typ)
- Video Deviation of 70 MHz IF Carrier 11.0 MHz peak (typ for full transponder)



SPECIAL FREQUENCY RECEIVERS · EXCITERS · CONVERTERS

LNR's Receivers and Exciters are adaptable to other frequency bands by simple interchange of the Frequency Converter Drawer which is accessible from the front panel. A 6 GHz FM/FDM Message Receiver, Model DRM6-D3 has been developed with the following features:

- Thumbwheel tunable from 5.925 to 6.425 GHz
- Synthesizer steps of 10 KHz
- Drawn-outter local oscillators phase-locked to internal or external 10 MHz reference (switchable).

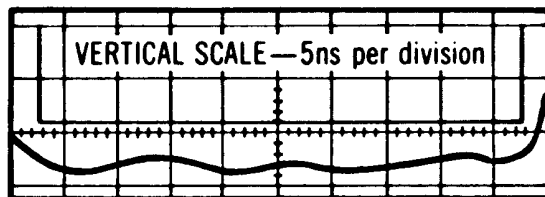


Model DRM6-D3

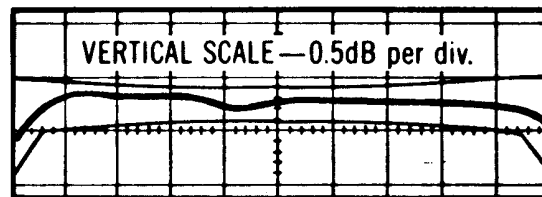
IF FILTER/EQUALIZER MODEL IF-70

- MEETS INTELSAT MASKS • LOW NOISE POWER RATIO AND RIPPLE • COMPUTER OPTIMIZED DESIGN • CUSTOM BANDWIDTHS AVAILABLE • VERY LOW DISTORTION • HIGH SKIRT SELECTIVITY • LIGHTWEIGHT, COMPACT • FOR MESSAGE, VIDEO, SCPC AND DATA • WIDE ENVIRONMENTAL TEMPERATURE RANGE • FAST DELIVERY

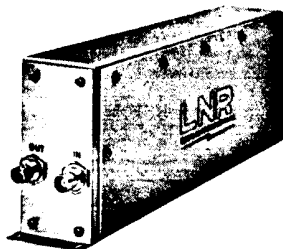
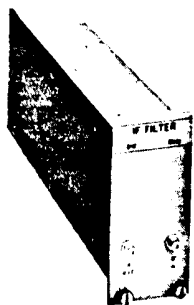
TYPICAL TEST RESULTS FOR IF-70B-7.5.



GROUP DELAY



AMPLITUDE

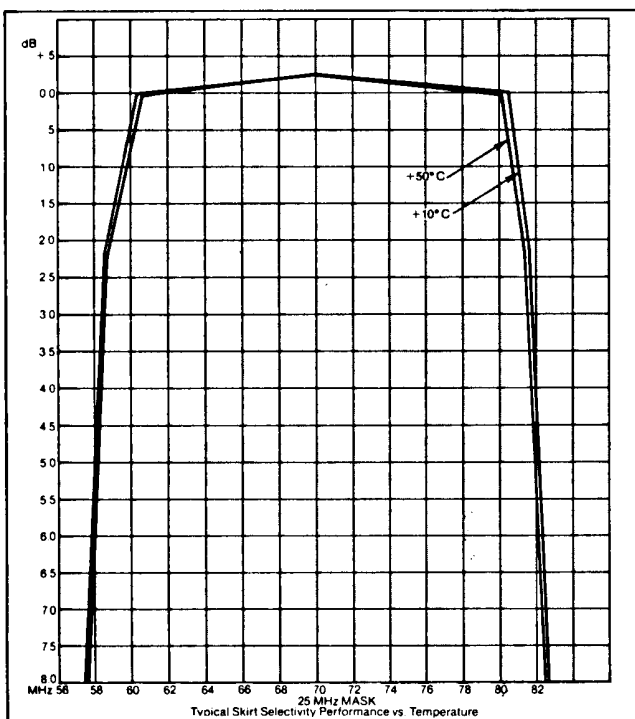


LNR's 70 MHz IF group-delay equalized filters are available in all INTELSAT message and video bandwidths, meet all INTELSAT mask specifications, and contribute exceptionally low Noise Power (typically 20 pwpo for 252 channels) when used in satellite communications systems. Ask for special data sheet and test results on the IF-70.

LNR's IF Filters employ high quality components with low temperature coefficients and realize excellent performance over the 0 to +40° C temperature range. Rugged construction assures mechanical stability and high reliability.

SPECIFICATIONS:

- Center Frequency 70 MHz
- Bandwidth 1.25 to 36 MHz
- Amplitude & Group Delay Responses Meets INTELSAT mask requirements or BG-28-72E
- Input & Output Impedance 75 ohms, unbalanced
- Input & Output Return Loss 20 dB min. over "A" band
- Insertion Loss 20 dB ± 1 dB
- Power Input Completely passive, none required
- Input/Output Connectors Sealectro (others available upon request)
- Dimensions 2" x 4" x 10" excluding connectors and front panel

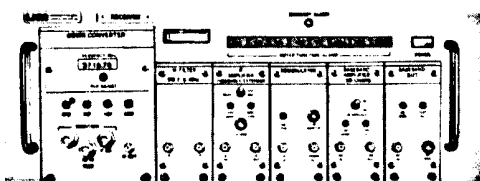


Order by Model Number as illustrated below:

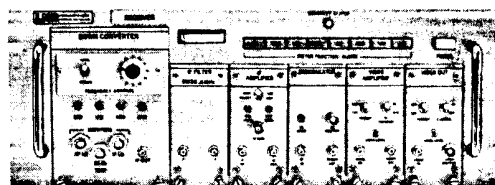
Model IF-70-7.5
 L channel size, MHz

Also available is the Model SIF-70, a 5 1/4" high by 19" wide rack-mount filter bank containing a full compliment of IF-70 Filters.

UP/DOWN CONVERTER OPTIONS



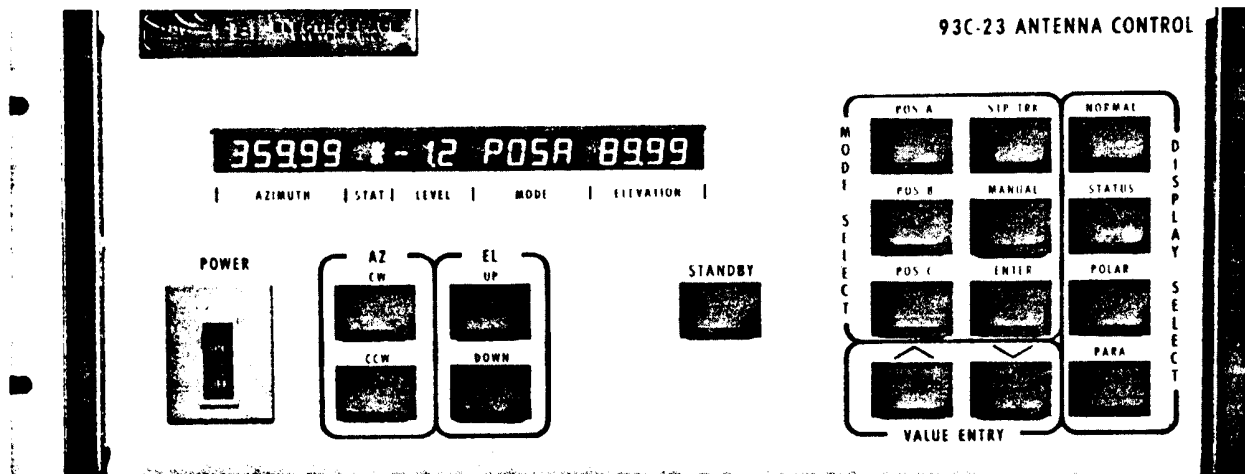
D1
 DRM4-D1
 Fixed Frequency Crystal Controlled



D2
 DRV4-D2
 Agile Multi-Frequency



93C-23 ANTENNA CONTROL UNIT



APPLICATION:

The ElectroSpace Systems, Inc. 93C-23 Control Unit is a microprocessor based controller for medium size antennas in satellite earth station service. This unit commands the antenna axis power drives to implement manual and automatic tracking and pointing control modes for medium size, steerable, parabolic reflectors. Potential applications include, but are not limited to, satellite communications, telemetry/controls and solar concentrators.

The 93C-23 is an all solid state, highly integrated design with multiple functions performed by the same hardware to provide a high level of reliability and maintainability. The many standard and optional features of this powerful unit are summarized herein.

- Precision, 14 bit (.022^o) standard or 16 bit (.0055^o) optional, Position Loop with Response Profiling
- Keyboard Data Entry and Recall
- Alphanumeric Display:
 - Dual Axis Position, .1^o standard or .01^o optional resolution
 - Mode Selection
 - Fault and Interlock Alarms
 - Parameter Recall and Monitor
 - Digital Signal Strength Meter
- Control Modes
 - Steptrack
 - Position Designate-Position A or B or C
 - Manual Rate
- Antenna Type Flexibility
 - Limited or Full Motion
 - AZ/EL, X/Y or HA/DEC
 - A.C. or D.C. Drive Capability

- Optional Polarization Capability
- Serial RS-232C/422 Computer or Modem Interface for Remote Supervisory Monitor and/or Control
- Internal Self-Test Interlocks
- Diagnostic Routines
- Tracking Channel Select (Auto) from 1 of 3 Inputs
- Non-Volatile Memory
- Default Mode Bypasses Microprocessor and Enables Manual Controls
- Absolute Position Alignment Offset Inputs Per Axis
- Discrete Command and Monitor Capability for other Earth Station Functions

The 93C-23 is operator oriented for ease of use. The display will indicate mode or a selected parameter during normal operation. Fault conditions are signalled by a flashing asterisk. The cause of the fault may be displayed by selecting STATUS from the Controller Keyboard.

SPECIFICATIONS:

Tracking Accuracy: 10% of received beamwidth RMS or better for beamwidths $\geq .20^{\circ}$

Position Control Accuracy: 0.1^o RMS standard or 0.04^o RMS optional

Remote Interface: a) Digital serial I/O per RS232C or RS422 c) Discrete Monitor: Contact Closure
b) Summary Fault Alarm Contact (Form C) d) Discrete Command: Relay Driver to Ground

Interface Connections: Mating Connectors - Included

Position Feedback: Hi-Level Synchro Transducer (Absolute Angle Measurement)

Steptrack Receiver Interface: DC Output Proportional to Signal Strength, $\pm 10V$ Analog

- a) Beacon Receiver with 2 Channel Select and +15V Control Line Capability
- b) Accepts Two Alternate Tracking Sources

Drive System Interfaces: Rate Commands - $\pm 10V$ Analog

Discrete Commands - Opto-isolated
Status Reporting - Fault Monitor Circuit in control system converts contact closures into status words that are available for display and fault reporting.

Drive System Configurations: The 93C-23 may be combined with several different Electrospace Systems, Inc. dual axis drive systems to reach the optimum performance at an economical price. The D.C. controller is a 1 ϕ , SCR based design with closed loop compensation for both current and rate. The A.C. controller consists of several power and solid state relays with associated circuitry. For AC systems, antenna velocities should be in the range of $.5/(D)(F)$ to $1.5/(D)(F)$ where "D" is Dish Diameter in meters and "F" is Receive Frequency in GHZ. Possible Drive System Configurations are:

Type of Motor	Motor Size	Configurations Available	Drive Unit Dimensions
A.C.	Up to 1/2 Hp, 1 ϕ	Control unit and the drive system are packaged together in the 93C-23 rack mount drawer	See 93C-23 dimensions below. Weight: 20Kg (45 pounds)
A.C.	Up to 3 Hp, 3 ϕ & Up to 1 Hp, 1 ϕ	a) Control unit is rack mounted and the drive system is wall mounted in a NEMA enclosure b) Control unit is rack mounted and the drive system is rack mounted in a separate enclosure	67.3cm (2.65'') high x 23.7cm (9.34'') deep x 61.0cm (24.0'') wide Weight: 23Kg (50 pounds) 17.8cm (7'') high x 45.7cm (18'') deep x 48.3cm (19'') wide Weight: 11Kg (25 pounds)
D.C.	Up to 1 HP	a) Control unit is rack mounted and the drive system is wall mounted in a NEMA enclosure. Motor transformer is internal to the enclosure. b) Control unit and drive system are separately rack mounted. Motor transformer is external to the enclosures.	51.6cm (20.3'') high x 17.8cm (7'') deep x 51.6cm (20.3'') wide. Weight: 23Kg (50 pounds) 8.9cm (3.5'') high x 45.7cm (18'') deep x 48.3cm (19'') wide Weight: 11Kg (25 pounds)

93C-23 Primary Power: 115V/220V, 60 HZ/50 HZ, 200 VA, Control Electronics Only

Dimensions: 17.8 cm (7'') high x 45.7 cm (18'') deep
48.3 cm (19'') wide rack mount, slides included.
Allow 7.6 cm (3'') in rear for connectors.

Weight: 18 Kg (40 pounds)

Shipping Weight: 36 Kg (80 pounds) (Export Packing Available)

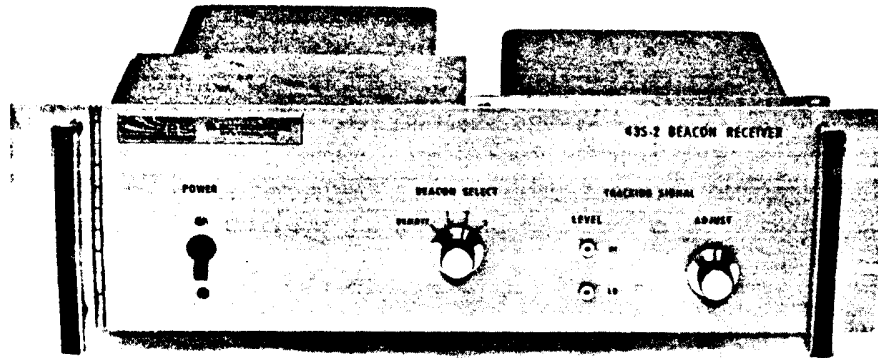
Operating Environment: 0 to 50 $^{\circ}$ C temperature, 90% humidity, non-condensing

Documentation: 1 Operation and Maintenance Manual is provided, including operation use and theory, part lists, schematics, assembly drawings and spares list.

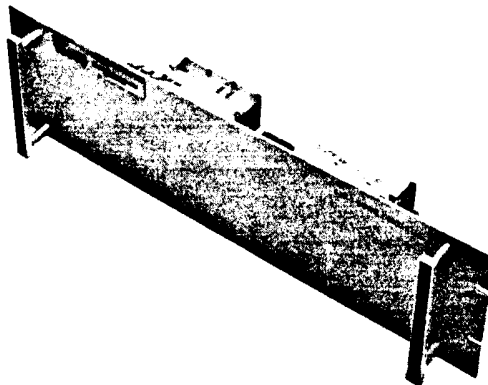
Cable: Position Transducers - 150 ft. total
Controls - 50 ft. total
Limits - 75 ft. total
Motor - 75 ft. total
Additional cable available as an option

The Electrospace Systems, Inc. Controls Division has designed, manufactured, and installed antenna control equipment on a worldwide basis for over a decade. As a result, Electrospace Systems, Inc. has a complete line of servo control equipment to support the many applications and implementation configurations of the 93C-23 antenna control unit. This equipment includes:

- Servo Drive System (previously discussed)
- Steptrack Beacon Receiver
- 4/12 GHz Tracking Down Converters
- Motor Drive Assemblies
- System Cabling
- Precision Position Synchro Data Gearboxes
- System Simulation Tracking Analysis
- Solar Sensors



43S-2 BEACON RECEIVER
13.3 cm (5.25") high x 22.9 cm (9") deep x 48.3 cm (19") wide



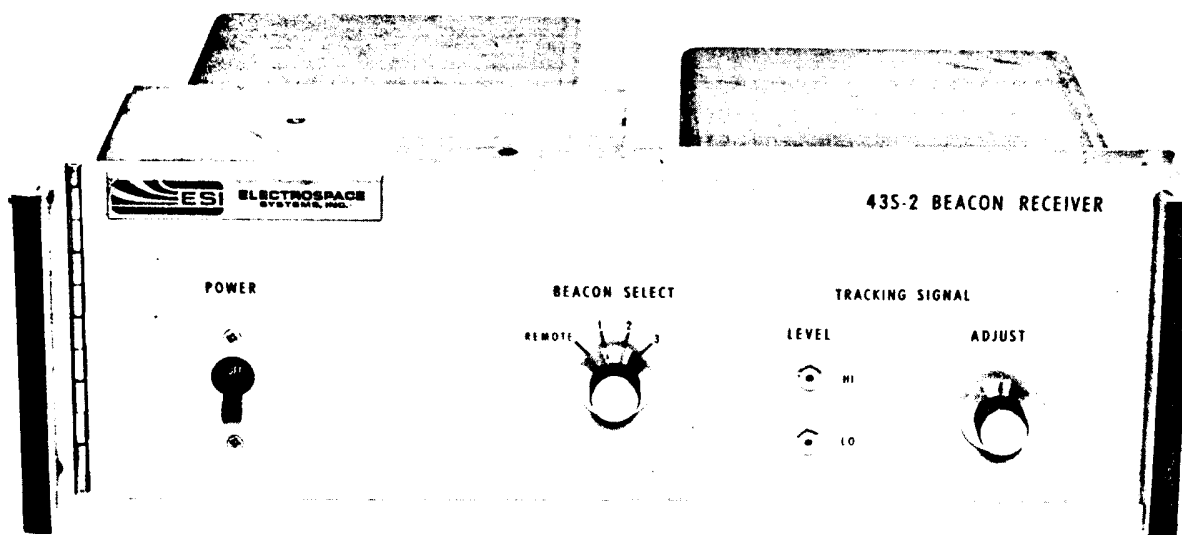
63R-1 DOWN CONVERTER
13.3 cm (5.25") high x 7.6 cm (3") deep x 48.3 cm (19") wide



P.O. Box 1359 Richardson, Texas 75080 (214) 231-9303 TWX 910-867-4768



43S-2 BEACON RECEIVER



APPLICATION:

The ElectroSpace Systems 43S-2 Beacon Receiver is designed for use with steptrack antenna control systems in international and domestic satellite communication earth stations. It provides a choice of up to three signal frequencies for autotrack operation. This results in high availability through redundancy of signal sources. Signal strength, as measured in a satellite beacon channel, is received, conditioned and provided to the steptrack servo system for RF-beam peaking purposes.

FEATURES:

In contrast to other available communication and beacon receivers, the 43S-2 is unique in that it contains only the necessary components to accomplish the steptracking function. An adjustable attenuator allows the user to compensate for weak or strong beacon signals at the earth station locations. Manual beacon selections are made at the front panel. The remote selection allows any of the beacon channels to be selected externally.

OPERATIONAL CHARACTERISTICS:

The Beacon Receiver provides an accurate dc voltage proportional to the RF signal level, stable to within an equivalent of ± 0.5 dB of signal level over the normal operating temperature range.

OPTIONS:

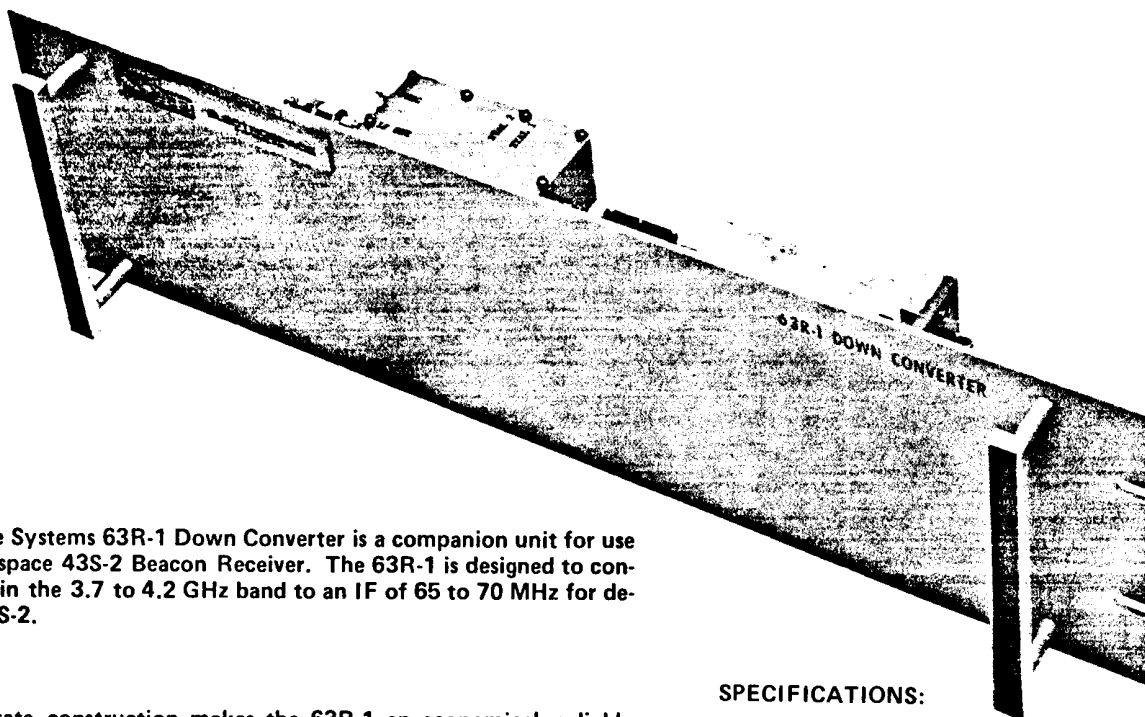
Beacon Frequency choices provided with 2 channels, 3rd channel optional.

SPECIFICATIONS:

Center Frequency: 65/70 MHz Nominal (others available)
 Input Impedance: 50 ohms Unbalanced (VSWR 1.5:1)
 Input RF Level: (Manually Adjustable)
 Maximum: -20 dBm
 Minimum: -62 dBm
 Dynamic Range: 8 dB
 Receiver Noise Figure: 10 dB
 Predetection Bandwidth: 200 kHz
 AFC Range: ± 100 kHz
 Output: D.C. level dependent on signal strength
 Gradient: .85 v/dB Nominal
 Range: +3 V dc to +12 V dc
 Stability: ± 0.5 dB over temperature
 Operating Temperature: 0°C to 50°C
 Humidity: 95% non-condensing
 Input Power: 115/230 V, 50/60 Hz, 50 VA
 Dimensions: 5 1/4" H x 19" W x 9" D (13.3 x 48.3 x 22.9 cm)
 NOTE: The front panel is hinged on the left side for maintenance access.
 Weight: 9 Pounds (4.1 Kg)
 Shipping Weight: 15 Pounds (6.8 Kg)
 Shipping Volume: 2 Cubic Feet (.05 cu m)



63R-1 DOWN CONVERTER



APPLICATION:

The ElectroSpace Systems 63R-1 Down Converter is a companion unit for use with the ElectroSpace 43S-2 Beacon Receiver. The 63R-1 is designed to convert frequencies in the 3.7 to 4.2 GHz band to an IF of 65 to 70 MHz for detection in the 43S-2.

FEATURES:

Modular, solid-state construction makes the 63R-1 an economical, reliable unit for use in satellite tracking systems. The oscillator is crystal controlled for accuracy and long term stability. Careful attention to impedance match, mixer performance, and noise contribution allows the down converter to maintain 40 dB of linear gain from -60 dBm to -100 dBm input.

OPERATIONAL CHARACTERISTICS:

The 63R-1 provides a down converted beacon with an RF to IF gain of nominal 40 dB (38 dB min.). Installation consists of two RF cable connections and a D.C. supply connection (+15V normally provided by 43S-2). No adjustments are required.

OPTIONS:

Related 63R-X down converters are available for operation in the X and Ku-Bands. Versions exist with multiple local oscillators to address beacon tones with greater than 5 MHz separation such as INMARSAT, INSAT, and DSCS.

ORDERING INFORMATION:

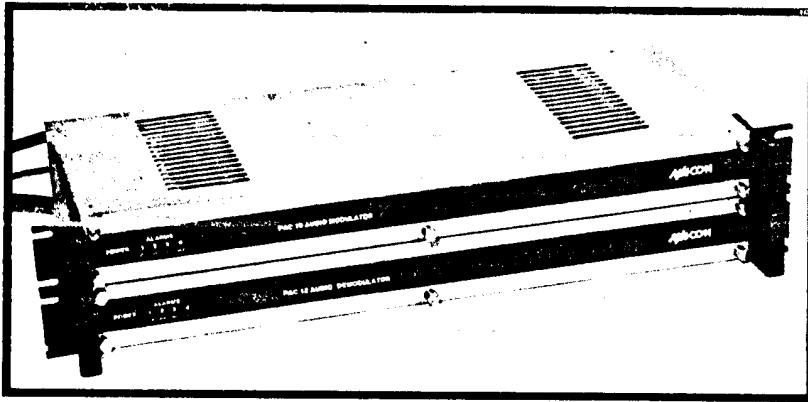
To order, specify RF and IF frequencies. Maximum frequency separation 5 MHz.

SPECIFICATIONS:

Input Power: +15V dc at 160 MA
Input/Output Impedance: 50 ohms unbalanced (VSWR 1.2:1)
RF Input Frequencies: 3.7 - 4.2 GHz, any specified 5 MHz segment within this band.
RF Input Level: -60 to -100 dBm
RF Output: 65 to 70 MHz (others available)
RF-IF Gain: 38 dB Min., 40 dB nominal
Image Rejection: 45 dB Min.
Noise Figure: 10 dB Max.
L.O. Reradiation: -60 dBm
Frequency Stability: ± 5 parts in 10^6
Temperature: 0°C to 50°C operating
Humidity: 95% non-condensing
Connectors: Type N Input, BNC Output
Dimensions: 5.25" H x 19" W x 3" D (13.3 x 48.3 x 7.6 cm)
Weight: 3 Pounds (1.4 Kg)
Shipping Weight: 10 Pounds (4.5 Kg)
Shipping Volume: 2 Cubic Feet (.05 cu m)



P.O. Box 1359 Richardson, Texas 75080 (214) 231-9303 TWX 910-867-4768



PAC-10/PAC-12 PROGRAM AUDIO CHANNEL SYSTEM

DESCRIPTION. The PAC-10 Subcarrier Modulator and PAC-12 Subcarrier Demodulator provide a cost effective means of transmitting and receiving high quality program audio information over conventional microwave relay equipment.

The "outstanding" headroom of the PAC-10/PAC-12 System allows the user to handle those "hot" program sources available in today's competitive environment. This extended headroom keeps the total harmonic distortion at an imperceptible level.

The PAC-10/PAC-12 System conforms to the proposed RS-250C differential phase and gain standards for individual left and right stereo transmission. For those applications requiring composite multi-channel sound transmission request M/A-COM's Bulletin MAC-MCS.

The "slim-line" PAC-10/PAC-12 System can accommodate up to four PAC-10 Subcarrier Modulators or PAC-12 Subcarrier Demodulators in a single rack space. This along with the optional "slim-line" HSB-10/HSB-12 Hot Standby Switch provides efficient use of precious rack space.

APPLICATION. The PAC-10/PAC-12 program audio channel system provides the ability to insert audio subcarriers above the video channel in conventional microwave relay systems. The efficient use of this unused spectrum gives the system's engineer a solution for those troublesome "housekeeping" chores. The ability to transmit and receive various program audio sources, alarm reporting, status monitoring, and remote control provide an effective means of controlling costs while maintaining performance.

The PAC-10/PAC-12 System operates on its own internal 115 Vac Power Supply. Optional power sources are 220 Vac or an external dc power supply. A barrier strip is provided in the dc format for easy connection.

The PAC-10/PAC-12 System comes equipped with a carrier alarm detector. Four red LED's on the front panel indicate which module has failed as well as providing a summary alarm to a rear mounted 9 pin "D" type connector (mating connector supplied). This alarm is configured for "fail-safe" operation and provides a Form C interface.

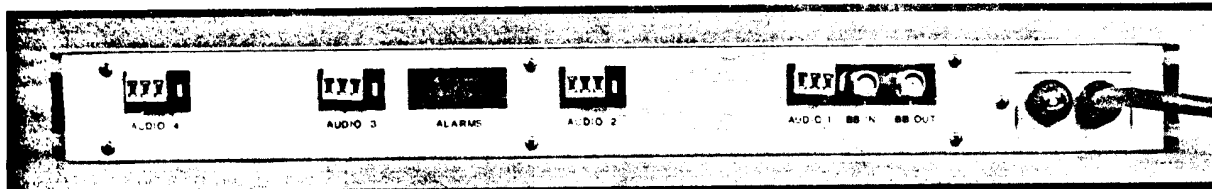
The PAC-10/PAC-12 removable front panel provides ready access for servicing needs.

FEATURES

- "Outstanding" Head Room and THD
- "Slim-Line" – Four Channels for One Rack Unit of Space
- Plug-In Circuit Card Expansion
- Carrier Alarm Equipped With Dual Interface Form-C Contacts
- Frequencies
 - Domestic – 4.83, 5.2, 5.8, 6.2, 6.8, 7.5, and 8.3 MHz
 - International – 7.023, 7.5, 8.065, 8.3, and 8.59 MHz
- Front Accessible

OPTIONS

- 220 Vac or DC Power Supply
- HSB-10/HSB-12 Hot Standby



PAC-10/PAC-12 Rear View

SPECIFICATIONS

GENERAL

Subcarrier Frequencies
 Domestic 4.83, 5.2, 5.8, 6.2, 6.8, 7.5, and 8.3 MHz
 CCIR 7.023, 7.5, 8.065, 8.3, and 8.59 MHz
 Alarm
 Fault loss of subcarrier or prime power
 Indication front panel LED 1-4
 Output Form C Contact – all connections available

ENVIRONMENTAL CONDITIONS

Ambient Temperature
 Operational - 30 to +55°C
 Meets All Specs + 10 to +40°C
 Relative Humidity 0 to 95% (+ 10 to +40°C)

PHYSICAL CHARACTERISTICS

Size 1.75" (h) x 19" (w) x 7.5" (d)
 (4.5 x 4.8 x 1.9 cm)
 Weight 7 lbs. (3.2 kg)

PRIMARY POWER

AC Model 120 Vac
 Standard
 Optional 220 Vac
 DC Model (For 4 Channel Operation)
 + 12 Vdc 350 mA
 - 12 Vdc 150 mA

SYSTEM PERFORMANCE*

Frequency Response (Ref 1 kHz @ 20 dB below TT)
 40 Hz to 100 Hz +0.5 dB, -1.0 dB
 100 Hz to 7.5 kHz ±0.5 dB
 7.5 kHz to 15 kHz +0.5 dB, -1.5 dB
 Distortion (THD) @ 75 kHz Deviation** less than 1%
 Signal-to-Noise Ratio (Ref to 75 kHz TT Level) 70 dB

PAC-10 MODULATOR

Audio Levels
 Input Level (@ 75 kHz Deviation)*** +8 dBm (1 kHz TT)
 Impedance 600 ohm balanced
 Return Loss 26 dB
 Pre-Emphasis (Can be strapped flat.)
 Standard 75 μs
 Optional 50 μs
 RF Subcarrier Output
 Modulation FM
 Level (P-P) 100 mV, nominal
 Adjustable (P-P) 50 to 150 mV
 Impedance High Z Bridging, approximately 1.5K
 Deviation (1 kHz TT) 75 kHz

PAC-12 DEMODULATOR

Audio Levels
 Output Level (@ 75 kHz Deviation)*** +8 dBm (1 kHz TT)
 Adjustment Range 0 to +8 dB above TT level
 Impedance 600 ohm balanced or strappable to less than 50 ohms
 Return Loss 26 dB
 RF Subcarrier Input
 Level (P-P) 50 to 150 mV
 Impedance High Z Bridging, approximately 1K

All specifications are subject to change without notice.
 *All specifications meet or exceed RS-250B and CCIR standards.
 **System design allows for 10 dB peak operation above this value.
 ***System levels are factory preset for +8 dBm input/output. Levels between 0 and +18 dBm input or output can be specified.

PAC-10 MODULATOR OPERATION. The audio input is 600 ohm balanced. This input is attenuated by the deviation control. This control is accessible on the front edge of the printed circuit card. Deviation can easily be reset in the field without expensive test equipment. Audio input and output preamplifiers isolate the 75 μ s pre-emphasis. They also provide the necessary level to the varactor controlled VCO for proper deviation.

The ECL voltage controlled oscillator (VCO) derives its stability from a phase-locked loop frequency synthesizer. The reference oscillator is crystal controlled.

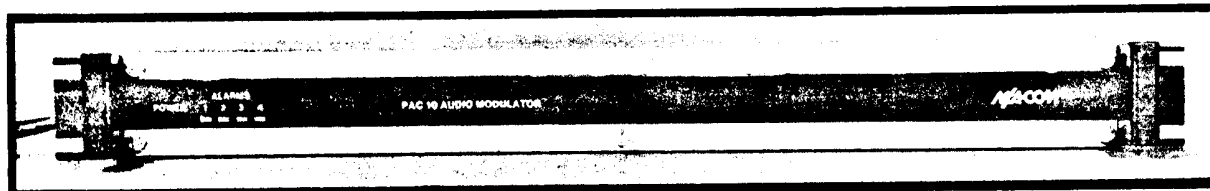
The tuned subcarrier amplifier filters the desired frequency. A subcarrier level adjust is also provided on the front edge of the printed circuit card. The output is high impedance for easy bridging on the video line.

An alarm detector samples the output level and compares it to a preset threshold. When this threshold is exceeded, an alarm LED on the front panel of the PAC-10 chassis is illuminated. There is also a saturated collector and Form-C interface available on the rear panel for remote alarming.

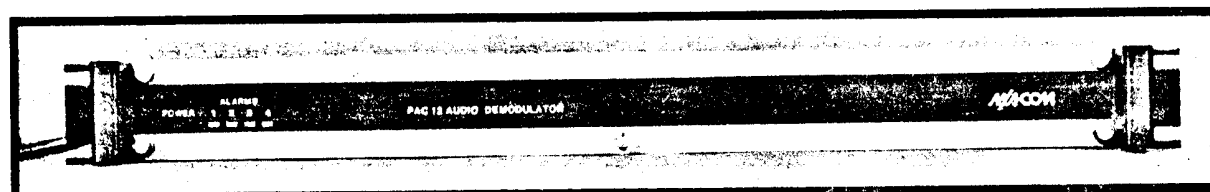
PAC-12 DEMODULATOR OPERATION. The demodulator input filter is fed composite baseband through a high impedance bridging buss on the backplane of the PAC-12 chassis. The bandpass filter is pre-tuned to the desired subcarrier frequency. A tuned buffer amplifier increases the desired level, while also providing an additional pole to the overall bandpass characteristic.

The filtered signal is fed to a quadrature detector. The quadrature detector integrated circuit contains limiting, detection, signal level sensing, and audio preamplification. The detected audio is fed through an emitter follower to the de-emphasis network. The "raw audio" is then filtered by an active low pass filter before going to the audio output amplifier. The output amplifier is then matched to provide a 600 ohm balanced output up to +18 dBm.

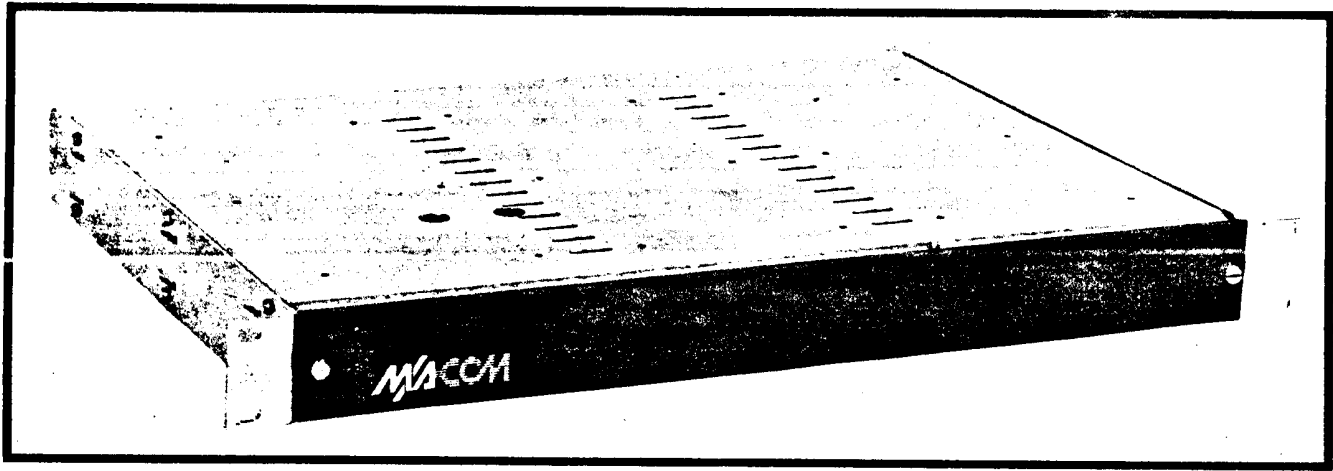
A dc signal proportional to the subcarrier level is supplied to an alarm comparator. This level is compared to a preset threshold. When a fault occurs, a red LED on the front panel of the PAC-12 Demodulator chassis is lit. An alarm interface connector on the rear panel provides a saturated collector or Form-C contacts for remote alarming.



PAC-10 Modulator



PAC-12 Demodulator



SC-1 SERVICE CHANNEL CONVERTER

DESCRIPTION. The SC-1 Service Channel Converter enables a range of facilities to be provided above the video and audio subcarriers on a microwave system.

The SC-1 Service Channel Converter is a complete single sideband modulator/demodulator in a unit that occupies one rack space in a standard 19-inch EIA rack. It has a single sideband suppressed carrier that permits parallel connection of multiple units in a multihop system for orderwire and supervisory/control functions.

Each unit has two 0.3 to 12 kHz channels and a single 16 to 108 kHz channel. One of the 0.3 to 12 kHz channels can be used for connection to omnibus orderwire, while the second channel is available for supervisory and control tones. The 16 to 108 kHz channel can carry up to 24 channels of frequency division multiplex. The transmit side has four separate outputs for driving separate sources. Conversely, the receive side has four separate inputs for multiple source applications.

FEATURES

- **Up/Downconversion**
- **Single Sideband Suppressed Carrier**
- **Crystal-Controlled Oscillators**
- **Separate Inputs/Outputs For:**
 - **Orderwire**
 - **Supervisory and Control**
 - **Up to 24 Telephone/Data Channels**
- **Four SSB Inputs/Outputs For Protected Repeaters**

SPECIFICATIONS

TRANSMIT END - INPUT

Frequency	
Channels 1 and 2	0.3 to 12 kHz
Channel 3	16 to 108 kHz
Impedance	
Channels 1 and 2	600 ohms balanced
Channel 3	75 ohms unbalanced
Levels	
Channels 1 and 2	- 14 dBm nominal; - 10 dBm maximum
Channel 3	- 20 dBm nominal
Connectors	
Channels 1 and 2	barrier strip
Channel 3	BNC female

TRANSMIT END - OUTPUT

Type	single-sideband, suppressed carrier
Frequency	8.59 or 9.023 MHz Standard
Bandwidth	110 kHz nominal
Number of Outputs	4
Impedance	75 ohms unbalanced
Level	- 16 dBm maximum
Lower Sideband Rejection	30 dB minimum
Carrier Level	- 70 dBm maximum
Connectors	BNC female

RECEIVE SIDE - INPUT

Frequency	8.59 or 9.023 MHz Standard
Bandwidth	110 kHz nominal
Number of Outputs	4
Impedance	75 ohms unbalanced
Level	- 10 dBm maximum total*
Port-to-Port Isolation	50 dB minimum
Demodulation Type	single-sideband, suppressed carrier
Lower Sideband Rejection	30 dB minimum
Connectors	BNC female

RECEIVE SIDE - OUTPUT

Frequency	
Channels 1 and 2	0.3 to 12 kHz
Channel 3	16 to 108 kHz
Impedance	
Channels 1 and 2	600 ohms balanced
Channel 3	75 ohms unbalanced
Levels	
Channels 1 and 2	- 14 dBm nominal; - 10 dBm maximum
Channel 3	- 20 dBm nominal
Connectors	
Channels 1 and 2	barrier strip
Channel 3	BNC female

TRANSMIT/RECEIVE LOOP

Frequency Response	
Channels 1 and 2	± 2 dB
Channel 3	± 0.5 dB/4 kHz; ± 2 dB total
Signal-to-Noise	
Channels 1 and 2	60 dB
Harmonic Distortion	
Channels 1 and 2	1%
Frequency Stability	
Temperature (+ 10 to 40°C)	± 1 x 10 ⁻⁷
Aging Rate (First Year)	5 x 10 ⁻⁹ /day average; 1 x 10 ⁻⁶ /year
Short Term Stability	
Constant Temperature	1 x 10 ⁻⁹ /second
Frequency Adjustment Setability	1 x 10 ⁻⁷

POWER REQUIREMENTS

AC	
Voltage	105 to 130 Vac or 210 to 260 Vac
Frequency	47 to 63 Hz
Power	15W
DC	
Voltage	- 21 to - 32 Vdc or - 42 to - 56 Vdc
Current	375 mA typical, 400 mA maximum

MECHANICAL

Size	1.75" (h) x 19" (w) x 13" (d) (48.3 x 33.0 x 4.5 cm)
Weight	8.75 lbs. (4 kg)

All specifications are subject to change without notice.
*Combined power from all four inputs.

G-LINE SERIES POINT-TO-POINT VIDEO MICROWAVE SYSTEMS

DESCRIPTION. The G-Line series point-to-point video microwave systems operate in the 2, 2.5, 6, 7, 8, 10, and 13 GHz bands. The G-Line equipment is fully solid-state, employing a blend of state-of-the-art and proven technologies. Both the high power Transmitters and low noise Receivers enable system designers the flexibility of optimum performance while maintaining cost effectiveness.

All G-Line series Transmitters and Receivers are readily accessed for service via a fold-down door on the front of the unit. All modules and test points are then easily accessible from the front of the rack for easy maintenance.

Multihop systems can be economically implemented with G-Line series equipment. This capability is a direct result of the linearity advantage achieved by the use of a high power 2 GHz transistor oscillator (with low-order multiplication to higher frequencies). This gives the G-Line an advantage over both earlier high-order multiplication of UHF oscillators and klystrons. Up to four audio program channels can be carried above the video. Multiple subcarriers can be carried above the video signal using subcarrier multiplex techniques. The M/A-COM MAC PAC-10/PAC-12 program audio system and SC-1 service channel converter allows the user the benefits of "that unused bandwidth" above the video.

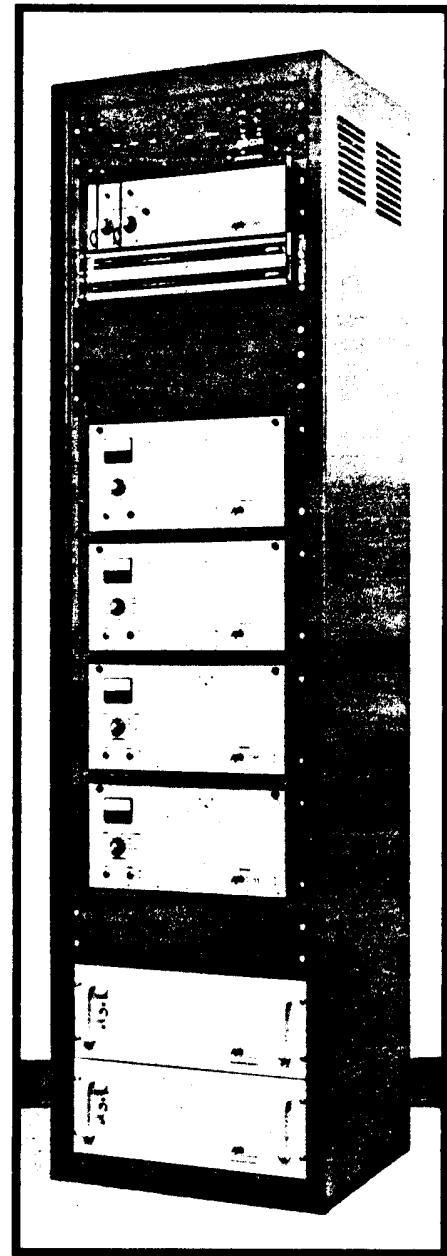
APPLICATIONS

POINT-TO-POINT. The G-Line series microwave radio is ideal for single or multi-channel applications, including duplex operations between two locations. The flexibility of the G-Line series microwave radio allows for ease of expansion or custom rack configurations.

POINT-TO-MULTI-POINT. For those applications that require common transmission to multiple receive sites, the G-Line series microwave radio can provide the cost effectiveness of sharing common Transmitters while maintaining a high degree of performance. The Transmitters can be configured for combinations of common and independent channel operation. The excellent linearity and stability of the G-Line series Transmitters ensure that the same degree of quality signals arrives at all locations. The MA-6GW or PA-1202 high power options allow splitter losses to be overcome while maintaining a manageable antenna system.

MEDIUM HAUL NETWORK. The outstanding performance characteristics of the G-Line series enables it to be used for economical multi-hop systems. For long haul systems see bulletin describing M/A-COM MAC's heterodyne products.

CUSTOM NETWORKS. M/A-COM MAC's system engineering group can design a custom package for your application. MAC's engineers can add stereo and/or monaural program audio, data, message, alarms, and orderwire above the video channel in the configuration that best suits you needs.



FEATURES

- 2, 2.5, 6, 7, 8, and 10 to 13 GHz Operating Frequency Bands
- 2 GHz Ultra Low Noise Linear Oscillator
- High Power Transmitter Outputs
- Excellent Signal-to-Noise Ratio
- Digital AFC
- Low Transmission Distortion
- Multihop Capability
- Hot Standby and Space/Frequency Diversity Options
- Unattended Remote Operation
- Flexibility

M/A-COM

TRANSMITTER. The baseband input to the G-Line Transmitter has an amplifier and pre-emphasis network to enhance the higher modulation frequencies and improve the uniformity of signal-to-noise ratio across the baseband. There is provision for a pilot oscillator if this is required for protection switching or fault reporting.

The Transmitter features a modulated 2 GHz transistor oscillator with digital AFC yielding a stability of $\pm 0.005\%$. This primary frequency-generating source delivers about 1W of power. The combination of high power level and high frequency results in optimum transmission linearity, low noise contribution, and high frequency stability.

The oscillator drives a multi-stage transistor power amplifier through a ferrite isolator which ensures loading independence from the amplifier input impedance. In G-Line Transmitters above 2 GHz, the power amplifier is followed by low-order varactor multipliers to produce the final Transmitter operating radio frequency. Ferrite isolators are used between stages to ensure long-term stability. The final output is coupled to a power monitor assembly. This includes a power detector which samples the RF power output and provides a front panel meter indication of RF power as well as an input to sensing and alarm circuits. If the RF output power falls below a predetermined value, a fault command is initiated and a fault lamp is illuminated on the front panel.

The 2 GHz oscillator and power amplifier utilize proven highly reliable transistors. The varactor diode multipliers are operated very conservatively; this yields a low diode temperature rise and results in stable long-term performance.

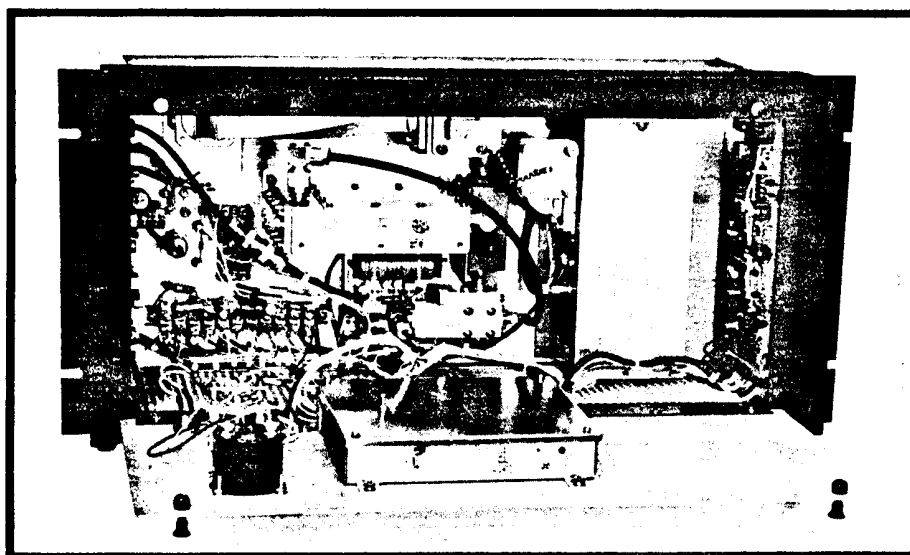
The final output is applied to the input of the branching network comprising a broadband ferrite isolator and channel filter. Here, it may be fed directly to the antenna or combined with other Transmitters or Receivers by use of a circulator and additional branching filters.

The 2 GHz oscillator is referenced to a harmonic of the stable crystal oscillator ensuring good long-term stability and eliminating high-order multiplier noise. Any difference between the two signals activates the digital AFC unit which provides a feedback signal to regulate the 2 GHz oscillator frequency. The AFC feedback signal is continuously monitored by the sensing and alarm module. If the correction voltage reaches a pre-determined value, a fault command is initiated and a fault lamp is illuminated on the front panel.

The wiring harness, connectors, 2 GHz oscillator, AFC reference oscillator, RF output assembly, baseband amplifier board, and Transmitter logic and alarm board are mounted on the chassis assembly. All input and output connectors are located on the back plate. Normal access is from the front of the unit. An external power supply furnishes the required voltage levels for operation [115/230 Vac (50 to 60 Hz), -24 or -48 Vdc are available as options].

A front panel meter with multiposition switch allows measurement of all power amplifier voltages, the oscillator voltage, power amplifier current, AFC voltage, RF power level, and (where fitted) pilot level. The latter three functions also operate the fault alarm lamp when out of limits. This alarm actuates the logic circuit to operate the hot standby RF switch (when equipped).

The G-Line Transmitters are housed in a U-shaped chassis assembly that form the back-plate and two side walls, and support perforated top and bottom covers. A front bezel with a fold-down door completes the basic enclosure which is slotted for standard rack mounting. The meter, meter-selector switch, AFC module, and alarm indicator lamps are fastened to the hinged door for easy access.



G-Line Transmitter - Door Opened

RECEIVER. The G-Line Receiver is coupled to the antenna through a channel filter and isolator. A circulator is interposed between the filter and antenna feed if the Receiver is being combined with other Receivers or Transmitters.

The front end of the Receiver employs a balanced mixer which utilizes a pair of Schottky diodes that provide a low noise figure. The Schottky diode also provides a very low conversion loss of the microwave signal to the 70 MHz intermediate frequency. Since the mixer is balanced, any AM noise present on the local oscillator is greatly reduced. An additional feature of balanced mixers is that they will continue to operate should one diode fail; the performance degradation is slight except during a severe fade.

G-Line Receivers utilize very low noise, highly stable, solid-state oscillators at microwave frequencies. The 2 GHz and 2.5 GHz Receivers use a transistor local oscillator and the 6, 7, 8, 10 to 13 GHz Receivers use Gunn local oscillators. Phase locked sources are also optionally available for use in the 6, 7, 8, and 10 to 13 GHz operating bands should they be desired.

The local oscillator signal is fed to the balanced mixer portion of the mixer-preamplifier where it is heterodyned with the microwave input signal to produce a 70 MHz intermediate frequency signal. The IF is then amplified in a three-stage preamplifier with approximately 25 dB of gain, ensuring a high level input to the IF network.

The 70 MHz IF network comprises filters, equalizers (as required), amplifiers, limiters, and a discriminator. It represents an optimum configuration for stability, linearity, and group delay. It minimizes the distortion products contributed by AM-PM conversion.

The IF amplifier has seven common-base amplifier stages and provides the major portion of the Receiver gain. An AGC loop is incorporated to maintain the output signal essentially constant over a 55 dB range of input signal to the Receiver.

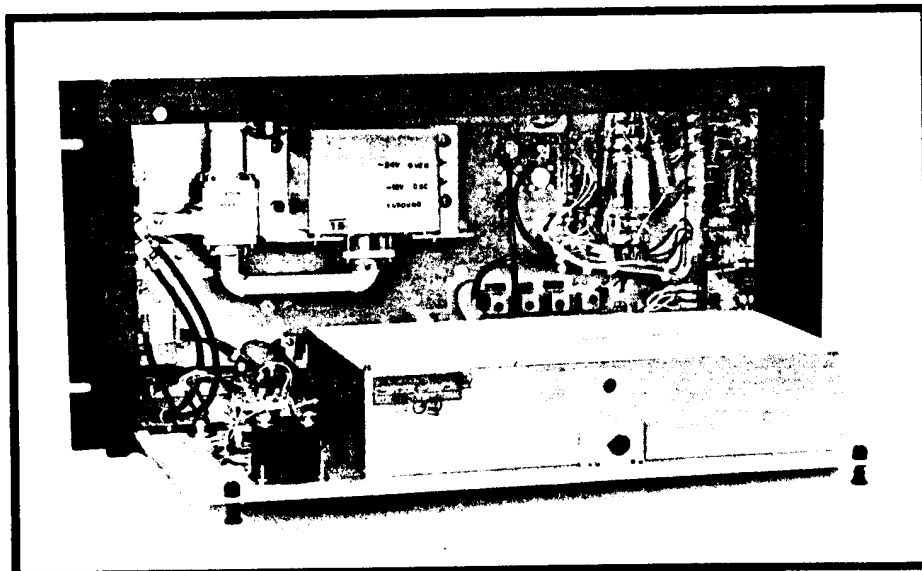
The video demodulator board comprises of a two-stage IF limiter, discriminator, de-emphasis network and baseband amplifiers. The "flat" baseband signal is routed to the baseband amplifier for level setting where the main output is squelched at threshold. The service channel or auxiliary output is picked off before the squelch switching circuits for continuous on-line operation.

The Receiver logic card monitors the received carrier level and lights an alarm lamp if the mute (squelch) switch is operated. It also actuates the baseband switch in a protected system.

A front panel meter with multiposition switch enables all supply voltages to be monitored, as well as mixer crystal currents, AGC voltage (received carrier level), discriminator zero, and pilot level (where fitted).

The G-Line Receiver is housed in a U-shaped chassis assembly that forms the backplate and two side walls, and supports perforated top and bottom covers. A front bezel with a fold-down door completes the basic enclosure which is slotted for standard rack mounting. The door mounts the meter switch, alarm lamp, and IF network and provides easy access to operating controls.

The wiring harness, connectors, mixer-preamplifier, local oscillator, and baseband amplifier mount on the chassis. All input and output connectors are on the backplate. All normal access is from the front. An external power supply furnishes the required voltage levels for operation [115/230 Vac (50 to 60 Hz), -24 or -48 Vdc are available as options].



G-Line Receiver - Door Opened

GENERAL SPECIFICATIONS

TRANSMITTER	
Capacity	one 525/625 line video signal plus multiple subcarrier options
Deviation	± 4 MHz
Frequency Stability	± 0.005%
- 30 to + 55°C	± 0.002%
+ 10 to + 40°C	
Baseband	
Video Level	1V P-P
Impedance	75 ohms, unbalanced
Return Loss	26 dB (50 Hz to 8.5 MHz excluding any filters)
RF Return Loss	26 dB (f_o ± 10 MHz)
RECEIVER	
Capacity	one 525/625 line video signal plus multiple subcarrier options
RF	
Bandwidth*	34 MHz
Return Loss**	26 dB (f_o ± 10 MHz)
IF	
Frequency	70 MHz
Bandwidth*	30 MHz
Return Loss***	26 dB (f_o ± 10 MHz)
Baseband	
Video Level	1V P-P
Impedance	75 ohms unbalanced
Return Loss	26 dB (50 Hz to 8.5 MHz excluding any filters)
VERTICAL RACK MOUNTING	
Transmitter	22.2 cm (5 rack spaces)
Receiver	22.2 cm (5 rack spaces)
Power Supply	
AC	17.8 cm (4 rack spaces)
DC	17.8 cm (4 rack spaces)
ENVIRONMENTAL	
Ambient Temperature	
Operational	- 30 to + 55°C
Meets All Specs	+ 10 to + 40°C
Relative Humidity	95% (+ 10 to + 40°C)
Altitude	
Operational	15,000 feet (4,500m)
Storage	50,000 feet (15,000m)
PRIMARY POWER	
Input	
AC	100 to 130V or 200 to 260V (50 to 60 Hz), single phase
DC	- 24 or - 48 Vdc with 100 mV P-P maximum ripple
Consumption	
Transmitter	
2G, 2.5G, 6GW, 7G	100W maximum
6G, 12G	60W maximum
Receiver (All)	50W maximum

SYSTEM SPECIFICATIONS

Video Performance	RS-250B, single hop, color TV, emphasis, CCIR weighting, - 35 dBm receive carrier level/hop, w/o RFI and echo distortion
Amplitude vs Frequency Response (reference to 200 kHz exclusive of any filter)	
10 kHz to 300 kHz	± 0.15 dB maximum
300 kHz to 5 MHz	± 0.25 dB maximum
5 MHz to 8 MHz	± 0.5 dB maximum
Chrominance Luminance	
Gain Inequality (RCL)	± 1 IRE unit maximum
Delay Inequality (RCD)	± 20 ns maximum
Waveform Distortion	
Field Time (FD)	3 IRE units maximum (clamped output)
Line Time (LD)	1 IRE unit maximum
Short Time (SD)	4 IRE units maximum (exclusive of filters)
Differential (10 to 90% APL)	
Gain	2% maximum
Phase	0.2° maximum
Insertion Gain	
1 Hour	± 0.15 dB
30 Day	± 0.25 dB
Signal-to-Low Frequency Noise Ratio (10 Hz to 10 kHz)	
AC Operation	54 dB minimum
DC Operation	60 dB minimum
Signal-to-Periodic Noise Ratio (10 kHz to 5 MHz)	
	60 dB minimum

All specifications are subject to change without notice.

*Other bandwidths optionally available, consult factory.

**Depending on specific RF bandwidth supplied.

***Depending on specific IF bandwidth supplied.

POWER SUPPLY. MAC's 115 Vac or 230 Vac (50 to 60 Hz) power supplies are recommended for operating the G-Line equipment where reliable commercial ac mains are available.

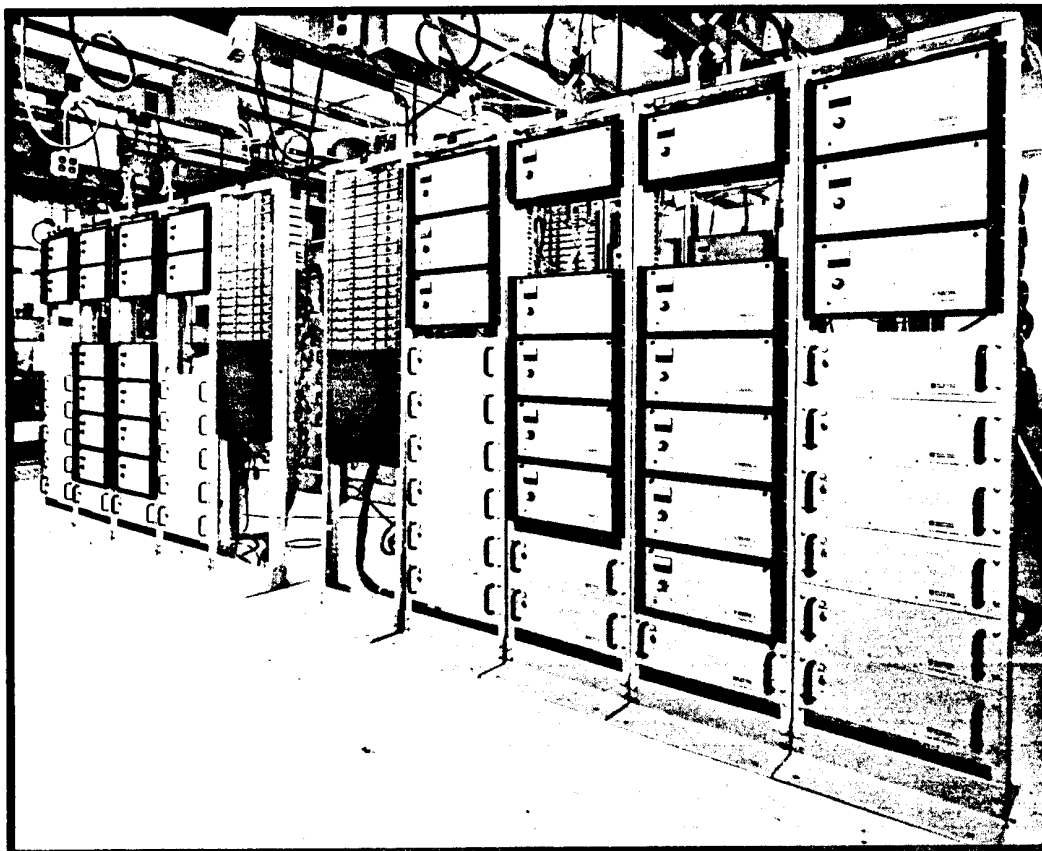
At remote, unattended locations or where primary power failure could be a problem and no-break operation is essential, the M/A-COM dc power supply unit is recommended. This is designed to accept voltages from nominal - 24V or - 48V batteries whether these are under charge or at maximum discharge. Suitable filtering is provided in the supply output, ensuring superior performance in locations subject to external interference.

EQUIPMENT CONFIGURATION OPTIONS. All G-Line series equipment can be supplied in the following optional configurations:

1. hot standby protected
2. space diversity protected
3. frequency diversity protected
4. transmitter high-power amplifiers
5. receiver low-noise preamplifiers
6. ac primary power
7. dc primary power

ACCESSORIES. A full range of accessories are available for use with G-Line series equipment.

1. PAC-10/PAC-12 Program Audio Systems.
2. PA-1202 ADA Power Amplifier for MA-12G only.
3. SC-1 Service Channel Converter.

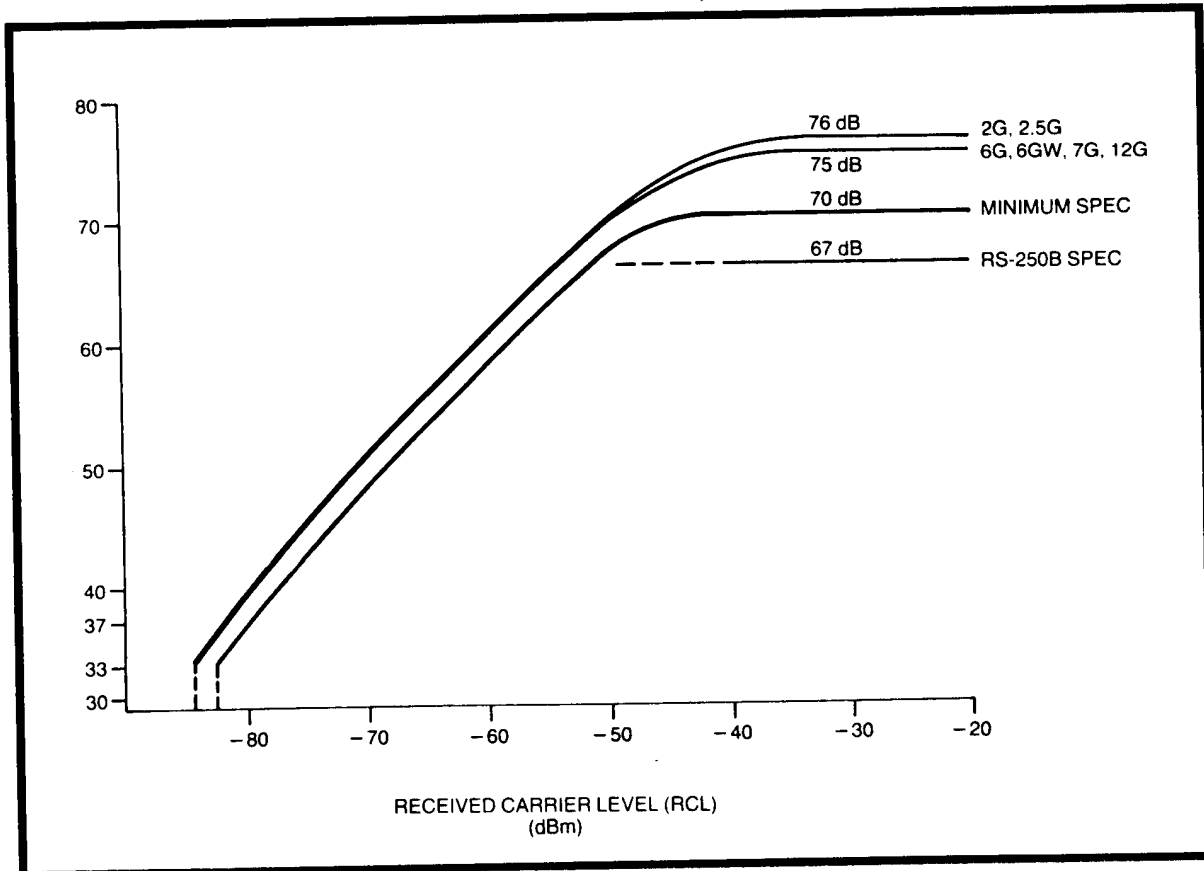


A Typical Multichannel Application

G-Line Models

	MA-2G	MA-2.5G	MA-6G	MA-6GW	MA-7G	MA-12G	MA-12G w/PA-1202
Radio Frequency Bands Range (GHz)	1.990-2.110	2.3-2.68	5.925-7.125	5.925-7.125	7.125-8.500	10.7-13.25	10.7-13.25
Transmitter Output Power Range*	+ 39.0 dBm	+ 37.0 dBm	+ 30.0 dBm	+ 35.6 dBm + 35.6 dBm	+ 32.0 dBm	+ 27.0 dBm + 26.0 dBm + 26.0 dBm	+ 31.6 dBm + 31.6 dBm + 31.6 dBm
Receiver Noise Figure (including filter)	8.0 dB	8.5 dB	8.5 dB	8.5 dB	9.0 dB	9.0 dB	9.0 dB
Receiver Threshold (to 37 dB S/N)	- 80.0 dBm	- 79.0 dBm	- 79.0 dBm	- 79.0 dBm	- 79.0 dBm	- 79.0 dBm	- 79.0 dBm
Signal-to-Noise Ratio (10 kHz to 5 MHz)	75.0 dB	70.0 dB	70.0 dB	70.0 dB	70.0 dB	70.0 dB	70.0 dB

*Minimum to branching network.



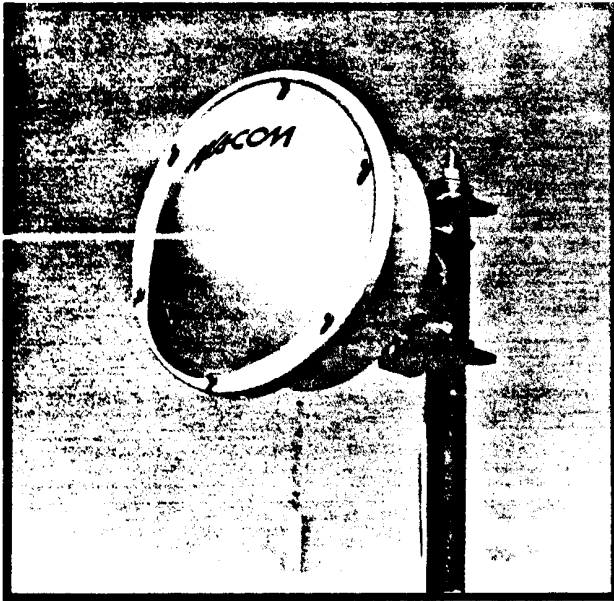
Line Series Typical Signal-to-Noise Performance

FCC Type Acceptance Data

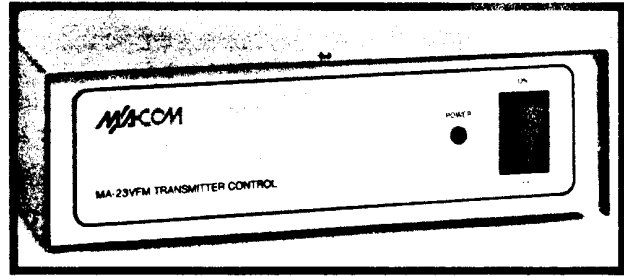
MODEL	TYPE NUMBER	EMISSION DESIGNATOR	FREQUENCY TOLERANCE	POWER OUTPUT	PART NO.
MA-2G	BV88U4MA2G	17000F9	± 0.005%	8W	21,74
MA-2.5G	BV88U4MA2.5G	17000F9	± 0.005%	8W	74
MA-6G	MA85T06G	10000F9 20000F9 25000F9 30000F9	± 0.005% ± 0.005% ± 0.005% ± 0.005%	2W 2W 2W 2W	94 94 74 21
MA-6GW	MA85T06GW	10000F9 25000F9 30000F9	± 0.005% ± 0.005% ± 0.005%	7W 7W 7W	94 74 21
MA-7G	MA-7G	25000F9	± 0.005%	3W	GOV
MA-12G	MA85T012G	12500F9 20000F9 25000F9	± 0.005% ± 0.005% ± 0.005%	1.5W 1.5W 1.5W	78 94 21,74,78,94
PA-1202	PA-1202	12500F9 25000F9	Amp Amp	3W 3W	74,78,94 74,78,94

*The use of 20000F9 in POFS 6 GHz band requires the user to obtain a waiver of frequency plan. The radio can be sold only to those with a waiver.

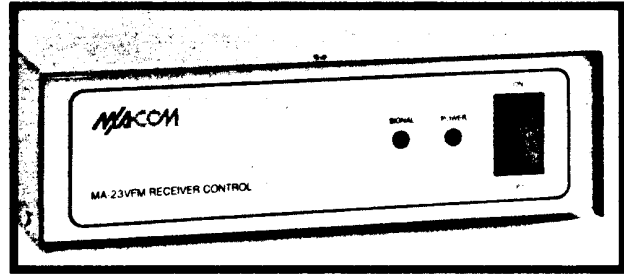
**FCC Part No. users: 21—Common Carrier; 74—Broadcast; 78—CATV (CARS);
81—Safety and Special (PSIT); 90—Land Mobile; 94—Private Operational Fixed (POFS).

M/A-COM 23 PRODUCT LINE

MA-23VFM, Pole Mount



Transmitter Remote Interface Unit



Receiver Remote Interface Unit

MA-23VFM 23 GHz FM MICROWAVE VIDEO SYSTEM

DESCRIPTION. M/A-COM's MA-23VFM System is a budget priced solid-state FM microwave radio system that provides reliable, short range video communications links in the 21.8 to 22.0 GHz and 23.0 to 23.2 GHz frequency band. This system is capable of transmitting full color video plus high quality subcarrier program channels with all of the advantages that only FM microwave systems can offer. The MA-23VFM System is ideal for relay of TVRO programs for CSTV systems as well as video conferencing or remote surveillance applications. The standard MA-23VFM System comes completely equipped with one subcarrier program channel for audio, data or telephony use.

The MA-23VFM System is an economical alternative to conventional coaxial cable links, especially where cable installation is impractical such as in congested downtown areas, across landscaped grounds or locations where trenching and aerial lines are not permitted. In these instances, the MA-23VFM System eliminates not only the prohibitive installation costs of cable systems, but also the lengthy delays encountered in obtaining municipal construction permits.

The compact, lightweight MA-23VFM System is engineered to provide reliable performance and simplicity of operation at reasonable cost. Transmitter and Receiver subsystems are comprised of weather-resistant RF units equipped with integral high gain antennas designed for outdoor use, and a Control/Interface Unit containing power supply and baseband circuits. Distances of 250 feet (76m) between the Control/Interface Unit and RF Heads are possible with no signal degradation. Units are completely aligned at the factory and do not require any adjustments once installed. Field proven, solid-state technology is employed featuring direct signal conversion Gunn Oscillators that have a long history of troublefree performance in other M/A-COM products serving the communications industry.

FEATURES

- High Power Output 66 mW Typical
- Low Cost, Compact FM Microwave System
- Full Color Compatible Video Plus Audio, Data, Control
- All Solid-State
- Simple Installation and Alignment
- Weather-Resistant RF Units
- Built-In 115 Vac Power Supply
- Ready to Mount on 2 to 4" O.D. Pipe

OPTIONS

- One or Two Audio/Data Subcarriers
- 500 kHz Return For Audio, Data, or Camera Control
- 230 Vac/625 Line Video Operation

FM ADVANTAGES

- Higher Signal-to-Noise Ratio – Superior Picture and Audio and Data Quality
- Higher Fade Margin – Longer Paths Without Repeaters
- Less Susceptible to Interference From Electrical Storms, RFI, and EMI

PRIMARY USES

- Teleconferencing
- CATV
- Surveillance
- Telephony via FDM

SPECIFICATIONS

GENERAL

Frequency Bands	21.8 to 22.0 GHz and 23.0 to 23.2 GHz
Channeling Plan* (50 MHz Channels at)	21.825, 21.875, 21.925, 21.975, 23.025, 23.075, 23.125, 23.175 GHz
Radio Capacity	525/625 line video plus two subcarrier program channels
Modulation	FM
Deviation	± 4 MHz
Antenna	12" diameter
Gain	33 dBi typical
Beamwidth (3 dB)	3.5°
Video Signal-to-Noise Ratio (with - 35 dBm RCL)	55 dB minimum
Subcarrier Bandwidth	15 kHz
PRIMARY POWER	
Source	120 Vac (50 to 60 Hz); 230 Vac optional
Power Consumption	
Transmitter	50W
Receiver	50W
RF Units powered via interconnection cable by Control/Interface Units.	
ENVIRONMENTAL	
RF Unit	
Ambient Temperature	
Operational	- 30 to + 50°C (- 22 to + 122°F)
Storage	- 40 to + 60°C (- 40 to + 140°F)
Relative Humidity	up to 100%
Wind Load	40 psf maximum
Control Unit	
Ambient Temperature	
Operational	+ 10 to + 40°C (+ 50 to + 104°F)
Storage	- 30 to + 50°C (- 22 to + 122°F)
Relative Humidity	up to 95%
TRANSMITTER	
Power Output	100 mW (+ 20 dBm) maximum, 50 mW (+ 17 dBm) minimum, 66 mW (+ 18 dBm) typical
Long Term Frequency Stability	± 0.03%
Spurious Response	per FCC Part 94
Video Input	
Level	1V P-P
Impedance	75 ohms
Return Loss	20 dB minimum
Audio Input	
Level	0 dBm
Impedance	600 ohms, balanced
Subcarrier Frequencies	6.8 MHz standard (other frequencies available)

RECEIVER

Type	dual conversion, superheterodyne
Noise Figure	12 dB nominal
RF Bandwidth	40 MHz
Local Oscillator	solid-state, Gunn oscillator
IF Bandwidth	40 MHz
Video Output	
Level	1V P-P
Impedance	75 ohms
Audio Output	
Level	+ 9 dBm
Impedance	600 ohms, balanced
Receiver Threshold	
(33 dB weighted S/N)	- 74 dBm

PHYSICAL

Size (Transmitter or Receiver)	
RF Unit (including antenna)	16" dia. x 10.75" (d) (40.6 x 27.5 cm)
Control/Interface Unit	3" (h) x 10.5" (w) x 8.25" (d) (7.6 x 26.7 x 21.0 cm)
Weight	
RF Unit	9 lbs. (4.1 kg)
Control/Interface Unit	4.5 lbs. (2.1 kg)

CONTROLLER UNIT TO RF ASSEMBLY**INTERCONNECTION**

Transmitter Configurations	
(Recommended Configuration)	
DC Power	250 feet maximum of #20 AWG 4 conductor, shielded wire
Video/BB	250 feet maximum of Type RG-6/U coax cable double shielded (braid and foil)
Technical Limits For Alternate Configuration	
DC Power	3.5V maximum dc drop at 1.4A or 2.5 ohm total loop resistance, or 10.5V minimum, 15V maximum RF Assembly input voltage.
Video/BB	1.7 dB maximum loss at 5 MHz
Receiver Configurations	
Recommended Configuration	
DC Power	250 feet maximum of #20 AWG 4 conductor, shielded wire
IF	250 feet maximum of Type RG-6/U coax cable double shielded (braid and foil)
Technical Limits For Alternate Configuration	
DC Power	3V maximum dc drop at 0.6A or 5 ohm total loop resistance, or 16.5V minimum RF Assembly input voltage.
IF	12 dB maximum loss at 140 MHz

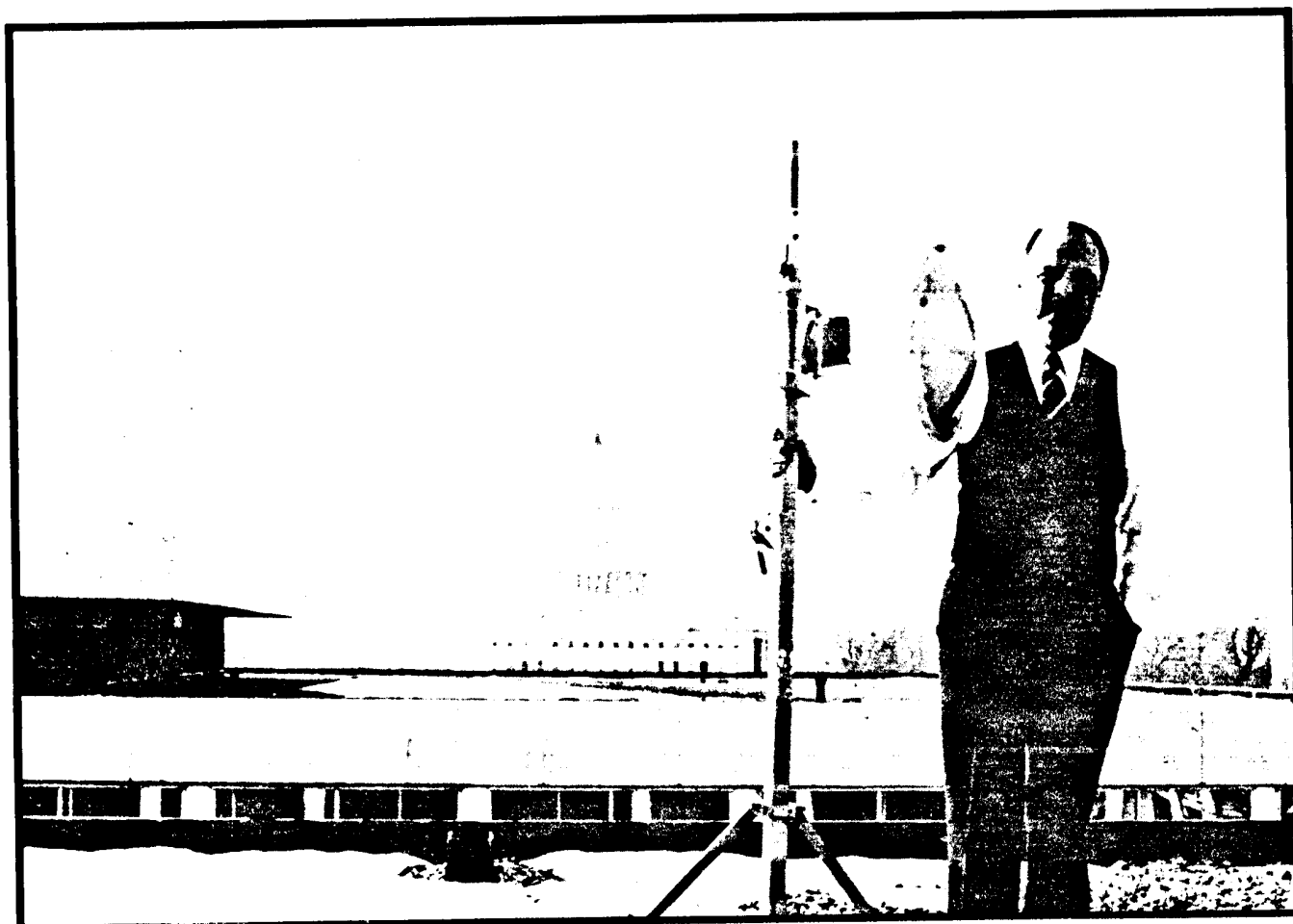
All specifications are subject to change without notice.

*The FCC prefers the following frequency pair plans:
 DUPLEX: 21.925/23.125 or 21.975/23.175 GHz.
 SIMPLEX: 21.825, 21.875, 23.025, or 23.075 GHz.

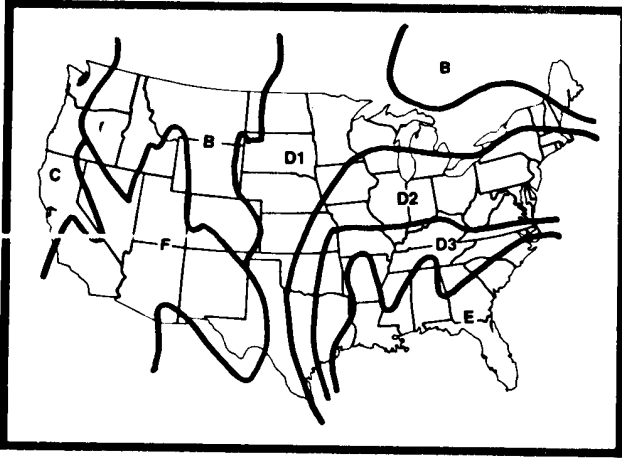
The MA-23VFM is the logical choice for low cost microwave communications links for the following reasons:

- FM superheterodyne design is inherently superior to AM systems in an interference environment – less susceptible to atmospheric conditions (electrical storms), RFI, and EMI.

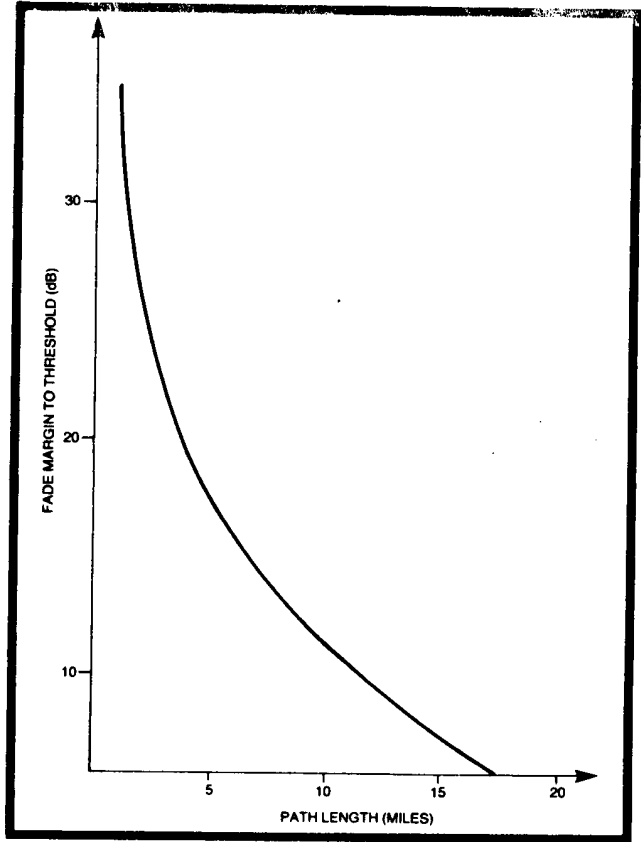
- 7.5 MHz bandwidth allows transmission of black and white or full color video.
- The MA-23VFM System can be equipped with up to two internal subcarrier channels for audio, data, or telephone line replacement. Plug-in subcarriers are available to allow field upgrading to maximum subcarrier capacity in minutes.



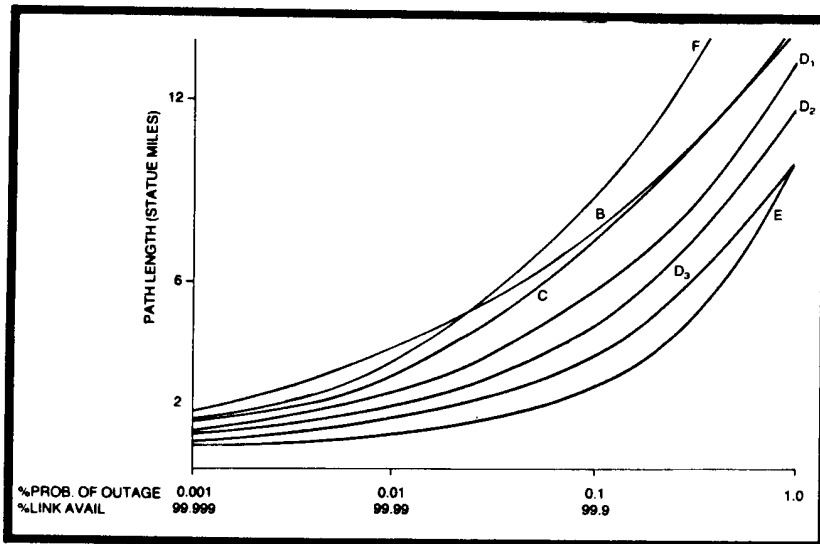
The MA-23VFM Now Being Used to Relay C-SPAN Programming From the Capitol Building



Rain Rate Climate Regions for the Continental United States



Fade Margin to Threshold vs Path Length



Link Availability vs Path Length



Now Being Built under License By:

TECTAN, Inc.

1216 Alamo Way

Pittsburg, CA 94565

Contact: Bill Leasy, COASTCOM (415)825-7500

Model 412 Frequency Agile SCPC FM Terminal

DESCRIPTION

COASTCOM's Model 412 is a frequency agile, single-channel-per-carrier (SCPC) wideband FM terminal for satellite transmission and reception of high quality audio, voice or data. The SCPC technique provides the user with direct access to satellite circuits from any location without having to combine with other channels.

The 412 Modulator accepts wideband audio signals (50 Hz to 15 kHz), compresses their dynamic range, and uses the resultant signals to frequency modulate an internally generated RF carrier. This modulated carrier, in the 52-88 MHz range, can then be used as the input to commonly used satellite up-converters and high power amplifiers (HPA's) for microwave transmission.

The 412 Modulator features an adaptive energy dispersal network to prevent energy concentrations at or near the carrier frequency and reduce the effect of intermodulation interference between carriers in the transponder. The 412 Modulator also contains a frequency stabilization network to maintain exact carrier frequency.

The 412 Demodulator accepts RF signals from an earth station's down-converter and selects the appropriate carrier from among those in the 52-88 MHz range. After demodulation, the 412 expands the signals to reproduce transmitted material with excellent quality. The 412 Demodulator features COASTCOM's patented phase-locked loop detector to provide threshold extension and exceptional performance in high-noise environments.

Model 412 is available in two versions to meet your system's needs:

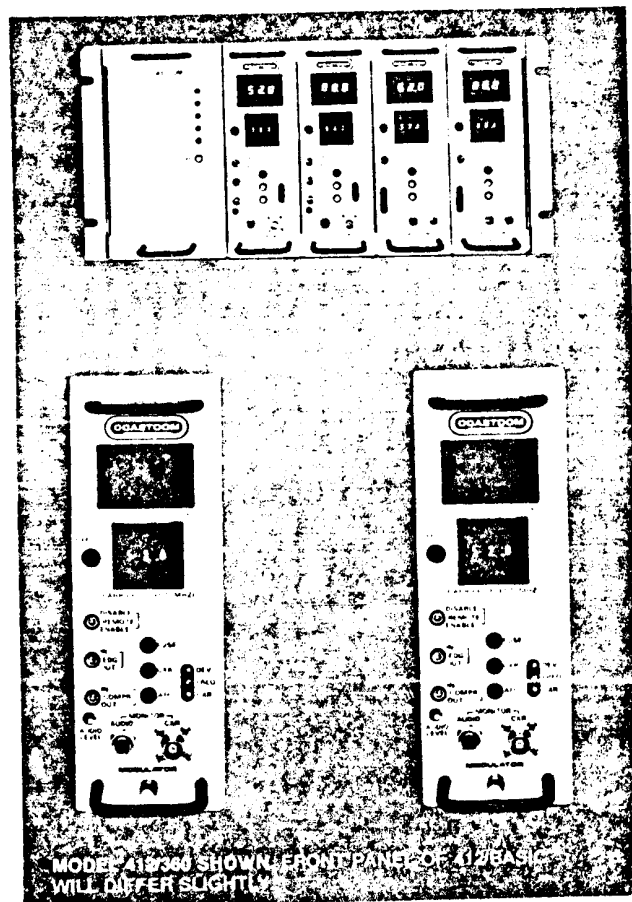
Model 412/Basic offers selection of 16 user-specified RF carrier frequencies, using a PROM for pre-selection. The PROM is user-changeable so that other channels may be programmed for greater versatility.

Model 412/360 expands the capability of the internal frequency synthesizer to provide selection of 360 standard channels (in 100 kHz increments) throughout the 52-88 MHz spectrum. With the 412/360, the standard 80 kHz AFC circuit gives virtually continuous receiver coverage of the 52-88 MHz range.

Each Modulator or Demodulator is a self-contained plug-in unit and requires no special installation. The 412 system is housed in an 8.75 inch (22.23 cm) shelf that will contain any combination of up to four plug-in modules plus a common power supply in 5 standard rack mounting spaces. Each version, 412/Basic and 412/360, meets the outstanding specifications listed on the reverse of this sheet.

FEATURES/PERFORMANCE

- **Frequency Agile.** One terminal does the job of many single channel units. Frequency selection can be made from the front panel or by remote control.
- **Threshold Extension** with COASTCOM's patented phase-locked loop detector. 1 dB noise threshold is at 60 dB-Hz, standard.
- **Exceptional Low Distortion** (0.1%) back-to-back operation to allow the use of various types of compandor networks without exceeding 1% distortion.
- **Adaptive Energy Dispersal Network** for transponder loading protection and reduced intermodulation interference.
- **Internal Frequency Synthesizer** for excellent frequency stability.
- **Carrier, Level and AFC alarms.**
- **Two Models** to fit your system needs: 412/Basic and 412/360.
- **15 kHz Bandwidth Standard.** Also available in specified bandwidths from 8-20 kHz.





2312 Stanwell Drive
 Concord, California 94520
 Telephone: 415/825-7500
 TWX: 910/481-5781

412/Basic 412/360

Performance Specifications (15 kHz Bandwidth)

Audio Interface:
 Input/Output
 Frequency Range 50 Hz to 15 kHz
 Average Program Level +8dBm
 Peak Program Level +18dBm
 Impedance 600 ohms balanced
 Connector Type Terminal Block

Audio Characteristics:
 Frequency response (1000 Hz REF)
 50 Hz to 125 Hz +0.4 to -0.8 dB
 125 Hz to 10 kHz ±0.4 dB
 10 kHz to 15 kHz +0.4 to -0.8 dB
 Total Harmonic Distortion (PPL) <1% 50 Hz to 15 kHz
 Intermodulation Distortion <1%
 Group Delay Distortion (1000 Hz REF)
 50 Hz to 15 kHz <1 ms
 Interchannel Phase Difference
 1000 Hz <6°
 0.5 and 15 kHz <10°

Level Stability
 Short Term (1 sec) ±0.15 dB
 Long Term (1 hr) ±1.0 dB over Time & Temp
 Insertion Gain ±0.25 dB
 Signal-to-Crosstalk Ratio (PPL) <65 dB

Modulator Characteristics:
 Input Frequency Range 50 Hz to 15 kHz
 Output Frequency Range 52 to 88 MHz
 Connector Type BNC Female
 Peak Carrier Deviation (+18 dBm) ±75 kHz
 Deviation Capability ±100 kHz at <1% Linearity
 Input Level +12 to +18 dBm PPL, -2 to +9 dBm APL
 Output Level -10 dBm
 Output Impedance 75 ohms unbalanced
 IF Level Stability
 Short Term (24 hrs) ±0.2 dB
 Long Term (30 days) ±0.5 dB
 Frequency Stability 3 parts in 10⁶ over operating temperature range

Frequency Agility **412/Basic**
 16 (max) User Specified
 Carrier Frequencies in 100
 kHz increments using PROM
 for pre-selection
412/360
 360 Standard Carrier
 Frequencies in 100 kHz
 increments
 Operating Channel Spacing 300 kHz Minimum
 Energy Dispersal 3.75 Hz ±1% Sinusoidal at
 40 kHz peak dev.

Demodulator Characteristics:
 Input Frequency Range 52 to 88 MHz
 Output Frequency Range 50 Hz to 15 kHz
 Connector Type BNC Female
 Impedance 75 ohms
 Input Level -65 to -20 dBm
 Output Level +12 to +18 dBm PPL,
 -2 to +9 dBm APL
 Adjacent Channel Selectivity ≥65 dB
 Frequency Agility Same as Modulator
 Operating Channel Spacing 300 kHz Minimum
 Signal-to-periodic Noise Ratio ≥67 dB
 AFC ±80 kHz

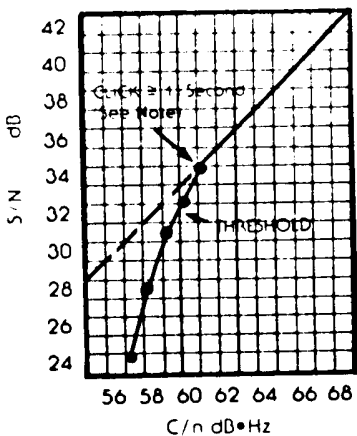
Environmental Requirements:
 Ambient Temperature Range for:
 Storage -40°C to +70°C
 Specification 0°C to +51°C
 Humidity 95% maximum
 Altitude:
 Storage 12 200 meters (40 260 ft)
 ASL
 Specification 3050 meters (10 000 ft) ASL

Power Requirements:
 Standard 115VAC ±10% 57-63 Hz

Dimensions:
 Standard 412 Shelf 22.23 cm (8.75") H x
 (Accepts Power Supply and 4 Plug-Ins
 in any combination.)
 45.72 cm (18") D x
 48.26 cm (19") W
 5 Rack mounting spaces
 20.41 kg (45 lbs)
 Fully Loaded Shelf

Weight

Typical S/N (In 15 kHz Audio Band) versus C/n With COASTCOM Threshold Extension



Note: Audio S/N is flat unweighted (Ref. to PPL) non-compandered with no emphasis. Click threshold C/n increases with deviation and modulating frequency. These values were obtained with no modulation, but are approximately the same up to 2 kHz modulation frequency and 75 kHz peak deviation. 1 dB threshold is at 60 dB*Hz. standard.

Control Functions:
 Frequency Agility Thumbwheel channel frequency selector and execute button
 Remote Control **412/Basic**
 50 pin connector for 4-line Binary plus strobe control from external source
412/360
 50-pin connector for 4-line strobe BCD input/output

When Ordering Specify:

- (1) Carrier Frequencies for the 412 Basic, in MHz to the first decimal place (412/360 carrier frequencies are standard)
- (2) Compandor Type: 2.1. 75 microsecond preemphasis 3.1 dbx³ model 321 with special preemphasis
- (3) Number and Type of Mods and Demods. (Note: 412/Basic and 412/360 are compatible in the same shelf. However, remote programming connections to the two units will be different.)

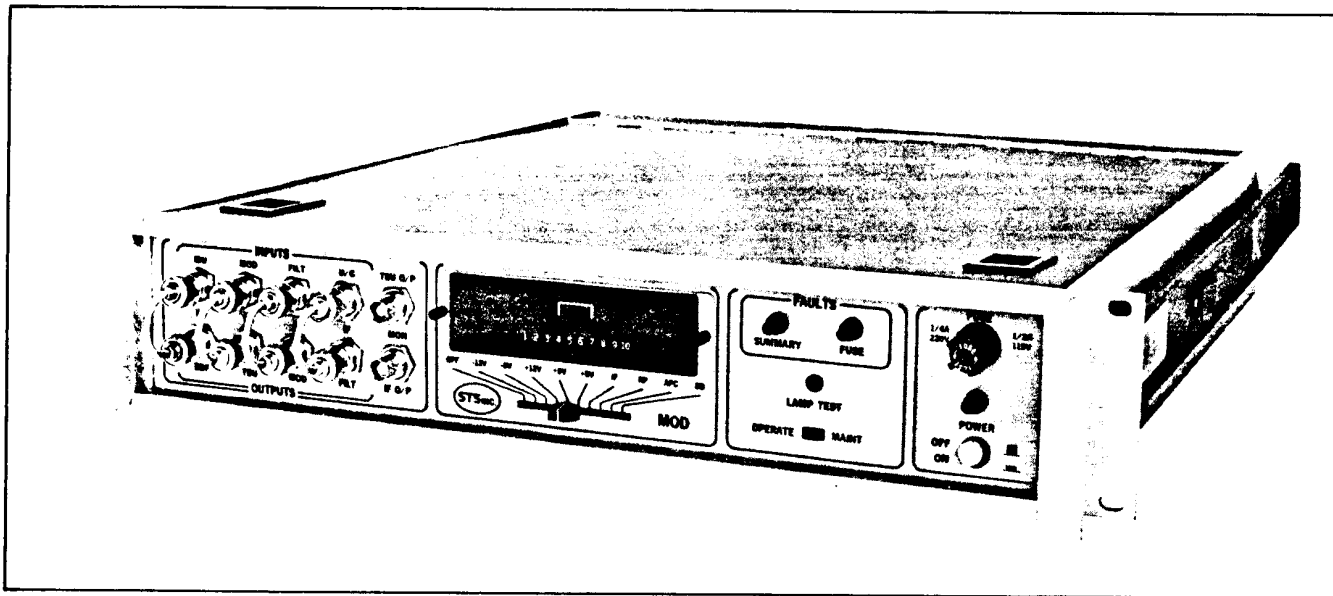


SATELLITE
TRANSMISSION
SYSTEMS, INC.

FM/FDM Modulators and Demodulators

70 MHz IF

MOD700 and DEM700



MOD 700

Applications

Satellite Transmission Systems' (STS) MOD700 Series Modulators and DEM700 Series Demodulators are intended for use in narrow or wideband transmission/reception of FM/FDM message and data.

Engineered for high performance, extended reliability and continuous duty in satellite earth stations, they are compliant with all DOMSAT and INTELSAT/CCIR standards, and interface readily with related earth station equipment.

Features

- Standard FDM channel capacities from 12 to 1872
- Rapid channel capacity changing capability via plug-in modules, with minimal readjustment
- Unique IF filter design for reduced delay-amplitude ripple and low delay distortion noise
- Automatic phase controlled modulator frequency
- Threshold extension demodulator
- Comprehensive built-in test equipment (BITE), with LED bar graph display
- Operate/maintenance switch deactivates alarms for testing
- Integrated monitor and control facilities—relay contacts and RS422 data interfaces
- Compact, modular slide-drawer construction with commonality of spares between mod and demod units (video and message modules also interchangeable)

Rapid Channel Capacity Changing

The MOD700 and DEM700 Series modulators and demodulators have been especially designed to permit rapid changes in channel capacity, without extensive realignment or adjustments.

Channel capacity changes are accomplished simply by replacement of plug-in modules, and if necessary, a minor readjustment of the dispersal frequency. All critical levels are normalized (realigned) by means of preset plug-in modules.

IF Filter/Equalizer

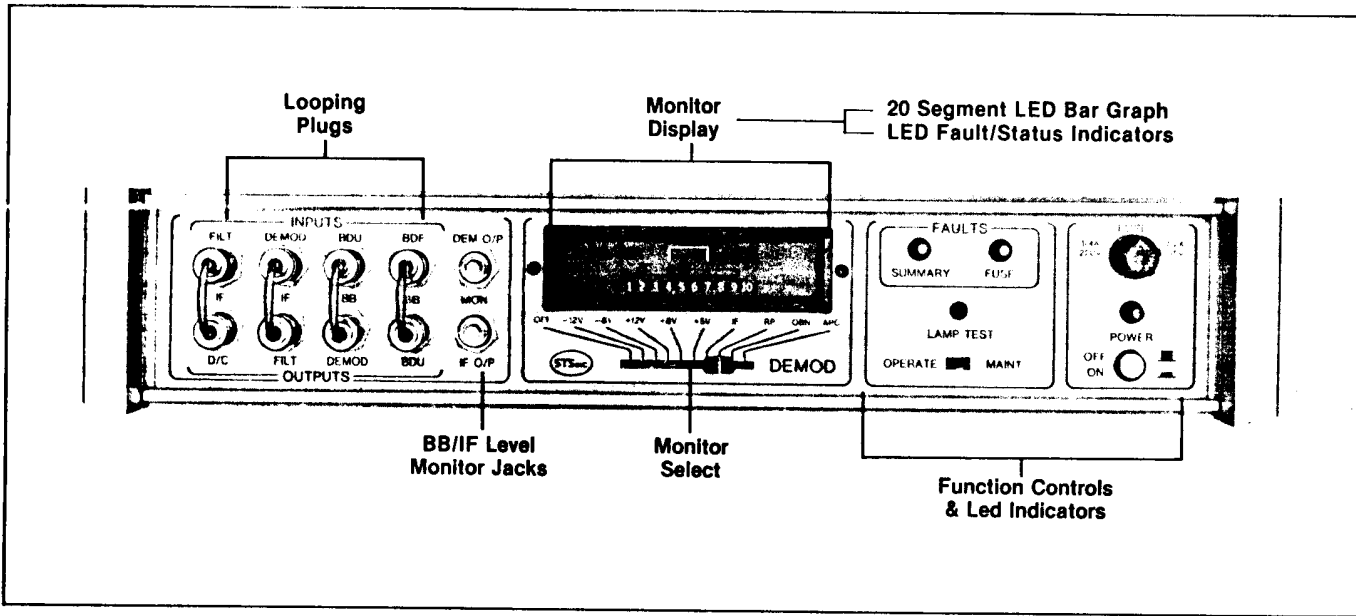
The STS IF Filter/Equalizer module design is based on arithmetic symmetry (as opposed to geometric symmetry), which provides greater resonator efficiency, and reduced filter complexity. The result is reduced phase-shift produced delay distortion (symmetrical), as well as far less amplitude-delay ripple.

Options

- Wideband mod/demod assemblies for FDM channel capacities up to 2892 channels, or video (Also see MOD702)
- 115 or 230VAC primary power
- Switchable (5) Channel Capacity Modulator (MOD 701) and external Selector/Filter unit (FIL100)

STS FM/FDM Modulators and Demodulators

MOD700 and DEM700



Model DEM700 Demodulator

Enhanced Operating, Maintenance and Troubleshooting Capabilities

Ease of operation and maintenance are assured by complete front panel control and monitoring of vital functions and operating parameters. An array of solid-state LEDs provide local fault/status indications and analog metering of selected voltages (bar graph). Up-front monitor jacks and inter-module looping plugs further aid in subsystem test and troubleshooting.

Efficient power consumption and rear exhaust fans maintain low operating temperatures to reduce the possibility of premature component failure, thereby improving reliability, extending longevity and minimizing downtime.

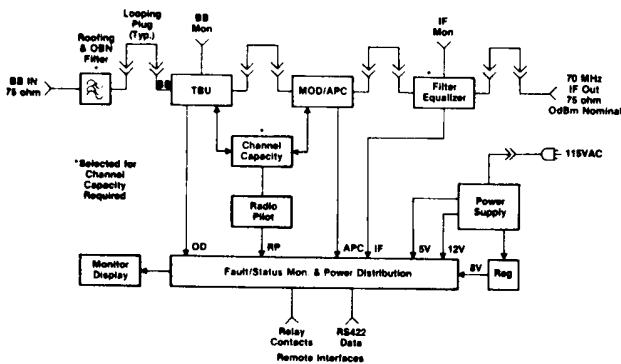
Advanced Remote Monitor and Control Facilities

Integral RS422 data and fail-safe (normally energized) relay contact interfaces provide compatibility with digital or conventional analog monitor and control subsystems.

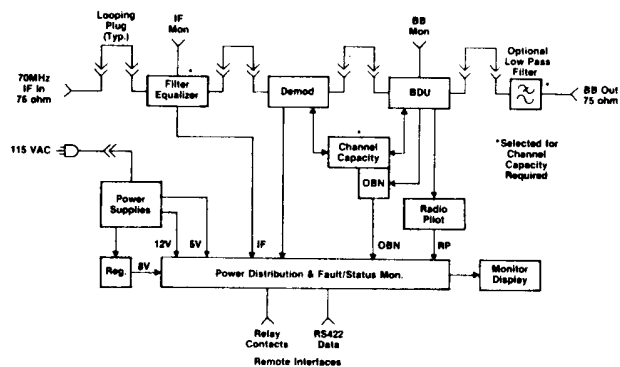
Switchable Channel Capacity Modulator

A specialized version of the MOD 700 Series Modulator is also available (MOD 701), incorporating a variable channel capacity modulator unit which is controlled by an external (5) Channel Capacity Selector/Filter Equalizer unit (FIL 100). Additional information is available upon request.

MOD700



DEM700



Specifications

Model Series	Modulator MOD700	Demodulator DEM700
IF characteristics	Output	Input
Frequency	70 MHz	70 MHz
Peak deviation	± 20 MHz	± 20 MHz
Frequency stability	± 10 kHz/year	N/A
Level	0 dBm (nominal) to - 20 dBm	- 40 to 0 dBm
Impedance	75 ohms, unbalanced (BNC)	75 ohms, unbalanced (BNC)
Return loss	23 dB	20 dB
Baseband	Input	Output
Channel capacities	12 to 2892 FDM channels	12 to 1872 FDM channels
Frequency: Range	10 Hz to 15 MHz	10 Hz to 10 MHz
Response	± 0.25 dB (less filters)	± 0.25 dB (less filters)
Level (test tone)	- 20 dBm (nominal) to - 45 dBm*	- 20 dBm
Stability	± 0.25 dB/month and 0.1 dB/day	± 0.25 dB/month and 0.1 dB/day
Impedance	75 ohms, unbalanced (BNC)	75 ohms, unbalanced (BNC)
Return loss	26 dB nominal	26 dB nominal
Pre/de-emphasis	Per CCIR REC 464	Per CCIR REC 464
Radio pilot	60 kHz (multiplexed)	60 kHz (multiplexed)
Pilot level	- 20 dBm0 (nominal)	- 20 dBm0 (nominal)
Dispersal: Frequency	20 Hz to 150 Hz (adjustable)	20 Hz to 150 Hz (adjustable)
Stability	± 1 Hz	± 1 Hz

* Customer Specified

B/B-IF Input to Output

Group delay:	
Linear	± 0.03ns/MHz
Parabolic	0.003ns/MHz ²
Ripple	0.2ns peak to peak
Amplitude response	< 0.2 dB peak to peak

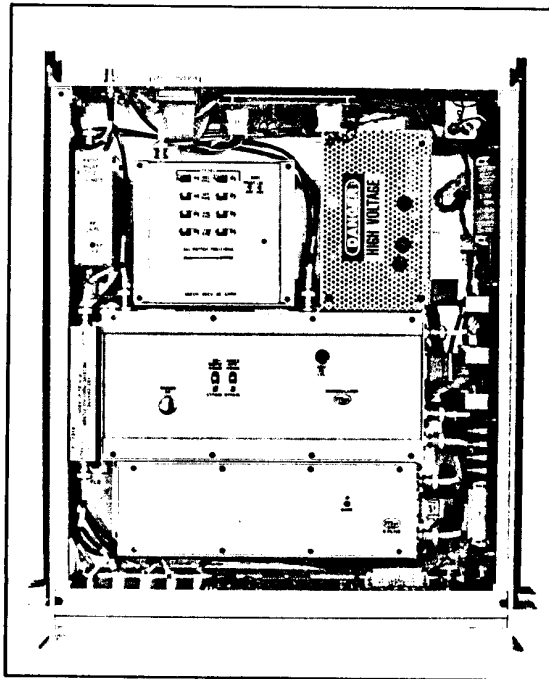
Primary Power Requirements

Voltage	115 or 230VAC ± 10% single phase
Frequency	50-60 Hz, ± 3 Hz
Consumption	37VA nominal

Environment	Operating	Storage
Temperature	0 to 50°C	- 30 to + 75°C
Humidity	0 to 95% (non-condensing)	0 to 100%
Maximum altitude (ASL)	10,000 ft.	50,000 ft.
Shock and vibration	As encountered in normal commercial shipping, handling and operation	

Mechanical Specifications

Net weight	25 lbs., nominal
Shipping weight	Approximately 40 lbs.
Volume	Approximately 3 cu. ft.

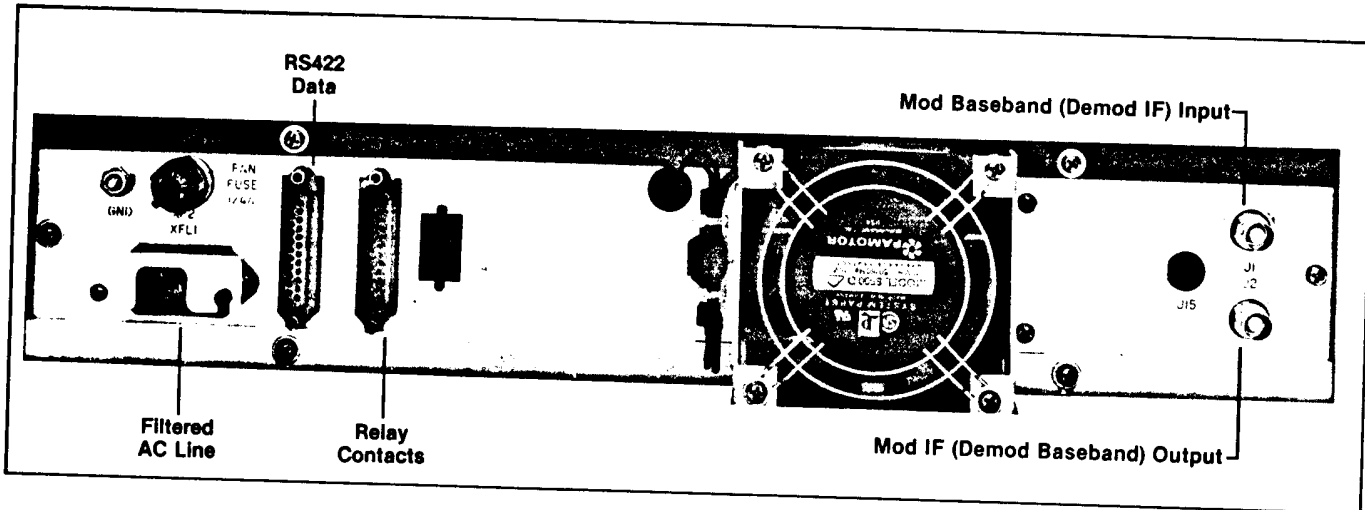
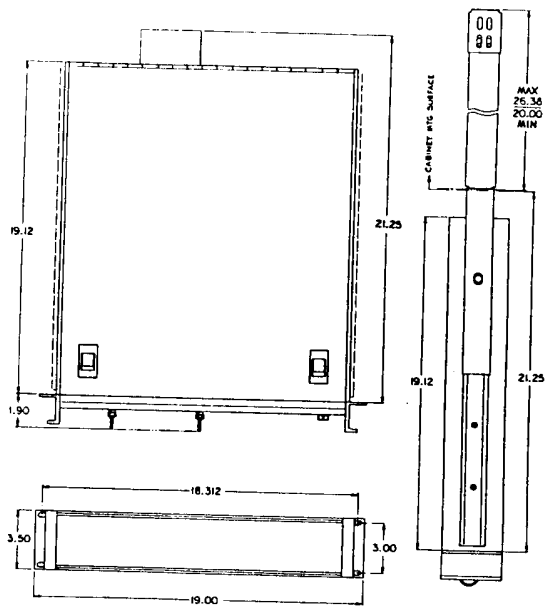
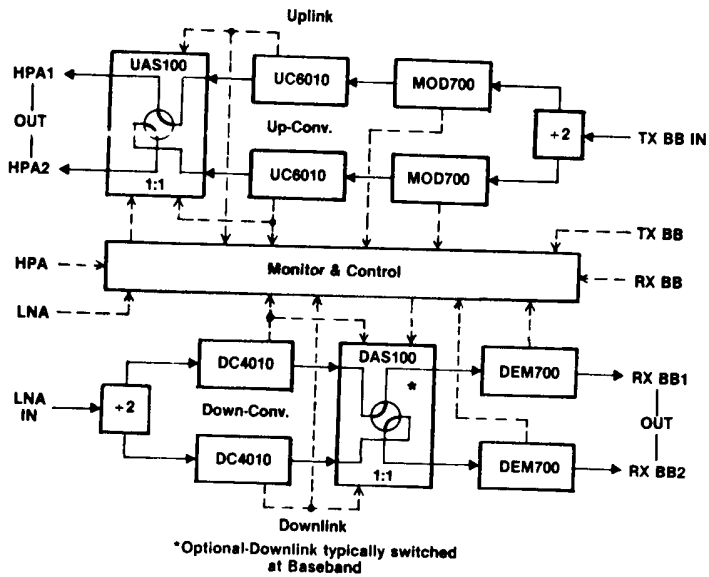


Demodulator Drawer (Top cover removed)

STS FM/FDM Modulators and Demodulators

MOD700 and DEM700

Typical 1:1 Redundant FM/FDM Message Transmit/Receive Configuration



Other STS Products

- Video modulators
- IF filter/equalizers
- Receiver interface unit
- Up and down converters (C and KU bands)
- 1:1 and 1:N protection switching (RF/IF/Data)
- Delay-amplitude equalizers
- Monitor and control subsystems (digital/analog)
- Test translators (C and Ku bands)

Satellite Transmission Systems, Inc. is a leading supplier of satellite transmit/receive earth stations. A complete range of services are available to satisfy your earth station requirements, including turnkey earth station installation and subsystems integration, as well as upgrades and modernization of existing systems.

These FM/FDM modulators and demodulators are part of an expanding line of field-proven ground communications equipment, designed and built by STS. For additional information and prompt assistance with your particular application, contact the STS marketing department.



SATELLITE TRANSMISSION SYSTEMS, INC.

A California Microwave, Inc. Subsidiary

125 Kennedy Drive
Hauppauge, New York 11788
(516) 231-1919
TWX 510 227-9895

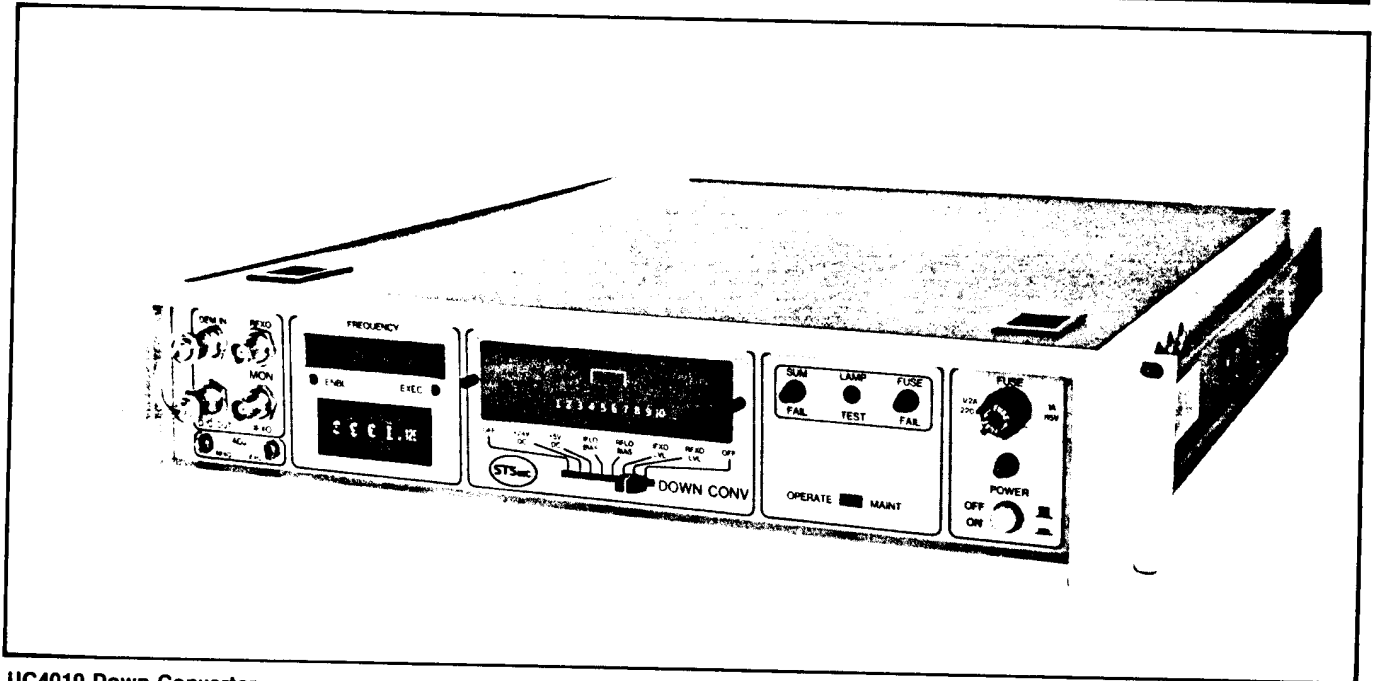


SATELLITE
TRANSMISSION
SYSTEMS, INC.

Synthesized Agile Frequency Converters

C band

UC6010 and DC4010



UC4010 Down Converter

Applications

Satellite Transmission Systems' (STS) UC6010 and DC4010 Series Agile, C band Up and Down Converters are primarily intended for use in narrow or wideband FDMA transmission/reception of FM/FDM message or video. They may also be used to provide frequency agile redundancy for several on-line, medium to high stability fixed frequency converters.

Features

- Synthesizer controlled, motor-tuned phase lock oscillators—standard 125 kHz steps
- Dual conversion—low phase/FM noise
- Front panel frequency trim adjust—crystal reference oscillators
- Operate/maintenance mode switch—deactivates alarms for testing
- Comprehensive built-in test equipment (BITE) with unique LED bar graph display
- Integrated monitor and control facilities—RS422 data and relay contact interfaces
- Compact, modular slide-drawer construction—commonality of spares between up and down converters

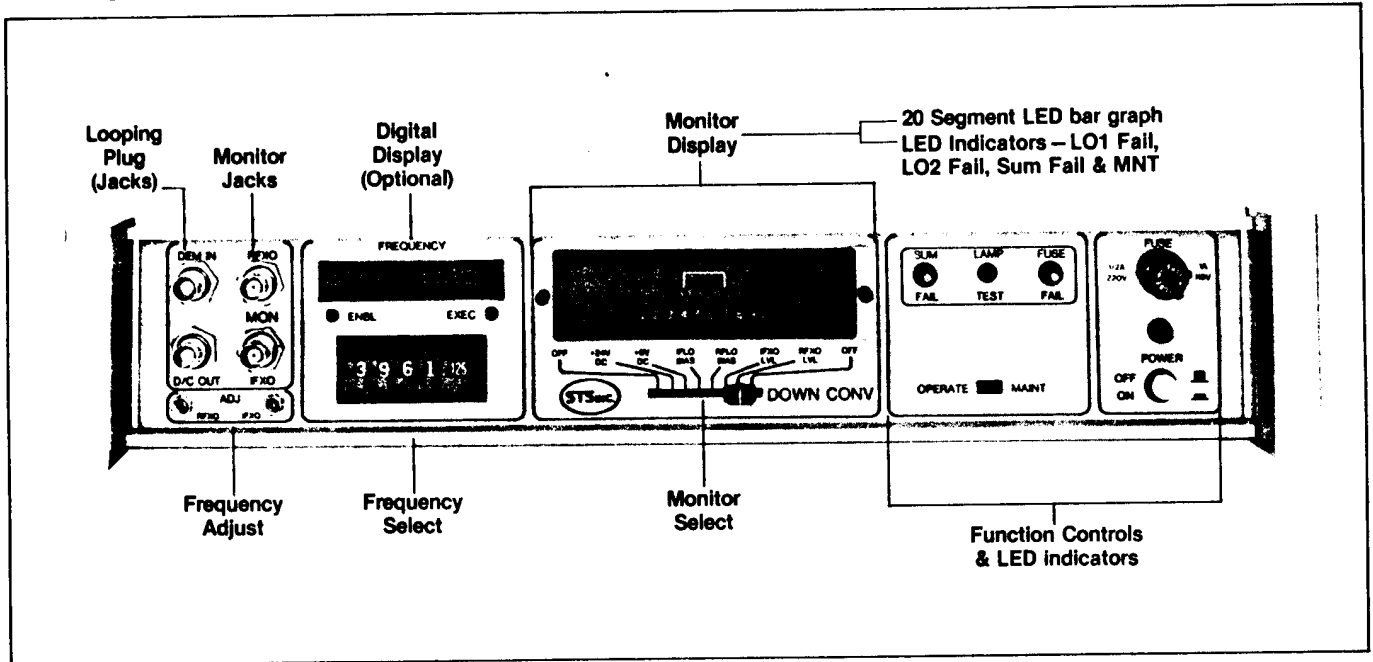
General

These synthesized agile frequency converters have been engineered by STS for high performance, extended reliability and continuous duty in satellite transmit/receive earth stations. Fully compliant with all DOMSAT and INTELSAT/CCIR standards, they are designed to interface readily with respective modulators/demodulators, HPA/LNA subsystems and related station equipment.

Dual conversion, utilizing state-of-the-art (digital thumbwheel controlled), frequency synthesizer tuned RF phase lock oscillators, with crystal reference oscillators, provides the desired agility while maintaining relatively high stability and spectral purity. Synthesizer motor-tuning provides exceptionally low phase/FM noise, with local or remote control in standard 125 kHz increments. A digital display of the frequency selected is available for remote control applications.

Options

- Remote frequency selection with local digital frequency display
- High speed electronic tuning
- 70 or 140 MHz IF bandwidth
- 115 or 230VAC primary power



Front Panel DC4010 Down Converter

Enhanced Operating, Maintenance and Troubleshooting Capabilities

Ease of operation and maintenance is assured by complete front panel control and monitoring of vital functions and operating parameters. An array of solid-state LEDs provide local fault/status indications and analog metering of selected voltages (bar graph). Up-front monitor jacks and looping plugs aid in converter and subsystem test and troubleshooting.

Efficient power consumption and rear exhaust fans maintain low operating temperatures to reduce the possibility of premature component failure, thereby improving reliability, extending longevity and minimizing downtime.

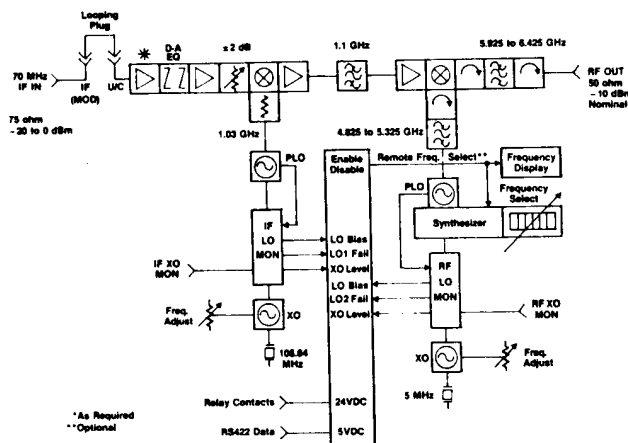
Advanced Remote Monitor and Control Facilities

Integral RS422 data and fail-safe (normally energized) relay contact interfaces provide compatibility with digital or conventional analog monitor and control subsystems. Converter control circuitry interfaces directly with the STS converter auto-switch units to establish fully integrated, unified converter subsystems.

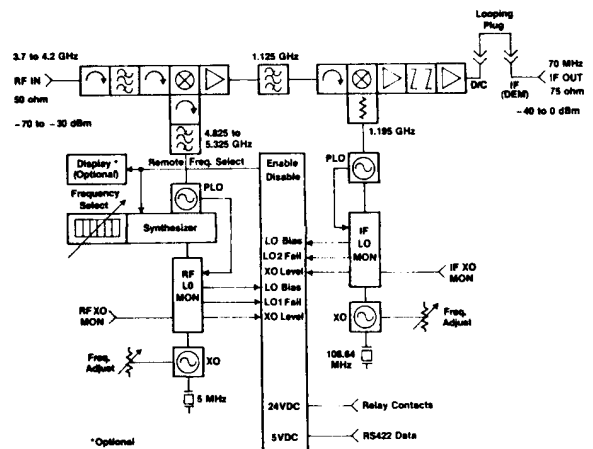
Remote Frequency Selection

Provisions for remote frequency selection are available as an option, featuring local/remote Enable and Execute mode switching, with a digital panel display of the frequency selected. Remote control is via parallel TTL, unbalanced, or BCD thumbwheel switches.

UC6010 Series Up Converter



DC4010 Series Down Converter



Specifications

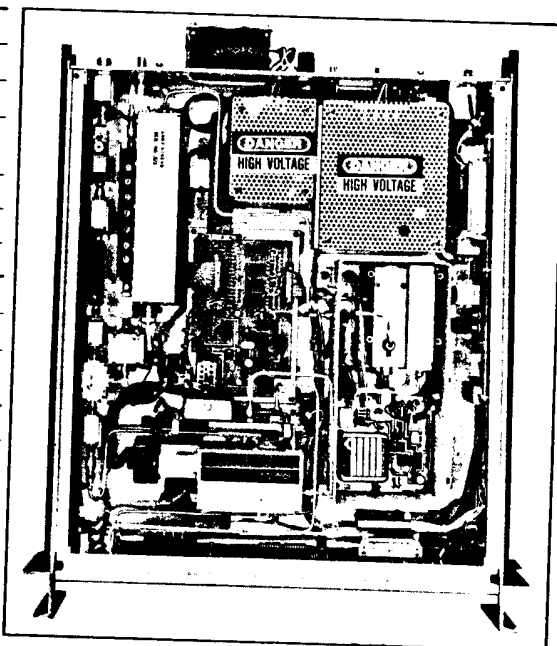
Up Converter

Down Converter

Model Series	UC6010	DC4010
RF Characteristics	Output	Input
Frequency Range: Standard Optional	5.925 to 6.425 GHz 5.845 to 6.425 GHz	3.7 to 4.2 GHz 3.62 to 4.2 GHz
Levels	- 10 dBm, nominal (Higher levels available)	- 70 to - 30 dBm
Impedance	50 ohms, unbalanced (Type N)	50 ohms, unbalanced (Type N)
VSWR	1.22:1	1.15:1
IF Characteristics	Input	Output
Frequency Range: Standard Optional	70 MHz ± 18 MHz 140 MHz ± 36 MHz	70 MHz ± 18 MHz 140 MHz ± 36 MHz
Levels	- 20 to 0 dBm (customer specified)	- 40 to 0 dBm
Impedance	75 ohms, unbalanced (BNC)	75 ohms, unbalanced (BNC)
Return loss	23 dB	20 dB
RF/IF Performance	Input to Output	Input to Output
Frequency sense	Positive (No spectrum inversion)	Positive (No spectrum inversion)
Conversion gain First IF	- 10 to + 10 dBm 1.1 GHz	+ 30 dB, nominal 1.125 GHz
Compression @ 1 dB	0 dBm	+ 15 dBm
Amplitude: Gain ripple Gain slope	0.4 dB (± 18 MHz) 0.05 dB/MHz	0.2 dB (± 18 MHz) 0.03 dB/MHz
Gain stability	± 0.25 dB/day	± 0.25 dB/day
Intermodulation: Third order intercept	+ 8 dBm	+ 25 dBm
Group delay: Linear Parabolic Ripple	0.05 ns/MHz 0.005 ns/MHz ² ± 0.5 ns peak	0.03 ns/MHz 0.003 ns/MHz ² ± 0.5 ns peak
Noise figure	N/A	14 dB
Image rejection	95 dBc	95 dBc
LO leakage	- 105 dBm (in band)	- 75 dBm (at input)

Synthesizer Tuned RF Local Oscillator

RF LO Frequency	4.825 to 5.325 GHz	
RF LO Type	Cavity-tuned phase-locked	
Synthesizer: Standard Optional	Motor-tuned, 125 KHz steps	Electronic-tuning, 125 KHz steps
Tuning	Automatic after frequency selection	
Control	Thumbwheel BCD local (remote optional)	
RF XO Reference	5 MHz crystal oscillator	
Frequency Stability		
s. Time	1x10 ⁻⁶ /yr	
s. Temperature	2x10 ⁻⁷	
Spectral Purity	Phase Noise (1 Hz SSB)	
Frequency offset	Motor-Tuned	Electronic
0 KHz	- 98 dBc	- 89 dBc
100 KHz	- 115 dBc	- 111 dBc
1 MHz	- 134 dBc	- 130 dBc
10 MHz	- 154 dBc	- 150 dBc



Down Converter Drawer (top cover removed)

STS Synthesized Agile Frequency Converters

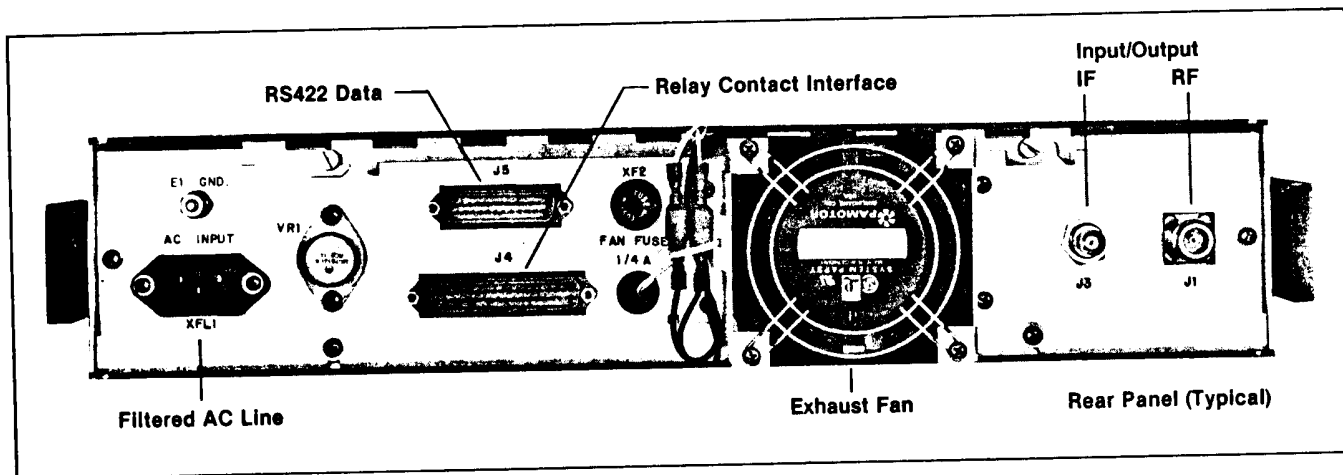
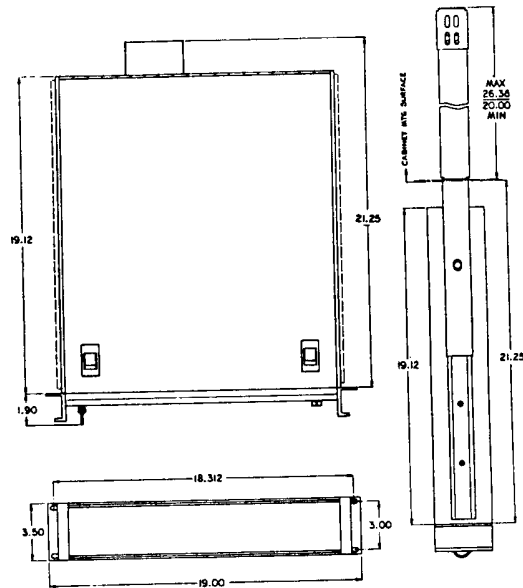
UC6010 and DC4010

Primary Power Requirements

Voltage	115VAC or 230VAC, $\pm 10\%$ single phase	
Frequency	50 to 60 Hz, ± 3 Hz	
Consumption	75 VA, nominal	
Environment	Operating	Storage
Temperature	0 to 50°C	- 30 to + 75°C
Humidity	0 to 95% (Non-condensing)	0 to 100%
Maximum Altitude (ASL)	10,000 ft.	50,000 ft.
Shock and vibration	As encountered in normal commercial shipping, handling and operation	

Mechanical Specifications

Net weight	25 lbs., nominal	
Shipping weight	Approximately 40 lbs.	
Volume	Approximately 3 cu. ft.	



Other STS Products

- Up/down converter auto-switching (1:1 and 1:N)
- Ku band agile frequency converters
- High stability frequency converters (C and Ku bands)
- Auxiliary/restoral local oscillator
- Modulators and demodulators
- Delay-amplitude equalizers
- 1:1 and 1:N data and IF switching
- IF filter/equalizers
- Monitor and control subsystems (digital/analog)
- Test translators (C and Ku bands)

Satellite Transmission Systems, Inc. is a leading supplier of satellite transmit/receive earth stations. A complete range of services are available to satisfy your earth station requirements, including turnkey earth station installations and subsystems integration, as well as upgrades and modernization of existing systems.

These agile frequency converters are part of an expanding line of field-proven ground communications equipment, designed and manufactured by STS. For additional information and prompt assistance with your particular application, contact the STS marketing department.



SATELLITE TRANSMISSION SYSTEMS, INC.

A California Microwave, Inc. Subsidiary

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TWX 510 227-9895

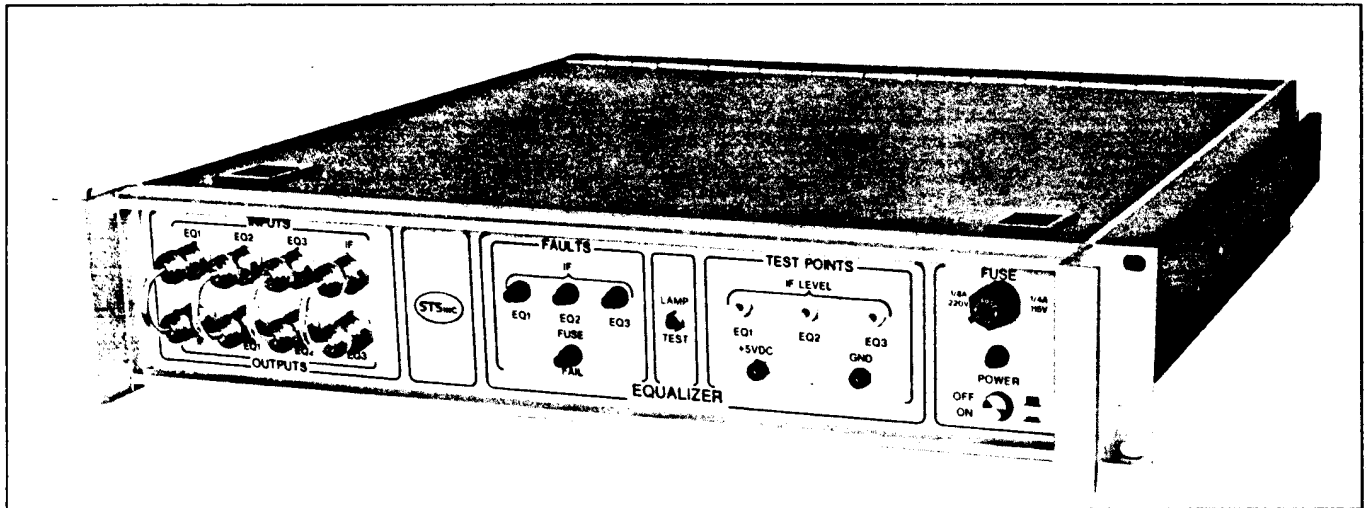


SATELLITE
TRANSMISSION
SYSTEMS, INC.

Delay-Amplitude Equalizers

70 MHz IF

DEQ700 and DEQ701



DEQ700

Features

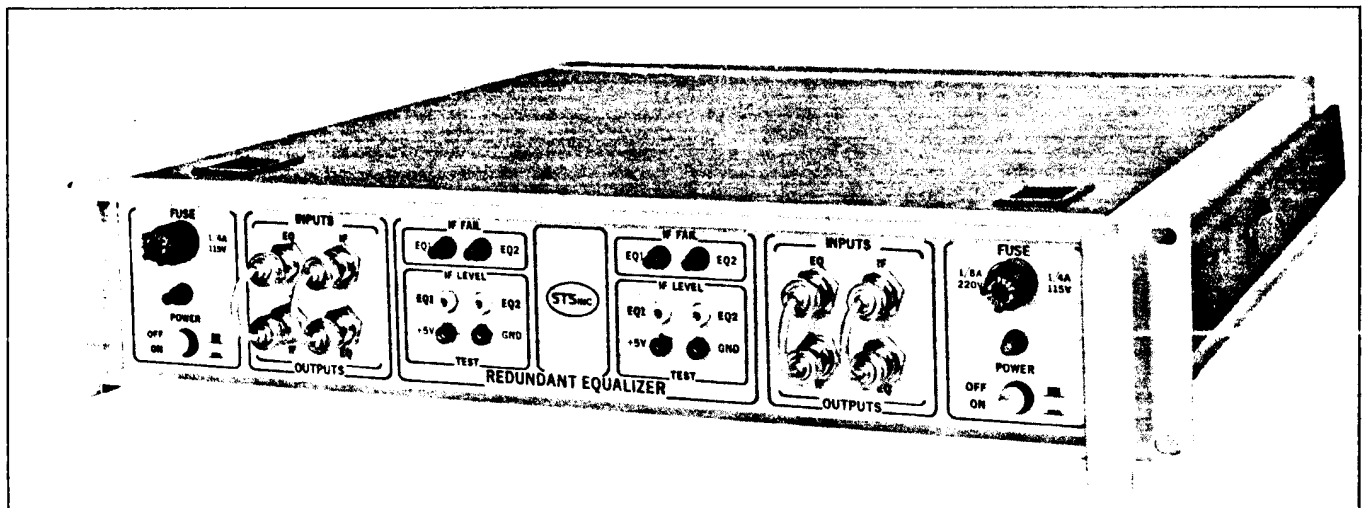
- Continuously variable group delay (magnitude and center frequency) and amplitude/slope
- No loss—adjustable for unity gain
- Redundant or non-redundant configurations
- Up to three, independently adjustable, 4-section delay/amplitude equalizer modules (cascaded)
- Built-in test equipment (BITE)
- Integrated monitor and control—relay contacts and RS422 data interfaces
- 115 or 230VAC primary power

Applications

Satellite Transmission Systems' (STS) DEQ700 Series Delay-Amplitude Equalizers are intended for use in satellite transmit/receive terminals to compensate for non-linear delay distortions generated by satellite filters, earth station equipment, waveguide or IFL cable. Fully compliant with all DOMSAT and INTELSAT/CCIR standards, they interface readily with all related earth station equipment.

Options

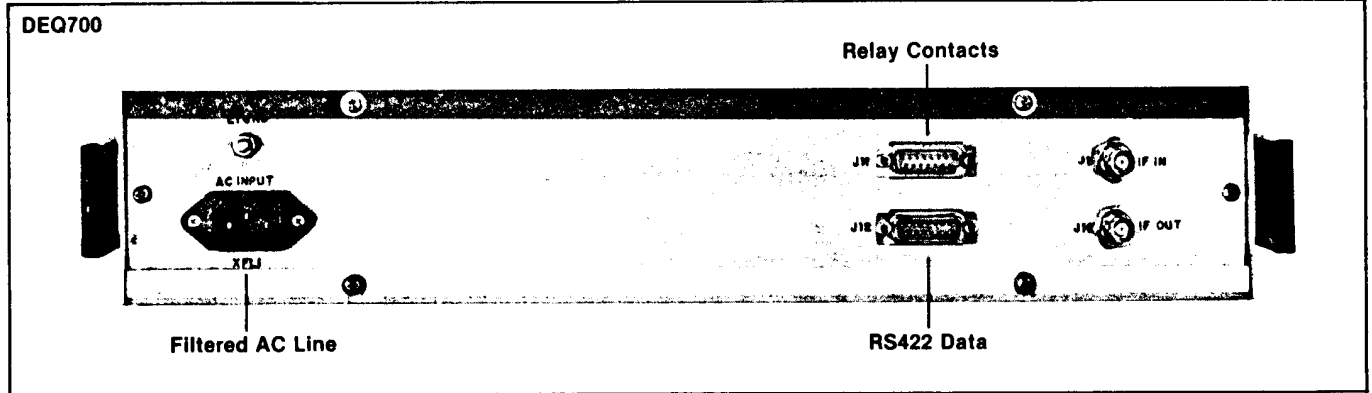
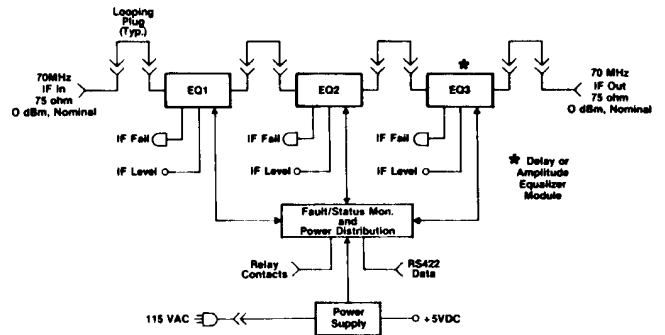
- 140 MHz IF (consult factory)



DEQ701

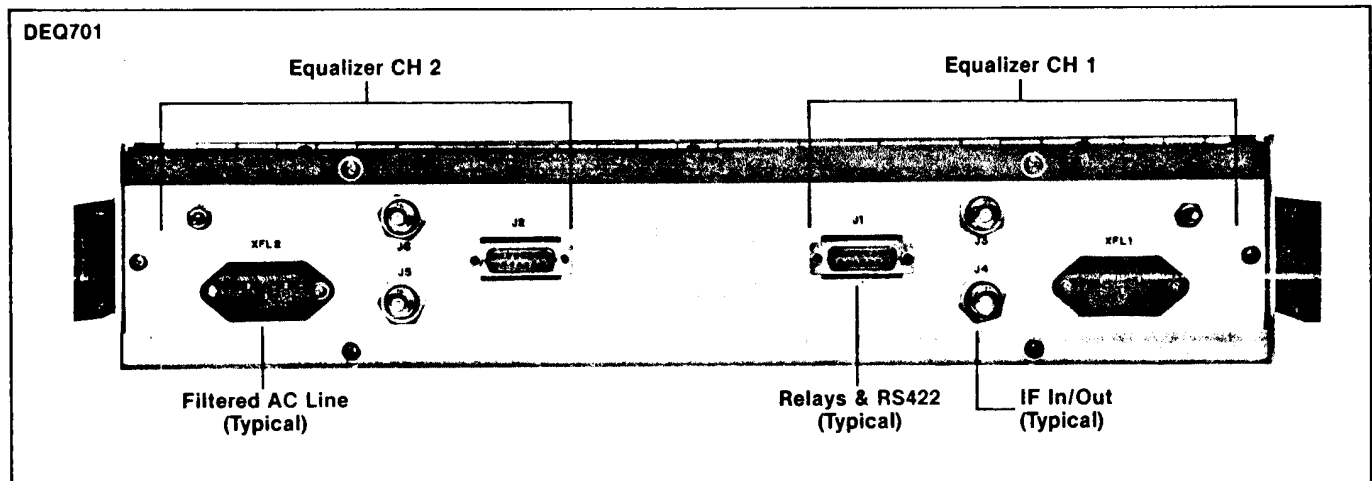
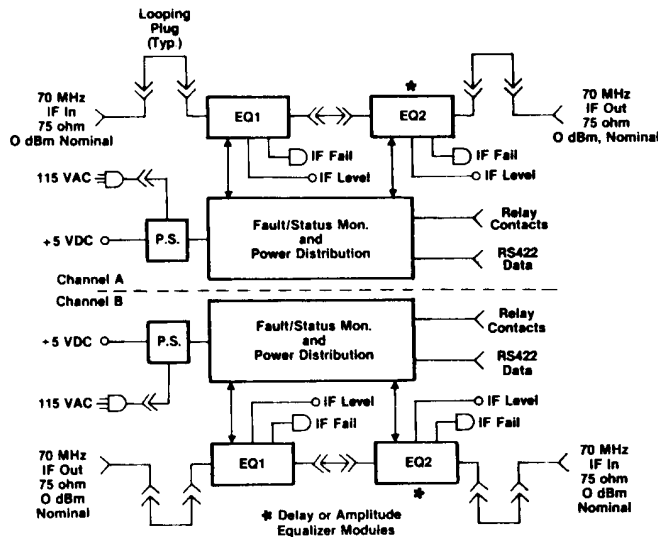
Model DEQ700

The Model DEQ700 is a single channel, rack mounting slide drawer assembly capable of housing from one to three STS equalizer modules in cascade. A typical DEQ700 configuration will utilize one or two delay equalizer modules for satellite and/or equipment equalization, followed by an amplitude (cable) equalizer module. The DEQ700 is self-contained with power supply, comprehensive fault/status monitoring and test facilities.



Model DEQ701

The Model DEQ701 is a dual channel drawer for redundant configurations, outfitted with one or two STS equalizer modules per channel. Each channel is completely independent of the other, including self-contained power supplies, control, monitoring and test facilities. The DEQ701 is intended as a compact, lower cost alternative to installing two (single channel) DEQ700 units, for redundancy, where the added versatility of three equalizer modules is not needed.

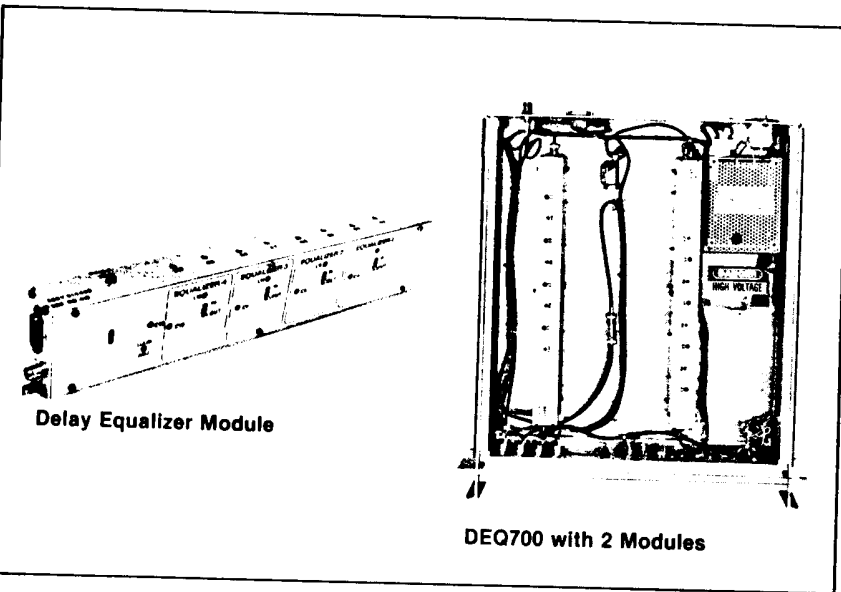


STS Equalizer Modules

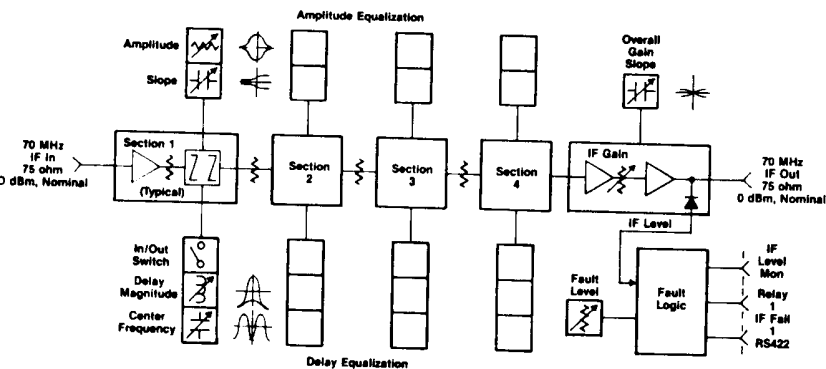
STS DEQ700 Series Modular Equalizers offer exceptional flexibility of delay-amplitude response shaping. Unlike the conventional approach of using fixed, plug-in delay sections, DEQ700 permits virtually any delay shape within the considerable range of adjustments provided.

The delay equalizer module has four sections that may be switched in or out of the through path, with continuously adjustable delay magnitude and frequency (parabolic linear), as well as amplitude/slope correction. For example, two sections can double the delay magnitude, and frequency may be varied to provide flat, "double-humped", true parabolic delay and slope response, or can even be adjusted to provide delay ripple.

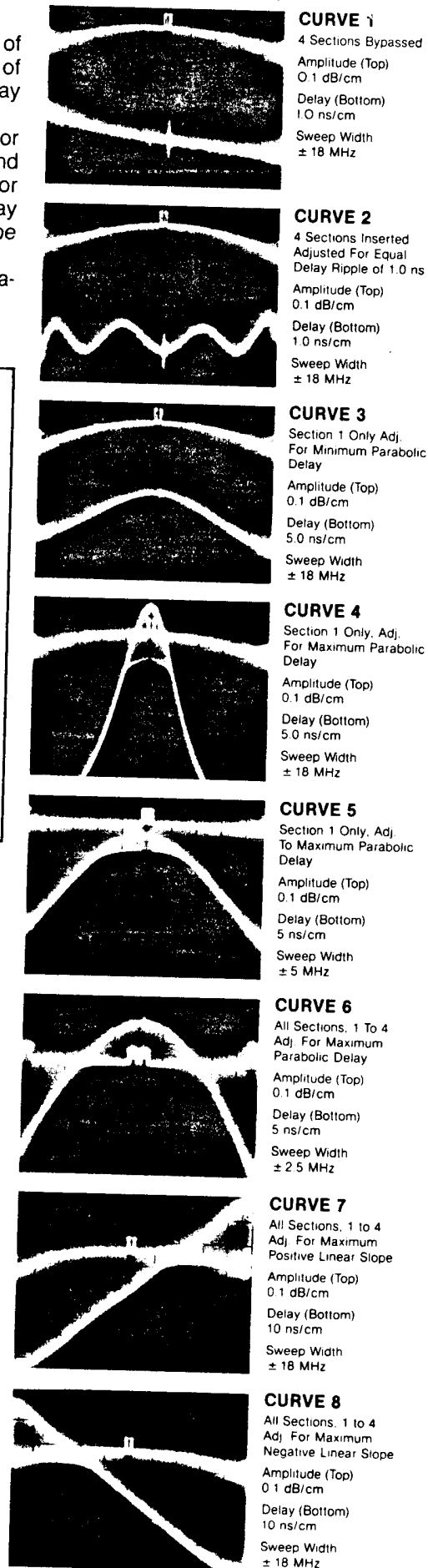
An optional amplitude equalizer module provides cable equalization capability, with switchable amplitude/slope adjustments and variable gain.



Delay Equalizer Module



Typical Curves



STS Delay - Amplitude Equalizers

DEQ700 and DEQ701

Specifications

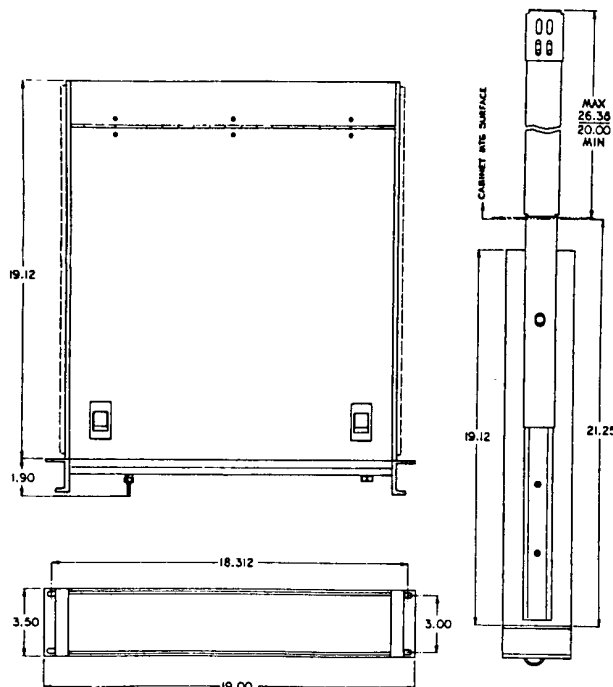
Delay Equalizer Module

Group delay response	Adjustable from 0 to:
36 MHz BW: Linear	$\pm 2\text{ns/MHz}$
Parabolic	0.13ns/MHz
5 MHz BW: Linear	$\pm 10\text{ ns/MHz}$
Parabolic	5ns/MHz^2
Amplitude response	
Equalizers out	0.1 dB peak to peak
Equalizers in	0.05 dB per section

Amplitude Equalizer Module

Amplitude response (36 MHz BW):

Slope adjustable ± 3 dB peak to peak in four switched increments, with continuously variable trim adjustment and 0 to 10 dB gain adjust.



DEQ700 and DEQ701

Input/Output Characteristics (1, 2 or 3 modules)

Frequency	70 MHz, ± 18 MHz
Levels	Single carrier 0 dBm
Impedance	75 ohms, unbalanced (BNC)
Return loss	Input, 23 dB/output 20 dB
Fault level adjust	- 1 to - 12 dBm output

Input to Output	1 Module	2 Modules	3 Modules
Gain	0 dB nominal (adjustable)		
1 dB compression	+ 8 dBm	+ 7 dBm	+ 6 dBm
3rd order intercept	+ 15 dBm	+ 13 dBm	+ 11 dBm
Amplitude response	± 0.05	± 0.1 dB	± 0.15 dB

Primary Power	DEQ700	DEQ701
Voltage	115 or 230 VAC, $\pm 10\%$ Single phase	
Frequency	50 to 60 Hz, ± 3 Hz	
Consumption (Fully configured)	13VA nominal	17VA nominal

Environment	Operating	Storage
Temperature	0 to 50°C	- 30 to + 75°C
Humidity	0 to 95% (non-condensing)	0 to 100%
Maximum altitude (ASL)	10,000 ft.	50,000 ft.
Shock and vibration	As encountered in normal commercial shipping, handling and operation.	

Mechanical Specifications

Net weight	25 lbs., nominal
Shipping weight	Approximately 40 lbs.
Volume	Approximately 3 cu. ft.

Other STS Products

- High stability-fixed and synthesized-agile up and down converters (C and KU bands)
- FM modulators and demodulators
- 1:1 and 1:N protection switching (RF/IF/Data)
- IF filter/equalizers
- Monitor and control subsystems (digital/analog)
- Test translators

Satellite Transmission Systems, Inc. is a leading supplier of satellite transmit/receive earth stations. A complete range of services are available to satisfy your earth station requirements including turnkey earth station installation and subsystems integration, as well as upgrades and modernization of existing systems.

The delay-amplitude equalizers are part of an expanding line of field-proven ground communications equipment, designed and built by STS. For additional information and prompt assistance with your particular application, contact the STS marketing department.



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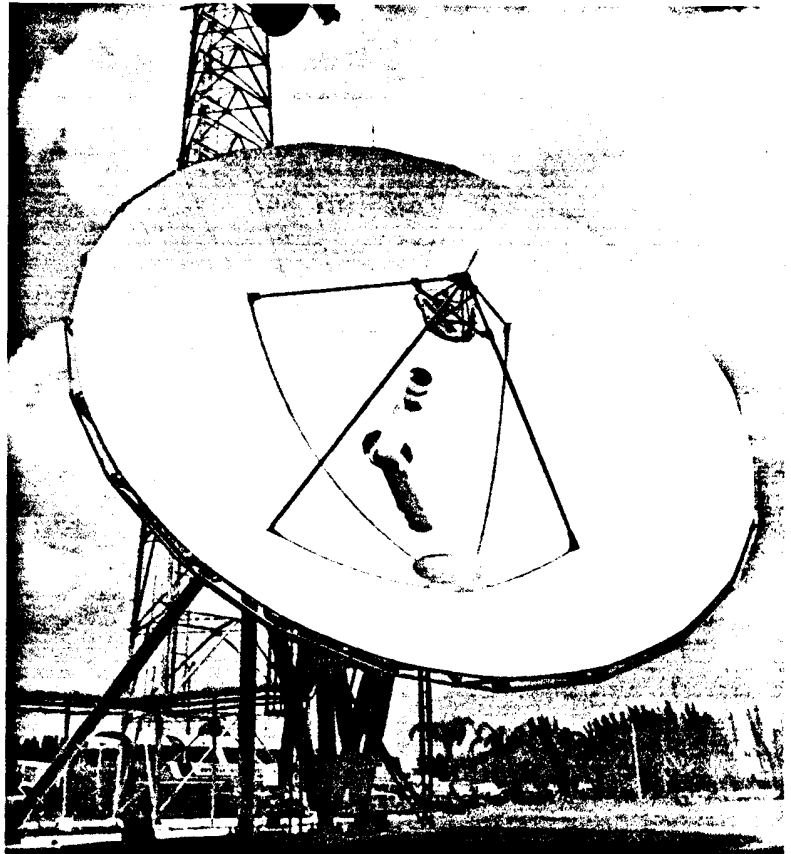


VERTEX COMMUNICATIONS CORPORATION
P.O. BOX 1277, KILGORE, TEXAS 75662

15-Meter C-Band Earth Station Antenna (V-Shaped Mount) Model 5265

FEATURES

- High performance
- Deep-dish reflector
- All-metal construction
- Mechanical quality and ruggedness



DESCRIPTION

The Harris Model 5265 15-Meter C-Band Antenna delivers outstanding performance for a variety of applications such as INTELSAT Standard "B" Earth Stations, domestic telephony and television networks, television uplinks, and private communication networks worldwide. The antenna features a unique and highly efficient deep-dish reflector combined with a high-performance Cassegrain feed. The system provides superior performance of 54.6 dB gain at 4 GHz and 57.6 dB gain at 6 GHz. The antenna meets the requirements for 2° satellite spacing per FCC Docket 81-704.

Harris antennas set the industry standard for mechanical quality and ruggedness, and the Model 5265 Antenna is no exception. The

aluminum reflector surface is supported by a steel V-shaped pedestal. The antenna system is extremely rigid and is designed to withstand hurricane-force winds without losing video signals. Manual azimuth, elevation and polarization adjustment drive is standard; motorized drive systems are provided for special requirements. Turnkey installation and installation assistance are also available.

ORDERING INFORMATION

Standard Model 5265 includes reflector, subreflector, backup structure, V-shaped mount, and feed mounting assembly. To order feed, see options.

OPTIONS

- A. Feed (Specify):
 - 2 port Rx/Rx linear polarization
 - 2 port Tx/Rx linear polarization
 - 4 port frequency reuse/linear
 - 4 port frequency reuse/linear/independent rotation
 - 4 port frequency reuse/circular
 - Other (Consult factory)
- B. Motor drive system:
 - 91350U (Order controller, option C)
- C. Antenna controller:
 - 9134 Jog Controller
 - 9135 Antenna Control System
 - 9165 Earth Station Controller
- D. Feed deicing
- E. Reflector deicing (Full or half)
- F. LNA enclosure
- G. Aircraft warning light
- H. Lightning protection

Specifications

15-Meter C-Band Earth Station Antenna (V-Shaped Mount) Model 5265

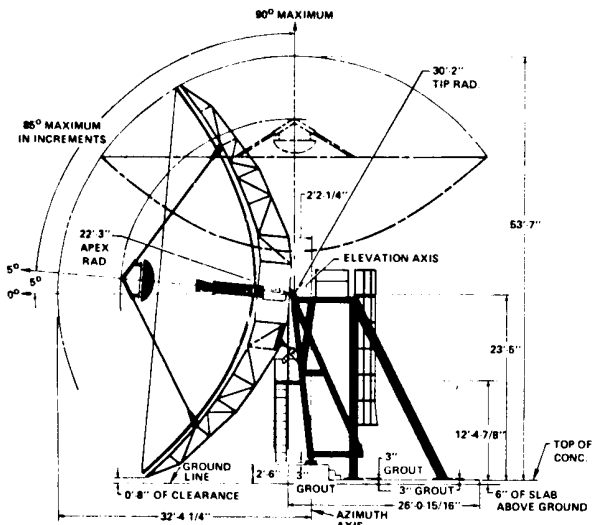
ELECTRICAL SPECIFICATIONS	RECEIVE	TRANSMIT
Frequency	3.7-4.2 GHz	5.925-6.425 GHz
Gain at 4 and 6 GHz (4 Port Feed)	54.6 dBi	57.6 dBi
VSWR	1.3:1	1.3:1
Beamwidth		
-3 dB	0.34°	0.23°
-15 dB	0.7°	0.46°
Antenna Noise Temperature		
5° Elevation	53° K	
10° Elevation	42° K	
20° Elevation	34° K	
40° Elevation	31° K	
Typical G/T at 20° Elevation, Clear Horizon, 4 GHz		
With 40° LNA dB° K	35.6	
With 100° LNA dB° K	33.1	
Power Handling Capability		5 kW/port
Feed Interface	CPR-229G	CPR-159G
Port-to-Port Isolation		
Tx to Rx	30 dB	30 dB
Rx-Rx, Tx-Tx Linear	35 dB	30 dB
Rx-Rx, Tx-Tx Circular	18 dB	18 dB
Cross Polarization Isolation		
On Axis	35 dB (typical 40 dB)	
Within 1 dB Contour	30 dB	
Axial Ratio (Circular Polarization)		
2 Port Tx/Rx	2.9 dB (INTELSAT III, IV)	
4 Port Frequency Reuse	0.5 dB (INTELSAT IVA, V)	
Sidelobes		
1st Sidelobe	-13 dB	
1° to 7°	29-25 log θ dBi	
7° to 9.2°	+ 8 dBi	
9.2° to 48°	32-25 log θ dBi	
48° to 180°	-10 dBi	

ENVIRONMENTAL SPECIFICATIONS	
Operational Winds	45 mi/h (72 km/h) gusts to 60 mi/h (97 km/h)
Survival Winds (Any Position)	125 mi/h (200 km/h)
Ambient Temperature (Survival)	-25° to 70° C (-13° to 158° F)
Rain (Operational and Survival)	Up to 4 in/h (10 cm/h)
Relative Humidity (Operational and Survival)	0% to 100% with condensation
Solar Radiation	360 BTU/h/ft ² (1000 Kcal/h/m ²)
Radial Ice (Operational)	¼ inch (0.6 cm) on all surfaces except reflector, with deicing heaters energized
Radial Ice (Survival)	1 inch (2.5 cm) on all surfaces; ½ inch (1.3 cm) on all surfaces with 80 mi/h (130 km/h) wind gusts
Shock and Vibration	As encountered during shipment by commercial air, rail or truck
Corrosive Atmosphere	As encountered in coastal regions and/or heavily industrialized areas
Seismic (Survival)	0.3 G's horizontal, 0.1 G's vertical

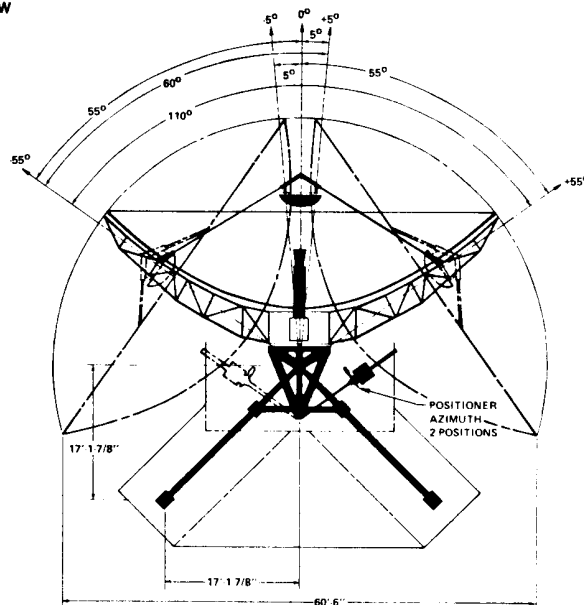
MECHANICAL SPECIFICATIONS	
Azimuth Travel	110° (two 60° increments)
Azimuth Travel Rate	0.015°/second
Elevation Travel	5° to 90° continuous
Elevation Travel Rate	0.015°/second
Polarization Travel	± 90°
Polarization Travel Rate	1.0°/second
Weight - Reflector	35,570 pounds (16,100 kg)
Weight - Pedestal	31,890 pounds (14,460 kg)
Shipping Weight (Typical)	75,200 pounds (34,100 kg)
Shipping Volume	8,450 cubic feet (239 cubic meters)
Finishes	
Reflector Surface	Aluminum panels with heat-diffusing white paint.
Reflector Backup Structure and Pedestal	Hot-dipped galvanized steel
Surface Accuracy	0.040 inch static (1.0 mm)
Foundation Size	26 ft x 46 ft approximately (7.9 m x 14 m)
Concrete Volume	107 cubic yards (81.8 cubic meters)
Reinforcing Steel	11,800 pounds (5,350 kg)
Soil Bearing Pressure	3,000 lb/ft ² (15,000 kg/m ²)

Specifications and product availability subject to change without notice

SIDE VIEW



PLAN VIEW



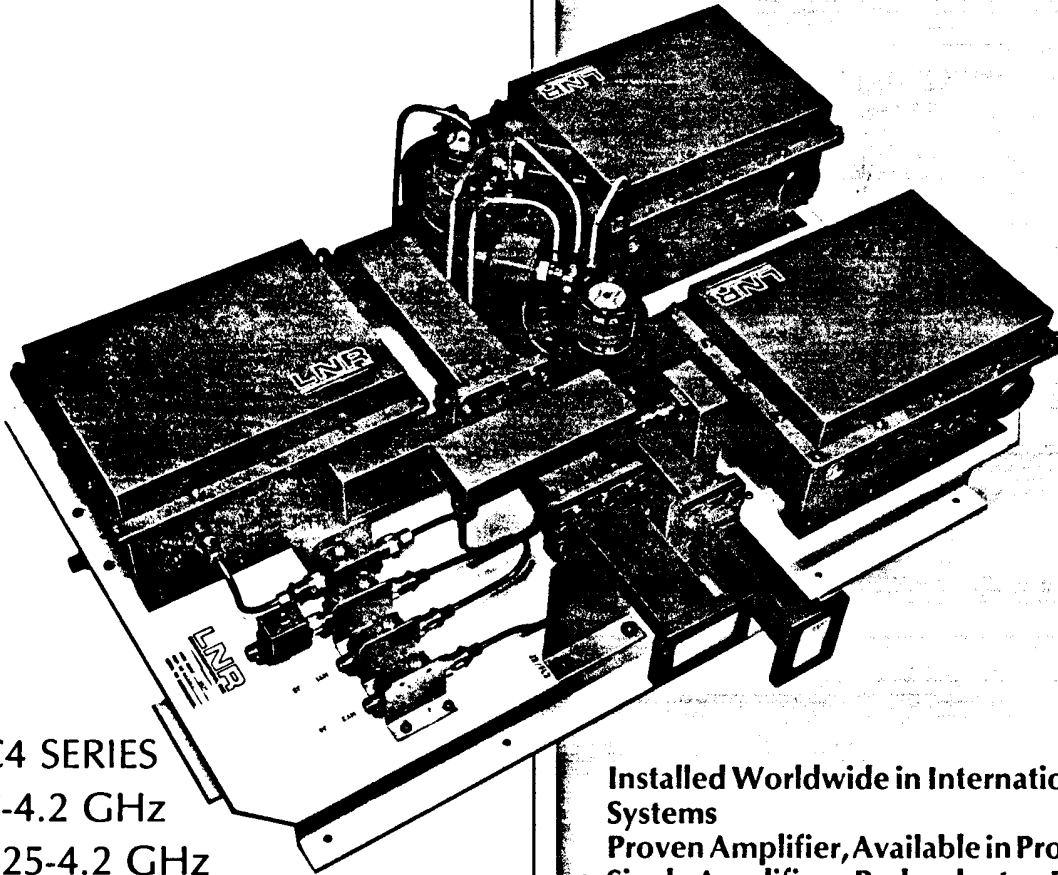
VERTEX COMMUNICATIONS CORPORATION
P.O. BOX 1277, KILGORE, TEXAS 75662

LNR

COMMUNICATIONS

180 Marcus Blvd., Hauppauge, N.Y. 11788
 TEL: (516)273-7111 TWX:510-227-9871

NC4 LOW NOISE AMPLIFIERS FOR SATELLITE COMMUNICATIONS



NC4 SERIES
 3.7-4.2 GHz
 3.625-4.2 GHz
 3.4-4.2 GHz

QUIET
30°K MAX.
 THE NC4-28S
 A NEW GENERATION
 OF LOW NOISE
 AMPLIFIERS.

Installed Worldwide in International and Domestic Systems
 Proven Amplifier, Available in Production Quantities
 Single Amplifiers, Redundant or Frequency Reuse Configurations
 Broad Range of Noise Temperature Options:

Frequency Range			Noise Temperature	
3.7-4.2 GHz	3.625-4.2 GHz	3.4-4.2 GHz	Typical	Maximum
Model			Typical	Maximum
NC4-28S	NC4-28S/575	—	28K	30K
NC4-30S	NC4-30S/575	—	30K	33K
NC4-33S	NC4-33S/575	—	31K	35K
NC4-38S	—	—	34K	38K
NC4-40S	NC4-40S/575	—	36K	43K
NC4-42S	—	—	42K	46K
NC4-45SC	—	NC4-40S/800	45K	50K
NC4-61	—	—	55K	60K

GENERAL SPECIFICATIONS

LNR MODEL NC4 SERIES LOW NOISE AMPLIFIERS

Frequency Range 3.7 to 4.2 GHz 3.625-4.2 GHz 3.4-4.2 GHz
 Bandwidth (Instantaneous (α 1dB) 500 MHz 575 MHz 800 MHz
 Noise Temperature

Frequency Range			Noise Temperature	
3.7-4.2 GHz	3.625-4.2 GHz	3.4-4.2 GHz	Typical*	Maximum*
Model			Typical*	Maximum*
NC4-28S	NC4-28S/575	—	28K	30K
NC4-30S	NC4-30S/575	—	30K	33K
NC4-33S	NC4-33S/575	—	31K	35K
NC4-38S	—	—	34K	38K
NC4-40S	NC4-40S/575	—	36K	43K
NC4-42S	—	—	42K	46K
NC4-45SC	—	NC4-40S / 800	45K	50K
NC4-61	—	—	55K	60K

*Note: Amplifier only; redundant systems higher depending upon configuration

Gain 60 dB (other values available)
 Gain ripple across band ± 0.5 dB (Max.)
 Gain slope ± 0.3 dB/10 MHz (Max.)
 Dynamic Range (1 dB gain compression) +10 dBm out
 Gain Stability—short term ± 0.1 dB/hour
 —medium term ± 0.2 dB/day
 —long term ± 0.5 dB/week
 Group Delay (per 40 MHz segment)
 Linear Component ± 0.1 ns/MHz (max.)
 Parabolic Component ± 0.01 ns/MHz² (max.)
 Ripple Component 0.3ns p-p (max.)
 VSWR
 Amplifier Redundant /TRIDUNDANT®
 Input 1.25 1.30
 Output 1.25 1.25
 Intermodulation (third order) Rejection is 60 dB (min.) for two carriers each at input levels of
 —62 dBm for 50 dB gain
 —67 dBm for 55 dB gain
 —72 dBm for 60 dB gain
 AM/PM Conversion 0.03°/dB (max.) for input level of
 —60 dBm for 50 dB gain
 —65 dBm for 55 dB gain
 —70 dBm for 60 dB gain
 Inband Overdrive 0 dBm at input with no permanent degradation of performance
 Out-of-Band signal levels The LNA shall deliver the specified performance when operated in the presence of
 input signal levels of -10 dBm in the 5925 to 6425 MHz transmit range.
 Spurious Below thermal noise/100 KHz (ref. input)
 Input/Output Connections Input—CPR229G
 Output—Type N Coaxial
 Pump Source Fundamental Solid-state Gunn oscillator(s)
 Prime Power 120/230 VAC $\pm 10\%$, 50/60 Hz (other voltages available)
 NC4-28S, -30S, -33S, -38S, -40S, -42S NC4-45SC, -61
 27x40x18 cm (10x12 $\frac{3}{4}$ x7 $\frac{1}{2}$ in.) 30x19x20 cm (12x7 $\frac{1}{4}$ x8 in.)
 Size
 Weight 16 kg. (35 lbs.) 9 kg. (20 lbs.)
 Power Consumption NC4-28S, -30S, -33S, -38S, -40S, -42S NC4-45SC, -61
 Operating 500W 250W
 Start-Up 1000W 350W

LNR can provide complementary Ground Communications Equipment including Up/Down Converters, Message and Video Receivers, Message and Video Exciters, Earth Station Test Instrumentation, etc. Data sheets are available for the asking. Special equipment can be supplied to individual earth station requirements. Please contact LNR Marketing Department.

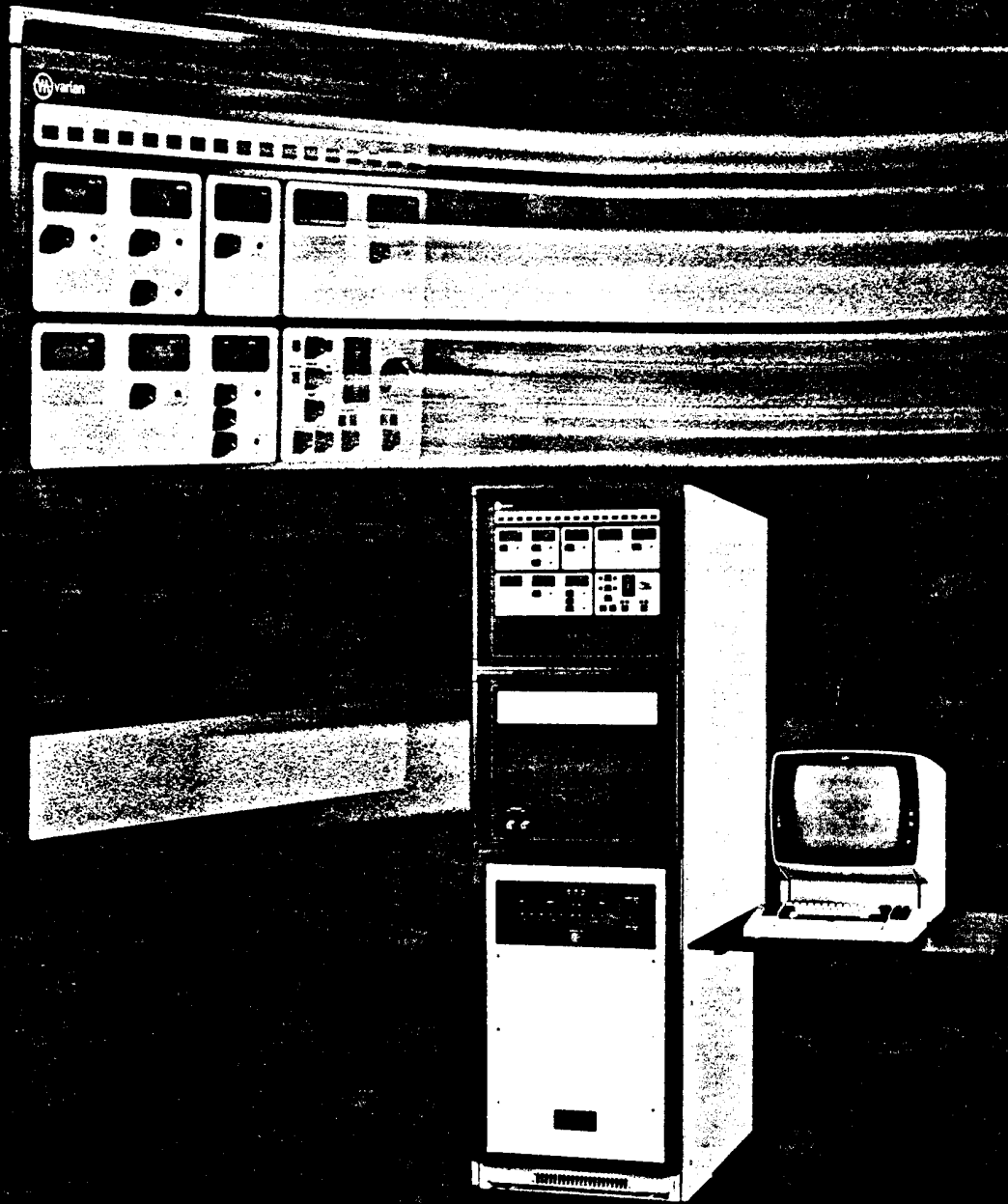
Other communications amplifiers and equipment available from 1 to 94 GHz

Specifications are subject to change without notice



COMMUNICATIONS, INC. 180 MARCUS BLVD. HAUPPAUGE, N.Y. 11788 TEL: (516) 273-7111 • TWX: 510-227-9871

series VZJ-2700G



GEN II c-band klystron power amplifier

VZJ-2700G SPECIFICATIONS**Electrical**

Frequency Band 5.925 to 6.425 GHz
(5.850 to 6.425 GHz with VA-936R Klystron)

Power Output/Gain/Bandwidth (at cabinet output flange)

TUBE Type ³	P _o NOM	P _o MIN ¹	GAIN @ RATED - 1 dB	
			POWER MIN ²	BANDWIDTH (MIN)
VA-936N	.75 kW	58.3 dBm	77 dB	40 MHz
VA-936J	1.7 kW	61.8 dBm	77 dB	40 MHz
VA-936L	3.35 kW	64.8 dBm	77 dB	45 MHz
VKC-7936L	3.35 kW	64.8 dBm	77 dB	45 MHz
VA-936R	3.35 kW	64.8 dBm	77 dB	48 MHz

RF Power Output Adjust	0 to 20 dB continuous, with ± 0.1 dB of desired setting.
RF Adjust Linearity	2 dB/turn ± 0.5 dB.
Gain Stability at Constant Drive and Constant Temperature	± 0.25 dB/24 hr.
Gain Variation vs. Temperature at Constant Drive:	
20° to 40°C	1 dB max/24 hr.
0° to 50°C	2.5 dB max/24 hr.
Gain Variation vs. Frequency	0.4 dB P/P max., F _o ± 13 MHz
Gain Slope vs. Frequency	± 0.02 dB/MHz, F _o ± 6 MHz. ± 0.04 dB/MHz, F _o ± 13 MHz.
Input VSWR	1.2:1 max.
Output VSWR (Cold)	1.2:1 max. ¹
Load VSWR	2.0:1 max. for full specification compliance; any value for no damage.
Harmonic Output (without filter)	- 55 dBc (2nd) ¹ - 50 dBc (3rd) ¹
Harmonic Output (with filter)	- 80 dBc (all)
AM/PM Conversion	4 °/dB max. at rated power output.
Noise and Spurious (excluding Harmonics)	- 70 dBw/4 kHz max. over 5.9 to 6.4 GHz. - 135 dBw/4 kHz max. over 3.7 to 4.2 GHz.
(at rated small signal gain)	- 110 dBw/1 MHz max. over 4.2 to 40.0 GHz.
Intermodulation Products	- 30 dBc for total power of 2 equal carriers at 7 dB back-off below rated power.
Residual FM	90 dB below a P/P deviation of 4 MHz in any 5 MHz band.
Residual AM	- 43 dBc max. up to 400 Hz; - 80 dBc max. up to 4 kHz; - 90 dBc max. up to 500 kHz (referenced to single carrier at rated power output)
Group Delay	In any 36 MHz transponder band: ± 0.25 nsec/MHz linear, max. 0.05 nsec/MHz parabolic, max. 2.0 nsec P/P ripple.

¹ Not including optional harmonic filter.

² Small signal gain (100W power output) is 80 dB min.

³ Other VA-936, VKC-7936 series or VKC-7980 series tubes can be provided.

VZJ-2700G SPECIFICATIONS

Electrical (cont.)

Prime Power 120/208 VAC $\pm 10\%$;
3 phase plus neutral and
ground (5 wire)
50 to 60 Hz $\pm 5\%$;
12 KVA max. for 3.35 kW
klystron.
7 kVA max. for 1.7 kW
klystron.
4 kVA max. for 0.75 kW
klystron.
1 kVA max. on standby

Power Factor 0.9 min.¹

In Rush Current 175% of full load max.¹

Heater Power Reduction Automatic 10% reduction in
heater power when beam is
turned off. Automatic
restoration to normal when
beam is applied.

Mechanical

Cabinet Dimensions 72"H x 23.5"W x 34"D

Weight \approx 1300 lbs typical

Optional Integral Components Motorized channel
selector/local control panel
Computer Interface card
RS232 or RS422 addressable
data transmission bus.
High power harmonic filter.
Peak power metering.
Line voltage adapter.

Customer Interface Electrical—top of cabinet.
Cooling—rear of cabinet.
RF input—top of cabinet
(Type N or CPR-137F).
RF output (CPR-137F
flange)—top of cabinet.
RF monitors—front of
cabinet.
Form "C" contacts, major
status and control—
top of cabinet.

Environmental

The amplifier will meet specified performance under any
combination of environmental conditions listed below.

CONDITION	OPERATIONAL	NON-OPERATIONAL
Temperature	- 10°C to + 50°C	- 40°C to + 80°C
Altitude	10,000 feet ²	40,000 feet
Relative Humidity	95% max.	95% max.
Shock/Vibration	As normally encountered in Earth Station operation.	As normally encountered in shipping and handling.

¹When used with VA-936L klystron.

²With standard adiabatic temperature derating

NOTE:

CHARACTERISTICS AND OPERATING VALUES ARE BASED ON PERFORMANCE TESTS. THESE FIGURES MAY CHANGE WITHOUT
NOTICE AS A RESULT OF ADDITIONAL DATA OR PRODUCT REFINEMENT. CONTACT VARIAN BEFORE USING THIS INFORMATION FOR
PRODUCT DESIGN.