

TECHNICAL MANUAL

HX 1V TELEVISION EXCITER
992 8372 001
988-2328-001

HARRIS

T.M. No. 888-2328-001

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Damaged or undamaged equipment should not be returned unless written approval and a Return Authorization is received from HARRIS CORPORATION, Broadcast Systems Division. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with HARRIS CORPORATION, Broadcast Systems Division, specify the HARRIS Order Number or Invoice Number.

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Replacement parts are available 24 hours a day, seven days a week from the HARRIS Service Parts Department. Telephone 217/222-8200 to contact the service parts department or address correspondence to Service Parts Department, HARRIS CORPORATION, Broadcast Systems Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. The HARRIS factory may also be contacted through a FAX facility (217/221-7096).

NOTE

The # symbol used in the parts list means used with (e.g. #C001 = used with C001).

**MANUAL REVISION HISTORY
HX 1V EXCITER
988-2328-001**

Rev. #	Date	ECN	Pages Affected:
001-A	May 1992	37936	Replaced Title Page, 5-4 and 5-5 Added MRH-1/MRH-2
001-B	June 1992	37946	Replaced Title Page, MRH-1/MRH-2 and pages 7-13 to 7-16
001-C	April 1993	38515	Replaced Title Page, MRH-1/MRH-2 and all of Section VII
001-D	Feb. 1994	38751	Replaced Title Page, MRH-1/MRH-2 and all of Section VII
001-E	July 1994	39201	Replaced Title Page, MRH-1/MRH-2 and all of Section VII
001-F	Aug. 1994	39224	Replaced Title Page, MRH-1/MRH-2, and pages iv, v, 4-2, 5-14, 5-16, 5-17, 7-17, 7-18, & 7-19
001-G	Oct. 1994	39513	Replaced Title Page, MRH-1/MRH-2, and pages 7-7 & 7-8
001-H	April 1995	39915	Replaced Title Page, MRH-1/MRH-2, and page 1-3
001-J	May 1995	39754	Replaced Title Page, MRH-1/MRH-2, and page 5-7
001-K	05-09-95	39893	Replaced Title Page, MRH-1/MRH-2, and pages 7-17 to 7-19
001-L	01-09-96	39936R	Replaced Title Page, MRH-1/MRH-2, and pages 7-12 to 7-14
001-M	02-28-96	TBD	Replaced Title Page, MRH-1/MRH-2, and page 4-8
001-N	10-28-96	41553	Replaced Title Page, MRH-1/MRH-2, and pages iv, v, and 4-7 to 4-10
001-N1	10-30-96	41456	Replaced Title Page, MRH-1/MRH-2, and pages 7-1 and 7-28. Added 7-29 & 7-30
001-N2	04-29-97	41005	Replaced Title Page, MRH-1/MRH-2, and pages 7-24 to 7-26
001-P	09-09-97	41796	Replaced Title Page, MRH-1/MRH-2, iv, v, and all of Sections IV, V, & VII
001-P1	02-08-99	42225	Replaced Title Page, MRH-1/MRH-2, and all of Section VII
001-P2	05-31-00	45921	Replaced Title Page, MRH-1/MRH-2, and all of Section VII

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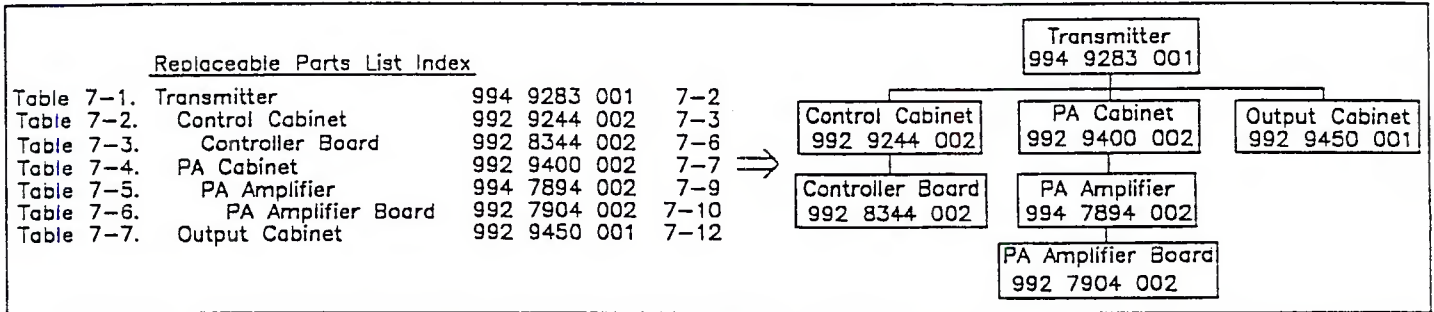
MRH-1/MRH-2

WARNING: Disconnect primary power prior to servicing.

Guide to Using Harris Parts List Information

The Harris Replaceable Parts List Index portrays a tree structure with the major items being leftmost in the index. The example below shows the Transmitter as the highest item in the tree structure. If you were to look at the bill of materials table for the Transmitter you would find the Control Cabinet, the PA Cabinet, and the Output Cabinet. In the Replaceable Parts List Index the Control Cabinet, PA Cabinet, and Output Cabinet show up one indentation level below the Transmitter and implies that they are used in the Transmitter. The Controller Board is indented one level below the Control Cabinet so it will show up in the bill of material for the Control Cabinet. The tree structure of this same index is shown to the right of the table and shows indentation level versus tree structure level.

Example of Replaceable Parts List Index and equivalent tree structure:



The part number of the item is shown to the right of the description as is the page in the manual where the bill for that part number starts.

Inside the actual tables, four main headings are used:

Table #-. ITEM NAME - HARRIS PART NUMBER - this line gives the information that corresponds to the Replaceable Parts List Index entry;

HARRIS P/N column gives the ten digit Harris part number (usually in ascending order);

DESCRIPTION column gives a 25 character or less description of the part number;

REF. SYMBOLS/EXPLANATIONS column 1) gives the reference designators for the item (i.e., C001, R102, etc.) that corresponds to the number found in the schematics (C001 in a bill of material is equivalent to C1 on the schematic) or 2) gives added information or further explanation (i.e., "Used for 208V operation only," or "Used for HT 10LS only," etc.).

Inside the individual tables some standard conventions are used:

A # symbol in front of a component such as #C001 under the REF. SYMBOLS/EXPLANATIONS column means that this item is used on or with C001 and is not the actual part number for C001.

In the ten digit part numbers, if the last three numbers are 000, the item is a part that Harris has purchased and has not manufactured or modified. If the last three numbers are other than 000, the item is either manufactured by Harris or is purchased from a vendor and modified for use in the Harris product.

The first three digits of the ten digit part number tell which family the part number belongs to - for example, all electrolytic (can) capacitors will be in the same family (524 xxxx 000). If an electrolytic (can) capacitor is found to have a 9xx xxxx xxx part number (a number outside of the normal family of numbers), it has probably been modified in some manner at the Harris factory and will therefore show up farther down into the individual parts list (because each table is normally sorted in ascending order). Most Harris made or modified assemblies will have 9xx xxxx xxx numbers associated with them.

The term "SEE HIGHER LEVEL BILL" in the description column implies that the reference designated part number will show up in a bill that is higher in the tree structure. This is often the case for components that may be frequency determinant or voltage determinant and are called out in a higher level bill structure that is more customer dependent than the bill at a lower level.

WARNING

THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY WARNINGS, INSTRUCTIONS AND REGULATIONS.

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care. HARRIS CORPORATION shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

During installation and operation of this equipment, local building codes and fire protection standards must be observed. The following National Fire Protection Association (NFPA) standards are recommended as reference:

- Automatic Fire Detectors, No. 72E
- Installation, Maintenance, and Use of Portable Fire Extinguishers, No. 10
- Halogenated Fire Extinguishing Agent Systems, No. 12A

WARNING

ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS, PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR WHEN FATIGUED.

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don't take chances.

WARNING

IN CASE OF EMERGENCY ENSURE THAT POWER HAS BEEN DISCONNECTED.

WARNING

IF OIL FILLED OR ELECTROLYTIC CAPACITORS ARE UTILIZED IN YOUR EQUIPMENT, AND IF A LEAK OR BULGE IS APPARENT ON THE CAPACITOR CASE WHEN THE UNIT IS OPENED FOR SERVICE OR MAINTENANCE, ALLOW THE UNIT TO COOL DOWN BEFORE ATTEMPTING TO REMOVE THE DEFECTIVE CAPACITOR. DO NOT ATTEMPT TO SERVICE A DEFECTIVE CAPACITOR WHILE IT IS HOT DUE TO THE POSSIBILITY OF A CASE RUPTURE AND SUBSEQUENT INJURY.

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WARNING: Disconnect primary power prior to servicing.

TREATMENT OF ELECTRICAL SHOCK

1. IF VICTIM IS NOT RESPONSIVE FOLLOW THE A-B-CS OF BASIC LIFE SUPPORT.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

(A) AIRWAY

IF UNCONSCIOUS,
OPEN AIRWAY



LIFT UP NECK
PUSH FOREHEAD BACK
CLEAR OUT MOUTH IF NECESSARY
OBSERVE FOR BREATHING

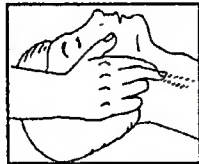
(B) BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL
4 QUICK FULL BREATHS
REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS POSSIBLE

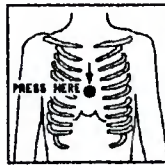
CHECK
CAROTID PULSE



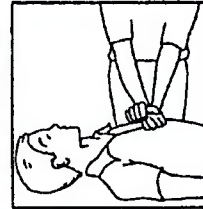
IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



APPROX. RATE OF COMPRESSIONS --80 PER MINUTE	{ ONE RESCUER 15 COMPRESSIONS 2 QUICK BREATHS
APPROX. RATE OF COMPRESSIONS --60 PER MINUTE	



NOTE: DO NOT INTERRUPT RHYTHM OF COMPRESSIONS
WHEN SECOND PERSON IS GIVING BREATH

CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE.

2. IF VICTIM IS RESPONSIVE.

- A. KEEP THEM WARM
- B. KEEP THEM AS QUIET AS POSSIBLE
- C. LOOSEN THEIR CLOTHING
- D. A RECLINING POSITION IS RECOMMENDED

FIRST-AID

Personnel engaged in the installation, operation, maintenance or servicing of this equipment are urged to become familiar with first-aid theory and practices. The following information is not intended to be complete first-aid procedures, it is a brief and is only to be used as a reference. It is the duty of all personnel using the equipment to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

Treatment of Electrical Burns

1. Extensive burned and broken skin
 - a. Cover area with clean sheet or cloth. (Cleanest available cloth article.)
 - b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
 - c. Treat victim for shock as required.
 - d. Arrange transportation to a hospital as quickly as possible.
 - e. If arms or legs are affected keep them elevated.

NOTE

If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold). Allow victim to sip slowly about 4 ounces (a half of glass) over a period of 15 minutes. Discontinue fluid if vomiting occurs. (Do not give alcohol.)

2. Less severe burns - (1st & 2nd degree)
 - a. Apply cool (not ice cold) compresses using the cleanest available cloth article.
 - b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
 - c. Apply clean dry dressing if necessary.
 - d. Treat victim for shock as required.
 - e. Arrange transportation to a hospital as quickly as possible.
 - f. If arms or legs are affected keep them elevated.

REFERENCE:

ILLINOIS HEART ASSOCIATION

AMERICAN RED CROSS STANDARD FIRST AID AND PERSONAL SAFETY MANUAL (SECOND EDITION)

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SECTION I GENERAL INFORMATION

1.1. Introduction

This section contains a general description, overall block diagram, and specifications of the Harris VHF TV exciter.

1.2. Equipment Description

The Harris VHF TV exciter is a CCIR system M television exciter. Both the aural and visual exciters are included in a single package. All operator indicators are front-panel mounted for ease of operation. An analog and an LED digital display provides indications of exciter parameters (see Figure 1-1).

All internal circuitry is mounted on plug-in circuit boards with the exception of the two modular final amplifiers, and the power supply. A motherboard provides power and control connections, all rf and if connections are coaxial. The motherboard will accommodate 13 plug-in circuit boards. The meter and control circuit board mounts behind the front panel. The aural and visual final amplifiers are mounted in the rear along with the power supply section.

Phase-locked loops in the visual as well as the aural circuits are stabilized from a single reference. Digital control circuits provide simple and precise user interface. Separate wide-band

RF final amplifiers are provided for both aural and visual outputs.

A flushing fan assures cool and reliable operation. The flow of the fan forces air between final visual and aural amplifiers and along side of the main power supply where the regulators are mounted. Cooling air exits on each side of the chassis and from the top cover after passing through the card cage where the plug-in circuit boards are housed.

The internal power supply allows operation from potentials in the 120-volt range as well as the 240-volt range, 50 or 60 Hz.

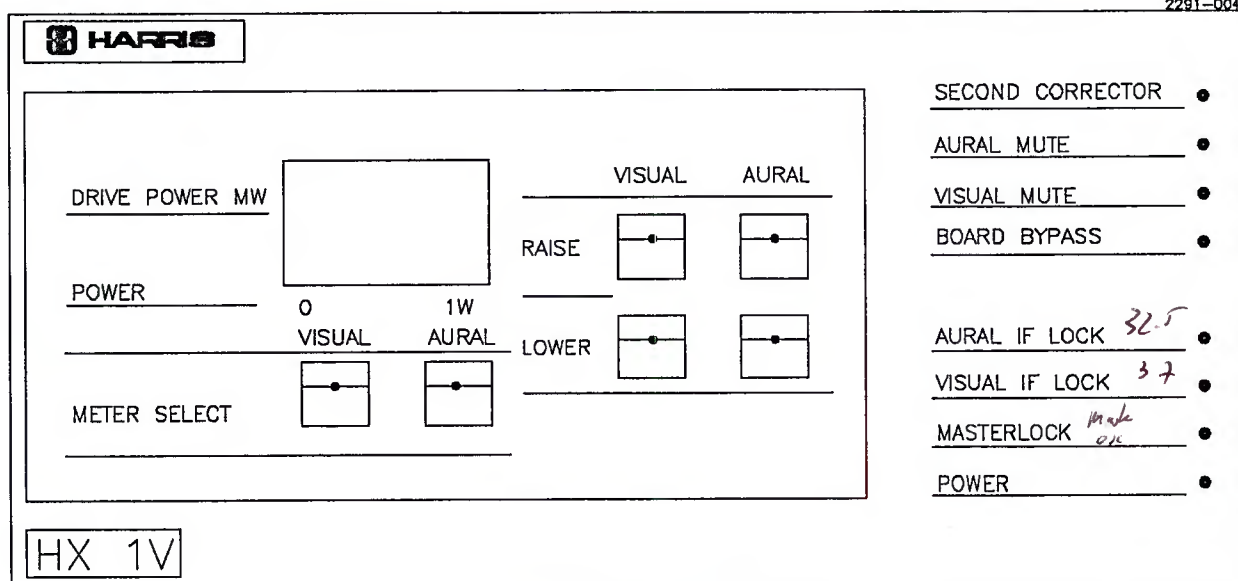
The unit mounts on slide rails in a standard 19-inch rack for ease of maintenance. The majority of controls mounted on circuit boards are accessible from the top.

1.3. Equipment Specifications

Refer to Table 1-1 for electrical and physical specifications of the VHF TV exciter.

NOTE

Specifications subject to change without notice.



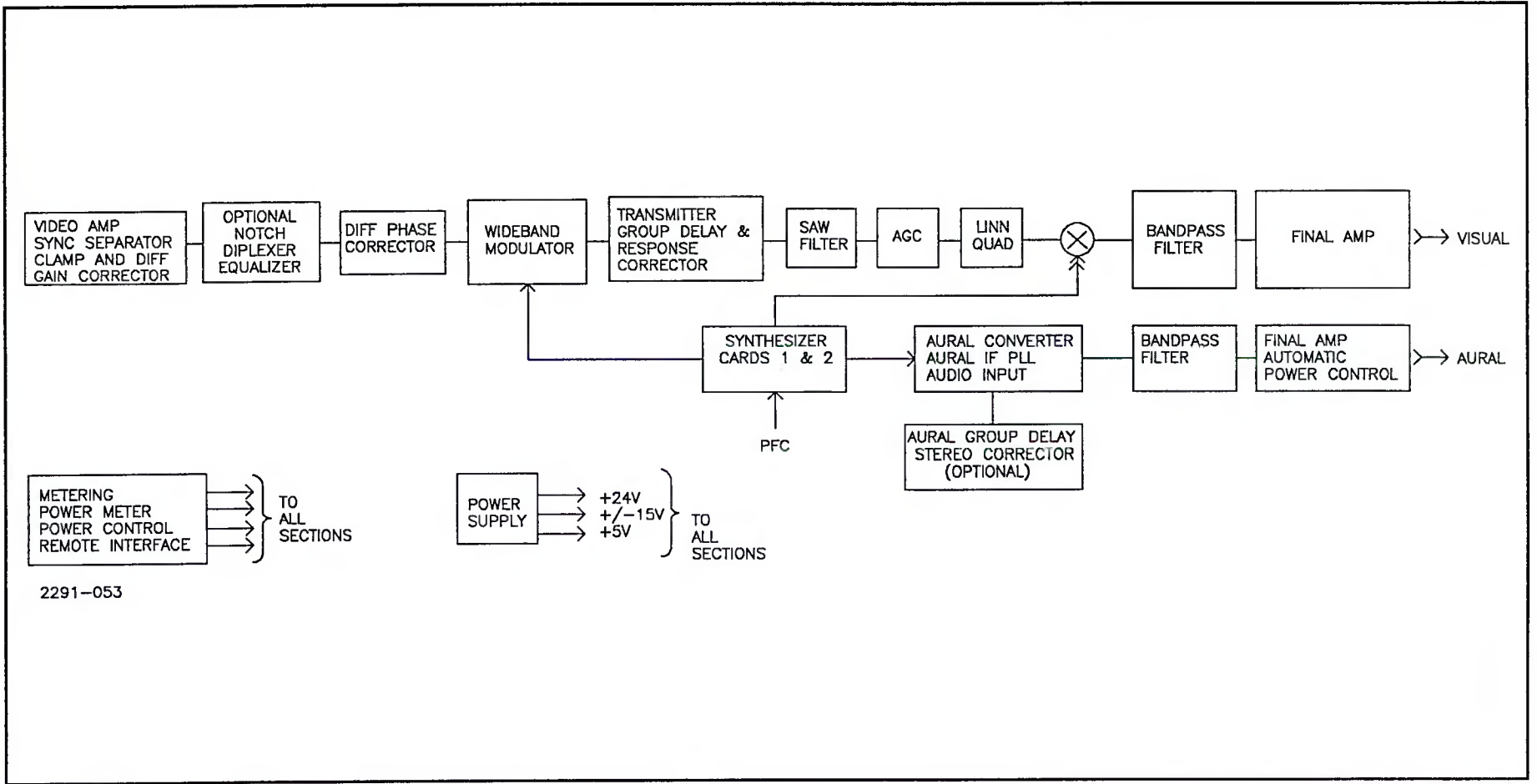


Figure 1-2. Simplified Block Diagram

Table I-1. Specifications

HARRIS HX1V VHF EXCITER SPECIFICATIONS

	System M ¹	System B ¹
VISUAL PERFORMANCE		
Power Output	1.0 watt peak ²	1.0 watt peak
Load Impedance	50 Ohms BNC connector	50 Ohms BNC connector
Frequency Range	54-88 MHz 174-216 MHz	47-88 MHz Band I 170-230 MHz Band III
Frequency Stability ³	±250 Hz (over 30 days)	±250 Hz (over 30 days)
Regulation of RF Output	<1%	<1%
Variation of RF Output	<1%	<1%
Visual Sideband Response	-1.25 MHz -40 dB or better -0.75 to 4.10 MHz ±0.4 dB 4.18 MHz ±0.5 dB +4.5 MHz -40 dB or better	-1.25 MHz -40 dB or better -0.75 to 5.0 MHz ±0.5 dB +5.5 MHz -40 dB or better
Frequency Response versus Brightness	±0.25 dB	±0.25 dB
Modulation Capability	0%	0%
Differential Gain	2% or better	2% or better
Differential Phase	1° or better	1° or better
Incidental Phase Modulation ⁴	±1° or better	±1° or better
Luminance Non-Linearity	2% or better	2% or better
K Factors	2T: 1%, 20T: 2% or less baseline disturbance	2T: 1.5%, 20T: 2% or less baseline disturbance
Signal to Noise ⁵	58 dB RMS	58 dB RMS
Equivalent Envelope Delay	0.2 to 2.1 MHz ±40 nsec @3.58 MHz ±25 nsec @4.18 MHz ±60 nsec (relative to FCC standard)	0.25 MHz ±10 nsec 1.0 to 4.43 MHz ±30 nsec 4.8 MHz ±40 nsec (relative to CCIR Report 624, Fig. 3, Curve B)
Video Input Level	0.75 to 2.0 volts 75 ohms 36 dB return loss	0.75 to 2.0 volts 75 ohms 36 dB return loss
AURAL PERFORMANCE		
Power Output	Single Channel 1.0 watt RMS	Dual Carrier Sound Channel 1, -13 dB Channel 2, -20 dB 50 ohms
Load Impedance	50 ohms	
Modulation Capability (Any Channel)	±100 kHz, ($f_m < 100$ Hz) ±200 kHz, ($f_m \geq 100$ Hz)	±100 kHz, ($f_m < 100$ Hz) ±200 kHz, ($f_m \geq 100$ Hz)
Frequency	Visual Carrier +4.5 MHz	Channel 1: Visual Carrier +4.5 or 5.5 MHz Channel 2: Visual Carrier +4.724 or 5.742 MHz
Intermodulation Products ⁶	N/A	-60 dB
AUDIO PERFORMANCE		
Input Level	Monaural 0 to 20 dBm adjustable	Either Channel 0 to 20 dBm adjustable
Input Impedance	600 ohm	600 ohm
Common Mode Rejection Ratio	-60 dB (up to 1 kHz)	-60 dB (up to 1 kHz)
FM Noise ⁶	-60 dB (at 25 kHz deviation)	-66 dB (at 50 kHz deviation)
AM Noise ⁷	-55 dB	-55 dB
Synchronous AM Noise ⁷	-40 dB	-40 dB
Harmonic Distortion	0.2%	0.35%
IMD Distortion	0.5%	0.5%
Frequency Response	±0.5 dB (30 to 15,000 Hz)	±0.5 dB (30 to 15,000 Hz)
Pre-Emphasis	Flat, 50 msec, 75 msec (selectable)	Flat, 50 msec, 75 msec (selectable)
Channel Crosstalk	N/A	80 dB
SCA Characteristics	2 inputs 1 volt RMS adjustable	N/A
Level		
Frequency Response	±0.5 dB, 20 Hz to 110 kHz	
Stereo Performance		
Stereo Separation	BTSC (without companding) 45 dB or better (50 to 15,000 Hz) -50 dB or better	IRT system 40 dB typical, 32 dB min. (50 to 15,000 Hz) N/A
Crosstalk (Stereo or Main to SAP)		
Input Level	1 volt RMS into 75 ohms	0 to 20 dBm adjustable
SERVICE CONDITIONS		
Ambient Temperature Range	0 to 50°C	0 to 50°C
Ambient Humidity Range	0 to 95%, non-condensing	0 to 95%, non-condensing
Altitude	Sea level to 10,000 ft.	Sea level to 3048 m.
Physical and Mechanical Dimensions	19" W x 22" D x 8.75" H; Weight: 51 lbs.	48 cm W x 56 cm D x 22 cm H; Weight: 23 kgs.
Electrical Requirements	208/240 volts, ±10% 50/60 Hz, 1 phase	208/240 volts, ±10% 50/60 Hz, 1 phase
Power Consumption	150 VA	150 VA

¹ Inquire about availability of other CCIR system standards.

² All specs guaranteed at 0.5 w without correction; at 1.0 w with correction.

³ ±2 Hz with optional Precise Frequency Control for System M.

⁴ Relative to blanking.

⁵ Relative to visual peak sync.

⁶ With de-emphasis.

⁷ Relative to 100% AM modulation.

SECTION II INSTALLATION

2.1. Introduction

This section contains information required for installation and preliminary checkout of the VHF TV exciter.

2.2. Unpacking

The equipment becomes the property of the customer when the unit is delivered to the carrier. Carefully unpack the unit and perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it has been determined that the unit was not damaged in shipment. Claims for damaged equipment must be filed promptly or the carrier may not accept the claim.

Each VHF TV exciter shipment consists of the following items in addition to the exciter:

Manual

Power cord

Exciter mounting hardware (only with units sold separately)

The contents of the shipment should be as indicated on the packing lists. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify the Harris Customer Service Department (217-222-8200) at the following address:

Harris Corporation, Broadcast Division

P. O. Box 4290

Quincy, IL 62305

ATTEN: Customer Service Department

2.3. Installation

The VHF TV exciter may be mounted in any convenient location in a 19 inch (48.3 cm) rack within reach of signal and power cables. The Exciter should not be mounted directly above heat generating equipment such as power amplifier stage, otherwise no special requirements need be observed.

WARNING

ASSURE POWER IS DISCONNECTED BEFORE PROCEEDING.

- a. Assure power is disconnected before proceeding.
- b. Set the unit on a work surface and remove any packing from the outside of the unit.
- c. If the exciter purchased was part of a transmitter, proceed directly to paragraph 2-3.2. If the exciter was purchased for other replacement configurations proceed with paragraph 2.3.1.

2.3.1. Exciter Mounting

- a. Remove the sliding portion of each slide rail from the sides of the exciter.

- b. Mount the front edge of each slide rail to its respective side of the cabinet with the hardware supplied.

CAUTION

ASSURE THE SLIDE RAILS ARE PARALLEL AND LEVEL BEFORE DRILLING MOUNTING HOLES IN THE RACK CABINET.

- c. Assure the slide rails are parallel and level. Mark and drill holes for mounting the rear of each rail. Hardware is supplied for this purpose.
- d. After the slide rails are mounted, extend both rails fully and lift the exciter onto the rails over the stops. Push the exciter fully into the rack.

2.3.2. Input Power Selection

Pull the exciter forward out of the rack until the slide-rail stops are encountered.

WARNING

ASSURE POWER IS DISCONNECTED BEFORE PROCEEDING.

- a. Assure power is disconnected before proceeding.
- b. Remove the top cover of the exciter and the cover of the power supply. Refer to paragraph 5.3.1. Check the wiring to the ac terminal strip on the right hand side of the power supply. Refer to Exciter Power Supply schematic 839-7900-504 and assure that the exciter is wired for operation with the primary voltage with which the unit will be used (105 to 125 volt range or 210 to 250 volt range). A tag on the exciter indicates the voltage the exciter was set to when leaving the factory.

2.3.3. Exciter Inputs And Outputs

Prepare cabling for the exciter inputs and outputs. The rear-panel connections available for use on the exciter are identified by Figure 2-1 and described by Table 2-1.

2.3.4. Exciter Remote Control Connections

Prepare cabling for the exciter remote controller. The functions available are described by Table 2-2.

2.3.5. Circuit Boards

There are 13 slots in the motherboard for exciter circuit boards. J1 is the slot on the right side when the exciter is viewed from the front. The circuit boards install in the sequence given in Table 2-3 with the component side to the left when viewed from the front.

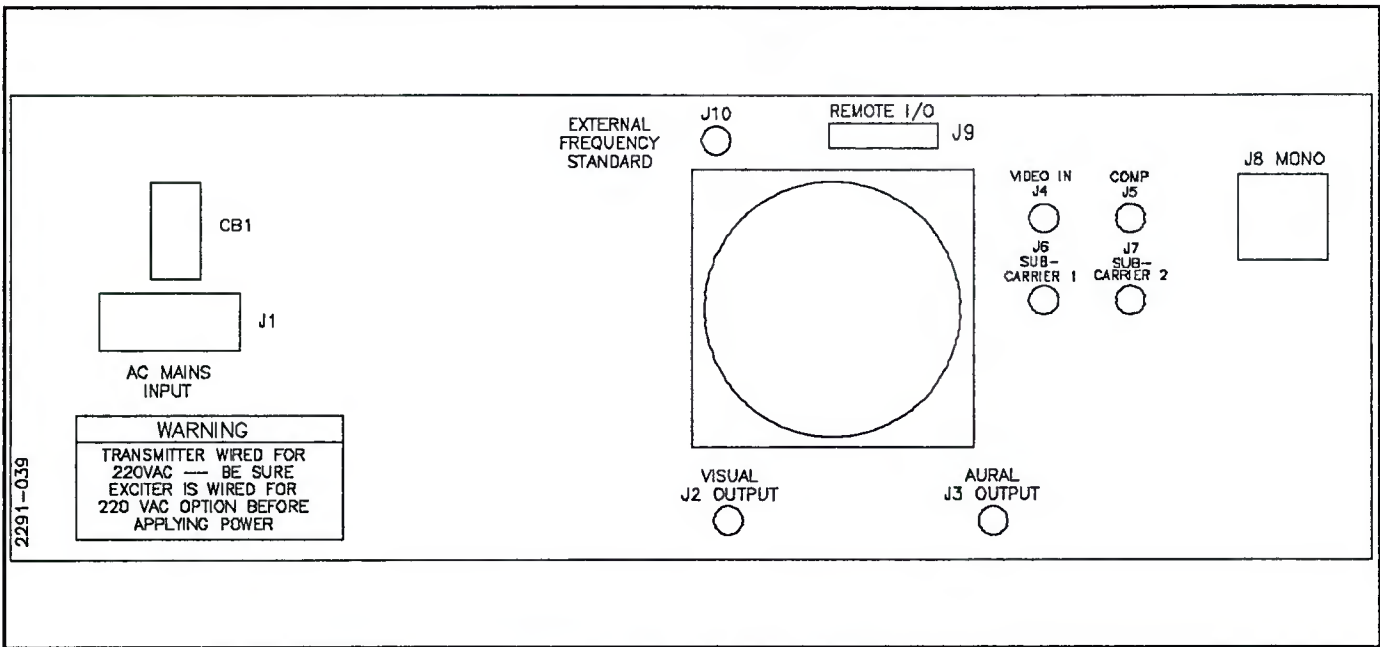


Figure 2-1. Exciter Inputs and Outputs

Table 2-1. Exciter Inputs and Outputs

CONNECTOR	DESCRIPTION
J-1	AC POWER
J-2	VISUAL RF OUT
J-3	AURAL RF OUT
J-4	VIDEO INPUT
J-5	COMPOSITE AUDIO IN
J-6	Sub-Carrier 1 IN
J-7	Sub-Carrier 2 IN
J-8	MONO AUDIO IN
J-9	CONTROL/REMOTE INTERFACE
J-10	EXTERNAL PFC (option)
CB1	BREAKER/ON/OFF SWITCH

Table 2-2. Exciter Remote Control Connections

J9 PIN #	FUNCTION	SIGNAL
1	VISUAL RAISE COMMAND	ACTIVE LOW
2	VISUAL LOWER COMMAND	ACTIVE LOW
3	AURAL RAISE COMMAND	ACTIVE LOW
4	AURAL LOWER COMMAND	ACTIVE LOW
5	AURAL MUTE COMMAND	ACTIVE LOW
6	VISUAL MUTE COMMAND	ACTIVE LOW
7	VISUAL POWER SENSE OUT	DC VOLTAGE PROPORTIONAL TO DAC SETTING
8	AURAL POWER SENSE OUT	DC VOLTAGE PROPORTIONAL TO DAC SETTING
9	VISUAL MUTED STATUS, OPEN COLLECTOR	LOW=MUTED
10	AURAL MUTED STATUS, OPEN COLLECTOR	LOW=MUTED
11	VISUAL UNLOCKED STATUS, OPEN COLLECTOR	LOW=UNLOCKED
12	AURAL UNLOCKED STATUS, OPEN COLLECTOR	LOW=UNLOCKED
13	DUAL CORRECTION STATUS, OPEN COLLECTOR	
14	VOLTAGE OUTPUT	+15V DC @ 10 MA
15	VISUAL VSWR INPUT, DC VOLTAGE	FOLDBACK PROPORTIONAL TO VSWR
16	AURAL VSWR INPUT, DC VOLTAGE	FOLDBACK PROPORTIONAL TO VSWR
17-20	UNUSED	
21	NOTCH DIPLEXER REMOTE (LOW = BYPASS)	
22	AURAL GROUP DELAY REMOTE (LOW = BYPASS)	
23-26	GROUND	
27	UNUSED	
28-37	USED FOR EXCITER SWITCHER	

Table 2-3. Circuit Board Placement

SLOT	CIRCUIT BOARD
J1	Video input/Diff Gain Corrector
J2	Notch Diplexer Equalizer (Optional)
J3	Open for option
J4	Differential Phase Corrector
J5	Modulator/Delay Compensator
J6	VSB/AGC
J7	Linearity/Quadrature Corrector
J8	Open for options
J9	Offset Option
J10	Visual Converter
J11	Open for options
J12	Aural Group Delay Corrector (Optional)
J13	Aural Converter

SECTION III OPERATION

3.1. Introduction

This section identifies all controls and indicators associated with the VHF TV exciter.

3.2. Controls And Indicators

Refer to Figure 3-1 for the location of all controls and indicators associated with day-to-day standard operation of the VHF TV exciter. The function of each control and indicator is listed in Table 3-1.

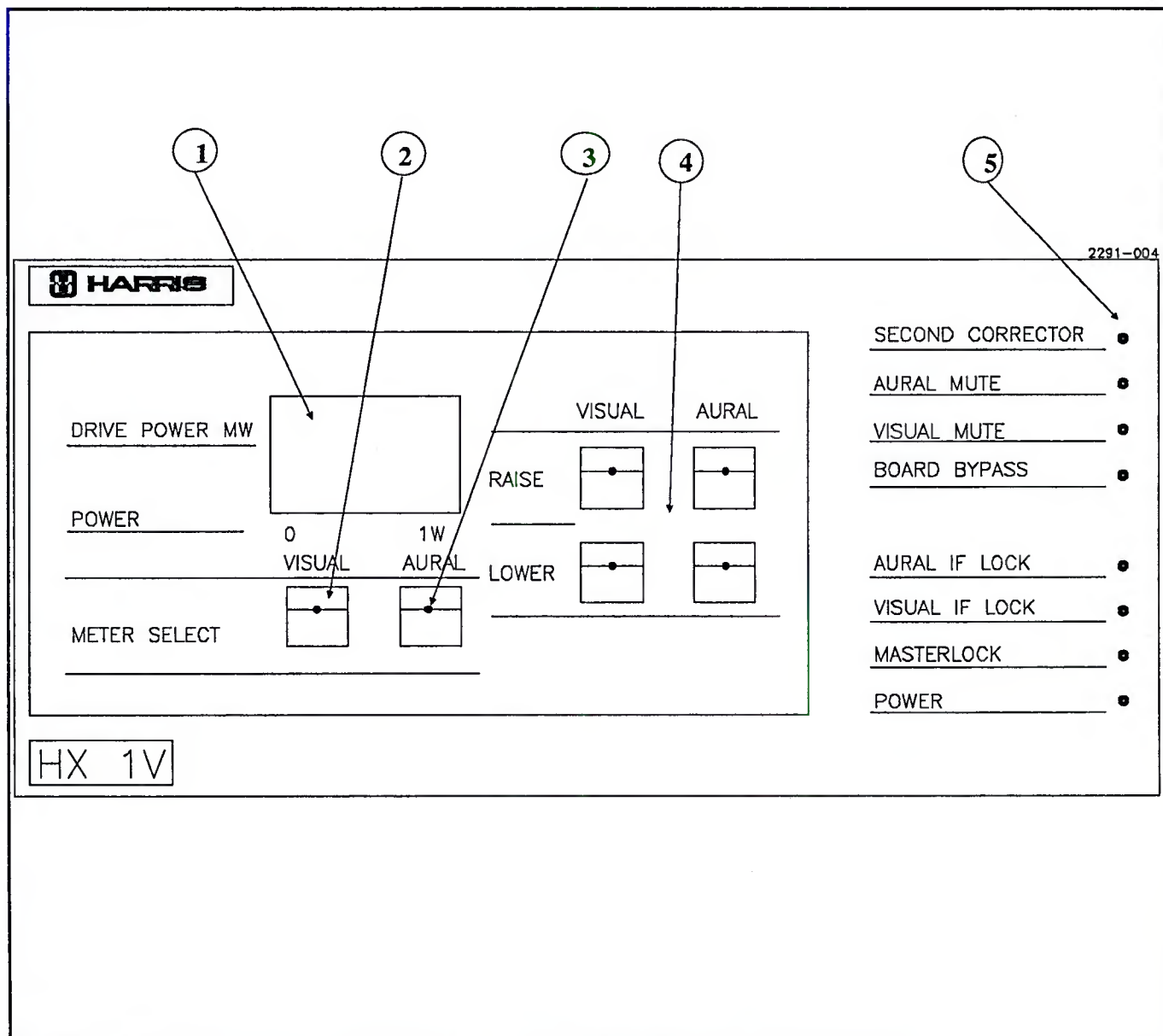


Figure 3-1. Exciter Controls and Indicators

Table 3-1. Exciter Controls and Indicators

REF	ITEM	FUNCTION
1	DRIVE POWER MW	Displays numeric drive power in milliwatts.
2	POWER BAR GRAPH	Displays power 0-1 watt. Visual power ref. peak sync. Aural power C.W.
3	METER SELECT DRIVE POWER	Selects Visual or Aural output for display on digital readout and power bar graph.
4	VISUAL/AURAL RAISE LOWER	<p>Momentary switch to raise or lower exciter output power. This is a two speed control. When first depressed the power will change slowly, but if it is then held down for approximately 10 seconds the power will change at a faster rate until released. It will return to the slower rate upon release. The power adjustment commands are independent of the meter select. Be sure to check metering before making exciter power adjustments to see if VIS or AUR PWR is being monitored.</p> <p>The controller power fail circuits maintain control after an ac power outage. During this time the power controls are still active and will raise or lower the power if depressed even though ac is not present.</p>
5	STATUS LEDS	
	SECOND CORRECTOR	Indicates optional corrector for dual power level is in use.
	AURAL MUTE	Indicates aural exciter is muted either internally (PLL failure) or externally (MAIN CONTROLLER on/off or overload.)
	VISUAL MUTE	Indicates VISUAL exciter is muted either internally (PLL failure) or externally (MAIN CONTROLLER on/off or overload.)
	BOARD BYPASS	Indicates one of the correction modules has been left in bypass position.(i.e. VSB, DELAY COMP) Jumpers are provided on the individual boards to disable its bypass status if a particular board is not needed for normal operation.
	AURAL IF LOCK	Illuminated when AURAL PLL is unlocked.
	VISUAL IF LOCK	Illuminated when VISUAL IF PLL is unlocked.
	MASTER LOCK	Illuminated when the MASTER PLL is unlocked.
	POWER	Illuminated when ac power is on. (AC POWER SWITCH/BREAKER IS LOCATED ON BACK PANEL OF UNIT.)

SECTION IV THEORY OF OPERATION

4.1. Introduction to Theory of Operation

This section provides theory of operation for the VHF TV exciter. For purposes of discussion, the circuitry is divided into functional subassemblies by the following text. Refer to the separately packaged block diagram and schematic diagram as required for the following description. All circuit boards plug into a mother board that provides interconnections between circuits.

4.2. Video Differential Gain/Low Frequency Linearity Correction Board

Refer to 843-5285-411

4.2.1. Functional Description

This video input card contains circuitry to allow the independent linearity adjustment of the luminance and the chrominance signal components. Circuitry can also clip the peak white luminance signal peaks that exceeds a set level.

This video card performs sync regeneration, low frequency linearity (LFL) correction, differential gain correction and white signal clipping. The interaction between differential gain and LFL corrections is minimized. The video signal is clamped with adjustable clipping levels. Output signal level can be easily adjusted. When the card is used in an HTEL 5/10 exciter, the input video and sync voltage levels can be monitored through exciter metering. The board is designed to work with NTSC and PAL signals.

4.2.2. Detailed Theory of Operation

4.2.2.1. Input Stage

Input video signal is fed to the video board from the I/O panel through an SMB connector. The shield is not grounded at any point in the cabling of the transmitter to allow common mode signal rejection in the first stage. Provisions for a selection of AC or DC coupling by changing the selector jumper JP5. The input circuit, opamp U3, is designed for approximately 40dB of input common mode rejection. It can be floated or grounded by jumper JP3. In this circuitry capacitor C31 is left as an option for cable compensating purpose. U3 is a unity gain amplifier, the output voltage is measured by two peak reading detector circuits, one measures the voltage above zero volts DC as a video component measurement, The other detector measures the amplitude of the negative sync voltage.

Adjustable voltage divider R1 sets the signal level for further processing and ultimately the card output level. U1 is a non-inverting amplifier with a gain of two when R46 is present. If R46 is replaced with a jumper, the gain is 1. U11 performs as a sync separator which outputs sync pulses at pin 1 and burst pulses at pin 5.

Burst pulses drive Q15 and Q14 which clamps the signal coming into U11. A notch filter at input pin 2 of U11 blocks burst frequency so that the sync level can go down as much as -6dB without affecting the performance of the clamping circuit.

4.2.2.2. Sync removal and Reinsertion Stage

The output signal from U6 is frequency response corrected (U14) before the delay line DL1 and Sync stripper U16. Since there is a timing difference between the sync pulses from U11 and the sync pulses of the main signal, DL1 is used for time compensation. Sync pulses from U11 are processed through U7 which creates stripping pulses and new sync pulses. Timing is correctly adjusted by pots R105, R110 at U7 so that the output from U16 is sync-stripped. U16 is a gain controllable opamp whose gain is controlled by pulses coming into pin 2. Blanking level is adjusted by R124 and R131. At the same time, new sync pulses from pin 8 of U7 are processed by Q13, Bessel lowpass filters and U2. The lowpass filters are to shape up the sync so that sync specs are met and 6MHz signal bandwidth is preserved. Jumpers JP1 and JP2 select between NTSC and PAL sync pulses. The newly created sync pulses are adjusted by R2 and fed to U2. U2 is an isolation stage between the filters and the input of signal-sync combiner U8. DL1 provides enough delay so that the new sync pulses and the video signal time up correctly. Timing for sync reinsertion is adjusted by R106 and R111 (in both circuits, sync stripping and sync creating, the first pots are to adjust trailing end of the pulse and the second pots adjust the leading end).

When video input is missing, PLL chip U17 fails to lock incoming sync with its internally generated 15kHz square wave. The output at pin 8 of U17 goes high, that turns on Q16. In order to isolate the digital chips from the rest of the circuit, isolated power supplies including L8 and L3, are used for U3, U4 and U17.

4.2.3. Differential Gain

Video from U5 is differential gain adjusted by U5, Q1, Q2, Q3 and Q4. The gain is decreased by shunting the video signal to AC ground through R28 and R29 and increased by the increase in feedback gain of U5. The gain corresponding to a certain video signal level is adjusted when either of Schottky switching diodes CR1, CR2, CR3, CR4 is turned on. In this case, the signal will see a small impedance, approx. 10ohms max., at the emitter of the transistor. R11, R12, R13 and R14 adjust the magnitude of the change or the slope of the differential gain curve. R3, R4, R5, R6 set the switching levels or the thresholds. The reference threshold levels are provided by the voltage dividers at the base of the transistors. These dividers are carefully and accurately designed so that the blanking level will not change. The differential gain stage is deactivated when all the threshold levels are switched to 4.3V by switch S1. S1 also provides the necessary voltage to activate Q9 and Q10 when the correction is off.

4.2.3.1. Low Frequency Linearity

To correct low frequency linearity (LFL), the burst frequency component of the video signal must be completely filtered out. DL2 is a high quality delay line that shifts the chroma frequency (3.58MHz for NTSC or 4.43MHz for PAL) 180 degrees. That is equivalent to a delay of 140ns for NTSC signal or 110ns for

PAL signal. The delayed signal and the original one are combined at the output of U10 and the resulted signal has no chroma component. Pot R96 adjusts the magnitude of the delayed signal until a perfect luminance is obtained. At the same time, signal subtraction is performed by U12 to restore the chrominance of the signal. The luminance is corrected by LFL correction circuit which is similar to the differential gain circuit above. AD8037, U4, is used as an opamp to allow control of the clipping levels of the signal. R71 sets the white clipping level and the sync clipping level is set by R96 and R104.

The chrominance and luminance are recombined at U15 to restore the video signal. Pot R115 adjusts the mixing ratio. This adjustment affects the response of the circuit. The response has a pole close to 4MHz. This response problem is corrected by C70 in the input of U15.

4.2.3.2. Output stage

Output stage consists of U15 which is designed as a first order allpass group delay equalizer. The circuit will provide enough group delay to compensate for the group delay of the frequency response correction network (U14).

The output level is controlled by U1 and R1

The board is set up so that when used with Harris HTEL and PLATINUM exciters with an input level of 0.75 to 2.0 volts. It will produce a maximum 1.5Vpp video signal on 75 ohm output load. For input levels below 0.75vpp, change R46 to 750 ohm.

4.3. Notch Diplexer Equalizer

Refer to 839-7900-493

4.3.1. General Description & Theory of Operation

Four active allpass networks are used to equalize the delay and amplitude response distortion caused by the Notch Diplexer. Each of the four sections are very similar in design but have considerable flexibility in adjustment.

The term allpass defines a network which has a changing phase characteristic, with a flat amplitude response. The action of an active allpass can best be explained using a simplified schematic, Figure 4-1.

If the voltage E1 was plotted as a function of frequency, it would have the familiar bandpass filter characteristic due to the tuned elements C1 and L1. E1 would have a related phase shift at various frequencies. E2 would have a flat amplitude response and no phase shift. When E1 and E2 are subtracted in A1, the

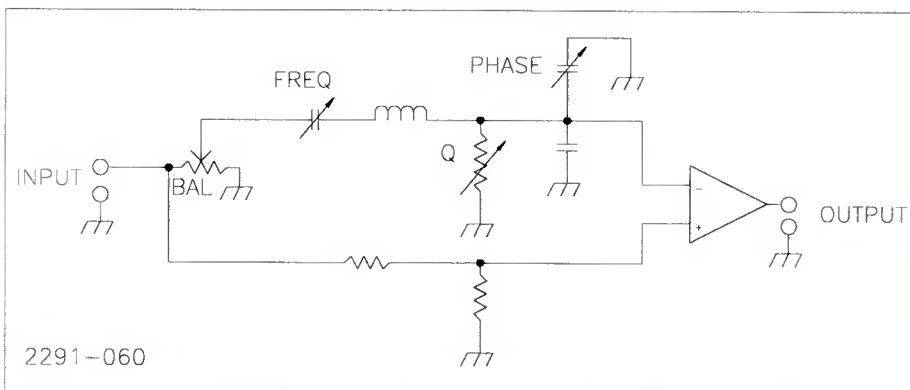


Figure 4-1. Simplified Schematic Active Allpass Network

output E3 has the unique property of having E1's phase and E2's amplitude. Thus the allpass network. In a practical circuit it is possible to have four significant controls.

- Frequency - C46, C4, C36, and C24 of actual circuit adjust the frequency of resonance or delay.
- Q - R42, R30, R85, and R92 of actual circuit adjust the Q of the resonant circuit or magnitude of delay.
- Balance - R40, R10, R80, and R52 of actual circuit adjust amplitude response - causes a peak or valley.
- Phase - C20, C3, C32, and C22 of actual circuit adjust amplitude response - causes a sinewave shape.

4.4. Differential Phase Corrector

Refer to 839-7900-490

The purpose of the differential phase corrector is to correct transmitter distortions of the color sub-carrier phase with luminance level. It operates at video and predistorts the color phase.

The differential phase corrector consists of a first order all pass network which provides a phase characteristic without disturbing the amplitude response. A clamp pulse generator and clamping circuits are provided to maintain blanking level.

The all pass network consists of two video paths 180 degrees out of phase. The out of phase signals are summed together in a RL network. The ratio of L to R determines the resultant phase. By changing the value of R with video luminance the corresponding phase is changed.

The input video is applied to a back porch clamp consisting of C45 and Q13. Clamping is done during back porch. L3 presents a high impedance to sub-carrier to prevent distortion due to the clamp pulse. A dual JFET Q14 provides a high impedance to the clamp and a low impedance output.

U1 forms a differential amplifier and generates the two video paths which are 180 degrees out of phase. Q6 is a current source for the differential amp and also provides bias stabilization. R4 and C1 set the amplifier's frequency response and are set for a flat response. C48 equalizes the two 180 degree outputs for symmetrical response and is set for minimum interaction between differential phase and gain. Q1 and Q2 buffer the two video paths and provide a low impedance drive for the all pass network.

L2 and R17 form the basic all pass network. The two video paths are summed together and buffered by Q3. R17's value is modified as a function of luminance level and creates the desired correction shape.

A Schotky diode network is used to change R17's value with luminance level. An adjustable reverse bias (Threshold) is applied to the diode. As the video level increases it will eventually exceed the diode's bias and the diode will become forward biased. When this happens the diode acts as a switch and places an adjustable resistor (Slope) in parallel with R17. There is a total of five diode networks to allow precise correction of differential phase.

The output of the allpass network is passed through a second clamp consisting

of C14 and Q4 and buffer amp Q4, it is then applied to the output amplifier.

The output amplifier consists of Q7, Q8 and Q15 provides a 75 ohm drive impedance for the output of the card and for the monitor output connector.

Clamp pulses are generated by a sync separator and are timed to coincide with back porch and level shifted to provide back porch clamping to 0 Vdc. U1 provides a inverted video output to drive the clamp pulse generator. Q9 and U4 amplify the inverted video signal to approximately 10V peak to peak. U4 is also band limited by C27 such that sub-carrier is suppressed and only luminance passes. CR11 provides rough peak sync clamping to 0Vdc. U5 is a high speed comparator and separates sync from the band limited video. U6 provides a time delay to correctly position the clamp pulses during back porch. Q10 and Q11 offset the clamp pulse to correctly bias the clamping FETs Q5 and Q13.

4.5. Modulator/Delay Compensator Board

Refer to 839-7900-443 (sheet 3)

4.5.1. Modulator Circuit

4.5.1.1. Functional Description

The Modulator printed circuit uses a double balanced mixer to perform modulation of the IF carrier by the video signal from the Amplifier board. In addition to the mixer, the board contains amplification circuits and a frequency response equalization network.

4.5.1.2. Detailed Description

The output signal from the IF Oscillator is applied to the Modulator input jack J1. Since the signal level from the oscillator ranges from 150 to 300 mV rms, the IF Drive potentiometer R1 is used to adjust the level supplied to amplifier Q1. The voltage gain of approximately 4 is determined by the ratio between R5 and the effective impedance at the collector of Q1. This impedance is the parallel combination of R4 and the impedance reflected back to the primary of T1, which is a 4:1 stepdown rf transformer. The output from Q1 and T1 provides the drive signal for the L (pin 3) and L' (pin 1) ports of the mixer U1. See Figure 4-2 .

Assuming perfect balance of the mixer diodes and transformers, there will not be an IF output when there is no current input

to the X port (pin 5). The Modulator Balance potentiometer R37 is adjusted to cancel any output caused by slight inherent mixer imbalance. The IF output from mixer port R (pin 6) is proportional to the current flowing into the X port (pin 5). Consequently, the video signal amplitude modulates the IF signal. To provide the correct modulation depth, some current must be added to the video signal. The Modulator Bias potentiometer R12 adjusts this current offset to provide the proper modulation depth. The Video Drive potentiometer R10 adjusts the amount of video signal current to the modulator.

The modulated output from the mixer U1 and the Modulator Balance potentiometer R37 are summed in the emitter of the grounded base amplifier Q2. The gain of approximately two is determined by the ratio of the emitter input resistor R16 and the collector impedance. The signal from R37 is added at the low impedance point at the emitter.

A frequency response equalization network is inserted between Q2 and Q3. Capacitors C10 and C11 control the frequency of this series resonant circuit and R20 controls the Q. R40 serves as a slope or tilt control. This permits correction for slight frequency response deviations elsewhere in the exciter circuits. A second harmonic trap, L3 and C12 or C13, is inserted at the input to the common base amplifier Q3. The signal is amplified six times and applied to emitter follower Q4. The output is routed through jumpers at P1 to test jack J2 or to the delay compensator circuit.

4.5.2. Delay Compensator Circuit

Refer to 839-7900-443 sheets 1 and 2

4.5.2.1. Functional Description

The Delay Compensator board contains two identical active allpass networks in cascade. An allpass network has the characteristic of flat amplitude response and nonlinear phase response. Since group delay is a result of nonlinear phase shift, an allpass network corrects group delay in the transmitter by providing compensation at certain frequencies. Delay errors caused by the notch diplexer (if used) are corrected by the notch diplexer equalizer.

In an active allpass network the signal is split into two paths: a narrow band path and wideband path. The narrow band path is a series tuned circuit with variable Q and frequency controls for adjustment of the amount of group delay correction and the

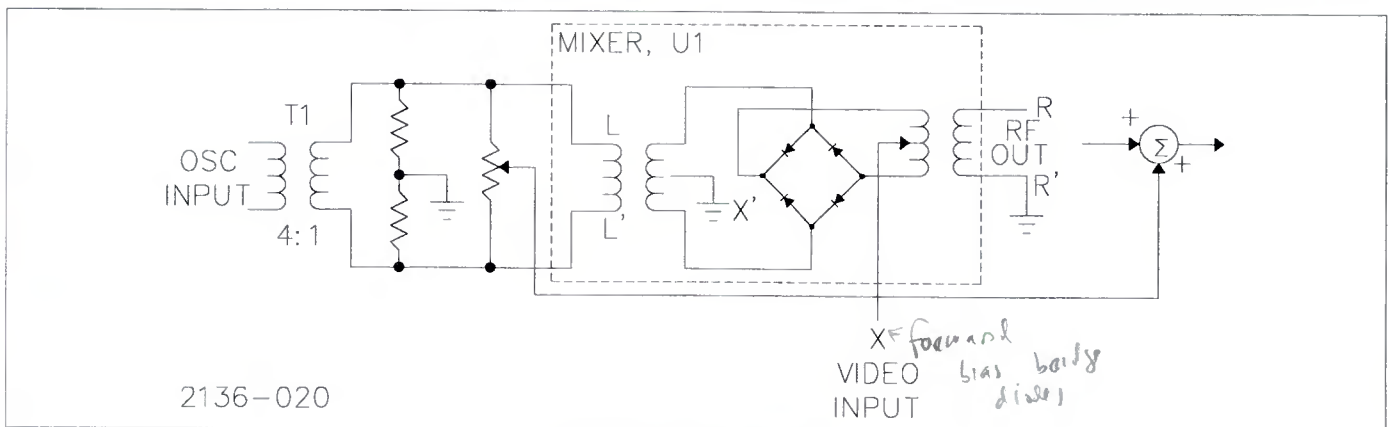


Figure 4-2. Modulator

frequency at which it is applied. The wideband path has only an attenuator and fixed phase shift network. For proper allpass operation, the signals must be combined at the output such that the narrow band signal is 6 dB greater and 180 degrees out-of-phase at the resonant frequency of the tuned circuit.

4.5.2.2. Detailed Description

The signal is applied to the allpass network through P1-1 and is split into two paths. In the narrow bandpath, emitter follower Q101 provides isolation and power amplification to drive the series resonant circuit of C109, C111 and L105. The Q is determined by the parallel combinations of R145, R147, R149, and R151 selected by the 16 position switch S103. L109, L115, C139 and C122 is a variable phase shift network providing the proper phase relationship between the two signal paths. BALANCE potentiometer R105 is used to obtain the proper amplitude relationship between the two paths. In the wideband path, the signal passes through a fixed phase shift network C103, L101 and C107, and a fixed attenuator R117, R119 and R121. The two signals are combined in T101. The secondary of T101 is the vector difference of the two signals applied to the primary.

When the BYPASS toggle switch S101 is set to the IN position, Q101 receives collector voltage, and PIN diode switches CR101 and CR103 are supplied current to turn them on. When S101 is set to the OUT position, Q101 and CR103 turn off blocking the narrow band path signal. CR101 is also turned off to compensate for a small gain change in the BYPASS mode. The signal still passes through the wideband path, but no group delay compensation is provided by the narrow band path. Q103 is a common base amplifier with a voltage gain of approximately nine to compensate for the loss in the allpass section. The output of the first allpass network is applied to the second network through emitter follower Q105.

Q102, Q104 and Q106 make up the second allpass network. The output of this section and the output of the Modulator/De-modulator Compensator board are applied to output jack J3.

4.6. VSB/AGC Board

Refer to 839-7900-491

4.6.1. Vestigial Sideband Filter Circuit

The purpose of the vestigial sideband filter circuit board is to provide frequency response shaping that is required in television. This is accomplished in filter FL1 which is a surface acoustic wave device.

In CCIR-M systems the filter also provides the receiver delay equalization.

The video IF signal is input through capacitors C1 and C2. The VSB IN/VSB OUT switch allows switching the VSB filter in or out of the circuit. When the switch is set to VSB IN, the signal path will be through CR1. When the switch is set to VSB OUT, the signal path will bypass the VSB filter.

4.6.1.1. VSB Signal Path

The signal through C1 and CR1 is applied to gain stage Q5 which provides approximately 15 dB of gain to overcome half the 30 dB loss in filter FL1. The signal is inductively coupled from Q5 to emitter-follower Q6. Resistor R23 establishes a

51-Ohm input impedance for filter FL1. The signal is coupled into FL1 by capacitor C16.

The output of the filter is coupled through C10 and applied to gain stage Q3 which provides approximately 15 dB of gain to overcome half the 30 dB loss in filter FL1.

4.6.1.2. Bypass Path

When the VSB OUT/VSB IN switch is set to VSB OUT, transistors Q1 and Q2 will bias diode CR2 on and bias diode CR1 off. The signal path will bypass the VSB filter. The arrangement of R6/R7/R8 in the bypass path is a variable attenuator which allows adjustment of the signal level from the bypass path to the same level as the output from the VSB filter path so that a level shift does not occur when the filter is switched in or out.

4.6.1.3. AGC Circuit (Visual)

Refer to drawing 839-7900-491

The visual exciter power is controlled by the IF AGC circuit.

Control voltage from the metering and control board is applied to the + input of comparator U101A. Detector input from the visual amplifier provides the - comparator input through buffer U101B.

In AUTO mode the output of U101A controls the attenuation through a voltage divider formed by PIN diode CR101 and R107. Attenuation is variable from 1 to approximately 40 dB. R116 provides adjustment of the AGC range by limiting the maximum current applied to CR101.

In MAN (manual) mode the control voltage is routed directly to the gain control circuit, and is used for trouble shooting purposes only.

Emitter follower Q101 provides isolation and low impedance drive. Q102 provides 10-11 dB of gain. The net gain of the AGC section is 9-10 dB with CR101 fully turned on.

4.7. Linearity/Quadrature Corrector Board

Refer to 839-7900-444

The purpose of this circuit board is to adjust the carrier phase and gain as a function of the video level. As the transmitter power output level increases, the amplitude of the signal will compress and the phase of the signal will shift. This circuit board will pre-distort the IF signal to compensate for the shift in phase and amplitude caused by the power amplifiers.

4.7.1. IF Linearity Corrector Circuit

4.7.1.1. Functional Description

Refer to sheet 1 of 839-7900-444

It is advantageous from the viewpoint of performance to perform differential gain correction on the IF signal instead of the video signal. The correction circuit uses diodes which are biased to turn on at a variable dc voltage level.

The signal is normally attenuated a fixed amount by using a resistive L-pad. The diodes are normally reverse biased by equal, but opposite polarity, dc voltages. Reducing the dc voltage amplitude permits the diodes to conduct on the signal peaks. This inserts additional resistance in parallel with the series arm of the L pad thereby decreasing the attenuation. Varying the resistance in series with the diodes provides for a variable gain expansion.

4.7.1.2. Detailed Description

The input signal is applied through input jack J1 to the 90 degree splitter. One output will be routed by jumpers at E1-4 to the Quadrature Corrector the other output to the Linearity Corrector circuit. Transistor amplifier pair Q1-Q2 amplifies the signal 10 times (20 dB). Q2 is a low impedance emitter follower which drives the initial gain network, CR1 through CR4. Threshold controls (TH1 and TH2) potentiometers R37 and R38 determine the turn on points of the diodes while slope controls (SL1 and SL2) potentiometers R10 and R11 vary the amount of gain expansion or compression achieved during the on period of the diodes. U1A and U1B are unity gain inverting amplifiers, with buffer amplifiers, to provide the opposite polarity dc voltage for biasing of the diodes. The 10 uH inductors, shunted by 2k ohm resistors, isolate the IF signal from the dc circuits. Diode CR9 compensates for temperature drift in CR1-CR8. Jumpers P3 and P2 are provided in both gain networks to allow either expansion or compression functions.

Transistors Q3 and Q4 amplify the signal approximately 8 dB before it is applied to the second expansion network. Threshold controls TH1, 2, and 3 are used to adjust the differential gain in the white to black region, while TH4 adjusts the sync amplitude.

The signal is applied to output through emitter follower Q5, matching resistor R28, and lowpass filter consisting of capacitors C22 and C23 and inductor L9. Jumpers at P6 route the output to the Quadrature Corrector or the test output J4. The linearity correction circuit may be bypassed by setting the toggle switch S1 to the Bypass position.

4.7.2. ICPM Corrector

Refer to sheet 2 of 839-7900-444

The gain expansion circuits of the Quadrature Corrector are identical to the Linearity circuit. Signals from the linearity and quadrature circuits are summed together by R162 and R159.

The two signals are 90 degrees apart in phase and the signal from the linearity circuit is much larger due to the low resistance of R162 (16 ohms) compared to R159 (100 ohms).

The resulting output is the vector sum of these two signals. A change of gain on the linearity side produces gain correction with only small change in phase of the sum vector. A change in gain on the Quadrature side produces change in phase of the carrier with little change in the magnitude of the vector sum.

Q106 has approximately 6 dB of gain. The output at J3 feeds the visual mixer.

The Quadrature Correction may be bypassed by setting switch S101 to bypass (out).

4.8. 1 Watt Final Amplifier

Final Amplifier - 992-8328-001

Circuit Board - 992-7093-001

Refer to schematic 839-7900-023

4.8.1. Functional Description

The exciter houses two identical class A final amplifiers. One amplifier is used for the sound output and one amplifier is used for the vision output. The jumper plug P1 is placed between 1 and 2 for sound service and between 1 and 3 for vision service

or dual carrier sound. This plug routes the control voltage to the input attenuator for single carrier sound AGC.

4.8.2. Theory Of Operation

4.8.2.1. RF Path

RF is input to J1 and applied to gain stage U3 through a capacitor C31. The gain of this stage is 18 dB. The output of this stage is attenuated by a pad consisting of pin diodes CR2, CR3, and CR4. These diodes function as current-controlled resistors. Regulator U5, R1 and CR1 form a bias network for the diodes. When the jumper plug is in the 1-3 position, the fixed diode current reduces the attenuation to the 3dB minimum value. If the jumper plug is in the 1-2 position, the AGC amplifier controls the attenuation.

After signal attenuation by the pad, the signal is then divided into two equal paths by HY1 and each path is amplified again by a 35 dB amplifier (U1 and U2). The signal is then re-combined by HY2 to the 1-Watt power level. The signal output is through a directional coupler with a -10 dB sample port.

4.8.2.2. RF Sample Detection

The sample from the directional coupler located in Final Amp is applied to peak detector CR5. The DC output of CR5 will be proportional to the RF output through the directional coupler. This DC potential is applied to buffer U4C.

As diode CR5 becomes warmer with operation, it will increase conduction. This temperature effect is overcome by use of a second diode, CR6, which is of the same type as CR5 and is mounted adjacent to CR5. The potential from CR6 is applied to buffer U4D.

The voltage from U4D is subtracted from the voltage from U4C at the input to summing amplifier U4A. The output is a voltage which remains proportional to the RF output through the directional coupler, but is now compensated for temperature variations.

4.8.2.3. AGC Loop (Vision)

The voltage at U4 pin 1 is now routed to the VSB/IF AGC as DETECTOR INPUT where it is the sample input to the AGC differential amplifier U101. Final amplifier attenuation is fixed at minimum.

4.8.2.4. AGC Loop (Single Carrier Sound)

Comparator U4B compares the potential from U4A pin 1 on the non-inverting input to a power control input potential on the inverting input which is generated on the metering and control circuit board. This potential is used as a reference to adjust the output level from U4B. This potential adjusts automatic gain control loop of the sound 1 watt amplifier circuit by varying the resistance of the RF interstage pad.

4.8.2.5. AGC Loop (Dual Carrier Sound)

The RF power sample DC voltage is routed to the Aural Linearization card as the sample for the AGC differential amplifier U1. Final amplifier attenuation is fixed at minimum.

4.8.3. Alignment

There are no adjustments except the change in jumper position that determines the AGC operation. Replacement of the

unit may also require realignment of the AGC or the set-up of exciter power limits.

4.9. BTSC Single Carrier Sound Circuit Board

Refer to schematic 839-7900-479

4.9.1. Functional Description

A voltage controlled oscillator is modulated by the combined audio signals, and up converted to the sound channel frequency. Integrated circuit U8 is the main phase lock loop for frequency control.

4.9.2. Detailed Circuit Theory

4.9.2.1. Voltage Controlled Oscillator (VCO)

The voltage controlled oscillator consists of Q1. The tuned circuit consists of CR1 through CR6, L1, C2 and C3. C5 and C6 establish the feedback ratio across Q1 to sustain oscillation. Varactor diodes in the oscillator circuit allow the frequency of oscillation to be changed simply by changing the bias on the varactors. The VCO output is applied to buffer Q2 which provides a gain of 15dB. The output of Q2 is routed through a resistive pad and monolithic amplifier U3 to provide high isolation for the VCO. The signal is attenuated and a sample is made before another amplification stage U4. The NE5205 amplifiers have a gain of about 18dB. J4 is the IF output, it may be optionally group delay corrected before up conversion to the sound channel frequency.

L2, L3, C21, C22 and C23 form a low pass filter to attenuate any harmonics.

4.9.2.2. Phase Lock Loop

The aural IF phase lock loop (PLL) is U8. With the exception of the prescaler U2, it contains the programmable divide by N counter, divide by R counter, the phase detector and the lock detection circuits.

The VCO frequency is sampled by U2 a divide by 10 or 11 dual modulus prescaler. The output of the prescaler is applied to U8 a multipurpose frequency synthesizer IC. U8 further divides the VCO frequency down to 12.5kHz.

U18 prescales the 16MHz input to 800kHz and applies it to U8. U8 then further divides the 800kHz to 12.5kHz. The phase detector within U8 compares the two signals, the phase detector outputs are filtered and the difference is integrated by U9. The output voltage of U9 varies the bias on the varactor cathodes. This controls the average frequency of the VCO. A large change in the phase detector output will cause the diodes in parallel with R25 or R26 to conduct, this will shorten the lock time if the phase/frequency error is large due to a power failure.

Q3, Q4 and Q5 process U8 lock detector output to drive the on board lock LED and the remote output.

4.9.2.3. Audio Inputs

Monaural audio is applied to buffers U19 followed by U10 which is configured as a differential amplifier to remove any common mode noise on the audio inputs. U11 is used to form the preemphasis network. The exact preemphasis curve used is determined by the selection of resistors R43, R44, R45 and R46.

Composite BTSC signal is applied to amplifiers U21 and U12 in a common mode rejecting circuit.

Subcarriers 1 and 2 are buffered, followed by a level control. Both are combined and can be summed with the monaural or composite input, depending on the position of J7.

The monaural or composite signals may be switched to the modulated oscillator by the CMOS switch U14. The switching is controlled by either the local switch, S3 or by remote control contact closure.

4.9.2.4. Up conversion

The IF output, J4, is either routed through the aural group delay corrector or jumpered to J3. The following pad is 10 dB without the delay equalizer or 6dB when the optional equalizer is used.

The local oscillator input is J2, the attenuated signal is amplified by U15 and drives the mixer LO input. L8 and C76 are a local oscillator trap.

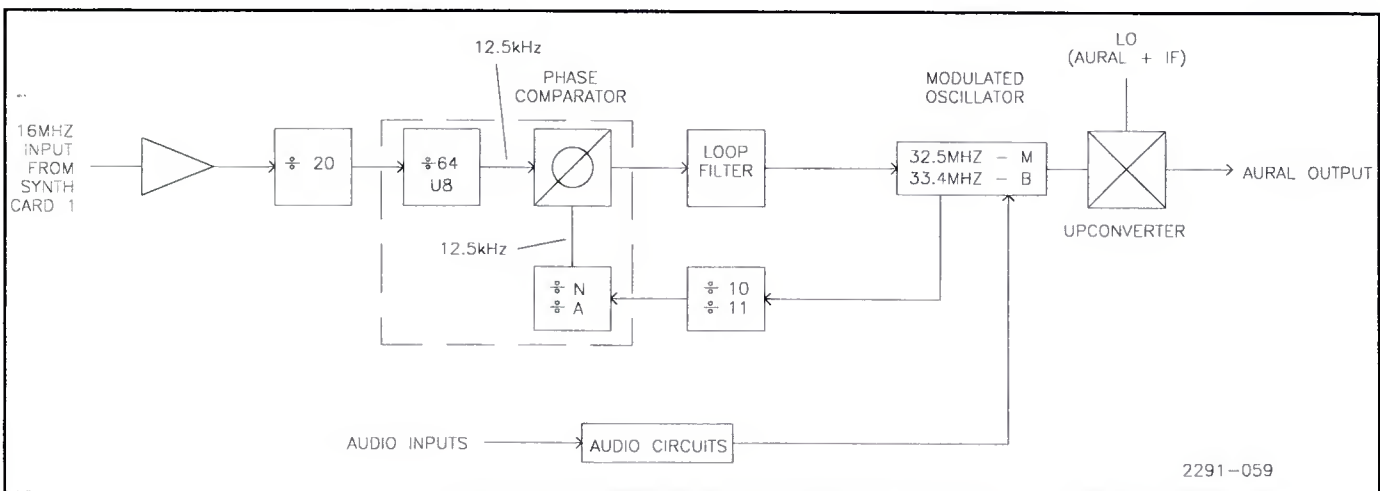


Figure 4-3. Aural Converter Block Diagram

4.10. Aural Delay Corrector Circuit Board (Optional)

Refer to Drawing 839-7900-492

4.10.1. Functional Description

The Aural Delay Corrector is provided as an option to equalize the aural rf circuits when operating through a notch diplexer. It is intended as a means of improving TV stereo operation when non-stereo type notch diplexers are used, namely, single cavity diplexers.

The Aural Delay Corrector is a passive, adjustable allpass circuit operating at the aural IF frequency of 32.5 MHz. The corrector is basically a single section allpass with two tuned resonators for equalizing the group delay error existing in the aural notch diplexer.

A bypass system is provided to allow switching the allpass section out and for switching in an adjustable pad to make up for the insertion loss of the allpass resonators. The bypass mode can be operated manually with a switch located on the board or remotely through external wiring that provides an isolated switch contact closure.

4.10.2. Detailed Description

The input signal path is through J1 and relay contacts 2,4 of K1 to pin 1 the input to HY1, a 90° PC mounted hybrid. The signal is divided equally between the output pins 2 and 5 with a 90° phase shift and is applied to resonators F1 and F2. The signal is reflected off the resonators and is recombined in HY1 at output pin 6. The delay equalized signal is connected to output jack J2 through bypass relay K1 contacts 6 and 8.

The 90 degree phase shift plus the resonator phase shift, when recombined in the hybrid, provides an inverse group delay curve to that existing in the rf output notch diplexer. Slight adjustment of resonators F1 and F2 provides an adjustable level of equalization to correct the rf output group delay. Typically,

resonators F1 and F2 are tuned to have the same delay curve and then both F1 and F2 are positioned on 32.5 MHz. A slight adjustment of either F1 or F2 will then flatten out or peak up the overall delay response curve as required for equalization.

An adjustable rf pad consisting of R1, R2 and R3 is used to match the insertion loss of the allpass circuit when the aural delay corrector is switched in and out of the aural IF path. Adjusting R3 provides about 6 dB of level adjustment between -2 and -6 dB insertion loss points to maintain nearly equal operating levels in either normal or bypass modes.

In the operating mode, bypass relay K1 is de-energized (drawing 837-7900-026 shows the de-energized mode).

To bypass the corrector, switch S1 grounds the bottom of K1 coil through CR2 to activate K1, bypassing the resonators and switching in the rf pad. +15VDC is applied to the coil of K1 through R4. CR1 bypasses coil transients and CR3 absorbs power supply transients.

Bypass switch S1 also activates the bypass board LED indicator on the front panel of the exciter through CR4. The bypass indicator line can be disabled for prolonged operation in the bypass mode without illuminating the front panel LED, if desired, by moving patch pin P1 from 2,3 contacts to 2,1. Normal operation requires P1 to be in 2,3 position for proper front panel LED indication of the aural corrector bypass mode.

CR5 isolates the switch contacts for remote control operation. The bypass mode can be activated remotely through an isolated contact closure wired to pins E1 and E2. A holding contact between E1 and E2 holds bypass relay K1 energized, bypassing the aural delay corrector. An open contact releases K1 for normal operation. Note, when S1 is in the bypass mode, remote operation is deactivated. Remote operation requires local switch S1 to be in the normal operating position.

4.11. VHF Synthesizer Card 1

Refer to schematic 839-7900-528

4.11.1. Circuit description

The VHF synthesizer card 1 performs two basic tasks:

- Creates all the reference frequencies used by the phase locked loops from on board 10MHz standard or an externally applied 5 or 10MHz PFC input.
- Creates IF frequency for the modulator of 37MHz for system M or 38.9MHz for system B.

4.11.2. Detailed Circuit Description

4.11.2.1. 10MHz Generation

10MHz is the main reference frequency used by the synthesizer. Used to create all other reference frequencies. The 10MHz has two primary sources, the on board OCXO or the PFC input. On board detection circuits sense the presence of a PFC input and automatic switching is used to select the appropriate 10MHz signal.

PFC input of either 5 or 10MHz applied to J5 is buffered by Q4 and amplified in a class C amplifier Q5. The output of this class C amp is rich in harmonics. A tuned circuit consisting of C20 and L1 and a series tuned 10MHz crystal Y1 selects the 10MHz harmonic. The level of 10MHz is detected by CR5 and compared by U3. If there is sufficient 10MHz level U3's output goes low and drives a PFC indicator DS1. U3 also drives a switchable 15V voltage regulator. When PFC is present the regulator is shut down and consequently shuts down on board

10MHz OCXO Y4. If there is an insufficient level of the PFC input, then U3 will select on board 10MHz OCXO Y4 by powering up the switchable voltage regulator U1, which in turn powers up the OCXO. The actual selection of the 10MHz signal, be it either the PFC input or on board standard, is performed by U4 configured as a SPDT switch. The output of this switch is the primary 10MHz signal and used to create all other reference frequencies.

4.11.2.2. 5MHz Generation

The primary 10MHz signal from U4 is distributed by a buffer U5 to other parts of the card. One output is applied to J3 for future use. A second output is divided by 2 in U6 to create a 5MHz reference frequency and is applied to J1. The third output creates the 800kHz reference frequency.

4.11.2.3. 16MHz Generation

10MHz from U5 is divided by 5 in U7. The output of U7 is a 20% duty cycle pulse train at 2MHz. This pulse train has high harmonic content. A tuned circuit consisting of L4 and C26 and a series 8MHz crystal Y2 selects the fourth harmonic or 8MHz. The 8MHz signal is full wave rectified or doubled by U8 to create the 16MHz reference frequency. Tuned circuit L5 and C28 and a series tuned 16MHz crystal Y3 performs further filtering of the 16MHz. The 16MHz signal is buffered by U9 and applied to J4.

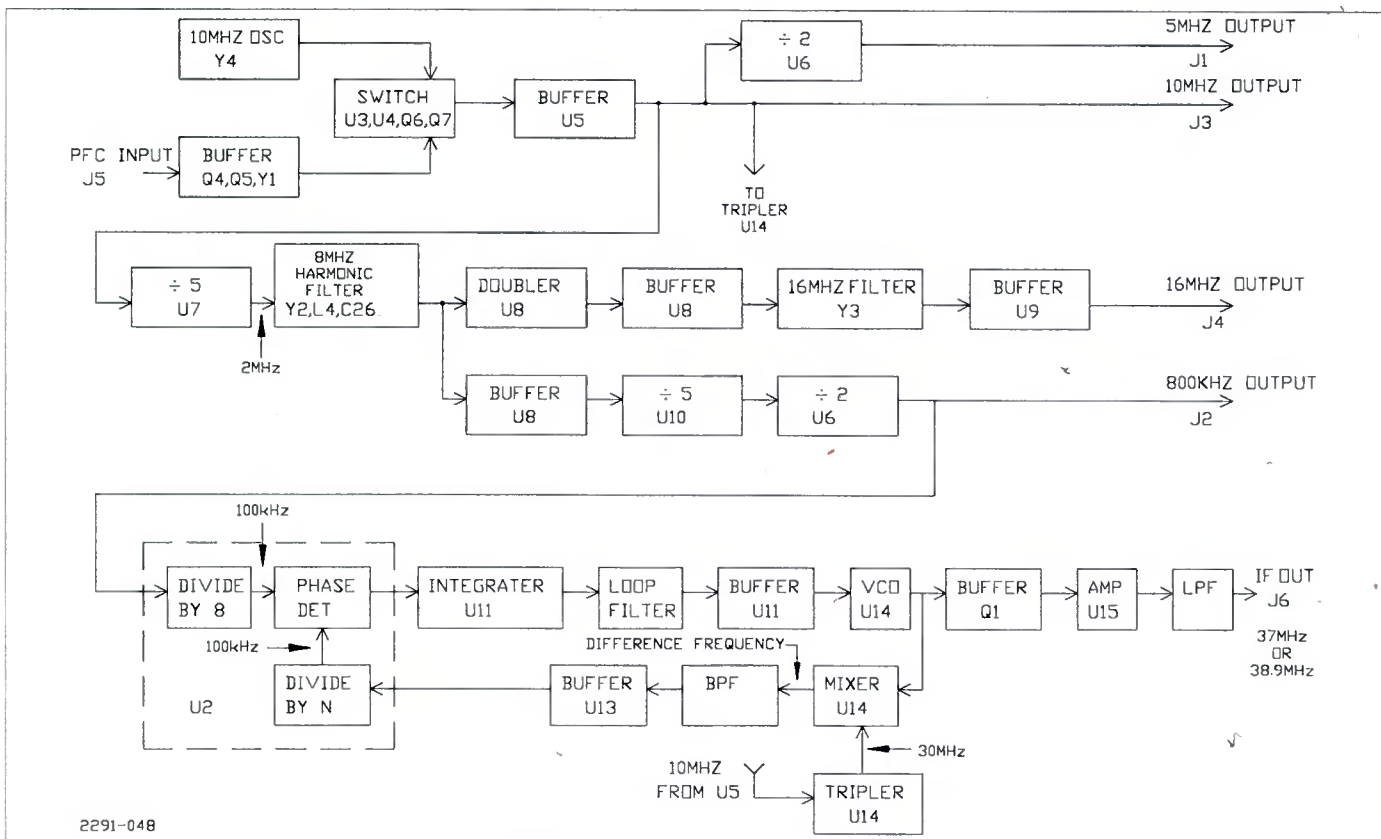


Figure 4-4. VHF Synthesizer Card 1 Block Diagram

4.11.2.4. 800kHz Generation

A second output of the 8MHz signal is buffered by U9 and then divided by 5 in U10 to create 1.6MHz. This 1.6MHz is divided by 2 in U6 to obtain 800kHz and is then applied to J2.

4.11.2.5. IF Generation

A PLL generates the IF carrier for the modulator. This PLL uses a mixing technique where the VCO frequency is mixed with a harmonic of the 10MHz reference and then locked to the 800kHz reference. Using the mixing technique reduces the total divider ratios and improves the phase noise performance.

U14 contains both the VCO and mixer. The tank for the VCO is formed with L15, C38 and the varactor diodes CR4, CR14 and CR15. The VCO frequency is mixed with the 3rd harmonic of 10MHz. The 10MHz applied to U14 via a square wave with good 3rd harmonic content. Tank circuit L7 and C107 peak the 30MHz level.

The output of U14 is the difference between the 30MHz and the VCO frequency, typical 7MHz for a 37MHz IF or 8.9MHz for a 38.9MHz IF. A band pass filter follows U14 to remove any unwanted mixer products. This filter consists of L6, L8, L20, C110, C111 and C112.

The filtered 7 to 9MHz signal is amplified by U13 and applied to a programmable divider chip U2.

The programmable divider chip U2 also receives the 800kHz reference frequency. Both the 800kHz reference and the mixed VCO frequency are divided down to 100kHz. A phase/frequency comparator within U2 compares the phase of the two 100kHz signals. Any difference in the frequency or phase is

detected and output as a pulse whose duty cycle is equal to the phase difference. U11 integrates these pulses to create a DC control voltage proportional to the phase difference. This DC control voltage is used to lock the VCO to the desired frequency.

A passive low pass filter is used on this control voltage to remove any 100kHz that might be present after the integrator. This filter consists of C121, C123, C125, C126, C122, C124, L9, L10 and L11.

The VCO frequency is sampled and buffered by Q1 and amplified by U15, Q2 and Q3. A low pass filter centered about the desired IF frequency removes any harmonics and unwanted spurs. This band pass filter consists of C138, C137, C134, C139, C140, C135, C136, L17, L18 and L19.

Lock detection is accomplished by U3 and its output mutes the exciter in the event of loss of lock.

4.12. VHF Synthesizer Card #2

Refer to schematic 839-7900-529

4.12.1. Circuit Description

The VHF synthesizer card 2 performs the task of generating the LO used to convert the visual and aural IFs to carrier. It contains a main PLL loop that runs from 150 to 300MHz in 5MHz increments and a ratchet PLL loop that runs from 10 to 15MHz in 10kHz increments. The main loop's VCO is offset by the ratchet loop in a SSB mixer prior to phase detection. This allows the final frequency to cover the 150 to 300MHz range in 10kHz increments. For low band channels the main loop's

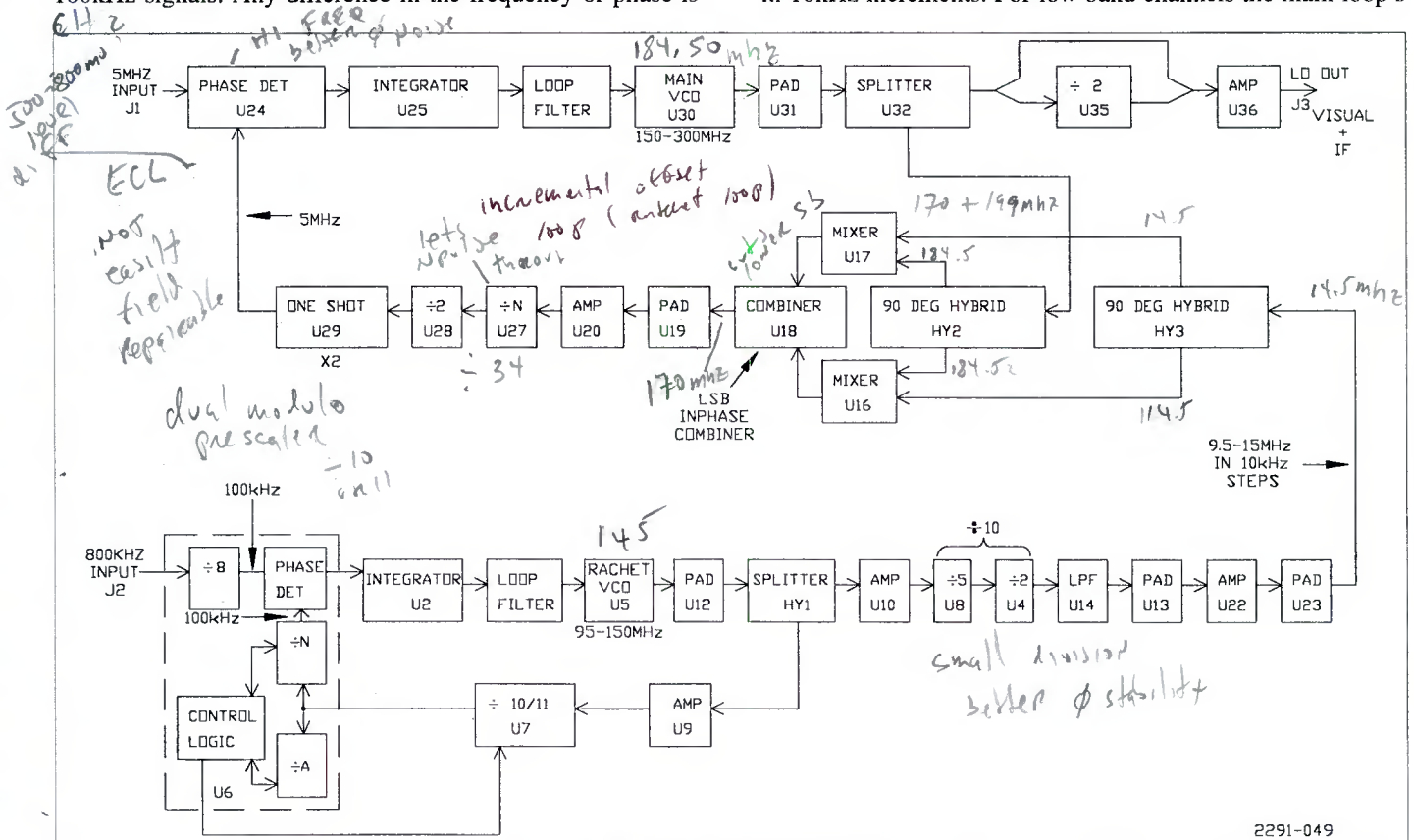


Figure 4-5. VHF Synthesizer Card 2 Block Diagram

output is divided by two yielding a frequency range of 75 to 150MHz in 5kHz increments.

4.12.1.1. Detailed Circuit Description.

4.12.1.1.1. 10 to 15MHz Ratchet Loop

The frequency of the ratchet loop is such that the difference of the desired LO minus the ratchet frequency yields a frequency divisible by 5MHz.

The primary rf source is a 95 to 150MHz VCO U5. U5's output is buffered by a 6dB pad U12 and split into two paths by hybrid HY1. One path is amplified 18dB by U9 and applied to a divide by 10/11 dual modulus prescaler U7. The output of the prescaler is applied to a programmable divider U6 where the VCO frequency is divided down to 100kHz.

An 800kHz reference signal from card 1 is applied to J2 and then to the programmable divider U6 where it is also divided down to 100kHz. A phase frequency detector within U6 compares the phase of the two 100kHz signals. Any difference in the frequency or phase is detected and output as a pulse whose duty cycle is equal to the phase difference. U2 integrates these pulses to create a DC control voltage proportional to the phase difference. The VCO is locked to the desired frequency by this DC control voltage.

A passive low pass filter is used on this control voltage to remove any 100kHz that might be present after the integrator. This filter consists of C33, C34, C35, C36, C37, L2 and L3.

Potentiometer R13 sets the gain of the loop for best stability and rejection to microphonics.

The other output of hybrid HY1 is amplified 18dB by U10, divided by 5 by U8, and then divided by 2 by U4. This total division of 10 yields a frequency range of 9.5 to 15MHz in 10kHz increments. The divided output of U4 is filtered by a 21.4MHz low pass and then buffered by a 6dB pad U13 and 12dB amplifier U22.

Lock detection is accomplished with U1 and its output is used to mute the exciter in the event of a loss of lock.

4.12.1.1.2. SSB Mixer

A single side band mixer is used to offset the main loop VCO's frequency by the ratchet loops frequency. This SSB mixer consists of mixers U16 and U17, 90 degree hybrids U2 and U3, a 0 degree power combiner U18, and attenuators U23 and U19.

The main loop's VCO signal is applied to one 90 degree hybrid and the ratchet loop's signal to the other 90 degree hybrid. The hybrid outputs are then mixed in the two mixers, which produce two primary outputs at the sum and the difference frequencies. When the mixers create these sums and differences, the sum signals are in phase but the difference frequencies have a 90 degree relationship with each other. This 90 degrees from the mixers plus the 90 degrees from the hybrids add and create a 180 degree difference. By phasing the hybrids correctly the output of the two mixers will have both lower side bands in phase but the upper side bands will be 180 degrees out of phase. When combined in the 0 degree combiner U18 the lower side bands will add and the upper side bands will cancel. The lower side band or difference frequency is then buffered and amplified 18dB by U20.

4.12.1.1.3. Main 150 to 300MHz PLL

A 150 to 300MHz VCO U30 is the primary signal source for the main PLL. U30's output is buffered by a 6dB attenuator U32 and then split into two paths by hybrid U32. One path is divided by 1 or 2 by U35, depending on the required frequency, then amplified 12dB by U36 and routed to the LO output J3. The other VCO output from splitter U32 is amplified 12dB by U33 and routed to the SSB mixer.

The output of the SSB mixer is applied to a programmable divider U27 which divides the main VCO frequency to 5MHz. The output of this divider is one pulse for every N input pulses. This small pulse is too narrow for good phase detection and must be stretched. The output of the counter is divided by 2 in U28 which yields a 50% duty cycle square wave. The square wave is then applied to a one shot monostable multivibrator U29 that triggers on both positive and negative edges. The multivibrator's output is twice the frequency of the input and cancels the divide by 2 of U28, the pulse width is 20nsec. This 5MHz pulse train is applied to the phase frequency comparator U24.

The 5MHz reference from card 1 is applied to J1 and then to phase frequency comparator U24 where the phase of the two 5MHz signals is compared. Any difference in the frequency or phase is detected and output as a pulse whose duty cycle is equal to the phase difference. U25 integrates these pulses to create a DC control voltage proportional to the phase difference. It is this DC control voltage that is used to lock the VCO to the desired frequency.

A passive low pass filter is used on this control voltage to remove any 5MHz that might be present after the integrator. This filter consists of C58, C57, C56, C53, C54, C55, L5, L6 and L7.

Potentiometer R44 is used to set the loop gain for best stability and rejection to microphonics.

Lock detection is accomplished with U1 and its output is used to mute the exciter in the event of a loss of lock.

4.13. Metering and Control Circuit Board

Refer to 839-7900-027

The purpose of the metering and control circuit board is to provide status outputs to the user interface, drive the LED's on the front panel of the exciter, it interfaces the switches with the control logic, and provides the exciter power output control. Sheet 1 of the schematic diagram is divided into the visual portion on top and the aural portion on bottom.

4.13.1. Visual Power Control Circuit

The control circuit consists of a 12-bit digital-to-analog converter U15 and a 12-bit up-down counter consisting of U9, U10, and U11. The up-down counter is clocked up and down via U7. U7 is a low-frequency oscillator which can oscillate at two frequencies. U7 begins operation at a low frequency and after a period of time, it changes to a higher frequency.

If one of the VISUAL POWER switches is depressed, the logic gates consisting of U1 and U2 allow the oscillator output to clock the up-down counter. When a RAISE or LOWER switch is not pressed, the logic inhibits the clock. A series of Schmitt triggers (U6) detects when a RAISE or LOWER switch has been pressed and forms a time delay circuit with R4 and C1. Before the time delay expires, the clock is allowed to

run at low frequency. After the time delay has expired, the clock frequency is increased. This dual frequency circuit allows small increments of power to be accomplished easily and also allows large power changes without delay.

Diode CR1 discharges capacitor C1 when the switch is released and returns the clock to slow operation. The timing sequence will start over again when a switch is again pressed.

The output of the up-down counter drives U15 which converts the digital input to an analog voltage output. The analog voltage output of U15 is applied to buffer amplifier U17 and CMOS muting switch U19. During normal operation, the power control potential is routed to the visual power amplifier through the closed contacts of U19. If the switch is open, the power amplifier will be muted.

4.13.2. Aural Power Control Circuit

The control circuit consists of a 12-bit digital-to-analog converter U16 and a 12-bit up-down counter consisting of U12, U13, and U14. The up-down counter is clocked up and down via U8. U8 is a low-frequency oscillator which can oscillate at two frequencies. U8 begins operation at a low frequency and after a period of time, it changes to a higher frequency.

If one of the AURAL POWER switches is depressed, the logic gates consisting of U4 and U5 allow the oscillator output to clock the up-down counter. When a RAISE or LOWER switch is not pressed, the logic inhibits the clock. A series of Schmitt triggers (U20) detects when a RAISE or LOWER switch has been pressed and forms a time delay circuit with R15 and C5. Before the time delay expires, the clock is allowed to run at low frequency. After the time delay has expired, the clock frequency is increased. This dual frequency circuit allows small increments of power to be accomplished easily and also allows large power changes without delay.

Diode CR2 discharges capacitor C5 when the switch is released and returns the clock to slow operation. The timing sequence will start over again when a switch is again pressed.

The output of the up-down counter drives U16 which converts the digital input to an analog voltage output. The analog voltage output of U16 is applied to buffer amplifier U18 and CMOS muting switch U19. During normal operation, the power control potential is routed to the aural power amplifier through the closed contacts of U19. If the switch is open, the power amplifier is muted.

4.13.3. Metering Circuit

The metering portion of the exciter is detailed on page 2 of the schematic diagram.

The VISUAL POWER and AURAL POWER switches (S5 and S6) operate a bi-stable flip-flop consisting of U21. The flip-flop selects through CMOS switch U22 whether visual power or aural power will be monitored. LED DS13 or DS14 will illuminate to indicate which switch has been selected.

DC potentials representative of aural or visual power (as selected) are routed through U22 to analog display U23/U24 and U25. Analog-to-digital converter U25 converts the analog voltage input to a digital level and drives the 3 1/2 digit main display (DS1 and DS2).

-3The lower portion of page 2 of the schematic diagram interfaces the IF lock, interfaces the master lock, details the logic that drives the front-panel LED's, and provides the outputs for remote control.

4.14. Main Power Supply

Refer to 839-7900-504

The power supply is located in right rear area of the main chassis. AC power is input to the exciter through an ac line filter and circuit breaker/switch. A fan, connected to the ac input potential, operates whenever power is switched on. Terminal board TB1 and a power transformer with five primary windings allows a wide selection of operational voltages in the 120 and 240 volt range.

All dc supplies in the exciter are full-wave rectified, filtered, and regulated for stable operation. The dc potentials are distributed throughout the exciter for operation of the internal circuitry. Certain potentials are re-regulated on some circuit boards to assure stable operation of certain critical circuits.

4.14.1. Positive 24 Volt Supply

A 24-volt winding of transformer T1 is full-wave rectified by bridge rectifier CR1 into a +29.2 volt dc source. This potential is regulated into a stable positive 24-volt supply at 2 amperes by U1. Diode CR9 protects the regulator from a reverse polarity potential applied to the output and diode CR4 protects the regulator from a short circuit on the regulator input. R16 provides a means to adjust the output of the regulator. Capacitor C6 prevents oscillation of the regulator and the capacitors on the output filter high frequency ac components.

4.14.2. Positive and Negative 15 Volt Supplies

A 32-volt winding of transformer T1 is full-wave rectified by bridge rectifier CR2 into a +20.2 and a -20.2 volt dc source. These potentials are regulated into stable positive and negative 15-volt supplies at 2 amperes by U2 and U3. Diodes CR10 and CR11 protect the regulators from a reverse polarity potential applied to the output and diodes CR5 and CR6 protect the regulators from a short circuit on the regulator inputs. R17 provides a means to adjust the output of the positive regulator and R18 provides a means to adjust the output of the negative regulator. Capacitors C7 and C8 prevent oscillation of the regulators and the capacitors on the output filter high frequency ac components.

4.14.3. Positive and Negative 5 Volt Supplies

A 17-volt winding of transformer T1 is full-wave rectified by bridge rectifier CR3 into a +10.4 and a -10.4 volt dc source. These potentials are regulated into stable positive and negative 5-volt supplies at 2 amperes by U4 and U5. Diodes CR12 and CR13 protect the regulators from a reverse polarity potential applied to the output and diodes CR7 and CR8 protect the regulators from a short circuit on the regulator inputs. R19 provides a means to adjust the output of the positive regulator and R20 provides a means to adjust the output of the negative regulator. Capacitors C9 and C10 prevent oscillation of the regulators and the capacitors on the output filter high frequency ac components.

SECTION V MAINTENANCE

5.1. Introduction

This section provides general maintenance information, electrical adjustment procedures, and troubleshooting information for the VHF TV exciter. It is strongly suggested that each procedure be read through completely before attempting any adjustments.

5.1.1. Safety Considerations

Only low potentials are present on the circuit boards within the VHF TV exciter (+24, +/-15, +/-5), however primary power is present in the shielded cage in the right rear of the unit. This area should be covered during troubleshooting to prevent accidental contact with the primary line potential. The information contained in this section should be performed by trained and experienced personnel. Good judgment, care, and common sense are the best accident preventives.

5.1.2. Routine Mechanical Maintenance

All electronic equipment is more stable if it is kept cool. Routinely verify the exciter cooling fan is operating. There is a fine mesh RF filter located between the fan and the exciter chassis. It is important that this filter be kept clean. It can be removed for cleaning by removing the four fan mounting screws. New exciters have captive nuts for the screws. Wash filter with soap and water and reassemble.

Other accumulations of dirt may be removed with a vacuum cleaner. Do not use high pressure compressed air.

5.2. Vision Path Adjustments

The transmitter is very stable, investigate the possibility that another problem exists before major adjustments are made. Problems might include:

- a. Exciter fan failure or a dirty fan filter causing the exciter to overheat due to reduced air flow.
- b. A change in exciter power supply voltage. Refer to power supply alignment procedure near the end this section.
- c. Any change in RF amplifier gain due to a soft failure could change the needed drive level or require a different amount of correction.

Investigate these possibilities before changing the correction.

5.3. Vision Adjustment Sequence

The exciter is factory tuned and tested and is ready for operation in the transmitter. Normal VISUAL adjustment consists of a brief check of the basic performance (items 1-3 in Table 5-1).

Then pre-correction and level matching for the transmitter (items 4-12 in Table 5-1) should be carried out in the order shown.

5.3.1. Optional Notch Diplexer Unity Gain

The purpose of this procedure is to set the Video gain of the Notch Diplexer EQ module to unity. If you do not have the Notch Diplexer EQ module, skip the following steps and move on to the Video Input/Diff Gain board adjustments.

The Notch Diplexer EQ was factory set for proper compensation of the diplexer if equipped - no adjustment should be necessary.

- a. Place Notch Diplexer Module on extender.
- b. Apply modulated staircase test signal to exciter.
- c. Set S1 to bypass.
- d. Measure video input level at TP2 with a high frequency scope and note the voltage.

Table 5-1. Visual Adjustment Sequence

Procedure	See	Section
1) Check video level	Video Input Set Up	5.3.2.1
2) Check depth of modulation	Depth Of Modulation	5.3.3
3) Check exciter swept response	Response Equalizer	5.3.6
4) Adjust ICPM	Quadrature Corrector	5.3.11
5) Differential gain coarse adjustment	IF Linearity Correction	5.3.11
6) Differential gain fine adjustment	Video Differential Gain	5.3.2.2
7) Luminance linearity correction	Luminance Linearity	5.3.3.3
8) Adjust differential phase	Differential Phase Corrector	5.3.13
9) Adjust group delay	IF Delay Compensation	5.3.14
10) Recheck sync level	Video Input Set Up	5.3.2.1
11) Recheck depth of modulation	Depth of Modulation	5.3.3
12) Adjust power limits	Power Limit Control	5.3.17

- e. Observe video output at TP6 and set R65 for unity gain across module.
- f. Set S1 to normal (correction in).
- g. Set R3 for unity gain at TP6 compared to TP2.
- h. Observe video at TP6 on a vectorscope or waveform monitor and set R43 for best differential gain.
- i. Proceed to video input board gain adjustments

5.3.2. Video Differential Gain/Low Frequency Linearity Board Adjustments

5.3.2.1. Video Level Adjustment

diff ↓

- a. Apply a 1Vp-p staircase luminance only video signal to the exciter video input.
- b. Set the following bypass switches to OUT: differential gain corrector, low frequency (LFL), notch diplexer equalizer, receiver equalizer and differential phase corrector.
- c. Connect a scope to the video monitor output on the Diff Phase board. J2 must be terminated with 75 ohms.
- d. Adjust R1 for the correct level of the video component and R2 for the correct sync amplitude. Sync plus video should equal one volt peak to peak.
- e. Check to verify that the IF Linearity, Quad corrector, and Differential Phase switches are in the IN position and that the initial adjustments have been completed.

5.3.2.2. Correction For Differential Gain.

Refer to Figure 5-1 below

- a. Select the differential gain display on the vectorscope. A waveform monitor with a subcarrier bandpass display may be used. It will be more difficult to view the small changes in differential gain.
- b. Apply a 1Vp-p staircase or ramp video signal with chroma to the exciter video input.
- c. Set the BYPASS (DIFF GAIN) switch to the IN position.
- d. Start with all differential gain controls maximum CCW.
- e. Adjust the sections of white compression or white expansion as needed. The goal is to straighten the vector-

scope display of differential gain. The threshold controls determine the starting point of the correction and the slope controls the amplitude of the correction.

5.3.2.3. Correction For Luminance Linearity Error

Set the BYPASS (LFL) switch to the IN position.

- a. Monitor the transmitter output with the demodulator connected to a waveform monitor and vectorscope.
- b. Place the waveform monitor in the differentiated step mode.
- c. Start with all LF linearity controls maximum CCW.
- d. Adjust the sections of white compression or white expansion as needed. The goal is equal amplitude of all the differentiated steps. The threshold controls determine the starting point of the correction and the slope controls the amplitude of the correction.
- e. Adjust CW the threshold control to set the point at which correction begins, if this point is not visible increase the slope.
- f. Adjust the slope control to change the amplitude of the correction.
- g. Adjust R2 for the correct sync level.

5.3.3. Depth of Modulation

Refer to Figure 5-2

Check the depth of modulation and adjust if needed. Depth of modulation is adjusted by R12, the MOD BIAS control on the MOD/DELAY board. Use MOD BIAS and SYNC LEVEL R2 to attain proper video levels at the transmitter output. Any further video level adjustments for program levels shall be done with R1, video gain on the video card.

Differential gain and low frequency linearity adjustments may have an affect on frequency response and group delay, check these parameters after the transmitter gain and linearity corrections have been made and trim the adjustments as needed.

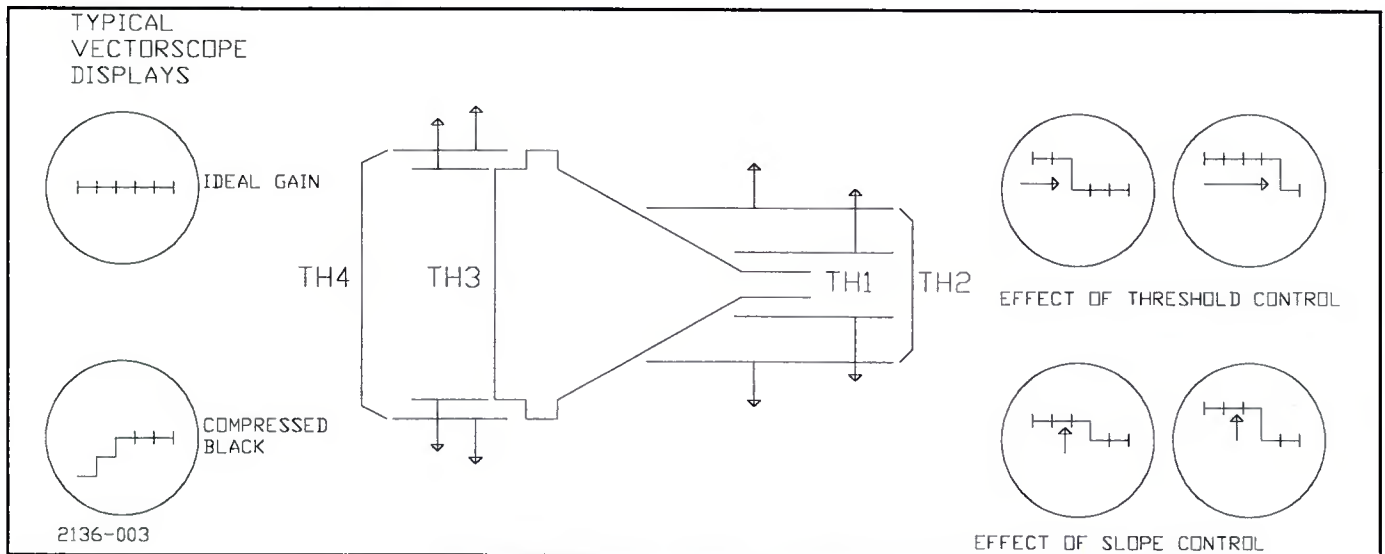


Figure 5-1. Diff. Gain, Effect of TH and SL Controls

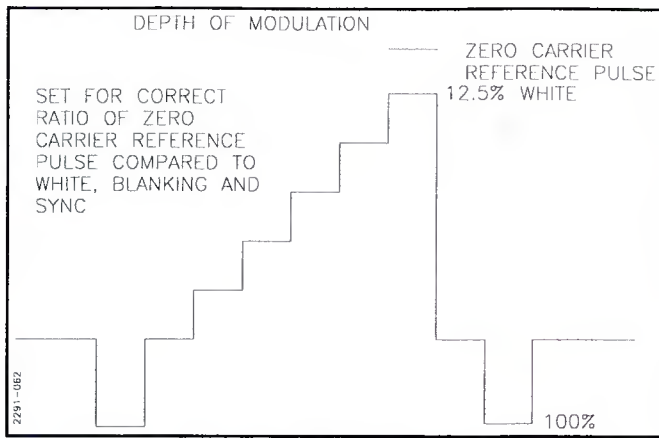


Figure 5-2. Depth of Modulation

5.3.4. Video input board alignment procedure

NOTE: For transmitter correction adjustment refer to the previous section. The alignment procedure is for boards that require a total alignment due to repair etc.

5.3.4.1. Initial System Setup

Refer to Table 5-2

Set JP1, JP2 and JP4 for NTSC or PAL.

Set JP5 for AC or DC coupling to ground or float the video input cable shield. Floating the shield may help with common mode signals caused by ground loops for example.

5.3.4.2. Control Presetting

- Turn off Differential Gain and Low Frequency Correctors to correctly align the board, by setting S1 and S2 to OUT. Temporarily install video card in exciter using extender card.
- Turn off white clipping by turning R71 fully counter-clockwise (CCW).
- Apply 1.0 volt p-p video to the input at J1 from a video test signal generator.
- Using an oscilloscope monitor the voltage at TP4 and adjust R1 for a 1.1 volt p-p level.
- Check TP8, the generated burst pulses should be 1.7 volts p-p.
- Check TP6, the regenerated sync pulse amplitude should be 5 volt p-p.

5.3.4.3. Loss of Video Adjustment

The following potentiometers are 4 turn.

- Turn R106 and R111 fully CCW.
- Adjust R141 until U17 locks and the loss of video indicator DS1 is off. Adjust R141 to be half way between the two points where DS1 illuminates, indicating loss of video.
- Temporarily remove video to check loss of video operation, DS1 should illuminate.

5.3.4.4. Sync Removal Adjustment

- Preset R110 full clockwise (CW) and R105 full CCW.
- Monitor TP7, sync-clipped video, with an DC coupled oscilloscope.

Table 5-2

SYSTEM	NTSC	PAL
JP1	3-2	1-2
JP2	1-2	3-2
JP4	1-2	3-2
COUPLING	AC	DC
JP5	3-2	1-2
GROUNDING	GROUND	FLOAT
JP3	1-2	3-2

- Adjust R131 until the waveform in Figure 5.3 is obtained. This adjustment will move most of the sync pulse to the blanking level.
- Adjust R110 and R105 until a sync-free waveform as shown in Figure 5-4 is obtained.
- R105 will remove any glitch if present just before burst. Be careful to only remove the glitch, not the burst.
- R110 will remove the sync.
- Readjust R131 until the blanking level is flat.
- Adjust R124 to set the blanking level to 0.0 volts DC.
- Recheck for flatness in the blanking level, readjust R131 if needed.

5.3.4.5. Sync Level Adjustment

Adjust R2 for approximately 700 mV p-p of sync at TP5.

5.3.4.6. Frequency Response and Group Delay

Use one of the following procedures.

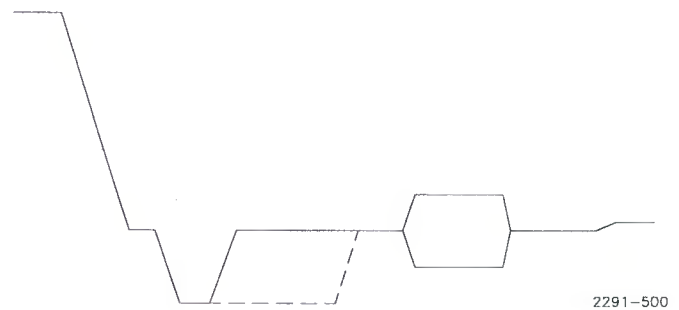


Figure 5-3. Sync Removal

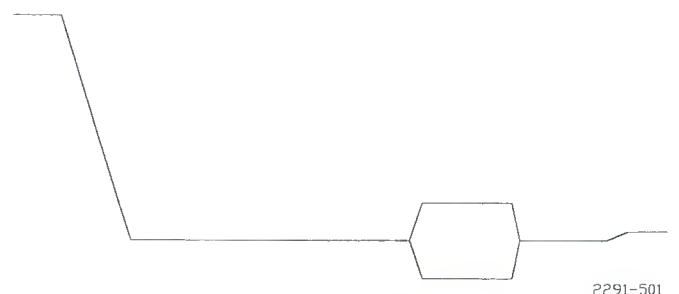


Figure 5-4. Blanking Level Flatness

5.3.4.6.1. VM700 alignment procedure.

If a VM700 is available, connect the video card output test jack J2 to the VM700, terminate the input with 75 ohms.

- a. Select a sinX/X generator signal.
- b. Select Group Delay and SinX/X from the measurement menu of the VM700.
- c. The response and group delay of the board are being adjusted. Use the VM700 Relative-Reference mode for best accuracy.
- d. First adjust R115 for best compromise between group delay and response.
- e. Adjust R120 for best frequency response.
- f. Adjust R157 for best group delay.
- g. Repeat steps e and f until the required response and group delay is achieved.

5.3.4.6.2. Waveform monitor procedure

- a. Select a multiburst test pattern signal.
- b. Adjust R115 for the flattest response as observed on the waveform monitor.
- c. Select a Multipulse or other group delay measuring signal from the generator.
- d. Adjust R115 for a best compromise for group delay and response, repeating steps a and b as needed.
- e. Adjust R120 for best frequency response.
- f. Adjust R157 for best group delay.

5.3.4.7. Sync Parameter Adjustment

- a. Observe video and reinserted sync at TP5.
- b. Adjust front porch duration with R111.
- c. If a glitch appears at the leading edge of sync, readjust R111 until it just disappears and the timing is still in within specification.
- d. Adjust sync duration with R106.

5.3.4.8. White Clip Adjustment

- a. Select a staircase or ramp signal from the generator that has 100% luminance.
- b. Increase video level with R1 until luminance level is higher than the desired clip level.
- c. Adjust R71 clockwise to set the luminance white clip to the desired level, such as 110%.
- d. Reset R1 for 100% luminance level.

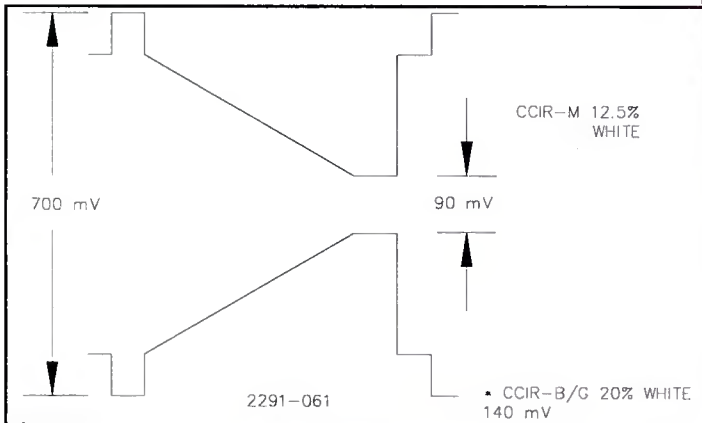


Figure 5-5. Modulator Output Waveform

- e. Differential gain and low frequency linearity adjustments may have an affect on frequency response and group delay, check these parameters after the transmitter gain and linearity corrections have been made and trim the adjustments as needed. Video and sync level final adjustments may be set with R1 and R2.

5.3.5. Visual Modulator Alignment Procedure

- a. This procedure adjusts the modulator output level and modulation depth. It is assumed that the modulator has not previously been set-up, is badly out of adjustment, or components have been replaced.
 1. Set IF drive control fully CW.
 2. Set modulator FREQ and Q controls fully CCW.
 3. Set VIDEO DR (DRIVE) control and MOD BIAS control to mid-range.
 4. Proper adjustment of the MOD BAL (BALANCE) control requires a demodulator with a display of ICPM. If this control has previously been adjusted, do not disturb its setting. Otherwise, set this control for mid-range, then refer to MOD BAL adjustment after completing this level and ratio adjustment.
 5. Apply a 1V p-p luminance only ramp/staircase to the exciter video input. Set VIDEO GAIN, R18, on the Video Input/Diff Gain board for 1V p-p at J2 on the Diff Phase board (J2 must be terminated in 75 ohms).
 6. Set jumper P1 to the MOD TEST POSITION (P1 2-3) on the MOD/DELAY COMP board. Connect the modulator PC board test output, J2, to the input of a high frequency oscilloscope (BW 50 MHz). Terminate in 50 ohms.
 7. Adjust the modulator video level control for 700 mV at peak of sync and mod bias control for 88mV p-p at white for CCIR - M (12.5% ratio) or 70mVp-p at white for CCIR - B (10% ratio). See Figure 5-5. The two controls interact so it will be necessary to go back and forth until both conditions are achieved at the same time.
 8. Restore jumpers and cables to normal.
- b. Although the setting of the IF DRIVE control is not critical, some adjustment may be desirable to improve linearity. This procedure assumes the modulator ratio is set up properly.
 1. Apply a modulated staircase/ramp to exciter input.
 2. Observe demodulated exciter output on a vectorscope (or band-limited sub-carrier on a waveform monitor).
 3. Adjust IF DRIVE, R1, for best differential gain.
- c. Modulator Balance

This adjustment should not normally be required unless a modulator component is replaced or a new un-adjusted PC board is installed. Before attempting this adjustment, insure that the modulator set-up adjustments have been accomplished.

 1. Apply a five step staircase to the exciter video input.
 2. Switch out all exciter correction by setting to bypass.
 3. Demodulate the exciter output and observe incidental phase on a WFM.

4. Adjust mod balance control for a minimum incidental phase at white.
5. Readjust MOD BIAS for correct modulation depth at white. See Figure 5-2.
6. If the differential phase was PREVIOUSLY adjusted, the transmitter differential phase and ICPM may need to be adjusted when the exciter is returned to operation.

- d. Check swept response at the output of the exciter and refer to response equalizer adjustments if required.

5.3.6. Response Equalizer Adjustments

Three controls make up the Response equalizer on the Modulator. See Figure 5-6.

- a. Slope control - used to tilt the entire sweep waveform from -0.75 to 4.18MHz
- b. Q and FREQUENCY (the other two controls) work together and are usually used to correct for response problems around the carrier (if needed at all).

These controls should be used only to flatten the exciter frequency response and not to correct tuning errors elsewhere.

If no equalization is required, the Q and FREQUENCY controls should be set fully CCW. This effectively removes them from the circuit. This adjustment procedure assumes that the modulator has been previously adjusted for the proper output level and modulation depth. If this has not been done, perform modulator set-up before proceeding.

Large amounts of equalization (1dB) are not normally required. However, large amounts of correction (if used) will attenuate the modulator board output level and may require readjusting the video level control to restore the correct modulator output level.

5.3.6.1. Adjustment Procedure

- a. Apply sync pulse video sweep (0-5 MHz) to the exciter video input.
- b. Observe swept response of exciter output. The VSB IN/OUT switch should be set to OUT. Set DELAY COMP IN/OUT switches to out.
- c. Set modulator Q and FREQ controls fully CCW. Swept response should be only slightly tilted at this time.
- d. Use the Slope control to take out as much tilt as possible (level up the -0.75 and 4.18 markers).
- e. If response is flat, leave Q and FREQ fully CCW (this effectively takes them out of circuit).

- f. If the -0.75 and 4.18MHz markers are even but there is a response problem in between them, adjustment of Q and FREQ will be necessary.
- g. Adjust modulator Q control partially CW and then adjust the FREQ control until changes in the passband response are evident. Watch the area below carrier it may take several turns.
- h. Using the least possible clockwise rotation of the Q control, alternately adjust Q, FREQ and Slope of the modulator section for the flattest response from -0.75 MHz to +4.18 MHz. Switch in VSB and touch up response if necessary

5.3.7. VSB Filter Gain Adjustment

- a. The PAD control, R7, adjusts the VSB filter circuit for unity gain as the filter is switched in and out.
- b. Set the exciter for minimum power out.
- c. Set jumper J101 to MANUAL position. Raise exciter power to a nominal power. Note the exciter power reading with the VSB filter in.
- d. Switch VSB out and set the PAD control, R7, on the VSB/AGC board, for the same power level observed when the filter was in.
- e. Switch VSB to IN, and set jumper, J101, back to AUTO.

5.3.8. IF AGC Adjustment

This adjustment sets the amount of headroom in the IF AGC circuit, and prevents overshoots in drive level after a loss of drive.

If readjustment is necessary perform the following steps after the Power Limit Adjustment.

- a. Connect a DC VOM to TP1 on the VSB/AGC board.
- b. Bring the transmitter up to normal operating power.
- c. Turn the IF AGC control (on the VSB/AGC board) fully CW for maximum voltage at TP1, and note the voltage.
- d. Now turn the IF AGC control CCW until the voltage at TP1 is 20% less than the maximum voltage noted in the previous step.

5.3.9. Depth Of Modulation

This procedure assumes video input set up has been performed and modulator alignment is intact. This check of the exciter for luminance modulation may be performed to establish a starting point in total transmitter set up. This procedure may also be used looking at total visual transmitter output to correct shift in modulation level due to linearity correction.

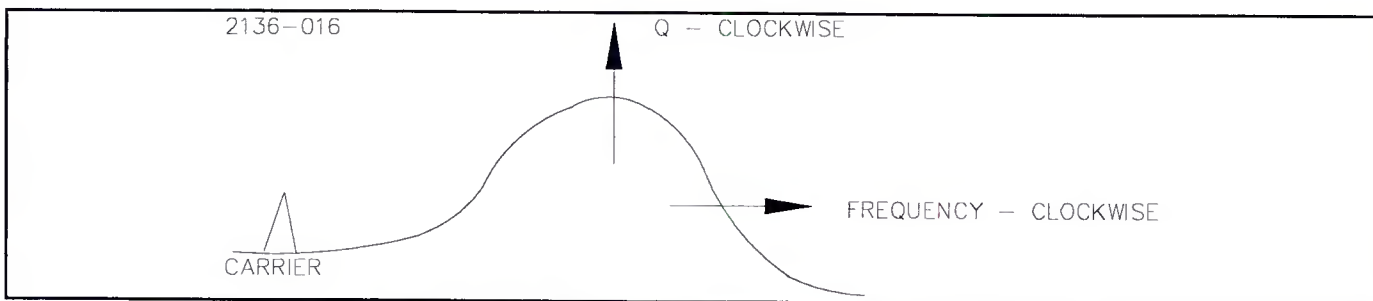


Figure 5-6. Modulator Q & Frequency Adjustment Effects

- a. If checking exciter only, connect exciters VIS RF output through attenuators to a demodulator, then set linearity and quad correction to bypass (out).
If checking transmitter output all linearity adjustment should have been previously done and correction left in the state normally used for transmission.
- b. Apply 1v p-p video with luminance ramp to exciter video input. (or use program V.I.T.S. containing a 12.5% luminance reference.)
- c. Observing demodulated video with zero-carrier reference set luminance level to 12.5% using the MOD BIAS control R12. BE SURE TO ADJUST ONLY THE BIAS. A complete modulator alignment will be required if any other controls are disturbed.

7 sets of controls
2 switches

5.3.10. IF Linearity and Quadrature Correction (Coarse Differential Gain and ICPM)

The following adjustments should be used to correct for differential gain and ICPM that is normally introduced in a transmitter. Keep in mind that the IF linearity adjustment is a coarse adjust. The fine adjust will come from the Video differential gain adjustments on the Video input board to be adjusted later. These adjustments should be made after the transmitter is at operating power, and any AGC or drive attenuator adjustments which might effect drive required have already been accomplished. IF Linearity and ICPM adjustments do interact.

5.3.10.1. Control Presets

- a. Apply modulated staircase signal to the video input.
- b. On linearity corrector, set TH-1 through TH-4 (threshold) fully CCW. Set SL-1 through SL-4 (slope) to mid-range. Set NORMAL/BYPASS switch to NORMAL (IN).
- c. On Quadrature Corrector, set TH-1, through TH-4 (threshold) fully CCW. Set SL-1 through SL-4 (slope) to midrange. Set NORMAL/BYPASS switch to NORMAL (IN).
- d. Adjust VISUAL POWER control for 100% power output.
- e. The thresholds will become active first in the sync or black region and will appear to walk across the vector scope display as you turn the control clockwise. The objective in this correction sequence is to place the breakpoints at the required level between sync and white then adjust the amount of gain or phase change using the slope control for each section of the corrector.

- threshold
+ diff
diff
0.5
0.5
0.5

5.3.10.2. ICPM Correction

Using a synchronous demodulator with a quadrature video output, monitor ICPM and perform the following steps on the Quadrature Corrector:

When a section of correction doesn't seem to work well, set its controls to maximum CCW and continue with other sections of the corrector. Many times the two sections that work the best will be all that is needed. The ICPM correction and IF Linearity correction do interact and adjustment may require more than one iteration of each corrector adjustment.

- a. Adjust TH-1 and SL-1 for optimum incidental phase in the white to gray region.

- b. Adjust TH-2 and SL-2 for optimum incidental phase in the gray to black region.
- c. Adjust TH-3 and SL-3 for optimum incidental phase in the black region.
- d. Adjust TH-4 and SL-4 for optimum incidental phase in the sync region.

If the direction of phase correction is not in the direction needed to counteract the transmitter shift you may reverse the jumpers at P1 on the IF linearity section of the corrector to reverse the direction of phase shift of all TH and SLOPE CONTROLS. Connecting P1 1-2 and 3-4 generally provides the direction of shift needed to compensate the Harris solid state HT series units.

Jumpers P101 and P102 on the quad section reverse the phase of ONLY TH-2 and TH-4, and may help in case of S shaped phase distortion curves.

5.3.10.3. IF Linearity Adjustments

Make final adjustments to the IF Linearity Corrector such that Differential gain is within 2 to 4 percent or as close as possible.

- a. Observe differential gain and perform the following IF Linearity Corrector adjustments (see Figure 5-1).
- b. Adjust TH-1 and SL-1 for optimum differential gain in the white to gray region.
- c. Adjust TH-2 and SL-2 for optimum differential gain in the gray to black region.
- d. Adjust TH-3 and SL-3 for optimum differential gain in the black region.
- e. Adjust TH-4 and SL-4 for optimum sync to video ratio at 100% power. Make minor adjustments to visual power as necessary.

NOTE

Plugs P2 and P3 on the Linearity Board are normally set for gain expansion (Pins 1-3). Compression can be accomplished in sections two and four by connecting plugs P3 and P2 to ground (pins 1-2). This may be needed to correct for U shaped gain curves.

5.3.11. Differential Gain Correction at Video

Refer to 5.3.2.

5.3.12. Differential Phase Correction

Using envelope detection on the demodulator observe the transmitter's differential phase distortion and adjust as follows (see Figure 5-8).

- a. Set Phase corrector NORMAL/BYPASS (in/out) switch to NORMAL(in) position.
- b. Set all slope controls mid range.
- c. Set all threshold controls fully CCW.
- d. Starting with threshold 1 advance the threshold control to set the first break-in point in the phase corrector, then adjust the slope to increase or decrease the desired amount of correction. If the correction is in the wrong direction adjust threshold 1 and 2 fully CCW and skip to threshold 3.
- e. Adjust the slope control CW to increase correction. Adjust the slope control CCW to decrease correction.
- f. Use remaining threshold and slope pairs as required to optimize the transmitter differential phase.

cu mod
sal for min inc of at white
if needed

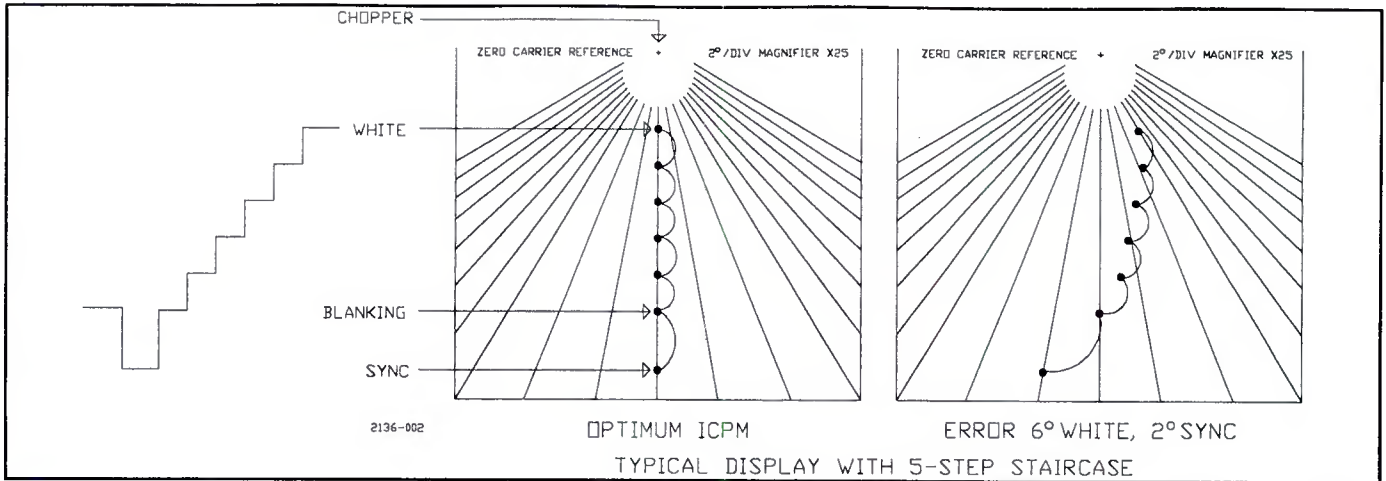


Figure 5-7. ICPM Display

5.3.12.1. Clamp Pulse

With a DC coupled scope on TP8, adjust R84 to put the clamp pulse peak at 0V.

5.3.12.2. Frequency response

Using a multiburst signal or video sideband adapter as a video source, adjust C1 for a flat response as monitored on J2 on the differential phase corrector card.

Adjust C48 for minimum interaction between differential gain and differential phase while switching the NORMAL/BYPASS switch in and out.

with test for out Gen be used below

b. Connect the exciters VIS RF OUT to the spectrum analyzer using attenuators.

c. Set both delay compensator bypass switches to out.

d. Switch off the VSB Filter.

e. Set Q of both delay compensators to 14. *- sets max Q for setup*

f. Set BALANCE of both fully CCW.

g. Switch on the front delay compensator.

h. Set the frequency of the null .75 MHz above carrier using FREQ control. See Figure 5-9.

i. Set front Q control to 8.

j. Alternately use BALANCE and PHASE controls to restore flat response.

k. Switch in the rear delay comp section.

l. Set the frequency of the null 3 MHz above carrier using FREQ control. See Figure 5-10.

m. Set rear Q to 8.

n. Alternately use BALANCE and PHASE of the rear section to restore flat response.

o. Switch VSB FILTER back in and reconnect exciter to transmitter.

5.3.13. Visual IF Delay Compensator Adjustments

The delay compensator board is used only to correct for delay introduced by tuned amplifiers following the exciter. Group delay adjustments should normally be performed after all other tuning and linearity adjustments have been completed. If the exciter is used by itself, both delay compensator sections should be bypassed.

use top dots only 2 sets of controls

should be minor correct goes back to normal

5.3.13.1. Delay Compensator Preliminary Set Up

The delay compensator is divided into two identical sections each having a wide band path and a narrow band path. The frequency of the narrow band sections may be preset to approximate the anticipated correction. This will make final adjustment through the transmitter less difficult.

a. Apply video sweep with sync to exciter video input.

5.3.13.2. Delay Compensator Adjustment Through Transmitter

Generally, the BALANCE and PHASE controls of each section can be used to correct minor frequency response deficiencies without interacting with the group delay adjustments. Refer to Figures 5-11 & 5-12. Correspondingly, moderate

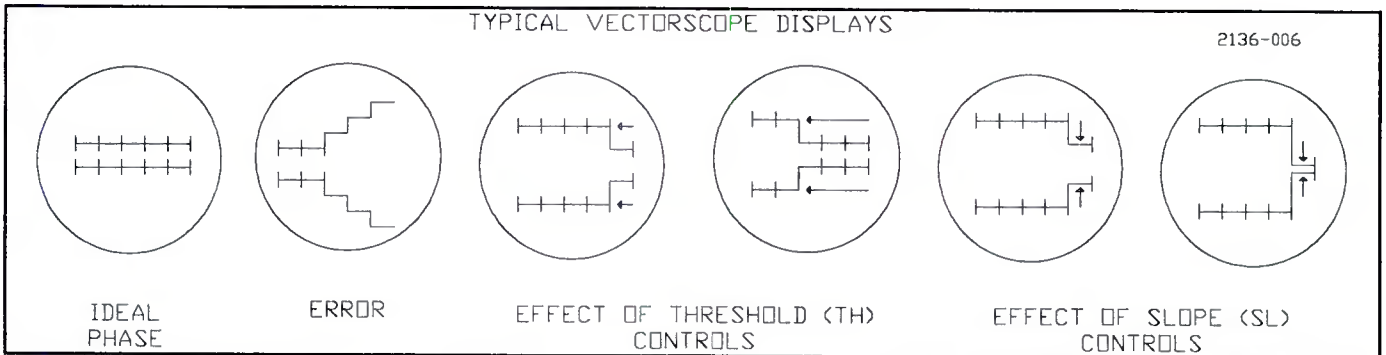


Figure 5-8. Diff. Phase, Effects of TH and SL Controls

adjustments of the group delay Q and FREQ controls will not affect the frequency response adjustment.

- a. Set up test equipment per Figure 5-13.
- b. Apply video sweep and sync to the exciter input and observe the transmitter output on a sideband analyzer.
- c. Sample the transmitter before the notch diplexer (if used) and set Notch Diplexer Equalizer to BYPASS.

NOTE

Since the equalized VSB filter provides receiver equalization, the demodulator sound trap should be on during the following adjustments for CCIR-M units.

- d. Set DELAY COMP switches to OUT position.
- e. Set VSB IN/OUT switch to OUT position.

can be done with multi-pulse, if nec.

- f. Ensure that transmitter frequency response is correct with both VSB and delay compensator bypassed.
- g. If group delay adjustments not have been previously performed, or the condition of alignment is unknown, perform preset adjustments.
- h. Switch the VSB and DELAY COMPS back in.
- i. Using the Balance and Phase controls, adjust for the best flat frequency response through the transmitter. The front corrector should control the low end of the band and the rear the high end. The Q and FREQUENCY controls primarily effect the group delay which is observed to be correct when minimum ringing occurs on 2T pulse and

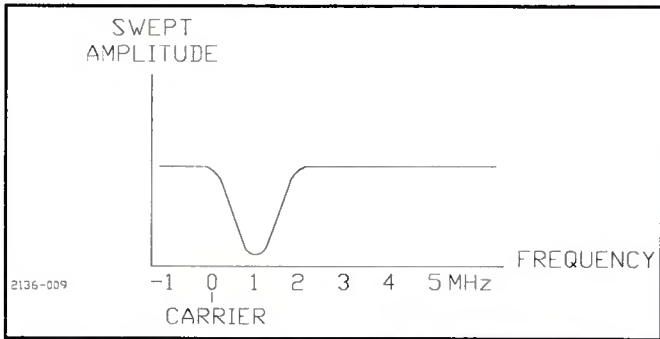


Figure 5-9

Preliminary Adjustment of the Left Section of the Delay Equal-

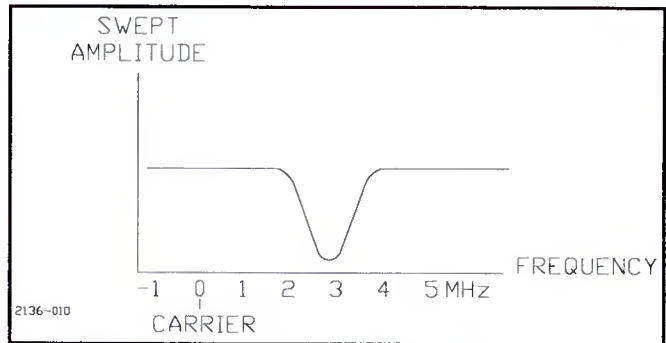


Figure 5-10

Preliminary Adjustment of the Right Section of the Delay

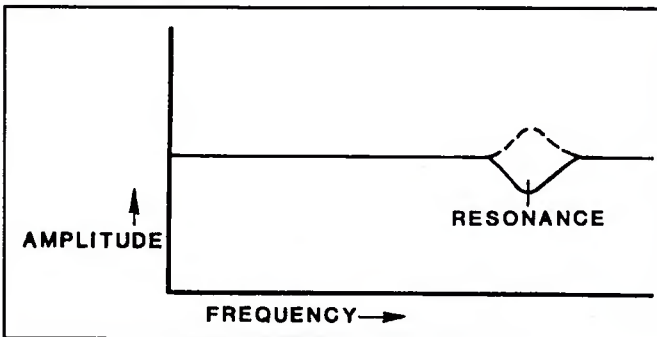


Figure 5-11. Effect of "BAL" Control on Amplitude Response

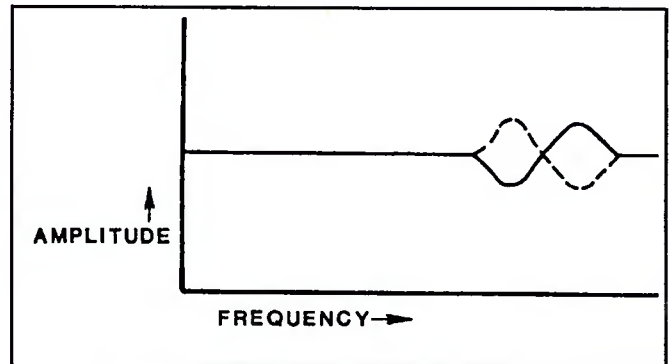


Figure 5-12. Effect of "PHASE" Control on Amplitude Response

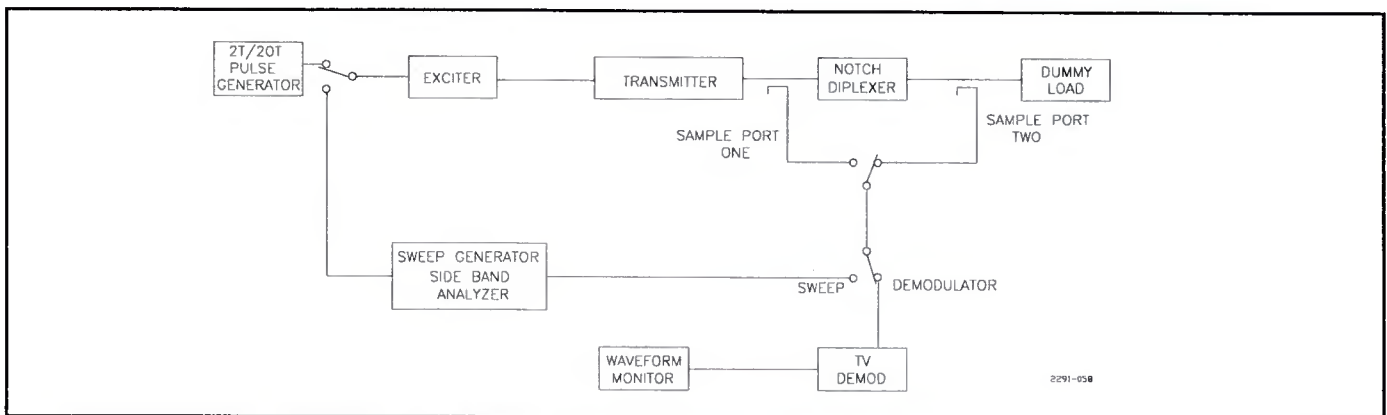


Figure 5-13. Test Equipment for Group Delay and Notch Diplexer Equalizer Adjustments

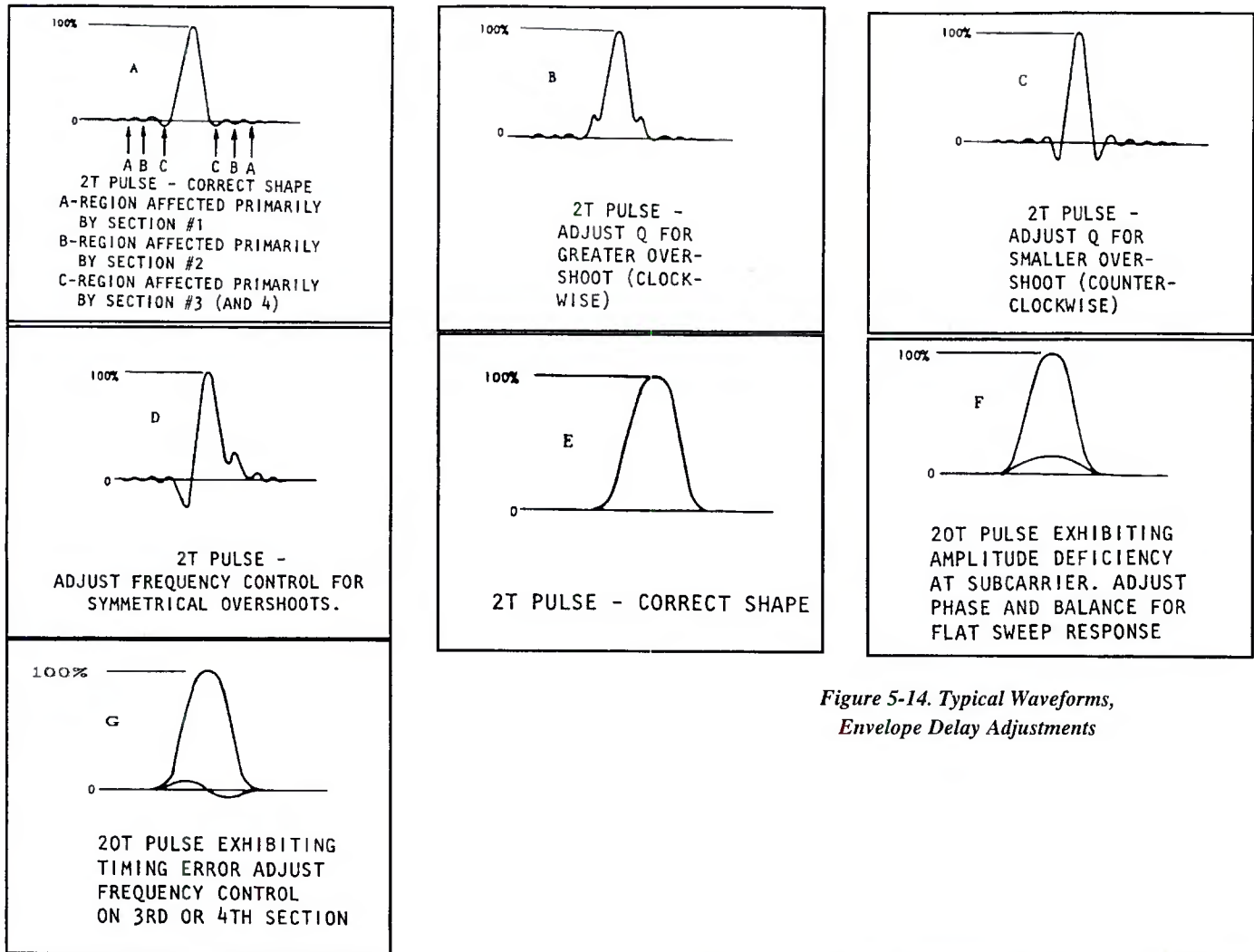


Figure 5-14. Typical Waveforms, Envelope Delay Adjustments

minimum baseline distortion is seen on the 12.5 or 20T modulated pulse. See Figure 5-14.

CAUTION

DO NOT TURN THE FREQUENCY CONTROLS MORE THAN ONE OR TWO TURNS FROM THE PRESET OR THEY MAY BE MOVED OUT OF THE PASSBAND AND THE EFFECT WILL NOT BE VISIBLE MAKING IT IMPOSSIBLE TO RECOVER THE DESIRED ALIGNMENT WITHOUT STARTING OVER.

- j. Apply composite video test signal to the exciter. Observing 2T adjust the front section FREQ for symmetrical overshoots, and the front Q for minimum ringing and overshoot.
- k. Observing 12.5 or 20T adjust rear FREQ for a symmetrical baseline, and the rear Q for best compromise of minimum ringing of window leading edge, 2T symmetry & close in ring, and baseline symmetry of the 12.5 or 20T pulse.
- l. Repeat several cycles of amplitude response and pulse adjustments until both conditions are satisfactory.
- m. Small changes in differential gain, ICPM, or differential phase may occur as a result of the delay adjustments a quick check of those parameters should be made when completing delay adjustments.

- n. Sample transmitter after the notch diplexer and proceed to notch diplexer equalizer adjustments if used.

5.3.14. Notch Diplexer Equalizer Adjustments

This optional module is used to compensate the visual group delay error caused by the aural cavities of a notch diplexer.

Four stagger-tuned all pass networks delay the lower video frequencies by an amount corresponding to the delay of the upper video frequency sidebands in the diplexer.

See drawing 839-7900-169

Controls are:

Section 1 controls the lowest frequency range

- Bal R-40
- Phase C-20
- Freq C-46
- Q R-42

Section 2 controls

- Bal R-10
- Phase C-3
- Freq C-4
- Q R-30

Section 3

- Bal R-80
- Phase C-32
- Freq C-36
- Q R-85

Section 4 controls the highest frequency range

- Bal R-52
- Phase C-22
- Freq C-24
- Q R-92

Gain and bias controls:

- In Circuit Gain R-3
- Bias R-43
- Master Gain R-65

5.3.15. Group delay adjustments

- The all pass networks have been preset to the approximate diplexer correction at the factory. Usually only slight adjustment to section 4 is needed in the field to optimize system performance.
- Observing 12.5T pulses adjust Q control R-92 to remove baseline disturbance. See Figure 5-14.
- Observing sweep adjust balance and phase controls for flattest response. The effect of these controls is shown in Figures 5-11 and 5-12.
- The phase of the last section can be used to peak up 4.18 MHz at video approximately 1 dB to compensate the high frequency roll off of the notch diplexer.

5.3.16. Power Limit Adjustments

1. Visual Power Limit

The Visual Power Limit control limits the maximum power available from the visual amplifier of the exciter. The Power Limit control is set such that the maximum power out of the transmitter is 110 percent.

- Using the VIS LIMIT control, reduce transmitter power output to 50 percent or less.
- Raise Visual transmitter power until it reaches a maximum or 100% using the Visual Raise button on the front of the Exciter.
- Repeat steps a and b until the Raise control will no longer increase the transmitter power output.
- Adjust the VIS LIMIT control until the transmitter power output is 110%.
- Lower Visual transmitter power output with the VISUAL lower control on the front of the Exciter to 100% (or your normal operating power).

1. Aural Power Limit

- The Aural Power Limit control limits the maximum power available from the aural amplifier of the exciter.
- Using the AUR LIMIT control, reduce transmitter power output to 50 percent or less.
- Raise Aural transmitter power until it reaches a maximum or 100% using the AURAL Raise button on the front of the Exciter.
- Repeat steps a and b until the Raise control will no longer increase the Aural transmitter power output.
- Adjust the AUR LIMIT control until the transmitter power output is 110%.
- Lower Transmitter power output with the Aural lower control on the front of the Exciter to 100% (or your normal operating power).

5.3.17. Final Amp

5.3.17.1. Visual/Aural Selection

There are no adjustments in the final amp, only selection of aural or visual service if it is necessary to replace the unit. Remove its cover and place J1 in the appropriate position.

5.4. Exciter Synthesizer Adjustments

5.4.1. VHF Synthesizer Card 1

5.4.1.1. 10MHz Frequency Standard Adjustment

- Remove power to the exciter.
- Remove the cover to the synthesizer slot and place card 1 on the extender card. Disconnect the PFC input, J5, from card 1. (If you do not have the PFC option, there won't be a cable connected to J5).
- Connect a frequency counter to the 10MHz connector J3.
- Apply power to the exciter and allow 15 minutes warm up minimum.
- Measure the frequency on the counter. It should be 10.000000MHz exactly. If not adjustment of R1 may be required.
- Reconnect the PFC input, J5, to card 1 and replace synthesizer card into the RFI enclosure and refit the cover.

5.4.1.2. Internal PFC Adjustment

- Remove power to the exciter.
- Verify that the PFC option has been installed in the exciter.
- Remove the cover to the synthesizer slot and place card 1 on the extender card.
- Connect a frequency counter to the 10MHz connector J3.
- Apply power to the exciter and allow 15 minutes warm up minimum.
- The PFC ON indicator DS1 should be illuminated. If not check that there is a minimum of 1Vpp at the PFC input, J5.
- Measure the frequency on the counter. It should be 10MHz exactly. If not adjustment of the internal PFC vernier may be required.
- Replace synthesizer card 1 into the RFI enclosure and refit the cover.

5.4.1.3. External PFC Adjustment

- Remove power to the exciter.
- Verify that the PFC option has been installed in the exciter and that the external 5 or 10MHz standard has been applied to the exciter at J10.
- Remove the cover to the synthesizer slot and place card 1 on the extender card.
- Connect a frequency counter to the 10MHz connector J3.
- Apply power to the exciter and allow 15 minutes warm up minimum.
- The PFC ON indicator DS1 should be illuminated. If not check that there is a minimum of 1Vpp at the PFC input, J5.

- g. Measure the frequency on the counter. It should be 10MHz exactly. If not adjustment of the external PFC frequency may be required.
- h. Replace synthesizer card 1 into the RFI enclosure and refit the cover.

Table 5-3

5.4.1.4. Testing An Untuned Card 1 Synthesizer

In the event that an untuned synthesizer card must be replaced in the field the following test equipment is required for satisfactory alignment:

- a. Oscilloscope Tektronic 475 or equivalent.
- b. Frequency counter HP5315A or equivalent.
- c. Spectrum analyzer HP3585 or equivalent.
- d. Modulation monitor HP8901 or equivalent.

5.4.1.4.1. Visual inspection

Visually inspect the PWB for shorts and opens. Visually inspect the PWB for the correct installation of all integrated circuits and semiconductors.

5.4.1.4.2. Programming

- a. Refer to the channel assignment and determine what frequency the synthesizer is to be set for.
- b. Refer to the programming chart, Table 5-3, and remove the jumpers for the correct IF frequency of operation.

NOTE: IN = LOW = 0
OUT = HIGH = 1

5.4.1.4.3. Test Connections

- a. Remove power from the exciter.
- b. Remove the cover from the synthesizer slot and place card 1 on the extender card.
- c. Turn on the exciter power supply.

5.4.1.4.4. Reference frequency chain setup

- a. Disconnect the PFC input to card 1 at J5. If applicable.
- b. Connect the frequency counter to the boards 10MHz connector J3. Allow 15 minute warm up.
- c. Adjust R1 (frequency Adjust) for 10.000000MHz as read on frequency counter.
- d. Connect the frequency counter to the boards 5MHz connector. The frequency should be 5.000000MHz.
- e. Connect the oscilloscope to TP4. Adjust L4 for maximum peak to peak signal.
- f. Connect the frequency counter to the boards 16MHz connector, J4. The frequency should be 16.000000MHz.
- g. Connect the frequency counter to the boards 800kHz connector. The frequency should be 800.000kHz.

5.4.1.4.5. PFC Setup

- a. Temporarily connect the spectrum analyzers rear panel 10MHz output to card 1's 10MHz PFC input J5.
- b. Connect the oscilloscope to TP1. Adjust L1 for maximum dc voltage on scope (Approximately 6VDC).
- c. DS1 (PFC ON IND.) should be on.
- d. Reconnect the exciter PFC input to card 1, J5 (if applicable).

5.4.1.4.6. 30MHz Peaking Adjustment

- a. Connect the spectrum analyzer through a scope probe to TP 6. Set the analyzer for a span of 0 - 40MHz.

SYNTHESIZER CARD 1		
PROGRAMING CHART		
IF FREQUENCY	JUMPER SELECTION	
MHz	7654321	PLL BW
37.0	1000110	001
37.1	1000111	001
37.2	1001000	001
37.3	1001001	001
37.4	1001010	001
37.5	1001011	001
37.6	1001100	001
37.7	1001101	001
37.8	1001110	001
37.9	1001111	001
38.0	1010000	001
38.1	1010001	001
38.2	1010010	001
38.3	1010011	001
38.4	1010100	001
38.5	1010101	001
38.6	1010110	001
38.7	1010111	001
38.8	1011000	001
38.9	1011001	001
39.0	1011010	001
40.0	1011011	001

- b. Adjust L7 for maximum 30MHz signal as seen on the analyzer.

5.4.1.4.7. PLL Lock Adjustment

- a. Connect the modulation monitor RF input to the boards 37MHz connector J6. Select frequency on the modulation monitor.
- b. Connect the oscilloscope to U11 pin 7.
- c. Adjust C38 for + 7Vdc on U11 pin 7. The loop should be locked. Lock is indicated by a stable dc voltage on the scope. The modulation monitor should read the desired IF frequency.

5.4.1.4.8. Output Filter Adjustment

- a. Connect the boards IF output J6 to the spectrum analyzers 50 ohm input. Set the analyzer for:
 - CENTER: 20MHz
 - SPAN: 40MHz
 - RBW: 1kHz
 - REF: +10dBm
 - RANGE: +10dBm
 - INPUT: 50 OHMS
- b. Alternately adjust L17, L18, L19 for maximum IF frequency level. The level should be +7dBm minimum. Spurs should be less than -80dBc.

5.4.1.4.9. FM Noise Measurement

- a. Connect the IF output J6 to the modulation monitor RF input.
- b. Measure the FM noise relative to 75kHz deviation with 75usec de-emphasis. The noise measured should be less than -80dB.

5.4.2. VHF Synthesizer Card 2

There are no user adjustments required on card 2.

5.4.2.1. Testing A Synthesizer Card 2

In the event that a synthesizer card must be replaced in the field the following test equipment is required for satisfactory alignment:

- a. Oscilloscope Tektronic 475 or equivalent.
- b. Frequency counter HP 5315A or equivalent.
- c. Spectrum analyzer HP3585 or equivalent.
- d. Modulation monitor HP8901 or equivalent.

5.4.2.2. Visual Inspection

- a. Visually inspect the PWB for shorts and opens.
- b. Visually inspect the PWB for the correct installation of all integrated circuits and semiconductors.

5.4.2.3. Programming

- a. Refer to the channel assignment and determine what frequency the synthesizer is to be set for.
- b. Refer to the programming chart (Table 5-4, 5-5 and 5-6) and remove the jumpers for the correct RACHET (Frach) and LO (Flo) frequency of operation.

NOTE: All columns except NO-6

Jumper in = low = 0

Jumper out = high = 1

Column NO-6

Jumper in = high = 1

Jumper out = low = 0

5.4.2.4. Test Connections

- a. Remove the cover from the synthesizer slot and place card 2 on the extender card.
- b. Connect the 5MHz and 800kHz from card 1 card 2 J1 and J2.
- c. Turn on the power supply.

5.4.2.5. Ratchet PLL Setup

- a. Set R13 for mid range.
- b. Connect the frequency counter through a scope probe to the junction of L4 and C39. The frequency measured should agree with the programming chart. This is the ratchet loop frequency (Frach on programming chart).
- c. Connect the spectrum analyzer's tracking generator output through a 100k resistor to U2 pin 3. Connect the

spectrum analyzers RF input through a scope probe to the junction of R15 and R13.

- d. Set the analyzer for:

START: 0Hz
STOP: 500kHz
RBW: 1kHz
REF: -25dBm
RANGE: -25dBm
INPUT: 1M ohm

- e. Adjust L3 for a notch centered at 100kHz.
- f. Adjust L2 for a notch centered at 200kHz.
- g. Remove the tracking generator and 100k resistor.

5.4.2.6. Main PLL Setup

- a. Set R44 to mid range. (This is a 5 turn pot).
- b. Connect the frequency counter to the LO output connector J3. The frequency measured should be the desired LO frequency (Flo on programming chart).
- c. Connect the spectrum analyzer's tracking generator output through a 100k resistor to U25 pin 3. Connect the spectrum analyzers RF input through a scope probe to the junction of R43 and R44.
- d. Set the analyzer for:

START: 0Hz
STOP: 500kHz
RBW: 1kHz
REF: -25dBm
RANGE: -25dBm
INPUT: 1M ohm

- e. Adjust L5 for a notch centered at 100kHz.
- f. Adjust L7 for a notch centered at 200kHz.
- g. Remove the tracking generator and 100k resistor.

5.4.2.7. FM Noise Measurement

- a. Connect the LO output J3 to the modulation monitor RF input.
- b. Measure the FM noise relative to 75kHz deviation using 75usec de-emphasis. The noise should be less than -80dB.

5.4.2.8. ICPM Measurement

At the exciter output, J2

- a. Adjust R13 for best ICPM and microphonics.
- b. Adjust R14 for best ICPM and Microphonics.
- c. ICPM should measure less than +/- .5 degree peak to peak.

5.4.2.9. Final Installation

- a. Remove card 2 from the extender and place it into the RFI enclosure.
- b. Refit the RFI enclosure cover to the synthesizer slot.
- c. Refit the exciter lid.

Table 5-4

SYNTHESIZER CARD 2									
PROGRAMMING CHART									
USA CHANNEL PROGRAMMING									
CHAN	F _{LO}	N _{U35}	F _{VCO}	F _{RACH}	1N0-7	1A0-5	F _{SSB}	N _{U27}	N0-6
					76543210	543210			6543210
2-	92.24	2	184.48	14.48	10010000	001000	170	34	1011110
2F	92.25	2	184.50	14.50	10010001	000000	170	34	1011110
2+	92.26	2	184.52	14.52	10010001	000010	170	34	1011110
3-	98.24	2	196.48	11.48	01110010	001000	185	37	1011011
3F	98.25	2	196.50	11.50	01110011	000000	185	37	1011011
3+	98.26	2	196.52	11.52	01110011	000010	185	37	1011011
4-	104.24	2	208.48	13.48	10000110	001000	195	39	1011001
4F	104.25	2	208.50	13.50	10000111	000000	195	39	1011001
4+	104.26	2	208.52	13.52	10000111	000010	195	39	1011001
5-	114.24	2	228.48	13.48	10000110	001000	215	43	1010101
5F	114.25	2	228.50	13.50	10000111	000000	215	43	1010101
5+	114.26	2	228.52	13.52	10000111	000010	215	43	1010101
6-	120.24	2	240.48	10.48	01101000	001000	230	46	1010010
6F	120.25	2	240.50	10.50	01101001	000000	230	46	1010010
6+	120.26	2	240.52	10.52	01101001	000010	230	46	1010010
7-	212.24	1	212.24	12.24	01111010	000100	200	40	1011000
7F	212.25	1	212.25	12.25	01111010	000101	200	40	1011000
7+	212.26	1	212.26	12.26	01111010	000110	200	40	1011000
8-	218.24	1	218.24	13.24	10000100	000100	205	41	1010111
8F	218.25	1	218.25	13.25	10000100	000101	205	41	1010111
8+	218.26	1	218.26	13.26	10000100	000110	205	41	1010111
9-	224.24	1	224.24	14.24	10001110	000100	210	42	1010110
9F	224.25	1	224.25	14.25	10001110	000101	210	42	1010110
9+	224.26	1	224.26	14.26	10001110	000110	210	42	1010110
10-	230.24	1	230.24	10.24	01100110	000100	220	44	1010100
10F	230.25	1	230.25	10.25	01100110	000101	220	44	1010100
10+	230.26	1	230.26	10.26	01100110	000110	220	44	1010100
11-	236.24	1	236.24	11.24	01110000	000100	225	45	1010011
11F	236.25	1	236.25	11.25	01110000	000101	225	45	1010011
11+	236.26	1	236.26	11.26	01110000	000110	225	45	1010011
12-	242.24	1	242.24	12.24	01111010	000100	230	46	1010010
12F	242.25	1	242.25	12.25	01111010	000101	230	46	1010010
12+	242.26	1	242.26	12.26	01111010	000110	230	46	1010010
13-	248.24	1	248.24	13.24	10000100	000100	235	47	1010001
13F	248.25	1	248.25	13.25	10000100	000101	235	47	1010001
13+	248.26	1	248.26	13.26	10000100	000110	235	47	1010001

Table 5-5

SYNTHESIZER CARD 2 PROGRAMMING CHART AUSTRALIAN CHANNEL PROGRAMMING									
CHAN	F _{LO}	N _{U35}	F _{VCO}	F _{RACH}	1N0-7	1A0-5	F _{SSB}	N _{U27}	N0-6
					76543210	543210			6543210
0	85.15	2	170.30	10.30	01100111	000000	160	32	0100000
1	96.15	2	192.30	12.30	01111011	000000	180	36	1011100
2	103.15	2	206.30	11.30	01110001	000000	195	39	1011001
3	125.15	2	250.30	10.30	01100111	000000	240	48	1010000
4	134.15	2	268.30	13.30	10000101	000000	255	51	1001101
5	141.15	2	282.30	12.30	01111011	000000	270	54	1001010
5A	177.15	1	177.15	12.15	01111001	000101	165	33	1011111
6	214.14	1	214.15	14.15	10001101	000101	200	40	1011000
7	221.15	1	212.15	12.15	01111001	000101	200	40	1011000
8	228.15	1	228.15	13.15	10000011	000101	210	42	1010110
9	235.15	1	235.15	10.15	01100101	000101	225	45	1010011
10	248.15	1	248.15	13.15	10000011	000101	235	47	1010001
11	255.15	1	255.15	10.15	01100101	000101	245	49	1001111

Table 5-6

SYNTHESIZER CARD 2 PROGRAMMING CHART EUROPEAN CHANNEL PROGRAMMING									
CHAN	F _{LO}	N _{U35}	F _{VCO}	F _{RACH}	1N0-7	1A0-5	F _{SSB}	N _{U27}	N0-6
					76543210	543210			6543210
E2	87.15	2	174.30	14.30	10001111	000000	160	32	1100000
E2A	88.65	2	176.30	11.30	01110001	000000	165	33	1011111
E3	94.15	2	188.30	13.30	10000101	000000	175	35	1011101
E4	101.15	2	202.30	12.30	01111011	000000	190	38	1011010
E5	214.15	1	214.15	14.15	10001101	000101	200	40	1011000
E6	221.15	1	221.15	11.15	01101111	000101	210	42	1010110
E7	228.15	1	228.15	13.15	10000011	000101	215	43	1010101
E8	235.15	1	235.15	10.15	01100101	000101	225	45	1010011
E9	242.15	1	242.15	12.15	01111001	000101	230	46	1010010
E10	249.15	1	249.15	14.15	10001101	000101	235	47	1010001
E11	256.15	1	256.15	11.15	01101111	000101	245	49	1001111
E12	263.15	1	263.15	13.15	10000011	000101	250	50	1001110

5.5. Aural Adjustments

5.5.1. Aural PLL/VCO

The PLL VCO on the Aural Converter board is factory set and adjustment should be made only if necessary.

- Set jumpers for desired frequency (see Table 5-7).
- Connect a dc coupled scope to TP1 (Directly below DS1).
- Adjust L1 for 8Vdc at TP1.
- The loop should be locked and DS1 should be off.

5.5.2. Frequency Adjustment

The operating frequencies are all determined by the reference oscillator on the Synthesizer Card 1. (Refer to 10MHZ Frequency Standard adjustment or PFC frequency adjustments on the VHF synthesizer Card 1 discussed earlier in this section).

5.5.3. Aural Deviation Adjustment Sequence

The following adjustments match the incoming signals to the exciter to provide proper on air deviation at transmitter output.

- Mono Deviation**
 - Apply +10dBm balanced mono signal to J8, the mono input of the exciter
 - Remove any signals from SC 1 and SC 2 (J6 and J7 on the back of the exciter)
 - Set J5 on the Aural converter board to local (Pins 2-3, the two pins closest to the top of the board).
 - Set S2 to mono/SC
 - Adjust R49 for desired deviation as observed using aural mod monitor
- SC 1 Deviation**
 - Apply 1V RMS unbalanced SC signal to SC 1 input
 - Remove any signal from mono input
 - Set J5 to local
 - Set S2 to Mono/SC
 - Adjust R58 for desired deviation of SC 1
- SC 2 Deviation**
 - Apply 1V RMS unbalanced SC signal to SC 2 input
 - Remove any signal from mono input
 - Set J5 to local
 - Set S2 to Mono/SC
 - Adjust R67 for desired deviation of SC 2
- Comp Deviation**
 - Apply 1V RMS unbalanced composite signal to the composite input, J5
 - Set J5 to local
 - Set S2 to Composite
 - Adjust R61 for desired deviation

5.6. Aural Group Delay Corrector Adjustments (option)

The intent of adjusting the aural group delay corrector is to make the overall aural IF to RF output path as transparent as possible to the aural stereo signal when operating through a notch diplexer.

It is good practice to begin the aural equalization process by noting the amount of stereo separation error, L into R or R into L, when the aural transmitter system is operated with and without the notch diplexer. This can be done by noting the separation values before and after the diplexer with an RF probe at these points connected to the aural demodulation test equipment.

For example, if -38dB of separation is measured at the input to the diplexer and -32dB after the diplexer (aural corrector out), then 6dB is the maximum amount of correction possible to make the system transparent. The effect of adjusting the corrector is to make the output separation equal to -38dB when the corrector is switched in. A 6dB improvement, of course, requires perfect equalization of the system which is not practical, but a close approximation can be readily achieved. In practice, acceptable levels of equalization occur when the corrector is adjusted for about 2 to 4 dB stereo separation improvement instead of the ideal 6dB as in the above example. If overall separation values better than -38dB (the input signal separation) are desired, then the baseband input system (stereo generator, etc.) must be adjusted.

NOTE

The aural group delay corrector has the characteristic that over compensation is possible by introducing additional L-R sideband phase shift. In some stereo systems this may appear to be beneficial by improving stereo separation at the output better than the input, however, there is a performance trade-off point where synchronous AM noise and SUB to SAP crosstalk begin to increase. This occurs when the output stereo separation begins to exceed the input separation value while adjusting the group delay corrector. It is recommended that only enough group delay correction be introduced into the system to correct for the notch diplexer.

The aural delay corrector can be adjusted without the need for group delay measuring equipment by simply adjusting it for best stereo separation. This is true for delay curves that are reasonably symmetrical.

Typically, a single cavity notch diplexer, properly tuned, will exhibit a symmetrical response curve for which the aural group delay corrector is intended to equalize. A properly tuned, single cavity notch diplexer implies that both cavities (a single cavity on each hybrid arm) are simultaneously tuned to the aural carrier frequency for minimum reject load power, a good indicator of symmetrical tuning. This is mentioned here because if the diplexer is not properly tuned, and a condition of

Table 5-7. PLL Switch Settings

PROGRAM DATA FOR U8																				
IF	A5	A4	A3	A2	A1	A0	RA2	RA1	RA0	N9	N8	N7	N6	N5	N4	N3	N2	N1	N0	
32.5MHz	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0=Jumper IN
33.4MHz	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	1=Jumper OUT

stagger tuning exists, then group delay equalization will be difficult. Correct delay equalization is still possible in this case, however, accurate group delay measuring equipment will be required.

The procedure described below is intended to be a simple routine adjustment that does not require expensive group delay measuring equipment.

5.6.1. Initial Procedure

NOTE

The aural group delay corrector has been factory set to equalize a typical single cavity notch diplexer. It may be close enough for satisfactory operation, try it first before making adjustments.

- Set the stereo input signal for BTSC equivalent mode operation (companding off) and briefly check the system for good overall wideband performance, i.e., satisfactory frequency response, low noise and distortion levels that might otherwise interfere with stereo separation measurements. Make this check before the diplexer and with the corrector switched out.
- Set the demodulated test output equipment for stereo separation tests, either L into R or R into L under maximum modulation levels (37.5 kHz for L or R only and an additional 5 kHz for the pilot).

NOTE

37.5 kHz deviation occurs due to 12.5 kHz modulation existing in the L+R channel and 25 kHz in the L-R channel for an L or R only input signal when the pilot PRO and SAP are switched off (BTSC linear mode).

- Note the amount of stereo separation existing in the system at two modulating frequencies (400 Hz and 4 kHz) before and after the diplexer with the delay corrector switched out. Be sure the diplexer cavities are at normal operating temperature.
- Switch the aural delay corrector in and determine if it is providing a satisfactory level of equalization at both modulating frequencies (400 Hz and 4 kHz). The corrector should equalize about 1/2 to 3/4 of the error introduced by the diplexer. Also, the separation values should be reasonably well balanced within 2 to 3 dB between 400 Hz and 4 kHz. If this level of performance is not achieved then adjustment is required.

5.6.2. Adjustments

- Set the modulating tone to 400 Hz and temporarily switch off the pilot, Pro and SAP carriers. Adjust the main channel for 37.5 kHz deviation with a L or R only input signal (BTSC equivalent mode) and switch the pilot back on. Be sure the RF sample is after the diplexer.
- Adjust F1 or F2 trimmer capacitors (see Figure 5-15) one at a time very slowly for best separation. It is good practice to note the starting position of each trimmer by noting the position of the adjustment slot. Typically, only a 1/4 turn on either side of the starting position is all that is necessary to notice a change in separation. Alternately adjust F1 and F2 for best separation.
- Set the modulating tone for 4 kHz and repeat the above, if necessary, to obtain about the same value of separation

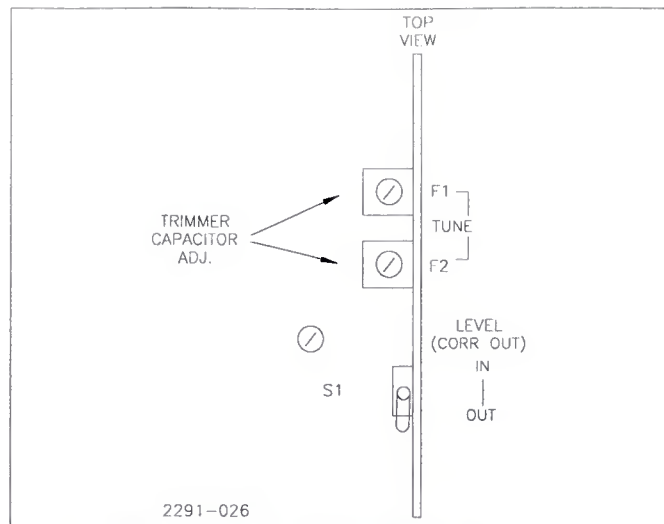


Figure 5-15. Top View of Aural Delay Corrector

as at 400 Hz. Only a very slight adjustment is needed to bring about a reasonable compromise between the two frequencies, typically within 2 to 3 dB.

NOTE

The RF sample after the diplexer will now show improved stereo separation while the input side of the diplexer will show decreased separation which is really the test equipment interpreting the precorrection as distortion. The same characteristic is also true of AM synchronous noise and crosstalk.

5.6.3. Retuning Procedure

- Should it be noticed that during tuning adjustment of F1 or F2 little or no reaction is observed and it is felt that the corrector has been tuned too far, then realignment of the corrector is necessary to get F1 and F2 resonators back on the aural IF carrier.
- A simple RF sweep test of the aural delay corrector will suffice in re-establishing performance. The objective is to locate the amplitude dips in the sweep response and retune them back on the aural IF frequency (32.50 MHz). Tuning of F1 and F2 is done by adjusting the trimmer capacitors. Refer to Figure 5-16 for typical test equipment setup. Attempt to get the sweep response curves shown in Figure 5-18 with the same amplitude levels as shown.

NOTE

This is a frequency response test. Measuring the group delay curve is not necessary at this time for a simple alignment of the resonators. From previous measurements on this circuit, each 1 dB of amplitude dip introduces approximately 100 ns of delay with the same general curve shape. The amplitude and frequency position of the response dip can then be used as a guide for proper operation of the delay corrector. Refer to Figure 5-18 for typical response curves showing this relationship.

- If an RF sweeper with an accurate 32.50 MHz marker is not available, then an alternate method of sweep alignment is shown in Figure 5-17. This method uses a visual sideband analyzer setup in the normal manner except the exciter visual IF output is fed to the aural delay corrector for sweep response alignment. The 4.5 MHz marker will

provide the accuracy for positioning the resonators on the aural IF frequency.

- d. The amplitude dip in the frequency response curve caused by F1 and F2 should be about equal in amplitude. If not, then adjust the link coupling as shown in Figure 5-20 for equal amplitudes and with the typical levels shown in Figure 5-19.
- e. When F1 and F2 amplitude dips are both positioned on the aural IF carrier, as shown in Figure 5-18, then the delay corrector is ready again for stereo separation adjustments as described above.

5.7. Meter Calibration

Meter calibrate controls are located along the top-front edge of the exciter on the Meter/Control board.

- a. Visual Power Calibrate (RF Wattmeter Method)
 1. Connect the visual RF output to a RF wattmeter and disconnect the I/O cable from the exciter.
 2. Apply a black picture (no set up) to the video input. Proper sync ratio must be maintained for meter cali-

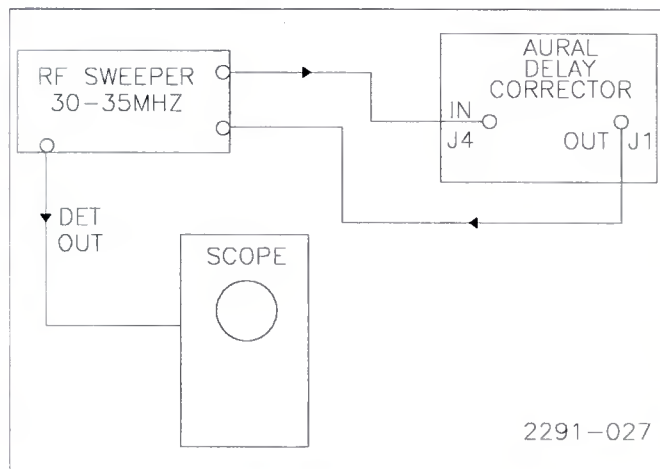


Figure 5-16. Typical Sweep Setup
Aural Delay Corrector

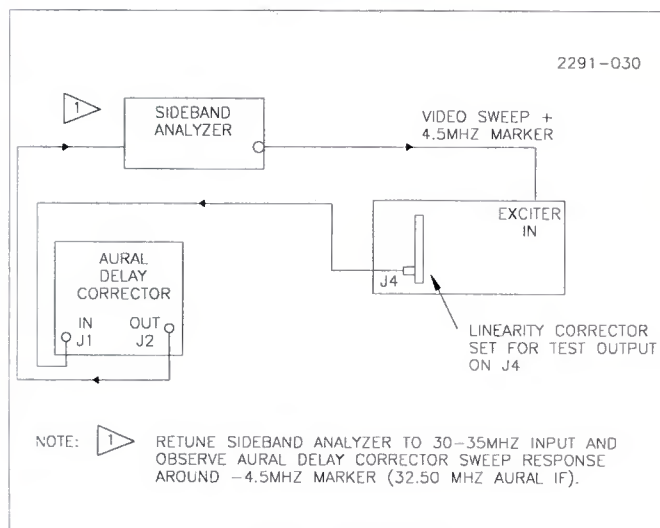


Figure 5-17. Alternate Sweep Method
Aural Delay Corrector

bration by observing demodulated exciter output on a waveform monitor or scope.

3. Increase visual power such that a 0.6W is read on a RF wattmeter. (Adjust VIS LIMIT if required, to obtain 1 watt out of the Exciter).
4. Now adjust the VIS PWR CAL CCW until all bars on the bar graph are lit. Then adjust CW until 3 of the bars go out. The Bar graph is now calibrated.
5. The CAL control sets the reference for the digital meter. It should be set so that both digital and analog bargraph meters agree. Adjust CAL such that % POWER METER reads 1000mW.
6. Lower the Exciter output to zero, and reconnect the RF output and the I/O cable to the Exciter.
7. Turn the transmitter on and raise the power to your normal operating power.
8. If the VIS LIMIT control was moved, it will be necessary to do POWER LIMIT ADJUSTMENTS later in this section.
- b. Alternate Visual Power Calibrate (Spectrum Analyzer Method)
 1. Apply video to the input of the Exciter.
 2. Connect a spectrum analyzer to the output of the exciter with a 10dB pad and disconnect the I/O cable from the back of the Exciter. The 10dB pad will keep you from overloading the input to the analyzer, which is usually rated at 1 watt input.
 3. Increase visual power until you have +20dBm on the spectrum analyzer at the peak of sync. (+20dBm with a 10dB pad is +30dBm which is equal to 1 watt. Adjustment of the "VIS LIMIT" control may be required, to obtain 1 watt out of the Exciter).

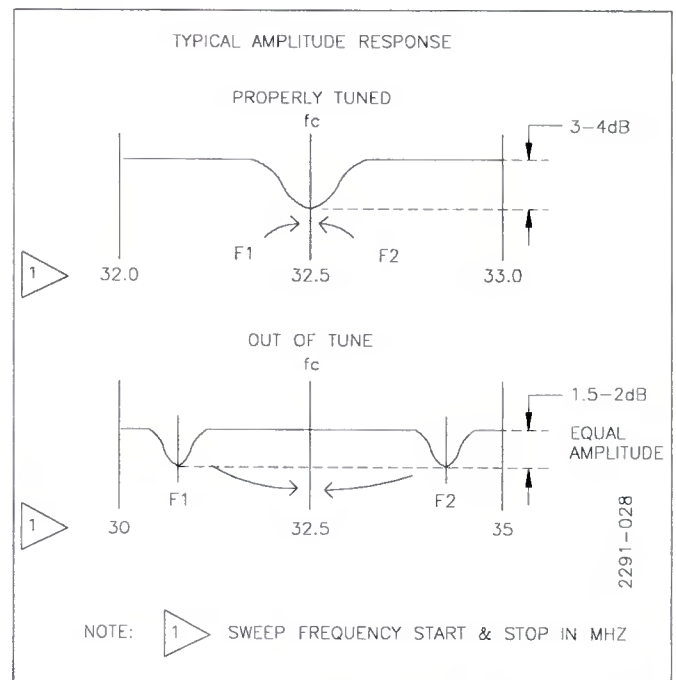


Figure 5-18. Aural Delay Corrector Amplitude Response
Curves. NOTE: Amplitude Response is Broadband with a Small
Response Dip as Shown Above.

4. Now adjust the VIS PWR CAL CCW until all bars on the bar graph are lit. Then adjust CW until 3 of the bars go out. The Bar graph is now calibrated.
 5. The CAL control sets the reference for the digital meter. It should be set so that both digital and analog bargraph meters agree. Adjust CAL such that % POWER METER reads 1000mW.
 6. Lower the Exciter output to zero, and reconnect the RF output and the I/O cable to the Exciter.
 7. Turn the transmitter on and raise the power to your normal operating power.
 8. If the VIS LIMIT control was moved, it will be necessary to do POWER LIMIT ADJUSTMENTS later in this section.
- c. Aural Power Calibrate
1. Connect AURAL RF OUT to a RF wattmeter.
 2. Adjust AURAL RAISE/LOWER for 1 watt output.
 3. Set AURAL calibrate pot R61 for full-scale 1 watt on the bar graph. The % POWER METER should read 1000.
- d. Refer to power limit adjustments if limit controls were adjusted during this procedure.

5.7.1. VSWR Foldback

A voltage applied to the VSWR inputs on the remote control connector will reduce power by a proportional amount. When used with the Harris transmitter these controls should be fully CW.

5.8. Power Supply Adjustment Procedure

Supply;Adjustment Procedure

The power supply has been set at the factory and adjustment should be made only if necessary.

A quick check of the 5 power supply voltages (+24,+15,-15,+5 and -5 volts) can be made by placing the Extender card into an empty slot and see if all 5 Green LED's come on. For a more accurate check, use a VOM to measure the supply voltages by looking at the rear lead of the 2W LED series dropping resistors on the Extender card. The voltages on each resistor should be from top to bottom, +24,+15,-15,+5 and -5 volts.

If the voltages need adjustment, it will be necessary to gain access to the power supply itself. The procedure is as follows;

- a. Remove power to the exciter.
- b. Remove rear top cover.
- c. Remove the rear aluminum cross-member to which the top rear cover was fastened. There are 2 screws in each end of the cross-member and 8 screws along the back that will need to be loosened. The cross-member may now be removed.
- d. Remove the 7 screws holding the top cover on the power supply. **WARNING** - Primary power is present inside the power supply cage if power is returned to the exciter. This area should be covered during troubleshooting to prevent accidental contact with the primary line potential.
- e. Using a DC VOM or scope, clip a test lead on one of the test points inside the power supply cage, route the test lead outside the cage, and refasten the power supply cover. Refer to Table 5-8 for test points and adjustments.
- f. Apply power to the exciter, and note the voltage.
- g. If adjustment is necessary, remove power from the exciter, remove the power supply cover, and make a slight adjustment on the appropriate potentiometer. Now refasten the power supply cover, return power to the exciter, and recheck the voltage. If it is still incorrect, repeat the procedure.

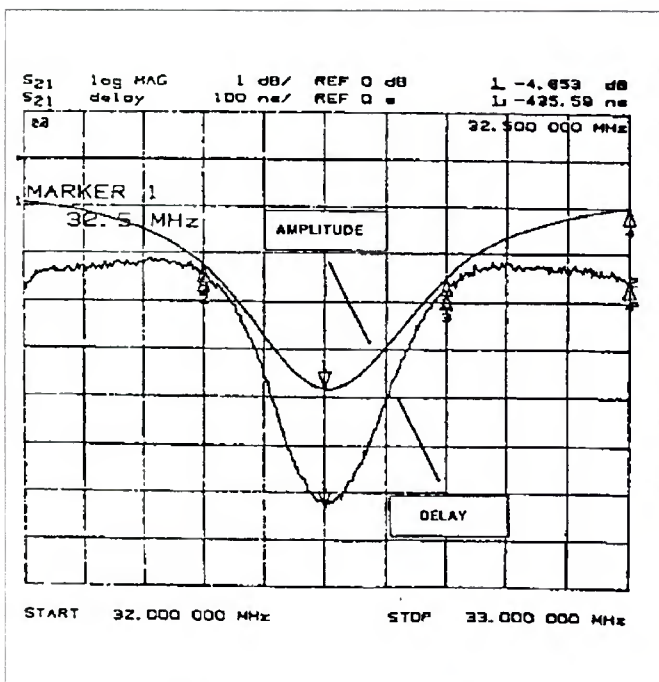


Figure 5-19. Typical Amplitude & Delay Aural Delay Corrector

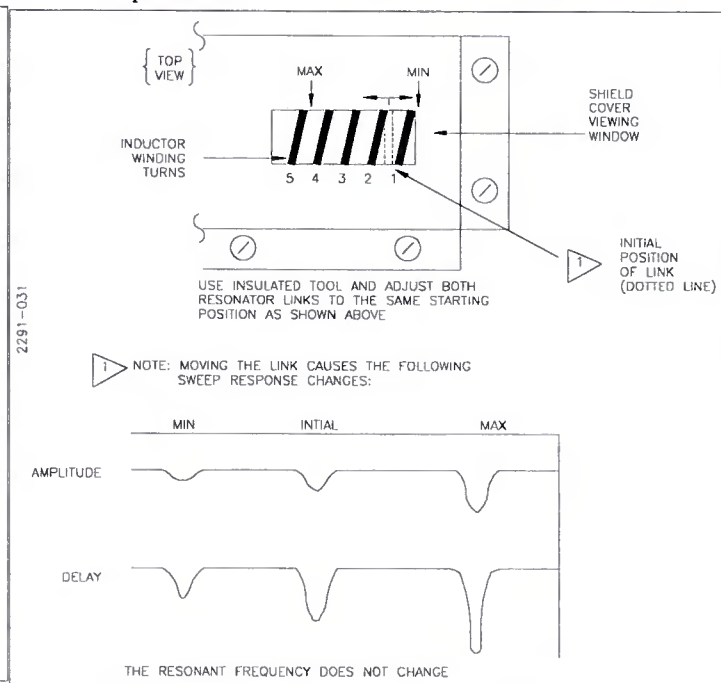


Figure 5-20. Link Coupling Adjustment Aural Delay Corrector

h. If it is correct, remove power and reassemble the exciter.

5.9. Component Replacement On Circuit Boards

The circuit boards used in the VHF TV exciter are double-sided circuit boards with plated through-holes. Soldering on this circuit board is possible with conventional tools if care is observed.

For repair, a de-soldering station is suggested such as an Air-Vac PVSG-60E De-Soldering System made by Air-Vac Engineering Co., Inc., 100 Gulf St., Milford, CT 06460 (203-874-2541). This de-soldering system utilizes a venturi to develop the suction and therefore requires an air pressure source of approximately 35 PSI. It is relatively inexpensive for such a system and works well.

Techniques must be developed using the de-soldering station. Sometimes, it may be necessary to add solder to the connection to assist heat flow to the connection several times until the solder can be removed in steps. Possibly, removing solder from both sides of the circuit board will assist in clearing the through-holes.

The circuit board used in the VHF TV exciter utilizes plated through-holes. Because of these through-holes, solder fills the holes by capillary action. This condition requires that defective components be removed carefully to avoid damage to the circuit board.

On all circuit boards, the adhesive securing the copper track to the circuit board melts at almost the same temperature at which solder melts. A circuit-board track can be destroyed by excessive heat or lateral movement during soldering. Use of a

heat source no larger than necessary with steady pressure is required for circuit board repair.

To remove a component from a circuit board such as the type used in the VHF TV exciter, cut the leads from the body of the defective component while the device is still soldered to the circuit board.

Carefully grasp each component lead, one at a time with miniature long-nose pliers. Heat each lead independently. When the solder begins to melt, carefully pull the lead from each hole. The holes may then be cleared of solder with vacuum.

Install the new component and solder the component in place.

WARNING

MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL-VENTILATED AREA, AWAY FROM FLAME (INCLUDING CIGARETTES) AND A HOT SOLDERING IRON. OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.

After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted with water and is not effective. Solvents are available at electronic supply houses which are useful.

The circuit board should be checked to ensure that the flux has been removed from the circuit board and not just smeared about. Rosin flux is not normally corrosive, but rosin can absorb enough moisture in time to become conductive and cause problems.

*Table 5-8
Power Supply Adjustments*

Voltage	Test Point	Adjust
+24	E1	R-16
+15	E3	R-17
-15	E5	R-18
+5	E7	R-19
-5	E9	R-20
GND	E10	

SECTION VI TROUBLESHOOTING

6.1. Introduction

Most troubleshooting consists of visual checks. All the various indicators (meters, led's, and fuse) should be used to isolate the problem to a specific area of the VHF TV exciter, the input, or the load.

Once the trouble is isolated, refer to Section IV for detailed explanations of the circuit theory and diagrams in section VIII to aid in problem resolution.

6.2. Troubleshooting Assistance

Assistance with troubleshooting is available from the Harris Customer Service Department either by letter to the following address or by telephone (217-222-8200) 24 hours a day.

Harris Corporation, Broadcast Division
P. O. Box 4290
Quincy, IL 62305
ATTEN: Customer Service Department

It is necessary to have the model number and serial number of the unit to retrieve certain information. Organize material before calling or writing, listing all observable symptoms and characteristics, sequence of events, meter readings, revision level of circuit boards.

6.3. Returns

To return material to Harris under warranty, a return authorization number must be obtained from the Harris Customer Service Department prior to returning any unit for any reason. A return authorization will assure speedy and accurate handling of your return. A written description including the following information must accompany all returns unit in addition to the return authorization number:

- a. The customer name, address, and telephone number.
- b. The return authorization number.
- c. A description of the problem or why the unit was returned.

Ship or otherwise return the product, transportation and insurance prepaid to:

Harris Corporation, Broadcast Division
P. O. Box 4290
Quincy, IL 62305

Units not under warranty may be returned for repair without return authorization. Contact our Repair Dept. for information on our current rates, estimates, and scheduling. If a quick turn around is needed for emergencies consult the Repair Dept. Supervisor by phone at 217-222-8200.

SECTION VII PARTS LIST

Introduction

This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the VHF TV exciter.

Replacement parts may be obtained from the Harris Customer Service Department at the following address or by calling 217/222-8200 24 hours a day.

Harris Corporation, Broadcast Systems Division
P. O. Box 4290
Quincy, IL 62305

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Table 7-1. FORMAT-TUNED EXCITER - 994 9253 000

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (f)</i>
992 8323 002	TUNED RFI AURAL GROUP	0.0 EA	OPTION QTY 1 REQ
992 8527 001	NOTCH DIP/REC EQ 8D	0.0 EA	OPTION QTY 1 REQ
994 9155 002	INTERNAL PFC KIT	0.0 EA	OPTION QTY 1 REQ
994 9175 002	EXTERNAL STD PFC KIT	0.0 EA	OPTION QTY 1 REQ
994 9253 002	TUNED EXCITER CH-2	0.0 EA	QTY 1 REQ
994 9253 003	TUNED EXCITER CH-3	0.0 EA	QTY 1 REQ
994 9253 004	TUNED EXCITER CH-4	0.0 EA	QTY 1 REQ
994 9253 005	TUNED EXCITER CH-5	0.0 EA	QTY 1 REQ
994 9253 006	TUNED EXCITER CH-6	0.0 EA	QTY 1 REQ
994 9253 007	TUNED EXCITER CH-7	0.0 EA	QTY 1 REQ
994 9253 008	TUNED EXCITER CH-8	0.0 EA	QTY 1 REQ
994 9253 009	TUNED EXCITER CH-9	0.0 EA	QTY 1 REQ
994 9253 010	TUNED EXCITER CH-10	0.0 EA	QTY 1 REQ
994 9253 011	TUNED EXCITER CH-11	0.0 EA	QTY 1 REQ
994 9253 012	TUNED EXCITER CH-12	0.0 EA	QTY 1 REQ
994 9253 013	TUNED EXCITER CH-13	0.0 EA	QTY 1 REQ

Table 7-2. TUNED RFI AURAL GROUP - 992 8323 002

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (b)</i>
545 0121 000	RES 1M OHM 1/4W 5% 1206	0.0 EA	R005 R006 ADD FOR SINGLE CAVITY HIGH BAND DIPLEXER QTY 2
992 8323 001	PWB AURAL GROUP DELAY	1.0 EA	

Table 7-3. PWB AURAL GROUP DELAY - 992 8323 001

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (h)</i>
358 1881 000	EJECTOR KIT CARD	1.0 EA	
382 1140 000	PWR DIVIDER, 2 WAY 90 DEG ESD	1.0 EA	HY001
384 0431 000	RECT. 1N4001 ESD	4.0 EA	CR001 CR002 CR004 CR005
384 0720 000	TRANSORB 1N6377 15V 5W ESD	1.0 EA	CR003
494 0483 000	INDUCTOR 1880NH 2%	2.0 EA	L002 L004
517 0052 000	CAP TRIMMER 0.8-11.0PF	2.0 EA	C001 C002
519 0014 000	CAP RF CHIP 3.3PF 500V	2.0 EA	C003 C004
545 0121 000	RES 1M OHM 1/4W 5% 1206	0.0 EA	R005 R006 ADD FOR HIGH BAND SINGLE CAVITY DIPLEXER QTY 2
548 2400 201	RES 100 OHM 1/2W 1%	1.0 EA	R004
548 2400 273	RES 562 OHM 1/2W 1%	1.0 EA	R001 R002
550 0882 000	POT 100 OHM 1/2W 10%	1.0 EA	R003
578 0021 000	RELAY DPDT 12V	1.0 EA	K001
604 0859 000	SW, TGL DPDT	1.0 EA	S001
610 0900 000	HEADER 3 CKT STRAIGHT	1.0 EA	P001
612 1184 000	SHUNT JUMPER 0.1" CENTERS	1.0 EA	P001
620 0700 000	*RECPT, MALE SMB,PC MOUNT	2.0 EA	J001 J002
822 0900 023	BRKT, CAP MOUNTING	2.0 EA	C001 C002
822 0900 183	COIL, L1-L3	2.0 EA	L001 L003
839 7900 028	COVER	2.0 EA	
839 7900 492	SCHEM, AUR GROUP DELAY	0.0 EA	
843 4999 361	PWB, GROUP DELAY CORR.	1.0 EA	
917 2100 497	CABLE, EXC 3-1/2" W1	1.0 EA	W001
917 2100 502	CABLE EXC 9" W6	1.0 EA	W006
917 2100 503	CABLE EXC 10" W7	1.0 EA	W007

Table 7-4. NOTCH DIP/REC EQ BD - 992 8527 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (k)
000 0000 010	B/M NOTE:	0.0 EA	SELECT ON TEST C021 C022 C023
358 1881 000	EJECTOR KIT CARD	1.0 EA	
380 0125 000	XSTR, NPN 2N4401 ESD	3.0 EA	Q001 Q003 Q004
380 0126 000	XSTR, PNP 2N4403 ESD	1.0 EA	Q002
382 1304 000	IC, HA5020 ESD	13.0 EA	U001 U002 U003 U004 U005 U006 U007 U008 U009 U010 U011 U012 U013
384 0431 000	RECT. 1N4001 ESD	1.0 EA	CR004
384 0719 000	TRANSZORB 1N6373 5V 5W ESD	2.0 EA	CR002 CR003
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	1.0 EA	CR001
494 0239 000	CHOKE WIDE BAND	2.0 EA	RFOC1 RFOC2
494 0372 000	CHOKE RF 0.10UH	15.0 EA	L002 L003 L004 L005 L007 L009 L010 L013 L014 L015 L016 L018 L021 L023 L024
494 0404 000	CHOKE RF 33.0UH	4.0 EA	L017 L019 L020 L022
500 0787 000	CAP, MICA, 200PF 500V 5%	1.0 EA	C016
500 0801 000	CAP, MICA, 2PF 500V +/- .5PF	1.0 EA	C079
500 0809 000	CAP, MICA, 22PF 500V 5%	1.0 EA	C014
500 0817 000	CAP, MICA, 47PF 500V 5%	2.0 EA	C003 C013
500 0821 000	CAP, MICA, 68PF 500V 5%	2.0 EA	C024 C074
500 0826 000	CAP, MICA, 120PF 500V 5%	1.0 EA	C001
500 0835 000	CAP, MICA, 470PF 500V 5%	1.0 EA	C010
500 0957 000	CAP, MICA, 7PF 500V +/- .5PF	1.0 EA	C080
516 0453 000	CAP .1UF 100V 20% X7R	3.0 EA	C004 C006 C008
516 0530 000	CAP .01UF 10% 100V X7R	26.0 EA	C026 C028 C030 C032 C034 C036 C038 C040 C042 C044 C046 C048 C050 C052 C054 C056 C058 C060 C062 C064 C066 C068 C070 C072 C075 C076
518 0108 000	CAP, VAR 9-120 PF 100V	10.0 EA	C002 C009 C011 C012 C015 C017 C018 C019 C020 C025
522 0548 000	CAP 10UF 50V 20%	26.0 EA	C027 C029 C031 C033 C035 C037 C039 C041 C043 C045 C047 C049 C051 C053 C055 C057 C059 C061 C063 C065 C067 C069 C071 C073 C077 C078
522 0550 000	CAP 100UF 25V 20%	2.0 EA	C005 C007
548 2400 001	RES 1 OHM 1/2W 1%	4.0 EA	R011 R020 R029 R031
548 2400 185	RES 75 OHM 1/2W 1%	19.0 EA	R001 R005 R006 R007 R023 R026 R038 R041 R052 R054 R055 R068 R069 R074 R075 R083 R084 R093 R101
548 2400 201	RES 100 OHM 1/2W 1%	7.0 EA	R034 R045 R048 R060 R063 R080 R089
548 2400 218	RES 150 OHM 1/2W 1%	8.0 EA	R002 R024 R025 R039 R040 R053 R094 R099
548 2400 242	RES 267 OHM 1/2W 1%	1.0 EA	R096
548 2400 266	RES 475 OHM 1/2W 1%	4.0 EA	R056 R067 R076 R085
548 2400 301	RES 1K OHM 1/2W 1%	23.0 EA	R010 R017 R022 R032 R033 R046 R047 R058 R059 R065 R066 R077 R078 R086 R087 R090 R091 R092 R095 R098 R100 R102 R013
548 2400 305	RES 1.1K OHM 1/2W 1%	1.0 EA	R004
548 2400 330	RES 2K OHM 1/2W 1%	3.0 EA	R003 R062 R104
548 2400 342	RES 2.67K OHM 1/2W 1%	7.0 EA	R012 R027 R037 R042 R044 R049 R051
548 2400 366	RES 4.75K OHM 1/2W 1%	4.0 EA	R019 R071 R072 R081
548 2400 385	RES 7.5K OHM 1/2W 1%	3.0 EA	R013 R030 R035

548 2400 434	RES 22.1K OHM 1/2W 1%	4.0 EA	R009 R015 R016 R018
548 2400 466	RES 47.5K OHM 1/2W 1%	2.0 EA	R008 R014
550 0628 000	POT 10K OHM .5W 10%	1.0 EA	R105
550 0842 000	POT 200 OHM 1/2W 10%	7.0 EA	R021 R028 R036 R043 R064 R079 R088
550 0865 000	POT 1K OHM 1/2W 10%	1.0 EA	R061
550 0901 000	POT 500 OHM 1/2W 10%	6.0 EA	R050 R057 R070 R073 R082 R097
604 0469 000	SW TGL SPDT	1.0 EA	S001
610 0900 000	HEADER 3 CKT STRAIGHT	5.0 EA	JP001 JP002 JP003 JP004 JP005
610 0933 000	JUMPER, PWB TEST POINT	7.0 EA	TP001 TP002 TP003 TP004 TP005 TP006 TP007
612 1184 000	SHUNT JUMPER 0.1" CENTERS	5.0 EA	
620 0700 000	*RECPT, MALE SMB,PC MOUNT	2.0 EA	J002 J003
839 7994 080	SCHEM, NOTCH DIP/REC EQ	0.0 EA	
843 4999 463	PWB, NOTCH DIP/REC EQ BD	1.0 EA	
917 2272 001	INDUCTOR, 20 UHY CT	2.0 EA	L011 L012 SELECT QTY 2 FOR SYS M,B, QTY 2 FOR SYS D,I,K1,L
917 2272 002	INDUCTOR, 38.5 UHY CT	3.0 EA	L001 L006 L008 SELECT QTY 3 FOR SYS M,B SELECT QTY 1 FOR SYS D,I,K1,L
917 2272 003	INDUCTOR, 13 UHY CT	0.0 EA	

Table 7-5. INTERNAL PFC KIT - 994 9155 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
306 0016 000	NUT, HEX KEP 6-32	2.0 EA	
358 1073 000	BRAKE FOR KNOBPOT	1.0 EA	#R001
552 0781 000	POT 20K OHM 1.5W	1.0 EA	R001
700 1251 000	CRYSTAL OSCILLATOR	1.0 EA	
839 7900 503	SCHEM, INT PFC FREQ STD	0.0 EA	
917 2100 500	CABLE EXC 8" W4	1.0 EA	
917 2100 502	CABLE EXC 9" W6	1.0 EA	
939 7900 230	BRKT, POT MTG PFC OPTION	1.0 EA	
999 2812 001	WIRE/TUBING LIST, INT PFC	1.0 EA	

Table 7-6. EXTERNAL STD PFC KIT - 994 9175 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (c)
917 2100 503	CABLE EXC 10" W7	1.0 EA	W007
917 2100 508	CABLE, PFC 15" W16	1.0 EA	W016

Table 7-7. BASIC HX1V EXC VIS/AUR - 992 8372 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (a)
000 0000 010	B/M NOTE:	0.0 EA	FOR SCHEMATIC LIST SEE 939-7911-051
007 4060 029	BRZ, FINGERS TWIST 97-560	59.50 IN	
007 4060 077	BRZ,PH FGR STK 97-0621-02	12.0 EA	#NOTES: 24 PIECES 7.7" LG
250 0086 000	PLUG/CORD MOLDED BLACK	1.0 EA	
354 0624 000	TERMINAL, MALE	2.0 EA	
356 0208 000	CLAMP, FLAT CABLE 2"	1.0 EA	
358 0165 000	STUD 82 OVAL HEAD	8.0 EA	
358 0184 000	RETAINER 82 ALL HDS	16.0 EA	#USE WITH 1/4 TURN FASTENERS
358 1214 000	SCREWLOCK, FEMALE	1.0 EA	#J009
358 1965 000	STUD 82-11-320-16	8.0 EA	
358 2104 000	CARD GUIDE	26.0 EA	
358 2613 000	RECEPTACLE, 82 LEAFSPRING	16.0 EA	

358 3283 000	SLIDE, FULL EXT DRAWER	1.0 EA	
358 3561 000	SPRING CLIP 0.50 DIA	0.0 EA	FD PART HB (4 REQ)
358 3562 000	SPRING CLIP 0.75 DIA	0.0 EA	FD PART LB (4 REQ)
382 1636 000	MIXER W/BNC CONNECTOR ESD	1.0 EA	MX001
402 0020 000	CLIP, FUSE	2.0 EA	#USE ON 943-4999-346
414 0240 000	CORE BALUN	1.0 EA	
424 0001 000	GROMMET 3/8 MTG DIA	1.0 EA	
430 0030 001	FAN 115VAC 106CFM 4.69"SQ	1.0 EA	
430 0192 000	FINGER GUARD, 119MM FAN	1.0 EA	
448 0512 000	FILTER SLIMLINE	1.0 EA	
448 0933 000	HINGE DOOR POSITIONING	2.0 EA	
556 0049 000	ATTEN, COAX, BNC, 6DB, 2W	1.0 EA	
610 0738 000	PLUG HOUSING	1.0 EA	
610 1113 000	PLUG/RECP, D, 37PIN	1.0 EA	
620 1563 000	POWER SPLITTER	1.0 EA	HY1
620 2109 000	JACK, BNC 75 OHM BULKHEAD	1.0 EA	
815 0365 001	BANDPASS FILTER	0.0 EA	FD PART HB
815 2324 001	BANDPASS FILTER	0.0 EA	FD PART LB
822 0900 106	LARGE WINDOW EXCITER	1.0 EA	
822 0900 371	SHIPPING LABEL	0.0 EA	
839 7900 050	BRKT, PLUNGER	1.0 EA	
839 7900 463	COVER DUAL PC BD	1.0 EA	
839 7900 464	COVER END PC BD	2.0 EA	
839 7900 465	COVER SINGLE PC BD	9.0 EA	
839 7900 466	BAR FRONT	1.0 EA	
839 7900 467	BAR TOP COVER	1.0 EA	
839 7900 541	WIRING DIAG, HX1V EXC.	0.0 EA	
843 4999 143	PANEL EXCIT MTG-UPPER	1.0 EA	
843 4999 144	PANEL EXCIT MTG-LOWER	1.0 EA	
843 4999 350	SUPPORT MTHBOARD	1.0 EA	
914 8789 002	MIXER PLATE	1.0 EA	
917 2100 208	CABLE EXC AMP	2.0 EA	W012 RIBBON
917 2100 210	CABLE EXC METER M/B	1.0 EA	W013
917 2100 497	CABLE, EXC 3-1/2" W1	3.0 EA	W001
917 2100 498	CABLE EXC 5" W2	1.0 EA	W002
917 2100 499	CABLE EXC 7" W3	1.0 EA	W003
917 2100 500	CABLE EXC 8" W4	2.0 EA	W004
917 2100 501	CABLE EXC 7" W5	2.0 EA	W005
917 2100 502	CABLE EXC 9" W6	7.0 EA	W006
917 2100 503	CABLE EXC 10" W7	4.0 EA	W007
917 2100 504	CABLE EXC 12" W8	1.0 EA	W008
917 2100 505	CABLE EXC 13" W9	4.0 EA	W009
917 2100 506	CABLE EXC 9" W10	2.0 EA	W010
917 2100 507	RIBBON CABLE EXC 43" W14	1.0 EA	W014
917 2100 508	CABLE, PFC 15" W16	0.0 EA	W016 #PFC CABLE IS AN OPTION QTY 1 REQ'D
917 2100 558	CABLE COAX 50 OHM 14"	2.0 EA	W011
917 2100 559	CABLE COAX 50 OHM 9"	2.0 EA	W022
917 2100 560	CABLE COAX 50 OHM 12"	1.0 EA	W023
917 2315 251	CABLE EXCITER 14" W251	1.0 EA	W251
917 2456 072	CABLE, VIDEO IN 11" W12	1.0 EA	W012 COAX
939 7900 051	BRKT, PLUNGER ASSY	1.0 EA	
939 7900 235	TOOL, EXCITER ALIGNMENT	1.0 EA	
939 7900 486	BAR, TOP FRONT	1.0 EA	
939 7900 488	BAR BOTTOM FRONT	2.0 EA	

943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 332	FRT PANEL EXCITER	1.0 EA	
943 4999 337	CAGE FRT ASSY	1.0 EA	
943 4999 338	CAGE REAR ASSY	1.0 EA	
943 4999 339	DIVIDER CARD CAGE	11.0 EA	
943 4999 346	COVER TOP REAR	1.0 EA	
943 4999 356	PLATE PWR AMP ASSY	1.0 EA	
943 4999 383	COVER TOP EXCITER HX1V	1.0 EA	
943 4999 402	PANEL REAR EXCITER	1.0 EA	
943 4999 861	CHASSIS EXCITER	1.0 EA	
992 8001 002	PWB, METERING & CONTROL	1.0 EA	
992 8260 001	PWB, MOD/DELAY COMP.	1.0 EA	
992 8262 001	PWB, LIN/QUAD CORR.	1.0 EA	
992 8288 001	PWB, EXCITER MOTHERBOARD	1.0 EA	
992 8299 001	AURAL CONVERTER PWB	1.0 EA	
992 8323 001	PWB AURAL GROUP DELAY	0.0 EA	#GROUP DELAY PWB IS AN OPTION QTY 1 REQUIRED
992 8324 001	VSBI/IF AGC BD	1.0 EA	
992 8325 001	PWB, DIFF PHASE CORR.	1.0 EA	
992 8326 002	CMR FILTER MODULE	1.0 EA	
992 8327 001	POWER SUPPLY EXT	1.0 EA	
992 8328 001	MODULE FINAL AMPL	2.0 EA	
992 8329 001	PWB, EXTENDER CARD	1.0 EA	
992 8347 001	PWB, SYNTHESIZER BD #1	1.0 EA	
992 8348 001	PWB, SYNTHESIZER BD #2	1.0 EA	
992 8527 001	NOTCH DIP/REC EQ BD	0.0 EA	#OPTION QTY 1 REQD WHENUSED.
992 9564 001	*PWA, VIDEO BOARD W/VIDEO	1.0 EA	

Table 7-8. PWB, METERING & CONTROL - 992 8001 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (h)
358 2827 000	SPACER, LED MOUNT .25 LG	8.0 EA	#DS005 #DS006 #DS007 #DS008 #DS009 #DS010 #DS011 #DS012
380 0319 000	XSTR, MPS-A14 ESD	2.0 EA	Q001 Q002
380 0713 000	DARLINGTON TRANSISTOR PNP ESD	7.0 EA	Q003 Q004 Q005 Q006 Q007 Q008 Q009
382 0285 000	IC CD4029BE ESD	6.0 EA	U009 U010 U011 U012 U013 U014
382 0523 000	IC, 4066/14066 ESD	2.0 EA	U019 U022
382 0587 000	IC, CD4011/MC14011 ESD	5.0 EA	U001 U002 U004 U005 U021
382 0593 000	IC TL072ACP ESD	4.0 EA	U017 U018 U027 U028
382 0618 000	IC, 4081/14081 ESD	2.0 EA	U003 U026
382 0626 000	IC, 4093B/14093B ESD	2.0 EA	U006 U020
382 0711 000	PRECISION IC MULTIPLIER ESD	1.0 EA	U029
382 0718 000	IC, AD7525KN ESD	2.0 EA	U015 U016
382 1008 000	IC, LM3914N ESD	2.0 EA	U023 U024
382 1026 000	IC, 4046B/14046 ESD	2.0 EA	U007 U008
382 1147 000	CONVERTER A/D 3-1/2 DIGIT ESD	1.0 EA	U025
384 0205 000	DIODE SILICON 1N914/4148 ESD	5.0 EA	CR001 CR002 CR014 CR015 CR016
384 0431 000	RECT. 1N4001 ESD	1.0 EA	CR003
384 0610 000	LED, GREEN ESD	1.0 EA	DS005
384 0611 000	LED, RED ESD	7.0 EA	DS006 DS007 DS008 DS009 DS010 DS011 DS012
384 0719 000	TRANSZORB 1N6373 5V 5W ESD	2.0 EA	CR010 CR013
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR011 CR012
384 0823 000	LED 10 SEG BARGRAPH, RED ESD	2.0 EA	DS003 DS004
384 0824 000	LED DISPLAY .560 INCH ESD	2.0 EA	DS001 DS002

386 0085 000	ZENER, 1N4740A 10V ESD	1.0 EA	CR004
506 0244 000	CAP .22UF 63V 5%	1.0 EA	C011
506 0246 000	CAP 0.47UF 63V 5%	1.0 EA	C010
516 0453 000	CAP .1UF 100V 20% X7R	10.0 EA	C001 C005 C009 C017 C018 C033 C034 C035 C036 C043
516 0530 000	CAP .01UF 10% 100V X7R	20.0 EA	C003 C007 C012 C019 C020 C021 C025 C026 C027 C028 C029 C030 C031 C032 C037 C038 C039 C040 C041 C042
516 0725 000	CAP 1.0UF 50V 20%	2.0 EA	C002 C006
516 0765 000	CAP 10PF 5% 100V C0G	1.0 EA	C008
522 0548 000	CAP 10UF 50V 20%	4.0 EA	C013 C014 C015 C016
526 0374 000	CAP 1.0F 5.5V	1.0 EA	C004
548 2400 130	RES 20 OHM 1/2W 1%	1.0 EA	R011
548 2400 269	RES 511 OHM 1/2W 1%	1.0 EA	R080
548 2400 301	RES 1K OHM 1/2W 1%	8.0 EA	R007 R009 R010 R018 R020 R021 R076 R077
548 2400 305	RES 1.1K OHM 1/2W 1%	1.0 EA	R029
548 2400 337	RES 2.37K OHM 1/2W 1%	1.0 EA	R030
548 2400 366	RES 4.75K OHM 1/2W 1%	2.0 EA	R003 R014
548 2400 401	RES 10K OHM 1/2W 1%	32.0 EA	R001 R002 R012 R013 R022 R023 R024 R025 R026 R027 R038 R039 R040 R041 R042 R043 R044 R045 R046 R047 R048 R049 R050 R051 R052 R053 R054 R055 R056 R057 R071 R081
548 2400 418	RES 15K OHM 1/2W 1%	1.0 EA	R033
548 2400 430	RES 20K OHM 1/2W 1%	1.0 EA	R028
548 2400 459	RES 40.2K OHM 1/2W 1%	1.0 EA	R037
548 2400 469	RES 51.1K OHM 1/2W 1%	2.0 EA	R063 R067
548 2400 477	RES 61.9K OHM 1/2W 1%	1.0 EA	R036
548 2400 489	RES 82.5K OHM 1/2W 1%	4.0 EA	R004 R005 R015 R016
548 2400 501	RES 100K OHM 1/2W 1%	11.0 EA	R006 R017 R031 R062 R065 R066 R068 R069 R070 R078 R079
548 2400 566	RES 475K OHM 1/2W 1%	1.0 EA	R034
548 2400 601	RES 1MEG OHM 1/2W 1%	1.0 EA	R035
550 0950 000	POT 2000 OHM 1/2W 10%	2.0 EA	R008 R019
550 0953 000	POT 20K .5W MULTITURN	1.0 EA	R032
550 0960 000	POT 1K OHM	4.0 EA	R058 R060 R061 R064
604 1111 000	SW PB GRAY MOM W/O LED	4.0 EA	SW001 SW002 SW003 SW004
604 1112 000	SW PB GRAY MOM W/GRN LED	2.0 EA	SW5/DS013 SW6/DS014
610 0828 000	HEADER, 26 PIN PC RIBBON	1.0 EA	J001
610 0900 000	HEADER 3 CKT STRAIGHT	2.0 EA	#JP001 #JP002
610 0933 000	JUMPER, PWB TEST POINT	1.0 EA	TP001
612 1184 000	SHUNT JUMPER 0.1" CENTERS	2.0 EA	JP001 JP002
612 1295 000	CONN, 37 PIN, STRAIGHT, D RECP	1.0 EA	J002
839 7900 027	SCHEM, METER & CONTROL	0.0 EA	
843 4999 038	PWB, METER BOARD	1.0 EA	

Table 7-9. PWB, MOD/DELAY COMP. - 992 8260 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (q)
358 1881 000	EJECTOR KIT CARD	1.0 EA	
380 0114 000	*XSTR, NPN, 2N5109 ESD	7.0 EA	Q001 Q003 Q004 Q101 Q102 Q105 Q106
380 0536 000	XSTR, NPN, 2N5179 ESD	3.0 EA	Q002 Q103 Q104
382 1225 000	IC, ASK-1 ESD	1.0 EA	MX001
384 0361 000	DIODE HP5082-3077/A5S377 ESD	4.0 EA	CR101 CR102 CR103 CR104
384 0431 000	RECT. 1N4001 ESD	2.0 EA	CR105 CR106
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR007 CR008

384 0838 000	TRANSZORB 1N6380 36V 5W ESD	1.0 EA	CR009
404 0198 000	SPACER TO-5, TO-9, TO-11	7.0 EA	XQ001 XQ003 XQ004 XQ101 XQ102 XQ105 XQ106
404 0264 000	HEAT SINK FOR TO-5 CASE	1.0 EA	XQ001
478 0392 000	XFMR, RF MODEL T4-1	4.0 EA	T001 T002 T101 T102
494 0239 000	CHOKE WIDE BAND	4.0 EA	L103 L104 L113 L114
494 0375 000	CHOKE RF 0.18UH	1.0 EA	L003
494 0376 000	CHOKE RF 0.22UH	4.0 EA	L109 L110 L115 L116
494 0378 000	CHOKE 0.33UH 10% 780MA	2.0 EA	L101 L102
494 0383 000	CHOKE RF 0.82UH	1.0 EA	L004
494 0384 000	CHOKE RF 1.00UH	4.0 EA	L105 L106 L111 L112
494 0388 000	CHOKE RF 2.20UH	1.0 EA	L002
494 0398 000	CHOKE RF 10.0UH +/- 10%	3.0 EA	L006 L107 L108
494 0446 000	CHOKE POWER LINE 100UH	2.0 EA	L001 L005
500 0804 000	CAP, MICA, 10PF 500V +/- .5PF	2.0 EA	C138 C139
500 0807 000	CAP, MICA, 18PF 500V 5%	1.0 EA	C013
500 0808 000	CAP, MICA, 20PF 500V 5%	1.0 EA	C012
500 0809 000	CAP, MICA, 22PF 500V 5%	4.0 EA	C103 C104 C107 C108
500 0840 000	CAP, MICA, 680PF 300V 5%	1.0 EA	C020
500 0957 000	CAP, MICA, 7PF 500V +/- .5PF	2.0 EA	C111 C112
516 0530 000	CAP .01UF 10% 100V X7R	1.0 EA	C019
516 0736 000	CAP .001UF 10% 100V X7R	41.0 EA	C001 C002 C003 C005 C007 C008 C009 C014 C016 C018 C021 C023 C025 C027 C029 C101 C102 C105 C106 C113 C114 C115 C116 C117 C118 C119 C120 C123 C124 C125 C126 C127 C128 C129 C130 C131 C132 C133 C134 C136 C137
516 0891 000	CAP 0.100UF 10% 50V	5.0 EA	C015 C022 C024 C026 C028
518 0045 000	CAP VAR 9-35PF 200V	2.0 EA	C121 C122
520 0446 000	CAP, VAR .8-10PF	1.0 EA	C011
520 0448 000	CAP, VAR .8-14PF	2.0 EA	C109 C110
522 0548 000	CAP 10UF 50V 20%	1.0 EA	C135
522 0561 000	CAP 100UF 63V 20%	3.0 EA	C004 C006 C017
548 2400 101	RES 10 OHM 1/2W 1%	5.0 EA	R005 R135 R136 R139 R140
548 2400 105	RES 11 OHM 1/2W 1%	1.0 EA	R022
548 2400 118	RES 15 OHM 1/2W 1%	1.0 EA	R019
548 2400 134	RES 22.1 OHM 1/2W 1%	6.0 EA	R033 R034 R145 R146 R153 R154
548 2400 147	RES 30.1 OHM 1/2W 1%	1.0 EA	R110
548 2400 158	RES 39.2 OHM 1/2W 1%	2.0 EA	R021 R029
548 2400 166	RES 47.5 OHM 1/2W 1%	3.0 EA	R109 R125 R126
548 2400 169	RES 51.1 OHM 1/2W 1%	3.0 EA	R016 R123 R124
548 2400 181	RES 68.1 OHM 1/2W 1%	3.0 EA	R006 R119 R120
548 2400 185	RES 75 OHM 1/2W 1%	2.0 EA	R121 R122
548 2400 201	RES 100 OHM 1/2W 1%	5.0 EA	R009 R018 R025 R101 R102
548 2400 205	RES 110 OHM 1/2W 1%	1.0 EA	R007
548 2400 209	RES 121 OHM 1/2W 1%	2.0 EA	R133 R134
548 2400 218	RES 150 OHM 1/2W 1%	2.0 EA	R103 R104
548 2400 226	RES 182 OHM 1/2W 1%	2.0 EA	R117 R118
548 2400 230	RES 200 OHM 1/2W 1%	2.0 EA	R035 R036
548 2400 234	RES 221 OHM 1/2W 1%	4.0 EA	R141 R142 R143 R144
548 2400 247	RES 301 OHM 1/2W 1%	2.0 EA	R004 R011
548 2400 251	RES 332 OHM 1/2W 1%	2.0 EA	R027 R032
548 2400 258	RES 392 OHM 1/2W 1%	4.0 EA	R113 R114 R115 R116
548 2400 262	RES 432 OHM 1/2W 1%	2.0 EA	R137 R138

548 2400 266	RES 475 OHM 1/2W 1%	2.0 EA	R008 R013
548 2400 277	RES 619 OHM 1/2W 1%	2.0 EA	R107 R108
548 2400 293	RES 909 OHM 1/2W 1%	1.0 EA	R030
548 2400 301	RES 1K OHM 1/2W 1%	1.0 EA	R017
548 2400 321	RES 1.62K OHM 1/2W 1%	4.0 EA	R111 R112 R129 R130
548 2400 326	RES 1.82K OHM 1/2W 1%	2.0 EA	R003 R038
548 2400 330	RES 2K OHM 1/2W 1%	1.0 EA	R031
548 2400 334	RES 2.21K OHM 1/2W 1%	3.0 EA	R002 R127 R128
548 2400 366	RES 4.75K OHM 1/2W 1%	6.0 EA	R014 R015 R023 R024 R026 R028
548 2400 381	RES 6.81K OHM 1/2W 1%	2.0 EA	R131 R132
550 0841 000	POT 50 OHM 1/2W 10%	3.0 EA	R001 R105 R106
550 0842 000	POT 200 OHM 1/2W 10%	2.0 EA	R020 R037
550 0865 000	POT 1K OHM 1/2W 10%	3.0 EA	R010 R012 R040
550 0901 000	POT 500 OHM 1/2W 10%	2.0 EA	R147 R148
604 0469 000	SW TGL SPDT	2.0 EA	S101 S102
610 0679 000	PLUG, SHORTING, .25" CTRS	2.0 EA	P001 P002
610 0933 000	JUMPER, PWB TEST POINT	1.0 EA	TP001
612 0775 000	JACK, PC MT, .040 PINS	6.0 EA	P1-1 P1-2 P1-3 P2-1 P2-2 P2-3
620 0700 000	*RECPT, MALE SMB,PC MOUNT	3.0 EA	J001 J002 J003
839 7900 443	SCHEM, MOD. DELAY	0.0 EA	
843 4999 324	PWB, MOD DELAY	1.0 EA	

Table 7-10. PWB, LIN/QUAD CORR. - 992 8262 001

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (I)</i>
358 1881 000	EJECTOR KIT CARD	1.0 EA	
380 0114 000	*XSTR, NPN, 2N5109 ESD	6.0 EA	Q002 Q004 Q005 Q102 Q104 Q105
380 0536 000	XSTR, NPN, 2N5179 ESD	4.0 EA	Q001 Q003 Q101 Q103
380 0622 000	XSTR, N-JFET U310 ESD	1.0 EA	Q106
382 0415 000	IC, 324 ESD	4.0 EA	U001 U002 U101 U102
384 0252 000	DIODE HP5082-2900/AHR2900 ESD	18.0 EA	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008 CR009 CR101 CR102 CR103 CR104 CR105 CR106 CR107 CR108 CR109
384 0431 000	RECT. 1N4001 ESD	2.0 EA	CR010 CR011
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR013 CR014
384 0838 000	TRANSZORB 1N6380 36V 5W ESD	1.0 EA	CR012
404 0198 000	SPACER TO-5, TO-9, TO-11	6.0 EA	XQ002 XQ004 XQ005 XQ102 XQ104 XQ105
404 0660 000	HEAT SINK	1.0 EA	XQ106
404 0725 000	HEAT SINK TO-5 CASE	6.0 EA	XQ002 XQ004 XQ005 XQ102 XQ104 XQ105
478 0412 000	XFMR RF T9-1	1.0 EA	T101
494 0239 000	CHOKE WIDE BAND	2.0 EA	L010 L110
494 0262 000	CHOKE RF 10UH 10%	16.0 EA	L001 L002 L003 L004 L005 L006 L007 L008 L101 L102 L103 L104 L105 L106 L107 L108
494 0376 000	CHOKE RF 0.22UH	2.0 EA	L009 L109
494 0446 000	CHOKE POWER LINE 100UH	2.0 EA	L011 L012
500 0753 000	CAP, MICA, 56PF 500V 5%	3.0 EA	C022 C023 C122
500 0759 000	CAP, MICA, 100PF 500V 5%	2.0 EA	C123 C124
500 0761 000	CAP, MICA, 150PF 500V 5%	1.0 EA	C024
500 0811 000	CAP, MICA, 27PF 500V 5%	2.0 EA	C012 C112
500 0822 000	CAP, MICA, 75PF 500V 5%	2.0 EA	C011 C111
516 0453 000	CAP .1UF 100V 20% X7R	16.0 EA	C006 C007 C008 C009 C015 C016 C017 C018 C106 C107 C108 C109 C115 C116 C117 C118
516 0530 000	CAP .01UF 10% 100V X7R	28.0 EA	

516 0736 000	CAP .001UF 10% 100V X7R	16.0 EA	C001 C003 C005 C010 C014 C020 C046 C047 C048 C049 C050 C051 C052 C053 C101 C103 C105 C110 C114 C120 C146 C147 C148 C149 C150 C151 C152 C153 C002 C013 C019 C021 C056 C057 C058 C059 C060 C113 C119 C121 C132 C133 C159 C160
516 0891 000	CAP 0.100UF 10% 50V	7.0 EA	C004 C044 C045 C102 C104 C144 C145
522 0561 000	CAP 100UF 63V 20%	5.0 EA	C029 C030 C129 C130 C161
526 0049 000	CAP 6.8UF 35V 20%	16.0 EA	C025 C026 C027 C028 C034 C035 C036 C037 C125 C126 C127 C128 C134 C135 C136 C137 C038 C039 C138 C139
526 0311 000	CAP 2.2UF 35V 10%	4.0 EA	R057 R157
540 1334 000	RES NETWORK 15K OHM	2.0 EA	R017 R117
540 1600 213	RES 330 OHM 3W 5%	2.0 EA	R007 R107
540 1600 216	RES 430 OHM 3W 5%	2.0 EA	R063 R064 R065 R163 R164 R165
548 2400 101	RES 10 OHM 1/2W 1%	6.0 EA	R162
548 2400 121	RES 16.2 OHM 1/2W 1%	1.0 EA	R154
548 2400 147	RES 30.1 OHM 1/2W 1%	1.0 EA	R028 R128
548 2400 166	RES 47.5 OHM 1/2W 1%	2.0 EA	R001 R066 R070 R101
548 2400 169	RES 51.1 OHM 1/2W 1%	4.0 EA	R005 R105
548 2400 177	RES 61.9 OHM 1/2W 1%	2.0 EA	R158
548 2400 185	RES 75 OHM 1/2W 1%	1.0 EA	R159 R160
548 2400 201	RES 100 OHM 1/2W 1%	2.0 EA	R120
548 2400 205	RES 110 OHM 1/2W 1%	1.0 EA	R054 R161
548 2400 218	RES 150 OHM 1/2W 1%	2.0 EA	R008
548 2400 226	RES 182 OHM 1/2W 1%	1.0 EA	R026 R126
548 2400 234	RES 221 OHM 1/2W 1%	2.0 EA	R009 R023 R109 R123
548 2400 237	RES 237 OHM 1/2W 1%	4.0 EA	R006 R015 R106 R108 R115
548 2400 247	RES 301 OHM 1/2W 1%	5.0 EA	R027 R127
548 2400 258	RES 392 OHM 1/2W 1%	2.0 EA	R019 R020
548 2400 262	RES 432 OHM 1/2W 1%	2.0 EA	R004 R014 R104 R114 R119
548 2400 285	RES 750 OHM 1/2W 1%	5.0 EA	R041 R068 R069 R141 R168 R169
548 2400 318	RES 1.5K OHM 1/2W 1%	6.0 EA	R029 R030 R031 R032 R033 R034 R035 R036 R129 R130 R131 R132 R133 R134 R135 R136
548 2400 330	RES 2K OHM 1/2W 1%	16.0 EA	R055 R056 R155 R156
548 2400 334	RES 2.21K OHM 1/2W 1%	4.0 EA	R003 R103
548 2400 342	RES 2.67K OHM 1/2W 1%	2.0 EA	R013 R113
548 2400 358	RES 3.92K OHM 1/2W 1%	2.0 EA	R044 R047 R050 R053 R144 R147 R150 R153
548 2400 385	RES 7.5K OHM 1/2W 1%	8.0 EA	R002 R102
548 2400 393	RES 9.09K OHM 1/2W 1%	2.0 EA	R024 R025 R124 R125
548 2400 401	RES 10K OHM 1/2W 1%	4.0 EA	R012 R112
548 2400 426	RES 18.2K OHM 1/2W 1%	2.0 EA	R011 R111
550 0842 000	POT 200 OHM 1/2W 10%	2.0 EA	R010 R021 R022 R037 R038 R039 R040 R110 R121 R122 R137 R138 R139 R140
550 0865 000	POT 1K OHM 1/2W 10%	14.0 EA	S001 S101
604 0859 000	SW, TGL DPDT	2.0 EA	P001 P001A P002
610 0679 000	PLUG, SHORTING, .25" CTRS	9.0 EA	P003 P004 P005 P006 P101 P102
612 0775 000	JACK, PC MT, .040 PINS	26.0 EA	P1-2 P1-4 P1-3 P1-1 P3-3 P3-1 P3-2 P2-3 P2- 1 P2-2 P4-3 P4-1 P4-4 P4-2 P6-3 P6-1 P6-2 P101-1 P101-2 P101-3 P102-3 P102-1 P102-2 P5-1 P5-2 P5-3
620 0700 000	*RECPT, MALE SMB,PC MOUNT	4.0 EA	J001 J002 J003 J004
620 1955 000	HYBRID, QUADRATURE	1.0 EA	HY001

839 7900 444	SCHEM, LIN/QUAD CORR.	0.0 EA
843 4999 325	PWB, LIN/QUAD CORR.	1.0 EA

Table 7-11. PWB, EXCITER MOTHERBOARD - 992 8288 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (c)
516 0736 000	CAP .001UF 10% 100V X7R	31.0 EA	C003 C006 C009 C012 C015 C016 C017 C018 C019 C020 C021 C022 C023 C024 C025 C026 C027 C028 C029 C030 C031 C032 C033 C034 C035 C036 C037 C038 C039 C040 C048
516 0777 000	CAP 100PF 5% 100V C0G	5.0 EA	C041 C042 C043 C044 C045
516 0891 000	CAP 0.100UF 10% 50V	5.0 EA	C002 C005 C008 C011 C014
522 0548 000	CAP 10UF 50V 20%	5.0 EA	C001 C004 C007 C010 C013
610 0679 000	PLUG, SHORTING, .25" CTRS	3.0 EA	P001 P002 P003
610 0828 000	HEADER, 26 PIN PC RIBBON	1.0 EA	J019
610 0848 000	HEADER, STRAIGHT 2 POS	4.0 EA	
610 1027 000	HEADER, MALE 12 PIN	2.0 EA	J018 J020
610 1064 000	HDR, 10 PIN PC RBN	2.0 EA	J016 J017
612 0904 000	JACK, PC MT GOLD PLATED	9.0 EA	#3 USED WITH P001 #3 USED WITH P002 #3 USED WITH P003
612 1184 000	SHUNT JUMPER 0.1" CENTERS	4.0 EA	
612 1309 000	CONN, PC EDGE 56 CONT	13.0 EA	J001 J002 J003 J004 J005 J006 J007 J008 J009 J010 J011 J012 J013
839 7900 475	SCHEM, MOTHERBOARD	0.0 EA	
843 4999 352	PWB, MOTHERBOARD EXC	1.0 EA	

Table 7-12. AURAL CONVERTER PWB - 992 8299 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (w)
358 1881 000	EJECTOR KIT CARD	1.0 EA	
358 1928 000	JUMPER 1/4 LG 1/8H	19.0 EA	
380 0189 000	XSTR, NPN 2N3904 ESD	3.0 EA	Q003 Q004 Q005
380 0707 000	XSTR, NPN BFR96 ESD	2.0 EA	Q001 Q002
382 0361 000	IC, IFC SRA-1 ESD	1.0 EA	MX001
382 0443 000	IC, CD4053BE ESD	1.0 EA	U014
382 0749 000	IC NE5532A ESD	7.0 EA	U009 U010 U011 U012 U019 U020 U021
382 0905 000	IC, 78L08/78L82 ESD	6.0 EA	U002 U005 U007 U013 U017 U023
382 0907 000	IC MC145152P2 ESD	1.0 EA	U008
382 1126 000	IC 78L12A ESD	2.0 EA	ESD U001 U016
383 0189 000	IC, SA5205A ESD	4.0 EA	U003 U004 U015 U022
383 0346 000	*IC, MC12019 ESD	2.0 EA	U006 U018
384 0205 000	DIODE SILICON 1N914/4148 ESD	12.0 EA	CR012 CR013 CR014 CR015 CR016 CR017 CR018 CR019 CR020 CR021 CR022 CR023
384 0611 000	LED, RED ESD	1.0 EA	DS001
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR010 CR011
404 0509 000	SOCKET IC 28 PIN	1.0 EA	XU008
404 0673 000	SOCKET 8 PIN DIP (DL)	12.0 EA	XU003 XU004 XU009 XU010 XU011 XU012 XU015 XU018 XU019 XU020 XU021 XU022
404 0675 000	SOCKET IC 16 CONT	1.0 EA	XU014
404 0873 000	SOCKET ADAPTER SOIC8-DIP8	5.0 EA	#U003 #U004 #U015 #U018 #U022
492 0636 000	COIL, VAR .366-.627UH	1.0 EA	L001
492 0765 000	FIXED RF INDUCTOR 345NH	4.0 EA	L002 L003 L009 L010
492 0769 000	FIXED RF INDUCTOR 600NH	1.0 EA	L008

494 0394 000	CHOKER 6.80UH	2.0 EA	L004 L005
494 0446 000	CHOKER POWER LINE 100UH	2.0 EA	L006 L007
500 1296 000	CAP 430PF 100V 5%	1.0 EA	C054
506 0232 000	CAP .01UF 100V 5%	6.0 EA	C081 C082 C083 C087 C088 C089
508 0529 000	CAP .01 UF 63VDCW	1.0 EA	C045
508 0559 000	CAP TRIMMER 3.5 - 38 PF	1.0 EA	C114
516 0453 000	CAP .1UF 100V 20% X7R	23.0 EA	C014 C019 C025 C028 C041 C042 C046 C047 C048 C051 C052 C060 C061 C069 C073 C079 C080 C084 C085 C090 C091 C092 C093
516 0530 000	CAP .01UF 10% 100V X7R	29.0 EA	C008 C009 C010 C011 C012 C013 C015 C016 C017 C018 C020 C024 C026 C027 C029 C058 C059 C064 C065 C067 C068 C070 C071 C072 C074 C107 C108 C109 C110
516 0725 000	CAP 1.0UF 50V 20%	1.0 EA	C075
516 0736 000	CAP .001UF 10% 100V X7R	10.0 EA	C007 C094 C095 C096 C097 C098 C099 C100 C105 C106
516 0765 000	CAP 10PF 5% 100V C0G	4.0 EA	C043 C044 C057 C086
516 0773 000	CAP 47PF 5% 100V C0G	1.0 EA	C002
516 0777 000	CAP 100PF 5% 100V C0G	3.0 EA	C021 C023 C053
516 0778 000	CAP 120PF 5% 100V C0G	3.0 EA	C022 C111 C112
516 0780 000	CAP 180PF 5% 100V C0G	2.0 EA	C005 C113
516 0782 000	CAP 270PF 5% 100V C0G	1.0 EA	C006
516 0783 000	CAP 330PF 5% 100V C0G	1.0 EA	C003
516 0786 000	CAP 560PF 5% 100V C0G	2.0 EA	C031 C034
516 0862 000	CAP 680PF 5% 100V C0G	1.0 EA	C001
520 0448 000	CAP, VAR .8-14PF	1.0 EA	C076
522 0548 000	CAP 10UF 50V 20%	5.0 EA	C030 C055 C056 C062 C063
522 0549 000	CAP 22UF 35V NON-POL	2.0 EA	C032 C033
522 0577 000	CAP 100UF 16V 20%	4.0 EA	C049 C050 C077 C078
526 0358 000	CAP 22UF 35V 10%	1.0 EA	C004
528 0036 000	DIODE VARACTOR KV3901	6.0 EA	CR001 CR002 CR003 CR004 CR005 CR006
548 2400 001	RES 1 OHM 1/2W 1%	1.0 EA	R064
548 2400 101	RES 10 OHM 1/2W 1%	1.0 EA	R005
548 2400 121	RES 16.2 OHM 1/2W 1%	1.0 EA	R013
548 2400 139	RES 24.9 OHM 1/2W 1%	3.0 EA	R122 R123 R124
548 2400 147	RES 30.1 OHM 1/2W 1%	1.0 EA	R084
548 2400 158	RES 39.2 OHM 1/2W 1%	1.0 EA	R109
548 2400 162	RES 43.2 OHM 1/2W 1%	1.0 EA	R081
548 2400 169	RES 51.1 OHM 1/2W 1%	2.0 EA	R009 R121
548 2400 181	RES 68.1 OHM 1/2W 1%	1.0 EA	R071
548 2400 185	RES 75 OHM 1/2W 1%	4.0 EA	R016 R056 R059 R065
548 2400 193	RES 90.9 OHM 1/2W 1%	4.0 EA	R015 R017 R070 R072
548 2400 201	RES 100 OHM 1/2W 1%	3.0 EA	R007 R008 R088
548 2400 212	RES 130 OHM 1/2W 1%	2.0 EA	R080 R082
548 2400 218	RES 150 OHM 1/2W 1%	4.0 EA	R040 R041 R108 R120
548 2400 226	RES 182 OHM 1/2W 1%	2.0 EA	R083 R085
548 2400 242	RES 267 OHM 1/2W 1%	1.0 EA	R086
548 2400 247	RES 301 OHM 1/2W 1%	3.0 EA	R012 R014 R042
548 2400 266	RES 475 OHM 1/2W 1%	1.0 EA	R006
548 2400 301	RES 1K OHM 1/2W 1%	12.0 EA	R001 R020 R021 R024 R057 R066 R069 R075 R076 R078 R079 R095
548 2400 318	RES 1.5K OHM 1/2W 1%	3.0 EA	R011 R093 R107
548 2400 321	RES 1.62K OHM 1/2W 1%	1.0 EA	R003
548 2400 334	RES 2.21K OHM 1/2W 1%	1.0 EA	R002

548 2400 351	RES 3.32K OHM 1/2W 1%	2.0 EA	R004 R010
548 2400 358	RES 3.92K OHM 1/2W 1%	2.0 EA	R092 R105
548 2400 366	RES 4.75K OHM 1/2W 1%	3.0 EA	R019 R110 R111
548 2400 369	RES 5.11K OHM 1/2W 1%	2.0 EA	R073 R074
548 2400 373	RES 5.62K OHM 1/2W 1%	3.0 EA	R027 R028 R055
548 2400 386	RES 7.68K OHM 1/2W 1%	2.0 EA	R018 R053
548 2400 401	RES 10K OHM 1/2W 1%	21.0 EA	R022 R023 R043 R044 R045 R046 R047 R048 R050 R051 R052 R060 R062 R063 R068 R098 R099 R100 R101 R103 R104
548 2400 442	RES 26.7K OHM 1/2W 1%	2.0 EA	R094 R106
548 2400 451	RES 33.2K OHM 1/2W 1%	4.0 EA	R090 R091 R096 R097
548 2400 469	RES 51.1K OHM 1/2W 1%	1.0 EA	R089
548 2400 501	RES 100K OHM 1/2W 1%	1.0 EA	R077
548 2400 547	RES 301K OHM 1/2W 1%	2.0 EA	R025 R026
550 0970 000	POT 1K OHM 1/2W 10%	4.0 EA	R049 R058 R061 R067
604 0469 000	SW TGL SPDT	1.0 EA	S002
610 0900 000	HEADER 3 CKT STRAIGHT	6.0 EA	J005 J007 J008 J009 J010 J011
610 0933 000	JUMPER, PWB TEST POINT	1.0 EA	TP001
612 1184 000	SHUNT JUMPER 0.1" CENTERS	6.0 EA	P005 P007 P008 P009 P010 P011
620 0700 000	*RECPT, MALE SMB,PC MOUNT	5.0 EA	J001 J002 J003 J004 J006
839 7900 479	SCH, AURAL CONVERTER	0.0 EA	
843 4999 355	PWB, AURAL CNVTR	1.0 EA	
939 7900 545	SHIELD PC BOARD	1.0 EA	
943 4999 176	COVER, PC BD	1.0 EA	
999 2559 002	HARDWARE LIST	1.0 EA	

Table 7-13. VSB/IF AGC BD - 992 8324 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 1881 000	EJECTOR KIT CARD	1.0 EA	
380 0114 000	*XSTR, NPN, 2N5109 ESD	5.0 EA	Q003 Q005 Q006 Q101 Q102
380 0152 000	XSTR, D40C5 ESD	1.0 EA	Q004
380 0189 000	XSTR, NPN 2N3904 ESD	2.0 EA	Q001 Q002
382 0428 000	IC, LM358 ESD	1.0 EA	U101
384 0321 000	*DIODE 5082-2800 ESD	1.0 EA	CR011
384 0355 000	DIODE HP5082-3081/A5S139 ESD	1.0 EA	CR101
384 0361 000	DIODE HP5082-3077/A5S377 ESD	6.0 EA	CR001 CR002 CR003 CR004 CR005 CR006
384 0431 000	RECT. 1N4001 ESD	1.0 EA	CR007
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR009 CR010
384 0838 000	TRANSZORB 1N6380 36V 5W ESD	1.0 EA	CR008
404 0198 000	SPACER TO-5, TO-9, TO-11	5.0 EA	XQ003 XQ005 XQ006 XQ101 XQ102
404 0513 000	HEAT SINK PA1-1CB	1.0 EA	Q004
404 0673 000	SOCKET 8 PIN DIP (DL)	1.0 EA	XU101
404 0725 000	HEAT SINK TO-5 CASE	3.0 EA	Q003 Q005 Q006
478 0392 000	XFMR, RF MODEL T4-1	3.0 EA	T001 T002 T101
484 0336 000	SAW FILTER ESD	1.0 EA	FL001
494 0239 000	CHOKE WIDE BAND	1.0 EA	L102
494 0398 000	CHOKE RF 10.0UH +/- 10%	2.0 EA	L001 L003
500 0801 000	CAP, MICA, 2PF 500V +/- .5PF	1.0 EA	C026
500 0826 000	CAP, MICA, 120PF 500V 5%	1.0 EA	C107
500 0844 000	CAP, MICA, 1000PF 100V 5%	1.0 EA	C008
516 0059 000	CAP, DISC .0015UF 1KV 10%	18.0 EA	C001 C002 C006 C007 C011 C017 C021 C022 C027 C028 C029 C030 C031 C101 C103 C106 C108 C114
516 0067 000	CAP DISC .003UF 1KV 20%	4.0 EA	C005 C010 C012 C018

516 0074 000	CAP, DISC .005UF 1KV 20%	1.0 EA	C016
516 0375 000	CAP .01UF 50V -20/+80% Z5U	6.0 EA	C019 C023 C024 C025 C102 C104
516 0453 000	CAP .1UF 100V 20% X7R	5.0 EA	C003 C004 C013 C014 C112
516 0556 000	CAP .33UF 100V 20%	1.0 EA	C115
522 0548 000	CAP 10UF 50V 20%	3.0 EA	C040 C041 C042
526 0342 000	CAP 2.7UF 35V 10%	3.0 EA	C015 C105 C111
548 2400 042	RES 2.67 OHM 1/2W 1%	1.0 EA	R114
548 2400 085	RES 7.5 OHM 1/2W 1%	2.0 EA	R006 R008
548 2400 109	RES 12.1 OHM 1/2W 1%	1.0 EA	R013
548 2400 118	RES 15 OHM 1/2W 1%	1.0 EA	R112
548 2400 126	RES 18.2 OHM 1/2W 1%	1.0 EA	R031
548 2400 169	RES 51.1 OHM 1/2W 1%	3.0 EA	R001 R021 R023
548 2400 181	RES 68.1 OHM 1/2W 1%	1.0 EA	R032
548 2400 185	RES 75 OHM 1/2W 1%	1.0 EA	R025
548 2400 201	RES 100 OHM 1/2W 1%	3.0 EA	R026 R101 R107
548 2400 234	RES 221 OHM 1/2W 1%	3.0 EA	R022 R024 R110
548 2400 247	RES 301 OHM 1/2W 1%	1.0 EA	R109
548 2400 258	RES 392 OHM 1/2W 1%	2.0 EA	R104 R106
548 2400 266	RES 475 OHM 1/2W 1%	1.0 EA	R105
548 2400 269	RES 511 OHM 1/2W 1%	2.0 EA	R113 R118
548 2400 273	RES 562 OHM 1/2W 1%	1.0 EA	R017
548 2400 285	RES 750 OHM 1/2W 1%	2.0 EA	R002 R018
548 2400 301	RES 1K OHM 1/2W 1%	3.0 EA	R012 R128 R132
548 2400 318	RES 1.5K OHM 1/2W 1%	7.0 EA	R005 R009 R010 R011 R027 R028 R029
548 2400 330	RES 2K OHM 1/2W 1%	2.0 EA	R020 R030
548 2400 401	RES 10K OHM 1/2W 1%	8.0 EA	R003 R004 R015 R016 R102 R103 R108 R115
548 2400 434	RES 22.1K OHM 1/2W 1%	1.0 EA	R019
548 2400 466	RES 47.5K OHM 1/2W 1%	1.0 EA	R120
548 2400 601	RES 1MEG OHM 1/2W 1%	1.0 EA	R127
550 0901 000	POT 500 OHM 1/2W 10%	1.0 EA	R007
550 0942 000	POT 100K OHM 1/2 W 10%	1.0 EA	R116
558 0045 000	HTR, SAW FILTER 5W 24VDC	1.0 EA	HR001
559 0047 000	THERMISTOR 10K OHM	1.0 EA	RT001
604 0469 000	SW TGL SPDT	1.0 EA	S001
610 0679 000	PLUG, SHORTING, .25" CTRS	1.0 EA	P002
610 0900 000	HEADER 3 CKT STRAIGHT	1.0 EA	J101
610 0933 000	JUMPER, PWB TEST POINT	1.0 EA	TP001
612 0775 000	JACK, PC MT, .040 PINS	3.0 EA	E001 E002 E003
612 1184 000	SHUNT JUMPER 0.1" CENTERS	1.0 EA	P101
620 0700 000	*RECPT, MALE SMB,PC MOUNT	3.0 EA	J001 J002 J003
817 2100 362	HEATER BLANKET	2.0 EA	#HR001 ONE ON TOP ONE ON BOTTOM COVER WITH 055-0190-009 TO A MIN OF .12 DEEP
839 7900 491	SCHEM, VSB/IF AGC	0.0 EA	
843 4999 362	PWB, VSB/IF AGC	1.0 EA	
999 2573 002	HARDWARE LIST, VSB IF AGC	1.0 EA	

Table 7-14. PWB, DIFF PHASE CORR. - 992 8325 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (m)
358 1881 000	EJECTOR KIT CARD	1.0 EA	
380 0086 000	XSTR, 2N4391 ESD	2.0 EA	Q005 Q013
380 0189 000	XSTR, NPN 2N3904 ESD	1.0 EA	Q006
380 0190 000	XSTR, PNP 2N3906 ESD	5.0 EA	Q008 Q009 Q010 Q011 Q012
380 0246 000	XSTR, 2N2219A ESD	5.0 EA	Q001 Q002 Q003 Q007 Q015

380 0558 000	XSTR, 2N5566 ESD	2.0 EA	Q004 Q014
382 0366 000	IC, MC14528BCP ESD	1.0 EA	U006
382 0371 000	IC, MC7912CT ESD	1.0 EA	U003
382 0406 000	IC, MC7812CT ESD	1.0 EA	U002
382 0440 000	IC, 3083 ESD	1.0 EA	U001
382 0452 000	IC, LM311/CA311 ESD	1.0 EA	U005
382 0947 000	IC, SE5534 ESD	1.0 EA	U004
384 0205 000	DIODE SILICON 1N914/4148 ESD	6.0 EA	CR011 CR012 CR013 CR014 CR015 CR016
384 0321 000	*DIODE 5082-2800 ESD	4.0 EA	CR017 CR018 CR019 CR020
384 0431 000	RECT. 1N4001 ESD	3.0 EA	CR006 CR009 CR010
384 0659 000	DIODE HP5082-2811/A2S811 ESD	5.0 EA	CR001 CR002 CR003 CR004 CR005
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR007 CR008
404 0198 000	SPACER TO-5, TO-9, TO-11	5.0 EA	#Q001 #Q002 #Q003 #Q007 #Q015
404 0660 000	HEAT SINK	2.0 EA	XQ004 XQ014
404 0673 000	SOCKET 8 PIN DIP (DL)	2.0 EA	#U004 #U005
404 0675 000	SOCKET IC 16 CONT	2.0 EA	#U001 #U006
494 0398 000	CHOKE RF 10.0UH +/- 10%	1.0 EA	L002
494 0413 000	CHOKE RF 330.0UH	2.0 EA	L001 L003
500 0817 000	CAP, MICA, 47PF 500V 5%	2.0 EA	C027 C036
500 0842 000	CAP, MICA, 820PF 300V 5%	1.0 EA	C033
508 0412 000	CAP .047UF 200V 5%	2.0 EA	C014 C045
508 0558 000	CAP TRIMMER 5-60 PF	1.0 EA	C001
508 0559 000	CAP TRIMMER 3.5 - 38 PF	1.0 EA	C048
516 0453 000	CAP .1UF 100V 20% X7R	15.0 EA	C021 C022 C023 C024 C026 C028 C029 C031 C032 C034 C035 C037 C040 C041 C042
516 0736 000	CAP .001UF 10% 100V X7R	2.0 EA	C015 C016
522 0548 000	CAP 10UF 50V 20%	4.0 EA	C025 C030 C038 C039
522 0550 000	CAP 100UF 25V 20%	19.0 EA	C002 C003 C004 C005 C006 C007 C008 C009 C010 C011 C012 C013 C017 C018 C019 C043 C044 C046 C047
540 0326 000	* RES 560 OHM 1W 5%	2.0 EA	R066 R110
548 2400 047	RES 3.01 OHM 1/2W 1%	2.0 EA	R053 R054
548 2400 166	RES 47.5 OHM 1/2W 1%	9.0 EA	R002 R011 R012 R034 R061 R064 R068 R087 R107
548 2400 185	RES 75 OHM 1/2W 1%	7.0 EA	R039 R040 R067 R073 R105 R106 R109
548 2400 201	RES 100 OHM 1/2W 1%	8.0 EA	R008 R009 R037 R041 R043 R099 R101 R103
548 2400 209	RES 121 OHM 1/2W 1%	2.0 EA	R065 R108
548 2400 230	RES 200 OHM 1/2W 1%	1.0 EA	R035
548 2400 247	RES 301 OHM 1/2W 1%	2.0 EA	R006 R007
548 2400 266	RES 475 OHM 1/2W 1%	2.0 EA	R038 R104
548 2400 269	RES 511 OHM 1/2W 1%	1.0 EA	R017
548 2400 273	RES 562 OHM 1/2W 1%	1.0 EA	R005
548 2400 285	RES 750 OHM 1/2W 1%	6.0 EA	R018 R019 R020 R052 R059 R063
548 2400 301	RES 1K OHM 1/2W 1%	16.0 EA	R013 R014 R015 R016 R026 R027 R028 R029 R031 R032 R036 R047 R049 R056 R058 R102
548 2400 309	RES 1.21K OHM 1/2W 1%	2.0 EA	R004 R033
548 2400 318	RES 1.5K OHM 1/2W 1%	1.0 EA	R071
548 2400 330	RES 2K OHM 1/2W 1%	3.0 EA	R062 R069 R088
548 2400 342	RES 2.67K OHM 1/2W 1%	1.0 EA	R077
548 2400 347	RES 3.01K OHM 1/2W 1%	1.0 EA	R072
548 2400 354	RES 3.57K OHM 1/2W 1%	1.0 EA	R083
548 2400 358	RES 3.92K OHM 1/2W 1%	1.0 EA	R080
548 2400 366	RES 4.75K OHM 1/2W 1%	8.0 EA	R024 R025 R030 R050 R055 R079 R081 R086

548 2400 401	RES 10K OHM 1/2W 1%	9.0 EA	R001 R003 R010 R042 R070 R074 R075 R076 R100
548 2400 418	RES 15K OHM 1/2W 1%	1.0 EA	R082
548 2400 466	RES 47.5K OHM 1/2W 1%	1.0 EA	R085
548 2400 530	RES 200K OHM 1/2W 1%	1.0 EA	R078
550 0628 000	POT 10K OHM .5W 10%	5.0 EA	R021 R022 R023 R051 R060
550 0865 000	POT 1K OHM 1/2W 10%	1.0 EA	R084
550 0899 000	POT 2K OHM 1/2W	5.0 EA	R044 R045 R046 R048 R057
604 0859 000	SW, TGL DPDT	1.0 EA	S001
610 0900 000	HEADER 3 CKT STRAIGHT	1.0 EA	J001
610 0933 000	JUMPER, PWB TEST POINT	8.0 EA	TP001 TP002 TP003 TP004 TP005 TP006 TP007 TP008
612 1184 000	SHUNT JUMPER 0.1" CENTERS	1.0 EA	P001
620 0700 000	*RECPT, MALE SMB,PC MOUNT	1.0 EA	J002
839 7900 490	SCHEM DIFF PHASE CORR	0.0 EA	
843 4999 363	PWB, DIFF PHASE	1.0 EA	
999 2562 001	HARDWARE LIST	1.0 EA	

Table 7-15. CMR FILTER MODULE - 992 8326 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (a)
612 0200 000	RECEPTACLE 3 CONTACT	1.0 EA	J008
839 7900 502	SCHEMATIC, CMR FILTER	0.0 EA	
843 4999 327	COVER TOP FILTER ASSY	1.0 EA	
843 4999 328	COVER TOP DUAL SOUND ASSY	1.0 EA	
917 2100 510	PC ASSY FIL BOX	1.0 EA	
917 2100 511	PC ASSY FIL BOX W/TOROID	1.0 EA	
939 7900 842	CABLE, FILTER BOX	1.0 EA	
943 4999 326	COVER, BOTTOM FILTER ASSY	1.0 EA	
943 4999 329	COVER BOT DUAL SD ASSY	1.0 EA	
999 2648 001	HARDWARE LIST	1.0 EA	

Table 7-16. PC ASSY FIL BOX - 917 2100 510

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (e)
354 0309 000	TERM SOLDER	3.0 EA	
384 0799 000	DIODE, BIPOLAR ESD	2.0 EA	CR002 CR005
516 0736 000	CAP .001UF 10% 100V X7R	4.0 EA	C002 C004 C006 C008
516 0891 000	CAP 0.100UF 10% 50V	4.0 EA	C001 C003 C005 C007
612 1268 000	RECEPTACLE RT ANG BNC	4.0 EA	J004 J004A J005 J005A
843 4999 354	PWB, FILTER BD.	1.0 EA	
922 0900 368	DIVIDER SHLD FILTER	2.0 EA	
922 0900 369	TOROID ASSY DIV SHLD	2.0 EA	

Table 7-17. PC ASSY FIL BOX W/TOROID - 917 2100 511

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (e)
354 0309 000	TERM SOLDER	3.0 EA	
384 0799 000	DIODE, BIPOLAR ESD	3.0 EA	CR003 CR008 CR011
516 0736 000	CAP .001UF 10% 100V X7R	5.0 EA	C002 C004 C006 C008 C010
516 0891 000	CAP 0.100UF 10% 50V	5.0 EA	C001 C003 C005 C007 C009
612 1268 000	RECEPTACLE RT ANG BNC	4.0 EA	J004 J004A J005 J005A
843 4999 354	PWB, FILTER BD.	1.0 EA	
922 0900 368	DIVIDER SHLD FILTER	2.0 EA	
922 0900 369	TOROID ASSY DIV SHLD	2.0 EA	

922 0900 370 TOROID FILTER PC BD 1.0 EA

Table 7-18. POWER SUPPLY EXT - 992 8327 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (h)
354 0624 000	TERMINAL, MALE	10.0 EA	
358 2995 000	END PLATE, 261 TERM BD	1.0 EA	
358 3226 000	INSULATING COVER, PLASTIC	5.0 EA	
382 1031 000	IC, LM338K ESD	3.0 EA	U001 U002 U004
382 1049 000	IC, LT1033/LM333 ESD	2.0 EA	U003 U005
410 0391 000	INSULATOR TRANSISTOR T03	5.0 EA	
414 0240 000	CORE BALUN	10.0 EA	L001 L002 L003 L004 L005 L006 L007 L008 L009 L010
472 1665 000	TRANSFORMER, POWER TOROID	1.0 EA	
484 0379 000	RFI POWER LINE FILTER	1.0 EA	FL001
508 0561 000	EMI FILTER FEEDTHRU	5.0 EA	FL002 FL003 FL004 FL005 FL006
560 0036 000	MOV 6500A 80J 150 VAC	2.0 EA	RV001 RV002
606 0834 000	CIRCUIT BREAKER 4A 250V	1.0 EA	CB001
612 0885 000	RECEPTACLE HOUSING	1.0 EA	J011
612 0978 000	HOUSING, RECPT 12 CKT	1.0 EA	
614 0786 000	TERM BD, 2C MODULAR 261	5.0 EA	#TB001
614 0787 000	TERM BD, 4C MODULAR 261	5.0 EA	#TB001
839 7900 504	SCHEM, POWER SUPPLY	0.0 EA	
922 0900 181	CABLE, EXC P.S.	1.0 EA	W019
939 7900 487	COVER PWR SUPPLY - TOP	1.0 EA	
943 4999 335	COVER PWR SUPPLY	1.0 EA	
943 5285 200	PWR SUPPLY EXCITER	1.0 EA	
943 5285 201	ANGLE, FILTER MTG	1.0 EA	
992 8021 001	PWB, POWER SUPPLY	1.0 EA	
999 2651 001	HARDWARE LIST	1.0 EA	
999 2652 001	WIRE/TUBING LIST	1.0 EA	

Table 7-19. PWB, POWER SUPPLY - 992 8021 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (k)
354 0336 000	TERMINAL, SOLDER	10.0 EA	E001 E002 E003 E004 E005 E006 E007 E008 E009 E010
354 0688 000	TERM, SOCKET, 0.093" DIA	12.0 EA	
384 0597 000	RECT 1N4002 ESD	10.0 EA	CR004 CR005 CR006 CR007 CR008 CR009 CR010 CR011 CR012 CR013
384 0702 000	RECT FW BRIDGE 600V 35A ESD	3.0 EA	CR001 CR002 CR003
404 0803 000	HEATSINK FOR BRIDGE	3.0 EA	#CR001 #CR002 #CR003
404 0804 000	TRANSISTOR SOCKET	5.0 EA	XU001 XU002 XU003 XU004 XU005
516 0453 000	CAP .1UF 100V 20% X7R	5.0 EA	C021 C022 C023 C024 C025
522 0548 000	CAP 10UF 50V 20%	5.0 EA	C006 C007 C008 C009 C010
522 0567 000	CAPACITOR 8200 MFD 16V	2.0 EA	C004 C005
522 0568 000	CAPACITOR 6800UF 50V 20%	3.0 EA	C001 C002 C003
522 0569 000	CAP 100UF 50V 20%	5.0 EA	C016 C017 C018 C019 C020
526 0318 000	CAP 10UF 35V 20%	5.0 EA	C011 C012 C013 C014 C015
540 0336 000	* RES 1.5K OHM 1W 5%	2.0 EA	R025 R026
540 0338 000	* RES 1.8K OHM 1W 5%	2.0 EA	R023 R024
540 0345 000	* RES 3.6K OHM 1W 5%	2.0 EA	R021 R022
548 2400 219	RES 154 OHM 1/2W 1%	5.0 EA	R001 R002 R003 R004 R005
548 2400 258	RES 392 OHM 1/2W 1%	2.0 EA	R009 R010

548 2400 319	RES 1.54K OHM 1/2W 1%	2.0 EA	R007 R008
548 2400 339	RES 2.49K OHM 1/2W 1%	1.0 EA	R006
550 0625 000	POT, 500 OHM .5W 10%	3.0 EA	R016 R017 R018
550 0812 000	POT 100 OHM 1/2W 10%	2.0 EA	R019 R020
610 0833 000	HOUSING, PLUG 12 POS	1.0 EA	J001
843 4999 069	PWB, POWER SUPPLY	1.0 EA	

Table 7-20. MODULE FINAL AMPL - 992 8328 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (c)
304 0089 000	NUT, HEX 6-32	6.0 EA	#USED AS SPACERS FOR PC BOARD TO KEEP OFF OF HEATSINK
382 0734 000	*IC, CA2830C/MHW592 ESD	2.0 EA	U001 U002
620 0571 000	RECEP. BNC UG535-U	2.0 EA	J001 J002
939 7900 499	BRKT GND FINAL AMP	2.0 EA	
939 7900 500	SPACER CONN/GND BRKT	2.0 EA	
943 4999 033	HEATSINK, RF AMP	1.0 EA	
943 4999 357	COVER FINAL AMP	1.0 EA	
992 7093 001	PWB, FINAL AMP	1.0 EA	
999 2567 001	HARDWARE LIST	1.0 EA	

Table 7-21. PWB, FINAL AMP - 992 7093 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (p)
382 0411 000	IC, PSC-2-1 ESD	2.0 EA	HY001 HY002
382 0594 000	*IC TL074ACN ESD	1.0 EA	U004
382 0746 000	IC, 79L05AC ESD	1.0 EA	U006
382 1126 000	IC 78L12A ESD	1.0 EA	U005
383 0189 000	IC, SA5205A ESD	1.0 EA	U003
384 0321 000	*DIODE 5082-2800 ESD	2.0 EA	CR005 CR006
384 0355 000	DIODE HP5082-3081/A5S139 ESD	3.0 EA	CR002 CR003 CR004
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	2.0 EA	CR007 CR008
384 0838 000	TRANSZORB 1N6380 36V 5W ESD	1.0 EA	CR009
386 0081 000	ZENER 1N4729A ESD	1.0 EA	CR001
404 0673 000	SOCKET 8 PIN DIP (DL)	1.0 EA	XU003
404 0674 000	SOCKET 14 PIN DIP (D-L)	1.0 EA	XU004
404 0873 000	SOCKET ADAPTER SOIC8-DIP8	1.0 EA	#U003
494 0262 000	CHOKE RF 10UH 10%	1.0 EA	L003
494 0390 000	CHOKE RF 3.30UH	2.0 EA	L001 L002
494 0398 000	CHOKE RF 10.0UH +/- 10%	1.0 EA	L004
516 0453 000	CAP .1UF 100V 20% X7R	15.0 EA	C007 C008 C009 C012 C014 C015 C016 C017 C018 C019 C023 C026 C028 C029 C030
516 0516 000	CAP 1UF 100V 20%	2.0 EA	C020 C021
516 0530 000	CAP .01UF 10% 100V X7R	11.0 EA	C001 C002 C003 C004 C005 C006 C022 C024 C025 C027 C031
526 0097 000	CAP 47UF 35V 20%	2.0 EA	C011 C013
526 0358 000	CAP 22UF 35V 10%	1.0 EA	C010
548 2400 169	RES 51.1 OHM 1/2W 1%	2.0 EA	R014 R015
548 2400 201	RES 100 OHM 1/2W 1%	1.0 EA	R017
548 2400 230	RES 200 OHM 1/2W 1%	1.0 EA	R016
548 2400 301	RES 1K OHM 1/2W 1%	3.0 EA	R004 R006 R007
548 2400 330	RES 2K OHM 1/2W 1%	1.0 EA	R002
548 2400 385	RES 7.5K OHM 1/2W 1%	1.0 EA	R001
548 2400 401	RES 10K OHM 1/2W 1%	1.0 EA	R005
548 2400 442	RES 26.7K OHM 1/2W 1%	1.0 EA	R003

548 2400 469	RES 51.1K OHM 1/2W 1%	4.0 EA	R008 R009 R010 R011
548 2400 701	RES 10MEG OHM 1/2W 1%	2.0 EA	R012 R013
610 0679 000	PLUG, SHORTING, .25" CTRS	1.0 EA	P001
610 0978 000	HDR 10C 2ROW RT ANG	1.0 EA	J003
612 0904 000	JACK, PC MT GOLD PLATED	3.0 EA	#3 PINS USED WITH P001
620 2518 000	DIR COUPLER, .5-500 MHZ	1.0 EA	DC001
839 7900 023	SCHEM, FINAL AMP	0.0 EA	
843 4999 031	PWB, FINAL AMP	1.0 EA	

Table 7-22. PWB, EXTENDER CARD - 992 8329 001

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (c)</i>
358 1881 000	EJECTOR KIT CARD	1.0 EA	
358 2612 000	BLOCK, MOUNTING	1.0 EA	
384 0661 000	LED, GRN, T 1-3/4, RT ANG ESD	5.0 EA	DS001 DS002 DS003 DS004 DS005
540 1600 210	RES 240 OHM 3W 5%	2.0 EA	R004 R005
540 1600 222	RES 750 OHM 3W 5%	2.0 EA	R002 R003
540 1600 303	RES 1.2K OHM 3W 5%	1.0 EA	R001
610 0933 000	JUMPER, PWB TEST POINT	1.0 EA	TP001
612 1225 000	CONN, PC EDGE 28 POS DUAL	1.0 EA	J001
839 7900 172	SCHEM, EXCITER EXTENDER	0.0 EA	
843 4999 364	PWB, EXTENDER CARD	1.0 EA	

Table 7-23. PWB, SYNTHESIZER BD #1 - 992 8347 001

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (p)</i>
358 1881 000	EJECTOR KIT CARD	1.0 EA	
358 1928 000	JUMPER 1/4 LG 1/8H	11.0 EA	JP001 JP002 JP003 JP004 JP005 JP006 JP007 JP008 JP009 JP010 JP012
380 0116 000	XSTR, 2N3866 ESD	3.0 EA	Q001 Q002 Q003
380 0189 000	XSTR, NPN 2N3904 ESD	3.0 EA	Q004 Q005 Q007
380 0190 000	XSTR, PNP 2N3906 ESD	1.0 EA	Q006
382 0184 000	IC, 340T-5/7805 +5V REG ESD	1.0 EA	U016
382 0521 000	IC, 339 ESD	1.0 EA	U003
382 0605 000	IC 7905C ESD	1.0 EA	U012
382 0690 000	IC 10131 ESD	1.0 EA	U006
382 0692 000	IC 10136 ESD	2.0 EA	U007 U010
382 0749 000	IC NE5532A ESD	1.0 EA	U011
382 0868 000	IC MC145151P2 ESD	1.0 EA	U002
382 1217 000	IC 1036 ESD	1.0 EA	U001
382 1221 000	IC 10216 ESD	4.0 EA	U004 U005 U008 U009
382 1228 000	IC NE 602 ESD	1.0 EA	U014
382 1230 000	IC NE 592 ESD	2.0 EA	U013 U015
384 0205 000	DIODE SILICON 1N914/4148 ESD	9.0 EA	CR003 CR005 CR006 CR007 CR008 CR010 CR011 CR012 CR015
384 0661 000	LED, GRN, T 1-3/4, RT ANG ESD	1.0 EA	DS001
404 0198 000	SPACER TO-5, TO-9, TO-11	3.0 EA	Q001 Q002 Q003
444 2958 000	XTAL 8 MHZ	1.0 EA	Y002
444 2959 000	XTAL 10 MHZ	1.0 EA	Y001
444 2960 000	XTAL 16 MHZ	1.0 EA	Y003
478 0392 000	XFMR, RF MODEL T4-1	1.0 EA	T001
492 0777 000	IND, VAR 2.2UH NOM	1.0 EA	L004
492 0778 000	IND VAR .288UH NOM	1.0 EA	L007
492 0779 000	IND VAR .33UH NOM	3.0 EA	L017 L018 L019
492 0780 000	IND VAR 1.23UH NOM	1.0 EA	L001

494 0379 000	CHOKE RF 0.39UH	1.0 EA	L015
494 0392 000	CHOKE RF 4.70UH	1.0 EA	L016
494 0398 000	CHOKE RF 10.0UH +/- 10%	2.0 EA	L012 L013
494 0399 000	CHOKE RF 12.0UH	2.0 EA	L006 L008
494 0402 000	CHOKE RF 22.0UH	3.0 EA	L002 L003 L014
494 0403 000	CHOKE RF 27.0UH	1.0 EA	L020
494 0465 000	IND, 2.7UH 5%	1.0 EA	L005
494 0468 000	IND 1,200 UH 10%	1.0 EA	L010
494 0469 000	IND 1,500 UH 10%	1.0 EA	L009
494 0470 000	IND 8,200 UH 10%	1.0 EA	L011
500 1253 000	CAP 5PF 100V +/- .5PF	2.0 EA	C134 C140
500 1268 000	CAP 33PF 500V 5%	1.0 EA	C028
500 1271 000	CAP 43PF 100V 5%	2.0 EA	C110 C112
500 1281 000	CAP 100PF 300V 5%	2.0 EA	C019 C107
500 1285 000	CAP 150PF 500V 5%	1.0 EA	C020
500 1287 000	CAP 180PF 500V 5%	1.0 EA	C026
500 1289 000	CAP 220PF 300V 5%	1.0 EA	C014
500 1292 000	CAP 300PF 300V 5%	1.0 EA	C126
506 0230 000	CAP .001UF 100VAC 5%	3.0 EA	C113 C114 C122
506 0234 000	CAP .0022UF 100V 5%	1.0 EA	C124
506 0236 000	CAP .0047UF 100/63V 5%	1.0 EA	C121
506 0239 000	CAP .022UF 100V 5%	2.0 EA	C116 C117
506 0254 000	CAP .0082UF 100V 5%	1.0 EA	C123
506 0263 000	CAP .0039UF 100V 5%	1.0 EA	C125
516 0417 000	CAP 1000PF 10% 200V	3.0 EA	C013 C103 C132
516 0530 000	CAP .01UF 10% 100V X7R	3.0 EA	C034 C039 C040
516 0767 000	CAP 15PF 5% 100V C0G	1.0 EA	C033
516 0768 000	CAP 18PF 5% 100V C0G	2.0 EA	C133 C136
516 0769 000	CAP 22PF 5% 100V C0G	1.0 EA	C137
516 0770 000	CAP 27PF 5% 100V C0G	2.0 EA	C135 C138
516 0773 000	CAP 47PF 5% 100V C0G	1.0 EA	C139
516 0782 000	CAP 270PF 5% 100V C0G	1.0 EA	C035
516 0831 000	CAP 0.010UF 10% 100V	17.0 EA	C003 C005 C007 C012 C015 C016 C036 C052 C053 C054 C055 C104 C105 C108 C109 C111 C130
516 0891 000	CAP 0.100UF 10% 50V	25.0 EA	C001 C004 C006 C008 C009 C010 C011 C017 C018 C021 C022 C023 C024 C025 C027 C029 C030 C031 C032 C045 C101 C115 C120 C128 C129
516 0906 000	CAP 33PF 10% 200V	2.0 EA	C118 C119
516 0907 000	CAP 0.330UF 10% 50V	3.0 EA	C050 C051 C102
516 0910 000	CAP 820PF 10% 200V	1.0 EA	C106
518 0057 000	CAP, VAR 9-35PF	1.0 EA	C038
526 0050 000	CAP 1UF 35V 20%	5.0 EA	C048 C049 C100 C127 C131
526 0311 000	CAP 2.2UF 35V 10%	1.0 EA	C002
526 0358 000	CAP 22UF 35V 10%	1.0 EA	C037
528 0037 000	DIODE, VARACTOR BB505	3.0 EA	CR004 CR013 CR014
548 2400 142	RES 26.7 OHM 1/2W 1%	4.0 EA	R050 R061 R133 R134
548 2400 151	RES 33.2 OHM 1/2W 1%	2.0 EA	R039 R063
548 2400 166	RES 47.5 OHM 1/2W 1%	5.0 EA	R043 R047 R051 R068 R138
548 2400 169	RES 51.1 OHM 1/2W 1%	1.0 EA	R035
548 2400 173	RES 56.2 OHM 1/2W 1%	1.0 EA	R017
548 2400 189	RES 82.5 OHM 1/2W 1%	5.0 EA	R023 R024 R025 R034 R062
548 2400 201	RES 100 OHM 1/2W 1%	3.0 EA	R002 R030 R031
548 2400 209	RES 121 OHM 1/2W 1%	1.0 EA	R108
548 2400 230	RES 200 OHM 1/2W 1%	2.0 EA	R139 R140

548 2400 234	RES 221 OHM 1/2W 1%	4.0 EA	R131 R132 R136 R137
548 2400 247	RES 301 OHM 1/2W 1%	1.0 EA	R126
548 2400 251	RES 332 OHM 1/2W 1%	1.0 EA	R054
548 2400 266	RES 475 OHM 1/2W 1%	8.0 EA	R019 R036 R105 R106 R109 R120 R121 R129
548 2400 268	RES 499 OHM 1/2W 1%	2.0 EA	R115 R116
548 2400 273	RES 562 OHM 1/2W 1%	2.0 EA	R032 R033
548 2400 281	RES 681 OHM 1/2W 1%	15.0 EA	R015 R037 R038 R042 R044 R048 R049 R052 R056 R058 R059 R060 R064 R065 R066
548 2400 289	RES 825 OHM 1/2W 1%	1.0 EA	R055
548 2400 301	RES 1K OHM 1/2W 1%	5.0 EA	R018 R045 R046 R057 R130
548 2400 309	RES 1.21K OHM 1/2W 1%	1.0 EA	R128
548 2400 318	RES 1.5K OHM 1/2W 1%	1.0 EA	R027
548 2400 326	RES 1.82K OHM 1/2W 1%	1.0 EA	R107
548 2400 330	RES 2K OHM 1/2W 1%	5.0 EA	R003 R004 R112 R113 R119
548 2400 334	RES 2.21K OHM 1/2W 1%	1.0 EA	R022
548 2400 342	RES 2.67K OHM 1/2W 1%	1.0 EA	R118
548 2400 351	RES 3.32K OHM 1/2W 1%	2.0 EA	R021 R026
548 2400 366	RES 4.75K OHM 1/2W 1%	3.0 EA	R029 R111 R114
548 2400 381	RES 6.81K OHM 1/2W 1%	1.0 EA	R020
548 2400 401	RES 10K OHM 1/2W 1%	7.0 EA	R008 R009 R010 R014 R028 R123 R124
548 2400 418	RES 15K OHM 1/2W 1%	2.0 EA	R005 R127
548 2400 426	RES 18.2K OHM 1/2W 1%	4.0 EA	R053 R067 R102 R125
548 2400 430	RES 20K OHM 1/2W 1%	1.0 EA	R122
548 2400 466	RES 47.5K OHM 1/2W 1%	1.0 EA	R117
548 2400 468	RES 49.9K OHM 1/2W 1%	1.0 EA	R006
548 2400 481	RES 68.1K OHM 1/2W 1%	1.0 EA	R016
548 2400 501	RES 100K OHM 1/2W 1%	1.0 EA	R013
550 1074 000	POT 20K OHM .75W 10%	1.0 EA	R001
620 0700 000	*RECPT, MALE SMB,PC MOUNT	6.0 EA	J001 J002 J003 J004 J005 J006
700 1271 000	OCXO 10 MHZ	1.0 EA	Y004
817 2199 001	SPEC, TEST PROCEDURE	0.0 EA	
839 7900 528	SCHEM, FREQ SYNTH CARD #1	0.0 EA	
843 4999 375	PWB, SYNTHESIZER BD #1	1.0 EA	
939 7900 540	SHIELD PC BOARD	1.0 EA	
999 2664 001	HARDWARE LIST	1.0 EA	

Table 7-24. PWB, SYNTHESIZER BD #2 - 992 8348 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (I)
358 1881 000	EJECTOR KIT CARD	1.0 EA	
358 1928 000	JUMPER 1/4 LG 1/8H	26.0 EA	
382 0411 000	IC, PSC-2-1 ESD	1.0 EA	HY001
382 0648 000	IC, LM339A ESD	1.0 EA	U001
382 0690 000	IC 10131 ESD	1.0 EA	U004
382 0907 000	IC MC145152P2 ESD	1.0 EA	U006
382 1126 000	IC 78L12A ESD	1.0 EA	U003
382 1218 000	IC 1007 ESD	1.0 EA	U002
382 1219 000	IC 1028 ESD	1.0 EA	U025
382 1220 000	IC 10E016 ESD	1.0 EA	U027
382 1221 000	IC 10216 ESD	1.0 EA	U026
382 1222 000	IC 12090 ESD	2.0 EA	U028 U035
382 1223 000	IC 12013 ESD	1.0 EA	U007
382 1224 000	IC 12040 ESD	1.0 EA	U024
382 1225 000	IC, ASK-1 ESD	2.0 EA	U016 U017
382 1226 000	IC MSC-2-1W ESD	2.0 EA	U018 U032
382 1227 000	IC 12009 ESD	1.0 EA	U008

382 1229 000	IC 10198 ESD	1.0 EA	U029
382 1231 000	IC MWA-130 ESD	1.0 EA	U022
382 1232 000	IC MWA-230 ESD	2.0 EA	U033 U036
382 1233 000	IC JH-139 ESD	1.0 EA	HY003
382 1234 000	IC V105L001 ESD	1.0 EA	U005
382 1235 000	IC M2009706 ESD	1.0 EA	U030
382 1237 000	IC JH-113 ESD	1.0 EA	HY002
383 0189 000	IC, SA5205A ESD	3.0 EA	U009 U010 U020
384 0205 000	DIODE SILICON 1N914/4148 ESD	3.0 EA	CR003 CR005 CR006
384 0659 000	DIODE HP5082-2811/A2S811 ESD	2.0 EA	CR001 CR002
384 0725 000	RECT 1N5818 ESD	1.0 EA	CR009
386 0078 000	ZENER, 1N4734A 5.6V ESD	1.0 EA	CR007
386 0163 000	ZENER, 1N4735A 6.2V ESD	1.0 EA	CR004
404 0198 000	SPACER TO-5, TO-9, TO-11	3.0 EA	XU022 XU033 XU036
404 0873 000	SOCKET ADAPTER SOIC8-DIP8	3.0 EA	#U009 #U010 #U020
478 0392 000	XFMR, RF MODEL T4-1	1.0 EA	T001
484 0392 000	FILTER, LOW PASS 21.4MHZ	1.0 EA	U014
492 0781 000	IND VAR 1000UH NOM	1.0 EA	L007
492 0782 000	IND VAR 3900UH NOM	2.0 EA	L005 L012
492 0783 000	IND VAR 2.2MH NOM	1.0 EA	L003
492 0784 000	IND VAR 1.5MH NOM	1.0 EA	L002
494 0238 000	CHOKERF 39UH	1.0 EA	L004
494 0390 000	CHOKERF 3.30UH	2.0 EA	L008 L009
494 0398 000	CHOKERF 10.0UH +/- 10%	1.0 EA	L010
494 0418 000	CHOKERF 820.0UH	1.0 EA	L006
494 0446 000	CHOKERF POWER LINE 100UH	1.0 EA	L011
494 0467 000	IND 8.2UH 10%	1.0 EA	L001
500 1293 000	CAP 330PF 100V 5%	1.0 EA	C056
500 1295 000	CAP 390PF 100V 5%	1.0 EA	C089
500 1300 000	CAP 620PF 100V 5%	3.0 EA	C034 C054 C057
506 0231 000	CAP .0015UF 63V 5%	2.0 EA	C036 C058
506 0234 000	CAP .0022UF 100V 5%	1.0 EA	C033
506 0235 000	CAP .0033UF 100V 5%	2.0 EA	C053 C055
506 0237 000	CAP .0068UF 100V 5%	2.0 EA	C035 C037
506 0253 000	CAP .0056UF 100V 5%	2.0 EA	C010 C011
506 0263 000	CAP .0039UF 100V 5%	1.0 EA	C090
516 0417 000	CAP 1000PF 10% 200V	10.0 EA	C007 C008 C045 C048 C066 C072 C074 C075 C077 C078
516 0827 000	CAP 4700PF 10% 100V	1.0 EA	C040
516 0831 000	CAP 0.010UF 10% 100V	12.0 EA	C001 C006 C017 C018 C020 C025 C026 C032 C039 C047 C065 C079
516 0833 000	CAP .022UF 10% 50V	2.0 EA	C044 C046
516 0834 000	CAP 0.047UF 10% 50V	2.0 EA	C043 C051
516 0891 000	CAP 0.100UF 10% 50V	29.0 EA	C002 C003 C004 C005 C009 C012 C013 C019 C021 C022 C023 C024 C038 C041 C049 C052 C061 C062 C063 C064 C067 C073 C076 C080 C081 C082 C085 C086 C087
516 0905 000	CAP 22PF 10% 200V	1.0 EA	C068
516 0906 000	CAP 33PF 10% 200V	1.0 EA	C030
516 0909 000	CAP 100PF 10% 200V	1.0 EA	C059
522 0548 000	CAP 10UF 50V 20%	3.0 EA	C014 C042 C050
522 0550 000	CAP 100UF 25V 20%	4.0 EA	C016 C027 C070 C088
526 0308 000	CAP 22UF 10V 20%	2.0 EA	C083 C084
526 0311 000	CAP 2.2UF 35V 10%	1.0 EA	C015
526 0316 000	CAP .47UF 35V 20%	1.0 EA	C060
526 0358 000	CAP 22UF 35V 10%	1.0 EA	C071

548 2400 001	RES 1 OHM 1/2W 1%	4.0 EA	R024 R025 R026 R057
548 2400 101	RES 10 OHM 1/2W 1%	1.0 EA	R056
548 2400 168	RES 49.9 OHM 1/2W 1%	7.0 EA	R022 R023 R048 R051 R055 R058 R059
548 2400 173	RES 56.2 OHM 1/2W 1%	2.0 EA	R005 R016
548 2400 185	RES 75 OHM 1/2W 1%	4.0 EA	R034 R035 R036 R037
548 2400 201	RES 100 OHM 1/2W 1%	5.0 EA	R014 R020 R021 R045 R046
548 2400 230	RES 200 OHM 1/2W 1%	1.0 EA	R030
548 2400 242	RES 267 OHM 1/2W 1%	2.0 EA	R018 R019
548 2400 251	RES 332 OHM 1/2W 1%	2.0 EA	R054 R065
548 2400 258	RES 392 OHM 1/2W 1%	8.0 EA	R028 R029 R052 R053 R060 R061 R062 R063
548 2400 268	RES 499 OHM 1/2W 1%	2.0 EA	R027 R042
548 2400 281	RES 681 OHM 1/2W 1%	2.0 EA	R006 R047
548 2400 301	RES 1K OHM 1/2W 1%	7.0 EA	R007 R008 R009 R010 R017 R033 R040
548 2400 347	RES 3.01K OHM 1/2W 1%	1.0 EA	R043
548 2400 351	RES 3.32K OHM 1/2W 1%	2.0 EA	R001 R049
548 2400 368	RES 4.99K OHM 1/2W 1%	1.0 EA	R015
548 2400 373	RES 5.62K OHM 1/2W 1%	1.0 EA	R067
548 2400 389	RES 8.25K OHM 1/2W 1%	1.0 EA	R041
548 2400 418	RES 15K OHM 1/2W 1%	2.0 EA	R011 R012
548 2400 426	RES 18.2K OHM 1/2W 1%	1.0 EA	R068
548 2400 434	RES 22.1K OHM 1/2W 1%	2.0 EA	R031 R032
548 2400 451	RES 33.2K OHM 1/2W 1%	1.0 EA	R004
548 2400 501	RES 100K OHM 1/2W 1%	2.0 EA	R002 R003
550 0935 000	POT 2K OHM 1/2W 10%	2.0 EA	R013 R044
556 0111 000	ATTEN 6DB 50 OHM	4.0 EA	U012 U013 U023 U031
556 0112 000	ATTEN 10DB 50 OHM	1.0 EA	U019
620 0700 000	*RECPT, MALE SMB,PC MOUNT	5.0 EA	J001 J002 J003 J004 J005
817 2200 001	SPEC, TEST PROCEDURE	0.0 EA	
839 7900 529	SCHEM, SYNTHESIZER BD #2	0.0 EA	
843 4999 376	PWB, SYNTHESIZER BD #2	1.0 EA	
939 2859 024	COAX CABLE, 50 OHM	1.0 EA	
939 7900 540	SHIELD PC BOARD	1.0 EA	
999 2663 001	HARDWARE LIST, PWB,SYNTHESIZER	1.0 EA	

Table 7-25. *PWA, VIDEO BOARD W/VIDEO - 992 9564 001

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (m)</i>
358 1881 000	EJECTOR KIT CARD	1.0 EA	
380 0189 000	XSTR, NPN 2N3904 ESD	11.0 EA	Q001 Q002 Q003 Q004 Q005 Q006 Q007 Q008 Q009 Q010 Q016
380 0190 000	XSTR, PNP 2N3906 ESD	2.0 EA	Q011 Q012
380 0573 000	XSTR, J309 ESD	1.0 EA	Q014
380 0578 000	XSTR, PN4258 ESD	2.0 EA	Q013 Q015
382 1379 000	IC CLC522 VGA ESD	1.0 EA	U016
382 1568 000	IC LM1881N ESD	1.0 EA	U011
382 1580 000	IC LT1252 VIDEO OPAMP ESD	9.0 EA	U001 U002 U003 U006 U008 U010 U012 U014 U015
382 1584 000	IC AD8037AN ESD	1.0 EA	U004
382 1598 000	IC 74AC00 ESD	1.0 EA	U007
382 1620 000	IC 9631 OPAMP ESD	1.0 EA	U005
382 1664 000	IC, OP AMP, TL054 ESD	1.0 EA	U013
383 0384 000	IC, 567D ESD	1.0 EA	U017
384 0205 000	DIODE SILICON 1N914/4148 ESD	8.0 EA	CR011 CR012 CR013 CR014 CR015 CR016 CR017 CR018
384 0431 000	RECT. 1N4001 ESD	2.0 EA	CR009 CR010

384 0659 000	DIODE HP5082-2811/A2S811 ESD	8.0 EA	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008
384 0719 000	TRANSZORB 1N6373 5V 5W ESD	2.0 EA	CR019 CR020
384 0780 000	LED, RED ESD	1.0 EA	DS001
404 0768 000	SOCKET 24 PIN DIP (DL)	1.0 EA	XDL001
404 0873 000	SOCKET ADAPTER SOIC8-DIP8	1.0 EA	#U017
484 0439 000	LINE, DELAY 200NS	1.0 EA	DL002
484 0445 000	LINE, DELAY 400NS	1.0 EA	DL001
492 0857 000	INDUCTOR, FIXED RF 197NH	1.0 EA	L009
494 0394 000	CHOKER 6.80UH	2.0 EA	L006 L007
494 0397 000	CHOKER RF 8.20UH	1.0 EA	L001
494 0398 000	CHOKER RF 10.0UH +/- 10%	1.0 EA	L002
494 0419 000	IND 1000UH 10%	2.0 EA	L003 L008
506 0232 000	CAP .01UF 100V 5%	1.0 EA	C074
506 0239 000	CAP .022UF 100V 5%	2.0 EA	C052 C060
516 0453 000	CAP .1UF 100V 20% X7R	21.0 EA	C001 C003 C004 C005 C008 C011 C012 C033 C043 C048 C054 C056 C061 C068 C069 C071 C072 C076 C077 C080 C081
516 0530 000	CAP .01UF 10% 100V X7R	3.0 EA	C028 C036 C073
516 0765 000	CAP 10PF 5% 100V C0G	1.0 EA	C070
516 0766 000	CAP 12PF 5% 100V C0G	2.0 EA	C020 C035
516 0769 000	CAP 22PF 5% 100V C0G	1.0 EA	C042
516 0773 000	CAP 47PF 5% 100V C0G	1.0 EA	C051
516 0777 000	CAP 100PF 5% 100V C0G	4.0 EA	C038 C039 C045 C046
516 0881 000	CAP 820PF 5% 100V C0G	1.0 EA	C015
516 0971 000	CAP 470PF 5% 100V C0G	1.0 EA	C079
516 0974 000	CAP 1000PF 5% 100V C0G	2.0 EA	C016 C029
522 0548 000	CAP 10UF 50V 20%	2.0 EA	C055 C075
522 0550 000	CAP 100UF 25V 20%	1.0 EA	C027
522 0570 000	CAP 2.2UF 50V 20%	1.0 EA	C067
522 0578 000	CAP 1.0UF 50V 20%	2.0 EA	C050 C053
522 0588 000	CAP 100UF 25V 20% NP	1.0 EA	C037
526 0096 000	CAP 100UF 10V 20%	5.0 EA	C002 C006 C017 C018 C078
526 0108 000	CAP 4.7UF 35V 20%	24.0 EA	C007 C009 C010 C013 C014 C019 C022 C023 C024 C030 C032 C034 C040 C041 C047 C049 C057 C058 C059 C062 C063 C064 C065 C066
548 2400 130	RES 20 OHM 1/2W 1%	1.0 EA	R150
548 2400 168	RES 49.9 OHM 1/2W 1%	3.0 EA	R069 R093 R112
548 2400 185	RES 75 OHM 1/2W 1%	3.0 EA	R065 R086 R151
548 2400 187	RES 78.7 OHM 1/2W 1%	1.0 EA	R080
548 2400 201	RES 100 OHM 1/2W 1%	8.0 EA	R038 R039 R040 R041 R042 R043 R044 R045
548 2400 209	RES 121 OHM 1/2W 1%	1.0 EA	R142
548 2400 213	RES 133 OHM 1/2W 1%	2.0 EA	R052 R053
548 2400 215	RES 140 OHM 1/2W 1%	1.0 EA	R084
548 2400 218	RES 150 OHM 1/2W 1%	4.0 EA	R054 R055 R098 R155
548 2400 222	RES 165 OHM 1/2W 1%	1.0 EA	R087
548 2400 226	RES 182 OHM 1/2W 1%	1.0 EA	R135
548 2400 228	RES 191 OHM 1/2W 1%	3.0 EA	R050 R051 R091
548 2400 230	RES 200 OHM 1/2W 1%	4.0 EA	R048 R049 R108 R156
548 2400 231	RES 205 OHM 1/2W 1%	1.0 EA	R119
548 2400 234	RES 221 OHM 1/2W 1%	3.0 EA	R027 R090 R097
548 2400 242	RES 267 OHM 1/2W 1%	1.0 EA	R072
548 2400 247	RES 301 OHM 1/2W 1%	1.0 EA	R109

548 2400 251	RES 332 OHM 1/2W 1%	1.0 EA	R073
548 2400 262	RES 432 OHM 1/2W 1%	1.0 EA	R136
548 2400 266	RES 475 OHM 1/2W 1%	4.0 EA	R077 R082 R085 R130
548 2400 268	RES 499 OHM 1/2W 1%	15.0 EA	R019 R020 R021 R022 R023 R024 R025 R026 R064 R067 R107 R114 R117 R118 R121
548 2400 273	RES 562 OHM 1/2W 1%	4.0 EA	R070 R100 R103 R129
548 2400 285	RES 750 OHM 1/2W 1%	7.0 EA	R036 R037 R047 R083 R089 R101 R147
548 2400 290	RES 845 OHM 1/2W 1%	9.0 EA	R056 R057 R058 R059 R060 R061 R062 R063 R102
548 2400 301	RES 1K OHM 1/2W 1%	22.0 EA	R028 R029 R032 R033 R034 R035 R074 R075 R076 R081 R092 R113 R116 R122 R133 R134 R138 R139 R140 R143 R152 R153
548 2400 313	RES 1.33K OHM 1/2W 1%	1.0 EA	R128
548 2400 323	RES 1.69K OHM 1/2W 1%	2.0 EA	R030 R031
548 2400 330	RES 2K OHM 1/2W 1%	2.0 EA	R127 R154
548 2400 334	RES 2.21K OHM 1/2W 1%	2.0 EA	R088 R125
548 2400 343	RES 2.74K OHM 1/2W 1%	1.0 EA	R099
548 2400 351	RES 3.32K OHM 1/2W 1%	1.0 EA	R137
548 2400 366	RES 4.75K OHM 1/2W 1%	2.0 EA	R094 R146
548 2400 373	RES 5.62K OHM 1/2W 1%	1.0 EA	R132
548 2400 401	RES 10K OHM 1/2W 1%	7.0 EA	R066 R068 R078 R079 R095 R148 R149
548 2400 451	RES 33.2K OHM 1/2W 1%	1.0 EA	R158
548 2400 573	RES 562K OHM 1/2W 1%	1.0 EA	R123
548 2400 581	RES 681K OHM 1/2W 1%	1.0 EA	R126
548 2400 601	RES 1MEG OHM 1/2W 1%	2.0 EA	R159 R160
550 0398 000	POT 1K OHM 1/2W 10%	3.0 EA	R071 R115 R157
550 0901 000	POT 500 OHM 1/2W 10%	8.0 EA	R003 R004 R005 R006 R007 R008 R009 R010
550 0913 000	POT, 5K OHM, 1/2W	1.0 EA	R120
550 0921 000	POT 100K OHM 1/2W	2.0 EA	R144 R145
550 0922 000	POT 10K OHM 1/2W	3.0 EA	R124 R131 R141
550 0923 000	POT 1K OHM 1/2W	1.0 EA	R001
550 0928 000	POT 20K OHM 1/2W	4.0 EA	R105 R106 R110 R111
550 1101 000	POT 20KOHM 1/2W	8.0 EA	R011 R012 R013 R014 R015 R016 R017 R018
550 1102 000	POT 200 OHM 1/2W	1.0 EA	R002
604 1192 000	SWITCH TGL SPDT	2.0 EA	S001 S002
610 0679 000	PLUG, SHORTING, .25" CTRS	1.0 EA	JP006
610 0900 000	HEADER 3 CKT STRAIGHT	5.0 EA	JP001 JP002 JP003 JP004 JP005
610 0933 000	JUMPER, PWB TEST POINT	9.0 EA	TP001 TP002 TP003 TP004 TP005 TP006 TP007 TP008 TP009
612 0775 000	JACK, PC MT, .040 PINS	3.0 EA	JP6-1 JP6-2 JP6-3
612 1184 000	SHUNT JUMPER 0.1" CENTERS	5.0 EA	
620 0700 000	*RECPT, MALE SMB,PC MOUNT	2.0 EA	J001 J002
843 5285 411	SCH, VIDEO DIFF GAIN, LFL	0.0 EA	
843 5285 413	PWB, VIDEO DIFF GAIN, LFL	1.0 EA	

Table 7-26. TUNED EXCITER CH-2 - 994 9253 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 3562 000	SPRING CLIP 0.75 DIA	8.0 EA	#BAND PASS FILTER
484 0098 000	FLTR BANDPASS CH-2,E3,A1	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-27. TUNED EXCITER CH-3 - 994 9253 003

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 3562 000	SPRING CLIP 0.75 DIA	8.0 EA	#BAND PASS FILTER
484 0099 000	FLTR BANDPASS CH-3, R2	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-28. TUNED EXCITER CH-4 - 994 9253 004

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 3562 000	SPRING CLIP 0.75 DIA	8.0 EA	#BAND PASS FILTER
484 0100 000	FILTER BANDPASS CH-4	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-29. TUNED EXCITER CH-5 - 994 9253 005

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 3562 000	SPRING CLIP 0.75 DIA	8.0 EA	#BAND PASS FILTER
484 0101 000	FLTR BANDPASS CH-5, R3	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-30. TUNED EXCITER CH-6 - 994 9253 006

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 3562 000	SPRING CLIP 0.75 DIA	8.0 EA	#BAND PASS FILTER
484 0102 000	FLTR BANDPASS CH-6, R4	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-31. TUNED EXCITER CH-7 - 994 9253 007

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS (d)
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0072 000	FLTR BANDPASS CH-7,E5,A6,R6	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-32. TUNED EXCITER CH-8 - 994 9253 008

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (d)</i>
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0073 000	FLTR BANDPASS CH-8,E6, A7,R7	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-33. TUNED EXCITER CH-9 - 994 9253 009

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (d)</i>
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0074 000	FILTER BANDPASS CH-9	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-34. TUNED EXCITER CH-10 - 994 9253 010

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (d)</i>
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0075 000	FLTR BANDPASS CH-10,E7,A8,R8	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-35. TUNED EXCITER CH-11 - 994 9253 011

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (d)</i>
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0076 000	FLTR BANDPASS CH-11,E8,A9,R9	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-36. TUNED EXCITER CH-12 - 994 9253 012

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (d)</i>
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0077 000	FLTR BANDPASS CH-12,E9,R10	4.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA	
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA	
988 2328 001	DP, HX1V	1.0 EA	
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA	

Table 7-37. TUNED EXCITER CH-13 - 994 9253 013

<i>HARRIS P/N</i>	<i>DESCRIPTION</i>	<i>QTY/UM</i>	<i>REF. SYMBOLS/EXPLANATIONS (d)</i>
358 3561 000	SPRING CLIP 0.50 DIA	8.0 EA	#BAND PASS FILTER
484 0078 000	FLTR BANDPASS CH-13,E10,A10	4.0 EA	

943 4999 087	BLANK 19.0" EXTRUSION	2.0 EA
943 4999 156	PLATE,MTG,SPARE EXTRUSION	2.0 EA
988 2328 001	DP, HX1V	1.0 EA
992 8372 001	BASIC HX1V EXC VIS/AUR	1.0 EA

ELECTROSTATIC DISCHARGE CONTROL A GUIDE TO HANDLING INTEGRATED CIRCUITS

This paper discusses methods and materials recommended for protection of ICs against ESD damage or degradation during manufacturing operations vulnerable to ESD exposure. Areas of concern include dice prep and handling, dice and package inspection, packing, shipping, receiving, testing, assembly and all operations where ICs are involved.

All integrated circuits are sensitive to electrostatic discharge (ESD) to some degree. Since the introduction of integrated circuits with MOS structures and high quality junctions, safe and effective means of handling these devices have been of primary importance.

If static discharge occurs at a sufficient magnitude, 2kV or greater, some damage or degradation will usually occur. It has been found that handling equipment and personnel can generate static potentials in excess of 10kV in a low humidity environment; thus it becomes necessary for additional measures to be implemented to eliminate or reduce static charge. Avoiding any damage or degradation by ESD when handling devices during the manufacturing flow is therefore essential.

ESD Protection and Prevention Measures

One method employed to protect gate oxide structures is to incorporate input protection diodes directly on the monolithic chip. However, there is no completely foolproof system of chip input protection in existence in the industry.

In areas where ICs are being handled, certain equipment should be utilized to reduce the damaging effects of ESD. Typically, equipment such as grounded work stations, conductive wrist straps, conductive floor mats, ionized air blowers and conductive packaging materials are included in the IC handling environment. Any time an individual intends to handle an IC, in any way, they must insure they have been grounded to eliminate circuit damage.

Grounding personnel can, practically, be performed by two methods. First, grounded wrist straps which are usually made of a conductive material, such as Velostat or metal. A resistor value of 1 megohm (1/2 watt) in series with the strap to ground completes a discharge path for ESD when the operator wears the strap in contact with the skin. Another method is to insure direct physical contact with a grounded, conductive work surface.

This consists of a conductive surface like Velostat, covering the work area. The surface is connected to a 1 megohm (1/2 watt) resistor in series with ground.

In addition to personnel grounding, areas where work is being performed with ICs, should be equipped with an ionized air blower. Ionized air blowers force positive and negative ions simultaneously over the work area so that any nonconductors that are near the work surface would have their static charge neutralized before it would cause device damage or degradation.

Relative humidity in the work area should be maintained as high as practical. When the work environment is less than 40% RH, a static build-up condition can exist on nonconductors allowing stored charges to remain near the ICs causing possible static electricity discharge to ICs.

Integrated circuits that are being shipped or transported require special handling and packaging materials to eliminate ESD damage. Dice or packaged devices should be in conductive carriers during all phases of transport and handling. Leads of packaged devices can be shorted by tubular metallic carriers, conductive foam or foil.

Do's and Don'ts for Integrated Circuit Handling

Do's

Do keep paper, nonconductive plastic, plastic foams and films or cardboard off the static controlled conductive bench top. Placing devices, loaded sticks or loaded burn-in boards on top of any of these materials effectively insulates them from ground and defeats the purpose of the static controlled conductive surface.

Do keep hand creams and food away from static controlled conductive work surfaces. If spilled on the bench top, these materials will contaminate and increase the resistivity of the work area.

Do be especially careful when using soldering guns around conductive work surfaces. Solder spills and heat from the gun may melt and damage the conductive mat.

Do check the grounded wrist strap connections daily. Make certain they are snugly fitted before starting work with the product.

Do put on grounded wrist strap before touching any devices. This drains off any static build-up from the operator.

Do know the ESD caution symbols.

Do remove devices or loaded sticks from shielding bags only when grounded via wrist strap at grounded work station. This also applies when loading or removing devices from the antistatic sticks or the loading on or removing from the burn-in boards.

Do wear grounded wrist straps in direct contact with the bare skin never over clothing.

Do use the same ESD control with empty burn-in boards as with loaded boards if boards contain permanently mounted ICs as part of driver circuits.

Do insure electrical test equipment and solder irons at an ESD control station are grounded and only uninsulated metal hand tools be used. Ordinary plastic solder suckers and other plastic assembly aids shall not be used.

Do use ionizing air blowers in static controlled areas when the use of plastic (nonconductive) materials cannot be avoided.

Don'ts

Don't allow anyone not grounded to touch devices, loaded sticks or loaded burn-in boards. To be grounded they must be standing on a conductive floor mat with conductive heel straps attached to footwear or must wear a grounded wrist strap.

Don't touch the devices by the pins or leads unless grounded since most ESD damage is done at these points.

Don't handle devices or loaded sticks during transport from work station to work station unless protected by shielding bags. These items must never be directly handled by anyone not grounded.

Don't use freon or chlorinated cleaners at a grounded work area.

Don't wax grounded static controlled conductive floor and bench top mats. This would allow build-up of an insulating layer and thus defeating the purpose of a conductive work surface.

Don't touch devices or loaded sticks or loaded burn-in boards with clothing or textiles even though grounded wrist strap is worn. This does not apply if conductive coats are worn.

Don't allow personnel to be attached to hard ground. There must always be 1 megohm series resistance (1/2 watt between the person and the ground).

Don't touch edge connectors of loaded burn-in boards or empty burn-in boards containing permanently mounted

driver circuits when not grounded. This also applies to burn-in programming cards containing ICs.

Don't unload stick on a metal bench top allowing rapid discharge of charged devices.

Don't touch leads. Handle devices by their package even though grounded.

Don't allow plastic "snow or peanut" polystyrene foam or other high dielectric materials to come in contact with devices or loaded sticks or loaded burn-in boards.

Don't allow rubber/plastic floor mats in front of static controlled work benches.

Don't solvent-clean devices when loaded in antistatic sticks since this will remove antistatic inner coating from sticks.

Don't use antistatic sticks for more than one throughput process. Used sticks should not be reused unless recoated.

Recommended Maintenance Procedures

Daily:

Perform visual inspection of ground wires and terminals on floor mats, bench tops, and grounding receptacles to ensure that proper electrical connections via 1 megohm resistor (1/2 watt) exist.

Clean bench top mats with a soft cloth or paper towel dampened with a mild solution of detergent and water.

Weekly:

Damp mop conductive floor mats to remove any accumulated dirt layer which causes high resistivity.

Annually:

Replace nuclear elements for ionized air blowers.

Review ESD protection procedures and equipment for updating and adequacy.

Static Controlled Work Station

The figure below shows an example of a work bench properly equipped to control electro-static discharge. Note that the wrist strap is connected to a 1 megohm resistor. This resistor can be omitted in the setup if the wrist strap has a 1 megohm assembled on the cable attached.

