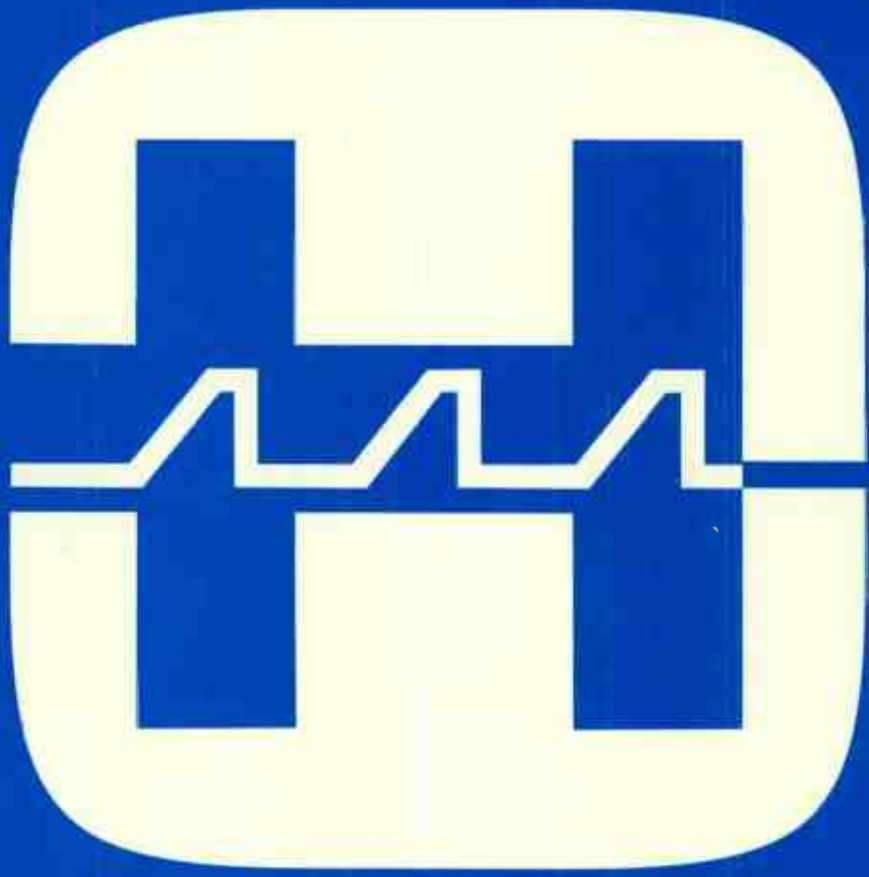
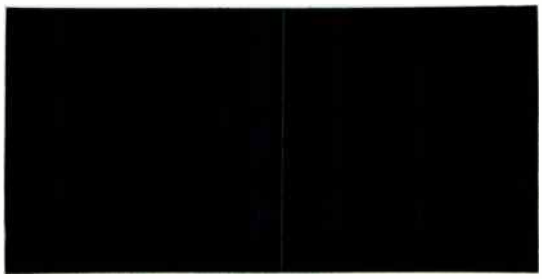
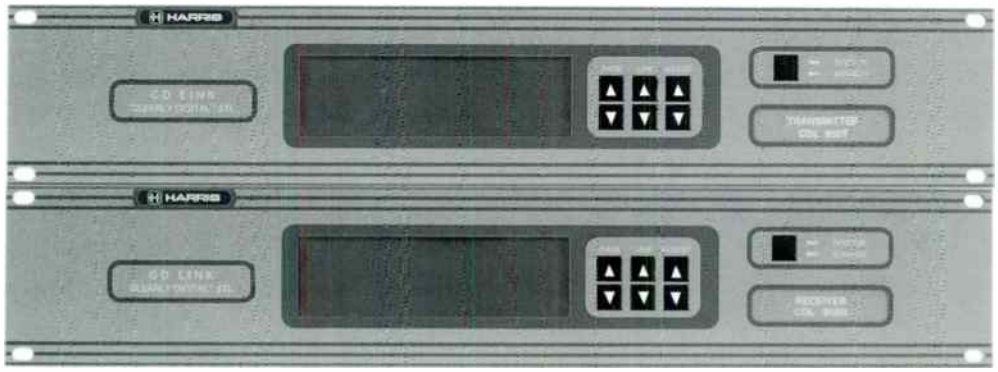


HARRIS



HARRIS CD LINK™
DIGITAL STUDIO-TRANSMITTER LINK



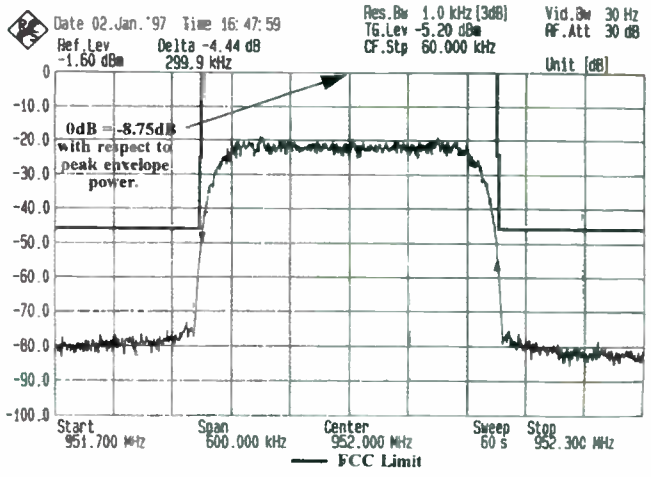
UNCOMPRESSED DIGITAL STL

The revolutionary CD LINK™ from Harris is an exclusive design allowing transmission of uncompressed AES3 digital audio in standard, 300kHz RF channels in the 950MHz STL band. The CD LINK was designed from its concept as a pure, digital radio rather than as a digital modem to work with existing analog STL radios. This approach has made it possible to eliminate all compression algorithms and their characteristic affects on the sonic quality of the link.

The Harris CD LINK provides an economical way to complete the path for uncompressed AES3 digital audio from the studio to the transmitter without expensive, common carrier connections. The output of the CD LINK plugs directly into the digital input of the Harris DIGIT™ Digital FM Exciter, for a completely uncompressed path from the studio through generation of the FM broadcast waveform for the cleanest possible on-air sound.

FEATURES/BENEFITS

- **UNCOMPRESSED,** bit-for-bit AES3 transmission technology eliminates all STL compression artifacts for lowest possible distortion; true 16-bit performance without perceptual coding and resulting peak overshoots.
- True, digital radio system using digital modulation techniques; no separate digital modems or analog modulators.
- Carries one uncompressed AES3 and two RS-232 data channels, optionally two 6kHz auxiliary audio channels or one 12kHz auxiliary channel.
- Includes one standard AES3 input, and dual 16-bit delta/sigma A/D converter to convert analog L&R input prior to transmission (alternate inputs).
- Signal-to-noise plus distortion (S/N+D) performance at -90dB or more; lowest by far of all current 950MHz band digital STLs for the cleanest on-air FM broadcast sound with no trace of "grittiness." Transparent to program pre-emphasis; passes 0, 25, 50 or 75µs pre-emphasis (AES3 or analog inputs).
- All operational settings and adjustments addressable from the front panel using an intuitively designed human interface.
- Similar transmitter and receiver control layouts simplify the learning curve and shorten setup time.
- Single-chassis design integrates the digital and RF circuits for reliability and less rack space requirements than current digital STLs.
- Meets FCC emission mask for 300kHz STL channels, 942-952MHz (see spectrum analyzer display below).



HARRIS

HARRIS CD LINK™ DIGITAL STL SPECIFICATIONS

SYSTEM

Digital I/O (Standard)

Format AES3 digital audio, uncompressed.

Data Rate Input: 32 or 48kb/s; Output: 32kb/s.

Connectors Inputs: XLR female, optical (alternate); Outputs: XLR male, optical.

Impedances Input: 220 ohms balanced (AES3 standard); Output: 110 ohms balanced.

Main Analog Channel I/O and Performance (Standard)

Number of Channels Two.

Frequency Response 5Hz-15kHz ±0.1dB.

Pre-emphasis Transparent to incoming signal; passes flat, 25, 50 or 75µs.

Total Harmonic Distortion ≤0.005% at 1kHz.

Dynamic Range ≥90dB.

Signal-to-Noise Ratio ≥90dB at 1kHz reference using 10Hz-22kHz filter.

Connectors Input: XLR female; Output: XLR male.

Impedance Input: 10,000 ohms, Output: 110 ohms.

Level +10dBm nominal at 400Hz, user adjustable to +26dBm (clipping).

Channel Availability Simultaneous analog L&R outputs provided along with AES3 output; can be used to feed an optional stereo generator for reserve FM transmitter, direct monitoring, etc.

Auxiliary Analog Audio Channel I/O and Performance (Optional)

Number of Channels Two or one.

Format Compressed digital.

Frequency Response 20Hz-6kHz, ±0.25dB, or 20Hz-12kHz (1 ch).

Total Harmonic Distortion ≤1% at 1kHz.

Dynamic Range ≥60dB.

Connectors Input: XLR female; Output: XLR male.

Impedance Input 10K/600 ohms, user selectable; Output: 110 ohms.

Level +10dBm nominal into 600 ohms at 400Hz, user adjustable to +26dBm (clipping).

Channel Availability Simultaneous with AES3 and main channel analog outputs.

Data Channels (Standard)

Number of channels Two.

Data Format RS-232, asynchronous, 7 or 8 data bits, 1 or 2 stop bits (user selectable).

Baud Rate Two channels up to 9600 on one, up to 4800 on other.

Connectors DB-25 male (two).

Coding

Channel Coding Uncompressed 16-bit PCM.

Main Audio Analog Input Conversion Dual 16-bit delta/sigma A/D at 48kb/s rate.

Data Latency 8ms, nominal.

Error Correction Reed Solomon with data error masking.

Auxiliary Program Channels Compressed format.

RF SECTIONS

Frequency Range 942-952MHz (other ranges available).

FCC Type Notification Identifer BOICD950.

Emission Designator 300KD7W.

Source Frequency synthesizer, 25kHz steps.

Occupied Bandwidth 300kHz (within FCC STL bandwidth limits).

Transmitter Output Power 15W peak, nominal.

Transmitter Load Impedance 50 ohms (isolator protected).

Transmitter Harmonic/Spurious Output Meets or exceeds all FCC, Canadian and CCIR standards.

RF I/O Connectors Type N female, 50 ohms.

Receiver Sensitivity 7µV (-90dBm) at 10^{-4} bit error rate.

Receiver Dynamic Range ≥70dB.

CONTROL AND MONITORING

User Controls

Radiate On/Off.

Front panel push-button setup and monitoring of operating parameters, including:

Tx Fwd Pwr, Tx Refl Pwr, received signal level, various alarms and diagnostics.

Display: 240 x 64 dot LCD matrix; reads parameter or bargraph audio level as selected by user menu.

Telemetry Outputs (0-4VDC):

Receiver alarm (BER monitor).

Received signal strength.

Eye (constellation) quality.

Failsafe Output: Form C contacts, 24VDC/1A maximum.

Remote Control I/O Connector DB-25 male.

MECHANICAL/ENVIRONMENTAL

Dimensions (transmitter/receiver): 19" (48.3cm) W x 3.5" (8.9cm) H x 13" (33cm) D, EIA rack mountable.

Weight Transmitter: 15 pounds (6.8kg); Receiver: 10 pounds (4.5kg).

AC Power Requirements 90-132 or 180- 264VAC, 50/60Hz, single phase.

Power Consumption Transmitter: 50W, nominal; Receiver: 35W, nominal.

Cooling Transmitter: Forced air using built-in, premium quality fan; Receiver: Conduction/ convection.

Altitude to 15,000 feet (4,573m) AMSL.

Humidity To 95%, non-condensing.

Ambient Temperature Range 0-50 degrees Celcius.

I.S. EN ISO 9001

Specifications subject to change without notice.

HARRIS CORPORATION, BROADCAST DIVISION
3200 WISMANN LANE, P.O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A.
U.S. AND CANADA: 217-222-8200; FAX: 217-221-7085
INTERNATIONAL: 217-222-8290; FAX: 217-221-7097
INTERNET: http://www.broadcast.harris.com

HARRIS

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P/N 994-9725-001

TECHNICAL MANUAL
CD LINK™
STUDIO TO TRANSMITTER LINK
994 9736 001

888-2413-001

T.M. No. 888-2413 001

Printed: May 1997

Returns And Exchanges

Damaged or undamaged equipment should not be returned unless written approval and a Return Authorization is received from HARRIS CORPORATION, Broadcast 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 Division, specify the HARRIS Order Number or Invoice Number.

Unpacking

Carefully unpack the equipment and preform a visual inspection to determine that no apparent damage was incurred during shipment. Retain the shipping materials until it has been determined that all received equipment is not damaged. Locate and retain all PACKING CHECK LISTs. Use the PACKING CHECK LIST to help locate and identify any components or assemblies which are removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Technical Assistance

HARRIS Technical and Troubleshooting assistance is available from HARRIS Field Service during normal business hours (8:00 AM - 5:00 PM Central Time). Emergency service is available 24 hours a day. Telephone 217/222-8200 to contact the Field Service Department or address correspondence to Field Service Department, HARRIS CORPORATION, Broadcast Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. The HARRIS factory may also be contacted through a FAX facility (217/222-7041) or a TELEX service (650/372-2976).

Replaceable Parts Service

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 Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. The HARRIS factory may also be contacted through a FAX facility (217/222-7041) or a TELEX service (650/372-2976).

NOTE

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

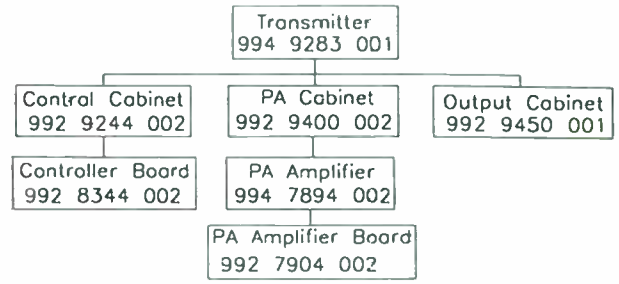
Guide to Using Harris Parts List Information

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:

Replaceable Parts List Index

Table 7-1.	Transmitter	994 9283 001	7-2
Table 7-2.	Control Cabinet	992 9244 002	7-3
Table 7-3.	Controller Board	992 8344 002	7-6
Table 7-4.	PA Cabinet	992 9400 002	7-7
Table 7-5.	PA Amplifier	994 7894 002	7-9
Table 7-6.	PA Amplifier Board	992 7904 002	7-10
Table 7-7.	Output Cabinet	992 9450 001	7-12



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.

HARRIS
BROADCAST Division
P.O. Box 4290, QUINCY, IL 62305
HARRIS PHONE: 217-222-8200
HARRIS FAX: 217-222-9443

PARTS ORDER FORM

BILLING INFORMATION

CUSTOMER NAME: _____

ADDRESS: _____

_____

_____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

PREFERRED PAYMENT METHOD: _____

SHIPPING INFORMATION

SHIP TO: (IF DIFFERENT FROM BILLING INFORMATION) _____

ADDRESS: _____

_____

_____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

SHIPMENT METHOD PREFERRED: _____

FREQUENCY (if required): _____

EQUIPMENT NAME: _____

EQUIPMENT PART NUMBER: _____

EQUIPMENT SERIAL NUMBER: _____

GUIDE FOR ORDERING PARTS

Please use the following parts order form, filling in as much information as possible. The complete information will allow double checking the part number for correctness or locating a substitute if the part is not available.
The equipment name, part number, and serial number will be found on the metal ID plate on the back of the unit. The serial number MUST be included for any parts ordered under warranty.
Describe the part using the description in the parts list if possible. Include the schematic information, schematic number, or number of next higher assembly. The next higher assembly is usually a 992-xxxx-00x type.

ITEM #	QTY ORD	HARRIS PART NUMBER	DESCRIPTION OF PART (PART'S NAME, DESCRIPTION, SPECIFICATION FROM PARTS LIST IF AVAILABLE)	SCHEMATIC REFERENCE REFERENCE NAME (e.g. C001, R100, etc)	ITEM USED ON (NEXT HIGHER ASSEMBLY IF KNOWN) (e.g. C001 used on 992 8025 001, schematic 839 8099 991)	COMMENTS

plorder

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.

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

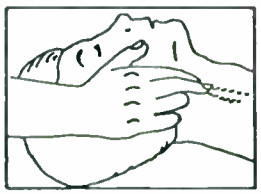
IF NOT BREATHING.
BEGIN ARTIFICIAL BREATHING

TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL

4 QUICK FULL BREATHS

REMEMBER MOUTH TO MOUTH RESUSCITATION MUST BE COMMENCED AS SOON AS POSSIBLE

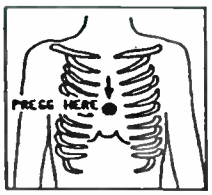
CHECK
CAROTID PULSE



IF PULSE ABSENT.
BEGIN ARTIFICIAL CIRCULATION

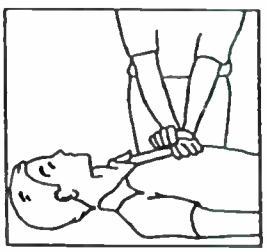
(C) CIRCULATION

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
- TWO RESCUERS
- 5 COMPRESSIONS
- 1 BREATH



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)

Table of Contents

WARNING: Disconnect primary power prior to servicing.

Section I
Introduction and Overall Description

1.1 Introduction

This technical manual contains installation, operating and maintenance procedures for the HARRIS CD LINK™ Digital Studio to Transmitter Link, models CDL950T and CDL950R.

- Section I - Introduction and Overall Description, describes the CD LINK™ transmitter and receiver and also describes the various sections of the technical manual.
- Section II - Installation and Initial Turn-On, outlines the planning steps needed to ensure your installation is trouble-free and describes the process of installing and turning on the CD LINK™ system for the first time. All rear-panel connections are described in this section.
- Section III - Operator's Guide, explains operation of equipment. This section can serve as a quick reference when operating CD LINK™ STL.
- Section IV - Overall System Theory, describes the circuit level details of the equipment.
- Section V - Setup and Maintenance, identifies all of the alignments and adjustments available to the user.
- Section VI - Options, lists and describes the optional features which may be purchased for CD LINK™ systems.
- Section VII - Troubleshooting, offers advice and tips about possible troubleshooting techniques when a problem is suspected.
- Section VIII - Parts List, is an indexed listing of field-replaceable parts for the CD LINK™ transmitter and receiver.
- Section IX - Drawings, contains drawings referenced in other parts of the technical manual.
- HARRIS CD LINK™ APPLICATIONS INFORMATION for FCC FORM 313
- HARRIS CD LINK™ DIGITAL STL SPECIFICATIONS
- IMPLEMENTING AN UNCOMPRESSED DIGITAL PATH FROM THE STUDIO TO THE "ON AIR" SIGNAL

1.2 Overall Description

The CD LINK™ CLEARLY DIGITAL STL is a digital studio to transmitter radio link operating in the 950 MHz broadcast STL band. The CDL950T transmitter combines both the digital modulator and the 950 MHz RF transmitter. The CDL950R receiver combines the RF receiver with the digital demodulator.

The STL operates without compression in a standard 300 kHz RF channel. As no compression is used in the AES3 program channel, the CD LINK™ system transmits faithfully the inputs provided to it without "cascading" artifacts when compression is used elsewhere in the system.

Input to the transmitter and output from the receiver may be:

- AES3 digital audio via standard XLR connector
- AES3 optical via the EIAJ CP-1201 connector
- Analog Left and Right Audio
- Two data channels, DATA1 and DATA2.
- a serial Control channel.
- a parallel control channel.
- One or two Auxiliary Audio channels, if the AUX Audio option is installed.
- Stereo composite output and 19kHz reference output are available from the receiver if the optional stereo generator is installed.

The transmitter and the receiver are mounted in identical size cases. Each unit mounts in a standard 19" (48.3cm) rackmount, occupying 2 RU, 3.5" (8.9cm) of vertical rack space. Each unit is 13" (33cm) deep.

The front panel of the transmitter and receiver are nearly identical (Figure 1-1). The label space below the OPERATE/STANDBY button is designated either as

TRANSMITTER	or	RECEIVER
CDL950T		CDL950R

Operation and adjustment of the CD LINK™ transmitter and receiver are by means of a group of front-panel switches and the LCD display. Operation is intuitive and easily learned. All procedures are described fully in Section III - Operators Guide and Section V - Maintenance, Alignments and Adjustments.

For technical specifications, please refer to the brochure in the rear of this technical manual.

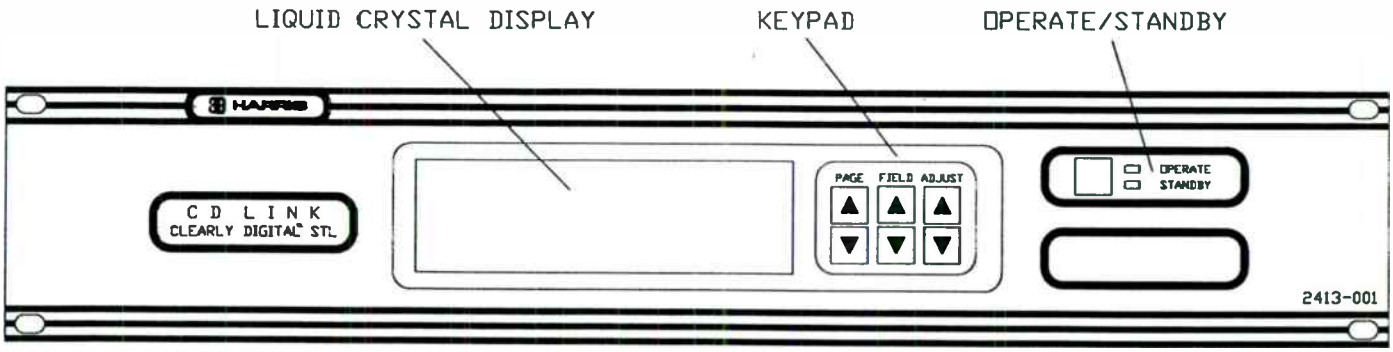


Figure 1-1. CD LINK Front Panel

WARNING: Disconnect primary power prior to servicing.

2.1 Installation Planning

The CD LINK™ transmitter and receiver are identical-sized units designed for mounting in a standard 19" EIA rack. The dimensions of the units are:

- Width 19" (48.3cm)
- Height 3.5" (8.9cm) (Two standard Rack Units)
- Depth 13" (33cm)

All connections are to the rear of the transmitter and receiver. For ease of cable routing at least 3" (7.6cm) clearance should be allowed behind the units.

Power and Cooling

The CD LINK™ transmitter consumes 50 watts and is equipped with an internal cooling fan.

Receiver power consumption is 35 watts. The receiver requires no fan.

Both units are designed to operate in an ambient temperature (within the equipment rack) of 0° to 50°C (32° to 122°F). A dust-free, vibration-free and non-corrosive environment is also important to ensure long and trouble-free operating life.

Note:

All electronic equipment operates best and with longest component life if the ambient temperature is closer to normal room temperature. It is best to avoid operating any equipment close to the maximum rated ambient temperature.

Operability

All operation and nearly all setup adjustments are made using the keypad and liquid crystal display on the front panel of the units. Plan to mount CD LINK™ units at or close to eye level.

Transient Protection

The power distribution system powering the CD LINK™ units and the input and output connections should be protected against undue transients which might damage the equipment. The RF output (Transmitter) and input (receiver) connections should also be protected against large transients which might enter through the transmission lines from the antennas. A suitable protection device for the RF lines is the IS-50NX-C2 Coaxial Protector manufactured by PolyPhaser Corporation.

Antennas and Path Design

Plan the transmit and receive antenna locations and height to ensure a reliable path. Path design is beyond the scope of this technical manual, but you should consider these points:

- There should be an unobstructed line of sight between the two antenna locations.
- All points in the path should have at least 0.6 fresnel zone clearance from the closest objects, including trees and buildings. (Fresnel clearance should be checked periodically to be sure new growth or new construction does not enter the 0.6 fresnel zone.)
- Antenna gains, transmission line losses, path loss and the desired fade margin should combine to produce an adequate signal level input to the receiver. The fade margin should be at least 0.5 dB per mile of path length.
- The radio frequency to be used should be free of interference from other services.

FCC Application Information

Appendix A in the rear of this technical manual contains useful antenna system planning information and FCC filing information.

2.2 Installation

Install each unit in the planned location and connect to a source of electrical power.

NOTE

The input power cord plugs into an AC IN connector on the rear panel which contains a line voltage selector switch. This switch is not used in CD LINK™ units. Each unit can be powered by any 50 or 60 Hz mains source, at any voltage from 90 - 264VAC. The power supply automatically adapts itself to the applied mains voltage without the need for user adjustment.

The AC fuse size in these units does not have to be changed when a different line voltage is applied. The CDL950T transmitter uses a 1ASB fuse and the CDL950R uses a 1/2ASB fuse.

Connect each unit to the antenna through suitable cable.

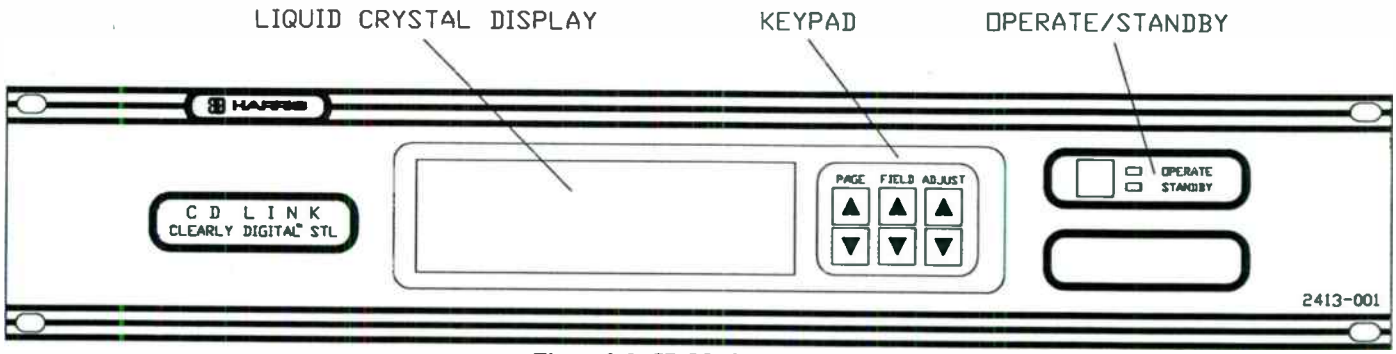


Figure 2-1. CD LINK Front Panel

WARNING: Disconnect primary power prior to servicing.

WARNING!

Do not connect the CDL950T transmitter to the antenna at this point. Before connecting to the antenna, make certain the unit is operating on the desired frequency as described in 2.3.1, Transmitter Setup.

2.3 Setup

Before they can communicate, the CD LINK™ transmitter and receiver must be set up for the intended service. Complete operating information is given in Section III, and setup information is given in Section V, but the following abbreviated sequence should permit the new user to place the equipment in operation and verify that it is working properly. Refer to Sections III and V as needed for greater detail.

2.3.1 Transmitter Setup

Transmitter setup should be checked before connecting the transmitter to the antenna to avoid possibility of interference with other services.

a. Apply power to the transmitter and make sure the OPERATE/STANDBY switch is set to STANDBY. If the transmitter is in OPERATE, press the OPERATE/STANDBY switch to select STANDBY.

NOTE

The transmitter is not harmed by brief periods of operation without an antenna or load attached to the RF output connector. Operation without an antenna or a load should be limited to 20 minutes.

b. Observe the Main Audio page on the Liquid Crystal Display. This is the page which appears first after the unit is turned on. The page should be similar to this:

```
STAT:  OK                MAIN 48K AES OPTO
FREQ 951.00               AUX 10K  0K
FWD  0.0W  TEMP 35°C   DATA1 2400 N 8
VSWR 1.0               DATA2 1200 N 8

L******* MAIN AUDIO BAR GRAPH *********
R******* MAIN AUDIO BAR GRAPH *********
```

c. Confirm the transmitter's frequency (FREQ) is set to the intended operating frequency.

d. If the input to the transmitter is to be digital:
   1. Confirm the main channel sample rate (MAIN) matches the sample rate of the intended input.
   2. Confirm the AES input is set to the intended type (XLR or OPTO).

e. If the input is analog:
   1. The sample rate is automatically set to 48K.
   2. The input impedance may be selected to 150, 600, or 10K ohms using JP1 on the transmitter Main Board (see 2.5, Transmitter Configuration Jumpers).

f. Confirm the AUX audio channels (if included) and the user data channels are correctly set for the intended use.

If any of the above require adjustment, turn to Transmitter Setup in Section V and use the instructions there to make the needed adjustments.

Analog Input Levels

If analog audio inputs or auxiliary audio inputs are to be used, connect the audio sources to these inputs and use the Main Audio Page (page 3.3.1) and the AUX Audio Page (page 3.4.2) to check the levels. If adjustment is required:

- Adjust the Main Audio Left and Right channel gains while observing the Main Screen Main Audio Bar Graph. The gain controls are reached through the rear panel and are labelled MAIN AUDIO IN - LEFT and RIGHT.
- Adjust The AUX audio input levels using the ADJUST keys, while observing the Transmitter Aux Audio Channels Setup page (see 5.2.2), which displays the AUX audio level bargraph.

When transmitter setup has been confirmed, connect the transmitter to the antenna. If operation is not yet desired, make sure the OPERATE/STANDBY switch remains selected to STANDBY.

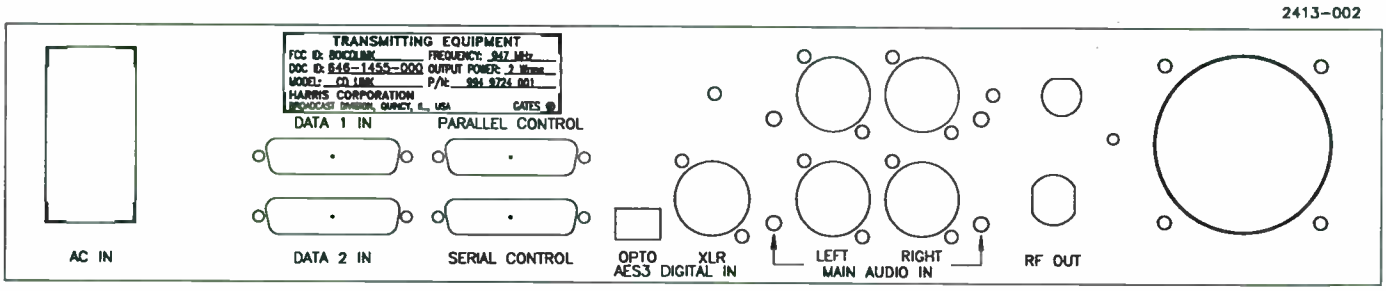


Figure 2-2. Transmitter Connector Locations

WARNING: Disconnect primary power prior to servicing.

2.3.2 Receiver Setup

Receiver setup is confirmed in a similar manner.

a. Apply power to the receiver and observe the receiver Main Audio Page.

```
STAT:   OK                    AUX: 10K  0K
FREQ: 951.00                DATA1: 2400 N 8
RF:    0 uV   QLTY 90%      DATA2: 2400 N 8
BER:   0      TIME: 0 S   STEREO: OFF 0.0%

L******* MAIN AUDIO BAR GRAPH *********
R******* MAIN AUDIO BAR GRAPH *********
```

a. Confirm these settings are correct for your use:
   1. FREQ - the desired receiver frequency.
   2. AUX - Auxiliary audio channel settings (if the Aux Audio option is installed).
   3. DATA1 & DATA2 - The user data channel settings.

Note:

These settings should agree with the settings in your CDL950T transmitter.

If any of these settings are not correct for your use, refer to Receiver Setup in Section 5 and make the needed changes.

If analog audio outputs, composite stereo output or auxiliary audio outputs are to be used, output levels may be adjusted once the STL is installed and the CDL950T transmitter signal is being received.

- Adjust the Main Audio Left and Right channel gain controls through the rear panel. They are labelled MAIN AUDIO OUT - LEFT and RIGHT. See 5.4, Analog Audio Level Adjustments.
- If the optional stereo generator is installed, adjust the COMPOSITE OUT level see 5.4) and the pilot level (see 5.3.5).
- If Auxiliary Audio Channels are installed, set The AUX audio output levels using Receiver AUX AUDIO CHANNELS SETUP. See 5.3.1.

2.3.3 Testing the System

When ready to check the transmitter and receiver together, make sure the antennas are connected. Then, use the transmitter OPERATE/STANDBY switch to select the transmitter to OPERATE.

- The FWD reading on the transmitter main page should rise to approximately 2.0W, indicating normal RF output.
- The VSWR reading on the transmitter main page should be low (less than 1.3:1), indicating the antenna and line are a good match to the transmitter output.
- At the receiver, observe RF, the received signal level, on the receiver main page.

Note:

If the receive and/or transmit antennas have not been previously aimed, it may be necessary to adjust one or both for maximum signal. The RF display may be used for this purpose, adjusting the antennas for maximum received signal.

If the SIG LEV display must be extended to another location for this adjustment, the signal level output on Pin 15 of the receiver PARALLEL CONTROL connector may be extended to a DC voltmeter at a convenient location.

The signal level output from this connector is a DC voltage between 0 and 4 Volts, with a nominal 3VDC for 250 uV RF input signal level.

Once the path has been adjusted to provide maximum input signal level to the receiver, the received signal strength should be close to the level predicted by the path calculation. Verify the quality of the received audio and data signals.

NOTE

The HEADPHONE jack at the rear of the receiver may be used to monitor the received audio signals. A stereo headphone pair with a mini phone plug is used. The headphones should have an impedance of between 600 and 2000 ohms.

2.3.3.1 Received Signal Quality

The quality of the received signal is displayed in three different ways:

- RF, the received signal level in microvolts. A minimum signal level of 7 microvolts is specified. Below this input level, loss of audio should be expected. Good design should allow adequate signal above this level to ensure against fades.
  A common rule of thumb is that 0.5 dB of fade margin should be allowed for each mile of path length. Using this rule, for a 20 mile path, allow 20 dB, requiring a minimum received signal level of 70 to 100 microvolts.
- QLTY, a measure of the quality of signal recovery, given as a number between 0% and 100%. QLTY is typically more than 80%. If QLTY is low and the RF level is normal, the most likely cause is interference from another signal.
- ERR RATE, the bit error rate (BER) of the recovered signal. A received signal level of 7 microvolts should produce a bit error rate of about 1E-4, 1 error every 10,000 bits. If QLTY is below 20%, the BER will increase.

2.4 Transmitter Rear Panel Connectors

These connectors appear on the rear of the CD LINK™ Transmitter (See Figure 2-2).

2.4.1 PARALLEL CONTROL

This 25 pin female "D" connector provides status, metering and control interconnections between the transmitter and other equipment.

The status outputs are open collector outputs which turn on (conduct to ground) when the condition occurs.

The metering outputs have a total DC output voltage range of 0 to 4 volts.

The control inputs are configured by jumpers - see 2.5 - Transmitter Configuration Jumpers.

PIN	NAME	DESCRIPTION
1	GND	Signal ground.
2	GND	Signal ground.
3	GND	Signal ground.
4	+12V	12 volts.
5	+12V	12 volts.
6	+12V	12 volts.
7	+12V	12 volts.
8	+12V	12 volts.
9	RAD ENA+	Radiate enable plus input. Jumpers JP4 and JP6 configure this pin. See 2.5, Transmitter Configuration Jumpers
10	RAD DIS+	Radiate disable plus input. Jumpers JP3 and JP5 configure this pin. See 2.5, Transmitter Configuration Jumpers
11	N.C.	Not connected.
12	GND	Signal ground.
13	GND	Signal ground.
14	FWD PWR	Forward power level output. 3 volts nominal for 2 watts output (See Note 1)
15	REV PWR	Reverse power level output. 3 volts nominal for 100% reverse power (See Note 1)
16	FAULT	Fault status output.
17	WARN	Warning status output.
18	STANDBY	Operate/Standby status output. - pulled to ground when in standby.
19		Spare Output.
20	N.C.	Not connected.
21	RAD ENA-	Radiate enable minus input. (See 2.5, Transmitter Configuration Jumpers).
22	RAD DIS-	Radiate disable minus input. (See 2.5, Transmitter Configuration Jumpers).
23	N.C.	Not connected.
24	N.C.	Not connected.
25	N.C.	Not connected.

Note 1: FWD PWR and REV PWR are DC voltage samples of the RF forward and reverse voltage at the transmitter output.

2.4.2 DATA 1 IN DATA 2 IN

Both connectors are 25 pin male "D", wired identically as "DCE" serial data ports. (DCE stands for Data Communications Equipment. A modem is a type of DCE. These ports are wired to accept data and to communicate using RTS, CTS and DSR as a modem would.)

The signals on these connectors are at RS-232 compatible voltage levels.

PIN	NAME	DESCRIPTION
1	GND	Chassis ground.
2	RXD	Received data.
3	TXD	Transmitted data (Not used at the CDL950T.)
4	RTS	Request to send. (Internally connected to CTS.)
5	CTS	Clear to send. (Internally connected to RTS.)
6	DSR	Data set ready. (Internally connected to +5 volts.)
7	GND	Signal ground.

2.4.3 SERIAL CONTROL

The serial control port is used to communicate with other products using the Harris Communications Protocol.

The connector is a 25 pin male "D", wired identically to the DATA connectors as a "DCE" serial data port.

The signals on this connector are at RS-232 compatible voltage levels.

PIN	NAME	DESCRIPTION
1	GND	Chassis ground.
2	RXD	Received data.
3	TXD	Transmitted data.
4	RTS	Request to send. (Internally connected to CTS.)
5	CTS	Clear to send. (Internally connected to RTS.)
6	DSR	Data set ready. (Internally connected to +5 volts.)
7	GND	Signal ground.
16	AUX TXD	Auxiliary transmitted data. Internally connected to TXD pin 3.

2.4.4 DIGITAL OPTO AES3 IN

This is an AES Optical Input Connector. An industry standard EIAJ CP-1201 connector is used.

2.4.5 DIGITAL XLR AES3 IN

A female XLR connector is used.

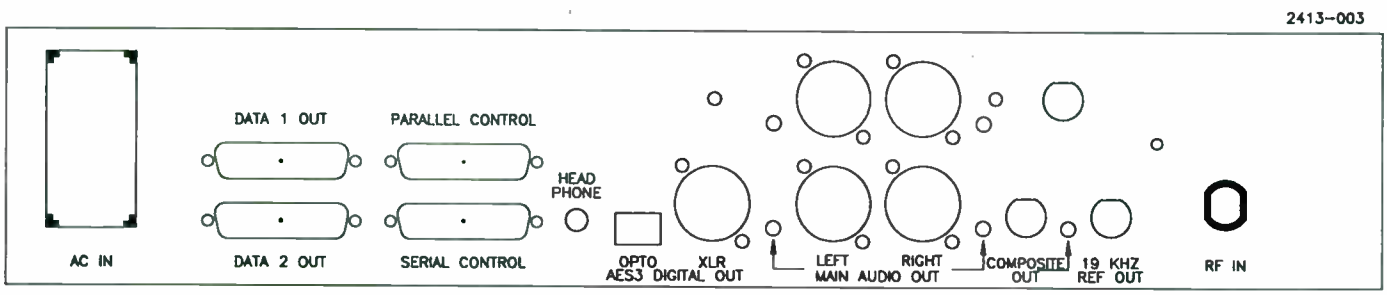


Figure 2-3. Receiver Connector Locations

WARNING: Disconnect primary power prior to servicing.

AES digital audio data uses a self-clocking encoding method which does not use polarity. Pins 2 and 3 on this connector can be connected to the cable in either order.

PIN	NAME	DESCRIPTION
1	GND	Signal ground.
2	SIG+	Input signal "A"
3	SIG-	Input signal "B"

The input impedance of the digital XLR input is 220 ohms, balanced. See section 4.2, System for a discussion of the input impedance.

2.4.6 AUDIO IN

There are four analog audio input connectors:

- MAIN AUDIO LEFT
- MAIN AUDIO RIGHT
- AUX AUDIO 1 (Optional)
- AUX AUDIO 2 (Optional)

All use XLR female connectors wired for differential input.

The pin assignment for these connectors is as follows:

PIN	NAME	DESCRIPTION
1	GND	Signal ground.
2	AUDIO+	Audio plus.
3	AUDIO -	Audio minus.

Each Main Audio input has a multi-turn trim pot to set the channel's input sensitivity. The trim pots allow full scale input adjustment over a -3dBm to +20 dBm signal range.

The Aux Audio input sensitivities are set using the Aux Audio Channels Setup Page (see 5.2.2).

2.4.7 RF OUT

A type N female connector is used. The nominal output power is 2 watts RMS. This is equivalent to 15 watts peak power.

2.5 Transmitter Configuration Jumpers

Jumpers on the main board can be set to select as follows:

JP1

Selects Right Channel input impedance. The possible choices are:

- 150 ohms
- 600 ohms
- 10K ohms

JP2

Selects Left Channel input impedance. The choices are the same as for the Right channel.

JP3 & JP5

Used to configure the RAD DIS+ and RAD DIS- pins of the PARALLEL CONTROL connector.

- When both jumpers are set to 1-2, RAD DIS+ is a voltage input. Radiate Disable is activated when RAD DIS+ is +12 volts higher than RAD DIS-.
- When both jumpers are set to 2-3, RAD DIS+ is internally connected to ground. Radiate Disable is activated when RAD DIS- is connected to ground or to RAD DIS+.

JP4 & JP6

Used to configure the RAD ENA+ pin of the PARALLEL CONTROL connector.

- When both jumpers are set to 1-2, RAD ENA+ is a voltage input. Radiate Enable is activated when the voltage applied to RAD ENA+ is +12 volts higher than RAD ENA-.
- When both jumpers are set to 2-3, RAD ENA+ is internally connected to ground. Radiate Enable is activated when RAD ENA- is connected to ground or to RAD ENA+.

NOTE

RAD DIS and RAD ENA are used to interconnect the operation of two transmitters in a redundant transmitter system.

2.6 Receiver Rear Panel Connectors

These connectors appear on the rear of the CD LINK™ Receiver (See Figure 2-3).

2.6.1 PARALLEL CONTROL

This 25 pin female "D" connector provides status, metering and control interconnections between the receiver and other equipment.

The status outputs are open collector outputs which turn on (conduct to ground) when the condition occurs.

The metering outputs have a total DC output voltage range of 0 to 4 volts.

The control inputs are configured by jumpers - see 2.7 - Receiver Configuration Jumpers.

The Failsafe Relay (Pins 12, 13 and 25) is a physical relay with all 3 contacts electrically isolated from the internal circuits.

PIN	NAME	DESCRIPTION
1	GND	Signal ground.
2	GND	Signal ground.
3	GND	Signal ground.
4	+12V	12 volts.
5	+12V	12 volts.
6	+12V	12 volts.
7	GND	Signal ground.
8	GND	Signal ground.
9	AESPWR	

A connection between Pins 5 on redundant receivers allows the optical output circuit in each receiver to receive power from the

WARNING: Disconnect primary power prior to servicing.

second receiver. This permits optical output in redundant systems.

10	STERGEN+	Stereo generator control plus input. (See 2.7, Receiver Configuration Jumpers)
11	STANDBY+	Standby plus input. (See 2.7, Receiver Configuration Jumpers)
12	FSAFE NO	Fail safe relay. Normally open contact
13	FSAFE ARM	Fail safe relay. Moving arm contact
14	SIG QLTY	Signal quality output. 3 volts nominal for 100%.
15	SIG LEVEL	Received signal level output. 3 volts nominal for 250 uV received level.
16	FAULT	Fault status output. normally pulled to ground. Opens when fault occurs.
17	WARN	Warning status output. normally pulled to ground. Opens when warning occurs.
18	OPERATE	Operate/Standby status output. Closed (On) when in Operate. Open (Off) when in standby.
19	N.C.	Not connected.
20	I EYE	I channel eye pattern analog voltage output.
21	Q EYE	Q channel eye pattern analog voltage output.
22	STERGEN-	Stereo generator control minus input. (See 2.7, Receiver Configuration Jumpers).
23	STANDBY-	Standby enable minus input. (See 2.7, Receiver Configuration Jumpers).
24	N.C.	Not connected.
25	FSAFE NC	Fail safe relay. Normally closed contact.

2.6.2 DATA 1 OUT DATA 2 OUT

Both connectors are 25 pin male "D", wired identically as "DCE" serial data ports. (DCE stands for Data Communications Equipment. A modem is a type of DCE. These ports are wired to accept data and to communicate using RTS, CTS and DSR as a modem would.)

The signals on these connectors are at RS-232 compatible voltage levels.

PIN	NAME	DESCRIPTION
1	GND	Chassis ground.
2	RXD	Received data (not used in CDL950R)
3	TXD	Transmitted data (to device connected to the CD LINK™ receiver).
4	RTS	Request to send. Internally connected to CTS.
5	CTS	Clear to send. Internally connected to RTS.
6	DSR	Data set ready. Internally connected to +5 volts.
7	GND	Signal ground.
16	AUX TXD	Auxiliary transmitted data. Internally connected to TXD pin 3.

2.6.3 SERIAL CONTROL

The serial control port is used to communicate with other products using the Harris Communications Protocol (see 5.2.3).

The connector is 25 pin male "D", wired as a "DCE" serial data port.

The signals on this connector are at RS-232 compatible voltage levels.

PIN	NAME	DESCRIPTION
1	GND	Chassis ground.
2	RXD	Received data (from device connected to the CD LINK™ receiver).
3	TXD	Transmitted data (to device connected to the CD LINK™ receiver).
4	RTS	Request to send. Internally connected to CTS.
5	CTS	Clear to send. Internally connected to RTS.
6	DSR	Data set ready. Internally connected to +5 volts.
7	GND	Signal ground.
16	AUX TXD	Auxiliary transmitted data. Internally connected to TXD pin 3.

2.6.4 AES3 DIGITAL OPTO OUT

An industry standard EIAJ CP-1201 connector is used.

2.6.5 AES3 DIGITAL XLR OUT

A male XLR connector is used.

AES digital audio data uses a self-clocking encoding method which does not use polarity. Pins 2 and 3 on this connector can be connected to the cable in either order.

PIN	NAME	DESCRIPTION
1	GND	Signal ground.
2	SIG+	Input signal "A"
3	SIG-	Input signal "B"

2.6.6 AUDIO OUT

There are four analog audio output connectors:

- MAIN AUDIO LEFT
- MAIN AUDIO RIGHT
- AUX AUDIO 1
- AUX AUDIO 2

All use XLR male connectors wired for differential output. Each MAIN channel (left, right) has a multi-turn trim pot to set the channel's output sensitivity. The trim pots allow full scale output adjustment over a -3dB to +20 dB signal range. The pots and their adjustment are described in Section 5-4.

The AUX channel levels (1, 2) are set using the keypad (see 5.3.1).

PIN	NAME	DESCRIPTION
1	GND	Signal ground.
2	AUDIO+	Audio plus.
3	AUDIO-	Audio minus.

WARNING: Disconnect primary power prior to servicing.

2.6.7 HEADPHONE

A mini phone jack is used and is compatible with headphones which have an impedance of 600 to 2000 ohms. The headphone jack is used to monitor the audio channels.

When the Main Audio Display is selected to the LCD screen, Left and Right audio are heard on the headphones. The ADJUST keys may be used to control the headphone volume.

When the AUX Audio/Data Display is selected, the AUX channels can be selected to the headphones. The ADJUST keys control the volume and the FIELD keys select the channel to be sent to each earpiece. See 3.5.2.

2.6.8 COMPOSITE OUTPUT

This output is activated if the optional Composite Stereo Generator is added. A female BNC connector is used.

Output level from this connector is 16V P-P maximum, adjustable through the rear panel by an adjustment potentiometer (Figure 2-3). The usual required level is 3.5V P-P.

The output impedance is 50 ohms.

2.6.9 19 kHz REF OUT

When the optional stereo generator is included, the 19kHz reference frequency from the generator is available from this female BNC connector.

The output level is a sinewave at either 1.7V P-P or 3.5V P-P, selected by JP12.

JP12 1-2 selects 3.5V P-P output.
JP12 2-3 selects 1.7V P-P output.

The output impedance is 50 ohms.

2.6.10 RF Input Connector

A type N female connector is used.

2.7 Receiver Configuration Jumpers

Jumpers on the main board can be set to select as follows:

JP1 & JP3

These jumpers are used to configure the STANDBY+ and STANDBY- pins in the PARALLEL CONTROL connector.

- Connecting pins 1 - 2 makes STANDBY+ a voltage input. The receiver is placed in STANDBY when STANDBY+ is +12 volts higher than STANDBY-.
- Connecting pins 2 - 3 grounds STANDBY+. The receiver is placed in STANDBY when STANDBY- is connected to STANDBY+ or any other ground pin.

JP2 & JP4

These jumpers configure the STERGEN+ and STERGEN- pins in the PARALLEL CONTROL connector.

- Connecting pins 1-2 causes STERGEN+ to be a voltage input. If the stereo generator is under external control, generator is off when voltage applied to STERGEN+ is +12 volts higher than STERGEN-, otherwise generator is on.
- Connecting pins 2-3 causes STERGEN+ to be internally connected to ground. If the stereo generator is under external control, the generator is off when STERGEN+ connected to STERGEN-, otherwise, the generator is on.

NOTE

RAD DIS and RAD ENA are used to interconnect the operation of two receivers in a redundant receiver system.

WARNING: Disconnect primary power prior to servicing.

3.1 The CD LINK™ Front Panel

The CD LINK™ transmitter and receiver both use the same front panel layout (Figure 3-1).

This section of the technical manual describes operation of the CD LINK™ transmitter and receiver. All operation and maintenance of the CD LINK™ units is done by using the front panel switches and the LCD display.

The **OPERATE/STANDBY** switch and indicators are used to turn RF transmission on and off and to show the current operating status. If a redundant system in installed, the **OPERATE/STANDBY** switch and indicators are also used to choose the operating unit.

The LIQUID CRYSTAL DISPLAY and and the KEYPAD are used to check the operation of the transmitter or receiver and to make any needed adjustments. Three display modes are included:

- **MONITOR**, the default and principal mode of operation, allows checking of the operating condition of the transmitter or receiver. **MONITOR** mode allows no adjustments.
- **SETUP** mode is used for user adjustments to the CD LINK™ transmitter and receiver.
- **FACTORY CAL** mode is included for factory initial calibration of CD LINK™ units.

FACTORY CAL and **SETUP** selections will be briefly identified but not described in this section. See Section V, Maintenance, Alignments and Adjustments for a full description of these modes.

3.2 OPERATE / STANDBY

OPERATE / STANDBY is an alternate-action button with indicators used to turn the transmitter ON and OFF.

In the receiver the OPERATE/STANDBY switch is used in redundant systems only.

When a fault condition occurs in a transmitter or receiver, the green OPERATE turns off and the red STANDBY flashes.

In the CDL950T transmitter, if the fault condition is caused by a failure in the RF power amplifier (see Section V - Faults), pressing the OPERATE/STANDBY switch to place the unit in standby and then pressing the switch a second time to place the unit in operate mode may clear the fault condition and turn on RF power.

Note:

If the RF power amplifier failure still exists the fault condition will be re-triggered and the power amplifier will be turned off again.

3.3 LCD Panel and Keypad

Each CD LINK™ transmitter or receiver contains a front panel six button keypad and a liquid crystal display to check and adjust the unit.

3.3.1 The Liquid Crystal Display

On the CD LINK™ transmitter or receiver, the backlit liquid crystal display can show 8 lines of text information as well as graphics such as real time audio level metering (See 3.4.1).

The backlight in the display remains lighted whenever the keypad is operated. It may be set to go dark if no keypress occurs for two minutes. (See 5.2.5, Display Setup Page.)

Each screen of displayed information is called a page. You can change pages (display a different screen full of information) by pressing the PAGE ↑ or PAGE ↓ keys.

MONITOR pages display the current operating parameters of CD LINK™. No adjustments (except headphone volume) can be made from the keypad when viewing a MONITOR page.

SETUP pages are selected from any MONITOR page when an adjustment is needed.

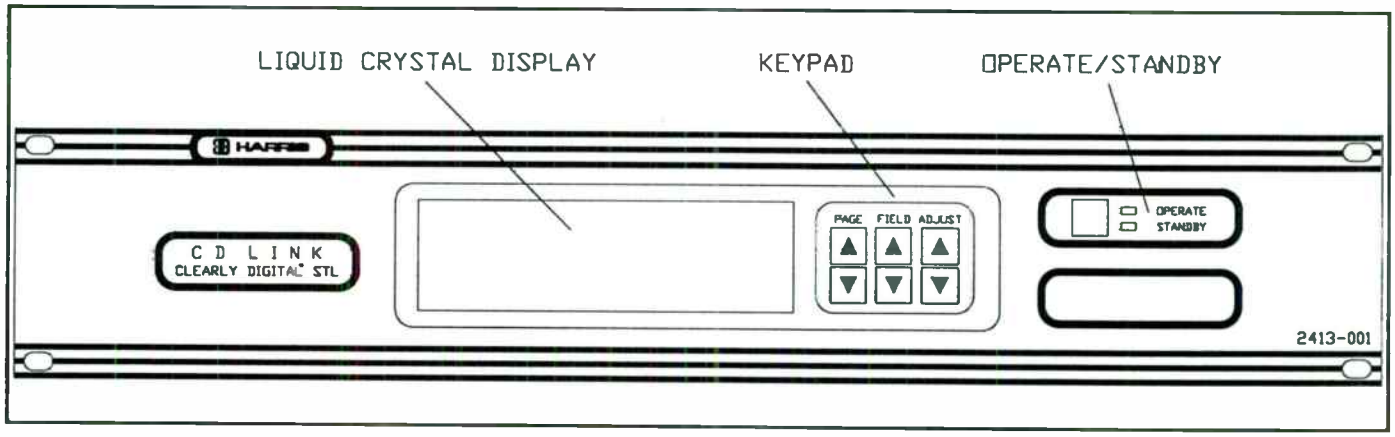


Figure 3-1
CD LINK Front Panel

WARNING: Disconnect primary power prior to servicing.

FACTORY CAL pages are used by manufacturing and service personnel to align and test the CD LINK™. They do not contain user adjustments. FACTORY CAL adjustments should be carried out only when Harris customer service advises.

Caution

Improper use of FACTORY CAL pages can result in loss of factory setup and can disable a transmitter or receiver.

3.3.2 Keypad Operation

The keypad is used to select display pages and to select from the **MONITOR** mode to the **SETUP** or the **FACTORY CAL** mode.

PAGE ↓ displays the next page (screen) of information.

PAGE ↑ displays the previous page of information.

FIELD ↓ highlights the next field on the current page.

FIELD ↑ highlights the previous field on the current page.

Note:

FIELD keys can only highlight the fields which can be adjusted. Most adjustments are carried out in SETUP mode.

ADJUST ↓ changes the value of the current (highlighted) field to a lesser value.

ADJUST ↑ changes the value of the current (highlighted) field to a greater value.

PAGE↑ and FIELD↑, pressed at the same time, switches to the **SETUP** pages. If **SETUP** is already displayed, pressing these keys returns to the **MONITOR** Pages.

Note:

When in **SETUP** *mode, if no key is pressed for 1 minute, the display automatically switches back to* **MONITOR**.

PAGE↑ and FIELD ↓, pressed at the same time, switches to the **FACTORY CAL** pages. If **FACTORY CAL** is already displayed, pressing these keys returns to the **MONITOR** Pages.

Note:

When in **FACTORY CAL** *mode the display will remain there until PAGE↑ and FIELD ↓ are used to return to* **MONITOR**. *There is no timed, automatic return to* **MONITOR** *mode from* **FACTORY CAL**.

The ADJUST ↑or ↓ keys are used to change field values from the SETUP or the FACTORY CAL modes.

- Where a field is numeric, ADJUST ↑ increases the value and ADJUST ↓ decreases the value.
- For YES/NO or ON/OFF fields, either key toggles the value.
- For fields which can take a value from a list, such as the main channel audio source, these keys select through all possible choices.

An auto-repeat function is build into the ADJUST ↑and ADJUST ↓ keys. If either is held down, it repeats at a rate of 5 per second after one second. After being held for five seconds, the rate increases to 20 per second.

3.4 Transmitter MONITOR Pages

The MONITOR pages are used to observe and check the CD LINK™ transmitter. No adjustments can be made in Transmitter MONITOR mode.

3.4.1 Main Audio Page

This is the default MONITOR page which always appears when the transmitter first is powered on.

This page redisplays automatically from any other MONITOR or SETUP page when a key is not pressed within one minute.

```
STAT:   OK                MAIN: 48K AES OPTO
FREQ: 951.000MHZ           AUX: 12K  0K
FWD:  2.0W  TEMP 35C     DATA1: 2400 N 8
VSWR: 1.10               DATA2: 1200 N 8

L******* MAIN AUDIO BAR GRAPH *********
R******* MAIN AUDIO BAR GRAPH *********
```

STAT:

- Displays OK, FAULT or WARNING. OK is the normal condition. If FAULT or WARNING appear, press PAGE ↓ twice to display the transmitter fault/warning MONITOR screen.

(See 3.4.3.)

FREQ:

- displays the current RF frequency in MHz.

FWD:

- displays the current forward power in watts.

VSWR:

- displays the voltage standing wave ratio at the transmitter's output. This is a true VSWR reading calculated from the transmitter output's Forward and Reflected power readings:

$$VSWR = \frac{FWD + REFL}{FWD - REFL}$$

TEMP

- displays the current temperature of the RF amplifier in degrees Celcius.

MAIN:

- displays the current configuration of the main left and right audio channels as one of the following:
  - 48K — 48K sample rate. Internally, the sample rate is converted to 32K.
  - 32K — 32K sample rate

- also indicates the type of input currently in use:

ANALOG	Analog input converted using built in A/D converter. Sample rate automatically set to 48K.
AES XLR	AES digital input via XLR connector.
AES OPTO	AES digital input via optical connector.

AUX:

- displays the current configuration of the two auxiliary audio channels. The left setting is for channel one, the right setting is for channel two.

0K The channel is not configured for use.
6K The channel is configured for a 6kHz sample rate.
12K The channel is configured for a 12kHz sample rate.

Note:

The combined sample rate for the two auxiliary audio channels cannot be greater that 12kHz. If one channel is used, it may be set to 6kHz or to 12kHz. If both channels are used, each must be set to 6kHz.

DATA1:
DATA2:

- display the current configuration for the two user data channels. Each displays three fields: baud rate, parity and data bits.
- Baud rates can be 0, 300, 1200, 2400, 4800 and 9600. A value of 0 means the channel is not configured for operation.

Note:

The total baud rate for the two data channels cannot be more than 9600.

- Parity can be even "E", odd "O" or none "N."
- The number of data bits can be 7 or 8.

MAIN AUDIO BAR GRAPH

Displays real time metering of the main channel left and right audio levels. The meter can be setup for log or linear scales and has a peak hold option. (See 5.2.5, Display Setup Page.)

The two-line bar graph displays the audio level in each main channel continuously. To aid the user in observing peak levels, a peak indicator is displayed on each scale with a longer delay than the main bargraph.

Whenever the audio level in a channel equals or exceeds the maximum, or clipping, level in the channel, the word "CLIP" appears on the right end of that bargraph to show that the level is too high.

3.4.2 Aux Audio/Data Page

From the Main Audio page, press PAGE ↓ once to move to the Aux Audio/Data Page.

```
DATA1   DATA          RADIATE ENABLE  ON
DATA2   IDLE          RADIATE DISABLE OFF


1******* AUX AUDIO BAR GRAPH *********
2******* AUX AUDIO BAR GRAPH *********
```

DATA1
DATA2

These fields provide quasi-real-time monitoring of the serial data input lines. Valid values are:

IDLE	No data is currently being received
DATA	Data is currently being correctly received
FRAME ERR	A framing error occurred while receiving a character. The baud rate is probably incorrect.
PARITY ERR	A parity error occurred while receiving a character. Check the parity setting for the data channel.
OVERRUN	Data received faster than it can be processed. Should never occur. Report condition to technical support.

RADIATE ENABLE and RADIATE DISABLE are the status of the transfer panel switch lines found on the ALARM In/Out rear panel connector.

RADIATE ENABLE ON instructs the CD LINK™ to turn on its RF power.

RADIATE DISABLE ON instructs the CD LINK™ to turn off its RF power.

NOTE

These fields and the transfer panel switch lines are used in CD LINK™ systems with redundant transmitters. Redundant systems are described in Section VI.

AUX AUDIO BAR GRAPH

Displays real time metering of the two auxiliary audio channel levels. The display is similar to the Main Audio Bar Graph on the Main Audio Page. (See 3.4.1, MAIN AUDIO BAR GRAPH.)

3.4.3 FAULT/WARNING MONITOR Page

```
------- FAULTS -------  --WARNINGS--
FWD PWR OK    RF LOCK   FAIL  VSWR     FAIL
TEMP      FAIL DECIM      OK  TEMP     OK
20 MHZ    OK   PACKER     OK  AES CLK  OK
26 VOLT   OK   DSP SYNC   OK  AES SIG  OK
               EEPROM     OK  AUX BD   OK
```


WARNING: Disconnect primary power prior to servicing.

Note:
Section VII - Troubleshooting describes the Transmitter and Receiver Fault and Warning screens and explains each fault and warning.

3.5 Receiver MONITOR Pages

These are the pages used to observe and check the receiver.

3.5.1 Main Audio Page

This is the default MONITOR page for the receiver. This page redisplays automatically from any other MONITOR or SETUP page when a key is not pressed within one minute.

When this screen displays, the main audio channel audio signals are sent to the headphone jack. The ADJUST keys can be used to raise and lower headphone volume.

```
STAT:   OK                    AUX: 12K  0K
FREQ: 951.000MHZ            DATA1: 2400 N 8
RF:    50uV   QLTY 90%      DATA2: 2400 N 8
BER:   2.5E-6 TIME: 30S   STEREO: ON   10.0%

L******* MAIN AUDIO BAR GRAPH *********
R******* MAIN AUDIO BAR GRAPH *********
```

STAT:

- Displays OK, FAULT or WARNING. OK is the normal condition. If FAULT or WARNING appear, press PAGE ↓ twice to display the receiver fault/warning MONITOR screen.

(See 3.5.3.)

FREQ:

This field displays the current RF frequency in MHz.

RF:

This field displays the received RF signal level in microvolts (uV) or millivolts (mV) as appropriate.

The minimum usable signal level is 7-10 uV. The system should be designed with a "normal" received signal level which is higher than this minimum level plus the desired fade margin.

Normal Level = 10 uV (+20dBuV) + Fade Margin (dB)

QLTY:

This field displays a rough approximation of the signal to noise performance, in percent. Higher QLTY values indicate better signal to noise performance. Typical QLTY readings are greater than 80%.

Note:
If the RF level is normal and is well above the minimum acceptable level (10 uV), yet the QLTY reading is low, the most likely cause is interference from another transmitter.

BER:

This field displays the receiver's bit error rate using scientific notation format. Examples:

1E-4	$1x10^{-4}$	1 error every 10,000 bits
2E-5	$2x10^{-5}$	2 errors every 100,000 bits
5E-6	$5x10^{-6}$	5 errors every 1,000,000 bits

Note:
See Section 5.3.4, Warning/Fault Setup, for a description of the Bit Error Rate and time interval.

- The BER will increase if RF is below 10 uV and QLTY is lower than 20%.

TIME:

This is the time interval over which the Bit Error Rate is averaged.

Note:
If the TIME: indication changes to 0 SEC, sync has been lost.

AUX:

This field displays the current configuration of the two auxiliary audio channels.

- The left setting is for channel one.
- The right setting is for channel two.

0K	The channel is not configured for use.
6K	The channel is configured for a 6 kHz sample rate.
12K	The channel is configured for a 12 kHz sample rate.

DATA1
DATA2

These fields display the current configuration for the two user data channels. Each displays three fields: baud rate, parity and data bits. Baud rates can be 0, 300, 1200, 2400, 4800 and 9600.

- A value of 0 means the channel is not configured for operation.
- Parity can be even "E", odd "O" or none "N."
- The number of data bits can be 7 or 8.

STEREO:

- indicates whether the optional stereo generator is ON or OFF.

- The second field is the 19kHz pilot tone level of the stereo generator. Percentage of modulation is displayed.

MAIN AUDIO BAR GRAPH

Displays real time metering of the main channel left and right audio levels. The meter can be setup for log or linear scales and has a peak hold option. (See 3.4.1, Transmitter MAIN AUDIO BAR GRAPH.)

3.5.2 External Control Pins & Aux Audio/Data

When in this screen, the auxiliary audio channels are sent to the head phones. The ADJUST ↓ and ADJUST ↑ keys control the headphone volume.

```
DATA 1:   IDLE    STANDBY ENABLE      OFF
DATA 2:   IDLE    STEREO DISABLE      OFF
HEAPHONE AUX1/AUX2 AUX1/AUX1 AUX2/AUX2

1******* AUX AUDIO BAR GRAPH *********
2******* AUX AUDIO BAR GRAPH *********
```

Use the FIELD keys to highlight the field which selects the desired channels to the headphone.

INDICATOR	HEADPHONE LEFT	HEADPHONE RIGHT
AUX1/AUX2	AUX1	AUX2
AUX1/AUX1	AUX1	AUX1
AUX2/AUX2	AUX2	AUX2

DATA 1:
DATA 2:

These fields indicate whether each data channel is currently IDLE or ACTIVE.

STANDBY ENABLE:

Indicates the external STANDBY pins are active and have placed unit in standby mode. (This input is normally used only in redundant receiving systems - see Section VI.)

STEREO DISABLE:

Indicates the external STERGEN pins are active. (Used only if the optional stereo generator is installed.)

When the stereo generator is set for external control, the stereo generator is turned off when these pins are active. When the pins are NOT active the stereo generator is on.

AUX AUDIO BAR GRAPH

Displays real time metering of the two auxiliary audio channel levels. This is similar to the Main Audio Bar Graph, 3.5.1.

3.5.3 Error Rate Monitor

This page displays the error rate in the received signal.

```
        SHORT/LONG TERM BIT ERROR RATES

RESET: NO        RF: 123.1uV  QLTY: 90%

                  SHORT     LONG  UNCORRECTED
ELAPSED SEC:        xxx   xxxxxx       xxxxxx
ERROR COUNT:    xxxxxx  xxxxxxx       xxxxxx
ERROR RATE:    xxxxxxx  xxxxxxx      xxxxxxx
```

RESET:

Pressing ADJUST ↑or ADJUST ↓ clears the error rate statistics on this screen to zero.

RF:

The current RF received signal strength is displayed here.

QLTY:

This field displays a rough approximation of the signal to noise performance, in percent. Higher QLTY values indicate better signal to noise performance. Typical QLTY readings are greater than 80%.

ELAPSED SEC:

This is the number of seconds since the last RESET.

ERROR COUNT:

This is a count of the number of errors detected.

ERROR RATE:

This is the ERROR COUNT per second in each column, based on dividing the ERROR COUNT in the column by the ELAPSED SEC. in the column.

Three columns of values are displayed:

- SHORT are the short term errors accumulated since the last RESET. RESET takes place automatically after a time interval set on the Fault/Warning Setup Page. RESET can also be commanded any time - see RESET, above.
- LONG are the long term errors accumulated over 101 hours.
- UNCORRECTED are the uncorrected errors accumulated over the last 101 hours.

3.5.4 FAULT/WARNING MONITOR Page

The receiver FAULT/WARNING MONITOR screen appears as follows.

```
-- FAULTS --     --WARNINGS--
SYNC      OK       SIG LEVEL    FAIL
DSP       OK       SIG QUALITY  OK
RF LOCK   OK       ERR RATE     OK
32K LOCK  OK       EEPROM       OK
                   AUX BD       OK
```

Note:

Section VII - Troubleshooting describes the Transmitter and Receiver Fault and Warning screens and explains each fault and warning.

WARNING: Disconnect primary power prior to servicing.

4.1 Introduction

CD LINK™ is a 950 MHz digital transmitter and receiver which can provide the digital interconnection between a digital studio audio system and the digital input to a transmitter. The digital input and the digital output can be either XLR or optical AES3.

Analog and AES3 digital program output are available simultaneously. Therefore the analog output may be used to provide input to an analog FM broadcast transmitter in a main/alternate transmitter system. An optional stereo generator may also be included in the receiver to provide composite stereo output to the back-up transmitter.

No program channel compression is used in the CD LINK™ STL, resulting in superior performance with no interaction between the link's signal transmission and digital compression which might be used earlier in the signal chain.

Auxiliary data paths are provided as possible remote control paths through the STL.

Two auxiliary audio channels may also be added a an option to permit transmission of SCA audio signals through the link.

4.2 System

Shown in Figure 4-1 is the CD LINK™ transmitter and receiver in a typical system. The output from the studio is preemphasized and processed into an AES/EBU digital signal and delivered to the XLR or the optical AES3 input of the CD LINK™ transmitter. SCA audio signals are input to (optional) AUX Audio inputs on the CD LINK™ transmitter. The transmitter output, 2 watts RMS, is routed to the antenna system and directed to the receive location.

The XLR AES3 input deviates from the present AES standard by providing a 220 ohm input impedance rather than a 110 ohm input. In systems using redundant transmitters, two CDL950T transmitter AES3 inputs may be paralleled without signal degradation. If only a single CDL950T transmitter is used, any reflected signal caused by the 220 ohm termination is absorbed in the 110 ohm source impedance required by AES3.

Incoming RF from the receive antenna is fed to the CD LINK™ receiver. The AES/EBU digital signal is routed from the receiver directly to the AES input of the Harris DIGIT™ exciter.

Optional SCA 1 and SCA 2 audio outputs from the CD LINK™ receiver are routed to SCA generators and the SCA generator outputs are fed to the SCA inputs on the DIGIT™ exciter.

4.3 CD LINK™ Transmitter

The transmitter consists of the following major subassemblies:

- A1, the transmitter main board
- A2, the Synthesizer/Modulator board
- A3, the RF output PA
- A4, the front panel overlay, containing the membrane switches and LED's.

A5, the Auxiliary Audio Encoder, is added piggyback on the main board when the Aux Audio channels are included.

Two power supplies are included in the transmitter:

- PS1 powers all assemblies except the RF PA.
- PS2 powers the PA.

Main Board

The transmitter Main Board, mounted to the bottom of the case, houses the transmitter analog circuits and most of the digital circuits. All signal and control input and output connectors on the back of the transmitter are mounted to the main board, with the exception of the RF OUT connector and the AC IN connector.

Audio input to the CD LINK™ transmitter may either be Left and Right analog audio or AES/EBU digital audio. Analog input audio is converted to AES/EBU in the audio front end.

Digital data and an optional auxiliary stereo or two-channel audio source may also be input. The optional Aux Audio board, when installed, mounts on top of the main board and connects to it at J5.

The main channel AES/EBU signal is combined with the data channels and the optional auxiliary audio into a single bitstream at the sample rate converter, which processes the digital signal into a form suitable for the RF Modulator. The input to the RF Modulator is at a data rate of 1.2 MB/s.

The main board outputs the data stream from J7 to Synthesizer/Modulator A2, J1.

Synthesizer/Modulator

The synthesizer/modulator board mounts to the left front side of the case. The data stream is received from the main board, modulated onto the RF carrier and output to RF PA A3. The RF Modulator uses an advanced modulation method to produce a transmitted symbol rate of 240 k Symbols/s at the selected output frequency.

RF PA

The RF PA is mounted in the left rear corner of the transmitter. The PA amplifies the low-level output from the Synthesizer/Modulator to 2 Watts rms, and outputs this signal to the transmitter output connector at the rear of the unit. A directional coupler in the PA output provides detected forward and reflected RF samples which are delivered to the main board to permit metering actual output power level and also permit detection of reflected power at the output.

Power Supplies

Power supplies PS1 and PS2 are mounted to the right-hand wall of the transmitter.

PS1 supplies +/- 15VDC to the TX Main board, which distributes supply voltages to all other circuits except the PA.

WARNING: Disconnect primary power prior to servicing.

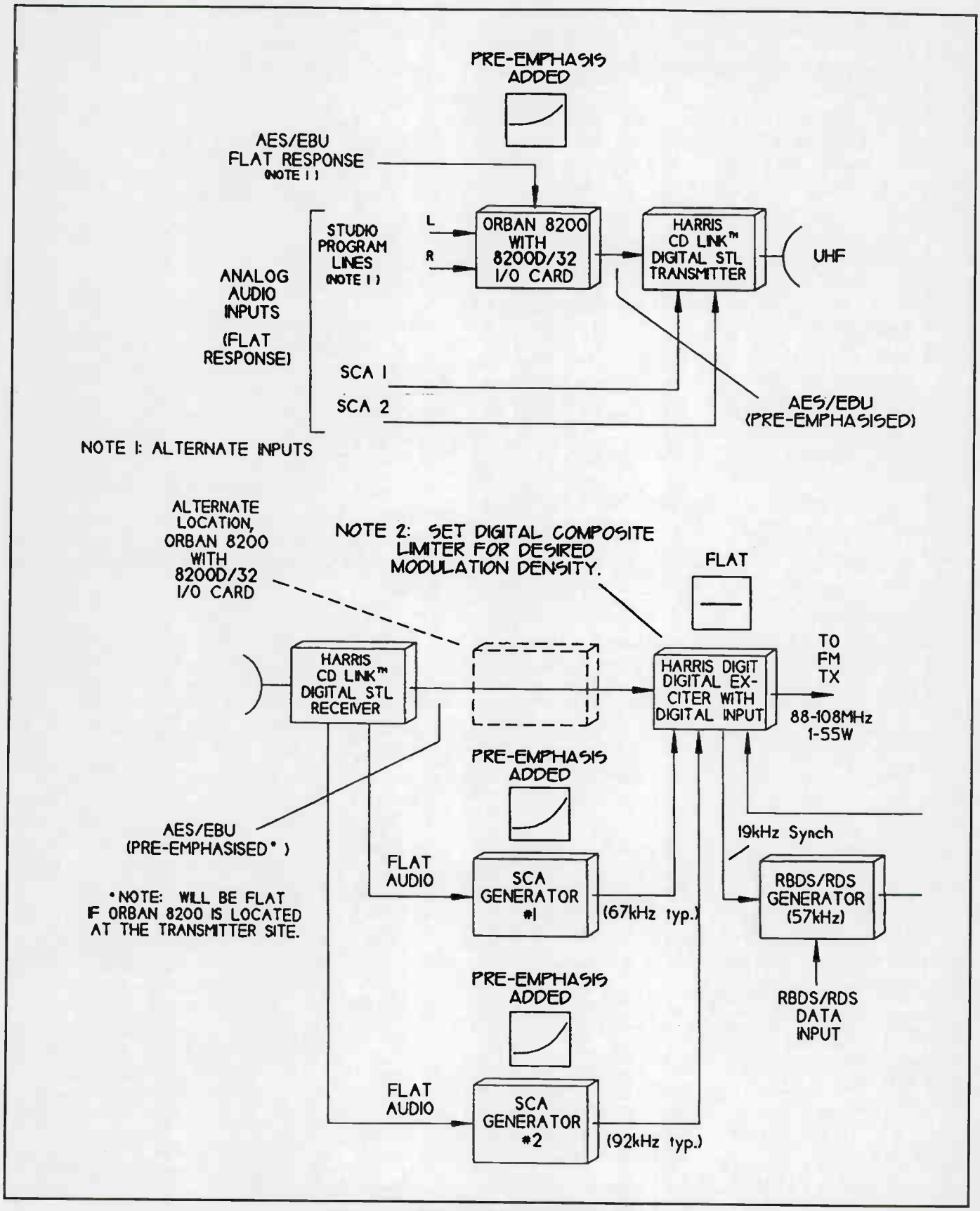


Figure 4-1. All Digital Path for FM Broadcast: HARRIS CD LINK DIGITAL STL

WARNING: Disconnect primary power prior to servicing.

PS2 supplies +26VDC to the PA.

The power supplies accept any input power source from 90VAC to 264VAC, 50 or 60 Hz, without need for operator selection.

Mains Fusing

A 1A SlowBlow fuse is installed in the rear panel input power connector to protect the equipment in case of internal short circuit. This fuse size is used for all input line voltages.

Control and Monitoring

The Microcontroller on the main board exercises complete control over setup, configuration, monitoring and alarming of the transmitter. Using the keypad and the Liquid Crystal Display, the user can view all aspects of the operating system and make any needed adjustments.

4.4 CD LINK™ Receiver

The receiver consists of the following major subassemblies:

- A1, the receiver main board.
- A2, the demodulator.
- A3, the front panel overlay, containing the membrane switches and the LED indicators.

A4, the Auxiliary Audio board, is added if Aux Audio channels are included.

Demodulator

The receiver RF and demodulator circuits are in the Receiver Demodulator board, mounted in the compartment on the left side of the CDL950R. The receiver demodulates and decodes the signal from the CD LINK™ transmitter in the RF Demodulator. The demodulator output, J6, connects to input J10 of the main board.

Receiver Main Board

The remaining digital and analog circuits for the receiver are on the Receiver Main Board, mounted to the bottom of the case. All rear-panel connectors except RF IN and AC IN are on the Main board. The received data from the demodulator board are unscrambled and unpacked into the Main Audio AES/EBU signal, which is output directly as XLR and optical AES/EBU, and also converted by a D/A section into Left and Right analog audio.

The digital data channels are output serially via UART's.

If the optional auxiliary audio channels are installed, added D/A channels output Aux 1 and Aux 2.

If the optional stereo generator is installed, a composite stereo signal and a 19kHz reference are available at BNC output connectors on the receiver.

Power Supply

The power supply, mounted to the right-hand wall of the case, supplies + / - 15VDC to the main board, which distributes voltages to the other boards.

The power supply accepts any input power source from 90VAC to 264VAC, 50 or 60 Hz, without need for operator selection.

Mains Fusing

A 1/2A SlowBlow fuse is installed in the rear panel input power connector to protect the equipment in case of internal short circuit. This fuse size is used for all input line voltages.

Control and Monitoring

As at the transmitter, the Microcontroller exercises complete control over setup, configuration, monitoring and alarming of the receiver. Using the keypad and the Liquid Crystal Display, the user can view all aspects of the operating system and make any needed adjustments.

WARNING: Disconnect primary power prior to servicing.

5.1 Introduction

Nearly all maintenance, alignment and adjustments to the CD LINK™ transmitter and receiver are carried out using the front panel Six Button keypad and Liquid Crystal Display. Refer to Section III, Operator's Guide to understand the operation of the keypad and the display.

- SETUP procedures are for the user, to let him configure the CD LINK™ transmitter and receiver to his system's requirements.
- FACTORY CAL procedures are primarily for use of HARRIS' factory engineers and field service personnel. They are described in this section to make users aware of their existence.

Note:
We recommend users avoid changing Factory Cal adjustments unless advised to perform one of them by our representatives.

5.2 Transmitter Setup

To enter or exit the SETUP pages, press both the PAGE ↑ and FIELD ↑ keys at the same time.

NOTE
CD LINK™ automatically exits the Setup Pages and returns to the Monitor Pages if a key isn't pressed within 1 minute.

Use PAGE ↑ and ↓ keys to select any transmitter setup page.

Use the FIELD ↑ and ↓ keys to select fields in each page.

Each field which can be selected can be adjusted using the ADJUST ↑ and ↓ keys.

Each transmitter setup page displays a

```
————————-[Help Line]————————-
```

at the bottom of the screen, explaining the range of choices available.

5.2.1 Audio Channels Setup

This page allows the user to set the transmitter for the types of inputs to be supplied to the transmitter and the needed internal data rates.

```
          AUDIO CHANNELS SETUP

MAIN SOURCE: AES OPT
MAIN RATE:    32K




————————-{Help Line]————————-
```

MAIN SOURCE

The main audio channel input to the transmitter. The source may be analog, AES digital XLR connector or AES digital optical connector.

MAIN RATE

The sample rate of the main source input. It may be either 32K or 48K samples per second. 48K is automatically selected when ANALOG input is selected. (The sampled signal is then internally sample rate converted down to 32K.)

5.2.2 Aux Audio Channels Setup

This page is used to set the Baud rates and the input gains of the two optional Auxilary Audio Channels.

(These channels are available only if the Aux Audio Channel option has been purchased.)

```
    AUX AUDIO CHANNELS SETUP

BANDWIDTH: 1)  12K     2)  OFF
GAIN:      1) -10.0DB  2) -10.0DB

1******* AUX AUDIO BAR GRAPH *********
2******* AUX AUDIO BAR GRAPH *********
————————-[Help Line]————————-
```

BANDWIDTH:

The bandwidth of each channel is selected by setting the sample rate for the channel. The channels may be configured as 0K (OFF), 6K or 12K.

The sum of the two channels' bandwidths must not be greater than 12K.

- Setting channel 1 reduces the channel 2 bandwidth if neccessary, to keep the sum of the channel bandwidths from exceeding 12K.
- Setting a channel to OFF causes its' bandwidth to default to 0K.
- If the option is not included, "N.A" appears instead of the baud rates.

GAIN:

Displays the gain settings of the two auxiliary audio channels. Selecting one these positions allows adjustment of the channel gain. A typical gain adjustment procedure is:

a. Move the cursor to the GAIN reading for the channel to be adjusted.
b. Connect an audio tone to the Aux channel input. The tone should be within the desired bandwidth (400 Hz or 1 kHz

would be suitable), and should be at the maximum expected peak level.

c. Use the ADJUST keys to set the channel level, observing the level on the Aux Audio Bargraph. Set the level below the clip point, to allow the desired headroom.

5.2.3 Digital Data Channels Setup

This page sets the parameters of the Digital Data Channel and the Control Channel inputs.

There are two user digital data channels and one control data channel. Each channel can be configured independently.

```
        DIGITAL DATA CHANNELS SETUP

DATA1:    1200 BAUD    NO PARITY   7 BITS
DATA2:    2400 BAUD  EVEN PARITY   7 BITS
CONTROL:  1200 BAUD    NO PARITY   8 BITS
     ID: 16

--------[Help Line]--------
```

DATA1
DATA2
CONTROL

For Each channel

- BAUD sets the baud rate of the channel.

Note:

The total combined baud rate of the data channels (DATA1 + DATA2 + CONTROL) may not exceed 12,000 baud, which corresponds to one 9600 baud channel and one 2400 baud channel. The combined baud rate of the DATA channels may not exceed 9600 baud. The control channel's maximum baud rate is 2400.

- PARITY selects whether the channel's parity is to be ODD, EVEN or NO parity.
- BITS sets the number of bits for each channel to be 7 or 8.

Control Channel

The control channel recognizes the Harris Communication Protocol. This protocol allows a computer to interrogate and setup the CD LINK.

The control channel baud rate can be set to 1200 or 2400. Parity is fixed at NO PARITY and data is fixed at 8 bits.

ID:

The Harris Communication Protocol requires each device to have a unique ID number so that the computer can correctly communicate with the device. The default ID number (16) is to be used unless the system is redundant. In redundant systems, one link should be set to ID: 16 and the other should be set to ID: 17.

5.2.4 RF Setup

This page is used to set the transmitter frequency.

```
              RF SETUP

RF FREQUENCY: 951.050 MHZ



--------[Help Line]--------
```

RF FREQUENCY

The transmitter frequency. The range is 942.000 to 952.000 MHz. When the ADJUST ↑ or ↓ key is pressed, the frequency changes by 25 kHz.

Note:

Holding down the ADJUST ↑ or ↓ key will cause the frequency to continue increasing until the key is released.

5.2.5 Warning/Fault Setup

This page is used to set the limits for transmitter Reverse Power WARNINGS.

```
          WARNING/FAULT SETUP

VSWR WARN:       1.2



--------[Help Line]--------
```

REV POWER WARN

The VSWR value above which the REV POWER warning will occur.

- May be set to any value between 1.0 and 4.0.

5.2.6 Display Setup

```
              DISPLAY SETUP
LCD CONTRAST:                  8
AUTO DIM DISPLAY:            YES
AUDIO METER SCALE:           LOG
AUDIO METER PEAK HOLD TIME:   .2 SEC
AUDIO METER DECAY TIME:      120 MSEC

--------[Help Line]--------
```

LCD CONTRAST

- has a possible range of 16 values.
- 0 causes the lightest display.

WARNING: Disconnect primary power prior to servicing.

- 15 causes the darkest display.

AUTO DIM DISPLAY

- If YES, causes the display backlight to turn off after 1 minute with no keypress. Any keypress turns the backlight on again.
- If the setting is NO, the backlight remains turned on.

AUDIO METER SCALE

Allows the user to select either a LOG or a LINEAR scale for the bargraph displays on the Main Audio Page and the Aux Audio/Data Page.

AUDIO METER PEAK HOLD TIME:

This is the duration in seconds a peak value is held before it starts to decay.

AUDIO METER DECAY TIME:

This is the time in milliseconds required for the peak indicator to drop after PEAK HOLD TIME expires. A large value results in a slower decay time.

5.3 Receiver Setup

To enter or exit the setup pages, press both the PAGE ↑ and FIELD ↑ keys at the same time.

NOTE

CD LINK™ automatically exits the Setup Pages and returns to the Monitor Pages if a key isn't pressed within 1 minute.

Use Use PAGE ↑ and ↓ keys to select any receiver setup page.

Use the FIELD ↑ and ↓ keys to select fields in each page.

Each field which can be selected can be adjusted using the ADJUST ↑ and ↓ keys.

Each receiver setup page displays a

```
————————-[Help Line]————————-
```

at the bottom of the screen, explaining the range of choices available.

5.3.1 Aux Audio Channels Setup

This page sets the auxiliary audio channels and outputs.

```
        AUX AUDIO CHANNELS SETUP

BANDWIDTH 1:   12K      2:   OFF
LEVEL     1: -3.0DBm   2: -3.0DBm

1******* AUX AUDIO BAR GRAPH *********
2******* AUX AUDIO BAR GRAPH *********
————————-[Help Line]————————-
```

BANDWIDTH:

The bandwidth of each channel is selected by setting the sample rate for the channel. The channels may be configured as 0K (OFF), 6K or 12K.

The sum of the two channels' bandwidths must not be greater than 12K.

- Setting channel 1 reduces the channel 2 bandwidth if neccessary, to keep the sum of the channel bandwidths from exceeding 12K.
- Setting a channel to OFF causes its' bandwidth to default to 0K.
- If the option is not included, "N.A" appears instead of the baud rates.

GAIN:

Displays the gain settings of the two auxiliary audio channels. Selecting one these positions allows adjustment of the channel gain. The Aux Audio Bar Graph display gives the current levels as an adjustment aid.

5.3.2 Digital Data Channels Setup

This page sets the parameters of the digital data channel inputs. For each of the channels used, these settings must be the same as or higher than the settings in the Transmitter Digital Data Channels page.

```
        DIGITAL DATA CHANNELS SETUP

DATA1     1200 BAUD     NO PARITY   7 BITS
DATA2     2400 BAUD   EVEN PARITY   7 BITS
CONTROL   1200 BAUD     NO PARITY   8 BITS
ID:  18
————————-[Help Line]————————-
```

DATA1
DATA2
CONTROL

There are two user digital data channels and one control data channel. Each channel can be configured independently.

For Each Channel

- BAUD sets the baud rate of the channel.

Note:

The total combined baud rate of the data channels (DATA1 + DATA2 + CONTROL) may not exceed 12,000 baud, which corresponds to one 9600 baud channel and one 2400 baud channel. The combined baud rate of the DATA channels may not exceed 9600 baud. The control channel's maximum baud rate is 2400.

- PARITY selects whether the channel's parity is to be ODD, EVEN or NO parity.
- BITS sets the number of bits for each channel to be 7 or 8.

Control Channel

The control channel uses the Harris Communication Protocol, which permits a computer to interrogate and setup each unit. Control channel baud rate can be set to 1200 or 2400. Parity is fixed at NO PARITY and data is fixed at 8 bits.

ID:

Each device using the Harris Communication Protocol must have a unique ID number. The default ID number is 18. If a system is to use Harris Communication Protocol with a computer connected to the SERIAL CONTROL port, any second unit must be set to ID 19.

NOTE

The SERIAL CONTROL port is an option for future custom applications. It is not required in order to operate a CD LINK™ STL.

5.3.3 RF Receiver Setup

This page is used to set the receiver to the proper frequency.

```
                RF RECEIVER SETUP

RF FREQUENCY                    951.050 MHZ
                RF RECEIVER SETUP



————————-[Help Line]————————-
```

RF FREQUENCY

The receiver frequency. The possible range is 942.000 to 952.000 MHz.

- When the ADJUST ↑ or ↓ key is pressed, the frequency changes 25 kHz.
- Holding down the ADJUST ↑ or ↓ key will cause it to auto increment (or decrement) the frequency.

5.3.4 Warning/Fault Setup

This page is used to set the limits for receiver FAULTS and WARNINGS. Adjustable FAIL SAFE timing is also included on this page.

```
              WARNING/FAULT SETUP
TURN OFF OUTPUTS ON FAULT? YES
FAIL SAFE RELAY TIMER:      30 MIN
RF LEVEL WARN:             20UV
RF QUALITY WARN:           25%
BER WARN:                 1.0E-06
BER AVERAGING TIME:         30 SEC
————————-[Help Line]————————-
```

TURN OFF OUTPUTS ON FAULT?

This field allows the user to choose whether the receiver outputs are turned off when the receiver is faulted. In redundant receiver systems, the outputs are connected in parallel but only one receiver may be active. The inactive receiver's outputs should be turned off to avoid loading the active receiver's outputs.

- Specify YES for redundant receiver installations.
- Specify NO for systems with a single receiver.

FAIL SAFE RELAY TIMER:

The failsafe relay contacts (pins 12 & 13 of the ALARM IN/OUT connector) close when a fault occurs and the time delay entered in this field has passed.

- The time interval may be set to any number from 0 minutes to 240 minutes.

RF LEVEL WARN:

The RF input signal level below which a warning is issued.

- The setting can be any value from 0 - 250 microvolts.

RF QUALITY WARN:

RF Quality is a calculated quality level for the received RF signal.

- The quality level may be between 0% and 100%.

BER WARN:

A warning alarm will be displayed if the Bit Error Rate is greater than this number.

BER AVERAGING TIME:

The time interval over which the Bit Error Rate is calculated.

		Bit Error Rate
1E-4	$1x10^{-4}$	1 error every 10,000
2E-5	$2x10^{-5}$	2 errors every 100,000
5E-6	$5x10^{-6}$	5 errors every 1,000,000

WARNING: Disconnect primary power prior to servicing.

The CD LINK™ raw received bit rate is 1,267,200 bits per second. A rough equivalent you can use is to divide 1E-6 by the error rate to determine the number of seconds between errors.

For example, an error rate of 3.5E-10 is roughly:

$$\frac{1E-6}{3.5E-10} = \frac{1\times10^{-6}}{3.5\times10^{-10}} = 2857 \text{ Sec} = 47.6 \text{ Minutes}$$

- Increasing the BER Averaging Time increases the resolution of the BER reading.
- Shortening the BER Averaging Time causes the BER to be more affected and more quickly affected by brief disruptions to the signal.

5.3.5 Stereo Generator Setup

This page turns ON the optional stereo generator if it has been installed, and also sets the optional stereo generator pilot level.

```
        STEREO GENERATOR SETUP

STATUS:       ON
PILOT LEVEL: 10.0% RELATIVE TO -6DBFS
                  FOR 75KHZ DEVIATION

--------[Help Line]--------
```

STATUS

Controls the ON/OFF state of the stereo generator.

- In the ON state, the generator outputs composite stereo and the 19 kHz pilot level.
- In the OFF state, neither of these signals is produced.
- In EXTERNAL, the FAULT IN/OUT connector controls the STEREO GENERATOR ON/OFF selection.
- NOT INSTALLED indicates the stereo generator option has not been installed in this CD LINK™ receiver.

Note:

Refer to Section II for details of the ALARM IN/OUT connector pins used to control the stereo generator.

PILOT LEVEL:

This field is used to set the pilot level in the composite output to a level of between 0% and 20% of the peak signal output.

Note:

CD LINK™ is designed to operate with a 6 dB headroom between program peak level and the clip level in the system. The Stereo Composite Output Level control (rear panel) is then adjusted to produce 3.5 Volts P-P when the Left and Right channel levels through the link are at -6 dB. When this has been carefully done and the transmitter's deviation has been set, the % number in the PILOT LEVEL field will be the actual pilot level seen on the modulation monitor.

5.3.6 Display Setup

The LCD display contrast can be set from this page, and the LCD backlight can be set to dim 1 minute after the last keypress.

```
            DISPLAY SETUP
LCD CONTRAST                      8
AUTO DIM DISPLAY                YES
AUDIO METER SCALE:              LOG
AUDIO METER PEAK HOLD TIME:    .2 SEC
AUDIO METER DECAY TIME:       120 MSEC
--------[Help Line]--------
```

LCD CONTRAST

- can take 16 values, 0 being the lightest, 15 the darkest.

AUTO DIM DISPLAY

- If YES, LCD back light is turned off 1 minute after last key press.
- If NO, back light is always on.

AUDIO METER SCALE:

Allows the user to select either a LOG or a LINEAR scale for the bargraph displays on the Main Audio Page and the Aux Audio/Data Page.

AUDIO METER PEAK HOLD TIME:

This is the duration in seconds a peak value is held before it starts to decay.

AUDIO METER DECAY TIME:

This is the time in milliseconds required for the peak indicator to drop after PEAK HOLD TIME expires. A large value results in a slower decay time.

5.4 Analog Audio Level Adjustments

The only adjustments not carried out from the front panel are:

- the transmitter Left and Right Main Channel analog audio input levels.
- the receiver Left and Right main channel analog audio output levels.
- the receiver stereo Composite Output level (if the optional stereo generator is installed).
- selection of 19kHz pilot level.

Transmitter Main Analog Input Levels

The transmitter analog input level controls are located in the transmitter back panel next to the Left and Right Main Audio In connectors. To adjust, supply program input to the analog connectors and adjust each control for the desired level while

WARNING: Disconnect primary power prior to servicing.

observing the Main Audio Bargraph on the transmitter Main Display.

- The recommended setting is -6 dB. This provides 6 dB of headroom above peak level before clipping occurs.

Note:

The transmitter main analog inputs are equipped with jumpers to permit the choice of 150 ohm, 600 ohm or high input impedance. See 2.5, Transmitter Configuration Jumpers for details.

Receiver Main Analog Output Levels

The receiver analog output level controls are located in the receiver back panel next to the Left and Right Main Audio output connectors. Adjust these controls to supply the desired audio levels from the Left and Right outputs.

Receiver Optional Stereo Composite Level

If the receiver Composite Output is activated by including the optional stereo generator, the Composite Output level control located next to the Composite Out connector in the receiver back panel can be used to adjust the composite output level.

The control should be adjusted to produce 3.5 Volts P-P when CD LINK™ is transmitting Left and Right audio at 6 dB below clip level.

Pilot Output Level

When the optional stereo generator is included, the 19kHz reference frequency output level is a sinewave at either 1.7V P-P or 3.5V P-P, selected by JP12 on the Receiver Main Board.

JP12 1-2selects 3.5V P-P output.
JP12 2-3selects 1.7V P-P output.

5.5 Transmitter FACTORY CAL Pages

These screens are used by HARRIS engineering, production and field support personnel to align CD LINK™ and diagnose problems.

Note:

We recommend users avoid changing Factory Cal adjustments unless advised to perform one of them by our representatives.

5.5.1 How to Enter and Exit

To enter or exit the FACTORY CAL pages, press both PAGE ↑ and FIELD ↓ at the same time.

Caution

Unlike the Setup Pages, The CD LINK™ does not automatically exit the FACTORY CAL Pages and return to the Monitor Pages after 1 minute.

5.5.2 EEPROM

```
FACTORY CAL: EEPROM:   STATUS: OK
TEST EEPROM:     NO    RESULT: PASSED
RESET DEFAULTS: NO
RESET EEPROM:    NO

  x x x  numeric sequence x x x x
  x x x x x x x x x x x x x x x x
COPYRIGHT @ 1996 HARRIS CORP.  REV 1.0
```

STATUS:

This field displays OK if the EEPROM data is valid. FAULT appears if the data is corrupt.

TEST EEPROM:

The technician tests the EEPROM by pressing ADJUST ↑ or ↓ in the field.

The results of the test are displayed in the TEST RESULTS field.

TEST RESULT	DESCRIPTION
PASSED	EEPROM OK. Original data restored.
00 FAIL	Writing value 00 to all locations failed.
FF FAIL	Writing hex FF to all locations failed.
55 FAIL	Writing hex 55 to all locations failed.
AA FAIL	Writing hex AA to all locations failed.
12 FAIL	Writing numeric sequence 1,2,3... failed.

If the EEPROM tests OK, its original contents are restored. (The test is non-destructive unless the EEPROM is faulty.)

If the EEPROM fails a test, the numeric sequence read from the EEPROM displays at the bottom of the screen. The numeric sequence location is shown by lines of "x"'s in the screen above. The numeric sequence is in hexadecimal numbers.

Caution

When a test fails, the original EEPROM data is lost. This data was probably corrupt in any event. The EEPROM should be replaced.

RESET DEFAULTS

Enables resetting of all user-entered setups and certain factory setup parameters to the default values. These parameters are not reset:

- Forward Power Coefficient
- REflected Power Coefficient
- Temperature Coefficient
- RF Modulator Phase, Offset and Gain Parameters

WARNING: Disconnect primary power prior to servicing.

RESET EEPROM:

This field enables reset of user setup and ALL factory calibration parameters.

CAUTION

Every CD LINK™ transmitter has unique RF amplifier and RF modulator setup/alignment parameters that are set during manufacturing (see following manual sections). If factory defaults are reloaded into the CD LINK™, these unique settings are lost and the unit will not function correctly until new parameters are entered.

The factory setup and alignment parameters for each unit are noted on a sticker which is attached to the rear panel of the unit at the completion of the factory tests.

5.5.3 DSP

The three DSP chips can be independently enabled or held in reset. This screen is used by HARRIS engineering for testing new software releases and is not required by production or end users.

```
                FACTORY CAL: DSP
DECIMATOR: RUNNING
PACKER:    RUNNING
TX FILTER: RUNNING
AUX BOARD: RUNNING
```

DECIMATOR:
PACKER:
TX FILTER:

Each of these fields represents a DSP chip in the transmitter. The fields are used to turn the chips off for testing.

AUX BOARD:

This field represents the DSP chip in the Aux Audio board. If the board is installed, the field is used to turn the chip off for testing.

CAUTION

Make sure all DSP chips are RUNNING after completing your tests.

5.5.4 RF AMP

This page allows factory calibration of the forward and reverse power and temperature sensors.

```
              FACTORY CAL: RF AMP

FWD POWER COEF      xxx      FWD: 1.2W
REV POWER COEF      xxx     VSWR: 1.09
TEMPERATURE COEF    xxx     TEMP: xxxC

FWD POWER FAULT:   1.6W FAULT: 2.5W
TEMPERATURE WARN:  75C  FAULT:  80C
```

These values are setup when the unit is manufactured and should be adjusted when the RF power amp module is serviced. In the screen drawing above, the values to be set are shown by "xxx" or by a typical value.

5.5.5 RF MODULATOR

This page allows factory calibration of the RF modulator.

```
          FACTORY CAL: RF MODULATOR

RF OUTPUT: NORMAL      I OFFSET: xxx
TEST WAVE: OFF         Q OFFSET: xxx
TEST FREQ: 16 KHZ      I GAIN    xxx
                       Q GAIN    xxx
PHASE: xxx COEF: XXXX
```

RF OUTPUT

Used to turn on the RF power amp and modulator. This command overrides any fault condition which might keep them turned off.

TEST WAVE

This field sets up the transmit filter DSP to generate various test pattern signals which aid in setting up the other parameters.

TEST FREQ

This field allows adjustment of the sine and/or cosine signals generated during alignment.

PHASE

This field is used to adjust the phase delay (between 0 and 359 degrees) of the RF amplifier's feedback signal to match its input.

COEF:

This entry is the amount of phase correction (in degrees per MHz) which is automatically added when the RF frequency is changed.

I GAIN
I OFFSET

These fields adjust the gain and voltage offset of the modulator's In Phase channel.

Q GAIN
Q OFFSET

These fields adjust the gain and voltage offset of the modulator's Quadrature channel.

Note:
The transmit filter DSP automatically returns to normal operating mode when this FACTORY CAL page is exited.

5.5.6 Miscellaneous Factory Cal

This screen is provided to enable or disable the Aux Audio Board.

```
  FACTORY CAL: MISCELLANEOUS

AUX AUDIO BOARD:  INSTALLED
```

5.6 Receiver FACTORY CAL Pages

These screens are used by HARRIS engineering, production and field support personnel to align CD LINK™ and diagnose problems.

Note:
We recommend users avoid changing Factory Cal adjustments unless advised to perform one of them by our representatives.

To enter or exit the receiver engineering FACTORY CAL pages, press both PAGE ↑ and FIELD ↓ at the same time.

Caution

Unlike the Setup Pages, The CD LINK™ does not automatically exit the FACTORY CAL Pages and return to the Monitor Pages if a key isn't pressed within 1 minute.

5.6.1 EEPROM

```
EEPROM FACTORY CAL:   STATUS:  OK
TEST EEPROM:     NO   RESULT: PASSED
RESET DEFAULTS: NO
RESET EEPROM:    NO

  x x x  numeric sequence x x x x
  x x x x x x x x x x x x x x x x
COPYRIGHT @ 1996 HARRIS CORP.  REV 1.0
```

STATUS

This field displays OK if the EEPROM data is valid and displays FAULT if the data is corrupt.

TEST EEPROM:

This field can be used to test the EEPROM by pressing ADJUST ↑ or ↓ in the TEST EEPROM: field.

TEST EEPROM: field.

The results of the test are displayed in the TEST RESULTS: field.

TEST RESULT	DESCRIPTION
PASSED	EEPROM OK. Original data restored.
00 FAIL	Writing value 00 to all locations failed.
FF FAIL	Writing hex FF to all locations failed.
55 FAIL	Writing hex 55 to all locations failed.
AA FAIL	Writing hex AA to all locations failed.
12 FAIL	Writing numeric sequence 1,2,3... failed.

If the EEPROM passes, its original contents are restored. (The test is non-destructive.)

If the EEPROM fails a test, the pattern read from the EEPROM displays at the bottom of the screen as a numeric sequence of hexadecimal numbers.

Caution

When a test fails, the original EEPROM data is lost. This data was probably corrupt in any event. The EEPROM should be replaced.

RESET DEFAULTS

This field is used to reset all user-entered setup and certain factory parameters. The Signal Level Scale Factor is not reset.

RESET EEPROM:

This field resets user-entered parameters and ALL factory parameters.

Caution

Every CD LINK™ receiver contains unique alignment parameters that are set in these FACTORY CAL screens during manufacturing. If factory defaults are reloaded into the CD LINK™, these unique settings are lost and the unit will not function correctly.

The factory setup and alignment parameters for each unit are noted on a sticker which is attached to the rear panel of the unit at the completion of the factory tests.

5.6.2 DSP/ECC

This page is used to set up the DSP during manufacture.

```
          FACTORY CAL: DSP/ECC
ECC RESET:  YES
ECC STATE:  OFF   RF: 123.1uV  QLTY:  90%

DSP STATE: RUNNING
               SHORT     LONG  UNCORRECTED
ELAPSED SEC:     123   123456       123456
ERROR COUNT: 123456   123456       123456
ERROR RATE: 1.2E-12 1.2E-12      1.2E-12
```

DSP/ECC

This field to the right of FACTORY CAL: allows manual reset of the main DSP integrated circuit chip and of long term bit error rate functions. The only use of this field is for engineering testing.

ECC RESET:

Commanding this field clears the error rate statistics and resets the elapsed time, error counts and error rates to zero.

ECC STATE:

This field controls the DSP error correction and error interpolation circuitry.

- In the OFF setting, error correction and interpolation is turned off. Errors in the received signals will be heard as snaps and pops in the audio outputs.

DSP STATE:

This field allows manual reset of the main DSP chip.

- RESET holds the DSP chip in its' reset state.
- RUNNING is the normal state.

ELAPSED SEC:
ERROR COUNT:
ERROR RATE:

Errors are evaluated internally and are displayed on this page as SHORT, LONG and UNCORRECTED. In each column:

- ELAPSED SEC gives the time elapsed since the count began.
- ERROR COUNT is the total number of errors during the interval.
- ERROR RATE is the ERROR COUNT divided by the ELAPSED SEC.

These fields display accumulated error statistics. Two counts are displayed, one before ECC error correction and one after ECC. The after ECC error count and BER are the closest to the user number displayed elsewhere, but may not be exactly the same since they accumulate over a longer time.

BER

This is the Bit Error Rate, displayed before and also after ECC.

- The BEFORE ECC rate is the rate of errors that can be corrected. For example, 1E-6 means one error every 1,000,000 bits is being detected and corrected.
- The AFTER ECC rate is the rate of errors that are detected but cannot be corrected. Uncorrected errors are processed by the error interpolation circuitry which approximates the correct value by examining correct values surrounding the erroneous value. They prevent clicks and pops on the audio outputs.

The CD LINK™ raw received bit rate is 1,267,200 bits per second, so a rough equivalent you can use is to divide 1E-6 by the error rate to determine the number of seconds between errors. For example, an error rate of 3.5E-10 is roughly 1 error every 47 minutes.

Caution

Make sure the DSP is running and the ECC is on after completing any tests.

5.6.3 SIGNAL LEVEL/DEMODULATOR

This page allows factory calibration of the RF signal level gains.

```
  FACTORY CAL: SIGNAL LEVEL/DEMODULATOR

EQUALIZER:     ON
PL SWEEP:      ON
RF LEVEL CAL: xxxx          RF: xxxxuV
RF QUALITY:  USE PEAK     QLTY: 65%

DIODE  22  PEAK  57  AVG  23  GAIN 208
```

EQUALIZER:

This field allows manual control of the demodulator's auto equalizer circuitry. The ON setting is the normal operating mode.

PL SWEEP:

The PL Sweep signal is used by the demodulator to acquire lock to an incoming signal. PL SWEEP should be ON for normal

operation. It is turned OFF only during certain engineering tests. This field has no user function.

RF LEVEL:

Scales the RF signal level. The calibrated RF level is displayed in the RF: field.

The calibration procedure is as follows:

- Inject a 100uV RF signal into receiver and adjust the CAL field until actual computed signal (RF:) reads 100uV.

RF QUALITY:

Selects the signal used to measure signal quality. QLTY: is the actual computed signal quality. The signal chosen to compute the quality may be either PEAK or AVERAGE.

- USE PEAK indicates the modem peak eye pattern deviation occurring during the measuring period (250mSec) is the basis of the signal QLTY reading.
- USE AVG means the average eye pattern deviation is the basis of the signal QLTY reading.

DIODE:
PEAK:
AVG:
GAIN:

These remaining four fields are the raw output of the analog to digital converter. They are displayed to verify correct operation of the converter. Each value has a range of 0-255.

A value can be converted to a voltage by multiplying the reading by 19.6 mV.

- DIODE is a reference value based on the forward drop of a silicon diode. The reading should be approximately 31 (.6 volts).
- PEAK is the peak modem eye pattern deviation.
- AVG is the average modem eye pattern deviation.
- GAIN is the log of the signal level.

5.6.4 Miscalleneous

This field is provided in the receiver to allow activation of the stereo generator option.

```
  FACTORY CAL: MISCALLANEOUS

STEREO GENERATOR:   INSTALLED
AUX AUDIO BOARD:    INSTALLED
AUX AUDIO DSP:      RUNNING
```

STEREO GENERATOR:

Set this field to INSTALLED if the optional stereo generator is in place. The setting if the generator is not installed is NOT INSTALLED.

AUX AUDIO BOARD:

Set this field to INSTALLED if the optional auxiliary audio board is installed. Set to NOT INSTALLED if the aux audio board is not present.

AUX AUDIO DSP:

Constrols the state of the auxiliary audio board reset line. The board is normally running but can be reset using this field.

6.1 Introduction

CD LINK™ offers the following options:

- Auxiliary Analog Audio Channels
- Stereo Generator
- Redundant STL Links

6.2 Auxiliary Analog Audio Channels

Auxiliary audio channels are an optional feature added to the transmitter and receiver if needed to convey SCA audio to the transmitter.

The option consists of two identical boards with add-on hardware and connecting cables.

Each board is mounted above the main board of the transmitter or receiver with the supplied mounting hardware, with the audio connectors in the rear panel holes provided.

The supplied ribbon cables connect Aux Audio board J5 to Transmitter Main board J5 or Receiver main board J8.

Each board is programmed using on-board jumper JP1 as the receiver Aux Audio board or the transmitter Aux audio board.

- Setting JP1 to the 1-2 position makes it a transmitter board.
- Setting JP1 to the 2-3 position makes it a receiver board.

Once installed, the channels are configured from the Audio Channels Setup Pages in the transmitter and the receiver.

The configuration may be either as:

- one channel, sampled at 12 kHZ
- two channels sampled at 6 kHZ

6.3 Stereo Generator

CD LINK™ is intended to provide direct digital input to the Harris DIGIT™ exciter. The optional stereo generator in CD LINK™ is not needed in order to supply an output to DIGIT™ if equipped with the Stereo generator input. Some users will, however, wish also to supply a stereo signal to an older analog back-up exciter. The optional stereo generator is offered to make a separate stereo generator at the radio transmitter location unnecessary.

The optional stereo generator does not include FM limiting to control peak modulation levels. To provide limiting for a back-up transmitter driven by this optional stereo generator, system limiting needs to be before the CD LINK™ input.

FM Limiting

In order to maintain transmitter modulation at high average levels without overmodulation, program audio level must be controlled by a special limiter. This limiter must be designed to work with the pre-emphasis required in the FM broadcast signal. Limiters which do not react according to pre-emphasis can cause severe overmodulation by high audio frequencies, which are broadcast at a higher relative level than low frequencies — to reduce noise in the received signal.

The Orban 8200 or similar FM peak limiter is required to provide modulation level control with respect to the pre-emphasis required for FM broadcasting. Proper control of FM modulation is not available in standard audio limiters provided in studio consoles, etc.

There is no substitute for a properly designed and properly adjusted FM limiter in an FM broadcast program path.

The stereo generator is added to the receiver board if purchased. Once installed, the stereo generator is turned on using the Stereo Generator Setup Page in the receiver.

6.4 Redundant STL

CD LINK™ may be purchased as a redundant STL link. In this version, there are two complete STL links on the same channel, one operating and one in standby mode. A failure of the operating transmitter or the operating receiver causes the standby unit to be selected.

In redundant systems the OPERATE/STANDBY indicators signal the current condition at each transmitter and receiver.

The OPERATE/STANDBY switch on the front panel of each unit is used to control switching and to indicate the current active unit.

In redundant transmitter systems using two CD LINKs, this switch is used to select the active transmitter.

The same switch is used at the receiver in redundant systems to select the active receiver.

When a fault in a redundant system causes the alternate transmitter or receiver to be selected, the green OPERATE light of the deselected unit goes dark and the red STANDBY light blinks.

CD LINK™ Transmitter

The OPERATE / STANDBY front panel switch turns the RF power amplifier on and off. This switch is always active.

A green OPERATE lamp lights when the RF power amplifier is on.

The red STANDBY lamp lights when the power amplifier is off.

When a fault condition causes RF power to turn off, the green light turns off and red light flashes.

If the fault condition is caused by a failure in the RF power amplifier (see Section V - Faults), pressing the OPERATE/STANDBY switch to place the unit in standby and then pressing the switch a second time to place the unit in operate mode may clear the fault condition and turn on RF power.

WARNING: Disconnect primary power prior to servicing.

Note:

If the RF power amplifier failure still exists the fault condition will be re-triggered and the power amplifier will be turned off again.

INDICATOR	MEANING
Solid green	OPERATE - RF amplifier turned on.
Solid red	Unit was placed in STANDBY by pressing Operate/Standby Switch. RF amplifier turned off.
Blinking green	Unit was previously in STANDBY. Unit is now transmitting due to activation of radiate enable lines on ALARM In/Out rear panel connector. RF power amplifier is turned on.
Blinking red	A fault or activation of radiate disable lines on ALARM In/Out rear panel connector has placed unit in STANDBY. RF power amplifier is turned off.

CD LINK™ Receiver

The OPERATE/STANDBY front panel switch is used in redundant systems containing two CD-LINK receivers. Pressing the switch toggles the receiver from operate to standby mode and vice versa.

In operate mode, the green LED lights and all outputs are active.

In standby mode, the red LED lights.

When the receiver is in standby mode, the AES XLR output and the two digital data RS-232 output ports are turned off. This enables switchless redundant receiver operation by simply paralleling these outputs from the two receivers.

As the optical outputs cannot be paralleled in this way, the receiver optical output can be powered from either receiver in the redundant system, allowing the optical driver from one receiver to act as the output for either of the receivers.

WARNING: Disconnect primary power prior to servicing.

7.1 Introduction

CD LINK™ transmitters and receivers can generate a number of FAULT and WARNING signals on the MONITOR Main Audio pages.

FAULT is a condition which shuts down the transmitter or receiver and turns ON the fault output at the rear panel FAULT IN/OUT connector.

WARNING does not shut down the unit, but does turn on the WARN output at the rear panel FAULT IN/OUT connector. These alarms signal improper conditions which should be investigated and corrected before they can cause difficulties.

If either a transmitter or a receiver displays FAULT or WARNING in place of OK, press PAGE ↓ twice to display the fault/warning MONITOR screen.

7.2 Transmitter Faults

The transmitter FAULT/WARNING MONITOR screen appears as follows.

```
------ FAULTS ------  -WARNINGS-
FWD PWR OK    RF LOCK  FAIL  VSWR     FAIL
TEMP    FAIL  DECIM     OK   TEMP     OK
20 MHZ  OK    PACKER    OK   AES CLK  OK
26 VOLT OK    DSP SYNC  OK   AES SIG  OK
              EEPROM    OK   AUX BD   OK
                             AUX SYNC OK
```

These actions take place automatically when a fault condition occurs:

a. The RF amplifier is turned off.
b. The fault pin on the FAULT IN/OUT rear panel connector is pulled to ground.
c. The word "FAULT" is displayed in the status field of the Configuration/Main Audio Monitor Page .
d. The condition causing the fault will display the message "FAIL" in the Fault/Warning Monitor Page.
e. If there were no faults for at least 30 seconds prior to the fault, CD LINK™ resets the following once to attempt to restore operation:
   1. The microprocessor
   2. All three DSP chips
   3. The phase lock loops

Transmitter Fault Conditions

FWD PWR:

RF output power exceeds limits set in the factory cal RF amp setup screen. Output power is either below low limit (~1.5W) or above hi limit (~3.0W).

- This fault condition is latched. To clear the FWD PWR fault, select the transmitter to STANDBY and then back to OPERATE. If the fault reappears after resetting there is a problem in the transmitter RF modulator or amplifier circuits.

TEMP:

The PA module temperature exceeds the fault limit set in the factory cal screen (default=80°C).

- This fault is cleared when the temperature drops 4°C below the limit.

20 MHz:

The transmitter main board does not detect the 20MHz precision clock from the synth/modulator board.

- For board testing purposes, this fault condition causes the transmitter main board to substitute another (low accuracy) clock to the DDS chip, allowing testing of the DDS without the synth/modulator board.
- This fault is cleared when the 20MHz signal resumes.

26 VOLT:

The 26 volt PA supply output is below 23 Volts.

- This fault is cleared by adjusting the power supply voltage above 23 Volts.

RF LOCK:

The RF Carrier PLL is not working.

- This fault is cleared when lock is restored.

DECIM:

The main CPU is not able to communicate with the decimator (sample rate converter DSP).

- This fault is cleared when communication resumes.

PACKER:

The main CPU is not able to communicate with the packer DSP.

- This fault is cleared when communications resumes.

DSP SYNC:

The packer DSP is not receiving valid digital audio from the sample rate converter.

WARNING: Disconnect primary power prior to servicing.

- This fault is cleared when valid data is received.

EEPROM:

The contents of the EEPROM are either uninitialized or have been corrupted.

- This fault is cleared by loading factory defaults using the factory cal : eeprom screen.

Caution

THE TRANSMITTER SHOULD NOT BE PLACED IN OPERATE MODE UNTIL THE MODULATOR CAL PARAMETERS HAVE BEEN SET. FAILING TO DO SO GUARANTEES THAT THE UNIT WILL TRANSMIT HIGH LEVEL WIDEBAND NOISE AND SUBJECT THE PA TO OVERLOAD CONDITIONS.

7.3 Transmitter WARNINGS

A warning indicates a problem that is not serious enough to cause the link to fail, nor cause RF radiation leakage outside the allocated spectrum. The unit is not taken off air.

These steps are taken when a warning condition occurs:

a. The warning pin on the FAULT IN/OUT rear panel connector is pulled to ground.
b. The word "WARNING" displays in the status field of the Configuration/Main Audio Monitor Page.
c. The condition causing the warning displays "FAIL" in the Fault/Warning Monitor Page

Transmitter WARNING Conditions

VSWR:

VSWR exceeds limit set in the Transmitter Warning/Fault Setup Page, 5.2.4.

- This warning is cleared by reducing VSWR below the limit or by placing the unit in standby mode.

TEMP:

The PA module temperature exceeds the warning limit set in the factory cal screen (default=75°C).

- This warning is cleared when the temperature drops below the limit.

AES CLK:

The digital audio input (XLR or optical) sample rate is incorrect or exceeds the input frequency tolerance(+/-.005%).

- This warning is cleared by correcting the input signal sample rate or by re-configuring the input sample rate to match the signal.

AES SIGNAL:

A valid digital audio signal is not present at the selected digital audio input.

- This warning is cleared when a valid digital signal is received at the input.

Note:

This warning does not test for incorrect sample rate, which is signalled by AES CLK. AES SIGNAL is cleared when a valid AES signal is connected.

AUX BD:

The auxiliary audio board is installed and is not working correctly.

AUX SYNC:

The Packer DSP is not receiving data from the auxiliary daughter board.

7.4 Receiver FAULTS

The receiver FAULT/WARNING MONITOR screen appears as follows.

```
-- FAULTS --     --WARNINGS--
SYNC      OK       SIG LEVEL    FAIL
DSP       OK       SIG QUALITY  OK
RF LOCK   OK       ERR RATE     OK
32K LOCK  OK       EEPROM       OK
                   AUX BD       OK
```

A fault is a failure that causes the CD LINK™ receiver to shut down The failure can be caused by loss of RF signal or by an internal circuit problem. The word FAULT appears in the status field.

These steps are taken when a fault occurs:

a. The main audio, auxiliary audio and stereo generator outputs are squelched. This allows two CD LINK™ receivers' analog outputs to be mixed together.
b. The AES and XLR outputs are disabled. This allows two CD LINK™ receivers' digital outputs to be connected together.
c. The FAULT pin on the FAULT In/Out rear panel connector is pulled to ground.
d. The word FAULT is displayed in the status field of the Configuration/Main Audio Monitor Page.
e. The condition causing the fault will display the message FAULT in the FAULT/Warning Monitor Page.
f. If there were no faults for at least 30 seconds prior to the fault, CD LINK™ waits 2 seconds to prevent resetting due to a short sync loss, then resets the following once to attempt to restore operation:
   1. The microprocessor

2. All three DSP chips
3. The phase lock loops

g. The fail safe transmitter relay is activated (see FAULT In/Out Connector) after the time period specified in the Warning/Fault Setup Screen.

Receiver FAULT Conditions

SYNC:

The demodulator has lost data SYNC. This can be caused by loss of RF signal or by an internal hardware problem.

DSP:

The main DSP chip has failed.

RF LOCK:

The RF phase lock loop circuit has failed.

32K LOCK:

The 32K phase lock loop circuit has failed.

7.5 Receiver WARNINGS

A warning indicates a problem that requires attention.

These steps are taken when a warning condition occurs:

a. The warning pin on the FAULT In/Out rear panel connector is pulled to ground.
b. The word "WARNING" displays in the status field of the Configuration/Main Audio Monitor Page .
c. The condition causing the warning displays FAIL in the Fault/Warning Monitor Page

Receiver WARNING Conditions

SIG LEVEL:

The received RF signal level is low.

- Check the antennas, feedlines and the RF path.

SIG QUALITY:

The demodulator signal quality is low.

- If SIG LEVEL is not low, check for a possible interfering signal.

ERR RATE:

The data error rate is high.

EEPROM:

The EEPROM data is corrupt, or the EEPROM has failed.

- The EEPROM can be tested and / or reset using the Factory Calibration EEPROM screen.

AUX BD:

Failure in the auxiliary audio daughter board.

7.6 Fuses and Power Supplies

The power supplies used in the CDL950T and CDL950R are extremely reliable and have no user adjustments. The fuses are conservatively rated and ought not blow unless there is a serious problem.

Power Supplies

The transmitter contains two switching power supplies and the receiver contains one power supply. There are no user adjustments. The supplies accomodate the full range of input voltages and frequencies possible without user action.

If one of these power supplies fails, it should be replaced.

NOTE

The line voltage selector included in the input connector is not used in these units.

Fuses

The CDL950T transmitter has a single 1ASB fuse in the rear panel input connector.

The CDL950R receiver has a single 1/2ASB fuse in the connector.

WARNING: Disconnect primary power prior to servicing.

Replaceable Parts List Index

WARNING: Disconnect primary power prior to servicing.

Table 8-1. BASIC, CD LINK STL - 994 9736 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
484 0460 000	FILTER, BANDPASS TUBULAR	0.0 EA	
988 2413 001	DP, CD-LINK XMTR & RECEIVER	2.0 EA	
992 9818 001	PWA, AUX AUDIO (DECODER)	0.0 EA	
992 9818 003	KIT, AUX AUDIO CABLE	0.0 EA	
992 9819 001	PWA, AUX AUDIO (ENCODER)	0.0 EA	
992 9838 001	OPTION, DGTL STEREO GENERATOR	0.0 EA	
994 9724 001	DIGITAL STL TRANSMITTER	1.0 EA	
994 9725 001	DIGITAL STL RECEIVER	1.0 EA	
994 9725 002	KIT, CAVITY FILTER, CD-LINK	0.0 EA	

Table 8-2. PWA, AUX AUDIO (DECODER) - 992 9818 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
610 0900 000	HEADER 3 CKT STRAIGHT	1.0 EA	JP001
610 0994 000	CONN, XLR 3-C NC3MD-H-BAG	2.0 EA	J003 J004
610 1111 000	HDR 50C 2ROW STRAIGHT	1.0 EA	J005
612 1184 000	JUMPER .1" CENTERS	1.0 EA	1/JP001
917 2435 930	FIRMWARE,AUX AUDIO DSP PROGRAM	1.0 EA	U007
917 2435 931	FIRMWARE, AUX AUDIO COUNTER A	1.0 EA	U002
917 2435 932	FIRMWARE, AUX AUDIO COUNTER B	1.0 EA	U003
917 2435 933	FIRMWARE, AUX AUDIO LOGIC, U1	1.0 EA	U001
992 9818 002	PWA, SMT ENCODER/DECODER	1.0 EA	

Table 8-3. PWA, SMT ENCODER/DECODER - 992 9818 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0.0 EA	THESE COMPONENT DESIGNATORS ARE NOT USED ON THIS B/M. C009 C010
383 0020 000	IC, 74HC74 ESD	1.0 EA	U004
383 0065 000	IC, NE5532 ESD	2.0 EA	U011 U012
383 0107 000	IC 74HC652 ESD	2.0 EA	U005 U006
383 0298 000	IC, AD1843 ESD	1.0 EA	U008
383 0299 000	IC, ADSP-2101 ESD	1.0 EA	U010
384 0943 000	DIODE, 914L ESD	8.0 EA	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008
404 0869 000	SOCKET, PLCC-32 SMT	1.0 EA	XU007
404 0886 000	SOCKET, PLCC SURFACE MTG	3.0 EA	XU001 XU002 XU003
445 0006 000	XTAL 20 MHZ SMT ESD	1.0 EA	Y001
445 0007 000	XTAL 24.576 ESD	1.0 EA	Y002
496 0054 000	IND, FIXED 22UH 20%	1.0 EA	L002
496 0080 000	IND, FIXED 100UH	1.0 EA	L001
515 0134 113	CAP 33PF 100V 5% 0805 C0G	4.0 EA	C001 C002 C003 C004
515 0136 301	CAP 1000PF 100V 10% 0805 X7R	8.0 EA	C050 C051 C052 C053 C054 C056 C057 C058
515 0136 401	CAP 0.01UF 100V 10% 0805 X7R	4.0 EA	C066 C067 C068 C069
515 0136 501	CAP 0.1UF 50V 10% 0805 X7R	22.0 EA	C005 C011 C013 C014 C015 C017 C018 C019 C020 C027 C028 C029 C030 C031 C032 C033 C034 C035 C036 C037 C038 C070
522 0634 000	CAP 10UF 25V	4.0 EA	C006 C039 C040 C041
522 0636 000	CAP 100UF 6.3V SMT	2.0 EA	C012 C026
523 0004 001	CAP 1UF 50V 20% SMT	10.0 EA	C007 C008 C042 C043 C044 C045 C046 C047 C048 C049
545 0308 119	RES 56.2 OHM 1% 0.1W 0805	4.0 EA	R011 R012 R013 R014

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545 0308 224	RES 909 OHM 1% 0.1W 0805	4.0 EA	R007 R008 R009 R010
545 0308 301	RES 1K OHM 1% 0.1W 0805	4.0 EA	R002 R023 R024 R025
545 0308 314	RES 3.57K OHM 1% 0.1W 0805	4.0 EA	R003 R004 R005 R006
545 0308 317	RES 4.75K OHM 1% 0.1W 0805	1.0 EA	R001
545 0308 401	RES 10K OHM 1% 0.1W 0805	9.0 EA	R019 R020 R021 R022 R026 R027 R028 R029 R030
545 0308 420	RES 61.9K OHM 1% 0.1W 0805	4.0 EA	R015 R016 R017 R018
843 5475 161	SCH, SMT ENCODER/DECODER	0.0 EA	
843 5475 163	PWB, SMT ENCODER/DECODER	1.0 EA	

Table 8-4. PWA, AUX AUDIO (ENCODER) - 992 9819 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
610 0900 000	HEADER 3 CKT STRAIGHT	1.0 EA	JP001
610 1111 000	HDR 50C 2ROW STRAIGHT	1.0 EA	J005
612 1184 000	JUMPER .1" CENTERS	1.0 EA	1/JP001
612 1209 000	CONN, XLR 3-C NC3FD-H-BAG	2.0 EA	J001 J002
917 2435 930	FIRMWARE,AUX AUDIO DSP PROGRAM	1.0 EA	U007
917 2435 931	FIRMWARE, AUX AUDIO COUNTER A	1.0 EA	U002
917 2435 932	FIRMWARE, AUX AUDIO COUNTER B	1.0 EA	U003
917 2435 933	FIRMWARE, AUX AUDIO LOGIC, U1	1.0 EA	U001
992 9818 002	PWA, SMT ENCODER/DECODER	1.0 EA	

Table 8-5. OPTION, DGTL STEREO GENERATOR - 992 9838 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
382 1595 000	IC, PCM63 ESD	1.0 EA	U015
383 0037 000	IC, DSP16A ESD	1.0 EA	U073
917 2435 912	FIRMWARE, RECEIVER MAIN,	1.0 EA	U063 U064
917 2435 916	FIRMWARE, RECEIVER MAIN, U75	1.0 EA	U075

Table 8-6. DIGITAL STL TRANSMITTER - 994 9724 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
250 0274 000	CORD, POWER 3C 7-1/2 FT	1.0 EA	
358 1214 000	SCREWLOCK, FEMALE	4.0 EA	
358 3190 000	PLUG, WHT .500" HOLE	1.0 EA	
398 0054 000	FUSE, SLOW CART 1A 250V	1.0 EA	
406 0530 000	DISPLAY, LCD, 240 X 64,	1.0 EA	DS001
430 0260 000	FAN, 24VDC BRUSHLESS	1.0 EA	
430 0261 000	FINGERGUARD, FAN	1.0 EA	
484 0420 000	FILTER, RFI POWER ENTRY	1.0 EA	
610 0981 000	HDR 20C 2ROW VERTICAL	1.0 EA	1/DS001
610 1295 000	HEADER, 2PIN, 1ROW, STRAIGHT	1.0 EA	1/DS001
646 1301 201	LABEL, DANGER HI VOLTAGE	2.0 EA	#P001 #P002
646 1487 000	NAMEPLATE PATENT, GENERIC	1.0 EA	
646 1593 000	OVERLAY, FRONT PNL, NEX/STL	1.0 EA	
646 1593 002	INSERT, TRANSMITTER	1.0 EA	
736 0282 000	POWER SUPPLY, SWITCHING	1.0 EA	PS002
736 0292 000	POWER SUPPLY, SWITCHING	1.0 EA	PS001
917 2435 903	WIRE CABLE PKG, DISCRETE XMTR	1.0 EA	
917 2435 935	WASHER, FLAT,	2.0 EA	
943 5475 002	CHASSIS, XMTR	1.0 EA	

WARNING: Disconnect primary power prior to servicing.

943 5475 003	PANEL, FRONT	1.0 EA
943 5475 005	DIVIDER, XMTR	1.0 EA
943 5475 006	COVER, TOP	1.0 EA
943 5475 010	COVER 24V POWER SUPPLY	1.0 EA
943 5475 011	COVER 5-15V POWR SUPPLY	1.0 EA
943 5475 012	PANEL, BLANK, AUX AUDIO	1.0 EA
943 5475 022	RIBBON CABLE PKG, XMTR,	1.0 EA
992 9755 001	PWA, XMTR MAIN	1.0 EA
992 9765 001	PWA, SYNTHESIZER/MODULATOR	1.0 EA
992 9765 020	PWA, RF PA	1.0 EA
999 2886 001	HARDWARE LIST, XMTR	1.0 EA

Table 8-7. PWA, XMTR MAIN - 992 9755 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
380 0787 000	RECEIVER, FIBER OPTIC ESD	1.0 EA	F001
382 0371 000	IC, MC7912CT ESD	1.0 EA	U011
382 0406 000	IC, MC7812CT ESD	2.0 EA	U010 U018
382 0746 000	IC, 79L05AC ESD	1.0 EA	U012
382 0882 000	IC, 78L05A ESD	1.0 EA	U007
382 1597 000	IC, YM3623B ESD	1.0 EA	U026
404 0509 000	SOCKET IC 28 PIN	1.0 EA	XU026
404 0842 000	HEATSINK FOR TO220	1.0 EA	XU018
492 0859 000	IND FIXED 4.7MH 5%	4.0 EA	L004 L005 L006 L007
492 0860 000	IND FIXED 1MH 5%	2.0 EA	L002 L008
492 0861 000	IND FIXED 10UH 10%	2.0 EA	L003 L009
492 0862 000	622LY-101K	1.0 EA	L014
506 0280 000	CAP, POLYSTYRENE 3300PF 63V 1%	2.0 EA	C131 C148
506 0286 000	CAP, 1500PF 63VDC 1%	4.0 EA	C132 C134 C142 C149
550 0314 000	POT 10K OHM 3/4W 10%	2.0 EA	R001 R002
566 0027 000	INVERTER, DC-AC	1.0 EA	M001
610 0851 000	HEADER 4 PIN SINGLE ROW	2.0 EA	JP001 JP002
610 0857 000	HDR 12C 1ROW STRAIGHT	1.0 EA	J008
610 0900 000	HEADER 3 CKT STRAIGHT	6.0 EA	JP003 JP004 JP005 JP006 JP007A JP007B
610 0979 000	HDR 10C 2ROW VERTICAL	1.0 EA	J004
610 0981 000	HDR 20C 2ROW VERTICAL	2.0 EA	J007 J010
610 1111 000	HDR 50C 2ROW STRAIGHT	1.0 EA	J005
610 1145 000	HDR, 6PIN, 1ROW, STRT,POL	1.0 EA	J002
610 1147 000	HDR, 5C, 1 ROW, POLARIZED	1.0 EA	J003
610 1290 000	CONN 25C RECP/PLUG D-TYPE	1.0 EA	P003
610 1291 000	CONN 25C PLUG/PLUG D-TYPE	1.0 EA	P005
610 1295 000	HEADER, 2PIN, 1ROW, STRAIGHT	1.0 EA	J009
612 1184 000	JUMPER .1" CENTERS	8.0 EA	1/XJP001 1/XJP002 1/XJP003 1/XJP004 1/XJP005 1/XJP006 1/XJP007A 1/XJP007B
612 1209 000	CONN, XLR 3-C NC3FD-H-BAG	3.0 EA	J001 P001 P002
917 2435 917	FIRMWARE, XMTR MAIN	1.0 EA	U005 U006 U037 U038
917 2435 918	FIRMWARE, XMTR MAIN, U5, U6	1.0 EA	U047
917 2435 919	FIRMWARE, XMTR MAIN, U41	1.0 EA	U041
917 2435 920	FIRMWARE, XMTR MAIN, U27	1.0 EA	U027
917 2435 921	FIRMWARE, XMTR MAIN, U35, U36	1.0 EA	U035 U036
917 2435 922	IND, ALIGNMENT .932 MH RED	2.0 EA	L012 L015
917 2435 923	IND, ALIGNMENT .991 MH GREEN	2.0 EA	L013 L016
992 9755 002	PWA, XMTR MAIN SMT	1.0 EA	
999 2887 001	HARDWARE LIST, MAIN XMTR	1.0 EA	

WARNING: Disconnect primary power prior to servicing.

Table 8-8. PWA, XMTR MAIN SMT - 992 9755 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0.0 EA	THESE COMPONENT DESIGNATORS ARE NOT USED ON THIS B/M. C124 C126 C143 C145 R104 R110 R119 R123 R127 R131
381 0003 001	XSTR, NPN, 3904 (SMT) ESD	1.0 EA	Q001
383 0007 000	IC, IDT7164 ESD	1.0 EA	U046
383 0010 000	IC, 74ACT32 ESD	1.0 EA	U031
383 0011 000	IC, 74HC139 ESD	1.0 EA	U051
383 0014 000	IC, 74HC32 ESD	1.0 EA	U063
383 0017 000	IC, 74HC4053 ESD	1.0 EA	U061
383 0022 000	IC, 74HCT373 ESD	1.0 EA	U039
383 0023 000	IC, 74HCT374 ESD	2.0 EA	U029 U054
383 0026 000	IC, 74LS174 ESD	1.0 EA	U032
383 0027 000	IC, 74LS378 ESD	4.0 EA	U050 U052 U055 U058
383 0028 000	IC, 74LS74A ESD	3.0 EA	U019 U022 U030
383 0032 000	IC, 80C535 ESD	1.0 EA	U042
383 0034 000	IC, CS5336 ESD	1.0 EA	U016
383 0037 000	IC, DSP16A ESD	3.0 EA	U015 U043 U044
383 0040 000	IC, LM318 ESD	2.0 EA	U048 U056
383 0064 000	IC AD9831 ESD	1.0 EA	U017
383 0065 000	IC, NE5532 ESD	5.0 EA	U008 U009 U013 U014 U060
383 0066 000	IC MC3486 ESD	1.0 EA	U001
383 0067 000	IC 16C452 ESD	1.0 EA	U057
383 0068 000	IC 74ACT157 ESD	1.0 EA	U020
383 0069 000	IC 74HC377 ESD	1.0 EA	U025
383 0070 000	IC 74HC160 ESD	1.0 EA	U040
383 0073 000	IC, MMDF2PO1HD ESD	1.0 EA	U059
383 0074 000	IC, 74HC86 ESD	1.0 EA	U023
383 0081 000	IC, MC1488 ESD	1.0 EA	U003
383 0102 000	IC, 74HC138D ESD	1.0 EA	U033
383 0161 000	IC, SN75468, 7 DRIVER, ESD	1.0 EA	U002
383 0197 000	IC MC145158-2 ESD	1.0 EA	U024
383 0244 000	IC ILD206 OPTO-COUPLER ESD	1.0 EA	IS001
383 0246 000	IC AD667 ESD	2.0 EA	U053 U062
383 0253 000	IC, LM358 ESD	3.0 EA	U004 U028 U045
383 0254 000	IC, 74HC04 (SMT) ESD	3.0 EA	U021 U034 U049
384 0943 000	DIODE, 914L ESD	14.0 EA	CR001 CR002 CR003 CR004 CR005 CR006 CR008 CR009 CR010 CR011 CR012 CR013 CR014 CR015
386 0463 000	ZENER MMBZ5257B ESD	1.0 EA	CR007
393 0009 000	IC, NM9306 ESD	1.0 EA	U047
404 0869 000	SOCKET, PLCC-32 SMT	1.0 EA	XU041
404 0886 000	SOCKET, PLCC SURFACE MTG	1.0 EA	XU027
404 0891 000	SOCKET, PLCC, SMT W/O LOCATORS	6.0 EA	XU005 XU006 XU035 XU036 XU037 XU038
445 0001 000	XTAL 18.432 MHZ SMT ESD	1.0 EA	Y001
445 0002 000	XTAL 16 MHZ SMT ESD	1.0 EA	Y002
445 0004 000	OSCILLATOR 36 MHZ SMT	1.0 EA	OSC004
445 0005 000	OSCILLATOR 60MHZ SMT	2.0 EA	OSC001 OSC002
478 0428 000	XFMR, RF, 0.05-200MHZ	1.0 EA	T001
496 0058 000	IND CHIP 10UH 10%	1.0 EA	L010

WARNING: Disconnect primary power prior to servicing.

496 0064 000	IND CHIP 39UH 5% SMT	1.0 EA	L011
496 0065 000	IND FIXED 47UH SMT	1.0 EA	L001
515 0134 017	CAP 4.7PF 100V +/-.25 0805 C0G	1.0 EA	C062
515 0134 105	CAP 15PF 100V 5% 0805 C0G	2.0 EA	C122 C139
515 0134 109	CAP 22PF 100V 5% 0805 C0G	1.0 EA	C066
515 0134 113	CAP 33PF 100V 5% 0805 C0G	2.0 EA	C093 C094
515 0134 115	CAP 39PF 100V 5% 0805 C0G	1.0 EA	C083
515 0134 119	CAP 56PF 100V 5% 0805 C0G	2.0 EA	C127 C146
515 0134 121	CAP 68PF 100V 5% 0805 C0G	1.0 EA	C073
515 0134 201	CAP 100PF 100V 5% 0805 C0G	6.0 EA	C018 C019 C020 C021 C128 C147
515 0134 205	CAP 150PF 100V 5% 0805 C0G	4.0 EA	C028 C029 C033 C034
515 0134 207	CAP 180PF 100V 5% 0805 C0G	3.0 EA	C053 C125 C144
515 0134 213	CAP 330PF 100V 5% 0805 C0G	1.0 EA	C112
515 0134 215	CAP 390PF 100V 5% 0805 C0G	2.0 EA	C051 C052
515 0134 217	CAP 470PF 100V 5% 0805 C0G	6.0 EA	C008 C009 C010 C011 C012 C015
515 0136 301	CAP 1000PF 100V 10% 0805 X7R	1.0 EA	C071
515 0136 313	CAP 3300PF 100V 10% 0805 X7R	2.0 EA	C045 C049
515 0136 323	CAP 8200PF 100V 10% 0805 X7R	1.0 EA	C076
515 0136 501	CAP 0.1UF 50V 10% 0805 X7R	77.0 EA	C001 C002 C003 C004 C005 C006 C007 C014 C016 C017 C022 C031 C032 C038 C039 C040 C041 C042 C043 C044 C047 C048 C056 C057 C058 C059 C063 C064 C065 C068 C069 C070 C072 C074 C077 C078 C079 C080 C081 C082 C084 C085 C086 C088 C089 C090 C091 C092 C095 C096 C097 C098 C099 C100 C101 C103 C107 C108 C109 C111 C113 C114 C115 C116 C117 C120 C121 C123 C129 C130 C133 C135 C136 C137 C138 C140 C141
515 0138 517	CAP 0.47UF 100V 10% 1812 X7R	4.0 EA	C060 C061 C118 C119
518 0115 000	CAP TRIM 8-40 PF	1.0 EA	C075
522 0634 000	CAP 10UF 25V	6.0 EA	C030 C035 C036 C037 C046 C110
522 0635 000	CAP 100UF 25V	8.0 EA	C013 C023 C024 C025 C026 C027 C050 C067
522 0636 000	CAP 100UF 6.3V SMT	2.0 EA	C054 C055
523 0001 217	CAP 470UF 6.3V 20% SMT	1.0 EA	C150
523 0002 117	CAP 47UF 25V 20% SMT	1.0 EA	C087
523 0004 001	CAP 1UF 50V 20% SMT	3.0 EA	C104 C105 C106
540 1562 000	RES NETWORK 10K OHM 2%	1.0 EA	R124
540 1564 000	RES NETWORK 1K OHM 0.5% SMT	2.0 EA	R052 R053
545 0308 101	RES 10 OHM 1% 0.1W 0805	2.0 EA	R060 R072
545 0308 117	RES 47.5 OHM 1% 0.1W 0805	1.0 EA	R054
545 0308 119	RES 56.2 OHM 1% 0.1W 0805	6.0 EA	R051 R055 R073 R090 R094 R097
545 0308 201	RES 100 OHM 1% 0.1W 0805	9.0 EA	R056 R059 R062 R069 R080 R095 C096 R117 R118
545 0308 203	RES 121 OHM 1% 0.1W 0805	2.0 EA	R003 R033
545 0308 205	RES 150 OHM 1% 0.1W 0805	2.0 EA	R007 R018
545 0308 209	RES 221 OHM 1% 0.1W 0805	4.0 EA	R012 R020 R023 R027
545 0308 211	RES 267 OHM 1% 0.1W 0805	1.0 EA	R070
545 0308 213	RES 332 OHM 1% 0.1W 0805	5.0 EA	R013 R014 R022 R063 R132
545 0308 215	RES 392 OHM 1% 0.1W 0805	2.0 EA	R114 R115
545 0308 219	RES 562 OHM 1% 0.1W 0805	5.0 EA	R028 R108 R116 R122 R128
545 0308 220	RES 619 OHM 1% 0.1W 0805	2.0 EA	R024 R025
545 0308 224	RES 909 OHM 1% 0.1W 0805	2.0 EA	R064 R065

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545 0308 301	RES 1K OHM 1% 0.1W 0805	13.0 EA	R011 R015 R016 R035 R042 R047 R048 R071 R075 R076 R093 R121 R129
545 0308 303	RES 1.21K OHM 1% 0.1W 0805	3.0 EA	R040 R043 R084
545 0308 305	RES 1.5K OHM 1% 0.1W 0805	4.0 EA	R009 R021 R125 R126
545 0308 306	RES 1.62K OHM 1% 0.1W 0805	2.0 EA	R057 R058
545 0308 308	RES 2K OHM 1% 0.1W 0805	1.0 EA	R098
545 0308 313	RES 3.32K OHM 1% 0.1W 0805	13.0 EA	R029 R030 R031 R032 R036 R037 R038 R039 R044 R049 R134 R135 R136
545 0308 315	RES 3.92K OHM 1% 0.1W 0805	1.0 EA	R061
545 0308 317	RES 4.75K OHM 1% 0.1W 0805	1.0 EA	R089
545 0308 319	RES 5.62K OHM 1% 0.1W 0805	2.0 EA	R026 R034
545 0308 321	RES 6.81K OHM 1% 0.1W 0805	1.0 EA	R010
545 0308 401	RES 10K OHM 1% 0.1W 0805	14.0 EA	R041 R045 R079 R101 R102 R103 R105 R106 R107 R109 R111 R112 R113 R137
545 0308 403	RES 12.1K OHM 1% 0.1W 0805	2.0 EA	R066 R067
545 0308 404	RES 13K OHM 1% 0.1W 0805	1.0 EA	R078
545 0308 406	RES 16.2K OHM 1% 0.1W 0805	2.0 EA	R082 R083
545 0308 409	RES 22.1K OHM 1% 0.1W 0805	8.0 EA	R004 R005 R006 R008 R074 R077 R099 R100
545 0308 413	RES 33.2K OHM 1% 0.1W 0805	9.0 EA	R017 R019 R081 R085 R138 R139 R140 R141 R142
545 0308 501	RES 100K OHM 1% 0.1W 0805	2.0 EA	R046 R050
545 0308 517	RES 475K OHM 1% 0.1W 0805	1.0 EA	R133
545 0308 601	RES 1MEG OHM 1% 0.1W 0805	1.0 EA	R068
843 5475 111	SCH, XMTR MAIN A/D CONVERTER	0.0 EA	
843 5475 113	PWB, XMTR MAIN A/D CONVERTER	1.0 EA	

Table 8-9. PWA, SYNTHESIZER/MODULATOR - 992 9765 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
610 0900 000	HEADER 3 CKT STRAIGHT	2.0 EA	JP001 JP002
610 0979 000	HDR 10C 2ROW VERTICAL	1.0 EA	J002
610 0981 000	HDR 20C 2ROW VERTICAL	1.0 EA	J001
612 1184 000	JUMPER .1" CENTERS	2.0 EA	1/JP001 1/JP002
612 1498 000	RECEPTACLE 6PIN	2.0 EA	J004 J005
620 2883 000	JACK, OSX PWB MTG	3.0 EA	J003 J006 TP002
917 2435 902	COVER VCO	1.0 EA	
992 9765 002	PWA, SYNTHESIZER/MODULATOR SMT	1.0 EA	
992 9793 001	PWA, VCO TRANSMITTER	1.0 EA	

Table 8-10. PWA, SYNTHESIZER/MODULATOR SMT - 992 9765 002

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0.0 EA	THESE PARTS ARE NOT USED AT THIS LEVEL. C037 C038 R003 R053 R059 R060
381 0001 000	XSTR MMBT2222ALT1 NPN ESD	2.0 EA	Q004 Q006
381 0003 001	XSTR, NPN, 3904 (SMT) ESD	2.0 EA	Q001 Q005
381 0003 002	XSTR, PNP MMBT3906 ESD	2.0 EA	Q002 Q003
383 0004 000	IC, RMS-11F ESD	2.0 EA	MX001 MX002
383 0029 000	IC, 78L05 ESD	1.0 EA	U002
383 0071 000	IC AD8403 ESD	1.0 EA	U011
383 0077 000	COUPLER, HYBRID SMT	1.0 EA	HY001
383 0078 000	IC, MONOLITHIC AMPLIFIER ESD	1.0 EA	U015
383 0079 000	IC, VECTOR MODULATOR ESD	2.0 EA	U013 U014

383 0080 000	IC, NE5534 ESD	2.0 EA	U004
			U005
383 0148 000	IC, 74HC14AD SO-14 ESD	1.0 EA	U001
383 0171 000	IC MAR-3SM ESD	2.0 EA	U006 U007
383 0197 000	IC MC145158-2 ESD	1.0 EA	U009
383 0198 000	IC MC12022 ESD	1.0 EA	U010
383 0253 000	IC, LM358 ESD	2.0 EA	U003 U012
384 0943 000	DIODE, 914L ESD	4.0 EA	CR001 CR002 CR003 CR004
414 0306 000	BEAD CORE, 45 OHM AT 100 MHZ	3.0 EA	RFC001 RFC002 RF003
414 0317 000	BEAD CORE, 115 OHM AT 100 MHZ	3.0 EA	RF004 RF005 RF006
496 0005 000	IND CHIP .022 UH 10%	4.0 EA	L001 L002 L005 L008
496 0048 000	IND CHIP 2.2UH 5%	2.0 EA	L006 L007
515 0134 011	CAP 2.7PF 100V +/-.25 0805 C0G	1.0 EA	C055
515 0134 017	CAP 4.7PF 100V +/-.25 0805 C0G	1.0 EA	C042
515 0134 113	CAP 33PF 100V 5% 0805 C0G	4.0 EA	C008 C009 C012 C024
515 0134 211	CAP 270PF 100V 5% 0805 C0G	2.0 EA	C070 C071
515 0134 217	CAP 470PF 100V 5% 0805 C0G	28.0 EA	C014 C015 C018 C019 C030 C031 C036 C040 C044 C045 C046 C047 C048 C049 C050 C051 C052 C053 C056 C059 C060 C061 C062 C063 C064 C065 C066 C?
515 0136 401	CAP 0.01UF 100V 10% 0805 X7R	1.0 EA	C035
515 0136 501	CAP 0.1UF 50V 10% 0805 X7R	14.0 EA	C001 C002 C005 C007 C010 C013 C016 C023 C032 C039 C041 C043 C058 C068
515 0138 509	CAP 0.22UF 100V 10% 1812 X7R	1.0 EA	C011
518 0114 000	CAP, TRIM 3-8PF	1.0 EA	C033
522 0636 000	CAP 100UF 6.3V SMT	2.0 EA	C022 C034
523 0003 101	CAP 10UF 35V 20% SMT	4.0 EA	C003 C004 C006 C027
526 0390 000	CAP 3.3UF 35V 10% 6032	1.0 EA	C067
545 0297 000	RES ZERO OHM 1206	2.0 EA	C017 R026
545 0308 109	RES 22.1 OHM 1% 0.1W 0805	1.0 EA	R061
545 0308 111	RES 26.7 OHM 1% 0.1W 0805	1.0 EA	R054
545 0308 112	RES 30.1 OHM 1% 0.1W 0805	2.0 EA	R065 R072
545 0308 117	RES 47.5 OHM 1% 0.1W 0805	2.0 EA	R083 R084
545 0308 118	RES 51.1 OHM 1% 0.1W 0805	2.0 EA	R045 R055
545 0308 119	RES 56.2 OHM 1% 0.1W 0805	2.0 EA	R014 R017
545 0308 120	RES 61.9 OHM 1% 0.1W 0805	2.0 EA	R015 R066
545 0308 121	RES 68.1 OHM 1% 0.1W 0805	2.0 EA	R069 R070
545 0308 122	RES 75 OHM 1% 0.1W 0805	2.0 EA	R071 R073
545 0308 201	RES 100 OHM 1% 0.1W 0805	2.0 EA	R064 R068
545 0308 202	RES 110 OHM 1% 0.1W 0805	2.0 EA	R001 R002
545 0308 205	RES 150 OHM 1% 0.1W 0805	3.0 EA	R020 R039 R?
545 0308 207	RES 182 OHM 1% 0.1W 0805	1.0 EA	R058
545 0308 208	RES 200 OHM 1% 0.1W 0805	1.0 EA	R074
545 0308 211	RES 267 OHM 1% 0.1W 0805	1.0 EA	R062
545 0308 217	RES 475 OHM 1% 0.1W 0805	2.0 EA	R056 R080
545 0308 220	RES 619 OHM 1% 0.1W 0805	4.0 EA	R013 R016 R075 R076
545 0308 222	RES 750 OHM 1% 0.1W 0805	1.0 EA	R029
545 0308 301	RES 1K OHM 1% 0.1W 0805	5.0 EA	R012 R023 R037 R042 R052
545 0308 302	RES 1.1K OHM 1% 0.1W 0805	4.0 EA	R009 R027 R081 R082
545 0308 303	RES 1.21K OHM 1% 0.1W 0805	1.0 EA	R019
545 0308 306	RES 1.62K OHM 1% 0.1W 0805	1.0 EA	R036
545 0308 309	RES 2.21K OHM 1% 0.1W 0805	6.0 EA	R008 R011 R024 R025 R041 R063
545 0308 323	RES 8.25K OHM 1% 0.1W 0805	1.0 EA	R048
545 0308 401	RES 10K OHM 1% 0.1W 0805	4.0 EA	R004 R006 R007 R057
545 0308 407	RES 18.2K OHM 1% 0.1W 0805	1.0 EA	R018

545 0308 408	RES 20K OHM 1% 0.1W 0805	1.0 EA	R005
545 0308 409	RES 22.1K OHM 1% 0.1W 0805	4.0 EA	R051 R077 R078 R079
545 0308 413	RES 33.2K OHM 1% 0.1W 0805	4.0 EA	R010 R021 R028 R038
545 0309 123	RES 82.5 OHM 1% 1/4W 1206	4.0 EA	R031 R032 R033 R034
545 0309 204	RES 130 OHM 1% 1/4W 1206	1.0 EA	R067
545 0309 217	RES 475 OHM 1% 1/4W 1206	1.0 EA	R046
700 1398 000	XTAL OSCILLATOR 20MHZ ESD	1.0 EA	OSC1
843 5475 121	SCH, SYNTHESIZER/MODULATOR	0.0 EA	
843 5475 123	PWB, SYNTHESIZER/MODULATOR	1.0 EA	

Table 8-11. PWA, VCO TRANSMITTER - 992 9793 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
383 0308 000	IC, MAR-8SM ESD	1.0 EA	U001
496 0063 000	INDUCTOR, CHIP .022UH 20%	1.0 EA	L001
515 0134 217	CAP 470PF 100V 5% 0805 C0G	3.0 EA	C001 C002 C003
545 0308 123	RES 82.5 OHM 1% 0.1W 0805	1.0 EA	R002
545 0308 301	RES 1K OHM 1% 0.1W 0805	1.0 EA	R003
551 0011 000	POT 200 OHM SMT .2W 5%	1.0 EA	R001
700 1401 000	VCO, 1.25-3.75V, 939-977MHZ	1.0 EA	OSC1
843 5475 151	SCH, VCO	0.0 EA	
843 5475 153	PWB, VCO	1.0 EA	

Table 8-12. PWA, RF PA - 992 9765 020

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0.0 EA	IF MHW916 IS USED, PLACE R8 IN 2-3 POS IF BGY916 IS USED, PLACE R8 IN 2-1 POS (IN REFERENCE TO 382-1625)
031 1710 021	GASKET, KNITTED WIRE MESH	1.310 FT	
055 0100 005	*THERMAL COMPOUND, 8OZ JAR	0.0 EA	XU002
252 0330 000	WIRE, SOLID 26AWG YEL	0.330 FT	
296 0259 000	TUBING TEFLON 18 AWG	0.080 FT	J002
302 0012 000	SCR, 2-56 X 1/4	5.0 EA	5/PCB
302 0014 000	SCR, 2-56 X 3/8	2.0 EA	2/J003
302 0105 000	SCR, 6-32 X 5/16	2.0 EA	2/U002
306 0001 000	NUT, HEX 2-56	2.0 EA	2/J003
310 0001 000	WASHER, FLAT #2	5.0 EA	5/PCB
310 0012 000	WASHER FLAT 6	2.0 EA	2/U002
312 0001 000	WASHER, INT LOCK 2	2.0 EA	2/J003
314 0001 000	WASHER, SPLIT-LOCK 2	7.0 EA	2/J003 5/PCB
314 0005 000	WASHER, SPLIT-LOCK 6	2.0 EA	2/U002
382 1588 000	IC, CE152R933CEB ESD	1.0 EA	U003
382 1625 000	IC MHW916 RF MODULE ESD	1.0 EA	U002
383 0253 000	IC, LM358 ESD	1.0 EA	U001
384 0877 000	DIODE, SCHOTTKY BAT62 40V ESD	2.0 EA	CR001 CR002
384 0943 000	DIODE, 914L ESD	1.0 EA	CR003
415 0001 002	BEAD, FERRITE CHIP	3.0 EA	RFC001 RFC002 RFC003
515 0134 101	CAP 10PF 100V 5% 0805 C0G	1.0 EA	C007
515 0134 213	CAP 330PF 100V 5% 0805 C0G	11.0 EA	C001 C002 C011 C016 C017 C018 C019 C020 C023 C024 C025
515 0136 401	CAP 0.01UF 100V 10% 0805 X7R	4.0 EA	C003 C004 C006 C013
515 0136 501	CAP 0.1UF 50V 10% 0805 X7R	3.0 EA	C009 C015 C021
518 0114 000	CAP, TRIM 3-8PF	1.0 EA	C005

WARNING: Disconnect primary power prior to servicing.

523 0003 201	CAP 100UF 35V 20% SMT	2.0 EA	C012 C022
545 0297 000	RES ZERO OHM 1206	1.0 EA	R008
545 0309 110	RES 23.7 OHM 1% 1/4W 1206	1.0 EA	R005
545 0309 118	RES 51.1 OHM 1% 1/4W 1206	4.0 EA	R001 R002 R003 R024
545 0309 119	RES 56.2 OHM 1% 1/4W 1206	2.0 EA	R004 R027
545 0309 203	RES 121 OHM 1% 1/4W 1206	2.0 EA	R023 R025
545 0309 209	RES 221 OHM 1% 1/4W 1206	1.0 EA	R016
545 0309 301	RES 1K OHM 1% 1/4W 1206	1.0 EA	R013
545 0309 318	RES 5.11K OHM 1% 1/4W 1206	1.0 EA	R020
545 0309 402	RES 11K OHM 1% 1/4W 1206	2.0 EA	R011 R015
545 0309 405	RES 15K OHM 1% 1/4W 1206	1.0 EA	R017
545 0309 408	RES 20K OHM 1% 1/4W 1206	2.0 EA	R012 R026
545 0309 411	RES 26.7K OHM 1% 1/4W 1206	1.0 EA	R028
545 0309 418	RES 51.1K OHM 1% 1/4W 1206	3.0 EA	R006 R007 R014
551 0011 000	POT 200 OHM SMT .2W 5%	1.0 EA	R001
610 0902 000	HDR 10 PIN STRAIGHT	1.0 EA	J001
610 1172 000	HDR, 2PIN,1ROW,STRT,POLAR	1.0 EA	J002
620 2883 000	JACK, OSX PWB MTG	2.0 EA	J004 J005
620 2937 000	JACK RECEPTACLE SMA	1.0 EA	J003
843 5475 131	SCH, RF PA	0.0 EA	
843 5475 133	PWB, RF PA	1.0 EA	
917 2435 901	COVER PA	1.0 EA	
943 5475 007	HEATSINK PA	1.0 EA	

Table 8-13. DIGITAL STL RECEIVER - 994 9725 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
250 0274 000	CORD, POWER 3C 7-1/2 FT	1.0 EA	
358 1214 000	SCREWLOCK, FEMALE	4.0 EA	
358 3190 000	PLUG, WHT .500" HOLE	1.0 EA	
398 0049 000	FUSE,SLOW CART .500A 250V	1.0 EA	
406 0530 000	DISPLAY, LCD, 240 X 64,	1.0 EA	DS001
484 0420 000	FILTER, RFI POWER ENTRY	1.0 EA	
610 0981 000	HDR 20C 2ROW VERTICAL	1.0 EA	1/DS001
610 1295 000	HEADER, 2PIN, 1ROW, STRAIGHT	1.0 EA	1/DS001
646 1301 201	LABEL, DANGER HI VOLTAGE	1.0 EA	#P001
646 1487 000	NAMEPLATE PATENT, GENERIC	1.0 EA	
646 1593 000	OVERLAY, FRONT PNL, NEX/STL	1.0 EA	
646 1593 001	INSERT, RECEIVER	1.0 EA	
736 0292 000	POWER SUPPLY, SWITCHING	1.0 EA	PS001
917 2435 904	WIRE CBL PKG,DISCRETE RECEIVER	1.0 EA	
917 2435 935	WASHER, FLAT,	2.0 EA	
943 5475 003	PANEL, FRONT	1.0 EA	
943 5475 006	COVER, TOP	1.0 EA	
943 5475 011	COVER 5-15V POWR SUPPLY	1.0 EA	
943 5475 012	PANEL, BLANK, AUX AUDIO	1.0 EA	
943 5475 013	CHASSIS, RECEIVER	1.0 EA	
943 5475 025	RIBBON CBL PKG, RECEIVER,	1.0 EA	
992 9559 001	PWA, RECEIVER DEMODULATOR	1.0 EA	
992 9559 020	PWA, RECEIVER MAIN	1.0 EA	
999 2888 001	HARDWARE LIST,DIGITAL RECEIVER	1.0 EA	

Table 8-14. PWA, RECEIVER DEMODULATOR - 992 9559 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
383 0248 000	IC, MAR-6 ESD	2.0 EA	U002 U007
383 0250 000	IC, MAR-1 ESD	1.0 EA	U010
484 0436 000	FILTER 50MHZ 3 POLE	1.0 EA	FL001
484 0437 000	FILTER, MICROWAVE BANDPASS	2.0 EA	FL002 FL003
506 0280 000	CAP, POLYSTYRENE 3300PF 63V 1%	2.0 EA	C006 C041
506 0281 000	CAP, POLYSTYRENE 2700PF 63V 1%	2.0 EA	C005 C040
506 0282 000	CAP, POLYSTYRENE 1200PF 63V 1%	4.0 EA	C007 C031 C042 C061
506 0283 000	CAP, POLYSTYRENE 1000PF 63V 1%	2.0 EA	C004 C039
515 0134 011	CAP 2.7PF 100V +/-.25 0805 C0G	1.0 EA	C091
519 0149 000	CAP, PORCELAIN 0.3PF CHIP	2.0 EA	C090 C092
519 0150 000	CAP, PORCELAIN 0.8PF, CHIP	1.0 EA	C089
610 0877 000	HDR, STR, 2 PIN, SQ	1.0 EA	JP001
610 0981 000	HDR 20C 2ROW VERTICAL	1.0 EA	J006
612 1184 000	JUMPER .1" CENTERS	1.0 EA	#JP001
612 1347 000	RECP SMA PCB MT STRAIGHT	1.0 EA	J005
612 1498 000	RECEPTACLE 6PIN	2.0 EA	J002 J003
620 2883 000	JACK, OSX PWB MTG	2.0 EA	J001 J004
917 2435 925	IND, ALIGNMENT .823 MH GOLD	2.0 EA	L002 L006
917 2435 926	IND, ALIGNMENT .997 MH BLUE	2.0 EA	L003 L007
917 2435 927	IND, ALIGNMENT 1.004 MH WHITE	2.0 EA	L004 L008
917 2435 934	RECEIVER/DEMOD 50MHZ BANDPASS	1.0 EA	FL004
992 9559 002	PWA, RECEIVER DEMODULATOR SMT	1.0 EA	
992 9773 001	PWA, RECEIVER, VCO	1.0 EA	

Table 8-15. PWA, RECEIVER DEMODULATOR SMT - 992 9559 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 002	APPEARS ON HIGHER LEVEL	0.0 EA	C089 C090 C091 C092 U002 U007
381 0001 000	XSTR MMBT2222ALT1 NPN ESD	3.0 EA	Q001 Q002 Q004
381 0003 001	XSTR, NPN, 3904 (SMT) ESD	2.0 EA	Q003 Q009
381 0003 002	XSTR, PNP MMBT3906 ESD	2.0 EA	Q006 Q007
383 0002 000	IC SD5400CY ESD	1.0 EA	Q008
383 0004 000	IC, RMS-11F ESD	1.0 EA	MX001
383 0006 000	IC, LM1496 ESD	2.0 EA	U004 U005
383 0020 000	IC, 74HC74 ESD	1.0 EA	U015
383 0029 000	IC, 78L05 ESD	1.0 EA	U013
383 0042 000	IC, MC145158 ESD	1.0 EA	U011
383 0065 000	IC, NE5532 ESD	2.0 EA	U001 U003
383 0105 000	IC MC34080 ESD	2.0 EA	U009
			U014
383 0196 000	IC MAT-04 ESD	1.0 EA	Q005
383 0198 000	IC MC12022 ESD	1.0 EA	U006
383 0243 000	IC, LT1014 QUAD OP AMP ESD	1.0 EA	U008
383 0253 000	IC, LM358 ESD	1.0 EA	U012
384 0943 000	DIODE, 914L ESD	2.0 EA	CR002 CR003
384 0955 000	DIODE, PIN BAR14-1 ESD	1.0 EA	CR001
385 0014 000	DIODE, VARACTOR MMBV2109 ESD	2.0 EA	CR004 CR005
414 0306 000	BEAD CORE, 45 OHM AT 100 MHZ	4.0 EA	RFC001 RFC002 RFC003 RFC004
496 0015 000	IND CHIP .150 UH 10%	1.0 EA	L009
496 0030 000	IND CHIP 1.5 UH 10%	1.0 EA	L011
496 0060 000	IND CHIP 4.7UH 10%	2.0 EA	L001 L010
496 0063 000	INDUCTOR, CHIP .022UH 20%	1.0 EA	L005

WARNING: Disconnect primary power prior to servicing.

515 0134 017	CAP 4.7PF 100V +/-.25 0805 C0G	1.0 EA	C045
515 0134 117	CAP 47PF 100V 5% 0805 C0G	2.0 EA	C033 C058
515 0134 201	CAP 100PF 100V 5% 0805 C0G	6.0 EA	C011 C013 C026 C028 C051 C052
515 0134 205	CAP 150PF 100V 5% 0805 C0G	2.0 EA	C003 C020
515 0134 209	CAP 220PF 100V 5% 0805 C0G	7.0 EA	C016 C025 C059 C064 C085 C087 C088
515 0134 217	CAP 470PF 100V 5% 0805 C0G	11.0 EA	C023 C032 C038 C049 C055 C062 C072 C074 C078 C082 C086
515 0136 401	CAP 0.01UF 100V 10% 0805 X7R	10.0 EA	C008 C009 C010 C015 C022 C048 C050 C054 C075 C083
515 0136 501	CAP 0.1UF 50V 10% 0805 X7R	11.0 EA	C037 C053 C057 C060 C065 C066 C068 C079 C080 C081 C084
515 0138 517	CAP 0.47UF 100V 10% 1812 X7R	1.0 EA	C067
515 0142 000	CAP, CHIP, 560PF, 1%, 100V	4.0 EA	C001 C012 C018 C027
515 0144 000	CAP, CHIP, 220PF, 1%, 100V	2.0 EA	C014 C029
515 0145 000	CAP, CHIP, 680PF, 1%, 100V	2.0 EA	C002 C019
522 0634 000	CAP 10UF 25V	5.0 EA	C024 C069 C071 C076 C077
522 0635 000	CAP 100UF 25V	3.0 EA	C017 C043 C063
522 0636 000	CAP 100UF 6.3V SMT	4.0 EA	C034 C056 C070 C073
523 0004 001	CAP 1UF 50V 20% SMT	2.0 EA	C021 C030
526 0384 000	CAP 10UF 16V 10%	4.0 EA	C035 C036 C046 C047
526 0389 000	CAP 2.2UF 35V 10% 6032	1.0 EA	C044
545 0308 105	RES 15 OHM 1% 0.1W 0805	1.0 EA	R059
545 0308 108	RES 20 OHM 1% 0.1W 0805	1.0 EA	R077
545 0308 109	RES 22.1 OHM 1% 0.1W 0805	1.0 EA	R074
545 0308 117	RES 47.5 OHM 1% 0.1W 0805	1.0 EA	R045
545 0308 118	RES 51.1 OHM 1% 0.1W 0805	3.0 EA	R036 R096 R108
545 0308 119	RES 56.2 OHM 1% 0.1W 0805	1.0 EA	R023
545 0308 120	RES 61.9 OHM 1% 0.1W 0805	1.0 EA	R071
545 0308 121	RES 68.1 OHM 1% 0.1W 0805	2.0 EA	R034 R064
545 0308 122	RES 75 OHM 1% 0.1W 0805	1.0 EA	R039
545 0308 201	RES 100 OHM 1% 0.1W 0805	4.0 EA	R004 R013 R030 R107
545 0308 205	RES 150 OHM 1% 0.1W 0805	1.0 EA	R015
545 0308 209	RES 221 OHM 1% 0.1W 0805	2.0 EA	R007 R093
545 0308 210	RES 237 OHM 1% 0.1W 0805	2.0 EA	R014 R085
545 0308 213	RES 332 OHM 1% 0.1W 0805	8.0 EA	R001 R006 R016 R029 R033 R066 R094 R?
545 0308 217	RES 475 OHM 1% 0.1W 0805	4.0 EA	R020 R032 R078 R079
545 0308 220	RES 619 OHM 1% 0.1W 0805	4.0 EA	R011 R012 R017 R022
545 0308 221	RES 681 OHM 1% 0.1W 0805	3.0 EA	R042 R046 R110
545 0308 222	RES 750 OHM 1% 0.1W 0805	1.0 EA	R082
545 0308 301	RES 1K OHM 1% 0.1W 0805	6.0 EA	R038 R058 R062 R068 R087 R095
545 0308 302	RES 1.1K OHM 1% 0.1W 0805	2.0 EA	R018 R037
545 0308 303	RES 1.21K OHM 1% 0.1W 0805	1.0 EA	R072
545 0308 304	RES 1.3K OHM 1% 0.1W 0805	1.0 EA	R031
545 0308 305	RES 1.5K OHM 1% 0.1W 0805	1.0 EA	R084
545 0308 309	RES 2.21K OHM 1% 0.1W 0805	2.0 EA	R063 R073
545 0308 312	RES 3.01K OHM 1% 0.1W 0805	7.0 EA	R003 R005 R026 R028 R050 R067 R086
545 0308 313	RES 3.32K OHM 1% 0.1W 0805	1.0 EA	R035
545 0308 315	RES 3.92K OHM 1% 0.1W 0805	2.0 EA	R040 R070
545 0308 317	RES 4.75K OHM 1% 0.1W 0805	2.0 EA	R024 R049
545 0308 318	RES 5.11K OHM 1% 0.1W 0805	6.0 EA	R051 R052 R080 R081 R092 R102
545 0308 323	RES 8.25K OHM 1% 0.1W 0805	5.0 EA	R008 R010 R021 R027 R097
545 0308 401	RES 10K OHM 1% 0.1W 0805	4.0 EA	R055 R056 R076 R088
545 0308 403	RES 12.1K OHM 1% 0.1W 0805	2.0 EA	R009 R019
545 0308 404	RES 13K OHM 1% 0.1W 0805	1.0 EA	R111

WARNING: Disconnect primary power prior to servicing.

545 0308 407	RES 18.2K OHM 1% 0.1W 0805	1.0 EA	R061
545 0308 408	RES 20K OHM 1% 0.1W 0805	4.0 EA	R057 R075 R083 R098
545 0308 409	RES 22.1K OHM 1% 0.1W 0805	8.0 EA	R047 R048 R065 R101 R104 R105 R106 R109
545 0308 411	RES 26.7K OHM 1% 0.1W 0805	2.0 EA	R100 R103
545 0308 413	RES 33.2K OHM 1% 0.1W 0805	2.0 EA	R091 R099
545 0308 512	RES 301K OHM 1% 0.1W 0805	1.0 EA	R069
545 0308 518	RES 511K OHM 1% 0.1W 0805	2.0 EA	R089 R090
545 0308 521	RES 681K OHM 1% 0.1W 0805	2.0 EA	R041 R053
545 0308 601	RES 1MEG OHM 1% 0.1W 0805	1.0 EA	R054
545 0309 204	RES 130 OHM 1% 1/4W 1206	1.0 EA	R043
545 0309 217	RES 475 OHM 1% 1/4W 1206	3.0 EA	R002 R025 R044
550 1095 000	POT 5K SMT VERT MTG	1.0 EA	R060
700 1398 000	XTAL OSCILLATOR 20MHZ ESD	1.0 EA	OSC1
843 5475 101	SCH, RECEIVER DEMODULATOR	0.0 EA	
843 5475 103	PWB, RECEIVER DEMODULATOR	1.0 EA	

Table 8-16. PWA, RECEIVER, VCO - 992 9773 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
383 0308 000	IC, MAR-8SM ESD	1.0 EA	U001
496 0063 000	INDUCTOR, CHIP .022UH 20%	1.0 EA	L001
515 0134 217	CAP 470PF 100V 5% 0805 C0G	3.0 EA	C001 C002 C003
545 0308 123	RES 82.5 OHM 1% 0.1W 0805	1.0 EA	R002
545 0308 301	RES 1K OHM 1% 0.1W 0805	1.0 EA	R003
551 0011 000	POT 200 OHM SMT .2W 5%	1.0 EA	R001
700 1400 000	VCO 0.7-4.3V, 962-995MHZ	1.0 EA	OSC1
843 5475 151	SCH, VCO	0.0 EA	
843 5475 153	PWB, VCO	1.0 EA	

Table 8-17. PWA, RECEIVER MAIN - 992 9559 020

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
300 1485 000	SCR, 4-40 X 5/16	5.0 EA	1/U014 1/U018 1/U019 1/U020 1/U025
304 0087 000	NUT, HEX 4-40	5.0 EA	1/U014 1/U018 1/U019 1/U020 1/U025
308 0003 000	NO 4 FLAT WASHER BRS	5.0 EA	1/U014 1/U018 1/U019 1/U020 1/U025
312 0045 000	WASHER, SPLIT-LOCK 4	5.0 EA	1/U014 1/U018 1/U019 1/U020 1/U025
380 0789 000	XMTR FIBER OPTIC ESD	1.0 EA	U001
382 0184 000	IC, 340T-5/7805 +5V REG ESD	1.0 EA	U020
382 0371 000	IC, MC7912CT ESD	1.0 EA	U025
382 0406 000	IC, MC7812CT ESD	2.0 EA	U014 U018
382 0605 000	IC 7905C ESD	1.0 EA	U019
404 0509 000	SOCKET IC 28 PIN	1.0 EA	XU015
404 0842 000	HEATSINK FOR TO220	1.0 EA	XU018
444 3019 000	OSC, V CONTROLLED XTAL, 12.672	1.0 EA	OSC2
492 0860 000	IND FIXED 1MH 5%	4.0 EA	L001 L002 L004 L005
492 0861 000	IND FIXED 10UH 10%	1.0 EA	L006
550 0314 000	POT 10K OHM 3/4W 10%	3.0 EA	RV001 RV002 RV003
566 0027 000	INVERTER, DC-AC	1.0 EA	M001
574 0450 000	RELAY SPDT 5VDC 3A	1.0 EA	K001
610 0857 000	HDR 12C 1ROW STRAIGHT	1.0 EA	J009
610 0900 000	HEADER 3 CKT STRAIGHT	8.0 EA	JP001 JP1A1 JP1B1 JP002 JP003 JP004 J005 JP010
610 0981 000	HDR 20C 2ROW VERTICAL	2.0 EA	J010 J011

610 0994 000	CONN, XLR 3-C NC3MD-H-BAG	3.0 EA	P001 P002 P003
610 1111 000	HDR 50C 2ROW STRAIGHT	1.0 EA	J008
610 1145 000	HDR, 6PIN, 1ROW, STRT,POL	1.0 EA	J006
610 1290 000	CONN 25C RECP/PLUG D-TYPE	1.0 EA	P004/P005
610 1291 000	CONN 25C PLUG/PLUG D-TYPE	1.0 EA	P006/P007
610 1295 000	HEADER, 2PIN, 1ROW, STRAIGHT	1.0 EA	J012
612 1184 000	JUMPER .1" CENTERS	7.0 EA	
612 1476 000	JACK, HEADPHONE STEREO	1.0 EA	J004
620 2930 000	RECEPTACLE RT ANGLE BNC	2.0 EA	J001 J002
917 2435 911	FIRMWARE, RECEIVER MAIN,	1.0 EA	
917 2435 913	FIRMWARE, RECEIVER MAIN,	1.0 EA	U028 U029
917 2435 914	FIRMWARE, RECEIVER MAIN, U59	1.0 EA	U065
917 2435 915	FIRMWARE, RECEIVER MAIN, U40	1.0 EA	U040
992 9559 021	PWA, RECEIVER MAIN SMT	1.0 EA	

Table 8-18. PWA, RECEIVER MAIN SMT - 992 9559 021

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0.0 EA	THESE PARTS ARE NOT USED AT THIS LEVEL. R085 R093
381 0001 000	XSTR MMBT2222ALT1 NPN ESD	6.0 EA	Q001 Q004 Q005 Q006 Q010 Q011
381 0003 001	XSTR, NPN, 3904 (SMT) ESD	1.0 EA	Q009
381 0007 000	XSTR MMBT2907 PNP ESD	4.0 EA	Q002 Q003 Q007 Q012
381 0009 000	XSTR MJD32 PNP ESD	1.0 EA	Q008
383 0007 000	IC, IDT7164 ESD	1.0 EA	U034
383 0011 000	IC, 74HC139 ESD	1.0 EA	U036
383 0012 000	IC, 74HC166 ESD	1.0 EA	U035
383 0013 000	IC, 74HC174 ESD	1.0 EA	U026
383 0014 000	IC, 74HC32 ESD	1.0 EA	U080
383 0015 000	IC, 74HC368 ESD	1.0 EA	U032
383 0016 000	IC, 74HC374 ESD	2.0 EA	U067 U084
383 0018 000	IC, 74HC4316 ESD	4.0 EA	U009 U021 U054 U055
383 0019 000	IC, 74HC595 ESD	2.0 EA	U082 U083
383 0020 000	IC, 74HC74 ESD	2.0 EA	U044 U081
383 0022 000	IC, 74HCT373 ESD	1.0 EA	U051
383 0025 000	IC, 74LS161A ESD	1.0 EA	U027
383 0029 000	IC, 78L05 ESD	1.0 EA	U022
383 0032 000	IC, 80C535 ESD	1.0 EA	U052
383 0036 000	IC, DF1700 ESD	1.0 EA	U023
383 0037 000	IC, DSP16A ESD	1.0 EA	U043
383 0038 000	IC, LM311 ESD	8.0 EA	U038 U039 U045 U046 U047 U048 U068 U069
383 0042 000	IC, MC145158 ESD	1.0 EA	U085
383 0043 000	IC, MC34084 ESD	5.0 EA	U024 U061 U062 U071 U072
383 0044 000	IC, PCM1700 ESD	1.0 EA	U004
383 0046 000	IC, YM3437C ESD	1.0 EA	U033
383 0065 000	IC, NE5532 ESD	8.0 EA	U002 U003 U007 U008 U010 U016 U017 U066
383 0067 000	IC 16C452 ESD	1.0 EA	U076
383 0072 000	IC AD8402 ESD	1.0 EA	U012
383 0102 000	IC, 74HC138D ESD	1.0 EA	U058
383 0103 000	IC SN75176BD ESD	1.0 EA	U006
383 0105 000	IC MC34080 ESD	2.0 EA	U074 U077
383 0107 000	IC 74HC652 ESD	1.0 EA	U050
383 0108 000	IC 74HC4052 ESD	1.0 EA	U013
383 0150 000	IC, 74HC04AD SO-14 ESD	3.0 EA	U037 U053 U070

383 0161 000	IC, SN75468, 7 DRIVER, ESD	1.0 EA	U011
383 0244 000	IC ILD206 OPTO-COUPLER ESD	1.0 EA	IS001
383 0253 000	IC, LM358 ESD	1.0 EA	U005
383 0256 000	IC, TL072 OP AMP SMT ESD	2.0 EA	U049 U086
383 0257 000	IC, MMAD1108 ESD	1.0 EA	U060
383 0301 000	*IC, 74HC4053 ESD	9.0 EA	U031 U041 U042 U056 U057 U078 U079 U087 U088
384 0943 000	DIODE, 914L ESD	12.0 EA	CR001 CR002 CR003 CR004 CR005 CR006 CR008 CR009 CR010 CR011 CR012 CR013
385 0014 000	DIODE, VARACTOR MMBV2109 ESD	2.0 EA	CR014 CR015
386 0463 000	ZENER MMBZ5257B ESD	1.0 EA	CR007
393 0009 000	IC, NM9306 ESD	1.0 EA	U065
404 0869 000	SOCKET, PLCC-32 SMT	1.0 EA	XU040
404 0886 000	SOCKET, PLCC SURFACE MTG	3.0 EA	XU030 XU059 XU075
404 0890 000	SOCKET, PLCC-84, SMT	1.0 EA	XU073
404 0891 000	SOCKET, PLCC, SMT W/O LOCATORS	4.0 EA	XU028 XU029 XU063 XU064
445 0002 000	XTAL 16 MHZ SMT ESD	1.0 EA	Y001
445 0005 000	OSCILLATOR 60MHZ SMT	2.0 EA	OSC1 OSC3
496 0038 000	IND CHIP 6.8 UH 10%	1.0 EA	L009
496 0067 000	IND CHIP 68UH 10%	1.0 EA	L003
496 0068 000	IND CHIP 150UH 5%	2.0 EA	L007 L008
515 0067 000	CAP CHIP 5600PF 5% 50V	2.0 EA	C167 C182
515 0089 000	CAP CHIP .068UF 10% 50V	1.0 EA	C159
515 0134 017	CAP 4.7PF 100V +/-.25 0805 C0G	1.0 EA	C191
515 0134 109	CAP 22PF 100V 5% 0805 C0G	3.0 EA	C043 C093 C094
515 0134 111	CAP 27PF 100V 5% 0805 C0G	1.0 EA	C031
515 0134 113	CAP 33PF 100V 5% 0805 C0G	3.0 EA	C110 C111 C184
515 0134 117	CAP 47PF 100V 5% 0805 C0G	1.0 EA	C055
515 0134 119	CAP 56PF 100V 5% 0805 C0G	2.0 EA	C026 C029
515 0134 121	CAP 68PF 100V 5% 0805 C0G	2.0 EA	C163 C171
515 0134 201	CAP 100PF 100V 5% 0805 C0G	1.0 EA	C052
515 0134 205	CAP 150PF 100V 5% 0805 C0G	1.0 EA	C049
515 0134 209	CAP 220PF 100V 5% 0805 C0G	3.0 EA	C197 C198 C199
515 0134 211	CAP 270PF 100V 5% 0805 C0G	1.0 EA	C004
515 0134 213	CAP 330PF 100V 5% 0805 C0G	2.0 EA	C022 C046
515 0134 217	CAP 470PF 100V 5% 0805 C0G	5.0 EA	C006 C010 C011 C017 C202
515 0134 219	CAP 560PF 100V 5% 0805 C0G	1.0 EA	C169
515 0134 221	CAP 680PF 100V 5% 0805 C0G	1.0 EA	C030
515 0136 301	CAP 1000PF 100V 10% 0805 X7R	10.0 EA	C012 C013 C014 C015 C135 C141 C145 C148 C149 C151
515 0136 307	CAP 1800PF 100V 10% 0805 X7R	2.0 EA	C186 C192
515 0136 311	CAP 2700PF 100V 10% 0805 X7R	1.0 EA	C201
515 0136 317	CAP 4700PF 100V 10% 0805 X7R	1.0 EA	C162
515 0136 401	CAP 0.01UF 100V 10% 0805 X7R	11.0 EA	C007 C008 C009 C018 C019 C024 C048 C133 C134 C139 C200
515 0136 409	CAP 0.022UF 100V 10% 0805 X7R	3.0 EA	C002 C003 C147
515 0136 411	CAP 0.027UF 100V 10% 0805 X7R	1.0 EA	C174
515 0136 413	CAP 0.033UF 100V 10% 0805 X7R	1.0 EA	C042
515 0136 501	CAP 0.1UF 50V 10% 0805 X7R	108.0 EA	C001 C005 C016 C020 C021 C027 C028 C033 C034 C036 C038 C039 C041 C044 C045 C053 C058 C062 C063 C064 C066 C067 C069 C072 C073 C079

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			C082 C083 C084 C086 C087 C088 C091 C092 C095 C096 C097 C098 C099 C100 C101 C102 C103 C104 C105 C106 C107 C108 C109 C112 C113 C114 C115 C116 C117 C118 C119 C120 C121 C122 C123 C124 C125 C126 C127 C128 C130 C131 C132 C136 C138 C140 C142 C143 C144 C146 C150 C152 C153 C154 C155 C156 C157 C158 C160 C161 C164 C165 C166 C170 C173 C175 C176 C177 C178 C179 C180 C181 C183 C185 C187 C188 C189 C190 C193 C194 C195 C196
515 0138 509	CAP 0.22UF 100V 10% 1812 X7R	1.0 EA	C172
515 0138 517	CAP 0.47UF 100V 10% 1812 X7R	2.0 EA	C037 C047
515 0150 000	CAP CHIP 680PF 1%	2.0 EA	C025 C051
515 0151 000	CAP CHIP 1200PF 1%	6.0 EA	C032 C035 C059 C065 C077 C078
515 0152 000	CAP CHIP 1800PF 1%	1.0 EA	C050
522 0634 000	CAP 10UF 25V	11.0 EA	C023 C040 C057 C061 C071 C076 C080 C081 C085 C129 C137
522 0635 000	CAP 100UF 25V	4.0 EA	C056 C068 C070 C090
522 0636 000	CAP 100UF 6.3V SMT	6.0 EA	C054 C060 C074 C075 C089 C168
540 1562 000	RES NETWORK 10K OHM 2%	1.0 EA	RP001
540 1564 000	RES NETWORK 1K OHM 0.5% SMT	1.0 EA	R113
545 0308 113	RES 33.2 OHM 1% 0.1W 0805	1.0 EA	R129
545 0308 118	RES 51.1 OHM 1% 0.1W 0805	14.0 EA	R001 R003 R097 R108 R115 R116 R117 R118 R121 R165 R179 R180 R194 R195
545 0308 119	RES 56.2 OHM 1% 0.1W 0805	6.0 EA	R022 R037 R066 R067 R068 R069
545 0308 120	RES 61.9 OHM 1% 0.1W 0805	1.0 EA	R232
545 0308 201	RES 100 OHM 1% 0.1W 0805	11.0 EA	R002 R125 R131 R132 R139 R142 R150 R177 R230 R234 R?
545 0308 204	RES 130 OHM 1% 0.1W 0805	1.0 EA	R169
545 0308 208	RES 200 OHM 1% 0.1W 0805	2.0 EA	R176 R202
545 0308 209	RES 221 OHM 1% 0.1W 0805	11.0 EA	R009 R010 R015 R016 R043 R127 R135 R144 R161 R186 R201
545 0308 210	RES 237 OHM 1% 0.1W 0805	1.0 EA	R233
545 0308 213	RES 332 OHM 1% 0.1W 0805	5.0 EA	R008 R012 R017 R076 R079
545 0308 215	RES 392 OHM 1% 0.1W 0805	2.0 EA	R199 R205
545 0308 216	RES 432 OHM 1% 0.1W 0805	1.0 EA	R044
545 0308 217	RES 475 OHM 1% 0.1W 0805	2.0 EA	R119 R120
545 0308 218	RES 511 OHM 1% 0.1W 0805	2.0 EA	R143 R149
545 0308 223	RES 825 OHM 1% 0.1W 0805	2.0 EA	R005 R028
545 0308 301	RES 1K OHM 1% 0.1W 0805	9.0 EA	R080 R081 R082 R083 R098 R105 R109 R110 R213
545 0308 303	RES 1.21K OHM 1% 0.1W 0805	1.0 EA	R137
545 0308 305	RES 1.5K OHM 1% 0.1W 0805	3.0 EA	R041 R049 R229
545 0308 307	RES 1.82K OHM 1% 0.1W 0805	2.0 EA	R077 R078
545 0308 308	RES 2K OHM 1% 0.1W 0805	8.0 EA	R064 R065 R159 R160 R181 R188 R189 R200
545 0308 309	RES 2.21K OHM 1% 0.1W 0805	5.0 EA	R019 R020 R074 R075 R148
545 0308 311	RES 2.67K OHM 1% 0.1W 0805	1.0 EA	R018
545 0308 312	RES 3.01K OHM 1% 0.1W 0805	1.0 EA	R162
545 0308 313	RES 3.32K OHM 1% 0.1W 0805	8.0 EA	R070 R071 R072 R073 R216 R235 R236 R237
545 0308 314	RES 3.57K OHM 1% 0.1W 0805	1.0 EA	R045
545 0308 315	RES 3.92K OHM 1% 0.1W 0805	2.0 EA	R084 R086
545 0308 316	RES 4.32K OHM 1% 0.1W 0805	1.0 EA	R196
545 0308 317	RES 4.75K OHM 1% 0.1W 0805	4.0 EA	R089 R099 R136 R191

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545 0308 318	RES 5.11K OHM 1% 0.1W 0805	5.0 EA	R027 R060 R061 R104 R224
545 0308 320	RES 6.19K OHM 1% 0.1W 0805	2.0 EA	R218 R226
545 0308 321	RES 6.81K OHM 1% 0.1W 0805	11.0 EA	R007 R011 R014 R026 R031 R032 R034 R036 R042 R126 R128
545 0308 323	RES 8.25K OHM 1% 0.1W 0805	6.0 EA	R004 R174 R211 R212 R222 R223
545 0308 324	RES 9.09K OHM 1% 0.1W 0805	4.0 EA	R088 R091 R140 R166
545 0308 401	RES 10K OHM 1% 0.1W 0805	20.0 EA	R006 R023 R024 R025 R029 R033 R035 R038 R040 R052 R058 R059 R062 R063 R103 R107 R130 R153 R183 R190
545 0308 402	RES 11K OHM 1% 0.1W 0805	1.0 EA	R145
545 0308 403	RES 12.1K OHM 1% 0.1W 0805	2.0 EA	R094 R106
545 0308 404	RES 13K OHM 1% 0.1W 0805	3.0 EA	R051 R056 R138
545 0308 405	RES 15K OHM 1% 0.1W 0805	1.0 EA	R155
545 0308 406	RES 16.2K OHM 1% 0.1W 0805	2.0 EA	R185 R193
545 0308 407	RES 18.2K OHM 1% 0.1W 0805	4.0 EA	R123 R133 R217 R221
545 0308 408	RES 20K OHM 1% 0.1W 0805	1.0 EA	R164
545 0308 409	RES 22.1K OHM 1% 0.1W 0805	13.0 EA	R013 R039 R111 R114 R122 R124 R147 R167 R173 R175 R184 R192 R225
545 0308 410	RES 23.7K OHM 1% 0.1W 0805	10.0 EA	R046 R050 R204 R206 R207 R208 R214 R215 R219 R220
545 0308 411	RES 26.7K OHM 1% 0.1W 0805	4.0 EA	R087 R095 R096 R101
545 0308 413	RES 33.2K OHM 1% 0.1W 0805	2.0 EA	R048 R054
545 0308 415	RES 39.2K OHM 1% 0.1W 0805	1.0 EA	R172
545 0308 417	RES 47.5K OHM 1% 0.1W 0805	1.0 EA	R152
545 0308 423	RES 82.5K OHM 1% 0.1W 0805	3.0 EA	R055 R057 R154
545 0308 424	RES 90.9K OHM 1% 0.1W 0805	2.0 EA	R090 R102
545 0308 501	RES 100K OHM 1% 0.1W 0805	8.0 EA	R112 R157 R158 R163 R170 R178 R182 R187
545 0308 506	RES 162K OHM 1% 0.1W 0805	1.0 EA	R146
545 0308 507	RES 182K OHM 1% 0.1W 0805	5.0 EA	R156 R209 R210 R227 R228
545 0308 509	RES 221K OHM 1% 0.1W 0805	3.0 EA	R168 R171 R198
545 0308 513	RES 332K OHM 1% 0.1W 0805	1.0 EA	R141
545 0308 516	RES 432K OHM 1% 0.1W 0805	2.0 EA	R092 R100
545 0308 520	RES 619K OHM 1% 0.1W 0805	1.0 EA	R134
545 0308 601	RES 1MEG OHM 1% 0.1W 0805	2.0 EA	R151 R203
545 0309 208	RES 200 OHM % 1/4W 1206	4.0 EA	R021 R030 R047 R053
843 5475 141	SCH, RECEIVER MAIN	0.0 EA	
843 5475 143	PWB, RECEIVER MAIN	1.0 EA	

WARNING: Disconnect primary power prior to servicing.

WARNING: Disconnect primary power prior to servicing.

HARRIS CD LINK™ APPLICATIONS INFORMATION for FCC FORM 313

I. The Harris CD LINK is FCC type notified for use as a Studio-Transmitter Link (STL) in the frequency band 942-952MHz. The following data will be useful in filling out FCC form 313 "Application for Authorization in the Auxiliary Radio Broadcast Services." Item numbers shown refer to FCC 313, April 1996 Edition.

Item	Description	Entry for FCC 313 Form
7A	Frequency / Bandwidth / Emission Type	(Assigned freq)* / 300kHz / 300KD7W
7B	Transmitter Power Output	2.00 watts
7B	Antenna Input Power	Per paragraph II following
7B	Effective Radiated Power	Per paragraph III following

* Enter assigned frequency in megahertz.

II. **ANTENNA INPUT POWER CALCULATION**

Input power to the antenna may be calculated by the following method.

A. Determine the efficiency of the transmission line system connecting the output of the transmitter to the input of the microwave transmitting antenna. This will include the main run of coaxial transmission line along with jumper cables and duplexer/filter losses, if a part of your installation.

Coax losses at 950MHz for various common cable diameters are shown in Table 1.

TABLE 1

Coax Diameter	1/2" Foam	7/8" Foam	1 1/4" Foam	1-5/8" Foam
Loss, dB per foot	0.024	0.015	0.0094	0.008

Enter the loss per foot of the cable used for the main coaxial line in your microwave transmitting antenna system into the "dB Loss, Unit" cell for the Main Coaxial Line row of Table 2.

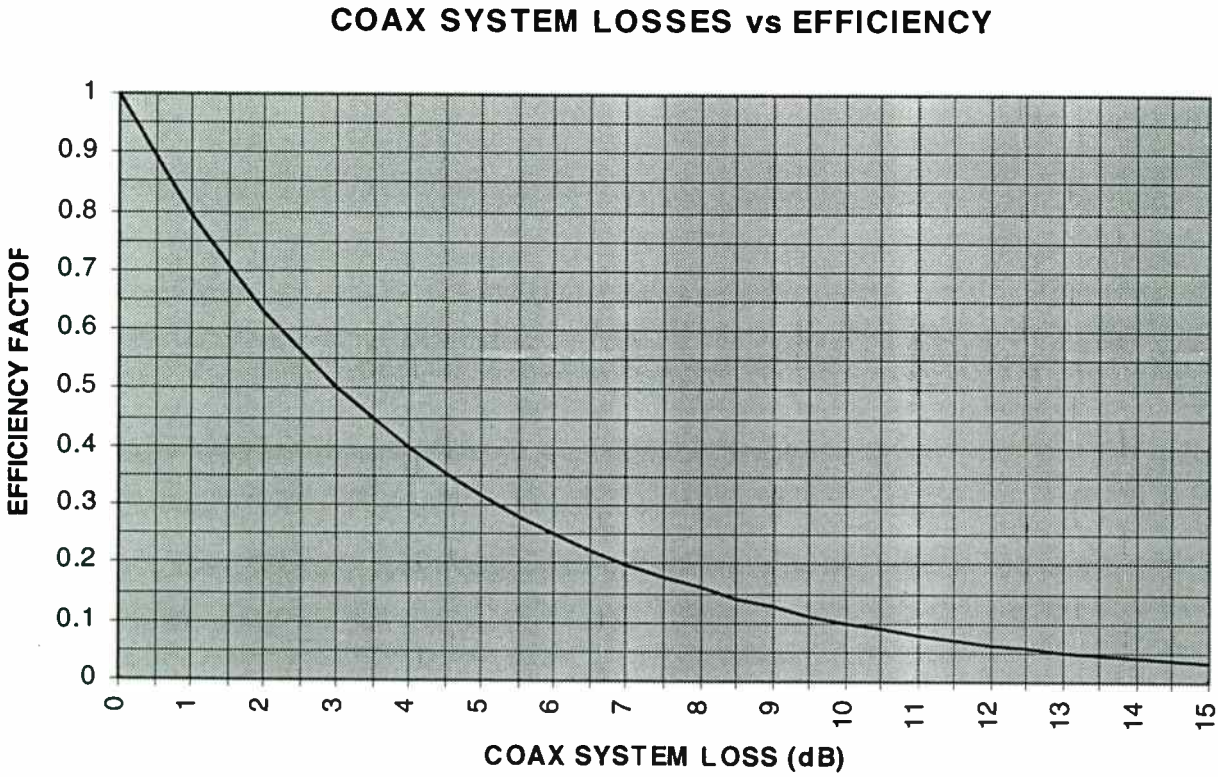
Use Table 2 to find the total decibel losses for all components of your transmission line system:

TABLE 2

Category	Quantity Used	dB Loss, Unit	dB Loss, Extended
(Prompt)	*(Enter number of feet, connector pairs used, etc):*	*(Enter unit loss):*	*(Multiply quantity by unit loss and enter below):*
Main Coaxial Line			
Connectors, mated pairs		0.125	
Jumper Cable, 1/2" diameter, 2 foot length		0.05	
Duplexer/filter (*use manufacturer's data*)			
Miscellaneous			
TOTAL SYSTEM LOSS, dB (*add extended losses in dB and enter*) ->			

B. Transmission line system efficiency can be determined by converting the total system loss in decibels (fromTable 2) to an efficiency factor "F," using Chart 1.

CHART 1



To calculate input power to the antenna, multiply the transmitter output power by efficiency factor F from Chart 1.

Example: First find the efficiency factor from Chart 1. Suppose the total of all losses for Table 2 was 3dB.

Total of system losses = 3dB (total of Table 2)
Efficiency Factor F (finding factor F for 3dB loss using Chart 1) = 0.5

Now, (CD LINK output power in watts) * (Efficiency Factor F) = Antenna Input Power in watts

Therefore (2 watts) * (0.5) = **1 watt** *Answer.*

NOTE: The exact value of F can be calculated using the formula $F = 1/(10^{(dB/10)})$, where dB = total system loss in dB.

Calculate the antenna input power for your application and enter the result in the correct block of item 7B of the FCC 313 form.

III. EFFECTIVE RADIATED POWER CALCULATION

Effective radiated power is the product of the power gain of the microwave antenna and the antenna input power. Power gains, beamwidths and other data for typical 950MHz antennas are shown in Table 3 .

TABLE 3

Antenna Name	Antenna Category	Diameter (inches)	Mid-band Power Gain[1] (X)	Front-to-Back Ratio (dB)	Half-power Beamwidth (degrees)
Andrew GP4F-890A	B	48	49.545	22	17
Andrew GP6F-890A	A	72	94.406	24	13
Andrew GP8F-890A	A	96	164.059	26	9.8
Andrew GP10F-890A	A	120	260.016	29	7.8
Mark P-9A48	B	48	50.699	28	17.5
Mark P-9A72	A	72	98.855	28	11.1
Mark P-9A96	A	96	156.675	29	8.7
Mark P-9A120	A	120	305.492	30	7.0
Marti SC-48	B	48	47.315	23	16
Scala PR-450	V-pol: A H-pol: B	36 x 48	63.096	20	12V/24H

[1] For aural microwave systems, FCC 313 form asks for ERP, not EIRP. Therefore the antenna gains in Table 3 shown are relative to a dipole radiator, not an isotropic radiator. The gain correction needed is -2.15dB from the published isotropic gain of the antenna.

To calculate effective radiated power (ERP) for your application, multiply the antenna input power you calculated using paragraph II of this Section by the antenna power gain from Table 3.

Example:

Suppose you are using a Mark P-9A72 antenna, and antenna input power as determined in paragraph II is one watt.

(Antenna Power Gain) * (Antenna Input Power, watts) = ERP, watts

(98.855) * 1 watt = **98.855 watts** *Answer.*

Calculate the ERP for your application and enter the result in the correct block of item 7B of the FCC 313 form.

Other data needed for the FCC 313 form can be found in station records and system installation detail.

IMPLEMENTING AN UNCOMPRESSED DIGITAL PATH FROM THE STUDIO TO THE "ON AIR" SIGNAL

BY:
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HARRIS

IMPLEMENTING AN UNCOMPRESSED DIGITAL PATH FROM THE STUDIO TO THE "ON AIR" SIGNAL

Geoffrey N. Mendenhall, P.E.
Vice President - Radio Product Line Manager
Harris Broadcast Division - Quincy, Illinois

SYNOPSIS

With the advent of recently introduced, uncompressed, digital STL links, STL modems, T1 data interface devices, and digital FM exciters, it is now possible to convey digital audio from the studio the transmitter input 100% digitally. This paper discusses the elimination of all A/D and D/A conversions between the studio source equipment and the RF modulator by providing a digital modulator that can accept direct digital inputs via the AES3 digital audio serial data standard. Issues regarding the elimination of data compression, the location of digital audio processing, the DSP stereo encoding process, and peak level control are addressed. Block diagrams showing the location of digital audio processing devices and STL components are included.

INTRODUCTION

For the past decade, the modulation performance quality of the FM exciter and transmitter system often exceeded the quality of the analog STL, making the STL the limiting factor in the overall transmission system. Recently, uncompressed, fully digital STLs and compressed digital STL modems (used to upgrade analog STLs) have been introduced. Analog phone lines are being replaced by T1 digital phone lines capable of carrying high data rates. In addition, fully digital audio processing equipment is now available and in use. This new generation of audio processing equipment accepts a digital audio input, processes this data fully in the digital domain, and outputs this processed data without any analog to digital (A/D) or digital to analog (D/A) conversions.

With these recent innovations, the conventional analog FM exciter has now become the limiting factor in an otherwise all digital system. A fully digital FM exciter that can accept

serial digital audio data directly, digitally process this data into the digital equivalent of stereo baseband, and then digitally modulate this information directly by DDS, using a numerically controlled oscillator, to an analog radio frequency carrier now completes the all-digital path from the audio source to the transmitter RF power amplifiers. The digital FM exciter is fully transparent to its digital input, eliminating the additional A/D and D/A conversions of audio data that are required with conventional analog audio processing, analog stereo encoding, and analog FM exciters. Before proceeding into the description of the data path from the source to the transmitter, a review of the terminology that is used will be helpful.

THE AES3 DIGITAL AUDIO INTERFACE SERIAL DATA STANDARD

Some years ago, Harris initiated the formation of a working group of radio and studio broadcast equipment manufacturers to define data format standards for both digital audio and for digitized composite baseband. The results of this working group were the selection of the AES3 (Audio Engineering Society/European Broadcast Union) serial data standard defined in the AES3-1984, ANSI S4.28-1984, AES3-1985, ANSI S4.40-1992 and AES3-1992 documents. This is the digital audio data format to be used as the interface standard for audio sources, mixing/control equipment, audio processing equipment, STL equipment, and transmitter inputs. The European Broadcasting Union has republished a standard which is identical to the AES3 standards, except for the use of transformer-coupled inputs and outputs. There is also a "consumer-use" digital interface standard, described in IEC958 and other documents as the IEC958 Type II (S/P DIF) Consumer Interface. Although it appears to be compatible with the professional AES3 digital interface in limited electrical terms, the data formats of the two standards are incompatible.

The different and changing data format requirements for interfacing digitized composite baseband directly to the digital modulator made it impractical to agree on a universal composite baseband standard. As the "lossy" data compression schemes cannot be applied to digitized baseband, the need for a composite baseband data format standard has largely been eliminated.

The format of the AES3 serial data subframe defined by AES3-1992, is shown in ***Figure 1.***

32 SUBFRAME FORMAT
OF
AES3 SERIAL DATA

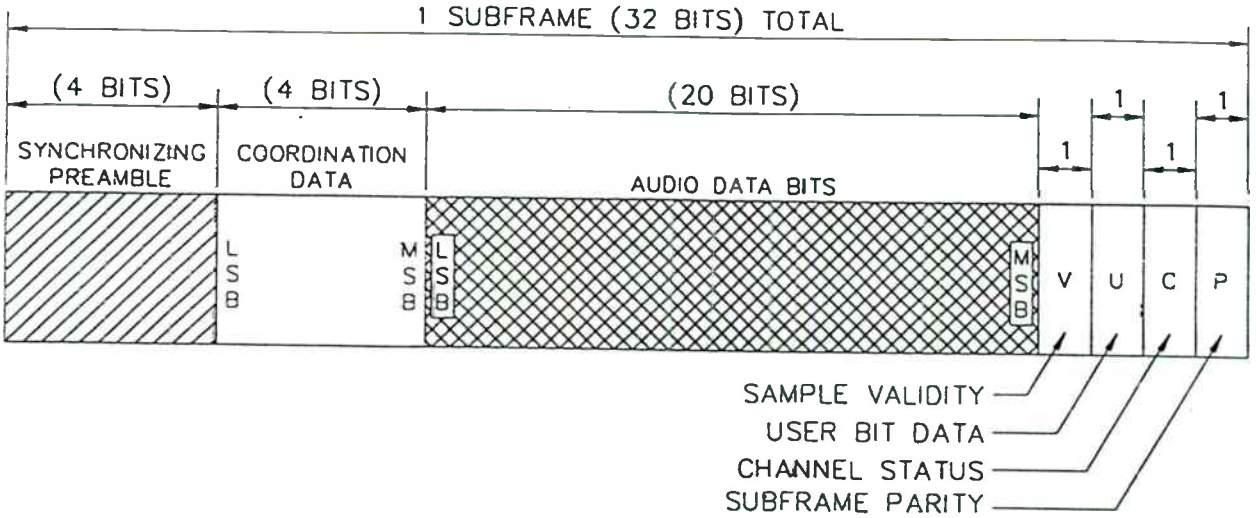


FIG. 1

Some highlights of the AES3 data format are:

- √ The interface format can accommodate 16, 20 or 24-bits of digital audio information.
- √ The interface handles serial data transmission of two channels of digitized audio over a conventional shielded, twisted-pair wire, for distances up to 300 feet.
- √ The interface uses standard 3 pin, XLR-type connectors, carrying balanced, RS-422 compatible signals that are polarity independent. The input and output impedance for the interface is 110 ohms.
- √ The data is sent least significant bit (LSB) first, with alternating subframes for Channel 1 and Channel 2.
- √ The data is self-clocking, and does not require an additional CLOCK connection to synchronize the source and destination. The SYNC data allows digital equipment to recognize the start of each 32-bit block of audio data and synchronize the master clocks.
- √ There are four ancillary bits for Validity, User Bit, Channel Status and Parity.
- √ The Validity Bit indicates whether the audio sample data bits are valid and error free.
- √ The User Bit carries hardware or system specific information.
- √ The Channel Status carries data concerning emphasis, sampling frequency, and various other information.
- √ The Parity Bit provides even parity over the current subframe, allowing simple detection of transmission errors.

The acceptance of the AES3 data interface standard by all the major broadcast equipment manufacturers makes is possible to build an all digital studio with an all digital link to the transmitter using standard off-the-shelf equipment. The standard AES3 transmit and receive chipsets support the three commonly used data rates of 48.0kHz (studio), 44.1kHz (consumer CD), and 32.0kHz (broadcast transmission). Since the current FM stereo transmission standard limits the frequency response of the left and right channels to a maximum of 15kHz, a 32.0kHz data rate is often used. There are situations, particularly in the studio environment, where the higher 48.0kHz data rate may be desired, so make sure that all the interfacing equipment has the ability to accept both the studio and broadcast transmission data rates.

DIGITAL SIGNAL PROCESSING

Digital Signal Processing (DSP) can be viewed as a technology that emulates analog functions by simulating these functions in software that runs on specialized, high speed, digital microcomputers. After analog audio is digitized into a series of numbers, these numbers can be manipulated mathematically to simulate processes normally performed by analog circuits. These simulations execute so rapidly, in nearly real time, they can be used as replacements for these analog functions. Filters, mixers, modulators, and virtually any other complex analog function can be performed by DSP if sufficient computing "horsepower" is available. DSP based products offer unique benefits by providing additional functions and precision that are unattainable with analog technology.

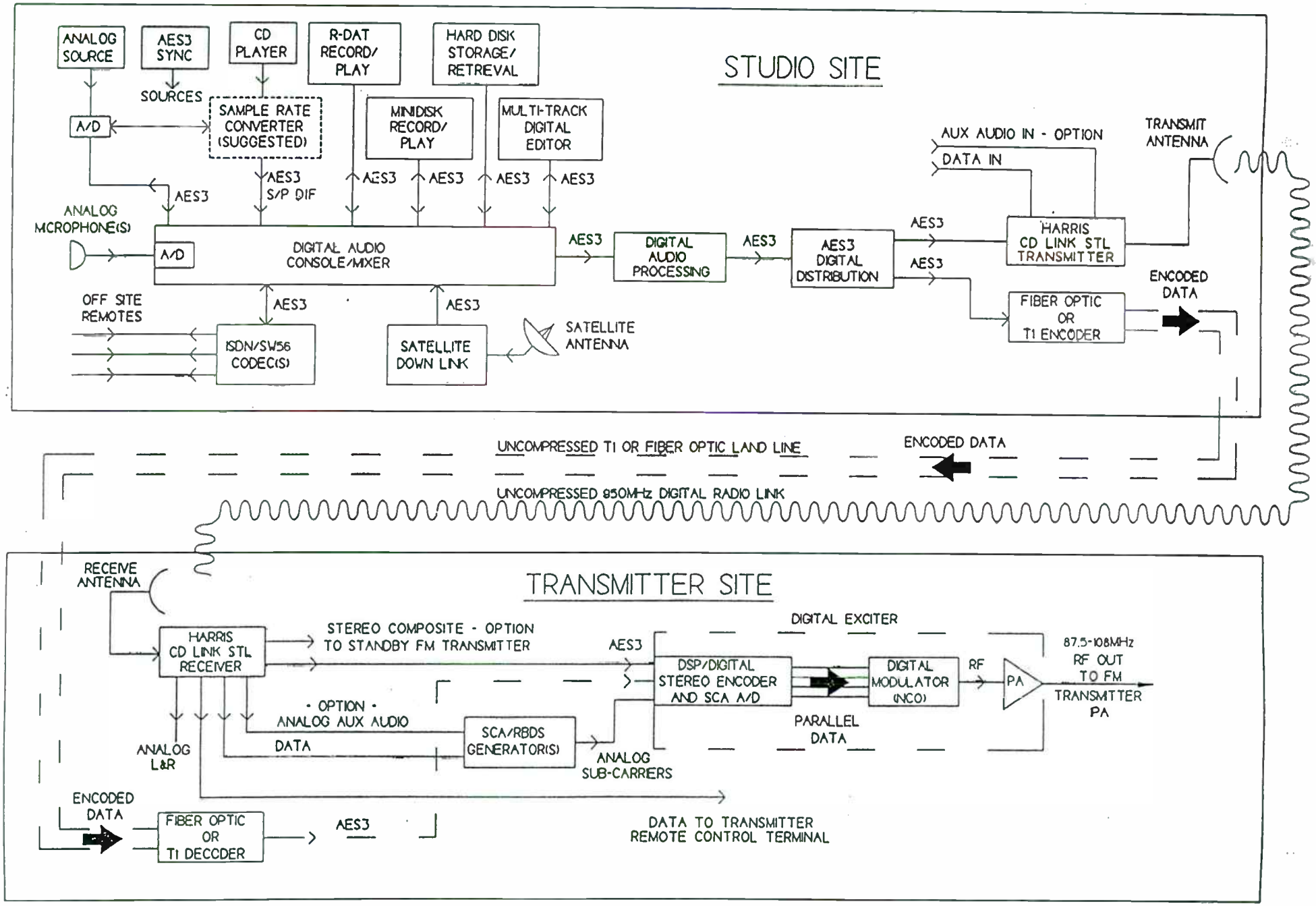
"LOSSY" COMPRESSION

"Lossy" data compression by at least 4:1 is required by STL modems used to reduce the data rate in order to meet the RF bandwidth requirement of the analog STL signal so it fits into the existing channel allocation. There are two types of data compression schemes, (1) "Loss-less" which introduce no change to the recovered data and (2) "Lossy" which cause a permanent loss of some of the recovered data. "Lossless" data compression introduces no effect on the retrieved data or audio quality, but current "lossless" compression technology used on personal computers, like *STACKER, DBLSPACE,* or *PKZIP* are not effective in reducing audio data, so virtually all data compression schemes used for reducing audio data are of the "lossy" type. "Lossy" data compression schemes take advantage of perceptual masking and other psychoacoustic effects in human hearing perception to discard some of the audio information without being very noticeable to the listener. There are several different "lossy" systems in broadcast use today that provide satisfactory results under certain conditions. The most sophisticated systems such as *MUSICAM/MPEG Level-II* and *PAK* offer less audio degradation.

IMPLEMENTING THE DIGITAL PATH

Figure 2 is a block diagram of a typical all digital path from the source to the transmitter.

THE ALL-DIGITAL UNCOMPRESSED PATH FROM SOURCE TO TRANSMITTER



Digital audio sources like CD players and R-DAT record/play machines may be consumer grade equipment with optical or S/P-DIF data interfaces which will require data rate conversion and other special accommodations at the digital console input. Most professional grade digital audio sources will use the 48.0kHz AES3 data interface standard which is compatible with the digital inputs to the mixing console. The microphone is about the only remaining analog source to the mixing console. The console mixes the data from the various sources in the digital domain and outputs the resulting mix as data in the AES3 format. Note that compressed data from the digital sources cannot be mixed in compressed form. It must first be expanded by the source or with a compatible data expansion function built into the input to the digital mixing console.

The AES3 output from the console is then distributed to other locations including the transmitter site. Two common ways to deliver the AES3 data are either through a digital STL radio link or through a T1 digital telephone line. Some digital STL's have the data compression and expansion and RF coding functions integrated into the radio units, while another approach uses an external pair of STL modems to compress the data into an analog baseband format that can be fed through an existing composite STL and then expanded at the transmitter site.

Until recently, all of the systems used with existing 950MHz STL channels, required "lossy" data compression to meet the occupied bandwidth requirements. The newly introduced Harris CD-LINK, spectrum efficient, fully digital, STL can now transport uncompressed, AES3, audio data with the same "bit for bit" transparency of a T1 digital phone line all within the 300kHz bandwidth of an existing 950MHz STL channel.

Digitally encoding the STL provides the additional benefit of adding more than 20dB of additional fade margin to an existing STL path.

The T1 digital phone line also has sufficient bandwidth to convey the AES3 data rates without the need for data compression.

If any type of "lossy" data compression is used in the studio to transmitter path, the digital audio processing device should be located at the transmitter site for direct connection to the digital exciter. Examples of "lossy" data compression are *APTx, DOLBY AC-2, MUSICAM, MPEG,* and *PAK.* These and other "lossy" data compression schemes produce an output that is not identical to the input by design of the digital signal processing algorithms used. Among the differences introduced, are changes in the absolute peak levels produced at the output which would cause overshoots and result in overmodulation of the transmitter. By locating the digital audio processing after data compression and expansion, the audio peak levels can be tightly controlled before feeding this data to the digital exciter. The use of a CD-LINK, uncompressed digital STL or uncompressed T1 digital phone line gives the flexibility of locating the digital audio processing at either the

studio or transmitter end of the data link since the data remains unchanged at either end of an uncompressed link.

The digital STL or T1 receiver converts the data back to the AES3 format for delivery directly to the digital input of the digital FM exciter.

The digital stereo encoder is located within the DIGIT® digital FM exciter and has a digital composite peak limiter (DCL) that provides a function similar to analog composite clipping without causing the inter-modulation distortion to baseband that analog baseband clipping causes. This feature is not absolutely required when the Optimod 8200 digital audio processor is located just before the digital exciter or at the studio end of an uncompressed digital link. However, the DCL can provide a loudness advantage without introducing distortion by virtue of it's "look ahead" algorithm.

DIGITAL EXCITER DIGITAL INPUT TO RF OUTPUT

Figure 3 is a block diagram of the Harris DIGIT®, digital FM exciter with AES3 input, DSP stereo encoder, and digital modulator.

The DIGIT® exciter input provides data rate conversion and encodes the left and right audio channels contained within the AES3 serial data format into parallel composite data that represents the equivalent of stereo baseband. This parallel data is fed into the numerically controlled oscillator (NCO) of the digital FM modulator. Unlike QUASI-DIGITAL Quadrature Modulation Schemes, the Harris DIGIT® utilizes true Direct Digital Synthesis (DDS) to directly covert the output of the NCO into a synthesized RF waveform which is upconverted to the carrier frequency and then amplified to the level required to drive the transmitter power amplifiers. No tuned circuits, varactor diodes, or other analog devices are used in the modulation process.

SCA / RBDS COMPATIBILITY

The exciter's digital input provides (3) analog subcarrier inputs which are compatible in level and impedance with standard SCA or RBDS generators. Although these subcarrier functions could be generated in the digital domain, there are so many different variations of subcarrier encoding methods used by different services, that the most practical way to provide total compatibility is with analog sub-carrier inputs. In addition, one of these SCA inputs can also be used as a backup composite stereo baseband input if the AES3 stereo data is interrupted.

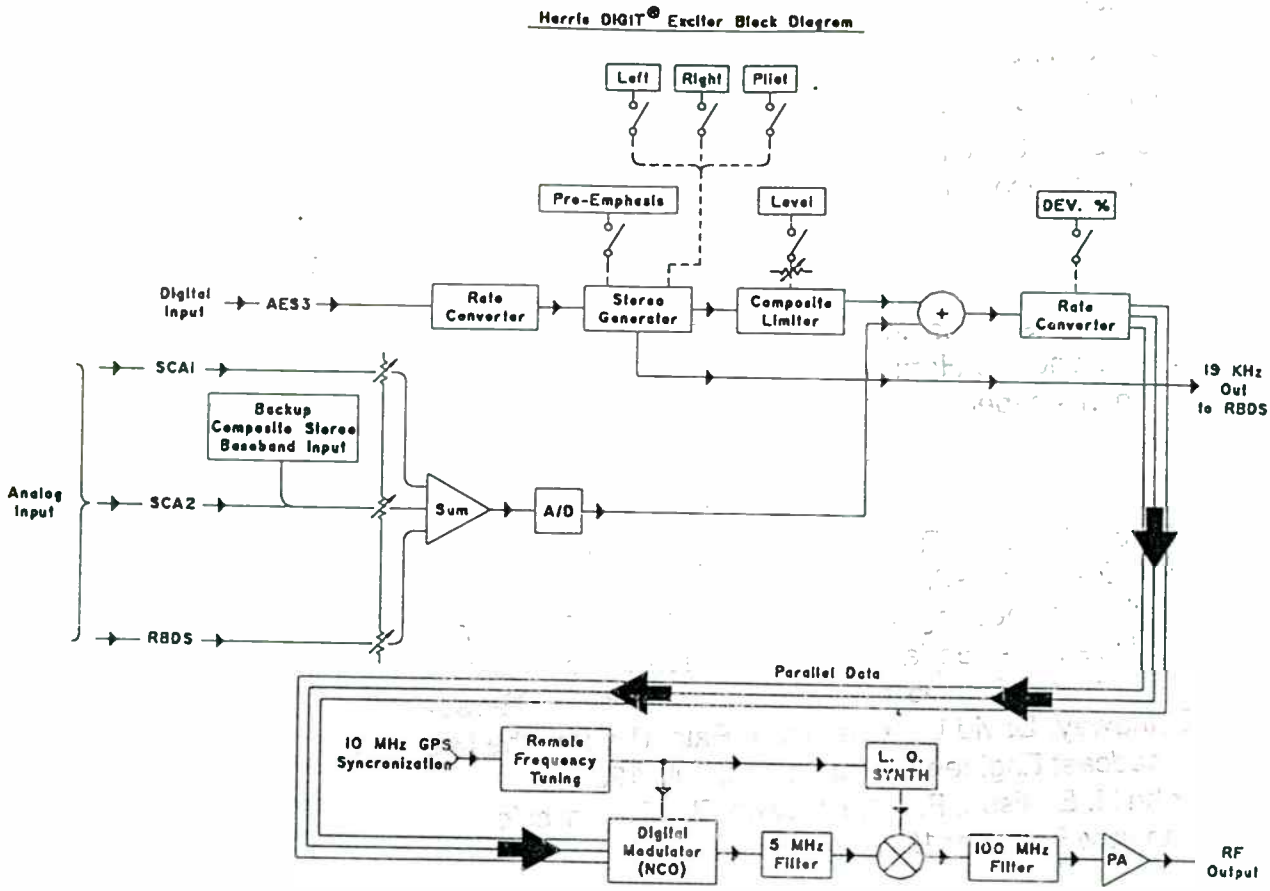


Fig. 3

SUMMARY

The radio broadcaster can now implement a totally digital system from the audio source to the RF carrier using standard off-the-shelf hardware. The advantages of an uncompressed all-digital path include:

- √ The elimination of all intervening A/D and D/A conversions and the distortions they introduce.
- √ Absolute system stability and repeatability day-after-day, year-after-year.
- √ Greatly improved fade margin for radio links.
- √ Fully digital, distortionless, FM generation assures that full digital quality is delivered to the "On-Air" signal without the noise and distortion build-up of an analog system.
- √ Easy interfacing between equipment without worries about level adjustment, hum pickup, or other interference.
- √ Half the number of interconnecting wires for stereo.
- √ Absolute phase matching and differential phase stability between stereo channels.

- √ Absolute frequency response and amplitude matching between stereo channels.
- √ Perfectly linear modulation process eliminates the need for pre-distortion.
- √ Avoidance of distortion caused by "cascaded compression algorithms".
- √ The ability to deliver the full audio quality of compact discs to the "On Air Signal" by using an uncompressed digital link.

ACKNOWLEDGMENTS

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4. John H. Battison, P.B. "Improving FM Transmission" Broadcast Engineering Magazine, January/February 1997.

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