TECHNICAL MANUAL
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DAX Series ACC+
Adaptive Carrier Control Plus

DAX1-6 Series ACC+
Adaptive Carrier Control Plus

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DAX Series ACC+
Adaptive Carrier Control Technical Manual

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WARNING: Disconnect primary power prior to servicing.

Technical Assistance

Technical and troubleshooting assistance for HARRIS Transmission products is available from HARRIS Field Service (factory location: Quincy Illinois USA) during normal business hours (8:00 AM - 5:00 PM Central Time). Telephone ***+1-217-222-8200*** to contact the Field Service Department; FAX ***+1-217-221-7086***; or E-mail questions to ***tsupport@harris.com.***
Emergency service is available 24 hours a day seven days a week *by telephone only*.
Online assistance including technical manuals white papers software downloads and service bulletins are available at ***http://www.broadcast.harris.com*** (from there click on ***Customer Support Portal*** under the ***Services & Support*** tab dropdown menu)**.**
Address written correspondence to Field Service Department HARRIS Broadcast Communications Division P.O. Box 4290 Quincy Illinois 62305-4290 USA. For other global service contact information please visit: ***http://www.broadcast.harris.com/contact***.
NOTE: For all service and parts correspondence you will need to provide the Sales Order number as well as the Serial Number for the transmitter or part in question. For future reference record those numbers here: _____/_____
Please provide these numbers for any written request or have these numbers ready in the event you choose to call regarding any Service or Parts requests. For warranty claims it will be required and for out of warranty products this will help us to best identify what specific hardware was shipped.

Replaceable Parts Service

Replacement parts are available from HARRIS Service Parts Department 7:00 AM to 7:00 PM Central Time Monday through Friday and 8:00 AM to 1:00 PM Central Time on Saturday. Telephone ***+1-217-222-8200*** or email ***servicepartsreq@harris.com*** to contact the Service Parts Dept.
Emergency replacement parts are available *by telephone only* 24 hours a day seven days a week by calling +***1-217-222-8200***.

Unpacking

Carefully unpack the equipment and perform a visual inspection to determine if any apparent damage was incurred during shipment. Retain the shipping materials until it has been verified that all equipment has been received undamaged. 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.

Returns And Exchanges

No equipment can be returned unless written approval and a Return Authorization is received from HARRIS Broadcast Communications 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 Broadcast Communications Division specify the HARRIS Order Number or Invoice Number.

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.

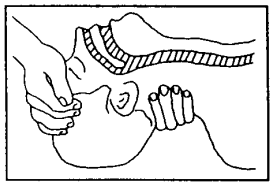
TREATMENT OF ELECTRICAL SHOCK

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

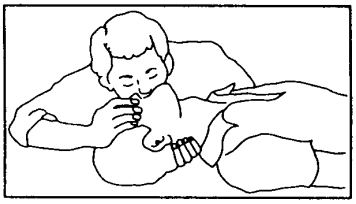
IF UNCONSCIOUS,
OPEN AIRWAY



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

(B) BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING

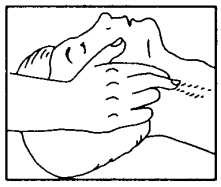


TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL

4 QUICK FULL BREATHS

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

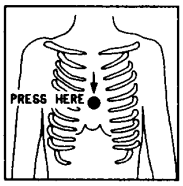
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

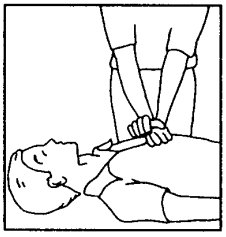
(C) CIRCULATION

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

WARNING: Disconnect primary power prior to servicing.

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 there by prevent avoidable loss of life.

Treatment of Electrical Burns

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

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

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

REFERENCE:
ILLINOIS HEART ASSOCIATION
AMERICAN RED CROSS STANDARD FIRST AID AND PERSONAL SAFETY MANUAL (SECOND EDITION)

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Section 1 Introduction 1

1.1 Scope And Purpose

This technical manual contains the information necessary to install and maintain the ACC+ Adaptive Carrier Control for the Harris DAX series of transmitters. The manual is conveniently divided into the following sections:

- SECTION I INTRODUCTION/SPECIFICATIONS. Provides general manual layout equipment description, block diagrams, description and specifications.
- SECTION II INSTALLATION/INITIAL TURN-ON. Provides detailed installation procedures and initial turn on instructions.
- SECTION III OPERATORS GUIDE. Provides a description of the normal operation of the unit using controls and indicators.
- SECTION IV OVERALL SYSTEM THEORY. Provides block diagram and detailed theory of operation of the controller unit and various sections that apply to the overall system.
- SECTION V MAINTENANCE/ALIGNMENTS. Provides board alignment procedures.
- SECTION VI TROUBLESHOOTING. Provides general information for troubleshooting.
- SECTION VII PARTS LIST. Provides a parts list for the entire assembly.

1.2 Equipment Description

The following technical manual is intended to familiarize the reader with the Harris Adaptive Carrier Control (ACC+) system for DAX transmitters. Even though DAX transmitters are already highly efficient (overall 83% or better), ACC+ may be used to further reduce operating costs. ACC+ is one version of Modulation Dependent Carrier Level (MDCL). ACC may also be referred to as Dynamic Carrier Control or Dynamic Amplitude Modulation.

An optional, outboard, 1RU, DAX1-6 ACC+ Kit, Harris Part Number 992 7285 077, is required to interconnect the ACC+ board to a DAX transmitter. The optional outboard unit replaces the standard analog (or digital) audio input location in the DAX.

Figure 1-1 MDCL (ACC+) 1 RU External assembly

1.2.1 ACC+ Concept

The ACC+ concept is very simple. ACC+ allows the carrier of the transmitter to be reduced during segments of low audio amplitude input, or no audio input, resulting in power savings. For example, if a transmitter is modulated 100% then the carrier is fully utilized. Without ACC+ if the audio input is reduced and modulation is only 50%,

then carrier power is wasted. In theory, ACC+ would reduce the carrier power until 95% modulation (for example) is again attained. If the audio input is increased, ACC+ would increase the carrier power high enough to prevent negative clipping and attain 95% modulation. Therefore, ACC+ is a form of carrier control that is dependent upon the audio input level and designed to reduce operating costs.

1.2.1.1 Graphical Representation

Refer to the graph (Figure 1-2) in this section.

a. The horizontal axis displays Audio Input (in dBm) with respect to 100% modulation. On the extreme right side of the scale 0dBm = the audio input level that creates 100% modulation. Typically this level is +10dBm.
b. The vertical axis displays Carrier Level (in dB) with respect to normal carrier. On the extreme top side of the scale full carrier = 0dB.
c. For a normal DAX transmitter the operation would be described by a single straight line at the top of the chart. The top right hand side equals 100% modulation at full carrier level.
d. The other set of lines on this graph represent the set of programmable ACC+ curves that are user selectable.

The amount of carrier reduction is controllable from -1 to -6 dB, in 1 dB steps corresponding with the set of horizontal lines in the center of the graph.

The point at which ACC+ starts is also selectable in terms of 95%, 90%, 85%, and 80% modulation. This corresponds with the set of upwards-sloping lines at the right-hand side of the graph.

The circuit is configurable to select only one of the flat horizontal lines and one of the upward-sloping lines. All other lines are ignored. These lines are merged to form a piecewise-linear function. The carrier level versus audio level is then described by this single function. The user can program a different ACC+ function which replaces one segment of the ACC+ function with one at a higher or lower level.

1.2.1.2 ACC+ Curve Example

For purposes of discussion, assume that the ACC+ function curve desired is the one on the graph that corresponds to 95% modulation and -6dB carrier power reduction. We will also assume that the transmitter is adjusted such that +10dBm audio input will create 100% transmitter modulation.

a. When +10dBm audio is applied to the transmitter, the ACC+ system is at the top right side of the graph. Carrier power is at full power, the audio input level is at +10dBm, and the transmitter is modulated 100%.
b. When the audio input level is reduced to -0.5dBm, carrier power is still 100% and transmitter modulation has dropped to 95% modulation.
c. When the audio input level is reduced to -2dBm, carrier power is reduced approximately -1.6dB, and transmitter modulation is maintained at 95% modulation.
d. When the audio input level is reduced to -6dBm, carrier power is reduced approximately -5.5dB, and transmitter modulation is maintained at 95% modulation.
e. When the audio input level is reduced to -7dBm, carrier power is reduced approximately -6dB, and transmitter modulation is reduced to 92% modulation.
f. When the audio input level is reduced to -10dBm, carrier power remains reduced -6dB, and transmitter modulation is reduced to 64% modulation.
g. Finally, when audio input is turned off, carrier power remains reduced -6dB and transmitter modulation is 0%.

See the curve graph below to determine the ACC+ output based on any of the other curves (80%, 85%, 90% or -1dB, -2dB, -3dB, -4dB, -5dB) selected.

NOTE:
Curves are selected by switch S1. See "2.5.3 Select ACC+ Curve (S1)".

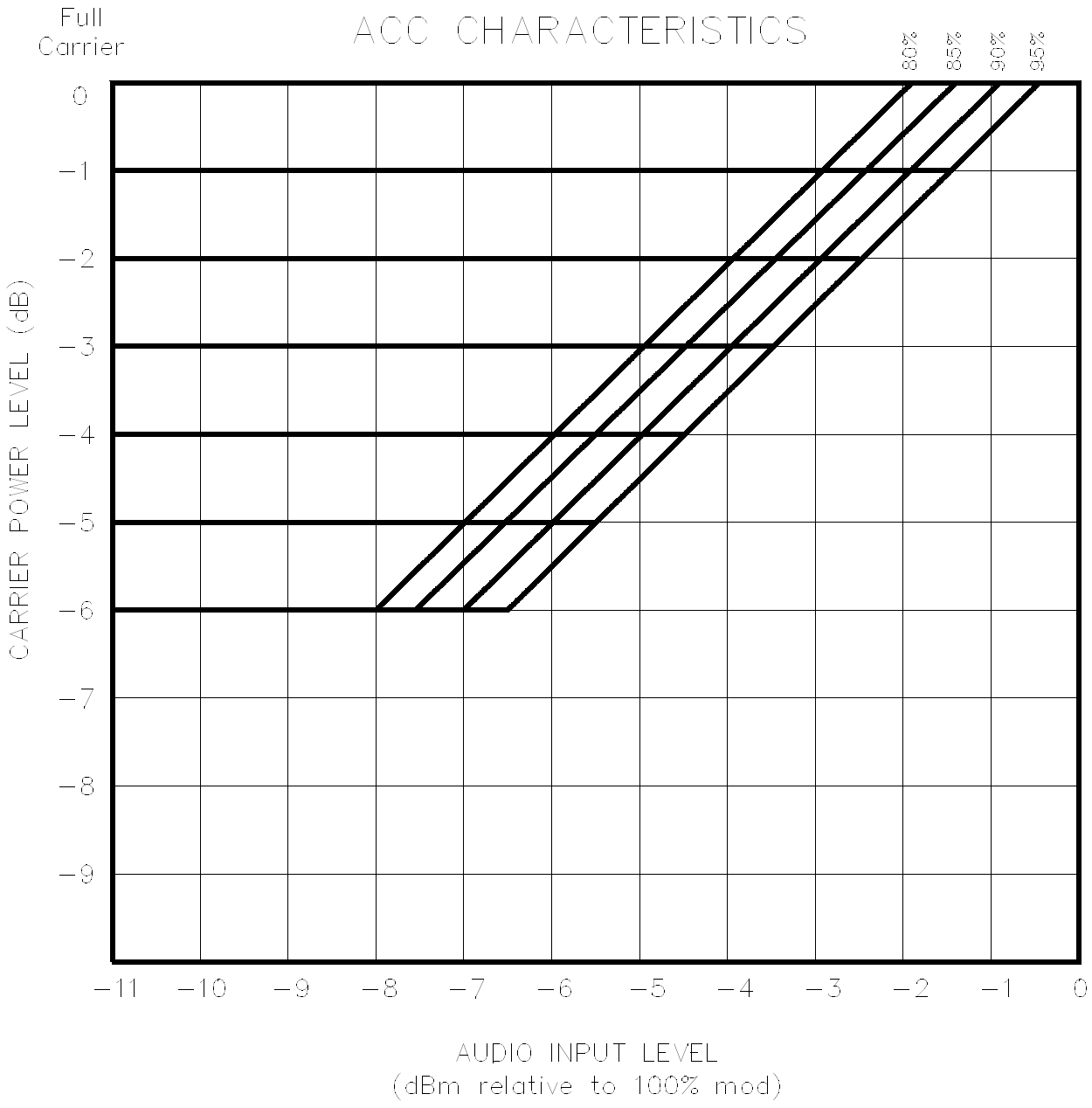

Figure 1-2
ACC+ Characteristics Curve Graph

WARNING: Disconnect primary power prior to servicing.

1.2.1.3 Power Savings

Due to the highly dynamic nature of typical programming, it is difficult to predict actual power savings. However, some stations have performed ACC+ tests on transmitters and reported as much as a 35% savings in power consumption over a non-ACC+ transmitter with no perceptible difference in audio quality or reception range.

The 95% and -6dB curve provides the most power savings, while the 80% and -1dB curve provides the least power savings.

1.2.1.4 Conclusion

ACC+ represents improved ways to reduce energy consumption and reduce operating cost. It can be used with our already highly efficient DX transmitters without effecting listener pleasure or disturbing coverage area.

1.3 Block Diagram

The ACC+ system is contained a 1RU rack mounted chassis external to the transmitter. Program audio is applied to the rear of the ACC+ chassis, and then connected to the transmitter audio input. A second BNC/BNC coaxial cable, routing the DAX's External I/O board's RF synthesizer output, is required for synchronization of the system. The power required by the ACC+ circuit board is supplied by an internal low voltage power supply.

1.4 Specifications

The following is a listing of the specifications for this unit.

1.4.1 Selectable Curves

24 curves in -1, -2, -3, -4, -5, or -6 dB carrier reduction steps at 80, 85, 90, or 95% modulation.

NOTE:
Curves are selected by switch S1. See "2.5.3 Select ACC+ Curve (S1)" .

1.4.2 Reduction Accuracy

Accuracy: +/-0.5dB carrier reduction accuracy when properly aligned.

1.4.3 Squarewave Overshoot

With ACC+ enabled, 3% maximum.

1.4.4 ACC+ Operation

ACC+ On/Off selectable by local toggle switch or by ground sink remote control.

1.4.5 Audio Input Level

Normally +10 dBm for 100% modulation.

1.4.6 Audio Input Impedance

Balanced input with selectable 600 ohm or high impedance.

1.4.7 Audio Input Connector

ACC board, J10, pins 1(+), 2(shield), and 3(-).

NOTE:
Specifications subject to change without notice.

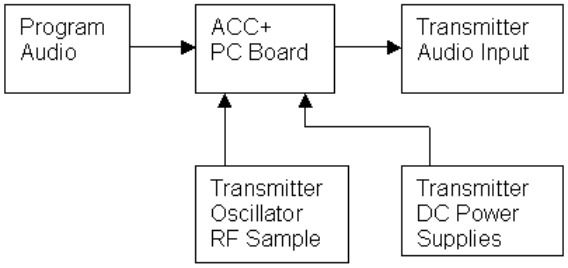

Figure 1-3
Simple Block Diagram of the ACC+ System

Section 2 Installation

2

2.1 Introduction

This section provides information and instructions necessary for the installation and alignment of the DAX ACC+ Kit, Harris Part Number 992-7285-077.

2.2 Returns And Exchanges

Damaged or undamaged equipment should not be returned unless a written Return Authorization is issued. When communicating with Harris Corporation, Broadcast Division, specify the order number or invoice number. Include complete details regarding circumstances and reasons for return in the request. Custom equipment or special order equipment is not returnable. In instances where return or exchange of equipment is at the request or convenience of the customer, a restocking fee will be charged. Special shipping instructions and coding will be provided to insure proper handling. All returns will be sent freight prepaid and properly insured by the customer.

2.3 Unpacking

Carefully unpack the unit and save all packing material. Inspect thoroughly for any damage incurred in shipment. Retain all PACKING CHECK LISTS (if provided) to locate and identify any components or assemblies removed for shipping.

The DAX ACC+ Kit , Harris Part Number 992-7285-077 contains:

a. A 1 RU ACC+ assembly including internal PC board and power supply.
b. Audio and RF Interconnect Cable Kit
c. Serial Cable for VT100 communication
d. Adjustment tool
e. ACC+/AMC+ Documentation Packages (Instruction Booklets and Drawing Package)
f. ACC+/AMC+ Software/Firmware

2.4 Installation

NOTE:
See "Figure 3-1 Component Locator" on page 3-2. See Table 6-1 on page 6-2 for a listing of test-points, jumpers, LEDs, and potentiometers.

2.4.1 Test Equipment Needed for Installation

The following test equipment is needed to install the ACC+ circuit and verify its performance:

a. Audio generator

b. Oscilloscope or modulation monitor
c. Personal Computer with Hyper-terminal (or similar software) and serial port
d. Spectrum analyzer (optional)
e. Multimeter

2.4.2 Mechanical Installation and Audio Connections

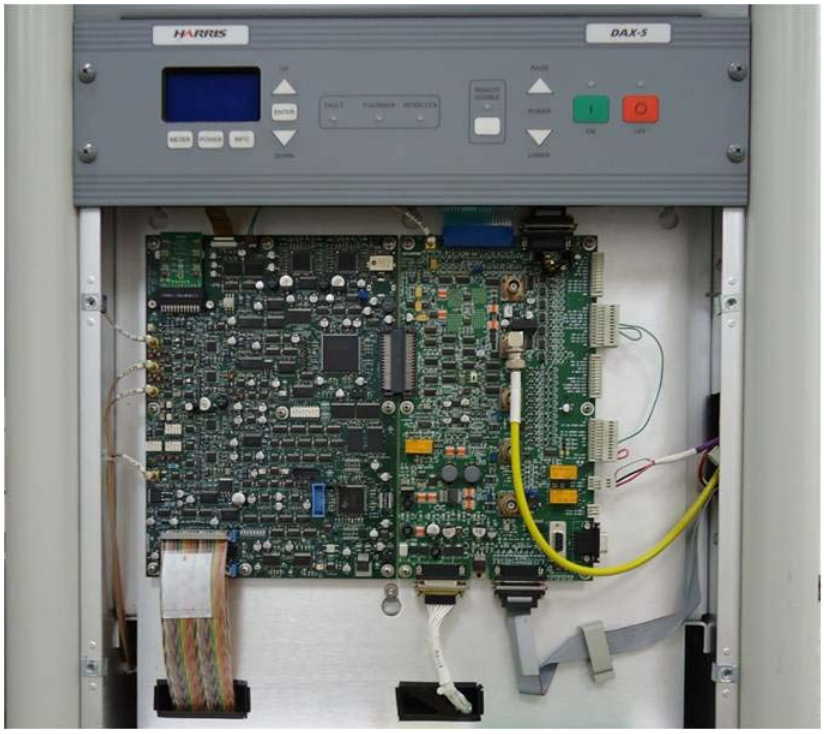

Figure 2-1 DAX5 Front View With Access Panel Removed Showing Interconnection of RF and Audio I/O

NOTE:
This installation procedure requires making a VT100 serial connection to the transmitter calibration pages and assumes the installer is familiar with the operation and maintenance of the DAX transmitter. The following procedures refer to the External I/O board which is located behind the Controller/External I/O panel on the front of the DAX. To perform these connections this panel will need to be removed.

a. Turn transmitter off and remove low voltage
b. Remove the existing audio input from the External I/O board in the DAX. This is located on the right side of the External I/O board. Connect the 733 series WAGO connector on the audio input cable supplied in the kit
c. Connect the BNC RF coaxial cable to the Synthesizer Output on the External I/O
d. Route the interconnect audio and RF cables cables into/out of the transmitter accordingly

WARNING: Disconnect primary power prior to servicing.

Figure 2-2 ACC Unit Top View (Rear of Unit At Bottom)

e. Place the chassis on a table and remove the top cover. Alternatively, as the unit comes standard with slide rails, the unit may be rack mounted. The unit requires 1 RU. The slide rails can accommodate a 12.5 inches (318 mm) to 17.25 inches (438 mm) spacing from front to rear rack rails, and allow for 12 inches (305 mm) of extension on the slide rails

f. Interconnect the audio and RF cable to the DAX, according to the interconnect wiring diagram

g. Connect AC power and test generator audio input into the 1 RU ACC+ chassis

Figure 2-3 ACC Unit Rear View

2.5 Initial Settings

This section provides the information necessary to preset jumpers, switch settings, potentiometers, and transmitter configuration prior to alignment.

2.5.1 Transmitter DC Coupling Selection Via VT100

NOTE:
Use of a PC and terminal application of your choice (such as HyperTerminal) connected to the **COM 2 port (J16)** on the External I/O board with a serial cable with DB-9 connector (supplied), is required to have access to the VT100 screens.

This section outlines the steps necessary to physically connect, start the terminal program, electronically handshake with, navigate the VT100 screens, and perform edits to the configuration. Refer to the Transmitter's Technical Manual for further details.

a. Using a pin for pin/not a crossover cable, connect to the transmitter's RS-232 Comm Port 2 (J16) serial connector on the External I/O board to your PC

b. Reapply low voltage to the transmitter

c. Start a terminal program (such as HyperTerminal) with the following settings

- Bits Per Second = 57600
- Data Bits = 8
- Parity = None
- Stop Bits = 1
- Flow Control = None
- Emulation = VT100

d. Call, or hit "Enter" twice to initiate handshake and start communications
To navigate around the VT100 Screens:

- Left/Right arrows to page back/forward
- Up/Down arrows to move cursor within page

e. Use the right arrow to page forward to Page 3

f. To access Page 4 of the VT100 programming, from page 3, press and hold your keyboard's "Shift" key, then single press and release "1", "2", and then "3". From that point on during this session, you will have access to page 4 by using the left/right arrow keys to page through all four VT100 screens

NOTE:
If you are using a non-English keyboard you may need to set the Keyboard Properties to English from Windows Control Panel: Keyboard for the above procedure to work

g. Use the right arrow key again to navigate to page 4 of 4

h. Type the corresponding letter in parenthesis "S" to toggle the audio input from AC to DC. - *do NOT hit "Enter"*

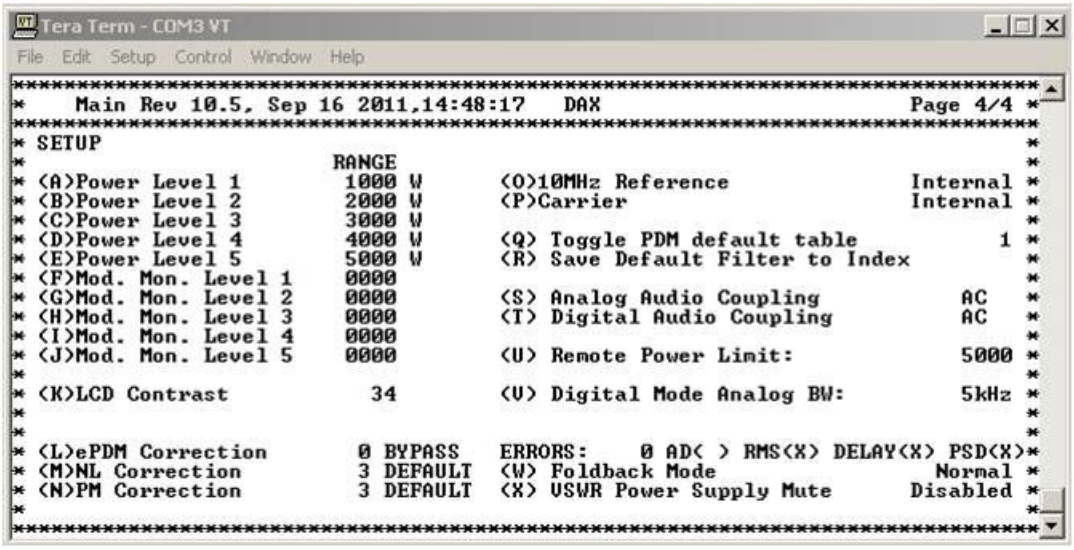

Figure 2-4 VT100 Page 4 of 4

2.5.2 ACC+ Board Configuration

NOTE:
Refer to the ACC+ schematic, drawing 843-5400-771, for further jumper selection details.

On the ACC+ board ensure the following:

a. Jumper JP1: 2-3 - Allows for high impedance for the carrier input

b. Jumper JP2: 1-2 - Allows for remote selection of EAMC+ mode. (not applicable for ACC+)

c. Jumper JP3: 1-2 and Jumper JP4: 1-2 - Allow for 600 ohm input impedance for the audio source

d. Jumper JP5: 2-3 - Allows for inversion/use of the negative audio to drive the peak detector (which generates the dc carrier level), in cases where positive audio is asymmetrically distorted.

e. Turn ACC+ off or bypassed, with switch S2 (Switch is left, DS1 is off)

2.5.3 Select ACC+ Curve (S1)

Configure the ACC+ board for the operation desired by referring to the tables below and the curve graph "Figure 1-2 ACC+ Characteristics Curve Graph" on page 1-3. Variables to determine operation are % of modulation: 40%-80%, 42.5%-85%, 45%-90% or 47.5%-95% and the level at which the power will stop reducing: -1, -2, -3, -4, -5 or -6dB

a. When looking at the installed board with the J2 BNC connector on the right near the top corner, S1-8 is on the top, and S1-1 is on the bottom. The switch should be clearly marked. See Figure 2-5

- 0 means the switch is closed, or in the ON position (switch is in the LEFT position when viewed with the BNC connector on the right side, top corner as installed).
- 1 means the switch is open or in the OFF position (switch is in the RIGHT position when viewed with the BNC connector on the right side, top corner as installed).

NOTE:
The CPLD must be reset in order for the changes of S1 to become active. To do this, press S4 on the ACC+ board *after you change the settings of S1*.

b. **Example: *-6dB, 45% - 95%***
For practice please reference the following picture and set the individual switches as indicated below and as shown in the picture.
S1-8 = 0 Switch to ON position
S1-7 = 0 Switch to ON position
S1-6 = 0 Switch to ON position
S1-5 = 0 Switch to ON position
S1-4 = 0 Switch to ON position
S1-3 = 1 Switch to OFF position
S1-2 = 0 Switch to ON position
S1-1 = 1 Switch to OFF position

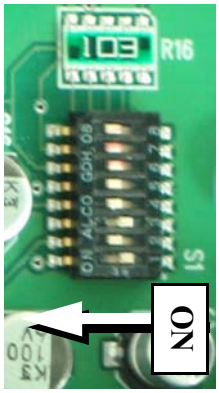

Figure 2-5 S1 Shown in Example Position (-6dB 45% - 95%)

Table 2-2
Curve Select Switch S1 Settings
ON = 0, OFF = 1

47.5% - 95 % modulation						
Switch	-1dB	-2dB	-3dB	-4dB	-5dB	-6dB
S1-1	0	1	0	1	0	1
S1-2	0	0	1	1	0	0
S1-3	0	0	0	0	1	1
S1-4	0	0	0	0	0	0
S1-5	0	0	0	0	0	0
S1-6	0	0	0	0	0	0
S1-7	0	0	0	0	0	0

Table 2-3
Curve Select Switch S1 Settings
ON = 0, OFF = 1

45% - 90 % modulation						
Switch	-1dB	-2dB	-3dB	-4dB	-5dB	-6dB
S1-1	0	1	0	1	0	1
S1-2	1	1	0	0	1	1
S1-3	1	1	0	0	0	0
S1-4	0	0	1	1	1	1
S1-5	0	0	0	0	0	0
S1-6	0	0	0	0	0	0
S1-7	0	0	0	0	0	0

Table 2-5
Curve Select Switch S1 Settings
ON = 0, OFF = 1

42.5% - 85 % modulation						
Switch	-1dB	-2dB	-3dB	-4dB	-5dB	-6dB
S1-1	0	1	0	1	0	1
S1-2	0	0	1	1	0	0
S1-3	1	1	1	1	0	0
S1-4	1	1	1	1	0	0
S1-5	0	0	0	0	1	1
S1-6	0	0	0	0	0	0
S1-7	0	0	0	0	0	0

Table 2-4
Curve Select Switch S1 Settings
ON = 0, OFF = 1

40% - 80 % modulation						
Switch	-1dB	-2dB	-3dB	-4dB	-5dB	-6dB
S1-1	0	1	0	1	0	1
S1-2	1	1	0	0	1	1
S1-3	0	0	1	1	1	1
S1-4	0	0	0	0	0	0
S1-5	1	1	1	1	1	1
S1-6	0	0	0	0	0	0
S1-7	0	0	0	0	0	0

2.5.4 Select ACC+ Phase Delay (S3)

For optimum ACC+ performance, the audio must be delayed by 1mS on this board. With dual channel oscilloscope probes on TP8 and TP12, you can verify the delay of 1mS after the following switch settings have been made *and the CPLD has been reset.*

Using the dipswitch weighting listing below, divide each by your carrier frequency to determine the individual delays for each position. **Then determine which switches will need to be enabled (set to OFF or right)** to provide the total 1mS delay for your carrier frequency. **All unused switches should be ON or left (logic 0).**

- S3- 1 = 8192
- S3- 2 = 4096
- S3- 3 = 2048
- S3- 4 = 1024
- S3- 5 = 512
- S3 6 = 256
- S3 7 = 128
- S3- 8 = 64

NOTE:
The CPLD must be reset in order for the changes of S3 to become active. To do this, press S4 on the ACC+ board *after you change the settings of S3.*

Example:

Using the table below that was created *based on a carrier frequency of 1089kHz,* the added delays of switches #4 and #8 create a total delay of 0.999mS. This is the closest value, to 1mS, attainable with this switch configuration.

NOTE:
It is better to be slightly over 1mS, than under.

Table 2-1 Example Phase Delay Chart

S3	Weighting	Carrier Frequency	Delay (mS)
1	8192	1089000	7.522
2	4096	1089000	3.761
3	2048	1089000	1.881
4	1024	1089000	0.940
5	512	1089000	0.470
6	256	1089000	0.235
7	128	1089000	0.118
8	64	1089000	0.059

2.6 ACC+ Setup for DAX1-6 Transmitters

This section provides alignment information for the ACC+ Adaptive Carrier Control board. In the event the ACC+ board requires replacement, and for new installations, this section is intended to provide guidance to establish ACC+ board level alignment.

NOTE:
See the Component Locator Figure 3-1 on page 3-2, to help locate potentiometers and testpoints for the procedures below. Also see Table 6-1 on page 6-2 for a listing of testpoints, jumpers, LEDs, and potentiometers

a. Connect Audio Input and Audio Output to/from an audio generator
b. Set audio generator output level to 10dBm for 600 Ohms, and audio frequency @ 1kHz
c. Turn audio generator output on
d. If not already done, turn DAX transmitter low voltage on
e. If not already done, set dipswitch S1 to customer Curve selection (On is "0").
"2.5.3 Select ACC+ Curve (S1)" on page 2-5
f. If not already done, set dipswitch S3 to customer Phase Delay setting (On is "0").
See "2.5.4 Select ACC+ Phase Delay (S3)" on page 2-6
g. Ensure S2 is set to ACC mode OFF (Switch is left, DS1 is off)
h. Monitor TP16 with an oscilloscope; adjust R76 until the peak to peak voltage is 7.60V
i. Monitor TP8 with an oscilloscope; adjust R64 for 1.0V peak to peak
j. Monitor TP12 with an oscilloscope; adjust R68 until the peak to peak voltage is 7.0V (7.0V = 10dBm @ 600 Ohms)
k. Adjust R78 and measure TP11 for 5.0 +/-0.02V using a digital voltmeter (DVM) negative probe on chassis ground
l. Adjust R119 fully clockwise (CW)

m. Adjust R121 fully clockwise (CW)

n. Using an oscilloscope, set a zero volt DC reference on the display and monitor TP20. With the scope probe DC coupled, adjust R105 until the bottom of the sine wave touches the zero reference level on the scope. It may be helpful to amplify the signal on the scope for ease of adjustment

NOTE:
This final value may typically be 20 to 30 mV above or below the zero volt reference.

o. While monitoring TP20 with the oscilloscope, adjust R113 until the peak to peak voltage is 2.2V

p. Switch S2 to ACC mode ON (Switch is right, DS1 is on)

q. While monitoring TP20 with an oscilloscope, adjust R104 until the bottom of the sine wave touches the zero reference level on the scope. It may be helpful to amplify the signal on the scope for ease of adjustment

r. While monitoring TP20 with the oscilloscope, adjust R119 CW for a peak to peak voltage of 2.2V

s. Switch S2 to ACC mode OFF (Switch is left, DS1 is off)

t. Select power mode 5 on the DAX

u. Record the value of the transmitter's Forward Power Scale. Some units have this documented in the factory final test data. The Forward Power Scale is also viewed on the VT100 terminal emulation, page 6 of 6

NOTE:
The Forward Power Scale is a hexadecimal number ranging from 0000 to FFFF, that raises or lowers the output power of the transmitter by scaling the FPGA's audio+DC signal. This register is changed using the transmitter user interface Raise and Lower push buttons, serial remote control and UP/DOWN arrow keys, or customer I/O raise and lower.
To access Page 6 of the VT100 programming, from page 4, press and hold your keyboard's "control" key, then single press and release "v". From that point on during this session, you will have access to page 5 by using the left/right arrow keys to page through all five VT100 screens.
Use the right arrow key again to navigate to page 5 of 5. From page 5, press and hold your keyboard's "control" key, then single press and release "v". Use the right arrow key again to navigate to page 6 of 6

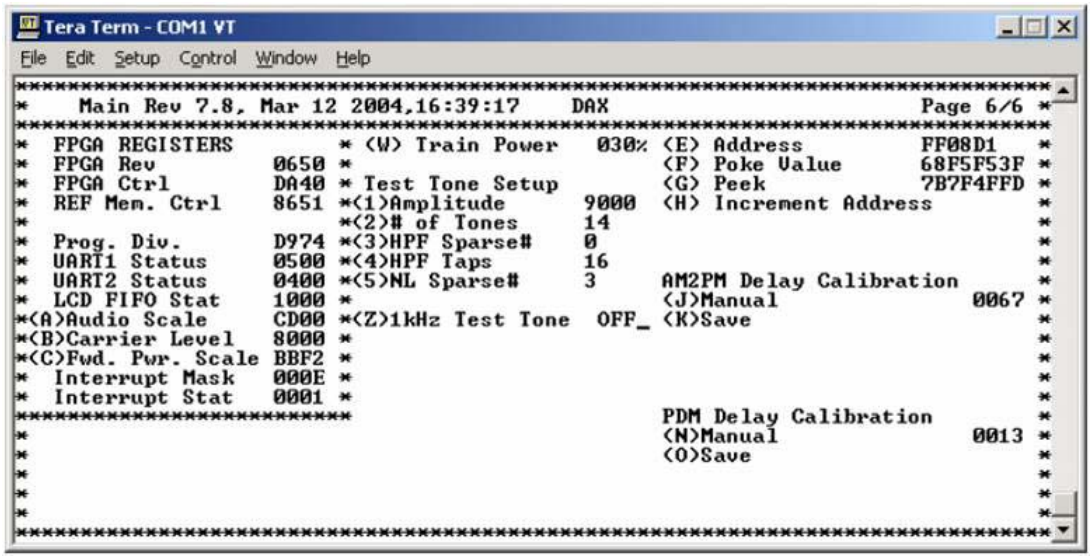

Figure 2-6 VT100 Page 6 of 6

WARNING: Disconnect primary power prior to servicing.

NOTE:

The transmitter should achieve similar forward power with the same Forward Power Scale, with AC or DC coupling on the audio input. To match the carrier power levels between AC coupling (DAX internal carrier power control) and DC coupling (DAX carrier level controlled by external DC source), it may be necessary to adjust R113. For example, if the transmitter attains the desired output using the DC carrier level from the external ACC+ assembly, yet still must be raised further before reaching the previous Forward Power Scale setting, it will be necessary to first reduce carrier power by adjusting R113 counter clockwise.

v. Turn transmitter on and slowly raise power by pressing the RAISE button to the previous Forward Power Scale factor while ensuring the transmitter does not exceed the desired forward power output level.

w. Use R105 and R113 to make the adjustment to produce the desired power level at 100% modulation.

NOTE:

R105 and R113 interact:
Turning R105 counter clockwise (CCW) causes carrier level to decrease and modulation to increase while turning it CW causes carrier level to increase and modulation to decrease.
Turning R113 CCW causes carrier level to decrease and turning it CW causes carrier level to increase (while having no significant effect on modulation).

x. Switch S2 to ACC mode ON (Switch is right, DS1 is on).

y. Use R104 and R119 to attain full power with 100% modulation.

NOTE:

R104 and R119 interact:
Turning R104 CCW causes carrier level to decrease and modulation to increase while turning it CW causes carrier level to increase and modulation to decrease.
Turning R119 CCW causes carrier level to decrease, and turning it CW causes carrier level to increase (while having no significant effect on modulation).

z. Remove modulation and verify desired power level reduction (See tables at "2.5.3 Select ACC+ Curve (S1)" on page 2-5). Minor re-adjustment to R104 and R119 may be needed to best satisfy both conditions: with 10dBm audio and without audio.

aa. As a final step, using program modulation, select between ACC ON and OFF while observing negative modulation. Turn R104 slightly (for example, turning CCW will decrease the modulation level but will also increase the carrier level) then adjust R119 (for example, turning CCW to lower the carrier level) back to the desired power level

To aid in the final alignment, the following list is a description of what affect adjusting the 4 most important potentiometers has.

- **ACC Bypassed or OFF**
  ***R105* DC Offset:**
  CCW causes Carrier level to decrease and Modulation level to increase.
  CW causes Carrier level to increase and Modulation level to decrease.
- **ACC ON or OFF** (normally aligned with ACC off)
  ***R113* Audio+DC Gain:**
  CCW causes Carrier level to decrease.
  CW causes Carrier level to increase.

- **ACC Operate Mode**
  ***R104* DC Offset:**
  CCW causes Carrier level to decrease and Modulation level to increase.
  CW causes Carrier level to increase and Modulation level to decrease.
- **ACC Operate Mode**
  ***R119* Audio+DC Trim:**
  CCW causes Carrier level to decrease.
  CW causes Carrier level to increase.

2.7 ACC+ Verification Procedure

a. Connect audio cable to the ACC board.

b. Set audio generator to +10 dBm or customer specified level.

c. Choose a Carrier Reduction Curve setting with S1.

d. Connect the audio output of the ACC board to the audio analyzer and connect a scope and a DMM to TP20 on the ACC Board.

e. For this example we will use (-6db) for 47.5% to 95% S1 dip switch set to 0000101.

f. Turn audio off from audio generator.

g. Turn ACC off with the S2 on the ACC board.

h. Observe DC Value with DMM at TP20 and record it here _____Vdc (Value 1 example 2.0Vdc).

i. Turn on ACC with the S2 on the ACC board.

j. Observe DC value with DMM at TP20 and record it here _____Vdc (Value 2 example 1.000Vdc).

k. Calculate the dB difference between the 2 values. 20 Log (value 1/value 2) example 6dB.

l. This value should correspond to the chart. With 0% input audio the carrier should drop 6dB.

NOTE:
dB in the next formula should be *negative* because you are minus 6db from 0. Example -6dB.

m. Use this formula to calculate the carrier power in percent. (Inv Log (dB/10) *100 = Cp). Carrier power in percent. Example 25%.

NOTE:
This verifies that the ACC board is working at 100% and 0% input audio.

n. Turn ACC ON with S2 on the ACC board.

o. Next, adjust the input audio from 0% to 100%. Example 10dBm = 4.898 Vrms on the audio generator.

NOTE:
This value is Audio Precision specific; your values may be different for dBm to VRMS.

100% audio = 4.898 Vrms
90% Audio = 4.898 * .9
80% Audio = 4.898 * .8 and so on

p. Observe the Peak-to-Peak waveform on the scope as you adjust the input audio from 0% to 100%.

q. Verify that the waveform negative peak never exceeds the ground reference until you go over 100% Input Audio.

r. Verify that the output DC value does not increase as the input audio is increased over 100%.

NOTE:
40% to 80% means that the DC Level out (Carrier Control) of the ACC board will not decrease until the Input Audio is below 80% and will continue to decrease until you reach 40% input Audio. Then it will remain constant.

2.8 Initial Turn On

a. Turn transmitter on HIGH.

b. Turn ACC+ on with S2 on the ACC+ board (Switch is up, DS1 is on).

2.8.1 Simplified ACC+ Verification

Another method of ACC+ is shown below.

a. Using an oscilloscope and the transmitter's forward power meter; or using a spectrum analyzer and modulation monitor connect the transmitter modulation monitor sample to the equipment described above.

b. Reduce audio input in 1 dB steps and record the level of carrier reduction and percentage of modulation.

c. Verify that the forward power of the transmitter as well as the percentage of modulation, is reduced according to the selected curve (See Figure 1-2 on page 1-3).

NOTE:
Errors in transmitter forward power metering at reduced powers or spectrum analyzer/modulation monitor calibration, may contribute to inaccuracies.

Section 3 Operation 3

3.1 Introduction

This section contains normal operational procedures and information pertaining to the function of the ACC+ Adaptive Carrier Control.

3.2 Operation

This operational procedure is presented under the assumption that the controller has been properly installed and checked out as outlined in Section II, Installation/Initial Turn-On, of this manual.

a. Normal ACC Bypass and ACC On operation
b. Identification of all panel controls and indicators

3.2.1 ACC+ Bypass

With the transmitter turned on, and ACC in Bypass, the forward power meter should show the power level selected and not change significantly with modulation.

3.2.2 ACC+ On

With the transmitter turned on, and ACC on it is normal to see the carrier power level fluctuate with modulation and DS1 indicator (ACC On) will be illuminated amber (yellow). The amount of carrier power level fluctuation will be determined by the curve selected.

3.2.3 Controls and Indicators

Figure 3-1, below, shows the following components' location:

- ON/BYPASS switch S2 (upper left corner of board)
- ON/BYPASS indicator DS1 (upper left corner of board)
- S1 Curve selection
- S3 Phase Delay selection
- J10 Audio Input connector
- JP3 and JP4 Audio Input Impedance selector
- J2 Carrier Input connector
- JP1 Carrier Input Termination selector
- All potentiometers
- J9 Remote Control connector
- J3 - J8Audio Output connectors
- J1 DC Power Input connector
- DC Power Supply connectors

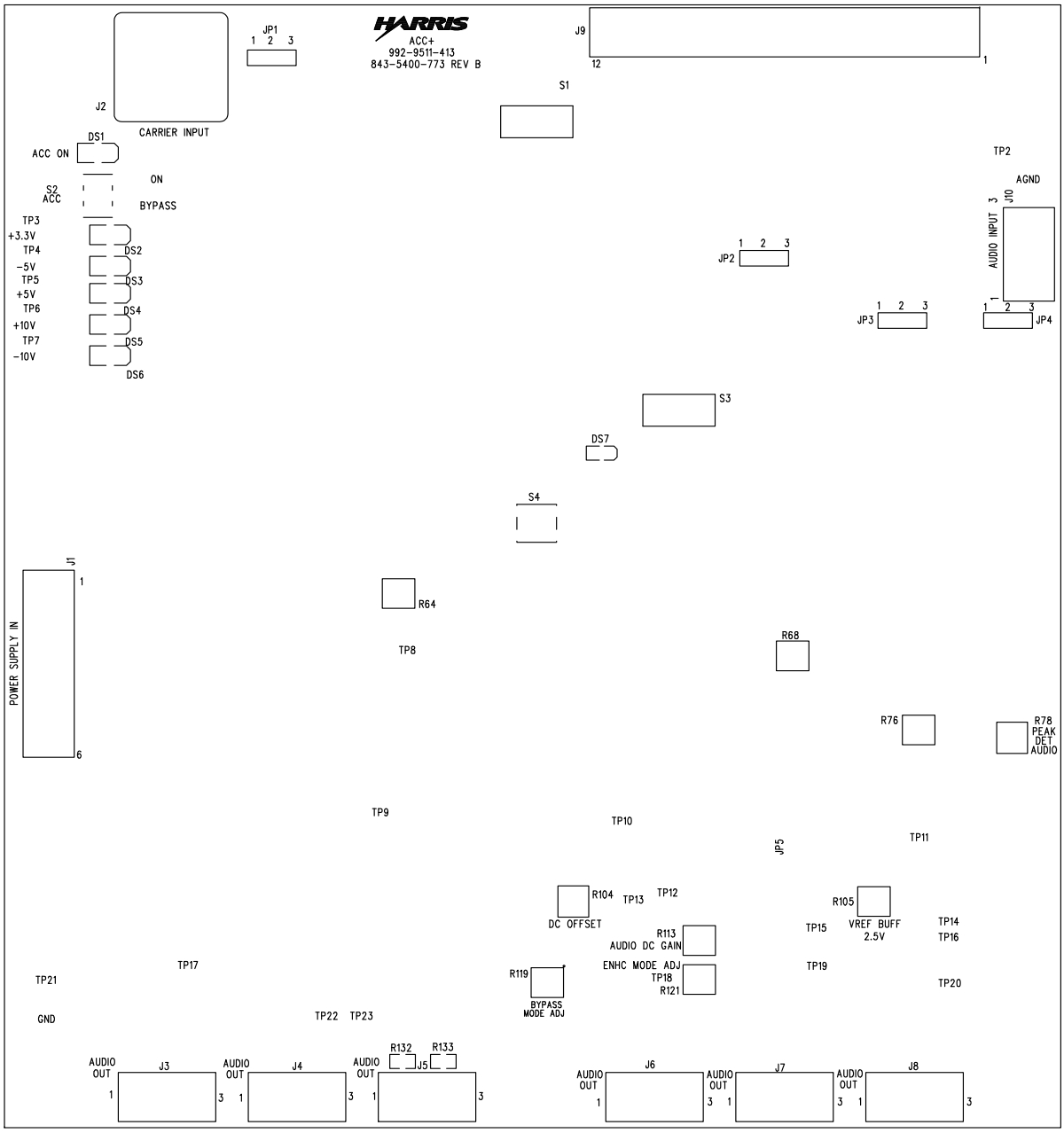

Figure 3-1
Component Locator

WARNING: Disconnect primary power prior to servicing.

Section 4 Theory

4

4.1 Introduction

This section presents the circuit description of the ACC+ Adaptive Carrier Control. Refer to Figure 4-1 Block Diagram and Figure 6-1 on page 6-3, Simplified Schematic.

4.1.1 ACC OFF Mode of Operation

The ACC mode can be turned OFF by putting S2 in the bypass position. When this is in bypass, the ACC feature is disabled and the output power of the transmitter will remain steady at the selected power level. DS1 will not be illuminated.

4.1.2 ACC+ ON Mode of Operation

The ACC mode can be turned ON by putting S2 in the ACC-ON position. When this mode is ON, the ACC feature is active and the output power of the transmitter will fluctuate with the % of modulation. DS1 will be illuminated amber. S2 must be on to enable the front panel and remote I/O on/off control.

4.2 Detailed Circuit Description

Refer to the schematics, 843-5400-771 and 843-5215-578 for the following discussion.

4.2.1 Audio Input

Audio input is connected to J10:

J10-1	+ Audio
J10-2	Ground
J10-3	- Audio

The input audio signal is filtered and buffered through a low pass filter and differential op-amp U21. Audio input impedance is selected by JP3 and JP4: JP3 1-2 & JP4 1-2 = 600 Ohms JP3 2-3 & JP4 2-3 = high impedance The buffered audio signal is then scaled and peak detected, with a fast attack and slow decade peak detector circuit consisting of U25 and U31

4.2.2 A/D Converter - Look Up Table

The DC level at TP14 is varying according to the audio input level. The peak-detected voltage is converted to a 12-bit digital data by the A/D converter (U16). The 12-bit word is then addressed to the pre-stored Look-Up-Table (LUT) content in the memory devices (U10, U9). The output of the LUT also has 12-bits of resolution and will vary according to the ACC curve that was selected.

4.2.3 D/A Converter

The 12-bit data from the LUT is then converted to transmitter's carrier level by the D/A converter (U13). The output is then adjusted by the DC offset control R104 and applied to switch U28.

4.2.4 Phase Delay

The non-sampled audio coming from U21 is fed into a A/D Converter (U14). The Digital out is then fed into a High Speed CMOS D-Type Flip Flop. The outputs of this drive a CPLD where, depending on the S3 settings, it will determine the amount of delay. The output of the CPLD is then fed to a D/A converter. The Output of the D/A then goes thru a DC blocking cap (C130) and then U15. R68 provides the DC Offset. This DC carrier level from U15 and the delayed audio signal are then summed through the opamp U30, with gain adjustment control from R113. This Audio + DC output is then applied to the audio driver.

4.2.5 Curve Selection

S1 selects which curve is selected by a series of pull-up resistors formed by R16 in conjunction with U10 and U9.

U29, U35, and U36 are a set of analog switches that allow the switching of the different modes of operation. These are bypass mode and normal ACC mode.

4.2.6 Carrier Synchronization

All digital circuits are operating synchronously, all of the clock pins are tied to the transmitter's carrier frequency for best performance and minimized inter-modulation products.

A carrier RF sample is obtained by a sample from the External I/O board JP8.

4.2.7 Remote Control

The ACC+ assembly is capable of local and remote table selection; it can be programmed to store up to 32 different ACC curves with 12-bit dynamic resolution.

Remote control of ACC mode ON/OFF and curve selection is activated by providing an active low from "A" ground, available at the rear panel CONTROL connector pins 10, 11, and 12, to the appropriate input pin 1-9.

On the ACC board, when the S2 ACC ON/OFF switch is ON (ACC ON), S1 and on the front panel and CONTROL pin 9 on the rear panel allow selection to disable the ACC mode.

When all S1 dip switches on the ACC board are set to the OFF position, connecting the appropriate CONTROL pin 1 through 7 to "A" ground, available at CONTROL connector pins 10, 11, and 12, equals setting curve selection dipswitches S1-1 through S1-7 ON, respectively.
(See 2.5.3 on page 2-5 for further details on curve selection)

4.2.8 Audio+DC Output Driver

The Audio+DC XLR output is connected to the transmitter's audio input.

The Audio+DC is distributed via 3 separate buffered differential driver op-amps outputs.

Pin1	Ground
Pin2	+ Audio
Pin3	- Audio

4.2.9 Power Supplies

An RFI filter with IEC connector for AC input includes provision for turn on/off control on the rear panel. The unit's internal switch mode power supply auto-ranges for AC sources from 90-264 VAC. A NEMA 15 to IEC power cord is included in the kit.

The ACC board's DC power is supplied from the internal power supply. The ±15 VDC and ground from the power supply is connected to J1-1, 4, 6. See drawing 843-5215-578 for details.

These supplies are regulated to +10, -10, +5, -5 and +3.3 VDC on the ACC+ board by regulators U1 through U4 and U9. Test points and indicators are provided near the edge of the board as troubleshooting aids. See drawing 843-5400-771 for details.

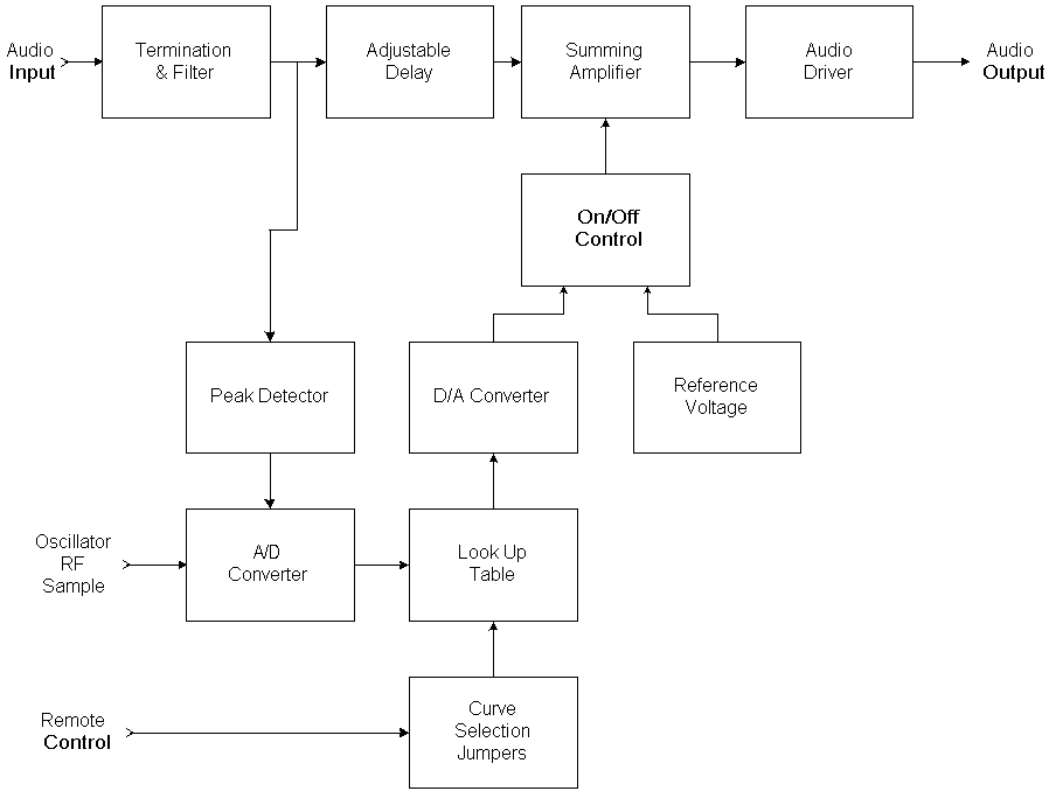

Figure 4-1
ACC+ Block Diagram

Section 5 Maintenance & Alignments

5

5.1 Introduction

This section provides alignment information for the ACC+ Adaptive Carrier Control board.

5.2 Purpose

The ACC+ board will require field adjustment for frequency and antenna effects. Also, in the event the ACC+ board requires replacement, this section is intended to provide guidance to establish ACC+ board level alignment.

5.3 Select ACC+ Curve (S1)

See""2.5.3 Select ACC+ Curve (S1)" on page 2-5 for this complete procedure.

5.4 Select ACC+ Phase Delay (S3)

See"2.5.4 Select ACC+ Phase Delay (S3)" on page 2-6 for this complete procedure.

5.5 ACC+ Alignment for DAX Transmitters

See"2.6 ACC+ Setup for DAX1-6 Transmitters" on page 2-7 for this complete procedure.

5.6 ACC+ Verification Procedure

See"2.7 ACC+ Verification Procedure" on page 2-10 for this complete procedure.

WARNING: Disconnect primary power prior to servicing.

WARNING: Disconnect primary power prior to servicing.

Section 6 Troubleshooting 6

6.1 Introduction

Troubleshooting of ACC+ consists of reading this manual and verifying proper installation and alignment. The following can be used as a guide. See Table 6-1 on page 6-2 for a listing of test points, jumpers, LEDs, and potentiometers.

6.2 Troubleshooting Hiearchy

6.2.1 Power Supplies

Verify power supplies are present at J1-4 and J1-6, and observe power supply indicators DS2-DS6.

6.2.2 Carrier Sync

Verify Oscillator sample at TP9. A 5Vp-p square wave at carrier frequency should be present.

6.2.3 Jumper Settings

Verify jumper settings are as described in sections 2 and 4 of this manual.

6.2.4 Audio Input/Output

Use an oscilloscope to verify correct audio signal at ACC+ input, J10. Also check for an audio output signal at J3.

6.3 ACC bypass mode

On the ACC board, when the S2 ACC ON/OFF switch is ON (ACC ON), S1 and on the front panel and CONTROL pin 9 on the rear panel allow bypassing the ACC mode.

Remote control of ACC mode ON/OFF, or bypass, is activated by providing an active low from "A" ground, available at the rear panel CONTROL connector pins 10, 11, and 12, to the appropriate input pin 1-9.

Alternatively, the transmitter's audio input can be reconfigured to AC coupling by VT100 serial remote connection. This was initially set to DC coupled mode when using the ACC+ board. AC coupled will enable the internal power control in the transmitter.

6.4 Component Table

The following table displays important test points jumpers LEDs and potentiometers.

Table 6-1 Pertinent Testpoints, Jumpers, LEDs, & Potentiometers

Test Point	LED (DS) or Jumper	Pot.	Name / Function	Comment / Value
	DS1		ACC+ On	Illuminates when ACC+ is Enabled
	DS7		Reset	
TP1			Carrier Input	
TP2			GND A	
TP3	DS2		+3.3Vdc	
TP4	DS3		-5Vdc	
TP5	DS4		+5Vdc	
TP6	DS5		+12.7Vdc	
TP7	DS6		-12.7Vdc	
TP8		R64	Non-Sampled Audio	1.0 - 1.2Vp-p
TP9			0.5V P-P	
TP10			Audio DC Offset	
TP11		R78	Audio	+5.0Vdc ±0.02Vdc
TP12		R68	Delayed Audio	6.93 - 7.2Vp-p
TP13				
TP14			Peak Detected Audio	
TP15			V Rdf Buffer 2.5Vdc	
TP16		R76	Audio	+7.6Vdc
TP17			Audio Outputs	
TP18			Audio Outputs	
TP19			Audio Outputs	
TP20		R104	Audio Outputs	3.0Vp-p on zero reference
TP21			GND	
TP22			Audio Outputs	
TP23			Audio Outputs	
		R105		VREF Buffer 2.5Vdc (Non-ACC Carrier Level Adjust)
		R113		Audio+DC Gain Adjust
		R119		ACC On Audio+DC Gain Adjust
		R121		Enhanced Mode Adjust
	JP1		Carrier Input Impedance Select	1-2: 50Ω Carrier Input 2-3: High Impedance Carrier Input
	JP2		Remote Activation of Enhanced Mode	2-3: Enables Remote Activation of Enhanced Mode
	JP3		Audio Input Impedance Select	1-2: 600Ω Audio Input Impedance 2-3: High Audio Input Impedance
	JP4		Audio Input Impedance Select	1-2: 600Ω Audio Input Impedance 2-3: High Audio Input Impedance
	JP5		Inverted or Non-Inverted Peak Detector	1-2: Positive Audio Detection 2-3: Negative Audio Detection

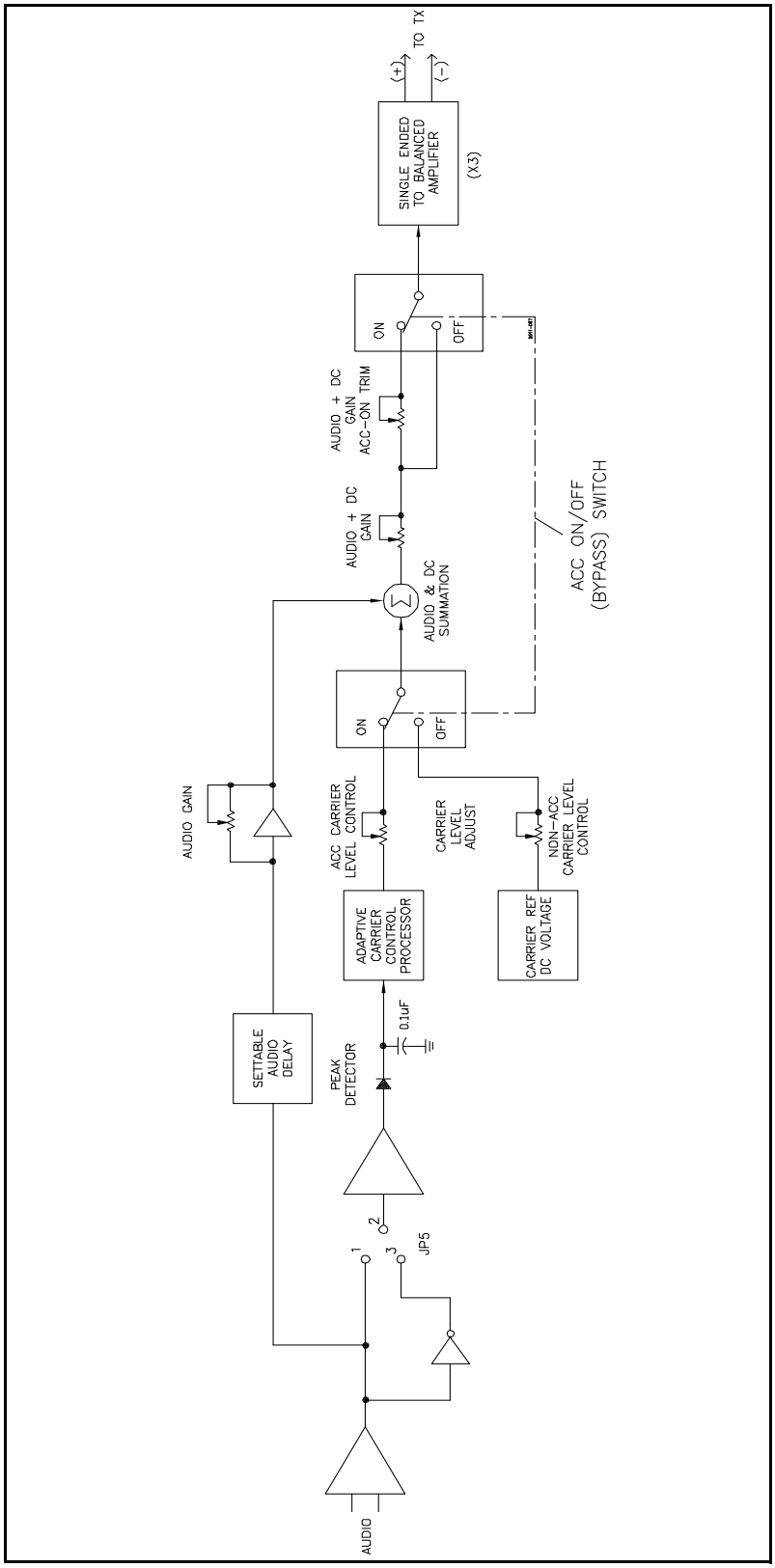

Figure 6-1 Simplified Schematic

WARNING: Disconnect primary power prior to servicing.

Section 7 Parts List

7

7.1 Parts List Located On Customer Portal

http://support.broadcast.harris.com/