MAINTENANCE MANUAL

EDACS GPS SIMULCAST SYSTEMS

SYSTEM ALIGNMENT AND FIELD TESTING PROCEDURES
(MASTR® III Stations)

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ERICSSON

1. INTRODUCTION

This manual contains the complete system level alignment procedures for a GPS Simulcast Communication System. These alignment procedures are applicable to systems equipped only with MASTR III Stations. All procedures must be completed for each RF channel in the sequence given. The alignment sequence is identified below. Read the entire procedure before beginning.

NOTE

Prior to starting these procedures, obtain propagation times from each site to the alignment receiver and the timing offsets to be set for your specific system configuration. This information is available from the propagation group at Ericsson Inc. System Engineering (SE) and is required to complete Tables 1 and 2 in this procedure.

Alignment Sequence:

1. Combiner Power Output
2. Exciter Level Adjustment
3. Delay Adjustment
4. Amplitude Equalization
5. Voter Setup and Alignment
6. Field testing

2. RELATED PUBLICATIONS

It may be necessary to refer to one or more of the following maintenance manuals when aligning the simulcast system. These manuals will provide additional information should you encounter technical difficulties during the alignment process. If a conflict exists in procedures, this document shall take precedence for Simulcast System Level Adjustments.

MASTR III Transmitter	LBI-39197
Compact Vertical Voter	LBI-39153
GPS Timing Module	AE/LZB 119 1875
LSD Selector Module	AE/LZB 119 1880
ReSync Module	AE/LZB 119 1876
Audio ALC Module	AE/LZB 119 1878
Audio Distribution	AE/LZB 119 1879
GETC Interface Module	AE/LZB 119 1659

NOTICE!

Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

NOTICE!

3. RECOMMENDED TEST EQUIPMENT AND CABLES

The test equipment required to complete the alignment procedure is listed in two separate lists: Test Equipment Supplied (Test Rack) and Test Equipment Required But Not Supplied. The test equipment identified in the second list is portable and must be supplied by the servicing technician.

Test Equipment Supplied

The following test equipment is provided and included in the Test Equipment Rack.

1. Digital Storage Oscilloscope, configured for rack mount - Tektronix TDS 410A
2. Transmission Test Set - CONVEX 806RM
3. Supplied Test Leads:
   - 2 Bantam - Bantam Plug 10' (AD6/PJ1210) (188D6118P17)
   - 2 Bantam - Bantam Plug 4' (ADC/PJ718) (188D6118P13)
   - 2 Bantam - BNC 8' (ADC/PAT007) (188D6118P32)
   - 2 Bantam - BNC 5' (188D6118P31)
   - 2 Extender Cards (ROA 117 2249)

Test Equipment Required But Not Supplied

1. Communications Service Monitor FM/AM 1200S with Spectrum Analyzer - IFR Systems Inc. or equivalent.

NOTE

Alternate monitors that may be used include the IFR COM120B and HP8920A. This procedure includes settings for each of these. All instruments do not give exactly the same reading - even when the same model is used. ***Use one monitor for setting all channels at all sites***

2. RF Watt Meter (Bird Model 43)
3. Portable Transmission Test Set (Ameritec Model AM 42, 44 or 48).
4. MASTR III Utilities Software, TQ3353.
5. MASTR III Programming Cable, TQ3356.
6. CPTC Programming Cable, 19B804346P111.

CAUTION

The test equipment used at each site should be the same unit or calibrated against one another using a "master" site to take into account any differences

4. ALIGNMENT PROCEDURES

4.1 COMBINER POWER OUTPUT (TX SITES ONLY)

1. At a Transmit Site, measure the output power of each channel from its associated combiner. Note and record the channel having the lowest power (highest port loss). If more than one combiner is used at a site, use the lowest power of all combiners.
2. Set all transmitter PA (Power Amplifier) power outputs to achieve the same power output (±5 watts) from the combiners using the Test & Alarm Computer (IEA), MASTR III handset or MASTR III Utility Software.

NOTE: Power must not exceed 100 watts, measured at the output of the station sniffer.

4.2 EXCITER LEVEL ADJUSTMENT

Two technicians are required to properly adjust the exciter level: one at the Control Point and one at the Transmit Site. Before beginning the adjustment procedure, establish a communications link to the technician at the Control Point. Perform each step of the procedure in the sequence given.

4.2.1 MASTR III Transmitter Presets

Configure the MASTR III as follows:

• DSP Compressor Gain*****	1,023	(OFF)
• Compressor Threshold*****	32,767	(Highest Setting Possible)
• Line Input*	0	(OFF)
• Repeater Gain*	1,023	(Unity Gain)

***** May be set at Test & Alarm Computer (IEA).

NOTE

To use the MASTR III handset or MIII utility software, the Test & Alarm Computer (IEA) must be disconnected by unplugging J14 on the "Program/Diagnostic Panel" in the rear of station cabinet.

4.2.2 Low Speed Data Deviation

NOTE

It is important that the same (or exactly matched) deviation measurement equipment be used at each site.

At The Control Point:

WARNING

This process is intended to be used during initial installation and on non-active systems.

1. On the control panel, set the following switches *(Figure 4).*
   - Site Under Test, PTT switch for channel under test to **ON**.
   - Site Under Test, A/D switch for channel under test to **A**.
   - For all other sites, set PTT switches to **OFF** and A/D switches to **D**.
2. Set **Test/Norm** switch S2 on the LSD Selector Module to the **Test** position and verify that the red **"test"** LED DS1 is ON *(Figure 5).*

At The Transmit Site:

1. Connect the exciter output (TX SYNTHESIZER RF OUT) of the channel under test directly to the input of the communications service monitor. This reduces external interference that can disturb the accuracy of the settings.
2. Set up the communications service monitor according to Table 1 and tune to receive the RF channel under test (USE TX FREQUENCY).

Table 1 - Service Monitor Set Up

Communications Service Monitor Setup for LSD Deviation:	
HP8920A	IF=15K, Filter 1=50Hz Filter 2=300 Hz LPF
IFR 1200S	FM NAR
IFR COM 120B	IF = 15 kHz HPF = OFF LPF = 20 kHz

3. Insert a Bantam plug in the TRANSMIT audio jack, (T601 TXV) **IN**, for the channel being adjusted. This removes MUX idle channel low level audio and prevents it from interfering with this adjustment.
4. Observe modulation analog meter on the communications service monitor and adjust **Channel Guard Pot** using the Test & Alarm Computer, MASTR III handset or MASTR III Utility Software. Adjust deviation according to Table 2.

Table 2 - LSD Deviation

Monitor	Deviation
HP8920A	0.500 kHz ± 10 Hz
IFR1200S	0.635 kHz ± 10 Hz
IFR COM 120B	0.525 kHz ± 10 Hz

5. Disconnect communications service monitor and reconnect exciter to PA.
6. Remove Bantam plug from TRANSMIT audio Jackfield and return the channel to service.
7. Repeat this test for the remaining sites/channels.
8. Set **Test/Norm** switch S2 on the LSD Selector Module to the **Norm** position and verify that the red **"test"** LED DS1 is OFF.

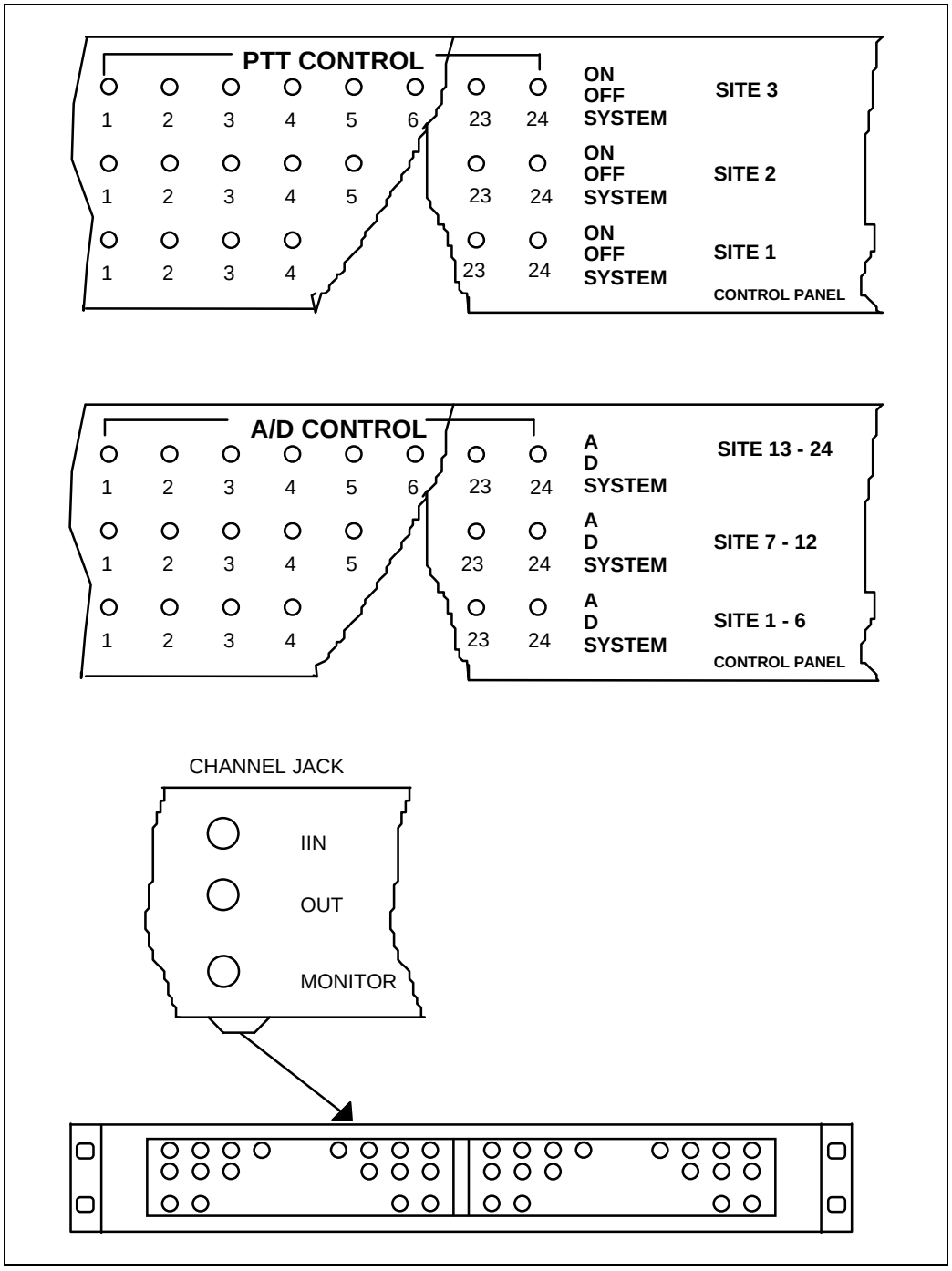


Figure 4 - Jackfield And Control Panel Detail

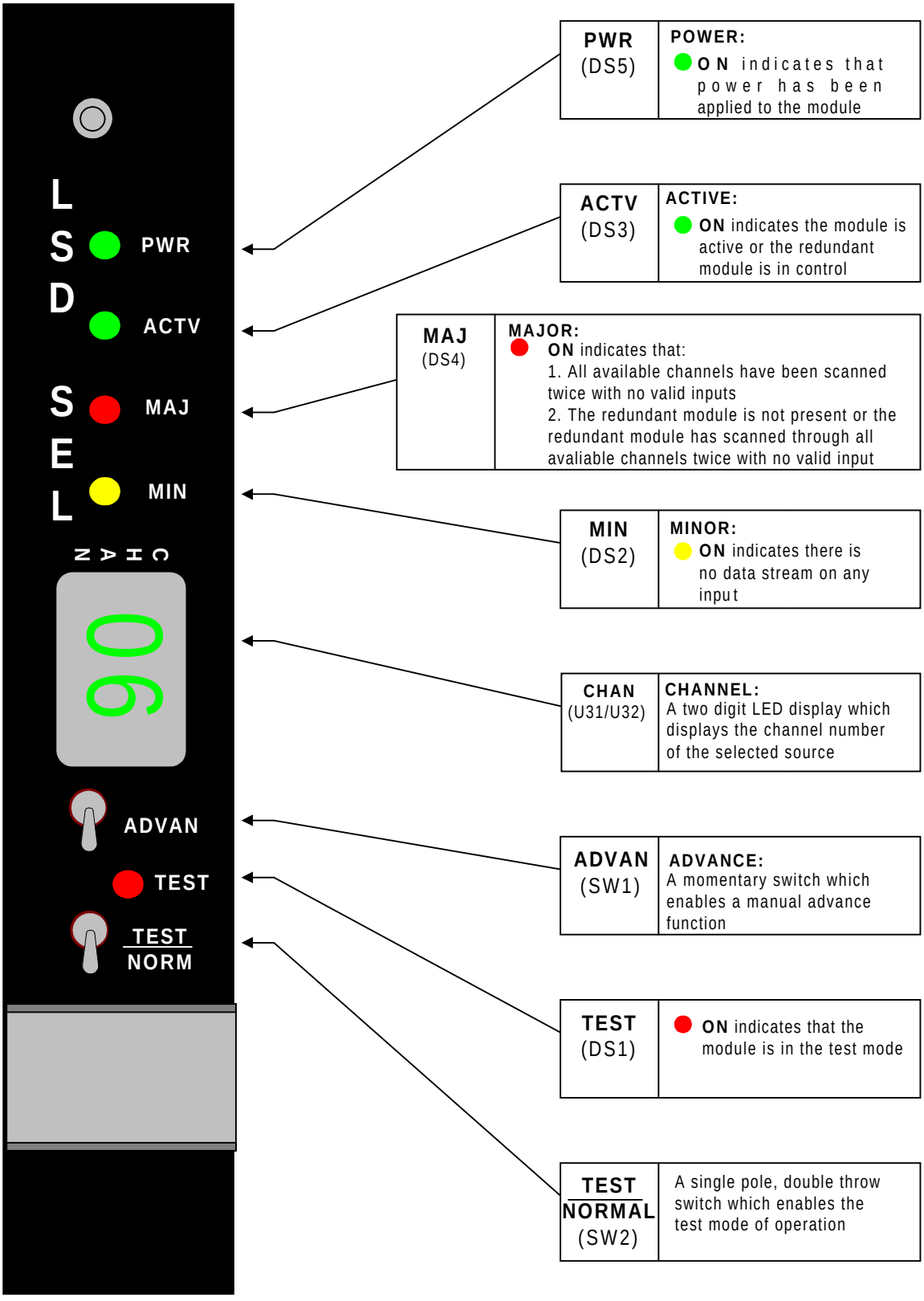


Figure 5 - LSD Selector Front Panel

NOTE

To check 150 baud deviation on a channel **after the system is installed** and operating:

A known correct station should be checked in the following method to establish an LSD Reference level. Set the station under test to the same values as obtained from the reference.

From the System manager, remove the channel under test from service.

At the **Control Point**, perform Step 1.

At the **Transmit Site**, perform steps 1 and 2.

On the GETC Interface Board in the Station GETC shelf under test, connect a jumper from TP201 (Station Bypass) to TP206 (ground) to place the station into **BYPASS**.

Record existing settings of station GETC DIP switches. Set GETC DIP switches as follows to produce an LSD of 100 Hz.

S1-1 Open	S1-6 Close
S1-2 Close	S1-7 Open
S1-3 Close	S1-8 Close
S1-4 Open	S2-8 Open
S1-5 Close	

Press and release "RESET" on station GETC.

Remove J17 on GETC if present.

Repeat Step 4 of procedure (**At the Transmit Site**).

Set GETC DIP switches to the original settings.

Press "RESET".

Remove the ground from TP201 and TP206 of the Station GETC Interface Module.

Re-install J17 to the original position on the GETC if it was removed above.

Restore the channel to service.

4.2.3 Limiter Deviation Adjustment

At The Control Point:

1. Set the CONVEX transmission test set for a 0 dBm, 1 kHz tone. This is 10 dB above average voice test tone level.
2. Insert the signal into the sites' transmit audio **OUT** circuit (A60X TXV).
3. SET PTT and A/D switches to ON and A respectively for channel/site under test.

At The Transmit Site:

WARNING

To avoid communication disturbances on an active system, take the channel under test out of service.

3. Remove J55 on the Station GETC board for the channel under test to remove the low speed data (LSD).
4. Connect the exciter directly to the input of the communications service monitor.
5. Set **DSP Line In Pot** to 100 using the Test & Alarm Computer, MASTR III handset or MASTR III Utility software.
6. Set up the communications service monitor according to Table 3 and observe the display. While adjusting the **TRANSMIT (Limiter) pot** using the Test & Alarm Computer, MASTR III handset or MASTR III Utility software, set the deviation according to Table 4.

Table 3 - Communications Service Monitor Set-up

Communications Service Monitor Set-up for Limiter Deviation:	
HP8920A	IF=15K, Filter 1=50 Hz Filter 2=15 kHz LPF
IFR 1200S	FM NAR
IFR COM 120B	IF=15K, HPF=OFF, LPF=20K

Table 4 - Service Monitor Deviation

Service Monitor	Normal Deviation	NPSPAC Deviation
HP8920A	3.75 ± .05 kHz	3.30 ± .05 kHz
IFR1200S	3.75 ± .05 kHz	3.30 ± .05 kHz
IFR COM 120B	4.00 ± .05 kHz	3.53 ± .05 kHz

At The Control Point:

1. Reduce the test tone level of the transmission test set to -10dBm.

At Each Transmit Site:

1. Verify approximately -10dBm is present at the transmitter audio input, (jackfield T601 TXV) **IN**, with meter terminated in 600 ohms. If the level is not within ±2dB of -10dBm then inspect the ALC and Audio Distribution modules, also verify the Intraplex Audio Module settings.
2. Remove meter from the (T601 TXV) jackfield.
3. With the communications service monitor set up according to Table 3, observe the deviation.
4. Using the Test & Alarm Computer (IEA), adjust **DSP LINE IN POT** to achieve the deviation specified in Table 5.

Table 5 - Service Monitor Deviation

Service Monitor	Normal Deviation	NPSPAC Deviation
HP8920A	3.00 ± .05 kHz	2.40 ± .05 kHz
IFR1200S	2.90 ± .05 kHz	2.30 ± .05 kHz
IFR COM 120B	3.10 ± .05 kHz	2.50 ± .05 kHz

5. Disconnect communications service monitor, reconnect exciter to the PA, and reinstall J55.
6. Disconnect Bantam Plug from J/F A60X TXV, at the Control Point.
7. Return the channel to service.
8. Repeat this procedure for the remaining sites on this channel, then complete the procedure for the remaining channels.

4.2.4 High Speed Data Deviation Adjustment

WARNING

To avoid communication disturbances on an active system, take the channel under test out of service.

At The Control Point:

1. On the control panel, set site/channel under test PTT to **ON** and the A/D switch to **D** for the site channel under test.
2. At the jackfield, patch the control channel data into the channel being set (D607 DATA) *(Figure 6).*

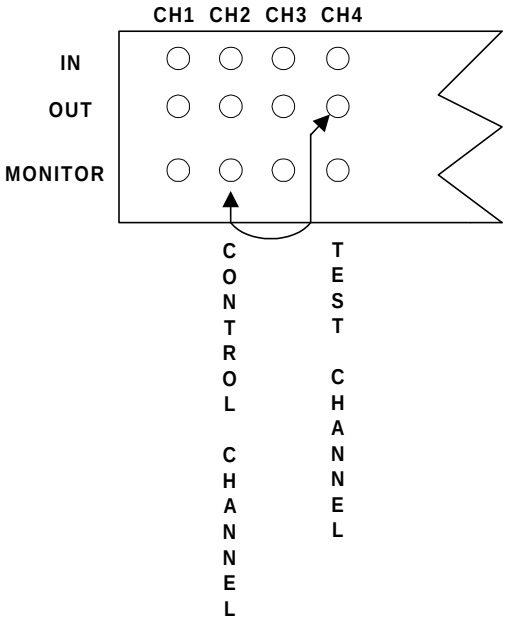


Figure 6 - Patch The Control Channel Data Into The Channel Being Set

At Each Transmit Site:

1. Connect the exciter directly to the input of the communications service monitor.
2. Set up communication service monitor according to Table 6.
3. Adjust R31 (data deviation) on the GETC circuit card assembly according to Table 7 and observed on the communications service monitor display.

Table 6 - Communication Service Monitor

Communications Service Monitor Setup for High Speed Data Deviation:	
HP8920A	IF=230K, Filter 1=<20Hz Filter 2=15 kHz LPF
IFR 1200S	FM MID
IFR COM 120B	IF=240K, HPF=OFF, LPF=20K

4. Reconnect exciter output to transmitter PA input.
5. Remove data patch from jackfield D607 and return the channel to service. Repeat for each channel and site. After exciter adjustments have been performed, return all switches on the control panel to the **SYSTEM** position.

NOTE

Any future changes to the **"TRANSMIT POT"** will change this High Speed Data Deviation.

Table 7 - High Speed Data Deviation

Service Monitor	Normal Deviation	NPSPAC Deviation
HP8920A	3.05 ± .05 kHz	2.40 ± .05 kHz
IFR 1200S	3.03 ± .05 kHz	2.40 ± .05 kHz
IFR COM 120B	2.90± .05 kHz	2.35 ± .05 kHz

4.3 DELAY AND LEVEL SETTING

Copy Table 9 from this Manual to use as a working copy. Enter your system specific data in the columns for Propagation To Test RX, Offset Delay, Total Delay, Expected Measured Delay and GPS RX A/B 1PPS Delay (See Table 1 "NOTES").

4.3.1 Non-Collocated TX Sites with the Control Point:

1. Using the Test & Alarm Computer (IEA), initially set the GPS receivers' **1PPS** Delay to 30 milliseconds for all transmit sites (Two GPS receivers per site). Any TX site specific offsets should be adjusted from this 30 milliseconds point. Input GPS RX A/B data from Table 9. Always enter the same delay for both GPS receivers at a site. Make sure to click on **"Write"** at the bottom of the screen to enter the delay.
2. At the Control Point set the GPS receivers' **1PPS** Delay to zero.

4.3.2 Collocated TX Sites with the Control Point:

The collocated TX site shares signals from the Control Point GPS receivers. The collocated TX site should be the Reference site. The delay for the collocated TX site is set in the MUX shelf to 29,444.95 microseconds as follows:

1. In the Intraplex MUX shelf, on the TD-1 delay module, verify switch 1, position 3 is **ON** for remote control operation.
2. Using the Test & Alarm Computer, adjust the **Actual Delay** on the T1-Delay module to 29,444.95 microseconds. Make sure to click on **"Write"** at the bottom of the screen to enter the delay.

4.3.3 Delay Measurement

1. Connect the test equipment as shown in Figure 7.
2. Patch data from the control channel to the test channel as figure 6 indicates.
3. Starting with the REFERENCE site (site 1) on the Control Panel, set the following switches for the channel being tested:
   - REFERENCE site PTT **ON**.
   - REFERENCE site A/D **'D'**.
   - All other sites PTT **OFF**.
   - All other sites A/D **'A'**.
4. Set the oscilloscope to view the first "dotting/Barker" region of data after the scope triggers using delayed sweep. Pick a uniquely identifiable peak or valley data *(Figure 8).* You may want to use an AVERAGE of the oscilloscope traces to display a smoother trace.
5. Set the delayed sweep on the oscilloscope to place the identified data point in the center of the screen. This is done for the REFERENCE Site only. All other sites data is measured in time from this point.
6. **At the Control Point** Control Panel, set the following switches *(Figure 4):*
   - Next Site PTT **ON**, (Test Channel)
   - Next Site A/D **'D'**, (Test Channel)
   - All other sites PTT **OFF**.

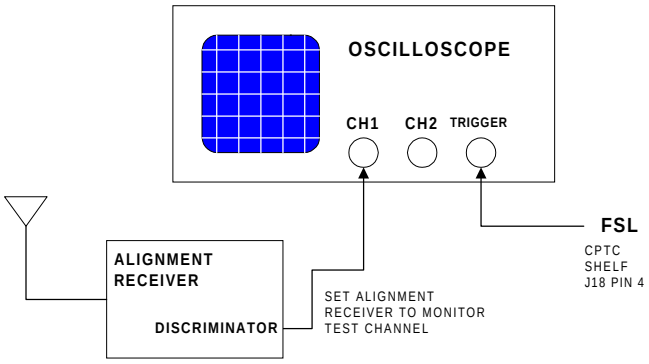


Figure 7- Equipment Connection

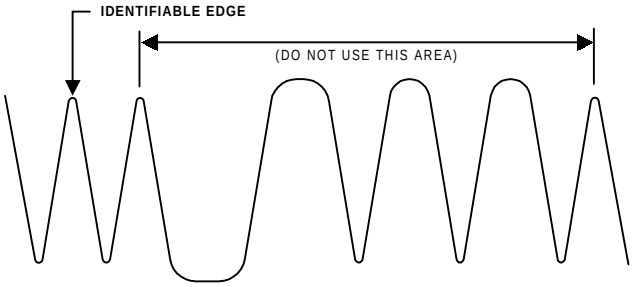


Figure 8 - Dotting/Barker Region

NOTE

For Tektronix TDS 410A:

To zoom in on a portion of the oscilloscope trace, do the following:

1. Press the Autoset button to clear all previous commands.
2. Press the Trigger Menu button, then press soft button for CH 2 as trigger.
3. Adjust the Trigger Level knob to lock the dotting/Barker region.
4. Press Zoom button.
5. Press soft button to turn Zoom on.
6. Adjust Horizontal Position knob to position dotting/Barker region on the screen.

7. Observe the oscilloscope display. This site should arrive at a different point than the REFERENCE site. This difference in arrival time between the site under test and the Reference site can be a negative value (to the left of the reference) or a positive value (to the right of the reference). Wait after setting the delay for "**Resync"** to occur (up to 1 minute) to verify that the correct amount of time was added or subtracted.
8. Record the differences in the "Actual Measured Delay" column of your working copy of Table 9. These measured values should be within ± 2 microseconds of the "Expected Measured delay." If they are not, verify that both GPS receivers are properly set. Verify the math in your Table 9 and alarm conditions at the sites.
9. It is advisable to patch the Control Channel data to each channel for the site and verify that each "Resyncs" to the same place in time.
10. Continue with remaining sites per procedure. It may be necessary for some sites to use a remote test receiver to receive a distant site. Use a previously adjusted site that is strong enough for the remote test receiver to use as a reference. Use this new reference signal from the remote test receiver to time remaining sites. Table 9 values for these sites must reflect values from the new References, not the original site 1 reference.
11. Remove the patch jumper on D607 Data jack.
12. If for any reason, the desired offset delays are *changed* after running this procedure, recalculate total and measured delays, then repeat the procedure with new values.

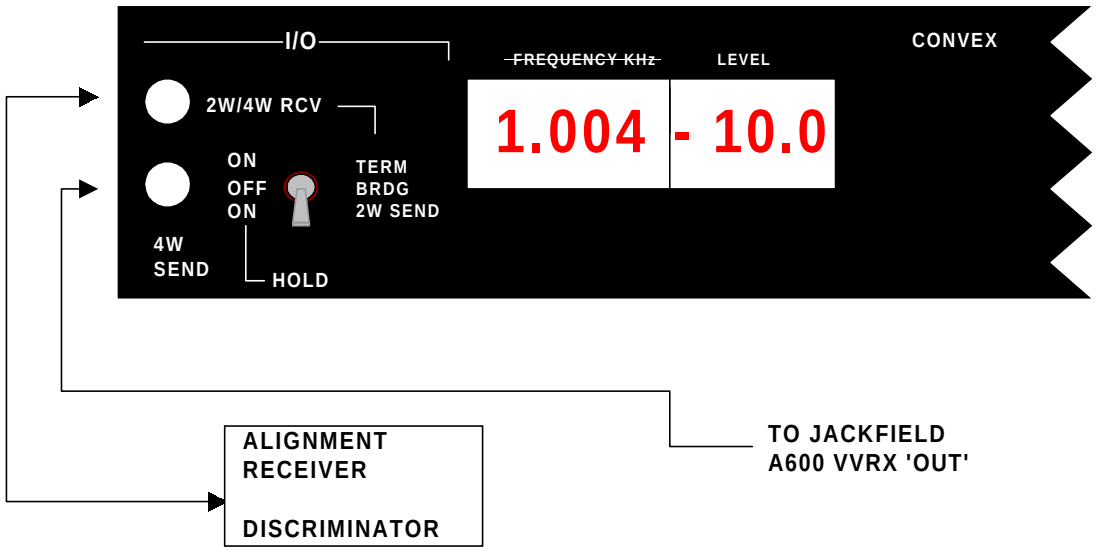


Figure 9 - Transmission Test Set

4.3.4 Amplitude Equalization

All transmitter exciter adjustments must be completed before making this adjustment.

WARNING

To avoid communication disturbances on an active system, take the channel under test out of service and remove station GETC J55 to eliminate LSD on the channel/site under test instead of inserting a bantam plug into jackfield D600 LSD/CR.

At the Control Point:

1. Fill in Table 8 with all TX site names.
2. Insert a Bantam Plug into Jackfield D600 LSD/CR 'IN' for site under test. This will removes the Low Speed Data from the station output.
3. Tune the alignment receiver for the channel under test.
4. Place the A/D switch to 'A' and PTT switch to 'ON' for the Test channel at each site *(one site at a time)* and record the 'RSSI Reading' in Table 8 for each site with the attenuators set to zero.
5. Use the site with the weakest signal strength as the reference *(site with the smallest RSSI Reading).* The weakest signal must result in a level producing full RX quieting. Adjust the attenuator toggle switches on the alignment receiver shelf to obtain the same 'RSSI Reading' as the reference site in Table 8. Record the attenuator settings in Table 8.
6. Place A/D switch to **'A'** and PTT switch to **'ON'** for channel/site under test.
7. Insert a 1000 Hz tone at - 10 dBm into Jackfield **A600 VVRX 'OUT'** using the **Transmission Test Set** for the channel under test *(Figure 9).*
8. Insert a Bantam Plug into Jackfield **D600 LSD/CR 'IN'** for site under test. This will remove the Low Speed Data from the station output.
9. Connect the Alignment Receiver's discriminator output to the input of the Transmission Test Set.
10. Adjust the attenuator toggle switches according to Table 8 on the Alignment Receiver Shelf for each site.
11. Using the Test & Alarm Computer, adjust the 'DSP Line In Pot' to obtain a level reading on the Transmission Test Set equal to the reference level within one tenth of a dB. (For the reference level, pick one channel).
12. Use the same reference level to adjust all channels at all sites.

Table 8 - Amplitude Equalization

Site Name	RSSI Reading	Attenuator Setting
1) Ref. Site		- - - - 0 - - - -
2)		
3)		
4)		
5)		
6)		
7)		
8)		
9)		
10)		
11)		
12)		
13)		
14)		
15)		
16)		
17)		
18)		
19)		
20)		
21)		
22)		
23)		
24)		

4.4 VOTING SELECTOR SETUP AND ALIGNMENT FOR VERTICAL VOTERS

Perform the steps in the order given. Refer to Voting Selector Panel LBI-38676 for additional detail.

At the Remote Site:

1. Connect a transmission test set, receive input set to 600 Ohm load, to channel 1 receive audio jackfield T601 RXV IN.
2. Apply an on frequency 1000 microvolt signal modulated by 1000 Hz with ±3.0 kHz deviation (±2.4 kHz NPSPAC) to the receiver antenna jack. Press and hold the station GETC RESET button.
3. Set the 'Line Out' pot using the Test & Alarm Computer or the MASTR III handset or MASTR III Utility software to produce -10 dBm at the transmission test set.
4. Release the station GETC RESET button.
5. Remove the RF signal from the receiver input.
6. Set the 1950 **Voting Tone gain pot** using the Test & Alarm computer (IEA) or the MASTR III handset or the MASTR III Utility software to produce -10 dBm at the transmission test set.
7. Set the transmission test set to measure input frequency. Verify 1950 Hz ±5 Hz is being sent.
8. Remove the transmission test set from T601 RXV jackfield.

At the Control Point:

1. Connect a transmission test set with receive input set to BRIDGE, to J1 on the analog voter receive card channel 1, and the site under test. Connect the other side of the input to the Voter GND pin on the power supply card.
2. With 1000 Hz, -10 dBm test tone received from the remote site receiver (per remote site Step 2), adjust "INPUT ADJ" pot on the voter receive module for a reading of -20 dBm.
3. Connect the transmission test set with receive input set to 600 Ohm terminated load to A600 VVRX Voted Audio jackfield **IN** jack for the channel under test. Push and hold the GETC Reset button for the duration of adjustment.
4. Temporarily remove the J7 on the Digital Interface Board for the site/channel under test. (J7 is for sites 1-6, J8 is for sites 7-10, and J18 is for sites 11-12. For more information refer to LBI 39153.
5. Adjust "OUTPUT ADJ" pot on the voter audio module to achieve a reading at the transmission test set of -10 dBm ±0.1 dB. This only has to be done ***once per voter channel***, not for every site.

NOTE

The voting selector will "fail" a receive module with constant tone after approximately 20 seconds. Interrupt the tone momentarily to restore the receive card from failure before taking this reading.

6. Disconnect transmission test set from A600 VVRX.
7. Remove the RF test equipment at the remote site.
8. With 1950 Hz idle voting tone received from the remote site, verify its level is -20 dBm ±6 dB at J1 of the voter receive module. **DO NOT** adjust R2 at the voter receiver module.
9. With 1950 Hz idle voting tone received from the remote site, set the transmission test set to measure frequency. Verify its frequency is 1950 Hz ±5 Hz.
10. If voter digital selectors are equipped with Rockwell Modems, set the output to -10 dBm, on the **R**ockwell **M**odem **I**nterface **C**ard (**RMIC**) associated with the voter digital selector.

NOTE

If equipped with Digital Dispatch, verify Jumpers J2 and J3 are in 2-3 position on the modem interface module.

At the Remote TX Site:

Remove the signal generator from the receiver input and reconnect antenna input cable to receiver.

Remaining Channels:

Repeat the "Voting Selector Setup and Alignment" procedure for all remaining channels at the site.

Remaining Remote TX Sites:

Repeat the "Voting Selector Setup and Alignment" procedure for all for the remaining remote TX sites.

4.4.1 For AUX RX Sites (NOT SIMULCAST TX SITES):

At AUX RX Site:

1. Connect a transmission test set, receive input set to 600 ohm load, to channel 1 Receiver line output at P101, Pins 3&4 (left) and P301, Pins 3&4 (right), at the rear of the receiver shelf.
2. Unplug the 25 pair connector from EDACS RX Audio panel.
3. Apply an on frequency 1000 microvolt signal modulated by 1000 Hz with ±3.0 kHz deviation (±2.4 kHz NPSPAC) to the receiver antenna jack. Press and hold the AUX receiver GETC RESET button.
4. Set the Line Out pot using the MASTR III Utility software on the AUX receiver system board to produce -10 dBm at the transmission test set.
5. Release the AUX receiver GETC RESET button.
6. Remove the RF signal from the receiver input.
7. Set the 1950 Hz Voting Tone gain pot using the MASTR III utility software to produce -10 dBm at the transmission test set.
8. Set the transmission test set to measure input frequency. Verify that 1950 Hz ±5 Hz is being sent.
9. Remove the transmission test set from the AUX receiver output terminals.
10. Reinstall the 25 pair connector on the EDACS RX Audio panel.

At The Control Point:

1. Connect a transmission test set with receive input set to BRIDGE, to J1 on the voter receive card channel 1, and the site under test. Connect the other side of the input to the Voter GND pin on the power supply card.
2. With 1000 Hz, -10 dBm test tone received from the remote site receiver, adjust R2 on the voter receive module for a reading of -20 dBm.
3. Connect transmission test set with receive input set to 600 Ohm load to A600 Voted Audio jackfield LINE jack for the channel under test.
4. Temporarily remove the J7 on the Digital Interface Board for the site/channel under test. (J7 is for sites 1-6, J8 is for sites 7-10, and J18 is for sites 11-12. For more information refer to LBI-39153.
5. Adjust "OUTPUT ADJ" pot on the voter audio module to achieve a reading at the transmission test set of -10 dBm ±0.1 dB. This only has to be done ***once per voter channel***, not for every site.

NOTE

The voting selector will "fail" a receive module with constant tone after approximately 20 seconds. Interrupt the tone momentarily to restore the receive card from failure before taking this reading.

6. Disconnect transmission test set from A600.

At AUX RX Site:

Remove 1000 Hz, -10 dBm test tone from the remote site receiver.

At The Control Point:

1. With 1950 Hz idle voting tone received from the remote site, verify its level is -20 dBm ±6 dB at J1 of the voter receive module. **DO NOT** adjust R2 at the receiver module.
2. With 1950 Hz idle voting tone received from the remote site, set the transmission test set to measure frequency. Verify its frequency is 1950 Hz ±5 Hz.
3. Disconnect the Transmission Test Set from J1.

4.4.2 Internal Modem Setup (Voter Digital receivers to AUX RX sites & AUX RX GETC's):

Modem Transmit Audio level ***must*** be set before adjusting the corresponding Receive end. This is not required with RS232 equipped AUX receiver sites.

At the AUX Receive Site:

1. Connect a transmission test set, receive input set to 600 ohm load, to channel 1 Receiver modem TX output at TB10 pins 1 & 2, at rear of RX GETC.
2. Unplug the 25 pair connector from EDACS RX Data panel.
3. Adjust R2 (PH TX ADJ) on the GETC board for -10 dBm indicated on the transmission test set.
4. Remove the transmission test set from the AUX receiver GETC modem TX terminals.
5. Repeat steps 1. through 4 for all channels at the AUX RX site.

6. Reinstall the 25 pair connector on the EDACS RX Audio panel.

4.4.3 At the Voter Digital RX GETC: (corresponding to the site/channel adjusted above)

This is not required with RS232 equipped AUX receive sites.

1. Connect an oscilloscope, input set to High Impedance Input, to the voter digital receiver GETC between U18-1 and GND.
2. Adjust R1 (PH RX ADJ) on the GETC board for 355 millivolt **P**eak-**P**eak (**P-P**) as indicated on the scope.
3. Disconnect the AC voltmeter from the voter digital receiver GETC.
4. Connect an oscilloscope vertical input probe between TP107 and GND.
5. Verify square waves are present on the display with periodic changes (approx. 1/second) indicating AUX site status messages are being received at the voter digital receiver GETC.
6. Repeat steps 1 through 5 above for all Voter AUX site digital receivers.

5. FIELD TESTING

1. The initial settings of the system have been influenced by the Simulcast Interference plot produced by the propagation studies. Now a physical "tour" of the overlap areas is done to check on both audio and data working.
2. Part of the key to correctly setting up a simulcast system is that *all* transmit limiters and deviations must be set up identically (or as near as is humanly possible), including low speed data (150 baud) deviation.

   The second part is that the audio amplitude and presented to all transmitters is identical and timed to arrive in the non-capture areas within tolerance. Data must also be presented to all transmitters with the same deviation and timed to arrive in the non-capture areas within tolerance.

   The preceding procedures set these parameters.
3. Non-capture areas can be identified by keying a transmitter from each site involved in covering a certain area on a specific channel. Set up a different tone modulating each TX site, so that each site may be identified. Presence of a single tone indicates the site is predominant; (capturing) multiple tones heard in succession indicate an overlap. Move through the area slowly to identify all sites (tones) involved.
4. Physical plots of site coverage are used to predict non-capture areas and to estimate site timing offsets. Accurate determination of non-capture areas and timing offsets are accomplished by use of the multiple receiver tool developed by Ericsson Inc. Engineering. Each site is set to transmit carrier on a different frequency from other sites. The coverage area is driven and information gathered automatically by the tool which collects location, signal strength of each site at each measured point, trunking access. This data is then processed by Propagation Engineering to determine overlap areas and optimize timing offset values for the sites.
5. The tool will take into account everything that propagation predictions cannot, such as buildings, reflections or shadows from terrain or man-made objects.

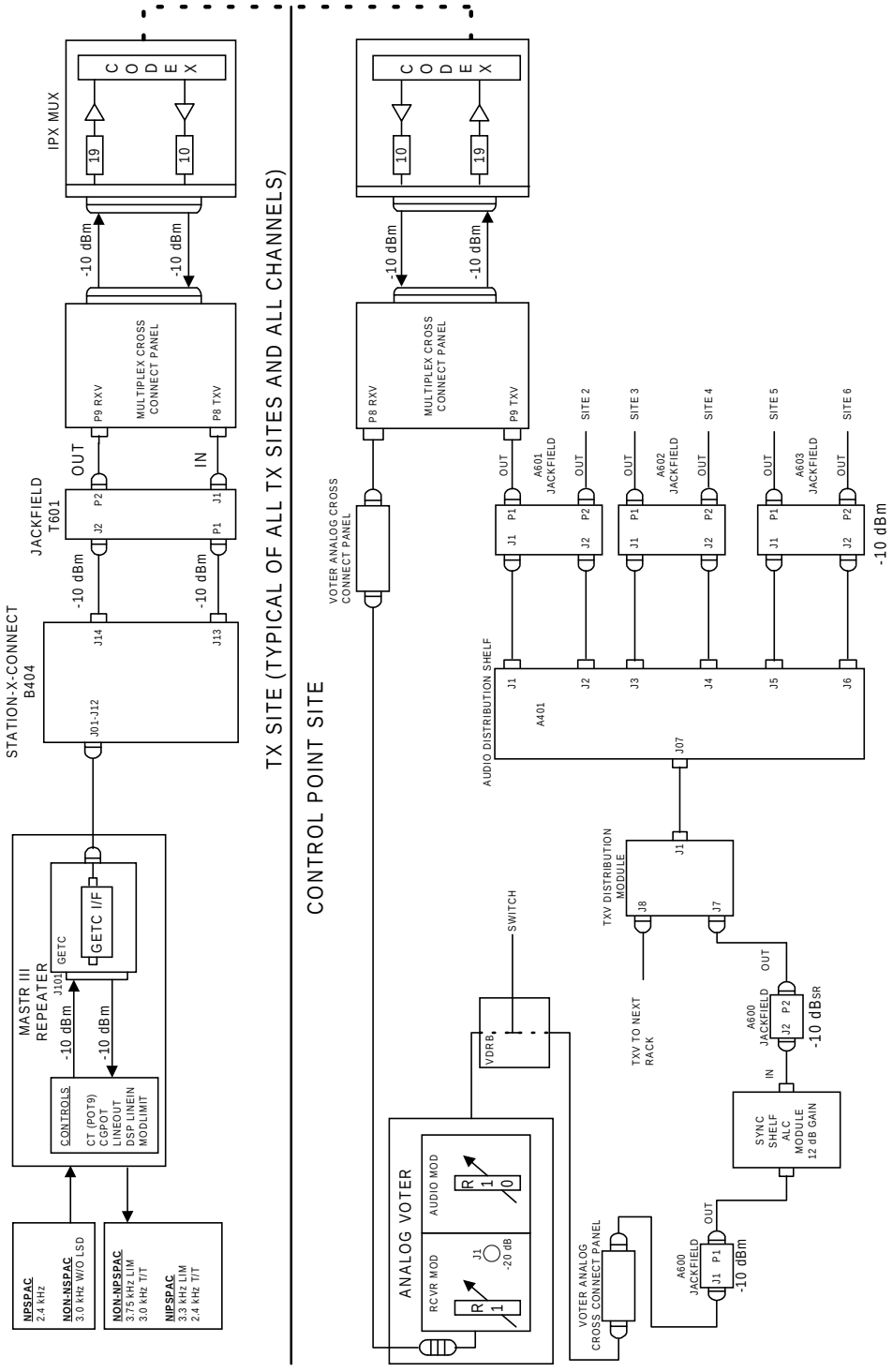
Table 9 - Time Delay Offsets Relative to Reference Site, Delay

SITE	Propagation To Test RX	Offset Delay	Total Delay	Expected Measured Delay	GPS RX "A" 1 PPS Delay	GPS RX "B" 1 PPS Delay	Actual Measured Delay
TX Site 1 REFERENCE				∅	30 milliseconds	30 milliseconds	∅
TX Site 2							
TX Site 3							
TX Site 4							
TX Site 5							
TX Site 6							
TX Site 7							
TX Site 8							
TX Site 9							
TX Site 10							

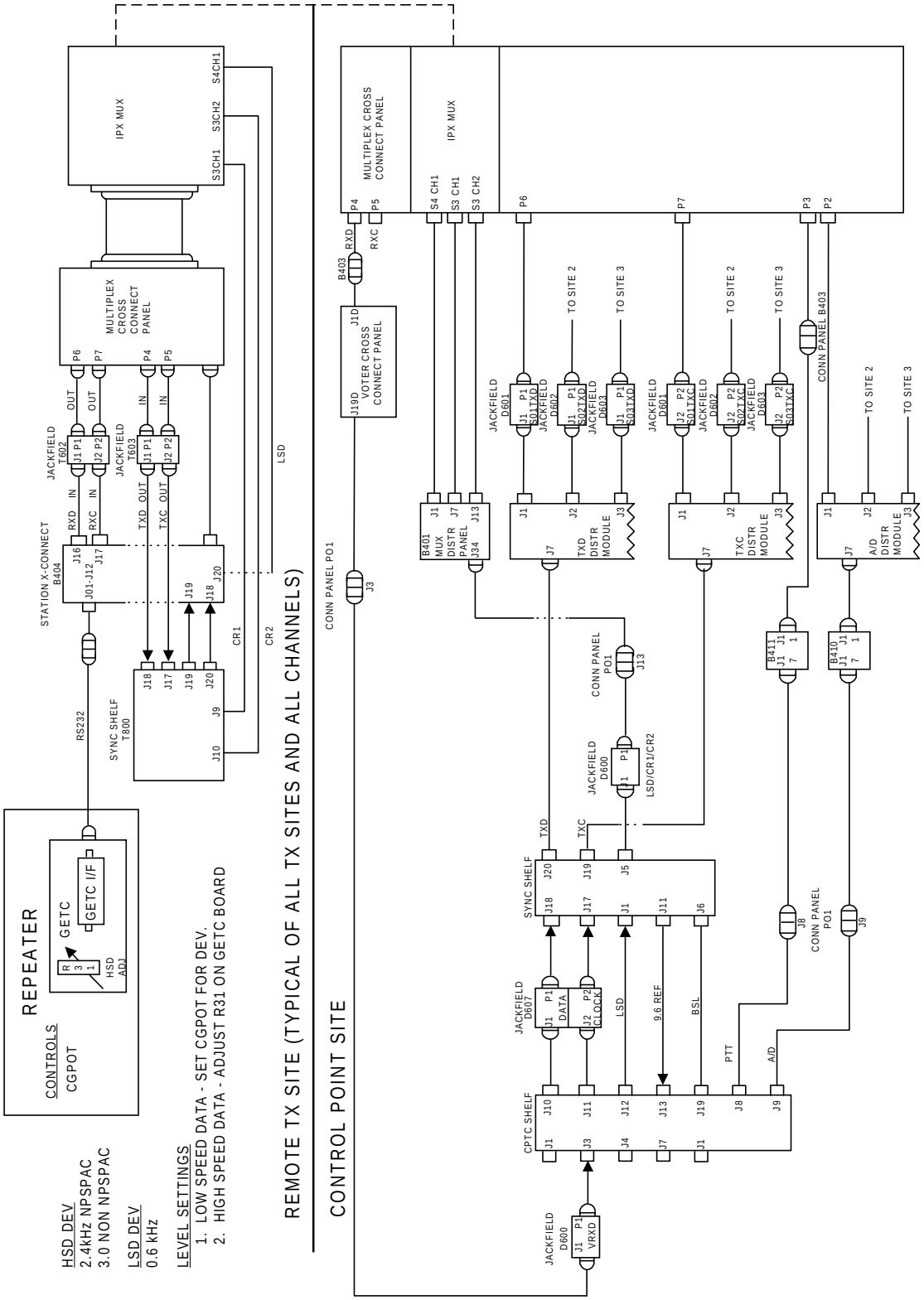
NOTES:

OBTAIN "PROPAGATION TO TEST RECEIVER" AND "OFFSET DELAY" VALUES FOR YOUR SPECIFIC SYSTEM FROM THE PROPAGATION GROUP IN SYSTEM ENGINEERING AT ERICSSON INC.

1. **Propagation to Test RX:** Is the point-to-point time taken by the RF signal to travel from a TX site to the Test receiver location (Approximately 5.2 microseconds per mile).
2. **Offset Delay:** Is the amount of shift in time required of a TX site, to move the center of its overlap with another site. This may be a *positive* number (later) or *negative* number (earlier).
3. **Total Delay:** Is the sum of the "Propagation To Test RX Delay" and "Offset Delay" values.
4. **Expected Measured Delay:** Is zero for the REFERENCE Site. All other sites "Expected Measured Delays" are the "Total Delay" of the site being measured ***minus*** the "Total Delay" for the REFERENCE Site (can be a negative value).
5. **GPS Delays:** Are the actual values set in the GPS Receivers for a site. "GPS Receiver 'A' 1PPS Delay" must be equal to "GPS Receiver 'B' 1PPS Delay." They are calculated by adding or subtracting the "OFFSET Delay" for that site from 30 milliseconds.
6. **Actual Measured Delay:** The measured difference in arrival time between the sites under test and the reference sites. This should equal the "Expected Measured Delay" within ± 2 microseconds.



Voice, MASTR III GPS Simulcast Station



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