KX165A ALIGNMENT PROCEDURE

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PROPRIETARY NOTICE

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REVISION HISTORY

Revision	ECO	By	Date	Description of Change
-				Initial Release

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1. INTRODUCTION

1.1 Purpose

This procedure describes the alignment for sub-assemblies as well as the initial unit level alignment for the KX 155A/165A.

1.2 Definitions and abbreviations

1.2.1 Definitions

Standard VOR test signal: An RF carrier, amplitude modulated simultaneously a) 30±1% by a “reference phase signal,” composed of a 9960 Hz subcarrier, which is, in turn, frequency modulated at a deviation ratio of 16 by a 30 ±0.1% Hz signal, and b) 30 ±1% by a 30±0.1% Hz “variable phase signal” which can be varied in phase with respect to the 30 Hz FM of the reference phase signal.

Standard LOC centering signal: An RF carrier modulated simultaneously by a 20 ± 1% 90 Hz ±0.3% and a 20 ± 1% 150 Hz ±0.3%. The difference in depth of modulation is less than 0.002.

Standard glideslope centering signal: An RF carrier modulated simultaneously by a 40 ± 1% 90 Hz ±0.3% and a 40 ± 1% 150 Hz ±0.3%. The difference in depth of modulation between the 90 and 150 Hz signals is less than 0.002.

Standard glideslope deviation signal: An RF carrier modulated simultaneously by a 40 ± 1% 90 Hz ±0.3% and a 40 ± 1% 150 Hz ±0.3%. The difference in depth of modulation is .091 ±0.002.

1.2.2 Abbreviations

Abbreviation	Description
"	inches of Mercury
Ω	ohm
µA	microampere
µF	microfarad
µV	microvolt
µW	microwatt
°C	degrees Celsius
°K	degrees Kelvin
A	ampere
AGC	automatic gain control
AGL	above ground level
APT	airport
ASCII	American Standard Code for Information Interchange

Abbreviation	Description
ATE	Automated Test Equipment
CDI	course deviation indicator
col	column
comm	communication
CW	continuous wave (unmodulated)
dB	decibel
dBm	decibels relative to 1 mW
est	estimated
FSS	Flight Service Station
ft	foot
GHz	Gigahertz
GPS	global positioning system
HIRF	high intensity radiated field
hP	hecto Pascals
Hz	Hertz
ICAO	International Civil Aviation Organization
ident	identifier
in.	inch
j	$\sqrt{-1}$
KΩ	kilo-ohm
KHz	kilohertz
KPN	King part number
KW	kilowatt
lb	pound
LRU	line replaceable unit
MΩ	megaohm
mA	milliampere
mag	magnetic
mB	millibar
mF	millifarad
MHz	Megahertz
mic	microphone
min	minute
MSL	mean sea level
mV	millivolt
mV	millivolt
mW	milliwatt
NDB	nondirectional beacon
nF	nanofarads
nm	nautical mile
p	page
pF	picofarad

Abbreviation	Description
pW	picowatt
reqd	required
RF	radio frequency
rms	root mean square
sec	second
SUA	special use airspace
UUT	Unit Under Test
V	volt
VHF	very high frequency
VOR	very high frequency omnidirectional radio range
VSWR	voltage standing wave ratio
W	watt
wpt	waypoint

1.3 References

1.3.1 Traceability references

ED-23B, Minimum Performance Specification for Airborne VHF Communications Equipment Operating in the Frequency Range 117.975 - 137.000 MHz, The European Organization for Civil Aviation Electronics.

RTCA DO-160C, Environmental Conditions and Test Procedures for Airborne Equipment, Radio Technical Commission for Aeronautics.

RTCA DO-178B, Software Considerations in Airborne Systems and Equipment Certification, Radio Technical Commission for Aeronautics.

RTCA DO-186a, Minimum Operational Performance Standards for Airborne Radio Communications Equipment Operating Within the Radio Frequency Range 117.975-137.000 MHz, Radio Technical Commission for Aeronautics; prepared by SC-172, October 20,1995; receiver is class C, D, transmitter is class 4.

RTCA DO-192 Minimum Operational Performance Standards for Airborne ILS Glideslope Receiving Equipment Operating Within the Radio Frequency Range 328.6-335.4 MHz, Radio Technical Commission for Aeronautics; prepared SC-153, July 1986.

RTCA DO-195 Minimum Operational Performance Standards for Airborne ILS Localizer Receiving Equipment Operating Within the Radio Frequency Range 108-112 MHz, Radio Technical Commission for Aeronautics; prepared by SC-153, November 17, 1986.

RTCA DO-196 Minimum Operational Performance Standards for Airborne VOR Receiving Equipment Operating Within the Radio Frequency Range 108-117.95 MHz, Radio Technical Commission for Aeronautics; prepared by SC-153, November 17, 1986.

RTCA DO-207, Minimum Operational Performance Standards for Devices that Prevent Blocked Channels Used in Two-Way Radio Communications Due to Unintentional Transmissions, Radio Technical Commission for Aeronautics. prepared by SC-163, January 25, 1991.

TSO-C34e, ILS Glideslope Receiving Equipment Operating within the Radio Frequency Range of 328.6-335.4 MegaHertz, Department of Transportation, Federal Aviation Administration, Office of Airworthiness, Washington, DC.

TSO-C36e, Airborne ILS Localizer Receiving Equipment Operating within the Radio Frequency Range of 108-112 MegaHertz, Department of Transportation, Federal Aviation Administration, Office of Airworthiness, Washington, DC.

TSO-C37d, VHF Radio Communication Transmitting Equipment Operating within 117.975 to 136.000 MHz, Department of Transportation, Federal Aviation Administration, Office of Airworthiness, Washington, DC.

TSO-C38d, VHF Radio Communications Receiving Equipment Operating within 117.975 to 136.000 MHz, Department of Transportation, Federal Aviation Administration, Office of Airworthiness, Washington, DC.

TSO-C40c, VOR Receiving Equipment Operating within the Radio Frequency Range of 108-117.95 MegaHertz, Department of Transportation, Federal Aviation Administration, Office of Airworthiness, Washington, DC.

TSO-C128, Devices that Prevent Blocked Channels Used in Two-way Radio Communications Due to Unintentional Transmissions, Department of Transportation, Federal Aviation Administration, Office of Airworthiness, Washington, DC.

KX155A/165A System Requirements Document, KPN 701-00555-0000

Minimum Performance Specification for KX 155A and KX 165A, KPN 004-00312-40000.

1.4 Assumptions and dependencies

For proper operation, the comm must be connected to a COMM source meeting the requirements in RTCA DO-186A with a 50 Ohm load. Likewise, the VOR, Localizer, and Glideslope receivers must be connected to antennae as specified in RTCA DO-196, DO-195, and DO-192, respectively.

1.5 Required Test Equipment

AM/FM RF Signal generator
DMM
Oscilloscope
PC computer, 386 or above, 4M Ram or above
Interface adapter PC-DIO-96 card
Frequency counter
Power Supply +5V,+9V & -12V
Audio Generator
Modulation analyzer
RMS voltmeter
KX155 Test Panel
KX155A Interface Panel
Watt meter
30 dB power attenuator, 50W minimum
Milli-Wattmeter or Spectrum Analyzer

2. Sub-Assembly Alignment Procedure

2.1 Comm/NAV Receiver Alignment

2.1.1 Equipment connections, EEPROM initialization and PC control panel setting

Connect the receiver board as shown in figure 1.

If this is the first time the board is being powered up, initialize the EEPROM by performing the following steps after DC power is applied (See section 2.1.2 for power supply settings):

Click on:
a) INIT/CONFIG
b) INITIALIZE EEPROM
c) Answer YES to the dialog box, wait for initialization to complete

If you want to make sure the initialization was successful, click on:
d) LOAD FROM EEPROM
e) Answer YES to the dialog box, and wait until the "DONE" message appears.
f) SHOW EE IMAGE on the menu bar. The upper right hand window should display zeros in all locations or other default values.

Set the PC Control Panel to the following initial default settings.

NAV_AGC	63
NAV_VCO	20
FILT_OUT	32
COM_VCO	32
COM_AGC	63
FILT_IN	32
COM SQL	63
REF_FREQ	40
PRESEL4	18, 0, 32, 0, 47 *
PRESEL3	18, 0, 32, 0, 47 *
PRESEL2	18, 0, 32, 0, 47 *
PRESEL1	13, 0, 28, 0, 42 *
RX/TX	RX
NAV Band	113.600-117.950MHz
Compressor	On
NAV Freq	117.950MHz
COM Freq	136.900MHz
Interpolate for Temp	Off
Interpolate for Freq	X

* For frequencies 118.1, 122.75, 127.5, 132.25 & 136.9 MHz respectively.

2.1.2 Test Equipment initial setting

All RF power level are “easy microvolts” (no 6dB pad). All power levels are at the receiver antenna connections.

Set Power Supplies to +5.25+/-.1V, +9.35+/-.05V and -12+/-.3V.

Signal Generator frequency to 136.900MHz and level to -67dBm.

2.1.3 Reference Oscillator, COM VCO, TX Drive and NAV VCO alignment.

Verify that the voltage at U27, pin 1, is 8.4 +/- .2 VDC.

2.1.3.1 25 KHz Radio

Connect the Frequency Counter to P3007-2. Adjust REF_FREQ until reference frequency is 20.950000MHz +/- 20 Hz. Store to EEPROM.

Tune COM Receiver to 136.900MHz. Monitor the DC voltage at TP3 (or P3001-12). Adjust COM_VCO for 8.4 +.1/-.4 V tuning voltage at TP3. Tune the receiver to 118MHz and select TX mode. Check that the tuning voltage is not less than 2.4 V. Select the value of C129 as required. If necessary, readjust COM_VCO tuning voltage upward to as high as 8.7 V max. at 136.900 MHz RX, to ensure that it remains above 2.4 V min at 118MHz TX. If it is necessary to increase the 136.900 MHz RX tuning voltage above 8.50 V, temporarily lower the 9 V live voltage down to 9.0 V (measured at P3001-17), and ensure that the Com synthesizer remains locked. Store to EEPROM.

2.1.3.2 8.33 KHz Radio

Connect the Frequency Counter to C172. Adjust TCXO until reference frequency is 20.950000MHz +/- 20 Hz.

Tune COM Receiver to 136.900MHz. Monitor the DC voltage at TP3 (or P3001-12). Adjust C146 for 8.4 +.1/-.4 V tuning voltage at TP3. Tune the receiver to 118MHz and select TX mode. Check that the tuning voltage is not less than 2.4 V. If necessary, readjust C146 tuning voltage upward to as high as 8.7 V max. at 136.900 MHz RX, to ensure that it remains above 2.4 V min at 118MHz TX. If it is necessary to increase the 136.900 MHz RX tuning voltage above 8.50 V, temporarily lower the 9 V live voltage down to 9.0 V (measured at P3001-17), and ensure that the Com synthesizer remains locked.

2.1.3.3 25 KHz / 8.33 KHz Radio

Monitor the level at J3005 when in the transmit mode at 127.5 MHz. Make this measurement with either a 50 ohm spectrum analyzer or a milli-wattmeter preceded by an appropriate lowpass filter to exclude the effects of the harmonic energy. Select R3095, if necessary, to provide +15.5 dBm ±1 dB.

Tune NAV Receiver to 117.950MHz, RX mode. Monitor the DC voltage at TP8 (or P3001-26). Adjust NAV_VCO for 7.25V+1.0/-.75V at TP8. Tune the NAV Receiver to 108.05MHz. Verify TP8 voltage is not less than 3.0V. If it is not, adjust NAV_VCO so that the 117.950MHz and 108.050MHz can be tuned while maintaining a maximum of 8.25 V and a minimum of 3.0 V. Store to EEPROM.

2.1.4 COM RF Preselector and IF Filter Alignment for 200-09061-0010 Boards

2.1.4.1 PRESELECTOR

Monitor the DC IF AGC voltage on P3002-3. Ensure that the COM preselector cover is in place.

Set the receiver frequency to 118.1 MHz receiver. Apply an input signal at the receiver input (J3006) at a frequency of 118.1 MHz. Adjust the input level such that an AGC voltage of NMT 1.5 V is observed.

Sequentially adjust the PRESEL1, PRESEL2, PRESEL3 and PRESEL4 for maximum AGC voltage. Reduce the input level as required to keep the AGC voltage less than 1.5 V. Repeat this sequence as required until no further improvement is noted. Click on the STORE TO EEPROM and answer YES to the dialog box.

Repeat the above steps at frequencies of 127.5 MHz and 136.9 MHz. (Frequencies 122.75 and 132.75 MHz are not programmed).

2.1.4.1 PRESELECTOR Alternate Procedure

If a spectrum analyzer and tracking generator are available, the following procedure may be used in lieu of the above AGC method in the factory. A modified COM preselector cover with a hole to allow access to U28 should be used during this procedure.
Apply a tracking generator to the input of the Com receiver (J3006) at a level of -30 dBm. Monitor U28, pin 4 with a RF high impedance probe connected to a spectrum analyzer, span 25 MHz, 5 dB/div.

Set the receiver frequency and the spectrum analyzer/tracking generator to Fc = 118.1 MHz. Adjust PRESEL1, PRESEL2, PRESEL3, and PRESEL4 for a rather symmetrical waveform with a single peak in the passband response. Typical -3 dB points should be Fc +/- .8 to 1 MHz; typical -30 dB points should be Fc +/- 5 to 7 MHz. Click on STORE TO EEPROM and answer YES to the dialog box.

Repeat the above steps at Fc = 127.5 MHz and 136.9 MHz. (Frequencies 122.75 and 132.75 MHz are not programmed).

2.1.4.3 IF FILTER

2.1.4.3.1 25 KHz Radio

Tune the COM Receiver to 118.100MHz. Apply a 118.100MHz, -50dBm, FM signal sin wave modulated with 30KHz peak deviation at a 100Hz rate to the COM antenna input. Do not readjust signal generator power level. Monitor TP31 or U15-18 using a scope probe and oscilloscope. Set scope for .2 msec/div. and external trigger on the sin wave modulation generator. Adjust FLT_IN and FLT_OUT so that the 21.4MHz envelope is at a maximum flat response. Press store button to store information in the EEPROM.

2.1.4.3.2 8.33 KHz Radio

Tune the COM Receiver to 118.100MHz. Apply a 118.100MHz, -50dBm, FM signal sin wave modulated with 25KHz peak deviation at a 50Hz rate to the COM antenna input. Do not readjust signal generator power level.

Using a Spectrum Analyzer monitor IF out (E13) on IF Filter board. Set the Spectrum Analyzer for 21.4MHz , SWP 2sec, Res BW 300Hz, and a 20KHz Span for Narrow Bandwidth, 50KHz Span for Wide bandwidth. Adjust C35 and C36 for Wide BW; adjust C33 and C34 for Narrow BW so that the 21.4MHz envelope is at a maximum flat response.

2.1.5 COM RF AGC Alignment

Ensure that the Com Preselector cover is in place. Tune the COM Receiver to 127.500 MHz. Monitor the DC RF AGC voltage on P3003-2. Note the RF AGC value with no input signal. Adjust the Signal Generator to 127.500MHz with a level of - 80 dBm, 30% modulated with 1 kHz and apply it to the Com receiver. Adjust the COM_AGC so that P3003-2 drops to at least 0.5 V less than the voltage observed with no input signal. Increase the input level to +6 dBm and monitor the Com audio output (P3002-1) on a scope. Ensure that the 1 kHz signal is not noticeably distorted. If necessary, readjust the COM_AGC up to 2 steps either direction to minimize distortion with the + 6 dBm input.

2.1.6 COM RF Squelch Alignment

Tune the COM Receiver to 127.500 MHz. Set Signal Generator to 127.500MHz, 1KHz 30% AM with a power level of -106dbm. Monitor the COM Audio at TP1 (P3002-1) with an oscilloscope. Adjust COM_SQL so that it opens at -106dbm. Press the store button to store information in the EEPROM.

2.1.7 NAV RF Preselector Alignment

Attach an RF cable to the Nav receiver input (E3001) via a temporary L3043 and C3339 configured as per the schematic drawing 002-09061-00XX. Attach the RF cable braid to the NAV preselector fence. Monitor the DC IF AGC voltage at TP7 (or P3001-28) using a DVM. Ground TP22, TP24, TP26, and TP28 (grounding can be done by placing a blob of solder between each of these test-points and an adjacent grounded testpoints). Set signal generator for +10dBm power level initially. Signal Generator power level should be varied as necessary to keep the TP7 AGC voltage between 1.2 and 1.6V. Set the NAV band to 108-113.55 MHz band.

Tune NAV receiver to 110.70MHz. Apply a 110.70MHz signal from a signal generator to the NAV antenna input. Adjust C303 (Pole 1) for a maximum voltage at TP7.

Tune NAV receiver to 109.80MHz. Apply a 109.80MHz signal from a signal generator to the NAV antenna input. Disconnect TP22 ground jumper and connect TP20 ground jumper. Adjust C220 (Pole 2) for a maximum voltage at TP7.

Tune NAV receiver to 112.20MHz. Apply a 112.20MHz signal from a signal generator to the NAV antenna input. Disconnect TP24 ground jumper and connect TP22 ground jumper. Adjust C236 (Pole 3) for a maximum voltage at TP7.

Tune NAV receiver to 113.00MHz. Apply a 113.00MHz signal from a signal generator to the NAV antenna input. Disconnect TP26 ground jumper and connect TP24 ground jumper. Adjust C252 (Pole 4) for a maximum voltage at TP7.

Set the NAV band to 113.6-118 MHz band. Tune NAV receiver to 113.80MHz. Apply a 113.80MHz signal from a signal generator to the NAV antenna input. Disconnect TP28 ground jumper and connect TP26 ground jumper. Adjust C305 (Pole 5) for a maximum voltage at TP7.

Remove all ground jumpers.

2.1.8 NAV IF Filter Alignment

Tune NAV receiver to 115.500MHz. Apply a 115.500MHz, -50 dBm, FM signal sine wave modulated with 30 KHz peak deviation at a 30 Hz rate to the NAV antenna input.

Monitor TP30 (Q35 collector) using a scope probe and oscilloscope. Set scope for 1msec/div and external trigger on the sine wave modulation generator. Adjust L33 and L34 so that the 20.5MHz envelope is at a maximum flat response.

2.1.9 NAV RF AGC Alignment

Tune NAV receiver to 115.5 MHz. Apply a -70 dBm, 115.5 MHz , 30 % modulated at 1kHz, input signal and adjust NAV_AGC for 0 +/- 0.35VDC at P3001-29. Increase the input level to +6 dBm and monitor the composite output (P3001-24) on a scope. Ensure that the 1 kHz signal is not noticeably distorted. Store to EEPROM.

Receiver Board Test Set Up

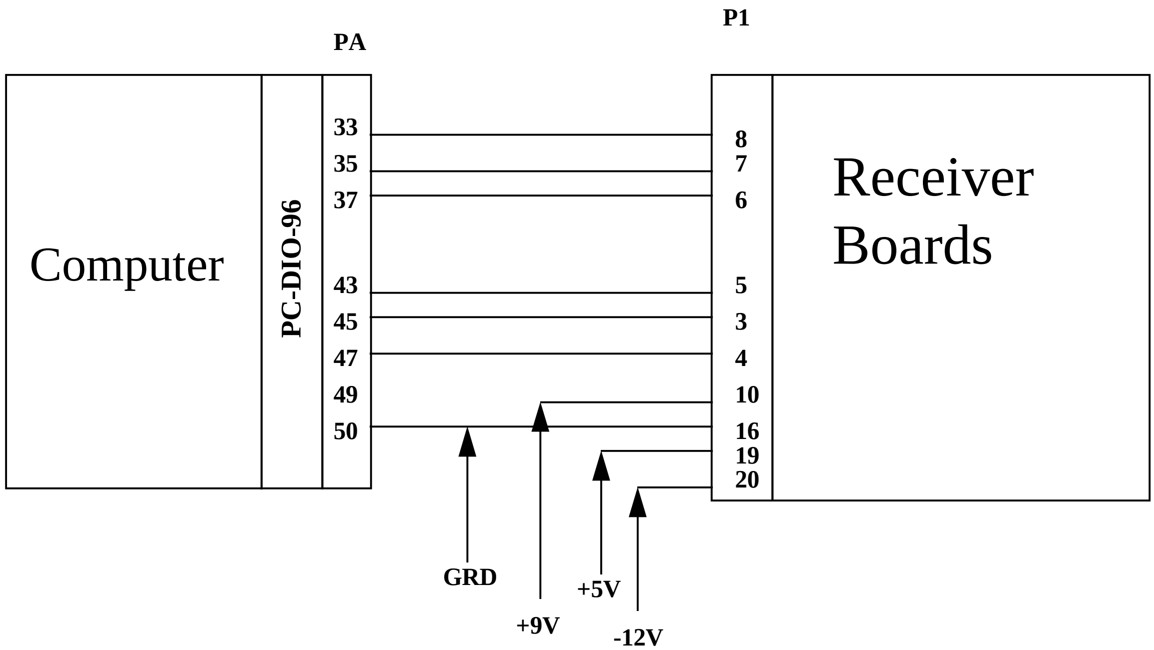

Figure 1 – Receiver Board Test Setup

2.1.10 EEPROM Temperature Compensation

Temperature Compensation Definition:

The microprocessor has the ability to change the D/A setting of various adjustments to compensate for temperature variations. A temperature sensor on the unit's Main Board is used to determine the temperature inside the KX155A. For the temperature compensated adjustments, the EEPRPOM contains either 5, 11 or 23 values corresponding to the temperature points defined below. These temperature values can be input to the EEPROM by using the above Receiver Board Test Set Up.

It should be noted that the NAV AGC, FILT IN , FILT OUT, COM RF AGC, COM SQL, and REF FREQ windows on the computer will always display the actual value sent to the D/A. At 25 degrees, this actual value is also stored in the 25 degree location in the EEPROM. However, for values at temperatures other than 25 degrees, the data stored in the EEPROM is the offset value referenced to the 25 C value. This offset value may be either a positive or a negative number. At temperatures between these data points, a linear interpolation is done. The default offset temperature value is 0.
Temperature Points:
Five points: -20, 0, 25, 50 and 75 degrees C.
Eleven points: -20, -15, -5, 5, 15, 25, 35, 45, 55, 65 and 75 degrees C.

Twenty-three points: -20, -15, -10, -5, 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70 , 75, 80 85 and 90 degrees C.

Adjustments that can be Temperature Compensated

The following adjustments can be temperature compensated.

NAV RF AGC - Increasing the value raises the RF input level at which the RF AGC becomes active. Five temperature points are utilized. Each increment in value changes the RF AGC point by about 4 dB.

FILT IN & FILT OUT- A higher value lowers the capacitance of the shunt LC network. Tuned for minimum passband ripple and loss. Five temperature points are utilized.

COM RF AGC - Increasing the value raises the RF input level at which the RF AGC and Carrier Squelch become active. Five temperature points are utilized. Each increment in value changes the AGC and the Carrier squelch point by about 2 dB.

COM SQL - Increasing the value allows the squelch to open on a signal containing more noise (i.e.: weaker signal) 11 temperature points are used. Separate settings are required for 8.3 kHz and 25 kHz operation. Each increment in value changes the noise squelch trip point by about 1 dB.

REF FREQ - Increasing the value raises the frequency of the reference oscillator. 23 temperature points are utilized. Each increment in value changes the 20.95 MHz reference frequency by about 20 Hz (or changes the TX Drive frequency by about 120 Hz). Not used in 8.33 kHz units.

Temperature Compensation Procedure

TEMPERATURE COMPENSATION MAY BE PERFORMED ONLY WITH THE APPROVAL OF THE TEST ENGINEER.   A WRITTEN RECORD OF THE TEMPERATURE COMPENSATION APPLIED TO EACH UNIT MUST BE GENERATED AND KEPT AS A PART OF THE UNIT’S RECORDS.

To load temperature compensation data using the Receiver Board Test Setup, perform the following steps:

1. In the TEMP window, type in the appropriate temperature point you wish to set.

2. In the appropriate window (NAV AGC, FILT IN , FILT OUT, COM RF AGC, COM SQL, or REF FREQ) adjust the value to the desired new value for the temperature displayed in the TEMP window.

3. Click on STORE TO EEPROM and answer Yes to the dialog box. Wait until the "DONE" message appears.

4. Repeat steps 2 and 3 as required to load compensation data into other EEPROM locations.
5. To verify the EEPROM data:
   a. Click on LOAD FROM EEPROM.
   b. Answer Yes to the dialog box , and wait until the "DONE" message appears.

c. Click on SHOW EE IMAGE on the menu bar. The upper right hand window should display the value of the memory locations. The following EEPROM map may be used to verify the comensation data. Temperature compensations are stored as + or - offset values from the 25 degree C data.

RECEIVER DATA EEPROM MAP

EEPROM Location	Temp deg C	Data Function			EEPROM Location	Freq MHz at 25 C	Data Function
3	-20	NAV_RF_AGC_1			49	118.1	COM_PRESEL_1_1
4	0	NAV_RF_AGC_2			50	118.1	COM_PRESEL_2_1
5	25	NAV_RF_AGC_3			51	118.1	COM_PRESEL_3_1
6	50	NAV_RF_AGC_4			52	118.1	COM_PRESEL_4_1
7	75	NAV_RF_AGC_5			53	122.75	COM_PRESEL_1_2
					54	122.75	COM_PRESEL_2_2
8	25	NAV_VCO			55	122.75	COM_PRESEL_3_2
					56	122.75	COM_PRESEL_4_2
9	-20	COM_SQUELCH_1_25KHZ			57	127.5	COM_PRESEL_1_3
10	-15	COM_SQUELCH_2_25KHZ			58	127.5	COM_PRESEL_2_3
11	-5	COM_SQUELCH_3_25KHZ			59	127.5	COM_PRESEL_3_3
12	5	COM_SQUELCH_4_25KHZ			60	127.5	COM_PRESEL_4_3
13	15	COM_SQUELCH_5_25KHZ			61	132.25	COM_PRESEL_1_4
14	25	COM_SQUELCH_6_25KHZ			62	132.25	COM_PRESEL_2_4
15	35	COM_SQUELCH_7_25KHZ			63	132.25	COM_PRESEL_3_4
16	45	COM_SQUELCH_8_25KHZ			64	132.25	COM_PRESEL_4_4
17	55	COM_SQUELCH_9_25KHZ			65	136.9	COM_PRESEL_1_5
18	65	COM_SQUELCH_10_25KHZ			66	136.9	COM_PRESEL_2_5
19	75	COM_SQUELCH_11_25KHZ			67	136.9	COM_PRESEL_3_5
					68	136.9	COM_PRESEL_4_5
20	25	COM_VCO					
21	-20	COM_RF_AGC_1					
22	0	COM_RF_AGC_2					
23	25	COM_RF_AGC_3					
24	50	COM_RF_AGC_4					
25	75	COM_RF_AGC_5					
26	-20	REF_FREQ_1					
27	-15	REF_FREQ_2					
28	-10	REF_FREQ_3					
29	-5	REF_FREQ_4					
30	0	REF_FREQ_5					
31	5	REF_FREQ_6					
32	10	REF_FREQ_7					
33	15	REF_FREQ_8					
34	20	REF_FREQ_9					
35	25	REF_FREQ_10					
36	30	REF_FREQ_11					
37	35	REF_FREQ_12					
38	40	REF_FREQ_13					
39	45	REF_FREQ_14					
40	50	REF_FREQ_15					
41	55	REF_FREQ_16					

42	60	REF_FREQ_17					
43	65	REF_FREQ_18					
44	70	REF_FREQ_19					
45	75	REF_FREQ_20					
46	80	REF_FREQ_21					
47	85	REF_FREQ_22					
48	90	REF_FREQ_23					
69	-20	IF_FILTER_IN_1					
70	-20	IF_FILTER_OUT_1					
71	0	IF_FILTER_IN_2					
72	0	IF_FILTER_OUT_2					
73	25	IF_FILTER_IN_3					
74	25	IF_FILTER_OUT_3					
75	50	IF_FILTER_IN_4					
76	50	IF_FILTER_OUT_4					
77	75	IF_FILTER_IN_5					
78	75	IF_FILTER_OUT_5					
79-167		TIME_TEMP_DATA					
168		RX_TEMP_OFFSET					
169-218		ERROR_MESSAGES					
219	-20	COM_SQUELCH_1_833KHZ					
220	-15	COM_SQUELCH_2_833KHZ					
221	-5	COM_SQUELCH_3_833KHZ					
222	5	COM_SQUELCH_4_833KHZ					
223	15	COM_SQUELCH_5_833KHZ					
224	25	COM_SQUELCH_6_833KHZ					
225	35	COM_SQUELCH_7_833KHZ					
226	45	COM_SQUELCH_8_833KHZ					
227	55	COM_SQUELCH_9_833KHZ					
228	65	COM_SQUELCH_10_833KHZ					
229	75	COM_SQUELCH_11_833KHZ					
230		COM_RX_VCO_OFFSET					
231-238		SPARE					
239-255		RX_TEST_BLOCK					

2.2 Transmitter

1. Transmitter should be mounted in base casting. Visually inspect the board to ensure all components are properly seated. Do not install transmitter shield at this time.

2. The turns spacing of L7, L12, L14 and L16 may be adjusted as necessary during this alignment process to obtain proper modulation and output power.

3. Using a known good 155A unit (KGU), attach P4004 to the MAIN Board J4 and P4005 to the RECEIVER Board J3005 of the KGU. Allow P4006 to remain disconnected, but verify the center conductor does not short against casting. Connect wattmeter to COMM ANT port.

4. Place the 155A unit in the ALIGN mode. With no modulation, adjust power output for 10 - 14watts at 118, 127.6, and 136.8 by adjusting TPWR.

5. Apply standard audio level to mic input. Verify COMPRESSOR pot values are at 0 on the KGU. Adjust MODULATION pot for 90% at 127.6 MHz by adjusting MIC. Set value for MODULATION pot at 118 and 136.8 for same reading obtained at 127.6. Adjust L12 for best symmetry of modulation versus frequency (i.e. 75% @ 118, 90% @ 127.6, 75% @ 136.8)

6. Remove modulation from the radio. Disconnect the radio from the 155A unit and connect it to a known good 165A unit.

7. Place the 165A unit in the ALIGN mode. With no modulation, adjust power output for 10.8 - 11.2watts at 118, 127.6, and 136.8 by adjusting TPWR.

8. Measure radio +28V current while transmitting into an open circuit for a minimum amount of time!!!! Transmitting for longer than 2 or 3 seconds risks destruction of the Transmitter's final transistor. Note the open circuit current draw at 118, 127.6, and 136.8 MHz.

9. If the open circuit current at 118 MHz is >3.5 amps, the value of C1 should be increased. Refer to the bill of material for optional values of C1.

10. Optimum tuning occurs when 118 MHz current is around 3 amps, and the 118 MHz current is roughly the same as the 136.8 MHz current. The 127.6 MHz current should be less than the other two.

11. OPTIONAL TEST - Plug P4006 into J3006 on RECEIVER board and check COMM Receiver Sensitivity to verify Receive path circuitry (CR3, P4006).

2.3 Main Board

None required

2.4 Audio Board

None Required

2.5 Front Panel

None Required

2.6 Glideslope Receiver

None Required

3. Unit Level Alignment

Most adjustments of the transceiver can be aligned from the front panel. Before placing the radio in alignment mode, leave the radio in the Com and Nav Active Entry mode before turning off the radio. To place the unit in the alignment mode, ground Pin C_ of P155A1, depress CHAN while turning the unit on and hold until the display shows "ALGN" on the Nav side of the display. Each line below represents a page that can be accessed by pushing the MODE button. The list of possible adjustments are shown in order below. The only adjustments that cannot be made via the front panel are Ident Bandstop Filter Adjust, R1096, VOR PLL ADJUST, R1008 and R1009 on the main board and R6024 (intercom mic gain) and R6046 (speaker power) on the audio board, as well as Nav preselector adjustments (C3303, C3220, C3236, C3252 and C3305) and Nav first IF filter adjustments (L3033 and L3034). On units equipped with a GS receiver, all GS adjustments are manual.

Adjustment	Mne-monic	Freq	Seq	Min	Max	De-fault	Address	Assy
Minimum Display Brightness	BRIM		0	0	255	20	168	main
Photocell Offset	PHOT		0	-99	99	0	166	main
Photocell Calibration	PHOF		0	-99	99	0	167	main
Sidetone Level	SIDE	127.6	0	0	255	127	169	main
Intercom	INTC	127.5	0	0	255	127	170	main
RX Compressor Disable	RDIS		0	0	1	0	171	main
VOR Centering offset	VORC	113.5	0	-99	99	0	172	main
LOC Centering offset	LOCC	111.7	0	-99	99	0	173	main
Glide Slope Centering offset	GSC	111.7	0	-99	99	0	228	main
Comm VCO alignment	CVCO	127.5	0	0	63	32	20	receiver
VOR/LOC Composite Level	COMP	111.7	0	0	255	127	4	main
Nav VCO Alignment	NVCO	113.5	0	0	63	20	8	receiver
Power Supply Voltage*	PSV		0	0	27	0	183	main
Temperature offset	TOFF	-50	0	-99	99	0	168	receiver
Comm Preselector tuning	CPRS	118.10	1	0	63	18	49	receiver
Comm Preselector tuning	CPRS	118.10	2	0	63	18	50	receiver
Comm Preselector tuning	CPRS	118.10	3	0	63	18	51	receiver
Comm Preselector tuning	CPRS	118.10	4	0	63	13	52	receiver
Comm Preselector tuning	CPRS	122.75	1	0	63	0	53	receiver
Comm Preselector tuning	CPRS	122.75	2	0	63	0	54	receiver
Comm Preselector tuning	CPRS	122.75	3	0	63	0	55	receiver
Comm Preselector tuning	CPRS	122.75	4	0	63	0	56	receiver
Comm Preselector tuning	CPRS	127.50	1	0	63	32	57	receiver
Comm Preselector tuning	CPRS	127.50	2	0	63	32	58	receiver
Comm Preselector tuning	CPRS	127.50	3	0	63	32	59	receiver
Comm Preselector tuning	CPRS	127.50	4	0	63	28	60	receiver
Comm Preselector tuning	CPRS	132.25	1	0	63	0	61	receiver
Comm Preselector tuning	CPRS	132.25	2	0	63	0	62	receiver
Comm Preselector tuning	CPRS	132.25	3	0	63	0	63	receiver
Comm Preselector tuning	CPRS	132.25	4	0	63	0	64	receiver
Comm Preselector tuning	CPRS	136.97	1	0	63	47	65	receiver
Comm Preselector tuning	CPRS	136.97	2	0	63	47	66	receiver
Comm Preselector tuning	CPRS	136.97	3	0	63	47	67	receiver
Comm Preselector tuning	CPRS	136.97	4	0	63	42	68	receiver
NAV RF AGC Threshold	NRAG	113.50	0	0	255	63	5	receiver
COM S/N Squelch (25kHz)	SNSQ	127.50	0	0	255	63	14	receiver

Adjustment	Mne-monic	Freq	Seq	Min	Max	De-fault	Address	Assy
COM S/N Squelch (8.33kHz)*	SNS8	127.500	0	0	255	63	224	receiver
Comm RF AGC Threshold	CRAG	127.50	0	0	255	63	23	receiver
RX Reference Frequency	REF	127.50	0	0	255	40	35	receiver
IF Filter	IFLT	127.50	1	0	255	32	73	receiver
IF Filter	IFLT	127.50	2	0	255	32	74	receiver
Transmitter power set at 10w	TPWR	118.00	1	0	255	148	174	main
Transmitter power set at 10w	TPWR	127.60	2	0	255	141	175	main
Transmitter power set at 10w	TPWR	136.80	3	0	255	137	176	main
Comm Mic Gain at 10w	MIC	118.00	1	0	255	38	177	main
Comm Mic Gain at 10w	MIC	127.60	2	0	255	22	178	main
Comm Mic Gain at 10w	MIC	136.80	3	0	255	16	179	main
Compressor threshold at 10w	COMT	118.00	1	0	255	3	180	main
Compressor threshold at 10w	COMT	127.60	2	0	255	15	181	main
Compressor threshold at 10w	COMT	136.80	3	0	255	23	182	main
Carrier Fade*	FADE	118.00	1	0	255	127	184	main
Carrier Fade*	FADE	127.60	2	0	255	127	185	main
Carrier Fade*	FADE	136.80	3	0	255	127	186	main
Transmitter power set at 5w	TPW5	118.00	1	0	255	84	187	main
Transmitter power set at 5w	TPW5	127.60	2	0	255	81	188	main
Transmitter power set at 5w	TPW5	136.80	3	0	255	79	189	main
Comm Mic Gain at 5w	MIC5	118.00	1	0	255	20	190	main
Comm Mic Gain at 5w	MIC5	127.60	2	0	255	14	191	main
Comm Mic Gain at 5w	MIC5	136.80	3	0	255	9	192	main
Compressor threshold at 5w	CMT5	118.00	1	0	255	17	193	main
Compressor threshold at 5w	CMT5	127.60	2	0	255	24	194	main
Compressor threshold at 5w	CMT5	136.80	3	0	255	31	195	main
Transmitter power set at 2w	TPW2	118.00	1	0	255	35	196	main
Transmitter power set at 2w	TPW2	127.60	2	0	255	33	197	main
Transmitter power set at 2w	TPW2	136.80	3	0	255	31	198	main
Comm Mic Gain at 2w	MIC2	118.00	1	0	255	12	199	main
Comm Mic Gain at 2w	MIC2	127.60	2	0	255	9	200	main
Comm Mic Gain at 2w	MIC2	136.80	3	0	255	5	201	main
Compressor threshold at 2w	CMT2	118.00	1	0	255	27	202	main
Compressor threshold at 2w	CMT2	127.60	2	0	255	32	203	main
Compressor threshold at 2w	CMT2	136.80	3	0	255	37	204	main
Transmitter Ambient Offset	TAOS		0	-99	99	-20	205	main
VOR/LOC Converter Offset	VLCO	111.7	0	-99	99	0	206	main
VOR/LOC Converter Width	VLCW	111.7	0	0	255	127	207	main
GS Centering Offset	GSCO	333.5	0	-99	99	0	226	main
GS Converter Course Width	GSCW	333.5	0	0	255	127	227	main

* Not currently used.

3.1 Main Board

3.2 *Display*

3.2.1 Photo Cell

1. Go to PHOT page.
2. Adjust the Nav INC/DEC knob to achieve the desired brightness when a pen light or a calibrated light source is placed over the photocell.

3.2.2 Display Brightness

1. Go to the BRIM page.
2. Adjust the Nav INC/DEC knob to achieve the desired brightness during minimum ambient light.

3.3 Communication Receiver Alignment

The following receiver adjustments do not need to be made if the preliminary adjustments were made in sections 2.1.3 - 2.1.6 Otherwise, the receiver may be aligned with an assembled unit.

3.3.1 Reference Oscillator

1. Connect the Frequency Counter to P3007-2. Optionally connect comm antenna to a frequency counter through appropriate attenuator and key the transmitter to read frequency.

2. Go to REF page and adjust frequency using the NAV inc/dec knobs until the reference frequency is 20.950000MHz +/- 20 Hz. (+/- 122 Hz at 127.5 MHz in transmit)

3.3.2 COM VCO and TX Drive

1. Tune COM Receiver to 136.900MHz.

2. Monitor the DC voltage at TP3 (or P3001-12).

3. Go to CVCO and adjust for 8.4 +.1/-.4 V tuning voltage at TP3003 using the Nav inc/dec knobs.

4. Tune the receiver to 118.0 MHz and depress MIC KEY, P155A1-6 on the rear connector to engage TX mode. Caution: connect a dummy load to the Com antenna connector.

5. Check that the tuning voltage is not less than 2.4 V. Select the value of C129 as required. If necessary, readjust the voltage upward to as high as 8.7 V max at 136.900 MHz RX, to ensure that it remains above

2.4 V min at 118 MHz TX. Do not exceed 8.50 V tuning voltage on any unit which has a 9 V line voltage (measured at P3001-17) of less than 9.1 V.

6. This step need be performed only if a component in the Q3015 circuit has been changed. Disconnect P4005 from J3005. Terminate the transmitter (P155A3) into 50 ohms. Monitor the level at J3005 when in the transmit mode at 127.5 MHz. Make this measurement with either a 50 ohm spectrum analyzer or a milli-wattmeter preceded by an appropriate lowpass filter to exclude the effects of the harmonic energy. Select R3095, if necessary, to provide +15.5 dBm ±1 dB.

3.3.3 COM RF Preselector and IF Filter Alignment for 200-09061-0010 Boards

1. Monitor the DC IF AGC voltage on P3002-3. Ensure that the COM preselector cover is in place.

2. Set the receiver frequency to 118.1 MHz receiver. Apply an input signal at the receiver input (J3006) at a frequency of 118.1 MHz. Adjust the input level such that an AGC voltage of NMT 1.5 V is observed.

3. Sequentially adjust the CPRS1, CPRS2, CPRS3 and CPRS4 for maximum AGC voltage. Reduce the input level as required to keep the AGC voltage less than 1.5 V. Repeat this sequence as required until no further improvement is noted.

4. Repeat the above steps at frequencies of 127.5 MHz and 136.9 MHz. (Frequencies 122.75 and 132.75 MHz are not programmed).

5. Tune the COM Receiver to 118.100MHz. Apply a 118.100MHz, -50dBm, FM signal sine wave modulated with 30kHz peak deviation at a 100Hz rate to the COM antenna input. Do not readjust signal generator power level. Monitor U3015-18 using a scope probe and oscilloscope. Set scope for .2 msec/div. and external trigger on the sine wave modulation generator. Adjust the Nav inc/dec knobs in each of the two IFLT pages so that the 21.4MHz envelope is at a maximum flat response.

3.3.4 COM RF AGC Alignment

1. Ensure that the Com preselector cover is in place. Tune the COM Receiver to 127.500 MHz. Note the Com RF AGC voltage on P3003-2 with no input signal applied to the receiver.

2. Adjust the Signal Generator to 127.500MHz with a level of -80 dBm. 30% AM modulated with 1 kHz and apply the signal to the Com receiver.

3. Continue to monitor the Com RF AGC voltage on P3003-2.

4. Adjust the Nav inc/dec knobs so that CRAG value decreases until the RF AGC voltage drops to at least 0.5 V less than the voltage observed with no input signal.

5. Increase the input level to +6dBm and monitor the Comm audio output at P3002-1. Ensure the audio signal is not noticeably distorted. If necessary, readjust the COM_AGC up to 2 steps either direction to minimize distortion with the +6 dBm input.

3.3.5 COM RF Squelch Alignment

3.3.5.1 25 KHz Radio

1 Tune the COM Receiver to 127.500 MHz.
2 Set Signal Generator to 127.500MHz, 1KHz 30% AM with a power level of -107dbm.
3 Monitor the COM Audio at TP3001 (P3002-A) with an oscilloscope.
4 Adjust Nav inc/dec knobs so that SNSQ opens at -106dBm.

3.3.5.2 8.33 KHz Radio

1 Tune the COM Receiver to 127.500 MHz.
2 Set Signal Generator to 127.500MHz, 1KHz 30% AM with a power level of -107dbm.
3 Monitor the COM Audio at TP3001 (P3002-A) with an oscilloscope.
4 Adjust Nav inc/dec knobs so that SNS8 opens at -106dBm.

3.4 Navigation Receiver Alignment

3.4.1 NAV VCO

1. Tune NAV Receiver to 117.950Mhz.

2. Monitor the DC voltage at TP3008 (or P3001-26).

3. Go to NVCO and adjust for 7.25V +1.0/-.75 at TP8 using Nav inc/dec knobs.

4. Tune the NAV Receiver to 108.05MHz.

5. Verify TP8 voltage is not less than 3.0V. If it is not, adjust NVCO so that the 117.950MHz and 108.050MHz can be tuned while maintaining a maximum of 8.25 V and a minimum of 3.0 V.

3.4.2 NAV RF Preselector Alignment

1. Monitor the DC IF AGC voltage at TP7 (or P3001-28) using a DVM. Ground TP3022, TP3024, TP3026, and TP3028 (grounding can be done by placing a blob of solder between each of these testpoints and an adjacent grounded testpoints). Set signal generator for +10dBm power level initially. Signal Generator power level should be varied as necessary to keep the TP3007 AGC voltage between 1.2 and 1.6V. Set the NAV band to 108-113.55 MHz band.

2. Tune NAV receiver to 110.70MHz. Apply a 110.70MHz signal from a signal generator to the NAV antenna input. Adjust C303 (Pole 1) for a maximum voltage at TP3007.

3. Tune NAV receiver to 109.80MHz. Apply a 109.80MHz signal from a signal generator to the NAV antenna input. Disconnect TP22 ground jumper and connect TP3020 ground jumper. Adjust C220 (Pole 2) for a maximum voltage at TP3007.

4. Tune NAV receiver to 112.20MHz. Apply a 112.20MHz signal from a signal generator to the NAV antenna input. Disconnect TP3024 ground jumper and connect TP3022 ground jumper. Adjust C236 (Pole 3) for a maximum voltage at TP3007.

5. Tune NAV receiver to 113.00MHz. Apply a 113.00MHz signal from a signal generator to the NAV antenna input. Disconnect TP3026 ground jumper and connect TP3024 ground jumper. Adjust C252 (Pole 4) for a maximum voltage at TP3007.

6. Set the NAV band to 113.60-118 MHz band. Tune NAV receiver to 113.80MHz. Apply a 113.80MHz signal from a signal generator to the NAV antenna input. Disconnect TP3028 ground jumper and connect TP3026 ground jumper. Adjust C305 (Pole 5) for a maximum voltage at TP3007.

7. Remove all ground jumpers.

3.4.3 NAV IF Filter Alignment

1. Tune NAV receiver to 113.500MHz. Apply a 113.500MHz, -50 dBm, FM signal sine wave modulated with 30 KHz peak deviation at a 30 Hz rate to the NAV antenna input.

2. Monitor TP3030 (Q3035 collector) using a scope probe and oscilloscope. Set scope for 1msec/div and external trigger on the sin wave modulation generator. Adjust L3033 and L3034 so that the 20.5MHz envelope is at a maximum flat response.

3.4.4 NAV RF AGC Alignment

1. Tune NAV receiver to 113.5 MHz. Apply a -70 dBm, 113.5 MHz , 30 % modulated at 1kHz, input signal and adjust NAV_AGC for 0 +/- 0.35VDC at P3001-29. Increase the input level to +6 dBm and monitor the composite output (P3001-24) on a scope. Ensure that the 1 kHz signal is not noticeably distorted.

3.4.5 PLL (manual adjustment)

3.4.5.2 REV 1 PCB

1. Attach a frequency counter to TP1001.

2. Use test leads or some other suitable means to short TP1004 to TP 1002. When properly shorted, the output signal will be a very stable reading on a frequency counter.

3. Adjust potentiometer R1007 for an output frequency of 8930Hz +/- 160Hz.

4. Remove the short between TP1004 and TP1002. Short TP1004 to TP1003.

5. Adjust potentiometer R1008 for an output frequency of 11360Hz +/- 250Hz.

3.4.6 LOC converter

3.4.6.1 Internal Converter Center Offset (KX 165A)

1. Go to VLCO page.

2. Monitor the voltage between +LEFT and +RIGHT (P165A2-J and P165A2-5) with a DVM set to show Volts to 4 decimal places.

3. Adjust VLCO using the NAV inc/dec knobs to achieve a reading of 0.0000V $\pm$ 0.0002V.

3.4.6.2 Internal Converter Course Width (KX 165A)

1. Go to the VLCW page.

2. Adjust VLCW using the NAV inc/dec knobs to achieve a reading of 0.1500V $\pm$ 0.0002V.

3.4.6.3 LOC Centering

1. Go to LOC C page and inject a standard LOC centering signal at 111.70 MHz, -73dBm.

Push the Nav Frequency Transfer button. The Unit display will flash as the calibration is performed automatically.

3.4.7 VOR converter

1. GO to VORC page and inject a standard VOR test signal at with 0 degree from at 113.50MHz, -73 dBm.
2. Push the Nav Frequency Transfer button. The Unit display will flash as the calibration is performed automatically.

3.4.8 VOR/LOC Composite Level

1. Apply a standard localizer centering signal with the 90 Hz component removed at 111.7mhz, -73dBm to the NAV antenna.
2. Monitor the composite level at P155A1pin H with an rms voltmeter.
3. Adjust COMP using the NAV inc/dec knobs so that the composite level is NLT 0.267VRMS and NMT 0.277 VRMS.

3.4.9 Ident (manual adjustment)

1. Input a standard VOR test signal with modulation of 1020Hz, -73dBm at 30%.
2. Push in the ident switch.
3. Adjust R1096 for a minimum audio output. Requirement is 15 dB of attenuation minimum with ident switch out vs in.

3.5 Comm Transmitter

3.5.1 Power and Modulation

1. In the 10 watt ALIGN page, set output power for 10.8 - 11.2 watts at 118, 127.6, and 136.8 MHz with no modulation by adjusting TPWR.

2. With audio input of 150 ± 10m Vrms @ 1kHz sinewave and COMPRESSOR pot, COMT, set to 0, adjust modulation for NLT 90% and NMT 95% at 118, 127.6, and 136.8 MHz by adjusting MIC.

3. Raise audio input level to 500 ± 10m Vrms. Adjust COMPRESSOR pot, COMT, for NLT 78% but NMT 82% modulation at 118, 127.6, and 136.8 MHz.

4. In the 5 watt ALIGN page, set output power for 10.8 –11.2 watts at 118, 127.6, and 136.8 MHz with no modulation by adjusting TPW5.

5. With audio input of 150 ± 10m Vrms @ 1 kHz sinewave and COMPRESSOR pot, CMT5, set to 0, adjust modulation for NLT 90% and NMT 95% at 118, 127.6, and 136.8 MHz by adjusting MIC5.

6. Raise audio input level to 500 ± 10m Vrms. Adjust COMPRESSOR pot, CMT5, for NLT 78% but NMT 82% modulation at 118, 127.6, and 136.8 MHz.

7. In the 2 watt ALIGN page, set output power for 4 +/- .5 watts at 118, 127.6, and 136.8 MHz with no modulation.

8. With audio input to of 150 ± 10m Vrms @ 1 kHz sinewave and COMPRESSOR pot, CMT2, set to 0, adjust modulation for NLT 90%and NMT 95% at 118, 127.6, and 136.8 MHz by adjusting MIC2.

9. Raise audio input level to 500 ± 10m Vrms. Adjust COMPRESSOR pot, CMT2, for NLT 78% but NMT 82% modulation at 118, 127.6, and 136.8 MHz.

10. Verify that the temperature offset TOFF has been set properly (typical value is 0). Set Transmitter Ambient Offset TAOS to -7 for units with glideslope, -4 for units without glideslope.

3.5.2 Sidetone Level

1. Go to SIDE page
2. Input a 200mVrms, 1kHz tone into the COMM MIC AUDIO INPUT P155A1-2.
3. Place the unit into transmit by grounding MIC KEY, P155A1-6.
4. Monitor the audio level out of COMM AUDIO/SIDETONE/INTERCOM OUT, P155A1-9.
5. Adjust Nav frequency knobs for NLT 1.3VRMS and NMT 1.5VRMS.

3.5.3 Intercom

1. Go to INTC page
2. Input a 200mVrms, 1kHz tone into the INTERCOM MIC P155A1-B.

3. Monitor the audio level out of COMM AUDIO/SIDETONE/INTERCOM OUT, P155A1-9.
4. Adjust Nav inc/dec knobs for NLT 7.07 VRMS.

3.6 Glideslope Receiver Alignment

Initial settings: R25 fully CCW

3.6.1 Reference Oscillator

1. Monitor TP9 using a counter.

2. Adjust C66 so that the frequency is 20.950 MHz +/- 10Hz (+/- 0.5 ppm).

3. If it is not possible to set the crystal oscillator within specification, the value of C68 can be changed according to values listed in the 200-09060-0000 Bill of Materials. If the crystal oscillator frequency is too high, increase the value of C68. If the crystal oscillator is too low, lower the value of C68.

3.6.2 VCO Adjustment

1. Channel the NAV receiver to 109.3 MHz (332 MHz GS channel, 331.970 GS LO frequency).

2. Monitor the DC voltage at TP3.

4. Adjust C75 for 4.0 +/- 0.1V.

5. If it is not possible to set the VCO within specification, the value of C73 can be changed according to values listed in the 200-09060-0000 Bill of Materials. If the VCO TP3 voltage is too high, decrease the value of C73. If the VCO TP3 voltage is too low, increase the value of C73.

3.6.3 RF Front End Alignment

1. Channel the NAV receiver to 109.3 MHz (332 MHz GS channel, 331.970 GS LO frequency).

2. Monitor TP6 with a DVM having 1mV resolution.

3. Apply a 332 MHz RF input at –87 dBm.

4. Adjust L5, L6, and L13 to maximize the voltage at TP6. If necessary, increase the RF input power so that TP6 voltage changes can be seen when adjusting L5, L6, and L13. Reduce input power to –87 dBm for final adjustment.

5. If it is not possible to set L5 to maximize the voltage at TP6, the value of C48 can be changed according to values listed in the 200-09060-0000 Bill of Materials.

3.6.4 R.F. A.G.C. Adjustment

1. Channel the NAV receiver to 109.3 MHz (332 MHz GS channel, 331.970 GS LO frequency).

2. Input a –87dBm signal at 332 MHz.

3. Monitor TP6 with a DVM having 1mV resolution.

4. Adjust R25 so that the voltage at TP6 drops 0.05 +/- 0.01 V.

3.6.5 Convertor Width and Centering Adjustment

1. Monitor the voltage between the GS UP and GS DOWN pins (P2-15 and 16) with a DVM having 0.1mV resolution.

2. Go to the GSC0 Alignment page.

3. Adjust GSC0 for 0.0 +/- 0.2 mV.

4. Go to the GSCW Alignment page.
5. Adjust GSCW for 150 +/-0.1mV.

3.6.6 Glideslope Receiver Centering Alignment

1. Go to the GSC Alignment page.

2. Connect a –76 dBm, 0.000 ddm, 333.5 MHz Glideslope signal to the antenna port.

3. Press the timer button to start the alignment.

4. When the display stops flashing, a number should be visible. If "---" is displayed, the alignment was not good and must be repeated.