Note: This Tune Up Procedure is taken from Section 2.5 of the report

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure

In the following procedure, the complete multi-channel translator is adjusted for optimum performance. This alignment procedure is performed by adjusting each circuit for its specified performance while observing the appropriate output parameters of the board or subassembly being adjusted.

Because of the broadband nature of the amplifier stages, this is a straightforward procedure, easily accomplished is RF test equipment is available. In this procedure, the input signals are first connected and each circuit is adjusted in sequence by connecting the test equipment to the specified point.

Equipment required:

1. Spectrum Analyzer (with tracking generator)
2. Network Analyzer
3. Power Meter
4. Multi-channel test signal
5. 30 dB Coupler
6. Attenuators
7. Digital Multimeter (DMM)
8. Frequency Counter

Translator (ITS-717)

VHF Generator, X8 Multiplier, UHF Bandpass Filter, X3 Multiplier
(A28, A29-1, A30, A31) 1500-1102, 1067-1109, 1107-1101, 1003-1004

1. Connect frequency counter to 10 MHz input cable (J3) of VHF Generator Board and adjust the 10 MHz oscillator for 10 MHz ±1Hz..

2. With J2 and J3 jumpers removed, adjust R19 for –3.0 volts at TP3.

3. Monitor J15 with a spectrum analyzer and J16 with a frequency counter.

4. Adjust L3, .L4, C12 and C21 to peak output signal at J15.

5. Adjust C11 for the correct frequency ±20Hz.

6. Reconnect jumpers on J2 and .J3 and reconnect J15.

7. Visually monitor DS1 to verify PLL locks. If Pll remains unlocked, use oscilloscope to minimize spikes on chip U1 by adjusting R46.

8. Monitor J2 on X8 Multiplier assembly with spectrum analyzer with center frequency set to eight times the crystal frequency.

9. Maximize the eigth harmonic (10 to 13 dBm) and minimize the seventh and nineth harmonic by adjusting C4, C6, C10, C12, C18 and C20.

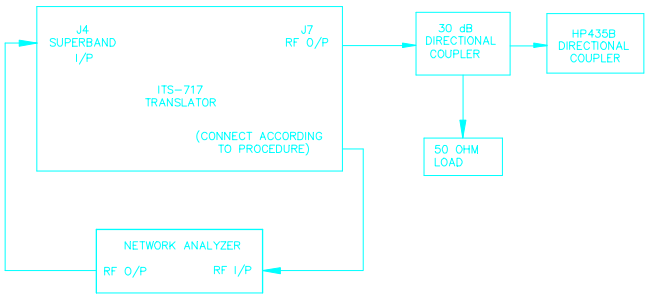
10. Reconnect J2 and connect analyzer to the output of the UHF Bandpass Filter (A30).

11. Tune filter to maximize the eighth harmonic of the crystal. Seventh and nineth harmonic should be at least 55 dB below eighth harmonic peak.

12. Monitor the output of the X3 Multiplier and tune filter to peak the LO (2278 MHz) signal.

Superband Bandpass Filter, 4 Section Bandpass Filter, 3 Section Broadband Filter
(A24-A1, A26, A11) 1509-1107, 2140-1043, 2500-2700

1 . Normalize cables of the network analyzer and connect the analyzer as shown below. Set analyzer to sweep the input frequency range. Note: The andlyzer will be used to monitor various points throught the translator.



2. Connect the RF input of the analyzer toJ3 of the Super band Bandpass Filter (A24-A1) and tune C2, C3, C4 C10, C11 and C12 to flatten the response of the module..

3. Move the input to the analyzer to the output of the Superband Bandpass Filter (J2) and retune capacitors for flat response

4. Disconnect analyzer snd set to sweep from 2500 to 2700 MHz. Normalize cables then connect analyzer output to the input of the 4 Section Bandpass Filter (A26). Connect the analyzer input to J5 on the rear panel.

5. Tune the 4 Section Bandpass Filter to flatten response.

6. Connect the RF input of the analyzer to the output of the 3 Section Broadband Filter (A11) and tune the filter for flat response.

2.5 Alignment Procedure - continued

ALC Control Board, Amplifier Attenuator Module
(A17, A12) 151510-1103, 1132-1509

1 . Set S1 on ALC control Board to Manual Mode and adjust R12 for 1.6V at FL3 of Amplifier Attenuator Module (A12).

2. Connect the RF input to the analyzer to the output of the Amplifier Attenuator Module (J2). Place the translator into the operate mode and tune the module to flatten the response.

Three Stage Amplifier Module (A13-A1) 1510-1106

This amplifier does not contain any RF tuning adjustments. The module contains three cascaded broadband GaAsFET amplifier stages providing a nominal gain of 36 dB. The operating current for the first two stages (Q101, Q201) is controlled by a pot mounted on a bias board within the module and can be set by measuring the voltage drop across the across a resister located next to each FET. The bias for the third stage (Q301) is set by measureing the voltage drop across the 0.05 ohm resistor located on the Four Section Bias Protection Board (1500-1114).

1. With no RF signal applied and with the transator off, unsolder the drain leads located near the ferrite beads of Q201 and Q301. Connect a digital voltmeter across R104 located next to Q101. Apply AC power to the transmitter and place the transmitter into the Operate mode.

2. Adjust the bias control resistor (R102) for a reading of 5.5 mV across R104. This voltage represents a bias current of 55 mAmps on Q101.

3 . Place the translator into the standby mode and then turn the translator off. Unsolder the drain lead of Q101 and resolder the drain lead of Q201. Apply AC power to the transmitter and place the transmitter into the Operate mode. Adjust the bias control (R202) for a reading of 60 mV across R204 located next to Q201. This voltage represents a bias current of 0.6 amps on Q201.

4. Place the transmitter into the standby mode and then turn the transmitter off. Resolder the drain leads of Q101 and Q301. Apply AC power to the transmitter and place the transmitter into the Operate mode. Adjust the bias control potentiometer R303 for a reading of 100 mV across R1 on the Four Section Bias Protection Board. This represents a bias current of 2.0 amps on Q301.

The output of this amplifier is fed to the 25 Watt Amplifier Module (A13-A2).

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure - continued

25Watt Amplifier Module (A13-A2) 1510-1164

This amplifier does not contain any RF tuning adjustments. The module contains two cascaded broadband GaAsFET amplifier stages (one FLL105MK driving two parallel FLL200IB-3's) providing a nominal gain of ???? dB. The operating current for each device (Q101, Q201, Q301) is controlled by a pot mounted near each device within the module and can be set by measuring the voltage drop across the 0.05 ohm resistor located on the Four Section Bias Protection Board (1500-1114).

GaAS FET Transistor	Potentiometer Adjustment	Bias Protection Board Resistor	Voltage Across Bias Protection Resistor	Drain Current Calculated
Q101	R106	R2	9.0 mV	180 mA
Q201	R202	R3	240.0 mV	4.8 A
Q301	R302	R4	240.0 mV	4.8 A

The voltages needed to operate the amplifier modules are provided by the + 12V/21 A switching supplies (A6 and A8) and the ±12 VDC Power Supply board (A3) which produces the –5VDC bias voltage.

The –5 VDC supply is non-adjustable with a regulated output. To prevent damage to the GaAs FET amplifiers, the +12VDC switching supplies will not turn on until the –5VDC bias supply is present.

The +12VDC/21A switching, regulated regulated power supplies do not require any adjustment.

The output of this module is fed to the RF output jack (J7) on the rear of the tray. Connect the RF output (J7) of the translator tray to the RF input (J2) of the amplifier tray. Connect the RF output (J4) of the amplifier tray to a RF power meter through a suitable directional coupler. Connect the main output of the coupler to a suitable load.

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure - continued

Broadband Amplifier (ITS-5765)

PFC Switching Power Supply (A3, A5) VS3-73-450-0001

The 2000W Power Factor Corrected Switching Power Supply operates from a standard 220 line voltage and outputs + 390VDC which is applied to a DC to DC converter in the 25W Power Amplifier Assembly. The PFC Switching Power Supply contains no user adjustments.

40W Switching Power Supply (A6) LPS-23

The 40W Switching Power Supply supplies +12 VDC to the various boards within the tray. No user adjustments are provided..

80W Switching Power Supply (A4) LPS-63

The 80W Switching Power Supply supplies -12 VDC to the various boards within the tray. No user adjustments are provided..

25W Amplifier Assembly (A1, A2, A3, A4) 1586-1117

The 25 Watt Amplifier Assembly is a wideband GaAs FET array that is factory pre-tuned to cover the particular channel frequency.

This Amplifier module does not contain any RF tuning adjustments. The module contains GaAs FET amplifiers. The operating current for each device (Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11 and Q12), with no drive applied, is controlled by a pot mounted on a bias board within the module, next to each corresponding FET, and can be set by measuring the voltage drop across the the corresponding 0.05 Ω resistors on the bias protection board. See chart below.

GaAs FET Transistor	Potentiometer Adjustment	Bias Protection Board Resistor	Voltage Across Bias Protection Resistor	Drain Current Calculated
Q4	R802	R58	.175V	7.0A
Q5	R802	R64	.175V	7.0A
Q6	R802	R121	.175V	7.0A
Q7	R802	R67	.175V	7.0A
Q8	R802	R122	.175V	7.0A
Q9 & Q10	R802	R63	.175V	2.38A
Q11	R802	R2	.175V	7.0A
Q12	R802	R1	.175V	7.0A

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure--continued

8 Section Bias Protection Board (A1) 1586-1109

There is one 8 Section Bias Protection Board located in each of the two 25 Watt Power Amplifier Assemblies.

These boards provide over current fuse protection and operating status LED indication of the amplifier modules. These boards also contain bias resistors used to set the operating current of the FET amplifiers within the amplifier modules (see 25 Watt Amplifier Assembly set up above). No user adjustments are provided on the board.

Power Detector/Control Board (A6) 1586-1118

Using a dummy load and a directional coupler with a calibrated power meter the Forward and Reflective power may be calibrated as follows:

1. To calibrate forward power on the front panel meter, first connect a suitable rated load and a calibrated power meter through a directional coupler to the RF output jack (J4) on the rear of the tray. Place the driver transmitter into manual mode operation.

2. Place the driver transmitter into the Operate mode.

3. Apply a digital IF test signal to the input of the driver transmitter and adjust the manual gain potentiometer of the driver transmitter for the full rated average output power level of the amplifier.

4. Adjust potentiometer R17 on the Power Detector/Control Board for 1V at TP2.

5. Remove the load connected to the amplifier and quickly Reflective Metering potentiometer for 1V at TP3. Note: This step must be performed quickly as to not sustain damage to the FET devices.

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure--continued

Broadband Amplifier (ITS-5767)

PFC Switching Power Supply (A3, A5) VS3-73-450-0001

The 2000W Power Factor Corrected Switching Power Supply operates from a standard 220 line voltage and outputs + 390VDC which is applied to a DC to DC converter in the 25W Power Amplifier Assembly. The PFC Switching Power Supply contains no user adjustments.

40W Switching Power Supply (A6) LPS-23

The 40W Switching Power Supply supplies +12 VDC to the various boards within the tray. No user adjustments are provided..

80W Switching Power Supply (A4) LPS-63

The 80W Switching Power Supply supplies -12 VDC to the various boards within the tray. No user adjustments are provided..

25W Amplifier Assembly (A1, A2, A3, A4) 1586-1117

The 25 Watt Amplifier Assembly is a wideband GaAs FET array that is factory pre-tuned to cover the particular channel frequency.

This Amplifier module does not contain any RF tuning adjustments. The module contains GaAs FET amplifiers. The operating current for each device (Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11 and Q12), with no drive applied, is controlled by a pot mounted on a bias board within the module, next to each corresponding FET, and can be set by measuring the voltage drop across the the corresponding 0.05 Ω resistors on the bias protection board. See chart below.

GaAs FET Transistor	Potentiometer Adjustment	Bias Protection Board Resistor	Voltage Across Bias Protection Resistor	Drain Current Calculated
Q4	R802	R58	.175V	7.0A
Q5	R802	R64	.175V	7.0A
Q6	R802	R121	.175V	7.0A
Q7	R802	R67	.175V	7.0A
Q8	R802	R122	.175V	7.0A
Q9 & Q10	R802	R63	.175V	2.38A
Q11	R802	R2	.175V	7.0A
Q12	R802	R1	.175V	7.0A

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure--continued

8 Section Bias Protection Board (A1) 1586-1109

There is one 8 Section Bias Protection Board located in each of the two 25 Watt Power Amplifier Assemblies.

These boards provide over current fuse protection and operating status LED indication of the amplifier modules. These boards also contain bias resistors used to set the operating current of the FET amplifiers within the amplifier modules (see 25 Watt Amplifier Assembly set up above). No user adjustments are provided on the board.

Power Detector/Control Board (A6) 1586-1118

Using a dummy load and a directional coupler with a calibrated power meter the Forward and Reflective power may be calibrated as follows:

1. To calibrate forward power on the front panel meter, first connect a suitable rated load and a calibrated power meter through a directional coupler to the RF output jack (J4) on the rear of the tray. Place the driver transmitter into manual mode operation.

2. Place the driver transmitter into the Operate mode.

3. Apply a digital IF test signal to the input of the driver transmitter and adjust the manual gain potentiometer of the driver transmitter for the full rated average output power level of the amplifier.

4. Adjust potentiometer R17 on the Power Detector/Control Board for 1V at TP2.

5. Remove the load connected to the amplifier and quickly Reflective Metering potentiometer for 1V at TP3. Note: This step must be performed quickly as to not sustain damage to the FET devices.

2.0 TECHNICAL DESCRIPTION

2.5 Alignment Procedure--continued

Combined Metering Tray

To begin alignment of the Combined metering tray, place the rear panel circuit breaker (CB1) into the on position.

±12VDC Power Supply Board (A2) 1265-1703

Check that all Green LED's on the board are illuminated. This indicates that the ±12VDC Power Supply Board is functioning correctly. Check that the front panel PWR LED is illuminated.

Dual Average Detector Board (A5) 1569-1129

1. Connect the output port of the waveguide combiner to an RF power meter using an appropriate coupler. With the translator tray in manual gain mode adjust Manual Gain potentiometer (R12) on the ALC control Board (1510-3103) within the translator tray for 100 Watts on the power meter.

2. Place a 50Ω load on the Reflective Sample port of the crossguide coupler on the waveguide combiner. Connect the Forward Sample port of the crossguide coupler on the waveguide combiner to the rear panel reflective input (REFL PWR I/P) jack (J3).

3. Set front panel meter switch to combined reflective power.

4. Adjust R10 for 100% on front panel meter.

5. Connect the Forward Sample port on the crossguide coupler to the rear panel forward sample input (J2) and the Reflective Sample port on the crossguide coupler to the rear panel Reflective Sample input (J3).

6. Check that the front panel meter combined reflective power reading is 10% or less.

7. Switch front panel meter to combined forward power and adjust R9 for 50% on front panel meter.

Combined Metering Control Board (A3) 1569-1401

1. Adjust R22 just until the front panel low output (LOW O/P) LED illuminates.

Dual Average Detector Board (A5) 1569-1129

1. Adjust R9 for a 100% combined forward power reading on front panel meter.