APPENDIX 6

TRANSMITTER ALIGNMENT

FOUR (4) PAGE ALIGNMENT PROCEDURE FOLLOWS THIS SHEET

GRAYSON ELECTRONICS COMPANY		TEST SPECIFICATION TITLE	
		GMT-20 POWER AMPLIFIER	
Dwg Number	Revision	Originator	Sheet
T000976	C	Todd L. Johnson	1 of 2

1.0 ENGINEERING PRODUCT SPECIFICATION

1.1 Theory of Operation

The power amplifier is made up of 3 GaAs field effect transistor stages. The assembly includes an output isolator, voltage regulation, gate bias, and self protection circuitry.

The RF is first attenuated to guarantee a good input match and then amplified by +29 and +40 dBm stages. These 2 stages make up the driver assembly. The RF is then passed to the final PA assembly where two +44 dBm quadrature combined stages amplify the RF signal. Feedback boards are located on the +44 dBm stages to broadband the amplifier and insure stability. An isolator protects the RF amplifiers from any mismatch or interfering signals. The enable assembly contains voltage regulators and switching circuitry to disconnect the supply voltage if any of the sense circuits report that the bias conditions are not normal. It also contains a small temperature sensor assembly to monitor the internal temperature of the amplifier.

1.2 Specifications

	Specification	Minimum	Nominal	Maximum
1.2.1	Operating Voltage	11.5 V	12.5 V	13.5 V
1.2.2	Operating Current		15 A	20 A
1.2.3	Frequency	1850 MHz		1990 MHz
1.2.4.1	Power Gain w/+14 dBm inp. level	30 dB		34 dB
1.2.4.2	Power Gain w/-10 dBm inp. level	30 dB		36 dB
1.2.5	Power Output	43.5 dBm		
1.2.6	Gain Variation vs. Frequency			3.0 dB
1.2.7	Input VSWR (Return Loss dB)			2.0:1 (9.5 dB)
1.2.8	Third Order Output Intercept Point	+54 dBm		
1.2.9	Temperature Range	-20 deg C		+70 deg C
1.2.10	Gain vs. Temperature			+/- 0.5 dB

2.0 MANUFACTURING TEST SPECIFICATION

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2.1 Network Analyzer Setup

2.1.1 Start Frequency to 1850 MHz
2.1.2 Stop Frequency to 1990 MHz
2.1.3 Set Markers at 1850, 1920, and 1990 MHz
2.1.4 Set Power Level to +12 dBm
2.1.5 Set Channel 1 to S11 and Channel to S21
2.1.6 Set Channel 1 Scale per Division to 5 dB and Channel 2 to 1 dB
2.1.7 Set Channel 1 Reference to 0 dB and Channel 2 to 32 dB
2.1.8 Save the settings and perform full calibration.
2.1.9 Reduce Power Level to -14 dBm

2.2 Power Meter Setup

2.2.1 Set up Power Meter for +45 dBm (with 30 dB pad)
2.2.2 Disconnect the Sensor from the pad, zero the meter, and calibrate the meter
2.2.3 Either Set the Calibration Factor for 1920 MHz or Enter Frequency into the meter (must have valid calibration table in meter)
2.2.4 Enter any Offset Necessary to Account for Cable Losses

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2.2.5 Connect the Power Meter to the D.U.T.

2.3 Voltage Regulator / Quiescent Current Adjustment

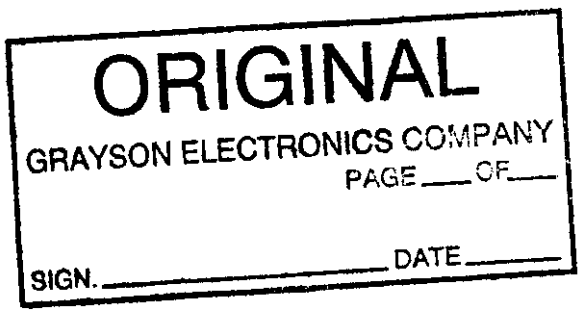
2.3.1 Using a multimeter, adjust the power supply to +12.4 Volts DC and **TURN OFF**.
2.3.2 Connect the Power Amplifier to the DC supply and the Network Analyzer.
2.3.3 Turn all bias potentiometers on the PA **FULL CLOCKWISE**.
2.3.4 Turn on the power supply and observe that the current is less than 100 mA.
2.3.5 Measure the voltage on the drain of any device and adjust the enable board, R2, for 10.3 VDC.
2.3.6 Adjust the bias voltage, R16, on Q1, FLL101ME for a difference of 0.3 VDC (150 mA) across R18. Readjust the supply voltage as necessary, paragraph 2.3.5.
2.3.7 Adjust the bias voltage, R17, on Q2, FLL120MK for a difference of 0.3 VDC (1.5 A) across R15 and R37. Readjust the supply voltage as necessary, paragraph 2.3.5.
2.3.8 Adjust the bias voltage of each FLL300IL-2, R12 on Q1 and R22 on Q2, for a difference of 0.3 VDC (6 A) across R16 and R25. Readjust the supply voltage as necessary, paragraph 2.3.5.

2.4 Power Amplifier RF Tuning

2.4.1 With the bias properly set, turn on the RF and observe the S21 and S11 patterns.
2.4.2 If the observed patterns are not within specifications, begin tuning exploration with the input to the FLL101ME, progressing to the output of the FLL300IL-2.
2.4.3 Once the most sensitive spot has been found, TURN OFF POWER and solder a piece of foil in place.
2.4.4 Repeat 2.4.2 and 2.4.3 until the specifications are met at input power levels of both -10 dBm and +14 dBm.
2.4.5 If the maximum power gain specification cannot be met, it is acceptable to increase the input attenuator by replacing R7, R8, and R9 with 150Ω, 39Ω, and 150Ω respectively (6dB), or with 120Ω, 56Ω, 120Ω respectively (8dB), as required.

2.5 Miscellaneous

2.5.1 Short the enable to ground to insure the enable circuitry is working properly.
2.5.2 Mark the chassis as tuned.



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2.0 Specifications

Specifications	Minimum	Nominal	Maximum
Primary Power (AC: 48-62 Hz)	85 VAC 11.3 VDC	110 VAC 12.0 VDC	 15.0 VDC
Power Consumption AC			250 Watts
Current Consumption DC			20 A
Frequency (20 or 30 KHz steps)	1.85 GHz		1.99 GHz
Frequency Stability (TCXO)		+/- 0.5PPM	+/- 1PPM
Output Power Level (Adjustable in 1dB steps)	3 dBm		43 dBm
Output Power Level Accuracy -20 to 0 deg. C 0 to +40 deg. C +40 to +55 deg. C	 -1.25 dB -0.75 dB -0 dB		 +0 dB +0.75 dB +1.5 dB
Output Harmonics	60 dBc		
Output Spurious	60 dBc		
Output VSWR			1.5:1
Load VSWR			Infinite all Phase angles
Modulation Bandwidth	5 MHz		
Duty Cycle Over Temperature		Continuous	
Operating Temperature Range	-20 deg. C		+55 deg. C

3.0 MANUFACTURING TEST SPECIFICATION

3.1 Test Setup

The GMT20 is tested as a complete unit. A personal computer is connected to the unit via the RS232 communications port. Power is applied to the unit with the supplied line and DC cords. Output power is to be measured with a calibrated meter. The calibration factor and any cable losses should be accounted for.

3.2 Test Procedure

Function	Test Steps	Desired Outcome
Label Unit	N/A	Label reflects date and number.
Physical Inspection	Check cables, hardware, etc.	N/A
AC Operation	Power unit up Check displays Check keypads Check temperature value Check voltage value Using terminal set P43, T1920, K	 Normal freq, mod, amp, and diag. All keys function. Reads approximately room temp. Reads 12.0 +/- 0.3 volts Puts out roughly 43 dBm.
Calibrate Unit	Calibrate power meter Account for cable loss Autocalibrate (filename: serial#.cal)	N/A N/A Successful calibration.
Modulation	Connect AC supply Set power to 43 dBm Enable modulation	N/A N/A Modulation window reads: "Ext"

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	Key the transmitter	Power < 23dBm may see error 11
Retain Last Configuration	Enter new frequency and power level Key the transmitter Cycle power off and back on	N/A N/A Should display last configuration
Adjust TCXO	Set frequency to 1900 MHz Using GTXCOM adjust TCXO to best output frequency ALT Y to save	N/A Freq should be within 200 Hz Program response: "No Response"
DC Operation	Set power supply to 12.2 VDC Set freq. to 1990 MHz, Level to 43 dBm Key the transmitter Lower supply voltage to 11.0 VDC Raise voltage to 11.3 VDC, Clear error Key the transmitter Raise voltage to 12.2 VDC, Clear error Key the transmitter	N/A N/A Transmits 43 dBm Error: "Low Batt" Normal displays Error: "Low Batt" Normal displays Normal operation
Burn In at Elevated Temperature	Connect power and RS232 Using GTXCOM change fan thresholds Command 6, register 221, value 15418 Disconnect RS232 DO NOT TURN OFF POWER Block 80% of intake and output airflow Burn in for 10 hours minimum Check internal temp and normal operation Turn off and let cool	N/A N/A N/A N/A N/A N/A N/A Internal temp > 50 deg C N/A
Power Cal Check	Calibrate power meter Account for cable loss Autocheck calibration (filename: serial#.chk) Print output, add date and serial #	N/A N/A Successful check of calibration. N/A
Check / Correct Points	Scan printout manually correct any bad points	Note on printout.
Physical Inspection	Check cables, hardware, etc.	N/A

With the successful completion of the above test procedure the unit is ready for shipment to customer. Note all data should be retained.

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