THEORY OF OPERATION

1 SYSTEM DESCRIPTION

1.1 AML MBRP-400 BLOCK DIAGRAM

A block diagram of the AML MBRP-400 MMDS Indoor Broadband Repeater is shown in Figure 1. Nominal signal levels are indicated in the Repeater block diagram, but these may vary due to amplifier gains, and microwave attenuator settings.

1.2 SIGNAL PATH

The MMDS signal enters the Preamplifier with PIN attenuator A7, controlled by the ALC (auto level control) circuit, and additionally amplified by amplifier A6. The signal then enters the feed forward circuit.

The feed forward circuit contains two loops. Each loop must balance for proper operation of the feed forward. The first loop, which starts at the 10 dB coupler, C2, and ends at the coupler-hybrid C3, provides for the main power amplification and error detection. The second loop, which starts at the coupler-hybrid C3, provides error correction.

Coupler C2 splits the signal into two paths. The lower path passes through the predistortion circuit, a 7 dB attenuator, and then the power amplifier A4.The predistortion circuit consists of a 3 dB hybrid H1, that splits the signal into two paths - a linear path and a non-linear path. The linear path consists of a phase shifter P1 and a linear amplifier A2. The non-linear path is composed of a distortion amplifier A8, a variable attenuator R1, a second distortion amplifier A3, and 10 dB attenuator. The signals from these paths are combined by another 3 dB hybrid H2, resulting in a predistorted signal that drives the power amplifier A4. A built-in 40 dB coupler at the output of A4 samples the outgoing signal. The ALC uses this sample to control the level of the input to the feed forward circuit. At the high operating levels, the intermodulation distortions are serious and must be corrected. This is necessary not only for compliance with the FCC out-of-band radiation regulations, but also to avoid overloading the error amplifier in the second loop. The signal, along with the distortions generated by A4, is sampled by the coupler-hybrid C3.

At the same time, the reference signal passes through the top path, which includes attenuator R2 and phase shifter P1. The signal then goes to port 2 of the coupler-hybrid, C3. At port 4 of C3, the signals passing through the two paths are again combined together. Signal cancellation is achieved by adjusting attenuator R2 and phase shifter P2 to make the non-distorted portion of the signal equal in amplitude and opposite in phase at the output of coupler-hybrid C3. This constitutes the first loop balance. While perfect cancellation over a wide band is not possible in a practical circuit, a signal cancellation of 20 dB over a 186 MHz band can be achieved in the MBRP-400. Thus the residual signal at the input of the second loop is almost as small as the sampled distortion components. The combined signal passes through attenuator R3, phase shifter P3, and amplifier A5 (100 W amplifier). Since the level of the distortion components and the residual signal is relatively low, A5, will not introduce excessive distortion.

In the arm of the second loop, the main signal with serious distortions passes through an isolator, I6, with a 100W load, and the low loss delay line T2. It is then combined with the

amplified distortion in coupler C4. Adjusting the attenuator R3 and the phase shifter P3 makes the residual distortion components from the two paths equal in amplitude and opposite in phase at port 3 of C4. The residual distortion components will be cancelled to a great degree and a much cleaner signal can be obtained at the Repeater output port. A 30 dB directional coupler, C5, is used to sample a small portion of the output signal at the test point. Finally, the signal passes through a pass band filter to remove the out of band intermodulation products

1.3 PREAMPLIFIER WITH PIN ATTENUATOR

The Preamplifier A7 is a dual balanced stage amplifier with voltage controlled attenuation over the 2.45 to 2.70 GHz frequency range. The unit typically provides +17 dBm output power, typically achieving 15 dB of gain over each stage. The amplifier contains an internal +5 Volt voltage regulator from the MC7800 series. The unit is powered by an external +15 Volt supply. The unit includes a PIN-diode attenuator stage at the output, that provides a minimum of 10 dB attenuation over the frequency range, with control current of 0 to + 15 mA. The control voltage is 0V for 0 dB attenuation and +5V for 10 dB minimum attenuation.

1.4 GaAs FET DRIVER AMPLIFIER

There are four FET amplifiers in the MBRP-400 system. The amplifier A2 and A6 have nominal gain of 10 dB and the IP3 of 40 dBm, operates from +15 Vdc and draws approximately 700 mA. The distortion amplifier A8 and A3 has a gain of 10 dB and an IP3 of 20 dBm. Amplifier A2, A3 and A8 are used in the predistortion circuit to create the pre-distorted signal before it enters to power amplifier A4.

1.5 POWER AMPLIFIER

There are two power amplifiers in the MBRP-400. The Power Amplifiers A4 and A5, is a multistage High Power Amplifier, which provides a minimum gain of 65 dB and output power capability of 100 watts (+50.0 dBm min @ P1dB). Mounted to the heat sink, the chassis is cooled by forced air being blown across the fins. The A4 operates from +12 Vdc and draws a current of 47 A. A4 provides the main amplification for the feed forward. Mean while amplifier A5 provides the error correction in the feed forward. The A5 also operates from +12 Vdc but draws only 42 A of current. The power amplifiers include the sample port at the output at approximately - 40 dBc. The amplifiers A4 and A5 also include the DC test point that provide the temperature of the amplifier, the reverse power detection, and the forward power detection.

CAUTION

Care should also be taken to avoid driving the amplifier beyond saturation as this may decrease its time to failure.

1.6 DC FANS

The 4-DC Fans are temperature controlled. Each fan draws a current of 450 mA @ 24Vdc. At Room Temperature, after the unit is stabilised, Fans #1, #2 and #4 are on. When the ambient temperature goes up by 6° C, Fan #3 will turn on. A drop of 4° Celsius, will turn Fan #2 off, and a further drop of 4°Celsius will cause the Fan #4 to turn off.

1.7 TEMPERATURE SENSOR BOARD

The temperature sensor attaches to the heatsink of the power amplifier. The output voltage depends on the temperature of the ground pin of the LM50C.

1.8 MONITOR PROBES

There are three monitor probes in the MBRP-400 system. The first and second monitor probes are located on the Power Amplifier (PA) Unit A and the Error Amplifier Unit C respectively. These monitor points are designated as Test Point 2 and Test Point 3 respectively. At these points the couplers are 40 dB down from the output of their respective Power Amplifiers. Finally, the third monitor probe comes from the Delay Unit. This monitor probe, Test Point 4, is located near the output of the MBRP-400 system. Therefore, this probe provides a test point of the output signal approximately 29 dB less than at the output.

1.9 POWER SUPPLIES

There are 6 power supplies in the MBRP-400 system. Three power supplies are in the Power Amplifier Unit (PAU) and the other three are in the Error Amplifier Unit (EAU).

The +12 V power supply provides the power to the Power Amplifier. This power supply has the capability of providing 50 A of current. This power supply has its own over temperature protection.

A dual output linear power supply, + 15 Vdc and +5 Vdc, also with overload protection, is used to provide the power to the Preamplifier A7,Distortion Amplifier A8, A3, linear Amplifier A2 and the Display panel.

A linear power supply, + 24 Vdc at 2.4 A, also with overload protection, is used to provide the power to the DC fans via the Display panel.

1.10 COUPLERS

There are four couplers in the circuit. The Couplers C2 and C4 are the precision 10 dB couplers. Coupler C3 is a special coupler. It is a combination of 50 dB coupler and 3 dB hybrid. This special coupler requires to minimize the losses between 50 dB coupling and the hybrid. Coupler C5 is a 30 dB coupler. This coupler samples the output signal.

1.11 FRONT PANEL

The display panel consists of three independent functional parts: the displays and indicators, the ALC (Automatic Level Control) circuit, and the Fan control circuit.

Displays and indicators.

There are 4 indicator lights: +5 Vdc (blue), + 15 Vdc, ALC (auto level control), and MLC (manual level control) (green).

There are six digital displays.

1. The ALC/MLC voltage
2. The Power Amplifier temperature
3. The current of the Power Amplifier
4. The voltage of the Power Amplifier
5. The reflected power at the output
6. The forward power at the output.

ALC circuit.

A DC signal, generated from the RF detector in A4, is compared with the threshold voltage, which is setup by the ALC potentiometer on the front panel. The difference in the voltage is amplified by the two stage amplifiers and is applied to the PIN attenuator. A low pass filter and an emitter follower precede the two stage amplifiers. A zener diode limits the maximum output voltage to 5V, which is the maximum operating range of the PIN attenuator (0 to 5V) of the Preamplifier A7. The last emitter follower in the cascade separates the PIN attenuator from the other parts of the circuit. The ALC circuit can operate in the manual mode, by switching the ALC/MLC switch (located on the rear panel) to MLC (Manual Level Control). The MLC level is setup by the potentiometer which is accessible on the front panel.

Fan control circuit

The Fan control circuit in the display panel controls the fans # 2, #3 and #4 that provide the cooling for the amplifier A4.

The three circuits that control the fan have similar functions.

Fan #3 operates as follows: At room temperature set R3 (TP3) to 6 mV higher than the input dc voltage from the Temperature sensor (TP1). When the previous condition occurs the comparator U1-D turn off Fan # 3. When the input signal raises by 6mV (corresponds to 6°C), the transistor Q3 is off, this turns Fan # 3 on. Fan #2 and Fan #4 operate the same way as Fan #3 except that the threshold voltage is set lower than the input signal from the temperature sensor at room temperature.

POWER SUPPLY DC1, DC2, DC3, DC4

1.0 SCOPE

This specification defines the requirements for a **Power Supply** for use in ground based microwave telecommunications systems.

FCC ID: D0063QAMLMBRP-400

2.0 ELECTRICAL REQUIREMENTS

ITEM	PARAMETER	Dash	SPECIFICATION	COMMENTS
2.1	AC Line Input	All	115/230 Vac	
2.2	Line Frequency	001 002 004 to 006	50 to 60 Hz	
		003	47 to 63 Hz	
2.3	Output Voltage	001	+ 5 Vdc / + 15 Vdc	DC1, DC4
		002	+ 24 Vdc	DC3
		003	+ 12Vdc	DC2
		004	+ 5 Vdc	
		005	+ 15 Vdc	
		006	+ 24 Vdc	
2.4	Current	001	3.0 A / 1.5 A	DC1, DC4
		002	2.4 A	DC3
		003	50A	DC2
		004	1.2 A	
		005	3.0 A	
		006	1.2 A	
2.5	Line Regulation	001 002 004 to 006	± 0.005% max over full input	
		003	± 0.2% max.	
2.6	Load Regulation	001 002 004 to 006	± 0.015% from zero to full load	
		003	± 0.2% max.	
2.7	Output Ripple	001 002 004 to 006	< 1mV pk-pk typ. (DC to 100kHz)	
		003	3 % max., 20 Mhz BW, full load	
2.8	Transient Response	001 002 004 to 006	Max. deviation less than ±1%. Recovers within 0.5% in less than 20µsec.	
2.9	Overvoltage Protection	001 002 004 to 006	SCR crowbar type standard on ±5V output. Set to 6.2V ±200mV.	
		003	115-135%	

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2.0 ELECTRICAL REQUIREMENTS (CONT.)

ITEM	PARAMETER	Dash	SPECIFICATION	COMMENTS
2.10	Operating Temperature	001 002 004 to 006	0 to +70°C. Derate linearly above +50°C to 50% load at +70°C.	
		-003	0°C to + 85°C	
2.11	Storage Temperature	001 002 004 to 006	-40°C to +85°C	
		-003	-20°C to +100°C	
2.12	Temperature Coefficient	001 002 004 to 006	< 0.03% per °C	
		003	±0.02% per °C max.	
2.13	Efficiency	001 002 004 to 006	5 V O/P 45% 15 V O/P 55% 24 V O/P 60%	
		003	80-90%	

3.0 MECHANICAL REQUIREMENTS

ITEM	PARAMETER	DASH	SPECIFICATION
3.1	Markings	All	No vendor name, logo, address, or part number shall be displayed. The unit shall be marked with the following information only: **AML Wireless Systems Inc. PART # 2881272-XXX Rev .** **SERIAL #** **DATE CODE** **COUNTRY OF ORIGIN**
3.2	Mechanical outline	001	7.00" x 4.87" x 2.50"
		002	5.63" x 4.88" x 2.50"
		003	7.36" x 7.00" x 1.37" (see drawing)
		004	4.125" x 3.875" x 1.75"
		005	5.63" x 4.88" x 2.50"
		006	4.87" x 4.00" x 1.62"
3.3	Finish	All	White epoxy paint suitable for outdoor operation.

4.0 QUALIFICATION AND ACCEPTANCE TESTING

Qualification and Acceptance testing shall be performed by the Vendor, in the Vendor's facilities and at the Vendor's expense. 100% testing shall be performed on all units as per relevant columns of TABLE A. Test descriptions are included in TABLE B.

5.0 TEST DATA SHEET

The Test Data Sheet (TDS) shall be a Vendor formatted document to record and submit the results of tests performed on each unit, as per Tables A and B. For first time orders, a blank of the TDS shall be submitted by the Vendor for approval by AML WSI 15 days ARO.

Results for all required parameters and test temperatures shall be included. Required plots shall be attached. Photocopies of data and plots shall be legible. Adequate legends shall be included with plots containing multiple traces.

The person responsible for performing the tests shall sign and date the TDS.

6.0 INCOMING INSPECTION BY AML WIRELESS SYSTEMS INC.

Incoming inspection in AML WSI shall conform to relevant AML WSI Incoming Inspection Procedure.

Power Supply Incoming Inspection Data Sheet QA2881272 shall be used to record and report the results of the verification.

TABLE A. TEST MATRIX

(Refer to TABLE B. for description of the tests associated with each code)

PARAMETER	QUALIFICATION			PRODUCTION		
	-40°C	25°C	+60°C	-40°C	25°C	+60°C
Insertion Loss	A	A	A	-	A	-
Return Loss	A	A	A	-	A	-
Flatness	A	A	A	-	A	-
Rejection	A	A	A	-	A	-
Group Delay	B	B	B	-	B	-
Marking, Physical Dimensions and Finish	Visual Inspection			Visual Inspection		

Table B. Test conditions associated with the codes used in TABLE A.

CODE	TEST CONDITION	DELIVERABLE IN TEST DATA SHEET (TDS)
A	Swept measurement using scalar network analyzer.	Attach copy of plot to TDS.
B	Swept measurement using vector network analyzer	Attach copy of plot to TDS.

Theory of Operation

AMPLIFIER A4

The 96-0130 High Powered Amplifier operates from 2.5 - 2.6 GHz. The output power is 100 watts (+50.0 dBm min @ P1dB) with a gain of 65 dB min. Mounted to a heatsink, the chassis is cooled by forced air being blown across the fins.

There are three RF connections to the amplifier. "RF IN" is used to supply the amplifier with drive. "RF OUT" is the output port of the amplifier that supplies the RF output power. The "Sample" port is an analog sample of the "RF OUT" port at approximately -40 dBc.

There is one DC connect on the amplifier. It consists of four power pins and five signal pins. The four power pins are divided as follows: Two are used to supply +12 VDC and the other two are used for GND. The 5 signal pins are given the following destinations:

- Pin #1 is an output of the forward detected voltage. The RF is sampled and rectified through a diode, this then feeds an op amp that has an output of 4 VDC @ rated P1dB in the center of the band. While the detected voltage is not necessarily linear, it can be calibrated and used as level detection or VSWR mismatch detection.

- Pin #2 is GND.

- Pin #3 is used as a "shutdown" input. When +5 VDC is applied, the bias board removes the drain voltages from the GaAs FET devices. This effectively shuts down the amplifier. When 0 VDC is input, the drain voltages are then turned on and applied to the RF devices.

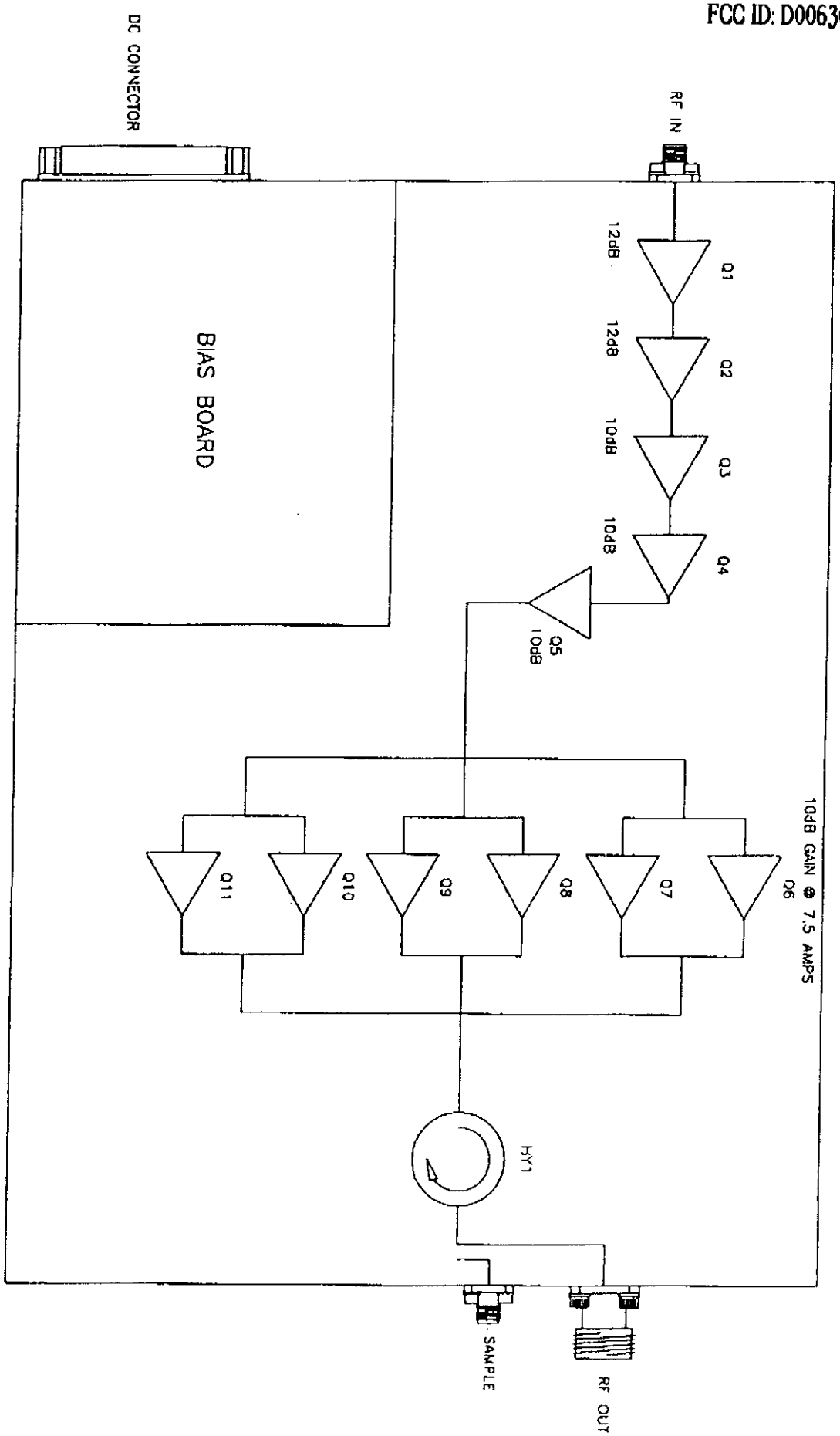
- Pin #4 is for "Temp Out". The temperature of the amp may be monitored on this pin. The reading is a DC voltage that is equivalent to 10 mv/deg C.

- Pin #5 is for the reverse power detection. This is similar to the forward power detection only in this configuration the reverse power is being detected.

The DC portion of amplifier consists of a Bias Board. The Bias Board regulates the incoming +12 VDC and monitors the shutdown signal. Bias conditioning, sequencing, and timing for the gate and drain voltages of the RF devices also occurs on the board.

The RF section consists of four substrates. They are as follows, the Pre-driver, the Driver, the Final and the Output substrate. The Predriver provides the largest amount of gain in the RF path. Consisting of four devices, linear

operation and small signal gain are realized. The Driver board consists of one 30 watt part that is driven into the linear region and feeds the RF to the Final substrate. The Final substrate consists of six 30 watt devices in parallel, each pulling approximately 7.5 amps. The power is then combined on the Output substrate. The Output substrate recombines the RF and provides isolation to the outside world via a circulator. The RF sample, Forward power detection and Reverse power detection are also present on this board. The output power is transitioned to the outside world via a "Type N" connector.


DC CONNECTOR
RF IN
BIAS BOARD
12dB
Q1
12dB
Q2
10dB
Q3
10dB
Q4
Q5
10dB
Q11
Q10
Q9
Q8
Q7
Q6
10dB GAIN @ 7.5 AMPS
HY1
SAMPLE
RF OUT

FCC ID: D0063QAMLMBRP-400

AML Wireless Systems Inc.

24 July 1997

Federal Communications Commission
7435 Oakland Mills Rd
Columbia, Maryland
21046

Subject: Statement of Quantity MBRP-400

It is estimated that production of the above stated unit shall be in large quantities.

Sincerely,

Lawrence W. Danilow

Lawrence W. Danilow
Senior Buyer

260 Saulteaux Crescent • Winnipeg, MB • R3J 3T2
Phone: (204) 949-2400 • Fax: (204) 889-1268

A2, A6, A3, A8, A7

JCA TECHNOLOGY

FCC ID: D0063QAMLMBRP-400

MODEL NUMBER: JCA23-2173 A2, A6

DESCRIPTION: SINGLE BALANCED STAGE AMPLIFIER OVER THE 2.45 TO 2.75 GHz FREQUENCY RANGE. THE UNIT PROVIDES MINIMUM 1 WATT OUTPUT POWER, ACHIEVING TYPICALLY 10 dB OF GAIN OVER THE SINGLE STAGE. THE AMPLIFIER CONTAINS AN INTERNAL +12 VOLT VOLTAGE REGULATOR FROM THE THE MCC7800 SERIES. THE UNIT IS POWERED BY AN EXTERNAL +15 VOLT SUPPLY. THE UNIT INCLUDES A FILLER LINE AT THE FIRST STAGE TO COMPLETE THE INSIDE OF THE UNIT. IT USES GaAs FETS.

MODEL NUMBER: JCA23-2185

DESCRIPTION: TWO-STAGE AMPLIFIER UTILIZING 2 BALANCED STAGES OVER THE 2.45 TO 2.75 GHz FREQUENCY RANGE. THE UNIT PROVIDES MINIMUM 1 WATT OUTPUT POWER. THE FIRST STAGE PROVIDES TYPICALLY 14 dB OF GAIN, USING A MEDIUM POWERED GaAs FET. THE SECOND STAGE PROVIDES TYPICALLY 10 dB OF GAIN, AND IS A HIGHER POWER DEVICE IN ORDER TO ACHIEVE THE OUPUT POWER. THE AMPLIFIER CONTAINS AN INTERNAL +12 VOLT VOLTAGE REGULATOR FROM THE MCC7800 SERIES. THE UNIT IS POWERED BY AN EXTERNAL +15 VOLT SUPPLY.

MODEL NUMBER: ATT23-211

DESCRIPTION: LOW LOSS VOLTAGE CONTROLLED ATTENUATOR. IT CONSISTS OF A SINGLE ATTENUATOR STAGE, UTILIZING PIN DIODES, WITH A PI-PAD AT THE OUTPUT. BIAS VOLTAGE IS +15 VOLTS, WITH A CONTROL VOLTAGE RANGE OF 0 TO +5 VOLTS.

JCA TECHNOLOGY

MODEL NUMBER: JCA23-143 A3, A8 FCC ID: D0063QAMLMBRP-400

DESCRIPTION: SINGLE STAGE LOW NOISE AMPLIFIER, UTILIZING A BALANCED DESIGN. THE SINGLE STAGE PROVIDES TYPICALLY 15 DB AND HAS A PI-PAD AT THE OUTPUT IN ORDER TO PAD DOWN THE GAIN TO MEET THE OVERALL UNIT SPEC FOR GAIN OF 8 MIN, 12 MAX. THE UNIT CONTAINS AN INTERNAL +12 VOLT REGULATOR OF THE MCC7800 SERIES AND OPERATES OFF OF AN EXTERNAL +15 VOLT DC SUPPLY. IT USES GaAs FET LOW NOISE FETS.

MODEL NUMBER: JCA23-4122

DESCRIPTION: THREE STAGE LOW NOISE TEMPERATURE COMPENSATED AMPLIFIER. THE FIRST STAGE GaAs FET DEVICE PROVIDES TYPICALLY 16 dB OF GAIN, FOLLOWED BY A SECOND STAGE TEMPERATURE COMPENSATION STAGE, IN ORDER TO STABILIZE THE GAIN OVER THE TEMPERATURE RANGE OF -40 TO +60 DEG C. THE THIRD STAGE CONTAINS A MEDIUM POWER GaAs FET AND PROVIDES TYPICALLY 10 dB OF GAIN. THE FOURTH STAGE IS A HIGH POWER GaAs FET THAT PROVIDES TYPICALLY 9 dB OF GAIN AND IS NEEDED TO ACHIEVE THE 1 WATT OUTPUT POWER LEVEL. THE UNIT IS INTERNALLY REGULATED WITH A +12 VOLT REGULATOR OF THE MCC7800 SERIES AND OPERATES OFF OF AN EXTERNAL +15 VOLT POWER SUPPLY.

A7

JCA TECHNOLOGY

MODEL NUMBER: JCA23-3452A A7 FCC ID: D0063QAMLMBRP-400

DESCRIPTION: DUAL BALANCED STAGE AMPLIFIER OVER THE 2.45 TO 2.70 GHz FREQUENCY RANGE. THE UNIT PROVIDES TYPICAL +17dBm OUTPUT POWER, ACHIEVING TYPICALLY 15 dB OF GAIN OVER THE EACH STAGE. THE AMPLIFIER CONTAINS AN INTERNAL +8 VOLT VOLTAGE REGULATOR FROM THE THE MCC7800 SERIES. THE UNIT IS POWERED BY AN EXTERNAL +15 VOLT SUPPLY. THE UNIT INCLUDES A PIN-DIODE ATTENUATOR INTERNALLY, CONTROLLED BY AN EXTERNAL 0 TO +5 VOLT VOLTAGE, 0 TO +15 mA CONTROL CURRENT, TO PROVIDE A GAIN ATTENUATION OF 10 dB MIN. ALL FETS ARE GALLIUM ARSENIDE.

MODEL NUMBER: JCA23-4136A

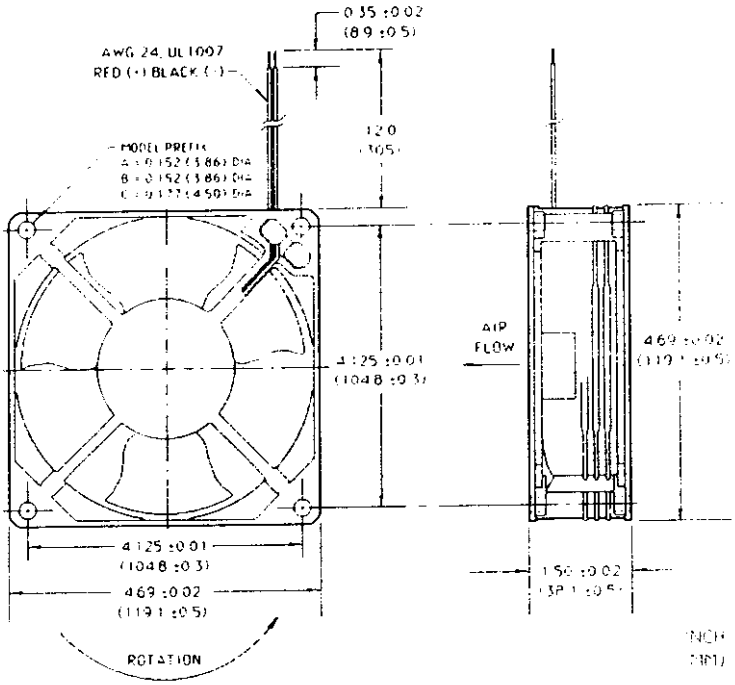
DESCRIPTION: THREE-STAGE AMPLIFIER UTILIZING 3 BALANCED STAGES OVER THE 2.45 TO 2.70 GHz FREQUENCY RANGE. THE UNIT PROVIDES TYPICAL 1 WATT OUTPUT POWER. THE FIRST STAGE PROVIDES TYPICALLY 16 dB OF GAIN, USING A MEDIUM POWERED GaAs FET. THE SECOND STAGE PROVIDES TYPICALLY 10 dB OF GAIN, AND IS A HIGHER POWER DEVICE IN ORDER TO ACHIEVE THE DRIVE THE FINAL HIGH POWER STAGE THAT ACHIEVES TYPICALLY 8 dB OF GAIN. THE UNIT INCLUDES A PIN-DIODED ATTENUATOR INTERNALLY, CONTROLLED BY AN EXTERNAL 0 TO +5 VOLT VOLTAGE, 0 TO +15 mA CONTROL CURRENT, TO PROVIDE 0 TO +7 dB OF ATTENUATION RANGE. THE AMPLIFIER INCLUDES AN INTERNAL +12 VOLT VOLTAGE REGULATOR FROM THE MCC7800 SERIES. THE UNIT IS POWERED BY AN EXTERNAL +15 VOLT DC POWER SUPPLY.

DC FAN

FCC ID: D0063QAMLMBRP-400

TA450DC

TA450DC is a high-performance series of brushless dc fans with air flow ratings of 53 to 130 CFM. All models in the series are available with quiet and lighhtweight 4.7-inch (119 mm) thermoplastic frames or rugged die-cast metal housings. Model selection offers operating voltage ranges centered on 5, 12, 24 or 48 VDC.



FEATURES

- 5V, 12V, 24V and 48V Models
- Polarity Protected
- Permanently Lubricated Ball Bearings
- UL Recognized, CSA Certified
- Thermally Managed Speed Control Available on All Models
- Solid State Brushless DC Motor with Permanent Magnet Rotor, Electronic Commutation with Hall Effect Sensor
- Color-Coded 12 in. (305 mm) Leads or Spade-Pin Terminals

Electrical and Mechanical Characteristics

	Operating Voltage					*Sound Level*				*Operating Temp.*		*Unit Weight*	
Model	Air Flow (CFM)	Nom. (V)	Range (V)	Current (mA)	Power (W)	Pressure (dBA)	NPEL (Bels)	Strut Side	Bearing	Min. (°C)	Max. (°C)	(oz.)	(g)
B34275*	53	5	4.5-5.5	250	1.25	32.9	4.2	Discharge	Ball	-10	+70	11.5	325
B31668	54	12	6.0-14	140	1.68	31.8	4.2	Discharge	Ball	-10	+70	11.5	325
B32832	58	12	6.0-14	180	2.16	33.8	4.2	Discharge	Ball	-10	+70	11.5	325
B32347	60	12	6.0-14	200	2.40	33.5	4.4	Discharge	Ball	-10	+70	11.5	325
B31787	60	24	12-28	100	2.40	33.5	4.4	Discharge	Ball	-10	+70	11.5	325
B34188	70	24	12-28	125	3.00	38.9	4.6	Discharge	Ball	-10	+70	11.5	325
B34270*	80	5	4.5-5.5	650	3.25	41.7	5.2	Discharge	Ball	-10	+70	11.5	325
B32837	80	24	12-28	170	4.08	41.1	5.0	Discharge	Ball	-10	+70	11.5	325
B31873	85	12	6.0-14	280	3.36	40.9	5.3	Discharge	Ball	-10	+70	11.5	325
B33050	88	12	6.0-14	310	3.72	43.6	5.3	Discharge	Ball	-10	+70	11.5	325
B33393	88	24	12-28	180	4.32	43.6	5.3	Discharge	Ball	-10	+70	11.5	325
B32286	95	12	6.0-14	400	4.80	49.2	5.5	Discharge	Ball	10	+70	11.5	325
B31276	104	12	6.0-14	440	5.28	55.7	6.6	Inlet	Ball	10	+70	11.5	325
B32861†	105	48	36-56	140	6.72	49.5	5.6	Discharge	Ball	10	+70	11.5	325
B31277	108	24	12-28	310	7.44	55.0	6.6	Inlet	Ball	10	+70	11.5	325
B34258*	110	5	4.5-5.5	1250	6.25	48.6	5.7	Discharge	Ball	10	+70	11.5	325
B31256†	112	12	6.0-14	490	5.88	50.4	6.0	Discharge	Ball	-10	+70	11.5	325
B31257	112	24	12-28	280	6.72	50.4	6.0	Discharge	Ball	-10	+70	11.5	325
B34262*	130	12	6.0-14	800	9.60	54.3	6.6	Discharge	Ball	-10	+70	11.5	325
B33534 -16A	130	24	12-28	450	10.80	54.3	6.6	Discharge	Ball	-10	+70	11.5	325

Note: Air flow, current, power and sound level ratings are at nominal voltage against zero static pressure. NPEL - Noise Power Emission Level. The first character of the model number designates the housing material and flange configuration (B - thermoplastic housing with open flange). TA450 fans are also available as 'A' models (die-cast housing, open flange) and C models (thermoplastic housing, closed flange). The die-cast versions weigh 21.2 oz. (500g). For power termination and signal options, designated by a suffix added to the model number, see the 'How to Order' section.

* UL recognition, CSA certification pending

† TUV approved to EN60950

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Wireless Systems Inc.	TEST DATA SHEET PROPRIETARY INFORMATION	2015020-004

Customer			
Part Number	2015020-004	Serial Number	
Model Number	MBRP-400	W/O Number	

Input Frequency : 2500 to 2686 MHz **Channel Loading : 31**

Nominal Input -48 dBm.
Unless otherwise noted, all tests are conducted with MLC/ALC set for
2 dB attenuation at 22 degees Celcius. The nominal output power is set for 27 dBm/Ch.

Test	Requirement		Data	
1 **Frequency Response** (2.500 to 2.686 MHz)	2	dB pk-pk	1.3	dB pk-pk
2 **Repeater Gain**	75±1	dB max.	75.5	dB
3 **C/CTB @ Nominal Output Power & 31 Ch loading**				
2501.25 MHz	51	dB max	54	dB
2591.25 MHz	51	dB max	55	dB
2681.25 MHz	51	dB max.	54.5	dB

4 **Front Panel Display**			Unit A	Unit C	
MLC/ALC Voltage		VDC	0.89	NC	VDC
Power Amp Temperature	45 - 65	°C	51.5	58.5	°C
Power Amp Current	50	A max.	45	41.6	A
Power Amp Voltage Supply	+12 ±0.5	VDC	11.75	11.83	VDC
Reflected Power	0 ± 0.1	VDC	0.2	0.1	VDC
Forward Power	6	VDC max.	2.3	1.0	VDC
+15 VDC LED			X	X	Check

5 **MLC\ALC Setting at 22°C**	2	dB	2	dB
6 **Repeater Test Point**	2531.25	MHz	-17.2	dBm
	2651.25	MHz	-17	dBm
7 **Noise power**	-98	dBm/Hz max.	-98.5	dBm/Hz

Part Number	2015020-004	Serial Number	
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9 **Repeater Test Point and RF Forward Power vs. Total Output Power, 31 Ch.**

Ouput Power (dBm/Ch)	Repeater Test Point (dBm/Ch)	RF Output Display (VDC)
22	-22.8	1
23	-21.8	1.2
24	-20.8	1.4
25	-19.8	1.7
26	-18.7	2
27	-17.7	2.32
28	-16.5	2.63
29	-15.3	2.93
30	-14.4	3.35
31	-13.5	3.66

Atten (dB)	MLC/ALC (VDC)
1	0.65
2	0.9
3	1.2
4	1.46
5	1.81
6	2.2
7	2.6
8	3.1
9	3.7
10	4.3

10 Module	P/N	S/N	Current	
Power Amplifier Unit A	2015013-001			
Power Amplifier (A4)	2881296-001	116	44.2	A
Linear Amplifier (A2)	2881265-002	113	300	mA
Linear Amplifier (A6)	2881265-002	110	250	mA
Linear Amplifier w/att. (A7)	2881283-002	102	320	mA
Distortion Amplifier (A3)	2881265-001	105	52	mA
Distortion Amplifier (A8)	2881265-001	109	50	mA
Phase Shifter (P1)	2881267-001	989		
Power Supply (DC2)	2881272-003	962175313		
Power Supply (DC3)	2881272-002	972077126		
Power Supply (DC4)	2881272-001	972278234		
Delay Loop Unit B	2015012-001			
Phase Shifter (P2)	2881267-001	987		
10 dB Coupler (C4)	2881299-010	B0337		
Power Amplifier Unit C	2015014-001			
Power Amplifier (A5)	2881296-001	106	416	A
Phase Shifter (P3)	2881267-001	988		
Power Supply (DC5)	2881272-003	971474021		
Power Supply (DC6)	2881272-002	972077117		
Power Supply (DC7)	2881272-001	972278233		

Tested by L.K. **Date** 17-Sep-97

Inspected by _____ **Date** _____