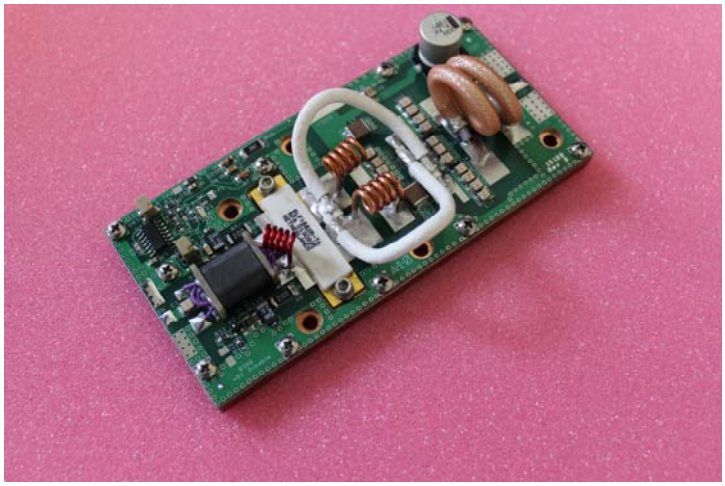
Broadcast Concepts Inc
11700 NW 102nd Road Suite 4Medley FL 33178
Tel: 305.887.8400 FAX 305.887.8444

Model P1000FM-188XR FM Pallet Amplifier

This amplifier module is ideal for final output stages in FM Broadcast Applications.

- **87.5 – 108.1MHz (FM BAND)**
- **50 Volts**
- **Input/output 50 ohms**
- **Pout: 1000W minimum**
- **Up to 82% efficiency**
- **24dB Gain**
- **NXP BLF188XR Mosfet**



Dimension (L x W x H inch) [5.00” x 2.375” x 1.25”]

Electrical Specifications				
Characteristics	min	typ	max	unit
Operating Frequency range	87.5		108.1	MHz
peak saturated power (@ 50V)	1000	1050	1100	W
P1dB @ 48V		800		W
Power Input		2	3.5	W
Input VSWR		1.2	1.7	VSWR
Power Gain	24	25	26	dB
Amplifier efficiency	77	78	82	%
Absolute maximum current rating	-	-	28	A dc
Insertion Phase variation (unit to unit)	-	+/-3.5	-	degrees
Power gain (unit to unit)	-	+/-1.0	-	dB
F2 Second Harmonic	-40	-45	-	dB
F3 Third Harmonic	-22	-25	-	dB
Bias Current per transistor: Factory set @48V.	90	100	110	MA dc
Drain voltage supply	28	48	52	V
Base plate operating temperature	0	n/a	70	Celsius
Load Mismatch (All phase angles, Id=16A, 10 seconds)			65:1	VSWR
Shipping Weight		1.5		LBS

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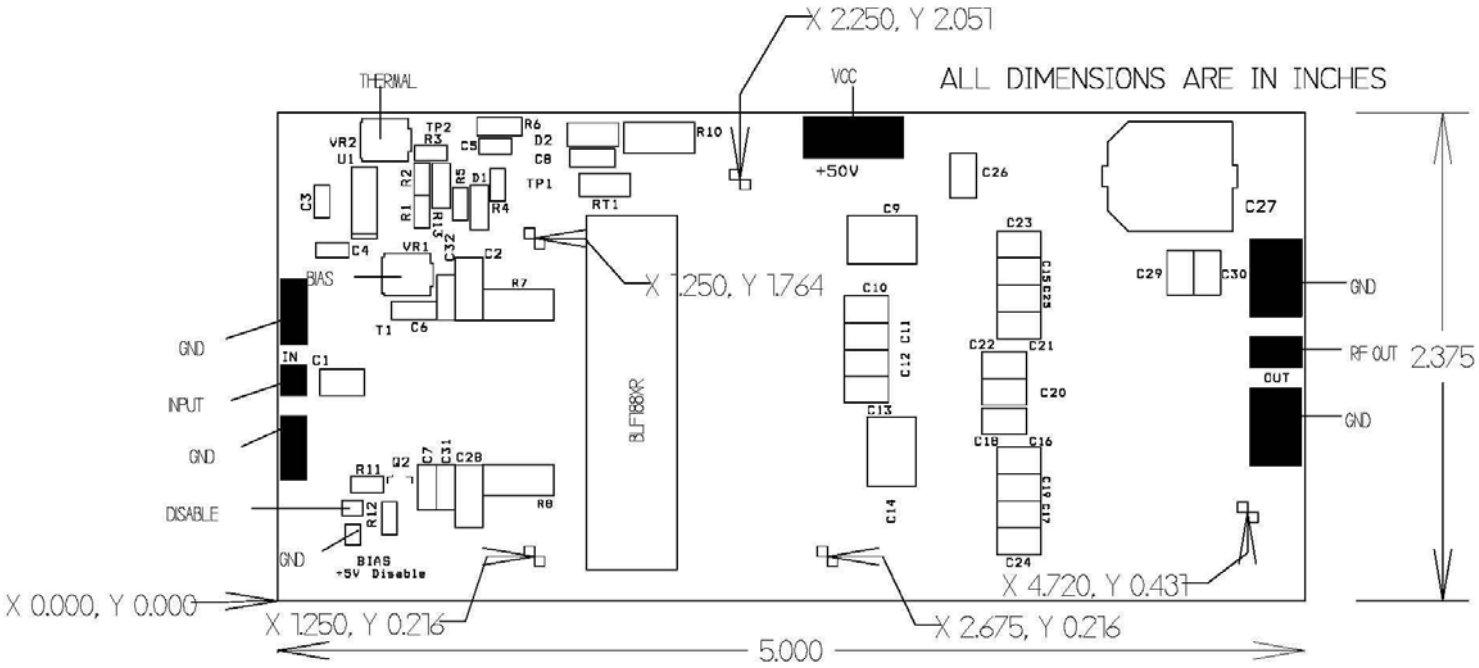
Amplifier Mechanical & Electrical Drawing: Figure 1



This drawing may be downloaded in DXF format: http://broadcastconcepts.com/177300/p1000fm.dxf

Heatsink Mounting/Hardware

Tips for Mechanical Mounting:

1 All mounting holes are 0.156 inch thru and they are designed for a #6 Screw. Stainless Steel mounting hardware is recommended, grade 18-8 or better. A lock washer of same material should also be used.
2 Ensure mounting surface is flat to better than 0.0025”
3 Use a thin layer of thermal compound on the backside of the PA - no more than 0.001” - 0.002” thickness!
4 Torque all screws to 10-12 in-lbs

Use of cooling air on top of pallet to keep output transformers cool is required. Output transformers are rated for continuous operation at 200C; however, temperatures under 75C are easily maintained at 1000W with airflow over the output cables. Keep all external circuitry away from input and output transformers to avoid interference - give at least 0.5 inch clearance above tallest cables to avoid creating feedback loops.

Warning: Failure to use a proper heat sink and/or improper installation will cause the transistors to burn out. This type of failure is not covered by warranty. This product can be ordered with a custom heat sink. Please contact factory for more information.

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Electrical Notes:

There is 1 VCC pad for the main power supply. The Meanwell RSP1500 is the suggested power supply for this amplifier. Do not attempt to connect ground to the pallet or modify the PCB for ground attachment. Ground can be attached to the heat sink that the pallet is mounted on.

The pot VR1 marked "Bias" controls the bias current for BLF188XR. The factory setting is 100ma and adjustment is not required.

The adjustment pot VR2 marked "Thermal" sets up the thermal compensation slope. Adjustment of this pot is not required; however, if it is accidently tampered with simply re-adjust it until "7.2 volts" is present at TP1 as this is the factory setting."Bias disable" removes bias voltage from the transistor. A voltage above 2.0V is required to activate the "bias disable" condition.

If transistor replacement is necessary always verify that the bias circuits are functioning before installing new parts. Transistor pocket must be cleaned with alcohol, all debris removed and new thermal compound applied prior to installing new transistor. Bias voltage should be adjusted to 0.5V before new part is installed. We assume no responsibility for self repairs. Please consider sending pallet back to factory for service.

When bias adjustment is required always use a small lab supply that is current limited. This will prevent accidental over bias and loss of a transistor.

Warning: **Solid state amplifiers can be easily destroyed! Operating the amplifier outside of its specifications will cause the mosfets to fail. These failures are not covered by warranty.**

- Do not over drive the amplifier.
- Do not run the amplifier into an open circuit. Do not run the amplifier when the SWR is unknown. System integrator must foresee adding VSWR protection if there is a risk that the amplifier will be subjected to high VSWR conditions. Do not adjust the bias settings or attempt transistor replacement without a current limited lab supply.
- Do not allow the amplifier to overheat. Do not let the base plate temp exceed 70C. This amplifier is capable of dissipating over 350W in the maximum working condition. **This product requires prior experience working with high power RF amplifiers. This is not for beginners.**
- This amplifier has been designed for analog FM broadcast. Performance in digital FM has not been evaluated.
- Expensive test equipment like RF wattmeters, dummy loads, Ammeters and thermal meters are required to verify proper installation. Operating this amplifier without this equipment is like driving blind. You won't be able to see what's really going on and the end result could be transistors that burn out.

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Calculating Die Temperature:

How do you know if the amplifier is running to hot? There are symptoms to watch for. If there is a significant drop in power of more than 5% over a short period of time the amplifier is likely overheating.

There is a scientific method that must be used to verify that the amplifier is installed and running within thermal limits. We do not recommend the “dropping power with time test” described above.

Use the thermal resistance (Rth) of the device to calculate the junction temperature. The Rth from the junction to the device flange for the BLF188XR is 0.11 °C /W. If the device is soldered down to the pallet baseplate, this same value can be used to determine Tj. If the device is greased down to the pallet baseplate, the Rth(j-h) value becomes 0.26K/W, as the thermal resistivity for the grease layer from the flange to the baseplate is approximately 0.15 °C /W.

Note: *We always use thermal grease under transistors because soldering them directly would render the pallets unserviceable.*

Example: Assuming that the device is running at 950W with the RF output power at 48V while consuming 25.3 amps on a pallet baseplate (e.g. 70 °C). Tj can be determined based on this condition for the given baseplate temperature:
• Dissipated power (Pd) = (48V x 25.3A) – (950W) = 264.4W
• Temperature rise (Tr) = Pd ´ Rth = 264.4W (0.26 °C/W) = 68.7 °C
• Junction temperature (Tj) = Th + Tr = 70°C + 68.7 °C = 138.7 °C

The best way to make this calculation is to measure the temperature of the transistor flange directly. In this case temperature rise is calculated using 0.11°C/W.

The maximum junction temperature for most LDMOS devices is 200C. We suggest staying under 175C. In the example above a base plate temperature of 70C was used. When the pallet is mounted to an efficient heatsink like one of our bonded fin models base plate temperatures in the 50C range are easily maintained at full output power.

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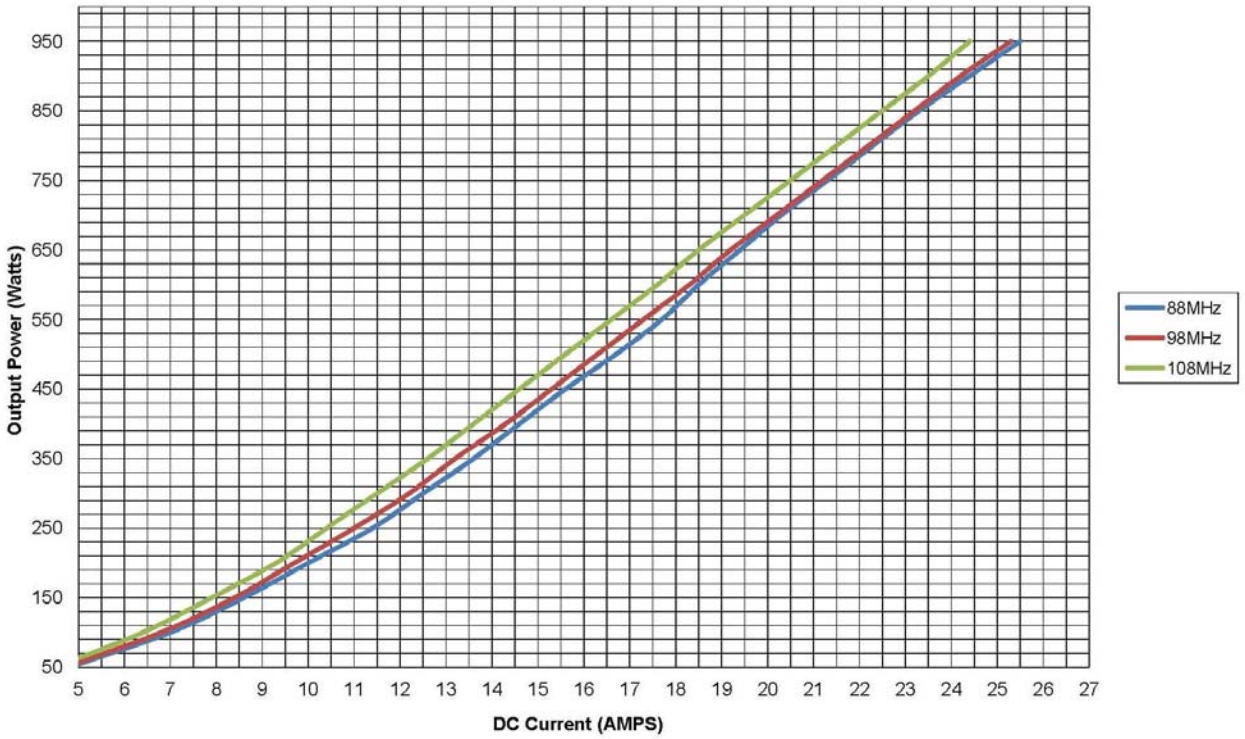
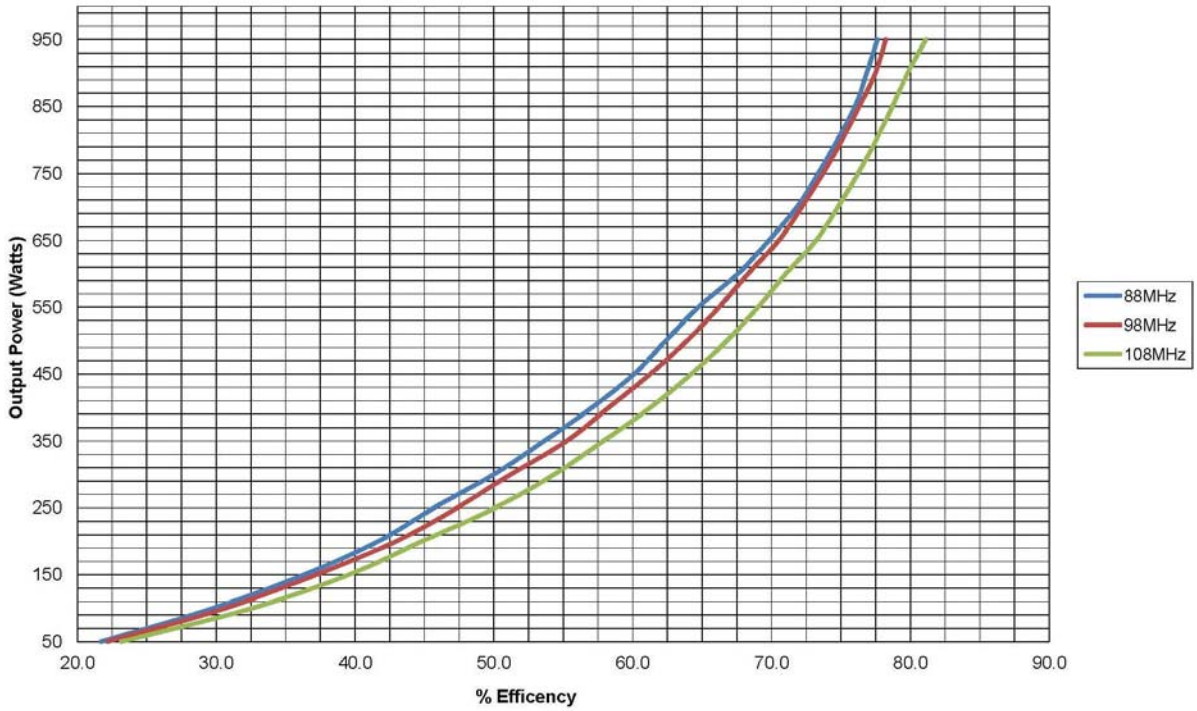
DC AMPS & Output Power @ 48VDC; 100ma bias BLF188XR



Output Power & Efficency @ 48VDC; 100ma bias BLF188XR



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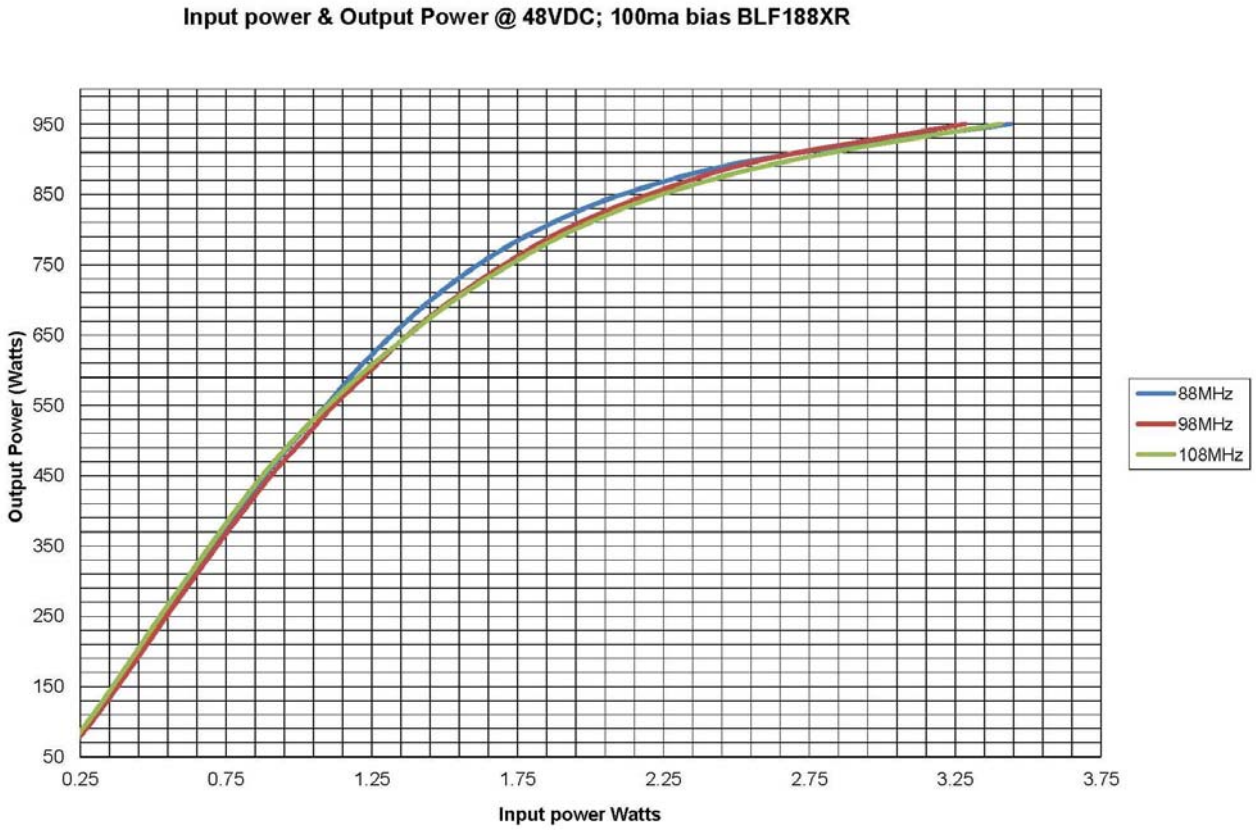

Low Pass Filter

A low pass filter is required to reduce harmonics. Harmonics from FM transmitters are regulated by most government regulatory authorities. Any of our low pass filters rated for at least 1000 watts can be used with this pallet. It is critical to install a 13.5 inch piece of RG400 between the pallet output and the filter input to prevent a filter reaction. When a filter reaction occurs the pallet sees a high mismatch which can cause the transistor to overheat and slowly burnout. The cause of filter reactions is not fully understood; however, reflected harmonic energy at a certain phase and frequency is strongly suspected. Filter reactions do not occur when 2 or more amplifiers are power combined since the combiners provide isolation from the low pass filter.

The BLF188XR can operate into open and short circuits without damage; however, operation into a mismatched load for even a few minutes can cause the transistor to fail from thermal stress. The BLF188XR is not clown proof. Thermal overload and RF overdrive will still destroy the transistor. It should be noted that load mismatches that cause the transistor to draw high current are the ones that are most likely to cause a thermal failure**.**

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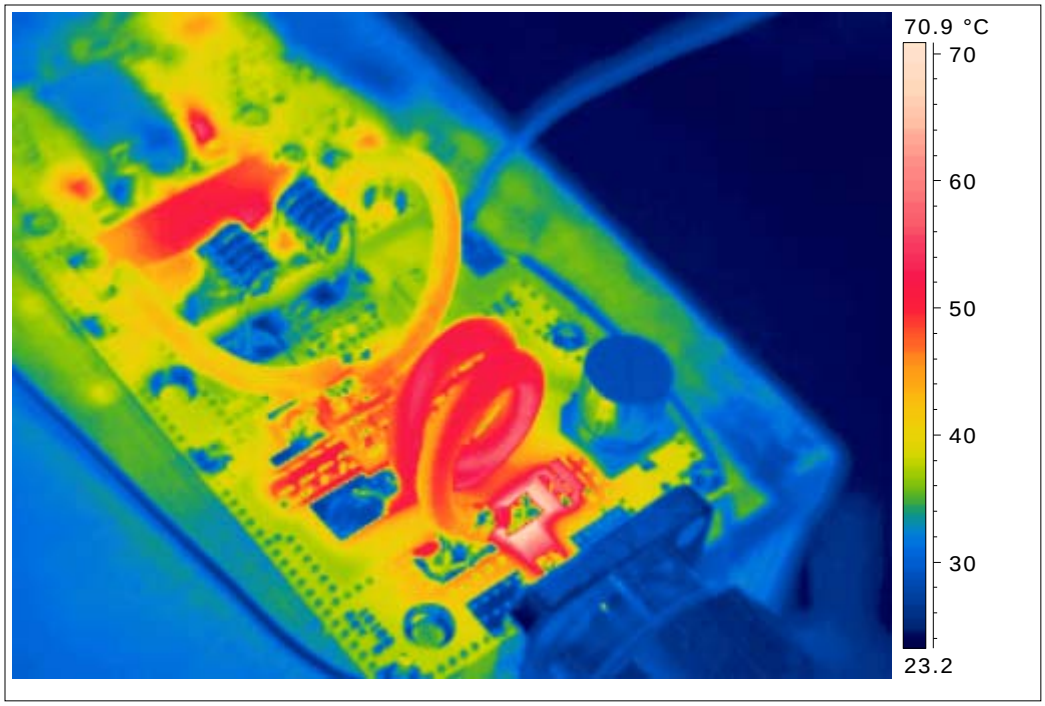

In order to maintain reliability and long life it is necessary to introduce airflow across the output cables. We use FLIR imaging cameras to verify all designs. In the IR image above the amplifier is running at 950 watts while the output balun is only 50C. Without airflow the output balun will increase to 145C in this working condition. Lead-Free solder is used on the output baluns because the melting temperature is over 220C and we know some customers will not install the amplifiers properly.

The 1000W rating for this amplifier is a maximum rating on a 50V supply. In a broadcast system there needs to be a low pass filter and directional coupler. These components introduce losses. We feel that this pallet can easily meet the design requirements for an 800W system. That's 800W after the low pass filter and directional coupler. This is a suggested operating condition with also takes into account the requirement that the amplifier is capable of driving loads that are less than perfect (up to 1.8:1 VSWR).