

DEM Part Number 3-3PACK
3 Watts, 10 GHz Linear Amplifier Complete Kit
Specifications

Frequency range:	10.0 - 10.5 GHz
Power Out (at 1 dB compression):	3 Watts nominal
Power Out (saturated):	>3.5 Watts
Power Input for rated power out:	<20 mw for linear operation. <30mW
Return Loss:	>10dB @10.368 GHz
DC requirements:	13.8 volts DC @ 2 amps. for nominal output 15 volts DC absolute maximum
Connectors:	SMA(F) only
Size:	3" L x 2" W x 2.5" H
Active devices:	FMM5061VF (Eudyna)
Keying Option:	PTT High or Low

Kit builders Checklist and Requirements

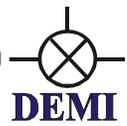
This kit is a simple 3 CM power amplifier but it requires some basic knowledge of FET operation and microwave principles. This amplifier will generate a minimum of 3 watts of power in the 10 GHz region. This amount of power could be harmful if not used correctly. Correct safety procedures must be maintained while aligning and using this power amplifier. This amplifier should never be operated into a open or un-terminated load. Quality coax and coaxial devices are required to test and align this kit. If you do not have any microwave construction experience, it is suggested that you return this kit and purchase a assembled version. Proper alignment of this kit requires a quality RF power meter that is specified to be used in the 10 GHz region, a accurate volt/ohm meter, a 50 Ohm load capable of dissipating 5 watts at 10 GHz, a 12-15 volt, 3 amp power supply, and a 10 mw driving source between 10 and 10.5 GHz. Any thing less than this will not ensure proper alignment and operation of this power amplifier kit. Improper assembly or alignment may cause premature failure of the active devices used and improper use of this product may cause harmful injury.

IMPORTANT!

The FET supplied with this kit is tested and the data is supplied with the packaging. We have had a 100% success rate with the FMM5061VF and do not foresee any problems in the future. Therefore, because it is in a kit, we can not replace this FET if it fails for you. If it fails, we assume it is because of improper assembly or testing. If you find this statement uncomfortable, return the kit for full credit towards an assembled version. The FET is approximately 60% of the price of this complete kit. You may purchase a replacement or spare at anytime but we feel it should **never** be required!

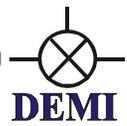
Pre-Assembly

This kits is supplied as a complete kit only. Any deviation of assembly or misuse of components will void any technical assistance provided by Down East Microwave Inc. Read all assembly instruction before starting assembly. If you have a question about a procedure (assembly or test) please call for technical assistance before starting the assembly. Be sure about what you are doing first!! Check all components with the parts list and begin when ready!



Assembly

1. Prepare the PC board by installing copper foil on the ground plane side beneath the RF input and output connectors. This foil improves the ground connection of the PCB to the enclosure and RF connectors. See Figure 1 for proper assembly. Make solder connections as smooth as possible. File smooth if necessary.
2. Install the PCB on the pallet using the three mounting holes located by IC2's mounting position with 3-48 x 3/16" screws. Do not tighten. Now install 4-40 x 3/16 screws in the corner holes of the PCB. Be sure the copper foil will cover the connector mounting holes on the ends of the pallet and the machined pocket in the heat sink is aligned with the FET hole in the circuit board. Bend the copper foil down over the pallet sides and verify that it is flush with the surface. If the circuit board has a bump in it or the foil will not fit smoothly to the pallet, you may need to file or compress the solder by gently taping with a small hammer. Be careful!!!
NOTE: We use the hammer in the factory! Solder compresses easily.
3. Using the component placement guide and the parts list, install all components on PCB except for R7, IC2, and D3. Keep the PCB as flat as possible during assembly. Flexing the PCB during or after assembly may fracture and destroy surface mounted components. See Figures 2,3, and 4 for proper pin prepping of K1, IC1, and R2. All components are surface mounted. Do not place any ground connection leads through any via holes! Be sure of the polarity of C4. Solder them on the top surface only. After assembly is complete, inspect the sides of the PCB for solder that may have "puddled" on the edge of the board. Remove the excess.
4. Prep the RF connectors by removing the Teflon extension and trim the pins to approximately 3/16" long. Install the SMA connectors on the outside of the housing I using 3-48 x 3/16" screws in the threaded holes. Just snug the screws do not tighten. Now install the RCA connectors on the sidewall without the washer or nut.
5. Place the housing on top of the heat sink assembly with the RCA connectors on the IC1 side of the circuit board. Align the housing with the circuit board by centering the connector pins with the input and output connections on the circuit board. If the copper foil is correct, the housing will fall into place and the bottom connector holes will line up with the mounting holes in the pallet behind the copper. Use a sharp object and puncture the foil through the connector holes and then insert the four 3-48 x 3/8" screws. Now this may be difficult because of alignment of the pallet screws. You may need to place the assembly in a clamping device such as a vice and "Squeeze" the housing down onto the pallet compressing the PCB on it's edge. Now install all of the connector screws and tighten being careful of the SMA pin alignment.
6. Inspect the IC2 pocket in the pallet and remove any debris that may have become trapped. It is extremely important that this surface is clean and flat before installing the MMIC. Apply the smallest amount of Thermal compound (heat sink grease) as possible to the bottom of the power FET. It should be a transparent layer. Wipe any excess off with a cotton tip applicator or the excess will migrate up to the circuit board after assembly of the MMIC on the pallet. Install the MMIC in the heat sink pocket aligning the leads as shown on the component placement. The leads should line up close to the center of the microstrip on the PCB. Install two 3-48 x 3/16" screws. Do not tighten.
7. Use Teflon wire to make connection from RCA connectors to the indicated points on the PCB. A large gauge and a small gauge wire is connected to the +13.8VDC input jack. The small gauge connects to the E6 pad on the PCB. The large gauge connects to the E11 pad. You should at this time decide if you want a PTT to ground (E5) or a PTT high (E4) and wire it appropriately to the second RCA jack. Use the lighter gauge for the PTT (push-to-talk). Also



wire the +5VDC jumper. (E10 to E9) with the light gauge. Then using two 1- ½" piece of heavy gauge wire, connect one end to the E7 and E8 pad.

8. Solder the RF connectors. Be sure of their connections. Verify the pins of IC2 are still aligned and the flange screws are tight, and then solder all pins. With a very short piece of solid wire from a leaded component, (One of the diodes) connect both pin 4 and pin 6 of IC2. Do this by making a short loop over the RF line as close to the IC as possible. Inspect for shorts. Install R7 on the output connector wall using two 4-40x ¼" screws(remove the 4-40's mounting the PCB to the pallet). The resistor is treaded. Then install D3 as shown.

Testing

1. At this time, the only missing component in the amplifier is the wire jumper from R7 to E8. With a Ohm meter, verify that IC2 is correctly installed and not shorted during installation. The gate (or Pin 1) is high impedance and if R2 was not installed it will not measure in the Mega-ohm region. The drain (or Pins 4 and 6) should measure only a ohm or two. It is difficult to verify if it is shorted so measure a few times to be sure. If the ohm meter test are OK go to step 2.
2. The amplifier requires a single 13.8 volts DC supply with a minimum 3 amp rating for the next test. Connect the power supply to the 13.8VDC connector. If you have a current limiting power supply limit it to 500 mA. All measurements are referenced to ground. Measure all +13.8VDC connections. If your power supply is less or more than 13.8VDC, all of the +13.8VDC voltages points will be your power supply voltage. Do not exceed 15.0 VDC or attempt to operate with less than 11 VDC. Now measure VR1 and confirm it is operating at 5 volts (± 0.3 VDC). Then check IC1. Measure the circuit for negative 5 VDC (± 0.5 VDC) at the junction of C4 to ground and positive 5 VDC at the junction of C12 to ground. Then measure the voltage on the gate lead (Pin 1 of IC2) directly and adjust R2 for maximum negative voltage. (-5VDC ± 0.5 VDC). If OK, key the PTT-L or -H and measure the voltage on R7 to verify that there is +13.8 VDC (or the power supply voltage!) Un-key the PTT and the voltage should slowly bleed out. You may short the output of R7 to ground to be sure it bleeds off. This slow bleeding will not happen after R7 is connected to E8.
3. Remove the DC power supply connection and install the large gauge wire from R7 to E8. Now terminate the input and output connections with a 50-ohm load of some type. The output requires a load capable of 5 watts. The input may be connected to the drive source but be sure the RF source is off.
4. Connect the power supply to the amp. Remembers to un-limit the current or readjust it to 2.5 amps. The next step needs to be understood before attempting. The idle current of the amplifier needs is controlled by the negative gate voltage. Be sure it is set for the maximum possible. If it is too low, IC2 will over dissipate and damage it. An adjustment of R2 may not be required but is available. To adjust it correctly you need a accurate current meter on the power supply or measure the voltage drop across R7. If you need to measure the voltage across R7, use good clip leads connected to your voltmeter. Key the PTT line and quickly verify that the current drain is not more than 2.5 amps. That would be a 7.5-volt drop across the 3 ohm resistor. If more release the PTT line immediately and check the gate circuit voltage or a short on the drain circuit. Most likely it will be less than 6 VDC drop. With the amplifier keyed, decrease the gate voltage (less negative) by adjusting R2 until minimum of 6 VDC drop is obtained. This should not take much adjusting at all.
5. After the idle current is set, remove the DC power before removing the clip leads that may be attached. Connect a RF power meter that is rated for 10 GHz and capable of measuring 5 watts. Then connect your drive source if not connected already. Reconnect the DC power



source. Key the PTT circuit. The amplifier will be drawing current. Now slowly apply RF drive and notice the output power on your power meter. It is sometimes possible to obtain as much as 3 watts with only 10 mw of drive. The current drain at the maximum power output level will be less than 2.5 amps. Do not exceed a drive level of 30 mw or whatever drive level saturates the power amplifier. If power output is low or non-existent, check all series RF components first, then re-check voltages without the RF drive applied. R7 will get hot to the touch! Remove to other two 4-40 x 1/4" screws holding the PCB to the pallet and install the Cover on the amplifier using the long 4-40 screws and #4 washers through the cover. The PCB is held in place by the enclosure.

Instructions for Use

1. To achieve maximum performance the amplifier should be mounted in a well ventilated area with heat sink fins in the vertical position for optimum cooling. A cooling fan is required for 100% duty cycle operation.
2. It is advisable but not necessary to use circulators and band pass filters when available. This will prevent stray oscillations and needless waste of power by amplifying local oscillator frequencies or generating high power out of band spurious signals.

3-3PA Component List

All resistors and capacitors are chip components unless specified.

C1 1.0 ρ F	C12 2.2 μ F can	VR1 78M05
C2 1000 ρ F	C13 0.1 μ F	Q2 2N2222
C3 0.1 μ F	C14 10.0 μ F Tant	D1 1N4000
C4 2.2 μ F can	C15 10.0 μ F Tant	D2 1N914 or 1N4148
C5 2.2 μ F can	C16 1000 ρ F	D3 CZ5348B
C6 100 μ F can	C17 10.0 μ F Tant	K1 G5V-5
C7 0.1 μ F	R2 200 POT	IC1 NMA0505S
C8 0.1 μ F	R3 5.1K Ω	IC2 FMM5061VF
C9 0.1 μ F	R4 5.1K Ω	PCB board
C10 1000 ρ F	R6 51 Ω	
C11 1.0 ρ F	R7 3 Ω 10 watt	

Hardware Parts

1	Pallet	4	3-48 x 3/8" screws
1	Enclosure and lid	7	3-48 x 3/16" screws
2	SMA connectors	4	4-40 x 1 1/4" screws
4	Screw type Rubber Feet	4	4-40 x 1/4" screws
2	RCA Connectors	1	Thermal compound
1	2" x 1" Copper Foil	4	#4 washers

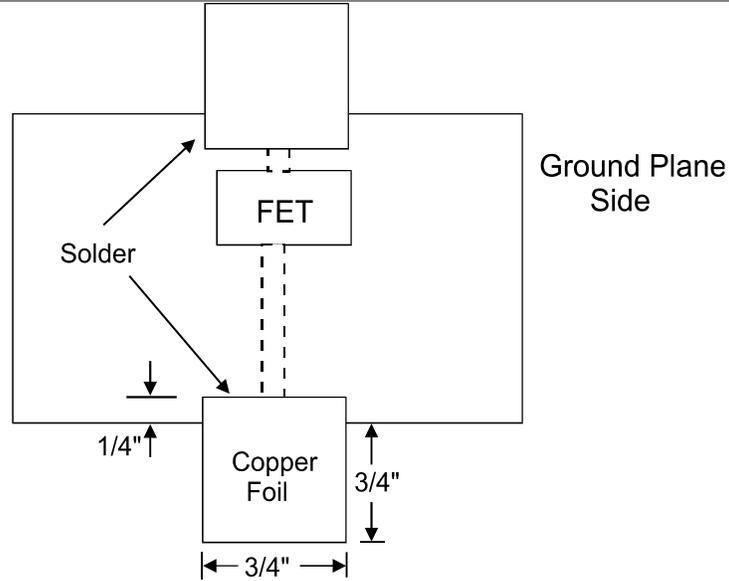


Figure 1

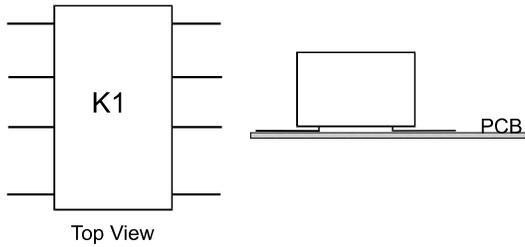


Figure 2

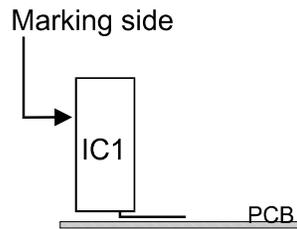


Figure 3

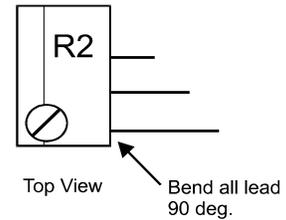
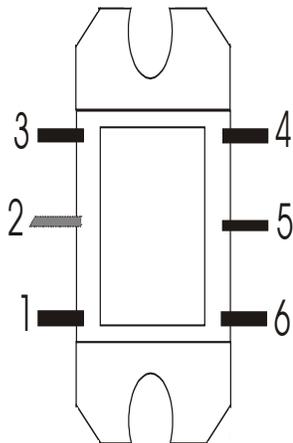


Figure 4



Pin Out:

1	VGG
2	RF in
3:	N.C.
4:	VDD
5:	RF Output
6:	VDD

3-3PA SCHEMATIC

