

60 W Power Amplifier Kit for 23 cm

KIT MKU PA 1360 DB6NT 9.2012

The described power amplifier is exclusively dedicated to amateur radio use. For construction, alignment and operation fundamental knowledge of RF technique is necessarily required. The constructor should be experienced in working with SMD parts; it shouldn't be a beginner's work because of the very small size of some parts. ESD sensitive devices (for example FETs) must be handled carefully which includes the use of a grounded soldering station and a conductive and grounded mat.

Brief description of construction:

The PCB must be placed into the case with M2 screws and sufficient silver conductive adhesive between PCB and case. Before this the milling for placing the transistor into the PCB must be controlled and broadened if necessary. Attention must be paid to the areas at the SMA connectors and at the MOSFET: the adhesive at the rim of the PCB mustn't create a short between the conductor path and GND.

The adhesive must be cured at the appropriate temperature. Afterwards the SMD parts and the SMA connectors should be mounted. A DC test must be done before the MOSFET is built in: after applying the control voltage (12 V) the gate voltage must be adjusted to the lowest value (about 1.8 V)! Then the MOSFET should be mounted with the included M2.5 lock washers and screws and some heat conductive paste (we recommend ARCTIC SILVER V) which should be put on very economically. There mustn't be any heat conductive paste between a conductor path and GND!

Adjustment of the quiescent current:

The power amplifier must be mounted on a heatsink. Details for dimensioning a heatsink are available on our website: http://www.kuhne-electronic.de/fileadmin/userfiles/_pdf/kuehlkoerper/heatsink.pdf

A suitable power meter with an attenuator (50 ohms) should be connected to the output of the power amplifier while the input must be terminated with 50 ohms (load). Then the power amplifier should be connected to a power supply (27 V) via an ampere meter. The current of the power supply should be limited to 0.6 A. The switch-on voltage (12 V) should be applied to switch the power amplifier on and then the quiescent current should be adjusted to 400 mA by the internal potentiometer.

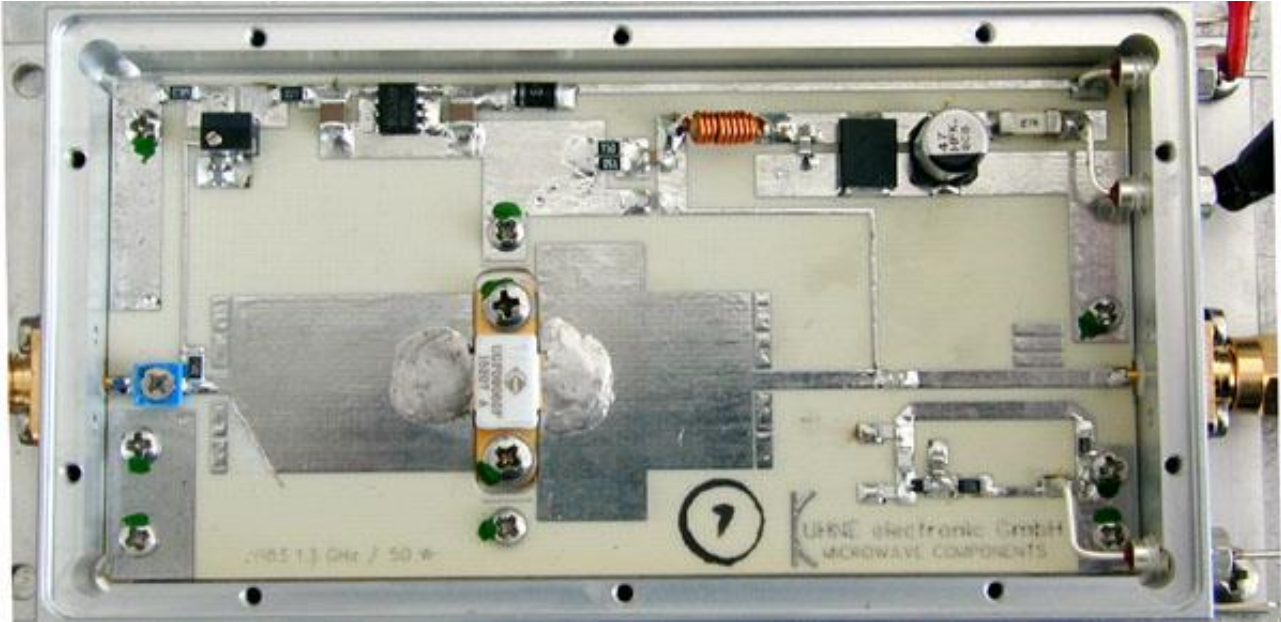
Alignment of the RF:

The current limiting of the power supply should be increased to 4.5 A. Afterwards a signal of 1 W should be applied to the power amplifier. The current consumption increases noticeable and more than 10 W should be measured at the output. Depending to the desired operating frequency the input of the transistor must be matched. The variable capacitor at the input should be tuned to maximum output power and the input stripline can be shortened or broadened (by applying a copper pad) to achieve maximum power and maximum input return loss. Then the input power should be increased step by step to maximum 4 W while the output stripline must be tuned to maximum output power. Finally min. 60 W should be reached.

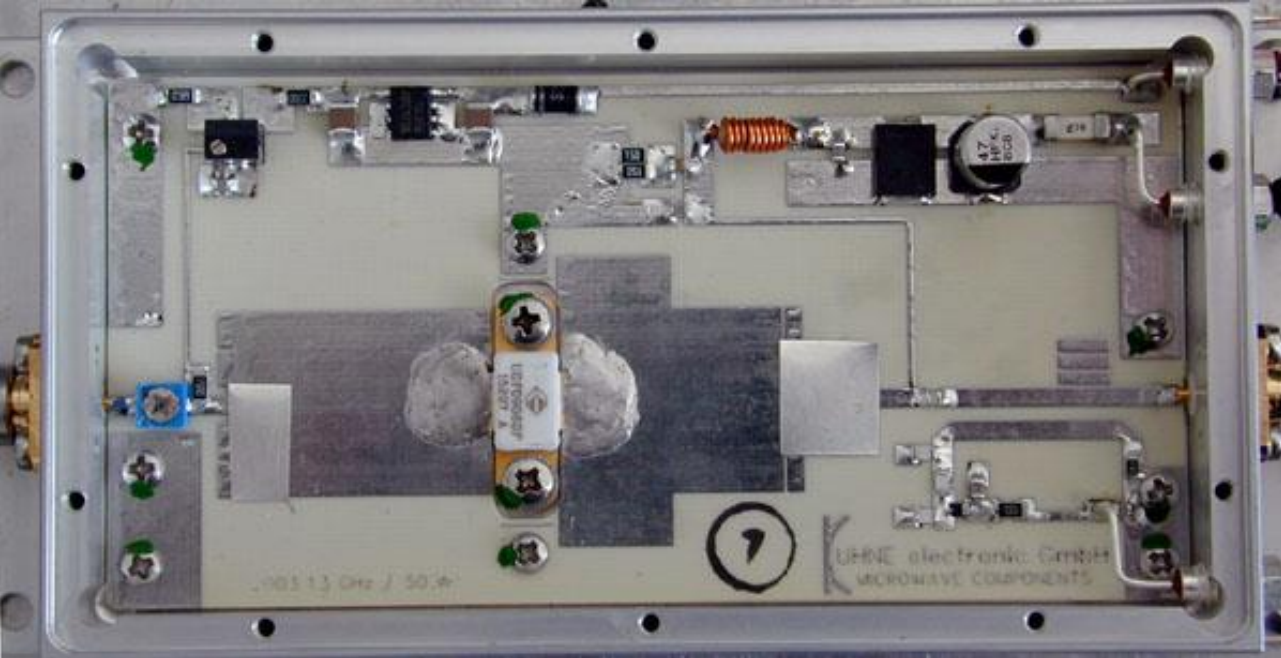
A higher input power level than 4 W will immediately destroy the MOSFET. The VSWR of the antenna should be better than 1.8:1! A sequence controller for the power amplifier and the coaxial relays is necessarily required. The frequency range 1240 ... 1300 MHz mustn't be exceeded!

Broadband matching for covering the whole band is possible, but then a compromise between gain and output power must be accepted.

Matching for 1296 MHz



Matching for 1270 MHz



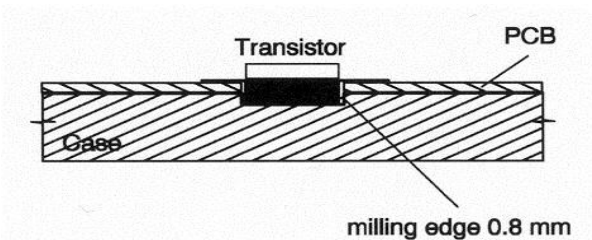
Matching for 1250 MHz



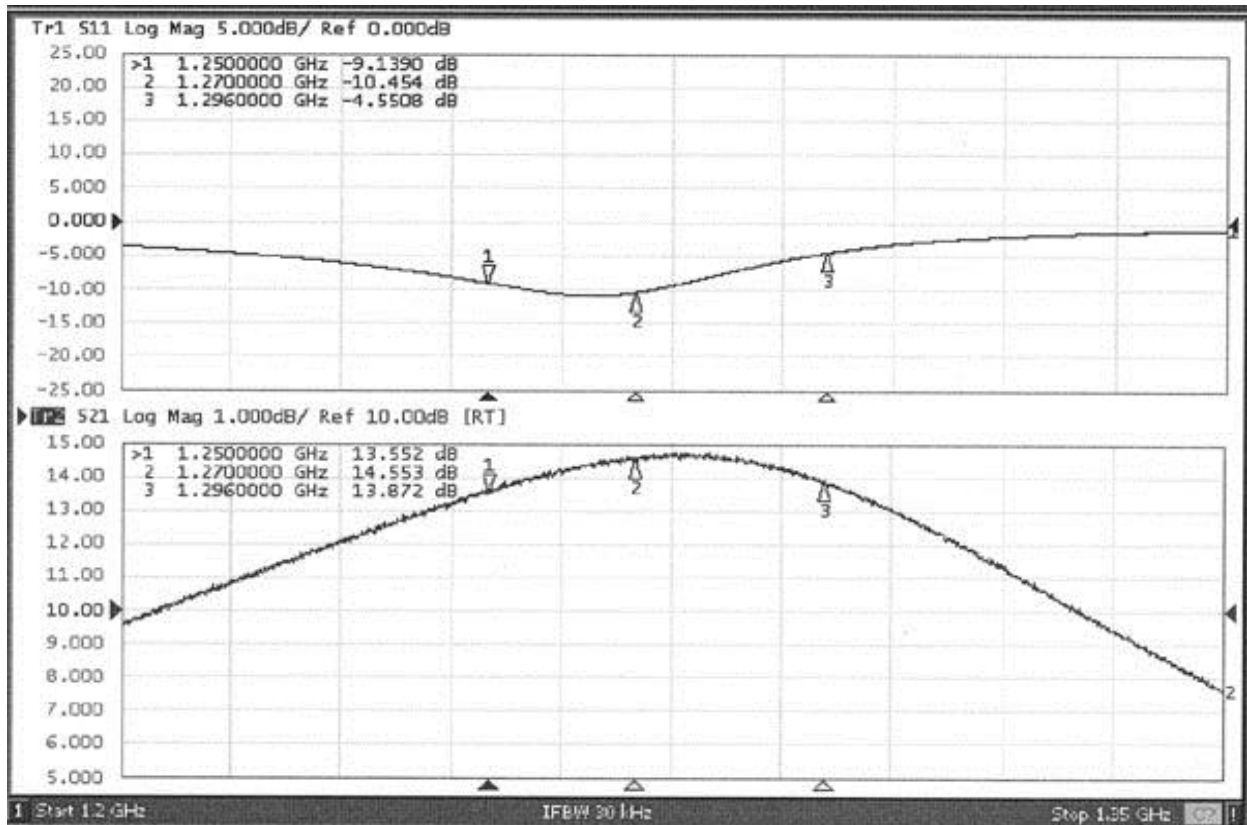
Measurements of some prototypes:

F [MHz]	P _{in} [W]	P _{out} [W]	I [A]	U _{MON} [V]
1296	2.2	50	3.8	3.7
1270	1.4	50	3.66	3.6
1250	1.5	50	3.82	3.7
1296	3.9	60	4.33	4.1
1270	3.1	60	4.20	4.0
1250	3.2	60	4.34	4.0

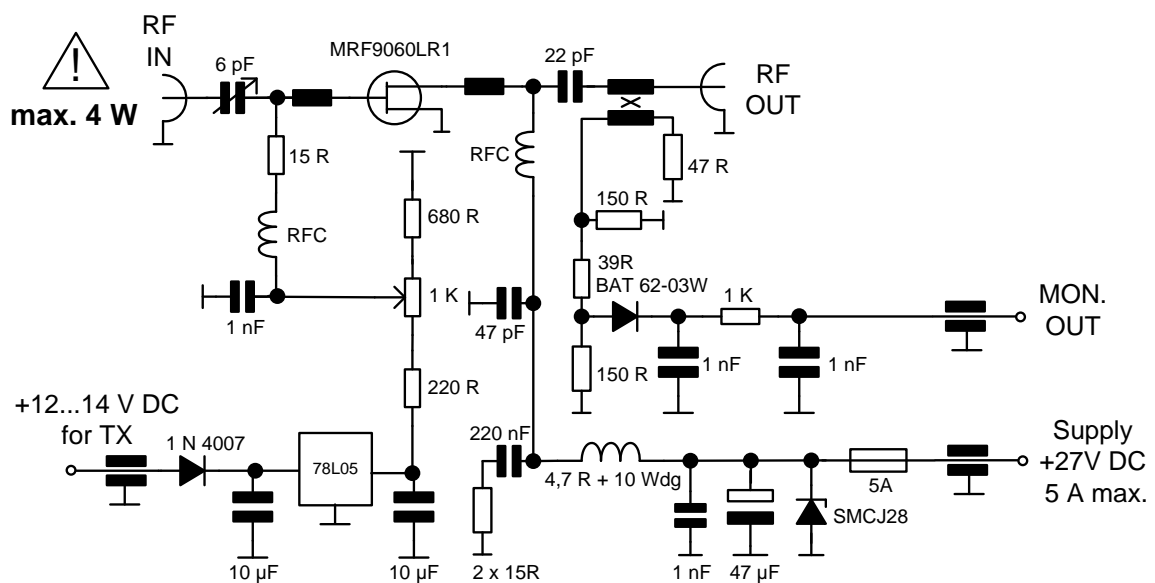
P1dB: 61 W @ 1296 MHz
 Harmonic rejection: ca. 40 dB
 IM3: 31 dBc @ 30 W PEP @ 1296 MHz



Gain and input return loss of the power amplifier tuned on 1270 MHz:



Schematic



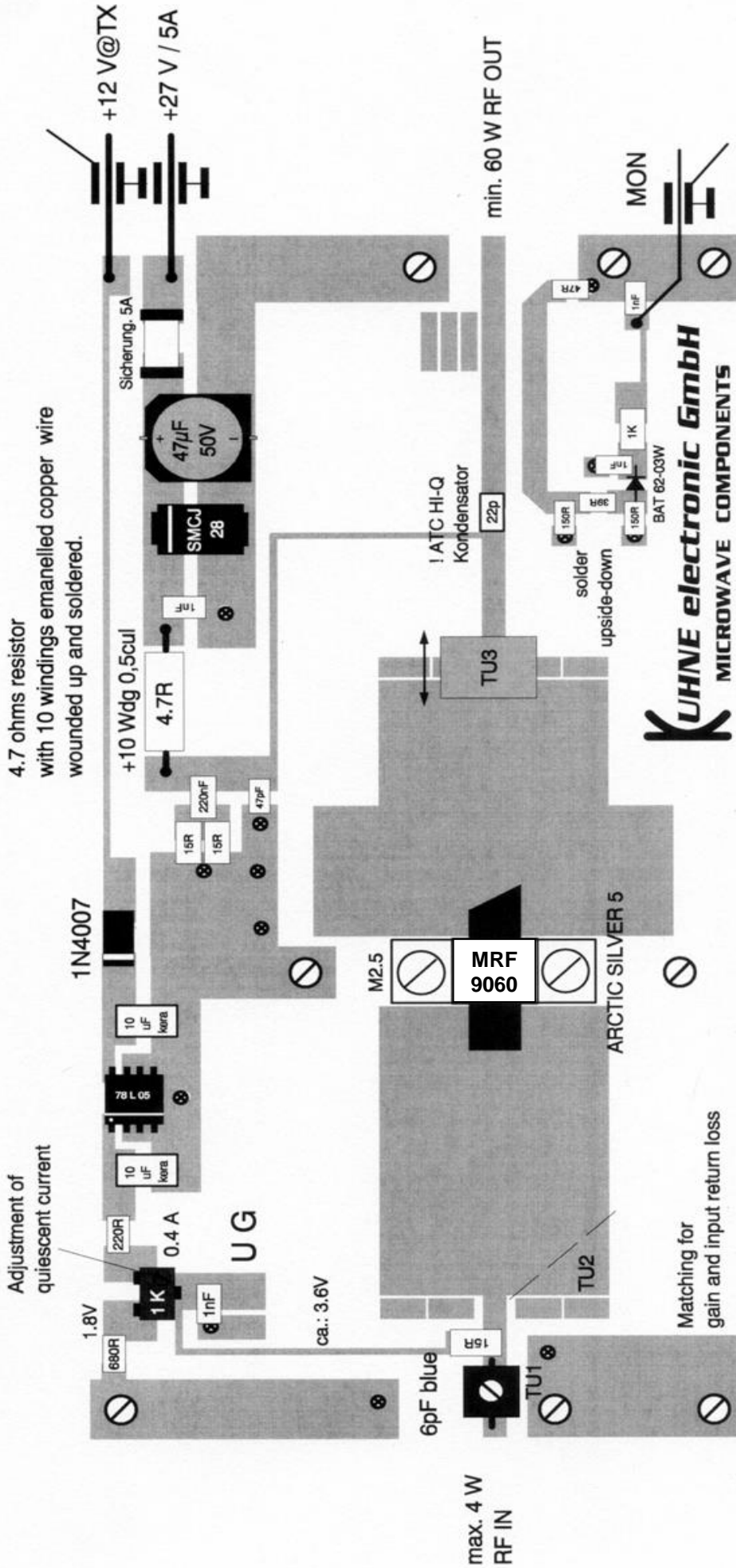
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For operating high frequency modules legal instructions must be followed!

Reference: „L-Band-Leistungsverstärker für AO-40-Uplink“ (Konrad Hupfer DJ1EE, UKW-Berichte 1/2003)

Power Amplifier 1.3 GHz / 60 Watt DB6NT

1240 - 1300 MHz
4 W IN - 60 W OUT



The transistor must be screwed into the clearance of the PCB and the milled edge of the bottom of the case. The connections must be kept short and soldered with the PCB.

TU1, 2 and 3 are Matching-Points

Bill of materials:

1	PCB	
1	MOSFET Transistor	MRF9060LR1
1	Variable capacitor	6 pF blue
6	Resistor	SMD 1206
4	Resistor	SMD 0805
1	Potentiometer	SMD 1 K
2	Ceramic capacitor	10µF/20V
6	Ceramic capacitor	SMD 0805
1	ATC Hi-Q-capacitor	22 pF
1	Resistor	4.7 ohms with 10 windings enamelled copper wire
1	TAZ diode	SMCJ28
1	Schottky Diode	BAT62-03W
1	Diode	LL4007/1N4007
1	Voltage regulator	78L05
1	Electrolytic capacitor	47 µF/50 V
1	Fuse	SMD 5 A
2	Connectors	SMA (4 hole)
3	Feed through capacitor	1.5 nF - 8/32 UNC
2	Solder lug	3 mm
8	Screw (stainless steel)	M2 x 4 RK
2	Screw (stainless steel)	M2,5 x 5
2	Lock washer	M2,5
8	Screw (stainless steel)	M2 x 3 RK

Additional parts available:

1	milled aluminium case	(incl. all drills, millings and threads)
1	heat conductive paste	ARCTIC SILVER V http://www.kuhne-electronic.de/en/products/other-components/heat-conductive-paste-arctic-silver-5.html
1	heatsink	SK 300 - 62 http://www.kuhne-electronic.de/en/products/heat-sinks/sk-300-62.html
1	fan	60 x 60 24 Volt http://www.kuhne-electronic.de/en/products/fans/fan-60x60-24-v.html
1	power supply	SP 150 W 27 http://www.kuhne-electronic.de/en/products/power-supply-units/sp-150-w-27.html

Other components or spare parts like helical filters or anything else are not available!
Please contact the following companies:

Eisch-Kafka Electronic GmbH
www.eisch-electronic.de

R.F. elettronica di Rota Franco
www.rfmicrowave.it

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