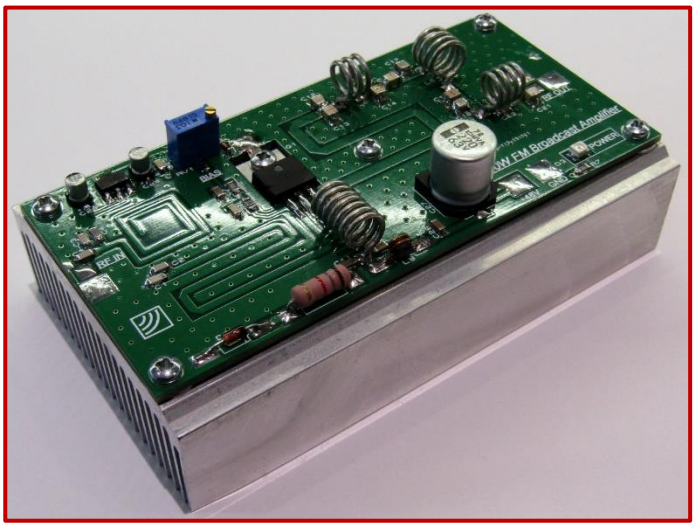
FM Broadcast Reference Design

48V 100W Broadband Amplifier using MRF101AN

Rev 1; 10/2019

Features

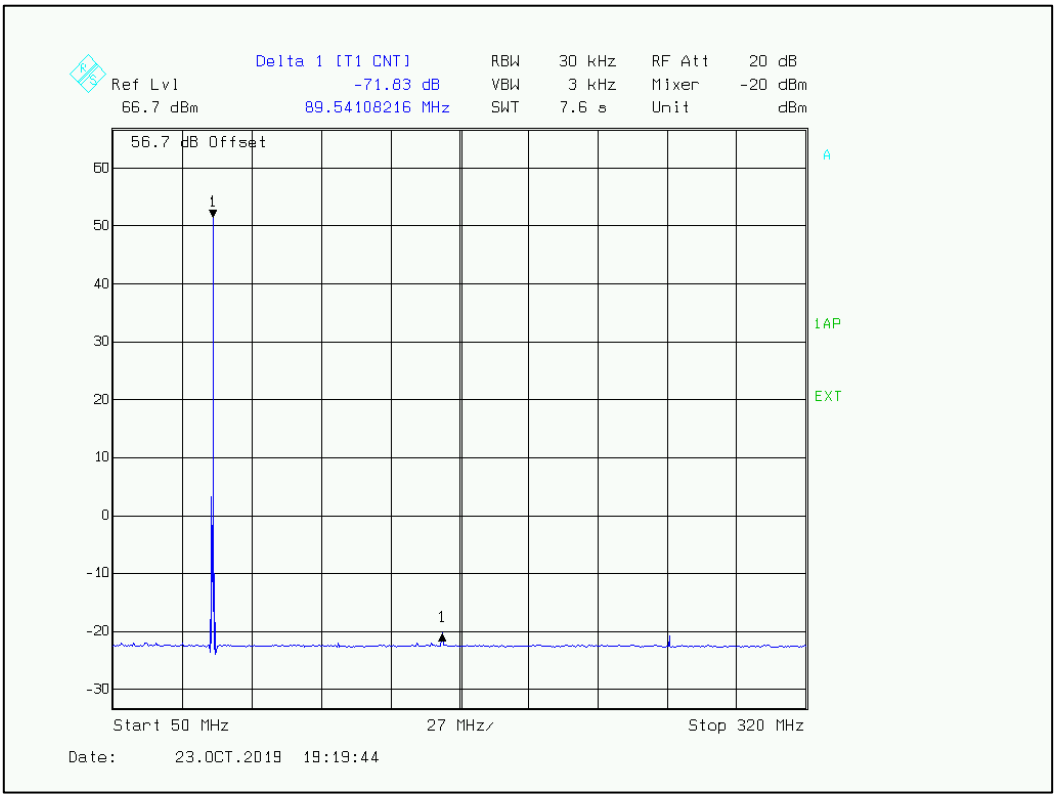
- Frequency Band 87.5 - 108MHz
- Output Power >100W
- Supply Voltage 48 Vdc
- Input Power 1W
- High Efficiency – Up to 80%
- On-board Low Pass Filter
- Broadband – No Tuning Required
- Temperature Compensated Bias
- High Ruggedness – Up To 65:1 SWR
- Output Complies with International Broadcast Standards



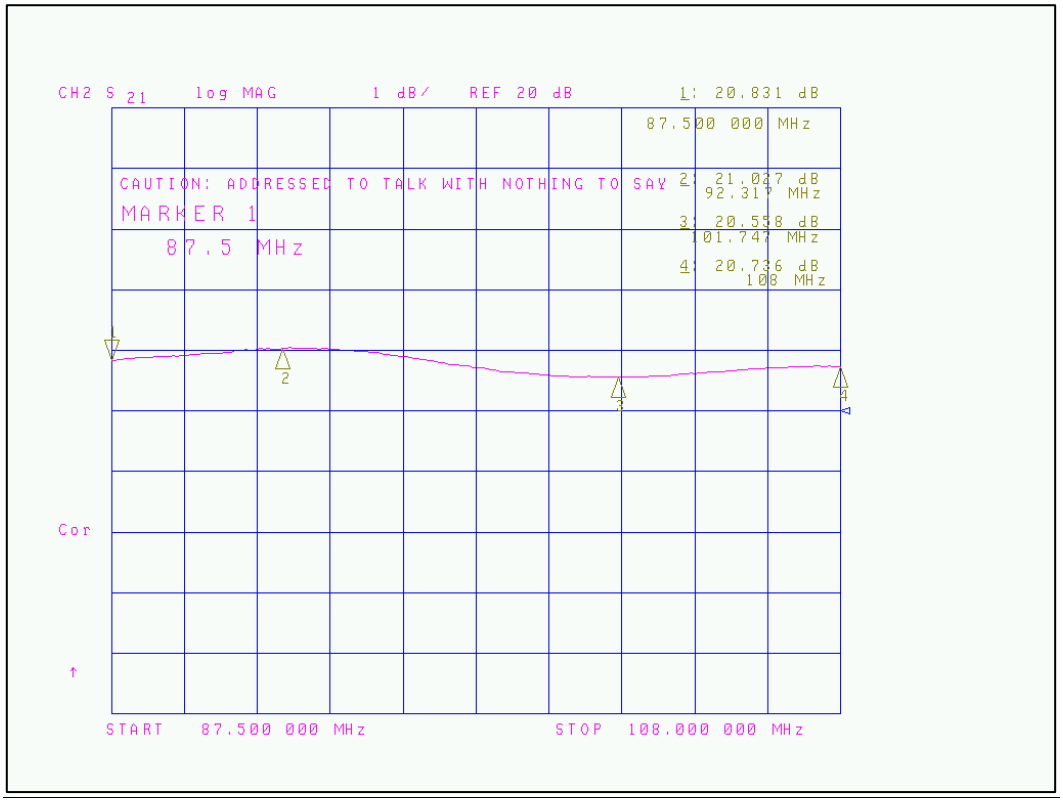
Typical Performance

Test Conditions: Vdd 48V, 100mA bias, 1W drive 87.5-108MHz, Output in to 50R load.

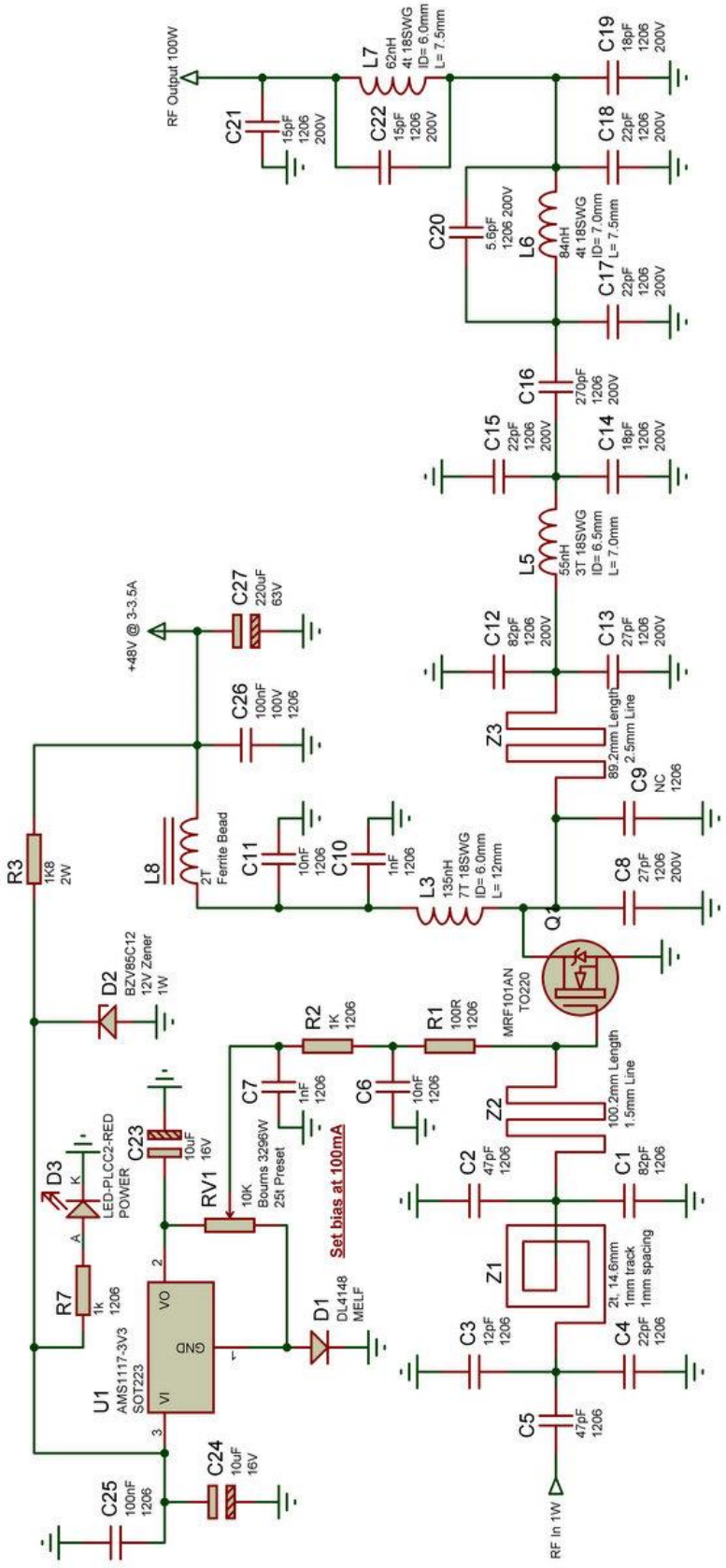
	Min	Typical	Max	Unit
Power Gain (S21)	20.5	20.7	21.0	dB
Gain Flatness		+/- 0.5		dB
Efficiency	70	74	80	%
Harmonic Output	-72	-79	-86	dBc
Input Return Loss (S11)	-10	-14	-23	dB
DC Current Consumption	3.1	3.4	3.8	A
Output Power	113	118	126	W
Input Power		1	1.5	W



Graph 1: Worst-case Harmonic Emission – 89.5MHz



Graph 2: Gain at 48V Supply 87.5 - 108MHz



Enigma Broadcast

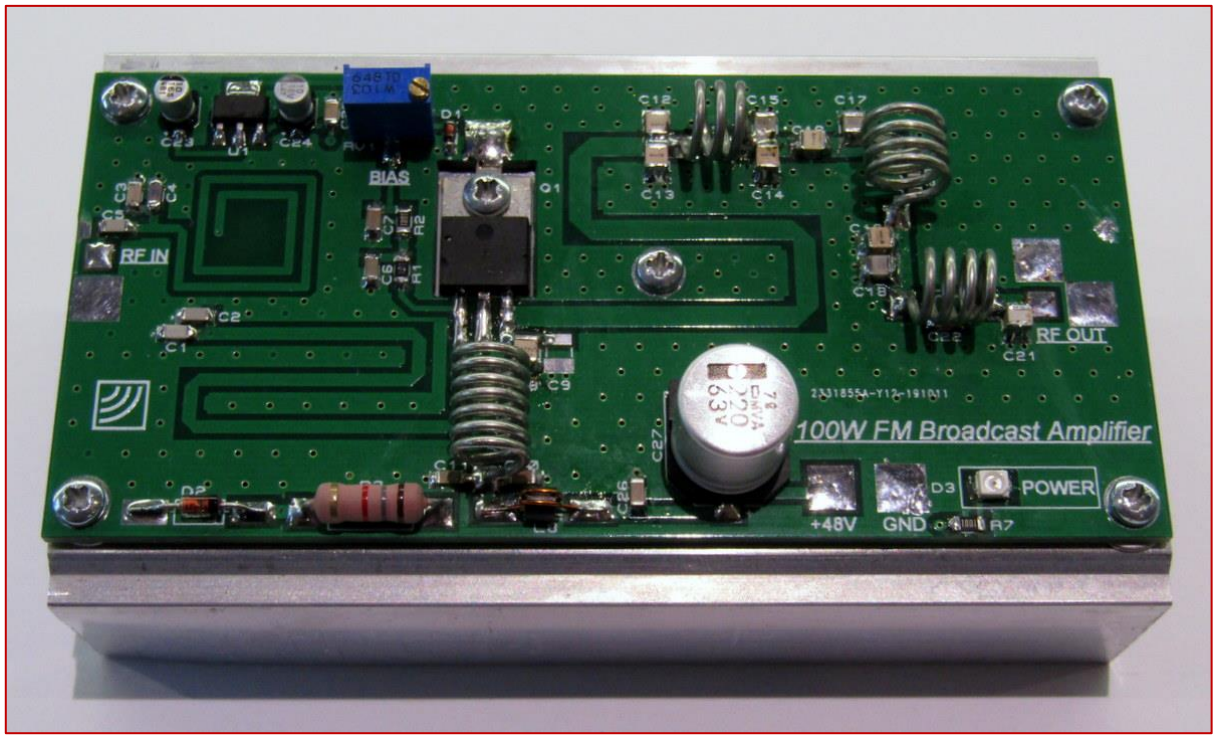
MRF101AN FM Broadcast Schematic Diagram

Parts List

Identifier	Value	Type	Notes	Part Link
R1	82R or 100R	1206		enigma-shop.com
R2, R7	1K	1206		enigma-shop.com
R3	1K8	2W carbon	Leaded	Cricklewood Elec
RV1	10K	Bourns 3296	25T Leaded	enigma-shop.com
C1	82pF	1206	50V	enigma-shop.com
C2, C5	47pF	1206	50V	enigma-shop.com
C3	12pF	1206	50V	enigma-shop.com
C4	22pF	1206	50V	enigma-shop.com
C6, C11	10nF	1206	50V	enigma-shop.com
C7, C10	1nF	1206	50V	enigma-shop.com
C8, C13	27pF	1206 or ATC100B	>200V	enigma-shop.com
C12	82pF	1206 or ATC100B	>200V	enigma-shop.com
C14, C19	18pF	1206 or ATC100B	>200V	enigma-shop.com
C16	270pF	1206 or ATC100B	>200V	enigma-shop.com
C20	5.6pF	1206	50V	enigma-shop.com
C21	15pF	1206 or ATC100B	>200V	enigma-shop.com
C22	15pF	1206	50V	enigma-shop.com
C23, C24	10uF	Electrolytic, size A	16V	enigma-shop.com
C25, C26	100nF	1206	100V	enigma-shop.com
C27	220uF	Electrolytic, size KE0	63V	enigma-shop.com
U1	AMS1117-3V3	SOT223 Regulator		enigma-shop.com
Q1	MRF101AN	TO220		enigma-shop.com
D1	RLS4148	MELF silicon diode		enigma-shop.com
D2	BZV85C12	12V, 1.3W leaded Zener diode		Cricklewood Elec
D3	LED	PLCC-2 Red		enigma-shop.com
L8	2T Ferrite Bead	FB43-101	2T 26 SWG wire on FB43-101	enigma-shop.com
L3	7T Air Coil	18 SWG Hand-wound	ID 6.0, L 12.0mm	SWC
L5	3T Air Coil	18 SWG Hand-wound	ID 6.5, L 7.0mm	SWC
L6	4T Air Coil	18 SWG Hand-wound	ID 7.0, L 7.5mm	SWC
L7	4T Air Coil	18 SWG Hand-wound	ID 6.0, L 7.5mm	SWC
Heatsink	HS110/ HS110B	120 x 69 x27mm		enigma-shop.com
Earth tag	M3			Rapid Elec
Power Supply	PSU200-48	48V 200W Power supply		enigma-shop.com
Washers	M4	Plain M4 washer		Rapid Elec
H/Sink Paste	K-5211	Kafuter K-5211	For Q1	enigma-shop.com

Construction Notes

- PCB Material is 1.6mm FR4 with 1oz copper plating. Prototypes were ordered from JLC PCB using the low-cost prototype service. Gerber files for the PCB can downloaded here. The hole for the MRF101AN is detailed on the MECH 1 layer of the gerber file.
- PCB should be mounted above the heatsink using four M4 washers as spacers.
- An M3 earth tag should be used to provide thermal contact from the MRF101AN tab and soldered to the PCB pad above Q1.
- All air coil diameters (ID) are the internal diameter. Wind the coil around a drill bit of the same size.
- All air coil lengths (L) are measured from wire-centre to wire-centre.
- All air coils are wound from 18 SWG tinned copper wire. This wire is about 1.25 mm diameter. The American equivalent is 16-17 AWG.
- For very high reliability it is recommended to use ATC100B capacitors on the output of the amplifier.
- Turn RV1 fully anticlockwise before powering on first time to set zero bias. Turn RV1 clockwise to adjust supply current to read 120mA at 48V without RF drive applied. This is equivalent to 100mA for the MRF101AN plus 20mA for the LED.
- A 60-80mm axial 12V fan can be used to cool the amplifier. Airflow >30CFM is recommended.



Completed FM Broadcast Amplifier

Warning

The output of this amplifier can cause RF burns. Do not touch the air coils or microstrip lines when the amplifier is producing RF power.

Please Note

This amplifier is capable of producing powerful RF signals on the FM broadcast band. Always broadcast within the regulations and operate with a broadcast licence. Enigma Broadcast cannot be held responsible for those using this information to broadcast illegally or without a licence.

We hope you enjoy this design.

Technical questions can be emailed to: info@enigma-shop.com