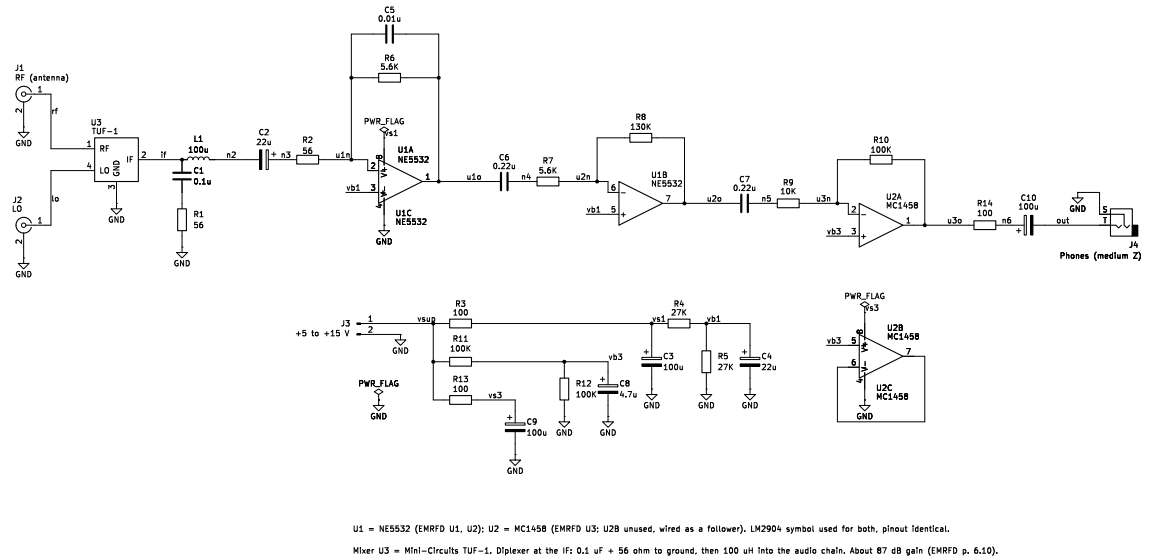
Direct-Conversion Receiver, 40 m (TUF-1 DBM)

40m · 50 Ω · 12 V · sim-pass
EMRFD p. 6.10; Mini-Circuits TUF-1+ datasheet (REV. A, M151107) p. 1

A complete direct-conversion receiver back end for 40 m. RF and a local oscillator go into a diode ring mixer, and the audio difference comes out to headphones.



BUILD LIST: TICK AS YOU GO

	Ref	Value	Qty	Part / notes
☐	C1	0.1 µF	1	
☐	C2, C4	22 µF	2	
☐	C5	0.01 µF	1	
☐	C6, C7	0.22 µF	2	
☐	C8	4.7 µF	1	
☐	C3, C9, C10, L1	100 µF	4	
☐	J1	RF (antenna)	1	
☐	J2	LO	1	
☐	J3	+5 to +15 V	1	
☐	J4	Phones (medium Z)	1	
☐	R1, R2	56 Ω	2	
☐	R4, R5	27 kΩ	2	
☐	R6, R7	5.6 kΩ	2	
☐	R8	130 kΩ	1	
☐	R9	10 kΩ	1	
☐	R3, R13, R14	100 Ω	3	
☐	R10-R12	100 kΩ	3	
☐	U1	NE5532	1	NE5532 dual op-amp
☐	U2	MC1458	1	MC1458 dual op-amp
☐	U3	TUF-1	1	Mini-Circuits TUF-1 double-balanced mixer

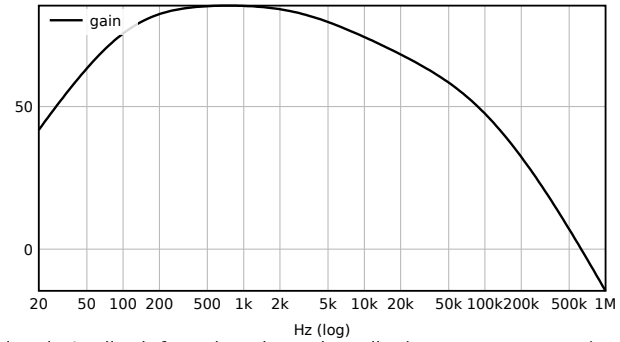
BUILD NOTES

- Drive the LO port at about +7 dBm from a clean oscillator.
- Headphone impedance isn't stated in EMRFD; the simulation assumes 600 Ω.
- Keep the audio input stage away from AC hum sources, and shield it.

Test: Inject a weak signal at 7.0 MHz with the LO 1 kHz away and listen for a clean tone. Check for hum and microphonics.

CHECK AGAINST

Check	Expect	Basis
Gain	87 dB · sim 85.3 dB ± 1	book
Conversion loss	9.6 dB	simulated



ngspice sim/audio.cir from the schematic netlist (not a measurement)

Full page:
https://qrpedia.com/circuits/receivers/dbm-direct-conversion-rx-40m/
Interactive sim, KiCad project, netlist and errata.

SPECIFICATIONS (FULL)

Spec	Value	Basis	Reference
Gain	87 dB	book	EMRFD p. 6.10, audio chain
Gain	85.3 dB ± 1	simulated	sim/audio.cir, 1 kHz, 600 ohm phones assumed
Conversion loss	9.6 dB	simulated	sim/mixer.cir, 1N5711 ring model; TUF-1+ datasheet p. 1 typ 5.85 dB (mid-band)

Simulated values are this build's ngspice results (± the build's check tolerance); book and measured values are as published.

HOW IT WORKS

The TUF-1 mixer multiplies the RF with the LO. Its IF port feeds a diplexer: 0.1 µF plus 56 Ω to ground terminates the mixer at RF, and a 100 µH choke passes audio on. A low-noise NE5532 stage and further op-amp stages give about 87 dB of audio gain (EMRFD p. 6.10). The simulation gives 85.3 dB at 1 kHz (**simulated**).

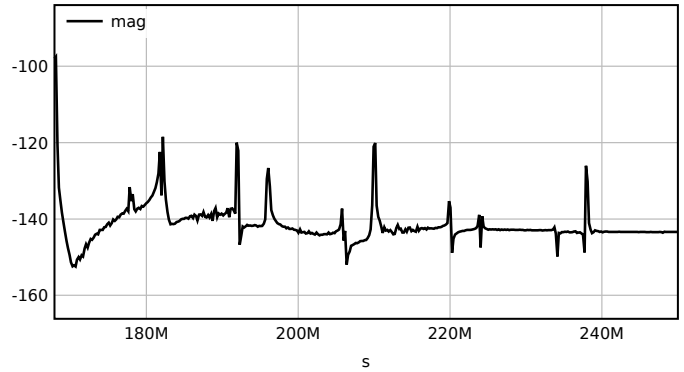
WHERE IT COMES FROM

A direct-conversion receiver example from Experimental Methods in RF Design, Chapter 6.

SOURCES

- EMRFD Fig 6.29, p. 6.10
- Mini-Circuits TUF-1+ datasheet (REV. A, M151107), p. 1

MORE SIMULATION



ngspice sim/mixer.cir from the schematic netlist (not a measurement)