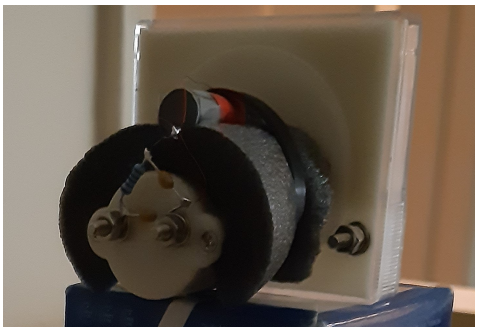
H-Probe for 30 m - 160 m Bands

Assembly and Calibration Guide



Revision	1
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Notice
The panel meter can be damaged in RF-fields above 0.3 A/m on 40 m band. Calibration is needed for each frequency used. Re-calibration has to be done if the probe was exposed to excessive radio frequency fields.

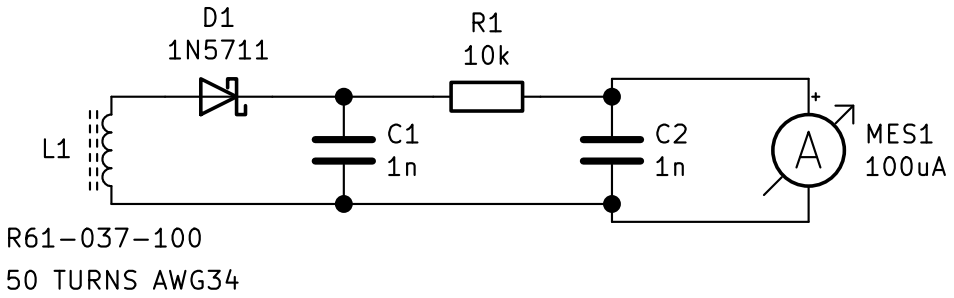

Figure 1: Circuit diagram of the probe is modified version of W8JI RF-current meter. Amidon material 61 starts to become lossy above 7 MHz. Schottky diode D1 rectifies RF-voltage induced to the probe coil L1. C1 and C2 filter the rectified signal and R1 feeds small current 0 - 100 μA to panel meter.

Calibration

The ferrite rod is placed in center of 0.2 m diameter loop from AWG12 solid Copper wire as shown in Figs. 2 and 3. The loop has impedance close to 50 Ω on bands used and provides good match to QRP transceiver like FT817 as seen from Fig. 4. Step attenuator (Elecraft AT1) is needed to measure power levels below 0.5 W with this transceiver.

Current in the loop assuming perfect match is $I = \sqrt{P/50\Omega}$. Here P is power from transceiver. Magnetic field in center of loop is $H = I/d$ with $d = 0.2$ m the loop diameter. Fig. 5 shows measured current on bands 20 m - 160 m with different field strengths.

Directivity can be tested by rotating the ferrite rod by 90° in horizontal or vertical plane.

Maximum coupling to electric field can be estimated by assuming the 10 mm long coil to be an electrically small dipole. The voltage on this dipole would be $v_E \sim E \cdot 5\text{mm}$. Here E is electric field in V/m.

Figure 2: Probe in center of 0.2 m diameter calibration loop.

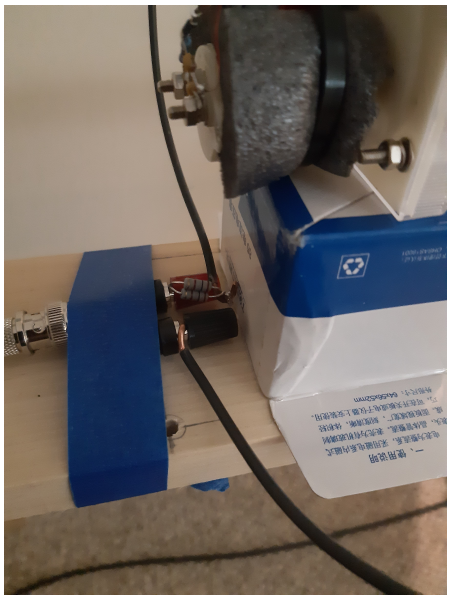

Figure 3: Loop is fed through two 100 Ω 2 W metal film resistors in parallel giving good match at low frequencies.

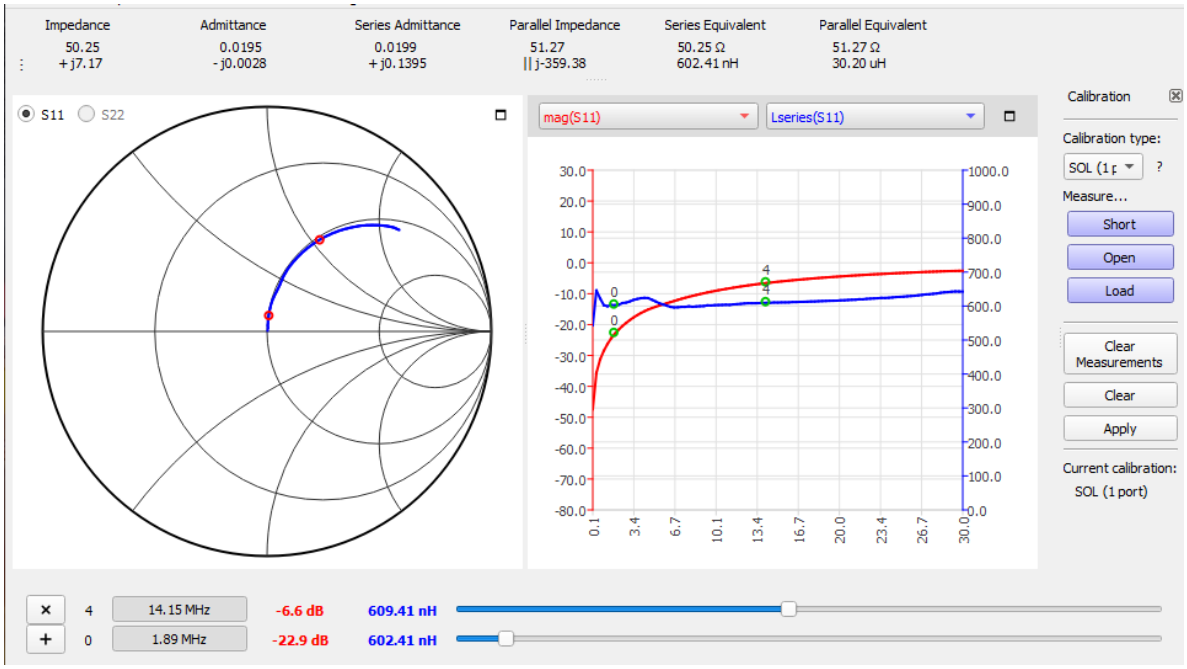

Figure 4: nanoVNA gives loop inductance of 600 nH and resistance 50 Ω. Return loss is more than 10 dB on 10 MHz and frequencies below that. Placing H-probe in center of calibration loop did not change the observed traces.

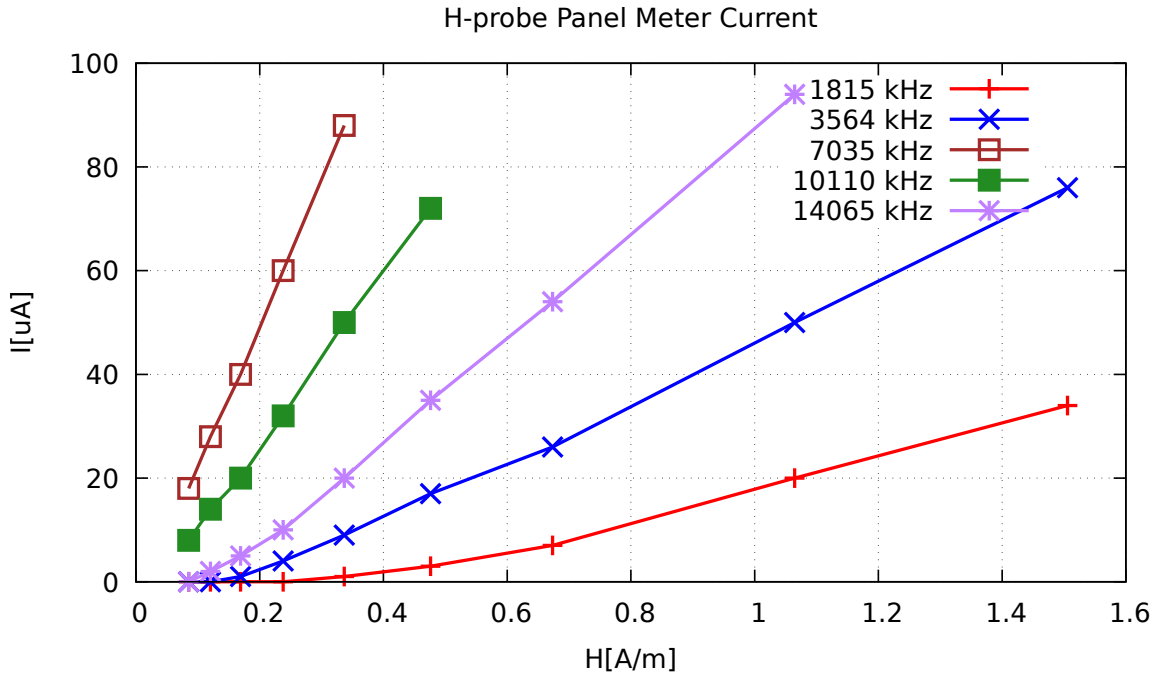

Figure 5: Typical H-field response on bands 20 m - 160 m. Sensitivity seems to be highest on 40 m band and lowest on 160 m. Signal detection is maximum in direction of the ferrite rod.