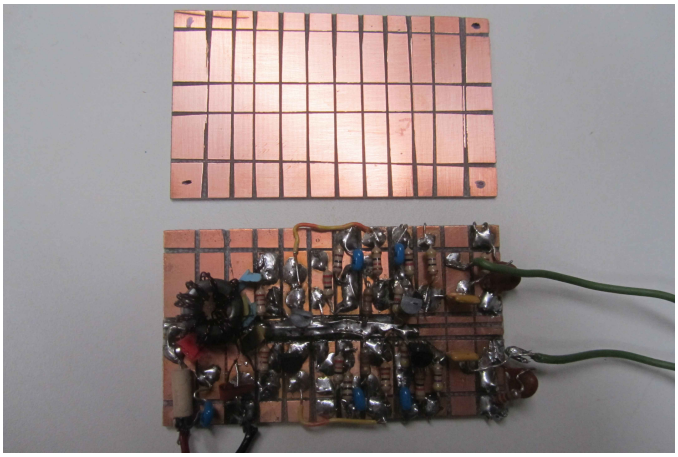
To date I have constructed twelve of these preamps. When I started I (mistakenly) held the view that the LZ1AQ preamp could be assembled using construction techniques common to the audio frequency band. Not so ... this is a wideband preamp and careful parts layout and grounding techniques are necessary for quality performance.

The first six versions were constructed using Radio Shack 276-150 Multipurpose RC Boards. Although a heavy wire common ground was added to this board it proved inadequate to control certain erratic preamp behavior at frequencies above ~1 MHz. I suspected that a ground plane was necessary, a view confirmed after receipt of a board constructed by Steve Ratzlaff. He had kindly forwarded his board to enable me to validate my measurement technique. (In the pictures that follow, measurements on Steve R's preamp are labeled '*SR*'.)

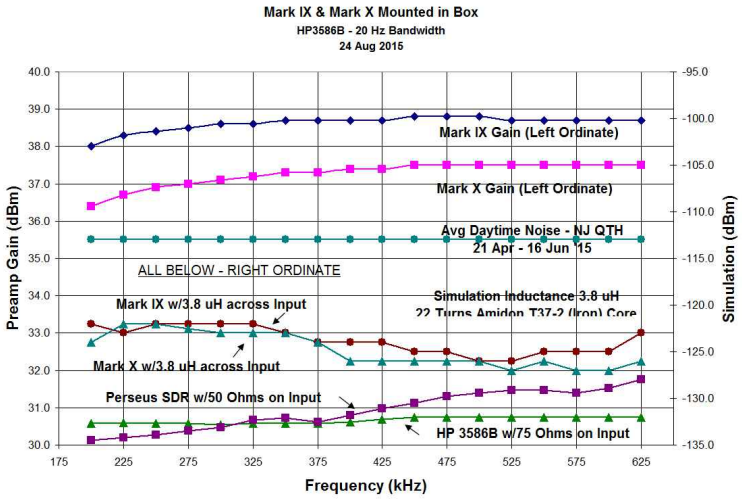
Next are descriptions and remarks concerning the last six versions of Chavdar's preamps. Constructed on double-sided printed circuit boards, these have proven quite satisfactory in actual operation.



(The preamps are numbered in order of construction as *Mark I*, *Mark II*, etc.)

**Mark VII** - constructed on a double-sided circuit board, components requiring a connection to ground have one end wrapped around the edge of the board and soldered to the bottom of the board which serves as a ground plane.

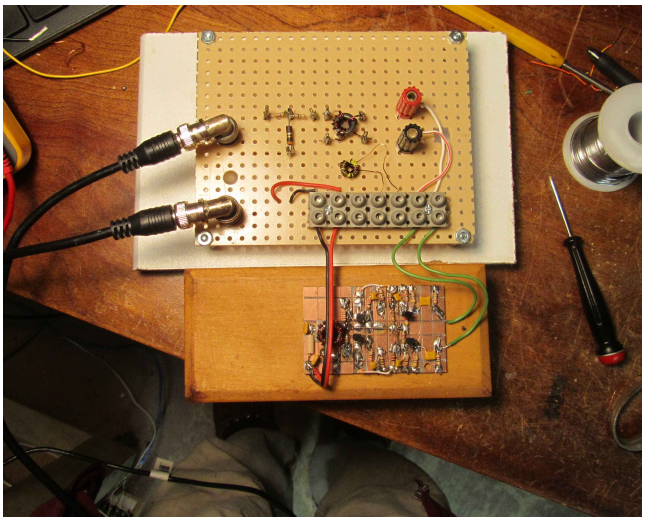
Shown above the Mark VII is a blank board awaiting component mounting. The top side of the board has been scored using a fine-toothed carpenter's miter saw while the board is held in place in the miter saw jig.




**Mark IX & Mark X -** This pair of preamps are mounted in a single box to serve a pair of (small) 4 Ft (edge) Orthogonal Loops currently in use in developing a home-brewed Bellini-Tosi stator-rotor direction finding scheme. (Note: This pair of antennas is not considered elsewhere in this report.)

The gain of ~38 dBm of these preamps is typical for all six of the preamps constructed thus far on the double-sided circuit board.

The antenna simulation data (3.8 uH) corresponds to the inductance of one of the loops of the 4 Ft pair.



**Test Jig - Gain and Simulation Measurements**

Mark VII shown connected for gain measurements. Jig based on design of Tony Casoroa.

Upper cable leads input from HP3586B tracking oscillator into a 38.1 dB fixed T-attenuator whence to a 8:2 turn winding on a FT50-75 (J) ferrite core. The transformer provides a balanced input signal to the Mark VII input (green leads).

The lower coax cable provides V+ to the preamp (via red/black leads) and, through suitable isolation circuitry, a return signal to the HP3586 Frequency Selective Level Meter input for gain measurements.


**Test Jig - Transistor Matching Unit**

This perhaps elaborate unit permitted a differential comparison of pairs of the PN2222A transistors or a measurement of their individual $h_{fe}$ as desired. The potentiometer (on right) permitted the setting of the total emitter current at any value up to 30 mA. Most matching was done at ~20 mA, the operating current of the transistors in the preamp circuit. (The meter has a full scale of 10 mA ... a current shunt raised the full scale to 30 mA.)

My overall experience is that, although careful matching is not to be discouraged, perhaps simple $h_{fe}$ measurement with my digital multimeter would have proven adequate in the Mark VII through Mark XII construction..

| Voltage/Resistance Measurements LZ1AQ Preamp - Mark VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Q3/Q4 ‡ (Input Transistors) | | | | Q1/Q2 ‡ (Output Transistors) | | |
| Voltage ( V+ = 10.0 volts, I = ~120 mA) | | | | | | | | |
| | Channel | E | B | C | | E | B | C |
| Mark VII | A | 1.028 | 1.902 | 5.35 | | 4.68 | 5.36 | 9.97 |
| | B | 1.028 | 1.904 | 5.29 | | 4.62 | 5.29 | 9.98 |
| Resistance (Ohms) | | | | | | | | |
| Mark VII | A | 46 | 1.06K | 3.08K | | 120 | 3.09K | 2.9K |
| | B | 46 | 1.06K | 3.09K | | 120 | 3.09K | 2.9K |
| ‡ See preamp schematic http://www.lz1aq.signacor.com | | | | | | | | |

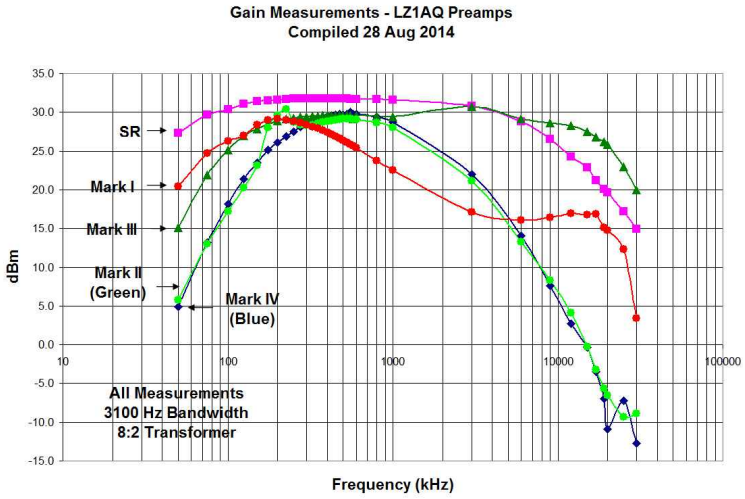
**Final Construction - Mark VII through Mark XII**

Gain averaged over six preamps: 38 ± 2 dBm
[200 - 700 kHz]

Output transformer: 10 turns bifilar wound, 7 turns/inch, on FT50-75(J) core.

Typical voltage and resistance shown in table at left. Values may vary by a few percent depending on the transistors parameters.

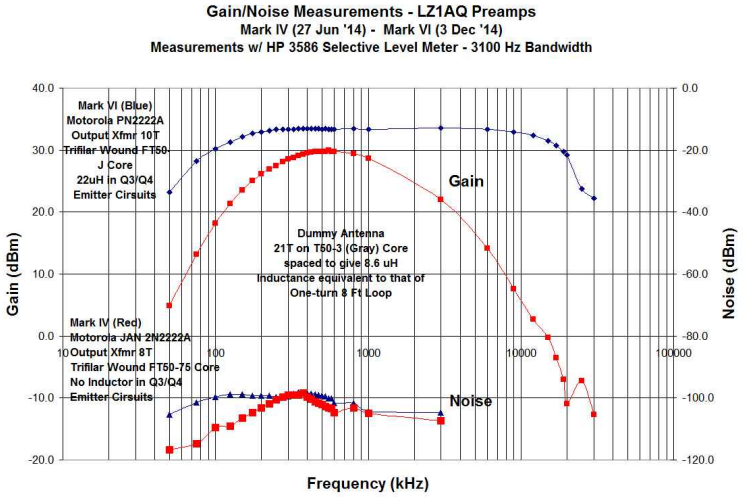
**Additional - Mark I through Mark VI Preamps**:
This section then concludes with comments and measurements made on the first six preamps constructed. Although these have since been consigned to the salvage-section of my junk box and are of no further interest to me, the information on transistor and ferrite cores used along with some other remarks may be of interest to some.




## Gain Measurements - Mark I / Mark III

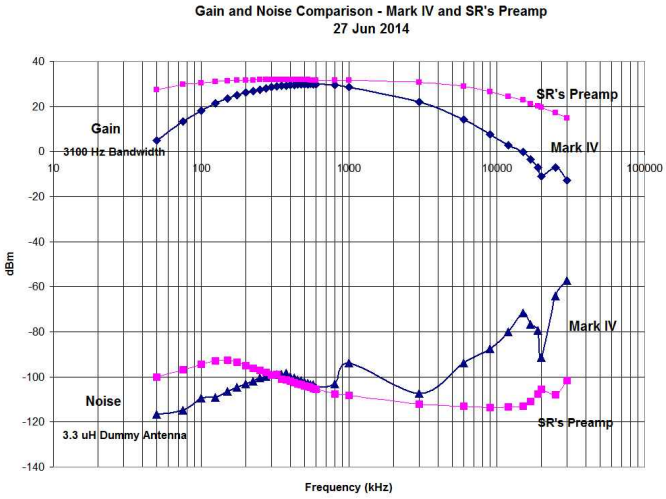
These first-constructed preamps were somewhat deficient on overall gain but particularly so at low frequencies. All three used 2N2222A transistors which already on hand in my junk box, rather than the recommended PN2222A version.

The upper most curve, labeled 'SR', shows my gain measurement on a properly constructed preamp kindly forwarded to me by Steve R. for the purpose of validating my measurement technique.




## Gain/Antenna Simulation Measurements - Mark IV and Mark VI

To increase the low frequency gain, Chavdar L. suggested the addition of 22 uH inductors in the emitter circuits of Q3 and Q4. Also to flatten the gain in the high frequency region, he suggested increasing the number of windings and using a different core for the output transformer. These changes were incorporated in the Mark VI version along with the use of the recommended PN2222A transistors.




## Erratic Behavior above ~ 1 MHz

Compared a simulated antenna input to Steve R's version, Mark IV exhibits an erratic behavior. When a double-sided circuit board was used to provide a ground plane for Mark VII and later preamps, the problem was eliminated.

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