REAL TIME ANTENNA GAIN COMPARATOR SYSTEM by IKØBDO

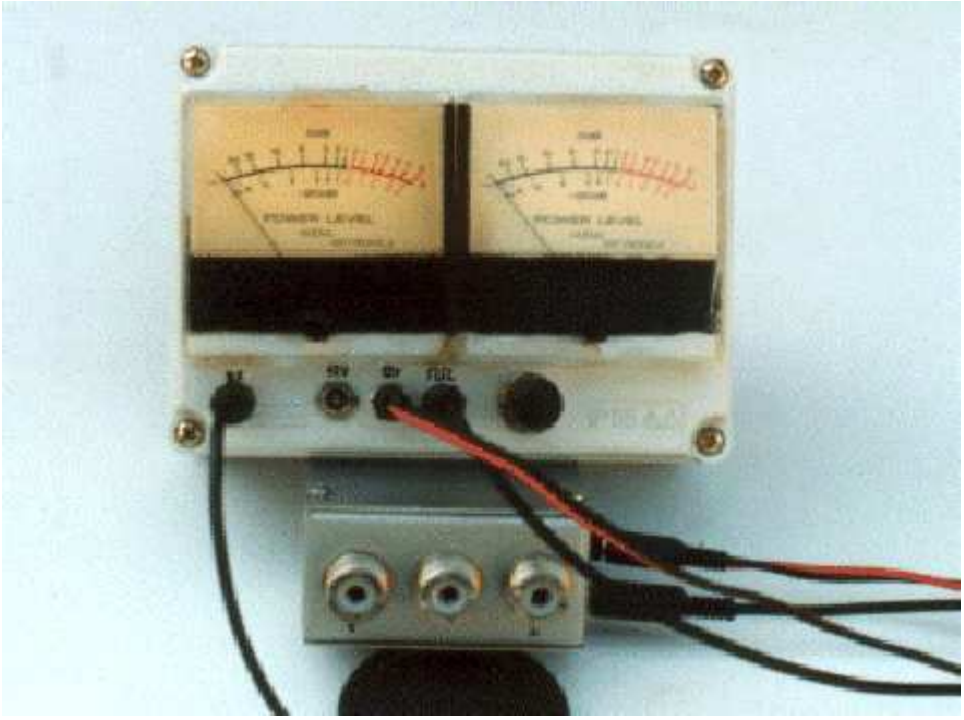

Fig.1 Automatic Antenna Gain Comparator by Roberto IKØBDO

REAL TIME ANTENNA GAIN COMPARATOR SYSTEM by IKØBDO The experience made on a preceding bench of measure, based on the physical connection through cable between the two transmitting and receiving places, has implicated notable limitations of use and of measure reliability. This is the new Measurer for antenna gain in real time mode; it is based on the first generation bench. This IKØBDO amateur tool, is low budget mind like the previous one, is based itself on the simultaneously comparison between two antenna, one of known gain or reference gain and the other one under analysis. The reference antenna could be a dipole, in such case the gain of the second antenna is the real one more the gain of the dipole over the isotropic, or an antenna could be compared as regards to another one; in this case, you can see which of these shows better gain, directly in dB. This is a really interesting field of application because allows you the optimisation of "real" gain antenna, inclusive of balun, mismatching, cable loss, and the more important thing: on the field. The focal point of this tool is the possibility of simultaneously measure the relative gain between the antennas. A simple receiver in CW/SSB is used and by means of the sampling of the signals at fast speed, such that the automatic gain control is not able to follow the differences. The sampling has gotten by alternating 100 time per second the reading, by means of an electronic solid state switch, realized with pin diodes. The AGC of the receiver is not able to follow the signal fluctuations, also if the loss of the signal, especially in UHF is not negligible, but there is not dealt to do a QSO, but draw only the comparative values with the best possible precision. The isolation between the two input doors, is around 22 dB in UHF, since the two antenna in analysis could have a gain difference less then this value, the datum could be considered just enough for measure and it could be optimised in the future. This insulation value between the two RF inputs, not yet optimised, it determine in effects a pejorative gain reading of the antenna under measure if you use a dipole connected on the other input. In fact, the signal received from the dipole, which is around +2.15 dBi, respect to a classical Yagi from +13dBi and more, has altered from the induced signal in the reference input from the antenna in proof. For this reason is preferable to use, like reference antenna, one with known gain which is near to that one under examination. The measure has done in low frequency and not in RF, but always with the audio determined from the RF signal difference, through a normal receiver. Since the antenna switch between the two inputs 100 time a second according to the signal that is listened to, the beacon tone received is not a clean note, on the contrary it ring to 100 Hz, whose level is as much higher as much increase the gain difference between the two antenna. If the two antennas, under proof and the reference one have the same gain, it would return a clean tone. The S-Meter of the receiver points out the resultant of the two signals from the antenna. The signal audio changes accordingly, but the relationship between the two cycles, since the automatic gain control of the RX also mediates the two signals, is not able to vary 100 time per second according to. It always represents the difference of level between the two signals, except saturation, that in the receipt of a beacon should not normally be happened.

An ulterior test could be made, by the use of a T connector by put only one signal on both the RF input doors to tall speed. The signal gotten out on the RX will be a perfect clean tone and both the instruments of the measure unit, they will point out the same value. For the regulation of the pin diode switching you needs an oscilloscope. With reference to the electric scheme, the P1 trimmer is regulated starting with the cursor from zero and growing up as soon as the audio signal from the RX settles without fragment. The resultant voltage on the cursor should be about 3 volt. The P2 trimmer is regulated with the same logic, but departing from 12 volt down to lower value, decreasing the voltage on the cursor down to, until the audio signal in gotten out from the receiver is stable and not chopped. It should happen for a voltage about to 8-volt value. Please pay attention that the negative pole of the power supply is not connected to ground, because the particular power supply to leave high the ground level of the RF coaxial input doors. You need to isolate, therefore, the RF connector of feeding of the 12 V as regards the box. It is implicit therefore, that the battery that feeds this tool must not be the same that it feed the receiving apparatus. This electronic switch has realized in a pillbox of aluminium of dimensions 70 x 35 x 40 mm using "PL" low cost connectors, you can use connector type "N".

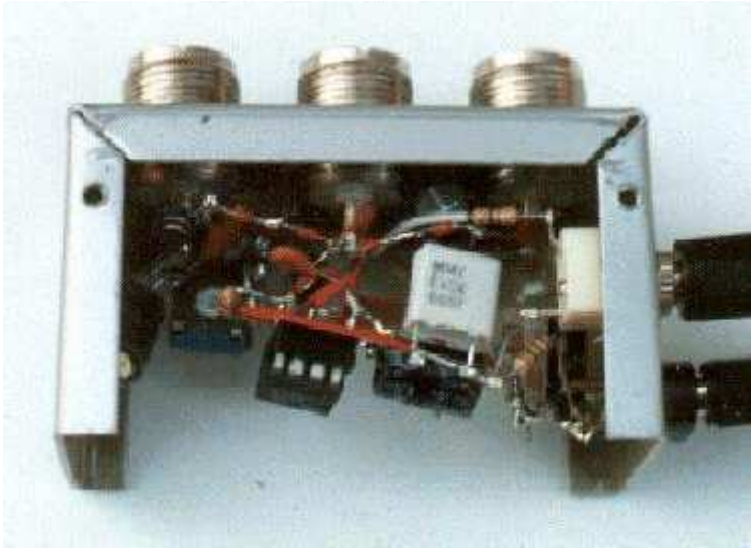

Fig. 2 photo of the RF swicthing unit

A similar box, right to use in portable, is fed to 12 volt. The measure analogue display box system has realized with two identical VU-meter types and is set in dB, each of which takes the relative audio signal only to the semi period half cycle of operation of each antenna. As the circuit shows, each circuit has the return toward the ground through a BC337 transistor. When the first is in management during the positive half cycle of the wave from the square wave given birth to from the NE555 that drive also the antenna switch by pin diodes, according to that is the signal entry, phase shifted of 180 degrees from a BF450 transistor. In the following half cycle the situation is then inverted: the first tool does not find the return toward ground. Therefore, the two tools work cyclic, 100 Hz according to, measuring each one the relative signal from each antenna. The P3 trimmer, place on the panel under the tools, is regulated increasing the polarization of the BF450 transistor until the relative indication of M1, settles. Increasing again could carry only to false measurements. The transformer in the BF entry could be any BF transformer for transistor push-pull circuits. His purpose is only to phase shift of 180° the low frequency signal then straighten both the measures. Is noticed that does not exist any ability of filter, since it is enough to get a middle value from the signal audio. You tune in the signal received not for the maximum on the S-Meter, but simply for the maximum simultaneously deviation of the two VU-meter indications. The two VU-meters and the relative circuit has climbed in a small box for electric circuits, dimensions 150 x 110 x 70 mm, the photo is the upper part of the figure in first page.

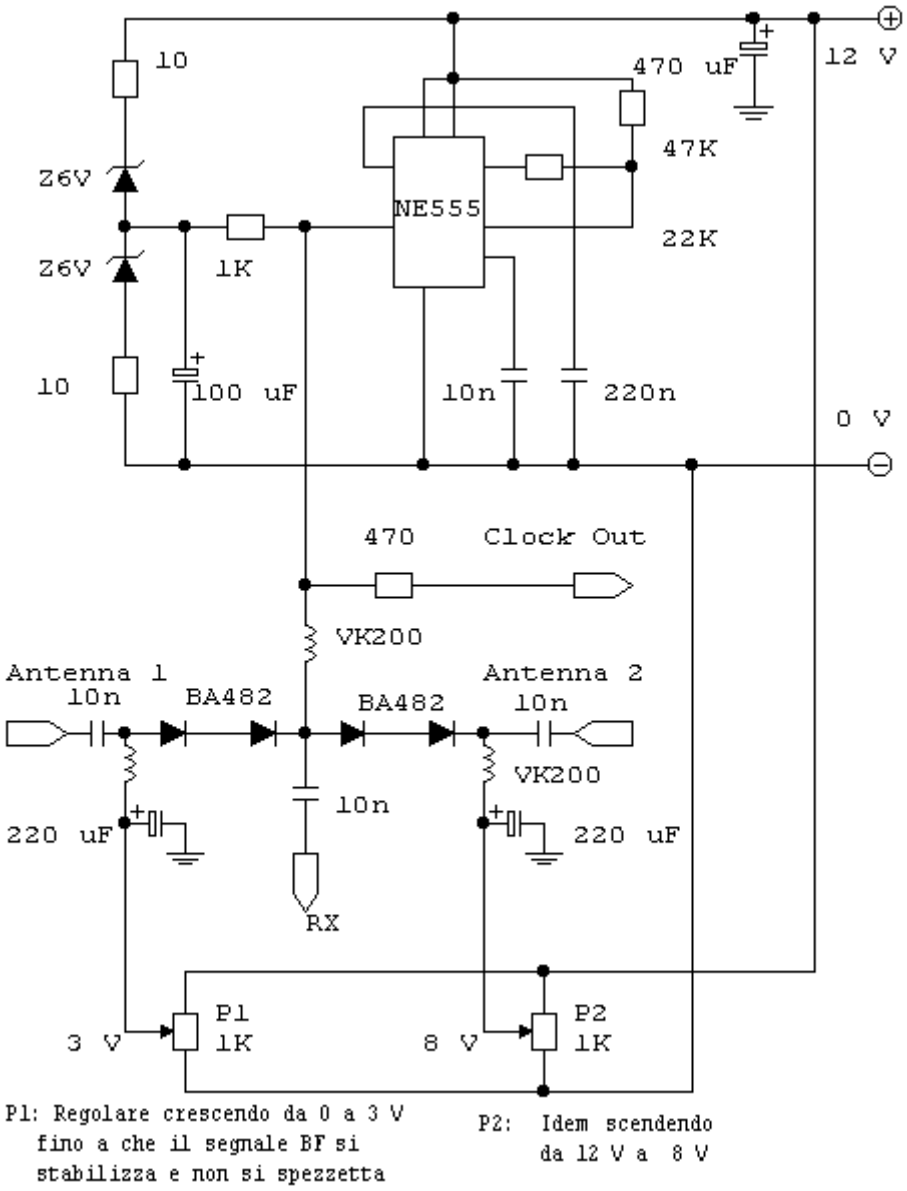

Fig. 3 Schematic diagram of the RF switching unit

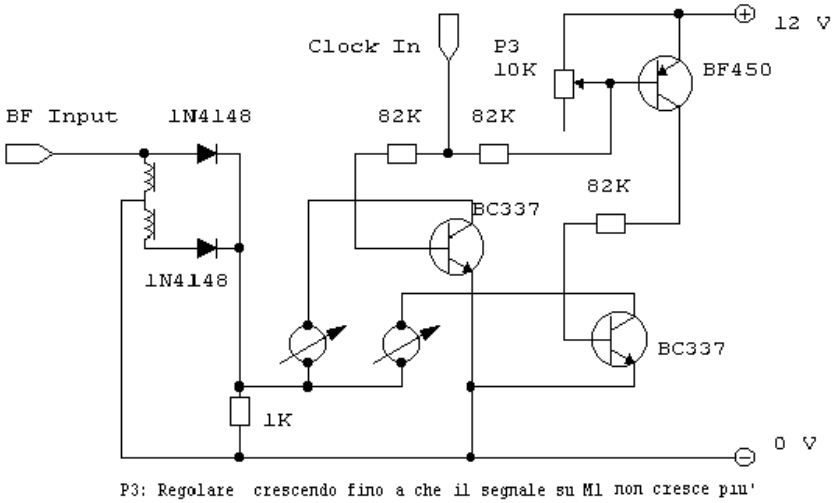

Fig. 4 Schematic diagram of the measure unit

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THE BEACONS

The VHF beacon has build with a quartz oscillator at 72.075 MHz, with the second harmonic that put out few mill watt of power at 144150 KHz, in CW/SSB band. The used UHF Beacon is at 432,360 MHz, in the upper SSB band, and has done with eleventh harmonics quartz, with a signal as little as S5-S6, but has been able to be received until to a pair of kilometres of distance. For the TX antenna of the beacon has been tried from the simple dipole to small Yagi that is the better choice.

THE TEST RANGE OR SITE CHOICE

The choice of the test site for the measures is not easy; select one of your own. In each case the distance between the transmitting position and the receiving one must not be less than 50 wavelength; i.e. 100 meters in VHF. The site must be select so that satisfy the followings characteristics beyond to the following recommendations:

a) To avoid reflections of the signal from part of the ground that involves errors of the measure should exist between the two places one "precipice." Well the terraces of two tops buildings could go like also operate from the eyelash of two hill elevations that see the ground with a negative angle of at least 45 degrees. In alternative, use your own “real site” and a far beacon without build one.

b) Use Yagi antenna for the beacon, so that they come reduced for as possible the reflections described above, or move it above the ground level for pitch comparison.

d) The power of the beacon must not be higher such to introduce saturation in the receiver.

e) The height to which they must be set the receiving antenna, both under test and the reference, must not be less than 3-6 wavelength, as you can.

f) The cables connection from both antennas to the RF switch must be identical.

g) Use for, as possible, antenna reference gains of +/- 6 dB gain as regards to that under test.

THE RESULTS MEASURES

By means of this tool, the measures made on dipoles in VHF and UHF, like also comparing any antenna between those of Known gain, has given satisfactory results. Considered the purely amatorial tool, the possibility to appreciate fractions of decibel in difference toward the theoretical, or over the professional from thousand of euro, it is a nice result. This project should be subject of further development by amateur radio.