

1:1 GUANELLA CURRENT BALUN

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Requiring a balun to feed a balanced feed line with an un-balanced T-Match tuner, a 1:1 Guanella Current balun design using a L15 ferrite toroid core was selected among others. A current balun may be for most situations the most suitable balun however due the extremely low and high impedances often encounter with multi-band balanced antenna system a balun may be required to step up or down the feed impedance presented at the T-Match tuner, it is for this reason that I chose to not include the balun as an integral feature of the T-Match tuner, opting for the flexibility of an outboard balun and the ability to trial various baluns subject to the antenna system and impedances presented.

The Guanella Current balun is a low loss, broadband balun that will ideally choke off common mode currents entering the radio room and importantly provide a transition from the un-balanced output of the T-Match tuner to the balanced antenna system feed line.

While using the balun to choke off common mode currents is best achieved at the antenna end of the feed line, this is not a practical arrangement for a balanced feed line system.

The Guanella Current balun will have application on other antenna systems such as coaxial feed dipoles and sloper antenna to mitigate the problem of common mode currents on the feed line.

Construction

The double bifilar winding of 10 turns are wound evenly spaced around the L15 ferrite toroid core with the two individual windings wound close together with a crossover half way through the winding so that balanced side terminates on the opposite side of the balun from the un-balanced termination. The toroidal core was rapped in an overlapping layer pink heavy duty Teflon plumbers tape to protect the enamelled copper wire from insulation puncture from abrasion with the toroid core.

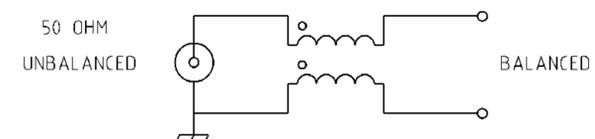


Figure 1 Schematic of the 1:1 Guanella Current balun

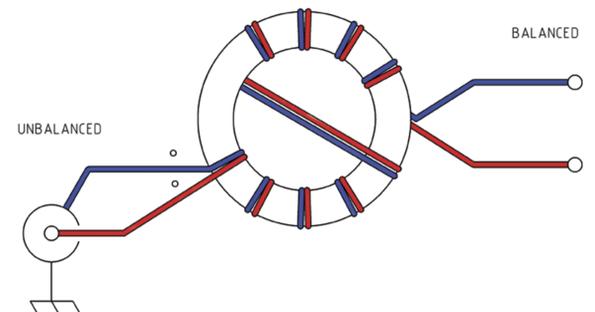


Figure 2 Wiring of the 1:1 Guanella Current balun.

Note this drawing shows winding connections only and not the number of turns required. See article for details.

Parts list.

- L15 ferrite toroid core. [Jaycar](#) Cat. No. LO-1238
- Pink heavy duty Teflon plumbers tape.
- About 2 x 600mm of 1.25mm Enamelled copper wire.
- Two Gold Banana Socket Binding Post - Black. [Jaycar](#) Cat. No. PT-0431
- SO-239 UHF chassis mount connector
- Sealed Polycarbonate Enclosures 82 x 80 x 55mm from [Jaycar](#) Cat. No. HB-6230. See Fig 3 for details

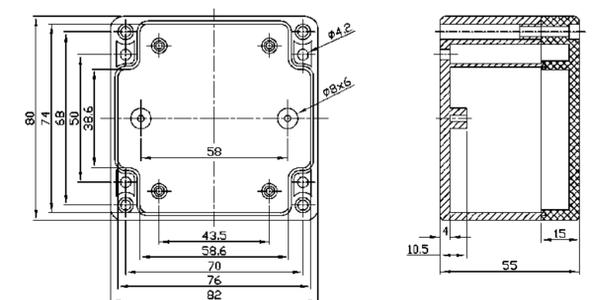


Figure 3 Sealed Polycarbonate Enclosures 82 x 80 x 55mm details. Designed to IP65 of IEC 529 and NEMA 4

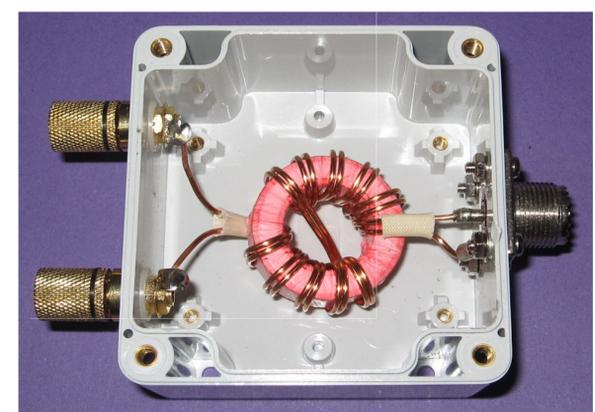


Photo 1 1:1 Guanella current balun assembled.

The evaluation of the efficiency of the balun over the desired bandwidth (1.8 - 30MHz) was carried out by testing the impedance that could be seen from unbalanced side to a resistive load applied to the balanced side using an antenna analyser. The efficiency is shown to be relatively flat from below 1.8MHz to above 30MHz. The below antenna analyser plot viewing a 50ohm resistive load attached to the balanced side of the balun and measured at a nominal impedance of 50ohms presented as anticipated an approximate 50ohm load to the analyser and ideally produced about a 1:1 SWR. Despite not having carried out this test previously the results are more or less what was expected and demonstrates that the balun's 1:1 current transformation occurs efficiently from 1.8 to well above 30MHz.

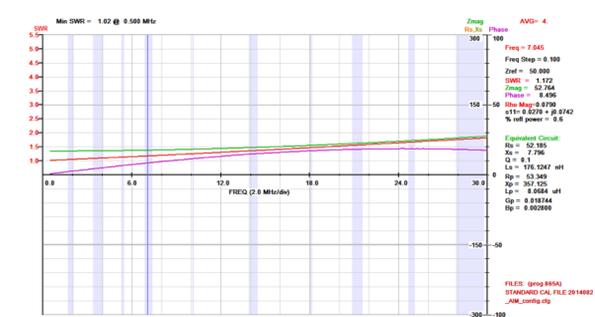


Figure 4 AIM 4170C antenna analyser plot viewing a 50ohm resistive load through the Guanella current balun. Note the 50ohm resistor appears as 50ohms due to the 1:1 balun ratio resulting in an ideal SWR of 1:1. This plot shows an SWR of almost exactly 1:1 with no reactance at a frequency of 500kHz with consistent rise in SWR throughout the HF spectrum to an SWR of approximately 1.8:1 and some inductive reactance at 30MHz.

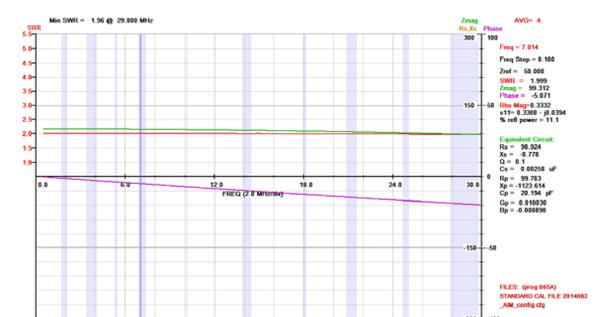


Figure 5 AIM 4170C antenna analyser plot viewing a 100ohm resistive load through the Guanella current balun. Note the 100ohm resistor appears as 100ohms due to the 1:1 balun ratio resulting in an ideal SWR of 2:1. This plot shows an SWR of approximately 2:1 from 500kHz through to 30MHz and with modest capacitive reactance towards the upper frequencies.

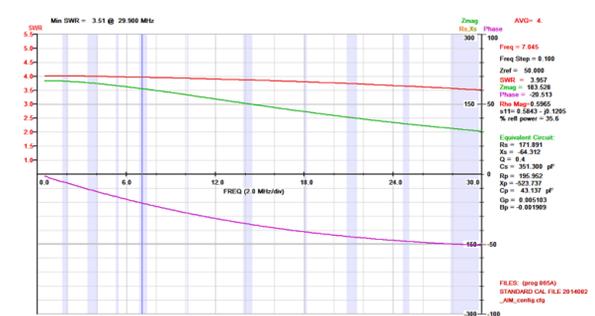


Figure 6 AIM 4170C antenna analyser plot viewing a 200ohm resistive load through the Guanella current balun. Note the 200ohm resistor appears as 200ohms due to the 1:1 balun ratio resulting in an ideal SWR of 4:1. This plot shows an SWR of approximately 4:1 at 500kHz dropping to 2:1 at 30MHz and with significant capacitive reactance towards the mid and upper frequencies.

AIM 4170C antenna analyser explanation:

SWR	Standing Wave Ratio.
Zmag	Total Impedance.
Rs	Resistive component of the total impedance
Theta	Phase angle between voltage and current. + indicates inductive reactance while - indicates capacitive reactance.

Also see other baluns and ununs:

- [BALUN 1:1 CHOKE & 1:4 BALUN](#) HF ladder feed-line to coaxial cable combination choke and 1:4 balun. (0.1MHz - 30MHz).
- [BALUN 1:1 CHOKING](#) Choking balun for lower HF and MF bands. (200kHz - 10MHz).
- [CHOKING 1:1 BALUN - HF BANDS](#) Reiserit choking balun. (1.0MHz - 30MHz). FT140-43 Ferrite Toroid Core.
- [CHOKING 1:1 BALUN - HF BANDS](#) Reiserit choking balun. (1.5MHz - 30MHz). FT140-43 Ferrite Toroid Core.
- [CHOKING 1:1 BALUN - LOW VHF BAND](#) Choking balun. (10MHz - 60MHz). FT140-43 Ferrite Toroid Core.
- [BALUN 1:1 CURRENT](#) 1:1 Guanella Current balun using a L15 ferrite core (1.8 - 30MHz).
- [BALUN 1:4 CURRENT](#) 1:4 Guanella Current balun using a L15 ferrite core (1.8 - 30MHz).
- [BALUN 1:4 SINGLE CORE CURRENT](#) 1:4 Guanella Current Balun, single FT240-43 ferrite toroid cores. (0.3MHz - 30MHz).
- [BALUN 1:1 VOLTAGE](#) 1:1 Ruthroff voltage balun using a T200-2 powdered iron toroid core (1.8 - 30MHz).
- [BALUN 6:1 VOLTAGE - VERSION 1](#) 6:1 Voltage balun using a L15 ferrite toroid core (1.8 - 30MHz).
- [BALUN 6:1 VOLTAGE - VERSION 2](#) 6:1 Voltage balun using a FT140-43 Ferrite Toroid Core (1.8 - 30MHz).
- [BALUN 9:1 VOLTAGE - VERSION 1](#) 9:1 Voltage balun using a L15 ferrite toroid core (1.8 - 30MHz).
- [BALUN 9:1 VOLTAGE - VERSION 2](#) 9:1 Voltage balun using a FT140-43 Ferrite Toroid Core (0.5 - 60MHz).
- [UNUN 9:1 VOLTAGE](#) 9:1 voltage unun using a T200-2 powdered iron toroid core (1.8 - 30MHz).
- [UNUN 9:1 VOLTAGE VERSION 2](#) 9:1 voltage unun using a L15 ferrite core (1.8 - 30MHz).
- [UNUN 9:1 VOLTAGE VERSION 3](#) 9:1 voltage unun using a FT140-43 ferrite core (0.5 - 60MHz).

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Page last revised 02 January 2022