The DL2JTE Loop: A Novel Antenna
Translation, possible theory of operation and comments
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László Rusvai, DL2JTE, came up with this unusual antenna, the result of many years of calculations and tiring experimentation.

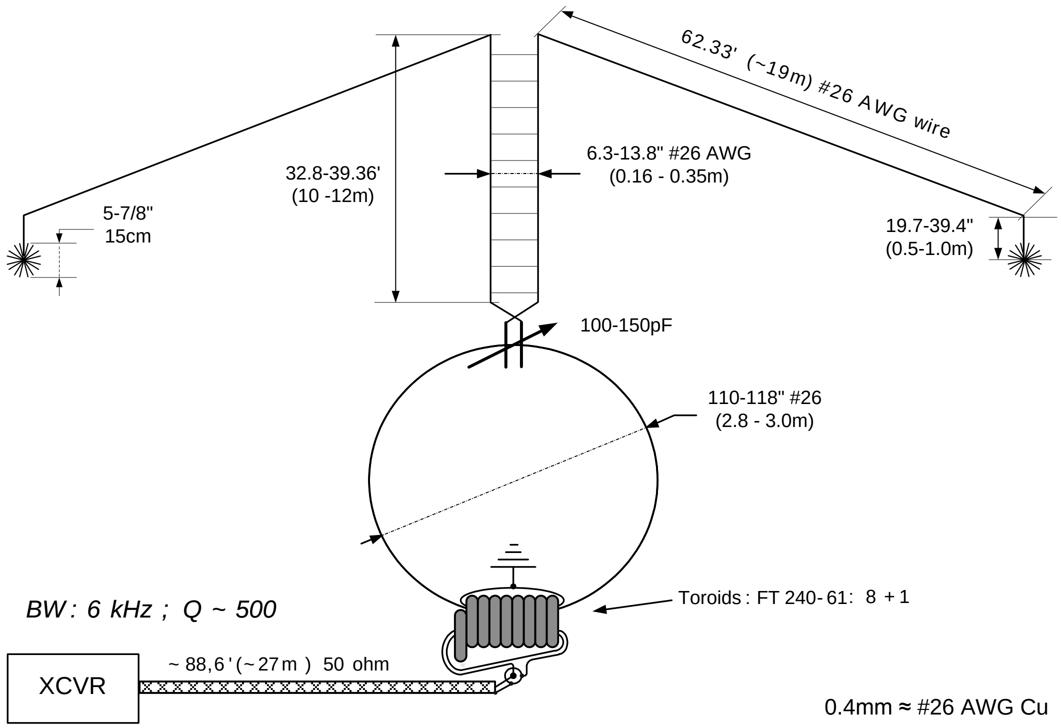
This is a novel antenna, quite different than any I have ever seen before. It consists of a loop, an attached dipole through a ladder network and an unusual coupling arrangement – see Figure 1 below.

The antena has some surprising characteristics. One is the choice of the wire diameter used: **0.4mm diameter** copper wire (≈ #26 AWG) gave the best results. This seems to contradict to the theory which states that the thicker the conductor, the less are the losses. Apparently this theory is correct if one is to consider the ohmic losses, the inductance, the skin effect may has an influence as well. Another surprise is that László could talk from Germany near Dresden to England, France, Italy, and Russia too with a **3 milliwatt** input power! — and he got excellent reports, see later.

Another way to look at the issue is to consider the capacitive circumstances. Every conductor has a certain capacitance even in free space, also dependent on the proximity to other objects – earth surface, houses, the thickness of the conductor – and the position of the conductor in space. These outside capacitances with the wire capacitance could be looked upon as a capacitive divider system. The larger diameter wire has a larger capacitance to the surrounding objects, therefore the attenuation is proportionally larger; this capacitance also promotes the pickup of noise (especially in our city-environments). This means a capcitive coupling to the noise sources. In this relation it makes sense that the antenna wire with a larger capacitance will pick up more noise than a thin wire, therefore this condition less advantageous from the capacitive divider point of view as well, it simply picks up more noise. This can be a limiting factor in trying to make a weak radio contact – the other side may hear you, but you can not hear them due to the QRM/QRN.

The unloaded antenna system Q is very high, approximately 500. This fact automatically provides an amplification factor at both transmitting and receiving. The transmitter load reduces the Q-factor to ~ 50 which means that at 100W input *only* as ~ 5kW equivalent power level appears, of course not at the 50-ohm input. The impedance of free space is ~373 ohms. This antenna was developed primarily due to the noisy city environment at the DL2JTE QTH. An antenna made out of a 2.5mm diameter (~ #10 AWG) copper conductor delivered an S7 – S9 QRM level, especially on weekends.

Using the 0.4mm (≈ 26 AWG) wire, he did not hear any noise after 7 months of use. If one fixed frequency operation is contemplated, coax traps can be used instead of the capacitor. Important is the toroids to have a wide bandwidth, optimum peremeability should be in the range of 100-120. Best results were obtained by using the nickel-zinc composition cores.



DL2JTE HA-LOOP-ANT. – 2010.10

Figure 1

Figure 1 shows the antenna's electrical system. The coupling between the antenna and the transceiver is a special development consisting of 9 FT-240-61 toroid rings. 8 rings are configured closely together and are common to both the antenna and the coupling coils; the 9th one is only for the coupling coil. Both systems are physically closely wound around the toriods to maximize the magnetic coupling, the antenna loop center is tied to the ground (at the DL2JTE location with a heavy wire to the lighning arrestor ground). This arrangement assures that no static charges will accumulate on the antenna, the ground-symmetric arrangement also has the potential to further reduce the noise pickup by cancellation. The two sites at the vertical ends of the dipole are capacitive hats also serving as mechanical stabilizers. They are a number of wires arranged in a ball, their diamater is about 6".

The results of all these features prove the 3mW transmitter power effectiveness. For instance, with 500µW (1/2mW), I had a stable SSB QSO with a station in Bremen, the distance between us was at least 500km (310 miles) ”....if reflection is encountered by the wave, the effective distance is even larger...” remarks László.

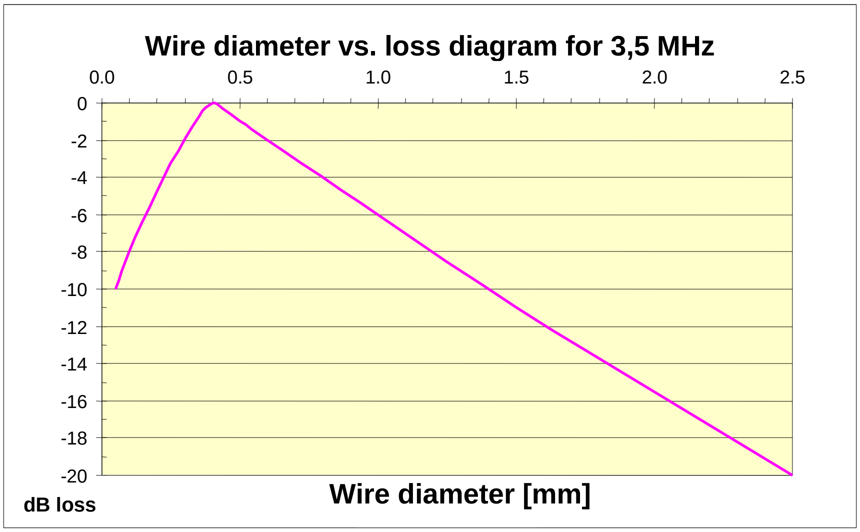


Figure 2

Figure 2 depicts the losses encountered in relation to the conductor diameter. With thinner than 0.4mm wires, most likely the ohmic resistance increases the losses. But it is surprising to see how sharply the losses increase with the increasing wire diameter. A 2mm wire diameter is down -16 dB in comparison to the 0.4mm conductor. The above data are the result of many years of experimentation and evaluation, supported by many stations with their reports.

The comparison data were obtained mainly during the QSOs over 500km (>310 miles) distances from different countries. The data differences obtained during the experiments were essentially independent of the antenna types of the responding stations. The callsigns of the actively participating stations were sofar: HA7MAC, HA3UX, HA0DI, HA8LKM, DK8FF – the list could go on-and-on.

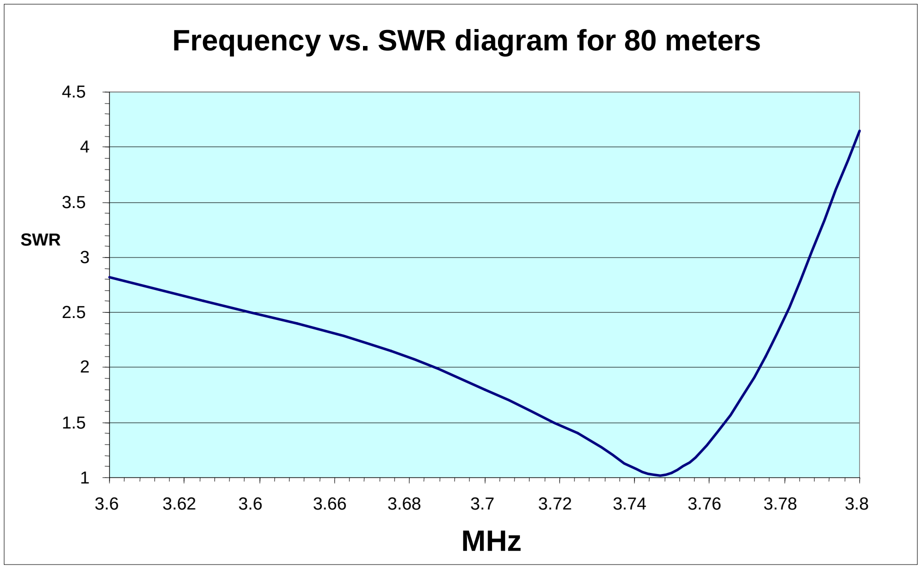


Figure 3

Figure 3 shows the VSWR when the antenna is tuned to resonance. The minimum goes down to a 1:1.02 value, virtually all power flows into the antenna.

Some remarks of the responding stations during the QSOs:

"This is maybe the simplest switchless known tuner + preselector – maybe this is the first balun-transformer – or maybe all these three simultaneously?"

Stations came to my CQ on 3.615 MHz and got these reports:

Date Time Station
Received report (all had average antennae – dipoles, etc.)

11.03.2010 19:02 IT9UTT RS 59+10
11.03.2010 19:13 F6GDO RS 59+20
11.05.2010 19:32 G0UEN RS 59+20
11.06.2010 18:42 UA2FHZ RS 59+20
11.11.2010 18:44 IV3IFY RS 59+20 – remarked that I am the strongest station on the band

11.11.2010 evening on the e-mail:

"I heard the QSOs from your QTH with 5-9 in Keszthely (Western Hungary) on the shore of Lake Balaton. My radio is a Grundig Satellit 650 with the stick antenna of the radio, receiving you on 3.616 MHz."

”Many DX! Tamás Várnai, SWL.”

Notes: Since the antenna is inductively coupled to the radio, not capacitively, the static noise of the surrounding does not get through and the receiver stays quiet. This is relevant mainly in the sea of noise in the cities, weak signal reception is therefore possible which would be drowned out normally by the QRM. The symmetric configuration of the antenna also helps to cancel out certain noises, the centerpoint grounding also helps to achieve this feat. According to measurements, an approximate **16-18dB** gain can be obtained relative to the input power.

Gábor Ács, **HA7MAC** developed a very functional stepping motor readout. It can be seen at www.ha7mac.com along with a short movie of the motor operation. Under the same address the **DL2JTE** site can also be brought up in the ANTENNA section.

Gabi adds: since the antenna shows only one resonance point, and does it sharply, the tuning algorithm becomes very simple. As can be seen in the diagrams, one has to seek only the point where the return current reaches the minimum (just measurable or 0). It is strongly advisable to insert a gear reduction unit between the tuning motor and the tuning capacitor. The motor should be removed from the immediate vicinity of the antenna to prevent QRM disturbing the measurements. The code and hardware (freely usable licence) can also be accessed on the above address. The development of the system can be followed there too. I want to bring into the attention of those who want to build the antenna system that unfortunately a lot of FAKE components are in circulation which can greatly increase the frustration of the builder. I myself have spent about 6 months in ”troubleshooting” until it became clear that I used bad components. These parts became useless at the higher frequencies.

The dimensions of the antenna are given both in imperial and metric measures. I include below a conversion table between AWG and metric wire diameters. **-30-**

AWG	#Metric [mm]
26	0.405
18	1.020
15	1.450
12	2.050
10	2.590

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