

# **The Radio Hotel** - Antenna Origins -- Part 2

## **How the Audion Vacuum Tube Changed Antenna Design**

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Amateur Radio stations in the days of spark resembled nothing like what we have today or even gear from 75 years ago. In the 1900's, Ham spark equipment was rudimentary. Typically, nothing store bought. Most hams borrowing the spark ignition coils from a Ford Model T vehicle. Antennas were strung up with whatever "iron wire" was available and then fed with single wire feeders directly from the transmitter LC output. The transmitter was also grounded to Earth. The antenna wire and this earth connection formed, as stated in Part 1, a capacitor that not only radiated, but formed part of the frequency determining LC output network. Just by dumb luck these stations did "get out", but barely.

Side Note: Due to the limited transmit and receive distances of the spark mode, the ARRL was formed in 1915 due to the need to "relay", across the country, these weak radio signals that just didn't go very far.....actually, at times, tens of miles between stations. So it was quite true, as one author put it, "*Once it did take a garage full of fairly frightening equipment to say almost nothing to almost nobody almost no distance away*".

However, things for the Hams in the 1920's were about to change. As Ward Silver calls it, the period of "CW and the Short Waves" 1921 thru to WW2. The vacuum tube triode, called The Audion" was invented by Lee De Forest in 1904 and it had slowly made its travels into the hobbyist realm in the later teens and early 1920's. With this new thermionic based device, one could devise an electronic based oscillator that could produce an uninterrupted stream of cycles at a defined frequency, literally a continuous wave – CW. Another important aspect of the electronic oscillator is that it had a much higher frequency generation capability than the mechanical spark machines. Shorter and shorter wavelengths (high and higher frequencies) were obtainable. Because of the Audion oscillator's improved spectral purity and its' ever expanding use for both commercial and Ham transmissions, the Spark method was declared illegal in 1924.

### **Frequency Generation Shifts from the LC network/Antenna Combination to an oscillator.**

From an antenna standpoint, since the output frequency was now determined by the oscillator before it even got to the antenna, there was no need for the antenna to be part of the "frequency determining" network (See Part 1). The size of the antenna needed was based on the resonant frequency and not on the amount of capacitance required by the transmitter's output circuitry. QST, October 1926, contains an article that shows empirical measurements being made for determining the equation -- *Wavelength / 1.56 = antenna length of the Hertz (half wavelength) antenna*. Hence, antennas got smaller and the move toward resonant, single wire antennas was afoot. Dipoles, doublets, verticals, started being the norm in the late 1920's. Experimentation into "short wave" antennas blossomed. QST, July 1925, asked questions of antennas and feed systems to which we know the answers implicitly today..... "*There is certainly plenty of room for experiments along this line. Is one wave length the best for the length of the wire, or would 1/2 wave be better (or twice the wave)? Would there be any advantage in inserting a little resistance to give more flexibility in tuning? Where is exactly the best point for connecting the feeder on to the aerial?*" Interesting questions, indeed. (Continued in May – Part 3)

FYI -- Two additional facts from this "CW and the Short Waves" period:

- 1924 - First "ham bands" (80, 40, 20, and 4-5 meters) designated legally.
- 1926 - Frequency control via quartz crystals was invented

### **Next time.... Antenna Origins Part 3 Yagi and Uda and Beverage, Oh My!**

*The purpose of **The Radio Hotel** is to give you a practical kick-start into exploring the workings of antenna systems. It is a series, so go back and read the previous columns to get the whole picture, as one month relies on the previous month's information. Google the buzz words and find out what they mean. Read up on antenna system theory to see how it all works together. You will be glad you did.*

