Clem Small, KR6A/1, CET

Largest-Smallest Antenna Contest

and the winners are...

The winners have now been determined in our "Largest and Smallest Antenna Ever" contest, and I want to thank everyone who submitted an entry. It has been interesting and entertaining sorting them out! The entries range from a tower antenna over four-tenths of a mile tall to antennas covering acres of ground, to a minuscule antenna in a swallowable capsule!

The biggest problem in deciding the winners was that there is more than one way to rate an antenna on how "big" it is! Should we say that the world's largest antenna is the tallest one, the one with the longest run of wire, or the one which covers the most area? Well, I took the coward's way out of this dilemma, and decided to name several winners in the "world's largest antenna" category!

The World's Tallest:

Surely a heavyweight contender for the world's largest antenna is the entry of *MT* reader Douglas Shinn. He suggested several antennas for this category, among them the guyed-mast antenna at Warzawa radio in Poland.

This monster is more than four-tenths of a mile in height (2,120.75 feet)! Such a mast will surely have its top frequently hidden by clouds. Just think of being the "steeplejack" responsible for climbing and changing the aircraft warning lights on this winning entry for the tallest antenna in the world.

But if Frank Lloyd Wright, the famous architect, had had his way, we might have had a different winner here. Wright proposed a building over a mile high! There was to be a broadcast antenna atop that building, which would surely have been the "highest" antenna erected by man.[2] OK, so "highest" doesn't necessarily mean "tallest," but either way, than antenna never got "off the ground" as far as I know. So we're stuck with "shorties" like the Warzawa mast!

Greatest Area Covered:

Reader Allen Easton wins in the "largest area covered" category with his entry of the very old antenna shown in figure 1. This antenna, pictured and described in Bill Orr's CB antenna handbook,[1] as well as in Loomis,[3] is a mere 600 feet in height, yet, in 1917, it covered hundreds of acres of French countryside!

Antennas in the early days of radio were considered to be large capacitors, and the more earth area you could blanket with your antenna, the greater the capacity of your antenna. The frequencies used in those days

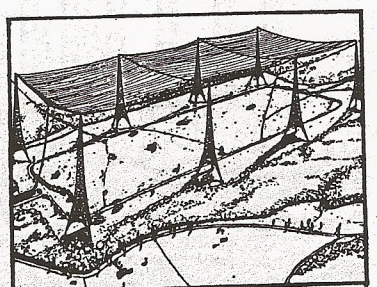

FIG. 1. ONE OF THE WORLD'S LARGEST ANTENNAS. (LOOMIS)

were quite low (in the LF and VLF bands) so the more capacity you could get the easier it was to make your antenna resonant. Giant antennas of the sort Allan submitted were highly prized in 1917!

It is interesting to note here a proposed "super antenna" which George Southworth reports in his *40 Years of Radio Research*,[4] which was to cover 50 square miles, an area comparable to all of Manhattan Island! The crash of 1929 stopped this longwave monster in its design stages, and radio's move to the shortwaves occurred before the economy recovered sufficiently to begin construction.

Dishing It Out:

A number of readers cited the radio-telescope antenna at Arecibo, Puerto Rico, as the world's largest. This antenna, a 1000 foot diameter dish, carved in a natural depression, is truly large for a dish antenna, and is widely reported as the world's largest antenna.

The Arecibo antenna is the largest fixed reflector antenna; however, the world's largest fully steerable reflector antenna is the 100 meter diameter radio telescope at the Max Plank Institute for Radioastronomy at Effelsberg, German.[5]

We weren't looking for the world's heaviest antenna, but it is interesting to note here that the Arecibo antenna feedhorn alone weighs 500 tons! That is one heavy antenna! Actually, though, larger dishes have been proposed. One source indicates that: "Reflector antennas that would dwarf even the Arecibo instrument have been studied for use in the gravity-free environment of space."

World's Longest Antenna:

Now, what about the longest antenna in the world? Readers Debby Stark and Douglas Shinn both suggest the antennas of the U.S. government's project ELF as contenders for this category. And they're both winners! This project touts antennas with runs of up to 56 miles of wire, though the antennas don't necessarily run in straight lines. These antennas, together with their powerful 76-Hz ELF transmitters, provide global communications with submerged submarines around the world![6]

And Now for the World's Smallest:

Robert Fischer of Huntington, West Virginia, came up with what seems at first thought to be a shoo-in for the world's smallest antenna. As most of your readers know, many receivers will pick up signals with no antenna at all attached to them. You can't get an antenna much shorter than zero length! But as Fischer correctly pointed out, in such cases some component in the receiver is acting as an antenna. Usually it is the antenna coil, or some signal is coming in on the AC line cord.

Another intriguing entry came from Debby Stark, who suggested the antenna of a "swizzle stick" transmitter in a "James Bond cocktail" as the world's smallest. *Monitoring Times* is famous for reporting on secret uses of radio, but I don't think we've covered that one yet! But of course, radio systems of this general nature do exist, and come in even smaller sizes! (*A martini olive transmitter with a toothpick antenna was a real-life contender!...Bob)*

An electronic security specialist in the Maryland area (name withheld on request) sent in his company's catalog along with a figure displaying his winning entry for the smallest antenna ever: a tiny ring around a .25 inch diameter capsule (fig. 2) to be carried by executives or political figures who run some risk of being kidnapped.

When swallowed, the pill-transmitter's battery activates by action of the stomach's own acid and sends a signal from this mighty-mite of an antenna which is reported to allow tracking from three to five miles away!

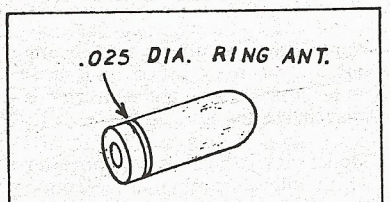

FIG. 2. PILL WITH WORLD'S SMALLEST ANTENNA.

Certainly we are getting down to the lower limits of antennas in practical use. But there is one smaller antenna of which I have heard--a cat whisker in a He-Ne laser. This whisker, although it is only a microscopic 22 μm in length, lends itself to analysis by long-wire antenna theory.[7] The cat-whisker is not really a long-wire antenna, or even an antenna at all, in the sense we usually think of one. But evidently it thinks that it is!

But Wait, Large is Actually Small!:

At this point it seems appropriate to consider the words of a well-known antenna pioneer, Harold A. Wheeler. In considering what is large and what is small in the world of antennas, he tells us: "The largest antenna in the world is a small antenna..."[8] Here he refers to the fact that the monster antennas, such as the ELF antenna, and the old French antenna discussed above, are made for really low frequencies, where the wavelength is very long (check my last month's column for a discussion of size of wavelength).

This means that, in terms of wavelength, the monster antennas look quite small to the radio waves with which they must deal. And so, as with all other things, it's your perspecti that determines just which is the largest or smallest antenna in the world. And that's what we're all looking for, isn't it, perspective?

So, congratulations to the winners, your prizes are on the way. And thanks again to each person who sent in an entry. I hope that everyone has enjoyed this trip through radio's antenna-land. It never gets boring there, that's for sure.

I told you last month that I'd finish the UHF/-VHF antenna series this month, but there is just not room for the contest results and that series, too. Next month we'll get back to the second and final part of the series. No April fooling!

RADIO RIDDLES

Last Month's Radio Riddle: Last month we left you with talk of ghosts, specters, phantoms, spirits and the question: "What is a phantom antenna?"

Well, I have a confession. A phantom antenna has nothing to do with spirits or ghosts. It is actually a circuit, sometimes consisting of only a resistor, which is used to substitute for an antenna. It is used in transmitter tests in which no radiation is desired. Other names for this type of antenna are: "artificial antenna," "mock antenna," "mute antenna," "dumb aerial," and the more

Computer Logic Chips

This month we are going to take a look at several of the more common logic chips that are used quite extensively in the computer world. These chips will return in subsequent columns as we attempt to put together a universal interface adapter card that will allow our computer to control a radio receiver, a signal generator, or whatever device you may decide is to be computer controlled.

The accent is on simplicity so that most of the design work will be at the controlled device itself, thus minimizing the interface hardware and allowing more than one device to be attached to the same adapter.

The interface adapter will be designed for the IBM PC bus for two very good reasons: first, IBM or IBM clone machines are widespread; second, and most compelling, I have access to an IBM and not to any of the other popular machines!

The principles outlined in the interface adapter design should be of help should anyone wish to modify the adapter for another machine. The biggest problem will be getting access to the technical specs of the bus, providing the machine even has a bus accessible to the user.

The 74LS244 and 74LS245 Buffer Chips

Referring to Figure 1, the 74LS244 is a mainstay of the IBM and clone logic world. Just about any adapter made for this machine uses one or more of these chips.

The principal use of this chip is buffering; one of the bus rules of the PC is that no adapter card shall present more than two TTL loads to the bus on any pin. The easiest way to accomplish this is to buffer all the bus lines on the card.

If the line drives in one direction only, such as an address line going to the adapter, the 244 is a good choice for the buffer. As we see from Figure 1, a line enters the 244 via one of the data lines and, after being buffered, exits the chip as data out with the ability to drive multiple chips on the adapter card. No matter how many chips the output is driving on the adapter, the bus sees only one TTL load at the input.

There are eight data buffers on one chip, making it handy in a byte-oriented machine. There are two other lines of concern to us--the gate lines. Gate 1 controls data 0 through 3 outputs, and gate 2 controls data 4 through 7.

If the gate line is low, the data out pin will be the same logical level as the corresponding data in pin; if the gate line is high, the input is unaffected but the output pin is left in a tri-state condition or floating. This serves as a way to "hook and unhook" data lines to a bus, among other things.

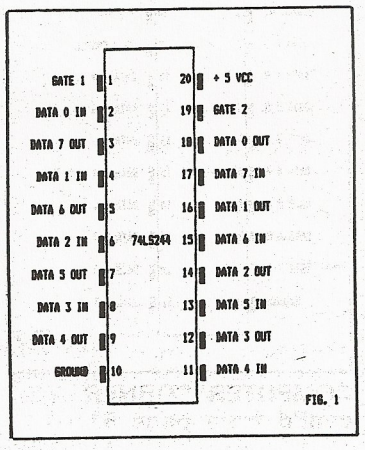

FIG. 1

The most common occurrence of this chip is in the address lines on most adapter cards, where the 244 is used to buffer the address circuitry from the bus.

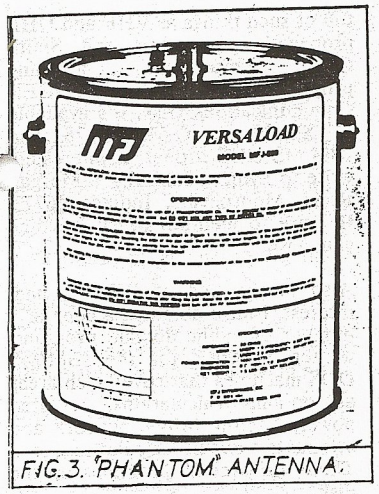

FIG.3. "PHANTOM" ANTENNA.

commonly used "dummy load" as shown in figure three.[9,10,11]

This Month's Radio Riddle: Well, now that we have just insulted the world of antennas by calling the mute antenna a "dummy," can you think of a way that we could make amends, and talk about a "smart antenna?" We'll try to answer that one next month. Hint: think "smart antenna system," rather than just "smart antenna."

In the meantime, drop me a line if you have any comments on the column, or suggestions for what we should cover in the future. ■

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