



A Tall Tale: What's Luck Got to Do With It?

by *Mike Violette*

Rising above the tidal marshes of Southern New Jersey stands a red and white antenna tower shadowing a World War II era radio shack. The marsh was a simple mosquito nursery in the 40s when the first modest building—a cinder block foundation and stick-framed walls—was erected as part of a string of radio stations that formed a wartime network on the East Coast. German subs prowled the waters just off the shore of Cape May which hosted just a few houses and one general store with peeling gray paint and sway-back roofline.

The Army Signal Corps operated the station and for years the tower radiated Morse and Voice. During some of the worst of the Nor'easters that raked the coast, the link was an important shore-to-ship link—an invisible lighthouse warning ships away from the hungry shoals.

During the Cold War, the station was used for protection against another set of submarine threats: Russian nukes.

“High Frequency” or HF communications evolved to VHF and to UHF and over time, and with Walls crumbling and balances shifting, the location was no longer of strategic significance to the Army—not to mention the shift of terrestrial communications to geosynchronous networks 22,000 miles aloft the Jersey Shore in airless orbits.

Thus, the installation passed from public service to private industry. WEMC opened and UHF-TV radiators were strung to the top of the mast and the radio shack, modest in its wartime construction, was expanded to include a news and weather studio. Up-to-the-minute local scandals and meteorology were dispensed to the Atlantic City market 40 miles to the Northeast.

Things were fine, for a while.

The beach is a confluence of water, land and sky. In the dead of winter, the crucible of the elements is even more pronounced. The grey gloom at twilight is foreboding; sounds are muffled by the strong wind, stiff, lofting sand that cuts like icy glass against exposed skin. It is a stretch to imagine

this being the same planet: comparing the frosty winter to the Sun-soaked summers (and why don't we get these jobs in June?). But in EMC, you often have to go where the work is. It is not always unpleasant—in the right company—and it's rarely boring, especially if you have a little luck.

That January we were called to investigate an interference problem. The “classic rock” programming from the station sharing the tower with the UHF-TV operator was spilling over into the audio and video of the local TV broadcast.

The signal modulated and wiggled the raster scan on the outbound video and in some conditions The Rolling Stones could be heard as a ghostly accompaniment to the nightly newscasts.

The TV station owned the tower and was getting ready to throw out the FM operator unless the problem was fixed. With real estate on transmit towers difficult to get (and some of the most expensive around), the radio station was desperate to fix the problem and keep on rocking the high rollers in nearby Sin City.

We arrived late in the day, cruising over from Lewes to Cape May, across the Delaware Bay. The wind cut the tops of the waves to a brisk chop during the ninety minute ride ferry ride. Arriving at the station, we were met at the door by the staff technician.

“I'm Lou.” Not holding out his hand. He eyed us warily and a bit wearily. Lou was sixty, sixty-five, with a dark furrowed brow and a fierce look. About five-foot eight, compact, ex-Navy, with huge forearms covered with smeary black tattoos.

We offered our business cards; he took and pocketed them without a glance.

“You guys called by the radio station, eh?” Lou asked, motioning us to follow him inside. “Hmph, you're the fourth or fifth buncha guys to come and take a look. No one knows what to do about this and my bosses are ready to kick the rock and rollers off the tower.”

“Follow me. I’ll show you what the problem is,” voiced with no enthusiasm.

We were lead into a room with a wall of monitors, just outside the control room—maybe six or eight TVs mounted on the wall. The five o’clock news was just airing and through the glass of the control room, we could see the news desk and the plastic-haired announcers, well into the breaking top stories.

“Take a look.” The screen had a sheen of dark bars that pulsed—wide then thin—traveling slowly and rolling up and off the top of the screen.

“See that crap? And it’s worse at high tide.” He paused, reached up and rotated the knob on a monitor on the wall. He turned it up. Loud.

“Guess who is playing?” he shouted over the mash of announcer and R&R, singing along with the throbbing audio “You make a grown man cry...”

We looked at each other and shrugged. Lou turned the music down and we continued the tour, heading outside to look at the tower.

“This is all new.” Lou said, exiting a back door and pointing skyward. The westering sun cut a long shadow of the mast across the marsh. We walked around the base of the tower. Several fat waveguides sprouted from the side of the building, snaking upwards. Arrays were hung at various heights along the 300’ tall structure: microwave dishes, paging antennas, monopole emergency services. Near the top, the FM and TV antennas were aimed north and east, towards Gomorrah on the sea.

“This tower was recently installed, along with the FM antenna. Since then the TV signal has been trashed. And my bosses are PO’d.”

“The FM array’s at the very top. The TV just below it. We tried all kinds of stuff—even went so far as to separate them as much as possible. Nothing’s helped.” The wind rose and we gripped our coats tightly. “The FM station’s been running at half-power. It helps a little, still the rock and roll doesn’t go over too well with the advertisers.”

Lou took us to the edge of the parking lot where the macadam dissolved into soft grasses and an inlet of water. “The old tower is over there.” He motioned to the marshy scrub. “It blew over last year during Hurricane Floyd.” We looked into the watery flats and here and there ribs and struts undulated above and into the flora, a long snaky skeleton.

What happened?

“Heh,” Lou snorted. “When they installed the tower, oh about seven or eight years ago, they didn’t seal the guy wires at their bases.” He swept our attention towards the edge of the marsh where the long wires disappeared into the scrub. “Over time, the tides spilled enough water into the anchors, eventually corroding ‘em. Floyd came in at 50 mph and phewww, pushed it right over.” He shook his head. “Tore the waveguides right out of the building. We had to re-build almost the whole wall.” He motioned back towards the station. “What a mess.”

He looked over the marsh. “We spent four days trying to find the antennas, using thirty foot poles. They must’ve hit hard, ‘cause they’re in the muck for good.” He paused “And, as they say, the old tower is now a man-made reef.” He laughed. “Let’s go inside, it’s cold out here.” We wondered if Lou was warming up to us.

“What do you guys want to see next?” We walked through the break room. Lou picked up a dark stained carafe of well-baked coffee and poured a cup. “Care for some? Sugar and white stuff on the counter.”

We asked to see the control room. “Can’t. Not ‘til after the news. And tonight’s a ‘special segment’. We won’t get in.”

How are the cables routed? “Cables?! You want cables?!” Lou walked us into the back and motioned up. “Cables we got.” We looked up. The ceiling looked like Medusa’s hairbrush after a grooming. “Parts of this station are over fifty years old. Nothing’s been taken out of here. When something breaks, we just run a new cable.”

We looked at each other and suggested that we take some field measurements, at least to look useful until we could see some of the station’s electronics.

“Do whatever you need to do. I’m on break ‘til after the news.” Lou left the room and headed back to the coffee pot.

We broke out the spectrum analyzer and bicon and made some measurements of the fields around the base of the tower. We verified that we could see the signal from the TV and, just for kicks, we identified the UHF signal. The levels were nominal, as I recall. We were certainly off-axis of the main beam, standing at the base of the tower. We figured that there was zero likelihood of anything happening between the antennas and any harmonics of 100 MHz would be greatly attenuated; besides, the frequencies didn’t line up with the WEMC’s UHF signal. The 100.7 MHz FM signal must be coupling into something in the station. We took the analyzer and a current probe inside and fiddled around with some Medusa’s strands. Sure enough, there was plenty of common mode current—on everything.

It was, aside from Lou’s curmudgeon-y character, a typical EMC job: Fix it, but don’t do anything. We decided to break

off and head into town for dinner and return the next day, hopefully with some ideas, or some magic, or some luck.

Wildwood in January is anything but wild and the shuttered shops and stores and deserted streets a bit disquieting, like after the Rapture or walking around Prypiat near Chernobyl, but with carvings of mermaids and fish in contrasting whimsy to the empty cold.

After dinner at the only open place (Suzanne's Family Restaurant, no ABC but setups are \$5) and a very brief walk on the beach, we checked into the hotel and turned on the TV, tuning to WEMC. Sure enough, the screen wavered and throbbed and with the sound at high volume: clearly Tom Petty.

High tide? Why was it worse at high tide, we wondered.

The next day we figured out some semblance of strategy. The only way we could wrangle some time poking around the console, where the stuff was getting in, was when the station was off-the-air. We negotiated with the station to be down after midnight.

As evening fell, we went back to the station. Lou greeted us again, this time a little friendlier. "We got things set. At midnight, we'll shut things down and you guys can do what you want. The FM signal's still up. The TV's down."

My dad used to joke "It's doesn't matter if you're skilful or lucky, as long as you're effective." It turned out it was one of those lucky times. After pondering all the potential modes of coupling in the snakepit of conductors, we were shooting a little in the dark.

The glow of the klystron ebbed and the TV signal faded and we started poking around the patch panels, looking for a clue. Flashlight in-hand, we lay on our backs looking up into the naked side of one of the mixing boards. Lou, what's this wire?

"That's a feed into the panel." It was a simple twisted wire-pair, an aluminized-mylar type with a pigtail shield.

We clamped the current probe on the wire and measured the current, about 30 milliamps at 100.7 MHz.

The pigtail connection was about three inches long—a nice service loop—and was connected to a ground screw for the

terminal board that, in turn had another few inches of 18 gauge (or so) wire running to a chassis screw. Norm used to say, too, that 'nothing is completely useless: it can always be used as a bad example.' Well, here was (another) one.

The impedance of any wire is equal to the Resistive plus Inductance terms according to the familiar $|Z| = |R + j\omega L| \Omega$ or $|R + j2\pi fL| \Omega$.

The inductance, from the *CRC Handbook*, is:

$$L = 2l[2.303\log(4l/d) - 1 + \mu/4 + (d/2l)] \text{ nH}$$

Where l is the length of the wire and d is the diameter and μ is the permeability of free space ($4\pi \times 10^{-7} \text{ nH/m}$).

The 26 gauge "pigtail" has a diameter of 0.4mm and, doing the math, the inductance works out to about 88 nH.

At 100 MHz, the impedance, then (neglecting resistance) is $Z = 2 \times 3.1415 \times 88 \approx 28 \Omega$.

Assuming the current that we measured flows through the shielded "ground," the voltage is around $V = IZ = 0.83$ Volts! Pretty hefty and at 100 MHz freely coupling to the wires the shield was supposed to protect.

We grabbed the copper tape and shorted the shield to the chassis of the panel with a nice wide strap. The self-inductance of the strap much less than the skinny wire.

We told Lou to give it a try. He shrugged and he walked back to the transmitter room and lit the klystron (which wasn't off, just idling).

"Let's see what we get here." He flipped on the test pattern and looked at the monitors and was, for the first time all day, quiet.

He went over and flipped on the monitor for the FM station. "Whaaat's love got to do, got to do with it?...".

"It's gone. You fixed it."

Lou was all smiles. ■

If you're reading this article, chances are you need compliance related information to do your job and do it well. Fortunately, there's more where this came from. As a subscriber you have access to our monthly print publication as well as a wealth of information on line. Subscriptions are free to qualified industry professionals.

Subscribe online at incompliancemag.com/subscribe

IN COMPLIANCE
Magazine