

# HT220 PRESERVATION SOCIETY NEWSLETTER

## FAREWELL TO TOM MILLS

*By Ed Fong, WB6IQN*

This month we regret the lost of one of our long time member Tom Mills (K6LHE). He was an avid admirer of the Motorola HT220 and had modified dozens in his life time. I officially met Tom in 1990 when I joined National Semiconductor but I had seen him previously at the Foothill swap. I also meant him at the Sunnyvale SARES meeting a few times in the early 80's.

I would always meet Tom at the swap meet and he was always a joy to talk to. His knowledge of radios was unsurpass since he worked on the design of IC's for radio and TV for 40 years. We would walk up and down the isles and he would see a radio and say "hey, I had one of those" and then would go through the technical details of the radio. He was the mastermind behind all the video driver chips using the VIP high voltage process at National Semiconductor. Chances are that your TV or computer monitor has a chip that Tom designed. I thought I had a passion for radios until I meant Tom. This guy knew his Collins R390's and his HT220's.

Tom lived in the neighborhood and I had talked to him just Wednesday August 28th when I was testing a radio with Ron Quan. He broke on in with his distinct voice "Hey, is that doctor Ed?" That was the last time I talked with him. He passed away Sunday evening September 1st.

He is survived by his wife Joyce. His daughter Jeni Johnstone and husband James, his son Robert Mills and wife Donna. They have two grand children Emma and Ian.

His widow Joyce had at the Sunday September 8 memorial service his HT220 and other memorabilia that made Tom so well loved by his friends.

So K6LHE, we say our final 73's. It has been my privilege knowing you and you will be missed, but your influence on me will be with me for a lifetime. v

## A BLAST FROM THE PAST



Here is a young lady shopping at Spectronics with various Moto stuff in her cart including a Motrac, HT220, HT200, a Consolette power supply, and she's browsing some tube-type mobile equipment (from a early 1970s Spectronics Catalog).

## MOTOROLA TRANSMITTER ID TAG

On the subject of Motracs, you can download this from [www.geocities.com/mikeht220/txidtag.html](http://www.geocities.com/mikeht220/txidtag.html)

Part #54B82256B31: The tag complies with F.C.C. requirements for identification tags on all radio transmitters. If transmitter is not in view of operating position or is not readily accessible for inspection, affix tag to control equipment.

Fill in the blanks with a typewriter or indelible ink [this is 1970 and you are not allowed to use a laser or inkjet printer because they won't exist for another 20 years or so]. Further directions and downloadable hi-res image from above URL.

## HT-220 MEMORIES

*from a HT-220 design engineer*

The design presented some real challenges because of the much smaller size and the biggest problem was not the electronics, but the battery! To fit into the new and smaller case, the battery could have only about half the volume of the old HT-200 battery, and this was a real problem.

Originally, the radio was to be called the HT-180. Reason? The old HT-200 put out 2 watts of transmit power (VHF). "200" -- "2 watts" - get it? But in order to get reasonable battery life from the new and smaller design, the transmitter had to be limited to 1.8 watts. Hence "HT-180." The marketeers, of course, decided that "HT-180" sounded like a step down rather than a step up, and since this was to be a shiny new product, pride of the fleet, it could not be permitted! The choice of "220" was pretty random, but it had to be catchy, and higher than "200."

Even with slightly reduced power, the battery was still a problem. As part of its specs, Motorola advertised a given number of hours of battery life, based on a 10-10-80 duty cycle. The new radio had to have the same or better battery life, of course, but the new battery wouldn't support it. The solution was to quietly change the ground rules, and the HT-220 battery life was based on a 5-5-90 duty cycle.

### **Why they used the spkr as a mike in the earliest models? The audio was super bad.**

The audio never sounded all that bad to me as long as you talked INTO it, rather than PAST it. Remember Broderick Crawford in Highway Patrol? In the opening scene, he was always leaning against the door of his police car, squinting into the sun, holding a microphone on a coil cord somewhere up near his ear, and saying dramatic things PAST his mic. Everyone thought this was the cool way to hold a mic, and it gave us fits. Anyway, I can tell you that a rush to market was NOT the driver in that choice. The design of a separate mic circuit would have been an absolutely trivial exercise, and Motorola would not have risked any kind of adverse customer reaction to save these few pennies or few days.

### **Why 39 ohms for the speaker resistance?**

The value of speaker resistance (39 ohms) was based purely on technical parameters. From the point of view of the guy designing the audio stages, several of the relevant design parameters were

already fixed. Given these parameters, 39 ohms is the right value for the speaker. An 8-ohm speaker, for instance, would have resulted in compromises somewhere in the circuit or the performance. The fixed parameters included: Amount of audio power desired -- too little and you can't hear the radio, too much and it eats into your battery life. Desire to use a capacitor to couple the audio amplifier to the speaker, rather than an output transformer (which would have occupied too much space).

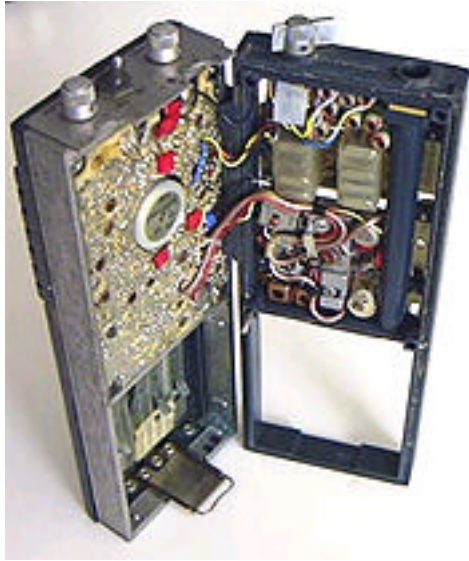
Given the power desired and the voltage available, you know how much load resistance the output amp must see ( $P=V^2/R$ ). Once you have decided that you are not going to use a transformer, then the audio amp is going to see the resistance of the speaker directly, not a transformed version of it. Voila! Well, it ain't quite that simple, but that's basically it.

### **"They're almost impossible to fix without the EXACT parts from Motorola."**

Re use of Motorola parts -- There are, in fact, probably several answers. First, Motorola had a big and growing semiconductor manufacturing division in those days, and there was certainly a desire keep the business in-house. An in-house source of supply also allows you to get devices with specific parameters, or tighter control of a critical parameter. It would also enable the designer to specify a new part which didn't even exist in the commercial world at that time. Remember, in the mid-60's transistors were still a pretty new thing, and not many types existed compared to today's long lists.

Motorola's semiconductor products division ran production lines for many commercially-numbered transistors. Each commercial number had published and industry-accepted specifications, and if you used a 2N918, these were the specs you had to work with. Sometimes the published specs included a wide range of variability in a given spec, and the designer had to cope with that wide range. These selected parts would be pulled, given an in-house number, and sent to the HT-220 production floor. This eliminated the variability that the designers would have had to cope with if they had been forced to use standard 2N918s. If you were repairing that radio a few years down the road, and you substituted a 2N918 for that transistor, it might or might not work.

## HT-220 MARINE (BOATER'S) MODEL



This was the one all the hams wanted because of its selectable high-low power. Motorola decided to develop and market this model for the new VHF marine band (156 MHz) which replaced in the 1970s the old shortwave marine band.

Using a specially-designed 5 watt amplifier controlled with a top panel switch, this option offered extended battery conservation on low power, while allowing the user to boost when needed the transmit power to a full 5 watts.

FCC regulations governing the simplex (non-relayed) channels of the VHF marine band mandate a power level of one watt or less in harbor areas to minimize interference among boaters.

The "marine" HT220 was thus able to comply with the law, winning type acceptance but not market acceptance. At a price of more than \$1000, few boaters would consider Motorola's handheld marine radio, which covered only six of the dozens of new channels available. The wealthiest boaters bought full-sized units, and small-time boaters did without.

Motorola's design was such that the RF output of the transmit side of the motherboard is detuned to about 500 milliwatts for a proper drive level to the amplifier module, as with the non-switchable amp, and thus becomes the "low" power level in operation. When selected, the motherboard output feeds past the high-power module effectively out of the circuit. On high power, the amp module is driven by the motherboard as with any high powered HT220 to about 5 watts.

## HT-220 SECRET SERVICE MODEL



The Secret Service was among the first government users to buy in quantity this version of the slimline HT220. The agency used it with its own coat sleeve-mounted mic and push-to-talk, along with a low-profile earpiece now synonymous with being anonymous as an agent on a protective detail. It is ideal for surveillance operations such as stake-outs, parades,

political rallies, etc. – any place where discreet communications are desired.

Fans of the HT220 have long known about a type of upper rear cover for the Slimline model which came to be known as the "Secret Service back." This cover was a thicker piece of upper plastic allowing the installation and use of some special circuits the agency used that otherwise would not fit in the tactical version of this radio.

Later, but near the end of the HT220's reign at the White House, the Secret Service ordered from Motorola some custom thickness front covers, with a stock factory speaker, for use with an agency-developed circuit board. The color and surface grain pattern is identical to a stock front, but no Motorola logo was included.

This expanded Slimline radio was used with the first version of a White House secure communications system involving multiple encryption codes used, both simplex and through agency repeaters.

A few examples of the radio ever to made it to private hands. The HT220 was, later replaced in the Protective Division with other Motorola models.

### Download Secret Service Model Spec Sheet

Front of sheet:

[www.geocities.com/mikeht220/ht220ss.html](http://www.geocities.com/mikeht220/ht220ss.html)

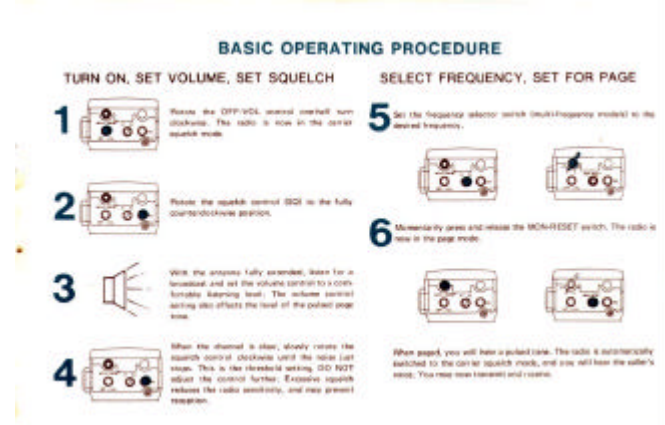
Back of sheet:

[www.geocities.com/mikeht220/ht220ss2.html](http://www.geocities.com/mikeht220/ht220ss2.html)



**HT-220 USER MANUAL**

Download this from,  
[www.geocities.com/mikeht220/ht220userguide.html](http://www.geocities.com/mikeht220/ht220userguide.html)



Now that you have spent considerable time tuning and bringing your HT-220 Handie-Talkie to working order, the big question is how to you operate it? Don't fret because these are actual scans from an actual user's manual for a HT220 (thanks to Ed Fong who loaned me this manual). S/N 68P81008C10-0

These scans are in jpeg format at 150 dpi. Use either Photoshop or adjust your browser print setup to print at the actual size (of 8 by 5.5 inches).

**LICENSE HOLDER**

Download this from,  
[www.geocities.com/mikeht220/licenseholder.html](http://www.geocities.com/mikeht220/licenseholder.html)



As prescribed by FCC rules, a 2-way radio system licensee must post the current authorization for his system at the site of the principal system control point.

As prescribed by FCC rules, a 2-way radio system licensee must post the current authorization for his system at the site of the principal system control point. Not sure if this regulation is still required but tradition calls for this notice for all base station radio gear made before 1980 (especially tube gear). This was scanned at 150 dpi and size is 8" by 6".

**HT-220 NOSTALGIA COMMENT**

by Dave Firis, HT220 Enthusiast, AL7OP

I came across a couple of boxes of '220s hidden inside a pile of secret service micors at a surplus vendor. They had all of the crystals crimped by long nose pliers. However, most of them still worked OK as the actual crystal must be located near the bottom of the cans and very few of the were actually broken. There were about 90 units and all of them worked on at least one of their 4 channels, about 25% worked on all four.

We sold many of these until we realized that the US Secret Service was STILL using these channels. When this happened we sold our services to the USSS to REMOVE the xtals, to INSURE that the remainder of the units (about 40 at that time) would not be bothering the gov't. We received \$375 from the USSS to disable radios that they had already paid (probably the local NYC MSS for the same thing. I also kept a couple around just for a piece of history.

>> sounds like a "major oh s---"

It was major.... I just didn't want MY door kicked in a 4 am.

**A KID'S TOY**

from the QTH.Net Mailing Lists at <http://www.qth.net>

I moved next door to my friend Tom and saw this kid running around with a Motorola HT220. I told Tom that his kid may have been playing with one of his HT's. Tom told me that he put an LED on the PTT and a battery and gave them to a couple of kids to play cops 'n robbers.

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