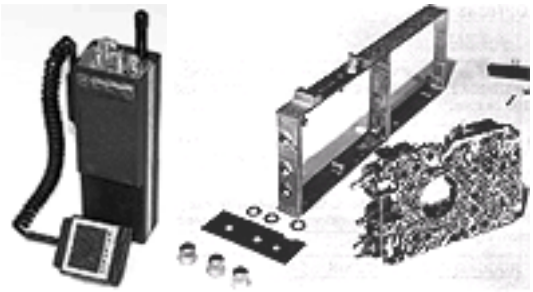

HT220 PRESERVATION SOCIETY NEWSLETTER

THE HT-220 "HANDIE TALKIE"

Back in the 20th century when only women wore earrings and men walked the surface of the Moon, the Motorola HT-220 was the hottest handheld on the market when it was introduced in 1969. Tougher than a pit bull, this VHF or UHF business band handheld in a weatherproof housing was the envy of ham radio operators for its compact size and performance. It contains a very sensitive and selective receiver, and a transmitter that can deliver up to 5 Watts (4 on UHF). It can easily be identified with the silver center band (metal frame) with stellar blue hi-impact plastic front and back. Servicing the HT220 is convenient as the front and back covers can be removed to access component board from both sides.

The HT-220 was the second generation of 2-way FM handhelds and successor to Motorola's first handheld, the HT-200. Custom-designed ICs were used in the HT-220 which vastly reduced the number of components and the overall size of the radio from the 200 series. The HT-200 circuitry was all discrete components and it is big and scary.

As the years gone by and the HT-220 moved into history, many of the newer handhelds haven't become smaller or have more transmit power than the HT-220. They have become more sophisticated, and some of the newer radios may have a more selective and sensitive receiver (though many new have taken a downturn in noise rejection). Frequency synthesis and microprocessor chips are the backbone of the new generation of portables which can offer more channel selection and trunking capabilities. The HT220 can be seen on The History Channel with an actor portraying historical police officer during station ID breaks.

"Handie Talkie" or HT is a trademark name by Motorola and can only be used for handhelds by the "Big /\/\." The name was first used in World War II when Motorola introduced a two-way radio small enough to be carried with one hand, as compared to the backmounted radios (Army "breakie backies"). ❖

HT220 RUGGEDNESS

(from Usenet)

"The newer Motos are not particularly good, they're cop and fireman proof, which means they are set up by techs and the only switches are on and off, and occasionally volume and channel, and are not nearly as well made as the older models (an officer beat a pitbull to death with an HT220 after the dog bit and held onto his gun hand, the new ones would just upset the dog some more). ❖

VISIT THE HT-220 WEBPAGE

www.batnet.com/mfwright/HT220.html

This site has HT220 handheld information including model tables, specifications, frequency conversions, parts and accessories, manual numbers, troubleshooting guide, and more. There are articles by users, technicians, ham radio operators, and engineers that worked on the HT220 program. ❖

Comments from visitors to this webpage:

"THOUSANDS STILL IN USE."
"I never thought the old rig would attract a cult following!"
"They hardly ever die! (batteries, of course are a different story)"
"I cut my teeth on the HT-200 and went on to the HT-220."
"I remember drooling over the HT220 25 years ago at swap meets."
"I use both VHF and UHF models everyday."
"I've taken VHF units up to 220 MHz (a real 220 220)."
"I thought I was the only HT-220 nut in the world."
"HT220 is truly an object deserving of such a shrine!"
"It was and still is a engineering marvel."
"It is the nicest looking, most purposeful radio ever produced."
"I remember the 70s the envy we felt for the BMOC that had a 220."
"What is that?!?" (from a generation X-er first seeing a HT220)

The HT-220 is Y2K compliant

VHF HT-220 MODEL NUMBERS

Models	*Slim-Line, 1.8 Watt*	*Omni, 1.8 Watt*	*Omni, 5 Watt*	*Xmit Chan*	*Rec Chan*
Std Squelch	H23FFN-1100	H23FFN-1101	H33FFN-1100	1	1
Internal Spkr/Mic	H23FFN-1110	H23FFN-1111	H33FFN-1110	2	1
	H23FFN-1130	H23FFN-1131	H33FFN-1130	2	2
		H23FFN-1171	H33FFN-1170	4	4
		H23FFN-1191	H33FFN-1190	6	6
PL Squelch	H23FFN-3100	H23FFN-3101	H33FFN-3100	1	1
Internal Spkr/Mic	H23FFN-3110	H23FFN-3111	H33FFN-3110	2	1
	H23FFN-3130	H23FFN-3131	H33FFN-3130	2	2
		H23FFN-3171	H33FFN-3170	4	4
		H23FFN-3191	H33FFN-3190	6	6
Std Squelch	H23FFN-1102	H23FFN-1103	H33FFN-1102	1	1
Remote Spkr/Mic	H23FFN-1112	H23FFN-1113	H33FFN-1112	2	1
	H23FFN-1132	H23FFN-1133	H33FFN-1132	2	2
		H23FFN-1173	H33FFN-1172	4	4
		H23FFN-1193	H33FFN-1192	6	6
PL Squelch	H23FFN-3102	H23FFN-3103	H33FFN-3102	1	1
Remote Spkr/Mic	H23FFN-3112	H23FFN-3113	H33FFN-3112	2	1
	H23FFN-3132	H23FFN-3133	H33FFN-3132	2	2
		H23FFN-3173	H33FFN-3172	4	4
		H23FFN-3193	H33FFN-3192	6	6
Std Squelch	N/A	H23FFN-1104	H33FFN-1104	1	1
Universal Spkr/Mic		H23FFN-1114	H33FFN-1114	2	1
		H23FFN-1134	H33FFN-1134	2	2
		H23FFN-1174	H33FFN-1174	4	4
		H23FFN-1194	H33FFN-1194	6	6
PL Squelch	N/A	H23FFN-3104	H33FFN-3104	1	1
UniversalSpkr/Mic		H23FFN-3114	H33FFN-3114	2	1
		H23FFN-3134	H33FFN-3134	2	2
		H23FFN-3174	H33FFN-3174	4	4
		H23FFN-3194	H33FFN-3194	6	6

UHF HT-220 MODEL NUMBERS

Models	*Slim-Line, 1.8 Watt*	*Omni, 1 Watt*	*Omni, 4 Watt*	*Xmit Chan*	*Rec Chan*
Std Squelch	H24FFN-1100	H24FFN-1101	H34FFN-1100	1	1
Internal Spkr/Mic	H24FFN-1110	H24FFN-1111	H34FFN-1110	2	1
	H24FFN-1130	H24FFN-1131	H34FFN-1130	2	2
		H24FFN-1171	H34FFN-1170	4	4
		H24FFN-1191	H34FFN-1190	6	6
PL Squelch	H24FFN-3100	H24FFN-3101	H34FFN-3100	1	1
Internal Spkr/Mic	H24FFN-3110	H24FFN-3111	H34FFN-3110	2	1
	H24FFN-3130	H24FFN-3131	H34FFN-3130	2	2
		H24FFN-3171	H34FFN-3170	4	4
		H24FFN-3191	H34FFN-3190	6	6
Std Squelch	H24FFN-1102	H24FFN-1103	H34FFN-1102	1	1
Remote Spkr/Mic	H24FFN-1112	H24FFN-1113	H34FFN-1112	2	1
	H24FFN-1132	H24FFN-1133	H34FFN-1132	2	2
		H24FFN-1173	H34FFN-1172	4	4
		H24FFN-1193	H34FFN-1192	6	6
PL Squelch	H24FFN-3102	H24FFN-3103	H34FFN-3102	1	1
Remote Spkr/Mic	H24FFN-3112	H24FFN-3113	H34FFN-3112	2	1
	H24FFN-3132	H24FFN-3133	H34FFN-3132	2	2
		H24FFN-3173	H34FFN-3172	4	4
		H24FFN-3193	H34FFN-3192	6	6
Std Squelch	N/A	H24FFN-1104	H34FFN-1104	1	1
Universal Spkr/Mic		H24FFN-1114	H34FFN-1114	2	1
		H24FFN-1134	H34FFN-1134	2	2
		H24FFN-1174	H34FFN-1174	4	4
		H24FFN-1194	H34FFN-1194	6	6
PL Squelch	N/A	H24FFN-3104	H34FFN-3104	1	1
Universal Spkr/Mic		H24FFN-3114	H34FFN-3114	2	1
		H24FFN-3134	H34FFN-3134	2	2
		H24FFN-3174	H34FFN-3174	4	4
		H24FFN-3194	H34FFN-3194	6	6

HT-220 PROGRAM DESIGN

By Jerry Zacker, Design Engineer (ret), *Motorola Inc.*

I recently retired from Motorola after 35 years of service which started back in February, 1966. My first assignment was to work on the VHF transmitter of the HT220. Back then, the 220 was only intended to be a 1 watt, 2 frequency, private-line radio at best. Due to some competition by General Electric, who was also coming out with a 1 watt unit, we upped the power to 1.8 watts on the VHF models. We also added the UHF models to the HT220 series. The initial acceptance of the 220 was so great, we went on to develop high power models and multi-frequency units. That kept us pretty busy for many years.

I helped develop the first multi-frequency VHF model for the Pacific Air Command Air Force, used by guards patrolling bases and also had a VOX feature. That was the first multi-frequency model. We went on to develop that model for commercial use.

I then worked on the HT100 VHF transmitter but the HT100 never became a big-seller. At 100 mW of power, it had limited range for a rather pricey unit. It was probably the smallest two-way portable radio of its time, however. I spent some time on the IDC circuit, one of the first ICs ever used in a portable radio, along with the 455 amp in the receiver. When we first planned the 220, we tried to use the receiver speaker as the transmitter microphone. However, we could never get consistent frequency response from the speakers. Some sounded good, others didn't. We eventually abandoned the idea and put in a small mic. Costly solution, but we had little choice.

The printed circuit boards were the first double-sided plated-through hole design to be used. We had a lot of problems getting those boards to be reliable. Many trips to the manufacturer to work-out processing problems. Eventually the quality issues were solved. But, occasional interconnect failures still showed up as field or factory problems. Those issues kept a lot of us busy and on the road.

Why an oddball number for the receiver IF?

I don't have an answer to your question about the IF. The receiver designer is long gone from Motorola. He became an Engineering Professor at Purdue University back in the 1970s. The IF frequency we used was most likely chosen to minimize receiver spurs and image interference. We would get a lot of guidance from Field Engineers on issues that dealt with system interference problems out in the "real world" of FM communications.

The HT220 was developed back at the Augusta Boulevard facility in Chicago. Motorola has since sold that facility after the Portable Products Division was moved to Ft. Lauderdale, FL in July 1971.

The old schematic I gave you was one of the working copies we used while the receiver was being designed. You'll probably note a couple of revision dates in the lower right-hand corner. It eventually developed into the final version that was first sold as a final product. That typically is how we documented the designs during development and revision levels.

As far as how we finalized the design and kept the circuit the same, product development was quite different back then compared to today's methodology. In the past, each product line had its own unique design and circuit layout. The first portable radio (HT200) was completely different from the next generation of portable, the HT220. The same for the MT500 and MX300. There were so many new innovations taking place in electronics back in those days. HT220 was the first to use ICs. MX300 used plug-in hybrid electronic circuits. Every new radio we designed was using some new state-of-the-art electronic device that rendered the previous designs technically obsolete. In today's electronic designs, most products are developed with a lot of similar circuitry that changes very little from model to model.

Also, remember that we had minimal competition back then. We could take 3 to 4 years to develop a product line. Today's markets want new designs in a year or less. That leaves very little time to make drastic circuit changes.

The manuals today are very different from those of the HT220. Remember, the 220 was a discrete component, very repairable radio. Unlike the custom IC based designs you see today. A lot of modem electronics is basically throw-away design when it breaks. Therefore, product manuals don't need to go into a lot of detailed repair or tuning info simply because you can't do that with today's products. Troubleshooting down to the component level is becoming a lost art. Even in the automotive industry.

I hope this history is helpful to you and your other 220 enthusiasts. It looks like you, and others, have done an excellent job of capturing the spirit of the HT220 and are keeping it alive. ❖

WORKING THE DREAM COME TRUE

by Paul Rohrbeck, Line Technician (ret), *Motorola Inc.*

I was a line technician at Motorola in Wilton Manors FL. I started in August 1969. The HT220 came to us several months after I was hired, I actually started on Pageboy One product, I worked "end of line" technician. When they got the screen rooms, I worked in final test for HT220. I was also in the SP products area and saw lotsa 'different' things.

I remember my job interview, There I was 21 years old still in electronics classes at the junior college (they didn't even know what RF was in class). My experience consisted of 6 months in a TV repair shop and the head of personnel asks me, "can you work on 2 tone sequential paging decoders," my answer was yes! What I didn't say was what the hell was that, no one that I know, me included had ever heard of a pager, much less knew what it was!! I was the 8th tech hired. Come to find out that they had been there less than 30 days and had not even advertised for help yet!! In the middle of this non-airconditioned rented warehouse floor was two lines of tables about 50 feet long. We sat back to back so we couldn't watch each other. The product was put on the bench on one end of the tables, passed down to the next person. Then it was brought to our table row, went through inspection then to us. We had repair personnel to repair for us so we could work for the quantity goals they wanted. In the beginning that quota was 5 units per tech for our 8 hr shift and we had a terrible time getting that many to work. Our test equipment was antique!! We had GAW power supplies, encoders, these were from Bob Galvin's [founder of Motorola] garage shop was the rumor. The signal generators were Boonton tube and frequency counters were nixie-tube type.

At final test, we actually had a few screen rooms, our test equipment was just as bad. Boontons that drifted freq, slow nixie tube counters and a archaic demod receiver hooked to a tektronics scope with paint marks where 5 Khz of deviation was supposed to be. Imagine setting Rx freq on a HT220, one hand holding the diddle stick, the other hand on the vernier of the Boonton, watching the frequency counter trying to get that foster seely discriminator to be correct. I remember spending hours trying to get that HT to put out 1.8 watts, not 1.7 watts, or worse yet the standby current was 1 milliamp outta spec!! When you got one out you were really proud of the accomplishment. Before I left, our quotas went to 30+ radios per person on a 8 hour shift. We were allowed 2% failure by our quality supervisors, they were rabid about quality!!

We had problems like circuit boards that were not etched properly, imagine long plating runs under 3 layers of parts shorted across like Rx audio into the Tx exciter... really weird symptoms!! Diodes installed correctly but the color band on the wrong side, same thing for resistors, what a challenge. What we really liked was when engineering would send us something with NO documentation. We didn't know what it was or what it did, but we had to get them out!! Use your imagination here to figure out how we handled it.

We saw things like a modified UHF HT220 stuffed into wooden bookends. They had a capacitive PTT embedded in the housing. They were for President Nixon in his office. They were alarm modules for emergencies. They each had a burst tone encoder with a specific frequency. The Secret Service had the decoder box from hell as we called it, it would light up the specific toe and alert the boys to problems.

Our biggest project was the Coronary Observation Radio [medical HT220]. We three technicians were responsible for every one of those radios that Motorola ever shipped. Each of us had paper documentation on EVERY piece that went out the door, who tested it, what each spec was complete, to the battery discharge curves for each unit. we also had special stamps to mark each assembly so you could track it back! Our MINIMUM quality spec was 100%. Nothing could leave till it was perfect. The only time these were to be used was when a person's life was at stake, we took it seriously.

I have seen a VHF HT220 put out almost 25 watts in stock condition, of course we did select every transistor with a curve tracer. It took 22VDC, drew lotsa amps and WOW what a RF burn you would get off the rear cover screws!

They also had some cool housing colors, you probably have seen the orange and yellow housings, but the ones I liked the best were a beautiful medium dark green, I haven't seen any of them since I left the factory. ❖

HT220 NEWSLETTER is published by the
HT-220 Preservation Society
Website: http://www.batnet.com/mfwright/HT220.html

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