Yaesu FT-90R

by
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For some time, Yaesu has been quite popular with the radio monitoring crowd when it comes to handheld receivers. Although intended for the amateur radio crowd, their HTs have become the standard by which others are gauged. Their ruggedness, wide range, good audio, and strong feature set have made the FT-50R, VX-1R and VX-5R great hits among a group of hobbyists who will never even use their transmit capabilities.

And now, with the FT-90R hot off the assembly line, it looks as if Yaesu is trying to dominate in the mobile market where the lack of choices and competition in the receiver arena have left a rift just begging to be filled.

What follows are my personal impressions regarding the features and performance of this receiver. This, in no way, should be viewed as an endorsement to purchase this radio nor is it intended to discourage anyone from buying it. I have no personal or business relations with Yaesu Corporation. These are simply thoughts offered to my fellow hobbyists who may be interested in purchasing this particular radio or learning more about it.

A lot of hard work and effort has gone into the testing and writing of this review. I would appreciate it if every effort is made to keep this document whole with me as the original author. Of course, it doesn't hurt that this document is copyrighted and therefore protected by US law and international treaties governing intellectual property. Except for personal use, and for the sake of brief

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This document contains the following sections:

What You Get

- FT-90R Micro Commander

- DTMF Microphone (MH-36B6J)
- Mobile Mounting Bracket (MMB-68)
- DC Power Cord w/Fuse (T9021715)
- Spare 15A Fuse
- Radio Schematics
- Yaesu sticker
- Operating Manual

Model Tested

- Serial #: 9F0501xx
- FCC ID: K66FT-90R
- Made in Japan

Basic Specs

Channels	182
Scan Banks	1
Search Bands	2
Coverage	100-230 300-530 810-999.975 MHz
Scan	10 chan/sec
Search	25 step/sec
Steps	5/10/12.5/20/25/50 kHz
Modes	AM & FM
Sensitivity	As specified in the manual : 0.18 µV @ 12 dB SINAD
Selectivity	As specified in the manual : 12/24 kHz (-6/-60 dB)
Conversion	Double
IFs	1=45.05 MHz 2=455 kHz
Priority	1 channel
Search skip	0 frequencies

Auto-Store	Yes
S-meter	Yes
Delay	No
Lockout	Per channel
Attenuator	No
Lock	No
Tone codes	CTCSS & DCS
Computer intf	No
Rotary control	Yes
Channel count	No
Data skip	No
Clock	No
Timers	No
Weather	No
Weather Alert	No
Light	Display + Microphone
Power	13.8 ± 15%
Audio	2 W @ 8 ohms, 10% THD
Size	3.9"(W) x 1.2"(H) x 5.4"(D) 100 (W) x 30 (H) x 138 (D) mm
Weight	640g/1.4lb
Memory	non-volatile

Operating Manual

- Like most before it, this Yaesu manual is another fine effort
- It starts right off with the table of contents inside the front cover
- This table is well done and looks more like an index with its multiple levels of indentation to help distinguish varying levels of details;

makes finding desired subjects quite quickly
- Page 2 details the radio's specifications; decent but they could use more details; only one set of sensitivity and selectivity figures are listed, presumably for FM reception
- A series of pages follow that detail the various controls and interfaces, giving page references to the most sought after information
- Next is a helpful section on antenna considerations: capability of handling 50 watts max, using vertical polarization, antenna for proper reception for this radio's wide band coverage, and careful consideration of 50 ohm co-ax selection (a nice chart is shown for 7 different types along with typical losses of 100 feet at 144 and 440 MHz)
- What follows next are several pages detailing installation as a mobile or base unit, along with important considerations
- Basic operational and tuning details are covered next followed by sections on receiving and transmitting
- Tone squelch (CTCSS & DCS) and DTMF are then covered
- Memory operations and capabilities are listed which naturally leads into the sections on scanning and searching
- ARTS and packet operations are covered next
- A large section on miscellaneous settings details the many features which are available under the SET menu
- The section titled Transceiver Cloning lets you know how to clone the data between from one FT-90R into another using the microphone jack and "user-constructed" cable
- The final section is a breakdown of the 38 options available under the SET menu system which is quite a handy reference which helps cut down on page flipping

Construction and Physical
- As one would expect from a good piece of ham radio gear, this unit is one tough little box
- Except for the front panel, all sides are made of very thick and durable metal
- Speaking of the front panel, a nice feature of the 90R is that this panel is detachable (to keep the significant other from playing with your radio while you're away ;-)!
- A simple click on the side-mounted control and it pops right off
- Once off, the panel itself is just a bit bigger than a Bic lighter with the obvious control extrusions
- The panel makes contact with the radio body through just four small, gold, anodized pins
- Along the left hand side of this panel are the volume and squelch controls; they are a decent size for a radio this small but there are no colored markings on them to help with visual inspection of their current setting
- Dominating the most amount of real estate is the large LCD
- Below the LCD are three buttons which are primarily used to access the SET menu and change option settings
- Over to the right is the large rotary control which has a nice feel and seems well made; would like to see better ridges for easier gripping though
- Above the rotary are the DISP/SS button and the blue power button which easily stands out against the all black panel
- Turning to the radio body, the top panel is filled with the speaker grill at the front and a ventilation grill toward the back
- Below the ventilation grill is a fan which can be controlled using several SET options and dissipates heat during radio operation

- On both the left and right hand sides are the mounting holes to attach to the mobile mounting bracket as well as a large number of ventilation slots that run down nearly the entire length
- The right hand side houses the RJ-45 "phone" jack used to attach the provided microphone or for radio cloning
- Turning to the back panel reveals an external speaker jack (1/8" format), power cord, SO-239 antenna connector and a series of metal cooling fins
- The power cord is a 10" "dongle" that terminates in a quick-release socket while the other end is attached permanently to the radio which feeds out through a flexible, rubber strain relief
- I imagine that this portion of the DC power cable is hard-wired to the radio since it contains the 15A fuse and therefore helps to prevent any circumvention of this protection feature
- Also supplied is the other part of the power cable with the mating connector which ends about six feet later in bare wire leads
- The bottom panel simply contains the usual ID sticker with FCC and Canadian ID numbers along with the unit's serial number
- The supplied microphone is of decent size and all plastic construction
- It connects to the radio via the RJ-45 plug at the end of coiled cord
- It has the usual push-to-talk button on the side, hanger stub on the back, up/down buttons on top, two switches on the right, a full DTMF keypad, and four auxiliary buttons
- What's even better is that the DTMF keypad is backlit in red and can be turned on or off by the side panel switch
- The other side panel switch is used to lock out the entire microphone to prevent accidental activation
- There's also an LED in the upper left corner to indicate when the radio is transmitting as well as when keys on the DTMF keypad are pressed

Pictures
- Radio & microphone
- Front panel
- Front panel detached
- Next to normal-to-small radios
- Next to micro radios
- Next to micro radios #2

Antenna
- No antenna is supplied with this radio
- The rear panel antenna connector is a SO-239 rated at 50 ohms
- The manual states that Europeans versions substitute this for an N-type connector

Features
- The LCD is quite large and dominates most of the front panel

- The entire display consists of a dot-matrix design
- The display is split into upper and lower sections with the upper half consisting of larger 'dots' while the lower half uses much smaller, finer dots. This allows the top line to display 7 characters while the bottom can hold 8
- The LCD is superbly backlit with soft, even, sky blue lighting that can be turned off or set at 1 of 4 intensities
- Contrast is decent but could be better. I found it a bit 'soft' and was hoping one of the 13 available contrast settings would work for my tastes
- The best viewing angle is from head-on or from slightly above. Contrast does suffer from below, way above and to the sides but it can still be read, even at extreme points
- The upper LCD line, which contains the most important data (frequency or alpha-tag) is easily readable due to the size of the characters and should give no one any trouble. The lower line is a bit more challenging since the characters are half the height of those above
- The S-meter is displayed on the bottom line and consists of 7 bars which increase in height as they approach the right hand side
- Typical usage on a variety of signals shows that my unit has an S-meter which seems well calibrated, neither under nor over reading
- Using this radio requires a mix of the keys found on the front panel as well as those on the microphone
- The front panel keys are necessary to use the SET menu and tune a frequency and switch between VHF & UHF in VFO mode, or move about channel data within memory mode
- The microphone keys are used to directly key in frequencies, switch between VFO and memory mode, and start a scan or search
- The numeric keys on the microphone present a nice challenge since the keys are set into "troughs" and must be pressed deeply to be activated. Have fun...
- Each key press is accompanied by the usual beep which can be turned off using the SET menu
- Keys on the microphone can be locked out using a slide switch on the side of the microphone
- The red backlight for the microphone DTMF keys is controlled by a similar slide switch on the side
- One of the first things I did was to disable the push-to-talk switch on the side of the microphone using the SET menu. Keep this in mind if you don't use an antenna WITH SUFFICIENT POWER HANDLING for both 2 meter and 70 centimeter bands or your share an antenna amongst multiple radios.
- Audio power is pretty good from such a small radio
- Audio signals for AM were fairly clear and quite while FM was crisp as would be expected from a small speaker
- The worst finding was that both AM and FM signals had long squelch tails, even with the squelch set quite high!
- The were also differences in squelch setting between AM and FM as well as VHF and upper-UHF. On AM the minimum squelch setting was at 11 o'clock while FM could be set around 10 o'clock. VHF FM signals could use 10 o'clock while 800 MHz had to be bumped up to 11 o'clock
- Performing a few simple tests showed that the radio does have power-on resume, picking up what it was doing just before it was turned off
- There is an automatic power-off (APO) feature designed to turn the radio off if no key activity is detected after a set amount of time. This time can be set between 1 and 12 hours in 1 hour increments. And it can't be used while scanning, searching or using priority

- The 90R comes with 47 selectable CTCSS tones which can be used to control squelch operation
- There are also 104 DCS codes available in both normal and inverted format
- While a DCS search feature is provided, no such luck for help in finding CTCSS tones
- To help keep the radio cool, there is a built-in fan whose operation can be selected from the SET menu and consists of using high and low speeds during transmitting and/or receiving to help regulate internal temperature
- From the factory, the 90R is programmed to scroll a demo message once powered on and until a key is pressed
- This message can be overwritten with one of your programming or you can choose, as I did, to turn it off completely
- Two reset operations are available with one simply resetting all SET menu selections to their factory defaults while the other does this and clears all memory contents

Amateur Radio Details

- The following are details which will be primarily of interest to amateur radio operators
- Transmit power comes in 5 levels: 5, 10, 20, 35 and 50 watts
- VHF allows 50 watts while UHF is limited to 35
- Repeater splits can be set manually, via the auto repeater shift (ARS) in the SET menu or by specifying individual transmit and receive frequencies
- CTCSS is available for both transmit and receive
- The radio can be programmed to beep when a specified CTCSS tone is detected
- European versions come with 1750 Hz tone calling for accessing repeaters
- The keypad is fully DTMF capable and transmits the proper tones when pressed while the transmit key is held in
- There are 8 DTMF dialer memories each of which can hold up to 16 digits
- Two speeds are available for the autodialer (10 and 20 digits per seconds)
- Microphone gain can be reduced to help reduce transmitter deviation and subsequent adjacent channel interference
- The 90R can use the ARTS system to help ensure two participating radios are kept within communication distance via periodic DCS transmit and receive operations which occur when this mode is enabled
- The ARTS mode can also be programmed to send your callsign every 9 minutes for station identification
- The time-out timer is used to prevent lengthy, unexpected transmissions by automatically turning off the transmitter after the designated time has elapsed (1 - 60 minutes)

SET Mode

- Like most amateur radios, a number of the radios features are accessed via a large selection of SET menu items
- The FT-90R has 38 such items:

01 Enable/disable alpha-numeric display
02 Set alpha-numeric tag
03 Set automatic power-off time

04 Enable/disable auto repeater shift
05 Select ARTS mode
06 Enable/disable key beep
07 Enable/disable CW ID
08 Program CW ID
09 Set display contrast
10 Set display backlight level
11 Voltage indication
12 Set DCS code
13 Activate DCS search
14 Select normal/inverted DCS
15 Set DTMF autodialer delay
16 Set DTMF sending speed
17 Program DTMF autodialer
18 Set fan function
19 Enable/disable transmit
20 Enable/disable key lock
21 Set packet baud rate
22 Program back arrow key
23 Program forward arrow key
24 Program P1 key
25 Program P2 key
26 Program ACC key
27 Adjust RF squelch level
28 Set repeater shift direction
29 Select scan resume condition
30 Set repeater shift value
31 Enable/disable memory skip
32 Select step size
33 Select CTCSS or DCS
34 Set CTCSS tone
35 Set time-out timer
36 Reduce microphone gain
37 Set transmit power
38 Select receive mode

VFO

- The radio is in VFO mode when a 'V' appears in the lower left of the display
- In this mode, the frequency can be tuned or entered directly via the microphone keypad
- The frequency is tuned using the rotary control
- By default, it simply steps by the currently set step size
- By pressing the rotary briefly, the VFO now steps in 1 MHz increments
- By pressing and holding the rotary longer, the VFO now steps in 10 MHz increments
- The frequency can also be adjusted one step at a time using the UP and DOWN keys on top of the microphone
- The VFO is split into VHF and UHF bands which are tuned independently with the rotary
- When the end of the band is reached, it simply wraps to the opposite end, so there's no tuning across VHF/UHF with the rotary. You have to press the SET button to switch between them. This is done automatically if entering a frequency from the keypad
- While the squelch control is used to normally set the squelch level, there is also an RF squelch which can also be used and manually select the strength of signal needed to break squelch; the available levels include S3, S5 and FULL
- The radio automatically selects AM mode for 110-136 MHz and FM everywhere else. To override this, SET menu option #38 is used to manually select the receive mode

Memory

- The radio is in memory mode when a 'M' or 'm' appears in the lower left of the display
- A 'M' indicates normal memory while 'm' indicates memory which has been locked and can therefore not be programmed (as a safety precaution)
- Pressing the VFO/MR quickly toggles back and forth between VFO and memory modes
- There are 180 memory channels and 2 "home" channels (1 for VHF and UHF)
- Each channel can be programmed with an 7 character alpha-tag for easy identification
- Tags are programmed via SET menu option #2 and include both upper and lower case letters, numbers and a large selection of symbols
- Once a channel is tagged, the tag appears in place of the frequency
- To enable display of the tag, SET menu option #1 is used
- Programming a channel starts with tuning the frequency and setting the desired options while in VFO mode
- The memory write operation is started by holding in the VFO/MR key
- The rotary is then used to select the desired channel
- Once done, VFO/MR is pressed to confirm the write operation
- To prevent any further programming of memory, the radio can be put in 'memory only' mode
- Recalling a memory channel can be done using the rotary control, the UP/DOWN buttons or keying in the channel number using the keypad

- Erasing of a memory channel can also be performed easily
- To prevent a channel from being scanned, its Skip setting may be enabled using SET menu option #31

Scanning

- With memory programmed a scan can be started by going into memory mode and holding the UP or DOWN key
- When scanning stops on an active signal, scanning will continue when the signal stops or after 5 seconds, depending on your selection of the resume condition as specified using SET menu option #29
- While memory channels can be skipped from the scanning sequence using each channel's Skip setting, the 90R also allows bothersome channels to be temporarily locked out
- If scanning stops on an undesired channel, it can be temporarily locked out by pressing the SET key while stopped on that channel
- As soon as scanning is terminated manually, all temporary locks are removed!
- When considering the fact that memory has 182 channels, one wonders how useful such a large number is when they are all contained within a single bank
- Quick testing using CTCSS functions detected no problems. Using a known frequency and tone, during scanning the radio locked right onto it. Using the same frequency but a different tone caused the scanning to pause for about 1/3 to 1/2 second on an active transmission before the scan resumed
- My empirical measurements place the scan speed at 10 chan/sec

Searching

- In VFO mode, VFO a search can be started by pressing and holding the UP or DOWN key
- The search will progress in the selected direction using the current step size and receive modes (which are usually left on their automatic settings)
- The 90R also comes with 2 programmable search limits; PMS1 & PMS2
- Each PMS has a lower and upper frequency limit which are programmed just like memory channels
- To search within one of these limits, either of the desired PMS frequencies are recalled in memory mode and then the rotary control is pressed
- This sets both the tuning and search ranges between the two frequencies of the PMS
- A search is started by simply holding the UP or DOWN key
- If both PMS1 and PMS2 have been programmed, the search will link both ranges together
- To only search one of the programmed two, simply lock out one of the frequencies from the undesired limit
- This operation is referred to as a band-scan so the scan resume condition applies here as well
- There is also a Smart Search feature which operates as an auto-store operation by placing active frequencies into a special bank of 50 memories (one each for PMS1 & PMS2)
- Once started, this Smart Search will stop when all 50 memories are filled or the end of the limit is reached. At this point, the Smart Search memories can be examined

- The Smart Search memories are cleared if the radio is put in another mode or a new Smart Search is started
- My empirical measurements place the search speed at 25 chan/sec

Priority
- On the US version of the 90R, memory channel #1 can be used as a priority channel
- Once enabled, memory channel #1's frequency is checked for activity every 5 seconds
- Priority can only be used in VFO and memory modes, not while scanning or searching

VHF/UHF Performance
- Birdie testing revealed 41 such frequencies
- This testing also revealed an unusual anomoly: it appears that the PLL unlocks between 175 - 179.995 and 985 - 999.9975 MHz
- Tuning a frequency within these ranges flashes the message "UN LOCK" and disables the squelch control
- At first I thought it might be a heat-related issue but turning on the receiver when cold and trying to tune in these ranges gives the same result
- The question now is, did Yaesu do this on purpose?
- Tuning around the spectrum to help get acquainted with its operation, I was astounded by this radio's selectivity which is the best I have seen in a while
- I then hooked up the 90R to my external 20-014 ground plane and searched its entire receive range for signs of imaging and intermod
- The biggest problem was from about 10 TV images; 3 on VHF-hi while the others were in the low to mid 400s
- Another bothersome problem was the appearance of 450/460 utility and public safety transmissions showing up on a few frequencies in the mid 300s; and even though the radio was in AM, they came through loud and clear and easily understandable
- Overall though, the results were very commendable considering the antenna used and the radio's double conversion circuitry!
- Next, I hooked both it and my AR-3000A to the same antenna via my Stridsberg multicoupler and test them back-to-back on a set of frequencies between 117 and 938 MHz
- On VHF, the 90R reception was indistinguishable from the AR-3000A and was even a bit better on the 2m band!
- As the frequency went higher, the AR-3000A began to pull ahead just a bit, with each taking rank over the other on an equal number of freqs
- But at 800 and up, the AR-3000A was easily the winner
- Toward the end of my testing, I had programmed memory with some test frequencies and was measuring the scan rate when I came across the most peculiar thing
- Even with no antenna, the 90R was receiving AM transmissions from commercial airplanes within about a 10 mile range (I live right on top of an international airport)!
- I set the squelch to its highest setting and I was still getting transmissions from planes on final approach!
- Astounded by this, I tuned the local NOAA weather station on 162.55 and found that while it was just strong enough to break the normal squelch setting, it was easily readable!

<u>Ranking</u>

Category	Score	Out of
Sensitivity	15	25
Selectivity	15	15
Interference rejection	15	20
Coverage	35	90
Channels	0	15
Channels per bank	0	15
Ease of use	5	20
Scan/Search speed	0	10
Receive modes	0	15
Step sizes	20	25
Conversion	0	10
Audio	15	20
Antenna	0	20
Construction	10	20
Size	15	15
Search	30	35
Attenuator	0	20
Auto-store	5	20
Search frequency lockout	0	15
Backlight	30	30
Alpha-tagging	10	20
VFO	10	10
Squelch tail	0	10
Priority	5	20

Delay	0	15
Hold	0	10
Rotary Control	10	10
S-meter	10	10
Power-on resume	0	10
Computer Interface	0	20
Tone Decode	10	15
Battery indicator	0	10
Channel count	0	5
Tape record control	0	5
Clock	0	5
Timers	5	5
Weather programmed	0	5
Weather alert	0	5
Data skip	0	5
Bank delete	0	5
Bank sort	0	5
Total	**270**	**670**
Total	**40**	**100**

Here's the [ranking criteria](#)

<u>Things I Like</u>

- Size!
- Detachable faceplate
- Backlit microphone keypad
- VHF sensitivity
- Selectivity
- Wide receive range

- Alpha-tags
- Audio quality and power
- CTCSS squelch
- DCS squelch and search
- Display backlight settings
- Temporary memory skip operation

Things I Would Change
- Extend reception down to 40 MHz
- Add memory banks
- Add CTCSS search
- Extend AM mode to 137 MHz
- Squelch tail
- Squelch variances
- Speed up scanning
- Beef up 800+ MHz sensitivity
- Add search skip/frequency lockout

Summary
- It sure looks like this radio could be another hit for Yaesu, especially among the scanner crowd
- Wide receive range, good sensitivity, great selectivity, little interference CTCSS & DCS decoding, lots of memory, two search limits, alpha-tags, and flexible viewing options add up to a winner
- The compact size and supplied mounting hardware will make it easy to add this radio to a vehicle where other radios won't fit or for those who need unobtrusive monitoring
- The detachable faceplate will add a level of theft deterrence and should make the radio's presence even harder to detect
- The biggest drawbacks are probably the squelch anomolies which are slight in light of all this radio has to offer
- Many will have to balance use of memory channels versus the slow scanning speed to help ensure they don't miss much activity
- All things considered, this radio is sure to fill a niche for those seeking a mobile receiver that packs a punch in a micro-sized package

June 15, 1999

Strong Signals