Product Review & Short Takes Columns from *QST* Magazine

August, 2002

Product Reviews

Yaesu FT-1000MP MARK-V Field HF Transceiver

Low Pass Filters:

- Gold Line 1089
- Gold Line 1089S
- Vectronics LP-30
- Vectronics LP-2500
- Nye-Viking 020-001
- Kenwood LF-30A
- MFJ-704
- Bencher YA-1

Yaesu FT-1000MP MARK-V Field HF Transceiver

By Rick Lindquist, N1RL
ARRL Senior News Editor

The Yaesu FT-1000MP MARK-V Field (or, if you prefer, the MARK-V FT-1000MP Field, as it appears on the *Operating Manual*) is the latest in a series of FT-1000 transceivers that traces its lineage back more than a decade to the FT-1000/FT-1000D—still perched atop the heap in Yaesu's competition-grade HF transceiver line. This is important to remember, because it says the Field has a hearty and laudable heritage that's withstood the test of time and countless hours of use in competitive and demanding environments. It also means that the basic technology is at least seven or eight years old.

Still, we found the original MARK-V to be a very capable radio that—as we put it—"breathes new life" into a proven competition-grade transceiver. In this case, we were referring to the FT-1000MP, the putative "gold standard" among many contesters and DXers that Yaesu discontinued when the MARK-V hit the streets.

Yaesu now has decided to backfill the upper end of its HF transceiver product line with the Field as the replacement for the original 'MP. Yes, the Field is a different radio in a few respects than the original MARK-V we looked at a couple of years ago, but by and large, it's very nearly identical. Its few and subtle differences are worth explaining in greater detail, however.

Look, Ma! A Handle!

Let's face it. The original MARK-V definitely did not exactly fall into the "travel radio" category, with its substantial mass and cooling fins and its separate, but absolutely necessary, FP-29 power supply to provide the 30 V dc for the MOSFET finals. There is no simple way to run the original MARK-V from 12 V dc. The Field's carrying handle and internal power supply makes a definite statement that's underlined by the transceiver's name.

Complementing the Field's carrying handle are the four rubber "feet" on the lefthand side of the transceiver that protect the finish when you set the unit down. Given its weight (33 pounds on the money), this is something you'll want to do at some point if you've got it in tow.

Close But No Clone

We strongly recommend reading (or re-reading, as the case may be) our review of the substantially similar MARK-V FT-1000MP (see "Product Review," *QST*, Nov 2000) as well as of the FT-1000MP (see "Product Review," *QST*, Apr 1996). There's not *that* much new or different about the Field, when compared to the original MARK-V or with the 'MP it's replacing in the Yaesu HF lineup. In a side-by-side comparison, there's nary a difference between the front panel of the Field and the predecessor MARK-V, except for the nomenclature. The Field's box is more compact and lacks the oversized cooling fins of the MARK-V. It's closer in size to the original 'MP.

One similarity was especially puzzling, however. When I first started checking out the radio, I thought I must have the power output cranked down, since I was only illuminating a small portion of the RF output "meter" LEDs. My surprise edged into dismay to discover that Yaesu continues to supply an LED power output "meter" with a full scale of 400 W—just as it had on the MARK-V. One must wonder why Yaesu even supplies a 400-W scale for the MARK-V, which, has a maximum power output of around 200 W. On the Field, however, the maximum power output is about 100 W, and it's much lower on AM and while using the Class A mode on SSB.

The Field uses a pair of 12-V, 100-W class 2SC2879 silicon power transistors in the output stage instead of the BLF147 30-V power MOSFETs the MARK-V employed to obtain its 200 W output. To most amateurs, the difference between 200 W and 100 W matters little. Where it comes into play with the Field is when using the Class A mode, which provides a "cleaner" SSB signal to drive an amplifier. On the Field, the Class A output power drops to 25 W down from 75 W on the MARK-V.

A less obvious distinction between the MARK-V and the Field is the internal antenna tuner. Yaesu says the MARK-V had a heavier-duty 200 W auto-tuner, while the 100-W output Field incorporates a lower-power auto-tuner borrowed from the earlier 'MP.

Given the complex menu system, users will appreciate Yaesu's inclusion of a laminated *Quick Code Sheet*, a sort of *Cliff's Notes* version of what's in the *Operating Manual*.

Bottom Line

Maintaining the performance standard set by the MARK-V, the Field replaces the original FT-1000MP in the Yaesu product line and swaps 100 W for portability and cost savings.

Performance Performance Performance

It's interesting to compare performance across the line, as measured in the ARRL Lab. The 14-MHz preamp-off numbers are compared below.

Dynamic Range

Dynamic range is essentially the ability of a receiver to discern a weak signal on one frequency without distortion in the midst of stronger signals on other frequencies in the receiver's passband. It comes in two flavors: blocking dynamic range (BDR) and two-tone, third order intermodulation distortion dynamic range (IMD DR).

BDR is the difference between the noise floor and an off-channel signal that causes 1 dB of gain compression (desense) in the receiver. The Field turned in BDR number of 122 dB—which, while quite decent, is some 20 dB worse than the original 'MP). The fraternal twin MARK-V we had measured 129 dB of BDR.

IMD DR gauges the difference in dB

Brennan Price, N4QX ▫ Assistant Technical Editor ▫ n4qx@arrl.org

Table 1
Yaesu FT-1000 MP MARK-V Field, serial number 2C010120

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 0.1-30 MHz; transmit, 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35,18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7 MHz.	Receive, as specified; transmit, 1.8-2, 3.5-4, 7-7.5, 10-10.5, 14-14.5, 18-18.5, 21-21.5, 24.5-25, 28-30 MHz.
Power requirement: Receive, 2.3 A, 13.8 V dc; transmit, 20 A, 13.8 V dc (100 W).	As specified.
Modes of operation: SSB, CW, AM, FM, AFSK.	As specified.
Receiver	***Receiver Dynamic Testing***
SSB/CW sensitivity, 2 kHz bandwidth, 10 dB S/N: 0.5-1.8 MHz, <2.0 µV; 1.8-30 MHz, <0.16 µV.	Noise floor (mds), 500 Hz filter: *Preamp off* / *Preamp on* 1.0 MHz –113 dBm / –120 dBm 3.5 MHz –125 dBm / –135 dBm 14 MHz –125 dBm / –133 dBm
AM sensitivity, 10 dB S/N: 0.5-1.8 MHz, <13 µV; 1.8-30 MHz, <2.0 µV.	10 dB (S+N)/N, 1-kHz tone, 30% modulation: *Preamp off* / *Preamp on* 1.0 MHz 12 µV / 5.5 µV 3.8 MHz 3.2 µV / 1.2 µV
FM sensitivity, 12 dB SINAD: 1.8-30 MHz, <0.5 µV.	For 12 dB SINAD: *Preamp off* / *Preamp on* 29 MHz 1.1 µV / 0.37 µV
Blocking dynamic range: Not specified.	Blocking dynamic range, 500 Hz filter: Spacing 20 kHz / 5 kHz *Preamp off/on* / *Preamp off/on* 3.5 MHz 122/123 dB / 106/107 dB 14 MHz 122/122 dB / 107/106 dB
Two-tone, third-order IMD dynamic range: Not specified.	Two-tone, third-order IMD dynamic range, 500 Hz filter: Spacing 20 kHz / 5 kHz *Preamp off/on* / *Preamp off/on* 3.5 MHz 94/93 dB / 69/74 dB 14 MHz 98/97 dB / 73/72 dB
Third-order intercept: Not specified.	Spacing 20 kHz / 5 kHz *Preamp off/on* / *Preamp off/on* 3.5 MHz +17.9/+5.0 dBm / –6.1/–16.1 dBm 14 MHz +20.3/+11.5 dBm / –5.2/–15.6 dBm
Second-order intercept: Not specified.	Preamp off, +68 dBm; preamp on, +64 dBm; with VRF on, preamp off, +102 dBm; preamp on, +100 dBm[1]
FM adjacent channel rejection: Not specified.	20 kHz channel spacing, preamp on: 29 MHz, 81 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing, preamp on: 29 MHz, 75 dB.

between the noise floor (MDS) and the strength of two equal-strength off-channel signals that produce a third-order product equal to the noise floor. IMD DR offers an objective way to tell if a receiver will be able to pull out that weak one in the din of stronger signals nearby. For the Field, this magic number was 98 dB—right in the ballpark of its forebears. (The best of the bunch that we measured was the MARK-V at 101 dB—and that's within measurement tolerance.)

Third-Order Intercept

A lot of evaluators like to refer to

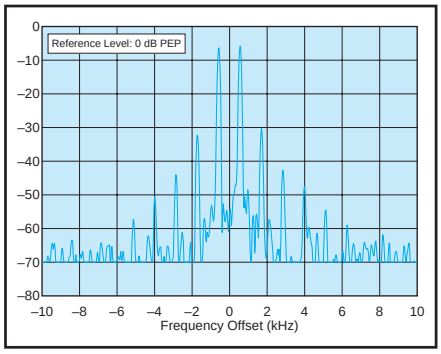


Figure 1—Worst-case spectral display of the FT-1000MP MARK-V Field transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 31 dB below PEP output, and the worst-case fifth-order product is approximately 44 dB down. The transmitter was being operated at 100 W output at 28.350 MHz.

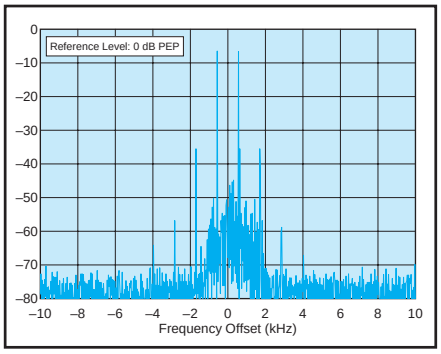


Figure 2—Worst-case spectral display of the FT-1000MP MARK-V Field transmitter during two-tone intermodulation distortion (IMD) testing in the Class A mode. The worst-case third-order product is approximately 36 dB below PEP output, and the worst-case fifth-order product is approximately 58 dB down. The transmitter was being operated at 25 W output at 21.250 MHz.

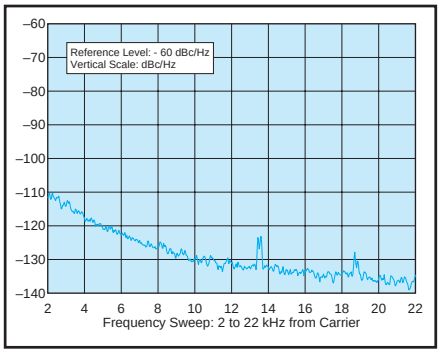


Figure 3—Worst-case spectral display of the FT-1000MP MARK-V Field transmitter during composite-noise testing at 14.020 MHz. Power output is 100 W. The carrier, off the left edge of the plot, is not shown. The plot shows composite transmitted noise 2 to 22 kHz from the carrier. Composite-noise testing in the Class A mode provided similar results.

Receiver	Receiver Dynamic Testing
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 135 µV; preamp on, 48 µV.
Squelch sensitivity: Not specified.	At threshold, preamp on: SSB, 14 MHz, 6.5 µV; FM, 29 MHz, 0.30 µV.
Receiver audio output: 2.0 W at 10% THD into 4 Ω.	3.2 W at 10% THD into 4 Ω.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth): CW-N (500 Hz filter): 372-833 Hz (461 Hz)[2] USB-W: 281-2771 Hz (2490 Hz) LSB-W: 290-2751 Hz (2469 Hz) AM: 89-2574 Hz (2485 Hz).
IF and image rejection: main receiver, 80 dB; sub receiver, IF rejection, 60 dB; image rejection, 50 dB.	First IF rejection, main receiver, 93 dB; sub receiver, 106 dB; image rejection, main receiver, 91 dB; sub receiver, 90 dB.

Transmitter	Transmitter Dynamic Testing
Power output: SSB, CW, FM, 100 W (high); AM, 25 W (high); Class A mode, SSB, 25 W.	CW, SSB, FM, typically 109 W high, < 1 W low; AM, typically 25 W high, < 1 W low.
Spurious-signal and harmonic suppression: 60 dB for harmonics.	60 dB. Meets FCC requirements for spectral purity.
SSB carrier suppression: 40 dB.	55 dB.
Undesired sideband suppression: 55 dB.	>65 dB.
Third-order intermodulation distortion (IMD) products: 31 dB at 100 W PEP; 40 dB at 25 W PEP (Class A).	See Figure 1.
CW keyer speed range: Not specified.	9 to 40 WPM.
CW keying characteristics: Not specified.	See Figure 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 28 ms.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 10 ms; FM, 10 ms. Unit is suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 3.
Size (height, width, depth): 5.3×16×13.7 inches; weight, 33 pounds.	

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.
Third-order intercept points were determined using S5 reference.
[1]Noise floor with VRF on was –122 dBm with preamp off and –131 dBm with the preamp on for 20 meters. Second-order measurements were made on serial number 2E030001, without the 500 Hz filter, courtesy of Steve Hacku, W1PXA.
[2]Range varies with pitch control setting.

something called third-order intercept (IP_3) to compare one receiver with another. IP_3 is a calculation that's based on the IMD DR and either the noise floor (MDS) or some higher signal level (often what's called an S5 reference). The Field's IP_3 came in at a hefty +20.3 dB, about 5 dB better than the original 'MP and about 6 dB worse than the MARK-V.

Second-Order Intercept

Starting with the MARK-V, Yaesu introduced something called variable RF front-end filter, or VRF—a tunable bandpass filter stage between the antenna and the fixed bandpass filters that are switched by diodes. We'd found VRF to be very effective in the MARK-V in reducing "noise" from a very strong signal—even one in the same band. We were surprised to find very little difference in our second-order intercept numbers with VRF enabled.

It turns out our review unit had an apparently defective VRF circuit. We borrowed and checked out a second radio, which turned in a measurement of +102 dBm, comparing nicely with the +110 dBm of the MARK-V and the 86 dBm of the 'MP. (For the record, we took this measurement without the optional 500-Hz filter installed.)

IF/Image Rejection

The Field beat its 80 dB specification for image rejection, although the 91 dB we measured on the Field was down slightly from the MARK-V and down considerably from the 'MP. It was a similar story for IF rejection, with the Field coming in at 93 dB (the sub-receiver turned in 106 dB), slightly worse than the MARK-V and well down from the 'MP.

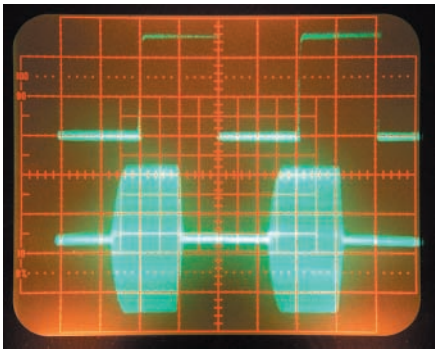


Figure 4—CW keying waveform for the FT-1000MP MARK-V Field showing the first two dits in full-break-in (QSK) mode. The equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz.

Clearing the Smoke

In general, we'd have to say that the Field compares nicely with the MARK-V it's based on and with the 'MP it replaces in the Yaesu product line. Distinctions were not especially dramatic, consistent with the lower price (about $500 less than the original MARK-V). This is a solid performer that continues the tradition of a fine Yaesu line.

Thanks to Mike Tracy, KC1SX, and Ed Hare, W1RFI, of the ARRL Lab and to Steve Hacku, W1PXA, for their assistance in preparing this review.

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; **www.vxstdusa.com**. $2399.95.

Low-Pass Filter Roundup

Reviewed by Steve Ford, WB8IMY
QST Editor

Who needs low-pass filters these days? Aren't modern transceivers and amplifiers designed to meet FCC requirements for spurious emissions?

Yes, today's transceivers and amplifiers are indeed designed to meet tougher FCC standards. As a result, they are much "cleaner" than rigs of yore. The old Knight transmitter I used as a Novice in the early '70s was a virtual TV interference generator. If I transmitted just 75 W on 15 meters, I could count on angry shouts from my parents before the first CQ had a chance to leave my antenna. A *low-pass filter* installed on the output virtually eliminated the offending RF energy above about 30 MHz. That stopped the interference cold and restored peace in the household.

Owning state-of-the-amateur-art electronics doesn't mean you're home free, though. Your HF transceiver or amplifier can pass FCC muster, yet still generate enough spurious energy to wreak havoc with cable TV, over-the-air TV and a host of other devices. This is especially true if you are running serious output power.

If spurious emissions are at the core of your interference woes, a low-pass filter is a good investment. You can also think of a low-pass filter as an insurance purchase. That is, if you ever find yourself the target of an FCC station inspection brought about by an angry neighbor, you can point to your low-pass filter with pride. Its presence demonstrates that you've done your part to make sure that your signal is clean.

QST author Don Cox, AA3EK, suggested that we "spot sample" and test the current crop of filters. We thought it was an excellent idea, so we contacted various dealers and rounded up eight products for you to consider.

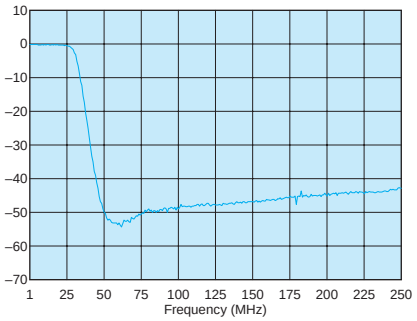
You'd think that one low-pass filter would be the same as another, but when you look at the ARRL Lab results, you'll see that there are substantial performance variations. In a perfect world, the response curve would drop like a rock at 30 MHz, then remain utterly flat all the way to daylight. Real-world filter designs and components vary, however, and so do the response curves. When making comparisons, you need to decide what kind of response is sufficient for your application and the money you wish to spend.

Other factors to consider include the insertion loss (how much RF do you lose in the filter itself?) and the input SWR on various bands. All of the filters tested for this reviewed exhibited excellent insertion loss and most had an acceptable input SWR. You will note, however, that

Gold Line 1089

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Cutoff Frequency: Not specified.	32 MHz
Attenuation of TV channel 2: 50 dB	53 dB (video carrier frequency)
Insertion Loss: Not specified.	3.5 MHz, <0.1 dB; 14 MHz, <0.1 dB; 29.7 MHz, 1.2 dB
Input SWR: Not specified.	3.5 MHz, 1.1:1; 14 MHz, 1.2:1; 29.7 MHz, 1.9:1
Filter response:	See accompanying figure.
Power rating (PEP): 1000 W	As specified.

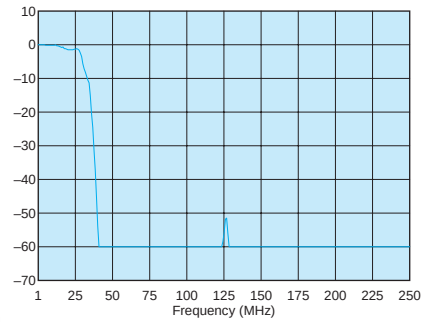
Manufacturer: Gold Line
PO Box 500
West Redding, CT 06896
tel 203-938-2588
www.gold-line.com
$59.95



Gold Line 1089S

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Cutoff Frequency: Not specified.	30 MHz
Attenuation of TV channel 2: 70 dB	As specified.[1]
Insertion Loss: Not specified.	3.5 MHz, <0.1 dB; 14 MHz, <0.1 dB; 29.7 MHz, 1.5 dB
Input SWR: Not specified.	3.5 MHz, 1.1:1; 14 MHz, 1.1:1; 29.7 MHz, 2.1:1
Filter response:	See accompanying figure.
Power rating (PEP): 1000 W	As specified.

Manufacturer: Gold Line
PO Box 500
West Redding, CT 06896
tel 203-938-2588
www.gold-line.com
$93.49

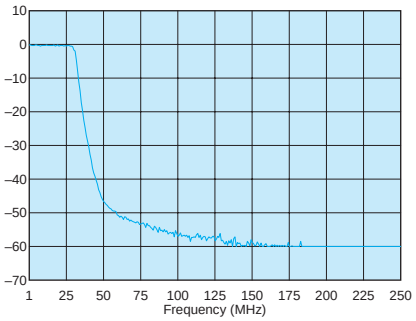


Vectronics LP-30

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Cutoff Frequency: 30 MHz	32 MHz
Attenuation of TV channel 2: 70 dB	48 dB
Insertion Loss: <0.25 dB at 30 MHz	3.5 MHz, <0.1 dB; 14 MHz, <0.1 dB; 29.7 MHz, 0.4 dB
Input SWR: <1.3:1	3.5 MHz, 1.1:1; 14 MHz, 1.1:1; 29.7 MHz, 1.3:1
Filter response:	See accompanying figure.
Power rating (PEP): 1500 W	As specified.

The old design of the Vectronics LP-30. Models of this type failed after four minutes of 40% duty cycle CW at 1.5 kW and 28.000 MHz.

The newer design of the Vectronics LP-30, distinguishable by the three screws in the top panel. This design met its specified power rating.

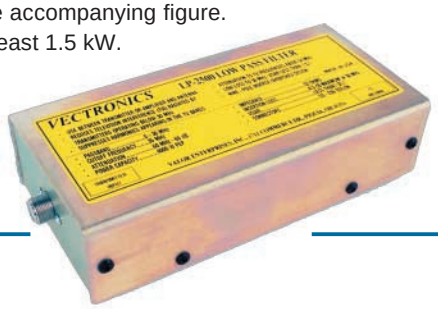


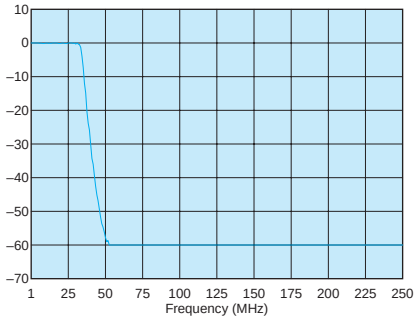
Manufacturer: Vectronics
300 Industrial Park Rd
Starkville, MS 39759
tel 800-363-2922
www.vectronics.com
$69.95

Vectronics LP-2500

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Cutoff Frequency: 35 MHz	35 MHz
Attenuation of TV channel 2: 60 dB[4]	As specified.[1]
Insertion Loss: <0.5 dB at 30 MHz	3.5 MHz, <0.1 dB; 14 MHz, <0.1 dB; 29.7 MHz, 0.2 dB
Input SWR: <1.35:1	3.5 MHz, 1.3:1; 14 MHz, 1.2:1; 29.7 MHz, 1:1
Filter response:	See accompanying figure.
Power rating (continuous): 2.5 kW	At least 1.5 kW.

Manufacturer: Vectronics
300 Industrial Park Rd
Starkville, MS 39759
tel 800-363-2922
www.vectronics.com
$139.95

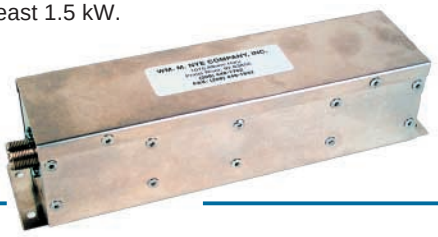


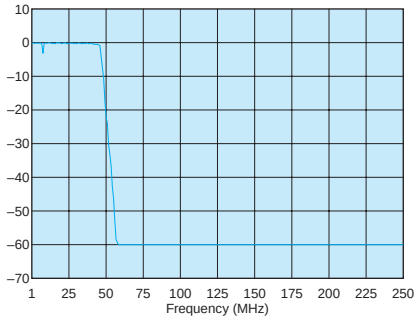


Nye-Viking 020-001

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Cutoff Frequency: Approx 45 MHz	48 MHz
Attenuation of TV channel 2: up to 65 dB (see note 3).	42 dB (video carrier)
Insertion Loss: Not specified.	3.5 MHz, <0.1 dB; 14 MHz, <0.1 dB; 29.7 MHz, 0.1 dB
Input SWR: Not specified.	3.5 MHz, 1:1; 14 MHz, 1.1:1; 29.7 MHz, 1:1
Filter response:	See accompanying figure.
Power rating (continuous): 2000 W	At least 1.5 kW.

Manufacturer: William M. Nye Company
1015 Albeni Hwy
Priest River, ID 83856
tel 208-448-1762
www.nyeviking.com/
$59





Kenwood LF-30A

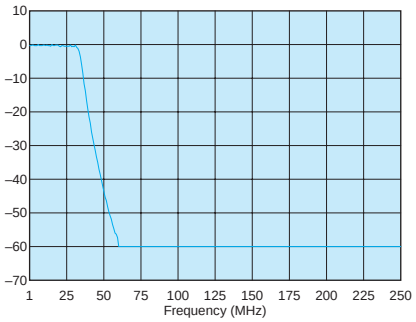
Manufacturer's Claimed Specifications
Cutoff Frequency: Not specified.
Attenuation of TV channel 2: see Note 2
Insertion Loss: <0.5 dB at 30 MHz.

Input SWR: Not specified.

Filter response:
Power rating (PEP): 1000 W

Manufacturer: Kenwood USA
PO Box 22745
Long Beach, CA 90801-5745
tel 310-639-9000
www.kenwoodusa.com
$64.95

Measured in the ARRL Lab
34 MHz
52 dB (video carrier)
3.5 MHz, <0.1 dB; 14 MHz, 0.1 dB; 29.7 MHz, 0.3 dB
3.5 MHz, 1:1; 14 MHz, 1:1; 29.7 MHz, 1.1:1
See accompanying figure.
As specified.



MFJ-704

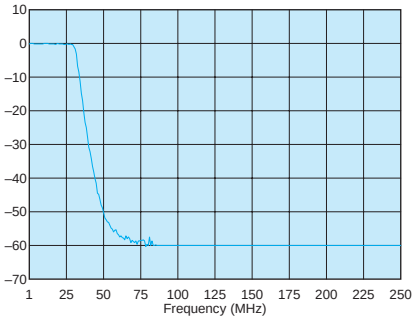
Manufacturer's Claimed Specifications
Cutoff Frequency: Not specified.
Attenuation of TV channel 2: Not specified
Insertion Loss: <0.5 dB 1.8-30 MHz

Input SWR: Not specified.

Filter response:
Power rating (PEP): 1.5 kW

Manufacturer: MFJ Enterprises
PO Box 494
Mississippi State, MS 39762
tel 800-647-1800
www.mfjenterprises.com
$49.95

Measured in the ARRL Lab
33 MHz
55 dB
3.5 MHz, 0.1 dB; 14 MHz, 0.1 dB; 29.7 MHz, 0.3 dB
3.5 MHz, 1.2:1; 14 MHz, 1:1; 29.7 MHz, 1.3:1
See accompanying figure.
As specified.



Bencher YA-1

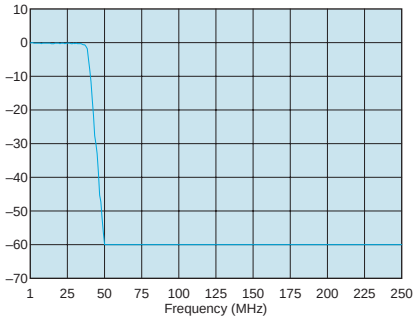
Manufacturer's Claimed Specifications
Cutoff Frequency: Not specified.
Attenuation of TV channel 2: 80 dB.
Insertion Loss: <0.2 dB.

Input SWR: <1.2:1.

Filter response:
Power rating (continuous): 1.5 kW

Manufacturer: Bencher Inc
831 N Central Ave
Wooddale, IL 60191
tel 630-238-1183
www.bencher.com/radioequip.html.
$75

Measured in the ARRL Lab
40 MHz (–3 dB)
At least 60 dB (video carrier frequency)[1]
3.5 MHz, <0.1 dB; 14 MHz, 0.3 dB; 29.7 MHz, 0.4 dB
3.5 MHz, 1.1:1; 14 MHz, 1.2:1; 29.7 MHz, 1.1:1
See accompanying figure.
As specified.



the input SWR on the two Gold Line models increased to about 2:1 at the top end of the 10-meter band.

At press time, Gold Line indicated that they are discontinuing both the 1089 and 1089S and getting out of the low-pass filter market.

Purchasers considering the Vectronics LP-30 model will want to ensure they get the newer design from the dealer. The two LP-30s ARRL purchased off the shelf from a dealer failed when subjected to 40% duty cycle CW at 1500 W and 28.000 MHz for four minutes. When we called the manufacturer, we were told that the design on this filter had been changed. The new design, which we procured from the manufacturer, met specifications. The LP-30s do not carry serial numbers, but the new design can be determined by the three screws in the top panel, which secure additional circuitry in the filter.

Notes for all Low Pass Filter Tables

[1]The limit of test measurement setup is 60 dB.

[2]The attenuation specification of the Kenwood LF-30A is 90 dB from 90 to 300 MHz. Attenuation for TV channel 2 is not specified.

[3]The specification on the Nye 020-001 states the filter "will provide up to 65 dB of attenuation...at and above 57 MHz (Channel 2)." Attenuation at 57 MHz was 52 dB.

[4]The specification on the Vectronics gives the attenuation as 60 dB at 60 MHz. Specification was met for both the Ch 2 video carrier (55.25 MHz) and 60 MHz. QST