VHF Radio Antennas

Shakespeare outdistances the pack in our on-the-water range tests. Digital and Comrod build tougher, higher-quality antennas, but they're expensive.

Without the right VHF radio antenna, even the most expensive VHF radio is worthless. Not only must the antenna allow the radio to effectively transmit its signals, it must be capable of withstanding the brutal forces of a boat pounding through a seaway (not to mention UV rays and salt spray). With these two primary duties in mind, we set out to review a group of 8- and 16-foot antennas. We took them to sea to find out how far they could transmit their signals, and later, we put them under the knife and performed autopsies to assess their quality of construction and potential durability.

PBR contacted the three most popular manufacturers of marine recreational antennas (Comrod, Digital Antenna, and Shakespeare) and requested their participation in our "at-sea" evaluation. A total of 10 different antenna models were entered into our test. Shakespeare sent us five 8-footers, ranging from $36 to $100. We also tested 8-foot models from Digital (529-VW) and Comrod (AV 60 BI8). All of the 8-footers are 6 dB antennas (see *What Is There to Gain From Gain?* on the opposite page). The field of 16-footers was much smaller, with one antenna each from the three manufacturers: the 17-½-foot Shakespeare 5018, the Comrod AV90312 (16 feet), and the Digital 532-VW (16 feet). The Comrod and Shakespeare are 9 dB antennas, while the Digital model is rated at 10 dB.

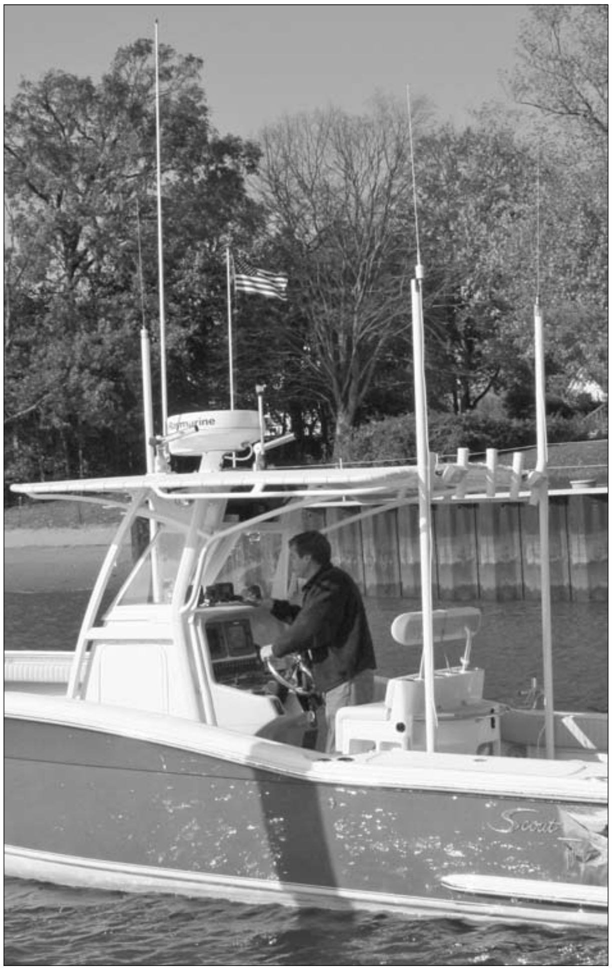
How We Tested

We tested the antennas in two groups: 8-foot and 16-foot. We asked each manufacturer to provide us with two samples of each antenna, so we could have a spare on hand in case we had any performance doubts about a particular product.

It was *PBR*'s intention to test these antennas in real-world conditions to gather comparative performance data during a day at sea. Because of the many variables that can influence any comparison of this nature, it cannot be considered a perfect evaluation of an antenna's absolute range, but rather a limited comparison of different antennas under specific identical (or as identical as possible) conditions. It would be impossible for us to eliminate all environmental factors in such a real-world test. However, the antennas were tested at the same time under virtually the same conditions, therefore we think our results are useful and informative.

Our performance test was fairly straightforward. We set up a control base at a local marina that had an unobstructed line of sight to Block Island Sound in Rhode Island. In theory, communication in the 150Mhz Marine VHF band is generally limited to line of sight, but as our tests revealed, transmission can exceed that parameter in the real world. At the base, we used an Icom M604 VHF radio (connected to an 8-foot 6 dB-gain antenna mounted about 40 feet above sea level) to send voice broadcasts to our test boat. (A second VHF radio and separate Station Master commercial antenna were also installed, so base and boat testers could communicate during the test. Cell phone coverage was spotty.)

We installed each 8-foot antenna on the oversized T-top of the test boat, a 26-foot Scout center console with twin F150 Yamahas.



Above: *In this real-world test, we took the antennas offshore to determine their maximum range.*

All three 16-foot antennas were tested on the same mounting platform 5 feet above the waterline. This is lower than where they likely would be mounted on a big boat, and upon reviewing our test data, one manufacturer suggested that our results may be misleading not only because of the lower-than-usual antenna heights, but also because our test setup made it more likely that structures around the antennas—T-top, etc..—would have interfered with performance. Another manufacture suggested that because the Shakespeare 5018 is longer than the other 16-foot antennas, it would theoretically have a greater range. Nevertheless, all the antennas faced the same less-than-perfect mounting arrangement, and as mentioned, eliminating every variable in such a test is impossible.

Only one test antenna was vertical at a time to eliminate the possibility of parasitic oscillation interference between idle antennas.

We ran the boat south of the control point on a predetermined track into open water. With each test antenna in use, we moved away from the control point until voice communications were unintelligible. The vessel route/track line was recorded via a Raymarine E-80 chartplotter. Waypoints were entered as each antenna lost communication with the base, and the entire track with antenna waypoints was saved to a CompactFlash memory card. The vessel's speed was 20 knots, with slowing to idle during communication periods with the base.

On the day that we tested the 16-foot VHF antennas, the seas were running 4 to 8 feet—not exactly the weather you want to be offshore in a center console, but we were able to accurately test all three long-stick antennas. After voice communication was lost, we turned our bow into the sea and then turned again to run with the sea to minimize side-to-side roll. Due to the deteriorating weather conditions, it was decided to postpone the testing of the 8-foot antennas for another day.

Several days later, we were back at sea with a full complement of 8-foot VHF antennas strapped to our T-top, happily making way in a relatively calm sea. The 8-foot VHF antenna test was completed without a hitch, and because we had a few extra hours of sunlight left, we decided to test the 16-footers again. Our results mirrored the outcome on the initial day of testing.

To double-check our final results, at the last waypoint location entered for each group, all antennas that were previously eliminated were connected and given one more chance to communicate with the base. This, we believed, would help rule out any channel interference that might have affected their range evaluation.

Our evaluation also included a thorough examination of the innards of these sticks, which proved to be enlightening. We cut open each antenna and studied the construction of the radiating element in hopes of identifying some performance differences. In addition, we rated the quality of materials and overall construction of each antenna.

For the record, here are the chief concerns raised by the manufacturers regarding our range comparison:

Comrod's Vidar Bakke suggested that the Shakespeare antenna may have outdistanced the two others because it is 18 inches longer. He said Comrod has performed tests similar to *PBR*'s indicating that "only small variations of

What Is There to Gain From Gain?

Recreational marine VHF antennas are usually broken down into three categories: 3- and 4-foot sailboat antennas (3 dB gain), 8-foot powerboat antennas (6 dB gain) and 16-plus-foot, long-stick antennas (9+ dB gain) that are popular on larger, long-range craft. Antenna gain is not a fixed quantitative value, but rather a ratio related to an antenna's effective radiated power (ERP).

An antenna's decibel rating can be thought of as the design of its transmit and receive footprint, or its radiation pattern. A 3 dB gain antenna has a nice circular transmit and receive pattern, whereas a 6 dB gain antenna operates in more of an oval vertical plane. For every 3 dB increase in an antenna's gain rating, the effective radiated power of the antenna doubles. Thus, a 6 dB gain, 8-foot VHF antenna has double the ERP of a 3 dB gain sailboat antenna, and the elliptical shape of the signal radiation pattern of a long stick antenna with 9 dB gain has double times the ERP of the 8-foot 6 dB antenna. A 9 dB gain antenna will communicate farther than a 3 dB or 6 dB gain antenna mounted at the same height abovedeck, on a calm day. But with the increase in antenna gain, attributed to the antenna's elongated radiated beam pattern, comes a tradeoff of signal fading when in a rolling sea. Because the beam pattern of a 9 dB gain antenna is elongated, when a vessel rolls, the "service area" of the 9 dB gain antenna dips toward the waterline and effectively puts VHF communications out of range until the antenna is once again level with the horizon.

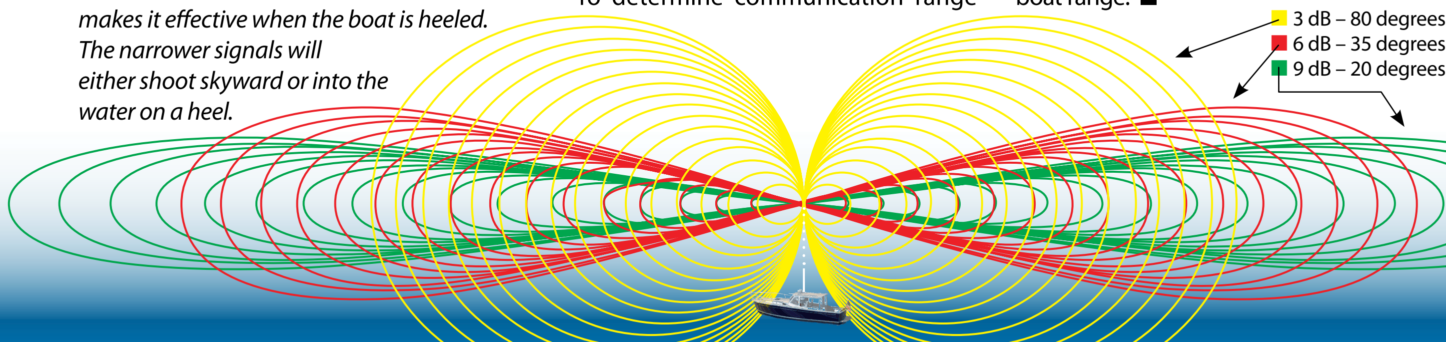
Communication in the 150Mhz marine VHF band is strictly line of sight. And although it is important to install an antenna that has as much gain as your particular vessel can physically and practically support, antenna height remains the single most important factor in effective transmission of VHF signals. A 3 dB gain antenna on top of a sailboat mast will easily outperform a 6 dB gain antenna on a center console powerboat. It should be noted that on center-console RIB or other small boat, a 3 dB gain sailboat antenna would not perform nearly as well as an eight-foot 6 dB antenna.

To determine communication range expressed in miles, you take the square root of the height of the VHF antenna above the waterline and multiply it by a factor of 1.52. Do this same calculation for the shore station or other boat that you are trying to talk to and add the two numbers together to arrive at the maximum distance that the two radios can communicate.

Mounting an antenna higher on a boat will usually require a longer coaxial cable run, and a longer coaxial cable means increased signal loss. Still, even if you double the antenna's mounting height—and increase the cable length accordingly—the overall range increases by approximately 25 percent.

Most of the 8-foot 6 dB antennas tested have radiating elements (the part of the antenna that transmits and receives the radio waves) that are 5/8 of a wavelength long, arranged in a collinear or stacked configuration. Because marine antennas have to be omni-directional, this design has proven to be the most efficient at radiating the radio signal less toward the sky and more toward the water's surface for maximum boat-to-boat range. ■

The round "beam" of the 3 dB antenna makes it effective when the boat is heeled. The narrower signals will either shoot skyward or into the water on a heel.



PBR VALUE GUIDE VHF ANTENNAS

MANUFACTURER	COMROD	DIGITAL MARINE	SHAKESPEARE			
MODEL	AV 60 BI8	529-VW	5102	5202	5206-C	5225 XT
LENGTH/GAIN (DB)	8′/ 6 dB	8′/ 6 dB	8′/ 6 dB	8′/ 6 dB	8′/ 6 dB	8′/6 dB
ANTENNA DESIGN	Collinear Array w/5/8 Wave Phased Element	Collinear Array w/ 5/8 Wave Phased Element	Collinear Array w/5/8 Wave Phased Element	Collinear Array w/ 5/8 Wave Phased Element	End-fed	Collinear Array w/ Phased 5/8 Wave Element
CABLE TYPE	RG-58 Optional	20′ Low Loss RG-8X	15′ RG-58	20′ RG-58	15′ RG-58	20′ Low Loss RG-8X
FERRULE TYPE	Stainless Steel	Stainless Steel	Chrome Plated Brass	Chrome Plated Brass	Chrome Plated Brass	Stainless Steel
WEIGHT	3 lbs.	2 lbs.	1.5 lbs.	2 lbs.	< 1 lb.	2 lbs.
TESTED RANGE (NM)	12.3	13.1	10.75	12.8	6.8	13.7
PRODUCT QUALITY	Excellent	Excellent	Fair	Good	Good	Excellent
WARRANTY	5 yrs.	5 yrs.	2 yrs.	2 yrs.	2 yrs.	5 yrs.
PRICE	$159	$149	$59	$79	$36	$82
SOURCE	Pilot Marine	consumermarine.com	defender.com	defender.com	westmarine.com	boatfix.com

the antenna height gave relatively large variations of receive signal strength."

Digital Antenna was concerned about the "on-the-water" nature of the range tests, and the installation of the 16-foot antennas, which company officials feel may have handicapped their 10 dB antenna. "An open-range test of monopole antenna must be conducted on an extremely level surface and is typically done on land," said John Jones, Digital's vice president of engineering. Jones suggested that because our results exceeded line-of-sight distances, environmental factors may have influenced our maximum range findings.

Jones also said the Digital 16-foot should have been mounted higher (at least one-wavelength, 6.25 feet above sea level), and that it should have been mounted where there would be fewer surrounding obstructions. "Our antenna provides more gain and distance; however it is more sensitive to improper installation. Our 10 dB gain antenna is designed to be mounted a minimum of 1 wavelength above water level," said Jones. (The information sheet that was sent to us with the Digital antenna tested did not provide these details and we did not this information on the Digital website.)

Given our experience with Digital, we have no reason to doubt that its 16-foot antenna, had it been installed as Digital suggested, would have likely matched the top results in our range test. This is not taking away anything from the other antennas that excelled in the field, which also would have done better with the company-recommended installation.

Comrod

The Comrod company designs and manufactures a complete and very high-end line of yacht and commercial marine antennas at its headquarters in Tau, Norway. Since its inception in 1948, Comrod has gained valuable insight and experience in fiberglass construction because it was established as a fishing pole manufacturer. Comrod antennas have been very popular overseas with the commercial ship market, but it was not until 2000 that the company actively marketed to the U.S. recreational boat market with an entirely new line of pleasure craft antennas.

All of the Comrad antennas came without attached coaxial antenna cable, which is optional. When we looked into this situation, we discovered an installation exclusive that Comrod enjoys over its competition. On the bottom of each Comrod antenna, inside the base of the mounting ferrule, is a male BNC antenna fitting where the antenna's coaxial cable would connect via a female BNC connector. The female connectors swivel 360 degrees, which means one could thread a Comrod antenna down onto a mounting base without the coaxial cable twisting up. Comrod provides a little plastic "cable tool" with each antenna that slips over the antenna coax and helps land the female BNC connector inside the antenna's ferrule. This "no-twist" cable feature and the ability to thread and un-thread a Comrod antenna off its mount without concern of attached antenna coax is especially important on VHF antenna installations where the coaxial cable needs to be longer than the standard 20 feet. Coax runs requiring more than 20 feet on a Shakespeare or Digital antenna would necessitate a cable splice, which causes signal loss. Because a Comrod antenna does not come standard with any predetermined cable length, you could pull a full length of RG-8X coax from the back of your VHF radio, all the way up to your vessel's tower or aft arch, add a BNC connector at the base of the Comrod, thread it onto the mount, and eliminate the coax splice at the 20-foot mark.

Comrod does offer RG-58 coaxial cable kits in: 5-, 7-, and 12-meter lengths for more standard types of installations, but we would not recommend ordering its RG-58 cable. Low-loss RG-8X, which is readily available at most marine stores, would be a better choice of antenna cable.

In our performance tests, both the 8- and 16-foot Comrod antennas finished third behind the Shakespeare and Digital antennas. The 8-footer held a transmission out to 12.3 nautical miles, which is about 2 nautical miles short of the top-performing Shakespeare 5225XP. The 16-foot Comrod held a transmission out to 18.3 nautical miles, which is just 0.8 nautical miles behind the Digital, and about 5 nautical miles short of the

	SHAKESPEARE	COMROD	DIGITAL MARINE	SHAKESPEARE
	5225 XP	AV90312	532-VW	5018
	8'/ 6 dB	16'/ 9 dB	16'/ 10 dB	17 1/2'/ 9 dB
	Collinear Array w/ 5/8 Wave Phased Element	Collinear Array w/ 5/8 Wave Phased Elements	Collinear Array w/1/2 Wave Phased Element	Collinear Array w/1/2 Wave Phased Element
	20' Low Loss RG-8X	RG-58 Optional	20' Low Loss RG-8X	
	Stainless Steel	Stainless Steel	Stainless Steel	Chrome Plated Brass
	2 lbs.	9.5 lbs.	7 lbs.	6 lbs.
	14.25	18.3	19.1	23.1
	Excellent	Excellent	Excellent	Excellent
	5 yrs.	5 yrs.	5 yrs.	5 yrs.
	$99	$399	$299	$239
	boatfix.com	Pilot Marine	consumermarine.com	defender.com

Shakespeare 17-½-footer.

Back at our shop, we sawed each antenna lengthwise. The Comrods gave us quite a work out—they're filled with a dense polyurethane foam, a Comrod exclusive. Filling the antenna with foam is said to lock out any condensation that would form inside the antenna due to temperature changes, subsequently corroding the antenna's copper and brass radiating elements. We think that the use of foam is a very good idea and will probably keep the conductors inside of these antennas corrosion-free for life.

If your boat is no stranger to running extremely hard in heavy seas, the possibility that a VHF antenna could snap in half due to forces from excessive whipping action is a reality. The extra heavy-duty construction of the Comrod antennas will all but eliminate the possibility of a physical failure. Comrod also provides with each 16-foot antenna a locking set screw and a tube of Loctite to insure that that the top section of the antenna never shakes loose and disconnects from the antenna's lower section.

Bottom Line: Although the Comrod antennas came up a little short in the range test, and they are expensive, the tubes on these antennas are definitely overbuilt and would last a long time.

Digital

The general consensus from established marine electronics dealers is that the Digital Antenna Co., based out of Sunrise Fla., manufactures the best VHF antenna currently on the market. Digital's powerboat VHF antennas are the only products in our test group that are still manufactured stateside.

The fit and finish of both the 8- and 16-foot antennas is impeccable, and Digital uses a custom RG-8X coaxial cable with an added layer of foil shielding beneath the tin shield. Cables provided with the Shakespeare and Comrod sticks do not have this additional shield. With the extra layer of foil, Digital's coax exhibits the lowest loss of signal per foot, according to the company. When the goal is to make sure that 100 percent of the VHF radio's signal reaches the antenna, details like using the best possible transmission cable with the lowest loss factor are paramount.

Another nice touch: Digital's standard use of a factory-installed, gold-plated mini-UHF connector on the end of the antenna coax. The mini connector is the roughly the same diameter as the coax cable itself, which means that you don't have to cut this connector off or core out any large holes to run the cable through your boat. Connecting the coax to the back of the radio is a snap. Digital provides a slick mini-UHF to UHF male (commonly referred to as a PL-259) adapter, which is also gold-plated and screws onto the Mini connector.

In our performance tests, the Digital antennas finished third to a pair of Shakespeare antennas in the 8-foot category and second to a Shakespeare in the 16-foot group. In the 16-foot test, the reach of Digital's 10 dB-gain antenna (19.1 nautical miles (nm) was four nm less than that of Shakespeare's 9 dB gain antenna (23.1 nm). The Digital 8-footer held a transmission to an impressive 13.1 nm, which is only 1 nm short of the Shakespeare 5225XP.

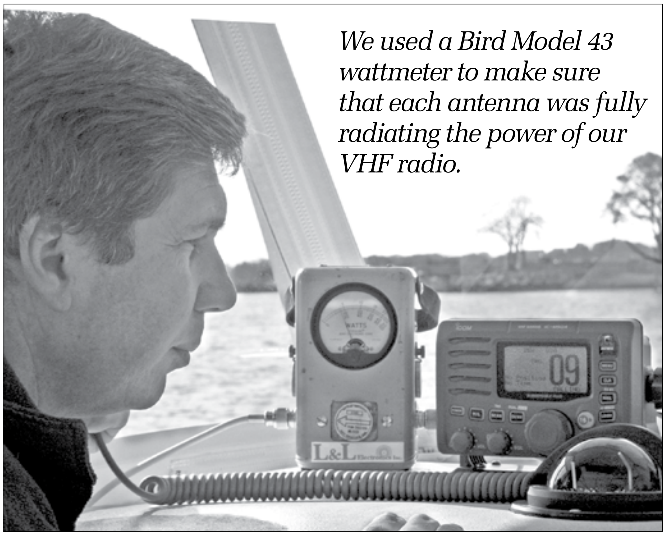
Our internal inspection of the 16-foot Digital revealed one huge brass-and-copper element that fills the entire antenna void. It would take the brass and copper of six comparable-sized Shakespeare antennas to make one 10 dB-gain Digital antenna. Not only was the Digital antenna full of expensive materials, but its overall design was impressive.

When we cut open the Digital 8' VHF antenna to expose its internal core, we observed a very well constructed, custom-looking radiating element that was similar in scale and stature to the 8-foot Comrod and the Shakespeare XT /XP products.

Bottom Line: Even though they are expensive and their range fell short of the Shakespeare models in our tests, we feel that the Digital antennas offer great value because they are built with high-grade materials. If you want an antenna that will last over the long haul, the Digital antennas are excellent choices.

Shakespeare

Founded in 1897 by the other William Shakespeare, the Shakespeare company is credited with manufacturing the first



We used a Bird Model 43 wattmeter to make sure that each antenna was fully radiating the power of our VHF radio.

fiberglass marine antenna (a double-side band AM antenna) in 1954. In the ever-changing world of marine electronics, Shakespeare has adapted well to the evolutions in marine communications. Its expertise in fiberglass molding and antenna design has kept this company churning out millions of marine antennas that have spanned the technology gap from Loran A and Loran C, through the inception of VHF, and most recently into digital cellular, Wi-Fi, and AIS (Automated Identification System).

Our test group included three antennas from Shakespeare's Galaxy lineup, the 8-foot 5225 XT and 5225 XP, and the 16-foot 5018. These antennas are coated with a high-gloss, UV-resistant polyurethane that protects the antenna's fiberglass strands from turning yellow, deteriorating, and becoming fiberglass shards (as was the case with some of Shakespeare's earlier antenna models). Inside the Galaxy antennas, Shakespeare has inserted a precision-cut radiating element that is said to have an ultra-low angle of signal radiation, yielding maximum range and minimum fading when compared to most other antenna designs. Last year, Shakespeare engineers added silver-plating to the radiating element of its flagship 8-foot, 6 dB-gain XT Galaxy antenna, creating the new "XP" model.

During the installation and dockside check of the 8-foot Shakespeare Galaxy antennas, we noticed that the more expensive, silver-plated XP antenna rattled excessively when we screwed it onto its four-way mounts.

The backup XP antenna also rattled when we gave the antenna a shake. The rattling didn't exactly give us confidence in what was supposed to be the higher-grade product. Shakespeare's Don Henry said the rattling occurs when the cable inside the element slaps against the side of the brass elements, but that this in no way impacts performance or durability of the antenna.

All three Galaxy antennas felt very light compared to Digital and Comrod antennas.

The fit and finish of the Galaxy antennas were right on par with the Comrod and Digital antennas.

Shakespeare provides 20 feet of low-loss RG-8x with their Galaxy antennas, which is quality coax, but not quite as nice as Digital's double-shielded coax with the factory-installed mini connectors.

Above: *Digital's slick mini connector (in tester's left hand) all but eliminates the hassles of breaking out the soldering iron and installing an antenna connector onto the coax.*

The radiating element inside the XP antenna, other than being silver-plated, was far less substantial than that of the Digital 529-VW. And the elements inside the big Galaxy were anorexic, in our opinion, joined together by RG59 / 75 Ohm cable and supported at the tip of the antenna via a small shock cord and a brass barrel swivel. "Looks can be deceiving," said Henry. "While the materials may not look that impressive, they are very well designed. The 5018 is an offshoot of the Shakespeare 4018, which has been sold since the early 1960s and is known as a workhorse antenna."

On the water, the 8-foot Shakespeare 5225XP Galaxy and the 17-foot, 6-inch Galaxy 5018 decisively outdistanced the others, holding their transmission to 14.25 nm and 23.1 nm, respectively.

In addition to Shakespeare's Galaxy antennas, we also tested its 8-foot 5202 Pro, as well as two of the Centennial 5102 and the Economy 5206-C. Shakespeare's 5202 is a well-respected antenna that has a proven track record, but lacks the high-gloss finish of the Galaxy product. The Centennial antenna is good for near-shore boating where maximum range is not a priority. The Economy antennas, because of their low cost, are a favorite among boat dealers who have to add a VHF radio to a new boat. But the 5206-C ranked dead last in our range test, with 50 percent less range than the Galaxy XT. Maximum range was less than 7 nm. All that is inside of the 5206-C antenna is a striped back piece of inexpensive coax cable.

Bottom Line: Shakespeare's Galaxy antennas performed the best in our test. They are priced right, and readily available at most retail locations. Based on our internal inspections, however, we feel the Comrod and the Digital hold the edge in the durability department.

Conclusion

In the 8-foot, 6 dB-gain category, Shakespeare's 5225 XT and XP held a slight range advantage over the Digital 529-VW. These two Shakespeare antennas are not as rugged as the Digital, but they cost significantly less. At $82, the 5225 XT earns Best Buy honors. We were impressed with the price and performance of the 5225 XP, too, but we think Shakespeare's top-of-the-line antenna should not rattle—at all. It makes us worry about its long-term durability.

With its exceptional range and top-quality construction, the Digital 529-VW is a smart choice for boats that frequently endure rough-water abuse. The Comrod is built to last, and we recommend it.

Shakespeare led the way by a much larger margin in the range test of long-stick antennas, with a contender that costs about $60 less than the runner-up in this group, the Digital 532-VW. But the Shakespeare 5018's construction quality falls short of the Digital and the Comrod AV90312, in our estimation. Therefore, we'd recommend the Shakespeare for boats that see limited rough-water use. The Digital and Comrod, based on our examinations of their innards, should withstand years of rough use. The Digital is $100 less than the Comrod, so it would be our top choice for ocean-going battlewagons. ■

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