

navico

Broadband Radar™

The Essential Guide



www.navico.com



LOWRANCE®

NORTHSTAR★

SIMRAD

Broadband Radar™

A New Revolution in Radar



The most significant radar breakthrough since 1940



Crystal clear image

Miss none of your immediate surroundings. Fantastic for tight maneuvers in marinas or in conditions of limited visibility.



InstantOn™

Solid-state technology produces an immediate, accurate on-screen image.



Low power consumption

Broadband Radar requires very little power: ideal for all types and size of boat.



Extremely low emissions

This safest of radars means it can be mounted anywhere. Broadband Radar has fewer emissions a mobile phone.



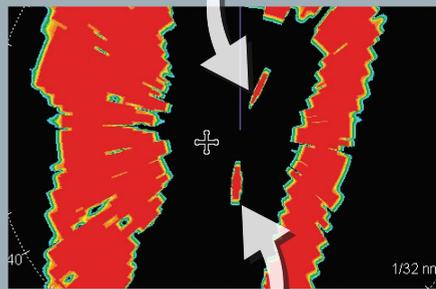
Quick installation

No reason to open the dome, no tune or zero mile adjustment, and best of all – no radar-licensed technician required.



Automatic clarity

Proven Auto Harbor and Offshore modes completely optimise the radar image – even on our shortest range of 200 feet. Just steer.



www.lowrance.com | www.northstarnav.com | www.simrad-yachting.com

LOWRANCE

NORTHSTAR

SIMRAD

Navico - Leader in Marine Electronics

Navico is the parent organization to five of the world's leading marine leisure electronics brands: B&G, Eagle, Lowrance, Northstar and Simrad Yachting. Together these brands develop and manufacture the full range of navigation and communications equipment used by craft in the leisure and coastal commercial sectors.

Formed in 2007 by the bringing together of Simrad Yachting, Lowrance Electronics and the marine division of Brunswick New Technologies, Navico has a truly global reach and offers an unrivalled breadth of choice to suit every requirement and budget, whether it is in chartplotters and echo-sounders for leisure boaters, racing instrumentation for grand-prix competitors, or fully integrated navigation systems for the largest luxury yachts.

As a research-driven organization Navico maintains center of technological excellence around the world, including development facilities for GPS and echo-sounder products in the USA, autosteering in Norway, instrumentation in the UK, and radar in New Zealand. The development of Broadband Radar is an excellent example of the long-term approach that Navico takes to ensuring that it remains at the forefront of marine electronics.

Over five years of R&D and the application of substantial funding, including a grant from the New Zealand government, went in to achieving this revolutionary advance in marine navigation, but the enthusiastic response to its introduction from the

worldwide boating community demonstrates the benefits of investing time and resources in seeking radical new solutions to the challenges of the marine environment.

Yachtsmen, anglers and professional mariners can expect to see a steady flow of similarly exciting new products from the Navico brands in the coming years. With a commitment to ever-enhanced

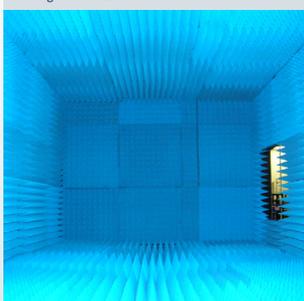
“Over five years of R&D went in to achieving this revolutionary advance in marine navigation”

performance, ease of operability and seamless systems integration, Navico will continue to set the pace in innovation for the marine electronics industry for the foreseeable future.

Broadband Radar Engineers in New Zealand



Pyramidal foam inside an anechoic chamber to eliminate internal signal reflections when testing the BR24



The BR24 Radome has undergone demanding waterproof testing



How does it work?

Broadband Radar compared to conventional pulse radar

Conventional pulse radar uses a magnetron to generate a pulsed microwave signal that is transmitted from the rotating radar antenna. This “bang” of microwave energy is reflected off targets that it hits and returns to the radar, the time it takes determines the range and bearing.

This type of radar transmission is, in layman’s terms like shouting loudly in one direction and then listening to see if you hear an echo, turning and then repeating.

Broadband Radar uses a different type of technology, allowing the radar to send out a continuous radar signal, with a changing tone or frequency, at a very much lower power and listen for the change in that signal, also continuously. This is more like whispering continuously and listening at the same time for the echo, made possible in the radar by using two antennas, one whispering and one listening.

The change in the tone of the transmitted radar signal determines the time taken for the signal to reach the target and return. This time determines the range and the bearing.

There is a distinct advantage in sending out a much lower signal, the distortion in a normal radar transmission, that is likened to a shout gets distorted at close ranges, this is often referred to as “main bang” interference and appears on the screen as a sunburst in the center of the screen. At short ranges this noise covers up any close in targets, reducing the effectiveness of the radar at short range. Many types of radar suppress this pulse and hide the noise; this also hides any short-range targets effectively blinding the radar to close by targets.

With the Broadband Radar only sending out a “whisper” the noise and distortion is just not there, hence there is no noise in the center of the screen and also no need for noise or main bang suppression. The benefit of this is that close up targets are not lost or hidden, with the radar able to show targets right up until they are alongside the boat. This short-range performance has never before been seen.

Conventional radars emit a pulse, and this pulse varies in length depending on the range. This pulse length determines the ability of the conventional radar to distinguish between close targets on a similar bearing. Usually this can be as short as 90ft at short ranges and up to 500ft at longer ranges. The Broadband Radar, using the continuously transmitted signal, is able to see targets as close as 6ft from the dome on the shortest scale and separate targets 30ft apart in range on the scales used for navigation.

This short-range performance is also enhanced with the minimum range scales now going beyond the conventional 1/8th of a mile range down to 1/32nd of a mile. To help with the comprehension of these shorter ranges the radar switches to feet for the shortest ranges, you can display 400ft, 300ft and 200ft, with range rings of only 100ft.



The dual microwave stripline arrays inside of the antenna dome allow continuous transmission and reception, unlike conventional radar that only has one antenna used for both.

The outcome of this whisper technology is, better short range detection, better visibility of close in targets and better target range resolution in comparison to conventional radar.

The better target range resolution also helps in reducing sea clutter. This is due to the radar being able to detect different targets

at small range difference, much better than conventional radar. Radar echoes from waves are much easier to filter out as the returns are smaller, rather than several waves returning a single large echo that displays as one target.

This helps keep a much clearer display and enables the detection of smaller floats or buoys in the water.

“It’s Magic”

Greg Konig, Vice-President for Navico’s Product Line was asked at a Press lunch if he could explain how Broadband Radar works “in Layman’s terms”. Konig obviously did not want to launch into a lengthy discourse over salad and sandwiches. “In Layman’s terms” he said, pausing for effect “...it’s magic!”

With help from Konig and other folks at Navico, we’ll now try to explain how Broadband Radar works and how it differs from conventional Pulse Radar

Conventional or pulse radar is generated by a magnetron, which has been compared to a valve opening and closing to release pulses of energy.

In layman’s terms: Imagine you are standing blindfolded near a house. You holler “hello!” and then listen to hear the echo. Let’s assume you are changing direction like a rotating radome as you continue to call “hello!” and listen again. You holler, pause, listen; holler, pause, listen. Your sense of hearing is more finely tuned than most, and the echoes tell you that there is an irregular object nearby in a particular direction at a specific distance.

Broadband Radar is a marketing name for what engineers call frequency-modulated continuous-wave (FMCW) radar. The word “broadband” nowadays is associated with good computer connectivity; Navico justified use of this term because its radar emits signals along a broad range of frequencies. It does this without a magnetron, instead using two solid-state amplifiers: one to transmit waves at continuously increasing frequencies, the other to simultaneously receive their echoes.

Now, Mr. Layman, you are standing near the same house, not hollering. You are whispering, “do, re, me, fa, so, la, ti, do; do, re, me, fa, so, la, ti, do,” etc. As you rotate and whisper, you listen for echoes, with an ear for nuance. You don’t pause; you whisper and listen simultaneously. You clock the echo from each discreet note and use these streaming time-stamps to build a mental picture of a building with a tree in front of it, but not touching.

“You are able to match what you see on the screen to reality quicker than you ordinarily could. It also eliminates sea clutter and rain clutter about five times better than your traditional radar, and you don’t have to tune the radar to get the signals to pop out from the noise.” Konig said.

Excerpts from “Radar Love” in Passage Maker Magazine, courtesy of Peter Swanson

ELECTRONICS

RADAR LOVE



NAVICO INTRODUCES GAME-CHANGING, “HUGGABLE” TECHNOLOGY

STORY BY PETER SWANSON

As I was enjoying after midnight and the very definition of unwelcome. Radar’s original military purpose was to detect attacks, and it was game-over if you, that is just what happened a couple years ago in Florida (and then off the North Carolina coast). The “surprise attack” was detected during my routine of periodically adjusting gain and range on my BWR radar. Going from 5 to 6 miles on the range scale, a huge yellow return presented itself on the display to seaward. “What the heck is that?” I wondered. “It must be more than a quarter mile long!”

If it had been a tug and barge in front, radar would have shown two well-separated return images. I looked nowhere for sea buoys, but the horizon was black as a trooper’s boot. Had it been a rain squall the return image would have been fuzzy and irregular in appearance. This long yellow “thing” was neither. Fortunately, it was not exactly straight parallel to the horizon, moving slowly and posing no danger of collision.

I then recalled that my national number was an “8” but a “they” float of 100-foot VPs from the U.S. Naval Academy had been practicing stability night maneuvers.

Being Broadband Radar, we give up to a dozen. Note the return just ahead of dead center on the radar display. That’s the ping.
48 passagemaker.com May/June 2009

Broadband and FMCW explained

Introducing a revolutionary new radar system unlike anything else on the recreational boating market. Utilizing solid-state technology, this breakthrough radar solution provides superior target detection and separation, ease of operation, and a new level of navigational safety to a wide range of boats.

The exclusive technology and performance characteristics of Broadband Radar make it an ideal match for almost any vessel. Unparalleled short-range resolution and discrimination make it an ideal complement to large radar systems on power and sailing yachts. User-friendly operation makes it an ideal primary radar for small to medium-sized vessels. And its small size, minimal power requirements and safer transmission energy levels open up the advantages of sophisticated radar to all boats.



Crystal clear image

The images displayed on the screen are so clear and easy to understand due to the use of some amazing technology, this is FMCW (Frequency Modulated Continuous Wave). The signal sent from the radar is simply a range of frequencies; hence the term Broadband, this signal is radiated from the rotating part of the antenna in much the same way as normal radar.

The real difference is in the way the radar looks out for the returned signal. Sending this signal out continuously and listening with a very sensitive receiver allows the radar to detect the change in frequency, from this change it is possible to calculate the range and bearing of the target. The Broadband Radar has two antennas inside, one transmitting all the time and the other dedicated to receiving the radar signals.

This clear signal back is what provides such a crystal clear image on the radar display, making it very quick and easy to understand the radar picture. No complicated tuning or learning curve makes it easy to operate and understand.



Low power consumption

Using new solid state technology reduces the power consumption of the radar significantly over conventional radar. Perfect for use on Sail boats where battery reserves are limited.



Extremely low emissions

Like no other radar, Broadband Radar is huggable. In fact, the BR24 radome emits one-tenth the emissions of a common mobile phone. No other radar is this safe! Broadband Radar transmits only 1/10th of one Watt, whereas pulse radar on a small boat emits a substantial 2000 Watts. Broadband Radar transmits a low power FMCW signal that is continuous. It produces extremely low emissions enabling the radar to be mounted in many more positions than conventional radar. This is ideal for small power boats where conventional radar is simply not an option.



Instant On™

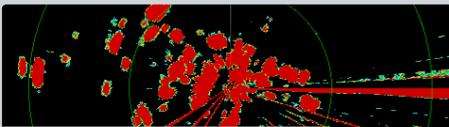
No magnetron, provides instant radar transmission, ideal for on a sail boat where you may not wish to have the radar running continuously. Compare this to waiting 90 to 180 seconds as you may have to do with conventional radar, gives you the radar picture the moment you need it.

Automatic clarity

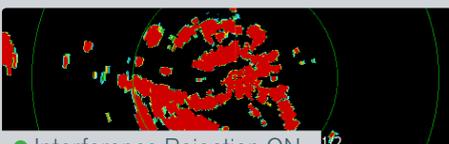
The Broadband Radar operates mostly automatically, with user selectable auto modes. No need for special tuning of the radar at start up or adjusting the tune when changing range, all this is taken care of with the auto modes, in Harbor or inshore, use the Auto Harbor mode, offshore fishing, use the Auto Offshore mode. The Broadband Radar takes care of all the fine-tuning automatically.

IR Interference rejection

This feature of the Broadband Radar automatically tunes out interference that may come from other radars operating in the vicinity. Multiple levels of interference rejection remove all noise depending on whether you are in a busy commercial harbor, shipping lanes or just out fishing with another boat. The special IR software will remove other radar noise; yet still maintain a perfect radar picture around the boat. Simple to use and the results are impressive.



● Interference Rejection OFF

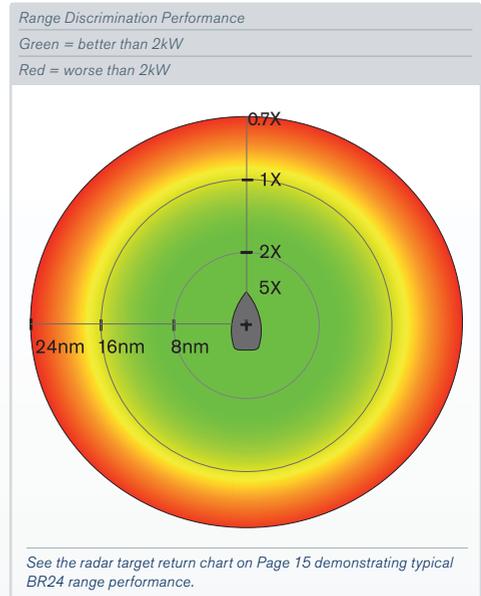


● Interference Rejection ON 1/2

Range discrimination performance

Range discrimination is a measure of the radar's ability to distinguish closely spaced targets on the same bearing. FMCW technology provides unsurpassed performance for your maximum safety and precise navigation. At 16nm and less the BR24 has from 1 to 5 times more range discrimination capability to see smaller targets than conventional 2kW pulse radars. This greatly improves your situational awareness.

The below graph uniquely demonstrates range discrimination performance of BR24 vs. pulse radar.



All weather performance

In bad weather, when visibility is low, that is when you will want to rely on your radar.

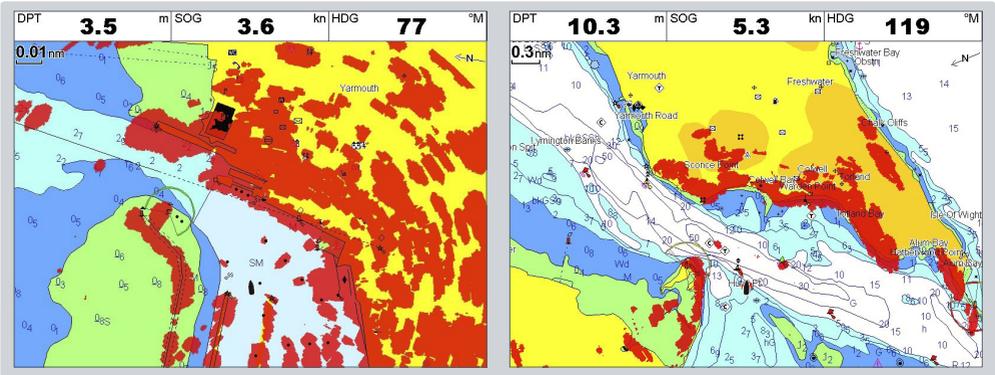
In a rain shower or snow the radar signal will penetrate and show you the radar picture you expect to see. The Rain Clutter feature on the radar reduces noise on the picture associated with rain, yet still provides you with a clean picture of the radar targets around you.

A new level of situational awareness

Broadband Radar with chart overlay

Radar Chart overlay is the perfect way to determine what are fixed targets and what could be moving targets such as ships.

Even at night or in fog or mist, using Broadband Radar in these close quarters it is possible to vastly improve safe navigation in restricted conditions at close range.



▲ The screen capture above shows perfectly how on very short ranges the Simrad NX45 with Broadband Radar and chart overlay show up targets and individual moorings inside a busy harbour. The boat is clearly seen in the centre of the chart and the large target showing alongside the pier is a ferry departing the harbour with another vessel showing up in the entrance channel to the harbor.

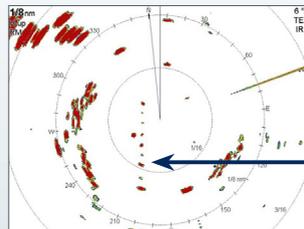
▲ Above we can see the radar shown with the chart at a greater range showing the entrance to the Solent. This shows the entrance to the estuary and the navigation marks are clearly shown, any targets appearing on the radar and not being seen on the chart would normally be other vessels, a great aid to navigation when visibility is restricted at night or in poor weather.

“A lot safer...”

At 200ft away from the boat on the port side are a series of very small channel marker floats, these are clearly visible, yet are made of plastic and are probably only 6 inches above the water.

The skipper of the boat who is used to this harbor says that at night being able to see these markers will make coming into this harbor a lot safer.

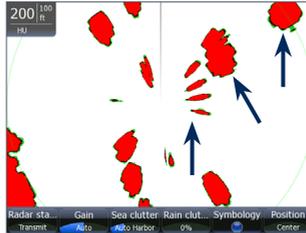
Channel markers are easily associated to visible surroundings ▼



See what you need to see, when you need to see it

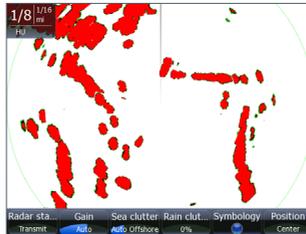
Four posts to starboard with two yachts clearly visible behind ▼

Only possible at this range as broadband radar has no main pulse suppression that a conventional radar suffers from. Possible to see targets close together and yet they are clearly shown as separate targets.



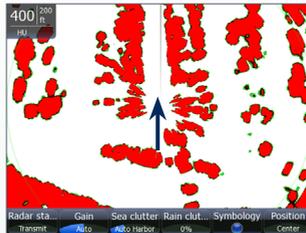
Breakwater to port, with three mooring buoys close in ▼

The Broadband Radar is able to separate targets that are close together much clearer than a conventional radar, here we see the three buoys clearly visible close to the breakwater.



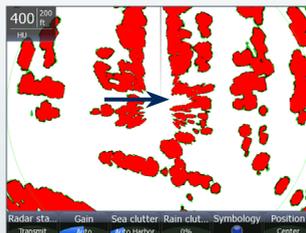
Left turn complete, moving along a row of boats ▼

In narrow harbors it is possible to use the Broadband Radar to find your berth. Often harbors have confusing lights and background lights that can make a night harbor entrance seem confusing. The radar at this scale makes it all very clear.



Vacant berths in a marina are easily identified ▼

At short ranges the Broadband Radar is showing up the individual yachts in their berths, ideal at night when visibility may be compromised. In this type of situation conventional radar would only show a merged target possibly obscured by the main pulse.



Is my display compatible?

Broadband Radar is compatible with many different advanced displays. To see if yours is compatible, see below.

Compatible Products:

LOWRANCE

Lowrance HDS (5,7,8,10)

www.lowrance.com



NORTHSTAR

Northstar 8000i (12,15), Northstar M121, Northstar M84

www.northstarnav.com



SIMRAD

www.simrad-yachting.com

Simrad GB40
Simrad NX40
Simrad NX45
Simrad NSE8
Simrad NSE12

Note: Your display may require a software upgrade to be BR24 compatible.



Award winning technology



Simrad BR24 Broadband Radar wins NMMA/BWI Innovation Award at 68th Miami International Boat Show

Simrad BR24 Broadband Radar™ was awarded the 2009 National Marine Manufacturers Association (NMMA) and Boating Writers International (BWI) Innovation Award for the Consumer Electronics category at this year's Miami International Boat Show. As stated by the NMMA, the Innovation Awards program, organized by NMMA and judged by BWI, recognizes those products that best meet the following criteria: innovative distinction from other products currently being manufactured; benefit to the marine industry and/or consumer; practicality; and cost-effectiveness.



Broadband Radar wins Sail Magazine Freeman K. Pittman Award

Chicago Strictly Sail '09 brought the first of what we hope to be many awards for our innovative new Broadband Radar. The Freeman K. Pittman award, instituted in 1997 by Sail Magazine, recognizes and rewards companies who have created innovative products that propel the sport of sailing and serve as a catalyst for growth in the sailing industry.

WON THE
EDY AND
NMEA
AWARDS
SEPTEMBER
2009

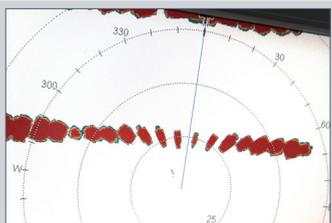
Seeing is believing...

Oyster Bed
(right)

Oyster bed returns
(far right)



©Sail-World.com

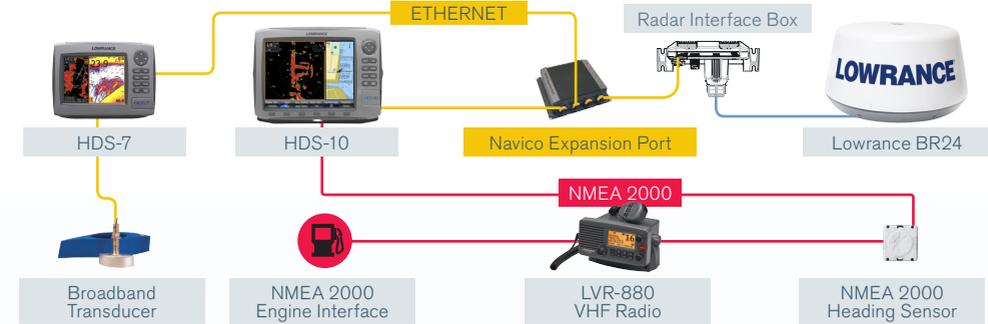


Typical installation options

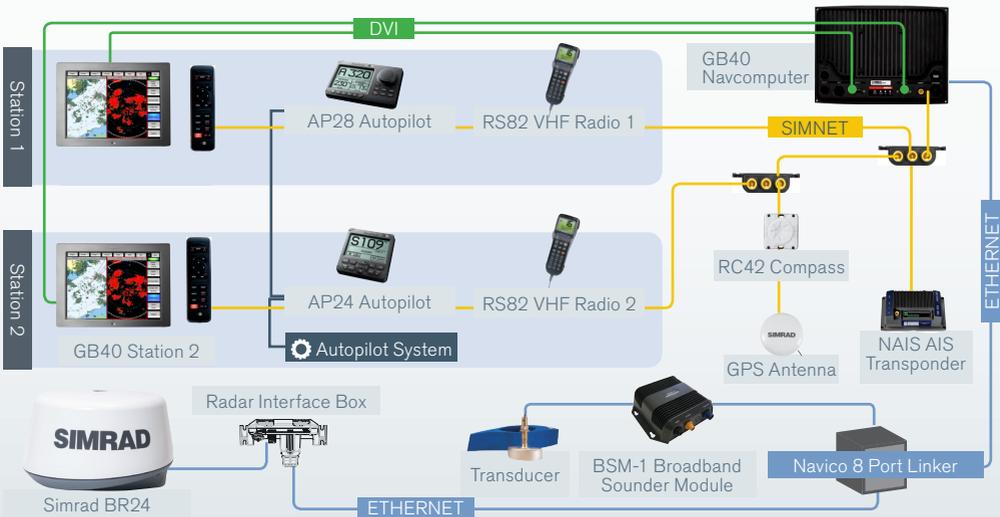
Simrad simple retro-fit installation (simplified diagram)



Lowrance expanded system (simplified diagram)



Simrad dual station (simplified diagram)



What are the press saying?

“It’s [Broadband Radar]
pretty close to a 10.”

Peter Swanson, Passagemaker

“Navico’s BR24 broadband solid-state radar is a quantum jump in recreational marine radar.”

Chuck Husik, Southern Boating

“After several hours of scoping target-rich Biscayne Bay, my impression [of the BR24 Broadband Radar] was a qualified “wow!”

Ben Ellison, Cruising World

“It’s going to revolutionize the way people navigate basically”

Dave Barham, Boat Fishing Monthly

“Great screen clarity, it’s really a game changer!”

John Burnham, Yachtworld.com/Boats.com

“There haven’t really been any structural breakthroughs in radar in a long time. What we saw today would enable people to use the product, really effectively, in close quarters, better than any radar product than I’m aware of.”

“This [Broadband Radar] gives people a reason to choose one radar product over another!”

Bruce Pelkey, Navigate-us

“The low power consumption makes it easier to run on a small boat with a two battery system.”

*

“I like the fact that it’s instant on and that you don’t have a 90 second warm up period. Half the time when you want [conventional] radar, by the time the 90 second period is over, what you wanted to see is already gone.”

*

“The detail that allows you to distinguish a guy’s tender idling around a boat from your boat 50-feet away ... that was pretty nice!”

*

Lenny Rudow, Marlin

“Broadband radar is a major development in radar technology.”

Chris Labozza, Nor’East Magazine



“If I want to buy a new radar,
I would choose this one”

Dieter Wanke, Skipper Magazine

“I would say the performance
of this new radar technology is
nothing short of remarkable”

RIB Magazine

“Being that inexperienced user,
I found it very
very easy to use”

Peter Nash,
Boating Business Magazine

“It’s so simple that everyone can just
open it, switch it on and use it”

ars-Åke Redeén. Båtliv Magazine

“Compared to conventional
radar, I found Broadband
Radar amazingly clear
for up close targets”

Toby Hodges, Yachting World Magazine

“I’ve run out
of superlatives.
Just buy one”

Simon Everett, Sports Boat & RIB Magazine

“Navico’s new BR24
broadband marine radar
is a game changer in the
recreational marine market.”

Chuck Husik, Southern Boating

“It’s early days, yet, but I’m convinced
that we’re in at the start of a
revolution that could well mean the
end of radar as we know it.”

Tim Bartlett Technical Editor, Motor Boating

“It’s [Broadband Radar] off the charts for new products.”

*

“It [Broadband Radar] saw two birds swimming on
the water’s surface 30 feet away. If I had not seen that
with my own eyes I would not have believed it.”

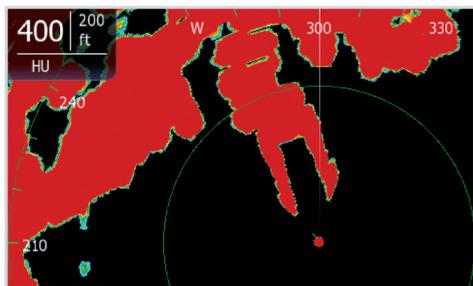
*

Ben Ellison, Yachting, Cruising World and Panbo

When to Use Pulse Radar

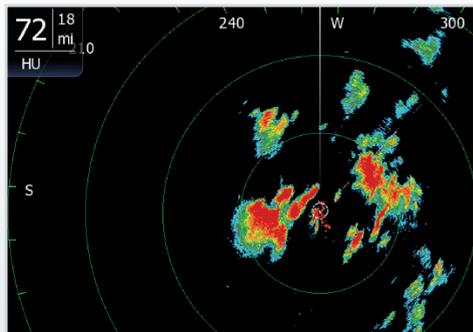
Broadband Radar is ideal for

- Close range operation in tight quarters with an unmatched full screen radar scale of 200'
- Precise navigation and collision avoidance situations up to 3nm
- All weather clutter rejection
- Natural sea clutter rejection
- Easy installation
- Maximum safety and situational awareness.



Pulse radar is ideal for

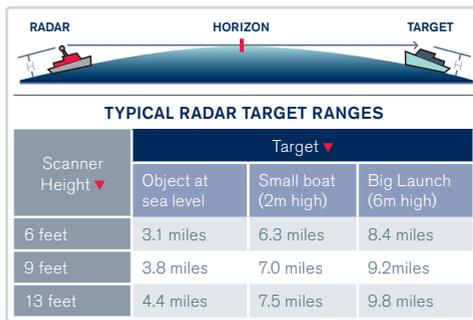
- Detailed visibility of storms and rain cells farther than 16-20nm away
- Seeing hard to detect sloping beaches and shorelines
- Triggering RACONS
- Cosmetic appearance of a turning open array.



• 6kW HD Digital Open Array (Pulse) Radar on 72nm range with full color storm cells

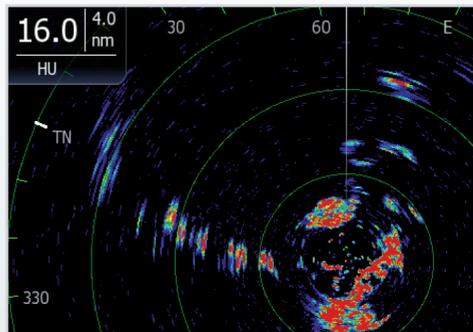
I can't see my friend's boat 6nm away. Why?

- Always be careful with distance and line of sight - all radars need to be higher to see farther, and the farther you look, the bigger and taller the object needs to be.



I can see coastline in the distance but my radar cannot see it. Why?

- This is true of all radars in some conditions due to the slope of the land, height of the coastline, vegetation, humidity, and distance.
- BR24 target detection ability decreases more rapidly than pulse radars as the radar range scale is increased while adequately seeing important larger targets far away.



• BR24 Broadband Radar on 16nm range with coastlines beyond 12nm

vs Broadband Radar

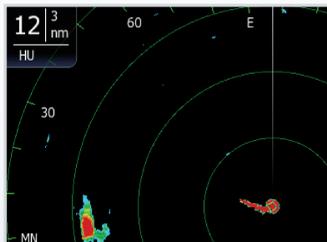
BR24 target detection ranges

Ballpark distances	Typical maximum range in good propagation conditions*
Target	
Large power station / wind farm	15-25nm
Long coastline with 100m high cliffs.	10-20nm
High density urban coastline	6-12nm
Forest covered coastline gently sloping to 250m	4-8nm
Low lying suburban coastline	4-8nm
Large container ship (ship dependent)	7-14nm
Low lying coastline < 50m, dense vegetation	3-6nm
Small low lying island	2-4nm
Medium size power boat	1-2nm
Channel markers with radar reflectors.	1-2nm
Small power or sail boat	0.5 to 1.5nm
Small marker buoy with no reflector.	0.25-0.5nm
Kayak	300-800ft
Birds	160-500ft

* Above data is typical target distances that can be seen with BR24. These are not guaranteed.

How far away can I expect to see rain with BR24?

Ballpark distances	Typical maximum range in good propagation conditions*
Rain Pattern	
Wide weather front with heavy rain.	6-12nm
Dense rain cell 100mm/hr	5-10nm
Heavy shower 25mm/hr	2-4nm
Light rain	1-2nm



Above: This varies widely with rainfall rate.

Left: BR24 showing strong storm cell about 10nm away.

Can I improve maximum usable range by using manual controls?

- In some cases, yes, but introduces more noise in the image and not recommended for non-experienced radar users.

How does BR24 range performance compare with different radar scanners in the market?

- The BR24's strength is in its short-medium range performance where radars are most frequently operated for improved situational awareness. Pulse radars decrease their pulse width by a factor of 10 at short ranges to get reasonable range resolution. BR24 changes it's sweep to get the same effect. The BR24 has 1-5 times the range resolution of the best pulse radars out to 16nm.
- Almost no dead spot with BR24, providing visibility to within feet of your boat.
- Pulse radars have more energy on target, so go farther than BR24 when in long pulse mode. BR24's excellent noise floor and signal processing make up for a portion of the pulse radar's raw power and provides complete safety from RF emissions.

General Recommendations for selecting BR24 or Pulse Radars

- BR24 is the best choice for the vast majority of radar applications and addresses the need for superior all weather navigation usage.
- Low emissions combined with a proven fact that "all collision incidents occur with objects less than 10' of the boat" - where radar visibility is now possible with FMCW, makes you and your family more safe in every way.
- Pulse radars are for operators that regularly go farther than 20nm offshore and need to keep tabs on distant storm cells and detect far away coastlines - in addition to seeing these objects on their chartplotter map. For these applications, our HD digital open array radars are recommended.

navico

LOWRANCE[®]

NORTHSTAR★

SIMRAD

www.lowrance.com | www.northstarnav.com | www.simrad-yachting.com