British 2m mobile REVIEW

At the NBC exhibition this year a newcomer to amateur radio made a spectacular appearance, the company in question being the British marine electronics firm of Navico. At the show they proudly launched their offerings for the 2m FM amateur market in the shape of the AMR1000 and AMR1000S transceivers, offering a number of features for the British and European markets that could make Japanese 'black boxes' appear rather limited. For a price of £247 for the AMR1000 or £299 for the AMR1000S (the two are identical apart from the latter having extra scanning and programming facilities), they could certainly become very popular. The HRT review team (of course) have done it again with a world first review, and here we put them through their paces . . .

Features

Each set gives transceive operation on FM over the 144-146MHz range with user-selectable 12.5kHz or 25kHz steps and a switchable transmit power of 25W or 5W, operating from a 13.8V nominal DC supply requiring approx. 5.5A. Their styling is typically European, sleek and modern to match a variety of installations without looking out of place. The front panel is reversible to allow mounting on a table top or under a car dashboard, or with the panel reversed to allow positioning above the operator, for instance in an HGV cab installation. This feature would also enable the set to be used in more unusual positions, for instance mounted onto the car's central column next to the front seat. A front panel mounted speaker is fitted to improve readability over the more usual lid-mounted speakers one often finds nowadays.

The front panel sports a large multi-function LCD, as well as giving a frequency indication. A novel feature of the set is the direct readout of all repeater and simplex channels in the more sensible form of 'R6' or 'S20' in place of the frequency, a single button switching between the two. In Channel mode, the required −600kHz repeater shift is automatically programmed for you as soon as you switch to a repeater channel, a one-touch reverse repeater facility also being available. UP/Down buttons on the facia and the fist mic allow frequency or channel change. When pressed in transmit mode these provide a manual 1750Hz tone for repeater access. An 'intelligent' auto-toneburst is also provided, where a short 1750Hz tone is given on repeater channels only if no carrier has been present on the channel for at least a few seconds.

To cater for European use, repeater channels R8 and R9 may be user-programmed for selection in addition to S8 and S9, and the extra French repeater channels of FR8b, FR9b, and FR10-14 may also be user-programmed for selection. Two digital VFOs are provided, a single button switching between the two, so that one may be left on S20 while the other is left on your local repeater or net channel. The AMR1000 always comes up on 145.500MHz (the calling channel) on switch-on, providing a starting reference for tuning on the move.

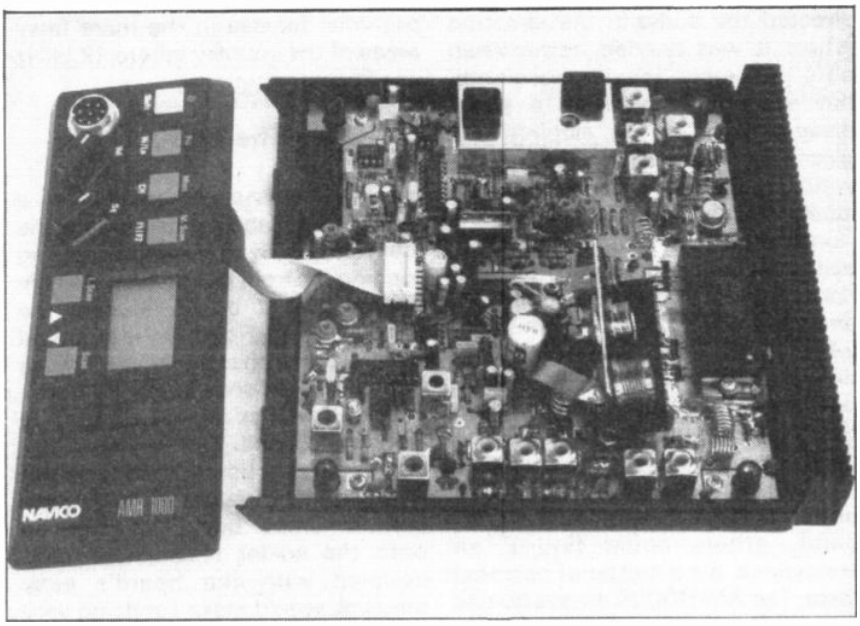
Beneath the frequency/channel readout on the LCD is a digital S-meter, showing 1-9 together with 9+20 and 9+40 to give an indication

of the received signal level. Adjacent to this is shown the selected transmit power level of 5W or 25W, TX or RX mode, and which digital VFO (F1/F2) is in use. A front panel mounted button switches the LCD backlight illumination on and off for night time use.

AMR1000S

In addition to the above features, the AMR1000S offers a more sophisticated variety of programmable options. As well as the direct readout of simplex and repeater channels, ten memory channels are also provided for local natter net use and the like. All memory or VFO simplex/repeater channels may be scanned for activity if required, and with suitable pre-programming the scan may search for an empty channel. A complete band scan may be initiated, in which up to 50 user programmed frequencies may be inhibited from selection to prevent the set locking up on beacon frequencies and so on. Alternatively, a limited band scan may be selected, searching between the two frequencies entered into the two digital VFOs (F1 and F2). A priority scan mode allows brief sampling of a pre-programmed channel while operating on another frequency, the scan locking onto the priority channel when active. The priority scan may also be used in conjunction with other scan modes if you like the hectic life!

The scan rate may be pre-programmed to between 10 channels per second and 1 channel every two seconds, and the scan 'hold' time between 4 seconds and 20 seconds before scan resume, or the scan may be set to hold until the received signal disappears. The auto toneburst length may be set to between 100ms and 1 second, and the time delay before auto-toneburst initiation to between 4 seconds and 20 seconds. Alternatively this facility may be inhibited. Other programmable features are in the level of LCD illumination and speaker audio muting for quiet use with data communication. In the AMR1000S, and EEPROM (electrically erasible programmable read only memory) is used to memorise the user-programmed features of the set, such as frequency, memory channels etc., so that when powered up it always retains the programmed settings. There is, as a result, no need to start changing lithium backup batteries in years to come.



Accessories

Each set comes supplied with a tiltable mounting bracket, plug-in fist mic and holder, fused DC power lead and a well presented A5 size operating instruction booklet. Optional extras are a mains power supply, DC-DC switched mode power supply (for 24V HGV use for example), internal and external extension loudspeakers, a telephone style handset, and a range of mobile and base station aerials. Navico have also promised a VOX-controlled hands-free microphone unit with some novel operating features in the near future.

On The Road

Shortly after its launch, I received an AMR1000 unit for evaluation, and a few weeks later following an invitation to visit Navico's factory I drove away with the AMR1000S model. A good deal of operation using both rigs was possible although this was mainly done with the AMR1000S due to the extra features.

Using the set while driving was simplicity itself. I rarely needed to take my eyes off the road. The microphone mounted up/down buttons were very easy to use for frequency change, the moulded volume and squelch knobs similarly were easily located by feel. Mounted above the centre of my dashboard, the set required just a quick glance to check exactly where on 2m I had ended up on when tuning or scanning. In the May HRT article *Mobile Radio Safety* I stated that an ideal synthesised 2m FM rig would have "a two digit readout of channel number, automatic repeater shift on repeater channels, and one-touch reverse repeater operation". Looking at the Navico rigs, what more can I say!

In QSO, reports of my transmitted audio were very good, with plenty of punch and little distortion, although one or two stations reported a slightly toppy response. I appreciated the "intelligent" auto toneburst. Even though I enthuse about mic-mounted tone buttons, which the Navico rig has, this type of toneburst makes operation more fumble free, especially if you prefer to use one of the many types of replacement boom or neck-slung microphones which don't come with a tone button.

On receive I found the set extremely sensitive; for example when driving around my local area I could hear distant repeaters with ease. There was enough audio from the internal speaker for use in a family type saloon car, but drivers of more noisy vehicles would undoubtedly find an extension speaker beneficial. The sloping front panel certainly

directed the audio in the direction where it was needed, rather than onto the carpet as with many sets, but at first I found it a slight disadvantage as the sloping LCD glass reflected daylight from my car window. Shifting the rig's position cured this. At night I found the LCD illumination just enough for readability without distraction; however, none of the controls were illuminated and I often had to try to remember which button performed which function. Because the AMR1000 always powers up on 145.500MHz, I found that by quickly switching off and then back on again I was always placed on the calling channel. This could be of use to some amateurs as a tuning point, others could find it an annoyance. It's a matter of personal taste. The AMR1000S always comes up on whichever frequency you have decided it should power up on.

I often used the set on long journeys having similarly long periods of QSO (I'm a natural woffler, sometimes I never stop!), and even though the set's rear heatsink became quite warm I found no problems of transmit power slumping or frequency shift. The receiver squelch was very sensitive, allowing very weak signals to stop the rig scanning if required. I found the digital S-meter of limited use, for two reasons: firstly, rather more than a quick glance is required to check the receive strength, in a similar manner to the difference between using a digital and analogue multimeter. I feel a bargraph display would have been better. Secondly, most received signals indicated at least S9, hence there was little difference in readout most of the time, although this was mainly due to the generally good signal levels I received in normal use.

At home, I powered the set up from a stabilised mains PSU and coupled various external aerials up to check how the set performed in a radio hostile environment. Using the rig in close proximity with my 2m packet radio station, which was automatically transmitting away merrily at the bottom of the band, showed the set to be very good indeed at strong signal tolerance. Similarly, tuning 12.5kHz off strong local signals gave an excellent rejection, with even the modulation sidebands of the other stations well down in level, showing the set has potential for use in the more busy areas of the country where 12.5kHz use is commonplace.

Inside The Box

The set is constructed from a sturdy two-piece die-casting for the main chassis, with a plastic moulding forming the front panel. A large single printed circuit board housing the analogue and RF circuitry is mounted directly to the chassis, smaller boards housing the control and interconnection facilities being fitted to the front panel itself.

The main board uses discreet components throughout, each component number being silk screened onto the solder resist. This fact, coupled with the board's easy removal, would make servicing very easy indeed, a stark contast to many other sets on the market. Adjustments such as TX high and low power level, and the deviation control, are also clearly identified enabling easy location by the user.

The receiver uses a pair of bandpass tuned circuits feeding a dual gate MOSFET front end amplifier, three further bandpass circuits follow to feed a single gate FET mixer. The resultant first IF of 21.4MHz is filtered by a pair of monolithic dual crystal filters, and a standard IF subsystem IC takes care of the second mixer, IF amplification at 455kHz and demodulation, a multi-pole ceramic filter providing a degree of further selectivity here.

On transmit, the VCO is directly modulated at final frequency, buffered and amplified before being applied to a block PA module to achieve the 25W RF power level. A multi-section low pass filter provides harmonic suppression, a PIN diode switching network giving TX/RX aerial changeover. A single-chip synthesiser and separate ECL prescalar provide control of the VCO in 12.5kHz steps, this being serially programmed by the microprocessor controller mounted on the front panel section.

Laboratory Tests

The receiver sensitivity, as found on air, was very good; the intermodulation rejection (ie rejection of off-channel mixing products from strong stations) was likewise quite good, especially in view of the sensitivity. However what certainly made me check my signal generator settings was the outstanding 12.5kHz adjacent channel rejection. This excellent result should allow you to operate quite happily using the in-between 12.5kHz channels in the presence of strong stations on either adjacent channel. The blocking performance of out-of-band signals was similarly excellent, which will soon be very important as government users have already started to occupy frequencies on either side of our already overcrowded 2m band. The S-meter dynamic range was far better than most FM rigs, but most of this occurred at weak signal levels, again confirming the air test results.

The transmitter was very clean indeed in terms of its harmonic output, the power output was well regulated above 13.8V, and gave only a slight reduction on high power with reduced supply voltages. The deviation was accurately set at just below the 5kHz absolute maximum level.

Conclusions

A British made 2m transceiver to be launched on to the market *must* be good to be able to compete with the numerous foreign-made offerings available. I'm very happy to say that in my opinion the Navico rig meets this goal. The manufacturers have certainly done their homework well. Not only does it out-perform its competition on technical grounds but it offers many very useful operating features not found on other rigs, and sells at what appears to be a very competitive price. I found this set one of the easiest to use on the move, enabling me to keep my eyes on the road rather than having to look at what the rig was doing.

It is not a micro-miniature unit, neither does it have flashing LEDs galore. If this is important to you, you may be disappointed. It does however have smooth styling with controls that do not need tiny fingers to operate. Whether the AMR1000 or the AMR1000S would suit you best is purely a personal choice; many users certainly don't want their set zooming off frequency automatically while others who travel around different areas appreciate these extra facilities to search out people to talk to.

Laboratory Results (AMR1000S)

Receiver

Sensitivity: Input level required to give 12dB SINAD
0.124uV pd

Maximum audio ouput: Measured at 1kHz on the onset of clipping	
3ohm load	1.47W RMS
8ohm load	1.08W RMS
15ohm load	850mW RMS

Squelch Sensitivity
Threshold 0.068uV pd (3.5dB SINAD)
Maximum 0.135uV pd (,20dB SINAD)

Image rejection: Increase in level of signal at first IF image frequency over level of on-channel signal to give identical 12dB SINAD signals.
91.5dB

Adjacent channel selectivity: Measured as increase in level of interfering signal, modulated with 400Hz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal.	
+12.5kHz	67.0dB
−12.5kHz	65.5dB
+25kHz	81.0dB
−25kHz	79.5dB

S-Meter Linearity		
Indication	**Sig. Level**	**Rel. Level**
S1	0.054uV pd	−12.0dB
S2	0.057uV pd	−11.5dB
S3	0.072uV pd	−9.5dB
S4	0.101uV pd	−6.5dB
S5	0.112uV pd	−5.6dB
S6	0.142uV pd	−3.6dB
S7	0.173uV pd	−1.8dB
S8	0.180uV pd	−1.5dB
S9	0.214uV pd	0dB ref
S9+20dB	0.617uV pd	+9.2dB
S9+40dB	2.490uV pd	+21.3dB

Blocking: Increased over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal.	
+100kHz	95.4dB
−100kHz	96.0dB
+1MHz	104.0dB
−1MHz	102.5dB
+10MHz	>115dB
−10MHz	>115dB

TX Power and Current Consumption			
Freq MHz Power	**10.8V Supply**	**13.8V Supply**	**15.6V Supply**
144MHz High	21.8W/5.80A	26.2W/5.95A	27.1E/5.96A
Low	5.10W/2.50A	5.25W/2.58A	5.20W/2.55A
145MHz High	21.9W/4.75A	25.1W/5.70A	25.2W/5.65A
Low	4.65W/2.45A	5.00W/2.55A	5.00W/2.51A
146MHz High	20.8W/4.85A	23.5W/5.60A	23.6W/5.50A
Low	4.45W/2.40A	4.60W/2.45A	4.55W/2.45A

Intermodulation rejection: Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd ordinary intermodulation product.	
25/50kHz spacing	73.5dB
50/100kHz spacing	73.5dB

Harmonics/Spurii	
2nd Harmonic	−81dBc
3rd Harmonic	−87dBc
4th Harmonic	<−90dBc
5th Harmonic	−88dBc
6th Harmonic	−89dBc
7th Harmonic	<−90dBc
Spurii	<−90dBc

Peak Deviation
4.79kHz

Toneburst Deviation
2.81kHz