

The MAGIC! - NES10-2 Noise Eliminating Speaker



By Jim Scholz VK4YHN

A few weeks ago I was asked by the Editor if I would evaluate and review a New Noise eliminating speaker (DSP technology) which had just arrived from BHI Engineering in the UK. Yes, why not I thought. Probably another 'gadget', but noise reduction and DSP (digital signal processing) is something that interests me so I was keen to have a look at it and put it through its paces. There are a plethora of gadgets that are 'supposed' to improve radio communications. Some don't work at all and some have (I think) a "Placebo Effect" on the station operator. An effect somewhat enhanced by the need to justify the money spent. (...to the resident environmental engineer-accountant no doubt! -ed) Others do work, particularly when it comes to DSP. Then again I have seen (or is that heard) some pretty lame DSP processors. Which would this be?

I have tried out or at least had the opportunity to listen to three other similar systems, so I am confident I can give you an objective report.

To begin, I should spend a moment explaining what a "DSP" is. A Digital Signal Processing (DSP) is a powerful and complex method of analysing and modifying analogue signals.

Audio signals like speech or radio relayed data are usually analogue signals. Sure they were digital before transmission and will be again when demodulated, but in radio systems they're analogue.

Speech and data signals have fairly well known and predictable but nevertheless complex characteristics. DSP systems convert the analogue signal to a digital signal. Using specialised hardware and software the characteristics of the signal is analysed and the noise content identified.

The digital signal processor can then modify the digital signal to enhance desired characteristics and to remove undesirable characteristics such as noise.

The processed signal is converted back to an analogue signal and sent on to a speaker, headphone, or data controller. There are a number of proprietary systems that do this. The NES10-2 is one of them.

TIME TO PLAY!

The box with the NES10-2 arrived. Not much to excite me yet—a small black speaker box measuring 110 x 65 x 55 mm.

Not particularly heavy (200g) but enough weight to give a solid feel and indicate immediately that there is something more than an extension speaker here.

A small but informative manual accompanied the NES10-2. At first glance I saw I could be read in a few minutes—which probably accounts for why I read it straight away.

Two DC leads were supplied, one as a pair of plain wire and one made up for what is now called the DC accessory plug in a car (formerly known as a cigarette lighter plug). The DC input can be from 12-28 Volts DC.

Connecting the speaker could not be easier. I plugged the 3.5 mm plug from the NES10-2 to the speaker output on the back of my FT900 HF all mode transceiver.

I connected the plain DC lead to the auxiliary DC output—also on the back of the transceiver. Of course any other DC source would do, and that's it. So Simple!

The manual suggested setting the audio level of the transceiver to 'normal' as you would in everyday use.

There is a switch on the top of the speaker which turns Noise Cancellation ON and OFF and a volume preset control on the speaker. I set this to about one third of its range.

There are four dip switches on the back of the unit used to set the level of processing. There are eight different noise cancellation level settings. The factory default is 6. I left it there to begin with.

Turning the transceiver on with the Noise Cancellation OFF I tuned to 7070kHz LSB.

The 'normal' noises could be heard for this band. Crackling, some frying (probably from power lines), impulse noise and a weak signal from a VK3 station could be heard.

HERE WE GO.

I threw the switch for Noise Cancellation to ON. For a split second no change. Within about 0.5 seconds the receiver noise quickly subsided to a very low level indeed. The weak VK3 signal appeared to come up out of the noise. To my delight the noise had fallen well down.

The crackling and frying all but disappeared completely. Astonishingly, listening to my HF receiver was almost like listening to a FM receiver with a mute. All of this without any user adjustment yet.

Now my wife (Rosemary) and I share different areas in the same 'detached family recreation facility' (shed). I have the station not far from where Rosemary participates in her hobby.

Rosemary came wandering in and by this time I had switched noise cancellation OFF. I said "listen to this" while nudging the volume up a bit too. She said, "Oh Jim I can't be bothered listening to that racket".

With a grin I said "Now listen" and I threw the switch to ON for Noise Cancellation. Presto, the signals became clear and there was next to no noise. Rosemary gave a smile which indicated 'approval' I gave a grin for totally different reasons.

Using a number of receivers and transceivers I tested the speaker out on many bands and modes. It is difficult to report on "noise reduction" in a 'measured' way. BHI Instrumentation claims a noise reduction of 20 dB.

Looking at the output of the speaker on an oscilloscope and comparing noises amplitudes with and without noise cancellation I have to concur that these claims appear to be correct.

However noise cancellation is one thing. Improved readability in communications is the objective and there is no quantitative test for this.

The time honoured method is totally subjective. You have to listen, make comparisons and from these, form an opinion.

With this in mind I did a large number of tests with various modes and signals strengths, with and without noise cancellation.

THE RESULTS

I have used the following rating system. B(number) indicates the 'Before readability' rating, that is with the NES10-2 switched OFF and A(number) for the 'After readability' rating. A '1' would indicate an unreadable signal and a '10' no noise.

The following modes were tested with the same results unless otherwise noted, SSB, AM, FM, FAX, CW, PSK31, RTTY, SHORWAVE BC, AM BC. Various bands were used across HF as well as VHF (2 metres). See Table 1 - below.

These are remarkable results. The processor has the most difficult time when the signal and noise are very low level. This is to be expected. Low level modulation with weak signal and noise is the most demanding test. Even so, appreciable improvement in noise reception was noticed. With stronger signals and better levels of modulation the noise reduction is in the order of 20dB.

The noise reduction is less (as would be expected) on wider bandwidth signals amplitude modulated signals such as double sideband (AM). Though FM is wider bandwidth and the processor works extremely well.

There was only one problem I found in the speaker that I had to review. The speaker produced a slight rattle at very high volume levels, higher than one would normally accept.

I suspected that this was mechanical and most likely the speaker grill. The volume level required to do this is verging on the maximum limits of the 2.5 Watt speaker. The rattle is not electronic.

The unit has a socket, provided for headphones, which bypasses the internal speaker while still allowing noise cancellation. When I did this the rattle at high audio output stopped.

(On reporting this to the manufacturer, BHI, we were assured that the rattle had only been reported twice with 600+ units in service. Were we unlucky, or was our testing procedure a little torturous? BHI agreed to look at our report which is appropriate QA procedure.

Thanks BHI! -ed)

HOW IT WORKS

The noise cancelling system operates in the frequency domain. The pass-band of the DSP technology is subdivided into sub-bands.

The system then works out whether the signal has speech or noise characteristics in the sub-band.

If the signal has noise characteristics, the noise portion is removed from this sub-band, depending on filter levels. If no noise is present the speech remains unchanged.

A technique called "spectral diffusion" is used to avoid the phenomenon of "musical tones" that you can find with many other DSP technologies for most filter settings.

There is almost no distortion of speech signals, even for very low signal-to-noise ratios of 0 dB and below.

The technology is self-adapting to changing noise environments. There is no training of the noise filter required. The user can adjust the level of noise suppression to their own needs. It does not change the characteristics of the noise, that is, residual noise still sounds natural.

CONCLUSIONS

Put simply I think the NES10-2 is the best noise reduction system I have seen. Those people who I demonstrated the unit to said the same. Over the 3 week evaluation period I demonstrated the unit to several radio users.

I even took the unit sea on a yacht using HF and VHF marine. If I was a distributor of these units I think I could have sold a half dozen without trying. Every radio user that heard the before and after test said "I must have one of them".

The NES10-2 is a very worthwhile addition to any station for the following reasons:-

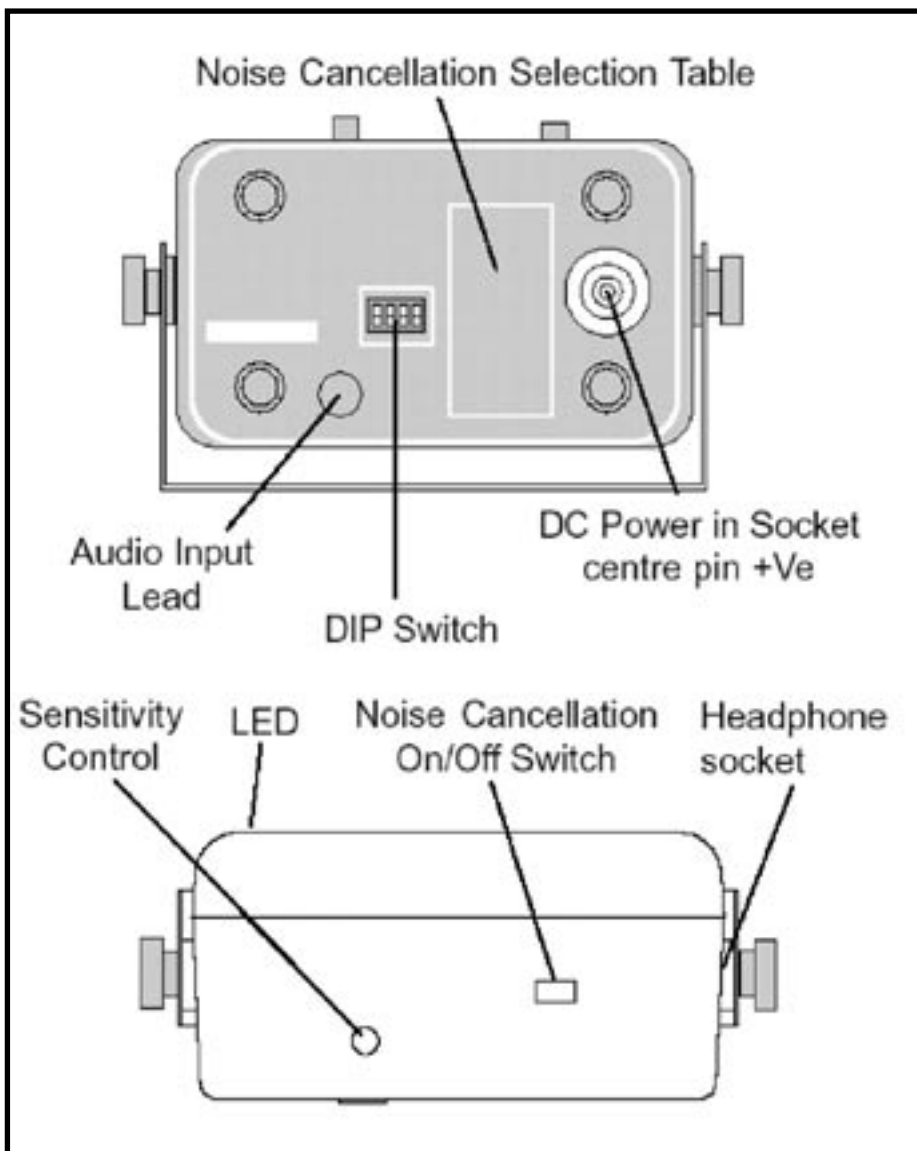
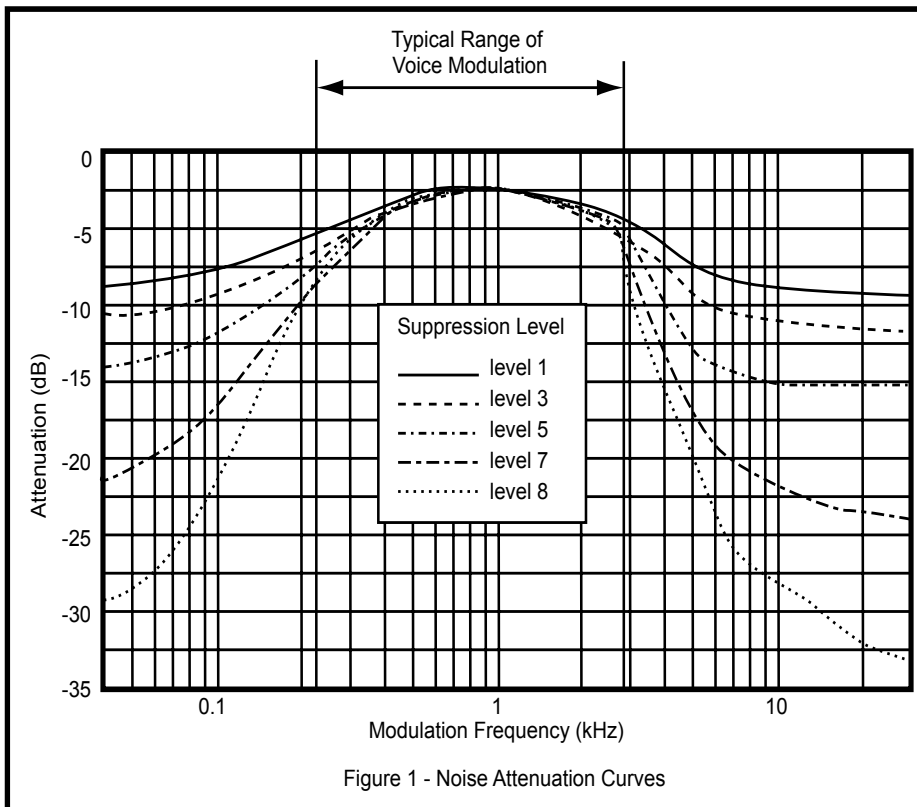
It made my station receivers sound like top of the line receivers with DSP. In fact I had some visitors over who have DSP receivers and they were astonished and perhaps slightly miffed at the performance on my "older" receivers.

No equipment modifications are necessary. I was able to listen in comfort with less 'stress' and communicate more effectively even in unfavourable conditions.

Table 1 - Subjective Comparison

On strong signals with no noise the speaker has no effect on readability.	B10/A10
Lightning crashes with strong signal (S9) -	B4/A9
Power line buzz with strong signal (S9) -	B3/A9
Strong signal (S9)- low level modulation. -	B1/A6
Moderate Signal (S5) - power line noise -	B3/A8
Weak Signal (S2) - Various noise -	B2/A8
Moderate Signal (S5) with ignition (impulse noise)	B3/A8.5





The speaker adds DSP functionality to all of my existing receivers. If I did purchase a new transceiver with DSP on its receiver, then only that receiver would benefit.

With the NES10-2 I can use it on all of my receivers where I want noise reduction. I usually have HF running and it is here that my wife, who is nearly always in earshot station. is a lot happier.

Received HF signals behave in a similar manner to a muted FM receiver in the presence of no signal. ie it sounds like you have squelch control on your old HF transceiver.

This unit will very much improve your receiver's abilities to pull out signals from noise, improving readability, and also making for a more pleasant radio experience.

It is worth mentioning that BHI also have an "inline module" version (NEIM1031) using the same technology.

Also, since the NES10-2 can be used on so many receivers at the one station a 1041 switch box is planned to be released shortly as an accessory.

If you really want to experience the sound of the NES10-2 when switched in and out of a receivers audio out then visit the magazines website at:-

<http://www.radiomag.com.au>

Have a look in the download section for the demonstration audio files and have listen for yourself.

The NES10-2 is sold in Australia by **Andrews Communications.**

Call Lee 02-9636-9060 or visit them at Shop 8, 41-51 Bathurst St, Greystaines, NSW.

Radio and Communications Magazine thanks BHI Instrumentation for the supply NES10-2 review.

NOW the GOOD NEWS
(for those that read this far)
Subscription Competition

The speaker used for the test came from England, donated to us by BHI Instrumentation - Recommended Retail Price - Great value @ \$325.

Now I know you'll think we're silly not to pocket it and run, but the truth is, it might only start a punch up between us! Well a tizzy anyway - and we're getting too old for all that excitement.

To stake your claim - you will need to subscribe, or increase you subscription by at least 6 issues, between February 23rd and April 30th 2003.

All subscribers will go in for the drawer to be drawn in public, by a non-staff member, at a general meeting of one of the local Radio Clubs. Just so you know it's on the up and up. The winner will be notified and if possible the speaker presented before publication.