A Nearly Predictable Broad Band Noise Source
by
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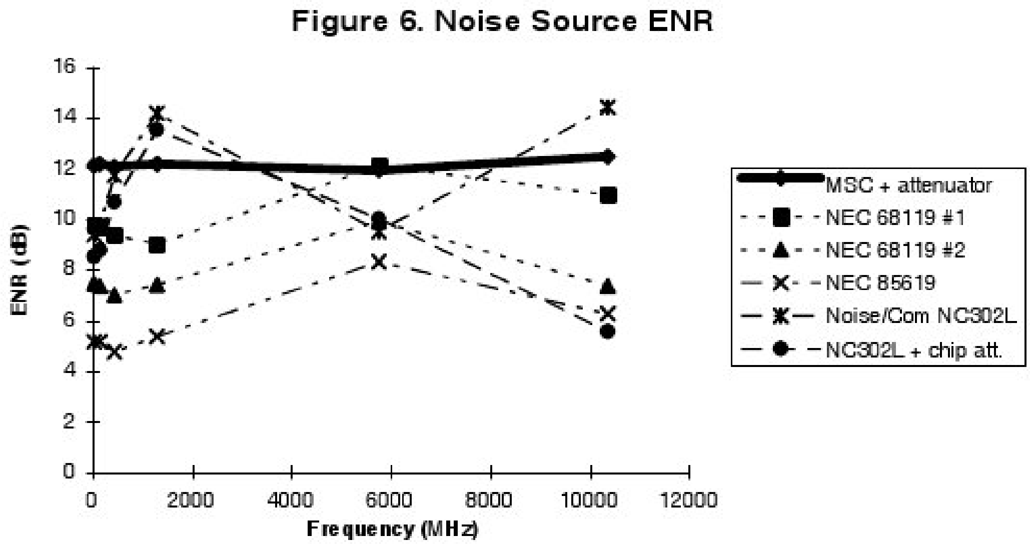
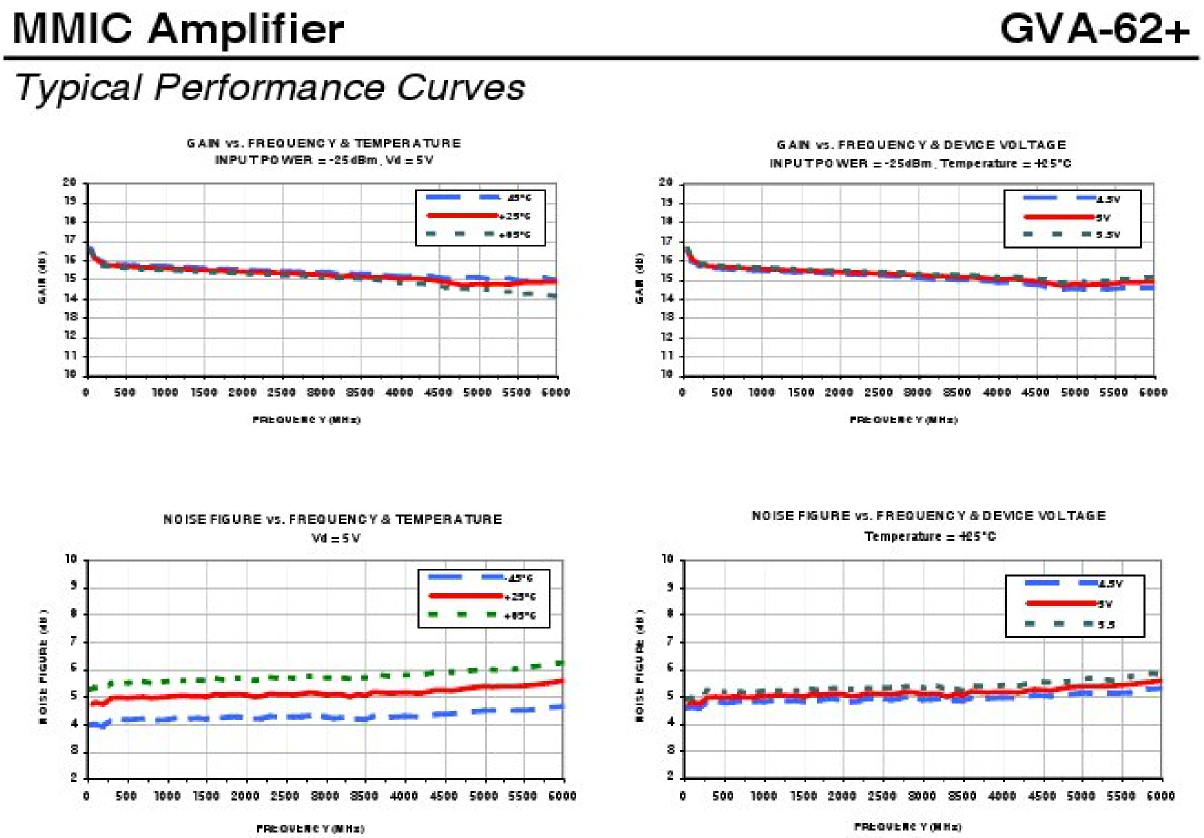
The latest generations of MMICs can be our next noise source for receiver testing. And can be way more predictable than the home built diode noise source. Not as good as a secondary NIST source or a VHF vacuum diode source, but not horrible either.



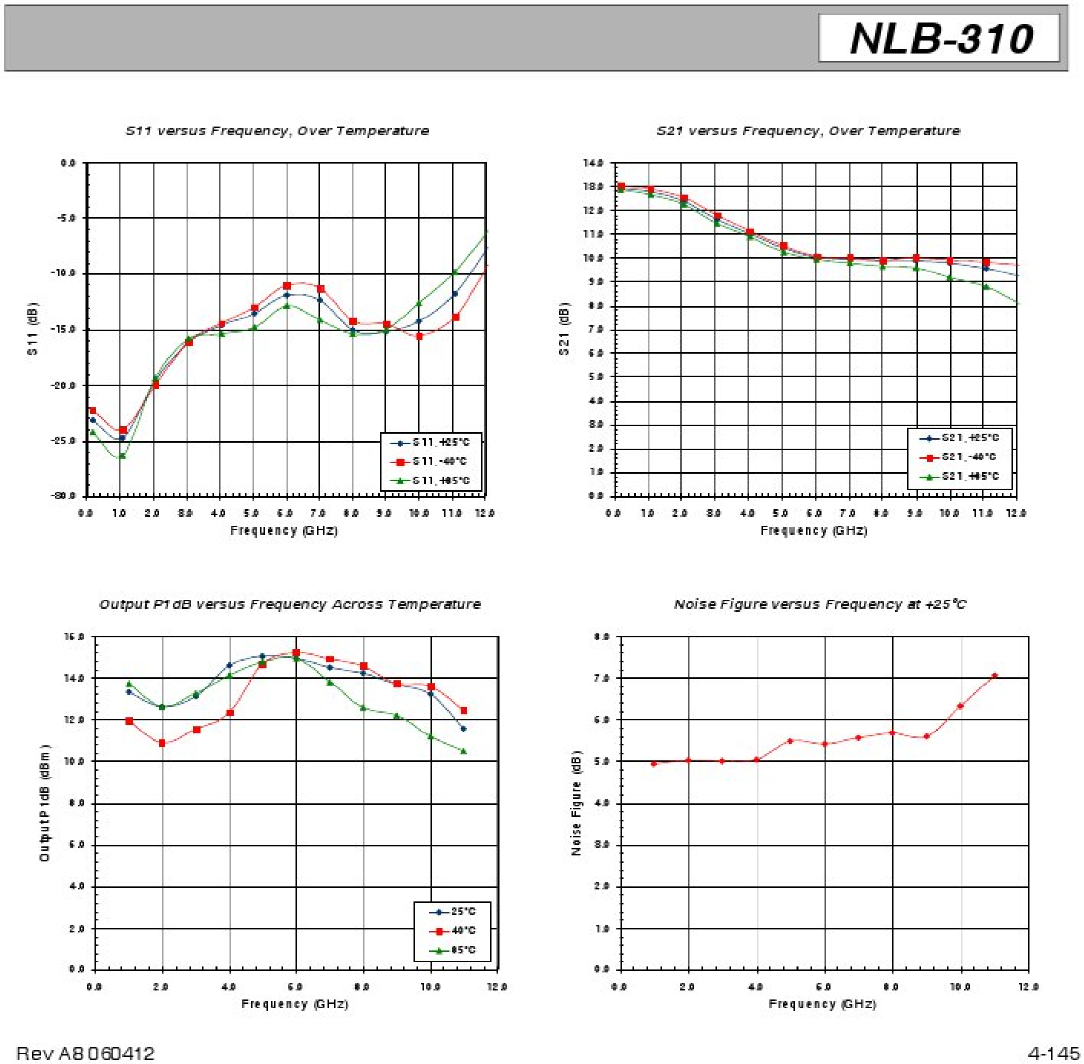
W1GHZ noise diode results from QEX 1999. http://www.w1ghz.org/noise/noise99.pdf

Looking at the data sheet for a MiniCircuits GVA-62 plus the graphs show gain varies from 16 to 14.8 from DC to 8 GHZ while NF over that same frequency range varies (with some dependence on temperature and supply voltage) from 5 to 6 dB. It just so happens that the output noise of any amplifier is exactly the NF plus the gain (when expressed in dB). So the output of the GVA-62 varies from 21 to 20.8 dB above a resistor at ambient with the input terminated in a 50 ohm resistor. The output (powered) return loss is decent also. With that much noise at least a 15 dB attenuator is appropriate for measuring noise of modern preamps, and that's enough to stabilize the output impedance for the two cases of power on and power off.



For the individual device, probably most easily mounted on half a DEMI dual ERA PC board, should have connectors for in and out so when used as a noise source it can have a good termination, while with the termination removed its not difficult to measure the actual gain and with occasional access to a calibrated noise source, the input NF and gain at frequencies of interest.

The NLB-310 is also appropriate (and rated for operation past 10 GHz) though the gain varies more. It might be that the LF gain (below 6 GHz) can be rolled off with a 50 ohm series resistor in the output trace, providing the capacitance can be kept down to about 1 pf shunting that resistor. That's difficult with most surface mount resistors, no matter the size. It may be necessary to use several resistors in series without mounting pads, e.g. with the intermediate junctions in space. It might take three or four resistor, I've not worked that out or tested the gain leveling. The NLB-310 may fit the DEMI board better than the GVA-62+.



Either will require a resistor for the output bias feed or else a bias tee coil (conical coil with powdered iron core).

Strictly speaking, the noise power at the amplifier output is the sum of the amplifier's added noise and the termination thermal noise increased by the amplifier gain.

$$P = G\,(nf + 1)kTB$$

where

G is numerical gain,

nf is noise factor

k is Boltzman's constant

T is absolute temperature Kelvin

B is bandwidth

or output enr(dB) = 10 log (G (nf + 1))

73, Jerry, K0CQ