Product review: RF-Links 2 Watt Broadband Linear Power Amplifier

Intro

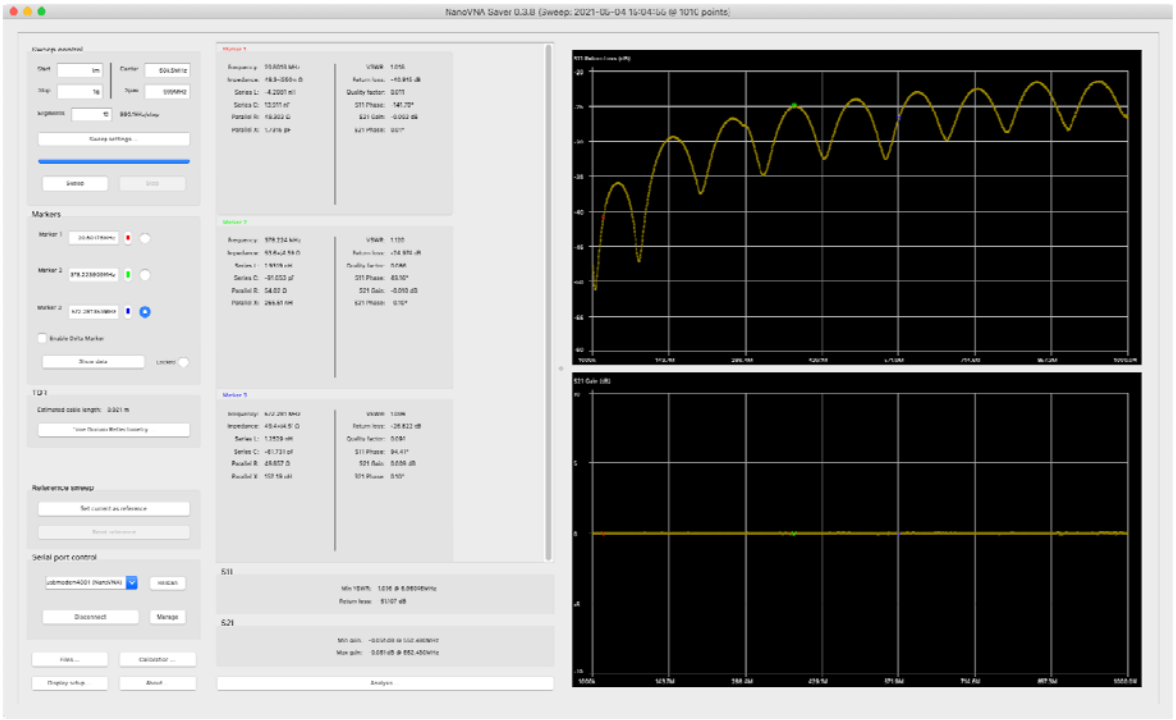
I'll admit - when I had first learned of RF-LINKS, I was sceptical. The website didn't use any modern JavaScript or other fancy frameworks. I thought: "Yes! Score!" to myself. I knew that this was probably a company that was focussed more on engineering than marketing, or at least began to hope. While that might be off putting to some, for those like me, this is a Good Sign. This hunch was confirmed, after reaching out by calling the company's sales line. I was quickly put in touch with Mark G., an Electrical Engineer with RF LINKS's testing facility. After a short introduction and discussion of what I was looking for, he suggested that he would, gratis, send an amplifier and antenna for my review. I was floored. Never had a generous offer like this from another vendor before for such a small sale interest. So, I thought to capture my experience and thoughts about RF LINKs subsequently. Oh, yes, the amp worked and provided clean gain as claimed -- with those details below.

How'd I find RF LINKS?

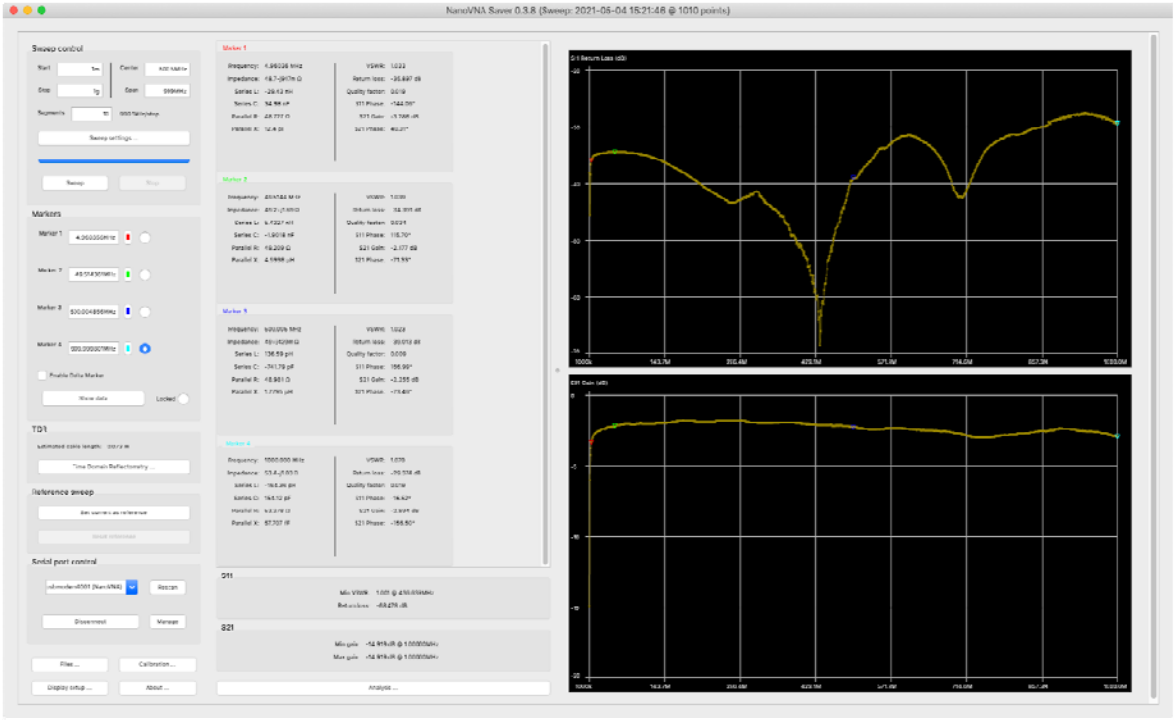
Like one finds many things in 2021, I turned to a few online broadcasting engineer forums, as well as some web searches. Interestingly, I didn't find RF LINKs directly through any of these means -- but through following a virtual trail of breadcrumbs mentioning lab and low-power broadcast hardware that experimentalists as well as low-power FM stations were using, or had used. It was on one of these deeply-linked forums that I finally saw a URL mentioning RF LINKS.

Typical price? Mostly they produce high quality equipment for Military use (USA Gov have been their customer for 25 years).

Where is it manufactured?
All made in the USA and in Canada. What's the origin of the parts inside? All USA original parts manufacturers: Qorvo, Analog, some Japanese, Toshiba, Mitsubishi.



Amplifier w/ 10 dB input atten + 30 dB output attenuation:



Average gain of four markers (5, 50, 500, 1000 Mhz) is -2.72675, and (after +40 dB attenuator compensation)

Estimated +37.27 dB of average gain provided by the amp, given our nominal 0 dBmw VNA output.

Self noise analysis: do we care?

Here's some interesting data using my VNA to explore input gain vs. output differences.

Parameters common to all measurements:

Fq start: 1 MHz
Fq end: 1000 MHz
990.1 KHz per VNA Fq step, 1010 points total over 999 MHz span
20 measurements per step averaging, 5 largest deviations from mean discarded
Amplifier output attenuator: -30 dB

First, we configure our VNA, and calibrate it w/ a through-cable & adapter set, which we will use throughout for all "device under test" (DUT) runs. Here's what we measure for the "through" cable & adapter set

RF amplifier model AMP-4754

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First, we configure our VNA, and calibrate it w/ a through-cable & adapter set, which we will use throughout for all "device under test" (DUT) runs. Here's what we measure for the "through" cable & adapter set:

Screen Shot 2021-05-04 at 3.05.01 PM.png>

Then we place the amp inline, with a 10 dB pad input, and 30 dB pad output, 0 dBmw ref still in place:

Screen Shot 2021-05-04 at 3.23.50 PM.png>

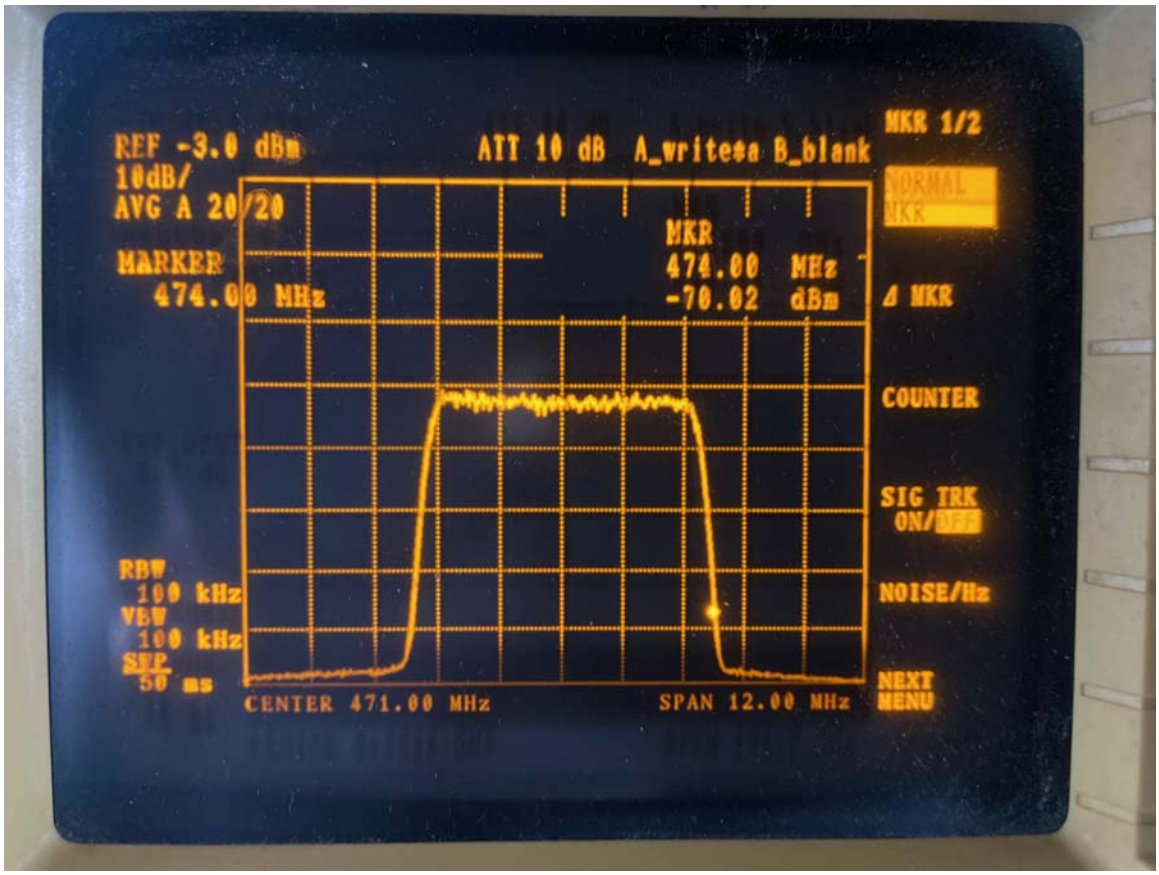
Pretty good gain fatness, no visible distortion products out of the unit polluting the VNA input, etc. Maybe the only interesting thing is the wildly variable input S11/return loss; this is somewhat interesting given the combination of attenuator & short adapters.

Average gain of four markers (5, 50, 500, 1000 Mhz) is -2.72675, and (after +40 dB attenuator compensation) suggests +37.27 dB of gain provided by the amp, given our nominal 0 dBmw VNA output. This seems like we're measuring 4 to 5 dB more gain than I expected, so perhaps you can remind me what the specs for this amp should be... heh.

More soon!

I began an initial quick check of antenna and amplifier function characteristics yesterday. Started looking at some QAM sources to get a feel for general input gain considerations, as well as network analyzer checks on input and output impedance characteristics. I made a few quick averaging measurements of a qam 64 constellation at p1db, which was found at an input power of about -16 dBmw total power, using a generic Dektec modulator source. Note even at that point we are seeing a nice ~34 dB rolloff at +3 mhz of channel center:

Anton K, RF Engineer
Micro systems


REF -3.0 dBm
10dB/
AVG A 20/20
MARKER
474.00 MHz
ATT 10 dB A_write#a B_blank
MKR
474.00 MHz
-70.02 dBm
MKR 1/2
NORMAL
MKR
Δ MKR
COUNTER
SIG TRK
ON/OFF
NOISE/Hz
NEXT
MENU
RBW
100 kHz
VBW
100 kHz
SWP
50 ms
CENTER 471.00 MHz
SPAN 12.00 MHz


FMMP1006


DVBC
1x
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3: off
4: off
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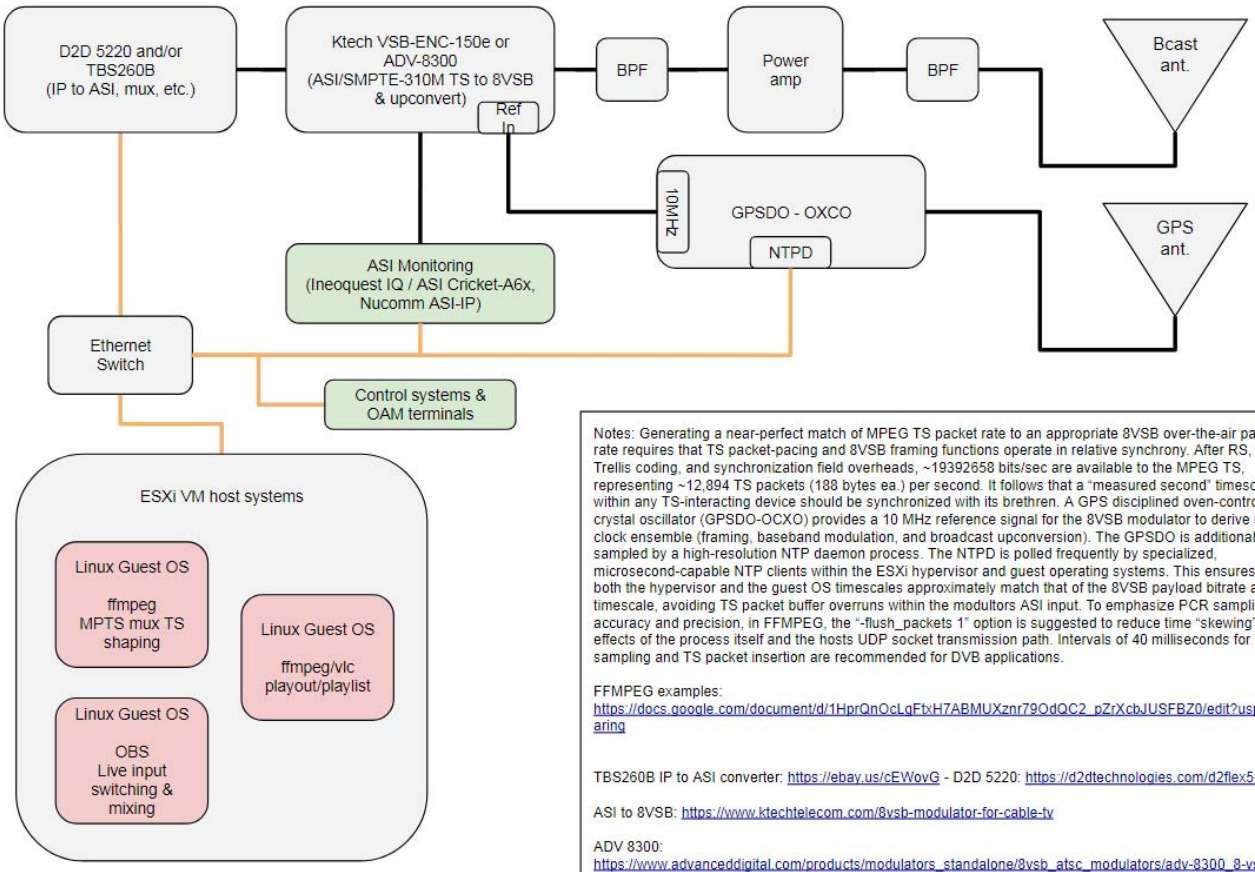

Notes: Generating a near-perfect match of MPEG TS packet rate to an appropriate 8VSB over-the-air payload rate requires that TS packet-pacing and 8VSB framing functions operate in relative synchrony. After RS, Trellis coding, and synchronization field overheads, ~19392658 bits/sec are available to the MPEG TS, representing ~12,894 TS packets (188 bytes ea.) per second. It follows that a "measured second" timescale within any TS-interacting device should be synchronized with its brethren. A GPS disciplined oven-controlled crystal oscillator (GPSDO-OCXO) provides a 10 MHz reference signal for the 8VSB modulator to derive its clock ensemble (framing, baseband modulation, and broadcast upconversion). The GPSDO is additionally sampled by a high-resolution NTP daemon process. The NTPD is polled frequently by specialized, microsecond-capable NTP clients within the ESXi hypervisor and guest operating systems. This ensures that both the hypervisor and the guest OS timescales approximately match that of the 8VSB payload bitrate and timescale, avoiding TS packet buffer overruns within the modultors ASI input. To emphasize PCR sampling accuracy and precision, in FFMPEG, the "-flush_packets 1" option is suggested to reduce time "skewing" effects of the process itself and the hosts UDP socket transmission path. Intervals of 40 milliseconds for PCR sampling and TS packet insertion are recommended for DVB applications.

FFMPEG examples:
https://docs.google.com/document/d/1HprQnOcLgFtxH7ABMUXznr79OdQC2_pZrXcbJUSFBZ0/edit?usp=sharing

TBS260B IP to ASI converter: https://ebay.us/cEWovG - D2D 5220: https://d2dtechnologies.com/d2flex5220/

ASI to 8VSB: https://www.ktechtelecom.com/8vsb-modulator-for-cable-tv

ADV 8300:
https://www.advanceddigital.com/products/modulators_standalone/8vsb_atsc_modulators/adv-8300_8-vsb_atsc_modulator/