L-band LNA-1535 from Wilmanco

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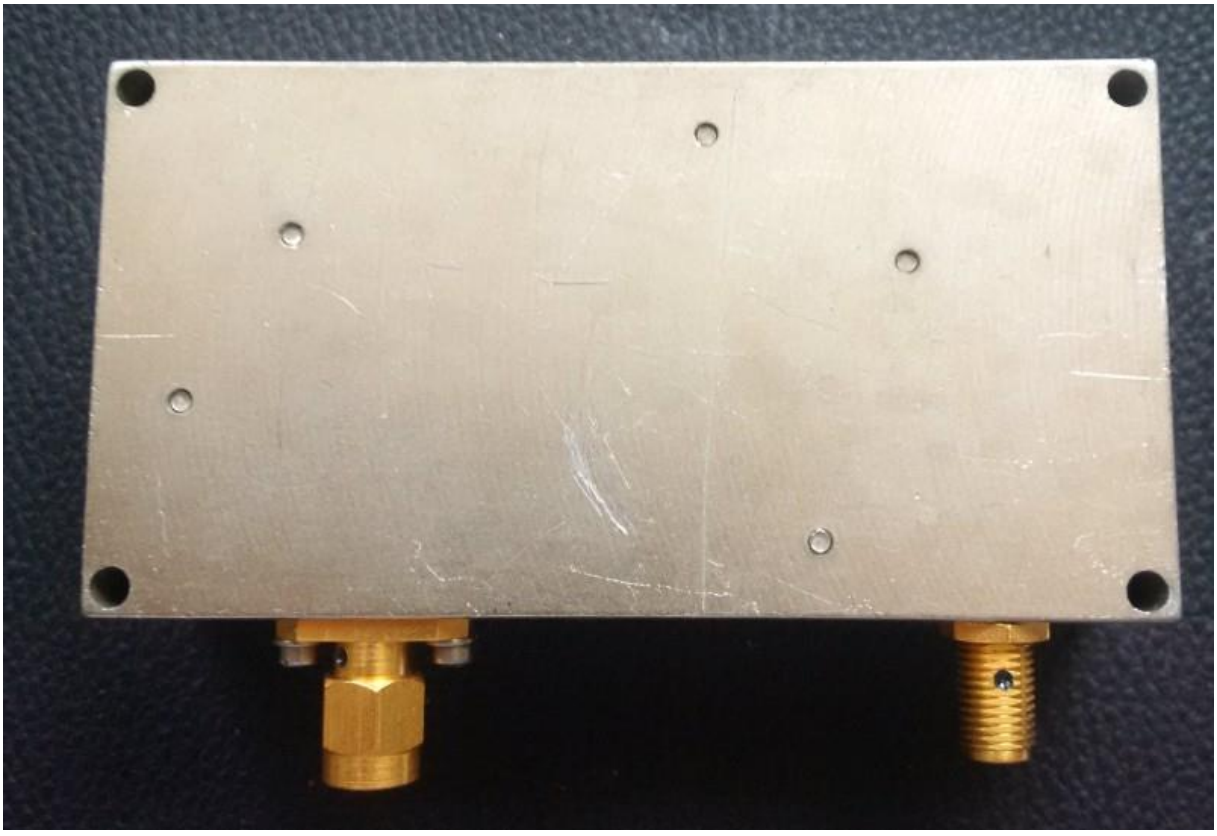
Hello,

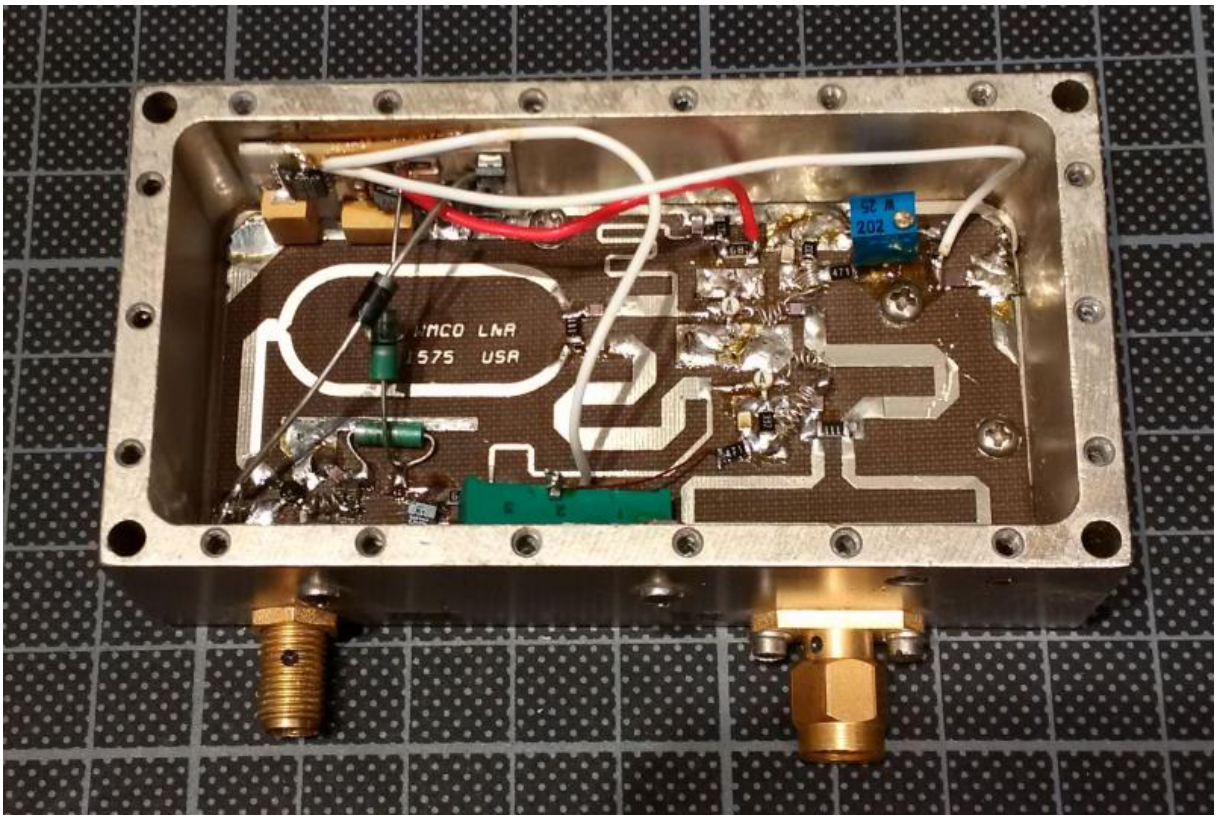
Recently I acquired a surplus amplifier marked with Wilmanco LNA1535.

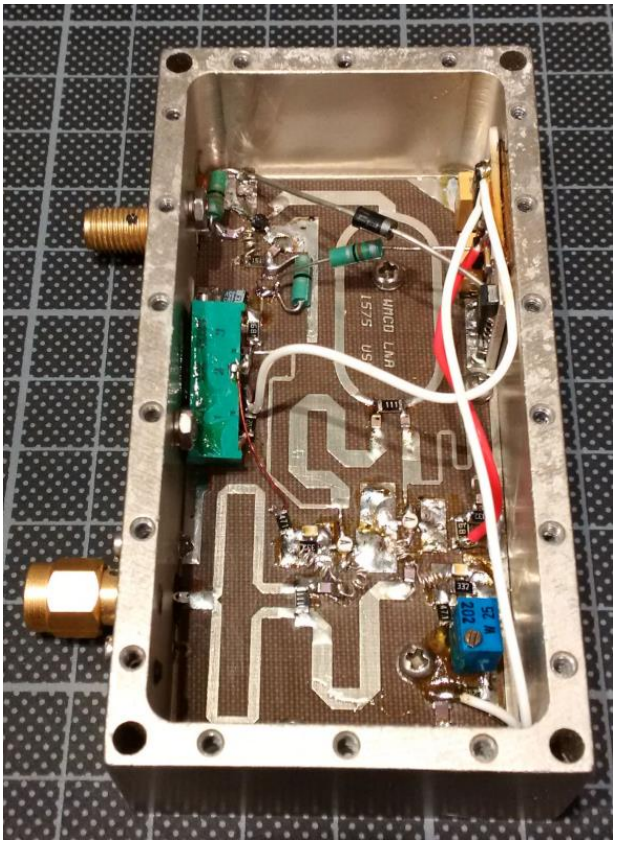
The amplifier is house in a milled aluminium encasing with a SMA-plug for the RF-input and a SMA-jack for the RF-output. The DC power is also supplied via the RF-output port (phantom feed).

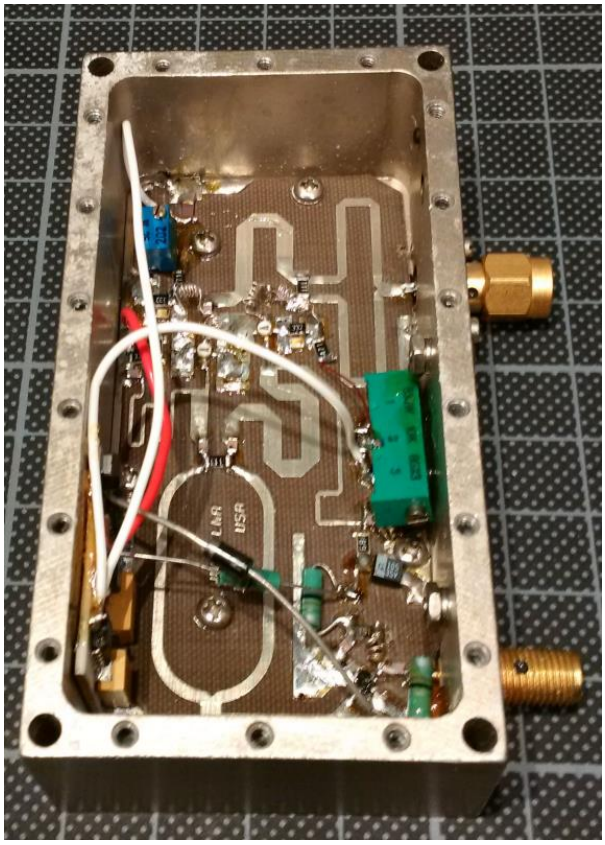
Here are some pictures of the amplifier:

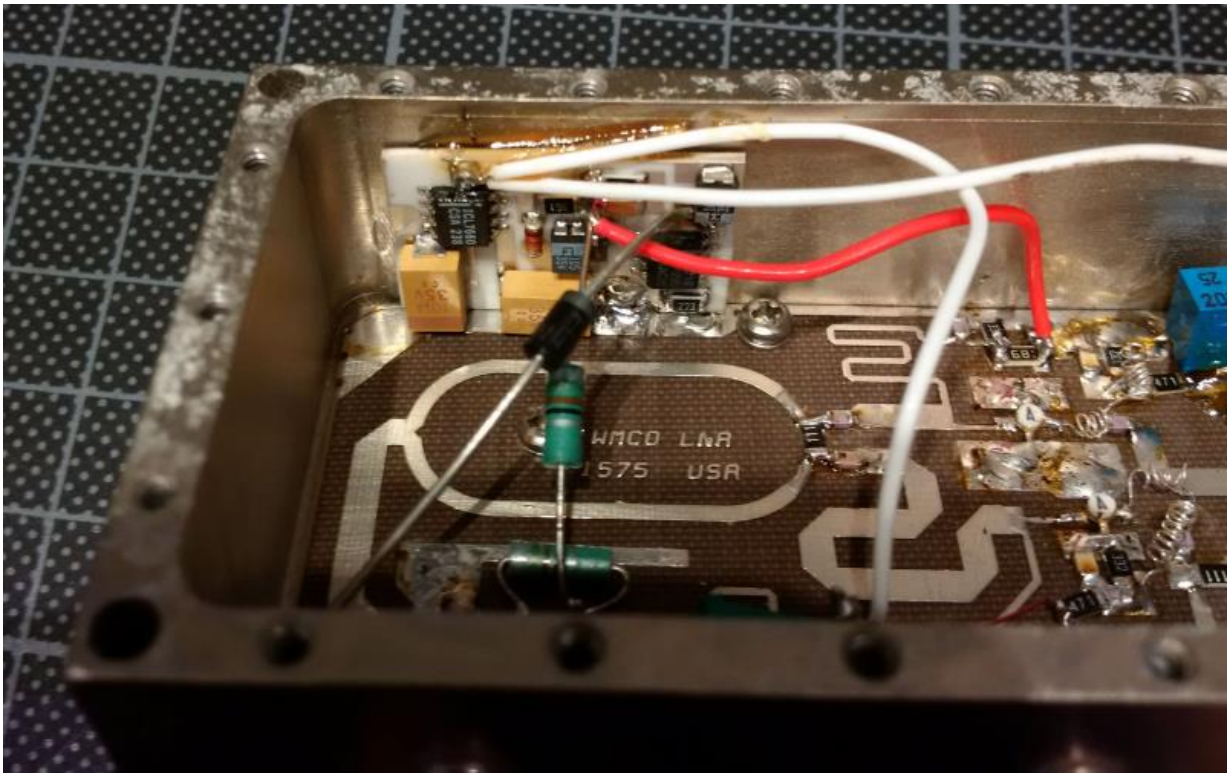


As I was not sure about the biasing I opened the amplifier. Here are some pictures of the inside:



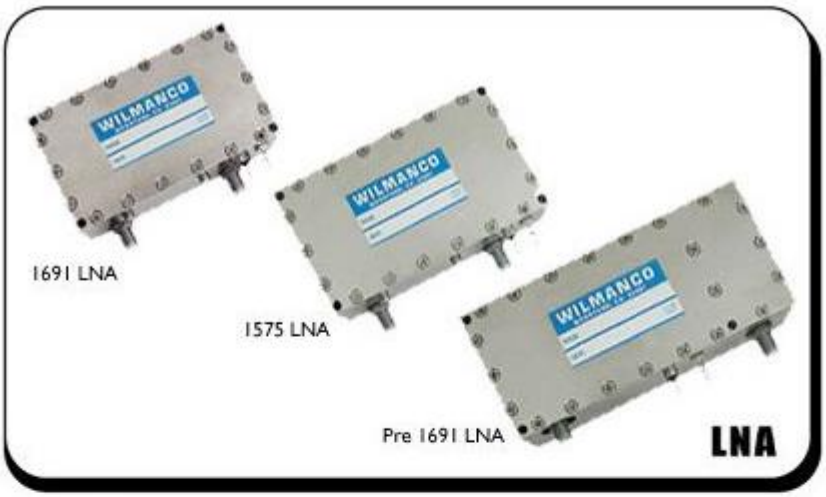






The PCB actually states not 1535 but 1575 MHz. However as can be seen later the small signal performance is anyhow very broadband. The amplifier is based on a balanced (push-pull) configuration with a MMIC broadband amplifier as a second stage. Biasing is via the RF-output and includes a reverse voltage protection with a diode. A small auxiliary PCB with a ICL7660 is generating the negative gate bias voltage for the transistor.

I did not find a datasheet on the internet but only of some similar devices.



General Description:

The **Wilmanco** WLNA series of L and S band low noise amplifiers provide high gain, low noise figure, high input return loss, preselection filtering, and image reject filtering, all in one machined electroless nickel plated aluminum housing.

Separate machined pockets are provided for the lumped constant preselector filter and stripline interdigital image reject output filter. The return loss of the balanced amplifier typically runs greater than 15dB, providing a good 50ohm match to the antenna circuit.

Three configurations are available depending on frequency range and filter requirements.

Electrical Specifications:

1575 LNA Specifications

LNA Type:	GaAsFET; balanced Amp. MMIC second stage
Gain:	+38dB, Min.
Noise Figure:	1.1dB, Max., 0.9dB typical
Bandwidth:	100 MHz Min., centered at 1575 MHz
DC Input:	+12 to +16 VDC, 85mA Max.

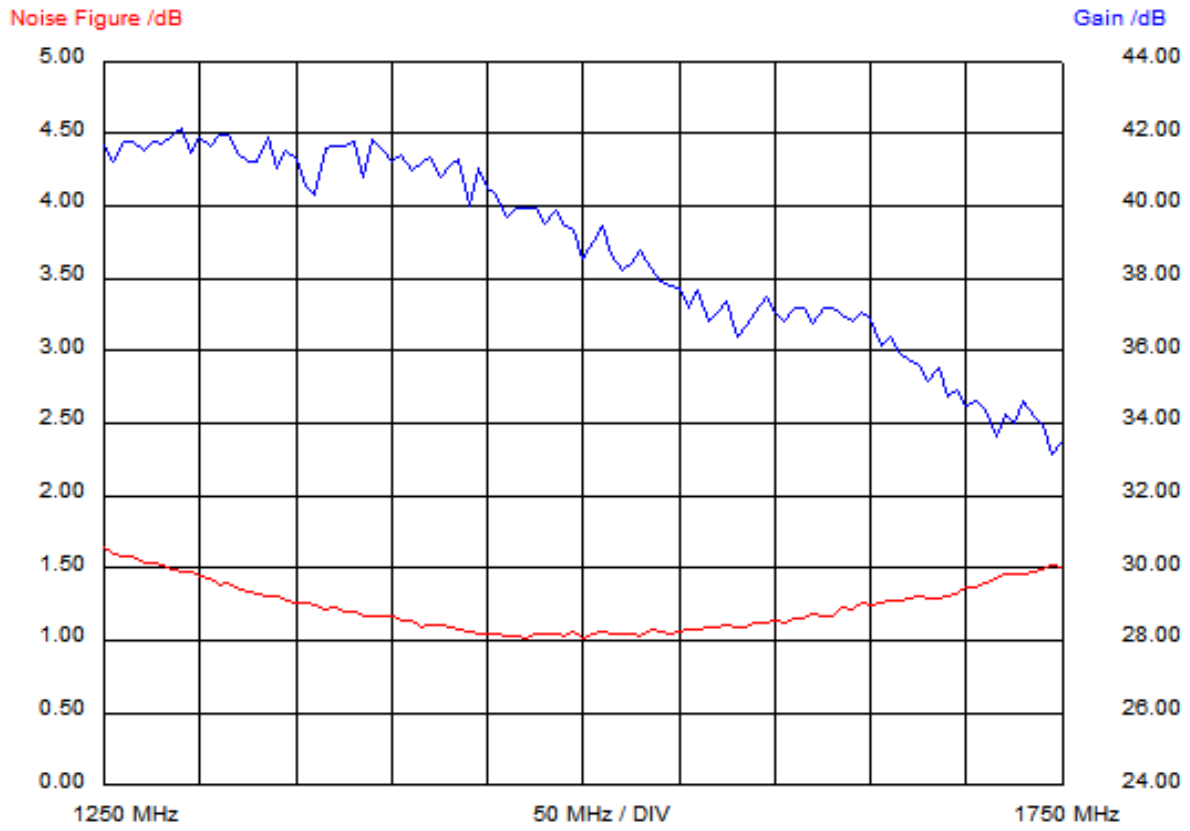
1691 LNA Specifications

LNA Type:	GaAsFET; balanced Amp. MMIC second stage
Gain:	+37dB, Min.
Noise Figure:	1.1dB Max., 0.9dB typical
Bandwidth:	100 MHz Min., centered at 1691 MHz
DC Input:	+12 to +16 VDC, 85mA Max.

Pre-1691 LNA Specifications

Preselector:	3-pole; lumped constant
Insertion Loss:	0.4dB, Max.
Filter Bandwidth:	300 MHz, nominal
LNA Type:	GaAsFET; balanced Amp. MMIC second stage
Gain:	+37dB, Min.
Noise Figure:	1.5dB Max.
Bandwidth:	100 MHz Min. centered at 1691 MHz
DC Input:	+12 to +16 VDC, 85 mA Max.

Next, I made some measurements to characterize its performance. All measurements were done with a supply voltage of 12.0V and a measured supply current of 80mA. In the next diagram you can see the gain and noise figure in the frequency range from 1250 MHz o 1750 MHz.



The small signal performance of the amplifier is very broadband. Below please find a table with the measured data:

Frequency	Gain	NF	Temp	Frequency	Gain	NF	Temp
1250 MHz	41.68 dB	1.64 dB	133.5 K	1350 MHz	41.28 dB	1.26 dB	97.6 K
1255 MHz	41.22 dB	1.60 dB	129.4 K	1355 MHz	40.57 dB	1.26 dB	97.6 K
1260 MHz	41.80 dB	1.58 dB	127.6 K	1360 MHz	40.33 dB	1.25 dB	96.8 K
1265 MHz	41.76 dB	1.58 dB	127.6 K	1365 MHz	41.58 dB	1.21 dB	93 K
1270 MHz	41.56 dB	1.54 dB	123.8 K	1370 MHz	41.63 dB	1.23 dB	94.8 K
1275 MHz	41.79 dB	1.54 dB	123.5 K	1375 MHz	41.63 dB	1.20 dB	92.5 K
1280 MHz	41.72 dB	1.52 dB	121.7 K	1380 MHz	41.76 dB	1.20 dB	92.1 K
1285 MHz	41.94 dB	1.49 dB	118.7 K	1385 MHz	40.82 dB	1.17 dB	89.8 K
1290 MHz	42.14 dB	1.47 dB	116.8 K	1390 MHz	41.86 dB	1.17 dB	89.4 K
1295 MHz	41.44 dB	1.48 dB	117.6 K	1395 MHz	41.51 dB	1.16 dB	89.2 K
1300 MHz	41.89 dB	1.44 dB	113.6 K	1400 MHz	41.20 dB	1.17 dB	89.5 K
1305 MHz	41.63 dB	1.43 dB	113.3 K	1405 MHz	41.42 dB	1.14 dB	86.7 K
1310 MHz	41.99 dB	1.38 dB	108.6 K	1410 MHz	40.97 dB	1.13 dB	86.2 K
1315 MHz	41.96 dB	1.40 dB	110.6 K	1415 MHz	41.18 dB	1.09 dB	82.9 K
1320 MHz	41.43 dB	1.35 dB	105.9 K	1420 MHz	41.38 dB	1.11 dB	84.1 K
1325 MHz	41.22 dB	1.34 dB	104.4 K	1425 MHz	40.82 dB	1.10 dB	83.9 K
1330 MHz	41.20 dB	1.32 dB	102.9 K	1430 MHz	41.10 dB	1.08 dB	82.3 K
1335 MHz	41.91 dB	1.31 dB	101.8 K	1435 MHz	41.30 dB	1.08 dB	81.9 K
1340 MHz	41.03 dB	1.31 dB	101.7 K	1440 MHz	40.01 dB	1.06 dB	80.4 K
1345 MHz	41.55 dB	1.28 dB	99.2 K	1445 MHz	41.02 dB	1.04 dB	78.7 K

Frequency	Gain	NF	Temp	Frequency	Gain	NF	Temp
1445 MHz	41.02 dB	1.04 dB	78.7 K	1600 MHz	37.03 dB	1.13 dB	86.4 K
1450 MHz	40.49 dB	1.05 dB	79.2 K	1605 MHz	36.81 dB	1.12 dB	85.3 K
1455 MHz	40.33 dB	1.04 dB	78.6 K	1610 MHz	37.19 dB	1.15 dB	88.3 K
1460 MHz	39.71 dB	1.03 dB	77.6 K	1615 MHz	37.20 dB	1.15 dB	88.2 K
1465 MHz	39.93 dB	1.03 dB	77.3 K	1620 MHz	36.74 dB	1.18 dB	90.2 K
1470 MHz	39.91 dB	1.02 dB	76.5 K	1625 MHz	37.17 dB	1.16 dB	88.8 K
1475 MHz	39.96 dB	1.05 dB	79.3 K	1630 MHz	37.21 dB	1.17 dB	89.8 K
1480 MHz	39.52 dB	1.04 dB	78.6 K	1635 MHz	37.01 dB	1.22 dB	94.1 K
1485 MHz	39.86 dB	1.04 dB	78.9 K	1640 MHz	36.80 dB	1.21 dB	93.5 K
1490 MHz	39.46 dB	1.03 dB	77.5 K	1645 MHz	37.06 dB	1.25 dB	96.9 K
1495 MHz	39.30 dB	1.06 dB	79.8 K	1650 MHz	36.90 dB	1.25 dB	96.5 K
1500 MHz	38.56 dB	1.02 dB	76.8 K	1655 MHz	36.14 dB	1.25 dB	97.1 K
1505 MHz	39.04 dB	1.05 dB	78.9 K	1660 MHz	36.40 dB	1.27 dB	98.6 K
1510 MHz	39.44 dB	1.06 dB	79.8 K	1665 MHz	35.94 dB	1.27 dB	98.6 K
1515 MHz	38.68 dB	1.04 dB	78.6 K	1670 MHz	35.72 dB	1.29 dB	100.2 K
1520 MHz	38.22 dB	1.04 dB	78.7 K	1675 MHz	35.58 dB	1.31 dB	101.9 K
1525 MHz	38.42 dB	1.04 dB	78.8 K	1680 MHz	35.16 dB	1.29 dB	100 K
1530 MHz	38.80 dB	1.03 dB	77.2 K	1685 MHz	35.50 dB	1.29 dB	100 K
1535 MHz	38.31 dB	1.07 dB	80.8 K	1690 MHz	34.77 dB	1.31 dB	101.9 K
1540 MHz	37.93 dB	1.06 dB	80.5 K	1695 MHz	34.90 dB	1.32 dB	103.1 K
1545 MHz	37.82 dB	1.04 dB	78.8 K	1700 MHz	34.46 dB	1.37 dB	107.2 K
1550 MHz	37.75 dB	1.05 dB	79.7 K	1705 MHz	34.64 dB	1.37 dB	107.8 K
1555 MHz	37.21 dB	1.08 dB	81.7 K	1710 MHz	34.33 dB	1.40 dB	110.3 K
1560 MHz	37.70 dB	1.07 dB	80.8 K	1715 MHz	33.65 dB	1.43 dB	113.2 K
1565 MHz	36.84 dB	1.08 dB	82.3 K	1720 MHz	34.25 dB	1.45 dB	115.1 K
1570 MHz	37.09 dB	1.09 dB	83 K	1725 MHz	34.02 dB	1.46 dB	115.9 K
1575 MHz	37.34 dB	1.11 dB	84.4 K	1730 MHz	34.60 dB	1.45 dB	115.3 K
1580 MHz	36.36 dB	1.09 dB	82.7 K	1735 MHz	34.19 dB	1.47 dB	116.8 K
1585 MHz	36.70 dB	1.10 dB	83.3 K	1740 MHz	33.92 dB	1.49 dB	118.4 K
1590 MHz	37.07 dB	1.12 dB	85.1 K	1745 MHz	33.15 dB	1.52 dB	121.4 K
1595 MHz	37.47 dB	1.12 dB	85.3 K	1750 MHz	33.52 dB	1.50 dB	120.1 K

As the measurements show, my amplifier is very similar to the 1575 MHz LNA which was shown in the datasheet above. The minimum noise figure was measured to be 1.0dB at 1500 MHz with an associated gain of 38.5dB. At 1535 MHz the noise figure is 1.1dB and the gain is 38.3dB.

If anyone has more data of this amplifier or the used transistors then please let me know.

I always appreciate feedback. Please send it to the Email address below.

Best regards

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