

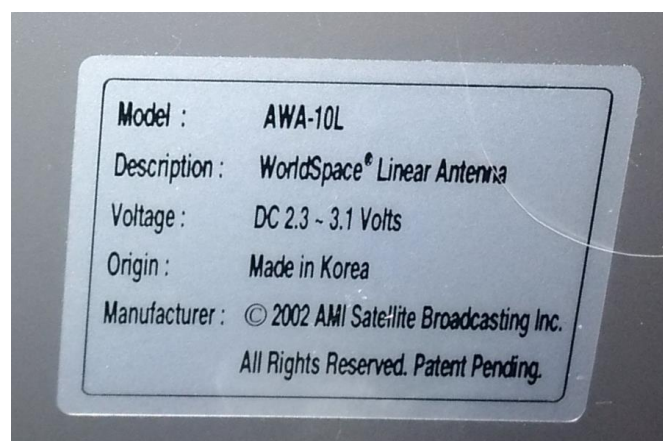
Emmendingen, 01.05.2017
Matthias Bopp DD1US

Modification of the Worldspace Antenna ANA-10L for wideband use

Rev 1.0

Hello,

recently I was able to acquire a couple of antennas for Worldspace. Part of them are the ANA-10L patch antennas. Here is a picture:



These antennas are liner polarized patch antennas built by the Korean company AML. These antennas use an embedded preamplifier which is biased through the cable to the receiver . The supply voltage range is 2,3 – 3,1 V. The antenna is sealed but I suppose based on the construction that it should not be used permanently outdoor unless it is protected from rain. The dark grey antenna has a diameter of 15cm and features an embedded hinge so that it can be directed to the Worldspace satellite. The thin RG174 kind of coaxial cable is approximately 2,5m long. As far as I know this antenna was supplied for instance together with the ASR-WS201 Worldspace Ami Digital Satellite Receiver.

As I was interested to see what's inside I opened and analyzed the content.



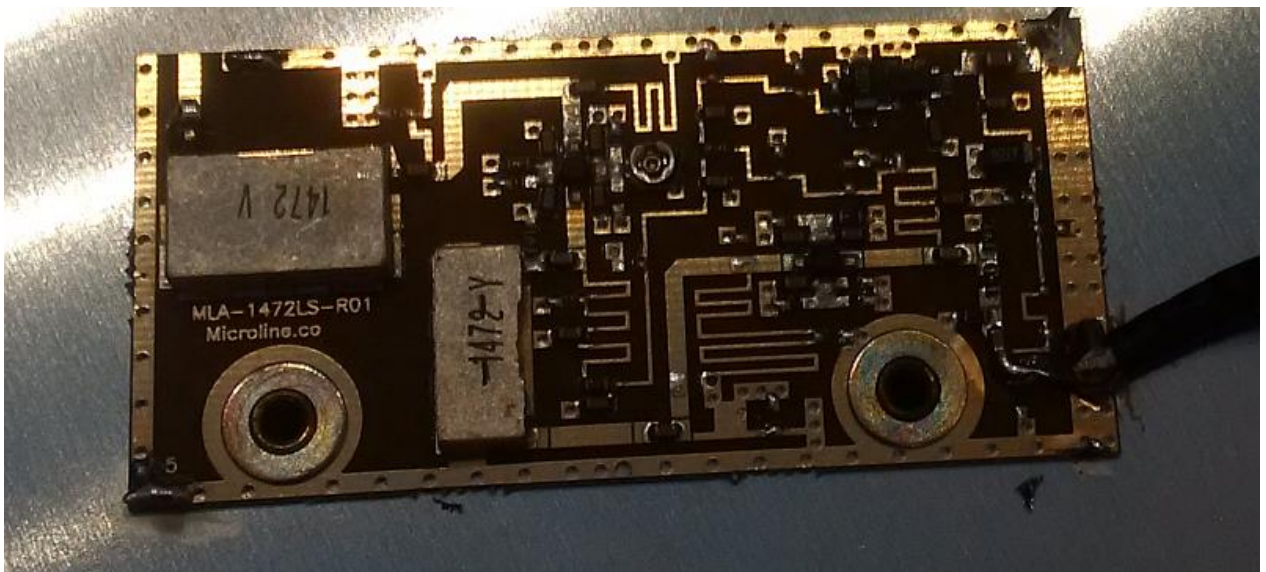
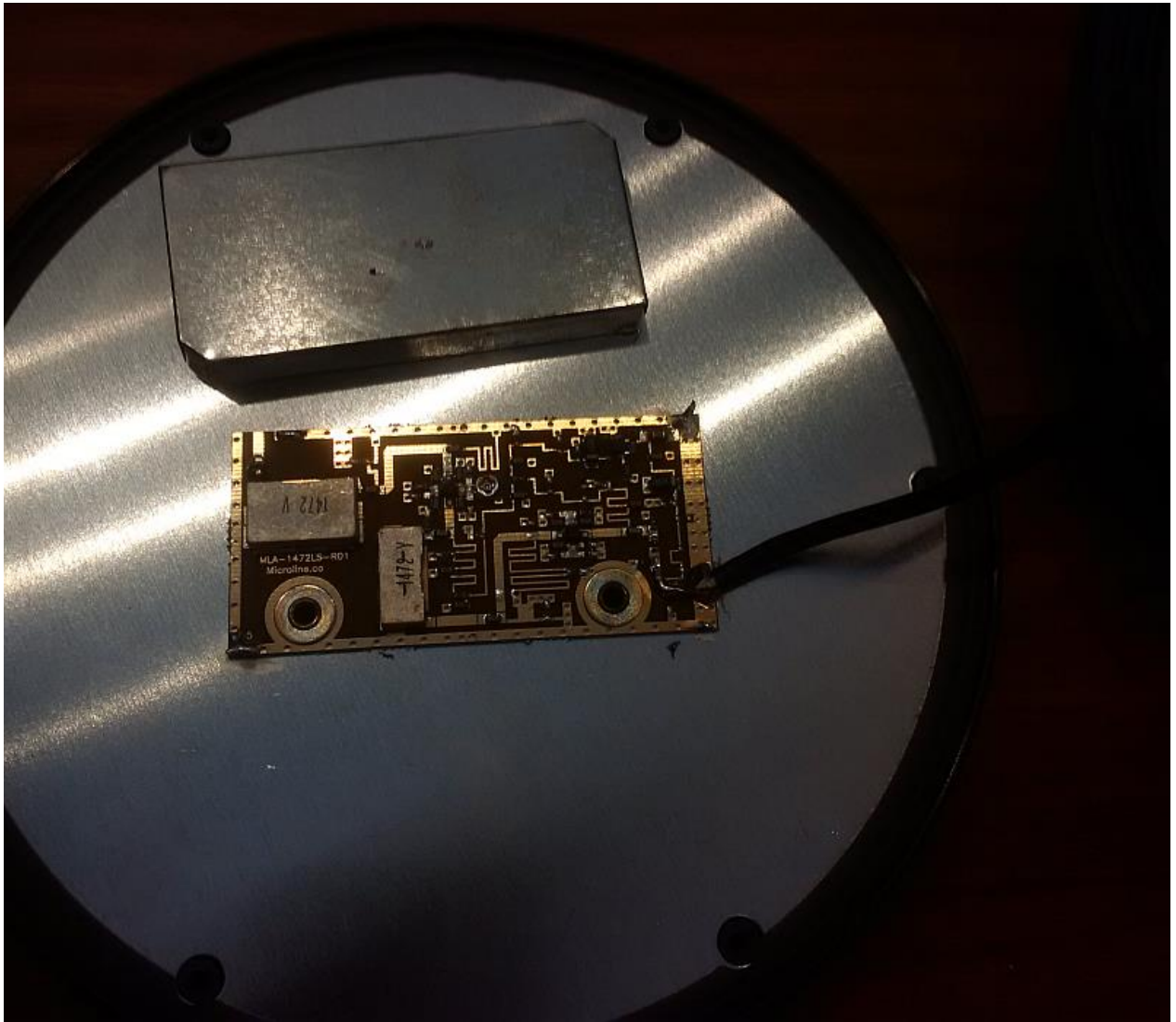
Please note the rather poor RF-connector which was later replaced by a BNC-type connector



Antenna opened, the amplifier is properly shielded. Please note the little pink sticker in the encasing. This is a kind of filter which allows moisture to exit the case.

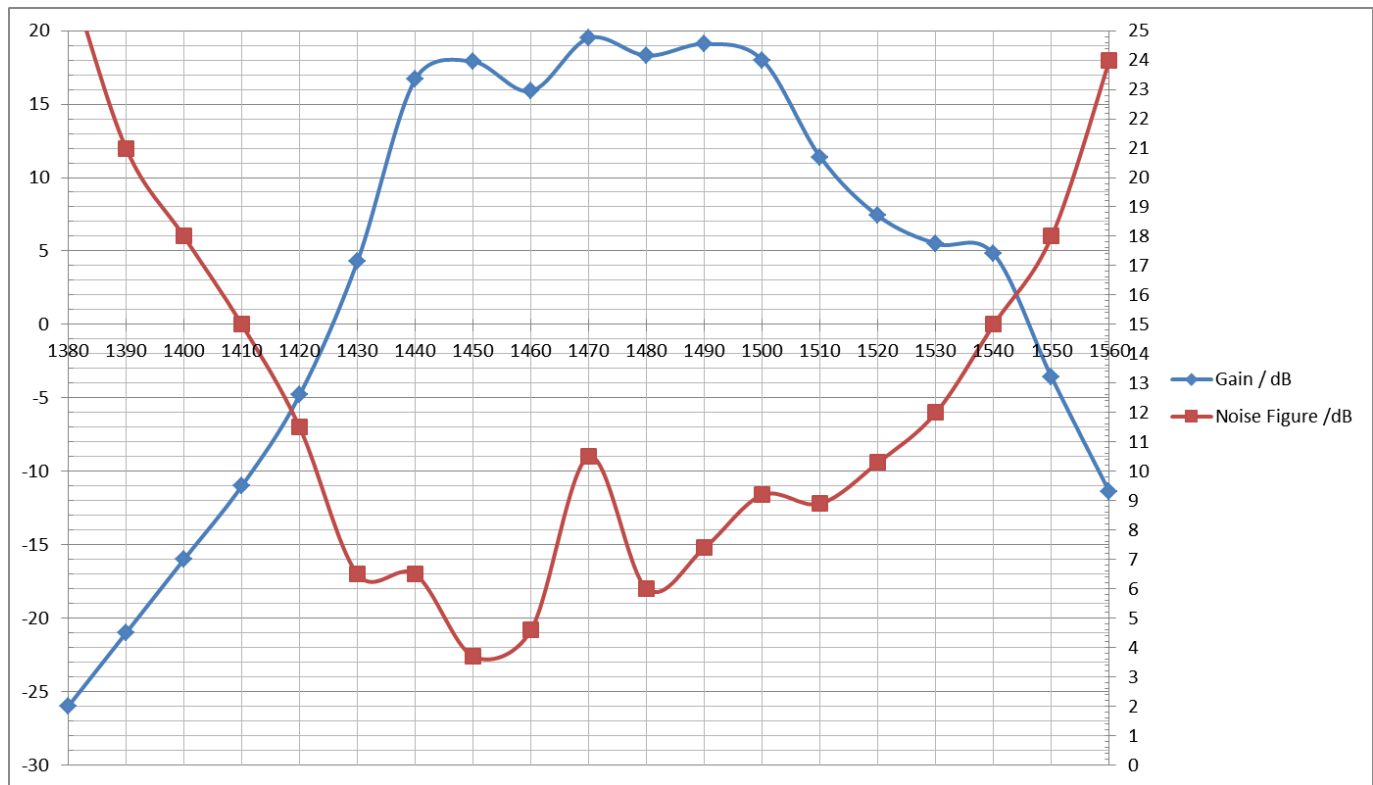


Shielding of the amplifier removed.



Detailed views of the 2 stage amplifier

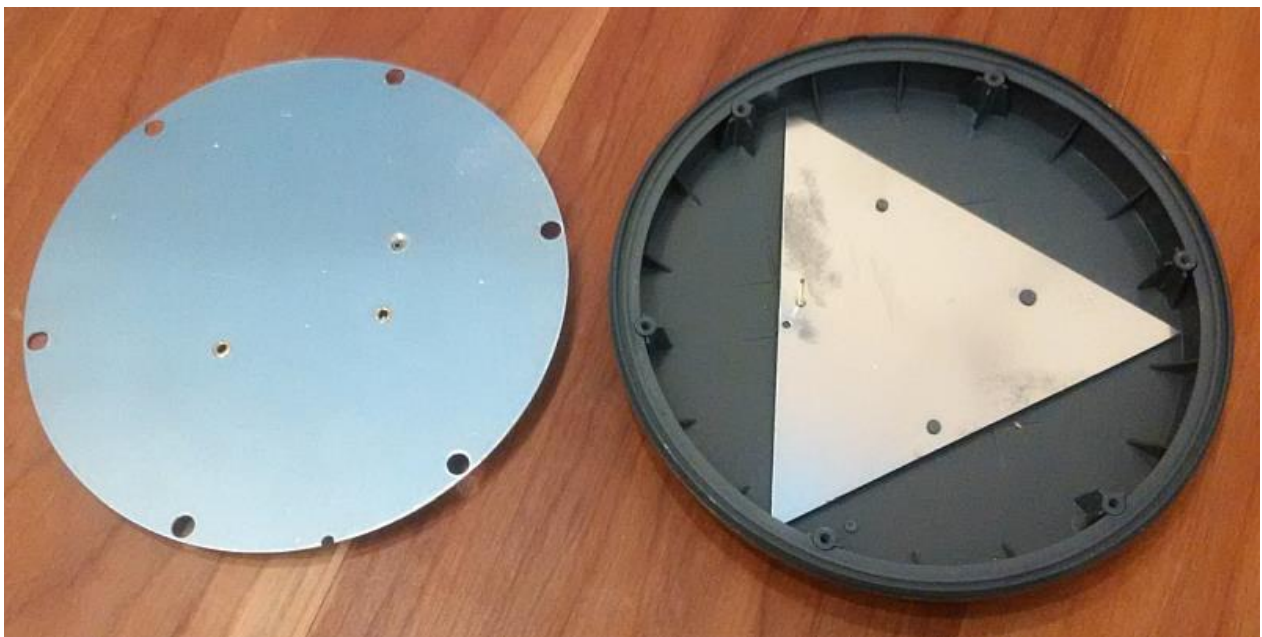
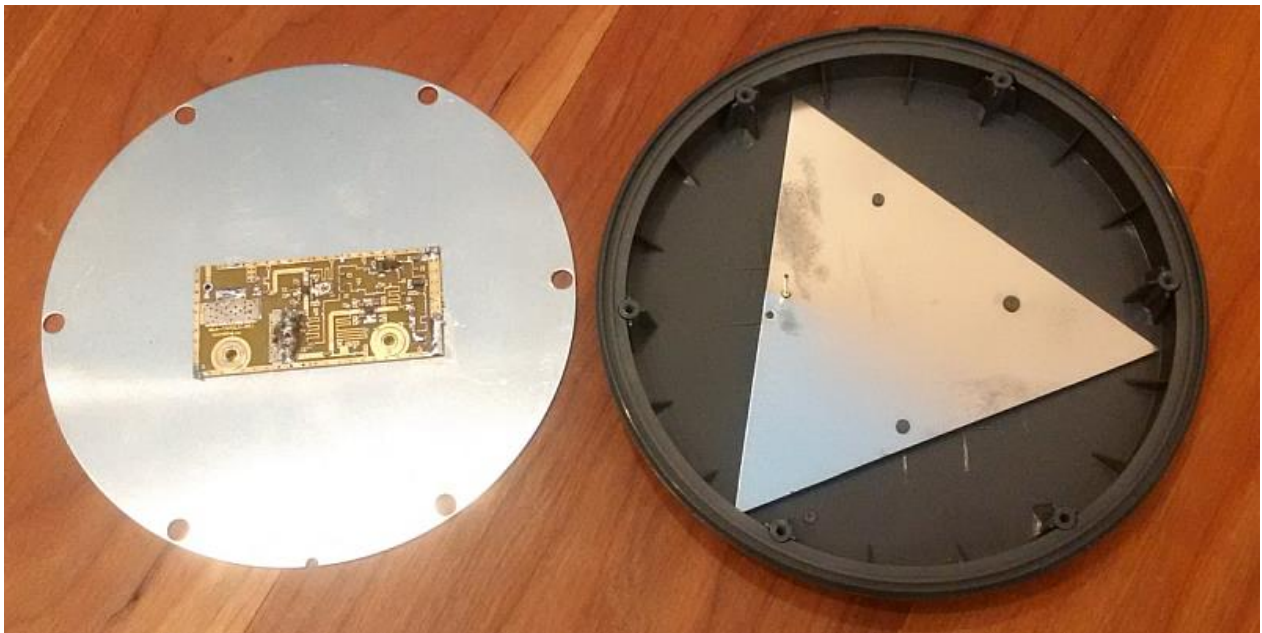
Here are some measurements of the amplifier before conducting any modifications:



Frequency /MHz	Gain / dB	Noise Figure /dB	Vs/V	Is/mA
1380	-26	27	2,6	30
1390	-21	21	2,6	30
1400	-16	18	2,6	30
1410	-11	15	2,6	30
1420	-4,8	11,5	2,6	30
1430	4,3	6,5	2,6	25
1440	16,7	6,5	2,6	30
1450	17,9	3,7	2,6	30
1460	15,9	4,6	2,6	30
1470	19,5	10,5	2,6	25
1480	18,3	6	2,6	30
1490	19,1	7,4	2,6	25
1500	18	9,2	2,6	30
1510	11,4	8,9	2,6	25
1520	7,4	10,3	2,6	30
1530	5,5	12	2,6	30
1540	4,8	15	2,6	30
1550	-3,6	18	2,6	30
1560	-11,4	24	2,6	30

Service	Region	Frequency /MHz	Gp /dB	NF /dB	Polarization
Worldspace	worldwide	1452-1492	18	5	LHCP @ 1.8-2.4V, RHCP @ 2.8-3.3V
Inmarsat	worldwide	1520-1550	5	12	RHCP
Outernet	Europe (Alphasat)	1545,94	0	16	RHCP
Outernet	USA	1539,8725	5	15	RHCP
Outernet	APAC	1545,9525	0	16	RHCP
GPS	worldwide	1575,42	n.a.	n.a	RHCP
Iridium	worldwide	1616-1626.5	n.a.	n.a	RHCP

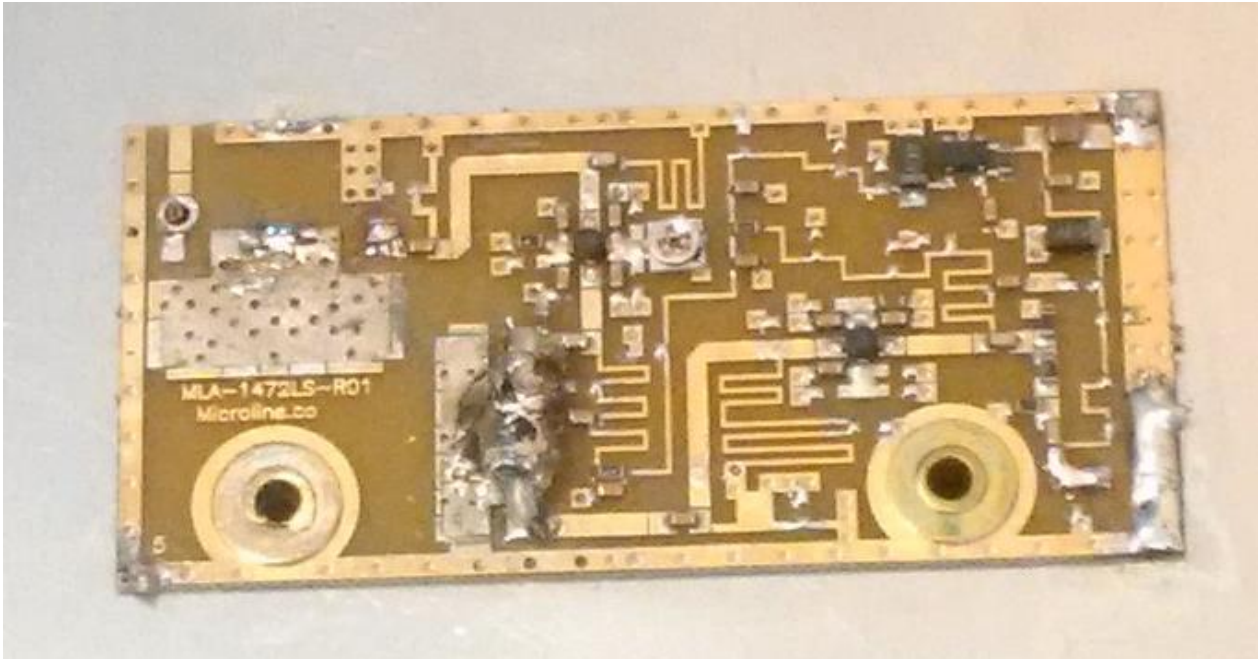
After this step I decided to modify the amplifier by removing the two dielectric filters.



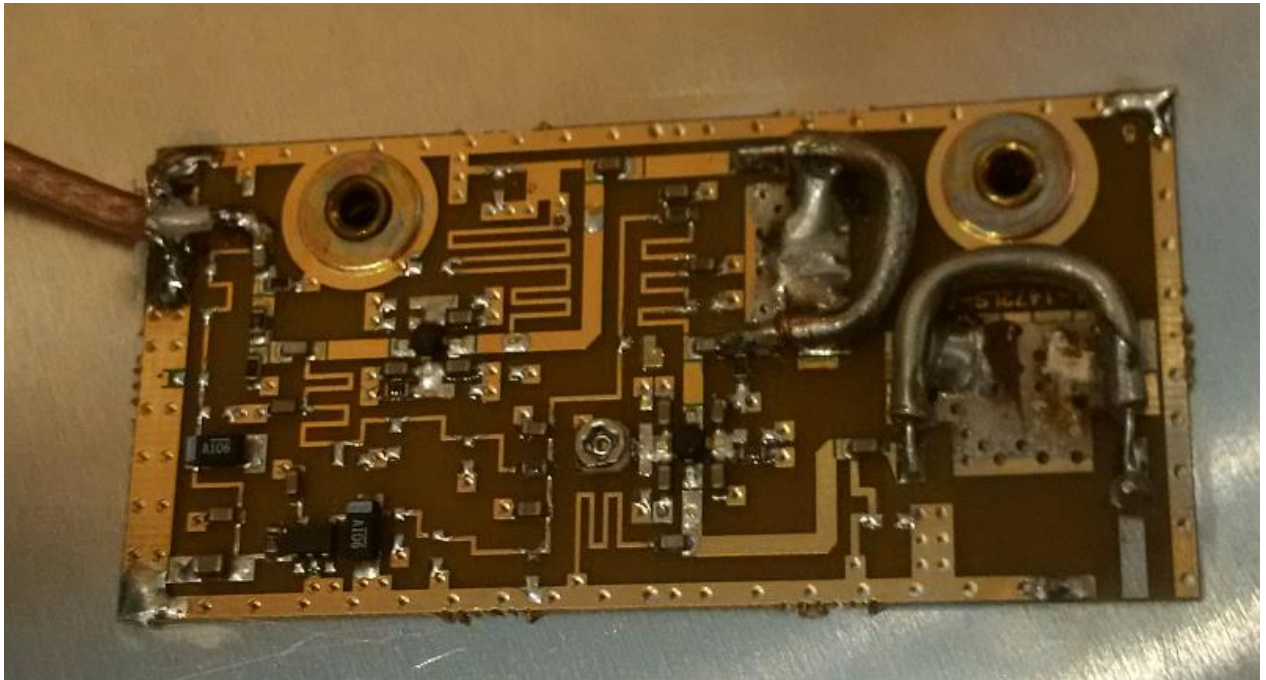
In the pictures above you can see the triangular shaped patch antenna. The metal disc, where the amplifier is mounted on, acts as the reflector disc of the patch antenna.



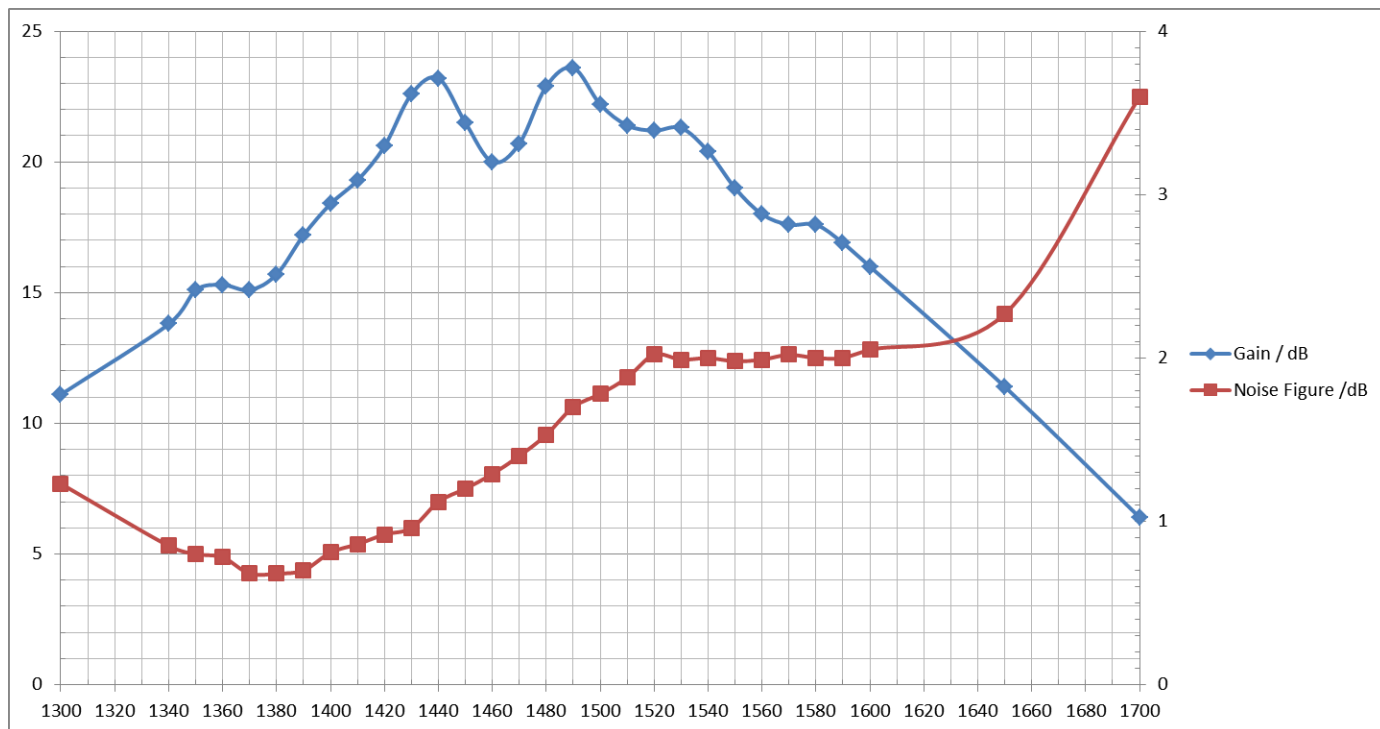
PCB with the two dielectrical filters removed



Next I bridged the connections using two short pieces of semi-rigid 50 Ohm coaxial cables.



Then I repeated the measurements of the two stage amplifier.



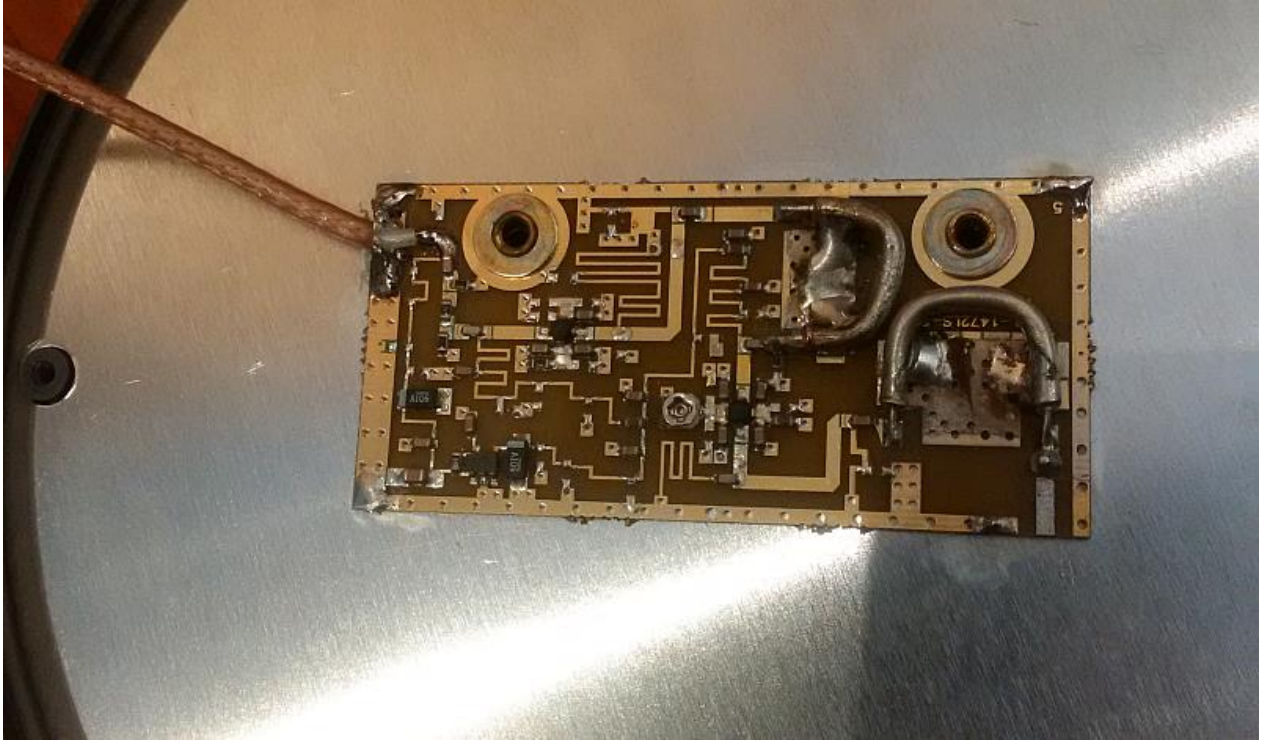
Frequency /MHz	Gain / dB	Noise Figure /dB	Vs/V	Is/mA
1300	11,1	1,23	2,6	30
1340	13,8	0,85	2,6	30
1350	15,1	0,8	2,6	30
1360	15,3	0,78	2,6	30
1370	15,1	0,68	2,6	30
1380	15,7	0,68	2,6	30
1390	17,2	0,7	2,6	30

1400	18,4	0,81	2,6	30
1410	19,3	0,86	2,6	30
1420	20,6	0,92	2,6	30
1430	22,6	0,96	2,6	30
1440	23,2	1,12	2,6	30
1450	21,5	1,2	2,6	30
1460	20	1,29	2,6	30
1470	20,7	1,4	2,6	30
1480	22,9	1,53	2,6	30
1490	23,6	1,7	2,6	30
1500	22,2	1,78	2,6	30
1510	21,4	1,88	2,6	30
1520	21,2	2,02	2,6	30
1530	21,3	1,99	2,6	30
1540	20,4	2	2,6	30
1550	19	1,98	2,6	30
1560	18	1,99	2,6	30
1570	17,6	2,02	2,6	30
1580	17,6	2	2,6	30
1590	16,9	2	2,6	30
1600	16	2,05	2,6	30
1650	11,4	2,27	2,6	30
1700	6,4	3,6	2,6	30

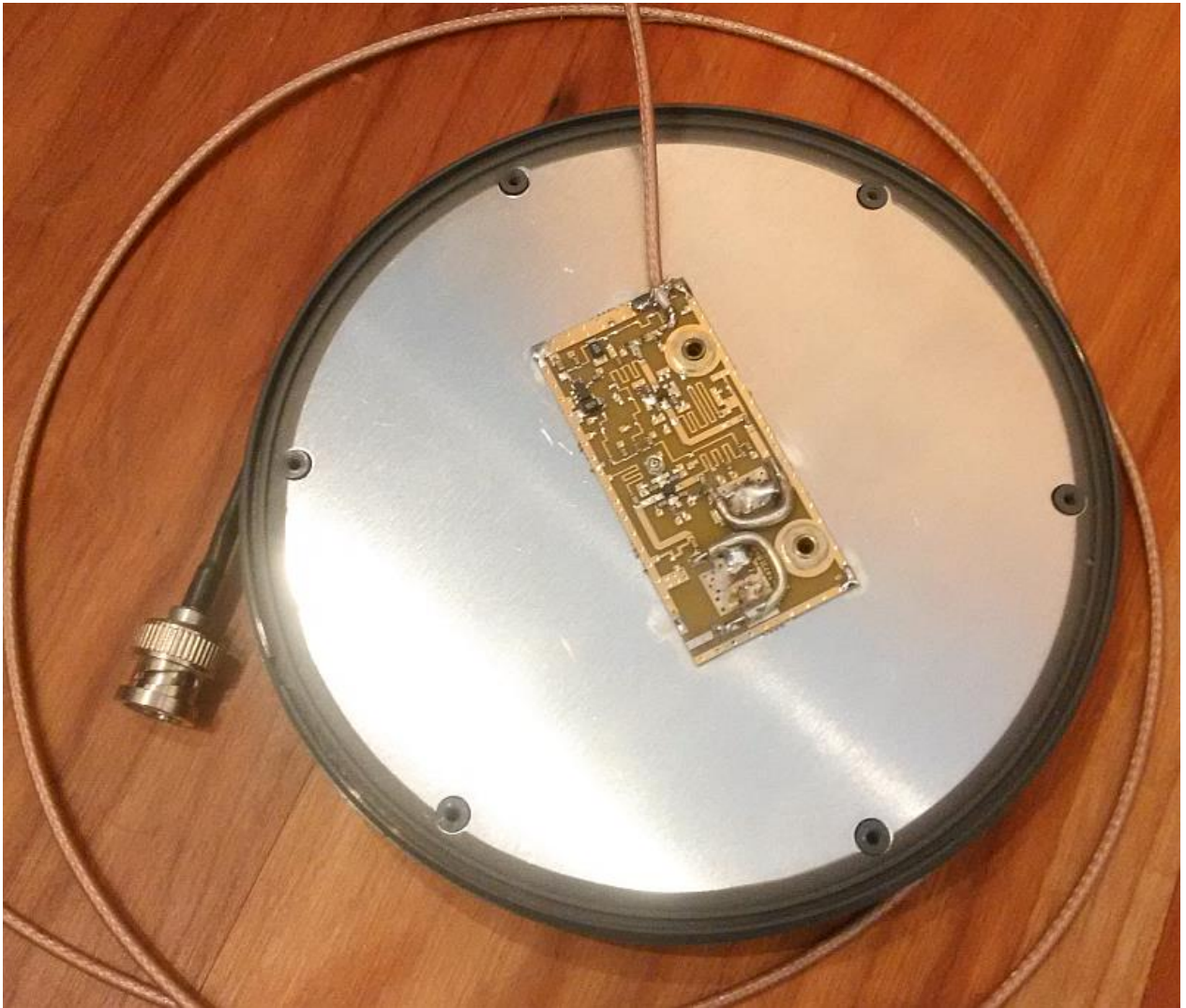
The wideband performance is thus much improved after the modification.

Service	Region	Frequency /MHz	Gp /dB	NF /dB	Polarization
Worldspace	worldwide	1452-1492	21	1,5	LHCP @ 1.8-2.4V, RHCP @ 2.8-3.3V
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GPS	worldwide	1575,42	18	2	RHCP
Iridium	worldwide	1616-1626.5	14	2,1	RHCP

Finally I reassembled the antenna replacing the rather poor RG-174 type of coaxial cable with a lower loss but still flexible coaxial cable. I also changed the connector to a more RF suitable BNC-type connector.



Patch antenna element reassembled and connected to the PCB





Now only the shielding is missing before closing the plastic encasing



Shielding reassembled

If you have any comments or further information then please send them to the Email address given below. Many thanks in advance for your feedback.

Best regards

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