

HIGH DINAMICS LOW NOISE PREAMPLIFIER SCP2 & SCP2P



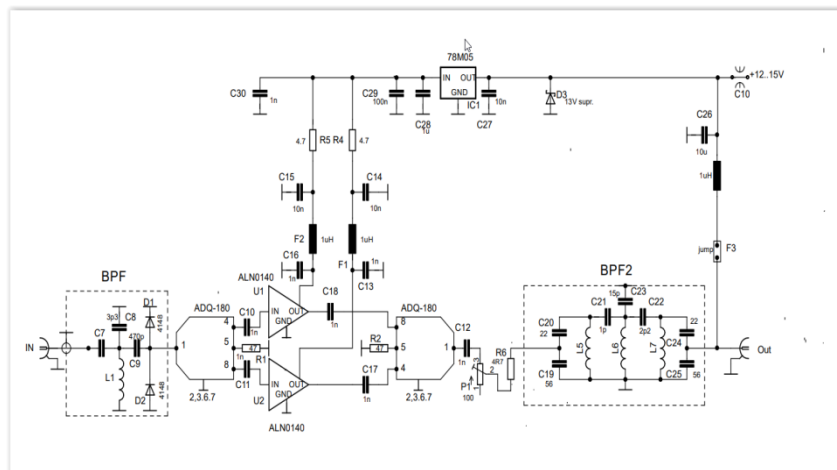
1. Introduction

The SCP2 and SCP2P are high dynamics, selective and low-noise preamplifiers for 144MHz.

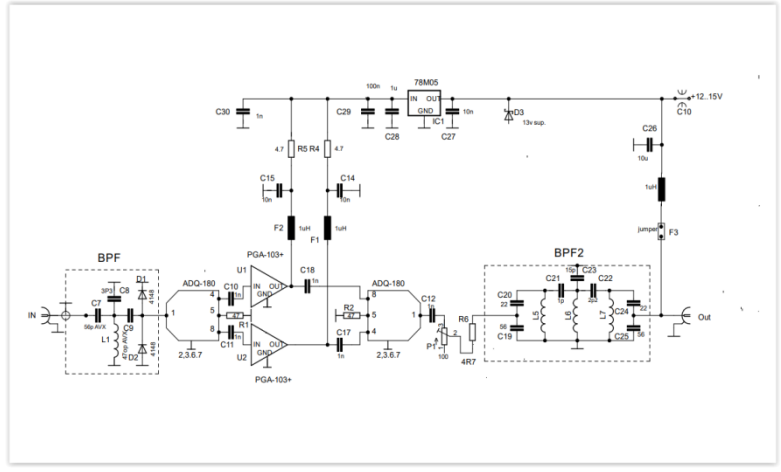
Both type of preamplifier we are built on base 2pcs high dynamics devices ALN0140WT and PGA103+by combiner technics.The input and output networks of the amplifiers are dimensioned so that both connections have an exact 50-ohm impedance,loaded with real 50 ohms.Both preamplifiers were builtin with SMD technology. The input circuit of the amplifier is built with HQ L-C components in a cell design and optimized for the best noise properties.The output filter gives good selectivity, the preamplifier gain is variable between 17 and22dB. Both preamplifiers are ideal and recommended for serious Contest, EME, Aurora works.

2.Circuit design

Our LNA schematics are shown below. Both preamplifiers are similar, different only in the used devices. SCP2 is built in with 2x ALN0140WT by ASB, and the SCP2P by 2x well known PGA-103+. The SCP2 produces higher dynamics. The NF is about same, the 2x ALN gives little bit lower NF.



1. SCP2 circuit diagram



2.SCP2P Circuit diagram

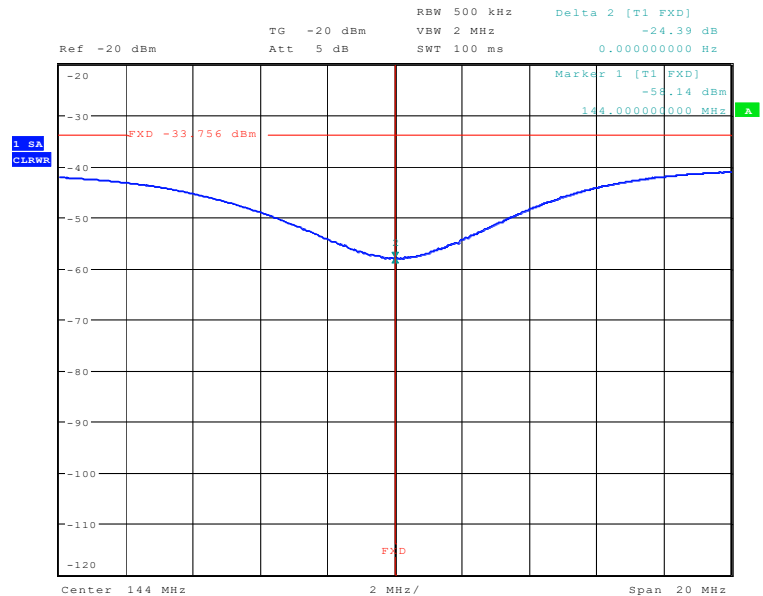
3.Measured parameters

The noise parameters measured with R&S FSQ-3 analyser and noise figure meter and Noisecom NC346A noise source.

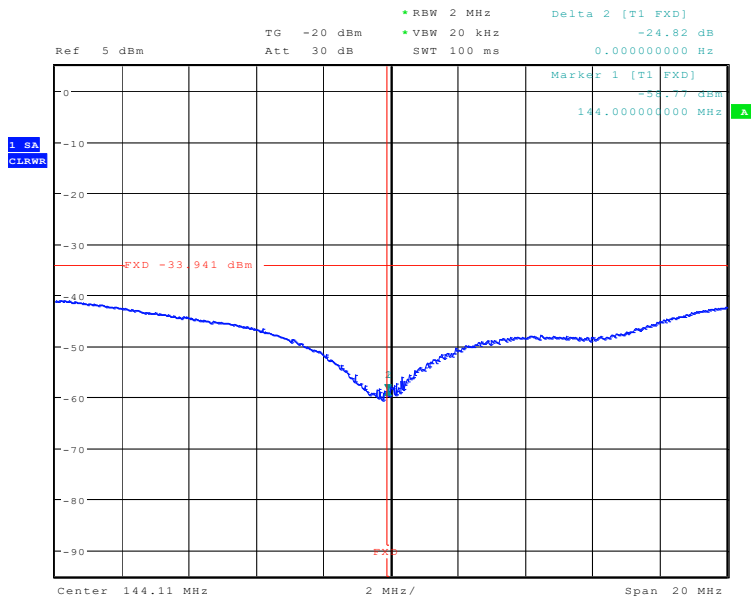
The I/O reflection parameters were measured with R&S CMU200, Agilent E4433D, + ZFSC-2-11.Both LNA was measured at HG5AZB's Laboratory.

The results are shown in fig. 3-16.

Input reflexion factor of SCP2 and SCP2P:



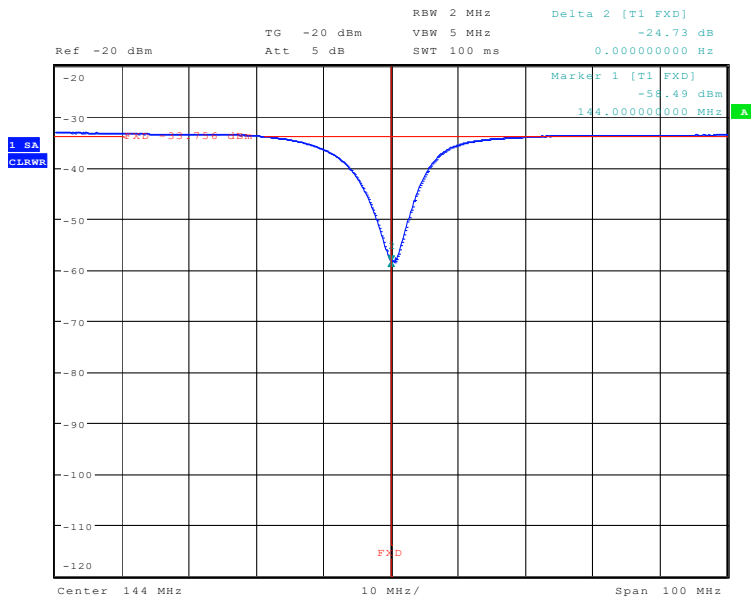
3. SCP2 Input reflexion factor



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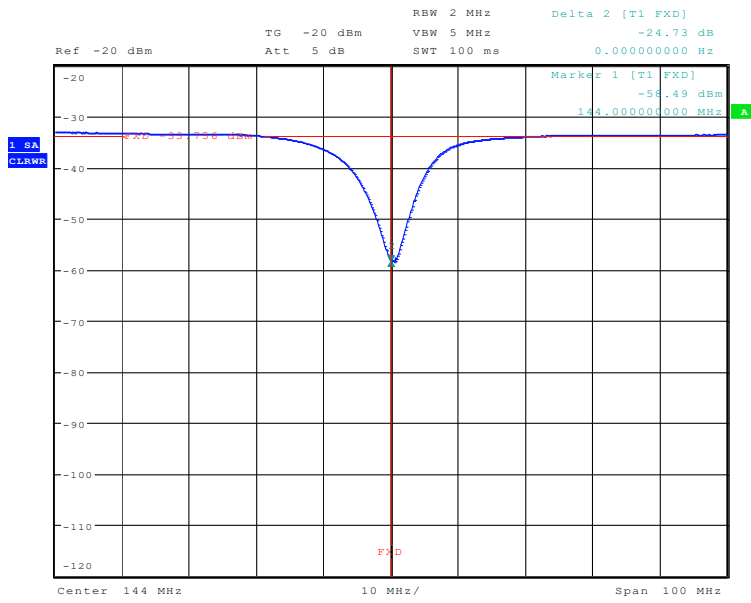
4. SCP2P Input reflexion factor

Output reflexion factor of SCP2 and SCP2P:



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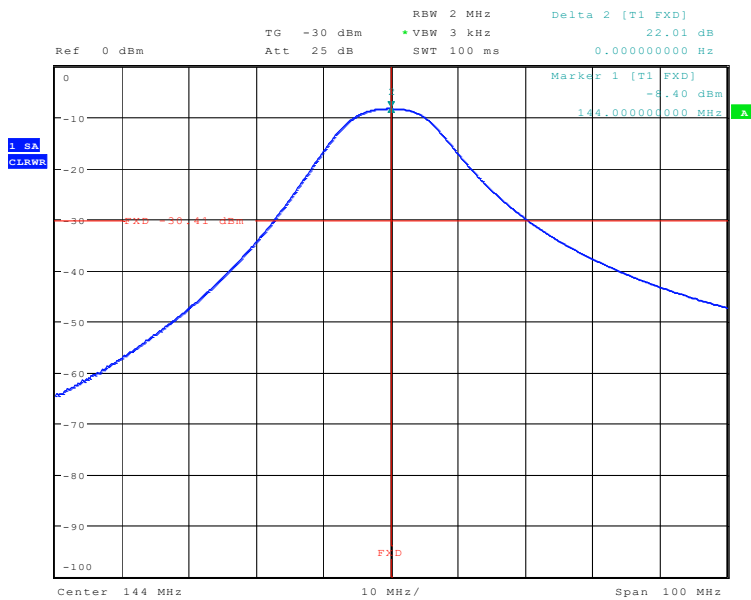
5. SCP2 Output reflexion factor



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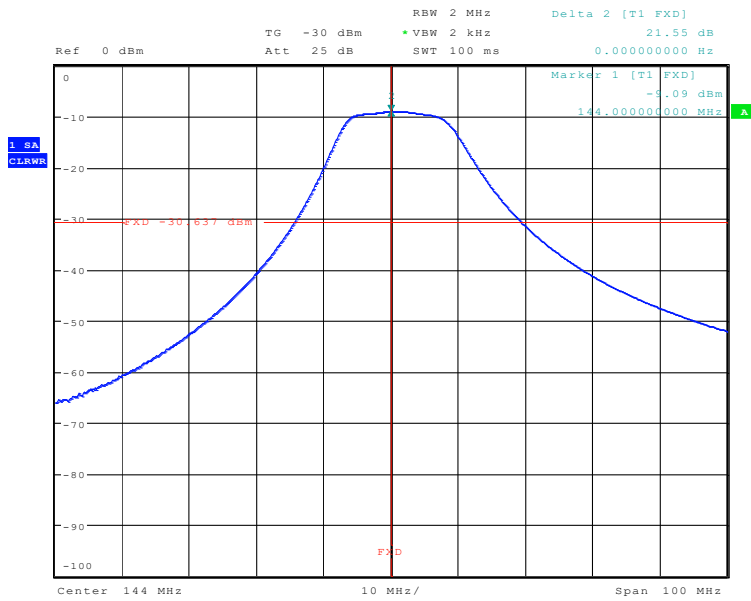
6. SCP2P Output reflexion factor

Gain parameters of SCP2 and SCP2P:



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7. SCP2 Gain



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8. SCP2P Gain

4. Noise Figure measurements

Direct	NOISE & GAIN			CALIBRATED	
RBW:	1 MHz	RF Atten.	0 dB	2nd Stage Corr.	On
Average:	1	Auto Ref Level	On	Image Rejection	...
Current Value					
RF:	144.4 MHz	ENR	6.43 dB	NF.	0.73 dB
LO:	...	Loss In	0 dB	Noise Temp.	52.88 K
IF:	...	Loss Out	0 dB	Gain	22 dB

Frequency List Results			
RF	NF	Noise Temp	Gain
144.00 MHz	0.75 dB	54.74 K	21.94 dB
144.10 MHz	0.74 dB	53.81 K	21.50 dB
144.20 MHz	0.79 dB	57.79 K	21.84 dB
144.30 MHz	0.73 dB	53.30 K	21.74 dB
144.40 MHz	0.73 dB	52.88 K	22.00 dB
144.50 MHz	0.78 dB	57.11 K	21.86 dB
144.60 MHz	0.73 dB	52.98 K	21.90 dB
144.70 MHz	0.69 dB	49.57 K	22.08 dB
144.80 MHz	0.75 dB	54.91 K	21.74 dB
144.90 MHz	0.73 dB	53.21 K	21.63 dB
145.00 MHz	0.75 dB	55.02 K	21.77 dB
145.10 MHz	0.75 dB	54.61 K	21.83 dB
145.20 MHz	0.73 dB	53.29 K	21.97 dB
145.30 MHz	0.76 dB	55.24 K	21.71 dB

Running ...

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9. SCP2 Noise Figure measurement

Direct		NOISE & GAIN		CALIBRATED	
RBW:	1 MHz	RF Atten.	0 dB	2nd Stage Corr.	On
Average:	1	Auto Ref Level	On	Image Rejection	...
Current Value					
RF:	144.2 MHz	ENR	6.43 dB	NF:	0.71 dB
LO:	...	Loss In	0 dB	Noise Temp.	51.23 K
IF:	...	Loss Out	0 dB	Gain	21.58 dB

Frequency List Results			
RF	NF	Noise Temp	Gain
144.00 MHz	0.72 dB	52.26 K	21.83 dB
144.10 MHz	0.67 dB	48.61 K	21.88 dB
144.20 MHz	0.71 dB	51.23 K	21.58 dB
144.30 MHz	0.74 dB	54.08 K	21.26 dB
144.40 MHz	0.75 dB	54.90 K	21.61 dB
144.50 MHz	0.75 dB	54.44 K	21.85 dB
144.60 MHz	0.74 dB	53.97 K	21.53 dB
144.70 MHz	0.72 dB	52.35 K	21.43 dB
144.80 MHz	0.76 dB	55.11 K	21.79 dB
144.90 MHz	0.78 dB	56.97 K	21.44 dB
145.00 MHz	0.78 dB	56.91 K	21.93 dB
145.10 MHz	0.73 dB	53.38 K	21.55 dB
145.20 MHz	0.75 dB	54.60 K	21.82 dB
145.30 MHz	0.72 dB	52.36 K	21.56 dB

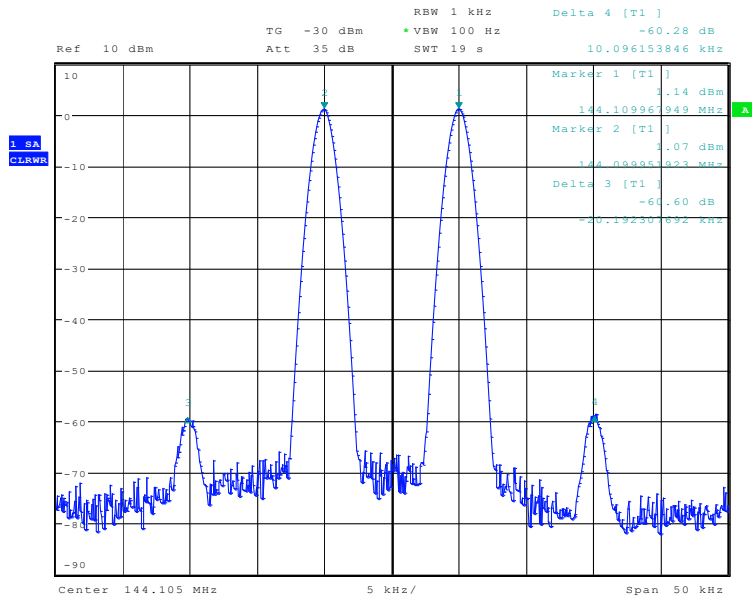
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10. SCP2P noise figure

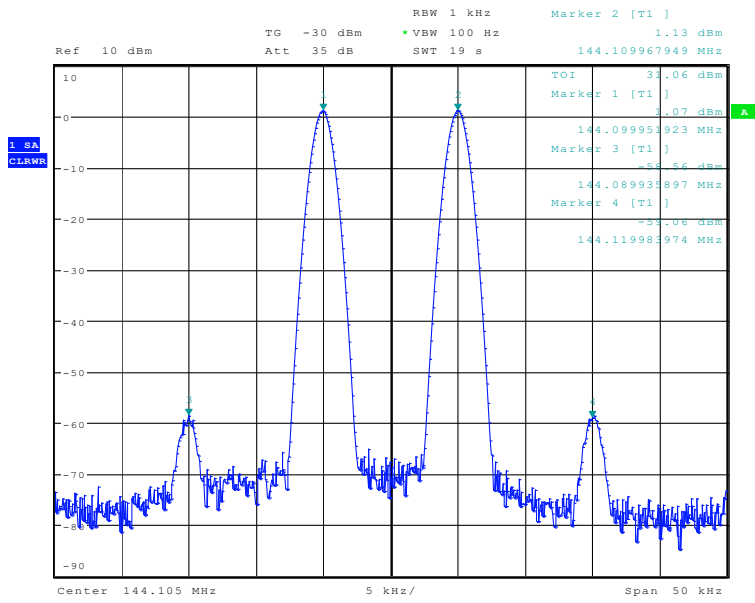
5. Intermodulation measurements (OIP3 & TOI)



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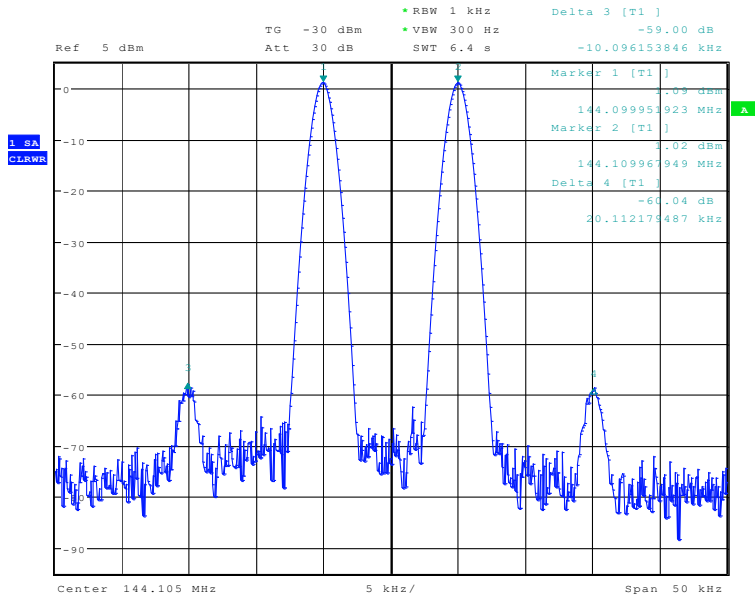
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11. SCP2 OIP3 Measurement (10KHz)



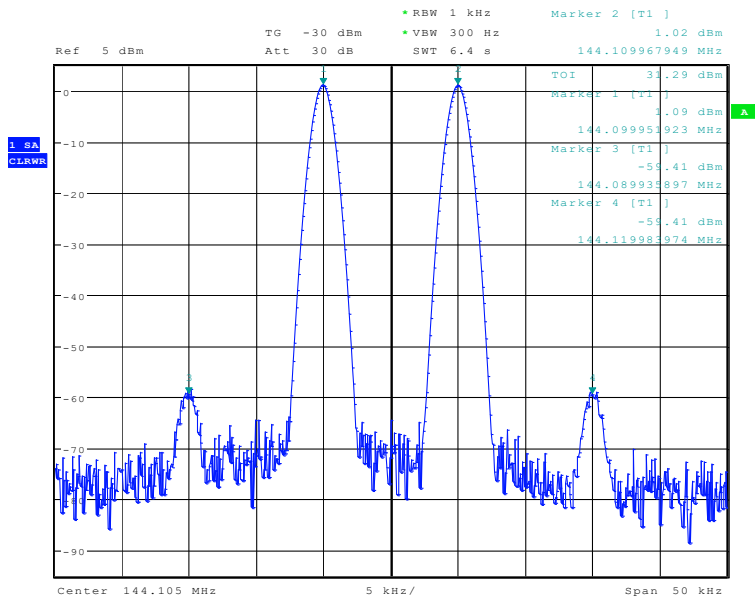
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12. SCP2 TOI measurement



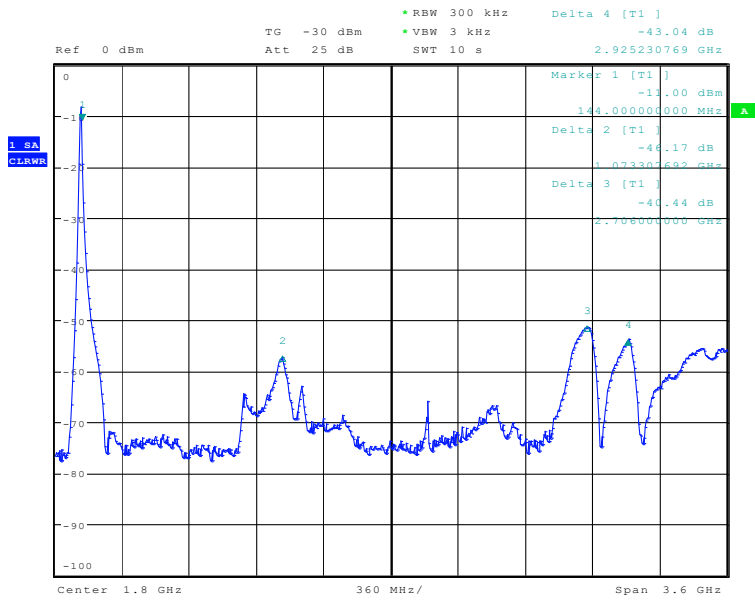
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13. SCP2P OIP3 measurement (10KHz)



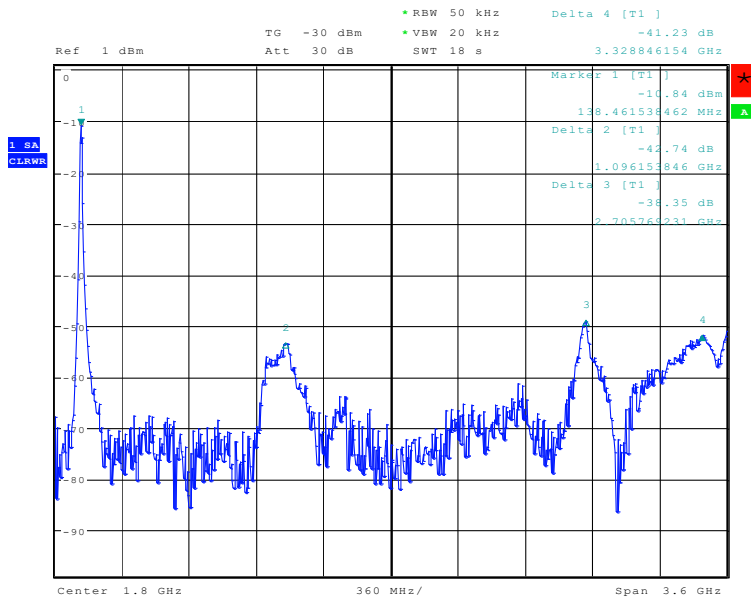
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14.SCP2P TOI measurement



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15.SCP2 wideband characteristic 0-3.6GHz

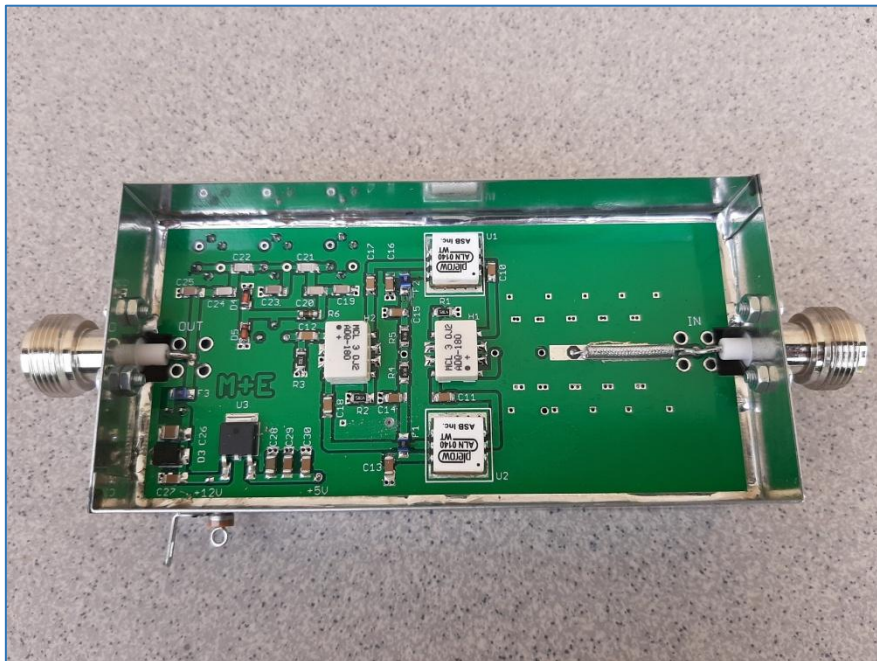


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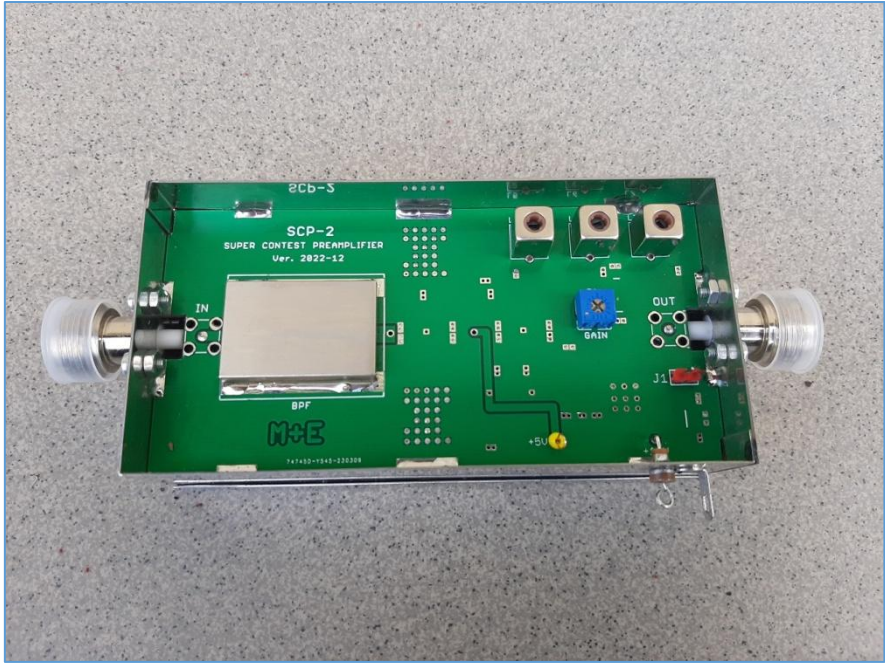
16.SCP2P wideband characteristic 0-3.6GHz

6. Construction

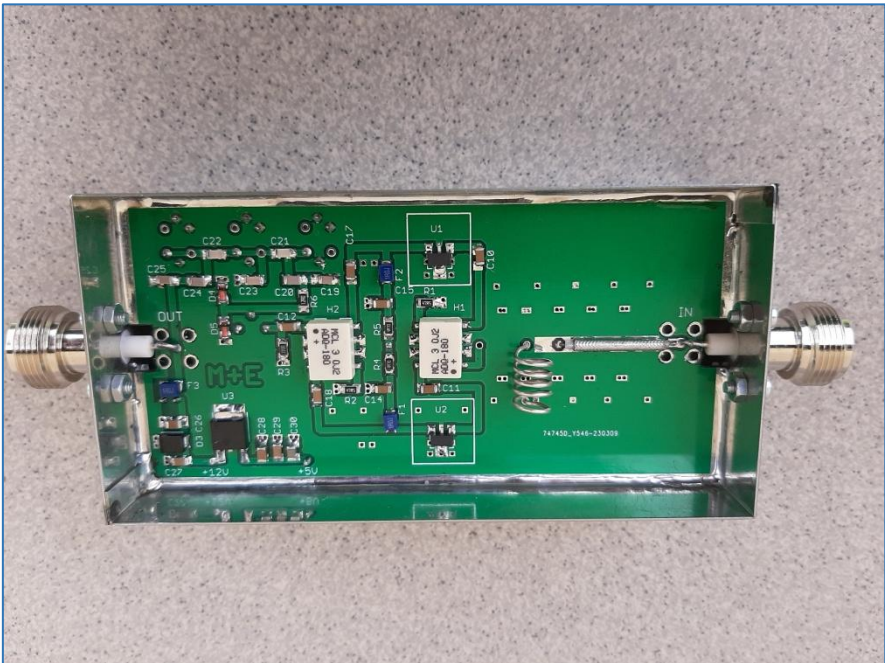
Both preamplifiers has been built on 1.5mm thick FR-4 type PCB.
Both built in in 114x58x32mm box. We offer N type connectors but we can deliver also with quality BNC or SMA connectors by request.
The layout of preamps and the full design visible on photos below:



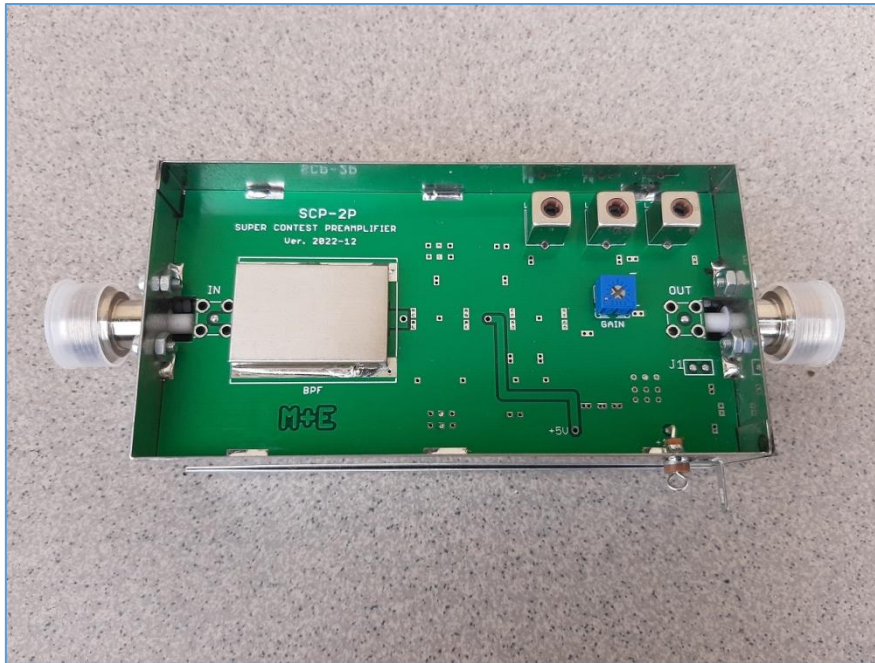
17. SCP2 bottom view



18. SCP2 top view



19.SCP2P bottom view



20. SCP2P top view

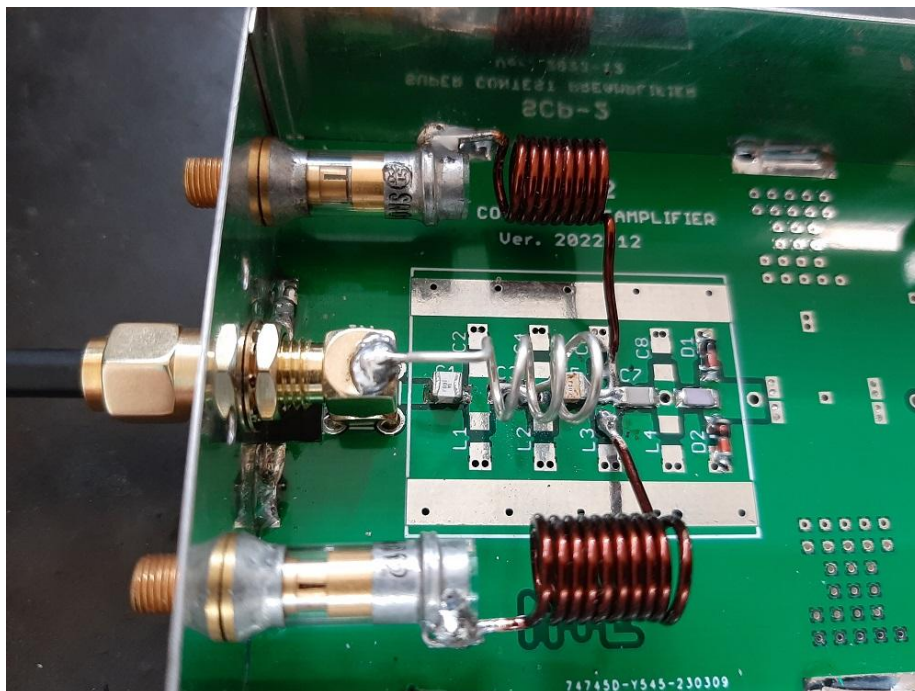
7. Technical data:

Technical data	SCP2	SCP2P
Frequency range:	144-148MHz	144-148MHz
Noise figure @ 20°C NF:	< 0.8 dB	< 0.8dB
Gain S21, typ.:	22 (var. 17-22 dB)	21 (var. 16-21dB)
Input return loss	>20dB	>20 dB
Output return loss	>20 dB	>20 dB
OIP3:	➤ +32dBm	➤ +31dBm
IIP3:	typ. +11dBm	typ. +10dBm
Devices:	2x ALN0140WT	2x PGA103+
Max. Input level:	22dBm	20dBm
Operating voltage:	+12...+15V	+12...+15V
Power consumption:	140mA	190mA
Dimensions:	114x58x32mm	114x58x32mm
Weight:	120g	120g
RF connectors:	2x N,BNC or SMA female	2X N,BNC or SMA female

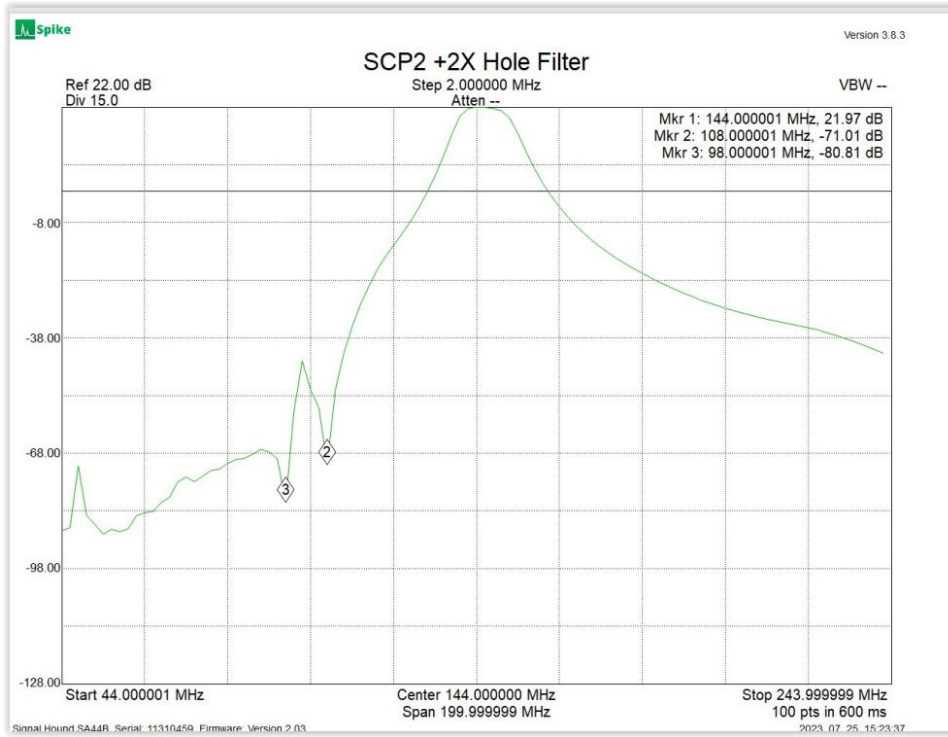
8.Conclusions:

We have designed a high dynamic range real 50 Ohm I/O LNA for the 2m band. Both LNA has excellent thermal and RF stability and $< 0.8\text{dB}$ NF. If you short the F3 you can supply the preamp by the inner line of the coax cable. We offer both types for quality contest operations. Both types produce much higher OIP3 than the well-known HA8ET EXTRA2 and VLNA-144 preamplifiers. We can use these LNA 30meter distance from professional FM broadcast stations (500W and 1KW ERP, hor. polarisation.) on HG1W contest station. Both neighbour FM broadcast produce about 0dBm level at our antennas feedpoints.

In our case, the input selectivity could be further increased by using 2 hole filters for 98 and 107MHz (QRM FM radio frqs):



The next page shows the transfer characteristics of preamplifiers with hole filters.



Many thanks to HG5AZB for the measurements and instructions!
