

Characterisation and Measurements of High Pass Filters and Notch Filters

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Acronyms

- HPF** High Pass Filter
- NF** Notch Filter
- SN** Serial Number

1 Introduction

This report aims to gather information on the characterisation of two Narrowband High Pass Filters and two Notch Filters.

The purpose of using these components is to obtain the output resulting from the combination of both types of devices, utilising components previously acquired by Yebes Observatory.

The components used in this report are as follows:

- **High Pass Filters (HPFs):** Passband from 3 GHz up to 18 GHz .
- **Notch Filters (NFs):** Passband from 3.518 GHz up to 3.8 GHz .

2 Notch Filters

The model of the Notch Filters used is **CNF03518M03800Q14A**, manufactured by Concept Microwave. Two filters have been used with the following Serial Numbers (SNs) 20240300564 and 20240300565.

These devices have the following specifications:

- **Notch Band:** $3.518\text{ GHz} - 3.8\text{ GHz}$.
- **Passband:** $DC - 3.485\text{ GHz}$ & $4\text{ GHz} - 14\text{ GHz}$.
- **Rejection:** $\geq 50\text{ dB}$.

A picture of the device is shown in Figure 2.1, and the data sheet is provided in Appendix A.



Figure 2.1: Picture of a NF. SN: 20240300564.

Figures 2.2 and 2.3 show the S -parameters of the NF with SNs 20240300564 and 20240300565, respectively. As seen in Figure 2.2, measurements of the S_{21} indicate that the $BW_{3\text{ dB}}$ is about 300 MHz , ranging from 3.5 GHz up to 3.8 GHz . Similar measurements are presented in Figure 2.3. Both filters exhibit an insertion loss of approximately 0.6 dB , measured at 3.2 GHz . As shown in both figures the rejection of both filters exceeds 50 dB .

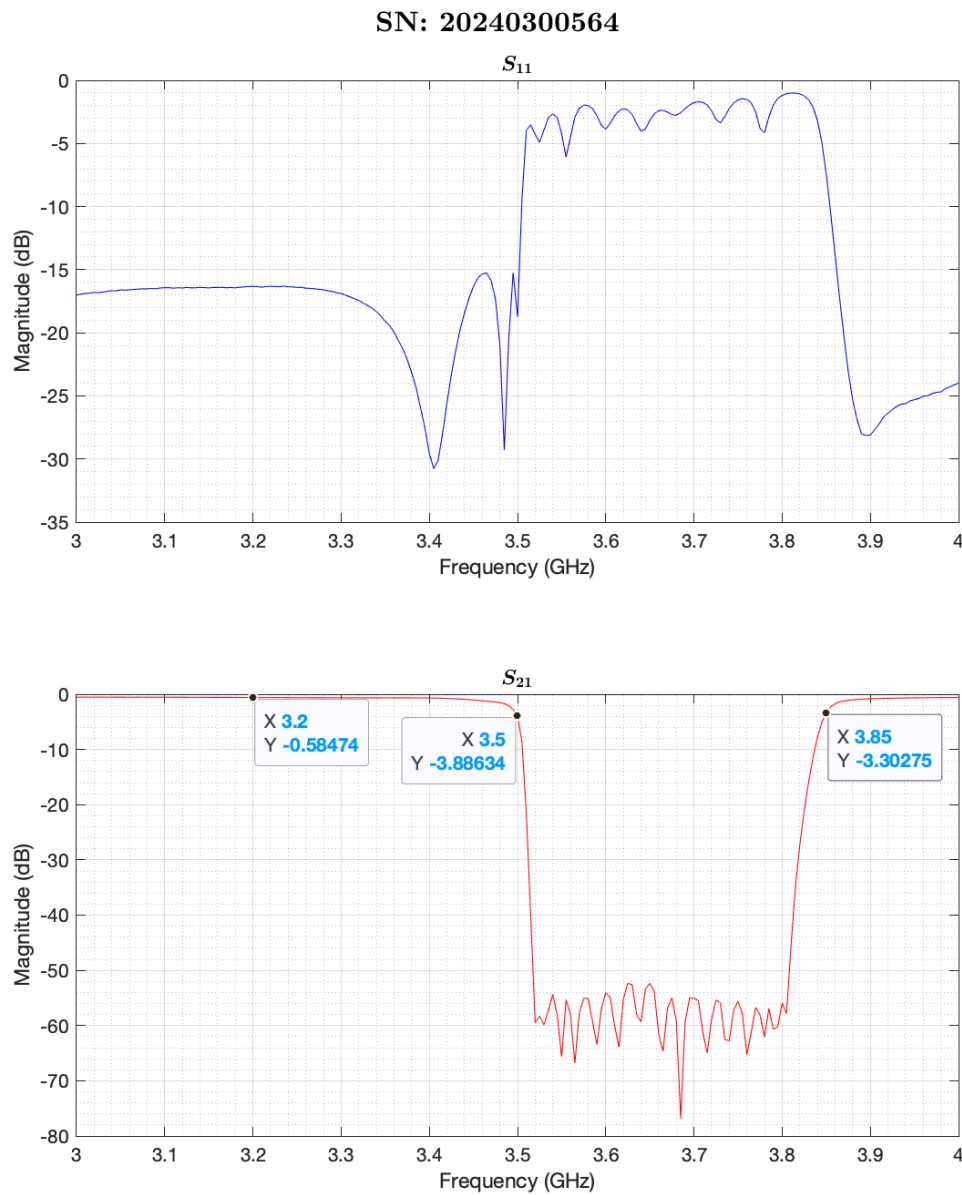


Figure 2.2: S -parameters of the NF. SN: 20240300564.

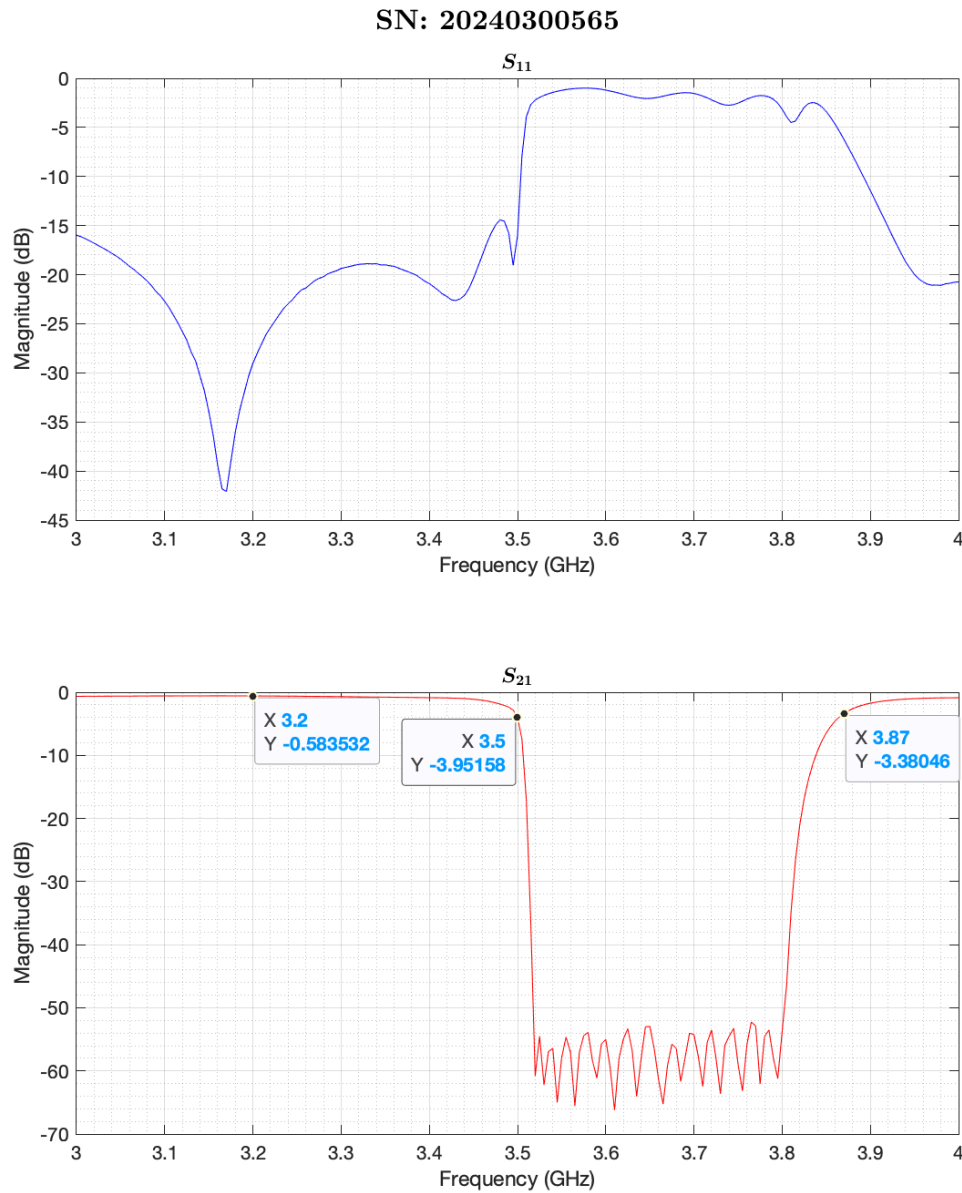


Figure 2.3: S -parameters of the NFs. SN: 20240300565.

3 High Pass Filters

The model of the High Pass Filters used is NHPF0300.1800SM, manufactured by NEOTech. Two filters have been used with SNs 21277001 and 21277002.

These devices have the following specifications:

- **Passband:** $3\text{ GHz} - 18\text{ GHz}$.

A picture of the device is shown in Figure 3.1, and the data sheet is provided in Appendix B.



Figure 3.1: Picture of a HPF.

Figures 3.2 and 3.3 show the S -parameters of the HPF with SNs 21277001 and 21277002, respectively. As seen in Figure 3.2, measurements of the S_{21} indicate that the both filters exhibit an insertion loss of approximately 0.4 dB , measured at 5 GHz . The band pass begins just below 3 GHz , with insertion loss increasing near 11 GHz up to 18 GHz , which marks the end of the passband. At 15 GHz , the insertion loss is about 0.9 dB .

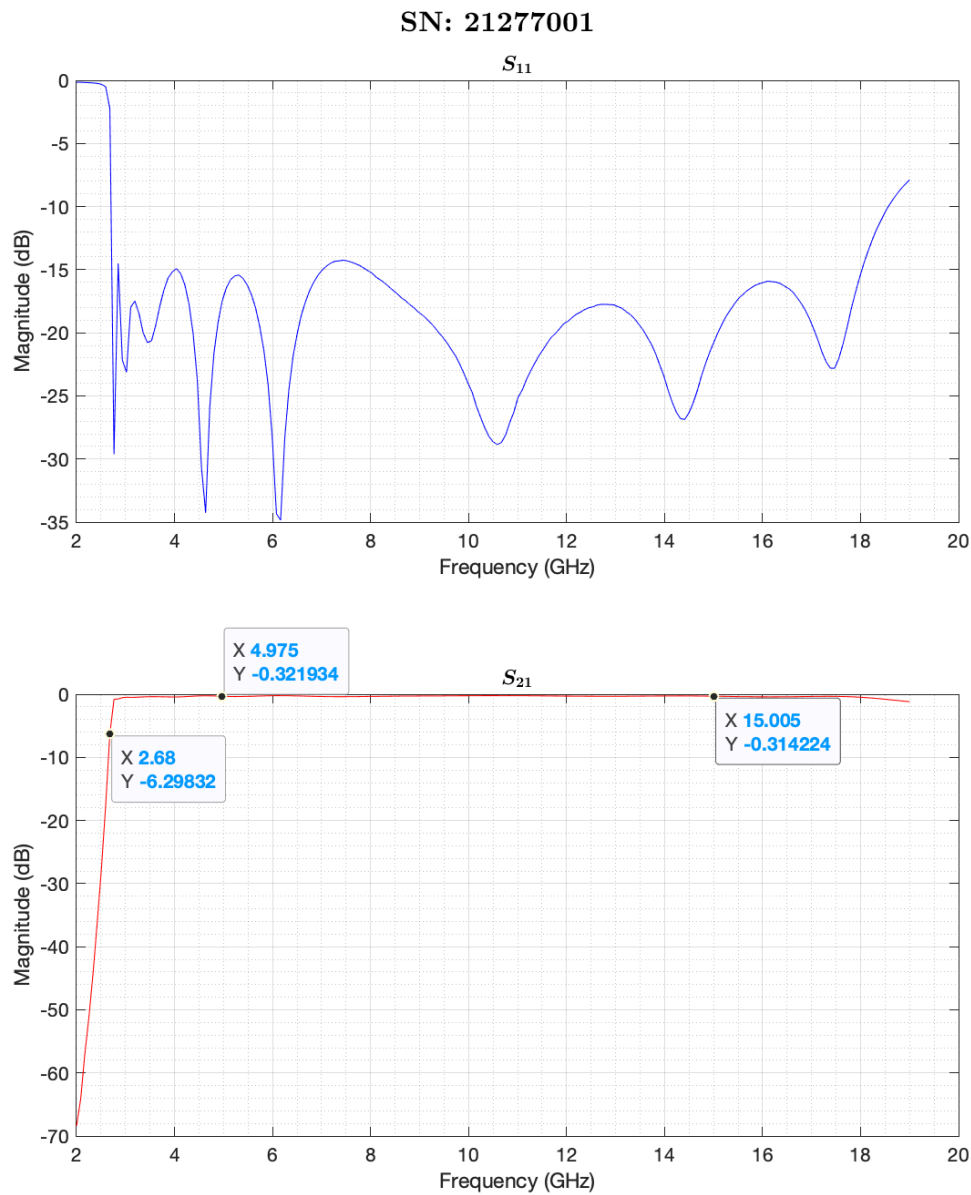


Figure 3.2: S -parameters of the HPFs. SN: 21277001.

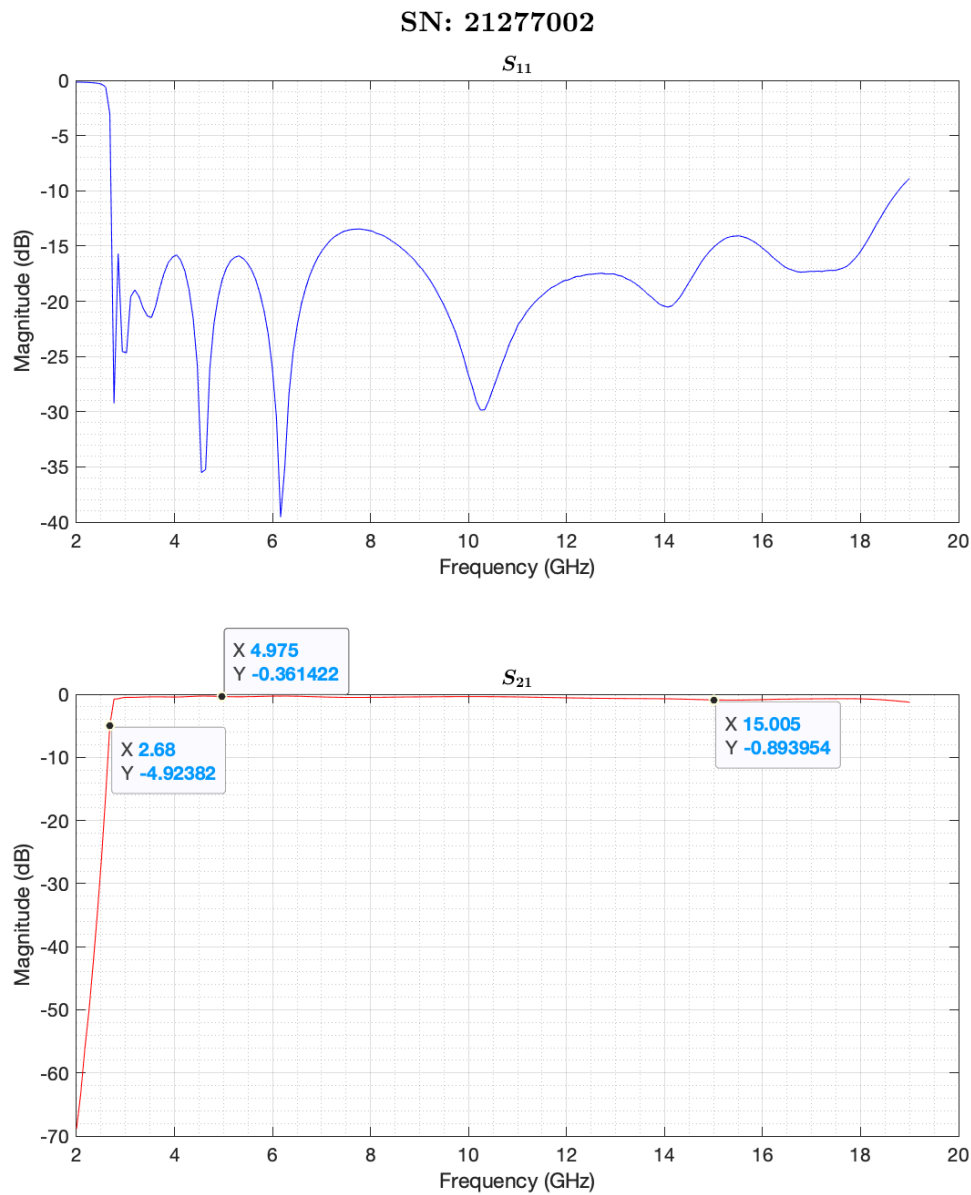


Figure 3.3: S -parameters of the HPFs. SN: 21277002.

4 Combination of HPFs and NFs

After characterising both types of filters, the final connection between them is illustrated in Figure 4.1.

The connections between these filters and the network analyser are as follows:

- Port 1 → SN: 21277001 (HPF) → SN: 20240300564 (NF) → Port 2
- Port 1 → SN: 21277002 (HPF) → SN: 20240300565 (NF) → Port 2

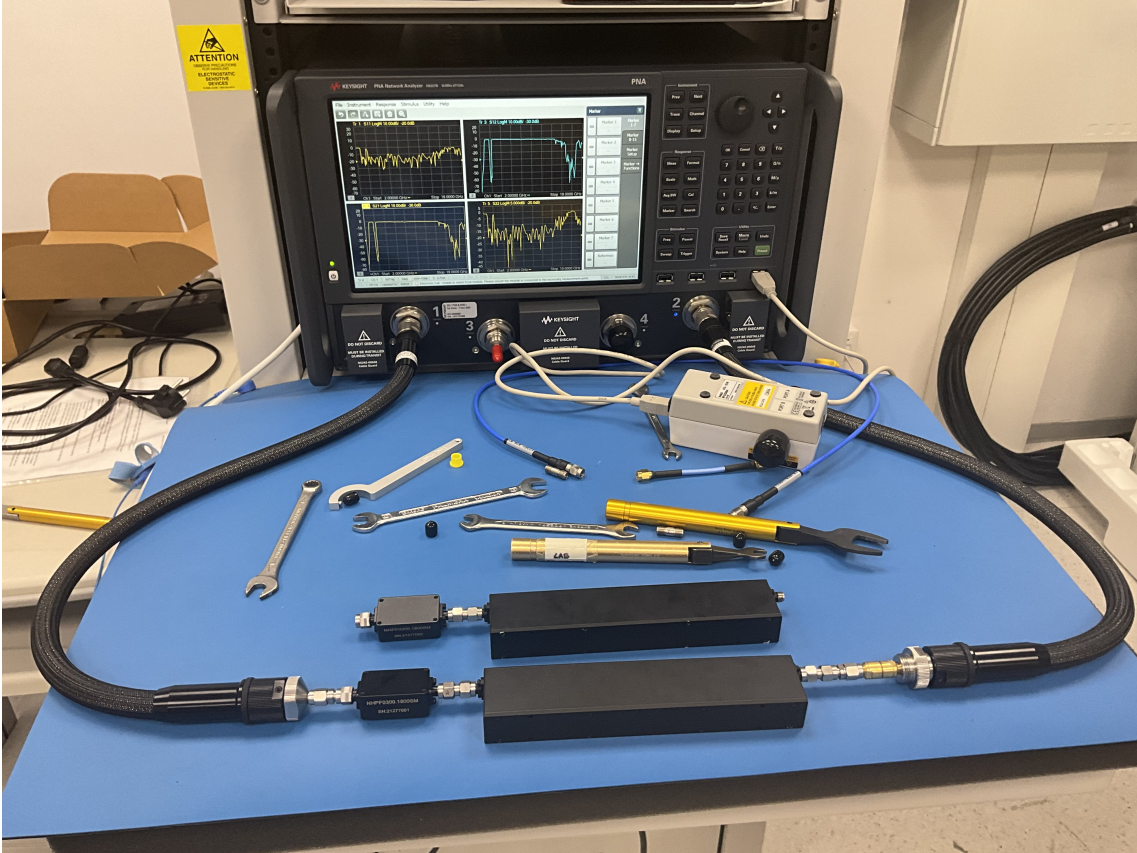


Figure 4.1: Combination of a NF and a HPF. SN: 21277001 → SN: 20240300564.

Figures 4.2 and 4.3 show the S -parameters of the previously mentioned combinations. In both cases, insertion loss is measured at approximately 10 GHz .

The first combination exhibits an insertion loss of 1.34 dB , while the second one shows a slightly higher insertion loss of 1.47 dB . These figures highlight the notch produced by the NFs and the degradation about 14 GHz as the passband of the NFs extends is up to 14 GHz .

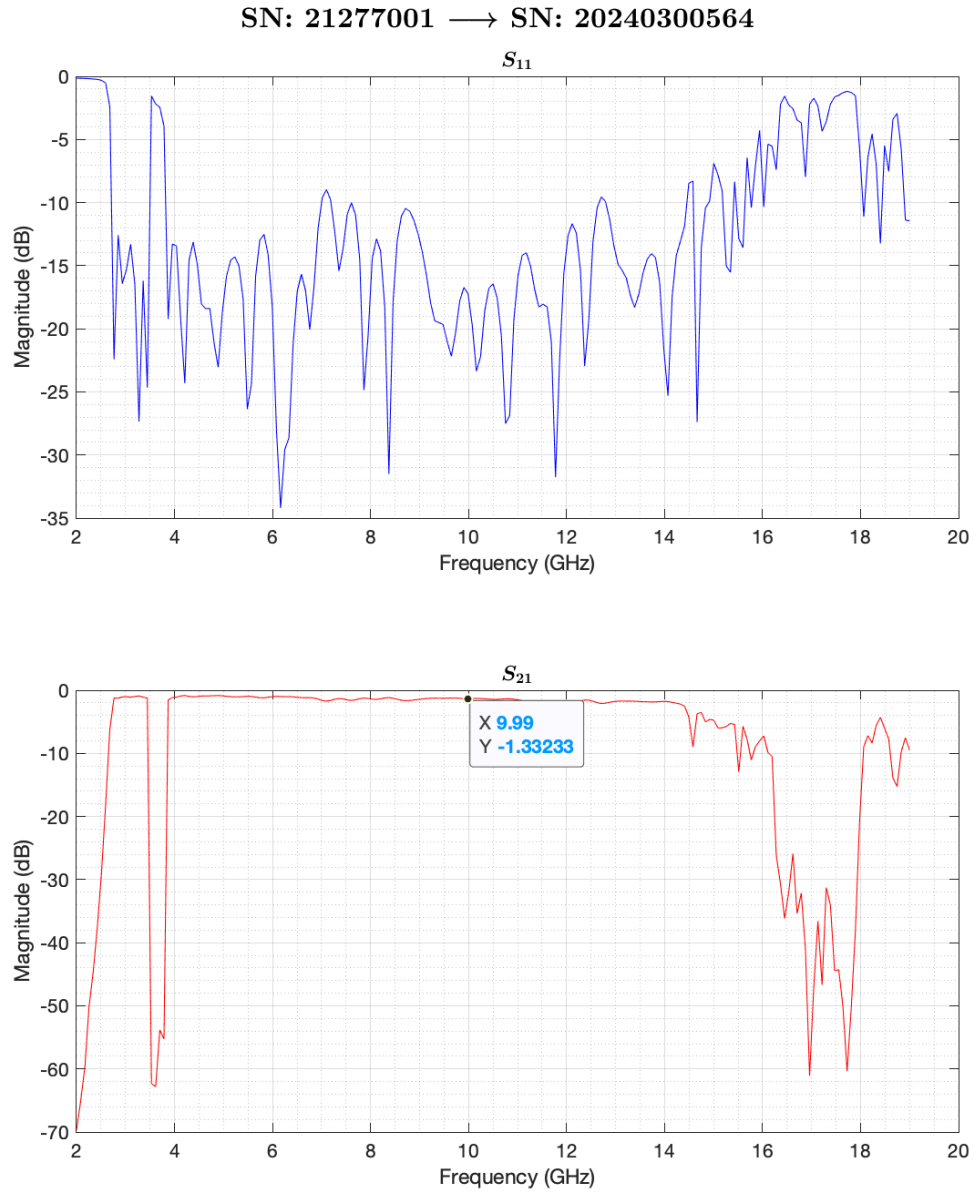


Figure 4.2: S -parameters of the combination of a NF and a HPF. SN: 21277001 → SN: 20240300564.

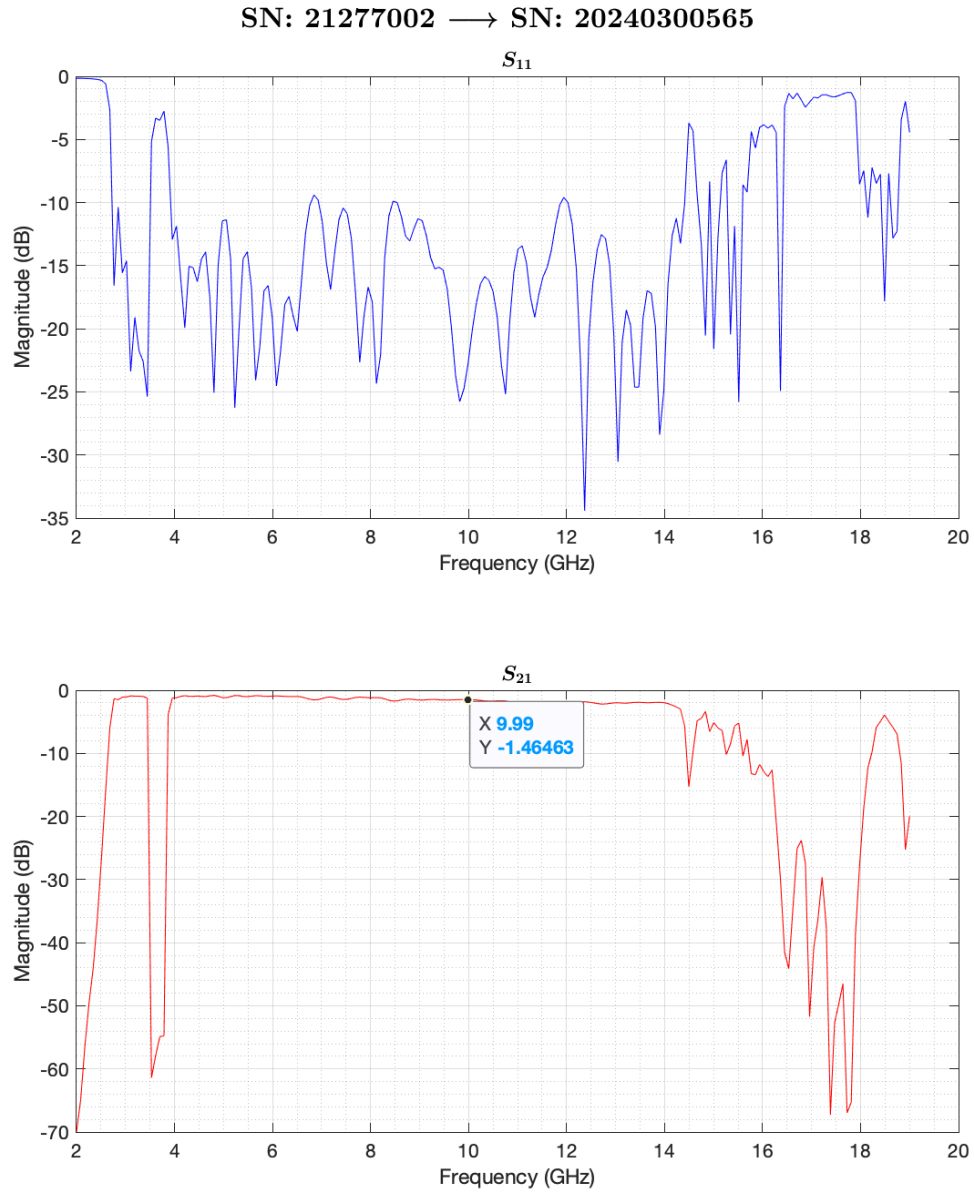


Figure 4.3: S -parameters of the combination of a NF and a HPF. SN: 21277002 → SN: 20240300565.

A Data sheet: Notch Filter (CNF03518M03800Q14A)

1. Feature

- ▶ High Performance
- ▶ High Reliability
- ▶ RoHS Compliant

Notch Filter

Part No: CNF03518M03800Q14A

Date: Feb.5th.2024

Revision No: Preliminary

2. Electrical Specifications

Parameter	Specification	Remark
Notch Band	3518-3800MHz	
Rejection	≥50dB	
Passband	DC-3485MHz & 4000-14000MHz	
Insertion loss	≤2.0dB	
VSWR	≤1.8	
Average Power	≤10W	
Impedance	50Ω	

3. Mechanical Specifications

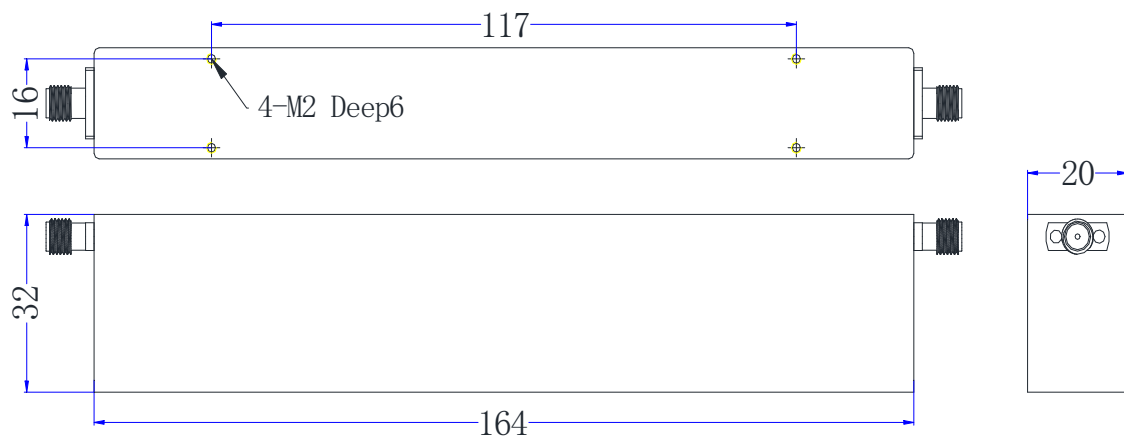
Parameter	Specifications	Remark
Dimensions	164.0 x 32.0 x 22.0 mm (Not including the tuning screws and connectors)	
Connector Type	SMA- female	
Surface Finish	Black Painting	

4. Temperature Specifications

Parameter	Specifications	Remark
Operational Temperature	0 to +50 °C	
Storage Temperature	-55 to +85 °C	



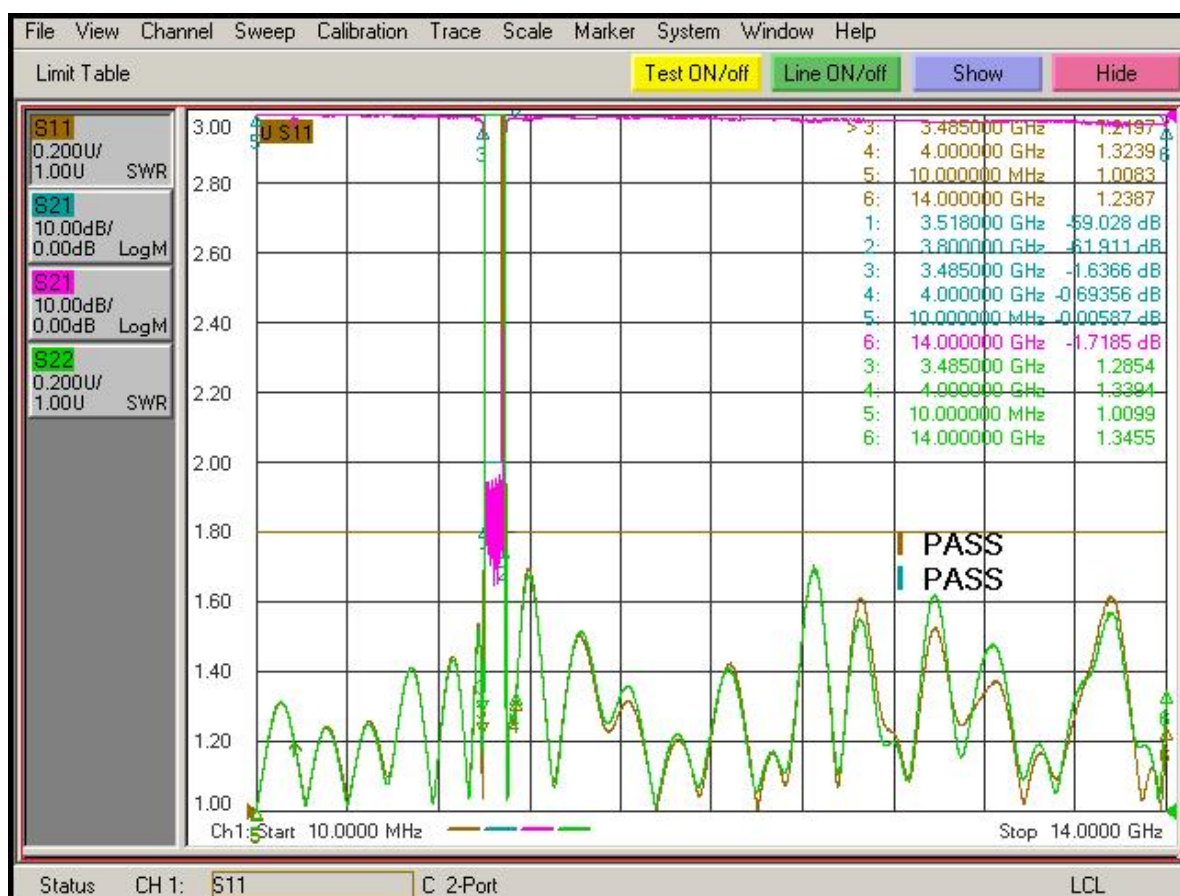
5.Outline Drawing ($\pm 0.5\text{mm}$)



6.Test Curve



CONCEPT



B Data sheet: High Pass Filter (NHPF0300.1800SM)



NEOTECH

NHPF0300.1800SM

HIGH PASS FILTER

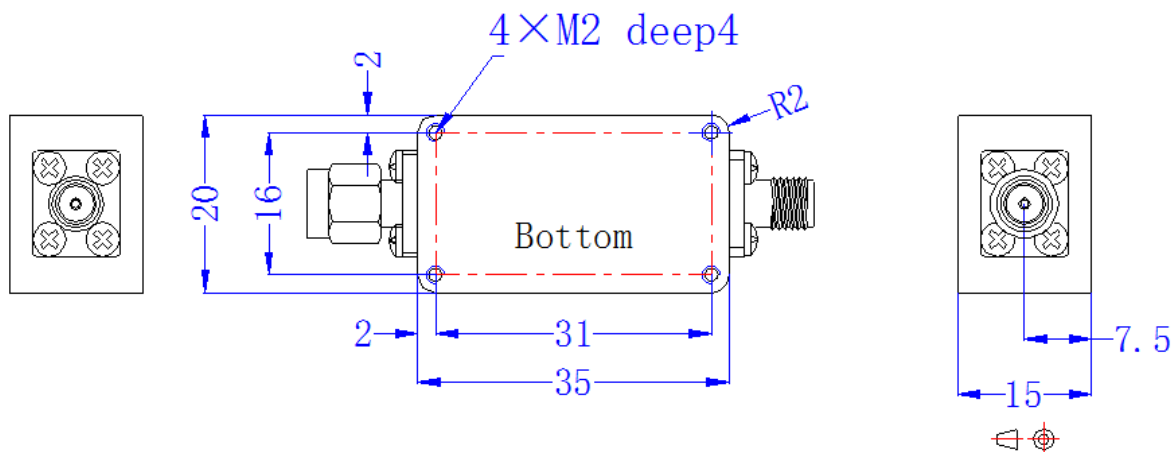
DATASHEET

ELECTRICAL SPECIFICATIONS

Parameter	Minimum	Typical	Maximum	Units
Frequency Range	3	-	18	GHz
Pass Band Insertion Loss	-	-	1.2	dB
Pass band Return loss	12	-	-	dB
Rejection at DC -2300Mhz	40	-	-	dB
Connector	SMA-Male (In) SMA-Female (Out)			
Operating Temperature Range	-10	-	+50	°C
Impedance	-	50	-	Ω
Finish	Black Paint			

OUTLINE DRAWING

- Dimensions in mm.
- Tolerance dimensions: +/-0.2mm



Rev.	Description	Date	Approved by

For more information, please contact us at info@myneotech.com