Consiglio Nazionale delle Ricerche

IEIIT
Istituto di Elettronica
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e delle Telecomunicazioni

Technical Report

Measured characteristics of the components of the Bar-SPOrt radiometer @ 32 GHz: part D of {A, B, C, D}

IRA 369/04

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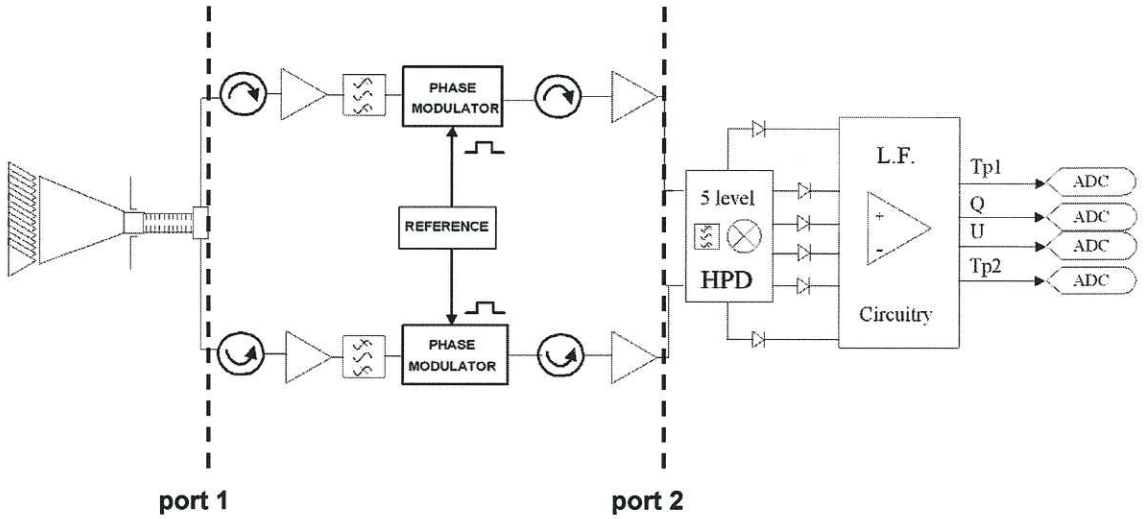
This part D contains the microwave characterization of the two amplifications chains on the basis of the measured data reported in parts A-B of this document.

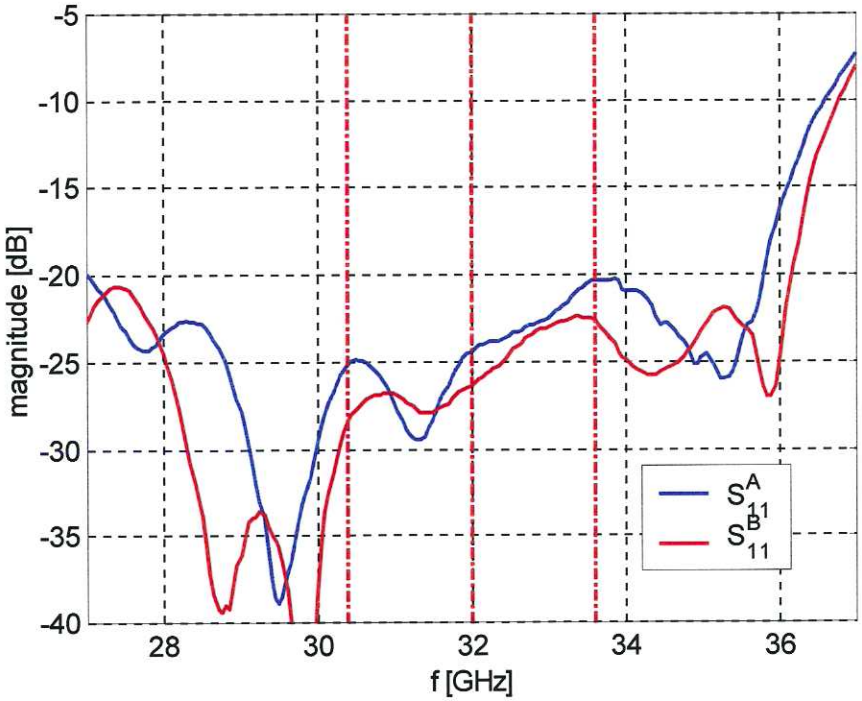


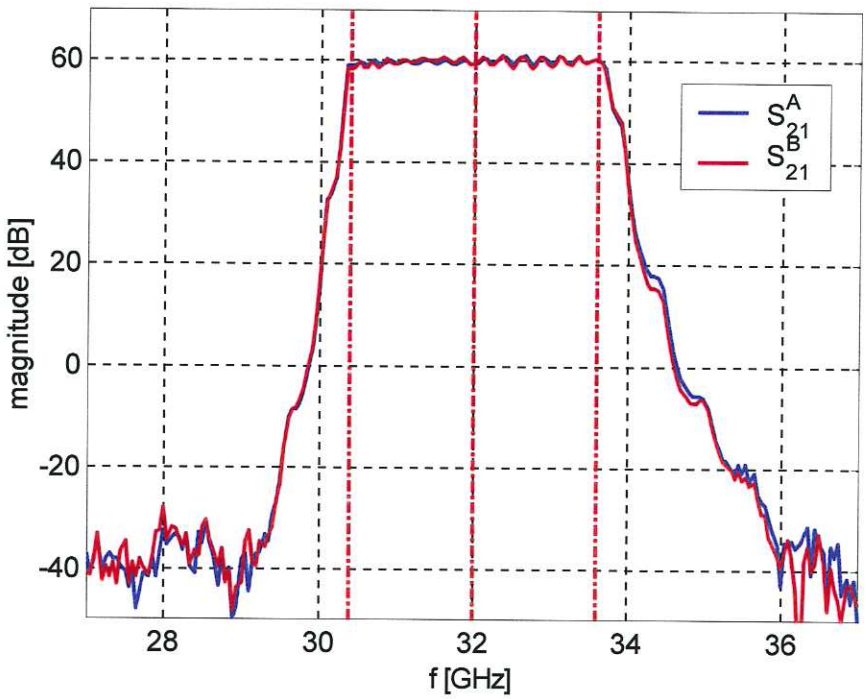
component	chain A	chain B
cryogenic circulator DORADO	SN 003	SN 002
WR28 waveguide line	12.000 mm	12.000 mm
cold LNA NRAO	SN AM001	SN AM003
WR28 waveguide line	80.000 mm	80.000 mm
S-shape transition IEIIT	SN 001	SN 002
outer filter IEIIT	SN F1	SN F2
WR28 waveguide line	25.000 mm	25.000 mm
phase modulator PMP1640	SN 12	SN 11
isolator DORADO	SN 10	SN 09
warm LNA NRAO	SN AM004	SN AM002

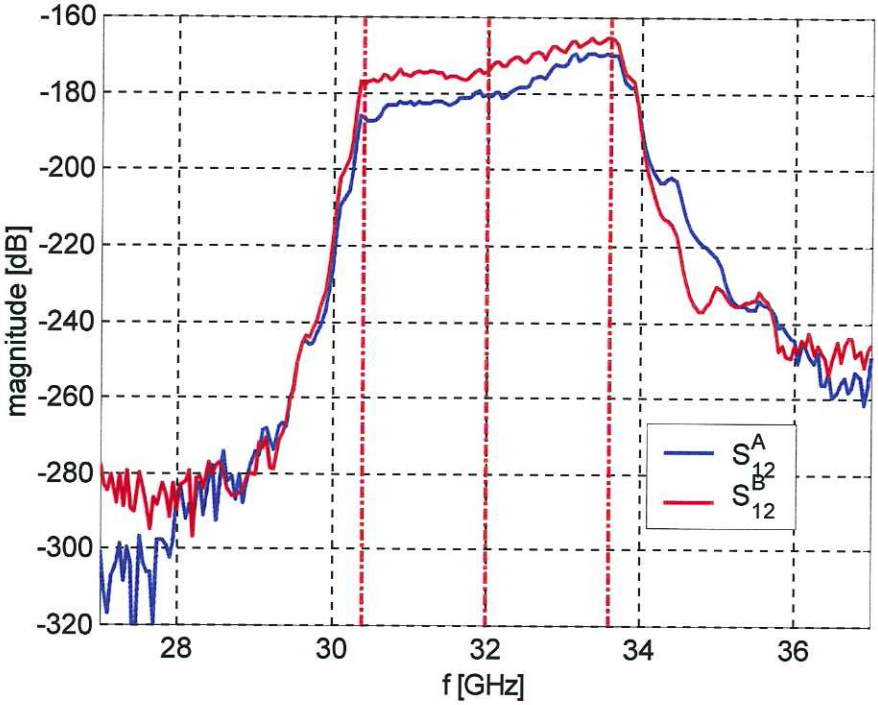
NOTES:

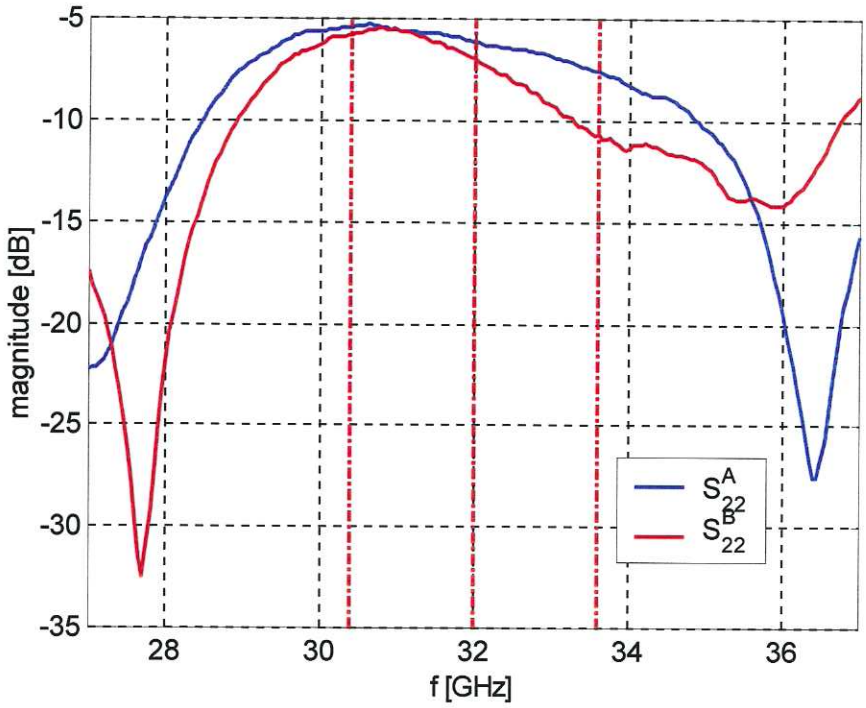
- all the reported data refer to room temperature;
- the microwave characterization of the entire chain was evaluated by cascading the measured scattering parameters of the components (slow prototyping); a mono-modal interaction between the components was assumed;
- the two outer filters can be interchanged without any significant degradation of the presented results;
- the input reflection @ port 1 of both channels is basically due to the cryogenic circulators;
- the in-band ripples in the transmission coefficients are caused by multi-reflections occurring between the amplifiers and the isoltators;
- correlation evaluation: $$Y = \frac{\langle A \cdot B^{*} \rangle}{\sqrt{\langle |A|^{2} \rangle \cdot \langle |B|^{2} \rangle}} = \frac{\int_{\Delta\omega} S_{21}^{(A)} S_{21}^{(B)*} e^{+jk_z l} d\omega}{\sqrt{\int_{\Delta\omega} |S_{21}^{(A)}|^{2} d\omega \cdot \int_{\Delta\omega} |S_{21}^{(B)}|^{2} d\omega}}$$

Measured characteristics when the phase modulators are @ status 1

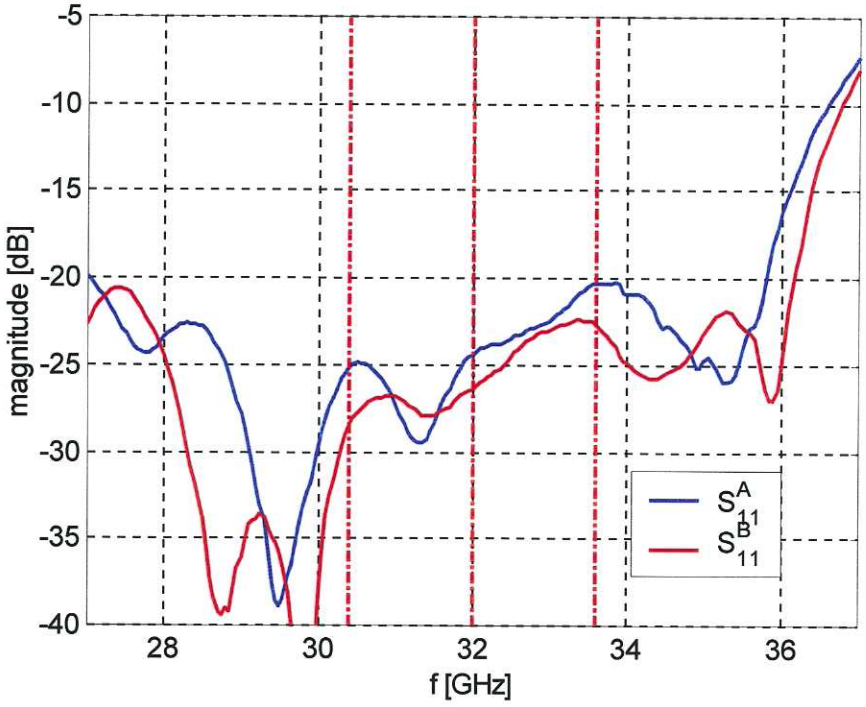


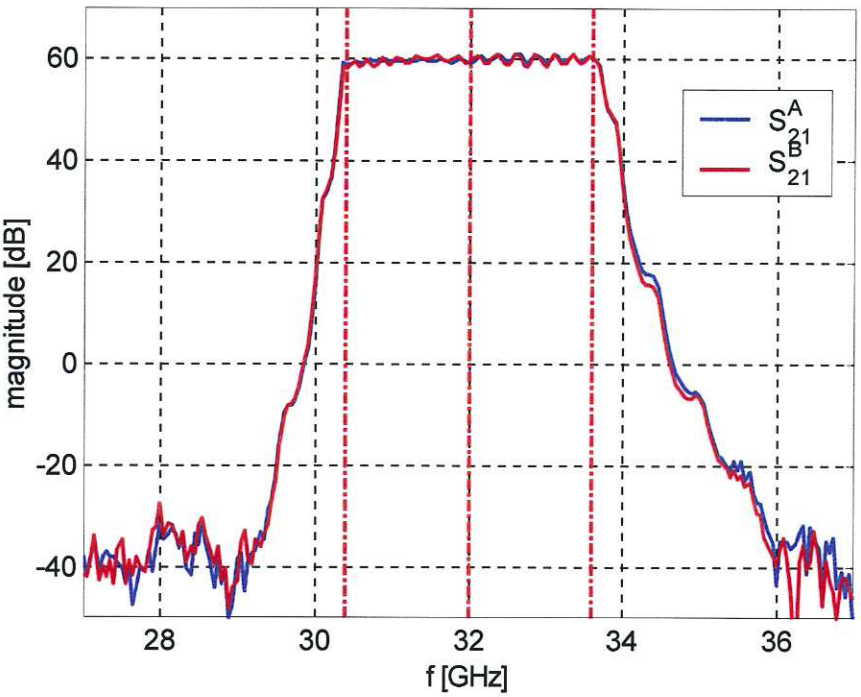

60
40
20
0
-20
-40
magnitude [dB]
28
30
32
34
36
f [GHz]
S_{21}^{A}
S_{21}^{B}

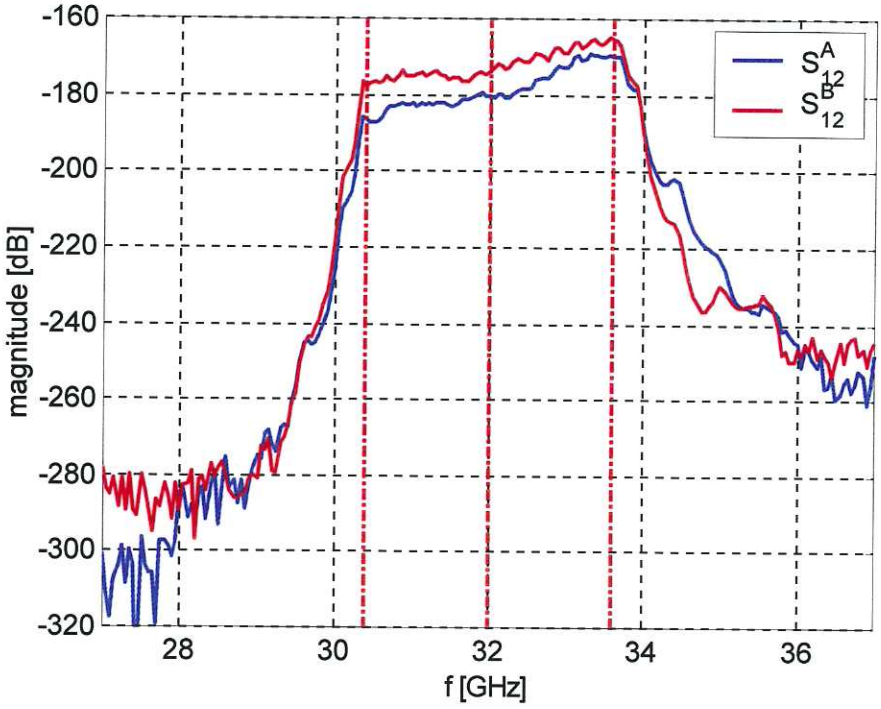

-160
-180
-200
-220
-240
-260
-280
-300
-320
magnitude [dB]
28
30
32
34
36
f [GHz]
S_{12}^{A}
S_{12}^{B}

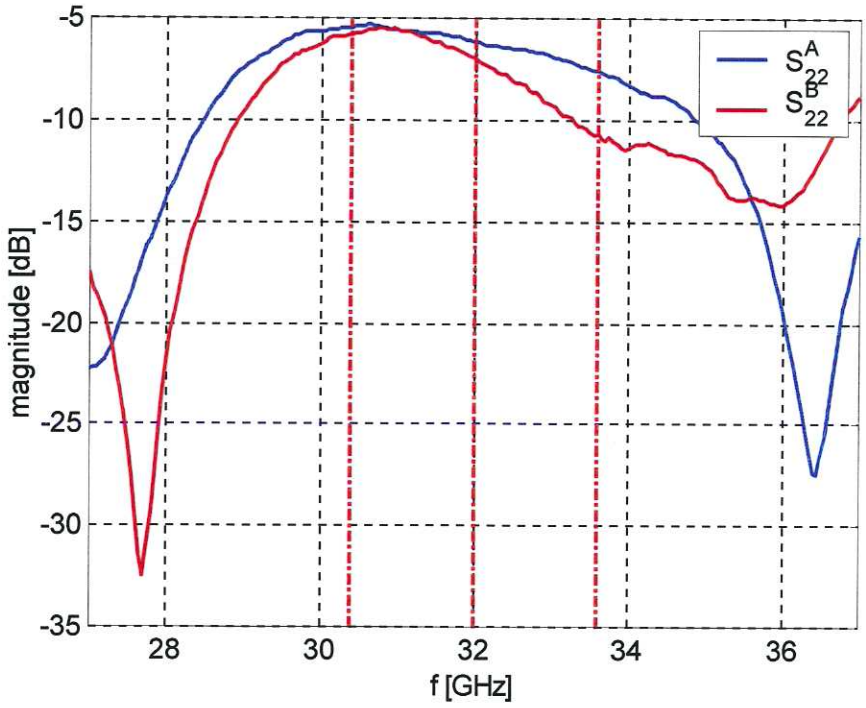

-5
-10
-15
-20
-25
-30
-35
magnitude [dB]
28
30
32
34
36
f [GHz]
S_{22}^{A}
S_{22}^{B}

Measured characteristics when the phase modulators are @ status 2



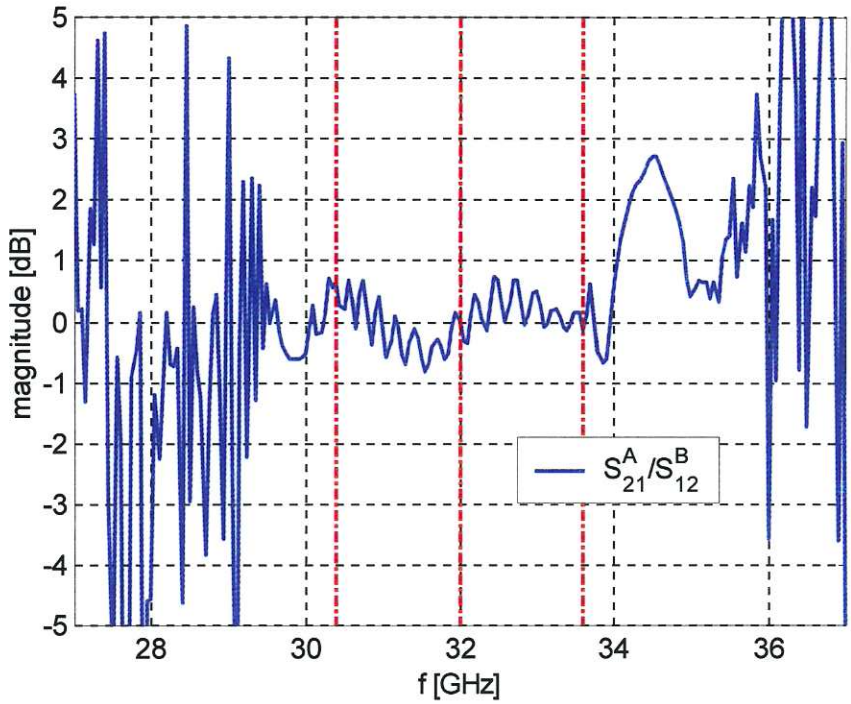


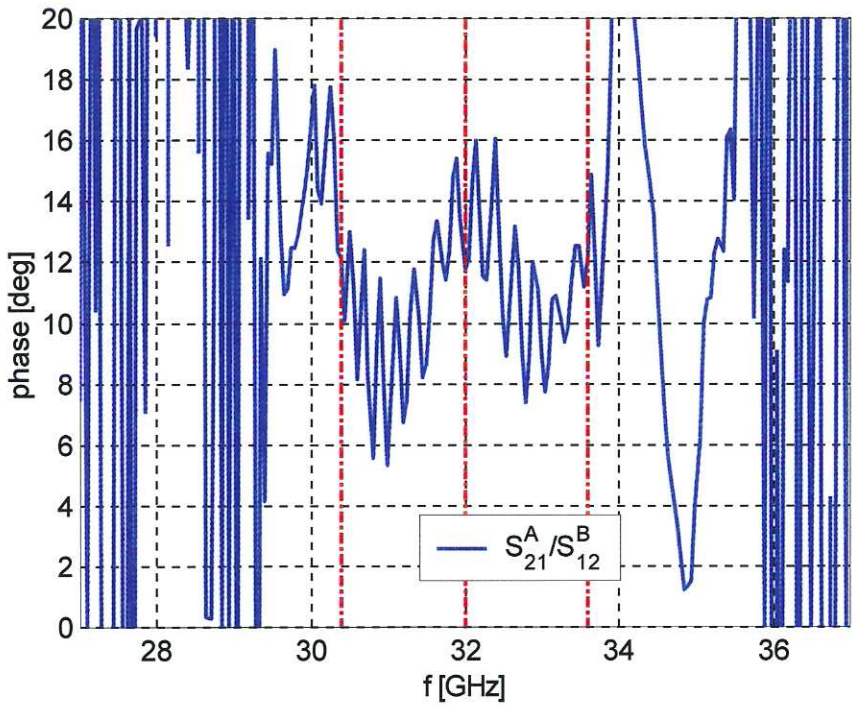

-160
-180
-200
-220
-240
-260
-280
-300
-320
magnitude [dB]
28
30
32
34
36
f [GHz]
S_{12}^{A}
S_{12}^{B}

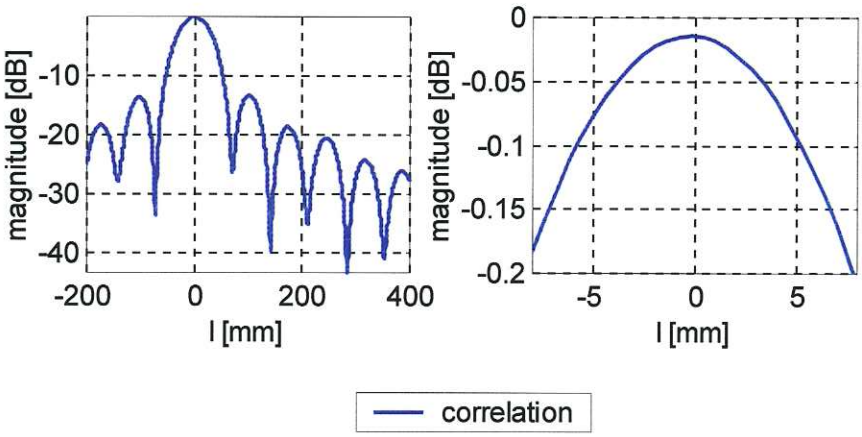

-5
-10
-15
-20
-25
-30
-35
magnitude [dB]
28
30
32
34
36
f [GHz]
S_{22}^{A}
S_{22}^{B}

	mean value of return loss @ port 1	mean value of gain @ port 1	mean value of return loss @ port 2	mean value of insertion loss @ port 2
chain A @ status 1	24.272 dB	60.023 dB	6.162 dB	176.937 dB
chain A @ status 2	24.272 dB	60.097 dB	6.162 dB	176.868 dB
chain B @ status 1	25.276 dB	59.994 dB	7.220 dB	171.249 dB
chain B @ status 2	25.276 dB	60.027 dB	7.220 dB	171.227 dB

Transfer function ratio when the phase modulator of chain A is @ status 1 & the phase modulator of chain B is @ status 1

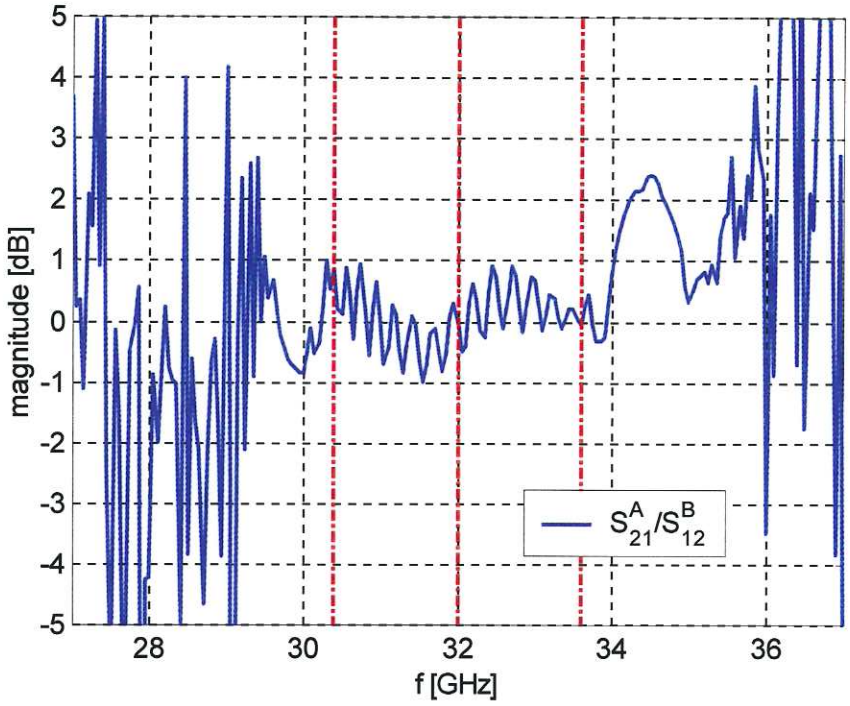


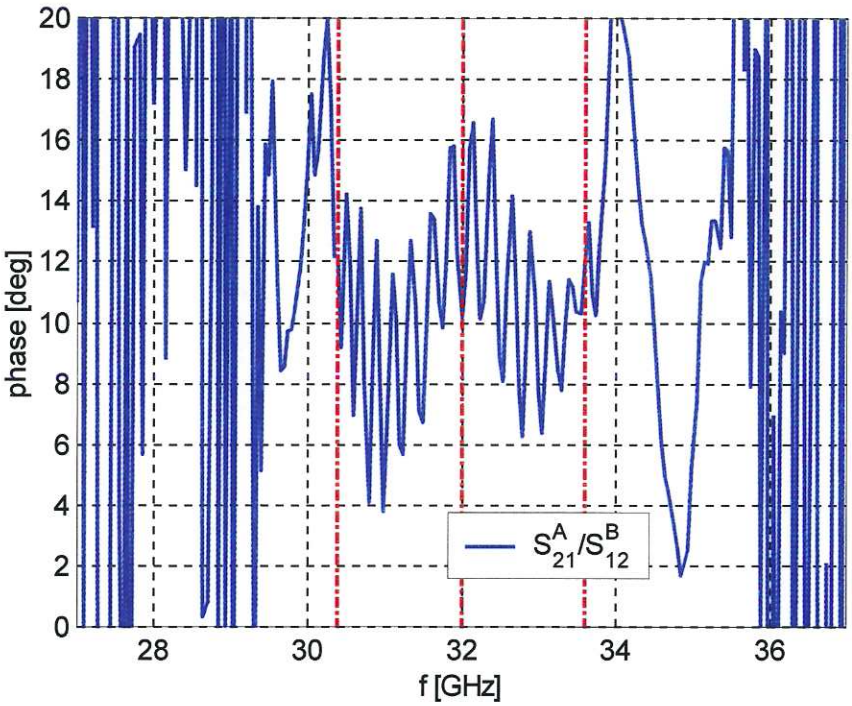


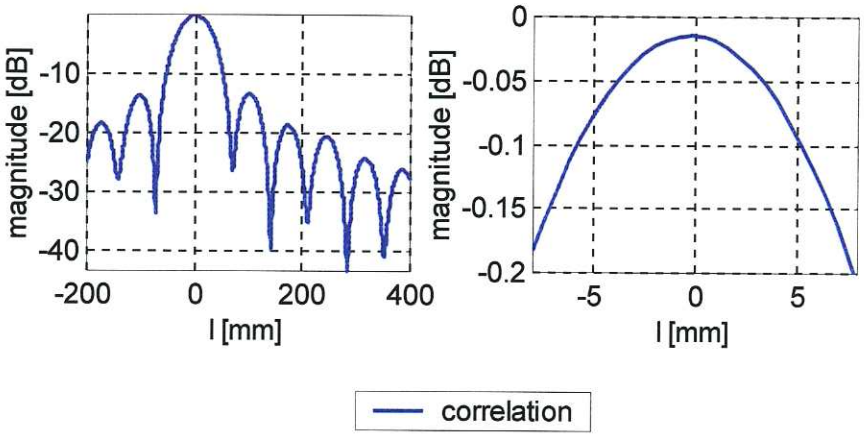


correlation γ = -0.014 dB;

Transfer function ratio when the phase modulator of chain A is @ status 2 & the phase modulator of chain B is @ status 2

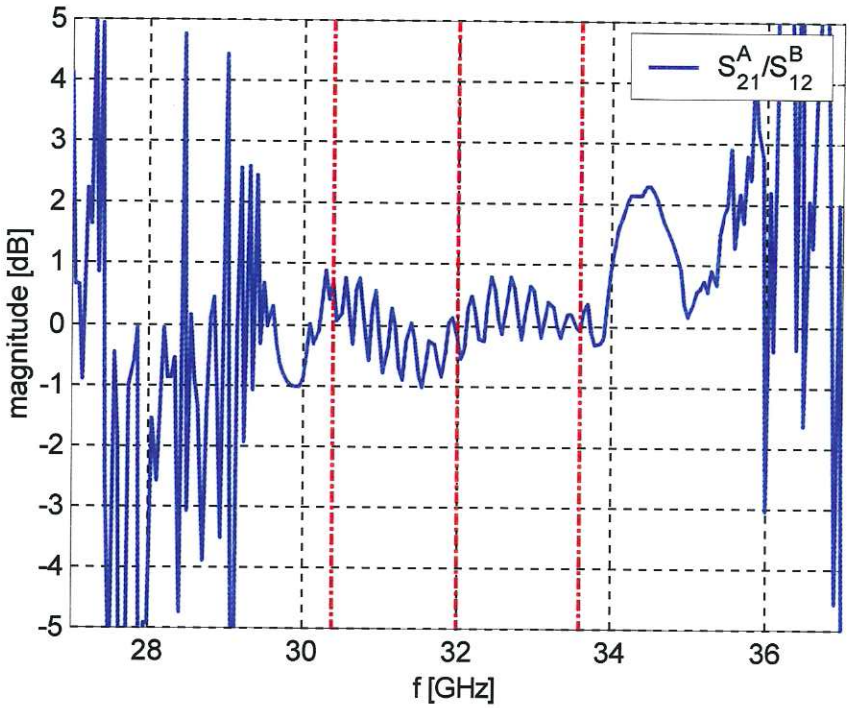


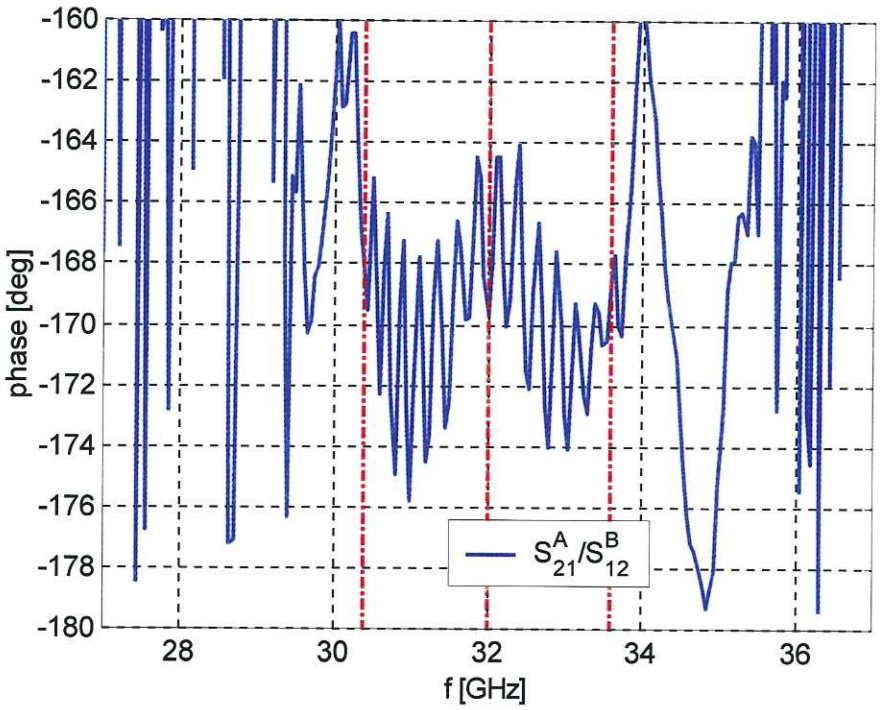


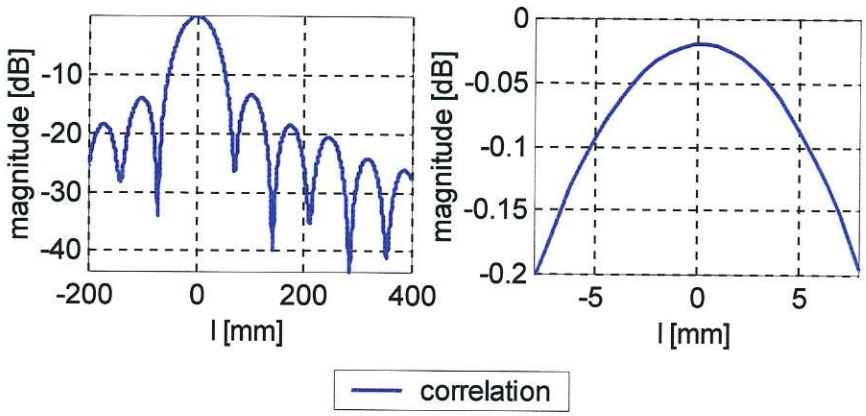


correlation γ = -0.021 dB;

Transfer function ratio when the phase modulator of chain A is @ status 1 & the phase modulator of chain B is @ status 2

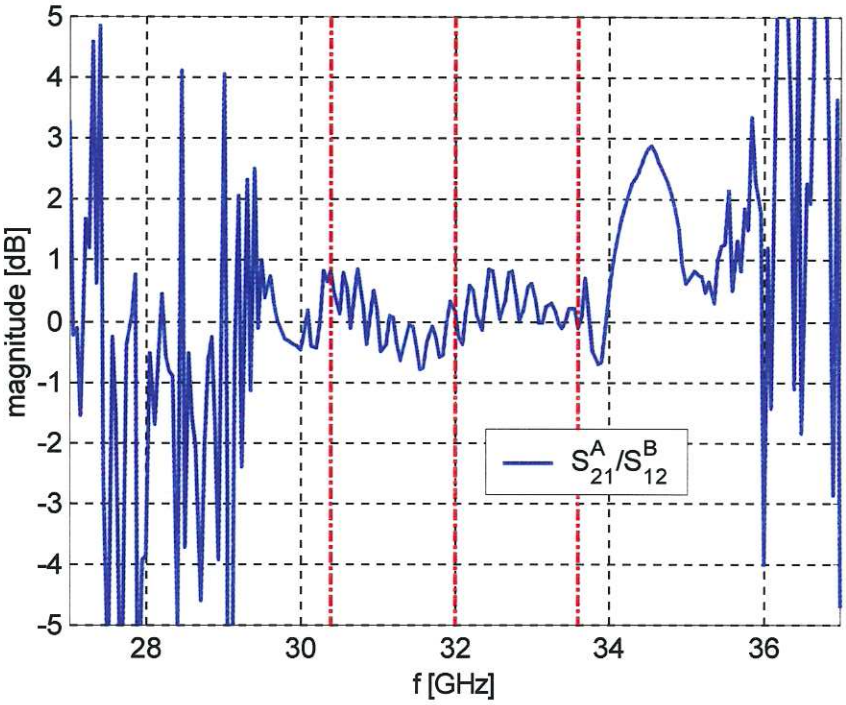


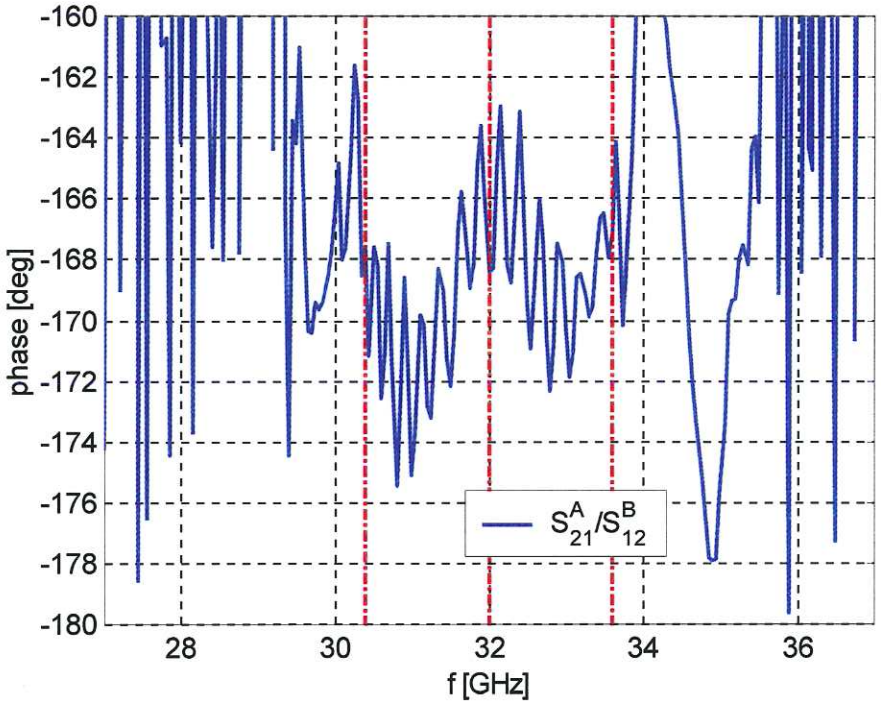


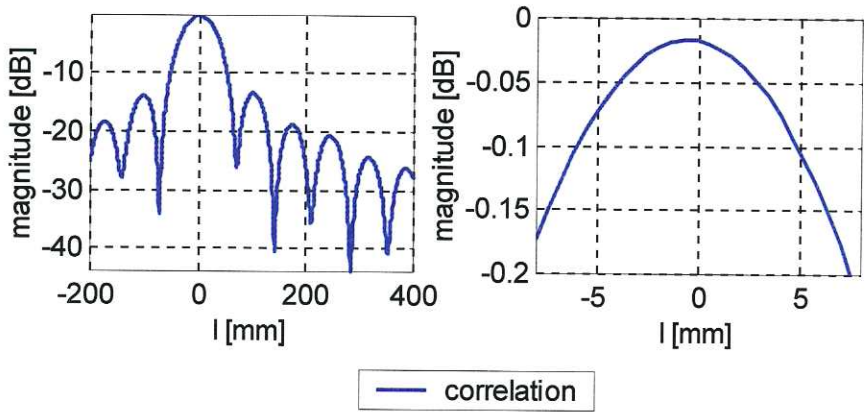


correlation γ = -0.019 dB;

Transfer function ratio when the phase modulator of chain A is @ status 2 & the phase modulator of chain B is @ status 1







correlation γ = -0.017 dB;