MoDeCH

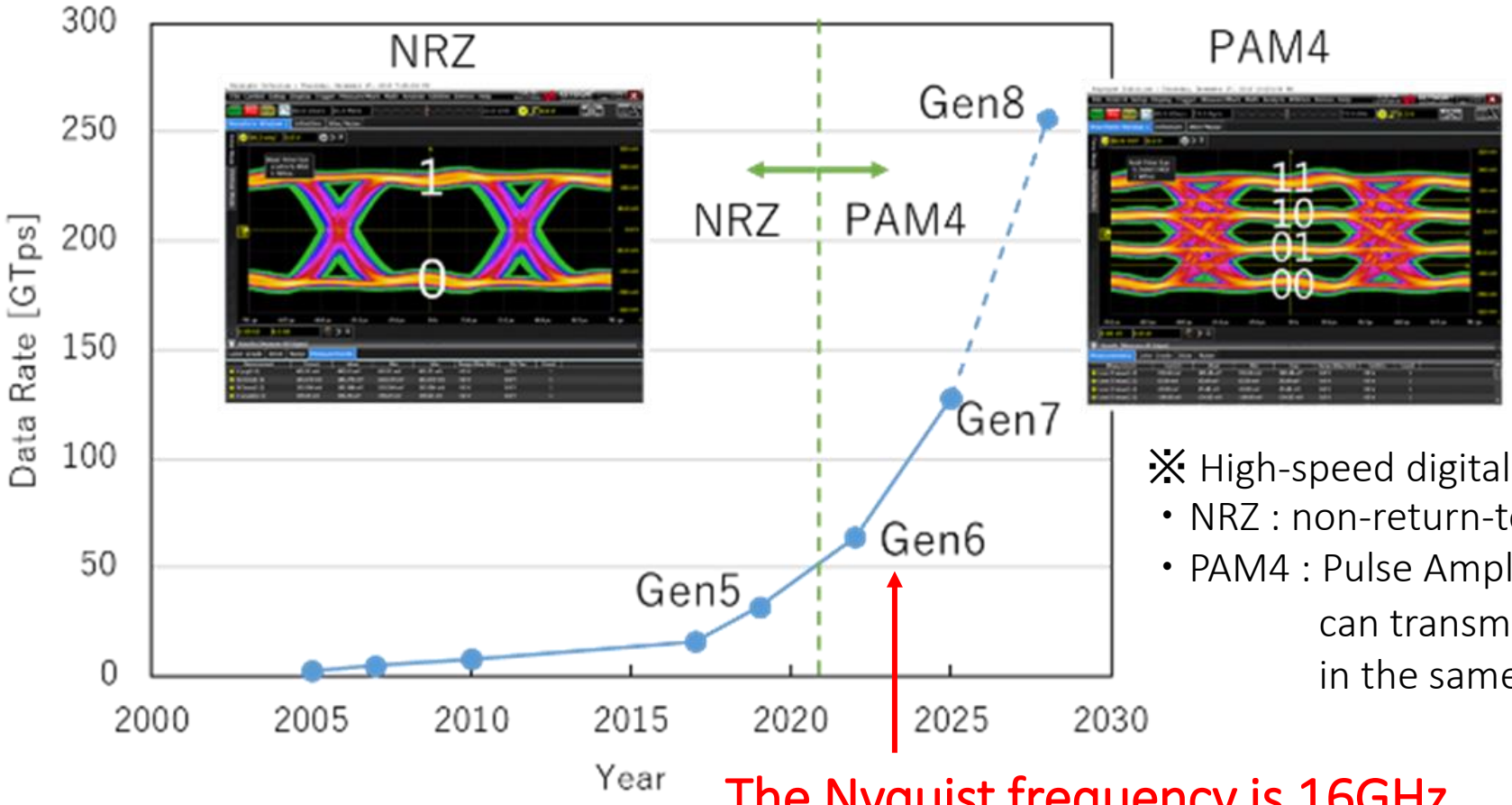
Modeling Design Technology

A 110-GHz Probing System for S-parameter Measurements of Three-Dimensional Objects

Modech Inc., November 11, 2025

To prepare for the next generation

We need high-frequency components from DC to millimeter waves.



※ High-speed digital signal modulation method:

- NRZ : non-return-to-zero
- PAM4 : Pulse Amplitude Modulation 4
  can transmit twice as much data as NRZ in the same amount of time

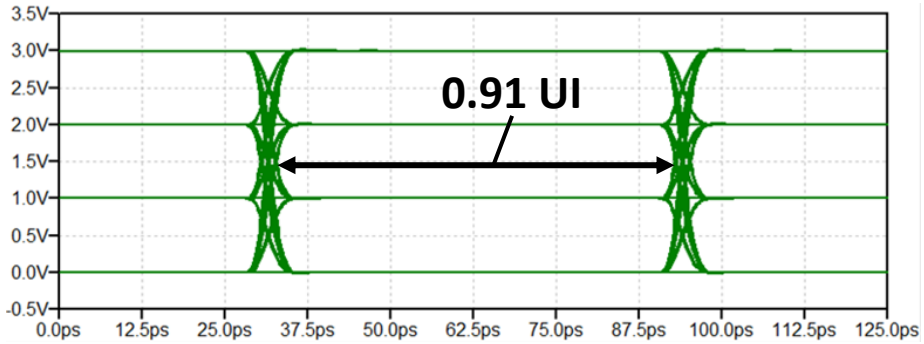
The Nyquist frequency is 16GHz

Source: 2024 54th European Microwave Conference(EuMC 2024)

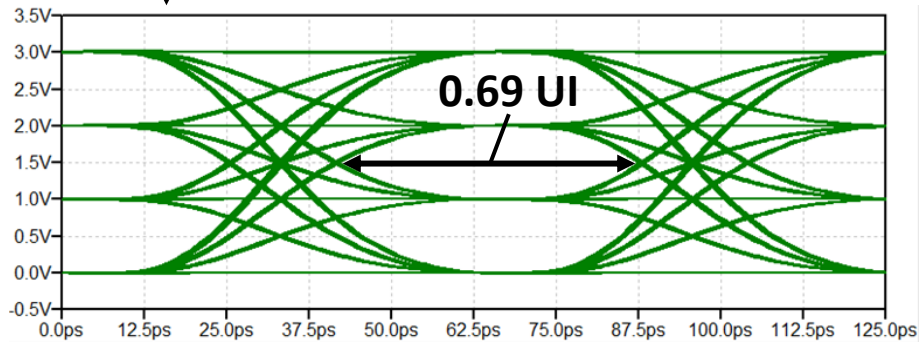
Importance of high-frequency component

Measure accurate wideband characteristics → Obtain precise eye pattern.

16Gbps PAM4 waves (Simulated)



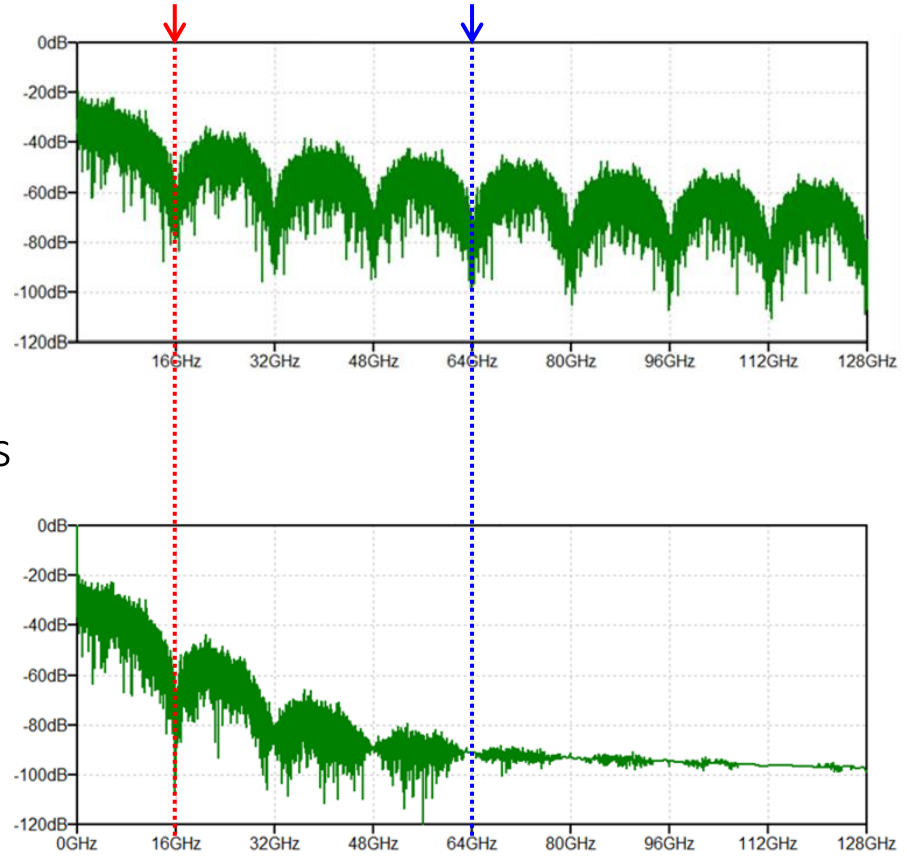
LPF-ed more than 16GHz freq. components



FFT

FFT

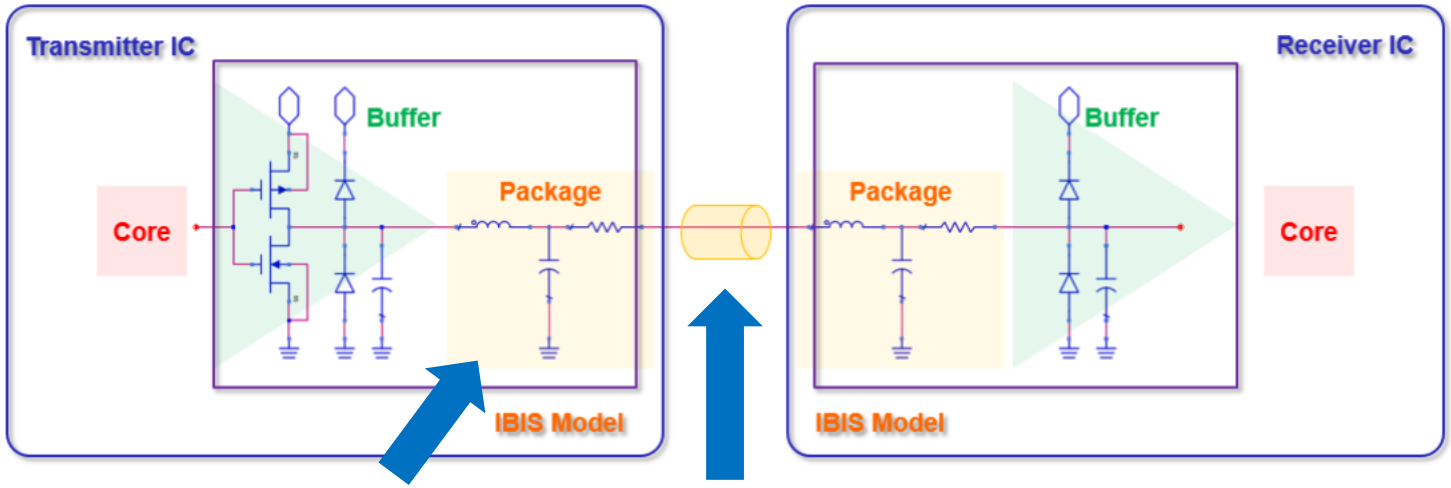
Nyquist Freq. the 4th order of the Nyquist freq.



Source: 2024 54th European Microwave Conference(EuMC 2024)

Package model, Channel model of high-frequency component

Channel and package models are created based on the measurement data.



Package model　　Channel model

Source: JEITA / EDA Model Specialty Committee

1st modeling

Measurement data ⇒ Simulation parameter

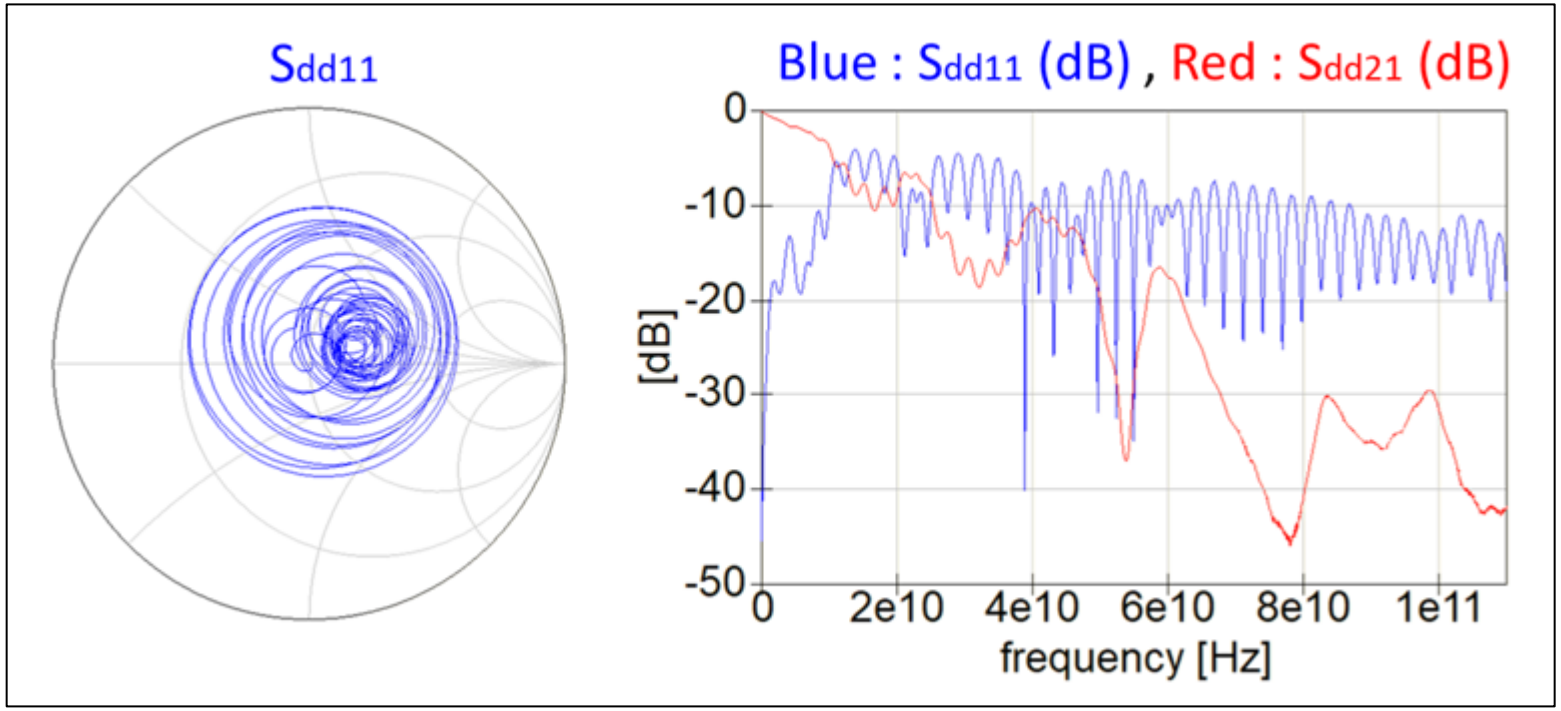
2nd modeling ⇒ Package model

Channel model

S-parameter measurement results for a channel including a connector by MoDeCH

Device to be measured

Measurement results (from 10MHz to 110GHz)



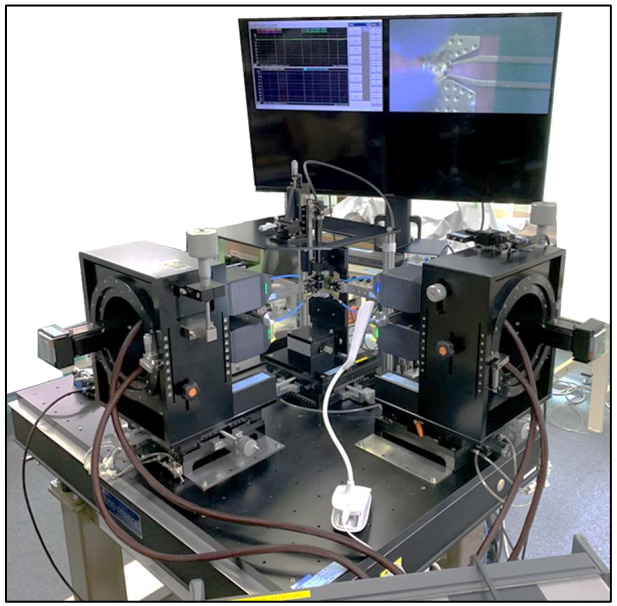
Source: 2024 54th European Microwave Conference(EuMC 2024)

S-parameter Measurements of Three-Dimensional Objects

We developed a system that can change the setup depending on the shape of the structure.

Set up for
flat structure measurement

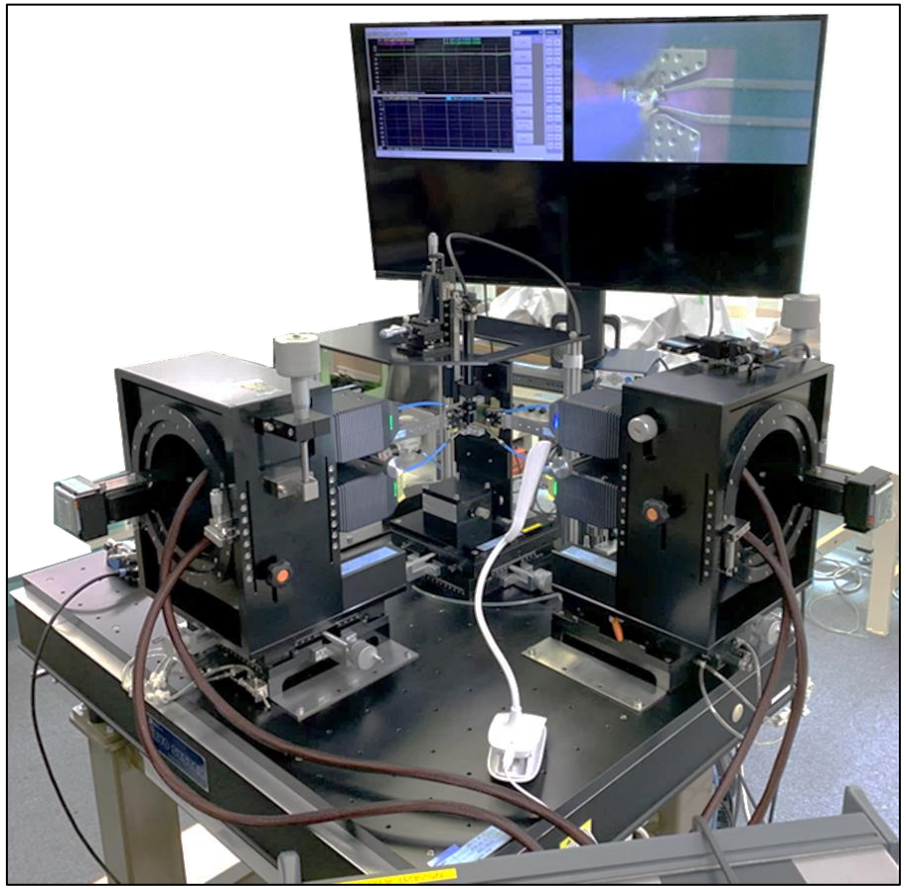
Set up for
bent structure measurement



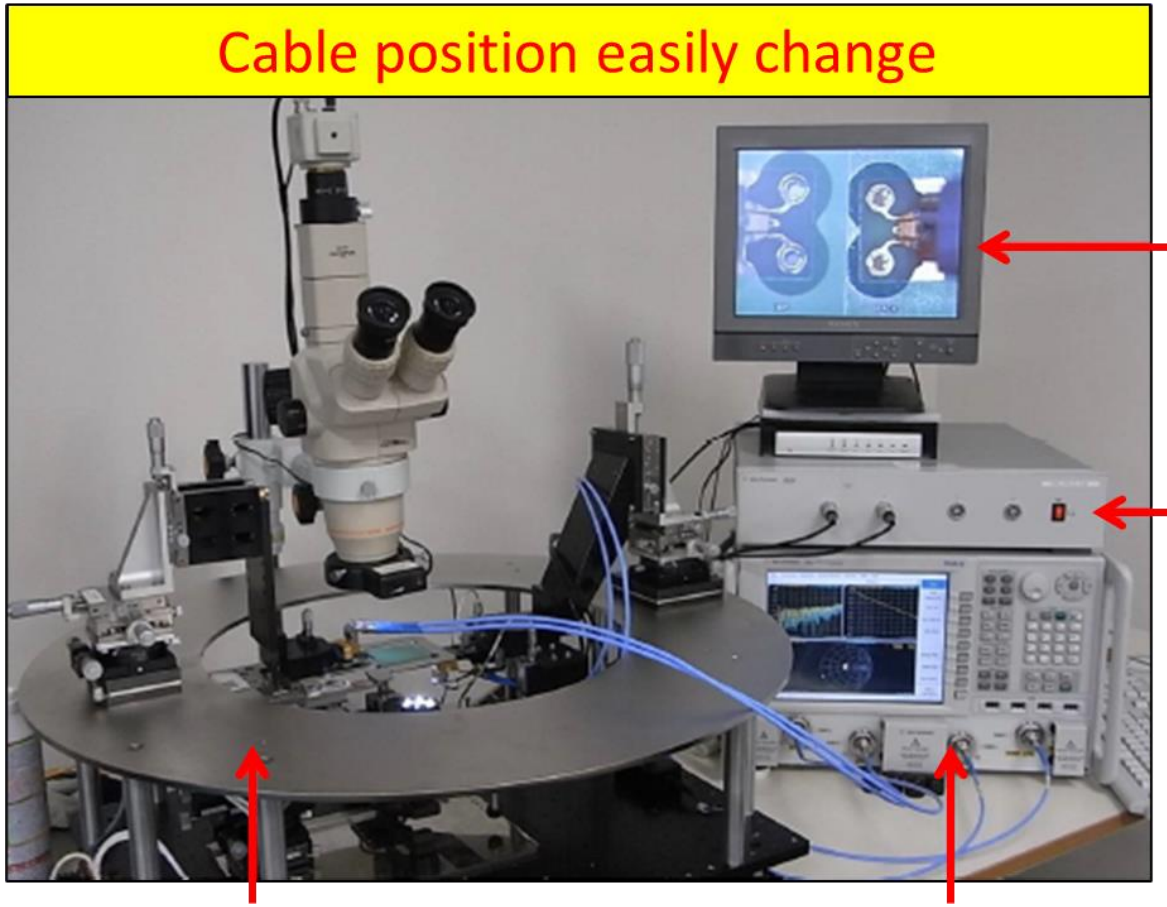
Source: 2024 54th European Microwave Conference(EuMC 2024)

Developed system vs Conventional system

Developed system



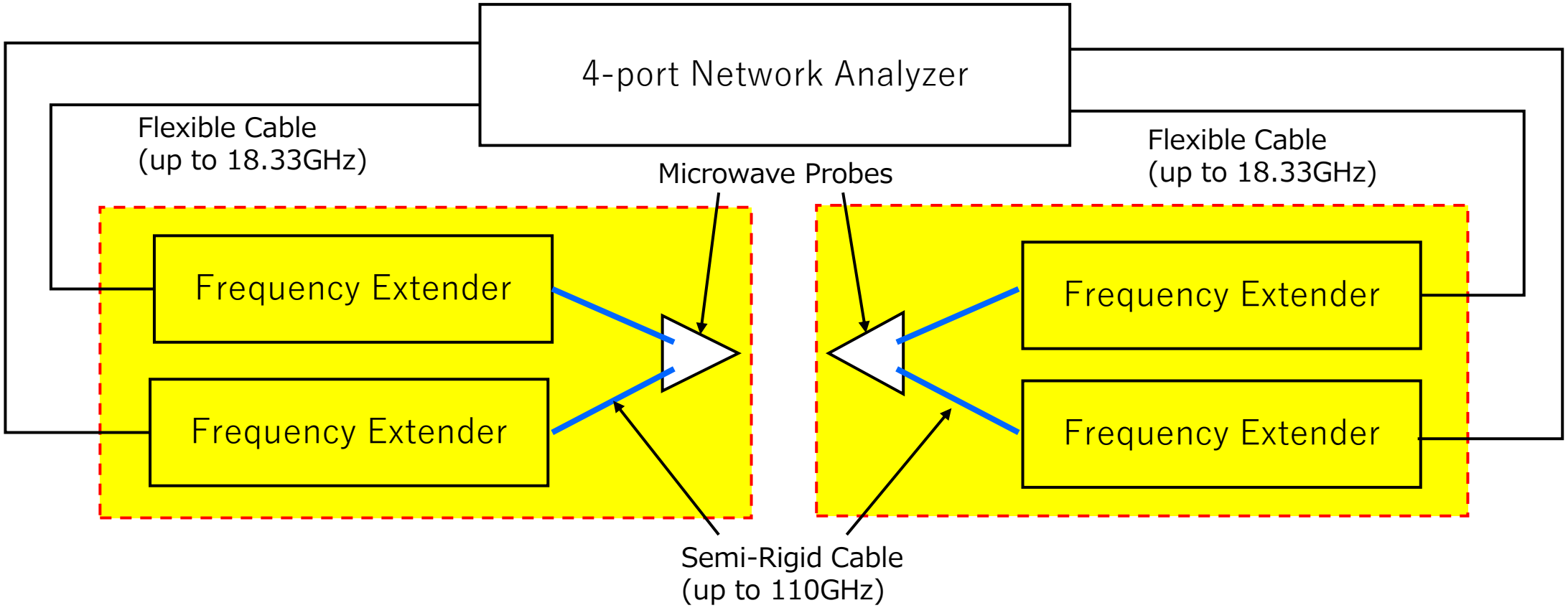
Conventional system



Source: 2024 54th European Microwave Conference(EuMC 2024)

Our system with improved reproducibility

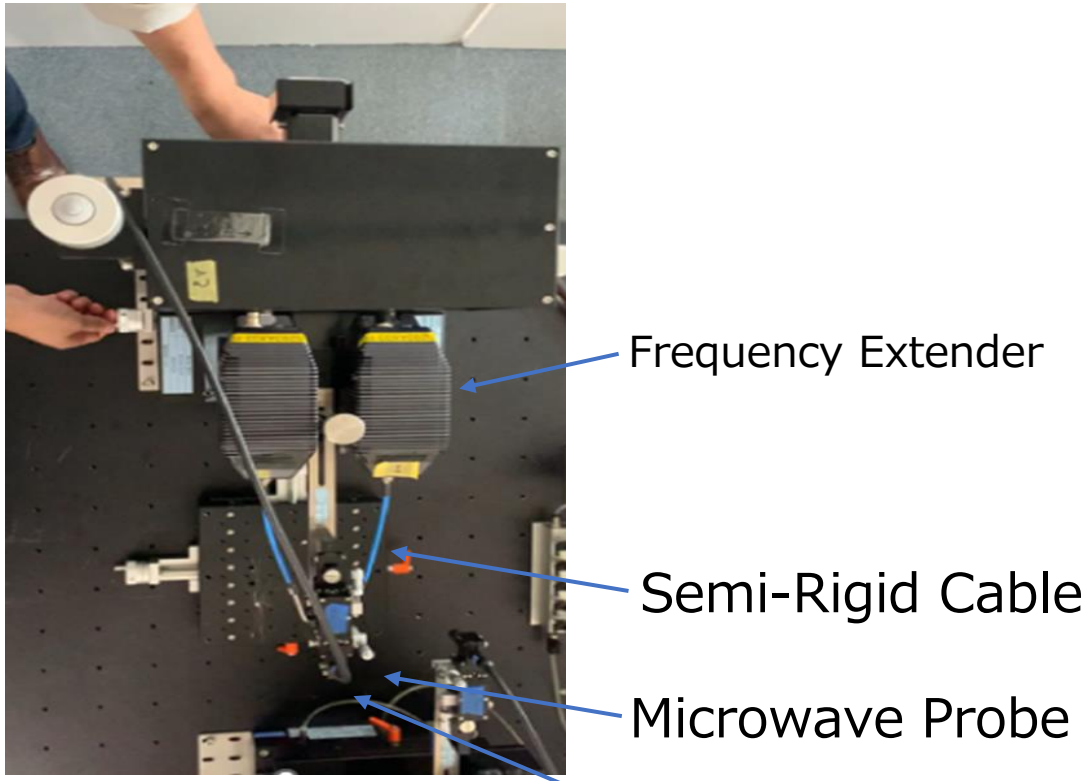
The developed system contacts the DUT without changing the relative positions of the RF probe and Frequency extender. This reduces deformation of the semi-rigid cables, which is a source of measurement errors.

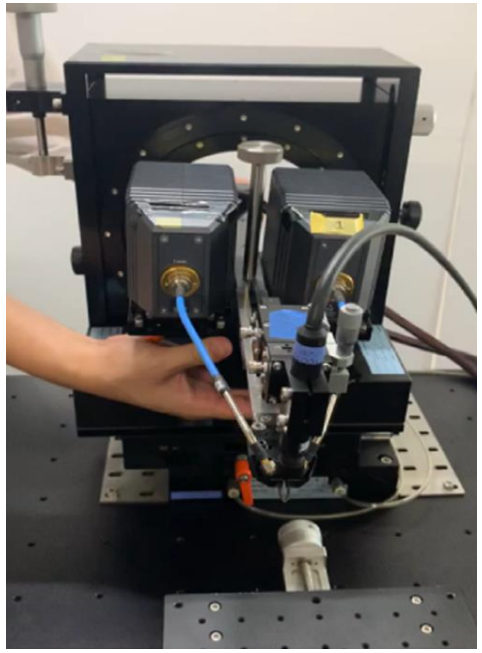


Source: 2024 54th European Microwave Conference(EuMC 2024)

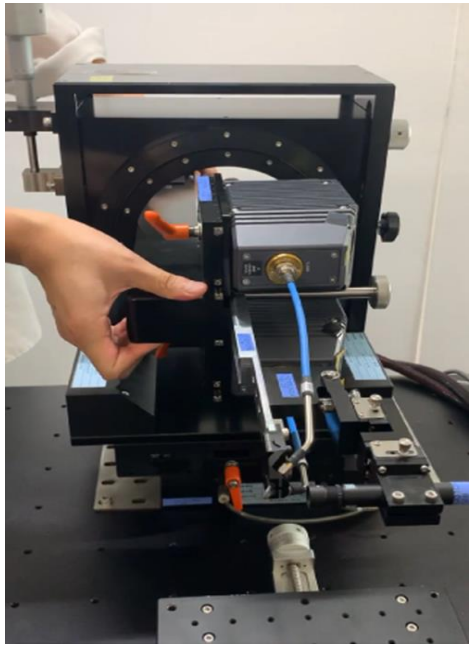
Developed system vs Conventional system

The developed system contacts the DUT without changing the relative positions of the RF probe and Frequency extender. This reduces deformation of the semi-rigid cable, which is a source of measurement errors.





Rotation angle : 0 deg.

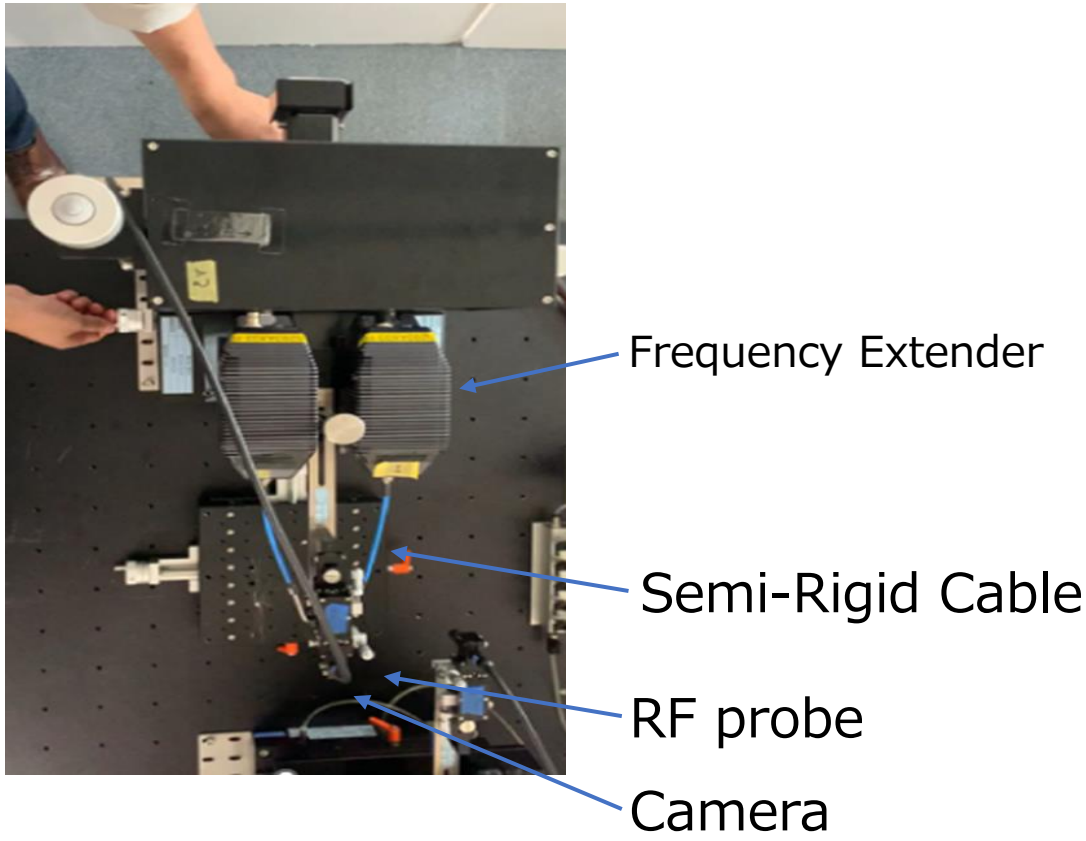


Rotation angle : - 90 deg.

Source: 2024 54th European Microwave Conference(EuMC 2024)

Developed system vs Conventional system

The developed system contacts the DUT without changing the relative positions of the RF probe and Frequency extender. This reduces deformation of the semi-rigid cable, which is a source of measurement errors.

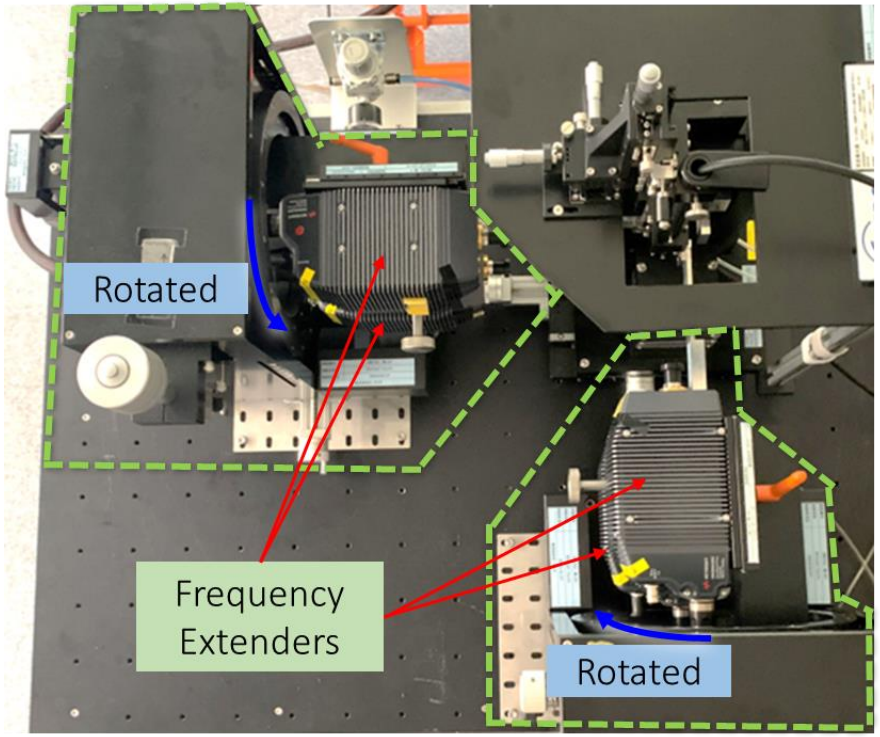


A dial for small angle rotation

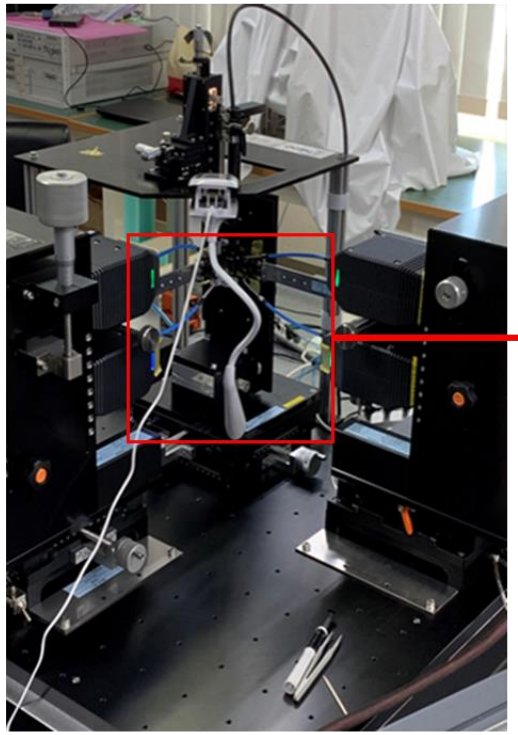
Source: 2024 54th European Microwave Conference(EuMC 2024)

Set up for bent structure measurement

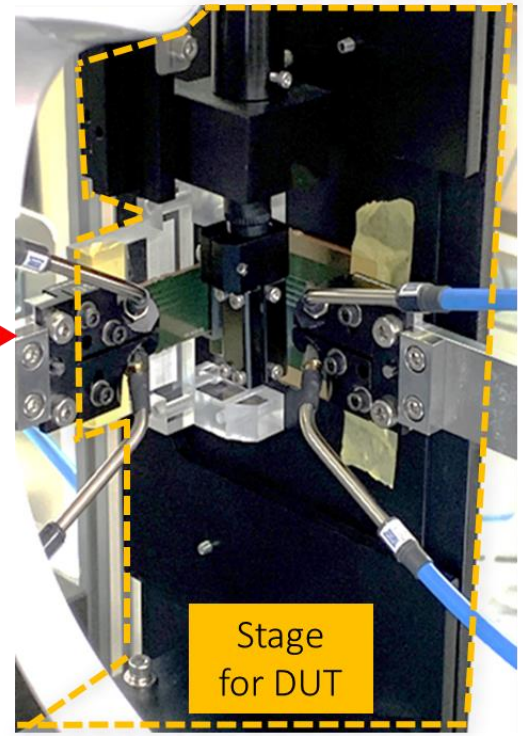
The developed system allows stable rotation of the RF probe, making this setup possible.



Developed system
Top-view



Setting result
Different perspective



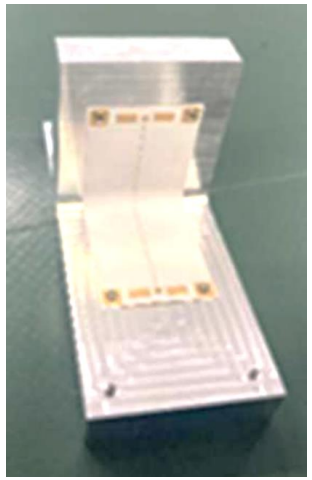
Probing scene
Enlarged view

Source: 2024 54th European Microwave Conference(EuMC 2024)

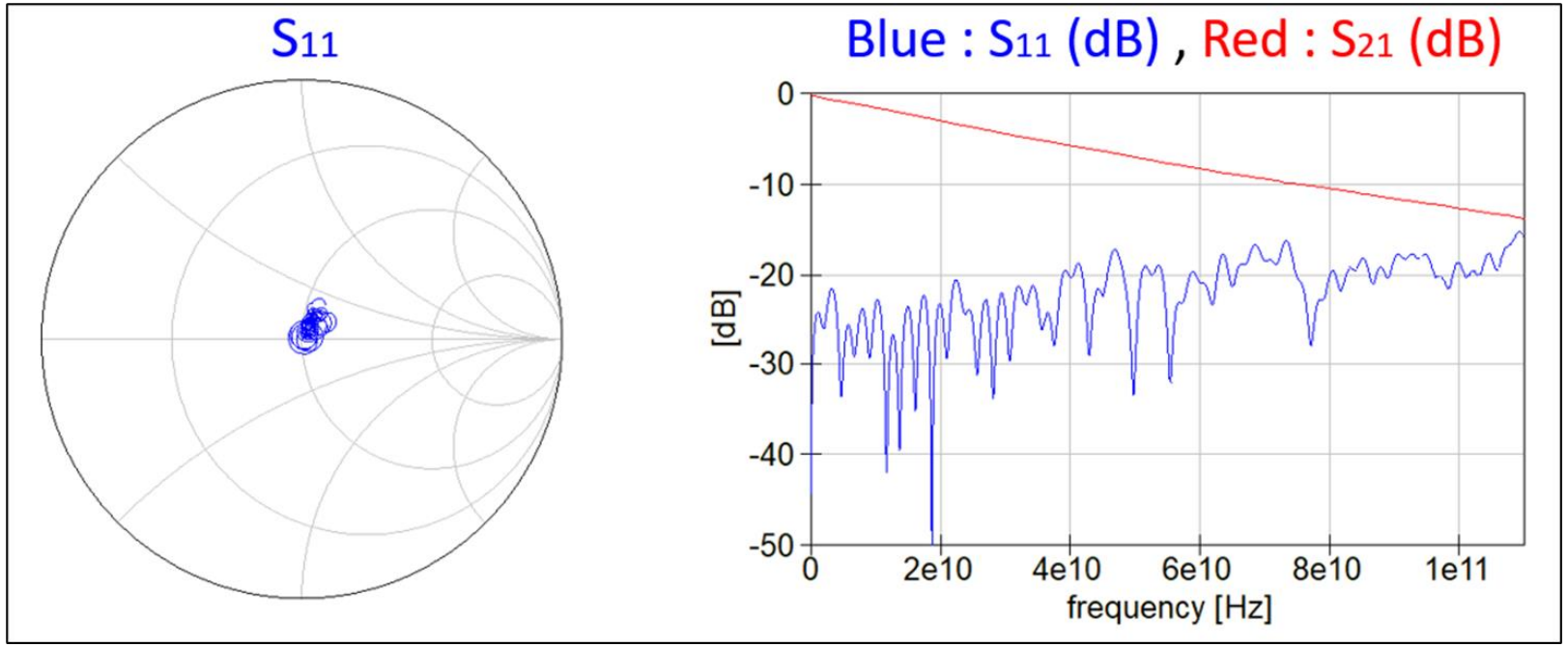
Characteristics of the bent through pattern

S-parameters measurement results for the bent.

Bent through pattern



Measurement results (from 10MHz to 110GHz)



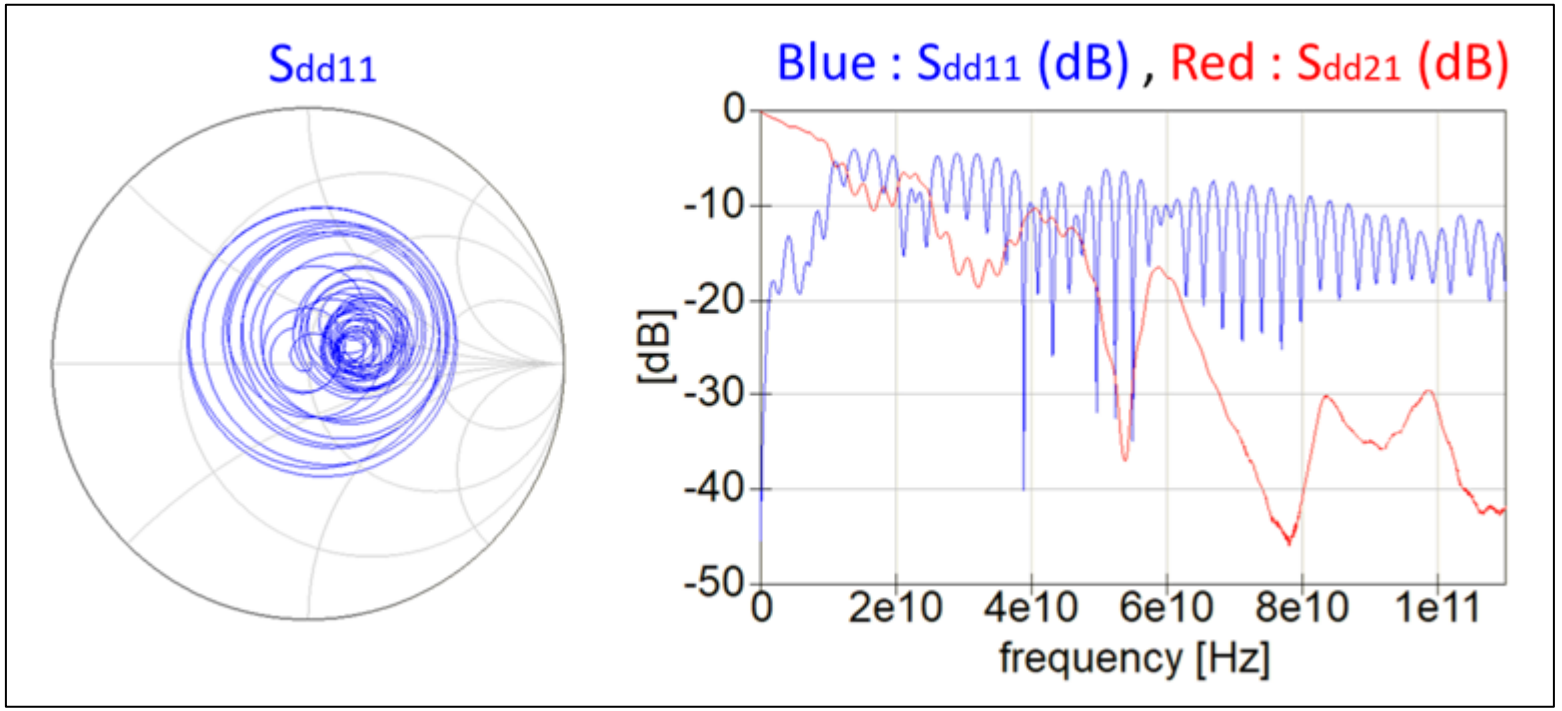
Source: 2024 54th European Microwave Conference(EuMC 2024)

Characteristics of the bent through pattern including a connector

S-parameters measurement results of the bent through pattern including a connector.

Bent through pattern including a connector

Measurement results (from 10MHz to 110GHz)

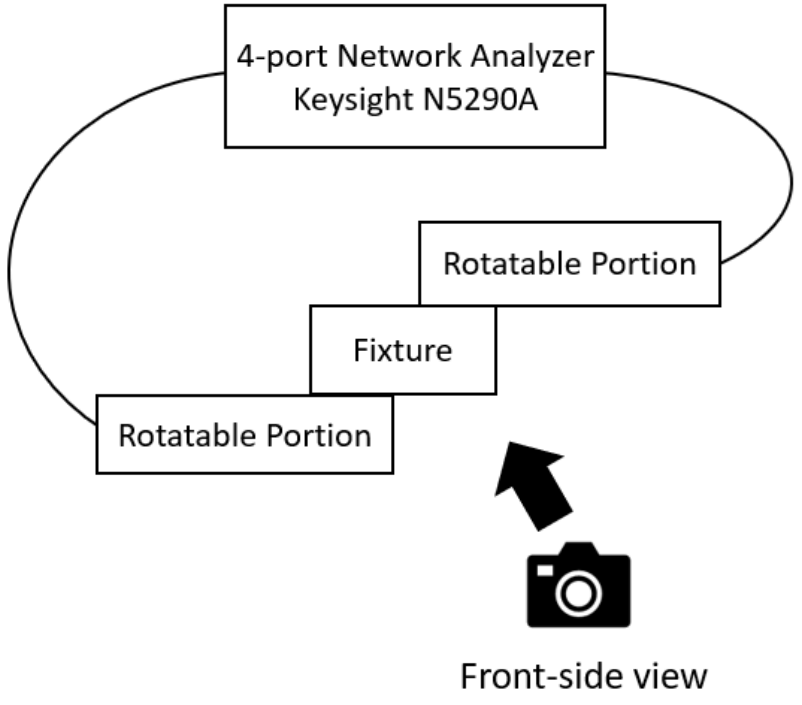


Source: 2024 54th European Microwave Conference(EuMC 2024)

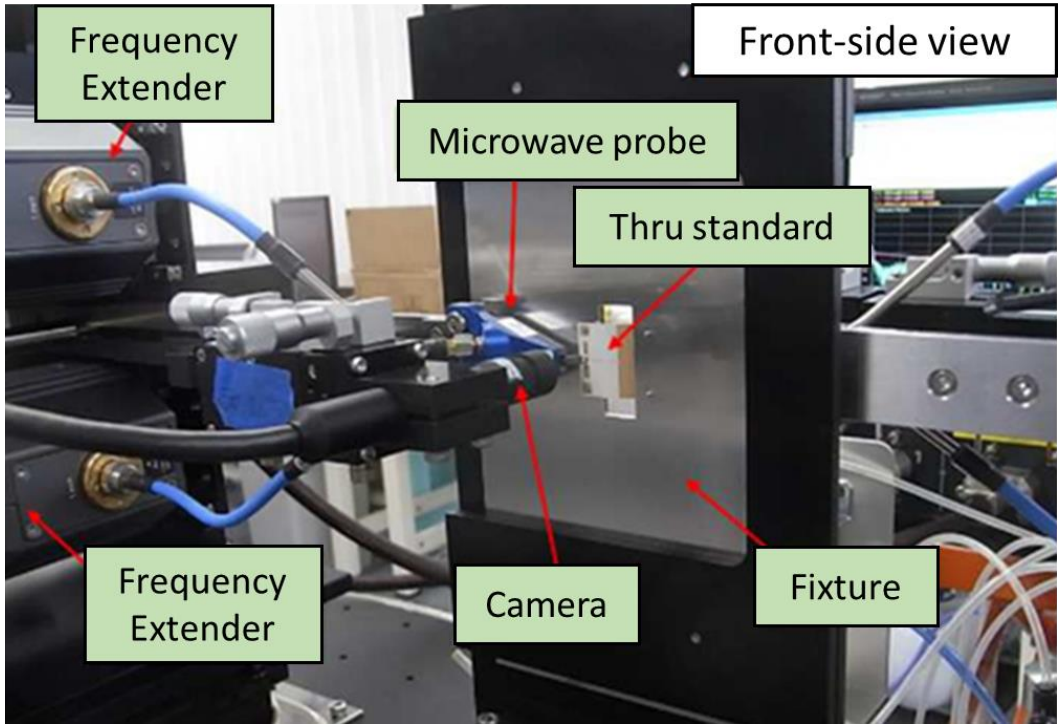
Set up for front to back structure measurement

The developed system allows stable rotation of the RF probe, making this set up possible.

Developed probing system (simplified)



Probing scene

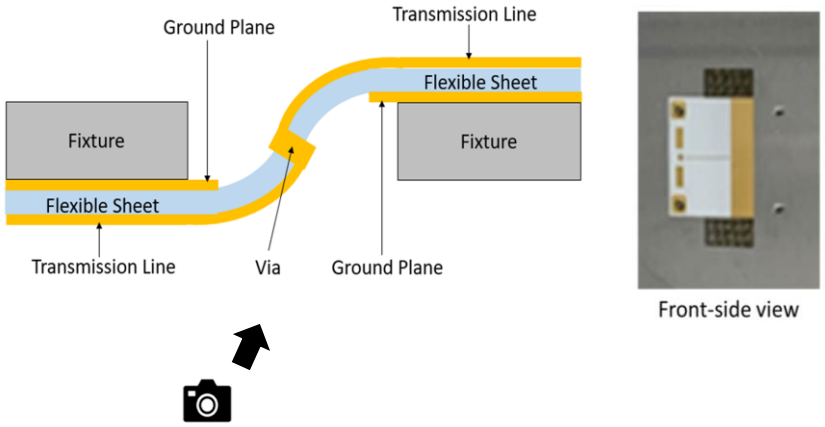


Source: 2024 54th European Microwave Conference(EuMC 2024)

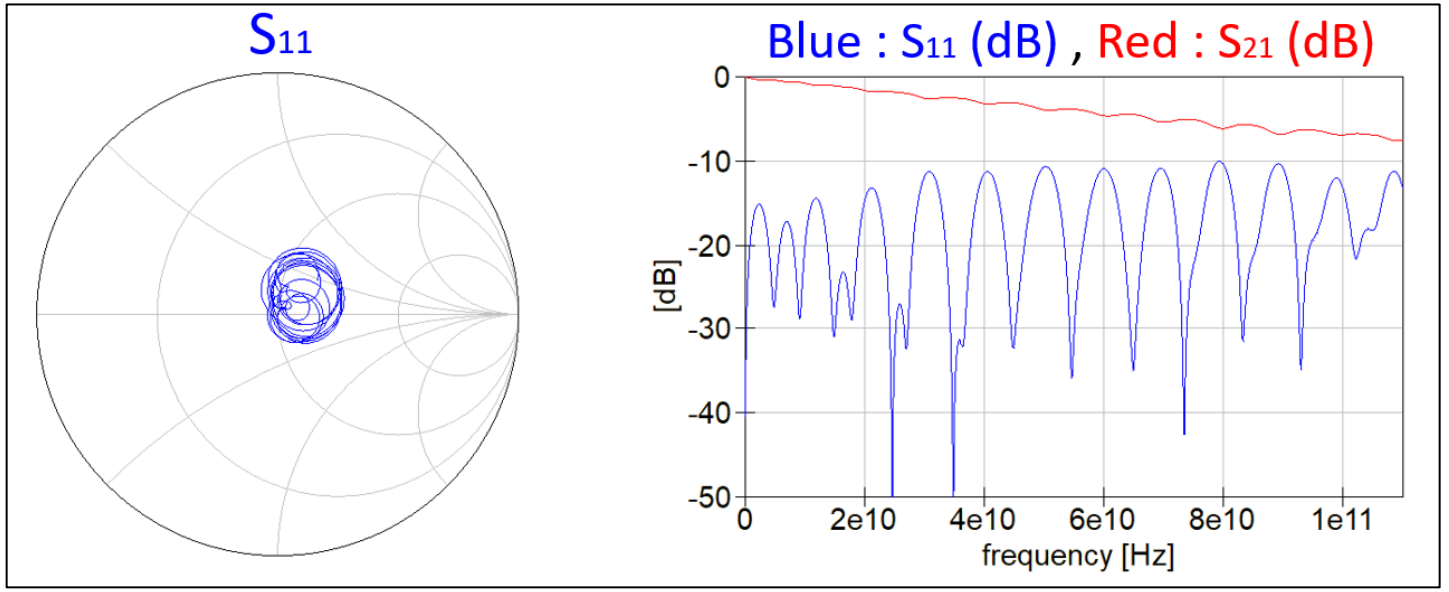
Characteristics for the front to back through

S-parameters measurement results of the through pattern including a via.

The through pattern including a via



Front-side view



Source: 2024 54th European Microwave Conference(EuMC 2024)

Conclusion

- We developed a 3D structure probing system with measurement reproducibility.
- We successfully measured the mixed-mode S-parameters of differential lines for next-generation high-speed transmission. (from 10MHz to 110GHz)

Acknowledgements

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Thanks! ありがとうございました!