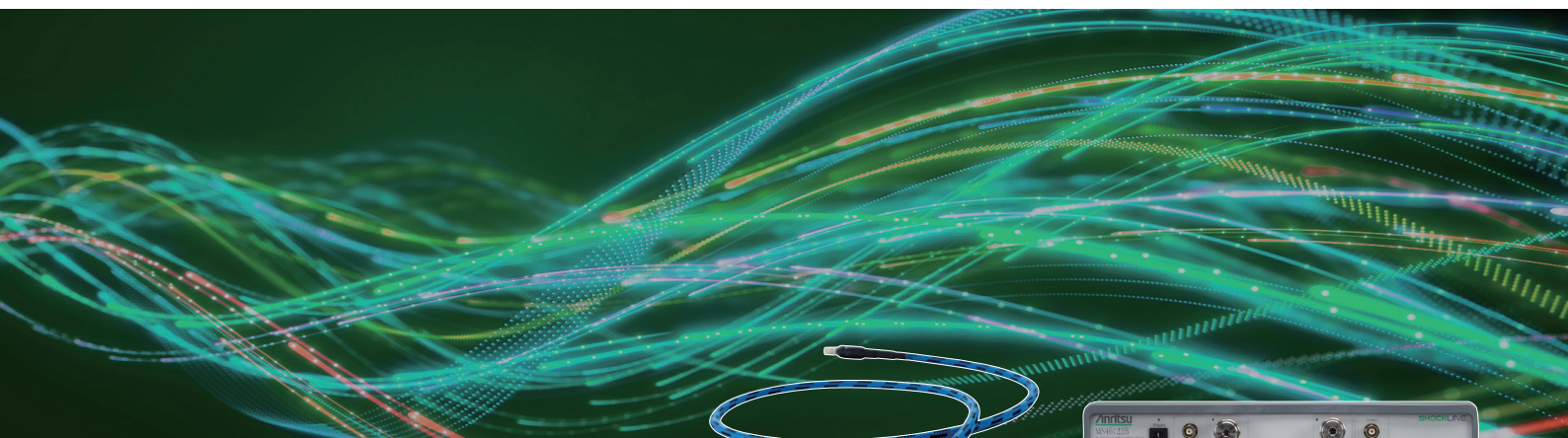
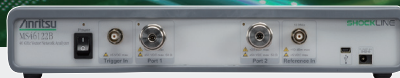




Junkosha Inc.

Junkosha
Microwave/mmWave Coaxial Cable Assembly
0 Series - Precision Test Grade Phase Stability



Compact USB Vector Network Analyzer
MS46122 Series

Visualizing High-Stability Characteristics of High-Quality mmWave Coaxial Cables Using Vector Network Analyzer to Promote Superiority Quality in OTA Test Environment

Introduction Purpose

Promote mmWave cable for high-accuracy testing to visualize amplitude errors caused by phase fluctuations due to cable bending and stretching.



Name: Junkosha Inc.
Established: 26 April 1954
Number of associates: approx. 750 (Japan and abroad)
Business: Provide solutions to a wide range of industrial fields worldwide, including the medical, aerospace, telecommunications, and semiconductor fields, based on our core technologies of high-precision molding technology, high-order processing technology, and polymer-modification technology.
Products: Provide wires and cables, tubes and fittings, films, injection-molded products, and composite high-performance components by molding and processing high-performance polymers, such as fluoropolymers.
Office: 2-2 Kanda-Surugadai, Chiyoda-ku, Tokyo, Japan
URL www.junkosha.com



Products Introduced

Vector Network Analyzer MS46122 Series
1 MHz to 43.5 GHz, reinforced Extended-K™(m) port (compatible with standard K-, 3.5-mm and SMA connectors)

Jig
Cable Performance Evaluator "CaPE-K": Kawashima Manufacturing Co., Ltd.

Background and Challenges

Help customers clearly understand impact of mmWave cable phase stability on measurements.

Reasons for Selection

Promote cables with excellent phase stability. Introduce Vector Network Analyzer (VNA) MS46122 Series to demonstrate high measurement accuracy in conditions close to practical operation.

Introduction Results and Prospects

Demonstrate high measurement accuracy by using phase-stable mmWave cables and pave way for Over-the-Air (OTA) tests without cable effects.



Digital Marketing and Field Sales
Mr. Masamichi Ishikawa

Background and Challenges

Help customers understand the impact of mmWave cable phase stability on measurement.

Junkosha is a leading company with core technologies in the molding and processing of fluoropolymers and other high-performance polymers. Junkosha's mainstay wire, cable, and assembly products are used in a wide range of fields from the K supercomputer to satellites, such as *Hayabusa*, medical devices, and chemical plants, supporting innovation in special applications requiring high durability, long life, and high reliability.

Junkosha's strength is that it develops and manufactures all dielectrics, cables, connectors, and assemblies that make up RF (radio frequency) coaxial cables. "Junkosha Microwave/mmWave Coaxial Cable Assembly" **0 Series - Precision Test Grade Phase Stability**, which offers world-class measurement stability, bending durability, and flexibility, has been delivered to numerous defense, broadcast, and communications infrastructure applications that require high reliability.

Junkosha's Mr. Masamichi Ishikawa describes the market trends targeted by this mmWave cable saying, "With the gradual spread of 5G and the shift of customer products toward higher frequencies such as mmWave, mmWave cables used in product R&D and during shipment inspections are

naturally required to have mmWave-compatible performance. It is well known that the frequency characteristics of the signal amplitude propagating through these cables generally fluctuates when the cable is bent, depending on the degree of degradation and the characteristics of the cable itself. This fluctuation causes measurement errors and is also a factor in deteriorating measurement stability. In response, it was a challenge to demonstrate the small fluctuations in amplitude-frequency characteristics of our cables, so customers realize its importance.

Fluctuations in signal amplitude-frequency characteristics occur because the phase of the signal changes with slight variation in the dielectric constant of the cable dielectric caused by cable bending or temperature changes.

The key dielectric components in Junkosha's mmWave cables are developed in-house and optimized for each required performance. As a result, Junkosha is proud of the cable's extremely high phase stability and phase-return characteristics, as well as its resistance to cable bending and temperature changes. However, cable performance was difficult for some customers to visualize.

Reasons for Selection Introduce Vector Network Analyzer MS46122 Series to demonstrate high measurement accuracy in conditions close to practical operation.

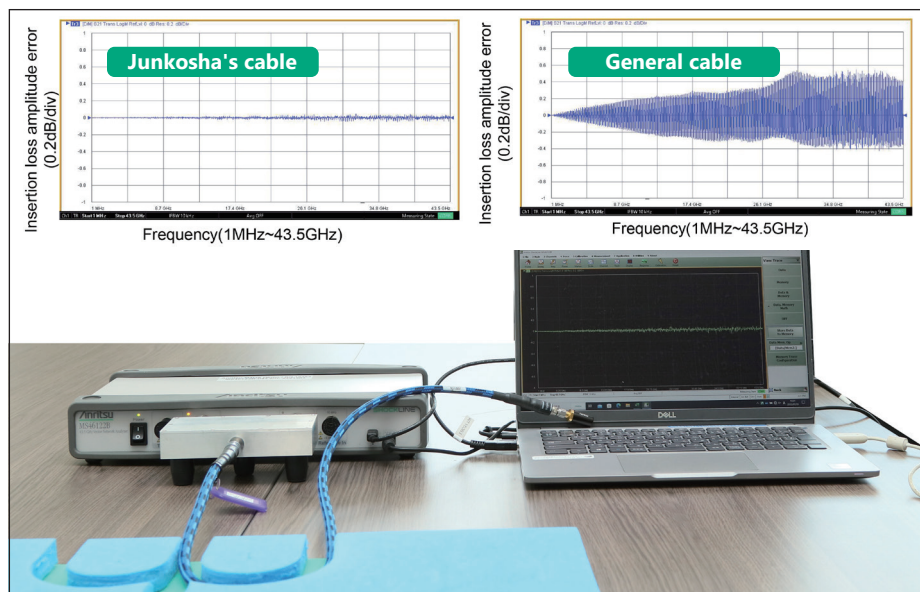
In 2019, Junkosha used Anritsu's VNA MS46122 Series to visualize mmWave cable performance and promote quality.

"We had previously demonstrated our product's mmWave cable connected to an ordinary VNA to show that the amount of phase fluctuation was small when bent. If the customer was measuring the phase directly, we could demonstrate the performance and value of the cable. However, it was difficult to demonstrate the value of our cables to customers evaluating performance in terms of error vector magnitude (EVM) and insertion loss where the effect of cable phase variation is indirect. Consequently, we needed a solution that clearly showed how the phase stability of our mmWave cables affected the customer's required measurements," said Mr. Ishikawa.

The effects of phase variation are hard to clearly understand from EVM or insertion loss.

Therefore, even when large phase variation is caused by cable performance, the effect of phase variation is mistakenly perceived as small at first glance, and there is a risk of ignoring that EVM and insertion loss measurement results actually include errors due to the effect of phase variation.

Junkosha worked with Anritsu to demonstrate to customers at trade shows and remote conferences using a test solution to visualize mmWave cable performance. This solution is achieved by



Testing Basic Performance of mmWave Cables Using VNA MS46122 Series and Cable Performance Evaluator CaPE-K. Amplitude variation is measured with the cable bent. The measurement results displayed on the PC show that the general mmWave cable (right) exhibits large amplitude fluctuations, whereas Junkosha's 0 Series mmWave cable (left) has almost no fluctuations.

combining Anritsu's VNA MS46122 Series and Kawashima Manufacturing's cable performance evaluator CaPE-K.

In this solution, the CaPE-K generates standing waves. The difference in the change in the standing wave before and after cable bending is evaluated by the VNA to capture the slight phase

change and visualize the variation in the amplitude-frequency response. This also allowed us to demonstrate the performance difference between cables and revealed the superiority of our high-performance mmWave cables.

Introduction Results and Prospects

Demonstrate high measurement accuracy by using phase-stable mmWave cables and pave way for OTA tests without cable effects.

Junkosha visualized phase fluctuations caused by bending and stretching mmWave cables using Anritsu's test solution. This also clarified the impact of insertion loss on measurement error caused by phase fluctuation during mmWave cable routing in the OTA test environment.

Previously, many customers had thought phase fluctuation has a small impact on EVM and insertion loss measurements up to 4G. Therefore, although they knew about phase effects on insertion loss and EVM, they attached little importance to the cable phase stability.

"However, introduction of 5G OTA testing changed the measurement environment drastically from 4G, and includes an increase in standing waves caused by worsening VSWR as well as the effects of phase fluctuations that are more likely to occur at the higher 5G frequency. The demonstration surprised the customers and helped them understand the increase in measurement variations caused by phase fluctuations and the concrete extent to which improved phase stability contrib-

utes to measurement accuracy. As a result, the more-demanding customers, such as major electronic device manufacturers, mobile communications carriers, and national research institutes, were interested in and adopted the system," said Mr. Ishikawa.

Anritsu's VNA MS46122 Series is compact, lightweight, and portable. Notably, since the system can be operated by an external PC via USB to display measurements, on-screen results can be displayed easily at remote conferences and exhibitions, and online demonstrations are possible using an external camera to show a bent cable.

Mr. Ishikawa said, "At a remote conference and exhibition, Anritsu supported a demonstration promoting cable quality. In addition to the cable evaluation, Anritsu was available for technical questions and answers about measurements. The result was a very intense demonstration."

Junkosha plans to collaborate with JAXA and other research and development organizations to accelerate product development in markets that

demand high reliability, such as aerospace. In the quantum computing field promoted by the Ministry of Economy, Trade and Industry, Junkosha is also researching and developing high-frequency cables to capture quantum signals.

"We will continue to provide products that meet the demand for higher frequencies and improved measurement accuracy. Even if we develop a high-performance cable, we cannot offer it as a product unless we have an environment in which to evaluate it. Anritsu has been our partner for many years, and we use the VNA MS46122 Series to test our products, but we hope Anritsu will develop test equipment and connectors for the 300-GHz band, which exceeds the current upper limit of 145 GHz," said Mr. Ishikawa.

Anritsu's test solutions support Junkosha in its efforts to expand its business globally by visualizing the absolute performance superiority of Junkosha's products.