

Quality through precision

More than 60 years of experience in the radiofrequency market have been condensed into **SPINNER**'s latest product range, a selection of W-band rotary joints for 94GHz applications. The company explains how it ensures its products are best-in-class.

In recent years, efforts to make the frequency range above 75GHz accessible to sensor applications have greatly increased. In combination with wide signal bandwidths, the high operating frequencies allow for high local resolutions. Compared with visible light and infrared radiation, millimetre waves (which have a frequency range of 30-300GHz) have the distinct advantage of being able to penetrate fog, rain and dust. This is further supplemented by the good penetration power of textile materials and plastics. As a result, millimetre waves have a wide field of application, ranging from personal checks (body scanners) to imaging radar sensors. As many applications require the sensor antenna to rotate, suitable high-frequency rotary joints are often required.

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SPINNER received an order for a 94GHz rotary joint, which will be used as part of a solution to detect objects and obstacles on roads. It is expected to be particularly useful in areas that are often affected by thick and persistent fogs during the winter months.

The company has risen to this challenge by developing a complete range of single-channel rotary joints for the W-band, with R900 (WR10) waveguide connections. The transmission band of the joints was set to a centre frequency of 94GHz. This is because atmosphere has a so-called transmission window, in which transmission loss is considerably lower than that of the neighbouring frequencies of the millimetre wave spectrum.

Miniature mission

SPINNER's engineers were faced with the complex task of technically implementing the radiofrequency concept. Their aim was to create a broad-band, power-stable and voltage-proof rotary joint that could meet the highest mechanical demands despite being the smallest possible size. Its lifetime of at least 100 million rotations (even under extreme temperatures) and its transferable-pulse peak power of at least 250W are also worth mentioning.



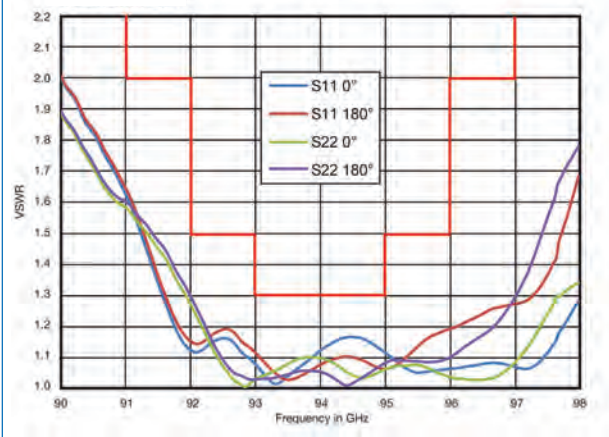
The 94GHz rotary joints will be used to help detect obstacles on roads during severe fogs.

Due to the low wavelength (approximately 3mm), it was not only necessary to select correspondingly small waveguide connections for the R900 (2.54mm × 1.27mm), but also to make all of the joint's internal structures small and compact. This placed extremely high demands on the design and precision of the product's mechanical structure. Because of this, particular value was placed on cooperation between the designers, high-frequency engineering team and production specialists from the first stage of development. This way, the number of necessary development steps could be kept to a minimum and the best possible results were achieved.

Small success

Through a sophisticated modular design, a full range of rotary joints has been developed. It includes four basic designs: the I-style, the U-style and two different L-styles. The range is therefore suitable for a number of installation applications. Highly precise production such as that

Figure 1: Typical VSWR response



delivered by SPINNER is a decisive factor for compliance with extremely strict radiofrequency requirements.

All of the components are produced by qualified specialists using highly accurate CNC turning and milling machines. In order to ensure the quality of the process, all manufactured parts are geometrically measured and documented. All components are galvanically finished, and a large number are gold-plated to deliver optimal electrical properties and high corrosion resistance. The technical measurement characterisation of the products was carried out

with a network analyser, including a frequency converter for the W-band (75-110GHz). Figure 1 (left) shows the measured VSWR frequency responses of a typical example of the L-type product, BN 636295. Around the central frequency of 94GHz, the VSWR typically lies below 1.2, which significantly surpasses that of all products currently available on the market. The change of reflective properties above the rotation angle is also very low under 96GHz. These properties only start to increase at higher frequencies.

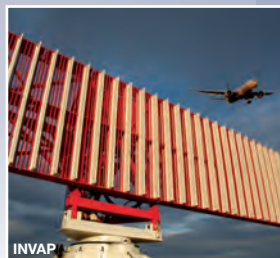
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With the new single-channel rotary joints for the 94GHz frequency range, SPINNER has created an unrivalled range of products that are distinguished by excellent electrical and mechanical qualities, and can be used in both broad-band FMCW sensors and narrow-band pulse systems. ■

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Headquartered in Munich, and with production facilities in Germany, Hungary, USA, China, and Brazil, the SPINNER Group now has over 1,200 employees worldwide.

Our subsidiaries and representatives are present in over 40 countries and provide our customers with an international network of support.

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