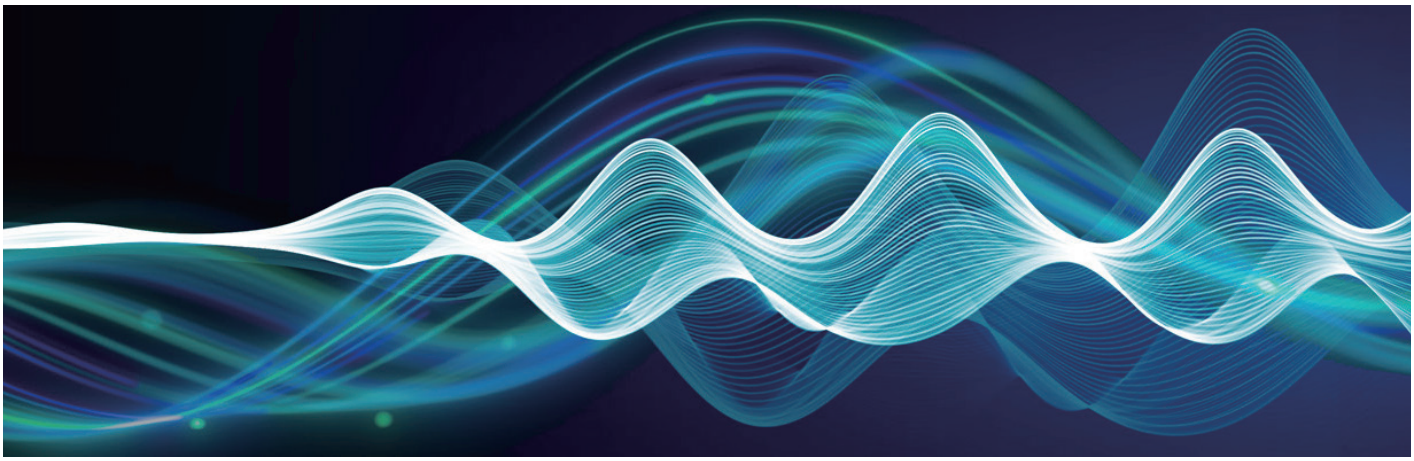


Reference Signal Sources for Next-Generation mmWave Device Testing

Challenges Presented by mmWave Device Evaluation

Research and development related to mmWave devices is accelerating in fields such as 6G communications, aerospace, and radio astronomy. These devices include up/down (U/D) converters, which perform frequency conversion. Accurately characterizing the intrinsic performance of U/D converters is essential during their development. Measurement results are influenced by both the device under test and the signal source performance. Therefore, minimizing the influence of the measurement system is essential for accurate device evaluation.

Issue: Accurate mmWave Device Evaluation with Minimal Measurement-System Influence

Solution

Two Signal Sources Optimized for Different Evaluation Needs



RF/Microwave Signal Generator MG36221A/41A/71A
9 kHz to 20/43.5/70 GHz

- Low phase noise: –136 dBc/Hz, typical, at 10 GHz with 10 kHz offset
- Frequency stability: $< \pm 1 \times 10^{-9}$/year, Option 0056
- High output power: up to +20 dBm, Option 0002



Microwave Frequency Synthesizer EcoSyn™ Lite MG36021A
10 MHz to 20 GHz

- Phase noise: –126 dBc/Hz, typical, at 10 GHz with 10 kHz offset
- High output power: up to +18 dBm at 20 GHz
- Compact size: 101.6 × 101.6 × 20.32 mm

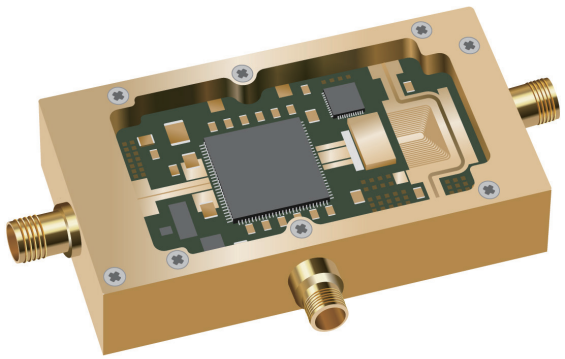
Low-Phase-Noise Local Oscillator (LO) Sources for Accurate Device Evaluation

Customer: mmWave Device Manufacturer (Model: MG36221A/MG36021A)

■ Challenges:

For the U/D converters used in 6G communications, phase noise is a key evaluation parameter because it affects the error vector magnitude (EVM) of modulated signals. The characteristics of the U/D converter itself, as well as the phase noise and frequency stability of the external LO source, both affect the measurement results.

High-accuracy evaluation requires a high-performance signal generator. However, deploying such signal generators across multiple measurement systems increases equipment costs and footprint. Our goal was to ensure the signal quality required for high-accuracy evaluation while reducing the cost and footprint associated with expanding measurement capacity.

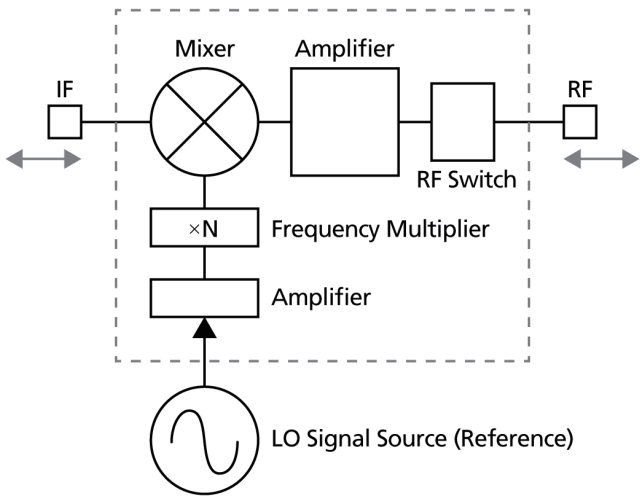


■ Solution:

For measurement systems where evaluation accuracy is the priority, the MG36221A can act as an external LO source, offering low phase noise and high frequency stability. By minimizing the influence of the signal source on the measurement results, the MG36221A enables the accurate characterization of U/D converter performance and the identification of areas for improvement.

To expand the measurement capacity, the compact MG36021A balances the required signal performance with cost and space efficiency. By selecting the signal source to suit each measurement system, this approach enables high-accuracy evaluation and the efficient expansion of the measurement capacity.

U/D Converter Block Diagram and Key Evaluation Parameters



Frequency Multiplier
Phase noise: PNout = PNin + 20logN
PN: Phase noise
N: Multiplication factor

Mixer (Frequency Converter)
Conversion loss/gain
Isolation

IF-to-RF and RF-to-IF Characteristics for Modulated-Signal Evaluation
EVM
ACLR, etc.

The contents of this document are subject to change without notice. The numerical results shown in each measurement screen example are not guaranteed values. Please refer to the catalog and data sheet for the standard values.

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