

Integrated Dual Polarized Scalar Horn Antenna Covers 24–42 GHz

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In the race to develop 5G mmWave hardware, accurate and efficient tools for measuring antenna performance are required to keep pace. SAGE Millimeter's model SAF-2434231535-358-S1-280-DP is a dual polarized, scalar, feed horn antenna assembly that covers all 5G frequency bands in the range from 24 to 42 GHz. An integrated orthomode transducer (OMT) yields orthogonal wave components when the antenna is used as a receiver and delivers full polarization agility when used as a transmitter. Both modes benefit from 15 dBi of mid-band gain, with 35 dB port isolation and 35 dB cross-polarization rejection.

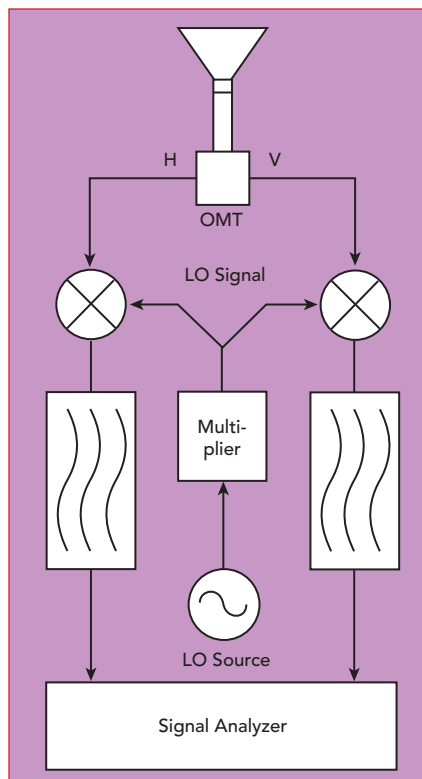
POLARIZATION DIVERSITY

As a receiver (see **Figure 1**), the antenna assembly can be combined with a pair of down-converters driven from a common local oscillator (LO). The down-converted signals are fed to a vector signal analyzer or a dual-channel oscilloscope to simultaneously resolve horizontal and vertical wave components and their phase relationship, provid-

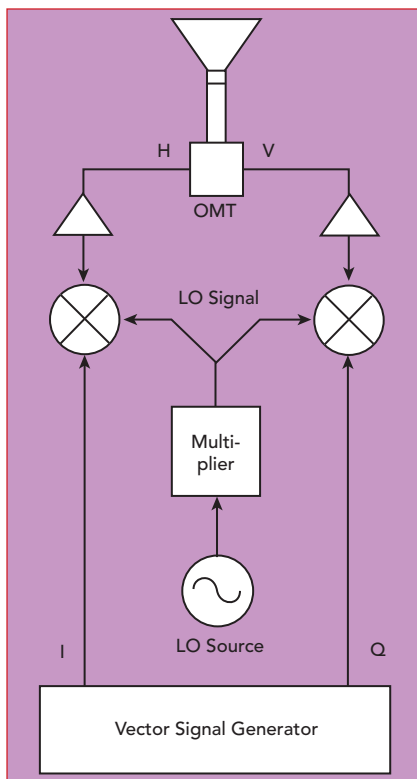
ing polarization information. When used as a signal source (see **Figure 2**), the antenna can be combined with a pair of up-converters that are fed from a common LO and driven by a vector signal generator. This configuration can generate any linear, circular or elliptical polarization.

Highly repeatable results are obtained when adjustments are made electronically, rather than more commonly switching antennas and other hardware to change polarization and frequency. As a result, the integrated antenna saves both time and cost, avoiding additional antennas, cables, fixtures and electronic components.

Applications for the dual polarized antenna assembly include characterizing mobile and fixed antennas and measuring propagation effects in complex environments. Such assessments are essential to maximize 5G system performance over the full range of operational settings. The feed's dual polarization and wide bandwidth are also well suited for advanced frequency-agile radar systems and high speed data communications.



▲ Fig. 1 The amplitude and polarization of a received signal can be determined using two down-converters, a common LO and vector signal analyzer.



▲ Fig. 2 A signal with adjustable amplitude and polarization can be generated using two up-converters, a common LO and vector signal generator.

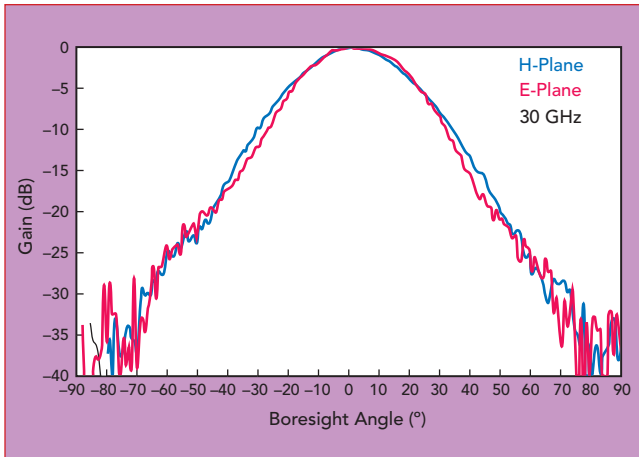
CONSISTENT PERFORMANCE

The E- and H-plane antenna patterns have sidelobe levels below -25 dB across the full operating spectrum (see **Figure 3**). The feed achieves good quiet-zone performance in anechoic chambers with limited size and absorption characteristics, making it a good fit for cost-sensitive antenna ranges. The antenna's 3 dB beamwidth is matched at 35 degrees for both the E- and H-planes. Return loss for the OMT ports is better than 20 dB, typically 25 to 30 dB (see **Figure 4**).

Constructed from gold-plated aluminum and brass, the antenna operates from -40°C to +85°C. Both ports are standard WR28 waveguide with UG-599/U flanges and 4-40 threaded holes. The overall length of the assembly is 4.1 in. (104 mm). The horn's maximum diameter is 1.6 in. (40.6 mm).

INTEGRATED SOLUTIONS

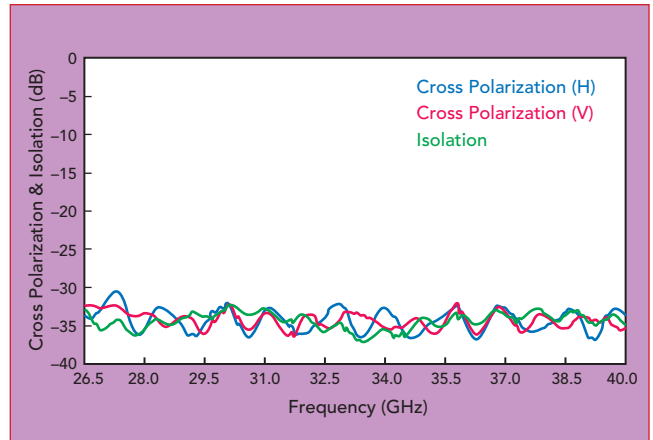
Good cross-polarization rejection, important for accurately controlling antenna polarization, relies on a high degree of symmetry in



▲ Fig. 3 From 24 to 42 GHz, the antenna typically achieves 15 dBi gain with a 3 dB beamwidth of 35 degrees.

the construction of the OMT and the scalar horn, with minimal mechanical gaps or misalignments between the components. As an integrated assembly, the antenna maximizes performance while allowing users to avoid the difficult tasks of separately purchasing a feed horn and OMT, then assembling precisely, testing in a calibrated antenna range and adjusting to optimize performance.

To meet a wide range of test and measurement needs, the antenna can be integrated with a variety of off-the-shelf components, including signal sources, vari-



▲ Fig. 4 Low cross-polarization and high isolation between OMT ports enable good control of the antenna's transmit and receive polarizations.

able attenuators, phase shifters, frequency converters, filters and customized instrumentation. The antenna can be combined with a dielectric lens or a Cassegrain reflector to achieve higher gain for radar and communication applications.

VENDORVIEW

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