

27 to 32 GHz, 4 W Linear Power Amplifier for 5G

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SAGE Millimeter's engineers have developed a 4 W linear, Ka-Band power amplifier to help its clients reach 5G. Developed for laboratory prototyping and rapid concept demonstration, the SBP-2733233836-KFKF-S1 will help users develop and test components in one of the main frequency bands used for 5G. Customers can save time and resources using an off-the-shelf amplifier with high performance, rather than investing in a custom component that requires a non-recurring engineering budget and a longer R&D timeline.

The small-signal gain, return loss and output power at 1 dB compression across 27 to 32 GHz are shown in **Figures 1** and **2**. The typical P_{1dB} is +36 dBm, the small-signal gain is 38 dB, and the input and output return losses are -10 dB or better. The amplifier is biased with a nominal drain voltage of +6 V_{DC}, drawing 4.2 A quiescent and 7 A under RF drive. It also requires a gate bias of -2 V_{DC} and draws less than 1 mA for gate control. The amplifier is housed in an aluminum case, measuring 1.2" (W) × 1.2" (L) × 0.5" (H), and typically weighs 1.3 oz. The amplifier has a compact profile, which makes it suitable for system integrators and feasible for volume manufacturing. The SBP-2733233836-KFKF-S1 has female K connectors at the input and output, although the design is offered with other configurations, such as right angle or end-launch WR-28 waveguide interfaces. Due to the high DC power consumption, the amplifier requires a proper heat sink for continuous wave operation, to prevent the case temperature from exceeding +50°C.

The laws of physics continue to challenge the implementation of millimeter wave technology. Due to the atmospheric attenuation in free space at Ka-Band, system engineers must balance power requirements and linearity for communications and instrumentation systems. Higher frequencies have shorter wavelengths, limiting the range for a given power. The solution to this limitation is to transmit higher power with higher antenna gain, but this adversely affects noise and can exponentially increase cost. SAGE Millimeter's SBP-2733233836-KFKF-S1 serves as a middle ground for the market, offering a higher output power at a price point accessible to cost-conscious programs. The high- power Ka-Band amplifier can be used for any variety of applications in the frequency range. The higher gain allows the amplifier chain to achieve the desired output power with a single unit, versus cascading multiple components to achieve the same gain and output power. This makes the SBP-2733233836-KFKF-S1 ideal for linear, high-power applications

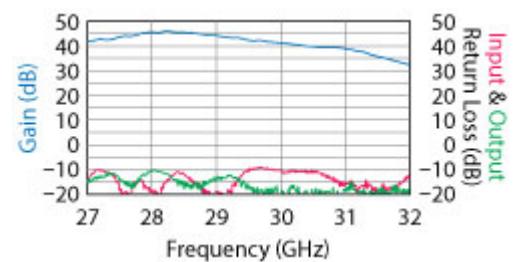


Figure 1 Small-signal gain and input/output return loss, with $V_d = +6$ V, $I_d = 4.2$ A, $V_g = -2$ V.

such as Ka-Band VSAT, high capacity point-to-point and point-to-multi-point radios and radar systems that demand +37 dBm of saturated output power.

With experience designing and manufacturing millimeter wave components and sub-assemblies, SAGE Millimeter works closely with its customers to meet extremely high frequency requirements across multiple industries. A recurring conversation SAGE engineers have with customers is how to balance the often competing interests of lead-time, performance and cost. Moving from microwave to millimeter wave frequencies can be an expensive process, with lab and test equipment upgrades and a formidable knowledge and experience gap. Responding to these challenges, SAGE began developing and manufacturing an extensive portfolio of demonstrated, ready-to-use components for the marketplace. The SBP-2733233836-KFKF-S1 power amplifier was inspired by an actual customer requirement for a ground-based SATCOM application and is one of many products to come from this ready-to-use initiative.

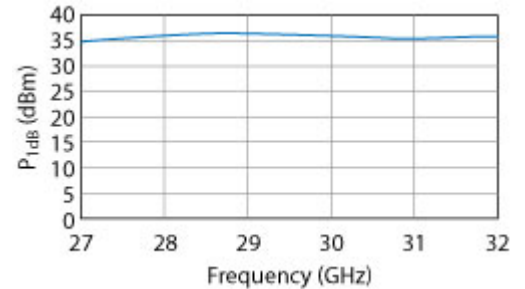


Figure 2 Output power at 1 dB compression, with $V_d = +6$ V, $I_d = 7$ A, $V_g = -2$ V.

This Ka-Band power amplifier holds true to the SAGE Millimeter design philosophy of creating elegant, easy-to-use components. The universal design makes for multi-system compatibility, enabling it to fit into most industry-standard systems and test setups. The amplifier can also be used with components from other manufacturers, but the best integration and performance is achieved when it is paired with other SAGE-designed components, such as mixers, oscillators, antennas and multipliers.

The SBP-2733233836-KFKF-S1 has received interest from many industry sectors working at Ka-Band, especially after the FCC's July 2016 action that allocated 10.85 GHz of spectrum above 24 GHz, of which 3.85 GHz is within Ka-Band. While additional spectrum was allocated at higher frequencies, telecommunications and wireless leaders have been working aggressively at 28, 37 and 39 GHz. The FCC's announcement unleashed waves of new innovation, with a wide economic impact in other industries, including radar systems, test equipment, VSAT/SATCOM, military and space. These diverse customers can take advantage of the SBP-2733233836-KFKF-S1 amplifier's performance, lead-time and cost.

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