# ULTRA-HIGH THERMAL CONDUCTIVITY, HEAT-DISSIPATING GEL MEETS PROCESSING,

## PERFORMANCE DEMANDS FOR HIGH BANDWIDTH 5G TELECOM INFRASTRUCTURE SYSTEMS

### Application Challenges and Objectives

- A new 5G massive MIMO active antenna design integrates high-power density components to deliver improved data throughput performance. The advanced ICs within the device generate very high heat.
- To ensure excellent performance, several thermal, processing, architectural and environmental challenges must be overcome, including: higher operational temperatures versus previous-generation components; smaller, lighter devices with greater thermal loads; deployment in dense urban areas and in elevated, difficult-to-service locations; high-volume production demands.

### Application Data and Testing

- State-of-the-art active antenna designs with more powerful and dense ICs require next-generation thermal management solutions to meet reliability and performance expectations. The thermal interface materials (TIM) selected must deliver on several requirements.
  - High thermal conductivity >10.0 W/m-K
  - Stability in application and durability to withstand dynamic environments and the realities of difficult-to-service locations.
  - Ability to mitigate various component dimensional tolerances and coefficient of thermal expansion (CTE) differences.
- Unit shipments of 5G active antennas are expected to grow by more than 30% (CAGR) between 2020 and 2025. [1] To capitalize on this demand, a material that can provide stable, consistent dispensing performance to meet automated, high-volume production volumes is necessary.
- Dispensing characteristics are critical for this customer. A material that can meet the exceptionally high thermal requirements, while delivering dispensing and flow rate performance equal to or better than market incumbent products (including those with lower thermal performance) is imperative.
- With deployments in unpredictable/hard-to-service locations, the TIM solution has to provide long-term reliability and robust vertical gap stability throughout multiple thermal cycles ( -40 / +125°C).
- A high-conformity material that can achieve a thin, low-resistance bond line while inducing very low component stress is desired to protect high-value components from damage.

## Henkel Solution and Results

- Henkel has developed a 10.0 W/m-K gel TIM that offers higher thermal conductivity than its predecessor but, remarkably, also has a nearly 30% increased flow rate as demonstrated by a simple cartridge dispense test. Formulating a material of this caliber that provides comprehensive performance and processing capability – high conductivity and excellent/stable dispensability -- is exceptional.
- In rheology (dispensability) testing, Henkel's BERGQUIST® *LIQUI FORM* TLF 10000 outperformed other evaluated materials.
- BERGQUIST® *LIQUI FORM* TLF 10000 gel TIM satisfies the intense heat dissipation requirements of new high bandwidth industrial infrastructure systems, including telecom and datacom applications. The formulation balances high thermal conductivity, low stress, automated dispensability, production consistency and in-application stability.
- Among the material's many benefits, and specific to this active antenna application, are:
    - Thermal conductivity of 10.0 W/m-K provides high heat dissipation for state-of-the-art 5G systems.
    - Pre-cured liquid gel requires no mixing or refrigeration, provides easy storage and handling.
    - High gap stability @ 1.5 mm for more than 2,500 hrs., with capability for larger gaps
    - Withstands stress, movement, various CTE tolerances, fluctuating operational states (peak use) of heat and external environmental conditions.
    - Has excellent thermal cycling performance for high reliability.
    - Optimized rheology for excellent, consistent dispensing performance to enable high-confidence mass production.
- Due to its excellent processability in combination with ultra-high thermal conductivity, BERGQUIST® *LIQUI FORM* TLF 10000 has been qualified for this new massive MIMO active antenna. The material has also been qualified for applications in the automotive ADAS sector.

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