

Andrew® Base Station Antenna Systems Environmental Product Testing Equipment and Standards

To ensure published performance of our products, all families of Andrew base station antennas are tested and must successfully complete rigorous environmental stress screening tests per IEC 68-2 standards or ETS 300 019-1-4 class 4.1E conditions prior to release for manufacturing.

Baseline Testing. Prior to environmental testing, the antenna is visually inspected and tested for electrical performance. The following electrical data is collected:

- VSWR plots
- IM plots
- Isolation plots, if applicable
- Pattern data that includes: Beamwidth (vertical and horizontal), Gain, Beamsquint/Tilt, Front-to-Back Ratio (F/B), First Sidelobe Level (FSL), Cross Polar Discrimination (if required), and other various antenna RF parameters.

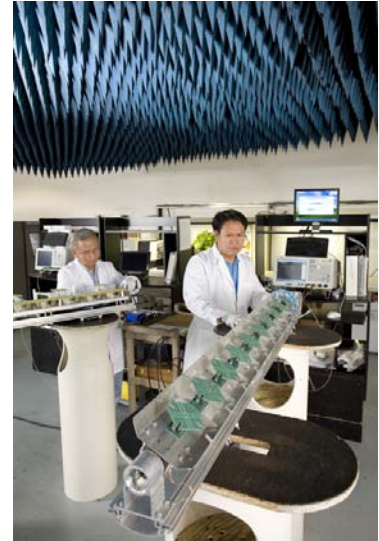
Reliability Solutions Testing. Products are subjected to the following tests as defined by the CommScope Qualification Test Plan and/or Product Development Scope Sheet. These tests are performed either by CommScope's in-house environmental lab or an outside independent test lab.

Cold Test. In accordance with IEC 68-2-1 at -40°C for 24 hours or in accordance with the ETS 300 019-1-4 class 4.1E conditions.

Heat Test. In accordance with IEC 68-2-2 at $+70^{\circ}\text{C}$ for 24 hours or in accordance with ETS 300 019-1-4 class 4.1E conditions.

Temperature Shock Test. In accordance with IEC 68-2-14 starting at -40°C and rising to $+70^{\circ}\text{C}$ in 10 cycles at 60 minutes at each temperature or in accordance with ETS 300 019-1-4 class 4.1E conditions.

Humidity Test. In accordance with IEC 68-2-30 with temperature extremes of $+25^{\circ}\text{C}$ to $+40^{\circ}\text{C}$ in 24 hour cycles and 90% relative humidity or in accordance with ETS 300 019-1-4 class 4.1E conditions.



Rain Test. In accordance with IEC 68-2-18, the unit is tested for a minimum of 4 hours in CommScope's custom designed rain chamber; which features 16 spray nozzles, 4 per corner, at a maximum of 43 psi pressure from each nozzle or in accordance with ETS 300 019-1-4 class 4.1E conditions.

Salt Fog Test. In accordance with IEC 68-2-11 (ASTM B117) the product is exposed to repetitive cycles for continuously 240 hours or in accordance with ETS 300 019-1-4 class 4.1E conditions.

Vibration Test. In accordance with IEC 68-2-6. Products are tested with a frequency range of 10–150 Hz, acceleration amplitude of 10 m/sec², displacement amplitude below 1.5 mm or less and 20 sweep cycles in each orthogonal direction or in accordance with ETS 300 019-1-4 class 4.1E conditions.



Solar Radiation Test (only for new radome or exposed non-metal parts). In accordance with IEC 68-2-5 at 40°C for 1,000 hours or in accordance with ETS 300 019-1-4 class 4.1E conditions.

Wind Survivability. The maximum panel deflection created under a specified wind load, with ice, is tested. The test unit is set up on the vibration table. Vibration will be increased to the level where the displacement amplitude meets the calculated value. This test will then run continuously for a minimum of 8 hours.

Packaging/Drop Test. Unit is packaged in the appropriate shipping carton and drop tested in accordance with TAPPI standard T802OM-91.

Post Test Verification. The electrical data is again collected after the reliability tests are completed. In some cases, the data is collected during the environmental test to assure the unit is performing well under extreme environments. The unit is visually inspected and data is verified against the pre-test data to assure there is no change in performance.



Installation Test. The testing unit is mounted using the specified hardware and mounting instructions. The hardware is verified for proper mounting and the instructions are verified for clarity, completeness and ease of customer use.



IM Testing. IM testing is conducted on 100% of all antennas using a two tone, 20 Watt per carrier test specification.

Power Handling Capability.

CommScope maintains on-site equipment capable of 16 carriers with up to 35 Watts per carrier to assure the products power handling during our design verification phase.

Pattern Test. Antenna patterns are qualified during the design phase and are periodically sampled during production. The pattern test is performed by an outdoor range or an indoor pattern scanner. Once all of the above parameters are met, the product is ready to turn over to our manufacturing group to build for our customers.



Base Station Antenna Systems Qualification Tests

| Test | Method | Condition | Duration | Parameters Tested |
|---------------------------|------------------------------|---------------------------------------------------------|-----------------------|---------------------------------------------------------|
| Low Temperature Exposure | IEC 60068-2-1 | -40°C | 24 h | RL ISO and PIM (pre and post) |
| High Temperature Exposure | IEC 60068-2-2 | +70°C | 24 h | RL ISO and PIM (pre and post) |
| Temperature Cycling | IEC 60068-2-14 | -40/+70°C | 12+ cycle/ 96 h | RL ISO and PIM (pre and post) |
| Humidity | IEC 60068-2-30 | +25/40°C @ 90% RH | 1 cycle/ 24 h | RL ISO and PIM (pre and post) |
| Rain | IEC 60068-2-18 | Wind Driven Rain | 8 h | RL (monitored in process) RL and PIM (pre and post) |
| Phase Shifter | Custom | Push & Pull Force Cyclic Operation | 5 each 1000 cycles | Average Force < 13.3 N RL ISO and PIM (pre and post) |
| Wind Loading | EIA-222-C | Simulated constant force of 241 km/h wind | 4 h/ surface | Visual/physical exam (RL and PIM pre and post) |
| Transportation Vibration | ASTM D 4169 or IEC 60068-2-6 | Truck Level 2 or equivalent | 3 h/axis | RL monitored RL and PIM (pre and post) |
| Salt Fog (Continuous) | IEC 60068-2-11 Test Ka | Continuous Exposure to 5 wt% NaCl mist @ +38°C | 96 h | Visual/physical exam |
| Salt Fog (Cyclic) | IEC 60068-2-52 Test Kb | 2 hrs salt mist followed by 20–22 h in 90% RH | 2+ cycle | Visual/physical exam |
| Solar (UV) Exposure | IEC 60068-2-5 | Accelerated weathering using UV-A exposure and humidity | 200+ h | Visual/physical exam |
| Package Drop (Shock) | ASTM D4169 | Packaged unit dropped | 10 drops | RL and PIM (pre and post) |