

SnapStak™ Stackable Snap-In Cable Hanger Electrical and Mechanical Testing Performance

Table of Contents

Introduction	1
Axial pull test and horizontal shear test.	2
Return loss and TDR impact test	3
Wind tunnel testing	4
Vibration testing	5
Thermal shock	5
Corrosion	6

Introduction

SnapStak™ self-stacking cable hangers enable installation engineers to neatly secure coaxial cables on congested communications towers simply by snapping them into place. Each SnapStak hanger accommodates one run of HELIAX® coaxial cable. Hangers can be double or triple stacked, from the tower face, depending on cable size. Snapstak hangers also may be used for other coaxial cable brands.

A major timesaving feature is the hanger's self-contained spring fork and retention tab design that

eliminates the need to use loose hardware to secure individual cable lines. Simply snap the hanger into a 3/4-inch hole in the prepunched tower mounting structure. Using various mounting accessories, you can mount SnapStak hangers directly to towers and also on building rooftops and water towers.

Constructed of stainless steel, the SnapStak snap-in hanger is strong enough to withstand extreme weather conditions and highly corrosive environments. Multiple retention tabs on the hanger prevent cable slippage and hanger disengagement from the tower, even under heavy ice and wind loads. The retention tabs at the base of the hanger also allow limited hanger float on the mounting structure, thus reducing vibration. This eases stress on the connections at the jumper cable, antenna, and RF device.

The Snapstak hanger has undergone an extensive battery of mechanical, environmental, and wind tunnel tests to ensure hanger safety and reliability, even under the most severe environmental conditions.



Dead Weight Hang Test

Axial Pull Test and Horizontal Shear Test

Cable hangers used in communication systems are typically subjected to heavy loading and other related stresses.

The purpose of this test is to verify that the hanger is strong enough to withstand pulling, hoisting and side load shear forces encountered during normal field conditions. The test was performed in accordance with MIL-C-39012C-3.24, 4.6.21.

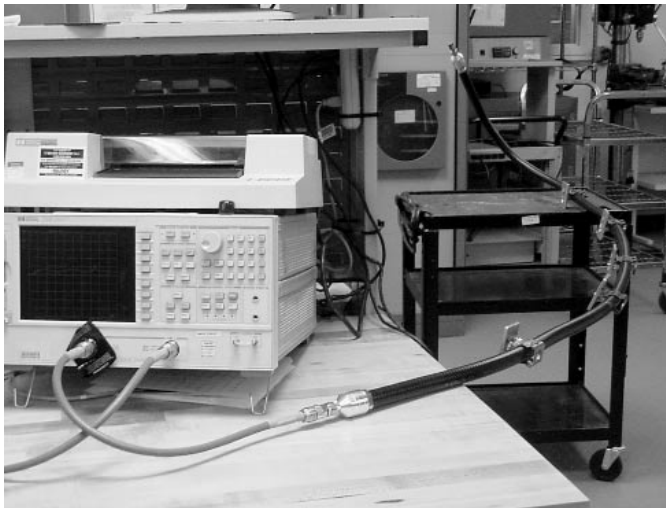
Several samples of SnapStak™ hangers for 1/2", 7/8", 1-1/4", and 1-5/8" HELIAX cables were applied to fixturing to simulate normal field installation. HELIAX cable sizes LDF4-50A, LDF5-50A, LDF6-50, and LDF7-50A from standard production runs were pulled through the hangers to measure the hanger's ability to support the cable weight, with a high margin of safety. A Tinius Olsen Super L Force Machine was used in the load range of 0 to 1200 pounds.

The hangers were also mounted in the horizontal plane to plates having thicknesses of 0.120" to 0.150". They were pulled axially to simulate a side load shear.

Results

Results show that the SnapStak hangers placed at 3-foot (1 meter) intervals along the cable are capable of securing in place 14.5 to 40 times the weight of the cable. Also, the force required to release the hanger from the mounting structure is well in excess of that which could be encountered at the site. The average amount of force required to pull the hanger over the corrugated crest of each cable and to release the hanger from the 0.750" x 0.120" mounting hole is indicated in the table below. Horizontal shear in a common mounting structure, with an after galvanizing thickness of 0.150" improved up to 48% over the thinner material.

Cable Size	Axial Weight lb (kg)	Horizontal Sheer lb (kg)
1/2"	18.3 (8.3)	128.8 (58.4)
7/8"	37.1 (16.8)	69.5 (31.5)
1-1/4"	36.3 (16.5)	69.5 (31.5)
1-5/8"	35.6 (16.1)	122 (55.3)



Return Loss and TDR setup. Notice hangers applied, and 90° bend in cable. Photo is for setup only.

Return Loss and TDR Impact Test

The purpose of this test is to verify that the SnapStak™ hanger, when properly mounted to a mounting structure, will not have any adverse effect on the electrical performance of the coaxial cable. This test was performed in accordance with Andrew Corporation Test Procedure 04AS00-01.

SnapStak hangers were attached, at 16-inch intervals, on nine foot lengths of 1/2", 7/8", 1-1/4", and 1-5/8" HELIAX coaxial cables from standard production. An HP8753E Vector Network Analyzer, with a 1-port calibration, was used to record measurements.

Virgin Return Loss (RL) and Time Domain Reflection (TDR) were recorded for each nine-foot cable sample. Then RL and TDR measurements were recorded after the application of each hanger, and one 90-degree bend to simulate normal field bending. Final RL and TDR measurements were recorded and plotted against the initial measurements.

Test results, listed below, indicate no TDR impacting of the cable greater than that of a normal field bend (90 degrees) and no significant decrease in return loss performance of the cable.

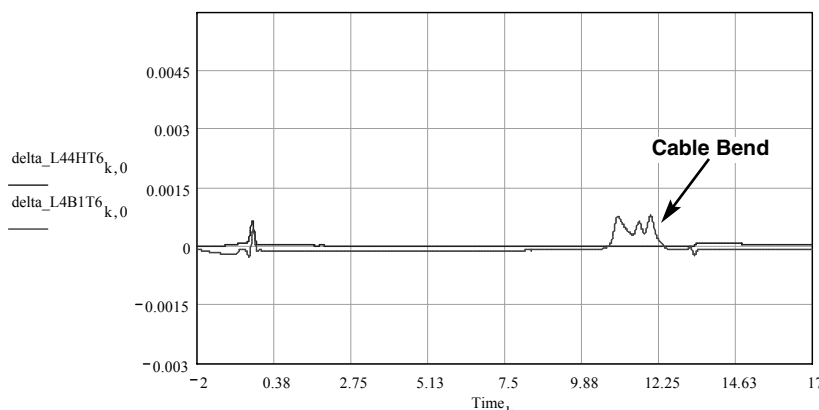
Return Loss Results

Test Condition	Worst Case RL at 6 GHz, dB
Null State	-17.4
2 Hangers Applied	-17.3
5 Hangers Applied	-17.3
5 Hangers Applied and 90° Bend	-17.7

The graph below was output directly from the MathCAD™ program. It details the TDR effects of the L4 SnapStak Hangers on a length of LDF4-50A cable. The upper trace is the TDR measurement with five L4 SnapStak hangers applied. Notice there is no significant impact.

The lower trace is the same length of cable with the same five hangers applied, but with one 90° bend (normal field installation bend). Notice that the bend in the cable impacts the cable greater than that of the application of the hangers.

Delta Plot of Voltage Reflection Coefficient for LDF4 cable sample with four L4 SnapStak hangers vs. LDF4 cable sample with one 90° bend, at 6 GHz





Wind Tunnel Test in progress. Wind speed 150 mph

SnapStak hangers successfully passed all criteria required for high-speed wind survival. After exposures to wind tunnel speeds of 150 mph, the hangers did not release from the mounting structure and showed no signs of fatigue, fracturing, or deforming. The coaxial cable did not slip from hangers and the hanger cable grips did not penetrate the cable jacketing.

Wind Tunnel Testing

High winds are the most damaging forces that SnapStak™ hangers will be exposed to in a typical wireless communication system. This test evaluates the SnapStak hanger's ability to survive these conditions.

SnapStak hangers were set in three and two stack configurations. Three sets of stacked hangers were attached to a fixture using 0.750" mounting holes, a wall thickness of 0.120" and 3 foot (1 meter) spacing. Seven foot lengths of 1/2", 7/8", 1-1/4", and 1 5/8" coaxial cable were installed in the hangers. The wind tunnel applied a wind speed of 150 mph in the X plane (direct side load).



Vibration setup in Y plane. Hangers in 3-out configuration

Vibration Testing

Vibration testing is performed to ensure extreme mechanical vibration induced on the cable and hanger system by winds will have no adverse affect on SnapStak hangers or the cable they are supporting.

SnapStak™ hangers were mounted to the vibration test fixture with 3 foot (1 meter) spacing via adapter blocks with 0.750" inch (19mm) holes. Standard production HELIAX cable in 1/2" and 7/8" sizes was mounted in a three-stack configuration and 1-1/4" and 1-5/8" sizes in a two-stack configuration. To test normal variation in the thickness of the mounting structure, two sets of mounting blocks were 0.120" in material thickness and two sets were 0.150" thick.

Varying wind directions and velocities were simulated in a four-hour sweep test in both X and Y planes with frequencies ranging from 10 to 2000 Hz. Maximum displacement was 0.65 inches at 10-55 Hz and acceleration was 6 Gs.

During the four-hour test cycle, SnapStak hangers did not release from each other or the 0.750" (19mm) mounting blocks. HELIAX cable did not slip from the hanger and the hanger cable grips did not penetrate the cable jacketing to the point of making contact with the copper outer conductor. Close inspection of the hangers showed no signs of fatigue, fracturing, or deformation.

Thermal Shock

Extreme and rapid temperature change is common at wireless communications sites, such as when a hot summer day produces a thunderstorm that rapidly cools the site infrastructure. Tests were performed on SnapStak hangers to measure the effects, if any, of high and low temperatures extremes on the Snapstack hangers.

SnapStak hangers were attached to standard production HELIAX coaxial cable in sizes 1/2", 7/8", 1-1/4", and 1-5/8" and exposed to thermal shock testing in accordance with standards: Andrew Corporation 04AS00-03-4.0, original revision and MIL-STD-202F, Method 107G. Samples were subjected to 25, one-hour cycles between the temperatures of +85°C and -55°C.

During and after the test, there was no evidence of cable loosening from hangers. Axial pull out forces averaged 11.8 ft-lb at initial slip, and 18.3 ft-lb over corrugated crests of cable.



Results - L4 SnapStak™ Hangers after Corrosion Test. No effect

Corrosion

Coastal areas of the world are most prone to suffer the effects of salt spray. Any product that is to be used in these locations must be prepared to deal with the severe environmental effects. For this reason, the Snapstak hangers are made from stainless steel. To evaluate the suitability of the SnapStak hanger, several samples were placed in a salt fog chamber in accordance with MIL-STD-1344A, Method 1001.1. The hangers were exposed to a 5% salt solution with a PH between 6.5 and 7.2 at temperatures between 93°F and 97°F. After 96 hours of exposure, the hangers showed no signs of rust, oxidation, corrosion, cracking or degradation in any way.