

Extended Environmental Simulation



Extended Environmental Simulation (EES)

Making sure GradConn products go through rigorous testing is our commitment that you receive connectors and cable assemblies of the highest quality and perform flawlessly for your application.

The Nautilus range of IP rated coaxial connectors and assemblies **already provide an excellent level of environmental protection**, but how does it perform over an extended period out in the field?

Working closely with independent test labs, GradConn's engineering team has developed a test plan to **simulate prolonged use in demanding environments**. The aim is to demonstrate Nautilus SMA Cable Assemblies **can maintain optimal performance throughout its life** when subject to various environmental conditions. The tests are designed with the aim of replicating five years usage in the field based on accelerated life testing.



EES Tests

EES consists of four core tests:

- 1) Electrical Performance
- 2) Salt Spray
- 3) IPX7 Testing
- 4) Thermal Shock



All tests are **cycled five times** to replicate a total of five years in the field, conducted to **industry test standard specifications**.



EES Test Overview

1 Electrical Performance

Four key parameters were tested at frequencies 1GHz, 2GHz and 3GHz and passed all requirements well within specification:

- **Insertion loss** – Testing ensures that the loss of signal power as it travels through a component or system is $<0.8\text{dB}$
- **Impedance** – To avoid signal reflections, an impedance of at least 45.55 Ohm is required. It retained between $51.9\text{-}52.3\text{ Ohms}$ from the tests.
- **VSWR (Voltage Standing Wave Ratio)** – Damage to equipment and distortions may occur if VSWR is not <1.5
- **Return Loss** – Ensure the reflected/returned signal power to the source, must be $>15\text{dB}$

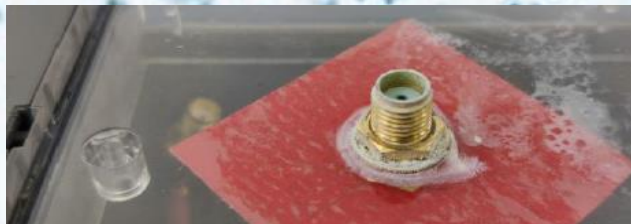
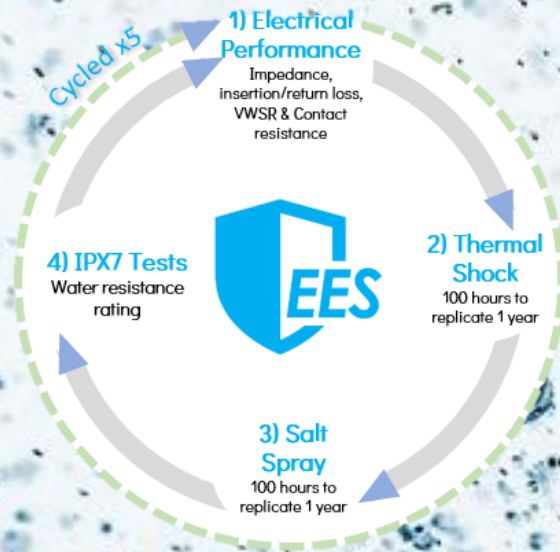


2 Thermal Shock

Thermal shock tests ensure Nautilus SMA connectors and cable assemblies *still operate effectively when subject to rapid fluctuations in temperature*. Ideal for devices deployed out in the field or simply due to product operation in more extreme temperature applications.

Samples are placed in a thermal shock test chamber subject to alternating temperatures of -40°C and 85°C for 30 minute periods each. Temperature transfer time took ≤ 10 seconds for 100 cycles.

The test results showed no significant change in performance.



3 Salt Spray Testing

There are potential applications that may subject Nautilus to low levels of salt spray and were incorporated with the ESS process.

Samples were placed in a test chamber and subjected to a salt solution of $5\%\text{NaCl}$ and $\text{ph } 6.5\text{-}7.2$, applied for 100 hours.

Results from the test exhibited salt deposits formed on the connector surface as expected, but did not interfere with the electrical performance of the connector as it was still within specification.

4 IPX7 Testing

As a core feature for Nautilus, the waterproof performance must be best in class. We test to IP67 and IP68 as standard. As the most popular Nautilus type in the range, it was a great chance to show SMA IP capabilities over prolonged periods.

A connector mounted on an enclosure was tested to IPX7 up to 1 meter under water for 30 minutes.

IPX7 testing was successful as there was no water intrusion within the sample and enclosure.



“Are Nautilus Assemblies tested to EES the right choice for me?”

The Nautilus range of connectors and assemblies already provide an excellent level of environmental protection for RF applications. By completing a series of extended life tests, you can be confident that the SMA Nautilus variants can also operate effectively in over prolonged periods with little/no impact from the environment on the performance.

If your application requires at least one of the following features, the Nautilus SMA connector and cable assembly options are good options:



Salt spray resistance



Subject to rapidly changing temperature environments



Prolonged exposure to water contact



A 'fit-and-forget' connection which requires little/no maintenance

“How can I get my hands on a Nautilus EES Cable assembly?”

Currently, SMA variants of the Nautilus range have gone through the EES process, but there are plans to apply the enhanced environmental simulation process across the broader range.




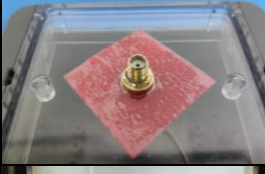

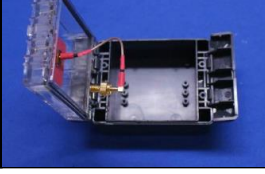
View the full range of Nautilus SMA on GradConn.com.

More information on Nautilus can also found on the [GradConn Nautilus Page](#).



A limited selection is also available on Digi-Key.com for immediate dispatch.

EES Test Detail

Test Type	Test Standard	Methodology	Example Device Under Test/Equipment Images	Parameters & Results from Cycle 5 (Full test reports available on requests)				
				Parameters	1GHz	2GHz	3GHz	Requirements
Electrical Performance	GradConn Standard Electrical Performance Specification	Implement 2-part full calibration of the device under test (DUT) with a Vector Network Analyser (VNA), firmly locking the SMA connectors into both sides of the DUT. Activate measurement function and select response menu for all S-Parameters.		Insertion Loss (dB)	0.385	0.392	0.478	<0.8dB
				Impedance (Ohm)	47.717	51.914	51.193	45-55
				VSWR	1.039	1.045	1.085	<1.5
				Return Loss (dB)	32.886	32.066	27.796	>15dB
Salt Spray	BS EN 60068-2-11-1999	Device under test consisting of a mounted connector on an enclosure is placed within a salt spray chamber. Test conditions as follows: 1) Temperature of the chamber 35°C 2) Temperature of the saturation 47°C 3) Salt Solution: 5%NaCl (by weight) 4) Volume of salt solution collected 1~2ml/h*80cm2 5) Test duration: 100 hours		Criterion	Test Result (Visual Inspection)			
				No corrosion should be found sample surface after test	No obvious corrosion was found on the metal terminals of the sample surface after test			
Thermal Shock	BS EN 60068-2-14-2009	Device under test consisting of a mounted connector on an enclosure is placed within a Thermal shock test chamber. Test conditions as follows: 1) Low temperature -40°C, dwell time 30mins 2) High temperature 85°C dwell time 30mins 3) Transfer time ≤10 seconds between temperatures 4) Number of cycles: 100		Criterion	Test Result (Visual Inspection)			
				No significant change should be found on sample surface after test	No significant change was found on the metal terminals of the sample surface after test			
IPX7	IEC 60529:2013	Device under test consisting of a mounted connector on an enclosure is placed within a waterproof grade testing machine. The sample is submerged 1000mm below the surface of the water at its lowest point for 30 minutes		Criterion	Test Result (Visual Inspection)			
				No water intrusion	No water invaded the inside of the sample			