To Test or Not to Test: Maintaining NEBS Certification

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Manufacturers of NEBS products must know when and how much to test to maintain certification.

You've reached the lofty goal of NEBS certification. All testing has been successfully completed, the test report is finished, and the customer is ecstatic. Life is good. Then reality strikes. Manufacturing is having trouble securing a field programmable gate array, marketing wants a new module, and the president wants hardware costs slashed. You think, "This is definitely going to affect my NEBS certification--what do I do?"

A telecommunications product constantly undergoes change throughout its evolution. Each change, no matter how minor, requires a balance between performing full Network Equipment Building System (NEBS) testing and about making an engineering judgment on whether testing is even required. This article focuses on helping designers determine this balance. It also explains how to maintain NEBS certification. Typical product and process changes are examined, with guidance provided to ensure that the customer maintains network integrity.

Change and Evolution

This article provides the necessary guidance to deal with product and process change. Change is good. Without change most companies wouldn't be in business very long. A first NEBS certification is just a snapshot in time. Manufacturers must maintain NEBS certification throughout the life of the product. Here are some typical changes in the life of a NEBS-certified product:

- Component revision change.
- Second sources.
- Software and firmware.
- New features.
- Cost reduction, including component depopulation, board relayout, manufacturing location change, and mechanical.

Staying in the Loop

How Do I Know That Change Is Even Taking Place in My Company? It is important to be able to answer this question. The answer lies in the company's TL 9000 process, provided that one is in place. TL 9000 is a set of quality system requirements for telecommunications service providers. A designated person must have sign-off authority on engineering change requests (ECRs) and engineering change orders (ECOs). Without this position, the company is managing by reaction, i.e., the company is in reaction mode every time someone thinks it's time for a NEBS test cycle.

It's also best if the designated authority does not report directly to engineering, manufacturing, sales, marketing, or any organization that is motivated simply by getting the product out the door. Not to say that these organizations do not want a quality product to go to the customer. They do. It's just not their primary focus. The designated authority should report directly to the quality or legal organization. The focus of these organizations is to follow rules and procedures and to be measured on this accordingly.

Impact	Severity	Meaning	Examples
Network	Minor	No impact on the network.	Resistors, capacitors, diodes, transistors
	Major	Indirect impact on the network.	Secondary components that could indirectly impact the network
	Critical	Direct impact on the network.	Microprocessor, FPGA, SDRAM, clock
Safety	Minor	No impact on product safety.	Resistors, capacitors, diodes, transistors
	Major	Indirect impact on product safety.	Some plastic parts
	Critical	Direct impact on product safety.	Dc/dc convertor, fuse, fan, transient suppression device, power connectors, relays, transformers

Table I. Factors that determine potential impact of change.

So, Once You're in the Loop, What's Next? As each ECR passes by for approval, it is critical to determine its impact on the company's NEBS certification. When the ECO is finally complete, the designated authority should feel comfortable approving it.

Changes to the Product

The potential impact of each change must be determined. Does the change impact the network? Does the change impact safety? If the answer is yes to either of these questions, is the impact minor, major, or critical? Table I will help you make these decisions.

If the change is network critical, it's a candidate for full NEBS testing. NEBS ensures network integrity, and if a part could potentially degrade that integrity, it must be verified. This can get a little tricky because a carrier-class product will have fault tolerance built in. It would be easy to dismiss a major component, because the system will work even if it fails. For example, a microprocessor on a system control module or a major line card is a major component. If it fails, there is backup, but it should be network critical because of its primary function.

If the change is safety critical, safety testing may be required by a nationally recognized testing laboratory (NRTL). At a minimum, the NRTL report will need to be updated.

After determining whether the change affects the network or safety, it is then best to work through each major section of GR-1089-CORE and GR-63-CORE. Determine whether the change affects any of the following:

- Temperature, humidity, altitude, heat dissipation, fire resistance, handling, seismic, airborne contaminants, acoustic, or illumination.
- ESD, EMC, lightning, ac power fault, steady-state induction, dc potential difference, safety, corrosion, bonding, or grounding.

Then determine whether the impact is minor, major, or critical. Now a decision must be made on the level of retest required: none, partial, or full.

Typical Changes

Some typical changes in the life of a telecommunications product include component revision, second sources, software and firmware, new features, and cost reduction.

Component Revision Change. Wouldn't it be nice if all of the components used in the initial design were readily and cost-effectively available throughout the life of a product? It wouldn't be surprising if a key component supplier decided to go from revision B to revision C the day after the first prototype comes in.

Second Sources. Only in very special cases should single-source components be allowed. With single sources, if a supplier cannot deliver, production is shut down. Second sources must be a fact of life with a telecommunications product.

Software and Firmware. Software and firmware will be under constant revision during development. When the product is released, there will be bug fixes, patches, and new releases. It would be too expensive to run full NEBS testing on each fix or patch. New releases must be properly scheduled to make the most out of a NEBS test cycle.

New Features. The customer and the market will demand new features from the product. New line cards will be developed, and they need to be NEBS qualified. It is important to understand the company's product road map so that proper planning identifies the most cost-effective time to do full NEBS testing. New line cards will require full NEBS testing. Like software and firmware changes, careful planning is required.

Cost Reduction. Sooner or later, a customer is going to want better pricing, and management is going to want higher margins to offset this cost. Examples here include alternate-source components, component depopulation, board relayout, manufacturing location change, and mechanical changes.

Description of product modification:	Revision change to APC chip. Went from revision B to revision C.
Network Critical?	NO. Covered by Fault Tolerance.
Safety Critical?	NO. Not a Critical Component.

Requirement	**Impact**			**Test?**	**Comments**
	Minor	***Major***	***Critical***		
GR-1089-CORE					
ESD		X		YES	Internal. Compliance Lab.
EMI Radiated		X		YES	External. Local EMC Lab.
EMI Immunity		X		YES	External. Local EMC Lab.
Lightning/Ac Fault	X				
Steady-State Ind.	X				
Dc Poten. Diff.	X				
Safety	X				
Corrosion	X				
Bonding/Grounding	X				
GR-63-CORE					
T/H/A		X		YES	Tested by Design Verification.
Heat Dissipation	X				
Fire Resistance	X				
Handling	X				
Seismic	X				
Airborne Contam.	X				
Acoustic	X				
Illumination	X				
SBC					
Input Voltage	X				

Range					
Low Transient	X				
High Transient	X				
Noise Induction	X				
NRTL (Safety)					
Input Current	X				
Leakage Current	X				
Dielectric Withstand	X				
Temperature Rise	X				
Bonding/Grounding	X				
Outside Plant	X				
GR-1089-CORE					
ESD			X	YES	NRTL.
EMI Radiated			X	YES	NRTL.
EMI Immunity			X	YES	NRTL.
Lightning/Ac Fault	X				
Steady-State Ind.	X				
Dc Poten. Diff.	X				
Safety			X	YES	NRTL.
Corrosion	X				
Bonding/Grounding			X	YES	NRTL.
GR-63-CORE					
T/H/A			X	YES	NRTL.
Heat Dissipation			X	YES	NRTL.
Fire Resistance	X				
Handling			X	YES	NRTL.

Seismic			X	YES	NRTL.
Airborne Contam.		X			Pin-for-pin direct replacement part. Testing not necessary.
Acoustic	X				
Illumination	X				
SBC					
Input Voltage Range			X	YES	NRTL.
Low Transient			X	YES	NRTL.
High Transient			X	YES	NRTL.
Noise Induction			X	YES	NRTL.
NRTL (Safety)					
Input Current			X	YES	NRTL.
Leakage Current			X	YES	NRTL.
Dielectric Withstand			X	YES	NRTL.
Temperature Rise			X	YES	NRTL.
Bonding/Grounding			X	YES	NRTL.
Outside Plant	X				

Figure 1. NEBS certification retest form, revision B.

Evaluation of Change

Each change must be evaluated independently and then as part of the system. The NEBS Certification Retest Form in Figure 1 can be used to determine whether no test, partial testing, or full NEBS testing is required. If in doubt, it's always best to check with the customer. If this is not possible, discuss the options with a test lab.

Conclusion

As mentioned earlier, change is good. These changes can easily become overwhelming. Order can be made from chaos with the right system. Use the NEBS Certification Retest Form outlined in this article to provide focus in determining when, and if, full NEBS testing is required.

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