

Leading the way in electronics



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DAVE'S WORLD

By: David Raby

September, 2016

Most of you know STI Electronics for our Training Resources. For many years we have provided high quality hands on training, training materials and curriculum development. STI employees have also spent countless hours in committee meetings participating in the development of industry standards used globally in the electronics industry. I'm very proud of our work and participation and the plan is to continue and expand in all of these areas.

What is one of our best kept secrets (not intentionally) is that in addition to the products and services discussed above, STI is also a Contract Manufacturer and Engineering Services organization. While we've always been a small company by SBA standards, our contract manufacturing and engineering capabilities are not typical of a "small" shop. We've invested in facilities and equipment that put our

capabilities miles ahead of most small companies. We have three SMT lines that allow us to produce volumes but we can also dedicate one line to prototypes and low volume production. One of the three SMT lines is housed within our Class 1000/ISO Class 6 Clean Room.

Quality is an expectation and priority in our Manufacturing and Engineering group and for all of our customers. However, for our top four current customers, quality takes on an importance of epic proportions. Non-functioning hardware for these customers could result in loss of life and limb in the field. Working together with our customers to ensure all expectations and requirements are met with quality at the top of the list, is a priority for STI. We take quality seriously on these products and that carries over to everything else we manufacture. We have certifications for ISO-9001-2008, IPC-A-610 and J-STD-001 plus J-STD-001ES (Space Addendum) and an IECEx QAR for manufacturing intrinsically safe



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David Raby

President/CEO

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communications equipment from South Africa. We are in the process of implementing AS-9100C and expect to have our certification by the end of this year. Having these certifications is a necessary requirement for the product mix we manufacture on a daily basis but certifications don't build product, STI employees do. STI employees are sensitive to the importance of the products they handle and are invested in STI's quality philosophy and commitment to meeting and overall exceeding the customers' expectations.

STI's Manufacturing and Engineering group has a definite advantage over our competitors since they have access to our complete Analytical and Failure

Analysis Lab as well as our Training Services Department. STI's Analytical and Failure Analysis Lab is adjacent to our manufacturing floor. Any unexpected issues that arise can be quickly analyzed, tested and a comprehensive solution presented to the manufacturing floor and to our customers. STI's Training Services staff is located in the front of the building and supplies the Manufacturing and Engineering Group with expertise in the industry standards used by our customers such as J-STD-001 and IPC-A-610.

It is difficult to put a price on quality but STI has put a lot of thought and effort into maintaining our founder, Jim Raby's philosophy of Zero Defects and "Build It Right the First Time". As a result, we may not be the lowest bidder on a project but customers will and do receive a quality product on the projects we are awarded. In many cases, STI is asked to rework and/or repair the hardware for a customer who issued a contract on price alone to a competitor and received

hardware that did not meet the customer's requirements.

STI's Engineering Services and Manufacturing Division is truly a total solutions partner for our customers. As an ITAR and DCAA Secured Facility, we are prepared to handle hardware regardless of its end use or intended application including commercial, automotive, energy, defense, high reliability, medical, etc. We are prepared to provide engineering support through DFM, design support, test, prototype development, manufacturing, box build, and failure analysis. STI also holds a patent for Imbedded Component Die Technology (IC/DT ®) that will enable hardware designed using this technology to use less real estate, significantly reduce weight and be more rugged.

STI is proud of its accomplishments over these last thirty-four years but none of our successes would have been possible without our employees. We have a very talented and dedicated group of employees who bring a myriad of experiences

to the table ranging from manufacturing in other small shops to large OEMs to some who are straight out of college. What they all have in common however, is their commitment to STI and to our customers. They all care about your product and your success.

Several of us at STI will be at SMTAI in Rosemont the end of September. Pat will be attending IPC Committee Meetings; Mark will be in the booth and at several of the Technical Conferences; Diana will be manning the booth and I will be doing some of all in addition to wandering around looking for snacks. Please stop any of us and say hello.

Please contact us if you'd like to know more about our manufacturing capabilities or anything else about STI. Thank you for your support over the years and I look forward to hearing how we can serve you better.

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ELECTRONIC FAILURE ANALYSIS

COPPER DISSOLUTION

Copper dissolution is the process necessary to form the intermetallics within the solder connection. When molten solder comes into contact with copper plating the copper dissolves into the solder alloy, and it continues until the solder solidifies or until the copper is fully diffused into the solder.

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It is a process needed to provide strength to a solder joint, however, it can become an issue if the copper dissolution occurs too rapidly. In lead-free solder alloys the reaction between the tin in the solder alloy and the copper in the PCB substrate occurs at a higher rate than if the tin is alloyed with other elements. The higher soldering temperatures and longer contact times with the solderable surfaces increases the amount of copper dissolution. If the soldering process is not properly controlled, it can lead to excessive copper loss and speed up the degradation of the plated copper connections.

Copper diffusion rates for the solder alloys depend on three main parameters:

- Chemical composition of the solder
- Reflow temperature
- Time above liquidus temperature

Such process parameters can and should be controlled to limit the amount of copper dissolution during the assembly processes. Other variables that could impact the total loss of copper are: minimum copper plating thickness and PCB surface finishes used.

Excessive copper dissolution is a major defect and reliability concern. If excessive copper dissolution occurs, it can negatively affect the long term reliability of the electronic hardware. STI's Analytical laboratory recently came upon some customer samples that were previously thought to exhibit solderability issues. When surface evaluation did not immediately provide the required answers, a cross-sectional evaluation was performed. Micro-sectional SEM evaluation of various solder connections revealed the presence of excessive copper dissolution. These examples show the extent in which the plated copper connections can be compromised:



Figure 1: Appears to be a cracked solder joint

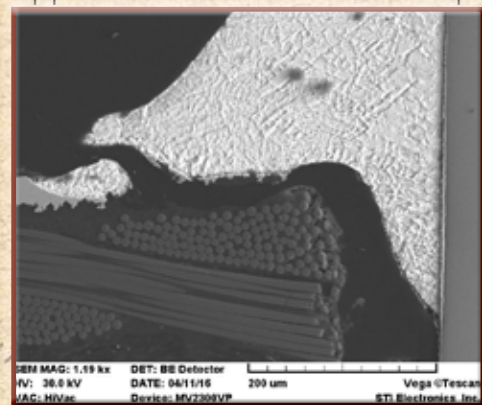


Figure 2: Excessive copper dissolution visible

Visual defects can and are sometimes dewetted in appearances. They can also manifest itself as a lifted pad state where the underlying copper pad adhesive system fails.

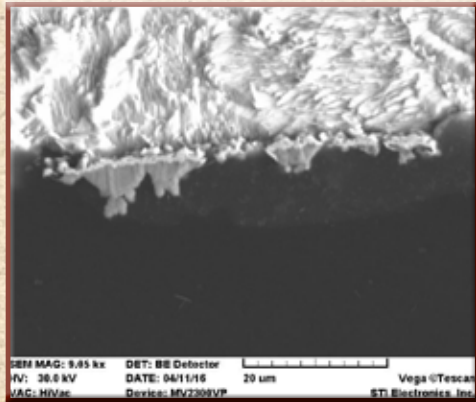


Figure 3: No significant copper layer visible

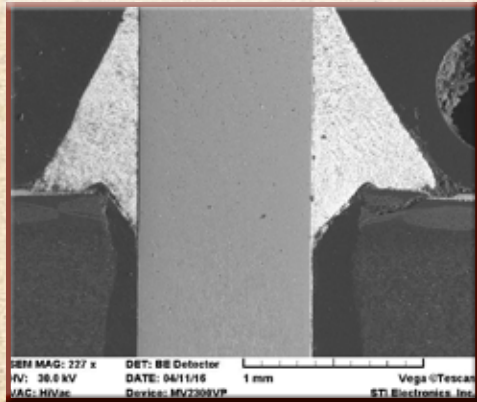


Figure 4: Failed electrical interface

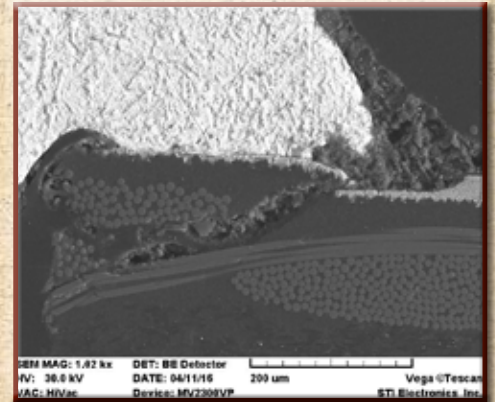


Figure 5: No bulk copper pad present

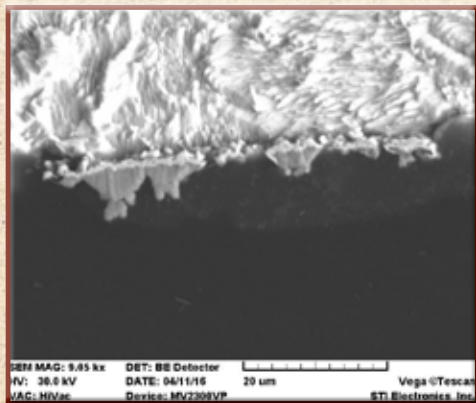


Figure 6: No bulk copper pad present



Figure 7: Dewetting in appearance

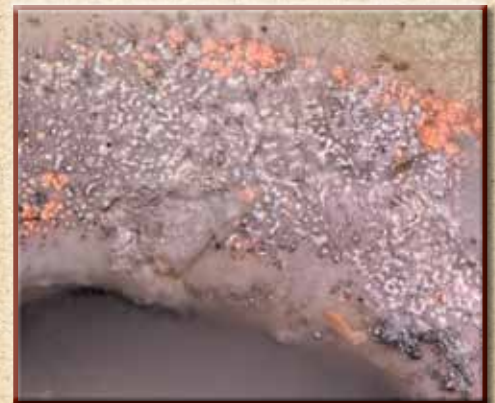


Figure 8: Dewetted visual appearance land surface

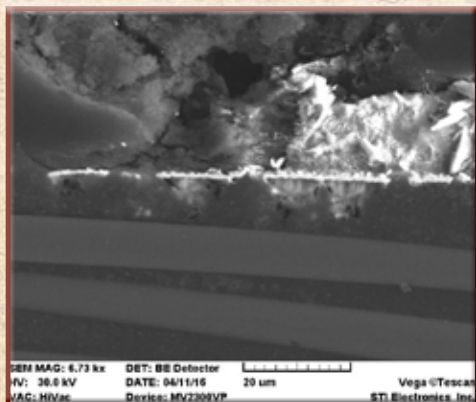


Figure 9: Cross-sectional view of almost completely consumed copper layer at the PCB interface. All one can see is an intermetallic formation with no underlying copper pad support.



Mel Parrish Retires



After over 15 years of dedicated service to STI Electronics, Mel Parrish, FSO/ Director of Training Materials, retired on July 7, 2016.

After retiring from the Air Force as an Electronics Curriculum Designer, Parrish began working in standards development and training while working for the Navy at China Lake during the generation of WS6536 through MIL-STD-2000. Parrish later went on to the Electronics Manufacturing Productivity Facility (EMPF) in Indianapolis, Indiana before joining STI in 2000.

Parrish has held a variety of leadership positions at STI culminating with his position as Director of Training Materials. As a collateral duty, Parrish also served as the Facility Security Officer (FSO). Parrish has been a major contributor to the IPC and is a Technical Activities Executive Committee (TAEC) lifetime member.

“Obviously, I have mixed emotions about Mel’s retirement. On the one hand, Mel has been a vital part of our organization for many years and will be missed. On the other hand, I’m happy that Mel will now be able to focus on the things that are most important to him ...family and hobbies,” said David Raby, President/CEO.



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TRAINING MATERIALS

Thermal Shock of Ceramic Chip Capacitors And The Hand Soldering Process

Ceramic chip capacitors have a long history of developing cracks during the electronics assembly manufacturing process. In many instances the cracks were induced by mechanical stresses. It was also very common for the cracks to be induced by thermal stresses. While the devices were capable of being processed at the required temperatures, the thermal gradient, or speed at which the temperature increases, often resulted in cracks due to the uneven expansion of the various device materials. This was a significant

problem when wave soldering was used for the soldering process. The ability to obtain greater control of the thermal gradient with modern reflow ovens resulted in a reduced occurrence of cracks caused by thermal stresses. The hand soldering process is extremely effective at heat transfer, but involves a very dramatic thermal gradient. This common occurrence from rapid temperature change resulted in the following note in IPC J-STD-001F:

Note: Some components can be catastrophically damaged internally when soldering iron tips make direct contact with the end terminations.

Obviously, the key to hand soldering of ceramic chip capacitors is to modify the process to include a more gradual thermal gradient that reduces the risk of damaging thermal stresses. One method that works is to replicate the process of a reflow oven. This can be done through the use of hot air. Hot air can be applied through a more controlled hot air rework system or the use of a hand held hot air pencil. When using a hand held hot air system, the operator has to carefully control the distance of the hot air source from the component and solder paste. By beginning the process with the heat source approximately six inches away and slowly moving the source closer to the component. The component will be slowly heated in a manner similar to the process of a reflow oven.

Another method that can be used involves hot plates or board preheaters. The device and/or printed board can be placed on a hot plate or preheater that has the temperature ramped up slowly from room temperature to within approximately 50° C of the liquidus temperature of the solder alloy being used. In this manner the temperature differential (or ΔT) between the device and the soldering iron tip are reduced to a level that does not induce thermal stresses into the device.

Looking for a solder training kit to try out these alternative procedures? Try our Fine Pitch SMT Kit (#405-0013). Along with BGAs and fine pitch QFPs, it has 130 passive resistor parts and locations as well as 130 passive capacitor parts and locations. More than enough to allow almost

anyone to become proficient with hand soldering of ceramic chip capacitors. This kit can also be used to determine overall production or machine process capability to meet the challenges of today's fine pitch component technologies. Lead Free component options are available with the ENIG board finish. Click below to place an order online



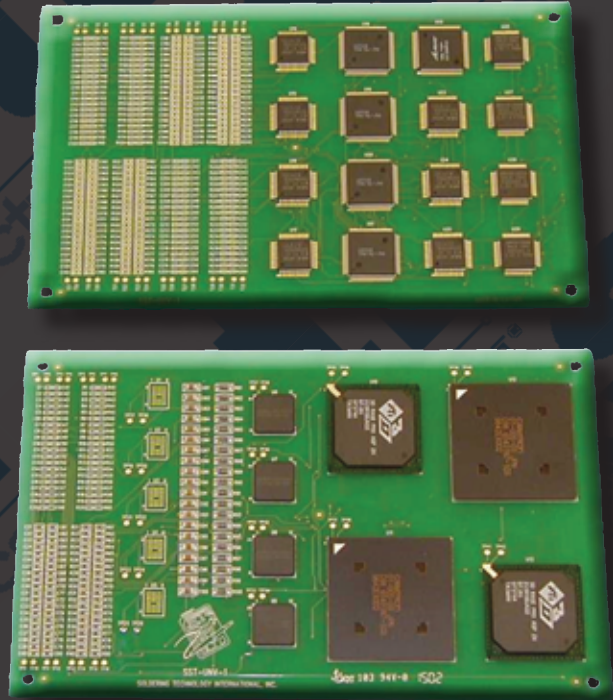
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Today's SMT and Lead Free processes present new challenges for employee skills and machine process capability. This kit allows you to develop critical skills and processes before they impact production. It is often used to determine overall production or machine process capability to meet the challenges of today's fine pitch component technologies. This kit offers all of this with guaranteed performance at a greatly reduced cost over operational assemblies.



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Employee

Spotlight

Meet:

PAM



Engineering
Services Division
in Inventory
Control

WORK

Pam will be celebrating 10 years with STI in October, 2016. Prior to working at STI, Pam worked at Big Springs Coca Cola, Tech 21 and SCI. Pam has over 36 years experience working in electronics manufacturing and inventory control.

FAMILY

Pam's nickname is Aunt Pammie. Pam says she lives a blessed life and has a beautiful, supportive family. Pam is married to her sweet husband Roger and has two furry babies, Mollie and Scooter. Pam also has 3 brothers, 2 sisters, 3 nieces, 7 nephews, 2 great nieces, 6 great nephews and a Mom who is 85 years young. The nieces, nephews, great nieces and great nephews are all the children she could ever want!

INTERESTS

Pam's hobbies include fishing, playing with her nieces/nephews, riding motorcycles, walking her dogs and watching Alabama Crimson Tide football- ROLL TIDE & PLAY BALL!!!

Pam's Fun Fact: "According to my great niece, Jada, I am coo-coo and my husband is crazy- LOL. I love Halloween and Christmas- especially at work where I have a crown in both costume categories. I love making up songs for my co-workers. One day I might grow up!"



ENGINEERING SERVICES

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Engineering Services

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New Equipment Announcements Seem to be a Recurring Theme in Our Newsletters.

This time our upgrade is a new placement system that provides STI's Contract Assembly Services with a significant improvement to its capabilities. With laser centering that can also confirm component release and tombstone picks, it still has an optimum placement rate of 20,900 chips per hour.



Complementing the new placement system is a new Juki TR6DN in-line matrix tray changer. The TR-6 is equipped with a dual shuttle that brings the components to the head for picking. The big advantage of this system is that no feeder space is lost.

It will be hard to keep up this pace for the next newsletter, but I look forward to the challenge.



Contact Information:
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Training Services Director
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TRAINING SERVICES

NEED A CUSTOM COURSE?

Many organizations require training that is tailored to fit a specific need. Where can you find a world class provider for course development? **STI Electronics, Inc.** is the answer. STI has designed courses for connections made to aircraft windshields to hands-on cable classes for cables designed by the customer. STI's extensive experience includes development of the following customized courses:

- Lead Free Awareness
- Flex and Rigid Flex Soldering/Rework
- Wave Soldering
- Solderability Testing to J-STD-002
- Low Residue/No Clean Process
- Basic Soldering
- BGA Rework
- Electrostatic Discharge (ESD)
- Cable/Harness 101
- IPC Training and Certification Curriculum for J-STD-001, IPC-A-610, IPC/WHMA-A-620, IPC/WHMA-A-620 Space Addendum.

STI can provide instructors to teach the course for you or you can purchase a turnkey solution complete with an instructor guide, slide presentation, testing and certificates that are yours to keep and use as long as needed with no fees associated with use after development is complete. You choose the amount of content desired and STI can use pictures of your actual products in the presentation to really bring it home to the students. STI understands the need to keep company specific information confidential and will do that throughout the development process.

When you have your own customized training program you can eliminate the annoying phrase heard so many times; "I know that's what they told you in class but this is how we do it on the floor."

Give me a call today at
256-705-5528 or email at
pscott@stielectronicsinc.com
and ask what we can do for you!



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2016 Schedule

Course	Location	Start Date	End Date
IPC-A-610 Certified IPC Specialist (CIS) Certification/Recertification Training Program	Madison, AL	6-Sep-16	9-Sep-16
IPC 7711/7721 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	8-Sep-16	9-Sep-16
IPC/WHMA-A-620B Certified IPC Trainer (CIT) Recertification Program	Madison, AL	12-Sep-16	13-Sep-16
IPC 7711/7721 Certified IPC Specialist (CIS) Rework/Repair and Modification Certification Program	Houston, TX	6-Sep-16	14-Sep-16
J-STD-001 Certified IPC Specialist (CIS) Recertification	Houston, TX	15-Sep-16	16-Sep-16
IPC/WHMA-A-620B-Space CIS Certification	Madison, AL	14-Sep-16	20-Sep-16
IPC/WHMA-A-620B-Space CIT Certification	Madison, AL	14-Sep-16	20-Sep-16
IPC J-STD-001 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	21-Sep-16	22-Sep-16
J-STD-001 Certified IPC Specialist (CIS) Certification	Madison, AL	19-Sep-16	23-Sep-16
IPC 7711/7721 Certified IPC Trainer (CIT) Certification Program	Madison, AL	19-Sep-16	23-Sep-16
IPC-A-610 Certified IPC Specialist (CIS) Certification/Recertification Training Program	Houston, TX	20-Sep-16	23-Sep-16
J-STD-001 Certified IPC Trainer (CIT) Recertification (Space Addendum Included)	Madison, AL	21-Sep-16	23-Sep-16
J-STD-001FS Space Addendum for CIT	Madison, AL	23-Sep-16	23-Sep-16
IPC 7711/7721 Certified IPC Specialist (CIS) Rework/Repair and Modification Recertification Program	Madison, AL	26-Sep-16	27-Sep-16
IPC-A-600 Certified IPC Trainer (CIT) Certification/Recertification Program	Madison, AL	26-Sep-16	28-Sep-16
IPC/WHMA-A-620 Certified IPC Specialist (CIS) Certification/Recertification Program (All Modules)	Madison, AL	26-Sep-16	29-Sep-16
J-STD-001 Certified IPC Specialist (CIS) Certification	Houston, TX	26-Sep-16	30-Sep-16
J-STD-001 Certified IPC Specialist (CIS) Recertification	Madison, AL	28-Sep-16	30-Sep-16
IPC J-STD-001 Certified IPC Trainer (CIT) Certification Program	Madison, AL	3-Oct-16	7-Oct-16

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2016 Schedule



Course	Location	Start Date	End Date
IPC 7711/7721 Certified IPC Specialist (CIS) Rework Certification Program Mods 1-6	Madison, AL	3-Oct-16	7-Oct-16
IPC-A-610 Certified IPC Trainer (CIT) Certification Program	Houston, TX	4-Oct-16	7-Oct-16
J-STD-001 Certified IPC Specialist (CIS) Recertification	Houston, TX	10-Oct-16	11-Oct-16
IPC/WHMA-A-620B Certified IPC Trainer (CIT) Certification Program	Madison, AL	11-Oct-16	14-Oct-16
IPC J-STD-001 Certified IPC Trainer (CIT) Recertification Program	Houston, TX	13-Oct-16	14-Oct-16
IPC/WHMA-A-620B Certified IPC Trainer (CIT) Recertification Program	Madison, AL	17-Oct-16	18-Oct-16
IPC 7711/7721 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	19-Oct-16	20-Oct-16
IPC/WHMA-A-620B-Space CIS Certification	Madison, AL	17-Oct-16	21-Oct-16
IPC/WHMA-A-620B-Space CIT Certification	Madison, AL	17-Oct-16	21-Oct-16
IPC 7711/7721 Certified IPC Trainer (CIT) Recertification Program	Houston, TX	20-Oct-16	21-Oct-16
IPC-A-610 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	24-Oct-16	25-Oct-16
IPC-A-610 Certified IPC Trainer (CIT) Certification Program	Madison, AL	24-Oct-16	27-Oct-16
IPC J-STD-001 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	26-Oct-16	27-Oct-16
IPC/WHMA-A-620B Certified IPC Trainer (CIT) Certification Program	Houston, TX	25-Oct-16	28-Oct-16
J-STD-001 Certified IPC Trainer (CIT) Recertification (Space Addendum Included)	Madison, AL	26-Oct-16	28-Oct-16
J-STD-001FS Space Addendum for CIT	Madison, AL	28-Oct-16	28-Oct-16
IPC J-STD-001 Certified IPC Trainer (CIT) Recertification Program	Houston, TX	31-Oct-16	1-Nov-16

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2016 Schedule

Course	Location	Start Date	End Date
MSFC/NASA 8739.1 Staking and Conformal Coating Recertification Course	Madison, AL	31-Oct-16	1-Nov-16
IPC-A-610 Certified IPC Trainer (CIT) Recertification Program	Houston, TX	2-Nov-16	3-Nov-16
IPC 7711/7721 Certified IPC Trainer (CIT) Certification Program	Madison, AL	31-Oct-16	4-Nov-16
MSFC/NASA 8739.4 Cable/Harness Recertification Course	Madison, AL	2-Nov-16	4-Nov-16
IPC 7711/7721 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	7-Nov-16	8-Nov-16
J-STD-001 Certified IPC Specialist (CIS) Recertification	Madison, AL	7-Nov-16	9-Nov-16
J-STD-001FS Space Addendum for CIS	Madison, AL	9-Nov-16	9-Nov-16
J-STD-001 Certified IPC Specialist (CIS) Certification	Houston, TX	7-Nov-16	11-Nov-16
J-STD-001 Certified IPC Specialist (CIS) Certification	Houston, TX	7-Nov-16	11-Nov-16
IPC-A-610 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	14-Nov-16	15-Nov-16
IPC J-STD-001 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	16-Nov-16	17-Nov-16
Basic Soldering	Madison, AL	14-Nov-16	18-Nov-16
IPC-A-610 Certified IPC Specialist (CIS) Certification/ Recertification Training Program	Houston, TX	15-Nov-16	18-Nov-16
J-STD-001 Certified IPC Trainer (CIT) Recertification (Space Addendum Included)	Madison, AL	16-Nov-16	18-Nov-16
J-STD-001FS Space Addendum for CIT	Madison, AL	18-Nov-16	18-Nov-16
IPC J-STD-001 Certified IPC Trainer (CIT) Certification Program	Madison, AL	28-Nov-16	2-Dec-16
MSFC/NASA 8739.4 Cable/Harness Certification Course	Madison, AL	28-Nov-16	2-Dec-16

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2016 Schedule



Course	Location	Start Date	End Date
IPC 7711/7721 Certified IPC Specialist (CIS) Rework/Repair and Modification Certification Program	Houston, TX	28-Nov-16	6-Dec-16
IPC-A-610 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	5-Dec-16	6-Dec-16
IPC J-STD-001 Certified IPC Trainer (CIT) Recertification Program	Madison, AL	7-Dec-16	8-Dec-16
J-STD-001 Certified IPC Trainer (CIT) Recertification (Space Addendum Included)	Madison, AL	7-Dec-16	9-Dec-16
J-STD-001 Certified IPC Specialist (CIS) Recertification	Houston, TX	8-Dec-16	9-Dec-16
J-STD-001FS Space Addendum for CIT	Madison, AL	9-Dec-16	9-Dec-16
IPC/WHMA-A-620 Certified IPC Specialist (CIS) Certification/Recertification Program (All Modules)	Madison, AL	12-Dec-16	14-Dec-16
MSFC/NASA 8739.4 Cable/Harness Recertification Course	Madison, AL	12-Dec-16	14-Dec-16
IPC 7711/7721 Certified IPC Specialist (CIS) Rework Certification Program Mods 1-6	Madison, AL	12-Dec-16	16-Dec-16
Basic Soldering	Houston, TX	12-Dec-16	16-Dec-16
MSFC/NASA 8739.1 Staking and Conformal Coating Certification Course	Madison, AL	19-Dec-16	22-Dec-16
STI Electronics, Inc. Training Centers			
STI Alabama Training Center 261 Palmer Road Madison, AL 35758 (800) 858-0604 www.stielectronicsinc.com	STI Houston Training Center 9920 W. Sam Houston Parkway South, Suite 420 Houston, TX 77099 (832) 374-0057 or (800) 858-0604 www.stielectronicsinc.com		

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