

Spring

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DLS News & Views

To help keep you better informed

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Digital Avionics Handbook, 3rd Ed.**DO-160G Testing for Avionics Chapter written by
Donald L. Sweeney, published 2014****Where do you start when you need your Avionics project certified?**

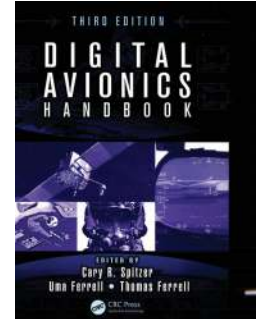
A new *Digital Avionics Handbook, Third Edition* was recently published to assist you in sorting out what it takes to have your product certified. I was quite excited to be asked by CRC (Chemical Rubber Handbooks) to write a new chapter on DO-160G testing for Avionics for this new edition since we at D.L.S. do this work every day. Those of you who ever needed a math table book (before computers) might remember the little green book printed on tissue paper, or later the not-so-small book. I bought my first CRC math table book in 1958 and it still stays near me even today.

This handbook, and especially the chapter I wrote, will be helpful for anyone considering Avionics, especially DO-160 testing, whether they are just beginning a project and want an overview or are a first time user/tester writing a "Test Plan," or someone who has tested and needs to understand what might have gone wrong.

For an early draft/white paper of the chapter which covers the entire DO-160G Sections 1-26 and includes more commentary and photos than was published in the book, go to: www.dlsemc.com/avionicshandbook. Each of the 26 sections includes an overview of the standard and how to use it, the purpose and applicability of the test, user guides, rationale for requirements, guidance in applying the requirements, commentary, possible troubleshooting techniques, and lessons learned from previous laboratory experience, along with the sequencing of the various tests.

As you read through the chapter on the DO-160G Standard, you will see how real life environmental effects are used to develop the requirements, with the entire goal to make the completed aircraft as safe as is reasonably possible. Probably the most important consideration early on is the need for a "test procedure" which should be generated and agreed upon by all parties involved, from the manufacturer/designer to the FAA or the agency granting final approval of the airworthiness of the components or final assembly. If one waits until the final submittal before having the tests approved, there will very likely be discussions which could require some or all of the testing to be repeated.

Digital Avionics Handbook, Third Edition is available for purchase on Amazon. You can also buy DO-160G Sections at www.rtca.org.

**FCC Updates****FCC KDB Publications Regarding Transmitters**

The FCC regularly provides Knowledge Data Base (KDB) publications on their website which are intended to provide important guidance on their regulations and procedures. Since these publications introduce changes and updates to regulations & procedures, they should be reviewed regularly to establish if there are any changes to requirements for your products. Some of the more recent KDB publications and drafts include the following:

- 640677: This draft provides clarification on the EMC regulations applying to RF Lighting and guidance on applying FCC regulations. Part 18 regulations for radiated and conducted emissions should be applied to all RF Lighting products including Fluorescent Lighting/CFL bulbs. Most LED lighting is not considered RF Lighting, but is subject to Part 15 technical regulations for radiated and conducted emissions following the FCC's Verification equipment authorization procedure.

continued on page 3

FCC and Industry Canada Electronic Labeling

Both FCC and Industry Canada require that equipment subject to certification have a permanent nameplate or label listing the Identifier (FCC ID / IC Number) and any other statements or requirements imposed by their specific regulations. These labels must be visible to the user at the time of purchase. Similarly, devices subject to FCC Declaration of Conformity (DoC) are required to be uniquely identified.

There are times when it is not practically feasible or appropriate for the manufacturer to place a label on the device. For instance, it may be that the device is too small or does not lend itself to permanent labeling. In such instances, the FCC and Industry Canada rules permit for alternative means of displaying the required information. Both authorities have introduced new guidelines for "Electronic Labeling" of products which have integrated displays. These documents are; FCC: KDB 784748 D02 E-labelling v01, and IC: Notice 2014-DRS1003.

Both documents clearly define when electronic labeling can be applied, what information must be displayed, and specific restrictions on ease of access by the user. In general, clear instructions must be provided to the user on how to access the regulatory information that is stored electronically. The user must be able to access the information easily and within three steps in the device's menu. There must be no special codes or accessories needed to access the information.

Products utilizing Electronic Labeling must also have a physical label on the product. This label may be on the packaging in individual packages and may be removable, but should be expected to survive shipping and handling. Both the FCC and Industry Canada will allow for e-labeling of devices approved as radio modules if the module or the host in which it is integrated has a display screen. There are specific conditions and requirements for e-labeling of modules, so please refer to the FCC & IC documents, or contact our team at 847-537-6400 for further details.

regulatory requirements **UPDATE**

FCC Radio Frequency Update

The FCC released Report & Order ET Docket 13-44 on December 30, 2014. In this document the FCC made significant changes to the RF equipment authorization process, along with increased TCB and test lab responsibilities. This ET Docket Report & Order will become effective 30 days after being published in the Federal Register (estimated March 1, 2015). The number of changes are numerous, but in this discussion I will attempt to cover those of most significance.

Changes affecting TCB's, test laboratories, manufacturers, and the certification process:

- The FCC will allow TCB's to issue all grants of equipment Certification, and discontinue the FCC OET's acceptance and granting of applications for equipment Certification.
- The TCB Exclusion List and Permit But Ask procedures will be eliminated and those devices will now be considered under the "FCC Pre-approval Guidance Procedures." Prior to testing, the TCB's will need to consult with the FCC OET regarding devices previously on those lists.
- TCB's will have the authority to take back (set aside) the grant of a Certification they have issued within the 30 days of issuance.
- TCB's will need to electronically file certifications through the Commission's Equipment Authorization System, including those for new technology. The FCC was very specific that all information relevant to the processing of an application for certification must be included as part of the electronic filing.
- TCB's will continue to be required to conduct post-market surveillance of 5 percent of all devices certified by the TCB.
- TCB's will continue to directly request samples from grantees. However, the FCC will add a process that allows TCB's to initiate a sample request from the Commission. Relevant to this process, upon request, the grantee must provide a voucher to the Commission or the TCB which authorizes the TCB to obtain a sample of the product from the marketplace at no cost to the Commission or TCB.

As an alternative to providing a voucher, the grantee can allow the Commission or TCB

to select a product randomly from the manufacturing or warehousing location. Furthermore, if special software or specialized mechanisms, methods, or modifications are required to test such unmodified production devices, the manufacturer must provide (at no cost) any special software, test hardware, methods, or modifications along with any necessary instructions to the Commission or TCB upon request.

Changes specifically affecting Test Labs:

- The requirement is introduced that all laboratories that perform Certification testing will now need to be accredited under ISO/IEC 17025. The FCC will cease recognizing new unaccredited Part 2.948-listed laboratories as of the effective date of the rules adopted in this Report and Order, and test labs which are currently FCC registered but not accredited will be recognized until their expiration date of recognition or for one year from the effective date, whichever is sooner.
- In the ET Document the FCC also announces they are adopting ANSI C63.4:2014. Test labs making radiated emission measurements above 1 GHz will need to meet the site validation requirements in ANSI C63.4:2014. The FCC reaffirms that testing is required to be done using ANSI C63.4 test procedures, and that CISPR 22 or CISPR 32 test methods will not be accepted for testing to FCC regulations.
- The FCC also announces they are adopting ANSI C63.10:2013 for testing of unlicensed wireless transmitters.
- The test lab must include in the application photographs or diagrams of the test set-up for each of the required types of tests performed and applicable for certification of the device.

It is important to our readers that D.L.S. Electronic Systems has prepared for all of the policy changes introduced in this FCC document, and is recognized by the FCC as an ISO 17025 accredited test laboratory. Therefore, this extensive change to FCC policies will not affect our clients and how they achieve certification or Declaration of Conformity compliance to FCC regulations.

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FCC KDB continued from page 1

- 784748 D02: Introduces Electronic Labeling options for Part 15 and Part 18 devices. (See sidebar on page 2.)
- 89033 D02: Provides updated information on compliance testing for the technical requirements applicable to the FCC rules recently revised for transmitters operating in the UNII services frequency bands.
- 935210: Provides measurement guidance for the evaluation of Signal Boosters operating under FCC Parts 22, 24, 27, and 90.
- 248227: Provides updated SAR Measurement Guidance for IEEE 802.11 Transmitters
- 971168: Provides a methodology for fully characterizing the fundamental power of wideband (> 1 MHz) digitally modulated RF signals acceptable to the FCC for demonstrating compliance for licensed transmitters.
- 937606: Provides test site requirements for performing radiated emissions measurements below 30 MHz. Specifically, before measurements can

be made at 1) a distance less than the limit distance, or 2) at an alternate test site, a bona fide attempt must be made to perform the measurements on an open field test site at the limit distance. Simply not having an OATS capable of making these measurements at the specified test distance is not acceptable criteria for compliance measurements using alternative methods.

- Part 15 update: Beginning January 12, 2015, auditory assistance devices that operate in the 72.0-73.0 MHz, 74.6-74.8 MHz, and 75.2-76.0 MHz bands must comply with the requirements of §15.237(c). Manufacture of devices not meeting this regulation shall cease on or before July 11, 2016. Current approved auditory assistance devices that operate in the 72.0-73.0 MHz, 74.6-74.8 MHz, and 75.2-76.0 MHz bands and manufactured in the United States, or imported into the United States, prior to July 11, 2016 may still be marketed.

All FCC KDB's can be found at:
<https://apps.fcc.gov/oetcf/kdb/index.cfm>.

Pre-Compliance Services

The D.L.S. technical staff provides pre-compliance consulting services for MIL STD, RTCA, Medical, Commercial, Industrial, and Telecom related products. Design reviews in the early stages of a program can provide a detailed and



comprehensive analysis that can lead to a less costly design modification, before final testing takes place, and enhance speed to market and eliminate costly delays. Senior level consulting engineers can provide these services on a program or hourly basis, and can include circuit board, enclosure, system, assembly, or component level. For more information about the D.L.S. consulting program, contact Jack Black at jblack@dlsemc.com.



Industry Canada

Industry Canada Updates Stds.

Industry Canada publications RSS-GEN, Issue 4 and RSP-100, Issue 10 were recently published. Both standards were entirely modified and published together since the changes made to one directly affected the other. The changes are too numerous to cover in their entirety in this article, but the highlights are provided.

Radio Standards Procedure RSP-100, Issue 10 - Certification of Radio Apparatus

- A section has been added describing the Listing Requirements in the Radio Equipment List (REL). This does not incorporate any changes to procedures, but is a clarification of the requirement.
- Product labeling requirements have been moved from RSS-GEN to RSP-100.
- Addition of E-labeling option (see sidebar page 2).
- Transmitter Module requirements have been moved from RSS-GEN to RSP-100.
- All new application forms for equipment certification have been added.
- Confidentiality rules have been incorporated in RSP-100 issue 10. Files for which confidentiality may be accepted include block diagrams, operational description, parts lists and tune-up information,

SDR software and security information, and schematic diagrams.

Radio Standards Specification RSS-Gen, Issue 4 - General Requirements for Compliance of Radio Apparatus

- The title of the standard has been changed from General Requirements and Information for the Certification of Radio Apparatus, to General Requirements for Compliance of Radio Apparatus.
- A section listing normative reference publications has been added.
- A section describing the requirements necessary to obtain an exemption for complying with Industry Canada RSS requirements has been added.
- The section on receiver requirements has been revised as per Regulatory Standards Notice 2012-DRS0126.
- General requirements for license exempt radio apparatus are now all included in one section of RSS-GEN. These requirements apply in addition to any specific requirements of product specific RSS standards.
- A section on test report requirements has been added, which specifies general information to be included in the test report, and that test report and data must not be older than 12 months at the time of applying for equipment certification.

UL-cUL 60950-1 Testing



D.L.S. Conformity Assessment under their authority as a certified UL third party testing laboratory, provides full UL-cUL 60950-1 testing on Information and Technology Equipment that results in a formal UL listing and certification. This unique program provides for a streamlined value added process, complete with engineering assistance, mitigation and troubleshooting if needed. By utilizing the DLS engineering staff to navigate through the construction review, risk assessment, and final testing process, D.L.S. can reduce the time to formally list your products with UL, and bear the UL safety mark. In addition, D.L.S. can perform CE mark Low Voltage Directive testing under IEC/EN 60950-1 at the same time, further reducing your compliance time. Coupled with the D.L.S. EMC testing team, a one stop compliance can be enjoyed. To ask for a quote, contact Jack Black at jblack@dlsemc.com.

Composite Shielding Effectiveness Testing under IEEE 299

There has been an increased use of composite materials to replace metal or metal materials in avionic, military, commercial, and industrial applications. D.L.S. provides shielding effectiveness testing to confirm the electromagnetic characteristics of these composite materials using the IEEE 299 Standard. This widely accepted industry standard replaced the outdated MIL STD 285. D.L.S. performs this testing using a custom built testing chamber, specifically designed for shielding effectiveness. This chamber offers a solid dividing wall chamber construction, providing 140 dB of attenuation between the two wall sections. D.L.S. has the ability to test samples up to 40 in. by 40 in. at frequencies up to 40 GHz.

D.L.S. offers shielding effectiveness to other standards as well, including DTL 83528, MIL STD 907B, MIL STD 1377, and ASTM D 4935.

For additional information about D.L.S. composite testing under IEEE 299, please go to www.dlsemc.com/IEEE299. To request our technical paper on Shielding Effectiveness Testing, please visit www.dlsemc.com/litrequest.



Composite Shielding Effectiveness Testing
in D.L.S. Lab

regulatory requirements **UPDATE**

IEC/EN 60335-1: 2012 Safety Std. includes EMC Testing

The current IEC/EN 60335-1:2012 Product Safety standard for Household Devices and Similar Equipment, incorporates EMC testing that is not covered under normal compliance testing used with CISPR 55014 compliance to the Electromagnetic Compatibility Directive.

This additional EMC testing is not required on all household and similar electrical equipment, and is only applicable if it employs, as described in Section 19.11 of the standard, a protective electronic circuit, electronic run away protection, and operational or standby mode maintained electronically. The definition of a protective electronic circuit is provided in Clause 3.9.3 in Amendment 1 of IEC/EN 60335-1:2012.

According to the definition, the protective electronic circuit is an “electronic circuit that prevents a hazardous situation under abnormal operating conditions. Parts of the circuit may also be used for functional purposes.”

In general, the appliances that incorporate electronic controls with sensing and responsive circuits (used for safety reasons) are subject to the tests of Clause 19.11.4. In other words, where the protection against a hazardous situation under abnormal operating conditions does not rely on the operation of fuses, circuit breakers, thermal cutouts, thermal fuses, etc., but on the operation of electronic circuits, such appliances must be tested according to Clause 19.11.4.

There is a wide range of appliances that can rely on proper operation of protective electronic circuits, for example: garage door openers, kitchen appliances, restaurant equipment, coffee makers, waffle irons, water treatment devices, and other motor-operated, heating, and combined appliances.

Additionally, appliances having a switch with an off position obtained by electronic disconnection, or a switch that can be placed in the standby mode, are subjected to the testing in those modes.

The test levels required for safety compliance are higher than the ones required under the CISPR 14-2 standard and are carried out after the electronic protective circuit has operated during the relevant test of abnormal operation described in Clause 19. Additional monitoring

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requirements are also noted for this test.

The EN 60335-1 standard requires testing performed while in standby or an electronically protected state. The tests below are required:

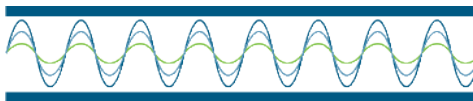
- Electrostatic Discharge in accordance to IEC 61000-4-2, level 4 (± 8 kV Contact Discharge, ± 15 kV Air Discharge).
- Electromagnetic Field Immunity test in accordance to IEC 61000-4-3 level 3 (10 V/m), with a dwell time for each frequency sufficient to observe a possible malfunction of the protective electronic circuit.
- Electrical Fast Transient test in accordance with IEC 61000-4-4, level 3 (± 2 kV) for signal and control lines and level 4 (± 4 kV) for power supply lines.
- Surge Immunity in accordance to IEC 61000-4-5, five positive and five negative discharges at level 3 (± 2 kV) coupled between each power line, and five positive and five negative discharges at level 4 (± 4 kV) coupled between each line and ground.
- Conducted Immunity test in accordance to IEC 61000-4-6 (10 V rms) and between 0.15 and 80 MHz, with a dwell time for each frequency sufficient to observe a possible malfunction of the protective electronic circuit.
- Voltage Dips and Interruptions in accordance with IEC 61000-4-11, with dips and interruptions specified in Table 1 of the standard, which are:
 - 0% during one cycle, at zero crossing of the supply voltage.
 - 40% during 10 cycles (if appliance runs at 50 Hz) or 12 cycles (if appliance runs at 60 Hz) and at zero crossing of the supply voltage.
 - 70% during 25 cycles (if appliance runs at 50 Hz) or 30 cycles (if appliance runs at 60 Hz) and at zero crossing of the supply voltage.
 - 80% during 250 cycles (if appliance runs at 50 Hz) or 300 cycles (if appliance runs at 60 Hz) and at zero crossing of the supply voltage.
- Harmonics and Interharmonics Immunity test in accordance to IEC 61000-4-13, test level Class 2 as described in the standard.

To show compliance, equipment or devices under test with an electronic switch in the off position, or in standby mode, shall not become operational. Equipment that has electronic protective circuitry must not present a hazardous situation, or equipment not functioning as intended in a safe manner.

regulatory requirements **UPDATE**

Expanded IEC/EN 60068 Environmental Testing

D.L.S. has expanded their environmental testing services to include IEC/EN 60068. This standard includes a series of methods for environmental testing along with their appropriate levels. It prescribes various environmental conditions for tests designed to assess the ability of electrical equipment and components to perform under various conditions. These include transportation, storage and their operational use. The purpose of these tests is to reveal mechanical weakness and/or degradation with specified performances. The list of tests includes temperature extremes, humidity, fluid exposure, salt spray, vibration, shock, pressure resistance, and sand and dust. A more detailed list can be found at: www.dlsemc.com/environmental-testing.



MIL-STD 461 & RTCA DO-160 Vehicle/ Large Equip. Testing



Removable lab wall for large projects at D.L.S.

D.L.S. performs specialized testing for vehicles and large equipment using two specially equipped anechoic chambers at the Wheeling, IL testing facilities.

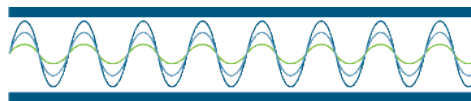
These large 28 x 25 x 20 chambers are outfitted

with special modular door construction, which allows for easy entry and set up for larger equipment. In addition, the chambers have reinforced floors, and provide special exhaust capabilities, along with cooling and heat control, with 26,000 cfm airflow capacity. Testing levels are 40 GHz up to 200 volts per meter, plus additional HIRF levels.

Qi Update

The Wireless Power Consortium (WPC) is adding resonance charging to Qi's inductive charging features and standards. This means that a receiver (the device that needs to be charged) and a transmitter (the charging pad or surface that's pushing the power to the device) will no longer need to be in close proximity to each other. New products can now be up to 45 mm apart, and be able to be charged. This new standard is also backwards compatible.

The Thermal Task Force of WPC is working on an amendment of the Base Station thermal performance test and a replacement of Thermal Test Power Receiver TPR#2. The Low Power Work Group will need Q1 of 2015 to handle the spec changes associated with the new thermal test and test tool. The Steering Group has therefore decided that the relaxation of the thermal test will be extended until March 31, 2015.



MIL-STD 810 Testing

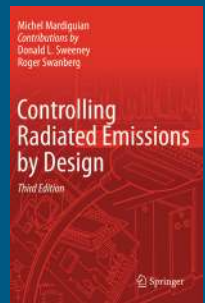
D.L.S. is accredited to perform testing on equipment and components covered under International Traffic in Arms Regulations, or ITAR regulations. The vast majority of the testing requirements for these products fall under MIL-STD 461 for electromagnetic compatibility, MIL-STD 810 for environmental and mechanical testing, and MIL-STD 704, MIL-STD 1275, and MIL-STD 1399 for power quality. Quotes for these testing requirements and others can be requested through the D.L.S. web site using www.dlsemc.com/requestquote.



ITAR testing at D.L.S. Lab

3 Reviews of new EMC Design Book

We are pleased to learn that *Controlling Radiated Emissions by Design*, edited and contributed to by Don Sweeney has had 3 positive book reviews. Read them and other information about the book at: www.dlsemc.com/emcdesignbook.



\$300 Discount or 50% discount

Be sure to register for our April 14-16 EMC Design Seminar by March 24 to receive a \$300 discount. Also, if you have previously taken the seminar and would like a refresher course using the new Third Edition of *Controlling Radiated Emissions by Design*, you will receive a 50% discount.

Win a free Apple iPad

For a chance to win a free Apple iPad, stop by D.L.S. booth #324 at the 2015 IEEE EMC and Signal Integrity Symposium March 15-20, at Santa Clara Convention Center in Santa Clara, CA



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*Controlling Radiated Emissions by Design, 3rd Edition
contributed to and edited by Donald L. Sweeney,
including the latest digital technology, published 2014*



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