# ACB and Sulis

## FCC Rules and Requirements
## Electrical and Radio Equipment

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ACB Sulis Consultants

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# Why are you here?

- Who do we have here?
- Why are you here?

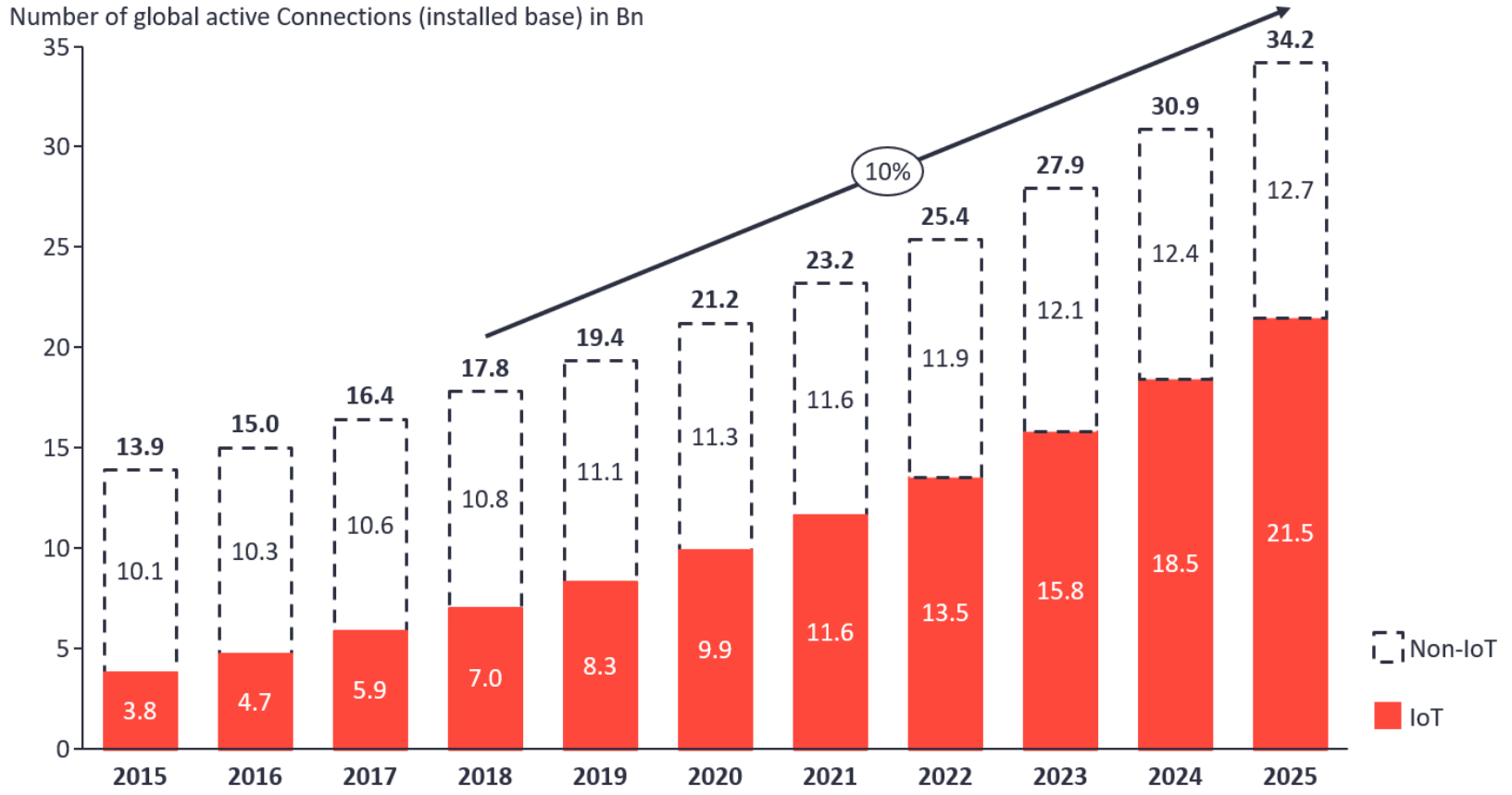
# FCC and ISED Compliance

- >10,000 new FCC certifications in 2019
- 5% market surveillance, is >500 products tested
- ISED and FCC gathering data and associating a risk factor to manufacturers, test labs, TCBs
- Real market surveillance is by competitors!
- You can make a great performing product; but if you can't sell it, it's effectively useless
- Successful time to market is the highest priority

IOT ANALYTICS

*Insights that empower you to understand IoT markets*

# Total number of active device connections worldwide




Note: Non-IoT includes all mobile phones, tablets, PCs, laptops, and fixed line phones. IoT includes all consumer and B2B devices connected – see IoT break-down for further details
Source: IoT Analytics Research 2018

# Agenda

- Overview of the FCC and ISED requirements
- Testing requirements
- Radio Modules
- Installing Radio Modules
- Application for Certification
- Technical Documentation and Labelling

# USA Equipment Authorisation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# USA Equipment Authorisation

- A product into the USA and Canada
  - FCC and ISED Canada
    - Control communication issues
      - Including interference, EMC, etc.
    - The requirements cover interference only
      - Only transmitter performance and EMC emissions
      - No receiver testing
      - Not ‘quality’ EMC (immunity)
      - Not ‘product’ safety
      - Does include RF exposure safety

# Choose Authorisation Route

- What are the authorisation routes:
  - There are two:
    - Supplier's Declaration of Conformity (sDoC)
    - Certification
  - Authorization route in the FCC rules and ISED standard

# Types of Equipment

First: Some explanations to ease the discussion with terminology:

- Unintentional Radiators
  - IT Equipment
  - Receivers
  - FCC Part 15, subpart B
- Intentional Radiators
  - Transmitters
  - FCC Part 15, subpart C (also subparts, D, E, F, G, H)
    - >50% of all new certifications are 15.247!
  - Licensed Parts 22, 24, 25, 27, 90, 101, etc.

# Summary of Authorisations

- Basic summary
  - Unintentional Radiators
    - Most people choose sDoC
    - For the FCC, Certification is an option
  - Intentional Radiators
    - Certification

# Choose Authorisation Route

- What are the authorisation routes:
  - Each ‘mode’ or operation is assessed
    - Similar to the EU, there is no “primary function” and each function must be fully tested
    - Each mode or function must also be authorised
    - sDoC and Certification could both apply to one product; for different operations of it
  - Multiple authorisations could apply to one product!
    - Different to the EU!

# Excluded

- Some devices do not require authorisation
  - Military equipment is not for the FCC
  - **Unintentional radiators**
    - Transport/Vehicles; Test Equipment; Appliances; Medical; low power consumption
    - See FCC 15.103 and ISED ICES-00x
  - **This is only the unintentional radiator**
    - If the device has a transmitter, that part/mode of the device still requires certification!

# sDoC

- Supplier's DoC for the device
  - Perform the required tests
    - AC conducted and radiated emissions tests
  - Add sDoC compliance statements
    - For example, statement in the user manual
    - For USA, the label may show FCC Logo, optional

# Certification

- Manufacturer has device certified for use
  - By a TCB/FCB (industry Certification Body)
  - Perform the required tests
    - Spurious emissions
    - Transmitter performance tests
  - Compile the required technical data (exhibits)
    - Submit all information to TCB/FCB
  - FCC Grant and ISED Certificate from TCB/FCB
    - Then ISED lists it

# Certification

- Certification of radio equipment
  - FCC ID or ISED number on the product and linked to online file
    - Unique to each device; to certification file; and it does not just mean “it passes some tests”
    - The FCC/ISED ID goes on the certified device
  - Technical documents held by the FCC / ISED
    - Schematics, block diagrams, photos, test results
    - Traceable to that product

# Final Product Authorisation

- One product with multiple modes
  - “Is that device sDoC or Certification”
    - The answer is often:  “Both, if you like”
    - Radio transmitter certified; digital device parts are most likely sDoC  (or certification, for FCC)

# Choose Authorisation Route

- Choosing which Authorisation route:
  - Examples of devices with one; or multiple
    - AV Projector
      - Computer Peripheral, maybe also unlicensed transmitter
    - Mobile Phone
      - Mixture of licensed transmitter, unlicensed transmitter, computer peripheral, electronic digital device, receiver
    - House appliance or vehicle electronics
      - Electronics may be exempt from authorisation; but it may contain a radio transmitter requiring certification

# Rebranding?

- New company taking responsibility
  - FCC Change in ID and ISED Multiple Listing
    - It is possible to do a Change in ID application
    - New company puts their own ID onto a device which has already been certified
    - Does not need re-testing, it's just paperwork
      - Letter from new company, requesting the change
      - Letter from original company, giving permission
      - Label and photos to show new markings

# Changing a Product?

- What happens when a product changes?
  - Products evolve; improve; develop; change
    - Engineers get bored easily
  - For sDoC, it's quite simple; test and store
  - For Certification; product data stored online
    - Test data; hardware details; conditions of use
    - Rated output power, channels, modulations
  - Changes can be permitted within certification; known as a **Permissive Change**

# Permissive Changes

- Changes permitted within a certification
  - If the hardware of the radio transmitter part of a device changes, the product requires a new certification and new FCC/ISED ID
    - “But it still passes!”
    - “But the power is the same!”
    - “It uses the same design idea as our other products!”
      - None of these things are relevant

# Permissive Changes

- Changes permitted within a certification
  - Does not require update to the FCC or ISED
    - Class 1 Permissive Change (C1PC)
  - Does require update to the FCC or ISED
    - Class 2 Permissive Change (C2PC)
  - Other Classes exist for ISED
    - Software changes (C3PC)
    - Change a module when installed into host (C4PC)

# Permissive Changes

- “Will it be C1PC or C2PC?”
  - In some cases, the change must be C2PC
    - Some changes the FCC and ISED really want to know about; and know what you did about it
  - In some cases, you really do not know the Class until you have done some testing
    - Emissions the same as before or better; C1PC
    - Emissions worse than before; C2PC

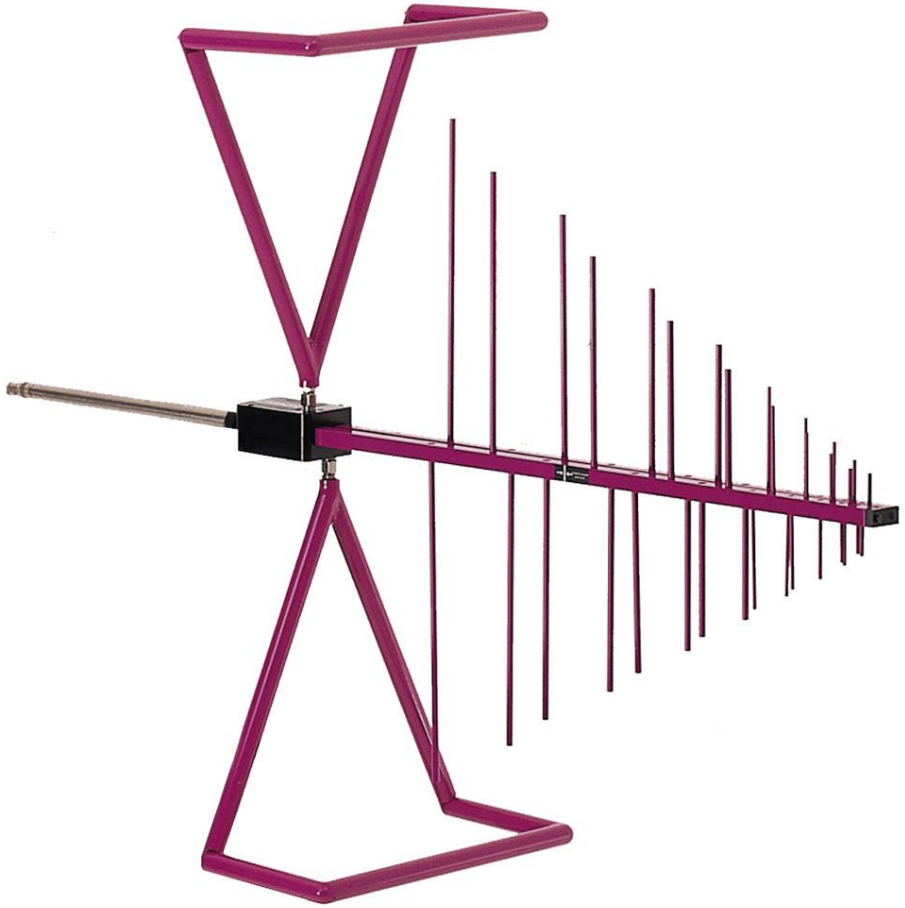
# Permissive Changes

- Modifying or incorporating
  - Incorporating a radio into another radio
  - New certification required for new radio

# Test vs Approval

- Can you see this difference?
  - Testing to the ANSI standards shows it can technically comply with the limits
  - ‘Testing only’ does not make it a legal product
  - sDoC or Certification is the approval process
  - Testing is needed for approval; but the manufacturer is responsible for maintaining technical compliance of their devices

# Testing



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# Testing

- What is EMC or Radio testing for FCC?
  - Making measurements on a product
    - In North America; typically we're talking about:
      - Noisy (spurious) emissions (EMC)
      - Transmitter performance (Radio)
  - Measurement for regulatory compliance
    - Test their way, to meet their rules
    - EU allows deviations and still meet the Directive; but FCC rules are clear about test methods

# Choice of Test Lab

- sDoC
  - Most commonly used for Part 15 subpart B; unintentional radiators
    - ISO 17025 accreditation is not required
    - Test lab does not need to be listed on FCC website
    - The test standard ANSI C63.4 must be followed; and that standard does require that a suitable test site is used for radiated measurements
      - ANSI C63.4 also contains specific reporting requirements

# Choice of Test Lab

- Certification
  - Mostly transmitters, or some electronics
    - ISO 17025 accreditation **is** required
    - Test lab must be listed on FCC website
      - The actual test site and specific frequency and FCC rule part capabilities must be detailed on the FCC website
      - Reporting requirements for a TCB are quite specific

# Choice of Test Lab

- FCC lab listing note
  - An accredited test lab cannot ‘authenticate’ reports from an unauthorised lab
    - The FCC takes this very seriously
    - The lab could lose its test site listing
    - It’s all about where the measurement is actually made, not about where the report is written
      - Must list the actual test site location, chamber, etc.

# Certification - Technical

- Testing to the FCC Requirements
  - Must use an approved test procedure
    - FCC rules must be followed
    - Must follow the authorised procedures
    - Cannot improvise unpublished test methods

# Certification - Technical

- Testing to the FCC Requirements
  - All the information is critical
    - If you only know the FCC rules; you'll know the product requirements but not how to test them
    - If you only know the ANSI standards; you'll know the test methods but not the product requirements
    - If you don't know the KDBs, you may not know the latest nuances or allowances
      - Membership of the TCB Council is helpful

# Part 15 – General Testing

- 15.33 – Frequency Range Radiated
  - Frequency range of radiated emissions
    - **Unintentional Radiators**

| Highest frequency generated or used in the device or on which the device operates or tunes (MHz) | Upper frequency of measurement range (MHz) |
|---|---|
| Below 1.705 | 30. |
| 1.705-108 | 1000. |
| 108-500 | 2000. |
| 500-1000 | 5000. |
| Above 1000 | 5th harmonic of the highest frequency or 40 GHz, whichever is lower. |

# Part 15 – General Testing

- 15.33 – Frequency Range Radiated
  - Frequency range of radiated emissions
    - **Intentional Radiators**

| Highest frequency of the intentional radiator | Upper frequency of measurement range (MHz) |
|---|---|
| <10 GHz | 10th harmonic of highest frequency or 40 GHz, whichever is lower. |
| ≥10 GHz and <30 GHz | 5th harmonic of highest frequency or 100 GHz, whichever is lower. |
| ≥30 GHz | 5th harmonic of highest frequency or 200 GHz, whichever is lower. |
| | |
| | |

# Part 15, subpart B

- Unintentional Radiators
  - Digital Devices, IT Equipment, Receivers
    - Typically sDoC (Part 15.101)
  - Main test cases are:
    - 15.107, AC Conducted Emissions
    - 15.109, Radiated Emissions
  - Alternative test:
    - 15.111, receiver antenna port emissions
  - ANSI C63.4-2014 and FCC Part 15

# Part 15, subpart B

- 15.107 and 15.207
- AC Conducted Emissions
  - For all AC and DC powered devices
    - Only battery powered devices are exempt
    - For DC powered, it is as if you are effectively testing the power supply!

# Part 15, subpart B

- 15.109 and 15.209
- Radiated Emissions
  - Ranges and requirements of 15.33 and 15.35
  - For Part 15 radiated emissions, it is a field strength measurement in dBµV/m
    - Test site photos are important

# Part 15, subpart C

- Intentional Radiators
  - Transmitters
    - Typically Certification (15.201)
  - Radio specific test cases are:
    - **15.xxx?, Transmitter measurements**
    - Depending on transmitter frequency and operation
  - ANSI C63.10-2013 and FCC Part 15

# Antenna Requirements

- Part 15C devices certified with antenna
  - Require testing with the antenna connected
    - All radiated test cases
  - Highest gain of each antenna type tested
    - “Type” is not defined
    - It’s based on radiation pattern, not the name
    - e.g., “omni” is not an antenna type

# Antenna Requirements

- Part 15 Tx devices certified with antenna
  - Device must have an integral or dedicated antenna, or a ‘unique’ antenna connector; unless it is for professional installation only
    - FCC Parts 15.203 and 15.204
  - Can only be used with certified antenna
    - New antennas added by Permissive Change

# Band Edges

- Note about emissions at band edges
  - Not often mentioned in the rules; but always a requirement, for all transmitters
    - Ensure device stays within band
    - Check carefully limits
      - 2483.5 MHz is a restricted band, so tight limits
    - If there's power reduction on edge channels, multiple power and band edge measurements
      - e.g., WLAN Channels 1, 2, 3, 6, 10, 11, 12, 13

# Worst Case?

- Mode, modulation, bandwidth
  - Each one must be proved to comply
  - It can be possible to report only the worst case (highest level) modes, as long as all were actually tested
    - ‘Reporting reduction’ is a paperwork issue and not the same as ‘test reduction’

# ISED Canada

- Testing for Canada
  - Very similar to the FCC
  - Test lab must be listed on ISED website
  - Additional bandwidth test
  - Reporting requirements are more detailed

# RF Exposure

- RF Exposure Safety
  - This is a really big issue for the FCC and ISED
    - More time and effort dedicated to SAR at the TCB Council Workshop than any other topic

# RF Exposure

- Two main types of assessment
  - MPE
    - Maximum Permissible Exposure
    - Power Density in air measurement ($W/m^2$)
    - Calculated using power and distance
  - SAR
    - Specific Absorption Rate
    - Power in body tissue measurement (W/kg)
    - Measured using a probe into simulated tissue

# RF Exposure

- Very Low Power (dBµV/m limits) devices
  - Do not require an assessment
- Devices using ‘mW’ as their power limit
  - <20 cm to person, must be assessed for SAR
  - >20 cm to person, must have MPE calculation

# RF Exposure – Canada

- Same idea in Canada
  - But limits and levels are tighter in Canada
  - Assessment approach is the same, but the numbers are different

# Radio Modules

# Why modules?

- A change in Industry
  - It's a wireless world
    - Entrepreneurs and marketing people
    - The IoT and M2M are a desired lifestyle but manufacturers of 'things' are not radio experts
    - A challenge for our industry
  - The solution
    - Radio manufacturers make modules
    - Other equipment manufacturers make their own products, and install a module

# Modular Approval Types

- Modular Approval?
  - This FCC and ISED Canada have a mature Modular Approval solution
  - The module is intended for any environment
  - Module is tested and certified as a module
  - Gives the module “super powers” to keep its certification when installed in other things
    - Does not guarantee “passing tests” in host!
    - Remember to keep those items separate!

# Modular Approval

- Modular Approval
  - The Module will have the FCC ID & ISED ID
    - The module must be labelled with the FCC ID: & IC:
  - Any host incorporating the module will show that the module is contained within it
    - Contains FCC ID: XXXYYYYY
    - Contains IC: 1234A-YYYYY
    - FCC ID and ISED ID will relate to module
    - If no modular approval, you cannot do ‘Contains’
      - Except some ‘Computer Peripheral’ cases

# Modular Approval

- Technical, administrative, testing and certification requirements for Modular Approval
  - A set of criteria exist for full Modular Approval certification, which allows the module to be used in any permitted host
    - If you do not meet all criteria, then you cannot achieve full Modular Approval

*Modular Approval criteria shown on the next page:*

# FCC Modular Approval

- Eight criteria for Modular Approval (15.212)
  1. Transmitter section must have its own shield
  2. Must have buffered modulation/data inputs
  3. Must have power supply regulation
  4. Must meet Part 15 antenna requirements
  5. Must be tested in stand-alone configuration
  6. Must be labelled with the FCC ID
  7. Must meet its own FCC rule part
  8. Must meet RF Exposure requirements

# FCC Limited Modular Approval

- “But my module passes without that!”
  - You cannot miss one of those requirements and still get Full Modular Approval
    - Engineering and legal reasons
- Possible to get Limited Modular Approval
    - (LMA)
  - Does not meet all the 8 requirements
  - Limited only to specific hosts or conditions




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# FCC Integrating Modules



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# FCC Integrating Modules

- Using (integrating) a certified module
  - Applicable to manufacturers of host equipment which have radio modules installed in them
  - Rely on certification of the module
    - No need to get certification of the host
    - In fact; you cannot certify the host based on module certification; unless you do some re-testing
  - The host must state that it contains the module and the host must show the module's FCC ID
    - Contains FCC ID: XXXYYYYY

# FCC Integrating Modules

- Using (integrating) a compliant module
  - You must follow the module's Grant limitations; if any limitations exist
    - Mobile or Portable and safe distance for RF Exposure
    - Requirements to consider co-location
      - Note that 'co-location' only exists when there is also 'simultaneous transmission'
      - "Co-location" is a term often used; but it implies that simultaneous transmission is understood
    - Being a module certified for 'mobile only' RF Exposure conditions would not make it a Limited Module

# FCC Integrating Modules

- Using (integrating) a compliant module
  - Host must comply with its own requirements
    - For example, Part 15B sDoC

# FCC Integrating Modules

- Using (integrating) a compliant module
  - Module's frequency is part of the consideration for upper limit of spurious emissions tests

| Highest frequency generated or used in the device or on which the device operates or tunes (MHz) | Upper frequency of measurement range (MHz) |
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| 108-500 | 2000. |
| 500-1000 | 5000. |
| Above 1000 | 5th harmonic of the highest frequency or 40 GHz, whichever is lower. |

# FCC Integrating Modules

- Using (integrating) a compliant module
  - Host must comply with all requirements
    - This is a relatively new clarification
      - Not a change in the rules
    - Does not mean full re-testing
      - Emissions check of worst mode is ok
      - Emissions check of ‘real mode’ is ok
      - Just do what you can
      - Module test report is available online
        - You can see the worst modes or channels there
      - More testing may be needed for an LMA

# FCC Integrating Modules

- Using (integrating) a compliant module
  - Host must comply with the FCC requirements, including multiple modules contained within it
    - FCC rules state that all transmitters must be enabled during transmitter tests
      - Test emissions when co-locating modules
      - This is in addition to the host's own testing
    - Device must meet the output power limits per band
      - For example, co-locating multiple 2.4 GHz devices means that the total sum power must not exceed the limit
        - When they simultaneously transmit

# FCC Integrating Modules

- Using (integrating) a compliant module
  - The company selling the final radio device (typically the “host”) is responsible for the whole product they provide
  - The final product must meet the FCC rules
    - In case of problems, the FCC will come to both companies and then see who is at fault

# FCC Integrating Modules

- Using (integrating) a compliant module
  - RF Exposure condition and exact antenna type must be followed by the installer
    - Otherwise the module could require a C2PC
  - Module installation instructions very important
    - FCC gets calls “I bought a module, what do I do?”
      - This should not happen!

# Final Host Assessment

- Re-Certify or Re-Test?
  - FCC taking a more ‘holistic’ approach
    - FCC emphasis on assessment of final product; in cases where a certified module is used
    - Modular Discussion Group worked with the FCC to determine some clear guidance for the industry
    - Amended modular KDB to clarify that testing on final system is necessary (February 2019)
      - Including guidance on how to test each transmitter mode

# Final Host Assessment

- Re-Certify or Re-Test?
  - Module discussions for FCC and a more ‘holistic’ approach to compliance
    - It’s a reminder that “modular approval” was intended as a solution to save the installer from the requirement to **certify** the final end product; but it was not intended to avoid any future **testing**
    - Save on authorisation process, but still have responsibility for final product compliance

# FCC Certification Process


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# FCC Certification Process

- Testing is complete and it's time to apply for Certification of the equipment
  - The manufacturer may create the application; but often they ask the test lab to create application for them
  - Documents must be uploaded to the FCC and ISED websites; by the Certification Body
  - TCB reviews all documents and certifies it
    - Cannot accept deviations or judgements

# Exhibits

- Technical application to the TCB
  - You must now organise the documentation to provide to the TCB / FCB
  - The TCB will review them for accuracy, consistency and meeting the rules
    - Application Forms
    - Technical documents
    - Test reports
    - Photos and manuals
    - Cover letters, etc.

# Exhibits – Risk Management

- I am often asked:
- "What's the minimum I can get away with, to guarantee certification?"
  - It's a two part question:
    - What's the minimum we can get away with?
    - What will guarantee certification?
  - Benefit to getting it correct?
    - Time to market; time to profits!
    - Reduced risks

# Exhibits – Risk Management

- Application
  - Certification file must describe the device
  - TCB/FCB should understand modes, power, frequency, antenna, modulations, etc.
  - TCB/FCB role is to review and understand; not just put numbers on the FCC and ISED websites

# Application Types

- Types of application for FCC and IC
  - New Certification
    - IC also has New Family and Addition to Family
  - Permissive Change
  - Change in FCC ID / Multiple Listing

# Common Mistakes

- Consistency
  - Manufacturer to check they agree with the data in the test reports
    - Communication between the lab and manufacturer
    - Check the documents before the TCB / FCB
    - Are the numbers what you would expect?
  - The numbers will be fixed when certified
    - It is not just “pass” or “fail”; the manufacturer will live with the numbers held by the FCC and ISED; and they are shown online

# Common Mistakes

- Quality of documents
  - Not understanding the level of detail required by the FCC and ISED
  - Not understanding the importance of the legal application forms
  - Consistency between documents
    - Output power, modes, use cases, etc.
  - ISED and FCC creating a company risk factor

# Common Mistakes

- Testing
  - Engineers deciding their own test methods
    - Not following published procedures
  - Sitting in an office and guessing ‘worst-case’
    - Not providing real evidence in the application
  - Thinking it’s like the EU

# Application to TCB/FCB

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# Application Forms

- Lots of paperwork involved!
  - Application forms
  - Cover letters to describe application
  - Signatures to accept legal responsibility

# Block Diagram

- Block Diagram of the part being certified
  - Mandatory for Unlicensed Devices (Part 15)
  - Optional for Licensed Devices
    - It is useful to review, so it is recommended

# Operation Description

- Technical Document or Datasheet
  - Mandatory for all Devices

# Schematic Diagrams

- Circuit Diagrams of the part being certified
  - Mandatory for all transmitter devices

# Parts List

- A Parts List of the Transmitter
  - Mandatory if the component values are not shown on the circuit diagrams

# Tune-Up Procedure

- Procedure for factory setting of transmitter
  - Mandatory for Licensed Devices
    - Show rated powers and tolerances

# Photos

- External and Internal Photos for all devices

# Label

- Label with the FCC ID must be shown
  - The label can be a drawing or a photograph
    - If photos are held short term confidential, a label drawing can be a useful solution
  - FCC ID and ISED number must be on a permanent part of the device
  - Other FCC markings should also be correct; such as appropriate use of the DoC logo
    - TCB checks all authorisation marks

# RF Exposure

- Demonstration of compliance
  - Low Power devices (dBµV/m)
    - Nothing necessary for most applications
  - Mobile dBm/Watts devices at >20 cm
    - MPE Calculation, based on output power or e.i.r.p.
  - Portable dBm/Watts devices at <20 cm
    - SAR test report, if power is ‘high’
    - Justification for no testing, if power is low

# Test Report

- Test Report
  - Test report to show compliance with the applicable FCC rule part

# Test Report

- Test Report
  - Manufacturer must support the test report
    - The test results must match the manufacturer's expectations and rated values
    - The TCB will compare the rated power and expected values to the measured values
      - It should not be just matching numbers to a limit
    - The user information and expected operation of the device must match the reported information
      - TCB must fully understand; it is not an admin role

# Test Report

- Test Report
  - Manufacturer must support the test report
    - Manufacturer is responsible for the content of the application, including the test results
    - The device will be certified based on those values

# Test Photos

- Photographs of the test set-up

# User Manual

- The User Manual must be provided
  - Mandatory for all applications
  - It must contain the compliance statements
  - It must not include misleading advice or information which conflicts with the details of the application
  - For modules, it is the installation instructions and perhaps the most important document

# User Manual Statements

- Summary of user manual statements
  - FCC 15.21 notice to user for all Part 15
    - Modifications to the device are not permitted
  - FCC 15.105 for Digital Device or Peripherals
    - Long statements which apply to many products
  - FCC 15.19 statements
    - In the user manual, if not on the label due to size
      - Or other examples of ‘impracticality’

# Finished!

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# Useful links

**USA**

- FCC rules are all in “Title 47 – Telecommunication” https://www.ecfr.gov/
- FCC KDB 996369: Modules https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=44637&switch=P
- FCC KDB 178919: Permissive Changes https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=33013&switch=P
- FCC KDB 896810: Suppliers Declaration of Conformity (SDoC) https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=203240&switch=P
- FCC KDB 784748 : Part 15 and 18 Labelling and user information https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=27980&switch=P
- FCC KDB 447498 DO1: SAR including SAR exemption https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?switch=P&id=20676
- FCC accredited test labs https://apps.fcc.gov/oetcf/eas/reports/TestFirmSearch.cfm

**Canada**

- RSP-100 — Certification of Radio Apparatus and Broadcasting Equipment https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01130.html
- Radio Standards, RSS-xxx: https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf06128.html
- RSS-102 EMF and SAR: https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01904.html
- Radio equipment list (certified equipment) https://sms-sgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e1s1
- EMC standards “ICES”: https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf06127.html
- ISED recognised test labs http://www.ic.gc.ca/eic/site/mra-arm.nsf/eng/nj00160.html

# Questions?

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