Wireless Module Integration

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**Who am I?**

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Wireless Modules

A brief overview of Wireless Module integration and what to be aware of for European ("CE" marking) and North American compliance.
## What are Wireless Modules?

## Regulatory requirements when integrating Wireless modules (Europe, FCC and Industry Canada)

## Common issues (things to be aware of)
Why use Wireless Modules?

• **What are Wireless modules?**
  – Wireless modules are proven technology “building blocks” that can be assembled into an application quickly and **without any great RF expertise**, greatly reducing development time and overall project risk.

• **Why use a module?**
  – Manufacturers / integrators are no longer required to possess a strong understanding of RF engineering principles or complex manufacturing experience to obtain Wireless communication.

• **Benefits of Wireless modules**
  – Reduced Time to Market
  – Reduced Development & Testing Expense *(cost savings can be huge!)*
  – Inherited Certification Testing
  – Simplified Manufacturing
  – Stable Hardware Platform
  – Technology Maintenance
  – Easy to Use . . .
Common module types . . .

- **Most common Modules that are integrated:**
  - **2.4GHz ISM Band** *(Worldwide band – very commonly used)*
    - Bluetooth
    - Zigbee
    - RF4CE (Remote Controls)
    - WLAN 802.11 b/g/n (WiFi)
  - **5GHz ISM Band**
    - WLAN 802.11 a/n/ac (WiFi)
  - **Below 1GHz**
    - Short Range Devices (SRD) 433/868/915MHz *(Frequency bands defined by region)*
  - **Licensed Cellular**
    - GSM / CDMA2000 (2G)
    - W-CDMA (3G)
    - LTE (4G)
    - Satellite (Iridium etc.)
Product types that now use modules

- Televisions
- Fridges
- Vending machines
- Telemetry equipment
- Measuring instruments
- Printers
- Laptops
- Personal computers
- Medical equipments
- Etc. The list is endless...
Growth of Wireless . . .

FCC TCB filings per year

- Annual TCB filings (approx 10% are modules)
European compliance ("CE" marking)

• Currently all Wireless devices must comply with the R&TTE Directive (1999/5/EC), unless they are within the scope of the Marine Equipment Directive or solely for Military use. The Radio Equipment Directive (RED) will apply from June 2016.

• Compliance is against generic “Essential Requirements” (Article 3) covering Health and Safety, EMC and Spectrum usage.

• Use of Harmonised Standards (HS) is the recommended route to compliance.
• **Article 3.1(a)** – Health and Safety of the User and others (*RED includes domestic animals*)

• **Article 3.1(b)** – EMC

• **Article 3.2** – Effective Spectrum usage (*RED covers “efficient” spectrum usage as well*)

*It is Mandatory that the essential requirements are met.*
R&TTE / RED modules

• Compliance with these directives is largely a “self-declaration” approach based on the use of HS.

• There is no such thing as “modular approval” (unlike FCC / IC which we will cover later).

• Modules can be “CE” marked if they are independently placed on the market but in this case they must comply fully with the “essential requirements”.
• A module which is only partially assessed for compliance (i.e. meeting the Article 3.2 RF requirements only) cannot be “CE” marked. This responsibility would fall to the manufacturer of the Host device (who then addresses Article 3.1 (Safety and EMC)).

• The module manufacturer should assess the module to demonstrate that it will still operate and be compliant when integrated into Host devices in a range of environments (e.g. where temperature extremes will affect performance).
• The module manufacturer should make clear to the integrator what environments the module has been designed to operate in (no point in selling a module that will work correctly over the temperature range -20°C to +55°C (as per most ETSI radio standards) if the integrator will employ it in equipment operating at temperatures outside that range!)
R&TTE / RED modules

• The module manufacturer should ideally supply instructions to the integrator on how to comply with the R&TTE-D (and RED) after the module has been integrated.

• In all cases, the manufacturer of the Host equipment remains ultimately responsible for the product compliance and should draw up a DoC stating his equipment complies with the R&TTE Directive (listing applied standards on the DoC is the preferred format).
Host equipment compliance

- Where an R&TTE compliant module has been integrated into a Host device, it is generally considered that no further Article 3.2 testing is required (this has been undertaken by the module manufacturer).

- Article 3.1 testing (H&S and EMC) should always be undertaken by the manufacturer of the Host equipment (further Article 3.2 testing may be required – e.g. if an external antenna has been used on the Host and was not assessed with the module).
Common issues . . .

• EMC testing on the Host device has not taken into account the integration of the module.

  For example…*a measuring instrument EMC tested to EN62326-1 has not taken into account the radio performance in accordance with the Radio EMC standards EN 301 489 series*).

• The Article 3.2 standard against which the module was originally tested no longer provides a presumption of conformity (i.e. has been superseded). *Harmonised Standards are a moving target!*
<table>
<thead>
<tr>
<th>ESO (1)</th>
<th>Reference and title of the standard (and reference document)</th>
<th>First publication OJ</th>
<th>Reference of superseded standard</th>
<th>Date of cessation of presumption of conformity of superseded standard Note 1</th>
<th>Article of Directive 1999/5/EC</th>
</tr>
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<tbody>
<tr>
<td>ETSI</td>
<td>EN 300 328 V1.8.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&amp;TTE Directive</td>
<td>23.10.2012</td>
<td>EN 300 328 V1.7.1 Note 2.1</td>
<td>Date expired (31.12.2014)</td>
<td>Article 3(2)</td>
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<td>This is the first publication</td>
<td>EN 300 328 V1.8.1 Note 2.1</td>
<td>30.11.2016</td>
<td>Article 3(2)</td>
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Module manufacturers should supply modules compliant with standards that are not about to expire!
Common issues . . .

• Technical files . . .
  
  – The manufacturer of the Host device must retain the Technical File for a period of 10 years (in case of Market Surveillance). The technical file should include details of the Wireless module.

  – If the Module manufacturer will not supply the technical file for the radio module to the Host manufacturer for IPR reasons, the Host manufacturer can reference (in his technical file) where the module technical file can be obtained and provide contact details.

  – So the final TCF can be simplified....
FCC and Industry Canada compliance

- Unlike the European R&TTE Directive, the FCC and Industry Canada have **clear rules** in place for **unlicensed** modules!

- The FCC rules are in CFR47 Part 15.212 and also in a Knowledge database document KDB996369 (dated October 2013)

- The Industry Canada rules are stipulated in RSP-100 Section 7

*(IC rules are very similar to FCC, so mainly FCC covered here)*
• Modules for USA / Canada must be certified.

• They are given “Modular Approval” (this is stated on the FCC grant).

• Generally, no further certification or radio testing is required on host devices which have a certified module integrated (EMC testing (Part 15B) is usually required).

• Unlike the European requirements, the module manufacturer has responsibilities.
FCC / IC compliance

- Manufacturer must request “Modular Approval” and include a letter in the exhibit package to the TCB certifying the Module.

- There are 8 specific Criteria to meet in order to gain “Modular Approval”.

- If one or more of these 8 criteria cannot be met, then “Limited Modular Approval” may be obtained which limits the host equipments into which the module can be integrated and may have certain grant conditions imposed.
8 criteria . . . the Module MUST . . .

1. Have its own shielding.
2. Have buffered modulation / data inputs.
3. Have power supply regulation.
4. Meet Part15 Antenna requirements.
5. Be tested in a stand-alone configuration.
6. Be labelled with the FCC ID.
7. Meet its own FCC rule / part.
8. Meet RF exposure requirements

*(refer to the KDB for a fuller explanation)*
Labelling

- Host products must be labelled externally to indicate that an approved transmitter module is contained within. e.g.

  FCC: “Contains FCC ID: XYZ 12345”

  Industry Canada: ”Contains IC: XXXX-YYYY”

  Similar words with same meaning will suffice
4.1 Product Labeling Requirements

Industry Canada product labeling requirements stipulate specific text be placed on the device containing the AWA24S module. The product must include the following text and must be located on the exterior of the OEM’s product. This same information must be included in the product user manual.

“This product contains Artaflex AWA24S Transmitter Module
Canadian Cert No IC: 6797A-AWA24S”

5.0 European Union Regulatory Approval

The European Union generally follows the guidelines of the FCC for emissions level requirements. FCC end-product compliance certification results, if available, may be used to satisfy EU requirements (Substitution Method). Please consult the ETSI EN 300 328 specifications to confirm inter-agency compliance. If comparable FCC testing has not been performed or if the specifications are not cross compliant, ETSI EN 300 328 testing will be required. Additionally, testing to the ETSI EN 301 489-1 & ETSI EN 301 489-7 (immunity testing) is strongly recommended. Artaflex assumes no responsibility for compliance of the end-product configuration.

5.1 Product Labeling Requirements

European Union product labeling requirements stipulate specific text is placed on the device containing the AWA24S module. The product must include the following text and must be located on the exterior of the OEM’s product. The same information may be included in the product user manual, however is not mandatory. Packaging and user documentation must indicate the use restrictions of the end-product (i.e. countries disallowing the operating frequencies of the AWA24S). The end-product must be labeled “CE”
The manufacturer of the Host equipment into which the module has been integrated must adhere to the Grant conditions for the Module.

For example:

*Don’t exceed the stipulated antenna gain*

*Do not use in a “Portable” application (<20cm from the human head or body) (all Modular approvals are for “Mobile” applications (used >20cm from human head or body)*

*Give careful consideration to collocation with other modules (seek advice from a TCB).*
The FCC Grant will state what type of approval the Module has and stipulate certain conditions of use, which must be adhered to. E.g. . . .

**Equipment Class:**

**Notes:**

**Modular Type:**

**Licensed Non-Broadcast Station Transmitter**

**Short Burst Data Transceiver**

**Single Modular**

Single Modular Approval. Output power listed is peak EIRP with maximum antenna gain of 3 dBi allowed. This module is approved in mobile / fixed configurations. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter within a host device, except in accordance with FCC multi transmitter product procedures. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.
Licensed modules . . .

- Unlicensed Modules are covered under the FCC Part 15 regulations, as above.

- Licensed Modules are certified against other FCC Rule / Parts (e.g. Pts 22/24 for GSM/3G, Pt25 for Satellite etc.)

- Generally the same procedures are followed for licensed Modules (e.g. meeting the 8 Criteria, (these are not Mandatory for FCC but are for IC))

- The Grantee is responsible for compliance in host installation.
Quad Band GSM module...
• Must supply the Host manufacturer with detailed installation instructions.

• Must supply the Host manufacturer with details on how to remain compliant with FCC / IC rules (e.g. what additional tests will / may need to be performed on Host equipment).

• Must supply labelling information.

*Note - during the Module certification process, these details will need to be checked by the TCB / FCB, so must be in the Installation / User manuals.*
Thank you for listening

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