Expanding Freescale i.MX Applications Processors
Wi-Fi/Bluetooth Connectivity

Scott Kerr, Team Connectivity
Murata Americas

06/25/2015
Serving broad range of applications

Computing/Consumer Electronics
- Mobile Phones
- IP Phones
- Tablets
- Ultrabooks
- A/V
- Toys

Energy/Industrial
- Industrial Appliances
- Smart Home
- Agriculture
- Lighting

Medical/Healthcare
- Fitness
- Wellness
- Monitoring
- Implants
- FDA

Automotive/Telematics
- In-Car Entertainment
- Aftermarket
Traditional Wi-Fi/Bluetooth Go-To Market Steps

Customer Contacts Murata Sales & HW Apps Support

Arrive at Module Selection

“Jury Rig” Hardware Platform to Evaluate

Debug “one-off” HW platform; obtain/port/debug driver

Spin Custom Board; Debug HW/SW Again

System Test; More Debug; Certifications; Ship
Better Wi-Fi/Bluetooth Go-To Market Steps

1. Customer Contacts Freescale or Murata Sales
2. Arrive at Module Selection
3. Customer Obtains Freescale EVK & Compatible Murata Wi-Fi/Bluetooth EVB
4. Customers Evaluates Freescale/Murata Solution
5. Spin Custom Board; Debug HW/SW One Time Only
6. System Test; More Debug; Certifications; Ship

FASTER
How Did We Arrive at Better?

- 3 large companies partnering to deliver world-class solutions for connected products

- Out-of-box processor and wireless connectivity for Linux and Android based systems

- Wi-Fi (802.11bgn, abgn, abgn/ac) & Bluetooth Smart Ready Options
Partnership Overview

- Murata is now a Freescale Connect “Proven Partner”

- This partnership offers a complete Wi-Fi and Bluetooth connectivity environment with Freescale’s i.MX processor platforms for building world class Internet-connected products.

- This enables developers to minimize the development time and effort for connectivity function implementation.

- Developers can now get verified Hardware and Software for Murata Wi-Fi and Bluetooth module on i.MX6 Freescale platform and reducing integration effort from several months to days.

- We are enabling 7 Broadcom based modules and enabling support for Linux and Android latest versions for out-of-box compatibility.
Module Options for i.MX platforms

Wi-Fi®/Bluetooth® Modules for Freescale i.MX

**SN8000**
- Part Number: 88-00153-00
- BCM43362 Chipset
- Industrial Grade: 24.0 x 11.4 x 1.9 mm

**Type 1FJ**
- Part Number: LBEE5Z1FJ
- BCM4343W Chipset
- Size: 21.0 x 10.0 x 2.0 mm

**Type ZX**
- Part Number: LBWA17DZX6
- BCM43362 Chipset
- Size: 7.0 x 6.0 x 1.2 mm

**Type 1FX**
- Part Number: LBWA1KL1FX
- BCM43364 Chipset
- Size: 6.95 x 5.15 x 1.1 mm

**Type 1DX**
- Part Number: LBEE5KL1DX
- BCM4343W Chipset
- Size: 6.95 x 5.15 x 1.1 mm

**Type 1BW**
- Part Number: LBEE5H5U1BW
- BCM43340 Chipset
- Size: 8.0 x 7.5 x 1.1 mm

**Type ZP**
- Part Number: LBEE5HMZPFC
- BCM4339 Chipset
- Size: 7.8 x 7.4 x 1.0 mm

© June 2015 Murata Americas  wireless.murata.com/imx  imxfaq@murata.com
Software for i.MX platforms

**Wi-Fi®/Bluetooth® Modules for Freescale i.MX**

**Platform**

Freescale EVK

Murata EVB

**Software**

- Freescale Linux and Android i.MX 6 BSPs will have native/integrated support for all Murata modules based on Broadcom chipsets.
- Upcoming Beta releases include Linux 3.14.x and Android Lollipop 5.1.x.
- Patch files provided to enable Freescale reference platform with Murata WLAN/BT solution.

© June 2015 Murata Americas wireless.murata.com/imx imxfaq@murata.com
Support Links

imxFAQ@murata.com → To provide a quick answer on most common questions about hardware, software, platform, etc.

wireless.murata.com/imx → Dedicated landing page for promotion of modules with Freescale’s i.MX processor platforms.
## Supported Freescale platforms

<table>
<thead>
<tr>
<th></th>
<th>SN8000</th>
<th>1FJ</th>
<th>ZX(*)</th>
<th>1FX</th>
<th>1BW</th>
<th>1DX</th>
<th>ZP</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.MX6 SABRE Board for Smart Devices</td>
<td>Supported</td>
<td>Coming soon</td>
<td>Supported</td>
<td>Coming Soon</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>
i.MX6 SABRE Platform for Smart Devices | Supported | Coming Soon | Supported | Coming Soon | Supported | Supported | Supported |
i.MX6 SABRE for Automotive | Supported | Coming Soon | Supported | Coming Soon | Supported | Supported | Supported |
i.MX6 Solo Lite EVK | Supported | Coming Soon | Supported | Coming Soon | Supported | Supported | Supported |

(*) Type ZX Eval kit is available in different form factor.
Hardware Solution for Existing i.MX 6SoloX

- i.MX 6SX Sabre SoloX
- Murata Wi-Fi/Bluetooth EVB
- 2.4/5.0 GHz Antenna (Dual-Band)
- Murata Type ZP EVB (BCM4339)
- Murata i.MX InterConnect
  => Provides Wi-Fi SDIO & Bluetooth UART connection
i.MX 6SX Sabre SoloX + Type ZP EVB

- SMA Rigid RF Threaded Connector
- Murata Type ZP EVB (BCM4339)
- Rigid 60-pin Samtec Connector
- Nylon HEX Standoffs provide secure support
- Murata i.MX InterConnect => Provides Wi-Fi SDIO/BT UART connection
Optional VEXT (4.0V-5.0V)
Allows Customer to measure current consumption of Wi-Fi/BT – useful when working on optimization

VIO_IN Jumper Select:
1.8V or VBAT_SDIO

Standoff between Adapter and EVB:
supports EVB for probing test points
High Level Hardware InterConnect Overview

Freescale i.MX 6 EVK

WLAN SDIO
BLUETOOTH
HCl H4-UART
Optional
WLAN/BT On-Off OOB IRQ

Murata i.MX InterConnect

Murata Wi-Fi/BT EVB:

ZP/1BW/1DX/1FX/1FJ/SN8000
## Murata Wi-Fi/Bluetooth Module EVB’s

<table>
<thead>
<tr>
<th>Type</th>
<th>BCM4339</th>
<th>BCM43340</th>
<th>BCM4343W</th>
<th>BCM43364</th>
<th>BCM43362</th>
<th>BCM4343W</th>
</tr>
</thead>
<tbody>
<tr>
<td>802.11a/b/g/n/ac BT/BLE</td>
<td>802.11a/b/g/n BT/BLE</td>
<td>802.11b/g/n BT/BLE</td>
<td>802.11b/g/n (Wi-Fi Only)</td>
<td>802.11b/g/n (Wi-Fi Only)</td>
<td>802.11b/g/n BT/BLE</td>
<td></td>
</tr>
<tr>
<td>7.8 x 7.4mm H: 1.0mm</td>
<td>8.0 x 7.5mm H: 1.1mm</td>
<td>6.95 x 5.15mm H: 1.1mm</td>
<td>6.95 x 5.15mm H: 1.1mm</td>
<td>24 x 11.4mm H: 1.9mm</td>
<td>21.0 x 10.0mm H: 2.0mm</td>
<td></td>
</tr>
</tbody>
</table>

---

Copyright © Murata Manufacturing Co., Ltd. All rights reserved. 22 July 2015
High Level Software Overview

Freescale Linux or Android BSP with native support for Broadcom Wi-Fi & Bluetooth

Freescale click-thru to obtain necessary Broadcom firmware and tools

Murata Patch for New DTS files & Android File System Mods

wireless.murata.com/imx/

community.freescale.com/community/imx/

Copyright © Murata Manufacturing Co., Ltd. All rights reserved.
Murata Software Changes?

Murata Patch for New DTS files & Android File System Mods

Additional DTS per i.MX 6 Platform => Unique DTB’s:
- MUX WLAN SDIO
- MUX Bluetooth UART
- MUX Optional Ctrl Signals
- Add Wi-Fi Driver Hooks

Android Specific:
- Modify Board Config Files
- Add Bluetooth Config Files
- Modify Boot Init Files
- Modify WPA Supplicant
Software Road Map => Integrate Patches

- Minimize complexity for End User
- Reduce Eval Board Bring-Up Time
- Provide code-base that is easier for customers/partners to port

Integrate Patches into BSP
Ideal (Revised) High Level Software Overview

Freescale Linux or Android BSP with native support for Broadcom Wi-Fi & Bluetooth

Freescale click-thru to obtain necessary Broadcom firmware and tools

wireless.murata.com/imx/

community.freescale.com/community/imx/

BASELINE SOFTWARE

HOW-TO DOCUMENTS

Copyright © Murata Manufacturing Co., Ltd. All rights reserved.
Utilizing Which Freescale BSP’s?

i.MX7 Beta BSP
- ETA: July
- Linux 3.14.x
- Android L5.1.x

Possible External Patch Release
- ETA: July 10th
- Linux 3.14.28_GA

i.MX6 Quad Plus Beta Patch?
- ETA: Late July
- Linux 3.14.x
- Android L5.1.x

i.MX6 Quad Plus GA BSP
- ETA: August
- Linux 3.14.x
- Android L5.1.x
Wi-Fi/Bluetooth Up & Running: Now What?

- Even after final partner/customer board is spun, Wi-Fi/Bluetooth is functioning; there are still considerable tasks to tackle:
  - System Test: may uncover corner-case failures.
  - Regulatory Certification: necessary for un-certified modules.
  - Wi-Fi/BT-Sig Certification: often necessary or even required for end product.

- Partners/Customers need to carefully consider expense/time required to obtain necessary Regulatory Certifications: FCC, IC, CE, etc.
  - **One upside of selecting pre-certified modules** such as **Type 1FJ** or **SN8000** => Regulatory Certification Step is much **easier**.

- Wi-Fi/BT-Sig Certifications are not inexpensive and can be time consuming. Definitely a good idea to make sure this plan is well mapped out.
Get more than 120 countries regulation.

We can propose the most suitable schedule considering lead time with rich experience.

Support flow

We can propose best scheme for customers products. e.g. some tests may be exempted by adaptation of module policy.

Reduce certification cost

We can handle business for enormous documentation, adjustment for each county’s specification, negotiation with certificate authority.
How To Make Regulatory Easier?

Freescale click-thru to obtain necessary “WL tool” and manufacturing test firmware.

wireless.murata.com/imx/

HOW-TO DOCUMENTS

community.freescale.com/community/imx/

RF Test Tool
## Approximate Regulatory Cost

<table>
<thead>
<tr>
<th></th>
<th>FCC</th>
<th>IC</th>
<th>CE</th>
<th>Japan</th>
<th>Korea</th>
<th>China</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type 1FX</strong></td>
<td>$10,000</td>
<td>$2,000</td>
<td>$12,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM43364</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.11b/g/n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(lowest cost)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type 1DX</strong></td>
<td>$12,000</td>
<td>$3,000</td>
<td>$15,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM4343W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.11b/g/n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT/BLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type 1BW</strong></td>
<td>$22,000</td>
<td>$6,000</td>
<td>$25,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM43340</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.11a/b/g/n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT/BLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type ZP</strong></td>
<td>$55,000</td>
<td>$10,000</td>
<td>$65,000</td>
<td>$11,000</td>
<td>$25,000</td>
<td>$33,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>BCM4339</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.11a/b/g/n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ac</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BT/BLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Example of 2x2</strong></td>
<td>$110,000</td>
<td>$10,000</td>
<td>$120,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIMO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.11a/b/g/n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(highest cost)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cost listed are approximate based on past testing and new certified lab quote on Type ZP.
About Wi-Fi Certification

**Wi-Fi certification** is a test program specified by Wi-Fi Alliance (WFA) for a wireless LAN device:

- To secure **interoperability** between WLAN devices
- To ensure its **conformance** with IEEE 802.11 standards
- To enhance its **performance, quality and usability** of WLAN connectivity

Only Wi-Fi CERTIFIED devices are allow to carry the Wi-Fi CERTIFIED logo
Wi-Fi Certification Process Overview

1. **Pre-testing**
   - Approval of ASD test plan by WFA
   - Making the ASD test plan

2. **Final Pre-testing**
   - Analyzing failure and re-testing

3. **Fix the problem**
   - Release of final SW

4. **Applying to WFA**
   - Request the certification test to ATL
   - Result of report
   - Get Certification!!

5. **Development of SW for product**
   - Preparing the test device

6. **Customer**
   - Supporting to prepare the test device
   - Pre-testing
   - Final Pre-testing

7. **Publication of the CID**
   - Making the Test Report
   - Allowing the usage of Wi-Fi logo
   - Wi-Fi certification Test in ATL

(it's reviewed in 20 business days)
# STA(11n+WPS) Certification Example

## Phase 1
- **ASD support**
- **Pre-Test support**

1. Consult about WLAN specs, SW capability, schedule, etc.
2. Compose “ASD test plan” and submit it to WFA
3. Receive approval from WFA *(It takes 20 business days)*
4. Perform pre-test in Murata Lab.

## Phase 2
- **Certification test support at ATL**

5. Make reservations at ATL
6. Apply device information & certification test to WFA
7. Perform certification test at ATL *(It takes about 3 days)*
8. Send “PASS” report from ATL to WFA

## Phase 3
- **Registration support**

9. Receive “PASS” approval from WFA *(It takes 1~3 days)*
10. Wi-Fi Certification COMPLETED !!!

*(It takes about 3 days)*

Copyright © Murata Manufacturing Co., Ltd. All rights reserved.
22 July 2015 28
Q & A?
Thank You