Murata Wi-Fi/BT EVK for i.MX6

Hardware User Manual

Revision History

Revision	Date	Author	Change Description
1.0	08/31/15	S. Kerr R. Willett	Initial version

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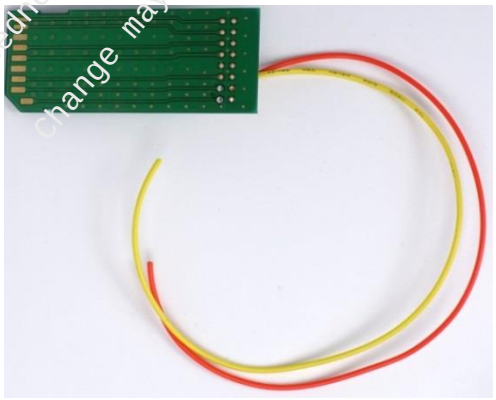
1 Murata Wi-Fi/BT EVK for i.MX6

1.1 Murata Kit Contents

The Murata Kit includes all hardware necessary to bring up Wi-Fi/Bluetooth on Freescale i.MX6 Platforms. See Table 1. Each color-coded bag contains a separate component.

Table 1: i.MX6 Kit Contents

Color Tag	Picture of Contents	Description of Contents
		Murata Wi-Fi/BT EVB such as Type ZP, Type 1BW, Type 1DX and SN8000. Type ZP is pictured.
		**Murata i.MX InterConnect Ver 1.0:** SD pins (MMC Plus) provide both Wi-Fi SDIO and Bluetooth UART and control lines.
	 	**Murata i.MX InterConnect Ver 2.0:** SD pins provide Wi-Fi SDIO; ribbon cable connection provides Bluetooth UART and control lines. 50 mm ribbon cable included.
	 	2.4/5.0 GHz Whip/Tilt SMA Antenna (for dual-band Wi-Fi) Or 2.4 GHz Whip SMA Antenna (for single band Wi-Fi)
		SD Card Extender – optional use for connecting control signals; such as: WL_REG_ON WL_HOST_WAKE BT_REG_ON BT_DEV_WAKE BT_HOST_WAKE

1.2 Murata Modules Supported

All Murata Wi-Fi/Bluetooth EVB's are pin compatible with both Murata i.MX InterConnect Adapters (Versions 1.0 & 2.0). Two InterConnect adapters are included to provide maximum flexibility for user to connect hardware easily to Freescale i.MX6 Platforms. The Murata Hardware Solution is outlined in Table 2: Murata Wi-Fi/Bluetooth EVB's. Two of the EVB's only support Wi-Fi (SN8000 and 1FX). All other EVB's are Wi-Fi/Bluetooth combo solutions.

Table 2: Murata Wi-Fi/Bluetooth EVB's

Type ZP	Type 1BW	Type 1DX	Type 1FX	SN8000 FCC/CE/IC CERTIFIED	Type 1FJ CERTIFIED W/ Connector
BCM4339	BCM43340	BCM4343W	BCM43364	BCM43362	BCM4343W
802.11a/b/g/n/ac BT/BLE	802.11a/b/g/n BT/BLE	802.11b/g/n BT/BLE	802.11b/g/n (Wi-Fi Only)	802.11b/g/n (Wi-Fi Only)	802.11b/g/n BT/BLE
7.8 x 7.4 Height: 1.0 (units: mm)	8.0 x 7.5 Height: 1.1 (units: mm)	6.95 x 5.15 Height: 1.1 (units: mm)	6.95 x 5.15 Height: 1.1 (units: mm)	24 x 11.4 Height: 1.9 (units: mm)	21.0 x 10.0 Height: 2.0 (units: mm)






1.3 i.MX6 MPU Interfaces Supported

Figure 1: Murata IMX Interconnect Kit Interfaces provides a graphical illustration of the interfaces supported.

- Wi-Fi SDIO: 4-bit SDIO interface (SDIO 2.0 and 3.0 modes supported). For both versions of adapter boards, the SDIO interface (SD_CLK, SD_CMD, SD_DATA0..3) is supported via standard SD card pinout.

- Bluetooth UART: H4 (4-wire signaling) is supported. This requires flow control lines RTS/CTS in addition to TX/RX. Maximum Bluetooth UART rate (for Broadcom-based Murata modules) is 4 Mbps; typically set to 3 Mbps. Default initialization rate is 115200 Baud. Murata i.MX InterConnect Ver 1.0 uses additional pins on EMMC/MMC Plus footprint (SD_DATA4..7) to provide UART connection in some instances. Murata i.MX InterConnect Ver 2.0 uses 20 pin ribbon cable interconnect to provide UART connection.

- GPIO Control Lines: WL_REG_ON, WL_HOST_WAKE, BT_REG_ON, BT_DEV_WAKE, and BT_HOST_WAKE. Murata i.MX InterConnect Ver 1.0 provides user option of configuring (additional) SD_DATA4..7 pins to be used to as control signals. Murata i.MX InterConnect Ver 2.0 provides control signal connections via ribbon cable interconnect.

- Optional PCM lines that can be "blue wired" if necessary. PCM lines are used for Bluetooth audio transport. For both Murata i.MX InterConnect versions, PCM "through holes" are provided at end of adapters for running "blue wire" to.

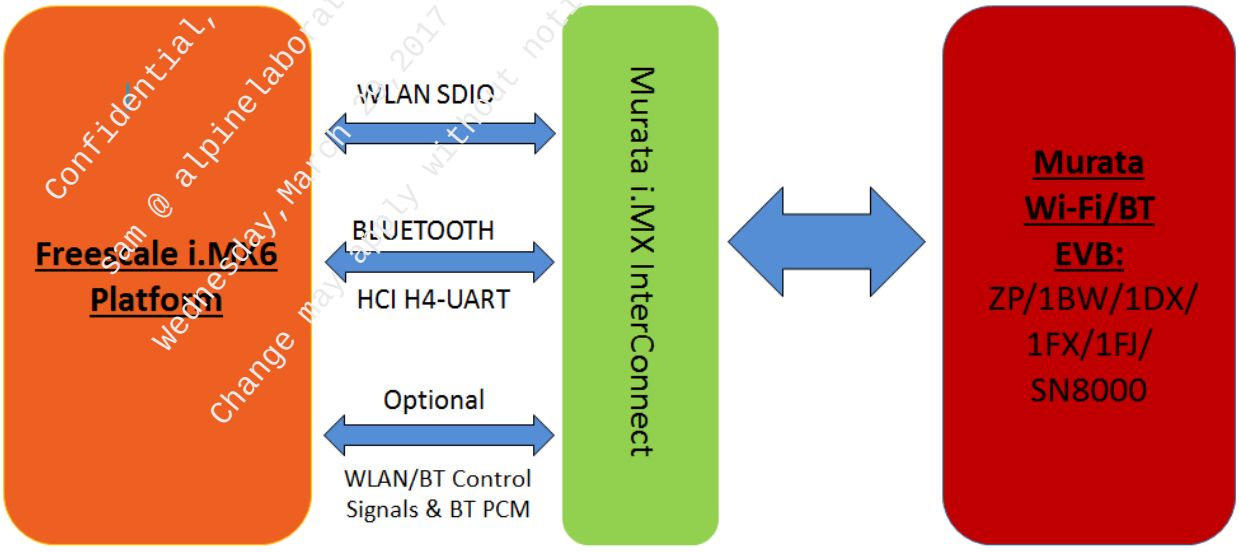


Figure 1: Murata IMX Interconnect Kit Interfaces

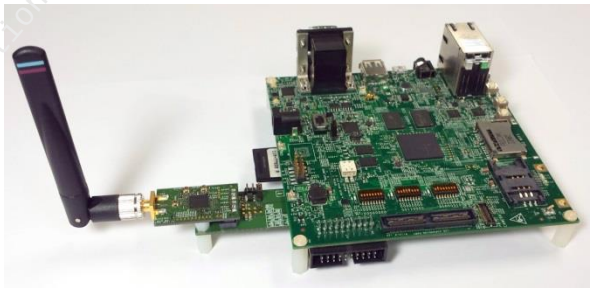
1.4 Freescale i.MX6 Platforms Supported

The Murata Wi-Fi/BT Kit is specifically designed to interconnect easily with Freescale i.MX6 Platforms. Table 3: Freescale Compatible Murata Wi-Fi/BT Kits lists the official Freescale branded i.MX6 Reference Platforms and which Murata Wi-Fi/BT kits (specifying Adapter Version) can be connected with them. Note that no third-party Freescale i.MX6 EVK's are supported. For more information on a given Freescale i.MX6 Platform or Murata module, clicking on the hyperlink will navigate you to the relevant web page.

Table 3: Freescale Compatible Murata Wi-Fi/BT Kits

	SN8000	1FJ	1FX	1DX	1BW	ZP
i.MX 6Quad SABRE-SD	Ver 1.0/2.0	Ver 2.0	Ver 1.0/2.0	Ver 2.0	Ver 2.0	Ver 2.0
i.MX 6SoloX SABRE-SD	Ver 1.0/2.0	Ver 1.0/2.0	Ver 1.0/2.0	Ver 1.0/2.0	Ver 1.0/2.0	Ver 1.0/2.0
i.MX 6SoloLite EVK	Ver 1.0	Ver 1.0	Ver 1.0	Ver 1.0	Ver 1.0	Ver 1.0
i.MX 6UltraLite EVK	Ver 2.0	Ver 2.0	Ver 2.0	Ver 2.0	Ver 2.0	Ver 2.0

i.MX6Quad SABRE-SD



i.MX 6SoloX SABRE-SD

i.MX 6Ultralite EVK

i.MX 6Sololite EVK

2 Murata i.MX InterConnect Adapter Options

The Murata Wi-Fi/Bluetooth is easily connected to the Freescale i.MX6 Platforms by employing Murata's custom i.MX InterConnect Adapter. Given the differences in Freescale i.MX6 Platforms, two versions of the adapter are made available in each kit. Figure 2 and Figure 3 show Murata i.MX InterConnect Ver 1.0 & Ver 2.0 adapters plugged into the i.MX 6SoloX SABRE-SD.

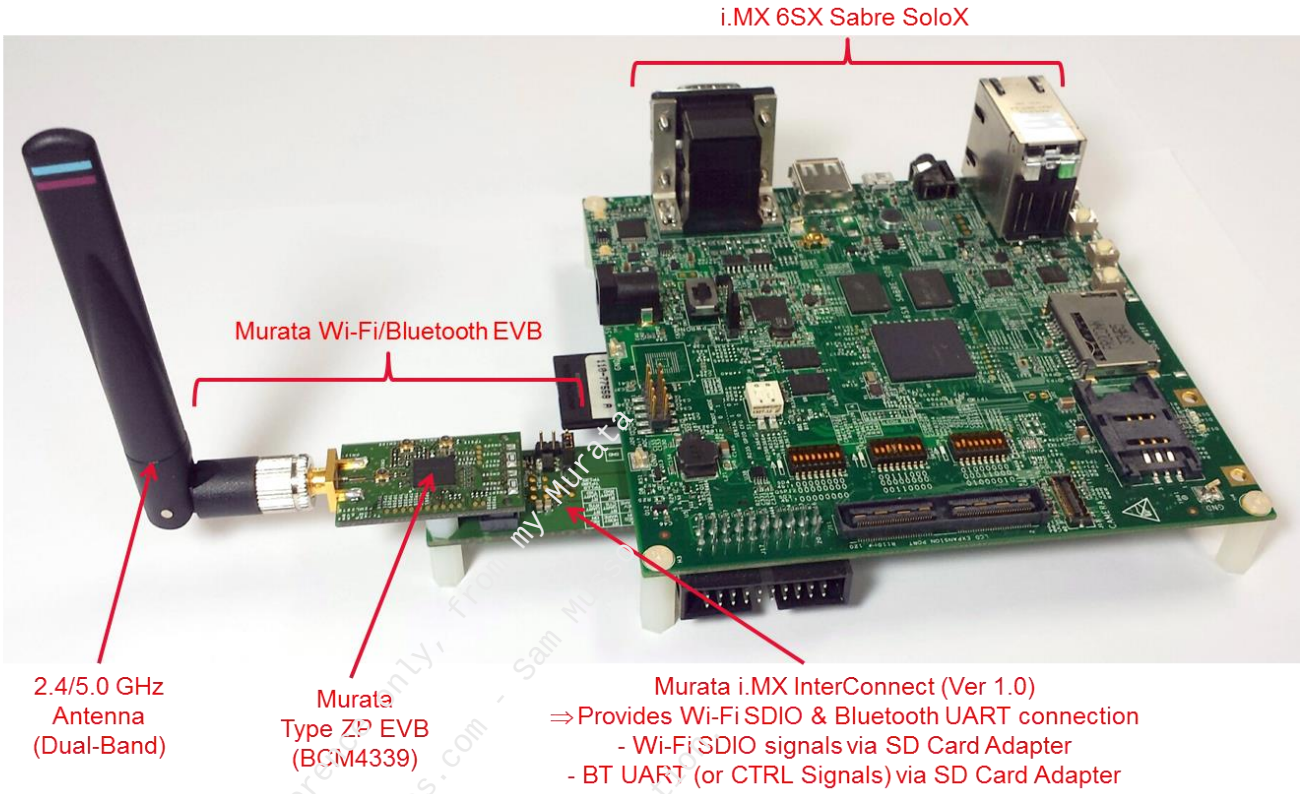


Figure 2: i.MX 6SoloX SABRE-SD, Type ZP EVK

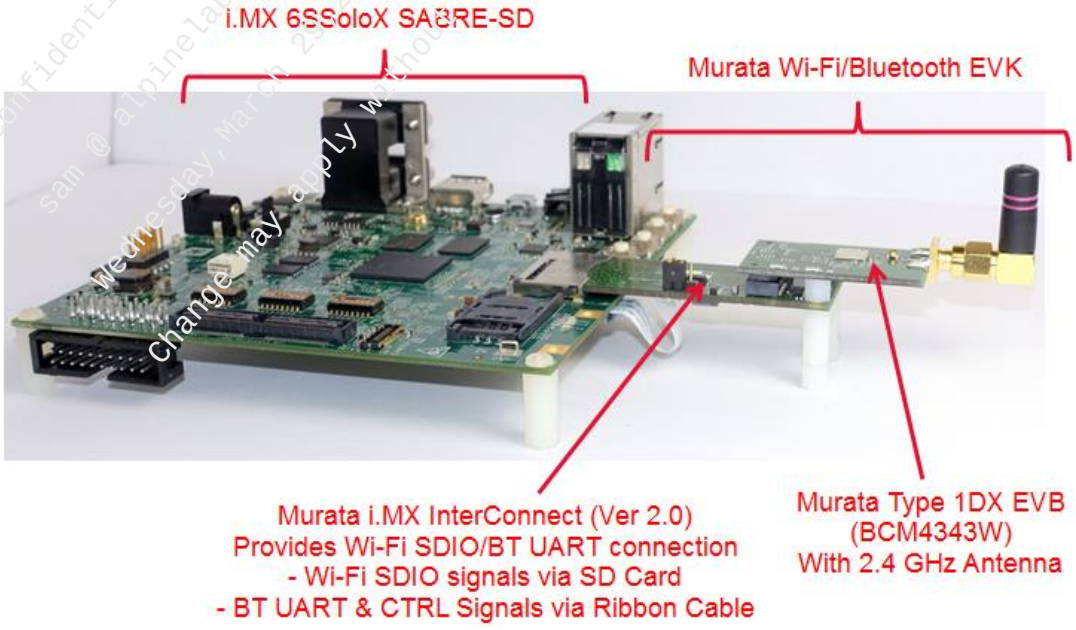


Figure 3: i.MX 6SoloX SABRE-SD, Type 1DX EVK

2.1 Version 1.0 Adapter Board

2.1.1 Overview

Figure 4 shows the top view of the Murata i.MX InterConnect Ver 1.0 Adapter. The adapter was designed to make use of Freescale EMMC/"MMC Plus" SD card connector footprint: in addition to SDIO _DATA0..3; there are four extra pads that bring out SDIO_DATA4..7 lines. The SDIO_DATA0..3 lines support 4-bit SDIO for WLAN. The additional SDIO_DATA4..7 lines can be used to support Bluetooth UART (TX/RX/CTS/RTS) or control signals – depending on which Freescale i.MX6 Platform is being interfaced.

The Murata adapter brings out test points (refer to silkscreen) which allow the end user to easily probe signals such as WL_REG_ON/BT_REG_ON/etc. These test points can also be used to blue-wire in signals if necessary. If the user designates the SD_DATA4..7 lines to be used as Bluetooth UART and requires dynamic control signals (BT_REG_ON/WL_REG_ON/WL_HOST_WAKE) then these test points (in addition to SD Card Extender/wires included in kit) can be used to wire in the necessary GPIO control signals.

In re-configuring the adapter board, special attention needs to be made to "short pad" options. "Short pads" are used on the adapter (i.e. TP119/TP106/TP135 in Figure 4) in place of small 0402 resistors so the end user can quickly/easily modify the connections. The primary usefulness of these "short pads" is to re-route signals between the SD_DATA4..7 pads and the Samtec 60-pin connector (which connects directly to Murata Wi-Fi/BT EVB). By referencing the adapter schematic (Figure 8) and/or connection table (Table 4), the user can determine the best configuration.

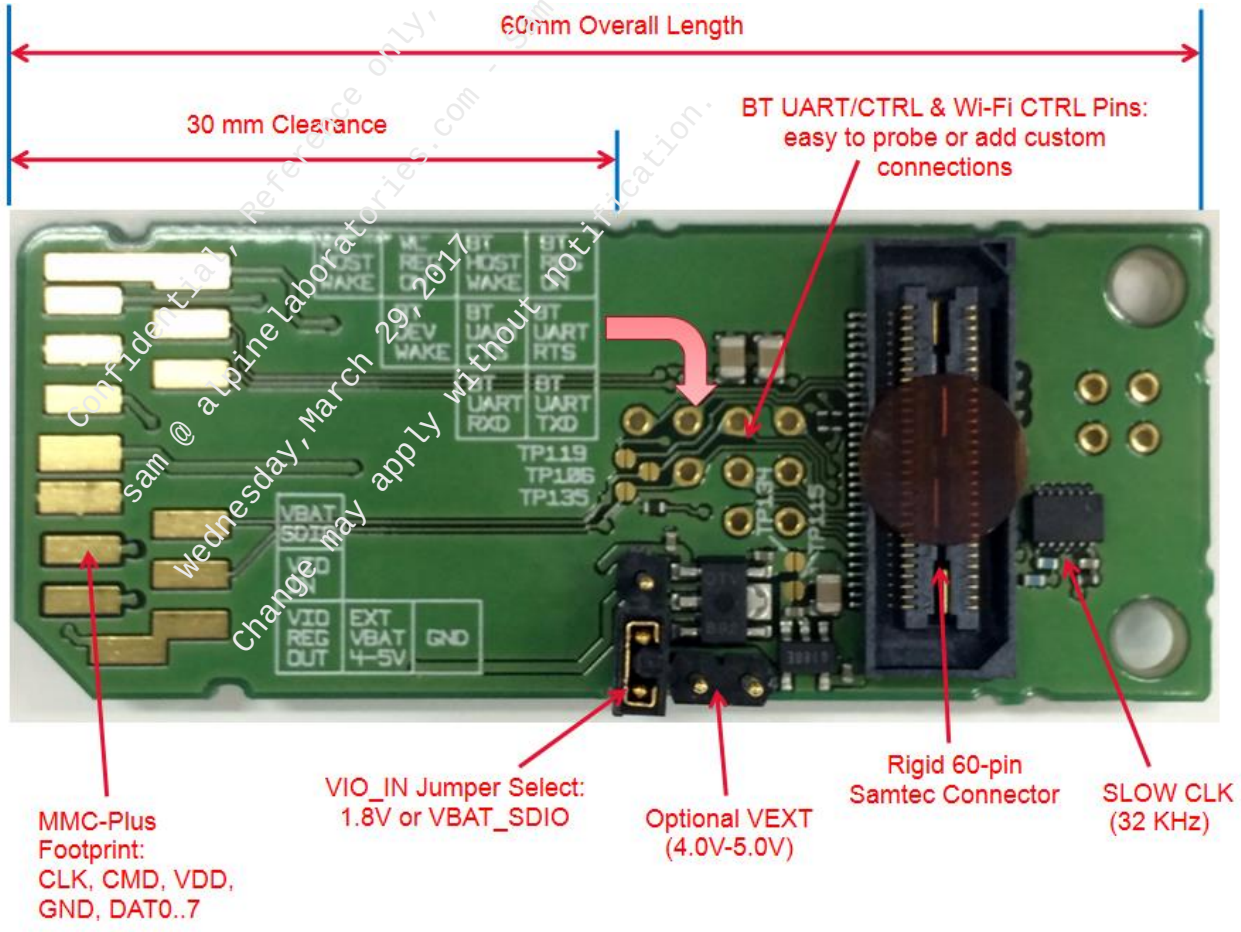


Figure 4: Murata i.MX InterConnect Ver 1.0 Adapter, Top View

The adapter board also includes “SLOW CLK” circuit for providing a more accurate 32 KHz signal than what is available on the Wi-Fi/BT chipset itself (when in sleep mode). Two regulators are designed to provide 1.8V VIO and give the end user the option of connecting an external power supply. The default configuration powers the Murata Wi-Fi/BT EVB from “VBAT SDIO” – voltage provided by Freescale i.MX6 Platform – typically ranges from 3.1V to 3.3V. When connecting “VEXT” (external voltage supply between 4V and 5V), the user can accurately measure the Wi-Fi/BT power consumption during specific test modes (i.e. IEEE power save, maximum transmit or receive modes, etc.).

Please refer to Figure 5: Murata i.MX InterConnect Ver 1.0 Adapter, Bottom View. Even though the WLAN SDIO signals (CLK, CMD, SDIO_DATA0..3) are not connected via “short pads”, they can still be probed if necessary. When testing SDIO 3.0 high throughput modes, probing SDIO_CLK can be very useful when analyzing signal integrity.

Most of the “short pads” are brought out on the bottom of the Ver 1.0 Adapter. Again referencing the schematic (Figure 8) or connection table (Table 4) will provide the user with the necessary/desired connection scheme. For convenience the silkscreen showing test points is replicated on the bottom of the adapter.

The Bluetooth PCM signals are brought out to test points at the end of the adapter. The user has the option of blue-wiring the PCM signals to the adapter.

Mounting holes are designed to allow nylon standoffs to support both the adapter and the Murata Wi-Fi/BT EVB. Given the need for occasionally probing test points on either the adapter or EVB, providing adequate mechanical support is important.

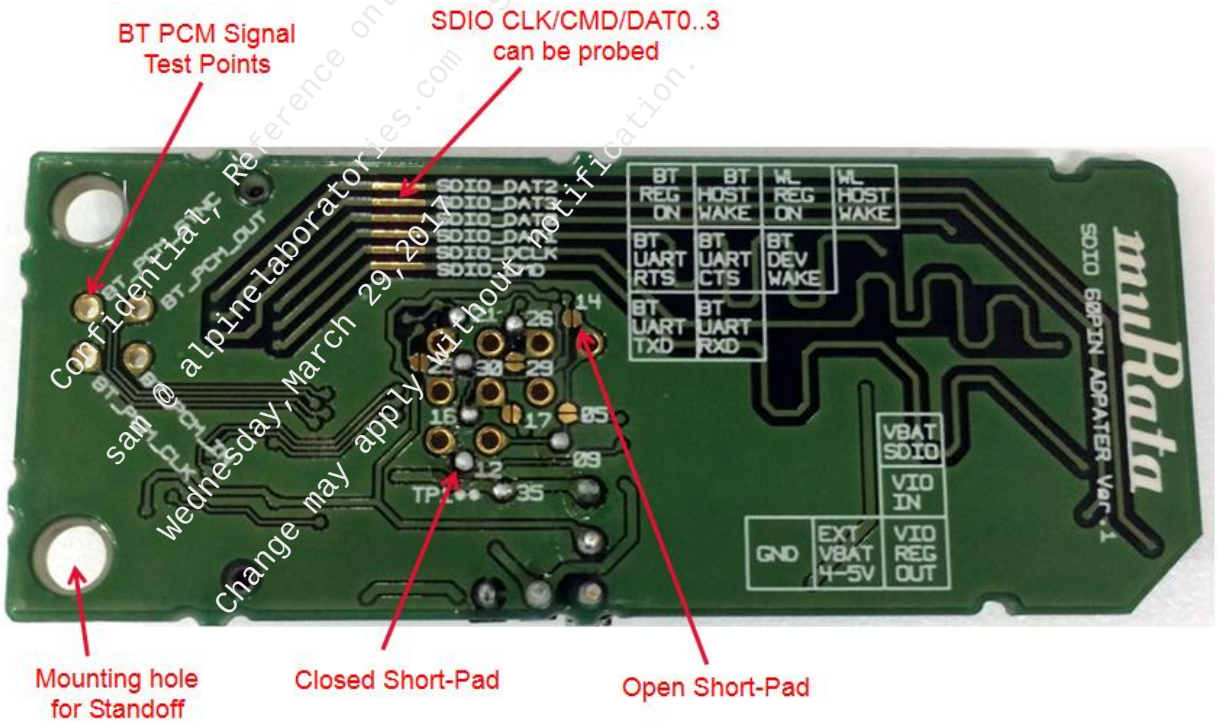


Figure 5: Murata i.MX InterConnect Ver 1.0 Adapter, Bottom View

Figure 6 and Figure 7 show the top and bottom layouts for the Ver 1.0 InterConnect Adapter. The default (open/short) connection setting on the “short pads” is shown graphically.

● Default short
○ Default open

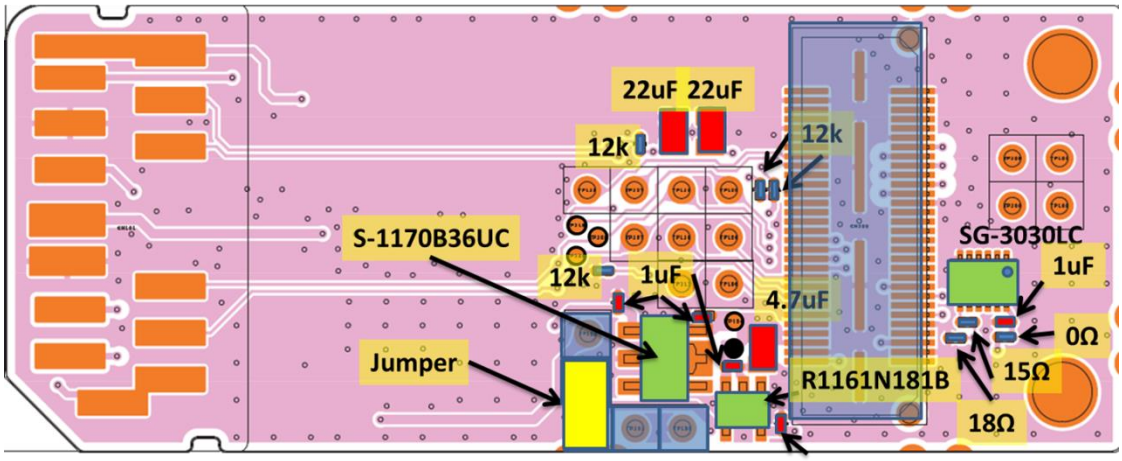


Figure 6: Ver 1.0 InterConnect Adapter, Top View

● Default short
○ Default open

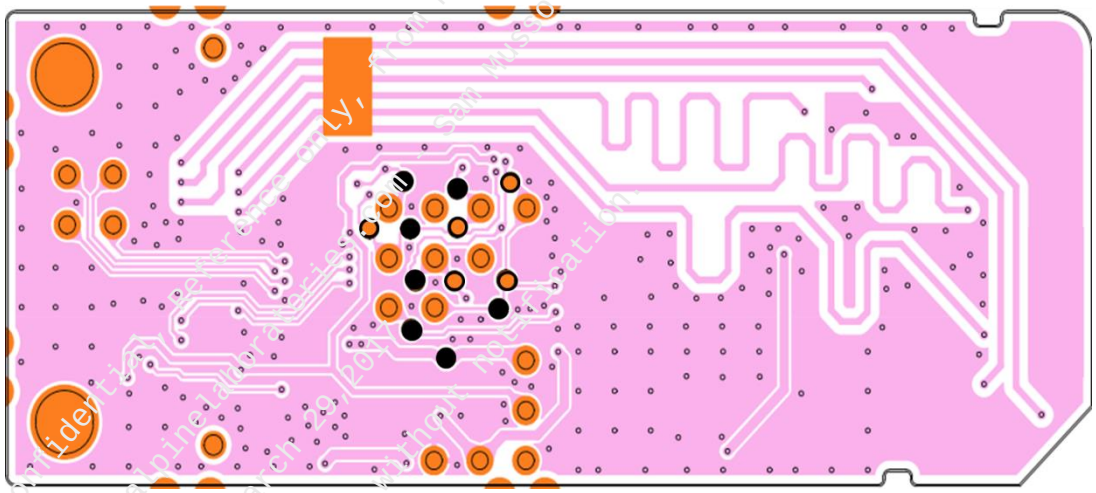


Figure 7: Ver 1.0 InterConnect Adapter, Bottom View

Figure 8: Murata i.MX InterConnect Ver 1.0 Adapter schematic is shown on page 15. If zooming in on schematic details is not adequate then please refer to schematic document.

“Interface” shows connections to Samtec 60-pin connector (CN100) and SD/EMMC pinout (CN101).

“Path option” shows various MUXing options for “additional” SD_DATA4..7 pins.

“Slow Clock In” details the external slow clock (32 KHz) circuit.

Lastly there are two “Power Block” sections. The bottom/middle “Power Block” section details the VIO jumper selection (VBAT_SDIO or 1.8V) and the 1.8 VIO circuit. The right “Power Block” section shows the optional VEXT power supply and “short pad” selection for VBAT_SDIO or VBAT_3.6V_REG_OUT (generated from VEXT).

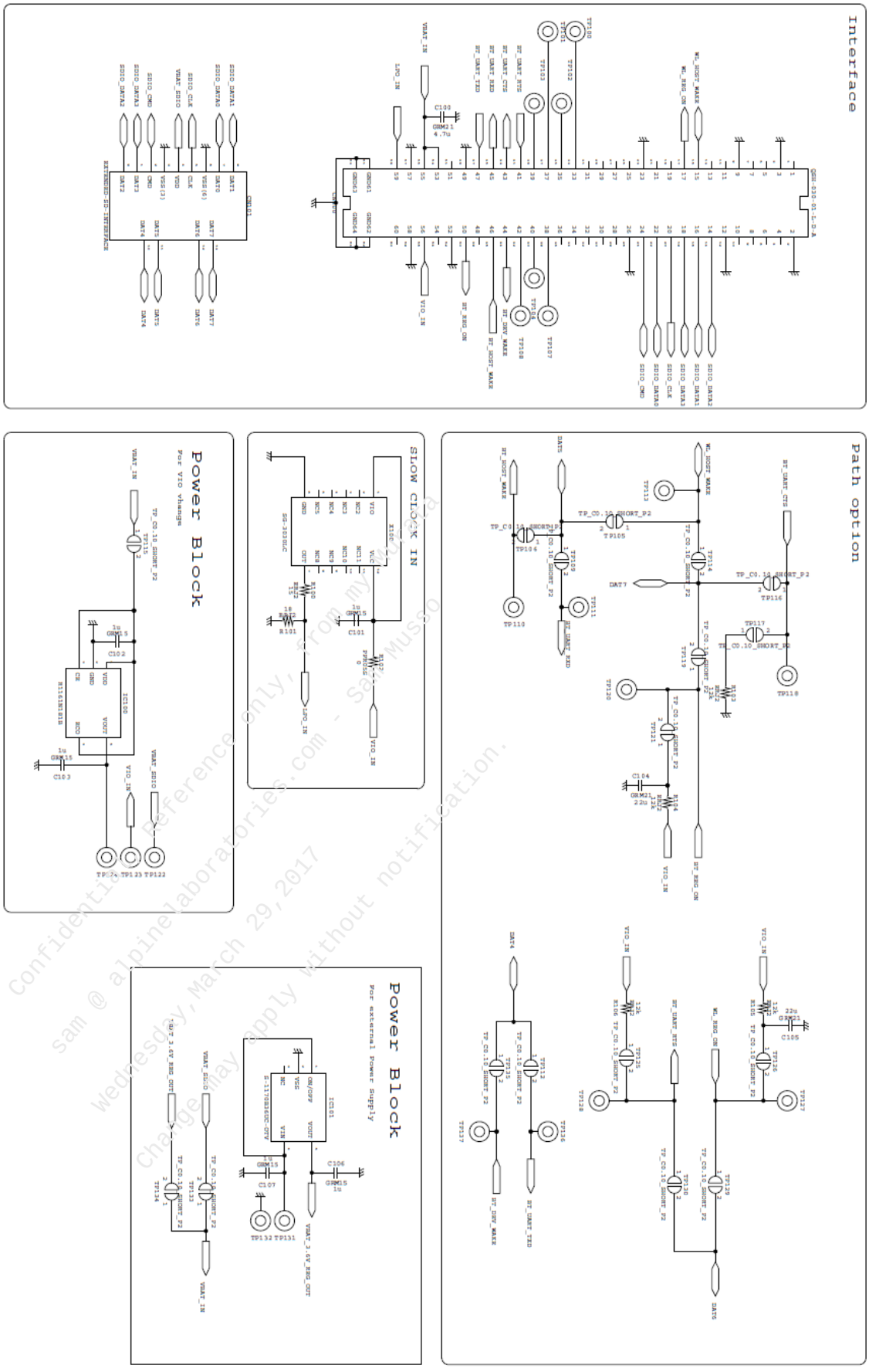


Figure 8: Murata i.MX InterConnect Ver 1.0 Adapter schematic

2.1.2 Default Configuration

Please refer to Table 4: Default Configuration for Ver 1.0 Adapter. Default VIO of VBAT_SDIO (3.1-3.3V) is selected by jumpering TP122 and TP123: for more details refer to silkscreen on adapter for “VIO” markings. Murata Wi-Fi/BT EVK is configured to draw power from Freescale Platform via “VDD” pin on SD card slot. WLAN SDIO is always default (no selection here) and Bluetooth UART is configured via SD_DATA4..7 lines. Note that this TX/RX/CTS/RTS UART connection is only available on i.MX 6SoloX SABRE-SD, and i.MX 6SoloLite EVK. WL_REG_ON and BT_REG_ON are driven by onboard circuitry so that both cores are enabled after power-on-reset. If specific control of either “REG_ON” signal is required then the “short pad” configuration on adapter must be changed and blue-wiring to additional SD Card Extender (included in kit) may be necessary. Note that WL_HOST_WAKE is not connected.

Table 4: Default Configuration for Ver 1.0 Adapter

Murata EVK Signal	Freescale i.MX6 Platform SD/MMC Pin	Short-Pad/ Jumper Closed	Notes
VBAT_IN	VDD	TP133	VBAT_SDIO from Freescale EVK typically 3.1-3.3V. Alternative option is connecting external power supply (4-5V Range) so VBAT_IN=3.6V (open TP133 and short TP134).
VIO_IN = 3.3V (VBAT_SDIO)	VDD (VBAT_SDIO)	(TP122+TP123)	For 1.8V: short TP115; and jumper (TP123+TP124).
SD_CLK; SD_CMD; SD_DATA0..3	CLK; CMD; SD_DAT0..3	N/A	WLAN 4-bit SDIO connection is default. Cannot be modified.
BT_UART_TXD	SD_DATA4	TP112	Alternate Murata EVK Signal: BT_DEV_WAKE
BT_UART_RXD	SD_DATA5	TP109	Alternate Murata EVK Signals: BT_HOST_WAKE; WL_HOST_WAKE
BT_UART_RTS	SD_DATA6	TP130	Alternate Murata EVK Signal: WL_REG_ON
BT_UART_CTS	SD_DATA7	TP116	Alternate Murata EVK Signals: WL_HOST_WAKE; BT_REG_ON
WL_REG_ON	N/A	TP126	Delayed signal going active high after power-up; enabling WLAN core.
BT_REG_ON	N/A	TP121	Delayed signal going active high after power-up; enabling Bluetooth core.

2.1.3 Wi-Fi WL_REG_ON Option

The WL_REG_ON takes the Broadcom chipset's WLAN core in and out of reset. The default configuration is that it will be enabled (active high) on power-up-reset so that the WLAN SDIO interface can be correctly enumerated during kernel boot-up. Obviously this signal is kept high until the next power-on reset occurs. Leaving the signal always active high typically works fine for Linux implementations when optimized powersave mode is not required. However it is typically needed for Android implementations. Also, dynamic WL_REG_ON works perfectly fine for Linux – if implemented correctly.

There are two different ways to modify the default "power-on reset WL_REG_ON" so that WL_REG_ON is controlled dynamically by the Freescale i.MX6 MPU.

2.1.3.1 Dynamic WL_REG_ON: First Approach

The First Approach is to make use of "short pad" MUXing on the Murata Adapter board. Refer to Table 5 for necessary modifications. Note that once BT_UART_RTS is disconnected, then the Bluetooth UART connection will not work (Exception: Very slow UART rate of 115200 baud works without flow control). Once this hardware modification is done, software changes are necessary to MUX the SD_DATA6 pin appropriately so that WLAN driver can control WL_REG_ON.

Table 5: Dynamic WL_REG_ON – First Approach

Murata EVK Signal	Freescale i.MX6 Platform SD/MMC Pin	Short-Pad/ Jumper Closed	Notes
BT_UART_RTS	SD_DATA6	TP130	Alternate Murata EVK Signal: WL_REG_ON
WL_REG_ON	N/A	TP126	Delayed signal going active high after power-up; enabling WLAN core.
WL_REG_ON	SD_DATA6	TP129	Open TP130 to disconnect BT_UART_RTS line. Short TP129 to connect WL_REG_ON to SD_DATA6. Open TP126 to disconnect power-up reset circuit.

2.1.3.2 Dynamic WL_REG_ON: Second Approach

The Second Approach is to make use of “SD Card Extender” which can be used to wire additional control signals. This allows the default Bluetooth UART configuration to be kept. The only necessary steps are: (i) Open TP126 to disconnect power-up reset circuit on Adapter board; (ii) Connect wire from “SD Card Extender” to WL_REG_ON test point. More details on this are provided later in Section 3 Connecting Murata Wi-Fi/BT Kit to Freescale i.MX6 Platform.

2.1.4 Wi-Fi WL_HOST_WAKE (OOB IRQ) Option

WL_HOST_WAKE is used for the OOB IRQ: out-of-band interrupt for WLAN. This is not configured in default configuration (Table 4). Default is SDIO in-band interrupt. For optimized throughput and power consumption, configuring WL_HOST_WAKE is recommended.

2.1.4.1 Configuring WL_HOST_WAKE: First Approach

The First Approach is to make use of “short pad” MUXing on the Murata Adapter board. Refer to Table 6 for necessary modifications. This approach allows BT_HOST_WAKE to be connected to SD_DATA5 (if desired). Note that once BT_UART_CTS is disconnected, then the Bluetooth UART connection will not work (Exception: Very slow UART rate of 115200 baud works without flow control). Once this hardware modification is done, software changes are necessary to MUX the SD_DATA7 pin appropriately so that WLAN driver “hooks up” OOB_IRQ correctly.

Table 6: Configuring WL_HOST_WAKE - First Approach

Murata EVK Signal	Freescale i.MX6 Platform SD/MMC Pin	Short-Pad/ Jumper Closed	Notes
BT_UART_CTS	SD_DATA7	TP116	Alternate Murata EVK Signals: WL_HOST_WAKE; BT_REG_ON
WL_HOST_WAKE	SD_DATA7	TP114	Open TP116 to disconnect BT_UART_CTS line. Short TP114 to connect WL_HOST_WAKE to SD_DATA7.

2.1.4.2 Configuring WL_HOST_WAKE: Second Approach

The Second Approach makes use of "short pad" MUXing on the Murata Adapter board. This configuration would allow BT_REG_ON to be connected to SD_DATA7 (if desired). Refer to Table 7 for necessary modifications. Note that once BT_UART_RXD is disconnected, then the Bluetooth UART connection will not work. Once this hardware modification is done, software changes are necessary to MUX the SD_DATA5 pin appropriately so that WLAN driver "hooks up" OOB_IRQ correctly.

Table 7: Configuring WL_HOST_WAKE - Second Approach

Murata EVK Signal	Freescale i.MX6 Platform SD/MMC Pin	Short-Pad/ Jumper Closed	Notes
BT_UART_RXD	SD_DATA5	TP109	Alternate Murata EVK Signals: BT_HOST_WAKE; WL_HOST_WAKE
WL_HOST_WAKE	SD_DATA5	TP105	Open TP109 to disconnect BT_UART_RXD line. Short TP105 to connect WL_HOST_WAKE to SD_DATA5.

2.1.4.3 Configuring WL_HOST_WAKE: Third Approach

The Third Approach is to make use of "SD Card Extender" which can be used to wire additional control signals. This allows the default Bluetooth UART configuration to be kept. The only necessary step is: Connect wire from "SD Card Extender" to WL_HOST_WAKE test point. More details on this are provided later in Section 3 Connecting Murata Wi-Fi/BT Kit to Freescale i.MX6 Platform.

2.1.5 BT_REG_ON Option

The BT_REG_ON takes the Broadcom chipset's Bluetooth core in and out of reset. The default configuration is that it will be enabled (active high) on power-up-reset so that the Bluetooth UART interface can be correctly initialized when the Bluetooth Stack comes up. Obviously this signal is kept high until the next power-on reset occurs. Leaving the signal always active high typically works fine for Linux implementations when optimized powersave mode is not required. However it is typically needed for Android implementations. Also, dynamic BT_REG_ON works perfectly fine for Linux – if implemented correctly.

There are two different ways to modify the default "power-on reset BT_REG_ON" so that BT_REG_ON is controlled dynamically by the Freescale i.MX6 MPU.

2.1.5.1 Dynamic BT_REG_ON: First Approach

The First Approach is to make use of “short pad” MUXing on the Murata Adapter board. Refer to Table 8 for necessary modifications. Note that once BT_UART_CTS is disconnected, then the Bluetooth UART connection will not work (Exception: Very slow UART rate of 115200 baud works without flow control). Once this hardware modification is done, software changes are necessary to MUX the SD_DATA7 pin appropriately so that Bluetooth Stack can control BT_REG_ON.

Table 8: Dynamic BT_REG_ON - First Approach

Murata EVK Signal	Freescale i.MX6 Platform SD/MMC Pin	Short-Pad/ Jumper Closed	Notes
BT_UART_CTS	SD_DATA7	TP116	Alternate Murata EVK Signals: WL_HOST_WAKE; BT_REG_ON
BT_REG_ON	N/A	TP121	Delayed signal going active high after power-up; enabling Bluetooth core.
BT_REG_ON	SD_DATA7	TP119	Open TP116 to disconnect BT_UART_CTS line. Short TP119 to connect BT_REG_ON to SD_DATA7. Open TP121 to disconnect power-up reset circuit.

2.1.5.2 Dynamic BT_REG_ON: Second approach

The Second Approach is to make use of “SD Card Extender” which can be used to wire additional control signals. This allows the default Bluetooth UART configuration to be kept. The only necessary steps are: (i) Open TP121 to disconnect power-up reset circuit on Adapter board; (ii) Connect wire from “SD Card Extender” to BT_REG_ON test point. More details on this are provided later in Section 3 Connecting Murata Wi-Fi/BT Kit to Freescale i.MX6 Platform.

2.1.6 BT_DEV_WAKE and BT_HOST_WAKE Options

Default configuration is to not connect BT_HOST_WAKE or BT_DEV_WAKE. These signals are used to enhance powersave mode for Bluetooth signaling. By referencing the schematic, there are additional MUXing options (via SD_DATA4 or SD_DATA5) for BT_DEV_WAKE and BT_HOST_WAKE respectively. The default software configuration does not include support for BT_HOST_WAKE/BT_DEV_WAKE signaling. Please contact Murata for more support if you would like to test/verify these signals.

2.2 Version 2.0 Adapter Board

2.2.1 Overview

Please refer to Figure 9: Murata i.MX InterConnect Ver 2.0 Adapter, Top View. This adapter was specifically designed for Freescale's "Wi-Fi/BT specific" interface: currently supported on i.MX 6Quad SABRE-SD, i.MX 6SoloX SABRE-SD, and i.MX 6UltraLite EVK. The adapter uses standard 4-bit SDIO pinout to provide WLAN interface (no additional SDIO_DATA4..7 lines are supported). A 20-pin ribbon cable connector provides Bluetooth UART and additional control signals (WL_REG_ON, WL_HOST_WAKE, BT_REG_ON, BT_DEV_WAKE and BT_HOST_WAKE).

Note that the orientation of the SD card contacts are flipped (reverse side). This is done so that the Murata Wi-Fi/BT EVK is "right side up" on i.MX 6SoloX SABRE-SD and i.MX 6UltraLite EVK. Unfortunately the i.MX 6Quad SABRE-SD has its SD card connector on underside – resulting in the Murata Wi-Fi/BT EVK being positioned upside-down. Refer to Section 3 Connecting Murata Wi-Fi/BT Kit to Freescale i.MX6 Platform.

The Murata adapter brings out test points (refer to silkscreen) which allow the end user to easily probe/connect BT PCM signals. These test points can also be used to blue-wire in signals if necessary. The adapter also has "short pad" options for connecting optional control signals: BT_DEV_WAKE and BT_HOST_WAKE. To understand/check all short pad "options", please refer to the adapter schematic (Figure 14) and connection table (Table 9).

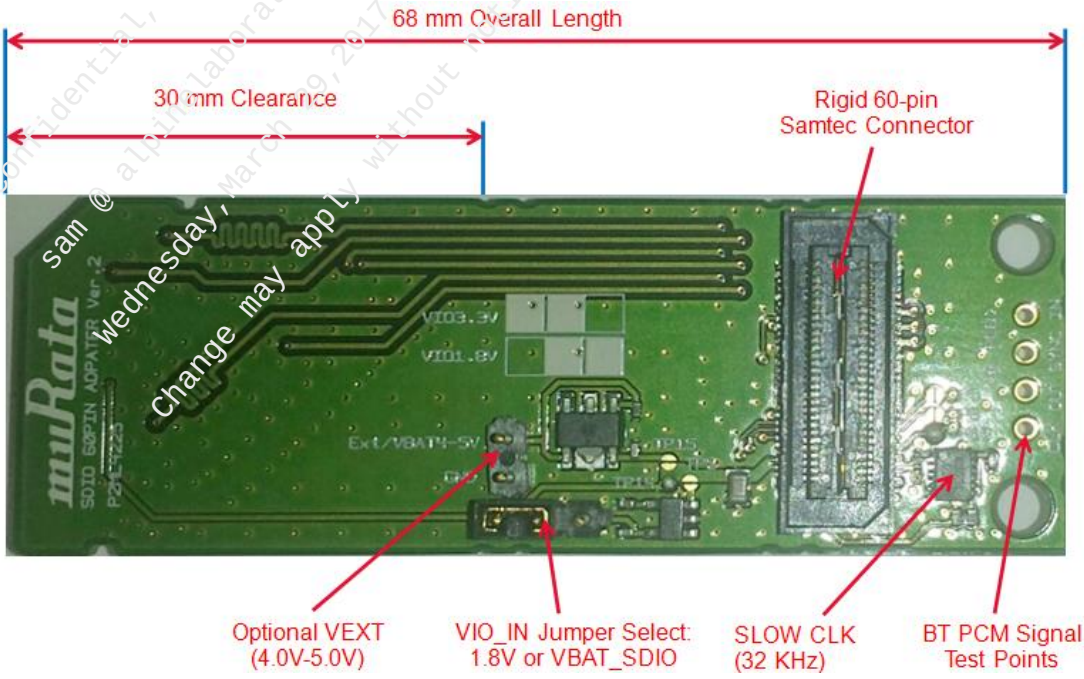


Figure 9: Murata i.MX InterConnect Ver 2.0 Adapter, Top View

The adapter board also includes “SLOW CLK” circuit for providing a more accurate 32 KHz signal than what is available on the Wi-Fi/BT chipset itself (when in sleep mode). Two regulators are designed to provide 1.8V VIO and give the end user the option of connecting an external power supply. The default configuration powers the Murata Wi-Fi/BT EVB from “VBAT SDIO” – voltage provided by Freescale i.MX6 Platform – typically ranges from 3.1V to 3.3V. When connecting “VEXT” (external voltage supply between 4V and 5V), the user can accurately measure the Wi-Fi/BT power consumption during specific test modes (i.e. IEEE power save, maximum transmit or receive modes, etc.).

Please refer to Figure 10: i.MX InterConnect Ver 2.0 Adapter, Bottom View. Two additional “short pads” are located next to ribbon cable connector. These short pads connect WL_REG_ON and WL_HOST_WAKE. Again referencing the schematic or connection tables will provide the user with the necessary/desired connection scheme. The Bluetooth PCM signals are brought out to test points at the end of the adapter. The user has the option of blue-wiring the PCM signals to the adapter.

Mounting holes are designed to allow nylon standoffs to support both the adapter and the Murata Wi-Fi/BT EVB. Given the need for occasionally probing test points on either the adapter or EVB, providing adequate mechanical support is important.

Ribbon cable connector used on Murata Adapter is Hirose #FH28E-20S-0.5SH(05). The ribbon cable included in Murata kit is made by Wurth Electronics #687620050002 (FFC Flat Flex Cable; 20 Position; 0.50mm Pitch; 50.0mm Length).

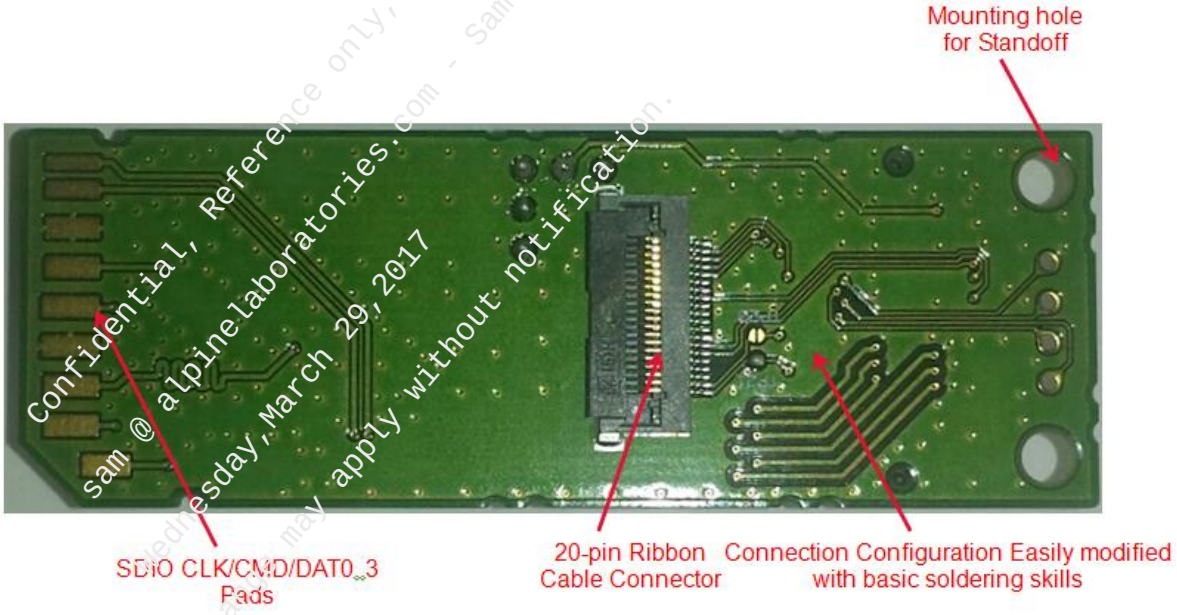


Figure 10: i.MX InterConnect Ver 2.0 Adapter, Bottom View

Please refer to Figure 11: Top Layout, Version 2.0 Adapter Board. One notable feature is on the SDIO trace lines: layout designed so all SDIO traces are of equal length.

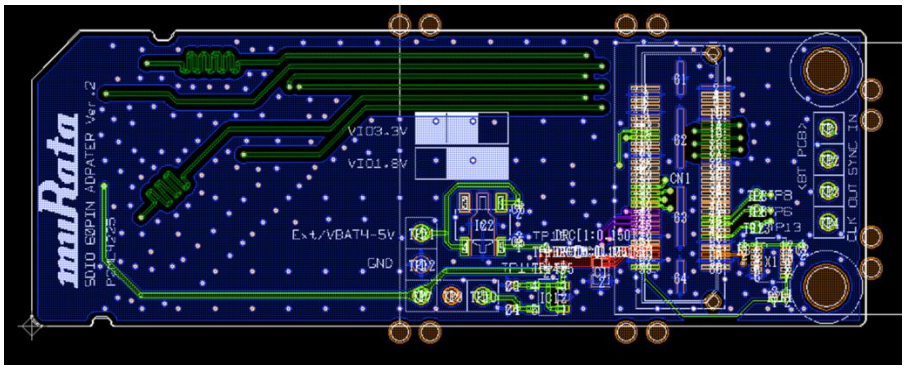


Figure 11: Top Layout, Version 2.0 Adapter Board

To provide additional information on Ver 2.0 Adapter layout, Figure 12: Version 2.0 Adapter Board, Power Section is included.

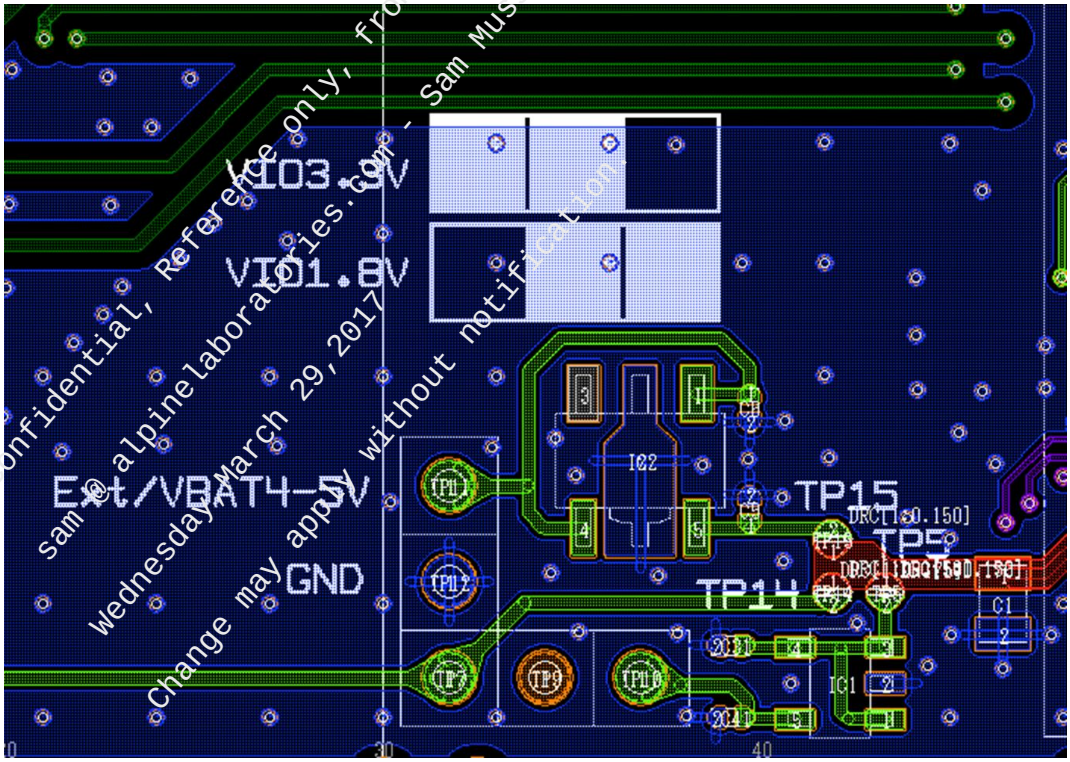


Figure 12: Version 2.0 Adapter Board, Power Section

Lastly for top layout, a blown-up section showing Samtec 60-pin connector, short pads, and PCM connection is shown in Figure 13: Version 2.0 Adapter Board, Samtec 60-pin Connector and PCM Connection.

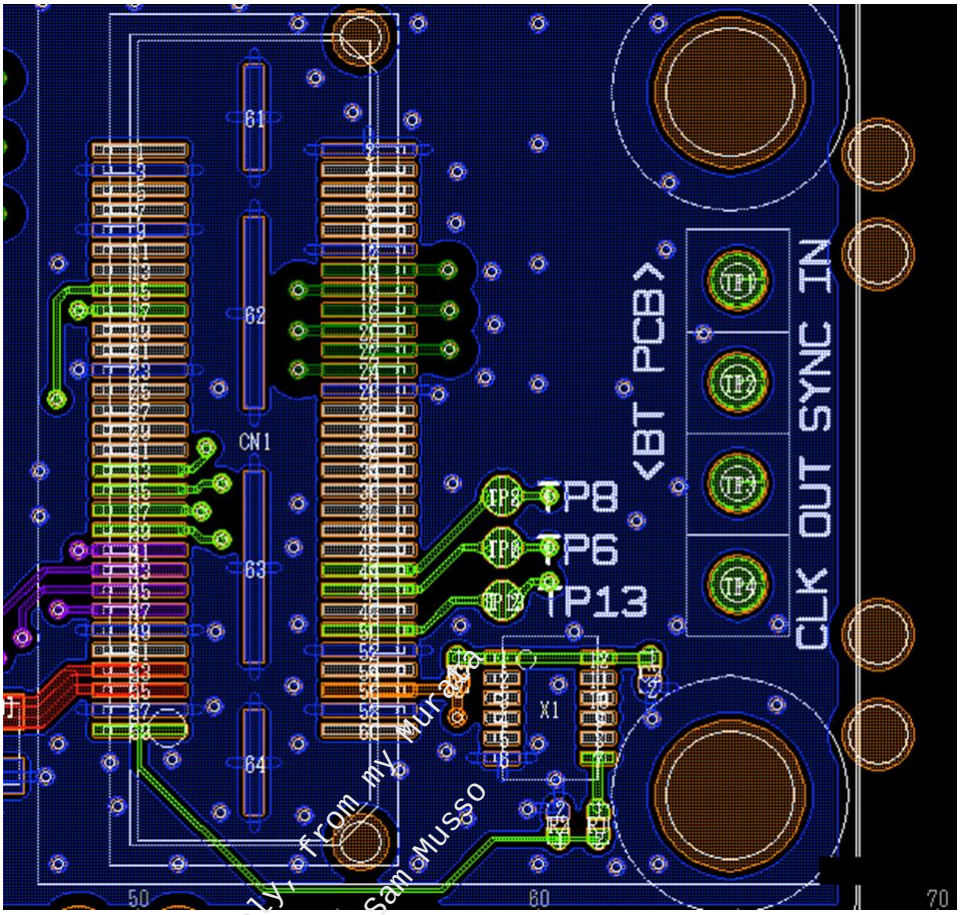


Figure 13: Version 2.0 Adapter Board, Samtec 60-pin Connector and PCM Connection

Figure 14: Murata i.MX InterConnect Ver 2.0 Adapter schematic is shown on page 25. If zooming in on schematic details is not adequate then please refer to schematic document.

“Interface” shows connections to Samtec 60-pin connector (CN1) and SD pinout (CN4).

“Ribbon Connector” shows detail on Bluetooth UART connection and “short pads” for control signals. Default configuration for control signals is to connect WL_REG_ON/BT_REG_ON/WL_HOST_WAKE. Both WL_REG_ON and BT_REG_ON must by driven by i.MX6 MPU given that there is no power-on reset circuit for these signals (unlike Version 1.0 Adapter). WL_HOST_WAKE is optional for software implementation – if OOB IRQ signaling is desired versus SDIO in-band signaling.

“Slow Clock In” details the external slow clock (32 KHz) circuit. This circuit provides a more accurate 32 KHz clock than chipset clock during powersave modes.

Lastly there are two “Power Block” sections. The bottom/middle “Power Block” section details the VIO jumper selection (VBAT_SDIO or 1.8V) and the 1.8 VIO circuit. The right “Power Block” section shows the optional VEXT power supply and “short pad” selection for VBAT_SDIO or VBAT_3.6V_REG_OUT (generated from VEXT). The default configuration is for the adapter to pull power from Freescale i.MX6 Platform via VBAT_SDIO.

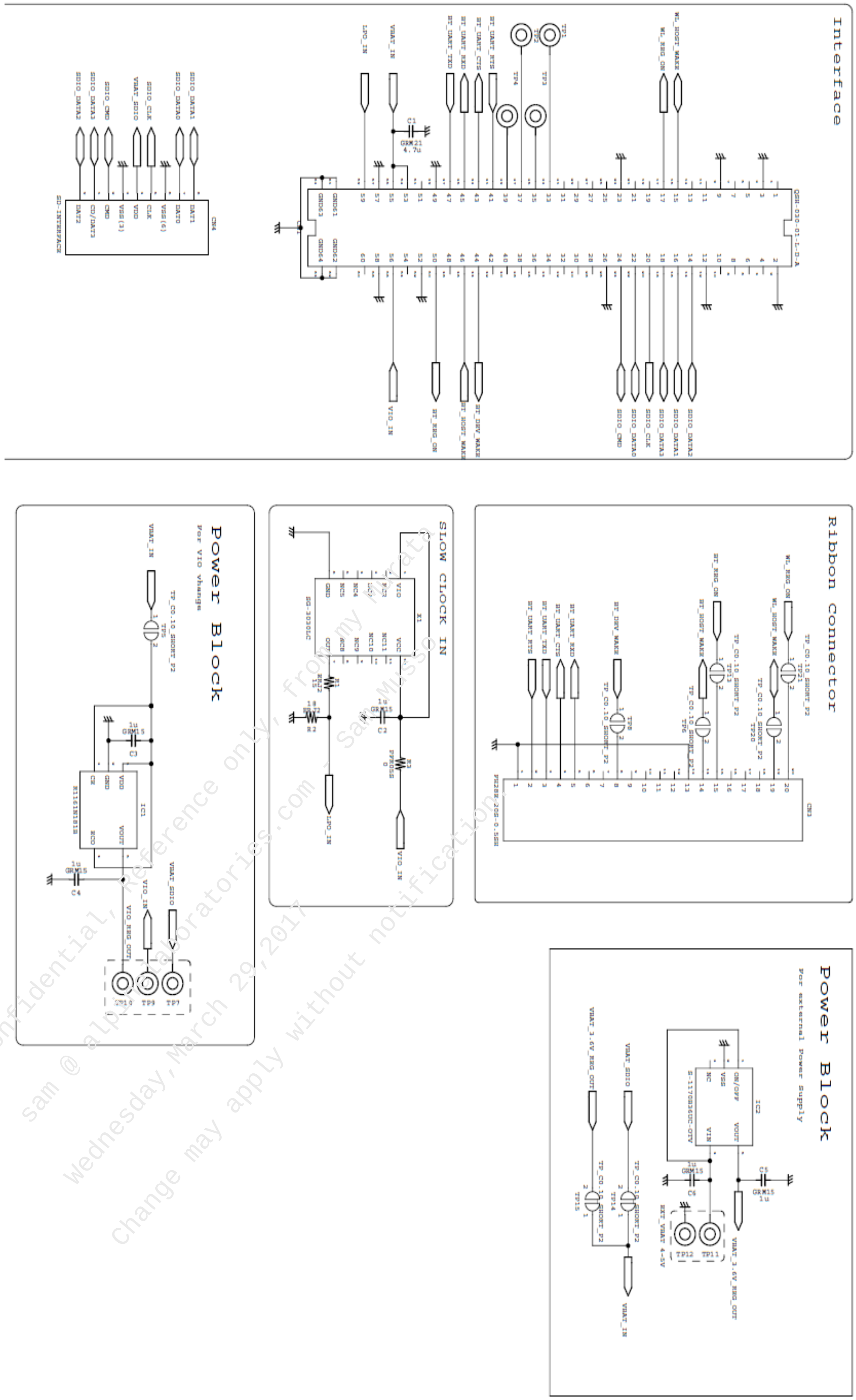


Figure 14: Murata i.MX InterConnect Ver 2.0 Adapter schematic

2.2.2 Default Configuration

Table 9 shows default configuration for Version 2.0 Adapter. Default VIO of VBAT_SDIO (3.1-3.3V) is selected by jumpering TP7 and TP9: refer to silkscreen on adapter for "VIO" markings. Murata Wi-Fi/BT EVK is configured to draw power from Freescale i.MX6 Platform via "VDD" pin on SD card slot. WLAN 4-bit SDIO connection is always default. Bluetooth UART also always default: straight through from ribbon cable connector. Ribbon cable interconnect is only available on i.MX 6Quad SABRE-SD, i.MX 6SoloX SABRE-SD, and i.MX 6UltraLite EVK.

NOTE: Rework may be required to properly connect control signals/UART on Freescale i.MX6 Platforms. Refer to Section 3 for specifics on necessary rework.

Table 9: Version 2.0 Adapter, Default Configuration

Murata EVK Signal	Freescale i.MX6 Platform SD Pin	Short-Pad/ Jumper Closed	Notes
VBAT_IN	VDD	TP14	VBAT_SDIO from Freescale EVK typically 3.1-3.3V. Alternative option is connecting external power supply (4-5V Range) so VBAT_IN=3.6V (open TP14 & short TP15).
VIO_IN = 3.3V (VBAT_SDIO)	VDD (VBAT_SDIO)	(TP7+TP9)	For 1.8V: short TP5 and jumper (TP9+TP10).
SD_CLK; SD_CMD; SD_DATA0..3	CLK; CMD; SD_DAT0..3	N/A	WLAN 4-bit SDIO connection is default. Cannot be modified.
BT_UART_TXD BT_UART_RXD BT_UART_RTS BT_UART_CTS	Same Signals via Ribbon Cable	N/A	Bluetooth UART connection is default. Cannot be modified.
WL_REG_ON	Connector; Pin #1	TP21	WL_REG_ON must be driven by i.MX6 MPU for WLAN.
WL_HOST_WAKE	Connector; Pin #2	TP20	WL_HOST_WAKE provides optional Out-Of-Band interrupt signaling.
BT_REG_ON	Connector; Pin #6	TP13	BT_REG_ON must be driven by i.MX6 MPU for Bluetooth.
BT_HOST_WAKE	Connector; Pin #7	TP6	Currently only supported on i.MX6UL.
BT_DEV_WAKE	Connector; Pin#13	TP8	Currently only supported on i.MX6UL.

WL_REG_ON and BT_REG_ON should be driven by i.MX6 MPU. WL_HOST_WAKE is connected on adapter board; however OOB IRQ signaling is optional in software implementation (SDIO in-band signaling can be used). BT_HOST_WAKE and BT_DEV_WAKE are used for optimizing power consumption (currently only supported on i.MX 6UltraLite EVK: however other Freescale i.MX6 Platforms provide test points).

2.2.3 Wi-Fi WL_HOST_WAKE (OOB IRQ) Option

WL_HOST_WAKE is used for the OOB IRQ: out-of-band interrupt for WLAN. This is connected on the adapter board (TP20 shorted). Software can be configured to run in-band SDIO interrupts or out-of-band interrupts using WL_HOST_WAKE. For optimized throughput and power consumption, configuring WL_HOST_WAKE is recommended.

2.2.4 BT_DEV_WAKE and BT_HOST_WAKE Options

Default configuration on Version 2.0 Adapter Board is with BT_HOST_WAKE or BT_DEV_WAKE connected. These signals are used to enhance powersave mode for Bluetooth signaling. Biggest issue here is that only the i.MX 6UltraLite EVK actually connects these signals (from ribbon cable connector) to the MPU – even then it is still a resistor stuffing option. The other two platforms (i.MX 6Quad SABRE-SD and i.MX 6SoloX SABRE-SD) only bring these pins out as test points. Therefore additional rework on these boards would have to be done to hook up BT_DEV_WAKE and BT_HOST_WAKE.

2.3 Adapter Board Selection

2.3.1 SDIO 2.0 vs. SDIO 3.0 Connectivity

Both Murata i.MX InterConnect Adapters support 1.8V VIO signaling. To run in SDIO 3.0 UHS modes, 1.8V signaling over SDIO bus is required[1]. Fastest UHS mode is SDR104 which equates to a 208 MHz SDIO clock rate. The Murata hardware has been designed specifically to support these high speed rates (even SDIO trace length, high-speed Samtec connector).

1.8V signaling over is achieved by modifying the VIO jumper settings on Adapter (possible TP short as well). Refer to Adapter "Default Configuration" sections. It is important to note that switching WLAN to run at 1.8V requires any other I/O pins to signal at 1.8V as well: we have to consider UART operation in this case.

If 1.8V signaling is required on i.MX 6SoloX SABRE-SD, the SD3 interface is the best selection – using Murata Version 1.0 Adapter.

i.MX 6SoloLite EVK's SD1 interface also supports 1.8V signaling.

i.MX 6Quad SABRE-SD only supports 3.3V signaling on either SD3 or SD2 interfaces (limitation imposed by voltage rails).

i.MX 6UL UltraLite EVK supports 1.8V on SD card interface.

For additional queries involving 1.8V signaling and/or UHS SDIO 3.0 mode, please contact Murata.

[1] Note that testing done on some of the Freescale i.MX6 Platforms has revealed that SDR104 mode can run at 3.3V signaling over SDIO bus.

2.3.2 Bluetooth Connectivity

Murata i.MX InterConnect Ver 2.0 adapter board is necessary to provide Bluetooth UART interface on i.MX 6Quad SABRE-SD and i.MX 6UltraLite EVK. Version 1.0 Adapter supports Bluetooth on both i.MX 6SoloX SABRE-SD and i.MX 6SoloLite EVK.

2.3.3 Murata Wi-Fi/BT EVK Orientation

If it is important to probe test points on top surface of Murata Wi-Fi/BT EVK, then adapter selection is important. It is important to note the Version 2.0 Adapter will leave Murata Wi-Fi/BT EVK in upside-down position on i.MX 6Quad SABRE-SD (default). One option is to flip Freescale SABRE-SD Platform over (requiring additional nylon offsets/spacers). Alternatively Version 1.0 Adapter can be used – for WLAN only connectivity.

3 Connecting Murata Wi-Fi/BT Kit to Freescale i.MX6 Platform

3.1 i.MX 6SoloX SABRE-SD

3.1.1 Version 1.0 Adapter Board

Figure 15, Figure 16 and Figure 17 illustrate how to connect Murata Wi-Fi/BT Kit to Freescale i.MX 6SoloX SABRE-SD: default configuration which has WL_REG_ON/BT_REG_ON wired as power-on-reset signals.

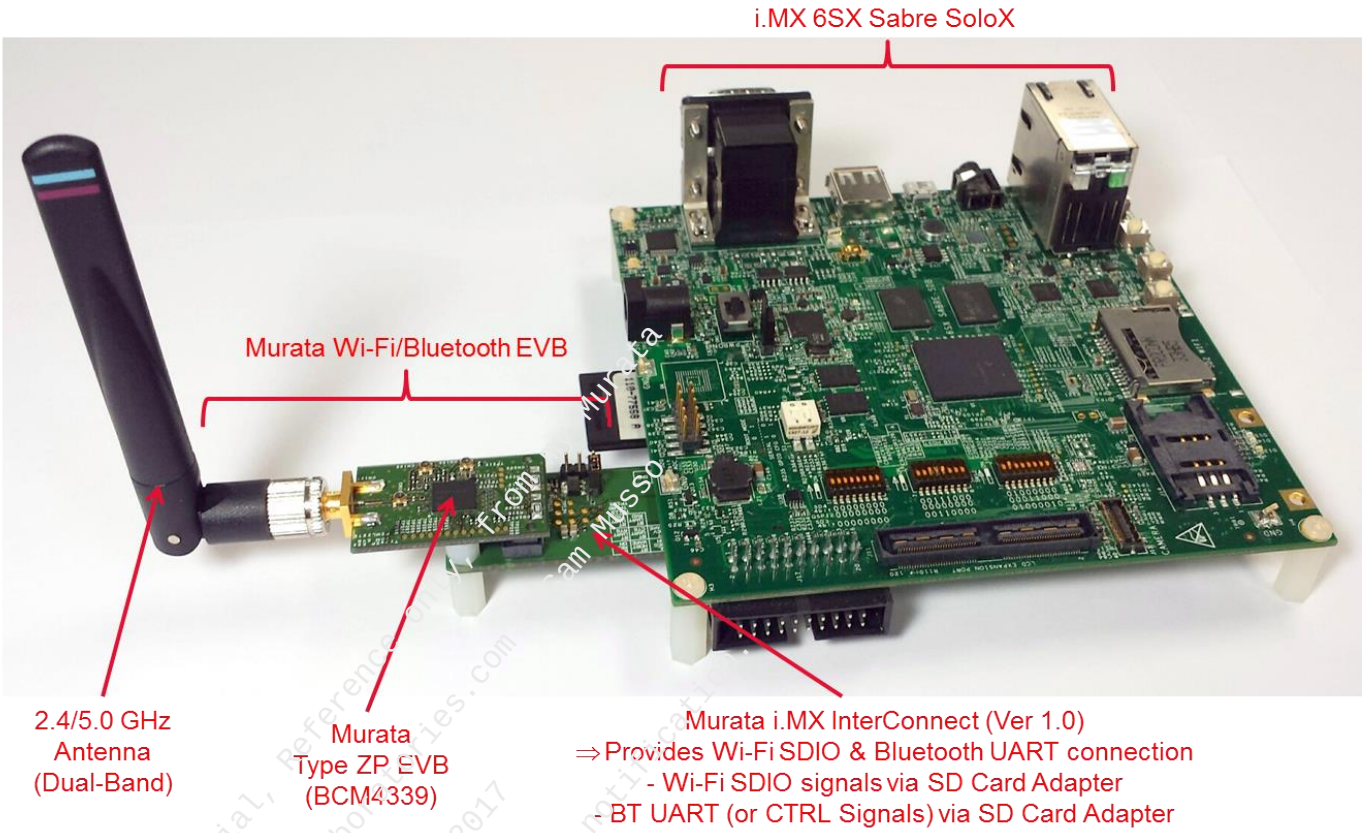


Figure 15: Connecting the Murata Wi-Fi/BT Kit to Freescale i.MX 6SoloX SABRE-SD

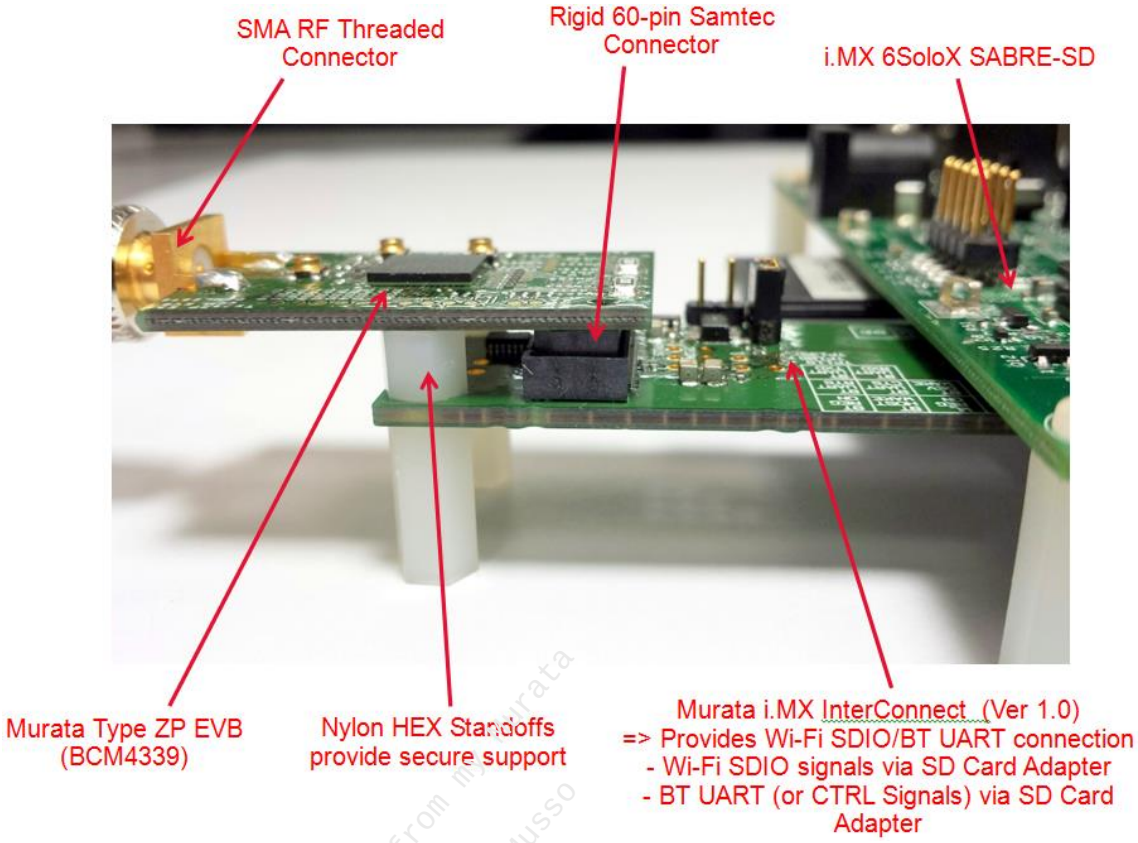


Figure 16: Connecting the Murata Wi-Fi/BT Kit to Freescale i.MX 6SoloX SABRE-SD

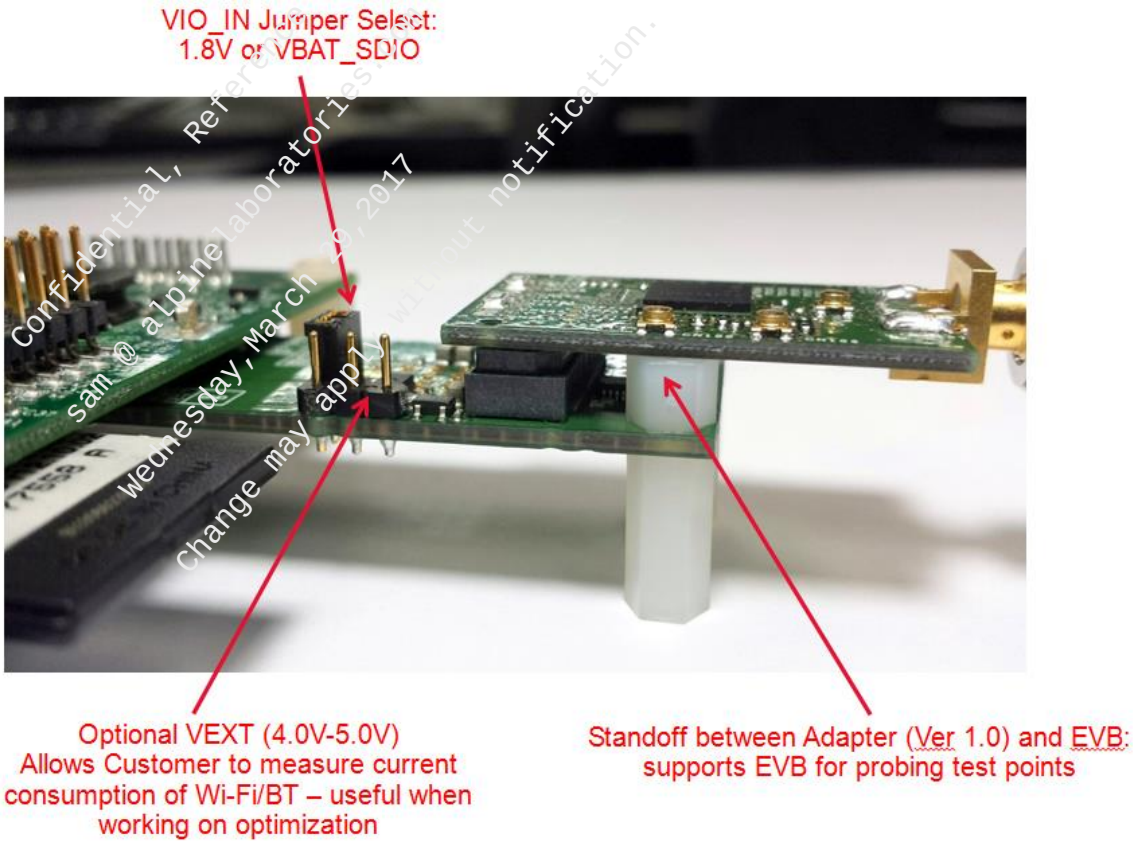


Figure 17: Connecting the Murata Wi-Fi/BT Kit to Freescale i.MX 6SoloX SABRE-SD

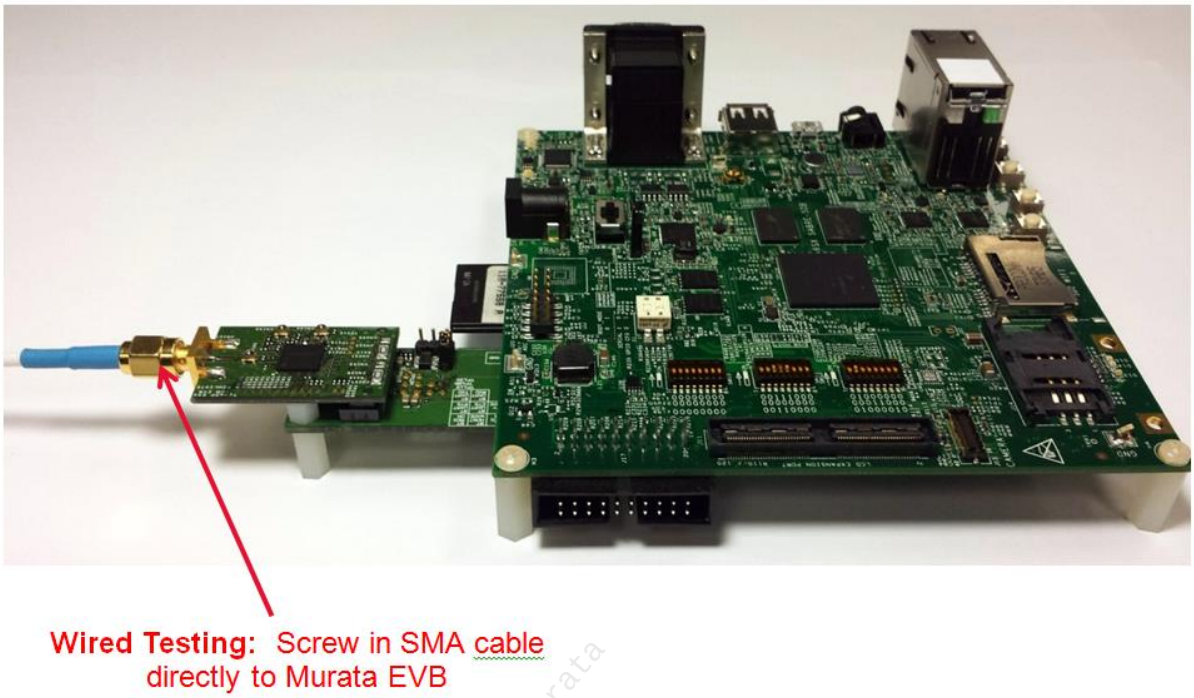


Figure 18: Connecting the Murata Wi-Fi/BT Kit to Freescale i.MX 6SoloX SABRE-SD

Figure 18 illustrates configuration for wired RF testing: easy to do given mounted SMA connector on Murata Wi-Fi/BT EVB.

3.1.1.1 Adding SD Card Extender to Version 1.0 Adapter on i.MX 6SoloX SABRE-SD

Note that WL_REG_ON/BT_REG_ON wired as power-on-reset signals works fine for Linux implementation. However if user needs dynamic control of the signals (optional WL_HOST_WAKE) as well, then one route is to use “SD Card Extender” included in kit to wire in additional signals – leveraging SD2 slot. Refer to Figure 19 and Figure 20 showing this implementation: WL_REG_ON/BT_REG_ON wired from SD2_DATA2/SD2_DATA3 respectively. Refer to Section 2.1 on modifications to Murata i.MX InterConnect Ver 1.0 Adapter. WL_HOST_WAKE can be similarly wired to SD2_DATA1 (not shown).

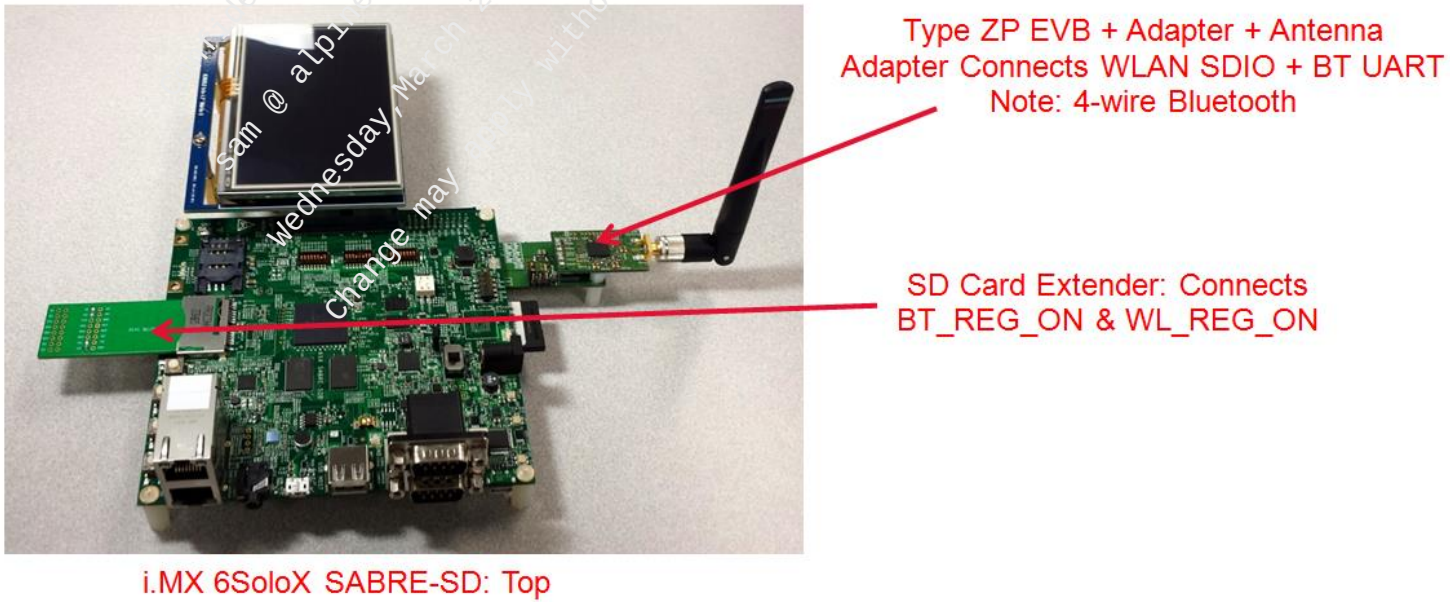


Figure 19: WL_REG_ON/BT_REG_ON wired from SD2: Top

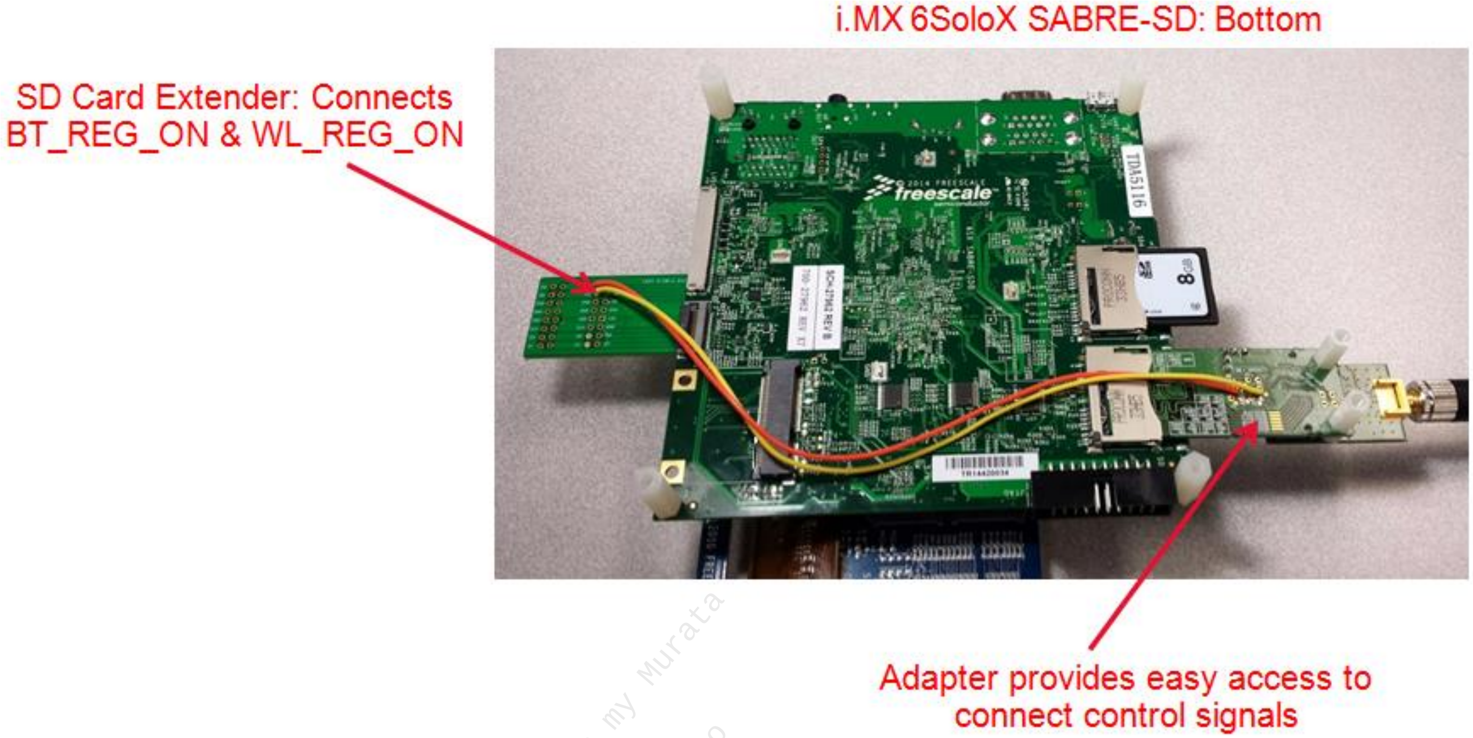


Figure 20: WL_REG_ON/BT_REG_ON wired from SD2: Bottom

Table 10 details additional connections made for dynamically controlled WL_REG_ON, BT_REG_ON, and (optionally) WL_HOST_WAKE signals. Freescale i.MX6 signals are listed against the Murata Wi-Fi/BT signals that they connect to. In addition the MUXing for Freescale pins is detailed – these values have to be declared in DTS file of modified kernel. Lastly the notes section details changes/checks necessary to Murata i.MX InterConnect Ver 1.0 Adapter. Of course moving signals to SD2 will require modifying software (MUXing in Kernel DTS file). Please reference Murata Software User's Guide on particulars.

Table 10: Connections for dynamically controlled WL_REG_ON, BT_REG_ON, and WL_HOST_WAKE signals

Freescale i.MX 6SoloX SABRE-SD (MCIMX6SX SDB) Signal	Freescale i.MX6 MUX Selection	Murata Wi-Fi/BT EVK Signal	Notes
SD2_DATA1	MX6SX_PAD_SD2_DATA1 __GPIO6_IO_9	WL_HOST_WAKE	Optional signal used for OOB IRQ: out-of-band interrupt. Open TP105 and TP114. Run wire directly from SD Card Extener (SD2_DATA1) to WL_HOST_WAKE TP113.
SD2_DATA2	MX6SX_PAD_SD2_DATA2 __GPIO6_IO_10	WL_REG_ON	Takes WLAN core in and out of reset. Open TP126 and TP129. Run wire directly from SD Card Extender (SD2_DATA2) to WL_REG_ON TP127.
SD2_DATA3	MX6SX_PAD_SD2_DATA3 __GPIO6_IO_11	BT_REG_ON	Takes Bluetooth core in and out of reset. Open TP119 and TP121. Run wire directly from SD Card Extender (SD2_DATA3) to BT_REG_ON TP120.
SD3_DATA0..3 SD3_CLK SD3_CMD		SDIO__DATA0..3 SDIO_CLK SDIO_CMD	Default 4-bit SDIO for WLAN interface.
SD3_DATA4	MX6SX_PAD_SD3_DATA4 __UART3_RX	BT_UART_TXD	Close TP112; Open TP135.
SD3_DATA5	MX6SX_PAD_SD3_DATA5 __UART3_TX	BT_UART_RXD	Close TP109; Open TP106.
SD3_DATA6	MX6SX_PAD_SD3_DATA6 __UART3_RTS_B	BT_UART_RTS	Straight-thru connection on RTS. Close TP130; Open TP125.
SD3_DATA7	MX6SX_PAD_SD3_DATA7_ _UART3_CTS_B	BT_UART_CTS	Straight-thru connection on CTS. Close TP116; Open TP117.

3.1.2 Version 2.0 Adapter Board

Figure 21 and Figure 22 show Murata i.MX InterConnect Ver 2.0 Adapter when connected to i.MX 6SoloX SABRE-SD. This connection provides full WLAN SDIO and Bluetooth UART connectivity with the ribbon cable connection. However there are two critical control signals that are needed for correct operation: WL_REG_ON and WL_HOST_WAKE. The SoloX needs to be modified to bring these control signals out to the ribbon cable adapter (BT_REG_ON is connected on the SoloX by default).

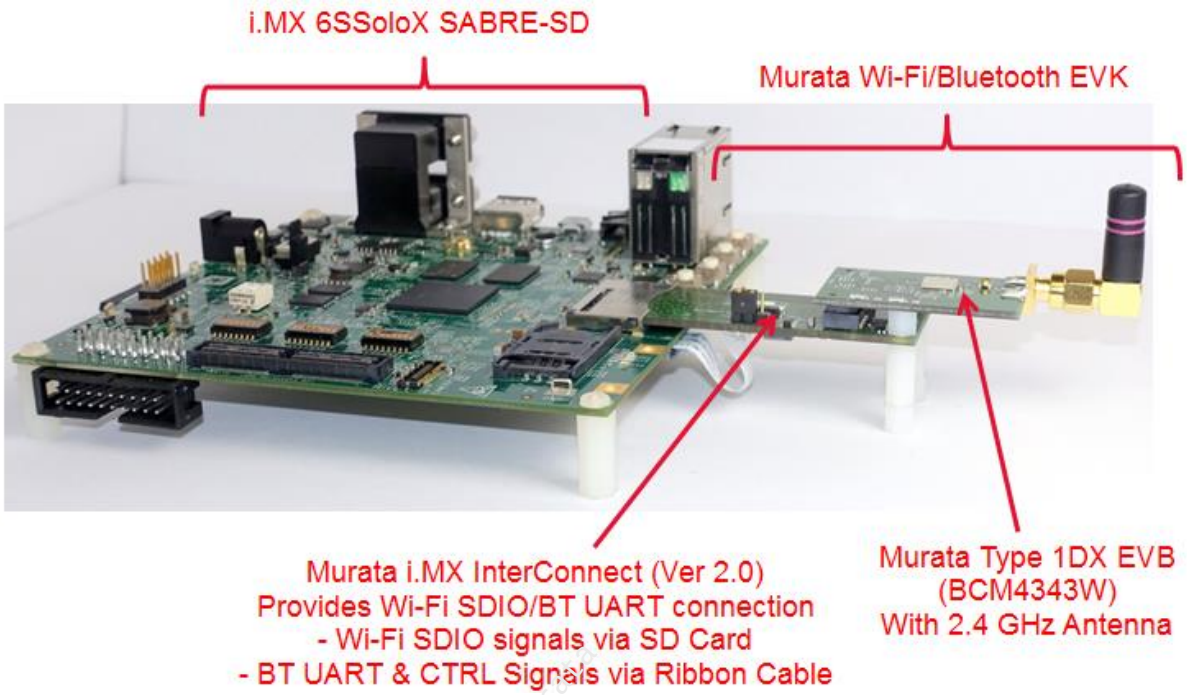


Figure 21: Murata i.MX InterConnect Ver 2.0 connected to i.MX 6SoloX SABRE-SD: Top

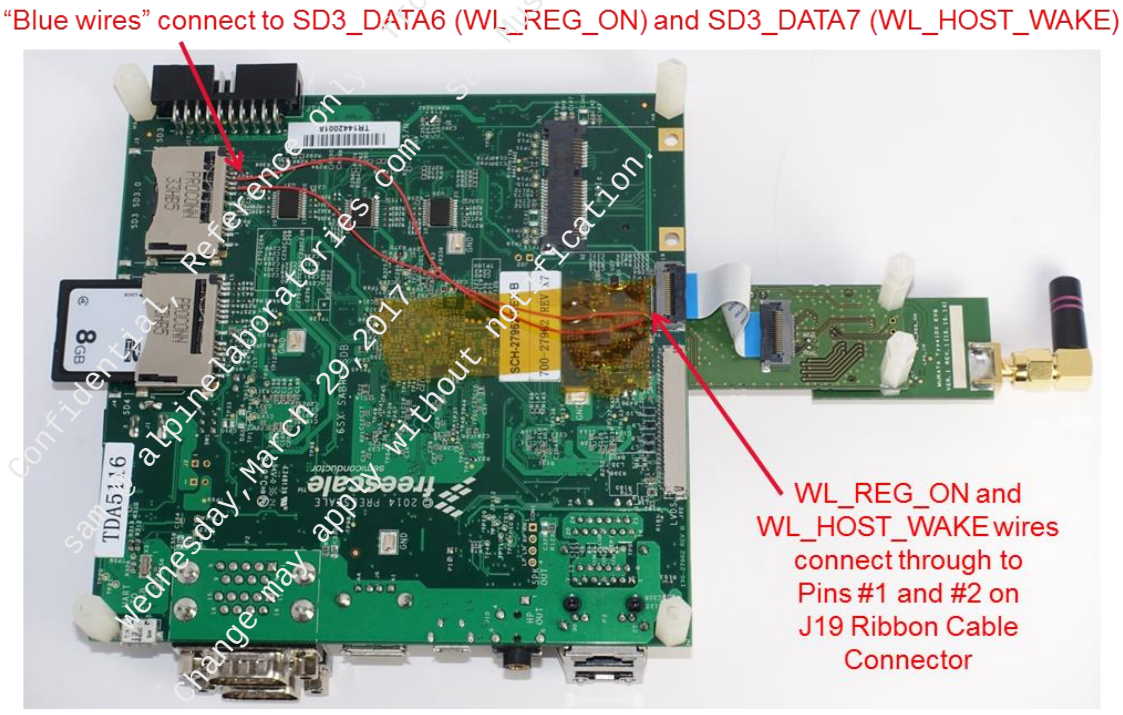


Figure 22: Murata i.MX InterConnect Ver 2.0 connected to i.MX 6SoloX SABRE-SD: Bottom

Figure 22: Murata i.MX InterConnect Ver 2.0 connected to i.MX 6SoloX SABRE-SD: Bottom shows necessary rework. SD3_DATA6/SD3_DATA7 lines were chosen for two reasons: easy soldering points for blue-wiring, and pins that are essentially not used in software.

Figure 23: Securing Ver 2.0 Adapter on SoloX illustrates one option of supporting Murata Wi-Fi/BT EVK securely. Use additional offset piece (Essentra part #CBMFTS205A) to screw into bottom of Ver 2.0 Adapter leg. This allows user to adjust height so that EVB is securely supported. The

configuration shown uses 2 x Male/Female Spacer (#CBMFTS205A) and 1 x Female/Female Spacer (#CBTS060A) on Murata Adapter mount points. Given that each kit ships with two adapters (Ver 1.0 and Ver 2.0) then user can “borrow” the two Male/Female Spacers from Ver 1.0 Adapter. For additional components refer to www.essentracomponents.ca.

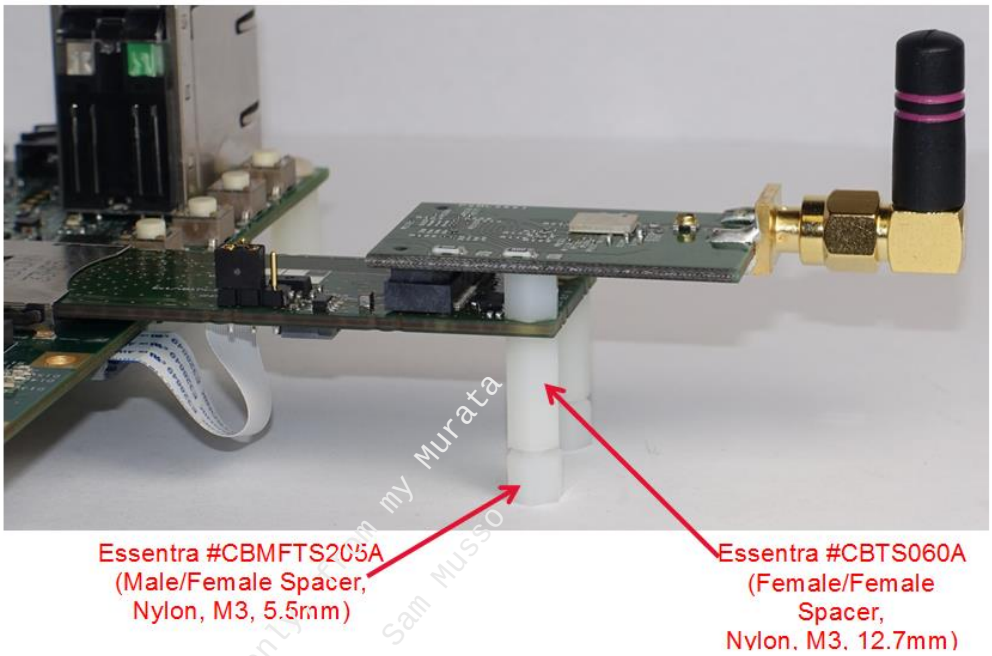


Figure 23: Securing Ver 2.0 Adapter on SoloX

Table 11 summarizes the ribbon cable connections, mapping the i.MX 6SoloX SABRE-SD Signals to the Murata Wi-Fi/BT Kit signals. It also includes the necessary MUX selection on the Freescale i.MX 6SoloX SABRE-SD Platform.

Table 11: Version 2.0 Adapter Board Ribbon Cable Connections on i.MX 6SoloX SABRE-SD

Host Pin#	Freescale i.MX 6SoloX SABRE-SD (MCIMX6SX SDB) Signal	Freescale i.MX6 MUX Selection	Murata Wi-Fi/BT EVK Signal	Notes
1	**SD3_DATA6**	MX6SX_PAD_SD3_DATA6 __GPIO7_IO_8	WL_REG_ON	Takes WLAN core in and out of reset. Blue-wire rework to connect.
2	**SD3_DATA7**	MX6SX_PAD_SD3_DATA7 __GPIO7_IO_9	WL_HOST_WAKE	Optional signal used for OOB IRQ: out-of-band interrupt. Blue-wire rework to connect.
6	**NAND_DATA06**/ BT_PWD_B	MX6SX_PAD_NAND_DATA06 __GPIO4_IO_10	BT_REG_ON	Takes Bluetooth core in and out of reset.
7	TP60	N/C	BT_HOST_WAKE	Optional signal used for Bluetooth power optimization. Module drives this signal to take host MPU out of sleep mode.
13	TP61	N/C	BT_DEV_WAKE	Optional signal used for Bluetooth power optimization. Host drives this signal to take Bluetooth core out of sleep mode.
16	**KEY_COL3**/ UART5_TXD	MX6SX_PAD_KEY_COL3 __UART5_TX	BT_UART_RXD	
17	**KEY_ROW2**/ UART5_CTS_B	MX6SX_PAD_KEY_ROW2 __UART5_CTS_B	BT_UART_CTS	Straight-thru connection on CTS.
18	**KEY_ROW3**/ UART5_RXD	MX6SX_PAD_KEY_ROW3 __UART5_RX	BT_UART_TXD	
19	**KEY_COL2**/ UART5_RTS_B	MX6SX_PAD_KEY_COL2 __UART5_RTS_B	BT_UART_RTS	Straight-thru connection on RTS.

3.1.2.1 i.MX 6SX SoloX SABRE-SD: Detailed Rework Instructions

To further clarify necessary rework, there are two layout images included.

Figure 24 shows zoomed-in section where J19 Ribbon Cable Connector is located on i.MX 6SoloX SABRE-SD. It is easiest to solder directly onto resistor pads (R327 and R328). The alternative of using “BT_WAKEUP” signal (refer to Freescale schematic SPF-27962.pdf) was considered. However this signal is connected to ENET1_RX_CLK which is needed for Ethernet connection.

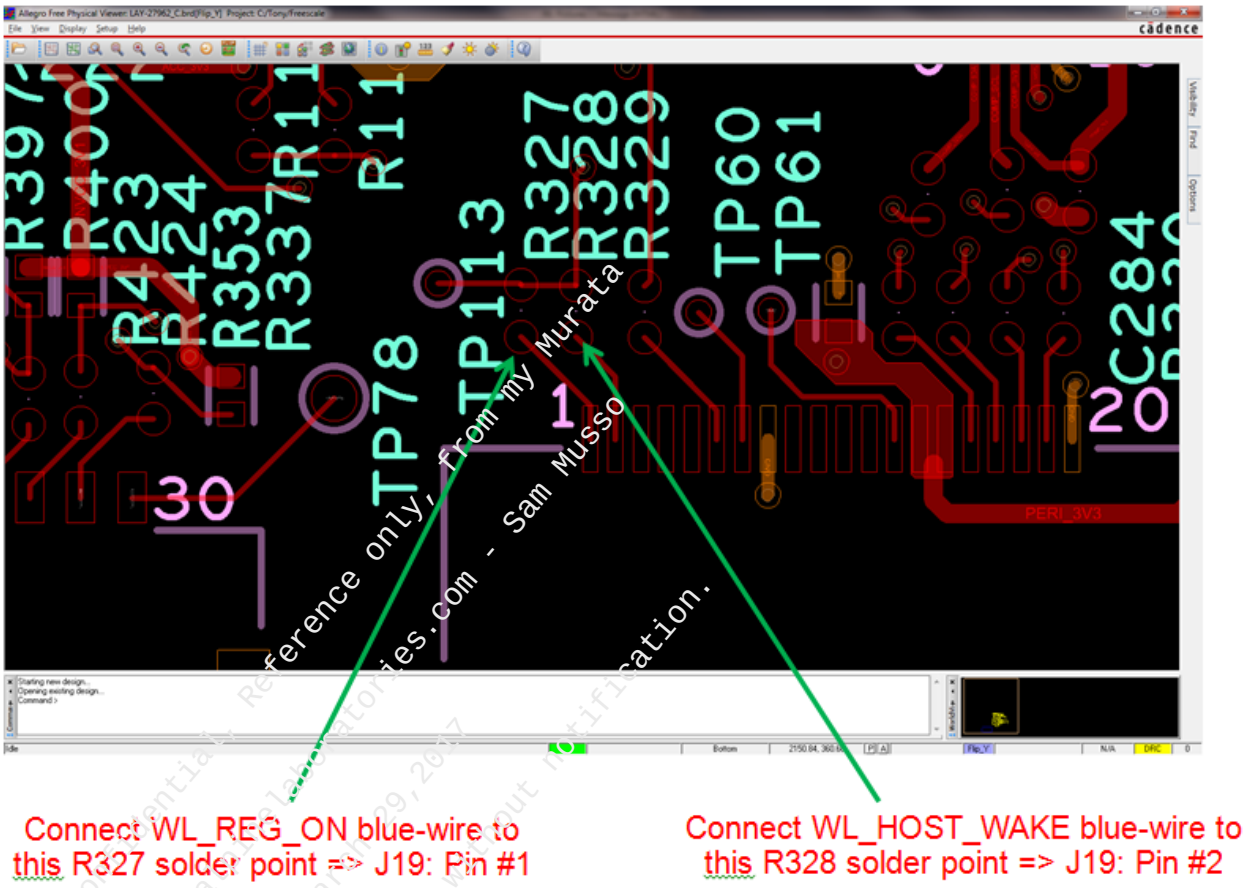


Figure 24: Blue-wiring WL_REG_ON and WL_HOST_WAKE signals to J19 pins

Figure 25 shows recommended SD3_DATA6 and SD3_DATA7 pins on J3 SD card connector. These pins provide a larger footprint which is easier to solder to. As already indicated SD3_DATA4..7 are typically unused signals. Once this rewire work is done, software changes to Kernel DTS file need to be done to MUX the signals correctly. Please reference Murata Software User’s Guide on particulars.

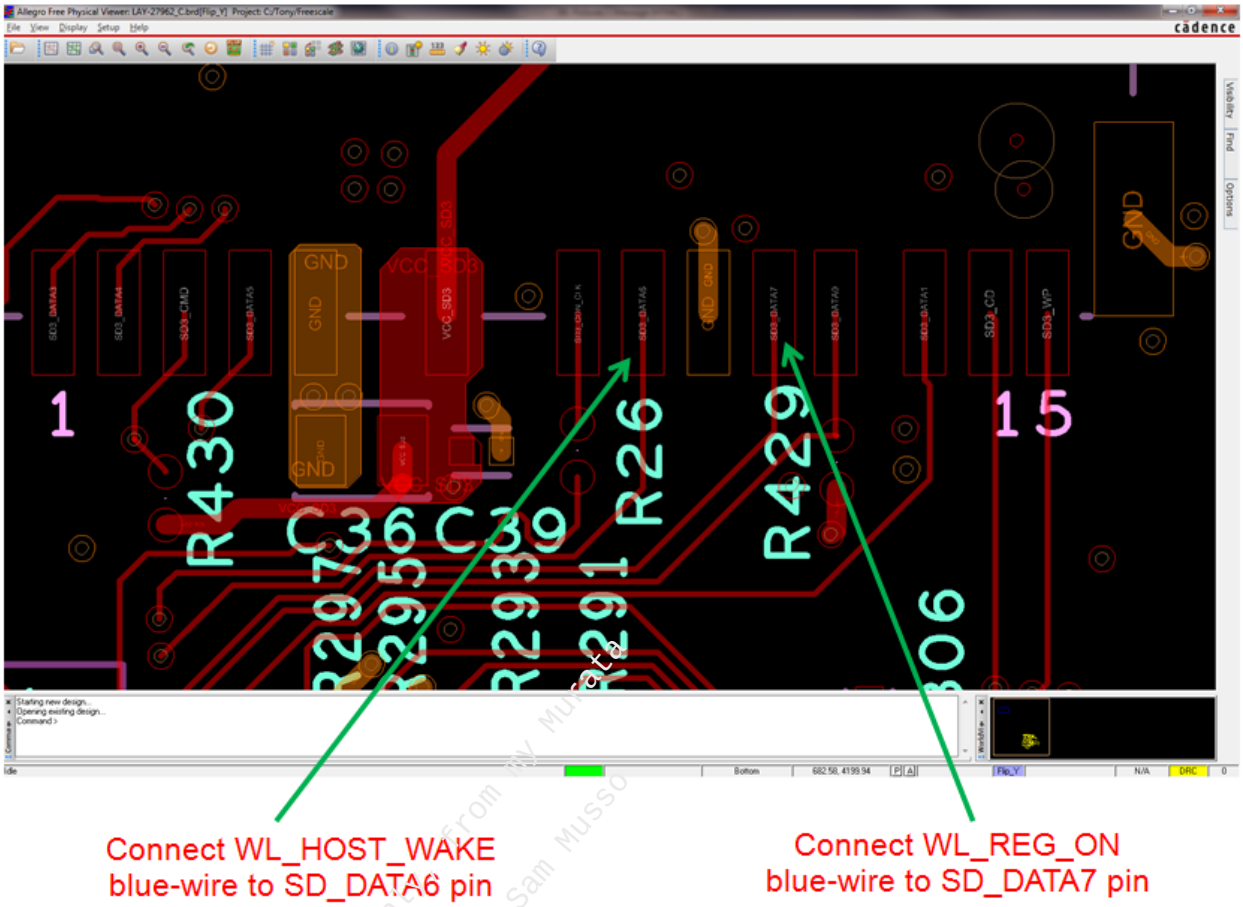


Figure 25: Blue-wiring WL_REG_ON and WL_HOST_WAKE signals to J3 pins

3.2 i.MX 6SoloLite EVK (Version 1.0 Adapter Board)

Figure 26 shows i.MX 6SoloLite EVK with Murata i.MX6 InterConnect Ver 1.0 Adapter and Type 1DX EVK. This configuration supports WLAN SDIO connection and Bluetooth UART. WL_REG_ON/BT_REG_ON are configured as power-on-reset signals. The Murata Kit is plugged into SD1 slot on the SoloLite.

Figure 27 shows the addition of “SD Card Extender”. This is used to connect WL_REG_ON (SD3_DATA2) and BT_REG_ON (SD3_DATA3) so these signals can be controlled dynamically by MPU. User can optionally connect WL_HOST_WAKE using SD3_DATA1 test point on SD Card Extender.

Lastly, Figure 28 shows a close-up view of the solution which allows dynamic control of WL_REG_ON and BT_REG_ON. Again, the control signals from SD3 are: SD3_DATA2 (WL_REG_ON) and SD3_DATA3 (BT_REG_ON). SD3_DATA1 can optionally be connected for WL_HOST_WAKE.

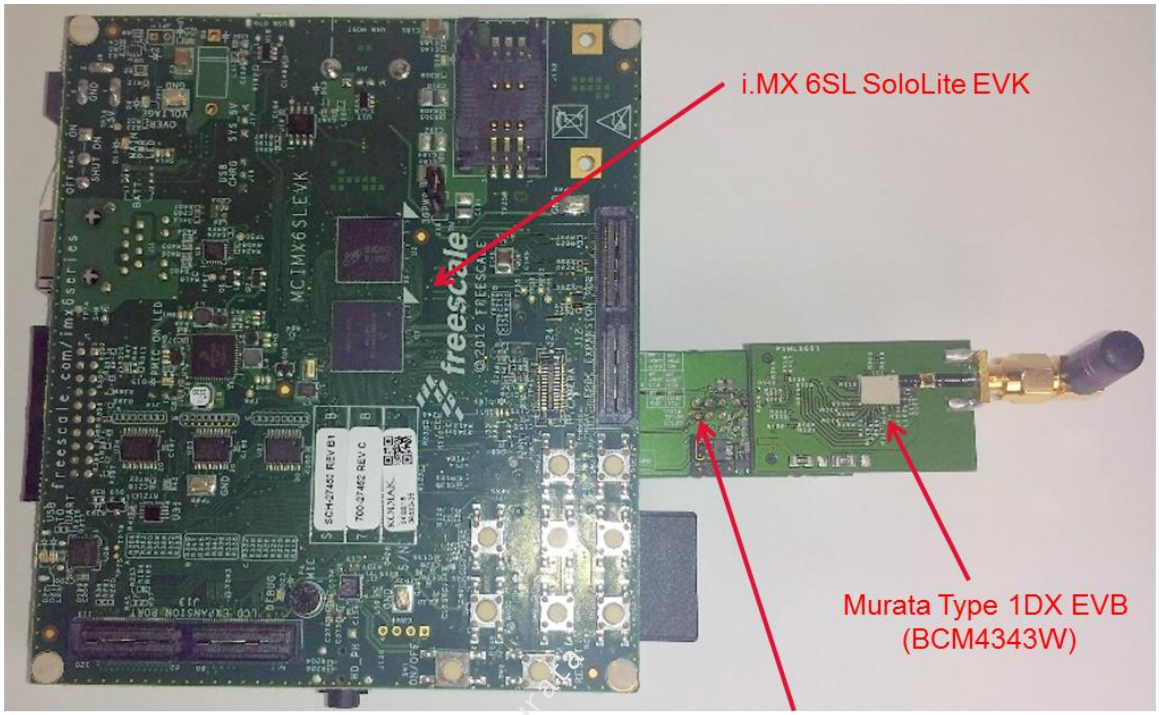


Figure 26: i.MX 6SoloLite EVK with Murata i.MX6 InterConnect Ver 1.0 Adapter and Type 1DX EVK

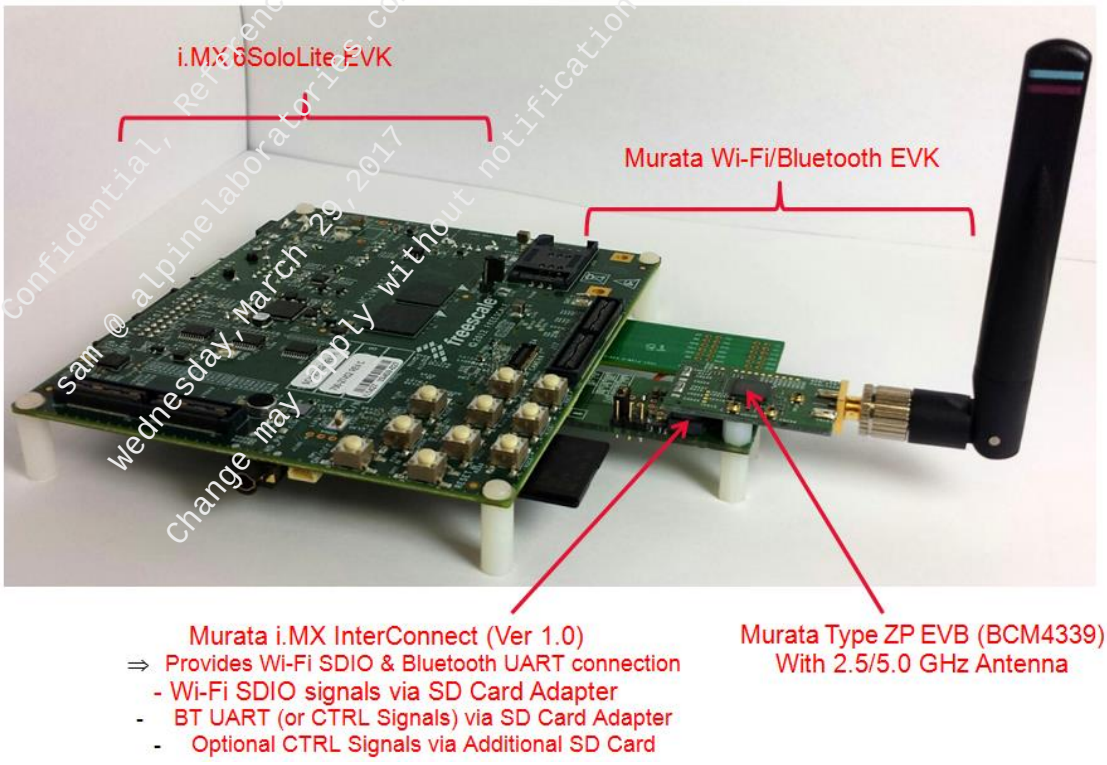


Figure 27: i.MX 6SoloLite EVK with Murata i.MX6 InterConnect Ver 1.0 Adapter and Type 1DX EVK with SD Card Extender

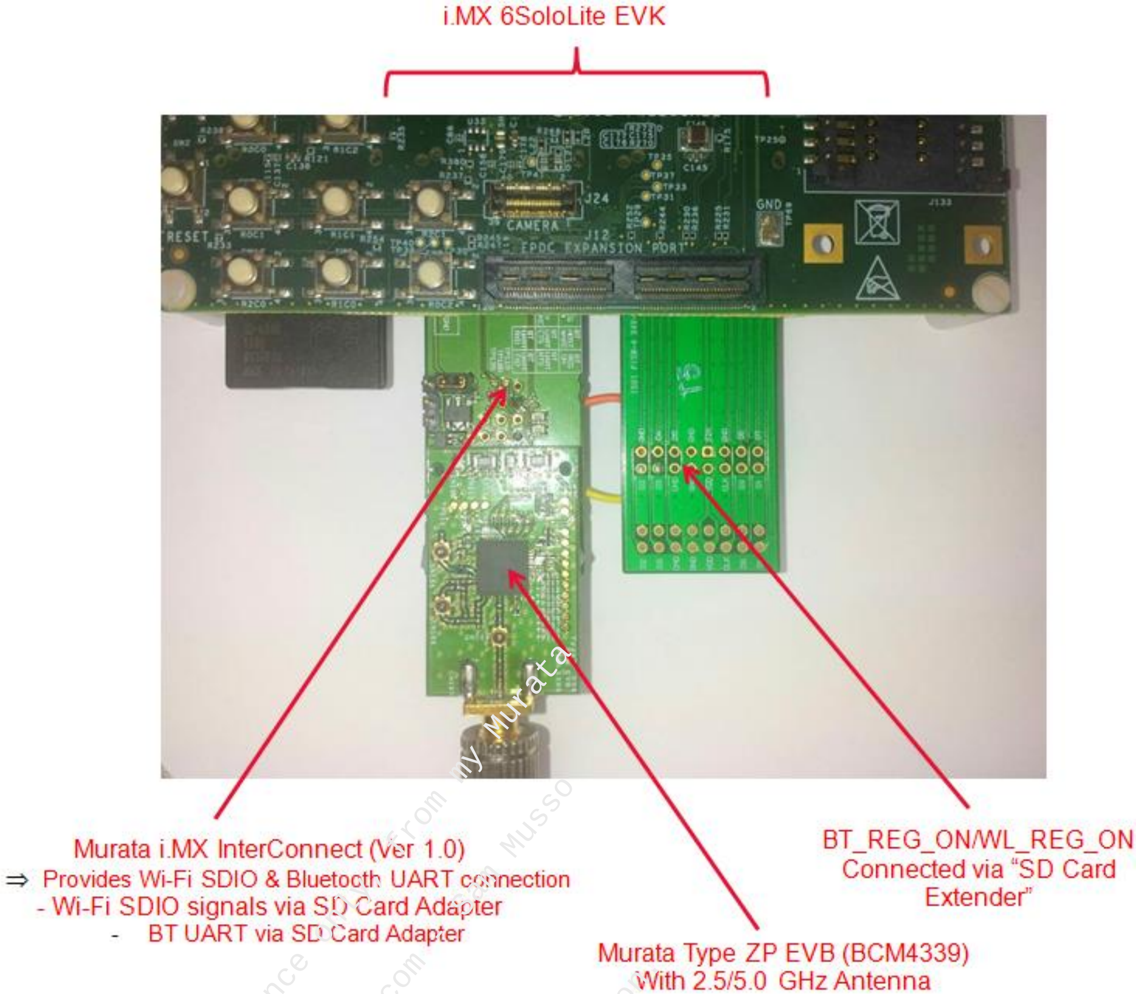


Figure 28: WL_REG_ON and BT_REG_ON Dynamic Control Solution

All these details are described in Table 12. Freescale i.MX6 signals are listed against the Murata Wi-Fi/BT signals that they connect to. In addition the MUXing for Freescale pins is detailed – these values have to be declared in DTS file of modified kernel. Lastly the notes section details changes/checks necessary to Murata i.MX InterConnect Ver 1.0 Adapter. Of course moving signals to SD3 will require modifying software (MUXing in Kernel DTS file). Please reference Murata Software User's Guide on particulars.

Table 12: Adding SD Card Extender to Version 1.0 Adapter on i.MX 6SoloLite EVK

Freescale i.MX 6SoloLite EVK (MCIMX6SLEVK) Signal	Freescale i.MX6 MUX Selection	Murata Wi-Fi/BT EVK Signal	Notes
SD3_DATA1	MX6SL_PAD_SD3_DAT1 __GPIO5_IO20	WL_HOST_WAKE	Optional signal used for OOB IRQ: out-of-band interrupt. Open TP105 and TP114. Run wire directly from SD Card Extener (SD3_DATA1) to WL_HOST_WAKE TP113.
SD3_DATA2	MX6SL_PAD_SD3_DAT2 __GPIO5_IO16	WL_REG_ON	Takes WLAN core in and out of reset. Open TP126 and TP129. Run wire directly from SD Card Extender (SD3_DATA2) to WL_REG_ON TP127.
SD3_DATA3	MX6SL_PAD_SD3_DAT3 __GPIO5_IO17	BT_REG_ON	Takes Bluetooth core in and out of reset. Open TP119 and TP121. Run wire directly from SD Card Extender (SD3_DATA3) to BT_REG_ON TP120.
SD1_DATA0..3 SD1_CLK SD1_CMD		SDIO__DATA0..3 SDIO_CLK SDIO_CMD	Default 4-bit SDIO for WLAN interface.
SD1_DATA4	MX6SL_PAD_SD1_DAT4 __UART4_RX_DATA	BT_UART_TXD	Close TP112; Open TP135.
SD1_DATA5	MX6SL_PAD_SD1_DAT5 __UART4_TX_DATA	BT_UART_RXD	Close TP109; Open TP106.
SD1_DATA6	MX6SL_PAD_SD1_DAT6 __UART4_RTS_B	BT_UART_RTS	Straight-thru connection on RTS. Close TP130; Open TP125.
SD1_DATA7	MX6SL_PAD_SD1_DAT7 __UART4_CTS_B	BT_UART_CTS	Straight-thru connection on CTS. Close TP116; Open TP117.

3.3 i.MX 6Quad SABRE-SD

3.3.1 Version 1.0 Adapter Board

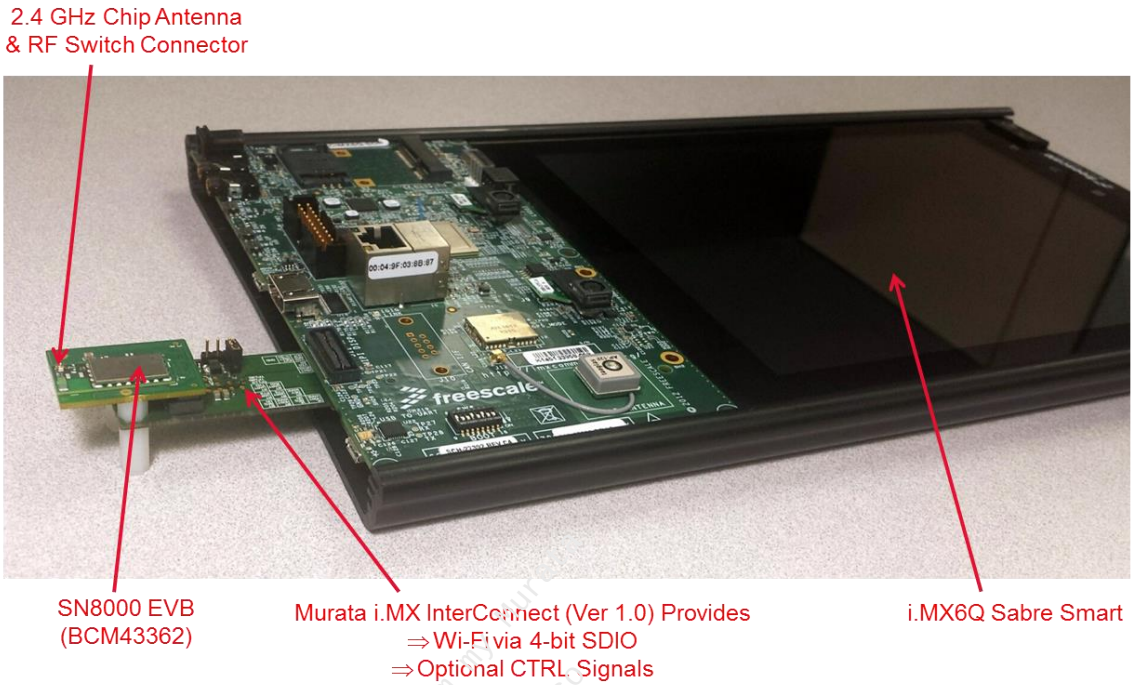


Figure 29: i.MX 6Quad SABRE-SD platform with Murata SN8000 Wi-Fi Kit connected to SD3 slot

Figure 29 shows the i.MX 6Quad SABRE-SD platform with Murata SN8000 Wi-Fi Kit connected to SD3 slot. The Murata i.MX InterConnect Ver 1.0 Adapter provides WLAN connection over 4-bit SDIO bus. The default configuration (WL_REG_ON is configured as power-on-reset) does not include any dynamic control signals.

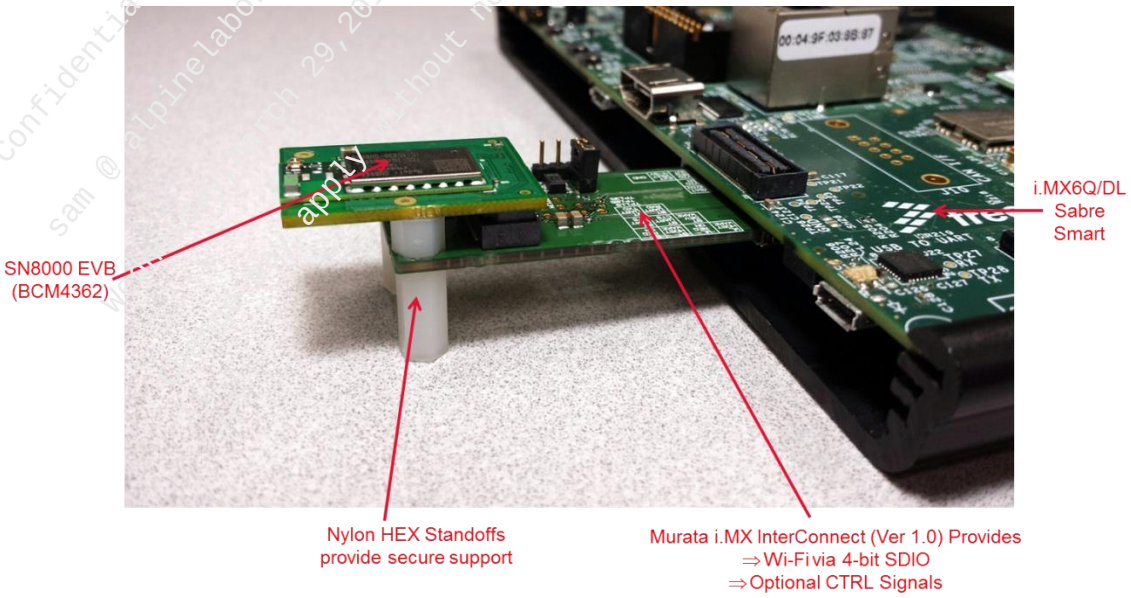


Figure 30: Close-up view of Murata Wi-Fi kit and Adapter

However if the Version 1.0 Adapter Board is reconfigured then both WL_REG_ON and WL_HOST_WAKE can be connected to SD3_DATA6 and SD3_DATA7 (refer to Section 2.1). Figure 30 (above) shows close-up view of Murata Wi-Fi kit and Adapter.

Note that both SD3 and SD2 slots on i.MX 6DL/Q do not provide a full 4-bit UART connection (only TX/RX and no CTS/RTS). As such, neither of these slots can support Wi-Fi/BT by themselves. However the additional four pins on SD3 and SD2 can be MUXed as control signals.

Although Version 1.0 Adapter on i.MX 6Quad SABRE-SD does not support Bluetooth, it does allow the user to run via SD3 slot which is very useful when using the large touchscreen (as pictured above).

If user elects to reconfigure WL_REG_ON and/or WL_HOST_WAKE (from default), then Kernel DTS file will require modifications to properly MUX the i.MX6. Please reference Murata Software User's Guide on particulars for this configuration.

3.3.2 Version 2.0 Adapter Board

Figure 31 shows Murata Type 1DX Kit plugged into Freescale i.MX 6Quad SABRE-SD using Version 2.0 Adapter. Main problem here (as can be seen) is the inverted position of Murata EVK. This would make it very hard to probe test points on the hardware. One approach to solve this issue would be to get taller standoffs for the SABRE-SD and flip main board upside down.

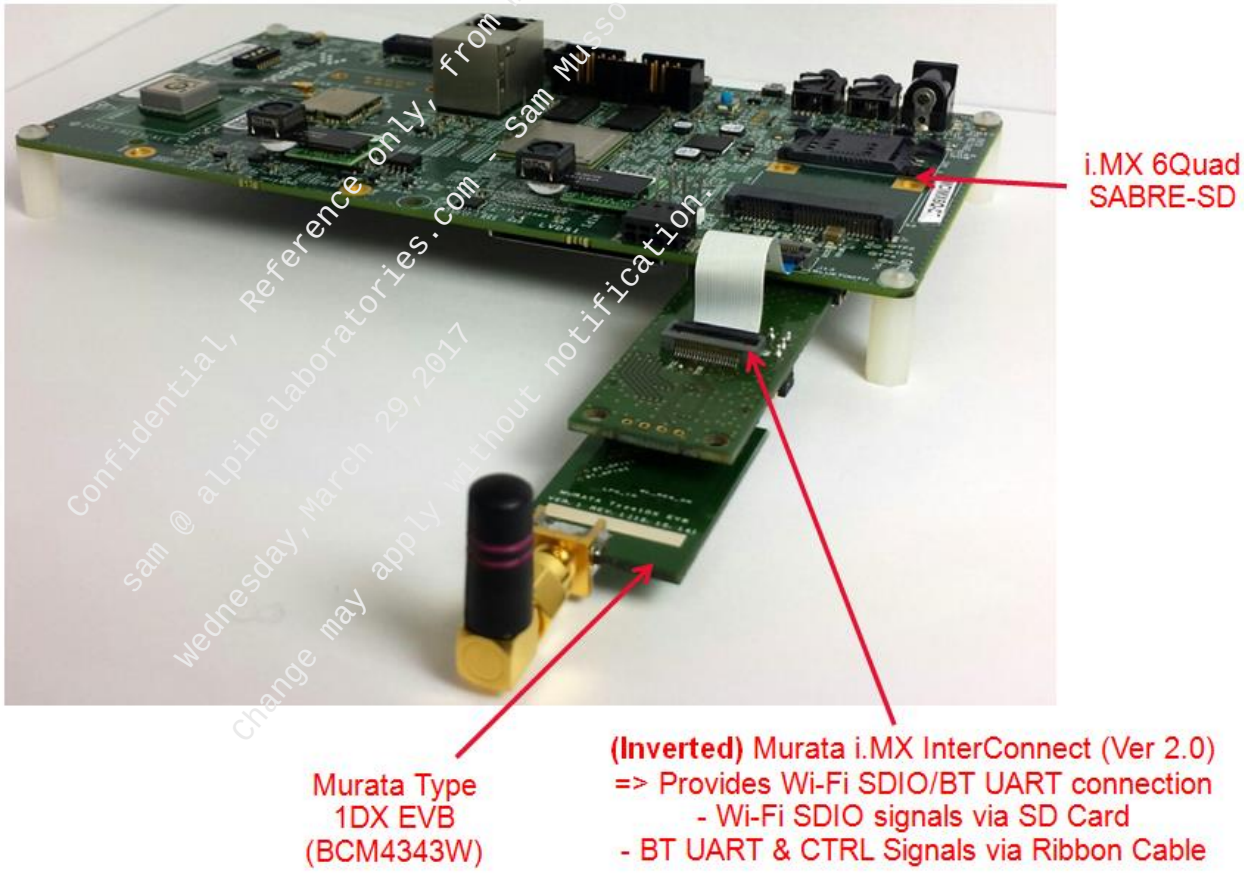


Figure 31: Murata Type 1DX Kit plugged into Freescale i.MX 6Quad SABRE-SD with Version 2.0 Adapter

Inverted i.MX 6Quad SABRE-SD is shown in Figure 32. This approach works fine if Ethernet port does not have to be accessed. Figure 33 illustrates one option of supporting Murata Wi-Fi/BT EVK

securely. Use additional offset piece (Essentra part #CBMFTS205A) to screw into bottom of Version 2.0 Adapter leg. This allows user to adjust height so that EVB is securely supported. The configuration shown uses 2 x Male/Female Spacer (#CBMFTS205A) and 1 x Female/Female Spacer (#CBTS060A) on every mount point (both Freescale Platform and Murata EVK). For additional components refer to www.essentracomponents.ca.

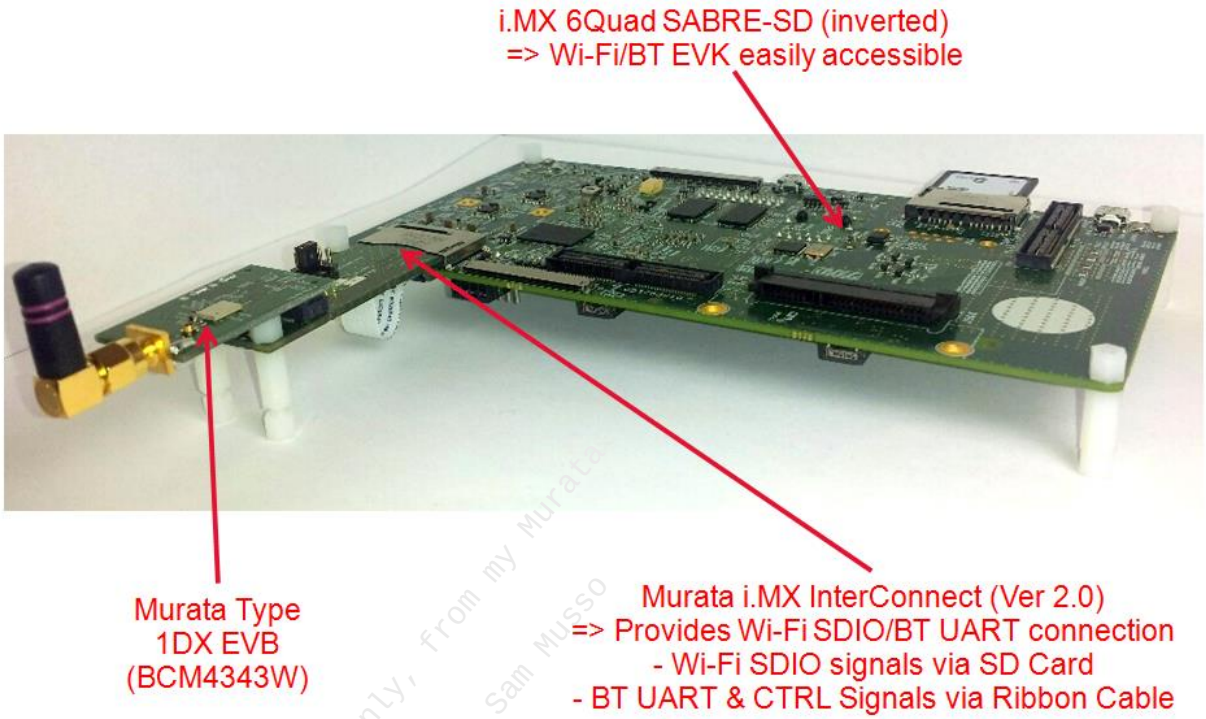


Figure 32: i.MX 6Quad SABRE-SD SABRE-SD flipped over

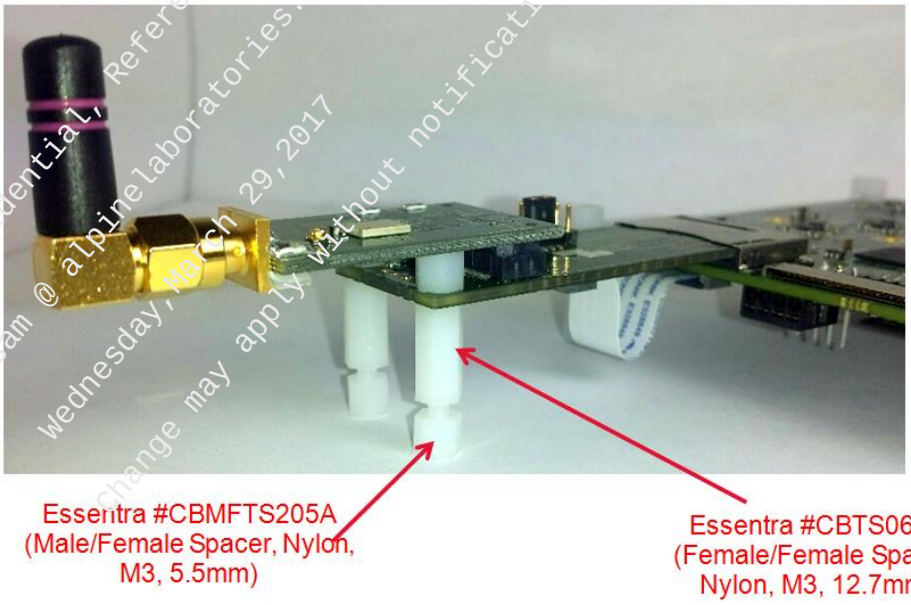


Figure 33: Supporting Murata Wi-Fi/BT EVK securely

Figure 34 shows a close up of the ribbon cable interconnect. It is essential that the ribbon cable is properly aligned and inserted before clamping at either end. It is best for user to limit number of insertions given that the ribbon cable will wear (eventually requiring replacement). The ribbon cable provided in the kit is Wurth Electronics #687620050002 (FFC Flat Flex Cable; 20 Position; 0.50mm Pitch; 50.0mm Length). We do not recommend any alternative products.

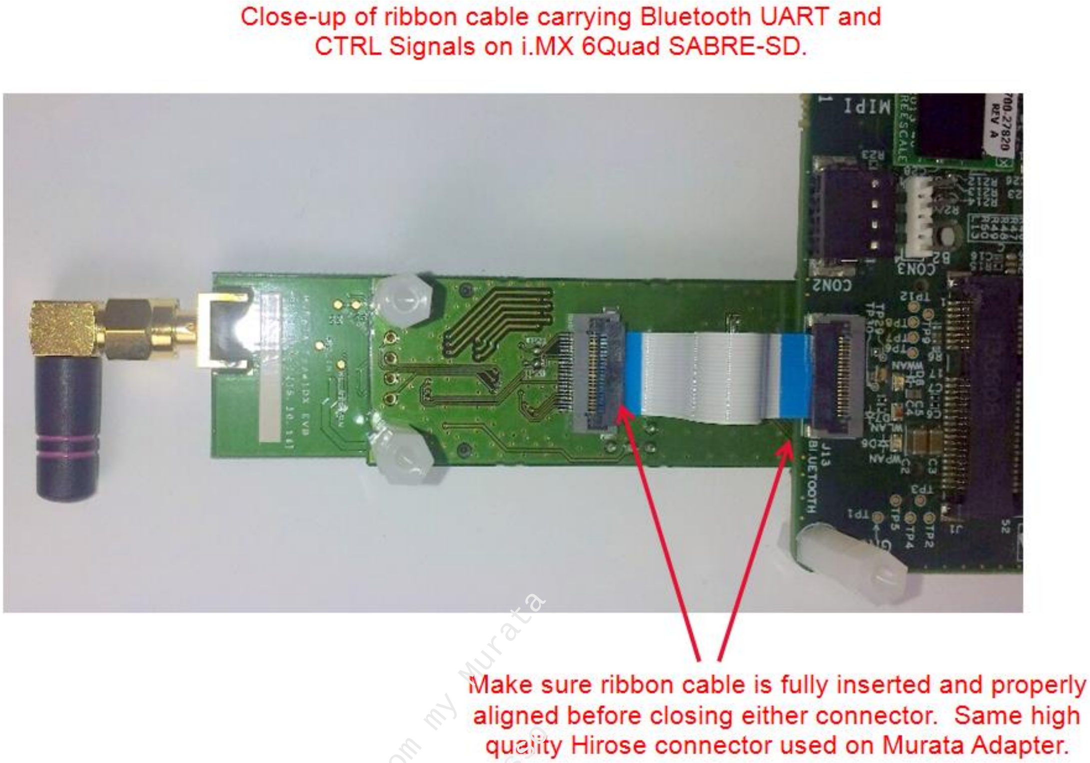


Figure 34: Ribbon Cable Interconnect

The Freescale i.MX 6Quad SABRE-SD requires rework to connect the Bluetooth UART and control signals necessary for Murata module to operate correctly. Page 15 of the Freescale schematic (SPF-27516_C3.pdf) correctly captures the necessary rework to be done. **Repeated here:**

> **NOTE**: To use J13, populate resistors R209 - R213 and depopulated the SPI NOR FLASH U14. Resistors R214 and R215 should not be populated because both UART outputs (TXDs) have been crossed together and both UART inputs (RXDs) have been crossed together. To make the UART work correctly, solder a jumper wire from R215 pad 1 to R214 pad 2 and from R215 pad 2 to R214 pad 1.

Table 13 summarizes the ribbon cable connections, mapping the i.MX 6Quad SABRE-SD Signals (MCIMX6Q-SDB/Schematic SPF-27516_C3.pdf) to the Murata Wi-Fi/BT Kit signals. It also includes the necessary MUX selection on the Freescale i.MX 6Quad SABRE-SD Platform.

Table 13: **Version 2.0 Adapter Board Ribbon Cable Connections on i.MX 6Quad SABRE-SD**

Host Pin#	Freescale i.MX 6Quad SABRE-SD (MCIMX6Q-SDB) Signal	Freescale i.MX6 MUX Selection	Murata Wi-Fi/BT EVK Signal	Notes
1	**KEY_ROW0**/ CSPI1_MOSI/ SPINOR_MOSI	MX6QDL_PAD_KEY_ROW0 __GPIO4_IO07	WL_REG_ON	Takes WLAN core in and out of reset. R586 must be populated in default position (Option A).
2	**KEY_COL0**/ CSPI1_CLK/ SPINOR_CLK	MX6QDL_PAD_KEY_COL0 __GPIO4_IO06	WL_HOST_WAKE	Optional signal used for OOB IRQ: out-of-band interrupt. R590 must be populated in default position (Option A).
6	**KEY_ROW6**	MX6QDL_PAD_GPIO_2 __KEY_ROW6	BT_REG_ON	Takes Bluetooth core in and out of reset. Note: GPIO(1,2).
7	TP29	N/C	BT_HOST_WAKE	Optional signal used for Bluetooth power optimization. Module drives this signal to take host MPU out of sleep mode.
13	TP30	N/C	BT_DEV_WAKE	Optional signal used for Bluetooth power optimization. Host drives this signal to take Bluetooth core out of sleep mode.
16	**KEY_COL1**/ CSPI1_MISO/ SPINOR_MISO	MX6QDL_PAD_KEY_COL1 __UART5_TX_DATA	BT_UART_RXD	Note: special rework required to connect UART5 TX to Murata BT RX. Also R583 must be populated in default position (Option A).
17	**KEY_ROW4**	MX6QDL_PAD_KEY_ROW4 __UART5_CTS_B	BT_UART_CTS	Straight-thru connection on CTS.
18	**KEY_ROW1**/ CSPI1_CS0/ SPINOR_CS0	MX6QDL_PAD_KEY_ROW1 __UART5_RX_DATA	BT_UART_TXD	Note: special rework required to connect UART5 RX to Murata BT TX. Also R584 must be populated in default position (Option A).
19	**KEY_COL4**	MX6QDL_PAD_KEY_COL4 __UART5_RTS_B	BT_UART_RTS	Straight-thru connection on RTS.

3.3.2.1 i.MX 6Quad SABRE-SD: Detailed Rework Instructions

1) Remove U14 (SPI NOR Flash) pictured in the layout Figure 35. U14 is framed by blue box. It is to the bottom right of i.MX6 MPU.

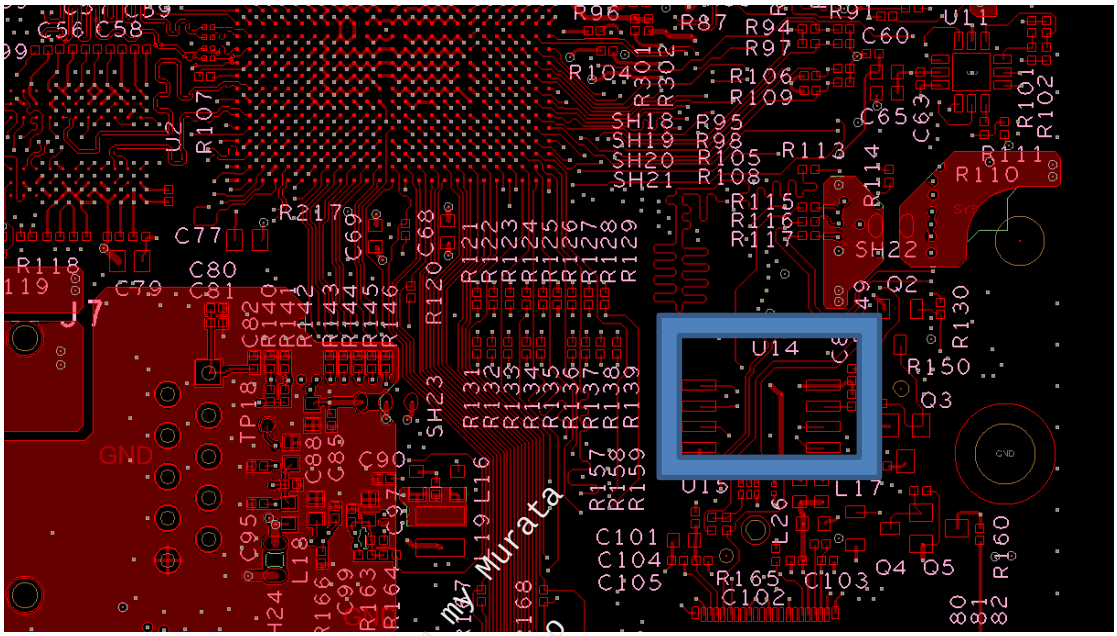


Figure 35: Remove U14 (SPI NOR Flash)

2) Note orientation of J13 Connector (Pin #1 on bottom left) in Figure 36. Populate resistors R209 (Pin #6/KEY_ROW6/BT_REG_ON: blue), R210 (Pin #17/KEY_ROW4/BT_UART_CTS: orange) and R211 (Pin #19/KEY_COL4/BT_UART_RTS: green).

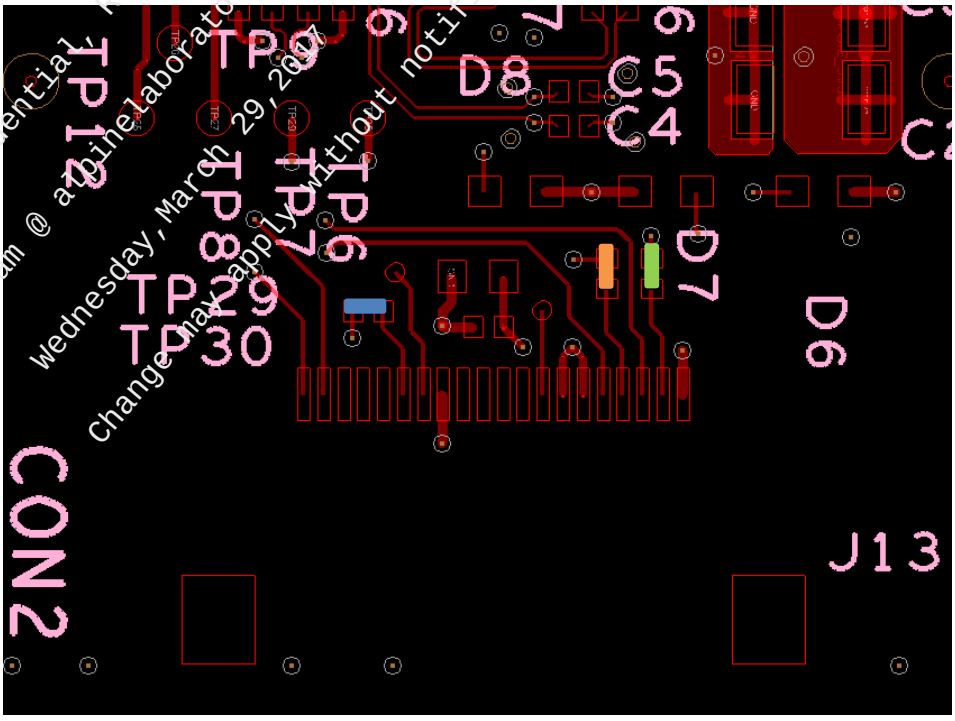


Figure 36: BT_REG_ON/BT_UART_CTS/BT_UART_RTS rework

3) Referring to Figure 37, populate resistors R212 (Pin#1/KEY_ROW0/WL_REG_ON: blue) and R213 (Pin#2/KEY_COL0/WL_HOST_WAKE: orange). Now we have to swap the TX/RX lines so “MPU TX <-> BT RX” and “MPU RX <-> BT RX”. R214/Pad#1 connects to R215/Pad#2; and R214/Pad#2 connects to R215/Pad#1. One connection can be crossed by placing resistor on 60 degree angle (approx.) and the other connection made with blue-wire (yellow) as shown.

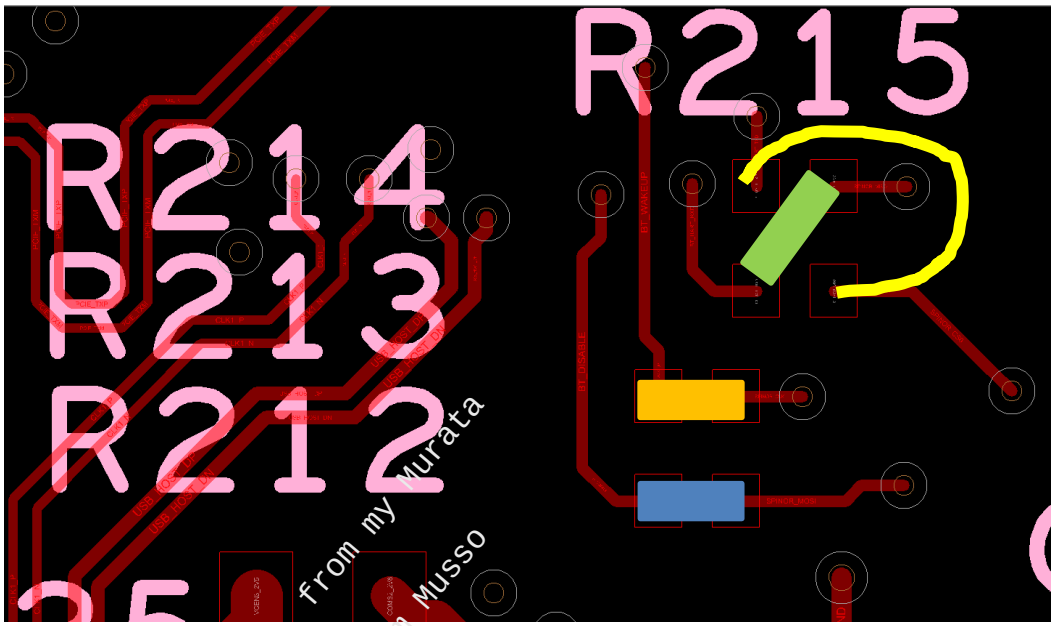


Figure 37: WL_REG_ON/WL_HOST_WAKE/BT_UART_TX/BT_UART_RX rework

The default software for i.MX 6DL/Q configures UART5 correctly with BT_REG_ON (for Android). However the Kernel DTS file will require modifications to properly MUX both WL_REG_ON and WL_HOST_WAKE. Please reference Murata Software User’s Guide on particulars for this configuration.

3.4 i.MX 6UltraLite EVK (Version 2.0 Adapter Board)

i.MX 6UltraLite EVK (Rev C) and Murata i.MX InterConnect Ver 2.0 Adapter Board provides Wi-Fi/BT connectivity by default with no rework required. However if out-of-band interrupts are desired, then a minor resistor change is necessary on Freescale EVK (to connect WL_HOST_WAKE signal). Figure 38 shows Murata Type 1DX Kit plugged into Freescale i.MX 6UltraLite EVK using Version 2.0 Adapter.

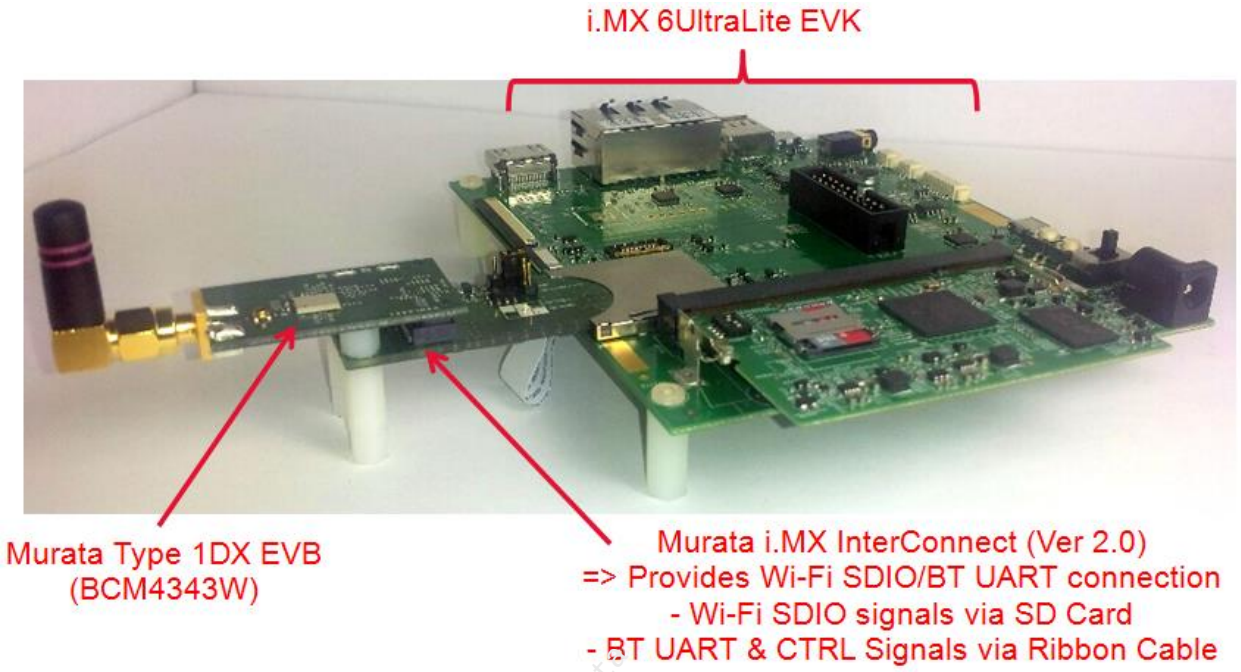


Figure 38: Murata Type 1DX Kit plugged into Freescale i.MX 6UltraLite EVK using Version 2.0 Adapter

Figure 39 shows one critical issue on i.MX 6UltraLite. The Freescale EVK uses “push-push” connector. It is very important to make sure Murata Wi-Fi/BT EVK is correctly inserted.

Figure 39: Correct Insertion of Murata EVK into SD Card Connector

Figure 40 illustrates one option of supporting Murata Wi-Fi/BT EVK securely. Use additional offset piece (Essentra part #CBMFTS205A) to screw into bottom of Version 2.0 Adapter leg. This allows user to adjust height so that EVB is securely supported. The configuration shown uses 2 x Male/Female Spacer (#CBMFTS205A) and 1 x Female/Female Spacer (#CBTS060A) on Murata Adapter mount points. Given that each kit ships with two adapters (Versions 1.0 & 2.0) then user can "borrow" the two Male/Female Spacers from Version 1.0 Adapter. For additional components refer to www.essentracomponents.ca.

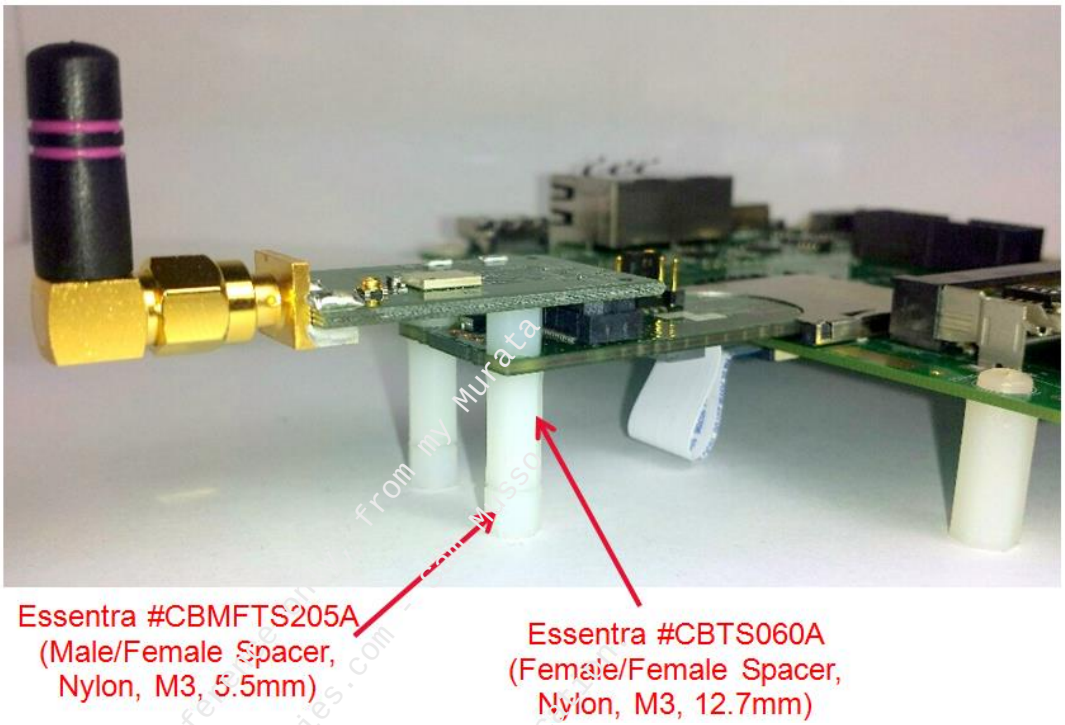


Figure 40: Support Option for Wi-Fi/BT EVK

Figure 41 shows a close up of the ribbon cable interconnect. It is essential that the ribbon cable is properly aligned and inserted before clamping at either end. It is best for user to limit number of insertions given that the ribbon cable will wear (eventually requiring replacement). The ribbon cable provided in the kit is Wurth Electronics #687620050002 (FFC Flat Flex Cable; 20 Position; 0.50mm Pitch; 50.0mm Length). We do not recommend any alternative products. On i.MX 6UltraLite EVK, the spacing on ribbon cable is fairly tight. However the Wurth ribbon cable is flexible enough that this does not cause any issues at all

.

> **NOTE:** Prior to fully inserting Murata i.MX InterConnect Adapter into SD card connector, it is strongly recommended to attach the ribbon cable first.

Figure 41: Close-up of Ribbon Cable Connector

The Bluetooth UART signals and additional control signals are provided with ribbon cable connector. Only standard WLAN SDIO signals (SD_DATA0..3, SD_CLK, and SD_CMD) are routed from SD card pads. Page 12 of the Freescale i.MX6UL Baseboard Rev C schematic (SPF-28616_20150714.pdf) shows Bluetooth (J1701) and WLAN (P1701/SD1) connections.

Refer to **Table 14** for connection mapping between Freescale and Murata hardware via ribbon cable. WL_REG_ON and BT_REG_ON are connected by default. WL_HOST_WAKE requires moving one resistor (from R1633 to R1704 location).

Table 14: Version 2.0 Adapter Board Ribbon Cable Connections on i.MX 6UltraLite EVK (Rev C)

Host Pin#	Freescale i.MX 6UltraLite EVK (MCIMX6UL-BB) Signal	Freescale i.MX6 MUX Selection	Murata Wi-Fi/BT EVK Signal	Notes
1	**SNVS_TAMPER1**/ BT_DISABLE	MX6UL_PAD_SNVS_TAMPER1 __GPIO5_IO01	WL_REG_ON	Takes WLAN core in and out of reset.
2	**ENET2_RXER**/ ECSPI4_SS0	MX6UL_PAD_ENET2_RX_ER __GPIO2_IO15	WL_HOST_WAKE	Optional signal used for OOB IRQ: out-of-band interrupt. On i.MX6UL, remove R1633 and populate R1704 (disconnects ENET2/U1601).
6	**BT_nPWD**	N/A	BT_REG_ON	Takes Bluetooth core in and out of reset. BT_nPWD is generated by U2101 using SHIFT_SDI/SHCP/STCP signals.
7	**ENET2_TXEN/** ECSPI4_MOSI	MX6UL_PAD_ENET2_TX_EN __GPIO2_IO13	BT_HOST_WAKE	Optional signal used for Bluetooth power optimization. Module drives this signal to take host MPU out of sleep mode.
13	**ENET2_TXD1/** ECSPI4_SCLK	MX6UL_PAD_ENET2_TX_DATA1 __GPIO2_IO13	BT_DEV_WAKE	Optional signal used for Bluetooth power optimization. Host drives this signal to take Bluetooth core out of sleep mode.
16	**UART2_TXD**	MX6UL_PAD_UART2_TX_DATA __UART2_DCE_TX	BT_UART_RXD	
17	**UART2_CTS_BB**	MX6UL_PAD_UART2_CTS_B __UART2_DCE_CTS	BT_UART_CTS	Straight-thru connection on CTS.
18	**UART2_RXD**	MX6UL_PAD_UART2_RX_DATA __UART2_DCE_RX	BT_UART_TXD	
19	**UART2_RTS_BB**	MX6UL_PAD_UART2_RTS_B __UART2_DCE_RTS	BT_UART_RTS	Straight-thru connection on RTS.

3.4.1.1 i.MX 6UltraLite EVK: Detailed Rework Instructions

1) The only (optional) rework on the i.MX 6UltraLite EVK is to connect WL_HOST_WAKE. To connect out-of-band interrupt signal, disconnect ENET2_RX_ER from U1601 (default is Ethernet connection), and connect to WL_HOST_WAKE instead. Figure 42 illustrates this change. These resistor pads are located on the top of the i.MX6UL EVK next to the SD card connector (P1701). The easiest approach is to remove the Zero Ohm resistor from R1633 location and move to R1704 location.

2) Next steps in rework would be to connect BT_DEV_WAKE and BT_HOST_WAKE. If you would like to implement this rework please contact Murata with any additional questions.

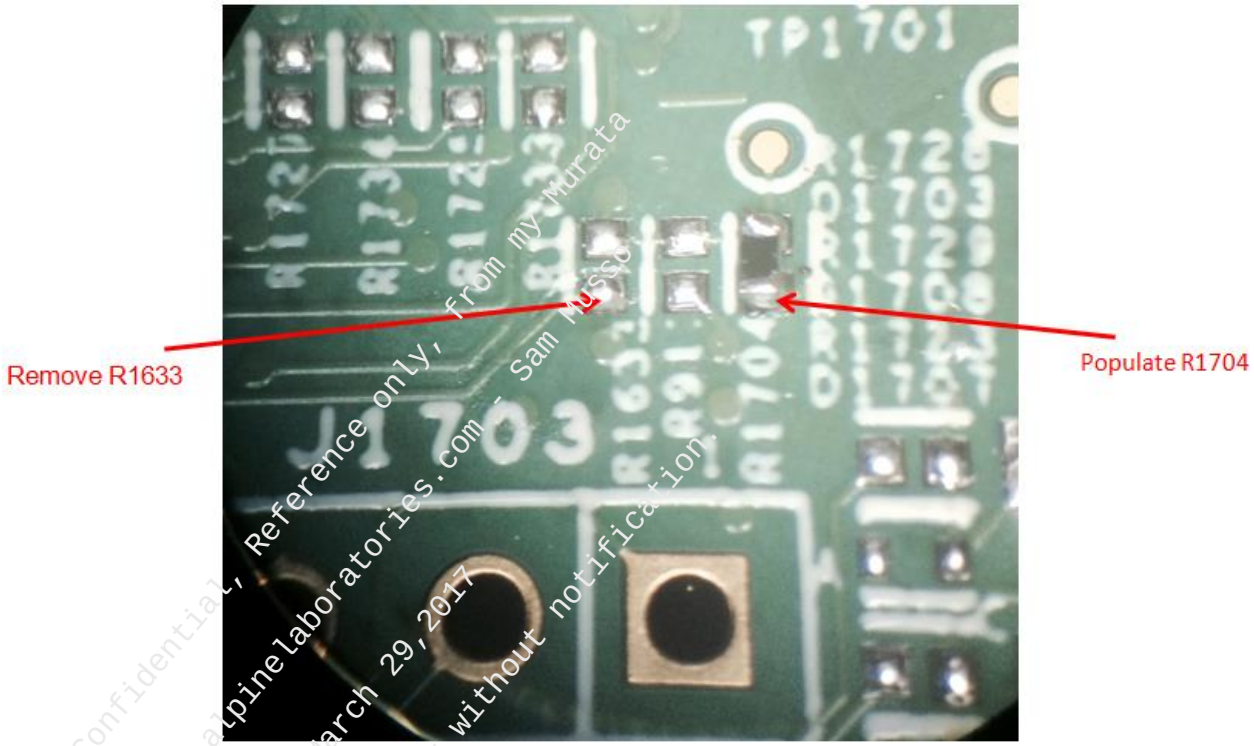


Figure 42: Rework for the i.MX 6Ultralite EVK