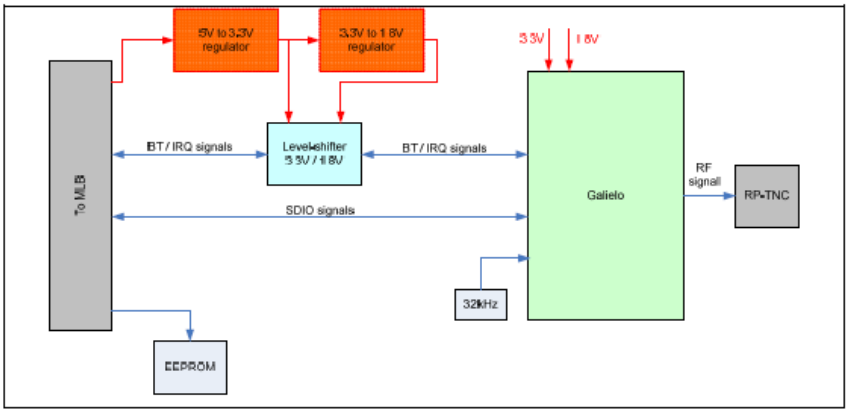
Intermec	**Communications Systems Statement of Work:**	Document Number: XXXXX
Model: RC12ABGN	**Specifications for a SDIO 802.11 a/b/g/n Wireless LAN and Bluetooth 2.1 Network Interface Land Grid Array Module**	Revision: Draft 06/06/2013
Intermec Engineering		

1 PURPOSE

This document describes the hardware design specifications of the Wireless abgn + Bluetooth option board for the Denali program.

1.1 System Block Diagram



1.2 Interfaces

1.2.1 Connector to Main Board

Through a 30pin connector, right angle, 2mm pitch

Input/Output direction is referenced from the view of the option board:

- Input: from the MLB to the option board
- Output: from option board to MLB

Pin #	Description	I/O	Pin #	Description	I/O
1	5V		2	5V	
3	GND		4	GND	
5	GND		6	SD_CMD	IO
7	GND		8	SD_D0	IO
9	GND		10	SD_D1	IO
11	GND		12	SD_D2	IO
13	GND		14	SD_D3	IO
15	GND		16	SD_CLK	I
17	GND		18	GND	
19	WIFI_PWR	I	20	BT_PWR	I
21	WLAN_IRQ	O	22	BT_RX	I
23	SCL	I	24	BT_TX	O

25	SDA	IO	26	BT_RTS
27	BT_IRQ	O	28	BT_CTS
29	GND		30	GND

1.2.2 RF Coaxial connector

RP-TNC Connector, Right Angle, Jack Bulkhead from DynaHz. MPN: 26-800x-11040.

Current MPN is 26-8003-11040.

IPN: 351-486-001

1.2.3 Interface to Galileo module

Refer to [1] "Galileo abgn System Specifications.doc", referred as CDC doc# "636425" for the complete description of the interface to Galileo module.

Below is an extract of the important signals to communicate to the Galileo module.

Input/Output direction is referenced from the view of the Galileo module:

- Input: from the carrier board to Galileo
- Output: from Galileo to carrier board

Pin #	Description	I/O	Remark
7	Vbat	I	
8	Vbat	I	
16	32kHz_CLK	I	
20	VDDIO	I	
32	VDDIO	I	
39	BATTERY_OK	I	
43	BT+PWR_EN	I	Active high
45	802.11_PWR_EN	I	
52	2.4_5GHz_RF	I/O	50 Ohm RF I/O
61	BT_RX	I	
62	BT_TX	O	
63	BT_PCM_VFS	I/O	Pull-low
64	SD_D3	I/O	
65	SD_D1	I/O	
66	SD_CLK	I	
67	SD_D2	I/O	
68	WLINK_TX	O	
74	BT_CTS	I	
75	BT_PCM_VDR	I	Pull-low
77	SD_CMD	I/O	

78	SD_D0	I/O	
80	WLINK_RX	I	
83	BT_RTS	O	
84	N.C.	-	Previously BT_IRQ
85	BT_PCM_VCK	I/O	Pull-low
86	BT_PCM_VDX	O	floating
87	BT_EN	I	Active high
89	WLAN_IRQ	O	Active low

This document is intended for Intermec Development Engineering and System Test Engineering.

This document contains information regarding the design, development and testing of a SDIO based IEEE 802.11 bgn and High Speed UART Bluetooth network interface MODULE based on a newly developed Intermec Wireless *platform* name Galileo. This variant is named ***Galileo bgn***

2 RC12ABGN Overview

RC12ABGN is an embedded wireless device platform that uses a 90 PAD Land Grid Array (LGA) form factor to allow for a low cost solution to mount highly integrated chipsets or OEM/ODM ***MODULES*** onto Intermec products. Galileo uses solder-down re-flow mounting only to a host MLB – there are no screws, digital or RF connectors. Test jigs are required to operate Galileo outside of a product.

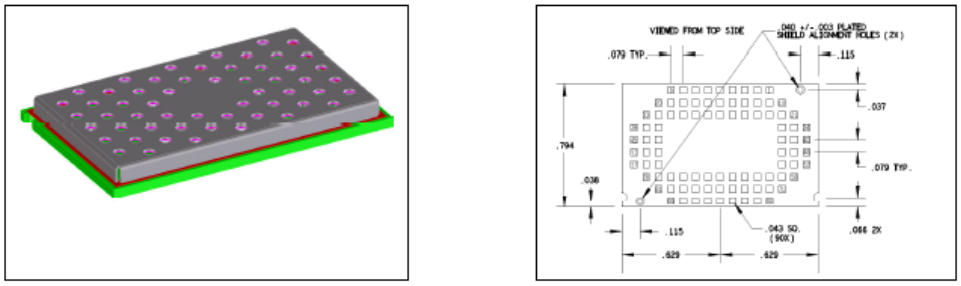


Figure 1: RC12ABGN platform

The RC12ABGN is an Intermec designed radio platform incorporating the MuRata WLAN/Bluetooth radio module LBEH1Z9PFC-TEMP. Please see reference section for data sheet. This device is a dual function IEEE 802.11 abgn transceiver, a Bluetooth 2.1 compliant radio transceiver. The module contains independent transceivers for each radio technology; IEEE 802.11 and Bluetooth. This variants system is capable of operating at the 2.4/5 GHz for the IEEE 802.11 transceiver, or 2.4 GHz band for the Bluetooth transceiver.

The MuRata MODULE is based on the following 802.11 and Bluetooth chipsets from Texas Instruments;

WL1273 Single-Chip MAC baseband processor and RF transceiver supporting 802.11 a/b/g/n standard

The RC12ABGN and subsequent variants will be manufactured by Contract manufacturer. Intermec is responsible for ensuring proper manufacturing test of the current and future designs.

2.1 IEEE802.11 transceiver description

The IEEE 802.11 transceiver is based on the Texas Instruments WL1273 single-chip IEEE 802.11abgn MAC, Baseband, and Direct Conversion transceiver. This system functions to provide wireless LAN connectivity supporting data rates from 1 Mbps to 54 Mbps and MCS0 to MCS7 in the 2.4-GHz band and 6-Mbps to 54-Mbpsand MCS0 to MCS7 connectivity in the 802.11a 5-GHz band.. The Triquint TQP6M9002 provides RF frontend capabilities for 2.4 GHz and 5 GHz operation. Either the 2.4 GHz or the 5 GHz transceiver is in operation at any one time.

The Texas Instruments WL1273 employs a 4-Wire SDIO system bus interface to the HOST.

The PLATFORM uses a single antenna port for both 2.4 GHz and 5 GHz operation of the IEEE transceivers.

The system provides a typical power output in the 2.4 GHz band of 17.5 dBm and 13 dBm for the 5 GHz band.

The 2.4 GHz transceiver supports data rates of 1, 2, 5.5 and 11 Mbps using CCK/DSSS and 6, 9, 12, 18, 24, 36, 48 and 54 Mbps using OFDM as per IEEE802.11-2007. Data rates MCS0 to MCS7 conform to amendment IEEE802.11n-2009.

The system is designed to only use the 20 MHz occupied BW capacity.

The 5 GHz transceiver supports data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbps using OFDM as per IEEE802.11-2007. Data rates MCS0 to MCS7 conform to amendment IEEE802.11n-2009.

Data transmission from the IEEE transceiver is initiated by the IEEE 802.11 compliant MAC software. The source of data to transmit can either be user supplied data (from the host systems) or network control packets (ACK's CTS, PSPoll, ProbeRequest etc). The transmitter is only active during the transmission of one of the packets previously mentioned.

2.2 Bluetooth transceiver description

The Bluetooth subsystem is built on the Texas Instruments BRF6450 ; a single-chip CMOS, Bluetooth® 2.1-compliant, Enhanced Data Rate (EDR) capable, stand-alone baseband processor with an integrated 2.4-GHz transceiver. The BRF6450 transceiver uses the Bluetooth SIG standard Host Controller Interface (HCI) via 4-Wire HighSpeed UART and PCM audio interfaces. The BRF6450 incorporates all Bluetooth 2.1 features including eSCO, AFH, and support for collaborative coexistence with WLAN devices.

The Bluetooth transceiver uses a single independent antenna that is common with the IEEE Transceiver.

The Bluetooth transceiver is built with a Bluetooth Class 1.5 specification RF output power (approx +6 dBm, for an approx 50meter range).

The Bluetooth transceiver uses Bluetooth compliant frequency hopping spread spectrum to cover 79 channels 1 MHz wide from 2.402 GHz to 2.481 GHz.

The Bluetooth transceiver supports Bluetooth Basic data rates of 1 Mbps (GFSK) as well as Enhanced Data Rates of 2 Mbps (π/4-DQPSK) and 3 Mbps (8-DPSK)

Data transmission from the Bluetooth transceiver is controlled by software in the baseband processor.

2.3 Simultaneous operation

Simultaneous operation of the WL1273 and BRF6450 transmitters is not possible when WiFi is operating on 802.11bgn (2.4 GHz) or 802.11an (5GHz) . While in operation, coexistence is always enabled. This arbitrates packets so that WiFi and Bluetooth packets are alternately transmitted. That is the transmissions are time division multiplexed.

The test tool does not allow simultaneous transmitter operation of 802.11bgn or 802.11an and Bluetooth.

3 System Level Requirements

The following is a summary list of MODULE baseline requirements that are detailed in subsequent clauses. This reflects the current 802.11abg implementation and will change to reflect any future updates such as 802.11n.

Table 1. Summary System Level Requirements

Radio	Feature	Description
WiFi	802.11abgn Physical Layer	Single Stream Transceiver with HT Preamble support
		Data rates 1, 2, 5.5,11, 6, 9, 12, 18, 24, 36, 48, 54, MCS0-7
		2.4 GHz band Conducted b rates RF Power 17.0 dBm +/-1.0 dB for DSSS/CCK
		2.4 GHz band Conducted g rates 6 – 36 Mbps RF Power 13 dBm +/-1.0 dB OFDM 48 – 54 Mbps RF Power 11.5 dBm +/- 1.0 dB OFDM MCS0 – MCS5 RF Power 13 dBm +/- 1.0 dB OFDM MCS6 – MCS7 RF Power 11.5 dBm +/- 1.0 OFDM **5 GHz Band** a rates 6 – 36 Mbps RF Power 14 dBm +/- 1.0 dB OFDM 48 – 54 Mbps RF Power 11.5 dBm +/- 1.0 dB OFDM MCS0 – MCS5 RF Power 14 dBm +/- 1.0 dB OFDM MCS6 – MCS7 RF Power 11.5 dBm +/- 1.0 dB OFDM
		Sensitivity -95dBm@1 Mbps / -70 dBm@54 Mbps
		OFDM Normal (800us) and Short Guard (400us) interval
		RX STBC, RIFS, and 20/40 MHz Coexitence support
	World-Wide Regulatory Support	802.11 d/h Compliant
		2.4 to 2.497 GHz Band, 4.9 to 5.85 GHz Bands
	RF/Antenna Interface	Combined RF port for WiFi 2.4 and 5 GHz bands
		Share RF port with Bluetooth
	Host Interface	SDIO 4 wire interface to Host
	Driver	Windows Mobile 6.X, Linux (Kernel 2.6) Compliant
	SW architecture	Low Host Burden FullMAC SW architecture
		A-MPDU (TX/RX), A-MSDU (RX), Block ACK support
		802.11 MAC contained on device
	Security	Capable of WPA/WPA2/802.11i
		WEP/TKIP/AES encryption
	Cisco Compliance	Capable of CCXv4 minimum with path to CCXv5
	Coexistence	802.15.2 Coexistence with co-located Bluetooth
	Supply Requirement	Low Power Operation 3.3 Vcc
		Device IO I/F at 1.8Vdc
Bluetooth	Bluetooth 2.1	Class 1.5 Conducted GFSK 100% Duty Cycle RF Output Power = 6.5 dBm +/- 1 dB 2-EDR 100% Duty Cycle RF Output Power = 5.5 dBm +/- 1 dB 3-EDR 100 % Duty Cycle RF Output Power = 5.5 dBm +/- 1 dB
		1 Mbps GFSK, 2 Mbps π/4-PSK, 3 Mbps 8-PSK
		Sensitivity better than -80 dBm all data rates
	World-Wide Regulatory Support	2.4 to 2.4835 GHz Band,
	RF/Antenna Interface	Shares antenna with WiFi
	Host Interface	UART 4 wire interface to Host (RX,TX,CTS,RTS)
		HCI Data rates approx 4 Mbps
	Driver	Windows Mobile 6.0 BT Stack Compliant
	SW architecture	Autonomous Flash based design
	Coexistence	802.15.2 Coexistence with co-located WiFi
	Supply Requirement	Low Power Operation 3.3 VDC
	PCM Interface	Slave or Master mode 4 – Wire (IN,OUT,CLK,SYNC)
	Power Management	BT_WAKE and HOST_WAKE

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains **FCC ID:EHA-RC12ABGN**". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.