84000100019_04

(“APT BELT CONNECTIVITY MODULE V1”)

FCC ID: **2AQ89-APT0001**

IC ID: **24336-APT0001**

USER MANUAL

Version 1.6

September 25, 2019

Revision Control

Version	Release Date	Description	Author
1.0	25 FEB 19	Initial Release	S. Kadiwala (MPC)
1.1	10 APR 19	Added Operational Descriptions for Temperature, Voltage, RF and Antenna (Section 6, 6.1-6.4)	S. Kadiwala (MPC)
1.2	16 APR 19	Added LABEL content under section 7	S. Kadiwala (MPC)
1.3	22 APR 19	Revised Label content in section 7 and added language clarifying end-product labeling for modular cert.	S. Kadiwala (MPC)
1.4	29APR 19	Revised Label content in section 7 to add IC	S. Kadiwala (MPC)
1.5	10 SEPT 19	• Updated label drawing snapshot to new revision in section 7 (pg. 10) • Corrected distance errata for RF exposure/allowable distance-to-body in Section 4.4 (pg. 5) • Added highlighted section restricting usage to APT (Sec. 1.0) • Added the actual module label information as required, in Section 7.0 and split into sections 7.1 (module packaging) and 7.2 (containing product) to avoid ambiguity.	S. Kadiwala (MPC)
1.6	25 SEPT 19	• Sec. 4.4 , 5.0 updated for errata	S. Kadiwala (MPC)

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1.0 INTENDED USE

This device is intended for use as an integrated module that provides wireless connectivity to APT Belt products. Specifically, this connectivity module is designed for operation at 2.4GHz and can be utilized for non-simultaneous Wifi or Bluetooth connectivity.

This device is NOT intended for resale to the general public, nor meant for integration into any device, other than an approved APT BELT hardware revision, by anyone other than ActiveProtective Technologies, Inc., and/or its subsidiaries or development partners. Use by anyone outside of the approved entities for the intended use outlined above shall be considered at the risk and detriment of the integrator or end-user.

1.1 RF TECHNICAL SPECIFICATIONS

This device contains an FCC-Approved module, notably the Murata 1DX IC, which has the following certification details:

FCC ID: VPYLB1DX

IC (Industry Canada) ID: 772C-LB1DX

All of the operational and technical RF specifications of the APT Belt Connectivity Module (**84000100019_04**) can be derived directly from the manufacturer's datasheet for this IC. A copy of the latest version of this datasheet can be requested from Murata directly, or a reference datasheet (as of the release date of this document) is available at: **https://wireless.murata.com/datasheet?/RFM/data/lbee5kl1dx.pdf**

2.0 INSTALLATION INSTRUCTIONS

2.1 POWER

This device consists of a populated PCB that contains a Board-to-Board connector (***RefDes P200***) that is used to interface with the APT Belt hardware product in which it is to be installed.

Among the key facets of this connector are the 1V8 (1.8V Power Supply), 3V3 (3.3V Power Supply) which are derived from the Main APT Belt product in the final application. For test purposes, a bed of test points of the same (and GND) are on the top surface of the module that can be probed or fly wired to provide the supply voltages externally for testing.

2.2 ANTENNA

The Module contains a Pulse W3008C chip antenna (***RefDes, ANT300***) that is used for both transmit and receive functions. There is no need for the installation of an auxiliary barrel, or other, external antenna to the connectivity module as it has a fixed-installation antenna already surface mounted.

2.3 COMMUNICATIONS

The major communications between the Connectivity module and the main product PCB are conducted over the SPI, I2C and UART buses whose lines are terminated by P200 (in order to communicate with the Main product PCB. Meanwhile, intra-Module connectivity is done over the Wifi SDIO bus, or the Bluetooth CTS/RTS/UART interface.

2.4 PRODUCT INTEGRATION

In order to install this device into a main product PCB, the OEM simply needs to follow the P200 pinout and assure the appropriate mating receptacle mechanical part is selected for installation on the main product. For more information, please consult the **84000100019_04_PARTS_LIST.PDF** document which is available in the ZIP package included with this manual.

3.0 LABELING INSTRUCTIONS

The size of this device makes certain labeling requirements difficult to satisfy physically upon the device itself. However, this does NOT exempt the integrator from certain labeling requirements which must be included in the **operational manual of the end product in which the Module is installed**.

A table below describes these requirements:

Equipment Authorization	Rule Part Device Type	Statement on Product[1]	Surface
Part 15 Verification	§15.19(a)(1) Receivers	This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.	§2.954 Devices must be labelled with a unique identifier.
	§15.19(a)(2) Stand-alone cable input selector switch	This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.	
	15.19(a)(3) All other devices	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.	
Part 15 Declaration of Conformity	§15.19(b)(1)(i) All Except PC assembled from DoC components	§2.1077 Compliance information. A statement, similar to that contained in §15.19(a)(3) of this chapter, that the product complies with part 15 of this chapters; and 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.	§2.1074 Unique identification (trade name and model number) and the logo below must be displayed on the device. FC
	§15.19(b)(1)(ii) PC assembled from DoC components		FC Assembled From tested components Complete system not tested

[1] *See* 47 C.F.R. §15.19(a)(5) for Verification and Certification; and §§15.19(b)(3) and 18.212(b) for Declaration of Conformity (DoC**). When the device is small or for such use that it is not practicable to place the statement on the product it must be placed in the instruction manual, pamphlet or packaging in which the device is marketed.**

4.0 FCC PART 15 STATEMENTS

4.1 §15.19 Label Interference Note for FCC Part 15 / IC RSS-GEN sec. 8.4 license exempt devices

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSSs. Operation is subject to the following two conditions: a.) this device may not cause harmful interference, and b.) this device must accept any interference received, including interference that may cause undesired operation.

4.2 §15.21 Modifications Note

Changes or modifications not expressly approved by the party responsible for compliance (ActiveProtective Technologies, Inc.) could void the user's authority to operate the equipment.

4.3 §15.105 Class B Digital Device - Interference Note

(Unintentional Transmitter)

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 or more 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.

4.4. RF EXPOSURE REQUIREMENTS

RF Exposure requirements for this module are met when installed in devices or equipment, that by structural design keeps the radio and antenna elements at least 3.15 cm from the human body.

5.0 (IC) INDUSTRY CANADA STATEMENTS

Contains IC:772C-LB1DX

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : 1) l'appareil ne doit pas produire de brouillage; 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment must be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en ardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

6.0 OPERATIONAL DESCRIPTION

6.1 OPERATING CONDITIONS

6.1.1 TEMPERATURE

The table below describes operating temperatures allowable:

	Min.	Typ.	Max.	**Unit**
OPERATING TEMPERATURE RANGE	-30	+25	+70	**°C**

6.1.2 VOLTAGE

The table below describes the operating voltages allowable to the VBAT and VDDIO pins/signals on the MODULE schematic:

	Operating Voltage (VOLTS)	
	3V3	**1V8**
MIN	3	1.71
TYP	3.6	1.8 or 3.3
MAX	4.8	3.63

6.2 RF FUNCTIONS

The APT BELT CONNECTIVITY MODULE is capable of basic 802.11 b, g, n functionalities along with Bluetooth EDR and BLE RF capabilities. The Module primarily operates therefore, in the 2.4GHz frequency range. A detailed table of operating frequencies and data rates for the various functions follows in the next section.

6.3 OPERATING FREQUENCY & FREQUENCY SOURCES

The tables below summarizeS the operating frequencies of the RF circuitry on the APT BELT CONNECTIVITY MODULE (WHICH ARE IDENTICALLY DERIVED FROM THE 1DX MODULE):

I) **802.11b**

Specification	IEEE802.11b
Mode	DSSS / CCK
Frequency	2400 - 2483.5MHz
Data rate	1, 2, 5.5, 11Mbps

II) **802.11g**

Specification	IEEE802.11g
Mode	OFDM
Frequency	2400 - 2483.5MHz
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps

III) **802.11n**

Specification	IEEE802.11n
Mode	OFDM
Frequency	2400 - 2483.5MHz
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps

IV) **Bluetooth EDR**

Normal conditions : 25deg.C, VBAT = 3.6V, VDDIO = 3.3V

Items	Contents
Bluetooth specification (power class)	Version 2.1 + EDR (Class1)
Channel frequency (spacing)	2402 to 2480 MHz (1MHz)

V) **BLE**

Conditions : 25deg.C, VBAT=3.6V, VDDIO= 3.3V

Items	Contents
Bluetooth specification (power class)	Version 4.1(LE)
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)
Number of RF Channel	40

6.4 ANTENNA INFORMATION

The antenna installed on the APT BELT CONNECTIVITY MODULE is the Pulse W3008C, with key design and typical performance information summarized as in the following sections, per the Chip Antenna manufacturer.

6.4.1 TYPICAL PERFORMANCE METRICS

Bluetooth / WLAN / WiFi, W3008C

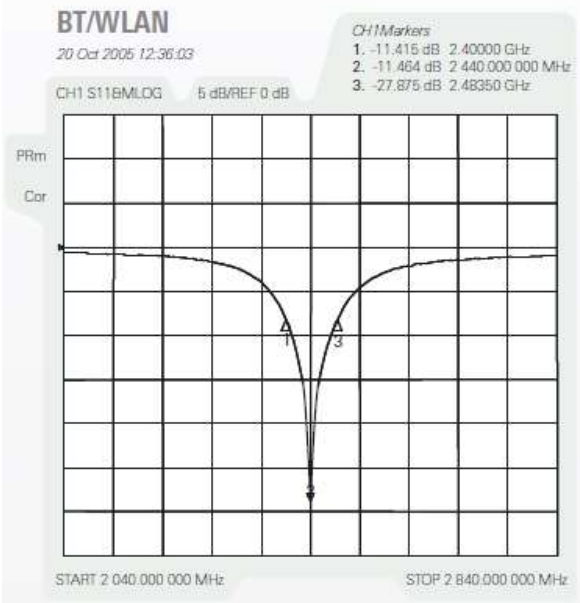
Typical performance (test board size 80x37 mm, PWB ground clearance area 4.00 x 6.25 mm)

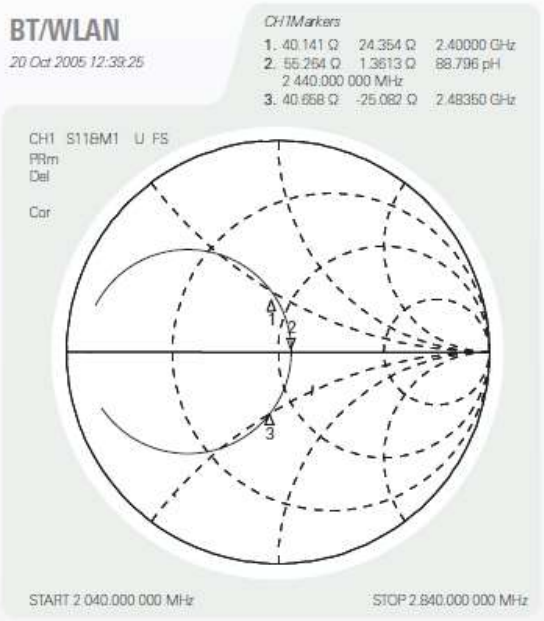
Frequency Range [MHz]	Linear Max Gain [dBi]	Efficiency [%] / [dB]	Return loss min. [dB]	Impedance [Ω]	Operating Temperature [°C]
2400–2483.5	2.2 (Peak) 1.9 (Band edges)	75 / -1.3 (Peak) 70 / -1.6 (Band edges)	-11	50	-40 to +85

6.4.2 S11 (RETURN LOSS), RADIATION EFFICIENCY & GAIN

Typical Electrical Characteristics (T=25 °C), W3008C

Typical Return Loss S11/ impedance, measured on the test board





Free space efficiency and maximum gain / PWB ground clearance area 4.00 x 6.25 mm

7.0 MODULAR INTEGRATION LABEL EXAMPLE

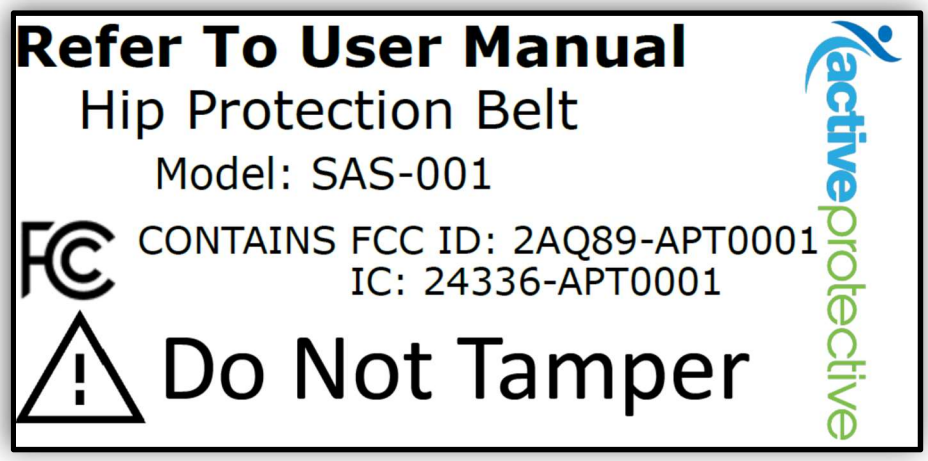
7.1 MODULE PACKAGING LABEL

Provided next is the label for the module device itself:

As the device is small in size, this label is provided in the module's user manual in lieu of physical application to the actual device.

7.2 END-PRODUCT LABEL

Below is an example of the label that must be applied to the surface of the <u>end-product</u> into which the module is integrated:



(!) This device is **<u>NOT</u>** meant for stand-alone operation without integration into an APT end-product. **<u>Any use, misuse or abuse, outside of the</u>**

approved operating condition(s) for this modular certified device are considered to be solely at the risk of the operator or integrator and are strictly prohibited.

For approved applications, the specification for the labeling of the end-product is shown below **for dimensional reference only (in mm):**