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Product Name: TI-BLE-73720-20-XX	Page : Page 1 of 19
Mfg: Belwith Products, LLC.	Date : 07/12/2013
Model #: SRD521	FCC ID: 2AAJWSRD521

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## 1) Scope of this document :

This product specification describes Belwith's Bluetooth Low Energy module, series number TI-BLE-73720-20-XX. It includes integration information and guidelines to allow a basic understanding of the module's functions, application and includes required documentation that is required to allow the integrator to properly label the OEM device.

**Caution!** Any changes or modifications to this module not approved by Belwith Products LLC could void the authority to operate this module.

It contains documentation for proper labeling as required by FCC part 15. This includes documents / labeling that must be applied to the end use host device by the OEM as outlined.

Use of this certified transmitter module ( section 15.212 ) can allow the end use host device manufacturer to reduce the testing associated with their product. Additional testing may be required to comply to all other applicable regulations.

## 2) Basic operation of module

TI-BLE module contains following:

1. Processor:

The processor is a power-optimized true system-on-chip (SoC) solution for both Bluetooth low energy and proprietary 2.4-GHz applications. This combines the excellent performance of a leading RF transceiver with an industry-standard enhanced 8051 MCU, in-system programmable flash memory, 8-KB RAM, and many other powerful supporting features and peripherals. Please refer Section 6 for detail pin outs.

2. Crystal 32MHz:

32MHz crystal is source of Main Clock freq. of system. It is Ultra Miniature size low profile SMD crystal. This crystal is shielded by metal shield so that it will not export any high frequency from the module. During RF transceiver this clock is enabled.

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**Specification:**

Part	<b>32MHz Crystal</b>
Frequency Stability	+/-20ppm
Frequency Tolerance	+/-10ppm
Load Capacitance	10pF
Motional Resistance(ESR)	50Ohm

3. Crystal 32KHz:

32KHz crystal is the source of Secondary clock freq. of system. It is ultra miniature size low profile SMD crystal. This crystal is shielded by metal shield (#6) so that it will not export any high frequency from module. This clock is used for timer, sleep mode, and power saving mode.

**Specification :**

Part	<b>32 KHz Crystal</b>
Frequency Tolerance	$\pm 20$ ppm
Load Capacitance	9pF
Motional Resistance(ESR)	70 kOhm

4. 2.4GHz Band pass Filter:

Murata makes the balance matching band pass filter it is used for impedance matching between the Antenna and the RF Output port.

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**Specification:**

Part	Band Pass Filter	
Unbalance Port Impedance (Nominal)	50 Ohm	
Balance Port Impedance (Nominal)	Conjugate match to CC2541	
Frequency Range (BW)	2450 +/- 50MHz	
Insertion Loss in BW	a. dB max at 25°C 1.95 dB max at -40 ~ 85 °C	
Attenuation	20.0 dB at 25 °C 19.0 dB at -40 ~ 85°C	@4800 ~ 5000 MHz
	20.0 dB at 25 °C 19.0 dB at -40 ~ 85°C	@7200 ~ 7500 MHz
Unbalance port V.S.W.R. in BW	1.90 Max	
Balance port V.S.W.R. in BW	2.30 Max	
Power Capacity	500 mW max	

5. LC Filter :

Ferrite bead and Ceramic capacitors are used in the LC filter. This filter is connected between the power supply pin of the processor and the power supply feed point of module. This filter will block high freq. noise in power supply and provide stability against EMI noise.

6. Metal Shield:

CRS Tin shield is used for shielding. Shield is directly connected to GND plane which will restrict emission of any high freq. that may be generated from the module. Its specification is below:

**Specification:**

Surface Area	259.21 mm <sup>2</sup>
Maximum Overall Dimension	16.50 x 16.50 mm
Maximum Overall Height	3.60 mm
Material Thickness	0.20 mm
Weight	0.5 gms
Material	0.20 mm CRS Tin

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### 3) Antenna

PCB Antenna (Inverted F type)

It is a 2.4 GHz PCB antenna. The Inverted F Antenna (IFA) was designed to match an on board impedance. Thus no additional matching components are necessary. Antenna design is configured so as not to attenuate the gain characteristics of the processor.

**Do not attempt any modifications.**

### 4) Ground Planes

Radio requires an RF ground plane on any device/host board made to work with this module. The ground plane should cover the majority of the remaining (as much as permitted by other components) of the Printed Circuit Board (PCB) area. This can be located on any layer of the PCB. Extend the RF ground plane parallel to module pins 31 and 32 the entire length of the board. Connect all ground pins and do not notch the ground plane around the module. Bottom of module is grounded so be cognizant of vias or conductive traces located under the module that are not soldered/masked to prevent shorting. Keep metallic components, connectors, copper traces, internal layers, and ground planes away from the antenna area in 3D space!

### 5) Frequency Hopping

This module uses frequency hopping for data communication with other BLE devices. A pseudo list of no less than 37 available data channels are used and sends data packets utilizing these channels. For advertising, it uses 3 fixed channels and hence it advertised fixed packet (47 bytes in length) on all three advertising channels.

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## 6) Pin Detail : See detail 9) for pin #1 location

Sr.No.	Pin Name	Pin Type	Description
1	GND	Ground	Ground Pin must be connected to solid gnd plane
2	GND	Ground	Ground Pin must be connected to solid gnd plane
3	P2.2/DC	Digital I/O	Port 2.2/Debug Clock
4	P2.1/DD	Digital I/O	Port 2.1/Debug Data
5	P2.0	Digital I/O	Port 2.0
6	P1.7	Digital I/O	Port 1.7
7	P1.6	Digital I/O	Port 1.6
8	VCC	Power (Analog)	2.0V–3.6-V analog power-supply connection
9	SCL	I <sup>2</sup> C clock or Digital I/O	Can be used as I2C clock pin or digital I/O. Leave floating if not used. If grounded disable pull up. Open Drain Output – External pull up is required for I <sup>2</sup> C Operation.
10	SDA	I <sup>2</sup> C data or Digital I/O	Can be used as I2C data pin or digital I/O. Leave floating if not used. If grounded disable pull up. Open Drain Output – External pull up is required for I <sup>2</sup> C Operation.
11	P1.5	Digital I/O	Port 1.5
12	P1.4	Digital I/O	Port 1.4
13	P1.3	Digital I/O	Port 1.3
14	P1.2	Digital I/O	Port 1.2
15	P0.7	Digital I/O	Port 0.7
16	P1.1	Digital I/O	Port -1.1 – 20mA drive capability
17	P1.0	Digital I/O	Port 1.0 – 20mA drive capability
18	P0.6	Digital I/O	Port 0.6
19	P0.5	Digital I/O	Port 0.5
20	P0.4	Digital I/O	Port 0.4
21	P0.3	Digital I/O	Port 0.3
22	P0.2	Digital I/O	Port 0.2
23	NC	-	Not Connected
24	NC	-	Not Connected
25	P0.1	Digital I/O	Port 0.1
26	P0.0	Digital I/O	Port 0.0

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27	RESET-	Digital Input	Reset, Active Low
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## 7) Electric specification:

### Absolute Maximum Ratings<sup>(1)</sup>:

over operating free-air temperature range (unless otherwise noted)

		Min	Max	Unit
Supply Voltage	All supply pin must have same voltage	-0.3	3.9	V
Voltage on any digital pin		-0.3	Vdd+0.3 <= 3.9	V
Input RF level			10	dBm
Storage Temp Range		-40	+80	°C
ESD <sup>(2)</sup>	All pins, excluding pins 25 and 26, according to human-body model, JEDEC STD 22, method A114		2	kV
	All pins, according to human-body model, JEDEC STD 22, 1 kV method A114		1	kV
	According to charged-device model, JEDEC STD 22, method C101		500	V

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) **CAUTION:** ESD sensitive device. Precautions should be used when handling the device in order to prevent permanent damage.

### Operating Condition Summary Specification:

Items	Specification
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Supply Voltage (Vdd)	2.0-3.6V
Vdd ripple	100mV max
Max. Voltage on any pin	Vdd + 0.3V (Not 5V Tolerant)
Ambient Temperature range	-40 °C to 85 °C

#### Current Consumption Summary Specification:

Measurement done at TA = 25 °C, VDD = 3V

Items	Specification
Power Mode 3 (120uSec Wakeup)	0.5uA
Power Mode 2 (120uSec Wakeup)	1uA
Power Mode 1 (4uSec Wakeup)	270uA
Low MCU Activity	6.7mA
Rx Standard Gain	17.8mA
Rx High Gain	20.1mA
Tx -20dBm	16.8mA
Tx 0dBm	18.2mA

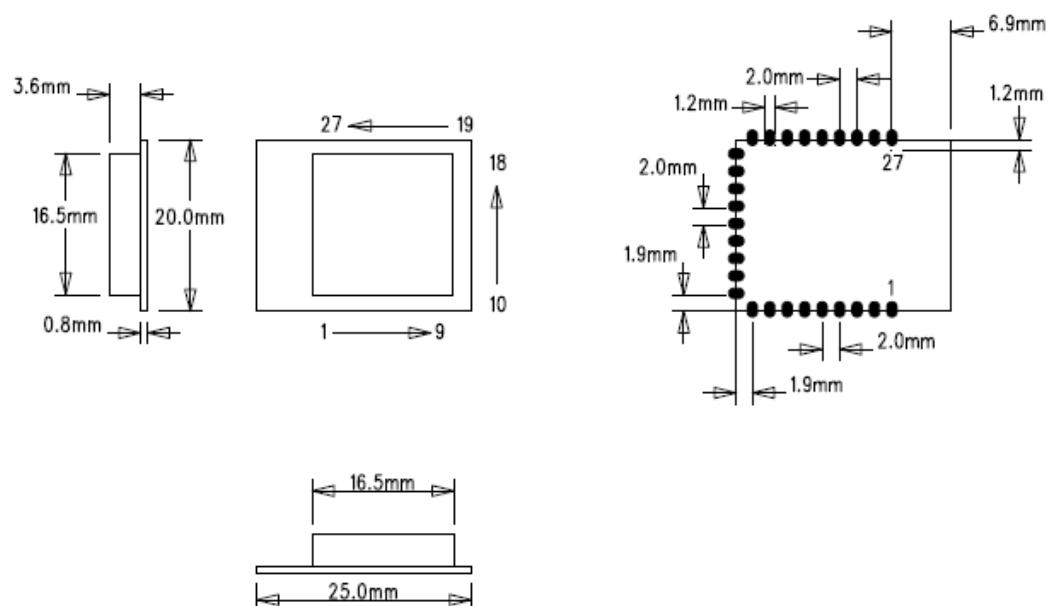
#### RF Specification Summary Specification:

Items	Specification
Frequency	2402-2480 MHz in 2MHz steps
Data rate and Modulation	1 Mbps, GFSK
Number of Channel	40: 37 data /3 advertising
Receive Sensitivity	-92 dBm
Output power	-23 to 0 dBm
Rx/Tx Turnaround	150uSec

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## 8) Mechanical Specification:

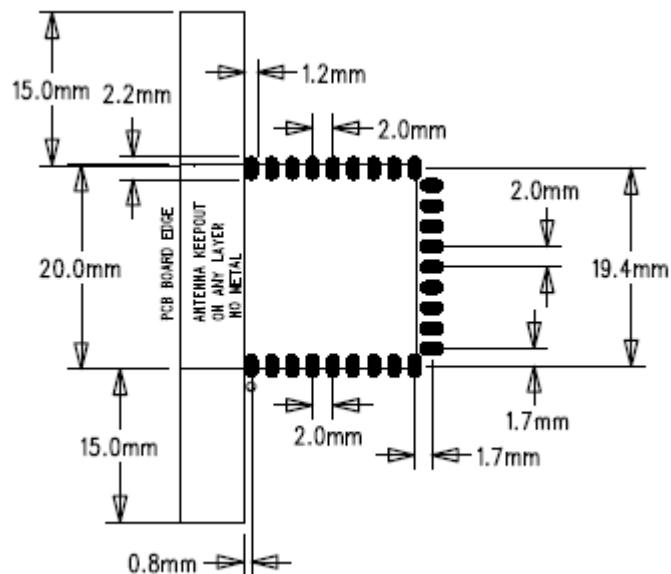
No.	Item	Dimension	Tolerance
1.	Length	25.00 mm	+/- 0.20
2.	Width	20.00 mm	+/- 0.20
3.	Height	4.20 mm	+/- 0.20



Note: All Dimensions are in mm.

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### 9) Recommended PCB Footprint: Dot indicates pin one.

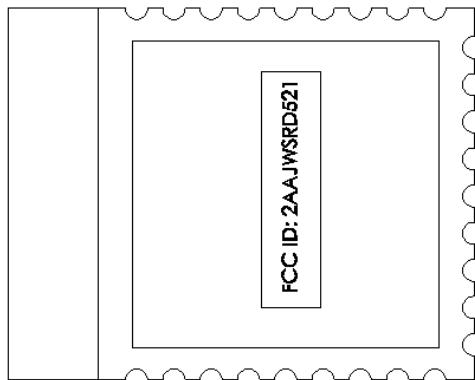


Note: All Dimensions are in mm.

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## 10) Physical view of module:

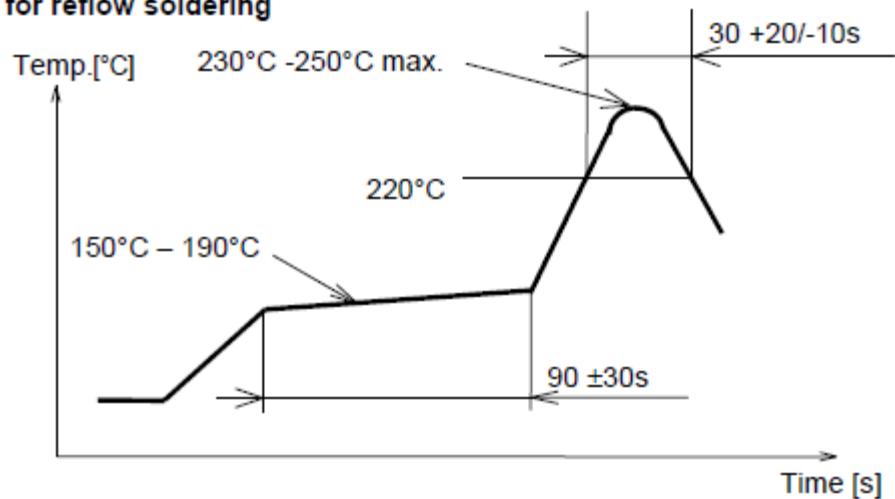
**(FCC ID label shown: construction material is polyester, permanent acrylic adhesive)   Do not remove this label**



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## 11) Soldering Temperature Profile:

**Our used temp. profile  
for reflow soldering**



Reflow permissible cycle: 2  
Opposite side reflow is prohibited due to module weight.

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## **12) Ordering Information:**

PART Number: TI-BLE-73720-20-XX. Model number SRD521.

Contact Belwith Products LLC. directly for further information.

Web address: [www.belwith.com](http://www.belwith.com)

Part is not available for online ordering.

Data sheet is available in electronic form or as printed document upon request.

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### 13) Module FCC, Exposure, Compliance Statements

FCC ID: 2AAJWSRD521

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.

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or 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 a 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 the 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.

In order to maintain compliance with FCC regulations. Operation with non-approved equipment is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to this module without the approval of manufacturer could void the user's authority to operate this equipment.

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#### **14)OEM / Host Labeling Information:**

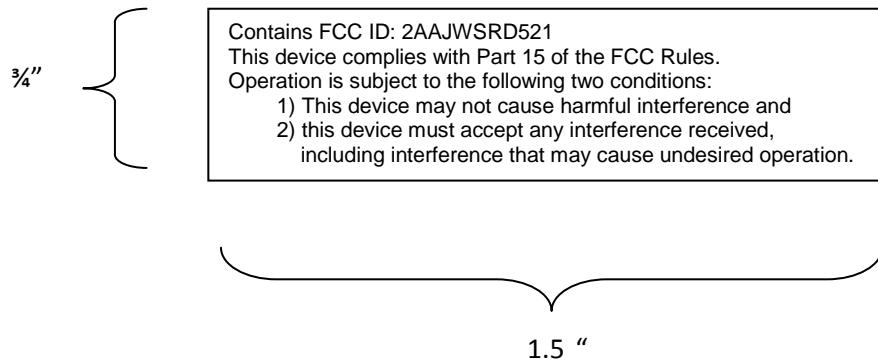
**In order to comply to the use rules of Model SRD521, The OEM / Host is required to label the product according:**

**Label #1-- 2 part statement label. This label must be applied to the Host /OEM product. ( exception being products that are defined in Alternate statement below)**

**Material: polyester white base with clear overcoat with permanent printing and acrylic adhesive. Size and printing as shown. Paper labels are not permitted, on the product.**

**This label to be placed on product visible to end user on Host / OEM device/product.**

**Alternate application: Printing permanently in the instructions is allowed whereas the Host / OEM product is smaller than the palm of a hand on the users instructions. Printing font must be 8 pt. or larger.**



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In addition to the FCC two part statement above, the following two (2) statement's should be placed in the host device/product user's manual. **The words "Do Not Print" indicate the title of the section and / or instructions they do not need to be printed in the host device/product manual.**

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1) **( FCC RF EXPOSURE STATEMENT) <<<< Do Not Print**

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

---

2) **(Print the following statement) <<<< Do Not Print**

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 a 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 the 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.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

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## 15) RoHS Declaration:

Declaration of environmental compatibility for supplied products:

We hereby declare to our best present knowledge based on declaration of our suppliers that this product does not contain the following substances which are banned by Directive 2002/95/EC (RoHS) or if present, a maximum concentration of 0.1% by weight in homogeneous materials for:

- Lead and lead compounds
- Mercury and mercury compounds
- Chromium (VI)
- PBB (polybrominated biphenyl) category
- PBDE (polybrominated biphenyl ether) category

And a maximum concentration of 0.01% by weight in homogeneous materials for

- Cadmium and cadmium compounds

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## 16) Datasheet status:

- This data sheet contains the final specification (RELEASE).
- Belwith reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
- Supplementary data is available upon request.
- Information supplied here is the most recent at the time of publication.
- Consult the most recently issued data sheet before initiating or completing a design.
- Contact Belwith customer service to secure the latest version of this data sheet: [www.belwith.com](http://www.belwith.com)
- Belwith assumes no responsibility for improper use of this product. Do not attempt to “overclock” or apply voltages other than what is shown in this document.
- All rights reserved. Design of these products shown here have U.S and foreign patents pending.

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## 17) Revision History:

Revision	Date	Author	Modification/Remarks
01.01	04/16/2013	Jatin Bhatt	Preliminary Release
01.02	04/24/2013	Jatin Bhatt	<ul style="list-style-type: none"> <li>1. Correction in Mech. Data</li> <li>2. Add Internal block diagram of CC2541</li> <li>3. Description of module</li> <li>4. Add Part number</li> </ul>
01.03	05/25/2013	Jatin Bhatt	Add TI-BLE part number
01.04	07/01/2013	M Cohen	Add label
01.05	07/04/2013	G Myers	Add FCC statements sec 12
01.06	07/05/2013	G Myers AH	Added Oscillator, antenna, ground plane info.
01.07	07/08/2013	G Myers	Added FCC number to header
01.08	07/08/2013	G Myers	Changed label info added hopping
01.09	07/11/2013	G Myers	Adjusted to three parts
01.10	07/19/2013	G Myers	Adjusted OEM statements, Antenna, hopping