
BLUETOOTH® 4.0 DUALMODE MODULE

Operating Conditions

- Operating voltage range: 3.3V to 4.2V
- Operating temperature: -20°C to 70°C
- ISM band 2.402 to 2.480 GHz

Features

- Bluetooth® Classic (BR/EDR) and Low Energy (LE)
- Complete, fully certified, embedded 2.4 GHz Bluetooth Version 4.0 module
- Bluetooth SIG Certified
- Simple, UART interface
- Transparent UART mode for seamless serial data over UART interface
- Easy to configure with Windows® based GUI or direct by MCU
- Firmware can be field upgradable via UART
- Integrated crystal, internal voltage regulator, and matching circuitry
- Multiple I/O pins for control and status
- Compact surface mount module: 22x12x2.4 mm
- Castellated surface mount pads for easy and reliable host PCB mounting
- Ideal for portable battery operated devices
- Internal battery regulator circuitry
- Worldwide regulatory certifications
- One LED driver with 16 steps brightness control

RF/Analog

- Frequency: 2.402 to 2.480 GHz
- Receive Sensitivity: -90 dBm (BR/EDR); -92 dBm (LE)
- Class 2 output power (+2 dBm typical)

Data Throughput

- 11 kbps (BR/EDR) when UART baud Rate is 115200 bps
- 8 Kbps (LE) when UART baud Rate is 115200 bps

MAC/Baseband/Higher Layer

- Secure AES128 encryption
- BTv3.0: GAP, SPP, SDP, RFCOMM, and L2CAP
- BTv4.0: GAP, GATT, ATT, SMP, and L2CAP

**Applications**

- mPOS (mobile point-of-sale) systems
- LED lighting (16 step)
- Wearables
- Digital sports
- Fitness devices
- Health Care/Medical
- Automotive accessories
- Home automation
- Remote control toys

General Description

The BM78 module is a fully-certified Bluetooth Version 4.0 (BR/EDR/LE) module for customers who want to easily add dual mode Bluetooth wireless capability to their products. The module bridges customers product to smart phones and tablets for convenient data transfer, control, and access to cloud applications delivering local connectivity for the Internet of Things (IoT).

It supports GAP, SDP, SPP, and GATT profiles. Data is transferred over the Bluetooth link by sending/receiving data via transparent UART mode, making it easy to integrate with any processor or Microcontroller with a UART interface. Configuration is made easy by using a Windows based GUI or directly via UART by an MCU.

BM78SPPX5NC2

Table of Contents

System Overview	3
Throughput	15
Electrical Characteristics	17
Radio Characteristics	21
Physical Dimensions	23
Antenna Placement Rule	31
Ordering Information	35
UI Setting	37
Reference Circuit	39
Bluetooth Behavior Auto/manual Pattern Configuration	41
Certification Notices	53
The Microchip Web Site	55
Customer Support	56
Worldwide Sales and Service	56

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1.0 SYSTEM OVERVIEW

The BM78 module is a complete, fully certified, embedded 2.4 GHz Bluetooth version 4.0 (BR/EDR/LE) wireless module. It includes an on board Bluetooth stack, cryptographic accelerator, power management subsystem, 2.4 GHz transceiver, and RF power amplifier (see Figure 1-1). Customers can embed Bluetooth functionality rapidly into virtually any device with the BM78 module.

The BM78 module enables rapid product development and faster time to market. The module has been designed to provide integrators with a simple Bluetooth solution that features:

- Ease of integration and programming
- Vastly reduced development time
- Minimum system cost
- Interoperability with Bluetooth hosts
- Maximum value in a range of applications

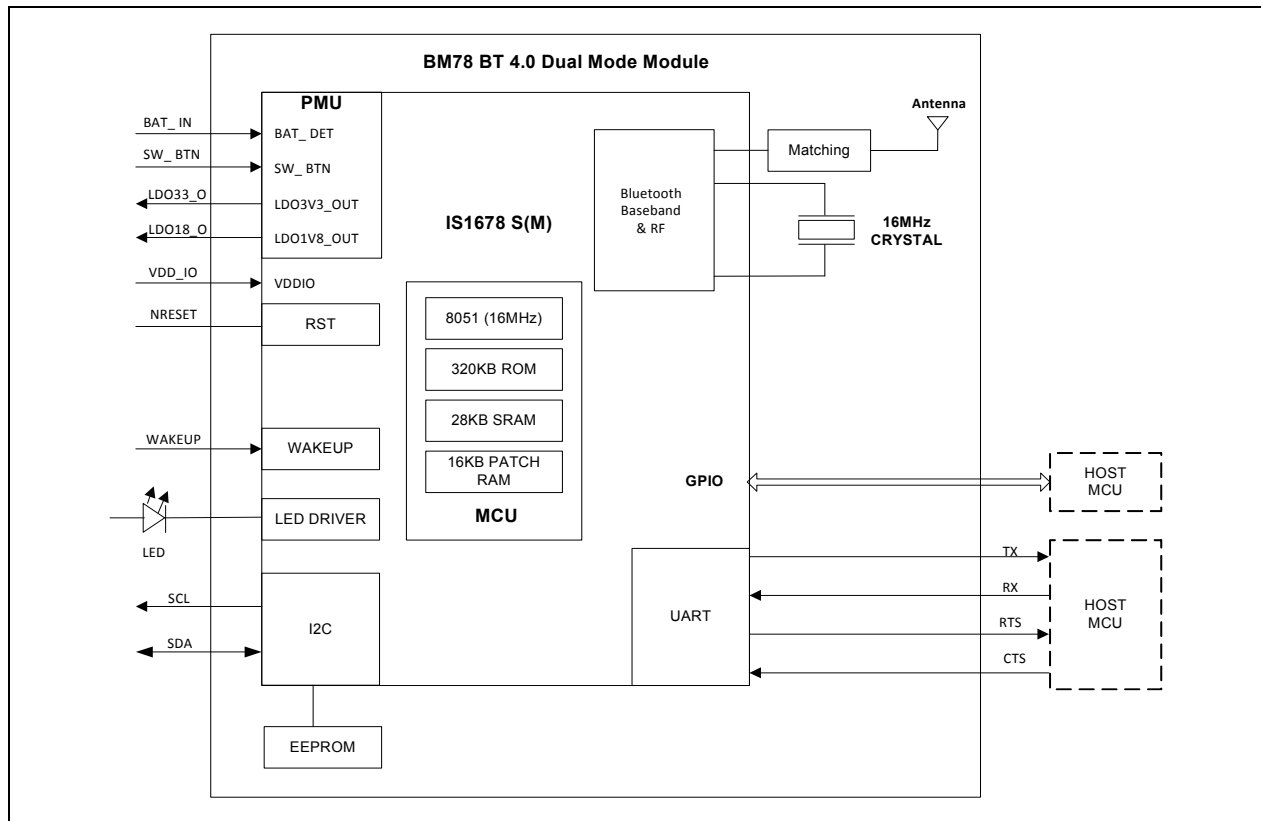
The BM78 module can independently maintain a low-power wireless connection. Low-power usage and flexible power management maximize the module's lifetime in battery-operated devices. A wide operating temperature range allows use in indoor and outdoor environments.

There are two Stock Keeping Units (SKUs) of BM78 module: BM78SPPS3NC2 and BM78SPP03NC2. The BM78SPPS3NC2 is a complete, fully regulatory certified module with an integral ceramic chip antenna and RF shield. The BM78SPP03NC2 is a lower cost alternative with an external antenna and no RF shield. The integrator is responsible for the antenna, antenna matching, and regulatory certifications.

The BM78 module is a small, compact, surface mount module with castellated pads for easy and reliable host PCB mounting. The module is compatible with standard pick-and-place equipment.

Figure 1-1 illustrates a typical example of the BM78 module based system.

FIGURE 1-1: BM78 BLOCK DIAGRAM



BM78SPPX5NC2

Table 1-1 describes the various pins of the BM78 module.

TABLE 1-1: PIN DESCRIPTION

S3 Pin	03 Pin	Symbol	Type	Description
1	—	GND	Power	Ground reference
2	—	GND	Power	Ground reference
3	1	GND	Power	Ground reference
4	2	BAT_IN	Power	Battery Input (3.3V to 4.2V) Main positive supply input Connect to 10uF (X5R/X7R) capacitor
5	3	SW_BTN	DI	Software Button H: Power On L: Power Off
6	4	LDO33_O	Power	Internal 3.3V LDO regulator output Connect to 10uF (X5R/X7R) capacitor
7	5	VDD_IO	Power	I/O positive supply input Ensure VDD_IO and MCU I/O voltages are compatible
8	6	LDO18_O	Power	Internal 1.8V LDO regulator output Connect to 10uF (X5R/X7R) capacitor
9	7	WAKEUP	DI	Wakeup from sleep mode (active low) (internal pull-up)
10	8	PMULDO_O	Power	Power management unit output Connect to 1uF (X5R/X7R) capacitor
11	9	P0_4	DO	UART_TX_IND: H: BM78 indicate UART data will be transmitted out after certain timing. (Setting by UI at "MCU setting", default wait 5ms)*1 L: Otherwise STATUS_IND_2: BM78 State indication, refer to P1_5
12	10	P1_5	DO	STATUS_IND: Bluetooth link status indication
13	11	P1_2/SCL	DO	I ² C SCL
14	12	P1_3/SDA	DIO	I ² C SDA
15	13	P1_7/CTS	DIO	Configurable Control or Indication pin or UART CTS (input)
16	14	P0_5	DIO	Configurable Control or Indication pin
17	15	P0_0/RTS	DIO	Configurable Control or Indication pin or UART RTS (output)
18	16	P2_0	DI	System configuration (internal pull-up)
19	17	P2_4	DI	System configuration (internal pull-up)
20	18	EAN	DI	External address-bus negative System configuration (internal pull-down) ROM: no connect FLASH: connect 4.7kohm to GND
21	19	RST_N	DI	Module reset (active low) (internal pull-up) Apply a pulse of at least 63 ns
22	20	RXD	DI	UART data input
23	21	TXD	DO	UART data output

Legend: Pin type abbreviation: A = Analog, D = Digital, I = Input, O = Output

TABLE 1-1: PIN DESCRIPTION (CONTINUED)

S3 Pin	03 Pin	Symbol	Type	Description
24	22	P3_1	DIO	Configurable Control or Indication pin (when configured as input: internal pull-up)
25	23	P3_2	DIO	Configurable Control or Indication pin (when configured as input: internal pull-up)
26	24	P3_3	DIO	Configurable Control or Indication pin (when configured as input: internal pull-up)
27	25	P3_4	DIO	Configurable Control or Indication pin (when configured as input: internal pull-up)
28	26	P3_6	DIO	Do not connect.
29	27	P3_7	DIO	Configurable Control or Indication pin (when configured as input: internal pull-up)
30	28	LED1	DO	Status LED
31	29	GND	Power	Ground reference
--	30	BT_RF	AIO	External antenna connection (50 ohm)
32	--	GND	Power	Ground reference
Legend: Pin type abbreviation: A = Analog, D = Digital, I = Input, O = Output				

BM78SPPX5NC2

Figure 1-2 and Figure 1-3 display the pin diagrams of the BM78SPPS5NC2.

FIGURE 1-2: BM78SPPS5NC2 PIN DIAGRAM

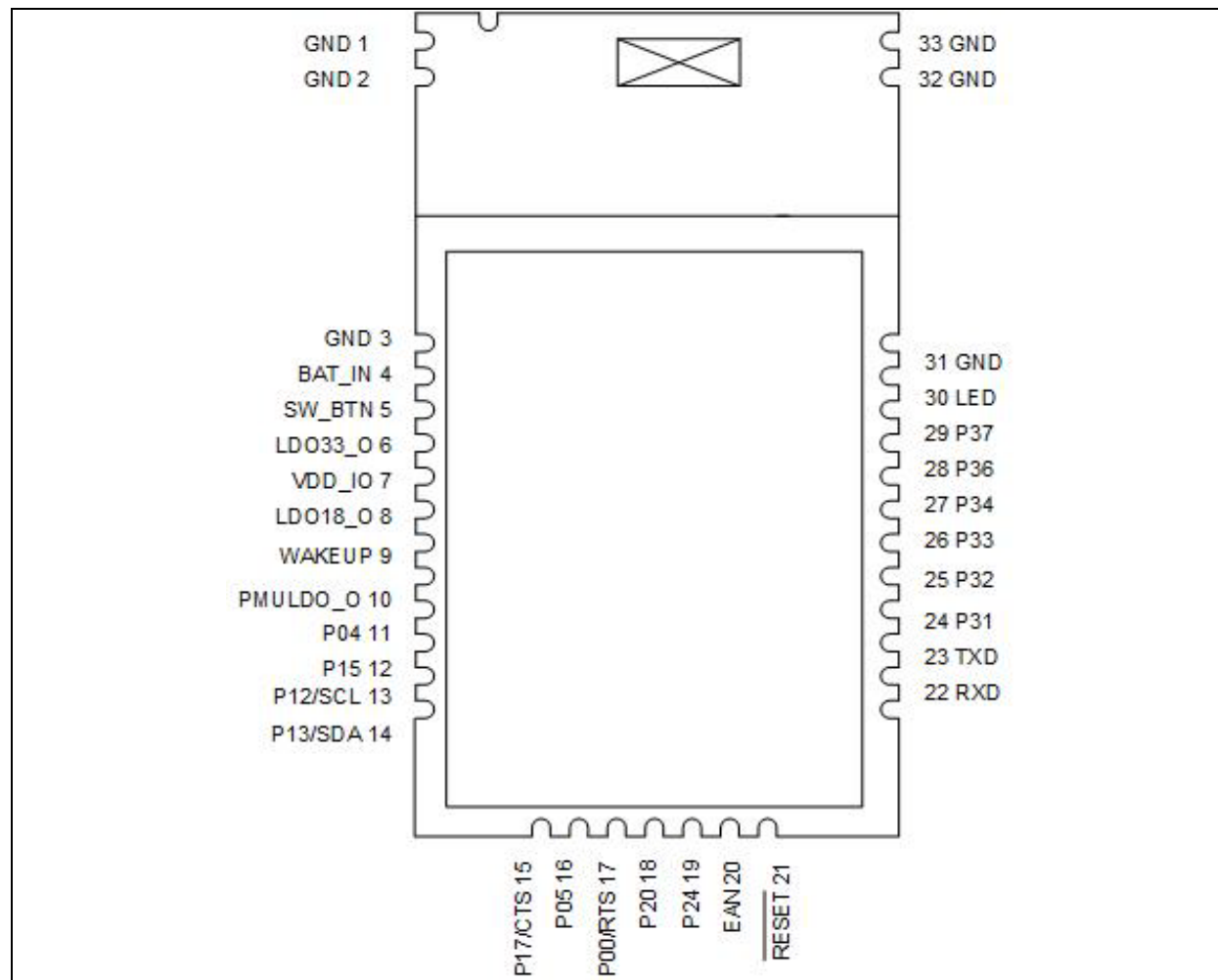
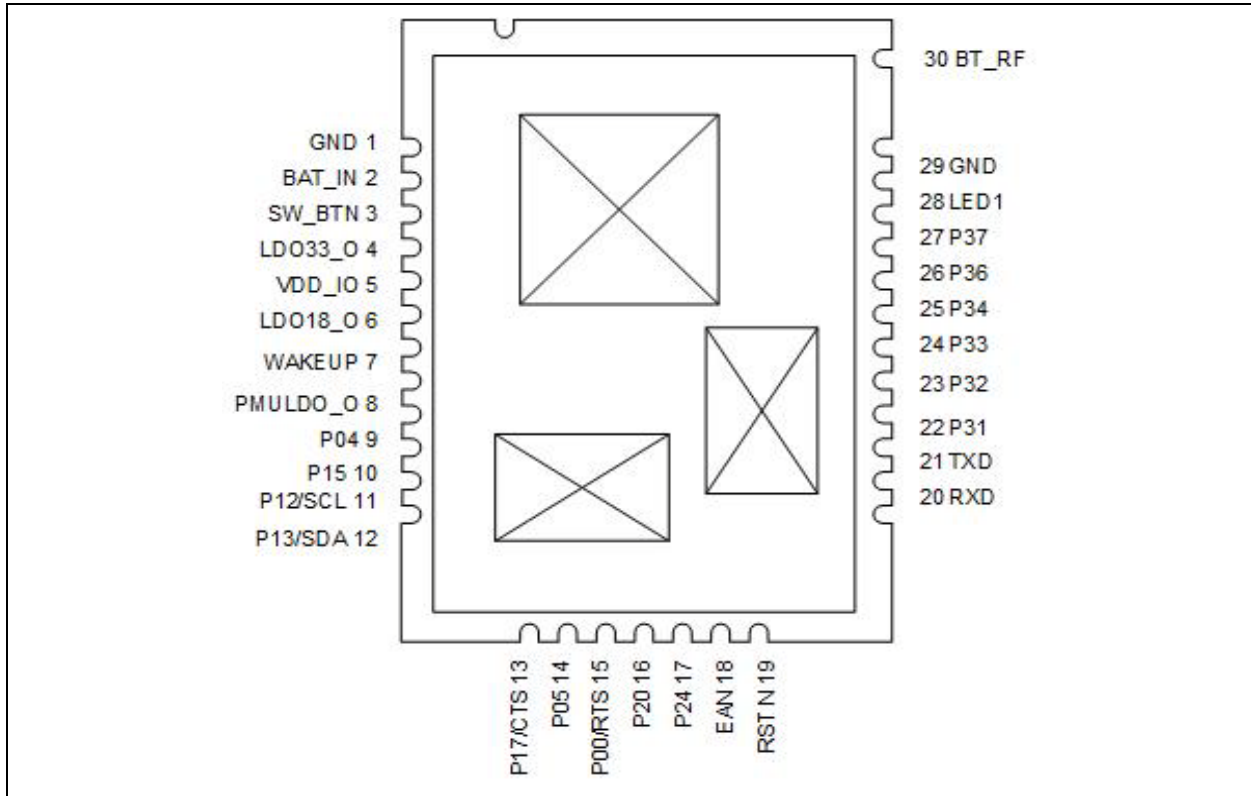


FIGURE 1-3: BM78SPP05NC2 PIN DIAGRAM



BM78SPPX5NC2

1.1 Control and Indication I/O Pins

I/O pins P0_0, P0_5, P1_7, P3_1, P3_2, P3_3, P3_4, and P3_7 are configurable control and indication I/O. Control signals are input to the BM78 module.

Indication signals are output from the BM78 module. [Table 1-2](#) shows configurable I/O pin assignment to control and indication signals.

TABLE 1-2: CONFIGURATION AND INDICATION I/O ASSIGNMENTS

	N/C	UART_RTS ⁽¹⁾⁽²⁾	UART_CTS ⁽¹⁾⁽²⁾	LOW_BATTERY_IND	RSSI_IND	GET_WIFI_INFO_KEY	LINK_DROP_CONTROL (DISCONNECT)	UART_RX_IND	PAIRING_KEY	INQUIRY CONTROL	PROFILE_IND
P0_0		■									
P0_5	■										
P1_7			■								
P3_1										■	
P3_2							■				
P3_3								■			
P3_4									■		
P3_7				■							

Note 1: RTS can only be assigned to P0_0 and CTS to P1_7.

2: RTS/CTS are fixed and cannot be configured while using flow control. Otherwise these pins can be configured as GPIOs.

1.2 Status Indication I/O Pins

I/O pins P1_5 and P0_4 are Status Indicator 1 and 2 signals respectively. Together, they provide status indication to the MCU as shown in [Table 1-3](#).

TABLE 1-3: STATUS INDICATION

P1_5/STATUS_IND_1	P0_4/STATUS_IND_2	Indication
H	H	Power-on to setting default and deep-sleep State. HH status should be stable for at least 500 ms.
H	L	Access state
L	H	Link state (UART data transmitting)
L	L	Link state (no UART data transmitted)

1.3 System Configuration

I/O pins P2_0, P2_4, and EAN place the BM78 module into operating modes as shown in [Table 1-4](#). P2_0, P2_4, and EAN each have internal pull-ups.

TABLE 1-4: SYSTEM CONFIGURATION SETTINGS

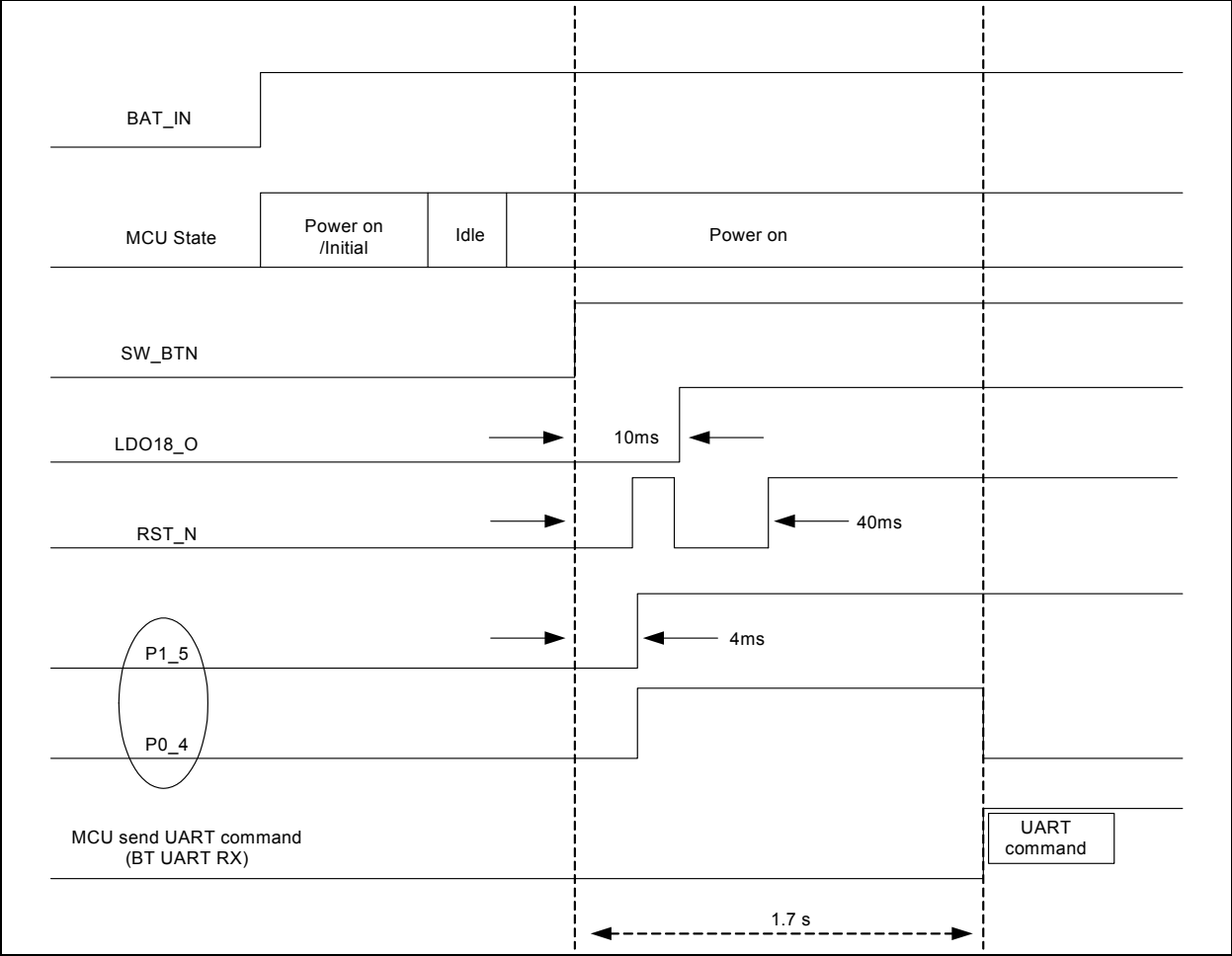
IC	P2_0	P2_4	EAN	Operational Mode
IS1678S	Low	High	High	Write EEPROM and test mode
	High	High	High	Normal operation/APP mode
IS1678SM	Low	Low	High	Write FLASH
	Low	High	Low	Write EEPROM and test mode
	High	High	Low	Normal operation/APP mode

1.4 Software Button (SW_BTN)

The Software Button (SW_BTN) input pin powers the BM78 module ON (high) or OFF (low) in to the S4 mode. S4 is the deep sleep mode and S2 is the sleep mode. The S4 mode is only initiated by SW_BTN. Power consumption is lower in the S4 mode.

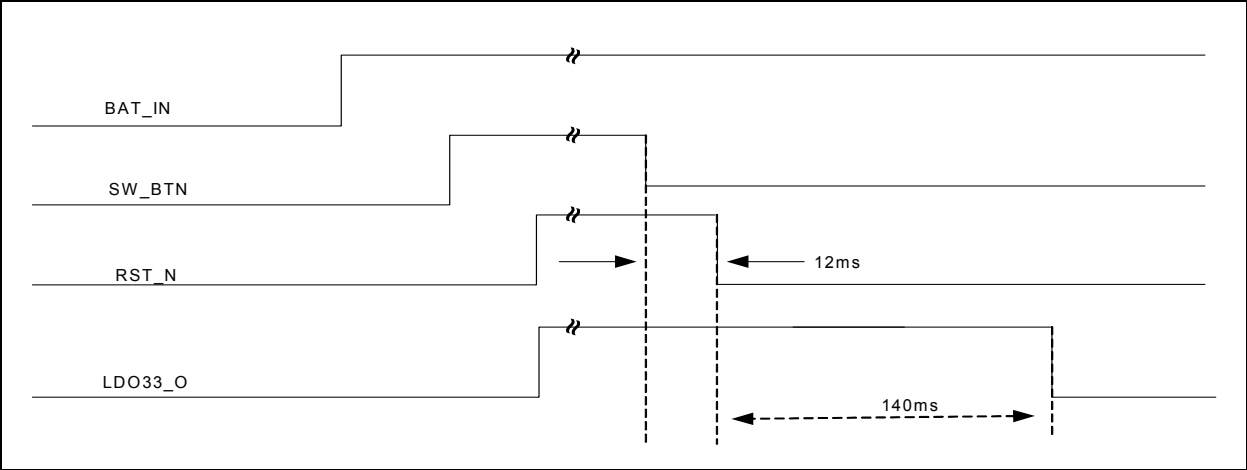
[Figure 1-4](#), [Figure 1-5](#), and [Figure 1-6](#) display the waveforms for the BM78 module in the high and the low (access and link) states respectively.

FIGURE 1-4: SW_BTN TIME (HIGH) AT APP MODE



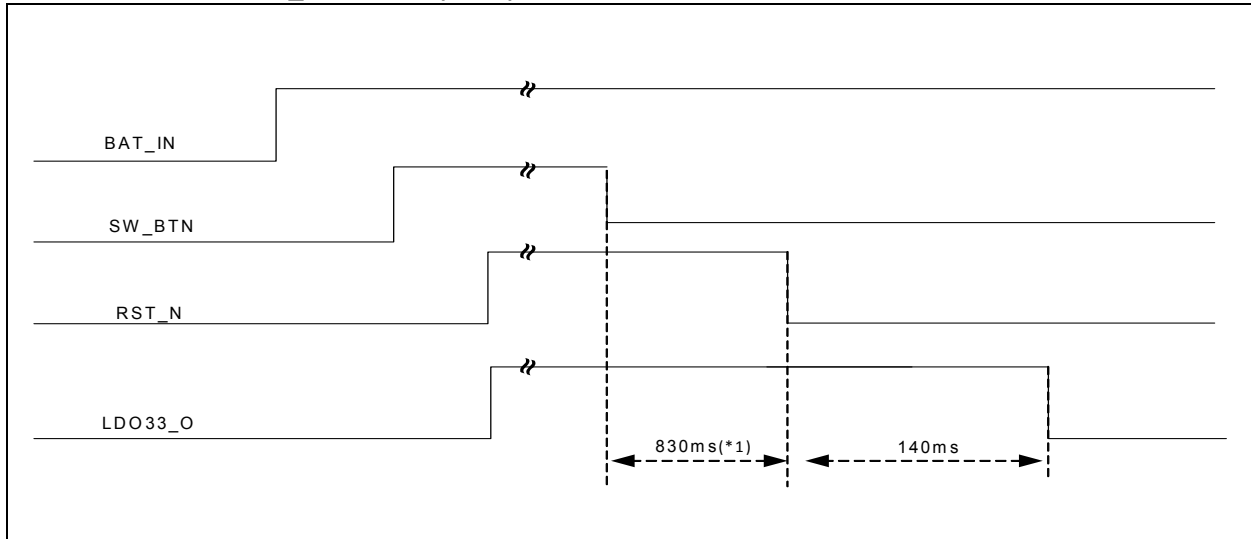
Note 1: P0_4/P1_5 state: Refer to [Table 1-3](#).
2: Reset is floating

FIGURE 1-5: SW_BTN TIME (LOW) AT ACCESS STATES



Note 1: SW_BTN pull low cannot be active in deep-sleep state.
2: Reset is floating.

FIGURE 1-6: SW_BTN TIME (LOW) AT LINK STATES



Note 1: *1: this is a typical value measured on iPhone 6. This time duration will vary from one smart phone to another.

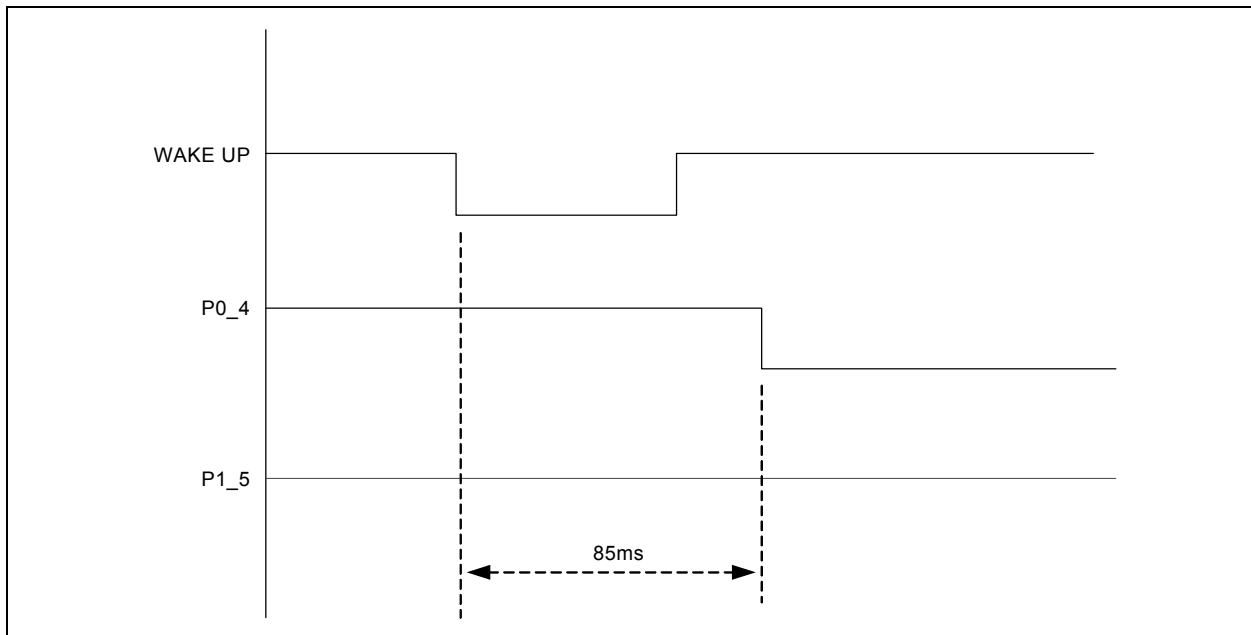
2: SW_BTN pull low cannot be active in deep sleep state.

3: Reset is floating.

1.5 WAKE UP

The wake-up input pin wakes the BM78 module from sleep mode (active low). Wake-up is always from S2 (sleep mode) to standby mode. [Figure 1-7](#) displays the waveforms for the BM78 module in the Wake Up mode.

FIGURE 1-7: WAKEUP TIME



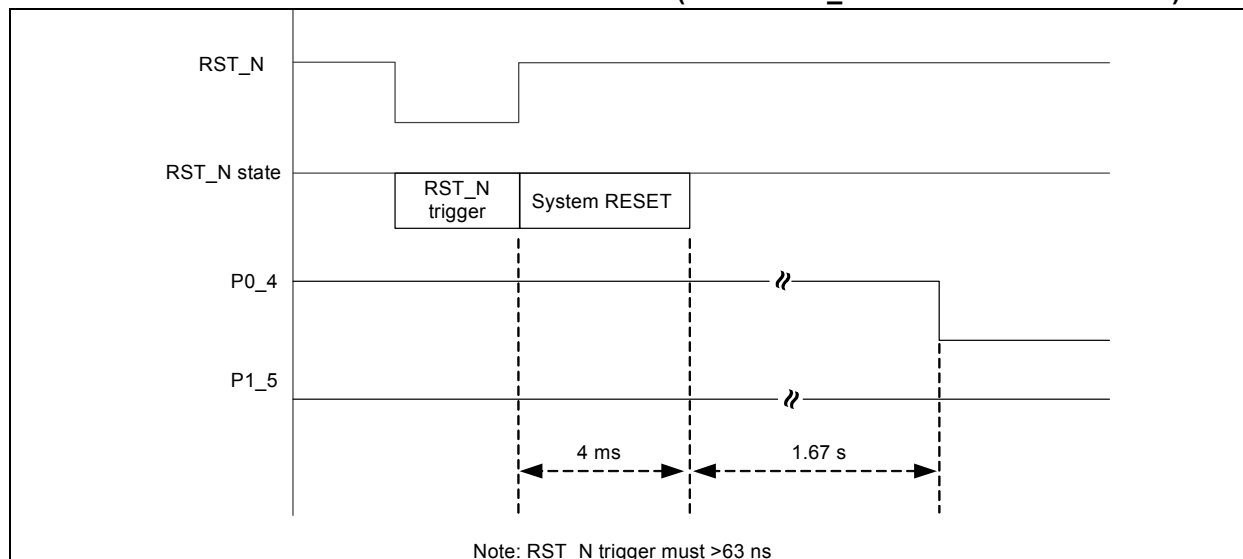
1.6 EXTERNAL RESET

A watchdog timer is capable of resetting the module. BM78 module has an integrated Power-On Reset (POR) circuit that resets all circuits to a known power-on state. This action can also be driven by an external reset signal that can be used to externally con-

trol the device, forcing it into a power-on reset state. The RST signal input is active low and no connection is required in most applications.

Figure 1-8 displays the waveforms for the BM78 module when it is reset (RST_N is set to active low).

FIGURE 1-8: TIMING WAVEFORMS ON RESET (WHEN RST_N IS SET TO ACTIVE LOW)



1.7 LED DRIVER

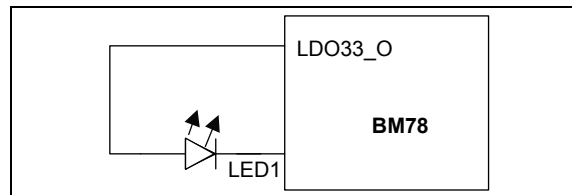
There is one dedicated LED driver to control the LED. The LED can be connected directly with the BM78 module as shown in Figure 1-9. The LED maximum current is 5 mA and it has 16 steps to trim brightness.

The status LED (LED1) indicates:

- Standby
- Link Back
- Low Battery
- Inquiry
- Link
- Page

Each indication is a configurable flashing sequence. LED brightness can also be configured.

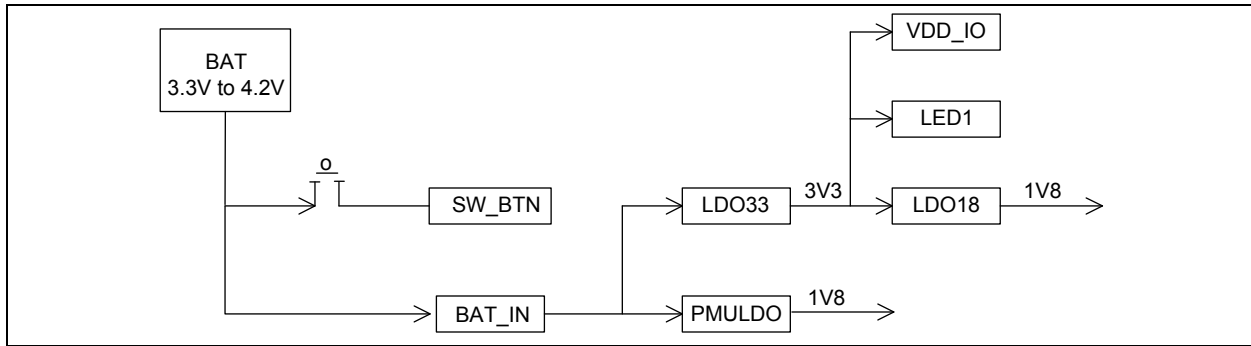
FIGURE 1-9: LED DRIVER



1.8 Power Tree

Figure 1-10 displays the power tree diagram of the BM78 module.

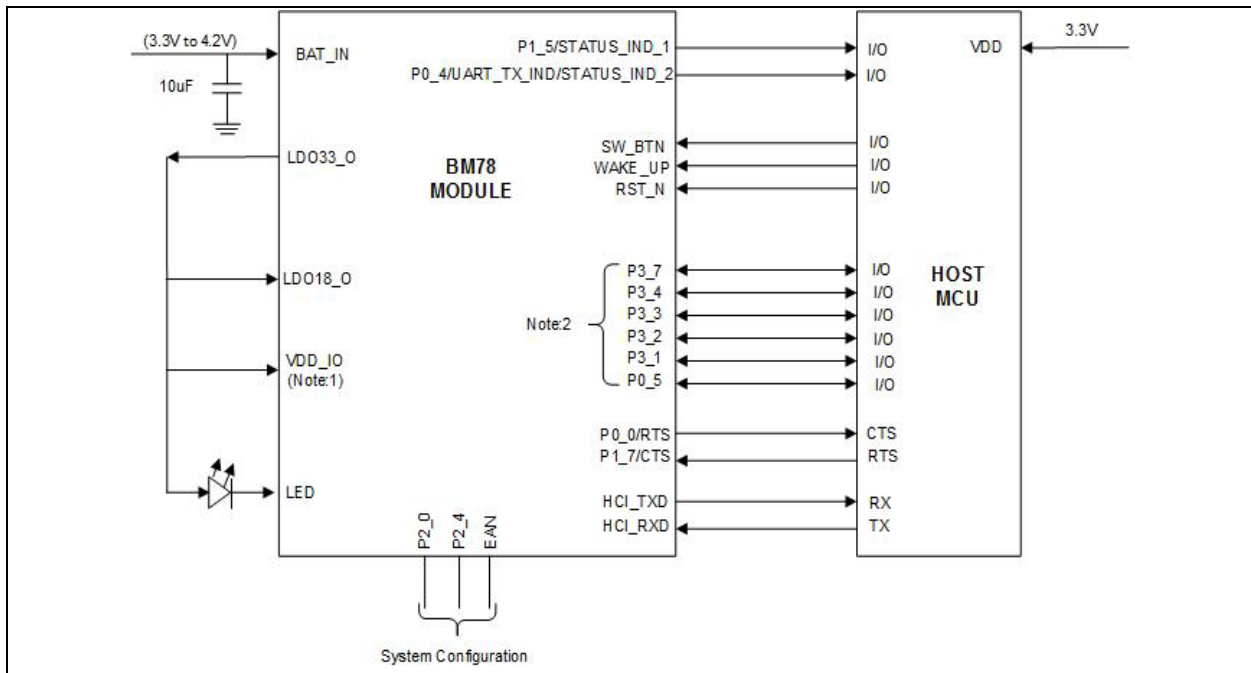
FIGURE 1-10: POWER TREE DIAGRAM



1.9 Host MCU Interface over UART

Figure 1-11 displays an example of UART interface with MCU.

FIGURE 1-11: POWER AND MCU INTERFACE EXAMPLE FOR THE BM78



Note 1: Ensure VDD_IO and MCU VDD voltages are compatible.

2: Control and indication ports are configurable.

Figure 1-11 shows an example power scheme using a 3.3V to MCU V_{DD}. Battery power is applied to the BAT_IN pin. From the LDO33_O pin, voltage can be routed to the VDD_IO pin and external circuitry including the MCU. This power scheme ensures that the BM78 module and MCU I/O voltages are compatible.

CAUTION: The internal 3.3V LDO current source must not exceed 50mA maximum.

BM78SPPX5NC2

NOTES:

2.0 THROUGHPUT

The BM78 module interfaces with host MCU over UART (TXD and RXD pins). It is highly recommended to use hardware flow control pins RTS and CTS. The BM78 module hardware flow control is disabled by

default and must be configured to be enabled. The UART Baud is configurable. The available signal rates are listed in [Table 2-1](#).

TABLE 2-1: UART BAUD

Baud	Crystal Frequency (MHz)	Actual Baud	Error Rate (%)
921600	16	941176	2.12
460800	16	457143	-0.79
307200	16	307692	0.16
230400	16	231884	0.64
115200	16	117647	2.1
57600	16	57145	-0.97
38400	16	38462	0.16
28800	16	28623	-0.62
19200	16	19231	0.16
14400	16	14480	0.55
9600	16	9615	0.16
4800	16	4808	0.16
2400	16	2399	-0.03

TABLE 2-2: APP MODE THROUGHPUT REPORT

BR/EDR Mode iPad® mini (Wi-Fi® disable){iOS® 7.0.4 (11B554a)}				
921600 bps	echo Tx	echo Rx	Tx	Rx
Burst Throughput (byte/s)	14384.46	9845.31	14521.5	14333.3
Normal Throughput (byte/s)	8437.462	8375.28	6674.11	14399.4
BR/EDR Mode iPad mini (Wi-Fi disable){iOS 7.0.4 (11B554a)}				
115200 bps	echo Tx	echo Rx	Tx	Rx
Burst Throughput (byte/s)	11080.55	9284.37	11640.3	11134.8
Normal Throughput (byte/s)	6248.758	6211.69	11513	11158.4
BR/EDR mode Android® Samsung® Note3/Android 4.3				
921600 bps	echo Tx	echo Rx	Tx	Rx
Normal Throughput (byte/s)	9727.704	9041.34	17030.1	10233.6
BR/EDR mode Android Samsung Note3/Android 4.3				
115200 bps	echo Tx	echo Rx	Tx	Rx
Normal Throughput (byte/s)	11312.2	10548.5	9842.5	11436.4
LE mode iPad mini (Wi-Fi disable){iOS 7.0.4 (11B554a)}				
115200 bps	Tx	Rx (response)	Rx (Reliable Burst Transmit)	
Normal Throughput (byte/s)	7935.2	3337.3	7082.1	
LE mode iPad mini (Wi-Fi disable){iOS 7.0.4 (11B554a)}				
921600 bps	Tx	Rx (response)	Rx (Reliable Burst Transmit)	
Normal Throughput (byte/s)	8063.2	3384.5	6839.9	

BM78SPPX5NC2

NOTES:

3.0 ELECTRICAL CHARACTERISTICS

Table 3-1 and the following tables provide the recommended operating conditions and the electrical specifications of the BM78 module.

TABLE 3-1: RECOMMENDED OPERATING CONDITIONS

Rating		Min.	Typical	Max.
Storage temperature range		-65°C	+25°C	+150°C
Ambient Operating temperature range		-20°C	+25°C	+70°C
Relative Humidity (Operating)		10%	—	90%
Relative Humidity (Storage)		10%	—	90%
ESD	HBM	—	±2KV	—
	MM	—	200V	—
HTOL ⁽¹⁾		—	1000 hrs	—
Supply voltage: BAT_IN		3.2V	—	4.3V
Supply voltage: VDD_IO		2.8V	3.3V	3.63V
Supply voltage: LDO18_IN		1.9V	3.3V	3.63V
Supply voltage: 1V8, VCC_RF, VDD_XO, AVDD_SAR		1.8V	1.9V	2.1V
SW_BTN		1.7V	—	4.3V
LED1		—	—	3.6V
Reset $V_{TH,res}$ threshold voltage		—	1.6V	—
V_{IL} input logic levels low		-0.3V	—	0.8V
V_{IH} input logic levels high		2.0V	—	3.6V
V_{OL} output logic levels low ($I_{OL} = 12mA$)		—	—	0.4V
V_{OH} output logic levels high ($I_{OH} = 12mA$)		2.4V	—	—
RF Tx mode		—	—	43 mA
RF Rx mode		—	—	37 mA
Note 1: HTOL life test condition: +125°C, BAT_IN = 4.2V, LDO33_O = 3.3V, LDO18_O = 1.9V				

TABLE 3-2: 1.8V LDO ⁽¹⁾(²)

Parameter	Min.	Typical	Max.	Unit
Operating Temperature	-20	—	70	°C
Input Voltage (V_{in}) ⁽³⁾	2.0	—	3.6	V
Output Current ($V_{IN} = 3.0V$ /load regulation with 80mV drop)	—	100	—	mA
Quiescent Current ($V_{in} < 3.0V$)	—	13	—	uA
Programmable output voltage (Condition: LDO18_IN = 3.0V)				
Range (3-bit selectable)	1.5	—	2.2	V
Default when power-on	—	1.8	—	V
Output steps	—	100	—	mV/step
Note 1: With 1uF capacitors at LDO18_O as the condition for IP verification.				
2: Output voltage can be calibrated by using the MP tool.				
3: When $V_{in} > 2.4V$, the LDO could supply 100mA loading; when $V_{in} < 2.4V$, the output voltage drop depends on the loading.				

BM78SPPX5NC2

TABLE 3-3: 3.3V LDO(¹)(²)

Parameter	Min.	Typical	Max.	Unit
Operating Temperature	-20	—	70	°C
Input Voltage (V _{IN})	3.2	—	4.3	V
Output Current (V _{IN} = 3.6V /load regulation with 100mV drop)	—	100	—	mA
Quiescent Current (V _{IN} = 3.6V)	—	150	—	uA
Programmable output voltage (Condition: BAT_IN = 4.3V)				
Range (3-bit selectable)	2.5	—	3.3	V
Default when power-on	—	3.3	—	V
Steps	—	100	—	mV/Step
Note 1: With 10uF capacitor at LDO33_O as the condition for IP verification.				
2: Output voltage can be calibrated by using the MP tool.				

TABLE 3-4: PMU LDO(¹)(²)

Parameter	Min.	Typical	Max.	Unit
Operating Temperature	-20	—	70	°C
Input Voltage (V _{IN})	3.2	—	4.3	V
Output Current (V _{IN} = 3.6V/load regulation with 0.3mV drop)	—	100	—	uA
Quiescent Current (V _{IN} = 3.6V)	—	120	—	uA
Adjustable output voltage (Condition: V _{in} = 3.3V)				
Range (2-bit selectable)	1.8	—	2.1	V
Default when power-on	—	1.9	—	V
Steps	—	100	—	mV/Step
Note 1: With 1uF capacitor at PMULDO_O as the condition for IP verification.				
2: Output voltage can be calibrated by using the MP tool.				

TABLE 3-5: SAR-ADC AND BATTERY VOLTAGE DETECTOR(¹)

Parameter	Min.	Typical	Max.	Unit
Operating Temperature	-20	—	70	°C
AVDD_SAR power supply	—	1.8	—	V
SAR_BAT(BAT_IN)	1.1	—	4.5	V
Resolution	—	10	—	bit
Operating Current (including bandgap)	—	—	1	mA
Deep-sleep Current	—	—	1	uA
Note 1: SAR_BAT is shorted to BAT_IN internally for battery voltage detection				

TABLE 3-6: INTENSITY CONTROLLABLE LED DRIVER

Parameter	Min.	Typical	Max.	Unit
Operating Temperature	-20	—	70	°C
Open-drain Voltage	—	—	3.6	V
Current Step	—	0.3	—	mA
Programmable Current Range	0	—	5	mA
Intensity control	—	16	—	step
Power down open-drain current	—	—	1	uA
Deep-sleep Current	—	—	1	uA

TABLE 3-7: POWER CONSUMPTION-CLASSIC⁽¹⁾⁽²⁾

Test Condition	Current Consumption (avg.) (mA)	Remarks
Standby mode	2.543	—
Deep-sleep mode	0.187	—
Connected+Sniff, Master (no data)	0.541	No data was transmitted Sniff interval = 500 ms
Connected+Sniff, Slave (no data)	0.551	No data was transmitted Sniff interval = 500 ms
Data, Master	10.67	Data transmitted at 115200 bps; block size = 500
Data, Slave	14.87	Data transmitted at 115200 bps; block size = 500
Note 1: Classic BR/EDR, RX_IND Function Enabled		
2: The data is from IS1678S-151		

TABLE 3-8: POWER CONSUMPTION -LOW ENERGY⁽¹⁾⁽²⁾⁽³⁾

Test Condition	Current Consumption (avg.) (mA)	Remarks
Deep-sleep mode	0.13	—
LE fast advertising	1.21	LE fast advertising interval = 100 ms
	0.88	LE fast advertising interval = 160 ms
	0.48	LE fast advertising interval = 500 ms
	1.72	LE fast advertising interval = 100 ms+ Beacon 100 ms
	0.62	LE fast advertising interval = 500 ms+ Beacon 500 ms
Reduced Power advertising	0.39	LE Reduced Power advertising interval = 961 ms
	1.00	LE Reduced Power advertising interval = 961 ms+Beacon 100 ms
	0.51	LE Reduced Power advertising interval = 961 ms+Beacon 500 ms
Connected (No data)	0.39	Connection interval = 1500 ms
	0.43	Connection interval = 600 ms
Note 1: Low Energy, RX_IND Function Enabled		
2: The data is from IS1678S-151		
3: Only LE		

BM78SPPX5NC2

TABLE 3-8: POWER CONSUMPTION -LOW ENERGY (¹)(²)(³)

Test Condition	Current Consumption (avg.) (mA)	Remarks
Connected (iPhone 6→IC)	0.45	Connection interval = 500 ms
	0.60	Connection interval = 200 ms
Connected (IC→iPhone 6)	6.6	Connection interval = 500 ms
	7.0	Connection interval = 200 ms
Note 1: Low Energy, RX_IND Function Enabled		
2: The data is from IS1678S-151		
3: Only LE		

4.0 RADIO CHARACTERISTICS

Table 4-1 provides the transmitter performance characteristics of the BM78 module.

TABLE 4-1: TRANSMITTER PERFORMANCE

	Min.	Typical	Max.	Bluetooth Specification	Unit
BDR power	—	2	—	-6 ~ +4	dBm
EDR (2M/3M) power	—	-1	—	-6 ~ +4	
LE power	—	2	—	-20 ~ +10	
Note 1: The RF Transmit power can be calibrated during production by using the MP Tool software and the MT8852 Bluetooth Test equipment. 2: Test condition: V _{CC RF} = 1.80V, temperature = 25°C.					

Table 4-2 provides the receiver performance characteristics of the BM78 module.

TABLE 4-2: RECEIVER PERFORMANCE

Basic Data Rate	Min.	Typical	Max.	Bluetooth Specification	Unit
BDR Sensitivity	—	-90	—	≤-70	dBm
EDR 2M Sensitivity	—	-90	—		
EDR 3M Sensitivity	—	-82	—		
LE Sensitivity	—	-92	—		
Note 1: Test condition: V _{CC RF} = 1.80V, temperature = 25°C.					

BM78SPPX5NC2

NOTES:

5.0 PHYSICAL DIMENSIONS

Figure 5-1 shows the physical dimensions of the BM78SPPS5NC2 module.

FIGURE 5-1: BM78SPPS5NC2 MODULE DIMENSIONS

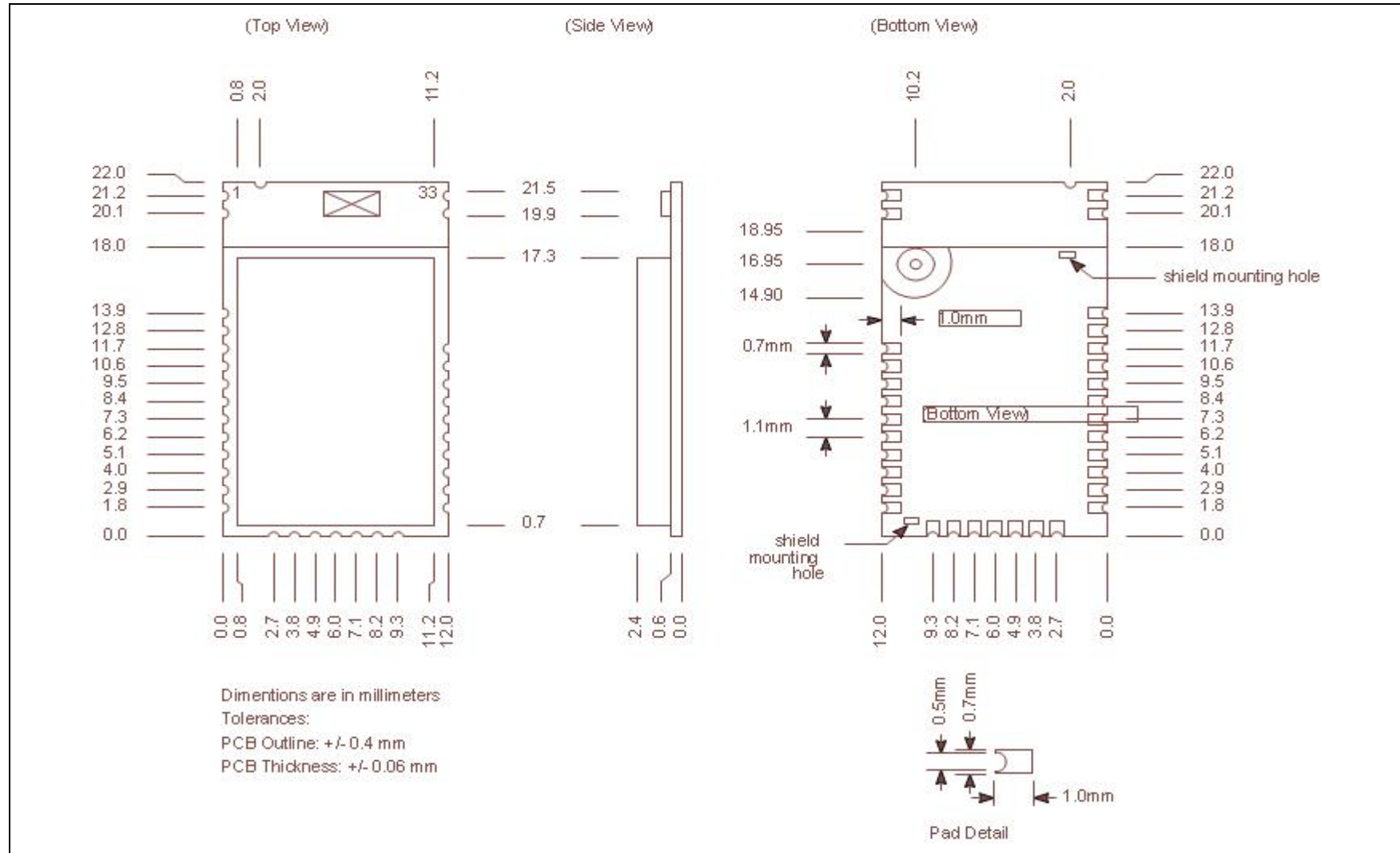


Figure 5-2 shows the recommended host PCB foot print.

FIGURE 5-2: BM78SPPS5NC2 RECOMMEDED PCB FOOTPRINT

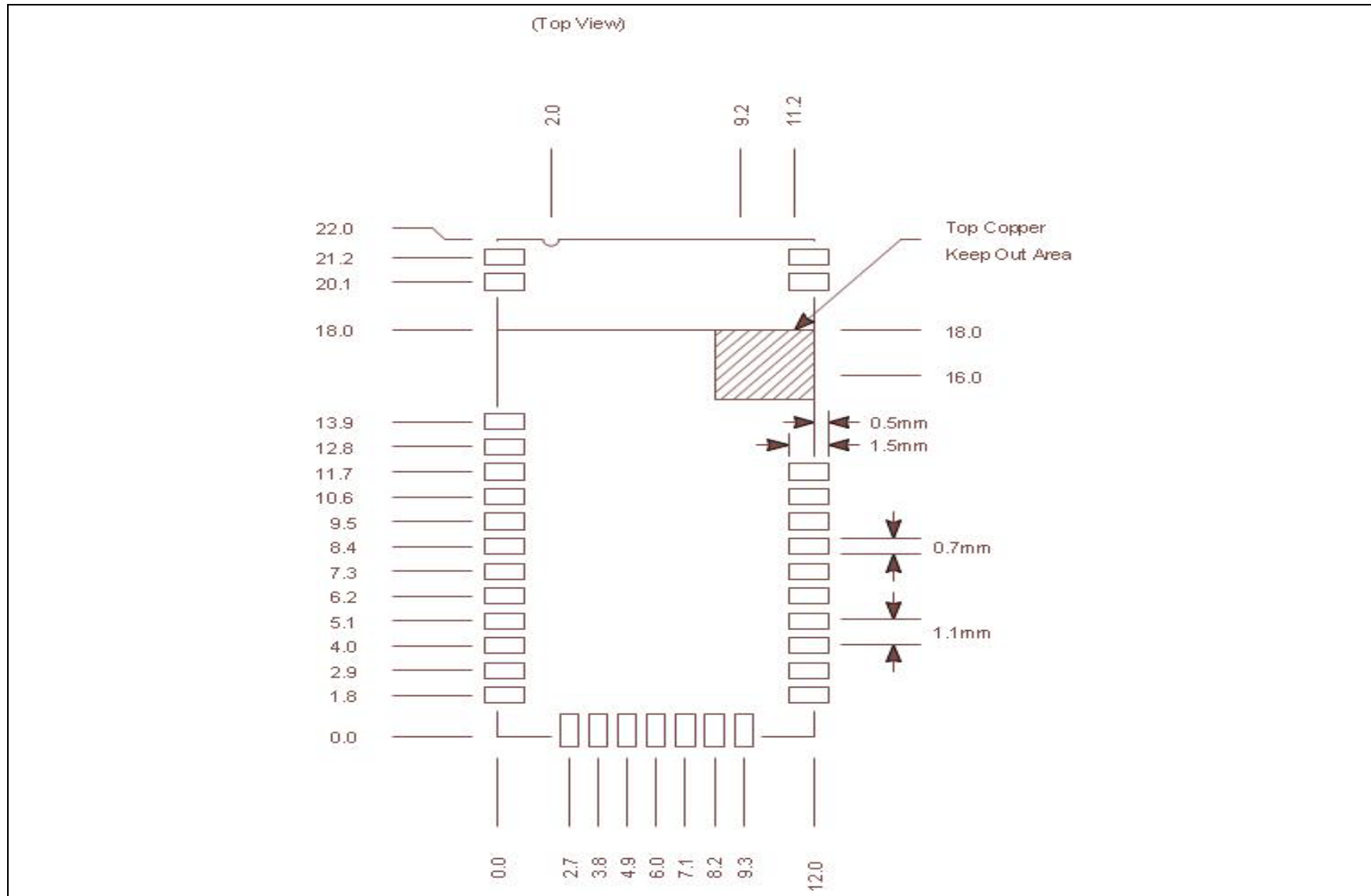


Figure 5-3 illustrates the recommendations for mounting the BM78SPPS5NC2 module on the host PCB. There should not be top copper layer near the test pin area shown in Figure 5-2. When laying out the host PCB, the areas under the antenna should not contain any top, inner layer, or bottom copper as displayed in Figure 5-3. A low-impedance ground plane will ensure best radio performance (best range and lowest noise). Figure 5-3 shows a minimum ground plane area to the left and right of the module for best antenna performance. The ground plane can be extended beyond the minimum recommended as needed for host PCB EMC noise reduction. For best range performance, keep all external metal away from the ceramic chip antenna at least 31 mm.

FIGURE 5-3: BM78SPPS05NC2 HOST PCB MOUNTING SUGGESTION

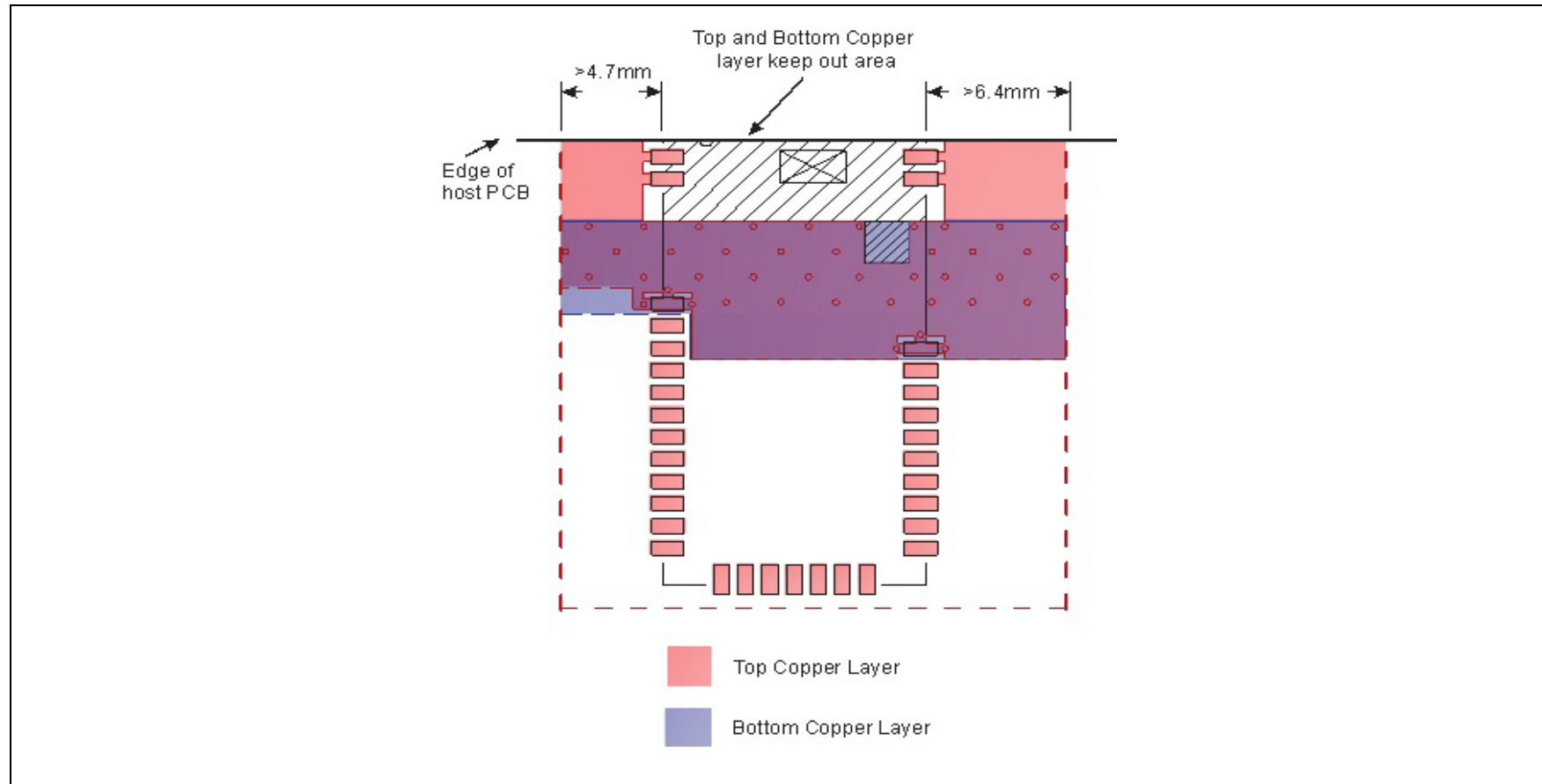


Figure 5-4 shows the physical dimensions of the BM78SPP05NC2 module.

FIGURE 5-4: BM78SPP05NC2 MODULE DIMENSIONS

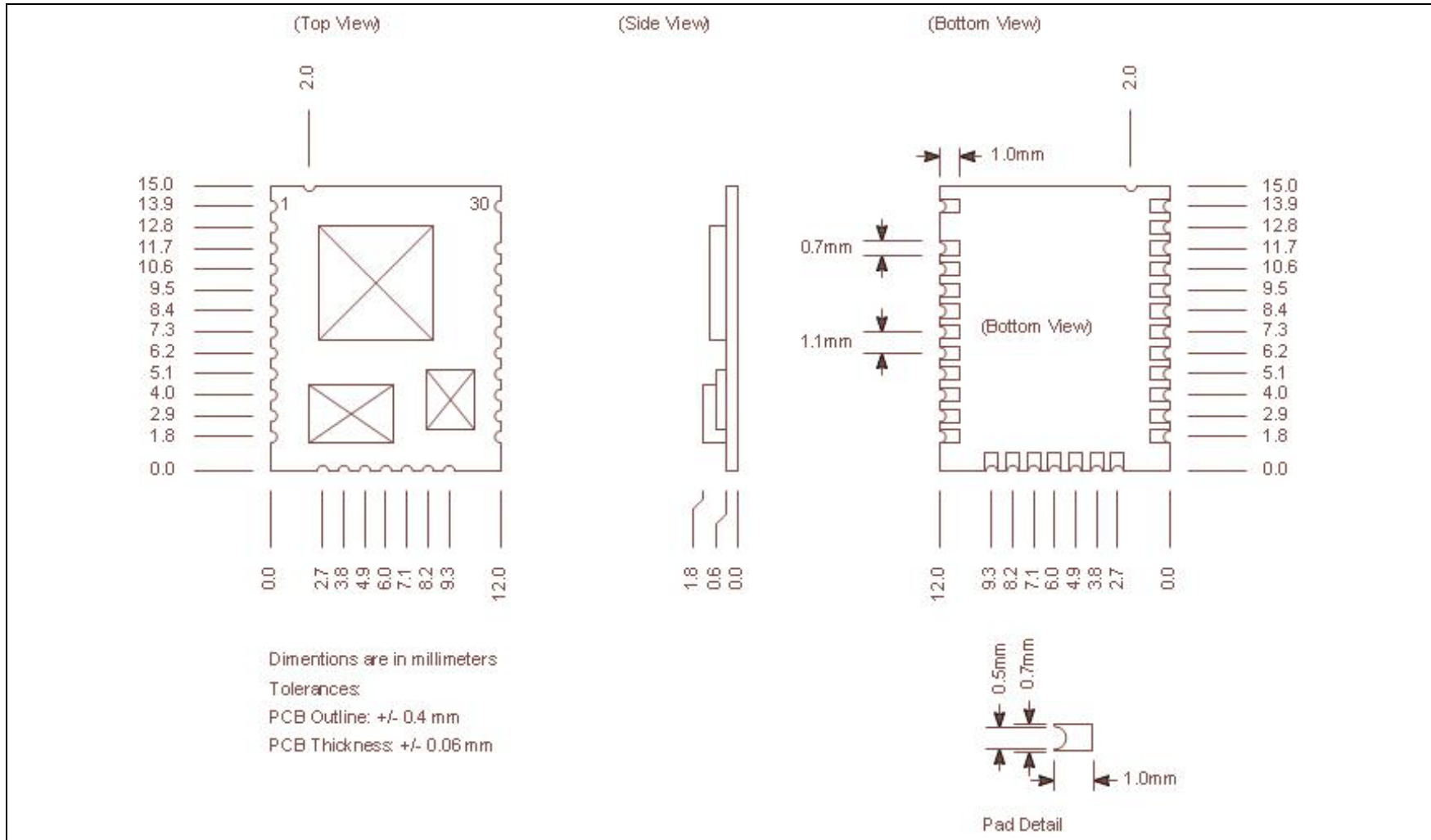


Figure 5-5 shows the recommended host PCB foot print.

FIGURE 5-5: BM78SPP05NC2 RECOMMENDED PCB FOOTPRINT

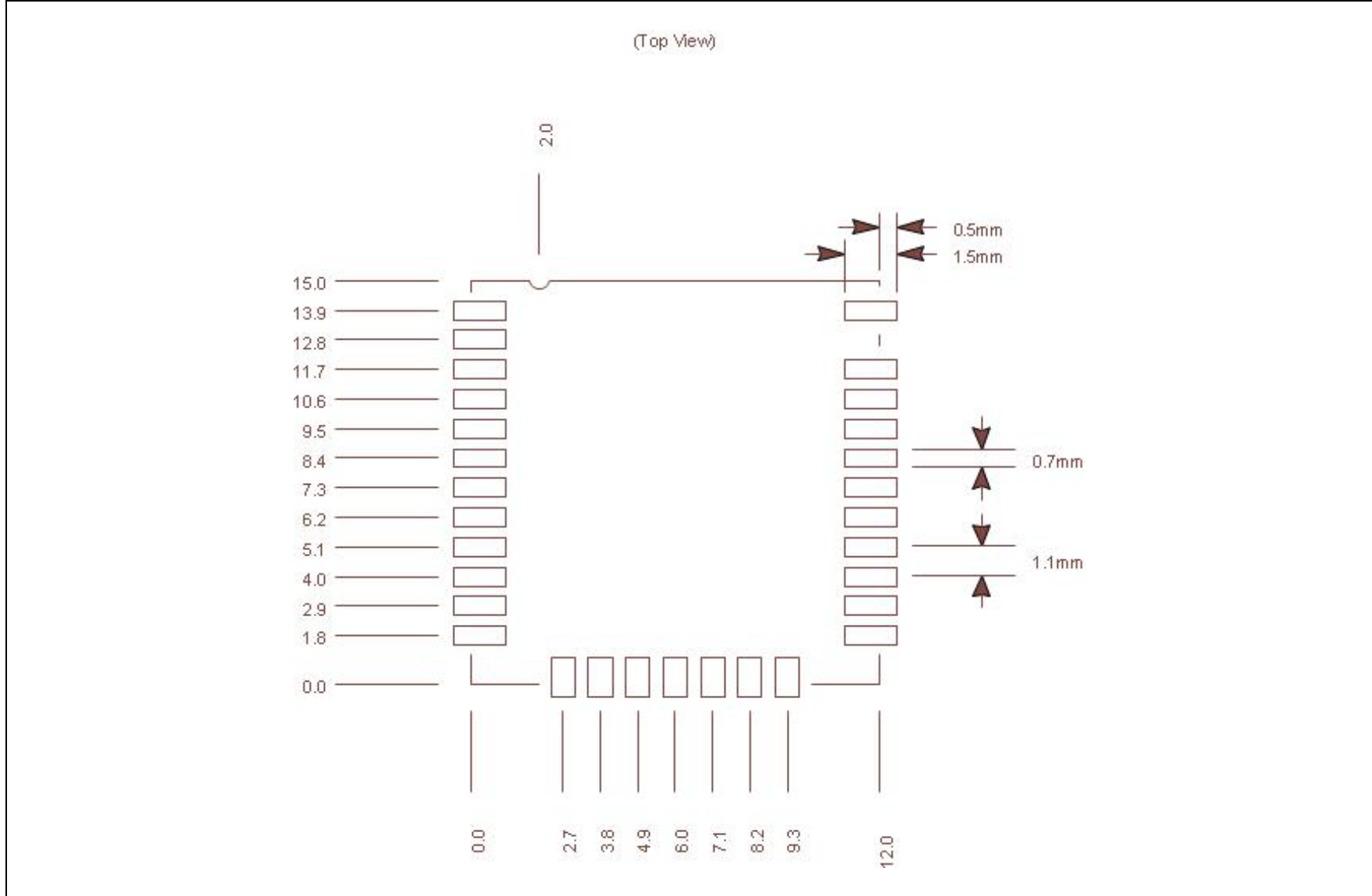
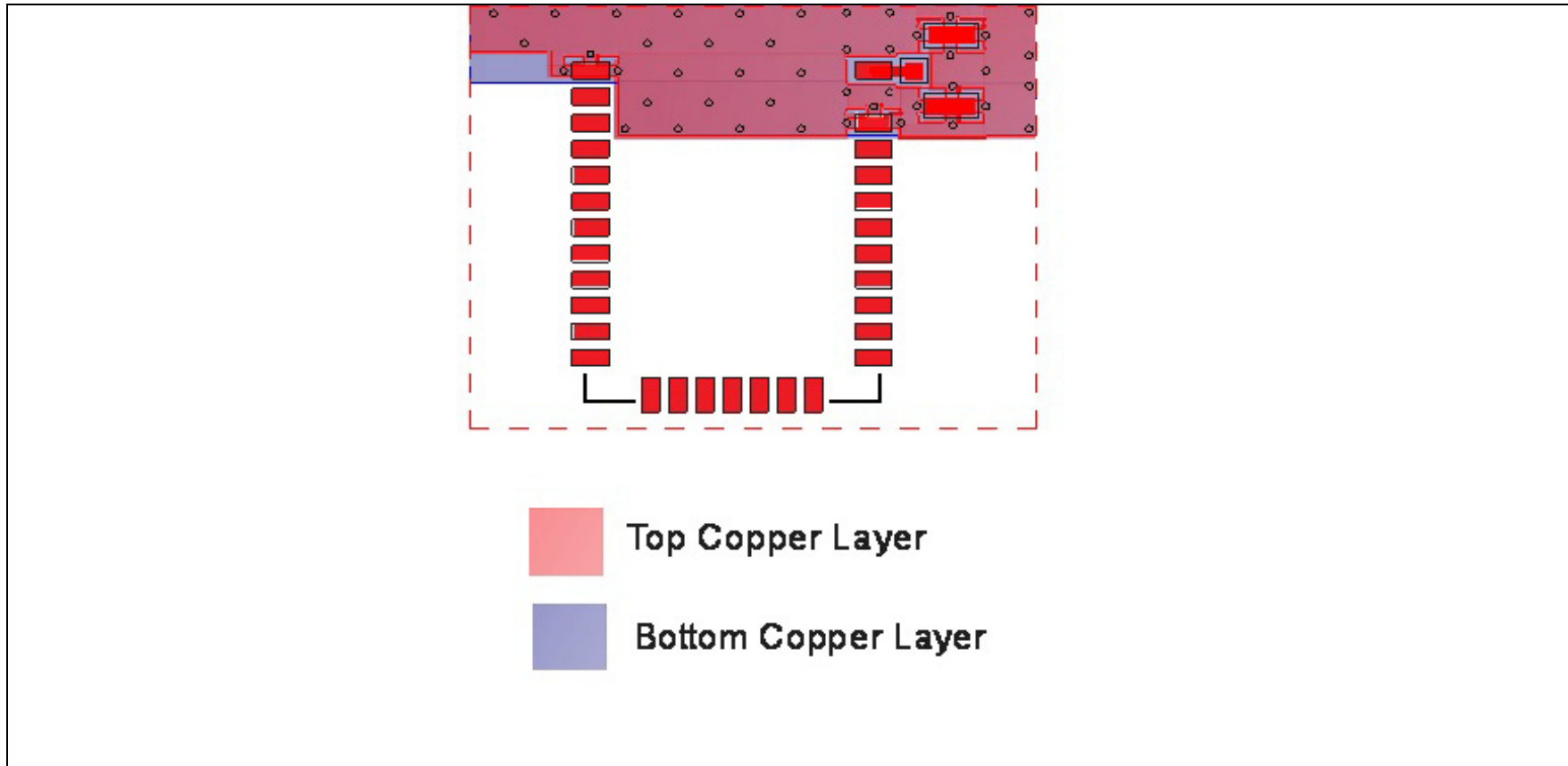


Figure 5-6 shows the recommended mounting details for the BM78SPP03NC2 module. It is highly recommended to layout the host PCB as suggested in Figure 7-6. A low-impedance ground plane will ensure best radio performance (best range, lowest noise). Pin 30 (BT_RF) is a 50 ohm connection to an external antenna connector, PCB trace antenna, or component (ceramic chip) antenna through a host PCB 50 ohm micro-strip trace. This trace can be extended to include passive parts for antenna attenuation padding, impedance matching, or to provide test posts. It is recommended that the micro-strip trace be as short as possible for minimum loss and best impedance matching. If the micro-strip trace is longer, it should be a 50 ohm impedance. Figure 7-6 shows an example connection to U.FL connector.

FIGURE 5-6: BM78SPP05NC2 HOST PCB MOUNTING SUGGESTION



5.1 Soldering Recommendations

The BM78 module wireless module should be assembled using standard lead-free reflow profile IPC/JEDEC J-STD-020. The module can be soldered to the host PCB by using standard leaded and lead-free solder reflow profiles. To avoid damaging the module, the following recommendations are provided:

- Follow solder reflow recommendations in Microchip Technology Application Note AN233 Solder Reflow Recommendation (DS00233).
- Do not exceed peak temperature (T_P) of 250°C.
- Refer to the solder paste data sheet for specific reflow profile recommendations.
- Use no-clean flux solder paste.
- Do not wash as moisture can be trapped under the shield.
- Use only one flow. If the PCB requires multiple flows, apply the module on the final flow.

Standard: IPC/JEDEC J-STD-020

Condition: Preheat: 150~200 °C ?60~120 seconds

Average ramp-up rate (217 °C to peak): 3 °C /sec max.

Temperature maintained above 217 : 60~150 seconds

Time within 5 °C of peak temperature: 30 ~ 40 seconds.

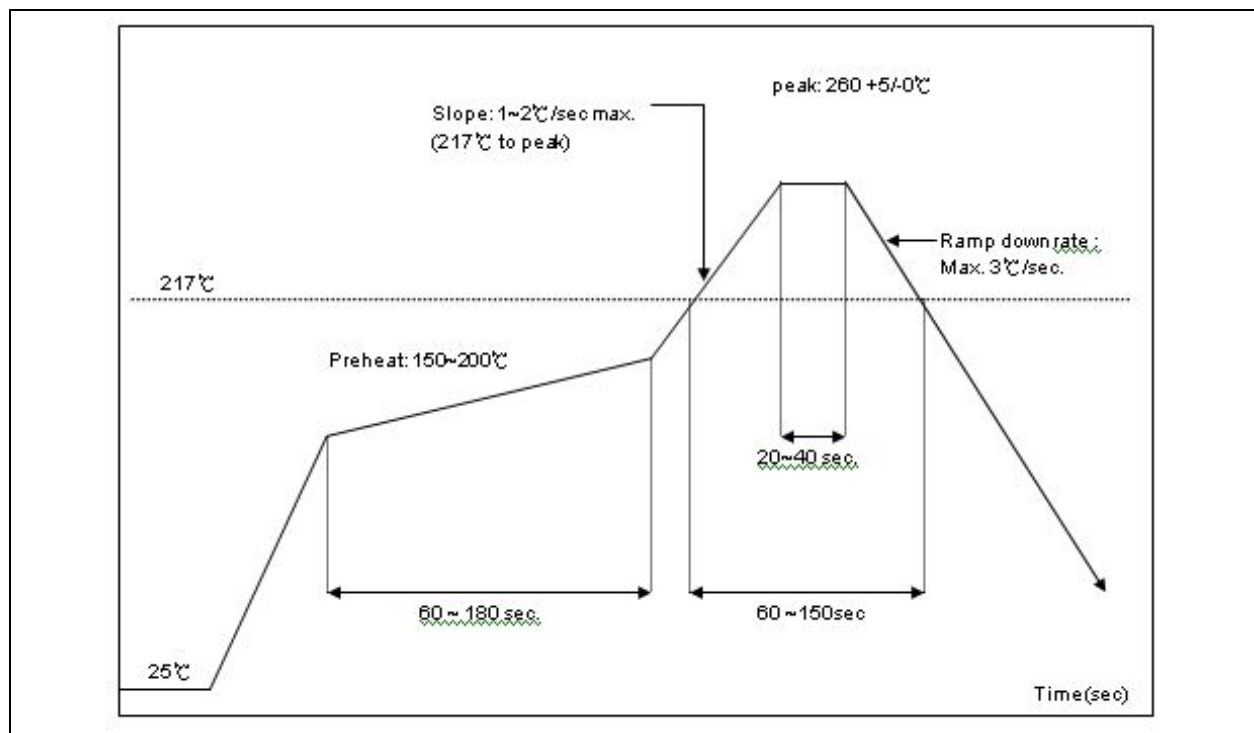
Peak temperature: 260 +5/-0 °C

Ramp-down rate (peak to 217 °C): 6 °C /sec. max.

Time 25 °C to peak temperature : 8 minutes max.

Cycle interval : 5 minutes

FIGURE 5-7: REFLOW PROFILE



BM78SPPX5NC2

NOTES:

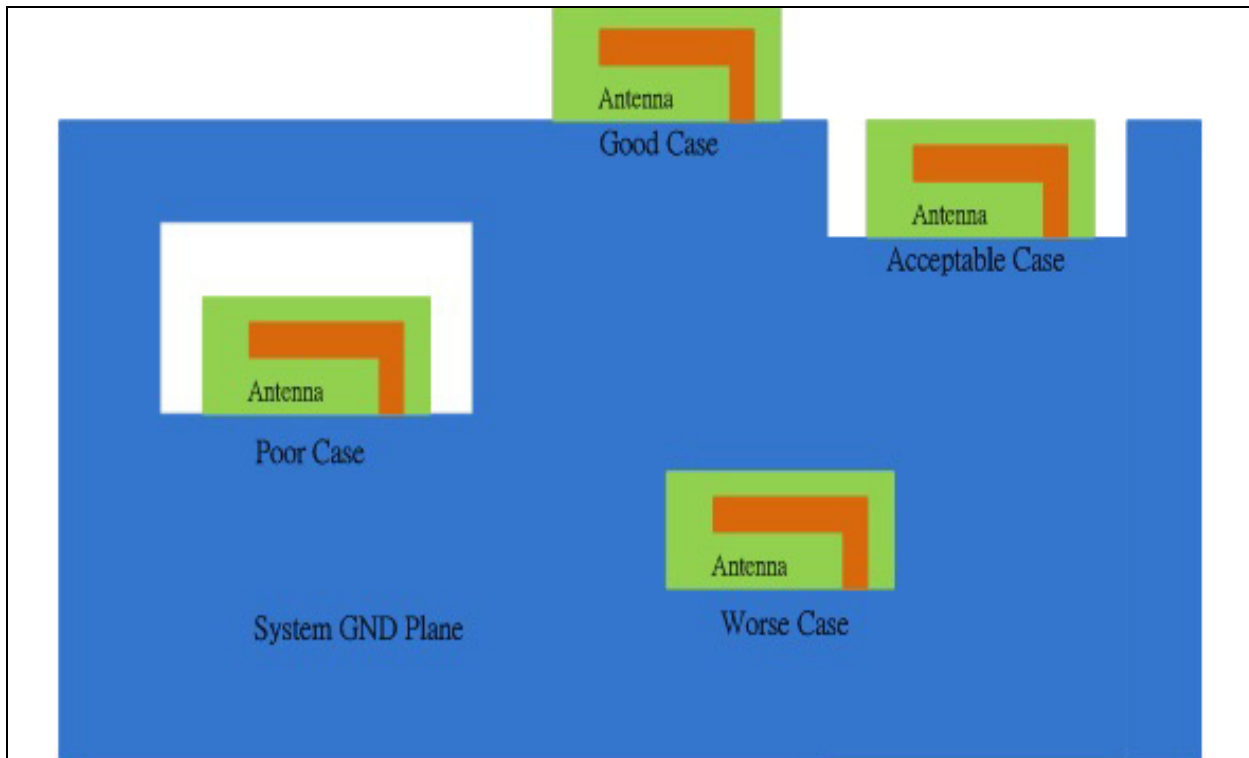
6.0 ANTENNA PLACEMENT RULE

For a Bluetooth wireless product, antenna placement affects whole system performance.

The antenna needs free space to transmit the RF signal, and it cannot be surrounded by the GND plane.

Figure 6-1 illustrates some examples of good and poor placement on a Main Application board with the GND plane.

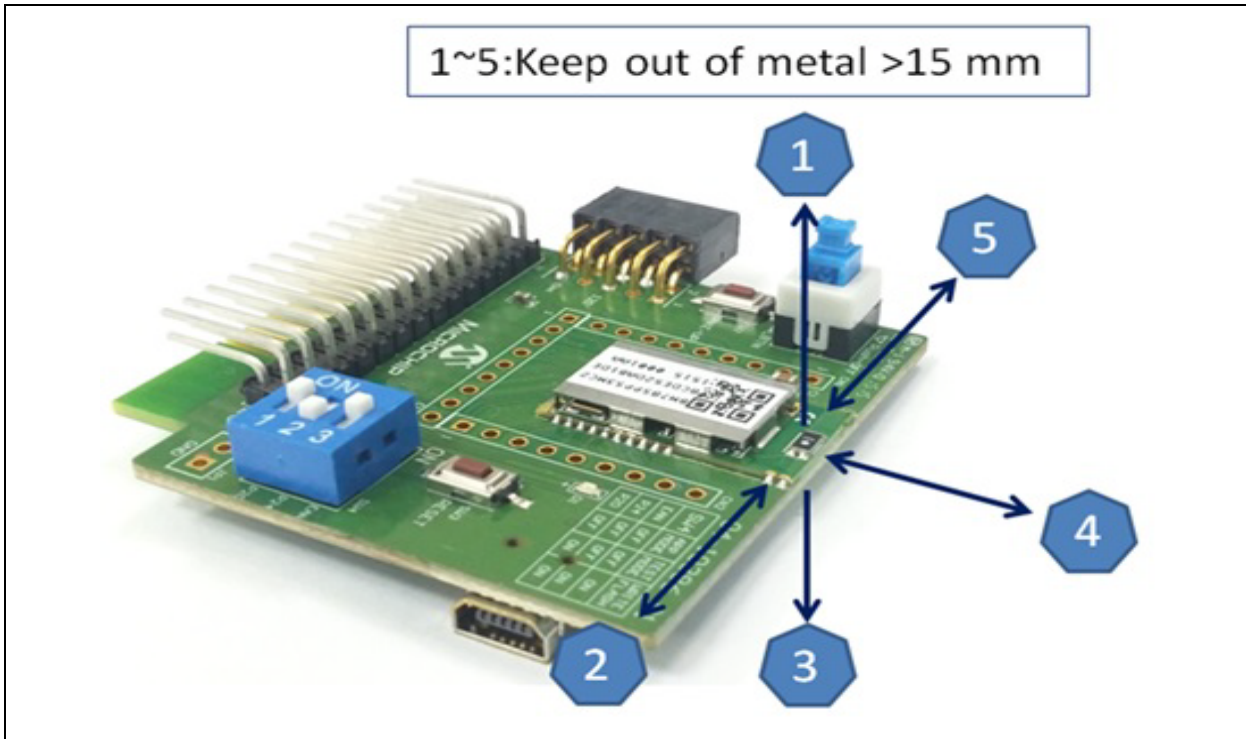
FIGURE 6-1: ANTENNA PLACEMENT EXAMPLES



BM78SPPX5NC2

Figure 6-2 shows the BM78 module mounted on the BM78 EVB and the recommendation on the keep out area for the antenna.

FIGURE 6-2: KEEP OUT AREA RECOMMENDED FOR ANTENNA

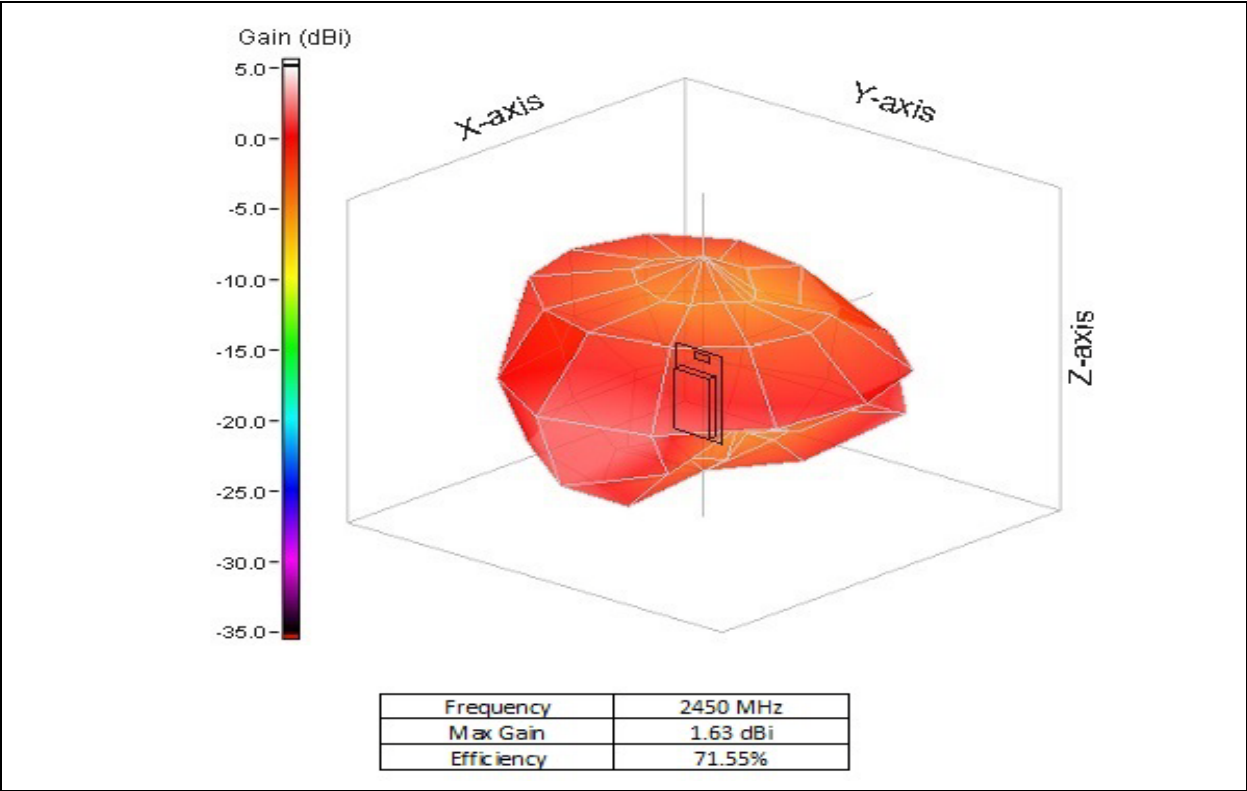


For more details on free space for antenna placement design, you can refer the design rule of the antenna manufacturer.

6.1 BM78SPPS5NC2 Ceramic Chip Antenna

The BM78SPPS5NC2 module contains an integral ceramic chip antenna. Figure 6-3 illustrates the antenna radiation pattern of the ceramic chip antenna on the BM78SPPS5NC2 module.

FIGURE 6-3: BM78SPPS5NC2 ANTENNA RADIATION PATTERN



7.0 ORDERING INFORMATION

Table 7-1 describes the various SKUs of the BM78 module.

TABLE 7-1: BM78 MODULE FAMILY TYPES

Part No.	Microchip IC	Status	Antenna	Bluetooth Version	Shield
BM78SPPS5NC2	IS1678	-	Ceramic chip	Bluetooth 4.0 Dual Mode, Class 2	Yes
BM78SPP05NC2	IS1678	-	External	Bluetooth 4.0 Dual Mode, Class 2	No

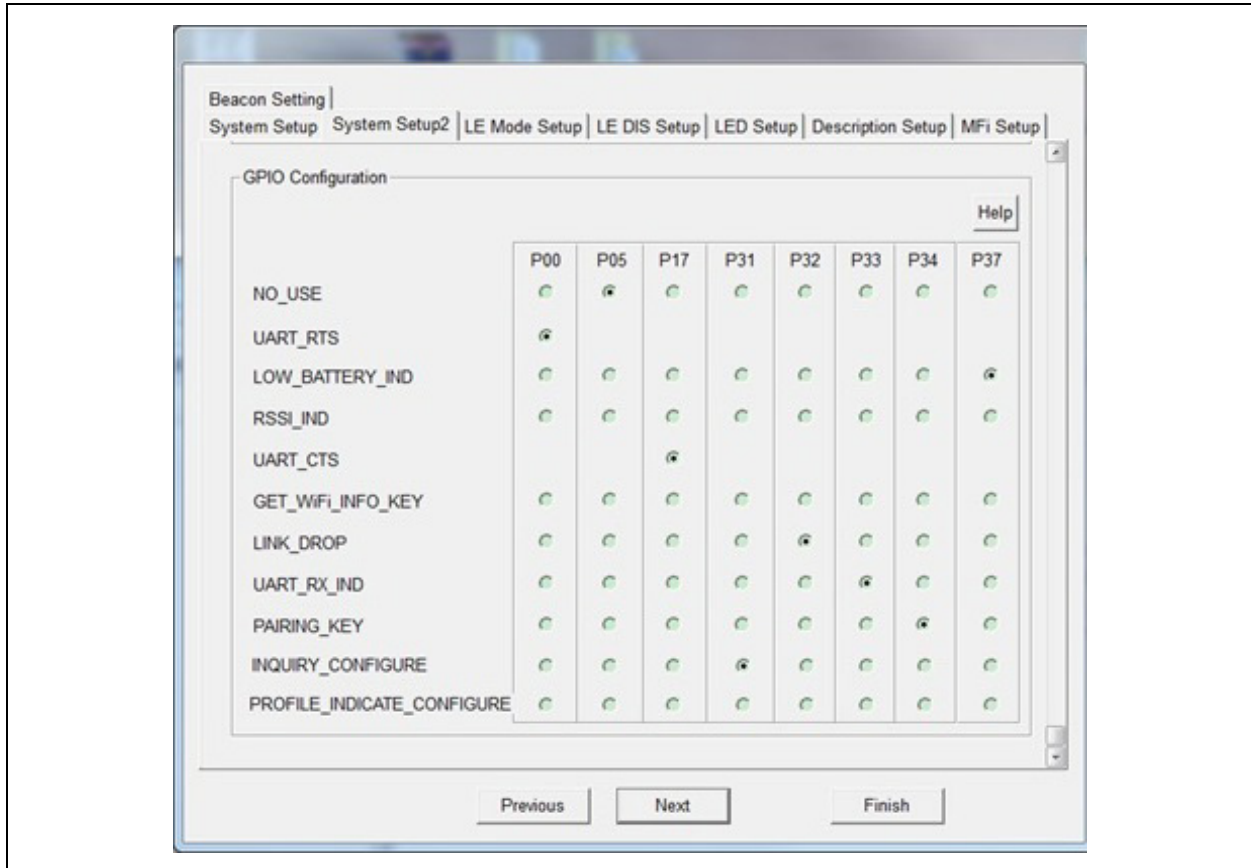
BM78SPPX5NC2

NOTES:

APPENDIX A: UI SETTING

Figure A-1 displays the UI settings screen for the BM78SPPx5NC2 module.

FIGURE A-1: BM78SPPX5NC2 UI SETTINGS SCREEN



BM78SPPX5NC2

NOTES:

BM78SPX5NC2

FIGURE B-1: BM78 REFERENCE CIRCUIT



NOTES:

APPENDIX C: BLUETOOTH BEHAVIOR AUTO/MANUAL PATTERN CONFIGURATION

C.1 Auto Pattern

BLEDK3 will be executed based on internal state machine that can be configured by UI tool. It only supports BLE slave and built-in services.

FIGURE C-1: BLUETOOTH BEHAVIOR

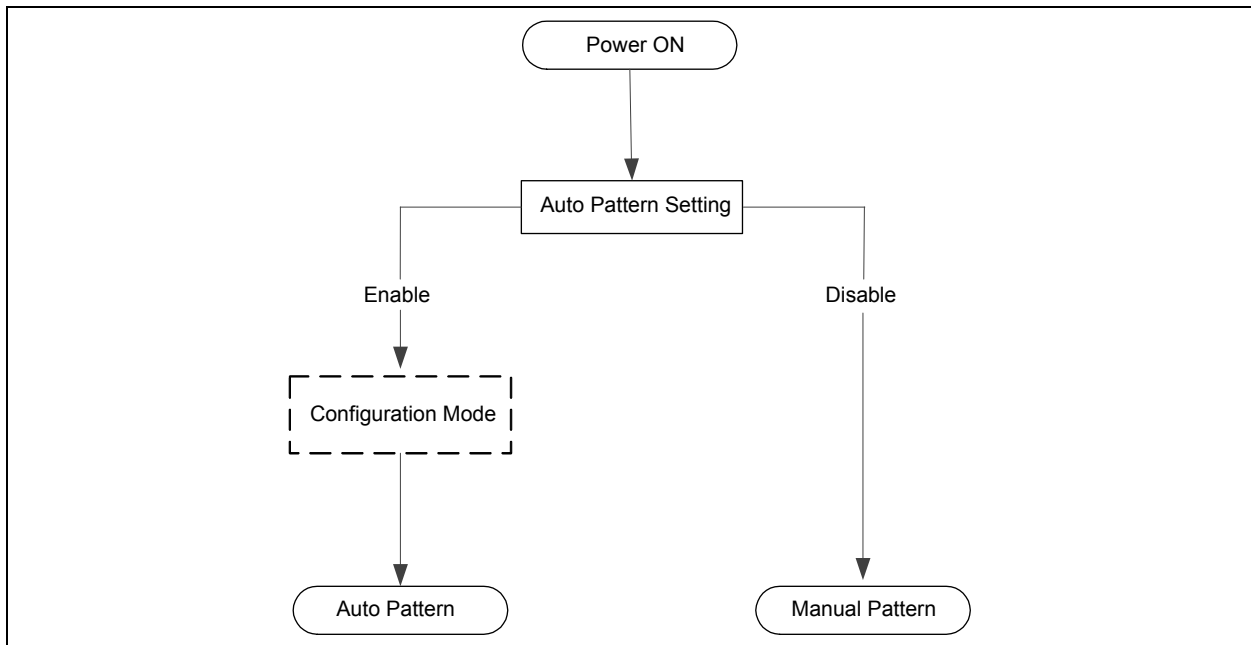


FIGURE C-2: AUTO PATTERN STATE

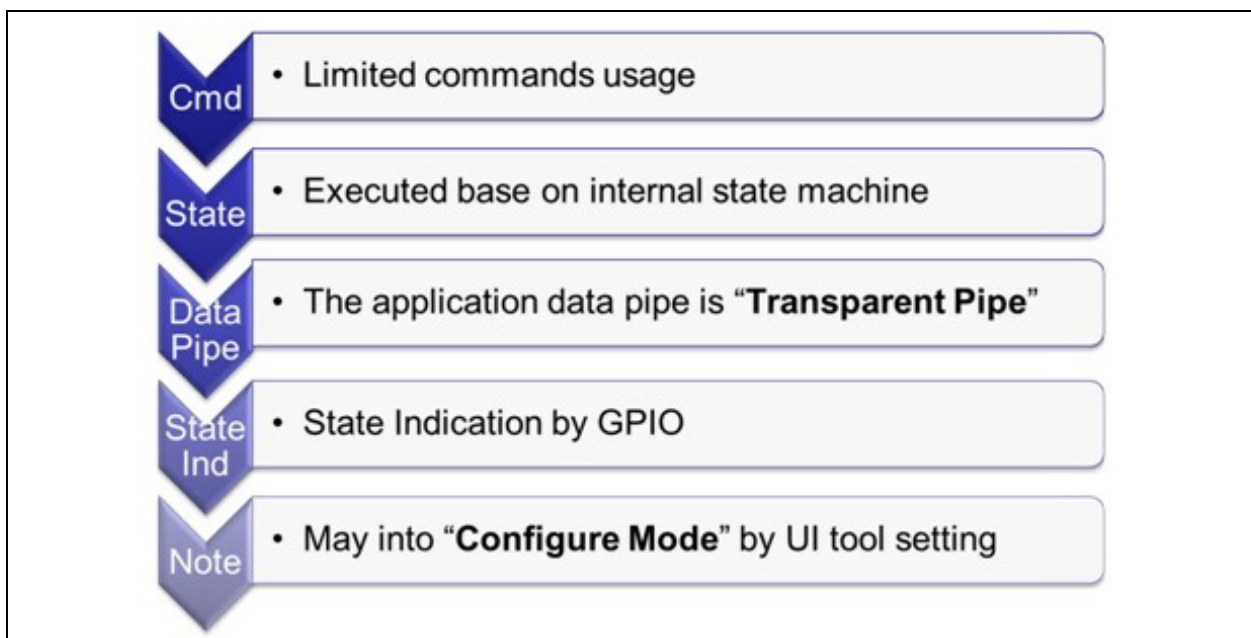


FIGURE C-3:

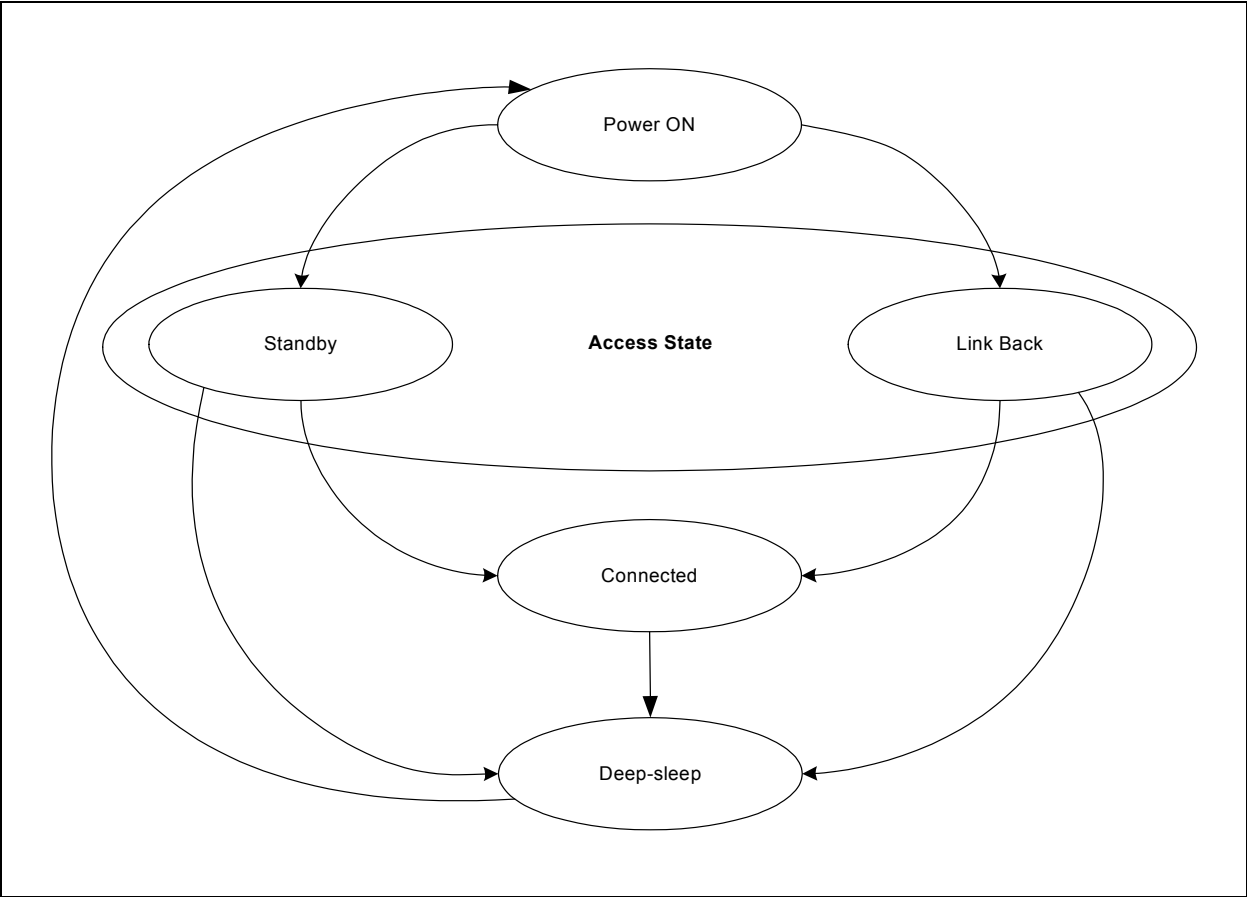


TABLE C-1:

Access State	Configure mode
	Standby mode
	Link back mode
	Pairing procedure
Link State	Connected mode
Deep-sleep State	Deep-sleep mode

C.2 Manual Pattern

BLEDK3 will be executed based on MCU command totally, it supports both BLE Master/Slave by using UART protocol with MCU. The appended services can only operate in manual pattern.

FIGURE C-4: MANUAL PATTERN STATE

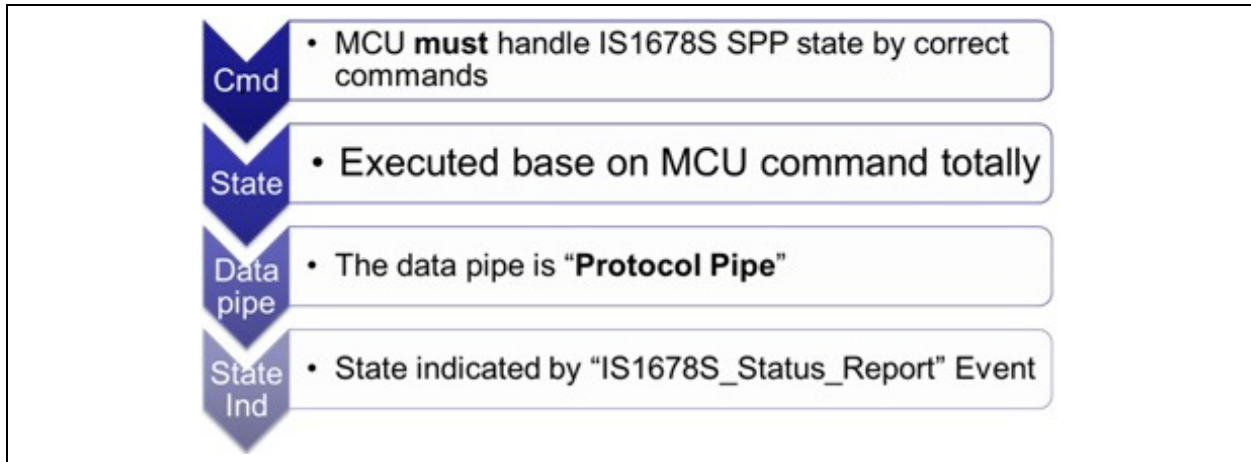
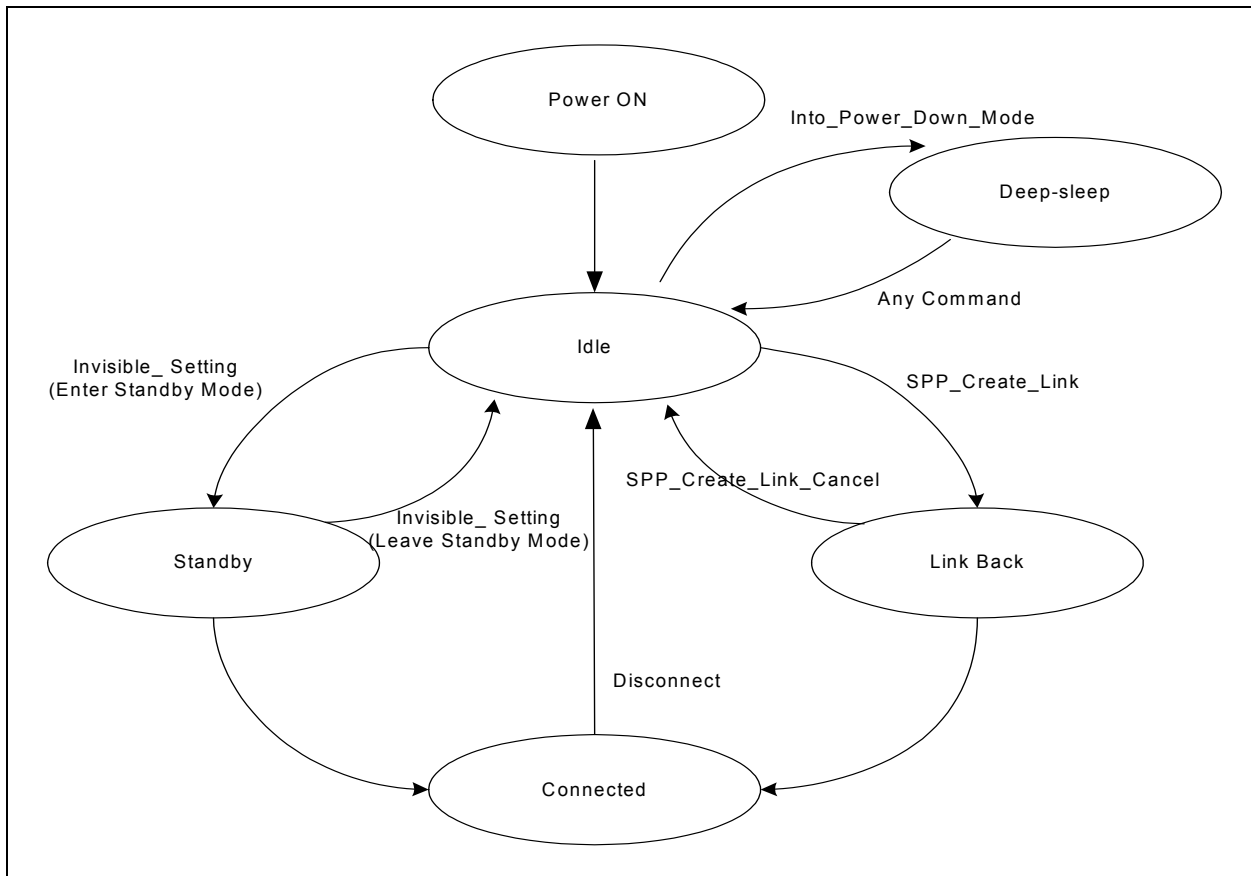


FIGURE C-5:



C.3 UI Setting

FIGURE C-6: BM78SPP05NC2 UI SETTING SCREEN

The screenshot displays the BM78SPP05NC2 UI Setting Screen. The interface is organized into several sections with tabs at the top: Beacon Setting, System Setup, System Setup2, LE Mode Setup, LE DIS Setup, LED Setup, Description Setup, and MFi Setup. The 'System Setup' tab is currently selected.

Beacon Setting

--- UART RX_IND: (0x0000:Disable,0x0018~0xFFFF , unit: byte) [Disable]

--- Max BLE Data Segment Size On Air: [Segment UART RX data]

--- Check UART RX Data Interval: 0x [00] (unit: 0.625ms) total : 0.000 ms

Operation Mode Setting

--- BT Operation Mode: [Dual Mode] [Help]

--- Operation Pattern: [Auto Pattern]

--- Configure Mode Timeout: 0x [Auto Pattern / Manual Pattern] (0:Disable Configure Mode, unit: 640ms) total : 0 ms

Sniff Mode Setting

--- Sniff Interval: 0x [0320] [2bytes] [Help] (unit: 0.625ms) total : 500.000 ms

--- Enter Sniff Waiting Time: 0x [7D] (0x01~0xFF,unit: 80ms) total : 10000 ms

--- Unsniff When Recieve Data From IC: [Enable]

Navigation buttons at the bottom: Previous, Next, Finish.

APPENDIX D: CERTIFICATION NOTICES

BM23 has got these countries regulatory approval:

- United States; FCC ID:
- Canada; IC ID:
- Europe
- Japan;
- Korea; Certification No:
- Taiwan; NCC No.:

BM78 module in certification test process.

For more information, please reference appendix.

C.1 REGULATORY APPROVAL

This section outlines the regulatory information for the **BM77SSPS3MC2** module for the following countries:

- United States
- Canada
- Europe
- Australia
- New Zealand
- Japan
- Korea
- Taiwan
- Other Regulatory Jurisdictions

C.1.1 UNITED STATES

The **BM77SSPS3MC2** module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C "Intentional Radiators" modular approval in accordance with Part 15.212 Modular Transmitter approval. Modular approval allows the end user to integrate the BM77 module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user's authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15 Subpart B "Unintentional Radiators"), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module

(i.e., Verification, or Declaration of Conformity) (e.g., transmitter modules may also contain digital logic functions) as appropriate.

C.1.2 LABELING AND USER INFORMATION REQUIREMENTS

The **BM77** module has been labeled with its own FCC ID number, and if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains Transmitter Module FCC ID:

A8TBM77SPPSYC2A

or

Contains FCC ID: **A8TBM77SPPSYC2A**

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

A user's manual for the finished product should include the following statement:

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.

Additional information on labeling and user information requirements for Part 15 devices can be found in KDB Publication 784748 available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB)
<http://apps.fcc.gov/oetcf/kdb/index.cfm>.

BM78SPPX5NC2

C.1.3 RF EXPOSURE

All transmitters regulated by FCC must comply with RF exposure requirements. KDB 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).

From the FCC Grant: Output power listed is conducted. This grant is valid only when the module is sold to OEM integrators and must be installed by the OEM or OEM integrators. This transmitter is restricted for use with the specific antenna(s) tested in this application for Certification and must not be co-located or operating in conjunction with any other antenna or transmitters within a host device, except in accordance with FCC multi-transmitter product procedures.

C.1.4 HELPFUL WEB SITES

Federal Communications Commission (FCC):
<http://www.fcc.gov>

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):
<http://apps.fcc.gov/oetcf/kdb/index.cfm>

C.2 Canada

The **BM77SSPS3MC2** module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-210 and RSS-Gen. Modular approval permits the installation of a module in a host device without the need to recertify the device.

C.2.1 LABELING AND USER INFORMATION REQUIREMENTS

Labeling Requirements for the Host Device (from Section 3.2.1, RSS-Gen, Issue 3, December 2010): The host device shall be properly labeled to identify the module within the host device.

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC:
12246A-BM77SPPSYC2

User Manual Notice for License-Exempt Radio Apparatus (from Section 7.1.3 RSS-Gen, Issue 3, December 2010): User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device complies with Industry Canada license-exempt RSS standard(s). 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Transmitter Antenna (from Section 7.1.2 RSS-Gen, Issue 3, December 2010): User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

The above notice may be affixed to the device instead of displayed in the user manual.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

C.2.2 RF EXPOSURE

All transmitters regulated by IC must comply with RF exposure requirements listed in RSS-102 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).

(Get direct quote from Certificate and place here)

C.2.3 HELPFUL WEB SITES

Industry Canada: <http://www.ic.gc.ca/>

C.3 Europe

The **BM77SPPS3MC2** module is an R&TTE Directive assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.

The **BM77** module has been tested to R&TTE Directive 1999/5/EC Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2) and are summarized in **Table 3-1: European Compliance Testing**. A Notified Body Opinion has also been issued. All test reports are available on the BM77 product web page at <http://www.microchip.com/bm77>.

The R&TTE Compliance Association provides guidance on modular devices in document **Technical Guidance Note 01** available at http://www.rteca.com/html/download_area.htm.

Note: To maintain conformance to the testing listed in **Table 3-1: European Compliance Testing**, the module shall be installed in accordance with the installation instructions in this data sheet and shall not be modified.

When integrating a radio module into a completed product the integrator becomes the manufacturer of the final product and is therefore responsible for demonstrating compliance of the final product with the essential requirements of the R&TTE Directive.

C.3.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the BM77 module must follow CE marking requirements. The R&TTE Compliance Association **Technical Guidance Note 01** provides guidance on final product CE marking.

C.3.2 ANTENNA REQUIREMENTS

From R&TTE Compliance Association document **Technical Guidance Note 01**:

Provided the integrator installing an assessed radio module with an integral or specific antenna and installed in conformance with the radio module manufacturer's installation instructions requires no further evaluation under Article 3.2 of the R&TTE Directive and does not require further involvement of an R&TTE Directive Notified Body for the final product. [Section 2.2.4]

The European Compliance Testing listed in [Table 1](#) was performed using the integral ceramic chip antenna.

BM78SPPX5NC2

C.3.3 HELPFUL WEB SITES

TABLE 1: EUROPEAN COMPLIANCE TESTING

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	EN 60950-1:2006+A11:2009+A1:2010	(3.1(a))	—	—	—
Health	EN 50371:2002-03			—	—
EMC	EN 301 489-1 V1.8.1 (2008-04)	(3.1(b))		—	—
	EN 301 489-17 V2.1.1 (2009-05)			—	—
Radio	EN 300 328 V1.7.1 (2006-10)	(3.2)		—	—
Notified Body Opinion	—	—	—	—	—

A document that can be used as a starting point in understanding the use of Short Range Devices (SRD) in Europe is the European Radio Communications Committee (ERC) Recommendation 70-03 E, which can be downloaded from the European Radio Communications Office (ERO) at: <http://www.ero.dk/>.

Additional helpful web sites are:

- Radio and Telecommunications Terminal Equipment (R&TTE):
http://ec.europa.eu/enterprise/rtte/index_en.htm
- European Conference of Postal and Telecommunications Administrations (CEPT):
<http://www.cept.org>
- European Telecommunications Standards Institute (ETSI):
<http://www.etsi.org>
- European Radio Communications Office (ERO):
<http://www.ero.dk>
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA):
<http://www.rtteca.com/>

C.4 Australia

The Australia radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, BM77 module RF transmitter test reports can be used in part to demonstrate compliance in accordance with ACMA Radio communications "Short Range Devices" Standard 2004 (The Short Range Devices standard calls up the AS/NZS 4268:2008 industry standard). The BM77 module test reports can be used as part of the product certification and compliance folder. For more information on the RF transmitter test reports, contact Microchip Technology Australia sales office.

To meet overall Australian final product compliance, the developer must construct a compliance folder containing all relevant compliance test reports e.g. RF, EMC, electrical safety and DoC (Declaration of Conformity) etc. It is the responsibility of the integrator to know what is required in the compliance folder for ACMA compliance. All test reports are available on the BM77 product web page at <http://www.microchip.com>. For more infor-

mation on Australia compliance, refer to the Australian Communications and Media Authority web site <http://www.acma.gov.au/>.

C.4.1 HELPFUL WEB SITES

The Australian Communications and Media Authority: www.acma.gov.au/.

C.5 New Zealand

The New Zealand radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, BM77 module RF transmitter test reports can be used in part to demonstrate compliance against the New Zealand "General User Radio License for Short Range Devices". New Zealand Radio communications (Radio Standards) Notice 2010 calls up the AS / NZS 4268:2008 industry standard. The BM77 module test reports can be used as part of the product certification and compliance folder. All test reports are available on the BM77 product web page at <http://www.microchip.com/bm77>. For more information on the RF transmitter test reports, contact Microchip Technology sales office.

Information on the New Zealand short range devices license can be found in the following web links:

<http://www.rsm.govt.nz/cms/licensees/types-of-licence/general-user-licences/short-range-devices>

and

<http://www.rsm.govt.nz/cms/policy-and-planning/spectrum-policy-overview/legislation/gazette-notices/product-compliance/>.

To meet overall New Zealand final product compliance, the developer must construct a compliance folder containing all relevant compliance test reports e.g. RF, EMC, electrical safety and DoC (Declaration of Conformity) etc. It is the responsibility of the developer to know what is required in the compliance folder for New Zealand Radio communications. For more information on New Zealand compliance, refer to the web site <http://www.rsm.govt.nz/>.

C.5.1 HELPFUL WEB SITES

Radio Spectrum Ministry of Economic Development: <http://www.rsm.govt.nz/>.

C.6 Japan

The **BM77SSPS3MC2** module has received type certification and is labeled with its own technical conformity mark and certification number as required to conform to the technical standards regulated by the Ministry of Internal Affairs and Communications (MIC) of Japan pursuant to the Radio Act of Japan.

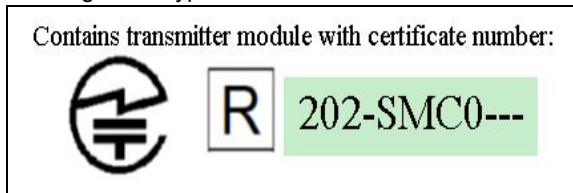
Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- If the host product is subject to electrical appliance safety (for example, powered from an AC mains), the host product may require Product Safety Electrical Appliance and Material (PSE) testing. The integrator should contact their conformance laboratory to determine if this testing is required.
- There is an voluntary Electromagnetic Compatibility (EMC) test for the host product administered by VCCI: http://www.vcci.jp/vcci_e/index.html

C.6.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the **BM77** module must follow Japan marking requirements. The integrator of the module should refer to the labeling requirements for Japan available at the Ministry of Internal Affairs and Communications (MIC) website.

The **BM77** module is labeled with its own technical conformity mark and certification number. The final product in which this module is being used must have a label referring to the type certified module inside:



C.6.2 HELPFUL WEB SITES

Ministry of Internal Affairs and Communications (MIC):
<http://www.tele.soumu.go.jp/e/index.htm>

Association of Radio Industries and Businesses (ARIB): <http://www.arib.or.jp/english/>

C.7 Korea

The **BM77SSPS3MC2** module has received certification of conformity in accordance with the Radio Waves Act. Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

C.7.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the **BM77** module must follow KC marking requirements. The integrator of the module should refer to the labeling requirements for Korea available on the Korea Communications Commission (KCC) website.

The **BM77** module is labeled with its own KC mark. The final product requires the KC mark and certificate number of the module:



C.7.2 HELPFUL WEB SITES

Korea Communications Commission (KCC):
<http://www.kcc.go.kr>

National Radio Research Agency (RRA):
<http://rra.go.kr>

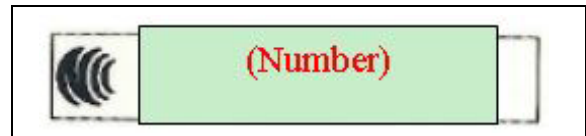
C.8 Taiwan

The **BM77SSPS3MC2** module has received compliance approval in accordance with the Telecommunications Act. Customers seeking to use the compliance approval in their product should contact Microchip Technology sales or distribution partners to obtain a Letter of Authority.

Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

C.8.1 LABELING AND USER INFORMATION REQUIREMENTS

The **BM77** module is labeled with its own NCC mark and certificate number as below:



The user's manual should contain below warning (for RF device) in traditional Chinese:

注意！

依據 低功率電波輻射性電機管理辦法

第十二條 經型式認證合格之低功率射頻電機，非經許可，

公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計

之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；

BM78SPPX5NC2

經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信規定作業之無線電信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性

電機設備之干擾。

C.8.2 HELPFUL WEB SITES

National Communications Commission (NCC):
<http://www.ncc.gov.tw>

C.9 Other Regulatory Jurisdictions

Should other regulatory jurisdiction certification be required by the customer, or the customer need to recertify the module for other reasons, a certification utility is available. For further regulatory Certification Utility and documentation, contact ISSC Technologies Corp.

C.10 Helpful Web Sites

A document that can be used as a starting point in understanding the use of Short Range Devices (SRD) in Europe is the European Radio Communications Committee (ERC) Recommendation 70-03 E, which can be downloaded from the European Radio Communications Office (ERO) at: <http://www.ero.dk/>.

Additional helpful web sites are:

- Radio and Telecommunications Terminal Equipment (R&TTE):
http://ec.europa.eu/enterprise/rtte/index_en.htm
- European Conference of Postal and Telecommunications Administrations (CEPT):
<http://www.cept.org>
- European Telecommunications Standards Institute (ETSI):
<http://www.etsi.org>
- European Radio Communications Office (ERO):
<http://www.ero.dk>
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA):
<http://www.rtteca.com/>

APPENDIX D: REVISION HISTORY

Revision A (July 2015)

This is the initial release of the BM78SPPX5NC2 Module Datasheet.

BM78SPPX5NC2

NOTES:

THE MICROCHIP WEB SITE

Microchip provides online support via our WWW site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

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- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: <http://microchip.com/support>

BM78SPPX5NC2

NOTES:

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- Microchip products meet the specification contained in their particular Microchip Data Sheet.
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- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

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