

MW320

WLAN Microcontroller
IEEE 802.11 b/g/n

Datasheet-Rev2.0

Revision History

Revision	Date	Remark
Rev 1.0	Oct 27,2016	Preliminary
Rev 2.0	May 27, 2019	1. Update MW300L to MW300L/ MW320 2. Add section 1-2 WLAN Module Block Diagram on page 6

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1. General Description

The MW320 is a high performance, low-power WLAN WiFi Module with highly integrated System-on-Chip (SoC) solution designed for a broad array of smart devices for Internet of Things (IoT), wearables, accessories, Machine-to-Machine (M2M), home automation, and Smart Energy applications.

A high degree of integration enables very low system costs requiring only a single 3.3V power input, a 38.4 MHz crystal, and SPI Flash. It has been integrated with on board sheet metal stamping antenna and another U.FL connector optional for external antenna.

The SoC includes a full-featured WLAN subsystem powered by proven and mature IEEE 802.11n/g/b Marvell technology. The WLAN subsystem integrates a WLAN MAC, baseband, and direct-conversion RF radio with integrated PA, LNA, and transmit/receive switch. It also integrates a CPU subsystem with integrated memory to run Marvell WLAN firmware to handle real time WLAN protocol processing to off-load many WLAN functions from the main application CPU.

The 88MW300/ 88MW320 application subsystem is powered by an ARM Cortex-M4F CPU that operates up to 200 MHz. The device supports an integrated 512 KB SRAM, 128 KB mask ROM, and a QSPI interface to external Flash. An integrated Flash Controller with a 32 KB SRAM cache enables execute In Place (XIP) support for firmware from Flash.

The SoC is designed for low-power operation and includes several low-power states and fast wake-up times. Multiple power domains and clocks can be individually shut down to save power. The SoC also has a high-efficiency internal PA that can be operated in low-power mode to save power. The microcontroller and WLAN subsystems can be placed into low-power states, independently, supporting a variety of application use cases. An internal DC-DC regulator provides the 1.8V rail for the WLAN subsystem.

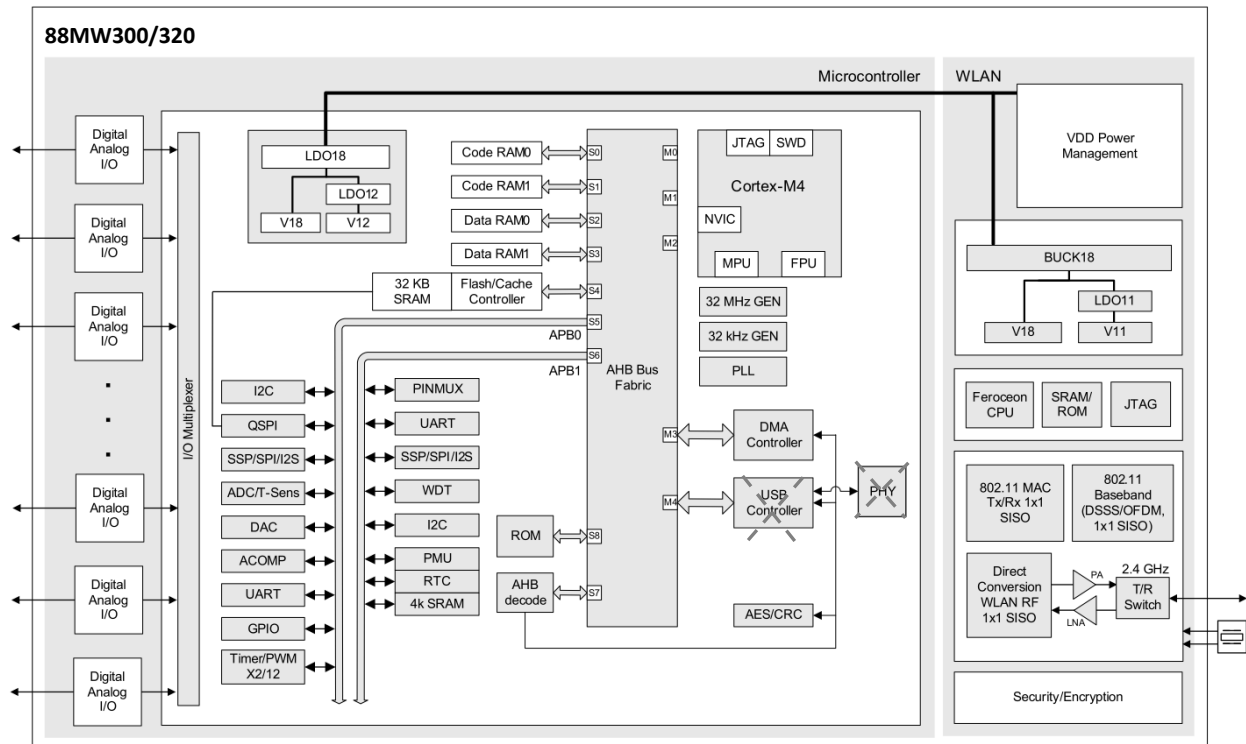
The SoC provides a full array of peripheral interfaces including SSP/SPI/I2S (3x), UART (3x), I2C (2x), General Purpose Timers and PWM, ADC, DAC, Analog Comparator, and GPIOs. It also includes a hardware cryptographic engine, RTC, and Watchdog Timer. The 88MW302/ 88MW322 includes a high speed USB On-The-Go (OTG) interface to enable USB audio, video, and other applications but 88MW300/ 88MW320 doesn't have this USB OTG.

A complete set of digital and analog interfaces enable direct interfacing for I/O avoiding the need for external chips. The application CPU can be used to support custom application development avoiding the need for another microcontroller or processor.

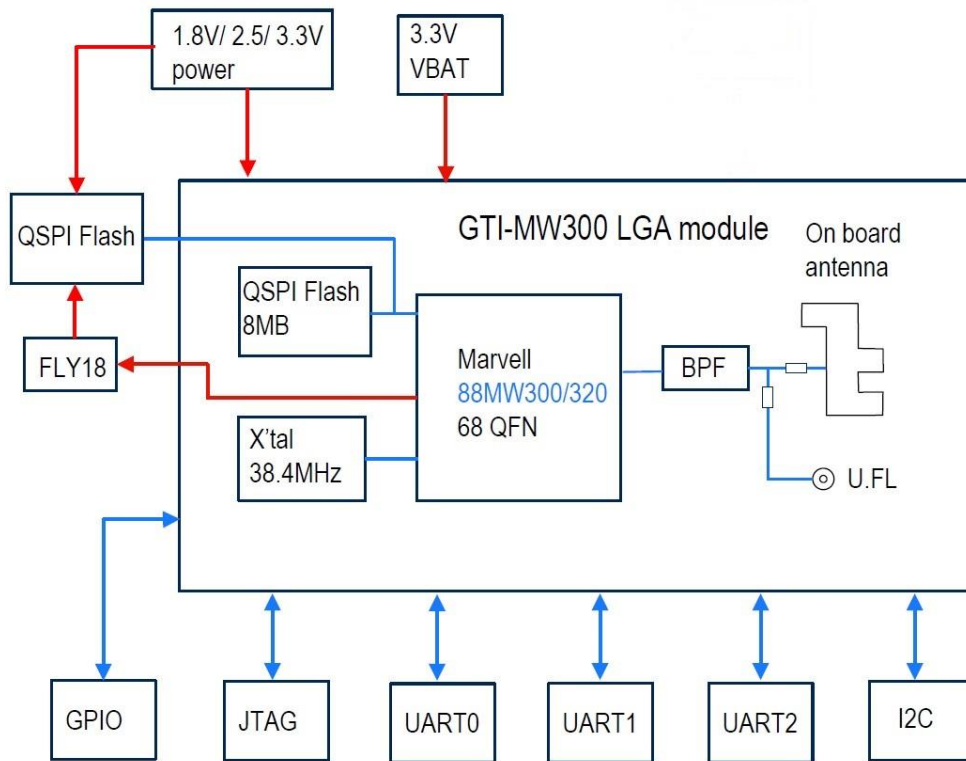
Section 1-1 shows an overall block diagram of the device.

1-1. WLAN Microcontroller Block Diagram

Note: MW320L does not have USB interface



1-2. WLAN module Block Diagram



➤ **Applications**

- White goods/appliances—refrigerator, washer, dryer, oven range, microwave, dishwasher, water heater, air conditioner
- Consumer devices and accessories—toys, speakers, headset, alarm clock, gaming accessory, remote control
- Home automation—smart outlet, light switch, security camera, thermostat, sprinkler controller, sensor, door lock, door bell, garage door, security system
- Personal health devices—weighing scale, glucometer, blood pressure monitor, fitness equipment
- IoT/wearables—coffee pot, rice cooker, vacuum cleaner, air purifier, smart watch, fitness bracelet, pet monitor
- Commercial/industrial—lighting, building automation, asset management, Point of Sale (POS) sales
- Gateways—Connecting IR, sub-Gig or Legacy RF, Bluetooth Smart, ZigBee, ZWave and other radios to Wi-Fi/IP network

➤ **Key Features**

- Highly integrated SoC requiring very few external components for a full system operation
- Multiple low-power modes and fast wake-up times,, Full-featured, single stream 802.11n/g/b WLAN
- High-efficiency PA with a low-power (10 dB) mode
- Cortex-M4F application CPU for applications with integrated 512 KB SRAM and 128 KB mask ROM
- Flash Controller with embedded 32 KB SRAM cache to support XIP from external SPI Flash,, Secure boot
- Full set of digital and analog I/O interfaces

➤ **Power Management**

- Power modes—active, idle, standby, sleep, shutoff, power-down
- Integrated high efficiency buck DC-DC converter
- Independent power domains
- Brownout detection,, Integrated POR
- Wake-up through dedicated GPIO, IRQ, and RTC

➤ **Temperature**

- Extended: -30 to 85°C
- Industrial: -40 to 85°C
- Storage: -55 to 125

➤ **Wireless**

- IEEE 802.11n/g/b, 1x1 SISO 2.4 GHz and HT20
- Integrated CPU, memory, MAC, DSSS/OFDM baseband, direct conversion RF radio, encryption
- Antenna diversity
- CMOS and low-swing sine wave input clock
- Low-power with deep sleep and standby modes
- Pre-regulated supplies
- Integrated T/R switch, PA, and LNA
- Optional 802.11n features
- One Time Programmable (OTP) memory to eliminate need for external EEPROM

➤ **WLAN Rx Path**

- Direct conversion architecture eliminates need for external SAW filter
- On-chip gain selectable LNA with optimized noise figure and power consumption
- High dynamic range AGC function in receive mode

➤ **WLAN Tx Path**

- Integrated PA with power control
- Optimized Tx gain distribution for linearity and noise performance

➤ **WLAN Local Oscillator**

- Fractional-N for multiple reference clock support
- Fine channel step

➤ **WLAN Encryption**

- WEP 64- and 128-bit encryption with hardware TKIP processing (WPA)
- AES-CCMP hardware implementation as part of 802.11i security standard (WPA2)
- Enhanced AES engine performance
- AES-Cipher-Based Message Authentication Code (CMAC) as part of the 802.11w security standard
- WLAN Authentication and Privacy Infrastructure (WAPI)

➤ **IEEE 802.11 Standards**

- 802.11 data rates of 1 and 2 Mbps
- 802.11b data rates of 5.5 and 11 Mbps
- 802.11g data rates 6, 9, 12, 18, 24, 36, 48, and 54 Mbps for multimedia content transmission
- 802.11g/b performance enhancements
- 802.11n compliant with maximum data rates up to 72.2 Mbps (20 MHz channel)
- 802.11d international roaming
- 802.11e quality of service
- 802.11h transmit power control
- 802.11i enhanced security
- 802.11k radio resource measurement
- 802.11n block acknowledgement extension
- 802.11r fast hand-off for AP roaming
- 802.11w protected management frames
- Fully supports clients (stations) implementing IEEE Power Save mode
- Wi-Fi direct connectivity

➤ **Microprocessor Processor**

- ARM Cortex-M4F, 32-bit
- 200 MHz main bus clock

➤ **Memory**

- 128 KB ROM
- 512 KB RAM

➤ **Flash Controller**

- Supports QSPI Flash devices
- Memory-mapped access to QSPI Flash devices
- 32 KB SRAM cache

➤ **Digital Interfaces**

- 3x I2S stereo (share BCK, DIN pins with PDM)
- 3x SPI master/slave
- 2x I2C master/slave
- 3x UART
- 1x QSPI
- Up to 50 GPIOs
- 2x wake-up pins

➤ **Analog**

- 2-step ADC with integrated PGA and configurable resolution/speed
 - 12-bit/2 MHz sample(s) for fast conversion
 - 16-bit/16 kHz sample/s with voice quality
 - 8 single channels or 4 differential channels
- 2-Channel or 1 differential channel DAC, 10-bit/500 ksps
- 2 Analog Comparators with programmable speed/current
- On-die/off-chip temperature sensing and battery monitor

➤ **Counters/Timers/PWM**

- General Purpose Timers (GPT) with LED PWM support
- Real Time Clock (RTC)
- CM4 system tick
- Watchdog Timer

2. Specifications Table

Class	Item	Parameters
Wireless Parameters	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	Frequency range	2.412GHz-2.484GHz
	Transmit Power	802.11b: +10.60dBm (@11Mbps)
		802.11g: +13.68dBm (@54Mbps)
		802.11n: +11.62dBm (@HT20, MCS7)
		802.11n: +11.81dBm (@HT40, MCS7)
	Receiver Sensitivity	802.11g: -66 dBm (@54Mbps, OFDM)
Hardware Parameters	Refer to 3. WIFI 2.4GHZ EVM/Power/Frequency Error/Rx table	
	Antenna Option	External: U.FL Connector
		Internal: On-board metal stamping antenna
	Data Interface	UART
		SPI, PWM, GPIO...
		Others: ADC, RTC...
	Operating Voltage	3.3V +/- 10%
	Operating Temp.	-30°C - 85°C
Software Parameters	Storage Temp.	-55°C - 125°C
	Dimensions and Size	30.00mm×15.00mm×6.00mm
	Network Type	STA /AP/STA+AP/Wi-Fi Direct
	Security Mechanisms	WEP/WPA-PSK/WPA2-PSK
	Encryption	WEP64/WEP128/TKIP/AES
	Customization	Local Wireless (OTA), Remote
	Reserved Resource	Web Page Upgrade
		Provide SDK for application develop
	Network Protocol	Flash: >200KB; SRAM:>100KB
	Network Protocol	IPv4,TCP/UDP/FTP/HTTP,TTPS,TLS,mDNS
	User Configuration	AT+instruction set, Web page/ Android/ iOS Smart Link APP tools

3. WIFI 2.4GHZ EVM/Power/Frequency Error/Rx table

Mode (b/g/n)	Speed (Mbps)	Channel (1/7/13)	Frequency (MHz)	Power Setting (dBm)	Power (dBm)	EVM (dB)	Frequency Error (ppm)	RX (%)
802.11b	11Mbps	1	2412	16	10.27	-37.45	8.42	--
		6	2437		10.36	-37.92	8.21	--
		11	2462		10.60	-38.92	8.07	--
802.11g	54Mbps	1	2412	12	13.29	-30.81	8.11	94.19%
		6	2437		13.54	-31.16	8.87	100.00%
		11	2462		13.68	-30.85	8.13	98.68%
802.11n	HT20- MCS7	1	2412	12	11.51	-30.90	8.88	--
		6	2437		11.62	-31.04	7.92	--
		11	2462		11.6	-30.92	7.31	--
802.11n	HT40- MCS7	3	2422	12	11.65	-31.08	7.94	--
		6	2437		11.81	-31.14	7.82	--
		9	2452		11.75	-31.10	7.61	--
tolerance range	--	--	--	11b: +16±2.5 11g: +12±2.0 11g: +12±2.0	11M: -45~-10 54M: -45~- 25 HT20- MCS7:	0±20	≥90%	

4. Electrical Characteristics

Power Consumption taken on RD-88MW300-B0-V3 boards with USB_AVDD33 trace cut on the board.

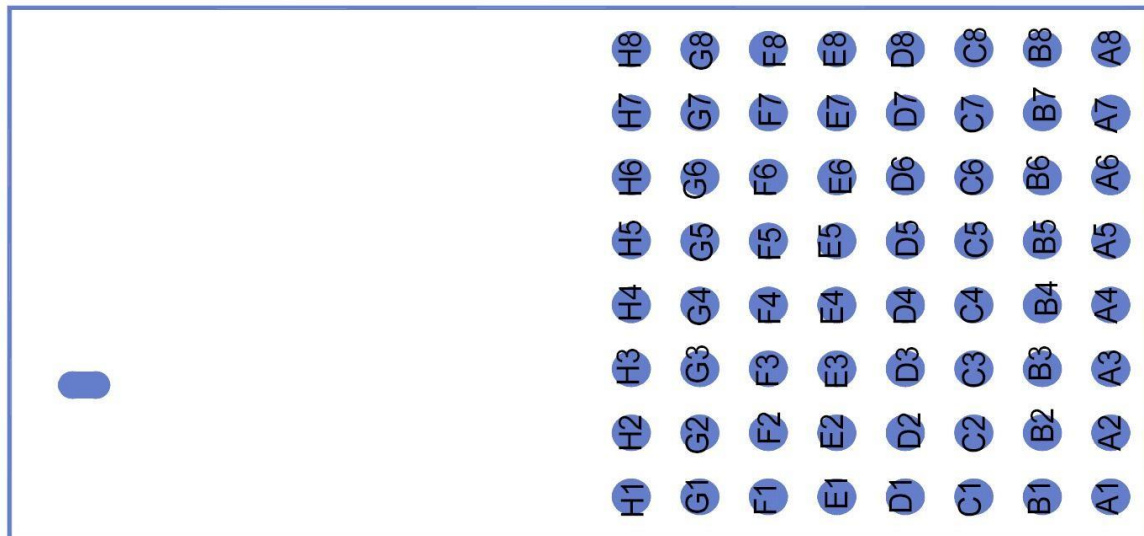
MCU State	WiFi Deep Sleep (mA)		WiFi STA Connected (mA)		WiFi IEEE PS (mA)		WiFi Power Down (mA)
	38.4Mhz	200Mhz	38.4Mhz	200Mhz	38.4Mhz	200Mhz	
PM0	11.11	42.8	~50	~80	18.6	~43.8	n/a **
PM1	8.3	28.17	~50	~69	9.3	29	n/a **
PM2	~.488 *		~43.6		1.64 (DTIM=1) .980(DTIM=3) .697(DTIM=10)		0.416 *
PM3	~0.12		~43.26		1.33 (DTIM=1) .650(DTIM=3) .302(DTIM=10)		0.061
PM4	~0.092		~43.24		1.28 (DTIM=1) .545(DTIM=3) .26(DTIM=10)		0.036

* These numbers were taken with the PU bit set. By setting this bit, the analog sections (ADC/DAC/ACOMP) are powered down.

**The MCU gets its clock from the WIFI subsection. When WIFI is powered down, the MCU is forced to run off of the internal RC32M clock. Marvell does not recommend this and hence this mode is not supported. Customers can instead put the WIFI in Deep Sleep to save power.

UDP		
RATE	TX Power(dBm)	Current(mA)
11 Mbps	16	100~130
54 Mbps	15	80~100
MCS7	13	70~90

5. Pin description



Pad	Name	Description
A1	GND	
A2	GND	
A3	GND	
A4	GND	
A5	GND	
A6	GND	
A7	GND	
A8	GND	
B1	GND	
B2	GND	
B3	GND	
B4	GND	
B5	SPI_D3	QSPI Data 3
B6	SPI_SSN	QSPI Chip Select (active low)
B7	VDDIO_2	VDDIO_2 domain: GPIO_28 to GPIO_33
B8	GND	

C1	GND	
C2	GND	
C3	GPIO_25	
C4	GND	
C5	SPI_CK	QSPI Clock
C6	SPI_D1	QSPI Data 1
C7	GPIO_39	
C8	GND	
D1	VDDIO_0	VDDIO_0 domain: GPIO_0 to GPIO_15
D2	VBUCK_IN	BUCK18 input 2.7V to 4.3V
D3	GPIO_24	
D4	GPIO_26	
D5	SPI_D0	QSPI Data 0
D6	SPI_D2	QSPI Data 2
D7	VTR_VDD33	3.3V OTP Write Operation or Floating for OTP Read Operation
D8	FLY18_O	On Chip 1.8V LDO output for 1.8V SPI Flash power supply
E1	GND	
E2	GPIO_22	WAKE_UP0
E3	RESTNn	Reset (active low)
E4	GPIO_23	
E5	VDDIO_AON	ADDIO_AON domain: GPIO_22 to GPIO_26, Resetn
E6	GPIO_40	
E7	GPIO_27	GPIO_16/ GPIO_27 Boot Options 00=boot from UART, 11=boot from Flash (default)
E8	GPIO_43	ADC0_1
F1	GPIO_2	UART0_TXD
F2	VDDIO_1	VDDIO_1 domain: GPIO_16 to GPIO_21
F3	GPIO_16	GPIO_16/ GPIO_27 Boot Options 00=boot from UART, 11=boot from Flash (default)
F4	GPIO_49	
F5	GPIO_44	
F6	GPIO_42	ADC0_0

F7	GPIO_41	
F8	VDDIO_3	VDDIO_3 domain: GPIO_34 to GPIO_49, GPIO_27
G1	AVDD33	3.3V Analog Power Supply
G2	GPIO_5	I2C0_SCL
G3	GPIO_8	TMS
G4	GPIO_6	TDO
G5	GPIO_3	UART0_RXD
G6	GPIO_46	ADC0_4
G7	GPIO_45	
G8	VBAT_IN	LDO18 VBAT Input. This pin connects to VBAT source 2.0V to 3.6V
H1	GPIO_1	
H2	GPIO_10	TRSTn
H3	GPIO_9	TDI
H4	GPIO_7	TCK
H5	GPIO_4	I2C0_SDA
H6	GPIO_48	ADC0_6
H7	GPIO_47	ADC0_5
H8	GPIO_0	

6. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : $<250^{\circ}\text{C}$

Number of Times : 2 times

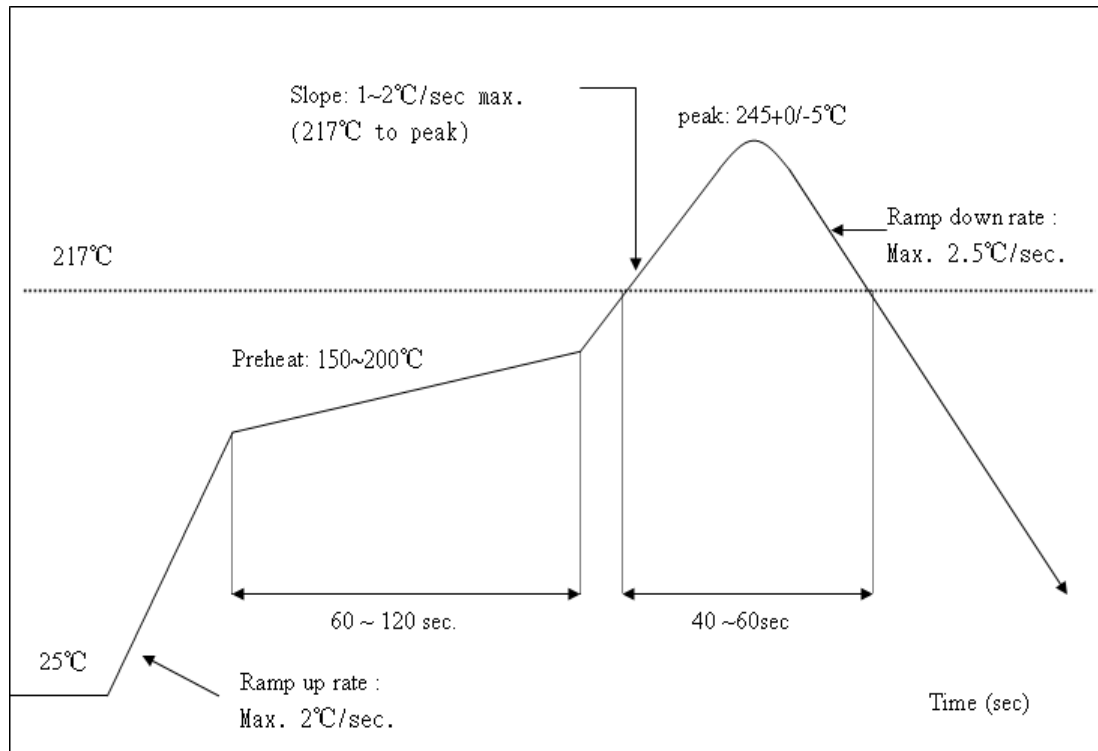


Figure 1-Reflow Soldering Profile

7. Module size and dimension

GTI-MW300L module physical size (Unit: mm)

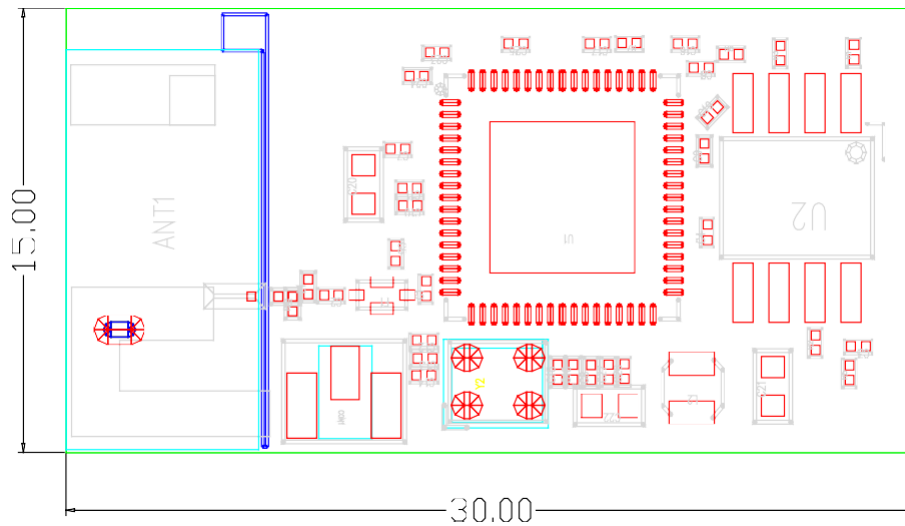


Figure 2- GTI_MW300L / MW320L module mechanical dimension – Top view (Unit: mm)

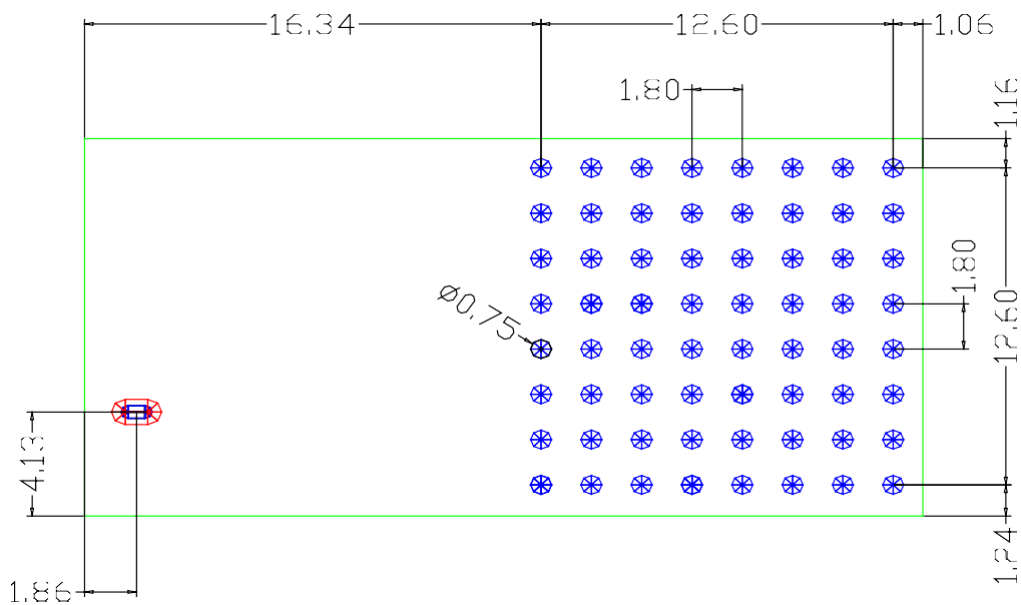


Figure 3- GTI-MW300L / MW320L module mechanical dimension-Bottom view (Unit: mm)

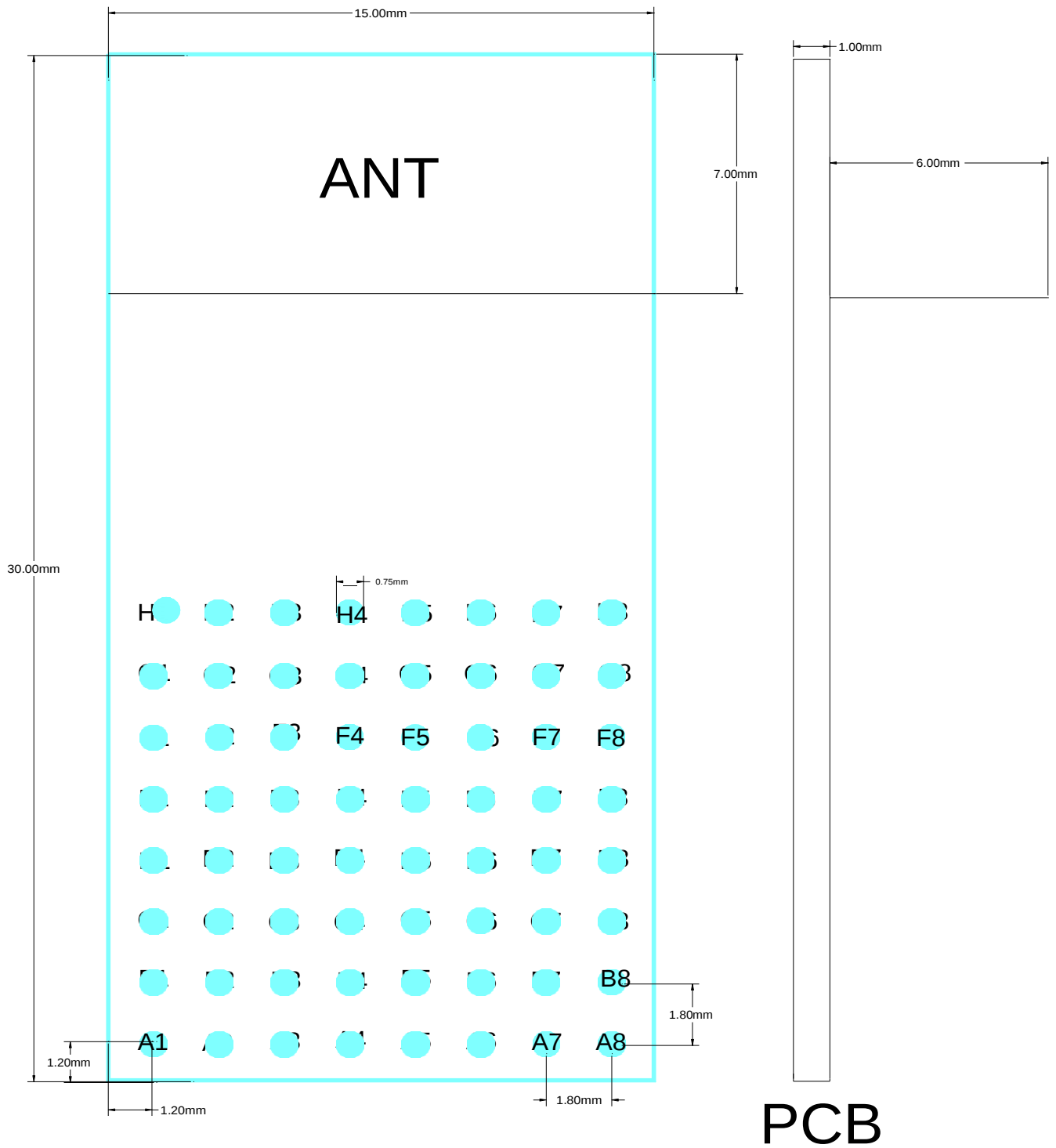
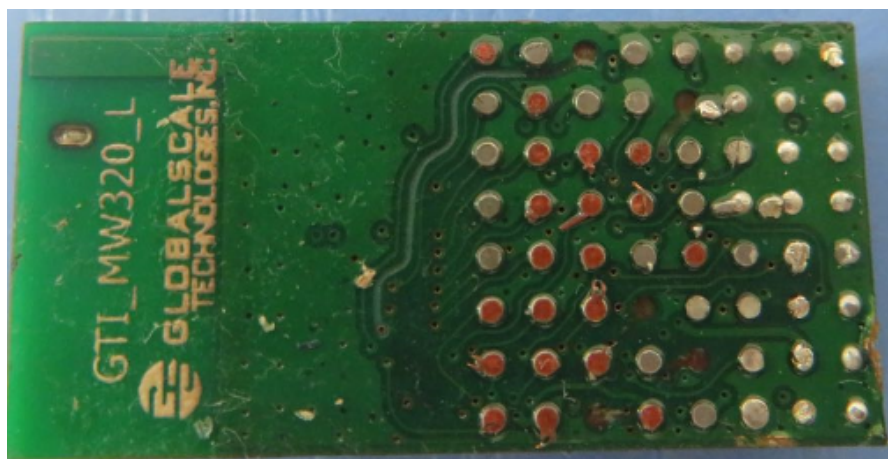
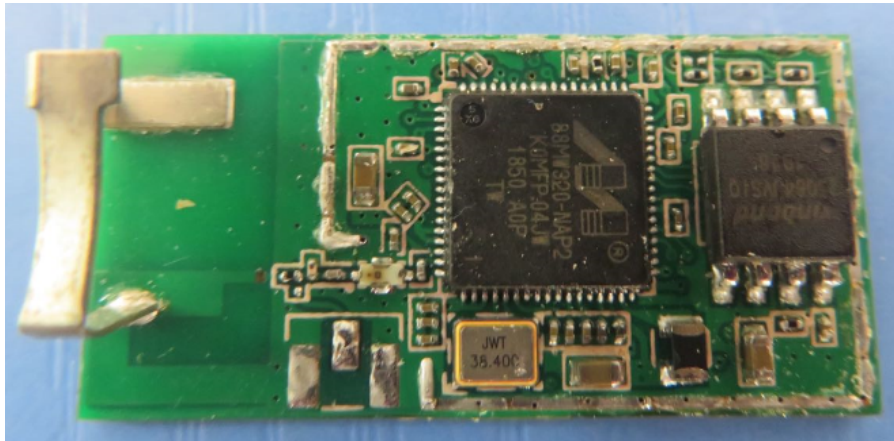
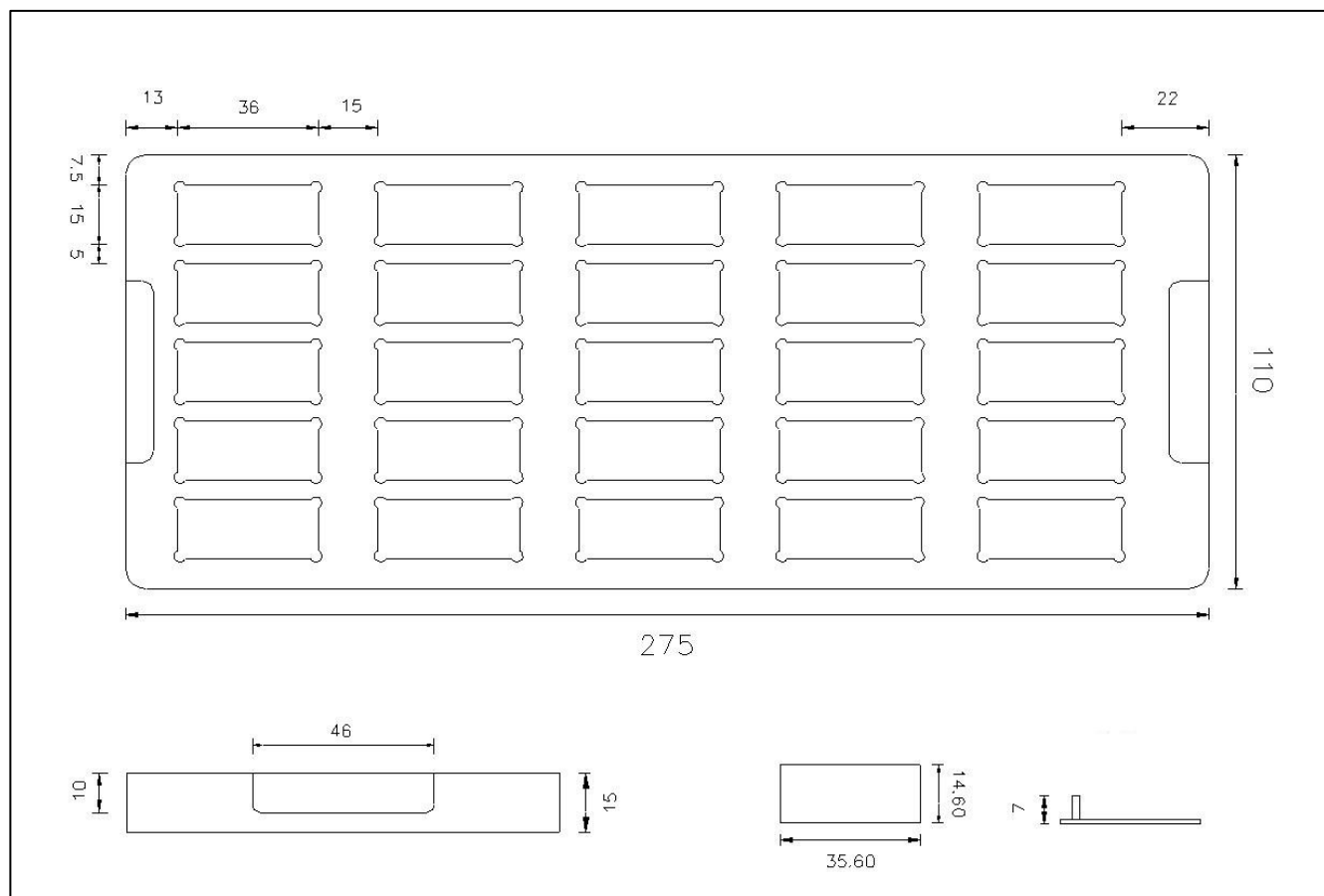


Figure 4-MW320module LGA pads (Unit: mm)

8. Pictures of module



9. Package and order information



FCC 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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 important announcement

Important Note:

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 0cm between the radiator and your body.

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

Country Code selection feature to be disabled for products marketed to the US/Canada.

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,
3. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing 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 cannot 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 cannot 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

The final end product must be labeled in a visible area with the following" Contains FCC ID:YCJMW320"

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.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

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.

2.7 Antennas

This radio transmitter YCJMW320 has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Model	Type	Connector	Peak gain (dBi)				
			2400-2483.5 MHz	5150-5250 MHz	5250-5350 MHz	5470-5725 MHz	5725-5850 MHz
2.4GWIFI	PCB antenna	/	0dBi	/	/	/	/

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID:YCJMW320".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

ISED Statement

- English: 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.

The digital apparatus complies with Canadian CAN ICES-3 (B)/NMB-3(B).

- French: 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. L'appareil numérique du CIEM conforme canadien peut - 3 (b) / nmb - 3 (b).

This device meets the exemption from the routine evaluation limits in section 2.5 of RSS 102 and compliance with RSS 102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Cet appareil est conforme à l'exemption des limites d'évaluation courante dans la section 2.5 du CNR - 102 et conformité avec RSS 102 de l'exposition aux RF, les utilisateurs peuvent obtenir des données canadiennes sur l'exposition aux champs RF et la conformité.

This equipment complies with Canada 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.

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé.

Cet équipement doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps.

ISED Modular Usage Statement

NOTE 1: When the ISED certification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use the wording "Contains transmitter module IC: 11044A-MW320" or "Contains IC: 11044A-MW320".

NOTE 1: Lorsque le numéro de certification ISED n'est pas visible lorsque le module est installé dans un autre appareil, l'extérieur de l'appareil dans lequel le module est installé doit également afficher une étiquette faisant référence au module inclus. Cette étiquette extérieure peut être libellée Contient le module émetteur IC:11044A-MW320 ou Contient IC: 11044A-MW320.