



WBU042-IG5V, WBU042-IG

IEEE 802.11 a/b/g/n/ac 2x2 + BT combo module

Product specification 1.1

Approved:	Approved:	Prepared by:
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Revision History

Date	Number	Approver	Comments
2018/10/18	1.0	Ben Ho	Initial Draft
2019/05/30	1.1		Add Regulatory Information
2019/06/13	1.2		Remove WiFi 2.4G HT40

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CHAPTER 1. MODULE OVERVIEW

The Foxconn WBU042 is a highly integrated module which features a low power 2x2 dual-band Wi-Fi subsystem and a Bluetooth subsystem. The Wi-Fi subsystem contains the 802.11a/b/g/n/ac radio, baseband, and MAC that are designed to meet both the low power and high throughput application.

WBU042 has a 32-bit RISC MCU that handles Wi-Fi and Bluetooth tasks, and an ARM Cortex-R4 MCU that could offload data frame processing in Wi-Fi host driver. The Bluetooth subsystem contains the Bluetooth radio, baseband, link controller. It also uses the 32-bit RISC MCU for the Bluetooth protocols

1-1 Key Characteristic

- 32-bits RISC MCU for Wi-Fi/Bluetooth protocols
- IEEE 802.11 a/b/g/n/ac compliant
- Support 20MHz, 40MHz, 80MHz in 2.4GHz band 5GHz band
- Dual-band 2T2R mode with data rate up to 600Mbps with USB3.0
- Integrated LNA, PA, and T/R switch
- Security support for WFA WPA/WPA2 personal, WPS2.0, WAPI
- Compliance to Bluetooth v5.0
- Integrated BALUN and PA
- USB device fully compliant to USB v3.0 specification

1-3 Block Diagram

The general HW architecture is shown below Figure:

BT: 2402 ~ 2480 MHz

WiFi: 2412 ~ 2472 (for US and Canada, the frequency range is limited to 2412 – 2462 in the Host Firmware.),
5150~5250MHz, 5250~5350MHz, 5470~5725MHz, 5725~5850MHz

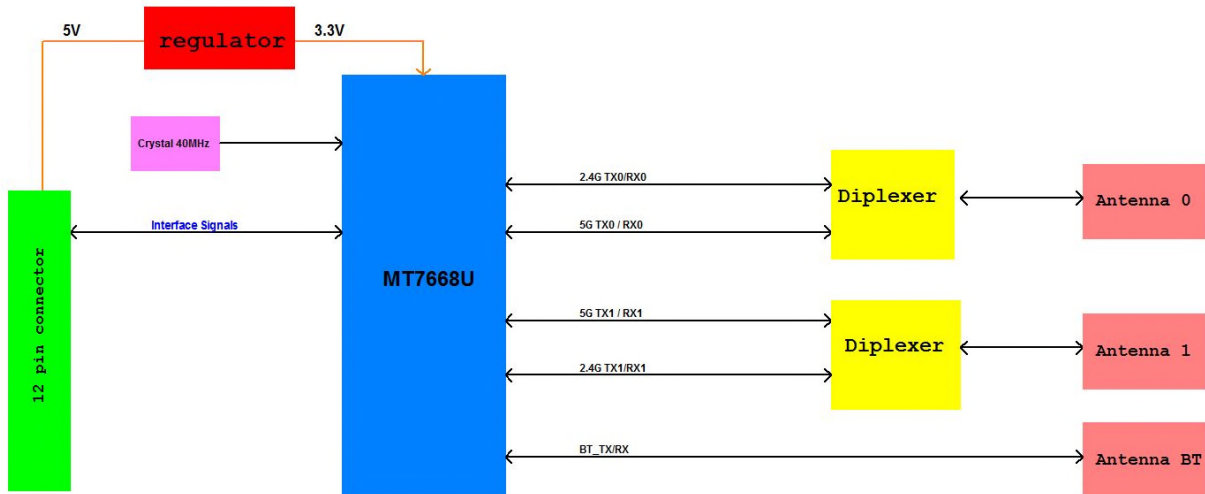


Figure 1 Module Block Diagram

1.4 Pin Definition



Figure 2 Pin Definitions (Module Top View)

Table 1 Pin Definitions

Pin number	Symbol name	Type	Pin description
1	GND	GND	Ground
2	RSL_L	I/O	Reset signal
3	WOW_L	I/O	Wake on WLAN signal output
4	WOBT_L	I/O	Wake on Bluetooth signal output
5	GND	GND	Ground
6	VCC	Power	DC 5V
7	VCC	Power	DC 5V
8	GND	GND	Ground
9	VSYNC	I/O	3D video sync signal
10	GND	GND	Ground
11	DP	I/O	USB 2.0 data+
12	DM	I/O	USB 2.0 data-

CHAPTER 2. ELECTRICAL AND RF SPECIFICATION

2-1 Recommended Operation Rating Table 2 Operation Rating

Parameter	Condition	Min	Typ.	Max.	Unit
VDD3_3	5V	4.5V	5V	5.5V	V
RF Interface	Zo		50		Ohm

2-2 Power Consumption

Table 3 Power Consumption

Description	Typical	Unit
IDLE	61	mA
2G/2T- N mode HT 20MHz MCS 7	150	mA
2G/2T- G mode OFDM54M	160	mA
2G/2T- B mode CCK11M	324	mA
5G/2T- AC mode VHT 80MHz MCS 9	158	mA
5G/2T- N mode HT 40MHz MCS 7	189	mA
5G/2T- N mode HT 20MHz MCS 7	218	mA
5G/2T- A mode OFDM54M	253	mA
2G/2R- N mode HT 20MHz MCS 7	72	mA
2G/2R- G mode OFDM54M	72	mA
2G/2R- B mode CCK11M	72	mA
5G/2R- AC mode HT 80MHz MCS 9	84	mA
5G/2R- N mode HT 40MHz MCS 7	81	mA
5G/2R- N mode HT 20MHz MCS 7	77	mA
5G/2R- A mode OFDM54M	77	mA

2-3 WiFi RF Specification – TX

Table 4 IEEE 802.11 b/g/n/ac TX Output Power (WLAN0&WLAN1)

Data Rate (Mbps)	Modulation	Tx Typical Power (dBm)	Data Rate (Mbps)	Modulation	Tx Typical Power (dBm)
1	DBPSK	12	HT20-MCS0	BPSK	8.5
2	DQPSK	12	HT20-MCS1	BPSK	8.5
5.5	CCK	12	HT20-MCS2	QPSK	8.5
11	CCK	12	HT20-MCS3	QPSK	8.5
6	OFDM	12	HT20-MCS4	16-QAM	8.5
9	OFDM	12	HT20-MCS5	16-QAM	8.5
12	OFDM	12	HT20-MCS6	64-QAM	8.5
18	OFDM	12	HT20-MCS7	64-QAM	8.5
24	OFDM	12			
36	OFDM	12			
48	OFDM	12			
54	OFDM	12			

Table 5 IEEE 802.11 a/n/ac TX Output Power(WLAN0&WLAN1)

Data Rate (Mbps)	Modulation	Tx Typical Power (dBm)	Data Rate (Mbps)	Modulation	Tx Typical Power (dBm)
6	OFDM	10	HT20-MCS0	BPSK	8
9	OFDM	10	HT20-MCS1	BPSK	8
12	OFDM	10	HT20-MCS2	QPSK	8
18	OFDM	10	HT20-MCS3	QPSK	8
24	OFDM	10	HT20-MCS4	16-QAM	8
36	OFDM	10	HT20-MCS5	16-QAM	8
48	OFDM	10	HT20-MCS6	64-QAM	8
54	OFDM	10	HT20-MCS7	64-QAM	8
			HT40-MCS0	BPSK	9
			HT40-MCS1	QPSK	9
			HT40-MCS2	QPSK	9
			HT40-MCS3	16-QAM	9
			HT40-MCS4	16-QAM	9
			HT40-MCS5	64-QAM	9
			HT40-MCS6	64-QAM	9
			HT40-MCS7	64-QAM	9
			VHT80_MCS0	BPSK	7.5
			VHT80_MCS1	QPSK	7.5
			VHT80_MCS2	QPSK	7.5
			VHT80_MCS3	16-QAM	7.5
			VHT80_MCS4	16-QAM	7.5
			VHT80_MCS5	64-QAM	7.5
			VHT80_MCS6	64-QAM	7.5
			VHT80_MCS7	64-QAM	7.5
			VHT80_MCS8	256-QAM	7.5
			VHT80_MCS9	256-QAM	7.5

2-4 WiFi RF Specification – RX

Table 6 IEEE 802.11 b/g/n RX Sensitivity (WLAN0&WLAN1)

Data Rate (Mbps)	Modulation	Rx Sensitivity (dBm)		Data Rate (Mbps)	Modulation	Rx Sensitivity (dBm)	
		Max.	Typ.			Max.	Typ.
1	DBPSK	-83	-90	HT20-MCS0	BPSK	-82	-89
2	DQPSK	-80	-87	HT20-MCS1	QPSK	-79	-86
5.5	CCK	-79	-86	HT20-MCS2	QPSK	-77	-84
11	CCK	-76	-83	HT20-MCS3	16-QAM	-74	-81
6	OFDM	-85	-90	HT20-MCS4	16-QAM	-70	-77
9	OFDM	-84	-88	HT20-MCS5	64-QAM	-66	-73
12	OFDM	-82	-87	HT20-MCS6	64-QAM	-65	-72
18	OFDM	-80	-85	HT20-MCS7	64-QAM	-64	-71
24	OFDM	-77	-82				
36	OFDM	-73	-78				
48	OFDM	-69	-74				
54	OFDM	-68	-72				

Table 5 IEEE 802.11 a/n/ac RX Sensitivity (WLAN0&WLAN1)

Data Rate (Mbps)	Modulation	Rx Sensitivity (dBm)		Data Rate (Mbps)	Modulation	Rx Sensitivity (dBm)	
		Max.	Typ.			Max.	Typ.
6	OFDM	-85	-90	HT20-MCS0	BPSK	-82	-88
9	OFDM	-84	-88	HT20-MCS1	QPSK	-79	-86
12	OFDM	-82	-87	HT20-MCS2	QPSK	-77	-84
18	OFDM	-80	-84	HT20-MCS3	16-QAM	-74	-81
24	OFDM	-77	-81	HT20-MCS4	16-QAM	-70	-77
36	OFDM	-73	-78	HT20-MCS5	64-QAM	-66	-73
48	OFDM	-69	-74	HT20-MCS6	64-QAM	-65	-72
54	OFDM	-68	-72	HT20-MCS7	64-QAM	-64	-71
				HT40-MCS0	BPSK	-79	-86
				HT40-MCS1	QPSK	-76	-83
				HT40-MCS2	QPSK	-74	-81
				HT40-MCS3	16-QAM	-71	-78
				HT40-MCS4	16-QAM	-67	-74
				HT40-MCS5	64-QAM	-63	-70
				HT40-MCS6	64-QAM	-62	-69
				HT40-MCS7	64-QAM	-61	-68
				VHT80_MCS0	BPSK	-76	-83
				VHT80_MCS1	QPSK	-73	-80
				VHT80_MCS2	QPSK	-71	-78
				VHT80_MCS3	16-QAM	-68	-75
				VHT80_MCS4	16-QAM	-64	-71
				VHT80_MCS5	64-QAM	-60	-67
				VHT80_MCS6	64-QAM	-59	-66
				VHT80_MCS7	64-QAM	-58	-65
				VHT80_MCS8	256-QAM	-53	-60
				VHT80_MCS9	256-QAM	-51	-58

2-5 Bluetooth RF Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Basic Data Rate – Transmit Performance					
RF Transmit Power (TRM01)		-1.5	2.5	6.5	dBm
Power Density (TRM02)	Per 100kHz	≤20			dBm
Power Control (TRM03)		2 ≤ step size ≤ 8			dB
TX Output Spectrum – Freq. Range (TRM04)	F(low)- CH0	> 2400			MHz
	F(high)-CH78	< 2483.5			
TX Output Spectrum – 20dB BW (TRM05)		f _H -f _L < 1000			MHz
TX Output Spectrum – Adjacent Channel Power (TRM06)	f-f ₀ = 2MHz	≤ -20			dBm
	f-f ₀ ≥ 3MHz	≤ -40			
TX Output Spectrum – Out of Band Spurious Emission	30MHz – 1GHz	≤ -36			dBm
	1GHz -12.75GHz	≤ -30			
	5.15GHz -5.35GHz	≤ -47			
	5.725GHz-5.825GHz	≤ -47			
Modulation Characteristic (TRM07)	Delta f1 avg	140 ≤ Δf _{1avg} ≤ 175			kHz
	Delta f2 max	≥ 115 at 99.9%			
	Delta f2 avg/Delta f1 avg	≥ 0.8			
Initial Carrier Frequency Tolerance (TRM08)		≤ ± 75			kHz
Carrier Frequency Drift (TRM09)	DH1	≤ ± 25			kHz
	DH3	≤ ± 40			
	DH5	≤ ± 40			
Maximum Drift Rate (TRM09)		20 kHz/50 us			
Enhanced Data Rate – Transmit Performance					
RF Transmit Power	π/4 DQPSK	2.5	4	5.5	dBm
	8DPSK	2.5	4	5.5	
Relative Transmit Power (TRM10)	All pairs	(P _{GFSK} -4 dB) < P _{DPSK} < (P _{GFSK} +1 dB)			
Carrier Frequency Stability (TRM11)	All packets	-75 ≤ w _i ≤ 75			kHz
	All blocks	-75 ≤ (w ₀ +w _i) ≤ 75			
	All blocks	-10 ≤ w ₀ ≤ 10			
Modulation Accuracy – RMS DEVM (TRM11)	π/4 DQPSK	≤ 20			%
	8DPSK	≤ 13			
Modulation Accuracy – Peak DEVM (TRM11)	π/4 DQPSK	≤ 35			
	8DPSK	≤ 25			
Modulation Accuracy – 99% DEVM (TRM11)	π/4 DQPSK	≤ 30			
	8DPSK	≤ 20			
EDR Differential Phase Emissions (TRM12)		≥ 99			%
In-band Spurious Emission (TRM13)	f-f ₀ = 1MHz	≤ -26			dB
	f-f ₀ = 2MHz	≤ -20			dBm
	f-f ₀ ≥ 3MHz	≤ -40			
TX Output Spectrum – Out of Band Spurious Emission	30MHz – 1GHz	≤ -36			dBm
	1GHz -12.75GHz	≤ -30			

	5.15GHz -5.35GHz	≤ -47	
	5.725GHz-5.825GHz	≤ -47	
Enhanced power control (TRM14)	Step Size	$2 \leq \text{Step Size} \leq 8$	dB
	Difference. Btw. GFSK, $\pi/4$ DQPSK,&8DPSK	≤ 10	
Basic Data Rate – Receiver Performance			
Sensitivity at 0.1% BER (RCV01-02)		≤ -81	dBm
C/I Co-Channel interference (RCV03)		≤ 11	
C/I Adjacent CH interference (RCV03)	$ f-f_0 = 1\text{MHz}$	≤ 0	dB
	$ f-f_0 = 2\text{MHz}$	≤ -30	
	$ f-f_0 \geq 3\text{MHz}$	≤ -40	
C/I Image CH interference (RCV03)	C/I_{image}	≤ -9	dB
	$C/I_{\text{image}\pm 1\text{MHz}}$	≤ -20	
Out of band Blocking (RCV04)	30MHz – 2000 MHz	-10	dBm
	2003MHz – 2399MHz	-27	
	2484MHz – 2997MHz	-27	
	3000MHz – 12750MHz	-10	
Intermodulation Performance at $\leq 0.1\%$ BER (RCV05)		-64	dBm
Maximum input power level		≥ -20	
Spurious Emission	30MHz – 12.75GHz	≤ -57	dBm
Enhanced Data Rate – Receiver Performance			
Sensitivity at 0.1% BER (RCV07)	$\pi/4$ DQPSK	≤ -85	dBm
	8DPSK	≤ -77	
EDR BER Floor Performance at $\leq 0.0007\%$ BER (RCV08)		-60	dBm
C/I Co-Channel interference (RCV09)	$\pi/4$ DQPSK	$\leq +13$	
	8DPSK	$\leq +21$	
C/I Adjacent Channel C/I $ f-f_0 = 1\text{MHz}$ (RCV09)	$\pi/4$ DQPSK	≤ 0	dB
	8DPSK	$\leq +5$	
C/I Adjacent Channel C/I $ f-f_0 = 2\text{MHz}$ (RCV09)	$\pi/4$ DQPSK	≤ -30	dB
	8DPSK	≤ -25	
C/I Adjacent Channel C/I $ f-f_0 \geq 3\text{MHz}$ (RCV09)	$\pi/4$ DQPSK	≤ -40	dB
	8DPSK	≤ -33	
C/I Image Channel C/I_{image} (RCV09)	$\pi/4$ DQPSK	≤ -7	dB
	8DPSK	≤ 0	
C/I Image Channel $C/I_{\text{image}\pm 1\text{MHz}}$ (RCV09)	$\pi/4$ DQPSK	≤ -20	dB
	8DPSK	≤ -13	
Maximum input power level (RCV10)		≥ -20	dBm
Spurious Emission	30MHz – 12.75GHz	≤ -57	

2-6 Bluetooth Low Energy RF Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Transmit Performance					
RF Transmit Power (TRM-LE01,02)		-1.5	2.5	6.5	dBm
In-Band Emission (TRM-LE03,04)	$ f - f_0 = 2\text{MHz}$	≤ -20			dBm
	$ f - f_0 \geq 3\text{MHz}$	≤ -30			
TX Output Spectrum – Out of Band Spurious Emission	30MHz – 1GHz	≤ -36			dBm
	1GHz -12.75GHz	≤ -30			
	5.15GHz -5.35GHz	≤ -47			
	5.725GHz-5.825GHz	≤ -47			
Modulation Characteristic (TRM-LE05)	Delta f1 avg	$225 \leq \Delta f_{1\text{avg}} \leq 275$			kHz
	Delta f2 max	≥ 185 at 99.9%			
	Delta f2 avg/Delta f1 avg	≥ 0.8			
Carrier Frequency Drift (TRM-LE06,07)	Center frequency	$\leq \pm 150$			kHz
	During any packet	$\leq \pm 50$			
Maximum Drift Rate (TRM-LE06,07)		20 Hz/50 us			
Receiver Performance					
Sensitivity at 30.8% PER(0.1%BER) (RCV-LE01,02)		≤ -81			dBm
C/I Co-Channel interference (RCV-LE03)	Co-channel	≤ 21			dB
C/I Adjacent CH interference (RCV-LE03)	$ f - f_0 = 1\text{MHz}$	≤ 15			
	$ f - f_0 = 2\text{MHz}$	≤ -17			
	$ f - f_0 \geq 3\text{MHz}$	≤ -27			
C/I Image CH interference (RCV-LE03)	C/I_{image}	≤ -9			
	$C/I_{\text{image} \pm 1\text{MHz}}$	≤ -15			
Out of band Blocking (RCV-LE04)	30MHz – 2000 MHz	-30			dBm
	2003MHz – 2399MHz	-35			
	2484MHz – 2997MHz	-35			
	3000MHz – 12750MHz	-30			
Intermodulation Performance at $\leq 30.8\%$ ($\leq 0.1\%$ BER) (RCV-LE05)		-64			dBm
Maximum input power level (RCV-LE06)		≥ -10			dBm
PER Report Integrity 50% \leq PER \leq 65.4% (RCV-LE07)		-30			dBm
Spurious Emission	30MHz – 12.75GHz	≤ -57			dBm

2-7 Antenna Specification Requirements

Nominal antenna port impedance specification is 50 ohms for the Foxconn WBU042 hardware.

For regulatory requirements, it is assumed that the antenna gain is:

For WLAN1 & WLAN2 (WiFi):

Antenna gain for the 2.4GHz band :3.5dBi(TBD)

Antenna gain for the 5GHz band :5dBi(TBD)

For BT (Bluetooth):

Antenna gain for the 2.4GHz band :3.5dBi(TBD)



2-8 Environment Specifications

Operating Conditions (preliminary)

Operation Temperature : 0 ~ 60°C

Storage Conditions (preliminary)

Non-Operation Temperature : -10 ~ 60°C (Typ. 25°C)

CHAPTER 3. MECHANICAL SPECIFICATION

3-1 Module Assembly Dimension

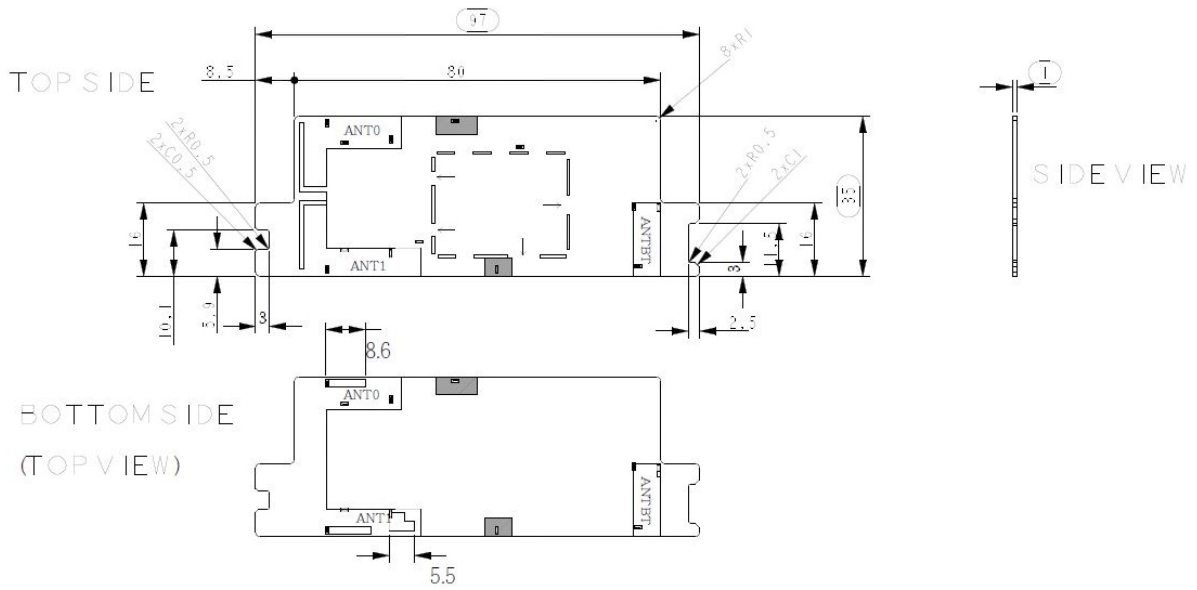


Figure 3 Mechanical Drawing

CHAPTER 4. REGULATORY INFORMATION

4-1 REGULATORY INFORMATION

Federal Communication Commission Interference Statement

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

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help. FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

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

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

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

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

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

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: RX3-WBU042IG". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Canada, Industry Canada (IC) Statement

This Class B digital apparatus complies with Canadian ICES-003.

This device complies with Industry Canada licence-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.

RF Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Required end product labeling:

Any device incorporating this module must include an external, visible, permanent marking or label which states: "Contains IC: 2878F-WBU042IG"

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 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.

Canada, Industrie Canada (IC) Déclaration

Cet appareil numérique de classe B est conforme à la norme NMB-003.

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.

Déclaration d'exposition aux radiations:

Cet appareil est conforme aux limites d'exposition aux rayonnements définies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à une distance minimale de 20 centimètres entre le radiateur et votre corps.

Obligation d'étiquetage du produit final:

Tout dispositif intégrant ce module doit comporter un externe, visible, marquage permanent ou une étiquette qui dit: "Contient IC : 2878F-WBU042IG".

Cet émetteur radio (identifier le dispositif par numéro de certification ou le numéro de modèle , si la catégorie II) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous avec le gain maximal admissible indiqué . types d'antennes non inclus dans cette liste , ayant un gain supérieur au gain maximum indiqué pour ce type , sont strictement interdits pour une utilisation avec cet appareil.

Taiwan, National Communications Commission (NCC) Statement

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；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，指依電信法規定作業之無線電通信。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。應避免影響附近雷達系統之操作。
本產品電磁波曝露量(MPE)標準值 1mW/cm²，送測產品實測值 0.018925 mW/cm²，建議使用時至少距離人體 20cm。

4-2 CERTIFICATION

Europe



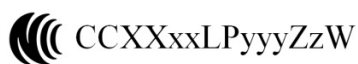
USA

FCC ID : RX3-WBU042IG

Canada

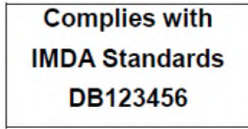
IC : 2878F-WBU042IG

NCC



To update following countries with CORRECT cert. numbers

Singapore



Brunei



OMAN



UAE

