WF60 Datasheet

Amp’ed RF Technology, Inc.

WF60 Product Specification

13.5mm x 14.6mm x 2.7 mm

Description

Amp'ed RF Tech presents the WF60 WiFi dual band module: 802.11abgn. The WF60 is a small footprint low cost RF module intended to help customers shorten product development cycles and reduce cost. It's fully compatible with Linux & Android systems, or our own upper layer stack, Amp'ed UP, for a complete host & controller solution.

Features

WLAN

- 802.11a/b/g/n
- Dual Band: 2.4GHz and 5GHz
- Output Power, +21.5dBm
- Power savings mode
- Transmit power back-off
- Wi-Fi Direct (concurrent)
- Wi-Fi Display
- Wi-Fi Protected Setup
- Soft Access Point
- Hotspot 2.0
- Security: WPAI/WPA2, AES, WEP

Hardware

- Interface, SDIO 2.0 or SPI
- 1 LPO input
- Standby current, 70 µA
- RoHS conformance
- FCC/IC/CE certified

Contents

1. Hardware Specifications

General Conditions (VIN= 3.6V and 25°C)

1.1. Recommended Operating Conditions

Rating	Min	Typical	Max	Unit
Operating Temperature Range	-40	-	85	°C
Supply Voltage VIN	3.0	3.6	4.8	Volts
Signal Pin Voltage	-	1.8	-	Volts
RF Frequency	2400	-	2483.5	MHz

1.2. Absolute Maximum Ratings

Rating	Min	Typical	Max	Unit
Storage temperature range	-55	-	+150	°C
Supply voltage VIN	-0.3	-	+5.0	Volts
I/O pin voltage VIO	-0.3	-	+2.5	Volts
RF input power	-	-	-5	dBm

1.3. I/O Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{IL}	Low-Level Input Voltage	-	0.6	Volts
V_{IH}	High-Level Input Voltage	1.3	-	Volts
V_{OL}	Low-Level Output Voltage	-	0.2	Volts
V_{OH}	High-Level Output Voltage	1.6	-	Volts
I_{OL}	Low –Level Output Current	-	4.0	mA
I_{OH}	High-Level Output Current	-	4.0	mA
R_{PU}	Pull-up Resistor	80	120	KΩ
R_{PD}	Pull-down Resistor	80	120	KΩ

1.4. Current Consumption

Modes (WLAN Max Power Consumption) **VBAT=3.6v**	**Avg**	**Unit**
Complete Power Down (PMUEN low)	17	µA
Sleep	101	µA
Power save (beacon period including DTIM 100ms, beacon length 1ms) -proprietary power saving features enabled	0.77	mA
RX (idle, 2.4GHz)	62.07	mA
RX (active, 2.4GHz, OFDM)	65.87	mA
TX (active, 2.4GHz, OFDM), 15.5dBm @RF port	257.67	mA
TX (active, 2.4GHz, OFDM), 20.5dBm @RF port	279.67	mA
A VoIP call using a standard codec G.711 (64Kb/s, 320 byte packets) and U-APSD (WMM power save) power-saving mode.	4.65	mA
Video streaming; the device is receiving 2.0 Mbps of data using legacy PSM mode (for example, MPEG-4@2Mbps)	13.31	mA
Ipeak: system maximum peak current draw	378	mA

1.5. Selected RF Characteristics

Parameters	Conditions	Typical	Unit
Antenna load		50	ohm
Wi-Fi Receiver 2.4GHz			
Sensitivity	DSSS 1Mbps@FER<8%	-98.5	dBm
Sensitivity	DSSS 2Mbps@FER<8%	-96	dBm
Sensitivity	CCK 5.5Mbps@FER<8%	-94	dBm
Sensitivity	CCK 11Mbps@FER<8%	-89	dBm
Sensitivity	BPSK 6Mbps@PER<10%	-94.5	dBm
Sensitivity	BPSK 9Mbps@PER<10%	-92.5	dBm
Sensitivity	QPSK 12Mbps@PER<10%	-91.5	dBm
Sensitivity	QPSK 18Mbps@PER<10%	-89	dBm
Sensitivity	16QAM 24Mbps@PER<10%	-86	dBm
Sensitivity	16QAM 36Mbps@PER<10%	-83	dBm
Sensitivity	64QAM 48Mbps@PER<10%	-78.5	dBm
Sensitivity	64QAM 54Mbps@PER<10%	-77	dBm
Sensitivity	BPSK 6.5Mbps@PER<10%	-92.5	dBm
Sensitivity	QPSK 13Mbps@PER<10%	-89.5	dBm
Sensitivity	QPSK 19.5Mbps@PER<10%	-87	dBm
Sensitivity	16QAM 26Mbps@PER<10%	-84.5	dBm
Sensitivity	16 QAM 39Mbps@PER<10%	-81	dBm
Sensitivity	64QAM 52Mbps@PER<10%	-77	dBm
Sensitivity	64QAM 58.5Mbps@PER<10%	-75.5	dBm
Sensitivity	64QAM 65Mbps@PER<10%	-73.5	dBm
Wi-Fi Receiver 5GHz 11n			
Sensitivity	BPSK 6.5Mbps@PER<10%,Nss=1	-91	dBm
Sensitivity	QPSK 13Mbps@PER<10%, Nss=1	-88	dBm
Sensitivity	16QAM 26MbpsPER<10%,Nss=1	-83	dBm
Sensitivity	64QAM 65MbpsPER<10%,Nss=1	-72.5	dBm
Wi-Fi Transmitter 2.4GHz			
Output Power	802.11b/g BPSK 1/2	20	dBm
Output Power	802.11b/g BPSK 3/4	20	dBm
Output Power	802.11b/g QPSK 1/2	20	dBm
Output Power	802.11b/g QPSK 3/4	20	dBm
Output Power	802.11b/g 16QAM 1/2	19.5	dBm
Output Power	802.11b/g 16QAM 3/4	18.5	dBm

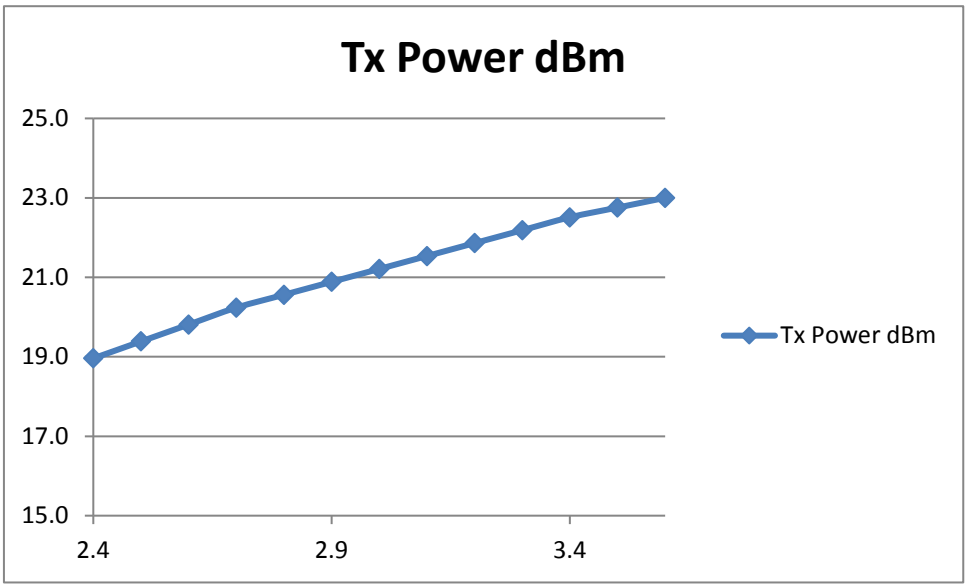
Output Power	802.11b/g 64QAM 2/3	17.5	dBm
Output Power	802.11b/g 64QAM 3/4	16.5	dBm
Output Power	802.11n MCS-0	20	dBm
Output Power	802.11n MCS-1	20	dBm
Output Power	802.11n MCS-2	20	dBm
Output Power	802.11n MCS-3	19.5	dBm
Output Power	802.11n MCS-4	18.5	dBm
Output Power	802.11n MCS-5	17.5	dBm
Output Power	802.11n MCS-6	16.5	dBm
Output Power	802.11n MCS-7	15.5	dBm
Wi-Fi Transmitter 5GHz, 11n			
Output Power	802.11n MCS-0	19.5	dBm
Output Power	802.11n MCS-7	14.5	dBm

1.6. Transmit Power Back-off

When 2.7 V < VIN < 3.6 V, the output power shall be backed off by 0.8 dB per300 mV drop of VIN below 3.6 V to guarantee meeting spectral mask, EVM, harmonic levels, spurious emissions and regulatory requirements in general.

When the load is not 50Ω, the output power is backed off to guarantee meeting spectral mask, EVM, harmonic levels, spurious emissions and regulatory requirements in general. The device is able to withstand a VSWR of up to 12:1 without any damage.

When the temperature increases from +25°C to +85°C, the output power shall be backed off by 0.25 dB per 10°C increase to guarantee meeting spectral mask, EVM, harmonic levels, spurious emissions and regulatory requirements in general.



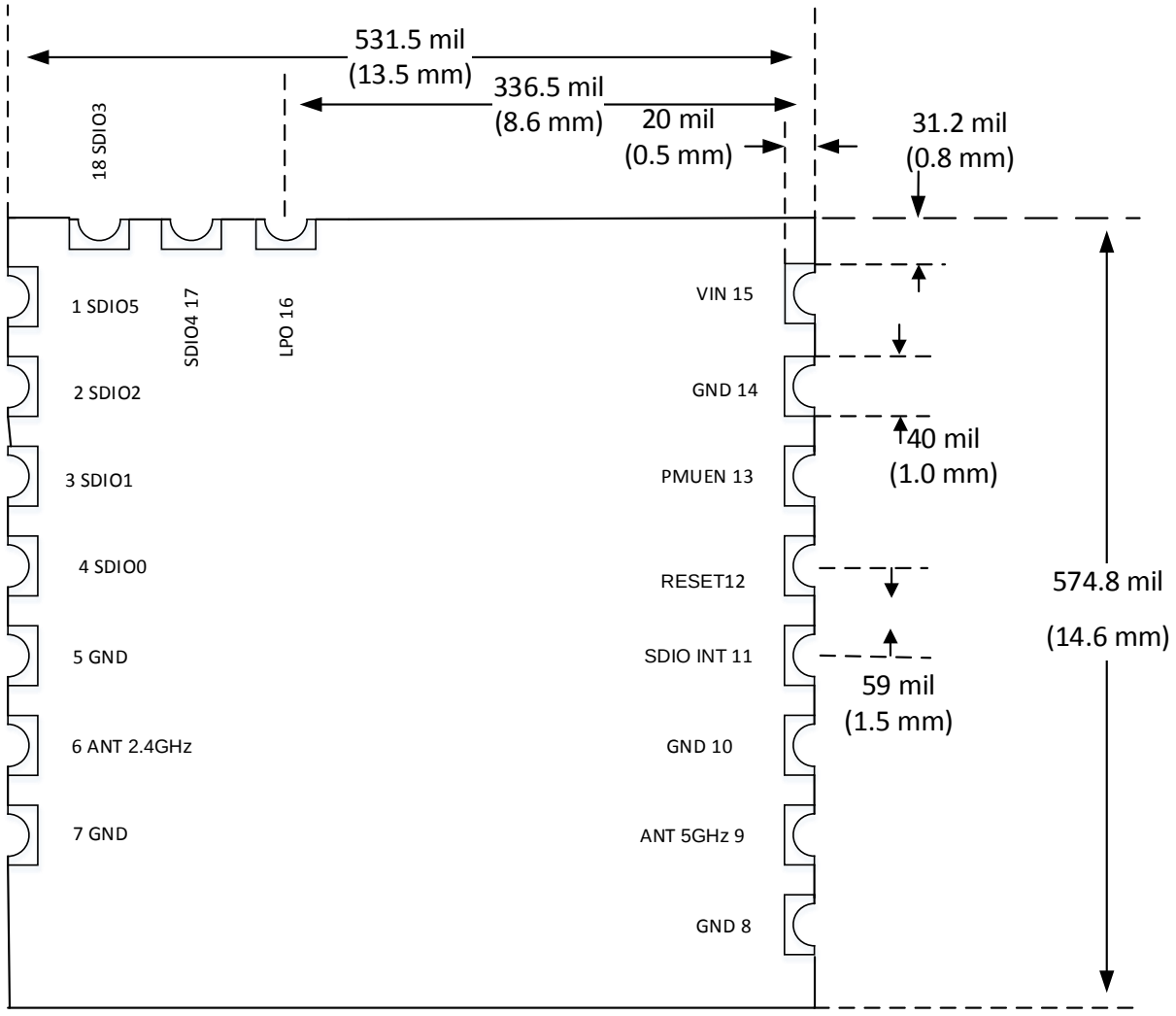
Tx Power vs Vin
(note: operation below 3.0Vbatt is not guaranteed)

1.7. Pin Assignment

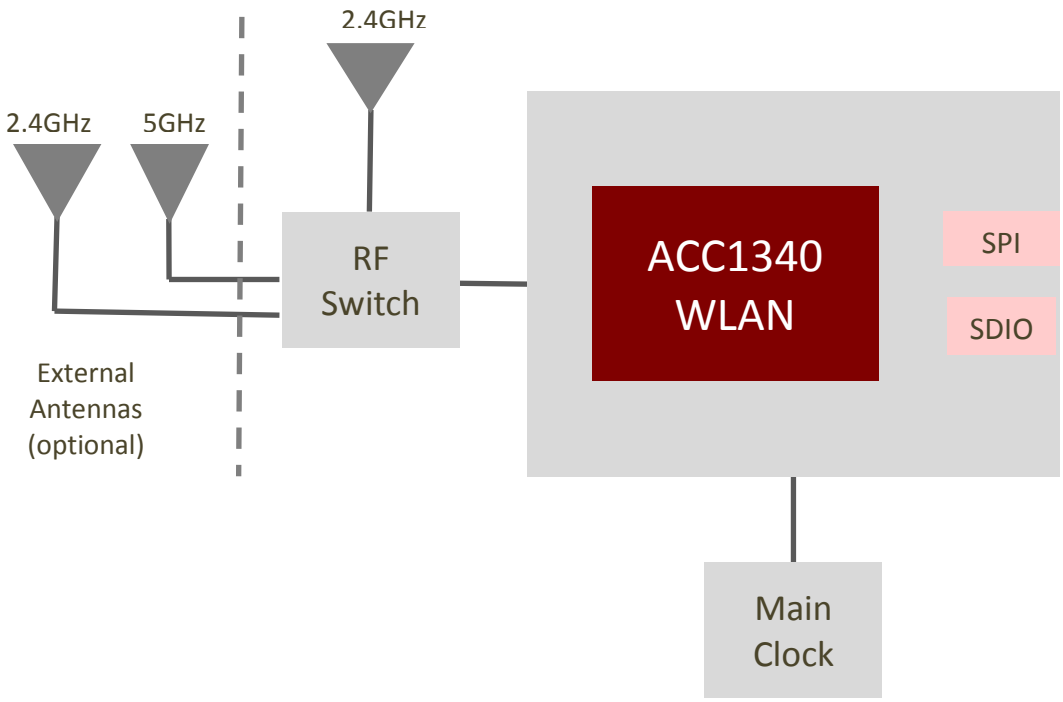
Name	Type	Pin #	Description	ALT Function
Power and Ground				
VIN		15	VIN	
GND		14	GND	
Control signal				
RESET	I	12	Reset input	
PMUEN	I	13	Power enable	
Digital interface				
SDIO [0]	I/O	4	SDIO CMD	SPI DI
SDIO [1]	I/O	3	SDIO DATA0	SPI DO
SDIO [2]	I/O	2	SDIO DATA1	SPI INT
SDIO [3]	I/O	18	SDIO DATA3	SPI CSN
SDIO [4]	I/O	17	SDIO CLK	SPI CLK
SDIO [5]	I/O	1	SDIO DATA2	
SDIO INT		11	SDIO INT	
LPO				
LPO	I	16	Low power clock input	
External Antenna				
GND		5	GND	
ANT 2.4G	I/O	6	External 2.4GHz antenna	
GND		7	GND	
GND		8	GND	
ANT 5G	I/O	9	External 5GHz antenna	
GND		10	GND	

1.8. Layout Drawing

Size: 13.5 mm x 14.6 mm x 2.7 mm



2. Hardware Block Diagram



3. Hardware Design

- All unused pins should be left floating; do not ground.
- All GND pins must be well grounded.
- The area around the antenna should be free of any ground planes, power planes, trace routings, or metal for at least 6.5 mm in all directions.
- Traces should not be routed underneath the module.

3.1. Module Reflow Installation

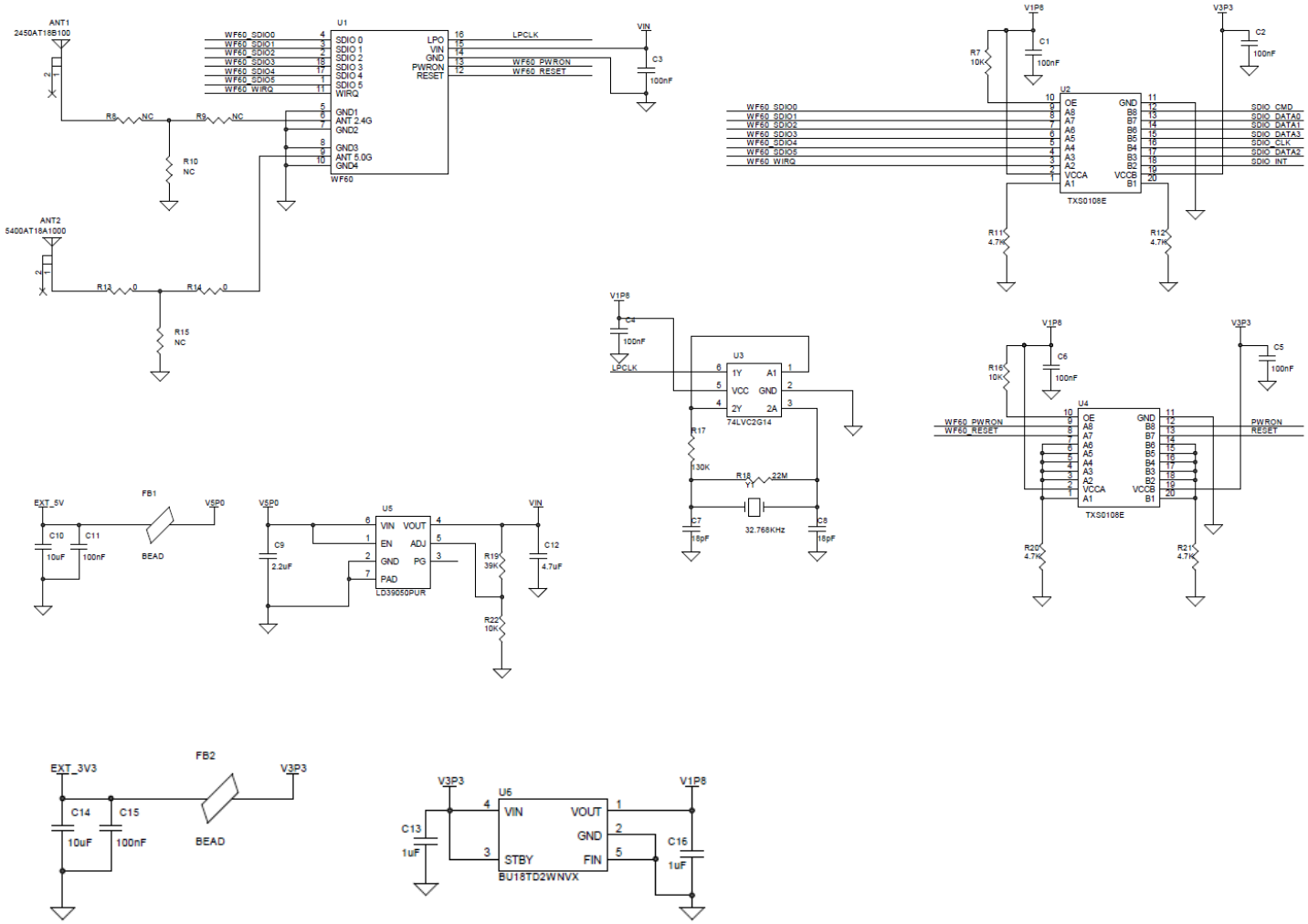
The WF60 is a surface mount Bluetooth module supplied on a 18 pin, 6-layer PCB. The final assembly recommended reflow profiles are:

For RoHS/Pb-free applications, Sn96.5/Ag3.0/Cu0.5 solder is recommended.

- Maximum peak temperature of 230° - 240°C (below 250°C).
- Maximum rise and fall slope after liquidous of < 2°C/second.
- Maximum rise and fall slope after liquidous of < 3°C/second.
- Maximum time at liquidous of 40 – 80 seconds.

4. Reference Design Example

The follow circuits are examples of typical Linux based platform connections to the WF60 module.



5. Startup behavior

5.1. RESET and PMUEN

A valid reset shall be obtained by maintaining RESET active (low) for at least two cycles of LPO after VIN is stable within its operating range. There is no constraint on the activation of the other supplies during this process.

5.2. SDIO and SPI interface

SDIO 5 is the selection pin; the state of this pin is monitored on the rising edge of RESET.

- LOW selects SPI
- HIGH selects SDIO

6. Regulatory Compliance

Federal Communications Commission statement:

This module has been tested and found to comply with the FCC Part15.

These limits are designed to provide reasonable protection against harmful interference in approved installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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.

Modifications or changes to this equipment not expressly approved by Amp'ed RF Technology may void the user's authority to operate this equipment.

The modular transmitter must be equipped with either a permanently affixed label or must be capable of electronically displaying its FCC identification number

(A) If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification 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 wording such as the following: "Contains Transmitter Module FCC ID: X3ZWFMOD9" or "Contains FCC ID: X3ZWFMOD9."

(B) If the modular transmitter uses an electronic display of the FCC identification number, the information must be readily accessible and visible on the modular transmitter or on the device in which it is installed. If the module is installed inside another device, then the outside of the device into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC certified transmitter module(s)."

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada statement:

Label of the end product:

The final end product must be labeled in a visible area with the following "Contains transmitter module IC: 8828A-MOD9"

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

Cetappareilnumérique de la classe B estconforme à la norme NMB-003 du Canada.

This device complies with RSS-210 of the Industry Canada 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.

Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

6.1. Modular Approval, FCC and IC

FCC ID: X3ZWFMOD9

IC: 8828A-MOD9

In accordance with FCC Part 15, the WF60 is listed above as a Limited Modular Transmitter device.

6.2. FCC Label Instructions

The outside of final products that contain a WF60 device must display a label referring to the enclosed module. This exterior label can use wording such as the following:

Contains Transmitter Module

FCC ID: X3ZWFMOD9

IC: 8828A-MOD9

Any similar wording that expresses the same meaning may be used.

6.3. CE Label Instructions

CE 0197

7. Ordering Information

Part Name	Description
WF60-DB	Dual band, internal antenna for 2.4GHz, 5GHz ext antenna
WF60-DB-EXT	Dual band, external antenna option for 2.4GHz, 5GHz ext antenna
WF60-LB	Low band only, 2.4GHz, internal antenna
WF60-LB-EXT	Low band only, 2.4GHz, ext antenna

8. Revision History

Data	Revision	Description
14-June-2016	1.0	First release
27-Aug-2018	1.1	Updated module reference design
2-Sep-20	1.2	Updated low voltage operation