Amphenol

Datasheet

Amphenol - Wi-Fi module

W105C

Document information

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Revision History

Version	Date	Note
1.0	2021-04-27	Created
1.1	2022-06-02	RF feature updated
1.2	2022-08-25	Pin description modified
1.3	2022-11-10	RF feature added
1.4	2022-12-20	Feature modified
1.5	2023-03-13	Certification Updated

Aim of this Document

The aim of this document is to give a detailed product description and product application including features and performance of the W105C.

Contents

1. Introduction

W105C modules designed base on RTL8710B chip solution, The SOC module is a highly intelligent platform for the Internet of Everything that contains a low-power Wi-Fi connectivity solution on one package.

1.1 Key Features

- Processor: RTL8710B

- Wi-Fi
- ✓ IEEE 802.11b/g/n
- ✓ 1T1R 2.4GHz Single Frequency
- ✓ Support HT20, HT40, up to 72Mbps@MCS7
- ✓ Support WPA/WPA2 PSK, Open /WEP /TKIP/CCMP

- ✓ Support WPA/WPA2 Enterprise
- ✓ Support WPS, Wi-Fi Direct
- ✓ Support IEEE Power Save mode

- Memory
- ✓ 1/2/4 MB optional

1.2 Application

- ✓ IOT
- ✓ Network Consumer Device
- ✓ Metering
- ✓ Building Automation

- ✓ Home Automation
- ✓ Smart lighting
- ✓ Industry Control

2. Module Overview

W105C could be used for IoT data communication, data collection and control because of rich peripheral interfaces. Data can be transmitted through module to the Internet of Things cloud service platform by using Wi-Fi network connection.

W105C is used in a lot of applications because it can support different form factors, many interface types, and wide temperature range.

2.1 Product Overview

Table 2-1 Specification of W105C

Wi-Fi	
Standard	IEEE 802.11b/g/n
RF	
Frequency	2.412GHz to 2.462GHz
Numbers of Channels	• 11 for North America
Modulation	802.11b: CCK, DQPSK, DBPSK, DSSS
	802.11g: 64-QAM,16-QAM, QPSK, BPSK, OFDM
	802.11n: 64-QAM,16-QAM,QPSK,BPSK,OFDM
Transmit Rate	802.11b: 1,2,5.5,11 Mbps
	802.11g: 6,9,12,18,24,36,48,54 Mbps
	802.11n: MCS0~7,up to 72 Mbps
Electrical Character	
Interfaces	GPIO;UART;ADC;SPI;I2C;PWM
Power supply	3.0V to 3.6V
Operation Temperature	-20°C to +85°C

2.2 Electrical specifications

2.2.1 Absolute maximum ratings

Table 2-2 Absolute maximum rating

Symbol	Description	Min	Max	Unit
VDD–VSS	Voltage	-0.3	3.6	V
VIN	Input voltage on any other pin	VSS-0.3	VDD+0.3	V
Power_ANT	Maximum power at receiver		+7	dBm
Temp_Storage	Storage temperature	-40	+125	℃

2.2.2 Maximum ESD rating

Table 2-3 Maximum ESD rating

Parameter	Min	Type	MAX	Unit	Remarks
Electrostatic discharge			±2	KV	Human body model
			±0.5	KV	Charged device model

2.2.3 Micro-controller subsystem

2.2.3.1 Digital Pins

Table 2-4 Digital Pins

Symbol	Note	Conditions	Specification			
			Min.	Typical	Max.	Unit
VIH	Input-High Voltage	LVTTL	2.0	-	3.6	V
VIL	Input-Low Voltage	LVTTL	-	-	0.8	V
VOH	Output-High Voltage	LVTTL	2.4	-	-	V
VOL	Output-Low Voltage	LVTTL	-	-	0.4	V

2.3 Typical Application Power consumption

The module current test environment is based on VDD=3.3V. Test under common office application environment (values measured under different test environments will be different).

Table 2-5 Typical application power consumption

Mode	W105C		Unit	Note
	Typ.	Max.		
Wi-Fi TX @11Mbps	286	-	mA	
Wi-Fi RX @11Mbps	110	-	mA	
Soft AP mode	126	332	mA	
Station mode	117	-	mA	

2.4 RF Characteristics

2.4.1 IEEE 802.11b mode

Table 2-6 IEEE802.11b Mode TX Characteristic

TX Characteristics	Min.	Typical	Max.	Unit
Spectrum Mask @ target power				
fc +/- 11MHz to +/-22MHz	-		-30	dBr
fc > +/-22MHz	-		-50	dBr
Frequency Error	-15	-	+15	ppm
Constellation Error(peak EVM)@ target power				
1Mbps	-	-27	-10	dB
2Mbps	-	-	-10	dB
5.5Mbps	-	-	-10	dB
11Mbps	-	-25	-10	dB

Table 2-7 IEEE802.11b Mode RX Characteristic

RX Characteristics	Min.	Typical	Max.	Unit
Minim um Input Level Sensitivity				
1Mbps (FER≦8%)	-	-98	-94	dBm
2Mbps (FER≦8%)	-	-96	-92	dBm
5.5Mbps (FER≦8%)	-	-94	-90	dBm
11Mbps (FER≦8%)	-	-90	-86	dBm

2.4.2 IEEE 802.11g mode

Table 2-8 IEEE802.11g Mode TX Characteristic

TX Characteristics	Min.	Typical	Max.	Unit
Spectrum Mask @ target power				
fc +/- 11MHz to +/-20MHz	-		-20	dBr
fc +/-20MHz to +/-30MHz	-		-28	dBr
fc > +/-30MHz			-40	dBr
Frequency Error	-15	-	+15	ppm
Constellation Error(peak EVM)@ target power				
6Mbps	-	-32	-10	dB
54Mbps	-	-32	-25	dB

Table 2-9 IEEE802.11g Mode RX Characteristic

RX Characteristics	Min.	Typical	Max.	Unit
Minimum Input Level Sensitivity				
6Mbps (FER≦8%)	-	-93	-89	dBm
54Mbps (FER≦8%)		-76	-72	dBm

2.4.3 IEEE 802.11n HT20 section

Table 2-10 IEEE802.11n Mode TX Characteristic

TX Characteristics	Min.	Typical	Max.	Unit
Spectrum Mask @ target power				
fc +/- 11MHz to +/-22MHz	-	-	-20	dBr
fc > +/-22MHz	-	-	-28	dBr
fc > +/-30MHz	-	-	-45	dBr
Frequency Error	-15	-	+15	ppm
Constellation Error(peak EVM)@ target power				
MCS0	-	-34	-5	dB
MCS7	-	-34	-28	dB

Table 2-11 IEEE802.11n Mode RX Characteristic

RX Characteristics	Min.	Typical	Max.	Unit
Minimum Input Level Sensitivity				
MCS0 (FER≦10%)	-	-92	-88	dBm
MCS7 (FER≦10%)	-	-73	-69	dBm

2.4.4   IEEE 802.11n HT40 section

Table 2-12 IEEE802.11n Mode TX Characteristic

TX Characteristics	Min.	Typical	Max.	Unit
Spectrum Mask @ target power				
fc +/- 11MHz to +/-22MHz	-	-	-20	dBr
fc > +/-22MHz	-	-	-28	dBr
fc > +/-30MHz	-	-	-45	dBr
Frequency Error	-15	-	+15	ppm
Constellation Error(peak EVM)@ target power				
MCS0	-	-33	-5	dB
MCS7	-	-34	-28	dB

Table 2-13 IEEE802.11n Mode RX Characteristic

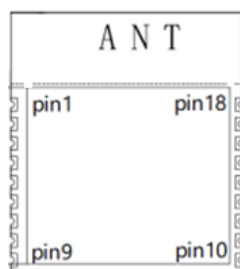| RX Characteristics	Min.	Typical	Max.	Unit
Minimum Input Level Sensitivity				
MCS0 (FER≦10%)	-	-90	-86	dBm
MCS7 (FER≦10%)	-	-69	-65	dBm

3. Pin Description

Figure 3-1 W105C Pin_out description

Table 3-1 PIN Definition

Pin Number	Name	Main Function (After Reset)	PWM	UART	I2C	SPI	Others
1	VDD						
2	Chip_Enable						
3	IO14		PWM0				
4	IO15		PWM1				
5	IO0		PWM2				
6	IO12		PWM3				
7	NC						
8	IO5		PWM4				
9	VSS						
10	NC						
11	IO18			UART0_RXD	I2C1_SCL	SPI0_SCL SPI1_CLK	TIMER4_TRIG
12	IO23		PWM0	UART0_TXD	I2C1_SDA	SPI0_MOSI SPI1_MOSI	
13	VSS						
14	IO19			UART0_CTS	I2C0_SDA	SPI0_CS SPI1_CS	TIMER5_TRIG
15	IO22		PWM5	UART0_RTS	I2C0_SCL	SPI0_MISO SPI1_MISO	
16	IO30			UART1_LOG_TXD			

17	IO29	UART1_LOG_RXD
18	VSS	

4. Mechanical

4.1 Size
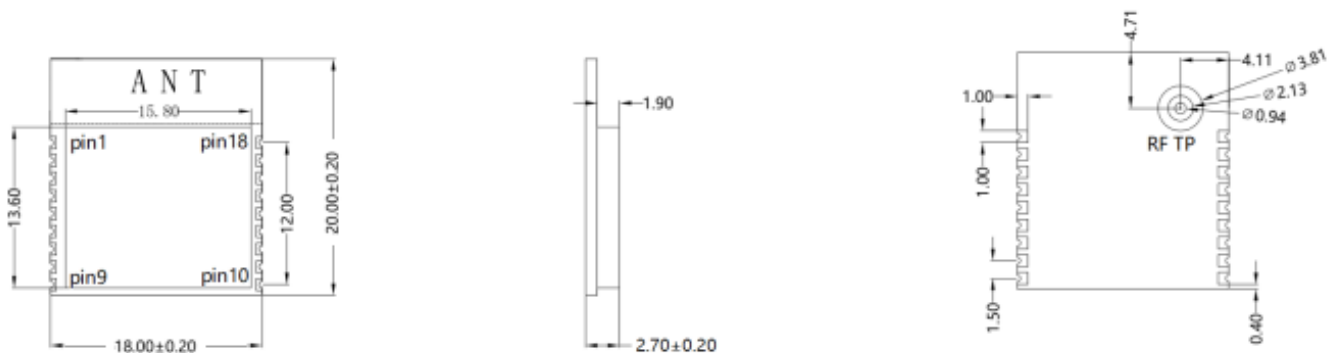
Unit：mm

Figure 4-1 Size

4.2 Use guidelines

A. SMT need machine:
- Reflow soldering SMT machine
- The AOI detector
- 6-8 mm diameter suction nozzle

B. Baking need equipment:
- Cabinet baking box
  - The antistatic, high temperature resistant tray
  - The antistatic high temperature resistant gloves
- Storage conditions as follows
  - Moisture bag must be stored in a temperature < 30 ° C, humidity 85% RH of the environment.
  - Dry packaging products, the guarantee period should be from 6 months from the date of packing seal.

- ◆ Sealed packaging is equipped with humidity indicator card, as shown in Figure 4-2.
- Humidity indicator CARDS and baking several ways as follows:

Figure 4-2 Temperature and humidity indicator CARDS

- When opened, if the temperature and humidity indicator CARDS read 10%, 20%, 30%,40% three color ring are blue, to continue to bake for 2 hours for module;
- When opened, if the humidity indicator CARDS read 10% color ring into pink, need to continue to bake module 4 hours;
- When opened, if the humidity indicator CARDS read into 10%, 20%, color ring into pink, need to continue to bake for 6 hours;
- When opened, if the humidity indicator CARDS read into 10%, 20%, 30% are pink color ring, need to continue to bake for 12 hours;
- When opened, if the humidity indicator CARDS read into 10%, 20%, 30% ,40%are pink color ring, need to continue to bake for 14 hours;
- Baking parameters are as follows:
    - ◆ Baking temperature: 125° C + / - 5° C;
    - ◆ Set the alarm temperature as 130° C;
    - ◆ Under the condition of natural cooling < 36 ℃, SMT placement can be made;
    - ◆ Dry times: 1 times;
- If opened the time more than 3 months, please ban the use of SMT process welding this batch module, zedoary because PCB process, more than 3 months bonding pad oxidation, SMT is likely to cause virtual welding, welding, the resulting problems we do not assume corresponding responsibility.
- Please to ESD (static discharge , static electricity discharge) protection module before SMT;
- Please according to the SMT reflow soldering curve, peak temperature 245° C, reflow soldering, temperature curve as shown in figure 14, section 7.6;
- For the first time in order to ensure the qualified rate of reflow soldering, first SMT please extraction 10% product to visual analysis, AOI inspection, to ensure that the furnace temperature control, device adsorption method, the rationality of the put way; Suggestions ： when batch production per hour 5-10 pieces of visual analysis, AOI test;

C. The matters needing attention
- In the entire production, each station of the operator must wear anti-static gloves;
- When baking, no more than baking time;
- When roasting, it is forbidden to join explosive, flammable, corrosive substances;
- When baking, high temperature module application tray in the oven, keep the air circulation between each module, at the same time avoid direct contact with the oven wall module;

- Baking, please will bake the door is closed, the guarantee baking box sealing, prevent leakage, temperature influence the baking effect;
- Don't open the door, as far as possible when baking box running if must open, shortening the time of can open the door as far as possible;
- After baking, must be natural cooling modules to < 36° C before wear anti-static gloves out, so as not to burn.
- Operation, forbidden module bottom touch water or dirt;
- Temperature and humidity control level for Level3, storage and baking conditions based on IPC/JEDEC J-STD - 020.

4.3 MSL/Storage Condition

Moisture Sensitivity level 3
1. Calculated shelf life in sealed bag is 12 months at <40° C and < 90% relative humidity(RH);
2. Peak Package body temperature: 260 ° C;
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must:
   Mounted within: 168 hours of factory conditions < 30° C/60% RH, or stored at <10% RH;
   If both of these conditions are not met, baking is required before mounting;
4. Devices require bake, before mounting if:
   a) Humidity indicator card is >10% when read at 23 ± 5° C
   b) 3a or 3b not met.
5. If baking is required, devices may be baked for 48 hours at 125 ± 5° C

4.4 Recommended Reflow Profile

  1. Ramp Up
Temp：<150℃，Time：60～90s, Ramp up degree 1～3℃/S ;
  2. Pre-Heat
Temp：150℃~200℃，time：60-120s，Ramp up degree 0.3-0.8 ℃/S;
  3. Curing
Peak temp 235℃~250℃ (Max ＜245℃)，time 30-70s;
  4. Cooling down
Temp：217℃~170℃，Ramp up degree 3～5℃/S;

Recommended reflow profile:

Temperature

°C
300

250
240

217
200

150

100

50

0

Peak Temperature
235-250℃

Pre-Heat time
60-120sec

Reflow Time
>30sec

Cooling down degree
3-5℃/sec

Ramp up degree
1-3℃/sec

Time

50   100   150   200   250   300 Sec

5. Recommended footprint
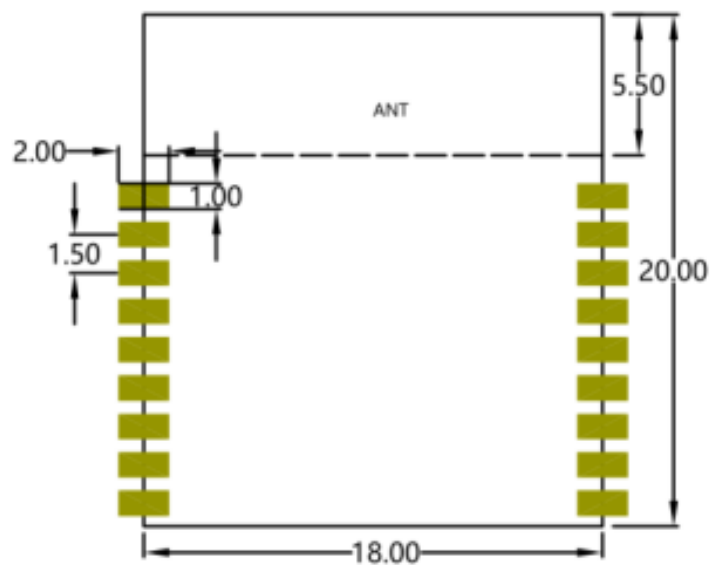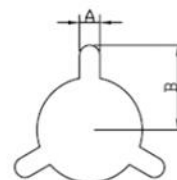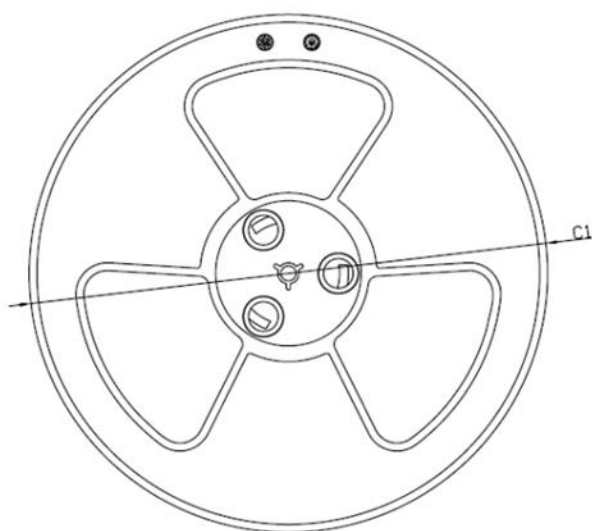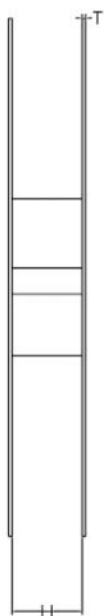
ANT

5.50

2.00

1.00

1.50

20.00

18.00
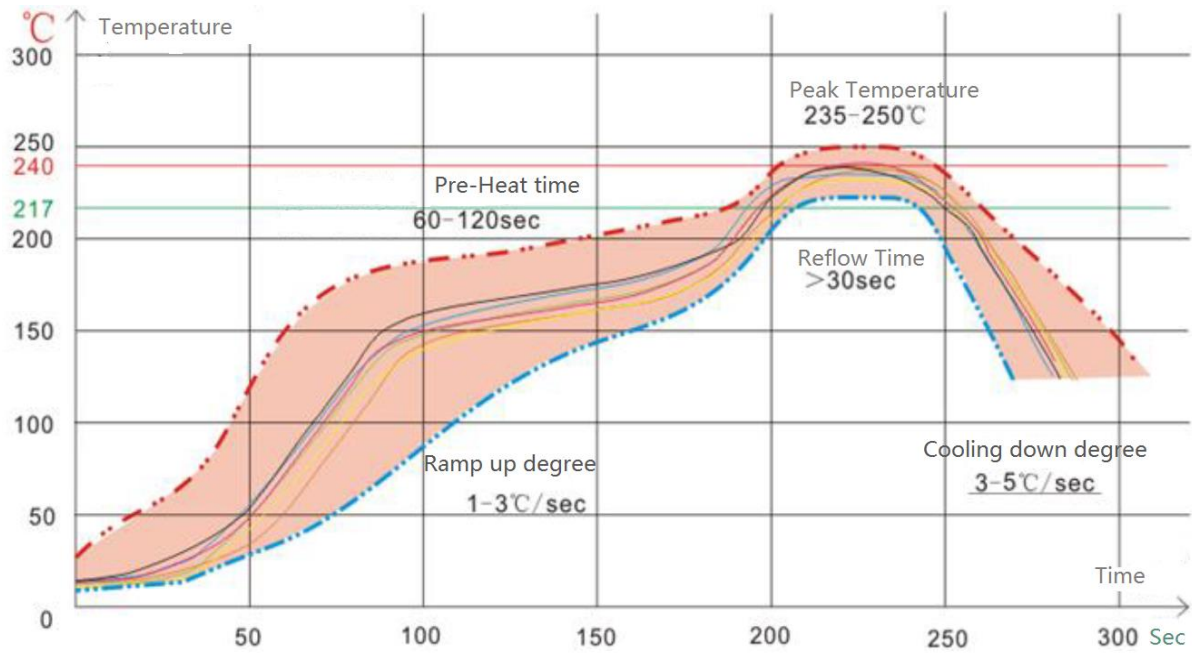
Figure 5-1Recommended footprint ; (unit: mm)

6. Package information

Production modules are delivered in reel, 650 modules in each reel.

spec	13″
c1±1	φ330
A±0.2	2.6
B±0.2	10.8
T±0.2	2.2
H±0.5	44.5

All dimensions in mm unless otherwise indicated.

7. Regulatory approval

W105C module has received regulatory approval from the following countries:
United States/FCC ID: 2BAG9-W105C00101
Europe: CE

Gain table for individual regulatory region

The default firmware uses a common gain table that meets IEEE 802.11 specifications and regulatory regions (W105C – United States/FCC, Europe/CE). In some cases, the output power is limited by the regulatory region with the most stringent transmit power limits. If the product's destination is known, the region-specific gain table can optionally be embedded into the firmware to optimize performance.

7.1 United States

The W105C modules have received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C "Intentional Radiators" single-modular approval in accordance with Part 15.212

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part
15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).
The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to application that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2BAG9-W105C00101"
The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
(2) The transmitter module may not be co-located with any other transmitter or antenna.
(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	2.4GHz band Peak Gain (dBi)
On-board antenna	1.0

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.

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.

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.

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.

List of applicable FCC rules

This module has been tested and found to comply with 15.247 requirements for Modular Approval. The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions: (For module device use)

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.

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 20 cm between the radiator & your body.

The user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

List of Applicable FCC Rules
FCC Part 15 Subpart C 15.247
Specific Operational Use Conditions
The module has Bluetooth functions.

• Operation Frequency:

– WiFi: 2412 ~ 2462 MHz

• Number of Channel: 11

• Type: On-Board antenna

• Gain: 1.0   dBi Max

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The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer 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.

7.2 Europe

The W105C modules is/are a Radio Equipment Directive (RED) assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.
The W105C modules has/have been tested to RED 2014/53/EU Essential Requirements mentioned in the following European Compliance table.
The device could be used with a separation distance of 20cm to the human body.

European Compliance

Certification	Standards	Article
Safety	EN 62368	3.1 a
Health	EN 62311	
EMC	EN 301 489-1	3.1 b
	EN 301 489-17	
Radio	EN 300 328	3.2

The ETSI provides guidance on modular devices in the "*Guide to the application of harmonised standards covering articles 3.1b and 3.2 of the RED 2014/53/EU (RED) to multi-radio and combined radio and nonradio equipment*" document available at

http://www.etsi.org/deliver/etsi_eg/203300_203399/203367/01.01.01_60/eg_203367v010101p.

pdf.

7.2.1   Labeling and User Information Requirements

The label on the final product that contains W105C modules must follow CE marking requirements.

7.2.2   Conformity Assessment

From ETSI Guidance Note EG 203367, section 6.1, when non-radio products are combined with a radio product: If the manufacturer of the combined equipment installs the radio product in a host non-radio product in equivalent assessment conditions (i.e. host equivalent to the one used for the assessment of the radio product) and according to the installation instructions for the radio product, then no additional assessment of the combined equipment against article 3.2 of the RED is required.

7.2.3   Simplified EU Declaration of Conformity

Hereby, Shanghai Amphenol Airwave Communication Electronics Co. Ltd. declares that the radio equipment type W105C is in compliance with Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following internet address:
https://www.amphenol-mcp.com/wireless-modules/W105C;

7.2.4   Approved Antenna Types

For the W105C module, the approval is received using the on-board antenna.

7.3 Other Regulatory information

If the customer needs another regulatory jurisdiction certification or to recertify the module for other reasons, contact Microchip for the required utilities and documentation.