SW-L Hardware Design

Wi-Fi Module Series

1.1. General Description

The module is a Wi-Fi module with low power consumption. It is a single-die Wi-Fi solution supporting IEEE 802.11a/b/g/n/ac/ax 2.4 GHz and 5 GHz Wi-Fi standards, which enables seamless integration of Wi-Fi technologies.

4.1. RF Performances

The following tables summarize the Wi-Fi transmitting and receiving performances of the module.

4.1.1. Wi-Fi RF Performances

Table 25: Wi-Fi Tx Power at 2.4 GHz (Unit: dBm)

Description VDD_FEM = 5 V	Typ.	Tolerance
802.11b @ 1 Mbps	20	±2 dB
802.11b @ 11 Mbps	20	±2 dB
802.11g @ 6 Mbps	20	±2 dB
802.11g @ 54 Mbps	19	±2 dB
802.11n, HT20 @ MCS 0	20	±2 dB
802.11n, HT20 @ MCS 7	18.5	±2 dB
802.11n, HT40 @ MCS 0	20	±2 dB
802.11n, HT40 @ MCS 7	18.5	±2 dB
802.11ax, HE20 @ MCS 0	20	±2 dB
802.11ax, HE20 @ MCS 11	17.5	±2 dB
802.11ax, HE40 @ MCS 0	20	±2 dB
802.11ax, HE40 @ MCS 11	17.5	±2 dB
Description VDD_FEM = 3.3 V	**Typ.**	**Tolerance**
802.11b @ 1 Mbps	19	±2 dB
802.11b @ 11 Mbps	19	±2 dB

802.11g @ 6 Mbps	17	±2 dB
802.11g @ 54 Mbps	15	±2 dB
802.11n, HT20 @ MCS 0	17	±2 dB

802.11n, HT20 @ MCS 7	15	±2 dB
802.11n, HT40 @ MCS 0	17	±2 dB
802.11n, HT40 @ MCS 7	15	±2 dB
802.11ax, HE20 @ MCS 0	17	±2 dB
802.11ax, HE20 @ MCS 11	14	±2 dB
802.11ax, HE40 @ MCS 0	17	±2 dB
802.11ax, HE40 @ MCS 11	14	±2 dB

Table 26: Wi-Fi Tx Power at 5 GHz (Unit: dBm)

Description VDD_FEM = 5 V	Typ.	Tolerance
802.11a @ 6 Mbps	20	±2 dB
802.11a @ 54 Mbps	19	±2 dB
802.11n, HT20 @ MCS 0	20	±2 dB
802.11n, HT20 @ MCS 7	18.5	±2 dB
802.11n, HT40 @ MCS 0	20	±2 dB
802.11n, HT40 @ MCS 7	18.5	±2 dB
802.11ac, VHT20 @ MCS 0	20	±2 dB
802.11ac, VHT20 @ MCS 8	17.5	±2 dB
802.11ac, VHT40 @ MCS 0	20	±2 dB
802.11ac, VHT40 @ MCS 9	17.5	±2 dB
802.11ac, VHT80 @ MCS 0	20	±2 dB
802.11ac, VHT80 @ MCS 9	17	±2 dB
802.11ax, HE20 @ MCS 0	20	±2 dB
802.11ax, HE20 @ MCS 11	17	±2 dB
802.11ax, HE40 @ MCS 0	20	±2 dB

802.11ax, HE40 @ MCS 11	17	±2 dB
802.11ax, HE80 @ MCS 0	20	±2 dB
802.11ax, HE80 @ MCS 11	16.5	±2 dB
Description VDD_FEM = 3.3 V	**Typ.**	**Tolerance**
802.11a @ 6 Mbps	18	±2 dB
802.11a @ 54 Mbps	16.5	±2 dB
802.11n, HT20 @ MCS 0	18	±2 dB
802.11n, HT20 @ MCS 7	16	±2 dB
802.11n, HT40 @ MCS 0	18	±2 dB
802.11n, HT40 @ MCS 7	16	±2 dB
802.11ac, VHT20 @ MCS 0	18	±2 dB
802.11ac, VHT20 @ MCS 8	15.5	±2 dB
802.11ac, VHT40 @ MCS 0	18	±2 dB
802.11ac, VHT40 @ MCS 9	15.5	±2 dB
802.11ac, VHT80 @ MCS 0	17.5	±2 dB
802.11ac, VHT80 @ MCS 9	15	±2 dB
802.11ax, HE20 @ MCS 0	18	±2 dB
802.11ax, HE20 @ MCS 11	15	±2 dB
802.11ax, HE40 @ MCS 0	18	±2 dB
802.11ax, HE40 @ MCS 11	15	±2 dB
802.11ax, HE80 @ MCS 0	17.5	±2 dB
802.11ax, HE80 @ MCS 11	14	±2 dB

Table 27: Wi-Fi Rx Sensitivity at 2.4 GHz (Unit: dBm)

Description VDD_FEM = 5 V or 3.3V	Typ.	Tolerance

802.11b @ 1 Mbps	-95	±2 dB
802.11b @ 11 Mbps	-89	±2 dB
802.11g @ 6 Mbps	-93	±2 dB
802.11g @ 54 Mbps	-75	±2 dB
802.11n, HT20 @ MCS 0	-91	±2 dB
802.11n, HT20 @ MCS 7	-72	±2 dB
802.11n, HT40 @ MCS 0	-89	±2 dB
802.11n, HT40 @ MCS 7	-70	±2 dB
802.11ax, HE20 @ MCS 0	-91	±2 dB
802.11ax, HE20 @ MCS 11	-63	±2 dB
802.11ax, HE40 @ MCS 0	-90	±2 dB
802.11ax, HE40 @ MCS 11	-61	±2 dB

Table 28: Wi-Fi Rx Sensitivity at 5 GHz (Unit: dBm)

Description VDD_FEM = 5 V or 3.3V	Typ.	Tolerance
802.11a @ 6 Mbps	-92	±2 dB
802.11a @ 54 Mbps	-74	±2 dB
802.11n, HT20 @ MCS 0	-91	±2 dB
802.11n, HT20 @ MCS 7	-72	±2 dB
802.11n, HT40 @ MCS 0	-88	±2 dB
802.11n, HT40 @ MCS 7	-70	±2 dB
802.11ac, VHT20 @ MCS 0	-91	±2 dB
802.11ac, VHT20 @ MCS 8	-70	±2 dB
802.11ac, VHT40 @ MCS 0	-90	±2 dB
802.11ac, VHT40 @ MCS 9	-65	±2 dB

802.11ac, VHT80 @ MCS 0	-86	±2 dB
802.11ac, VHT80 @ MCS 9	-61	±2 dB
802.11ax, HE20 @ MCS 0	-91	±2 dB
802.11ax, HE20 @ MCS 11	-63	±2 dB
802.11ax, HE40 @ MCS 0	-90	±2 dB
802.11ax, HE40 @ MCS 11	-60	±2 dB
802.11ax, HE80 @ MCS 0	-86	±2 dB
802.11ax, HE80 @ MCS 11	-58	±2 dB

5 Warning

2. This module is limited to installation in 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.

Antenna Installation
(1) The antenna must be installed such that 25 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 thismodule. Other types of antennas and/or higher gain antennas may require additional authorization for operation.
(4)The max allowed antenna gain is 1 dBi for external monopole antenna.

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/IC 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/IC authorization.

7.2. FCC Statement

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.

1) The antenna must be installed such that 25 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna.

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 25 cm between the radiator & your body.