Datasheet

ZWave 700 Module

Revision: 2.3

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Volansys Technologies Private Limited
Block A 7th Floor, Safal Profitaire, Corporate Road,
Prahladnagar, Ahmedabad 380015, India
www.volansys.com
Phone: 91-79-4004-1994
Email: info@volansys.com

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Revision History

Revision	Date	Details of change	Author	Reviewer	Approver
1.0	23-12-19	Initial Draft	SD	JB	JB
2.0	13-01-20	Initial Draft - Updated the document as per the PCB revision 2.0	SD	KB	KB
2.1	13-03-20	Added Volansy's SKU in table 3.	SD	KB	KB
2.2	13-04-20	Added antennas to section 2.6 and added range test section 3.4	SD	KB	KB
2.3	06-03-2021	Added saw filter, Changed shield	YP	YP	KB

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide introduction to key features, architecture and other relevant electrical and mechanical characteristics of ZWave 700 module.

1.2 Scope

The scope of this document is to explain in detail the design of the ZWave 700 module. This document is henceforth, to be used as a direct reference by end customers intending to use this product as per their use case.

1.3 Acronyms and abbreviations

Terms	Definition
NC	Not Connected
NP	Not Present
PCB	Printed Circuit Board
FER	Frame Error Rate
IO	Input Output
TBD	To Be Defined
RF	Radio Frequency

Table 1: Acronyms and Abbreviations

1.4 References

Reference Document Title	Provided By	Remarks
Schematics Design	Volansys	Primary reference
Layout Design	Volansys	N/A

Table 2: References

1.5 Document Conventions

Note:

A requirement may include an explanation of the requirement or the interaction between requirements, or other information useful in determining the intent of the requirement. The note, however, is not part of the requirement. Notes are indicated by the prefix “Note”, by verbs other than “shall,” or by enclosure in parentheses.

1.6 Copyright Information

1.7 Warranty

For details on the Volansys ZWave 700 module warranty policy, please Email us on :- Business@volansystech.com

2 PRODUCT OVERVIEW

The ZWave 700 module is based on the Silicon Labs ZGM130S SiP module supporting the newer Z Wave 700 protocol and is a fully integrated ZWave module enabling rapid development of ZWave based solutions.

The ZWave 700 module is built with low power gecko technology and is an ideal solution for energy friendly smart home control applications such as motion sensors, door/window sensors, access control, appliance control, energy management, etc in the “Internet of Things”.

The ZWave 700 module is fully complaint with MikroBUS standard.

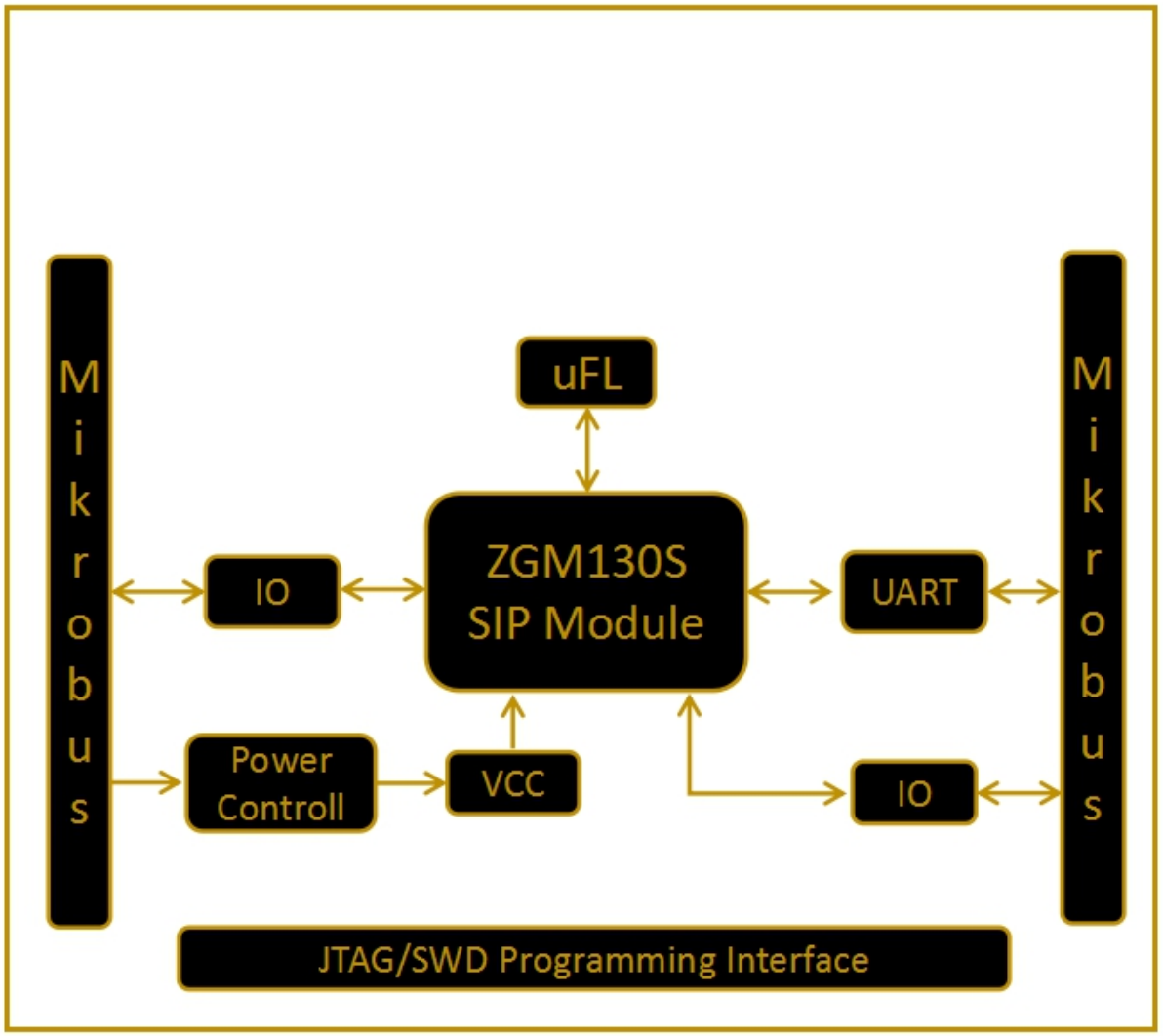


Figure 2-1: ZWave 700 Module Block Diagram

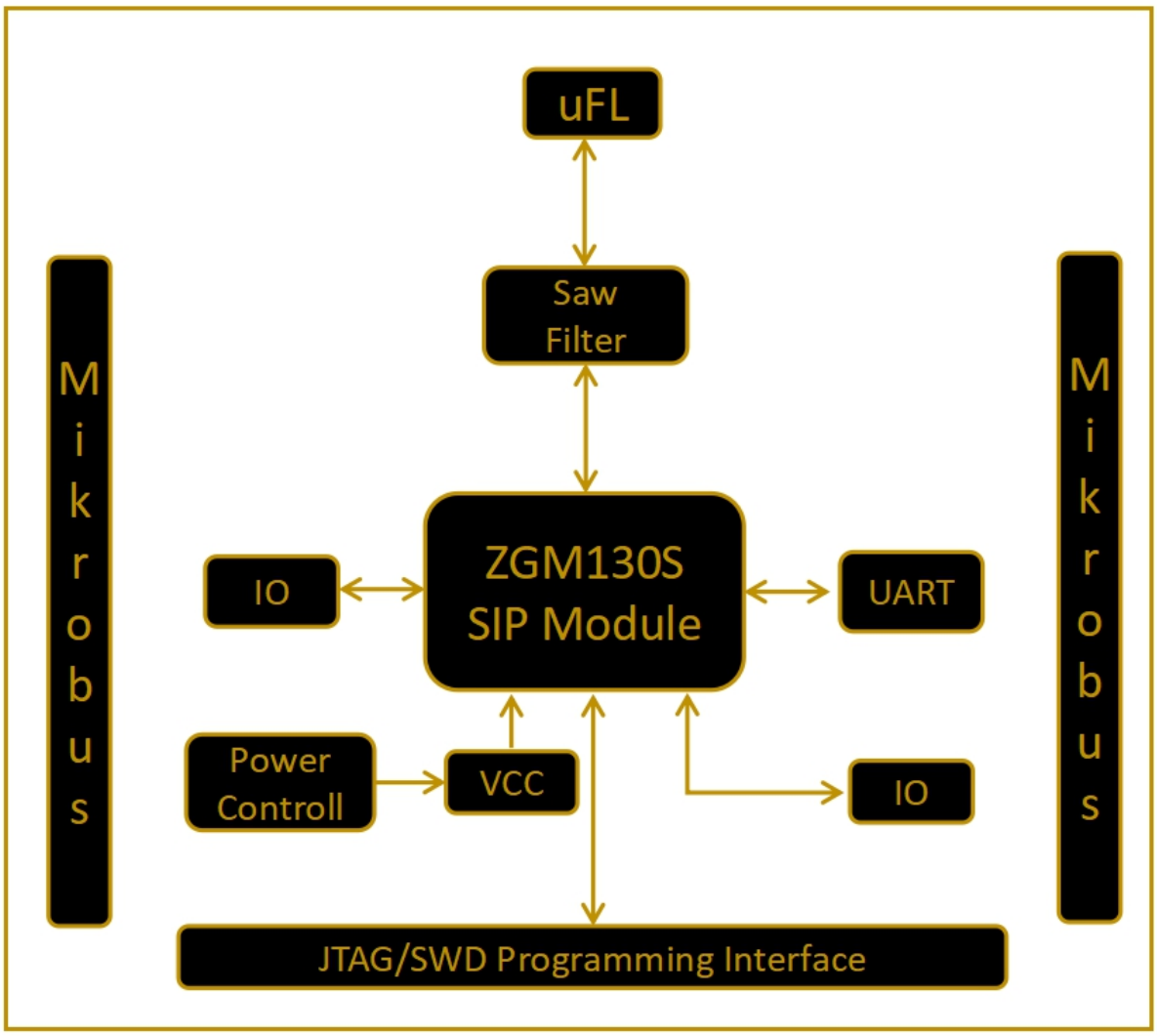
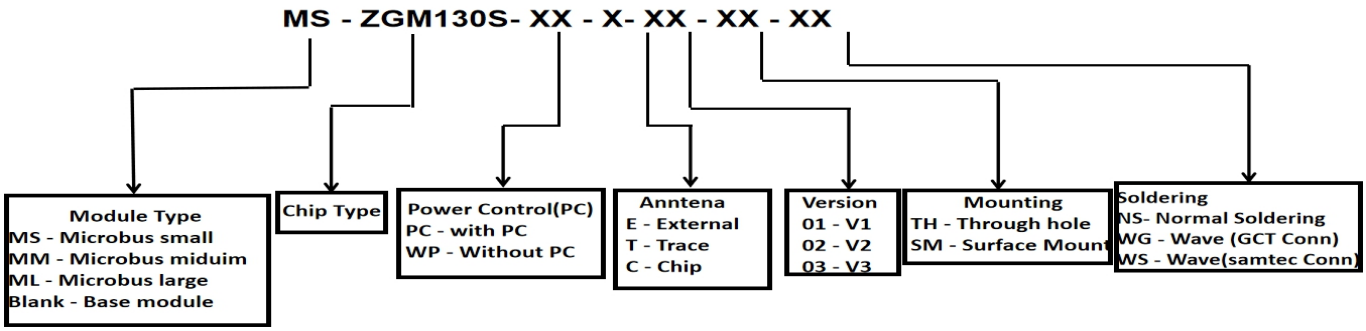


Figure 2-2 Zwave with SAW Filter

Sr	Volansys SKU	Description
1	MS-ZGM130S-WP-E-02-TH-NS	Module without power control integrated pin without SAW
2	MS-ZGM130S-WP-E-02-TH-WS	Module without power control integrated pin wave solderable. Without SAW
3	MS-ZGM130S-WP-E-03-TH-NS	Module without power control integrated pin SAW Filter

Table 3: Module Options



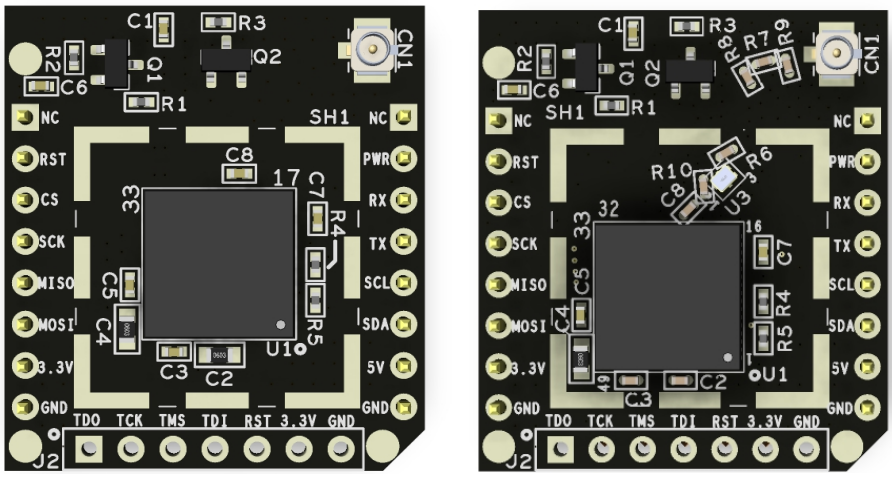


Figure 3-3 : Without SAW filter and with SAW filter

2.1 Module Features

- MikroBUS compatible
- 6 general purpose IOs
- Module ON/OFF control through IO pin
- ZWave 9.6/40/100 kbps data rates
- Supports all Zwave Sub-GHz bands (865.2 MHz - 926.3 MHz)
- TX power up to 13 dBm
- Range greater than 100 meters
- -97.9 dBm sensitivity at 100 kbps GFSK
- 9.8 mA RX current at 100 kbps GFSK
- 13.3 mA TX current at 0 dBm output power
- ARM Cortex - M4+ floating point unit @ 39 MHz
- 64 KB application and ZWave framework flash
- 8 KB application RAM

2.2 Suggested Applications

- Smart homes
- Security

- Lighting
- Health and wellness
- Metering
- Building automation

2.3 Application of SAW filters in Zwave

In several regions, upload in the LTE band occurs at frequencies located closer than 10 MHz from frequencies used by Z-Wave. Due to the high power level allowed, in addition to the loose restrictions on side band emissions granted to the LTE band, the LTE upload may interfere significantly with the operation of a listening Z-Wave node located nearby.

To reduce the impact from other devices, the Z-wave device must incorporate a SAW filter which attenuates these technologies, thus preventing saturation of the receiver.

The effects of interference from LTE is outlined in LTE Case Study.

For Z-Wave gateways (outside EU freq.) with LTE embedded, it is recommended to analyze the specific need for a SAW filter in depth. Optionally, a SAW filter bank can be added and controlled via the SAW0 and SAW1 output pins for operation in different regions

This means:

No SAW

End-devices and gateways without LTE modem embedded no SAW filter is recommend.

Gateways on EU frequency with LTE modem embedded no SAW filter is recommend.

SAW recommended

Gateways with LTE embedded on U and H related frequencies using a SAW filter is recommend.

2.4 Module Pin Details

The pin detail for the ZWave 700 module is as described below:

Note: All the pin marked as "IOx" are multiplexed internally and can be used to realise interfaces as per the details mentioned in table 5.

Module Pin Name	Pin		mikro™ BUS			Pin	Module Pin Name
J1.1	NC	1	AN	PWM	16	NC	J3.1
J1.2	RST	2	RST	INT	15	PWR	J3.2
J1.3	IO1	3	CS	RX	14	RX	J3.3
J1.4	IO2	4	SCK	TX	13	TX	J3.4
J1.5	IO3	5	MISO	SCL	12	IO6	J3.5
J1.6	IO4	6	MOSI	SDA	11	IO5	J3.6
J1.7	3.3V	7	3.3V	5V	10	NC	J3.7
J1.8	GND	8	GND	GND	9	GND	J3.8

Table 4: Module Pin Details

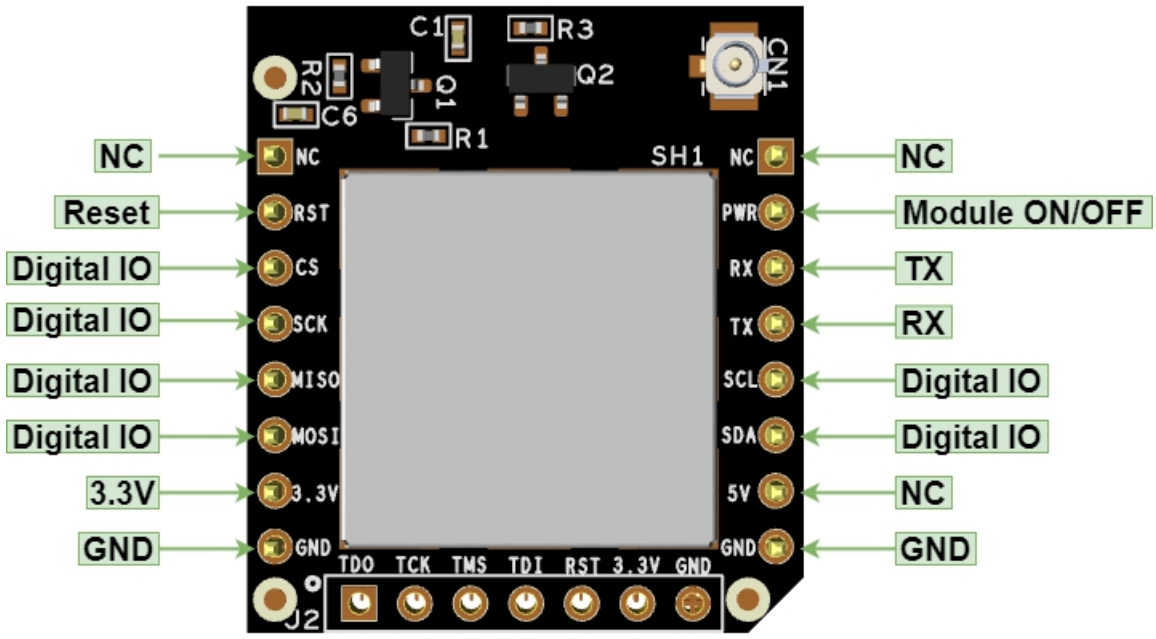


Figure 2-4: Module Pin Details

2.5 Module Pin Details

By default, the ZWave 700 module is configured to communicate with the host using the UART interface which is available on the pins 3 and 4 on the header "J3". Refer to figure 2 for location of these pins.

The Zwave 700 module also has total of 6 pins which can be used as general purpose IO pins. These IOs are also internally multiplexed in the ZGM130S SiP module and can be programmed to operate as either IOs or interface pins. Interfaces such as I^2C, SPI, UART can be realised using this feature on any of the 6 available IOs. Table below shows the pin muxing details of each of the 6 available IOs. This feature proves itself useful when realising end device use cases with the ZWave 700 module.

IO No.	Pin No.	Pin	Pin Alternate Functionalities				
			Analog	Timer	Communication	Radio	Other
IO1	J1.3	PA2	VDAC0_OUT1ALT / OPA1_OUTALT #1 BUSDY BUSCX OPA0_P	TIM0_CC0 #2 TIM0_CC1 #1 TIM0_CC2 #0 TIM0_CDTI0 #31 TIM0_CDTI1 #30 TIM0_CDTI2 #29 TIM1_CC0 #2 TIM1_CC1 #1 TIM1_CC2 #0 TIM1_CC3 #31 WTIM0_CC0 #2 WTIM0_CC1 #0 LETIM0_OUT0 #2 LETIM0_OUT1 #1 PCNT0_S0IN #2 PCNT0_S1IN #1	US0_TX #2 US0_RX #1 US0_CLK #0 US0_CS #31 US0_CTS #30 US0_RTS #29 US1_TX #2 US1_RX #1 US1_CLK #0 US1_CS #31 US1_CTS #30 US1_RTS #29 LEU0_TX #2 LEU0_RX #1 I2C0_SDA #2 I2C0_SCL #1	FRC_DCLK #2 FRC_DOUT #1 FRC_DFRAME #0 MODEM_DCLK #2 MODEM_DIN #1 MODEM_DOUT #0	PRS_CH6 #2 PRS_CH7 #1 PRS_CH8 #0 PRS_CH9 #10 ACMP0_O #2 ACMP1_O #2 LES_CH10

IO2	J1.4	PA3	BUSCY BUSDX VDAC0_OUT0 / OPA0_OUT	TIM0_CC0 #3 TIM0_CC1 #2 TIM0_CC2 #1 TIM0_CDTI0 #0 TIM0_CDTI1 #31 TIM0_CDTI2 #30 TIM1_CC0 #3 TIM1_CC1 #2 TIM1_CC2 #1 TIM1_CC3 #0 WTIM0_CC0 #3 WTIM0_CC1 #1 LETIM0_OUT0 #3 LETIM0_OUT1 #2 PCNT0_S0IN #3 PCNT0_S1IN #2	US0_TX #3 US0_RX #2 US0_CLK #1 US0_CS #0 US0_CTS #31 US0_RTS #30 US1_TX #3 US1_RX #2 US1_CLK #1 US1_CS #0 US1_CTS #31 US1_RTS #30 LEU0_TX #3 LEU0_RX #2 I2C0_SDA #3 I2C0_SCL #2	FRC_DCLK #3 FRC_DOUT #2 FRC_DFRAME #1 MODEM_DCLK #3 MODEM_DIN #2 MODEM_DOUT #1	PRS_CH6 #3 PRS_CH7 #2 PRS_CH8 #1 PRS_CH9 #0 ACMP0_O #3 ACMP1_O #3 LES_CH11 GPIO_EM4WU8
IO3	J1.5	PA4	VDAC0_OUT1ALT / OPA1_OUTALT #2 BUSDY BUSCX OPA0_N	TIM0_CC0 #4 TIM0_CC1 #3 TIM0_CC2 #2 TIM0_CDTI0 #1 TIM0_CDTI1 #0 TIM0_CDTI2 #31 TIM1_CC0 #4 TIM1_CC1 #3 TIM1_CC2 #2 TIM1_CC3 #1 WTIM0_CC0 #4 WTIM0_CC1 #2 WTIM0_CC2 #0 LETIM0_OUT0 #4 LETIM0_OUT1 #3 PCNT0_S0IN #4 PCNT0_S1IN #3	US0_TX #4 US0_RX #3 US0_CLK #2 US0_CS #1 US0_CTS #0 US0_RTS #31 US1_TX #4 US1_RX #3 US1_CLK #2 US1_CS #1 US1_CTS #0 US1_RTS #31 LEU0_TX #4 LEU0_RX #3 I2C0_SDA #4 I2C0_SCL #3	FRC_DCLK #4 FRC_DOUT #3 FRC_DFRAME #2 MODEM_DCLK #4 MODEM_DIN #3 MODEM_DOUT #2	PRS_CH6 #4 PRS_CH7 #3 PRS_CH8 #2 PRS_CH9 #1 ACMP0_O #4 ACMP1_O #4 LES_CH12

IO4	J1.6	PA5	VDAC0_OUT0ALT / OPA0_OUTALT #0 BUSCY BUSDX	TIM0_CC0 #5 TIM0_CC1 #4 TIM0_CC2 #3 TIM0_CDTI0 #2 TIM0_CDTI1 #1 TIM0_CDTI2 #0 TIM1_CC0 #5 TIM1_CC1 #4 TIM1_CC2 #3 TIM1_CC3 #2 WTIM0_CC0 #5 WTIM0_CC1 #3 WTIM0_CC2 #1 LETIM0_OUT0 #5 LETIM0_OUT1 #4 PCNT0_S0IN #5 PCNT0_S1IN #4	US0_TX #5 US0_RX #4 US0_CLK #3 US0_CS #2 US0_CTS #1 US0_RTS #0 US1_TX #5 US1_RX #4 US1_CLK #3 US1_CS #2 US1_CTS #1 US1_RTS #0 US2_TX #0 US2_RX #31 US2_CLK #30 US2_CS #29 US2_CTS #28 US2_RTS #27 LEU0_TX #5 LEU0_RX #4 I2C0_SDA #5 I2C0_SCL #4	FRC_DCLK #5 FRC_DOUT #4 FRC_DFRAME #3 MODEM_DCLK #5 MODEM_DIN #4 MODEM_DOUT #3	CMU_CLKI0 #4 PRS_CH6 #5 PRS_CH7 #4 PRS_CH8 #3 PRS_CH9 #2 ACMP0_O #5 ACMP1_O #5 LES_CH13 ETM_TCLK #1
IO5	J3.6	PF5	BUSAY BUSBX	TIM0_CC0 #29 TIM0_CC1 #28 TIM0_CC2 #27 TIM0_CDTI0 #26 TIM0_CDTI1 #25 TIM0_CDTI2 #24 TIM1_CC0 #29 TIM1_CC1 #28 TIM1_CC2 #27 TIM1_CC3 #26 LETIM0_OUT0 #29 LETIM0_OUT1 #28 PCNT0_S0IN #29 PCNT0_S1IN #28	US0_TX #29 US0_RX #28 US0_CLK #27 US0_CS #26 US0_CTS #25 US0_RTS #24 US1_TX #29 US1_RX #28 US1_CLK #27 US1_CS #26 US1_CTS #25 US1_RTS #24 US2_TX #18 US2_RX #17 US2_CLK #16 US2_CS #15 US2_CTS #14 US2_RTS #13 LEU0_TX #29 LEU0_RX #28 I2C0_SDA #29 I2C0_SCL #28	FRC_DCLK #29 FRC_DOUT #28 FRC_DFRAME #27 MODEM_DCLK #29 MODEM_DIN #28 MODEM_DOUT #27	PRS_CH0 #5 PRS_CH1 #4 PRS_CH2 #3 PRS_CH3 #2 ACMP0_O #29 ACMP1_O #29

IO6	J3.5	PF4	BUSBY BUSAX	TIM0_CC0 #28 TIM0_CC1 #27 TIM0_CC2 #26 TIM0_CDTI0 #25 TIM0_CDTI1 #24 TIM0_CDTI2 #23 TIM1_CC0 #28 TIM1_CC1 #27 TIM1_CC2 #26 TIM1_CC3 #25 LETIM0_OUT0 #28 LETIM0_OUT1 #27 PCNT0_S0IN #28 PCNT0_S1IN #27	US0_TX #28 US0_RX #27 US0_CLK #26 US0_CS #25 US0_CTS #24 US0_RTS #23 US1_TX #28 US1_RX #27 US1_CLK #26 US1_CS #25 US1_CTS #24 US1_RTS #23 US2_TX #17 US2_RX #16 US2_CLK #15 US2_CS #14 US2_CTS #13 US2_RTS #12 LEU0_TX #28 LEU0_RX #27 I2C0_SDA #28 I2C0_SCL #27	FRC_DCLK #28 FRC_DOUT #27 FRC_DFRAME #26 MODEM_DCLK #28 MODEM_DIN #27 MODEM_DOUT #26	PRS_CH0 #4 PRS_CH1 #3 PRS_CH2 #2 PRS_CH3 #1 ACMP0_O #28 ACMP1_O #28

Table 5: IO Alternate functionalities

2.6 Antenna

The Zwave 700 module needs an external antenna to transmit and receive the Zwave RF traffic. The external antenna can be connected to the module using the U.FL connector marked “CN1” on the module. The antenna can be a patch, trace or whip antenna capable of resonating in the Zwave operating frequency range (865.2 - 926.3 MHz) and having an U.FL female connector for connecting to the RF path.

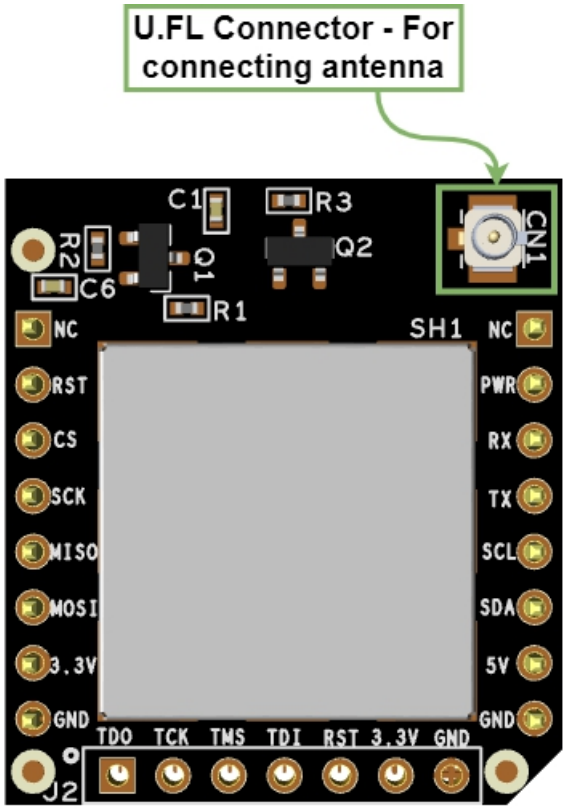


Figure 2-5: Antenna Connector

The Zwave 700 module is tested with the following two flex patch antennas.

W3312B0100 (Pulse Larsen Antennas)

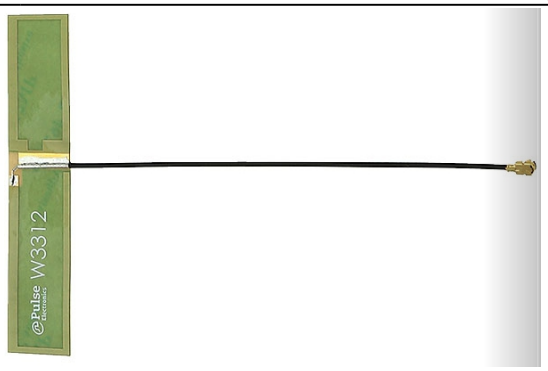


Figure 2-6: Flex Patch Antenna - 1

Following are the features of the antenna:

- Frequency range: 863 MHz - 928 MHz
- Number of bands: 2
- Return loss: -8 dB
- Gain: 0.8 dBi
- Termination: U.FL connector
- Mounting type: Adhesive
- Dimensions: 75 x 15 mm

2111400100 (Molex)

Figure 2-7: Flex Patch Antenna - 2

Following are the features of the antenna:

- Frequency range: 868 MHz - 928 MHz
- Number of bands: 2
- Return loss: -5 dB
- Gain: 1 dBi
- Termination: U.FL connector
- Mounting type: Adhesive
- Dimensions: 38 x 10 mm

2.7 Module Power ON/OFF

ZWave 700 module has a functionality through which a user can cycle power to the module. This can be done by using the pin 2 of the header “J3” (Pin 15 or INT in MikroBUS). A logic high (3.3V) at this pin will turn the module ON and a logic low (0V) at this pin will turn the module OFF. Continuous operation of the module will require a constant logic high at pin 2 of the header “J3”(Pin 15 or INT in MikroBUS). ZWave 700 module is also available with a direct power scheme if this functionality is not desired.

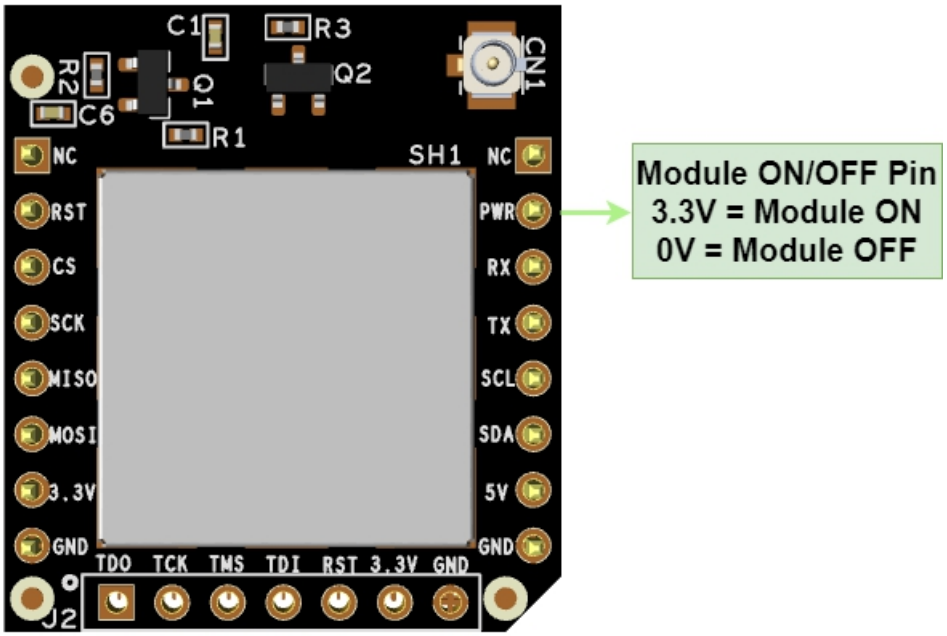


Figure 2-8: Module Power ON/OFF Pin

2.8 Module Reset

Pin 2 of the header “J2” (Pin 2 or RST in MikroBUS) is to be used for resetting the module externally. The reset input pin is active low. This pin is already pulled up internally and so would not require any external pull-up resistors on the host boards. To apply an external reset to this pin, only drive this pin low during reset and let the internal pull-up ensure that the reset is released.

2.9 Debug and Programming

Programming of the ZWave 700 module can be done through the JTAG/SWD interface provided on the header “J2”. The pin out of the programming header is shown in the figure 5 below.

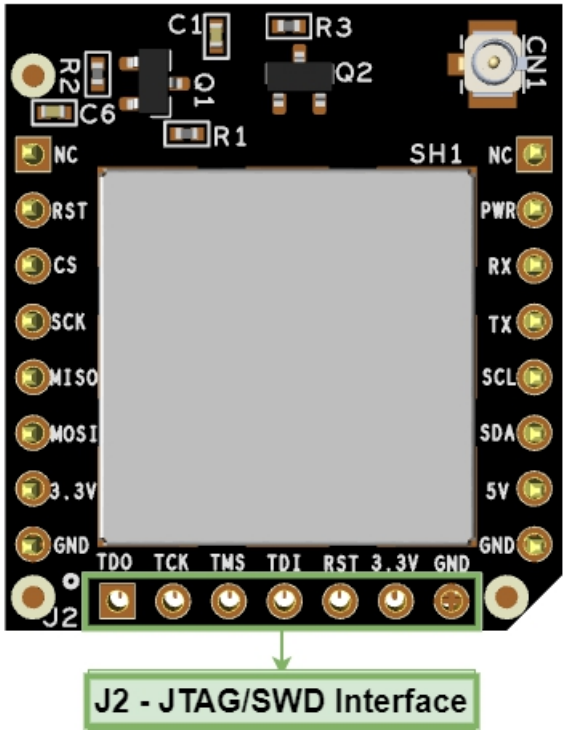


Figure 2-9: ZWave 700 Module Programming Interface

To program the Zwave 700 module, following are the prerequisites;

- Install Simplicity Studio version 4.1.11.4 on a Windows Machine.
- Install Flex SDK 2.6.2.0 and Gecko SDK Suite 2.6.2.
- Connect “Debug” header of the SLWSTK6050A with J2 interface of the ZWave 700 module using a compatible JTAG cable.

More information on the EVK SLWSTK6050A , please refer to UG381: ZGM130S Zen Gecko Wireless Starter Kit User’s Guide available here,
https://www.silabs.com/documents/login/user-guides/ug381-brd4202a-user-guide.pdf

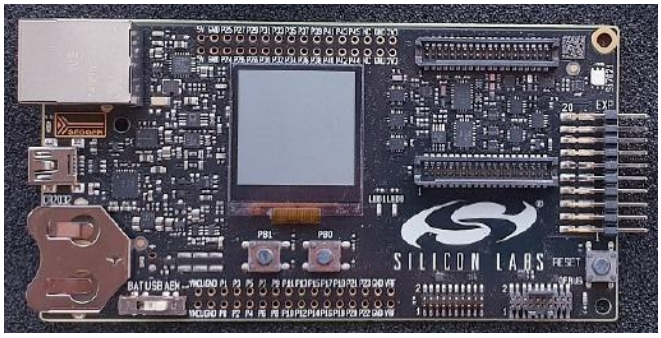


Figure 2-10: SLWSTK6050A EVK For ZWave 700 Modules

Follow the below mentioned steps to program a ZWave 700 module.

1. Launch simplicity studio in windows machine.

2. Select the EVK Kit to be used for flashing in the Simplicity Studio available at upper left corner as shown below.

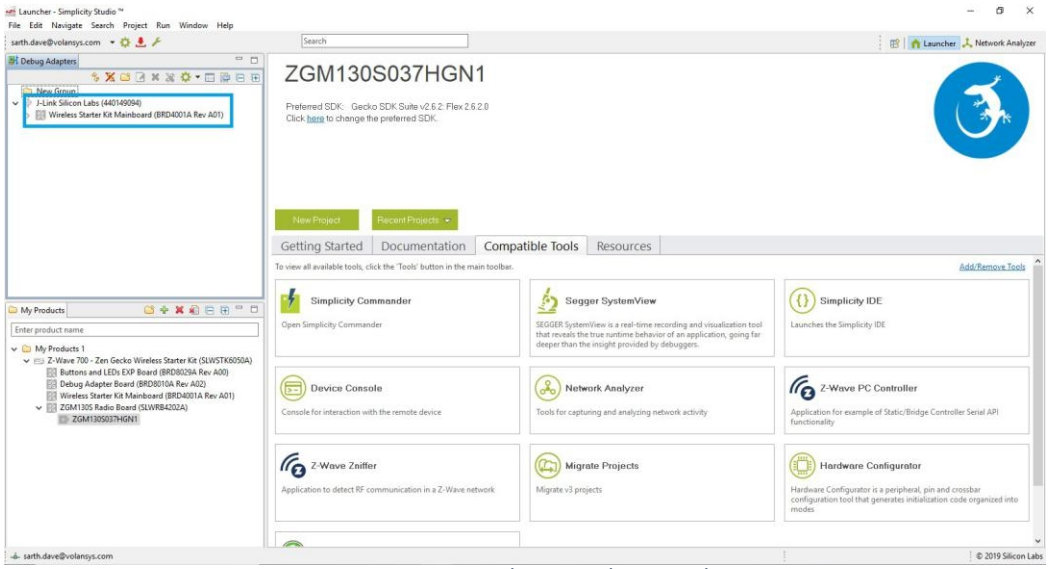


Figure 2-11: Simplicity Studio Launch

3. Select the compatible product in “My Products” Menu as shown below. In our case, it will be ZGM130S module.

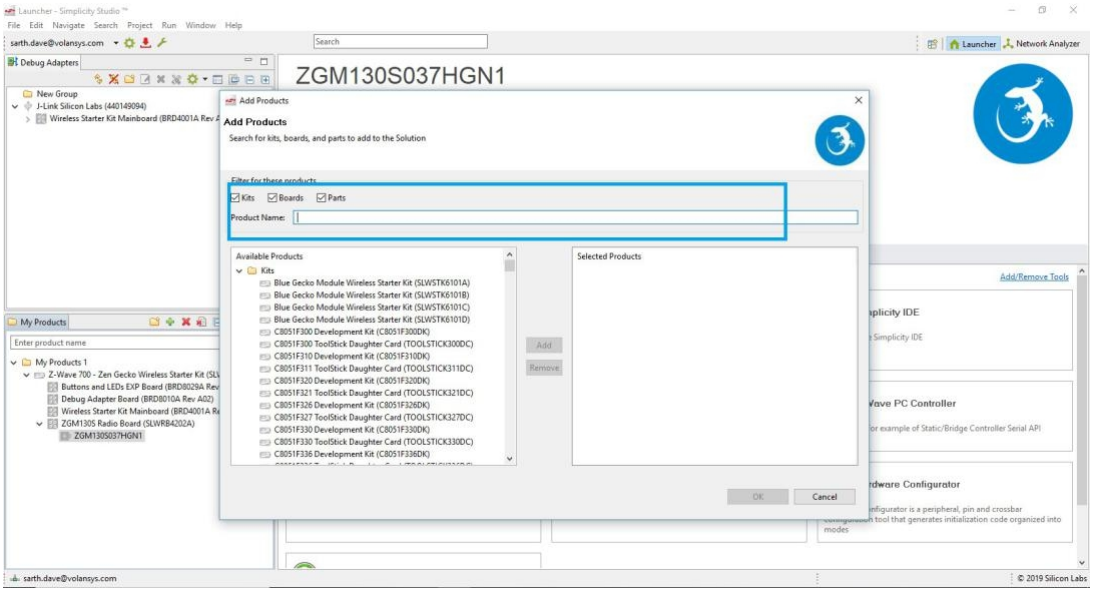


Figure 2-12: Simplicity Studio - Add Products

4. Once added, the selected product should be populated as shown below.

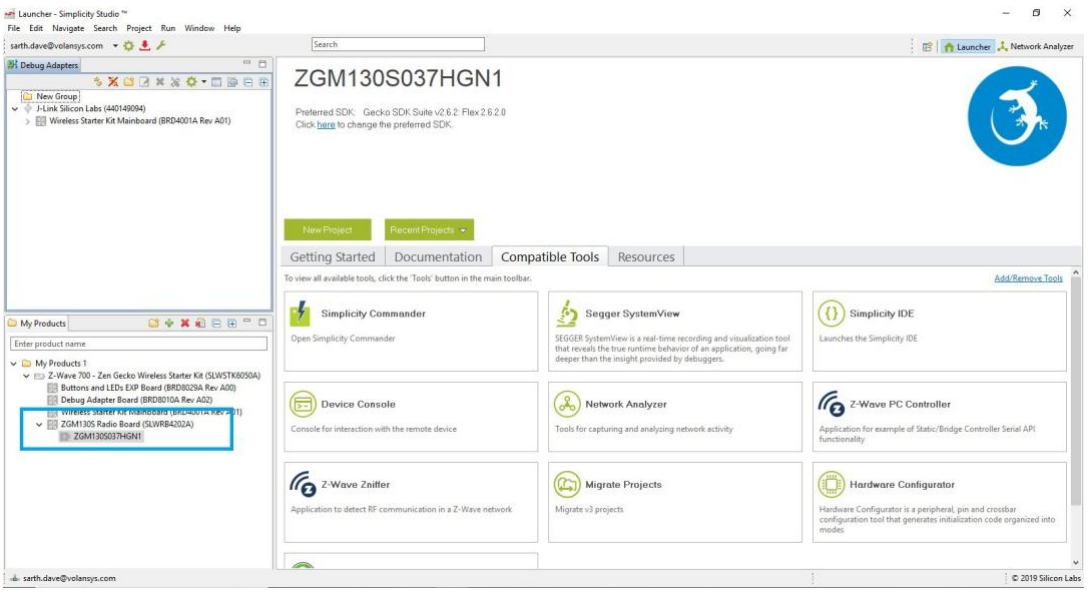


Figure 2-13: Simplicity Studio - My Products

5. To flash the Z-Wave-700 module, select “Simplicity Commander” from the Compatible Tools. Once done, it should launch the simplicity commander window.

6. Select the J-Link device connected to the machine as shown below and press Connect.

7. Connect ZGM130S module using the JTAG/SWD protocol at 8000KHz.If the module is detected on the JTAG/SWD interface, the device should appear as shown below.

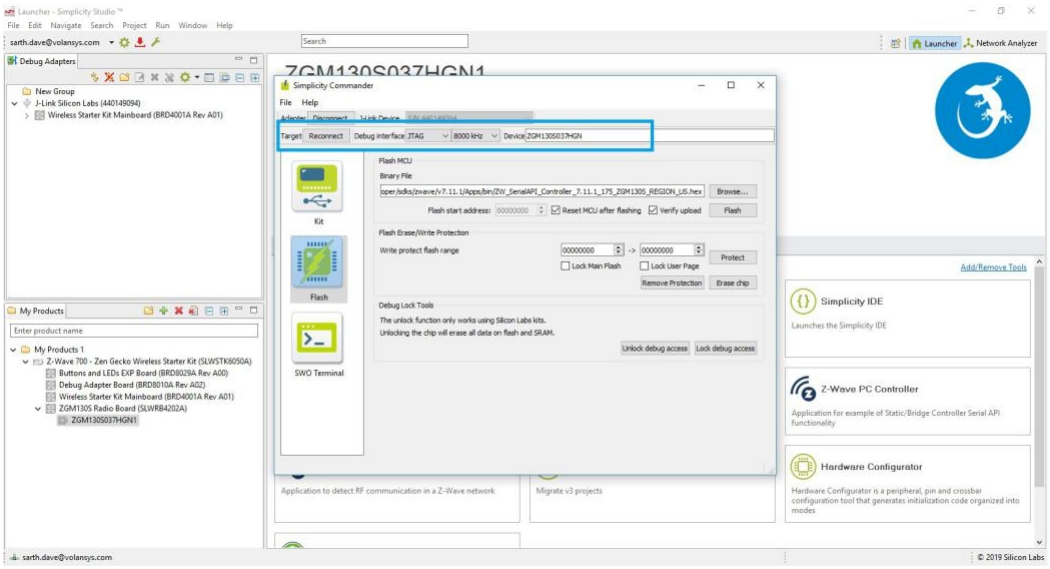


Figure 2-14: Simplicity Studio - Connect JTAG/SWD

8. Select the Flash option available in the left pane.

9. Once done, select the appropriate binary file to be flashed on the Z-wave-700 module as shown in below images.

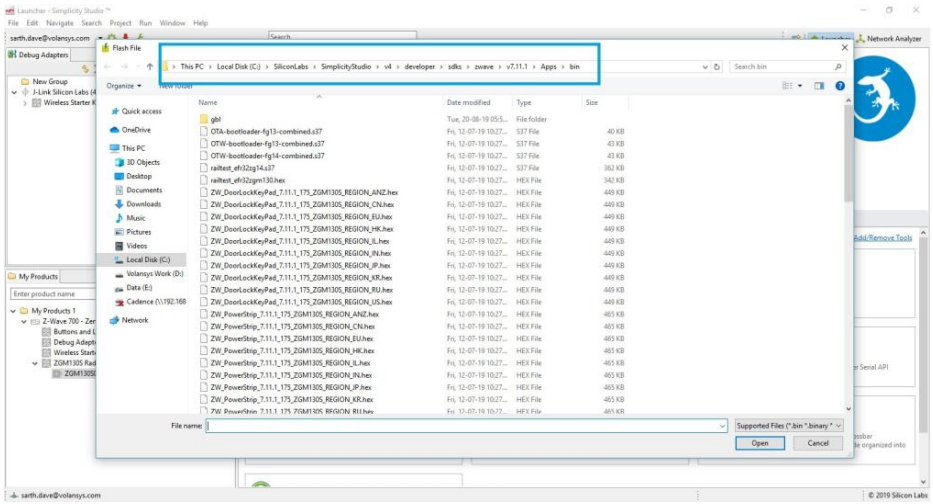


Figure 2-15: Simplicity Studio - Location of Binary Files

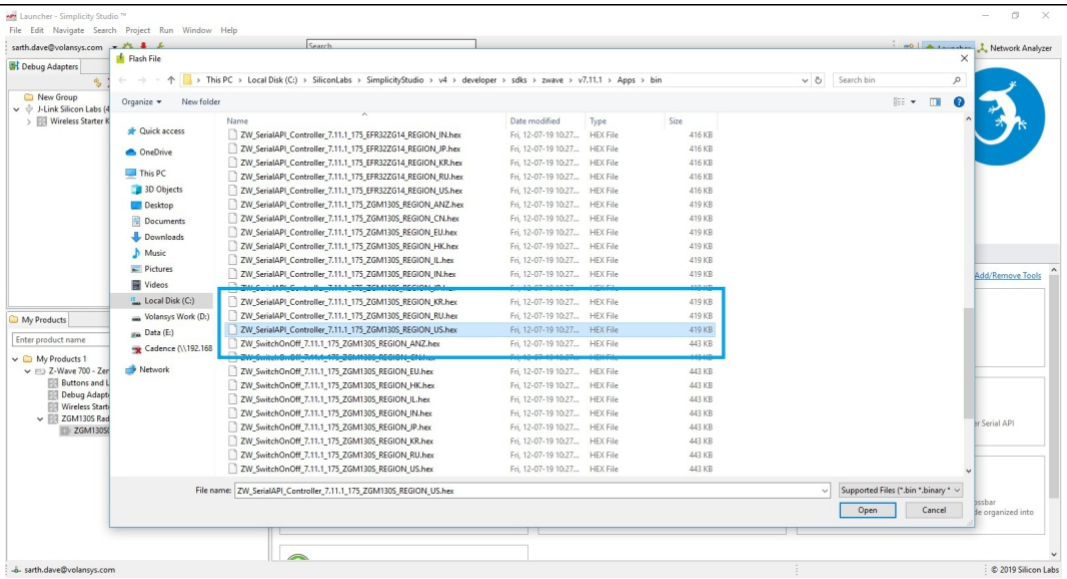


Figure 2-16: Simplicity Studio - Select Binary Files

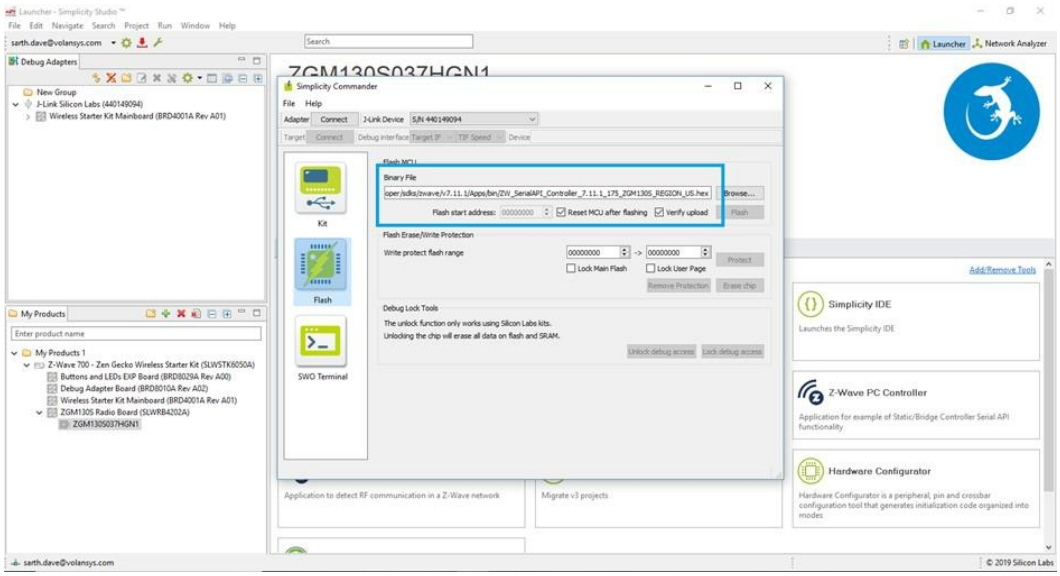


Figure 2-17: Simplicity Studio - Flash Binary Files

10. After the above step, perform Flash operation and the binaries should flash successfully.

Note: The flashing of Z-Wave-700 module can be also performed only by Simplicity commander without installation of Simplicity Studio. To perform flashing using this method, follow the steps 6 - 10.

3 ELECTRICAL CHARACTERISTICS

3.1 Absolute Maximum Ratings

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Storage temperature range	S_{tag}		-40	-	85	°C
Voltage on any supply pin	VDD_{max}		-	3.3	3.3	V
Voltage ramp up rate on any supply pin	$VDD_{rampmax}$		-	-	1	V/us
DC voltage on any IO pin	V_{digpin}	5V tolerant IO pins	-	-	5.25	V
		Standard IO pins	-	-	3.6	V
Total current into supply pins	I_{VDDmax}	Source	-	-	200	mA
Total current into VSS ground lines	I_{VSSmax}	Sink	-	-	200	mA
Current per IO pin	I_{IOmax}	Sink	-	-	50	mA
		Source	-	-	50	mA
Current for all IO pins	$I_{IOMaxall}$	Sink	-	-	200	mA
		Source	-	-	200	mA
Junction temperature	T_J		-40	-	105	°C

Table 6: Absolute Maximum Ratings

3.2 Recommended Operating Conditions

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Operating ambient temperature range	T_A	-G temperature grade	-40	25	85	°C
AVDD supply voltage	V_{AVDD}		-	3.3	3.8	V
VREGVDD supply voltage	$V_{VREGVDD}$		-	3.3	3.8	V
VREGVDD current	$I_{VREGVDD}$		-	-	200	mA
IOVDD operating voltage	V_{IOVDD}	All IOVDD pins	-	3.3	3.8	V
HFCLK frequency	f_{HFCLK}	VSCALE2	-	-	39	MHz

Table 7: Recommended Operating Conditions

3.3 RF Characteristics

Sub-GHz RF Receiver Characteristics for 915 MHz Band						
Parameter	**Symbol**	**Test Condition**	**Min**	**Typ**	**Max**	**Unit**
RF tuning frequency range	F_{range}		902	-	930	MHz
Max usable input level, 1% FER	SAT100K	Desired is reference 100 kbps GFSK signal	-	10	-	dBm
Sensitivity	SENS	Desired is reference 100 kbps GFSK signal, 1% FER, Frequency = 916 MHz, T<=85 °C	-	-97.5	-	dBm
Level above which RFSENSE will trigger	$RFSENSE_{TRIG}$	CW at 915 MHz	-	-28.1	-	dBm
Level below which RFSENSE will not trigger	$RFSENSE_{THRES}$	CW at 915 MHz	-	-50	-	dBm
Upper limit of input power range over which RSSI	$RSSI_{MAX}$		-	-	5	dBm

resolution is maintained						
Lower limit of input power range over which RSSI resolution is maintained	$RSSI_{MIN}$		-98	-	-	dBm
RSSI resolution	$RSSI_{RES}$	Over $RSSI_{MIN}$ to $RSSI_{MAX}$ range	-	0.25	-	dBm

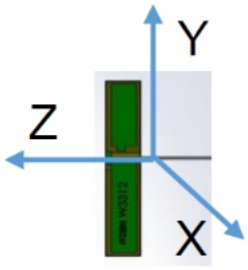
Table 8: RF Characteristics - Receiver

Sub-GHz RF Transmitter Characteristics for 915 MHz Band						
Parameter	**Symbol**	**Test Condition**	**Min**	**Typ**	**Max**	**Unit**
RF tuning frequency range	F_{range}		902	-	930	MHz
Maximum TX power	$POUT_{max}$	4 dBm output power setting	-	4	-	dBm
Minimum active TX power	$POUT_{min}$		-	-30	-	dBm
Output power step size	$POUT_{step}$	output power > 0 dBm	-	0.5	-	dB
Output power variation vs temperature, peak to peak	$POUT_{var\_t}$	-40 to 85 C	-	1.79	-	dB
Output power variation vs RF frequency	$POUT_{var\_f}$	T=25 C, over specified RF frequency range	-	1.11	-	dB

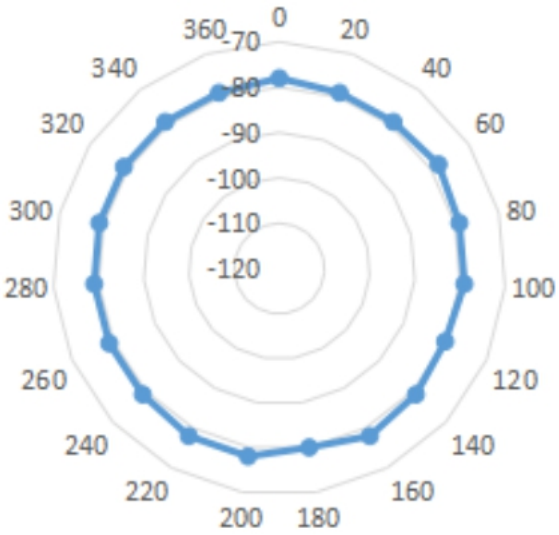
Table 9: RF Characteristics - Transmitter

3.4 RF Range

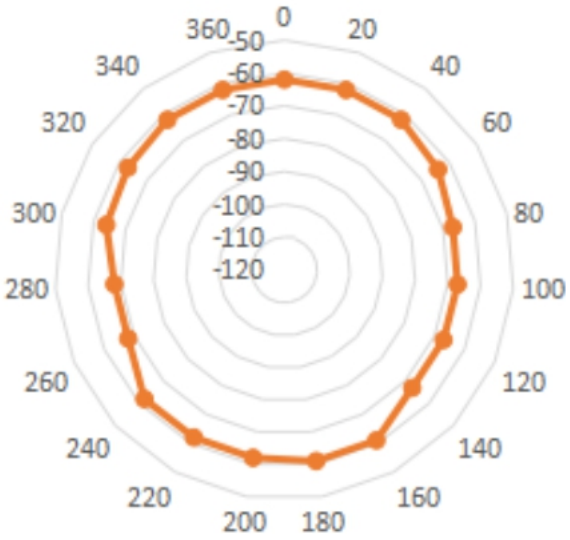
The ZWave 700 module has been tested to and proven to provide 130 meters range in Line of Sight (LOS) measurements. The range measurements of the ZWave 700 module were taken using **W3312B0100** flex patch antenna mounted on a 3 mm thick plate of ABS plastic to simulate the loading effect on the antenna and considers a Packet Error Rate (PER) of <= 10%. The figure below shows the lobe patterns of the used antenna.



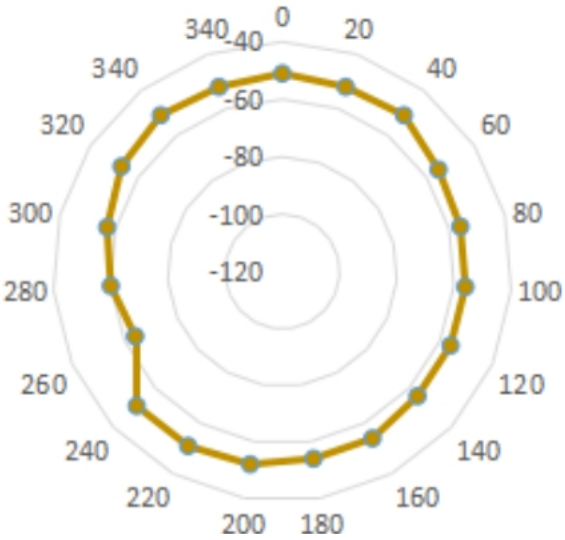
Antenna Axes



RSSI - XY Plane



RSSI - YZ Plane



RSSI - XZ Plane

Figure 3-1: RF Range Test Data

3.5 Module Dimensions

The Zwave 700 module comes in two versions.

1. MikroBUS complaint for mounting on female headers. (SKU: MS-ZGM130S-XX-E-02-TH-NS)

2. MikroBUS complaint for assembly with wave soldering. (SKU: MS-ZGM130S-XX-E-02-TH-WS)

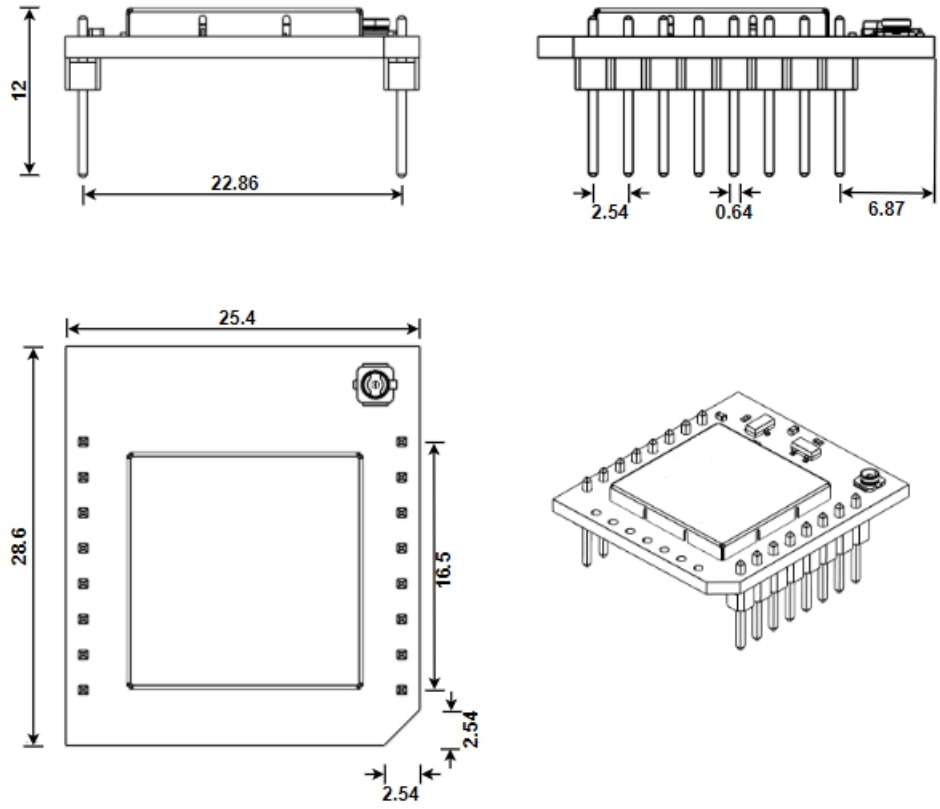


Figure 3-2: ZWave 700 Module - Dimensions (for mounting on female headers)

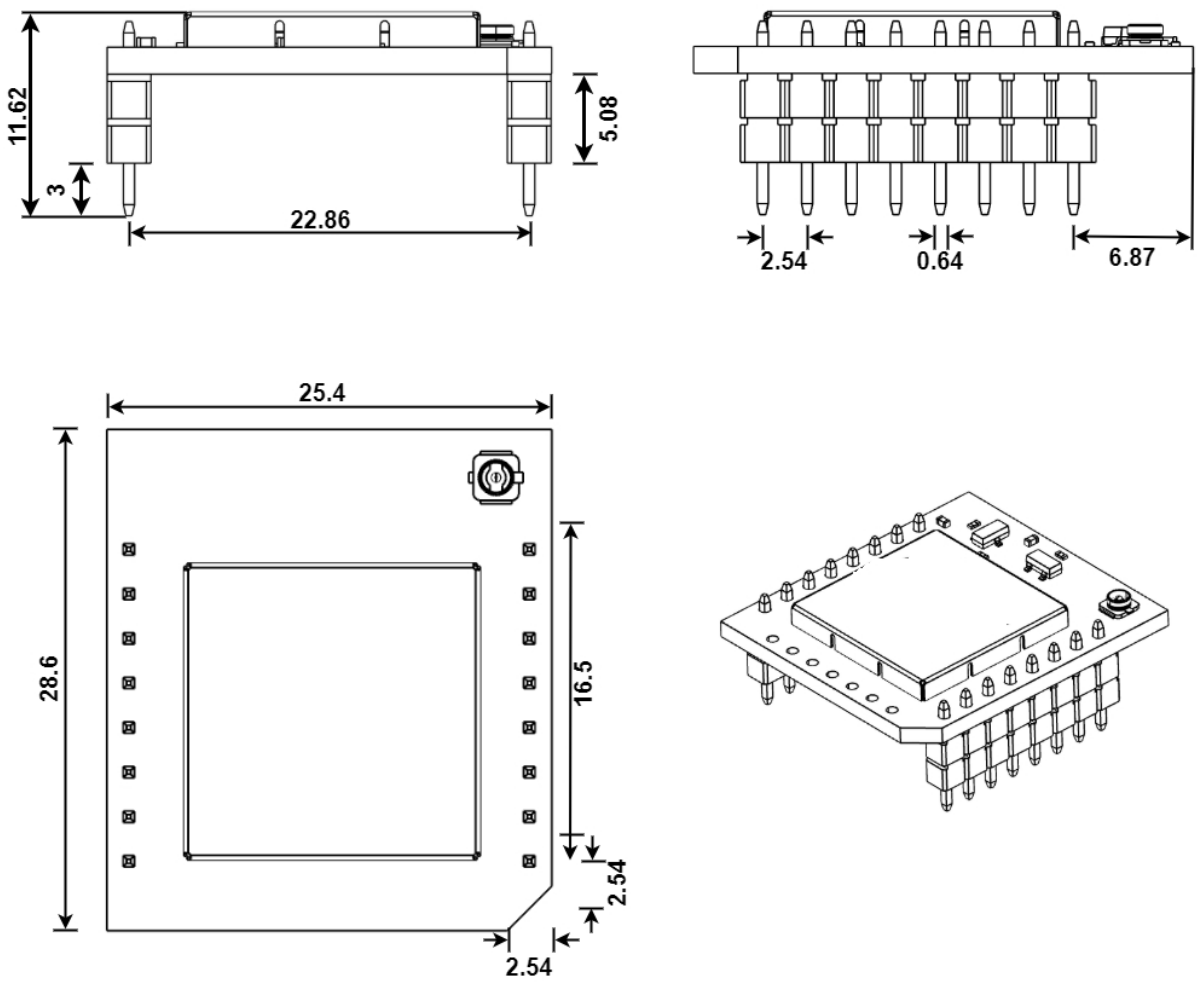


Figure 3-3: ZWave 700 Module - Dimensions (for assembly using wave soldering)

4 CERTIFICATIONS

FCC regulatory conformance:

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.

(2) This device must accept any interference received, including interference that may cause

undesired operation.

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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

IC regulatory conformance

This device complies with CAN ICES-003 (B)/NMB-003(B). This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause

undesired operation of the device.

Cet appareil est conforme à la norme CAN ICES-003 (B)/NMB-003 (B).

Cet appareil contient des émetteurs / récepteurs exempt (s) de licence qui sont conformes aux RSS exemptes de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:

(1) Cet appareil ne doit pas provoquer d'interférences.

(2) Cet appareil doit accepter toute interférence, y compris les interférences susceptibles

de provoquer un fonctionnement indésirable de l'appareil.

RF Exposure

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d ’ exposition aux rayonnements de la IC établies pour unenvironnement non contrôé. Cet équipement doit être installé et fonctionner à au moins 20cm de distance d’un radiateur ou de votre corps.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module’s label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: “Contains transmitter module FCC ID: 2AKNO-ZW700”. Additionally, the following statement should be included on the label and in the final product’s user manual: “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 interferences, and

(2) this device must accept any interference received, including interference that may cause

undesired operation."

for all other operating configurations, including portable configuration with respect to Part 2.1093

and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user The module is limited to installation in mobile or fixed applications. Separate approval is required IC labeling requirement for the final end product:

The final end product must be labeled in a visible area with the following "Contains IC:22256-ZW700" The Host Marketing Name (HMN) must be indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online. This radio transmitter [IC:22256-ZW700] has been approved by Innovation, Science and Economic Development Canada 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.

Frequency range Manufacturer Peak gain Impedance Antenna type

908.4-916MHz Molex 1.0dBi 50Ω Flex Patch Antenna

5 APPLICATION NOTE

5.1 Safety Precautions

These specifications are intended to preserve the quality assurance of products as individual components. Before use, check and evaluate the module's operation when mounted on your products. Abide by these specifications when using the products. These products may short-circuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then provide the following fail safe functions as a minimum:

- Ensure the safety of the whole system by installing a protection circuit and a protection device.
- Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a single fault causing an unsafe status.

5.2 Design Engineering Notes

- Heat is the major cause of shortening the life of the modules. Avoid assembly and use of the target equipment in conditions where the product's temperature may exceed the maximum allowable. Failure to do so may result in degrading of the product's functions and damage to the product.
- If pulses or other transient loads (a large load applied in a short time) are applied to the products, before use, check and evaluate their operation when assembled onto your products.
- These products are not intended for other uses, other than under the special conditions shown below. Before using these products under such special conditions, check their performance and reliability under the said special conditions carefully, to determine whether or not they can be used in such a manner.
- In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash. In direct sunlight, outdoors, or in a dusty environment. In an environment where condensation occurs. In an environment with a high concentration of harmful gas (ex. salty air, HCl, Cl2, SO2, H2S, NH3, and NOx).
- If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.
- Mechanical stress during assembly of the board and operation has to be avoided.
- Pressing on parts of the metal cover or fastening objects to the metal cover is not permitted.

5.3 Storage Conditions

The module must not be stressed mechanically during storage. Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance, may well be adversely affected:

- Storage in salty air or in an environment with a high concentration of corrosive gas, such as Cl_2, H_2S, NH_3, SO_2, or NO_X.
- Storage (before assembly of the end product) of the modules for more than one year after the date of delivery at your company even if all the above conditions (1) to (3) have been met, should be avoided.