CPU Embedded WLAN Module IEEE802.11b/g/n

WYSACVLAY

User Manual

Please note that this user manual should not be provided to end-users.

By purchase of any of products described in this document, the customer is deemed to understand and accept contents of this document.

ATTENTION: Software related to this module may be under Japan export control. Depending on the customer's country and application (e.g. weapons), Taiyo Yuden may not be able to provide the software to all customers. Please contact your local Taiyo Yuden sales office for additional information.

To contact your local sales office and for additional product information, please visit www.ty-top.com.

WYSACVLAY

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Rev. record

24-Jul. 2019> Ver.0.1 Release tentative version

WYSACVLAY

TAIYO YUDEN CO., LTD.

Control No.	Control name
HD-AG-A191006 (1/6)	General Items

Scope

This specification (“Specification”) applies to the hybrid IC “WYSACVLAY” for use ***Wireless LAN*** module (“Product”) manufacture by TAIYO YUDEN CO., LTD. (“TAIYO YUDEN”)

1. User Code: WYSACVLAY- * *
   Type: WYSACVLAY

   The part number listed in this data report may be different from actual production part number.

2. Chip: Marvell 88MW320

3. Function: CPU embedded Radio frequency transfer Module. (***IEEE802.11b/g/n*** standard conformity)

4. Application: IoT equipments

5. Structure: Hybrid IC loaded with silicon monolithic semiconductor
   Ability of lead free mounting at customer's assembly (Heat resistance of this Product) : Yes
   Containment of hazardous substance in this Product;
   *This product conforms to RoHS Directive.

6. Outline: 44-pin leadless chip carrier

7. Marking: Japan ID, IC ID, FCC ID, Manufacture, Model, Lot number, Part number on Shielding Case

8. Features:
   -***IEEE802.11b/g/n*** standard conformity
   Transmit speed: WLAN11n (72.2/65/58.5/57.8/52/43.3/39/28.9/26/21.7/19.5/14.4/13.0/7.2/6.5),
   WLAN11g (54/48/36/24/18/12/9/6Mbps), WLAN11b (11/5.5/2/1 Mbps),
   Channel Number: 1 to 11 channel (USA/Canada)
   1 to 13 channel (Japan /EU)
   Host interface: UART
   Built-in WLAN front end, Flash Memory (4MB), Xtal, Power circuits
   Embedded CPU (Coretex-M4)

9. Security: WPA-2 using AES/CCMP along with legacy security features

10. Packing:
    Packaging method: Tray
    Packaging unit: 84 pieces/Tray, 840pieces/Box

    Standard order quantity : 840 pcs multiples

11. Notes:

a. Please conduct validation and verification of our products in actual condition of mounting and operating environment before using our products.

b. The products listed in this specification are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment including, without limitation, mobile phone, and PC). Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, disaster prevention equipment, medical equipment, highly public information network equipment including, without limitation, telephone exchange, and base station). Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment, nuclear control equipment, undersea equipment, military equipment).
When our products are used even for high safety and/or reliability-required devices or circuits of general electronic equipment, it is strongly
recommended to perform a thorough safety evaluation prior to use of our products and to install a protection circuit as necessary.
Please note that unless you obtain prior written consent of TAIYO YUDEN, TAIYO YUDEN shall not be in any way responsible for any damages incurred by you or third parties arising from use of the products listed in this specification for any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

c. Please note that TAIYO YUDEN shall have no responsibility for any controversies or disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from use of our products. TAIYO YUDEN grants no license for such rights.

d. Please note that TAIYO YUDEN shall not be liable for any defect and/or malfunction arising from use of the product under the terms and conditions other than the operating conditions hereof. In addition, when this product is used under environmental conditions such as over voltage, it may be destroyed in short mode. To ensure the security of customer's product, please add an extra fuse or/and a protection circuit for over voltage.

e. In some cases, TAIYO YUDEN may use replacements as component parts of products. Such replacement shall apply only to component part of products, which TAIYO YUDEN deems it possible to replace or substitute according to (i) scope of warranty provided in this specification (e.g. electric characteristics, outline, dimension, conditions of use, reliability tests, official standard (type approvals etc.))

f. Because product is not designed for radiation durability, please refrain from exposing product to radiation in the use.

g. Communication between this product and other might not be established nor maintained depending upon radio environment or operating condition of this product and other products with wireless technology.

h. This product operates in the unlicensed ISM band at (#9). In case this product is used around the other wireless devices which operate in same frequency band of this product, there is a possibility that interference occurs between this product and such other devices. If such interference occurs, please stop the operation of other devices or relocate this product before using this product or do not use this product around the other wireless devices.

i. Do not alter hardware and/or software of this Product. Please note that TAIYO YUDEN shall not be liable for any problem if it is caused by customer's alteration of Hardware without Taiyo Yuden's prior approvals.

j. TAIYO YUDEN does not guarantee functions and performances which depend on the customer's firmware. TAIYO YUDEN does not assume liabilities for defects and failures (i) in functions, performances and quality of the Customer's product incorporating the Products and (ii) which may occur as the Product is incorporated in the Customer's product.

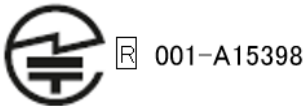
k. Caution for Export
Some of our products listed in this specification may require specific procedures for export according to “U.S. Export Administration Regulations”, “Foreign Exchange and Foreign Trade Control Law” of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales staff.

12. Radio type approval

a. Japan Regulatory Information

This module is approved with the specific antenna on this module. Please ensure that your product shall bear a label with the following information. If the product is so small that it is not practicable to place the label, please place it in the instruction manual and package. The mark diameter shall be equal or greater than 3 mm.

This product installs a radio system which has been approved as a radio station in a low power data communication system based on the Radio Law.
WYSACVLAY : 001-A15398



b. Canada Regulatory Information

i) The following statements in rectangle must be described on the user manual of the host device of this module;

This device complies with Innovation, Science and Economic Development Canada license-exempt RSS standards. 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.

Le présent appareil est conforme aux CNR Innovation, Sciences et Développement économique Canada applicables auxappareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1) l'appareil ne doit pas produire de brouillage;
2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi,
même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISED. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le dispositif rayonnant et le corps.

ii) Please notify certified ID by either one of the following method on your product.

Specifiez ID certifiée dans votre produit par une de méthode suivante.

-Contains Transmitter module IC : 4389B-WYSACVLAY
-Contains IC : 4389B-WYSACVLAY

c. FCC Regulatory Information

i) The following statements in rectangle must described on the user manual of the host device of this module;

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.

FCC CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

ii)Please notify certified ID by either one of the following method.

-Contains Transmitter Module FCC ID: RYYWYSACVLAY
-Contains FCC ID: RYYWYSACVLAY

iii) The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

iv) This module can set the output power by the application software which is developed by module installer. Any end user cannot change the output power.

v) Wireless LAN of this module complies with the following standards:
・FCC part 15 Subpart C（2.4GHz band)

vi) This product is FCC approved only as a module. Manufacturers of final devices has a responsibility for the conditions which are not approved as a module. Please carry out the tests of FCC Part 15 Subpart B in case your final device installs this module.

vii) Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the FCC multi-transmitter procedures. When installing this module to your final devices, please make sure to carry out all the necessary evaluations according to the

applicable guidelines like follows:
-for RF exposure: KDB 447498, KDB 996369 and any other relevant guidelines
-for EMC: KDB 996369 D04 and any other relevant guidelines

viii) When you install this module to your final devices, please ensure that your final composite product complies with the applicable FCC rules in reference to a guidance in KDB 996369.

ix) When you install this module to your final devices, please ensure to perform all the required equipment authorization and testing for the technical parameters which are not covered by the module grant (e.g., unintentional radiator Part 15 Subpart B requirements, or transmitters used in the host which are not previously approved as modules).

x) Antenna List
This module is approved along with the following antennas.
You cannot use any antennas other than the listed ones because it deviates from the accredited conditions

No.	Manufacture	Part No.	Antenna Type	Antenna Gain
1	TAIYO YUDEN	N/A (Printed on PCB)	Monopole	-2.9dBi @2.4GHz Band

d. CE Regulatory Information

i) When your end product installs this module, it is required to proceed additional certification processes before placing on the market in EU member states to make your products fully comply with relative EU standards.
ii) TAIYO YUDEN can provide you the test reports of conducted measurement portion for the radio module. You can utilize the test reports for the certification processes of your end product as it requires radio testing.

Control No.		Control name
HD-AM-A191006	(1/1)	Absolute maximum ratings

Absolute maximum ratings

Item	Symbol	Rating				Remark
		Min.	Typ.	Max.	Unit	
Supply voltage 1	VIO	-		3.63	V	
Supply voltage 2	VIOH	-		3.63	V	
Supply voltage 3	VIOF	-		3.63	V	
Supply voltage 4	V33	-		3.63	V	
Storage temperature range	Tstg	-40		85	Degrees C	
Operation temperature range	Topr	-30	25	85	Degrees C	

Recommendation operating range

Item	Symbol	Rating				Remark
		Min.	Typ.	Max.	Unit	
Supply voltage 1	VIO	3.0	3.3	3.6	V	
Supply voltage 2	VIOH	3.0	3.3	3.6	V	
Supply voltage 3	VIOF	3.0	3.3	3.6	V	
Supply voltage 4	V33	3.0	3.3	3.6	V	

Built in flash memory characteristics

Item	Rating				Remark
	Min.	Typ.	Max.	Unit	
Write/Erase Cycle	10,000	-	-	Times	

DIGITAL IO FEATURES

Inter-Integrated Circuit (I2C)

The I2C bus interface complies with the common I2C protocol and can operate in standard mode (with date rates up to 100Kb/s), fast mode (with data rate up to 400Kb/s) and high-speed mode (with data rate up to 2Mb/s). Additionally, high-speed mode devices and fast mode devices are downward compatible.
The I2C bus interface unit has the following features:

- I2C serial interfaces consisting of a serial data line (SDL) and serial clock (SCL)
- Three speeds:
  Standard mode (up to 100Kb/s)
  Fast mode (up to 400Kb/s)
  High-speed mode (2Mb/s)
- Master or Slave I2C operation
- 7 or 10 bit addressing
- 16 * 32 bits deep transmit and receive buffers, respectively
- interrupt operation
- DMA function

Synchronous Serial Protocol(SSP)

An SSP port is a synchronous serial controller that can be connected to a variety of external Analog-to-Digital converters (ADC), audio and telecommunication codecs, and many other devices that use serial protocols for data transfer.
The SSP ports are configurable to operate in Master mode (the attached peripheral function as a slave) or Slave mode (the attached peripheral functions as a master).
The SSP ports support serial bit rates from 1Mbps (minimum recommended speed) up to 25 Mbps. A FIFO is provided for Transmit data and a second independent FIFO is provided for Receive data. The two FIFOs are both 16 x 32 bits wide or both are 32 x 16 bits wide. The FIFOs can be loaded or emptied by the Cortex-M4F Processor or by DMA burst transfers.

The SSP port features are as follows:
- Supports Motorola Serial Peripheral Interface (SPI)
- Supports DMA transfer

Universal Asynchronous Receiver Transmitter (UART)

- Separate 64x8 transmit and 64x11 receive FIFO memory buffers to reduce CPU interrupts
- Programmable baud rate generator
- Ability to add or delete standard asynchronous communication bits (start ,stop, and parity) in the serial data
- Flow control
  - RTS(output) controlled by the UART Receive FIFO
  - CTS(input) from modem control UART transmitter
- Separate DMA requests for Transmit and Receive data services

Analog Digital Converter (ADC)

WYSACVLAY has ADCs with up to 16-bit resolution. ADCs has individually configurable channels, and reference voltage.

- Selectable resolution (12 to 16 bits)
- Single-ended and differential conversions
- ADC gain setting: 0.5x, 1x, 2x
- Selectable reference voltage (Vref)
  - Internal reference 1.2V
  - Internal reference 1.8V
  - External reference (do not exceed 1.8V)

Digital Analog Converter (DAC)

WYSACVLAY has DAC with 10-bit resolution. It includes 2 channels. Each channel can output a single-ended signal or combine both channels to output a differential signal.

- 10-bit resolution
- Flexible waveform generator (sinusoidal, triangle, etc.) at various frequency range
- Selectable output mode: single-ended or differential
- Internal or external reference voltage
- Three selectable output ranges
- Supports event trigger from GPIO

Analog Comparator (ACOMP)

WYSACVLAY has analog comparators which operate over the full range of power supply VIO. ACOMP can select many positive inputs and negative inputs.

- 7 selectable external positive inputs
- 7 selectable external negative inputs
- 2 selectable internal positive inputs
  - DACA output
  - DACB output
- 5 selectable internal negative inputs
  - DACA output
  - DACB output
  - VIO, VIO*0.75, VIO*0.5, VIO*0.25
  - Internal reference 1.2V (Vref_12)
  - GND
- Selectable positive and negative hysteresis between 0 and 70mV with 10mV step
- Comparator output on GPIOs through alternate functionality, output inversion available

General Purpose Input Output (GPIO)

WYSACVLAY provides GPIO pins.

- General purpose IO – Configurable IO state as Input high / low or Output high/low
- Be able to accept external signals as interrupt source.
  The type of interrupt is programmable with either a rising edge or falling edge.

General Purpose Timers (GPT)

- 4 independent channels with multiple modes
- Edge-aligned and Center-aligned Pulse Width Modulation(PWM) with frequency range from 1KHz to 25MHz
- 1-shot mode to trigger a 1-time output change

DC Specifications

Peak Current / Power consumption

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

No.	Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
1	Peak Current	V33I	Ip1	-	-	400	mA	
2	Power consumption3	Burst Tx (72.2Mbps)	Pc3	-	267	-	mW	Duty 4.2%
3	Power consumption4	Continuous Rx (72.2Mbps)	Pc4	-	271	-	mW	
4	Power consumption5	Burst Tx (54Mbps)	Pc5	-	347	-	mW	Duty 25.4%
5	Power consumption6	Continuous Rx (54Mbps)	Pc6	-	267	-	mW	
6	Power consumption7	Burst Tx (11Mbps)	Pc7	-	545	-	mW	Duty 46.8%
7	Power consumption8	Continuous Rx (11Mbps)	Pc8	-	267	-	mW	
8	Power consumption9	Sleep (MPU: Stand By (Low Power Mode in PM2) WLAN: Deep sleep)	Pc9	-	2	-	mW	

Digital Pad Ratings

No.	Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
1	Input high voltage		VIH	0.7*VIO	-	VIO+0.4	V	Note1
				0.7*VIOH	-	VIOH+0.4	V	Note2
2	Input low voltage		VIL	-0.4	-	0.3*VIO	V	Note1
				-0.4	-	0.3*VIOH	V	Note2
3	Output high voltage	I_{OH}=3mA	VOH	VIO-0.5V	-	-	V	Note1
				VIOH-0.5V	-	-	V	Note2
4	Output low voltage	I_{OL}=4mA	VOL	-	-	0.4	V	

Note1: Apply to IO pads which IO domain is VIO.

Note2: Apply to IO pads which IO domain is VIOH.

ADC Electrical Characteristics

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

	Parameter	Condition	Min	Typ	Max	Unit	Remark
Reference Voltage							
1	Internal Reference Voltage		1.20	1.22	1.23	V	
2	External Reference Voltage		0.6	-	1.8	V	
Analog Inputs							
3	Absolute Input Voltage		0	-	VIO	V	Note1
4	Input Voltage Range	Single-ended with input buffer gain=0.5x	0	-	2*Vref	V	
5		Single-ended with input buffer gain=1x	0	-	Vref		
6		Single-ended with input buffer gain=2x	0	-	0.5*Vref		
7		Differential with input buffer gain=0.5x	-2*Vref	-	2*Vref		Note2
8		Differential with input buffer gain=1x	-Vref	-	Vref		Note2
9		Differential with input buffer gain=2x	-0.5*Vref	-	0.5*Vref		Note2
DC Accuracy							
10	Resolution	Single-ended	-	-	15	bits	
11		Differential	-	-	16		

Notes:

1. The input voltage for each channel must be positive and cannot exceed the VIO voltage level.
2. Differential value: (Positive channel input voltage) – (Negative channel input voltage)

DAC Electrical Characteristics

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

No.	Parameter	Condition	Min	Typ	Max	Unit	Remark
Conversion Range							
1	Voltage Conversion Range	x_RANGE[1:0][*1] : 00 REF_SEL[*2] : 0		0.16+(0.64 * input data/1023)		V	
2		x_RANGE[1:0] : 01/10 REF_SEL : 0		0.19+(1.01 * input data/1023)		V	
3		x_RANGE[1:0] : 11 REF_SEL : 0		0.18+(1.42 * input data/1023)		V	
4		x_RANGE[1:0] : 00 REF_SEL : 1		0.08*Vref_ext+(0.32* Vref_ext*input data /1023)		V	
5		x_RANGE[1:0] : 01/10 REF_SEL : 1		0.095*Vref_ext+(0.505* Vref_ext*input data /1023)		V	
6		x_RANGE[1:0] : 11 REF_SEL : 1		0.09*Vref_ext+(0.71* Vref_ext*input data /1023)		V	
DC Accuracy							
7	Resolution				10	bits	

[*1]Register for output voltage range control

[*2] Register for reference selector (0x0:internal reference, 0x1:external reference(Vref_ext))

ACOMP Electrical Characteristics

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

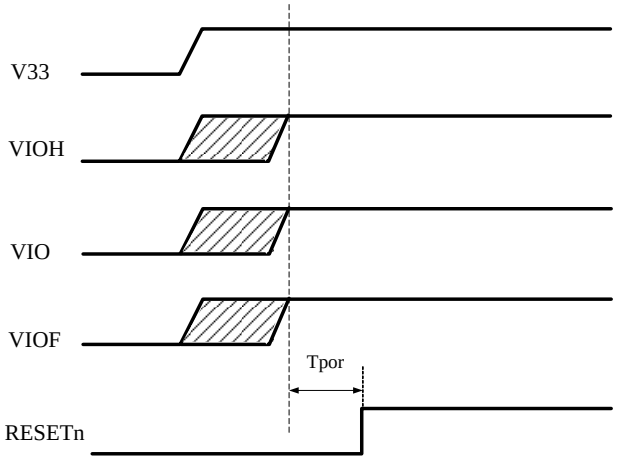
No.	Parameter	Condition	Min	Typ	Max	Unit	Remark
Analog Input							
1	Analog Input Voltage		0	-	VIO	V	
Reference Voltage							
2	Internal Reference Voltage		1.20	1.22	1.23	V	
Hysteresis							
3	Hysteresis	Programming in 7 steps and 0	-	0	-	mV	
			-	10	-		
			-	20	-		
			-	30	-		
			-	40	-		
			-	50	-		
			-	60	-		
			-	70	-		

AC Specifications

Power on sequence

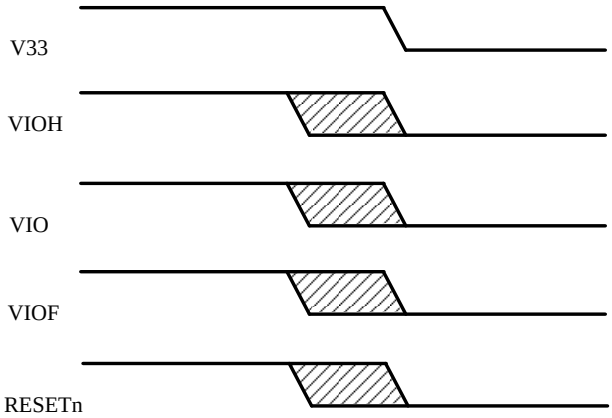
	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	Valid Power to RESETN de-asserted		Tpor	300	-	-	mS	

V33 should be powered up with or before VIOH or VIO or VIOF.
RESETn must remain asserted for minimum of Tpor after V33 and VIOH, VIO, VIOF are stable.
V33, VIOH, VIO and VIOF should start up from less than 0.15V.



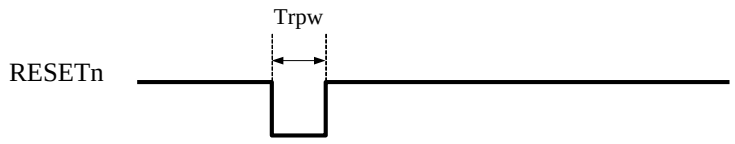
Power off sequence

V33 should be powered off with or after VIOH or VIO or VIOF.
RESETn should not exceed VIO+0.4V.



RESETn Pulse Width

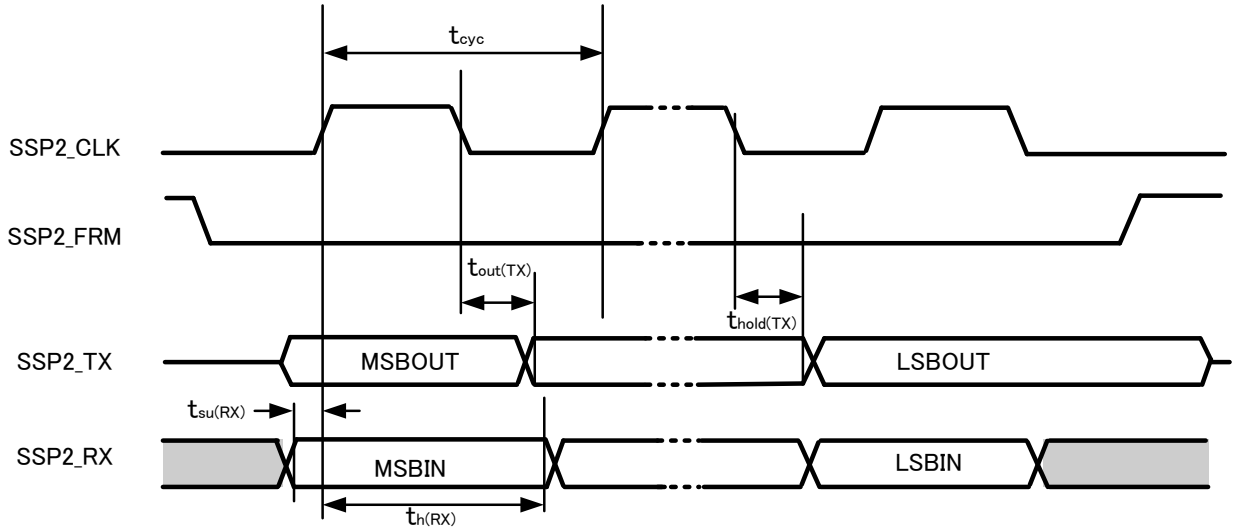
Parameter	Condition	Symbol	Min	Typ	Max	Unit
Minimum reset pulse width on RESETn pin	-	Trpw	300			Ms



Control No.	Control name
HD-AE-A191006 (8/10)	Electrical characteristics

SSP timing specification

	Parameter	Symbol	Condition	Min	Typ	Max	Unit	Remark
1	TX delay time	$t_{out(TX)}$	Master	-	-	3	ns	
			Slave	-	-	15		
2	TX hold time	$t_{hold(TX)}$	Master	-2	-	-	ns	
			Slave	0	-	-		
	RX set up time	$t_{su(RX)}$	Master	12	-	-	ns	
			Slave	4				
3	RX hold time	$t_{h(RX)}$	Master	2	-	-	ns	
			Slave					
4	Serial Bit Clock cycle time	Tcyc	Master	40	-	1000	ns	
			Slave					



RF Specifications (WLAN 11n/72.2Mbps, OFDM)

The Specification applies for Ta=25 degrees C, Supply voltage =Typical voltage.

No.	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	RF frequency range		FREQ	2412		2462	MHz	
2	TX Power		Po	7	9	11	dBm	Note1
3	Spectrum Mask	1st Side Lobe	M1	-		-20	dBc	
		2nd Side Lobe	M2	-		-28	dBc	
		3rd Side Lobe	M3	-		-45	dBc	
4	Symbol clock tolerance		Ft	-25		25	ppm	
5	Frequency tolerance		Ft	-25		25	ppm	
6	EVM	Rms	EVM	-		-28	dB	
7	TX Out of band spurious1	30MHz to 1GHz	TOS1	-		-36	dBm	
8	TX Out of band spurious2	1GHz to 12.75GHz	TOS2	-		-30	dBm	
9	TX Out of band spurious3	1.8GHz to 1.9GHz 5.15GHz to 5.3GHz	TOS3			-47	dBm	
10	Rx sensitivity	PER<10%	SEN	-	-68	-64	dBm	
11	Maximum Input Level	PER<10%	MIL	-20		-	dBm	
12	RX Out of band spurious1	30MHz to 1GHz	ROS1	-		-57	dBm	
13	RX Out of band spurious2	1GHz to 12.75GHz	ROS2	-		-47	dBm	

Note1:Tx power should be set as typical value. If not, it may violate radio regulations of each country.

RF Specifications (WLAN 11g/54Mbps, OFDM)

The Specification applies for Ta=25 degrees C, Supply voltage =Typical voltage

No.	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	RF frequency range		FREQ	2412		2462	MHz	
2	TX Power		Po	7	9	11	dBm	Note2
3	Spectrum Mask	1st Side Lobe	M1	-		-20	dBc	
		2nd Side Lobe	M2	-		-28	dBc	
		3rd Side Lobe	M3	-		-40	dBc	
4	Symbol clock tolerance		Ft	-25		25	ppm	
5	Frequency tolerance		Ft	-25		25	ppm	
6	EVM	Rms	EVM	-		-25	dB	
7	TX Out of band spurious1	30MHz to 1GHz	TOS1	-		-36	dBm	
8	TX Out of band spurious2	1GHz to 12.75GHz	TOS2	-		-30	dBm	
9	TX Out of band spurious3	1.8GHz to 1.9GHz 5.15GHz to 5.3GHz	TOS3			-47	dBm	
10	Rx sensitivity	PER<10%	SEN	-	-71	-65	dBm	
11	Maximum Input Level	PER<10%	MIL	-20		-	dBm	
12	RX Out of band spurious1	30MHz to 1GHz	ROS1	-		-57	dBm	
13	RX Out of band spurious2	1GHz to 12.75GHz	ROS2	-		-47	dBm	

Note2: Tx power should be set as typical value. If not, it may violate radio regulations of each country.

RF Specifications (WLAN 11b/11Mbps, CCK)

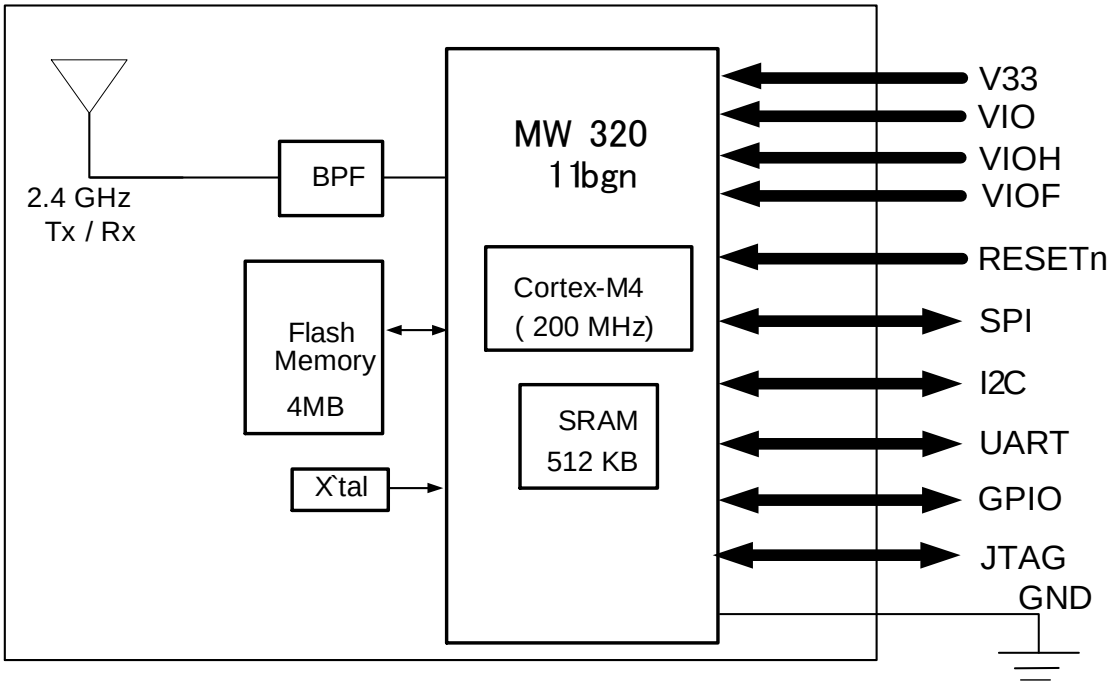
The Specification applies for Ta=25 degrees C, Supply voltage=Typical voltage

No.	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	RF frequency range		FREQ	2412		2462	MHz	
2	TX Power		Po	13	15	17	dBm	Note1
3	Spectrum Mask	1st Side Lobe	M1	-		-30	dBc	
		2nd Side Lobe	M2	-		-50	dBc	
4	Power up-down rump	Power up	TU	-		2	us	
		Power down	TD	-		2	us	
5	Frequency tolerance		Ft	-25		25	ppm	
6	EVM	Peak	EVM	-		35	%	
7	TX Out of band spurious1	30MHz to 1GHz	TOS1	-		-36	dBm	
8	TX Out of band spurious2	1GHz to 12.75GHz	TOS2	-		-30	dBm	
9	TX Out of band spurious3	1.8GHz to 1.9GHz 5.15GHz to 5.3GHz	TOS3			-47	dBm	
10	Rx sensitivity	PER<8%	SEN		-86	-76	dBm	
11	Maximum Input Level	PER<8%	MIL	-10			dBm	
12	RX Out of band spurious1	30MHz to 1GHz	ROS1	-		-57	dBm	
13	RX Out of band spurious2	1GHz to 12.75GHz	ROS2	-		-47	dBm	

Note1: Tx power should be set as typical value. If not, it may violate radio regulations of each country.

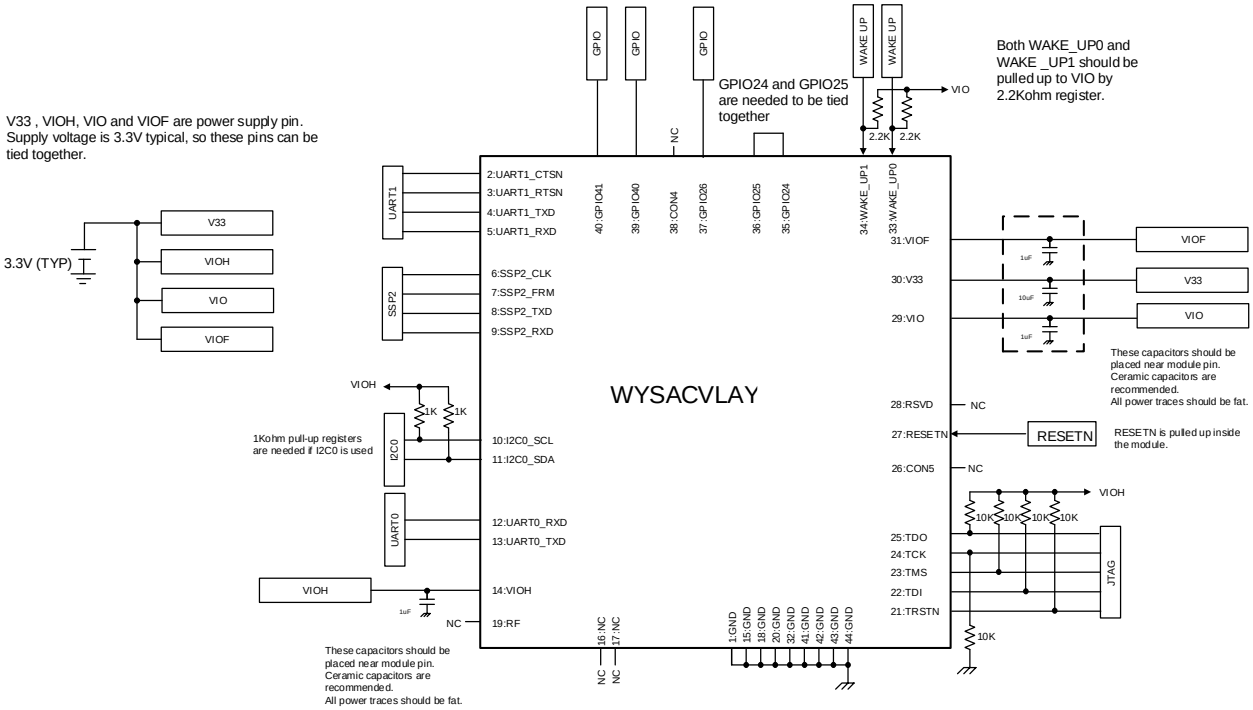
Control No.	Control name
HD-MC-A191006 (1/2)	Circuit Schematic

Block Diagram



Control No.	Control name
HD-MC-A191006 (2/2)	Circuit Schematic

Example of peripheral circuit schematics



Note1: All IO pins should be left open (no need to pull-up or pull-down) if not used.

Note2: This schematics is based on board file named “TY-MW320_brd_vxx.c”

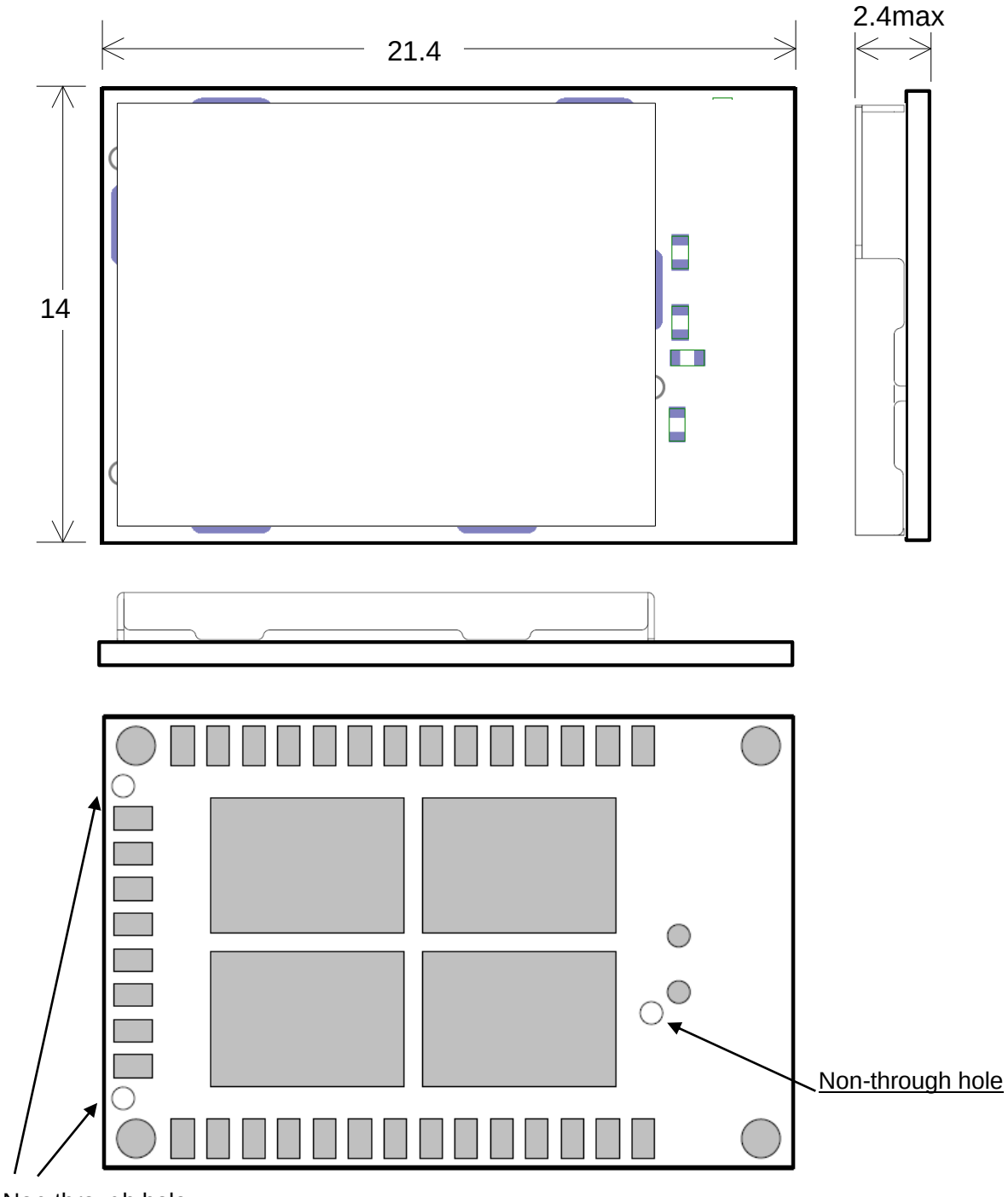
WYSACVLAY

TAIYO YUDEN CO., LTD.

Control No.	Control name
HD-AD-A191006 (1/5)	Outline/Appearance

OUTLINE

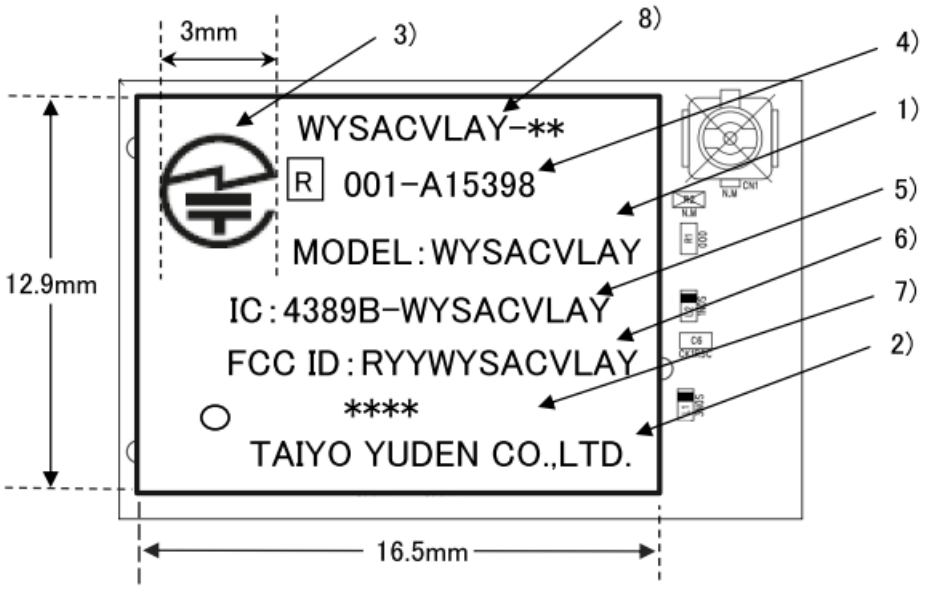
Unit: mm, Tolerances unless otherwise specified:



(TOP VIEW)

Control No.	Control name
HD-AD-A191006 (2/5)	Outline/Appearance

Indication of Shield Case

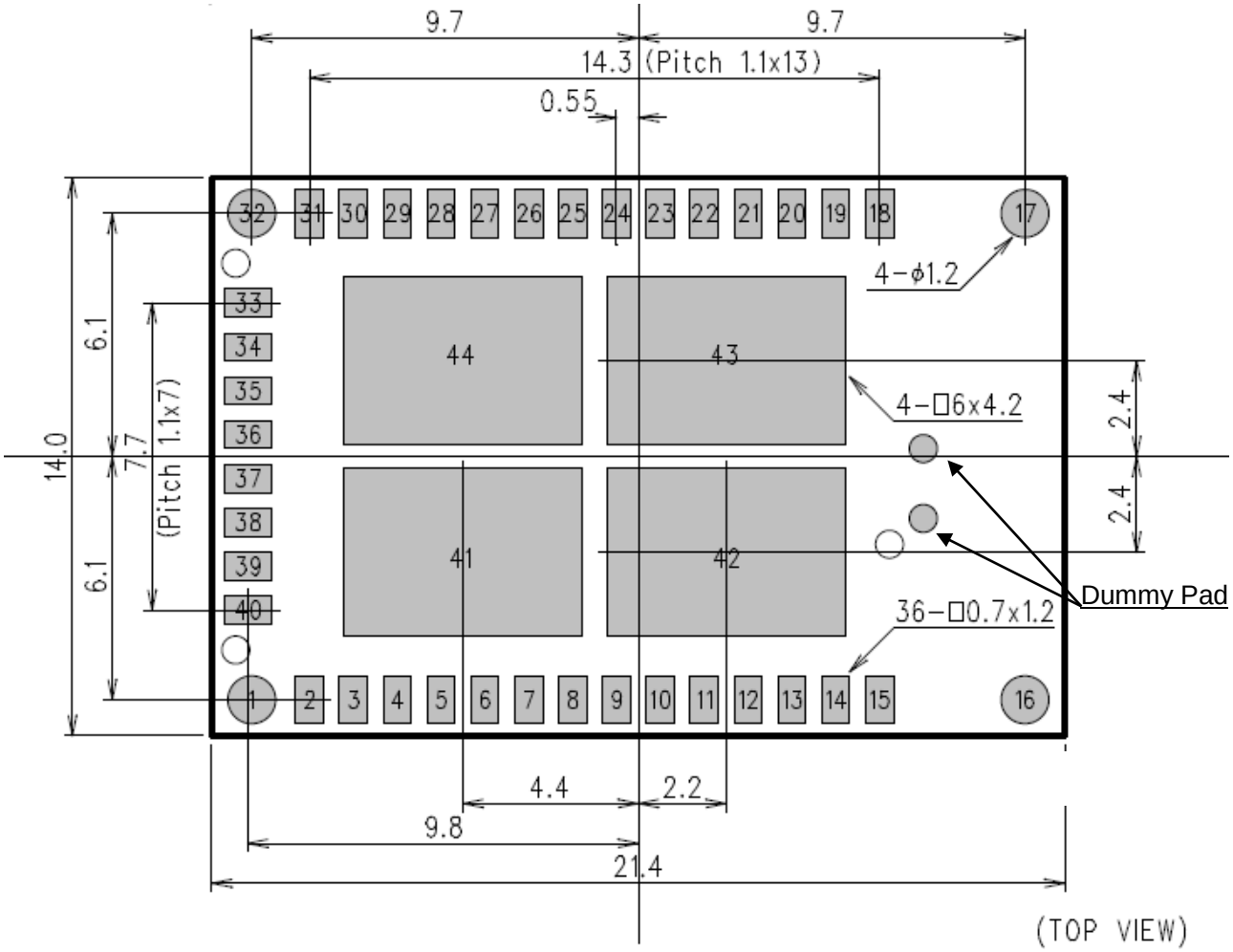


1) Model : WYSACVLAY
2) Manufacture : TAIYO YUDEN CO.,LTD.
3) Japan logo mark : Specified logo mark
4) Japan ID : 001-A15398
5) IC ID : 4389B-WYSACVLAY
6) FCC ID : RYYWYSACVLAY
7) Part Number : WYSACVLAY-**
8) Lot number : Four digits
9) 1pin mark : φ0.6mm hole on the shield case

Control No.		Control name
HD-AD-A191006	(3/5)	Outline/Appearance

Module Pad Dimension

Unit: mm

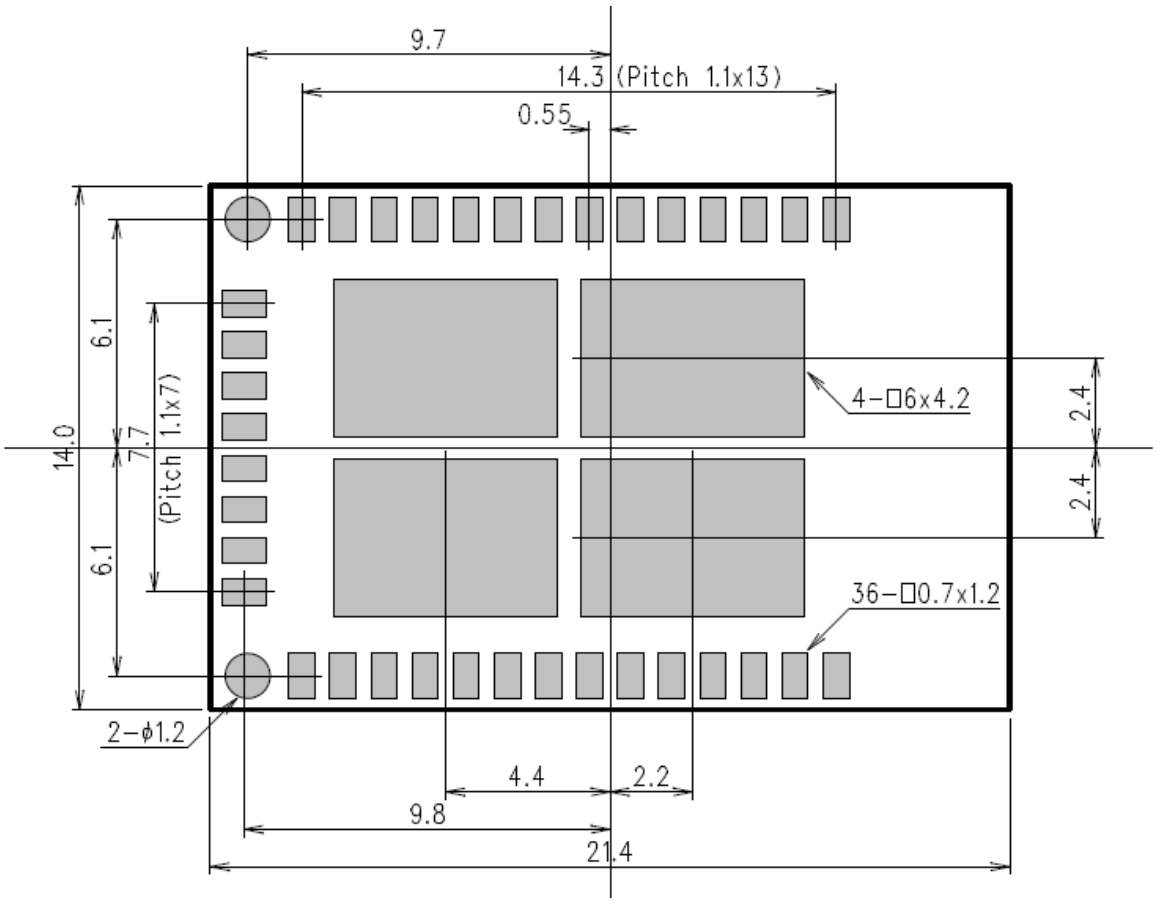


Recommended Land Pattern Dimension

We recommend that pad sizes on mother board and pad sizes on module should be the same except for Pad-16 and Pad-17. Pad-16 and Pad-17 are not needed to solder on mother board and Land patterns for these pads are not needed.

Unit: mm

(Top View)

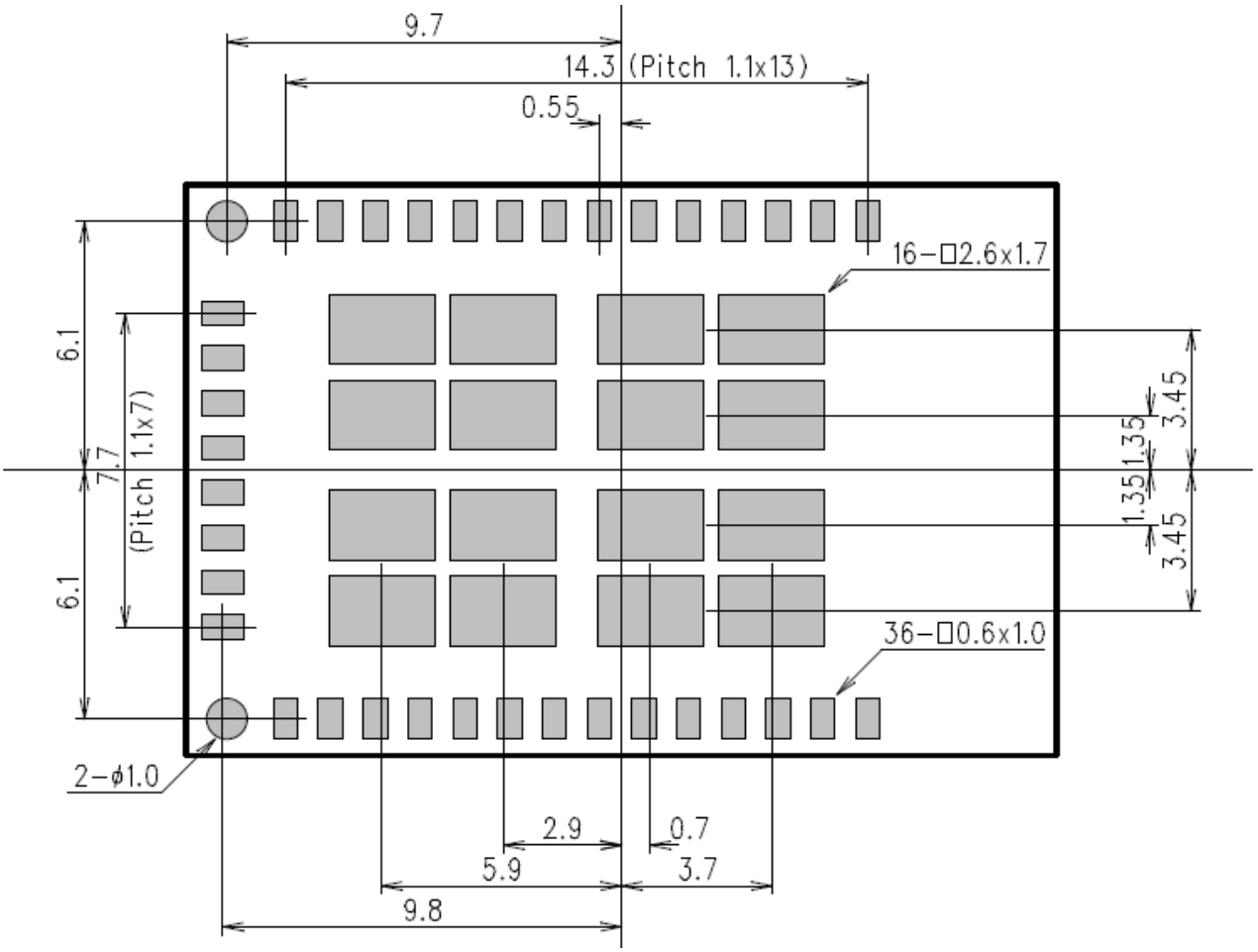


Control No.	Control name
HD-AD-A191006 (5/5)	Outline/Appearance

Recommended Metal Mask (Solder Mask) Conditions

Mask size see bellow. Thickness of the Metal Mask should be in the range 0.1 mm

Unit: mm



Control No.	Control name
HD-BA-A191006 (1/4)	Pin Layout

Pin layout

Pin No	module pin name	Type	power domain	Description	88mw320 GPIO No
1	GND	-	Ground	GND	-
2	UART1_CTSn	I	VIO	UART1 CTSn (L:Clear to send, H:Not clear to send)	GPIO42
3	UART1_RTSn	O	VIO	UART1 RTSn(L:Request to send, H:Not request to send)	GPIO43
4	UART1_TXD	O	VIO	UART1 TXD	GPIO44
5	UART1_RXD	I	VIO	UART1 RXD	GPIO45
6	SSP2_CLK	I/O	VIO	Synchronous Serial Interface (SPI_CLK)	GPIO46
7	SSP2_FRM	I/O	VIO	Synchronous Serial Interface (SPI_CSN)	GPIO47
8	SSP2_TXD	O	VIO	Synchronous Serial Interface (SPI_DO)	GPIO48
9	SSP2_RXD	I	VIO	Synchronous Serial Interface (SPI_DI)	GPIO49
10	I2C0_SCL	I/O	VIOH	I2C0 SCL. Pull up to VIOH with 1Kohm register if use this pin.	GPIO5
11	I2C0_SDA	I/O	VIOH	I2C0 SDA. Pull up to VIOH with 1Kohm register if use this pin.	GPIO4
12	UART0_RXD	I	VIOH	UART0 RXD	GPIO3
13	UART0_TXD	O	VIOH	UART0 TXD	GPIO2
14	VIOH	I	VIOH	I/O Digital Power Supply	-
15	GND	-	Ground	GND	-
16	N.C	-	-	Dummy pad. No connect and do not solder.	-
17	N.C	-	-	Dummy pad. No connect and do not solder.	-
18	GND	-	Ground	GND	-
19	RF	I/O	-	WLAN RF Interface (2.4 GHz Transmit/Receive) Should be left open and do not trace longer than land pattern.	-
20	GND	-	Ground	GND	-
21	TRSTn	I	VIOH	JTAG-TRSTN (Active L)	GPIO10
22	TDI	I	VIOH	JTAG-TDI	GPIO9
23	TMS	I	VIOH	JTAG-TMS	GPIO8
24	TCK	I	VIOH	JTAG-TCK	GPIO7
25	TDO	O	VIOH	JTAG-TDO	GPIO6

Control No.	Control name
HD-BA-A191006 (2/4)	Pin Layout

Pin No	module pin name	Type	power domain	Description	88mw320 GPIO No
26	CON5	I/O	VIO	Configuration Pin. Should be left open. (Boot from internal flash memory)	GPIO16
27	RESETn	I	VIO	RESET signal (Active low) Pulled up to VIO with 51Kohm register inside the module.	-
28	RSVD	-	-	No Connect. Should be left open.	-
29	VIO	I	VIO	I/O Digital Power Supply	-
30	V33	I	V33	3.3V Power Supply	-
31	VIOF	I	VIO_F	I/O Digital Power Supply	-
32	GND	-	Ground	GND	-
33	WAKE_UP0	I	VIO	Wakeup-0 signal (Active L). Should be pulled up to VIO with 2.2K ohm register outside the module.	GPIO22
34	WAKE_UP1	I	VIO	Wakeup-1 signal (Active L). Should be pulled up to VIO with 2.2K ohm register outside the module.	GPIO23
35	GPIO24	I/O	VIO	GPIO24 and GPIO25 are used to calibrate RC32k inside the module. Tie GPIO24 and GPIO25 outside the module and do not tie other signal.	GPIO24
36	GPIO25	I/O	VIO	GPIO24 and GPIO25 are used to calibrate RC32k inside the module. Tie GPIO24 and GPIO25 outside the module and do not tie other signal.	GPIO25
37	GPIO26	I/O	VIO	General Purpose I/O 26	GPIO26
38	CON4	I/O	VIO	Configuration Pin. Should be left open. (Boot from internal flash memory)	GPIO27
39	GPIO40	I/O	VIO	General Purpose I/O 40.	GPIO40
40	GPIO41	I/O	VIO	General Purpose I/O 41.	GPIO41
41	GND	-	Ground	GND	-
42	GND	-	Ground	GND	-
43	GND	-	Ground	GND	-
44	GND	-	Ground	GND	-

*Note: IO pins should be left open if not used, unless otherwise noted.

Control No.	Control name
HD-BA-A191006 (3/4)	Pin Layout

IO Pin alternate functions

Pin No	Function0	Function1	Function2	Function3	Function4	Note
2	GPIO_42	ADC0_Channel0/ ACOMP0 Channel0/ ACOMP1 Channel0	**UART1_CTSn**	SSP1_CLK		
3	GPIO_43	ADC0_Channel1/ ACOMP0 Channel1/ ACOMP1 Channel1 DAC Channel B Output	**UART1_RTSn**	SSP1_FRM		
4	GPIO_44	ADC0_Channel2/ ACOMP0_Channel2/ ACOMP1_Channel2/ DAC Channel A Output	**UART1_TXD**	SSP1_TXD		
5	GPIO_45	ADC0_Channel3/ ACOMP0 Channel3/ ACOMP1 Channel3/ EXT_VREF – ADC or DAC external voltage reference input	**UART1_RXD**	SSP1_RXD		
6	GPIO_46	ADC0_Channel 4/ ACOMP0 Channel 4/ ACOMP1 Channel 4/	UART2_CTSn	**SSP2_CLK**		
7	GPIO_47	ADC0_Channel 5/ ACOMP0 Channel 5/ ACOMP1 Channel 5/	UART2_RTSn	**SSP2_FRM**		
8	GPIO_48	ADC0_Channel 6/ ACOMP0_Channel 6/ ACOMP1_Channel 6/	UART2_TXD	**SSP2_TXD**		
9	GPIO_49	ADC0_Channel 7/ ACOMP0_Channel 7/ ACOMP1_Channel 7/	UART2_RXD	**SSP2_RXD**		
10	GPIO_5	GPT0_Channel5	**I2C0_SCL**			
11	GPIO_4	GPT0_Channel4	**I2C0_SDA**			
12	GPIO_3	GPT0_Channel3	**UART0_RXD**	SSP0_RXD		
13	GPIO_2	GPT0_Channel2	**UART0_TXD**	SSP0_TXD		
21	**TRSTn**	GPIO_10	UART2_RXD	SSP2_RXD	I2C1_SCL	
22	**TDI**	GPIO_9	UART2_TXD	SSP2_TXD	I2C1_SDA	
23	**TMS**	GPIO_8	UART2_RTSn	SSP2_FRM	I2C0_SCL	
24	**TCK**	GPIO_7	UART2_CTSn	SSP2_CLK	I2C0_SDA	
25	**TDO**	GPIO_6	I2C1_SDA			
26	**GPIO_16**	CON[5]				

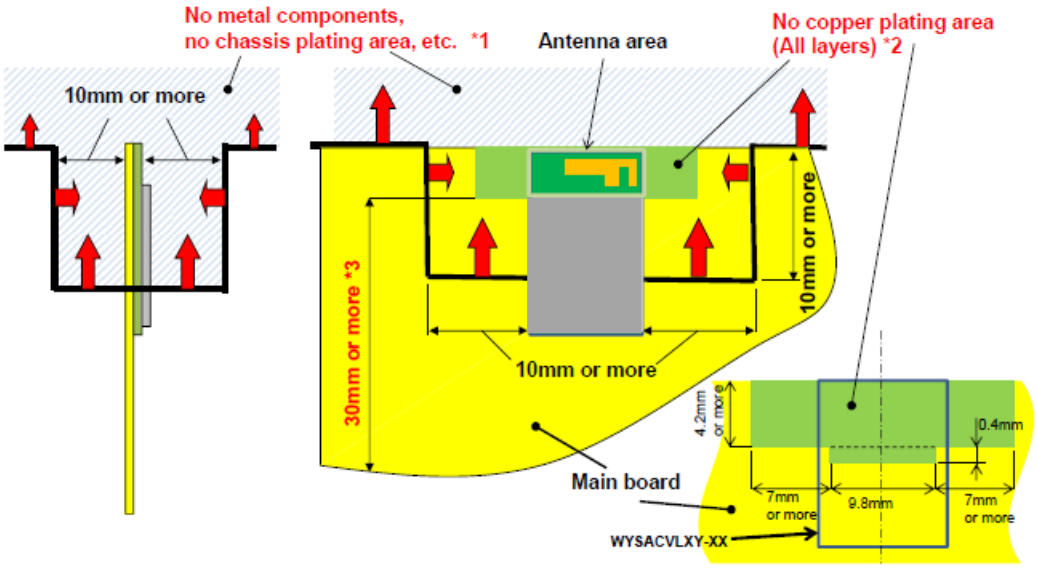
Control No.	Control name
HD-BA-A191006 (4/4)	Pin Layout

Pin No	Function0	Function1	Function2	Function3	Function4	Note
33	**WAKE_UP0**	GPIO_22				
34	**WAKE_UP1**	GPIO_23				
35		**GPIO_24**				
36		**GPIO_25**				
37		**GPIO_26**				
38	**GPIO_27**	CON[4]				
39	**GPIO_40**	DAC_External_Trigger0	ACOMP0_GPIO_OUT	ACOMP1_GPIO_OUT		
40	**GPIO_41**	DAC_External_Trigger1	ACOMP0_EDGE_PULSE	ACOMP1_EDGE_PULSE		

Note: **Bold** indicates default function configured in the board file named “TY_MW320_brd_vxx.C”

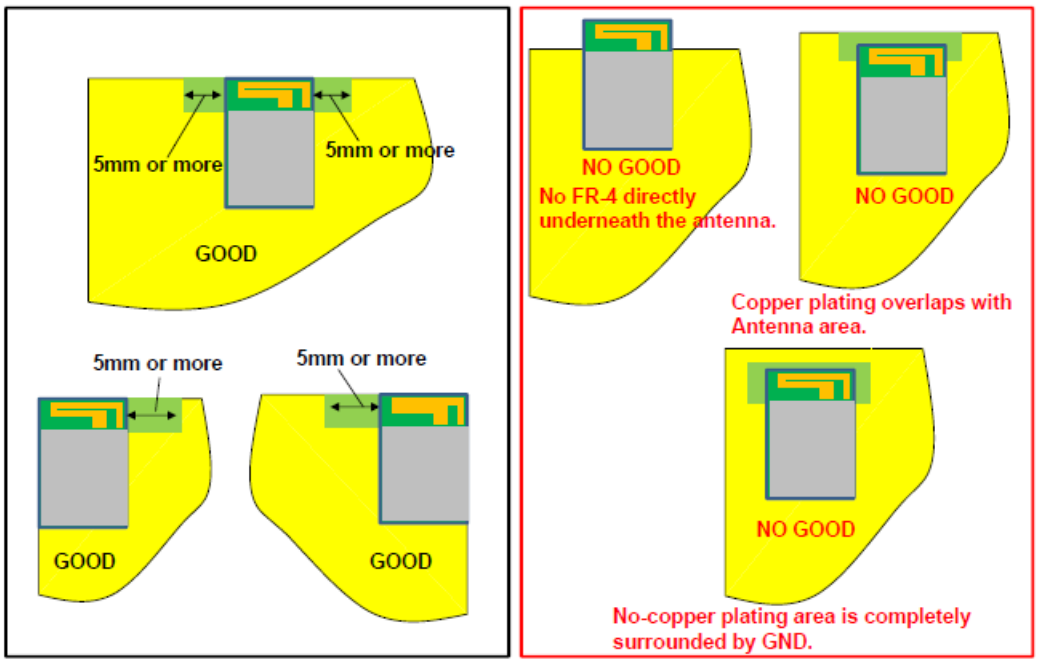
Control No. (1/3)	Control name Antenna Application Note

1. Recommended module mounting example

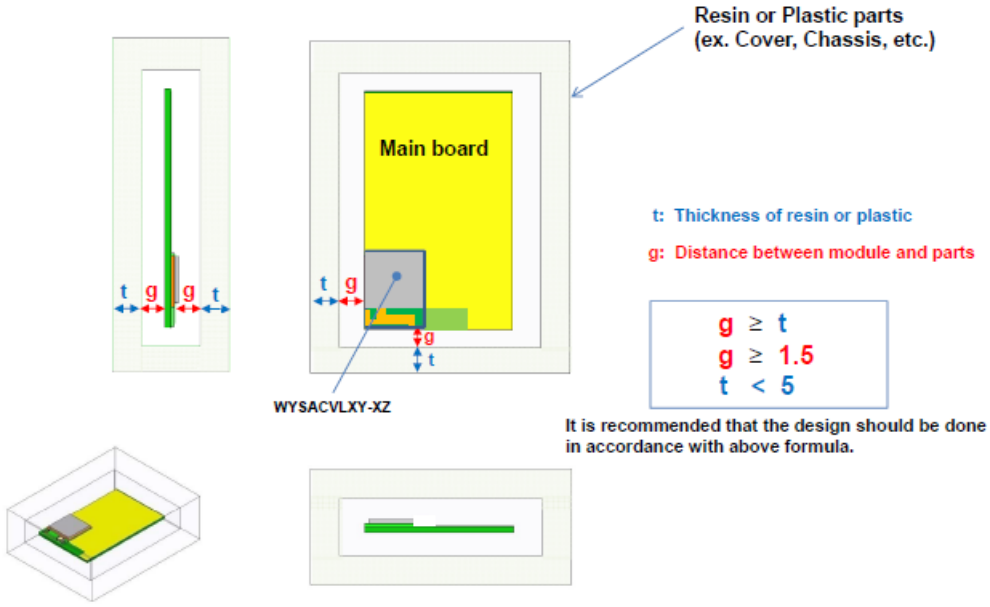


*1 Please do not place any metal components in blue shaded space,(*1) such as signal line and metal chassis as possible except for main board while mounting the components in *1 space on the main board is allowed except for no copper plating area. (*2).
*2 This area is routing prohibited area on the main board. Please do not place copper on any layer. Please remain use of FR-4 dielectric material. The antenna is tuned with the FR-4.
*3 Characteristics may deteriorate when GND pattern length is less than 30mm. It should be 30 mm or more as possible.
Even when above mentioned condition is satisfied, communication performance may be significantly deteriorated depending on the structure of the product.

2. Other module mounting examples

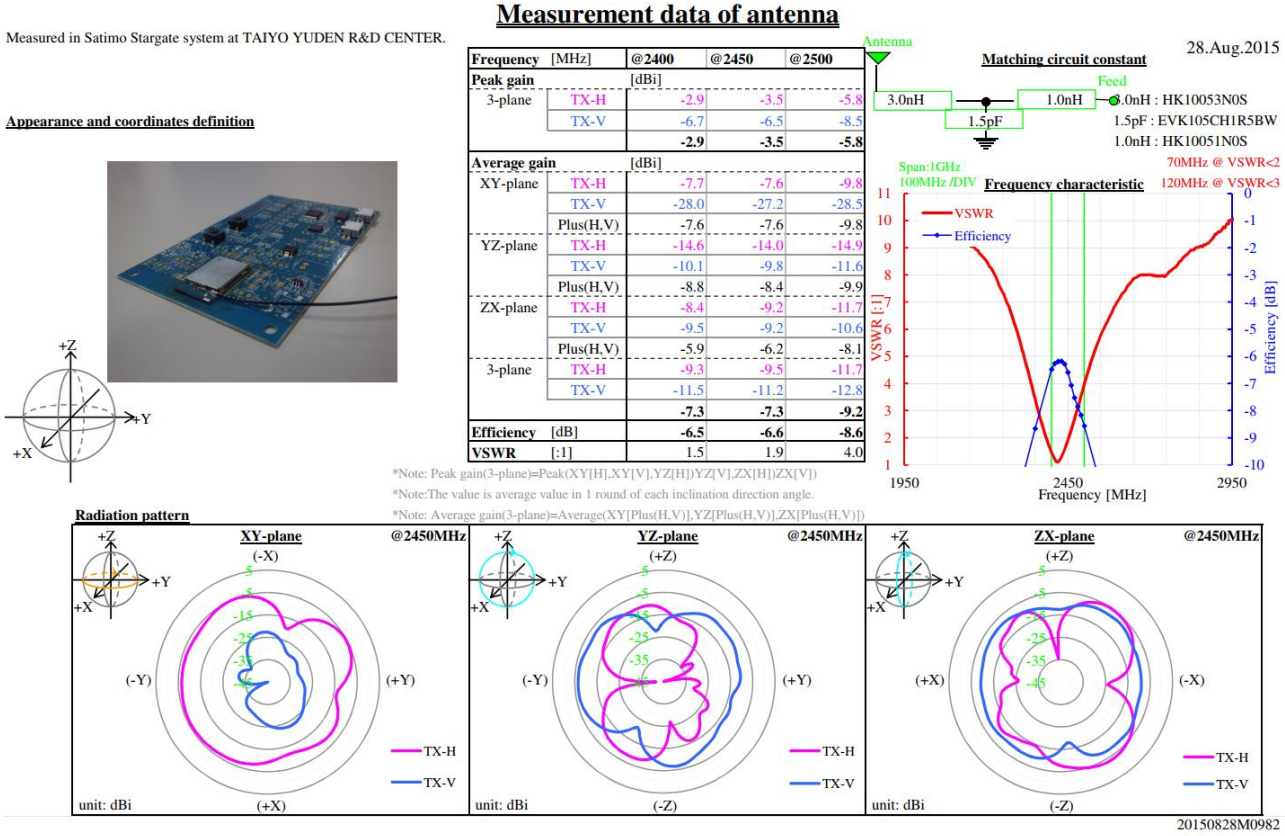


3. Placement of resin or plastic parts



Please do not apply molding over the antenna area of WYSACVLXY-XZ.

4. Directional characteristics example (when mounted on evaluation board)



Frequency [MHz]		@2400	@2450	@2500
Peak gain		[dBi]		
3-plane	TX-H	-2.9	-3.5	-5.8
	TX-V	-6.7	-6.5	-8.5
		-2.9	**-3.5**	**-5.8**
Average gain		[dBi]		
XY-plane	TX-H	-7.7	-7.6	-9.8
	TX-V	-28.0	-27.2	-28.5
	Plus(H,V)	-7.6	-7.6	-9.8
YZ-plane	TX-H	-14.6	-14.0	-14.9
	TX-V	-10.1	-9.8	-11.6
	Plus(H,V)	-8.8	-8.4	-9.9
ZX-plane	TX-H	-8.4	-9.2	-11.7
	TX-V	-9.5	-9.2	-10.6
	Plus(H,V)	-5.9	-6.2	-8.1
3-plane	TX-H	-9.3	-9.5	-11.7
	TX-V	-11.5	-11.2	-12.8
		-7.3	**-7.3**	**-9.2**
Efficiency	[dB]	**-6.5**	**-6.6**	**-8.6**
VSWR	[:1]	1.5	1.9	4.0

5. About this Application Note

-This Application Note has been prepared as a reference material to help obtaining the antenna performance mounted on **WYSACVLAY** module better while it is not guaranteed or assured to obtain better communication performance and distance.

-This product **"WYSACVLAY** module" has been certified and matching circuit constant for antenna within module cannot be changed when ambient environment condition changes. The product must be re-certified when matching circuit constant is changed.