

PRODUCT SPECIFICATION

Product Name	S76S 2D
Version	A
Doc No	901-
Date	2025/5/28

Document History

Date	Revised Contents	Revised By	Version
2024/12/12	Initial Version	Kenny	A
2025/1/22	CubeWorks Change of FCC ID	Gyouho	CW
2025/5/28	Additional note on FCC	Gyouho	CW2

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1. General Description

The S76S 2D integrates ARM Cortex®-M0+ (32-bit RISC core operating at a 32MHz frequency) MCU with LoRa™ modulation that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

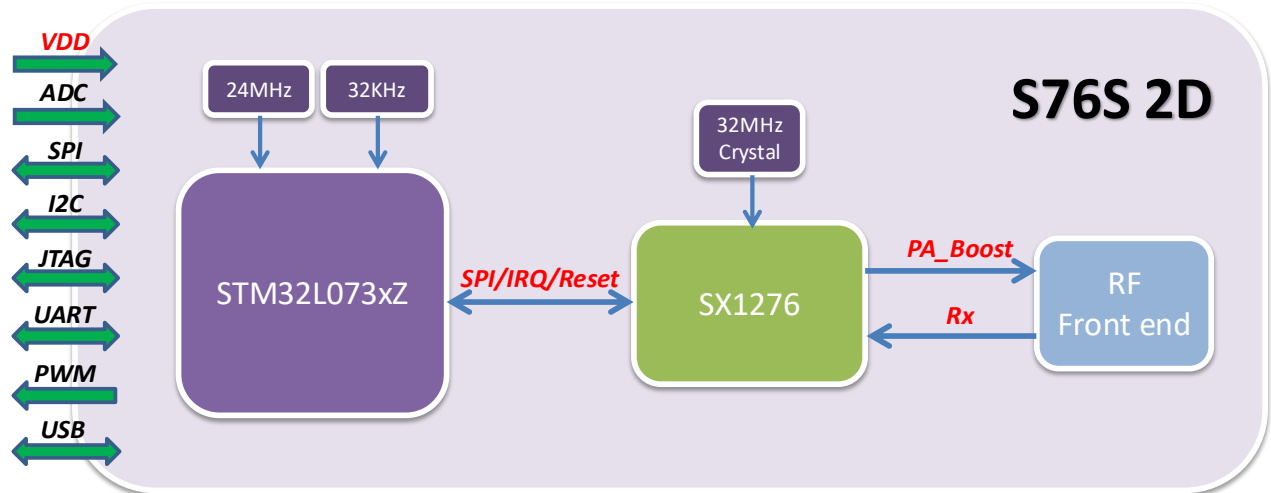
S76S 2D can achieve a sensitivity of over -137 dBm. The high sensitivity combined with the integrated +20 dBm power amplifier yields industry leading link budget making it optimal for any low data rate application requiring range or robustness. LoRa™ also provides significant advantages in both blocking and selectivity over conventional modulation techniques, solving the traditional design compromise between range, interference immunity and energy consumption.

Feature

- Small footprint : 13 mm x 11 mm x 1.1 mm
- LoRa™ Modem
- +20 dBm constant RF output vs. V supply
- Programmable bit rate up to 37500 bps
- High sensitivity: down to -137 dBm
- Excellent blocking immunity
- Preamble detection
- Automatic RF Sense and CAD with ultra-fast AFC
- Payload up to 128 bytes with CRC
- Embedded memories (up to 192 Kbytes of Flash memory and 20 Kbytes of RAM)

Block Diagram

A simplified block diagram of the S76S 2D module is depicted in the figure below.



1-1. Product Version

The features of S76S 2D is detailed in the following table

Part Number	Frequency Range	Spreading Factor	Bandwidth (K Hz)	Effective Bitrate (bps)	Est. Sensitivity (dBm)
S76S 2D	902-928 MHz 863-870 MHz	6 - 12**	62.5 - 500	146 - 37500	-109 to -137*

Note: * LORA setting SF=12, BW=62.5k, Long-Range Mode, highest LNA gain, *LnaBoost* for Band 1.

** LORA setting SF=12, suggest to add Offset on TX freq. to compensate temperature Coefficient of XTAL@ Temp < -20°C

1-2. Specification

Model Name	S76S 2D
Product Description	LoRa Wireless Communication Module
Host Interface	UART
Operation Conditions	
Temperature	- Storage : -50°C ~ +105°C - Operating : -40°C ~ +85°C
Humidity	- Operating : 10 ~ 95% (Non-Condensing) - Storage : 5 ~ 95% (Non-Condensing)
Dimension	13 mm x 11 mm x 1.1 mm
Package	LGA type

2. Electrical Characteristics

2-1. Absolute Maximum Ratings

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD33	Supply Voltage	-0.3		3.9	V
V _{IN}	Input voltage on digital pins	-0.3		3.9	V
P _{mr}	RF Input Level			+10	dBm

2-2. Recommended Operating Range

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD33	Supply Voltage	2.4	3.3	3.6	V
ML	RF Input Level			+10	dBm

2-3. Power Consumption Characteristics

Symbol	Parameter	Conditions	Typ.	Max.	Unit
IDDSL	Supply current in Sleep mode	Sleep Stop Mode		5	uA
IDDST	Supply current in Standby mode	Crystal oscillator enabled	9	9.6	mA
IDDR	Supply current in Receive mode		17.5		mA
IDDT	Supply current in Transmit mode with impedance matching	RF SetPW = +20 dBm RF SetPW = +17 dBm RF SetPW = +13 dBm RF SetPW = + 7 dBm	127 82 65 49		mA

2-4. RF Characteristics

The table below gives the electrical specifications for the transceiver operating with LoRa™ modulation.

Following conditions apply unless otherwise specified:

- Supply voltage = 3.3 V.
- Temperature = 25° C.
- Frequency bands: 915/868 MHz
- Error Correction Code (EC) = 4/6.
- Packet Error Rate (PER)= 1%
- CRC on payload enabled.
- Payload length = 64 bytes.
- Preamble Length = 12 symbols (programmed register Preamble Length=8)
- With matched impedances

LoRa Transmitter (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range	Band1	863	915	928	MHz
Tx Pwr Level @Module O/P	PA_BOOST pin	17.5	18.5	20.0	dBm
LoRa Receiver (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range	Band1	863	915	928	MHz
RF sensitivity, (Long-Range Mode, highest LNA gain, LNA boost, 62.5 kHz bandwidth)	SF = 10		-133		dBm
	SF = 11		-135		dBm
	SF = 12		-137		dBm
RF sensitivity, (Long-Range Mode, highest LNA gain, LNA boost, 125 kHz bandwidth)	SF = 7		-121		dBm
	SF = 8		-124		dBm
	SF = 9		-127		dBm
	SF = 10		-130		dBm
	SF = 11		-131		dBm
	SF = 12		-134		dBm
RF sensitivity, (Long-Range Mode, highest LNA gain, LNA boost, 500 kHz bandwidth)	SF = 7		-114		dBm
	SF = 8		-117		dBm
	SF = 9		-120		dBm
	SF = 10		-123		dBm
	SF = 11		-126		dBm
	SF = 12		-128		dBm

2-5. Digital Characteristics

2-5-1. DC characteristics

Input voltage levels

Symbol	Description	Conditions	Min	Typ.	Max	Unit
V _{IH}	I/O input high level voltage	NRST	0.7xVDD33	-	-	V
		BOOT0	0.7xVDD33	-	-	V
		GPIO	0.7xVDD33	-	-	V
V _{IL}	I/O input low level voltage	NRST	-	-	0.3xVDD33	V
		BOOT0	-	-	0.14xVDD33	V
		GPIO	-	-	0.3xVDD33	V
R _{PU}	Weak pull-up Equivalent resistor	V _{IN} = GND	30	45	60	K Ω
R _{PD}	Weak pull-down Equivalent resistor	V _{IN} = VDD33	30	45	60	K Ω

Output voltage levels

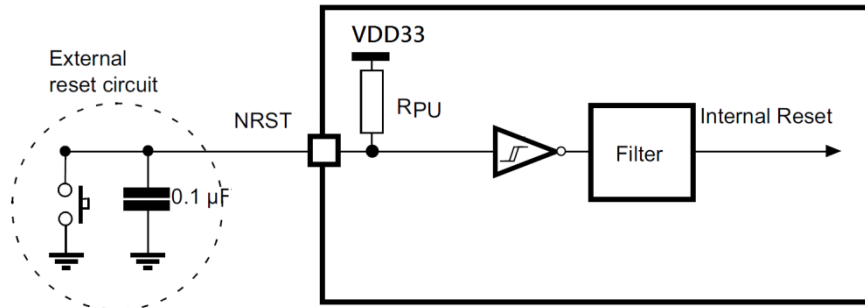
Symbol	Description	Conditions	Min	Max	Unit
V _{OL}	Output low level voltage for an I/O pin	CMOS port / IIO = +8 mA 2.7 V ≤ VDD33 ≤ 3.6 V	-	0.4	V
V _{OH}	Output high level voltage for an I/O pin		VDD33-0.4	-	
V _{OL}	Output low level voltage for an I/O pin	TTL port / IIO = + 8 mA 2.7 V ≤ VDD33 ≤ 3.6 V	-	0.4	
V _{OH}	Output high level voltage for an I/O pin		2.4	-	
V _{OL}	Output low level voltage for an I/O pin	IIO = +15 mA 2.7 V ≤ VDD33 ≤ 3.6 V	-	1.3	
V _{OH}	Output high level voltage for an I/O pin	IIO = -15 mA 2.7 V ≤ VDD33 ≤ 3.6 V	VDD33-1.3	-	
V _{OL}	Output low level voltage for an I/O pin	IIO = +4 mA 1.65 V ≤ VDD33 ≤ 3.6 V	-	0.45	
V _{OH}	Output high level voltage for an I/O pin	IIO = +4 mA 1.65 V ≤ VDD33 ≤ 3.6 V	VDD33-0.45	-	

2-5-2. NRST pin characteristics

The NRST pin input driver uses CMOS technology.

It is connected to a permanent pull-up resistor (R_{PU}).

The following figure is recommended NRST pin protection circuit against parasitic resets.



Symbol	Description	Conditions	Min	Typ.	Max	Unit
$V_{IL(NRST)}$	NRST input low level voltage		VSS		0.8	V
$V_{IH(NRST)}$	NRST input high level voltage		1.4		VDD33	V
$V_{OL(NRST)}$	NRST output low level voltage	$I_{OL} = 2\text{mA}$ $2.7\text{V} < \text{VDD33} < 3.6\text{V}$			0.4	V
$V_{OL(NRST)}$	NRST output low level voltage	$I_{OL} = 1.5\text{mA}$ $1.65\text{V} < \text{VDD33} < 2.7\text{V}$			0.4	V
$V_{hys(NRST)}$	NRST schmitt trigger voltage hysteresis			10% VDD33		mV
R_{PU}	Weak pull-up Equivalent resistor	$V_{IN} = \text{GND}$	30	45	60	K Ω
V_F	NRST Input filtered pulse				50	nS
V_{NF}	NRST Input not filtered pulse	$\text{VDD33} > 2.7\text{V}$		350		nS

2-5-3. UART Interface Parameters

Baud Rate = 115200 bps

Data Bits = 8 bits

Stop Bits = 1 bit

Parity Check = None

Flow Control = None

3. Pin Definition

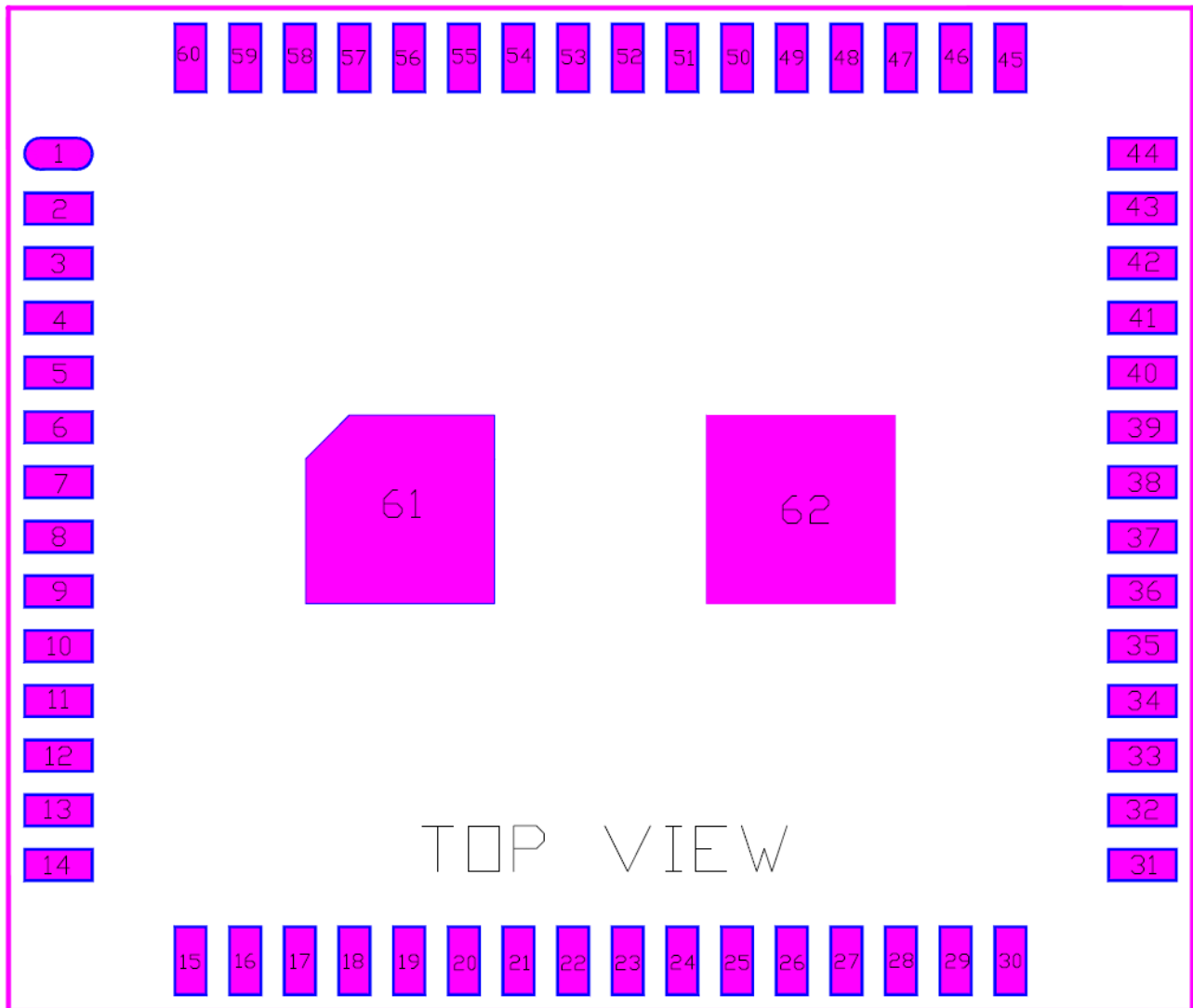
Pin	Definition	I/O	Description
1	NC		
2	GND		Ground pin
3	GND		Ground pin
4	PC0	I/O	MCU pin name: PC0
5	PC1	I/O	MCU pin name: PC1
6	PC2	I/O	MCU pin name: PC2
7	PC3	I/O	MCU pin name: PC3
8	NC		
9	NC		
10	NC		
11	NC		
12	NRST		Hardware reset pin
13	PA0	I/O	MCU pin name: PA0
14	GND		Ground pin
15	GND		Ground pin
16	PA2	I/O	MCU pin name: PA2
17	PA3	I/O	MCU pin name: PA3
18	PA4_SPI1_NSS	I/O	MCU pin name: PA4
19	PA5_SPI1_SCK	I/O	MCU pin name: PA5
20	PA6_SPI1_MISO	I/O	MCU pin name: PA6
21	PA7_SPI1_MOSI	I/O	MCU pin name: PA7
22	PC4	I/O	MCU pin name: PC4
23	PC5	I/O	MCU pin name: PC5
24	PB0	I/O	MCU pin name: PB0
25	PB1	I/O	MCU pin name: PB1
26	PC6	I/O	MCU pin name: PC6
27	PC7	I/O	MCU pin name: PC7
28	PC8	I/O	MCU pin name: PC8
29	PC9	I/O	MCU pin name: PC9
30	RXTX/RFMOD	O	Control signal from SX1276, which connects to internal RF switch at the same time.

31	GND		Ground pin
32	GND		Ground pin
33	RF_ANT	I/O	RF I/O
34	GND		Ground pin
35	GND		Ground pin
36	PA1_RF_FEM_CPS	O	Control signal from MCU_PA1, which connects to internal RF switch at the same time.
37	GND		Ground pin
38	NC		
39	GND		Ground pin
40	NC		
41	GND		Ground pin
42	NC		
43	VDD33		Power Supply
44	VDD33		Power Supply
45	PA8	I/O	MCU pin name: PA8
46	PA10_USART1_RX	I/O	MCU pin name: PA10
47	PA9_USART1_TX	I/O	MCU pin name: PA9
48	PA11	I/O	MCU pin name: PA11
49	PA12	I/O	MCU pin name: PA12
50	PA13_SWDIO		Serial wire (SWD) debug interface
51	PA14_SWCLK		Serial wire (SWD) debug interface
52	PC10	I/O	MCU pin name: PC10
53	PC11	I/O	MCU pin name: PC11
54	PC12	I/O	MCU pin name: PC12
55	PD2	I/O	MCU pin name: PD2
56	PB5	I/O	MCU pin name: PB5
57	PB6_SCL	I/O	MCU pin name: PB6
58	PB7_SDA	I/O	MCU pin name: PB7
59	BOOT0	I	Boot mode selection pin
60	PB8	I/O	MCU pin name: PB8
61	GND		Ground Pin
62	GND		Ground Pin

✂ For detailed functions of pin definitions, please refer to [STM32L073](#) datasheet.

3-1. Pin Assignment

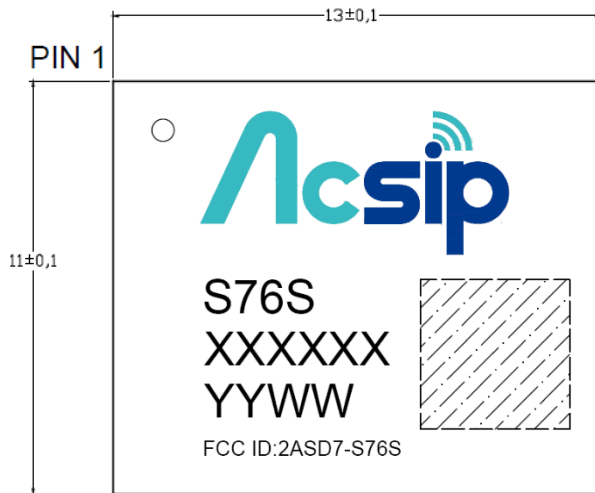
The SiP module will conform to the following pin map, shown in the following diagram.



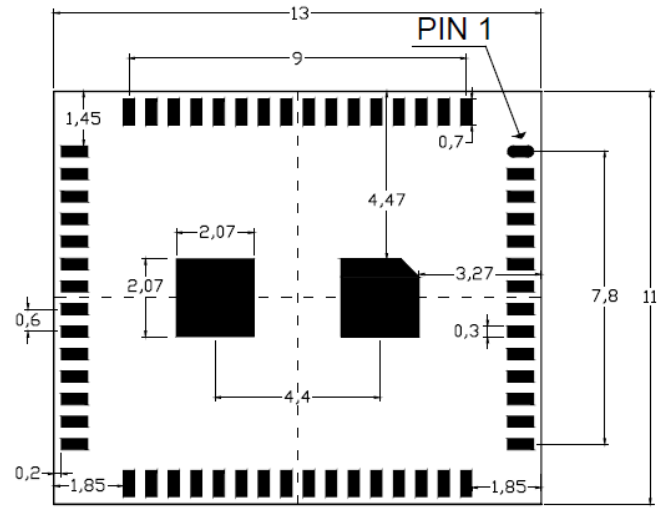
TOP View

4. Mechanical Dimension

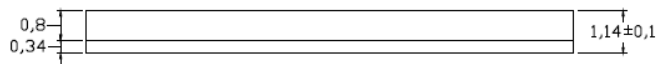
Unit: mm



TOP VIEW



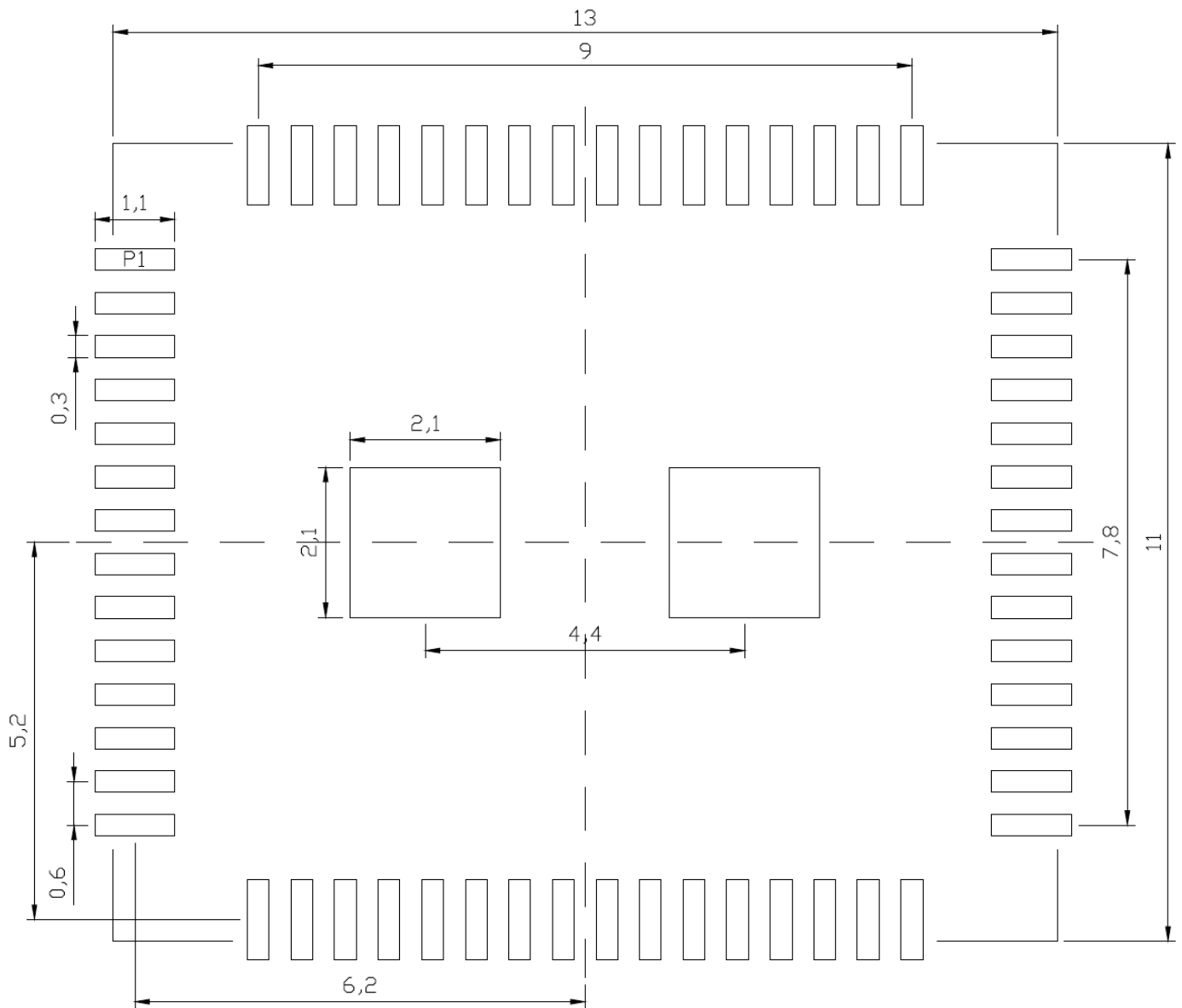
BOTTOM VIEW



SIDE VIEW

4-1. Recommended Footprint

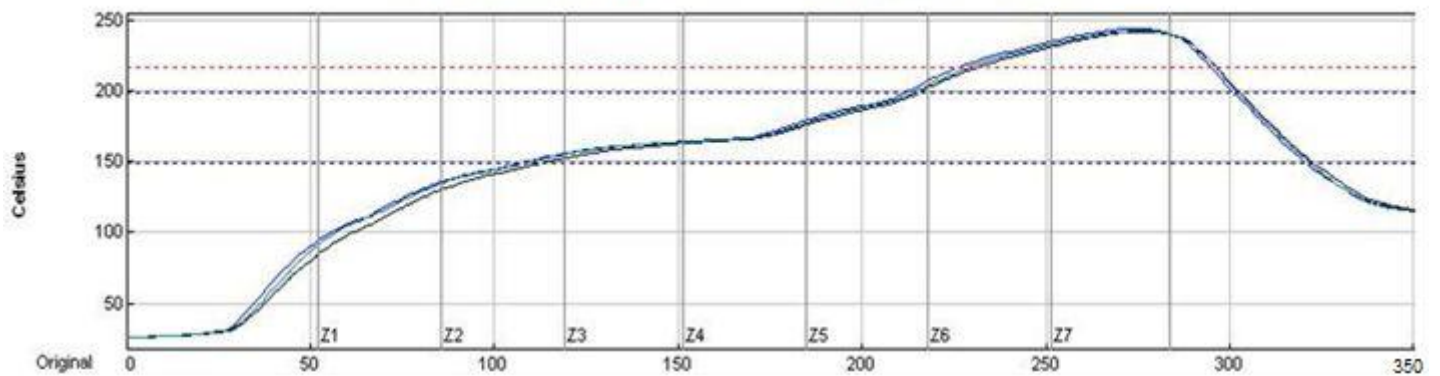
Unit: mm



TOP View

5. Recommended Reflow Profile

Reflow Profile for SiP on board Assembly



Preheat time	150°C—200°C : 105+/-15sec
Dwell time	Over 220°C : 70+5/-10 sec
Peak Temp	240 +10/-5°C
Ramp Up/Down Rate	Up: 3 +0/-2 °C / sec Down: 2 +0/-1°C / sec

6. SiP Module Preparation

6-1. Handling

Handling the module must wear the anti-static wrist strap to avoid ESD damage. After each module is aligned and tested, it should be transport and storage with anti -static tray and packing. This protective package must be remained in suitable environment until the module is assembled and soldered onto the main board.

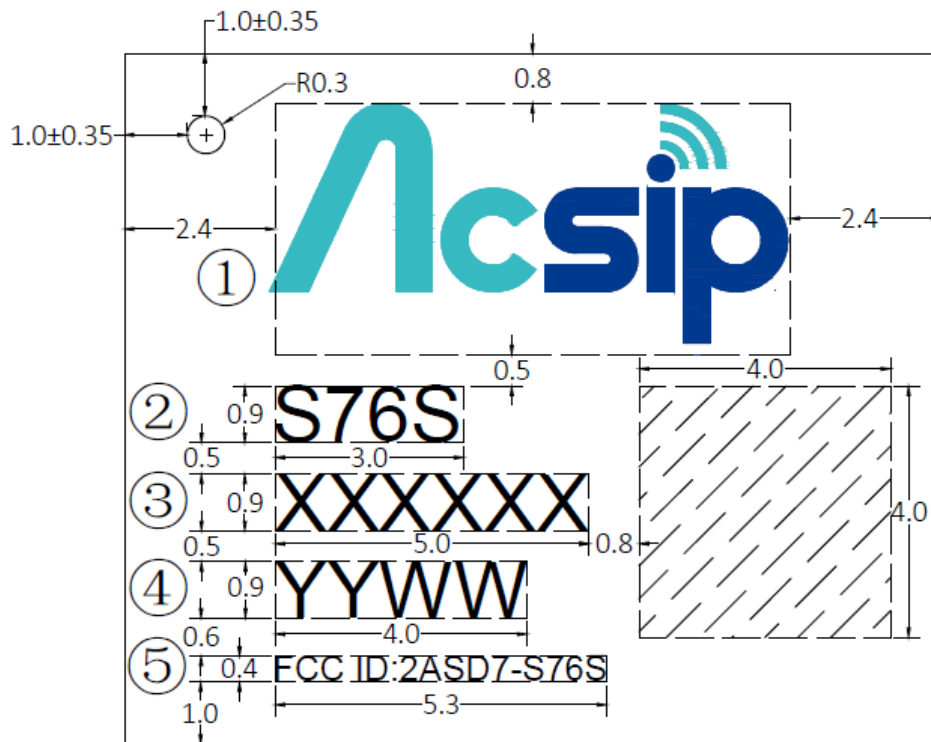
6-2. SMT Preparation

1. Calculated shelf life in sealed bag: 6 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH).
2. Peak package body temperature: 250°C .
3. After bag was opened, devices that will be subjected to reflow solder or other high temperature process must.
 - A. Mounted within: 168 hours of factory conditions $<30^{\circ}\text{C}/60\%\text{RH}$.
 - B. Stored at $\leq 10\%\text{RH}$ with N2 flow box.
4. Devices require baking, before mounting, if:
 - A. Package bag does not keep in vacuumed while first time open.
 - B. Humidity Indicator Card is $>10\%$ when read at $23\pm 5^{\circ}\text{C}$.
 - C. Expose at 3A condition over 8 hours or Expose at 3B condition over 24 hours.
5. If baking is required, devices may be baked for 12 hours at $125\pm 5^{\circ}\text{C}$.

7. Package Information

7-1. Product Making

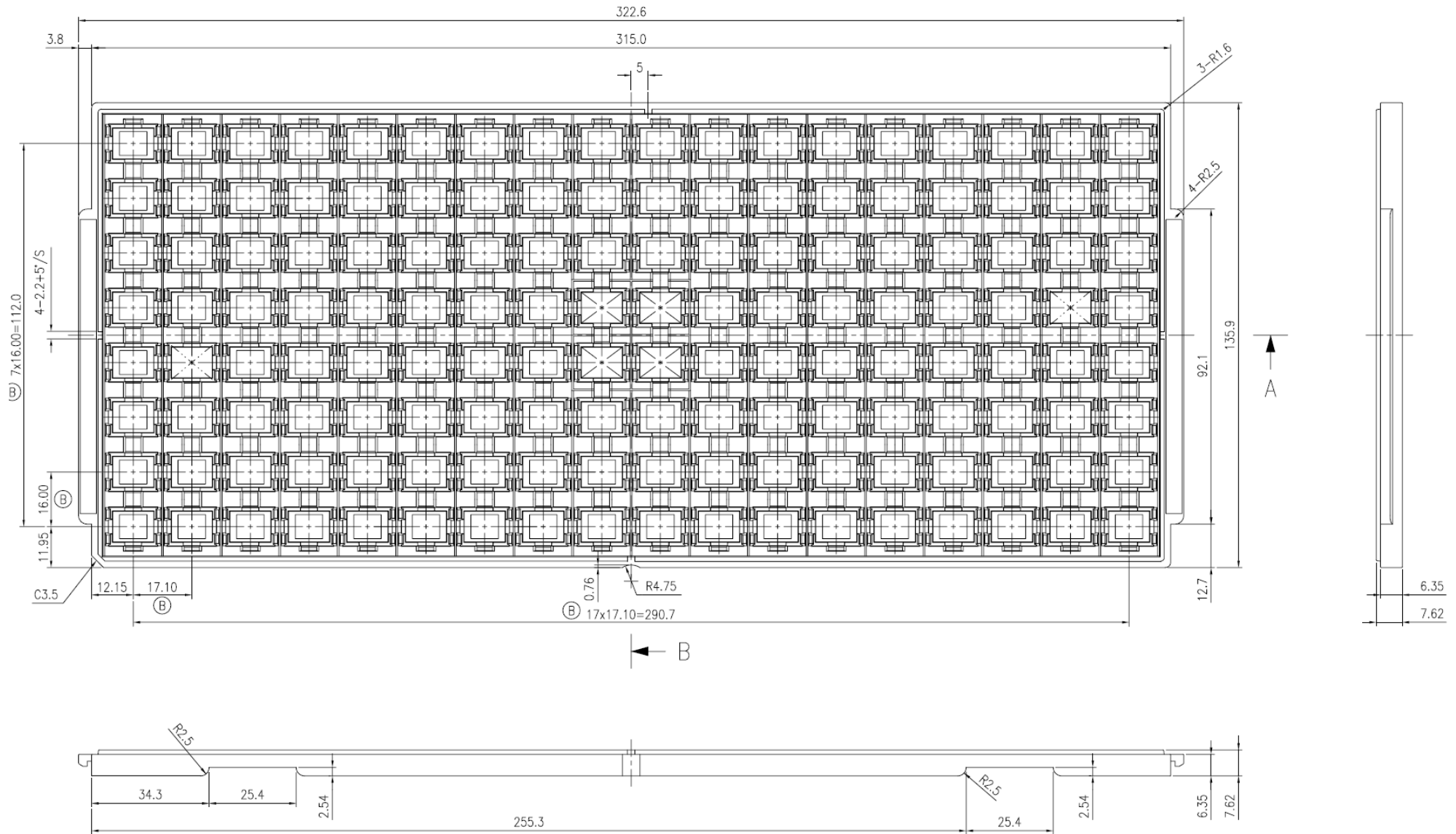
Figure 1 below details the standard product marking for all AcSiP Corp. products. Cross reference to the applicable line number and table for a full detail of all the variables.



- ① : Acsip Logo
- ② : Project name
- ③ : Acsip lot no.
- ④ : Date code
- ⑤ : FCC ID

Figure 1. Standard Product Marking Diagram TOP VIEW

7-2. Tray Dimension



7-3. Packing Information

第一聯方向
Pin1 orientation

承載盤
Tray

斜角
Chamfer

產品與盤子之方向關係
TFBGA and tray orientation.

打包裝帶
Packing Band

Tray 標籤排列由大到小
Tray label order of rank from big to small

打包裝帶
Packing Band

打包裝帶
Packing Band

抗靜電泡棉
Extra anti-static foam

使用抗靜電泡棉包裹承載盤角落,再以打包裝帶固定。
Add extra anti-static foam Cushioning at the corners and fit by packing band.

溫度卡
Humidity Card

2包乾燥包
2 Desiccant

封口
Seal line

斜角
CHAMFER

抗靜電袋
Anti-static aluminum foil bag

將承載盤與1張溫度指示卡與2包乾燥劑與產品進入抗靜電鋁箔袋中。
Put 1 humidity card and 2 desiccant and tray into anti-static aluminum foil bag.

內箱
Inner Box

標籤 A
Label A

氣泡墊
bubble cushion

靜電防護標誌
ESD symbol

內箱標籤A
Inner Label A

Weekly code 標籤F
Weekly code Label F

膠帶
Tape

封箱貼紙
Seal Tag

將已真空包裝產品貼上標籤A
再以氣泡墊包裹後放入內箱內。
Paste label A and ESD symbol on the Anti-static aluminum foil bag.
Put packed product with bubble cushion into inner box.

封箱貼紙外黏透明膠帶和貼上標籤。
Adhere labels and tape as shown.

外箱
CARTON

外箱標籤C
Shipping label C

外箱標籤G
Shipping label G

外箱標籤B
Shipping label B

重量標籤
Weight Label

Weekly code 標籤F
Weekly code Label F

封箱貼紙(上/下)
seal Tape (Top/Bottom)

膠帶
Tape

標籤D (左右兩側)
Label D (Right/Left)

外箱選擇依實際數量四盒或六盒裝
Carton selected according to the actual number of four boxes or six boxes.

外箱黏透明膠帶和貼上標籤。
Adhere labels and tape as shown.

REVISION HISTORY

REV	DESCRIPTION	RELEASED BY	DATE
1	Original	Jack	2019/08/13
2	更新圖示Pin1 orientation位置	Halu	2022/10/14

注意:
NOTE:

- 不足整數箱部份,需塞入填充物避免碰撞損壞。
Squeeze Fillings Into The Unfilled Space Of The Inner Box And Carton To Void The Collision And Damage.
- 二條打包裝帶應捆打於盤上之凹槽處。(Tray 標籤排列由大到小)
Packing Band Shall Be Packed On The Dint Of Tray .(Tray label order of rank from big to small)
- 真空包裝完需平放靜待30分鐘
Vacuum packing finished be flat and wait 30 minutes

PROJECTION

DIMENSIONING

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN MM.
ALL PROJECTIONS ARE THIRD ORDER.

TOLERANCES:

LINEAR	ANGULAR
X.X =	±1°
X.XX =	
X.XXX =	

HEADQUARTER

3F-1, No207, Fusing Rd, Taoyuan City, 330, TAIWAN, R.O.C.
TEL:886-3-2868388
FAX:886-3-3475000

TEL:(03)-2868388
FAX:(03)-3475000

APPROVALS	SIGN	DATE
DRAWING	Jack	2019/08/13
CHECKED	Jack	2019/08/13
APPROVED	Louis	2019/08/13

CUSTOMER DRAWING NO.:
TITLE:
PACKING SPEC.
PACKING FOR S76S

DWG. NO.:
S76S PKG

REV
02

SIZE: A4
SCALE: N/A
SHEET 1 of 1

7-4. Humidity Indicator Card



Dry



Wet

Indicates 指示點:

10%,20%,30,40%,50%,60% relative humidity

10%,20%,30,40%,50%,60% 相對濕度

Color Change 顏色變化:

Brown (Dry) ---> Blue (Wet)

棕色 (乾燥) ---> 藍色 (潮溼)

8. FCC statement

Federal Communication Commission Interference Statement

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.

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

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.

IMPORTANT NOTE:

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 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/CANADA

This device is intended only for OEM integrators under the following conditions:

- 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.

As long as the above conditions 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.

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.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2ASD7-S76S".

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.

Compliance of Host Devices:

The FCC ID: 2ASD7-S76S was granted as Limited Modular Approval because it cannot be tested stand alone. Each host specific installation will require a Class II permissive change filed by the grantee.

The following tests will be required to be performed for the Class II Permissive Change.

- Radiated emissions (transmitter) according to FCC Part 15C, Article 15.247 (d)

Each new host configuration requires a Class II Permissive Change.