ASR6601

Development Board Test Guide

Version 1.2.0

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About This Document

This document introduces how to test ASR6601 development board to facilitate the developers to better understand the performance of LPWAN SoC ASR6601.

Intended Readers

This document is mainly for engineers who use this chip to develop their own platform and products, for instance:

- PCB Hardware Development Engineer
- Software Engineer
- Technical Support Engineer

Included Chip Models

The product models corresponding to this document are as follows.

Model	Flash	SRAM	Core	Package	Frequency
ASR6601SE	256 KB	64 KB	32-bit 48 MHz Arm China STAR-MC1 Processor	QFN68, 8*8 mm	150 ~ 960 MHz
ASR6601CB	128 KB	16 KB	32-bit 48 MHz Arm China STAR-MC1 Processor	QFN48, 6*6 mm	150 ~ 960 MHz
ASR6601SER	256 KB	64 KB	32-bit 48 MHz Arm China STAR-MC1 Processor	QFN68, 8*8 mm	150 ~ 960 MHz
ASR6601CBR	128 KB	16 KB	32-bit 48 MHz Arm China STAR-MC1 Processor	QFN48, 6*6 mm	150 ~ 960 MHz

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Revision History

Date	Version	Release Notes
2020.08	V0.1.0	First release.
2020.09	V0.2.0	Updated some pictures.
2020.10	V0.3.0	Updated the pictures of ASR6601SE development board v2.0.
2021.01	V1.1.0	Deleted Chapter 1, and move the contents to "About This Document".
2021.05	V1.2.0	Updated Section 1.3.

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List of Figures

1.   Preparation

1.1   Hardware

LoRa nodes hardware requirements:

(1)   1 ASR6601 development board

(2)   1 antenna

(3)   1 USB cable

(4)   1 PC

1.1.1   ASR6601 Development Board

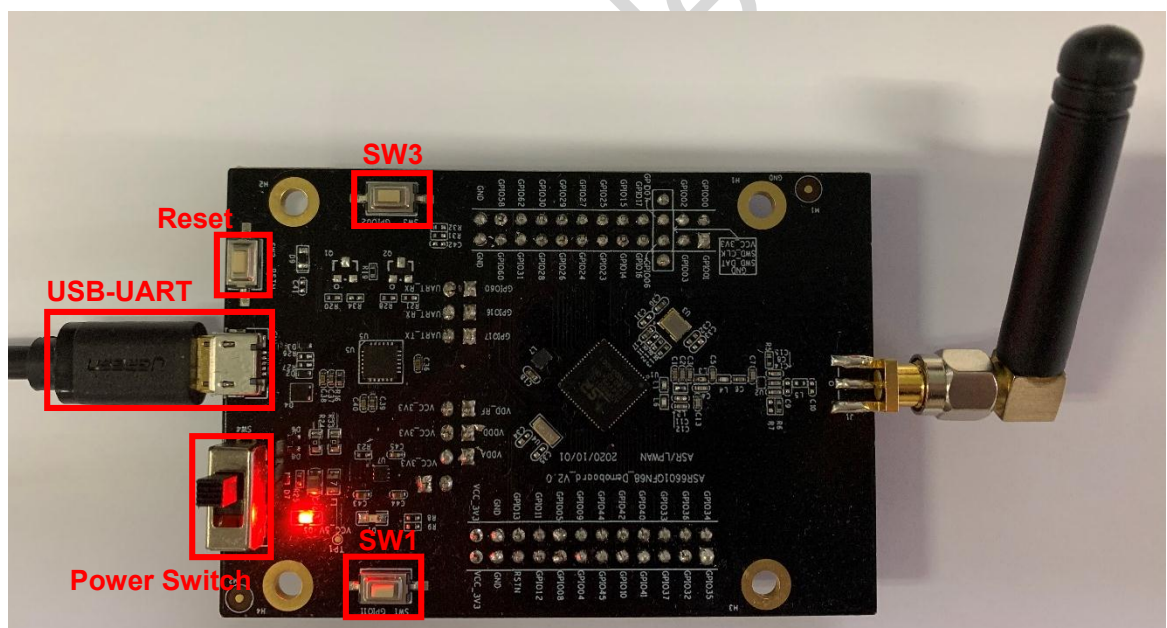ASR6601SE development board v2.0 front and back photos are as follows:

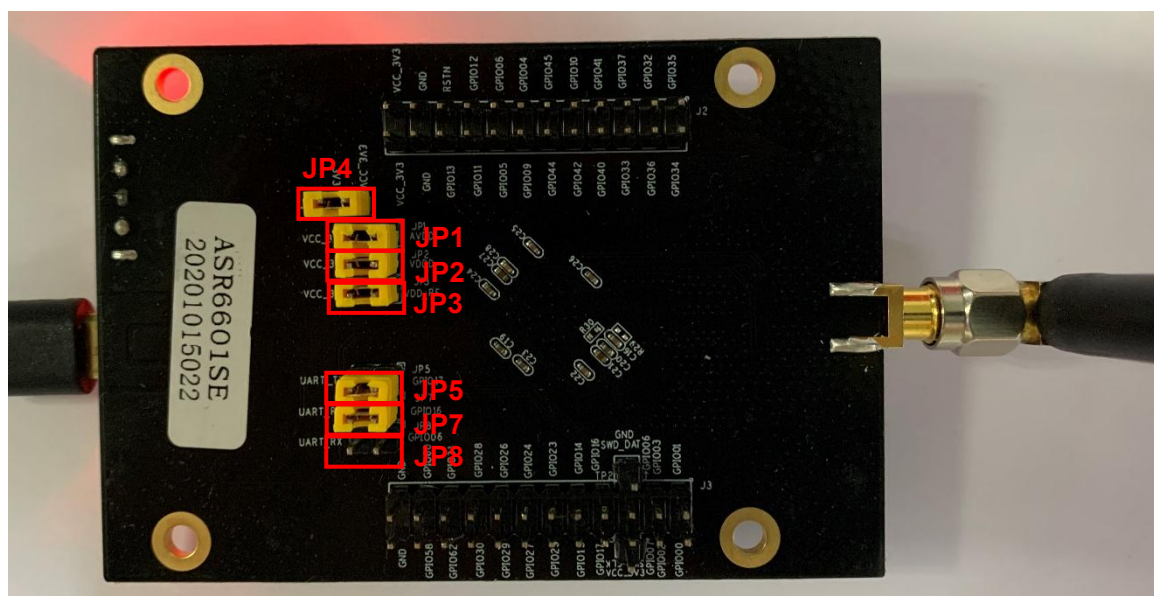**Figure 1-1 The Front View of ASR6601SE Development Board v2.0**

Figure 1-2 The Back View of ASR6601SE Development Board v2.0

Table 1-1 ASR6601SE Development Board v2.0 Interface

Interface	Description
USB-UART	USB
Power Switch	Power switch
Reset	Reset button
SW3	It's the Download button pressed to pull up GPIO02
SW1	It's the User button pressed to pull down GPIO11
JP1	Jumper1
JP2	Jumper2
JP3	Jumper3
JP4	Jumper4, which can be used to test the board's total power consumption
JP5	Connect UART_TX jumper, then select UART0_TX. Reference: Schematics
JP6 (only used in ASR6601CB development board)	Connect UART_TX jumper, then select LPUART_TX. Reference: Schematics
JP7	Connect UART_TX jumper, then select UART0_RX. Reference: Schematics
JP8	Connect UART_TX jumper, then select LPUART_RX. Reference: Schematics

1.1.2   Jumper Connection

When testing ASR6601 development board, please make sure the following jumpers' state is set correctly.

Table 1-2 Jumper Connection State

Jumper	Connection State
JP1	Connected
JP2	Connected
JP3	Connected
JP4	Connected
JP5	Connected
JP6 (only used in ASR6601CB development board)	Not connected
JP7	Connected
JP8	Not connected

1.2   Software

1.2.1   Development Environment

Customers can use KEIL to develop ASR6601. Makefile also can be used for compilation and download. For further details, please refer to *ASR6601_ Quick Start Guide.*

1.2.2   Test Codes

Test codes can be found in the directory of *projects\${DEMO_BOARD}\examples\lora\lora_test* in SDK. *${DEMO_BOARD}* is the corresponding board name. For example, ASR6601SE-EVAL stands for ASR6601SE/SER development board, and ASR6601CB-EVAL stands for ASR6601CB/CBR development board.

1.3   Compilation and Download

Please refer to *ASR6601_ Quick Start Guide* for compilation and download introductions.

2.   Tests

There are some AT commands built in test codes, which can be used to test part of functions.

2.1   Power Test

Test Command: With one serial port tool, and run AT command *AT+CTXCW= 490000000,22* to test the power. Please refer to *Section 3.2.6* for parameter descriptions.

Reference Result: 21 dbm

2.2   Sensitivity Test

Test Command: With one serial port tool, and run AT command *AT+CRXS=490000000,0,0,2,0* to test the sensitivity. Please refer to *Section 3.2.3* for parameter descriptions.

Reference Result: -138 dbm

2.3   Power Consumption Test

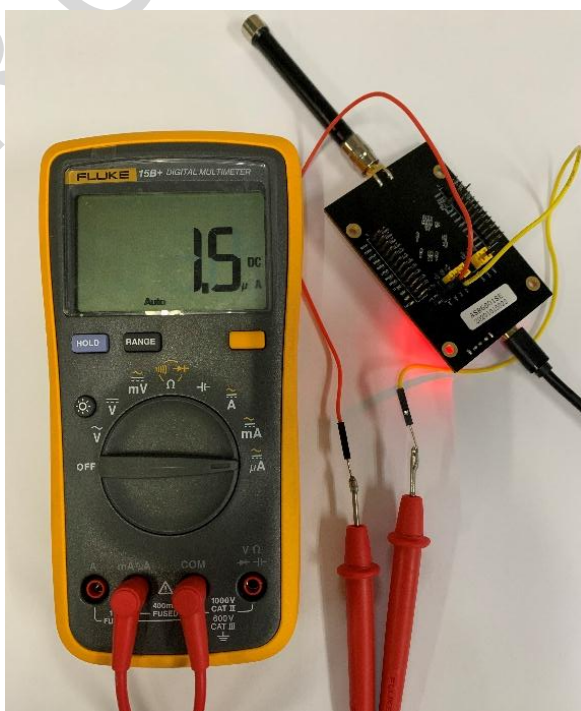Unplug the JP4 jumper. Connect the multimeter. Please see Figure 2-1 for reference.

Figure 2-1 Power Consumption Test Reference Result

2.3.1   TX Power Consumption Test

Test Commands: AT+CTXCW=490000000,22

Reference Result: 110 mA

2.3.2   RX Power Consumption Test

Test Commands: AT+CRX=490000000,0,0,1

Reference Result: 8.9 mA

2.3.3   DeepSleep Power Consumption Test

Test Commands: AT+CSLEEP=0

Reference Result: 1.5 uA

3. Basic AT Commands

3.1 Overview

Table 3-1 AT Commands Summary

Commands	Description
AT+CTXCW	Send one sustained wave
AT+CTX	Send one LoRa package in every other second
AT+CRXS	Receive commands. Sensitivity test applicable
AT+CRX	Receive commands. Distance test applicable
AT+CSLEEP	Low-power test commands
AT+CSTDBY	Sx1262 Standby mode test commands

3.2 Commands

3.2.1 Low-power Test Commands +CSLEEP

Execute Command	AT+CSLEEP=<sleep_mode>
Parameters	This command is executed to enter DeepSleep mode. **<sleep_mode>**: mainly about the settings in sx1262 ● 0: Warm start ● 1: Cold start
Example	AT+CSLEEP=0

3.2.2 Lower-power Test Commands +CSTDBY

Execute Command	AT+CSTDBY=<standby_mode>
Parameters	The execution of this command will make SX1262 be in Standby mode, and make MCU be in Stop3 mode **<standby_mode>**: ● 0: STDBY_RC mode ● 1: STDBY_XOSC mode
Example	AT+CSTDBY=0

3.2.3   Test Commands +CRXS

Execute Command	AT+CRXS=<freq>,<data_rate>,<bandwidth>,<code_rate>,<ldo>
Parameters	This command is maninly used to test sensitivity. **freq**: 150000000-960000000 **data_rate**: 8 levels from DR0 to DR7 and the corrsponding spreading factors are from SF12 to SF5. ● 0: SF12 ● 1: SF11 ● 2: SF10 ● 3: SF9 ● 4: SF8 ● 5: SF7 ● 6: SF6 ● 7: SF5 **bandwidth**: 0~9 ● 0: 125 KHz ● 1: 250 KHz ● 2: 500 KHz ● 3: 62.5 KHz ● 4: 41.67 KHz ● 5: 31.25 KHz ● 6: 20.83 KHz ● 7: 15.63 KHz ● 8: 10.42 KHz ● 9: 7.81 KHz **code_rate**: 1~4 ● 1: 4/5 ● 2: 4/6 ● 3: 4/7 ● 4: 4/8 **ldo**: 0 or 1 ● 1: start low-bitrate optimizing ● 0: close low-bitrate optimizing
Example	AT+CRXS=490000000,0,0,2,0 start to recv package (freq: 490000000, dr:0, bw: 0, cr: 2, ldo: 0)
Notes	When the user types in CRXS test commands, the system will enter infinite loop, in order to keep testing. Users can restart the system to start the next round of test.

3.2.4　Test Commands +CRX

Execute Command	AT+CRX=<freq>,<data_rate>,<bandwidth>,<code_rate>
Parameters	This command is executed to enter RX continously receiving mode. **freq**: 150000000-960000000 **data_rate**: 8 levels from DR0 to DR7 and the corrsponding spreading factors are from SF12 to SF5. 　● 0: SF12 　● 1: SF11 　● 2: SF10 　● 3: SF9 　● 4: SF8 　● 5: SF7 　● 6: SF6 　● 7: SF5 **bandwidth**: 0~9 　● 0: 125 KHz 　● 1: 250 KHz 　● 2: 500 KHz 　● 3: 62.5 KHz 　● 4: 41.67 KHz 　● 5: 31.25 KHz 　● 6: 20.83 Hz 　● 7: 15.63 Hz 　● 8: 10.42 KHz 　● 9: 7.81 KHz **code_rate**: 1~4 　● 1: 4/5 　● 2: 4/6 　● 3: 4/7 　● 4: 4/8
Example	AT+CRX=490000000,0,0,1 start to recv package (freq: 490000000, dr:0, bw: 0, cr: 1)
Notes	When the user types in CRS test commands, the system will enter infinite loop, in order to keep testing. Users can restart the system to start the next round of test.

3.2.5   Test Commands +CTX

Execute Command	AT+CTX=<freq>,<data_rate>,<bandwidth>,<code_rate>,<pwr>[,tx_len]

Parameters	This command is executed to send data in loop at the interval of one second.
	freq: 150000000-960000000
	data_rate: 8 levels from DR0 to DR7 and the corrsponding spreading factors are from SF12 to SF5.
	  ● 0: SF12
	  ● 1: SF11
	  ● 2: SF10
	  ● 3: SF9
	  ● 4: SF8
	  ● 5: SF7
	  ● 6: SF6
	  ● 7: SF5
	bandwidth: 0~9
	  ● 0: 125 KHz
	  ● 1: 250 KHz
	  ● 2: 500 KHz
	  ● 3: 62.5 KHz
	  ● 4: 41.67 KHz
	  ● 5: 31.25 KHz
	  ● 6: 20.83 Hz
	  ● 7: 15.63 Hz
	  ● 8: 10.42 KHz
	  ● 9: 7.81 KHz
	code_rate: 1~4
	  ● 1: 4/5
	  ● 2: 4/6
	  ● 3: 4/7
	  ● 4: 4/8
	pwr: The transmitting power of SX1262 will value from 0 to 22
	tx_len: It means the length of Tx packets. The Tx packets will use sending seriel numbers by default, the rest will be filled in with 0x00

Example	AT+CTX=490000000,0,0,1,22 start to tx data(freq: 490000000, dr: 0, bw:0, cr: 1, power: 22): 1
Notes	When the user types in CTX test commands, the system will enter infinite loop, in order to keep testing. Users can restart the system to start the next round of test.

3.2.6   Test Commands +CTXCW

Execute Command	AT+CTXCW=<freq>,<pwr>[,opt]
Parameters	This command is executed to send the continous wave. **freq**: 150000000-960000000 **pwr**: The transmitting power of SX1262 will value from 0 to 22 **opt**: The PA Optimal setting of SX1262 will value from 0 to 3, and default value is 0. ● 0: [0x04,0x07,0x00,0x01] ● 1: [0x03,0x05,0x00,0x01] ● 2: [0x02,0x03,0x00,0x01] ● 3: [0x02,0x02,0x00,0x01] Please refer to Chapter PA Optimal Setting in *SX1262 Datasheet* for the details regarding opt.
Example	AT+CTXCW=490000000,22 Start to txcw (freq: 490000000, power: 22db, opt: 0) AT+CTXCW=490000000,22,2 Start to txcw (freq: 490000000, power: 22db, opt: 2)
Notes	When the user types in CTXCW test commands, the system will enter infinite loop, in order to keep testing. Users can restart the system to start the next round of test.

A.   Appendix - Reference

Summaries of the reference information mentioned in this document:

1.   Please refer to *ASR6601_Quick Start Guide* for compilation and download introductions.

2.   Please refer to Chapter PA Optimal Setting in *SX1262 Datasheet* for details regarding opt.