



ASR6601

Test Report

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About This Document

This document provides the test report for IoT 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
2021.05	V1.0.0	First Release.

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1. Test Overview

1.1 Hardware

68-Pin ASR6601-SE V1.0 Development Board

1.2 Software

ASR6601 V1.0 SDK

1.3 Equipment

Agilent N5182B and Agilent N9020A

1.4 Test Items and Results Summary

Table 1-1 Test Items and Results Summary

No.	Category	Test Item	Result
1	TX Test	Frequency Offset	4.25 ppm (XO)
		Transmit Power	21.06 dBm (22 dBm)
		Harmonic Test	-46.94 dBm (2 nd harmonic)
		Phase Noise	-99.965
2	RX Test	RX Sensitivity	-138.4 dBm
3	Power Test	TX Power Consumption	111 mA (22 dBm)
		RX Power Consumption	8.7 mA
		DeepSleep Power Consumption	1.5 uA

2. Test Implementation

2.1 TX Test

2.1.1 Setup TX Test Environment

See Figure 2-1 for TX test environment setup:



Figure 2-1 Setup TX Test Environment

2.1.2 Frequency Offset Test

1. Test Method

(1) Frequency setting:

- Set to LoRa CW mode with 470.0 MHz frequency
- Set the power to 22.0 dBm

(2) Spectrum analyzer setting:

- Center frequency is 470.0 MHz, Span is 2 MHz, Ref amp is 25.0 dBm
- Measure the CW frequency with the marker of the spectrum analyzer

2. Illustration

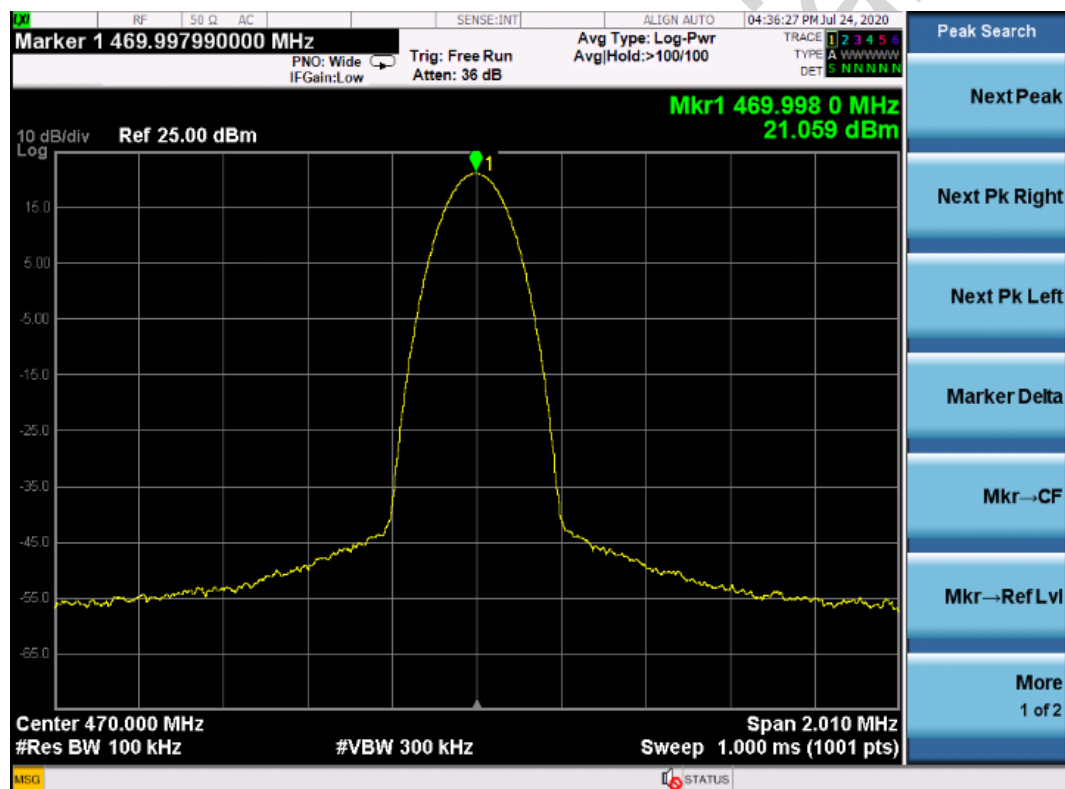


Figure 2-2 Frequency Offset Test

3. Test Result

Table 2-1 Frequency Offset Test Result

SN	Set (MHz)	Test (MHz)	PPM
1#	470.000	469.9980	4.25

2.1.3 Transmit Power Test

1. Test Method

(1) Frequency setting:

- Set to LoRa CW mode with 470.0 MHz frequency
- Set the power to 22 dBm

(2) Spectrum analyzer setting:

- Set frequency point at 1st, 2nd, 3rd, 4th and 5th of the basic frequency.
Span is 2 MHz (or 5 MHz), Ref amp is 25 dBm
- Max Hold mode

2. Illustration

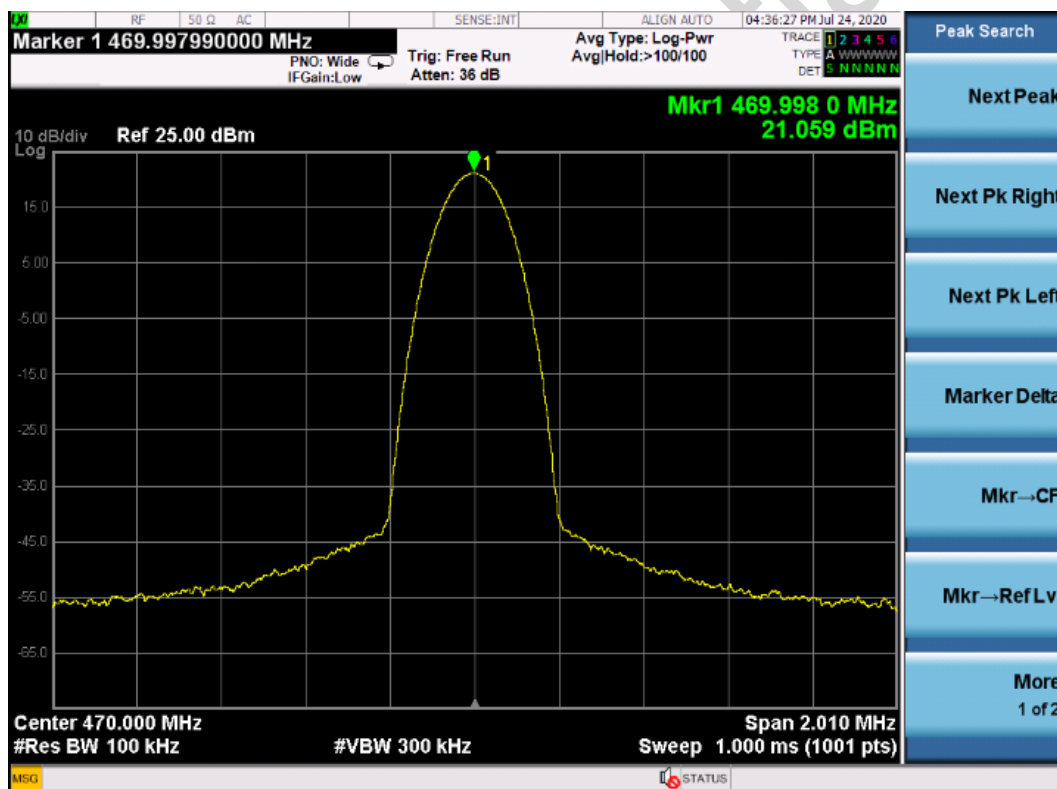


Figure 2-3 Transmit Power Test

3. Test Result

Table 2-2 Maximum Transmit Power Test Result

SN	Frequency (MHz)	Set (dBm)	Basic (dBm)
1#	470	22	21.06
2#	470	22	20.97

2.1.4 Harmonic Test

1. Test Method

(1) Frequency settings

- Set to LoRa CW mode with 470.0 MHz frequency
- Set the power to 22 dBm

(2) Spectrum analyzer settings

- Set frequency point at 1st, 2nd, 3rd, 4th and 5th of the basic frequency. Span is 2 MHz (or 5 MHz), Ref amp is 25 dBm
- Max Hold mode

2. Illustration

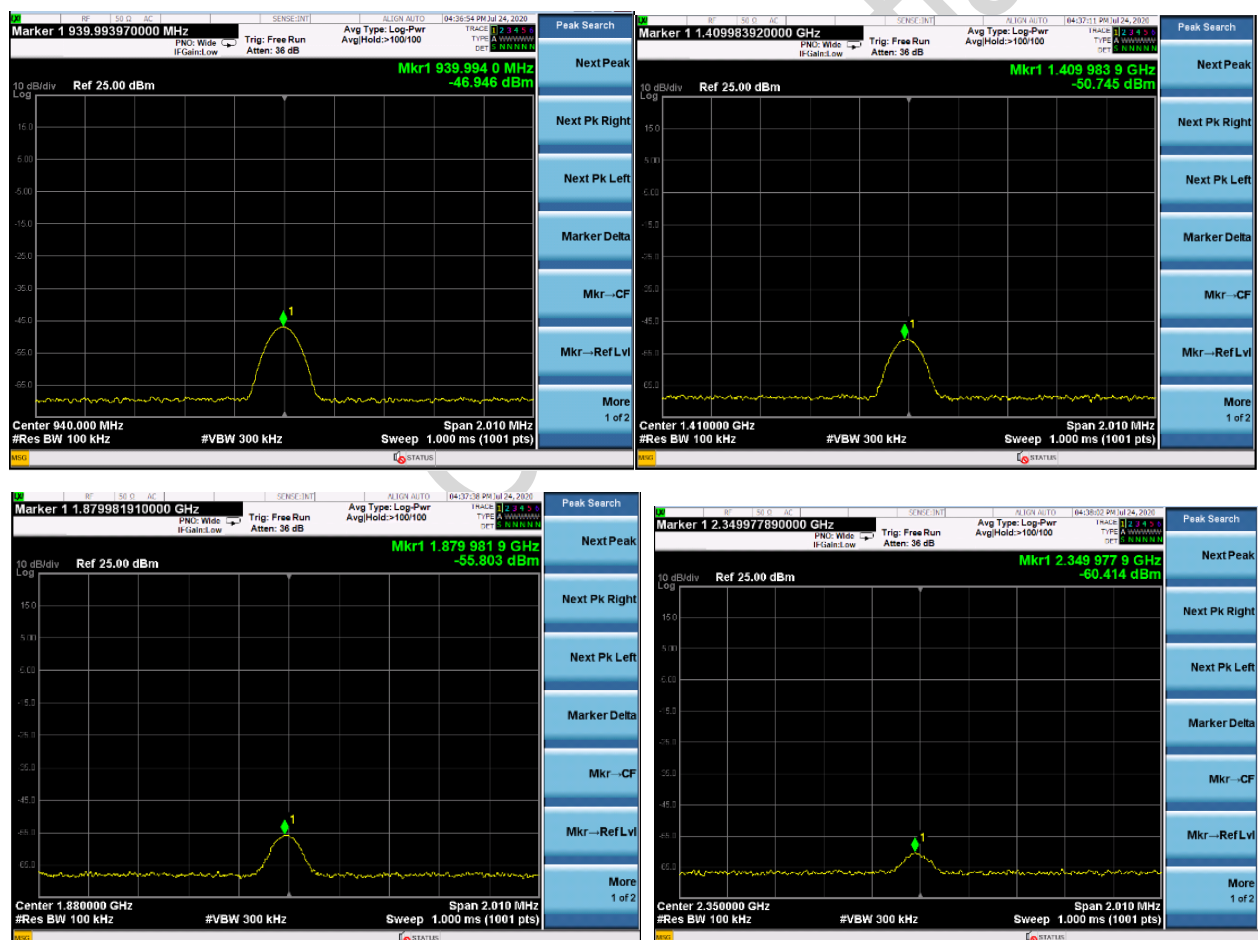


Figure 2-4 2nd/3rd/4th/5th Harmonic Test

3. Test Result

Table 2-3 Harmonic Test Result

SN	Frequency (MHz)	Set (dBm)	Basic (dBm)	2nd (dBm)	3rd (dBm)	4th (dBm)	5th (dBm)
1#	470	22	21.06	-46.94	-50.74	-55.80	-60.41
2#	470	22	20.97	-45.42	-49.57	-56.22	-59.28

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2.1.5 Phase Noise Test

1. Test Method

(1) Frequency setting:

- Set to LoRa CW mode with 470.0 MHz frequency
- Set the power to 22 dBm

(2) Spectrum analyzer setting:

- Marker → Delta; Function → maker noise
- Span is 2 MHz (or 5 MHz), Ref amp is 25 dBm
- Max Hold mode

2. Illustration

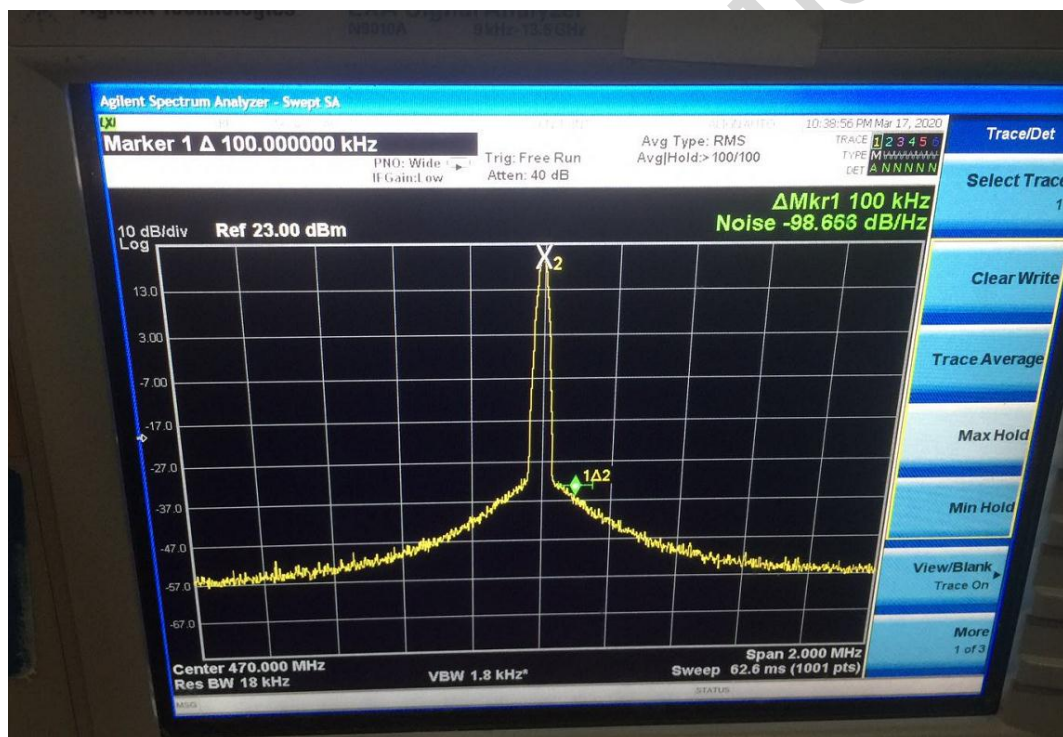


Figure 2-5 Phase Noise Test

3. Test Result

Table 2-4 Phase Noise Test Result

SN	Frequency (MHz)	ACT (MHz)	Phase Noise (dB/Hz)
1#	470	469.999	-98.653
2#	470	469.999	-99.965

2.2 RX Test

2.2.1 RX Test Environment Setup

See Figure 2-6 for RX Test environment setup:

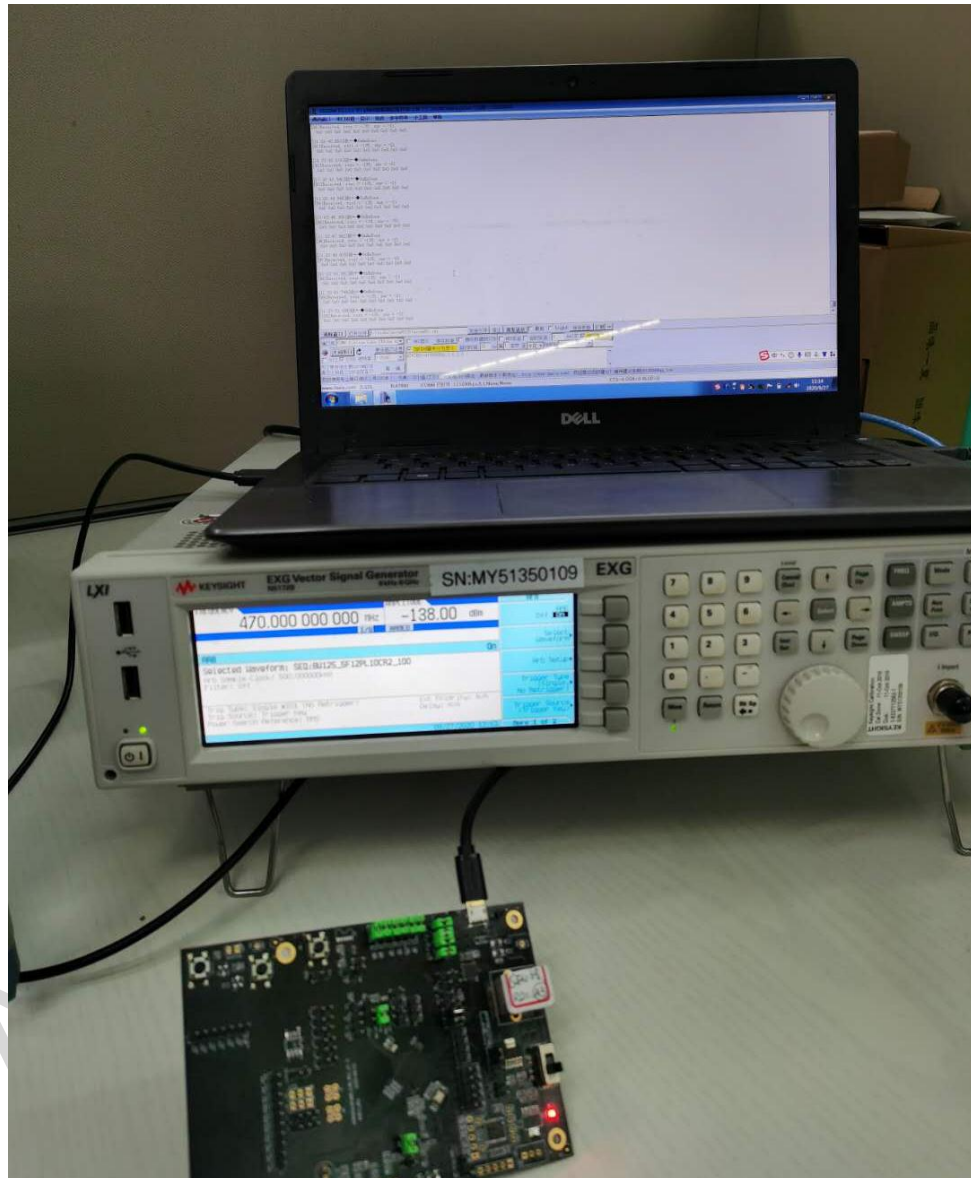


Figure 2-6 Setup RX Test Environment

2.2.2 RX Sensitivity Test

1. Test Method

(1) Frequency setting:

- Set to LoRa RX test mode with 470.0 MHz frequency

(2) Signal generator setting:

- Load related waveform for different SF
- Measure the SNR threshold as below

Table 2-5 RX Sensitivity Test Specification

SF	BW (KHz)	Package RSSI (dBm)	SNR Limit (dB)
SF7	125	<123	-7.5
SF8	125		-10
SF9	125		-12.5
SF10	125	<130	-15
SF11	125		-17.5
SF12	125	<135	-20

2. Test Result

Table 2-6 RX Sensitivity Test Result

SN	Frequency (MHz)	SF	BW (KHz)	SNR (dB)	Sensitivity (dBm)
#1	470	7	125	-5	-124.5
		8		-9.5	-127.8
		9		-11.5	-130.7
		10		-14	-132.8
		11		-16.5	-135.7
		12		-19	-138.4

2.3 Power Consumption Test

1. Test Method

(1) Frequency setting:

- Set to 470 MHz frequency under TX, RX, Standby and Sleep mode

(2) Multimeter setting:

- Set the multimeter to current test mode

(3) AT Command:

- TX: AT+CTXCW=470000000,22
- RX: AT+CRX=470000000,0
- Deep sleep: AT+CSLEEP=1

2. Illustration

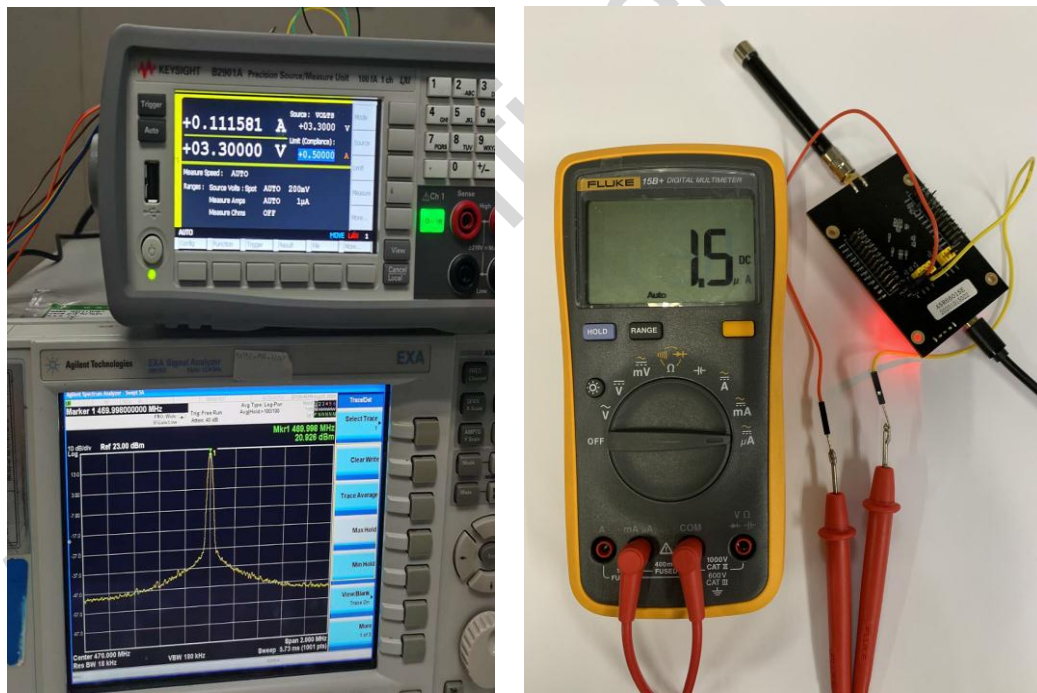


Figure 2-7 Power Consumption Test

3. Test Result

Table 2-7 Power Consumption Test Result

SN	Frequency	Test Mode	Power Consumption	Test AT Command	Remark
#1	470 MHz	TX	111 mA	AT+CTXCW=470000000,22	DC-DC used, 22 dBm
		RX	8.7 mA	AT+CRX=470000000,0	DC-DC used
		Deep Sleep	1.5 uA	AT+CSLEEP=1	DC-DC used

4. Note

The power consumption test result is for ASR6601 SoC with front-end RF.