



**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 STAR	QFN68, 8*8 mm	150 ~ 960 MHz
ASR6601CB	128 KB	16 KB	32-bit 48 MHz ARM STAR	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 <sup>nd</sup> 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

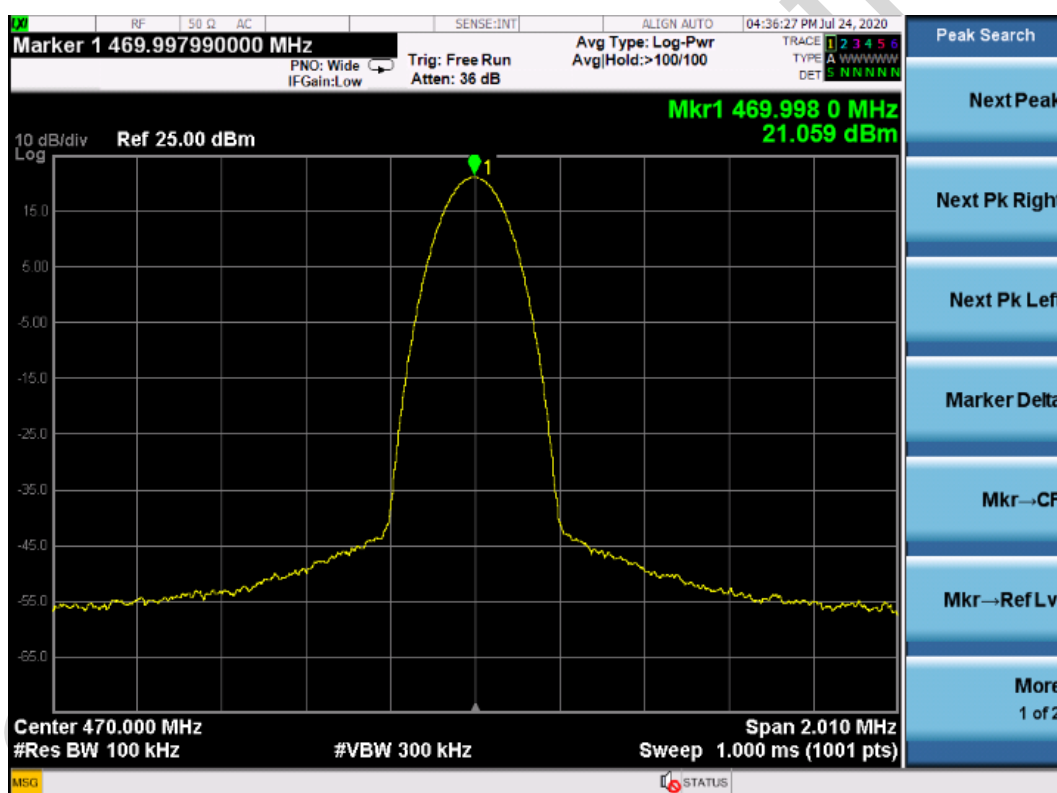


Figure 2-2 Frequency Offset Test

### 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

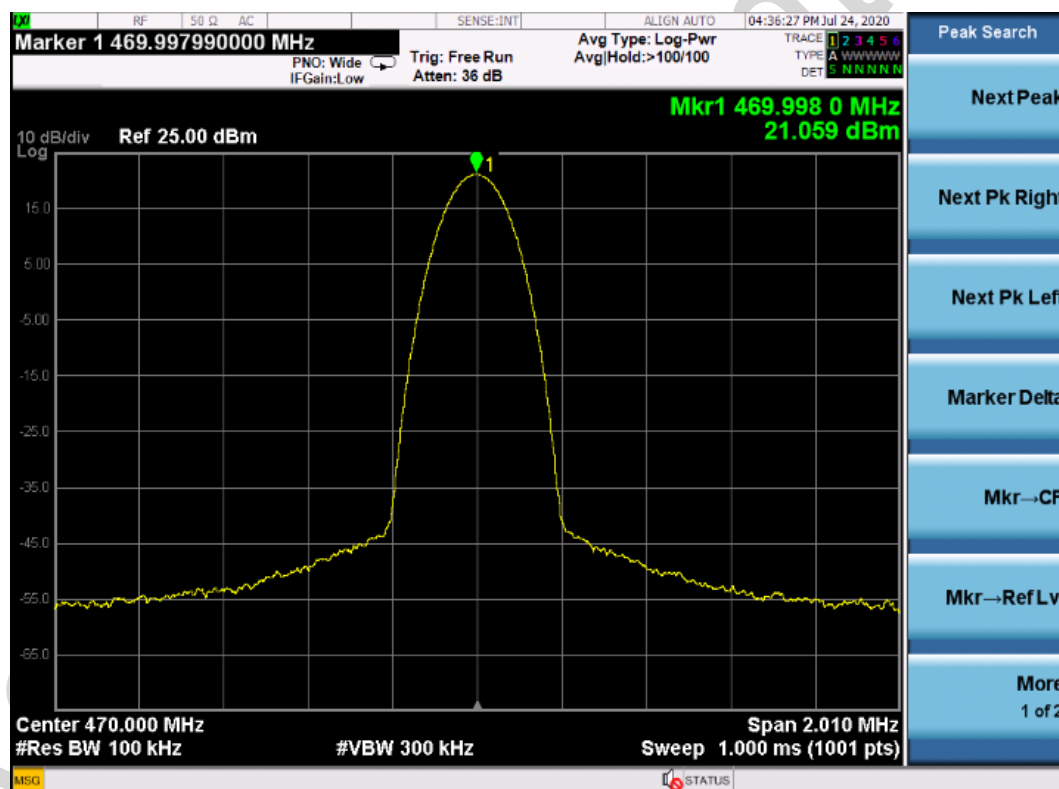


Figure 2-3 Transmit Power Test

#### 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

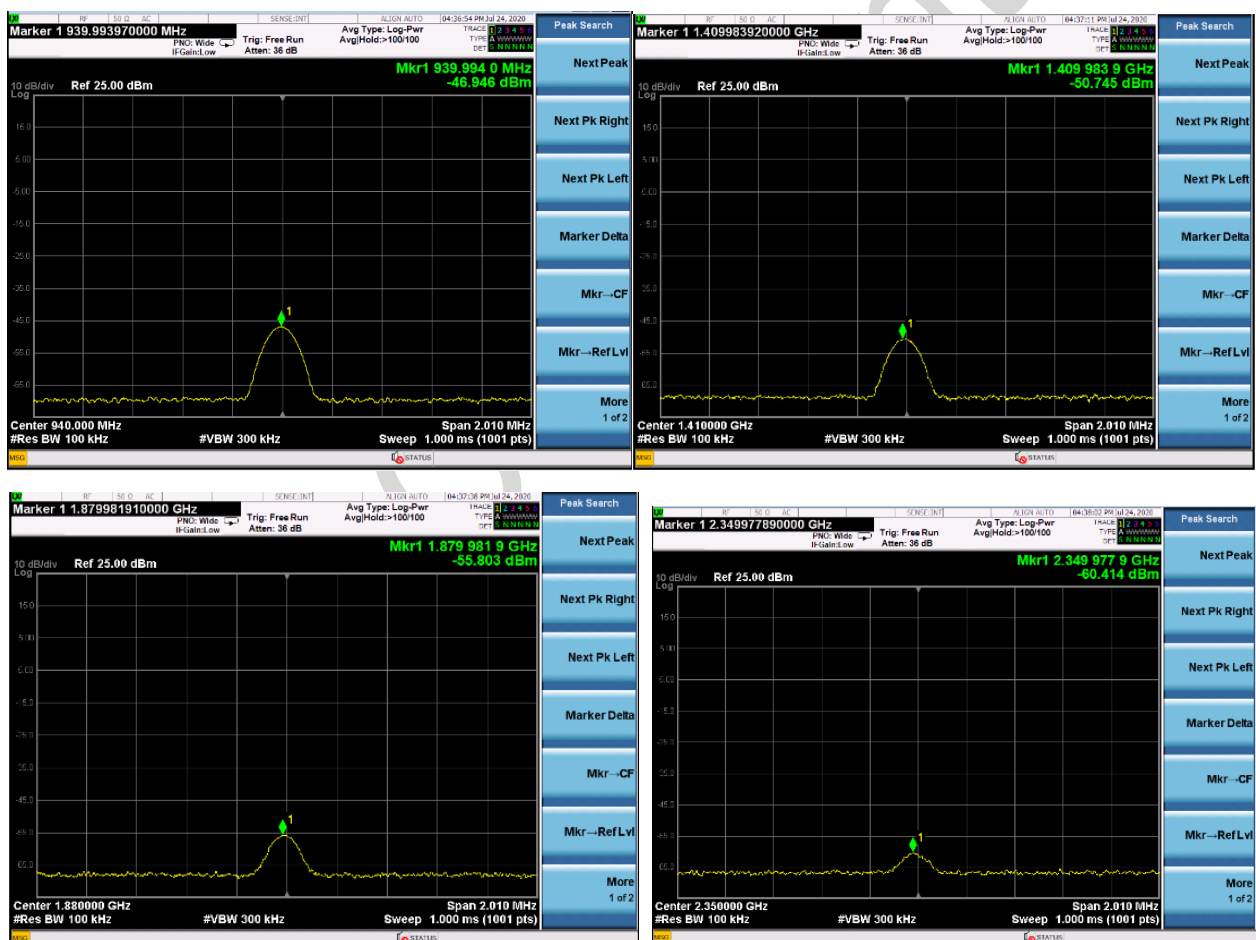


Figure 2-4 2nd/3rd/4th/5th Harmonic Test

### 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 → marker noise
- Span is 2 MHz (or 5 MHz), Ref amp is 25 dBm
- Max Hold mode

### 2. Illustration

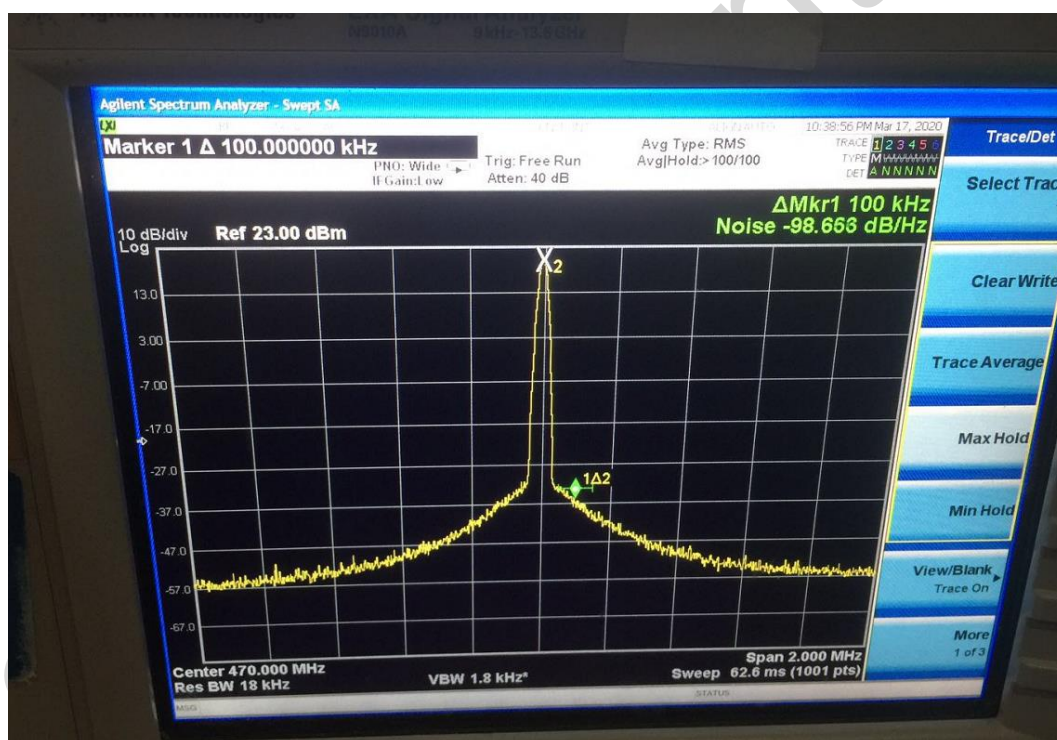


Figure 2-5 Phase Noise Test

### 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

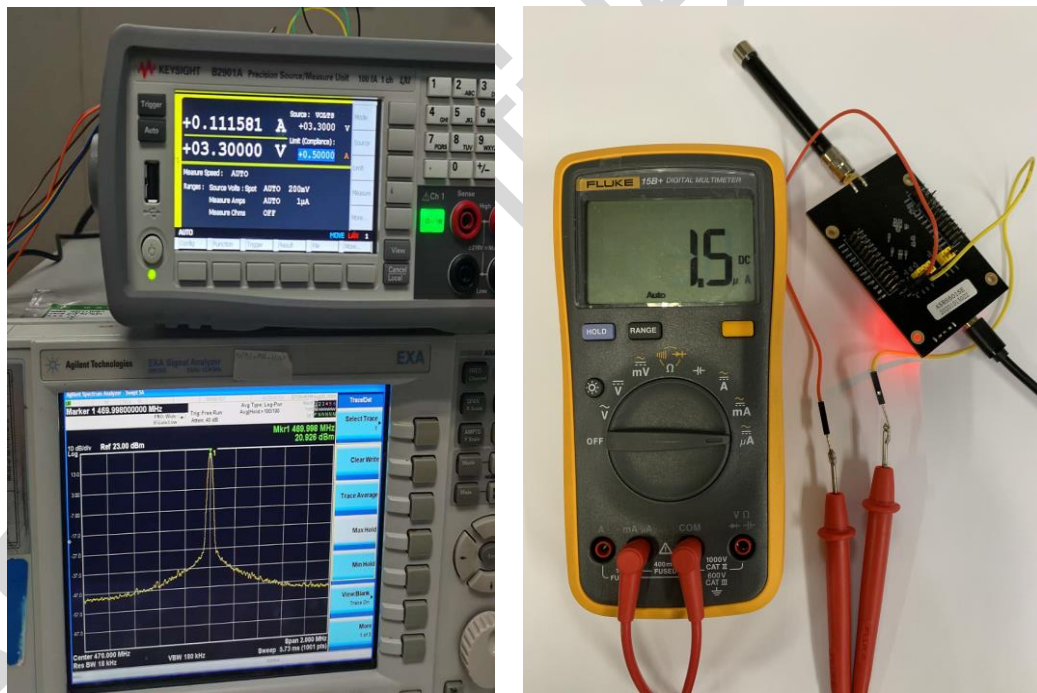


Figure 2-7 Power Consumption Test



### 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.