

## RX72N Group

### Voice Recognition Demonstration (AmiVoice Micro)

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#### Introduction

This application note explains demo operation using Advanced Media, Inc. word voice recognition library 'AmiVoice® Micro' and Techno Mathematical Co., Ltd. Beamforming and noise suppressor middleware 'Zoom Voice'.

#### Target Device

RX72N-Envision Kit (RTK5RX72N0C00000BJ)

USB-UART conversion board (410-212 / Digilent)

#### Related Documents

1. RX72N Envision Kit User's Manual (R20UT4788EJ0100)
2. RX72N Group Voice Recognition Sample Software (AmiVoiceMicro) (R11AN0514EJ0100)
3. Renesas Flash Programmer V3.08 Flash writing software user's manual (R20UT4813EJ0200)

AmiVoice® Micro belongs to Advanced Media, Inc.. (Shown as AmiVoice in this document.)

Zoom Voice belongs to Techno Mathematical Co., Ltd. (Shown as Zoom Voice in this document.)

Note: This demonstration is a trial version which limit the software working time to 10 minutes.  
For full version, please contact your [sales](#).

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**1. Outline**

This demonstration is a voice recognition demo which work on RX72N Envision Kit (RTK5RX72N0C00000BJ) using RX72N voice recognition sample software (AmiVoice). By connecting USB-UART conversion board, RX72N Envision Kit can connect to terminal software (Tera Term) and voice recognition evaluation tool.

Figure1.1 shows the demo environment.

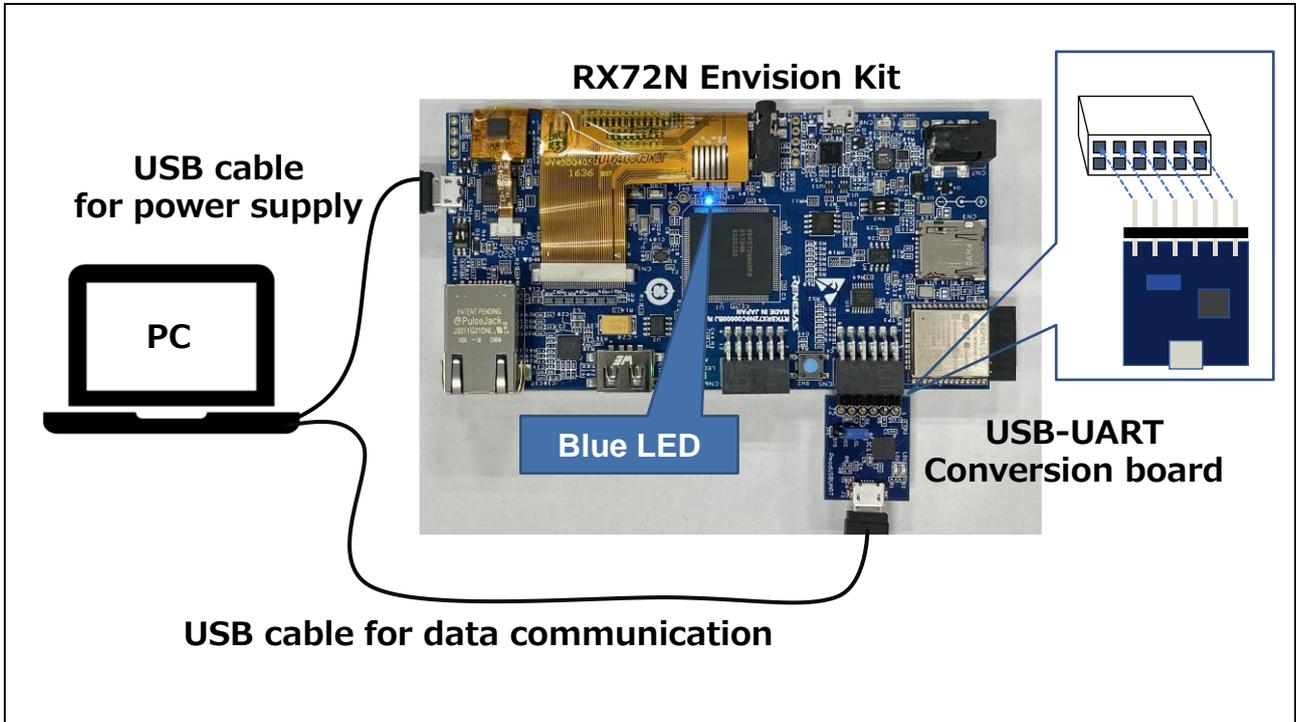


Figure 1.1 Demo Environment

## 2. Demo operation

Demo operation procedure is explained as below.

### 2.1 Writing

This section describes the procedure for writing the voice recognition sample software (RTK5RX72N0C00000BJ\_A\_EN.mot) to the RX72N Envision Kit using the Renesas Flash Programmer (RFP).

#### 2.1.1 Install RFP

Download RFP from below URL.

Renesas Flash Programmer V3.08.03 is used for this app note.

URL: <https://www.renesas.com/jp/en/software-tool/renesas-flash-programmer-programming-gui>

Downloads						
Title, start typing to filter			All types	Format	File Size	Date
Software						
🔒	<a href="#">Renesas Flash Programmer V3.08.03 Linux(ARM32)</a>	日本語	Software & Tools - Evaluation Software	TGZ	26.20 MB	Jul 20, 2021
🔒	<a href="#">Renesas Flash Programmer V3.08.03 Linux(ARM64)</a>	日本語	Software & Tools - Evaluation Software	TGZ	26.43 MB	Jul 20, 2021
🔒	<a href="#">Renesas Flash Programmer V3.08.03 Linux(x64)</a>	日本語	Software & Tools - Evaluation Software	TGZ	25.55 MB	Jul 20, 2021
🔒	<a href="#">Renesas Flash Programmer V3.08.03 Windows</a>	日本語	Software & Tools - Evaluation Software	ZIP	74.81 MB	Jul 20, 2021
🔒	<a href="#">[Free-of-charge edition] Renesas Flash Programmer V2.05.03</a>	日本語	Software & Tools - Evaluation Software	ZIP	47.64 MB	Mar 7, 2016

Figure 2.1 Downloads

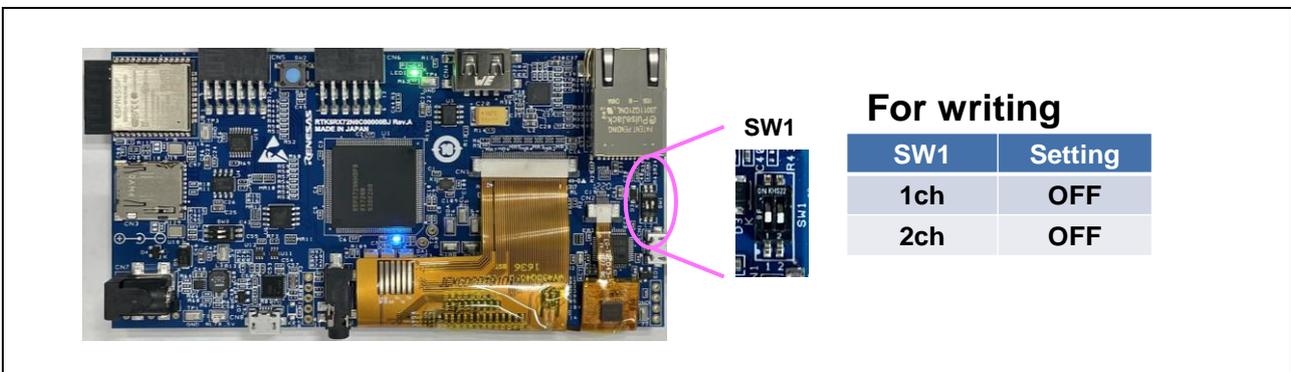
#### 2.1.2 FW writing procedure by RFP

This section describes FW writing procedure using RFP.

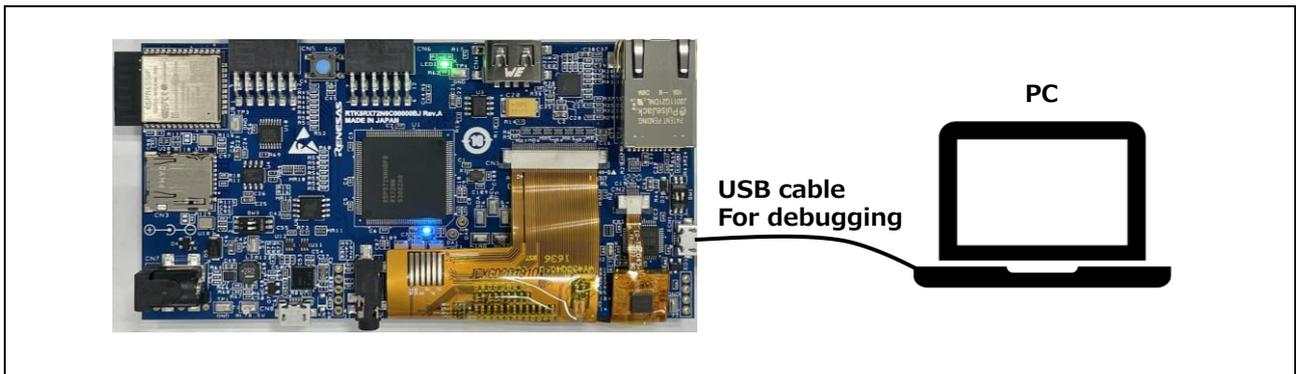
See related document 3. Renesas Flash Programmer V3.08 Flash writing software user's manual (R20UT4813JJ0200) for the detail of RFP.

1. Set the SW1 of RX72N Envision Kit as below.

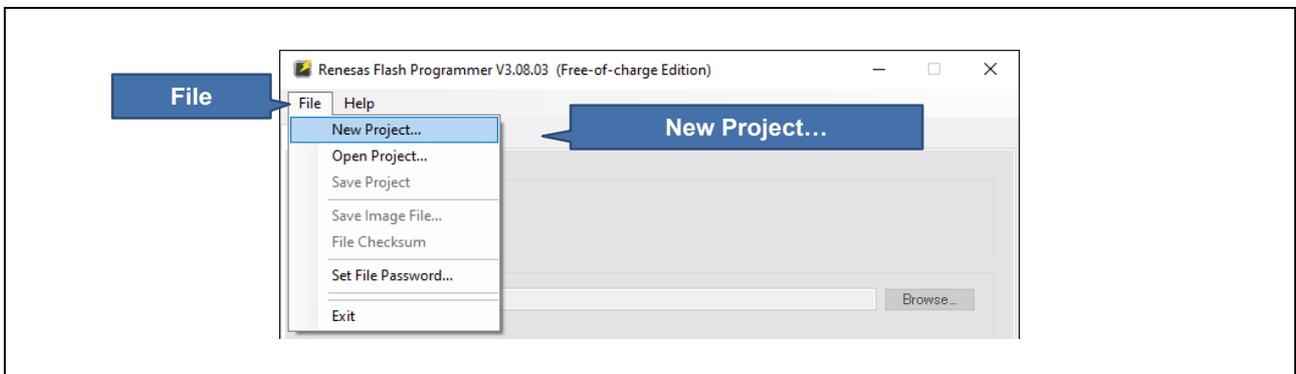
Refer related document 1. RX72N Envision Kit User's manual (R20UT4788EJ0100) for detail.



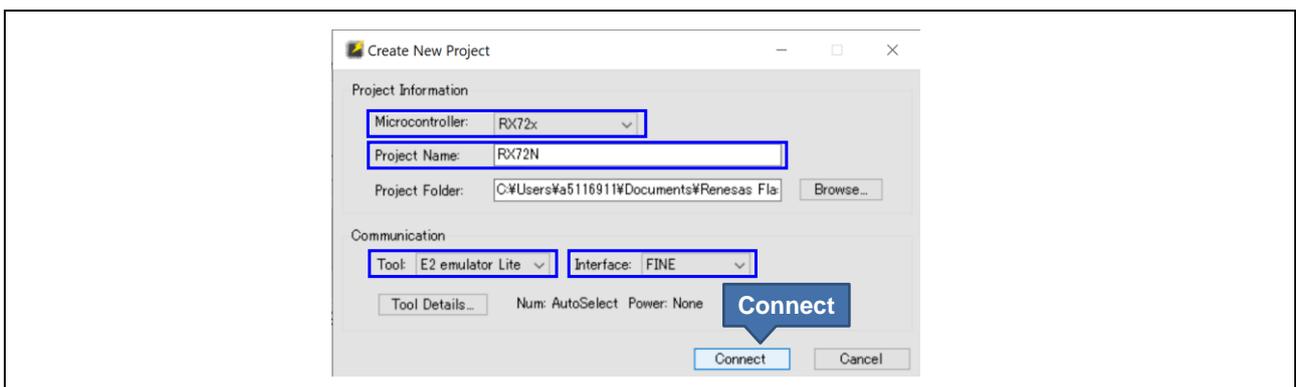
2. Connect RX72N Envision Kit to PC with USB microB cable.



3. Start RFP on PC
4. Select 'New project' from 'File' tub in tool bar.



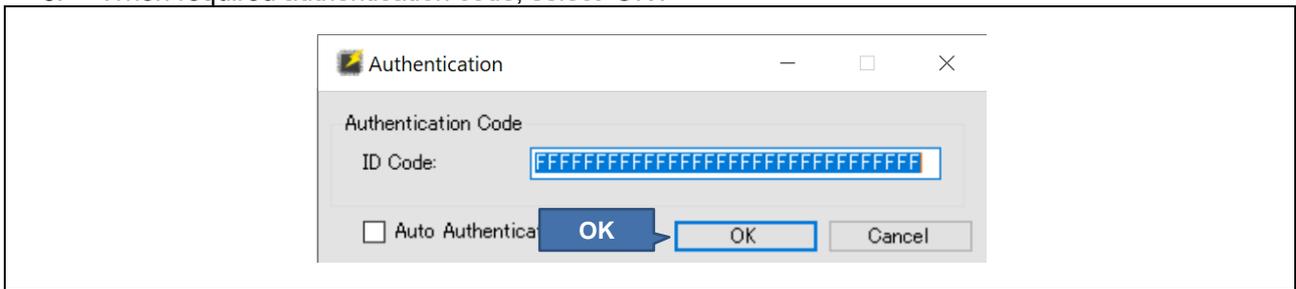
5. Set the project and communication method referring to below and click 'Connect'.



**Table 2.1 Setting for project information and communication**

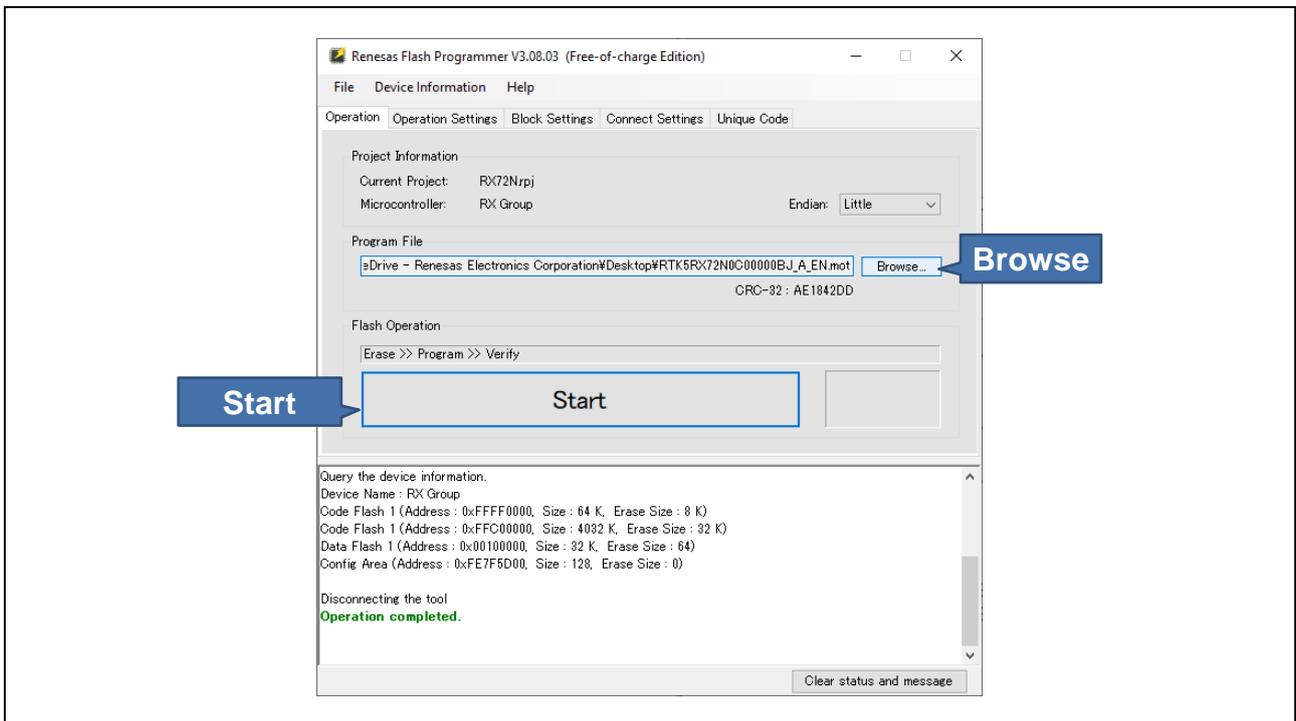
Item	Setting
Micro controller	RX72x
Project name	(any project name)
Tool	E2 emulator Lite
Interface	FINE

6. When required authentication code, select 'OK'.



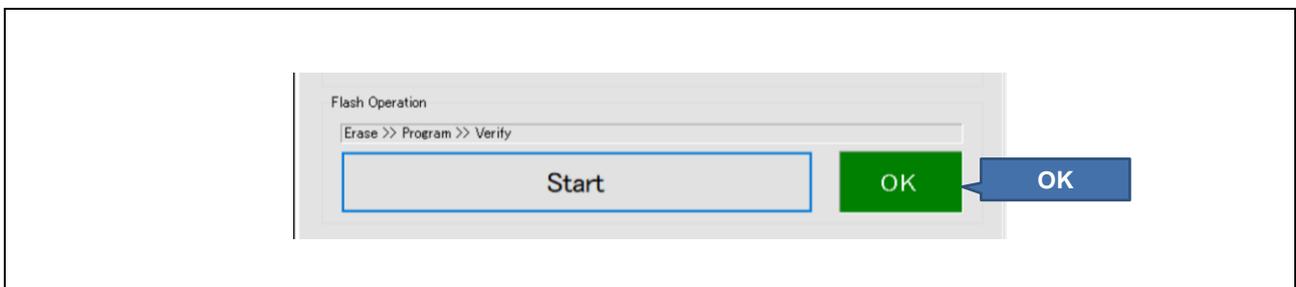
7. When connection is completed 'Operation completed' appears on status message.

8. Select applicable mot file from 'Browse' and click 'Start' to start writing.



9. Again, authentication code confirmation required. Select 'OK'.

10. When writing is completed, the message 'OK' will be displayed.



11. After writing, set SW1(2ch) to ON. If SW1(2ch) is OFF, it will not start voice recognition.



SW1	Setting
1ch	OFF
2ch	ON

## 2.2 Power supply

The power supply for this demonstration is supplied via USB microB connector.

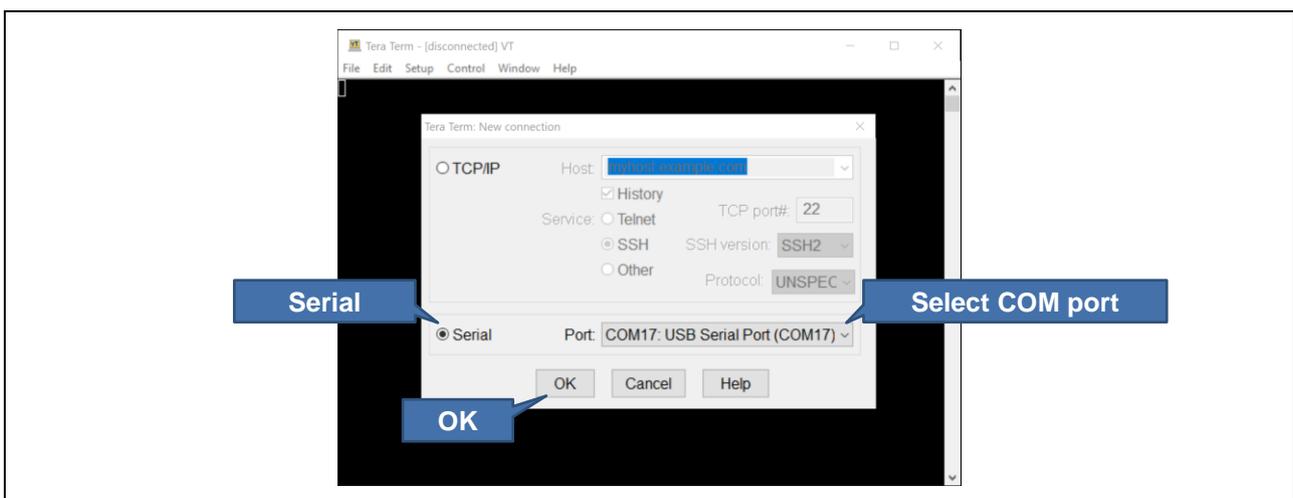
USB 5V supply capable USB AC adopter, mobile battery and PC can be used for power supply.

Note: Do not supply power from the USB-UART conversion board (PMOD™ connector).  
 For details on power supply, refer to the related document 1. RX72N Envision Kit User's Manual (R20UT4788EJ0100).

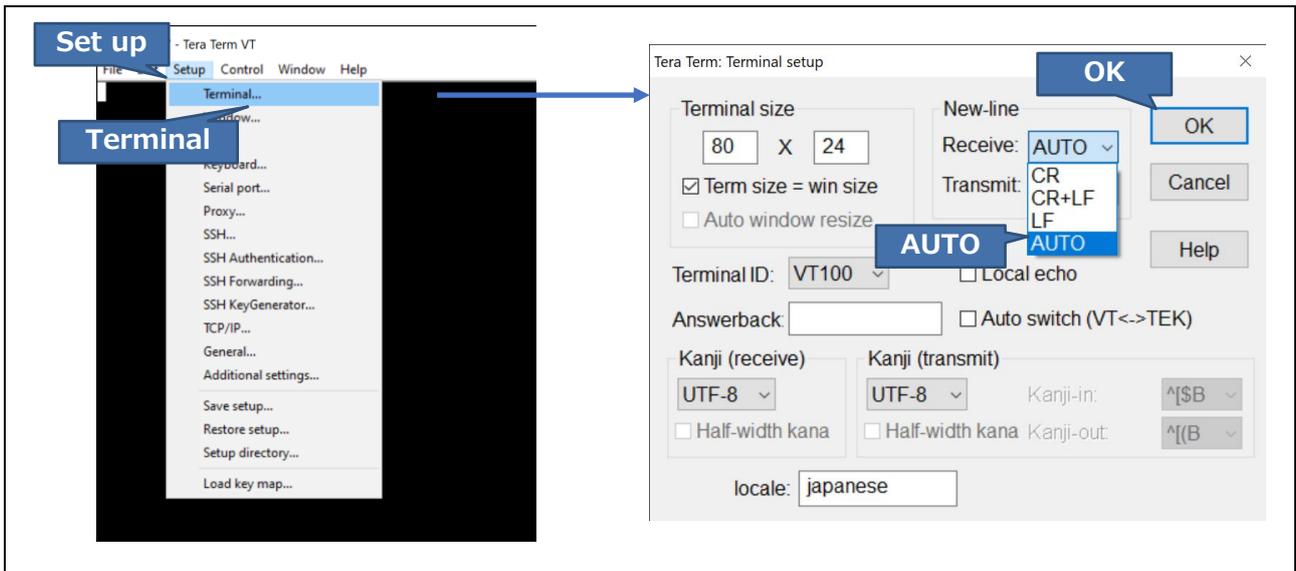
## 2.3 Terminal software setting

In this demo, the recognition result can be displayed and the parameters can be set with the terminal software (Tera Term) by connecting to a personal computer using a USB-UART conversion board. The procedure for connecting to the terminal software is explained below.

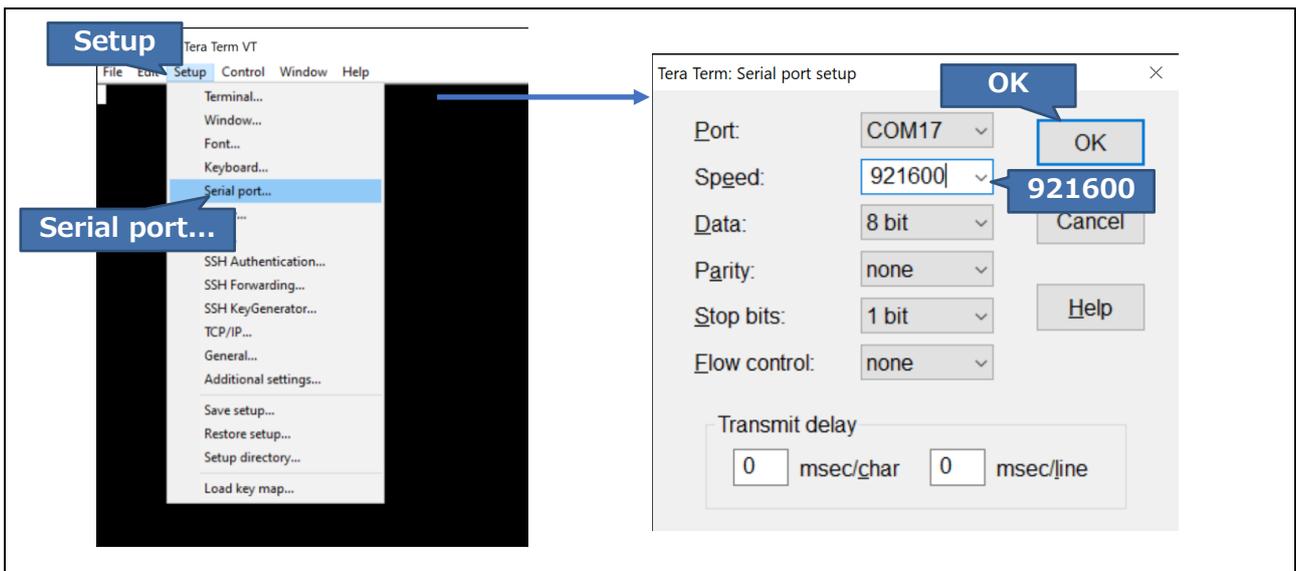
1. Start Tera Term.
2. Select 'Serial' and COM port which is connected to the board, then click 'OK'.



3. Select 'Terminal' from setting tub and set the indent code to 'AUTO' for receive side, then click 'OK'.



4. Select 'Serial port' from setting tub and set the speed to '921600' then click 'OK'.



### 3. Demo procedure

Start demonstration by talking to the demo board.

#### 3.1 Recognition direction

When use beamforming, voice should come from below arrow.

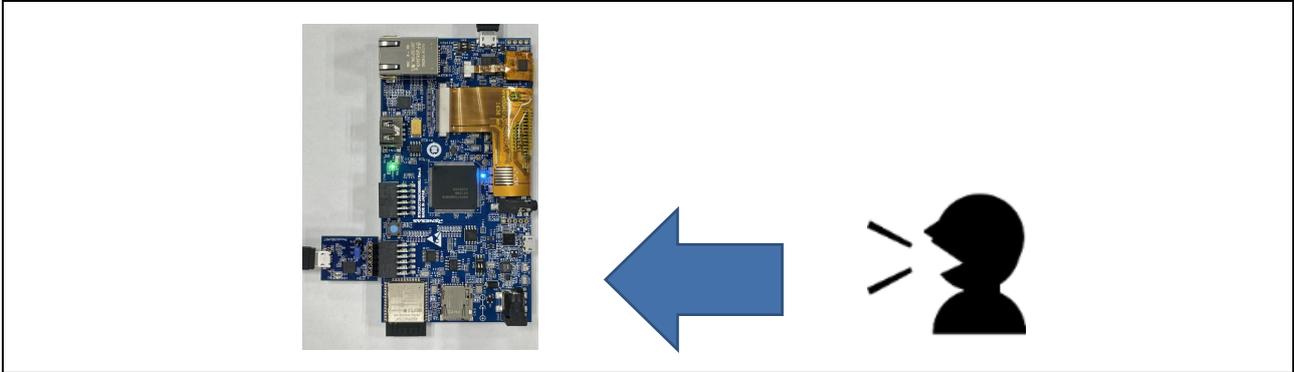


Figure 3.1 Voice direction when beamforming

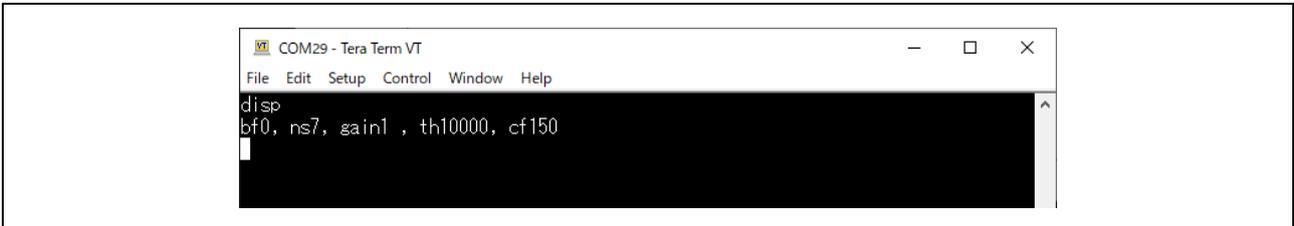
#### 3.2 Voice Command

Refer Chapter4 for recognizable voice command and action according to the recognition result.

#### 3.3 Display on PC

Below shows display example of Tera Term. Refer Chapter4 for detail.

- Display the settings



- Display the recognition results

If the confidence level of a recognized word exceeds the set confidence threshold, it judges that the word is recognized and display 'OK.'



## 4. Functions

The functions of this demonstration are as below.

1. Get audio input data from microphone
2. Noise suppression, beamforming and voice recognition processing
3. Turn ON the Blue LED
4. Transfer operation information via USB

### 4.1 Recognizable voice and actions by recognition results

When demo starts, the blue LED is OFF and turns ON when the voice is recognized by AmiVoice.

After utterance detection, demo operates by recognition result as listed Table 4.1.

**Table 4.1 Recognizable voice and actions by recognition results**

No.	Voice	Activity	
		Blue LED	UART(PMOD)
1	Ami Voice	ON	Transmit recognition result
2	Turn on the electric fan	ON	Transmit recognition result
3	Electric fan swing	ON	Transmit recognition result
4	Turn on the air conditioner	ON	Transmit recognition result
5	Raise the temperature	ON	Transmit recognition result
6	Open the door	ON	Transmit recognition result
7	Turn on the light	ON	Transmit recognition result

## 4.2 Voice recognition setting on the terminal software

This demo can change setting and display of both AmiVoice and Zoom Voice on terminal software (Tera Term).

Changeable conditions are as below.

- Condition1 Beamforming reduction amount of Zoom Voice
- Condition2 Noise reduction of Zoom Voice
- Condition3 Amplification width of voice data
- Condition4 Utterance detection threshold of AmiVoice (Detect Threshold)
- Condition5 Confidence Threshold value of AmiVoice (Confidence Threshold)

### 4.2.1 Parameter display

To display current parameter, input 'disp' on Tera Term and press Enter key.

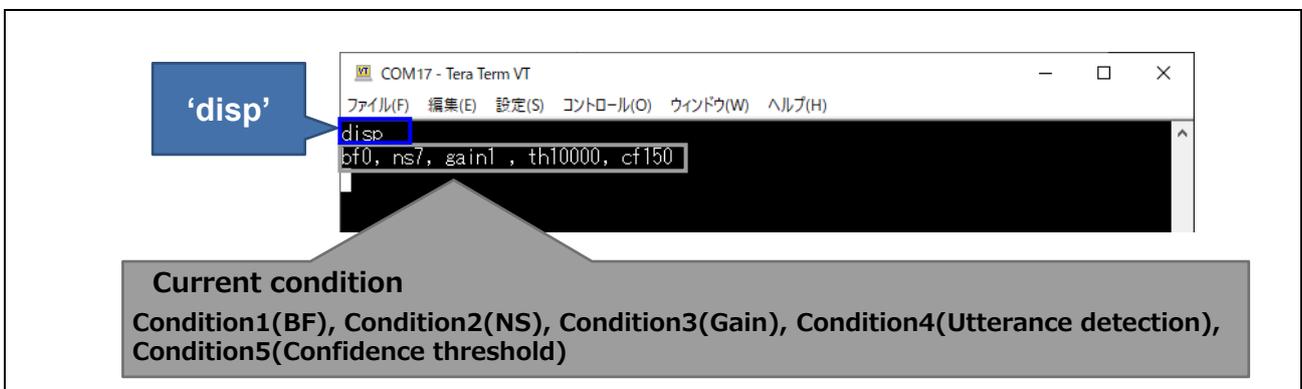


Figure 4.1 Parameter display

### 4.2.2 Parameter setting

To change the parameter setting, input the condition you want to change and value on Tera Term, then press Enter key.

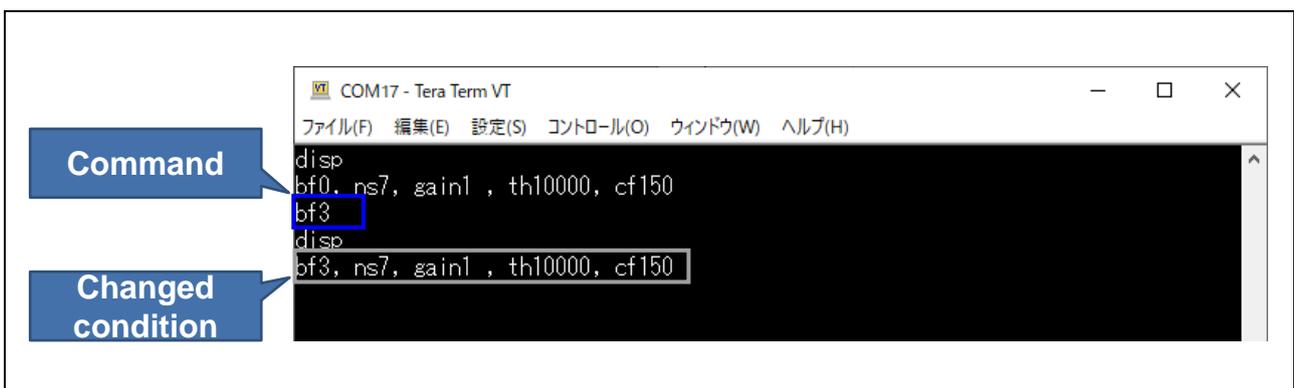


Figure 4.2 Parameter setting

### 4.2.3 Parameter setting command

This section describes the conditions you want to change and how to enter the changed values.

- Change Zoom Voice Beamforming reduction amount  
Zoom Voice Beamforming amount can be changed by inputting number 0 to 7 after 'bf'.

**Table 4.2 Zoom Voice Beamforming reduction change**

Setting	Changeable condition	String input to Teraterm
1	Function OFF	bf0
2	1	bf1
3	2	bf2
4	3	bf3
5	4	bf4
6	5	bf5
7	6	bf6
8	7	bf7

- Change Zoom Voice noise reduction amount  
Zoom Voice noise reduction can be changed by inputting number 0 to 9 after 'ns'.

**Table 4.3 Zoom Voice noise reduction change**

Setting	Changeable condition	String input to Teraterm
1	Function OFF	ns0
2	1	ns1
3	2	ns2
4	3	ns3
5	4	ns4
6	5	ns5
7	6	ns6
8	7	ns7
9	8	ns8
10	9	ns9

- Change amplification width of voice data  
To change amplification width of voice data, input number 0 to 9 after 'gain'.

**Table 4.4 Amplification width of voice data change**

Setting	Changeable condition	String input to Teraterm
1	Function OFF	gain0
2	1	gain1
3	2	gain2
4	3	gain3
5	4	gain4
6	5	gain5
7	6	gain6
8	7	gain7
9	8	gain8
10	9	gain9

- Change utterance detection of AmiVoice (Detect Threshold)  
To change the utterance detection threshold, input value 1000 to 1500 after 'th.'

**Table 4.5 Change utterance detection of AmiVoice**

Setting	Changed value	String input to Teraterm
example	Change to 13000	th13000

- Change confidence threshold value of AmiVoice (Confidence Threshold)  
To change confidence threshold of AmiVoie, input value 0 to 255 after 'cf.'

**Table 4.6 Change confidence threshold of AmiVoice**

Setting	Changed value	String input to Teraterm
example	Change to 200	cf200

### 5. Voice Recognition Evaluation Tool

This Evaluation tool can display waveform of the sound gathered from microphone of demo board, change parameters, and get the log data of recognition results by connecting Voice Recognition Demo board and Voice Recognition Evaluation Tool (V\_Monitor\_v300A\_Uart.exe)

How to operate this Voice Recognition Evaluation Tool is explained as below.

#### 5.1 Structure

- PC (Windows10)      \*Doesn't support Windows7/8/8.1.
- Voice Recognition Demo Board
- Voice Recognition Evaluation Tool(V\_Monitor\_v300A\_Uart.exe).      \*No installation required.
- USB microB cable
- Audacity(Audio playback/editor software for PC)      \* Not required if not playback sound data.

The structure of Voice Recognition Evaluation using this tool is shown as Figure 5.1.

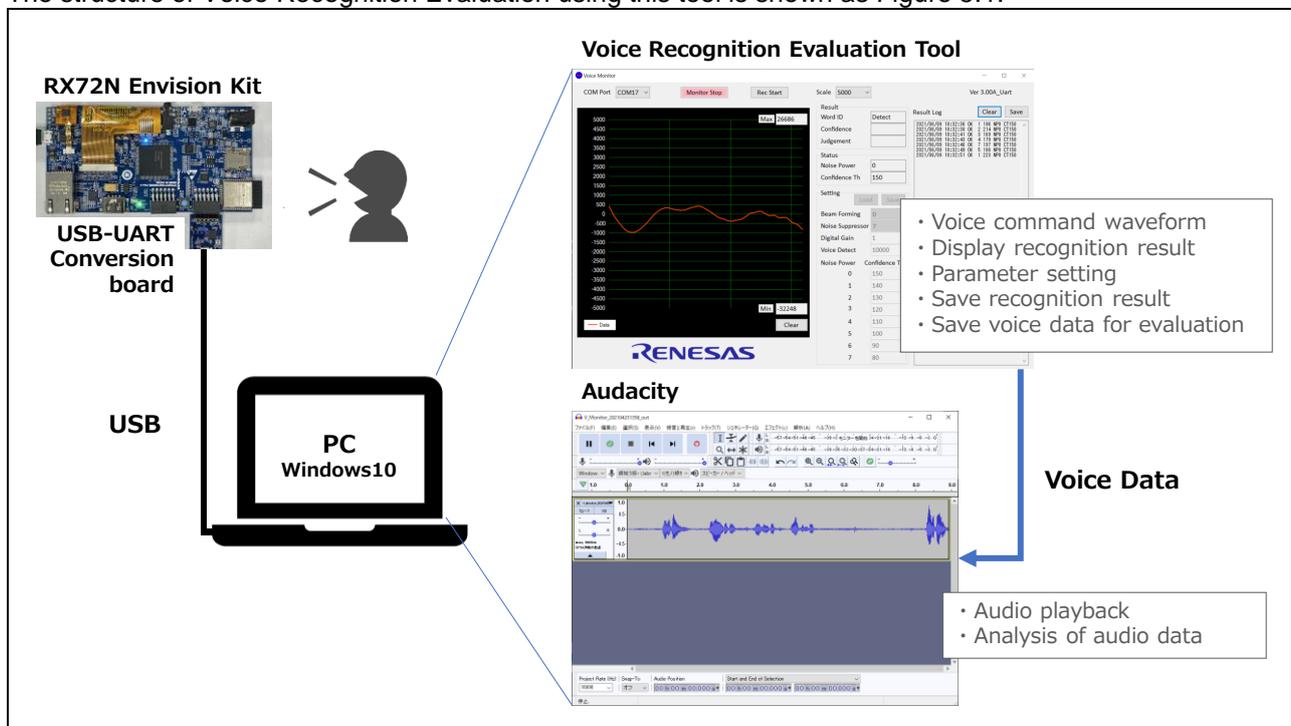


Figure 5.1 Structure

### 5.2 Operation Procedure

This section describes the Voice Recognition Evaluation tool operation procedure. Refer Chapter 6 for detail functions and settings.

1. Copy Voice Recognin Evaluation Tool to your PC. (Installation is not necessary.)
2. Connect PC and Voice Recognition board by USB microB cable.
3. Double click the exe file (V\_Monitor\_v300A\_Uart.exe) and start Voice Recognition Evaluation tool.
4. Select “COM Port” which Voice Recognition board is connected to and click “Monitor Start” to display the waveform.

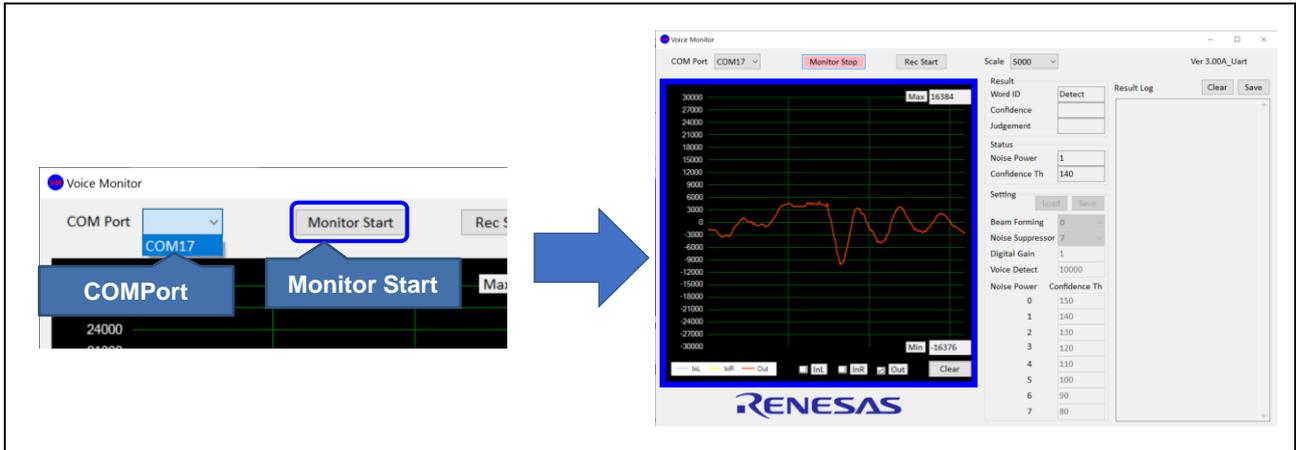
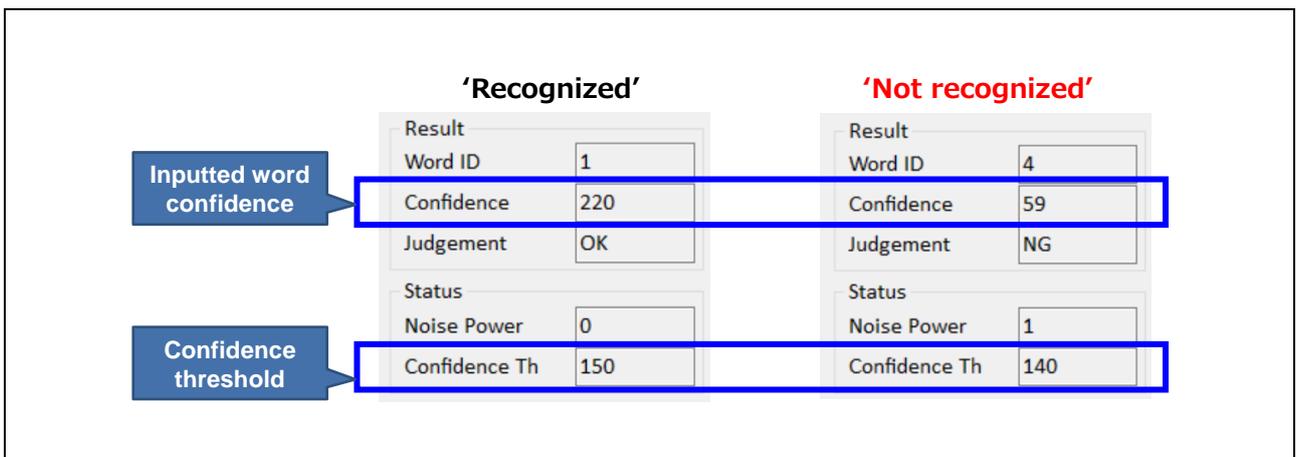


Figure 5.2 Evaluation procedure

5. Start recognition by talking to the demo board.
6. Speak some words and if recognize the voice, the tool shows the recognition result under “Result” and “Result Log”.
7. When the inputted word confidence (a value which shows similarity of voice input and registered word) exceed the confidence threshold (a line for eliminating lower confidence result) shown as Confidence Th, it recognizes as ‘recognized.’



8. Change parameters by “Status” and “Setting,” to expect recognition accuracy improvement. See Chapter 6 for detail.

### 6. Voice Recognition Evaluation Tool functions

This section describes voice recognition evaluation tool functions.

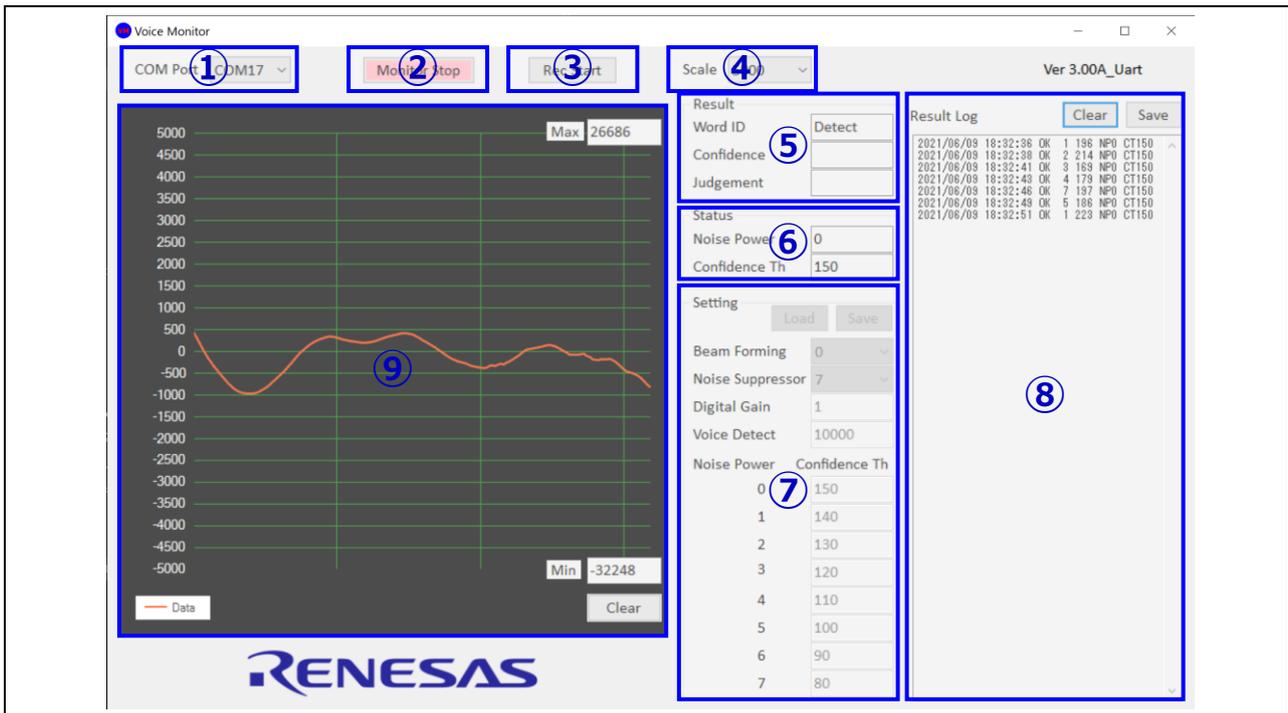


Figure 6.1 Evaluation tool

① COM Port

Select the COM port which is connected to the demo board from the pull-down. By selecting the COM port, it starts reading and displaying each parameter of the demo.

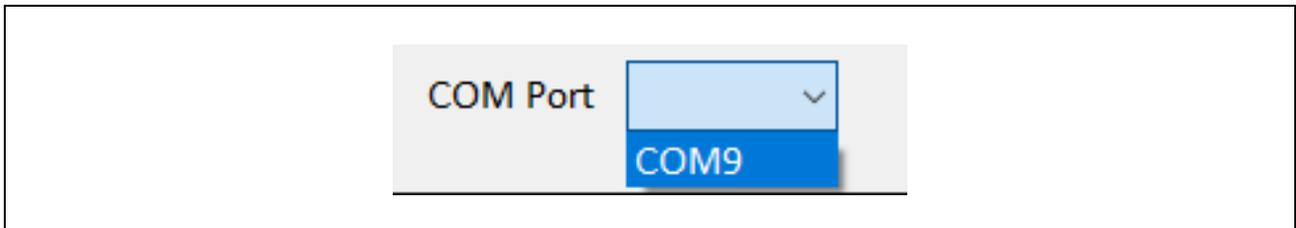


Figure 6.2 COM Port

② Monitor Start / Stop

By clicking this, start monitoring the voice command.

Click Monitor Start to display the voice waveform and stop to click Monitor Stop.



Figure 6.3 Monitor Start / Stop

③ Rec Start / Stop

Click to save the voice data.

Click 'Rec Start' to start recording and click 'Rec Stop' to end.

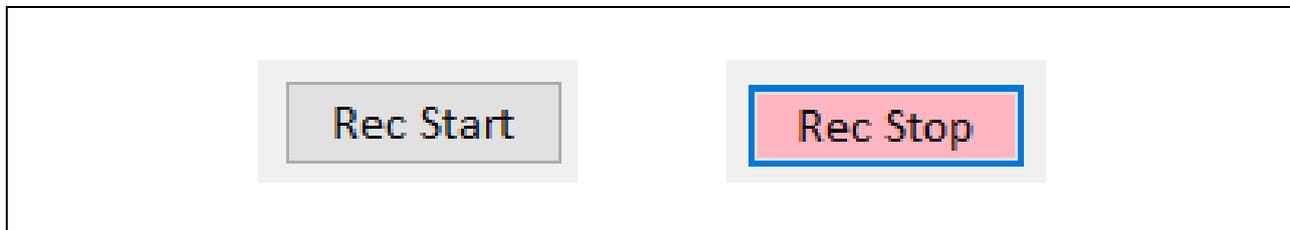


Figure 6.4 Rec Start/Stop

Below file will be created to the same folder as V\_Monitor\_v300A\_Uart.exe.

- V\_Monitor\_yyyymmddhhmm\_out.log

Note: The voice data can be play backed by Audacity.  
Refer chapter 7 for detail.

④ Scale

Select graph scale from pull down.



Figure 6.5 Scale

⑤ Result

Result of voice recognition is displayed.

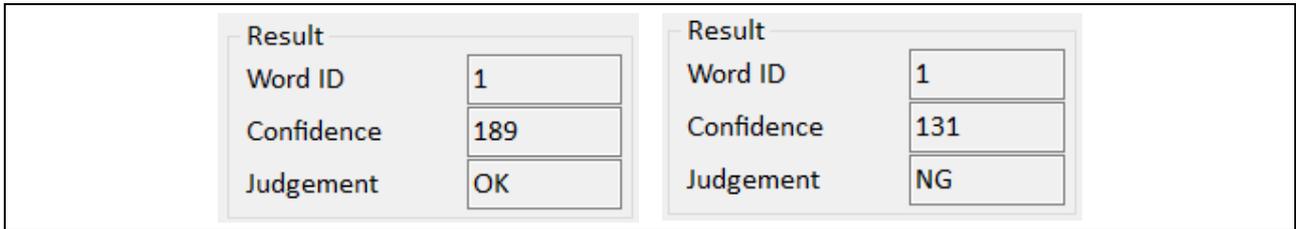


Figure 6.6 Result

- Word ID : Recognized word ID
- Confidence : Recognized word confidence as 0 to 255
- Judgement : Show OK when recognized word confidence exceed the confidence threshold.  
Show NG when recognized word confidence lower the confidence threshold.

⑥ Status

Status of voice recognition is displayed.

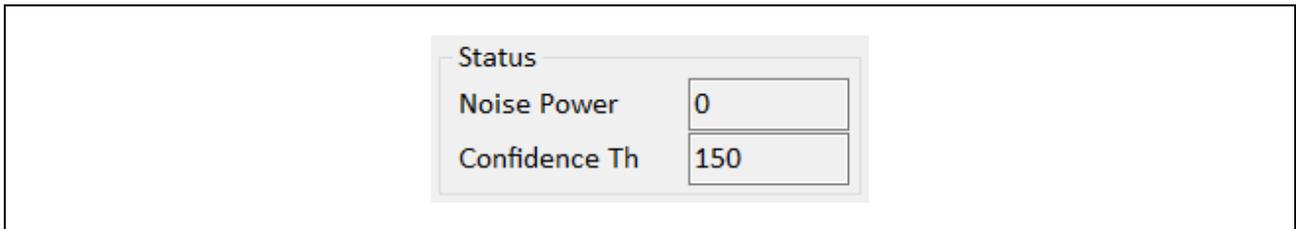


Figure 6.7 Status

- Noise power : Displays the strength of ambient noise from 0 to 7.  
The larger the number, the larger the noise. Recognized word ID
- Confidence Th : Displays confidence threshold value for Noise Power which is set referring  
⑦Setting

## ⑦ Setting

In this section, set the parameter for voice recognition and noise reduction.

Noise Power	Confidence Th
0	150
1	140
2	130
3	120
4	110
5	100
6	90
7	80

**Figure 6.8 Setting**

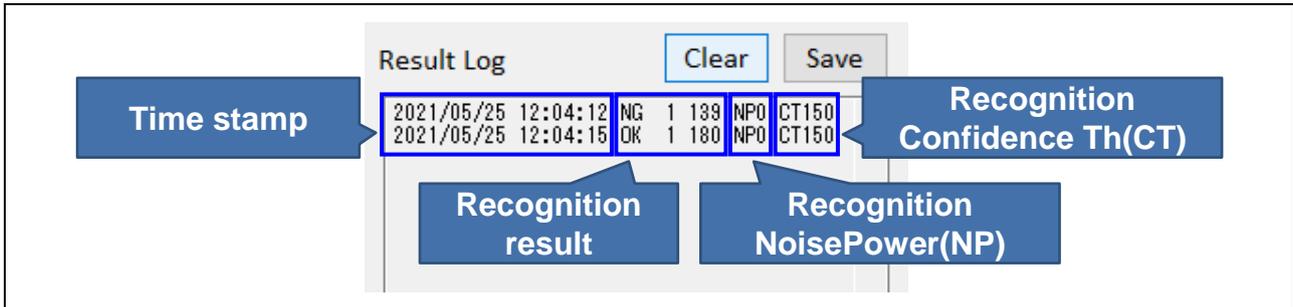
- Beam Forming : Set the Beam Forming noise reduction amount from 0(off) to 7. The bigger the value, the narrower the beam forming sound collection angle.
- Noise Suppressor : Set the Noise Suppressor noise reduction amount from 0(off) to 9. The bigger the value, the larger the amount of noise reduction.
- Digital Gain : Set the voice signal amplification from 1 to 9.
- Voice Detect : Set the utterance detection threshold from 0 to 15000.  
Most of the case, set from 1000 to 15000 and the lower the value, the easier the utterance detection.
- Confidence Th : Set the confidence threshold per each Noise Power from 0 to 255.

Changed value is updated when clicking Monitor Start.

- Save : Click 'Save' to create 'V\_Monitor\_yymmddhhmm\_t.ini' file and save above setting.
- Load : Click 'Load' and read 'V\_Monitor\_yymmddhhmm\_t.ini' file to realize saved setting.

⑧ Result Log

Display the voice recognition result as below.



- Clear : Click to clear the log displayed at 'Result Log'.
- Save : Click to save the log displayed at 'Result Log'.

⑨ Waveform

Displays voice wave form of voice input from on board microphone and its MAX/MIN (from -32768 to +32767) value.

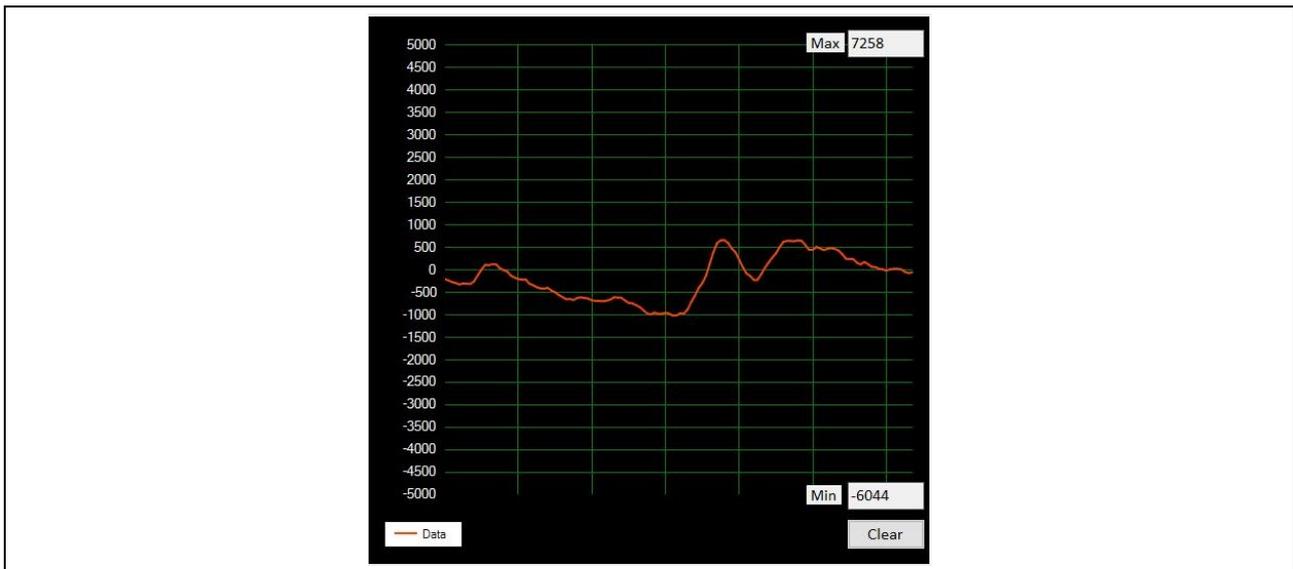


Figure6.10 Waveform

- Clear : Click 'Clear' to clear the MAX/MIN value.

## 7. Voice playback using Audacity

Voice playback free software, Audacity enables waveform analysis and voice playback of saved log data. This chapter describes how to import the voice data file created by voice recognition evaluation tool.

Note: Audacity is used for voice data playback. In case of recording only, Audacity is not necessary.

1. Install Audacity.  
Audacity (<https://www.audacityteam.org/>)
2. Start Audacity
3. Click and select 'File', 'import', then import 'Raw data'.

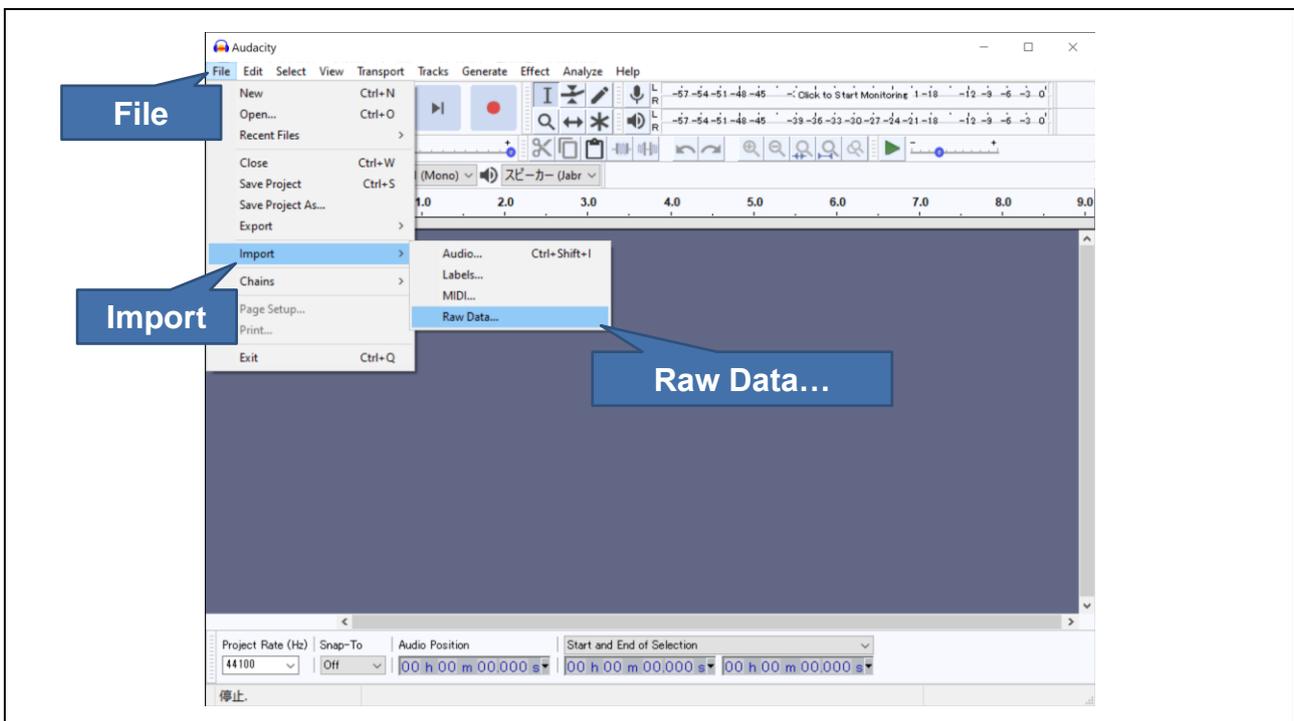


Figure7.1 Import

1. Select the saved recorded voice data file and click 'import' as below.

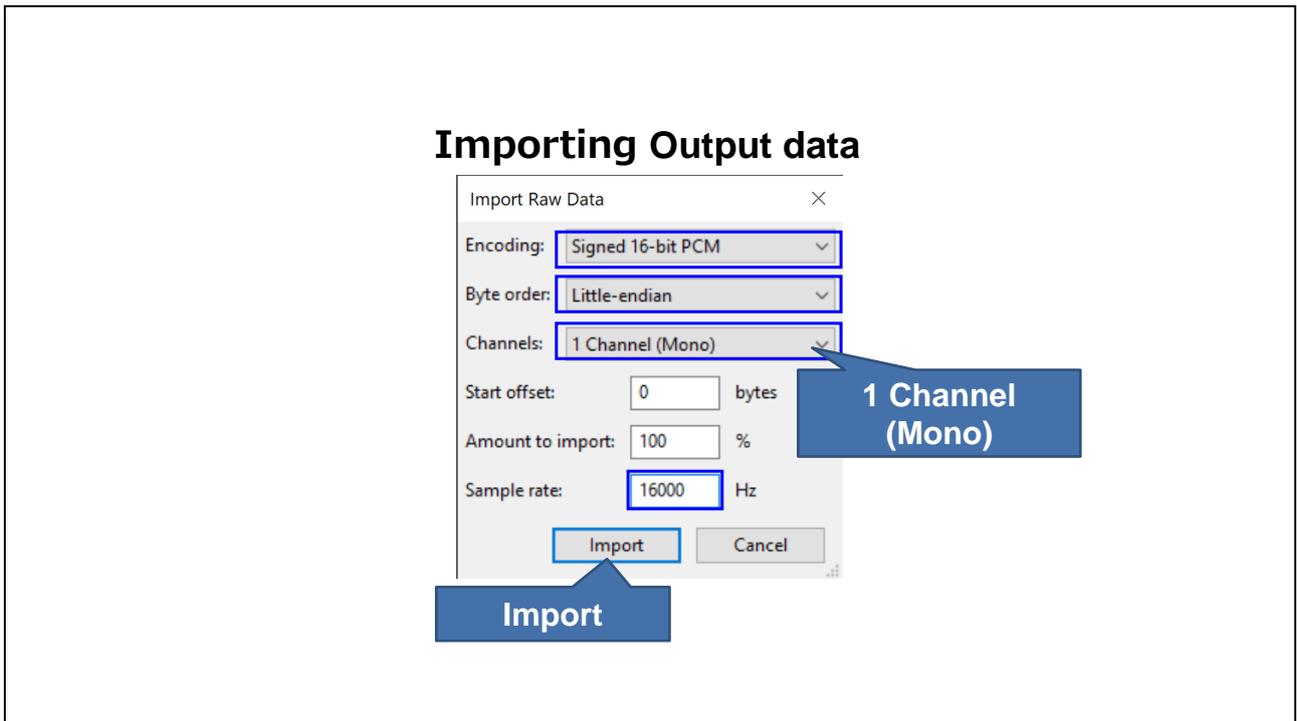


Figure7.2 Import setting

2. When completed reading voice data, it displays the voice wave form and able to play back the voice data by clicking 'Play'.

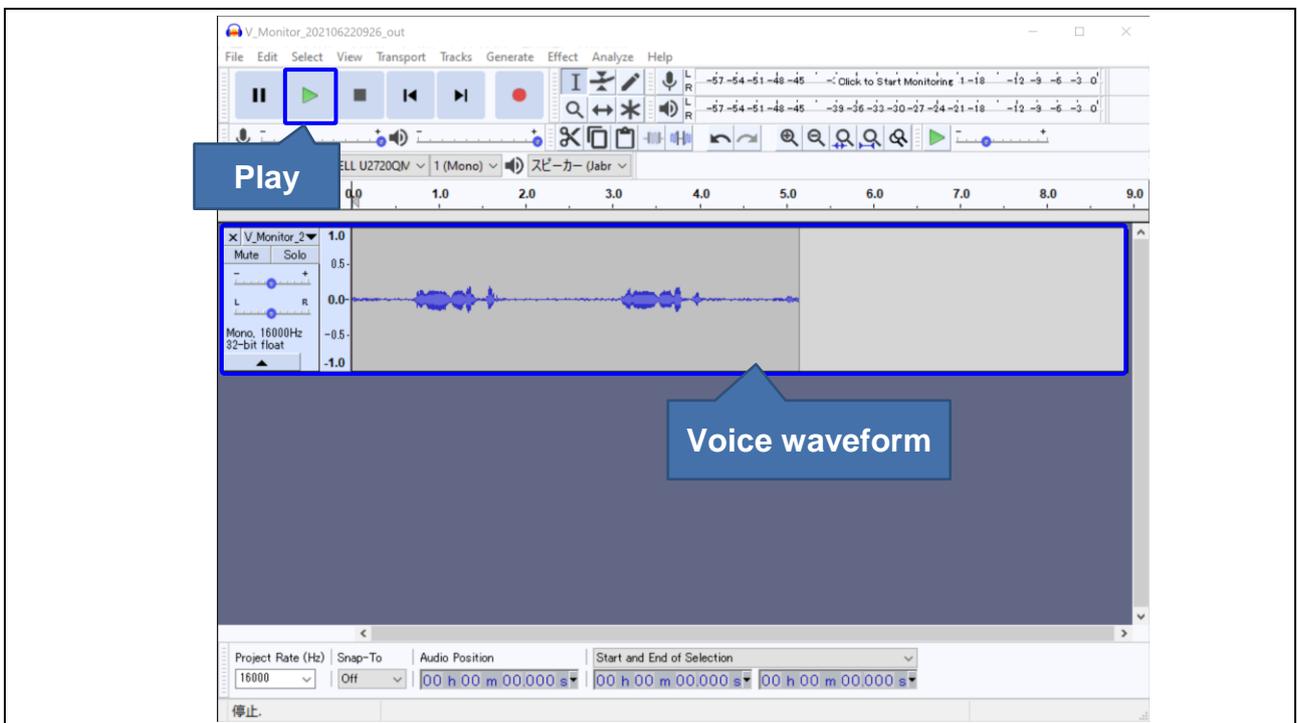


Figure 7.3 Confirm voice waveform

**Revision History**

Rev.	Date	Description	
		Page	Summary
1.00	Aug.31.21	-	First release

## General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

### 1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

### 2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

### 3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

### 4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

### 5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

### 6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.).

### 7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

### 8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

## Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
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4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
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