API Example Usage Guide

API Version 0.55.55

2025-1-20



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1. C/C++

1.1 Configure Development Environment

1. Open VS Studio 2019 and create a new project.

pen recent		Get sta	arted
earch recent (Alt+S) Today	<mark>-</mark> م	*	Clone a repository Get code from an online repository like GitHub or Azure DevOps
Yesterday This week This month Older		Ċ	Open a project or solution Open a local Visual Studio project or .sln file
			Open a local folder Navigate and edit code within any folder
		<u>د</u> *	Create a new project Choose a project template with code scaffolding to get started
			Continue without code \rightarrow

2. Select Empty Project and click Next.



3. Fill in the project name and storage location, uncheck "Place solution and project in the same directory," and then click Create.

u	и

4. Once created, copy the htra_api folder from the delivery USB drive Windows\HTRA_API\x86 to the same level directory of the project (this example is for configuring an x86 architecture project; if you want to configure an x64 architecture project, copy the Windows\HTRA_API\x64\htra_api folder).

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SWP.sin	12/5/2024 4:16 PM	Visual Studio Solu	2 KB	

5. Double-click to open SWP.sln, and create a new SWP.cpp file in the source files.

Add New Item - SWP	Sort by: Default		? X Search (Ctrl+E) P =			Search Solution Explorer P - Solution 'SWP' (1 of 1 pro SWP References External Depender Warder Files
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6. Click on "Project" in the menu bar and select "Properties."

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				Rescan Solution		
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				Clear Browsing Database Err	Drs	
			ta)	Manage Connected Services		
			ø	Set as Startup Project		
				Export Template		
			6	Manage NuGet Packages		
			عر	SWP Properties		

7. Select "Win32" for the configuration platform, and set the environment variable in Configuration Properties -> Debug to Path=..\htra_api (when configuring for the x64 architecture, select "x64" for the configuration platform; otherwise, steps 7-10 of the configuration process are the same as for the x86 architecture (Win32)).

SWP Property Pag	ges		? ×
Configuration:	Debug	V Platform: Win32	Configuration Manager
Configuratio General Advance	on Properties	Debugger to launch: Local Windows Debugger	~
Debuggin VC+0 ▷ C/C++ ▷ Inker ▷ Manifest ▷ XML Doc ▷ Browseln ▷ Build Eve ▷ Custom ▷ Code An	ng rectories : Tool :ument Generator nformation ents Build Step alysis	Command S(TargetPath) Command Arguments	r
		Environment Specifies the environment for the debugee, or variables to merge with ex	cisting environment.
		ОК	Cancel Apply

8. Set the Additional Include Directories in Configuration Properties -> C/C++ -> General to \$(SolutionDir)\htra_api.

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Configu	uration Properties		Additional Includ	e Directories	;	\$(SolutionDir)\htra_api			
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	General		Translate Includes	to Imports		No			
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	Command Line		SDL checks			Yes (/sdl)			
▷ Link	(er		Multi-processor (Compilation					
⊳ Mar	nifest Tool		Enable Address S	anitizer		No			
⊳ XMI	L Document Genera	Add	litional Include D	irectories					
⊳ Brov	wse Information	Spec	cifies one or more ath1)	e directories	to add to t	he include path. Separate v	with ';'	if more than one	ē.

9. Set the Additional Library Directories in Configuration Properties -> Linker ->

General to \$(SolutionDir)\htra_api.

Configuration:	Debug	~	Platform: Win32		~		Configuration Manager		er
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 Linker 		Incremental Lin	k Database Fi	ile	\$(IntDir)\$(Targe	tName).ilk			
Gen	neral	Suppress Startu	p Banner		Yes (/NOLOGO)				
Inpu	ut 🔪	lanore Import I	ibrary		No				
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- Couch		Allows the user to t	overnde the e	nvironme	ntai library path. (LIBPATH:roider)			
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10. Add htra_api.lib to the Additional Dependencies in Configuration Properties

-> Linker -> Input.

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Exte Adv All C Con Linker Gen Inpu Mar Deb Syst Opti Emb Win Adv	ernal Includes anced Dptions nmand Line eral at infest File ugging em imization bedded IDL dows Metadata anced	Additional Dependencies htra_ar Ignore All Default Libraries Ignore Specific Default tibraries Module Default cubraries Module to Assembly Embed Managed Resource File Force Symbol References Delay Loaded DIIs Assembly Link Resource	Coniguration Manager
 All C Con Manifes XML Do Browse Build Ev Custom Code An 	options nmand Line st Tool occument Genera Information vents n Build Step nalysis	Additional Dependencies Specifies additional items to add to the link comma	nd line. [i.e. kernel32.lib]

11. At this point, the environment configuration is complete, and programming development can begin. You can refer to the C/C++ examples included on the USB drive, specifically in

```
Windows\HTRA_API_Example\HTRA_C++_Examples\HTRA_C++_Examples.
```

Name	Date modified	Type Size			
		ASG_CWOutput.cpp	6/7/2024 6:13 PM	C++ 源文件	5 KB
.V5	11/22/2024 4:01 PM	DET_GetPowerTrace_Adaptive.cpp	6/7/2024 6:14 PM	C++ 源文件	8 KB
Debug	11/26/2024 3:37 PM	DET_GetPowerTrace_FixedPoints.cpp	6/7/2024 7:05 PM	C++ 源文件	8 KB
htra ani	11/15/2024 4-24 DM	DSP_AMDemod.cpp	6/7/2024 7:05 PM	C++ 源文件	9 KB
	11/10/2024 4/24 PW	DSP_DDC.cpp	6/7/2024 7:05 PM	C++ 源文件	9 KB
HTRA_C++_Examples	12/5/2024 4:42 PM	DSP_FMDemod.cpp	6/7/2024 7:05 PM	C++ 源文件	9 KB
HTRA API Example Introduction CN.pdf	5/8/2024 9:45 AM	DSP_IQSToSpectrum.cpp	6/7/2024 7:06 PM	C++ 源文件	8 KB
		DSP_LPF.cpp	6/7/2024 7:06 PM	C++ 源文件	9 KB
HIRA_C++_Examples.sin	6/7/2024 5:58 PM	c example.h	6/7/2024 7:16 PM	C Header 源文件	1 KB
		HTRA_C++_Examples.vcxproj	12/5/2024 2:39 PM	VCXPROJ File	9 KB
		HTRA_C++_Examples.vcxproj.filters	12/4/2024 2:25 PM	VC++ Project Filte	3 KB
		HTRA_C++_Examples.vcxproj.user	6/7/2024 7:08 PM	Per-User Project O	1 KB
		 IQS_GetIQ_Adaptive.cpp 	6/7/2024 7:06 PM	C++ 源文件	8 KB
		IQS_GetIQ_FixedPoints.cpp	11/26/2024 3:37 PM	C++ 源文件	8 KB
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		RTA_GetRealTimeSpectrum_Adaptive.cp	p 6/7/2024 7:06 PM	C++ 源文件	8 KB
		RTA_GetRealTimeSpectrum_FixedPoints	c 6/7/2024 7:06 PM	C++ 39.52/#	8 KB
		SWP_GetSpectrum_Standard.cpp	12/4/2024 2:43 PM	C++ 源文件	8 KB

1.2 Usage Process for C++ Examples

1.2.1 Usage of General C++ Examples

The usage process for general C++ examples included on the USB drive is as follows:

 Use Visual Studio to open the solution HTRA_C++_Examples.sln locate d in the folder Windows\HTRA_API_Example\HTRA_C++_Examples on the provi ded USB drive.

Ð	>	Windo	ows >	HTRA_API_Ex	ample >	HTRA_C++	_Examples	> HT	"RA_C++_Exa	mples	>
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	HTRA_C	C++_Exam	nples		1/16/2025 2:	07 PM	File folder				
	📲 HTRA_C	C++_Exam	nples.sln		6/7/2024 5:5	8 PM	Visual Studio	Solut	2 KB		

 Click on the right side to access the HTRA_C++_Examples project and click on the main.cpp file within it.

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3. Each routine in the C++ example is encapsulated in a separate functio n. To use the example, simply uncomment it (multiple examples cannot be us ed simultaneously). For instance, when testing the Device_GetDeviceInfo routin e, uncomment it, save, select the expected compilation architecture (both x86 and x64 are acceptable), and click run. The image shown indicates that the device is running normally.

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1.2.2 Usage of the recording and playback example

1. Open the solution Htra_RecordingandPlayBack.sln located in the folder Windows\HTRA_API_Example\Htra_RecordingandPlayBack on the provided USB drive using Visual Studio.

	USB Drive (E:) > Windows > HTRA_(C++_Examples	lecordingandPlayBack	>	Searcl
A])	🖻 🔟 🏷 Sort ~ 🗮 View ~				
	Name	Date modified	Туре	Size	
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	Htra_RecordingandPlayBack	1/16/2025 10:56 AM	File folder		
ΙΓ	📲 Htra_RecordingandPlayBack.sln	12/25/2024 3:14 PM	Visual Studio Solution	2 KB	
15					

2. Click on the right side to access the Htra_RecordingandPlayBack projec t and click on the main.cpp file within it.

3. Each routine in the recording and playback example is encapsulated in a separate function. To use the example, simply uncomment it (multiple examples cannot be used simultaneously).

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(1) Usage of the reading example

1) For example, when reading SWP mode stream disk data, uncomment the

SWPMode_PlayBack function and save.

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15 16 17	return Status;				++ SWPMode_PlayBackcpp ++ SWPMode_Recording.cpp Resource files

 Place the recorded file data from SWP mode into the folder "Window s\HTRA_C++_Examples\Htra_RecordingandPlayBack\Htra_RecordingandPlayBac k\data".

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3) Click to enter SWPMode_PlayBack.cpp and modify the name of the re corded file in the SWPMode_PlayBack() function.

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4) Running the program will generate the parsed data file "SWPMode_Da ta.txt" in the data folder under the SWP mode.



(2) Usage of the recording example

- 1) For example, when testing the IQSMode_Recording routine, uncommen
- t and save.

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2) Click to enter the IQSMode_Recording() function, configure the param eters, and run the program. You can find the recorded file data in the "Windows\HTRA_C++_Examples\Htra_RecordingandPlayBack\Htra_Recordingand PlayBack\data" folder under the IQS mode.

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	SWPMode_Data.txt			1/17/2025 12:0	00 PM	Text Docu	ment	3,690 KB				

1.3 Device-related

1.3.1 Get device information

Device_GetDeviceInfo.cpp: Retrieves device information, including API version, USB version, device model, device UID, MCU version, FPGA version, and device temperature.

1.3.2 Device standby

Device_SysPowerState.cpp: An example of setting the device's standby stat e, which can be configured to normal operating state or RF powered down st ate (low power).

1.3.3 GNSS-related

Device_AboutGNSS.cpp: Retrieves information such as latitude, longitude, altitude, and time obtained from the GNSS module, acquires GNSS-related latitude and time information from MeasAuxInfo in SWP mode, and obtains latitude and time information from IQStream.DeviceState in IQS mode.

1.3.4 Get and modify the IP address of the NX device

Device_GetAndSetIP.cpp: Retrieve the device's IP address and modify it using the device UID or the device's current IP address.

1.3.5 Mode switching time consumption

Device_TimeOfSetMode.cpp: Get the time required for the current host computer to switch between different modes.

1.4 SWP mode

1.4.1 Standard spectrum acquisition

SWP_GetSpectrum_Standard.cpp: Obtain spectrum data by calling the function interface.

1.4.2 Simplified configuration mode

SWP_EZGetPartialSweep.cpp: Quickly acquire spectrum data using a simplified configuration.

1.4.3 Maximum and minimum hold

SWP_MaxHold_MinHold.cpp: Set the trace mode to MaxHold or MinHold, and use SWP_ResetTraceHold to reset the hold.

1.4.4 Average Trace

SWP_TraceAverage.cpp: Average processing of the acquired trace.

1.4.5 Automatic Configuration Measurement

SWP_AutoSetMeasure.cpp: Automatically configures relevant parameters based on specific SWP applications, completing measurements by issuing automatic configuration parameters.

1.4.6 Frequency Compensation

SWP_SetFreqCompensation . cpp : When an external attenuator is presen t, compensation can be applied to the corresponding frequency band to ensu re that the test results remain accurate.

1.4.7 Function execution time, scanning speed, and throughput

SWP_TimeOfSetFunction.cpp: Obtains the call duration of the SWP_Configuration, SWP_GetPartialSweep, and SWP_GetFullSweep functions, along with the scanning speed and throughput under the current configuration.

1.4.8 Obtain spectrum peak values

SWP_PickMaxPower.cpp: Obtain the maximum power point of the current spectrum and its corresponding frequency point.

1.4.9 Signals and Spurious

SWP_GetSpectrum_SigAndSpur.cpp: This can distinguish between signals an d spurious after obtaining spectrum data.

1.4.10 Simultaneous Acquisition of Spectrum and IQ

SWP_GetSpectrumAndIQS.cpp: This allows for the simultaneous acquisition of spectrum data and IQ data.

1.4.11 Reading SWP Stream Disk Data from SAStudio4

SWPMode_PlayBack.cpp: This can read the recorded file data in SWP mo de from SAStudio4 and write the read spectrum data into SWP Mode_Data.tx t.

1.4.12 Using GNSS 10MHz Reference Clock

SWP_GNSSReferenceClock.cpp: This uses a high-quality GNSS module's 10 MHz reference clock in SWP mode.

1.4.13 External Trigger Mode

SWP_GetSpectrum_Trigger.cpp: This obtains spectrum data when the trigg

er source is set to external trigger.

1.4.14 Trace Alignment Method

SWP_GetSpectrum_TraceAlign.cpp: Obtain spectrum data when the trace a lignment method is set to align to the starting frequency or align to the cen ter frequency.

1.4.15 Number of Spectrum Frames Obtainable Within a Certain Time

SWP_Fixedtime_GetFrames.cpp: Loop 50 times to obtain 10 seconds of sp ectrum data, resulting in the average number of spectrum frames that can be obtained within 10 seconds.

1.4.16 External Trigger Calibration of Internal 10MHz Reference Clo ck

SWP_GetSpectrum_Calibration.cpp: An example of the device calibrating th e clock via GNSS-1PPS or through external trigger.

1.5 IQS Mode

1.5.1 Obtain Fixed Number or Continuous Stream of IQ Data

IQS_GetIQ_Standard.cpp: Obtain a fixed number or continuous stream of IQ data under professional configuration.

1.5.2 Simplified configuration mode

IQS_GetIQ_EZStandard.cpp: Quickly obtain IQ data using a simplified configuration.

1.5.3 IQ data converted to voltage V units

IQS_ScaleIQDataToVolts.cpp: Converts the acquired IQ data into data measured in volts (V).

1.5.4 Time taken to issue configuration and acquire IQ

IQS_ConfigandGetIQ_Time.cpp: Obtains the call duration of the IQS_Config uration and IQS_GetIQStream_PM1 functions.

1.5.5 IQ to Spectrum Data

DSP_IQSToSpectrum.cpp: Converts the acquired time-domain IQ data into spectrum data using spectral analysis methods.

1.5.6 IQ to Spectrum (using liquid library version)

IQS_ToSpectrumByLiquid.cpp: Uses the liquid library to convert the acquired time-domain IQ data into spectrum data through spectral analysis methods.

1.5.7 FM Demodulation

DSP_FMDemod.cpp: Performs FM demodulation on the IQ data and plays the demodulated audio.

1.5.8 AM Demodulation

DSP_AM_Demod.cpp: Performs AM demodulation on IQ data and plays the demodulated audio.

1.5.9 Digital Downconversion

DSP_DDC.cpp: Resamples the obtained IQ data.

1.5.10 Digital Low-Pass Filter

DSP_LPF.cpp: Perform low-pass filtering on the obtained IQ data.

1.5.11 Audio Analysis

IQS_AudioAnalysis.cpp: Performs audio analysis on the demodulated IQ data to obtain audio voltage, audio frequency, signal-to-noise ratio, and total harmonic distortion.

1.5.12 Read the IQS stream disk data from SAStudio4

IQSMode_PlayBack.cpp: Parses the recorded file data in IQS mode from SAStudio4 and writes the read spectrum data into the IQS Mode_Data.txt file.

1.5.13 Record IQ data in .wav format

IQSMode_Recording.cpp: Stores the acquired IQ data in .wav format.

1.5.14 .wav changed to .csv

IQSMode_WavToCsv.cpp: Parses and extracts I and Q channel data from the .wav recording file data in IQS mode, converting it into a .CSV format file for saving.

1.5.15 Streaming and reading IQ data

IQS_GetIQToTxt.cpp: Writes the obtained IQ data into a .txt file.

1.5.16 Multithreaded acquisition, processing, and streaming of IQ data

IQS_Multithread_GetIQ_FFT_Write: Simultaneously acquires IQ data, performs FFT, and writes IQ data into a .txt file.

1.5.17 GNSS 1PPS trigger

IQS_GNSS_1PPS.cpp: Configures the trigger source to be the 1PPS signal provided

by the internal GNSS system.

1.5.18 IQS multi-device synchronization

IQS_MultiDevSync_fixed.cpp: Multiple devices simultaneously collect the same signal at the same time.

1.5.19 External Trigger

IQS_ExternalTrigger.cpp: Configure the trigger source as external trigger.

1.5.20 Timer Trigger

IQS_TimerTrigger.cpp: Configure the trigger source as timer trigger.

1.5.21 Level Trigger

IQS_LevelTrigger.cpp: Configure the trigger source as level trigger.

1.5.22 Using GNSS 10MHz Reference Clock

IQS_Enable_GNSS_10MHz.cpp: Use a high-quality GNSS module's 10MHz reference clock in IQS mode.

1.6 DET Mode

1.6.1 Obtain detection data for fixed points or continuous streams.

DETMode_Standard.cpp: Obtain detection data for fixed points or continu ous streams.

1.6.2 Simplified configuration mode

DETMode_EZStandard.cpp: Quickly obtain detection data through a simplified configuration.

1.6.3 Read the DET stream disk data of SAStudio4

DETMode_PlayBack.cpp: Read the recorded files in DET mode from SAStu dio4 and output the detection data to the DETMode_Data.txt file.

1.6.4 Pulse detection (to be opened later)

1.7 RTA mode

1.7.1 Obtain real-time spectrum data for a fixed number of points or continuous stream

RTAMode_Standard.cpp: Obtain real-time spectrum data for a fixed numb er of points (duration) or continuous stream.

1.7.2 Simplified configuration mode

RTAMode_EZStandard.cpp: Quickly obtain real-time spectrum data through simple configuration.

1.7.3 Read the RTA stream disk data of SAStudio4

RTA_Mode_PlayBack.cpp: Read the recorded file data in RTA mode from SAStudio4, while being able to specify reading a certain packet of data, and write the read spectrum data to the RTAMode_Data.txt file.

1.7.4 Time consumption of each frame of data in RTA mode

RTAMode_Standard_perframe.cpp: Acquire 100 frames of data and calculat e the average processing time for each frame.

1.8 ASG Signal Source (optional)

1.8.1 Output single tone/sweep/power scan signals

ASG_SignalOutput.cpp: Output single tone/sweep/power scan signals as ne eded.

2. Digital Demodulation (optional)

3. Qt

3.1 Configure Development Environment

1. As shown in the figure, first create a new folder to store the entire project (taking QtTest as an example, it is recommended not to use a Chinese path), and then create a htra_api folder within the folder to store the dynamic link libraries and calibration files.



2. Copy all files from the Windows\HTRA_API\x64\htra_api folder on the USB drive to the newly created QtTest\htra_api folder (taking the x64 architecture program as an example; for the x86 architecture program, simply copy the corresponding architecture's libraries).

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🏙 htra_api.lib	11/25/2024 2:01 PM	Object File Library	47 KB
libiomp5md.dll	4/30/2024 3:30 AM	Application extension	2,015 KB
libliquid.dll	1/12/2024 8:37 AM	Application extension	1,739 KB

3. Open Qt Creator, click on File, and select New File or Project.



4. Select Create Form Application.

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		Choose Cancel

5. After filling in the project name, click Browse to change the p	project path.
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6. Select the directory as the QtTest address created in the first step and click

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8. Select qmake and click Next to continue.

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10. Click Next to continue.

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11. Select a build environment for the project and click Next to continue.

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12. Click Finish to create the project.

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13. Click Edit, right-click the Test project, and click Add Library.

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14. Select External Library and click Next.

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15. Click Browse Library File.

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16. Select the htra_api.lib library in QTest\htra_api and click Open.

17. Uncheck all options in Windows, click on Static Library, select the Windows platform, and click Next.

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18. Click Finish to add the external library.

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19. Continue to add the libliquid.lib and libmkl.lib libraries following the same

steps as before.

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Fielders	15 HEADERS += \	
• • Sources	16 mainwindow.h	
a maincipp	17	
> > Forme	18 FORMS += \	
· · · · · · · · · · · · · · · · · · ·	19 mainwindow.ui	
	20 A Default rules for deployment	
	22 gast target path = /tmo/Ss(TARGET)/bin	
	<pre>23 else: unix:landroid: target.path = /opt/\$\${TARGET}/bin</pre>	
	24 :isEmpty(target.path): INSTALLS += target	
	25	
	26 win32: LIBS += -L\$\$PWD//htra_api/ -lhtra_api	
	27 Superson and a second second	
	20 INCLODERAIN += SSPWD//NTra_api	
	23 DEPENDIVALIT - SPEND//IICra_ap)	
	31 win32:1win32-g++: PRE TARGETDEPS += \$\$PWD//htra api/htra api.lib	
	32 else:win32-g++: PRE_TARGETDEPS += \$\$PWD//htra_api/libhtra_api.a	
	33	
	3.4	
	so wins2: LLBS += -LSSHWU//ntra_api/ -Ltibliquid	
	37 TNCLUDEPATH += \$\$PWD//btra api	
Dava Decements - 12	38 DEPENDPATH += \$\$PWD//htra_api	
open Documents • E•	2 39 March 200 M	
a Test prot	40 win32::win32-g++: PRE_TARGETDEPS += \$\$PWD//htra_api/libliquid.lib	
a nescoro	41 else:win32-g++: PRE_TARGETDEPS += \$\$PWD//htra_api/liblibliquid.a	
	2 window 1700 an 146000 (lines and (314bold)	
	AS WINSZ, LIBS +LOSTWO//NCTA_api/ -LCIDMAC	
	45 INCLUDEPATH += \$\$PWD//htra api	
	46 DEPENDPATH += \$\$PWD//htra_api	
	47	
	48 win32:1win32-g++: PRE_TARGETDEPS += \$\$PWD//htra_api/libmkl.lib	
	<pre>dig else:win32-g++: PRE_TARGETDEPS += \$\$PWD//htra_api/liblibmkl.a</pre>	
	24	
Yould you like to take a quick U	I tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.	Take UI Tour Do Not Show Ag

You can also directly add -llibliquid and -llibmkl after -llibhtra_api as shown below.


20. Save the Test.pro file, and then you can write the code normally.



21. After writing the code, click Run. The device should function normally as shown in the figure.

📴 mainwi	ndow.cpp @ Test - Qt Creato	36	- 0 ×
File Edit	View Build Debug Ar	nalyze Tools Window Help	
	Projects - T. 😁 🗄 🖾	🔨 💫 🗈 🖬 mainwindow.cpp 🔹 🔹 🔩 MainWindow:MainWindow(QWildget *)	+ # CRLF (₱ 🖂 Line: 30, Col: 68 🕒
<u>۾</u>	🗸 😼 Test	1 #include "mainwindow.h"	1
Welcome	Test.pro	2 #include "ui_mainwindow.h"	I
_	🛩 🔀 Headers	3 #include <qdebug></qdebug>	1
=	mainwindow.h		I
Edit	✓ ≥ Sources	5 Finctude (http://www.selfer.com/	1
Ø	a main.cpp	7 Thoshudo (station h)	1
Design	a mainwindow.cpp	8 #include secting.it/	I
ö.,	> 😕 Forms	9	I
Debug		10 using namespace std:	1
0		11	1
ور		12 MainWindow::MainWindow(QWidget *parent)	
Projects		13 : QMainWindow(parent)	
82		14 , ui(new Ui::NainWindow)	
Extensions			
0		10 ul->setupul(this);	
Help		$\begin{vmatrix} 1 \\ 1 \end{vmatrix}$ int Status = 0:	
		19 voidt Device = NULL:	
		20 int DevNum = 0;	
		21	
		22 BootProfile_TypeDef BootProfile;	
		23 BootInfo_TypeDef BootInfo;	
		24	
		25 BootProfile.DevicePowerSupply = USBPortAndPowerPort;	
		26	
		27 BootProfile.PhysicalInterface = USB;	
	Open Documents 🝷 🗄 📼		
	d mainwindow.cpp *	30 Status = Device Open(&Device, DevNum, &BootProfile, &BootInfo);	
		31 * if (Status == APIRETVAL NGError) (
		<pre>32 qDebug() <<function_ "device="" <<="" <<line_="" opened="" pre="" successful!";<=""></function_></pre>	
Tact		33 * } else {	
Ĩ			
- - -		Application Output As S V I II II S V Liter + -	^ D
Debug		lest	
~		16:47:07: Starting C:\Users\60536\Desktop\QtTest\Test\build\Desktop_Qt_5_15_2_MSVC2019_64bit-Debug\debug\Test.exe	1
		MainWindow::MainWindow 32 Device opened successful:	· · · · · · · · · · · · · · · · · · ·
Da		MannWindow::WannWindow 53 Configuration successful!	
24		MainWindow::WainWindow 62 Frequency[0] = -0.021090+00 ; PowerSpec_dBm[0] = -78,6547	
\gg	R Turne to locate /Ct	1 Issue 2 Search Results 3 Annication District 4 Comple Cutrut 5 Terminal 9 General Message :	⇒ Π.

3.2 Qt Example Usage Process

The usage process for the Qt examples included in the USB drive is as follows:

 As shown in the figure, use Qt Creator to open the htrademo.pro file located in the Windows\HTRA_API_Example\HTRA_Qt_Examples\htrademo fold er on the USB drive (please ensure the project path does not contain Chines e characters).

□ > USB Drive (F:) > Windows >	HTRA_API_Example	> HTRA_Qt_Examples > htrademo >
Î	≡ View ~ ····	
Name	Date modified	Size
ainwindow.ui	1/16/2025 9:59 AM	1 KB
m htrademo.pro	1/16/2025 10:42 AM	3 KB
🗟 htrademo.pro.user	1/16/2025 2:51 PM	20 КВ
SWP_TraceAverage.cpp	1/9/2025 9:29 PM	6 KB
B		

2. Click on the project to configure a build environment for it.

htrader	rtrademo - Qt Creator — 🔿 🗙						
File Edit	View Build Debug Analyze Tools	Window Help					
G Welcome	Manage Kits	Build Settings Edit build configuration: Debug >/ Add • Remove Rename Clone					
Edit	Active Project	General					
Design	Import Existing Build	Shadow build: Build directory: C(Lisers(60539)Desktop)/HTRA.QC, Examples/htrademolbuild(Desktop,QC,5,15,2,MSVC2019, 64bit-Debug		Browse			
Debug	Build & Run	A The build directory should be at the same level as the source directory. Tooltip in target selector:					
Projects	Desktop Qt 5.15.2 MinGW 6	Separate debug info: Default		~			
22 Extensions	Desktop Qt 5.15.2 MSVC2 P Build	QML debugging and profiling: Enable QML debugging and profiling: Enable					
0	► Run	Qt Quick Compiler: Default		~			
Help	 Python 3.13.0 	amake system() behavior when parsing: Use global setting		~			
	Hide Inactive Kits						
	Project Settings	Build Steps					
	Editor	qmake: qmake.exe htrademo.pro		Details 🔻			
	Language Server Code Style	Make: jom.exe in C:\Users\60536\Desktop\HTRA_Qt_Examples\htrademo\build\Desktop_Qt_5_15_2_MSVC2019_64bit-Debug		Details 🔻			
	Documentation Comments Dependencies	Add Build Step •					
	Environment	Clean Steps					
	C++ File Naming C++ Code Model	Make: jom.exe clean in C\Users\60536\Desktop)HTRA_Qt_Examples\htrademo\build\Desktop_Qt_5_15_2.MSVC2019_64bit-Debug		Details 🔻			
htrademo	Clangd Ouick Fixes	Add Clean Step •					
	Clang Tools	Build Environment					
Debug	CMake						
⊳	Testing	Use System Environment		Details 🔻			
۵ ه		Custom Output Parsers					

3. After configuring the build environment, click on Edit, and then click on main.cpp in the Sources folder of the htrademo project.



4. Since each example in the Qt provided examples is encapsulated in a separate function, you can simply uncomment the desired example when usin g it (multiple examples cannot be used simultaneously). For instance, when te sting the Device_GetDeviceInfo example, uncomment it, save, and click run. T he image shown indicates that the device is operating normally.

cpp @ htrade	emo - Qt Creator			- 0	
Proj	iects - T. C I+ II	window Help 1 ⟨ main.cpp → X ∳ main() → int	- u e® ⊡	Line: 1, Col: 1	
	lOS MultiDevS	1 #include "example.h"			
J	IOS Multithrea	2 int main()			
ome					
=		int status - 0,			
-	C IQS_IImeringc	<pre>7 Status = Device_GetDeviceInfo(); 8 //Status = Device_SysPowerState();</pre>			
	G IQS_IoSpectru	<pre>9 //Status = Device_AboutGNSS(); //Status = Device_CotActGradies();</pre>			
e.	d main.cpp	<pre>10 //status = Device_DetAmaset(r(); 11 //status = Device_TimeOfSetMode();</pre>			
e 1	d mainwindow.c	12 13 //Status = SWP GetSpectrum Standard():			
2	RTAMode_EZSI	<pre>14 //Status = SWP_EZGetPartialSweep();</pre>			
•	RTAMode_Star	<pre>15 //Status = SMP_MaxHold_MinHold(); 16 //Status = SMP_TraceAverage();</pre>			
9	RTAMode Star	<pre>17 //Status = SMP_AutoSetMeasure(); 18 //Status = SMP_AutoSetMeasure();</pre>			
,	CIM/D AutoSath	<pre>//status = SWP_Time0fSetFunction();</pre>			
-	CWD Callbasta	20 //Status = SMP_PickNaxPower(); 21 //Status = SMP_GetSpectrum SigndSpur();			
	G SWP_Calibrate	<pre>22 //Status = SWP_GetSpectrumAndIQS(); //Status = SWP_GetSpectrumAndIQS();</pre>			
2	G SWP_EZGetPar	23 //status = sme_onsonerie ence.tot(); 24 //status = SiN_ectspectrum_Iriger();			
10.0	SWP_Fixedtime	25 //Status = SMP_GetSpectrum_TraceAlign(); 26 //Status = SMP_GetSpectrum_TraceAlign();			
	GetSpect	<pre>27 //Status = SMP_CalibrateRefClock();</pre>			
2	Charlen Catenart	28			
		38 //Status = 105_Get10_EZStandard(); //Status = 105_Get10_EZStandard();			
no Op i	en Docume_ 🔹 🖽 🖃	<pre>31 //Status = log_oriz(ziandard(); 32 //Status = IQS_scalelQoatarovoits();</pre>			
1 🤷	main.cpp *	<pre>33 //Status = IQS_ConfigandGetIQ_Time(); 34 //Status = IQS_ToSpectrumByLiguid();</pre>			
· •		<pre>25 //Status = IQS_AudioAnalysis();</pre>			
9		Application Output Ag A Pilter + -			
		htrademo 🗵			
8		11:81:17: Starting C:\Users\68536\Desktoo\New folder (3)\HTRA 0t Examples\htrademo\build\Desktop 0t 5 15 2 MSV2019 64bit-Deb	ug\debug\htrademo.exe		
		htra api verion: 0.55.55			
5		BusSpeed: 3			
		Model: 13, E90 R3			

3.3 Qt Example Description

The purpose of the Qt examples can be directly referenced in the C/C++ examples section.

4. Python

4.1 Configure Development Environment

Create a folder on the desktop and name it, for example, test. Open the USB drive and copy the "HTRA_API" folder and "htra_api.py" file from "\Windows\HTRA_API_Example\HTRA_Python_Examples" on the USB drive to the newly created folder.

🖵 > … Windows > HTRA_API_Exar	mple > HTRA_Python	_Examples >	Search HTRA_P
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Name	Date modified	Size	
HTRA_API	1/8/2025 11:03 AM		
ASG_CWOutput.py	1/8/2025 11:00 AM	4 KB	
DET_GetPowerTrace_Standard.py	1/8/2025 10:43 AM	6 KB	
Device_GetDeviceInfo.py	1/8/2025 10:45 AM	3 KB	
DSP_IQSToSpectrum.py	1/8/2025 10:56 AM	7 KB	
htra_api.py	12/9/2024 7:18 PM	62 KB	
IQS_GetIQdata_Standard.py	1/8/2025 10:37 AM	6 KB	
👼 python Call HTRA API Manual_CN.pdf	6/17/2024 4:20 PM	587 KB	
RTA_GetRealTimeSpectrum_Standard.py	1/8/2025 10:37 AM	6 KB	
SWPMode_Standard.py	1/8/2025 10:06 AM	4 KB	
🚬 test X +			
\leftarrow \rightarrow \uparrow C \square \rightarrow This PC	> OS (C:) > Users >	60536 > Desktop > test	
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🕖 Music 🛷 Name	^ Da	te modified Type	Size
Videos 🖈 📓 htra_api.py	5/9	9/2024 6:28 AM JetBrains PyCha	arm 55 KB
🖿 IDE 🔰 HTRA_API	6/1	17/2024 3:12 PM File folder	
CopyFFW			

2. Open Visual Studio Code, click on File and then Open Folder, and open the

folder you just created.

×1 F	ile Edit Selection View G	io Run Terr	minal Help \leftarrow \rightarrow	₽ Search		□□□₀; -	σx
¢	New Text File New File Ctrl+Alt+V	Ctrl+N Vindows+N					
ρ							
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÷	Open Workspace from File						
т вS	Add Folder to Workspace		ig evolved				
	Save Workspace As			Walkthroughs			
œ	Save			Get Started with VS Code Customize your editor, learn the basics, and s	tart coding		
	Save All			Get Started with GitLens Updaled			
				Get Started with C++ Development			
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	🛃 Downloads	*	SAStudio4 (0.55.5)	5/29/2024 5:52 PM	File folder		
	Documents	*	SAStudio4 (English)	6/4/2024 10:09 AM	File folder		
	Pictures	*		5/31/2024 11:35 AM	File folder		
	Musia			5/51/2024 11.55 AW		_	
		*	iest 🔤 test	6/17/2024 3:39 PM	File tolder		
	🛂 Videos	*	📒 updater	6/4/2024 1:51 PM	File folder		
		Folder	test				
		. oraci.					
					Select Folder	Cance	el

3. Create a new Python file.

📢 File Edit Selection View Go Run Terminal Help	← →	,D test	
If the fails belocion View Go Aust Immined Help: Immined Transmission Immined Transmission	 ★ → Visual Studio Code Editing evolved Start Creefic. Creefic. 	ρ2 wa Walkthroughs Continuous after kenn heines, and dat odde Continuous after kenn heines, and dat odde	0000 - 0 ×
	 Quertine. Convertine. 	Collimits your editic fram the basics, and start colling (*) Get Started with Citizms Specific Get Started with C++ Development More.	
© → OUTLINE ⇔ TIMELINE		🗸 Show welcome page on startup	

4. Write code normally. You can refer to the Python examples included in the USB drive, specifically in the folder "\Windows\HTRA_API_Example\HTRA_Python_Examples" for the project.

XI (
Ф							
0							
~	🔹 htra_api.py						
90							
Pr.			4 St	atus = 0			in the second se
~				vice = c_void_p()			
a>			7 80	otProfile BootProfile	typeDef()		
_			8 80	otInfo = BootInfo TypeDe			
HP I			9 BO	otProfile.DevicePowerSup	ly = DevicePowerSupply_TypeDef.US8P	ortAndPowerPort	
-			10 80	otProfile.PhysicalInterf	<pre>sce = PhysicalInterface_TypeDef.US8</pre>		
л				atus = dll.Device_Open(p	pinter(Device),DevNum,pointer(BootPr	ofile),pointer(BootInfo))	
				(Status == 0):			
0							
				print("Device opening "			
			20 SM	P_ProfileIn = SHP_Profil			
			21 SN	P ProfileOut = SMP Profi			
				1.SMP_ProfileDeInit(point	ter(Device),pointer(SMP_ProfileIn))		
			24 SN	P_ProfileIn.CenterFreq_H			
				elysisSpan = 50e6			
			26 SN	P_ProfileIn.FreqAssignmen	t=SWP_FreqAssignment_TypeDef.Center	Span	
			27 SN	P_ProfileIn.RBaMode = RB	Mode_TypeDe+.RBk_OneThousandthSpan		
			28 58	Provide a dil SVD Configures	Mode_TypeDet.Rew_UnePercentspan	FileTel seistes/SUB BasEileCut) seistes/To	
			20 10	(Status as Q):			
				print("Configuration d	istribution successful")		
				print("Configuration d			
Q			38 Fr	equency [c_double Tru	ceinto.FullsweeptracePoints)()		
~			40 00	nerspec_use (c_tiost	[naceInfo PartialsweepTracePoints]()		
\$22	> OUTLINE		41 Pa	ctialSner (c_float T	raceInfo, PartialsweenTracePoints)()		
233	> TIMELINE		42 Ho	pIndex = c int(0)			

4.2 Python Example Usage Process

The usage process of the Python examples included in the USB drive is as follows:

1. As shown in the figure, open the entire project using vscode or anot her compiler from the USB drive provided: Windows\HTRA_API_Example\HTRA _Python_Examples. The htra_api.py file in the project is the mapping file for the dynamic link library in Python, while the other files are example program s (the role of the examples will be described in subsequent chapters).



2. Select any example program, configure the Python environment for it, and run the program directly. For instance, when using the SWPMode_Standar d.py example, the device is shown to be operating normally as illustrated.

×			P HTRA_Python_Examples	8 ~	0: 🗖 🗖 –		
Сŋ		SWPMode_Standard.py X				Þ 🗹 B	
	HTRA_PYTHON_EXAMPLES				Run Python File		
Q	> _pycache_				Run Python File in Dedicated Terminal		
-	> HTRA_API						
90	ASG_CWOutput.py	3 Status = 0			Python Debugger: Debug Python File		
2	DET_GetPowerTrace_Standard.pv	4 Device = c_void_p			Python Debugger: Debug using launch.is	ion 📄	
~	Device GetDeviceInfo.py	S Devium = c_int(0)					
a>	DSP IOSToSpectrum.pv	7 BootProfile = Boot	Profile TypeDef()				
	htra aniny	8 BootInfo = BootInf	o TypeDef()				
EFF .	IOS GetIOdata Standard nv						
	python Call HTRA API Manual CN pd	f 10 BootProfile.Device	PowerSupply = DevicePowerSupply_TypeDef.USBPortAndPowerPort				
д	RTA GetRealTimeSpectrum Standard	11 BootProfile.Physic	alInterface = PhysicalInterface_TypeDef.USB				
	CWDMode Standard m						
		13 #BootProfile.Physi	calInterface = PhysicalInterface_TypeDef.ETH				
		15 #BootProfile ETH 6	emoteDoort = 5000				
-		16 #BootProfile.ETH B	eadTimeOut = 10000				
e5							
		22 Status = dil.Devic	e_open(pointer(Device),DevNum,pointer(BootProfile),pointer(Bootin	110))			
		24 print("Device	is opened successfully")				
			ONSOLE TERMINAL PORTS			<u>ن</u> … ب	
		PS F:\Windows\HTRA API Exa	mple\HTRA Python Examples>				
		PS F:\Windows\HTRA_API_Exa	mple\HTRA_Python_Examples>				
		PS F:\Windows\HTRA_API_Exa	mple\HTRA_Python_Examples>				
		PS F:\Windows\HTRA_API_Exa	mple\HTRA_Python_Examples>				
		PS_F:\Windows\HTRA_AP1_EX	mple(HTRA_Python_Examples>				
0		PS F:\Windows\HTRA API Exa	mple\HTRA Python Examples> & C:/Users/60536/AppData/Local/Programs/Py	thon/Python38/python.	exe f:/Windows/HTRA API Example/HTRA	Python E	xampl
8		es/SWPMode_Standard.py					
072		 Device is opened successful 	lly				
503	> TIMELINE	Configuration defievery su	cceeded				
1	Released Qala Ma	U		1-14	CARD COMPANIES IN DAMAGE		

4.3 Python Example Description

4.3.1 Get device information

Device_GetDeviceInfo.py: Retrieves various device information, including API version, USB version, device model, device UID, MCU version, FPGA version, and device temperature.

4.3.2 Obtain Standard Spectrum Data

SWP_GetSpectrum_Standard.py: Obtains complete spectrum data within a specified frequency band.

4.3.3 Obtain IQ Data for a Fixed Number of Points or Duration

IQS_GetIQdata_Standard.py: Obtains IQ data under different trigger modes in IQS mode.

4.3.4 Obtain Power Detection Data for a Fixed Number of Points or Duration

DET_GetPowerTrace_Standard.py: Obtains power detection data under different trigger modes in DET mode.

4.3.5 Obtain real-time spectrum data for a fixed number of points or duration

RTA_GetRealTimeSpectrum_Standard.py: Obtain real-time spectrum data under different trigger modes in RTA mode.

4.3.6 IQ to Spectrum Data

DSP_IQSToSpectrum.py: Convert the IQ data obtained in IQS mode into spectrum

data.

5. Matlab

5.1 Configure Development Environment

The method of calling htra_api in 32-bit is basically the same as in 64-bit, so the following tutorial uses Matlab 2016a as an example to illustrate how to call the 64-bit htra_api.

5.1.1 Install MSYS2

Download and installation link: https://www.msys2.org/https://www.msys2.org/

- 1. Download the installer MSYS2-x86_64-20231026.exe
- 2. Run the installer. MSYS2 requires 64-bit Windows 8.1 or higher.
- 3. The default installation path is C:\msys64, but you can choose a different path

as needed.

MSYS2 Setup	×
Installation Folder	Installation Folder Please specify the directory where MSYS2 will
Start Menu shortcuts Installing	C:\msys64 Browse
Finished	
	Next Cancel

4. Once completed, click Finish.

	×
MSYS2 Setup	
Installation Folder	Completing the MSYS2 Wizard
installation rolder	Click Finish to exit the MSYS2 Wizard.
Start Menu shortcuts	Run MSYS2 now.
Installing	
Finished	
	Einish

5. Now, MSYS2 is ready, and the terminal for the UCRT64 environment has started.



6. To install the GCC tools, enter the command: pacman -S mingw-w64-ucrtx86_64-gcc

<u>M</u> ~	-	×
32322@harogic UCRT64 ~		-
\$ pacman -5 mingw-wb4-ucrt-x86_64-gcc		

7. The terminal window will display the following output. Press "Enter" to

continue.

<u>M</u> ~	_		×		
32322@harogic UCRT64 ~ \$ pacman -5 mingw-w64-ucrt-x86_64-gcc resolving dependencies looking for conflicting packages					
<pre>Packages (15) mingw-w64-ucrt-x86_64-binutils-2.41-2 mingw-w64-ucrt-x86_64-crt-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-gcc-libs-13.2.0-2 mingw-w64-ucrt-x86_64-gmp-6.3.0-2 mingw-w64-ucrt-x86_64-isl-0.26-1 mingw-w64-ucrt-x86_64-libiconv-1.17-3 mingw-w64-ucrt-x86_64-libwinpthread-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-mingthread-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-mingthread-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-mingthread-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-winpthreads-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-winpthreads-git-11.0.0.r239.g037ba0184-1 mingw-w64-ucrt-x86_64-zibi-1.3-1 mingw-w64-ucrt-x86_64-zstd-1.5.5-1 mingw-w64-ucrt-x86_64-gcc-13.2.0-2</pre>					
Total Download Size: 49.38 MiB Total Installed Size: 418.89 MiB					
:: Proceed with installation? [Y/n] y					
mingw-w64-ucrt-x86_6 6.1 MiB 2043 KiB/s 00:03 [####################################	########	##] 10	00%		
mingw-w64-ucrt-x86_6 3.4 MiB 939 KiB/s 00:04 [####################################	########	##] 10	00%		
mingw-w64-ucrt-x86_6 6.0 MiB 1453 KiB/s 00:04 [####################################	########	##] 10	00%		
mingw-w64-ucrt-x86_6 1452.1 KiB 340 KiB/s 00:04 [########################	########	##J 10	00%		

8. Enter the command gcc --version to check the version information of GCC.

<u>M</u> ~	- 0	×
Processing package changes		
(1/15) installing mingw-w64-ucrt-x86 64-libwinpth	[#####################################	100%
2/15) installing mingw-w64-ucrt-x86 64-gcc-libs	[<i>#################################</i>]	100%
3/15) installing mingw-w64-ucrt-x86 64-zstd	[<i>################################</i>]	100%
4/15) installing mingw-w64-ucrt-x86_64-binutils	[<i>#################################</i>]	100%
5/15) installing mingw-w64-ucrt-x86_64-headers-git	[<i>################################</i>]	100%
6/15) installing mingw-w64-ucrt-x86_64-crt-git	[#####################################	100%
7/15) installing mingw-w64-ucrt-x86_64-gmp	[###################################	100%
8/15) installing mingw-w64-ucrt-x86_64-isl	[#####################################]	100%
9/15) installing mingw-w64-ucrt-x86_64-libiconv	[###################################	100%
(10/15) installing mingw-w64-ucrt-x86_64-mpfr	[####################################]	100%
<pre>(11/15) installing mingw-w64-ucrt-x86_64-mpc</pre>	[######################################	100%
12/15) installing mingw-w64-ucrt-x86_64-windows-d	[######################################	100%
(13/15) installing mingw-w64-ucrt-x86_64-winpthrea	[#####################################]	100%
14/15) installing mingw-w64-ucrt-x86_64-zlib	[######################################	100%
<pre>(15/15) installing mingw-w64-ucrt-x86_64-gcc</pre>	[####################################]	100%
2322@harogic UCRT64 ~		
accversion		
acc exe (Rev2 Ruilt by MSYS2 project) 13 2 0		
opyright (C) 2023 Free Software Foundation. Inc.		
This is free software: see the source for copying cond	litions. There is NO	
varranty: not even for MERCHANTABILITY or FITNESS FOR	A PARTICULAR PURPOSE.	
arraney, not even for headmannibility of filmebb for	A PARTECEAR POR OBET	
32322@harogic_UCRT64 ~		

5.1.2 Configure Matlab

 Resolve the issue of Chinese characters appearing garbled when opening .m files in Matlab 2016a.

Note: If you are using a version of Matlab higher than 2019a, please ignore

this step.

(1) Check the current encoding format:

In the Matlab command line, enter: feature('locale')

Со	mmand Window		\odot
	>> feature('locale')		
	ans =		
	ctype:	'zh_CN.GBK'	
	collate:	'zh_CN.GBK'	
	time:	'zh_CN.GBK'	
	numeric:	'en_US_POSIX.GBK'	
	monetary:	'zh_CN.GBK'	
	messages:	'en_US.GBK'	
	encoding:	' GBK'	
	terminalEncoding:	'GBK'	
	jvmEncoding:	'GBK'	
	status:	'MathWorks locale management system initialized.'	
	warning:	,,	
fx;	>>		

From the figure, it can be seen that the encoding format is GBK.

(2) Right-click the shortcut of Matlab2016a and select "Open file location"

to open the folder where Matlab.exe is located.

- (3) In the folder shown in step (2), find the two files lcdata.xml and lcdata_utf8.xml, rename lcdata.xml to lcdata_old.xml to back up the original lcdata.xml.
- (4) Copy lcdata_utf8.xml to the same folder and rename the newly copied file lcdata_utf8.xml to lcdata.xml.
- (5) Open Icdata.xml and delete the GBK-related code shown in the image below.



(6) Find the "UTF-8" section, add the code from the marked line in the

image to the corresponding position in the image, save lcdata.xml, and

then close the file.

	<pre><encoding name="UTF-8"></encoding></pre>
	<pre><encoding_alias name="utf8"></encoding_alias></pre>
531	<pre><rr></rr></pre> <pre></pre> <pre></pre> <pre></pre>

- (7) After restarting Matlab, the garbled Chinese characters will return to normal.
- Method 1 for configuring the compilation environment: configure in the script While running the script, execute the commands setenv('MW_MINGW64_LOC', 'D:\msys64\ucrt64') and mex -setup C++ to configure the compilation environment for the C++ programming language.

```
SWPMode_Standard.m × +
1
        % Configure the compilation environment
        setenv('MW_MINGW64_LOC', 'D:\msys64\mingw64');
2 -
3 -
            -setup C++
        mex
4
        filePath = fullfile(pwd, 'htra_api_mat');
5 -
6
        % Check if the folder exists, and if not, create the folder
7
       if ~exist(filePath, 'dir')
8 -
            mkdir(filePath); % Create a destination folder
9 -
            run('htra_api.m');
10 -
            filePath = fullfile(pwd, 'htra_api_mat');
11 -
12 -
       end
13
```

Note: D:\msys64\ucrt64 is the folder where the compilation environment is located. Please check if there are files such as c^{++} . exe, g^{++} . exe, and gcc. exe in the bin folder at this address. If they exist, this address is the compilation environment address; if not, please find the correct address of the compilation environment.

3. Method 2 for configuring the compilation environment: modify the startup.m file

(1) In the Matlab terminal, input: userpath, and the command line window

will output a result similar to: C:\Users\YourUsername\Documents\MATLAB

Cor	nmand Window
	>> userpath
	ans =
	C:\Users\ \Documents\MATLAB;
fx	>>

(2) Check if the startup.m file exists at C:\Users\YourUsername\Documents\MATLAB. If it does not exist, create a new startup.m file at this location. The steps for creation are as follows:

1) Matlab terminal input: cd('C:\Users\YourUsername\Documents\MATLAB'), switch the working directory to C:\Users\YourUsername\Documents\MATLAB.

Com	nmand Window
	>> userpath
	ans =
	C:\Users\ \Documents\MATLAB;
fx	<pre>>> cd('C:\Users\ \Documents\MATLAB') >> </pre>

2) Matlab terminal input: edit startup.m, select "Yes" in the pop-up window to

create the startup.m file.

Command Window	MATLAB Editor ×
// userpath	File C:\Users\& \Documents\MATLAB\startup.m does not exist. Do you want to create it?
ans =	Do not show this prompt again.
	Yes No
C:\Users\ \Documents\!	IATLAB;
>> cd('C:\Users\ \Docu	uments\MATLAB')
>> edit startup.m	
fx	

3) Add commands in the startup.m file.

setenv('MW_MINGW64_LOC', 'D:\msys64\ucrt64'); and mex -setup C++.



- 4) startup.m After editing the file, save and close it.
- 5) Restart Matlab, and observe that the command line window

appears as shown in the figure below, indicating that the configuration is complete.



Call htra_api.dll Description 5.1.3

loadlibrary 1.

The loadlibrary function can load dynamic link libraries. loadlibrary('.\htra api\htra_api.dll','.\htra_api\htra_api.h'); Ensure that the file paths for .dll and .

```
h are correct.
```

```
%Loadhtra_api.dll
if not(libisloaded('htra_api.dll'))
    %The file paths for .dll and .h files should be carefully noted
    loadlibrary('.\htra_api\htra_api.dll','.\htra_api\htra_api.h');
end
```

2. libfunctions

libfunctions('htra api'); This is used to view all available functions in htra api.dll.

%View all functions in the API libfunctions('htra_api');

3. libpointer

libpointer allows the creation of data type pointers in Matlab and passes them to external library functions.

```
%Open the device
%Create a Device pointer
Device = libpointer;
DevNum = 0;
Status = 0;
```

4. libstruct

libstruct is used to define structure types in Matlab and pass them to external

library functions.

```
%Create a BootProfile structure.
BootProfile = libstruct('BootProfile_TypeDef');
save(fullfile(folderPath, 'BootProfile.mat'), 'BootProfile');
%Create the DeviceInfo structure
DeviceInfo = libstruct('DeviceInfo_TypeDef');
save(fullfile(folderPath, 'DeviceInfo.mat'), 'DeviceInfo');
```

5. get

The get function is used to retrieve the property values of a structure.

```
%Call the Device_Open function
Status = calllib('htra_api', 'Device_Open', Device, DevNum, BootProfile_p, BootInfo_p);
get(BootInfo_p); %Print the value of BootInfo_p
```

6. calllib

calllib is the command in Matlab used to call functions in htra_api.dll.

```
%Call the Device_Open function
Status = calllib('htra_api', 'Device_Open', Device, DevNum, BootProfile, BootInfo);
get(BootProfile);%Prints the value of BootInfo_p
```

7. load

load is used to load the .mat structure files generated in htra_api.m.

```
% Load the BootProfile_TypeDef structure directly.
load(fullfile(filePath, 'BootProfile.mat'));
% Load the BootInfo_TypeDef structure directly
load(fullfile(filePath, 'BootInfo.mat'));
```

8. fullfile

fullfile is a function in Matlab used to generate complete file paths. It loads the BootProfile.mat and BootInfo.mat files from the filePath.

```
% Load the BootProfile_TypeDef structure directly.
load(fullfile(filePath, 'BootProfile.mat'));
% Load the BootInfo_TypeDef structure directly
load(fullfile(filePath, 'BootInfo.mat'));
```

9. unloadlibrary

unloadlibrary is used to unload a previously loaded htra_api library, appearing in pairs with loadlibrary.

%Unload library file unloadlibrary('htra_api'); disp('Uninstall complete')

5.2 Matlab example usage process

The usage process for the Matlab examples included on the USB drive is as follows:

1. Open the Windows\HTRA_API_Example\HTRA_Matlab_Examples folder o n the USB drive, and double-click any .m file to open the example. For instr uctions on how to run the example, please refer directly to step 4.

2. If you cannot open the example in step 1, please continue to this st ep and copy the address Windows\HTRA_API_Example\HTRA_Matlab_Examples.

〕	∵ ≣ View ∵			Copy Address as Text
Name	Date modified	Туре	Size	Edit Address
📒 htra_api	1/16/2025 1:46 PM	File folder		
ASG_CWOutput.m	1/9/2025 5:46 PM	M File	7 KB	Delete History
CreatPeakMarker.m	1/9/2025 3:51 PM	M File	6 KB	
DETMode_Standard.m	1/9/2025 3:50 PM	M File	6 KB	
Device_QueryDeviceInfo.m	1/9/2025 12:03 PM	M File	5 KB	
DSP_IQSToSpectrum.m	1/9/2025 3:49 PM	M File	7 KB	
GNSS_DOCXO_LockState.m	1/9/2025 5:08 PM	M File	5 KB	
htra_api.m	1/9/2025 12:02 PM	M File	4 KB	
IQSMode_MultiDevSync_Standard.m	1/9/2025 3:40 PM	M File	9 KB	
IQSMode_Standard.m	1/9/2025 3:41 PM	M File	7 KB	
RTAMode_Standard.m	1/9/2025 3:33 PM	M File	6 KB	
RTAMode_Standard_new.m	1/14/2025 5:24 PM	M File	10 KB	
SWPMode_per5minute_findMax.m	1/9/2025 3:29 PM	M File	6 KB	
SWPMode_Standard.m	1/16/2025 2:24 PM	M File	6 KB	

3. Open the Matlab software installed on your system.

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HOME R.OTS APPS	mentation 👂 🛣
Conception Conceptica Conceptica Conceptica Conceptica Conceptica Conceptica	
	- P
Current Folder 💿 Command Window	♥ Workspace ●
MEX configured to use 'MinGW64 Compiler (C++)' for C++ language compilation. Warning: The MATLAB C and Fortran AFI has changed to support MATLAB d d d d d d d d d d d d d d d	Name -

4. After pasting the copied address into the file address box, press Ente r to navigate to the \Windows\HTRA_API_Example\HTRA_Matlab_Examples fold er included with the materials.

A MATI 48 220161

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item New Open (Cord const New Open (Cord rest 2012) + (Cord rest 20	nd Files oncpare Import Data Desktop • ©	Command Without Service Command Without Service	• W
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 5. Click on the .m file on the left as needed, click "Run," and wait for the Figure 1 window to appear, indicating that the example has run successfu lly. For the functional descriptions of each example, please refer to section 5.
 2 Matlab Example Description.



5.3 Introduction to Accompanying Examples

5.3.1 Get device information

Device_QueryDeviceInfo.m: Retrieve device information, including API versi on, USB version, device model, device UID, MCU version, FPGA version, and d evice temperature.

5.3.2 Obtain Standard Spectrum Data

SWPMode_Standard.m: Obtain complete spectrum data within the specifie d frequency band.

5.3.3 Create multiple cursors to display the frequency and power of the cursors.

CreatPeakMarker.m: Obtain spectrum data within the specified frequency band, create cursors, and perform peak searching.

5.3.4 Collect the peak spectrum every five minutes.

SWPMode_per5minute_findMax.m: Obtain spectrum data within the specifi ed frequency band and search for the peak globally every five minutes.

5.3.5 Obtain continuous stream or fixed number of IQ data.

IQSMode_Standard.m: Acquire IQ data under different trigger modes in I QS mode.

5.3.6 The acquired IQ data is converted into spectrum data.

DSP_IQSToSpectrum.m: After acquiring IQ data, the obtained IQ data is c onverted into spectrum data.

5.3.7 Acquire continuous stream or fixed number of power detect ion data.

DET_GetPowerTrace_FixedPoints.m: Acquire power detection data under dif ferent triggering modes in DET mode.

5.3.8 Acquire continuous stream or fixed duration real-time spectr um data.

RTAMode_FixedPoints.m: Acquire real-time spectrum data under different t riggering modes in RTA mode.

5.3.9 Internal signal source output signal.

ASG_CWOutput.m: Output single-tone signals, frequency sweep signals, an d power sweep signals. Applicable only to devices with signal source options.

5.3.10 Lock GNSS antenna and DOCXO oscillator.

GNSS_DOCXO_LockState.m: Call the API interface to lock the GNSS antenn a and DOCXO oscillator, applicable only to devices with IO expansion board o ptions.

5.3.11 Multi-machine synchronization

IQSMode_MultiDevSync_Standard.m: When using the same reference clock source input and the same trigger source input, two devices simultaneously a cquire IQ data, allowing for the observation of the synchronization of their co llected data.

6. C#

6.1 Configure Development Environment

6.1.1 Development Environment Confirmation

Open Visual Studio Installer, check the .NET desktop development components and Universal Windows Platform development components, and click Modify to ensure that Visual Studio 2019 has the C# development environment.

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stalling – Visual Studio Community 2019 – 16.11.37							
Norkloads Individual components Language packs	Installation locations						
Python development Editing, debugging, interactive development and source control for Python.	Node.js development Build scalable network applications using Node.js, an asynchronous event-driven JavaScript runtime.	lı •	Desktop dev	etails elopme	nt with	C++	
Desktop & Mobile (5)		_	✓ C++ core	e desktop f	eatures		
WET desktop development Build WPF, Windows Forms, and console applications using C#, Visual Basic, and F# with .NET and .NET Frame	Desktop development with C++ Build modern C++ apps for Windows using tools of your choice, including MSVC, Clang, CMake, or MSBuild.	8	MSVC v1 Windows Just-In-Ti C++ prof C++ CM	42 - VS 20 10 SDK (1 ime debug filing tools ake tools fo	19 C++ x 0.0.19041 ger or Windou	54/x86 bi .0) ws	uild t
Universal Windows Platform development Create applications for the Universal Windows Platform with C#, VB, or optionally C++.	Mobile development with .NET (out of support) Build cross-platform applications for iOS, Android or Windows using Xamatin.		 C++ ATE Test Adag Test Adag Live Shar IntelliCox C++ Atf 	pter for Bo pter for Bo pter for Go e de	ost.Test ogle Test	i toois (xi	30 Q
Mobile development with C++ Build cross-platform applications for IOS, Android or Windows using C++.			C++ Add MSVC v1- C++ MFC C++/CLI C++/CLI C++ Cla	42 - VS 20 C for latest support fo dules for v	er 19 C++ A v142 buil r v142 build Window	RM64 bu d tools () ild tools tools (x6 s (12.0.0	iild t (86 (Late 4/x8 - x64
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6.1.2 Project Setup

1. Open Visual Studio 2019 and click on Create a New Project.

				_	_
Visual Studio 2019					
Open <u>r</u> ecent		Get sta	rted		
Search recent (Alt+S)	- م	→Ï	<u>Clone a repository</u> Get code from an online repository like GitHub or Azure DevOps		
 Yesterday This week This month 		Ъ	Open a project or solution Open a local Visual Studio project or .sln file		
		2	Open a local folder Navigate and edit code within any folder		
		*3	Create a <u>new project</u> Choose a project template with code scaffolding to get started		

2. Select C# Console Application and click Next.



3. Enter the project name and storage location, uncheck the option to place the solution and project in the same directory. Select .NET Framework 4.5 as the framework, and finally click Create.

		-		×
Configure your new project				
Console App (.NET Framework) C# Windows Console				
Project name				
ConsoleApp1				
Location				
C:\Users\60536\Desktop				
Solution name 🛈				
ConsoleApp1				
Place solution and project in the same directory				
Framework				
.NET Framework 4.5 -				
	Back		ate	

4. Once the creation is complete, open the project, right-click on the solution,

and select Add New Project.

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This item does not support previousing	,	Add to Source Control Age

5. Select Class Library (.NET Framework) under Library type for the project type,

and click Next.



6. The library name can be modified as needed, such as HtraApi, and the location should not be changed, remaining at the same directory level as the solution. The result is shown in the figure, select the .NET Framework 4.5 framework, and click Create.

	e yo	ur	IIC VV	1 J	~~	G							
Class Library (.NI	ET Fram	newor	k) c#	Windows	LR								
Project name													
HtraApi													
Location													
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Framework													
.NET Framework 4.5													
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ConsoleApp1		×	+						1	Back	-	eate	×
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7. Right-click on ConsoleApp1 and select Properties.

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2 Using System.Collections.Generic;			Solution Toncoletano II D of 3 projects	
4 using System.Ling;			ConsoleApp1	
5 using System.Threading.Tasks;			L Build	
			Rebuild	
7 Cnamespace ConsoleApp1			Gean	
			Analyze and Code Cleanup	
9 A class Program			Publish	
			Scope to This	
11 Static void Main(string[] args)			Vew Solution Explorer View	
			Build Dependencies	
			Manage NuGet Packages	
			Be Cat as Startup Deciart	
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			Debug	
			Initialize Interactive with Project	
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			Load Direct Dependencies of Project	
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		- a v	P Copy Full Path	
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Show output from:			Open in lerminal	
		یا ہے ا	Properties	Alt+Enter

8. View the project's build properties, change the target platform to x86, click Debug, enter htra_api\ in the working directory, and save. If the situation in Figure 12 occurs, click OK and save again.

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Warning level: 4 ~			
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		 Start external program: 		Browse		P References P App.config
		Start browser with URL:				Program.cs
		Start options				HtraApi
	Signing	Command line arguments:				
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		Debugger engines		working directory.	a server a server of versa	
		Fnable native code debu	inging			
		Enable SQL Server debu	gging		OK	

9. Right-click on the library HtraApi and select Properties.



10. View the library's build properties, change the target platform to x86, and save.

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11. Copy the contents of the HtraApi.cs file from the folder \Windows\HTRA_API_Example\HTRA_C#_Examples included in the accompanying materials to the Class1.cs file in the project library and save.

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12. Select the ConsoleApp1 project, right-click on References, and choose Add Reference.



13. Select the HtraApi library and confirm the addition of the library reference.

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14. Copy the htra_api folder from \Windows\HTRA_API\x86 on the accompanying USB drive to the Debug folder under the project's bin folder, and ensure that the CalFile folder within the htra_api folder contains the calibration files.

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15. Write code normally. You can refer to the C# examples included in the accompanying USB drive, specifically the projects in \Windows\HTRA_API_Example\HTRA_C#_Examples.

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6.2 C# Example Usage Process

The usage process of the C# examples included in the USB drive is as follows:

1. Open the USB drive using Visual Studio and navigate to the folder W indows\HTRA_API_Example\HTRA_CSharp_Examples, then open the solution file HTRA_CSharp_Examples.sln.

□ > USB Drive (F:) > Windows >	HTRA_API_Example > H	TRA_CSharp_Examples	>
ີ ຝີ້ 🖻 🕅 🕅 Sort ∽	Wiew - ····		
Name	Date modified	Туре	Size
HTRA_CSharp_Examples	1/8/2025 4:11 PM	File folder	
늘 HtraApi	1/8/2025 4:11 PM	File folder	
🚞 packages	1/8/2025 4:11 PM	File folder	
HTRA_CSharp_Examples.sln	11/27/2024 3:58 PM	Visual Studio Solution	2 KB
🖺 HtraApi.cs	7/1/2024 4:13 PM	C# Source File	182 KB
Readme.txt	6/11/2024 8:15 PM	Text Document	1 KB

 Click on the HTRA_CSharp_Examples project on the right side, and th en click on the Programe.cs file.

Object Browser	Program.cs* a X		🗕 🗢 Solut	ion Explorer 👻 🖣 🗙
HTRA_CSharp_Exam	iples v KHTRA_CSharp_Examples.Program		• 🕂 💿	ି 🖞 🖉 ୀତ - 😂 🖒 🖉 🔞 🗠 🗡 🕺
			Sear	h Solution Explorer (Ctrl+:)
	space HTRA CSharp Examples			HTRA_CSharp_Examples
				Properties
	oreferences class Program			App.config
10 🖋				c= ASG_CWOutput.cs
	static void Main(string[] args)			c* Demodulation.cs c* DET GetRowerTrace Standard.cs
12				c* Device_GetDeviceInfo.cs
13 14	Device GetDeviceInfo Device GetDeviceInfo = new Device GetDevic			 c* DSP_DDC.cs ca DSP_IOST=Superstrum as
15	<pre>Device_GetDeviceInfo.Example();</pre>			 c= DSP_LQSIOSpectrum.cs c= DSP_LPE.cs
16	//SWD GatSpactnum Standard SWD GatSpactnum Standard - new SWD (GetSnectrum Standard():		c* IQS_GetIQdata_Standard.cs
18				packages.config
19				c= RTA_GetRealTimeSpectrum_Standard.cs
	<pre>//iQS_GetIQdata_Standard IQS_GetIQdata_Standard = new IQS_GetIQ //IQS_GetIQdata_Standard.Example();</pre>			c= SWP_GetSpectrum_Standard.cs
22				ca HtraApi
	<pre>//RTA_GetRealTimeSpectrum_Standard_RTA_GetRealTimeSpectrum_Stan //RTA_GetRealTimeSpectrum_Standard_Example():</pre>	ndard = new RTA_GetRealTimeSpectrum_Standard();		
25				
			Solut	tion Explorer Git Changes
28			-	erties - + + ×
106 % • 🧭 No is	sues found 🔰 🔮 👻 🖣			
			• # ×	a 🖉
Show output from: D	ebug	(1997_00 (1997) A Contraction (1997)	r · vurppus reasing	
'ETRA_CSharp_Examp	les.exe' (CLR v4.0.30319: HTRA_CSharp_Examples.exe): Loaded 'F:\Windows\HTRA_API_Example\HTRA_API_Examples.exe'	comarp_Examples(nina_connrp_Examples(on(Decog(nina_connrp_ ample\HTRA_CSharp_Examples(HTRA_CSharp_Examples(bin)Debug(H	traApi.dll'. Symbol	
The program '[2203	[2] HTRA_CSharp_Bxamples.exe' has exited with code -1073741510 (0xc000013a).			

3. Since each example in the C# included examples is encapsulated in a separate class, you can run the examples by uncommenting them (multiple ex amples cannot be used simultaneously). For instance, when testing the Device _GetDeviceInfo example, uncomment it and click run; as shown in the figure, the device is running normally.
| b() File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help Search (Corr+Q) P HTRA_CSharp_Examples | Sign in 🗛 — 🗇 🗙 |
|---|--|
| | 🖻 Live Share 🕅 |
| General Program.cs 🐵 🗙 | |
| Control C | <u> </u> |
| 4 USING System. Treading. Tasks; | Search Solution Explorer (Ctrl+;) |
| <pre>1</pre> | Solution TRRA Charp Example: (2 of 2 project ¹/₂ ¹ Birderscas ¹ A Charp Example: (2 of 2 project ¹/₂ ¹ Birderscas ¹ Apocoting ¹ Birderscas ¹ Apocoting ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas ¹ Control Birderscas |
| DeviceInfo.DeviceUlD: 3122511900300940 24 MCU Firmware: 0.5.15 5 FPGG.Firmware: 0.5.15 5 Device Temperature: 70.42°C | Git Changes |
| 28 [process evited with code 0 (0x00000000)] | - # × |
| <pre>tosx • @> [process exited with code 0 (0x000000000)] Vou can now close this terminal with Ctrl+0, or press Enter to restart. Snew output form 'Final compress 'The program'[] termorList Codema 'The program'[]</pre> | |
| 🗇 Ready | 🔶 🔺 Add to Source Control 🔺 |

6.3 C# Example Descriptions

6.3.1 Get device information

Device_GetDeviceInfo.cs: Retrieves device information including API version, USB version, device model, device UID, MCU version, FPGA version, and device temperature.

6.3.2 Obtain Standard Spectrum Data

SWP_GetSpectrum_Standard.cs: Obtains complete spectrum data within a specified frequency band.

6.3.3 Obtain IQ Data for a Fixed Number of Points or Duration

IQS_GetIQdata_Standard.cs: Acquires IQ data under different trigger modes in IQS mode.

6.3.4 Obtain Power Detection Data for a Fixed Number of Points or Duration

DET_GetPowerTrace_Standard.cs: Obtains power detection data under different trigger modes in DET mode.

6.3.5 Obtain real-time spectrum data for a fixed number of points or duration

RTA_GetRealTimeSpectrum_Standard.cs: Retrieves real-time spectrum data under different trigger modes in RTA mode.

6.3.6 Output single-tone signal

ASG_CWOutput.cs: Devices with signal source functionality options output

single-tone signals, frequency sweep signals, or power sweep signals through ASG functionality.

6.3.7 AM/FM Demodulation

Demodulation.cs: DSP_FMDemod performs FM demodulation and playback of the acquired IQ data. DSP_AMDemod performs AM demodulation and playback of the acquired IQ data.

6.3.8 IQ to Spectrum Data

DSP_IQSToSpectrum.cs: Converts the IQ data obtained in IQS mode into spectrum data.

6.3.9 Low-pass filtering

DSP_LPF.cs: Applies low-pass filtering to the acquired IQ data and converts it to spectrum.

6.3.10 Digital Downconversion

DSP_DDC.cs: Performs digital down-conversion on the acquired IQ data and converts it to spectrum.

7. Java (to be supplemented)

8. Labview

8.1 Configure Development Environment

8.1.1 Export library functions from htra_api.dll using LabVIEW

1. Create a folder (e.g., HTRA_Labview) and copy the htra_api folder from the USB drive located at Windows\HTRA_API\x86 into this folder. Then create another folder (e.g., VIS) to place the exported VIs.

This PC > Data (D:) > HTRA_L	abview >		Sea	arch HTRA_Labview	
(▲) (№) (ℕ) Sort ~ Ξ	≣ View ~ ···				
Name	Date modified	Туре	Size		
TIS VIS	11/15/2024 10:35 AM	File folder			
🚯 htra_api.dll	9/23/2024 11:01 AM	Application exten	930 KB		
c htra_api.h	11/13/2024 9:56 AM	C Header 源文件	137 KB		

2. LabVIEW does not recognize the uint64_t and int64_t data types during import, so before importing, all parameters of type uint64_t and int64_t need to be changed to double. Note that after exporting the functions, these modified parameter types should be changed back to uint64_t or int64_t in the VIs.



3. Change the encoding format of htra_api.h to UTF-8.

Go Bun	Jerminal Lielp	Select Action			
C htm_s		DET_F Reopen with Encoding			
D: > HTR	A_Labview > C htra_api.h >	Save with Encoding			
817	typedef struct				
818					
819	DeviceInfo_TypeDef DeviceInfo; // Device				
820			UTF-8 with BOM Guessed from content		
821	uint32_t-BusSpeed; // Bus speed inform		UTF-8 unt		
823	uint32 t APTVersion: // APT version		UTF-16LE utflife D UN-4521 ITTE 0		
824			UTF-16 BE utilities		
825			Western (Windows 1252) windows1252		
826			Western (ISO 8859-1) iso88591		
827	<pre>int WarningCodes[7]; // List c</pre>		Western (ISO 8859-3) iso88593		
828	int Warnings; // Total		Western (ISO 8859-15) iso885915		
829	Jacorineo_typeder;		Western (Mac Roman) macroman		
231			DOS (CP 437) cp437		
832			Arabic (Windows 1256) windows1256		
833			Arabic (ISO 8859-6) iso88596		
834	<pre>int16_t Temperature; // Equipment 1</pre>		Baltic (Windows 1257) windows 1257		
835	uint16_t RFState; // Radio statu		Baltic (ISO 8859-40 ico88594		
836	<pre>uint16_t-BBState; // Baseband st</pre>		Cettic (ISO 8859-14) iso885914		
837			Central European (Windows 1250) windows 1250		
810	float tatituda:	ordinates, corresponding to the current packet.	Central European 05() 8859-21 ind8502		
848	- float Longitude: // The Longitu	de coordinate corresponding to the current pa	Central European (CP 852) (m852		itinguish east longitude fr
841					
842	<pre>uint16_t GainPattern; // Gain control</pre>				
843					
844					
845	 uint32_t ConvertPattern; // Frequency c 				
840	uintsz_t wcoriw; // wco rrequer				
848	uint32 t SamleRate:				
849	uint16 t CPU BCFlag; // CPU-FFT-Spt	cifies the BC flag bit required for the frame			
858	wint16_t IFOverflow; - // If the equi				
851	uintl6_t DecimateFactor; // The extract				
852	 uint16_t OptionState; · · // Optional st 				
853					
004	DeviceState TuneDeft				
856					
857					
858					
859					
860	uint32_t MaxIndex; // Indicates				
861	<pre>tloat MaxPower_dBm; - // The maxim</pre>				
062	Intil to Tomanaturato - // Environment				
864	uintie t RFState: // Radio ste				
				Ln 830, Col 1 Tab Si	ze:4 UTF-8 with BOM LF () C+

4. Open LabVIEW, and select "Tools--->Import--->Shared Library."

🔄 LabVIEW		– 🗆 X
File Operate	Tools Help	
	Measurement & Automation Explorer	
	Instrumentation	
La	Merge	
	Security •	
	User Name	
-	Convert Build Script	
	Source Control	
-	LB Manager	
	Import 🕨	.NET Controls to Palette hg
	Shared Variable	ActiveX Controls to Palette
	Distributed System Manager	Shared Library (.dll)
-	Find VIs on Disk	Web Service
	Prepare Example VIs for NI Example Finder	
	Remote Panel Connection Manager	
	Web Publishing Tool	
🕖 Find I	Control and Simulation	Support 🛛 😣 Welcome to LabVIEW
Connec	Find LabVIEW Add-ons	ssion forums or Learn to use LabVIEW and upgrade
Turistion	Advanced	
	Options	
	ews	-

5. Select "Create VIs for a shared library" and click "Next."

city Create or Update M	lode	INSTRUM
Create VIs for a shared I Creates VIs based on the Update VIs for a shared	ibrary e header file and shared library file : library	you provide.
Updates previously impo	orted VIs for the following project lik	braries
Project	DLL File	Date
htra_api.lvlib	htra_api.dll	14:11:55 01/26/2024
saAPI.lvlib	htra_api.dll	14:07:19 01/26/2024
saAPI.lvlib	htra_api.dll	10:17:37 01/25/2024
htra_api.lvlib	htra_api.dll	16:59:08 11/21/2023
htra_api.lvlib	htra_api.dll	15:27:00 11/21/2023
htra_api.lvlib	htra_api.dll	15:15:30 11/21/2023
htra_api.lvlib	htra_api.dll	16:21:13 08/25/2023
htra_api.lvlib	htra_api.dll	11:36:04 08/25/2023
htra_api.lvlib	htra_api.dll	10:26:48 08/25/2023

6. In the "Shared Library (.dll) File" and "Header (.h) File" sections, select the corresponding library files from the previously created folder. After selecting the shared library file path, the header file path can be automatically recognized and does not need to be selected again. Then click "Next."

📴 Import Shared Library	X
Select Shared Library and Header File	
Shared Library (.dll) File	
D:\HTRA_Labview\htra_api.dll	
☐ Shared library file is not on the local machine	
Header (.h) File	
D:\HTRA_Labview\htra_api.h	
Back	t Cancel Help

7. In the "Include" section, configure the paths for other dependency files, which are generally located in the folder where Visual Studio is installed, as shown in the image below, and then click "Next" to wait for parsing.

onfigure Include Paths	and Preprocessor Definitions	
Include D:\Program Files (x86)\Microsoft Visual Studio\2019\Community\VC\Tools\M	™ X 1 ↓ SVC\14.29.30133\include
	Parse Header File	×
	Parsing the header file	
	This might take a few minutes. Please wai	t.
Preprocessor Definitic	ons (use ;' to separate multiple preprocessor definitions	.)
	Back	Cancel Help

8. Select the functions to be exported; some functions have been deprecated or

are not yet available. You can refer to htra_api.h for selection, and after making your selections, click "Next."

Select Functions to Convert The shared library contains 201 function(s). The declarations of 136 function(s) are found and recognized in the header file and these function(s) can be wrapped. The remaining function(s) cannot be wrapped. If you want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions below. You want to import these functions, please review the warning messages next to the functions, below. You want to import these functions, please review the warning messages next to the functions, below. You want to import these functions, please review the warning function(s), for the function (the function). ASD_GenerateFMWaveform 0 Sp_GetWindowCoefficient(unsign ellowedge). ASG_Configuration 0 DetT_EZProfileDelnit 0 DET_SyncTimerByExtTrigger_Single 0 Desp_Convolution 0 DSP_Convolution 0 Desp_Convolution 0 DSP_Convolution 0 Desp_Convolution 0 DSP_Convolutio	🙀 Import Shared Library	×
The shared library contains 201 function(s). The declarations of 136 function(s) are found and recognized in the header file and these function(s) can be wrapped. The remaining function(s) cannot be wrapped. If you want to import these functions, please review the warning messages next to the functions below. You will need to fix the problems before you can continue with the wizard.	Select Functions to Convert	
 DSP_AudioAnalysis () DSP_Close () DSP_Convolution () DSP_DDC_Configuration () DSP_DDC_Delnit () DSP_DDC_GetDelay () 	The shared library contains 201 function(s). The declarations of 136 fu in the header file and these functions, please review the warning messag will need to fix the problems before you can continue with the wizard.	Inction(s) are found and recognized g function(s) cannot be wrapped. If ges next to the functions below. You DSP_GetWindowCoefficient void DSP_GetWindowCoefficient(unsign ed long Window, long n, double *Coefficient);
	 DSP_AudioAnalysis () DSP_Close () DSP_Convolution () DSP_DDC_Configuration () DSP_DDC_Delnit () DSP_DDC_GetDelay () Check All Uncheck All 	

9. For "Project Library Path," select the VIS folder in the library and header

file paths, and then click "Next."

mport Shared Library			
onfigure Project Library Settings		X	NATIONAL INSTRUMENT
Project Library Name (Jylib)			
htra_api			
Designet Library Dath			
D:\HTRA Labyiew\VIS			
Copy the shared library file to the destination of	directory.		
Copy the shared library file to the destination of	directory.		
Copy the shared library file to the destination of	directory.		
Copy the shared library file to the destination of	directory.		
Copy the shared library file to the destination of	directory.		
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Copy the shared library file to the destination o	directory.		
Copy the shared library file to the destination o	directory.		
Copy the shared library file to the destination of	directory.		
Copy the shared library file to the destination of	directory.		

10. For "Error Handling Mode," it is recommended to select "Simple Error Handling," and then click "Next."

nport Shared Library	X
Select Error Handling Mode	
Error Handling Mode	
Simple Error Handling	~
Example Block Diagram	
error in (no error) Device Number (1930) Service Channel 1320 DMA Channel 1320 Des Words [1920] Data [UB]	error out EET Return Value Fi32 Data Output Fue]
You want to call the generated function only when there are no en	rrors in.
Back	Next Cancel Help

11. Set the call library node for each function to "Run in any thread." After all

settings are complete, click "Next" and wait for the VI to be generated.

ASD_Close ()	Settings Name ar	nd Description	
ASD_Open ()			
ASG_Configuration ()		. Dreferred Everytion C	
ASG_ProfileDeInit ()	VI Execution Prope	erties Preferred Execution S	ystem
DET_BusTriggerStart ()	Reentrant Execu	ition Same As Caller	\sim
DET_BustriggerStop ()			
DET_EZCOnfiguration ()			
	Call Library Node Set	ttings	
DSP Close ()	Thread	Calling Conventi	on
DSP DDC Configuration ()	O Rup in LIL thread	O stdcall (M/IN	
DSP DDC Delnit ()			AFI
DSP_DDC_GetDelay ()	Kun in any threa	a V	
DSP_DDC_Reset ()			
DSP_Decimate ()	Declaration in Heade	er File	
DSP_FFT_Configuration ()	HTRA APL void ASD	Close(void** AnalogMod):	
DSP_FFT_DeInit ()		elose(volu Analoginiou),	
DSP_IFCalibration ()			
DSP_InterceptSpectrum () Configuration ()	Function Name		
DSP_LPF_Configuration () DSP_LPF_Delpit ()	ASD Close		
	-		
DSP LPF Reset ()			
DSP NCO Execute ()	Call Library Function	Node Prototype	
DSP_Open ()	void ASD_Close(uns	igned long *AnalogMod);	
DCD Transformer ACDD 0			

12. Check "Open the generated library," and "View the report" is optional; then

click "Finish."

mport Shared Library		
inish		
Open the gener	ted library	
□ View the report	(Errors occurred during the processing, please vi	ew the report for more information.
	1	
	Back E	

13. The VI in the VIS folder is the exported API function. Thus, the export of the

API function is complete.

This PC > Data (D:) > HTRA_Labv	iew ≻ VIS ≻ VIs		Search VIs	م
〕 🖻 û î\ Sort ∽ ≡ V	/iew × ····			Preview
Name	Date modified	Туре	Size	
🛃 ASD Close.vi	11/15/2024 10:35 AM	LabVIEW Instrume	9 KB	
🛋 ASD Demodulate AM.vi	11/15/2024 10:35 AM	LabVIEW Instrume	23 KB	
🛋 ASD Demodulate FM.vi	11/15/2024 10:35 AM	LabVIEW Instrume	24 KB	
🛋 ASD Open.vi	11/15/2024 10:35 AM	LabVIEW Instrume	9 KB	
🛋 ASG Configuration.vi	11/15/2024 10:35 AM	LabVIEW Instrume	15 KB	
属 ASG Profile De Init.vi	11/15/2024 10:35 AM	LabVIEW Instrume	12 KB	
🛋 DET Bus Trigger Start.vi	11/15/2024 10:35 AM	LabVIEW Instrume	9 KB	
🛋 DET Bus Trigger Stop.vi	11/15/2024 10:35 AM	LabVIEW Instrume	9 KB	
🛋 DET Configuration.vi	11/15/2024 10:35 AM	LabVIEW Instrume	26 KB	
🛋 DET Get Power Stream.vi	11/15/2024 10:35 AM	LabVIEW Instrume	19 KB	
🛋 DET Profile De Init.vi	11/15/2024 10:35 AM	LabVIEW Instrume	20 KB	
🛃 Device Close.vi	11/15/2024 10:35 AM	LabVIEW Instrume	9 KB	
🛃 Device Open.vi	11/15/2024 10:35 AM	LabVIEW Instrume	15 KB	
Device Query Device State Realtime.vi	11/15/2024 10:35 AM	LabVIEW Instrume	13 KB	

8.1.2 Using the API in the LabVIEW environment



1. Open LabVIEW and click "Create Project."

2. Select "Blank Project" and click "Finish."



3. A blank unnamed project will appear; press "Ctrl+S" to save the project, select

the project save path, name the project, and then click "OK."

📴 Untitled Project 1 - Proj	ect Explorer		_	
File Edit View Project	Operate Tools Window Help			
]] 🏝 🔁 🎒 🐰 🖻 🖺) 🗙 🗍 💕 🕰 🖽 🕶 🥐 🛕 🗍 🐎	📴 🛃 📙 🔍 🗐 🔍		
ltems Files				
Project: Untitled Pro	oject 1 s ations			
Name the Project (Untitle	ed Project 1)			×
\leftrightarrow \rightarrow \checkmark \uparrow	« Data (D:) > HTRA_Labview_Demo	~ C Se	arch HTRA_Lab	view_Demo 🔎
Organize 👻 New fold	er			≣ - 👔
> 🔷 WPS云盘	Name	✓ Date modified	Туре	Size
> 📥 Acer (C:)		No items match your search.		
> 👝 Data (D:)				
> 🛬 Network				
File name: HTRA	Labview_Examples			~
Save as type: Project	cts (*.lvproj)			~
∧ Hide Folders		C	ОК	Cancel

4. Copy the htra_api folder from the \Windows\HTRA_API\x86 folder on the USB drive to the same directory as the project. Additionally, you can create an Examples folder to store examples. If needed, you can also create a folder named Subvi to store sub VIs.

This PC > Data (D:) > HTRA_L	abview_Demo >		Search	n HTRA_Labview_Demo
▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲	≣ View ∽ ····			Prev
Name	Date modified	Туре	Size	
📒 Examples	11/11/2024 4:36 PM	File folder		
🚞 htra_api	11/11/2024 3:34 PM	File folder		
📒 Subvi	11/11/2024 2:56 PM	File folder		
HTRA_Labview_Examples.aliases	11/11/2024 4:36 PM	ALIASES File	1 KB	_
HTRA_Labview_Examples.lvlps	11/11/2024 4:26 PM	LVLPS File	1 KB	
👪 HTRA_Labview_Examples.lvproj	11/11/2024 4:26 PM	LabVIEW Project	2 KB	

5. Copy the previously exported library functions, specifically the contents of the VIS folder created in section 8.1.1, to the htra_api folder.

This PC > Data (D:) > HT	RA_Labview_Demo > htra_	api >	Search	htra_api	٩
) 🖻 🔟 🏷 Sort ~	\equiv View \cdot				Preview
Name	Date modified	Туре	Size		
CalFile	10/8/2024 9:37 AM	File folder			
TIS VIS	11/11/2024 3:34 PM	File folder			
🚯 htra_api.dll	9/23/2024 11:01 AM	Application exten	930 KB		
C htra_api.h	9/23/2024 10:56 AM	C Header 源文件	137 KB		
👭 htra_api.lib	9/23/2024 11:01 AM	Object File Library	48 KB		
😼 htra_api.lvlib	11/11/2024 1:39 PM	LabVIEW Library	14 KB		
libgcc_s_dw2-1.dll	1/12/2024 8:37 AM	Application exten	123 KB		
libiomp5md.dll	4/30/2024 3:30 AM	Application exten	1,900 KB		
🗟 libliquid.dll	1/12/2024 8:37 AM	Application exten	1,743 KB		
🔢 libliquid.lib	1/12/2024 8:37 AM	Object File Library	1,618 KB		
libmkl.dll	4/30/2024 3:30 AM	Application exten	42,043 KB		
🔢 libmkl.lib	4/30/2024 3:30 AM	Object File Library	6 KB		
libwinpthread-1.dll	1/12/2024 8:37 AM	Application exten	67 KB		
C liquid.h	1/12/2024 8:37 AM	C Header 源文件	481 KB		
c mkl_dfti.h	4/30/2024 3:30 AM	C Header 源文件	11 KB		
C mkl_service.h	4/30/2024 3:30 AM	C Header 源文件	8 KB		
c mkl_types.h	4/30/2024 3:30 AM	C Header 源文件	5 KB		

6. In the LabVIEW project, add the newly created Examples folder and the

htra_api folder to the project, and then save.

👪 HTRA_Labview_Examples.lvproj * - Project Explored	r	_		×
File Edit View Project Operate Tools W	lindow Help			
🎦 🗃 🗿 🗴 🗈 🕼 🗙 💕 尾 🎰 🕶	🐔 🛕 🛛 🛼 🍺 🛃 🗍 🔍 🍫 🔍 🔍			
Items Files				
🖃 🙀 Project: HTRA_Labview_Examples.lvproj				
Wy Compu New Sxample				
⊕ Ø htra_api Add ►	File			
🖙 📸 Build Sp 🛛 Find Project Items	Folder (Auto-populating)			
Arrange By Expand All	Hyperlink			
Collapse All		iples.lvp	roj	
Help Properties	⊷ 😰 Examples ତ 🧕 htra_api		_	
	Build Specifications		_	
			_	

7. A new VI is created in the Examples folder, where the exported Labview API functions can be called within the block diagram page, and the calling process is consistent with that in the C environment.

HTRA_Labview_Exam	🙀 HTRA_Labview_Examples.lvproj - Project Explorer						×
File Edit View Proj	ile Edit View Project Operate Tools Window Help						
]) 🏝 😂 🎒 🗶 🔖	🗈 🗙 📗 📽 📭 🛯 🐨 🐔 📗 🛸 💓 🥪 📗	Ð	/ IQ 🔍 🔍				
Items Files							
🖃 😼 Project: HTRA_L	abview_Examples.lvproj						
My Compute	er						
🕀 🚺 htra_api	New		VI				
- 🍟 Depende	Explore		Control				
- 🔁 Build Spe	Show in Files View Ctrl+E		Library				
	Add	Þ	Variable				
-	Stop Auto-populating	-	Class				
-		_	XControl				
	Items incorrectly claimed by a library	_					
	Arrange By	►					
	Remove from Project						

8. Finally, save this program to the Examples folder and rename it.

Name the VI (Untitled 1)	×
\leftarrow \rightarrow \checkmark \uparrow \blacksquare « HTRA_Labview_Demo \rightarrow Examples	✓ C Search Examples
Organize 🔻 New folder	≣ - 0
Name ^	Date modified Type Size
🗸 📮 This PC	No items match your search.
> 🖕 WPS云盘	
> 🚣 Acer (C:)	
> 🗕 Data (D:)	
> 🛬 Network	
· · · · · · · · · · · · · · · · · · ·	
File name: SWP_Example	~
Save as type: VIs (*.vi;*.vit)	~
∧ Hide Folders	New LLB OK Cancel

8.1.3 Use the newly exported library functions in an existing project.

Below, we will take the library function DSP_InterceptSpectrum() as an example to explain how to use the newly imported function in an existing project.

1. For the method of exporting library functions, please refer to section 8.1.1. Note that in the popped-up htra_api.lvlib, you should delete the exported functions and DLL files from the project, and then close htra_api.lvlib, as shown in the figure below.

	0	~
File Edit View Project Operate Tools Window Help		
Items Files		
🕞 🔂 htra_api.lvlib		
- JSP Intercept Spectrum Open		
Print		
Remove from Project		

2. Copy the exported DSP_InterceptSpectrum function VI to the htra_api\V Is folder of the existing project.

				-		×
ackup > ···· HTRA_Labview_Examples Fo	older (1) > htra_api	> VIs	Search VIs			Q
🖻 🛍 🛝 Sort -> 🗮 View ->					Prev	iew
Name	Date modified	Туре	Size			
🛋 DSP Generate Sine Waveform.vi	11/15/2024 10:38 AM	LabVIEW Instrume	15 KB			
🛋 DSP Get White Gaussian Noise.vi	11/15/2024 10:38 AM	LabVIEW Instrume	13 KB			
🛋 DSP Get Window Coefficient.vi	11/15/2024 10:38 AM	LabVIEW Instrume	15 KB			
BSP IF Calibration.vi	11/15/2024 10:38 AM	LabVIEW Instrume	14 KB			
🛋 DSP Intercept Spectrum.vi	11/19/2024 4:28 PM	LabVIEW Instrume	13 KB			
B DSP LPF Configuration.vi	11/17/2024 10:03 PM	LabVIEW Instrume	13 KB			
🛋 DSP LPF De Init.vi	11/17/2024 10:03 PM	LabVIEW Instrume	12 KB			
BSP LPF Execute Complex.vi	11/18/2024 11:14 AM	LabVIEW Instrume	48 KB			
🛋 DSP LPF Execute Real.vi	11/15/2024 10:38 AM	LabVIEW Instrume	15 KB			
🛋 DSP LPF Reset.vi	11/15/2024 10:38 AM	LabVIEW Instrume	13 KB			
🛋 DSP Open.vi	11/17/2024 8:46 PM	LabVIEW Instrume	11 KB			

3. Open the project with LabVIEW, then open the htra_api\V Is folder and

htra_api.lvlib within the project.



4. Drag the DSP_InterceptSpectrum function VI from the V Is folder into htra_api.lvlib. At this point, you can use the newly added VI function normally.

k Project: HTRA_Labview_Examples.lvproj	
🖶 💂 My Computer	
🗄 🔯 Example	
🖨 👩 htra_api	
🗄 📁 CalFile	
🖶 📵 Vis	
- 🗟 htra api.dll	
- c htra_api.h	
- 🔠 htra_api.lib	
🖨 🔂 htra_api.lvlib	
- 🔜 ASD Close.vi	
- 🔜 ASD Demodulate AM.vi	
- 🔜 ASD Demodulate FM.vi	
ASD Open.vi	
- 🔜 ASG Configuration.vi	
- 😹 ASG Profile De Init.vi	
– 🔜 DET Bus Trigger Start.vi	
- 🔜 DET Bus Trigger Stop.vi	
– 🔜 DET Configuration.vi	
- 🔜 DET Get Power Stream.vi	
– 🔜 DET GetTrace.vi	
- 🔜 DET Profile De Init.vi	
– 🔜 Device Close.vi	
- 🔜 Device Open.vi	
– 📕 Device Query Device Info Realtime.vi	
- 🔜 Device Query Device Info.vi	
– 🔜 Device Query Device State Realtime.vi	
- 🔜 Device Query Device State.vi	
– 🛃 DSP Audio Analysis.vi	
- 🔜 DSP Close.vi	
– 🔜 DSP DDC Configuration.vi	
- 🔜 DSP DDC De Init.vi	
- 🔜 DSP DDC Execute.vi	
DSP DDC Get Delay.vi	
- 🔣 DSP FFT Configuration.vi	
- SP FFT De Init.vi	
- 🔣 DSP FFT IQS To Spectrum.vi	
DSP Intercept Spectrum.vi	
- 🜉 DSP LPF Configuration.vi	
🖂 🖂 USP LPF De Init.vi	

8.1.4 Generate an EXE from the VI in LabVIEW.

Below, we will take the LabVIEW project in the Windows\HTRA_API_Example folder on the USB drive as an example to explain how to generate an EXE from the program VI.

1. Open the LabVIEW project, then select "Build Specifications --> New --> Application (EXE)".

HTRA_Labview_Examples.lvproj	- Project Explorer			_		×
File Edit View Project Op	le Edit View Project Operate Tools Window Help					
]] *a 🗃 🞒 🔏 🖻 û X] Items Files	😰 尾 📺 🕶 🚰 🛕] !	\$ [9 🛃] Q, 🧐 Q, Q,				
□ B Project: HTRA_Labview_E □ □ My Computer □ □ Example □ □ Example □ □ htra_api □ □ Dependencies	xamples.lvproj					
🕀 🚖 Build Specification	New 🕨	Application (EXE)				
	Build All	Installer .NET Interop Assembly				
	Find Project Items	Packed Library				
	Arrange By Expand All Collapse All	Shared Library (DLL) Source Distribution Zip File				
	Help					
[

2. Fill in the standard name of the program file generated, the name of the exe,

and the target directory path in "Information".

SWP_Example Properties		×
Category	Information	
Information Source Files Destinations Source Files Leon Advanced Additional Exclusions Version Information Windows Security Shared Variable Deployment Run-Time Languages Web Services Pre/Post Build Actions Preview	Build specification name SWP_Example Target filename SWP.exe Destination directory C<\Users\15335\Desktop\0.55.52\Windows\HTRA_API_Example\HTRA_Labview_Examples\bin	
	Build OK Cancel	Help

3. Select the vi programs, CalFile folder, and all dependent library files to be exported as exe in "Source Files".

ategory		Source Fi	les
nformation			
ource Files	Project Files		Startup VIs
estinations	🕀 💂 My Computer		
ource File Settings	🖨 🚞 Example		
con	DET_Example.vi		
dvanced	IQS_Example.vi		
dditional Exclusions	RTA_Example.vi		
ersion Information	SWP_Example.vi	-	
Vindows Security	🖨 🚞 htra_api		
hared Variable Deployment	🖨 🧰 CalFile		
un-Time Languages			
/eb Services	htra_api.dll		
re/Post Build Actions	tra_api.h		
review	htra_api.lib		
	🕀 🔂 htra_api.lvlib		Always Included
	libgcc_s_dw2-1.dll		CalFile
	libiomp5md.dll		📲 🚯 htra api.dll
	libliquid.dll		libgcc s dw2-1.dll
	libliquid.lib		libiomp5md.dll
	libmkl.dll	→	libliquid.dll
	libmkl.lib		- 🗟 libmkl.dll
	libwinpthread-1.dll		libwinpthread-1.dll
	C liquid.h		
	C mkl dfti.h		
	C mkl service.h	-	
	C mkl types.h		

4. Add a layer of htra_api to the target path of "Support Directory" in "Destinations" to store the libraries and calibration folder.

	Destinations
nation	Destinations
e Files Destinations SWP.exe Support Director sonal Exclusions on Information sws Security d Variable Deployment time Languages	Destination label Support Directory Destination path C:\Users\15335\Desktop\0.55.52\Windows\ HTRA_API_Example\HTRA_Labview_Examples\ bin\htra_api Destination type
ost Build Actions	Directory Preserve disk hierarchy LLB Add files to new project library Library name
+ ×	

5. Add a CalFile folder to store the device's calibration files, and add the target

path of CalFile to the directory under "Support Directory".

SWP_Example Properties	;	×
Category	Destinations	
Information Source Files Cestinations Scource Files Licon Advanced Additional Exclusions Version Information Windows Security Shared Variable Deployment Run-Time Languages Web Services Pre/Post Build Actions Preview	Destination label Swpport Directory CalFile Destination path C\Uerx\1533\Desttop\0.55.52\Windows\ HTRA_APLExample\HTRA_Labview_Examples\ bin\htra_aplCalFile Destination type Image: Directory Direc	
	Build OK Cancel Help	

6. In "Source Files Settings", select the target path of the calibration files to "CalFile".



7. Select the target paths of all dependent libraries to the "Support Directory".

tegory	_	Source File Settings
ormation urce Files stinations urce FileSettings in vanced iditional Exclusions sion Information ndows Security ared Variable Deployment n-Time Languages b Senziers	Project Files My Computer Example CalFile Vis CalFile Vis Mtra_api.dil - C htra_api.dil - C htra_api.lib B m htra_api.lib	Inclusion Type Always Included Destination Support Directory
to services /Post Build Actions eview	 ibiorop5md.dll ibiorop5md.dll ibiquid.dll ibiquid.dll ibiquid.lib ibmkl.dll ibiwinpthread-1.dll c lipwinth c med.dti b 	Customize VI Properties Use default save settings Remove front panel Remove block diagram
	C mkl_service.h mkl_service.h E mkl_types.h Bependencies	No password change Remove password Apply new password
		Rename this file in the build

8. Click "Build".



9. At this point, the generation of the exe program from the vi program in

Labview is complete.



8.2 The usage process of Labview examples

The usage process of Labview examples included in the USB drive is as follows:

1. Open the accompanying USB drive using LabVIEW in the folder Windo ws\HTRA_API_Example\HTRA_Labview_Examples, and open the project HTRA_La bview_Examples.lvproj.

\Box > USB Drive (F:) > Windows >	HTRA_API_Example > HTI	RA_Labview_Examples	>
ট 🗐 🖻 🗊 🕄 Sort ∽ ≣	View · ···		
Name	Date modified	Туре	Size
늘 Example	1/9/2025 3:17 PM	File folder	
늘 htra_api	1/9/2025 3:48 PM	File folder	
T VI	1/9/2025 3:17 PM	File folder	
HTRA_Labview_Examples.aliases	11/29/2024 6:09 PM	ALIASES File	1 KB
HTRA_Labview_Examples.lvlps	11/29/2024 6:09 PM	LVLPS File	2 KB
💁 HTRA_Labview_Examples.lvproj	11/29/2024 6:09 PM	LabVIEW Project	28 KB

2. After opening the project, double-click to open any routine vi in the Example folder. For example, here we open SWP_GetSpectrum_Standard.vi to use the SWP mode routine.



3. Once the program is opened, simply click the run button in the uppe r left corner, as shown in the image where the program is running normally.



8.3 Labview Example Description

8.3.1 Get device information

Device_GetDeviceInfo.vi: An example for obtaining various device information, including: API version, device model, device UID, MCU version, FPGA version, and device temperature.

8.3.2 Standard spectrum acquisition

SWP_GetSpectrum_Standard.vi: Obtains standard spectrum data within a specified frequency band and displays the image.

8.3.3 Obtain IQ Data for a Fixed Number of Points or Duration

IQS_GetIQ_FixedPoints.vi: Obtains IQ data with a fixed number of points. When the device receives a Bus trigger signal, it returns IQ data with a fixed number of points.

8.3.4 Streaming and reading IQ data

IQS_RecordAndPlayback.vi: Obtains IQ data, records the IQ data as a txt file, and plays back the recorded IQ data.

8.3.5 IQ to Spectrum Data

DSP_IQSToSpectrum.vi: Obtains IQ data and converts the acquired IQ data into spectrum data.

8.3.6 Digital Downconversion

DSP_DDC.vi: Performs digital downconversion on the IQ data stream and resamples to generate a sub-IQ stream for further spectrum analysis.

8.3.7 Audio Analysis

DSP_AudioAnalysis.vi: Analyzes audio voltage (V), audio frequency (Hz), signal-tonoise ratio (dB), and total harmonic distortion (%).

8.3.8 Obtain Power Detection Data for a Fixed Number of Points or Duration

DET_GetPowerTrace.vi: Obtain a fixed number of DET data points. When the device receives a Bus trigger signal, it returns a fixed number of DET data points.

8.3.9 Obtain real-time spectrum data for a fixed number of points or

duration

RTA_GetRealTimeSpectrum.vi: Obtain a fixed number of RTA data points. When the device receives a Bus trigger signal, it returns a fixed number of RTA data points.

8.3.10 ASG Signal Source Output Signal

ASG_CWOutput.vi: Control the internal signal generator of the device to output single-tone signals, sweep signals, and power scan signals.

9. Linux

9.1 Environment Version Compatibility Self-Check

When using the device in a Linux system, you first need to confirm whether the current Linux environment's system architecture, gcc version, and GLIBC version are supported according to the following process:

1. Open the terminal and enter "uname -a" to check the Linux system architecture, for example, here the Linux system architecture is x86 64.

2. In the terminal, enter "gcc -v" to check the system gcc version, for example, here the gcc version is 7.5.0.

3. In the terminal, enter "Idd --version" to check the system GLIBC version, for example, here the GLIBC version is 2.27.



4. Confirm whether the current environment is supported according to the terminal information comparison table. If it is not yet supported, please contact technical support personnel.

X86 processor	Supports Intel and AMD processors
ARM processor	aarch64 (armv8), armv7 processors, such as: Raspberry Pi 4b, RK3399,
	RK3568, RK3588, T507, NVIDIA Jetson TX2
Compilation	gcc4.8, glib2.17 and above

environment	
Distribution	Customized system for Raspberry Pi 4b, Ubuntu 18.04, etc.

9.2 Accompanying documentation

Currently, the Linux section of the accompanying USB drive contains the following materials:

9.2.1 HTRA_C++_Examples

The HTRA_C++_Examples folder contains:

- Examples folder: C++ example programs (see section 9.4 for usage).<u>Chapter9.4</u>
- Makefile: A build script used to compile the example programs into executable files.
- 3. bin folder: Used to store device calibration files and executable files

generated from the example programs.

> USB Drive (F:) > Linux > HTRA_C++_Examples > Search HTRA_C++_Examples						
A the sort → Sort → Wiew	•••					
Name	Date modified	Туре	Size			
늘 bin	12/11/2024 5:36 PM	File folder				
Examples	12/11/2024 5:36 PM	File folder				
h Makefile	4/30/2024 3:30 AM	File	1 KB			
README.txt	4/30/2024 3:30 AM	Text Document	1 KB			

9.2.2 HTRA_Qt_Examples

The HTRA_Qt_Examples folder contains:

- htrademo folder: Qt examples and pro files (see section 9.5 for usage).
- bin folder: Used to store device calibration files and executable files compiled from the example programs.
- 3. htraapi folder: Used to store dynamic link libraries.

> USB Drive (F:) > Linux > HTRA_Qt_E	Search HTRA_Qt_Examples		
▲ Interpreting A Sort - ■ View	~		
Name	Date modified	Туре	Size
늘 bin	12/11/2024 5:36 PM	File folder	
늘 htraapi	12/11/2024 5:36 PM	File folder	
늘 htrademo	12/11/2024 5:36 PM	File folder	
README.txt	5/10/2024 2:32 AM	Text Document	1 KB

9.2.3 HTRA_Python_Examples

HTRA_Python_Examples folder specifically contains:

- 1. Python example programs (see section 9.6 for usage). Chapter 9.6
- 2. CalFile folder: stores device calibration files.
- 3. Htraapi folder: used to store dynamic link libraries.

Q	> USB Drive (F:) > Linux > HT	RA_Python_Examples	> Sea
ũ	▲) 🖄 🕅 N Sort ~	Wiew - ····	
	Name	Date modified	Size
	CalFile	1/8/2025 4:11 PM	
	💳 htraapi	1/8/2025 4:11 PM	
	NSG_CWOutput.py	1/8/2025 11:00 AM	4 KB
	DET_GetPowerTrace_Standard.py	1/8/2025 10:43 AM	6 KB

9.2.4 Install_HTRA_SDK

Install_HTRA_SDK folder contains:

- 1. install_htraapi_lib.sh: driver configuration script.
- 2. Install_HTRA_SDK\htraapi\configs folder: driver configuration files.
- 3. Install_HTRA_SDK\htraapi\inc folder: header files.
- Install_HTRA_SDK\htraapi\lib\arrch64 folder: arrch64 architecture dyna mic link libraries.
- Install_HTRA_SDK\htraapi\lib\arrch64_gcc7.5 folder: Dynamic link library for arrch64 architecture with more efficient FFT (requires system gcc version higher than 7.5).

- Install_HTRA_SDK\htraapi\lib\x86_64 folder: Dynamic link library for x8
 6_64 architecture.
- Install_HTRA_SDK\htraapi\lib \ x86_64_gcc5.4 folder: Dynamic link libra ry for x86_64 architecture with more efficient FFT (requires system g cc version higher than 5.4).
- Install_HTRA_SDK\htraapi\lib\armv7 folder: Dynamic link library for ar mv7 architecture.

\Box > USB Drive (F:) > Linux > In	stall_HTRA_SDK >			Search Ins
🛅 🔄 🖻 🗊 🔨 Sort -	Wiew ~ ····			
Name	Date modified	Size		
🚞 htraapi	1/7/2025 11:18 AM			
🔳 install_htraapi_lib.sh	4/30/2024 3:30 AM		3 KB	
README.txt	4/30/2024 3:30 AM		1 KB	
> USB Drive (F:) > Linux > Instal ▲ ▲ ▲ Sort ~ ■	I_HTRA_SDK > htra	api > lib	>	Search lib
Name	Date modified	Туре	Size	
aarch64	12/11/2024 5:36 PM	File folder		
aarch64_gcc7.5	12/11/2024 5:36 PM	File folder		
armv7	12/11/2024 5:36 PM	File folder		
x 86_64	12/11/2024 5:36 PM	File folder		
x 86_64_gcc5.4	12/11/2024 5:36 PM	File folder		

9.3 Driver file configuration

To use the device in Linux, the driver file must be configured first. The specific process is as follows:

1. Driver file configuration: First, drag the Install_HTRA_SDK folder into the Linux host computer, then open a terminal in the Install_HTRA_SDK folder and enter "sudo sh install_htraapi_lib.sh" to configure the driver file. If the special development board does not have the sudo command, simply enter "sh install_htraapi_lib.sh".



2. Configuration check: Ensure the device is correctly connected to the host computer (if the host computer is a virtual machine, ensure the device is connected to the virtual machine and that USB compatibility is 3.1) and provide normal power to the device. At this point, as shown in the figure, enter "Isusb" in the terminal to view the list of USB devices on the machine, where "ID: 6430 (or ID: 3675 or ID: 04b5)" indicates successful device connection.

						htra@ubuntu: ~	
File	Edit	View S	Search	Ter	minal Help		
htr	a@ubu	intu:~\$	lsust)			
Bus	004	Device	002:	ID	367f:0001		
Bus	004	Device	001:	ID	1d6b:0003	Linux Foundation 3.0 root hub	
Bus	003	Device	001:	ID	1d6b:0002	Linux Foundation 2.0 root hub	
Bus	001	Device	001:	ID	1d6b:0002	Linux Foundation 2.0 root hub	
Bus	002	Device	003:	ID	0e0f:0002	VMware, Inc. Virtual USB Hub	
Bus	002	Device	002:	ID	0e0f:0003	VMware, Inc. Virtual Mouse	
Bus	002	Device	001:	ID	1d6b:0001	Linux Foundation 1.1 root hub	
htr	a@ubu	intu:~\$					

9.4 C++ example usage and project creation

9.4.1 C++ example usage

Under the premise that the device is properly connected and the driver files have been correctly configured as per Section 9.3, if you wish to use the C++ examples included on the USB drive, you can refer to the following process (the specific functions of the examples can be directly viewed in the description in Chapter 1):Chapter 9.3Chapter One

 Select the program to compile: First, copy the Linux\ HTRA_C++_Exam ples folder from the USB drive to the host computer. Double-click to open m ain.cpp in the Examples folder, and uncomment the example you need to tes t (the following steps will take the SWP_GetSpectrum_Standard example as an example), as shown in the figure to uncomment.

Open 🕶	<u>م</u>	main.cpp esktop/1/HTRA_C++_Exam		Save =	
	Makefile	×	main.cpp		×
#include	"example.h"				
<pre>int main({</pre>	<pre>) nt Status = 0; tus = Device_GetDeviceInfo(); /Status = Device_SysPowerState s = SWP_GetSpectrum_Standard() /Status = SWP_EZGetPartialSwee /Status = SWP_MaxHold_MinHoldd /Status = SWP_TraceAverage(); /Status = SWP_AutoSetMeasure() /Status = SWP_SetFreqCompensat /Status = SWP_PickMaxPower();</pre>	<pre>e(); ep(); ep(); (); tion();</pre>			

2. Refer to the system architecture in section 9.1, and based on the sel ected test example, open the terminal in the HTRA_C++_Examples folder, follo

wing the host computer's system architecture. Chapter 9.1

For x86_86 system, input (the example routine here is SWP_GetSpectrum_Standard):

make Example=SWP_GetSpectrum_Standard

For aarch64 system, input:

make TARG=aarch64 Example=SWP_GetSpectrum_Standard

For armv7 system, input:

make TARG=armv7 Example=SWP_GetSpectrum_Standard



3. Verify the calibration file: Open the HTRA_C++_Examples\bin\CalFile fol

der, and ensure that the folder contains the device calibration files, as shown in the figure.

<	> < Desktop	Linux	HTRA	_C++_Examples	bin	CalFile	Þ	
Ø	Recent							
ŵ	Home	02	23	023				
Ē	Desktop	4248	500b0	4248500b0 00b0036				
۵	Documents	ifaca	al.txt	rfacal.txt				
∻	Downloads							

4. Run the program: After the program compiles successfully and the cal ibration is confirmed to be correct, open the terminal and input:

./bin/SWP_GetSpectrum_Standard

The example shown in the figure is a normal operation example.

				htra@ubuntu: ~/Desktop/1/HTRA_C++_Examples	● 🛛 😣
File	Edit	View	Search	Terminal Help	
htra g++ es/r aapi htra	@ubun -o bi ain.c /lib/ @ubun	tu:~/ n/SWF pp Ex x86_6 tu:~/	/Deskto CetSp amples 4 -lht Deskto	<pre>p/1/HTRA_C++_Examples\$ make Example=SWP_GetSp ectrum_Standard Examples/SWP_GetSpectrum_Stan /Error_handling.cpp -std=c++11 -I/opt/htraapi raapi -Wl,-rpath='/opt/htraapi/lib/x86_64' p/1/HTRA_C++_Examples\$./bin/SWP_GetSpectrum_ cessfully</pre>	bectrum_Standard hdard.cpp Exampl i/inc -L/opt/htr _Standard
<u>C</u> onf	igura	tion	deliev	ery succeeded.	
9.4.2 C++ Project Creation and Compilation

Assuming that the driver files have been correctly configured as per Section 9.3, if you want to create a C++ project for compilation, please refer to the following process: <u>Chapter 9.3</u>

Write Code: Since the Linux dynamic link library provided with the USB drive is identical to that in Windows, the code only needs to comply with the API programming guidelines.

Compile and Run:

 As shown in the figure, first create a new folder to store the entire project (taking C++_Test as an example), then create a CalFile folder within the folder to store calibration files, and create an htraapi folder to store header files and dynamic link libraries.

Desktop C++_Test)	م	:	≡	
CalFile htraapi				

2. Create an inc folder under the htraapi folder to store header files, and a lib folder to store dynamic link libraries.



 Copy the files from the CalFile folder on the provided USB drive to the newly created C++_Test\CalFile folder.

□ > USB Drive (F:) > CalFile Search CalFile							
<u>,</u>	(I) (I						
Na	me	Date modified	Туре	Size			
C	23_4248500b000b0036_ifacal.txt	8/9/2024 10:23 AM	Text Document	431 KB			
	23_4248500b000b0036_rfacal.txt	8/9/2024 10:23 AM	Text Document	12,214 KB			
<	> ◀ 🏠 Home	Desktop C++_Test	CalFile 🕨				
Ø	Recent		111 I.				
企	Home						
	Desktop	023_023 4248500b0 424850 00b0036 00b00	00b0				
۵	Documents	ifacal.txt rfacal	.txt				
⇒	Downloads						

4. Copy the header files from the Linux\Install_HTRA_SDK\htraapi\inc folder on

the provided USB drive to the newly created C++_Test\htraapi\inc folder.

> USB Drive (F:) > Linux > Install_HTRA_SDK > htraapi > inc							
$▲$ \bigcirc \bigcirc \bigcirc \land Sort \sim $≡$ View \sim ····							
Name	^	[Date modif	ied	Туре	Size	
🗓 htra_api.h		1	11/25/2024	1:58 PM	C/C++ Header	14	1 KB
Desktop	C++_Test	htraapi	inc	Þ	Q	:	
htra_api.h	1						

5. Refer to the system architecture in section 9.1, and then according to the instructions in section 9.2.4, copy the dynamic link libraries corresponding to the architecture from the Linux\Install_HTRA_SDK\htraapi\lib folder to the newly created C++_Test\htraapi\lib folder (taking the x86_64 architecture host computer as an example).Chapter9.1Chapter9.2.4

🖵 > U	ISB Drive (F:) > I	.inux > Insta	all_HTRA_SDK	> ht	raapi > lik	>	x86_64	
	i I	↑V Sort ~ 📲	View ~					
Name	^	I	Date modified		Туре		Size	
🗋 libgo	pmp.so.1.0.0		11/15/2013 11:24 P	М	0 File		59 KB	
🗋 libhti	raapi.so.0.55.55		1/6/2025 10:17 AM		55 File		1,087 KB	
🗋 libliq	uid.so		1/12/2024 12:00 AN	1	SO File		1,026 KB	
🗋 libus	b-1.0.so.0.2.0		1/12/2024 12:00 AN	1	0 File		425 KB	
	DME.txt		1/12/2024 12:00 AN	1	Text Document	t	1 KB	
Desktop	C++_Test htr	aapi lib)	•			۹	=	
A second se		A set of the set of th						
libgom	p. libhtraapi.	libliquid.so	libusb-1.0.					

6. Open the terminal in the lib folder location and enter the following commands to create soft links for the copied dynamic link libraries (the commands for the dynamic link libraries of the three architectures are the same):

In -sf libhtraapi.so.0.55.5 libhtraapi.so.0 (Here, the libhtraapi.so library is taken as

an example with version 0.55.55; modify the version number for other versions.)

so.0.2.0

In -sf libhtraapi.so.0 libhtraapi.so

so.0.55.55

so.1.0.0

- In -sf libusb-1.0.so.0.2.0 libusb-1.0.so.0
- In -sf libusb-1.0.so.0 libusb-1.0.so
- In -sf libgomp.so.1.0.0 libgomp.so.1
- In -sf libgomp.so.1 libgomp.so

			htra	a@ubunt	u: ~/De	esktop/C	С++_Т	ˈest/	htraapi/lib)		•••
File Ec	lit View	Search	Termin	al Help								
htra@u	buntu:~/	/Deskt	op/C++_	_Test/h	traapi	i/lib\$	ln ·	-sf	libhtraa	pi.so.0.	55.55	libhtra
api.so htra@u htra@u 0.so.0 htra@u htra@u htra@u	.0 buntu:~/ buntu:~/ buntu:~/ buntu:~/ buntu:~/	/Deskto /Deskto /Deskto /Deskto /Deskto	op/C++ op/C++ op/C++ op/C++ op/C++	_Test/h _Test/h _Test/h _Test/h _Test/h	traap [†] traap [†] traap [†] traap [†] traap [†]	i/lib\$ i/lib\$ i/lib\$ i/lib\$ i/lib\$	ln · ln · ln · ln ·	-sf -sf -sf -sf -sf	libhtraa libusb-1 libusb-1 libgomp. libgomp.	pi.so.0 0.so.0. 0.so.0 so.1.0.0 so.1 lib	libht 2.0 l libus libg gomp.	raapi.so ibusb-1. b-1.0.so omp.so.1 so
ntraœu	buncu:~/	Deskt	op/C++.	_rest/n	сгаар	1/1105						
Home	Desktop	C++_	Test	htraapi	lib					Q ::	■	
Home	Desktop	C++_	Test	htraapi				li) E	
Home	Desktop	C++_	Test libgomp so.1	htraapi o. libo so.	lib Jomp. 1.0.0	libhtr	raapi. o	li	bhtraapi. so.0	Q E	i. lib	liquid.so

7. Store the written code files in the outermost folder of C++_Test.



8. Compile to generate the executable file: First, check the system architecture according to the process in section 9.1, then open the terminal in the C++_Test folder (the image below takes the x86_64 system as an example), and input according to the host system architecture.Chapter9.1

For x86_64 system input (example test.cpp here):

g++ -o Test Test.cpp -std=c++11 -I ./htraapi/inc -L ./htraapi/lib -lhtraapi -Wl,-

rpath='./htraapi/lib'

Input for arrch64 system:

aarch64-linux-gnu-g++-o Test Test.cpp -std=c++11 -I ./htraapi/inc -L ./htraapi/lib -

```
Ihtraapi -WI,-rpath='./htraapi/lib'
```

For armv7 system, input:

```
arm-linux-gnueabihf-g++-o Test Test.cpp -std=c++11 -I ./htraapi/inc -L ./htra
api/lib -lhtraapi -WI,-rpath='./htraapi/lib'
```

	htra@ubuntu: ~/Desktop/C++_Test 🕒 🕒 🕲								
File Edi	t View Sear	ch Termina	ıl Help	b					
htra@ub /inc -L htra@ub	t <mark>ra@ubuntu:~/Desktop/C++_Test</mark> \$ g++ -o Test Test.cpp -std=c++11 -I ./htraapi 'inc -L ./htraapi/lib -lhtraapi -Wl,-rpath='./htraapi/lib' tra@ubuntu:~/Desktop/C++_Test\$ []								
Desktop	C++_Test	htraapi	lib			٩	=		
CalF	ile htraa	api T	est	c++ Test.cpp					

9. Run the program: Enter ./Test to start the executable file.



9.4.3 C++ Project Cross-Compilation

Under the premise that the host computer has a cross-compilation toolchain, if you want to cross-compile to use the device, please refer to the following process (taking the cross-compilation of an aarch64 executable program on an x86_64 host computer as an example):

1. First, generate the executable file for the target architecture:

(1) Create a project and place the calibration files and header files according to steps 1-4 in the compilation and running method in section 9.4.2. <u>Chapter 9.4.2</u>

(2) Place the cross-compiled target architecture library files as per step 5. For example, when cross-compiling an executable for the arrch64 architecture, please place the library files for the arrch64 architecture.

및 → USB Drive (F:) → Linux → Ins	stall_HTRA_SDK > h	traapi > lib >	aarch64
। ▲) 🖄 🗊 î î Sort ~	≡ View ~ ····		
Name	Date modified	Туре	Size
libgomp.so.1.0.0	10/9/2013 2:57 AM	0 File	51 KB
libhtraapi.so.0.55.55	1/6/2025 10:17 AM	55 File	1,087 KB
libliquid.so	1/12/2024 12:00 AM	SO File	906 KB
libusb-1.0.so.0.2.0	1/12/2024 12:00 AM	0 File	490 KB
README.txt	1/12/2024 12:00 AM	Text Document	1 KB

(3) Perform soft linking and program writing storage according to steps 6-7.

(4) Compile the executable file using the target architecture compilation command as described in step 8. The compilation command for the aarch64 architecture is expected to be used when compiling the executable file for the aarch64 system, as shown in the figure below.

htra@ubuntu: ~/Desktop/C++_Test								•••		
File Edit	File Edit View Search Terminal Help									
htra@ubu 1 -I ./H htra@ubu	<pre>htra@ubuntu:~/Desktop/C++_Test\$ aarch64-linux-gnu-g++ -o Test Test.cpp -std=c++1 I -I ./htraapi/inc -L ./htraapi/lib -lhtraapi -Wl,-rpath='./htraapi/lib' htra@ubuntu:~/Desktop/C++_Test\$ []</pre>									
> <	☆ Home	Desktop	C++_Test	htraapi	lib)		٩	=		
Recent Home		CalFile	htraa	pi		c++ Test.cpp				
Desktop										

(5) After generating the executable file, input 'file Test' to check the architecture of the executable program, and you will see that the current executable program architecture is aarch64.



2. At this point, the executable program has been successfully generated, and

you can now run the program on the aarch64 host machine using the device:

(1) Navigate to the project directory (the example project is located on the desktop, so input 'cd Desktop/'), and compress the entire folder into a zip file, for

	htra@ubuntu: ~/Desktop	● 🛛 😣
	File Edit View Search Terminal Help	
C++ Test	htra@ubuntu:~\$ cd Desktop/	
_	htra@ubuntu:~/Desktop\$ zip -r C++_Test.zip C++_Test	
	adding: C++_Test/ (stored 0%)	
	adding: C++_Test/htraapi/ (stored 0%)	
zip	adding: C++_Test/htraapi/lib/ (stored 0%)	
C++ Test.	adding: C++_Test/htraapi/lib/libliquid.so (deflated 63%)	
zip	adding: C++_Test/htraapi/lib/libhtraapi.so.0.55.53 (deflated 62%)	
	adding: C++_Test/htraapi/lib/libusb-1.0.so.0 (deflated 65%)	
	adding: C++_Test/htraapi/lib/libhtraapi.so.0 (deflated 62%)	
	adding: C++_Test/htraapi/lib/libusb-1.0.so.0.2.0 (deflated 65%)	
	adding: C++_Test/htraapi/lib/libusb-1.0.so (deflated 65%)	
	adding: C++_Test/htraapi/lib/libhtraapi.so (deflated 62%)	
	adding: C++_Test/htraapi/inc/ (stored 0%)	
	adding: C++_Test/htraapi/inc/htra_api.h (deflated 79%)	
	adding: C++_Test/Test (deflated 74%)	
	adding: C++_Test/CalFile/ (stored 0%)	
	adding: C++_Test/CalFile/023_4248500b000b0036_rfacal.txt (deflated 64%))
	adding: C++_Test/CalFile/023_4248500b000b0036_ifacal.txt (deflated 61%))
	adding: C++ Test/Test.cpp (deflated 65%)	

example, input 'zip -r C++_Test.zip C++_Test' to create the zip archive.

(2) Copy the zip file to the aarch64 host machine.

		15 GB Volume			
	File Edit View Sort Go Tools				
1	$\blacksquare \blacksquare \blacksquare \blacksquare \blacksquare \bullet \leftarrow \rightarrow$	/media/pi/15 GB Volume			
	Home Folder	Name			
	🚐 Filesystem Root	Windows			
C++ Toot zin	🚐 15 GB Volume 🛛 🔺	Linux			
C++_Test.2ip	Pictures	CalFile			
	Public	ApplicationGuide			
	Temptates	Quick Start GuideV1.1_CN .pdf			
	o Videos	Overview for Documents in Flash Disk_CN.pdf			
e K	▶ <mark>I</mark> lib	C++_Test.zip			

(3) Navigate to the location where the zip file is stored (in this example, the zip file is on the desktop, so input 'cd Desktop/'), and extract the project (input 'unzip C++_Test').

	pi@raspberrypi: ~/Desktop	~ ^ X
C++_Test.zip	File Edit Tabs Help pi@raspberrypi:~ \$ cd Desktop/ pi@raspberrypi:~ \$ cd Desktop/	-
	Archive: C++_Test.zip creating: C++_Test/ inflating: C++_Test/Test.cpp	
C++_Test	<pre>inflating: C++_Test/Test creating: C++_Test/htraapi/ creating: C++_Test/htraapi/lib/ ieflitie: C++_Test/htraapi/lib/</pre>	
	<pre>inflating: C++_Test/htraapi/lib/libusb-1.0.so.0.2.0 inflating: C++_Test/htraapi/lib/libliquid.so inflating: C++_Test/htraapi/lib/libusb-1.0.so</pre>	
	<pre>inflating: C++_Test/htraapi/lib/libusb-1.0.so.0 inflating: C++_Test/htraapi/lib/libusb-1.0.so.0 inflating: C++_Test/htraapi/lib/libusb-1.o.so.0</pre>	
	inflating: C++_Test/htraapi/lib/libhtraapi.so.0.55.53 creating: C++_Test/htraapi/inc/ inflating: C++_Test/htraapi/inc/htra_api.h	

(4) Configure the driver files on the aarch64 host machine as per the steps in section 9.3.<u>Chapter9.3</u>

(5) After configuring the driver files, input 'cd C++_Test/' to enter the folder, and then simply input './Test' to run the program.



9.5 Using Qt Examples and Project Creation

9.5.1 Using Qt Examples

To use the Qt examples included on the USB drive, provided that the device is properly connected and the driver files have been configured correctly as per Section 9.3, please refer to the following process (the purpose of this Qt example is to obtain complete spectrum data within a specified frequency band):<u>Chapter9.3</u>

1. Copy the Linux\HTRA_Qt_Examples folder from the included USB drive to the host computer, and then navigate to the HTRA_Qt_Examples\htraapi subfolder as shown in the figure.

De	sktop HTRA_Qt_Examples htraapi	م		
	Name		Size	Modified
	htra_api.h		139.7 kB	19 Sep
	Qt_Make.sh		389 bytes	27 Aug

2. Refer to the system architecture in the process outlined in Section 9.1, and then follow the instructions in Section 9.2.4 to copy the dynamic link libraries corresponding architecture from the to the system Linux\Install HTRA SDK\htraapi\lib folder on the USB drive the to HTRA Qt Examples\htraapi folder (this example uses an x86 64 architecture host computer).Chapter9.1Chapter9.2.4

및 → USB Drive (F:) →	Linux > Install_HTRA_SD	⊮K > htraapi > lib	> x86_64
ì \land 🖄	↑↓ Sort ~ 🛛 🗮 View ~		
Name	Date modified	д Туре	Size
libgomp.so.1.0.0	11/15/2013 11	1:24 PM 0 File	59 KB
libhtraapi.so.0.55.55	1/6/2025 10:1	7 AM 55 File	1,087 KB
libliquid.so	1/12/2024 12:	00 AM SO File	1,026 KB
libusb-1.0.so.0.2.0	1/12/2024 12:	00 AM 0 File	425 KB
README.txt	1/12/2024 12:	00 AM Text Document	1 KB

Desktop	HTRA	_Qt_Exam	iples htr	aapi 🕨		Q =	■	
		Q				•		
Historica de la composition de					 The second second	Harman Ha		
htra_api	i.h li	bgomp. so.1.0.0	libhtraapi so.0.55.55	libliquid.so	libusb-1.0. so.0.2.0	Qt_Make. sh		

3. Open a terminal in the current folder, enter "sudo sh Qt_Make.sh", and then follow the prompts to enter the sudo password to grant permission for creating soft links to the libraries.



4. After running the script, use Qt Creator to open the htrademo.pro file in the

htrademo folder.

<	> 🕢 🏠 Home	Desktop te	st HTRA_QI	_Examples	htrademo	
Θ	Recent					
ŵ	Home	htrademo.	c++	c++ mainwindo	mainwindo	mainwindo
	Desktop	рго	e.nepp	w.cpp	w.h	w.ui

5. First, select the build environment for the project.



6. Once the build environment is configured successfully, click on Edit, then click on the htrademo.pro file. As shown in the figure below, fill in the corresponding library file names at the location indicated by the red arrow based on the library files selected in Step 2. (This example only uses the libraries libhtraapi.so, libliquid.so, and libusb-1.0.so, so it is sufficient to ensure -lhtraapi -lliquid -lusb-1.0 are included. If the libiomp5.so library is used, -liomp5 should be added later; if the libmkl.so library is used, -lmkl should be added; if libgomp.so is used, -lgomp should be added; if the libarmral.so library is used, -larmral should be added.)



7. Open the HTRA_Qt_Examples\bin\CalFile folder and ensure that there is a

device calibration file in the folder.

Deskto	o test	HTRA_Qt_Examples	bin	CalFile	Þ	۹
42 01 if	023_ 48500b0 0b0036_ acal.txt	023_ 4248500b0 00b0036_ rfacal.txt				

8. After confirming that there is a calibration file, select any example in main.cpp.



9. Click Run, and as shown in the figure, the device is functioning normally.



9.5.2 Qt Project Creation and Compilation

Under the premise that the driver files have been correctly configured according to section 9.3, if you want to create a Qt project for compilation, please refer to the following process: <u>Chapter 9.3</u>

First, when writing code, since the Linux dynamic link libraries provided with the USB drive are identical to those for Windows, the code only needs to comply with the API programming guidelines.

Next, the process for creating the project is as follows:

1. As shown in the figure, first create a new folder to store the entire project (taking QtTest as an example), then create a bin folder within this folder to store calibration files and the generated executable files, and create an htraapi folder to store header files and dynamic link libraries.



2. Create a CalFile folder under the bin folder to store the device calibration files.



3. Copy the files from the CalFile folder on the provided USB drive to the newly

created QtTest\bin\CalFile folder.

Ð	↓ USB Drive (F:) → CalFile								
Ō		Ŕ	ÎÌ	↑↓ Sort ~	\equiv View $\scriptstyle{\scriptstyle \vee}$				
	Name		^		Date m	nodified	Туре	Size	
	023_4248500b000b0036_ifacal.txt			8/9/20	24 10:23 AM	Text Document	431 KB		
	023_4248500b000b0036_rfacal.txt			8/9/20	24 10:23 AM	Text Document	12,214 KB		

Desk	top QtTes	t bin (CalFile 🕨	٩	•][:-
	023_ 4248500b0 00b0036_ ifacal.txt	023_ 4248500b0 00b0036_ rfacal.txt)			

4. Copy the header files from the Linux\Install_HTRA_SDK\htraapi\inc folder on

the provided USB drive to the newly created QtTest\htraapi folder.

> USB Drive (F:) > Linux > Install_HTRA_SDK > htraapi > inc							
▲) 🖄 û îl Sort -	View ~ •••						
Name	Date modified	Туре	Size				
ាំ htra_api.h	11/25/2024 1:58 PM	C/C++ Header	141 KB				
Desktop QtTest htraapi 🕨		۹	=				
htra_api.h							

5. Refer to the system architecture in section 9.1, and then according to section 9.2.4, copy the dynamic link libraries corresponding to the system architecture from the Linux\Install_HTRA_SDK\htraapi\lib folder on the provided USB drive to the newly created QtTest\htraapi folder (taking the x86_64 architecture for the host computer as an example).Chapter9.1Chapter9.2.4

\Box > USB Drive (F:) >	Linux > Install_HTRA_SDK >	htraapi > lib >	x86_64
1 🔄 🖻	↑↓ Sort \cdot $≡$ View \cdot		
Name	Date modified	Туре	Size
libgomp.so.1.0.0	11/15/2013 11:24 PM	0 File	59 KB
libhtraapi.so.0.55.55	1/6/2025 10:17 AM	55 File	1,087 KB
libliquid.so	1/12/2024 12:00 AM	SO File	1,026 KB
libusb-1.0.so.0.2.0	1/12/2024 12:00 AM	0 File	425 KB
README.txt	1/12/2024 12:00 AM	Text Document	1 KB

Desktop	QtTest	htraapi	Þ			۹	:=	≡	
htra_ap	pi.h libo	jomp. l	libhtraapi. so.0.55.55	libliquid.so	libusb-1.0. so.0.2.0				

6. Open a terminal at the location of the htraapi folder and enter the following command to create a soft link for the copied dynamic link libraries (the soft link command for different architectures is the same):

In -sf libhtraapi.so.0.55.5 libhtraapi.so.0 (Here, the libhtraapi.so library is taken as an example with version 0.55.55; modify the version number for other versions.)

In -sf libhtraapi.so.0 libhtraapi.so

In -sf libusb-1.0.so.0.2.0 libusb-1.0.so.0

In -sf libusb-1.0.so.0 libusb-1.0.so

In -sf libgomp.so.1.0.0 libgomp.so.1

In -sf libgomp.so.1 libgomp.so

			htra@ubun	tu: ~/Desktop	/QtTest/htraap		
File E	dit View S	earch Tern	ninal Help				
htra@u .0	ibuntu:~/D	esktop/Q	tTest/htraa	api\$ ln -sf	libhtraapi.	so.0.55.55	libhtraapi.so
htra@u htra@u htra@u htra@u htra@u	ibuntu:~/D ibuntu:~/D ibuntu:~/D ibuntu:~/D ibuntu:~/D	esktop/Q esktop/Q esktop/Q esktop/Q esktop/Q	tTest/htraa tTest/htraa tTest/htraa tTest/htraa tTest/htraa	api\$ ln -sf api\$ ln -sf api\$ ln -sf api\$ ln -sf api\$ ln -sf	libhtraapi. libusb-1.0. libusb-1.0. libgomp.so. libgomp.so.	so.0 libhtra so.0.2.0 lib so.0 libusb 1.0.0 libgor 1 libgomp.so	aapi.so busb-1.0.so.0 -1.0.so np.so.1 D
Home	Desktop	QtTest	htraapi 🕨			৫ =	
	Handbard (1997) Handbard (1997) Handba						A constraint of the second sec
	htra_api	.h libgon	np.so libgo so	mp. libgo .1 so.1.	mp. libhtraa 0.0 so	pi. libhtraapi so.0	i. libhtraapi. so.0.55.55
	libliquid.	so libusb so	-1.0. libust	0-1.0. libusb .0 so.0.	-1.0. 2.0		

7. Open Qt Creator, click on File, and select New File or Project.

			Qt Creator		= • ×
File Edit Build Debug Analyze	<u>T</u> ools <u>W</u> indow	<u>H</u> elp			
💫 New File or Project	Ctrl+N				
늘 Open File or Project	Ctrl+O				
Open File <u>W</u> ith		Tutorials			
Recent <u>F</u> iles					
Recent Projects		·	1 []		
Sessions		Tutorial	Tutorial	Tutorial	Tutorial
Close Project					
Close All Files in Project					
Close All Projects and Editors					
🖉 Save	Ctrl+S				
🔯 Save <u>A</u> s		ing and Runn	Help: Creating a Mobile	Help: Creating a Qt Qui	Help: Creating a Qt Wid
Save All	Ctrl+Shift+S	or build compile help	Tags: qt creator qt quick designer qml	Tags: qt creator qt quick designer	Tags: qt creator qt designer widgets c++
🖓 Revert to Saved				help	
Close	Ctrl+W]]		
Close All	Ctrl+Shift+W	Tutorial	Tutorial	Video Tutorial	Video Tutorial
Close Others					
Close All Except Visible					
🕮 Print	Ctrl+P				
😇 E <u>x</u> it	Ctrl+Q	a		4:06	13:28
L Qt Account	Help. Get	ting started Pr	Help: Getting Started Pr	Online: Digital Instrume	Online: Getting Started
	Tags: qt qu	ick controls tumbler help	Tags: qt qt creator qt designer widgets c++ help	Tags: qt creator qt quick automotive safe renderer controls video	Tags: qt creator qt quick video
Online Community					
Blogs					
A User Guide		Video Tutorial	Video Tutorial	Video Tutorial	Video Tutorial
P. Type to locate (Ctrl	1 Issues	2 Search Results	3 Application Output 4 Compile O	utput 5 QML Debugger C	8 Test Results 🗢 🔤 🛛

8. Select Create Form Application.

			Qt Creator		008
<u>F</u> ile <u>E</u> dit	<u>Build</u> Debug	Analyze Tools Window Help			
			New File or Project — Qt Creator	S	
Welcome	Projects	Choose a template:		All Templates 👻	
Edit	Example:	Projects Application	Qt Widgets Application	Creates a Qt application for the desktop. Includes a Qt Designer- based main window	
Design	Tutorials	Other Project Non-Ot Project	Qt Console Application	Preselects a desktop Qt for building the application if available.	Tutorial
🐞 Debug	- 1	Import Project Files and Classes	Qt for Python - Empty	Supported Platforms: Desktop	
پ Projects	New to Q	C++ Modeling	Qt for Python - Window		reating a Qt Wid
() Help	own applicatie explore Qt Cre	Qt GLSL	Qt Quick Application - Empty		d help
	Get Start	General Java	Qt Quick Application - Scroll		Video Tutorial
	- 1	Python	Qt Quick Application - Stack		
	- 1		Qt Quick Application - Swipe		13:28
—	L Qt Accoun			¥ Cancel √ Choose	creator qt quick video
	Online Cor				
	Blogs	Video Tutori	Video Tutorial	Video Tutorial	Video Tutorial
-	Oser Guide				
	P. Type to	ocate (Ctrl 1 Issues 2 Search Re	sults 3 Application Output 4 Compile O	Dutput 5 QML Debugger C 8 Test Re	esults 🗢 🖬 🖉

9. After filling in the project name, click Browse to change the project path.

	Qt Widgets Application — Qt Creator 🛛 😵
Location	Project Location
Build System Details Translation Kits Summary	This wizard generates a Qt Widgets Application project. The application derives by default from QApplication and includes an empty widget.
	Name: Test Create in: /home/: Browse Use as default project location Browse
	Next > Cancel

10. Select the directory as the QtTest address created in the first step and click Open.

Car	ncel	Choose Directory		Q Open
0	Recent	▲ ▲ Desktop QtTest ▶		53
企	Home	Name 👻	Size	Modified
	Desktop	📄 htraapi		03:49
۵	Documents	📄 bin		03:42

11. After selecting the path, click Next.

	Qt Widgets Application — Qt Creator	8					
	Project Location						
Build System Details Translation Kits Summary	This wizard generates a Qt Widgets Application project. The application derives by default from QApplication and includes an empty widget.						
	Name: Test						
	Create in: /home/. /Desktop/QtTest Browse						
	<u>N</u> ext > Cano	:el					

12. Click Next to continue.

	QI	t Widgets Ap	plication — Q)t Creator			8
Location	Define Buil	d System					
Build System Details Translation Kits Summary	Build system: c	ımake					•
					< <u>B</u> ack	<u>N</u> ext >	Cancel

13. Click Next to continue.

Location	Class Inf	ormation	
Build System Details		Specify basic information about the classes for which you want to generate skeleton source code files.	
Translation	Class name:	MainWindow	
Kits Summary	Base class:	QMainWindow	,
	Header file:	mainwindow.h	
	Source file:	mainwindow.cpp	
		✓ Generate form	
	Form file:	mainwindow.ui	

14. Click Next to continue.

	Qt	: Widgets Applic	ation — Qt Cre	ator	8	
Location	Translation	File				
Build System Details	If you plan to provide translations for your project's user interface via the Qt Linguist tool, please select a language here. A corresponding translation (.ts) file will be generated for you.					
// Translation Kits	Language:	<none></none>			•	
Summary	Translation file:	<none></none>	.ts			
				< <u>B</u> ack <u>N</u> e	ext > Cancel	

15. Select the x86_64 build environment for the project and then continue by clicking next.

	Qt Widgets Application — Qt Creator	8				
Location	Kit Selection					
Build System	The following kits can be used for project Test :	•				
Details	Type to filter kits by name					
Translation	Select all kits					
Summary	Desktop	Details 👻				
	🗹 🖵 Desktop Qt 5.12.8 GCC 64bit	Details 👻				
	🗆 🖵 arrch64	Details 👻				
	< <u>B</u> ack <u>N</u> ext >	Cancel				

16. Click Finish to create the project.

	Qt Widgets Appl	lication — Qt Creator		8			
Location	Project Management						
Build System	Add as a subproject to project:	<none></none>		~			
Details Translation Kits > Summary	Add to <u>v</u> ersion control:	<none></none>		 Configure 			
	Files to be added in /home/zhangguorong/Desl	ktop/QtTest/Test:					
	Test.pro main.cpp mainwindow.cpp mainwindow.h mainwindow.ui						
			< <u>B</u> ack <u>F</u> inis	h Cancel			

17. Click Edit, right-click the Test project, and click Add Library.

			main.cpp - Qt Creator		⊜ 🗊 😣
<u>F</u> ile <u>E</u> di	t <u>B</u> uild <u>D</u> ebug	<u>A</u> nalyze <u>T</u> ools <u>W</u> indow <u>H</u> elp			
	Projects	🗢 🔽 😁 🖽 🖂 🔬 🖬 🖬 main.cpp	imes imes <select symbol=""></select>	≑ Unix (LF)	≑ Line: 1, Col: 1 🛛 🕀+
	👻 🐻 Test	Build	ግพ.h"		^
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0		New Subproject			
Help		Add Library	1		
		Find in This Directory			
		Close All Files in Project "Test"			
		Close Project "Test"			
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	Open Documents	Expand All			
Test	main.cpp		-		
Γ.					
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	■ P. Type to loo	ate (Ctrl 1 Issues 2 Search Results	s 3 Application Output 4 Compile Output	5 QML Debugger C 8 Test Results	÷ ≓∎/

18. Select External Library and click Next.



19. Click Browse Library File.

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Design	 Mainw Forms 	indow.cpp	Specify the librar	y to link to and t	he includes path			
N Debug			Type Details	Library type: Library file:	Linux (lib*.so lib*.a)	• Browse		
پر Projects			Summary	Include path: Platform	Linkage:	Browse		
PHelp				✓ Linux	Mac: Library			
				✓ Windows	Library Framework	ork		
	Open Documents	- + B+ ₪			✓ Library inside "debug" or "release	" subfolder		
Test	main.cpp	<u>م</u>			Add "d" suffix for debug version			
Debug					< <u>B</u> ack <u>N</u> ext :	Cancel		
~	🔲 🔎 Type to lo	ocate (Ctrl	1 Issues 2 Search	n Results - 3 App	olication Output 4 Compile Output 5	QML Debugger C	8 Test Results	 ↓ ↓

20. Select Q Test\htraapi, the library previously copied and soft-linked, and click

Open.

Can	ncel	Choose File	C	ک Open
Ø	Recent	▲ Desktop QtTest htraapi ▶		
企	Home	Name	Size	Modified
	Desktop	libusb-1.0.so	434.8 kB	29 Apr 2024
Б	Documents	📄 libliquid.so	1.1 MB	29 Apr 2024
	Documents	📔 libhtraapi.so	927.6 kB	24 Nov 2024
∻	Downloads			

21. Select the Linux platform and click Next.

				in.cpp @ Test - Qt Creator		
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	Projects 🗢 🛪 😁 🗛 🖻	i < 🖂 🖻 🗟 mair	ъ.срр	imes <select symbol=""></select>	≎ Unix	(LF) \$ Line: 1, Col: 1
	 Test Test pro 	1 #include "	mainwindow.h"			
	Headers		۵	dd Library — Ot Creator		
E	 Sources 					
Edit	main.cpp	External Library Specify the libra	ry to link to and	the includes path		
	Forms		,			
			Library bype:	Lipux (lib* so lib* a)		
÷.		Type	Library type.			
		Summary	Library file:	ong/Desktop/QtTest/htraapi/libhtraapi.so	Browse	
J.			Include path:	he/zhangguorong/Desktop/QtTest/htraapi	Browse	
Projects			Platform	Linkage: Dynamic		
V			✓ Linux			
			Mac			
			Window	Library O Framework	k	
				Windows:		
				Library inside "debug" or "release" o	subfolder	
	Open Documents 💠 🗄 📼			Add "d" suffix for debug version	subrotuer	
Test	main.cpp					
_ ,						
				< <u>B</u> ack <u>N</u> ext >	Cancel	
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	P. Type to locate (Ctrl	1 Issues 2 Searc	h Results 3 Ap	oplication Output 4 Compile Output 5 Q	ML Debugger C	8 Test Results 💠 🛛 🚽 🖉

22. Click Finish to add the external library.

				main.cpp (@ Test - Qt Creator			● 🖲 😣
<u>F</u> ile <u>E</u> d	it <u>B</u> uild <u>D</u> ebug <u>A</u> na	alyze <u>T</u> ools	<u>W</u> indow <u>H</u> elp					
Welcome	Projects + ` Test Test.pro	₹. ↔ ⊞+ ⊡	A second seco	kCPP nainwindow.h"	¢ × ≺Select Symbol>	+ Ur	nix (LF) 🤤	↓ Line: 1, Col: 1
vercome Edit Design Ø Projects Projects	ini Headers ini Heade	w.cpp	Type Details Summary	Add Llbr Summary The following snippet Test.pro file: unix:!macx: LIB INCLUDEPATH += DEPENDPATH += \$	ary — Qt Creator t will be added to the S += -L\$\$PWD//htraapi/ \$\$PWD//htraapi \$PWD//htraapi	'-lhtraapi		
Test Debug	Open Documents main.cpp	+ 8+ c	1 Issues - 2 Search	a Results 3 Anniicati	< <u>B</u> ack <u>Fi</u>	nish Cancel	8 Test Pesults	

23. Click Edit, then click the Test.pro file. As shown in the figure below, fill in the corresponding library file names at the position indicated by the red arrow based on the library files selected in the previous step (5). (This example only uses libhtraapi.so, libliquid.so, and libusb-1.0.so, so it is sufficient to ensure -lhtraapi -lliquid -lusb-1.0 are included. If the libiomp5.so library is used, -liomp5 should be added later; if libmkl.so is used, -lmkl should be added; if libgomp.so is used, -lgomp should be added; if libarmral.so is used, -larmral should be added.)



24. As shown in the figure below, add

DESTDIR = \$\$clean_path(\$\$PWD/../bin)

(This step specifies the location for generating the executable program.)



25. As shown in the figure below, after the library files, add

-Wl,-rpath,\$\$PWD/../htraapi

(This step specifies the library path for linking the executable program.)



26. Save the Test.pro file, and then write the code in mainwindow.cpp.



27. After writing the code correctly, click run. As shown in the figure, you can see

that the program is running normally in the application output.

	mainwindow.cpp @ Test - Qt Creator	
<u>File Edit Build Debug Analyze Tool</u>	s <u>W</u> indow <u>H</u> elp	
Projects 🗢 🕂 🖽	🗉 < 🕞 📾 mainwindow.cpp 🕴 🗧 🖊 MainWindow::MainWindow(QWi 🗘 Unix (LF)	¢ Line: 28, Col: 68 ⊟+
Image: Second	<pre>include "mainwindow.tp include "mainwindow.tp include "mainwindow.tp include string_api.h> finclude string_h> finclude str</pre>	
Open Documents 🔶 🗄 🕂	Application Output 🔰 < > 🕨 📕 🎼 🌣 📿 Filter + -	~ 🗉
main.cpp Test mainwindow.cpp	Test ¥	
Debug	Mainkindow 30 Device opened successful1 Mainkindow 50 Frequency[0] = -6.62109e+06;	
P. Type to locate (Ctrl	1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger C 8 Test Result	s ≑ 🖬 /

28. Close Qt Creator, enter the QtTest\bin folder, open the terminal, and type ./Test to run the executable program.

Desktop	QtTest	bin					٩	:=		
	Eile									
	unte	Test	,	ை	untu: ~/D	eskton/OtTest	/hin			
			• •••			-skeop/Qerese/	U.I.I			
File Edit	View Se	arch Te	rminal I	lelp						
(base) MainWind MainWind	ow 44 De ow 65 Co	j@ub vice o onfigur	untu:~ pened ation	/Desktop/ Successfi Successfi	QtTest/b ll! ll!	in\$./Test				
MainWind	low 94 Fr	equenc	y[0] =	-6.6210)9e+06 ;	PowerSpec_0	dBm[0]	= •	86.096	7
MainWind	ow 94 Fr	equenc	y[0] =	-6.6210)9e+06 ;	PowerSpec_0	dBm[0]	= -	87.168	2
MainWind	ow 94 Fr	equenc	y[0] =	-6.6210)9e+06 ;	PowerSpec_0	dBm[0]	= -	89.351	.8

9.5.3 Cross-compiling Qt projects

Under the premise that the host computer has a cross-compilation toolchain, if you want to cross-compile to use the device, please refer to the following process (taking the cross-compilation of an aarch64 executable program on an x86_64 host computer as an example):

1. First, generate the executable file for the target architecture:

(1) Create the project and place the calibration files and header files according to steps 1-4 of the form program creation process.<u>QtProject Creation and Compilation</u>

(2) Place the cross-compilation target architecture library files according to step 5 of the form program creation process. For example, if you expect to cross-compile an executable for the arrch64 architecture, please place the library files for the arrch64 architecture.

🖵 > USB Drive (F:) > Linux > 🛛	stall_HTRA_SDK >	htraapi > lib >	aarch64
ট 🗐 🖻 🗊 🕄 Sort ∽	Wiew ~		
Name	Date modified	Туре	Size
libgomp.so.1.0.0	10/9/2013 2:57 AM	0 File	51 KB
libhtraapi.so.0.55.55	1/6/2025 10:17 AM	55 File	1,087 KB
libliquid.so	1/12/2024 12:00 AM	SO File	906 KB
libusb-1.0.so.0.2.0	1/12/2024 12:00 AM	0 File	490 KB
README.txt	1/12/2024 12:00 AM	Text Document	1 KB

(3) Create a soft link for the dynamic link library according to step 6 of the form program creation process.

(4) Create the program according to steps 7-13 of the form program creation process, and in step 14, select the build kit for the cross-compilation target architecture (for example, in this example, select the build kit for the arrch64 architecture).

	Qt Widgets Application — Qt Creator	8						
Location	Kit Selection							
Build System	The following kits can be used for project untitled :							
Details	Type to filter kits by name							
Translation	Select all kits							
Summary	Desktop	Details 👻						
	Desktop Qt 5.12.8 GCC 64bit	Details 👻						
	✓	Details 👻						
	< <u>B</u> ack <u>N</u> ext >	Cancel						

(5) Follow steps 16-26 of the form program creation process to create the project, reference the libraries, modify the location for generating the executable program, and write the project.

(6) Click the build button in the lower left corner to build the executable program.



(7) After building the executable program, open the terminal in the QtTest\bin folder and type file Test to check the architecture of the executable program (the name of the executable program here is Test, so type file Test).

htra@ubuntu: ~/Desktop/QtTest/bin	• • • •
File Edit View Search Terminal Help	
<pre>htra@ubuntu:~/Desktop/QtTest/bin\$ file Test Test: ELF 64-bit LSB shared object, ARM aarch64, version 1 (SYSV), dy inked, interpreter /lib/ld-linux-aarch64.so.1, for GNU/Linux 3.7.0, E]=664b014870dba5dcb7e25e3eb17432ef378b7b1d, not stripped htra@ubuntu:~/Desktop/QtTest/bin\$</pre>	ynamically l BuildID[sha1

2. At this point, the executable program has been successfully generated, and you can now run the program on the aarch64 host machine using the device:

(1) Navigate to the project location (in this example, the project is located on the desktop, so type cd Desktop/), and compress the entire folder into a zip file, for example, type zip -r Qt Test.zip Qt Test to create a zip archive.

htra@ubuntu: ~/Desktop 🕒 🗖	8
File Edit View Search Terminal Help	
htra@ubuntu:~\$ cd Desktop/	
htra@ubuntu:~/Desktop\$ zip -r QtTest.zip QtTest	
updating: QtTest/ (stored 0%)	
updating: QtTest/htraapi/ (stored 0%)	l I
updating: QtTest/htraapi/libliquid.so (deflated 60%)	l I
updating: QtTest/htraapi/libhtraapi.so.0.55.53 (deflated 64%)	l I
updating: QtTest/htraapi/libusb-1.0.so.0 (deflated 62%)	
updating: QtTest/htraapi/libhtraapi.so.0 (deflated 64%)	
updating: QtTest/htraapi/libusb-1.0.so.0.2.0 (deflated 62%)	
updating: QtTest/htraapi/libusb-1.0.so (deflated 62%)	
updating: QtTest/htraapi/libhtraapi.so (deflated 64%)	
updating: QtTest/htraapi/htra_api.h (deflated 79%)	
updating: QtTest/Test/ (stored 0%)	
updating: OtTest/Test/main.cop (deflated 27%)	

(2) Copy the zip file to the aarch64 host machine.

		/media/rpdzkj/1E2A-96E8/te
QtTest.zip	Places ✓ Image: Home Folder Image: Desktop Image: Trash Can	QtTest.zip

(3) Navigate to the location of the compressed package (in this example, the compressed package is located on the desktop, so input cd Desktop/), and unzip the project (input unzip QtTest here).

7				rpdzkj@	localh	ost: ~/	Desktop)	25	~ ^ 8
File	Edit	Tabs	Help							
rpdzk rpdzk	j@loc	alhost alhost	t:~\$ cd De t:~/ <mark>Deskt</mark> o	sktop/ p\$ unzip	QtTest.	.zip				
Archi cr	ve: eatin	QtTest g: Qt	t.zip Test/							
cr inf	eatin	g: Qt a: Ot	Test/Test/ Test/Test/	, mainwindo	w.ui					
inf	latin	g: Qt	Test/Test/	mainwindo	w.cpp w.h					
inf	latin	g: Qt	Test/Test/	main.cpp						
inf	latin	g: Qt g: Qt	Test/Test/	Test.pro.	user					

(4) Configure the driver files on the aarch64 host machine as per the steps in section 9.3.<u>Chapter9.3</u>

(5) After configuring the driver files, input cd QtTest/ to enter the folder, then input chmod 777 Test to provide execution permissions for the program, and finally input ./Test to run the program.

📮 rpdzkj@localhost: ~/Desktop/QtTest/bin	~ ^ 😣
File Edit Tabs Help	
<pre>rpdzkj@localhost:~/Desktop/QtTest/bin\$ chmod 777 Test rpdzkj@localhost:~/Desktop/QtTest/bin\$./Test</pre>	
arm release ver of this libmali is 'g6p0-01eac0', rk so ver is '5'.	
Failed creating base context during opening of kernel driver. Kernel module may not have been loaded	
arm_release_ver of this libmali is 'g6p0-01eac0', rk_so_ver is '5'.	
Kernel module may not have been loaded	
MainWindow 44 Device opened successful!	
MainWindow 93 Configuration successful: MainWindow 94 Frequency[0] = -1.2e+06 ; PowerSpec_dBm[0] = -38.5426	
MainWindow 94 Frequency[0] = -1.2e+06 ; PowerSpec_dBm[0] = -36.4309	
MainWindow 94 Frequency[0] = -1.2e+06 ; PowerSpec_dBm[0] = -32.2113 MainWindow 94 Frequency[0] = -1.2e+06 ; PowerSpec_dBm[0] = -29.7813	
MainWindow 94 Frequency[0] = -1.2e+06 ;	

9.6 Usage of Python examples and project creation

9.6.1 Usage of Python examples

Assuming the device is properly connected and the driver files have been configured correctly as per section 9.3, if you want to use the Python examples included on the USB drive, you can refer to the following process (the specific functions of the Python examples can be directly viewed in section 4.2):<u>Chapter9.3</u>

1. Copy the Linux\HTRA_Python_Examples folder from the included USB drive to the host computer, then open a terminal in the HTRA_Python_Examples folder and input which python3 to check the location of the Python interpreter (for example, it may be located at /usr/bin).



2. Based on the interpreter address obtained earlier, input sudo cp -r CalFile /usr/bin to copy the device calibration file to the same directory as the interpreter (Python3) (for example, in this case, the same directory is /usr/bin; if the actual interpreter location is different, modify the address accordingly).



3. First, refer to the system architecture in section 9.1, then according to section 9.2.4, copy the dynamic link libraries from the corresponding system architecture folder under the included USB drive Linux\Install_HTRA_SDK\htraapi\lib to the HTRA_Python_Examples\htraapi folder (this example uses the x86_64 architecture host computer).<u>Chapter9.1Chapter9.2.4</u>

_	〕 → USB Drive (F:) →	Linux → Instal	I_HTRA_SDK >	htraapi → lil	b > x86_64	
Õ.	A) 🖻 🗊	∿ Sort ~ 🔳	E View ∽ ••••			
	Name	D	ate modified	Туре	Size	
	libgomp.so.1.0.0	11	1/15/2013 11:24 PM	0 File	59 KB	
	libhtraapi.so.0.55.55	1/	/6/2025 10:17 AM	55 File	1,087 KB	
	libliquid.so	1/	/12/2024 12:00 AM	SO File	1,026 KB	
	libusb-1.0.so.0.2.0	1/	/12/2024 12:00 AM	0 File	425 KB	
	README.txt	1/	/12/2024 12:00 AM	Text Documen	it 1 KB	
D	esktop HTRA_Pytho	n_Examples h	traapi 🔸		ସ = =	• • •
	libgomp. so.1.0.0 so.0.55.	pi. libliquid.so	libusb-1.0. so.0.2.0	Py_Make.sh		

4. Open a terminal in the current folder and input "sudo sh Py_Make.sh", then follow the prompts to enter the sudo password to provide permissions for creating soft links to the libraries.

		htra@ubuntu	ı: ~/Desktop/	/HTRA_Python	_Examples/h	traapi	000		
File Edi	it View Se	arch Terminal	Help						
htra@ubuntu:~/Desktop/HTRA_Python_Examples/htraapi\$ sudo sh Py_Make.sh [sudo] password for htra: htra@ubuntu:~/Desktop/HTRA_Python_Examples/htraapi\$ []									
Home	Desktop	HTRA_Python_E	Examples h	itraapi 🕨		۹ =			
		 A second s		A constraint of the second sec	n no na serie de la constante	n en	 Marine Marine Marine Marine Marine Ma		
	libgomp.	so libgomp. so.1	libgomp. so.1.0.0	libhtraapi. so	libhtraapi. so.0	libhtraapi. so.0.55.55	libliquid.so		
		A second		A constraint of the second sec					
	libusb-1.	0. libusb-1.0.	libusb-1.0.	Py_Make.sh					
	SO	so.0	so.0.2.0						

5. In the HTRA_ Python_ Examples location, open a terminal and input python3 SWPMode_Standard.py to run the example. (This example uses SWPMode_Standard.py as an example)



9.6.2 Python Project Creation

Under the premise that the driver files have been correctly configured according to section 9.3, if you want to create and write a Python project, please refer to the following process: <u>Chapter 9.3</u>

First, when writing code, since the Linux dynamic link library provided with the USB drive is identical to that in Windows, the code only needs to comply with the API programming guidelines.

Secondly, when running the program, simply place the program in the example folder and follow the process outlined in the Python example usage section.<u>PythonExample Usage</u>

9.7 Java (to be supplemented)

It is important to note that when writing programs in Java to control devices on a Linux system, the CalFile folder needs to be placed in the same directory as the Java interpreter.