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APN Content Level	BASIC		INTERMEDIATE	✓	ADVANCED		Confidentiality	Public	✓	Private	
Hardware Compatibility	Product Line		AirPrime	Series	Q26xx			WMPxx			
					SL60xx			SL80xx			
Software Compatibility	OpenAT Framework 2.52										

1 Version

Application Notes may be updated over their lifetime. To ensure you design with the correct version, please check the application notes page in <http://developer.sierrawireless.com/> for latest versions.

2 Introduction

This Application Note (APN) is provided to Sierra Wireless distributors and clients to aid more rapid development of embedded applications using the Sierra Wireless portfolio of cellular solutions. To request a new application note, contact your regional Sierra Wireless Product Marketing Manager.

3 Application Note Description

This application note contains two sets of sample code:

1. Voice over IP using PCM (VOIP_PCM) which is applicable to 3G modules
2. Voice over IP using AMR (VOIP_AMR) which is applicable to 2G modules

On both sample code set, a UDP server listening on port 1234 will be created. This UDP server is used to receive the audio data sent from the peer side. The received data will be stored in the audio play buffer queue which will be played in real-time by the speaker. For the record data transfer process, a 500ms timer will be called cyclically to send the recorded data from the microphone to the peer side through the UDP service.

3.1 Voice over IP using PCM

The PCM data will be recorded at a rate of 16K bytes per second. For every 500ms, 8 UDP packets – each containing 1000 bytes of PCM data will be sent to the peer side by the UDP service. The figure below illustrates the data transfer mechanism for every 500ms.

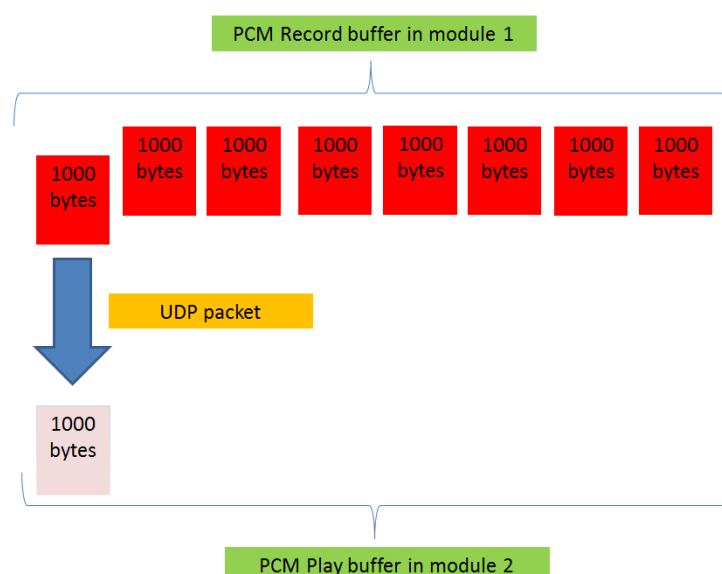


Figure 1. Voice Over IP Using PCM

3.2 Voice over IP using AMR

The AMR data will be recorded at an approximate rate of 700 bytes per second. For every 500ms, one UDP packet containing 350 bytes of PCM data will be sent to the peer side by the UDP service. The figure below illustrates the data transfer mechanism for every 500ms.

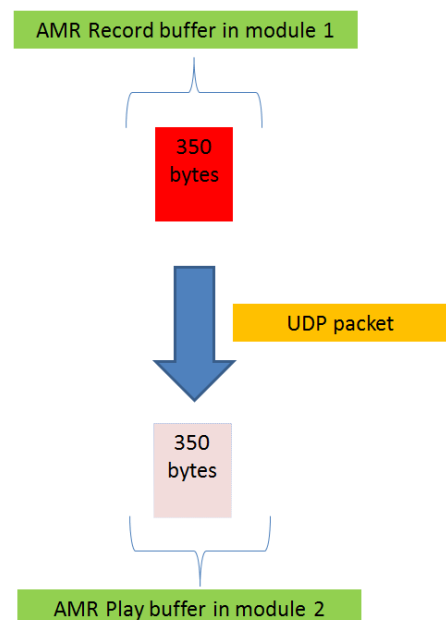


Figure 2. Voice Over IP using AMR

4 Custom AT Commands

The following AT commands are included in the application:

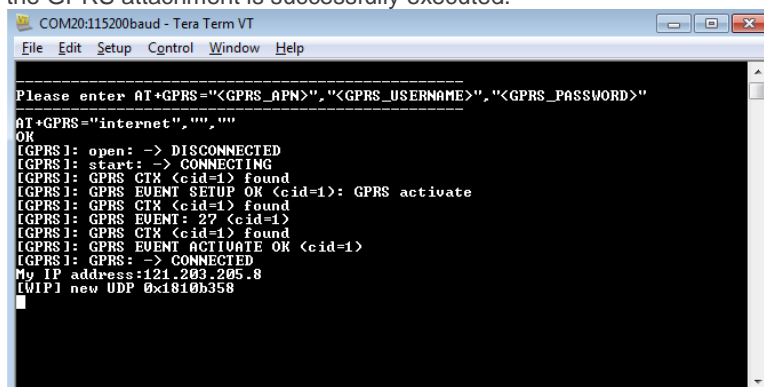
AT Command Syntax		
AT+GPRS="<GPRS_APN>","<GPRS_USERNAME>","<GPRS_PASSWORD>"		
Parameters	Values	Description
GPRS_APN	string	Access point name
GPRS_USERNAME	string	User name for GPRS
GPRS_PASSWORD	string	Password for GPRS

AT Command Syntax		
AT+STARTVOIP=,"<VOIP_PEER_IP>",<VOIP_PEER_PORT>		
Description		
This command is used to start the VOIP toward another module running the same OpenAT application.		
Parameters	Values	Description
VOIP_PEER_IP	string	The IP address of the peer side
VOIP_PEER_PORT	string	Listening port of the UDP server created on peer side. Please note that this must be set to 1234 as the source code has hardcoded this value in pcm_record_play.c: #define UDP_SERVER_LOCAL_PORT 1234

AT Command Syntax
AT+STOPVOIP
Description
This command is used to stop the VOIP. Type this command on both modules when user wants to stop the VOIP call.

5 Example

1. Make a GSM voice call using the ATD command to make sure that both the microphone and speaker are working properly on both modules.
2. Download the same application to both modules. Please note that VOIP_AMR is applicable to 2G modules only and VOIP_PCM is applicable to 3G modules only.
3. Input the GPRS information using the custom AT command +GPRS. The IP address will be printed out on UART1 if the GPRS attachment is successfully executed.



```

Please enter AT+GPRS="internet","",""
AT+GPRS="internet","",""
OK
[GPRS]: open: -> DISCONNECTED
[GPRS]: start: -> CONNECTING
[GPRS]: GPRS CTX <cid=1> found
[GPRS]: GPRS EVENT SETUP OK <cid=1>: GPRS activate
[GPRS]: GPRS CTX <cid=1> found
[GPRS]: GPRS EVENT: 27 <cid=1>
[GPRS]: GPRS CTX <cid=1> found
[GPRS]: GPRS EVENT ACTIVATE OK <cid=1>
[GPRS]: GPRS: -> CONNECTED
My IP address:121.203.205.8
[UIP] new UDP 0x1810b358
  
```

4. Establish a VOIP connection using AT+STARTVOIP=,"<VOIP_PEER_IP>",<VOIP_PEER_PORT>. For example, if module 1 has IP address "111.111.111.111", and module 2 has IP address "222.222.222.222", type the following to establish VOIP connection:

Module 1 : AT+STARTVOIP="222.222.222.222",1234

Module 2 : AT+STARTVOIP ="111.111.111.111",1234

Now both sides should be able to talk to each other through the microphone and speaker.

5. To stop the VOIP connection, run AT+STOPVOIP on both modules.

6 Package Deliverables

This application note is delivered as a single compressed zip archive as follows:

Filename	Description
AirPrime - Voice Over IP - Application Note - Rev1.1.zip	The zip file includes this application note and the source codes of VOIP_PCM and VOIP_AMR.

6.1 Documentation

Filename	Description
AirPrime - Voice Over IP - Application Note - Rev1.1.pdf	Voice over IP application note

6.2 Software

Filename	Description
\\VOIP_PCM\\src\\appli.c	Source code for VOIP using PCM
\\VOIP_PCM\\src\\cfg_gprs.c	Source code for VOIP using PCM
\\VOIP_PCM\\src\\generated.c	Source code for VOIP using PCM
\\VOIP_PCM\\src\\pcm_buffer.c	Source code for VOIP using PCM
\\VOIP_PCM\\src\\pcm_record_play.c	Source code for VOIP using PCM
\\VOIP_PCM\\inc\\pcm_buffer.h	Header file for VOIP using PCM
\\VOIP_AMR\\src\\appli.c	Source code for VOIP using AMR
\\VOIP_AMR\\src\\cfg_gprs.c	Source code for VOIP using AMR
\\VOIP_AMR\\src\\generated.c	Source code for VOIP using AMR
\\VOIP_AMR\\src\\pcm_buffer.c	Source code for VOIP using AMR
\\VOIP_AMR\\src\\pcm_record_play.c	Source code for VOIP using AMR
\\VOIP_AMR\\inc\\pcm_buffer.h	Header file for VOIP using AMR

Note: VOIP_AMR is applicable to 2G modules only, and VOIP_PCM is applicable to 3G modules only.

7 Software Compatibility Matrix

Firmware	Open AT Application Framework/SDK	Library/Libraries
FW 7.52	Open AT Framework 2.52	Internet 5.56.0.201305170830

8 Support

For direct clients: contact your Sierra Wireless FAE

For distributor clients: contact your distributor FAE

For distributors: contact your Sierra Wireless FAE

9 Document History

Version	Date	History
1.0	January 17, 2014	Creation
1.1	January 22, 2014	Updated resource link in section 1 Version



10 Legal Notice

Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

Safety and Hazards

Do not operate the Sierra Wireless modem in areas where cellular modems are not advised without proper device certifications. These areas include environments where cellular radio can interfere such as explosive atmospheres, medical equipment, or any other equipment which may be susceptible to any form of radio interference. The Sierra Wireless modem can transmit signals that could interfere with this equipment. Do not operate the Sierra Wireless modem in any aircraft, whether the aircraft is on the ground or in flight. In aircraft, the Sierra Wireless modem **MUST BE POWERED OFF**. When operating, the Sierra Wireless modem can transmit signals that could interfere with various onboard systems.

Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.

The driver or operator of any vehicle should not operate the Sierra Wireless modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces, operating such communications devices while in control of a vehicle is an offence.

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