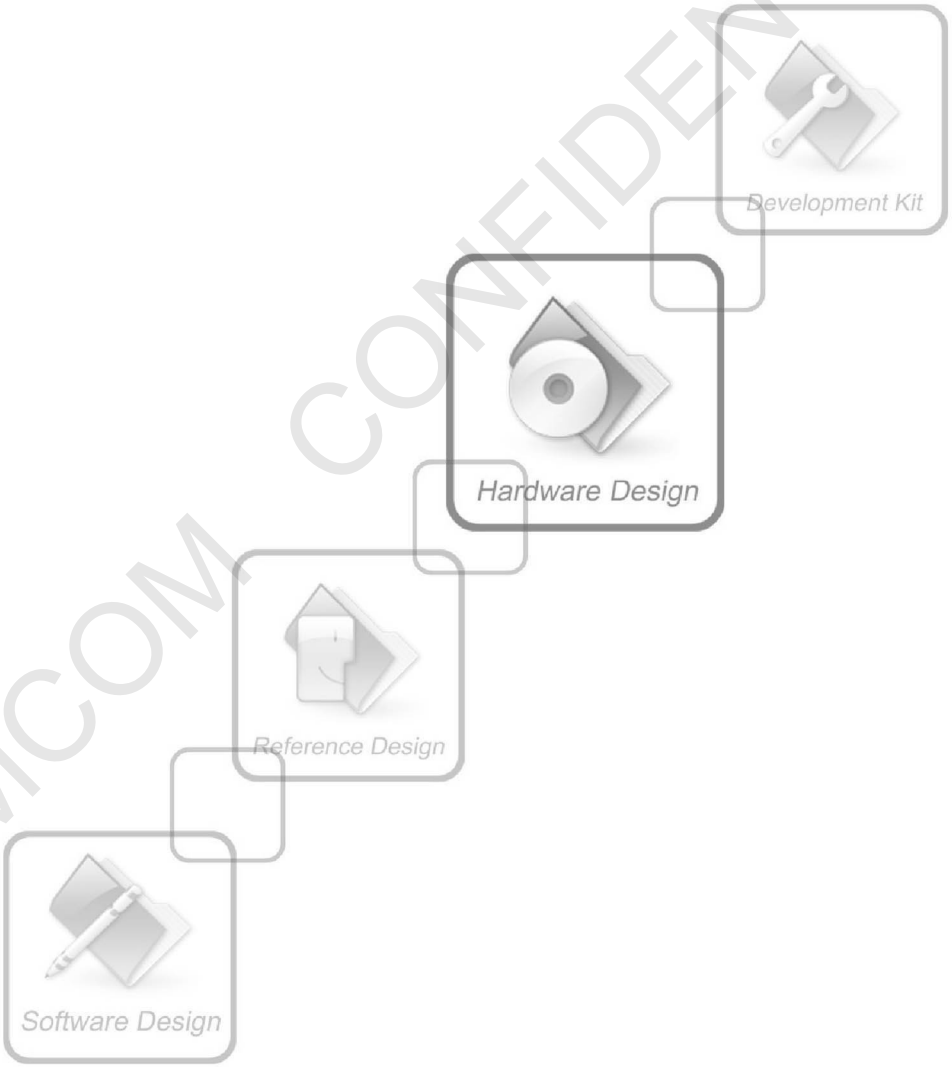
SIM5300EA_Audio_Application Note



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Document Title	SIM5300EA_Audio_Application_Note
Version	1.01
Date	2016-11-10
Status	Released
Document Control ID	SIM5300EA_Audio_Application_Note_V1.01

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Revision History

Date	Version	Description of change	Author
2016-11-04	1.00	New Version	Xiuyu.zhang
2016-11-10	1.01	Update the format	Xiuyu.zhang

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1 INTRODUCTION

SIM5300EA provides some AT commands for audio tuning. This document describes how to design and tune the audio part for best performance of SIMCOM WCDMA wireless module.

2 SCOPE OF THE DOCUMENT

This document intends for the following module:

•SIM5300EA

3 AUDIO APPLICATION

3.1 ANALOG AUDIO BRIEF INTRODUCTION

Table 1: Audio interface

Pin name	Pin number	IO	Description
MIC_P	19	AI	Differential audio input
MIC_N	20		
SPK_P	21	AO	Differential audio output
SPK_N	22		

The audio interfaces are only for SIM5300EA; these pins of SIM5300E are NC

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4.1 SPEAKER INTERFACE CONFIGURATION

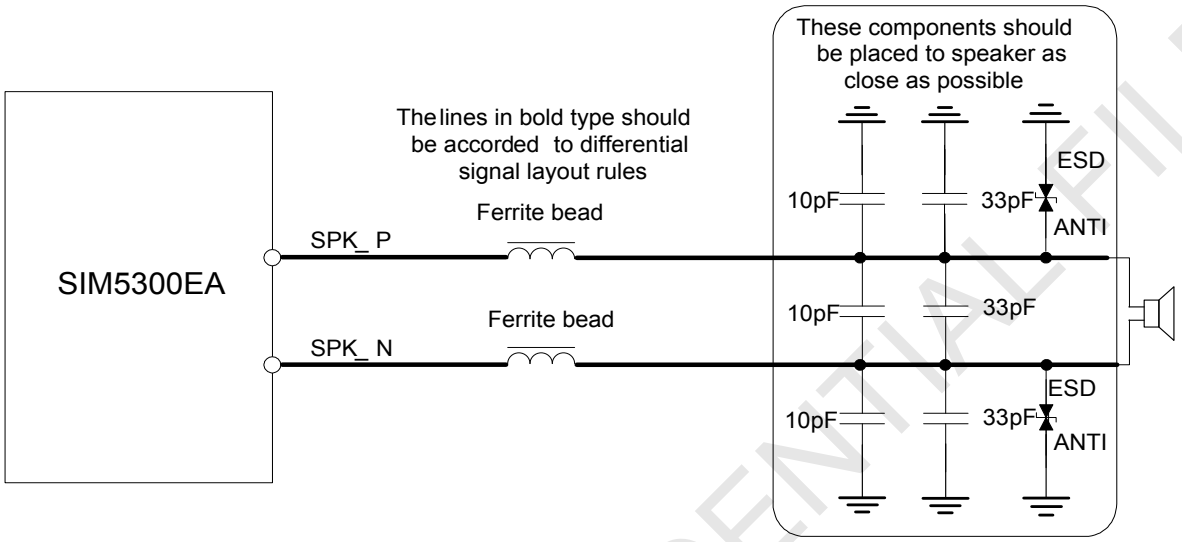

Figure 1: Speaker interface configuration

33p and 10p are suggested to be added beside the 32 Ohm receiver to reduce RF interfere. The width of SPK_P and SPK_N lines are typical 6 mils to reduce impedance. The SPK_P and SPK_N should layout differential and be far away from VBAT, RF signals, clock and other high power or high frequency signals.

If user needs to use an amplifier circuit for audio, National Semiconductor Company's LM4890 is recommended.

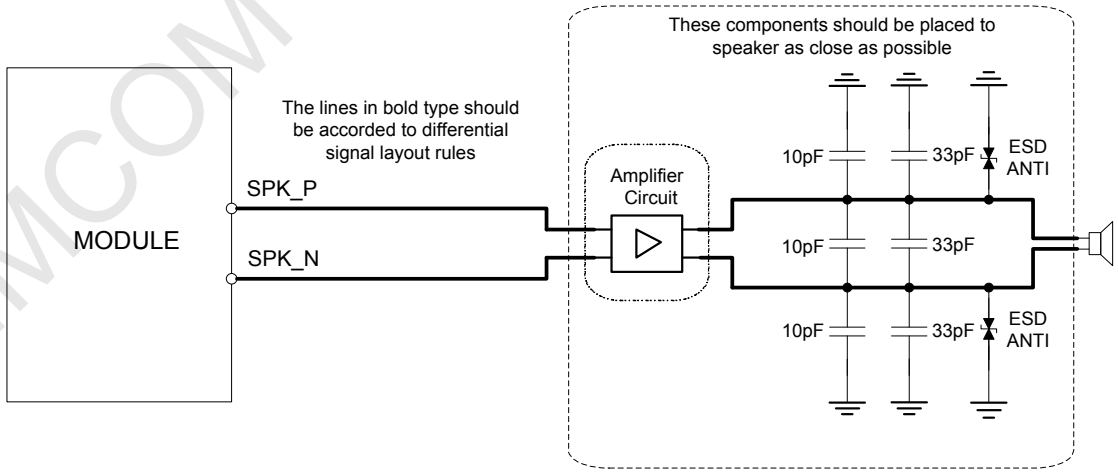

Figure 2: Speaker with amplifier reference circuit

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4.2 MICROPHONE INTERFACES CONFIGURATION

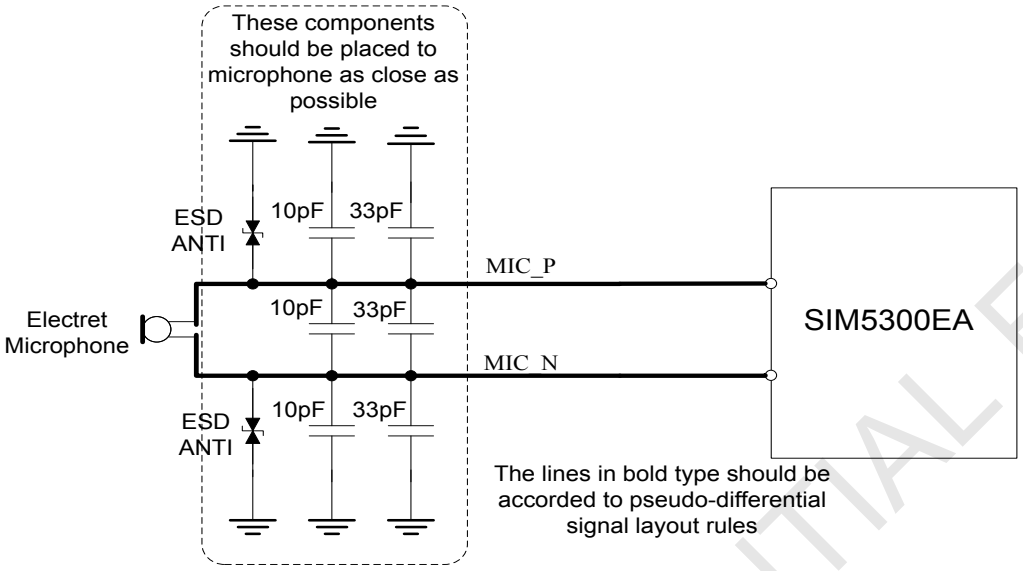

Figure 3: Microphone interface configuration

SIM5300EA has integrated internal MIC bias circuit. There is no need to pull the MIC_P up to the external source as it has been pulled up in the Module. MIC_P and MIC_N should be layout pseudo-differential.

4.3 REFERENCED ELECTRONIC CHARACTERISTIC

Table 2: MIC Input Characteristics

Parameter		Min	Typ	Max	Unit
Mic biasing Voltage		2.5	2.54	2.8	V
Working Current				3	mA
External Microphone Load Resistance			2.2		kΩ
Equivalent output noise	Gain set to 35.25dB		110		uv

Table 3: Audio Output Characteristics

Parameter			Min	Typ	Max	Unit
Normal Output	RL=32Ω Receiver	Output power			90	mW

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5 AUDIO TUNING

The audio signal can be influenced by varying AT commands.

Parameters of mic volumes, spk volume, sidetone and echo can be adjusted with corresponding AT commands.

For more information on the AT commands and parameters please refer to <SIM5300E_AT_Command_Manual_V1.XX.doc>.

5.1 AT+CHFA

This command is used to switch channels.

Main audio handset channel is 0.

The SIM5300EA only support one channel, so the value of CHFA should always be 0.

AT+CHFA Swap the Audio Channels	
Test Command **AT+CHFA=?**	Response **+CHFA: (0 = NORMAL_AUDIO)** **OK**
Read Command **AT+CHFA?**	Response **+CHFA: <n>** **OK**
Write Command **AT+CHFA=<n>**	Response **OK** If error is related to ME functionality: **+CME ERROR: <err>**

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Parameters	**<n>** **0** Main audio handset channel
Reference	Note Support channel 0 only

5.2 AT+CMIC

This command is to adjust microphone volume of current channel. Adjustment range: 0~15, which 0 is to turn off the mic channel, and 1 means the minimum value,15 is the maximal value. Default value for main audio handset channel is 7;

Setting CMIC value is independent from other command, which is adjusted separately, saved automatically, and taking effect immediately.

For detailed instruction about this command, please refer to

< SIM5300E_AT_Command_Manual_V1.XX >.

AT+CMIC Change the Microphone Gain Level	
Test Command **AT+CMIC=?**	Response **+CMIC: (list of supported <channel>s),(list of supported <gainlevel>s)** **OK**
Read Command **AT+CMIC?**	Response **+CMIC: <channel>,<gainlevel>** **OK**
Write Command **AT+CMIC=<channel>,<gainlevel>**	Response **OK** If error is related to ME functionality:

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	+CME ERROR: <err>
Parameters	**<channel>** **0** Main audio handset channel **<gainlevel>** Int:0 – 15 **0 -96dB (turn off)** **1 -9dB** **2 -7.5 dB** **3 -6 dB** **4 -4.5 dB** **5 -3 dB** **6 -1.5 dB** **7 0 dB** **8 1.5 dB** **9 3 dB** **10 4.5 dB** **11 6 dB** **12 7.5 dB** **13 9 dB** **14 10.5 dB** **15 12 dB**
Reference	Note Support channel 0 only

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5.3 AT+CLVL

This command is to adjust the receiver volume of current channel. Adjustment range is:0~100, which the minimum adjustable step size is 10.

0 is to turn off the spk channel, and 10 means the minimum value,100 is the maximal value.

Default volume of spk is 40, which needs to be set to corresponding channels to tuning volume.

Setting CLVL value is independent from other command, which is adjusted separately, saved automatically, and taking effect immediately.

For detailed instruction about this command, please refer to

< SIM5300E_AT_Command_Manual_V1.XX >.

AT+CLVL Loud Speaker Volume Level	
Test Command **AT+CLVL=?**	Response **+CLVL: (list of supported <level>s)** **OK** If error is related to ME functionality: **+CME ERROR: <err>**
Read Command **AT+CLVL?**	Response **+CLVL: <level>** **OK** If error is related to ME functionality: **+CME ERROR: <err>**

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Write Command	Response
AT+CLVL=<level>	**OK** If error is related to ME functionality: **+CME ERROR: <err>**
Parameters	**<level>** Integer type value with manufacturer specific range (smallest value represents the lowest sound level) **0 -96 dB (turn off)** **10 -6.5 dB** **20 -5 dB** **30 -3.5 dB** **40 -2 dB** **50 -0.5 dB** **60 1 dB** **70 2.5 dB** **80 4 dB** **90 5.5 dB** **100 7 dB**
Reference GSM 07.07 [13]	Note

5.4 AT+SIDET

This command is to adjust sidetone volume of current channel. Adjustment range is:0~16.

0 is to turn off the sidetone, and 1 is the minimum value, 16 is the maximal value.

Default audio channel is 0 and the value of audio sidetone is 0, which means the sidetone function is default in off mode.

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The SIDET performance is influenced be the mic and the spk value.

The SIDET is adjusted separately, saved automatically, and taking effect immediately.

For detailed instruction about this command, please refer to

< SIM5300E_AT_Command_Manual_V1.XX >.

AT+SIDET Change the Side Tone Gain Level	
Test Command **AT+SIDET=?**	Response **+SIDET: (**list of supported **<channel>**s**),(**list of supported **<gainlevel>**s**)** **OK**
Read Command **AT+SIDET?**	Response **+SIDET:** <**channel**>,**<gainlevel>** **OK**
Write Command **AT+SIDET=<channel>,<gainlevel>**	Response **OK** **ERROR**
Parameters	**<channel>** **0** Main audio handset channel **<gainlevel>** **Int:** **0** **-96 dB (**turn off the sidetone function) **1** **-39.5 dB** **2** **-38 dB** **3** **-36.5 dB** **4** **-35 dB**

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	5 -33.5 dB **6 -32 dB** **7 -30.5 dB** **8 -29 dB** **9 -27.5 dB** **10 -26 dB** **11 -24.5 dB** **12 -23 dB** **13 -21.5 dB** **14 -20 dB** **15 -18.5 dB** **16 -17 dB**
Reference	Note • Support channel 0 only

5.5 AT+ECHO

This command is to adjust echo volume of current channel. We have combined the setting of ES, SER and AGC into a serial numbers.

Adjustment range is 0~9, 0 is to turn off the echo suppression function, and 1 is the minimum value, 9 is the maximal value.

Default audio channel is 0 and the value for audio echo is 0, which means the echo suppression function is default in off mode.

The echo performance is influenced be the value of the mic, spk and the performance of mic, spk.

The ECHO is adjusted separately, saved automatically, and taking effect immediately.

For detailed instruction about this command, please refer to

< SIM5300E_AT_Command_Manual_V1.XX >.

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AT+ECHO Echo Cancellation Control	
Test Command **AT+ECHO=?**	Response **+ECHO: (list of supported <channel>s), (list of supported <es>s)** **OK**
Read Command **AT+ECHO?**	Response **+ECHO: < channel >,<es>** **OK**
Write Command **AT+ECHO=< channel >,<es>**	Response **OK** If error is related to ME functionality: **+CME ERROR: <err>**
Parameters	**< channel >** Audio channel **0** Main audio handset channel **<es>** Echo suppression **0 turn off the ECHO suppression function** **1-9 the bigger the value, the stronger the restraint.**
Reference	Note • Support channel 0 only

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5.6 TDD NOISE

Making sure the module has a good connection to ground which can help to reduce the TDD noise and improve ESD performance.

Filtering capacitors and beads are suggested to be added in the audio lines, 33p and 10p can help reduce the 850Mhz/900Mhz and 1800Mhz/1900Mhz RF interfere. For mic signal, the filtering capacitors are suggested to add beside the module pins. For spk signal, the filtering capacitors and beads are suggested to add beside the speaker connector.

6 LAYOUT GUIDE

The audio signals are sensitive to RF signals and power sources (for example VBAT). Please make sure that the audio signals are far away from the RF signals and VBAT. The output signals and input signals should be kept away from each other by ground. The differential lines should be routed together.

Filtering capacitors and beads are suggested to be added in the audio lines, 33p and 10p can help reduce the 850Mhz/900Mhz and 1800Mhz/1900Mhz RF interfere. If it is mic signal, the filtering capacitors are suggested to add beside the module pins. If it is output trace, the filtering capacitors and beads are suggested to add beside the handset/ headset/speaker connector.

One can send design to us for checking.

7 APPENDIX

Table 4: Terms and Abbreviations

Abbreviation	Description
ES	Echo Suppression
EC	Echo Cancellation
SES	Selective Echo Suppression
DT	Double Talk
FAP	Fast Affine Projection

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SLR	Sending Loudness Rating
RLR	Receiving Loudness Rating
STMR	Side Tone Masking Rating

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