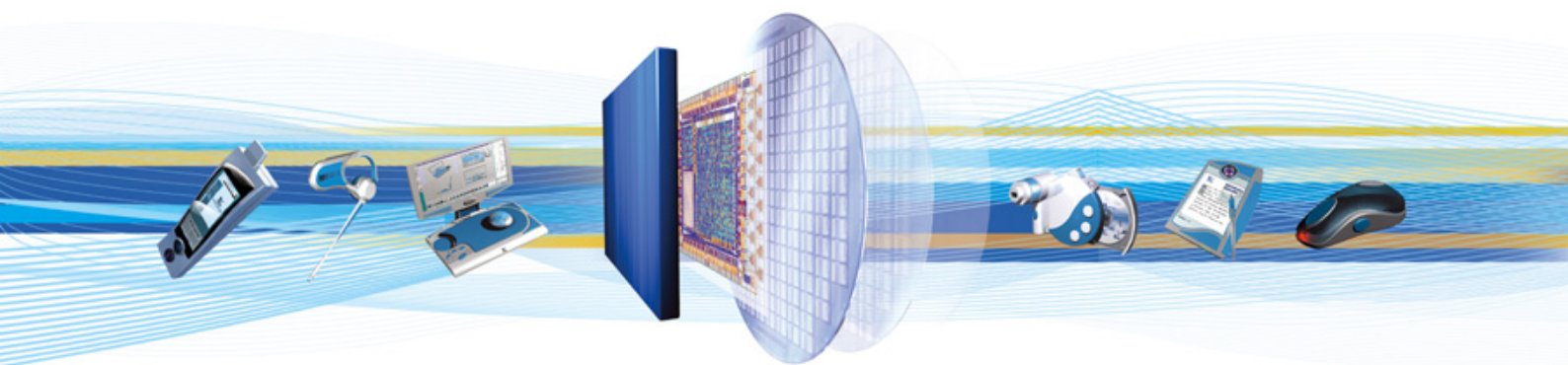




BlueLab™

BlueLab v3.2 ParamMgr User Guide

July 2005



CSR

Churchill House
Cambridge Business Park
Cowley Road
Cambridge CB4 0WZ
United Kingdom

Registered in England 3665875

Tel: +44 (0)1223 692000

Fax: +44 (0)1223 692001

www.csr.com

Contents

1	Introduction	3
2	Drop Down [File] Functions	4
2.1	Opening Parameters from .psr file	4
2.2	Saving Parameters from .psr file	4
2.3	Sending Parameters Directly	5
2.4	Saving Parameters to a .txt file	5
2.5	Closing the ParamMgr Wizard	5
3	Drop Down [Misc] Functions	6
3.1	Setting the Status Update Control	6
3.2	Load Default Parameters	7
3.3	Security Encryption Key	7
4	Gains - Adjustable Tuning Parameters	9
4.1	MIC Gain	9
4.2	Send Gain	10
4.3	SPKR Gain	11
5	Level Control - Adjustable Tuning Parameters	12
5.1	Automatic Level Tuning (ALT) and Volume Control	12
5.2	Howling Suppression	14
5.3	Soft Clipper	14
5.4	Ref Gain	15
6	AEC - Adjustable Tuning Parameters	16
6.1	MIC SAT	16
6.2	Send VAD	16
6.3	Receive VAD	17
6.4	Receive Attenuation	18
6.5	State Cntrl	18
6.6	Comfort Noise	19
7	OMS - Adjustable Tuning Parameters	20
7.1	Noise Suppression	20
	Terms and Definitions	21
	Document History	22

1 Introduction

This document describes the controls available to tune the CVC Acoustic Echo Canceller. BlueLab v3.2 and CSR BlueCore3-Multimedia Demonstrator Board (DEV-PC-1307C) are required to use these instructions. The Parameter Manager Tuning Wizard software is included with the BlueLab v3.2 SDK.

The default directory location is `c:\BlueLab3_2\apps\av_headset_hfp\cvc`

The default file name is `ParamMgr.exe`

The Parameter Manager Tuning Wizard is a tool that can assist you in creating the compatible files used by the CVC Echo Cancellation application software installed on the BlueCore3-Multimedia Demonstrator Board. This document assumes you have the CVC software application operational and you want to make tuning adjustment based on the acoustic characteristics of your product.

Refer to the *Tuning Procedure (when available)*, it will provide guidelines to assist you through the tuning methodology, with the goal of achieving optimum performance from the software.

The Parameter Manager Tuning Wizard is an executable provided in the `apps\av_headset_hfp\cvc` folder. The name is `ParamMgr.exe`. Double clicking on the `ParamMgr.exe` will launch the wizard, the *Main* sample screen shot is shown in Figure 1.1

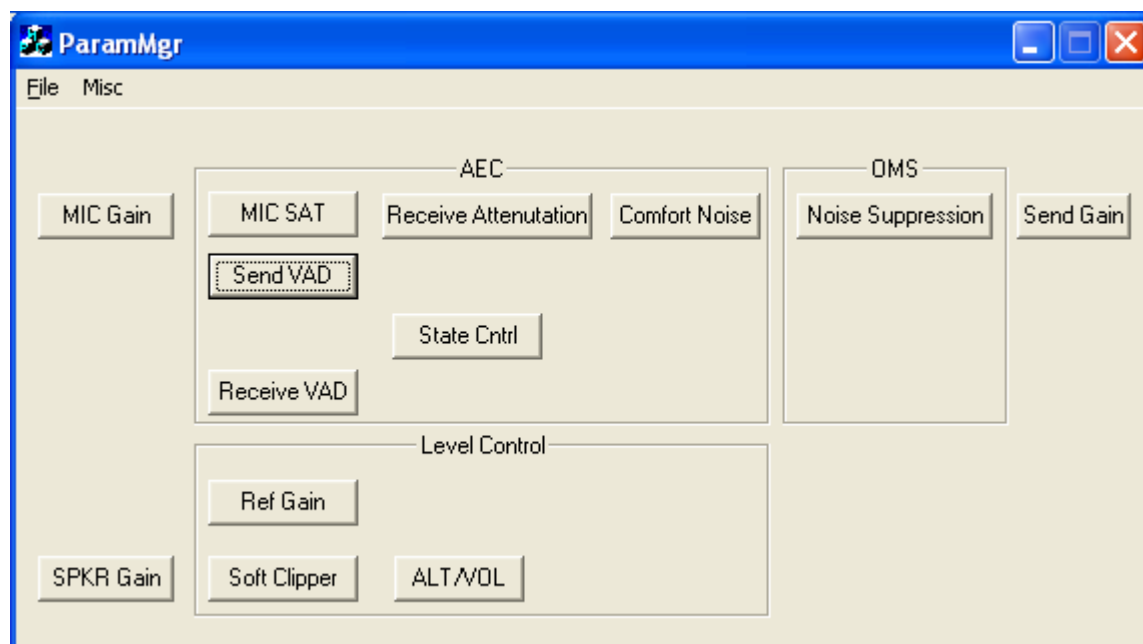
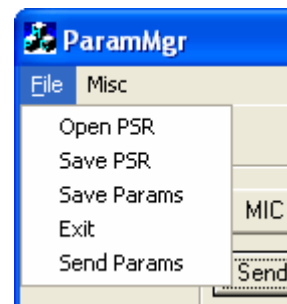


Figure 1.1– ParamMgr.exe “Main Menu” screen shot

2 Drop Down [File] Functions

From the *Main* menu, select the *File* menu, you are presented with five navigation options.

- Open PSR** - open an existing .psr file
- Save PSR** - allows you to “save as” the .psr file
- Save Params** - allows you to “save as” a .txt file
- Exit** - exits the ParamMgr without saving
- Send Params** - automatically sends the Parameters to the target demonstrator using the SPI interface.

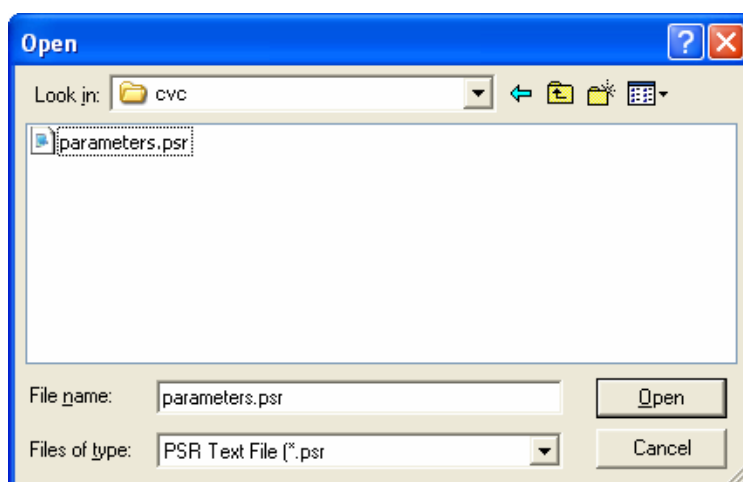


2.1 Opening Parameters from .psr File

[Open PSR]

Normally you would open the supplied `parameters.psr` file included in the `apps\lav_headset_hfp\cvc` sub-folder. This is your starting point to begin making adjustments.

The “as shipped” `parameters.psr` file will match the default, if loaded from the *Misc* drop down list.

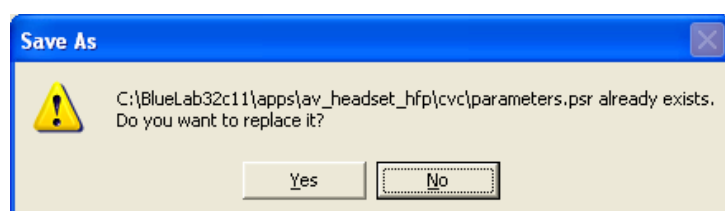
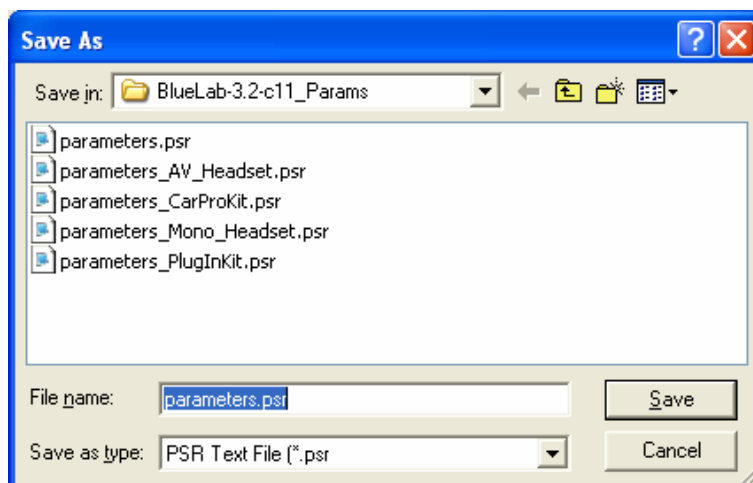


2.2 Saving Parameters from .psr File

[Save PSR]

Once changes have been made to the `parameters.psr` file, you may want to save the settings for future use or to replace a file. Select **Save PSR** from the ParamMgr main page. The Save As dialog opens, define the Save in: location and the File name:

If you define the same location and file name, the “Save As” dialog box warns – “Do you want to replace it?” If Yes, the file is replaced with the changes. If No, save under a different name or location.



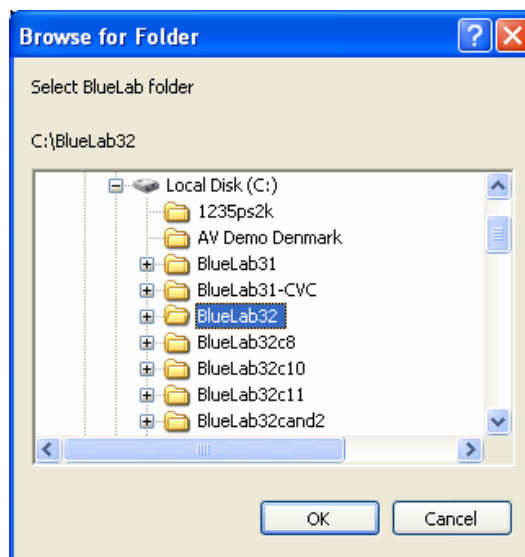
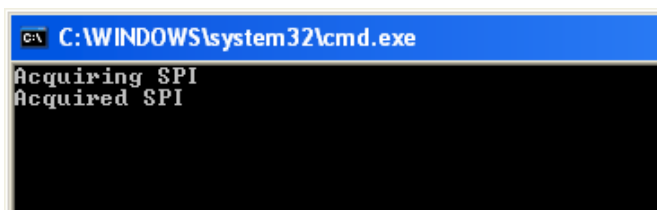
You can manually use the PSTool → File, Merge to download the PSKeys contained in the `user_named.psr` file or directly download the Parameters using the “**Send Params**” command.

2.3 Sending Parameters Directly

[Send Param]

Once you have made tuning modifications within the ParamMgr tool, you can directly download the parameters to the demonstrator board. From the **Send Param** drop down list, the first time a “Browse for Folder” dialog box appears. Select the root directory of the BlueLab application, then OK.

Once selecting OK, the Command Prompt window is opened indicating Acquiring SPI then Acquired SPI. When complete the window is automatically closed. For the parameters to take affect, reset the demonstrator board.



For all subsequent **Send Param** commands, the “Browse for Folder” request is bypassed, directly opening the command prompt window.

In the example shown, c:\BlueLab32 is the root directory of the cvc app.

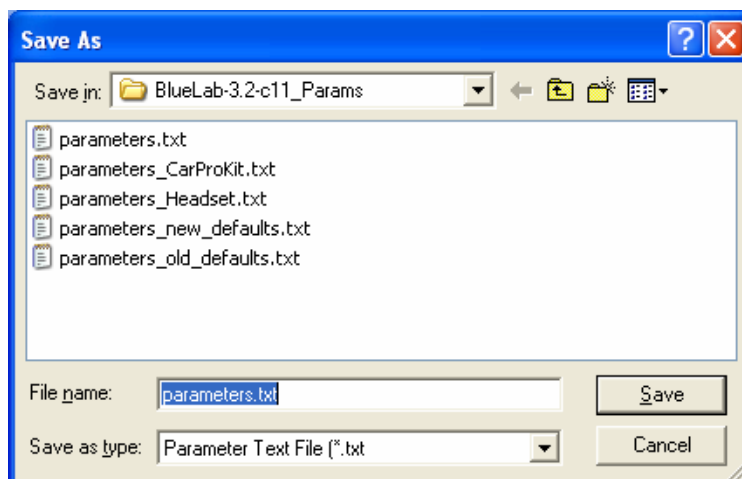
Note:

Send Param assumes you have the board powered, cabled and a working SPI interface.

2.4 Saving Parameters to a .txt File

[Save Params]

Save Params allows you to “save as” the parameter list to a .txt file. This convenient .txt listing of the parameter keys, serves no other purpose than a reference document.



2.5 Closing the ParamMgr Wizard

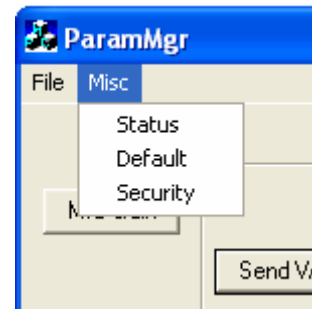
[Exit]

Choosing **Exit** or clicking the upper right red [X] closes the ParamMgr application wizard. No data is automatically saved.

3 Drop Down [Misc] Functions

From the *Main* menu, select the **Misc** drop down list, three operations are available.

- Status** - Debug port enable and update rate
- Default** - loads default parameters
- Security** - entry of security key



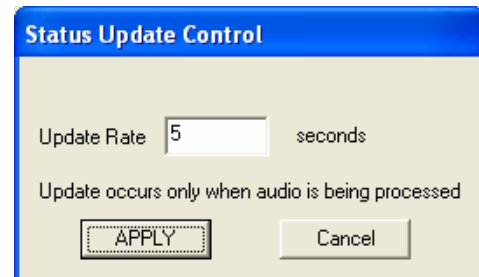
3.1 Setting the Status Update Control

[Status]

Status Update Control menu contains the refresh rate for the status debug messages. In order to view the debug messages, you must compile the VM code with the `DEBUG_PRINT_ENABLED` within xIDE.

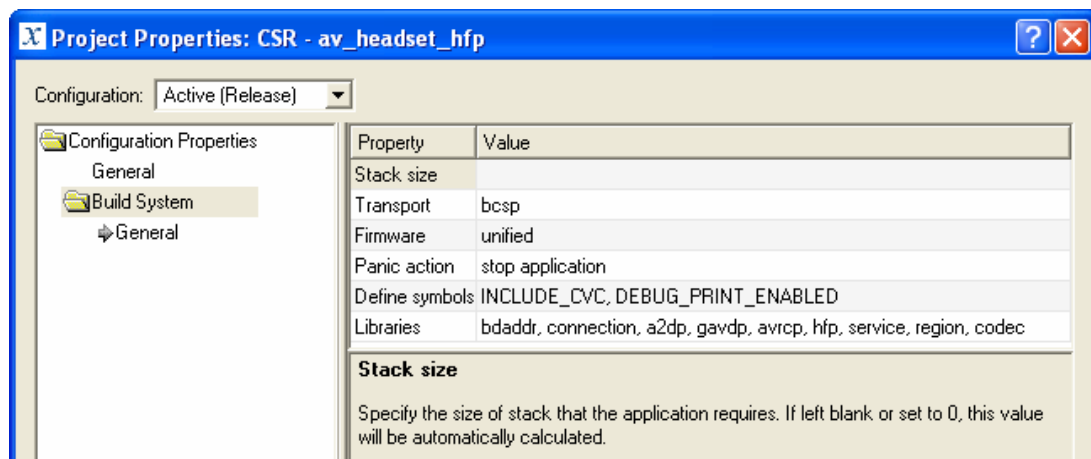
Note:

Enabling debugs will significantly slow the applications performance.



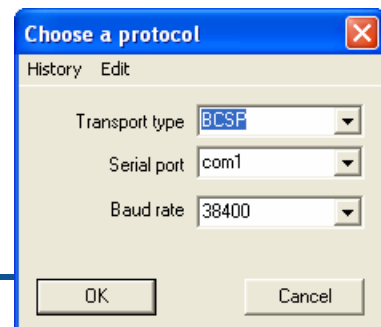
To determine the print debug mode, in xIDE under *Project -> Properties -> Build System*

- **Transport** set to bcsdp
- **Firmware** set to unified
- **Hardware** set to BC3-multimedia (kalimba)
- **Panic action** set to stop application
- **Define Symbols** set to `DEBUG_PRINT_ENABLED` if debugs are desired, otherwise leave blank (or change symbol) to disable print debugs.



If debugs are enabled you must start VMSpy. VMSpy is located at `\BlueLab3_2\tools\bin\vmSpy.exe`. Select Connect (may vary based on your computer specifics) then Choose a protocol. After first use of VMSpy, a shortcut under History can be used to set protocol.

- **Transport type** BCSP
- **Serial Port** com1



- **Baud Rate** 38400
- Click **OK**.

Confirm that UART Baud Rate is the same between VMSpy and BlueCore3-Multimedia by opening PSTool and observing the value in `PSKEY_UART_BAUDRATE`.

When `DEBUG_PRINT_ENABLED` is selected and you're in an active call, the **Update Rate xx seconds** controls the rate for which the information is refreshed onto the screen. The recommended rate is between 2 to 5 seconds.

USR10, CLARITY_PARAM_STATUPDT, Default 0x00 0271, Update Rate [5] seconds

3.2 Load Default Parameters

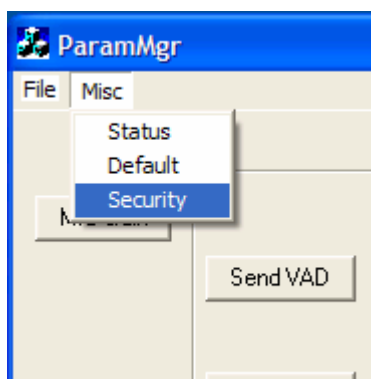
[Default]

By selecting *Default* from the drop down list, the default parameters are loaded from within the ParamMgr.exe application.

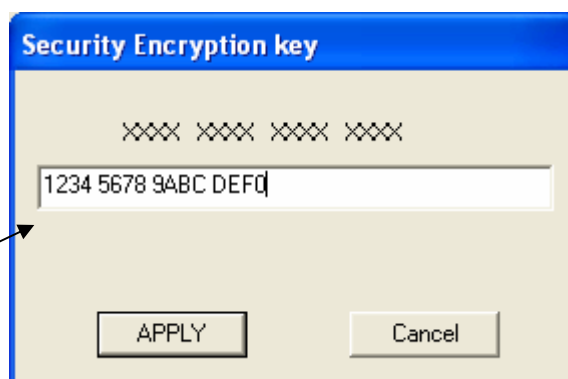
3.3 Security Encryption Key

[Security]

The provided CVC software requires a license key in order to function correctly when the demonstration period of five minutes has elapsed. The security key can be entered from the *Main* menu, choose *Misc* then *Security*.



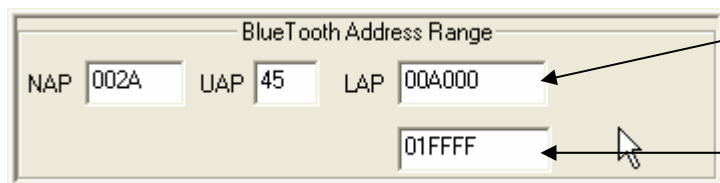
It is the customer's responsibility to provide CSR with a Bluetooth Address range. A single key will be issued for a given range of LAP addresses. The NAP and UAP address portion must remain fixed, only the LAP can vary. If either the NAP or UAP change for a given range of LAPs, separate security keys are required.



Based on a Bluetooth range, a Security Key will be supplied by CSR. You will be required to enter the "Security Encryption Key" in the field provided.

Security Key

Example:



Starting Bluetooth address
Ex. **002A 45 00A000**

Ending Bluetooth address
Ex. **002A 45 01FFFF**

Security Key issued by CSR: ex. **1234 5678 9ABC DEF0** (one key per Bluetooth range)

Entering the wrong key will cause the audio to mute after 5 minutes of operation. The Security Key is defined as PSKEY_USR28, CLARITY_LICENSE_KEY.

USR28, CLARITY_LICENSE_KEY, Default 0000 0000 0000 0000, [customer specific]

4 Gains - Adjustable Tuning Parameters

4.1 MIC Gain

From the *Main* page selecting the MIC GAIN button causes the **Microphone Gain Setting** drop down list to appear. The selection made from the dropdown list determines the gain applied to the incoming microphone signal.

In addition to the dropdown a *Check Box, Add 20 dB Mic Level Gain* exists. If selected, an additional 20 dB will be combined with the *Gain [dBr]* value selected in the dropdown list. The **TOTAL Gain dB** is shown in the *Tables 4.1.1 and 4.1.2*.

It is best to avoid Digital Gain where possible. Digital Gain will increase the noise floor that could affect the overall voice quality of the product. As *Table 4.1.1* illustrates, it is recommended to operate between Gain [dBr] from -45 to 0 (steps 1 through 16).

Microphone Gain Setting				USR_15				
Step	Digital Gain	Analog Gain	Gain [dBr]	Add 20 dB Mic Level Gain		TOTAL Gain dB	Clarity_Param_ADC_Gain with 20dB	
1	8	0	-45	x	20dB	-25	8000	Digital Attenuation
2	9	0	-41.5	x	20dB	-21.5	8001	
3	10	0	-39	x	20dB	-19	8002	
4	11	0	-35.5	x	20dB	-15.5	8003	
5	12	0	-33	x	20dB	-13	8004	
6	13	0	-29.5	x	20dB	-9.5	8005	
7	14	0	-27	x	20dB	-7	8006	
8	15	0	-23.5	x	20dB	-3.5	8007	
9	0	0	-21	x	20dB	-1	8008	Analog Gain
10	0	1	-18	x	20dB	2	8009	
11	0	2	-15	x	20dB	5	800A	
12	0	3	-12	x	20dB	8	800B	
13	0	4	-9	x	20dB	11	800C	
14	0	5	-6	x	20dB	14	800D	
15	0	6	-3	x	20dB	17	800E	
16	0	7	0	x	20dB	20	800F	
17	1	7	3.5	x	20dB	23.5	8010	Digital Gain plus Analog Gain
18	2	7	6	x	20dB	26	8011	
19	3	7	9.5	x	20dB	29.5	8012	
20	4	7	12	x	20dB	32	8013	
21	5	7	15.5	x	20dB	35.5	8014	
22	6	7	18	x	20dB	38	8015	
23	7	7	21.5	x	20dB	41.5	8016	

Table 4.1.1 - TOTAL Gain with 20dB Check Box Selected

Should the *Check Box – Add 20 dB Mic Level Gain* not be selected, then the Gain [dBr] value selected in the dropdown list will be used directly to determine the microphone Gain. *Table 4.1.2* shows the **TOTAL Gain** applied. As above, it is recommended to avoid using digital gain, operating from -45 to 0 Gain [dBr] (steps 1 through 16).

Step	Microphone Gain Setting			USR_15	
	Digital Gain	Analog Gain	Gain [dBr]	20dB Add 20 dB Mic Level Gain	Clarity_Param_ADC_Gain without adding 20db
1	8	0	-45		0000
2	9	0	-41.5		0001
3	10	0	-39		0002
4	11	0	-35.5		0003
5	12	0	-33		0004
6	13	0	-29.5		0005
7	14	0	-27		0006
8	15	0	-23.5		0007
9	0	0	-21		0008
10	0	1	-18		0009
11	0	2	-15		000A
12	0	3	-12		000B
13	0	4	-9		000C
14	0	5	-6		000D
15	0	6	-3		000E
16	0	7	0		000F
17	1	7	3.5		0010
18	2	7	6		0011
19	3	7	9.5		0012
20	4	7	12		0013
21	5	7	15.5		0014
22	6	7	18		0015
23	7	7	21.5		0016

Table 4.1.2 - TOTAL Gain without the 20dB Check Box Selected

MIC Gain

The MIC Gain parameter is the overall gain applied to the microphone signal. This parameter ranges from -45 dB to +21.5 dB. Adjust this value for nominal use case. If the Gain parameter is set too high, there is more acoustic coupling and possible saturation. If the Gain parameter is set too low, however, the near end user will sound distant and the resolution for the AEC/NS algorithms may be too low causing distortions such as choppy send speech. The far right column of *Tables 4.1.1 and 4.1.2* illustrates the value for MIC Gain.

Add 20 dB Mic Level Gain

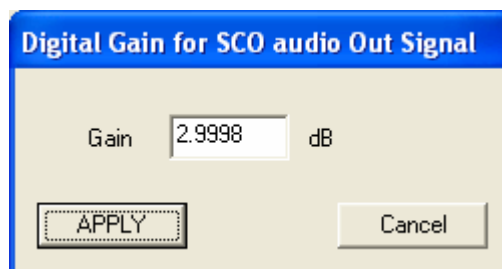
Selecting this box will add 20dB of analog gain to the ADC. This box should be checked if using a non-amplified microphone.

USR10, CLARITY_PARAM_ADC_GAIN, Default 0x000D, Gain dBr [-6] [] 20dB

4.2 Send Gain

Gain

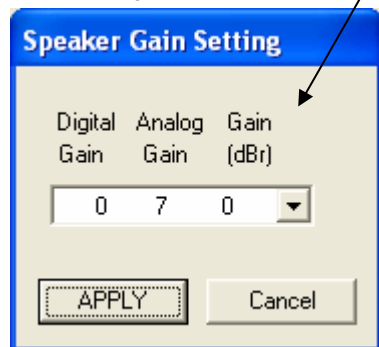
The Gain parameter is the amount of digital gain applied to the Send-Out signal. This parameter ranges from -114 dB to 24 dB. One trick used to reduce acoustic echo is to reduce the Input Gain and increase the Send Out gain. This can be used with the caveat that there may be some slight distortions introduced due to the input signal being low resolution.



USR10, CLARITY_PARAM_SNDGAIN, Default 0x0B 4CD6, Gain [2.9998] dB

4.3 SPKR Gain

From the *Main* page selecting the SPKR GAIN button causes the **Speaker Gain Setting** drop down list to appear. The selection made from the dropdown list determines the gain applied to the RCV-AEC signal shown in *Figure 5.1.1*.



It is best to avoid using Digital Gain where possible. Digital Gain will increase the noise floor and is likely to distort or clip the audio out of the CODEC. That would affect the

overall voice quality of the product. As *Table 4.3.1* illustrates, it is recommended to operate within Gain [dBr] from -45 to 0 (steps 1 to 16).

Speaker Gain Setting				Step	
Digital Gain	Analog Gain	Gain [dBr]			
8	0	-45	Digital Attenuation	1	
9	0	-41.5		2	
10	0	-39		3	
11	0	-35.5		4	
12	0	-33		5	
13	0	-29.5		6	
14	0	-27		7	
15	0	-23.5		8	
0	0	-21	Analog Gain	9	
0	1	-18		10	
0	2	-15		11	
0	3	-12		12	
0	4	-9		13	
0	5	-6		14	
0	6	-3		15	
0	7	0		16	
1	7	3.5	Digital Gain plus Analog Gain	17	
2	7	6		18	
3	7	9.5		19	
4	7	12		20	
5	7	15.5		21	
6	7	18		22	
7	7	21.5		23	

Figure 4.3.1 Speaker Gain Table

Gain [dBr]

The Gain parameter is the overall gain applied to the loudspeaker signal. The far right column in *Figure 4.3.1* illustrates the Gain [dBr] value. This parameter ranges from -45 dBr to +21.5 dBr.

USR10, CLARITY_PARAM_DAC_GAIN, Default 0x000F, Gain dBr [0]

5 Level Control - Adjustable Tuning Parameters

5.1 Automatic Level Tuning (ALT) and Volume Control

The CVC algorithm applies an ALT to the RCV-In signal. This attempts to normalize the far end speech and compensate for the level variance amongst different phone manufacturers and carrier sensitivities. As illustrated in Figure 5.1.1, the framework provides the “Phone Volume” (0 to 15). This volume is cross-referenced to a user definable “Volume Table” parameter set. Based on these parameter settings, determines the level of signal that passes to the CODEC RCV-AEC.

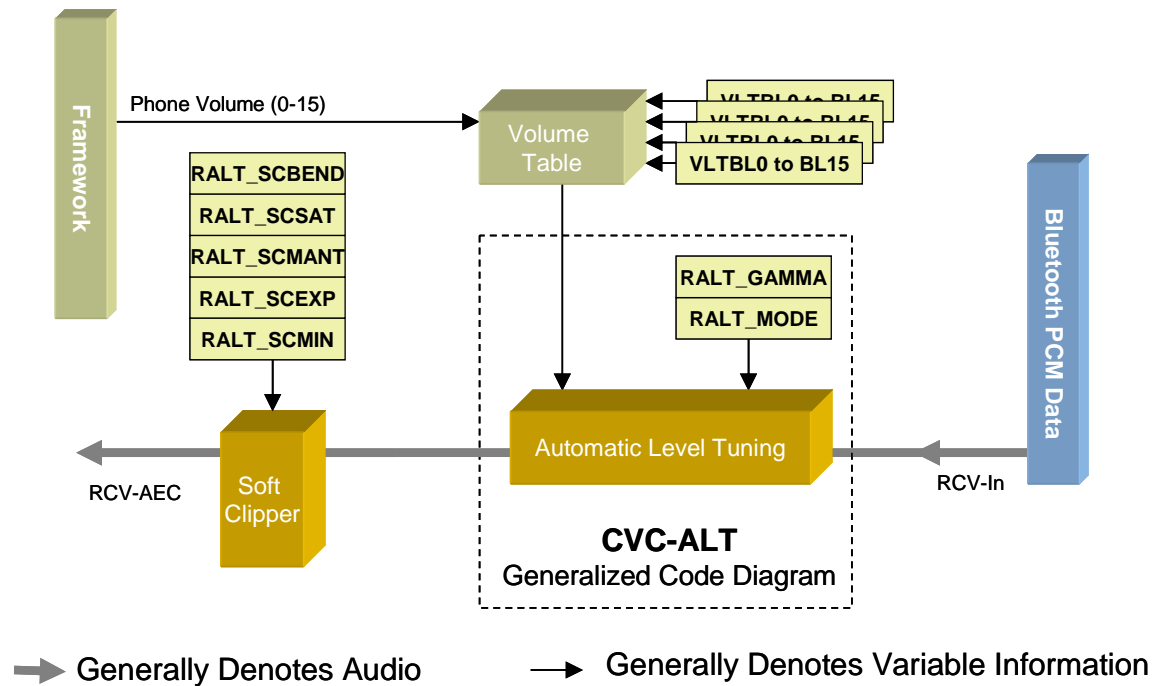


Figure 5.1.1 – ALT / Volume Gain Switching Diagram

Time Constant for mean maximum value

USR10, CLARITY_PARAM_RALT_MODE, Default 0x7F FFFF, [1]

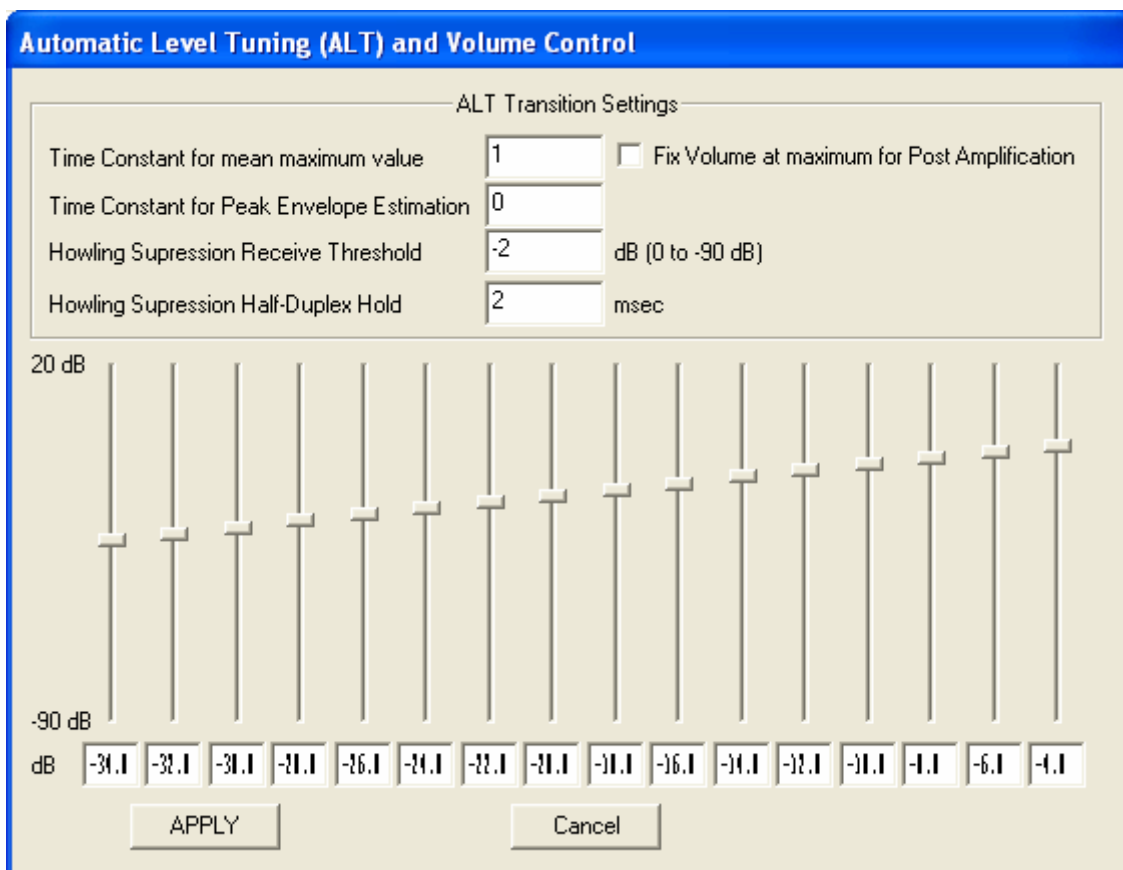
Time Constant for Peak Envelope Estimation

USR10, CLARITY_PARAM_RALT_GAMMA, Default 0x0000 0000, [0]

Volume Table Parameters

In order for the user to define the volume, the Automatic Level Tuning (ALT) and Volume Control window is used. Since the CVC application knows the volume information from the mobile phone. Each of the 16 phone volume steps is assigned a corresponding slider gain control.

As shown in Figure 5.1.2, Bluetooth phones support 16 volume steps; each step has a discrete volume setting (phone min. to the left, max. to the right).



Automatic Level Tuning (ALT) and Volume Control

ALT Transition Settings

Time Constant for mean maximum value: 1

Time Constant for Peak Envelope Estimation: 0

Howling Supression Receive Threshold: -2 dB (0 to -90 dB)

Howling Supression Half-Duplex Hold: 2 msec

☐ Fix Volume at maximum for Post Amplification

Volume sliders (16 total):

- Slider 0: -34.1 dB
- Slider 1: -32.1 dB
- Slider 2: -30.1 dB
- Slider 3: -28.1 dB
- Slider 4: -26.1 dB
- Slider 5: -24.1 dB
- Slider 6: -22.1 dB
- Slider 7: -20.1 dB
- Slider 8: -18.1 dB
- Slider 9: -16.1 dB
- Slider 10: -14.1 dB
- Slider 11: -12.1 dB
- Slider 12: -10.1 dB
- Slider 13: -8.1 dB
- Slider 14: -6.1 dB
- Slider 15: -4.1 dB

Buttons: APPLY, Cancel

Figure 5.1.2 ALT and Volume Control

Min Volume (0) ← → Max. Volume (15)

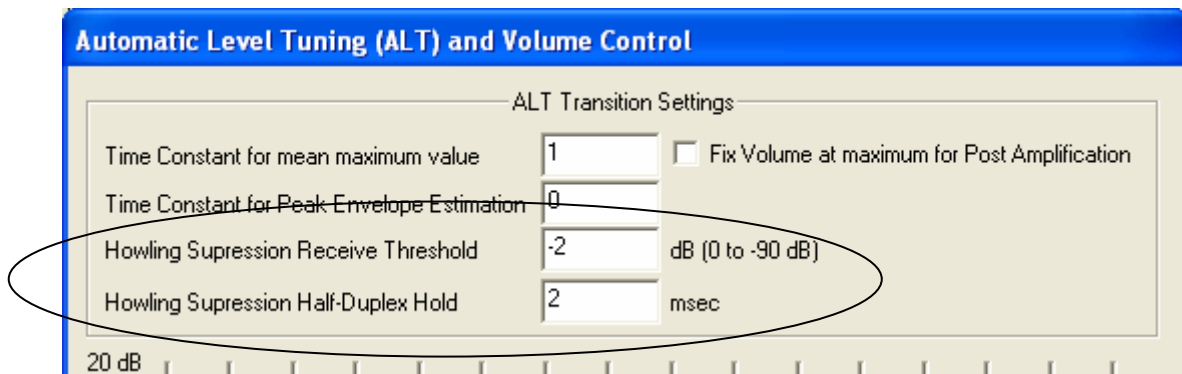
The volume used by CVC application for loudspeaker control is determined by the slider positions. Each slider volume step, ranges from -90 dB to +20dB. In the example *Figure 5.1.2* in volume position 0, the ALT will deliver -36.8 dB speech level based on full scale; position 1 delivers -35.1 dB and so on.

The affected parameters are VLTBL0 to VLTBL15 as listed below:

USR10, CLARITY_PARAM_VLTBL0,	Default 0x02 8DCE,	[-34.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL1,	Default 0x03 3718,	[-32.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL2,	Default 0x04 0C37,	[-30.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL3,	Default 0x05 1884,	[-28.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL4,	Default 0x06 6A4A,	[-26.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL5,	Default 0x08 1385,	[-24.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL6,	Default 0x0A 2ADA,	[-22.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL7,	Default 0x0C CCCC,	[-20.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL8,	Default 0x10 1D3F,	[-18.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL9,	Default 0x14 4960,	[-16.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL10,	Default 0x19 8A13,	[-14.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL11,	Default 0x20 26F2,	[-12.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL12,	Default 0x28 7A26,	[-10.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL13,	Default 0x32 F52C,	[-8.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL14,	Default 0x40 26E6,	[-6.0] dB relative to full scale
USR10, CLARITY_PARAM_VLTBL15,	Default 0x50 C335,	[-4.0] dB relative to full scale

5.2 Howling Suppression

Howling Suppression is a variable used to force the echo canceller software to aggressively attenuate the far end signal (half duplex mode) when the receive energy is excessive. This can occur in an acoustic feedback situation, or very loud car-to-car communication. The control for this feature is included in the ALT/VOL window of the ParamMgr tool.



The Howling Suppression scans the 64 samples in each SCO receive buffer. It counts the number samples that exceed the Howling Suppression Receive Threshold. If any samples exceed the Howling Suppression Receive Threshold, the AEC enters half-duplex mode for the period specified by the Howling Suppression Receive Half-Duplex Hold time.

The 2 parameters are used for the Howling Suppression condition.

Howling Suppression Receive Threshold – The user specifies the threshold (range 0 to -90 dB) value that a sample must exceed to cause the howling condition. The Threshold Trigger point is in dB, where 0 dB is full scale.

Howling Suppression Receive Half-Duplex Hold - User specifies how long to stay in half duplex. Enter the time in milliseconds.

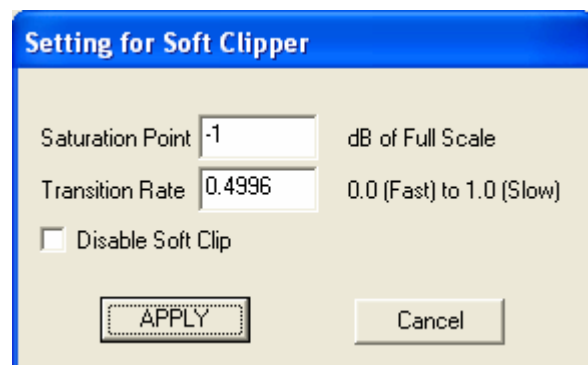
USR10, CLARITY_PARAM_RCVSATTHRES, Default 0x65 AC8B, -2 dB
 USR10, CLARITY_PARAM_RCVSATHOLD, Default 0x00 0001, 2 ms

5.3 Soft Clipper

The Soft Clipper Radio button controls the parameters for the Soft Clipper. A Soft Clipper is needed in an HFK system in order to model the non-linearities of the loudspeaker and power amplifier.

Saturation Point

The Saturation Point parameter sets the amplitude value saturation or clipping point of the RCV-OUT signal. Amplitude values for RCV-OUT above the Saturation Point will be set to the Saturation Point. This parameter ranges from -90 dBFS to 0 dBFS. If the saturation point is not set low enough meaning that the actual saturation point is below soft clipper saturation point, the primary filter will not be able to cancel as much acoustic echo. If the saturation point is set too low meaning that the actual saturation point is above the soft clipper saturation point, the primary filter will be able to cancel the maximum amount of acoustic echo. However, the loudspeaker will sound more distorted.



Transition Rate

The Transition Rate parameter determines how quickly the saturation is applied. This parameter ranges from 0.0 (Fast) to 1.0 (Slow). If the Transition Rate parameter is set to 0, amplitudes below the Saturation Point will have no saturation applied while amplitudes above the Saturation Point will be saturated to the Saturation Point. In other words, the amplitude region below the Saturation Point will be entirely linear. If the Transition Rate parameter is set to 1.0, however, there will be some saturation applied below the saturation point. The amount of saturation applied increases as the RCV-OUT amplitude tends toward the saturation point.

Disable Soft Clip

Selecting this box will disable the Soft Clipper. Only select this box if the system is used with high-quality (low distortion) loudspeakers. The SCBEND parameter is the primary value used to disable the soft clipper (7F FFFF) disabled.

Soft Clipper Parameters

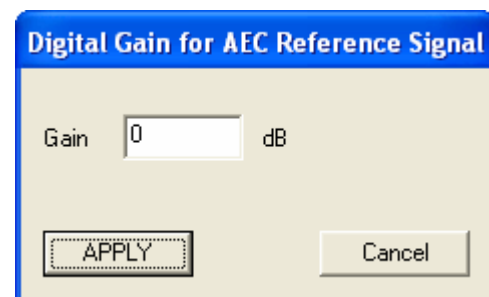
The Soft Clipper is comprised of five parameters that are computed based on the state of the "Settings for Soft Clipper" and don't map directly to discrete parameters. Any changes to the Saturation Point, Transition Rate or to Disable the Soft Clip could change anyone or all parameters. The parameters are defined as:

USR10, CLARITY_PARAM_RALT_SCBEND,	Default 0x1C 7F49
USR10, CLARITY_PARAM_RALT_SCSAT,	Default 0x39 0A40
USR10, CLARITY_PARAM_RALT_SCMANT,	Default 0x5C 1779
USR10, CLARITY_PARAM_RALT_SCEXP,	Default 0xFF FFFF
USR10, CLARITY_PARAM_RALT_SCMIN,	Default 0x2A D073

5.4 Ref Gain

Gain

The Gain parameter determines the amount of digital gain applied to the RCV-IN signal before the AEC block. This Gain parameter does not get applied to the RCV-OUT signal. This parameter is used to help ensure that there is a lossy echo path. The AEC algorithm implemented requires that the RCV-IN signal be greater in amplitude than the SEND-IN signal for the primary filter to operate correctly.



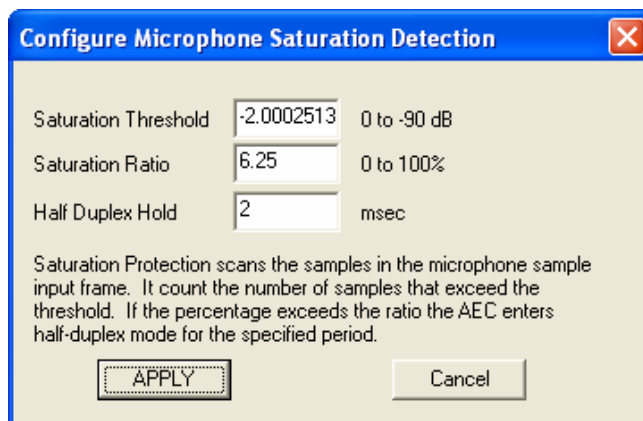
USR10, CLARITY_PARAM_REFGAIN, Default 0x07 FFFF, Gain [0.0] dB

6 AEC - Adjustable Tuning Parameters

6.1 MIC SAT

MIC SAT is a variable used to force the echo canceller software into a half duplex mode when the microphone signal reaches certain criteria. Normally used when the microphone and loudspeaker have high acoustic coupling (short distance) or the loudspeaker volume is excessive.

MIC SAT (Microphone saturation) protection scans the 64 samples in each input buffer. It counts the number samples that exceed the Saturation Threshold. If the percentage of samples exceed the Saturation Ratio, the AEC enters half-duplex mode for the period specified by the hold time.



Configure Microphone Saturation Detection

Saturation Threshold: -2.0002513 0 to -90 dB

Saturation Ratio: 6.25 0 to 100%

Half Duplex Hold: 2 msec

Saturation Protection scans the samples in the microphone sample input frame. It count the number of samples that exceed the threshold. If the percentage exceeds the ratio the AEC enters half-duplex mode for the specified period.

APPLY Cancel

There are 3 parameters used for the MIC SAT DETECTION condition.

Saturation Threshold – The user specifies the threshold (range 0 to -90 dB) value that a sample must exceed to be included into the ratio calculation. The Threshold Trigger point is in dB, where 0 dB is full scale.

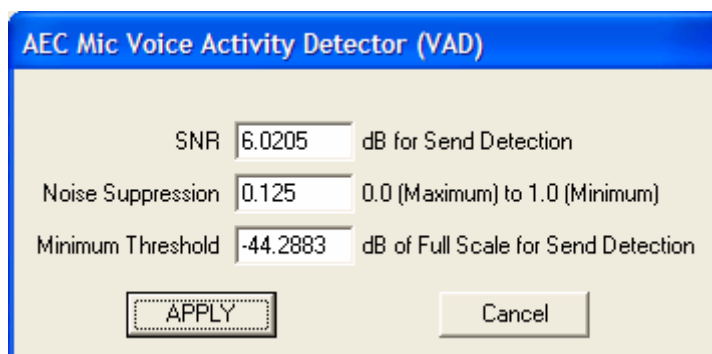
Saturation Ratio - Is how many samples within a frame have exceeded the saturation threshold. The user specifies the Percentage based on the formula $[x \text{ samples} / 64 * 100] = \text{Saturation Ratio}$. Set this very low (1.56 % (1 sample)) for this to effectively trigger on threshold only. Range from 0 to 100 percent.

Half Duplex Hold - User specifies how long to stay in half duplex. Enter the time in milliseconds.

USR10, CLARITY_PARAM_SNDSATTHRES, Default 0x00 65AB, -2.0002513 dB
 USR10, CLARITY_PARAM_SNDSATRATIO, Default 0x00 0004, 6.25 %
 USR10, CLARITY_PARAM_SNDSATHOLD, Default 0x00 0001, 2 ms

6.2 Send VAD

The Send VAD Radio button controls the parameters for the Send Path Voice Activity Detector (VAD). The VAD uses a short time estimate and a long time estimate to determine if speech is present.



AEC Mic Voice Activity Detector (VAD)

SNR: 6.0205 dB for Send Detection

Noise Suppression: 0.125 0.0 (Maximum) to 1.0 (Minimum)

Minimum Threshold: -44.2883 dB of Full Scale for Send Detection

APPLY Cancel

SNR

The SNR parameter is the factor that the short time estimate must be greater than the long time estimate in order to be classified as speech event. The larger this value is set, the more difficult it is to detect Send speech which means that the system has more difficulty entering the Send State and therefore the system will become more HALF-DUPLEX. This parameter ranges from 0 dB to 90 dB.

USR10, CLARITY_PARAM_SNDGAMMA, Default 0x10 0000, SNR [6.0205] dB

Noise Suppression

The Noise Suppression parameter is the amount of noise suppression to apply to the short time estimate. The smaller this value, the more noise suppression will be applied. This parameter ranges from 0.0 (maximum amount of noise suppression) to 1.0 (minimum amount of noise suppression).

USR10, CLARITY_PARAM_SNDMULT, Default 0x40 0000, Noise Suppression [0.125]

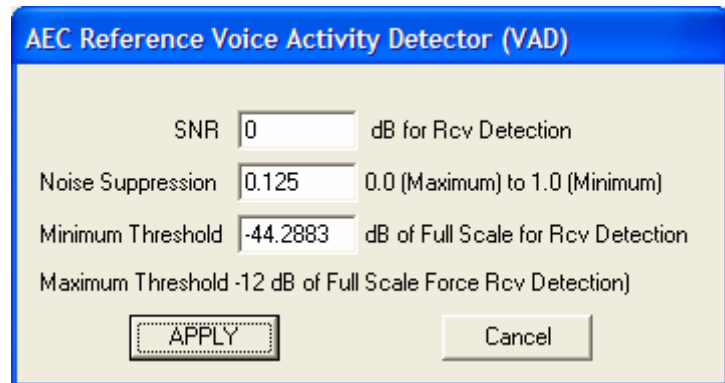
Minimum Threshold

The Minimum Threshold parameter is the minimum amplitude value of the short time estimate that can be recognized as speech, even if the other constraints are met. If the amplitude value of the short time estimate is less than this Minimum Threshold parameter, no speech will be detected, even if the short time estimate is some factor greater than the long time estimate. This value is used to reduce the amount of false speech detects due to noise. This value is usually set to the noise floor of the send path. This parameter ranges from -138 dB to 0 dB. If this value is set to 0 dB, the SEND VAD will never detect send speech.

USR10, CLARITY_PARAM_SNDTHRES, Default 0x00 C800, Min Threshold [-44.2883] dB

6.3 Receive VAD

The Receive VAD Radio button controls the parameters for the Receive Path Voice Activity Detector (VAD). The VAD uses a short time estimate and a long time estimate to determine if speech is present.



The dialog box titled "AEC Reference Voice Activity Detector (VAD)" contains the following settings:

- SNR: 0 dB for Rcv Detection
- Noise Suppression: 0.125 (0.0 (Maximum) to 1.0 (Minimum))
- Minimum Threshold: -44.2883 dB of Full Scale for Rcv Detection
- Maximum Threshold: -12 dB of Full Scale Force Rcv Detection

Buttons: APPLY, Cancel

SNR

The SNR parameter is the factor that the short time estimate must be greater than the long time estimate in order to be classified as speech event. The larger this value is set, the more difficult it is to detect RCV speech. This parameter ranges from 0 dB to 90 dB.

USR10, CLARITY_PARAM_RCVGAMMA, Default 0x10 0000, SNR [0] dB

Noise Suppression

The Noise Suppression parameter is the amount of noise suppression to apply to the short time estimate. The smaller this value, the more noise suppression will be applied. This parameter ranges from 0.0 (maximum amount of noise suppression) to 1.0 (minimum amount of noise suppression).

USR10, CLARITY_PARAM_RCMULT, Default 0x7F FFFF, Noise Suppression [0.125]

Minimum Threshold

The Minimum Threshold parameter is the minimum amplitude value of the short time estimate that can be recognized as speech, even if the other constraints are met. If the amplitude value of the short time estimate is less than this Minimum Threshold parameter, no speech will be detected, even if the short time estimate is some factor greater than the long time estimate. This value is used to reduce the amount of false speech detects due to noise. This value is usually set to the noise floor of the receive path. This parameter ranges from -138 dB to -12 dB.

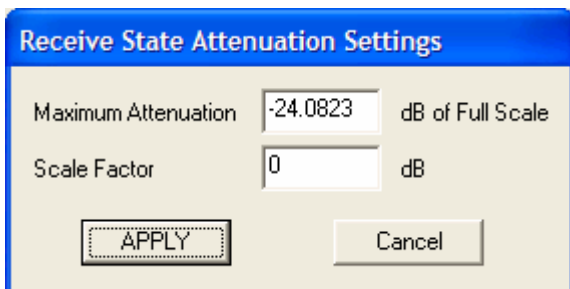
USR10, CLARITY_PARAM_RCVTHRES, Default 0x00 C800, Min Thre [-44.2883] dB

Maximum Threshold

The Maximum Threshold parameter sets the minimum amplitude value of the short time estimate at which speech is detected no matter if other constraints are not met. If the short time estimate is greater than the Maximum Threshold, the short time estimate does not have to be a SNR factor greater than the long time estimate in order for speech to be detected. It is currently set to -12dB FS or 0.25.

No USR key, hard coded parameter.

6.4 Receive Attenuation



The dialog box titled "Receive State Attenuation Settings" contains two input fields: "Maximum Attenuation" with a value of -24.0823 dB of Full Scale, and "Scale Factor" with a value of 0 dB. At the bottom are "APPLY" and "Cancel" buttons.

The Receive State Attenuation Settings Radio button controls the parameters for the Receive Attenuator (RA). The RA will attenuate residual send, if in pure receive state. Two parameters control this mode.

Maximum Attenuation

The Maximum Attenuation parameter sets the maximum amount of attenuation the residual filter can apply. This value ranges from -138 dBFS to 0 dBFS. Decrease this value if there is some slight residual echo heard on the Send-Out signal. Setting this value too low, however, can make the send-out noise floor sound unnatural.

USR10, CLARITY_PARAM_ATT_OFF, Default 0x08 0000, Max Attenuation [-24.0823] dB

Scale Factor

USR10, CLARITY_PARAM_ATT_MULT, Default 0x7F FFFF, Scale Factor [0] dB

6.5 State Cntrl

The State Cntrl radio button controls how the residual filter behaves in the various states.

Send State Transition

Time Constant

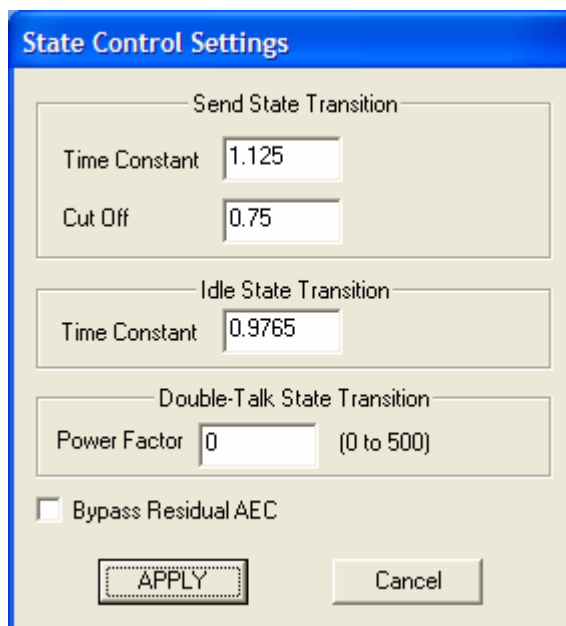
The Time Constant parameter controls the rate at which the amount of residual attenuation changes during the Send State. There is no residual attenuation applied in the Send State, however, the attenuation value is updated in the Send State proportional to Time Constant. This parameter ranges from 0 to 2. Values greater than 1.0 indicate that the attenuation is decreasing while values of Time Constant less than 1.0 indicate that the attenuation is increasing. Setting this parameter to a value less than 1.0 will make the overall system more HALF-DUPLEX.

USR10, CLARITY_PARAM_SEND_TC, Default 0x48 0000, Scale Factor [1.125]

Cut Off

The Cut Off parameter is the maximum value that the residual attenuation value can be while in the Send State. Decreasing this value will make the overall system more HALF-DUPLEX because the residual attenuation will not be able to lessen as much during the SEND-STATE. This parameter ranges from 0 to 1.0.

USR10, CLARITY_PARAM_SEND_ADJ, Default 0x60 0000, Cut Off [0.75]



The dialog box titled "State Control Settings" contains three sections: "Send State Transition" with "Time Constant" (1.125) and "Cut Off" (0.75); "Idle State Transition" with "Time Constant" (0.9765); and "Double-Talk State Transition" with "Power Factor" (0) and a range of (0 to 500). There is also a checkbox for "Bypass Residual AEC". At the bottom are "APPLY" and "Cancel" buttons.

Idle State Transition

Time Constant

The Time Constant parameter controls the rate at which the amount of residual attenuation changes during the Idle State. This parameter ranges from 0 to 1.0. The lower this parameter is set, the faster the increase in attenuation during the IDLE STATE and hence the more HALF-DUPLEX the system will become.

USR10, CLARITY_PARAM_IDLE_TC, Default 0x7D 0000, Time Constant [0.9765]

Double-Talk State Transition

Power Factor

The Double-Talk State Transition, Power Factor can slightly affect the responds when in the double talk state. Normally, this value is unchanged at 0.

USR10, CLARITY_PARAM_REG_PWR, Default 0x00 0000, Power Factor [0]

Bypass Residual AEC

Selecting this box will disable Residual AEC. This button should be left unchecked. For TEST MODE ONLY it is used to determine how much echo cancellation is derived from primary filter or residual filter.

USR10, CLARITY_PARAM_SYSCTRL, Default 0x00 0000, Bypass Residual AEC [0]

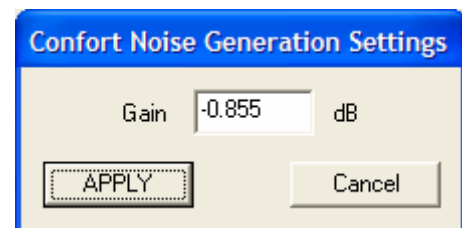
6.6 Comfort Noise

The Comfort Noise radio box has a single Gain control. Comfort Noise is added to the Send-Out signal after the noise suppression block and is used to mitigate the noise floor modulations introduced by the residual attenuation generated by the AEC. Comfort noise can also be used to mask low-level acoustic echo.

Gain

The Gain parameter sets the amplitude level of the added comfort noise signal.

USR10, CLARITY_PARAM_NS_ADJ, Default 0x3A 0000, Gain [-0.855] dB

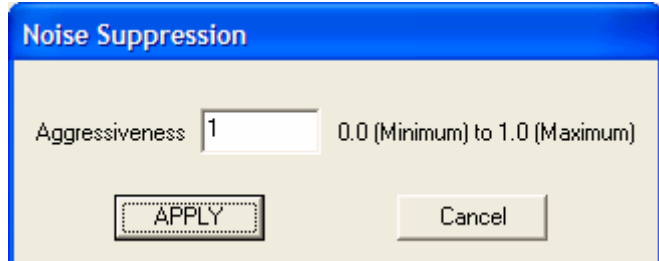


7 OMS - Adjustable Tuning Parameters

7.1 Noise Suppression

Aggressiveness

The Aggressiveness parameter determines the aggressiveness of the OMS noise suppression algorithm. This parameter ranges from 0 (minimum aggressiveness) to 1.0 (maximum aggressiveness). Typically, this value is set between 0.9 to 1.0, this provides the highest noise suppression while maintaining good speech quality.



The dialog box titled "Noise Suppression" has a blue header. Inside, the label "Aggressiveness" is followed by a text input field containing the value "1". To the right of the input field, the text "0.0 (Minimum) to 1.0 (Maximum)" indicates the range. At the bottom, there are two buttons: "APPLY" and "Cancel".

USR10, CLARITY_PARAM_OMS_AGGRES, Default 0x7F FFFF, Aggressiveness [1]

Terms and Definitions

BlueCore™	Group term for CSR's range of Bluetooth wireless technology chips
Bluetooth®	Set of technologies providing audio and data transfer over short-range radio connections
CSR	Cambridge Silicon Radio
AEC	Acoustic Echo Canceller
ASR	Automatic Speech Recognition
CVC	Clear Voice Capture
DSP	Digital Signal Processor
OMS	'One Microphone Solution' noise reduction
PC	Personal Computer
USB	Universal Serial Bus
VM	Virtual Machine

Document History

Revision	Date	History
a	6 JUL 05	Original publication of this document. (CSR reference: blab-ug-007Pa)

BlueLab™

BlueLab v3.2 ParamMgr User Guide

blab-ug-007Pa

July 2005

BlueLab™ v3.2 ParamMgr User Guide

Unless otherwise stated, words and logos marked with ™ or ® are trademarks registered or owned by Cambridge Silicon Radio Limited or its affiliates. Bluetooth® and the Bluetooth logos are trademarks owned by Bluetooth SIG, Inc. and licensed to CSR. Other products, services and names used in this document may have been trademarked by their respective owners.

The publication of this information does not imply that any license is granted under any patent or other rights owned by Cambridge Silicon Radio Limited.

CSR reserves the right to make technical changes to its products as part of its development programme.

While every care has been taken to ensure the accuracy of the contents of this document, CSR cannot accept responsibility for any errors.

CSR's products are not authorised for use in life-support or safety-critical applications.