

Overview

NatureDSP Squelch+ is software package providing CTCSS/DCS sub-audio signaling functions for FRS, PMR446 and analog radios. Additional optional modules such as tone generation, voiceband/sub-audio filtering and pre/de-emphasis add versatility to the design. Its seamlessly supports both simple and advanced multi-channel radios with no additional cost. Multichannel operation enables to make group calling and scanning.

Software is reentrant, compatible with most RTOSes such as DSP-BIOS. Link-time configurability saves data and program memory if some optional modules are disabled completely.

Features

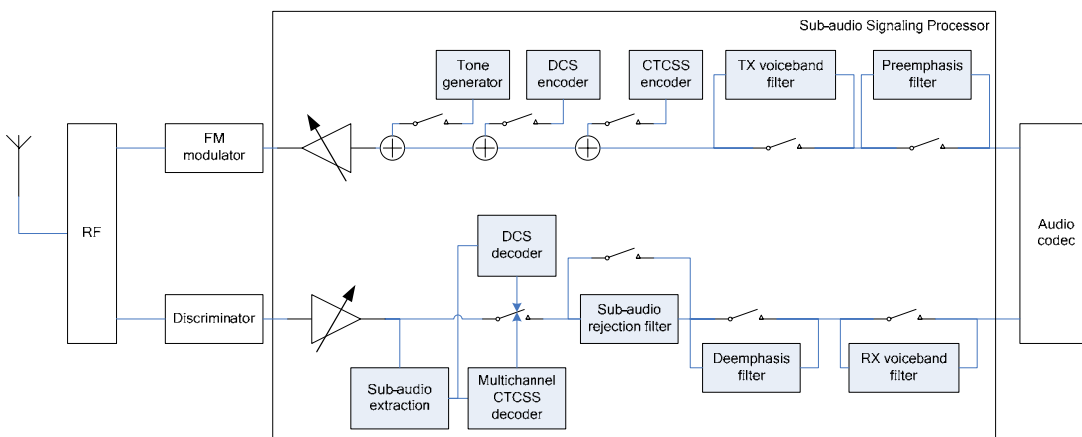
- **selectable** tone generator, pre/de-emphasis, voiceband and sub-audio tone rejection filters
- **extended set** of TIA/EIA-603 tones and user-defined tones in range 60 to 260 Hz
- up to **8** independently simultaneously decoded CTCSS tones enable group calls
- DCS decoder supports 52/83/104 **standard** code sets
- **DCS polarity autodetection**
- **faster** response and deresponse time
- **excellent** voiceband filtering
- **wide** dynamic range
- **reliable** detection under a strong noise level
- **economy** DARAM/cache usage
- **true fixed point** implementation with saturation, no floating point
- **fully portable** ANSI C code
- library for MS Visual Studio **for free** – enables development under PC environment

Applications

- digital/analog UHF two-way radios
- UHF basestations and repeaters
- APCO P25/PMR/LMR equipment
- analog/ham radios

Specifications

Figure below shows typical integration diagram of Sub-audio signaling processor. It enables easy integration with typical 14- or 16-bit codecs and analog or digital discriminator circuits.



Simplified block diagram

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Parameter	Value			Units	Notes
	Min	Max	Typ		
General					
Sample rate			8	kHz	
Pre/de-emphasis filters					
Slope			6	dB/oct.	Reference 0 dB gain point @ 1 kHz
Range	300	3000		Hz	
Tone generator					
Resolution			0.1	Hz	
Spurious level		-80		dBc	
Harmonics level		-85		dBc	
CTCSS encoder					
Frequency	60	260		Hz	
Resolution			0.1	Hz	
DCS encoder					
Code sets					52/83/104, positive/inverted
Delay			12	msec	
RX/TX gain					
Limits	-90	90		dB	
Resolution			0.01	dB	
CTCSS decoder					
Selectivity			$\pm 0.012F_{\text{tone}}$		pure tone, NOTE -[2]
Selectivity			$\pm 0.012F_{\text{tone}}$		CTCSS composite signal, NOTE -[3]
Dynamic range	-26	12	0	dB	pure tone, NOTE -[2]
Average response time			130	msec	CTCSS composite signal, NOTE -[3]
Average deresponse time			100	msec	CTCSS composite signal, NOTE -[3]
Noise performance			4	dB	NOTE -[4]
DCS decoder					
Dynamic range	-40	12	0	dB	pure DCS signal, NOTE -[5]
Average response time			230	msec	DCS composite signal, NOTE -[6]
Average deresponse time			160	msec	DCS composite signal, NOTE -[6]
Noise performance			7.5	dB	NOTE -[7]
RX/TX voiceband filter					
Attenuation			0	dB	
Passband ripple			0.2	dB	
Passband	300	3000		Hz	
Stopband (lower)	0	260		Hz	
Stopband (upper)	3400	4000		Hz	
Stopband attenuation	40				
Sub-audio rejection filter					
Attenuation	25			dB	

NOTES:

- [1] Reference level 0 dB is measured as a level of full scale 14-bit sinewave signal
- [2] Pure tone means CTCSS tone with frequency 151.4 Hz with 0 dB level
- [3] CTCSS composite signal is the sum of 1 kHz sinewave with 0 dB level, 151.4 Hz CTCSS tone with 15% deviation (level -16.5 dB) and Gaussian noise with level -8.4 dB (SINAD 9 dB).
- [4] CTCSS noise performance is measured as a SINAD value of composite signal when probability of detection not less than 90% and average response time does not exceed 250 msec

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- [5] Pure DCS signal means DCS code 023 with 0 dB level
- [6] DCS composite signal is the sum of 1 kHz sinewave with 0 dB level, DCS code 023 with 15% deviation (level -16.5 dB) and Gaussian noise with level -10.6 dB (SINAD 11 dB).
- [7] DCS noise performance is measured as a SINAD value of composite signal when probability of detection not less than 90% and average response time does not exceed 400 msec

Availability

This software package is available in binaries and in source code written on fully portable C-language for:

- Texas Instruments TMS320C54xx, TMS320C55xx, TMS320C64xx, OMAP, DaVinci
- ARM7, ARM9, ARM9E
- MS Windows

XDAIS compliant library is available upon request



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