

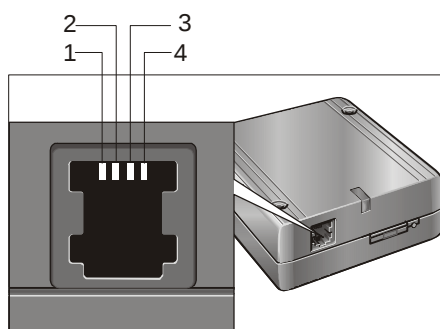
3.7 Audio Interface

The audio interface provides an analog input for a microphone and an analog output for an ear-piece.

- The microphone input and the earpiece output are balanced.
- For electret microphones a supply source is implemented.
- The microphone supply characteristics are optimized for the recommended Votronic handset. This handset has been used as the reference handset for type approval (see [Chapter 6](#)). An extra approval must be obtained for integrating other handsets or amplifiers.

The amplification of sending direction, receiving direction and sidetone depend on the current audio mode.

EMC immunity complies with the vehicular environment requirements according to EN 301 489-7.



Pin assignment:

- 1** MICN (Microphone -)
- 2** EPN (Earpiece)
- 3** EPP (Earpiece)
- 4** MICP (Microphone +)

Figure 6: Audio Western plug (4-pole female)

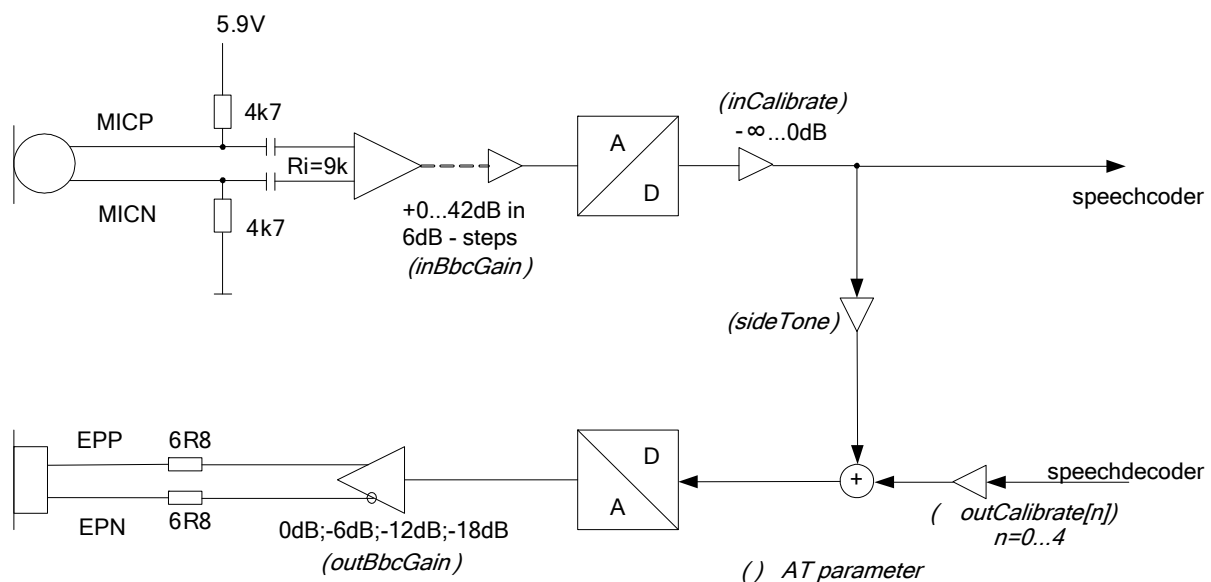


Figure 7: Audio block diagram

3.7.1 Supported Audio Modes

The audio interface can be configured by AT commands. Refer to [\[1\]](#) for details.

The electrical characteristics of the voiceband part vary with the audio mode. Specifications are listed in [Table 20](#). To suit several types of audio equipment, three audio modes given by default can be selected by the AT command AT^SNFS.

Regarding audio performance, compliance with the TS 51010-1 specification and GCF recommendations has been certified for the parameters provided by audio mode 1 and audio interface 1. The settings are optimized for the reference handset (type Votronic) connected to the MC55i Terminal. To ensure that the reference parameters are always within the limits demanded by the standards they cannot be changed by AT command. Furthermore, the reference parameters are set as factory default.

In audio mode 4 and 5, the gain in the microphone, earpiece and the sidetone path can be adjusted from the cellular device application by using further AT commands.

Please note that the 2nd audio interface of the MC55i module is not connected in the MC55i Terminal. Audio modes 2, 3 and 6 can be selected by setting AT^SAIC=2,1,1, for further details refer to [\[1\]](#).

Table 11: Audio modes

Audio mode number: AT^SNFS=	1 (Default settings, not adjustable)	4	5
Audio mode name	Default Handset	User Handset	Plain Codec 1
Purpose	Recommended handset (see Chapter 6)	User provided handset	Direct access to speech coder
Gain programmable via AT command	NO	YES	YES
Sidetone	YES	YES	YES
Volume control	NO	YES	YES
Echo control (send)	Cancellation	Cancellation	NO
MIC input signal for 0dBm0 @ 1024 Hz (at default gain settings)	18mV	18mV	315 mV
Earpiece output signal in mV eff. @ 0dBm0, 1024 Hz, no load (at default gain settings); @ 3.14 dBm0	620mV	620mV default @ max volume	880 mV 3.7 Vpp
Sidetone gain (at default settings)	21.5dB	21.5dB	-∞ dB

3.7.2 Speech processing

The voiceband filter includes a digital interpolation low-pass filter for received voiceband signals with digital noise shaping and a digital decimation low-pass filter for voiceband signals to be transmitted.

After voiceband (interpolation) filtering the resulting 4Mbit/s data stream is digital-to-analog converted and amplified by a programmable gain stage in the voiceband processing part. The output signal can directly be connected to the earpiece of the GSM cellular device or to an external handset earpiece (via I/O connector). In the opposite direction the input signal from the microphone is first amplified by a programmable amplifier. After analog-to-digital conversion a 4Mbit/s data stream is generated and voiceband (decimation) filtering is performed.

The resulting speech samples from the voiceband filters are handled by the DSP of the baseband controller to calculate e.g. amplifications, sidetone, echo cancellation or noise suppression.

Full rate, half rate and enhanced full rate, speech and channel encoding including voice activity detection (VAD) and discontinuous transmission (DTX) and digital GMSK modulation are also performed on the GSM baseband processor.

Note: With regard to acoustic shock, the cellular application must be designed to avoid sending false AT commands that might increase the amplification, e.g. for a high sensitive earpiece.