



# ETSI FR-GSM Speech Coder



## Processor

Motorola StarCore™ MSC8101 DSP.

## Background

**SIGNALS+SOFTWARE** are developing a complete suite of communication software for the Motorola MSC8100 family of DSPs. The initial development platform, the MSC8101, utilizes the StarCore™ 140 four ALU (Algorithmic Logic Unit) DSP core. This device also has 512kb memory and a Communications Processor Module (CPM) making it a versatile device for communication applications.

The algorithm to be implemented is the ETSI Full-Rate (FR) GSM recommendation, digital mobile telephone system. The encoder compresses linear-PCM (Pulse Code Modulated), narrowband speech input data, at a sample rate of 8kHz, to 13 000 bps, and uses a Regular Pulse Excitation with Long-Term Prediction (RPE-LTP) algorithm. The software will include voice activity detection, error concealment, and discontinuous transmission facilities.

The FR-GSM algorithm implements silence compression techniques to reduce the transmitted bit rate during the silent intervals of speech. Systems allowing discontinuous transmission (DTX) are based on Voice Activity Detection (VAD) algorithms and Comfort Noise Generator (CNG) algorithms that allows the insertion of Silence Insertion Descriptor (SID) frames during the silence intervals. This also provides the additional advantage of using lower processing loads and DSP bandwidth resource during silence frames.

## Features and Performance

- Passes all ETSI FR-GSM test vectors.

FR-GSM	Memory (bytes)				Processing Load (MCPS)
	Program	Tables	Permanent	Stack	
Encode	10352	400	712*n	1384	n * 3.34
Decode	7312	212	480*n	376	n * 0.95
Encode + Decode	15520	452	1192*n	1384	n * 4.29

**Table 1 : DSP Requirements for FRGSM – frame-based interface**

FR-GSM	Memory (bytes)					Processing Load (MCPS)
	Program	Tables	Permanent	Temporary	Stack	
Encode	10352	400	712*n	744*m	640	n * 3.34
Decode	7312	212	480*n	116*m	260	n * 0.95
Encode + Decode	15520	452	1192*n	860*m	640	n * 4.29

**Table 2 : DSP Requirements for FRGSM – module-based interface**

**Note:** Processing loads quote worst-case scenarios and n represents the number of channels and m is the number of channels that are processed simultaneously.

Program memory table values are initialisation values. Kbytes equals 1024 bytes.

### Technical Notes

The following 3GPP/ETSI specifications are implemented:

Description	3GPP Number	GSM Number
Speech Processing Functions	TS 46.001	06.01
Speech Transcoding	TS 46.010	06.10
Substitution and muting of lost frames	TS 46.011	06.11
Comfort Noise Generation (CNG)	TS 46.012	06.12
Discontinuous Transmission (DTX)	TS 46.031	06.31
Voice Activity Detection (VAD)	TS 46.032	06.32

### Interface Details

For convenience the individual software functions will be supplied as a single library module. The library will contain all the object code that is required to link in to a user's top-level application code. The audio functions will either be callable as C functions or as assembly functions.

The software is available within two interface options, frame based calling and module based calling which allows delay-optimised implementation of the algorithm to suit the requirements of the overall system.

### Availability

Code is available now for a one-off payment and/or royalties depending on the commercial application. It is anticipated that a significantly optimised version (sub 2 MCPS) will be introduced within the next month. Please contact **SIGNALS+SOFTWARE** for more details.

Also available or in development for StarCore™ are a full range of vocoders including AMR-GSM, EFR-GSM as well as other communication algorithms.

### SIGNALS+SOFTWARE

**SIGNALS+SOFTWARE** was founded in 1992 as a developer of high quality Digital Signal Processing application software for the communications industry. Supplying to a whole range of customers, including large blue chip corporations, **SIGNALS+SOFTWARE** has quickly established itself as the world leader in DSP software design and production.

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