CLAIMS

1. A method of sending non-speech information through a speech codec comprising:

processing a plurality of input data symbols to produce a plurality of first pulse signals;

shaping the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic; and

encoding the plurality of shaped first pulse signals with a speech codec.

2. The method of claim 1 wherein the processing comprises modulating the plurality of input data symbols using pulse position modulation, wherein the pulse position modulation comprises a first mapping of the plurality of input data symbols to one of a plurality of predetermined positions within a modulation frame.

3. The method of claim 1 wherein the shaping comprises transforming the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals.

4. The method of claim 3 wherein transforming comprises applying a transform signal selected from the group consisting of amplitude transform, root-raised cosine transform, and polarity transform.

5. The method of claim 3 wherein the tail portion of the shaped pulse samples which extend beyond the end of the modulation frame are repositioned to the beginning of the modulation frame.

6. The method of claim 3 further comprising filtering the plurality of shaped pulse samples by applying a linear prediction synthesis filter to the plurality of shaped pulse samples.

7. The method of claim 2 wherein the pulse position modulation further comprises a second mapping of the plurality of input data symbols to one of a plurality of predetermined positions within a modulation frame.

8. The method of claim 7 further comprising:

receiving an indication signal indicative of a transmission state;

selecting the first mapping if the indication signal indicates a first transmission state; and

selecting the second mapping if the indication signal indicates a second transmission state.

9. The method of claim 8 wherein the first transmission state is identified by preceding the first pulse signal with a first identifier signal and the second transmission state is identified by preceding the second pulse signal with a second identifier signal.

10. An apparatus comprising:

a processor configured to process a plurality of input data symbols to produce a plurality of first pulse signals;

a shaper configured to shape the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic; and

a speech codec configured to encode the plurality of shaped first pulse signals to produce a speech packet.

11. The apparatus of claim 10, wherein the processor is configured to modulate the plurality of input data symbols using pulse position modulation, wherein the pulse position modulation comprises a first mapping of the plurality of input data symbols to one of a plurality of predetermined positions within a modulation frame.

12. The apparatus of claim 10, wherein the shaper is configured to transform the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals.

13. The apparatus of claim 12, wherein the shaper is further configured to reposition the tail portion of the shaped pulse samples which extend beyond the end of the modulation frame to the beginning of the modulation frame.

14. The apparatus of claim 12, wherein the shaper is further configured to filter the plurality of shaped pulse samples by applying a linear prediction synthesis filter to the plurality of shaped pulse samples.

15. The apparatus of claim 11, wherein the pulse position modulation further comprises a second mapping of the plurality of input data symbols to one of a plurality of predetermined positions within a modulation frame.

16. The apparatus of claim 15, wherein the processor is further configured to:
receive an indication signal indicative of a transmission state;

select the first mapping if the indication signal indicates a first transmission state; and

select the second mapping if the indication signal indicates a second transmission state.

17. The apparatus of claim 16, wherein the processor is further configured to identify the first transmission state by preceding the first pulse signal with a first identifier signal and the second transmission state by preceding the second pulse signal with a second identifier signal.

18. An apparatus comprising:

means for processing a plurality of input data symbols to produce a plurality of first pulse signals;

means for shaping the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic; and

means for encoding the shaped first pulse signals with a speech codec.

19. The apparatus of claim 18, wherein the means for processing is configured to modulate the plurality of input data symbols using pulse position modulation, wherein the pulse position modulation comprises a first mapping of the plurality of input data symbols to one of a plurality of predetermined positions within a modulation frame.

20. The apparatus of claim 18, wherein the means for shaping is configured to transform the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals.

21. The apparatus of claim 20, wherein the means for shaping is further configured to reposition the tail portion of the shaped pulse samples which extend beyond the end of the modulation frame to the beginning of the modulation frame.

22. The apparatus of claims 20, wherein the means for shaping is further configured to filter the plurality of shaped pulse samples by applying a linear prediction synthesis filter to the plurality of shaped pulse samples.

23. The apparatus of claim 19, wherein the pulse position modulation comprises a second mapping of the plurality of input data symbols to one of a plurality of predetermined positions within a modulation frame.

24. The apparatus of claim 23, wherein the means for processing is further configured to:

receive an indication signal indicative of a transmission state;

select the first mapping if the indication signal indicates a first transmission state; and

select the second mapping if the indication signal indicates a second transmission state.

25. The apparatus of claim 24, wherein the means for processing is further configured to identify the first transmission state by preceding the first pulse signal with

a first identifier signal and the second transmission state by preceding the second pulse signal with a second identifier signal.

26. A system for communicating data over an in-band communication system from a vehicle containing an in-vehicle system (IVS) to a public safety answering point (PSAP) comprising:

one or more sensors located in the IVS for providing IVS sensor data;

an IVS transmitter located in the IVS for transmitting the IVS sensor data;

a PSAP receiver located in the PSAP for receiving the IVS sensor data;

a PSAP transmitter located in the PSAP for transmitting PSAP command data; and

an IVS receiver located in the IVS for receiving the PSAP command data;

wherein the IVS transmitter comprises:

an IVS message formatter for formatting the IVS sensor data and producing an IVS message;

an IVS processor for processing the IVS message and producing a plurality of IVS shaped pulse signals;

an IVS speech encoder for encoding the IVS shaped pulse signals and producing an IVS encoded signal;

an IVS synchronization generator for generating an IVS synchronization signal; and

an IVS transmit controller for transmitting a sequence of IVS synchronization signals and IVS messages;

wherein the PSAP receiver comprises:

a PSAP detector for detecting the IVS synchronization signal;

a PSAP demodulator for demodulating the IVS message and producing a received IVS message;

wherein the PSAP transmitter comprises:

a PSAP message formatter for formatting the PSAP command data and producing a PSAP command message;

a PSAP processor for processing the PSAP command message and producing a plurality of PSAP shaped pulse signals;

a PSAP speech encoder for encoding the PSAP shaped pulse signals and producing a PSAP encoded signal;

a PSAP synchronization generator for generating a PSAP synchronization signal; and

a PSAP transmit controller for transmitting a sequence of PSAP synchronization signals and PSAP command messages;

wherein the IVS receiver comprises:

an IVS detector for detecting the PSAP synchronization signal;

an IVS demodulator for demodulating the PSAP messages and producing a received PSAP message.

CLAIMS

1. A method of sending non-speech information through a speech codec comprising:

processing a plurality of input data symbols to produce a plurality of first pulse signals;

shaping the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic, wherein the shaping comprises transforming the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals, and wherein the tail portion of the shaped pulse samples which extend beyond the end of a modulation frame are repositioned to the beginning of the modulation frame; and

encoding the plurality of shaped first pulse signals with a speech codec.

2. The method of claim 1 wherein the processing comprises modulating the plurality of input data symbols using pulse position modulation, wherein the pulse position modulation comprises a first mapping of the plurality of input data symbols to one of a plurality of predetermined positions within the modulation frame.

3. The method of claim 2 wherein the pulse position modulation further comprises a second mapping of the plurality of input data symbols to one of a plurality of predetermined positions within the modulation frame.

4. The method of claim **3** further comprising:

receiving an indication signal indicative of a transmission state;

selecting the first mapping if the indication signal indicates a first transmission state; and

selecting the second mapping if the indication signal indicates a second transmission state.

5. The method of claim **4** wherein the first transmission state is identified by preceding the first pulse signal with a first identifier signal and the second transmission state is identified by preceding the second pulse signal with a second identifier signal.

6. The method of claim **1** wherein transforming comprises applying a transform signal selected from the group consisting of amplitude transform, root-raised cosine transform, and polarity transform.

7. The method of claim **1** further comprising filtering the plurality of shaped pulse samples by applying a linear prediction synthesis filter to the plurality of shaped pulse samples.

8. A non-transitory memory storing a computer program that, when executed, causes a computer to perform the acts of:

processing a plurality of input data symbols to produce a plurality of first pulse signals;

shaping the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic, wherein the shaping comprises transforming the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals, and wherein the

tail portion of the shaped pulse samples which extend beyond the end of a modulation frame are repositioned to the beginning of the modulation frame; and

encoding the plurality of shaped first pulse signals with a speech codec.

9. An apparatus comprising:

a processor configured to process a plurality of input data symbols to produce a plurality of first pulse signals;

a shaper configured to shape the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic, wherein the shaper is further configured to transform the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals, and wherein the shaper is further configured to reposition the tail portion of the shaped pulse samples which extend beyond the end of a modulation frame to the beginning of the modulation frame; and

a speech codec configured to encode the plurality of shaped first pulse signals to produce a speech packet.

10. The apparatus of claim **9**, wherein the processor is configured to modulate the plurality of input data symbols using pulse position modulation, wherein the pulse position modulation comprises a first mapping of the plurality of input data symbols to one of a plurality of predetermined positions within the modulation frame.

11. The apparatus of claim **10**, wherein the pulse position modulation further comprises a second mapping of the plurality of input data symbols to one of a plurality of predetermined positions within the modulation frame.

12. The apparatus of claim **11**, wherein the processor is further configured to:

receive an indication signal indicative of a transmission state;

select the first mapping if the indication signal indicates a first transmission state; and

select the second mapping if the indication signal indicates a second transmission state.

13. The apparatus of claim **12**, wherein the processor is further configured to identify the first transmission state by preceding the first pulse signal with a first identifier signal and the second transmission state by preceding the second pulse signal with a second identifier signal.

14. The apparatus of claim **9**, wherein the shaper is further configured to filter the plurality of shaped pulse samples by applying a linear prediction synthesis filter to the plurality of shaped pulse samples.

15. An apparatus comprising:

means for processing a plurality of input data symbols to produce a plurality of first pulse signals;

means for shaping the plurality of first pulse signals to produce a plurality of shaped first pulse signals, wherein the plurality of shaped first pulse signals have a spectrally noise-like characteristic, wherein the means for shaping is configured to transform the plurality of first pulse signals to produce a plurality of shaped pulse samples, wherein the plurality of shaped pulse samples are used to form the plurality of shaped first pulse signals, and wherein the means for shaping is further configured to reposition the tail portion of the shaped pulse samples which extend beyond the end of a modulation frame to the beginning of the modulation frame; and

means for encoding the shaped first pulse signals with a speech codec.

16. The apparatus of claim **15**, wherein the means for processing is configured to modulate the plurality of input data symbols using pulse position modulation, wherein the pulse position modulation comprises a first mapping of the plurality of input data symbols to one of a plurality of predetermined positions within the modulation frame.

17. The apparatus of claim **16**, wherein the pulse position modulation comprises a second mapping of the plurality of input data symbols to one of a plurality of predetermined positions within the modulation frame.

18. The apparatus of claim **17**, wherein the means for processing is further configured to:

receive an indication signal indicative of a transmission state;

select the first mapping if the indication signal indicates a first transmission state; and

select the second mapping if the indication signal indicates a second transmission state.

19. The apparatus of claim **18**, wherein the means for processing is further configured to identify the first transmission state by preceding the first pulse signal with a first identifier signal and the second transmission state by preceding the second pulse signal with a second identifier signal.

20. The apparatus of claim **15**, wherein the means for shaping is further configured to filter the plurality of shaped pulse samples by applying a linear prediction synthesis filter to the plurality of shaped pulse samples.

21. A system for communicating data over an in-band communication system from a vehicle containing an in-vehicle system (IVS) to a public safety answering point (PSAP) comprising:

one or more sensors located in the IVS for providing IVS sensor data, wherein the sensor data is indicative of a malfunction of the vehicle;

an IVS transmitter located in the IVS for transmitting the IVS sensor data;

a PSAP receiver located in the PSAP for receiving the IVS sensor data;

a PSAP transmitter located in the PSAP for transmitting PSAP command data; and

an IVS receiver located in the IVS for receiving the PSAP command data;

wherein the IVS transmitter comprises:

an IVS message formatter for formatting the IVS sensor data and producing an IVS message;

an IVS processor for processing the IVS message and producing a plurality of IVS shaped pulse signals;

an IVS speech encoder for encoding the IVS shaped pulse signals and producing an IVS encoded signal;

an IVS synchronization generator for generating an IVS synchronization signal; and

an IVS transmit controller for transmitting a sequence of IVS synchronization signals and IVS messages;

wherein the PSAP receiver comprises:

a PSAP detector for detecting the IVS synchronization signal; and

a PSAP demodulator for demodulating the IVS message and producing a received IVS message;

wherein the PSAP transmitter comprises:

a PSAP message formatter for formatting the PSAP command data and producing a PSAP command message;

a PSAP processor for processing the PSAP command message and producing a plurality of PSAP shaped pulse signals;

a PSAP speech encoder for encoding the PSAP shaped pulse signals and producing a PSAP encoded signal;

a PSAP synchronization generator for generating a PSAP synchronization signal; and

a PSAP transmit controller for transmitting a sequence of PSAP synchronization signals and PSAP command messages;

wherein the IVS receiver comprises:

an IVS detector for detecting the PSAP synchronization signal; and

an IVS demodulator for demodulating the PSAP messages and producing a received PSAP message.