CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A system for collecting at least one signal comprising:

an analog sampler, for receiving said at least one signal as an analog electrical signal, for folding said analog electrical signal using at least two different frequencies simultaneously into at least two respective intermediate frequency (IF) signals respectively according to said at least two different frequencies;

at least two digital frequency analyzers, each respectively coupled with said analog sampler, each one of said at least two digital frequency analyzers for digitally sampling a respective one of said at least two respective IF signals into at least one respective digital signal and for spectrally analyzing said at least one respective digital signal; and

a processor, coupled with each one of said at least two digital frequency analyzers, for determining a plurality of linear combinations of said at least two respective IF signals with respect to said at least two different frequencies used in said analog sampler and for determining at least one frequency of said at least one signal by evaluating said plurality of linear combinations of said at least two respective IF signals;

wherein each one of said at least two digital frequency analyzers comprises:

a digital sampler, coupled with said analog sampler, for digitally sampling said respective one of said at least two respective IF signals;

a logic layer, coupled with said digital sampler and with said processor; and

at least one Fourier transformer, coupled with said logic layer, for determining a plurality of discrete Fourier transforms (DFTs) of said digitally sampled respective one said at least two respective IF signals;

wherein said plurality of DFTs is comprised of a plurality of discrete Fourier transform (DFT) chunks;

wherein a given one of said DFT chunks overlaps a subsequent one of said DFT chunks by at least a predetermined amount; and

wherein said logic layer dilutes the data of said plurality of DFTs by a process of peak picking.

2. The system according to claim 1, further comprising:

a signal collector, for collecting said at least one signal and converting said at least one collected signal into said analog electrical signal; and

an analog front end, coupled with said signal collector and with said analog sampler.

3. The system according to claim 1, wherein a sampling rate of said at least two different frequencies is in the low gigahertz range.

4. The system according to claim 1, wherein said processor determines said plurality of linear combinations according to:

$$l \cdot Cf_i \pm \Delta Cf_i = m \cdot Cf_j \pm \Delta Cf_j = ISf$$

wherein Cf_i and Cf_j respectively represent said at least two different frequencies;

wherein ΔCf_i and ΔCf_j respectively represent a frequency of said at least one respective digital signal;

wherein l and m represent integer coefficients;

wherein i does not equal j; and

wherein ISf represents said determined at least one frequency of said at least one signal.

5. The system according to claim 1, wherein said processor determines a plurality of characteristics of said at least one signal based on said determined at least one frequency of said at least one signal.

6. The system according to claim 5, wherein said processor outputs a digital description of said at least one signal, said digital description comprising said plurality of characteristics.

7. The system according to claim 1, wherein said analog sampler, said at least two digital frequency analyzers and said processor continuously operate in real-time.

8. The system according to claim 2, wherein said analog sampler is an analog optical sampler comprising:

a plurality of optical pulse generators, for generating said at least two different frequencies, wherein each of said at least two different frequencies is an optical pulse train;

a multiplexer, coupled with each one of said plurality of optical pulse generators, for multiplexing said at least two different frequencies into a multiplexed sampling signal;

a fiber amplifier, coupled with said multiplexer, for amplifying said multiplexed sampling signal;

a modulator, coupled with said fiber amplifier and with said analog front end, for analog sampling said analog electrical signal

with said multiplexed sampling signal, thereby generating a sampled analog optical signal;

a demultiplexer, coupled with said modulator, for demultiplexing said sampled analog optical signal according to respective wavelengths of said plurality of optical pulse generators into a plurality of demultiplexed sampled optical signals;

a respective plurality of photodiodes, each one of said respective plurality of photodiodes respectively coupled with said demultiplexer, for converting each one of said plurality of demultiplexed sampled optical signals into a plurality of sampled analog electrical signals;

a respective plurality of low pass filters, each one of said respective plurality of low pass filters coupled with a respective one of said respective plurality of photodiodes, for attenuating high frequencies in each one of said plurality of sampled analog electrical signals and generating said at least two respective IF signals; and

a respective plurality of amplifiers, each one of said respective plurality of amplifiers coupled with a respective one of said respective plurality of low pass filters and with a respective one of said at least two digital frequency analyzers, for amplifying said at least two respective IF signals.

9. The system according to claim 8, each one of said plurality of optical pulse generators comprising:

a continuous wave laser, for generating laser light;

an electro-absorption modulator, coupled with said continuous wave laser and with said multiplexer; and

a comb generator, coupled with said electro-absorption modulator, for generating a unique frequency;

wherein said electro-absorption modulator substantially modulates said laser light with said unique frequency thereby generating said optical pulse train.

10. The system according to claim 2, wherein said analog sampler is an analog optical sampler comprising:

a plurality of frequency generators, for generating said at least two different frequencies, wherein each of said at least two different frequencies is a pulse train, each one of said plurality of frequency generators comprising:

a continuous wave laser, for generating laser light;

an electro-absorption modulator, coupled with said continuous wave laser;

a frequency combiner, coupled with said electro-absorption modulator; and

a plurality of frequency oscillators, coupled with said frequency combiner, for generating a plurality of frequencies;

wherein said frequency combiner combines said plurality of frequencies; and

wherein said electro-absorption modulator substantially modulates said laser light with said plurality of frequencies thereby generating said pulse train;

an optical multiplexer, coupled with each respective electro-absorption modulator of each one of said plurality of frequency generators, for combining said at least two different frequencies into a multiplexed sampling signal;

a fiber amplifier, coupled with said multiplexer, for amplifying said multiplexed sampling signal;

a modulator, coupled with said fiber amplifier and with said analog front end, for analog sampling said analog electrical signal

with said multiplexed sampling signal, thereby generating a sampled analog optical signal;

a demultiplexer, coupled with said modulator, for demultiplexing said sampled analog optical signal according to respective frequencies of said plurality of frequency generators into a plurality of demultiplexed sampled optical signals;

a respective plurality of photodiodes, each one of said respective plurality of photodiodes respectively coupled with said demultiplexer, for converting each one of said plurality of demultiplexed sampled optical signals into a plurality of sampled analog electrical signals;

a respective plurality of low pass filters, each one of said respective plurality of low pass filters coupled with a respective one of said respective plurality of photodiodes, for attenuating high frequencies in said plurality of sampled analog electrical signals and generating said at least two respective IF signals; and

a respective plurality of amplifiers, each one of said respective plurality of amplifiers coupled with a respective one of said respective plurality of low pass filters and with a respective one of said at least two digital frequency analyzers, for amplifying said at least two respective IF signals.

11. The system according to claim 1, wherein said processor implements a plurality of digital band reject filters in each of said at least two digital frequency analyzers.

12. The system according to claim 1, wherein said logic layer and said at least one Fourier transformer are a field-programmable gate array (FPGA).

13. The system according to claim 1, wherein said plurality of DFTs determined in each one of said at least two digital frequency analyzers is determined synchronously.

14. The system according to claim 1, said processor comprising:

a frequency determinator, coupled with said logic layer, for receiving and unaliasing said plurality of DFT chunks and for determining said at least one frequency of said at least one signal;

a characteristics determinator, coupled with said frequency determinator, for determining a plurality of characteristics of said at least one signal; and

a clock, coupled with said logic layer, for providing a synchronization signal to said logic layer for synchronizing said at least one Fourier transformer.

15. The system according to claim 2, wherein said analog sampler is an analog radio frequency (RF) sampler comprising:

a plurality of RF generators, for generating said at least two different frequencies;

a respective plurality of RF mixers, each one being respectively coupled with one of said plurality of RF generators;

a power splitter, coupled with each one of said respective plurality of RF mixers and with said analog front end, for splitting said analog electrical signal into at least two analog electrical signals, wherein each one of said plurality of RF mixers mixes a respective one of said at least two different frequencies with a respective one of said at least two analog electrical signals, thereby generating at least two respective full band folded signals;

a respective plurality of low pass filters, each one of said respective plurality of low pass filters coupled with a respective one

of said respective plurality of RF mixers, for attenuating high frequencies in said at least two respective full band folded signals thereby generating said at least two respective IF signals; and

a respective plurality of amplifiers, each one of said respective plurality of amplifiers coupled with a respective one of said respective plurality of low pass filters, for amplifying said at least two respective IF signals;

wherein each of said at least two different frequencies is an RF pulse train.

16. The system according to claim 15, each one of said plurality of RF generators comprising:

an RF signal generator, for generating an RF signal;

a first amplifier, coupled with said RF signal generator, for amplifying said RF signal;

a comb generator, coupled with said first amplifier, for generating a frequency at the frequency of said RF signal, said frequency having a baseband frequency; and

a second amplifier, coupled with said comb generator and with a respective one of said respective plurality of RF mixers, for amplifying said baseband frequency of said frequency,

wherein said comb generator modulates said RF signal, thereby generating said RF pulse train.

17. The system according to claim 1, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a single signal and thereby determines a single frequency of said at least one signal.

18. The system according to claim 1, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a plurality of signals received simultaneously and thereby simultaneously determines a plurality of frequencies of said plurality of signals received simultaneously.

19. The system according to claim 1, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a noise signal.

20. A system for collecting at least one signal, a frequency of said at least one signal being within a defined frequency band, comprising:

an analog sampler, for receiving said at least one signal as an analog electrical signal, for folding said analog electrical signal using at least one frequency into at least one respective intermediate frequency (IF) signal according to said at least one frequency;

at least one digital frequency analyzer, coupled with said analog sampler, said at least one digital frequency analyzer for digitally sampling said at least one respective IF signal into at least one respective digital signal and for spectrally analyzing said at least one respective digital signal; and

a processor, coupled with said at least one digital frequency analyzer, for determining a plurality of linear combinations of said at least one respective IF signal with respect to said at least one frequency used in said analog sampler and for determining at least one frequency of said at least one signal by evaluating said plurality of linear combinations of said at least one respective IF signal;

wherein said at least one respective IF signal has a frequency within said frequency band;

wherein at least one digital frequency analyzer comprises:

a digital sampler, coupled with said analog optical sampler, for digitally sampling said at least one respective IF signal;

a logic layer, coupled with said digital sampler and with said processor; and

at least one Fourier transformer, coupled with said logic layer, for determining a plurality of discrete Fourier transforms (DFTs) of said at least one respective IF signal,

wherein said plurality of DFTs is comprised of a plurality of discrete Fourier transform (DFT) chunks,

wherein a given one of said DFT chunks overlaps a subsequent one of said DFT chunks by at least a predetermined amount, and

wherein said logic layer dilutes the data of said plurality of DFTs by a process of peak picking.

21. The system according to claim 20, wherein said analog sampler is an analog optical sampler further comprising:

an optical pulse generator, for generating said at least one frequency;

a fiber amplifier, coupled with said optical pulse generator, for amplifying said at least one frequency;

a modulator, coupled with said fiber amplifier and with an analog front end, for analog sampling said analog electrical signal with said at least one frequency, thereby generating a sampled analog optical signal;

a photodiode, coupled with said modulator, for converting said sampled analog optical signal into a sampled analog electrical signal;

a low pass filter, coupled with said photodiode, for attenuating high frequencies in said sampled analog electrical signal and generating said at least one respective IF signal; and

an amplifier, coupled with said low pass filter and with said at least one digital frequency analyzer, for amplifying said at least one respective IF signal,

wherein said at least one frequency is an optical pulse train.

22. The system according to claim 20, wherein said analog sampler is an analog radio frequency (RF) sampler comprising:

an RF generator, for generating said at least one frequency;

an RF mixer, coupled with said RF generator and an analog front end for mixing said at least one frequency with said analog electrical signal, thereby generating a full band folded signal;

a low pass filter, coupled with said RF mixer, for attenuating high frequencies in said full band folded signal thereby generating said at least one respective IF signal; and

an amplifier, coupled with said low pass filter, for amplifying said at least one respective IF signal,

wherein said at least one frequency is an RF pulse train.

23. The system according to claim 20, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a single signal and thereby determines a single frequency of said at least one signal.

24. The system according to claim 20, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a plurality of

signals received simultaneously and thereby simultaneously determines a plurality of frequencies of said plurality of signals received simultaneously.

25. The system according to claim 20, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a noise signal.

26. A method for collecting at least one signal comprising the procedures of:

collecting at least one signal;

folding said collected at least one signal using at least two different frequencies simultaneously, thereby generating at least two respective intermediate frequency (IF) signals;

digitally sampling each one of said at least two respective IF signals, thereby generating at least two respective sampled IF signals;

spectrally analyzing said at least two respective sampled IF signals; and

processing each one of said at least two respective sampled IF signals, thereby determining at least one characteristic of said collected at least one signal;

wherein said procedure of spectrally analyzing comprises the sub-procedures of executing a plurality of fast Fourier transforms on said at least two respective sampled IF signals, thereby determining at least two sets of discrete Fourier transforms (DFTs); and

diluting the data of said plurality of DFTs by a process of peak picking;

wherein each one of said two sets of DFTs comprises a plurality of discrete Fourier transform (DFT) chunks; and

wherein a given one of said plurality of DFT chunks overlaps a subsequent one of said plurality of DFT chunks by at least a predetermined amount.

27. The method according to claim 26, further comprising the procedures of:

analog filtering said collected at least one signal; and

analog processing said collected at least one signal.

28. The method according to claim 26, wherein said procedure of folding comprises the sub-procedures of:

multiplexing said at least two different frequencies simultaneously into a multiplexed signal;

modulating said multiplexed signal with said collected at least one signal;

demultiplexing said modulated multiplexed signal according to said at least two different frequencies into at least two folded sampling signals;

converting said at least two folded sampling signals into at least two electrical signals; and

low pass filtering said at least two electrical signals, thereby eliminating high frequency images of said at least two electrical signals and generating said at least two respective IF signals.

29. The method according to claim 26, wherein said procedure of processing comprises the sub-procedures of:

determining a plurality of linear combinations of said at least two different frequencies used in said procedure of folding; and

evaluating said plurality of linear combinations, thereby determining at least one frequency of said collected at least one signal.

30. The method according to claim 26, further comprising the procedure of digitally processing said at least two respective sampled IF signals after said procedure of digitally sampling each one of said at least two respective IF signals.

31. The method according to claim 29, wherein according to said sub-procedure of evaluating, said procedure of processing determines that said at least one signal comprises a single signal, said sub-procedure of evaluating further comprising determining a single frequency of said at least one signal.

32. The method according to claim 29, wherein according to said sub-procedure of evaluating, said procedure of processing determines that said at least one signal comprises a plurality of signals received simultaneously, said sub-procedure of evaluating further comprising simultaneously determining a plurality of frequencies of said plurality of signals received simultaneously.

33. The method according to claim 29, wherein according to said sub-procedure of evaluating, said procedure of processing determines that said at least one signal comprises a noise signal.

34. The method according to claim 26, wherein said procedure of folding comprises the sub-procedures of:

splitting said collected at least one signal into at least two analog electrical signals;

mixing a respective one of said at least two different frequencies with a respective one of said at least two analog electrical signals, thereby generating at least two respective full band folded signals; and

low pass filtering said at least two respective full band folded signals, thereby eliminating high frequency images of said at least two full band folded signals and generating said at least two respective IF signals.

35. A method for collecting at least one signal simultaneously comprising the procedures of:

collecting at least one signal;

folding said collected at least one signal using at least two different frequencies simultaneously, thereby generating at least two respective intermediate frequency (IF) signals;

digitally sampling each one of said at least two respective IF signals, thereby generating at least two respective sampled IF signals;

digitally processing said at least two respective sampled IF signals; and

processing each one of said at least two respective sampled IF signals, thereby determining at least one characteristic of said collected at least one signal,

wherein said procedure of digitally processing comprises the sub-procedures of executing a plurality of fast Fourier transforms on said at least two respective sampled IF signals, thereby determining at least two sets of discrete Fourier transforms (DFTs); and

diluting the data of said plurality of DFTs by a process of peak picking,

wherein each one of said two sets of DFTs comprises a plurality of discrete Fourier transform (DFT) chunks, and

wherein a given one of said plurality of DFT chunks overlaps a subsequent one of said plurality of DFT chunks by at least a predetermined amount.

CLAIMS

1. System (100) for collecting at least one signal (112) comprising:

an analog sampler (106), for receiving said at least one signal as an analog electrical signal, for folding said analog electrical signal using at least two different frequencies simultaneously into at least two respective intermediate frequency (IF) signals (116A, 116B) respectively according to said at least two different frequencies;

at least two digital frequency analyzers (108A, 108B), each respectively coupled with said analog sampler, each one of said at least two digital frequency analyzers for digitally sampling a respective one of said at least two respective IF signals into at least one respective digital signal and for spectrally analyzing said at least one respective digital signal; and

a processor (110), coupled with each one of said at least two digital frequency analyzers, for determining a plurality of linear combinations of said at least two respective IF signals with respect to said at least two different frequencies used in said analog sampler and for determining at least one frequency of said at least one signal by evaluating said plurality of linear combinations of said at least two respective IF signals,

characterized in that each one of said at least two digital frequency analyzers comprises:

a digital sampler (222), coupled with said analog sampler, for digitally sampling said respective one of said at least two respective IF signals;

a logic layer (224), coupled with said digital sampler and with said processor; and

at least one Fourier transformer (226), coupled with said logic layer, for determining a plurality of discrete Fourier transforms (DFTs)

of said digitally sampled respective one said at least two respective IF signals,

wherein said plurality of DFTs is comprised of a plurality of discrete Fourier transform (DFT) chunks,

wherein a given one of said DFT chunks overlaps a subsequent one of said DFT chunks by at least a predetermined amount, and

wherein said logic layer dilutes the data of said plurality of DFTs by a process of peak picking.

2. The system according to claim 1, further comprising:

a signal collector (102), for collecting said at least one signal and converting said at least one collected signal into said analog electrical signal; and

an analog front end (104), coupled with said signal collector and with said analog sampler.

3. The system according to claim 1, wherein a sampling rate of said at least two different frequencies is in the low gigahertz range.

4. The system according to claim 1, wherein said processor determines said plurality of linear combinations according to

$$l \cdot Cf_i \pm \Delta Cf_i = m \cdot Cf_j \pm \Delta Cf_j = ISf$$

wherein Cf_i and Cf_j respectively represent said at least two different frequencies,

wherein ΔCf_i and ΔCf_j respectively represent a frequency of said at least one respective digital signal,

wherein *l* and *m* represent integer coefficients,

wherein i does not equal j, and

wherein ISf represents said determined at least one frequency of said at least one signal.

5. The system according to claim 1, wherein said processor determines a plurality of characteristics of said at least one signal based on said determined at least one frequency of said at least one signal.

6. The system according to claim 5, wherein said processor outputs a digital description of said at least one signal, said digital description comprising said plurality of characteristics.

7. The system according to claim 1, wherein said analog sampler, said at least two digital frequency analyzers and said processor continuously operate in real-time.

8. The system according to claim 2, wherein said analog sampler is an analog optical sampler (140) comprising:

a plurality of optical pulse generators (150A, 150B), for generating said at least two different frequencies, wherein each of said at least two different frequencies is an optical pulse train;

a multiplexer (152), coupled with each one of said plurality of optical pulse generators, for multiplexing said at least two different frequencies into a multiplexed sampling signal;

a fiber amplifier (154), coupled with said multiplexer, for amplifying said multiplexed sampling signal;

a modulator (156), coupled with said fiber amplifier and with said analog front end, for analog sampling said analog electrical signal with said multiplexed sampling signal, thereby generating a sampled analog optical signal;

a demultiplexer (158), coupled with said modulator, for demultiplexing said sampled analog optical signal according to

respective wavelengths of said plurality of optical pulse generators into a plurality of demultiplexed sampled optical signals;

a respective plurality of photodiodes (160A, 160B), each one of said respective plurality of photodiodes respectively coupled with said demultiplexer, for converting each one of said plurality of demultiplexed sampled optical signals into a plurality of sampled analog electrical signals;

a respective plurality of low pass filters (162A, 162B), each one of said respective plurality of low pass filters coupled with a respective one of said respective plurality of photodiodes, for attenuating high frequencies in each one of said plurality of sampled analog electrical signals and generating said at least two respective IF signals; and

a respective plurality of amplifiers (164A, 164B), each one of said respective plurality of amplifiers coupled with a respective one of said respective plurality of low pass filters and with a respective one of said at least two digital frequency analyzers, for amplifying said at least two respective IF signals.

9. The system according to claim 8, each one of said plurality of optical pulse generators comprising:

a continuous wave laser (202), for generating laser light;

an electro-absorption modulator (204), coupled with said continuous wave laser and with said multiplexer; and

a comb generator (206), coupled with said electro-absorption modulator, for generating a unique frequency,

wherein said electro-absorption modulator substantially modulates said laser light with said unique frequency thereby generating said optical pulse train.

10. The system according to claim 2, wherein said analog sampler is an analog optical sampler comprising:

a plurality of frequency generators, for generating said at least two different frequencies, wherein each of said at least two different frequencies is a pulse train, each one of said plurality of frequency generators comprising:

a continuous wave laser (202), for generating laser light;

an electro-absorption modulator (204), coupled with said continuous wave laser;

a frequency combiner, coupled with said electro-absorption modulator; and

a plurality of frequency oscillators, coupled with said frequency combiner, for generating a plurality of frequencies,

wherein said frequency combiner combines said plurality of frequencies, and

wherein said electro-absorption modulator substantially modulates said laser light with said plurality of frequencies thereby generating said pulse train;

an optical multiplexer (152), coupled with each respective electro-absorption modulator of each one of said plurality of frequency generators, for combining said at least two different frequencies into a multiplexed sampling signal;

a fiber amplifier (154), coupled with said multiplexer, for amplifying said multiplexed sampling signal;

a modulator (156), coupled with said fiber amplifier and with said analog front end, for analog sampling said analog electrical signal with said multiplexed sampling signal, thereby generating a sampled analog optical signal;

a demultiplexer (158), coupled with said modulator, for demultiplexing said sampled analog optical signal according to

respective frequencies of said plurality of frequency generators into a plurality of demultiplexed sampled optical signals;

a respective plurality of photodiodes (160A, 160B), each one of said respective plurality of photodiodes respectively coupled with said demultiplexer, for converting each one of said plurality of demultiplexed sampled optical signals into a plurality of sampled analog electrical signals;

a respective plurality of low pass filters (162A, 162B), each one of said respective plurality of low pass filters coupled with a respective one of said respective plurality of photodiodes, for attenuating high frequencies in said plurality of sampled analog electrical signals and generating said at least two respective IF signals; and

a respective plurality of amplifiers (164A, 164B), each one of said respective plurality of amplifiers coupled with a respective one of said respective plurality of low pass filters and with a respective one of said at least two digital frequency analyzers, for amplifying said at least two respective IF signals.

11. The system according to claim 1, wherein said processor implements a plurality of digital band reject filters in each of said at least two digital frequency analyzers.

12. The system according to claim 1, wherein said logic layer and said at least one Fourier transformer are a field-programmable gate array (FPGA).

13. The system according to claim 1, wherein said plurality of DFTs determined in each one of said at least two digital frequency analyzers is determined synchronously.

14. The system according to claim 1, said processor comprising:

a frequency determinator (232), coupled with said logic layer, for receiving and unaliasing said plurality of DFT chunks and for determining said at least one frequency of said at least one signal;

a characteristics determinator (234), coupled with said frequency determinator, for determining a plurality of characteristics of said at least one signal; and

a clock (236), coupled with said logic layer, for providing a synchronization signal to said logic layer for synchronizing said at least one Fourier transformer.

15. The system according to claim 2, wherein said analog sampler is an analog radio frequency (RF) sampler (340) comprising:

a plurality of RF generators (342A, 342B), for generating said at least two different frequencies;

a respective plurality of RF mixers (348A, 348B), each one being respectively coupled with one of said plurality of RF generators;

a power splitter (344), coupled with each one of said respective plurality of RF mixers and with said analog front end, for splitting said analog electrical signal into at least two analog electrical signals, wherein each one of said plurality of RF mixers mixes a respective one of said at least two different frequencies with a respective one of said at least two analog electrical signals, thereby generating at least two respective full band folded signals;

a respective plurality of low pass filters (350A, 350B), each one of said respective plurality of low pass filters coupled with a respective one of said respective plurality of RF mixers, for attenuating high frequencies in said at least two respective full band

folded signals thereby generating said at least two respective IF signals; and

a respective plurality of amplifiers (352A, 352B), each one of said respective plurality of amplifiers coupled with a respective one of said respective plurality of low pass filters, for amplifying said at least two respective IF signals,

wherein each of said at least two different frequencies is an RF pulse train.

16. The system according to claim 15, each one of said plurality of RF generators (380) comprising:

an RF signal generator (382), for generating an RF signal;

a first amplifier (384), coupled with said RF signal generator, for amplifying said RF signal;

a comb generator (386), coupled with said first amplifier, for generating a frequency at the frequency of said RF signal, said frequency having a baseband frequency; and

a second amplifier (388), coupled with said comb generator and with a respective one of said respective plurality of RF mixers, for amplifying said baseband frequency of said frequency,

wherein said comb generator modulates said RF signal, thereby generating said RF pulse train.

17. The system according to claim 1, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a single signal and thereby determines a single frequency of said at least one signal.

18. The system according to claim 1, wherein said processor determines according to said evaluating of said plurality of linear combinations

that said at least one signal comprises a plurality of signals received simultaneously and thereby simultaneously determines a plurality of frequencies of said plurality of signals received simultaneously.

19. The system according to claim 1, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a noise signal.

20. System (100) for collecting at least one signal, a frequency of said at least one signal being within a defined frequency band, comprising:

an analog sampler (106), for receiving said at least one signal as an analog electrical signal, for folding said analog electrical signal using at least one frequency into at least one respective intermediate frequency (IF) signal (116A) according to said at least one frequency;

at least one digital frequency analyzer (108A), coupled with said analog sampler, said at least one digital frequency analyzer for digitally sampling said at least one respective IF signal into at least one respective digital signal and for spectrally analyzing said at least one respective digital signal; and

a processor (110), coupled with said at least one digital frequency analyzer, for determining a plurality of linear combinations of said at least one respective IF signal with respect to said at least one frequency used in said analog sampler and for determining at least one frequency of said at least one signal by evaluating said plurality of linear combinations of said at least one respective IF signal,

wherein said at least one respective IF signal has a frequency within said frequency band,

characterized in that said at least one digital frequency analyzer comprises:

a digital sampler (222), coupled with said analog optical sampler, for digitally sampling said at least one respective IF signal;

a logic layer (224), coupled with said digital sampler and with said processor; and

at least one Fourier transformer (226), coupled with said logic layer, for determining a plurality of discrete Fourier transforms (DFTs) of said at least one respective IF signal,

wherein said plurality of DFTs is comprised of a plurality of discrete Fourier transform (DFT) chunks,

wherein a given one of said DFT chunks overlaps a subsequent one of said DFT chunks by at least a predetermined amount, and

wherein said logic layer dilutes the data of said plurality of DFTs by a process of peak picking.

21. The system according to claim 20, wherein said analog sampler is an analog optical sampler (140) further comprising:

an optical pulse generator (150A), for generating said at least one frequency;

a fiber amplifier (154), coupled with said optical pulse generator, for amplifying said at least one frequency;

a modulator (156), coupled with said fiber amplifier and with an analog front end, for analog sampling said analog electrical signal with said at least one frequency, thereby generating a sampled analog optical signal;

a photodiode (160A), coupled with said modulator, for converting said sampled analog optical signal into a sampled analog electrical signal;

a low pass filter (162A), coupled with said photodiode, for attenuating high frequencies in said sampled analog electrical signal and generating said at least one respective IF signal; and

an amplifier (164A), coupled with said low pass filter and with said at least one digital frequency analyzer, for amplifying said at least one respective IF signal,

wherein said at least one frequency is an optical pulse train.

22. The system according to claim 20, wherein said analog sampler is an analog radio frequency (RF) sampler (340) comprising:

an RF generator (342A), for generating said at least one frequency;

an RF mixer (348A), coupled with said RF generator and an analog front end for mixing said at least one frequency with said analog electrical signal, thereby generating a full band folded signal;

a low pass filter (350A), coupled with said RF mixer, for attenuating high frequencies in said full band folded signal thereby generating said at least one respective IF signal; and

an amplifier (352A), coupled with said low pass filter, for amplifying said at least one respective IF signal,

wherein said at least one frequency is an RF pulse train.

23. The system according to claim 20, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a single signal and thereby determines a single frequency of said at least one signal.

24. The system according to claim 20, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a plurality of signals received simultaneously and thereby simultaneously determines a plurality of frequencies of said plurality of signals received simultaneously.

25. The system according to claim 20, wherein said processor determines according to said evaluating of said plurality of linear combinations that said at least one signal comprises a noise signal.

26. Method for collecting at least one signal comprising the procedures of:

collecting (300) at least one signal;

folding (306) said collected at least one signal using at least two different frequencies simultaneously, thereby generating at least two respective intermediate frequency (IF) signals;

digitally sampling (308) each one of said at least two respective IF signals, thereby generating at least two respective sampled IF signals;

spectrally analyzing (312) said at least two respective sampled IF signals; and

processing (314) each one of said at least two respective sampled IF signals, thereby determining at least one characteristic of said collected at least one signal,

characterized in that said procedure of spectrally analyzing comprises the sub-procedures of executing a plurality of fast Fourier transforms on said at least two respective sampled IF signals, thereby determining at least two sets of discrete Fourier transforms (DFTs); and

diluting the data of said plurality of DFTs by a process of peak picking,

wherein each one of said two sets of DFTs comprises a plurality of discrete Fourier transform (DFT) chunks, and

wherein a given one of said plurality of DFT chunks overlaps a subsequent one of said plurality of DFT chunks by at least a predetermined amount.

27. The method according to claim 26, further comprising the procedures of:

analog filtering (302) said collected at least one signal; and

analog processing (304) said collected at least one signal.

28. The method according to claim 26, wherein said procedure of folding comprises the sub-procedures of:

multiplexing said at least two different frequencies *simultaneously into a multiplexed signal*;

modulating said multiplexed signal with said collected at least one signal;

demultiplexing said modulated multiplexed signal according to said at least two different frequencies into at least two folded sampling signals;

converting said at least two folded sampling signals into at least two electrical signals; and

low pass filtering said at least two electrical signals, thereby eliminating high frequency images of said at least two electrical signals and generating said at least two respective IF signals.

29. The method according to claim 26, wherein said procedure of processing comprises the sub-procedures of:

determining a plurality of linear combinations of said at least two different frequencies used in said procedure of folding; and

evaluating said plurality of linear combinations, thereby determining at least one frequency of said collected at least one signal.

30. The method according to claim 26, further comprising the procedure of digitally processing (310) said at least two respective sampled IF signals after said procedure of digitally sampling each one of said at least two respective IF signals.

31. The method according to claim 29, wherein according to said sub-procedure of evaluating, said procedure of processing determines that said at least one signal comprises a single signal, said sub-procedure of evaluating further comprising determining a single frequency of said at least one signal.

32. The method according to claim 29, wherein according to said sub-procedure of evaluating, said procedure of processing determines that said at least one signal comprises a plurality of signals received simultaneously, said sub-procedure of evaluating further comprising simultaneously determining a plurality of frequencies of said plurality of signals received simultaneously.

33. The method according to claim 29, wherein according to said sub-procedure of evaluating, said procedure of processing determines that said at least one signal comprises a noise signal.

34. The method according to claim 26, wherein said procedure of folding comprises the sub-procedures of:

splitting said collected at least one signal into at least two analog electrical signals;

mixing a respective one of said at least two different frequencies with a respective one of said at least two analog electrical signals, thereby generating at least two respective full band folded signals; and

low pass filtering said at least two respective full band folded signals, thereby eliminating high frequency images of said at least two full band folded signals and generating said at least two respective IF signals.

35. Method for collecting at least one signal simultaneously comprising the procedures of:

collecting (300) at least one signal;

folding (306) said collected at least one signal using at least two different frequencies simultaneously, thereby generating at least two respective intermediate frequency (IF) signals;

digitally sampling (308) each one of said at least two respective IF signals, thereby generating at least two respective sampled IF signals;

digitally processing (310) said at least two respective sampled IF signals; and

processing (314) each one of said at least two respective sampled IF signals, thereby determining at least one characteristic of said collected at least one signal,

characterized in that said procedure of digitally processing comprises the sub-procedures of executing a plurality of fast Fourier transforms on said at least two respective sampled IF signals, thereby determining at least two sets of discrete Fourier transforms (DFTs); and

diluting the data of said plurality of DFTs by a process of peak picking,

wherein each one of said two sets of DFTs comprises a plurality of discrete Fourier transform (DFT) chunks, and

wherein a given one of said plurality of DFT chunks overlaps a subsequent one of said plurality of DFT chunks by at least a predetermined amount.