Claims

1 – A system for radio frequency tagging a transmitter of a useful first signal S_u, by a tagging second signal C_{tag} comprising parameterizable time and frequency characteristics, said tagging second signal is transmitted simultaneously accompanying the useful first signal S_u, said transmitter operating in a communication system or network, in a system comprising a number of users authorized and adapted to recognize the tagging second signal through specific processing operations, said system comprising at least the following elements:

the transmitter configured~~signal generation means (20, 21, 22):~~

~~- adapted~~ to produce the~~a~~ useful first signal S_u in a given frequency band B, at a frequency f_{Su} and an amplitude A_{Su}, and configured to

- know~~ing~~ at least the values of a~~the~~ band parameter B_{Su} of the useful first signal S_u and of the amplitude A_{Su} of the useful first signal S_u, the transmitter further configured~~adapted~~ to determine, from said values, ~~the~~ parameters of the tagging second signal C_{tag}, the parameters comprising~~such as~~:

a~~- the~~ carrier of the tagging second signal C_{tag},

a~~- the~~ band B_{Ctag} of the tagging second signal,

an~~- the~~ amplitude A_{Ctag} of the tagging second signal with a signal level X dB lower than the useful first signal $X = A_{Ctag}/A_{Su}$, and

~~- the~~ time characteristics of the tagging second signal C_{tag}, comprising:~~such as~~

~~- its~~ modulation characteristics of the tagging second signal C_{tag}, including: a constellation, a rate R_{Ctag}, a possible filtering in transmission,

a~~- its~~ duration and a~~its~~ repetition period, T_{Ctag}, and

a~~- the~~ description of a~~its~~ construction over the repetitiona period T_{Ctag},

a transmission antenna configured~~(25) adapted~~ to simultaneously transmit said useful first signal S_u and said tagging second signal, the level of said tagging second signal~~which~~ being~~is~~ X dB lower than the useful first signal S_u, and

a receiver configured to~~means for~~ receive~~ing~~ and to processing ~~(30, 31, 32)~~ the useful first signal and the tagging second signal, and further configured~~adapted~~ to detect and to discriminate the tagging second signal from the useful first signal.

2 – The system as claimed in claim 1, wherein~~characterized in that~~ the transmitter~~signal generation means~~ comprises:

–a first generator configured~~(20) adapted~~ to produce said useful first signal S_u in the~~a given frequency~~ band parameter B_{Su}, at the~~a~~ frequency f_{Su} and the~~an~~ amplitude A_{Su},

–a second generator configured to~~(21)~~ know~~ing~~ at least the values of the band parameter B_{Su} of the useful first signal S_u and of the amplitude A_{Su} of the useful first signal S_u, the second generator further configured~~adapted~~ to determine, from said values, the parameters of the tagging second signal C_{tag}:

–the carrier of C_{tag},

–the band B_{Ctag} of C_{tag},

–the amplitude A_{Ctag} of C_{tag},

–the time characteristics of the tagging second signal including~~such as~~ a modulation rate (denoted R_{Ctag}), a repetition period, denoted T_{Ctag}, and

–the description of the~~its precise~~ construction over the repetition~~a~~ period T_{Ctag}, and

–a store/forward system ~~(22)~~, or a digital exciter ~~(22)~~, configured to receive~~ing~~ the useful first signal S_u and the tagging second signal C_{tag} and adapted to forward said signals by controlling the amplitudes and ~~the~~ synchronisms thereof.

~~3 – The system as claimed in one of claims 1 or 2, characterized in that it comprises a means for preliminary base band storage of the tagging signal C_{tag} over a repetition period T_{Ctag}, adapted to allow rereading in authorized receivers for the purposes of their processing operations.~~

34 – The system as claimed in ~~one of~~ claims 1 ~~or 2~~, wherein~~characterized in that~~ the useful first signal and the tagging second signal transmitter~~generation and transmission means~~ is configured to~~are adapted~~:

–to produce:

–a base band signal, and

–a resultant signal at ~~an~~the instant t, $S(t) = S_u(t)+(A_{Ctag}/A_{Su}).C_{tag}(t)$, said resultant signal S(t) being obtained by ~~an~~the addition of the base band signals $S_u(t)$ and $C_{tag}(t)$ at ~~an~~the output of the two generators ~~(20, 21)~~, by observing ~~a~~the ratio of the amplitudes $X = A_{Su}/A_{Ctag}$ by ~~an~~the application of ~~a~~the weighting $X = A_{Ctag}/A_{Su}$ to the tagging second signal $C_{tag}(t)$, then

–to transpose onto a carrier f_0 and to amplify by a factor A_{Su} the signal S(t) resulting from ~~the~~ mixing, in order to generate, at the output, ~~an~~the amplified total analog signal on carrier $S_{Carrier}(t) = [A_{Su}.S_u(t)+(A_{Ctag}).C_{tag}(t)].\cos(2\pi f_0 t)$.

4 – The system as claimed in claim 1, comprising a means for preliminary base band storage of the tagging second signal C_{tag} over a repetition period T_{Ctag}, adapted to allow rereading in authorized receivers for the purposes of their processing operations.

5 – The system as claimed in claim 1, wherein~~characterized in that~~ the transmitted~~signal generation means are~~ comprises~~osed~~:

~~of~~ a single digital generator with programmable memory and ~~of~~ a single transposition and amplification digital-analog conversion stage,

–said digital generator is configured~~adapted~~ to be used sequentially in order to generate the useful first signal S_u then the tagging second signal C_{tag},

–said digital generator comprising~~has~~ a programmable memory, and

–said digital generator is configured to~~adapted~~:

–~~to~~ generate the tagging second signal $C_{tag}(k.T_E)$ and the useful first signal $S_u(k.T_E)$ in base band at ~~a~~the sampling instants $t = k.T_E$ with T_E: ~~a~~the sampling period, k: ~~a~~the time index of the samplinge period k, by

observing athe weighting $X = A_{Ctag}/A_{Su}$ on the sampled tagging second signal $C_{tag}(k.T_E)$, then,

to generate, in sampled form, athe resultant mix $S(k.T_E) = S_u(k.T_E)+(A_{Ctag}/A_{Su}).C_{tag}(k.T_E)$ in base band at the sampling instants $t = k.T_E$, and

said transposition and amplification digital-analog conversion stage is configuredadapted to generate athe total analog signal on carrier at anthe output $S_{Carrier}(t) = [A_{Su}.S_u(t)+(A_{Ctag}).C_{tag}(t)].\cos(2\pi f_0 t)$ using the digital-analog conversion transforming $S(k.T_E)$ into $S(t)$, the transposition onto carrier f_0, and the amplification by a factor A_{Su}.

6 – The system as claimed in one of claims 1 to 5, whereincharacterized in that the value of X is betweenat least equal to -10 dB, and preferably varies from -20 dB andto -50 dB.

7 – The system as claimed in one of claims 1 to 6, whereincharacterized in that the a device for generating the signal C_{tag} comprises a generatormeans configuredadapted to generate pseudo-random codes PN, of parameterizable level, period and composition to form the tagging second signal, said composition is obtained by using one of the following methods: totally arbitrary, by simulations or by computations, by shift registers or by combinations between shift registers.

8 – The system as claimed in claim 7, characterized in that it comprisinges a generator of binary sequences chosen from the following sequence list: binary sequences of maximum length, Gold or Gold-type sequences, dual-BCH sequences, simple or extended Kasami sequences, Mac Eliece sequences, Barker codes, or any other type of pseudo-random sequence generated by algebraic methods.

9 – The system as claimed in one of claims 1 to 8, whereincharacterized in that the receiverreception means comprises a database (35) comprising

characteristics of codes used for ~~the~~ generation of the tagging second signal C_{tag}.

10 – The ~~transmission-reception~~ system as claimed in ~~one of~~ claims ~~1 to 8~~, whereincharacterized in that the receiverreception means isare an informed receiverreception means, comprising a database ~~(35)~~ made up of ~~the~~ complete characteristics and of a~~the~~ composition of ~~the~~ codes used for ~~the~~ generation of the tagging second signal C_{tag}.

11 – A method for radio frequency tagging a transmitter of a useful first signal S_u, by a tagging second signal C_{tag} comprising parameterizable time and frequency characteristics, said tagging second signal is transmitted simultaneously accompanying the useful first signal S_u, said transmitter operating in a system comprising a number of users authorized and adapted to recognize the tagging second signal, through specific processing operations, ~~characterized in that it~~ comprisinges at least the following steps:

~~–~~producing a~~the~~ useful first signal S_u in a given frequency band B, at a frequency f_{Su} and an amplitude A_{Su}, ~~and~~

~~–~~knowing at least ~~the~~ values of a~~the~~ band parameter B_{Su} of the useful first signal S_u and of the amplitude A_{Su} of the useful first signal S_u, determining, from said values, the parameters of the tagging second signal C_{tag}:

a~~– the~~ carrier of C_{tag},

a~~– the~~ band B_{Ctag} of C_{tag},

an~~– the~~ amplitude A_{Ctag} of C_{tag} with a signal level X dB lower than the useful first signal $X = A_{Ctag}/A_{Su}$,

~~– the~~ time characteristics of C_{tag}, comprising~~such as~~:

- ~~its~~ modulation characteristics of the tagging second signal C_{tag}, including: a constellation, a rate R_{Ctag}, a possible filtering in transmission,
- a~~its~~ duration and a~~its~~ repetition period, T_{Ctag},
- a~~the~~ description of a~~its~~ construction over the repetitiona period T_{Ctag} adapted to allow regeneration in authorized receivers for ~~the purposes of their~~ processing operations,

--simultaneously transmitting ~~(25)~~ said signal S_u and said tagging second signal, the level of said tagging second signal~~which~~ is X dB lower than the useful first signal S_u, and

--discriminating ~~(30, 31, 32)~~, at a~~the~~ signal reception level, the tagging second signal from the useful first signal.

12 – The method as claimed in claim 11, wherein~~characterized in that~~ distinct transmitters~~generation means~~ are used to produce the useful first signal S_u and the tagging second signal C_{tag}.

13 – The method as claimed in ~~one of~~ claims 11 ~~or 12~~, wherein~~characterized in that~~ a resultant signal is generated at a~~the~~ instant t $S(t) = S_u(t)+(A_{Ctag}/A_{Su}).C_{tag}(t)$ that is transposed onto a carrier f_0 and that is amplified by a factor A_{Su}, to obtain a signal on carrier amplified at a~~the~~ output $S_{Carrier}(t) = [A_{Su}.S_u(t)+(A_{Ctag}).C_{tag}(t)].\cos(2\pi f_0 t)$, said resultant signal S(t) being obtained by a~~the~~ addition of the base band signals at a~~the~~ output of two analog or digital generators ~~(20, 21)~~, by observing the amplitudes A_{Su} and A_{Ctag} by a~~the~~ application of a weighting $X = A_{Ctag}/A_{Su}$ to the tagging second signal in the resultant signal.

14 – The method as claimed in ~~one of~~ claims 11 ~~to 13~~, wherein~~characterized in that~~ a value of X is chosen that is between~~at least equal to -10 dB, and preferably varying from~~ -20 dB and~~to~~ -50 dB.

15 – The method as claimed in ~~one of~~ claims 11 ~~to 14~~, wherein~~characterized in that~~ pseudo-random codes PN are generated, of parameterizable level, period and composition, to form the tagging second signal.

16 – The method as claimed in ~~one of~~ claims 11 ~~to 15~~, wherein~~characterized in that~~ characteristics of codes stored in a database ~~(35)~~ are used in order to discriminate, at a~~the~~ signal reception level, the tagging second signal C_{tag} from the useful first signal.

17 – The method as claimed in ~~one of~~ claims 11 ~~to 15~~, characterized in that wherein the following are used:

an- informed receiver~~reception means~~, comprising a database made up of ~~the~~ complete characteristics and of a~~the~~ composition of ~~the~~ codes used for ~~the~~ generation of the tagging second signal C_{tag}, ~~and~~

~~–~~detection techniques of a type oriented on the characteristics of the signal, based on a~~the~~ use of cyclical self-correlation, an~~the~~ estimation of a~~the~~ first moment being restricted to a~~the~~ range of ~~the~~ cyclical frequencies close to a~~the~~ modulation rate of the tagging second signal C_{tag} restricted to ~~the~~ ranges of ~~the~~ delays close to zero and close to the repetition period T of the tagging second signal C_{tag}, an~~the~~ estimation of a~~the~~ second moment being restricted to a~~the~~ range of the cyclical frequencies close to the modulation rate increased by twice the carrier frequency, and

~~–~~detection techniques of an informed type, based on filtering adapted to the tagging second signal C_{tag}.