List of Symbols

Symbol	Definition
A_1	event that $s_1 > s_2$ and $s_1 > \Gamma$
A_2	event that $s_2 > s_1$ and $s_2 > \Gamma$
$\alpha(t)$	auxiliary signal defined in [25]
B_1	the given event $\lvert e_\tau \rvert \le \frac{T_c}{2}$
B_2	the given event $\frac{N-1}{2} T_c \le \lvert e_\tau \rvert \le \frac{NT_c}{2}$
β	the parameter in both auto-correlation and cross-correlation functions
$c(t)$	pseudo-noise (PN) signal
$E(\cdot)$	expectation operation
e_τ	phase difference between τ and $\hat{\tau}$
$\eta_{1,k+1}$	noise on branch 1 at $k+1$ second
$\eta_{2,k+1}$	noise on branch 2 at $k+1$ second
$\eta_{I1,k+1}$	imaginary part of noise on branch 1 at $k+1$ second
$\eta_{I2,k+1}$	imaginary part of noise on branch 2 at $k+1$ second
$\eta_{R1,k+1}$	real part of noise on branch 1 at $k+1$ second
$\eta_{R2,k+1}$	real part of noise on branch 2 at $k+1$ second
$f_x(t)$	distribution function where x is Chi-square random variable with degree 2 of freedom (in Appendix B)
$f_x(t)$	distribution function where x is Gaussian random variable (in Chapter 4)
$g(t)$	summation signal of $c(t)$ with its delay versions
Γ	threshold level in phase alignment detectors
Γ'	Γ / nN_0T_c (in Chapter 3 and Appendix B)
Γ'	$\Gamma / \sqrt{2PT_c}$ (in Chapter 4)

γ_k	fraction of phase shift at k second
$H(\omega)$	frequency response of the filter
H_0, H_1	hypotheses in phase alignment detection
$h(t)$	impulse response function of the filter
$h(x)$	polynomial for generating m-sequence
$I_0(\cdot)$	modified Bessel function of 1st kind and order zero
j_k	integer of phase shift at k second
K_p	constant of penalty time
K_{VCC}	gain of voltage controlled clock
M	filter length
N	number of chip in a period of m-sequence
N_0	level of power spectrum density of noise
n	integration length in phase alignment detectors of the proposed scheme
n'	integration length of the serial search scheme (in Chapter 3; non-coherent serial search scheme, in Chapter 4; coherent serial search scheme)
$n(t)$	a zero mean AWGN
ω_c	carrier frequency
P	power of the received signal
P_d	detection probability
P_{fa}	false alarm probability
P_{T_c}	unit amplitude rectangular pulse shape in the interval $[0, T_c]$
p_1	real part signal on branch 1
p_2	real part signal on branch 2
q_1	imaginary part signal on branch 1
q_2	imaginary part signal on branch 2
$R_{kl}(\beta)$	correlation function

R_1	ratio of mean acquisition time of the conventional scheme over the proposed scheme
R_2	ratio of variance of acquisition time of the conventional scheme over the proposed scheme
SNR	signal to noise ratio
$s(t)$	received signal
s_1	signal on branch 1 of the phase alignment detector
s_2	signal on branch 2 of the phase alignment detector
$\sigma^2_{\text{co,serial}}$	variance of acquisition time of the coherent serial search scheme
$\sigma^2_{\text{co,close}}$	variance of acquisition time of the coherent proposed scheme
$\sigma^2_{I1,k+1}$	variance of imaginary part of noise on branch 1 at k+1 second
$\sigma^2_{I2,k+1}$	variance of imaginary part of noise on branch 2 at k+1 second
$\sigma^2_{\text{non,serial}}$	variance of acquisition time of the noncoherent serial search scheme
$\sigma^2_{\text{non,close}}$	variance of acquisition time of the noncoherent proposed scheme
$\sigma^2_{R1,k+1}$	variance of real part of noise on branch 1 at k+1 second
$\sigma^2_{R2,k+1}$	variance of real part of noise on branch 2 at k+1 second
$\sigma^2_{s_1}$	variance of noise in phase alignment detector on branch 1
$\sigma^2_{s_2}$	variance of noise in phase alignment detector on branch 2
θ	carrier phase
T_c	chip duration
$\overline{T}_{\text{co,close}}$	mean acquisition time of the coherent proposed scheme
$\overline{T}_{\text{co,serial}}$	mean acquisition time of the coherent serial search scheme
$\overline{T}_{\text{non,close}}$	mean acquisition time of the noncoherent proposed scheme
$\overline{T}_{\text{non,serial}}$	mean acquisition time of the noncoherent serial search scheme
τ	phase shift of the received PN signal
$\hat{\tau}$	phase shift of the local PN signal

$\hat{\tau}_k$	phase shift of the local PN signal at k second
$u(t)$	equivalent base-band of the non-coherent received signal
$v(t)$	equivalent base-band of the coherent received signal
$v_{k+1}(\hat{\tau}_k, \tau)$	signal component
w	the processed signal used to control voltage controlled clock
$x(t)$	signal of $\alpha(t)$ subtracted with advance version of $\alpha(t)$
$x_2(t)$	new auxiliary signal
$y(t)$	processed signal
$z(t)$	complex envelope of a zero mean AWGN
$z_I(t)$	imaginary part of $z(t)$
$z_R(t)$	real part of $z(t)$
ζ_I	expectation of imaginary part of noise
ζ_R	expectation of real part of noise