AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics and Communications Engineering Department

Performance Improvement of Peak to Average Ratio for OFDM Carrier

A thesis

Submitted in partial fulfillment of the requirements of the degree

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Submitted by

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STATEMENT

This dissertation is submitted to Ain shams university for the degree of Master of Science in Electrical Engineering (Electronics and Communications Engineering).

The work included in this thesis was carried out by the author at the Electronics and Communications Engineering Department, Faculty of Engineering, Ain shams university, Cairo, Egypt.

No part of this thesis was submitted for a degree or a qualification at any other university or institution.

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ABSTRACT

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Orthogonal Frequency Division Multiplexing (OFDM) is widely believed as the enabling Technology for wireless communications due to its high data rates transmission capability and robustness against multipath effects. However, OFDM poses high peak-to-average power ratio (PAPR) problem, as a consequence of independently modulated carriers, that causes low efficiency of the amplifier and increases the complexities of analog-to-digital converter (ADC) and digital-to-analog converter (DAC). This issue is especially important for mobile terminals to sustain longer battery life time. Therefore, reducing the PAPR can be regarded as an important issue to realize efficient and affordable mobile communication services.

This thesis proposes an efficient PAPR reduction methodology for OFDM signals by using carrier interferometry (CI) . CI is capable of reducing the probability of high peaks occurrence, however, some of the high peak still remains. Then, Pseudo-Orthogonal Carrier Interferometry(PO-CI) is performed to limit these peaks .In this thesis, we evaluated the PAPR problem on multicarrier system especially OFDM. For OFDM we proposed the use of CI spreading code to reduce its PAPR. Then we focus on the correction of PO-CI codes The proposed method is able to reduce PAPR and also presented minimum BER performance degradation.Throughput of CI and PO-CI codes is then evaluated with the case of $N=256$ and large N=512, where N is the number of subcarriers. The results confirm that the proposed method is capable for reducing the PAPR significantly, present minimum BER degradation and does not introduce spectrum increasing or out-of-band noise.

Keywords: OFDM, PAPR reduction, Spreading code, Pseudo-Orthogonal, Carrier Interferometry,

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List of Abbreviations

ADC	analog-to-digital converters
ADSL	Asymetric Digital Subscriber Line
AMPS	Advanced Mobile Phone Service
CAP	Carrierless amplitude phase
CDMA	Code division multiple access
CI	Carrier Interferometry
COFDM	Coded orthogonal frequency division multiplexing
CP	cyclic prefix
DAB	digital audio broadcasting
DMT	Discrete Multitone
DVB-T	digital video broadcasting
EHF	Extremely high bands
ETSI	European Telecommunications Standardisation Institute
FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction
FFT	Fast Fourier Transform
FM	Frequency Modulation
GI	guard interval
GSM	Global System for Mobile Telecommunications
HDSL	High bit rate Digital Subscriber Line
HDTV	high definition digital television

HIPERLAN/2	High Performance LAN type2
ICI	Inter-Carrier Interference
IDFT	Inverse Discrete Fourier Transform
IFFT	Inverse Fast Fourier Transform
ISDN	integrated-services digital network
LO	local oscillator
MMAC	Multimedia Access communication
PAPR	Peak To Average Power Ratio
PO-CI	Pseudo-Orthogonal Carrier Interferometry
QOS	Quality Of Service
SHF	super high frequency bands
TDMA	time division multiple access
UHF	Ultra High Frequencies
UMTS	Universal Mobile Telecommunications System
VCO	voltage controlled oscillator
WWW	World Wide Web

List of Symbols

Δf	Change In Source Frequancy
f_o	Source Frequancy
v	Speed
c	Speed Of Light
M	number of carriers
T	symbol period
T_s	total length of the symbol
T_G	length of the guard period
T_{FFT}	the size of the IFFT
f_s	the sample rate
N_{FFT}	the size of the FFT
T_{GRC}	the length of the RC guard period
T_{GF}	the length of the flat guard period
p_{sat}	Saturation Power
$s(t)$	Multicarrier Symbol
p_{mean}	Average Power
p_o	Power Of One Carrier
N	Number Of Carriers
A	Carrier Amplitude
α_i	Fade Parameter
ϕ_i	Phase Offset
k	No. Of symbols
$R_{1,2}$	Cross Correlation rms