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خلاصة البحث

إن المقدرة على تطبيق عدد من بروتوكولات الإتصال هـي احـدى المزايا الاساسـية للراديـو المعـرف برمجيـا ، هـذه الميـزة تجعـل الراديو المعرف برمجيا قادراً على الاتصال بمختلف انواع الراديــو التقليدية بدون الحوجة الى التغيير في الاجزاء الصلبة من الجهاز.
إن الغرض من هذا البحث هو تصميم لراديـو معـرف برمجيـا فـي النطاق القاعدي لتحقيق عدة انـواع مـن التعـديل. تتكـون اللوحـة المصممة للنظام من: معالج للإشـارة الرقميـة و محـول للإشـارة التماثلية الى رقمية ومحول للإشارة الرقمية الى تماثلية لتحقيق انــواع التعــديل الســابقة، اضــافة الــى متحكمــة دقيقــة كواجهــة للمستخدم لإغراض التحكم في اللوحة.
في هذا البحث، تمت مناقشة الإختلاف بين مختلف هياكل الراديو المعرف برمجيا، اضافة الى أن مختلف الأجزاء الصلبة فـي لوحـة النطـاق الأدنـى تـم توضـيحها مـن حيـث الخصـائص ومـن ثـم تـم اختيارالأجزاء المناسبة للتصميم. اضافة الى ذلـك، تمـت مناقشـة عدة انواع من التعديل بشقيه التماثلي والرقمي ومن ثم محاكاتها باستخدام برنامج المـاتلاب باضـافة الـى برنامـج CCS المتخصـص في تطوير برامج معالجة الإشارة الرقمية بلغة C. اخيراً تم تعديل برنامج معالج الاشارة الرقمية وانزاله في اللوحة المُصممَة ومــن ثم اختباره باستخدام بيانات واشارات حقيقية.
تم تحليل اداء التصميم وذلك بمقارنة النتائج المأخوذة من برامــج المحاكاة مع النتائج الحقيقية ووجد انها متشابهة.

Abstract

The ability to support multiple communication protocol is a fundamental feature of Software Defined Radio (SDR). This feature allows SDR to communicate with different radios without need for hardware change.

The aim of this thesis is to design and implement a SDR in baseband to realize multiple modulation techniques (waveforms). The designed SDR baseband board consists of a Digital Signal Processor (DSP) and digital to analog and analog to digital convertors (ADC, DAC) to realize multiple waveforms, furthermore, a microcontroller is used as user interface to control the SDR baseband board.

In this thesis, different Software Defined Radio architectures are discussed. The different baseband board hardware specifications are explained and the appropriate parts are selected for design, also multiple modulation techniques (analog and digital) are discussed and simulated using Matlab as well as C using Code Composer Studio. Finally, the DSP C program is modified and downloaded into SDR baseband board and tested using real time signal.

The performance of the design is investigated by comparing the simulation with those results and results obtained from real time implementation. It is concluded that the simulation results and implementation results are nearly similar.

ABBREVIATIONS

ADC	Analog to Digital Convertor
ALU	Arithmetic Logic Unit
AM	Amplitude Modulation
AR	Auto Regressive
ARAU	Auxiliary Register Arithmetic Units
ASIC	Application Specific Integrated Circuit
ASK	Amplitude Shift Keying
AWGN	Additive White Gaussian Noise
BFSK	Binary Frequency Shift Keying
BPSK	Binary Phase Shift Keying
BSP	Buffered Serial Port
CCS	Code Composer Studio
CFIR	Compensation FIR Filter
CIC	Cascaded Integrator-Comb
CMOS	Complementary Metal Oxide Semiconductor
CODEC	CODER / DECODR
CSSU	Compare, Select, and Store Unit
DAC	Digital to Analog Convertor
DC	Direct Current
DDC	Digital Down Converter
DDS	Direct Digital Synthesizer
DSB	Double Sideband
DSP	Digital Signal Processor
DUC	Digital Up Converter

EEPROM	Electrically Erasable Programmable Read-Only Memory
ENOB	Effective Number Of Bits
FFT	Fast Fourier Transform
FM	Frequency Modulation
FPGA	Field Programmable Gate Array
FSK	Frequency Shift Keying
GUI	Graphical User Interface
HDL	Hardware Description Language
HPI	Host Port Interface
IDE	Integrated Development Environment
IF	Intermediate Frequency
JTAG	Joint Test Action Group
LSB	Lower Sideband
McBSP	Multichannel Buffer Serial Interface
MCU	Main Control Unit
MIPS	Million Instructions Per Second
NCO	Numerical Controlled Oscillator
PFIR	Pulse Shaping FIR Filter
PLL	Phase Locked Loop
PM	Phase Modulation
PRD	Timer Period Register
PSC	Pre-Scalar Counter
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
QPSK	Quaternary Phase Shift Keying

RAM	Random Access Memory
RF	Radio Frequency
ROM	Read Only Memory
RTC	Real Time Counter
RTDX	Real Time Data Exchange
SDR	Software Defined Radio
SFDR	Spurious Free Dynamic Range
SINAD	Signal to Noise and Distortion ratio
SNR	Signal to Noise Ratio
SSB	Single Side Band Modulation
SWI	Software Interrupt
TDDR	Timer Divide Down Ratio
TI	Texas Instrument
USB	Upper Sideband
USART	Universal Synchronous Asynchronous Receiver and Transmitter
VCO	Voltage Controlled Oscillator
VHF	Very High Frequency
XIO	External-Input/Output

List of figures