**Sudan University of Science &Technology**
**College of Graduate studies**
Center for Engineering and Technical Studies
(CETS)

# PERFORMANCE EVALUATION OF OFDM CHANNEL FOR FIXED WIMAX SYSTEM

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This Thesis is Submitted in Fulfillment of the Requirement

For the Degree of Master in Telecommunications Engineering

To the college of Graduate Studies

By

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June 2010

# ACKNOWLEDGMENTS

I would like to acknowledge many people who helped me during the course of this work, supporting it in one way or another.

First of all, I want to thank my family for their endless support. I also would like to express my deepest appreciation to my thesis advisor Dr. Ashraf Gasim Elsid Abdalla for their support and help in answering my questions.

Finally, I want to thank Merowe technical college for giving me the opportunity to obtain my postgraduate education.

# ABSTRACT

WiMAX operates on the same general principles as WiFi; it sends data from one computer to another via radio signals. A computer (either a desktop or a laptop) equipped with WiMAX card would receive data from the WiMAX transmitting station. WiMAX should be able to handle up to 70 Mbps. And will blanket a radius of 30 miles (50 km) with wireless access. The increased range is due to the frequencies used and the power of the transmitter. So these features make WiMAX system very suitable for work in Sudan, because Sudan has a very large area and the distribution of the population is rural rather than urban.

This thesis is to evaluate and investigate the effects of few radio channel impairment factors such as AWGN, and multipath to the performance of OFDM channel.

Also in this thesis the estimation of SNR was done under the effects of noise and multipath for the four recommended modulation techniques; BPSK, QPSK, 16-QAM, 64-QAM for different cyclic prefix lengths, and calculated BER.

The evaluation was done in simulation developed using MATLAB 7.8.

# [illegible]

يعمل النظام واي ماكس بنفس المبدأ العام الذي يعمل به الـ wifi، حيث يرسل البيانات من كمبيوتر لآخر من خلال إشارات الراديو. فالكمبيوتر (سواءاً كان كمبيوتر مكتبي شخصي او محمول ) الذي يحتوي علي كرت الواي ماكس يشطيع إستقبال البيانات من محطة إرسال الواي ماكس. كما يشطيع النظام واي ماكس إرسال البيانات بسرعة تصل إلي 70Mbps.

و سيغطي النظام واي ماكس مساحة نصف قطرها 30 ميل (50كلم )لا سلكياً.

زيادة المدي ناتجة عن الترددات التي يستخدمها نظام الواي ماكس وقدرة المرسل. هذه الخاصية للنظام واي ماكس جعلته مناسب جداً للعمل في السودان، وذلك لأن السودان له مساحات شاسعة جداً من الصعب تغطيتها بواسطة الأنظمة الأخري، كما إن توزيع السكان في السودان ريفي أكثر من انه حضري.

هذه الاطروحة تدرس وتفحص تأثير بعض عوامل ضعف القناة الراديوية مثل الـAWGN والإنتشار المتعدد علي أداء التنضيد بتقسيم التردد العمودي (OFDM). ايضاً في هذه الرسالة تم تخمين قيمة نسبة الاشارة الي الضجيج (SNR) مقابل قيم (BER) محسوبة. تحت تأثير الضجيج والارسال المتعدد المسارات (multipath) لتقنيات التعديل المختلفة الموصي بها ( BPSK, QPSK, 16-QAM, 64-QAM) ، لأطوال بادئة دورية (cyclic prefix) مختلفة.

تم تقييم الأداء عن طريق النمذجة والمحاكاة (Simulation) بإستخدام برنامج MATLAB 7.8 .

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# ABBREVIATIONS

| | |
|---|---|
| AMPS | Advanced Mobile Phone Service |
| ASN | access service network |
| AWGN | Additive White Gaussian Noise |
| BER | Bit Error Rate |
| BPSK | Binary Phase Shift Keying |
| BS | Base station |
| BTC | Block turbo coding |
| BWA | broadband wireless access |
| CDMA | Code Division Multiple Access |
| CP | Cyclic Prefix |
| CPE | Customer Premises Equipment |
| CSN | connectivity service network |
| CTC | Convolutional turbo codes |
| DSL | Digital Subscriber line |
| DSSS | Direct Sequence Spread Spectrum |
| FDD | Frequency Division Duplexing |
| FDMA | Frequency Division Multiple Access |
| FEC | Forward Error Coding |
| FFT | Fast Fourier Transform |
| FSK | frequency shift keying modulation |
| GSM | global system for mobile |
| HSDPA | high speed downlink packet access |

| | |
|---|---|
| ICI | Inter-Carrier Interference |
| ISI | Inter Symbol Interference |
| LAN | local area network |
| LLC | Logical link control |
| LOS | Line of Sight |
| MAC | Medium Access Control |
| MAN | Metropolitan area network |
| MCM | Multi-Carrier Modulation |
| MIB | Management Information Base |
| MIMO | multiple-input multiple-output |
| NLOS | Non Line of Sight |
| NMT | Nordic Mobile Telephone |
| OFDMA | Orthogonal Frequency Division Multiple Access |
| OSI | Open Systems Interconnection |
| PRBS | point-to-multipoint |
| PTP | point-to-point |
| PMP | pseudorandom bit sequence |
| QAM | Quadrature Amplitude Modulation |
| QoS | Quality of Service |
| QPSK | Quadrature Phase Shift keying |
| R-S | Reed-Solomon |
| SOFDMA | Scalable Orthogonal Frequency Division Multiple Access |
| SDMA | Space division multiple access |
| SNR | Signal to Noise Ratio |
| TDMA | Time Division Multiple Access |
| TACS | Total Access Communications System |
| TDD | Time Division Duplexing |
| UMTS | universal mobile telephone system |
| Wi-Fi | Wireless Fidelity |
| WiMAX | Worldwide Interoperability for Microwave Access |