To my mother and my father

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Abstract

High Altitude Platform Stations (HAPs) are communication facilities situated at an altitude of 17 to 20 km and at a specified fixed point relative to the Earth. They are mostly solar-powered, unmanned, and remotely operated. HAPs, when fully deployed will have the capability of providing services and applications ranging from broadband wireless access, navigation and positioning systems, remote sensing and weather observation/monitoring systems, future generation mobile, telephony, digital TV etc. Rainfall poses a serious issue to HAP since due to its position rainfall creates the maximum attenuation scenario and causes a decrease in the carrier to noise ratio. In this thesis the modulation technique will be adapted according to the carrier to noise ratio as a proposed solution to rain attenuation problem.

A graphical User Interface was designed using MATLAB to provide the best modulation technique that offers the highest possible data rate with a minimum BER having different rain rates. A case study was carried out in two cities-Khartoum and Juba-to suggest which of them is appropriate to implement HAP in.

المستخلص

محطات المنصات عالية الارتفاع (HAPs) هي مرافق الاتصالات التي تقع على ارتفاع يتراوح من 17 إلى 20 كيلومترا وعند نقطة معينة ثابتة بالنسبة للأرض. وهي في الغالب تعمل بالطاقة الشمسية، من دون طيار، وتعمل عن بعد.(HAPs) عندما يتم تفعيلها بالكامل يكون لديها القدرة على توفير الخدمات والتطبيقات التي تتراوح بين الاتصالات اللاسلكية عريضة النطاق، ونظم الملاحة وتحديد المواقع، والاستشعار عن بعد ونظم رصد الأحوال الجوية / الرصد، انظمه الاتصالات للجيل القادم ، الاتصالات الهاتفية، وأجهزة التلفزيون الرقمية وغيرها. هطول الأمطار يشكل قضية خطيرة إلى ال HAP فنسبة لموقعها هطول الأمطار هو سبب الحد الأقصى للتوهين و يسبب ايضا نقصا في نسبة الاشاره الى الضجيج. في هذه الرساله تقنية التعديل ستتكيف وفقا لنسبة الاشاره الى الضجيج كحل مقترح لمشكلة توهين المطر.

تم تصميم واجهة المستخدم الرسومية باستخدام MATLAB لتوفير أفضل تقنية تعديل التي توفر أعلى معدل بيانات ممكن مع وجود الحد الأدنى لل BER بوجود معدلات أمطار مختلفة. وأجريت دراسة حالة في اثنين من المدن -الخرطوم و وجوبا- لاقتراح أيهما مناسب لتنفيذ الHAP .

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List of Abbreviation

HAPS	High Altitude Platform
FSS	Fixed Satellite Services
CNR	Carrier to Noise Ratio
QAM	Quadrature Amplitude Modulation
PSK	Phase Shift Keying
QPSK	Quadrature Phase Shift Keying
MATLAB	**Ma**trix **Lab**oratory
WRC	World Radio communications Conference
ITU	International Telecommunication Union
RR	Radio Regulations
HALE Platforms	High Altitude Long Endurance Platforms
TT&C	Telemetry Tracking and Command
PSTN	Public Switched Telephone Network
UMTS	Universal Mobile Telecommunications System
MBMS	Multimedia Broadcast and Multicast Services
B-FWA	Broadband Fixed Wireless Access
QoS	Quality of Service

GUI	Graphical User Interface
BER	Bit Error Rate

Symbols

C/N	Carrier to Noise Ratio
EIRP	Equivalent Isotropic Radiated Power
PEIRP	EIRP for HAPS in dB
LFS	Free Space Loss
Ar	Rain Attenuation
G	Receive Antenna Gain
T	Noise System Temperature
G/T	Figure of Merit
K	Boltzmann Constant
R	Data Rate
R	Rainfall Rate
rR	Total Rainy Slant Path Length
hS	Ground Station Antenna Height above Mean Sea Level
hR	Effective Rain Height
elev	Elevation Angle