

Regional Development Forum 2008

"Bridging the Standardization Gap in Developing Countries"
20th May 2008

Broadband Wireless Access systems and developments

Marcos Guimarães Castello Branco

**CPqD - Telecommunication Researcher
ITU-R - Vice-Chairman –Study Group 4**

CPqD Research and Development Center



Summary

- Introduction
- CPqD activities in Radiocommunication Study Groups;
- Benefits to wireless developments and Brazilian regulations;
- CPqD Research and Developments in Broadband Wireless Systems;
- Conclusions



Introduction

ITU Forum: 20th May 2008

Introduction

- Radio frequency systems are becoming popular with new fixed and mobile applications and IP technologies;
- Standardized technologies are promoting interoperability between hardware and software components;
- Activities within International Standardization and Regulation Organizations such as ITU, assures long term R&D results.



CPqD activities in Radiocommunication Study Groups

ITU Forum: 20th May 2008

Brazilian Radiocommunication Study Committee (CBC2)

- ITU-R Study Groups (Satellite, Terrestrial and Scientific Services);
- CITECEL's Radio and Satellite Groups – Regional Agreements;
- MERCOSUL – Neighbor countries joint studies and coordination rules;
- Anatel's radiocommunication service rules and procedures;
- Radiocommunication Network Service Providers;
- Radio products manufacturers (standards and specifications)



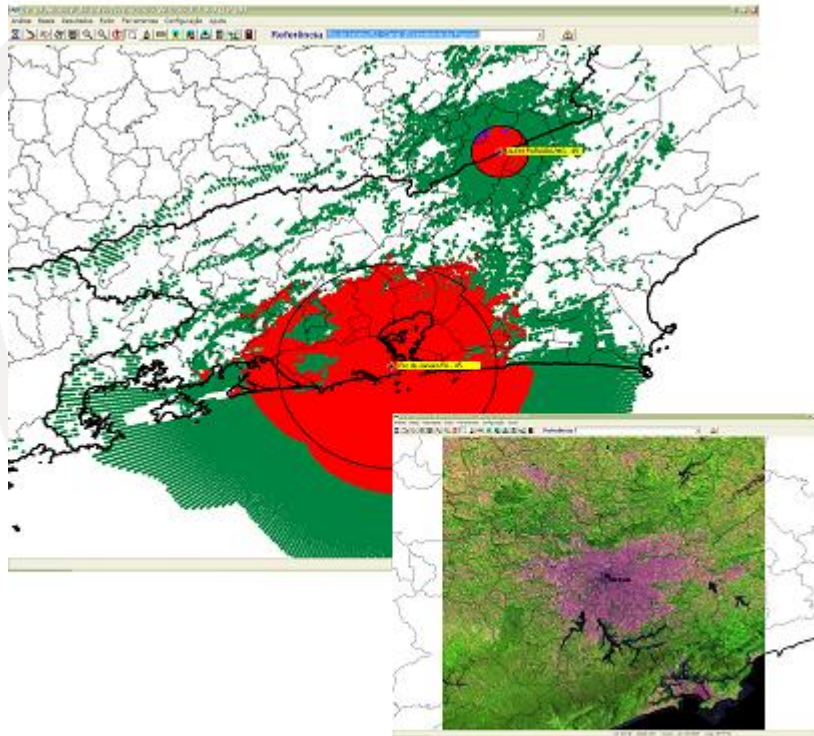
Benefits to wireless developments and Brazilian regulations

ITU Forum: 20th May 2008

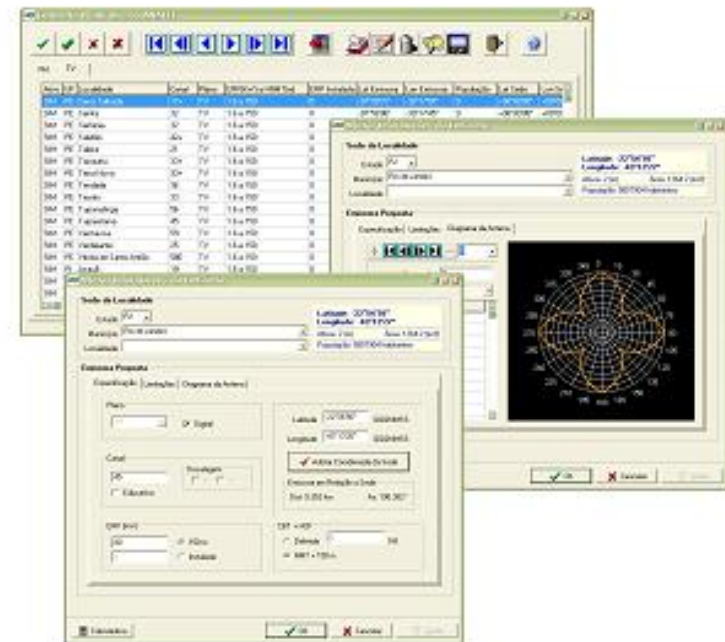
Benefits to wireless developments and Brazilian regulations

- Update of spectrum allocation and frequency sharing criteria (SGs, WRCs, RR);
- Interference calculation, mitigation and coordination studies;
- Power and e.i.r.p. limits;
- Antenna requirements;
- Service quality and performance criteria;
- Transmit rates and bandwidths (spectrum sharing)

Software tools for spectrum planning (e.g.: FM and TV Broadcasting channels)



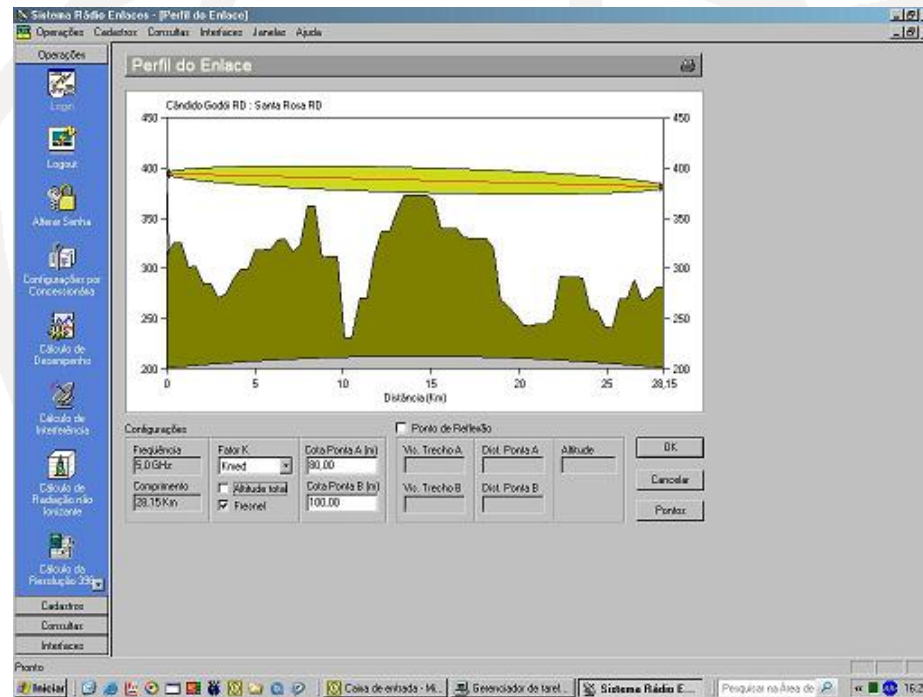
Point to area interference
criteria based on ITU-R
P.1546-1



(*) Basis for Anatel's public tool for broadcasters

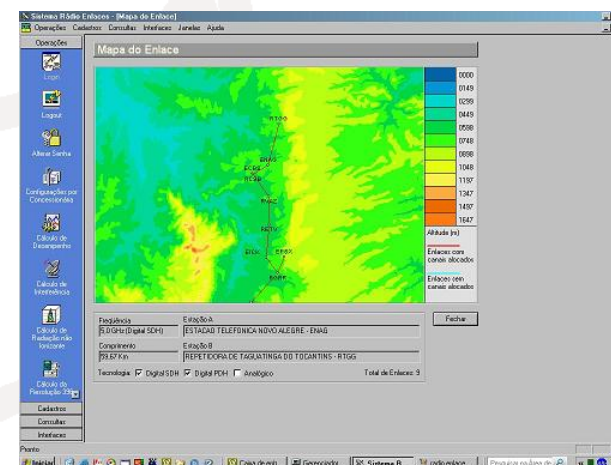
ITU Forum: 20th May 2008

Software tools for P-P Radio Link Analysis



The screenshot shows the 'Cálculo de Desempenho de Enlace' window. It contains several tables of technical data:

DADOS DO ENLAÇE	UNID.	POINHO A	POINHO B	DADOS DO EQUIPAMENTO	POINHO A	POINHO B
Característica		RF (dBm) - 30dBm			RF (dBm) - 30dBm	
Localidade	BR/RS			Fabricante	HUBER	
Nome	CANDIDO GODOI RD	SANTA ROSA RD		Frequência	5000 MHz	
Estação	5000	5000		Planície/Tx	dBm - 19.20	
UF/Estado	RS	RS		Quilômetros da Central	1000	
UF/Cidade	RS	RS		Tipo Antena	YAGI	
UF/Estado	RS	RS		União de SDC	dBm - 17.00	
UF/Cidade	RS	RS		União de SDC	dBm - 49.00	
UF/Estado	RS	RS		Perda constante de descida Tx	dB - 3.20	
UF/Cidade	RS	RS		Perda constante de descida Rx	dB - 3.20	
UF/Estado	RS	RS		Área de cobertura SDC	MHz - 1.2000	
UF/Cidade	RS	RS		Área de cobertura SDC	MHz - 2.0000	
UF/Estado	RS	RS		Área de cobertura SDC	MHz - 3.0000	
UF/Cidade	RS	RS		Área de cobertura SDC	MHz - 4.0000	



Software tools for P-P Radio Link Analysis – ITU Ref.Basis

- a) **ITU-R P.526** - Propagation by Diffraction
- b) **ITU-R P.530** - Propagation Data and Prediction methods required for the Design of Terrestrial Line-of-Sight Systems
- c) **ITU-R P.837** - Characteristics of Precipitation for Propagation Modeling
- d) **ITU-R P.841** - Conversion of Annual Statistics to Worst-month Statistics
- e) **ITU-R P.838** - Specific attenuation model for rain for use in prediction methods
- f) **ITU-T G.821** - Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an Integrated Services Digital Network
- g) **ITU-R P.525** - Calculation of free-space attenuation
- h) **ITU-R P 453** - The radio refractive index: its formula and refractivity data
- i) **ITU-R F.1093** - Effects of Multipath Propagation on the Design and Operation of Line-of-Sight Digital Radio-Relay Systems
- j) **ITU-R F.393** - Allowable noise power in the hypothetical reference circuit for radio-relay systems for telephony using frequency-division multiplex
- k) **ITU-R F.395** - Noise in the radio portion of circuits to be established over real radio-relay links for FDM telephony
- l) **ITU-R F.397** - Allowable noise power in the hypothetical reference circuit of trans-horizon radio-relay systems for telephony using frequency-division multiplex
- m) **ITU-R F.404** - Frequency deviation for analogue radio-relay systems for telephony using frequency-division multiplex

Satellite earth station antenna database

BASE DE DADOS DE ANTENAS DE ESTAÇÕES TERRENAS DE SATÉLITES GEOESTACIONÁRIOS

ANATEL
Agência Nacional de Telecomunicações

CONTRATO PVSSA 059 / 2002

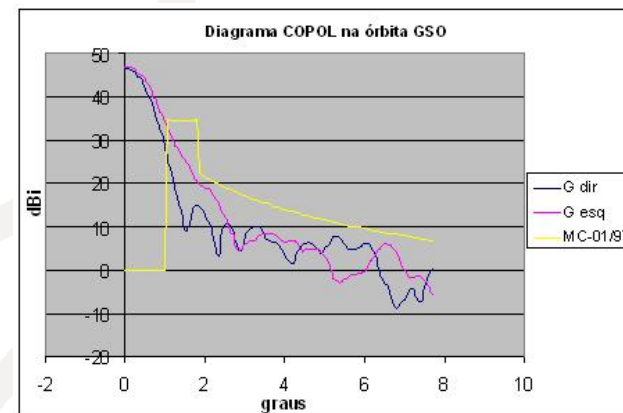
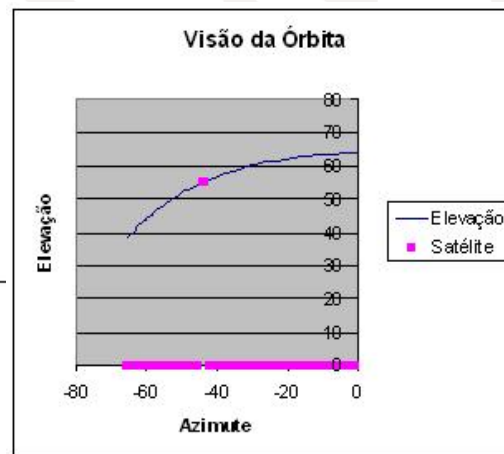
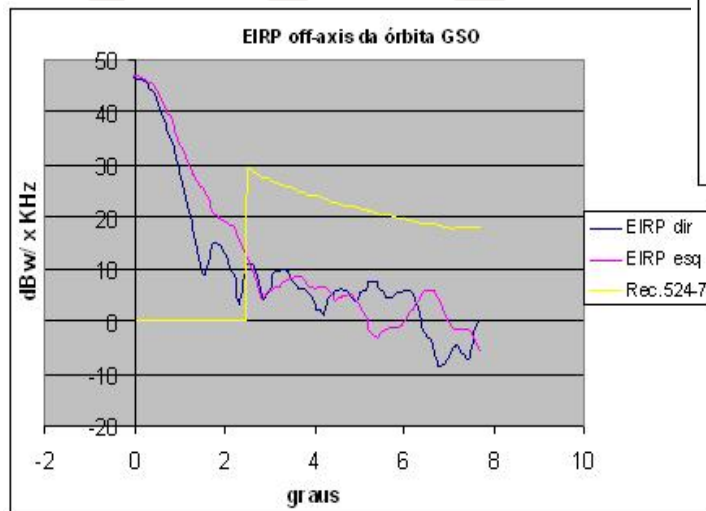
CRP
Telecom & IT Solutions

(Novembro 2002) - Versão 4 blocos com 181 linhas ou mais cada

Off-axis e.i.r.p. criteria based on ITU-R S.524

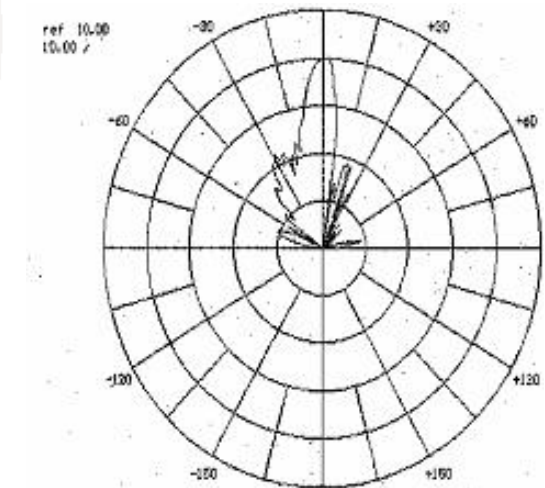
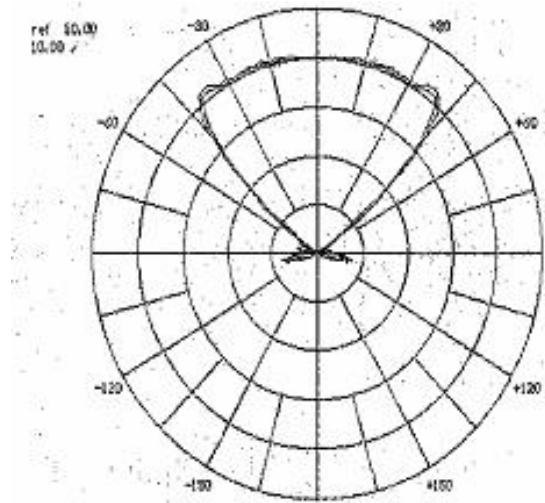
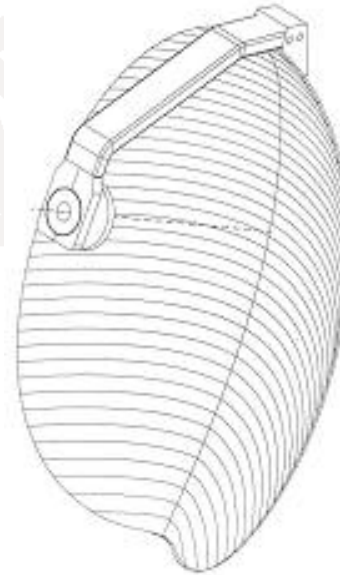
Antenna sidelobe limits based on ITU-R S.465,580 and 731

ITU-R S. 1717 – Electronic Data Pattern File Format



P-MP Base Station Characteristics

- **Contributions** to Recommendation **ITU-R F. 1336** – *“Reference radiation patterns of omnidirectional, sectoral and other antennas in point-to-multipoint systems for use in sharing studies in the frequency range from 1 GHz to about 70 GHz”*

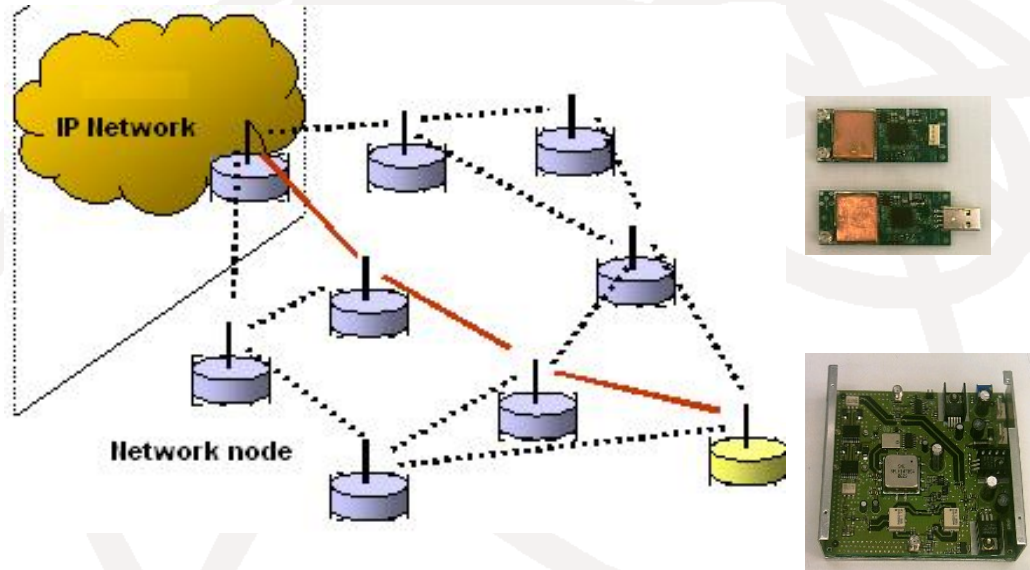




CPqD Research and Developments in Broadband Wireless Systems

ITU Forum: 20th May 2008

Ad-Hoc Wireless Networks



Potential applications:

- Military;
- Emergency and Disaster Relief;
- Temporary events;
- Monitoring systems;
- Measurement systems;
- Vehicles traffic control
-

Main characteristics:

- Ad-Hoc Node (Transmission, Reception and Packet Routing¹);
- Does not require control equipment;
- Dynamic and flexible topology;
- May be fixed or mobile;
- Low cost and easy to deploy

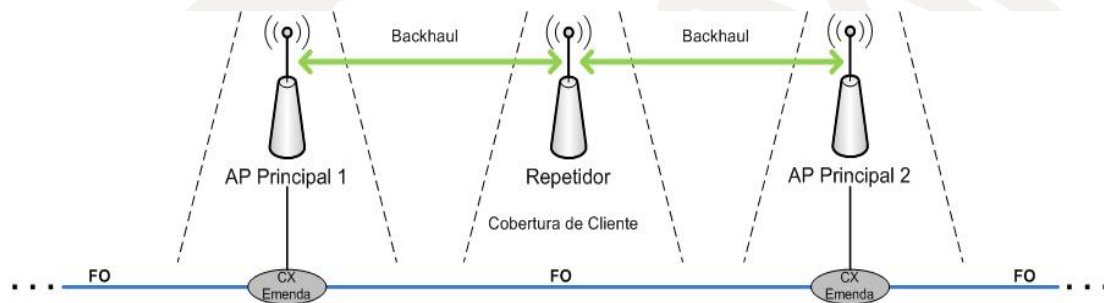
IEEE 802-11g adapted to

225-233 MHz / 248-256 MHz

1,5 to 13,5 Mbit/s

(Res. 365 – Anatel)

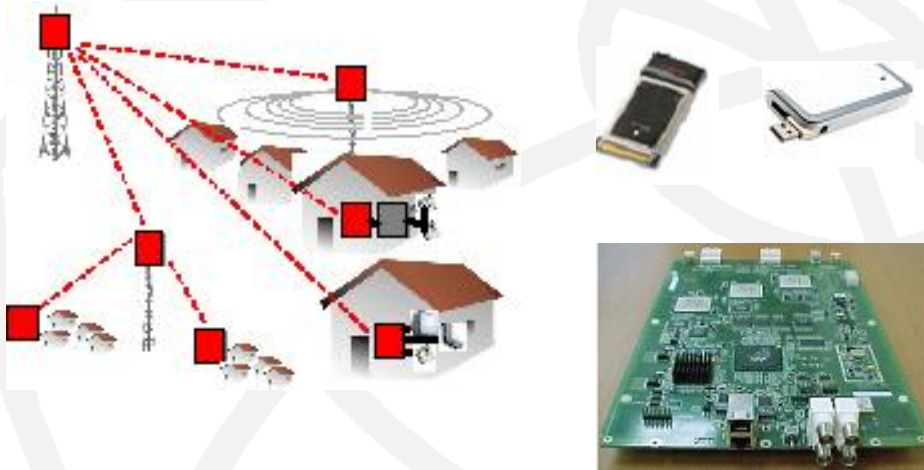
Wireless System for High Voltage Transmission Lines



- WLAN outdoor AP;
- Optical Switch interface to ground cable OPGW;
- Local energy supply system;
- Omnidirectional coverage;
- Quadruple play access (Data, VoIP, Video and Mobility);
- Fully integrated to corporate network (Electric Energy Utility).



WiMAX (IP-OFDMA) Networks



Potential applications:

- Wireless internet
- VoIP over the air
- Triple-play services
- Wireless backhaul
- Communication for utilities

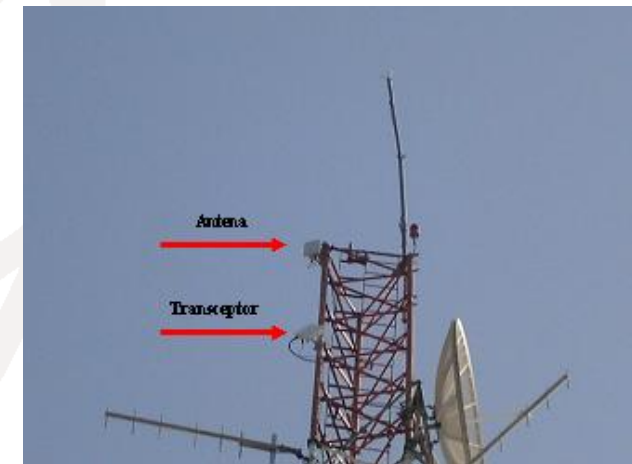
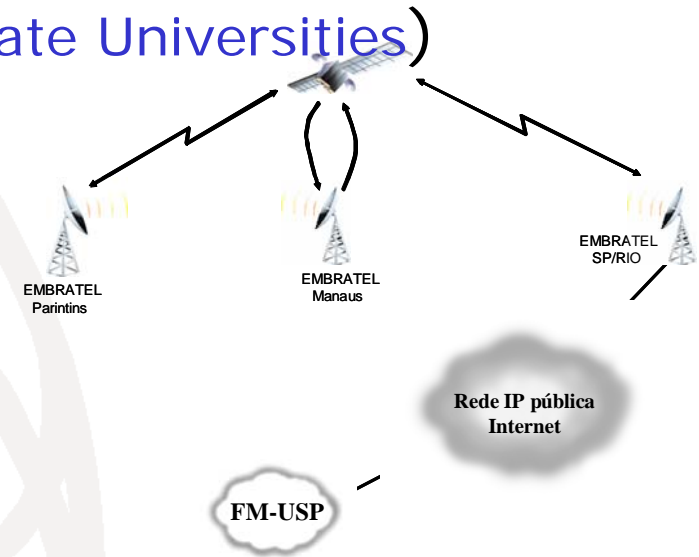
Main characteristics:

- Based on open standard (IEEE 802.16)
- Operates on licensed and unlicensed bands
- Supports up to 74 Mbps per sector and NLOS operation
- Advanced QoS management over the air interface
- Mobility management
- Advanced security features at layer-2

IEEE 802-16e integrated to IEEE 802.11 Mesh, with focus on frequency bands below 6 GHz.

WiMax Digital Inclusion Project to Amazon School - Parintins / AM

e-Learning Education and Medical support
(CPqD/Proxim/Embratel/Intel/UFAM+USP State Universities)



Wireless Access Developments and Services – ITU Ref. Basis

- Services:
 - ITU-R M.1822 - Framework for services supported by IMT;
- Development Objectives and Guidelines
 - ITU-R M.1645 - Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000;
 - ITU-R M.1225 - Guidelines for evaluation of radio transmission technologies for IMT-2000
- Security
 - ITU-T X.805 - Security architecture for systems providing end-to-end communications;
 - ITU-T X.509 - Information technology – Open systems interconnection – The Directory: Public-key and attribute certificate frameworks
- VoIP codecs
 - ITU-T G.711 - Pulse code modulation (PCM) of voice frequencies;
 - ITU-T G.729 - Coding of speech at 8 kbit/s using conjugate-structure

Conclusions

- Broadband Wireless Access Systems (both fixed and mobile) are being deployed very fast and achieving important and flexible solutions to corporate and public necessities in different areas;
- Participation in ITU standardization activities, in partnerships with other international organizations, is the key success factor to get better and solid results in the wireless projects.

Marcos Guimarães Castello Branco

castello@cpqd.com.br

Phone: +55-19-37056543

www.cpqd.com.br

Thank you!