National Telecommunications Agency

Brazil Experience and Activities Regarding Human Exposure to EMF

Agostinho Linhares

Vice-chair of SG 5 RG-LAC

linhares@anatel.gov.br

+55 61 2312-2557

Agenda

- **EMF: Emission, Propagation and Exposure**
- **EMF Regulation and Limits in Brazil**
- **Activities Related to EMF Exposure**
- **EMF Enforcement**
- **EMF Monitoring**
- **EMF Database**

EMF: Emission, propagation and exposure

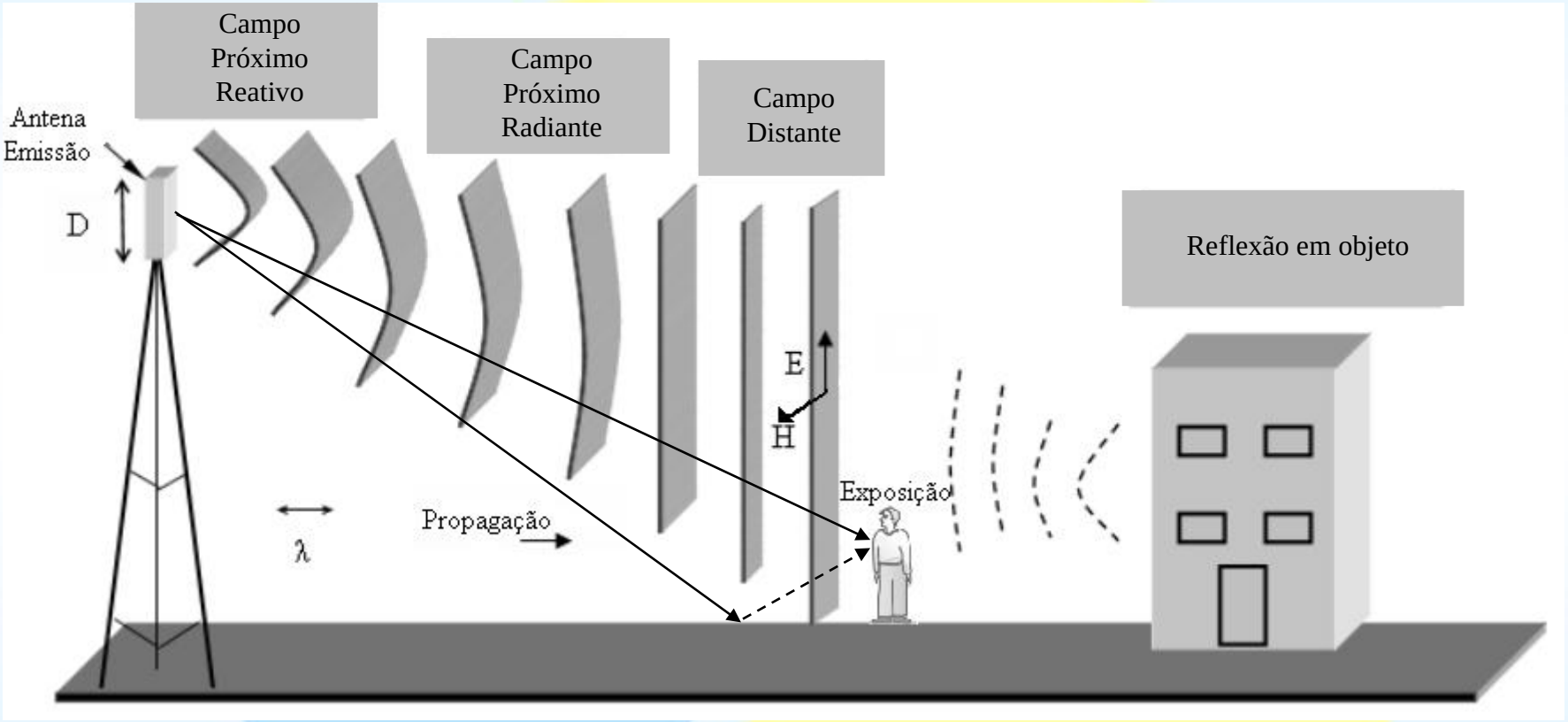


Figure adapted from ICNIRP RFReview

EMF Regulation and Limits in Brazil

Resolution nº 303

- Considering the concern about the proliferation of mobile telephony towers and possible health effects of EMF, in july 1999, Anatel adopted the ICNIRP guidelines for limiting exposure to RF fields that provide protection for workers and the general public against known adverse health effects.

- In july 2002, besides the ICNIRP exposure to EMF limits, Anatel established procedures for evaluate the compliance with the threshold adopted, calculations, measurement and enforcement. The resolution nº 303 is a reference in Brazil, was used as reference in other countries, is followed by every radiocommunication station in Brazil and is cited in journals and Technical Papers.

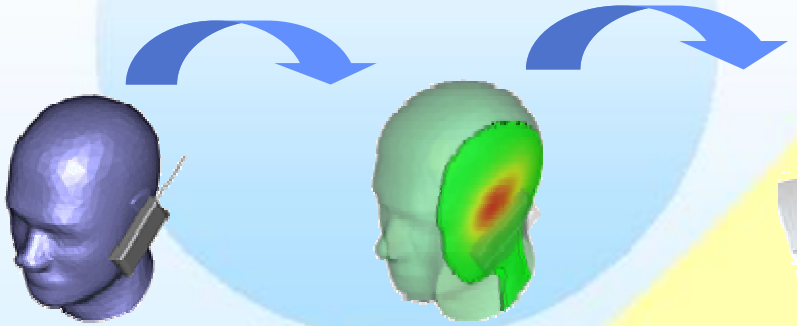
EMF Regulation and Limits in Brazil

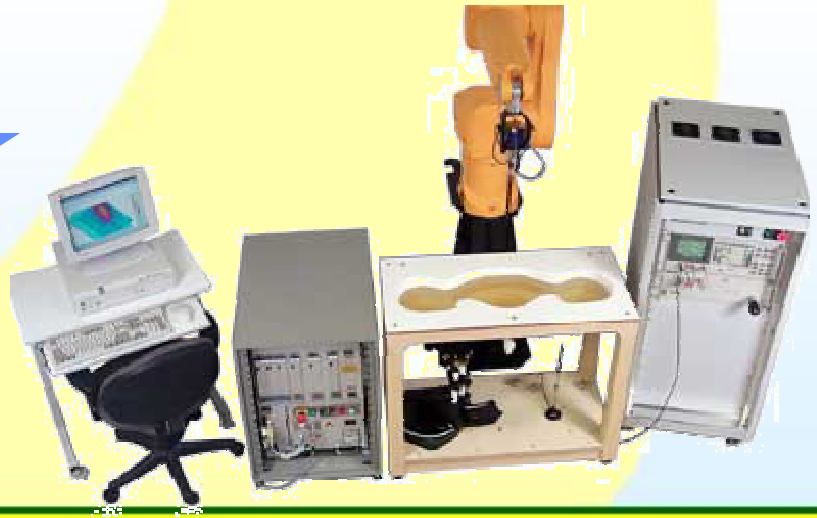
Resolution nº 533

- Procedures for evaluation portable devices (mobile phone)
  - Specific Absorption Ratio (SAR)

Exposure characteristics	SAR (W / kg)		
	Whole body	head and trunk	limbs
Occupational	0,4	10	20
General public	0,08	2	4

  - Tests are performed in laboratories and results presented in the user manual
  - CPqD, CERTLAB and INPE





EMF Exposure Limits in Brazil: Law 11,934

- The bill nr. 2,576 was proposed in 2000. Previously, it treated only radio frequencies between 150 MHz and 1000 MHz. It was establishing a 35 V/m limit for this range.
- The background of the proposed bill was founded in questionable researches with a lack of technical and scientific basis.
- Amendments to the proposed bill, technical support from Anatel, Ministries and other entities were able to influence the approval of a Law following WHO and ICNIRP recommendations.
- Brazil has a National Regulation (Resolution nº 303 – Anatel) since 2002.
- The Law nr 11,934 was approved in 2009, after nine years of discussions.

MAIN POINTS OF THE LAW

- The Law nr. 11,934 determines that radiocommunications systems and power lines cannot exposure general public and workers to electric, magnetic or electromagnetic field strengths higher than those recommended by WHO. This law includes all frequencies bellow 300 GHz.

- Definition of *critical area, which* is a 50-meters-radius region surrounding hospitals, clinics, schools, day care centers and homes for old people. Anatel or a specialized organization designated by Anatel will have to assess the compliance with EMF exposure limits of the radiocommunication stations installed in these areas no later than 60 days after the issue of the station license.

- The law determines that EMF exposure evaluation will have to be done in all radiocommunications stations in maximum 5 years intervals. Additionally, all mobile phones specific absorption rate (SAR) and all measurement results will be published in the Internet.

- Anatel will provide a EMF monitoring system and make the results available in the Internet. This system will have a EMF level layer superimposed to the map layer. The results will be based on theorical calculations and measured values in the field.

Activities

- **Anatel is developing many activities related to EMF exposure, such as:**

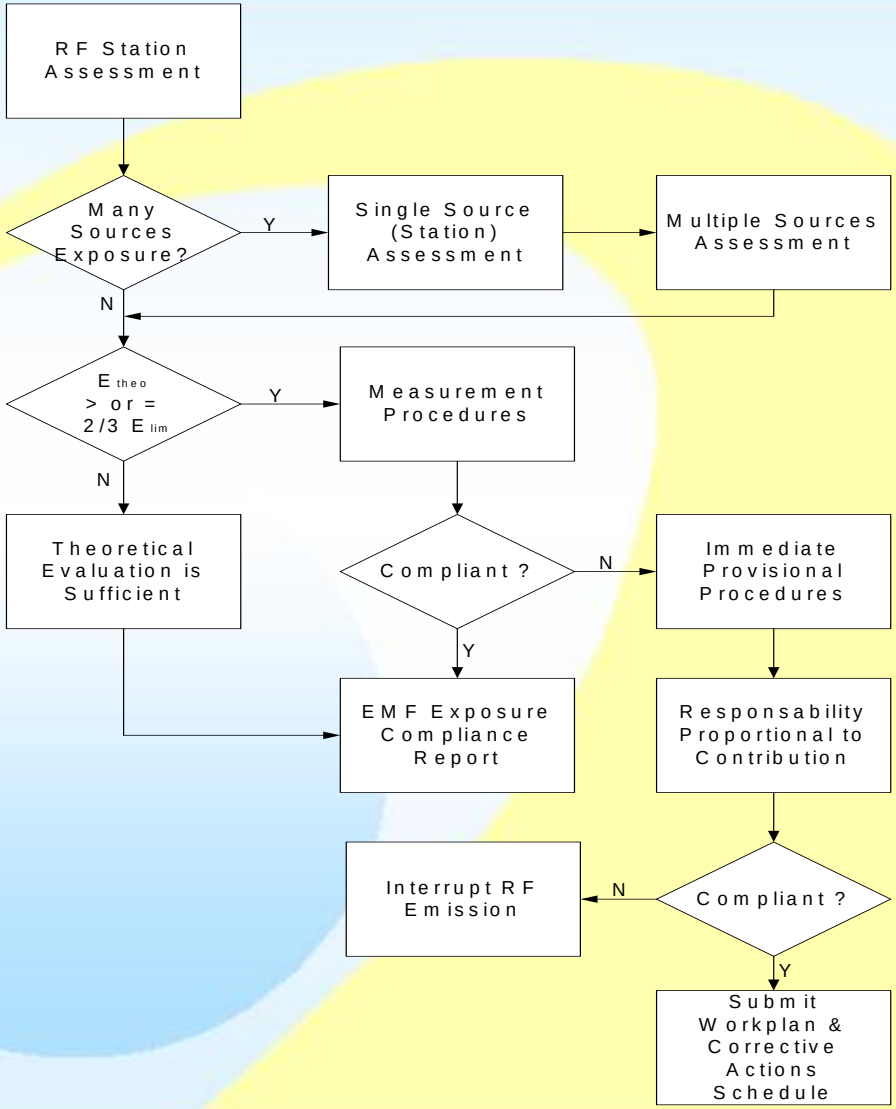
  - ✓ Regular enforcement activities
  - ✓ EMF monitoring network system
  - ✓ National EMF database
  - ✓ EMF Exposure Map in Brazil
  - ✓ Reviewing of Resolution nr. 303
  - ✓ Events Participation

Regular Enforcement Activities

- ANATEL has performed almost 5,000 EMF assessments since 2005. These measurements are planned on Anatel´s annual enforcement plan or in response to specific demands, coming from the society and collected from different sources, such as call center, web services and other public relations channels.

- ANATEL uses broadband equipment (isotropic probe) and narrow band equipment for EMF exposure evaluation.

Evaluation of Human Exposure to EMF and Enforcement (Res. 303)



EMF Monitoring

- EMF Monitoring systems are employed as a part of management risk information system used by Anatel in order to promote conscious awareness on the subject and deal with people concerns on this matter. The automated EMF monitoring network is composed by 52 equipments that can be used in cars or fixed in lampposts or any other fixed places.

EMF Database

Telecom Station Query – Example

Pesquisa Estações por Entidade/Endereço (232/212)

Dados da Entidade

Razão Social/Nome:	14 BRASIL TELECOM CELULAR S/A		
CNPJ/CPF:	05423963000111	**Número FISTEL:**	50013052683
Serviço:	010 - SERVIÇO MOVEL PESSOAL		
Qtde. Estações:	305		

Dados do Contrato

Nº Entidade:	1364219	**Tipo:**	Autorização	**Situação:**	Em Vigor
Nº Ato de Serviço:	33115/2002	**Data:**	11/12/2002	**Data Publicação:**	12/12/2002
Nº Contrato/Termo de Serviço:	028/2002	**Data:**	18/12/2002	**Data Publicação:**	23/12/2002

Lista de Estação(ões) por Localidade

Estação nº683920472 / Licenciada

Det.	Nome	Tipo Estação	UF	Município	Bairro	Logradouro	Latitude	Longitude	Alt.	Dt Inclusão	Dt 1ºLic.	Dt Últ. Lic.	Dt Imp. Lic.
⊟	DF_BSA_014	Estação Rádio Base	DF	Brasília	SCN	SCN Q. 3 CONJUNTO 02 LOTE F - nº S/N	155471760	47W530790	1088	15/10/2003	26/01/2004	28/04/2008	05/05/2008

Antenas

Setor	Tipo Antena	Ganho	Frente Costa	Ângulo 1/2 Potência	Ângulo Elevação	Azimute	Polarização	Altura	Raio Cobertura	Código Equipamento	Quantidade Antena/Setor
1	817	17,5	30	67	7	0	X	35	6	0670031933 - 4249	1
1	817	15,2	30	63	7	0	X	35	6	0121021293 - 12862	1
2	817	15,2	30	63	7	120	X	35	6	0121021293 - 12862	1
2	817	17,5	30	67	7	120	X	35	6	0670031933 - 4249	1
3	817	17,5	30	67	7	240	X	35	6	0670031933 - 4249	1
3	817	15,2	30	63	7	240	X	35	6	0121021293 - 12862	1

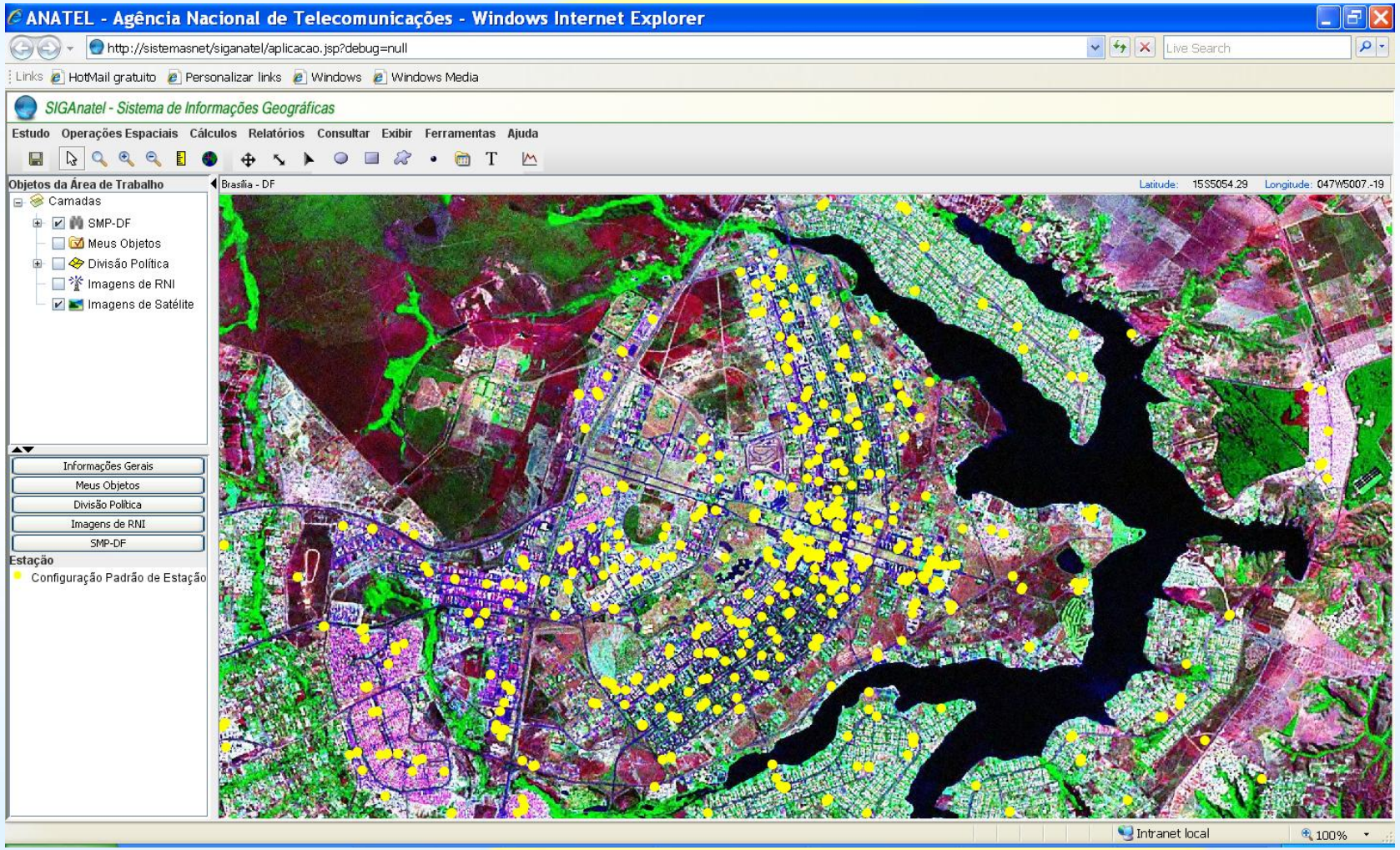
Equipamentos

Setor	Transmissão	Designação Emissão	Código do Equipamento	Potência	Rede	Quantidade Equipamento/Setor	Data Validade RF
2	1835,00 MHz a 1850,00 MHz	200KM7W--	0864030635 - 5668	28,2 W	3029	4	22/12/2017
3	1835,00 MHz a 1850,00 MHz	200KM7W--	0864030635 - 5668	28,2 W	3029	4	22/12/2017
1	1835,00 MHz a 1850,00 MHz	200KM7W--	0864030635 - 5668	28,2 W	3029	4	22/12/2017
1	2110,00 MHz a 2125,00 MHz	5M00G9W--	1893071882 - 20546	39,4 W	3029	1	30/04/2023
2	2110,00 MHz a 2125,00 MHz	5M00G9W--	1893071882 - 20546	39,4 W	3029	1	30/04/2023
3	2110,00 MHz a 2125,00 MHz	5M00G9W--	1893071882 - 20546	39,4 W	3029	1	30/04/2023

There are more than 1,000 BTS in the Federal District!

EMF Database

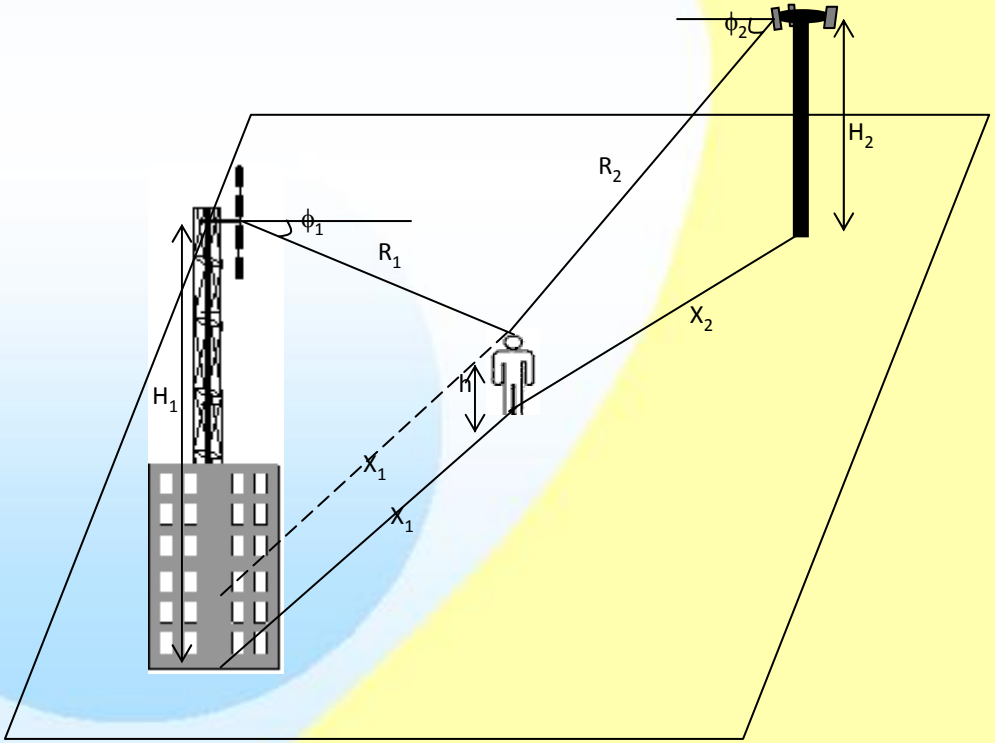
BTS in Brasília – Pilot Plan



Simultaneous Exposure to Multiple RF Fields

$$E_T = \left(\sum_{i=1}^{N} E_i^2 \right)^{\frac{1}{2}}$$

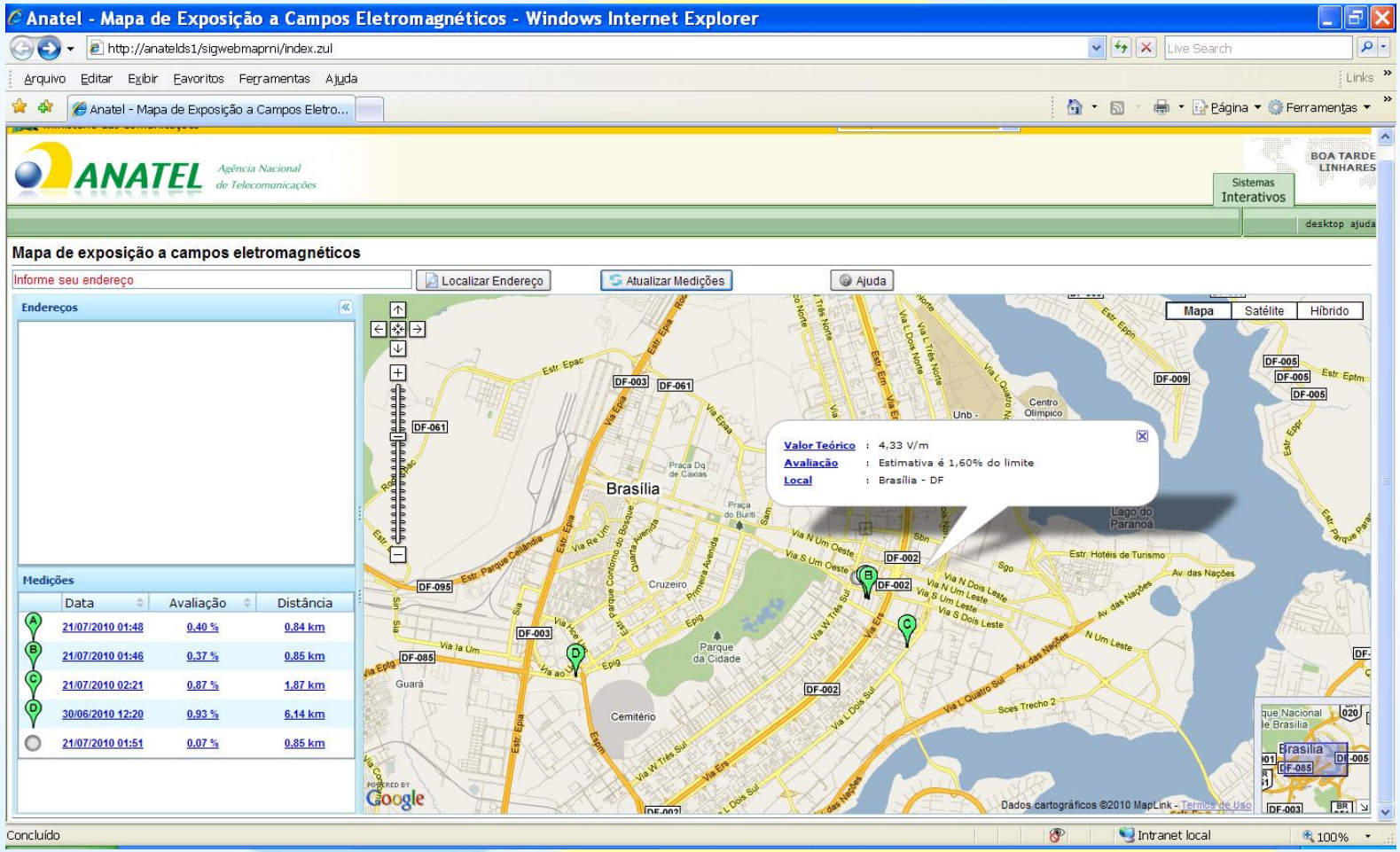
$$\sum_{i=100kHz}^{1MHz} \left(\frac{E_i}{c} \right)^2 + \sum_{i\rangle 1MHz}^{300GHz} \left(\frac{E_i}{E_{L,i}} \right)^2 \leq 1$$



Simultaneous Exposure to Multiple RF Fields

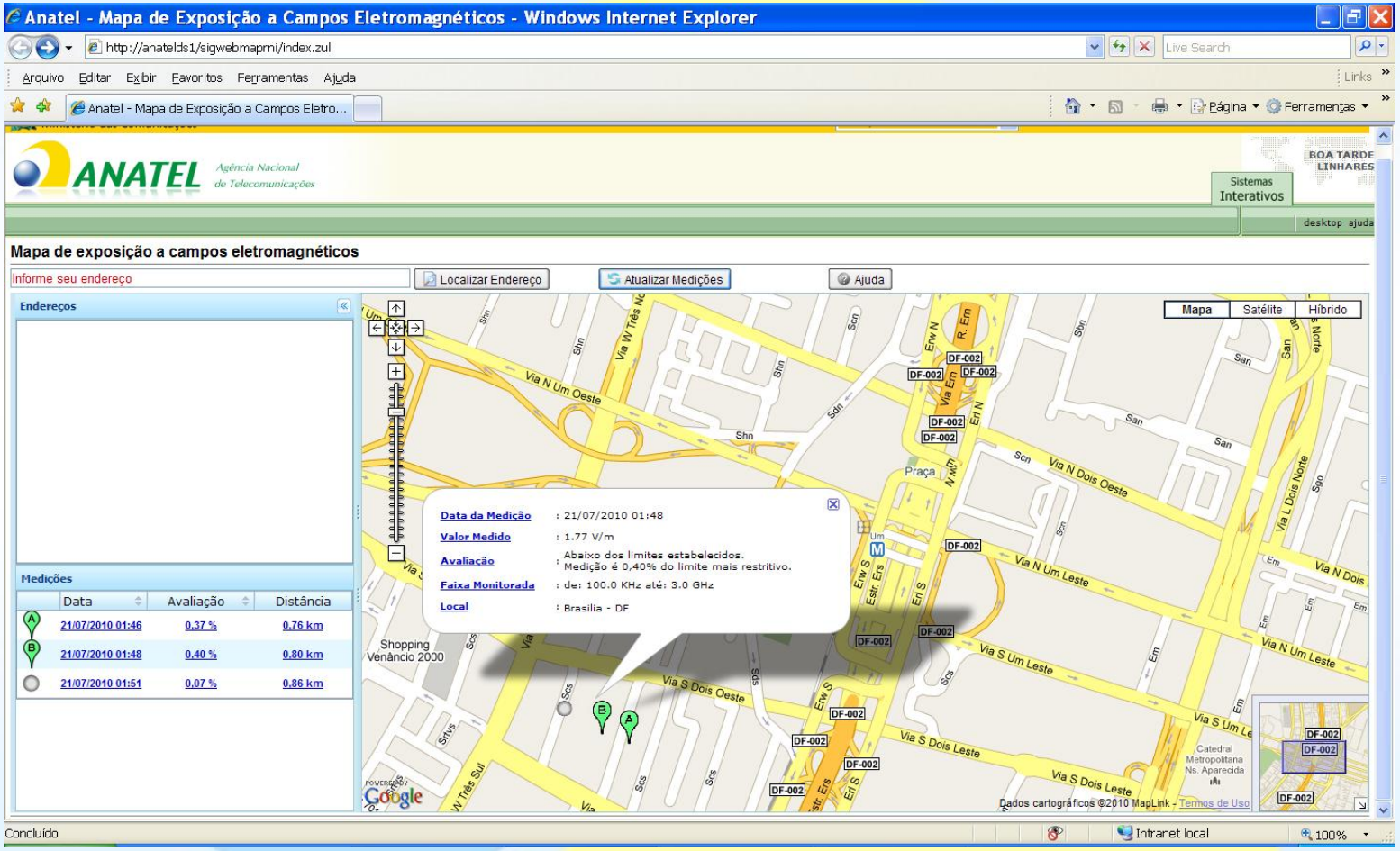
- Example 1:
- E_1 = 10 V/m ; E_2 = E_3 = ... = E_{10} = 2 V/m
- E_{TOTAL} = 11,7 V/m (sum of vectors @ uncorrelated signals)
- Example 2:
- E_1 = 20 V/m ; E_2 = 10 V/m ; E_3 = 10 V/m
- E_{TOTAL} = 24,5 V/m
- Considering more 100 signals with 1 V/m each → E_{TOTAL} = 26,46 V/m

EMF Exposure Map in Brazil

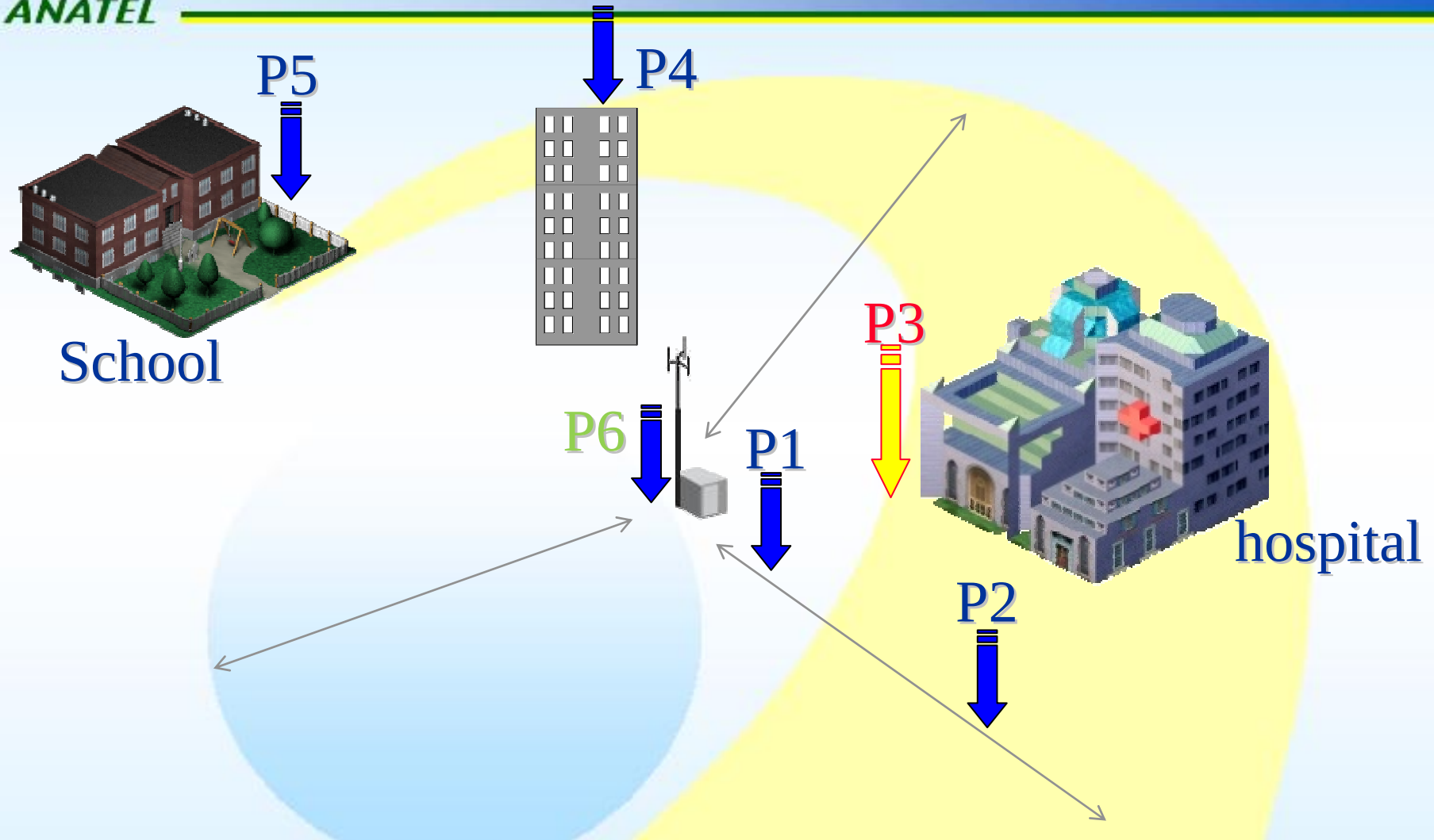


http://sistemas.anatel.gov.br/sigwebmaprni/index.zul

EMF Exposure Map in Brazil

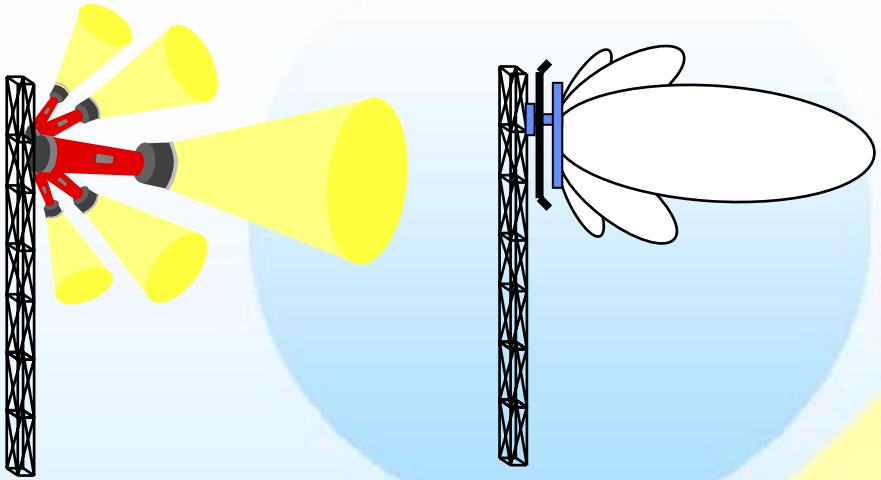


Res. 303 Review: Selecting Measuring Points



Public Audiences and Workshops

- Anatel has been emphasizing and clarifying that technical aspects should not be treated in local legislation
- Management of Visual Impact (sharing, integration to urban landscape, rooftop/facade installation and infrastructure integration)



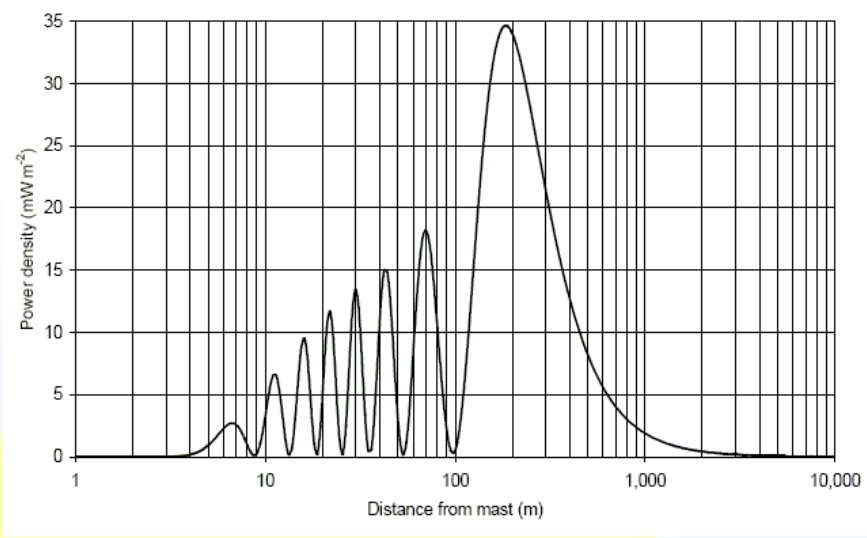


Fig. 15 of NRPB –R321

National Telecommunications Agency

Superintendence of Radiofrequency and Enforcement

General Department of Certification and Spectrum Engineering

Department of Spectrum Engineering