

C2M Webinar EMF exposure monitoring in France

Emmanuelle Conil emmanuelle.conil@anfr.fr

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PLAN



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02 | ANFR MISSIONS

03 | IN SITU EXPOSURE MONITORING



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SPECTRUM AND SOCIETY/ECONOMY

A growing number of industry sectors rely on spectrum

A wealth of applications

- 5G Mobile high speed broadband
- HD DVB-T
- Internet of things
- Smart cities
- MHealth
- Connected vehicles
- Satellites (Television, Galileo, Copernicus, ...)
- Weather Radars, Civil Aviation, Defense
- Wireless microphones and video cameras
- Weapon systems
- Aeronautical and maritime communications
- Exploration of the Earth and the universe





Access to spectrum conditions the activity of many companies



...

THE RETAIL USERS: WHO ARE THEY?





ANFR manages spectrum as a "wholesaler" → spectrum allocation

Administrations and independent authorities decide final usages \rightarrow spectrum assignments:

- Commercial Services "electronic communications": ARCEP, ARCOM
- Ministries using frequencies

ADMINISTRATIONS INVOLVED

Three ministries involved:

- Health
- Environment
- Electronic Communications

Two French national agencies:

- The French agency for food, environmental and occupational health safety (ANSES) assesses potential health risks from exposure to non-ionizing electromagnetic fields
- The national frequencies agency (ANFR) checks that the operators abide by the law when granting emitting authorizations

ANFR does not have any expertise in health issues



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Exposure limits: French decree n°2002-775

RÉPUBLIQUE FRANÇAISE Liberti Egalitie Futurniti

Basic restrictions to protect from adverse health effect

 Between 100 kHz and 10 GHz, SAR Specific absorption rate (W/kg) evaluated over 6 minutes and defined for whole body and localised exposure



Reference levels derived from the whole body basic restriction

- Electric field, magnetic field and power density
- From 100 kHz to 10 GHz, evaluation over 6 minutes, above, time averaging period decreasing with frequency



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International

Negotiations

« Spectrum diplomat »

National Spectrum

Planning

« Spectrum notary »

Jamming resolution,

surveillance,

« Spectrum guardian »

EMF exposure

« Trusted third-party »

ANFR PRESENTATION



IMPLANTATIONS DE L'ANFR Siège de l'Agence nationale des fréquences 78, avenue du Général de Gaulle Service régional de Villejulf 94704 Maisons-Alfort Cedex 112, rue Edouard-Vallant Tél : 01 45 18 72 72 94815 Villeluff Cedex Tel : 01 49 58 31 00 Centre de contrôle international Antenne de Boulogne Rue du Cap - Site d'Alprech de Rambouillet Route de Cerqueuse 62480 Le Portei Tel.: 03 21 99 71 54 78660 Prunay-en-Yvelines Tel.: 01 34 94 17 00 Service régional de Nancy Technopôle de Brabois 7, allée de Longchamp 54600 Villers-les-Nancy Tel : 03 83 44 70 00 Pôle technique de Brest Pôle technique de CS 13829 Saint-Dié-des-Vosges 29238 Brest Codex 3 4, rue Alphonse-Matter Tel: 02 98 34 12 00 BP 8314 88108 Saint-Dié-des-Vosges Tel.: 03 29 42 20 20 Service régional de Donges Service régional BP 39 de Lyon 44480 Donges Tel.: 02 40 45 36 36 522, route de Neuville 01390 Saint-Andréde-Corcy Tel : 04 72 26 80 00 Service régional de Toulouse BP 70103 31170 Tournefeuille Service régional Tel : 05 61 15 94 30 d'Alx-Marseille Bát AS Europarc Pichaury 1 330, rue Gauthier de la Lauzière CS 80330 3799 Alx-en-Provence Cedex 3 Tel.: 04 42 12 10 10

Key numbers: 300 agents 7 directions 11 locations in mainland France

4 overseas sites: French Polynesia Antilles / Guiana La Reunion / Mayotte New Caledonia

Management of intangible asset of State for the benefit of gouvernemental and commercial users

ANFR MISSIONS RELATED TO EMF EXPOSURE





MARKET SURVEILLANCE



ANFR controls the conformity of the radio terminals placed on the market

In addition to administrative controls, ANFR controls the SAR of the mobile phones



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MARKET SURVEILLANCE REINFORCEMENT





In 2019, 70 mobile phones tested

In 2020, number of controls increased to 95. Since mid-2020, ANFR is also controling limb SAR

In 2021, number of controls still increasing with 140 mobile phones tested including most common 5G models

NEW LAB SAR AT ANFR



- Innovation
- Standardisation
- Market Surveillance support

ANFR MISSIONS RELATED TO EMF EXPOSURE





ENSURE COMPLIANCE WITH REGULATORY LIMITS





Values fixed by Decree No. 2002-775 of May 3, 2002 relating to limit values for public exposure to electromagnetic fields emitted by equipment used in telecommunications networks or by radio installations identical to those of the European Recommendation of July 12, 1999

ANTENNAS AUTHORIZATION PROCESS



An ANFR chaired commission (COMSIS) is delivering authorization for new antennas or for modifications of existing antennas

Members: ANFR, ministries using radiofrequencies spectrum, assigning authorities (ARCEP for electronic communications and CSA for audiovisual medias), mobile operators

3 cases fixed by law*:

- Radiated power < 1 W: no process
- 1 W < radiated power < 5 W: declaration process
- radiated power > 5 W: consultation process and authorization linked with operator's commitment to:
 - \rightarrow respect exposure limits as provided for by decree
 - → ensure a level of exposure as low as possible in particular institutions (schools, hospitals...)

* Commission Implementing Regulation (EU) 2020/1070 of 20 July 2020) On going evolution of the ANFR process (order of 22 september 2021 on SAWAP installation)

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COMPLIANCE BOUNDARIES



ANFR publishes an informative guide on practical rules to install new antennas

Safety zones are areas where the level of exposure may exceed regulatory limits



- Mobile telephony base stations
- Broacasting
- PMR
- WLAN

EXAMPLE : Safety zone around a mobile telephony base station installed on a roof is between 5 and 15 meters in front of the antennas and up to 6 meters on the side depending on characteristics (power, technologies).

In line with EN IEC standard 62232





ENSURE COMPLIANCE WITH REGULATORY LIMITS





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IN SITU MEASUREMENT PROTOCOL

- Methodology of measurements of the RF electromagnetic fields induced by fixed base stations emitting in the frequency range 9 kHz - 300 GHz
- Intended to ensure the compliance with the regulatory limits indicated in a French decree based on 1999 European recommendation, itself based on ICNIRP limits
- Based on the basic standard EN 50492 / EN 62232
- Official document, regularly revised to take into account the technological evolutions, referenced in the French Official Journal
- It is used by COFRAC accredited laboratories which perform measurements

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ATYPICAL POINTS



Criteria defined by ANFR

- In situ evaluation by an accredited laboratory following ANFR protocol
- Global level exposure above or equal to 6 V/m
- Habitation and places accessible to public
- Indoor and outdoor



Follow up by ANFR

- As soon as an atypical point is identified, a notification is sent to main contributors
- Contributors have 6 months to answer
- Examples of actions to resolve the atypical points: power reduction, re-orientation, switch off of an antenna, displacement
- Antenna can be maintained as it is if coverage or quality of service would be affected

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INTRODUCTION



A French in situ measurement protocol To verify compliance with exposure limit values To give RF information on exposure levels To allow laboratories accredited by COFRAC to take measurements In line with international EN IEC 62232 standard

National surveillance process

Measurements campaigns Everyone can ask for free for a in situ evaluation of exposure at home or at any place accessible by the public mesures.anfr.fr cartoradio.fr

More than 10 000 measurements in 2021 ~3 000 persons per year are asking for measurement

French government organises national campaigns

- Each 3 years, in 1000 cities representing French population (measurement in front of city halls)
- Dedicated campaigns to specific establishments (schools, hospitals...)
- 5G follow up

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GLOBAL IN SITU EXPOSURE MONITORING



- About half of measured exposure levels are under the level of sensibility of the measurement probe 0,38 V/m
 Trend of increase of the highest levels (1% of highest values exceed almost 7 V/m)→ mean value is increasing
- 30% 7 **▲ 6.8** 2014 6.1 2015 Champ électrique global (V/m) T N W F G 25% ▲5.9 2016 ▲ 5.5 2017 A 5 **4.9** 20% 2018 Occurence (%) **▲** 4.3 2019 Médiane 2020 2021 Moyenne A Percentile à 99% 10% 5% = 0.83 = 0.78= 0.85 = 0.85 = 0,68 = 0.66 = 0.68 = 0.70 0% 0.38 0 ≥1 ≥ 2 ≥ 3 ≥4 ≥ 5 ≥6 Niveau de champ en V/m 2014 2015 2017 2018 2019 2021 2016 2020

The trend of a slight increase observed in 2018 is confirmed for the highest values, but the median value remains stable.

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DETAILLED IN SITU EXPOSURE MONITORING





Contributeur principal

- Mobile telephony is the main contributor in 60 % of cases
- In more than 15 % of cases, no significant sources have been measured (>0,05 V/m)
- Indoor, WiFi is the main contributor in 17 % of cases, this value is up from previous years

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5G IN SITU EXPOSURE EVOLUTION

Exposure should vary more in time and space than in 2G-3G-4G





STATUS ON 5G ROLL OUT IN FRANCE





60 431 sites of mobile telephony authorised in France at 01/04/2022 55 % of sites include 5G (32 930 sites) 99 % of sites include 4G (59 687 sites) 99 % of sites include 3G (59 682 sites) 73 % of sites include 2G (43 8778 sites)

https://www.anfr.fr/gestion-des-frequences-sites/lobservatoire/

5G MONITORING CAMPAIGN





3 in situ measurements:

- Before putting into operation the 5G service,
- After 4 and 8 months of 5G operation to follow up the EMF exposure evolution with the increase of 5G traffic

All environment concerned (rural, suburban, urban, dense urban)

All mobile operators concerned (4 in France)

All 5G bands concerned (low bands shared with legacy technologies and new core band (with a specific load of the antenna by downloading a 1 GB file to load the antenna)

1500 sites 90% high band 10% low bands 3 evaluations per site Before + 4 months + 8 months

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5G MONITORING CAMPAIGN RESULTS

Low frequency bands

- Exposure remains very comparable after activation of 5G
- Mostly, difference is < 0,2 V/m with a mean value around 0 V/m

3500 MHz band

- The overall exposure generated after the activation of 5G on the 3500 MHz band is comparable to that before its activation
- The first results of artificially generated traffic to solicit the 5G antenna suggest an eventual increase of around 20%

On going :

Step 3 to be included in the analysis

Few users use the network in relation to its potential, which may explain this slight increase in exposure. Measurements will continue in order to monitor the evolution of exposure according to the expected increase in traffic in the coming years



IN SITU EXPOSURE MONITORING IN TIME





To follow up exposure evolution Transparency and information of public

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PARIS 8^e EXAMPLE





Clearly visible macro phenomena (holidays, week end...) In that example, strong variability day/night, week/week end No visible impact of 5G put into service on neighboring sites Slight increase

https://observatoiredesondes.fr/





National surveillance process based on ANFR protocol

- 10 000 measurements in 2021
- Free of charge of everyone \rightarrow ~3 000 measurements per year
- National campaign for specific establishments, evolution in front of city hall, 5G impact
- Local campaign at level of cities as in Lille, Marseille

Autonomous probes

- Few installed by ANFR, mostly installed by local authorities
- In time surveillance
- Available on line in real time

Agence nationale des fréquences

78, Avenue du Général de Gaulle 94704 MAISONS-ALFORT CEDEX France +33 (0)1 45 18 72 72 www.anfr.fr

