



Agencia Nacional del Espectro



TIC

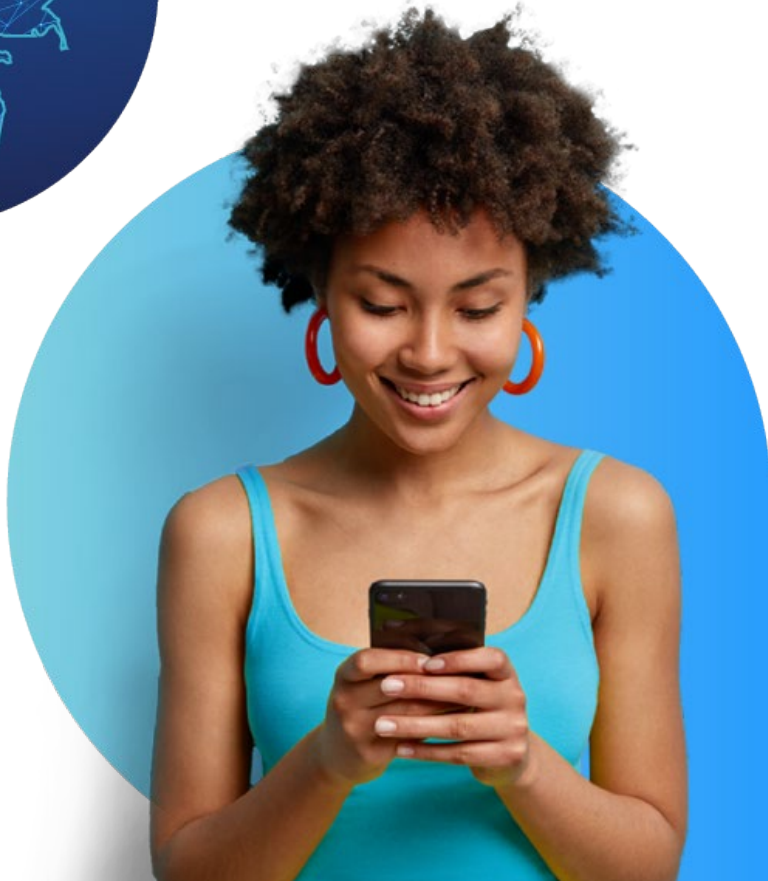
# Adoption of EMF Exposure Limits in Colombia based on ICNIRP 2020 guidelines

ITU-D Study Group 2 Question 7/2 workshop

[www.ane.gov.co](http://www.ane.gov.co)

MAY 2024





## Objectives of the new regulation in Colombia

- To define assessment methods that are applicable to 5G stations

---

- To Simplify assessment methods

---

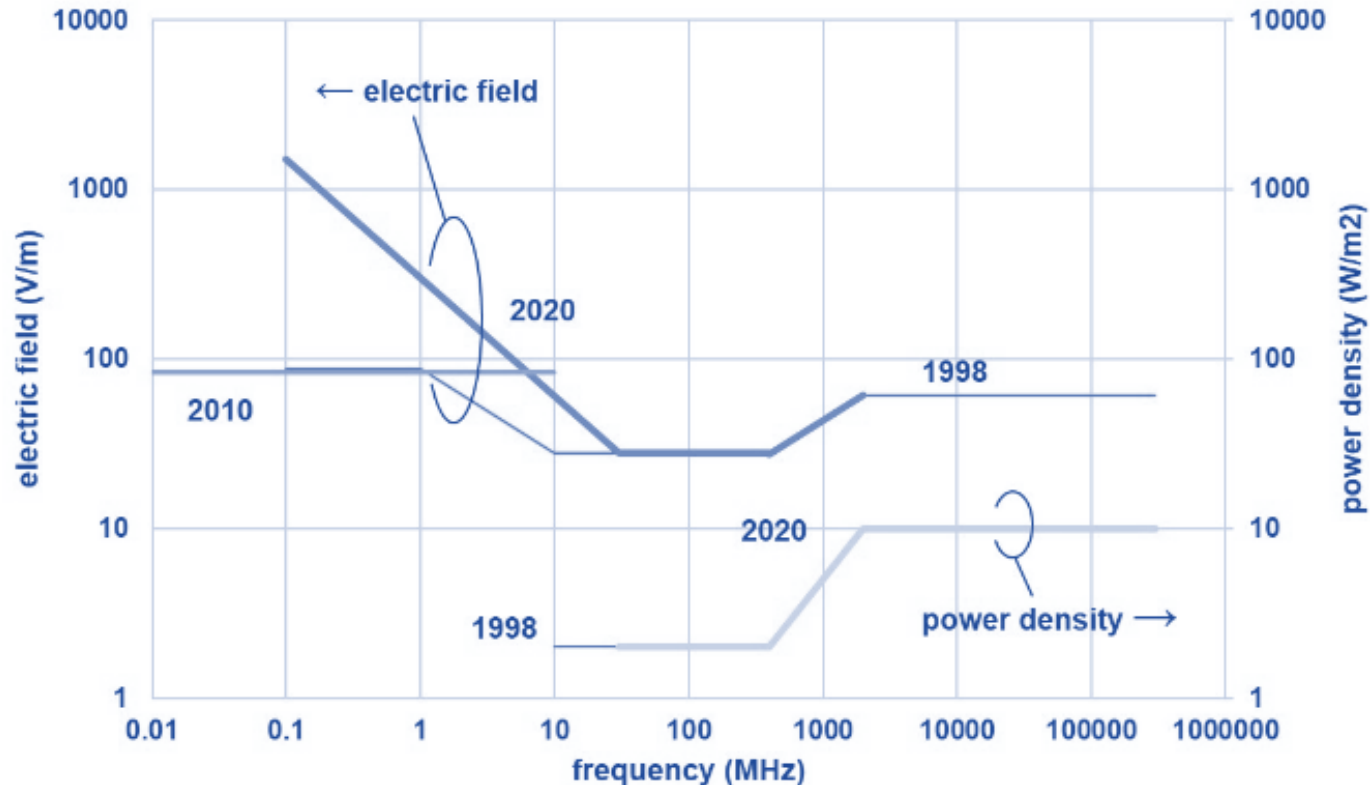
- To adopt EMF exposure limits in accordance with ICNIRP 2020

## Exposure Limits in previous Regulation (Resolution 774/18)

| Exposure       | Frequency range | E (V/m)                | H (A/m)                 | S (W/m <sup>2</sup> ) |
|----------------|-----------------|------------------------|-------------------------|-----------------------|
| Occupational   | 9 – 100 kHz     | 170                    | 80                      | -                     |
|                | 100 kHz – 1 MHz | 610                    | 1,6/f                   | -                     |
|                | 1 – 10 MHz      | 610/f                  | 1,6/f                   | -                     |
|                | 10 – 400 MHz    | 61                     | 0,16                    | 10                    |
|                | 400 – 2.000 MHz | 3 f <sup>1/2</sup>     | 0,008 f <sup>1/2</sup>  | f/40                  |
|                | 2 – 300 GHz     | 137                    | 0,36                    | 50                    |
| General public | 9 – 100 kHz     | 83                     | 21                      | -                     |
|                | 100 - 150 kHz   | 87                     | 5                       | -                     |
|                | 0,15 – 1 MHz    | 87                     | 0,73/f                  | -                     |
|                | 1 – 10 MHz      | 87/f <sup>1/2</sup>    | 0,73/f                  | -                     |
|                | 10 – 400 MHz    | 28                     | 0,073                   | 2                     |
|                | 400 – 2.000 MHz | 1,375 f <sup>1/2</sup> | 0,0037 f <sup>1/2</sup> | f/200                 |
|                | 2 – 300 GHz     | 61                     | 0,16                    | 10                    |

Limits were based on the **ICNIRP 1998 and ICNIRP 2010** guidelines.

# ICNIRP 2020 Impact on Colombian Regulation



- Below 30 MHz limits are higher
- Between 10 MHz and 30 MHz limits no longer include power density
- Starting at 2 GHz the limits are only expressed in power density

Source: <https://www.icnirp.org/en/differences.html>

## Adopted exposure limits (Resolution 773/23)

| Exposure       | Frequency range | $E_{inc}$ (V m <sup>-1</sup> ) | $H_{inc}$ (A m <sup>-1</sup> ) | $S_{inc}$ (W m <sup>-2</sup> ) |
|----------------|-----------------|--------------------------------|--------------------------------|--------------------------------|
| Occupational   | 0.1 – 30 MHz    | $660/f_M^{0.7}$                | $4.9/f_M$                      | NA                             |
|                | >30 – 400 MHz   | 61                             | 0.16                           | 10                             |
|                | >400 – 2000 MHz | $3f_M^{0.5}$                   | $0.008f_M^{0.5}$               | $f_M/40$                       |
|                | >2 – 300 GHz    | NA                             | NA                             | 50                             |
| General public | 0.1 – 30 MHz    | $300/f_M^{0.7}$                | $2.2/f_M$                      | NA                             |
|                | >30 – 400 MHz   | 27.7                           | 0.073                          | 2                              |
|                | >400 – 2000 MHz | $1.375f_M^{0.5}$               | $0.0037f_M^{0.5}$              | $f_M/200$                      |
|                | >2 – 300 GHz    | NA                             | NA                             | 10                             |

Corresponds to ICNIRP 2020 reference levels (the whole body)

## Assessment Compliance With Exposure Limits Procedures



**Simplified assessment  
procedures**

**IMT Base Stations**  
(Rec. UIT-T K.100)

**Other Stations**  
(Annex C Rec.  
UIT-T K.70)



**EMF  
measurements**

## Other Stations Simplified Assessment

| Before... | Frequency           | General public exposure                |  |
|-----------|---------------------|--|--|
|           | 1 - 10 MHz          | $r = 0.10 \sqrt{\text{EIRP} \times f}$ | $r = 0.129 \sqrt{\text{ERP} \times f}$ |
|           | 10 - 400 MHz        | $r = 0.319 \sqrt{\text{EIRP}}$         | $r = 0.409 \sqrt{\text{ERP}}$          |
|           | 400 - 2.000 MHz     | $r = 6.38 \sqrt{\text{EIRP}/f}$        | $r = 8.16 \sqrt{\text{ERP}/f}$         |
|           | 2.000 - 300.000 MHz | $r = 0.143 \sqrt{\text{EIRP}}$         | $r = 0.184 \sqrt{\text{ERP}}$          |

**Below 30 MHz limits no longer include power density**

| Now | Frequency           | General public exposure         |                                |
|-----|---------------------|---------------------------------|--------------------------------|
|     | 30 - 400 MHz        | $r = 0.319 \sqrt{\text{EIRP}}$  | $r = 0.409 \sqrt{\text{ERP}}$  |
|     | 400 - 2.000 MHz     | $r = 6.38 \sqrt{\text{EIRP}/f}$ | $r = 8.16 \sqrt{\text{ERP}/f}$ |
|     | 2.000 - 300.000 MHz | $r = 0.143 \sqrt{\text{EIRP}}$  | $r = 0.184 \sqrt{\text{ERP}}$  |



## Impact on EMF Measurements

- Both E and H must be measured to assess limits compliance of RF stations operating at frequencies below 30 MHz

- 
- Above 2 GHz E can be measured, results to assess compliance must be shown in power density (S)

$$S = E^2 / 377\Omega$$

- 
- Broadband measurements should use the limits expressed in S





## IMT Base Station Simplified Assessment

- There is no impact of the ICNIRP 2020 guidelines, but there is of 5G (new in Colombia)

---

- The simplified assessment procedure (UIT-T K.100) is based on EIRP, antenna height, main lobe direction (azimuth and tilt)

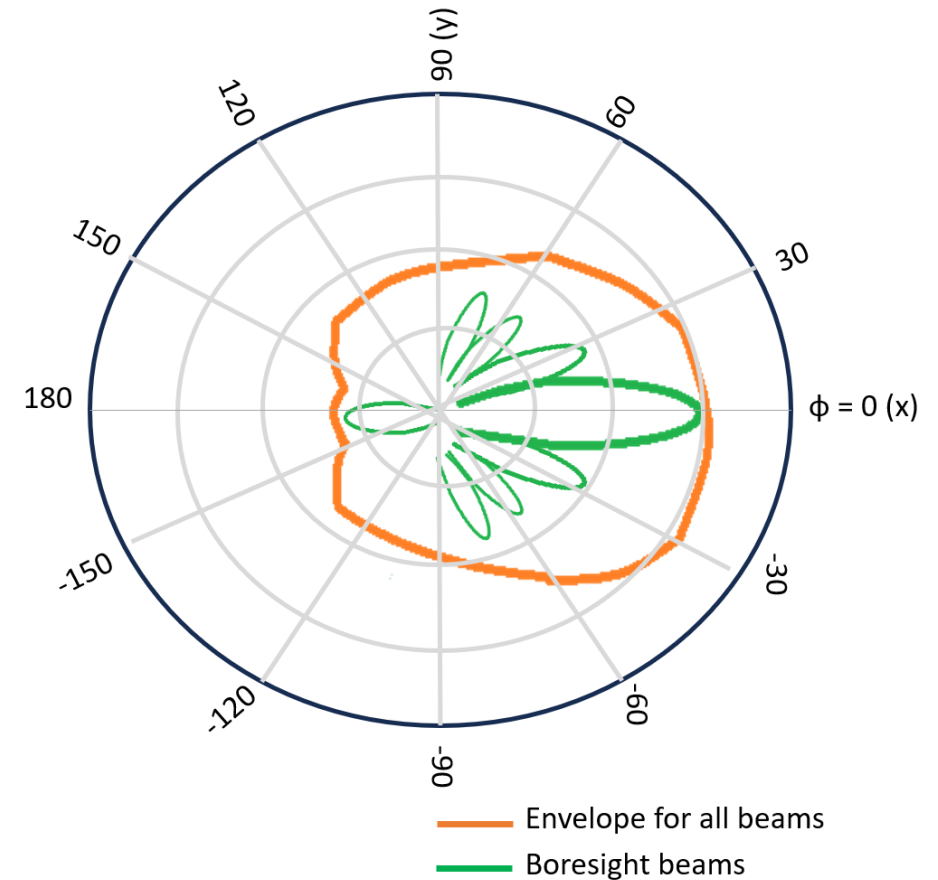
---

- Due to beamforming of Active Antenna System-AAS (massive MIMO) EMF is not constant at an evaluation point

## IMT Base Station Simplified Assessment

### Solution:

- Applying Power Reduction Factor-PRF and use the traffic beam envelope.
- PRF defined as the difference between the theoretical power and the actual maximum RF power
- **PRF= 0.25 (TDD); 0.32 (FDD)** (@ mid band 16T, 32T, 64T antenna arrays)



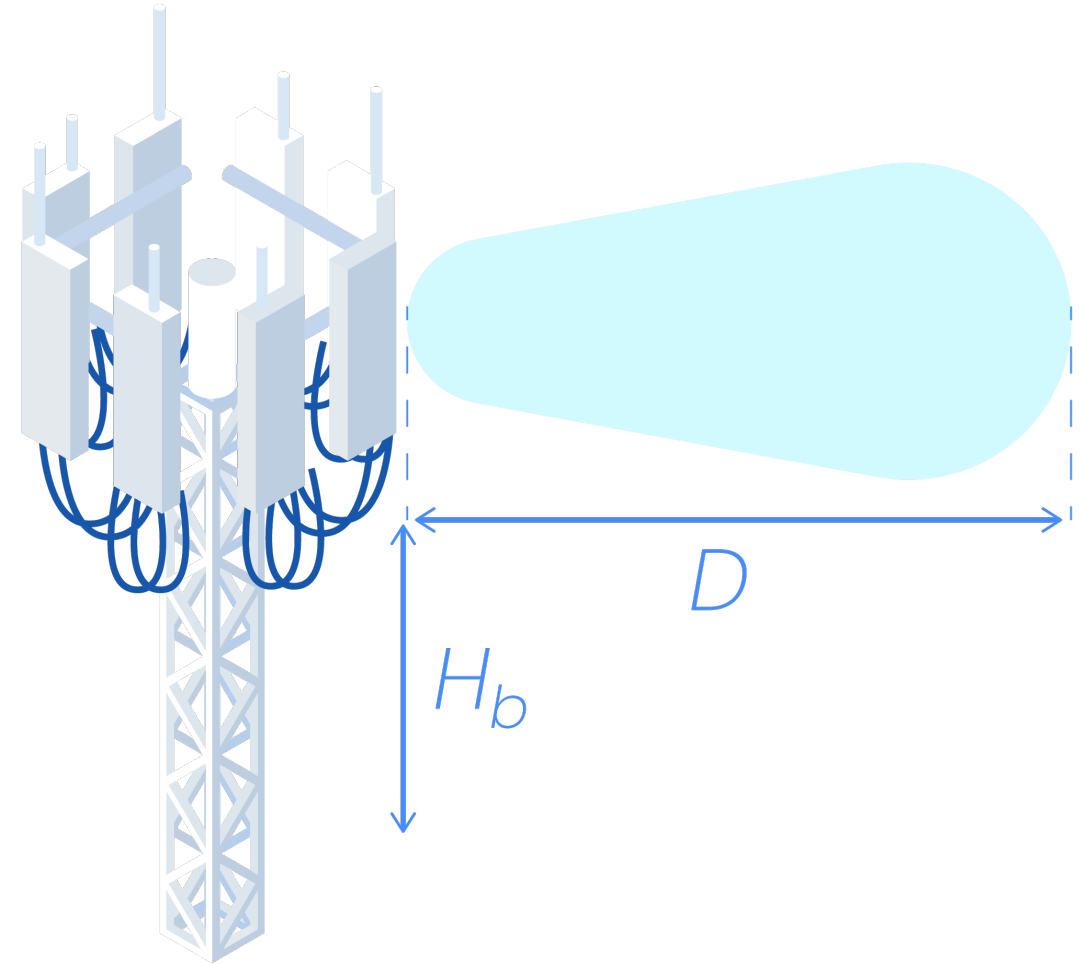
## IMT Base Station Simplified Assessment

Compliance distances ( $EIRP * PRF > 100W$ ):

$$D = \sqrt{((EIRP * PRF) / (4\pi * S_{lim}))}$$

$$H_b = \max(D * \tan(\alpha), 3.5)$$

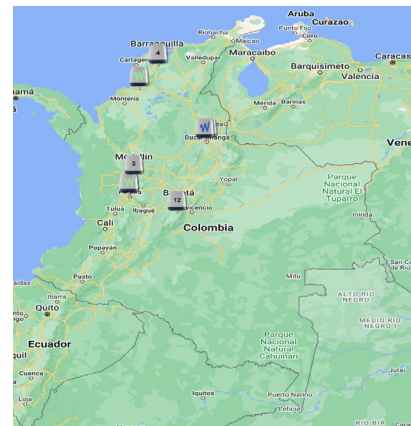
$(\alpha)$  : is the maximum electrical and mechanical downtilt considering the configured beam-steering range in the elevation plane



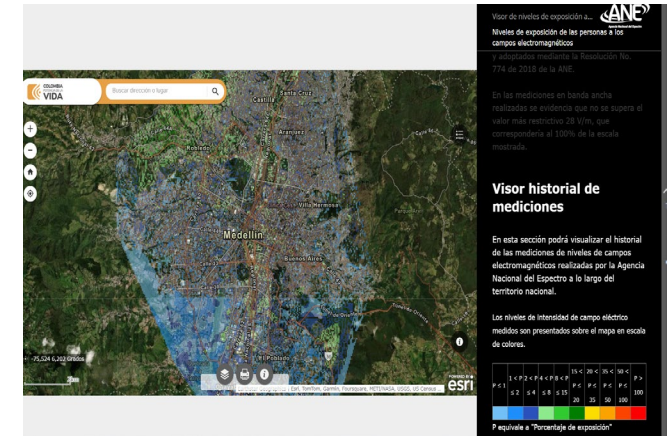
## Published information for people



Electromagnetic Compliance  
Registration System



EMF Monitoring  
System



(UIT-T K.113)



[www.ane.gov.co](http://www.ane.gov.co)

PBX: 601-6000030

[contactenos@ane.gov.co](mailto:contactenos@ane.gov.co)

