Departamento
de Controle do Espaço Aéreo
Department of Airspace Control

CURRENT REGULATORY STATUS OF 5G IMPLEMENTATION IN THE 3.5 GHz FREQUENCY BAND IN BRAZIL

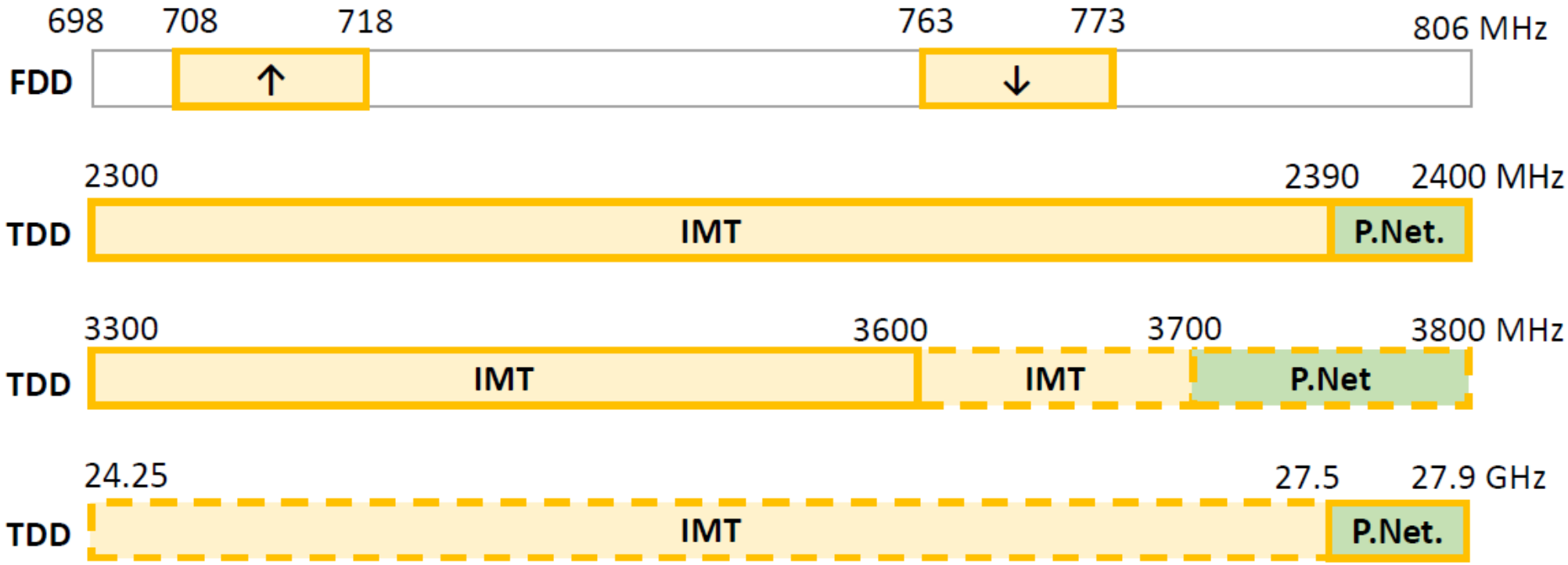
REGIONAL PREPARATORY GROUP (RPG) MEETING FOR WRC-2023

Cairo, Egypt, 28-29 August 2023


ANATEL
5G Auction in Brazil
and
the 3.5 GHz band

Spectrum Blocks

The purpose of the Auction is granting licenses to use radio frequencies in the following bands:



Legend:

- To be auctioned
- Not to be auctioned (Industry 4.0)
- Allocated before 2021
- Allocated in 2021

NATIONAL 3,5 GHz

ANATEL

3 X 100 MHz

Claro	Vivo	Tim
3.3 – 3.4	3.4 – 3.5	3.5 – 3.6

REGIONAL 3,5 GHz

ANATEL

80 MHz

3.60 GHz — 3.68 GHz

REGION	OPERATOR
São Paulo + Norte	Sercomtel
Nordeste	Brisanet
Centro-Oeste *	Brisanet
Sul	Consórcio 5G Sul
RJ, ES e MG *	Cloud2u
Setores 3, 22, 25 e 33 do PGO	Algar Telecom

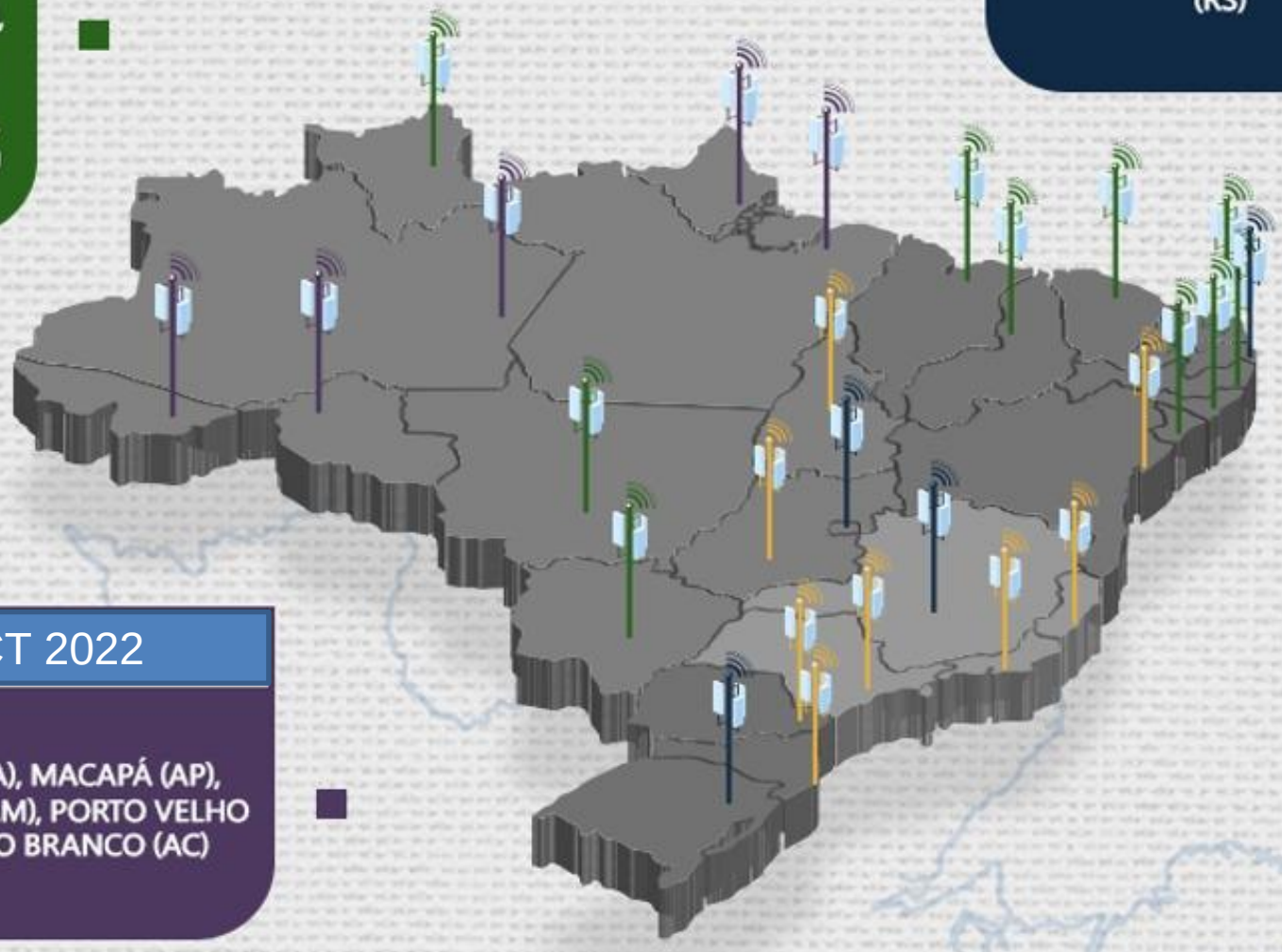
IMPLEMENTATION TIMELINE

JUL 2022

BRASÍLIA (DF), BELO HORIZONTE (MG), JOÃO PESSOA (PB), PORTO ALEGRE (RS)

SET 2022

FORTALEZA (CE), NATAL (RN), RECIFE (PE), ARACAJU (SE), BOA VISTA (RR), CAMPO GRANDE (MS), CUIABÁ (MT), MACEIÓ (AL), SÃO LUÍS (MA) E TERESINA (PI)



AUG 2022

SÃO PAULO (SP), CURITIBA (PR), GOIÂNIA (GO), SALVADOR (BA), FLORIANÓPOLIS (SC), PALMAS (TO), RIO DE JANEIRO (RJ), VITÓRIA (ES)

OCT 2022

BELÉM (PA), MACAPÁ (AP), MANAUS (AM), PORTO VELHO (RO) E RIO BRANCO (AC)

Conexão até 100 vezes mais rápida

PUBLIC CONSULTATION No. 36/ANATEL - May 20, 2022

*"The National Telecommunications Agency (ANATEL) submits to comments and suggestions from the overall public, a proposal for **Operational Requirements for 5G stations** operating in the 3.5 GHz band **for the protection of radio altimeters** operating in the 4.2 – 4.4 GHz band."*

PUBLIC CONSULTATION No. 36 -----> ACT No. 9064 – JUN 28, 2022:

- *CONSIDERING that the radio altimeters operate under the **Aeronautical Radionavigation Service**, which is classified as a **Safety Service**, according to **No. 4.10** of the ITU-R Radio Regulation.*
- *CONSIDERING the **meetings between ANATEL and the National Civil Aviation Agency (ANAC)** to address the operation of 5G systems in Brazil.*
- *CONSIDERING the **list of aerodromes** that have **approach procedures in low visibility conditions** that depend on radio altimeters, as reported by the Department of Airspace Control (DECEA).*
- *CONSIDERING the Contributions received.*

ACT No. 9064/ANATEL - JUNE 28, 2022

- *Art. 1. To establish, on a provisional and precautionary basis, that the main beams of the antennas used in base, nodal or repeater stations operating in the sub-band from 3 300 MHz to 3 700 MHz, installed in areas close to the aerodromes specified in the Annex, have their pointing limited between the horizon line and below.*
- *§ 1. The area covered (precaution zone) by the caput is bounded by the rectangle comprised by the following distances:*

  I - 2100 meters from the edges of the landing and take-off runway; and

  II - 910 meters on each side of the central axis of the runway.
- *§ 2. The pointing limit provided for in Art 1º applies to both AAS and non-AAS antennas;*
- *Art. 2. For the base station, nodal or repeater installed in the areas defined in § 1 art. 1, the maximum power (EIRP), by polarization, must be limited to:*

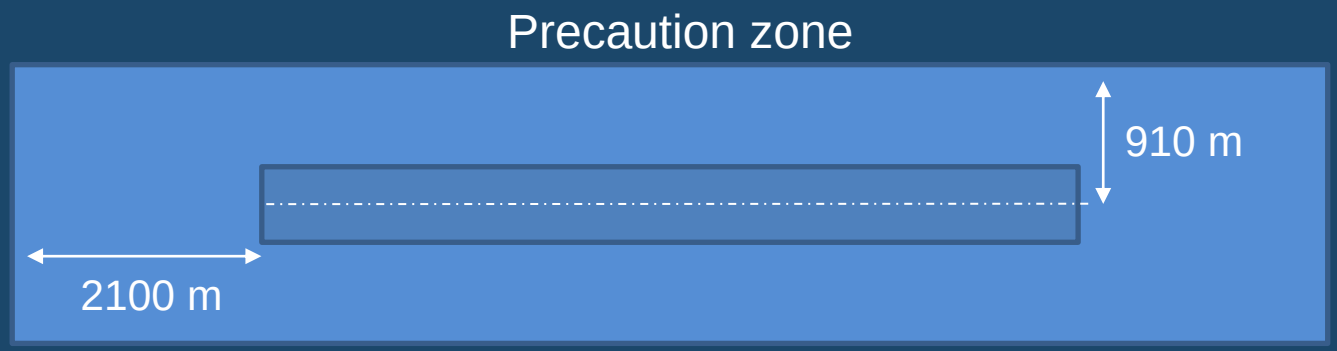
  I. 67 dBm/100 MHz, when operating in the 3 300 MHz to 3 600 MHz sub-band; or

  II. 65 dBm/100 MHz, when operating in the sub-band above 3 600 MHz.
- *Art. 3. The rules established by this ACT will be reviewed until Dec 31, 2022, considering the evolution of the matter at the national and international level.*

CURRENT REGULATORY STATUS – ACT No. 9064/2022

5G Base Stations power limits within the precaution zone

- EIRP max = 67 dBm /100 MHz per polarization @ 3 300-3 600 MHz.
- EIRP max = 65 dBm /100 MHz per polarization @ 3 600-3 700 MHz.
- Antenna pointing (AAS and non AAS) limited between the Horizon line and below.

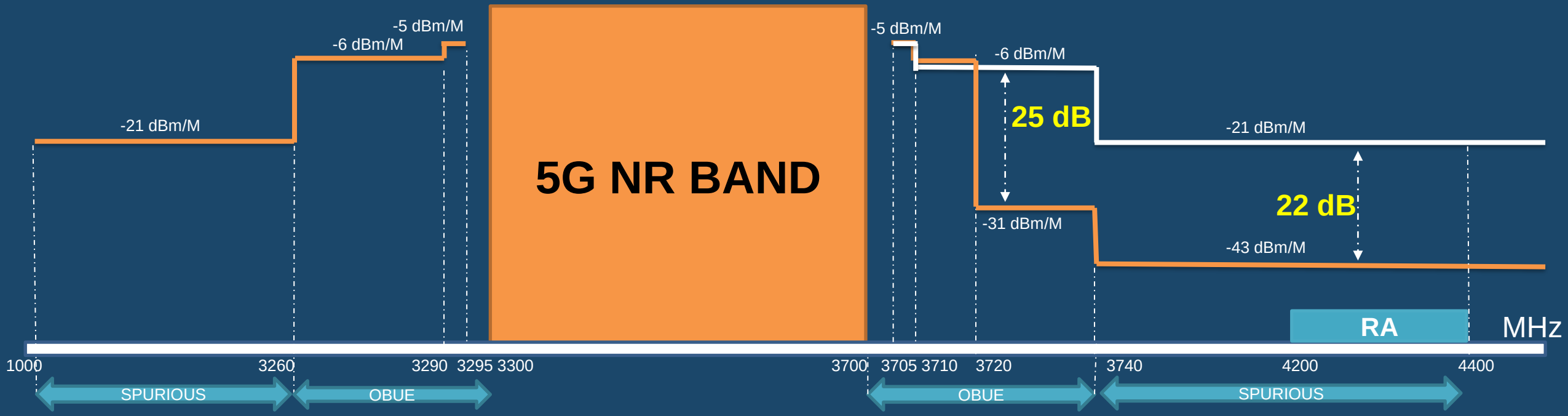


5G Base Stations power limits outside the precaution zone

- EIRP max = 65 dBm/10 MHz per polarization @ 3 300-3 700 MHz

CURRENT REGULATORY STATUS – ACT No. 1477/2021

Unwanted Emission Limits – TRP limits for Base Stations with AAS



3GPP max TRP

ANATEL max TRP

PUBLIC CONSULTATION No. 86/ANATEL - Dec 29, 2022

ACT No. 1051 – FEB 01, 2023:

- *Art. 1 Amends Act. No. 9064, specifying that the rules established by this Act **will be reviewed until July 31, 2023**, considering the evolution of the studies carried out at national and international level.“*

PUBLIC CONSULTATION No. 38 (Aug 01, 2023):

- Change the ACT 9064 ---> to remove the power limit restrictions for 5G BS inside the precaution zone.
- Contributions will be accepted till August, 31 2023.

PUBLIC CONSULTATION No. 39 (Aug 03, 2023 to Aug 31, 2023):

- Clearly specify the unwanted 5G emissions limits : -43 dBm/MHz in the Frequency band 4 200- 4 400 MHz.
- **Contributions will be accepeted till September, 17 2023.**

SUMMARY

ACT No. 9064/ANATEL - IN FORCE

INSIDE PRECAUTION ZONE:

- EIRP max = 67 dBm /100 MHz per polarization @ 3 300-3 600 MHz.
- EIRP max = 65 dBm /100 MHz per polarization @ 3 600-3 700 MHz.
- Antenna pointing limited between the Horizon line and below within precaution zone.

No impact on RA

PUBLIC CONSULTATION No. 38 PROPOSAL

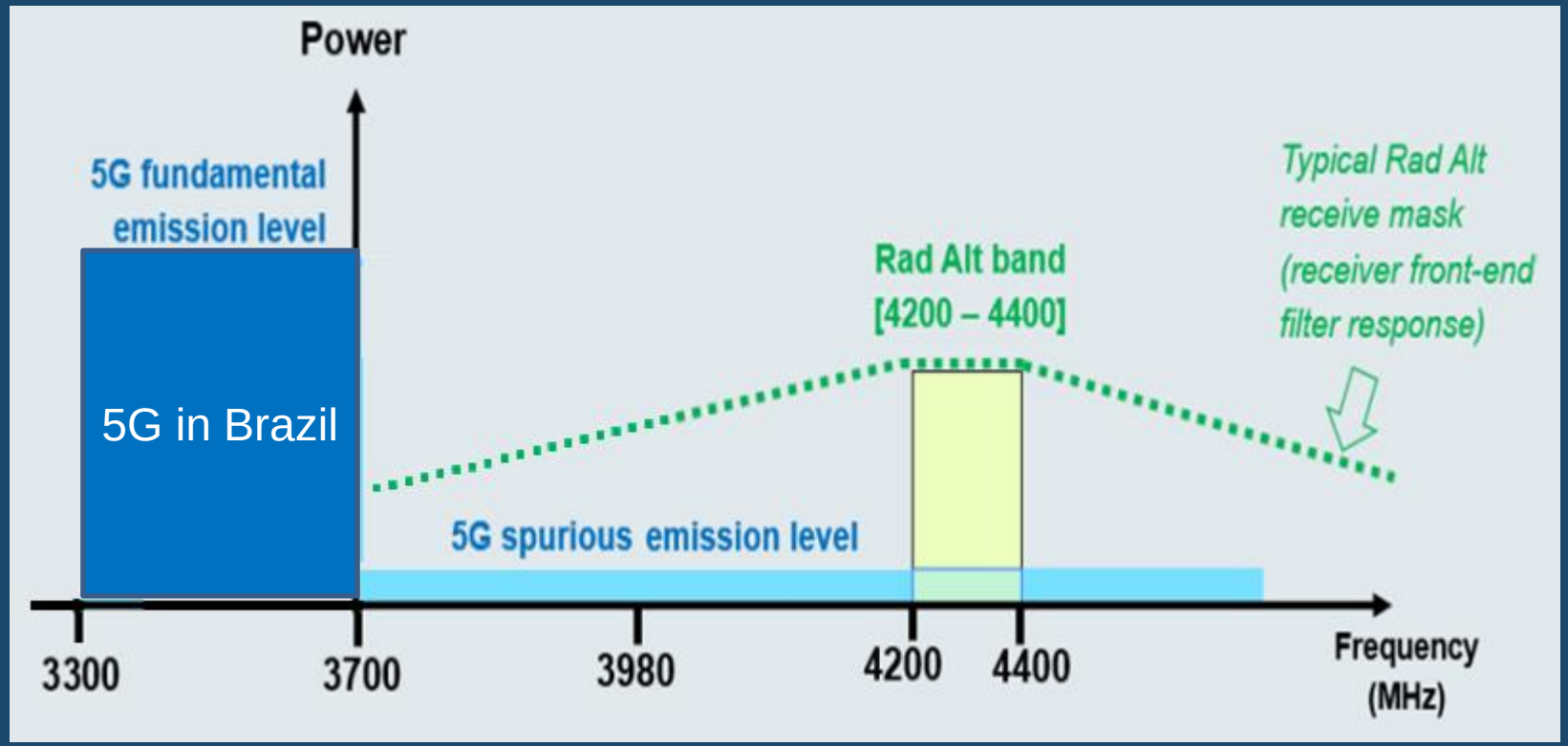
INSIDE PRECAUTION ZONE:

- ~~EIRP max = 67 dBm /100 MHz per polarization @ 3 300-3 600 MHz.~~
- ~~EIRP max = 65 dBm /100 MHz per polarization @ 3 600-3 700 MHz.~~
- **EIRP max = 75 dBm /100 MHz per polarization @ 3 300-3 700 MHz.**
- Antenna pointing limited between the Horizon line and below within precaution zone.

Possible impact on RA

FUNDAMENTAL AND SPURIOUS 5G EMISSIONS

FREQUENCY (MHz)	RA typical Rx filter (ITU-R 2059)
3,950	-2.89 dB
3,850	-4.01 dB
3,750	-5.14 dB
3,650	-6.28 dB

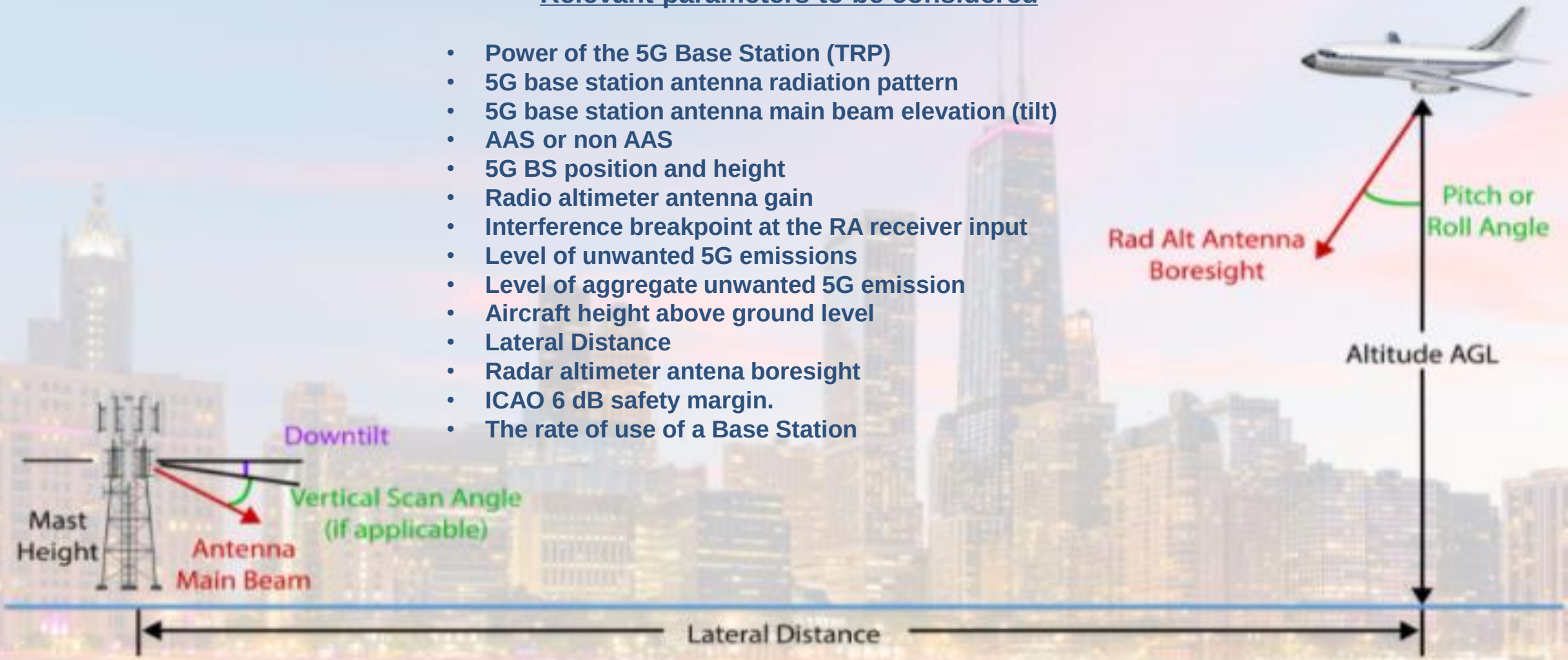


Typical Interference Scenario

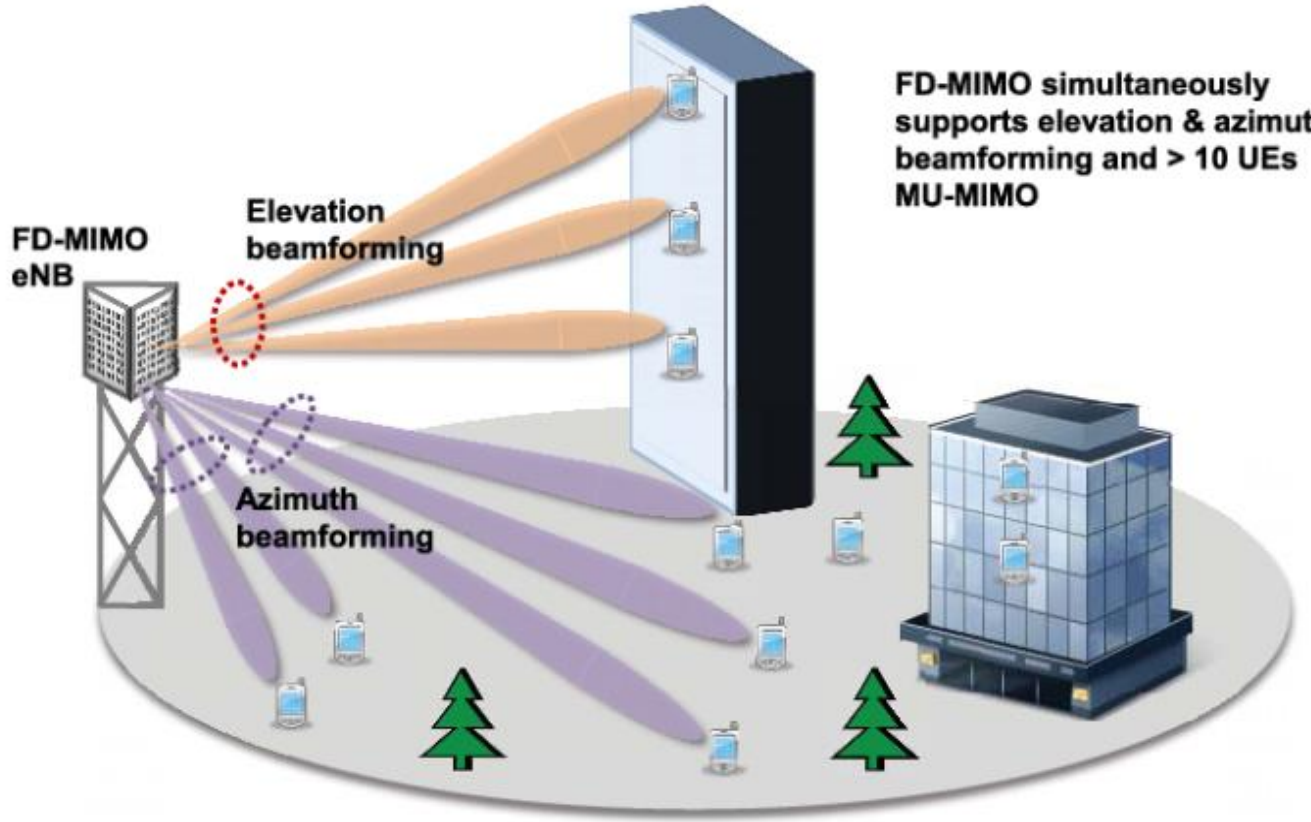
different implementations make it difficult to find a single worldwide solution

Relevant parameters to be considered

- Power of the 5G Base Station (TRP)
- 5G base station antenna radiation pattern
- 5G base station antenna main beam elevation (tilt)
- AAS or non AAS
- 5G BS position and height
- Radio altimeter antenna gain
- Interference breakpoint at the RA receiver input
- Level of unwanted 5G emissions
- Level of aggregate unwanted 5G emission
- Aircraft height above ground level
- Lateral Distance
- Radar altimeter antena boresight
- ICAO 6 dB safety margin.
- The rate of use of a Base Station



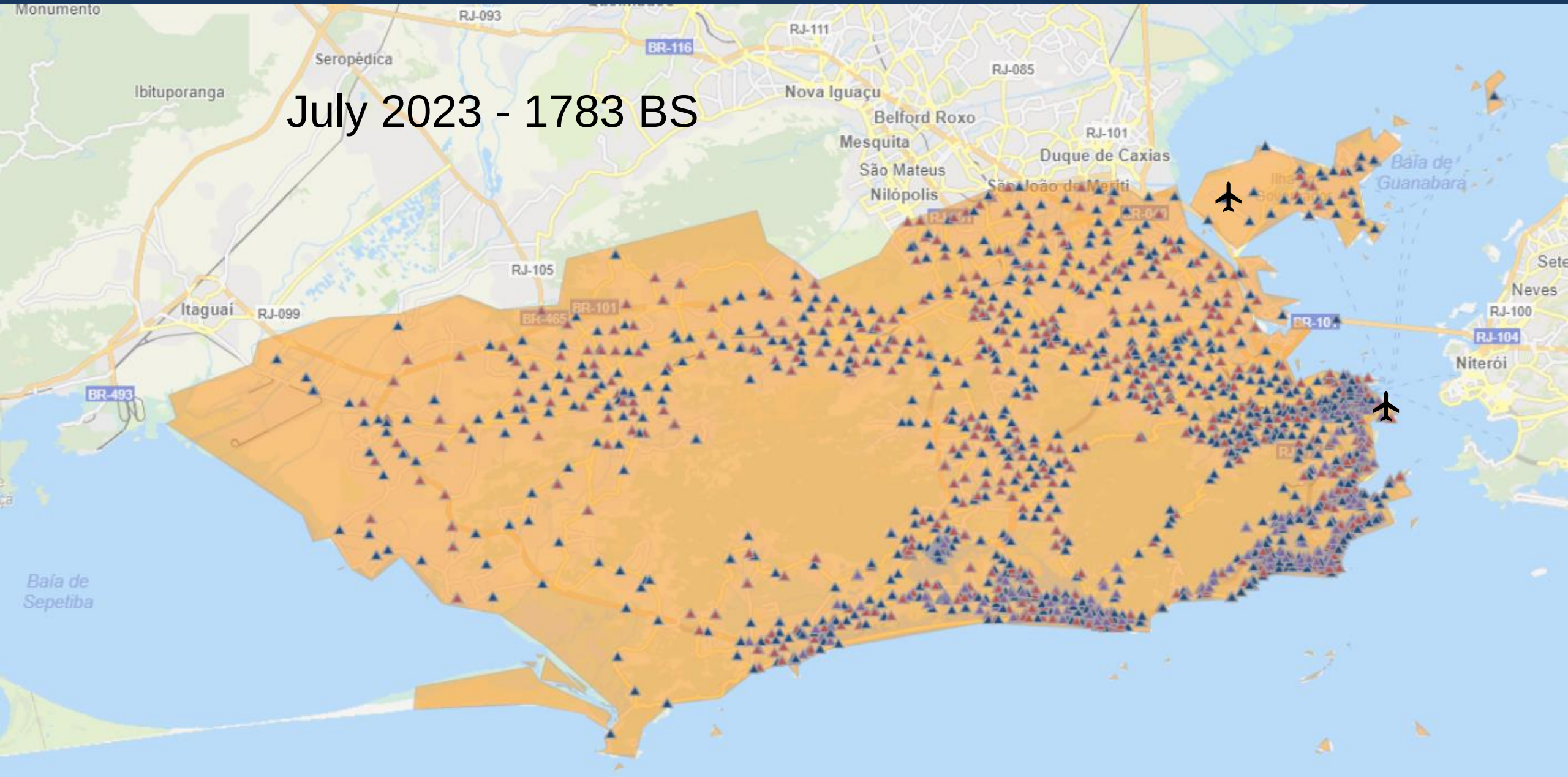
Massive MIMO



Advanced Antenna Systems **allows higher gain**, concentrating energy to the direction of the user.

maximum eirp is not expected for a single user

RIO DE JANEIRO STATE – 5G/3.5 GHz BASE STATIONS

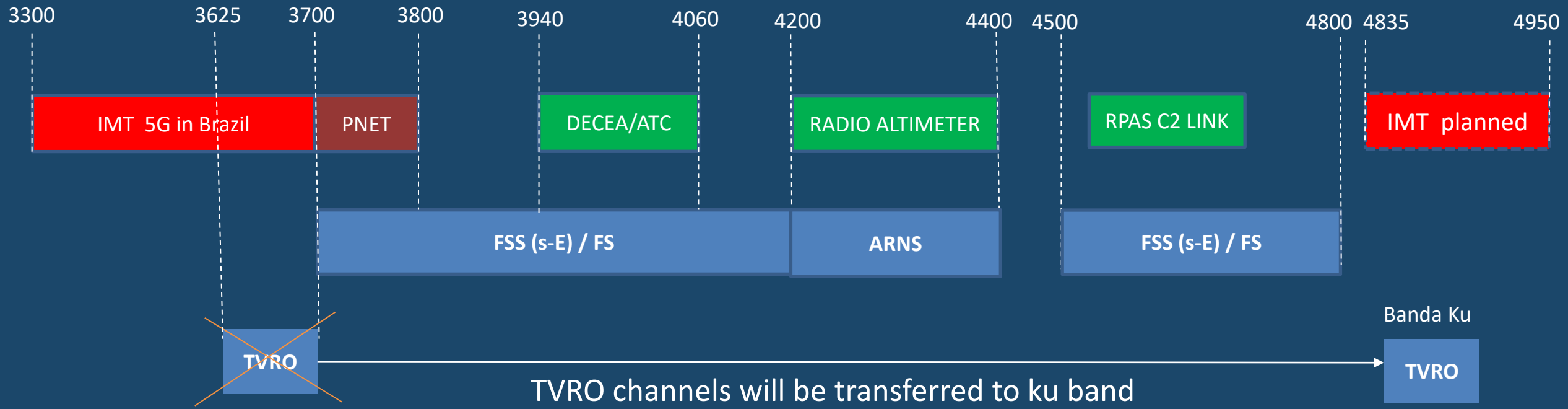


ANTONIO CARLOS JOBIM AIRPORT – PRECAUTION ZONES

SANTOS DUMONT AIRPORT – PRECAUTION ZONE

5G BS - July 2023

C BAND SPECTRUM USE - BRAZIL



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