ATDI Software
Use for Space Services
Yerevan, 15 December 2017

AGENDA

- ABOUT US
- ICS TELECOM EV - GENERAL
- USE OF ICS TELECOM EV FOR SPACE SERVICES
- USE CASE: IMT AND FSS

IoT 5G Lte WiFi

Company Overview

ATDI is a global market leader in solutions for the design, planning and modelling of radio networks and spectrum management.

- Established in 1991 in Paris
- 100+ experts from 29 countries in 11 global offices
- More than 2000 customers worldwide, including 90+ spectrum regulation authorities

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ATDI's Offices

Paris (HQ) | Washington | Madrid | London | Warsaw | Kyiv | Moscow | Tel Aviv | Mumbai | Singapore | Sydney

ICS TELECOM EV

ICS telecom EV overview

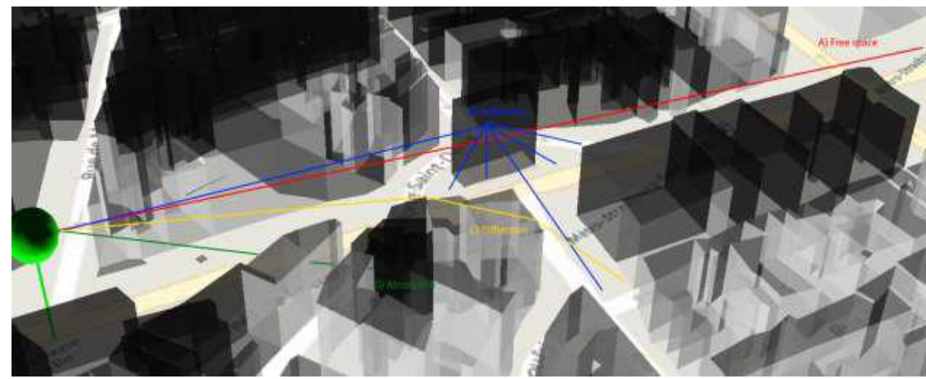
An all-in-one software solution for the design, deployment and optimization of radiocommunication networks

- 5G (soon)
- Internet of Things
- LTE
- Public Safety
- Dynamic Spectrum
- Broadcast
- Aviation & UAS
- Satellites
- Railways
- Dynamic Spectrum

mmWave Planning

Challenge

At high frequencies, diffraction losses become so high that there is an almost binary switch between ‘served’ and ‘unserved’ areas as shadowing by environmental clutter interrupts the line-of-sight between base station and user.



Solution

Using generic deterministic propagation models, mmWave stations can be computed at the same time as VHF/UHF and SHF stations with ATDI solution.

Carrier aggregation simulations | mmWave coverage planning | Coverage planning (2D/3D) | Interference calculations | Capacity planning (DL/UL throughput) | Traffic analysis | Monte Carlo simulations | Automated site planning | Automated site optimization | Automated frequency planning | Refarming frequency bands and intersystem coexistence | Transport (microwave) planning

ICS telecom EV Main Features

USE THIS…	TO PERFORM THESE
Multi-technology platform	Technology evaluation
Full 3D propagation engine	Network design and planning
Mixed indoor/outdoor calculations	Business modelling
Interference analysis and frequency planning	System administration
Population and traffic analysis	International and regional coordination
Prospective planning (site searching)	Spectrum monitoring
Integrated GIS, raster and vector layers	Environmental constraints

IoT 5G Lte

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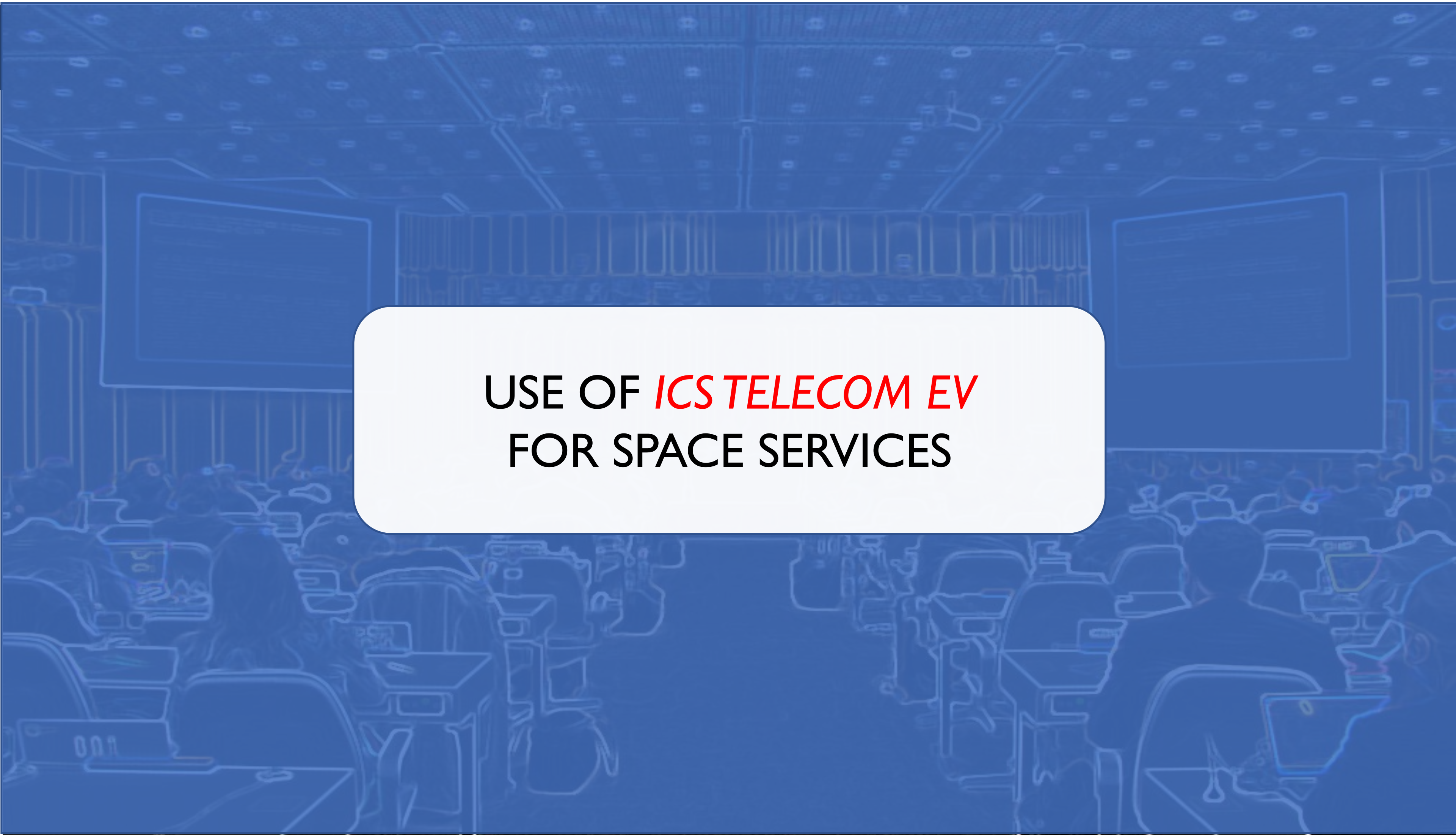


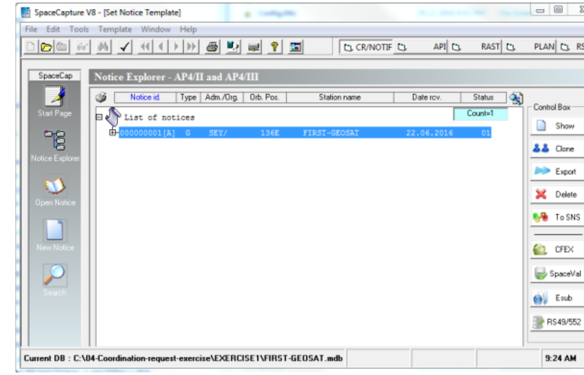
USE OF *ICS TELECOM EV* FOR SPACE SERVICES

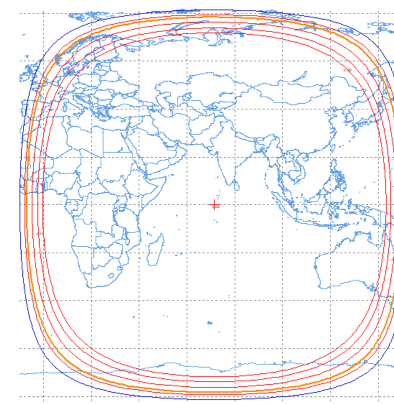
A software for space services for administrations

ITU-BR Space Software

- Help an ADM in the preparation of Electronic Filings to the ITU:
  - ✓ According to the RR (Articles 9 and 11, Appendices 30,30A,30B)
  - ✓ In the appropriate submission format (Appendix 4)
  - ✓ In compliance with the technical and operational limits (Articles 5, 21, 22, etc., Appendices 30,30A,30B)
  - ✓ Using the appropriate methods to identify potential coordination requirements (Appendices 7,8, 30,30A,30B, etc.)

- Run technical exams on satellite networks of other administrations to assess their impact on ADM's space/terrestrial networks (essentially already done by the BR)





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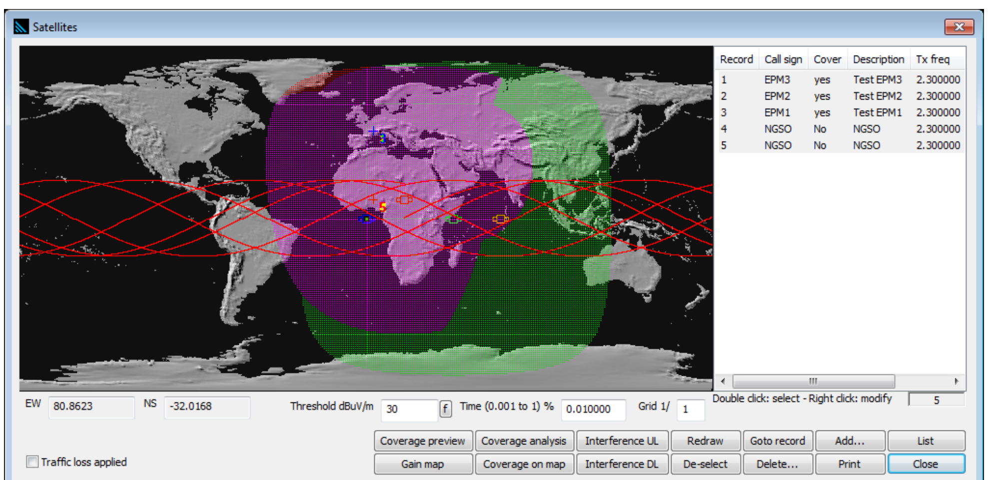
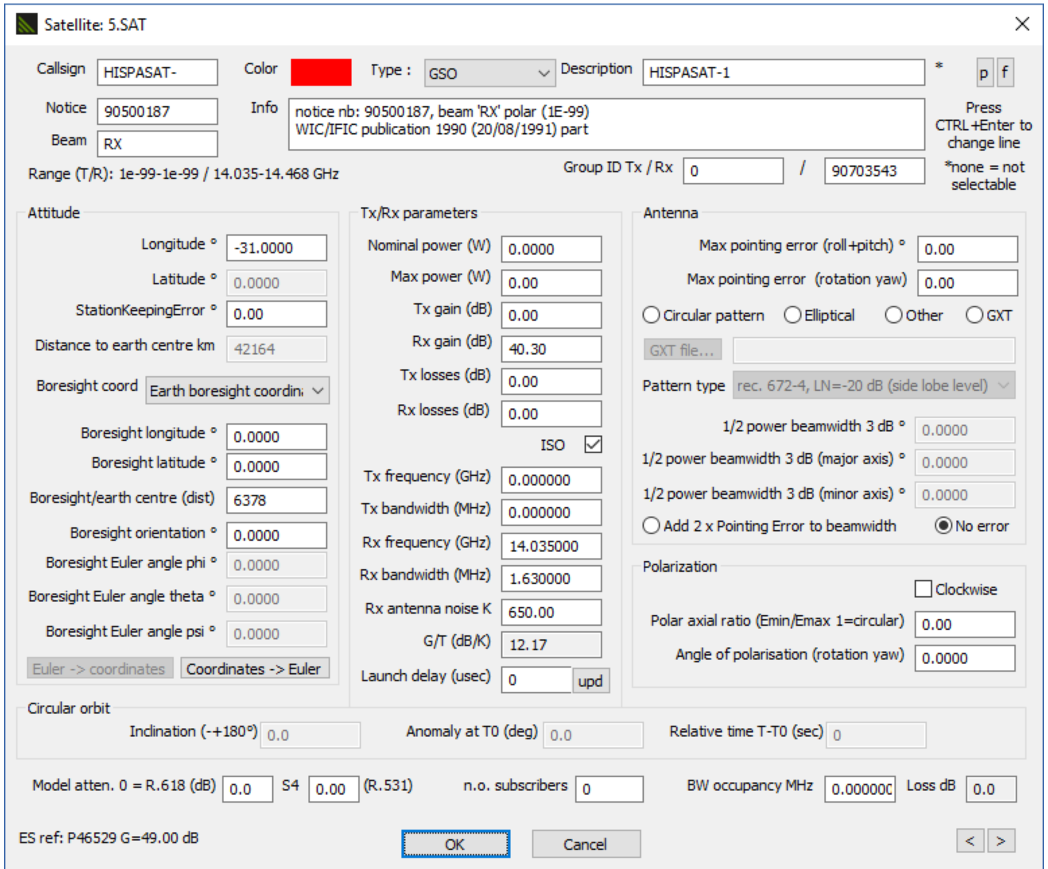
Helps the administrations to extend the analysis to the national level:

- Planning of the satellite network
- Inter-service analysis of the affect of a satellite network on/from other services in the same country:
  - ✓ Allocated Terrestrial Service → Allocated Satellite Service
  - ✓ Studies on Future Terrestrial Service → Future Satellite Service
  - ✓ Studies on Future Satellite Service → Future Terrestrial Service



ICS telecom EV with BR IFIC – Export from Space BRIFIC

Interface with the Space BRIFIC and GIMS databases:



USE CASE: IMT AND FSS

IMT VS. FSS: WRC-15 Outcome

WRC-15 AI 1.1: IMT Identification, C-band specific:

3400-3600 MHz: Global allocation to IMT, except some APT countries

3600-3700 MHz: No IMT, except 4 CITEL countries

3700-4200 MHz: No IMT

WRC-19 Agenda Item 1.13 – further spectrum identification for IMT

- Over 33 GHz of spectrum are under study

- Potential identification of IMT in frequency bands where FSS is allocated as a primary service:

Candidate band	Potential sharing band	Allocation in ITU Region 1
24.25-27.5 GHz	24.65-25.25 GHz	FSS (E-s)
37.5-40.5 GHz	37.5-40.5 GHz	FSS (s-E)
40.5-42.5 GHz	40.5-42.5 GHz	FSS (s-E)
42.5-43.5 GHz	42.5-43.5 GHz	FSS (E-s)

Note: the 24.25-27.5 GHz ("the 26 GHz band") has been identified as a pioneer band for 5G mm-wave use in Europe.

IMT Case for more spectrum

Based on predictions for a very high growth in demand for mobile traffic

Above 24 GHz:
The availability of wide contiguous bands, which would allow the use of wider bandwidth channels (100–500 MHz or more), and advanced antenna technologies:

- Significantly higher data rates to be delivered in areas of very high MBB traffic density
- Better range and reliability

1-6 GHz bands:
Offers a good mixture of coverage and capacity benefits.
Specifically, **the C-band (3.3-3.8 GHz)** is expected to form the basis of many initial 5G services, which will later on spread into higher frequencies.

FSS Case for Spectrum

Above 24 GHz:

- Traditional applications demand more BW:
  Increased demand for TV services in HD format, and deployment of UHD

- New applications and non-GSO constellations demand higher data rates:
  A shift towards Ka-band, and later to 40 GHz (V-band), is expected

- C and Ku-bands are highly congested, while finding a space in the traditional Ka-band for a new system is also becoming a challenge

C-band:

- Wide coverage
- Favorable propagation characteristics
- Heavily used by satellites with total investments at ~USD 10bn

Satellite applications overview

TV Broadcast

Fixed VSAT

Content Distribution

Governmental Use

Safety services

IP satellite video and hybrid broadcast-broadband

Comms on the move (connected planes, cars, ships, trains)

20cm Flat Panel Antenna

Consumer Broadband

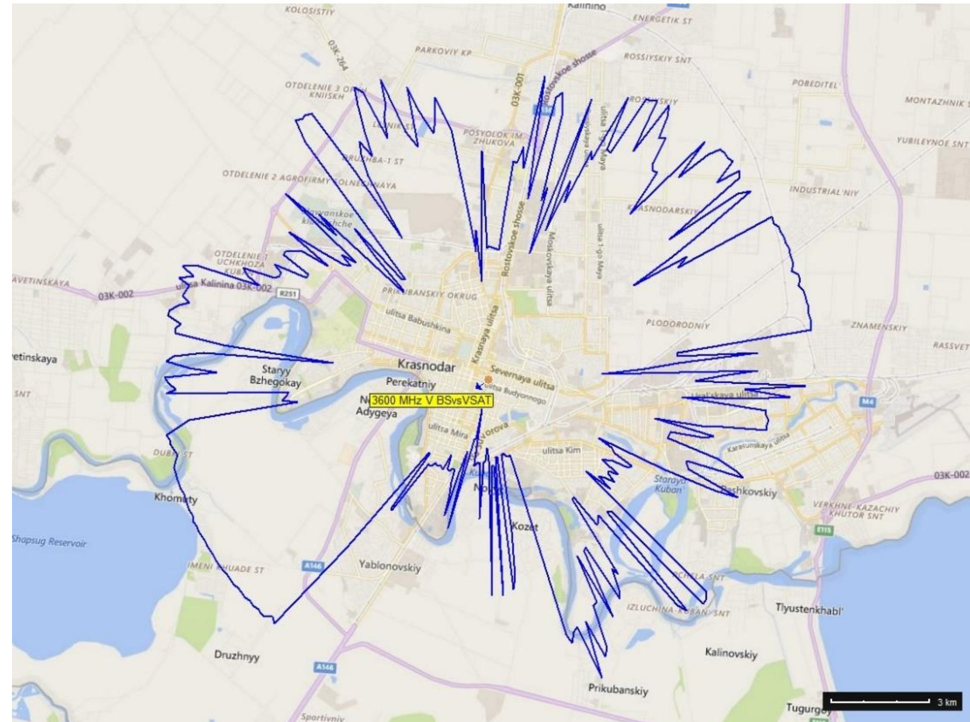
Mobile Backhaul

M2M Communications

IMT vs FSS : C-band sharing scenario

(Possible) 5G BS parameters:
Power: 5W
Carrier BW: 20 MHz
Gain: 5 dBi
Rooftop antenna 2m

FSS ES parameters:
Antenna Gain: 34 dBi
Carrier BW: 1 MHz



5G station is to be located at 1-12 km away from a satellite ES to meet the criteria for compatibility

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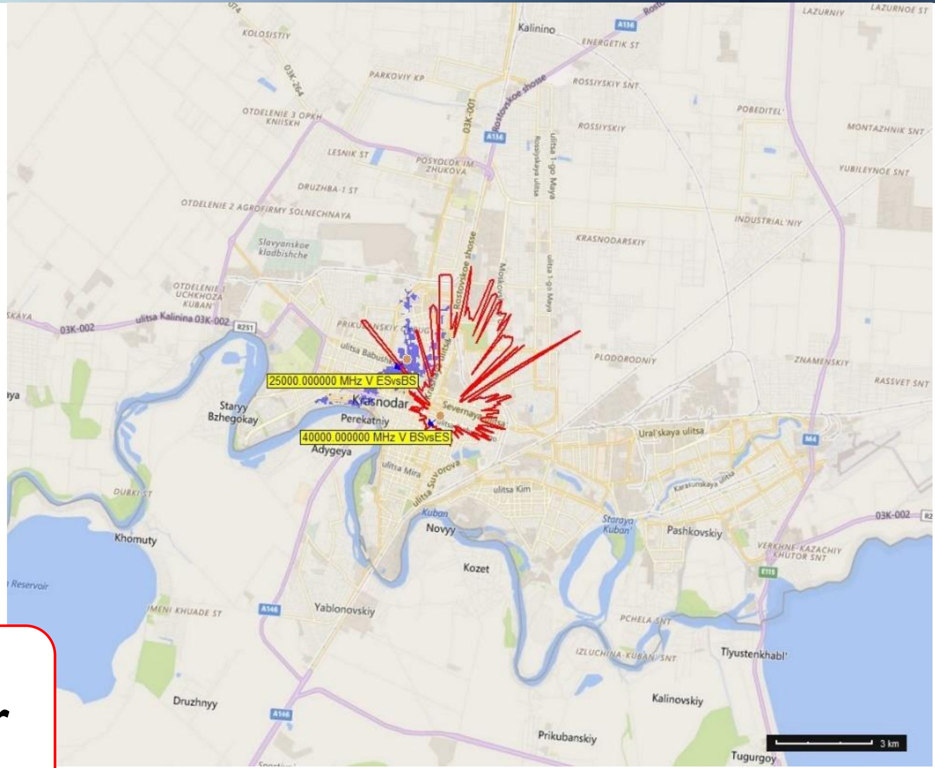
5G vs FSS : mm-wave bands

(Possible) 5G BS parameters:
Power: 5W
Carrier BW: 100 MHz
Gain: 5 dBi
Rooftop antenna 2m

FSS ES parameters:
Antenna Gain: 45 dBi
Carrier BW: 100MHz
Power: 100W



Red contour: 5G BS "restricted" area around FSS ES at 40 GHz → much smaller than in C-band

Blue coverage: Transmitting ES exceeds the compatibility criteria to a 5G BS at 25 GHz

IMT and FSS frequency sharing: a glance into the future

Past experience

- Technical difficulties to implement frequency sharing
- Applications overlap is not significant
- Winner takes it all approach: mobile "attack" and satellite "defend" spectrum

Future of IMT and FSS co-existence:

- Higher frequency bands could be easier to share
- Satellites may be an important part of the 5G ecosystem
- Frequency bands under discussions are relatively free

IMT and FSS frequency sharing: Conclusion

The technical analysis of the FSS vs IMT co-existence is becoming increasingly relevant

The use of appropriate radio engineering tools is mandatory for informed decisions on this case of frequency sharing:

- IMT and FSS features implemented in one tool
- Interface with most updated databases of IMT and FSS and space/earth stations

Спасибо за внимание!