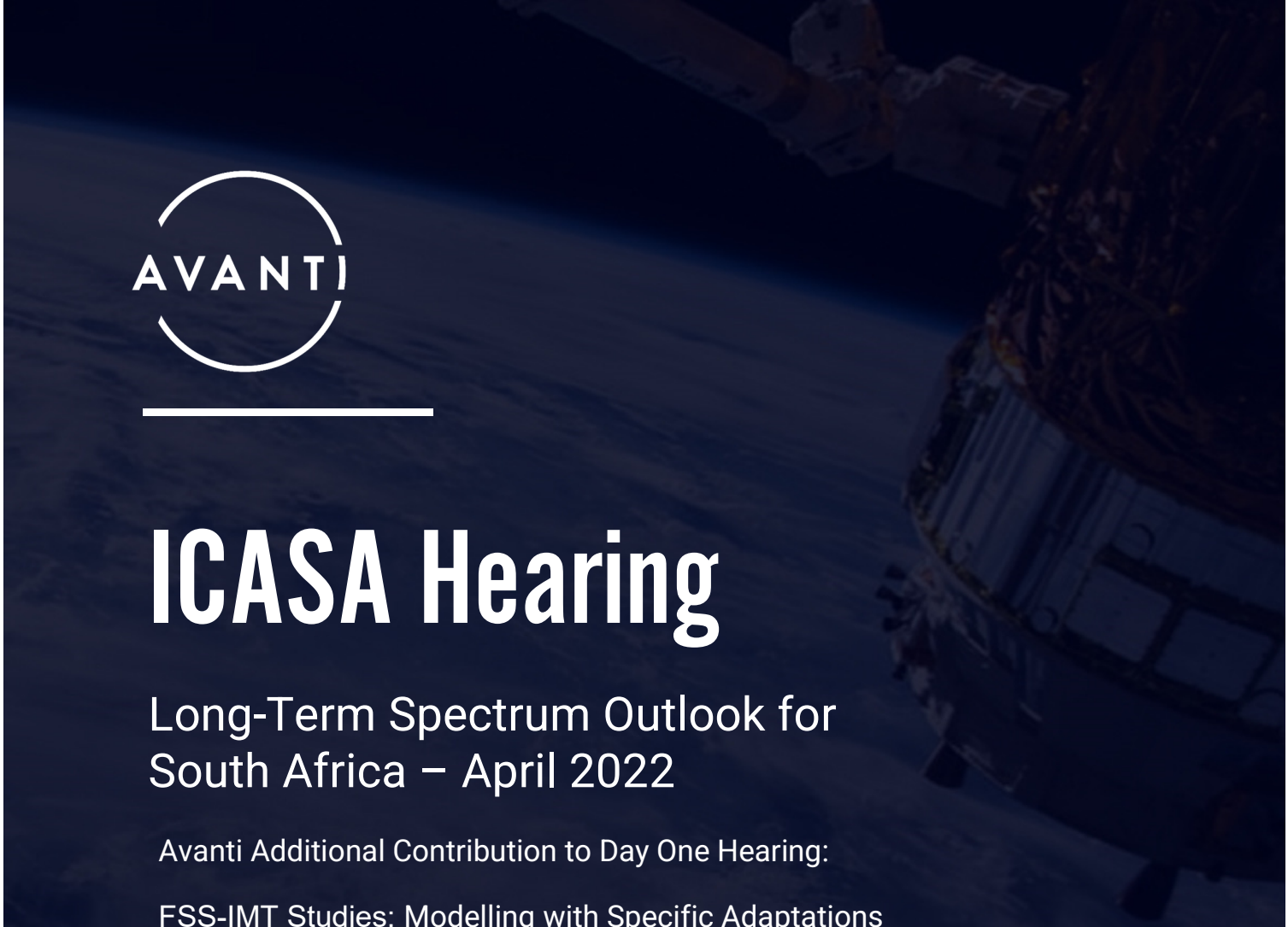


ICASA Hearing

Long-Term Spectrum Outlook for South Africa – April 2022

Avanti Additional Contribution to Day One Hearing:

FSS-IMT Studies: Modelling with Specific Adaptations relevant to the Administration Concerned to Confirm the Conditions for the Protection of Existing and Planned Services

Contents

INTRODUCTION CASE STUDY

Avanti has modelled the cases of reception of transmissions from its space stations by its ground Earth station (GES) in the 3600-4200 MHz band (the 'C-band') in the presence of transmissions from IMT / 5G base stations.

The method used for the modelling follows the approach adopted by Transfinite (https://www.transfinite.com/) and undertaken for the UK Administration (Ofcom), but with specific and relevant national adaptations.

Avanti considers that modelling should be used to inform decision-making, with specific adaptations relevant to the Administration concerned, to confirm the conditions for the protection of existing and planned services.

a) Case Study

As stated above, Avanti has based the study on the case 3 of Transfinite report, which is set out below:

- **Antenna azimuth and elevation**. Low elevation operation in the direction of a proposed IMT network will generate the worst case.
- **Antenna height** above ground level. Generally, this is important because height provides clearance from local shielding (e.g. terrain and clutter). All 5G base stations antennas in the simulation have been modelled assuming they are at the same height AGL.
- **Antenna gain and sidelobe performance**. In practice, the sidelobe gain is important. Even for the lowest elevation angles and for the smallest dishes the interferer will not impact the main lobe. The Earth station antenna is specified as per REC-580. Recommendation ITU-R S580-6 gives a sidelobe gain performance that is independent of peak gain.
- **Link Noise**. Lower noise means that there is a higher I/N for a given value of I.
- **Frequency overlap**. Full frequency overlap between IMT base station transmissions and GES telemetering received signals is assumed.

b) Methodology

The methodology is based on performing an I/N calculation against all carriers in the satellite Earth station link on a grid of points covering the country concerned for both single-entry and aggregate interferences cases.

FURTHER STUDIES

The complexity of the modelling increases significantly when aggregate interference from 5G cellular base stations is considered. This is because the assumptions have to be made for the potential deployment of urban and sub-urban IMT base stations in the absence of real deployment.

SIMULATION PARAMETERS

Earth Station

Parameter	Value	Unit
Antenna diameter		m
Antenna reference pattern		
Antenna efficiency		%
Latitude		deg
Longitude		deg
Frequency		GHz
Bandwidth		kHz
Polarization		
Receive level		dBW
System Noise		K

Table 0-1: Earth Station Parameters

GSO Satellites

Table 0-2: Satellite Locations

IMT Base Station (BS)

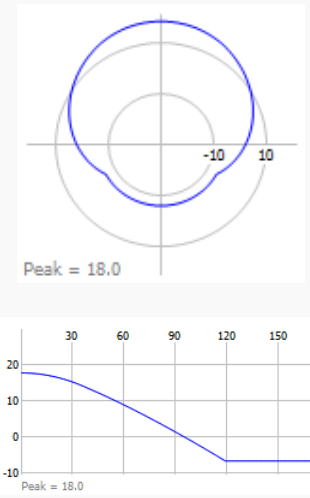
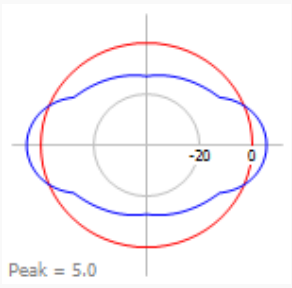
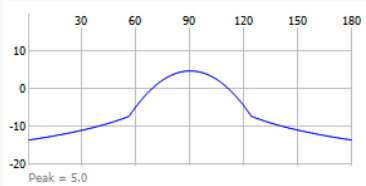
Parameter	Macro Suburban	Small Cell Outdoor	Unit
Antenna Height			m
Sectorization	3-sectors	Single sector	
Down tilt	6	N/A	deg
Antenna Pattern	Rec F-1336 Recs 3-1-1 	Rec F-1336 Recs 2-1  	
Max antenna Gain	18	5	dBi
Antenna Polarization	LHCP	LHCP	
Max Output power	16	-6	dBW

Table 0-3: IMT Base Station Parameters

Propagation Model

The propagation model defined in Recommendation ITU-R P.452-16 is used for Terrestrial Links

Terrain Model

To model the terrain over the country concerned the format used in the simulations is TSL SWBD Merged SRTM-3 V3-0, Format: 3 arc second (90m)

Clutter Model

Clutter model has been added on the propagation model based on:

Clutter type	Nominal Height (m)	Nominal Distance (km)
Orchard	4	0.1

Table 0-4: Clutter Model

Protection Criteria

Based on reference studies, long-term interference tests Based on ITU-R S.1432 are considered in this study.

The protection criteria used in this study was taken from the Radiocommunication Bureau's frequency coordination guidelines and procedures for satellite Earth stations as adopted by the ITU-R. Based on [4] the protection criteria used in this study is expressed as the ratio of interfering signal power to system noise denoted by I/N expressed in decibels and illustrated in Figure 0-1.

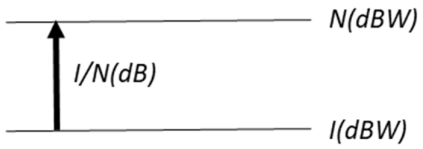


Figure 0-1: Application of Protection Criteria

The study has considered long-term interference tests only. Avanti believes that further study is needed to establish the impact of short-term aggregate interference. The protection criteria used in the simulation work is summarised in Table3-5 below.

Service	Test	Comment
FSS Earth Station	I/N ≤ -12.2dB, 20% time	ΔT/T=6% N:System Noise

Table 0-5: Protection Criteria

REFERENCES

[1] Geographic Sharing in C-Band Final Report Transfinite (https://www.ofcom.org.uk/__data/assets/pdf_file/0012/51303/c-band-sharing.pdf)

[2] WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R S.[UP TO 86 GHZ FSS PROTECTION]: Protection criteria for fixed-satellite service networks operating in frequency below 86 GHz for time-invariant and time-variant interference in the context of sharing studies with other co-primary services

[3] DRAFT NEW REPORT ITU-R [FSS-IMT C-BAND DOWNLINK]: Sharing studies between International Mobile Telecommunication-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands in the WRC study cycle leading to WRC-15

FSS protection criteria, Recommendation ITU-R S.1432-1, WRC-19 agenda items 1.13, 1.14, 1.16: PROTECTION CRITERIA OF SYSTEMS IN THE FIXED-SATELLITE SERVICE

[4] Avanti's baseline parameters for the IMT base stations are extracted from document JTG 4567- 07152 – which is the basis for a Draft New ITU-R Report.