Dutch Authority for Digital Infrastructure
Ministry of Economic Affairs and Climate Policy

Dutch Authority for Digital Infrastructure

For a **safely connected** Netherlands

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28 March 2023

Dynamic Spectrum Management and Sharing (DSMS)

History of Spectrum Management

Increasing demand & possibilities

Sharing is not a new concept

Growing interest in DSMS

Study and Basic concept

Pilot and operational challenges

Future enhancements

History of Spectrum Management

- 1849: first international treaty (on telegraph)
- 1865: first International Telegraph Conference
- 1906: first International Radiotelegraph Conference (maritime driven, Marconi-Telefunken)

Standardisation required (source: itu.int)

"

However, barriers slowed the flow of messages across international borders. For example, in 1852 at the frontier of France and the Grand Duchy of Baden, a common telegraph station was established at Strasbourg. It had two employees, one from each territory. When the French employee received a telegram from Paris, he had to write its text onto a special form and hand it across the table to his colleague, who translated it into German and then sent it again on its way. In addition, sending international messages meant that a plethora of agreements among administrations had to be made on tariffs and technical matters.

"

History of Spectrum Management

- 1932: first general Radio Regulations
- 1938: first international Radiocommunications Conference
- …
- 1987: pan-European mobile (GSM)

GENERAL RADIOCOMMUNICATION REGULATIONS, MADRID, 1932 (Art. 7)

Frequencies kc/s	Wave-lengths m	SERVICES: General allocation	Regional agreements: European Region	Regional agreements: Other Regions
150–160	2,000–1,875	Mobile.		
160–285 (4)	1,875–1,053		160–240 (1,875–1,250) Broadcasting (3). 240–255 (1,250–1,176) (a) not open to public correspondence. (b) Broadcasting (2), (3). 255–265 (1,176–1,132) (a) Aeronautical. (b) Broadcasting (2), (3). 265–285 (1,132–1,053) Aeronautical.	160–194 (1,875–1,546) (a) Fixed. (b) Mobile. 194–285 (1,546–1,053) (a) Aeronautical. (b) Fixed not open to public correspondence. (c) Mobile except commercial ship stations.
			Aeronautical.	Radiobeacons.

17. 7. 87 Official Journal of the European Communities No L 196/85

COUNCIL DIRECTIVE

of 25 June 1987

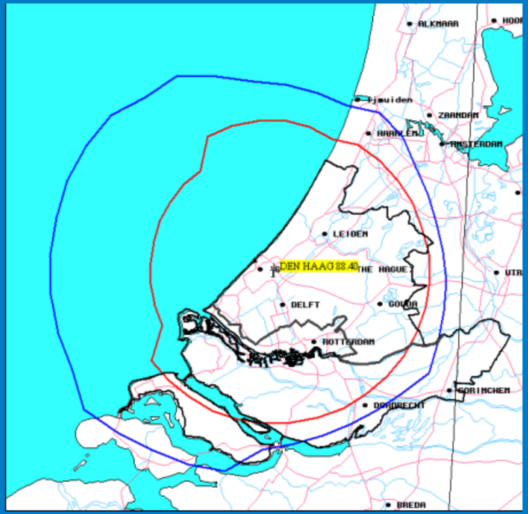
on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community

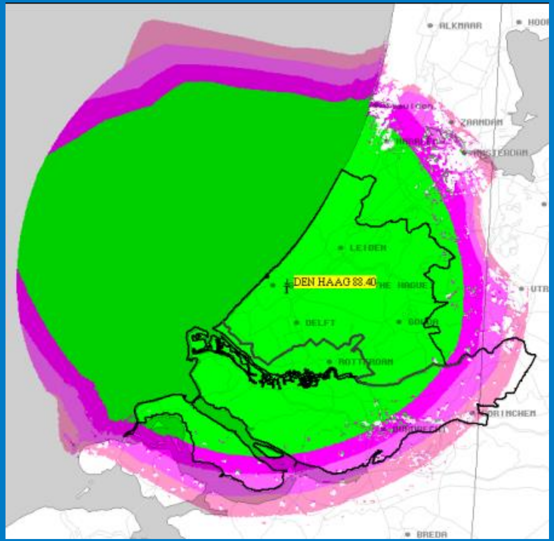
(87/372/EEC)

Increasing demand and possibilities

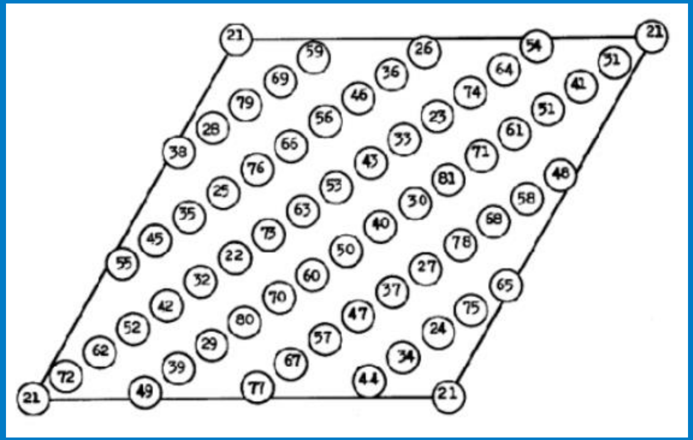
There have been an ever increasing demand for radio spectrum:

- Better semiconductors
- Better modelling possibilities
- Better propagation prediction
- More relevant data (clutter, height)
- More computational power





Sharing is not a new concept



- Sharing possible around 4 axis:
  - Frequency separation
  - Spatial separation
  - Time separation
  - Signal separation
- Intra-system (e.g. use of same broadcast frequency after a certain distance)
- Inter-service (e.g. wireless microphones in between TV service area’s)

Growing interest in DSMS

EUROPEAN COMMISSION
Directorate-General for Communications Networks, Content and Technology

Connectivity
Radio Spectrum Policy Group
RSPG Secretariat

Brussels, 10 February 2021
DG CNECT/B4/RSPG Secretariat

RSPG21-016 FINAL

RADIO SPECTRUM POLICY GROUP

RSPG Report on Spectrum Sharing

A forward-looking survey

EUROPEAN COMMISSION
Directorate-General for Communications Networks, Content and Technology

Connectivity
Radio Spectrum Policy Group
RSPG Secretariat

Brussels, 16 June 2021
DG CNECT/B4/RSPG Secretariat

RSPG21-022 FINAL

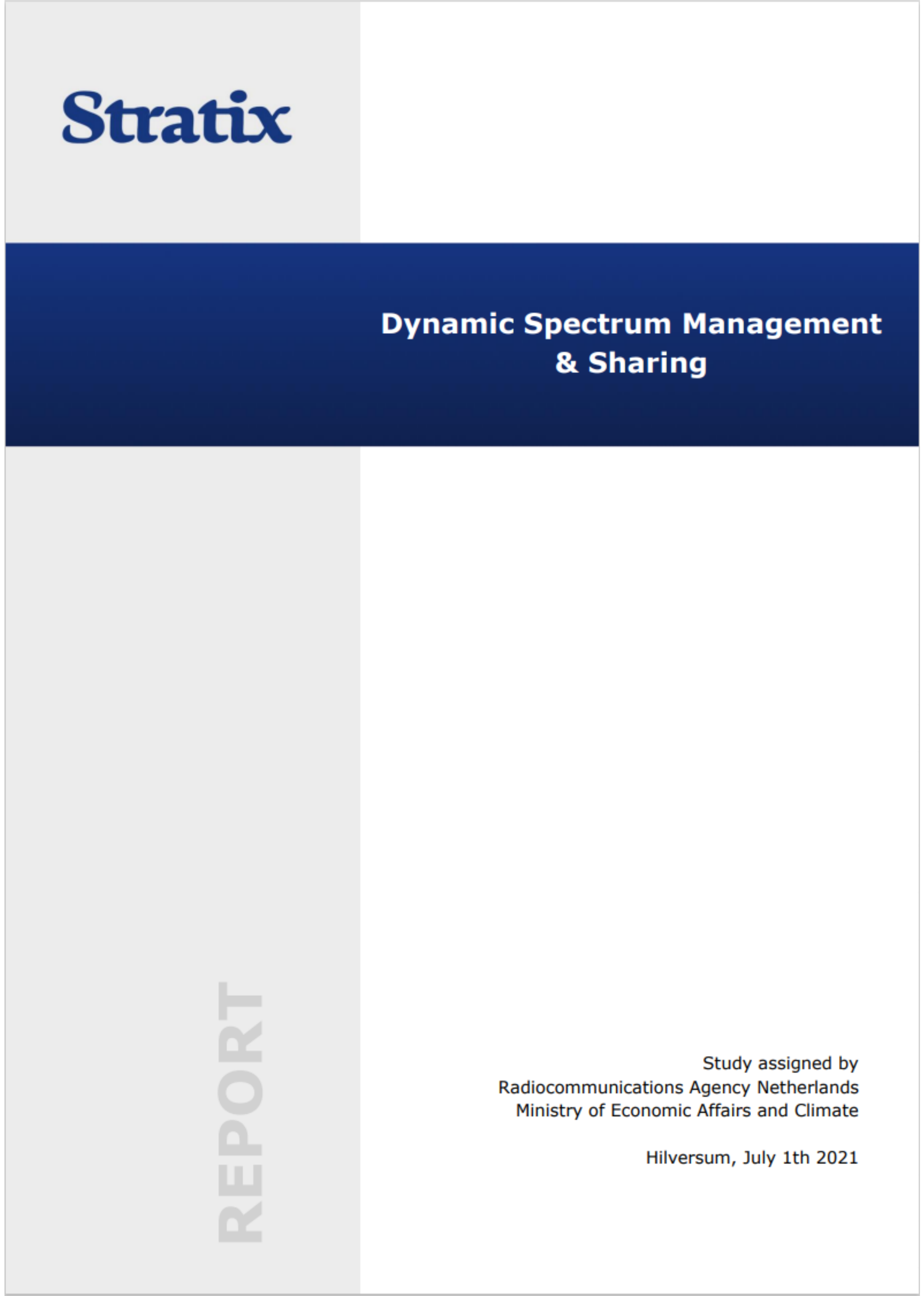
RADIO SPECTRUM POLICY GROUP

RSPG Opinion

on

Spectrum Sharing – Pioneer initiatives and bands

25. Member States are encouraged to support the development of initial "*proof of concept*" systems in bands where advanced spectrum sharing systems, such as cognitive radio systems and other ICT or database assisted systems have been developed at least at the experimental level and are under the control of the regulator, and to devise how those systems can be reused and considered for sharing solutions in other frequency bands.


Stratix

Dynamic Spectrum Management & Sharing

REPORT

Study assigned by
Radiocommunications Agency Netherlands
Ministry of Economic Affairs and Climate

Hilversum, July 1th 2021

Study and basic concept of DSMS

Possible bands:

- UHF
- 3.8-4.2 GHz
- 6 GHz
- 8-12 GHz
- 26 GHz

CEPT mandate on shared use of 3.8 – 4.2 GHz for local/vertical use

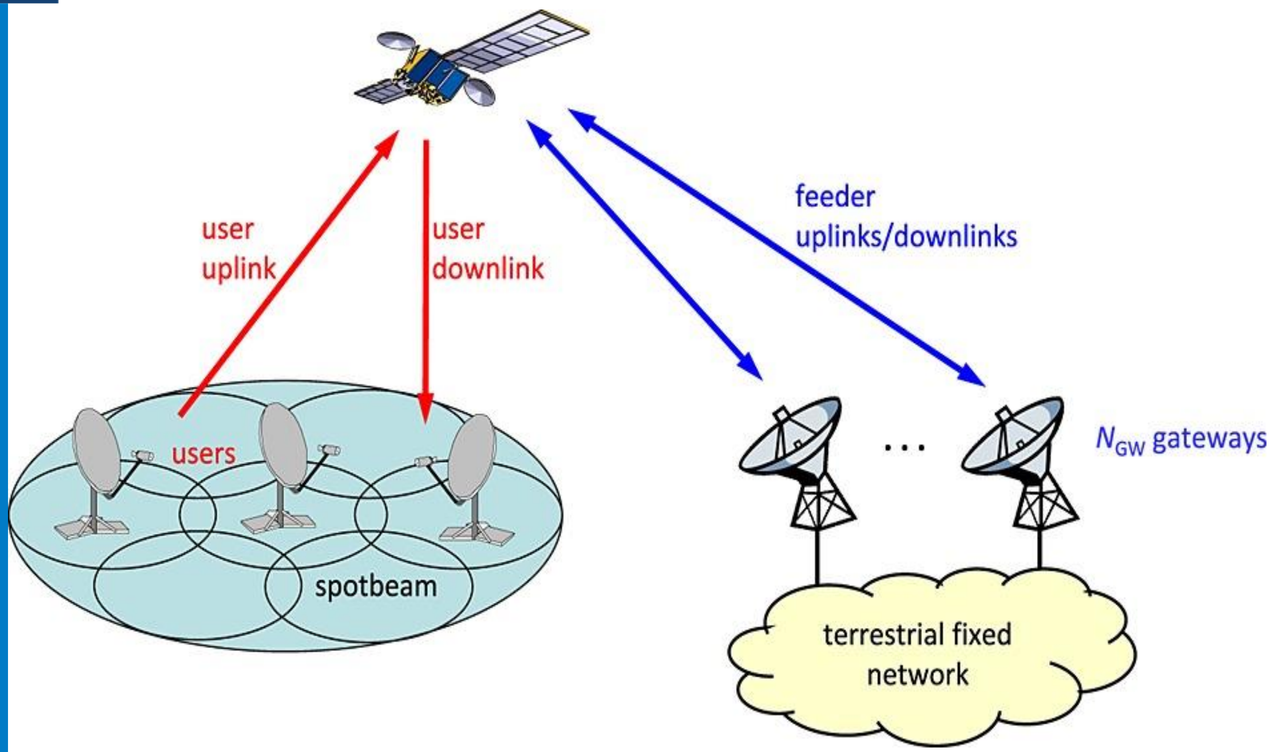
Study and basic concept of DSMS – characteristics

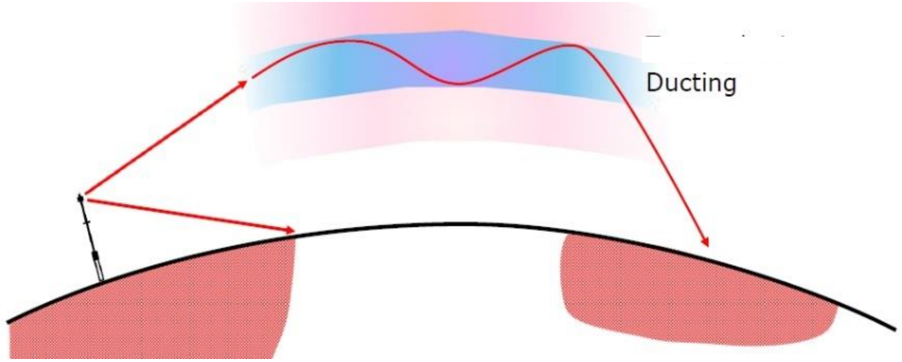
Primary use:

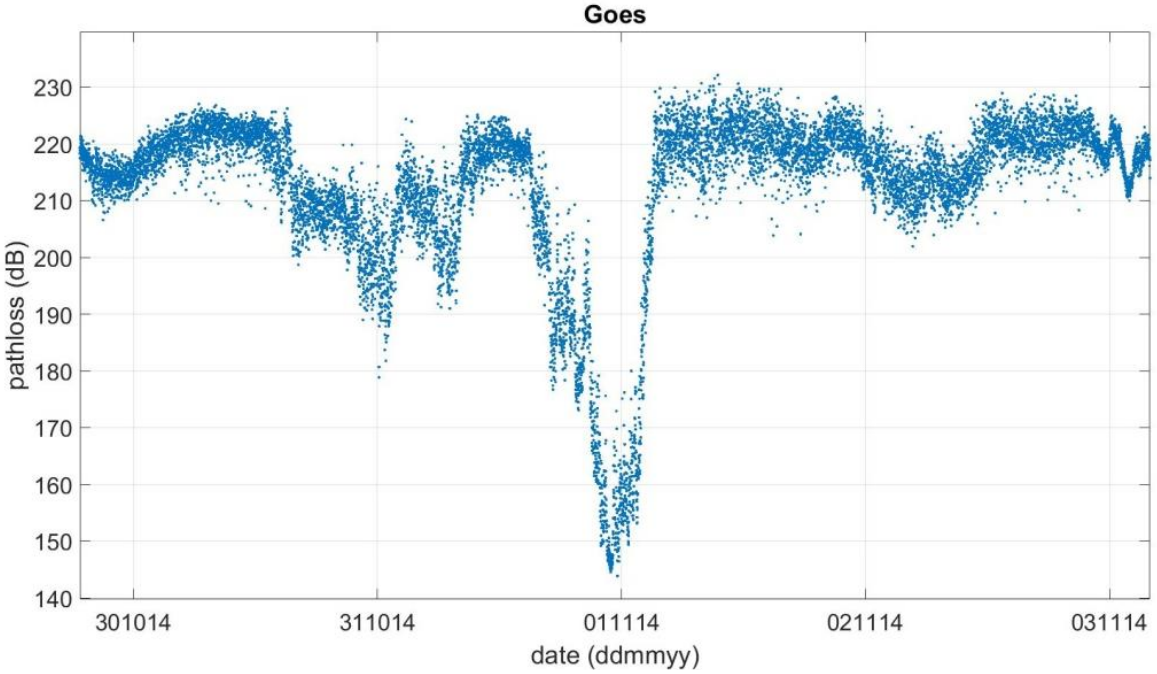
- Fixed satellite reception (FSS)
- Full 400 MHz BW
- 100% of the time
- Protection from interference >99,995%

Particular propagation:

- Ducting
- Path loss decreases with ~60 dB!







Study and basic concept of DSMS – ducting

- Ducting is rare
- not (yet?) predictable

884 IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION, VOL. 66, NO. 2, FEBRUARY 2018

Multiyear Trans-Horizon Radio Propagation Measurements at 3.5 GHz

System Design and Measurement Results Over Land and Wetland Paths in The Netherlands

Loek C. Colussi, Roel Schiphorst, *Member, IEEE*, Herman W. M. Teinsma,
Ben A. Witvliet, *Senior Member, IEEE*, Sjoert R. Fleurke, Mark J. Bentum, *Senior Member, IEEE*,
Erik van Maanen, and Johan Griffioen

Study and basic concept of DSMS – gain

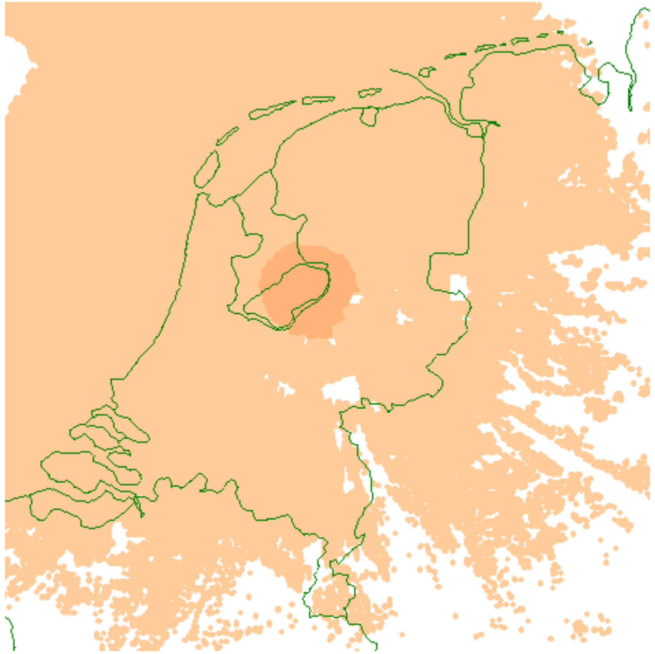
Protection required for >99,995% of the time

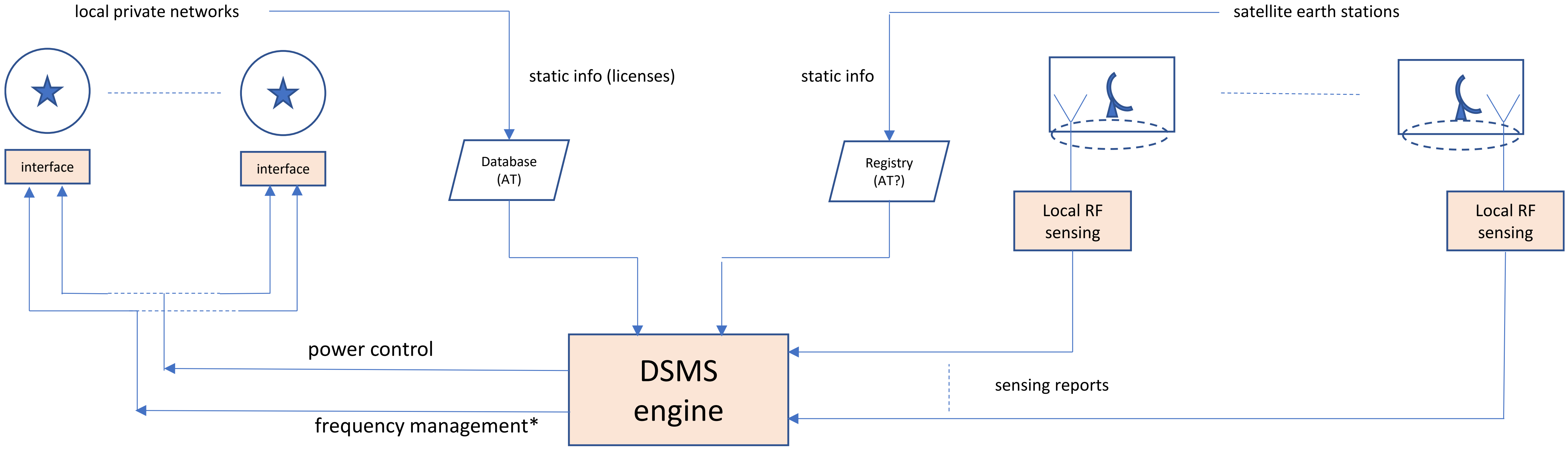
=

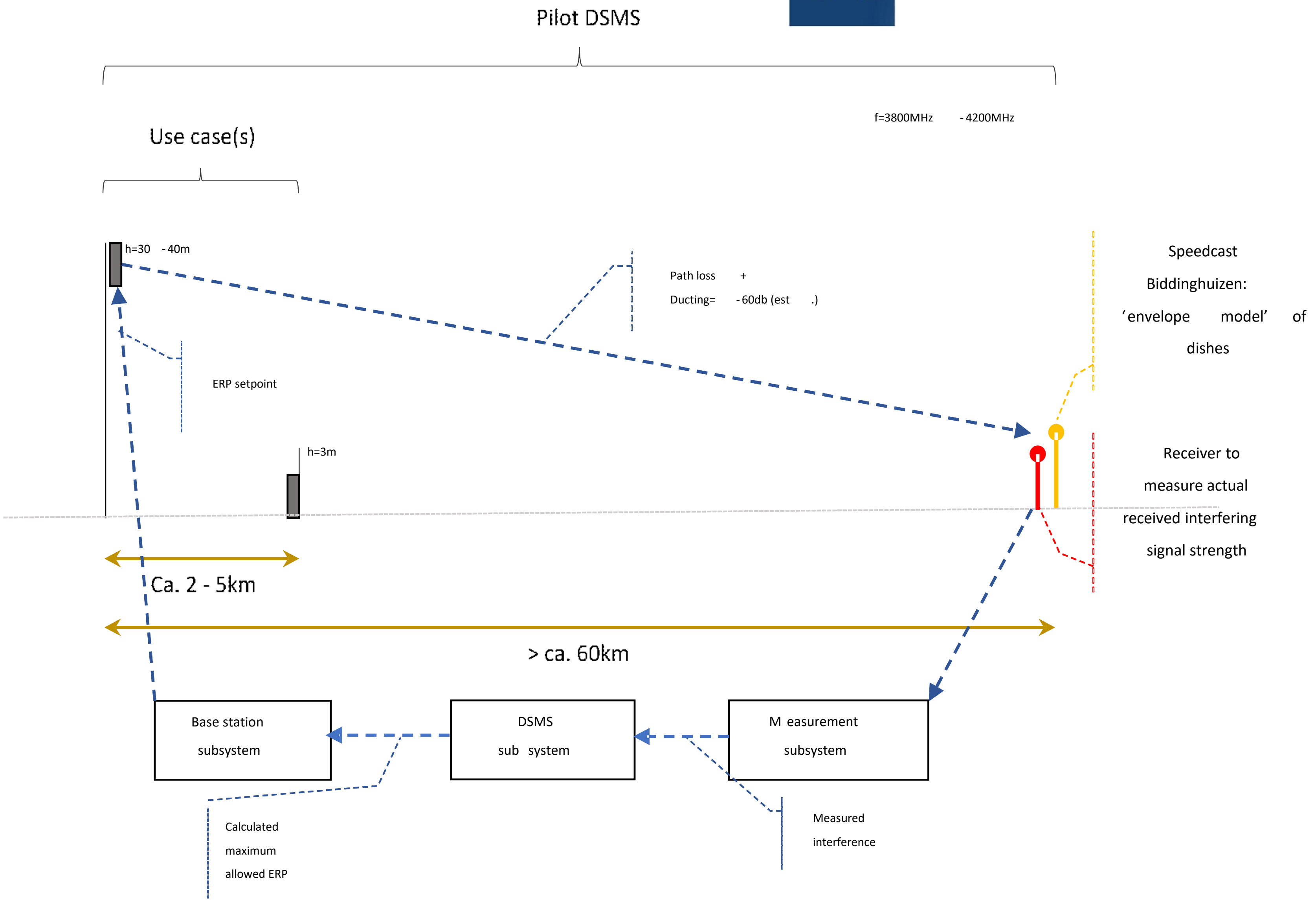
Protection against interference during ducting (= high level of interference = worst case)

But during the rest of the time, interference is much lower

(figures are indicative and only for illustration purposes)




local private networks
satellite earth stations
static info (licenses)
static info
interface
interface
Database
(AT)
Registry
(AT?)
Local RF
sensing
Local RF
sensing
power control
DSMS
engine
sensing reports
frequency management*


Pilot DSMS
Use case(s)
f=3800MHz - 4200MHz
h=30 - 40m
Path loss +
Ducting= - 60db (est .)
Speedcast
Biddinghuizen:
‘envelope model’ of
dishes
ERP setpoint
h=3m
Receiver to
measure actual
received interfering
signal strength
Ca. 2 - 5km
> ca. 60km
Base station
subsystem
DSMS
sub system
M easurement
subsystem
Calculated
maximum
allowed ERP
Measured
interference

simplifications

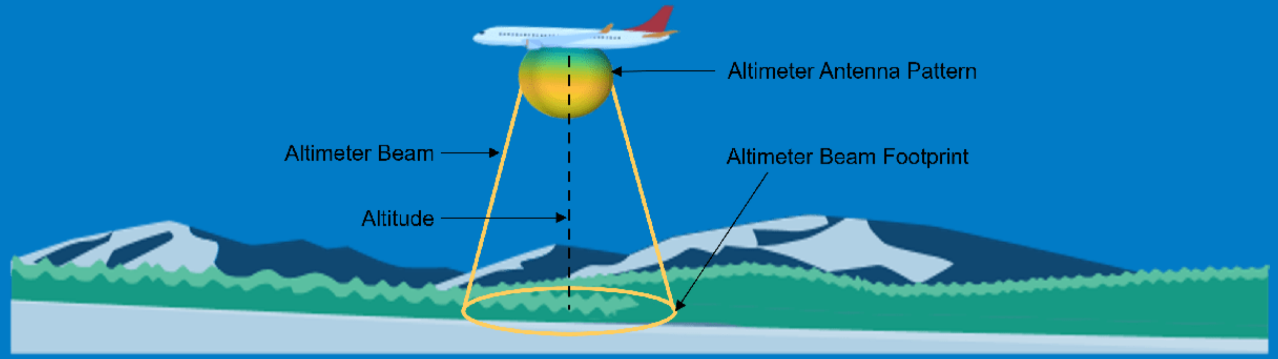
- 1 model of groundstation to be protected
- Assumed full 400 MHz used by this model
- 1 interferer (=private 5G network)
- Power reduction of private 5G network is only way to reduce interference

Pilot

- Cooperation with BTG
- Cooperation with equipment providers
- Discussed several private 5G use cases:
  - Schiphol
  - Port authority Rotterdam

Operational challenges

- Altimeters on board of planes/helicopters (~4.4 GHz)
- Sensing should be very sensitive
- Availability of 3.8 – 4.2 GHz can not be guaranteed: ‘anchor band’ or alternative channel required
- Adjustment of power 5G base station requires time and can not be continuous
- Location
- Equipment
- DSMS engine



Goal of pilot

- Get it to work (technical)
- Learn how the use case behaves when power of private network is changed
- Gather measurement data and analyze behavior
- Building trust

Future additions and enhancements

- Automated frequency assignment of 5G private networks in 3.8 – 4.2 GHz
- Protection of actual FSS dishes (taking direction of dishes into account)
- More directional sensing
- Sensing including ‘fingerprinting’ of 5G interferer
- Adjustment of antenna-patterns of 5G private networks during interference situation (‘nulling’)
- Standardizing interfacing/protocol
- Introducing AI?

Final thoughts

- A ‘system’ will manage frequency assignment: what policies to implement?
- How to deal with request when not enough frequencies are available?
- Who will manage the ‘DSMS engine’ and sensing?
- How to deal with cross-border interference?

Any questions?

For a **safely connected** Netherlands

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