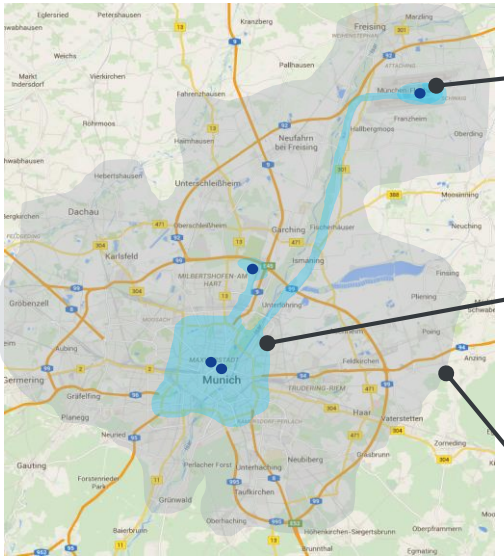
NOKIA

Lisenced Shared Access

Lidia Varukina, Ph.D.
Head of Technology
East Europe Nokia
June 7, 2018

5G SPECTRUM PRINCIPLE VIEW

Coverage of a city in 2020



High Bands
- **26GHz (“mm-Wave”)**
- Airports, Stadiums, Malls,…
- Extreme Bandwidths
- Supports full extreme mobile broadband

Mid Range
- **3.5 GHz (“C-Band”)**
- Dense urban coverage
- Large Bandwidth
- Reusing sites for 1800/2100/2600 MHz

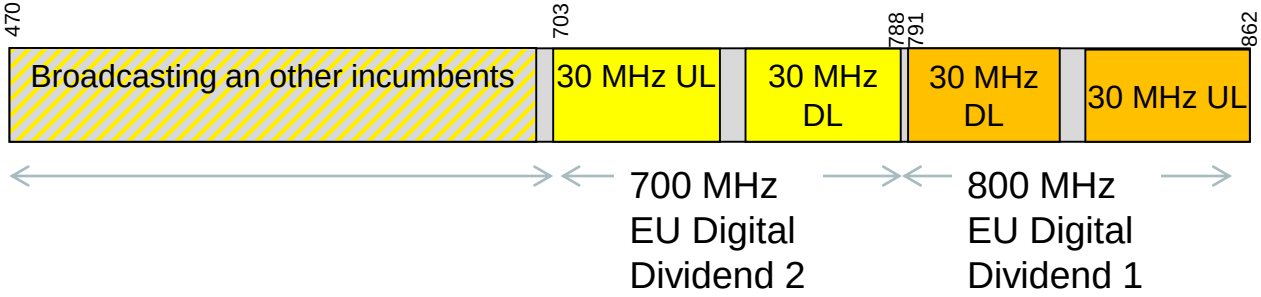
Low Bands
- **700MHz**
- Massive IoT and ultra reliable low latency
- Reusing existing sites for 800/900 MHz

Are 5G pioneer bands available for mobile operators?

NOKIA

UHF (<1 GHZ) SPECTRUM IS GOLDMINE

UHF spectrum is vital for broadband coverage, especially to address digital divide



Are bands 700 MHz, 800 MHz available for mobile operators?

NOKIA

SPECTRUM LICENSING SCHEMES

Mainstream approach

Auctions of Cleared Spectrum

Exclusive use

Guaranteed Quality of Service

Complementary License Model

Licensed Shared Access

Exclusive Shared Use

Exclusive use on a shared and binary basis in Time, Location, and/or Frequency with Incumbent (government, defense...)

Predictable Quality of Service

Shared Approach Unlicensed

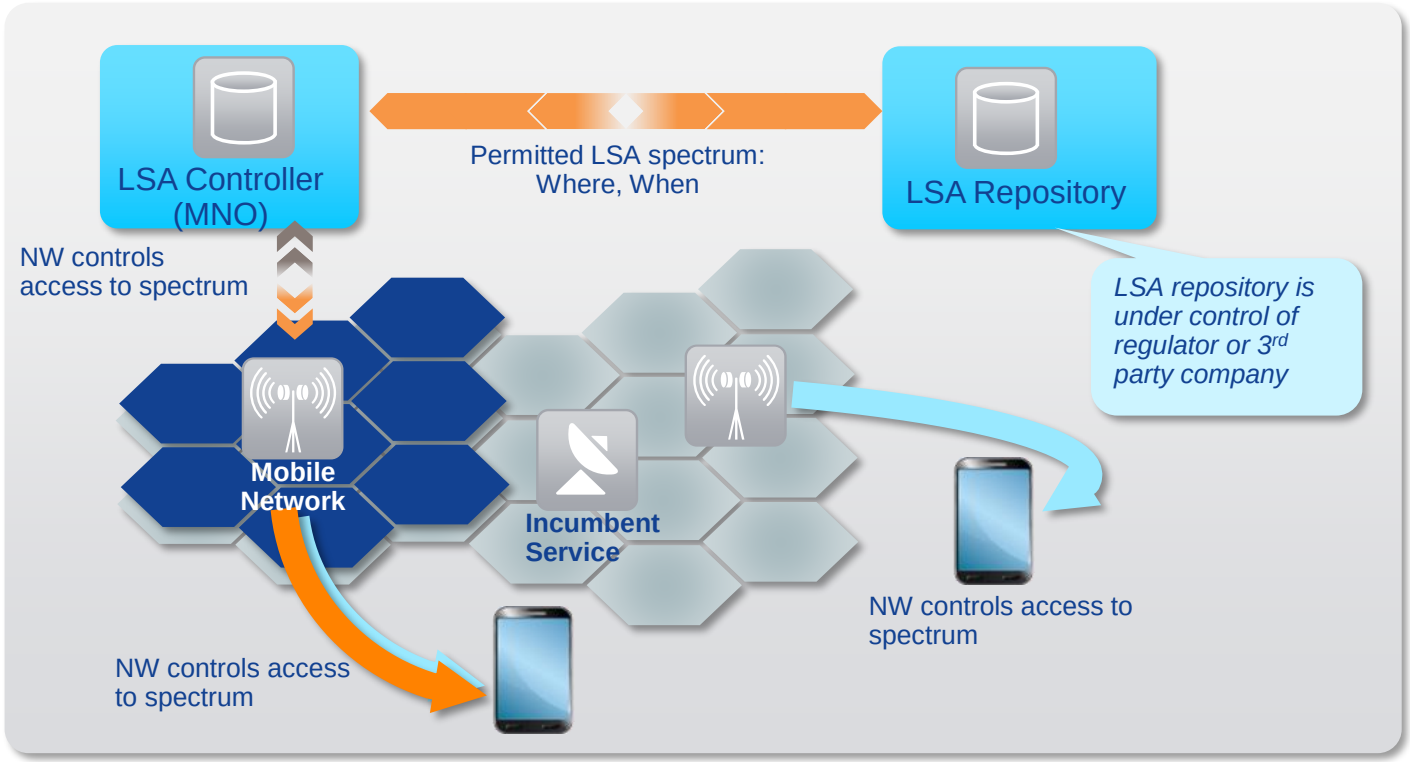
e.g. Wi-Fi spectrum

Shared Use

Unpredictable Quality of Service

NOKIA

LICENSED SHARED ACCESS (LSA)



- Spectrum sharing agreement between different systems under permission/ control of the Regulator

- ETSI standardized

NOKIA

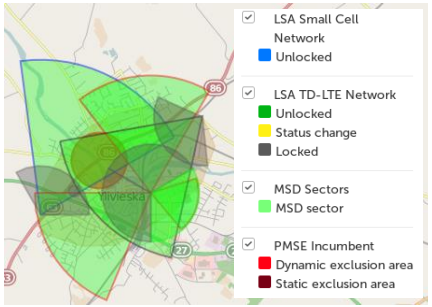
LSA SYSTEM VALIDATED ON THE COMMERCIAL NETWORKS

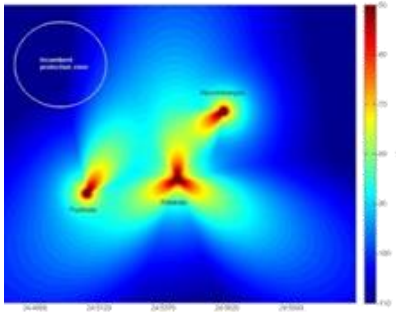
Self Organized Network (SON) algorithms facilitate spectrum control and LSA implementation

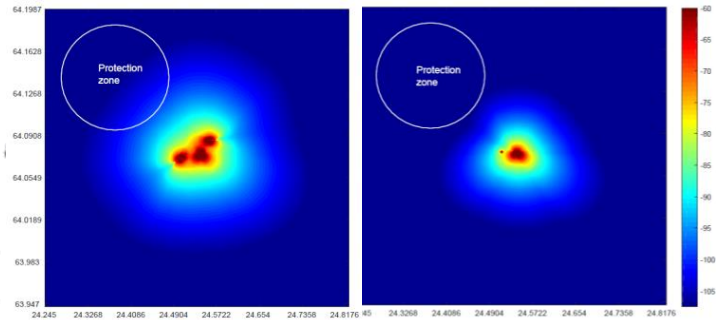
Minimum Separation distance

Protection Zone Optimization

Aggregated Power Control algorithm







Coverage layer - on

LSA 2.3 GHz cell - on

Deactivated LSA cell

Reconfigured LSA cell

Restriction Zone (RZ)

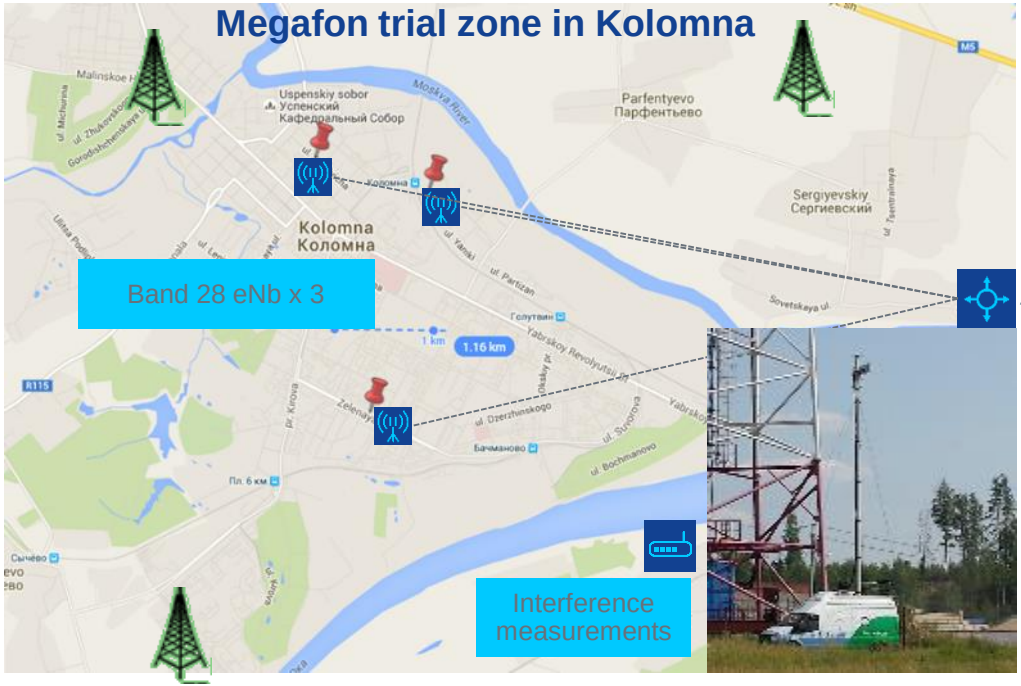
Minimum separation distance (MSD)

S. Yrjölä et al., "Field trial of LSA with enhanced spectrum controller power control algorithms and LTE enablers," Springer JSPS, pp.1–14, 2016.

NOKIA

FIELD TRIAL OF LICENSED SHARED ACCESS IN RUSSIA

Moscow region, June 2016



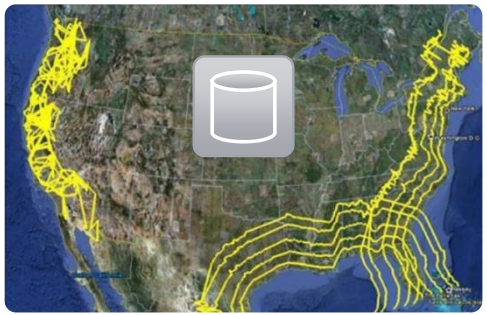
- Trial in the frame of Cognitive Radio Study, ruled by the State Radio Frequency Comission
- Proved compatibility and hybrid usage of band 700 MHz by broadcasting and MBB

http://www.cnews.ru/news/line/2016-07-07_megafonnokia_i_niir_sdelali_eshche_odin_shag_v

МегаФон НИИР NOKIA

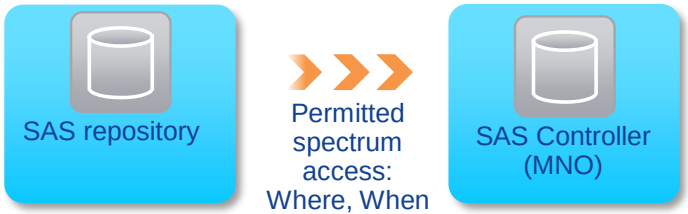
EXAMPLE OF SPECTRUM SHARING

Spectrum Access System (SAS) for navy radars and MBB at 3.5 GHz

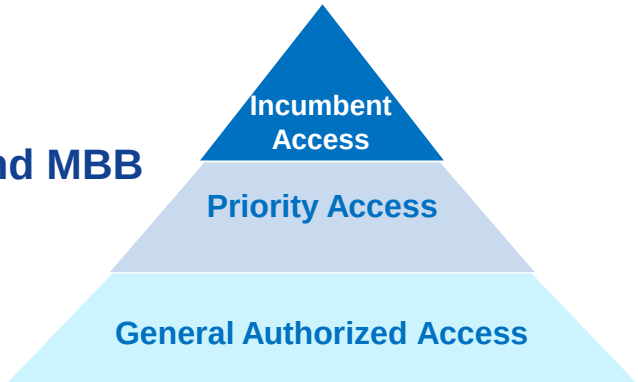


NTIA Report

Exclusion zones for wireless access 3550 – 3650 GHz



3-tier licenses for radars and MBB



- TD-LTE 3,5 GHz
- Dynamic spectrum access:
  - Sensor network;
  - Interference and spectrum utilization data at SAS repository

SAS: Spectrum Access System
CBRS: Citizens Broadband Radio Service

NOKIA

LICENSED SHARED ACCESS (LSA) ADVANTAGES

LSA can speed up access to new spectrum bands, as most of the bands identified for mobile broadband are in use by incumbents

LSA can speed up 5G allocations as wide contiguous bandwidth spectrum bands are needed

LSA is frequency agnostic

LSA can address digital divide via UHF spectrum sharing between mobile broadband and incumbents


NOKIA