ADAPTIVE ANTENNA OF NEW TYPE FOR MOBILE NETWORKS

GEOSCAN Technologies

in cooperation with

MTS [MTS](#) (Russian mobile operator)

NC **NeuroConnex** (Denkendorf, Germany)

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FINLANDING

PROGRAM FOR HI-TECH COMPANIES TO ENTER THE FINISH MARKET

MINISTRY OF ECONOMY AND LABOUR OF FINLAND

Open Joint Stock Company "Design Bureau "LUCH"

Open Joint Stock Company
"Design Bureau "LUCH"
was founded in 1963

Products:
- Microwave equipment
- Phased array antennas
- Antenna-feeder equipment

Deliveries to:
Russia, Ukraine, Moldova, Belarus, and other countries

Anti-missile radar "Volga", 2002

Radar "Vostok-E", 2006

Background

Russian design bureaus spend a lot of money to design military production. Sometimes the development consists of tens or hundreds R&D projects. But usually we do not think how to commercialize this huge and unique experience.

This project is such an attempt to develop commercial product based on this experience.

Product

"I really liked this technique and would love to see in practice how much is improved."
John Glossner,
General Program Chair,
Wireless Innovation Conference SDR'11,
Washington, DC

GEOSCAN Technologies in cooperation with MTS (Russian mobile operator) and NeuroConnex (Denkendorf, Germany) offers adaptive antenna of new type for base stations for cellular mobile networks.

Technology

Multiantenna system with spatial signal processing

The antenna system does not use beams for the space division. The antenna elements receive signals from all directions and a special mathematical algorithm selects desired signals with the best signal-to-noise ratio. Such technology is more efficient than the conventional beam forming or multipath MIMO.

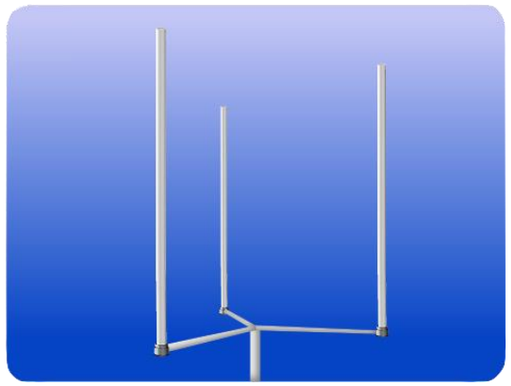
Antenna can be designed to operate in any existing network – GSM, 3G standards, LTE, Wi-MAX, Wi-Fi and in networks used MIMO.

Details in short video presentation (4 min): geoscan.org/beam-free/#videopresentation
Further information: geoscan.org/beam-free

The main advantage

✓ **Increase in the network capacity**

Antenna provides a few uplink and downlink simultaneous streams over the same frequency channel without transmission speed reducing (for example, 6-element antenna provides up to 6 simultaneous full speed streams).



3 ELEMENTS

= 3×

6 ELEMENTS

= 6×

Other advantages

- ✓ **Higher communication quality**

- ✓ **Extended coverage area**
  Extended coverage reduces the number of the base stations resulting in the lower capital and operating expenses, and higher profitability.

- ✓ **Substantial increase in the efficiency of frequency resource utilization**

Our customers / Monetization

Our customers:

- Mobile operators
- Companies are building mobile networks
- Distributors of telecommunication equipment

(at present we have an official agreement with Russian mobile operator MTS about testing our antenna and confirmation that in case of successful testing MTS is going to buy pilot batch; Russian mobile operator Beeline (VimpelCom) expressed interest to use our antennas in sparsely populated regions; Germany company NeuroConnex is taking part in this project as co-investor and R&D partner; some other companies (Etisalat, Scartel (Yota), Cisco) expressed intention to test the antenna – refer to slide 21)

Monetization:

We are going to produce equipment and sell it directly and through distributers to mobile operators and companies building mobile networks.

Why do customers need our product?

Thus in case of using proposed antenna it is necessary 2-5 times fewer base stations to cover the same area.

- ✓ **The cost** of the network based on the proposed antenna **is 2-4 times lower** in comparison with the network based on the traditional antennas. **Operating expenses decrease up to 50-70%**.

- ✓ In case of modernizing an existing network (without adding new base stations) **the network capacity** (total data rate) **increases several times** (magnification depends on number of antenna elements) **and quality of service is substantially getting higher**. **It allows to attract new customers and provides competitive advantage.**

Awards and Recognition

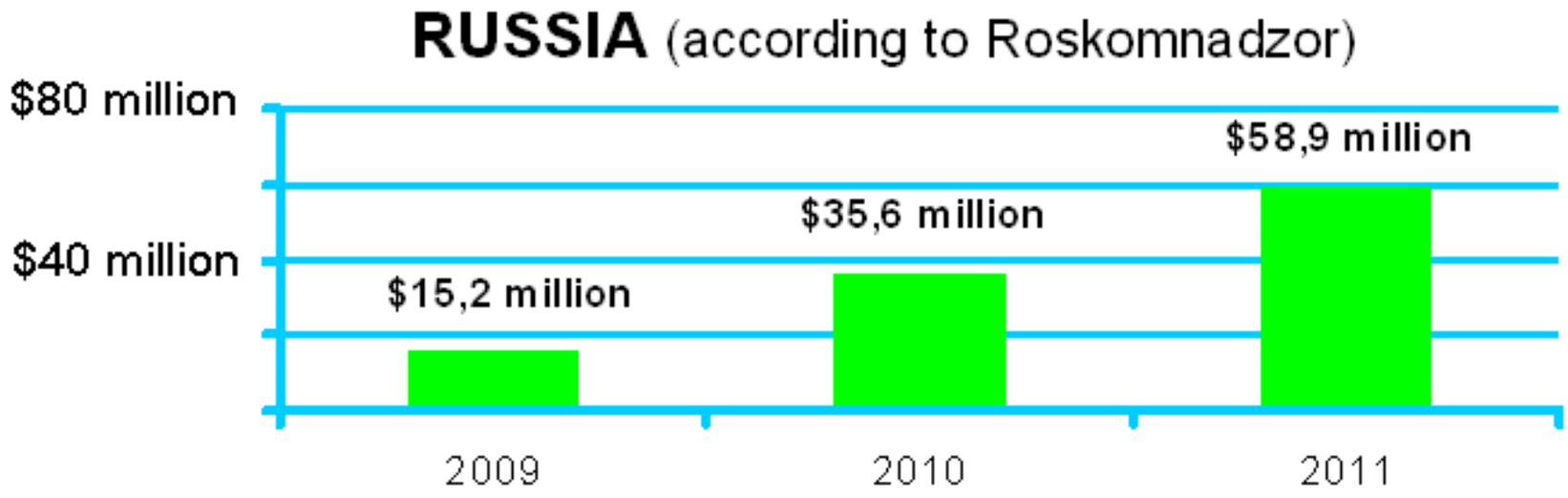
Technology

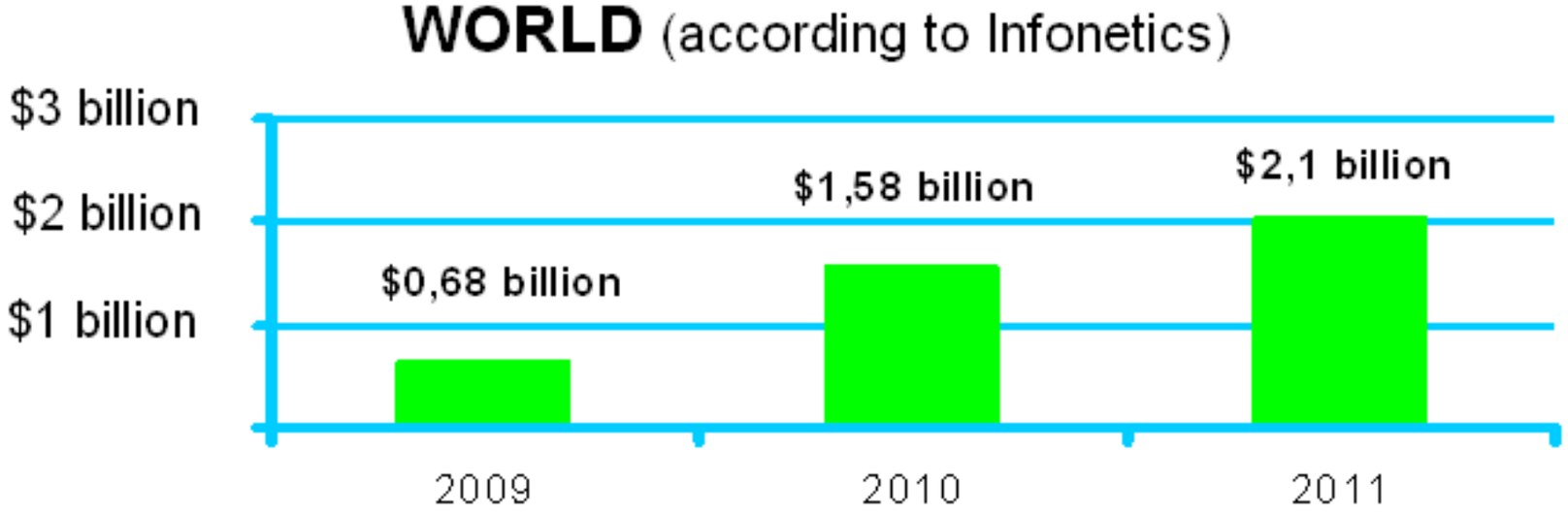
- Asia-Pacific Radio Science Conference (AP-RASC'10, Japan), YS Award
- Mathematical Methods in Electromagnetic Theory (MMET*10, Ukraine), 3rd Prize at the Best Paper Competition
- Wireless Innovation Conference (SDR'11-WInnComm, USA), General Program Chair John Glossner review: "I really liked this technique and would love to see in practice how much is improved."

Project

- Winner of *Finlanding* program organized by the Finnish Ministry of Economy and Labour in frame of a project MOCT (2014)
- Winner of Higher School of Economics competitions "*Open competitions of innovation projects*"
- "*Telecom Ideas*", 1st Prize
- Moscow government support (Department of Science, Industrial Policy and Entrepreneurship)

Market volume





Potential market

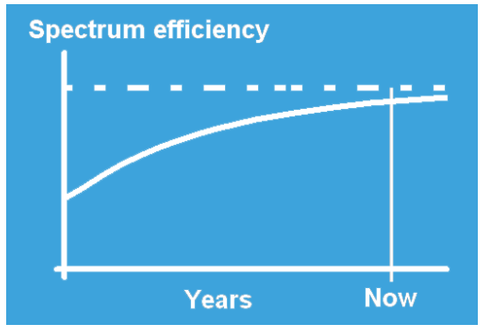
It shows that market volume is quite big and enough to compensate project risk-weighted expenses.

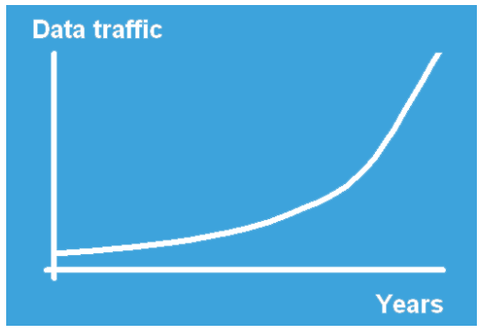
But the potential market is more important!

Why?

Customer’s problem

- Up-to-date telecommunication equipment provides spectrum efficiency close to Shannon Limit.
  (It means: in limited frequency range data speed is close to the maximum theoretical limit.)
- Frequency spectrum is limited.
- But data traffic grows exponentially every year.





How to increase data speed in wireless communication to meet exponentially increasing data traffic needs if now data speed is close to the theoretical limit and the frequency spectrum is limited too?

- Cognitive radio? – Network capacity (data rate) increasing is strongly limited too.
- Millimeter wave frequencies (e.g. 60-80 GHz)? – High signal attenuation; only line-of-sight; not possible to use outdoor in urban areas.
- Shortening distance between base stations to 100-200m? – Very expensive.
- Etc…

Customer’s problem

How to meet exponentially increasing data traffic needs in wireless communication if modern modulation and coding schemes are close to the theoretical limit and the frequency spectrum is limited?

At present only methods of spatial signal processing can solve this problem over the long-term.

These methods increase network capacity (total data rate) proportionally to number of antenna element (antenna can consist of 5, 20, 50, ... elements).

It is expected that during the next 10-20 years the spatial signal processing methods will be one of the main technologies providing data speed growth in wireless networks. During this period the technology will be highly demanded in market.

* Conventional (multipath) MIMO is not able to satisfy the exponentially increasing data traffic needs because limited by number of "good paths". In the real-life environment the number of "good paths" usually is not more than 3.

Project strategy

2 STAGES :

1st stage: ADAPTIVE ANTENNA OF NEW TYPE FOR MOBILE NETWORKS
(antenna based on spatial signal processing method – see slide 4)

2nd stage: Focus on designing spatial signal processing antennas/systems for various wireless communication systems.

Why did nobody do it before?

- **It was very expensive**

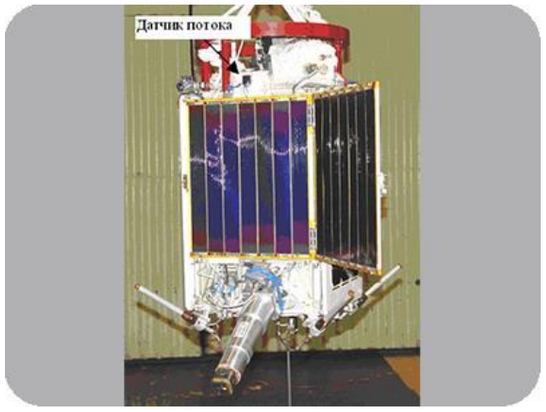
Phased array antennas used in army for a few tens years (in Soviet Union from 196x). But it was very expensive (e.g. military radar cost millions and tens millions dollars). Due to developing digital signal processing components the cost goes down. Phased arrays (systems with spatial signal processing) had become available for commercial application just 2-3 years ago.

- **It was not needed**

For example 10 years ago the mobile networks mostly used for voce calls and there was no problem of data speed shortage. The problem had arisen after wide use of data communication through 3G mobile networks. At firstly it was solving by conventional methods – using more efficient modulation and coding schemes, adding new frequency ranges and so on. But just now all these methods are close to limit.

Why our company?

- ✓ We are not needed to develop from zero. The project is based on our previous R&D projects.
- ✓ Our engineers have strong knowledge and big experience in these fields.
- ✓ Since Soviet Union such areas as phased array antennas, radio wave propagation, multipath propagation, spatial signal processing are strongly developed in Russia.



What do we expect in EU?

- **R&D partner.**
- **Co-investment possibilities.**
- **Partner to promote the project in Europe.**

What do we expect in Finland?

- Specialists with the real experience of promoting telecommunication equipment for mobile networks.
- Former Nokia’s staff members.
- Ex Nokia's production infrastructure.

Finance indicators

Payback period: 2.8 years

NPV (4 years): $0.9 million

IRR (4 years): 120%

Financial model and other financial information – under request.

Team

Project manager: Igor Sergeev

LinkedIn: http://www.linkedin.com/pub/igor-sergeev/39/a9/588

Our company has all necessary high qualified specialists.
For information visit http://geoscan.org/persons.htm

Agreements with potential customers

- Russian mobile operator MTS offered to test proposed antenna and buy pilot batch in case of successful testing (official agreement, confirmation note).

- Germany company NeuroConnex is taking part in this project as co-investor and is going to promote project product trough its partners (official agreement, confirmation note).

- Russian mobile operator Beeline (VimpelCom) expressed interest to use our antennas in sparsely populated regions.

- Some other companies (Etisalat, Scartel (Yota), Cisco) expressed intention to test the antenna.

Further information

Project page: geoscan.org/beam-free

Short video presentation: http://geoscan.org/beam-free/#videopresentation

Comparison with the conventional panel (sectorial) and multibeam antennas: http://geoscan.org/beam-free/files/beam-free_ursi.pdf