

On Development of Recommendations for estimation of electromagnetic environment and interference environment in GNSS frequency bands

Outline proposal on the Recommendations Content

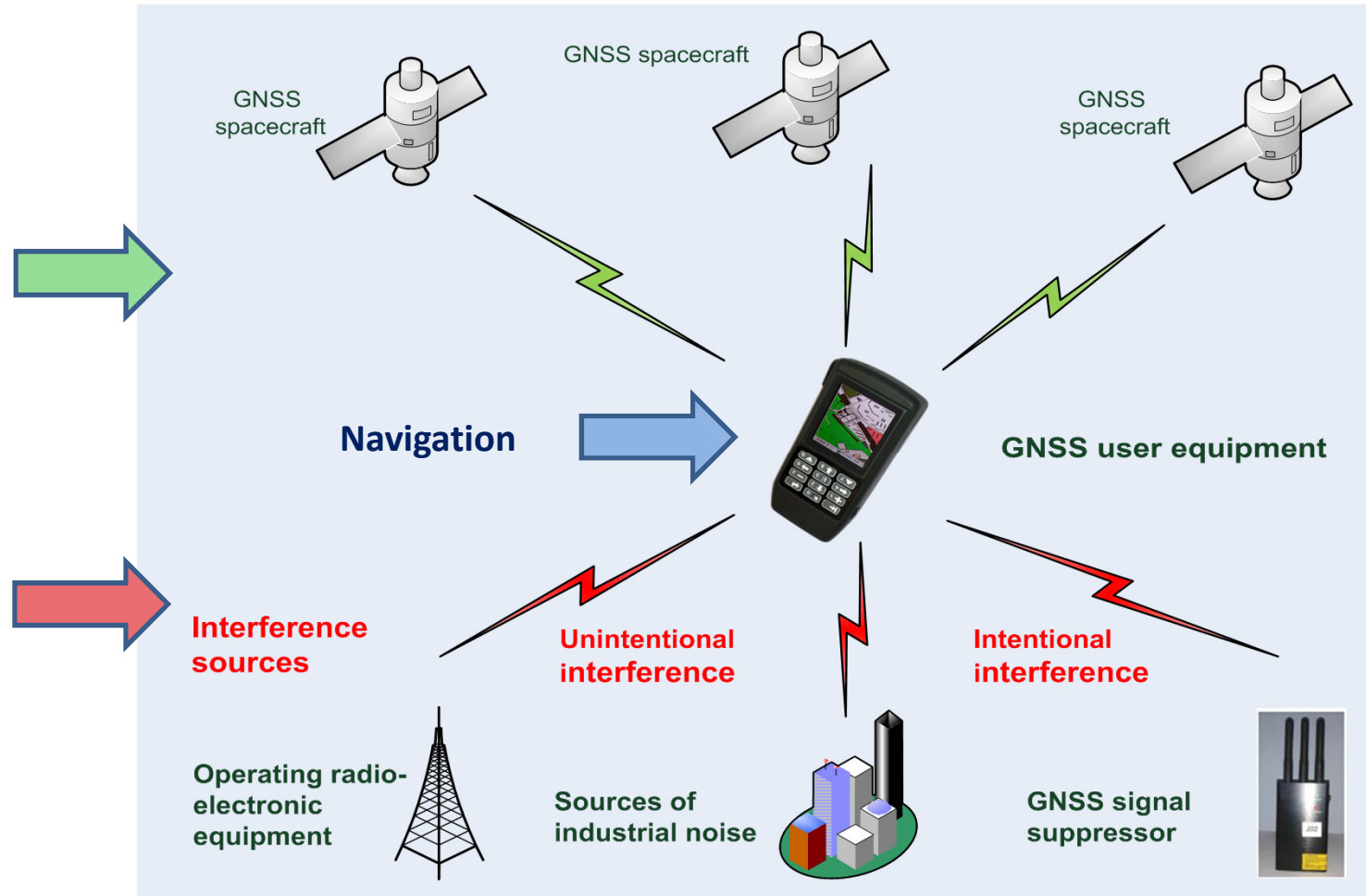
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Navigation management conditions. Aggregated emissions at the input of receiving antenna of GNSS user equipment

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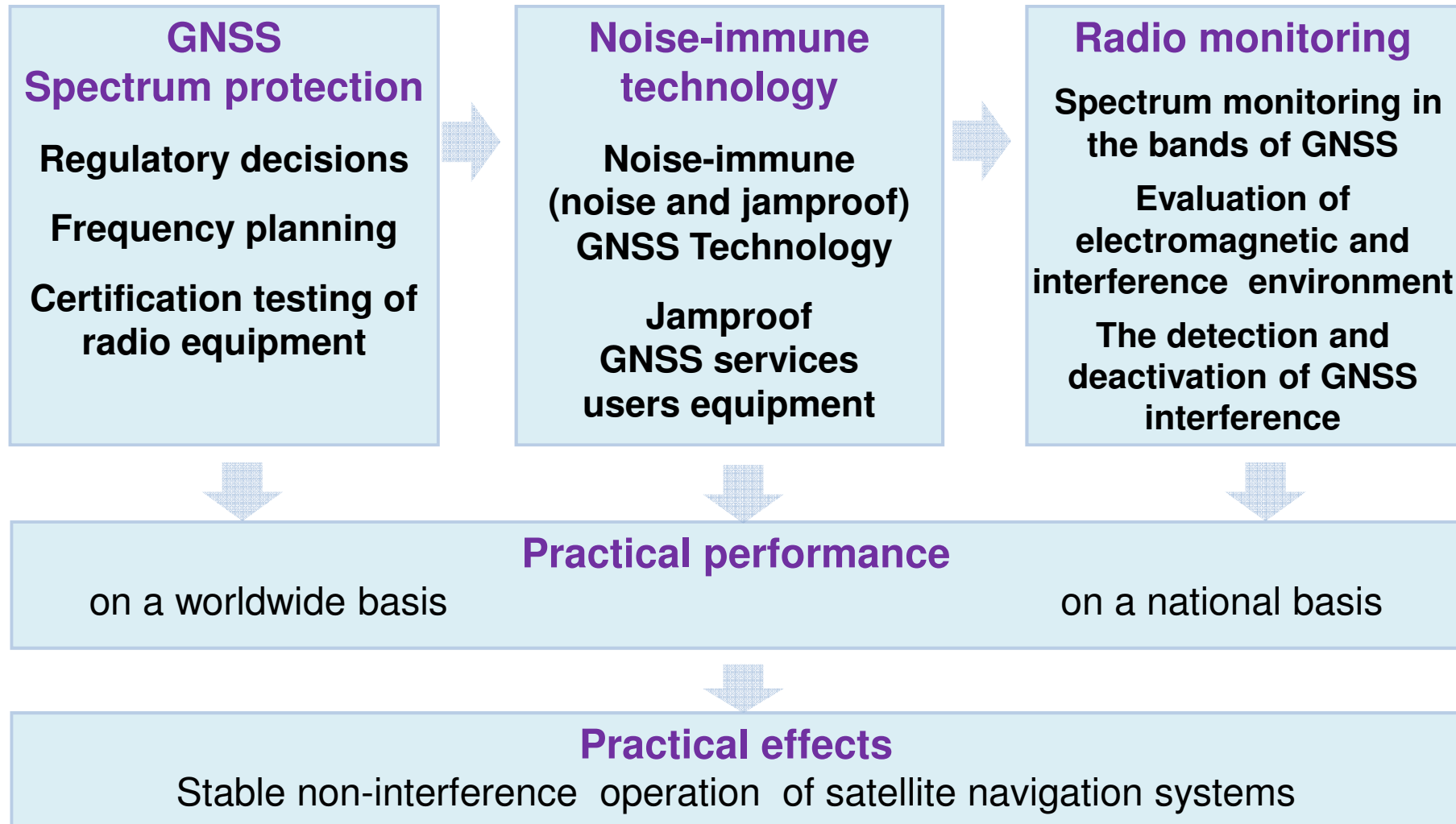
Desired signals

Negative impact



Maintaining of non-interference operation of satellite navigation systems

includes:



High level of electromagnetic background noise and interference in the GNSS frequency bands are the causes of the failure of satellite navigation systems

In this regard, the actual task of developing specific recommendations for conducting radio monitoring for the purposes of estimation of electromagnetic environment and interference environment in GNSS frequency bands

Next are suggestions for the structure of such recommendations

Section 1.

Goals and tasks of Evaluation of electromagnetic and interference environment in the interests of GNSS

Goals:

Supporting stable non-interference operation of GNSS and GNSS users equipment

Tasks:

Performance control and monitoring of proper (required) conditions for the distribution and reception of GNSS signals

Section 2.

Spectrum protection.

The conditions of electromagnetic compatibility and without interference work of GNSS

In this Section is proposed:

2.1 Recommendations in the area of international cooperation

*International coordination in the protection of GNSS
spectrum.*

*Ensuring without interference work of GNSS and users of
GNSS services*

Recommendations for cooperation in this area

2.2 Recommendations at the national level

Section 2. Spectrum protection.

The conditions of electromagnetic compatibility and without interference work of GNSS

2.2 Recommendations at the national level have to offer:

- *the determination of the authorized organizations in the field of electromagnetic environment estimation and of interference environment estimation in GNSS frequency Bands;*
- *technological access of the authorized organizations to the databases of frequency planning and the permits to use of radio frequencies;*
- *certification tests of equipment of consumers of GNSS services for resistance to electromagnetic noise and interfering influences;*
- *the establishment of the maximum permissible background noise levels and levels of emissions for other sources of emissions for GNSS equipment and users of GNSS services based on the requirements of providing reliable GNSS signals propagation and reception*

Section 3.

Monitored parameters of electromagnetic and interference environment conditions in the frequency bands of GNSS

Section includes recommendations in the following areas:

- *determining the list of parameters of conditions of electromagnetic and interference environment affecting on the quality of GNSS signals propagation and reception;*
- *normalization of the values of state parameters of conditions of electromagnetic and interference environment affecting on the quality of GNSS signals propagation and reception;*

Section 4.

Preliminary calculation of parameters of state of electromagnetic environment and possible interference

4.1 Models of radio-waves propagation in the frequency bands of GNSS

ITU Recommendations in the area of models of radio-wave propagation in the frequency bands of GNSS

4.2 Analysis of the database of radio-electronic equipment operating in the shared and neighbouring frequency bands of GNSS

Calculation of possible presence and activity of radio emissions sources in the point of GNSS signal reception

4.3 Reports generation

Visualization of radio emissions sources activity in the shared and neighbouring frequency bands of GNSS at a set point on digital map (point of estimation of electromagnetic and interference environment parameters)

Section 5.

Measurement tasks in the interests of evaluation of electromagnetic environment state parameters and interference environment in the frequency bands of GNSS

This section should include:

- 5.1 Complete list of measuring tasks**
- 5.2 Primary measuring tasks**
- 5.3 Secondary measurements.
Secondary processing of primary measurement data**

Section 6.

Measuring instruments and systems for solving tasks of electromagnetic environment estimation and of interference environment estimation in GNSS frequency Bands

Chapter (section) includes recommendations concerning – equipment requirements:

- 6.1 Measuring receivers and spectrum analyzers**
- 6.2 Antennas**
- 6.3 Communication network for distributed measuring systems**
- 6.4 Means of processing and visualization of measurement data**

Section 7.

Radio monitoring of GNSS frequency bands

Chapter (section) includes recommendation concerning:

- 7.1 Radiofrequency spectrum in the GNSS frequency band for electromagnetic environment estimation and of interference environment estimation.
Integral energy characteristics of the spectrum**
- 7.2 Organization and planning of radio monitoring**
- 7.3 Estimation of electromagnetic noise background**

Section 8. Secondary processing of the monitoring data.
Total estimation of electromagnetic and interference environment

Chapter (section) includes methodological recommendations concerning :

8.1 Total estimation of electromagnetic and interference environment in a set location point

Methodological approaches to conducting measurements and estimations in the interest of :

- *express analysis of electromagnetic and jamming environment;*
- *promptly detection of deterioration of the conditions of propagation and reception of GNSS signals*
- *promptly detection of interference in the GNSS frequency bands*

Section 8. Total estimation of electromagnetic and interference environment

*Methodological approach to measurements and the analysis of the
electromagnetic and the interference environment*

presented at the meetings last year :

- 1. ICG Workshop on GNSS Spectrum Protection and interference Detection
and Mitigation, Vienna, Austria 10 June 2015**

*presentation: «Practical aspects of the evaluation of interference
environment in the GNSS frequency bands. The analysis of the spatial
distribution of emissions in the frequency bands of GNSS»*

- 2. Experts Meeting on Global Navigation Satellite Systems (GNSS) Services.
Vienna, Austria, 15 - 18 December 2015**

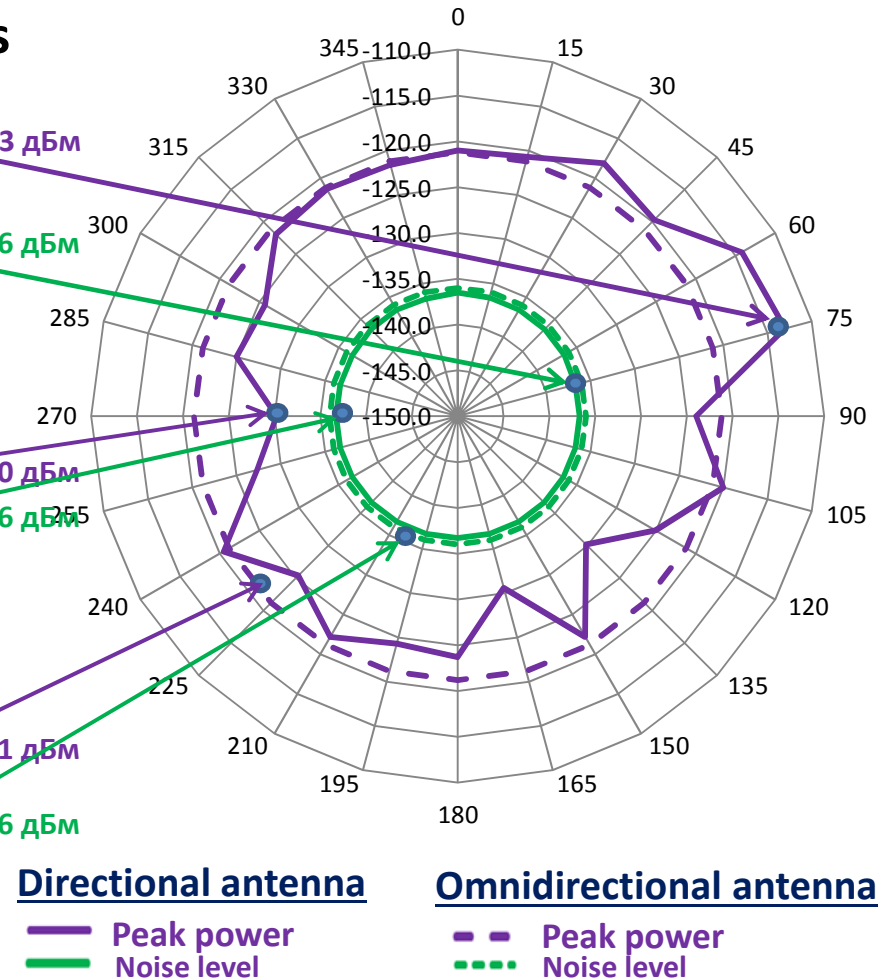
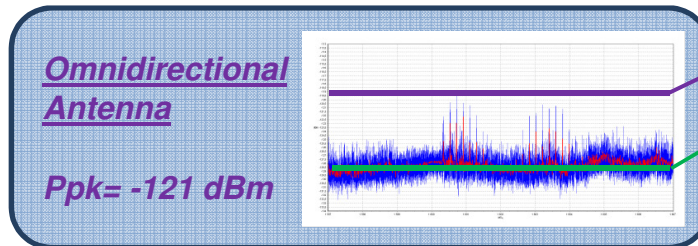
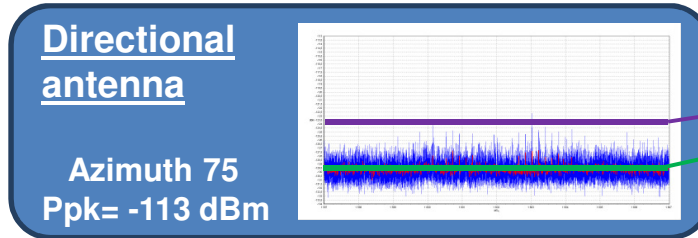
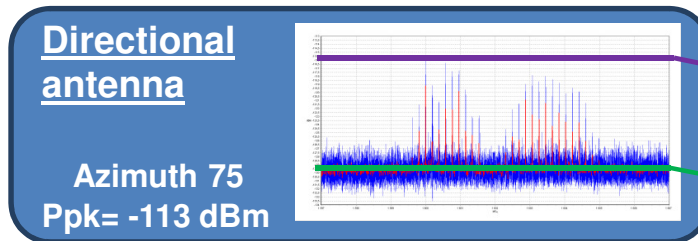
*presentation: «On development of recommendations applicable to radio
monitoring for the purposes of interference environment estimation in
the radio frequency bands of GNSS»*

<http://www.unoosa.org/pdf/icg/2015/2015abstracts.pdf>

<http://www.unoosa.org/pdf/icg/2015/presentations/51.pdf>

Section 8. Total estimation of electromagnetic and interference environment

The basis of the methodological approach - the construction and analysis of special diagrams of the spatial distribution of energy emission in the GNSS frequency bands



Section 8. Secondary processing of the monitoring data.
Total estimation of electromagnetic and interference environment

Chapter (section) includes methodological recommendations concerning :

8.2 Total estimation of electromagnetic and interference environment in the area

- *Location maps of radio equipment operating in neighbouring and combined bands with GNSS frequency band*
- *Maps of the values of the levels of electromagnetic background noise in the areas in the frequency bands of GNSS*
- *Maps of the density of the interference impact in the areas in the frequency bands of GNSS*

Section 9.

The storage of data. Exchange data formats

It is proposed to include description of storage formats and data exchange in this section:

- 9.1 The data formats for information about radio equipment operating and other sources of emissions in neighbouring and combined frequency bands with GNSS**
- 9.2 The data formats for information about means of radio monitoring**
- 9.3 Data formats for information about results of measurements and monitoring**
- 9.4 Data formats for information about interference impact in frequency bands of GNSS**

Proposals to the draft decision

- 1. It is necessary to arrange preparation of the draft of Recommendations for estimation of electromagnetic environment and interference environment in the GNSS frequency bands**
- 2. Proposed content of Recommendations regarding the main sections of the document was reviewed**
- 3. Experts of IDM Task Force - it is advisable to submit proposals for sections of the draft Recommendations for discussion at the meetings of the IDM Task Force**
- 4. It is advisable to prepare and submit the current version of the draft Recommendations for consideration by the IDM Task Force**

Proposals to the draft decision

5. Recommendations should be directed to :

- promptly detection of interference hindering the propagation and reception of GNSS signals,
- identification of interference, ensuring the termination of the interference

6. Recommendations should take into account :

- unique features of satellite navigation systems,
- unique features of GNSS frequency bands,
- sensitivity of satellite navigation systems to high levels of electromagnetic noise background and high levels of interference



International Committee on
Global Navigation Satellite Systems

*We can summarise the proposals
and prepare draft recommendations
for consideration and approval*

Thank you for your attention

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