# GUIDELINES
## With elements of technical solution depending on the nature of radiocommunication service

Technical solution within the application form for the issuance of an individual licence for the use of radio-frequencies is given in the technical documentation, which shall be submitted with the application form as an integral part thereof.

## I. TECHNICAL DOCUMENTATION

Pursuant to Arts. 126 and 128 of the Law on Planning and Construction, technical documentation shall be made by an undertaking and/or other legal entity or entrepreneur listed in the relevant registry for technical documentation preparation, with employees holding a licence for authorized project designer. Technical documentation shall be signed by the authorized project designer.

### I.1. GENERAL

For all natures of radiocommunication services:

a) Technical documentation shall be made in accordance with:

1. Law on Electronic Communications (*Official Gazette of RS*, nos. 44/10 and 60/13-CC);
2. Law on Planning and Construction (*Official Gazette of RS*, nos.72/09, 81/09, 64/10-CC, 24/11, 121/12, 42/13-CC and 50/13-CC);
3. Law on Environmental Protection (*Official Gazette of RS*, nos. 135/04, 36/09, 36/09 – other law, 72/09 – other law and 43/11- CC);
4. Law on Environmental Impact Assessment (*Official Gazette of RS*, nos. 135/04 and 36/09);
5. Regulation Stipulating Radio Frequency Bands Allocation Plan (*Official Gazette of RS*, no. 99/12)

b) Technical documentation shall include the following:

1. Cover page;
2. Information on the investor;
3. Information on the authorized project designer and/or project organisation;
4. Provisions of the laws and bylaws applied in the particular case;
5. Statement on the documentation preparation, signed by the authorized project designer;
6. Project task;
7. Antenna position (on the mast) and transmitter position (in the building)
8. Technical solution;
9. Statement substantiating the implementation of prescribed measures for safety at work;

10. Decision of the responsible authority substantiating that the project does not require an environmental impact assessment and/or a decision of the responsible authority approving the study on the environmental impact assessment;
11. Impact assessment for the operation of other radiocommunications systems
12. Relevant necessary calculations;
13. Accompanying graphical documentation.

c) An original copy of the technical documentation shall be submitted in bound form, stamped and signed by the person who was in charge of preparing the technical documentation and by the investor. The aforementioned documentation shall be accompanied by an electronic copy thereof.

## II. BROADCASTING SERVICE

### II.1. Technical documentation

In addition to the requirements referred to in Chapter I herein, the technical documentation for the broadcasting service shall be drafted in accordance with:

1. Frequency/location assignment plan for terrestrial analogue FM and TV broadcasting stations for the territory of the Republic of Serbia (*Official Gazette of RS*, nos. 9/12, 30/12 and 93/13);
2. Rulebook determining Frequency/Location/Allotment Assignment Plan for digital terrestrial TV broadcasting stations in UHF band for the territory of the Republic of Serbia (*Official Gazette of RS*, no. 73/13);
3. Rulebook on requirements for determining protection zone for electronic communication networks and accompanying facilities, radio corridor and protection area and the manner of performing the construction works when building a facility (*Official Gazette of RS*, no. 16/12);
4. Rulebook on technical and exploitation conditions for the use of broadcasting stations for emitting black and white and colour television (*Official Journal of SFRY*, no. 8/78);
5. Rulebook on technical and exploitation conditions for FM broadcasting stations (*Official Official Journal of SFRY*, no. 57/75);
6. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.1546-4 – Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3000 MHz;
7. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.1812-2 - **A path-specific propagation prediction method for point-to-area terrestrial services in the VHF and UHF bands;**
8. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.526-11 – Propagation by diffraction;

9. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R BT.417-5 – Minimum field strengths for which protection may be sought in planning an analogue terrestrial television service;
10. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R BS.412-9 – Planning standards for terrestrial FM sound broadcasting at VHF;
11. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R BT.1368-8 – Planning criteria for digital terrestrial television service in the VHF/UHF bands;
12. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R BT.2033 – Planning criteria, including protection ratios, for second generation of digital terrestrial television broadcasting systems in the VHF/UHF bands;
13. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R BS.1660-3 – Technical basis for planning of terrestrial digital sound broadcasting in the VHF band.
14. ITU Radiocommunication Bureau (RB) Report: ITU-R BT.2254 Frequency & Network Planning Aspects of DVB T2;
15. EBU tech 3348: Frequency & Network Planning Aspects of DVB T2

Technical documentation shall be made for a TV channel (in analogue television) and/or an FM radio-frequency obtained in the Public Tender for the issuance of licences for television and radio programme and shall adhere to technical and other parameters and data stipulated in Frequency/location assignment plan for analogue terrestrial FM and TV broadcasting stations for the territory of the Republic of Serbia.

Technical documentation for digital terrestrial television shall be made either for a television channel defined by Annex 4 of the Rulebook determining Frequency/Location Assignment Plan for analogue terrestrial analogue FM and TV broadcasting stations for the territory of the Republic of Serbia or for a particular area and a television channel within a particular multiplex (network) defined by the Rulebook determining Frequency/Location/Allotment Assignment Plan for digital terrestrial TV broadcasting stations in UHF band for the territory of the Republic of Serbia (*Official Gazette of RS,* no. 73/13), based on technical and other parameters referred to in these Rulebooks.

Until the switchover from analogue to digital television programme broadcasting is completed, project design, technical documentation and network roll-out (multiplexes) shall be based on the Rulebook determining Frequency/Location/Allotment Assignment Plan for digital terrestrial TV broadcasting stations in UHF band for the territory of the Republic of Serbia (*Official Gazette of RS,* no. 73/13) and the network technical parameters in accordance with the Rulebook on the switchover from analogue to digital television programme broadcasting and access to the multiplex in the digital terrestrial broadcasting (*Official Gazette of RS,* no. 55/12).

### II.2. Technical solution

Technical solution for broadcasting service shall include:

*1. Applied propagation method*

The application of the statistical method and the deterministic method is recommended. The application of the empirically determined correction factors is acceptable only if in accordance with the character of the method applied. The documentation shall describe only the methods used in the case concerned.

*2. Terrain profile in relation to broadcasting location*

For radiated powers under 1 kW (VHF) and/or 10 kW (UHF), a profile of a 50km-distance shall be submitted and effective heights ($h_{eff}$) in 36 directions - every $10^o$ starting from True North, shall be calculated. For radiated powers over 1 kW (VHF) and/or10 kW (UHF), a profile of at least 50km-distance shall be submitted and effective heights ($h_{eff}$) in at least 120 directions - every $3^o$ starting from True North, shall be calculated.

*3. Coverage calculation*

In directions for which the terrain profiles have been drafted, the distance, calculated according to the appropriate method, at which the level of field strength equals the minimum usable field strength, or usable field strength if available according to the relevant recommendations. Coverage calculations are performed in accordance with the real antenna pattern.

*4. Information on antenna:*

- antenna description and characteristics,
- disposition of individual antennas and antenna power supply system,
- antenna pattern and antenna system gain in relation to half-wave dipole,
- calculated transmission losses.

*5. Coverage area*

Coverage area shall be drawn on the geographical map of the appropriate representative fraction (RF), of at least 1: 200 000, and/or 1: 100 000 for low-power transmitters (the size of the drawing shall not be less than A3 paper format). The representative fraction and the scale shall be obligatory elements of the drawing.

*6. Data about equipment*

The description and the technical characteristics of equipment used for obtaining the proposed antenna pattern and radiated power shall be provided.

7. *A filed out coordination form for an FM radio station and a coordination form for a TV radio station as well as the application form for the issuance of a licence for the use of radio-frequencies for a radio station (to be filled out for analogue broadcasting)*

Coordination form for analogue broadcasting stations shall be filled out online. The filled out coordination form shall then be written on a CD and submitted along with the technical documentation. All requested fields in the coordination form MUST be filled out.

N.B.
Geographic coordinates of the radio station for which the frequency usage is requested, shall be given in WGS84 system (WGS84 coordinates should be accurate and determined with the aid of GPS).
The filled out licence form for the use of radio frequency shall be enclosed with the technical documentation.

## III. MOBILE SERVICE:

### III.1. Technical documentation for mobile service

In addition to the requirements referred to in Chapter I herein, the technical documentation for the mobile service shall be prepared in accordance with:

1. Radio-frequency Allotment Plan for GSM/DCS 1800 Radio System (*Official Gazette of RS*, no. 17/08) and/or valid rule regulating the Radio Frequency Allotment Plan;
2. Radio-frequency Allotment Plan for UMTS/IMT-2000 Radio System (*Official Gazette of RS* , no. 17/08);
3. Radio Frequency Allotment Plan for Radio Systems in the frequency band 410-420/420-430 MHz (*Official Gazette of RS*, no. 8/09)
4. Specific radio frequency allotment plans for individual services (health care, fire brigade, electric power industry services, power distribution services, anti-hail protection services, etc.);
5. Rulebook on requirements for determining protection zone for electronic communication networks and accompanying facilities, radio corridor and protection area and the manner of performing the construction works when building a facility (*Official Gazette of RS*, no. 16/12);
6. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.1546-4 – Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3000 MHz;
7. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.526-11 – Propagation by diffraction;
8. Rulebook on technical and exploitation conditions for the use of radio stations for FM and PM radio-telephone emission (*Official Journal of SFRY*, nos. 28/81, 42/82 and 64/86).

### III.2. Technical solution

Technical solution for the mobile service must include the following:

1. User's need for radio links (except for public mobile):

shall include the operation procedure of the user that needs radio-link establishment. The following shall be defined within the operation procedure: the entities between which the information is exchanged via radio-link, the nature and type of information, the number and the average duration of information, the minimum necessary information to be exchanged simultaneously, as well as the territory covered by the type of service concerned.

2. Concept of radio-link system solution (except for public mobile):

shall define the types of radio networks (simplex, semi-duplex, duplex, integration of several radio networks, etc.) and shall include the schematic presentation of the radio-system and the estimated traffic density. The concept of radio-link system solution should meet the specified

needs for radio networks as well as the rational use of the allocated radio-frequencies and provide the technical and technological unity of the radio-link system within the scope of the work (if necessary).

3. Base station propagation method:

The application of the statistical method, as given in ITU-R P. 1546-4, and the deterministic method, as given in ITU-R P. 526-11, is recommended. The application of the empirically determined correction factors is acceptable only if in accordance with the character of the method applied. The documentation shall include only the methods used in the case concerned. Coverage calculation shall be made to the minimum usable field strength, according to the appropriate rules, and in accordance with the real radiation pattern of the antenna system. The propagation model shall be tabular (except for public mobile) and given on the geographical map of the appropriate representative fraction (RF) which shall be adapted to the size of the base station coverage area, and/or the size of the radio network which is being presented. The representative fraction and the scale are considered as obligatory elements of the drawing. The coverage zone should be drawn on A3 paper format or larger in case of radio networks of regional and national importance.

4. Terrain profiles in relation to the transmitter location (except for public mobile):

drawn for a 50-km distance, and effective heights ($h_{eff}$) in 36 directions – each $10^{o}$ starting from True North shall also be calculated.

5. Antenna system:

information on antenna: type of antenna, polarization, antenna gain, directivity, azimuth of maximum radiation, angular beamwidth of main lobe, elevation angle, front-to-back ratio, etc. For directional antennas, the antenna pattern and antenna system gain should be given in both graphic and numerical formats in relation to the half-wave dipole.

6. The analysis of the potential mutual interferences between radio stations within the proposed system (except for public mobile).

7. Radio link error performance:
for a single-channel radio link between two base stations and for radio networks between base radio station and fixed radio station (except for public mobile).

8. The operation mode of radio stations within the radio network (except for public mobile):

1) The operation procedure and the manner of establishing radio links (PL tone, selective call, identification, conversation time limit), as well as all special conditions necessary for the simultaneous operation of several radio stations on one micro-location;
2) number of radio stations in radio networks according to class and their technical characteristics.

9. Filled out licence form for the use of radio-frequencies for a radio station

A filled out licence form for the use of radio-frequencies for a radio station shall be submitted as part of the technical documentation. All requested fields in the form MUST be filled out. Geographic coordinates should be given in WGS84 system (WGS84 coordinates should be accurate and determined with the aid of GPS).

## IV. FIXED SERVICE

### IV.1. Technical documentation for fixed service (microwave links)

In addition to the requirements referred to in Chapter I herein, the technical documentation for fixed service (microwave links) shall be made in accordance with the following:

1. Rulebook on requirements for determining protection zone for electronic communication networks and accompanying facilities, radio corridor and protection area and the manner of performing the construction works when building a facility (*Official Gazette of RS*, no. 16/12);
2. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.530-13: Propagation data and prediction methods required for the design of terrestrial line-of-sight systems;
3. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.676-8: Attenuation by atmospheric gases;
4. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.838-3: Specific attenuation model for rain for use in prediction methods;
5. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.525-2: Calculation of free-space attenuation;
6. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R F.1668-1: Error performance objectives for real digital fixed wireless links used in 27500 km hypothetical reference paths and connections;
7. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R F.1703: Availability objectives for real digital fixed wireless links used in 27500 km hypothetical reference paths and connections;
8. Guidelines on designing digital microwave systems (*PTT Gazette*, no. 16/87).

**IV.2.1. Technical solution for fixed service (microwave links) shall include the following:**

1. Purpose of the microwave link/links;
2. Geographic data on the location for every radio station (geographic coordinates, altitude of site above sea level, height of antenna above ground);
3. Path profile;
4. Basic technical data on each microwave link (capacity, configuration, frequency band, path length);
5. Basic technical characteristics of microwave devices;
6. Basic technical characteristics of the antenna (gain, type, manufacturer, radiation pattern);

7. Short description of the error performance method in accordance with the proposed error performance and availability objectives for the microwave link in question;
8. Error performance method and microwave link availability along with the statement substantiating compliance with the prescribed norms and link availability time (the results of calculations should be tabular and given for each path length);
9. Filled out licence form for the use of radio-frequencies for radio stations;
10. Geographic coordinates shall be given in WGS84 system (WGS84 coordinates shall be defined accurately with the aid of GPS).

## V. SATELLITE SERVICE

### V.1. Technical documentation for radio stations in satellite service

In addition to the requirements referred to in Chapter I herein, the technical documentation for radio stations in satellite service shall be prepared in accordance with the following:

1. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R S.521-4: Hypothetical reference digital paths for systems using digital transmission in the fixed-satellite service;
2. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R S.524-9: Maximum permissible levels of off-axis e.i.r.p. density from earth stations in geostationary-satellite orbit networks operating in the fixed-satellite service transmitting in the 6 GHz, 13 GHz, 14 GHz and 30 GHz frequency bands;
3. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R S.579-6: Availability objectives for hypothetical reference circuits and hypothetical reference digital paths when used for telephony using pulse code modulation, or as part of an integrated service digital network hypothetical reference connection, in the fixed-satellite service operating below 15 GHz;
4. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R S.614-4: Allowable error performance for a satellite hypothetical reference digital path in the fixed-satellite service operating below 15 GHz when forming part of an international connection in an integrated services digital network;
5. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R S.1062-4: Allowable error performance for a satellite hypothetical reference digital path operating below 15 GHz;
6. ITU Radiocommunication Bureau (RB) Recommendation: ITU-R P.618-9: Propagation data and prediction methods required for the design of earth-space telecommunication systems;
7. ITU Radiocommunication Bureau (RB) Recommendations for VSAT: ITU-R S.725, ITU-R S.726-1.

### V.2. Technical solution for radio stations in satellite service shall include the following:

1. technical documentation containing the information on the description of operation (purpose, block diagram, network topology, etc.);
2. geographic data on the site of the earth radio station (geographic coordinates, altitude of site above sea level, height of antenna above ground level);
3. name and the satellite orbital position;
4. technical characteristics of the device (transceiver);

5. basic technical characteristics of the antenna (gain, type and manufacturer);
6. filled out ApS 4/III form, coordinate contours (in accordance with Appendix 7) when the earth radio station operates as a receiver and as a transmitter in accordance with ITU Radio Regulation, Article 11, Section III;
7. short description of the error performance method along with the adopted initial technical parameters for the devices and accompanying equipment
8. calculation of the necessary transmitter power and radiated power along with the satellite uplink and downlink path budget. (path budget results shall be provided in tabular form);
9. filled out licence form for the use of radio-frequencies for radio stations
10. geographic coordinates given in the WGS84 system (WGS84 coordinates shall be accurately identified with the aid of GPS).