
Dr. Mindaugas Žilinskas
Deputy Director General
Communications Regulatory Authority Republic of Lithuania
Ankara, 9-10 May 2018
Lithuania

- 65 200 sq. km. – area.
- 2,743,500 – population.
- 100 years of the restored Lithuania.
- Official language – Lithuanian.

LABAS
MERHABA
RRT Communications Regulatory Authority

RRT is an independent public institution responsible for the regulation of electronic communications, postal and railway sectors; est. in 2001

- **163 Employees**
  - 63 Women
  - 100 Men

- 7 employees have a doctoral (Ph.D) degree

- Engineering or technical: 75
- Mathematics and informatics: 10
- Economics: 21
- Public administration: 10
- Law: 16
- Other areas: 12
RRT activities

- Regulation of rail transport market
- Regulation of the postal sector
- Regulation of the electronic communication sector
- Management and supervision of electronic communications resources
- Supervision of devices and equipment
- Supervision of trust service providers
- Radio spectrum management and supervision
- Harmful Internet content prevention
- Protection of consumers’ rights and legitimate interests
### Rationale for generations of regulation.

<table>
<thead>
<tr>
<th>Generation</th>
<th>Regulatory authority</th>
<th>Regulatory mandate</th>
<th>Regulatory regime</th>
<th>Competition framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Consolidated with policy-maker and/or industry</td>
<td>Business as usual</td>
<td>Doing as we have always done</td>
<td>State-owned monopoly</td>
</tr>
<tr>
<td>G2</td>
<td>Separate agency</td>
<td>First wave of regulatory reform</td>
<td>Doing more</td>
<td>Liberalization</td>
</tr>
<tr>
<td>G3</td>
<td>Separate agency, autonomous in decision-making</td>
<td>Advanced liberalization of ICT sector</td>
<td>Doing the right things</td>
<td>Partial competition</td>
</tr>
<tr>
<td>G4</td>
<td>Separate agency with enforcement power</td>
<td>Adjacent issues become core mandate</td>
<td>Doing the things right</td>
<td>Full competition</td>
</tr>
<tr>
<td>G5</td>
<td>Separate agency as part of a network of partner regulators</td>
<td>Separate agency as part of a network of partner regulators</td>
<td>Doing things together</td>
<td>Intra-modal competition</td>
</tr>
</tbody>
</table>

Source: ITU
<table>
<thead>
<tr>
<th></th>
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<td>Poland</td>
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<td>19</td>
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<td>27</td>
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<td>5</td>
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<td>-2</td>
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<td>Turkey</td>
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<td>19.5</td>
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<td>24.3</td>
<td>92.8</td>
<td>9</td>
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<td>19.5</td>
<td>28</td>
<td>27</td>
<td>92.5</td>
<td>10</td>
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<td>-5</td>
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<td>92.0</td>
<td>12</td>
<td>32</td>
<td>20</td>
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<td>Dominican Rep.</td>
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<td>19</td>
<td>26</td>
<td>28</td>
<td>92.0</td>
<td>12</td>
<td>26</td>
<td>14</td>
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<td>18</td>
<td>17</td>
<td>30</td>
<td>27</td>
<td>92.0</td>
<td>12</td>
<td>16</td>
<td>4</td>
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<tr>
<td>Lithuania</td>
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<td>18</td>
<td>28</td>
<td>27</td>
<td>92.0</td>
<td>12</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Finland</td>
<td>18</td>
<td>18</td>
<td>28</td>
<td>27</td>
<td>91.0</td>
<td>16</td>
<td>28</td>
<td>12</td>
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<td>France</td>
<td>18</td>
<td>19.5</td>
<td>30</td>
<td>23</td>
<td>90.5</td>
<td>17</td>
<td>11</td>
<td>-6</td>
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<tr>
<td>Greece</td>
<td>20</td>
<td>17</td>
<td>28</td>
<td>25.3</td>
<td>90.3</td>
<td>18</td>
<td>10</td>
<td>-8</td>
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<tr>
<td>Iceland</td>
<td>18</td>
<td>18</td>
<td>26</td>
<td>28</td>
<td>90.0</td>
<td>19</td>
<td>36</td>
<td>17</td>
</tr>
<tr>
<td>Switzerland</td>
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<td>18</td>
<td>28</td>
<td>27</td>
<td>90.0</td>
<td>19</td>
<td>19</td>
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</tr>
</tbody>
</table>
Mandate of the ICT regulator.

Source: ITU
Mobile communications

“One of the major trends moving ICT markets – Mobile-the engine for expanded local access to the internet.”

Global ICT Regulatory Outlook 2017

LTE coverage (2017).

OpenSignal
Mobile communications “the engine for expanded local access to the internet.”

LTE speed (2017).
Mobile communications

Measured average download speed in LTE networks (in Mbps)

<table>
<thead>
<tr>
<th>Company</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telia</td>
<td>26.6</td>
<td>38.4</td>
<td>43.1</td>
</tr>
<tr>
<td>Tele2</td>
<td>14.3</td>
<td>31.7</td>
<td>37.8</td>
</tr>
<tr>
<td>Bité</td>
<td>23.4</td>
<td>28.3</td>
<td>30.0</td>
</tr>
<tr>
<td>LRTC</td>
<td>22.9</td>
<td></td>
<td>30.2</td>
</tr>
</tbody>
</table>
Electronic communications
FTTP coverage

By country, 2016

Source: Broadband Coverage in Europe 2016, a study by IHS Markit and Point Topic for the European Commission

© 2017 IHS Markit
The number of FTTx subscribers per 100 households EU ranking. Source: IDATE for FTTH Council Europe, February 2016
Electronic communications

Fixed Broadband Price

Fixed Broadband Price (2015)
(cheapest standalone 12-30 Mbps connection)

Sources: (access cost) Broadband Internet Access Cost (BIAC), annual studies for the EC realised by Van Dijk; (income) real adjusted gross disposable income of households per capita (Eurostat: tec00113)
Fixed Broadband prices in Europe 2016,

Study prepared for EC 2017 September 21.
doi:10.2759/630850
Average revenue per user (ARPU) in mobile communications, 2015

Source: Eurostat
Mobile communications

Mobile - the engine for expanded local access to the internet
(Global ICT Regulatory Outlook 2017 ITU)

How to stimulate the growth of mobile networks?

• Technologically neutral licenses;
• Infrastructure sharing;
• Secondary trading;
• License exempt access;
• Licensed sharing access (LSA);
• Mobile number portability;
• Light licensing regime for some supplementary services;
• Frequencies fees regulation (just for CRA expenses, lower than FFTx);
• Calculations and publications of their networks coverages.
The growth of UMTS Base stations

Licenses for UMTS networks were issued in February of 2006
Publications started 2012 Q2
UMTS (2012 I half-year)

Operator I

Operator II
UMTS (2013 I half-year)

Operator I

Operator II
Mobile communications

UMTS (2014 II half-year)

Operator I

Operator II
The growth of LTE Base stations

LTE, LTE+, LTE++

LTE-800:
LTE-900:
LTE-1800:
LTE-2100:
LTE-2600.

Number registered BSs per year

Total number of BSs
## Mobile communications

### Coverage (2017 Q4)

**Mobile communications**

Next - download speed calculations, in Mbps and publications

<table>
<thead>
<tr>
<th></th>
<th>GSM networks coverage</th>
<th>UMTS networks coverage</th>
<th>LTE networks coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-95 dBm</td>
<td>-85 dBm</td>
<td>-75 dBm</td>
</tr>
<tr>
<td>UAB „Bitė Lietuva“</td>
<td>99,4</td>
<td>90,7</td>
<td>65,4</td>
</tr>
<tr>
<td>Telia Lietuva, AB</td>
<td>99,7</td>
<td>95,2</td>
<td>74,1</td>
</tr>
<tr>
<td>UAB „Tele2“</td>
<td>99,8</td>
<td>97,0</td>
<td>78,8</td>
</tr>
</tbody>
</table>
Electronic communications market

Investment in ICT sector of Lithuania, in millions EUR.

Main investments in to: LTE, FTTx

- 2014: 82.3 million EUR
- 2015: 78.9 million EUR
- 2016: 97.8 million EUR
- 2017: 76.9 million EUR
Electronic communications market

Revenue, in millions EUR.

<table>
<thead>
<tr>
<th>Year</th>
<th>Broadcasting (radio, tv) services</th>
<th>Public mobile telephone services</th>
<th>Data transmission services</th>
<th>Network connection services</th>
<th>Total revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>111,0</td>
<td>192,5</td>
<td>64,4</td>
<td>54,5</td>
<td>607,0</td>
</tr>
<tr>
<td>2015</td>
<td>131,4</td>
<td>182,4</td>
<td>64,6</td>
<td>48,5</td>
<td>626,2</td>
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<tr>
<td>2016</td>
<td>140,6</td>
<td>178,5</td>
<td>69,0</td>
<td>44,8</td>
<td>656,1</td>
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<tr>
<td>2017</td>
<td>142,8</td>
<td>173,6</td>
<td>71,8</td>
<td>39,9</td>
<td>680,8</td>
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</table>
Electronic communications market. Shaping social life

Pay TV; customers distribution

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>CableTV</td>
<td>20.2%</td>
<td>24.9%</td>
<td>29.1%</td>
<td>32.2%</td>
</tr>
<tr>
<td>DVB-T</td>
<td>57.3%</td>
<td>55.1%</td>
<td>53.3%</td>
<td>52.7%</td>
</tr>
<tr>
<td>IPTV</td>
<td>12.8%</td>
<td>11.6%</td>
<td>10.4%</td>
<td>9.3%</td>
</tr>
<tr>
<td>MDTV</td>
<td>1.8%</td>
<td>1.7%</td>
<td>1.5%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Satellite TV</td>
<td>1.1%</td>
<td>0.5%</td>
<td>0.5%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
Electronic communications market

http://matuok.lt 119 000 measurements (speed test tool by OOKLA www.speedtest.net )

<table>
<thead>
<tr>
<th>Interneto prieigos paslaugų teikėjas</th>
<th>Download speed, Mbps</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAB „Cgates“</td>
<td>87,1</td>
<td>7860</td>
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<tr>
<td>UAB „Penkių kontinentų komunikacijų centras“</td>
<td>82,9</td>
<td>2223</td>
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<td>VĮ „Infrostruktūra“</td>
<td>72,9</td>
<td>1005</td>
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<td>68,0</td>
<td>1040</td>
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<td>UAB „Tele2“</td>
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<td>16831</td>
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<td>UAB „NNT“</td>
<td>20,4</td>
<td>1181</td>
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<td>19,2</td>
<td>7870</td>
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<td>AB Lietuvos radijo ir televizijos centras</td>
<td>11,4</td>
<td>15883</td>
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</tbody>
</table>
Electronic communications market

Measurements of download speed
Electronic communications market

Date and map of download speed measurements in Lithuania
**Electronic communications market**

- **Find Internet** - information of providers on internet services in specific places of Lithuania
- **Internet speed measurement**
- **Wireless Internet speed**
- **Mobile coverage**
- **Safe Internet**
- **Security incidents**
“Opportunities and Threats”
Harmonization of radio frequencies for IMT Digital dividends and coordination issues

790-862 MHz (61-69 TV channels) 800 MHz band  Digital Dividend 1 - WRC12

RR 5.312 and RR 9.21
“Opportunities and Threats”
Harmonization of radio frequencies for IMT Digital dividends and coordination issues
“Opportunities and Threats”
5G in 2nd Digital Dividend

694-790 MHz (49-60 TV channels) 700 MHz band  Digital Dividend 2 - WRC15
Coordination agreements on compatibility between IMT and aeronautical radio navigation systems were signed in Geneva on 3 November 2015 with Russian Federation and Belorussia.

- Field strength level at the point of ARNS according to the ITU-R rec. M.1830 and/or certain value on the border line.

“Opportunities and Threats”

5G in 700 MHz
Refarming of DVB-T
“Opportunities and Threats”
5G in 700 MHz
Refarming of DVB-T
“Opportunities and Threats”

5G in 700 MHz Refarming of DVB-T

Q2-2 end of migration

completed 2017 2018 2019 2020 2021 2022 no date

RSPG18-009 Final, January 2018.
“Opportunities and Threats”
5G in 700 MHz
DVB-T impact

Legend:

-6 dB ≤ I/N < 0 dB
0 dB ≤ I/N < 10 dB
10 dB ≤ I/N < 20 dB
20 dB ≤ I/N < 40 dB
40 dB ≤ I/N < 60 dB
60 dB ≤ I/N < 110 dB
5G in 700 MHz
Dependence of radius of BS on the level of TV interference (ITU-R P.1546)

(N=-115 dBm) Radius of BS decrease 5-16 times
5.1.3 A digital entry in the Plan may also be notified with characteristics different from those appearing in the Plan, for transmissions in the broadcasting service or in other primary terrestrial services operating in conformity with the Radio Regulations, provided that the peak power density in any 4 kHz of the above-mentioned notified assignments shall not exceed the spectral power density in the same 4 kHz of the digital entry in the Plan. Such use shall not claim more protection than that afforded to the above-mentioned digital entry.
“Opportunities and Threats”  5G in 700 MHz
Lithuanian case, GE06 provision 5.1.3
5G in L – Band: 1427-1518 MHz and aeronautical telemetry stations

Report ITU-R M.2286 (12/2013)

“Opportunities and Threats”

RR 5.342
“Opportunities and Threats”

5G in L-Band

ATS ground station and LTE -1400 MHz stations arrangement

~ 4000 sectors
“Opportunities and Threats”

Interference scenario including aggregate affect of a network

ECO software SEAMCAT:
ITU – Rec. 525;
ITU Rec. 1546;
Antenna – ITU – R F 1245
5G in L-Band

Methods: I/N and C/(I+N)

I/N = -6 dB, separation distance up to 360 km, at H_ant = 50 m

C/(I+N) = 13,
separation distance 10 km

"Opportunities and Threats"
Spectrum monitoring and enforcement during 2017

3941 measurements

28 infringements

208 – infringements of MS agreements from bordering countries;
144 infringements of MS agreements from LTU side
Market control
Assessment of Compliance
Emissions Testing in Open Area and Anechoic Chamber
Total number of equipment tested

Number of equipment tested in the accredited lab
Including equipment taken from the market in Lithuania
EMC and RED/R&TTE market surveillance

Technical compliance checks (tests in the accredited laboratory)
Compliance to essential requirements of EMCD, R&T TED, RED, equipment taken from the market

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</tr>
</thead>
<tbody>
<tr>
<td>EMC D</td>
<td>24</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td>17</td>
<td>15</td>
<td>22</td>
<td>21</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>R&amp;T TED *</td>
<td>38</td>
<td>60</td>
<td>29</td>
<td>9</td>
<td>17</td>
<td>20</td>
<td>16</td>
<td>27</td>
<td>26</td>
<td>18</td>
</tr>
<tr>
<td>Sum:</td>
<td>62</td>
<td>76</td>
<td>53</td>
<td>41</td>
<td>34</td>
<td>35</td>
<td>38</td>
<td>48</td>
<td>59</td>
<td>45</td>
</tr>
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Non compliance to harmonised standards:

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</tr>
</thead>
<tbody>
<tr>
<td>EMC D</td>
<td>42%</td>
<td>56%</td>
<td>4%</td>
<td>63%</td>
<td>65%</td>
<td>80%</td>
<td>45%</td>
<td>71%</td>
<td>30%</td>
<td>37%</td>
</tr>
<tr>
<td>R&amp;T TED D</td>
<td>50%</td>
<td>48%</td>
<td>52%</td>
<td>78%</td>
<td>82%</td>
<td>40%</td>
<td>19%</td>
<td>48%</td>
<td>58%</td>
<td>56%</td>
</tr>
</tbody>
</table>

NOTE * EMC and efficient use of radio spectrum aspects of R&T TED
Supervision of business undertakings

- Risk evaluation and management
- Control questionnaires
- Inspections (public schedule, procedures established in the rules)
- Consulting (by phone with audiorecording)
- Application of „new-in-the-business“ status (1 year without fines)
- Minor violations (elimination term)
- Feedback

Fine up to 3 % of revenue depending on damage to customers

5G features
“Technologies Shaping Social Life”
Emergency call, positioning „arc“ on the map
(timing advance 2G, round trip time 3G, first in EU)
“Technologies Shaping Social Life”
112 E-call service since the 1th of October 2017

eCall – case study

1) eCall - OEM

Mobile Operators must be able to recognize the eCall ‘flag’ in their networks by 31 March 2016.

2) MNO

eCall functionality has to be fitted to all new models of cars and light vans in the EU by 31 March 2018.

3) PSAP

EU member states must be able to process eCalls via call their emergency call centre (PSAP) by 1 October 2017.
Narrowband IoT (NB-IoT) specification was frozen at Release 13 of the 3GPP specification (LTE-Advanced Pro), in June 2016.
Protection of fixed monitoring stations against interference from strong electromagnetic fields

A model for calculating the maximum permissible field strength was proposed, which assumes that:

- the most critical combination is the intermodulation of three signals of the same power;
- interference due to intermodulation products begin to be visible when the level of the 3rd order intermodulation product exceeds the receiver noise floor.

The new Recommendation ITU-R SM.575-2 has been prepared based on this model.

Dependence of maximum permissible field strength values of several typical signals on a frequency
Determination of the radiated power through field strength measurement along a route

A model for determination of the radiated power was proposed, which assumes that the difference between the measured and the calculated values of the field strength occurs only because of the radiated power $P_m$ value used in the model.

This method is included in the new revision of ECC Recommendation (12)03 “Determination of the radiated power through field strength measurements in the frequency range from 87.5 MHz to 6000 MHz”.

The best-fit value $P_m$ is the value of radiated power determined from the field strength measurement along the route.

The suggested method allows to determine radiated power of broadcast FM radio stations with error less than 2 dB.

The field strength level as a function of the distance from the transmitting antenna along the route which coincides with antenna’s beam axis
Height scan methods for determining the radiated power at microwaves frequencies

A new method for determination of the field strength of direct wave was proposed, which made it possible to significantly improve the accuracy of the height scan method. This method is included in the new revision of ECC Recommendation (12)03 “Determination of the radiated power through field strength measurements in the frequency range from 87.5 MHz to 6000 MHz”.

It is hard to believe but using this method the acceptable measurement error was obtained even at signal-to-noise ratio of about 3 dB.

The field strength at low signal level as function on height.
WiFi in 5925–6425 MHz, Broad band PPDR in 410-430 MHz, L-band

Source: Global ICT Regulatory Outlook 2017

ECC 44th Meeting
Dublin, 28 February-3 March 2017
Date issued: 10 February 2017
Source: Belarus, Estonia, Lichtenstein, Lithuania, Russian Federation, Slovenia, Switzerland
Subject: proposed studies on Wireless Access Systems including Radio Local area networks in 6 GHz band

ECC PT1 #58
Prague, Czech Republic, 16-20 April 2018
Date issued: 11 April 2018
Source: Lithuania, Hungary, Poland
Subject: L-band x-border MFCN vs. ATS
Number: ECC PT1(18)065

WG SE7
Hamburg, Germany, 6-8 February 2017.
Source: Lithuania
Subject: Compatibility between RAS and LTE UE in 400 MHz frequency band.
Number: WG SE7(17)002.
Thank You!

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