



**Regional Workshop for Europe and CIS On Spectrum Management
and Transition to Digital Terrestrial Television Broadcasting
5-7 May 2015, Hotel Mercure Buda**

**Digital Terrestrial Television Transition – SPECTRUM
MANAGEMENT - Bosnia And Herzegovina Experience**

Jasmin MUSOVIC
***Director of Radiomonitoring, IT and
Licence Compliance***



**BOSNIA AND HERZEGOVINA
Communications Regulatory Agency**



OVERVIEW

- **Structure**
- **Spectrum management tools,**
- **Cross-border frequency coordination,**
- **Spectrum fee,**
- **Auctions,**
- **Monitoring**

STRUCTURE

- LICENCING:
 - GENERAL LICENCE
 - SPECIFIC LICENCE
- NEW TECHNOLOGIES
 - 3G,
 - 4G
 - 5G?
- TESTING AND VERIFYING

SPECTRUM MANAGEMENT TOOLS

- RADIO PLANNING SOFTWARE
- SPECTRUM MANAGEMENT SOFTWARE
- RF PORTAL

RADIO PLANNING SOFTWARE

- DIGITAL MAPS (10 AND 50M RESOLUTION)
- ALL PROPAGATION MODELS
- ANTENNA PATTERNS
- MANY USEFULL FEATURES
 - Site searching, site candidates, optimizing
 - Coverage calculation (UL/DL)
 - Direction finder coverage efficiency
 - Direction finder localization efficiency
 - Radar coverage
 - Microwave link path budget
 - Traffic analysis
- STANDARDS SUPPORTED
- NETWORK VERIFICATION
- ALL WIRELESS TECHNOLOGIES FROM 8 KHZ TO 450 GHZ

Tx/Rx

Nominal power (W)

Dynamic (dB)

Tx ant gain (dBi)

Rx ant gain (dBi)

Losses (dB)

Tx add losses (dB)

E.I.R.P (W)

Frequency (MHz)

Antenna height (m)

Tx bandwidth (KHz)

Rx bandwidth (KHz)

Tx/Rx parameters: 2 c356334

General Patterns Channels Site Advanced

Type (0) Signal (15) Modulation (19) NFD

Tx/Rx A (0) DVB 8MHz 16-QAM 2/3

Cover. threshold (dBuV/m)* Launch delay (us)

Rx threshold (dBuV/m)* Frequency offset (Hz)

Carrier Availability %

C/N (dB) Activity u/dl (%)

Channel (#) Initial power

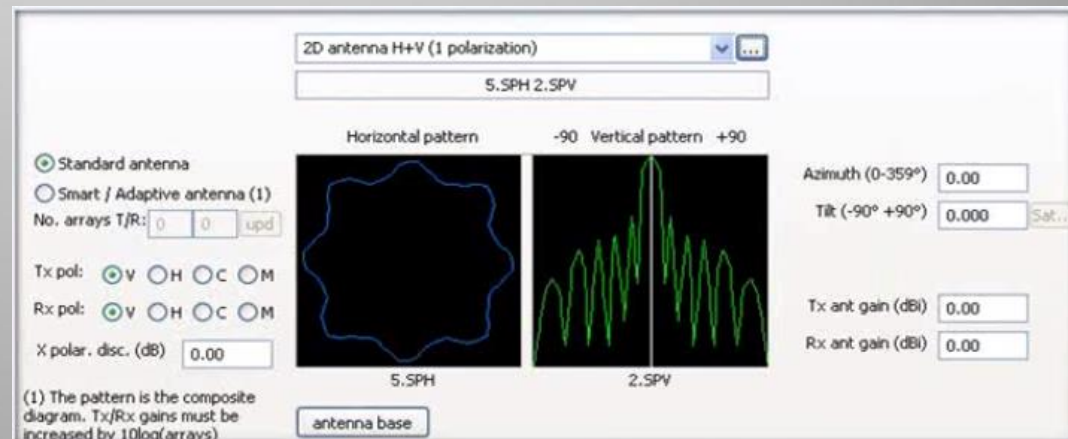
% ☐ 70 ☐ 95 ☐ 99 ☐ 0

C/I ☐ Steady ☒ Tropo

Floor offset

Active set

* Thresholds



SPECTRUM MANAGEMENT SOFTWARE

Applications for regulators allows the implementation of automated processes for:

- License management, operational management
- Calculation of fees following the technical and administrative parameters of the frequency assignments and the licenses
- Generation of documents (report, invoices, receipts), billing, and payment follow-up
- International notification, international coordination
- Spectrum monitoring
- Spectrum planning, frequency assignments
- Zone allotments or band attributions
- Web interface, web services, web portals
- Management of data: antennas, equipment, site, frequency plans, allocation charts (foot notes, services...) etc.

RF PORTAL

<http://rak.ba/eng/>

Announcements

PUBLIC INVITATION FOR SUBMITTING APPLICATIONS FOR ASSIGNMENT OF FREQUENCY BLOCKS IN BAND 11.7 - 12.5 GHz



Please be informed that a public invitation for applications for assignment of frequency blocks in band 11.5 - 12.5 GHz, has been published in the "OG".

02/03/2011

INFO

Older announcements

PUBLIC INVITATION FOR SUBMITTING APPLICATIONS FOR ASSIGNMENT OF FREQUENCY BLOCKS IN BAND 11.7 - 12.5 GHz

Please be informed that a public invitation for applications for assignment of frequency blocks in band 11.5 - 12.5 GHz, has been published in the "OG".

02/03/2011

World Radio Conference WRC-12

Preparations for the World Radio Conference WRC-12 ...

02/03/2010

World Radio Conference WRC-12

Preparations for the World Radio Conference WRC-12 ...



Calculator

Select service

- Microwave link, point-to-point
- Microwave link, point-to-point, portable/mobile
- Microwave link, point-to-multipoint, distribution of TV channels
- Wireless access systems
- Fixed-satellite
- Broadcasting (technical annexes)
- Aeronautical and Maritime
- Amateur
- Earth mobile systems (PMR, PAMR, telecommand, telemetry)

Fees (KM)

a) The results of calculator are only informative, the only valid basis of payment are documents (Conclusions, Bills and Solutions) issuing agency upon receipt and review of applications.
b) Amounts are relating on using of RF spectrum, expenditure under other licenses, possible necessary to deal with service (for broadcasting GSM service etc.) not taken into consideration.

Copyright © Regulatorna agencija za komunikacije 2010.

[Home](#) | [RF spectrum](#) | [Calculator](#) | [News](#) | [Announcements](#) | [Documents](#) | [FAQ](#)

Regulatorna agencija za komunikaciju / Radiofrekvencijski spektar
Regulatorna agencija za komunikaciju / Radiofrekvencijski spektar
Communications Regulatory Agency / Radio Frequency Spectrum

BOS HRV SRP **ENG**

www.rak.ba

[Home](#) [RF Spectrum](#) [Calculator](#) [News](#) [Announcements](#) [Documents](#) [FAQ](#)

The Radio Frequency Spectrum Allocation and Utilisation Plan in Bosnia and Herzegovina

Search through RF Spectrum

Dynamic search through the Table of Allocation and Utilisation of the Radio Spectrum in Bosnia and Herzegovina by bands, allocations, utilisations, regulatory documents ...

Calculator

Calculate amounts of fees for licences in radio communications and levy for radio frequency spectrum utilisation

Download application

Download needed instructions and application forms for requests for licences in radio communications issued by the Communications Regulatory Agency

News

REGULATIVE HARMONISATION

The Rule 50/10 on utilization plan for bands 30 - 68 MHz, 68 - 87.5 MHz, 146 - 174 MHz, 380 - 400 MHz, 406 - 430 MHz, 440 - 470 MHz.

Announcements

PUBLIC INVITATION FOR SUBMITTING APPLICATIONS FOR ASSIGNMENT OF FREQUENCY BLOCKS IN BAND 11.7 - 12.5 GHz

Please be informed that a public invitation for applications for assignment of frequency blocks in band 11.5 - 12.5 GHz, has been published in the "OG".

Useful links

<http://www.etsi.org>
European Telecommunications Standards Institute

Use advanced search for frequency spectrum according to parameters in lower fields

Lower Frequency	Upper Frequency	Allocation	Footnotes	Application	Regulation	ETSI Standards	Manner of Assignment	Documents
2.5	3.5	GH						Search
2500.00	2520.00	MHz						
		Fixed		IMT	ECC/DEC(02)06 ECC/DEC(05)05 BH Rule 72/2014	EN 301 908		
		MOBILE except aeronautical mobile						
		5.384A						
2520.00	2655.00	MHz						
		FIXED	EU2 EU15 EU16	IMT	ECC/DEC(02)06 ECC/DEC(05)05 BH Rule 72/2014	EN 301 908		
		MOBILE except aeronautical mobile		SAP/ISAB and ENG/IOB	ERC/REC 25-10	EN 302 064	first come first serve	Application Form
		5.384A		Defence systems				
		5.339						
		5.418B						
		5.418C						
2655.00	2670.00	MHz						
		FIXED	BH3 EU2 EU15 EU16	IMT	ECC/DEC(02)06 ECC/DEC(05)05 BH Rule 72/2014	EN 301 908		
		Radio astronomy		Radio astronomy				
		Space research (passive)		SAP/ISAB and ENG/IOB	ERC/REC 25-10	EN 302 064	first come first serve	Application Form
		MOBILE except aeronautical mobile						

CROSS-BORDER FREQUENCY COORDINATION

- BILATERAL COORDINATION AND AGREEMENTS
 - PREFERENCE CHANNELS
- QUICK INTERFERENCE CANCELATION
 - EXCHANGE OF RADIOMONITORING DATA
 - TRUST AND RELIABILITY
- EASY LICENCING AND „ONE STOP SHOP” PRINCIPLE

SPECTRUM FEE

- TWO PARTS OF FEE
 - FOR LICENCE
 - GOES TO CRA BUDGETING ACCOUNT
 - FOR RADIO SPECTRUM USAGE
 - GOES TO STATE BUDGETING TREASURE
- TECHNOLOGY NEUTRALITY
- PROMOTION OF HIGHER FREQUENCY BANDS
- TESTING AND VERIFYING

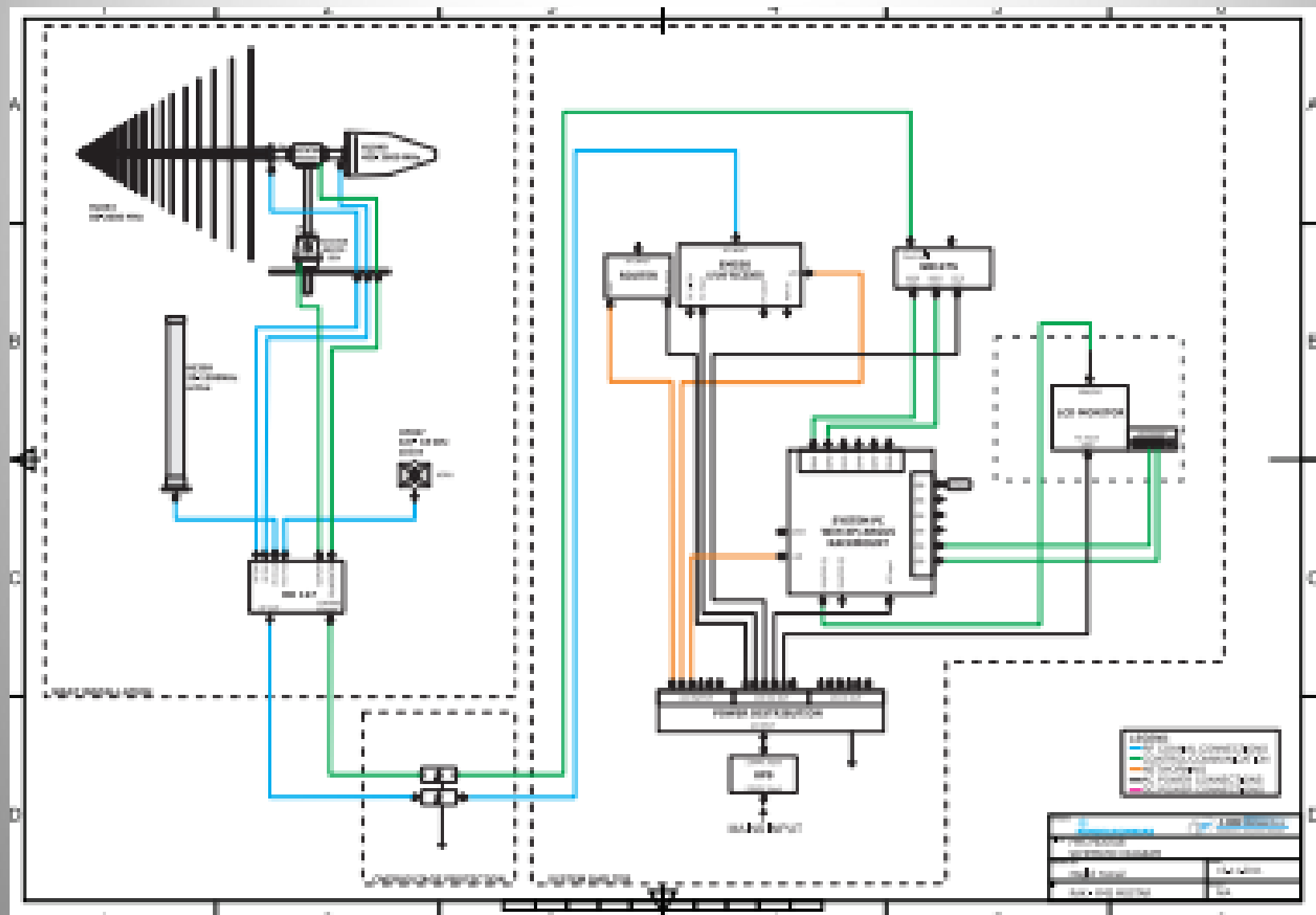
AUCTIONS

- The market in BH is not ready for entrance of new players
- There are three telecom operators for:
 - Fixed voice
 - Mobile voice
- There are vast number of network operators who are offering capacities and infrastructure
- There are 46 operators, which provide triple play service in the frame of licences for ISP, TV programme distribution, and voice on:
 - Local
 - Regional
 - Countrywide scale

RADIO MONITORING

- RADIO MONITORING STATIONS NETWORK
 - MANNED:
 - FIXED
 - UNMANNED
 - MOBILE
 - TRANSPORTABLE
 - REMOTE FIXED





RADIO MONITORING SOFTWARE TOOLs

RF Monitoring Management System

RF monitoring management system with web interface

[Transmitters map »](#)

Inventory management

Special measurement equipment and systems

[Administration »](#)

[Inventory list »](#)

[Equipment maintenance info »](#)

[Equipment maintenance warnings »](#)

[Monitoring stations list »](#)

[Monitoring stations maintenance info »](#)

[Monitoring stations maintenance warnings »](#)

Transmitters & Monitoring stations management

All about registered transmitters and monitoring stations
in Bosnia and Herzegovina

[Administration »](#)

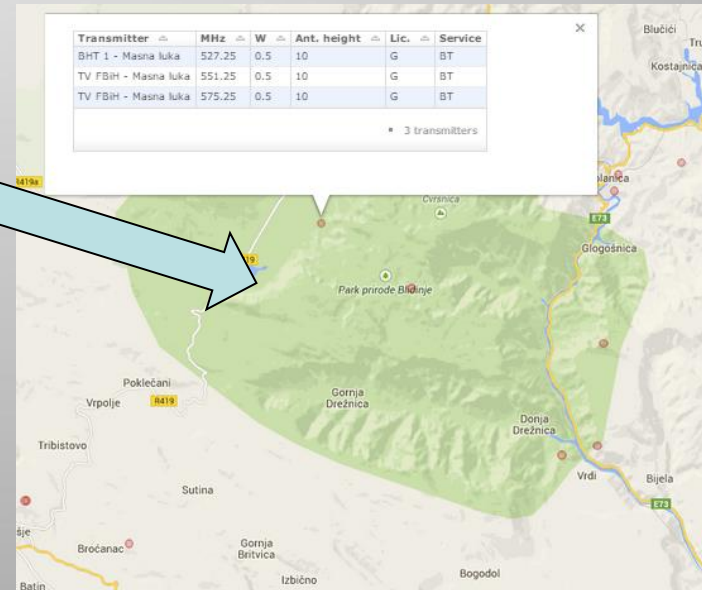
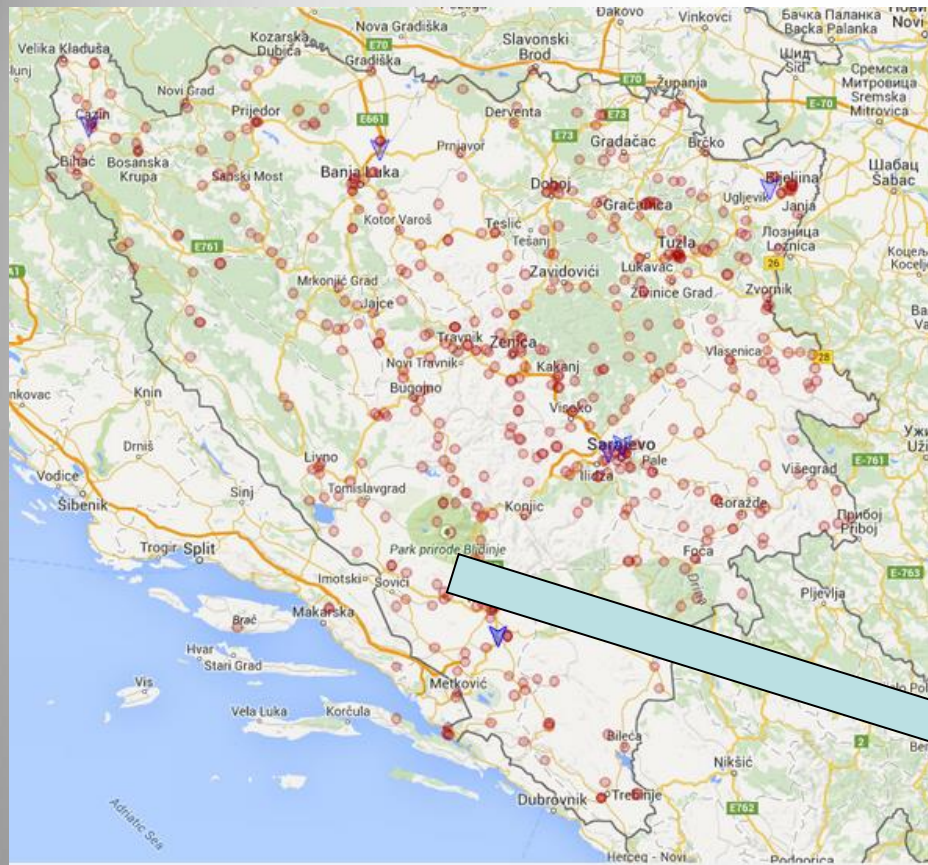
[Annexes of licensed transmitters »](#)

[Transmitters visualization and reporting »](#)

Automatic measurement system

[BCFM measurement »](#)

[RDS decoded »](#)



Date range: Any date Transmitter: Frequency: Monit. st: Submit

Transmitter	Frequency MHz	Monitoring station	Chart	Date	Time	Diagnosis	Level dB(uV/m)	Frequency offset (kHz)	Bandwidth occupied (kHz)	FM modulation (kHz)	MPX dB	Radio Line of Sight	Measurement reliable
Studio 88 - Fortica	104.6	RMS-MO Gubavica		April 30, 2015	00:27:41	Modulation exceeded: 22%	77.2910955862	0.822	96.562	91.218	—	NO	
RSG - Fortica	104.3	RMS-MO Gubavica		April 30, 2015	00:27:10	Modulation exceeded: 22%	71.6712724147	0.344	65.875	91.366	—	NO	
Kalman - Fortica	90	RMS-MO Gubavica		April 30, 2015	00:26:38	OK	81.8932288298	0.092	73.5	69.784	—	NO	
Radio FBiH - Fortica	91.7	RMS-MO Gubavica		April 30, 2015	00:26:06	OK	82.5129659183	0.137	39.937	70.471	—	NO	
Otvorena mreza - Fortica	94	RMS-MO Gubavica		April 30, 2015	00:25:35	Modulation exceeded: 8%	74.4734515808	0.039	50.125	81.131	—	NO	
RTV Mostar - Fortica	97.9	RMS-MO Gubavica		April 30, 2015	00:25:03	OK	83.3416528115	0.168	0.687	4.504	—	NO	
Omladinski radio X - Fortica	88.6	RMS-MO Gubavica		April 30, 2015	00:24:32	OK	68.4939030544	0.061	65.375	70.077	—	NO	
BH Radio 1 - Fortica	97.3	RMS-MO Gubavica		April 30, 2015	00:24:00	OK	83.8007099484	0.047	81.125	60.574	—	NO	
Radio postaja Mostar - Mikuljaca	100.9	RMS-MO Gubavica		April 30, 2015	00:23:28	Transmitting stopped	36.8446457318	35.823	99.687	99.842	—	NO	
MIR Medjugorje - Mikuljaca	100	RMS-MO Gubavica		April 30, 2015	00:22:56	Modulation exceeded: 6%	79.08404788	0.057	88.25	79.128	—	NO	
Oscar C - Mikuljaca	103.4	RMS-MO Gubavica		April 30, 2015	00:22:25	OK	81.2116349232	0.116	89.937	73.838	—	NO	
RTV Herceg Bosna - Mikuljaca	107.5	RMS-MO Gubavica		April 30, 2015	00:21:53	Modulation exceeded: 6%	90.4812852077	0.453	99.062	79.416	—	NO	

Date range: Any date Transmitter: Monit. st: Submit

Transmitter	Monitoring station	Date	Time	PI code (Assigned)	PI code (On the Air)	Diagnosis	Traffic program	Traffic announcement	RDS Program	RDS Text
Studio 88 - Fortica	RMS-MO Gubavica	April 30, 2015	00:27:41	F0EC	F0EC	OK	0	0	STUD_88	
RSG - Fortica	RMS-MO Gubavica	April 30, 2015	00:27:10	F091	—	—	—	—	—	—
Kalman - Fortica	RMS-MO Gubavica	April 30, 2015	00:26:38	F0F2	F2BA	Wrong PI	0	0	KALMAN	
Radio FBiH - Fortica	RMS-MO Gubavica	April 30, 2015	00:26:06	F012	F209	Wrong PI	0	0	RADIO.F	RADIO FEDERACIJE
Otvorena mreza - Fortica	RMS-MO Gubavica	April 30, 2015	00:25:35	F208	F208	Wrong PI	0	0	O*MREZA	
RTV Mostar - Fortica	RMS-MO Gubavica	April 30, 2015	00:25:03	F021	F021	OK	1	0	RTV MO	RADIO TELEVIZIJA MOSTAR
Omladinski radio X - Fortica	RMS-MO Gubavica	April 30, 2015	00:24:32	F057	F158	Wrong PI	1	0	Radio X	Radi
BH Radio 1 - Fortica	RMS-MO Gubavica	April 30, 2015	00:24:00	F001	F201	Wrong PI	0	0	BHRADIO1	
Radio postaja Mostar - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:23:28	F004	—	—	—	—	—	—
MIR Medjugorje - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:22:56	F083	—	—	—	—	—	—
Oscar C - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:22:25	F006	F2FE	Wrong PI	0	0	OSCAR C	
RTV Herceg Bosna - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:21:53	F01B	F01B	OK	0	0	RADIO-HB	
Radio Grude - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:21:21	F06E	F06E	OK	0	0	R.GRUDE	radiogrude@tel.net.ba
Obicni radio - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:20:50	F12D	—	—	—	—	—	—
RDV - Mikuljaca	RMS-MO Gubavica	April 30, 2015	00:20:18	F068	F068	OK	1	0	* DV *	
Studio 88 - Fortica	RMS-MO Gubavica	April 27, 2015	11:11:14	F0EC	—	—	—	—	—	—
Studio 88 - Fortica	RMS-MO Gubavica	April 27, 2015	11:11:05	F0EC	—	—	—	—	—	—
RSG - Fortica	RMS-MO Gubavica	April 27, 2015	11:10:43	F091	—	—	—	—	—	—
RSG - Fortica	RMS-MO Gubavica	April 27, 2015	11:10:33	F091	—	—	—	—	—	—
Kalman - Fortica	RMS-MO Gubavica	April 27, 2015	11:10:11	F0F2	F2BA	Wrong PI	0	0	KALMAN	
Kalman - Fortica	RMS-MO Gubavica	April 27, 2015	11:10:01	F0F2	—	—	—	—	—	—
Radio FBiH - Fortica	RMS-MO Gubavica	April 27, 2015	11:09:40	F012	F209	Wrong PI	0	0	RADIO.F	RADIO FEDERACIJE
Radio FBiH - Fortica	RMS-MO Gubavica	April 27, 2015	11:09:30	F012	—	—	—	—	—	—
Otvorena mreza - Fortica	RMS-MO Gubavica	April 27, 2015	11:09:08	—	F208	Wrong PI	0	0	O*MREZA	
Otvorena mreza - Fortica	RMS-MO Gubavica	April 27, 2015	11:08:58	—	F208	Wrong PI	0	0	O*MREZA	

THANK YOU FOR YOUR ATTENTION

Jasmin MUSOVIC, MScEE

CRA BH

email: jmusovic@rak.ba