

## NETWORK OF WEATHER RADARS IN REPUBLIC OF SRPSKA, BOSNIA AND HERZEGOVINA

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### 1 Introduction

This paper will present a new weather radar network in the region of the Western Balkans. This new radar network will very well fit into the existing radar networks in Croatia and Serbia, so that by establishing it, most of the Western Balkan region will be covered by high quality radar data. As can be seen from Figure 1, it is currently the southwestern and southern part of the Balkans without quality radar data. In the next few years, it is expected that the efforts of Croatia, Bosnia and Herzegovina (Republic of Srpska) and Serbia in the procurement and installation of new radars will significantly change the existing state to better.

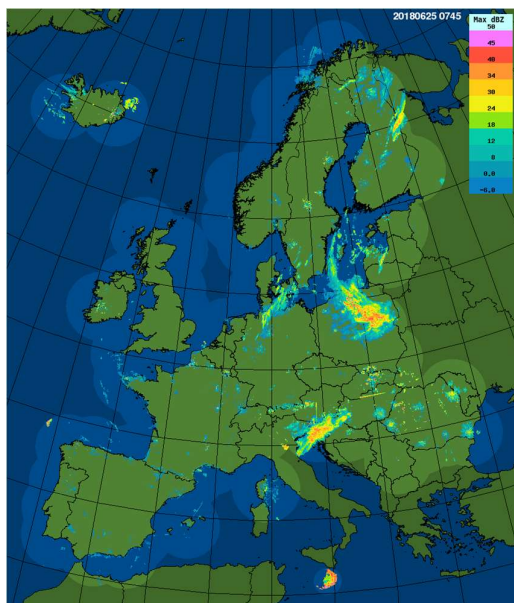


Figure 1: Opera European weather radar composite products 09/25/2018 07:45. It is adopted from the OPERA webpage.

### 2 Weather Radar at the location Borje

During July 2017, JP "Protivgradna preventiva RS" a.d. has installed the EEC DWSR-3501C SDP Doppler Weather Radar at the location of Borje, Republic of Srpska, Bosnia and Herzegovina. The location of the new radar is Lat 44.58326400°N, Long 17.60608900°E and height 1075 m. From this location in the range of 200 km, most of the territory of Bosnia and Herzegovina, as well as parts of the territory of Croatia, are covered. Figure 2 shows the technical characteristics of this radar:

DWSR-3501C SDP System Level Technical Characteristics	
Transmitter Type	Magnetron (EEC-5257-35)
Frequency	5,200 – 5,700 MHz
Transmitter Power	350 kW
Pulse Repetition Frequency	200 - 2400 PPS (within the duty cycle)
Pulse Width	0.4 to 2.0 µsec
Maximum Effective Range	>500 km (Reflectivity) and >250 km (Velocity) (Range Error is less than 1% of the range)
Maximum Velocity Detection	No Unfolding ~ 25 m/s 3:2 Unfolding ~ 50 m/s 4:3 Unfolding ~ 75 m/s 5:4 Unfolding ~ 100 m/s
Receiver Sensitivity – MDS	-114 dBm @ 2µsec
Noise Ratio	< 2.5 dB
Ground Clutter Suppression	≥ 40 dB (typically ~ 45 dB)
System Operational Availability	Better than 99.0%
System Power Requirements	Single Phase 220-240 VAC ± 10%, 50/60 Hz ± 10%

Figure 2: Technical characteristics EEC DWSR-3501C SDP Doppler Weather Radar

DWSR-3501C SDP Transmitter Performance Characteristics		
Transmitter Type	Magnetron (EEC-5257-35)	
RF Power Output	250 kW (nominal)	

IQ2 Receiver and Signal Processor Performance Characteristics		
Dynamic range:	> 105 dB at 0.5-MHz bandwidth	
Range Resolution:	15.625 m standard for 4 channels with 76.72MHz clock, other combinations by option, for example 15m with 80MHz clock	
Number of Range Gates	4096 (typical), 8192 (optional)	
Flexibility:	All IQ2 firmware and software can be updated through the server	

IQ2 Signal Processor Moments		
Reflectivity	Zh, Zv (corrected), [dBZ] / UZh, UZv (uncorrected), [dBZ]	
Radial Velocity	Vh, Vv, [m/s]	
Spectral Width	Wh, Wv, [m/s]	
Differential Phase	ΦDP, [degrees]	
Correlation Coefficient	ρHV, [0.00 – 1.00]	
Linear Depolarization Ratio	LDR, [dB]	
Specific Differential Phase	KDP, [degrees]	
Differential Reflectivity	ZDR, [dB]	
Clutter power	CCORh, CCORv, [dB]	
Signal quality index	SQI	

D-Series Pedestal Performance Characteristics		
Type	Elevation over Azimuth	
Azimuth Velocity	> 36°/sec maximum	
Azimuth Acceleration	> 15°/sec <sup>2</sup>	
Azimuth Deceleration	> 15°/sec <sup>2</sup>	
Azimuth Rotation	360°, clockwise or counterclockwise	
Elevation Movement Range	Manual Mode -2° to + 92° (Bumper Stops)	Automatic Mode -0.5° to + 90° (Software)
Elevation Velocity	Manual Mode Variable from 0°/sec to 15°/sec	Automatic Mode Software controlled up to 5 scans per minute
Azimuth & Elevation Pointing Accuracy	Better than ± 0.1°	
Azimuth & Elevation Display Resolution	Better than ± 0.1°	
Safety Devices	Safe switch on Pedestal and Access door interlock, Latched Key Maintenance Control	

4.2 Meter (14-Foot) Reflector Performance Characteristics	
Reflector Type	Varies (Spun Aluminum or Composite)
Feed Horn Type	Orthogonal (Dual Polarization)
Beam width	< 1.0° (0.95° typical above 5600 MHz)
Gain	≥ 45 dB (typical)
Operating Frequency	5200-5700 MHz
Wavelength	5.0 cm at 5625 MHz
Standard Polarization	Dual Polarization (SIDPOL)
Side Lobes	≥ 25 dB down from main lobe @ ≤10° (nominal)
VSWR (at Reflector)	1.15:1 (typical)

Figure 2: Technical characteristics EEC DWSR-3501C SDP Doppler Weather Radar

Figure 3 shows the tower at the location of Borje:



Figure 3: The tower at location of Borje

### 3 Network of weather radars

By the end of 2018, it is planned to set up another EEC DWSR-3501C SDP Doppler Weather Radar at Jahorina, Republic of Srpska, Bosnia and Herzegovina. Location of the planned radar is Lat 43.72019944°N, Long 18.56186110°E and height 1911.5 m. In this way, in the 200km range, both radars would cover the entire territory of the Republic of Srpska, Bosnia and Herzegovina, parts of the territory of Croatia, Serbia and almost the entire territory of Montenegro. Coverage of the territory of the new radar network and its integration into existing radar networks in Croatia and Serbia will be shown.

Figure 4 shows the coverage at locations of Borje and Jahorina in the 200 km range

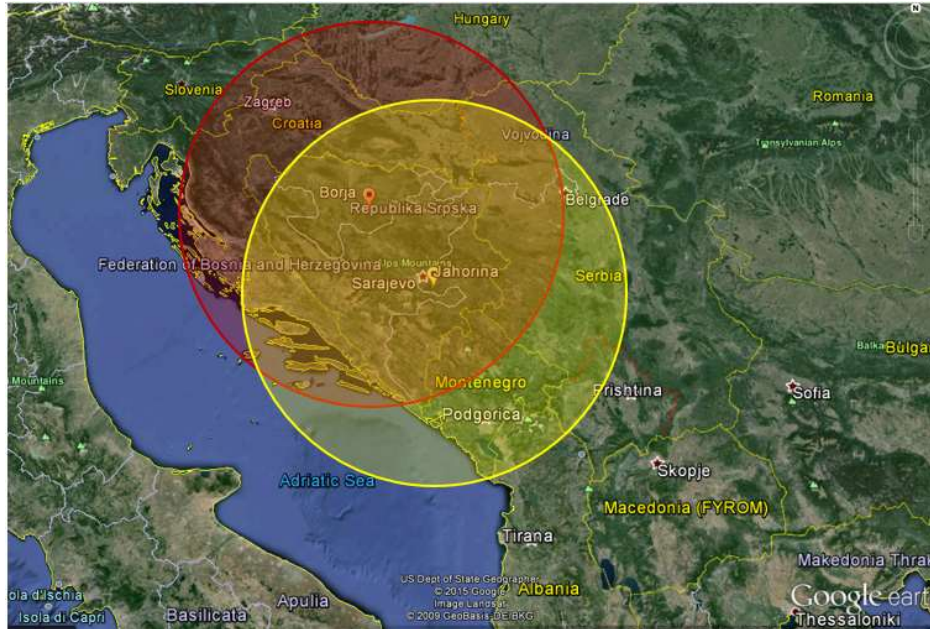


Figure 4: The coverage at locations of Borje and Jahorina in the 200 km range

Figure 5 shows the coverage at locations of Borje ,Jahorina (Republic of Srpska, Bosnia and Herzegovina), Bilogora(Croatia), Fruska gora and Jastrebac (Serbia) in the 200 km range:

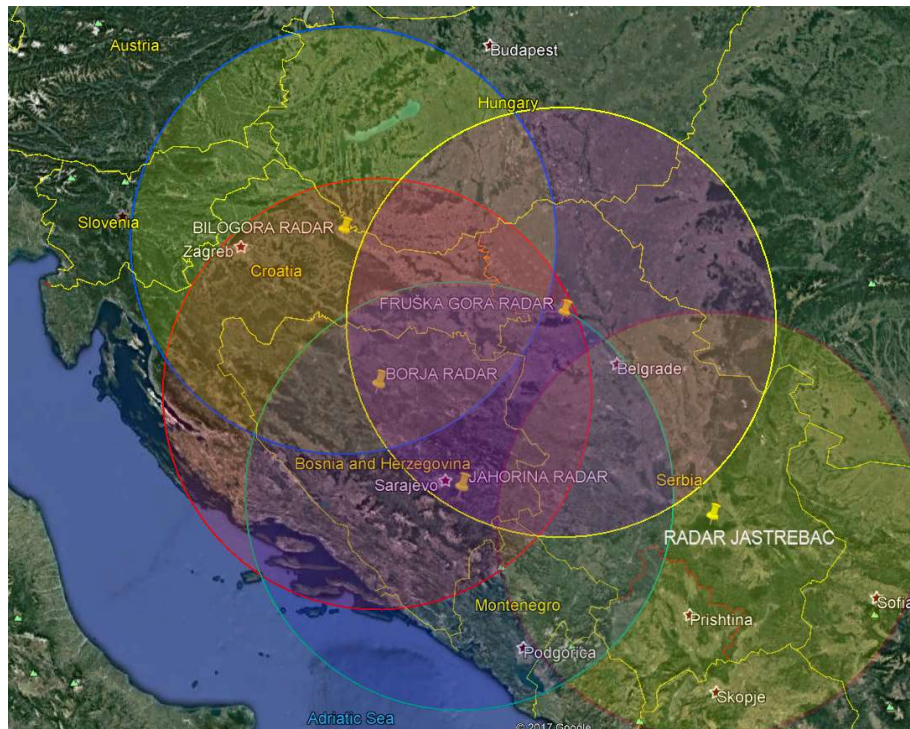


Figure 5: The coverage at locations of Borje ,Jahorina (Republic of Srpska, Bosnia and Herzegovina), Bilogora(Croatia), Fruska gora and Jastrebac (Serbia) in the 200 km range



Also, the connection of a new radar network in Republic of Srpska, Bosnia and Herzegovina to European and regional radar networks is planned, especially in the OPERA (Operational Programme for the Exchange of Weather Radar Information).

### References

**Enterprise Electronics Corporation**, Technical Documentation Set Operations and Technical Manual

DWSR-3501C SDP - 24 September 2015

**Enterprise Electronics Corporation**, EDGE 6 User Manual - 29 January 2015

**Enterprise Electronics Corporation**, EDGE 6 Technical Manual - 29 January 2015

**OPERA radar animation** is available online.: <http://eumetnet.eu/activities/observations-programme/current-activities/opera-radar-animation/> - Url visited 25.06.2018.