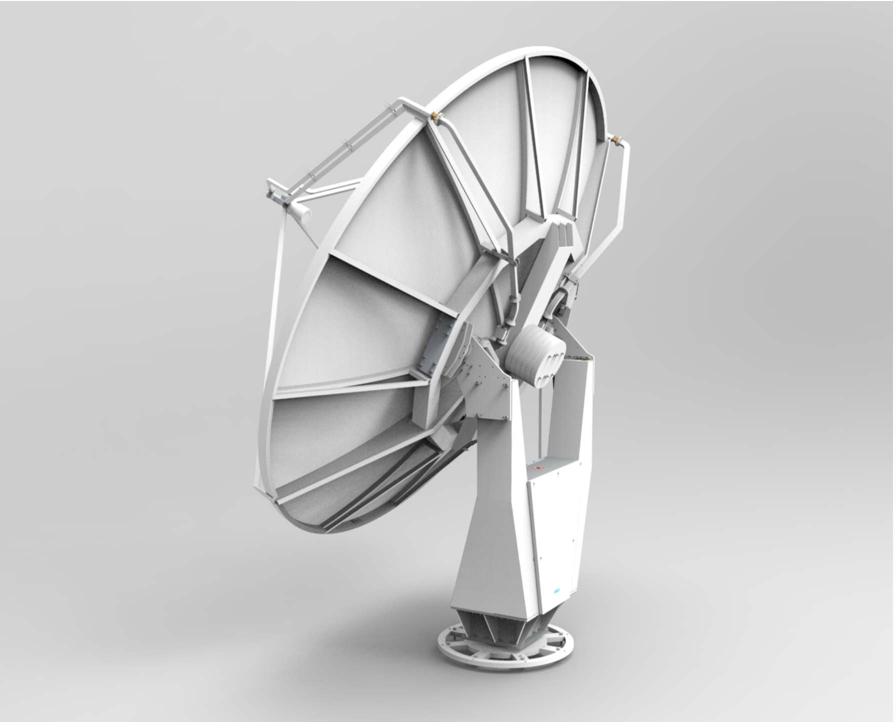
VAISALA

Weather Radar WRM200



Features

- 250 kW magnetron transmitter with low-maintenance solid-state modulator
- Vaisala lightweight, semi-yoke style pedestal
- 1° beamwidth low side lobe antenna
- Modular single cabinet design containing transmitter, receiver, controller, processor, dehydrator, polarization waveguide assembly
- Built around RVP900™ and IRIS™ software
- Remote control and monitoring
- Image rejection > 80 dB (> 100 dB with Vaisala waveguide filters)
- Optional built-in automatic dual-channel calibration

Vaisala Weather Radar WRM200 is a dual-polarization C-band radar that uses a magnetron transmitter.

Dual-polarization

- Precision horizontal and vertical beam matching
- > 35 dB integrated cross-polarization isolation
- Enhanced reflectivity processing in STAR mode

Dual-polarization radars send vertically and horizontally polarized microwaves to measure the parameters needed for analyzing the target shape and improving data quality.

Targets are identified as, for example, rain, hail, or snow, using sophisticated data processing techniques.

HydroClass™

Vaisala Hydrometeor Classification (HydroClass) software makes optimal use of dual-channel measurements to detect the types of scatterers present in the atmosphere, such as rain, hail, snow, graupel, and even non-meteorological targets such as insects, chaff, and sea clutter.

The benefit is improved data quality and more accurate warnings for hazardous weather such as hail.

Enhanced reflectivity

Enhanced reflectivity is a signal processing technique that improves the detection capabilities of a dual-polarization radar.

The technique uses echo power estimation to improve the detectivity of weak signals over a long range.

Enhanced reflectivity is exclusive to Vaisala dual-polarization radars and RVP900™.

Attenuation Correction

Attenuation by intervening heavy precipitation has been a long-standing concern with weather radars, especially in tropical environments where heavy rain is common.

Dual-polarization radars meet this challenge by performing accurate, real-time attenuation corrections.

Technical Data

Transmitter

Transmitter tube	Coaxial magnetron VMC-2033A
Modulator type	Solid-state, utilizing IGBT technology
Frequency range	5.5 ... 5.7 GHz
Peak power	250 kW
Pulse widths	0.5, 0.8, 1.0, or 2.0 µs.
Duty cycle	0.12 %
Phase stability	< 0.5° rms
Pulse Repetition Frequency	50 ... 2400 Hz
Average Power	300 W, 0.0012 duty cycle
Modes	STAR or LDR
Dimensions (W × H × D)	483 × 622 × 920 mm
Weight	76 kg (typical configuration)

Antenna and Pedestal

Total weight (4.5 m antenna and pedestal)	1530 kg

Antenna

Type	Center-fed parabolic reflector
Reflector diameter	4.5 m
Gain (typical)	45 dB
Beam width	< 1.0°
Difference between H and V beam widths	< 0.1° (<0.2 dB difference in gain)
Peak sidelobes at main polarization planes	< -29 dB
Integrated cross-pol isolation	< -35 dB
Cross-pol isolation at main polarization planes	< -36 dB
H/V alignment (squint angle)	< 0.1°
Weight (reflector with counterweight plate)	620 kg

Pedestal

Type	Semi-yoke elevation over azimuth
Angle span software limits	-2 ... 108°
Maximum scan rate (azimuth and elevation)	40 degrees/second (6.67 rpm)
Acceleration	20 degrees/second^2
Position accuracy	< 0.1°
Motors	Brushless AC servo
Weight	910 kg

Signal processing

Signal processor	Vaisala RVP900
Azimuth averaging	2 ... 1024 pulses
Clutter filters	IIR, fixed, and adaptive width GMAP > 50 dB rejection
Data outputs (8 and 16 bit)	Ah/v, Azdr, CCOR, CSP, CSR, dBT, dBZ, dBZt, KDP, LDR, LOG, PHIH/V, PHIDP, PMI, R, RHOHV, SNR, SQI, T, V, VC, W, Z, ZC, ZDR,ZDRC,Zh, Zv, Zhv
Dual PRF velocity de-aliasing	2:3, 3:4, or 4:5 for 2X, 3X, or 4X de-aliasing
High sensitivity Zhv STAR mode processing	> 3 dB improvement detection gain
IF digitizing	16 bits, 100 MHz in 5 channels
Number of range bins	Up to 8168 per channel
Optional data outputs	HCLASS, I/Q
Processing modes	PPP, FFT/DFT, Random Phase 2nd trip filtering/ recovery
Range resolution	N*22 m
Range de-aliasing by random phase	

System specifications

Input power	Voltage: 3-phase 230/400 VAC ± 10 % 50-60 Hz ± 5 % Site mains supply fuses: min 16 A
Pedestal	Max. 1050 W Typical 200 W
Radar cabinet[1)]	Max. 2500 W Typical 2000 W 2)
Phase stability	< 0.5° rms
Maximum RhoHV	> 0.99

1) Includes cabinet cooler power consumption.
2) Ambient temperature +22 °C, RH 50 %.

Options

Radome	Typical 6.7 m, foam core sandwich, random panel
Automatic calibration	
Forward and reverse transmitted power monitoring	
Wide dynamic range receiver > 115 dB	

Radar receiver

Type	Dual-stage, dual-channel IF downconverter and digitizer
Noise figure	< 2 dB
Dynamic range	> 99 dB (2 µs pulse) (option > 115 dB)
Image rejection	> 80 dB > 100 dB with waveguide filters
Tuning range	5.5 ... 5.7 GHz
1st intermediate frequency	442 MHz
2nd intermediate frequency	60 MHz

Radar Controller

Type	Vaisala RCP8 with IRIS Radar
Scan modes	PPI, RHI, Volume, Sector, Manual, Rapid Scan
Local display	Real time, Ascope, BITE, products

Radar cabinet

Dimensions (W × H × D)	600 × 1800 × 1320 mm
Total height	1890 mm[1)]
Weight	380 kg
Cooling	Air-conditioned
Operating temperature	+10 ... + 40 °C
Recommended operating temperature	+15 ... + 25 °C
Operating humidity	0 ... 95 %RH, non-condensing
Storage temperature	−50 ... +50 °C
Operating altitude/ Ambient pressure	Up to 3000 m Up to 700 hPA

1) *The total height includes the cabinet protection unit and cabinet legs.*

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3 **Antenna and pedestal**

3.1 Antenna

The most important part of a dual polarization radar is the antenna. It's vital that the antenna has a proven low side lobe level, excellent cross polarization isolation characteristics (because otherwise h and v channel data will be mixed to each other), and that the main beam lobes of two polarizations match. In fact the antenna beam patterns are the limiting factors in quality of the polarimetric variables, namely differential reflectivity, differential phase, linear depolarization ratio and co-polar correlation coefficient and therefore the antenna design and quality are key issues for the overall radar performance.

Because of the importance of the antenna in determining the overall quality of the data, in the Vaisala's WRA111 antenna dish shape and structure have been carefully designed to optimize the performance for operation at dual polarization. The solid surface reflector is manufactured to a tolerance of 1 mm. With this precision, in a slightly larger dish than is normally used for a 1-degree beam, and tapered feed pattern, an excellent side lobe performance is achieved.

The antenna system is equipped at the factory for dual polarization applications with an orthomode feedhorn and dual waveguide structures. Integrated cross polarization isolation is better than -37.1 dB.

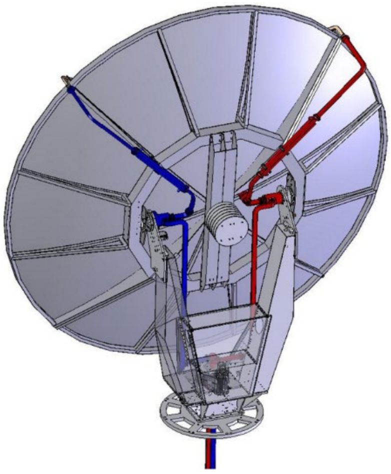

Figure 5 WRA111 Dual Polarization Antenna

Figure 5 shows the rear view of the antenna. The vertical polarization waveguides are drawn in blue and horizontal waveguides in red.

A typical radiation pattern of Vaisala Antenna is shown in Figure 6. From the figure you can see that the antenna has matched co-polar horizontal and vertical main lobe patterns enabling the radar to make uncontaminated dual pol measurements, such as differential reflectivity (ZDR) and differential phase (PhiDP). The antenna forms a symmetrical beam with a half power beam width of typically below 0.94 degrees.

FORM 1, item 33.f

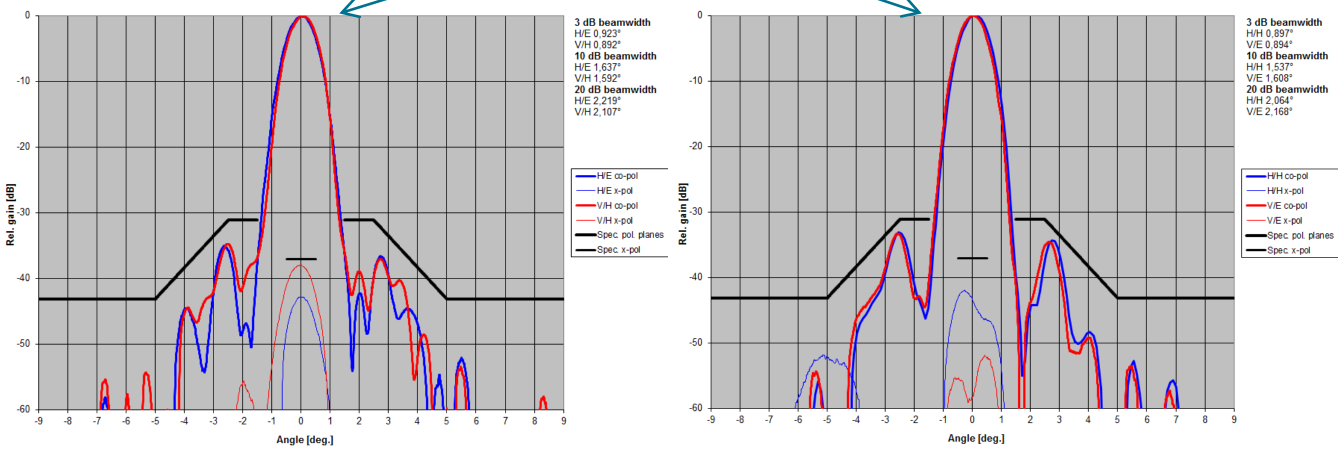

Figure 6 WRA111 Antenna Beam Patterns, Horizontal (H) and Vertical (V) planes

TheWRA111 antenna side lobes at the main polarization planes (horizontal and vertical) roll off quickly below level of -43.1 dB (±5.0° from the main lobe) including Electric Field (E-Field) and Magnetic Field (H-Field). At the feed strut planes, the side lobes are well below -30 dB. Antenna's integrated cross-polarization isolation (covering both main planes and strut planes) is better than –37.1 dB which makes it the best in the industry.

The antenna and pedestal are installed in a radar tower covered by a Radome. The antenna consists of a reflector dish, antenna feed with an orthomode transducer (OMT), feed supporting struts, and waveguides.

FORM 1, item 32

The reflector dish is parabolic with a center-fed (circular) corrugated horn. The horizontal and vertical polarization waveguides are attached to their corresponding OMT ports.

Figure 7 Waveguides Connected to the Orthomode Feed