

# GuideWave<sup>®</sup> Azimuthal Resistivity Tool

Provides deep-reading resistivity measurements that enable accurately navigating and landing wells in geologic targets

## Applications

- Proactive geosteering in complex reservoirs in which geosteering is impossible using traditional, reactive methods
- Gathering data in upper and lower boundaries of formations that previously had a symmetric response when using traditional, nonazimuthal tools
- Validating geological models

## Features and Benefits

- The GuideWave tool combines deep-reading resistivity measurements with proactive geosteering capabilities, which facilitates accurate identification of targets and eliminates the need for costly, time-consuming pilot holes.
- State-of-the-art inversion algorithms calculate the distance to the formation boundaries above and below the tool. Quantifiable distance-to-boundary detection enables better planning of well production.
- Deep resistivity images can be produced from azimuthal signatures.
- All measurements are fully compensated to minimize borehole effects.

## Tool Description

The Weatherford GuideWave azimuthal resistivity tool provides deep-reading measurements that enable accurately navigating and landing horizontal wells within geologic targets. The unique design of the GuideWave tool incorporates radial, axial, and tilted antenna orientations that gather measurements for accurately determining the distance to formation boundaries and formation resistivity. Phase and attenuation resistivities are measured with multiple antenna spacings and frequencies, all of which are fully compensated to eliminate receiver drift and to reduce borehole effects.

The directionality of deep-reading azimuthal measurements with 360° boundary detection enables proactive geosteering. Using the GuideWave tool to drill horizontal wells in complex formations increases reservoir contact, mitigates drilling hazards, avoids fluid contacts, and minimizes sidetracks.



The Weatherford GuideWave azimuthal resistivity tool has radial, axial, and tilted antenna orientations that enable capturing 360° resistivity measurements.



# GuideWave® Azimuthal Resistivity Tool

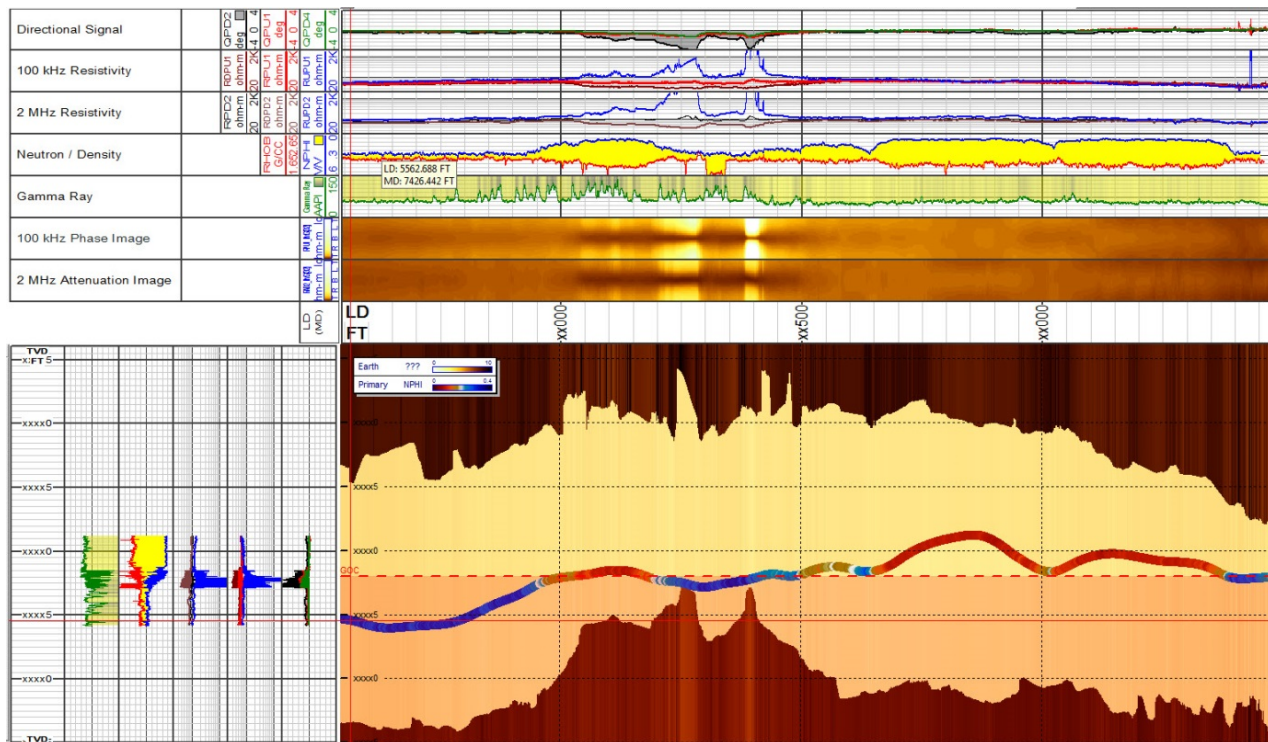
## Specifications

### Azimuthal Resistivity Measurements

#### Distance to Boundary

Frequency	2 MHz	400 kHz	100 kHz
Antenna spacing	56 in. (1,422.4 mm)	56 in. (1,422.4 mm)	76 in. (1,930.4 mm)
Reservoir/boundary resistivity	Distance to boundary*-phase		
100/1 ohm·m	6 ft (1.8 m)	12 ft (3.7 m)	15 ft (4.6 m)
Reservoir/boundary resistivity	Distance to boundary*-attenuation		
100/1 ohm·m	14 ft (4.3 m)	16 ft (4.9 m)	33 ft (10.1 m)

\*Vertical resolution is not applicable for azimuthal measurements.



The Weatherford GuideWave azimuthal resistivity tool proactively steers the drilling bit up, down, and around geological features to keep the borehole within the target zone.



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## Specifications (continued)

### Nonazimuthal Resistivity Measurements

#### Performance

	Phase	Attenuation
Measurement range (all spacing)	0.1 to 4,000 ohm-m	0.1 to 200 ohm-m
Accuracy	±0.25 mmhos	±0.5 mmhos

### Total Resistivity Measurements

Tool size	4-3/4 and 6-3/4 in. (120.7 and 171.5 mm)				4-3/4 in. (120.7 mm)	6-3/4 in. (171.5 mm)
Frequency	2 MHz		400 kHz		100 kHz	
Antenna spacing	30 in. (762 mm)	46 in. (1,168.4 mm)	30 in. (762 mm)	46 in. (1,168.4 mm)	76 in. (1.930.4 mm)	
Bed resistivity	Diameter of investigation-phase					
0.2 ohm·m	1.9 ft (0.6 m)	2.4 ft (0.7 m)	2.6 ft (0.8 m)	3.3 ft (1 m)	5.5 ft (1.7 m)	5.6 ft (1.7 m)
2 ohm·m	3 ft (0.9 m)	3.7 ft (1.1 m)	3.1 ft (0.9 m)	5.2 ft (1.6 m)	9.1 ft (2.8 m)	9.2 ft (2.8 m)
20 ohm·m	4.6 ft (1.4 m)	5.9 ft (1.8 m)	6 ft (1.8 m)	8 ft (2.4 m)	13.9 ft (4.2 m)	14.1 ft (4.3 m)
200 ohm·m	6.5 ft (2 m)	8.9 ft (2.7 m)	7.3 ft (2.2 m)	10.5 ft (3.2 m)	17.8 ft (5.4 m)	18.1 ft (5.5 m)
2,000 ohm·m	7.6 ft (2.3 m)	11.1 ft (3.4 m)	7.9 ft (2.4 m)	11.8 ft (3.6 m)	19.3 ft (5.9 m)	19.6 ft (6 m)
Bed resistivity	Diameter of investigation-attenuation					
0.2 ohm·m	2.9 ft (0.9 m)	3.5 ft (1.1 m)	4.1 ft (1.2 m)	5.1 ft (1.6 m)	8.8 ft (2.7 m)	9 ft (2.7 m)
2 ohm·m	4.8 ft (1.5 m)	5.9 ft (1.8 m)	7.2 ft (2.2 m)	8.7 ft (2.7 m)	15.6 ft (4.8 m)	15.8 ft (4.8 m)
20 ohm·m	8.6 ft (2.6 m)	10.3 ft (3.1 m)	14.2 ft (4.3 m)	16.4 ft (5 m)	30.5 ft (9.3 m)	30.9 ft (9.4 m)
200 ohm·m	18.3 ft (5.6 m)	20.6 ft (6.3 m)	34.4 ft (10.5 m)	37.1 ft (11.3 m)	70.4 ft (21.5 m)	70.9 ft (21.6 m)
Bed resistivity	Vertical resolution*-phase					
1 ohm·m	0.5 ft (0.2 m)	0.5 ft (0.2 m)	1 ft (0.3 m)	1 ft (0.3 m)	2.2 ft (0.7 m)	2.7 ft (0.8 m)
100 ohm·m	2.3 ft (0.7 m)	3 ft (0.9 m)	2.9 ft (0.9 m)	4 ft (1.2 m)	7 ft (2.1 m)	7.2 ft (2.2 m)
Bed resistivity	Vertical resolution*-attenuation					
1 ohm·m	1.4 ft (0.4 m)	1.4 ft (0.4 m)	2.4 ft (0.7 m)	2.8 ft (0.9 m)	5.4 ft (1.6 m)	5.6 ft (1.7 m)
100 ohm·m	5.5 ft (1.7 m)	6.6 ft (2 m)	8 ft (2.4 m)	9.3 ft (2.8 m)	19.5 ft (5.9 m)	19.7 ft (6 m)

\*Resolution is 50%.



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## Specifications (continued)

### Mechanical

Tool size	4-3/4 in. (120.7 mm)	6-3/4 in. (171.5 mm)
Maximum outside diameter	5.27 in. (133.9 mm)	7.27 in. (184.7 mm)
Length	34.7 ft (10.6 m)	35.3 ft (10.8 m)
Weight	2,100 lb (952.5 kg)	3,500 lb (1,587.6 kg)
Top connection, thread type	3-1/2 IF box	4-1/2 IF box
Bottom connection, thread type	3-1/2 IF pin	4-1/2 IF pin
Measure point from the bottom of the tool	17.2 ft (5.2 m)	17.7 ft (5.4 m)
Make-up torque	9,900 to 10,900 ft-lb (13,423 to 14,778 N·m)	28,000 to 32,000 ft-lb (37,963 to 43,386 N·m)
Maximum torque	16,700 ft-lb (22,642 N·m)	44,700 ft-lb (60,605 N·m)
Equivalent bending stiffness	4.75 x 2.54 in. (120.7 x 64.5 mm)	6.75 x 3.4 in. (171.5 x 86.4 mm)
Bending strength ratio	2.10	2.53
Maximum dogleg severity, rotating	15°/100 ft (30 m)	8°/100 ft (30 m)
Maximum doglog severity, sliding	30°/100 ft (30 m)	16°/100 ft (30 m)
Maximum flow rate	350 gal/min (1,325 L/min)	700 gal/min (2,650 L/min)
Maximum operating temperature	302°F (150°C)	
Maximum operating pressure	Standard: 20,000 psi (137.9 MPa)	
	Optional: 30,000 psi (206.8 MPa)	
Maximum sand content	2%	

