AWR

DUAL-FREQUENCY ARRAY WAVE RESISTIVITY SERVICE

APPLICATIONS

- HPHT wells
- Formation evaluation and petro-physical and anisotropy analyses
- Well placement with PayZone Steering* real-time forward modeling service
- Thin-bed modeling
- Invasion analysis

FEATURES & ADVANTAGES

- Compatibility with any mud type
- Tool placement anywhere in BHA
- Data acquisition with pumps on or off
- Compatibility with modular ABS* advanced battery sub
- High-speed data download
- High-capacity memory
- Fast acquisition mode
- Fully compensated, symmetrical antenna array for accurate quantitative measurements even in poor hole
- Low-frequency measurements for fewer eccentricity effects in oil-base mud
- 12 curves for phase shift and attenuation
- Deep, medium, shallow measurements

GAMMA RAY FEATURES

- API-calibrated measurement
- Rugged scintillation detector for high-resolution, repeatable logs
- Sensor 3 ft from tool bottom for early formation identification

INCLINATION FEATURES

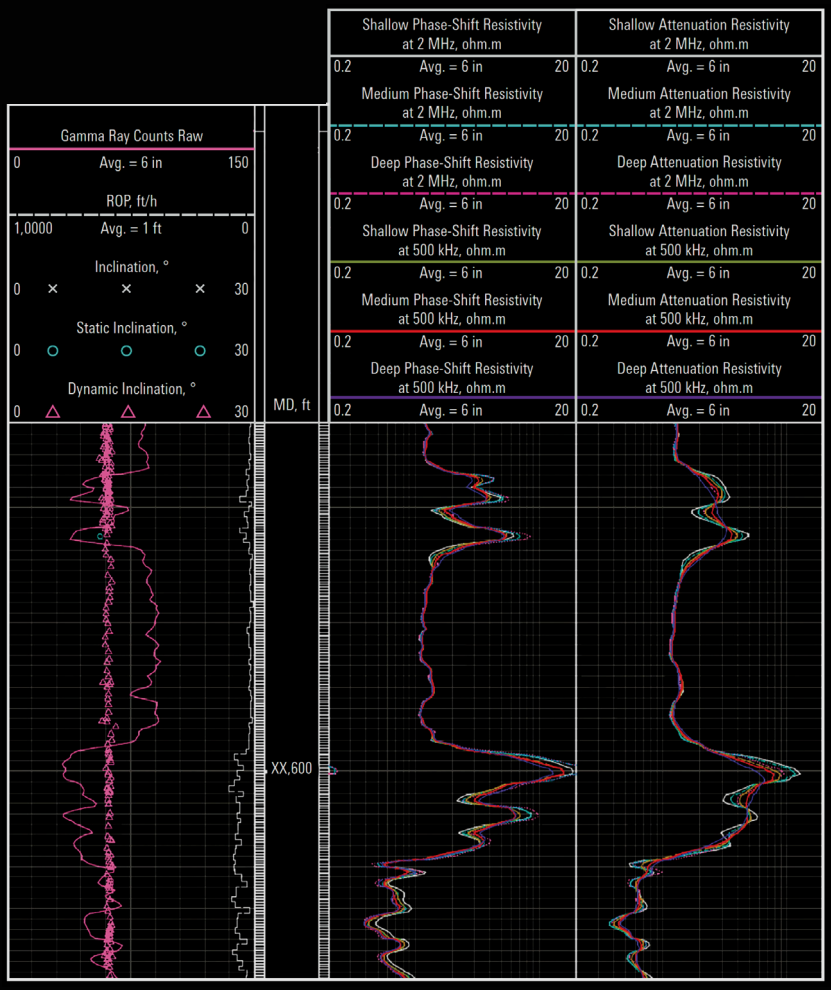
- Static and dynamic inclination
- Sensor 2 ft from tool bottom for tight directional control

With its modular design, the AWR* Array Wave Resistivity service fits anywhere in the LWD tool string, enabling flexible BHA configurations. In addition to resistivity data, it delivers scintillation type gamma ray (GR) and near-bit inclination measurements.

Operating at 2 MHz or 500 kHz, transmitters at spacings of 15, 25, and 45 in from the receivers deliver data from multiple depths of investigation. The spacings provide robust quantitative data for invasion corrections and processing without dielectric assumptions. Horizontal resistivity data are delivered in real time.

Rated for pressures to 25,000 psi and static bottomhole temperatures to 350 degF, the tool can also operate with the ABS battery, which provides more than 300 hours of operating capacity and is replaceable at the rig site.

The AWR service is available in nominal collar sizes from 43⁄4 to 91⁄2 in for hole sizes from 57⁄16 to 26 in and operates in all mud types.



AWR Servies provides high- and low-frequency curves through the pay section.

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TOOL SPECIFICATIONS

Tool OD, in [mm]	9 1⁄2 [241]	8 [203]	6 3⁄4 [171.5]	4 3⁄4 [121]
Tool length, ft [m]	20.0 [6]	20.0 [6]	20.0 [6]	20.0 [6]
Battery length, ft [m]	15.5 [4.7]	15.5 [4.7]	15.5 [4.7]	15.5 [4.7]
Flow range, galUS/min [m3/min]	250 to 1,250 [0.9 to 4.7]	250 to 1,125 [0.9 to 4.3]	250 to 750 [0.9 to 2.8]	0 to 375 [0 to 1.4]
Pressure drop in water, psi [kPa]				
at 1,000 galUS/min	280 [1,930.5]	280 [1,930.5]	n/a	n/a
at 500 galUS/min	80 [552]	80 [552]	80 [552]	n/a
at 375 galUS/min	50 [345]	50 [345]	50 [345]	65 [444]
at 250 galUS/min	30 [207]	30 [207]	30 [207]	29 [200]
at 100 galUS/min	n/a	n/a	n/a	6 [41.4]

RESISTIVITY SENSOR SPECIFICATIONS

Sensor type	Dual-frequency, compensated, triple spaced			
	Measurement range, ohm.m	**Accuracy, %**	**Range, ohm.m**	**Accuracy, %**
2-MHz phase	0.01 to 40	±2	40 to 500	±0.35
500-kHz phase	0.01 to 15	±2	15 to 200	±1.2
2-MHz attenuation	0.01 to 20	±2	20 to 100	±2.3
500-kHz attenuation	0.01 to 5	±2	5 to 20	±10

GR SENSOR SPECIFICATIONS

Detector type	Scintillation
Measurement range, gAPI	0 to 600

TEMPERATURE SENSOR SPECIFICATIONS

Range, degF [degC]	32 to 302 [0 to 150], 32 to 350 [0 to 175]†
Resolution, degF [degC]	±1 [±0.5]
Accuracy, degF [degC]	±4 [±2]

ENVIRONMENTAL SPECIFICATIONS

Max. vibration, gn [m/s2]	20 to 500 [196 to 4,903]
Max. working pressure, psi [MPa]	25,000 [172]
Mud sand content, %	1
Borehole fluid compatibility	Freshwater-, saline-, oil-, and synthetic-base muds; memory logging in air or gas

Inclination measurement range, 0 to 180°	**Accuracy**	**Resolution**
For any tool orientation, °	±0.2	0.1
Toolface range, 0 to 360°		
For inclination >6°, °	±1.5	1.5
For 3° inclination, °	±3.0	1.5

†Optional SURVIVOR* HPHT tool