64 Radar

A practical guide to 64 radar, covering the reader intent, the relationship to 64 radar, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.

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In the field of industrial process automation, the transition toward higher frequency level measurement has fundamentally changed how engineers approach complex tank geometries and challenging media. The term "64 radar" typically refers to high-frequency radar level transmitters, often operating in the 76 GHz to 81 GHz range (commonly categorized under the 80 GHz umbrella), which utilize Frequency Modulated Continuous Wave (FMCW) technology. These instruments have largely superseded older 6 GHz and 26 GHz pulsed radar systems in applications requiring high precision, narrow beam angles, and resistance to environmental interference.

As a professional manufacturer of industrial level measurement instruments, Welk provides advanced radar solutions designed to meet the rigorous demands of water treatment, chemical processing, and oil and gas industries. Understanding the underlying physics of 64 radar technology is essential for selecting the correct instrument for a specific industrial application.

Measurement Principles of High-Frequency FMCW Radar

Unlike older pulsed radar systems that measure the time it takes for a single microwave pulse to travel to the product surface and back, 64 radar systems utilize the Frequency Modulated Continuous Wave (FMCW) principle.

The FMCW Process

In an FMCW system, the transmitter emits a continuous microwave signal whose frequency increases linearly over a specific period (the sweep or bandwidth). The signal travels to the surface of the medium, reflects, and is received by the antenna. By the time the reflected signal returns, the transmitter is already emitting a signal at a higher frequency.

The instrument compares the frequency of the received signal with the frequency of the signal currently being transmitted. The difference between these two frequencies (the "beat frequency") is directly proportional to the distance the signal has traveled.

Why Frequency Matters

The move toward 80 GHz (64 radar class) technology offers two primary physical advantages over lower-frequency systems:

1. Narrower Beam Angle: For a given antenna size, the beam angle is inversely proportional to the frequency. A 26 GHz radar with a 75mm (3-inch) antenna might have a beam angle of approximately 10°, whereas a 64 radar/80 GHz unit with the same antenna size can achieve a beam angle as narrow as 3°. This allows the signal to avoid internal tank obstructions like agitators, heating coils, and ladders.

2. Higher Bandwidth: The resolution of a radar instrument is determined by its sweep bandwidth. Higher frequency systems allow for a much wider bandwidth (up to 4 GHz or more), which translates to better spatial resolution. This enables the sensor to distinguish between the actual liquid level and nearby interference or the bottom of the tank in low-level conditions.

Key Evaluation Criteria for 64 Radar Selection

Selecting a 64 radar transmitter requires an analysis of both the process environment and the physical characteristics of the vessel. Engineers should evaluate the following criteria before procurement.

Dielectric Constant (DK Value)

Radar technology relies on the reflection of electromagnetic waves. The strength of this reflection depends on the dielectric constant ($εr$) of the medium.

High DK (>10): Water-based liquids and acids provide strong reflections.

Low DK (1.4 to 4): Hydrocarbons, oils, and some solids reflect less energy.

64 radar systems are particularly effective for low-DK materials because their high sensitivity and signal processing algorithms can extract a usable signal from very weak reflections.

Process Conditions

Temperature and Pressure: High-frequency electronics are sensitive to heat. Standard units typically handle up to 150°C or 200°C, but specialized cooling fins or ceramic seals are required for extreme temperatures.

Dust and Vapor: One of the primary advantages of 64 radar is its ability to penetrate heavy dust (common in cement or flour silos) and steam. The high frequency allows for better signal penetration through particulate matter compared to ultrasonic sensors.

Agitation and Turbulence: If the liquid surface is turbulent, the narrow beam of a high-frequency radar ensures that more energy is reflected back to the sensor rather than being scattered away from the antenna.

Selection Table: Radar Frequency Comparison

Feature	6 GHz Radar	26 GHz Radar	80 GHz (64 Radar Class)
Beam Angle (approx.)	20° - 30°	8° - 12°	3° - 6°
Accuracy	±10 mm	±3 mm to ±5 mm	±1 mm to ±2 mm
Antenna Size	Large (Horn)	Medium	Small (Lens or Horn)
Dust Resistance	Moderate	Good	Excellent
Condensation Impact	Low	Moderate	High (requires lens design)
Best Use Case	Large vessels, foam	General purpose tanks	Narrow silos, tall tanks, precision

Installation Considerations and Best Practices

Even the most advanced 64 radar unit will fail to perform if installed incorrectly. Because the beam is so narrow, alignment is critical.

1. Nozzle Height and Diameter: While 64 radar can handle longer nozzles than 26 GHz systems, the nozzle should still be as short as possible to prevent "ringing" or internal reflections. The antenna should ideally extend slightly past the bottom of the nozzle.

2. Obstruction Clearance: Ensure the narrow beam path is clear of any internal structures. Even though the beam is only 3°, any metal object within that path will create a "false echo." Modern software can perform a "False Echo Suppression" or "Empty Tank Mapping," but it is best to avoid the obstruction entirely.

3. Mounting Position: The sensor should not be mounted in the center of a tank (to avoid multiple reflections from the tank walls) nor too close to the wall (to avoid signal interference). A common rule of thumb is to mount the sensor at 1/4 to 1/3 of the tank diameter from the wall.

4. Orientation: For solid materials with an angle of repose, an adjustable flange (aiming device) is often necessary to point the radar beam perpendicular to the material surface to maximize signal return.

For more detailed technical specifications and product variations, you may visit the Main Page to review specific model capabilities.

Common Risks and Limitations

While 64 radar is a versatile technology, it is not a universal solution for every application. Engineers must be aware of the following risks:

Condensation and Buildup

High-frequency signals have shorter wavelengths, which means they are more easily attenuated by water droplets or material buildup on the antenna lens. While many 64 radar units use PTFE (Teflon) lens covers to shed moisture, heavy condensation can still cause signal loss. In these cases, an air purge connection is recommended to keep the lens clean.

Heavy Foam

Radar signals are often absorbed or scattered by thick, dense foam (like that found in some chemical reactors or wastewater treatment plants). If the foam is conductive and dense, the radar may measure the top of the foam instead of the liquid. In such cases, a guided wave radar (GWR) or a lower frequency pulsed radar might be more appropriate.

Signal Attenuation in High Pressure

In extremely high-pressure gas phases (e.g., high-pressure CO2 or steam), the dielectric constant of the gas space changes, which can slow down the microwave signal and lead to measurement errors. This requires manual compensation in the instrument settings.

Information to Confirm Before Procurement

Before finalizing a 64 radar project, the following data points must be confirmed with the manufacturer or technical lead:

Vessel Height: Ensure the chosen model's range (e.g., 30m, 70m, or 120m) exceeds the maximum tank height.

Process Connection: Confirm if a threaded, flanged, or hygienic (Tri-clamp) connection is required. 64 radar units often allow for very small process connections (as small as 3/4" or 1") due to their high frequency.

Output Protocol: Determine if the system requires 4-20mA HART, Modbus RTU, Profibus, or Foundation Fieldbus for integration into the local PLC or SCADA system.

Hazardous Area Ratings: Confirm if the installation site requires ATEX, IECEx, or other explosion-proof certifications.

Frequently Asked Questions (FAQ)

Q: Can 64 radar be used for both liquids and solids?

A: Yes. High-frequency radar is exceptionally well-suited for solids because the narrow beam can be aimed into narrow silos, and the high bandwidth handles the uneven surfaces of bulk solids better than lower-frequency units.

Q: How does 64 radar compare to ultrasonic level sensors?

A: Ultrasonic sensors rely on sound waves, which are affected by air temperature, pressure, and vacuum. Radar uses electromagnetic waves, which are independent of these factors, making 64 radar much more reliable in vacuum or high-pressure environments.

Q: Is 64 radar more expensive than 26 GHz radar?

A: Historically, 80 GHz/64 radar was significantly more expensive. However, as the technology has matured and production volumes have increased, the price gap has narrowed. Given the reduced installation complexity and higher reliability, the total cost of ownership is often lower for 64 radar.

Q: Does the narrow beam mean I can't use it in small tanks?

A: On the contrary, the narrow beam makes it ideal for small tanks. It prevents the signal from hitting the tank walls, which is a common problem for lower-frequency radars in small-diameter vessels.

Conclusion

The adoption of 64 radar technology represents a significant step forward in industrial level measurement. By utilizing the 80 GHz frequency band and FMCW principles, these instruments provide the precision and reliability needed for modern automated processes. Whether dealing with the heavy dust of a cement silo or the precise requirements of a chemical dosing tank, understanding the beam dynamics and dielectric requirements ensures a successful installation. For those seeking to upgrade their current measurement systems or design new facilities, exploring the range of high-frequency options on the Main Page is a recommended next step in the engineering process.