

Experiment Description

VEGA Grieshaber KG (“VEGA”), a manufacturer of level and pressure instrumentation for the process industry, seeks a Spectrum Horizons experimental license to test new radar level measuring instruments. Specially, VEGA plans to test Tank Level Probing Radars (“TLPR”) and Level Probing Radars (“LPR”) operating in the 167–182 GHz and 231.5–250 GHz frequency bands.

VEGA intends to conduct limited field tests with fewer than 20 devices to demonstrate functionality and investigate marketplace viability of LPRs and TLPRs operating in these frequency ranges. Devices would be placed at nine different locations, with attention to avoiding zones needed to protect identified radioastronomy sites.

The advantages of the 167–182 GHz and 231.5–250 GHz frequency ranges include the high center frequency of the bands, which allows for small antenna and instrument designs, and the use of large measurement bandwidth. Small antenna designs allow measurements through small process openings which previously were not possible. Indeed, measurements using openings of just a half inch are conceivable. A large measurement bandwidth allows for a large spatial resolution of the possible radar targets in a container. This means increased measurement accuracy and reduced probability of false detections. Furthermore, level probing radars usually have a dead zone in close proximity to the antenna. Measurement accuracy in the dead zone is generally very low, and measurement may be impossible in the case of poorly reflecting media. A high measurement bandwidth allows for designs with smaller dead zones.

Development and testing above 160 GHz will allow for further improvements in industrial automation by allowing measurements in previously unworkable spaces and containers. Level probing radars could also be used to replace other types of sensors (e.g., ultra-sonic sensors), which have several disadvantages by comparison.

VEGA is also seeking to use these field tests to answer several other critical questions about level measurement devices at frequencies above 160 GHz:

- For instance, these experiments will help determine whether measurement technologies above 160 GHz exhibit different behavior with respect to the media to be measured. For example, foams produced in a wide variety of processes exhibit a broad range of reflective properties, mostly dependent on the size of the air bubbles that make up the foam. Depending on the application, customers may want to detect the surface of the foam or, in contrast, the medium underneath the foam (e.g., a liquid). Since foams are difficult to simulate, testing will show how well devices operating at frequencies above 160 GHz can handle these scenarios.
- These experiments also offer the possibility to test the influence of gases on measurement. For example, 80 GHz radar technology cannot be reasonably applied to processes involving ammonia-containing gases because of high signal attenuation.

Testing devices above 160 GHz will help determine whether, and to what extent, different gases affect measurements above 160 GHz.

Finally, the experiments will inform how to more effectively manufacture reliable sensors capable of operating at such high frequencies, at acceptable costs. For example:

- The very small wavelength of signals above 160 GHz places increased demands on the mechanical accuracy of the parts used in measuring instruments. In some cases, completely new concepts for signal routing have to be developed. VEGA's testing will provide critical data as to the durability of its sensor technology in real-world environmental conditions, and as to the technology's ability to withstand varying conditions, such as high and low temperatures, rapid temperature changes, high and low pressures, humidity, etc.
- The proposed experiment will inform whether state-of-the-art semiconductor and manufacturing technologies for sensor technology—not just level measurement technology—can support production of devices that successfully operate above 160 GHz in a technologically and economically viable way.