Quinteccent Inc.
Outdoor Antenna Test Range
Chihuahuan Desert Rangeland Center
Dona Ana County, New Mexico
Application for Experimental License

Explanation of Experiments and Need for Experimental License

Overview:

Quinteccent Incorporated in and its employees have been developing and installing HF direction finding and related systems and components for the government and commercial industries since 2004.

A current need exists to test a new class of multi-octave RF antennas in the HF, VHF and UHF ranges. This includes measurement of the antenna characteristics in Azimuth and elevation as well as its ability to direction find test signals in a controlled environment.

The Chihuahuan Desert Rangeland Research Center (Figure 1) in Dona Ana County New Mexico (http://chihuahuansc.nmsu.edu/index.html) is the proposed site for testing. It is roughly 100 square miles of land connected with the University of New Mexico, is sparsely populated and approximately 7 miles from most population. Radium Springs is the nearest city of ~1700 people. It is positioned next to the Jornada Research Institute. The Institute is approximately 300 square miles of property that in general are manned by few than 20 people. The isolated location reduces the potential for interference from outside signals effecting our measurements and reciprocally from our measurement effecting outside equipment and communications.

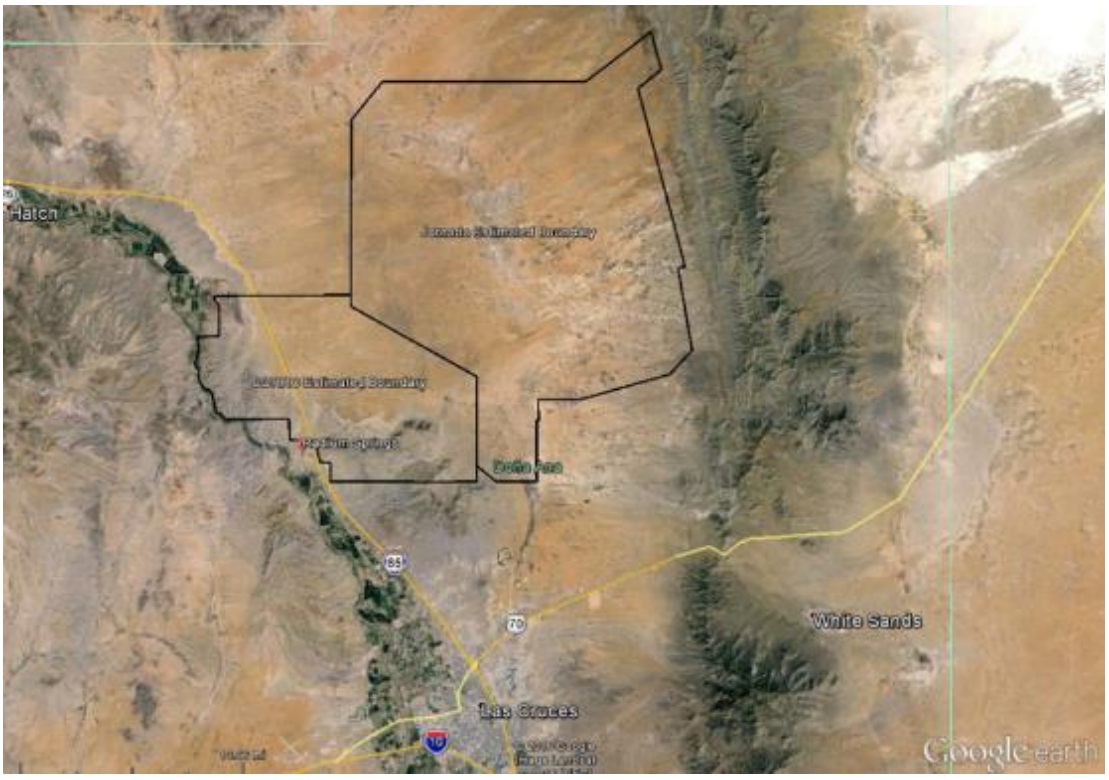

Figure 1: Chihuahuan Desert Ranchland Research Center New Mexico

Synopsis:

- Extent of Spectrum use: 1 MHz to 500 MHz, (0.01 Hz bandwidth during transmission)
- Operational Power level: 20 watts peak
- Time of spectrum use: 30 milliseconds per frequency step, 0.01 Hz of occupied bandwidth during each step
- System antenna examples: ETS- Lindgren EMCO 6512 (1MHz to 30MHZ, 3180B (30 MHz to 500 MHz)
- Minimal testing each day: 8 hours
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Description of operations:

The outdoor antenna test range operates with 1 transmit antenna (TX) site located 1,000 meters from the receive antenna site location (Figure 2). Test signals are transmitted from the TX antenna to the antenna under test (AUT) for each measurement. The range is initially calibrated by using 2 known antennas (examples below). A test CW signal (generated by a laboratory signal generator with a bandwidth of less than 0.01 Hz) is input into the standard gain antenna at one end of the test range and the broadcast signal is received at the other end of the test range into a second identical standard gain antenna. This allows the effects of the measurement equipment and the range to be calibrated out of the measurement. The AUT is then installed in place of the receive standard gain antenna and measurements are made as described below.

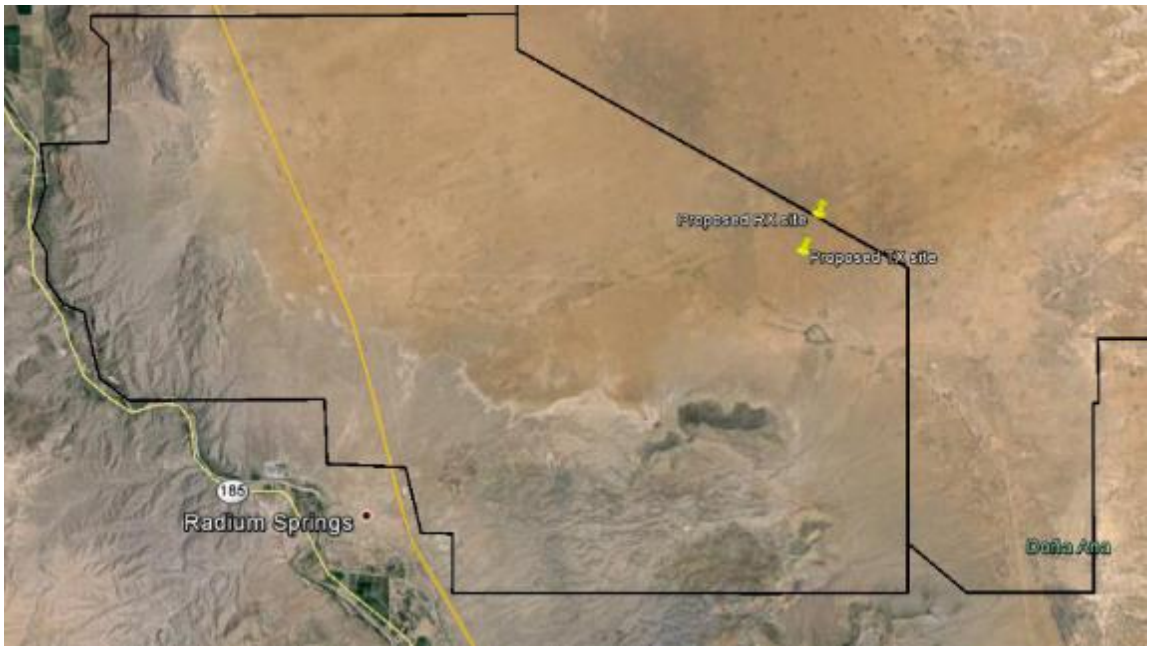

Figure 2: Proposed Antenna test site location

- ETS – Lindgren 6512 Passive H-field loop Frequency range: 1 to 30 MHz
- ETS – Lindgren 3180B Broadband Mini-Bicon Antenna Frequency Range: 30MHz to 500 MHz

Antenna pattern measurements:

The test range transmit antennas are used to conduct tests to measure the antenna patterns (frequency and polarization) of new compact HF/UHF/VFH antennas and antenna arrays. The antenna under test is held stationary on a rotatable platform where the incident RF field from the test transmit standard gain antenna is measured. Once the measurement is completed the system shifts to the next frequency and the measurement is repeated. When the frequency list has been completed the antenna under test is rotated to a new position and the measurement sequence is repeated. In general measurements are made every degree of azimuth and possibly every 5 degrees for elevation (elevation is only set up for +-15 degrees). This would equate to a maximum of 2520 measurements at each frequency. If 101 frequencies were used (more than typical) there would be ~258,600 measurements. Each measurement takes less than 30 millisecond meaning the transmitter is on for a total of ~7750 seconds (~129 minutes) for each complete measurement. In practice it takes several hours to complete each full measurement because of the delay time waiting for the positioner to move and settle in the next physical position and for the standard gain antennas to be swapped out for the change in bands. For these measurements, the transmitter would be periodically broadcasting a signal at any single frequency for approximately 11 seconds 360 positions for 30 milliseconds). Once completed the measurement data will be combined and the antenna patterns of the test antenna will be known.

Antenna resonance tests

The test range would be used to measure the resonances of the antenna. This would be accomplished by transmitting a swept frequency at the antenna under test and measuring the RF field at the antenna. The signal generator (0.01 Hz of bandwidth) simulates a true sweep by making a measurement and then incrementing the frequency a small amount as it makes each measurement. The typical dwell time on any given frequency is less than 30 ms. For this measurement a significant number of frequencies are used but there is no rotational measurement. There could be 5000 frequencies used again for 30 ms each for a total transmission of 150 second. The measurement has the ability to exclude a specific frequency but given the very narrow CW tone used and the short duration of the transmission at any given frequency the risk of interference is low. The RF responses are compiled to determine the resonance of the antenna under test.

The resonance test might also include a power handling test where the transmitter is connected to the Antenna under test and the power increased while the RF transmitted signal is monitored. Power levels would be maintained below 43 dBm.

Direction finding measurements:

Determination of the angular sensitivity of an arrayed set of antennas under test will require the transmission of a test signal and the rotation of the array under test. The antenna array under test is mounted as in the antenna pattern measurement and the transmitted signal is received out of each of the array antennas for a given frequency. After range calibration, the antenna under test is mounted on a rotatable platform. A test signal is transmitted and the incident RF field is measured out of the antenna under test. As each measurement is completed the measurement system shifts to the next frequency and make a repeat measurement. When the frequency list has been completed the antenna under test

is rotated to a new position and the measurement sequence is repeated. Once completed the measurement data will be combined and the direction finding capabilities for a single frequency transmission will be known. Additional test would be conducted with the cooperative use of 2 remote antenna towers (Lookout Peak Figure 3, and Twin Peak Figure 4). This 2 locations will allow for the determination of the impact of multiple controlled signals simultaneously incident on the array under test. Measurements of this type would be performed in a manner similar to the antenna pattern measurement (the same equipment is used for both types of measurements). Combined transmit times would be less than times for antenna pattern measurements principally because the measurement only covers 180 degrees of rotation to document the performance. It is also likely these measurements would not require as many frequencies to validate the performance.

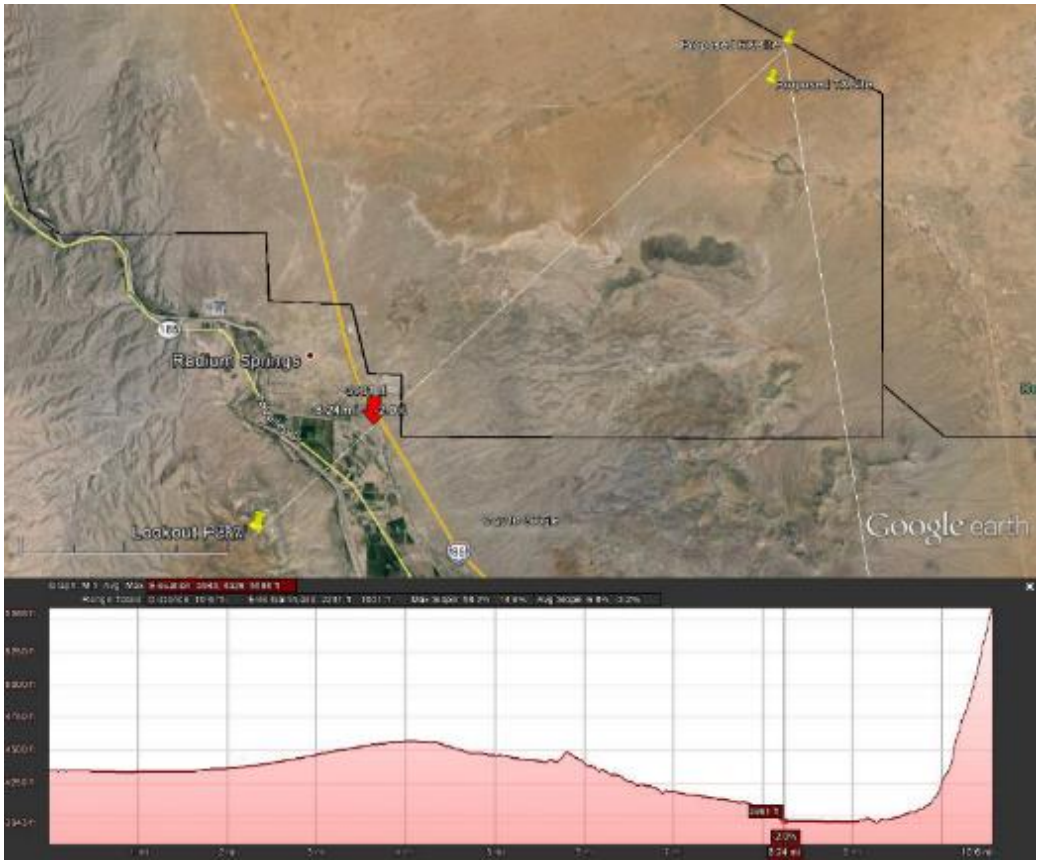

Figure 3: Path from Lookout Peak to Test Site

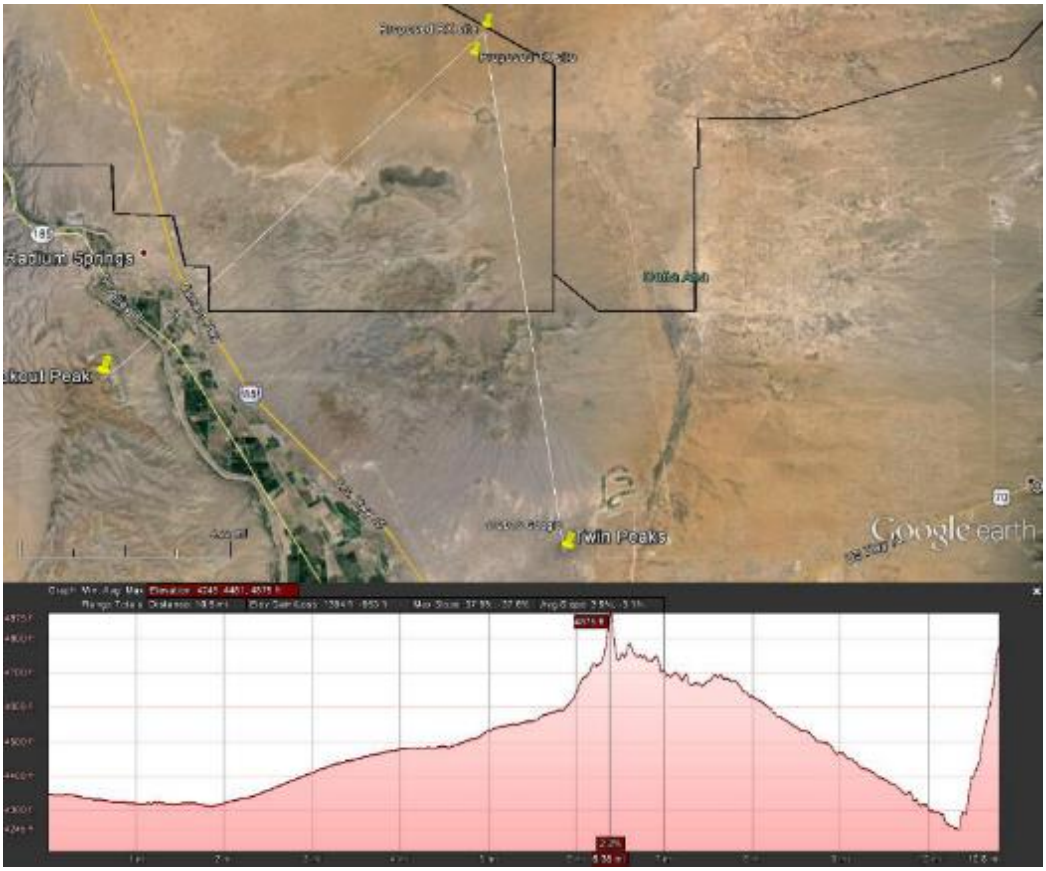

Figure 4: Path from Twin Peaks to Test Site

The application requests authorization to periodically conduct tests at various frequencies across an approximately 500 MHz frequency range. The tests use very narrow short duration (0.01 Hz, 0.03 ms), unmodulated continuous wave signals. This combination reduces the risk of impact to others.

The typical live testing use of the facility would be 5 days per month or less. Additional time on the range is required for set up and tear down of the experiments but does not require RF transmission

The proposed test site has been selected to be away from most industry and population to reduce the impact of environmental RF noise on our measurements and the impact of the measurement on the local RF environment. There are 2 population centers within 20 miles of the test site. Radium Springs (Pop. ~1700) and Las Cruces (Pop. ~100,000). Neither city is expected to be impacted by the testing.

Partners:

Quinteccent is teamed with Las Cruces Radio Center (LCRC) and New Mexico State University (NMSU). LCRC located at 4970 Blank Quartz Road Las Cruses, New Mexico 88011. LCRC will be participating in the testing of these new antennas.

NMSU is head quartered at 1780E University Avenue, Las Cruces New Mexico 88003. NMSU is the land holder of the property and has agreed to lease use of the property for the proposed testing.

Limitations on Use:

Low Power testing: It is anticipated that most transmit signals will be between 0 dBm (30 mW) to 30 dBm (1W) into the antenna but we are requesting approval up to 43 dBm (20 watts) into the antenna to allow for some power handling tests.

Limited Time of Use of Spectrum: It is anticipated that the antenna measurements will used ~ 30 days across an 18 month period 8 hours per day. The RF spectrum use of any given day would also be minimal.

Conclusion:

Quinteccent seeks authorization for operations at its outdoor antenna test range. The purpose of the range is to determine the antenna patterns and performance parameters of the Antennas Under Test. The antennas are tested by using transmitters which sweep/step across many discrete frequencies and record the receive signals at the AUTs thereby determining the performance of the antennas under test. While the testing is thorough the power level is only medium and the time on any single frequency is very brief.

If there are any questions, please contact Ken Limparis, President, Quinteccent Inc., 443-838-5447 ken.l@quinteccent.com