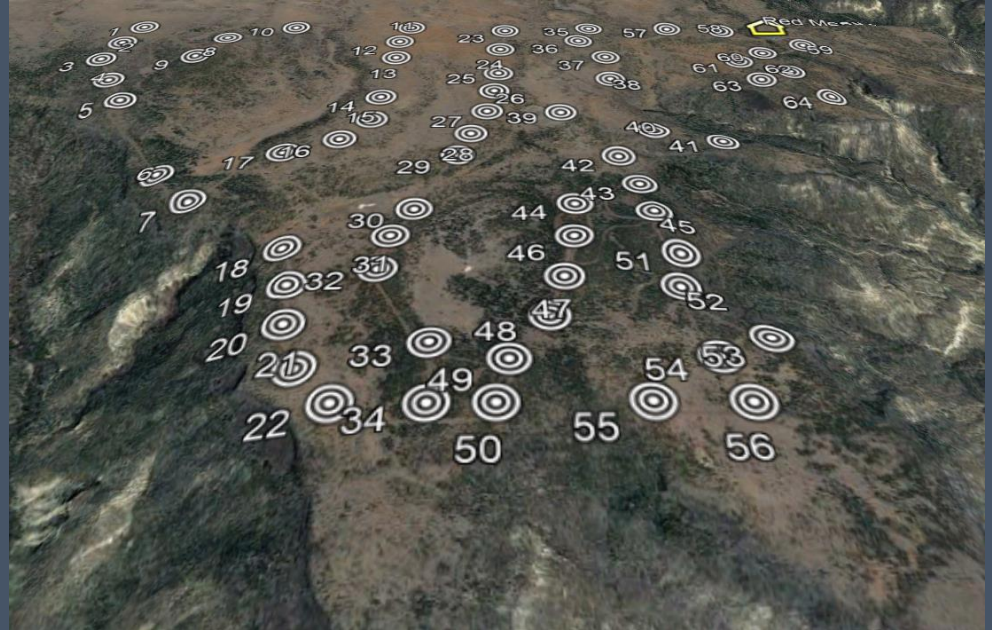


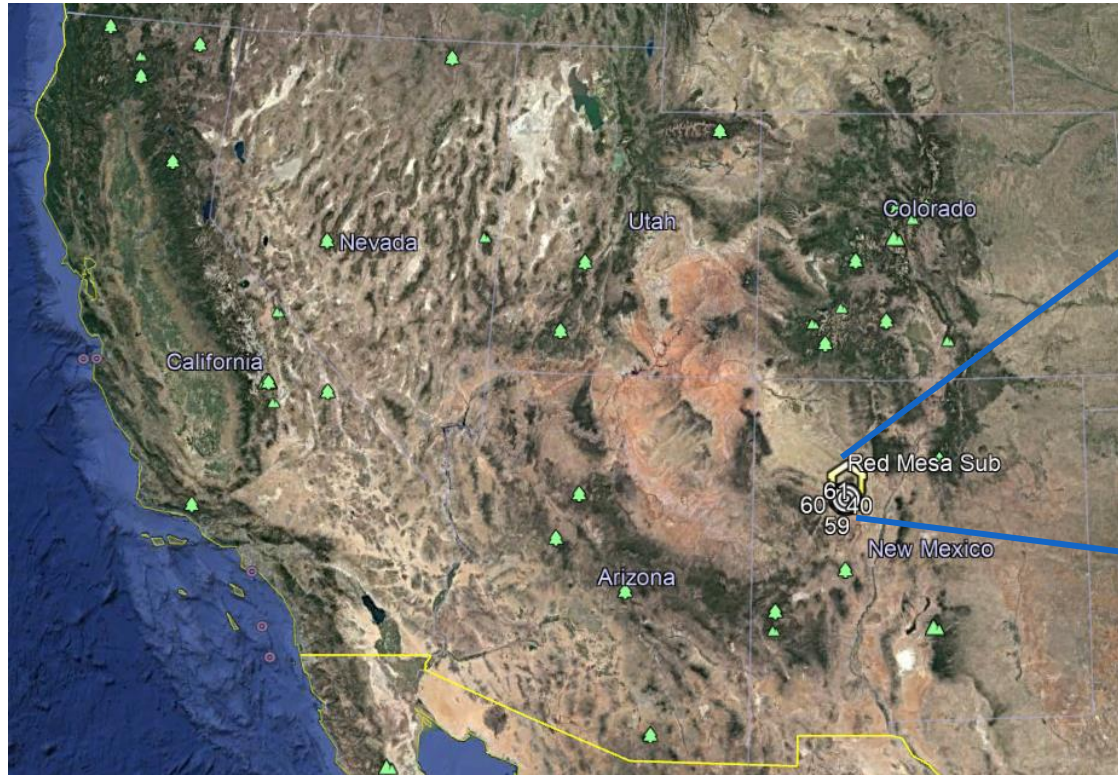
RED MESA WIND PARK

Coverage Analysis
for xSpec System v.1

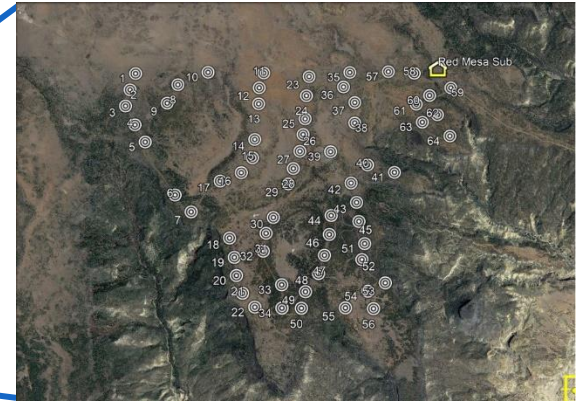
October 2019



Wind park: Area to be Served



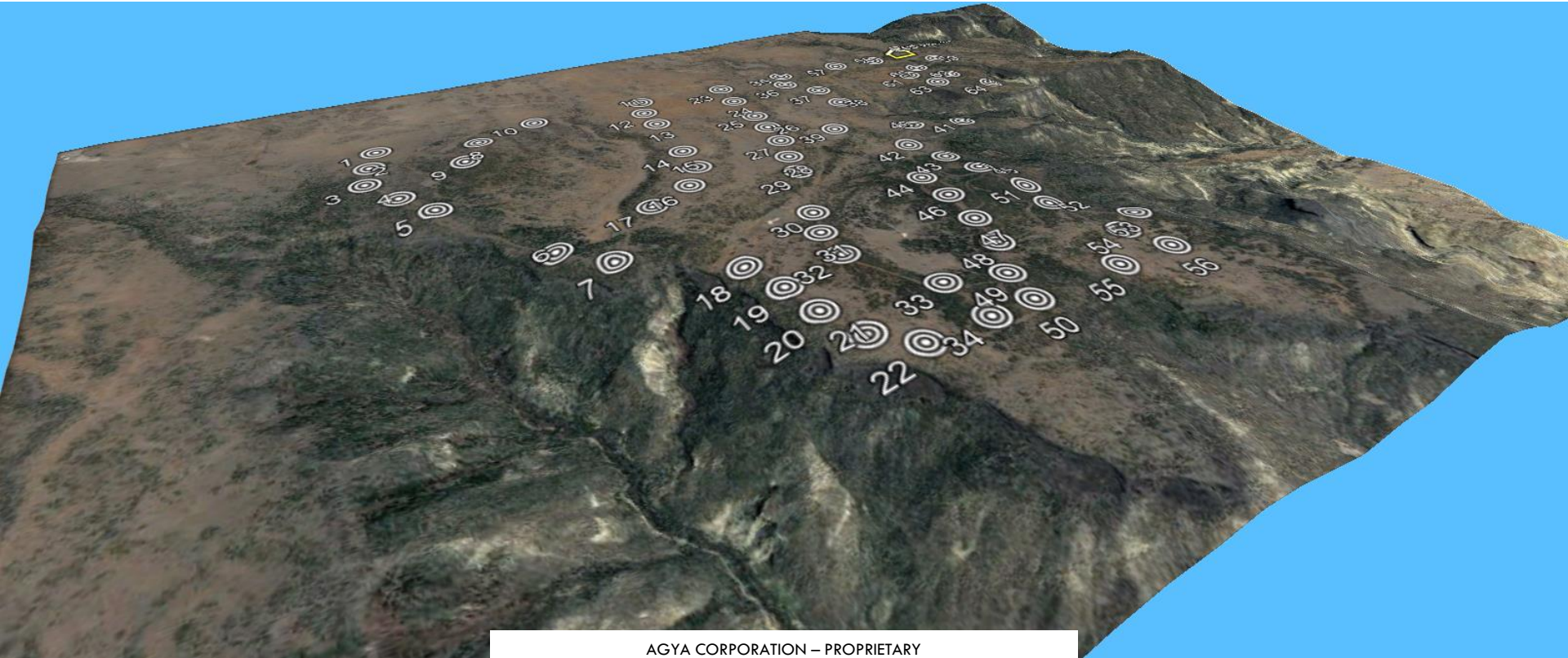
NW Corner:
35°17'00" N
107°26'00" W



Reference: Google Earth

SE Corner:
35°13'30" N
107°20'00" W

Terrain Elevation Data (Accuracy $\sim 10\text{arcsec}$ $\sim 250\text{m}$)



System Specification (xSpec @ 1.79GHz)

Requirements:

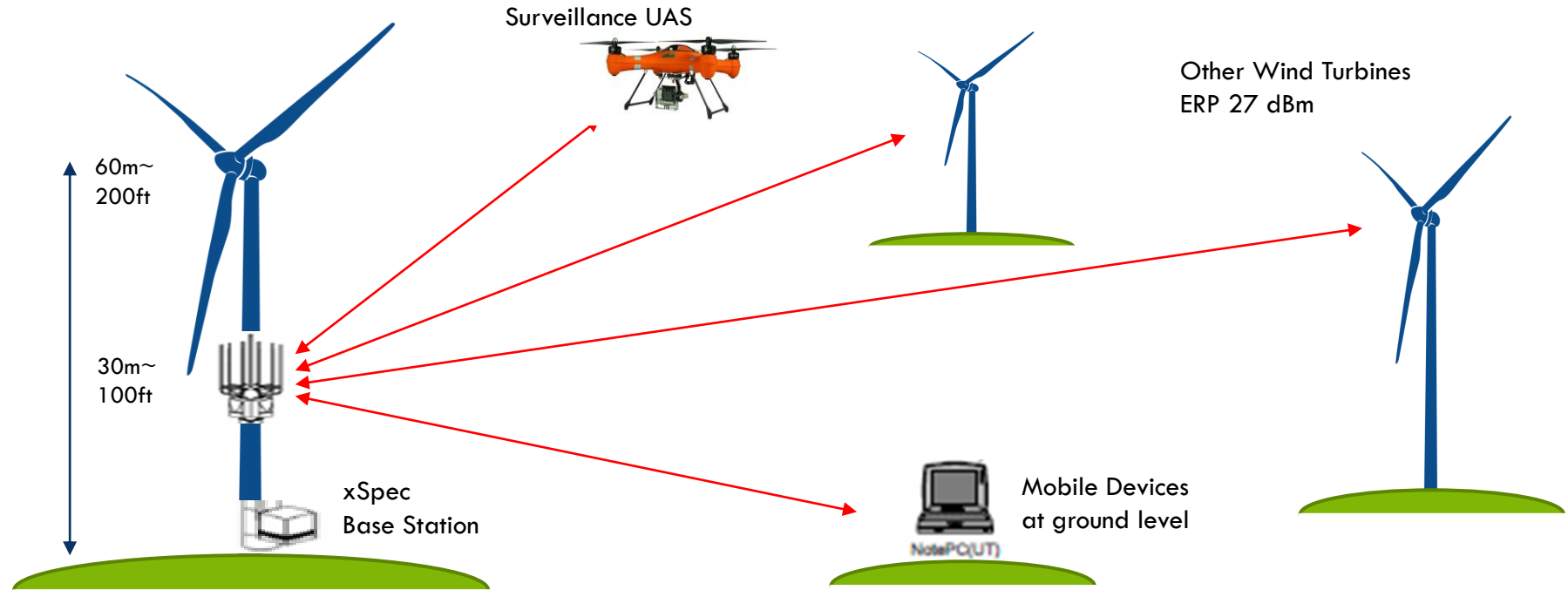
- 10 Mbps throughput
- AES256 over the air
- Ground coverage to laptops and coverage at 200ft to Turbines Nacelle
- Ethernet or fiber interface to network connection



System Parameters:

- Tower Tx power (dBm): 43
- Mobile Tx power (dBm): 27
- Frequency (MHz): 1794.69
- Downlink Access Control / Modulation: TDMA / QAM
- Uplink Access Control / Modulation: TDMA / QAM
- RF Filter BW (MHz): 5
- Maximum Allowable Path Loss (dB): 120
- Omni Antennas Gain (dBi): 10
- Total 32Mbps Throughput @5MHz
- Encryption available at application layer (including AES256)

Architecture and System Components



Coverage Maps Cell 27 (PL < 120 dB)

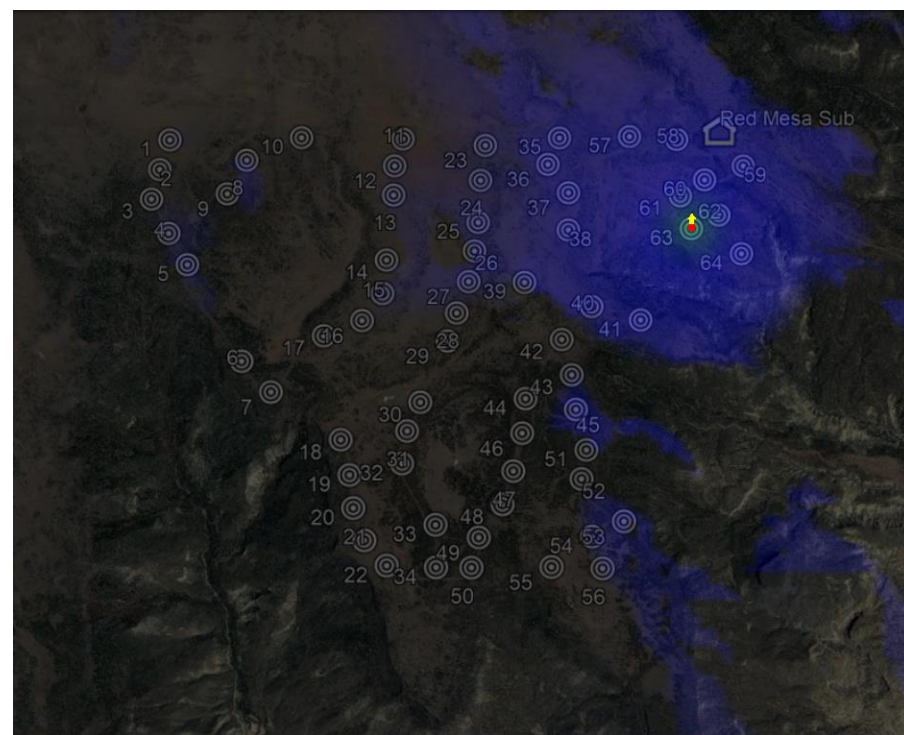


Note:
Only 1 Cell
(Base Station) is
unable to cover the
whole Wind park,
with recommended
quality.

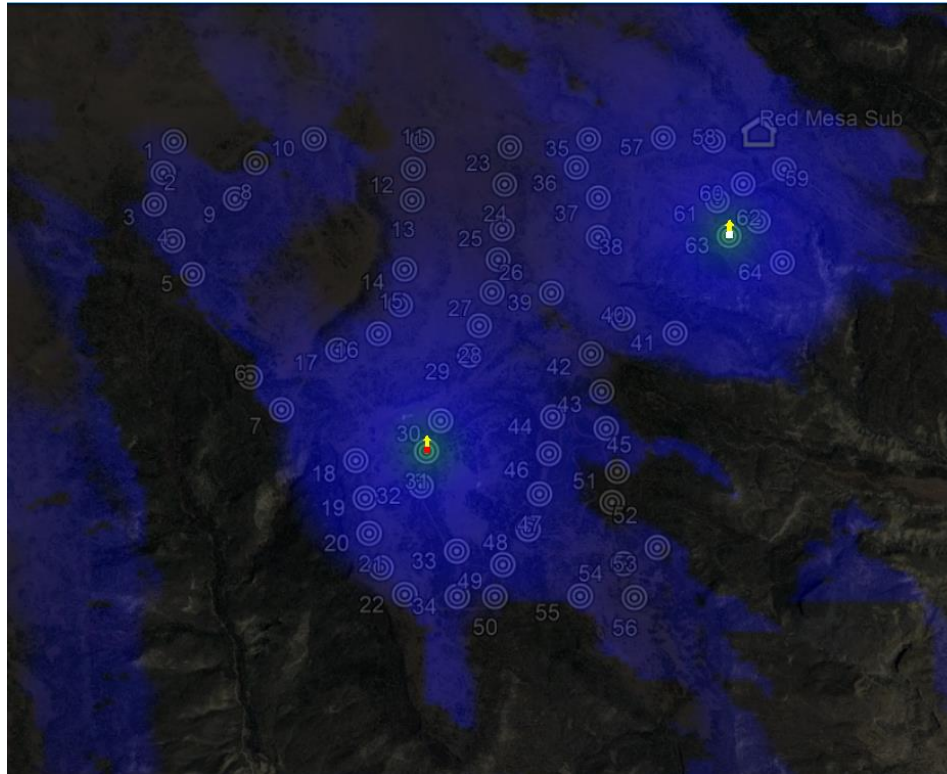
Coverage Maps Cell 18 & 41 (PL < 120 dB)



Coverage Maps Cell 31 & 63 (PL < 120 dB)



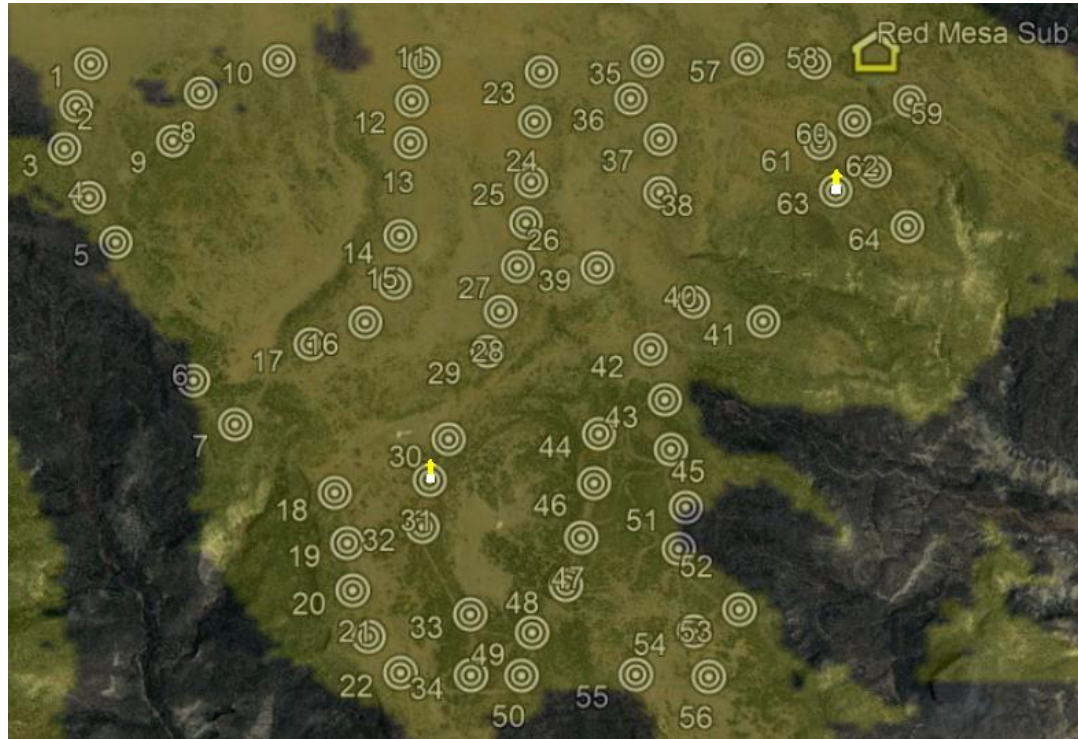
Coverage Maps Cell 31 & 63 (PL < 120 dB)



Note:

Two Cells
(Base Stations 31 & 63)
are able to cover the
whole Wind park with
xSpec System.

Final Coverage - Cell 31 & 63 (PL < 130 dB)

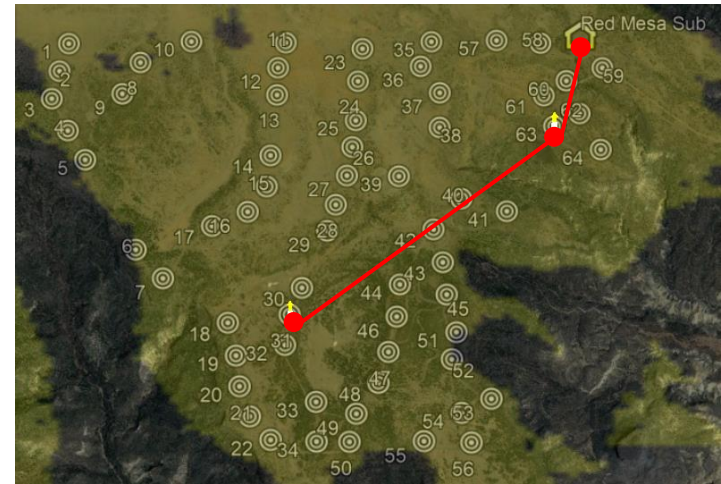


Note:

With a 10 dB less restrict margin for the path loss, a good coverage is obtained.

xSpec Basic System Dimensioning

- Two Base Stations complete set (antennas etc.)
- Cell 31 at
 - $35^{\circ}14'55.28''\text{N}$
 - $107^{\circ}23'13.97''\text{W}$
- Cell 63 at
 - $35^{\circ}15'54.36''\text{N}$
 - $107^{\circ}21'36.41''\text{W}$
- Central Office at Red Mesa Sub
- 2 μ wave links (microwave links)

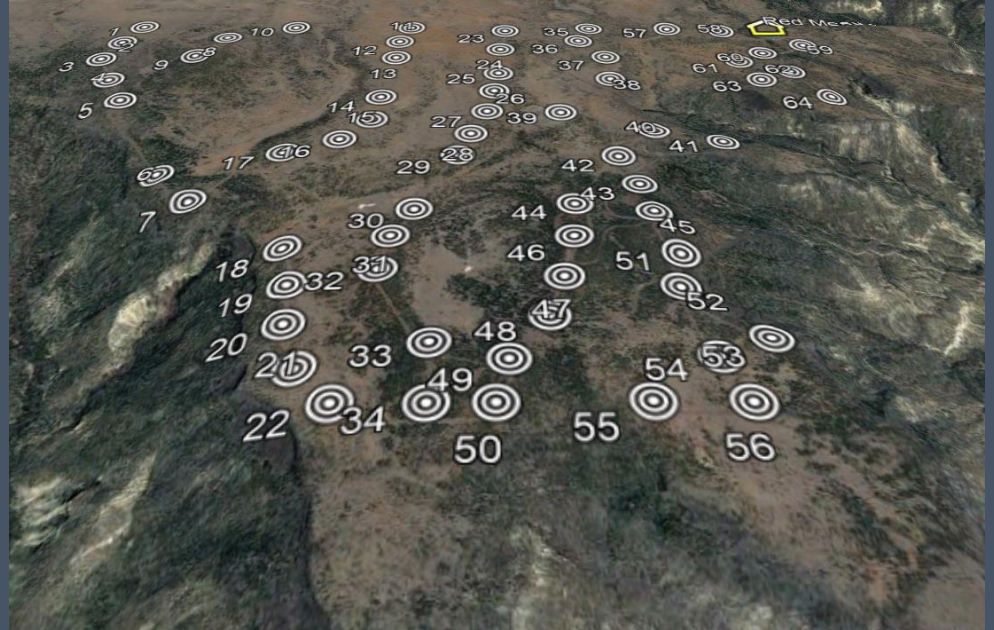


— μ wave links

Note: System is modular, and can be expanded to many other similar Wind Parks.

RED MESA WIND PARK

Back ups



Thank You!



MBWA Technology Comparison

	xSpec™	HSDPA	LTE	Mobile WiMax
Duplex	TDD	FDD	FDD	TDD
Spectrum bandwidth	5MHz	10MHz(5MHzx2)*1	40MHz(20MHzx2)*1	10MHz
under real deployment	5MHz	10MHz or more	120MHz(40MHzx3)*2	30MHz(10MHzx3)*2
Downlink base station capacity (Spectral efficiency)	24.4Mbps/3.3MHz (7.4bps/Hz)	7.2Mbps/5MHz (1.4bps/Hz)	300Mbps/20MHz (15.0bps/Hz)	40.3Mbps/6.7MHz (6.0bps/Hz)
under real deployment	24.4Mbps/3.3MHz (7.4bps/Hz)	7.2Mbps/5MHz (1.4bps/Hz)	300Mbps/60MHz (5.0bps/Hz)	40.3Mbps/20MHz (2.0bps/Hz)
Base Station coverage (NLOS/urban/in radius)	3km	1.5km	1.5km	750m
Max. modulation (downlink)	24QAM	16QAM	64QAM	64QAM
MIMO	none	none	4X4	2X2
Downlink max. user data rate (when 10 users are active per one BS)	2Mbps	700kbps	30Mbps	4Mbps
Availability of max. data rate	Available even reasonably remote from the BS		Proximity to BS	

*1 Pair-band for downlink & uplink

*2 3-sector configuration (reuse factor=3).

WiBro == Korea-original Mobile WiMAX