Engineering Analysis for Playas Deployment, Band 66 Addition

Overview

Deploy to three locations to the remote Playas, NM test area. The DOD is establishing a remote 5G testbed at the abandoned property of Playas, NM. This study is to augment the cellular configurations with band 66 Long Term Evolution (LTE) radios serving as 5G Non-Stand Alone (NSA) mmWave anchors. The three locations selected for deployment are:

Playas Skeet Tower

31°54'45.6"N 108°33'46.8"W

31.912654,-108.563005

Playas Town Center

31°54'49.6"N 108°32'04.5"W

31.913767,-108.534573

Playas Water Tower

31°54'11.2"N 108°31'29.4"W

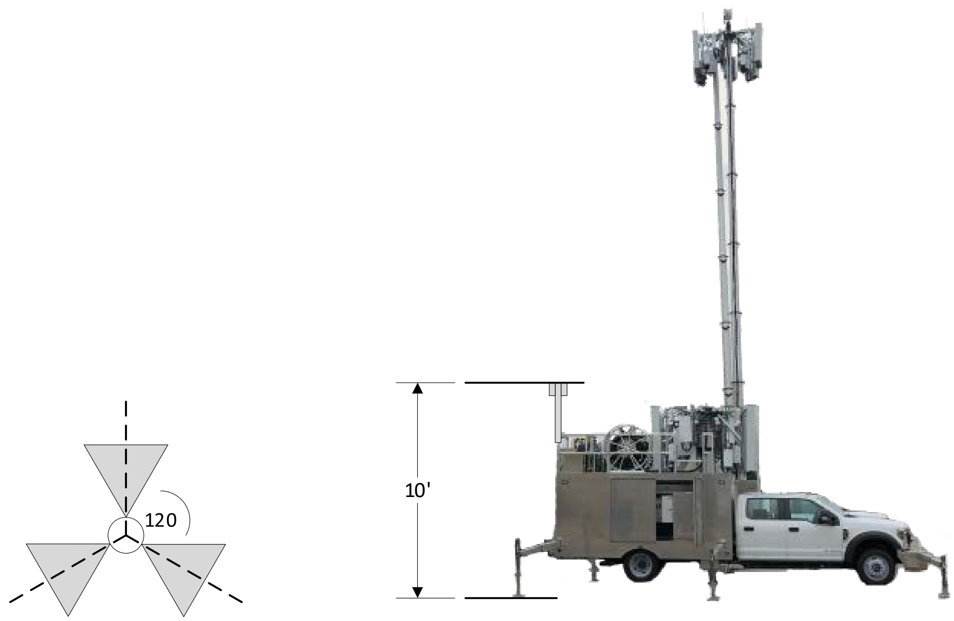
31.903105,-108.524844

Configuration

The Office of the Under Secretary of Defense (OUSD) is deploying 5G Cell on Light Truck (COLT) systems to the location to provide temporary coverage for the testbed. These systems include three bands, each with three sectors, supporting Third Generation Partnership Project (3GPP) bands 71, 41, and 260. These are US frequency allocations across 600 MHz, Educational Broadband Service (EBS), Broadband Radio Service (BRS), and 37/39 GHz bands. Each COLT is fitted with an antenna mast with 60’ of elevation. Each sector is rotated approximately 120° from its neighbor. These configurations are described under CallSign WW9XJH.

The COLTs will be modified to include micro cells on band 66 to serve as alternate LTE anchor radios for the band 260 5G New Radio (NR) waveforms. These band 66 micro radios operate in the Advanced Wireless Services (AWS) band. Each COLT will include a short supplemental mast at approximately 10’ as shown in the Figure 1 below. The band 66 radios will not be deployed on the pneumatic masts to reduce the propagation of the signal and to mitigate interference with existing license holders.

Figure 1: Deployment Diagram



Oceus used a variety of open-source information to create this analysis. The Universal Licensing System (ULS) published by the FCC provided information on the current license holders in the local area. We also leveraged the information published by opencellid.org to demonstrate the remoteness of the site. Very few samples were available from these locations which speaks to the rural area under consideration. Further, the hifld-geoplatform.opendata.arcgis.com site was used to search for nearby radio towers as reported to the FCC.

At each of the locations, our deployment is to orient one sector directly north and then every 120° for the two remaining sectors. The Effective Radiated Power (ERP), peak, for band 66:

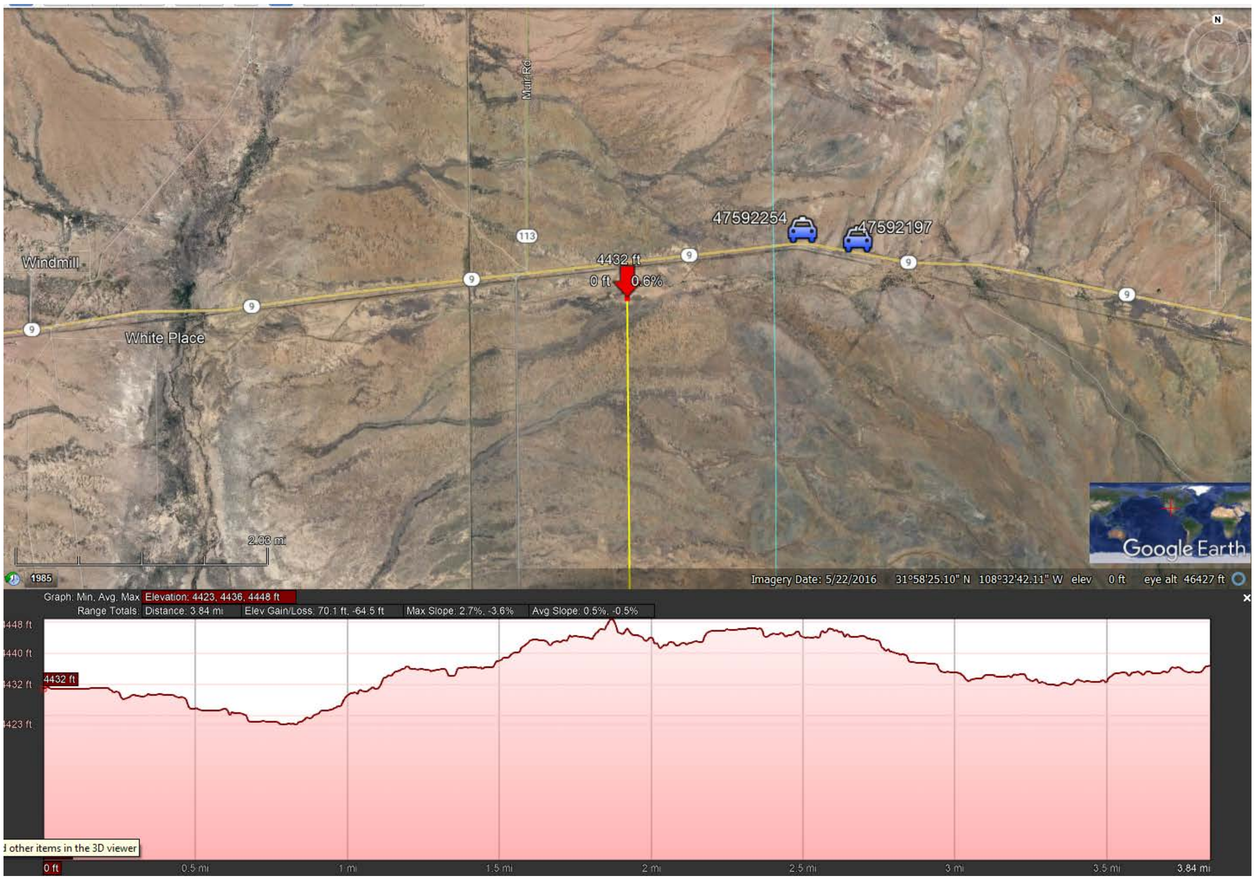
Band 66 ERP: 50 W (47 dBm)

For frequencies below 6 GHz, we used the Hata-open model with our results summarized below. At 6 km, we calculate significant power levels would be received by users, which will require further mitigation by the deployed systems (-99 dBm@2.1GHz). Mitigation solutions will be implemented for nearby license holders.

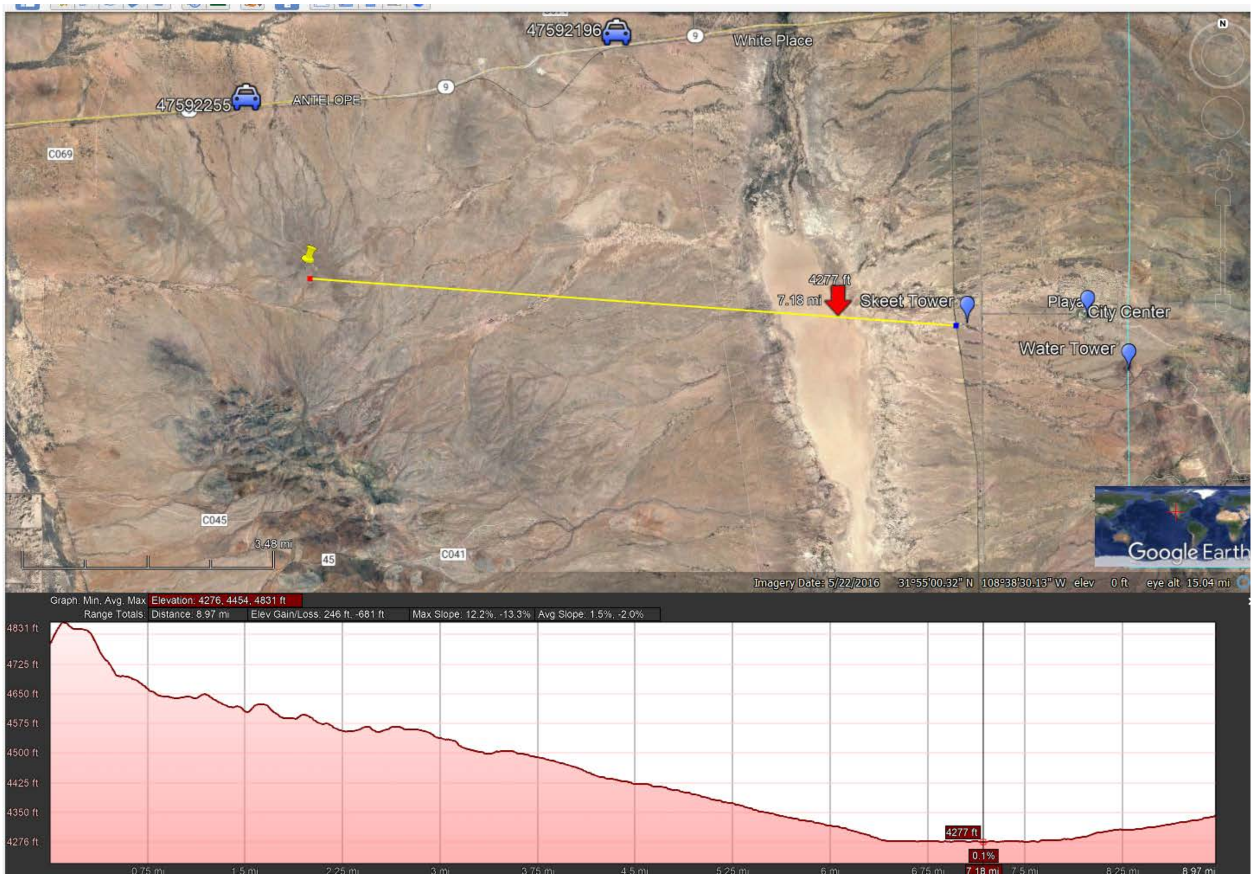
Propagation models: CCIR, Hata, Walfisch-Ikegami (WIM)							
		Link distance (km)	6				
		Propagation model	CCIR	Hata-l. city	Hata-s. city	Hata-suburb	Hata-open
		Loss (dB)	173.5	179.0	178.5	166.1	145.7
	INPUT PARAMETERS (see diagram below)						
	Frequency in MHz		f MHz	2100	Enter these parameters or accept		
	Physical antenna height 1 in m		h b	4		the default values	
	Physical antenna height 2 in m		h m	2		already given.	
	Percentage of buildings		%	10	for CCIR model		
	WIM building height		h B	20	for Walfisch-Ikegami non-line-of-sight (		
	WIM building separation		b	100	"		
	WIM street width		w	20	"		
	WIM angle		phi	28	"		
	WIM NLOS environment			Other	Enter either "Large City" or "Other" (w		

Looking at the path profiles, there are several physical barriers to mitigate signal propagation beyond our 5 km area of operation.

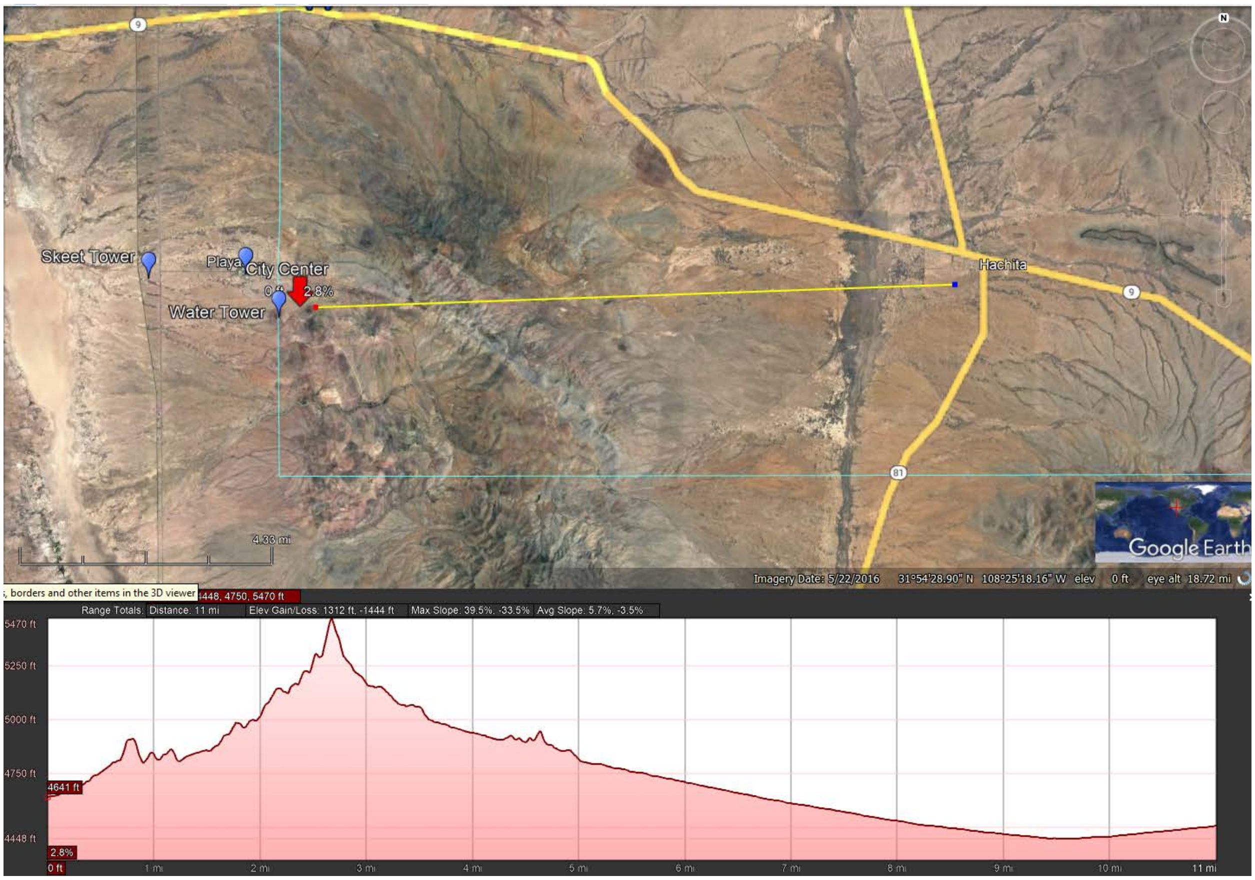
North path profile:



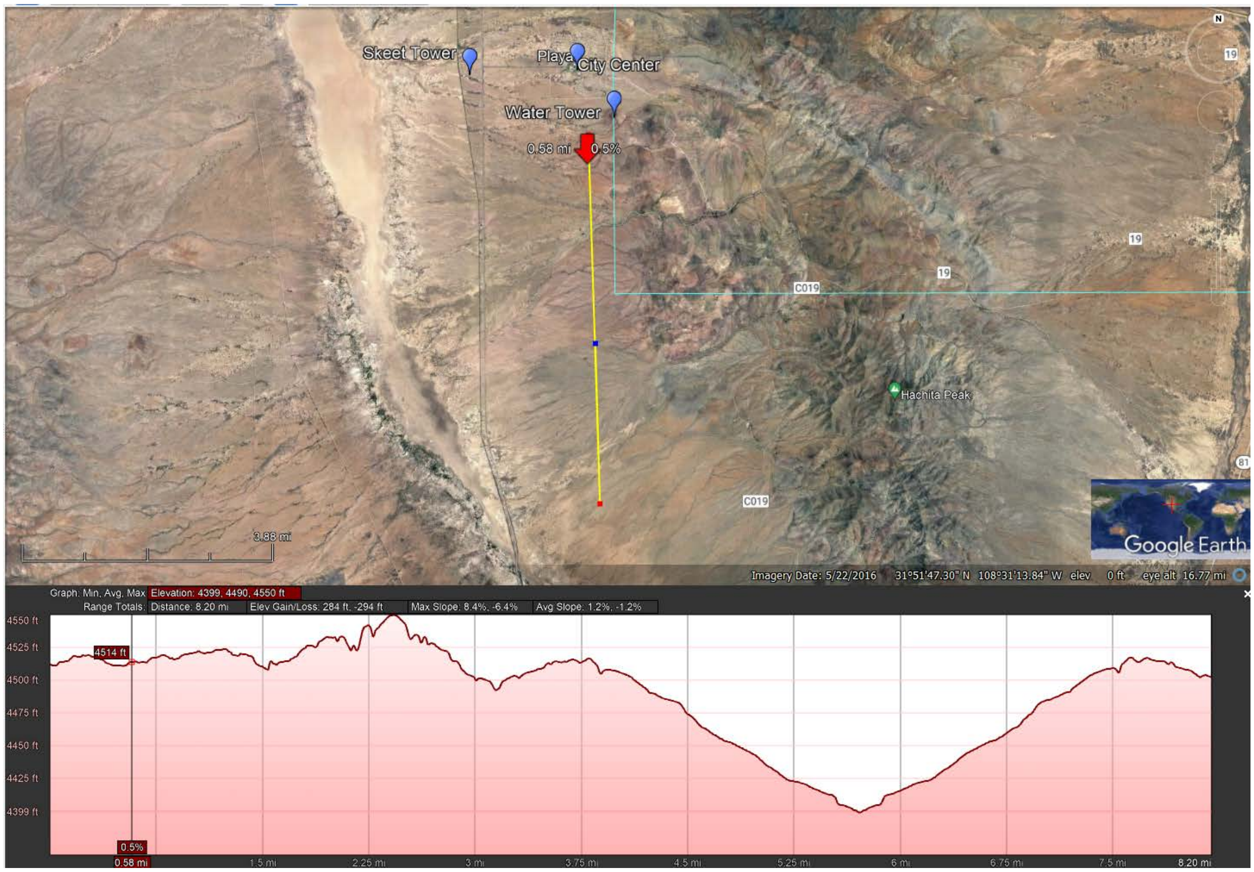
West path profile:



East path profile:



Southern path profile:



Mitigations:

Eastern signal propagation is completely blocked by the ridgeline which greatly exceeds the antenna height of the radio. The city of Hichita is completed masked from the radio source.

Southern signal propagation is into uninhabited desert area. There is no potential interference in this direction.

Signal propagation to the west could be a challenge given the location of the commercial tower which seems to be providing long-distance service to highway 9. However, the terrain to the west is a gradual incline. There is an increase of over 500 ft from the testbed locations to the commercial tower. As long as no uptilt is provided on the beams transmitting west, the signal will be greatly attenuated by 100 dB or more in addition to the pathloss. This will have no impact on commercial services.

Northern signal propagation will require a combination of down-tilt and power reductions to mitigate signal interference. A 2° down-tilt of the antennas pointing north should be sufficient to reduce the coverage area and remove any potential interference with the rare commercial users nearly 4 miles away.

Additionally, this testbed is targeting using Multi-Operator Core Network (MOCN) technology as service is established. This will enable further testbed operations which overlay commercial and private spectrum users, simultaneously. This will have the benefit of expanding the coverage of the commercial network while enabling private cellular operations.