



Application Note

Upgrading Antennas to Improve Radio Performance

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Testing and reporting performed by [Aliter Technologies](#)



Product support provided by [Obsidian Technologies](#)



1. Summary

Utilizing high quality antennas is a cost effective way to upgrade the performance of an existing radio systems for better RF link margin and higher data/video throughput across many types of terrain and operating conditions.

While many radios are now outfitted with performance-focused antennas direct from the factory, older radios or products that have seen multiple years of field deployment may no longer be matched with the best performing accessories. Upgrading the antennas used with each radio is an easy way to extend the operating life of existing radio stock and ensures those who are using them can communicate when and where they need without technical difficulties.




2. Test Parameters

In the fall of 2016, Aliter Technologies tested the Persistent Systems MPU4 radio with three antennas including one from Southwest Antennas, in three different environments: open field, forest, and urban.

On one side of the test link was a radio stationed at a fixed position, while the other side of the link was moved at specific distance intervals, where SNR (dB) and uplink / downlink speeds (Mbps) were recorded for each antenna type. Each antenna was tested at the same distance during the same weather conditions.

2.1 Antenna Selection:

Antenna 1 Southwest Antennas Part # 1085-117	Antenna 2	Antenna 3
Frequency: 2.2 – 2.5 GHz Impedance: 50 Ohms VSWR: <2.0:1 Gain: 4 dBi Polarization: Vertical 	Frequency: 2.2 – 2.5 GHz Impedance: 50 Ohms VSWR: <2.0:1 Gain: 4 dBi Polarization: Vertical 	Frequency: 2.2 – 2.5 GHz Impedance: 50 Ohms VSWR: <2.0:1 Gain: 2 dBi Polarization: Vertical 

2.2 Radio Specifications:

Radio: Persistent Systems MPU4 (Serial Numbers: 15227, 15228)

Firmware Version: 18.5.8f

Frequency: 2,327 MHz

Bandwidth: 5 MHz

Maximum Link Distance: 1.98 miles / 3.2 km

Channel Density: 4-8 nodes

Max Transmit Power: 2 Watts

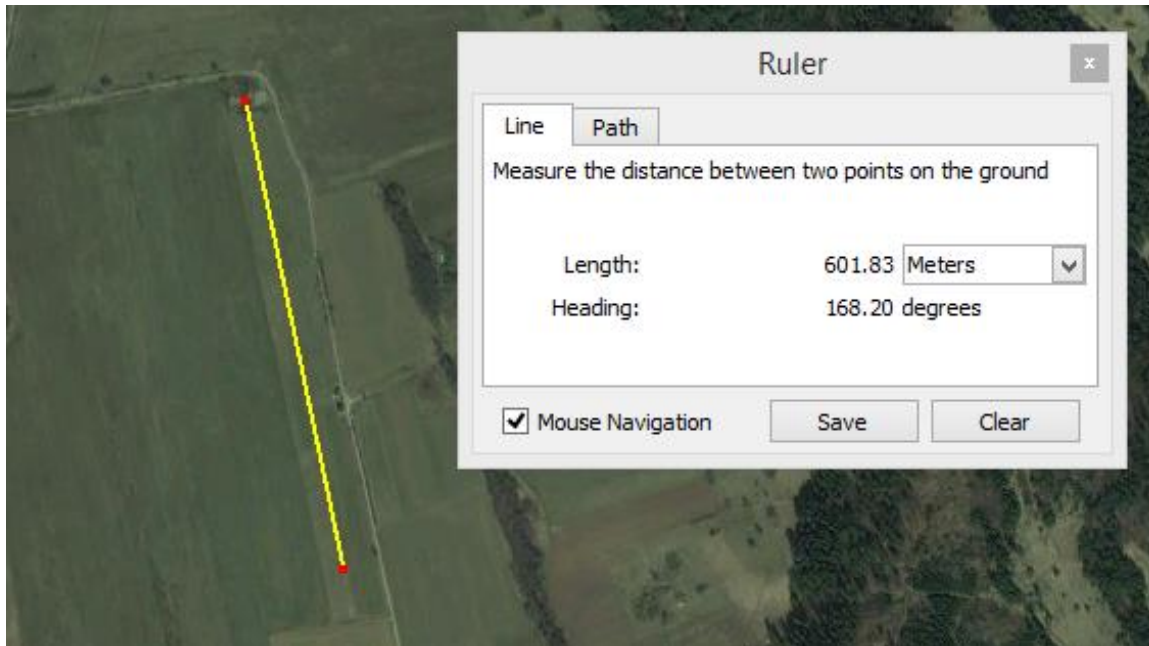


Test 1: Open Field / Ground Wave

Area of testing: [Lat. 48.846895°](#), [Long. 19.476113°](#)

Date: October 25th, 2016

Weather conditions: Cloudy



Photograph of testing area



Radios used in open field test

Test 1 Results

Distance	Antenna Type	SNR (dB)	Uplink Speed (Mbps)	Downlink Speed (Mbps)
328 ft (100 m)	Antenna 1 (SWA)	57.12	21.9	21.3
	Antenna 2	46.10	21.5	21.0
	Antenna 3	47.90	22.2	21.4
656 ft (200 m)	Antenna 1 (SWA)	46.55	21.8	19.6
	Antenna 2	37.8	19.6	20.3
	Antenna 3	41.45	21.9	20.1
984 ft (300 m)	Antenna 1 (SWA)	40.92	20.1	16.2
	Antenna 2	30.36	20.1	19.6
	Antenna 3	36.4	20.6	16.4
1,312 ft (400 m)	Antenna 1 (SWA)	35.62	20.1	18.0
	Antenna 2	25.12	11.8	12.1
	Antenna 3	28.2	15.9	11.9
1,650 ft (500 m)	Antenna 1 (SWA)	32.68	14.3	13.4
	Antenna 2	21.30	10.7	8.12
	Antenna 3	25.62	12.6	10.2
1,968 ft (600 m)	Antenna 1 (SWA)	26.10	13.1	11.5
	Antenna 2	14.3	--	6.38
	Antenna 3	19.58	8.05	6.62



Test 1 Result Conclusions

The Southwest Antennas Part # 1085-117 was able to significantly extend the effective operating distance of the radio, especially with distances in excess of 985 feet / 300 meters. At 1,968 feet / 600 meters, Part # 1085-117 offers nearly twice the uplink and downlink speed of the other antenna options.



Test 2: Forest

Area of testing: [Lat. 48.845520°](#), [Long. 19.468930°](#)

Date: October 25th, 2016

Weather condition: Sunny



Photograph of testing area



Radios used in forest test

Test 2 Results

Distance	Antenna Type	SNR (dB)	Uplink Speed (Mbps)	Downlink Speed (Mbps)
328 ft (100 m)	Antenna 1 (SWA)	40.10	22.4	24.3
	Antenna 2	32.6	13.4	13.1
	Antenna 3	35.15	21.1	22.2
656 ft (200 m)	Antenna 1 (SWA)	23.3	22.2	22.4
	Antenna 2	16.5	9.7	13.1
	Antenna 3	16.4	10.6	13.6
984 ft (300 m)	Antenna 1 (SWA)	10.10	8.3	8.7
	Antenna 2	--	--	--
	Antenna 3	7.6	3.7	3.7
1,312 ft (400 m)	Antenna 1 (SWA)	12.7	9.03	12.9
	Antenna 2	11.3	7.6	8.8
	Antenna 3	9.75	8.47	8.47
1,650 ft (500 m)	Antenna 1 (SWA)	1.32	--	--
	Antenna 2	--	--	--
	Antenna 3	--	--	--



Test 2 Conclusions

Southwest Antennas Part # 1085-117 continues to improve radio performance at all communication distances, offering a significant uplink and downlink speeds beyond 656 feet / 200 meters.

Test 3: Urban

Area of testing: [Lat. 49.085009°](#), [Long. 19.619065°](#)

Date: November 23rd, 2016

Weather condition: Sunny

Radio 1 located inside building, 1st Floor



Office where radio 1 was located during testing (center building)



Urban test locations (left) along road





Radios used during urban testing

Test 3 Results

Distance	Antenna Type	SNR (dB)	Uplink Speed (Mbps)	Downlink Speed (Mbps)
328 ft (100 m)	Antenna 1 (SWA)	33.7	19.4	21.7
	Antenna 2	24.19	19.2	18.8
	Antenna 3	25.5	20.2	21.1
656 ft (200 m)	Antenna 1 (SWA)	13.6	7.7	8.02
	Antenna 2	--	--	--
	Antenna 3	--	--	--
820 ft (250 m)	Antenna 1 (SWA)	13.5	10.2	11.2
	Antenna 2	--	--	--
	Antenna 3	8.9	7.9	8.05
984 ft (300 m)	Antenna 1 (SWA)	11.7	7.4	6.6
	Antenna 2	--	--	--
	Antenna 3	7.5	0.42	2.9
1,148 ft (350 m)	Antenna 1 (SWA)	12.28	8.04	8.24
	Antenna 2	--	--	--
	Antenna 3	4.2	--	--

Test 3 Conclusion

During the urban testing, Southwest Antennas Part # 1085-117 was able to offer strong uplink and downlink speeds even at the edge of test area, located 1,148 feet / 350 meters from the base radio.

Conclusion

As testing demonstrates, upgrading to a high-performance antenna is one way to achieve better radio performance in challenging RF environments, and is an easy way to extend the lifespan of radio equipment. For help selecting the proper antennas for your system, please contact Southwest Antennas at sales@southwestantennas.com or call (858) 277-3300.