

Improving Hotspot Coverage with a Better Antenna

Measuring performance with a Browan Object Locator

V1.0

Overview

- * This presentation shows the improvement in Helium hotspot coverage resulting from switching the hotspot antenna from an ANT-916-MHW-RPS-S 5.4 dBi antenna to a RAK 5.8 dBi Fiber Glass antenna.
- * Performance improvement is measured using signal strength data collected from a Browan Object Locator & visual information from Helium Explorer and Helium Mapper
- * **Result: Switching from the ANT-916 antenna to the RAK antenna resulted in an average improvement of 0.5 RSSI and 7.6 db SNR**

Outline

- * Objective
- * Hardware
- * Results in Helium Explorer and Mapper
- * Signal Strength Measurements
- * Summary & Recap
- * References

Objective

- * Increase hotspot range without spending a lot of money and without running afoul of the homeowner association

Hardware

Antenna – Before and After



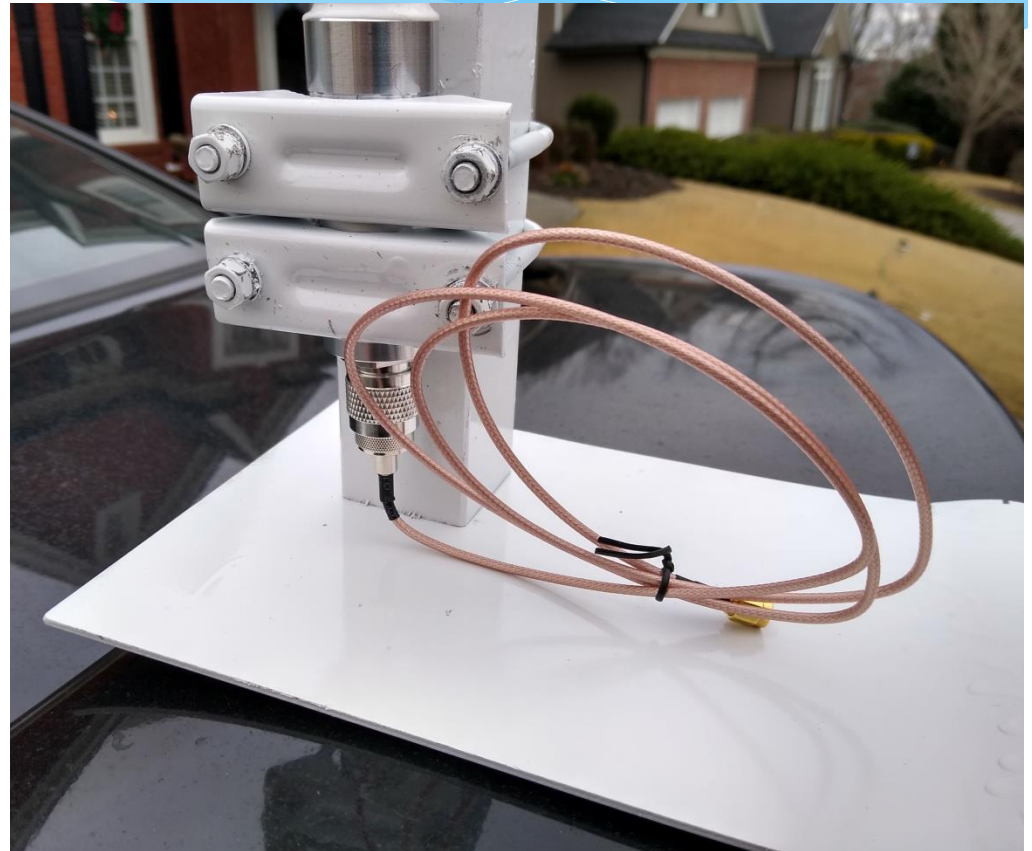
ANT-916-MHW-RPS-S 5.4 dBi antenna



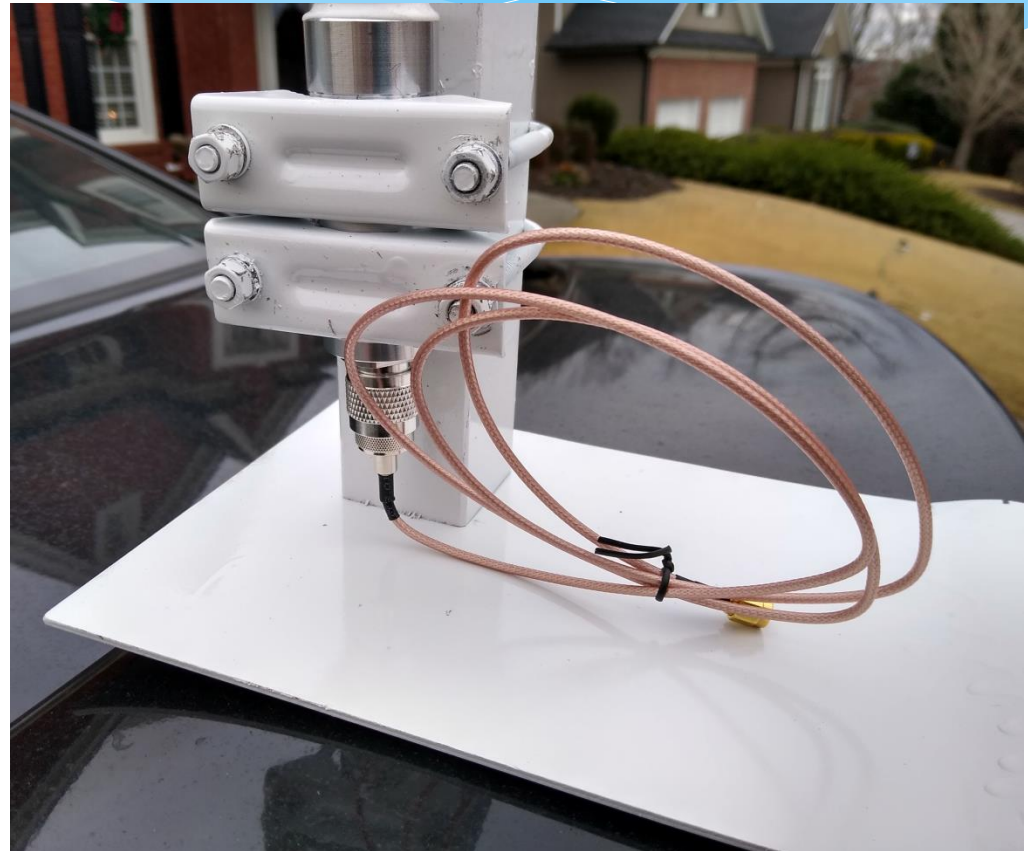
RAK 5.8 dBi Fiber Glass antenna



Antenna and Mount

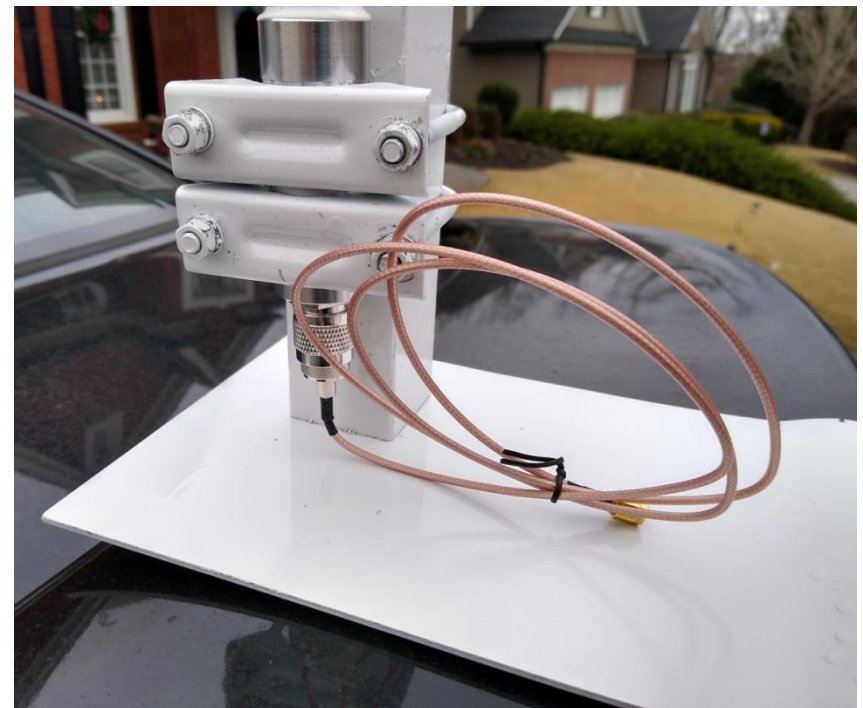


Antenna and Mount



Parts List

Item	Description	Cost
1	Rak 5.8 dBI Fiberglass Antenna, (ordered on special, shipping free)	\$40.00
2	.080 (5/64) thick Aluminum, 6"x24", (cut from piece measuring 12"x24")	\$17.50
3	Six inch,(6") 1-1/4x1-1/4 wood furniture leg with embedded 5/16 threaded bolt	\$5.27
4	5/16 Flat Washer, 5/16 Machine Nut	\$1.57
5	Paint to match house trim	\$7.32
	Total	\$71.66



Antenna Aesthetics

Painted mount and bracket to match the house trim (Gary's house – location of creamy-holographic-cat)



Browan Object Locator

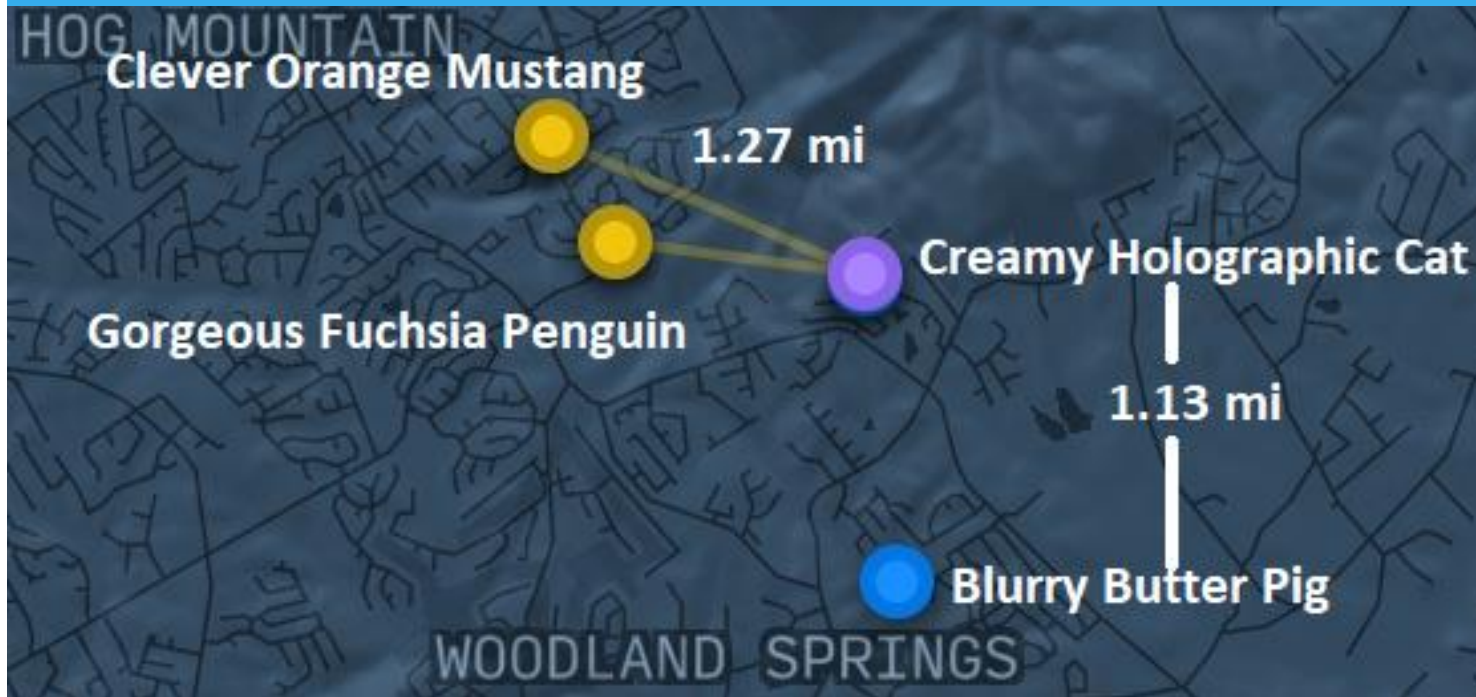
The Tabs object locator is a multi-purpose tracker designed for asset tracking, pet tracking, personal objects, and valuable assets. The sensor is composed of a GNSS receiver, a push button, an LED indicator, and a USB-C connector. It contains a LiPo battery that can be recharged through the USB-C connector, and also includes a three-axis accelerometer which is optimized for different asset applications for response time and battery life.

<https://www.calchipconnect.com/products/browan-object-locator>



Results in Helium Explorer and Mapper

Hotspot Witnesses – Before New Antenna



- * 2 Creamy Holographic Cat witnesses
- * Clever Orange Mustang
- * Gorgeous Fuchsia Penguin

Blurry Buttery Pig is out of range as it sits in a valley

Hotspot	Alt.
Creamy	351 m
Clever	315 m
Gorgeous	315 m
Blurry	301 m

Hotspot Witnesses – After New Antenna



- * 3 Creamy Holographic Cat witnesses
 - * Clever Orange Mustang
 - * Gorgeous Fuchsia Penguin
 - * Blurry Butter Pig

Hotspot	Alt.
Creamy	351 m
Clever	315 m
Gorgeous	315 m
Blurry	301 m

Helium Mapper – Before and After



- * (left side) Before antenna upgrade
- * (right side) After antenna upgrade - Creamy Holographic Cat reaches 3.5 mi.

Coverage Mapping with a BOL

Integrating a Browan Object Locator with <https://mappers.helium.com>

- * <https://developer.helium.com/devices/coverage-mapping/mappers-quickstart>
- * <https://github.com/helium/console-decoders/tree/master/Browan/TAB> (use this code for the BOL's decoder function)

The screenshot shows the Helium console interface with a sidebar on the left containing navigation options like 'Devices', 'Integrations', 'Labels', 'Functions', 'Organizations', and 'Users'. The main content area is titled 'Devices' and displays a table of 6 devices. The table has columns for Device Name, Device EUI, Labels, Integrations, Frame Up, Frame Down, Packets Transferred, DC Used, and Date Activated. The device 'Mike's BOL' is highlighted with a red box. The table data is as follows:

Device Name	Device EUI	Labels	Integrations	Frame Up	Frame Down	Packets Transferred	DC Used	Date Activated
Gary's BOL	554c200002	CayenneInt_Gary'sBOL Mappers Integration BOL	CayenneInt_Gary'sBOL Mappers Integration GAS_Mike'sBOL-fromHelium pipedreamint_BOL	14559	2	27780	15499	Sep 4, 2020 5:41 AM
Mike's BOL	554c200000	CayenneInt_Mike'sBOL Mappers Integration BOL	CayenneInt_Mike'sBOL Mappers Integration GAS_Mike'sBOL-fromHelium pipedreamint_BOL	43450	1	23690	14664	Sep 4, 2020 4:12 AM
RBS305-ATH-US	cc02f00001	RBS305 RBS305-cayenne-int	pipedreamint_RBS305 Cayenne-RBS305	1195	131	3559	3103	Sep 12, 2020 12:37 PM
TBH#1100	554c200001	TBH#1100 CayenneInt_TBH#1100	pipedreamint_TBH#1100 CayenneInt_TBH#1100	4690	1	1549	1547	Sep 4, 2020 5:41 AM
TBHV110	554c200001	CayenneInt_TBHV110 TBHV110	CayenneInt_TBHV110 pipedreamint_TBHV110	1137	1	6235	6227	Sep 4, 2020 5:41 AM
TBHV1110_2	554c200000	TBHV110	pipedreamint_TBHV110	707	1	348	348	Dec 12, 2020 5:42 PM

Signal Strength Measurements

Measuring Signal Quality



- * Browan Object Locator (BOL) device at Mike's house
- * Creamy Holographic Cat hotspot at Gary's house

- * Continuously Logging data from the BOL to a Google Sheet (Helium Network > Pipedream > Google Sheet)
 - * Date/Time
 - * Hotspot
 - * RSSI
 - * SNR
 - * Latitude and Longitude

Signal Quality – Before and After

	A	B	C	E	F	G	H	T
1	Timestamp	From Device	Hotspot	Dist to Hotspot (miles)	rssi	snr	Accura	BOL - Nearest Address
16173	Sun, 22 Nov 2020 15:40:17 GMT	Mike's BOL	creamy-holographic-cat	1.269	-107	-14.800	4	Mike's House
17218	Sat, 28 Nov 2020 17:00:28 GMT	Mike's BOL	creamy-holographic-cat	1.265	-106	-16.200	4	Mike's House
17265	Sat, 28 Nov 2020 17:40:26 GMT	Mike's BOL	creamy-holographic-cat	1.264	-105	-13.200	4	Mike's House
17409	Sat, 28 Nov 2020 20:13:39 GMT	Mike's BOL	creamy-holographic-cat	1.263	-106	-17.000	4	Mike's House
17579	Sat, 28 Nov 2020 21:11:07 GMT	Mike's BOL	creamy-holographic-cat	1.268	-107	-10.000	4	Mike's House
17591	Sat, 28 Nov 2020 21:13:15 GMT	Mike's BOL	creamy-holographic-cat	1.268	-107	-14.800	4	Mike's House
17808	Sat, 28 Nov 2020 22:03:51 GMT	Mike's BOL	creamy-holographic-cat	1.267	-106	-18.500	4	Mike's House
17829	Sun, 29 Nov 2020 18:15:17 GMT	Mike's BOL	creamy-holographic-cat	1.261	-106	-14.200	8	Mike's House
20496	Sat, 12 Dec 2020 01:41:57 GMT	Mike's BOL	creamy-holographic-cat	1.268	-103	-1.000	4	Mike's House
20498	Sat, 12 Dec 2020 01:42:29 GMT	Mike's BOL	creamy-holographic-cat	1.273	-106	-7.500	8	Mike's House
20500	Sat, 12 Dec 2020 01:43:01 GMT	Mike's BOL	creamy-holographic-cat	1.272	-106	-8.200	4	Mike's House
20509	Sat, 12 Dec 2020 01:45:25 GMT	Mike's BOL	creamy-holographic-cat	1.270	-107	-4.500	4	Mike's House
20514	Sat, 12 Dec 2020 01:48:24 GMT	Mike's BOL	creamy-holographic-cat	1.258	-106	-15.200	4	Mike's House
20515	Sat, 12 Dec 2020 01:48:40 GMT	Mike's BOL	creamy-holographic-cat	1.258	-106	-5.000	4	Mike's House
20517	Sat, 12 Dec 2020 01:49:12 GMT	Mike's BOL	creamy-holographic-cat	1.259	-106	-9.000	4	Mike's House
20519	Sat, 12 Dec 2020 07:16:33 GMT	Mike's BOL	creamy-holographic-cat	1.260	-106	-7.500	4	Mike's House
20523								
20524			Hotspot Antenna	Date	AVG RSSI	AVG SNR		
20525			ANT-916-MHW-RPS-S, 5.4dBi	Before 12/12	-106.25	-14.838		
20526			RAKWireless 5.8 dBi	12/12	-105.75	-7.237		
20527			Delta (improvement)		0.5	7.6		

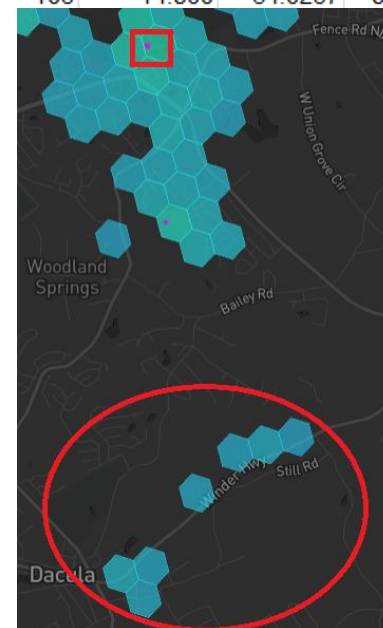
Switching from the ANT-916 antenna to the RAK antenna resulted in an average improvement of 0.5 RSSI and 7.6 db SNR.

Data source is from BOL data logged to a Google Sheet.

Signal Quality at Furthest Points

T21506 370 Franklin Dr SE, Dacula, GA 30019, United States									
	A	B	C	D	F	G	N	O	
1	Date & Time	From Device	Hotspot	Dist to Hotspot	rssi	snr	BOL Lat	BOL Long	BOL - Nearest
21500	Sun, 13 Dec 2020 15:41:54 GMT	Mike's BOL	creamy-holographic-cat	2.765	-107	-8.500	33.99843	-83.87794	Winder Hwy NE,
21501	Sun, 13 Dec 2020 15:42:18 GMT	Mike's BOL	creamy-holographic-cat	2.958	-107	-13.800	33.99498	-83.88234	Dacula Animal H
21502	Sun, 13 Dec 2020 15:42:50 GMT	Mike's BOL	creamy-holographic-cat	3.271	-107	-10.800	33.99016	-83.88925	2669 Winder Hw
21503	Sun, 13 Dec 2020 15:42:55 GMT	Mike's BOL	creamy-holographic-cat	3.321	-104	-3.200	33.98946	-83.89	2694 Winder Hw
21504	Sun, 13 Dec 2020 15:43:02 GMT	Mike's BOL	creamy-holographic-cat	3.356	-106	-11.000	33.98895	-83.89048	US-29-BR, Dacu
21505	Sun, 13 Dec 2020 15:43:23 GMT	Mike's BOL	creamy-holographic-cat	3.491	-107	-9.200	33.98699	-83.8896	375 Franklin Dr S
21506	Sun, 13 Dec 2020 15:43:34 GMT	Mike's BOL	creamy-holographic-cat	3.518	-106	-14.000	33.98659	-83.88961	370 Franklin Dr S
21507	Sun, 13 Dec 2020 17:16:59 GMT	Mike's BOL	creamy-holographic-cat	0.805	-108	-11.800	34.02607	-83.89118	3255 Fence Rd I
21508	Sun, 13 Dec 2020 17:17:06 GMT	Mike's BOL	creamy-holographic-cat	0.749	-106	-14.800	34.0267	-83.88966	3291 Fence Rd I

- * TOP – Google Sheet Data log from BOL
- * RIGHT – mappers.helium.com showing creamy-holographic-cat (red square) and newly mapped data points after antenna upgrade (red circle)



Summary & Recap

- * Switching to the RAK antenna measurably increased the range of the hotspot
 - * Able to reach 1 additional hotspot witness 1.13 miles away that is located in a valley
 - * Able to reach a sensor 3.5 miles away
 - * At a distance of 1.2 miles, saw an average improvement of 0.5 RSSI and 7.6 db SNR in signal quality

References

Item	More Information
ANT-916-MHW-RPS-S 5.4 dBi antenna from Digi-key	https://www.digikey.com/en/products/detail/linx-technologies-inc/ANT-916-MHW-RPS-S/446320
RAK 5.8 dBi Fiber Glass antenna	https://store.rakwireless.com/products/fiber-glass-antenna?variant=27103006359652
Helium Explorer	https://explorer.helium.com/coverage
Helium Mapper	https://mappers.helium.com/
HowTo_ReverseGeoCode_in_Pipedream-SHARE.pdf (White Paper with details on gps calculations shown today; references for getting started with logging data to Google Sheets through Pipedream)	https://github.com/mikedsp/helium/blob/master/MyDocuments/HowTo_ReverseGeoCode_in_Pipedream-SHARE.pdf

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Thanks!

