## Overview and Explanation of Use & Compliance with NTIA 8.3.28

<u>Overview:</u> Raven Industries, Inc. is filing this application for use of a GPS re-radiation system at its facility at 47513 254<sup>th</sup> Street, Baltic, Minnehaha County, South Dakota to re-radiate GPS within the building in order to verify signal acquisition of GPS products being developed. This product relies on an antenna that is integrated into the unit requiring the re-radiated signal to verify operation.

General compliance with NTIA section 8.3.28 set forth below are Raven's responses to the requirements of 8.3.28 as those answers apply for this location.

For any questions about this application please contact Laura Zumhofe, Raven Compliance Manager, 605-731-0982, laura.zumhofe@ravenind.com

## Compliance with the Requirements of NTIA Manual Section 8.3.28

 Individual authorization is for indoor use only, and is required for each device at a specific site. Answer: Yes, Raven Industries, Inc. confirms that this device is for indoor use only inside Raven's facility and used by Raven employees

2. Applications for frequency assignment should be applied for as an XT station class with a note indicating the device is to be used as an "Experimental RNSS Test Equipment for the purpose of testing GPS receivers" and describing how the device will be used.

Answer: Yes, Raven Industries, Inc. confirms that this application for frequency assignment is applied for as an XT station class and will be used as Experimental RNSS Test Equipment for the purpose of testing GPS receivers. Specifically, this device is used to re-radiate GPS within the building in order to verify signal acquisition of GPS products being developed and tested. Many of these products rely on an antenna that is integrated into the unit requiring the re-radiated signal to verify operation.

3. Approved applications for frequency assignment will be entered in the GMF.

Answer: Yes, Raven Industries, Inc. affirms that we accept the fact that the requested frequency of 1575.42 Mhz will be published in the Government Master File (GMF) database.

4. The maximum length of the assignment will be two years, with possible renewal. Answer: Yes, Raven Industries, Inc. confirms understanding that the authorization will be for two (2) years, and it will seek renewals when required.

5. The area of potential interference to GPS reception (e.g., military or contractor facility) has to be under the control of the user.

Answer: Yes, Raven Industries, Inc. is in sole control of the GPS re-radiator units inside the building at 47513 254th Street, Baltic, SD 57003

6. The maximum equivalent isotropically radiated power (EIRP) must be such that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building where the test is being conducted. The calculations showing compliance with this requirement must be provided with the



application for frequency assignment and should be based on free space propagation with no allowance for additional attenuation (e.g., building attenuation.)

Answer: The re-radiators will be running at -146.69857 dBm at 100 feet from the building, this does not include attenuation from the building itself. Free space loss includes the 100 feet outside of the nearest point of the building. The calculations showing compliance with this requirement are provided below, under Question 2.

7. GPS users in the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.

Answer: Raven Industries, Inc. will post notices that re-radiated GPS is in use and may cause disruption of GPS service.

8. The use is limited to activity for the purpose of testing RNSS equipment/systems.

Answer: Raven Industries, Inc. confirms that these units are for testing of its GPS related products only.

9. A "Stop Buzzer" point of contact for the authorized device must be identified and available at all times during GPS reradiation operation of the device under any condition.

Answer: To "Stop Buzzer" contact: Nathan Dixon @ Nathan.dixon@ravenind.com or 800-243-5435 ext. 2618



205 E 6th Street, Sioux Falls, SD 57104 www.ravenind.com

## Question 2. <u>"Please provide a detailed calculation(s) for the link budget specified on item 6 of section 8.3.28. Please make</u> certain the ERP submitted on your application matches with what you calculate on the link budget."

Jostance (th)         Gain/Loss Bis         Bistance (th)         Bistance		1			Link Budge	et Power Lev	el (Radiato	A - RIC Development)
Discret (ft)         dB         dBW         Weil         PW           exclude Signal Level         99         135         1557         127         127           M4 00 Cable         100         -51         1231         931         4386         446-08           GSB Cable         20         -6         1377         1077         1568         6           GSB Cable         20         -6         1377         1077         1568         127-56           GSB Cable         20         -6         1377         1077         1568         216-56           GSB Cable         20         -6         1377         1077         1568         216-56           Recived Power (evel           res Space Loss         1157420000         Hz         Ince (Mhz) dB/100ht         Freq         dB/20ht         Recived Power (evel         100 feet from building (no attenuation figured for building           res Forequency         157420000         Hz         Ince (MHz) dB/100ht         Freq         dB/20ht         Recived Power (evel         100 feet from building (no attenuation figured for building           reters/foot         0.308         NS			Gain/Loss		Link Duug			
eceived Signal Level microna Gan MR 400 Cable 100 5.1 127 1395 14 495 15 485 15 485 15 485 1 485 14 495 40 5 1 485 14 495 40 5 1 4 495 4 4 5 6		Distance (ft)	dB	dBW	dBm	Watts	nW	
ntens Gan Anti- MR 400 Cable 100 -5.1 -1221 -0.133.1 4.898E.1 4.85E.0 -20 -10 -10 -10 -10 -10 -10 -10 -10 -10 -1	Received Signal Level	2.0000000 (.1.)		-157	-127	1.995E-16	2E-10	
MR 400 cable teronator 23 Splitter 23 Splitter 23 Splitter 23 Splitter 24 Splitter 25 Splitter 20 -4.6 1337, 107, 1.5985,14 1.57.68 3 107, 77, 1.6985,14 1.57.68 3 107, 77, 1.6985,14 1.57.68 3 107, 77, 1.6985,14 1.57.68 3 107, 77, 1.6985,14 1.57.68 Related Power (#) 100 feet from building (no attenuation figured for building meters/foot 0 .3048 RG 58 loss in dB/100/t 75 Frequency 15 Splitter 16 SS loss in dB/100/t 10 145 10 128 100 128	Antenna Gain		39	-118	-88	1.585E-12	1.58E-06	
Itenuation       Itenuation <thitenuation< th="">       Itenuation       Itenuation<th>LMR 400 Cable</th><th>100</th><th>-5.1</th><th>-123.1</th><th>-93.1</th><th>4.898E-13</th><th>4.9E-07</th><th></th></thitenuation<>	LMR 400 Cable	100	-5.1	-123.1	-93.1	4.898E-13	4.9E-07	
2 spilter G88 Cable 20 -46 1377 1077 1698E 11 10 -68 9387 -176.59857 146.69857 10 -8 9387 -176.59857 146.69857 10 -8 9387 -176.69857 146.69857 10 -8 1	Attenuator		-10	-133.1	-103.1	4.898E-14	4.9E-08	
GS 261e 20 -4-6 -1377 -1077 16985-14 1.7E-05 Related Power Level respect to 55 107.7 -77.7 166985 1 136621 1.27E-05 Related Power Level Related Power Relate	1:2 Splitter		0	-133.1	-103.1	4.898E-14	4.9E-08	
anison Amplifier       30       107.7       77.7       L698E-11       J.7E-05       Radiated Power (evel)         ree Space Loss       140       -68.99857       -176.6985       1.166.6986       2.139E-12       2.14E-12       Received Power (evel)         peed of light       299792458       m/s       LMR 400       RG 58       dB/100 ft       Freq       dB/100 ft         P/S Frequency       1575420000       Hz       freq (MHz)       dB/100 ft       Freq       dB/100 ft       -	RG58 Cable	20	-4.6	-137.7	-107.7	1.698E-14	1.7E-08	
ree Space Loss 140 -68 99837 -176.69857 -146.6986 2.139F.18 2.14F-12 Received Power @ 100 feet from building (no attenuation figured for building for attenuation for attenuation figured for building for attenuation figured for building for attenuation figured for building for attenuation for attenuation figured for building for attenuation figured for building for attenuation for a	Radiator Amplifier		30	-107.7	-77.7	1.698E-11	1.7E-05	Radiated Power Level
peed of light 299792458 m/s LMR 400 PS Frequency 1575420000 Hz freq (MHz) dB/100ft Freq dB/100 ft Vavelength 0.190293673 meters 1500 5.1 1500 23 neters/foot 0.3048 RG 58 Loss In dB/100ft 1 0.46 1 0.46 1 0.46 1 0.06 1 0.0 1.4 1 0.46 1 0.0 5.4 1 0.00 1.4 1 0.46 1 0.0 5.4 1 0.00 1.4 1 0.0 5.4 1 0.00 1.4 1 0.0 7.9 1 0.0 1.4 1 0.0 1.4	Free Space Loss	140	-68.99857	-176.69857	-146.6986	2.139E-18	2.14E-12	Received Power @ 100 feet from building (no attenuation figured for building
peed of light       299792458       m/s       LMR 400       RG 58         #95 Frequency       1575420000       hz       freq (Mhz)       dB/100t       res         weelength       0.390295673       meters       1500       23       freq (Mhz)       dB/100t         neters/foot       0.3048       RG 58       freq (MHz)       dB/100t       freq (MHz)       dB/100t         7       0.3048       RG 58       freq (MHz)       dB/100t       freq (MHz)       dB/100t         10       1.0       1.4       0.46       100       freq (MHz)       dB/100t       freq (Mz)       freq (Mz)       f								
peed of light       299792458 m/s       LMR 400         PS Frequency       1575420000 hz         1575420000 hz       freq (Mhz) dB/100ft         reters/foot       0.3048         RG 58 Loss in dB/100ft       1         100       1.4         50       5.0         100       3.8         200       5.4         100       1.4         50       5.0         100       1.4         50       5.0         100       1.4         50       5.4         1000       1.5         1000       1.1         1000       1.4         50       5.0         1000       1.4         50       5.0         1000       1.4         500       1.000         1000       1.4         500       1.000         1000       1.4         500       1.000         1000       1.4         500       1.000         1.100       2.3         1.001       1.000         1.000       1.000         1.000       1.000								
PS Prequency       1575420000 Hz       freq (Mhz)       dB/100t       Freq       dB/100 t         vavelength       0.190293673 meters       1500       5.1       1500       23	Speed of light	299792458	m/s	LMR 400		RG 58		
Variation       0.190293973       meters       1500       5.1       1500       23         neters/foot       0.3048       RG 58	GPS Frequency	1575420000	Hz	freg (Mhz)	dB/100ft	Freq	dB/100 ft	
Interestion       Interestion <thinterestion< th=""> <thinterestion< th=""></thinterestion<></thinterestion<>	Wavelength	0.190293673	meters	1500	5.1	1500	23	CPS .
neters/foot       0.3048       RG 58       Image: Constraint of the constraint o						2000		Antenna +39dB Gain
RG 58       rfreq (Mitz) dB/100ft         1       0.46         10       1.4         200       5.4         100       3.8         200       5.4         100       3.8         200       5.4         100       1.1         000       11.1         000       12.8         9000       12.8         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       20         1500       150         1500       150         1500       150         1500       150         1500       150         1500       150         1500       150         1500       150	meters/foot	0.3048						
RG 58       rfreq (MHz)       dB/100ft       10       14         20       54       50       2.8       10       1.4         20       5.4       200       5.4       50       2.8         200       5.4       700       1.1       50       2.8       50       2.00       5.4       50       2.8       50       2.00       5.4       50       2.8       50       2.00       1.1       50       2.8       50       2.00       1.00       1.1       50       2.8       50       1.00       1		0.5010						
RG 58 Loss in dB/100ft       1       0.46         20       5.0       2.8         10       3.8         200       5.4         200       5.4         200       5.4         200       5.4         200       5.4         200       5.4         200       5.4         200       5.4         200       1.1         900       1.2.8         900       1.2.8         900       1.4.5 <td></td> <td></td> <td></td> <td></td> <td></td> <td>RG 58</td> <td></td> <td></td>						RG 58		
RG 58 Loss in dB/100ft       10.46         10       1.4         50       2.8         100       3.8         200       5.4         400       7.9         700       11.1         900       12.8         1000       1.00         1000       1.00         1000       1.00         1000       1.00         1000       1.1         900       12.8         1000       1.00         1000 </td <td></td> <td></td> <td></td> <td></td> <td>L</td> <td>freq (MHz)</td> <td>dB/100ft</td> <td>LMR 400</td>					L	freq (MHz)	dB/100ft	LMR 400
1       1		RG 58 I	oss in dB/	(100ft		1	0.46	100 ft
25       50       128         100       3.8         200       5.4         100       3.8         200       5.4         100       11.1         900       12.8         700       11.1         900       12.8         100       3.8         100       3.8         100       3.8         100       1.1         900       12.8         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       14.5         10100       14.5         10100       14.5         10100       14.5         10100       14.5         10100       14.5         10100       14.5         10100       14.5         10100       14.5         10100 </td <td></td> <td></td> <td>.000 111 010/</td> <td>10010</td> <td></td> <td>10</td> <td>1.4</td> <td></td>			.000 111 010/	10010		10	1.4	
20       38         15       200         0       54         200       54         400       79         900       111         900       128         7000       145         1500       23         1500       23         1500       23         1500       23         1500       1500         1500       23         1500       1500		25				50	2.4	
10       100       5.4         10       100       7.9         700       11.1         900       12.8         1000       14.5 <td></td> <td>20</td> <td></td> <td>~</td> <td></td> <td>100</td> <td>2.0</td> <td></td>		20		~		100	2.0	
10       400       7.9         700       11.1         900       12.8         900       14.5         100       1500         1000       14.5         1000       14.5         1000       14.5         1000       14.5         1000       1000         1000       23         1000       14.5         1000       14.5         1000       1000 <td< td=""><td></td><td>15</td><td>~</td><td></td><td></td><td>200</td><td>5.0</td><td></td></td<>		15	~			200	5.0	
s		10				400	70	
0       0       12.8         900       12.8         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       23         1500       1500         1500		5				700	1.3	Splitter Splitter +OdB
0       500       1000       14.5         -10dB       -10dB       -10dB         -10dB       -10dB		o 🌠 💷				900	12.8	
10dB      10dB <td< td=""><td></td><td>0 500</td><td>1000 :</td><td>1500 2000</td><td></td><td>1000</td><td>14.5</td><td>S Attenuator</td></td<>		0 500	1000 :	1500 2000		1000	14.5	S Attenuator
Image: Set of the set of						1500	23	≤ -10dB
Image: Image						1.00	25	
Image: Image								
Image: Constraint of the second s								IMD DC 59
Image: Constraint of the second s								20 ft
Image: state of the								2011
Image: state of the								
Image: Sector of the sector of th								
Image: Constraint of the second se								
Image: Constraint of the second se								
Image: Constraint of the second se								
Image: Constraint of the second se								
Image: Constraint of the second se								Arc
Radiator A       Ric Development								
RIC Development								Radiator A
								RIC Development

We Solve Great Challenges.



205 E 6th Street, Sioux Falls, SD 57104 www.ravenind.com