

Compliance with NTIA Criteria, Drawing of Exhibit Hall where Re-radiation equipment will be installed, and link budget:

Exhibit showing compliance with Section 8.3.28 of the NTIA Manual –
Use of Fixed Devices That Re-Radiate Signals Received from the Global Positioning
System

NTIA Criteria:

1. *Individual authorization is for indoor use only, and is required for each device at a specific site:*

GPS Networking is applying for a temporary authorization to use GPS re-radiation at the annual Institute of Navigation Conference to be held in Fort Worth, TX in September 2006. The proposed use of re-radiation equipment will be inside the exhibit hall for use by government and civilian exhibitors and for their demonstrations of products to the navigation community. The installation will be for one re-radiation device, to be installed centrally in the exhibit hall, see diagram.

2. *Applications for frequency assignment shall be applied for as an “XT” station class with a note indicated that 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.*

GPS Networking has filed for an STA through the FCC’s experimental licensing system, requesting a temporary experimental authorization. The purpose of the demonstration is to allow various Army, Air Force, Coast Guard units and various defense and federal contractors to demonstrate their GPS-enabled technologies at a professional meeting. The use is temporary in nature, and it is for the demonstration of GPS enabled technologies to prove that those technologies can actually perform as expected. The nature of the exhibit makes it impossible for the exhibitors to take their demonstrations outside, so there is a need to bring a GPS signal into the exhibit hall during the hours that the exhibit hall is open.

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

GPS Networking requests the assistance of the FCC and NTIA to ensure that this frequency assignment is entered into the government master file.

4. *The maximum length of the assignment will be two years, with possible renewal.*

GPS Networking is requesting a temporary authorization that will last less than a week, from Sunday, September 24, 2006 to Friday, September 29, 2006. This timeframe would allow for installation and testing and cover the demonstrations during the exhibit hall hours of the conference.

Compliance with NTIA Criteria, Drawing of Exhibit Hall where Re-radiation equipment will be installed, and link budget:

5. The area of potential interference to GPS reception has to be under the control of the user.

The convention center exhibit hall has restricted access to conference attendees. The general public cannot just enter the hall. GPS Networking is willing to post signs inside the exhibit hall alerting conference attendees that re-radiation is in use. The re-radiation system will only be in use for limited periods of time during the conference, when the exhibitors need the signal.

6. The maximum equivalent isotropically radiated power (EIRP) must be such that the calculated emissions are no greater than -140dBm/24MHz 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).

GPS Networking is submitting those calculations as part of a link budget at the end of this exhibit. Further, we are submitting diagrams showing the installation and the distances from the installation to the door to almost 100 feet outside of the building. Attachment A.

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.

As stated above, GPS Networking is willing to post signs in the exhibit hall to notify users that there is potential interference to GPS reception.

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

The exhibitors at the Institute of Navigation conference do test and demonstrate RNSS systems. Those tests and demonstrations are provided to the conference attendees, all members of the navigation community, in an effort to show how navigational systems might work in a real-world environment. This is not for operational use.

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

The "Stop Buzzer" point of contact is: Steve Waite, President of GPS Networking, and he is reachable by cellular telephone at (719) 240-7345.

Compliance with NTIA Criteria, Drawing of Exhibit Hall where Re-radiation equipment will be installed, and link budget:

Attachment A – Calculations and Diagrams related to re-radiation equipment installation

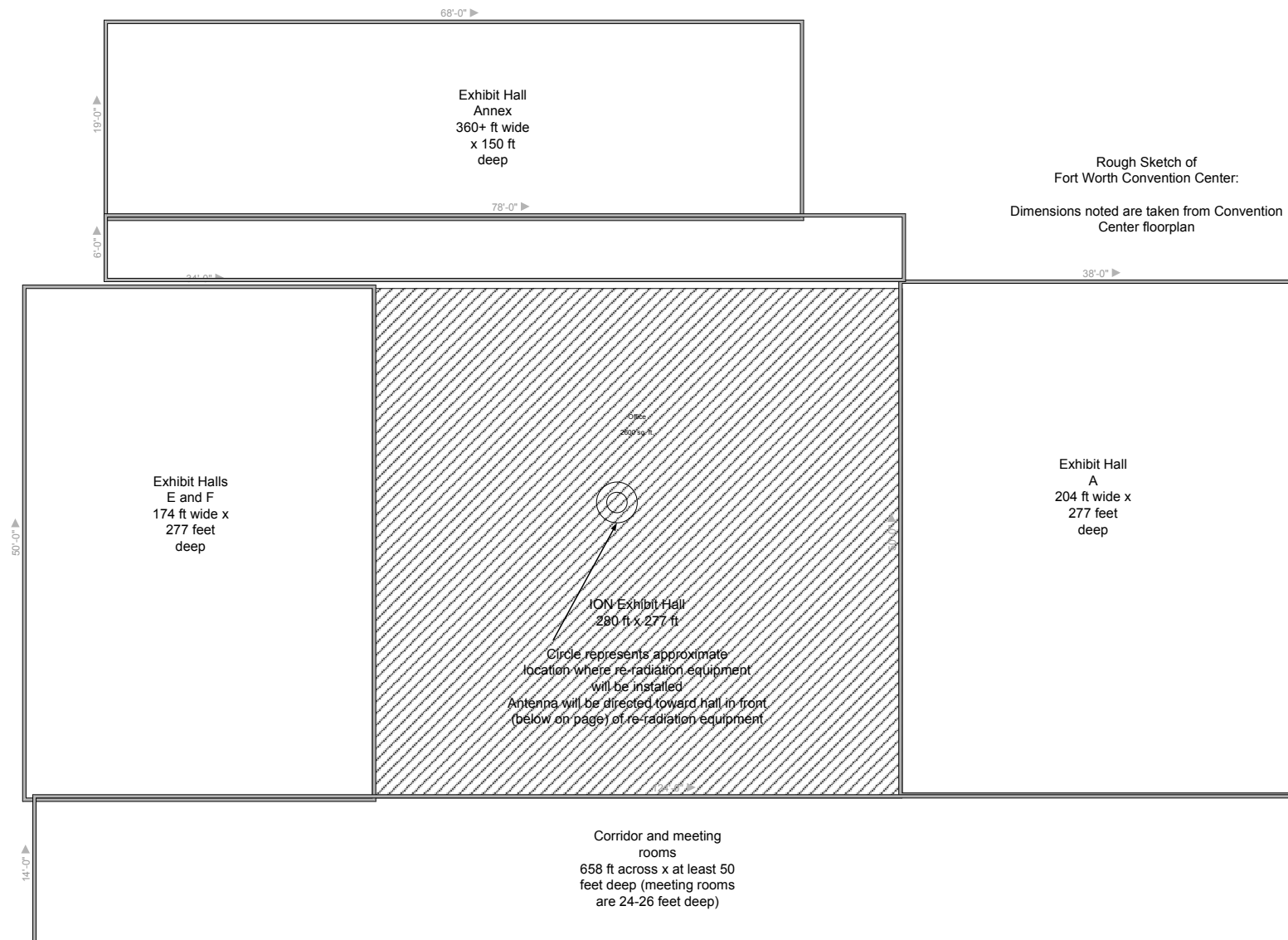
The drawing set out on the next page is a rough approximation of the floor plan of the Fort Worth Convention Center, where the Institute of Navigation meeting will be held. The room dimensions noted inside the room shapes were taken from the floor plans and room capacity tables presented by the Fort Worth Convention Center.¹ The concentric circle marking near the middle of the exhibit hall marks the approximate location where the re-radiation equipment will be installed. The antenna will be hung from the ceiling, oriented toward the front of the hall (the corridor side) at a slight downward angle.

The exhibit hall to be used for this conference measures 277 feet deep and 280 feet across. The corridor and conference rooms outside of the exhibit hall (below the hall, in the drawing) are at least 50 additional feet of indoor space. The conference rooms off the corridor measure at least 24 feet deep, and on the Convention Center floor plan, the corridor is wider than those conference rooms are deep. Behind the exhibit hall there is a section of restrooms and other utility spaces. We do not have dimensions for this space, but based upon the floor plan from the convention center, it appears to be 20-25 feet deep. Behind the restrooms and utility area, there is an indoor annex used for loading and unloading. The annex is 150 feet deep. The re-radiating antenna will be a minimum of 100 feet from any wall in the exhibit hall, and the exhibit hall is surrounded by other aspects of the convention center.

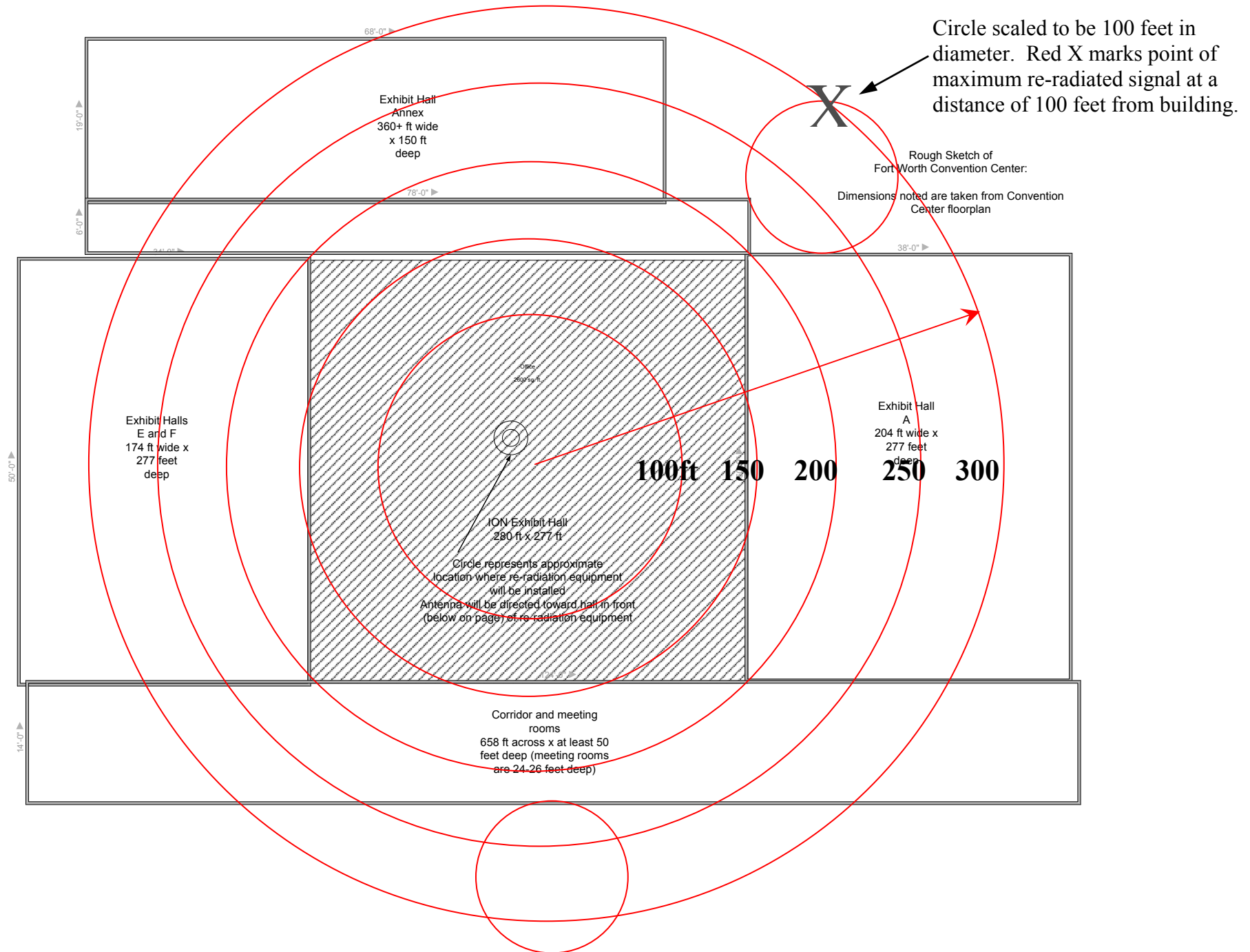
The link budget calculation on the page following the diagram describes the signal strength at distances of 100, 150, 200, 250, and 300 feet from the re-radiating antenna. At all times, this distance is inside a radius specified in item 6 of the NTIA criteria “100 feet from the building”, and the calculation assumes that there is no building attenuation for the signal.

¹ There are numbers outside of the room shapes in the diagram. Those are artifacts from the drawing program, and they have no bearing on reality. For the actual floor plan or room dimensions, please see: <http://www.fortworthgov.org/publicevents/convention/floorplan.asp>. The exhibit hall for the ION meeting will use exhibit space B, C, and D.

Drawing of Exhibit Hall where Re-radiation equipment will be installed:



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Link Budget and Calculations showing compliance with Item 6 of NTIA Criteria:

The second diagram above shows contours at distances of 100 ft to 300 ft from the re-radiating antenna. The power level, see below, of the re-radiating system at the 250 ft. contour is below the power level specified in item 6 of the criteria. As the diagram shows, the 250 ft contour is within 100 ft of the building, with most of that contour being contained inside the building itself. In the link budget below, there are calculations showing the EIRP of the re-radiated signal at a range of distances. Those distances are measured from the re-radiating antenna.

GPS L1 Link Budget

Satellite Transmitter

Transmitter Power (25 Watts)	14	dBW
RF Losses in trasmitter path	-1.25	dB
Antenna Gain (with respect to an isotrope)	13.5	dB

Satellite EIRP

26.25 dBW

Propagation

Atmosherpic and Polarization Losses	-0.5	dB
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$$\begin{aligned}
 \text{Free Space Path Loss} &= -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right] \\
 \text{where } d &= \text{distance from antenna} = 2.52\text{E}+07 \text{ meters} \\
 c &= \text{speed of light} = 3.00\text{E}+08 \text{ m/sec} \\
 f &= \text{frequency} = 1.58\text{E}+09 \text{ Hz} \\
 \lambda &= \text{wavelength} = c/f = 1.90\text{E}-01 \text{ meters} \\
 &= -10 \log_{10} \left[\frac{3.17\text{E}+08}{1.90\text{E}-01} \right]^2 \\
 &= -10 \log_{10} 1.67\text{E}+09 \\
 \text{Free Space Path Loss over Distance} &= -184.43 \text{ dB}
 \end{aligned}$$

Received Power on Earth

-158.68 dBW

-128.68 dBm

Gain of Receive Antenna	38	dB
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Drawing of Exhibit Hall where Re-radiation equipment will be installed:

RF losses in 300 feet of LMR400UF cabling and connectors from Receive Antenna to Line Amplifier

-18.95 dB

Gain of Two Line Amplifiers

40 dB

RF Power at Input to Re-Radiating Antenna

-69.63 dBm

Gain of Passive Re-Radiating Antenna

3 dBic

Radiated Power at Antenna Boresight

-66.63 dBm

Power Levels at a Distance from the Re-Radiating Antenna

$$\text{Free Space Path Loss} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$$

where d = distance from antenna = 100 feet

c = speed of light = 3.00E+08 m/sec

f = frequency = 1.58E+09 Hz

lambda = wavelength = c/f = 1.90E-01 meters

$$= -10 \log_{10} \left[\frac{383.023}{1.90E-01} \right]^2$$

$$= -10 \log_{10} 2.01E+03$$

Free Space Path Loss over Distance -66.07 dB

RF power level at 100 ft distance = -132.70 dBm

$$\text{Free Space Path Loss} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$$

where d = distance from antenna = 150 feet

c = speed of light = 3.00E+08 m/sec

f = frequency = 1.58E+09 Hz

lambda = wavelength = c/f = 1.90E-01 meters

$$\left[\frac{\quad}{\quad} \right]^2$$

Drawing of Exhibit Hall where Re-radiation equipment will be installed:

	= -10log ₁₀	574.5345	1.90E-01
	= -10log ₁₀	3.02E+03	
Free Space Path Loss over Distance	-69.59	dB	
RF power level at 150 ft distance =	-136.22	dBm	

$\text{Free Space Path Loss} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$			
where d = distance from antenna =	200	feet	
c = speed of light =	3.00E+08	m/sec	
f = frequency =	1.58E+09	Hz	
lambda = wavelength = c/f =	1.90E-01	meters	
	= -10log ₁₀	$\left[\frac{766.046}{1.90E-01} \right]^2$	
	= -10log ₁₀	4.02E+03	
Free Space Path Loss over Distance	-72.09	dB	
RF power level at 200 ft distance =	-138.72	dBm	

$\text{Free Space Path Loss} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$			
where d = distance from antenna =	250	feet	
c = speed of light =	3.00E+08	m/sec	
f = frequency =	1.58E+09	Hz	
lambda = wavelength = c/f =	1.90E-01	meters	
	= -10log ₁₀	$\left[\frac{957.5574}{1.90E-01} \right]^2$	
	= -10log ₁₀	5.03E+03	
Free Space Path Loss over Distance	-74.03	dB	
RF power level at 250 ft distance =	-140.66	dBm	

Drawing of Exhibit Hall where Re-radiation equipment will be installed:

$$\overline{\text{Free Space Path Loss}} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$$

where d = distance from antenna = 300 feet

c = speed of light = 3.00E+08 m/sec

f = frequency = 1.58E+09 Hz

lambda = wavelength = c/f = 1.90E-01 meters

$$= -10 \log_{10} \left[\frac{1149.069}{6.03 \times 10^3} \right]$$

Free Space Path Loss over Distance -75.61 dB

RF power level at 300 ft distance = -142.24 dBm