

# **SIRIUS SATELLITE RADIO**

REMOTE RADIATOR VEHICLE TESTING  
UNIVERSITY OF MICHIGAN  
Model SP-4, version 3

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## DISCUSSION OF TESTING AND RESULTS

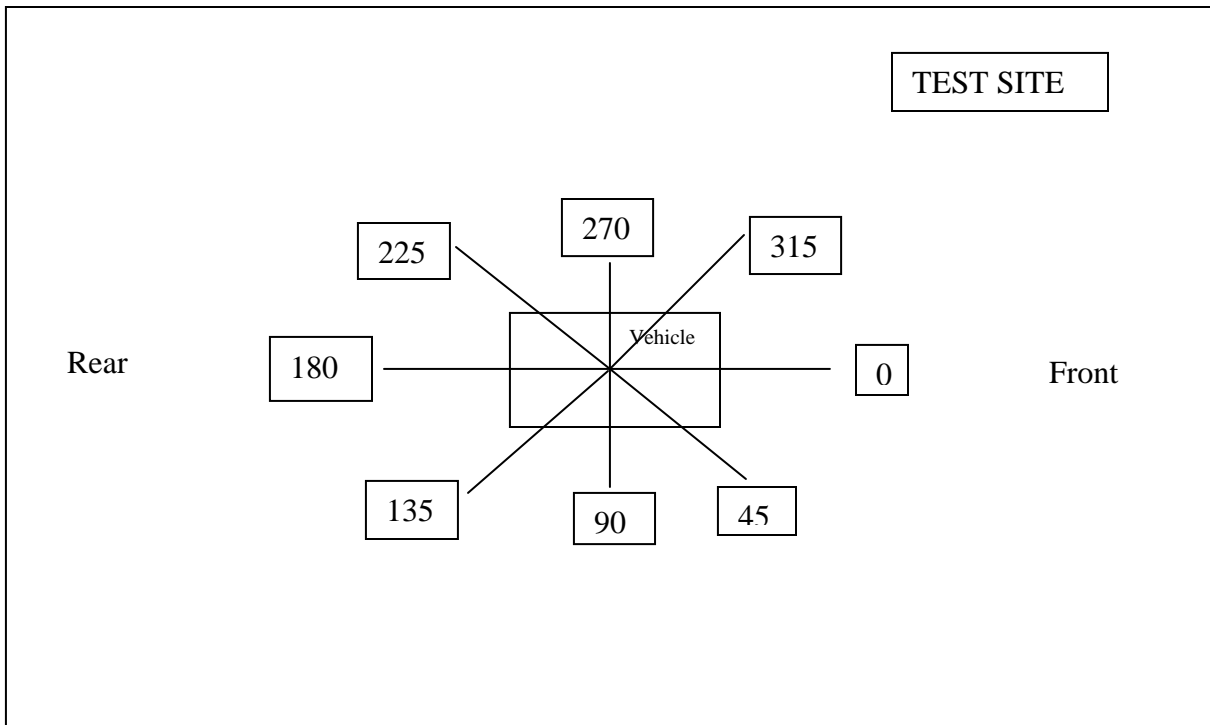
Satellite radio products function to receive satellite radio channels, decode the modulation on the satellite signal and modulate the recovered base band signal onto a carrier in the FM radio band for reception by the FM radio in the vehicle. The remote radiator concept provides for better coupling to the car radio of the modulated FM signal from the satellite receiver.

These tests were implemented to gather data on a remote radiator configuration with Sirius Satellite radio products. The data was taken on 8 radials with 3 different vehicles at a distance of 3 meters from the closest point of the vehicle.

In situ testing was performed for three vehicles based on the following vehicle sizes; small, medium, and large. The selected vehicles were: Chrysler 300, Nissan Quest, and a Honda Accord. The above vehicles have window mount antennas and the remote antenna was located adjacent to the window antenna in each case. Three frequencies in the FM band were measured; one near the low end (88 MHz), middle, (98 MHz) and high end (108 MHz) of the band in both horizontal and vertical polarizations.

The results show that the remote radiator with this model produced levels that were a minimum of -5 dB below the FCC Section 15.239 limit with an average margin of -14 dB below the limit when measured 3 meters from the perimeter of the vehicle. In the tables that follow, Kg is the correction factor for preamp gain and cable loss and Ka is the antenna factor for the measurement antenna.

Below is a diagram of the radial arrangement for measurements as laid out on the test site showing their position relative to the vehicle position. Measurement were made using an antenna and mast moved to each marked location. Antenna height was varied from 1 to 4 meters at each location.



# Chrysler 300 w/ Rear Glass Antenna

Radial Angle	88.5 MHz (dBuV)		95.9 MHz (dBuV)		106.3 MHz (dBuV)	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
0	46.4	46.6	46.5	45.0	43.0	45.6
45	41.9	29.9	39.0	30.3	41.3	31.5
90	32.4	45.0	35.3	43.6	40.5	39.6
135	48.2	49.3	51.0	49.3	44.2	44.6
180	54.7	34.7	54.3	33.0	44.8	29.3
225	49.2	47.1	50.5	50.8	45.3	43.5
270	30.0	49.6	39.6	50.0	43.4	30.8
315	43.5	46.9	43.0	48.0	40.8	44.3
Max dBuV	54.7	49.6	54.3	50.8	45.3	45.6
Max dBuV/m	41.7	36.6	42.2	38.7	34.4	34.7
Limit Margin	-6.3	-11.4	-5.8	-9.3	-13.6	-13.3

54.7	Max Reading (dBuV)
42.2	Max Output (dBuV/m)
-5.8	Min Margin (dB)

Range and BICON calibration (05Oct06)			
	Kg	Ka	Corr
88	20.8	7.8	-13
98	20.4	8.3	-12.1
108	19.9	9	-10.9



# Nissan Quest w/ Side Glass Diversity

Radial Angle	88.5 MHz (dBu)		95.9 MHz (dBu)		106.3 MHz (dBu)	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
0	31.1	27.7	34.6	34.1	42.7	31.5
45	40.1	36.8	41.0	41.6	44.2	36.5
90	39.4	34.2	47.0	35.5	47.5	39.8
135	36.8	37.8	41.7	40.2	41.1	31.9
180	34.8	35.8	34.9	38.6	35.2	27.5
225	35.8	29.9	27.5	36.1	27.3	36.7
270	35.5	31.8	37.9	33.8	45.6	36.5
315	34.6	35.5	37.0	35.5	44.7	38.7
Max dBu	40.1	37.8	47	41.6	47.5	39.8
Max dBu/m	27.1	24.8	34.9	29.5	36.6	28.9
Limit Margin	-20.9	-23.2	-13.1	-18.5	-11.4	-19.1

47.5	Max Reading (dBu)
36.6	Max Output (dBu/m)
-11.4	Min Margin (dB)

Range and E100N calibration (05Oct06)			
	Kg	Ka	Corr
88	20.8	7.8	-13
98	20.4	8.3	-12.1
108	19.9	9	-10.9



# Honda Accord with Rear Glass Antenna

Radial Angle	88.5MHz (dBu)		95.9MHz (dBu)		106.3MHz (dBu)	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
0	45.4	30.9	41.2	29.7	46.5	30.8
45	41.7	41.5	35.6	34.3	39.7	33.4
90	34.0	47.7	33.9	34.0	42.4	41.9
135	50.6	45.6	38.4	37.9	42.5	42.4
180	55.9	33.1	39.1	32.3	41.5	30.8
225	52.0	44.0	39.9	37.9	43.4	36.1
270	41.0	49.9	38.1	31.7	36.6	42.2
315	37.5	44.7	39.1	36.0	42.9	32.1
Max dBu	55.9	49.9	41.2	37.9	46.5	42.4
Max dBu/m	42.9	36.9	29.1	25.8	35.6	31.5
Limit Margin	-5.1	-11.1	-18.9	-22.2	-12.4	-16.5

55.9	Max Reading (dBu)
42.9	Max Output (dBu/m)
-5.1	Mn Margin (dB)

Range and EIRP Calibration (05Oct06)			
	Kg	Ka	Corr
88	20.8	7.8	-13
98	20.4	8.3	-12.1
108	19.9	9	-10.9



## TEST SITE PHOTOS

