SECTION 4

ASSESSMENT OF COMPATIBILITY FOR SINGLE UWB DEVICE

4.1 INTRODUCTION

The results of an EMC analyses for a single UWB device versus the following systems are contained in this section: the NEXRAD, ARSR-4, ASR-9, RF Altimeters, ATCRBS, DME, MLS, SARSAT LUT, a 4 GHz Earth station, a TDWR, and a shipboard maritime radionavigation radar.

A summary section for each system contains tables that show the maximum permitted UWB EIRP for a range of PRFs from 0.001 to 500 MHz. Also included in the tables are the required separation distances for the victim receiver and the UWB device when its EIRP is equal to the reference level of -41.3 dBm/MHz RMS. In cases where the maximum permitted EIRP is above the reference level, the required separation distance does not apply and "Not Applicable" or "NA" is put into the column. Sample graphs are provided which show the maximum permitted UWB EIRP versus distance from the victim receiver for various PRFs. The maximum permitted EIRP level for UWB devices is also discussed in relationship to the reference level and the effect that the UWB signal would have on the victim receiver.

For this analysis the average power is based on a spectrum analyzer RMS detector function.[33] At the end of this section is a discussion on system, operating frequency, maximum permissible UWB EIRP, and the minimum required separation distance when the UWB EIRP is equal to the reference level.

4.2 NEXRAD RADAR (2700-3000 MHz)

Analyses of potential interference from a single UWB device into a NEXRAD receiver was performed using the methodology described in Section 3, the NEXRAD characteristics given in Appendix A, and the analysis parameters shown in TABLE 4-1. The NEXRAD radar antenna height in TABLE 4-1 is the average height of all the NEXRAD radars in the Government Master File (GMF) of frequency assignments.

[33] The measurement procedure used by the FCC is based on a log-average detector function.

TABLE 4-1
UWB and NEXRAD Analysis Parameters

Parameter	Value
Protection Criteria	I/N = -6 dB (average (RMS) interference power)
Radar Antenna Height	28 meters
Radar Tilt Angle	0.5 degrees above horizon
UWB Device Height	2 meters, 30 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

The results for a non-dithered UWB signal analyses are shown in TABLE 4-2 for a UWB height of 2 meters. These results show that the NEXRAD interference protection criteria is exceeded with a UWB EIRP of -41.7 dBm or greater for UWB PRFs above 0.1 MHz. This is 0.4 dB below the reference level. For PRFs at and below 0.1 MHz the maximum UWB EIRP is -39.1 dBm, which is 2.2 dB above the reference level. For UWB devices with PRFs above 0.1 MHz, the required separation distance is 1.4 km when the UWB EIRP equals the reference level. A graph of the maximum permitted UWB EIRP versus distance is shown in Figure 4-1 for a PRF of 1 MHz.

TABLE 4-2
Non-Dithered UWB Signal into NEXRAD Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-2.6	-39.1	2.2	NA
.01	-2.6	-39.1	2.2	NA
.1	-2.6	-39.1	2.2	NA
1	0.0	-41.7	-0.4	1.4
10	0.0	-41.7	-0.4	1.4
100	0.0	-41.7	-0.4	1.4
500	0.0	-41.7	-0.4	1.4

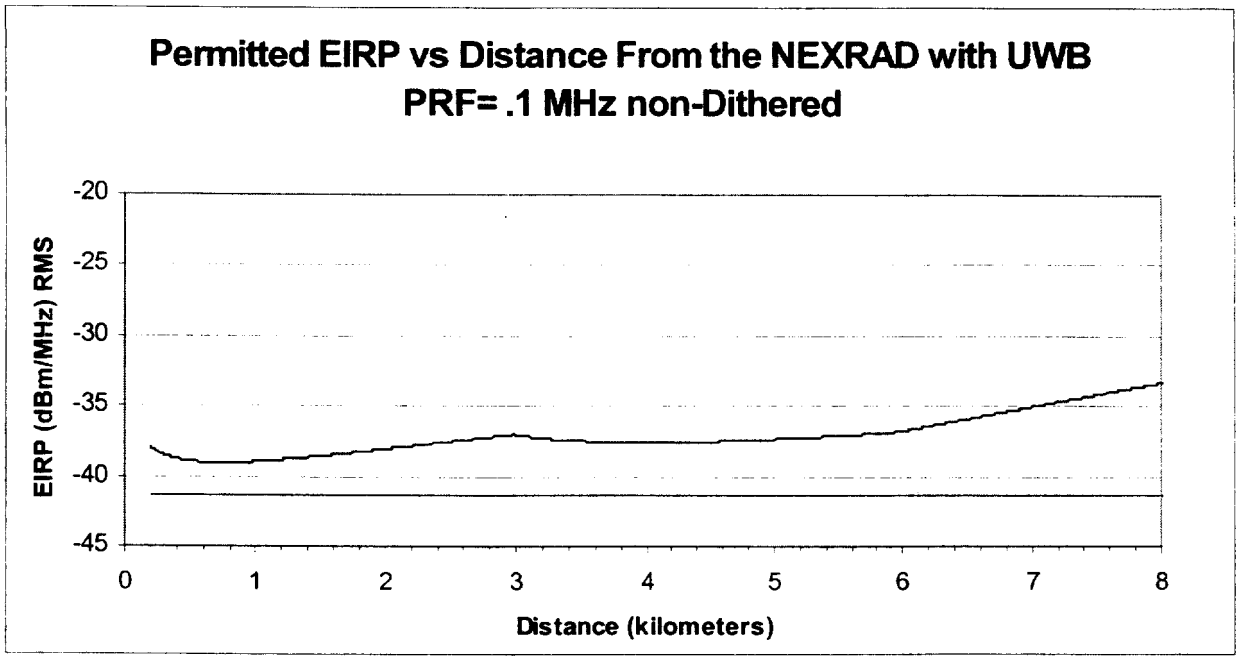

Figure 4-1. Maximum Permitted UWB EIRP for non-Dithered PRF of 0.1 MHz (UWB Height = 2m).

Above a PRF of 0.1 MHz, the BWCF is equal to zero and the graph will change. It is shown below in Figure 4-2.

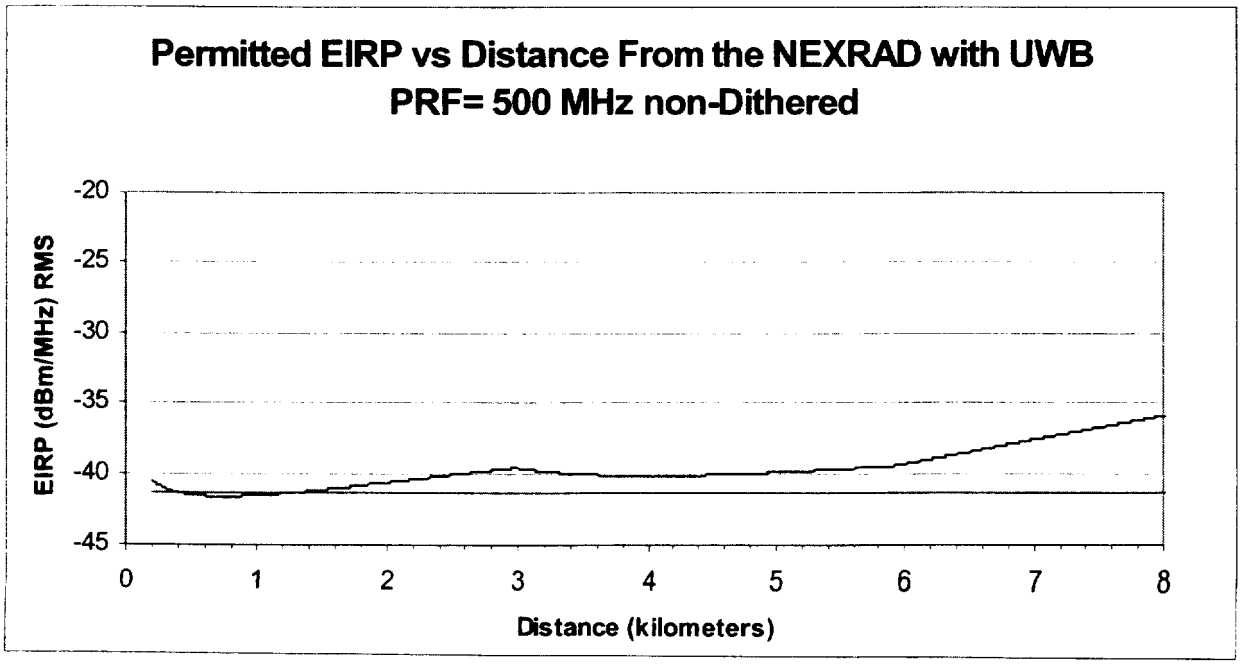

Figure 4-2. Maximum Permitted UWB EIRP for non-Dithered PRF of 500MHz (UWB Height = 2m).

The results for a dithered UWB signal analyses are shown in TABLE 4-3. The results for a dithered UWB signal show that the maximum allowable UWB EIRP is -39.1 dBm regardless of the PRF. The permitted UWB EIRP level is 2.2 dB above the -41.3 dBm/MHz RMS reference level. A graph of the maximum permitted dithered UWB EIRP versus distance is shown in Figure 4-3.

TABLE 4-3
Dithered UWB Signal into NEXRAD Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-2.6	-39.1	2.2	NA
.01	-2.6	-39.1	2.2	NA
.1	-2.6	-39.1	2.2	NA
1	-2.6	-39.1	2.2	NA
10	-2.6	-39.1	2.2	NA
100	-2.6	-39.1	2.2	NA
500	-2.6	-39.1	2.2	NA

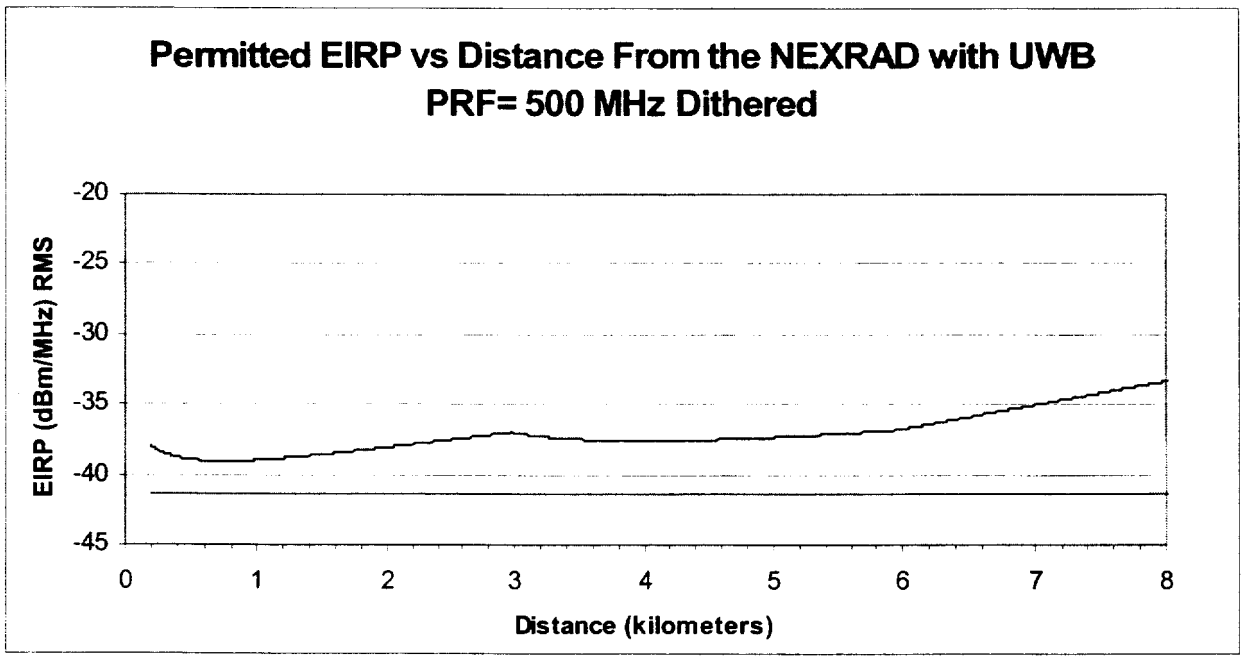

Figure 4-3. Maximum Permitted UWB EIRP for Dithered PRF (UWB Height = 2m).

Analyses was also performed for a UWB height of 30 meters. The results for a non-dithered UWB signal analyses are shown in TABLE 4-4. The results show that for UWB PRFs at and below 0.1 MHz the maximum permitted UWB EIRP is -73.3 dBm. For PRFs above 0.1 MHz the maximum permitted EIRP is -75.9 dBm. These levels are 32 and 34.6 dB below the reference level. The separation distances for a NEXRAD receiver and a UWB device with an EIRP equal to the reference level range from 5.8 km for UWB PRFs at and below 0.1 MHz to 7.8 km for PRFs above 0.1 MHz.

TABLE 4-4
Non-Dithered UWB Signal into NEXRAD Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-2.6	-73.3	-32.0	5.8
.01	-2.6	-73.3	-32.0	5.8
.1	-2.6	-73.3	-32.0	5.8
1	0	-75.9	-34.6	7.8
10	0	-75.9	-34.6	7.8
100	0	-75.9	-34.6	7.8
500	0	-75.9	-34.6	7.8

The results for a dithered UWB signal are shown in TABLE 4-5. The results show that the maximum permitted UWB EIRP is -73.3 dBm regardless of the UWB PRF. The separation distance for a NEXRAD receiver and a dithered UWB device with an EIRP equal to the reference level is 5.8 km. A graph of the maximum permitted dithered UWB EIRP versus distance for a UWB height of 30 meters is shown in Figure 4-4.

TABLE 4-5
Dithered UWB Signal into NEXRAD Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS (km)
.001	-2.6	-73.3	-32.0	5.8
.01	-2.6	-73.3	-32.0	5.8
.1	-2.6	-73.3	-32.0	5.8
1	-2.6	-73.3	-32.0	5.8
10	-2.6	-73.3	-32.0	5.8
100	-2.6	-73.3	-32.0	5.8
500	-2.6	-73.3	-32.0	5.8

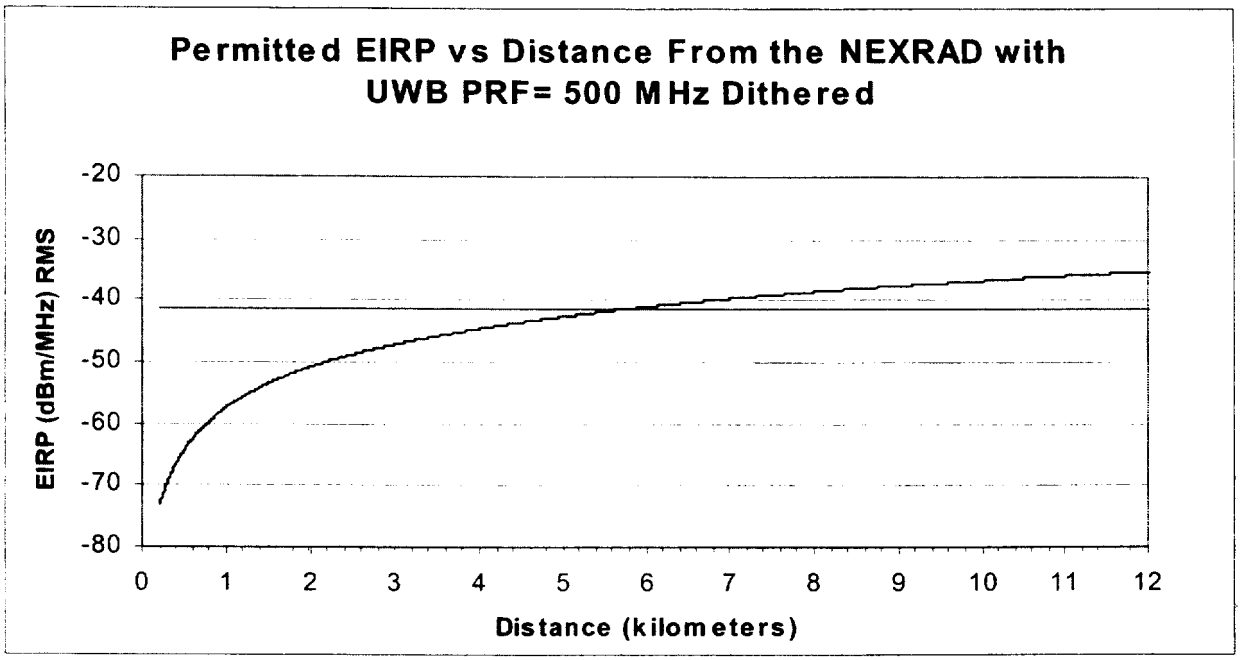

Figure 4-4. Maximum Permitted UWB EIRP for Dithered PRF (UWB Height = 30 m).

Discussion of Single Entry Results

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of NEXRAD radars and within the 2700-3000 MHz frequency band would exceed current interference protection requirements with UWB PRFs above 0.1 MHz and/or operating heights comparable to the NEXRAD antenna. UWB devices operating at that power level would add to the system noise, rendering the radar less capable of tracking and monitoring meteorological events.

Three factors significantly influence these results, namely, the radar antenna height, radar antenna tilt angle, and the height of the UWB device. When the radar antenna and the UWB device are operating in the same horizontal plane, the vertical elevation angle between them is zero degrees which results in a greater radar antenna gain. The analytical model takes into account the height of the radar, the height of the UWB device, and the radar tilt angle to compute the radar antenna gain, which is then used in the UWB interference calculations. For example, when the UWB height is 2 meters, the NEXRAD antenna height is 28 meters, and the distance is 1 km, the off-axis angle is -1.5 degrees, the NEXRAD tilt angle is 0.5 degrees, the radar antenna gain is 24.6 dBi (from Figure A-1 at -2 degrees). However, for a UWB height of 30 meters and a distance of 1 km the off-axis angle is +0.10 degrees and the radar antenna gain is 43 dBi.

A higher radar antenna gain raises the UWB interference power level in the radar receiver. For compatible operations, this requires a lower maximum permitted UWB EIRP and a longer separation distance to satisfy the receiver's protection criteria.

4.3 ARSR-4 RADAR (1215-1400 MHz)

Analyses of potential interference from a single UWB device into an ARSR-4 receiver was performed using the methodology described in Section 3, the ARSR-4 characteristics given in Appendix A, and the analysis parameters shown in TABLE 4-6. The ARSR-4 radar antenna height in TABLE 4-6 is the average height of all the ARSR-4 radars in the GMF of frequency assignments.

TABLE 4-6
UWB and ARSR-4 Analysis Parameters

Parameter	Value
Protection Criteria	I/N = -10 dB (average (RMS) interference power)
Radar Antenna Height	22 meters
Radar Tilt Angle	2 degrees above horizon
UWB Device Height	2 meters, 30 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

The results of the non-dithered UWB device signal analyses are shown in TABLE 4-7 for a UWB height of 2 meters. These results show that the ARSR-4 interference protection criteria is exceeded with a UWB EIRP of -59.6 dBm or greater for UWB PRFs at or below 0.1 MHz. For PRFs above 0.1 MHz the criteria is exceeded for a UWB EIRP greater than -61.2 dBm. These levels are 18.3 and 19.9 dB below the -41.3 dBm/MHz RMS reference level. For UWB devices with PRFs at or above 0.1 MHz and the UWB EIRP equal the reference level, the distance separations range from 5.5 km to 6.1 km to satisfy the ARSR-4 interference protection criteria. A graph of the maximum permitted UWB EIRP versus distance is shown in Figure 4-5 for a PRF of 0.1 MHz and a UWB height of 2 meters.

TABLE 4-7
Non-Dithered UWB Signal into ARSR-4 Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.6	-59.6	-18.3	5.5
.01	-1.6	-59.6	-18.3	5.5
.1	-1.6	-59.6	-18.3	5.5
1	0.0	-61.2	-19.9	6.1
10	0.0	-61.2	-19.9	6.1
100	0.0	-61.2	-19.9	6.1
500	0.0	-61.2	-19.9	6.1

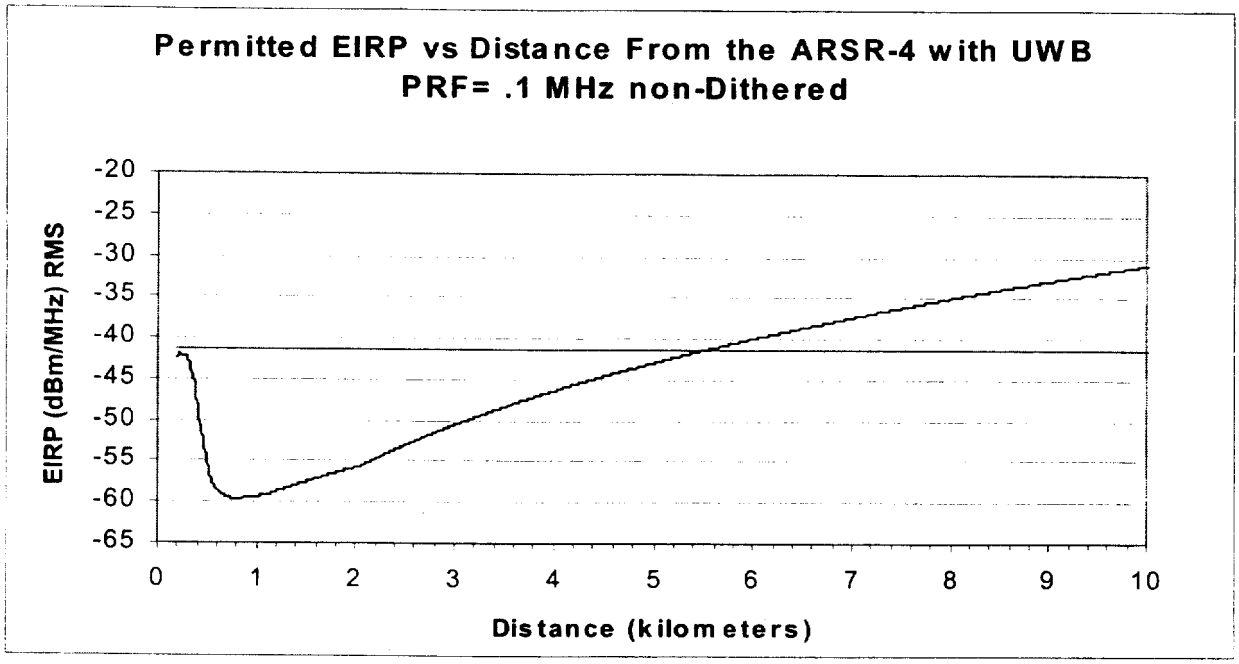

Figure 4-5. Maximum Permitted UWB EIRP for non-Dithered PRF of 0.1 MHz (UWB Height = 2m).

Above a PRF of 0.1 MHz, the BWCF is equal to zero and the graph will change. It is shown below in Figure 4-6.

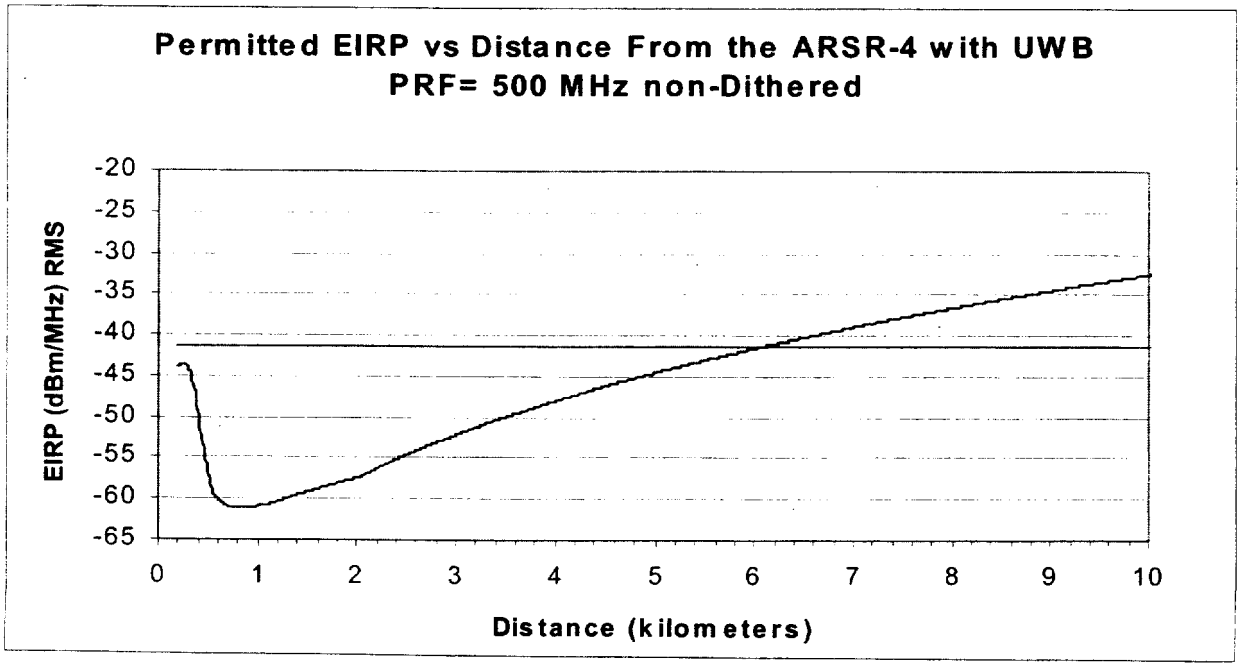

Figure 4-6. Maximum Permitted UWB EIRP for non-Dithered PRF of 500MHz (UWB Height = 2m).

The results for a dithered UWB signal are shown in TABLE 4-8. For a dithered signal the maximum allowable UWB EIRP is -59.6 dBm regardless of the PRF. The permitted UWB EIRP level is 18.3 dB below the -41.3 dBm/MHz RMS reference level. The distance separation is 5.5 km to satisfy the ARSR-4 interference protection criteria with the UWB EIRP equal to the reference level. A graph of the maximum permitted dithered UWB EIRP versus distance is shown in Figure 4-7.

TABLE 4-8
Dithered UWB Signal into ARSR-4 Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.6	-59.6	-18.3	5.5
.01	-1.6	-59.6	-18.3	5.5
.1	-1.6	-59.6	-18.3	5.5
1	-1.6	-59.6	-18.3	5.5
10	-1.6	-59.6	-18.3	5.5
100	-1.6	-59.6	-18.3	5.5
500	-1.6	-59.6	-18.3	5.5

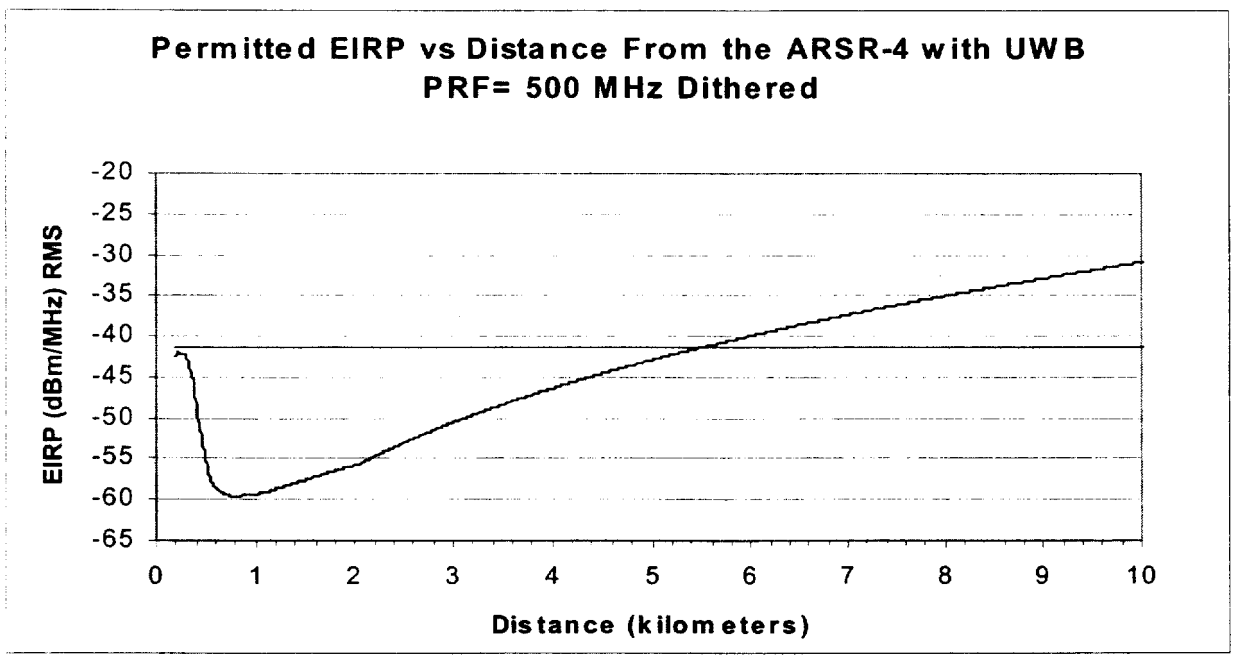

Figure 4-7. Maximum Permitted UWB EIRP for Dithered PRF (UWB Height = 2m).

As the UWB device becomes closer than 1 km to the radar, the radar antenna gain used in the interference calculations rapidly drops off which allows a higher UWB EIRP. This effect is responsible for the minima in the graphs of Figures 4-5, 4-6, and 4-7.

The shape of the graph is independent of the UWB PRF because the dithering results in a BWCF of 1.6 dB regardless of the PRF.

Analyses was also performed for a UWB height of 30 meters. The results for a non-dithered UWB signal are shown in TABLE 4-9. These results show that the ARSR-4 interference protection criteria is exceeded with a UWB EIRP of -80.0 dBm or greater for UWB PRFs at or below 0.1 MHz. For PRFs above 0.1 MHz the criteria is exceeded for a UWB EIRP greater than -81.6 dBm. These levels are 38.7 and 40.3 dB below the -41.3 dBm/MHz RMS reference level. For UWB devices with the UWB EIRP equal the reference level, the distance separations range are beyond 15 km to satisfy the ARSR-4 interference protection criteria.

TABLE 4-9
Non-Dithered UWB Signal into ARSR-4 Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.6	-80.0	-38.7	>15
.01	-1.6	-80.0	-38.7	>15
.1	-1.6	-80.0	-38.7	>15
1	0	-81.6	-40.3	>15
10	0	-81.6	-40.3	>15
100	0	-81.6	-40.3	>15
500	0	-81.6	-40.3	>15

The results for a dithered interference analyses are shown in TABLE 4-10.

TABLE 4-10
Dithered UWB Signal into ARSR-4 Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.6	-80.0	-38.7	>15
.01	-1.6	-80.0	-38.7	>15
.1	-1.6	-80.0	-38.7	>15
1	-1.6	-80.0	-38.7	>15
10	-1.6	-80.0	-38.7	>15
100	-1.6	-80.0	-38.7	>15
500	-1.6	-80.0	-38.7	>15

The results for a dithered UWB signal analyses show that the maximum UWB EIRP is -80.0 dBm regardless of the PRF, which is 38.7 dB below the reference level. The ARSR-4 and UWB device separation distance is beyond 15 km when the UWB EIRP is equal to the reference level.

A graph of the maximum permitted dithered UWB EIRP versus distance is shown in Figure 4-8 for a UWB height of 30 meters.

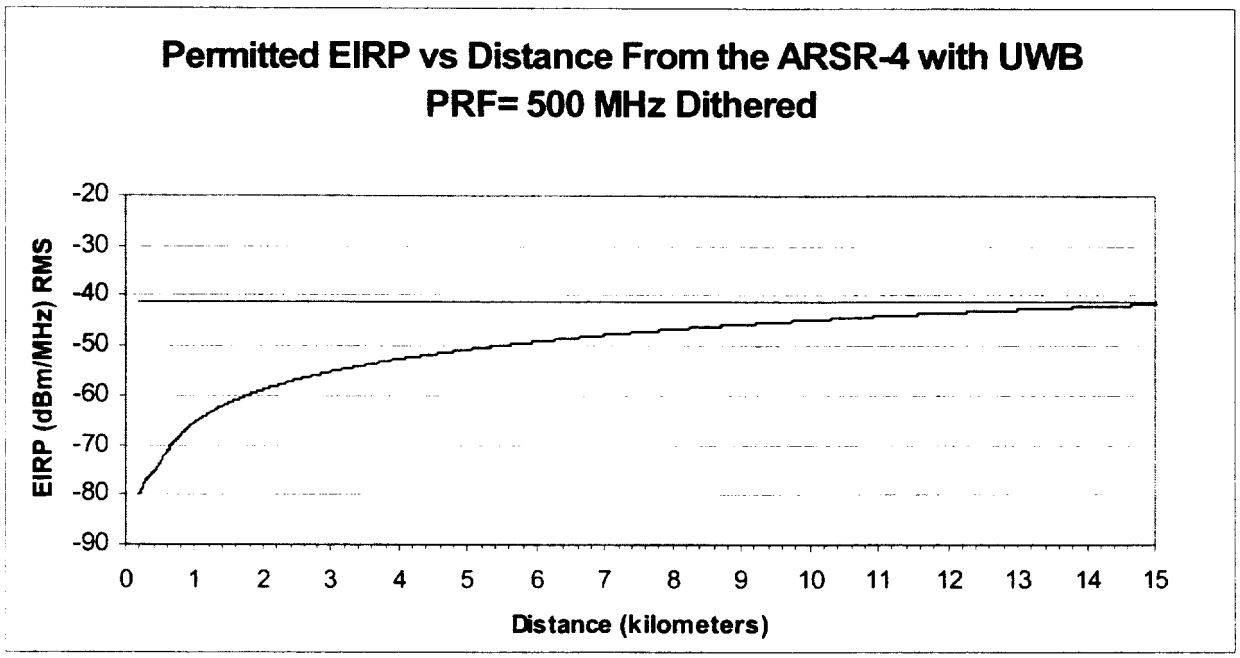

Figure 4-8. Maximum Permitted UWB EIRP for Dithered PRF (UWB Height = 30 m).

The shape of the graph in Figure 4-8 is different than graphs in the previous figures because of the geometry of the scenario when the UWB height is 30 meters. At this height when the UWB device moves toward the radar, the gain of the radar antenna used in the interference calculations does not significantly change and the driving factor in calculating the maximum permissible UWB EIRP is the propagation loss.

Discussion of Single Entry Results

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of ARSR-4 radars and within the 1215-1400 MHz frequency band would exceed current interference protection requirements. UWB devices operating at that power level would add to the system noise, rendering the ARSR-4 radar less capable of tracking and detecting aircraft.

Three factors significantly influence these results, namely, the radar antenna height, radar antenna tilt angle, and the height of the UWB device. When the radar antenna and the UWB device are operating in the same horizontal plane, the vertical elevation angle

between them is zero degrees which results in a greater radar antenna gain. The analytical model takes into account the height of the radar, the height of the UWB device, and the radar tilt angle to compute the radar antenna gain, which is then used in the UWB interference calculations. For example, when the UWB height is 2 meters and the distance is 1 km, the off-axis + tilt angle is -3.1 degrees and the radar antenna gain is 33.3 dBi. However, for a UWB height of 30 meters and a distance of 1 km the off-axis + tilt angle is -1.5 degrees and the radar antenna gain is 39.5 dBi.

A higher radar antenna gain raises the UWB interference power level in the radar receiver. For compatible operations, this requires a lower maximum permitted UWB EIRP and a longer separation distance to satisfy the receiver's protection criteria.

4.4 ASR-9 RADAR (2700-2900 MHz)

Analyses of potential interference from a single UWB device into an ASR-9 receiver was performed using the methodology described in Section 3, the ASR-9 characteristics given in Appendix A, and the analysis parameters shown in TABLE 4-11. The ASR-9 radar antenna height in TABLE 4-11 is the average height of all the ASR-9 radars in the GMF of frequency assignments.

TABLE 4-11
UWB and ASR-9 Analysis Parameters

Parameter	Value
Protection Criteria	I/N = -10 dB (average (RMS) interference power)
Radar Antenna Height	17 meters
Radar Tilt Angle	2 degrees above horizon
UWB Device Height	2 meters, 30 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

The results for a non-dithered UWB signal analyses are shown in TABLE 4-12 for a UWB height of 2 meters. These results show that the ASR-9 interference protection criteria is exceeded with a UWB EIRP of -44.1 dBm or greater for UWB PRFs at and below 0.1 MHz. For PRFs above 0.1 MHz the criteria is exceeded for a UWB EIRP greater than -45.9 dBm. These levels are 2.8 and 4.6 dB below the -41.3 dBm/MHz RMS reference level. For UWB devices with PRFs at or above 0.1 MHz and the UWB EIRP equal the reference level, the distance separations range from 0.8 km to 1.1 km to satisfy the ASR-9 interference protection criteria. A graph of the maximum permitted UWB EIRP versus distance is shown in Figure 4-9 for a non-dithered PRF of 0.1 MHz and in Figure 4-10 for a non-dithered PRF of 500 MHz.

TABLE 4-12
Non-Dithered UWB Signal into ASR-9 Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.9	-44.1	-2.8	0.8
.01	-1.9	-44.1	-2.8	0.8
.1	-1.9	-44.1	-2.8	0.8
1	0.0	-45.9	-4.6	1.1
10	0.0	-45.9	-4.6	1.1
100	0.0	-45.9	-4.6	1.1
500	0.0	-45.9	-4.6	1.1

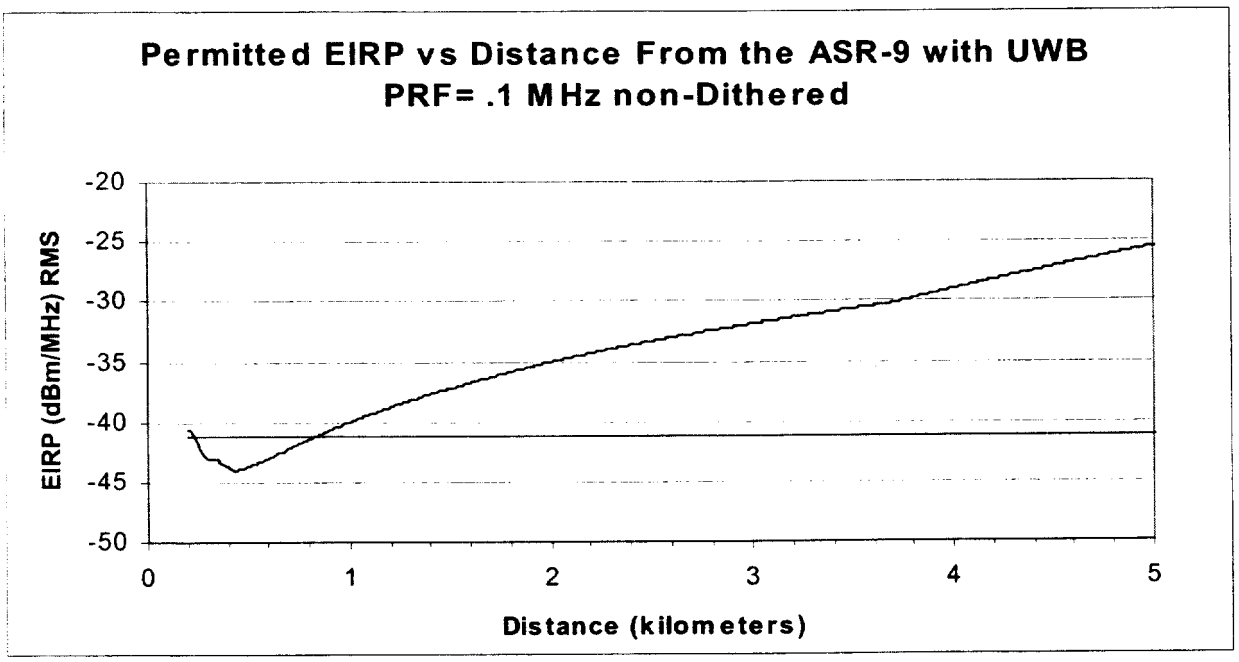

Figure 4-9. Maximum Permitted UWB EIRP for non-Dithered PRF of 0.1 MHz (UWB Height = 2m).

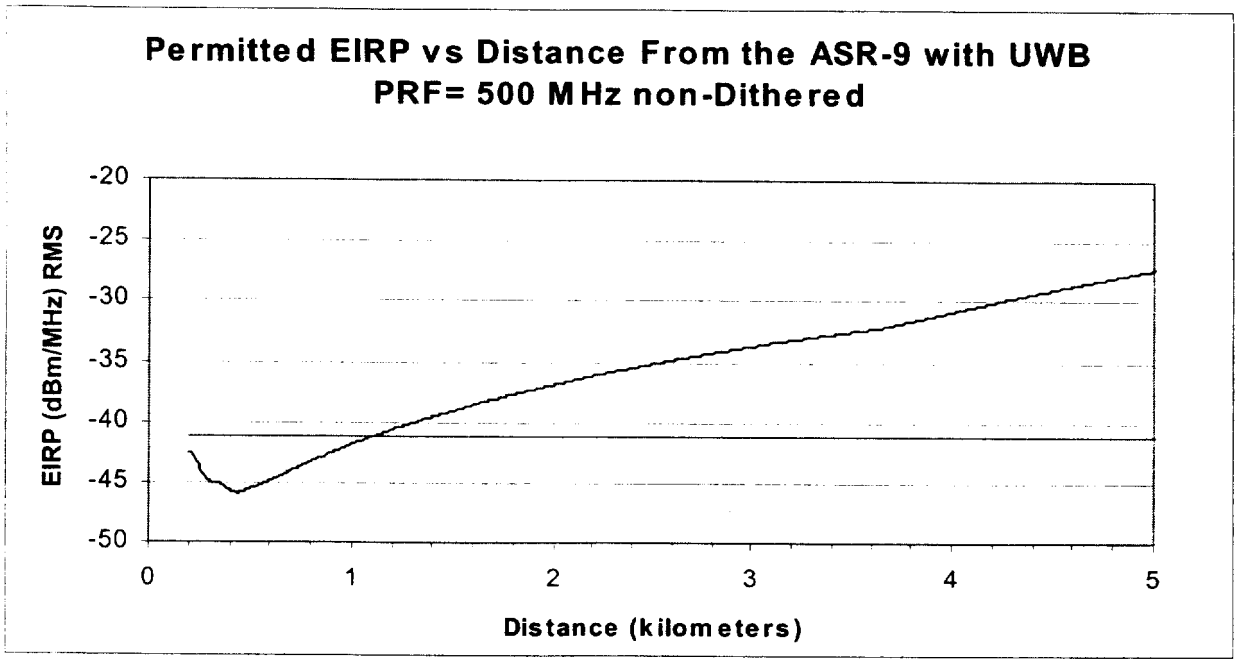

Figure 4-10. Maximum Permitted UWB EIRP for non-Dithered PRF of 500MHz (UWB Height = 2m).

The results for a dithered UWB signal analyses are shown in TABLE 4-13. The results for a dithered signal show that the maximum allowable UWB EIRP is -44.1 dBm regardless of the PRF. The permitted UWB EIRP level is 2.8 dB below the -41.3 dBm/MHz RMS reference level. The distance separation is 0.8 km to satisfy the ASR-9 interference protection criteria with the UWB EIRP equal to the reference level. A graph of the maximum permitted dithered UWB EIRP versus distance is shown in Figure 4-11 for a UWB height of 2 meters.

TABLE 4-13
Dithered UWB Signal into ASR-9 Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS)	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.9	-44.1	-2.8	0.8
.01	-1.9	-44.1	-2.8	0.8
.1	-1.9	-44.1	-2.8	0.8
1	-1.9	-44.1	-2.8	0.8
10	-1.9	-44.1	-2.8	0.8
100	-1.9	-44.1	-2.8	0.8
500	-1.9	-44.1	-2.8	0.8

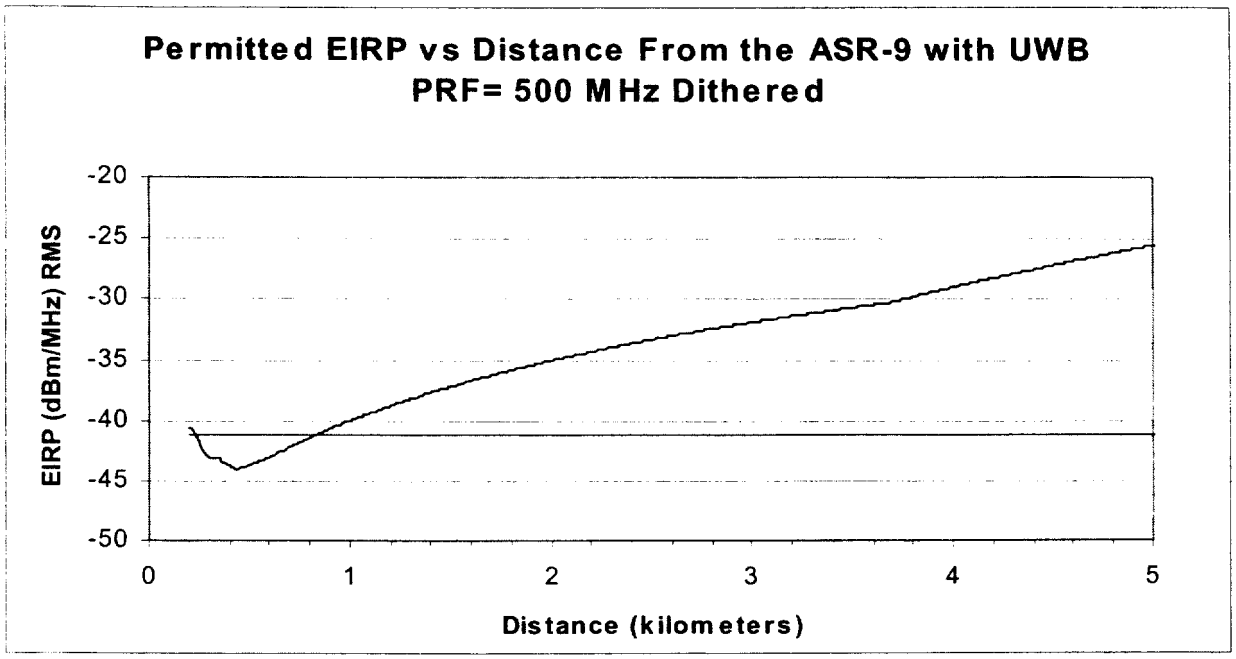

Figure 4-11. Maximum Permitted UWB EIRP for Dithered PRF (UWB Height = 2m).

The shape of the graph is independent of the UWB PRF because the dithering results in a BWCF of -1.9 dB regardless of the PRF.

Analyses was also performed for a UWB height of 30 meters. The results for a non-dithered UWB signal analyses are shown in TABLE 4-14. These results show that the ASR-9 interference protection criteria is exceeded with a UWB EIRP of -64.4 dBm or greater for UWB PRFs below 0.1 MHz. For PRFs above 0.1 MHz the criteria is exceeded for a UWB EIRP greater than -66.2 dBm. These levels are 23.1 and 24.9 dB below the -41.3 dBm/MHz RMS reference level. For UWB devices with PRFs at or above 0.1 MHz and the UWB EIRP equal the reference level, the distance separations range from 1.3 km to 1.5 km to satisfy the ASR-9 interference protection criteria.

TABLE 4-14
Non-Dithered UWB Signal into ASR-9 Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.9	-64.4	-23.1	1.3
.01	-1.9	-64.4	-23.1	1.3
.1	-1.9	-64.4	-23.1	1.3
1	0	-66.2	-24.9	1.5
10	0	-66.2	-24.9	1.5
100	0	-66.2	-24.9	1.5
500	0	-66.2	-24.9	1.5

The results for dithered UWB signal analyses are shown in TABLE 4-15.

TABLE 4-15
Dithered UWB Signal into ASR-9 Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.9	-64.5	-23.2	1.3
.01	-1.9	-64.5	-23.2	1.3
.1	-1.9	-64.5	-23.2	1.3
1	-1.9	-64.5	-23.2	1.3
10	-1.9	-64.5	-23.2	1.3
100	-1.9	-64.5	-23.2	1.3
500	-1.9	-64.5	-23.2	1.3

For a dithered signal the ASR-9 interference protection criteria is exceeded with a UWB EIRP of -64.5 dBm or greater regardless of the PRF. The distance separation is 1.3 km to satisfy the ASR-9 interference protection criteria with the UWB EIRP equal to the reference level. A graph of the maximum permitted dithered UWB EIRP versus distance is shown in Figure 4-12 for a UWB height of 30 meters and a PRF of 500 MHz.

Figure 4-12 shows that when the ASR-9 and the UWB device are close in height, the antenna gain does not change significantly with distance and the propagation loss is the prime factor in determining the maximum permitted UWB EIRP and/or the separation distance.

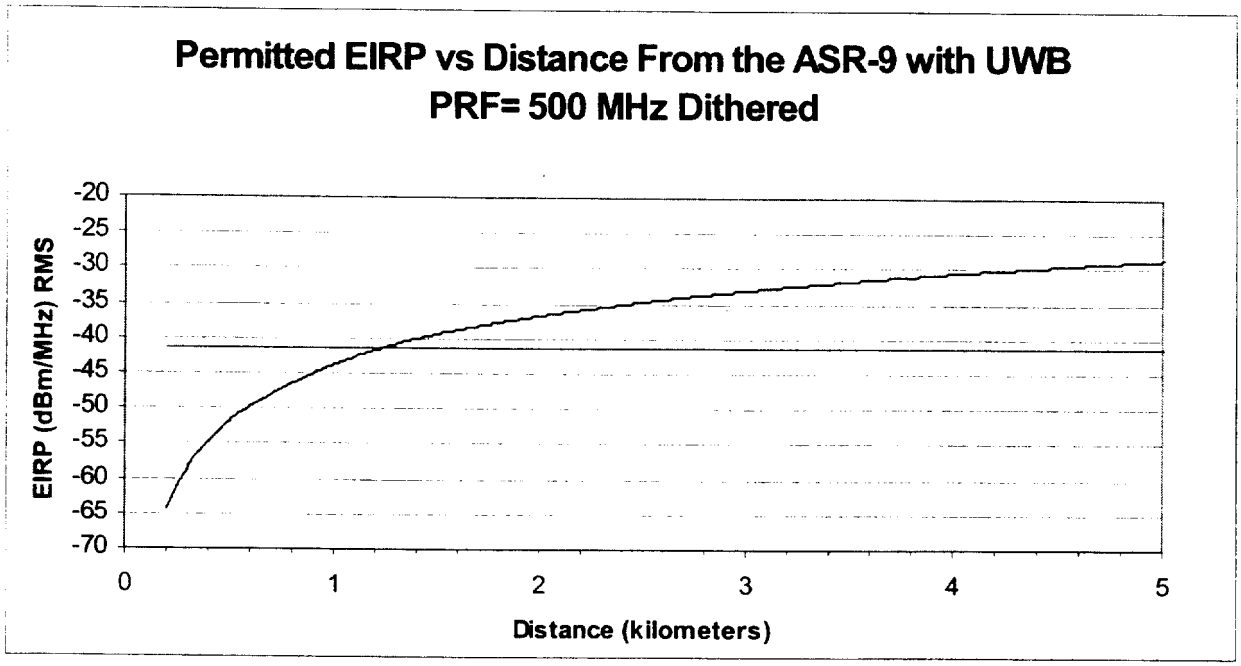

Figure 4-12. Maximum Permitted UWB EIRP for Dithered PRF (UWB Height = 30 m).

Discussion of Single Entry Results

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of ASR-9 radars and within the 2700-2900 MHz frequency band would exceed current interference protection requirements. UWB devices operating at that power level would add to the system noise, rendering the ASR-9 radar less capable of tracking and detecting aircraft.

Three factors significantly influence these results, namely, the radar antenna height, radar antenna tilt angle, and the height of the UWB device. When the radar antenna and the UWB device are operating in the same horizontal plane, the vertical elevation angle between them is zero degrees which results in a greater radar antenna gain. The analytical model takes into account the height of the radar, the height of the UWB device, and the radar tilt angle to compute the radar antenna gain, which is then used in the UWB interference calculations. For example, when the UWB height is 2 meters and the distance is 1 km, the off-axis + tilt angle is -2.9 degrees and the radar antenna gain is 23 dBi. However, for a UWB height of 30 meters and a distance of 1 km, the off-axis + tilt angle is -1.3 degrees and the radar antenna gain is 27 dBi.

A higher radar antenna gain raises the UWB interference power level in the radar receiver. For compatible operations, this requires a lower maximum permitted UWB EIRP and a longer separation distance to satisfy the receiver's protection criteria.

4.5 ALTIMETERS (4200-4400 MHz)

The results of the analyses using the equipment characteristics in Appendix A and the methodologies in Section 3 and RTCA Document DO-155 show that a UWB device operating at a power level of -41.3 dBm/1MHz RMS and within the 4200-4400 MHz frequency band will not exceed the interference protection criteria of the CW and pulsed altimeters considered in this report.

TABLE 4-16 shows the received desired signal power, S, for the minimum and maximum operational height of the CW and pulsed altimeters. Also included is the maximum permissible interference power, I, to satisfy the receiver's protection criteria and its relationship to the reference level of -41.3 dBm/1MHz RMS. For the CW altimeter at the minimum altitude of 30 meters, the received desired signal is -39.0 dBm and the maximum permissible interference power is -51.0 dBm to satisfy the receiver's protection criteria. This equates to a UWB EIRP level of 24.5 dBm, which is 65.8 dB above the reference level. At the maximum altitude of 762 meters, the received desired signal power is -67 dBm and the maximum permissible interference power is -79.0 dBm to satisfy the receivers protection criteria. This equates to a UWB EIRP of 25.2 dBm, which is 66.5 dB above the reference level. These levels are for a UWB height of 2 meters. The same description of the results also applies to the pulsed altimeter. These levels are for a dithered UWB signal.

TABLE 4-16
Altimeter Analyses Summary

System	Minimum Altitude CW Altimeter = 30 meters Pulsed Altimeter = 30 meters				Maximum Altitude CW Altimeter = 762 meters Pulsed Altimeter = 1524 meters			
	S (dBm)	I (dBm)	EIRP (dBm)	Delta Reference (dB)	S (dBm)	I (dBm)	EIRP (dBm)	Delta Reference (dB)
CW Altimeter	-39.0	-51.0	24.5	65.8	-67.0	-79.0	25.2	66.5
Pulsed Altimeter	-30.4	-36.3	14.3	55.6	-64.3	-70.4	14.9	56.2

The table shows that both systems provide sufficient desired signal power in the link budget to overcome the effects of a single UWB device when the UWB EIRP is equal to the reference level.

4.6 ATCRBS (1030 and 1090 MHz)

Analyses of potential interference from a single UWB device into an ATCRBS transponder and interrogator receiver was performed using the methodology described in Section 3, the ATCRBS characteristics given in Appendix A, and the analysis parameters shown in TABLEs 4-17and 4-18.

TABLE 4-17
UWB and ATCRBS Interrogator Analysis Parameters

Parameter	Value
Protection Criteria	S/I = 12 dB (average (RMS) interference power)
Desired Signal Power	-79 dBm
Maximum Interference	-91 dBm
Antenna Height	22 meters
UWB Device Height	2 meters, 30 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

TABLE 4-18
UWB and ATCRBS Transponder Analysis Parameters

Parameter	Value
Protection Criteria	S/I = 12 dB (average (RMS) interference power)
Desired Signal Power	-77 dBm
Maximum Interference	-89 dBm
Antenna Height	10 meters
UWB Device Height	2 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

Interrogator

The results for a non-dithered UWB signal analyses into an ATCRBS interrogator receiver are shown in TABLE 4-19 for a UWB height of 2 meters. These results show that the maximum permitted UWB EIRP is -30.5 dBm for PRFs at and below 1 MHz, which is 10.8 dB above the reference level. For PRFs above 1 MHz the maximum permitted UWB EIRP is -21.0, which is 20.3 dB above the reference level.

TABLE 4-19
Non-Dithered UWB Signal into ATCRBS Interrogator Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	9.5	-30.5	10.8	NA
.01	9.5	-30.5	10.8	NA
.1	9.5	-30.5	10.8	NA
1	9.5	-30.5	10.8	NA
10	0.0	-21.0	20.3	NA
100	0.0	-21.0	20.3	NA
500	0.0	-21.0	20.3	NA

The results for a dithered UWB signal analyses into an ATCRBS interrogator receiver are shown in TABLE 4-20. The maximum permitted UWB EIRP is -30.5 dBm regardless of the PRF, which is 10.8 dB above the reference level.

TABLE 4-20
Dithered UWB Signal into ATCRBS Interrogator Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	9.5	-30.5	10.8	NA
.01	9.5	-30.5	10.8	NA
.1	9.5	-30.5	10.8	NA
1	9.5	-30.5	10.8	NA
10	9.5	-30.5	10.8	NA
100	9.5	-30.5	10.8	NA
500	9.5	-30.5	10.8	NA

Analyses was also performed for a UWB height of 30 meters. The results for a non-dithered signal analyses are shown in TABLE 4-21. The results show that the maximum permitted UWB EIRP is -45.3 dBm for PRFs at and below 1 MHz, which is 4 dB below the reference level. For PRFs above 1 MHz the maximum permitted UWB EIRP is -35.7 dBm, which is 5.6 dB above the reference level. The required separation distances for PRFs at and below 1 MHz is 270 meters.

TABLE 4-21
Non-Dithered UWB Signal into ATCRBS Interrogator Receiver(UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	9.5	-45.3	-4.0	270
.01	9.5	-45.3	-4.0	270
.1	9.5	-45.3	-4.0	270
1	9.5	-45.3	-4.0	270
10	0.0	-35.7	5.6	NA
100	0.0	-35.7	5.6	NA
500	0.0	-35.7	5.6	NA

TABLE 4-22 shows that for a dithered signal, the maximum permitted UWB EIRP is -45.3 dBm regardless of the PRF, which is 4 dB below the reference level. The separation distance for a UWB device with an EIRP equal to the reference level and an ATCRBS interrogator receiver is 270 meters.

TABLE 4-22
Dithered UWB Signal into ATCRBS Interrogator Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	9.5	-45.3	-4.0	270
.01	9.5	-45.3	-4.0	270
.1	9.5	-45.3	-4.0	270
1	9.5	-45.3	-4.0	270
10	9.5	-45.3	-4.0	270
100	9.5	-45.3	-4.0	270
500	9.5	-45.3	-4.0	270

Discussion of Single Entry Results for ATCRBS Interrogator

These results indicate that operation of a UWB device at power a power level of -41.3 dBm/MHz RMS in the vicinity of a ATCRBS interrogator and on the frequency of 1090 MHz would exceed current ATCRBS interrogator interference protection requirements if the UWB device were operating in the same horizontal plane as the ATCRBS antenna and closer than 270 meters.

Transponder

The results for a non-dithered UWB signal analyses into an ATCRBS transponder receiver are shown in TABLE 4-23 for a UWB height of 2 meters. These results show that the maximum permitted UWB EIRP is -44.4 for PRFs at and below 1 MHz, which is 3.1 dB below the reference level. For PRFs at and above 10 MHz, the maximum permitted UWB EIRP is -37.0, which is 4.3 dB above the reference level. The horizontal separation distance for PRFs at and below 1 MHz is 20 meters.

TABLE 4-23
Non-Dithered UWB Signal into ATCRBS Transponder (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	7.4	-44.4	-3.1	.02
.01	7.4	-44.4	-3.1	.02
.1	7.4	-44.4	-3.1	.02
1	7.4	-44.4	-3.1	.02
10	0.0	-37.0	4.3	NA
100	0	-37.0	4.3	NA
500	0	-37.0	4.3	NA

The results for a dithered UWB signal analyses into an ATCRBS transponder receiver are shown in TABLE 4-24. The maximum permitted UWB EIRP is -44.4 dBm regardless of the PRF, which is 3.1 dB below the reference level.

TABLE 4-24
Dithered UWB Interference into ATCRBS Transponder (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	7.4	-44.4	-3.1	.02
.01	7.4	-44.4	-3.1	.02
.1	7.4	-44.4	-3.1	.02
1	7.4	-44.4	-3.1	.02
10	7.4	-44.4	-3.1	.02
100	7.4	-44.4	-3.1	.02
500	7.4	-44.4	-3.1	.02

Discussion of Single Entry Results for ATCRBS Transponder

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of an ATCRBS transponder and on the frequency of 1030 MHz would require 20 meters of horizontal separation distance to satisfy the ATCRBS transponder interference protection requirements.

4.7 DME (960-1200 MHz)

Analyses of potential interference from a single UWB device into a DME transponder and interrogator receiver was performed using the methodology described in Section 3, the DME characteristics given in Appendix A, and the analysis parameters shown in TABLEs 4-25 and 4-26.

TABLE 4-25
UWB and DME Interrogator Analysis Parameters

Parameter	Value
Protection Criteria	I/N=-7 dB (average (RMS) interference power)
Receiver Noise Power	-108 dBm
Maximum Interference	-115 dBm
Minimum Aircraft Height	30 meters
UWB Device Height	2 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

TABLE 4-26
UWB and DME Transponder Analysis Parameters

Parameter	Value
Protection Criteria	I/N = -16dB (average (RMS) interference power)
Receiver Noise Power	-106 dBm
Maximum Interference	-122 dBm
Antenna Height	10 meters
UWB Device Height	2 meters, 30 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

Interrogator

The results for a non-dithered UWB signal analyses into a DME interrogator receiver are shown in TABLE 4-27 for a UWB height of 2 meters. These results show that the maximum permitted UWB EIRP for PRFs at and below 0.1 MHz is -45.5 dBm, which is 4.2 dB below the reference level. For PRFs above 0.1 MHz the maximum permitted UWB EIRP is -47.3 dBm, which is 6.0 dB below the reference level. For a UWB device with an EIRP equal to the reference level, the horizontal separation distance is 80 meters for PRFs at and below 0.1 MHz and 90 meters for PRFs above 0.1 MHz.

TABLE 4-27
Non-Dithered UWB Signal into DME Interrogator (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.9	-45.5	-4.2	.08
.01	-1.9	-45.5	-4.2	.08
.1	-1.9	-45.5	-4.2	.08
1	0	-47.3	-6.0	.09
10	0	-47.3	-6.0	.09
100	0	-47.3	-6.0	.09
500	0	-47.3	-6.0	.09

The results for a dithered UWB signal into a DME interrogator receiver fora UWB height of 2 meters are shown in TABLE 4-28. The maximum permitted UWB EIRP is -45.5 dBm regardless of the PRF, which is 4.2 dB below the reference level.

TABLE 4-28
Dithered UWB Signal into DME Interrogator Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.9	-45.5	-4.2	.08
.01	-1.9	-45.5	-4.2	.08
.1	-1.9	-45.5	-4.2	.08
1	-1.9	-45.5	-4.2	.08
10	-1.9	-45.5	-4.2	.08
100	-1.9	-45.5	-4.2	.08
500	-1.9	-45.5	-4.2	.08

Analyses were not performed for a UWB height of 30 meters due to the geometry of the interference scenario.

Discussion of Single Entry Results for DME Interrogator

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of a DME interrogator and within the 960-1215 MHz frequency band would need 80 to 90 meters of horizontal separation distance to satisfy the current DME interrogator interference protection requirements.

Transponder

The results for a non-dithered UWB signal analyses into a DME transponder receiver are shown in TABLE 4-29 for a UWB height of 2 meters. These results show that the maximum permitted UWB EIRP is -63.2 dBm for PRFs at and below 0.1 MHz, which is 21.9 dB below the reference level. For PRFs above 0.1 MHz the maximum permitted UWB EIRP is -64.2 dBm, which is 22.9 dB below the reference level. The separation distances for a DME transponder and a UWB device with a EIRP equal to the reference level range from 0.26 km for PRFs at and below 0.1 MHz to 0.29 km for PRFs above 0.1 MHz.

TABLE 4-29
Non-Dithered UWB Signal into DME Transponder Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.0	-63.2	-21.9	.26
.01	-1.0	-63.2	-21.9	.26
.1	-1.0	-63.2	-21.9	.26
1	0.0	-64.2	-22.9	.29
10	0.0	-64.2	-22.9	.29
100	0.0	-64.2	-22.9	.29
500	0.0	-64.2	-22.9	.29

The results for a dithered UWB signal analyses into a DME transponder receiver are shown in TABLE 4-30 for a UWB height of 2 meters. The maximum permitted UWB EIRP is -63.2 dBm regardless of the PRF, which is 21.9 dB below the reference level. The separation distance is 0.26 km to satisfy the protection criteria with the UWB EIRP equal to the reference level.

TABLE 4-30
Dithered UWB Signal into DME Transponder Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.0	-63.2	-21.9	.26
.01	-1.0	-63.2	-21.9	.26
.1	-1.0	-63.2	-21.9	.26
1	-1.0	-63.2	-21.9	.26
10	-1.0	-63.2	-21.9	.26
100	-1.0	-632	-21.9	.26
500	-1.0	-63.2	-21.9	.26

Analyses was also performed for a UWB height of 30 meters and are shown in TABLE 4-31. These results show that the maximum permitted UWB EIRP is -56.3 dBm for PRFs at and below 0.1 MHz, which is 15.0 dB below the reference level. For PRFs above 0.1 MHz the maximum permitted UWB EIRP is -57.3 dBm, which is 16.0 dB below the reference level. The separation distances for a UWB device with a EIRP equal to the reference level range from 0.26 km for PRFs at and below 0.1 MHz to 0.29 km for PRFs above 0.1 MHz.

TABLE 4-31
Non-Dithered UWB Signal into DME Transponder Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS)
.001	-1.0	-56.3	-15.0	.26
.01	-1.0	-56.3	-15.0	.26
.1	-1.0	-56.3	-15.0	.26
1	0.0	-57.3	-16.0	.29
10	0.0	-57.3	-16.0	.29
100	0.0	-57.3	-16.0	.29
500	0.0	-57.3	-16.0	.29

The results for a dithered UWB signal analyses into a DME transponder receiver are shown in TABLE 4-32 for a UWB height of 30 meters. The maximum permitted UWB EIRP is -56.3 dBm regardless of the PRF, which is 15.0 dB below the reference level. The separation distance is 0.26 km to satisfy the protection criteria with the UWB EIRP equal to the reference level.

TABLE 4-32
Dithered UWB Signal into DME Transponder Receiver (UWB Height = 30 m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-1.0	-56.3	-15.0	.26
.01	-1.0	-56.3	-15.0	.26
.1	-1.0	-56.3	-15.0	.26
1	-1.0	-56.3	-15.0	.26
10	-1.0	-56.3	-15.0	.26
100	-1.0	-56.3	-15.0	.26
500	-1.0	-56.3	-15.0	.26

Discussion of Single Entry Results for DME Transponder

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of a DME transponder and within the 960-1215 MHz frequency band would need 0.26 to 0.29 km of separation distance to satisfy the current DME transponder interference protection requirements.

4.8 MLS (5000-5250 MHz)

Analyses of potential interference from a single UWB device into a MLS receiver was performed using the methodology described in Section 3, the MLS characteristics given in Appendix A, and the analysis parameters shown in TABLE 4-33. The MLS receiver height represents an aircraft Category II landing decision height, including terrain.

TABLE 4-33
UWB and MLS Analysis Parameters

Parameter	Value
Permissible Interference	I=-134 dBm (average (RMS) interference power)
Minimum Aircraft Height	30 meters
UWB Device Height	2 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

The results for a non-dithered UWB signal analyses are shown in TABLE 4-34 for a UWB height of 2 meters. These results show that for PRFs at and below 0.1 MHz the maximum permitted UWB EIRP -45.4 dBm, which is 4.1 dB below the reference level. For PRFs at and above 1 MHz the maximum EIRP is -56.3 dB, which is 12.3 dB below the reference level. For a UWB device with an EIRP equal to the reference level this requires a horizontal separation distance of 70 meters to satisfy the MLS receiver protection criteria for PRFs at and below 0.1 MHz and 160 meters for PRFs above 0.1 MHz.

TABLE 4-34
Non-Dithered UWB Signal into MLS Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-8.2	-45.4	-4.1	0.07
.01	-8.2	-45.4	-4.1	0.07
.1	-8.2	-45.4	-4.1	0.07
1	0	-56.3	-12.3	0.16
10	0	-56.3	-12.3	0.16
100	0	-56.3	-12.3	0.16
500	0	-56.3	-12.3	0.16

The results for a dithered UWB signal are shown in TABLE 4-35. These results show that the maximum permitted UWB EIRP is -45.4 dBm regardless of the PRF, which is 4.1 dB below the reference level. The horizontal separation distance is 70 meters.

TABLE 4-35
Dithered UWB Signal into MLS Receiver (UWB Height = 2m)

PRF (MHz)	BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP Equals -41.3 dBm/MHz RMS
.001	-8.2	-45.4	-4.1	0.07
.01	-8.2	-45.4	-4.1	0.07
.1	-8.2	-45.4	-4.1	0.07
1	-8.2	-45.4	-4.1	0.07
10	-8.2	-45.4	-4.1	0.07
100	-8.2	-45.4	-4.1	0.07
500	-8.2	-45.4	-4.1	0.07

Analyses was not performed for a UWB height of 30 meters due to the geometry of the scenario. Figure 4-13 shows the maximum permitted UWB EIRP for a height of 2 meters.

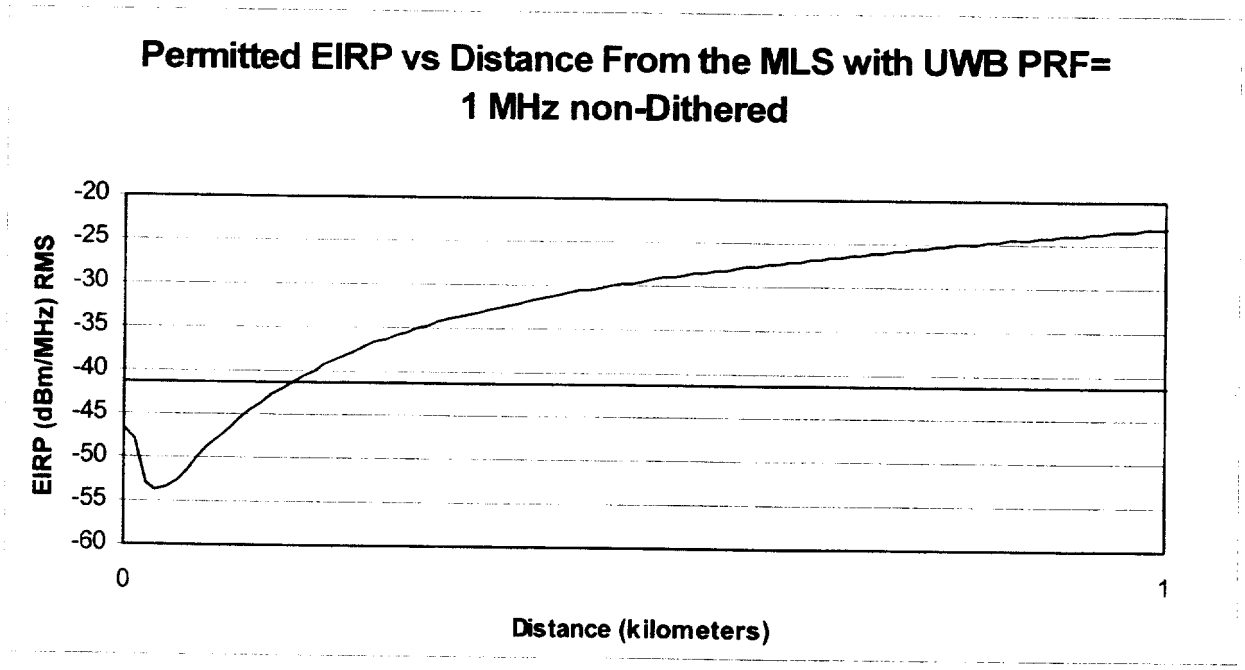

Figure 4-13. Maximum Permissible UWB EIRP for non-Dithered 1 MHz PRF (UWB Height = 2 m).

Discussion of Single Entry Results

These results indicate that operation of a UWB device at a power level of -41.3 dBm/MHz RMS in the vicinity of MLS receivers and within the 5030-5091 MHz

frequency band would require about 70 to 160 meters of horizontal separation distance (measured from centerline of aircraft at 30 meter altitude) to satisfy the MLS receiver protection criteria.

4.9 SARSAT LUT (1544-1545 MHz)

The SARSAT LUT analyses consists of two subsections delineating protection criteria with an average (RMS) interference power and peak interference, respectively.

4.9.a SARSAT LUT (1544-1545 MHz)

Analyses of potential interference from a single UWB device into a SARSAT LUT receiver was performed using the methodology described in Section 3, the SARSAT LUT characteristics given in Appendix A, and the analysis parameters shown in TABLE 4-36a. The SARSAT LUT antenna height in TABLE 4-36a is a typical value.

TABLE 4-36a
UWB and SARSAT LUT Analysis Parameters

Parameter	Value
Protection Criteria	I/N = -9 dB (average (RMS) interference power)
Antenna Height	12 meters
Antenna Vertical Tilt Angle	0 degrees
UWB Device Height	2 meters, 30 meters
Measurement Bandwidth	1 MHz
Reference Power Level	-41.3 dBm/MHz average (RMS), EIRP

The results for a non-dithered UWB signal analyses are shown in TABLE 4-37a for a UWB height of 2 meters. These results show that for PRFs at and below 0.1 MHz the maximum permitted UWB EIRP is -68.4 dBm/MHz, which is 27.1 dB below the reference level. For PRFs at and above 1 MHz the level is -69.4 dBm/MHz, which is 28.1 dB below the reference level. The separation distance for a UWB device with an EIRP equal to the reference level and a SARSAT LUT is 2.9 km for UWB PRFs at and below 0.1 MHz and 3.1 km for PRFs at and above 1 MHz. A graph of the maximum permitted UWB EIRP versus distance is shown in Figure 4-13a for a non-dithered PRF of 1 MHz and a UWB height of 2 meters.

TABLE 4-37a
Non-Dithered UWB Signal into SARSAT LUT Receiver (UWB Height = 2m)

PRF (MHz)	Average BWCF (dB)	Maximum Permitted UWB EIRP (dBm/MHz) RMS	Delta Reference Level (dB)	Distance (km) Where Permitted UWB EIRP equals -41.3 dBm/MHz RMS
.001	-1.0	-68.4	-27.1	2.9
.01	-1.0	-68.4	-27.1	2.9
.1	-1.0	-68.4	-27.1	2.9
1	0.0	-69.4	-28.1	3.1
10	0.0	-69.4	-28.1	3.1
100	0.0	-69.4	-28.1	3.1
500	0.0	-69.4	-28.1	3.1

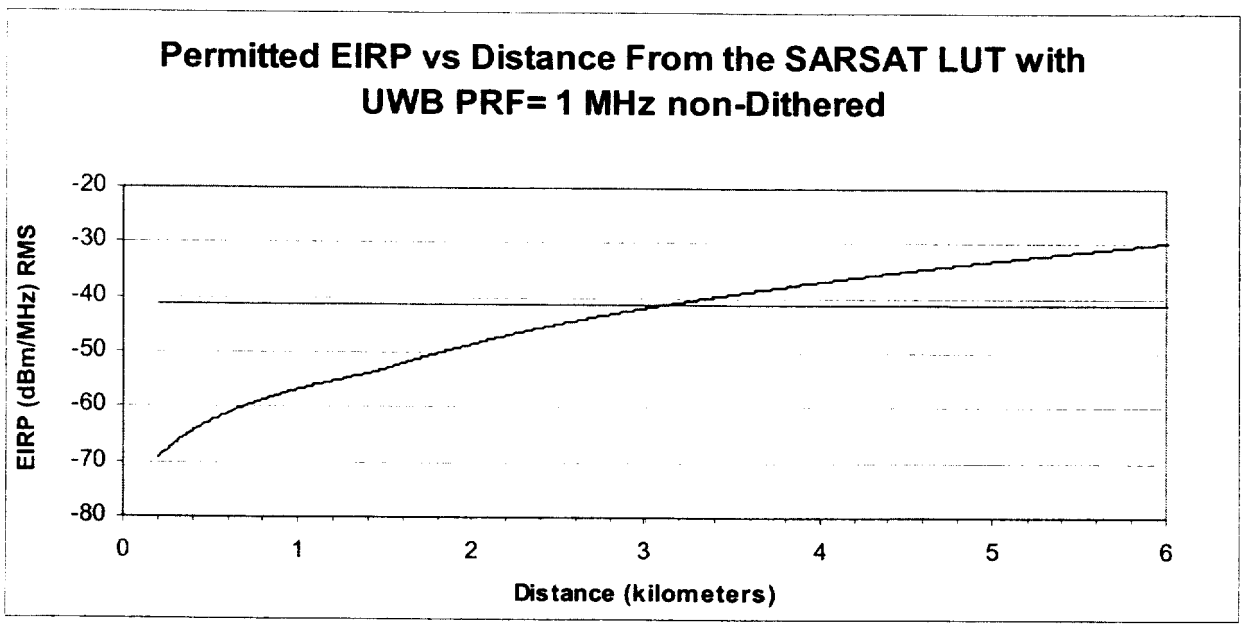

Figure 4-13a. Maximum Permitted UWB EIRP for non-Dithered PRF of 1 MHz (UWB Height = 2m).

The results for a dithered UWB signal analyses are shown in TABLE 4-38a for a UWB height of 2 meters. These results show that the maximum permitted UWB EIRP is -68.4 dBm regardless of the PRF, which is 27.1 dB below the reference level. The separation distance for a dithered UWB device with an EIRP equal to the reference level and a SARSAT LUT is 2.9 km regardless of the UWB PRF. A graph of the maximum permitted UWB EIRP versus distance is shown in Figure 4-14a for a dithered PRF of 1 MHz and a UWB height of 2 meters.