

**Before The  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

_____ )	
In The Matter Of )	
Revision of Part 15 of the Commission's )	ET Docket No. 98-153
Rules Regarding Ultra-Wideband )	
Transmission Systems )	
_____ )	

To: The Commission

**QUALCOMM INCORPORATED' S PETITION FOR RECONSIDERATION**

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**PETITION FOR RECONSIDERATION**

QUALCOMM Incorporated (“QUALCOMM”), by its attorneys and pursuant to Section 405 of the Communications Act, 47 U.S.C. Sec. 405, and Section 1.429 of the Commission’s Rules, 47 C.F.R. §1.429, hereby petitions for reconsideration of the Commission’s First Report And Order (“First R & O”), FCC 02-48, released April 22, 2002 in this proceeding, which sets the technical parameters for the operation of ultra wideband (“UWB”) devices.

**I. Summary**

For the reasons set forth herein and for additional reasons set forth in a petition for reconsideration being filed by Sprint Corporation (“Sprint”) in which QUALCOMM joins, QUALCOMM urges the Commission to reconsider the First R & O and to revise the emissions mask adopted therein to provide additional protections for the PCS band to ensure that there is no harmful interference from UWB devices to PCS phones, particularly PCS phones which contain assisted GPS technology for E911 service. QUALCOMM supports the development of innovative technologies such as UWB. However, the First R&O does not establish the necessary safeguards to ensure that UWB devices will not cause harmful interference with existing wireless services, particularly E911, which is a safety of life service.

At this time, a number of the nation’s largest carriers, such as Sprint PCS, Verizon Wireless, ALLTEL, and others, are in the middle of deploying assisted GPS technology to

comply with the Commission's E911 mandate. Nevertheless, the Commission adopted the emissions mask in the First R&O without any test data to verify that UWB devices operating at these emission limits will not interfere with the communications link in the PCS band which is so critical for wireless phones using assisted GPS. As a matter of law, QUALCOMM and the wireless carriers did not have the burden to show that UWB devices will interfere with E911 service, and on that basis alone, the Commission should reconsider the First R&O, which impermissibly placed the burden on QUALCOMM to show the absence of interference from UWB devices. Despite the clear evidence showing that UWB devices interfere harmfully with both PCS and E911, UWB devices were not available for industry testing. This testing is crucial to ensure that the 1 million customers who currently use GPS-equipped wireless phones may have confidence that when they call 911 from their wireless phones, police and emergency personnel will be able to locate them accurately and precisely.

Even so, QUALCOMM's test data did show that UWB devices will cause harmful interference in the PCS band to wireless phones, including those with assisted GPS technology, and this harmful interference will cause blocked calls, dropped calls, and less reliable PCS and E911 service. Rather than requiring the proponents of UWB to present test data proving that this harm to the public will not occur, both the First R&O and the separate and more detailed discussion of QUALCOMM's submissions referred to in the First R&O<sup>1</sup> misinterpret QUALCOMM's data and analysis on the basis of three fundamental errors.

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<sup>1</sup> The First R&O states that a "more detailed discussion of the Qualcomm analysis has been placed in the docket file for this proceeding." First R&O at para. 160. That separate document contains a FCC Staff Analysis of QUALCOMM's test data and mathematical analysis concerning the harmful interference to PCS systems from UWB devices. ET Docket No. 98-153, First Report and Order, Potential Interference to PCS from UWB Transmitters Based on Analyses from Qualcomm Incorporated, February 14, 2002 ("FCC Staff Analysis") at Pgs. 4-7. However, many of the conclusions in the FCC Staff's analysis are repeated in the First R&O, including the findings that a received signal level of -96 dBm is the minimum PCS signal level in deciding the extent of protection for PCS systems from out-of-band emissions from UWB devices (FCC Staff Analysis at Pg. 6; First R&O at para. 162) and that the notion that any emission 6 dB below the thermal noise floor of a PCS receiver will cause harmful interference is flawed because it is not based on the signal-to-noise ratio using the signal levels actually employed by a PCS system (FCC Staff Analysis at Pg. 4; First R&O at para. 161).

First, the First R&O and the FCC Staff Analysis disputed the fact that PCS handsets can work near the  $-100$  dBm signal level, and this was the Commission's ground for its conclusion that its rules for UWB devices did not have to protect PCS handsets working at such signal levels from the interference from UWB devices found in QUALCOMM's tests. First R&O at para. 162; FCC Staff Analysis at Pg. 6. However, in this petition, QUALCOMM is presenting actual data from a call with a PCS handset which verifies that PCS handsets can and do operate with received signals weaker than  $-100$  dBm. Indeed, QUALCOMM's data verifies that PCS handsets can and do operate at levels lower than  $-105$  dBm. The data even shows that, in some instances, a PCS phone can operate with a received signal of  $-106$  dBm.

Thus, QUALCOMM's data establishes that the Commission was wrong to assume that a PCS received signal level of  $-96$  dBm "adequately characterizes a low level PCS signal based on real world applications." First R&O at para. 162. Accordingly, the Commission should reconsider the First R&O to provide additional protection to the PCS band from UWB emissions because the First R&O was based on the erroneous assumption that the Commission did not have to protect PCS handsets at received signal levels weaker than  $-100$  dBm.

Second, the First R&O and the FCC Staff Analysis criticized QUALCOMM's analysis of the harmful interference from a UWB device to a PCS system which showed that UWB emissions of greater than 6 dB below the thermal noise floor of a PCS receiver will cause harmful interference because, according to the First R&O and the FCC Staff Analysis, QUALCOMM's analysis was not based on a signal-to-noise ratio using the signal levels actually employed by the communications system. First R&O at para 161; FCC Staff Analysis at Pg. 4. This criticism was the Commission's basis for disregarding QUALCOMM's analysis of interference in setting the out-of-band emissions levels for UWB devices into the PCS band. Id. In this petition, QUALCOMM submits an analysis of the interference to a PCS phone from a UWB device using the emissions mask set in the First R&O for indoor UWB systems. This analysis shows that the PCS phone will suffer 5.58 dB degradation in its signal-to-noise ratio at a 3 meter separation distance and a 13.9 dB degradation at a 1 meter separation distance. This

degradation is substantial and certainly meets the Commission's definition of harmful interference in that it will seriously degrade, obstruct, or interrupt the performance of the PCS system.

Third, while the Commission concluded from its analysis of QUALCOMM's test data that "it could be advantageous to provide additional protection to PCS operation in the 1850-1990 MHz band due to its potential use in E-911 applications," the Commission concluded that "12 dB of attenuation below the Part 15 general emission limits appears more than sufficient to provide this protection, as described in our discussion of the Qualcomm analyses." *Id.* at para. 192. The notion that 12 dB of attenuation is more than sufficient to protect PCS systems for E911 service against interference from UWB devices operating indoors has no basis in any of QUALCOMM's test data. In fact, the signal-to-noise plus interference analysis submitted in this Petition, which is calculated based on the limits for a UWB device operating indoors, shows that 12 dB of attenuation below the Part 15 limits is not nearly enough to protect a wireless phone operating in the PCS band from suffering substantial degradation in service due to harmful interference from a UWB device.

As QUALCOMM has maintained throughout this proceeding, in order for E911 service to be reliable, robust, and highly accurate, the Commission must protect both the GPS band and the communications link. Nothing in the record of this proceeding demonstrates that E911 service will be sufficiently protected indoors if UWB devices can operate only 12 dB below the Part 15 limit. The Commission's rules should provide additional protection for the PCS band. The information available to QUALCOMM shows that the PCS band requires the same 34 dB of attenuation below the Part 15 limit as the Commission provided for the GPS band.

The information available to QUALCOMM concerning the harmful interference is limited because, as QUALCOMM has explained repeatedly in this proceeding, the major proponents of UWB have refused to make devices available for testing. Consequently, QUALCOMM asks once again that there be a set of transparent, collaborative tests of actual UWB devices with the complete participation and input of interested parties from the public and

private sector to determine the full extent of the harmful interference from UWB devices to all existing communications services. Absent such tests, the public can have no assurance that safety of life services, including E911, will receive sufficient protection.

## **II. The First R&O Is Legally Flawed**

The First R&O is fundamentally flawed as a matter of law because in evaluating QUALCOMM's test data, the Commission put the burden on QUALCOMM to prove that there will be interference from UWB devices, rather than demanding proof that UWB operations at given limits will not cause interference to PCS service. There is no proof that the limits in the First R&O for out-of-band emissions into the PCS band will not cause interference to the PCS band, and instead, those limits are based on mere conjecture.

As a matter of law, the burden was on the UWB proponents to "demonstrate conclusively" that UWB operations at the limits set in the First R&O would have "no potential for interference" and would function "without the hazard of interference." Non-Geostationary Satellite Orbit Fixed-Satellite Service, 14 FCC Rcd 1131, 1180 (1998); New Channels Communications, 57 R.R. 2d 1600 (1985); Cosmopolitan Enterprises, 15 F.C.C. 2d 659, 674 (1967). The First R&O failed to apply these precedents or to explain why the Commission chose to depart from them, in violation of a cardinal precept of administrative law that an agency must always follow its precedent or explain why it is departing from such precedent. Gilbert v. NLRB, 56 F.3d 1438, 1445 (D.C. Cir. 1995); Greater Boston Television Corp. v. FCC, 444 F.2d 841, 852 (D.C. Cir. 1970). The Commission should reconsider the First R&O, follow these precedents, and provide greater protection for the PCS band because, in particular, there has been no demonstration that UWB will not cause harmful interference with only 12 dB of additional attenuation for indoor UWB operations.

**III. The First R&O Misinterpreted QUALCOMM's Interference Analysis By Finding Erroneously That PCS Handsets Cannot Work Near The -100 dBm Level**

At paragraph 162 of the First R&O,<sup>2</sup> the Commission disputed the fact the PCS handsets can work near the -100 dBm signal level. Figure 1 on the next page represents recent data from a test conducted in San Diego. The mobile phone was in the conversation state for 5 minutes. The chart depicts the received power, transmit power and frame error rate as logged by the handset and analyzed by data analysis tool developed by QUALCOMM. The average frame error rate during the call is 1.28%. As can be seen from the chart, the received signal is weaker than -100 dBm most of the time during the call. Time instants where frame error rates exceed 2% correspond to durations when the received power went below -105 dBm. This indeed proves that a handset can sustain a call at the edge of coverage.

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<sup>2</sup> The same finding is made at Page 6 of the FCC Staff Analysis. ET Docket No. 98-153, First Report and Order Potential Interference to PCS from UWB Transmitters Based on Analyses from Qualcomm Incorporated at Pg. 6

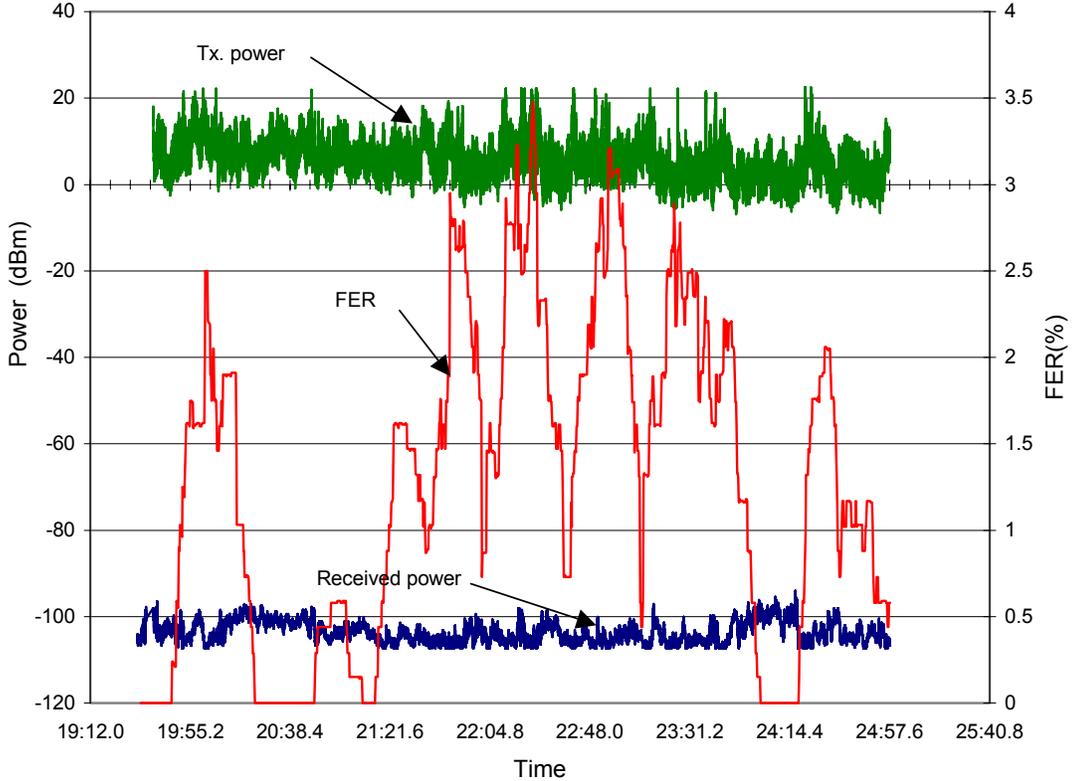


Figure 1 Handset received power, transmit power and frame error rate at weak coverage location

Thus, the conclusion at paragraph 162 in the First R&O that “-96 dBm/1.25 MHz adequately characterizes a low level PCS signal level based on real world applications” is erroneous, and this error completely undermines the Commission’s analysis of QUALCOMM’s testing of the interference to PCS phones from UWB devices in the First R&O. The data above shows that a PCS phone can operate at received power levels lower than -105 dBm; Figure 1 shows received power in some instances of -106 dBm.<sup>3</sup>

<sup>3</sup> Thus, the data in Figure 1 show that the FCC Staff Analysis was wrong to find that it was unreasonable for Sprint PCS to make the statement that PCS systems operate at the -105 dBm thermal noise floor. See FCC Staff Analysis at Pg. 6.

The erroneous conclusion in paragraph 162 of the First R&O caused the Commission to disregard QUALCOMM's test data and to conclude, without any supporting test data, that 12 dB of attenuation below the Part 15 limits is enough to protect PCS. The Commission should reconsider the First R&O now that this error is apparent and provide more protection for the PCS band.

**IV. The First R&O Misinterpreted QUALCOMM's Interference Analysis By Insisting That the Signal Levels Were Not Realistic; PCS Systems Will Suffer Harmful Interference Assuming the Signal Levels for UWB Devices Set in the First R&O**

At paragraph 161 of the First R&O, the Commission disregarded QUALCOMM's analysis of the harmful interference from a UWB device to a PCS system on the basis that an interference analysis for a communications system needs to be based on a signal to noise ratio using the signal levels actually employed by the system.<sup>4</sup> In order to eliminate any source of confusion, QUALCOMM has performed an analysis using the mask defined for indoor UWB systems. Figure 2 on the next page depicts the variation of signal-to-noise plus interference as a function of the separation distance between the PCS phone and the UWB device. It is assumed that the UWB device complies with the First R&O's emission limits.

As can be seen from the figure, the C/(N+I) is -8.9 dB at one meter separation and -0.58 dB at 3 meters. These results correspond to 13.9 dB and 5.58 dB degradation in signal-to-noise ratio, respectively. QUALCOMM strongly believes that the one meter separation distance is realistic, and there will exist a whole variety of real life scenarios where the PCS phone will be at a one meter distance from several UWB devices. A degradation in signal-to-noise ratio of 13.9 dB will have major impact of the performance of the PCS network and hence is not

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<sup>4</sup> The same criticism is made in the FCC Staff Analysis at page 4. ET Docket No. 98-153, First Report and Order Potential Interference to PCS from UWB Transmitters Based on Analyses from Qualcomm Incorporated, page 4.

acceptable. In addition, since these PCS phones have to comply with the FCC E911 mandate, there is a substantial concern that such degradation may affect the performance of the safety of life system.

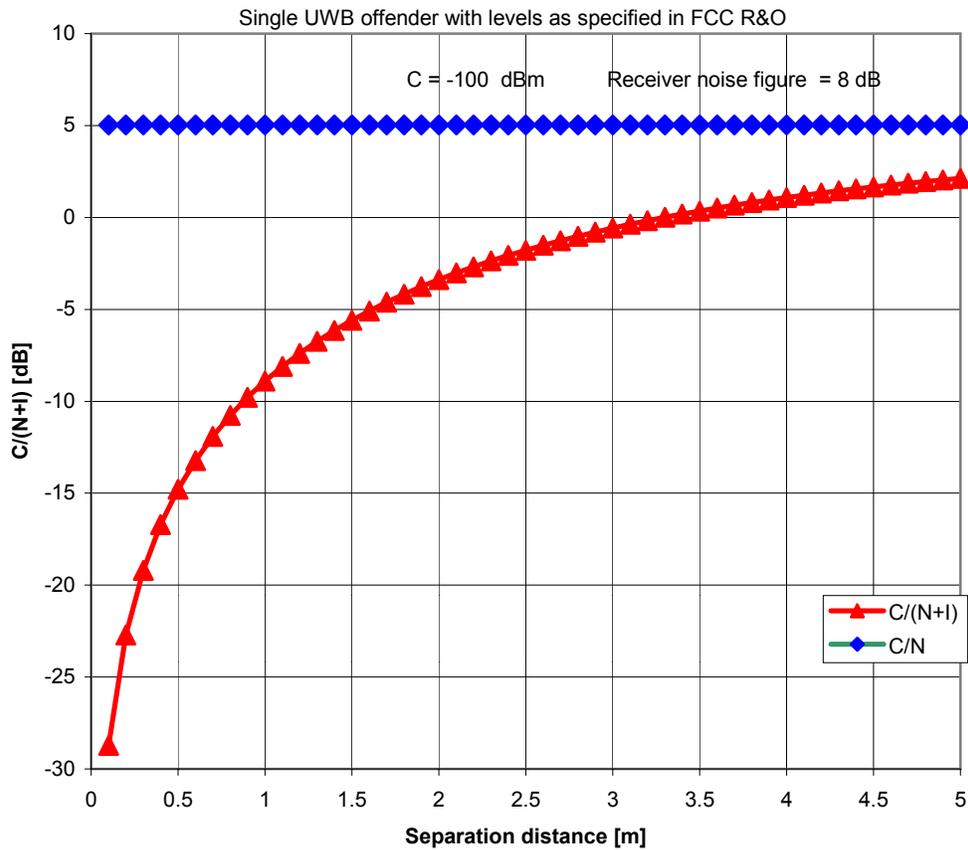


Figure 2 C/(N+I) as a function of separation distance between PCS phone and UWB device

The FCC Staff, in their analysis<sup>5</sup> assumed that the PCS received signal level is  $-85$  dBm and the interference from a single UWB device is not to exceed the thermal noise floor by greater than 10 dB. Figure 2 demonstrates that allowing a single UWB device to exceed the thermal noise floor by up to 10 dB (which corresponds to 1.5 meters of separation between the UWB device and a wireless phone), consistent with the First R&O, will result in intolerable

degradation in the signal-to-noise plus interference and will permit UWB devices to cause harmful interference within the meaning of the Commission's rules to PCS phones.

In fact, the FCC Staff Analysis is contradictory in seeking to justify the conclusion that 12 dB of attenuation below the Part 15 limits will provide sufficient protection for the PCS band. The Staff prepared one interference link budget with a PCS received signal level of -85 dBm to rebut QUALCOMM's mathematical analysis and another one with a PCS received signal level of -96 dBm to rebut QUALCOMM's test results. FCC Staff Analysis at Pgs. 5, 6. Neither budget is realistic or indicative of the received power levels at which PCS phones can and do operate.

QUALCOMM's test report<sup>6</sup> has demonstrated that the UWB power cannot exceed 10 dB below the CDMA received power in order not to degrade the frame error rate of the PCS system. (The frame error rate is the accepted measurement of the call quality of a PCS system. Degradation in the frame error rate consists of dropped calls, blocked calls, and the like.) Based on the above minimum PCS signal level and receiver parameters suggested by QUALCOMM and agreed upon by the FCC Staff, the minimum separation distance can be calculated as follows:

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<sup>5</sup> FCC Staff Analysis at Page 5.

Interference link budget for a single UWB transmitter			
Parameter	Value	Units	Equation
Frequency	1900	MHz	F
Received signal level	-100	dBm	R
Allowed IX level	-110	dBm	IX
UWB EIRP	-52.28	dBm	$P = -41.25 + 10 \log(1.25) - 12$
UWB antenna gain	0	dBi	GT
Victim rcve. antenna gain	-4.6	dBi	GR
Victim rcvr. line loss	2	dB	LR
Path loss required	51.12	dB	$L = P + GT + GR - LR - IX$
Minimum separation	4.52	m	$20 \log(d) = L - 20 \log(F) + 27.56$

The Commission should reconsider the First R&O and adjust the emission limits to provide greater protection for the PCS band from harmful interference, consistent with the data presented above.

**V. The Commission Should Reconsider the First R&O to Provide Additional Protection For the PCS Band Given Its Concern About E911 Service**

Finally, the First R&O voices a concern over E911, but does not take sufficient action to give the necessary protection in the PCS band to ensure that carriers can provide fully reliable E911 service at all times and under all circumstances, when Americans will need it. Although the Commission concluded from its analysis of QUALCOMM’s test data that “it could be advantageous to provide additional protection to PCS operation in the 1850-1990 MHz band due to its potential use in E-911 applications,” the Commission went on to conclude that “12 dB of attenuation below the Part 15 general emission limits appears more than sufficient to provide this protection, as described in our discussion of the Qualcomm analyses.” *Id.* at para. 192. The foregoing sections of this Petition have demonstrated that the conclusion that 12 dB of attenuation is sufficient is based entirely on misinterpretations of QUALCOMM’s analyzes. The notion that 12 dB of attenuation is more than sufficient to protect PCS systems for E911 service against interference from UWB devices operating indoors has no basis in any of QUALCOMM’s

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<sup>6</sup> QUALCOMM comments 5/10/01.

analyzes. And, there is no test in the record of this proceeding from any source to justify the conclusion that 12 dB of attenuation in the PCS band is sufficient to protect E911 service.

It bears repeating that in order for E911 service to be reliable, robust, and highly accurate, the Commission must protect both the GPS band and the communications link in the PCS band. The First R&O does not provide sufficient protection in the PCS band, a result which is contrary to the Commission's E911 policy. QUALCOMM asks the Commission to provide additional protection in the PCS band against harmful interference in the PCS band so that the PCS band would have the same 34 dB of attenuation given to the GPS band in the First R&O, consistent with the proper interpretation of QUALCOMM's testing.

QUALCOMM continues to believe that additional testing should be conducted to determine the full extent of the harmful interference from UWB devices to wireless phones. To date, the major proponents of UWB have refused to make their devices available to QUALCOMM for such testing. In light of the Commission's issuance of the First R&O, the public and all parties to this proceeding have a strong interest in a conclusive resolution of the interference issues in this proceeding. To that end, QUALCOMM asks that the Commission provide for a transparent, collaborative tests of actual UWB devices with the complete participation and input of interested parties from the public and private sector to determine the full extent of the harmful interference from UWB devices to all existing communications services. Absent such tests, the public can have no assurance that safety of life services, including E911, will receive sufficient protection.

Respectfully submitted,

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