ORIGINAL EX PARTE OR LATE FILED

MILLER & VAN EATON
P. L. L. C.

MATTHEW C. AMES
KENNETH A. BRUNETTI†
FREDERICK E. ELLROD III
MARCI L. FRISCHKORN
MITSUKO R. HERRERA†
WILLIAM L. LOWERY

†Admitted to Practice in California Only

Incorporating the Practice of Miller & Holbrooke

1155 CONNECTICUT AVENUE, N.W.
SUITE 1000
WASHINGTON, D.C. 20036-4320
TELEPHONE (202) 785-0600
FAX (202) 785-1234

MILLER & VAN EATON, L.L.P.
400 MONTGOMERY STREET
SUITE 501
SAN FRANCISCO, CALIFORNIA 94104-1215
TELEPHONE (415) 477-3650
FAX (415) 477-3652

WWW.MILLERVANEATON.COM

WILLIAM R. MALONE
NICHOLAS P. MILLER
HOLLY L. SAURER
JOSEPH VAN EATON

OF COUNSEL:
JAMES R. HOBSON
GERARD L. LEDERER**
JOHN F. NOBLE

**Admitted to Practice in New Jersey Only

RECEIVED
FEB - 6 2002
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

February 6, 2002

Via Hand Delivery

Deliver to:

Suite 110
236 Massachusetts Avenue N.E.
Washington DC 20002

Mr. William Caton
Acting Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

No. of Copies rec'd 0+1
List A B C D E

Re: Ex Parte Presentation in ET Docket No. 98-153

Dear Mr. Caton:

Pursuant to 47 C.F.R. § 1.1206, the Airports Council International-North America ("ACI-NA") submits this original and one copy of a letter disclosing an oral and written ex parte presentation in the above-captioned proceeding. On February 6, 2002, the attached letter setting forth the concerns of ACI-NA regarding the Commission's proposed Ultra-Wideband rules was delivered to Chairman Powell.

ORIGINAL

Please contact me with any questions.

Very truly yours,

Miller & Van Eaton, P.L.L.C.

By Matthew C. Ames

cc: Hon. Michael Powell
Hon. Kathleen Q. Abernathy
Hon. Michael J. Copps
Hon. Kevin J. Martin
Peter Tenhula, Sr. Legal Advisor to the Chairman
Bryan Tramont, Sr. Legal Advisor to Commissioner Abernathy
Paul Margie, Legal Advisor to Commissioner Copps
Monica Desai, Legal Advisor to Commissioner Martin
Bruce Franca, Acting Chief, OET
Julius P. Knapp, Deputy Chief, OET
Michael Marcus, Associate Chief of Technology, OET
Lisa Gaisford, Assistant Chief of Management, OET
Karen Rackley, Chief, Technical Rules Branch, OET
John A. Reed, Senior Engineer, Technical Rules Branch, OET

2030\01\MCA00904.DOC

AIRPORTS COUNCIL
INTERNATIONAL

ORIGINAL

RECEIVED
FEB - 6 2002
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

February 6, 2002

Honorable Michael Powell
Chairman
Federal Communications Commission
445 12th Street S.W.
Washington DC 20554

Re: ET Docket No. 98-153, Revision Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems

Dear Mr. Chairman:

I write to express the serious concerns of the Airports Council International-North America ("ACI-NA") regarding the Commission's proposed rules permitting expanded use of ultra-wideband ("UWB") devices. ACI-NA represents the local, regional and state governing bodies that own and operate the principal airports served by scheduled air carriers in the United States. The U.S. airport members of ACI-NA enplane more than 98 percent of the total domestic, and virtually all international, scheduled airline passenger and cargo traffic in the United States. Accordingly, ACI-NA's member airports are deeply committed to maintaining the safety and efficiency of the nation's air transport system.

As you know, the Department of Transportation ("DOT") and other federal agencies have expressed reservations regarding the Commission's UWB proposal, particularly regarding the potential for interference with Global Positioning System ("GPS") applications. One important concern with respect to such interference by UWB devices was discussed by the Radio Technical

1775 K Street NW, Suite 500 • Washington, DC 20006 • Tel:(202)293-8500 • Fax:(202)331-1362 • www.aci-na.org

Commission for Aeronautics ("RTCA") in a report prepared for DOT.[1] The RTCA Report points out that the interference effects of UWB applications "to GPS and other key systems is not negligible as some of its proponents have claimed."

Furthermore, the RTCA Report did not address an important and related issue of great importance to airports, which heightens the need for careful evaluation of UWB interference effects. The RTCA Report was primarily concerned with interference with in-flight navigational uses of GPS during the high altitude, or en-route, phases of flight. ACI-NA, on the other hand, has an additional concern, because GPS technology can be used to greatly increase the take-off and landing capacity of airports. The aviation industry is in the process of developing and deploying Automatic Dependent Surveillance – Broadcast ("ADS-B") systems. ADS-B allows pilots to determine their own positions using GPS receivers, and then continuously transmits that location information to nearby aircraft and ground systems.

For safety reasons, FAA regulations prohibit simultaneous landings on pairs of runways spaced closer than 4300 feet during periods of low visibility. This means that many airports are restricted to the use of a single arrival runway during low visibility weather, with a resultant dramatic increase in delays. The greater precision of ADS-B, however, can make it possible to conduct simultaneous operations even in low visibility on these closely spaced parallel runways. This capability is especially important at the many airports that currently face critical capacity constraints (such as San Francisco, Seattle, Boston, Newark, St. Louis and others). Thus, safe and effective use of GPS technology offers the public enormous savings by providing quick and dramatic increases in efficiency at airports across the country, without the delays and vast

[1] Second Interim Report to the Department of Transportation, Ultra-Wideband Technology Radio Frequency Interference Effects to Global Positioning System Receivers and Interference

expenditures necessarily arising from the construction of new runway capacity. Interference from UWB devices, however, may sharply limit the usefulness of ADS-B systems.

The RTCA Report establishes that potential UWB interference with GPS raises significant concerns for airport safety that need further study. In the high RF-emission environment in and around an airport, the likelihood of UWB interference is even higher than in the in-flight context, and the potential consequences therefore are even more dangerous than in in-flight situations. Furthermore, premature deployment of UWB devices would threaten the viability of important new GPS applications, including ADS-B. Consequently, ACI-NA urges the Commission to re-examine its proposed rules to address interference concerns more completely, both in general, and specifically to ensure that UWB applications do not interfere with the use of ADS-B devices.

Sincerely,

Richard Marchi

Richard F. Marchi
Senior Vice President, Technical Affairs
Airports Council International-North America

cc: Hon. Kathleen Q. Abernathy
Hon. Michael J. Copps
Hon. Kevin J. Martin
Peter Tenhula, Sr. Legal Advisor to the Chairman
Bryan Tramont, Sr. Legal Advisor to Commissioner Abernathy
Paul Margie, Legal Advisor to Commissioner Copps
Monica Desai, Legal Advisor to Commissioner Martin
Bruce Franca, Acting Chief, OET
Julius P. Knapp, Deputy Chief, OET
Michael Marcus, Associate Chief of Technology, OET
Lisa Gaisford, Assistant Chief of Management, OET
Karen Rackley, Chief, Technical Rules Branch, OET
John A. Reed, Senior Engineer, Technical Rules Branch, OET

Encounter Scenario Development, RTCA Special Committee 159 (March 27, 2001) (the "RTCA Report"). Relevant portions of the RTCA Report are attached.

RTCA Paper No. 086-01/PMC-139

Second Interim Report to the Department of Transportation:

Ultra-Wideband Technology Radio Frequency Interference Effects to Global Positioning System Receivers and Interference Encounter Scenario Development

Prepared by
RTCA Special Committee 159

March 27, 2001

TABLE OF CONTENTS

Table of Contents 2
Corrigendum 3a
1.0 EXECUTIVE SUMMARY 4
2.0 INTRODUCTION 6
3.0 UWB RFI EFFECTS TESTS ON GPS RECEIVERS 8
3.1 Department of Transportation-Sponsored Tests at Stanford University 8
3.1.1 Noise Equivalency Factor Measurement and Analysis Method 8
3.1.2 Stanford University Phase II Test Results 10
3.1.2.1 Pseudorange Accuracy Testing: 10
3.1.2.2 Acquisition Testing: 16
3.1.2.3 Stanford Results Summary: 17
3.1.3 GPS Receiver UWB RFI Effects Model and Generalized RFI Analysis Equations .. 17
3.2 Time Domain Corp.- Sponsored RFI Testing and Analysis 18
3.2.1 Applied Research Labs: University of Texas (ARL:UT) UWB RFI Data Collection Effort 18
3.2.2 Johns Hopkins University Applied Physics Laboratory (JHU/APL) Data Reduction and Analysis 19
3.3 NTIA Tests on Ultra-Wideband Devices and Compatibility with Non-GPS Federal Systems 22
3.3.1 Results: Single Emitter 23
3.3.2 Results: Aggregate Emitters 26
3.3.3 Interpretation of Results 27
3.4 NTIA GPS RFI Susceptibility Tests and Analysis 28
3.4.1 Measurement Approach 28
3.4.1.1 GPS Receivers Selected for Testing 28
3.4.1.2 UWB Signals Examined 28
3.4.1.3 Performance Criteria Used 29
3.4.1.4 Measurements Performed 29
3.4.2 Analysis Approach 29
3.4.2.1 Link Analysis Equation 29
3.4.2.2 Link Equation Factors 30
3.4.3 Development of the GPS/UWB Operational Scenarios 34
3.4.4 NTIA Measurement and Analysis Results 35
3.4.3.1 Measurement Results Discussion 35
3.4.3.2 Analysis Results 36
3.4.5 NTIA Conclusions 36
4.0 RFI ENCOUNTER SCENARIO DEVELOPMENT 43
4.1. Aviation Approach Scenarios 44
4.1.1 Minimum RFI Separation Distance and Link Budget for Category II/III Approaches 45
4.1.1.1 Category II/III Minimum Separation Distance: 45
4.1.1.2 Precision Approach RFI Link Budgets: 46
4.1.2 Non-precision Approaches 47
4.2 Other Aviation Scenarios 49
4.2.1 Aircraft Surface Movement Scenario 49

4.2.2 Aircraft Enroute Navigation with On-board Personal Electronic Device RFI 49
4.2.3 Aeronautical Mobile Satellite (Route) Service (AMS(R)S) Scenario Development and RFI Impact Assessment 50
4.2.3.1. AMS(R)S Operational Scenario 50
4.2.3.2. AMS(R)S Receiver Susceptibility and Interference Emission Limits 50
4.3 Non-Aviation Scenarios 52
4.3.1 Enhanced 911 52
4.3.1.1 E-911 Background 52
4.3.1.2 E911 GPS Indoors 54
4.3.1.3 E911 GPS Outdoors 54
4.3.1.4 E911 UWB Environment 54
4.3.1.5 Summary and Conclusions 55
APPENDIX A GPS RECEIVER UWB RFI EFFECTS MODEL – BASIS FOR INTERFERENCE LINK BUDGET 56
A.1 UWB Pulse Characteristics 56
A.2 Sequences of UWB Pulses 58
A.2.1 What the GPS Receiver (Correlator) Sees 58
A.3 Pulse Collisions 63
A.4 Conclusions 64
APPENDIX B GENERALIZED RFI EFFECTS COMPUTATION METHOD 68
B.1 Case I: $B_{IF} < R_P$ 68
B.2 Case II: $B_h \ll$ Average R_p 68
B.3 Case III: $B_h <$ Average R_p 68
B.4 Case 4: $R_P \ll B_h$ 69
APPENDIX C LINE-OF-SIGHT PROPAGATION FROM MULTIPLE RFI SOURCES 70
APPENDIX D TOTAL SYSTEM ERROR STATISTICS 72
D.1 Flight Technical Error 72
D.2 Navigation System Error 72
D.3 Accuracy of Worst Case Geometry vs. Accuracy Averaged Over all Geometries 73
D.4 Total System Error Calculation 74
D.5 Summary and Recommendations 77

RTCA, Inc.
1140 Connecticut Avenue , N. W., Suite 1020
Washington, D.C. 20036

CORRIGENDUM

to

Second Interim Report to the Department of Transportation:

Ultra-Wideband Technology Radio Frequency Interference Effects to Global Positioning System Receivers and Interference Encounter Scenario Development (RTCA Paper No. 086-01/PMC-139)

Prepared by
RTCA Special Committee 159

March 27, 2001

This corrigendum corrects the Executive Summary, page 5, fourth paragraph to be consistent with the conclusions stated in paragraph 4.3.1.5 - Summary and Conclusions, on page 55.

- **Executive Summary, page 5, fourth paragraph –**

  - Delete the last sentence: "The E-911 case...below the proposed Part 15 limits."

- **The Executive Summary, page 5, fourth paragraph, should read:**

  New scenario development work since the first interim RTCA report (Sept. 2000) reported here are initial descriptions of aeronautical mobile satcom safety communications, on-board aircraft personal electronic device RFI to enroute navigation and GPS-based enhanced-911 position reporting through cellular telephone. E-911 relies heavily on GPS for position reporting. Furthermore, indoor, urban canyon and foliage make certain GPS operations much more sensitive to interference. UWB Wireless Local Area Networks have already been announced, using very high PRFs and may be used widely. The Part 15 EIRP limit of –71.3 dBW/MHz results in a received level at 3 meter separation 24.3 dB above the GPS receiver noise floor. Unless UWB device EIRP values are reduced below that level, excessive interference to GPS-based E-911 operations may result. Further work is needed to quantify the scenario.

April 13, 2001

RTCA Paper No. 101-01/PMC-140

1.0 EXECUTIVE SUMMARY

The Global Positioning System (GPS) is significant because it is a key element in the development of the "Free Flight" air traffic management structure of the future which is needed to enable the expected growth of air travel and alleviate the currently overcrowded air routes. It is also fast becoming the technology of choice in other public safety positioning and navigation applications (e.g., E-911, maritime, IVHS) and has become imbedded in the national AC power and telecommunications infrastructure. GPS uses, however, a set of rather weak radio signals from satellites in 20,200 kilometer high orbits and, as such, is susceptible to being overpowered by strong terrestrial interference. It operates in one of the "restricted frequency bands" of Title 47 C.F.R. Part 15 and requires protection from harmful interference by international treaty. The FCC in its May 2000 Notice of Purposed Rule Making (on ET Docket 98-153) proposed to allow intentional ultra-wideband (UWB) transmissions across the GPS and several other restricted frequency bands of key importance to aviation and other public safety applications. The proposed power level had previously been allowed only for unintentional spurious emissions.

Since its June, 2000 tasking by the Department of Transportation, RTCA has followed and reviewed 5 major activities relating to UWB radio frequency interference (RFI) to aviation systems, in general, and GPS, in particular. They are the DOT-sponsored UWB RFI tests at Stanford University, The Time Domain Corp.-sponsored RFI data collection effort at Applied Research Labs: University of Texas (ARL:UT), and data analysis effort at Johns Hopkins University Applied Physics Lab (JHU/APL), and two National Telecommunications and Information Administration (NTIA) RFI test and analysis efforts (one on UWB characterization and non-GPS system impact assessment, and the other on GPS RFI impact).

RTCA has also developed RFI encounter scenarios necessary in the impact assessments in particular for aviation precision approach and non-precision approach. RTCA has acted as a forum to help development of other public safety operational scenarios such as cell phone embedded GPS E-911 and maritime navigation in harbors and inland waterways.

Results from the various test programs have been reported and discussed at RTCA. From the Stanford tests on an aviation approach-grade GPS receiver, three different types of UWB RFI effects are observed: CW-like, noise-like, and pulse-like. These are categorized by similarity to previous RTCA published (RTCA/DO-235) susceptibility study results from conventional RFI signals. The degree of UWB RFI impact is observed to depend on UWB signal characteristics such as pulse repetition frequency (PRF), waveform gating and modulation in relation to the GPS receiver bandwidth. Stanford quantified the degree of RFI impact by a "noise equivalency factor" for later use by RTCA in an RFI link analysis.

RTCA developed aviation approach scenarios for Category II/III precision approach and Non-precision approach. The Category II/III scenario was based on previous work for Category I which was recorded in DO-235. From the scenario parameters, an RFI link analysis was performed and yielded the result that maximum allowed UWB RFI emission level must be less than −100 dBW/MHz (28.7 dB below the proposed Part 15 limit of −71.3 dBW/MHz). The non-precision approach case fell within the bounds of the precision approach cases.

NTIA UWB characterization efforts show the usefulness of the RMS spectral density technique in measuring UWB emissions. NTIA non-GPS assessment results showed UWB RFI impact at Part 15 levels to several key Federal systems (up to 6 km spacing required from air route surveillance radars).

Similar to Stanford, NTIA GPS results on a set of general purpose GPS receivers also showed the CW-like, noise-like, pulse-like UWB RFI impacts depending on UWB PRF, waveform gating and modulation in relation to the GPS receiver bandwidth. Susceptibility values were in agreement with RTCA and ITU published standards (-140.5 dBW/MHz broadband, and –150.5 dBW discrete line, relative to a GPS received signal level of –164.5 dBW) even though test criteria were somewhat different than those on which the standards was based. Link analyses for the scenarios used in their compatibility assessments showed UWB low-end power values similar to the RTCA precision approach cases.

JHU/APL concluded from their analysis of the ARL:UT data collection that UWB RFI impact is also waveform-dependent though their results do not bring out the receiver dependence aspect. Furthermore, they concluded that "for UWB devices with average powers that are compliant with the current FCC Part 15 regulations, the performance of GPS receivers exhibits severe degradation when the separation between the GPS receiver and UWB devices is less than about 3 meters." As described in more detail in the body of this RTCA report, RTCA took issue with that conclusion and some related ones. It noted that a device emitting at the Part 15 emission limit in the GPS band 3 meters from a GPS receiving antenna causes the received interference to be more than 200 times the internationally-recognized value for unacceptable interference. This is equivalent to a noise density that is 24.3 dB above the thermal noise density for a typical GPS receiver.

New scenario development work since the first interim RTCA report (Sept. 2000) reported here are initial descriptions of aeronautical mobile satcom safety communications, on-board aircraft personal electronic device RFI to enroute navigation and GPS-based enhanced-911 position reporting through cellular telephone. The E-911 case RFI link analysis shows that indoor GPS-based E-911 is probably one of the most stringent of all the scenarios and requires a UWB power reduction of more than 60 dB below proposed Part 15 limits.

It is clear from the results summarized above and discussed in this report that UWB RFI impact to GPS and other key systems is not negligible as some of its proponents claimed. Due to the complexity of the interaction, considerable care and further work will likely be needed before rules for UWB can be drafted. Since some of the UWB RFI studies are on-going, the RTCA study group will continue to review new study material as it becomes available. Final reports for the original GPS L5 RFI environment study and for the update to the RTCA DO-235 study report on the GPS L1 environment are planned for release early in 2002.