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Assessment of Radio Frequency Interference Relevant to the GNSS L5/E5A Frequency Band

RTCA DO-292
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FOREWORD

This report was prepared by Special Committee 159 (SC-159) and approved by the RTCA Program Management Committee (PMC) on July 29, 2004.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- Coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;
- Analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity, and efficiency;
- Developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and
- Assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

The organizations' recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U.S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

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1 INTRODUCTION

1.1 Background

The original GNSS L1 RFI environment assessment by RTCA (RTCA/DO-235), completed in late 1996, identified potential sources of RFI and assessed the vulnerability of GNSS receivers (particularly GPS) to that interference. The navigation signals considered were the GPS and GLONASS Standard Positioning Service (SPS) signals on their respective L1 carriers, and the L1 signals transmitted by the FAA Wide Area Augmentation System (WAAS). The original assessment was motivated by a number of factors. These included sporadic GPS interference trouble reports from various RFI sources, the potential RFI from new sources in adjacent frequency bands, and the need to identify appropriate mitigation measures for flight-critical GNSS applications. Out of the original assessment work came susceptibility requirements for RTCA/DO-229 GPS/WAAS airborne receiver standard, two proposals for “Big-LEO” Mobile Satellite Service transmitter emission requirements, and several other key findings.

In a November 1999, letter, the Department of Transportation (DOT) requested that RTCA to "continue to further the necessary work for L5 and determine appropriate susceptibility criterion and subsequent unwanted emission protection levels for this new GPS signal." The letter went on to say "We ask that the RTCA take on this task and devote a Working Group towards defining the appropriate unwanted emission protection levels and susceptibility criteria for L5. We request that such work be published in an RTCA report similar in nature to Assessment of Radio Frequency Interference Relevant to the GNSS, RTCA Report DO-235 of January 1997. In response, the RTCA undertook to investigate the RFI environment near the GPS L5 frequency (1176.45 ± 12 MHz), and determine appropriate receiver susceptibility criteria and related RFI unwanted emission limits for the use with new civil signal. ." In a June 2000 DOT letter, the DOT requested that RTCA "examine the issues of potential interference from ultra-wideband (UWB) technology to critical aviation systems, including the Global Positioning System (GPS)." It went on to say "We ask RTCA's assistance in developing appropriate operational scenarios for these systems. It suggested, "RTCA may wish to expand the charter of the current SC-159 WG6 to include this work for analysis of impacts at both L5 and L1." In a July 2000 letter to Mr. Joseph Canny, DOT, RTCA replied, "SC-159 is currently addressing Ultra Wide Band (UWB) interference issues for the L5 band and will now include the L1 band in its work. Recent SC-159 documents [1-1, -2, -3] addressed these issues pertaining to GNSS L1. This report addresses potential radio frequency interference to the future GPS L5 signal when used for aeronautical radionavigation, and includes RFI to the Galileo E5A signal as well, where feasible.

The frequency band for L5 was selected from a large number of candidates, because it has the most favorable characteristics: It is close enough in frequency to L1 and L2 that the GPS satellite can support it; it is separated from L1 sufficiently to provide all the benefits from a second signal; and it is allocated worldwide to the aeronautical radionavigation service (ARNS). This allocation status will provide GPS L5 with regulatory protection from interference that is not available in bands allocated to other services.

The potential sources of RFI to the GPS L5 signal are vastly more complicated than those for the L1 signal. For instance, L1 operates in a frequency band where the only signal, which is in-band to GPS, is GPS itself, plus its own augmentations. Unlike L1, the L5

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