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Space data and information transfer systems — Spacecraft Onboard Interface Systems — Low Data-Rate Wireless Communications for Spacecraft Monitoring and Control

Systèmes de transfert des informations et données spatiales — Services d'interfaces à bord des véhicules spatiaux — Communication sans fil à faible débit de données pour la surveillance et le contrôle des véhicules spatiaux



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The Consultative Committee for Space Data Systems

Recommendation for Space Data System Practices

SPACECRAFT ONBOARD INTERFACE SYSTEMS—LOW DATA-RATE WIRELESS COMMUNICATIONS FOR SPACECRAFT MONITORING AND CONTROL

RECOMMENDED PRACTICE

CCSDS 882.0-M-1

MAGENTA BOOK

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This document has been approved for publication by the Management Council of the Consultative Committee for Space Data Systems (CCSDS) and represents the consensus technical agreement of the participating CCSDS Member Agencies. The procedure for review and authorization of CCSDS documents is detailed in *Organization and Processes for the Consultative Committee for Space Data Systems* (CCSDS A02.1-Y-3), and the record of Agency participation in the authorization of this document can be obtained from the CCSDS Secretariat at the address below.

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FOREWORD

This document is a CCSDS Recommended Practice, which is the consensus result as of the date of publication of the Best Practices for low data-rate communication systems for spacecraft monitor and control in support of space missions.

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1 INTRODUCTION

1.1 PURPOSE

This document presents the recommended practices for the utilization of low data-rate wireless communication technologies in support of spacecraft ground testing and flight monitoring and control applications. Relevant technical background information can be found in reference [3].

The recommended practices contained in this document enable member agencies to select the best option(s) available for interoperable wireless communications in the support of spacecraft monitoring and control applications. The specification of a Recommended Practice facilitates interoperable communications and forms the foundation for cross-support of communication systems between separate member space agencies.

1.2 SCOPE

This Recommended Practice is targeted towards monitoring and control systems, typically low data-rate and low-power wireless-based applications.

1.3 APPLICABILITY

This Recommended Practice specifies protocols (including at least the Physical [PHY] layer and Medium Access Control [MAC] sublayer of the Open Systems Interconnection [OSI] Model—see reference [F1]) that enable a basic interoperable wireless communication system to support low data-rate spacecraft monitoring and control applications.

1.4 RATIONALE

From an engineering standpoint, mission managers, along with engineers and developers, are faced with a plethora of wireless communication choices, both standards-based and proprietary. This Recommended Practice provides guidance in the selection of systems necessary to achieve interoperable communications in support of wireless, low data-rate monitoring and control.

1.5 DOCUMENT STRUCTURE

This document is composed from a top-down (technology) perspective, first defining the technology as a recommended practice, then providing informative material supporting specific application profiles. (For more information on space mission use cases addressed by wireless technologies, see reference [3]).

Section 2 provides an informational overview of the rationale and benefits of spacecraft onboard wireless technologies for use in spacecraft monitoring and control operations.

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Section 3 provides recommended practices and applicable standards relating to low data-rate wireless communication systems.

Annex A justifies the choice of an alternative, scheduled medium access scheme.

Annex B discusses security considerations related to the specifications in this document.

Annex C provides an informative description of the recommended practices, through an overview of the technologies, and a set of application profiles where the recommendations are applicable.

Annex D provides justification for selection of the 2.4 GHz band.

Annex E lists abbreviations used in this document along with their expanded forms.

Annex F provides a list of informative references.

1.6 DEFINITIONS

low data-rate: 250 kbps or less.

NOTE – In general the definition of low data-rate is somewhat ambiguous; for this Recommended Practice it is specified as 250 kbps.

low power: 10 mW or less (typical).

quality of service, QoS: The ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.

1.7 CONVENTIONS

1.7.1 NOMENCLATURE

The following conventions apply for the normative specifications in this Recommended Practice:

a) the words ‘shall’ and ‘must’ imply a binding and verifiable specification;

b) the word ‘should’ implies an optional, but desirable, specification;

c) the word ‘may’ implies an optional specification;

d) the words ‘is’, ‘are’, and ‘will’ imply statements of fact.

NOTE – These conventions do not imply constraints on diction in text that is clearly informative in nature.

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