

ANSI/CTA Standard

Antenna Control Interface

ANSI/CTA-909-B R-2016

(Formerly ANSI/CEA-909-B)

January 2011



**Consumer
Technology
Association**

NOTICE

Consumer Technology Association (CTA)TM Standards, Bulletins and other technical publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards, Bulletins and other technical publications shall not in any respect preclude any member or nonmember of the Consumer Technology Association from manufacturing or selling products not conforming to such Standards, Bulletins or other technical publications, nor shall the existence of such Standards, Bulletins and other technical publications preclude their voluntary use by those other than Consumer Technology Association members, whether the standard is to be used either domestically or internationally.

Standards, Bulletins and other technical publications are adopted by the Consumer Technology Association in accordance with the American National Standards Institute (ANSI) patent policy. By such action, the Consumer Technology Association does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Standard, Bulletin or other technical publication.

Note: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

This document does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

This document is copyrighted by the Consumer Technology Association and may not be reproduced, in whole or part, without written permission. Federal copyright law prohibits unauthorized reproduction of this document by any means. Organizations may obtain permission to reproduce a limited number of copies by entering into a license agreement. Requests to reproduce text, data, charts, figures or other material should be made to the Consumer Technology Association.

(Formulated under the cognizance of the CTA **R4 Video Systems Committee**.)

Published by
©CONSUMER TECHNOLOGY ASSOCIATION 2015
Technology & Standards Department
www.CTA.tech

All rights reserved

FOREWORD

This standard, CTA-909-B R-2016, was developed under the auspices of the Consumer Technology Association (CTA) R4 Video Systems Committee.

CONTENTS

1 Scope	1
2 References	1
2.1 Normative References	1
2.1.1 Normative Reference List	1
2.1.2 Normative Reference Acquisition	1
2.2 Informative References	Error! Bookmark not defined.
2.2.1 Informative Reference List	Error! Bookmark not defined.
2.2.2 Informative Reference Acquisition	Error! Bookmark not defined.
3 Introduction	1
4 Initialization	2
5 Data Signaling Characteristics	2
5.1 Transmission Rate	2
5.2 Symbol Rate	2
5.3 Symbol Period	2
5.4 Symbol Rise & Fall Time	3
5.5 Logic 0	3
5.6 Logic 1	3
6 Power Supply	3
7 Defined Interfaces	3
7.1 Dedicated Connector	3
7.1.1 Data Voltage Levels	3
7.1.2 Detection of a Smart Antenna with Dedicated Interface	4
7.1.3 Connector	5
7.2 Coaxial Input Connector and Shared Use	7
7.2.1 Data Voltage Levels	7
7.2.2 Detection of Smart Antenna Controlled over the Coaxial Input	7
8 Communication Modes	10
8.1 Mode Detection	10
8.2 Mode A	10
8.3 Mode B	11
8.3.1 Program Codes	12
8.3.2 Mechanical Antenna Specific Protocol	12
8.3.3 Timing Diagrams (normative)	14
8.3.4 Automatic Programming	16
8.3.5 Manual Programming	16
Annex A Examples (Informative)	17
A.1 Example 1 - TV Emulator/Data Stream Transmitter	17
A.2 Example 2 - Antenna Emulator/Data Stream Receiver	19
A.3 Example 3 - Example Implementation for Shared Connector	27
Annex B Example Applications for CEA-909 (Informative)	28
B.1 Example 1 - Simple Set Top Antenna with Pre-Amp	28
B.2 Example 2A - Four In, One Out RF Switch	28
B.3 Example 2B - Multiple Inputs, One Output	28

B.4 Example 3A - Mechanical Antenna Rotor with Programmable Pointing Direction	28
B.5 Example 3B - Mechanical Antenna Rotor with 4-bit Direction Code	28
B.6 Example 4 - Mast-Mounted Pre- Amp Seeking Gain Control Bits Plus RF Channel Number	28
B.7 Example 5 - Compact Set top Antenna with Horizontal & Vertical Dipole Elements	29
B.8 Example 6 - Multiplexed Control Signals onto RF Coaxial Cable Center Conductor	29
B.9 IR Remote Control for Antenna	29
Annex C Mode A Antenna Optimization Strategy—Example and Commentary.....	35
C.1 Objectives	35
C.2 Initial Channel Search	35
C.3 Optimization Search	35
C.4 Normal Operation	36

Figures

Figure 1 Logic Symbol Tolerances	3
Figure 2 Offset Latch Modular Plug	5
Figure 3 Offset Latch Modular Jack	6
Figure 4 Antenna Impedance Regions.....	9
Figure 5 Mode B Antenna Response Signal.....	10
Figure 6 Serial Data Stream from the DTV receiver to the Antenna	11
Figure 7 TV Emulator Data Stream Transmitter.....	18
Figure 8 Interface Circuits Used in an Emulator.....	19
Figure 9 Antenna Interface for First Six Bits Only.....	21
Figure 10 Full 14 Bit Antenna Interface using Standard Logic IC's.....	22
Figure 11 Alternative Using Counter to replace Analog RC Pulse Measurement.....	23
Figure 12 Programmable Gate Array	24
Figure 13 Input data stream	25
Figure 14 Expanded Time Scale	25
Figure 15 Input Data.....	26
Figure 16 Same as Figure 14 with Expanded Time Scale	26
Figure 17 Example Implementation for Shared Connector	27
Figure 18 Bit Assignments.....	30
Figure 19 Orthogonal Dipoles.....	30
Figure 20 RF Switch.....	31
Figure 21 Mechanical Antenna with Programmable Direction	32
Figure 22 Alternative Mechanical Antenna with 4 Bit Direction Control.....	32
Figure 23 Antenna Amplifier with Adjustable Filtering	33
Figure 24 Set Top Antenna with Horizontal and Vertical Elements	33
Figure 25 External (to DTV receiver) Method for Multiplexing Control Signals onto Coaxial Cable	34
Figure 26 Optional IR Remote Control.....	34

Tables

Table 1 Pin Assignments.....	6
Table 2 Summary of Nominal Detection Conditions	8
Table 3 Program Codes and Reserved Ranges	12

(This page intentionally left blank.)

Antenna Control Interface

1 Scope

CEA-909-B describes an antenna control subsystem for receiving terrestrial transmissions. The primary use is to facilitate television reception. The receiver controls the antenna apparatus to optimize the signal automatically for best reception by adjusting its configuration.

CEA-909-B allows any receiver to operate with any antenna, regardless of manufacturer. CEA-909-B defines the data algorithms used, connection standards, and other requirements. The antenna configuration is neither specified nor implied, leaving certain antenna design considerations to the manufacturer.

2 References

2.1 Normative References

The following standards contain provisions that, through reference in this text, constitute normative provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Section 2.1.1.

2.1.1 Normative Reference List

1. CEA-542-B, Cable Television Channel Identification Plan, July, 2003
2. FCC Channelization Rules, 47 CFR 73.603 Numerical designation of channel numbers
3. TIA-968-A, Telecommunications Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network, February, 2005
4. ANSI/SCTE 02 2006 "Specifications, F Connector, Female, Indoor,"

2.1.2 Normative Reference Acquisition

ANSI/SCTE Standards:

- Society of Cable Television Telecommunications Engineers (SCTE), 140 Philips Road, Exton PA 19341; Phone 800-542-5040; Fax 610-363-5898; Internet <http://www.scte.org>; Email info@scte.org

CEA & TIA Standards:

- Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740; Internet <http://global.ihs.com>; Email global@ihs.com

3 Introduction

The antenna control interface specified in this document enables the receiving system, which includes both the antenna and the DTV receiver, to provide improved digital television reception. CEA-909-B describes a means to optimize a suitably designed receiving antenna's directional pattern, gain, polarization, and tuning for each channel. Control of the antenna parameters is via a serial bitstream issued by the receiver over one of two defined interfaces: a separate dedicated connector or the antenna input coaxial connector. The determination of optimum antenna pattern, gain, etc. is achieved within the receiver by analysis of the received signal at different antenna settings. The search algorithm to determine the optimum setting is not specified in this document, and creating a rapid and effective search routine is expected to be a point of competition among manufacturers.

Determination of the optimum antenna parameters involves more than simply maximizing the signal level. The interface in this document inherently treats the receiver and antenna as a single system.

Demodulators in digital TVs can regard the antenna as an additional controllable resource, beyond gain