

SURFACE VEHICLE RECOMMENDED PRACTICE

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ITS Data Bus—Low Impedance Stereo Audio (LISA)

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- 1. Scope**—This SAE Recommended Practice describes the Low Impedance Stereo Audio (LISA) bus, which may be used in conjunction with the Physical Layer of the IDB-C, as described in SAE J2366-1. The audio arbitration messages used to control access to the LISA bus are specified in SAE J2366-7.

The IDB-C is a non-proprietary virtual token passing bus, designed to allow disparate consumer, vehicle, and commercial electronic components to communicate and share information.

2. References

- 2.1 Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

- 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, or <http://www.sae.org>.

SAE J2366-1—ITS Data Bus—Physical Layer
SAE J2366-7—ITS Data Bus—Application Message Layer

2.2 Related Publications

- 2.2.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, or <http://www.sae.org>.

SAE J2355—ITS Data Bus—Architecture Reference Model Information Report
SAE J2366-2—ITS Data Bus—Link Layer
SAE J2366-4—ITS Data Bus—Thin Transport Layer
SAE J2590—PMODE for In-Vehicle Networks

3. Definitions

- 3.1 Audio Arbitration**—Audio Arbitration is the process through which a Transmitter requests and is granted permission to generate audio output onto the LISA bus. When used with the IDB-C, the Audio Arbitration mechanism and required messages are defined in SAE J2366-7.

- 3.2 IDB-C**—The IDB-C is a member of the ITS Data Bus (IDB) family of networks, defined by the SAE J2366 series of documents.

- 3.3 ITS**—Intelligent Transportation Systems

- 3.4 LISA**—Low Impedance Stereo Audio – the subject of this document.

- 3.5 Receiver**—A Receiver is a device capable of accepting an analog audio input signal, e.g., audio amplifier, memo recorder.

- 3.6 Transmitter**—A Transmitter is a device capable of generating an analog audio signal, e.g., CD-changer, wireless phone, text-to-speech synthesizer.

- 4. The LISA Bus**—The LISA bus is designed to allow multiple Transmitters and Receivers to be “bussed” on a single unshielded twisted pair (UTP). One UTP is required for each LISA channel. A stereo configuration would therefore include 2 UTPs. Additional UTPs can be used for additional channels, as required. The LISA bus allows summing (mixing) of multiple Transmitters and Receivers, if desired, and is designed to be compliant with typical automotive EMC requirements.

When used with IDB-C, the Audio Arbitration mechanism defined in SAE J2366-7 controls access to the LISA bus.

Appendix A shows examples of a LISA Transmitter, Receiver, and Transceiver circuit, and also provides an example of an overall system grounding method that can help to reduce interference and ground potential issues.

- 4.1 Transmitter**—A Transmitter always presents high impedance to the LISA bus, regardless of whether it is actually generating any audio output (Active) or not (Inactive). Transmitters fall into the categories shown in Table 1:

TABLE 1—TRANSMITTER TYPES AND USAGE PROFILES

Category	Name	Description
Type 1	Priority	This category includes devices that would override the entertainment content for some period of time. Examples include cell phones, route guidance instructions, and driver information (voice alerts).
Type 2	Entertainment	This category includes devices such as CD players, radios, talking books, and other similar devices that generate continuous audio content.
Type 3	Alert	This category includes chimes, alerts, and other audio signals, that are very short in duration and are typically time sequenced apart.

- 4.1.1 NUMBER OF TRANSMITTERS**—The number of Active Transmitters is limited by the Receiver input level and the type of audio transmitted by each Transmitter. It is theoretically possible to have 16 Active Transmitters providing that the Receiver input is not overloaded or the effects of clipping are not considered objectionable. The bus is specified such that it is possible to have one full volume Type 1 or Type 2 source and one full volume Type 3 source Active at the same time. Additional sources or alternate combinations can be supported by reducing the lower priority sources to low volume or muted states.

It is the responsibility of the audio arbiter to manage the output level of the Transmitters such that the total signal level on the bus is within the valid range and the final audio output is not objectionable to the listener.

- 4.1.2 TRANSMITTER OUTPUT**—Transmitters must operate in a high impedance state. Transmitters shall not cause audible noise or attenuation when they join the LISA bus or when powering up.

Transmitters shall have single ended high impedance current drive characteristics to avoid back-loading active signals on the bus. Transmitter parameters are shown in Table 2.

Transmitters may be Active (generating audio content) or Inactive (not generating audio content). The state shall be controlled by the Audio Arbitration scheme defined in SAE J2366-7.

Each Transmitter shall support at least two output levels: High (full volume) and Muted. An additional Low volume output level should be supported, but may not make sense for all nodes (e.g., a backup warning aid). Additional levels may be supported at the discretion of the device manufacturer.