Dear Ms. Dortch:


In accordance with Section 1.1206 of the Commission’s rules, 47 C.F.R. § 1.1206, and the Commission’s Public Notice dated March 29, 2007 (DA 07-1435), a copy of this letter with the attached Technical Paper is being filed in the docket via ECFS.

The Paper begins with the following statement: “The SDAR service providers are working to define the technology for internal interoperability (a single receiver that can comprehend both services).” (emphasis added) The goal of this paper is to discuss peripheral interoperable applications. A peripheral SDAR receiver, for the purpose of this paper, is defined as a component of an audio system that can be added to an existing audio system for the purpose of receiving XM Satellite Radio or Sirius Satellite Radio programming.”

Please note the date of the Paper; this should be of great importance to the Commission as these two companies were cooperating on Interoperability well before the creation of their joint venture Interoperable Technologies LLC created in February 2003. The Paper concludes with the authors gratefully acknowledging “the participation of Sirius Satellite Radio and XM Satellite Radio.”
Given the evidence above as well as all prior evidence provided, it is clear that interoperable receivers have been produced for several years yet consumers have been and continue to be denied access to this technology.

I submit that the FCC is failing the consumer by not enforcing the Interoperable Mandate and forcing the companies to provide a ubiquitous receiver to allow end users (i.e.: consumers) awareness of and access to a single device capable of receiving services of both SDARS companies.

Respectfully,

Michael Hartleib

2001-01-0006 Peripheral SDAR Interoperability
Peripheral SDAR Interoperability

Robert Hjelmeland and Chris Ols
Delphi Automotive Systems, Delco Electronics
Peripheral SDAR Interoperability

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Delphi Automotive Systems, Delco Electronics

ABSTRACT

Radio broadcasting has entered the digital era, where services are delivered from the studio to the listener entirely in the digital domain. The Satellite Digital Audio Receiver Systems (SDARS) being developed provides the means to receive high-quality digital radio services. The SDARS receiver will be a peripheral component to the existing audio system in the vehicle for the first generation. Subsequent generations of the product will examine the opportunity for up-integrating the SDARS receiver into the modules of existing entertainment systems. This paper will outline a set of common operating characteristics that may be used in peripheral SDAR applications. If adhered to, this will allow the XM Satellite Radio service and Sirius Satellite Radio service to co-habitat on the same audio system or be interchangeable at a receiver module level. Many of the points discussed in this paper are not specific to or under the control of the SDARS service providers. Some items require compliance with existing vehicle practices while others are new to the automotive environment.

INTRODUCTION

There are two SDAR service providers: Sirius Satellite Radio and XM Satellite Radio. Each service provider will be capable of producing commercial free entertainment for vehicular applications by early 2001 for a small monthly fee (~10/month).

Sirius Satellite Radio uses three Space Systems / Loral satellites in an inclined elliptical orbit constellation. The satellites are backed up by a terrestrial repeater system consisting of ~100 sites in 56 markets.

In contrast, XM uses two of the most powerful communications satellites known (Hughes HS702, with communication payloads by Acatel) in a geo-stationary configuration. Any gaps in the coverage are addressed by the planned 1,500 terrestrial repeaters.

XM and Sirius have agreed that certain aspects of the receivers shall be similar, if not the same. This will allow each service provider to be implemented in a vehicle with little or no impact to the OEM.

The SDAR service providers are working to define the technology for internal interoperability (a single receiver that can comprehend both services). The goal of this paper is to discuss peripheral interoperable applications. A peripheral SDAR receiver, for the purpose of this paper, is defined as a component of an audio system that can be added to an existing audio system for the purpose of receiving XM Satellite Radio or Sirius Satellite Radio programming.

Peripheral interoperability for SDARS can be addressed in three categories: Hardware, Software, and Human Factors. Hardware issues will cover aspects of SDARS such as connectors and audio interface features. Software will cover aspects of SDARS such as reporting common quality indicators. Human Factors will examine similarities and differences of how the receivers are manipulated in various 'typical' applications.

HARDWARE

The obvious starting point for commonality between XM Satellite Radio and Sirius Satellite Radio is in the interface hardware. The hardware issue can be narrowed down to: RF Connectors, Body Connectors, Labels, Displays, Line Level Audio and Antenna configurations.

RF CONNECTOR

There will be two RF connectors for each SDAR receiver, in the first generation. One connector will be used for the satellite signal, the other for the terrestrial signal. Since the connectors are used in automotive applications, they must be colored and keyed in such a fashion as to ensure proper connections in "blind" mating situations.

The FAKRA standard for SMB type connectors has been adopted. This standard calls for impedance of 50Ω, Shielding value of 40dB/1GHz minimum, contact resistance of 40mΩ, 25 mating cycles minimum.

The Terrestrial connection shall be BLACK (A keying). The Satellite connection shall be CURRY in color (K keying). A XM only application may typically use GREEN (key E) for Terrestrial and BORDEAUX VIOLET for the
A SIRIUS only application may typically use Natural (key B) for Terrestrial and BLUE (Code C) for Satellite. The Z key should not be used for production as it can be mated to any other connector. The following diagram illustrates the connector color & keying combinations.

**BODY CONNECTOR**

The "Body Connector" may contain power, ground, line level audio out and vehicle/HMI communications. The specific connector signal assignment (e.g. pin 1 is Battery) will vary from vehicle to vehicle. However, the USCAR standard has been adopted for SDARS use.

**LABELING**

Labeling is important on SDAR applications due to the requirement to track Electronic Serial Numbers (ESN’s). The ESN is an alpha-numeric code which allows the service providers to track individual units.

The details of the label design are left to the discretion of the hardware manufacturer, however the label should contain the following information at a minimum: ESN, Service Provider "Marks", hardware manufacturers "Mark". The label should be printed using a 10pt font.

**DISPLAY’S**

The patrons visual experience with SDAR will revolve directly around the HMI (Human Machine Interface) display. As such, the service providers have established a common set of minimum requirements for the display.

The display shall have a minimum of one line of 8 character text. The character set provided to the display shall be consistent with 7 bit US-ASCII characters (ISO-8859-1, Latin 1). The display may be Liquid Crystal (LCD), Vacuum Florescent (VF) or whatever is deemed appropriate to remain in harmony with other displays in the system.

Additional display interoperability issues are outlined in the HMI section of this report. (e.g. what type of information is displayed)

**ANTENNA**

The antenna can be argued as the single most critical component of the SDAR system. From the OEM point of view it is highly desirable to have an antenna that could be placed on a vehicle and be compatible with both SDAR service providers.

Although several antenna vendors have elements of an antenna, few have a truly interoperable antenna solution at the time of writing. The major stumbling block has revolved around the active circuitry that is unique to each service providers allocated RF spectrum.

To address this issue, it is recommended that the DC power for the XM antenna be supplied to the active circuitry by via the Terrestrial coax. For a Sirius application, the DC power for the antenna can be supplied to the active circuitry via the Satellite coax.

This scheme has the advantage that a single antenna can be placed on the vehicle, the remote SDAR unit would essentially "configure" the antenna for the correct application. In addition, this scenario would allow for both remote receivers to share the same antenna in the same application.

The next issue revolving around the antenna sub-system is the selection and length of coaxial cable. It is recommended that the coax be RG315 or similar with a total length not to exceed 10 feet, loss for each connector should be factored into the coax length calculations.
SOFTWARE

For the purposes of this paper, the topic of software is limited to the software that is running on the system controller (i.e. this report will not examine the nuances of the software in either service providers DSP or ASIC’s).

The majority of software developed for the system controller will be unique for the vehicle application. (e.g. power moding, vehicle communications) However, there are some common behavioral elements that are applicable to all SDARS receivers.

RECEPTION QUALITY INDICATORS

The major reception quality indicator is BER (Bit Error Rate). For SDARS applications, BER indicates how many symbols have been altered as a result of the various error correction algorithms within the signal processing chain. BER should be made available to the service tool that is used by the OEM’s trouble-shooter. Some applications have considered making the BER available to the patron through the HMI’s display. In these cases the BER is initiated following a unique button press sequence.

POWER MODING

In a vehicle application, the use of vehicle power - whether supplied by the charging system or battery – can be a great concern to the OEM. Each vehicle platform may set out unique requirements for power moding the SDARS receiver during various ignition conditions.

HUMAN Machine Interface

Human Machine Interface (HMI) can be viewed as a combination of hardware and software issues that directly impact the patrons’ SDARS experience.

The HMI may take several forms for any given audio system. The Radio Head Unit (RHU) may serve as the HMI for manipulating SDARS. In other applications the RHU may be augmented by a dedicated HMI remotely located.

This section will describe a common set of performance expectations for SDARS receivers HMI.

ENTERING SDARS MODE

SDARS mode on a typical radio head unit (RHU) may be entered by cycling the “band” button AM→FM1→FM2→SDARS. If SIRIUS and XM cohabit on the same audio system, the OEM shall provide direction as to which service appears after FM2 in the band selection sequence.

If the audio system includes a remote HMI (Human Machine Interface), but relies on the RHU for audio amplification, SDARS mode may be entered by using the AUXILIARY audio mode on the RHU. The HMI will then illuminate and SDARS will be acknowledged as the active audio source.

MANUAL TUNING

Manual tuning (tuning without the aid of classification) will have a common set of characteristics.

Initial offerings from both SDARS providers will be limited to 100 channels of programming. As the market demand changes, or on special occasions (game of the week), the actual number of channels available to the patron may increase or decrease from 100. No matter the channel count, the tuning operation shall wrap from the highest available channel to the lowest (and from the lowest to the highest).

With 100 or more channels of programming it may take an unacceptably long time to increment or decrement through the entire service offers. Some systems will address this issue by the use of a numeric entry system, others will elect to a ‘quick step’ approach.

The ‘quick step’ manual tuning would be entered by the patron holding the manual increment/decrement button for a calibratable time, the SDARS receiver would then mute audio, and begin incrementing / decrementing through the service offerings at a calibratable rate. The time to enter the ‘quick step’ and the rate at which they dwell on a channel shall be calibratable to match the other audio sources in the audio system.

SEEKING BY CLASSIFICATION

SEEK in a typical AM/FM receiver was a function that would test the band for stations that meet criteria of signal strength. Since all the channels provided in an SDARS application are of the same signal strength the SEEK function has been redefined to SEEK by CLASSIFICATION.

Classification is a term associated with the programming format available on the subscribed channel. For example: Country, Rock, Classical, Jazz etc. Sometimes this is referred to as PTY (Program Type), Genre, or Category.

While the audio system has SDARS selected as the active audio source, the patron may enter SEEK mode by pressing the same button on the RHU as they would to enter AM/FM Seek. The audio may mute, while the display refreshes to show the available classifications. The patron may navigate through the available classifications by manipulating the tune button/knob. Once a desired classification has been selected, the patron may manipulate the Seek button. The receiver would then increment or decrement to the next available channel with the matching Classification.
Unlike FM RDS the SDAR programming classifications are dynamic in nature. That is to say that from time to time the service providers may elect to modify their classification schemes, therefore the HMI must be capable of adapting. Both service providers ASIC's have the capability of reporting to a system controller if a change is required and the nature of the change.

SCAN FUNCTIONS

SDARs may implement a SCAN function similar to AM/FM. Once this mode is entered, the receiver shall dwell on channel for a calibratable time and then automatically increment / decrement to the next channel, regardless of that channels classification.

PRESETS AND RECALLS

Each SDAR receiver shall retain at least 24 channels. This memory may be parsed for multiple drivers, multiple modes and multiple buttons.

For example, one vehicle application may have up to three drivers identified through personalization, with 6 preset buttons, and two SDAR modes (SDAR1, SDAR2) for a total of 36 total memory locations. Another application may have 4 drivers, 6 buttons and one SDAR mode for 24 memory locations.

Setting and recalling channel memories shall be done in accordance with other AM/FM memory functions found in the existing entertainment system.

ANNOUNCEMENT MESSAGES

Announcement Messages are a collection of standardized text displays that appear for a given condition that may result in the patron being inconvenienced in some fashion.

No RF Signal

No RF Signal is a condition that may result from a prolonged period of time in an area that is not covered by the satellite or terrestrial signals (tunnels for example).

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Display Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Character</td>
<td>No Signal</td>
</tr>
<tr>
<td>10 Character</td>
<td>No Signal</td>
</tr>
<tr>
<td>16 Character</td>
<td>No Signal</td>
</tr>
</tbody>
</table>

Weak RF Signal

Weak RF signals may be the result of foliage, other RF sources that generate ‘noise’ (microwave ovens), or objects blocking the interfering with the antenna’s performance.

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Display Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Character</td>
<td>SUBSCRIB</td>
</tr>
<tr>
<td>10 Character</td>
<td>SUBSCRIBE</td>
</tr>
<tr>
<td>16 Character</td>
<td>SUBSCRIBE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Display Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Character</td>
<td>1-888-539-SIRI</td>
</tr>
<tr>
<td>10 Character</td>
<td>1-888-xxxx-xxxx</td>
</tr>
<tr>
<td>16 Character</td>
<td>1-888-539-SIRI 1-888-539-7474</td>
</tr>
</tbody>
</table>

NOTE: XM subscription number was not available at the time of writing.

Service Update

Service Update is the phrase associated with the occasional modification by the service provider to the programming line up.

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Display Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 character</td>
<td>Updating</td>
</tr>
<tr>
<td>10 character</td>
<td>Updating</td>
</tr>
<tr>
<td>16 character</td>
<td>Service Updating</td>
</tr>
</tbody>
</table>
Antenna Fault

In the unlikely event that the antenna becomes damaged or disconnected, the patron will be notified.

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Display Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 character</td>
<td>Antenna?</td>
</tr>
<tr>
<td>10 character</td>
<td>Chk Antena</td>
</tr>
<tr>
<td>16 character</td>
<td>Check Antenna</td>
</tr>
</tbody>
</table>

Channel not in Service

If a patron were to set a preset to a channel that was removed by the service provider from the channel line up, the following message would occur for 2 seconds, while the audio was muted, the receiver would then default to channel 1.

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Display Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 character</td>
<td>Removed</td>
</tr>
<tr>
<td>10 character</td>
<td>Removed</td>
</tr>
<tr>
<td>16 character</td>
<td>Removed</td>
</tr>
</tbody>
</table>

CONCLUSION

This paper has outlined a set of common elements for peripheral SDAR applications. Communication between XM and Sirius will allow the OEM’s a degree of flexibility to meet the demands of the market place. Communication will also lead to fewer permutations of the SDAR product, thereby leading to a common SDAR experience for the patron.

ACKNOWLEDGMENTS

The authors would like to gratefully acknowledge the participation of Sirius Satellite Radio and XM Satellite Radio.

REFERENCES


2. Road vehicles – Radio-frequency (MVRF) interface – Dimensions and electrical requirements, AK 22/5 Nr. 08/00. (FAKRA Spec).

DEFINITIONS, ACRONYMS, ABBREVIATIONS

SDARS: Satellite Digital Audio Receiver Systems

Patron: the person or persons who purchase the SDAR services from either XM Satellite Radio or Sirius Satellite Radio.

HMI: Human Machine Interface. The HMI varies from vehicle to vehicle, but is essentially the device that the patron uses to access the SDAR service. Physically, the HMI may take the form of a Radio Head Unit (RHU) or a separate display/controller.

ESN: Electronics Serial Number, alphanumeric representation of the individual SDAR unit.

ASIC: Application Specific Integrated Circuit

OEM: Original Equipment Manufacturer

Blind Mating: a situation where the receiver is not visible to the person attempting to connect the antenna or body harness.

Classification: the term associated with the programming format available on the subscribed channel. For example: Country, Rock, Classical. Sometimes this is referred to as PTY (Program Type), Genre, or Category.