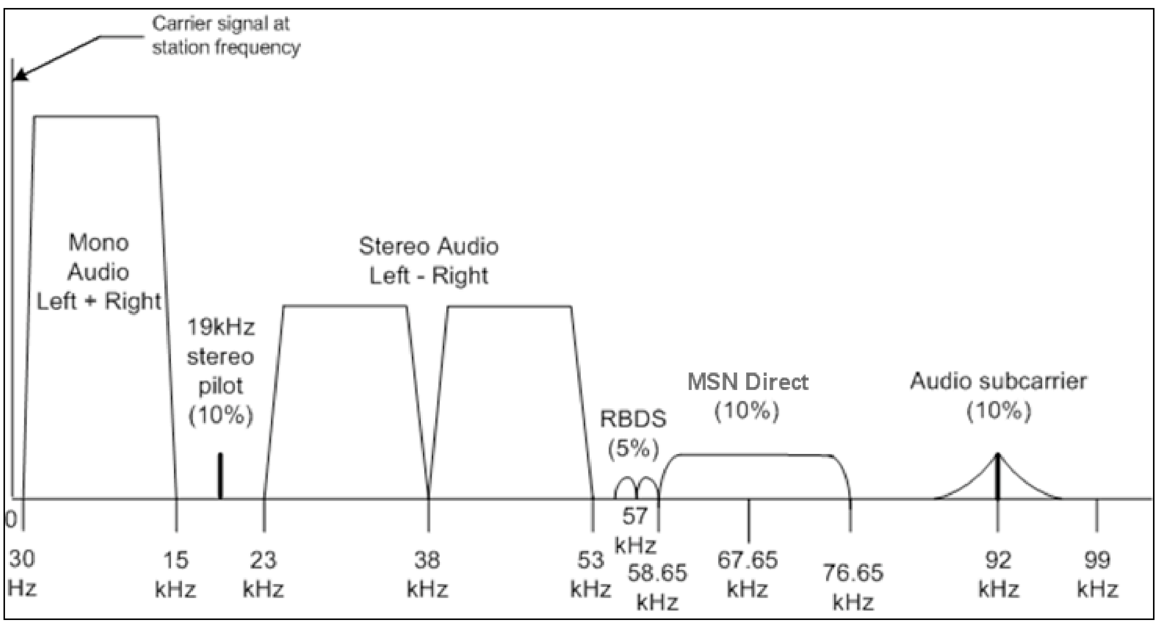
A Comparison of RDS and MSN® Direct

May 2008

Introduction

RDS (Radio Data System) and MSN® Direct both utilize "subcarrier" channels on the FM radio band. A subcarrier is a separate analog or digital signal that carries encoded information alongside a main radio transmission. MSN Direct provides service to consumers in the US and Canada. RDS has been used in Europe for several years for data delivery and has recently been more widely adopted in the United States. The official name for RDS in the US is RBDS (Radio Broadcast Data System), but since there are only minor differences between the two standards this document refers to both as RDS. DARC (Data Radio Channel) is another FM subcarrier technology that has been used in Japan for several years for information delivery.

RDS and MSN Direct differ significantly from each other. They occupy different locations of the FM band, have different injection levels (similar to power level), use different over-the-air (OTA) protocols, provide different amounts of bandwidth, use different methods for error correction, and carry different types of information. The following diagram is a visual representation of RDS and MSN Direct on the FM spectrum. The vertical axis represents the injection level percentage typically allocated to each subcarrier.



Bandwidth

RDS delivers 1.1875 Kbps with overhead and 0.673 Kbps without overhead.[1] MSN Direct bandwidth is 11.5 Kbps with overhead and 10.5 Kbps without overhead.

---

[1] RDS: The Radio Data System, Dietmar Kopitz and Bev Marks, appendix E, p 277

Therefore MSN Direct offers roughly 15 times more bandwidth for encoded information than RDS.

Traffic Bandwidth

The maximum bandwidth available for traffic information on RDS is approximately 100 bps.[2] MSN Direct uses a dynamic bandwidth allocation algorithm based on the type of data, its priority relative to other types of information, its age, and how many times it has previously been sent. Traffic is given the highest priority (as compared to other content), effectively ensuring that in any given city, all sensor-based speed updates and all new incidents are transmitted every two minutes. Bigger cities containing more road sensors and incidents get more bandwidth than smaller ones with fewer sensors. As an example, MSN Direct currently dedicates up to 300 bps for traffic data in Los Angeles, which far exceeds what is possible with RDS. As the number of road sensors in LA increases, the amount of bandwidth allocated by MSN Direct for traffic information will also increase. All networks have a maximum bandwidth, but that value is much higher and more dynamic in MSN Direct than RDS.

A trick that is sometimes employed by RDS traffic providers to work around the lack of sufficient bandwidth for flow data is to omit sensor speeds where the actual speed is at or near the speed limit. Lack of data for any particular road segment is supposed to indicate to the device that traffic is “free flowing”. The problem with this approach is that there isn’t a good way for the RDS receiver to differentiate slow traffic data that hasn’t yet been received from free flowing road segments. It assumes that if something hasn’t been received it must be free flowing; however that may not be the case. This approach is especially problematic with a broadcast network where there is no backchannel from the end device to the server/tower to acknowledge receipt of information. Since all wireless devices frequently experience periods of poor reception, they will fail to receive at least some of the data. Good error correction can reduce the impact, but as described below, the error correction approach employed by RDS isn’t particularly robust, and even the best error correction algorithms are only a partial solution. In addition to poor reception, outages anywhere along the chain from the sensor to the aggregator to the broadcaster will also prevent data from being sent, and therefore received. Again, there is no way for the RDS receiver to differentiate this missed data from free flowing data. MSN Direct avoids this problem by sending all current road-sensor information, including sensor-based speeds for free flowing road segments, every two minutes.

Error Correction

RDS uses an optimal single-burst error correcting code capable of correcting any single burst of errors that spans five bits or less. However, the use of the full error-correcting capability greatly increases the undetected error rate and thus also reduces the reliability of the block synchronization system.[3] In addition, the RDS-TMC ALERT-C specification (ISO 14819-1) recommends an error correction scheme whereby the same traffic information is repeated at least two times in the transmission. The receiver compares

---

[2] RDS: The Radio Data System by Deitmar Kopitz and Bev Marks, appendix E, page 281.
[3] RDS: The Radio Data System by Deitmar Kopitz and Bev Marks, page 223

the repeated data blocks and if they are the same it assumes the data contains no errors.[4]

MSN Direct employs a more comprehensive set of error correction algorithms, using techniques that are well-known for being extremely effective for transmitting data over noisy communication links. The algorithms include Viterbi, Interleaving, Reed-Solomon, and Low Density Parity Codes (LDPC). These algorithms are time-tested and used in many different technology systems, including GSM and CDMA cellular networks, digital television, compact disks, satellite communications, and 802.11 LANs (WiFi). They perform well individually, but equally important is how well they work in conjunction with each other. Viterbi is a forward error correction technique used at the lowest levels in MSN Direct to detect small but relatively frequent errors. Interleaving and Reed Solomon were chosen because they are good at correcting for larger bursts of errors that occur less frequently, a condition typically encountered by mobile devices as they travel about. Finally, LDPC is used for correcting errors in very large items that take a long time to download.

Unique Keys and Encryption

Multiple types of encryption were designed into MSN Direct from the very beginning and at the lowest levels. A combination of unique security keys etched into each receiver, the Extended Tiny Encryption Algorithm (XTEA), and the RSA algorithm enable several very important features, including the ability to:

- individually address each device
- encrypt the content that is sent over-the-air
- activate and deactivate devices, thereby enabling subscription scenarios and anti-theft features
- send personal content such as private messages and calendar appointments
- verify the authenticity of content via digital signatures

RDS does not include these security features natively. They can be layered on top of RDS, but significant engineering work is required to accomplish the same level of functionality that is built directly into MSN Direct.

Content Services

The consumer content provided by RDS as of Q1 2008 is station/artist/song information, traffic incidents, and limited traffic speed data. The content available on MSN Direct currently includes traffic (both incidents and sensor-based speed data), local gas prices, weather reports and forecasts, movie times, news headlines and breaking news alerts, stock quotes, private messages, local events, emergency alerts, user-defined locations ("Send to GPS" from Live Search Maps), and airport delay information. Sufficient bandwidth exists for additional services to be added in the future.

Broadcaster Availability

MSN Direct is broadcaster agnostic. Microsoft identified the radio stations that provide the most comprehensive coverage in a given area and obtained leases for the

[4] ISO 14819-1, Traffic and Traveler Information – TTI messages via traffic message coding, Part 1: Coding protocol for Radio Data System – Traffic Message Channel (RDS-TMC) using ALERT-C, section 7.3

necessary subcarrier on those towers (except in a few rare cases). Microsoft currently holds subcarrier leases from almost 30 different broadcasting companies, from the largest such as Clear Channel, CBS Radio, and Rogers to the smallest privately owned and university stations. This arrangement enables Microsoft to provide a comprehensive MSN Direct service in metropolitan areas across the US and Canada.

The availability and content provided by RDS varies by broadcaster. Many broadcasters have enabled RDS for station/artist/song information, but not all have enabled other services such as traffic incidents. And there are no cross-broadcaster roaming agreements that allow subscribers of one broadcaster's traffic service to access another broadcaster's content.

More information

For more information see www.msndirect.com/partners. To discuss opportunities in utilizing the MSN Direct network in your products and services, please contact MSN Direct Business Development at dbbusdev@microsoft.com.