The New World of HD Radio Technology
Joe D'Angelo, SVP of Broadcast Radio, Xperi Inc.

WHO WE ARE

AM / FM RADIO – THE REACH MEDIUM

92% of Americans 12+ listen to the radio every week

HOW HD RADIO WORKS

1. Analog and digital signals sent separately
2. Audio combined prior to transmission
3. Composite signal transmitted by station
4. Multipath distortion only affects analog signal
5. Broadcast is compatible with both analog and digital radios – only digital radios receive digital multicast channels

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HOW HD RADIO WORKS

- HD Radio Technology uses In-Band, On Channel (IBOC) method
- Enables simultaneous transmission of analog and digital signals
- Analog receivers continue to function normally
- Additional digital channels “invisible” to analog-only receivers
- Digital transmissions immune to multipath distortion, adjacent channel interference and static

HD RADIO BY THE NUMBERS

- Virtually 100% coverage of the top 100 metros
- 95% of U.S. population live within reception distance of an HD Radio station
- Over 43 million HD Radio-equipped cars on the road

NUMBER OF MULTICAST CHANNELS

- 2,006 Stations
  - 1,461 HD2 Channels
  - 471 HD3 Channels
  - 76 HD4 Channels

NUMBER OF STATIONS ON-AIR

- 2,206 HD Radio Stations Currently On The Air
  - 205 of the Top 200 Nielsen Measured Metros
  - 50 States Served (+ DC, Puerto Rico and Guam)
  - U.S. Population Served: 282 M (90% U.S. 6+)

% OF US LISTENERS

- Stations that use HD Radio Technology
- Stations broadcasting in digital
- Stations broadcasting in analog

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HD RADIO AND THE BATTLE FOR THE DASHBOARD

All major auto brands offer factory-installed HD Radio Technology

- HD RADIO TECHNOLOGY STANDARD FEATURE ON ALL VEHICLES
- HD RADIO TECHNOLOGY STANDARD FEATURE ON SOME VEHICLES
- HD RADIO TECHNOLOGY AVAILABLE AS PART OF OPTION PACKAGE

New cars delivered annually with factory-installed HD Radio (United States)
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HD RADIO AND THE BATTLE FOR THE DASHBOARD

Running total HD Radio receivers (includes home and aftermarket) (North America)

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumer Electronics</th>
<th>Auto OEM &amp; Aftermarket</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>8.15</td>
<td>6.72</td>
<td>14.87</td>
</tr>
<tr>
<td>2013</td>
<td>13.05</td>
<td>12.24</td>
<td>25.29</td>
</tr>
<tr>
<td>2014</td>
<td>22.75</td>
<td>20.15</td>
<td>42.90</td>
</tr>
<tr>
<td>2015</td>
<td>30.76</td>
<td>27.56</td>
<td>58.32</td>
</tr>
<tr>
<td>2016</td>
<td>48.55</td>
<td>45.44</td>
<td>94.00</td>
</tr>
<tr>
<td>2017</td>
<td>59.21</td>
<td>56.21</td>
<td>115.42</td>
</tr>
<tr>
<td>2018 Y-T-D</td>
<td></td>
<td></td>
<td>115.42</td>
</tr>
</tbody>
</table>

HD RADIO BY THE NUMBERS

79% of U.S. Radio listeners tune to stations broadcasting with HD Radio Technology each and every week.

Listening to stations broadcasting in Digital: 79%
Listening to stations broadcasting in Analog: 21%

HD RADIO CONSUMER SATISFACTION

Overall consumer satisfaction with the technology:

- Virtually all (98%) HD Radio Technology users surveyed are satisfied with their HD Radio Technology experience.
- 91% of listeners said they are "completely" or "very" satisfied with the HD Radio Experience.
- 55% indicated they are "completely" satisfied with the HD Radio Experience.
- Those under 40 years old and heavy users (listen to radio >15 hours a week) have the highest satisfaction with HD Radio Technology.

Among HD Radio Technology users, 98% are satisfied.
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HD RADIO CONSUMER SATISFACTION

Strong consumer advocacy of the technology:
- 97% of current HD Radio users would recommend it to others
- 77% of non-HD Radio users would recommend it to others
- None of the current HD Radio users surveyed stated that they "Definitely would not" recommend the technology to others

HD RADIO TECHNOLOGY USERS

- HD Radio User
- Non-HD Radio User

HD RADIO BY THE NUMBERS

- U.S. Stations Converted: 2,465
- U.S. Stations On-Air / HD2-HD3-HD4 Digital Channels: 2,206 / 2,008
- U.S. total HD Radio Audio Services (Digital Channels): 4,214
- U.S. total HD Radio Artist Experience Stations / Channels: 874 / 1,621
- U.S. Stations Delivering Digital Traffic Services (iHeart and BTC): ~700
- U.S. TSL to digital audio in HD Radio-equipped Cars: 155.5 M hours/week
- U.S. total HD Radio-equipped Cars: 47.7 M / 17.4%

HD RADIO BY THE NUMBERS

- Over 49.9 million HD Radio-equipped cars on the road in North America
  - Over 4.1 million consumer HD Radio home and portable receivers
  - Over 54 million HD Radio receivers in U.S., Canada & Mexico
- HD Radio U.S. auto penetration over 17% in the top 10 DMAs:
  - #1 - New York: 30.4%
  - #2 - Los Angeles: 27.9%
  - #3 - Chicago: 19.3%
  - #4 - Philadelphia: 19.9%
  - #5 - Dallas: 18.6%
  - #6 - Washington, DC: 20.3%
  - #7 - Houston: 19.9%
  - #8 - San Francisco: 24.8%
  - #9 - Atlanta: 17.5%
  - #10 - Boston: 24.2%
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HD RADIO BY THE NUMBERS

<table>
<thead>
<tr>
<th>City</th>
<th>Total # HDEC* In DMA</th>
<th>Total % HDEC* In DMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York DMA</td>
<td>4,089,131</td>
<td>30.4%</td>
</tr>
<tr>
<td>Miami DMA</td>
<td>1,110,789</td>
<td>29.8%</td>
</tr>
<tr>
<td>Los Angeles DMA</td>
<td>3,537,042</td>
<td>27.9%</td>
</tr>
<tr>
<td>West Palm Beach DMA</td>
<td>477,709</td>
<td>27.4%</td>
</tr>
<tr>
<td>Burlington DMA</td>
<td>206,631</td>
<td>27.0%</td>
</tr>
<tr>
<td>Detroit DMA</td>
<td>1,087,584</td>
<td>26.9%</td>
</tr>
<tr>
<td>San Francisco DMA</td>
<td>1,369,282</td>
<td>24.8%</td>
</tr>
<tr>
<td>Boston DMA</td>
<td>1,343,816</td>
<td>24.2%</td>
</tr>
<tr>
<td>Juneau DMA</td>
<td>7,989</td>
<td>23.2%</td>
</tr>
<tr>
<td>Baltimore DMA</td>
<td>506,071</td>
<td>22.9%</td>
</tr>
</tbody>
</table>

* HDEC = HD Radio-equipped cars.

HD RADIO BY THE NUMBERS

- Top 10 highest HD Radio auto penetration DMAs
- Total HD Radio Artist Experience Stations / Channels: 874 / 1,621
- Stations Delivering Digital Traffic Services (iHeart and BTC): ~700
- AM stations simulcast on HD1 / HD2 / HD3 / HD4 channels: 234
  - 2 AM stations simulcast on HD1 channel
  - 163 AM stations simulcast on HD2 channel
  - 64 AM stations simulcast on HD3 channel
  - 5 AM stations simulcast on HD4 channel

HD RADIO BY THE NUMBERS

- HD Radio-equipped cars – DMAs in the state of Georgia

<table>
<thead>
<tr>
<th>Geography Measured</th>
<th>% HDEC* Sold in 2017</th>
<th>Total # HDEC* In DMA</th>
<th>Total % HDEC* In DMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>#10 - Atlanta DMA</td>
<td>39.1%</td>
<td>714,980</td>
<td>13.3%</td>
</tr>
<tr>
<td>#91 - Savannah DMA</td>
<td>41.3%</td>
<td>101,599</td>
<td>12.6%</td>
</tr>
<tr>
<td>#111 - Augusta DMA</td>
<td>39.0%</td>
<td>56,626</td>
<td>8.8%</td>
</tr>
<tr>
<td>#127 - Macon DMA</td>
<td>37.5%</td>
<td>47,982</td>
<td>8.2%</td>
</tr>
<tr>
<td>#127 - Columbus DMA</td>
<td>42.3%</td>
<td>49,616</td>
<td>9.3%</td>
</tr>
<tr>
<td>#152 - Albany DMA</td>
<td>37.5%</td>
<td>24,733</td>
<td>7.1%</td>
</tr>
</tbody>
</table>

- Georgia counties included: Chattahoochee, Tallahassee, Jacksonville and Dothan DMAs

STATE OF GEORGIA TOTAL

- 42.8%
- 3,033,360
- 14.8%
HD RADIO IN THE NEW YORK DMA

- DMA Rank: #1
- Radio Metro Rank: #1
- Average weekly TSL* to all radio stations in New York DMA: 8:58 (HH:mm)
- Average weekly TSL* to all HD Radio stations in New York DMA: 8:14 (HH:mm)

Percentage of new cars sold in New York in 2018 Y-T-D that came with factory installed HD Radio receivers: 66.1%

Average In-Car Weekly TSL* to New York HD Radio stations: 3:37 (HH:mm)

The 4.1 million HD Radio-equipped cars means over 13.6 million hours per week of in-car listening to New York stations using HD Radio Technology

Percent of HD Radio-equipped cars in the New York DMA: 30.4%

AM / FM RADIO – THE REACH MEDIUM

RADIO REMAINS BY FAR THE DOMINANT MEDIUM IN THE CAR

Americans average 73 minutes of audio listening in the car per day
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AM / FM RADIO – THE REACH MEDIUM

<table>
<thead>
<tr>
<th>Audio Source Used in the Car</th>
<th>% Currently Ever Using Audio Source in Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM/FM Radio</td>
<td>82%</td>
</tr>
<tr>
<td>CD Player</td>
<td>69%</td>
</tr>
<tr>
<td>Pandora Radio</td>
<td>63%</td>
</tr>
<tr>
<td>Online Radio</td>
<td>28%</td>
</tr>
<tr>
<td>Podcasts</td>
<td>23%</td>
</tr>
<tr>
<td>Satellite Radio</td>
<td>21%</td>
</tr>
</tbody>
</table>

HEAVIEST IN-CAR MEDIA USAGE

HD RADIO DIGITAL AUDIO FEATURES

HD Radio audio programming is 100% subscription-free!

- **Program Info**: Displays information like artist, song title and album name.
- **HD2/HD3/HD4**: FM stations can divide the digital signal offering up to 3 additional digital-only audio programs on multicast channels. Over 3,200 AM and FM stations now broadcasting with HD Radio Technology across the U.S., and over 1,300 new, extra local multicast channels are also now available.
- **Digital Sound**: HD Radio Technology offers crystal clear, static-free sound with none of the clicks, hisses or pops associated with traditional analog radio. FM becomes CD quality and AM sounds like FM.
- **Artist Experience**: Images related to the broadcast can be displayed on the radio display, including items such as album cover art and station or advertiser logos.

HD RADIO AND THE BATTLE FOR THE DASHBOARD

HD Radio offers crystal clear, static-free sound with none of the clicks, hisses or pops associated with traditional analog radio.

Program Info displays information such as artist, song title and album name.

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HD RADIO DIGITAL AUDIO FEATURES

FM STATIONS CAN DIVIDE THEIR DIGITAL SIGNAL OFFERING INTO UP TO 3 ADDITIONAL DIGITAL-ONLY AUDIO PROGRAMS ON THE MULTICAST CHANNELS

1. Digital simulcast of analog signal Format: Adult Contemporary
   - Target demographic: Women 25-54
   - WNEW-FM 102.7 New York, NY

2. Targeted niche programming Format: Smooth Jazz
   - Target demographic: Adults 35-64

3. AM station simulcast Format: All News
   - Target demographic: Men 25-54

   - Target demographic: Men 18-49

HD RADIO COMPELLING CONTENT

Stations creating new, unique HD Radio programming

- 92.5 HD2
- Oldies 94.7
- 97.3 Comic
- Riff 2
- WXUK
- WFLY
- WLSD
- WQOC
- WXRR
- WXHY
- WQIY
- WHHL
- 103.5
- WMMJ
- WJBO
- WLPW
- WZBG
- WJGG
- W5HT
- KEOS
- W4QZ
- W3VY
- W2QZ
- KQV

HD RADIO ARTIST/ADVERTISER EXPERIENCE

Images related to the broadcast can be displayed on the in-car display, such as album cover art, station logos and of course advertiser logos.
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HD RADIO ARTIST/ADVERTISER EXPERIENCE

ENHANCED ADS INCREASE IMPACT

HD RADIO ARTIST/ADVERTISER EXPERIENCE

IN-VEHICLE DISPLAYS LIFT MESSAGE RECALL FOR ADS

HD RADIO ARTIST/ADVERTISER EXPERIENCE

LISTENERS REMEMBER MORE BRANDS WITH ENHANCED ADS

What products/brands do you recall hearing in the radio clip you just heard?

Lawn Scent Product Brand A 53% Lift
Lawn Scent Product Brand B 37% Lift
Vehicle Brand X 39% Lift
Aero Humidifier X 50% Lift
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HD RADIO ARTIST/ADVERTISER EXPERIENCE

- Westwood One / Home Depot Live National AE Test
  - 3 spots during national campaign in July sent with live AE images
  - Campaign conducted in 175 DMAs nationwide
  - Commercials included text metadata (“More Saving, More Doing”)
  - 10 key markets did not get images; used for comparison purposes
  - Final test results due in August

HD RADIO ARTIST/ADVERTISER EXPERIENCE

- Local stations also using AE to super-serve local advertisers
  - Pitch as part of “total digital” package w/web banner ads, metadata
  - Use to either increase spot rate or get greater % of the buy
  - Clusters using as value-added if buy covers multiple stations
  - HD Radio/Nielsen study helps convince advertisers of “lift” from image
  - Houston, Las Vegas & Sacramento all have significant AE activity