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February 7, 2008

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street SW
Washington, D.C. 20554

Re: **NOTICE OF EX PARTE PRESENTATION**
RM-11271
ET Docket Nos. 06-135, 05-213, 03-92

Dear Ms. Dortch:

Pursuant to Section 1.1206 of the Commission's rules,[1] the purpose of this letter is to notify the Commission that representatives of AMI Semiconductor ("AMIS") met yesterday with representatives of the Office of Engineering and Technology ("OET") to discuss the attached PowerPoint presentation. Present at the meeting were:

Bryan N. Tramont, Wilkinson Barker Knauer, LLP
Robert G. Kirk, Wilkinson Barker Knauer, LLP
Marc Niklaus, Product Line Manager Audiology Solutions, AMIS
Gareth Weale, Design Center Manager Medical Wireless Applications, AMIS

Julius P. Knapp, Chief, OET
Bruce A. Romano, Associate Chief, OET
Alan R. Stillwell, Associate Chief, OET Management Committee, OET
Mark Settle, Associate Chief, Policy and Rules Division, OET
Gary R. Thayer, Attorney/Electronics Engineer, OET

If you have any questions concerning this notice, please contact the undersigned.

Respectfully submitted,

/s/Bryan N. Tramont
Bryan N. Tramont
Robert G. Kirk

cc: Julius P. Knapp (via e-mail)
Bruce A. Romano (via e-mail)
Alan R. Stillwell (via e-mail)
Mark Settle (via e-mail)
Gary R. Thayer (via e-mail)

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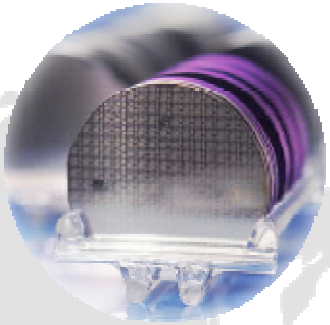
[1] *See* 47 C.F.R. §§ 1.1206(a), (b).

Hearing Aids and MedRadio

Modifications to Proposed Rules

February 6, 2008

AMI Semiconductor -- Overview



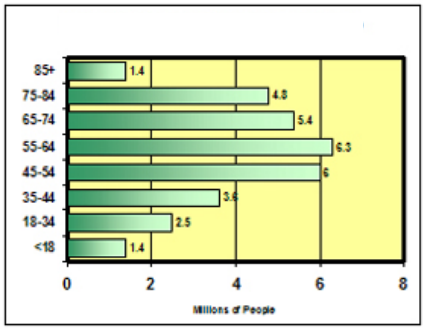
- Founded: 1966
  - Worldwide Headquarters: Pocatello, Idaho
  - Manufacturing: Idaho, Belgium, The Philippines
  - Design Centers: Worldwide Locations
- Revenues: $615.8M FY2007
- Employees: 2,900+ Worldwide
- Ownership: AMIS Holdings, Inc. (NASDAQ: AMIS)
- Business: Design and manufacture mixed-signal and digital semiconductor products for a variety of applications:
  - Automotive
  - Medical
  - Industrial
  - Communications
- Medical applications include:
  - Implantable Medical Devices (IMD) such as defibrillators, pacemakers, neurostimulators
  - Hearing and Audio Solutions (HAS) such as hearing aids, electronic stethoscopes
  - Diagnostics, Therapy, and Monitoring (DTM) such as glucose, pulse-oxy meters

Summary

- The MICS/MEDS bands are optimal for body worn communications
- MEDS bands provide perfect opportunity to permit deployment of next-generation hearing aids that improve hearing capabilities by utilizing wireless technology such as in:
  - Bi-directional ear-to-ear synchronization and communication
  - Remote sound pick up and relay to the hearing aid
  - Secondary audio device to hearing aid
- MEDS bands would be harmonized with international standards and therefore provide worldwide access and deployment capability for these hearing aids
- Deployment of next-generation wireless hearing aids in the MEDS bands would not interfere with MICS-based devices
- AMIS proposed rules that would permit deployment of these hearing aids in one of the two proposed MEDS bands

Hearing Aid Basics: Quick Facts

- Hearing loss population: **~1-in-10** (31.5 million in US)
- Low adoption rate: **~1-in-5 (20%)** in US & Western Europe
  ~5-6% in the rest of the world
- Reasons for low adoption: Stigma, cosmetics, denial, high cost, constrained channel, efficiency
- Binaural rate (two aids): **75-80% US**
  60% Western Europe; 10-12% rest of W.
- Avg. age of first time user: **69**
- Avg. replacement frequency: **5 years**
- Retail price: **$1,500-3,000**
- Global sales (retail): **~$10 billion**



US hearing loss population by age group

Sources: MarkeTrak VII (July 2005); Better Hearing Institute (BHI); Carnegie Research (2005)

Key Trends

Ever smaller, more features, even fashionable!

- Newer aids lower the average age of new users by 9 years
  - Increases new user rate by 29%-points
  - Helps more hearing impaired people

ITE Styles
Customized to shape of ear

BTE
Customized
ear mold

Mini BTE
Customized
ear mold

Mini BTE "Thin tube"
Non-occluding "open fit" ear molds
Standard ear mold sizes
Some designs place the receiver in the ear

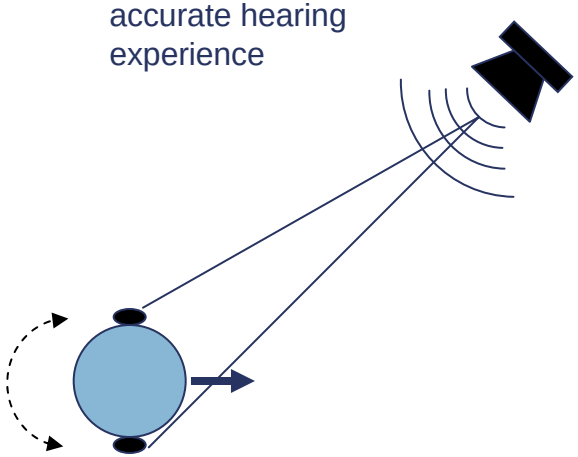
- **Popularity of smaller styles drive need for smaller electronics and smaller battery**
- **Desire for long battery life (at least one week) demands ultra-low power electronics**
- **And HAs must include new features all the time: such as wireless connectivity**

Source: Better Hearing Institute (BHI) Study, 2006

Where wireless enabled hearing aids can help today

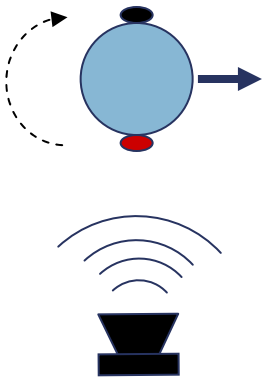
Wireless ear to ear synchronization for a better 3D listening experience

- The brain localizes sound by analyzing incoming delay and intensity differences between the L and R ear
- Two un-synchronized aids will individually amplify/correct the sound, resulting in lost directional information
- Wirelessly synchronized aids can exchange data to restore an accurate hearing experience



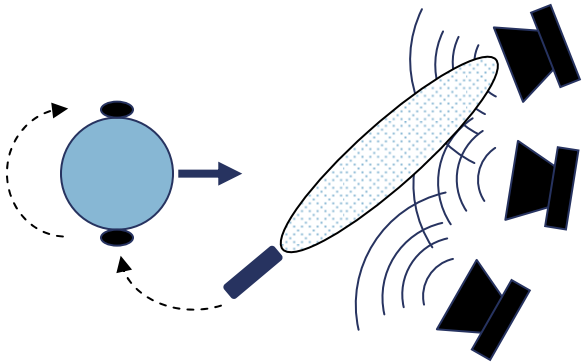
Wireless "sound relay" for more safety

- When sound emanates from one direction only, in the case where that side's ear is fully impaired, capturing the sound with the remaining ear can be challenging.
- Capturing and relaying the sound from one side to the other adds listening comfort, safety by restoring a 360° aural field!



Wireless "audio zoom" for increased listening comfort

- Hearing impaired peoples are challenged the most in noisy situations
- Hand-held or body worn "zooming microphones" can help select sounds of interest.
- Wirelessly relaying it to the aids adds freedom of movement

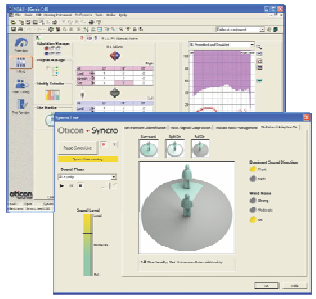


Wireless Link
Sound Waves
Sound pick up zone

Wireless hearing aid devices of tomorrow

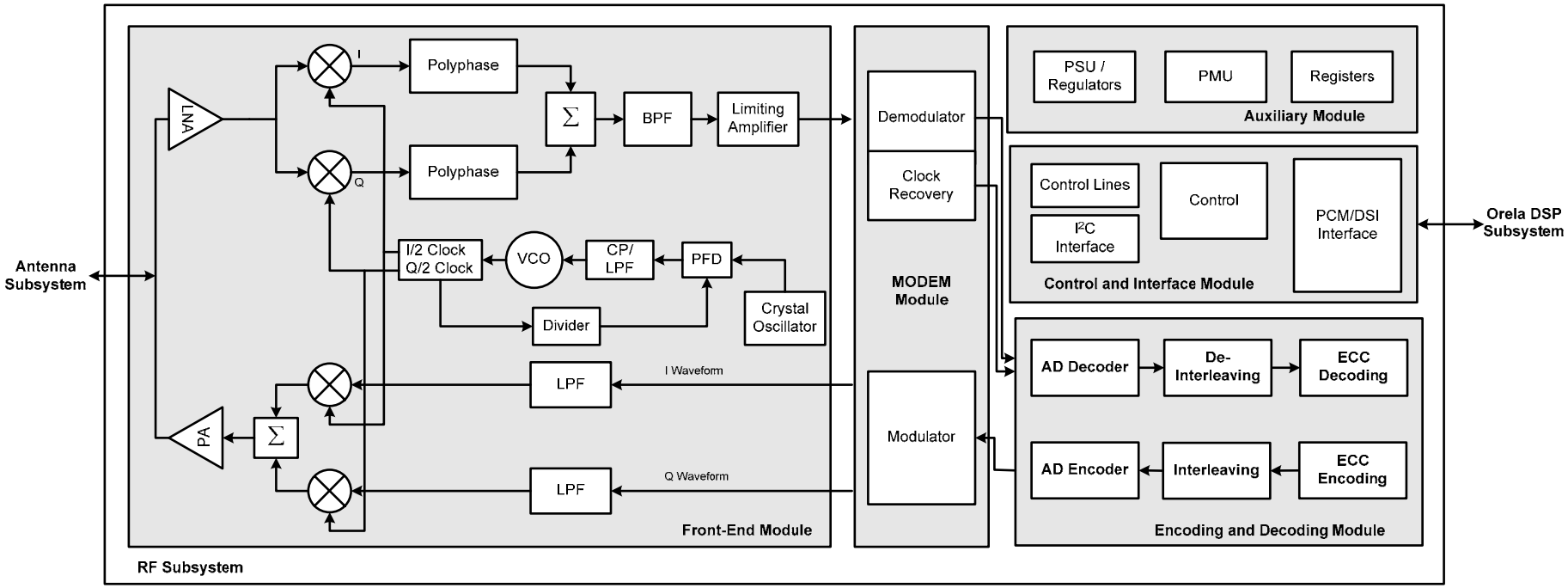
- **Future generations of wireless technology for hearing aids**
  - **Wireless connectivity with secondary audio devices (cell phones)**
    - Helps solve GSM interference issues with hearing aids (HAC)
    - Provides effective audio quality from GSM devices for the hearing impaired
  - **Wireless fitting**
    - To allow for an unimpeded listening experience for fitting
    - Wireless fitting allows for a better user experience for the use of the HA
    - Audiologist/Specialist can make changes to HA parameters in real-time

Wireless fitting (programming)



Connectivity with secondary audio devices (cell phone)

Ultra Low-Power Radio Hearing Aids
System block diagram



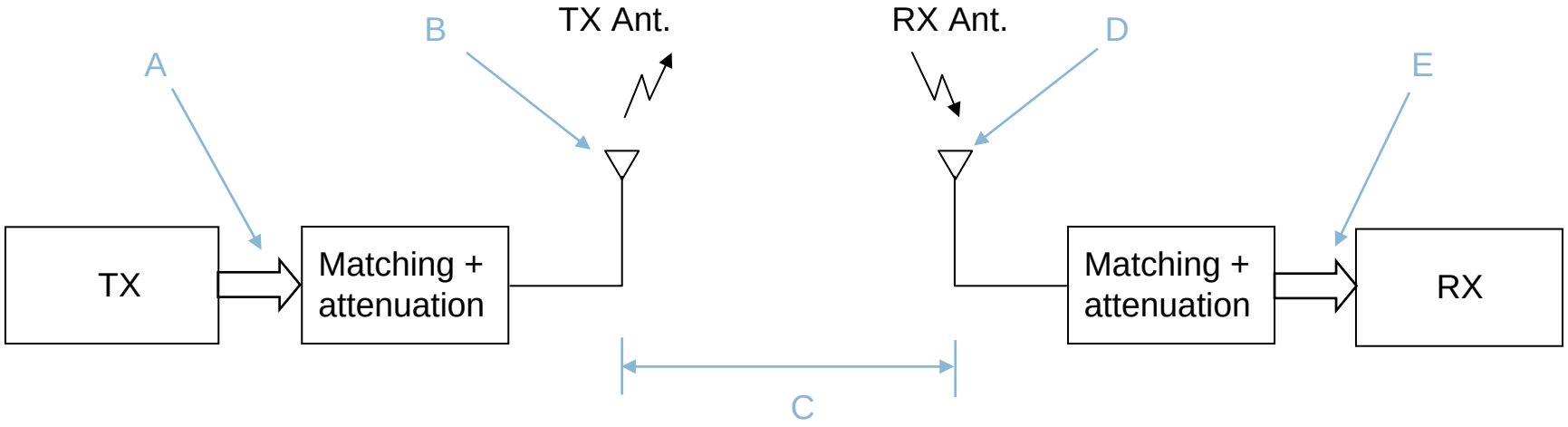
- All wireless functionality integrated into one single silicon chip
- Complete hearing aid system encapsulated into one module, including the audio/speech processing engine (DSP) and the required analog front-end and output stages: direct interface to microphones, speaker, controls and battery
- System antenna is designed to fit inside a hearing aid shell
- Complete RF system power consumption ~ 1.9mA drawn from a 1.25V Zinc Air battery

Ultra Low Power Radio Hearing Aids
Main characteristics

Parameter	Target Specification	Validated on silicon
Data Rate	128 kbps	131 kbps (using 26 MHz crystal)
Maximum Tx Output Power	-15 dBm	-15 dBm
Minimum Rx Sensitivity	-75 dBm	-83 dBm (@ BER=10E-3)
Maximum Bit Error Rate	10E-3	10E-3 (@ 1m comm. distance) – No ECC
Maximum Spurious Emission	-20 dBc (402-405 MHz)	< -20 dBc
Maximum Modulation Bandwidth	300 kHz @ -20 dBc	300 kHz @ -20 dBc
Maximum Current Consumption	1.3 mA	~1.9 mA
Communication Distance (CROS) HA to HA	0.35m	Up to 1m

Ultra Low Power Radio hearing aids

Typical estimated link budget



		Current MICS/ HA requirements	Proposed MEDS
A	TX Power EIRP	-16dBm	-36dBm
B	Matching plus antenna gain	0dBm	0dBm
C	6' (2 meters) free space loss (@405MHz)	-31dBm	-31dBm
D	RX antenna gain and matching	-10dBm	-10dBm
E	Headroom to decode the signal	**-67dBm**	**-87dBm**

Incoming signals below -85dBm assuming a 300kHz channel is a challenge for the AMIS ULP radio!

Example: TX @ -16dBm -10dBm antenna – path loss ➔ EIRP < -26dBm

Major challenges for wireless enabled HAs

- **World-wide Compatibility**
  - Hearing aid users travel across the globe. They need their wireless enabled hearing aids to operate anywhere in the world
- **Mechanical form-factor**
  - The mechanical size will only allow for a very integrated radio (few externals)
  - The antenna must be “protected” and inside the hearing aid housing, hence will be small
- **Power consumption**
  - The radio is constrained by the power provided by a small coin-cell battery.
- **Wireless link**
  - Studies show that the 400MHz frequency range is the “sweet spot” for in and around the body communications, with minimal loss due to body tissue absorption hence best “energy efficiency” from the radio.
  - The spectrum to be chosen **must be “protected” and free of interferers** with much more available radio output power

Proposed MEDS Rules

- New § 95.401(h). The Medical Device Radiocommunication Service ("MedRadio" or "MEDS") – a service that may be used for ultra-low power transmissions from implanted and body-worn devices that restore bodily functions (*i.e.*, sight, hearing, muscle movement) and/or perform critical diagnostic, therapeutic, or monitoring functions. The rules for this service are contained in subpart M of this part.

- Add new § 95.631(l). MEDS transmitters may transmit any emission type appropriate for communications in this service. Given potential hearing aid applications, MEDS transmitters may be used to provide voice communications.

- The MEDS wing bands are perfectly suited for wireless Hearing Aid operations but:
  - The MEDS maximum allowed duty cycle and EIRP should be the same as for MICS --16dBm, 100% DC
  - 300kHz is necessary for optimal hearing aid operation, thus aggregation of the 100kHz channels should be permitted
  - Only one of the two MEDS wing bands is necessary for hearing aid applications.

Proposed MICS/MEDS Band Plan

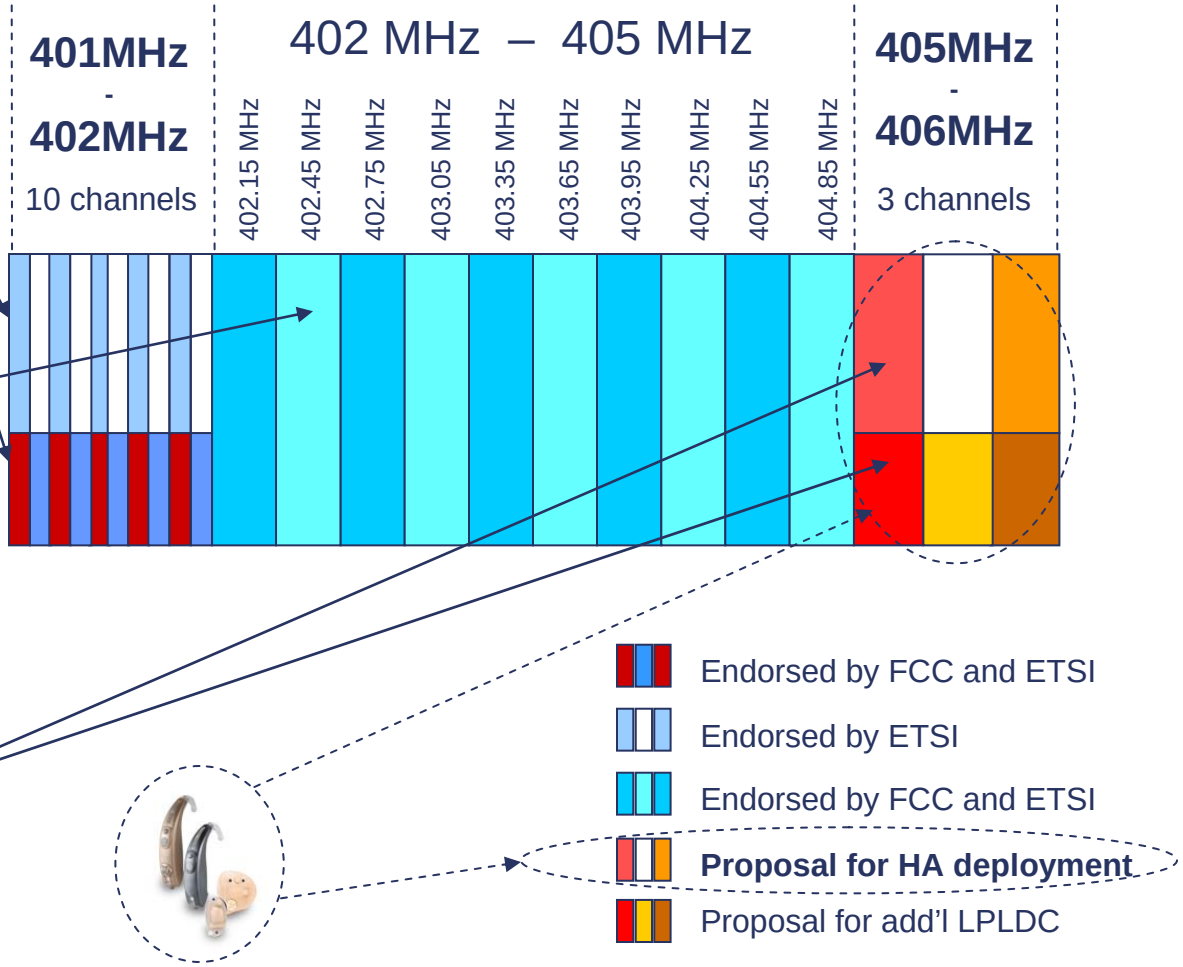
To Accommodate hearing aid deployment

MEDS lower wing band
10 channels 100kHz
-36dBm, no CCA, no LBT
RX/TX and TX only, 0.1% DC

-16dBm, LBT, 100% DC

MICS
10 channels 300kHz
-16dBm, CCA + TX on LIC, 100% DC

MEDS upper wing band
Can combine up to 3 x 100kHz channels (for a total of 300kHz)
-16dBm, LBT, 100% DC



For additional information

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