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September 14, 2007

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: **NOTICE OF *EX PARTE* MEETINGS**

ET Docket No. 04-186; Unlicensed Operation in the TV Broadcast Bands

Dear Ms. Dortch:

On September 13th, 2007, Shure Incorporated ("Shure") met with Renée Crittendon, Legal Advisor to Commissioner Adelstein, to discuss Docket No. 04-186. Attending this meeting on behalf of Shure were Ahren Hartman, Director, Platform Planning, and Edgar Reihl, Technology Director, Advanced Development, along with Catherine Wang and Tim Bransford of Bingham McCutchen LLP, outside counsel to Shure.

During this meeting Shure reemphasized the irreplaceable role that wireless microphone operations play in broadcasting, news, sports, entertainment, theatre and within Houses of Worship. Shure stressed that the record before the Commission does not support the introduction of personal/portable devices in the broadcasting "white spaces." Nor does the record support spectrum sensing technology as an effective interference avoidance mechanism for unlicensed operations in the aforementioned bands.

To the extent the Commission continues to contemplate the introduction of unlicensed devices in the "white spaces," Shure urged the Commission to adopt meaningful technical requirements that protect incumbent operators. Specifically, in order to provide minimal adequate protection for incumbent operators, Shure asked the Commission to follow the recommendations of IEEE 802.22 and incorporate adjacent TV channel protection, IEEE 802.22's full set of Dynamic Frequency Selection ("DFS") parameters, network sensing requirements, and beacon protection.

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A summary of Shure's position and a Power Point presentation submitted to the Commission regarding Docket No. 04-186 are attached to this filing. If you have any questions regarding these meetings, please do not hesitate to contact the undersigned.

Very truly yours,

/s/

Catherine Wang
Timothy L. Bransford

cc (by email): Renée Crittendon

Unlicensed Devices in the "White Spaces"
ET Docket 04-186
SHURE INCORPORATED

- Shure has worked constructively with OET for 4 years on White Spaces interference issues

- Wireless microphone operations at stake include broadcasting, news, sports, entertainment, theatre, Houses of Worship, etc. The "white spaces" are not vacant!

- We applaud the Commission's commitment *not* to take actions that would cause interference to existing operations

- Significant engineering analysis shows interference to TV, wireless microphones, and cable equipment

- Prototype devices failed FCC spectrum sensing testing

- No field testing has been done

- The record before the Commission does not support going forward with personal portables

    - Not enough information to write meaningful technical requirements
    - Spectrum sensing as an interference "solution" in the TV bands has not been demonstrated
    - Personal portable devices are not necessary to achieve the Commission's rural broadband goals

- Adjacent channel protection is critical for the introduction of <u>any</u> (fixed or portable) white spaces device

    - The IEEE, the world's largest engineering organization, concluded that White Space devices could operate without interference to existing TV and wireless microphone operations if operation on channels adjacent to TV signals are excluded.
    - Rural channels free from interference need to be identified.
    - Other interference protection measures are also important; Shure has identified those measures to OET and in comments.

- Consumers and users from many different sectors stand to suffer and have expressed concern about the interference that will be caused by personal portable white space devices.

American Arts Alliance
American Federation of Musicians (AFM)
American Federation of Television and Radio Artists (AFTRA)
Association for Maximum Service Television, Inc. (MSTV)
American Symphony Orchestra League
Association of Performing Arts Presenters
ATK Audiotek Corp.
Audio-Technica U.S., Inc.
Billboard Magazine
Capitol Broadcasting Company, Inc.
City of New York
Cohen, Dippell and Everist, P.C.
Community Broadcasters Association (CBA)
Country Music Association (CMA)
Cox Broadcasting, Inc.
Dance/USA
ESPN, Inc.
Front of House Magazine
GE Healthcare
Grand Ole Opry
Guitar Center, Inc.
Mr. Ed Greene (Emmy award winning audio engineer)
Hitachi Home Electronics (America), Inc.
Hubbard Broadcasting Company, Inc.
IEEE (Institute of Electrical and Electronics Engineers)
International Music Products Association (NAMM)
The League of American Theatres and Producers
Learfield Communications, Inc. (manager of multi-media rights of 35 major universities)
LG Electronics
Major League Baseball (MLB)
Masque Sound
McGraw-Hill Broadcasting Company, Inc.
Media General, Inc.
NASCAR
The National Academy of Recording Arts and Sciences (NARAS)
National Alliance for Musical Theatre
National Association of Broadcasters (NAB)
National Basketball Association (NBA)
National Cable & Telecommunications Association (NCTA)
National Collegiate Athletic Association (NCAA)
National Football League (NFL)
National Hockey League (NHL)
The National Religious Broadcasters (NRB)
National Translator Association
OPERA America
Panasonic Corporation of North America
The PGA Tour
The Professional Audio Manufacturers Alliance (PAMA)
Production Resources Group (PRG Audio)
Professional Wireless Systems
Radio-Television News Directors Association (RTNDA)
The Recording Academy (GRAMMYs)
The Recording Artists' Coalition
Roadstar Internet
Samsung Electronics
Sennheiser USA

Shure Incorporated
Sound Associates, Inc.
Sports Video Group
Springboard Productions, Inc.
Sprint Nextel Corporation
Mr. James Stoffo (RF coordinator for multiple NFL “Super Bowls” and other high profile events)
Theatre Communications Group
TTE Corporation (RCA)
TV Transmission Antenna Group, Inc.
Mr. Ed Wieczorek (former head of RF engineering for NBC operations at Rockefeller Center)
Wireless First
Wireless Internet Service Provider's Association (WISPA)
Wolfpack Sports Marketing (affiliated with North Carolina State University)

-- White Spaces -- Wireless Microphone Solutions

FCC OET 04-186
13 September 2007
Shure Incorporated

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Wireless Microphone Solutions

Proposed solutions for protecting Wireless Microphones from harmful unlicensed White Space Device (WSD) interference:

1. Adjacent TV Channel Protection
2. Effective DFS Spectrum Sensing Protection
3. Beacon Protection

IEEE 802.22 supports using all three solutions for microphone protection and successful WSD operation.

The FCC can protect wireless microphones from new unlicensed WSD interference by adopting these solutions into the Part 15 rules.

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Adjacent Channel Protection Benefits

IEEE 802 studies concluded Adjacent Channel Protection prevents interference to DTV and Wireless Microphones and also benefits White Space Devices

White Space Devices Benefits

- Eases out-of-band emissions requirements for WSD transmitters to protect DTV

TV Broadcasting Benefits

- Protects DTV transmission from out-of-band emissions interference
- Allows successful planned microphone frequency coordination for sports, political, and religious events

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Adjacent Channel WSD Filtered Operation Will Interfere with DTV

The FCC WSD test report stated that adjacent channel interference only extended for a distance of 2 meters

--BUT--

- This assumed the use of a very expensive, laboratory grade filter on the output of the WSD transmitter
- The output power was reduced by the filter/attenuator to only 6.6 mW, not the 100 mW proposed by the White Spaces Coalition (11.8 dB difference)
- The TV signal used for the test was also more than 20 dB above TOV

+11.8 dB – (-20 dB) = 31.8 dB power difference

31.8 dB power difference => 38.9 times distance factor

2 meters * 38.9 = 77.8 meters

Using the Commission's data, but factoring in WSD operation at 100 mW with a desired DTV signal near TOV, ***the interference distance would actually be 77.8 meters (252 feet)!***

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An Unfiltered WSD Device Is Even Worse

- The FCC WSD tests also measured adjacent channel interference from an *unfiltered* WSD transmitter. In that case, interference extended for a distance of **47 meters**, which is *not* insignificant!
- As before, the TV signal used for the test was more than 20 dB above TOV

  20 dB power difference

  20 dB power difference => 10 times distance factor

  47 meters * 10 = 470 meters

Again, using the Commission's data for this test, but assuming a desired DTV signal near TOV, ***the interference distance would actually be 470 meters (1542 feet)!***

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WSD Adjacent Channel Operation

- Unfiltered WSD operation in adjacent TV channels will cause DTV interference out to **1542 feet** (in prior example)
- FCC OET Report shows adjacent channel WSD operation **<u>not possible</u>** without causing interference to DTV

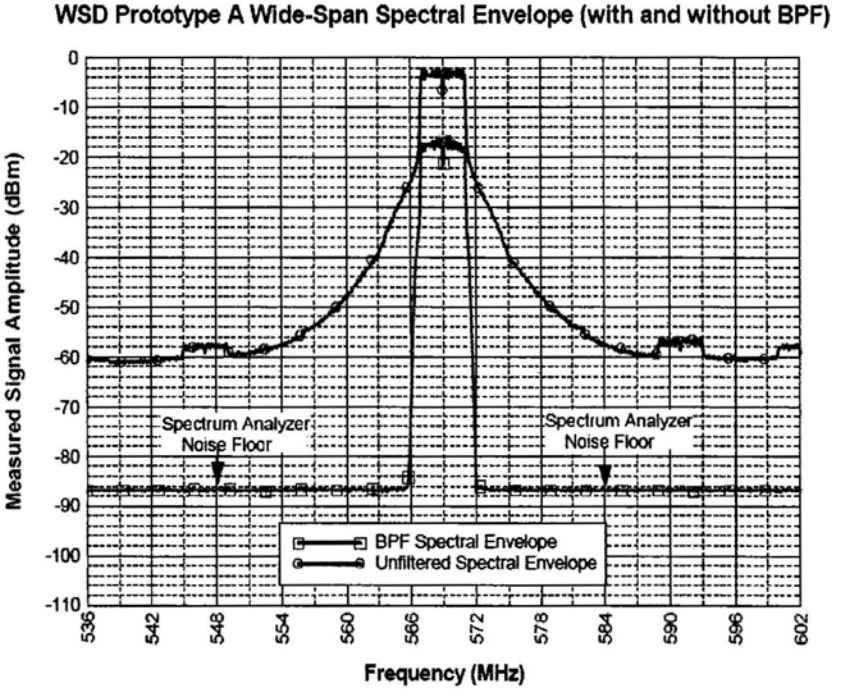

Figure 4-9. Prototype A Emissions on Channel 30 and N±5 Adjacent Channels.

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Adjacent Channel Protection

Adjacent Channel Protection benefits:

- Example: **2007 National Football League Opening Night Broadcast**
  - **6** days of setup, rehearsal, frequency coordination
  - **130** channels of wireless audio used for TV broadcast
  - **13.5** Million TV audience viewers
  - Advanced coordination between NBC, Society of Broadcast Engineers (SBE) and independent wireless consultants made possible by available spectrum

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NFL 2007 Opening Night Broadcast

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Spectrum Sensing Not Proven To Work

Effective Spectrum Sensing requires ALL of the following:

- **Compliance to ALL DFS parameters in real-world testing**
  - Cannot just test sensing threshold
- **Network (distributed) sensing**
  - Must require more than one device to sense environment
  - Sensing is useless without networked devices sensing simultaneously
- **Make Interference Range = Sensing Range of WSD**
  - Achieved by reducing the WSD power level by the difference in path loss between WSD and microphone

EXAMPLE from prior OET presentation (next slide):
WSD transmit distance path loss = 127 dB
Sensing distance path loss = 114 dB
Path loss difference = 13 dB (127 dB – 114 dB)

Reduce 100mW WSD transmit by 13 dB =~ 5-10 mW

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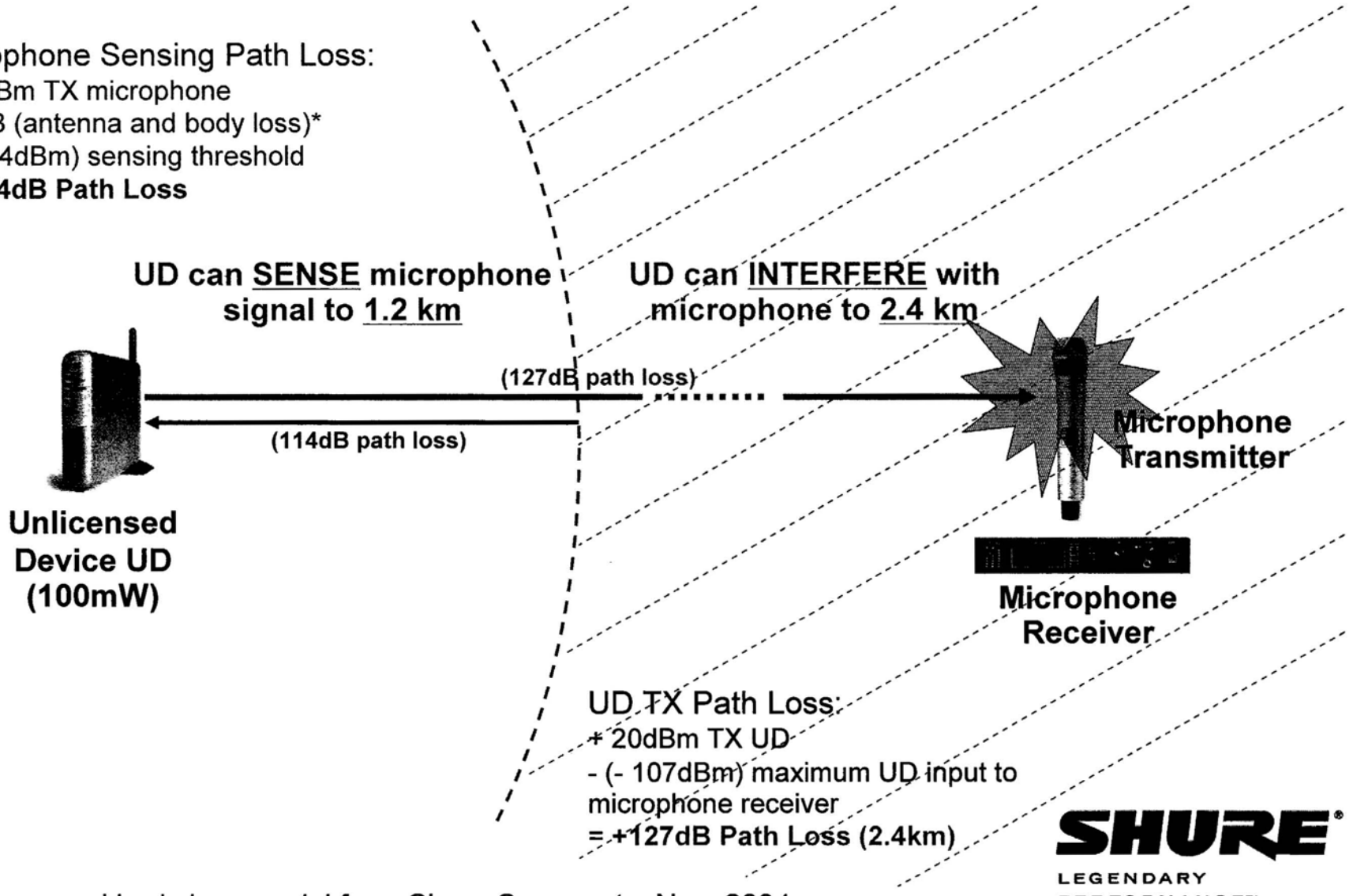
EXAMPLE: Spectrum Sensing

Microphone Sensing Path Loss:
+ 10dBm TX microphone
- 10dB (antenna and body loss)*
- (- 114dBm) sensing threshold
= +114dB Path Loss



* Antenna and body loss model from Shure Comments, Nov. 2004

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Spectrum Sensing Not Proven To Work

IEEE 802.22 Dynamic Frequency Selection (DFS) Parameters for protecting Wireless Microphones

DFS Parameter for Wireless Microphones	Value
Channel Availability Check Time	30 sec
Non-Occupancy Period	60 minutes
Channel Detection Time	500 msec
Channel Setup Time	2 sec
Channel Opening Transmission Time (Aggregate transmission time)	100 msec
Channel Move Time (In-service monitoring)	2 sec
Channel Closing Transmission Time (Aggregate transmission time)	100 msec
Interference Detection Threshold	-107 dBm

As it stands in the FCC OET report, **spectrum sensing is not effective** in protecting wireless microphones

FCC OET Report only tested <u>ONE</u> of the <u>EIGHT</u> DFS variables needed to protect microphones

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Beacon Protection

Beacon protection is required to protect Wireless Microphones for:

- Super-scale TV broadcast productions such as the Olympics and,
- Unanticipated events such as emergency and disaster communications and broadcast coverage

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Fixed Deployment Only Is Feasible

IEEE 802.22 engineering analysis is the only group to address DTV and Wireless Microphone protection from unlicensed White Space Device interference

- 802.22 only developing standard for FIXED service only
- Concluded **Adjacent Channel Protection** is required to protect both DTV and Wireless Microphones
- There is NO work to study personal/portable issues within IEEE 802

As it stands in the FCC OET report, **spectrum sensing is not effective** in protecting Wireless Microphones or DTV

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