Evaluation of Sound Perception to Identify Candidate Frequency for Wireless Networking

Paper authors:

Kuruvilla Mathew,

CE Tan, Biju Issac

Organisation

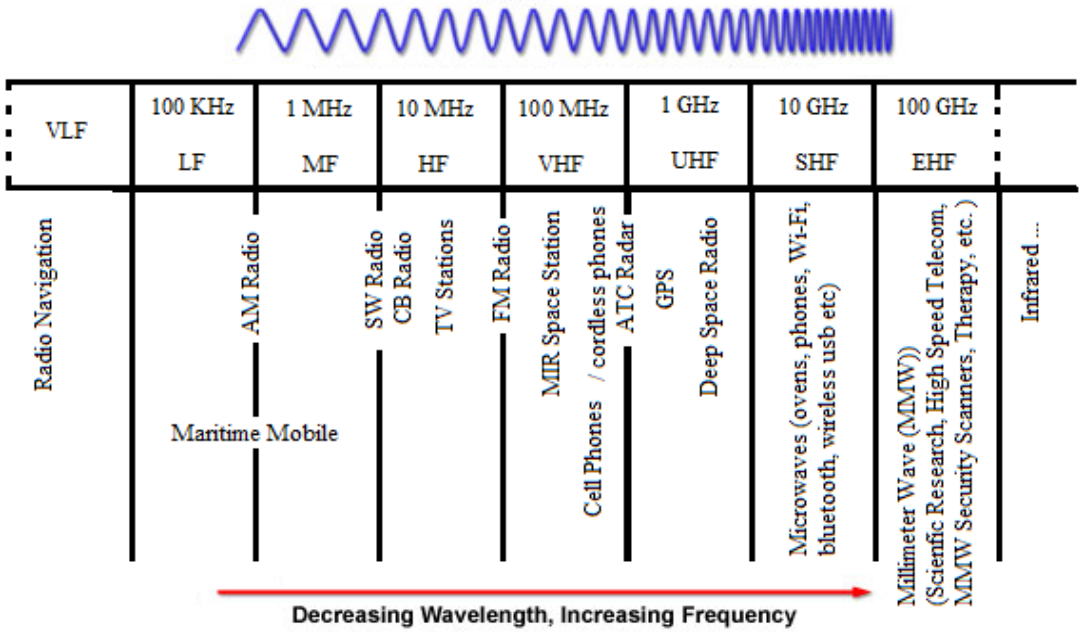
- Introduction
- Background and context
- The Survey, Analysis and Results
- Noise Analysis on Candidate Frequencies
- Conclusion
- Summary and Future Work

Introduction

- Wireless signal for dense jungle terrain
  - Ubiquitous Wireless Signal
  - Power efficient
  - Lower attenuation over obstacles
  - Cost effective
- Sound
  - Perceivable range? Normally not tested above 8 KHz [9]
  - culturally, demographically and age neutral survey
  - Noise profile of the candidate frequency

Background and Context

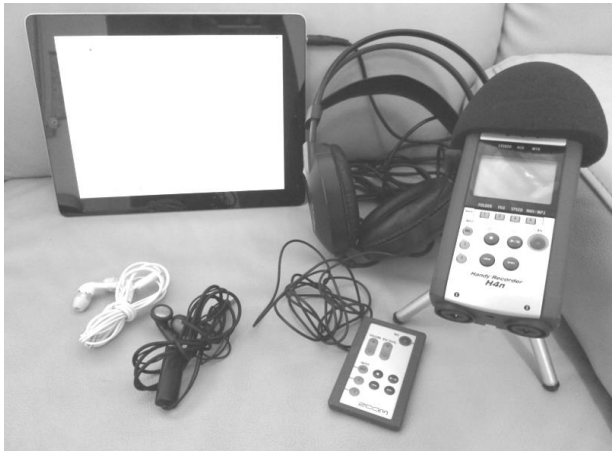
- Popular Wireless Signals
  - Nature of the signals
- The Terrain
  - Jungle
- New Signal Idea
  - Sound and Percievable Frequency
- The Survey



The Survey, Analysis, Results

- Population
  - Culture, Gender and Age Neutral
- Signals
  - Low freq from 15 Hz to 250 Hz
  - High freq from 12 KHz to 22 KHz
- Hardware
  - iPad, AKG K99,

  Zoom H4n, phones…



The Survey, Analysis, Results

- Process
  - Normal environment,
  - White noise calibratior
  - Play for Lowest to higher & highest to lower freq
- Results

  < 25 Hz

  > 18 KHz

TABLE I
RESULTS OF AUDIO PERCEPTION SURVEY

DocN	Geo	AG	Low (Hz)	High (KHz)
JL1325-01	India, Middle/ S. Asia	< 15	25	17
JL1325-02	Indonesia, E. Asia	< 30	30	16
JL1325-03	Malaysia, E. Asia	< 30	50	17
JL1325-04	Australia, Oceania	< 30	35	17
JL1325-05	Netherlands, Europe	< 30	35	16
JL1325-06	Hungary, Europe	< 30	35	14
JL1325-07	Korea, E. Asia	< 55	50	14
JL1326-01	Brazil, S. America	< 30	30	14
JL1326-02	Malaysia, E. Asia	< 30	30	14
JL1329-01	Japan, E. Asia	< 55	25	14
JL1329-02	Switzerland, Europe	< 30	30	14
JL1330-01	Malaysia, E. Asia	< 30	40	18
JL1330-02	England, Europe	< 30	30	17

DocN = Participant Response Document Number (name not included to protect respondent privacy); Geo = Geography/ Country, AG = Age Group; Low = Lowest Perceived Frequency, High = Highest Perceived Frequency

The Survey, Analysis, Results

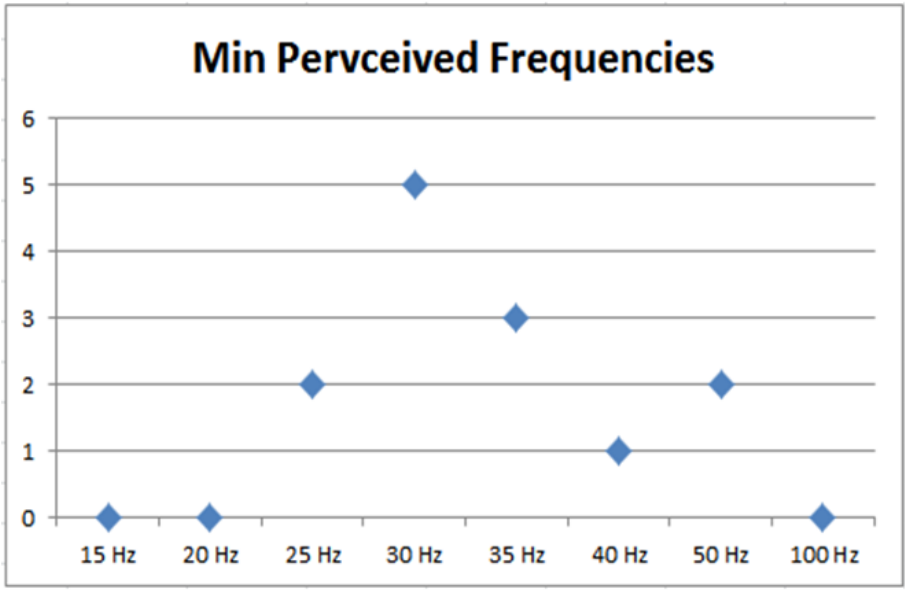


Fig. 3. Survey result plotted for frequency of sound against number of participants who's lowest perceivable frequency

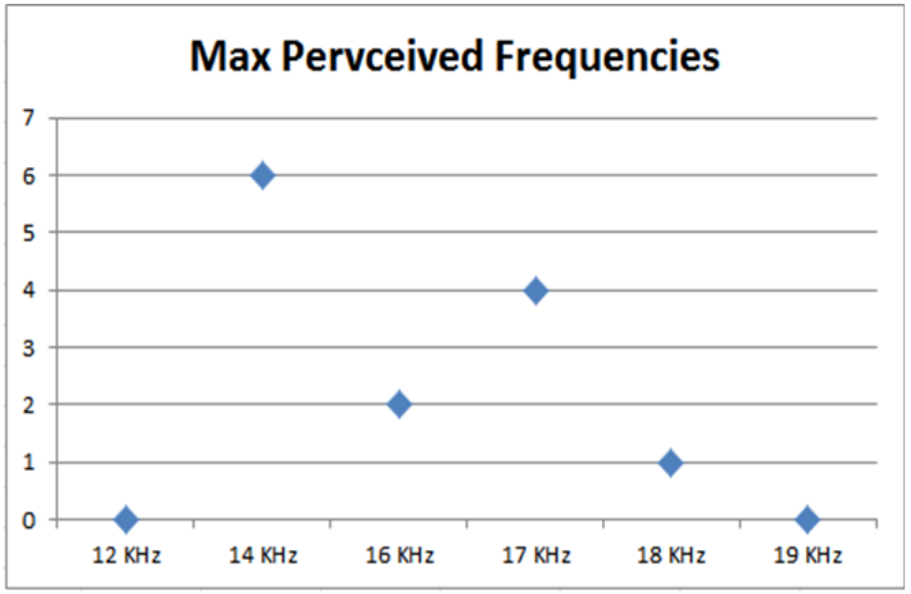


Fig. 4. Survey result plotted for frequency of sound against number of participants whose highest perceivable frequency

Noise Analysis on Candidate Freq

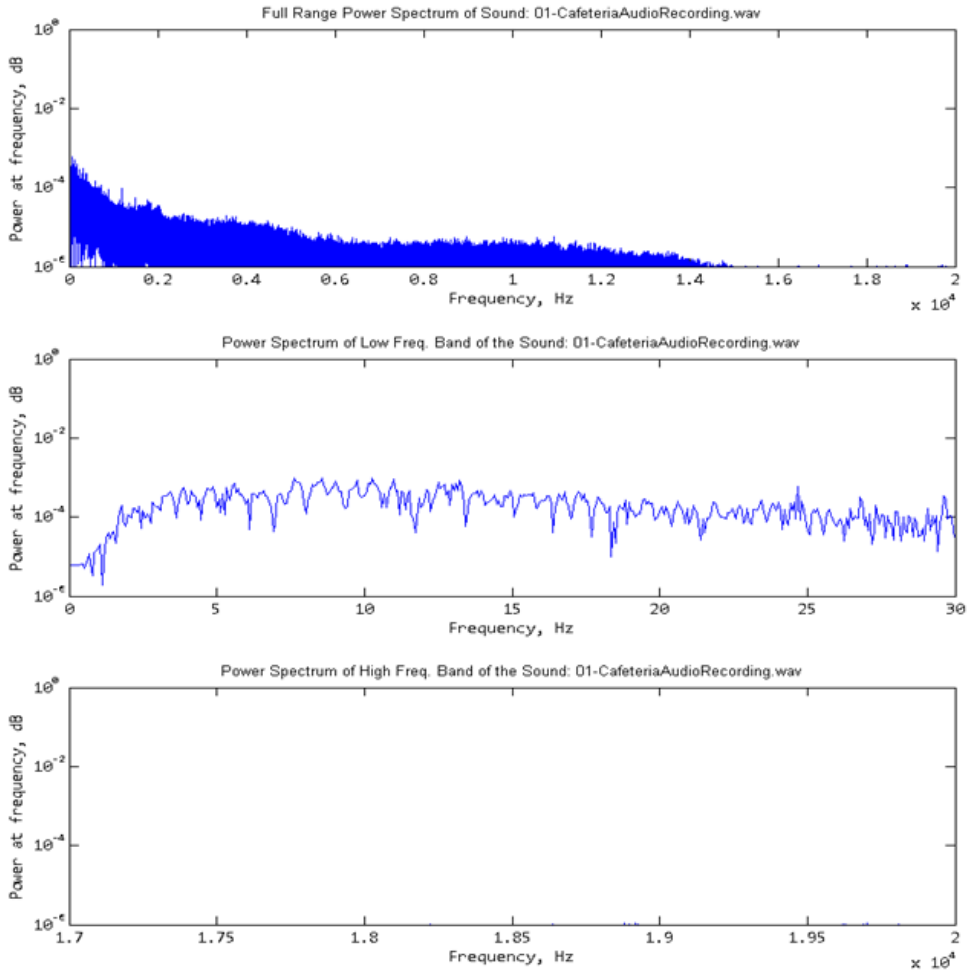
- Ambient Noise
- Candidate bands
- Zoom H4n Recording
  - Standardised mic settings for comparability
- Matlab
  - Filter and analysis

Noise Analysis on Candidate Freq

- Results …

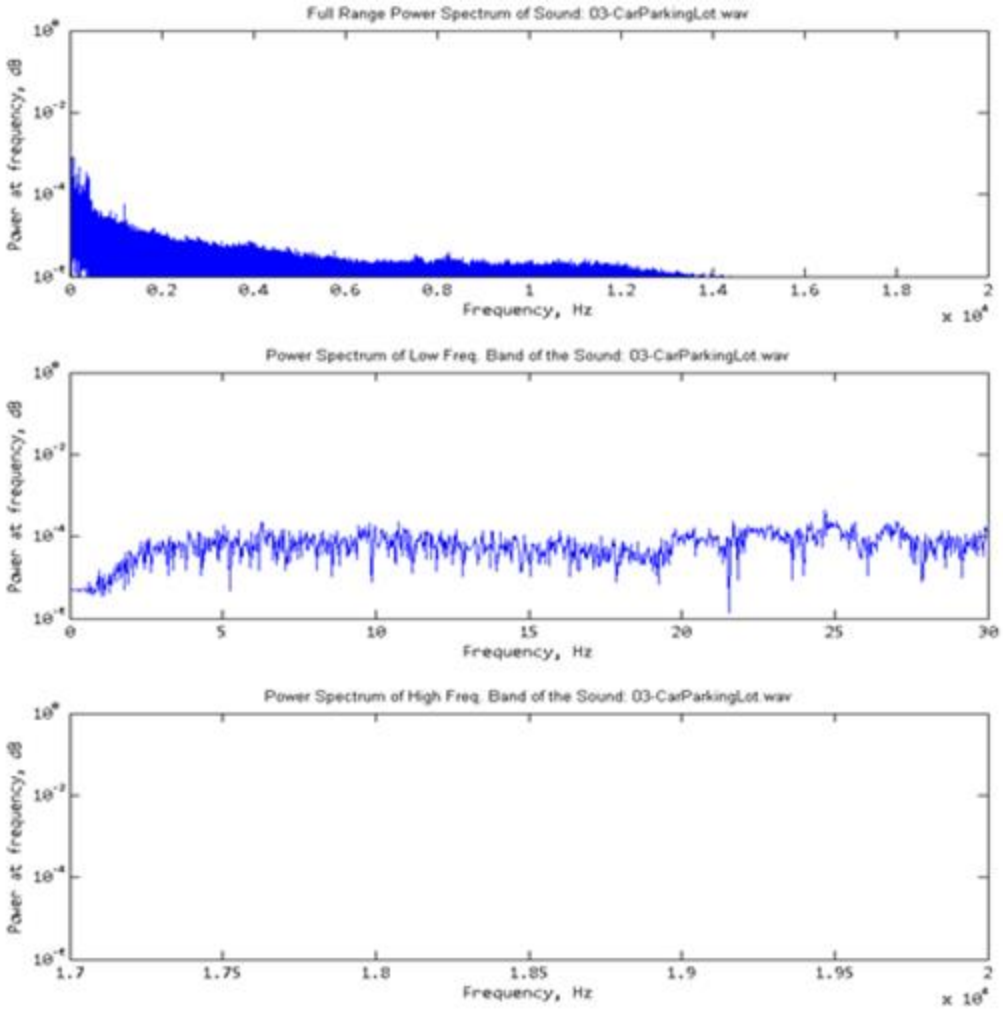
- Consistent pattern (up to 10^{-6} db)
  - Low or absent high freq noise
  - Strong presence of low freq noise

Noise Analysis on Candidate Freq



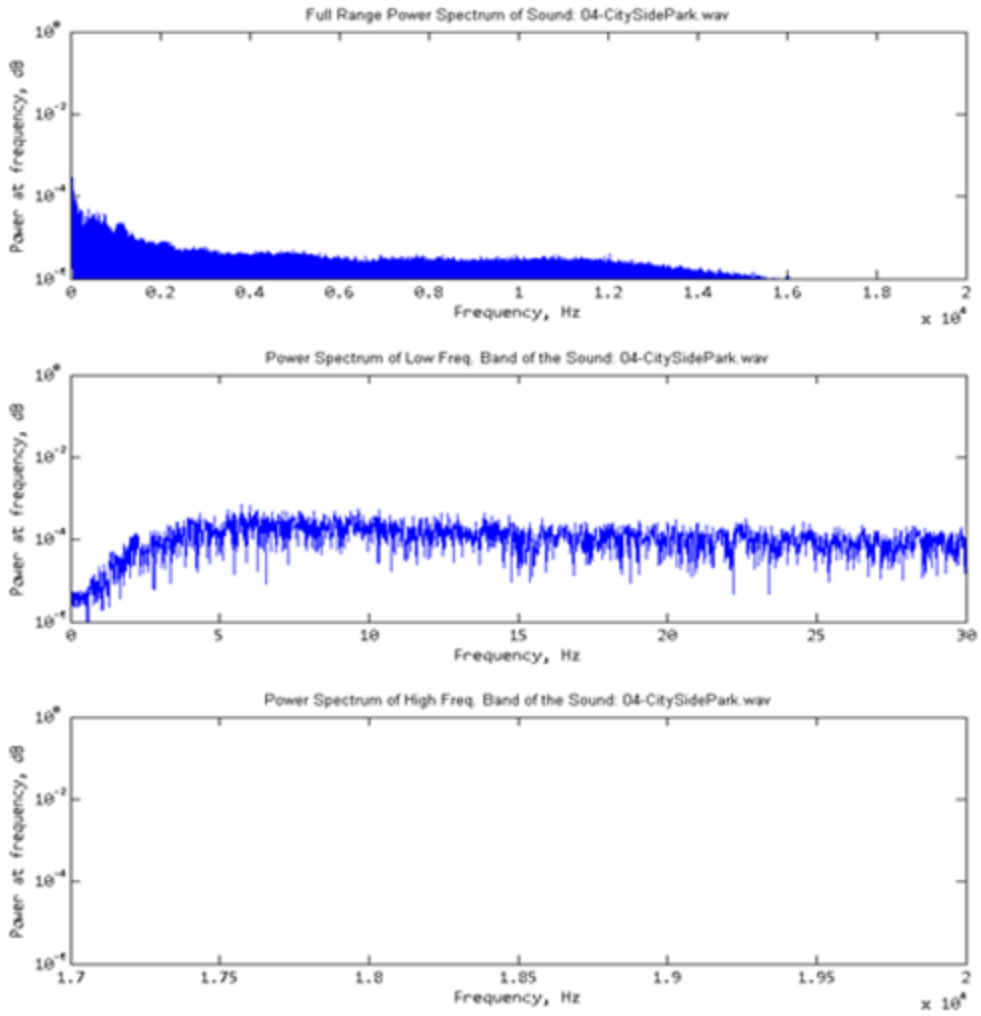
Cafeteria Noise Analysis

Noise Analysis on Candidate Freq



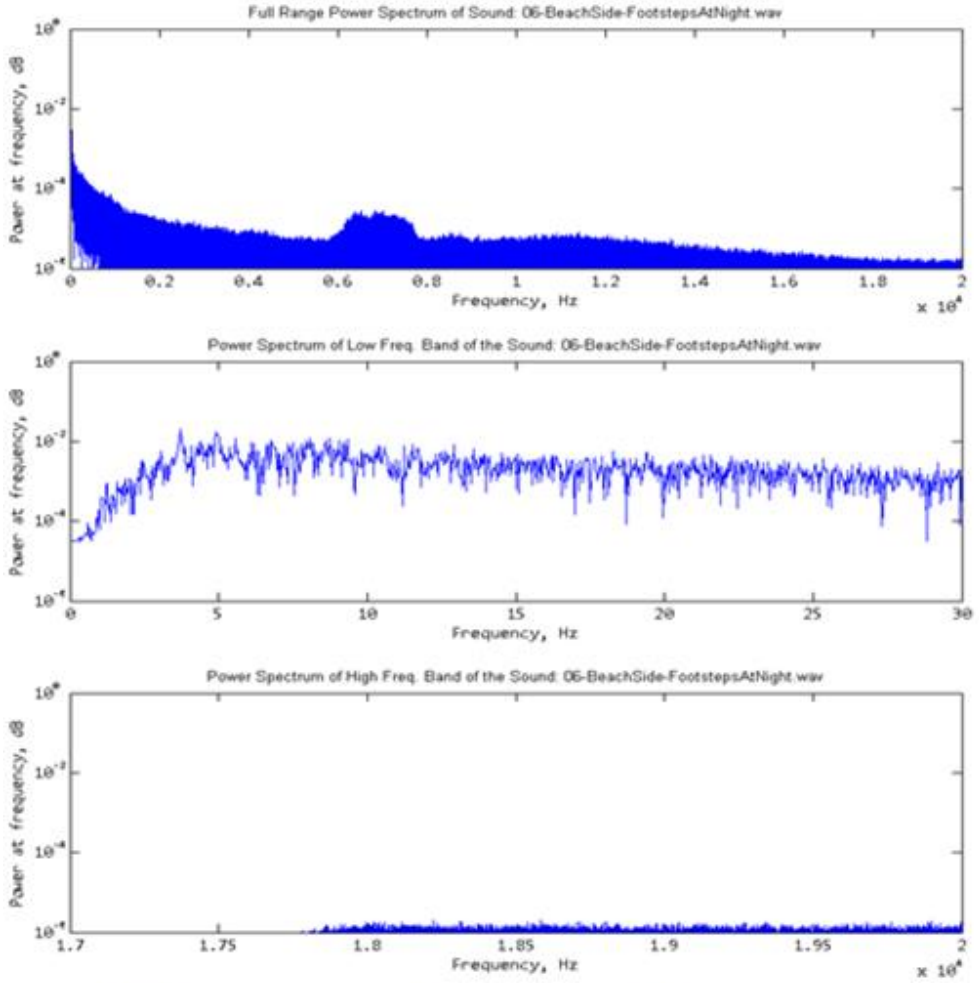
The Car Park Noise Analysis

Noise Analysis on Candidate Freq



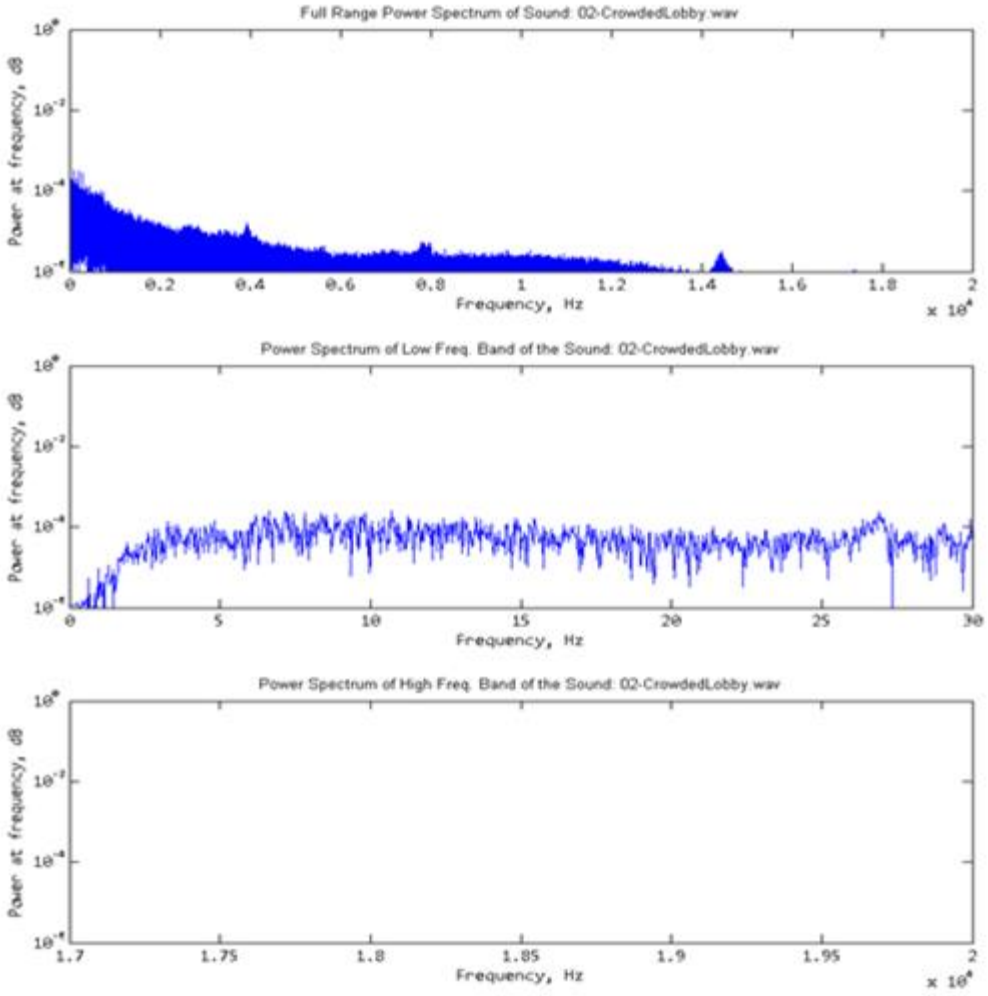
City Side Park Noise Analysis

Noise Analysis on Candidate Freq



The Beach at night with footsteps Noise Analysis

Noise Analysis on Candidate Freq



The Crowded Lobby Noise Analysis

Conclusion

- Quieter high frequency band
- High frequency band can support higher data rate
- Ubiquitous devices may work better with higher frequency with little or no modification

Summary and Future Work

- Study noise in target environment
- Study actual attenuation in target environment
- Study usability of ubiquitous consumer devices
- Study data encoding over sound