Wiley Rein LLP

1776 K STREET NW
WASHINGTON, DC 20006
PHONE 202.719.7000

www.wileyrein.com

Stamp and Return

February 2, 2017

Gregory L. Masters
202.719.7370
GMasters@wileyrein.com

VIA HAND DELIVERY

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

Accepted / Filed

FEB - 2 2017

Federal Communications Commission
Office of the Secretary

Re: **Alpha Media Licensee LLC**
WIIL(FM), Union Grove, Wisconsin
Facility ID No. 28473
Report Pursuant to Experimental Authorization

Dear Ms. Dortch:

Pursuant to 47 C.F.R. § 5.203 and the May 27, 2016 letter of the Deputy Chief, Audio Division, Media Bureau (the "Bureau Letter"), we are transmitting herewith on behalf of Alpha Media Licensee LLC ("Alpha"), licensee of WIIL(FM), Union Grove, Wisconsin, the required report following the completion of the experimental operation authorized by the Bureau Letter. The testing was performed on an intermittent basis between September 15, 2016 and December 14, 2016 under Alpha's supervision, in association with technical services provided by Geo-Broadcast Solutions, LLC ("GBS"). The principal focus of the testing was to determine the efficacy of the GBS technology in a mobile environment.

Should there be any questions concerning this matter, please contact the undersigned.

Very truly yours,

Gregory L. Masters

cc: James Bradshaw, Audio Division, Media Bureau (via e-mail)
Robert Gates, Audio Division, Media Bureau (via e-mail)

ZoneCasting™ Proposed Test

Geo-Broadcast Solutions, LLC
Alpha Media Licensee, LLC Partnership

WIIL(FM) Channel: 236B 95.1 MHz Union Grove, WI
ZoneCasting Zone: Milwaukee, WI

Geo-Broadcast Solutions, LLC
875 North Michigan Ave.
Suite 3708 |
Chicago, IL 60611

December 21, 2016

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EXECUTIVE SUMMARY

BACKGROUND FOR TEST AUTHORITY

Geo-Broadcast Solutions, LLC, ("GBS") has developed a system whereby a network of synchronous FM boosters can originate programming separate from a primary FM station – a system known as "ZoneCasting™". This technology uses lower power, lower height FM transmitters operating on the same frequency, and within the service contour, of a primary FM station transmitter. This test plan is intended to determine the compatibility of ZoneCasting with standard FM broadcast stations and measures the potential for interference received by listeners.

GBS has filed a Petition for Rulemaking to modify FCC rule 47CFR 74.1231(i) to allow the Zonecasting system to operate without further experimental authority from the Commission. Experimental Authorizations have been granted by the Commission and tests have been successfully conducted in Avon Park, Florida, and Randolph, Utah, and the latest tests have just been completed in the Milwaukee area under the Experimental Authorization granted by the Commission on May 27, 2016. The station which was utilized in the most recent testing was WIIL(FM) Channel: 236B 95.1 MHz Union Grove, Wisconsin, which is licensed to Alpha.

GENERAL DESCRIPTION OF TEST

GBS has developed a system that will allow an FM radio station to divide its signal into segments with the use of proprietary booster system design, audio and control switching, IP routing, hardware, software and implementation techniques. This innovative idea allows a primary FM broadcast station to run different audio messages, such as Public Service Announcements (PSAs), traffic, weather, amber alerts, and commercial announcements on different booster transmitters simultaneously, thereby creating additional time capacity for such announcements. GBS holds U.S. Patent # 8,862,048 on this technology "Equipment, System and Methodologies for Segmentation of Listening Area into Sub-Areas Enabling Delivery of Localized Auxiliary Information", as well as patents pending. This third test focuses on mobile testing and resulting audio transition quality.

With the tests described herein, GBS conducted experimental operations on station WIIL (FM) to determine the feasibility of broadcasting independent, targeted messages on co-channel FM Booster stations in the Milwaukee, Wisconsin area. GBS constructed four temporary FM Booster sites with seven FM Boosters to periodically broadcast noncommercial announcements on the booster stations while simultaneously broadcasting different programming on the main station. This created a ZoneCasting "Zone" in downtown and northeast Milwaukee. The urban test area posed unique challenges to the system design due to multiple sources of signal reflections. It was thought that this type of implementation creates the most stress on the system and created a difficult and challenging test bed.

Leading up to and incorporated in this test, technology and propagation analysis developed and utilized by GBS and its technical partners and the knowledge gained from this and the previous tests has allowed GBS to significantly advance the art since the first tests were established five years ago. Synchronization of the main transmitter with the booster transmitters has developed significantly over the last few years, allowing identical modulation to within just a few tenths of one decibel, identical frequency matching using GPS synchronization, and stable, real-time FM envelope synchronization has been developed to a point not achievable until recently. Characterization of FM exciters used in various brands of transmitters has also added to the knowledge base so that precise control of the synchronization can be better achieved. The art has progressed in the areas of synchronization such that when local programming is not separate from main programming, the simulcast local in-building listening quality and signal strength is augmented over that of just the main transmitter alone with virtually no areas of self-interference even with no terrain blockage. This enhances the listening experience in all environments. When separate programming is introduced to the boosters in the Zone area, the close matching of many of the above parameters can also significantly reduce any interference areas even though the programming itself is different.

Based upon the test routes driven and analysis conducted by GBS, when separate programming is initiated in the Zonecasting zone, an area, in this case, covering under one percent of the total listening audience, interference is received in the transition area only during the brief time programming is separate. By placing multiple close-by low-height transmission "nodes" and back-to-back antennas, GBS has reduced the interference in the transition zone between differing program materials in most cases to well under fifteen seconds, in most instances, in the mobile environment.[2]

The detailed description, test routes, and analysis of the testing conducted during the FCC authorized Experimental Authorization follows this executive summary.[3]

ZONECAST DESIGN

In addition to internal GBS research and field tests, GBS has funded and has quantified research results to determine the parameters for interference with a ZoneCasting network. The parameters were derived from accurate simulations of transmitted FM signals at NPR Labs, which

[2] Clearly this is *de minimus*.
[3] Audio samples will be provided upon request.

were then evaluated by a large group of listeners in controlled subjective testing at Towson University[4] For ZoneCasting, these parameters define the RF interference (C/I) ratios in both stereophonic and monophonic FM transmission, for fixed and mobile reception.

Extensive network design work at NPR Labs has identified the power and height for the ZoneCasting nodes under a variety of primary station types and terrain conditions.

Using appropriate parameters for these nodes, interference within the target area of the zone can be effectively eliminated. This requires a sufficient density of nodes (per square kilometer) to provide field strengths at all locations across the target area to overcome the primary transmitter's signal by a prescribed interference ratio.

Interference between the ZoneCasting network and the primary transmitter's signal occurs in a boundary area around the zone where neither the ZoneCasting signal nor the primary transmitter signal exceeds a specific interference ratio. While this boundary interference cannot be eliminated, the experimental testing as detailed in this report demonstrates that this residual interference can be reduced by lowering the power and height of each node, and increasing the number of nodes within the desired zone area. These results suggest that the area of residual interference may be technically controlled to fall within less populated area and overall can be designed to be acceptably small, in comparison with the overall larger service area of the primary station and the derived benefits of ZoneCasting.

The ZoneCasting origination is intended to operate for only a few minutes per hour, during programming breaks, therefore, the impact of potential interference to listeners is not considered to be significant.[5] Further, by combining Maxxcasting technology (which is inherently a part of the

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[4] The methodology for laboratory and listener testing of both ZoneCasting and MaxxCasting is described in "Design Parameters for FM Signal Repeaters Based on Listener Testing", Dr. Ellyn Sheffield, Melinda Hines and John Kean, NAB 2013 Broadcast Engineering Conference Proceedings. Also see Appendix two of this report

[5] Interference to main station's signal. Because booster stations operate on the same frequency as the primary station, operation of the booster may cause interference to reception of the main station's signal. However, booster stations may not cause Interference to reception

Zonecasting topology) during periods when the Zonecasting is inactive, the station's listeners in the Zonecasting areas will experience significantly improved signal quality and building penetration.

BOOSTER LOCATIONS

The proposed zone consists of four transmission sites with seven distinct FM transmitters, each with its own antenna array.

Table 1: Proposed Booster Locations

Site Number	Address	ASR or ATC#	Type	Antenna RAD AGL (m)	Antenna RAD AGL (m)	Antenna RAD AGL (ft)	MAX ERP (W)	Azimuth (deg)
1A	BREWERY WORKS RT WI / Schlitz	275915	Roof Top	25	23	82	3650	100
1B	BREWERY WORKS RT WI / Schlitz	275915	Roof Top	25	23	82	255	250
2 SBA	Milwaukee WI1	1060030	Monopole	30	40	98	5000	140
4A	Hilton Milwaukee City Center	1057880	Tower	135	88	442	500	85
4B	Hilton Milwaukee City Center	1057880	Tower	140	88	461	350	250
5A	Phoenix Building	US-WI-6004	Roof Top	25	23	82	1500	85
5B	Phoenix Building	US-WI-6004	Roof Top	25	23	82	1000	250

of the primary station's signal within the community of license. The main station's signal may also cause interference to reception of the booster station. It Is up to the licensee of the primary station to decide whether the gain realized by the booster offsets any potential interference. See 47 CFR Section 74.1203(c).

Figure 1: Milwaukee Transmission Locations Aerial View

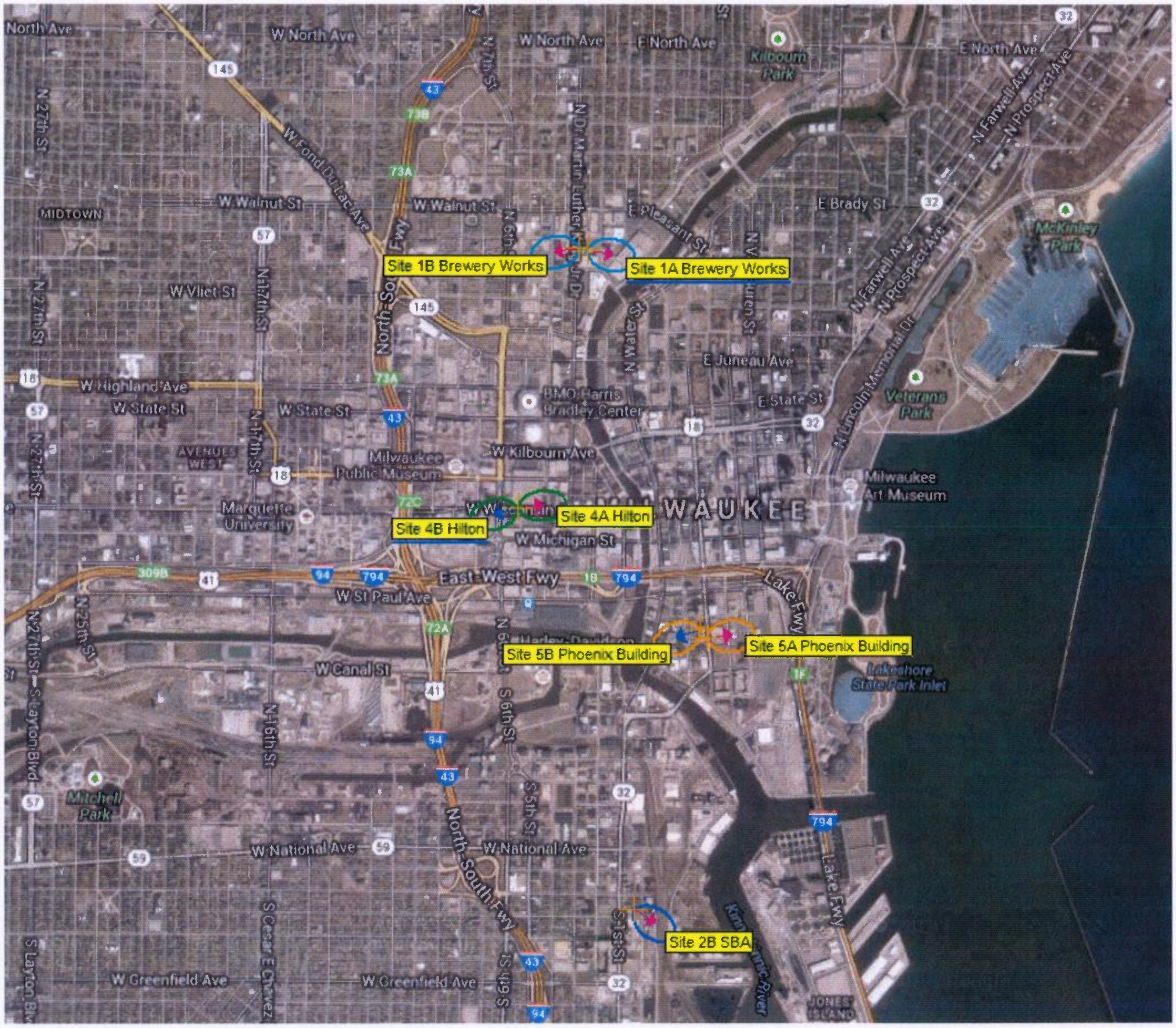
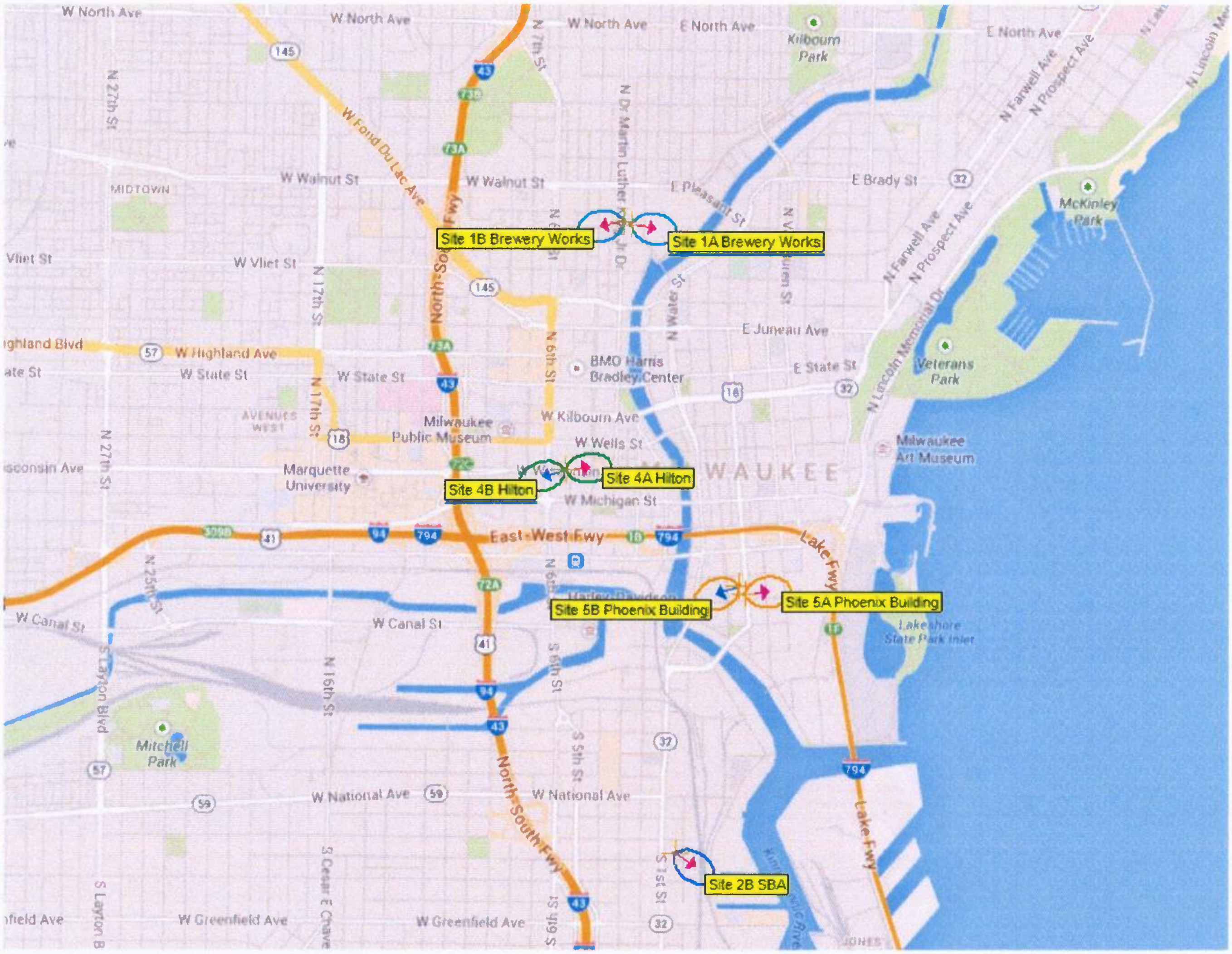


Figure 2: Milwaukee Transmission Locations Street Map View



DRIVE TEST LOCATIONS

Drive tests were located inside the ZoneCasting Zone, were selected to be within the Transition Area, and in the Main WIIL(FM) service area were to collect RF signal and audio quality measurements. The main focus of the test was to measure and record audio performance as the receiver physically passes thru the Transition Areas.

TEST MEASUREMENT EQUIPMENT

An Audemat-Aztec FM-MC4™ was used to collect the audio samples in the field. The FM-MC4 is a professionally calibrated FM receiver with a GPS receiver, and all the measurements are automatically logged. It is an FCC approved calibrated receiver supplied with a calibrated antenna.

GoldenEar™ is a software product which is used with the FM-MC4 Measurement Receiver. It is intended to evaluate the overall quality of an FM station reception through signal measurements and audio recording.

Figure 3: Audemat FM-MC4™

The FM-MC4 enables the following main operations to be carried out on a FM audio signal:

- Quantifying the signal value constituting the Base-band MPX signal
- Quantifying the MPX signal's power value
- Quantifying the demodulated signals' value constituting the audio message
- Ensuring different processing of these quantifications (corrections, averages, statistical calculations, phase, synchronization)
- Ensuring different representations of these quantifications.
- The FM-MC4 measurement receiver is also acquires raw data from the FM broadcasting station. These signals are read in digital form through the PC interface such as the RF level

From these raw signals, several calculated signals are deduced:

- RF level

- Multipath ratio
- MPX exceeding (over nominal level)

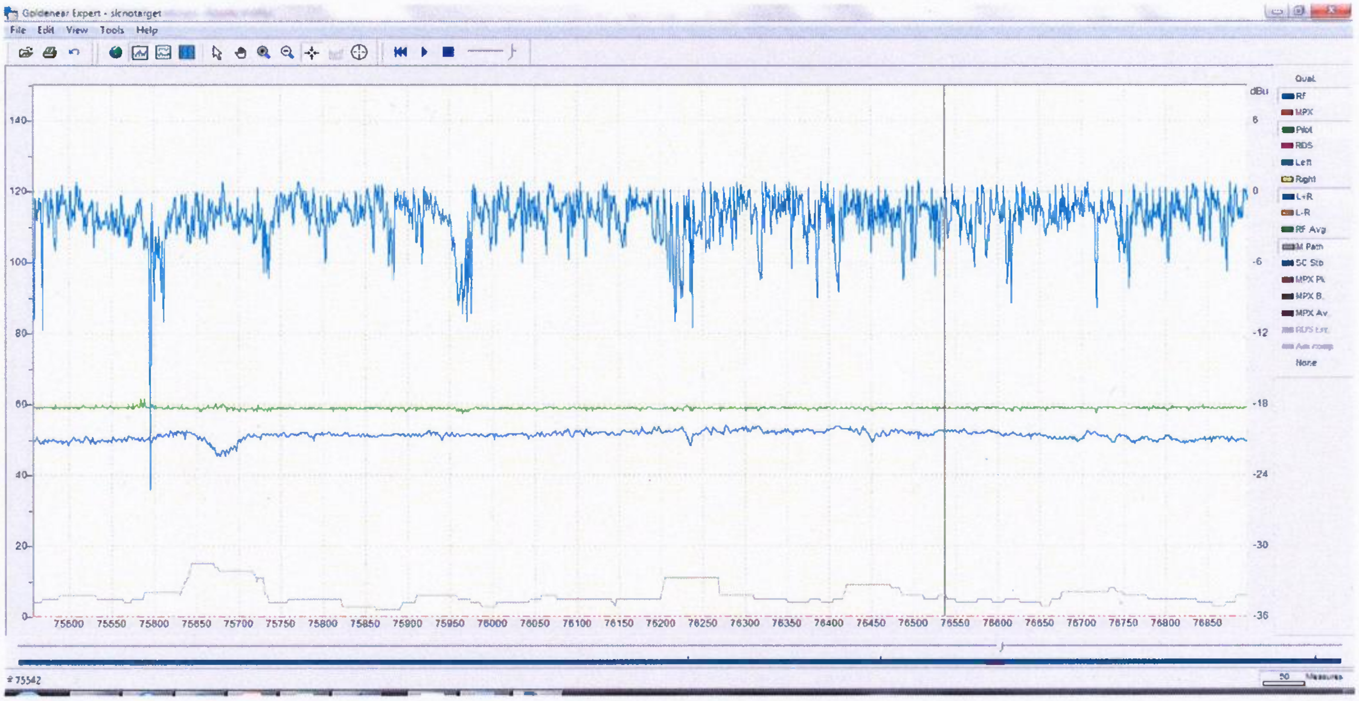
The first signal processing is done within the FM-MC4. The signal under test is the Multiplex signal whose format is defined by a pass-band of 100 kHz. This analog MPX signal is converted into a digital value using an A/D converter. Sampling frequency is fixed at 256 kHz, which guarantees quantification of any signal up to theoretical maximum deviation of 128 kHz. For subjective listening the audio output of the receiver was recorded digitally in a (CCIT 22.050 kHz, 8-bit) WAV file format by the GoldenEar™ software.

For conversion of the Absolute field (dBµV) into a Relative field (dBµV/m), several calibrated files are supplied with the FM-MC4, including: K coefficient validation, RF Antenna and Cable validation, and Loss and Gain validation. Appendix One contains details on these files.

The GoldenEar software is meant to provide a numerical method for quantifying a pure subjective concept, which is quality of received FM audio. As the method is a numerical one, it will be applied every time the same way, therefore it is an objective measure, as opposed to having numerous subjects listen to and evaluate the audio.

An example graphical output is shown below, indicating RF level (Green), Pilot Stability (Dark Blue), Multipath Ratio (Grey), and L+R (Light Blue), for a portion of a stationary PSA measurement recording.

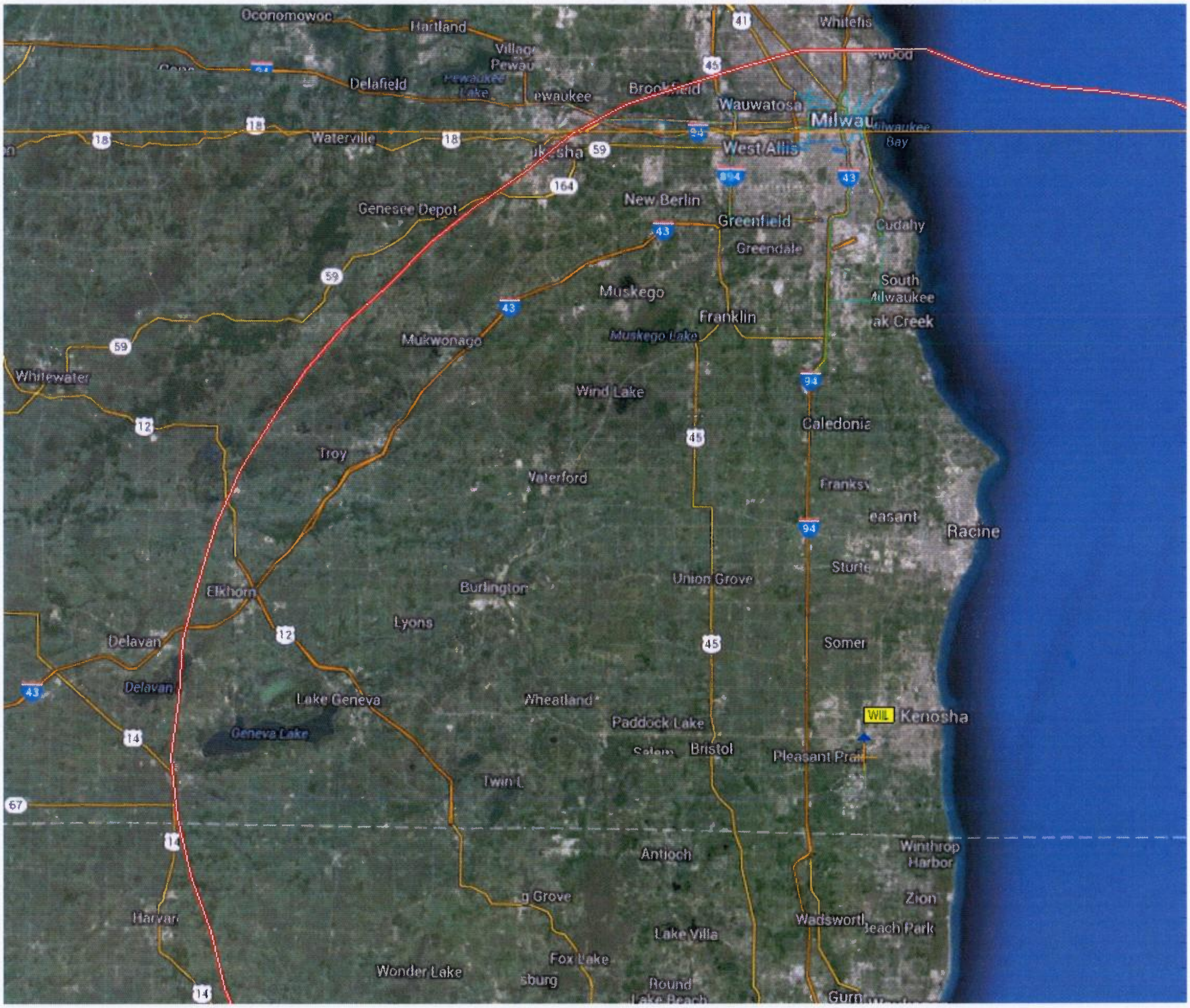
Figure 4: GoldenEar™ Signal Display



RF MEASUREMENT RESULTS

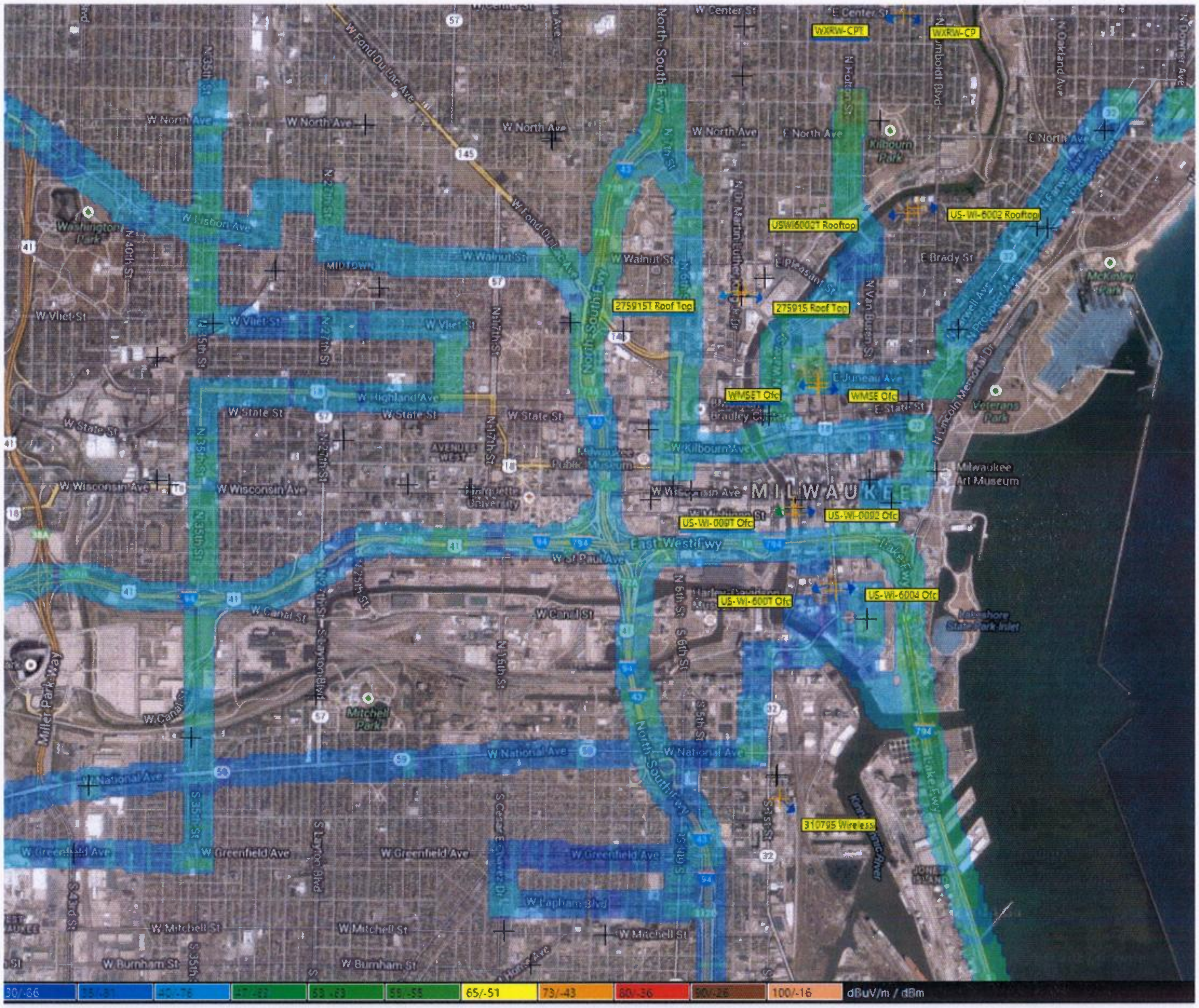
The RF propagation of WIIL(FM) was accurately measured and the data collected was used to tune the RF propagation model. The 54 dBu Service Area for WIIL(FM) is shown below.

Figure Five: 54 dBu Service Contour for WIIL(FM)



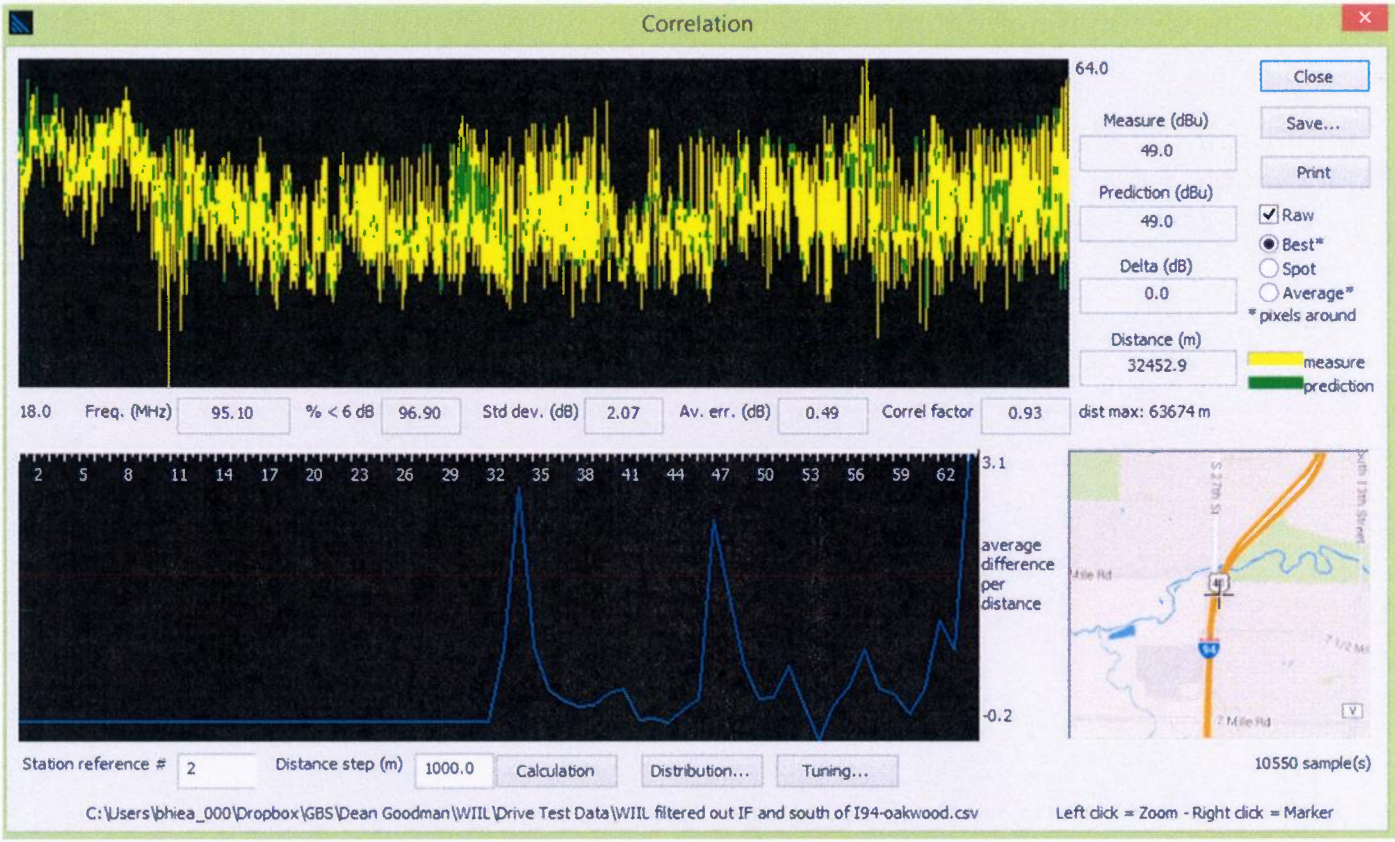
The area of data collection and relative signal strength is indicated in the following figure.

Figure 6: RF Propagation Measurements for WIIL(FM)



The above mapped measurements were imported into the GBS propagation model, generally based on the International Standard ITU-R 525/526 with sub-path attenuations. Given the 10 meter terrain and clutter data, an accurate model was constructed after only a few correlation analyses which optimized the propagation model parameters. Over the drive measurement route, 10,550 samples of signal strength were made. It should be noted that the signal strength of the primary station in the test area without the assistance of boosters is actually well below 54dBu and is of marginal quality due to the urban nature of the downtown Milwaukee area.

Figure 7: WIIL(FM) Final Correlation Analysis



The final prediction model had an average error of 0.49 dB and a standard deviation of 2.07 dB, with 96.9% of all samples recorded within a 6-dB window from the mean. This provided a highly accurate model for use in booster design and placement. The following figures indicated the post corrected coverage prediction for WIIL(FM), with 39 dBμV/m used as a threshold.

Figure 8: WIIL(FM) Post Corrected Coverage Prediction

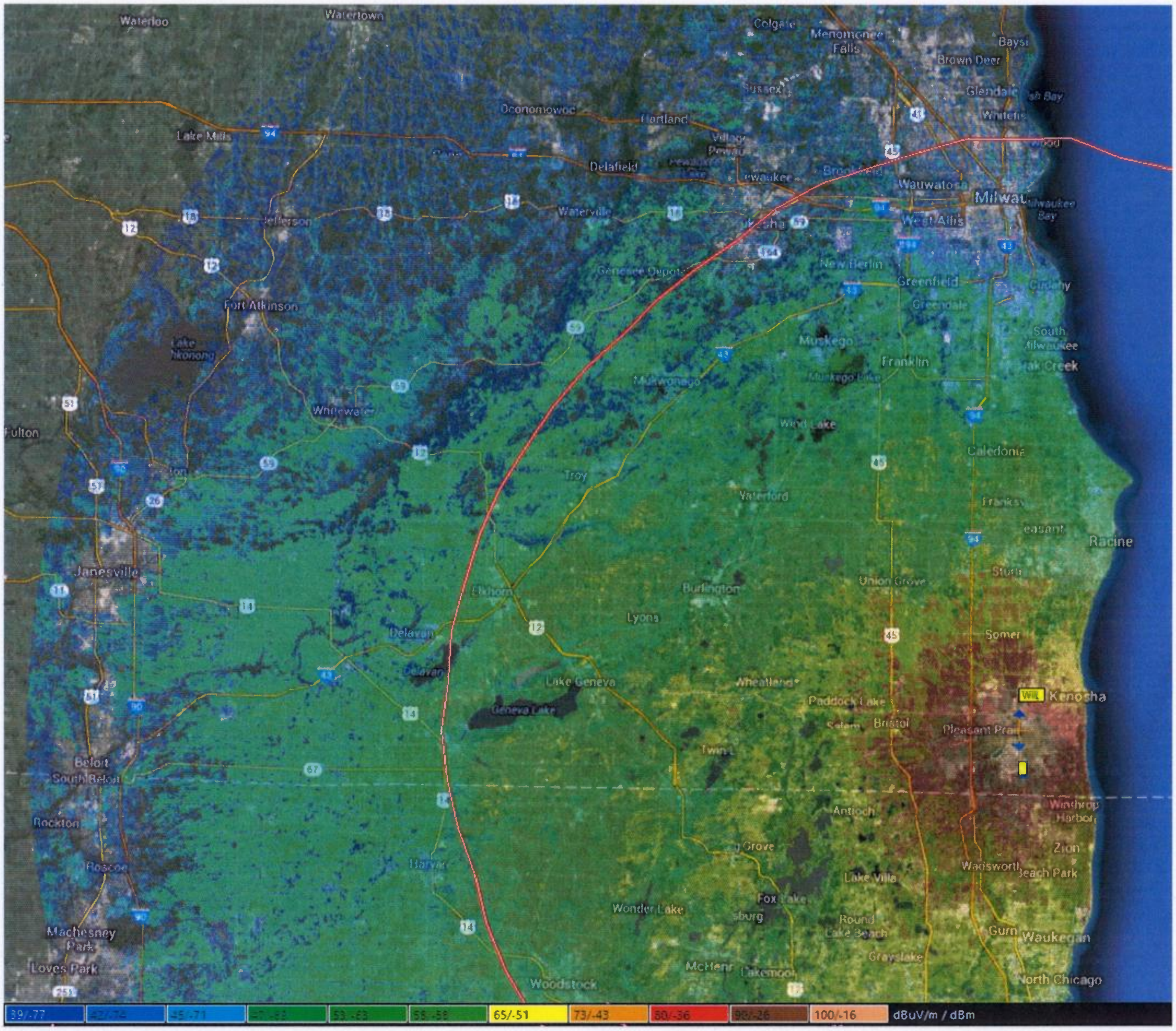
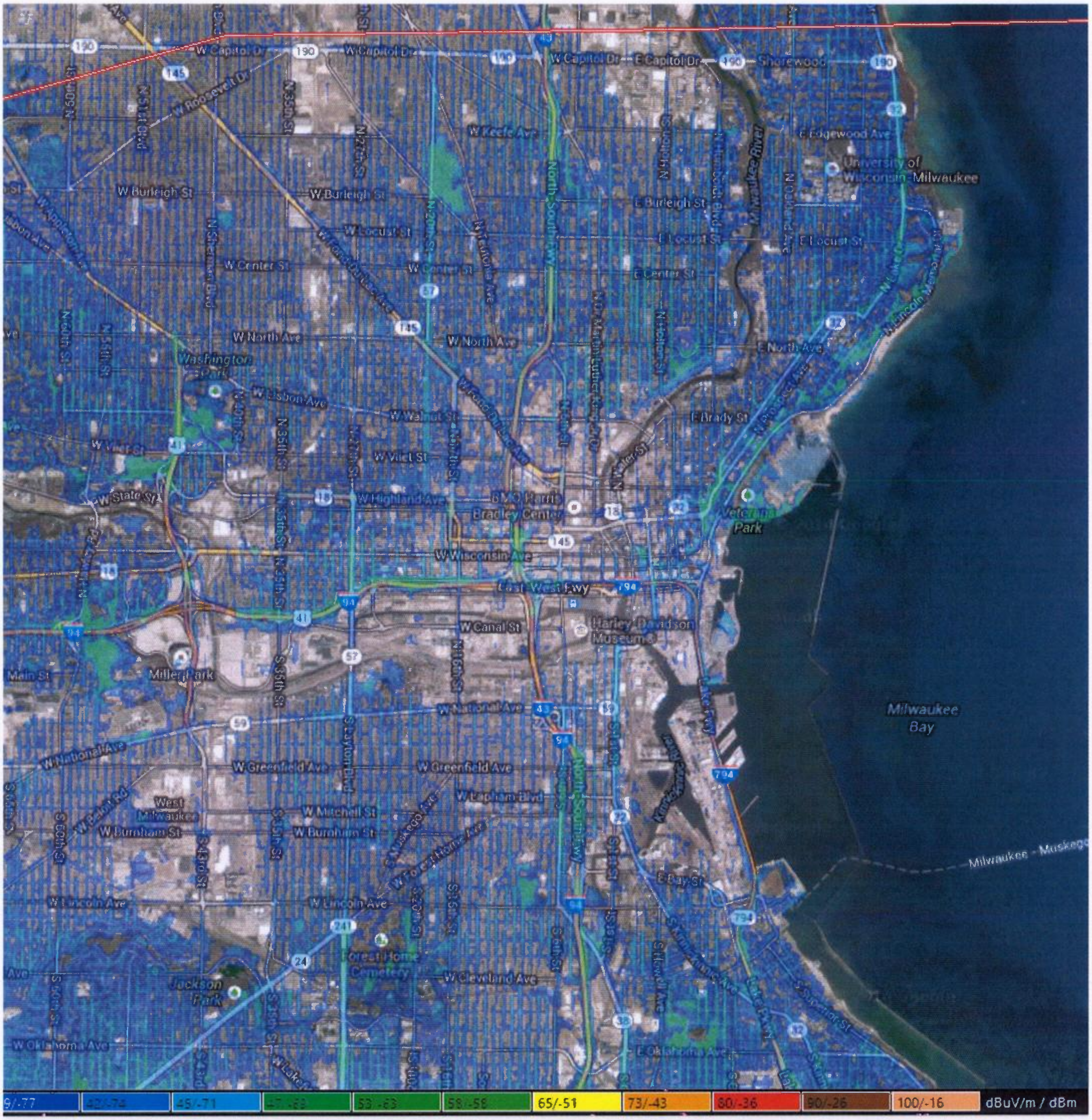


Figure 9: WIIL(FM) Milwaukee Area Post Corrected Coverage Prediction



BOOSTER NODE DESIGN

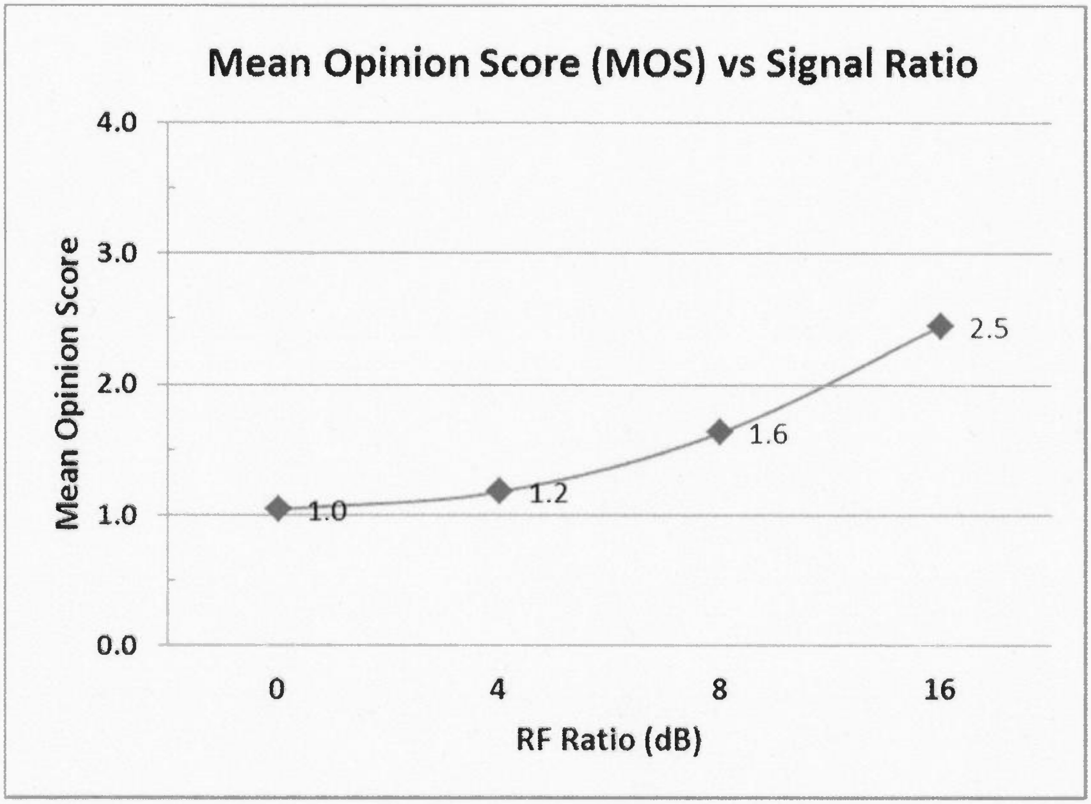
Given the measured and correlated WIIL(FM) main signal, booster locations were then chosen. As mentioned, four locations with seven transmitters were chosen, with a number of the transmitters used to improve the C/I ratios by simulcasting the main WIIL(FM) signal, same content.

In the listening tests conducted by NPR Labs and Towson University, several criteria were considered.

- Listeners evaluated
- Mono and Stereo modes
- Speech, music, voiceover
- Time-of-arrival between signals
- RF ratios between signals
- Listener participants were asked to rate the audio paralleling ITU-R five-grade impairment scale
- (1=bad, 2=poor, 3=fair, 4=good, 5=excellent)

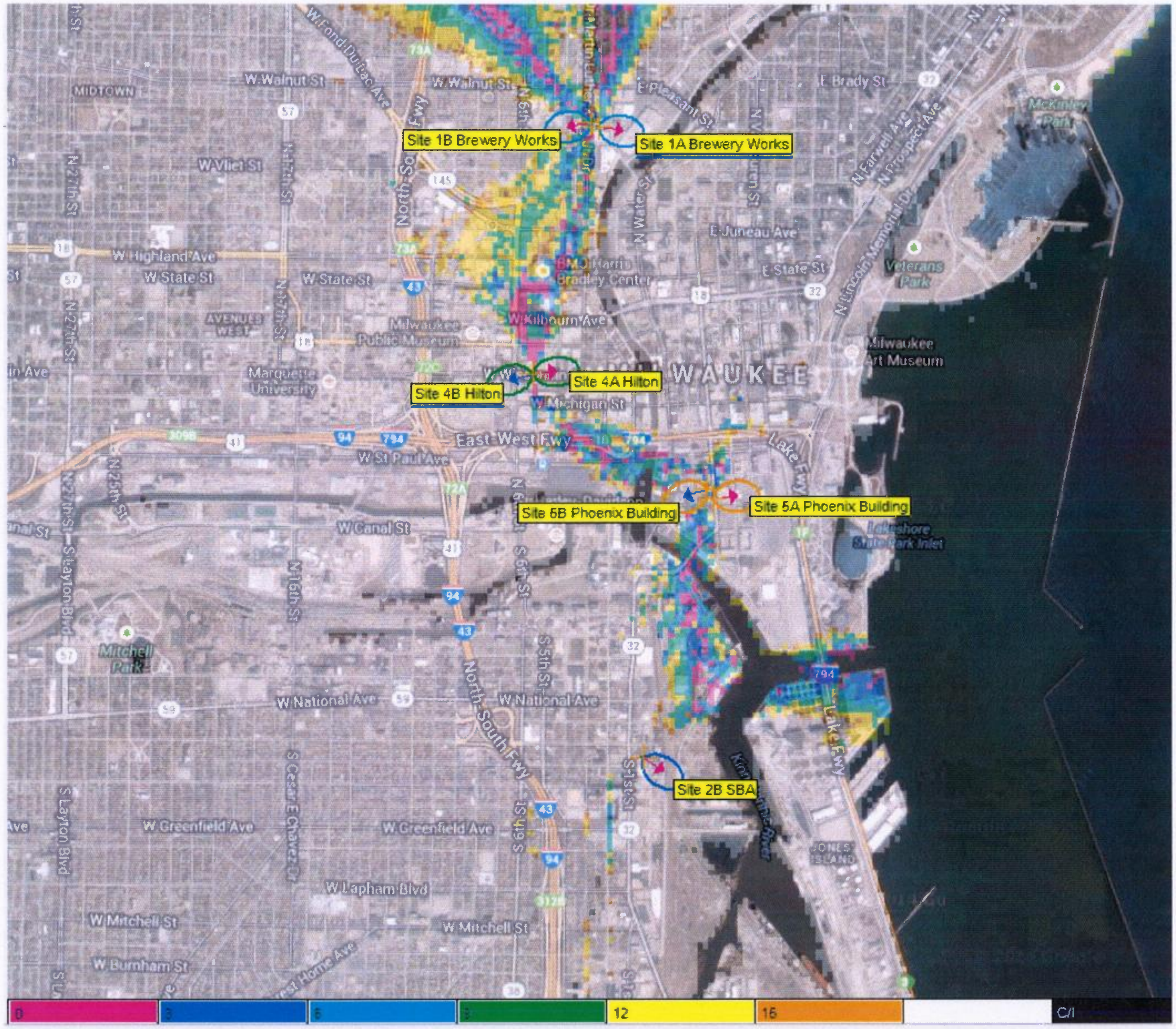
For ZoneCasting spots in Mono, the average minimum threshold for acceptability was found at approximately 16 dB C/I, at a MOS score of 2.5, under mobile multipath fading conditions. Appendix Two provides more information about the listening tests.

Figure 10: C/I Design Parameters



Given the 16 dB C/I design requirement, a predicted area of the Milwaukee zone is designed, with predicted transition area interference indicated in the color-coded areas in the below figure (those areas with a C/I from 0 to 16 dB). Drive tests throughout the both the ZoneCasting area, the main signal area, and transition areas were performed.

Figure 11: Pre Measured C/I Prediction

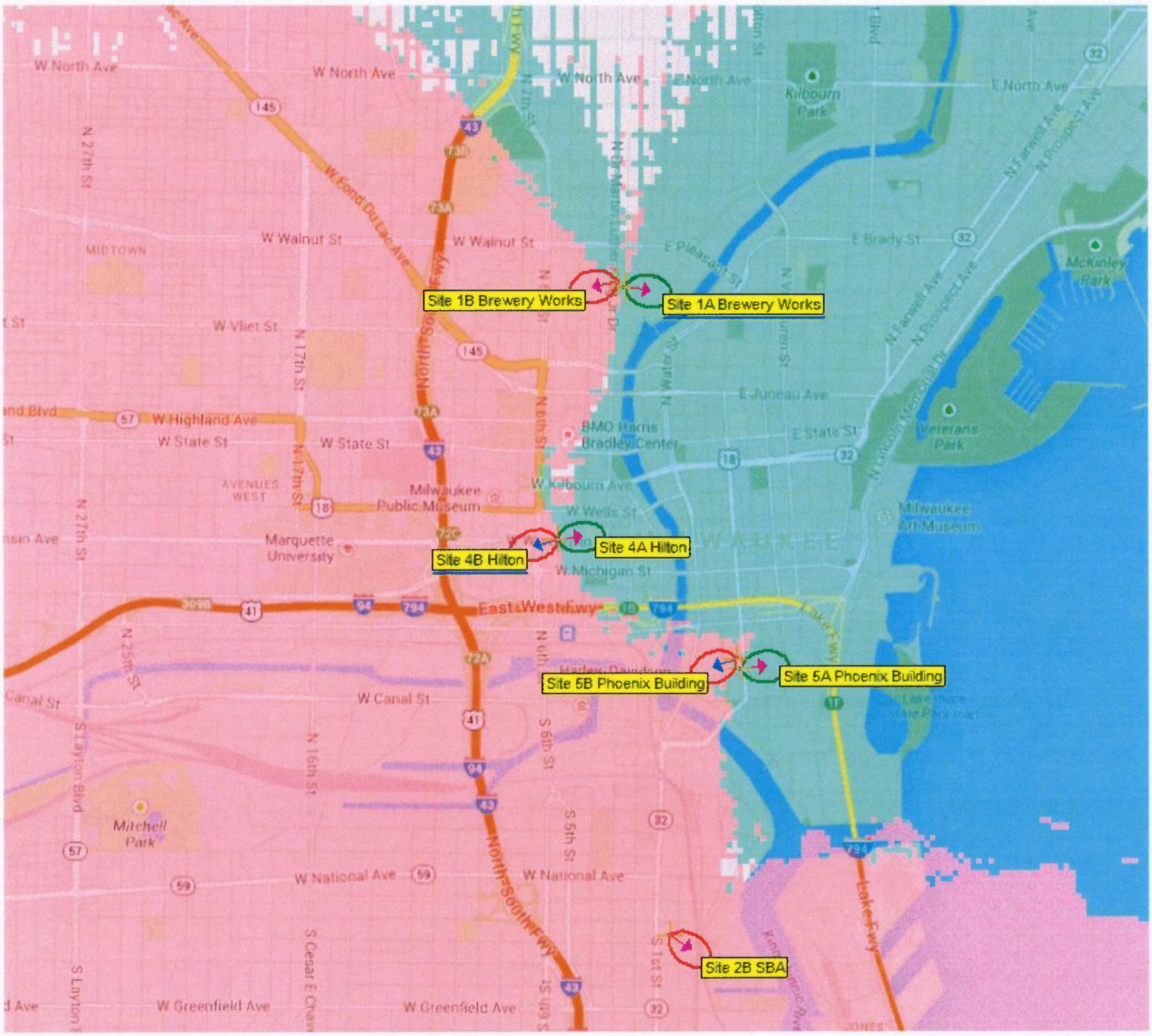


Transition zone interference is designed to occur over water, rivers, parks, and other low listening areas as much as possible.

Zone Boundary Definition

Given the predicted C/I values, an approximate ZoneCasting Zone area can be predicted, with the Main Zone represented in Red, the ZoneCasting Zone represented in Green.

Figure 12: ZoneCasting Zone Area Approximate Boundary



BOOSTER NODE CONSTRUCTION

Four RF Sites locations, with Seven RF transmitters/antenna arrays were used in the test. All sites used GatesAir Flexiva™ FM transmitters, IPLink200s with Synchrocast® distribution equipment, a private MPLS IP and point-to-point wireless data network for distributing the audio, and GPS for time synchronization and frequency stability. The Antenna Arrays consist of Shively 6025 Log Periodic antennas, slanted at 30 degrees' rotation. The "B" sites rebroadcast the Main WIIL(FM) signal, and the "A" sites broadcast different content (PSA announcements). A typical antenna configuration (Phoenix Building node) looks like the following:

Figure 13: Typical ZoneCasting Equipment Configuration

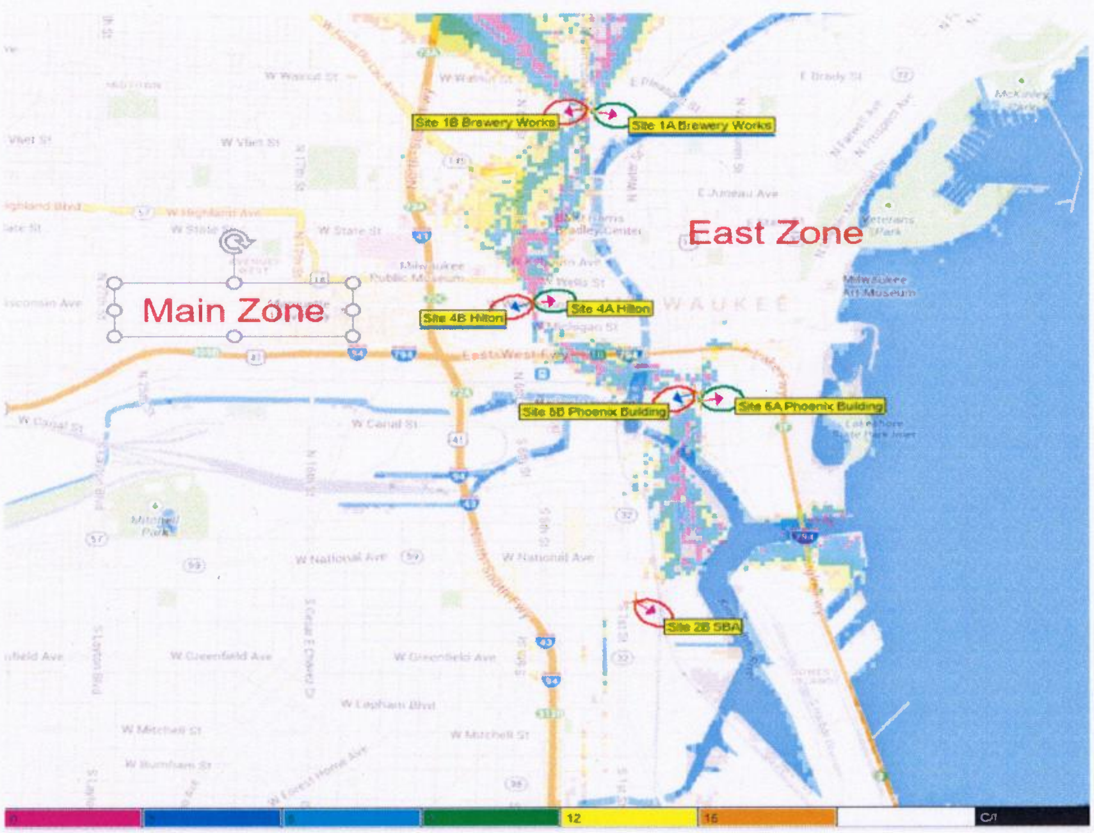
RF ANALYSIS OF THE TEST AREA

Because of the booster placement, optimized for population coverage and terrain, the objective is to determine if the implemented targeted messaging correlated well with the substantial amount of RF engineering performed on this test. Routes and audio recordings thru the Transition areas are shown.

Drive Test Routes

Drive tests thru the transition zones, where a transition from the Main zone to the East zone were performed. The Main zone broadcasts identical content as the Main WIIL(FM) transmitter, and each Main zone booster node are synchronized together with each other and the Main. The East zone broadcast different content (PSA spots) than the Main transmitter, and each East zone booster node are synchronized together with each other.

Figure 14: Transition Zone Drive Test Areas



Samples of the audio along the drive route, approximately 45 seconds of each, is presented along with this report in a Power Point presentation where the audio can be played with a 'point and click'.

Table 2: Drive Test Transition Routes

Route	Area and Audio File	Transition Occurs
Main to East	Near Brewery node on Cherry Street Brewery-transition.mp3	12-23 sec
Main to East	Near Hilton node on Wells Street milwaukee_Wells-transition.mp3	22-24 sec
Main to East	Near Phoenix Building Node on St. Paul Street Phoenix_st-paula-transition.mp3	23-30 sec

Figure 15: Brewery Node Transition Zone Drive Test

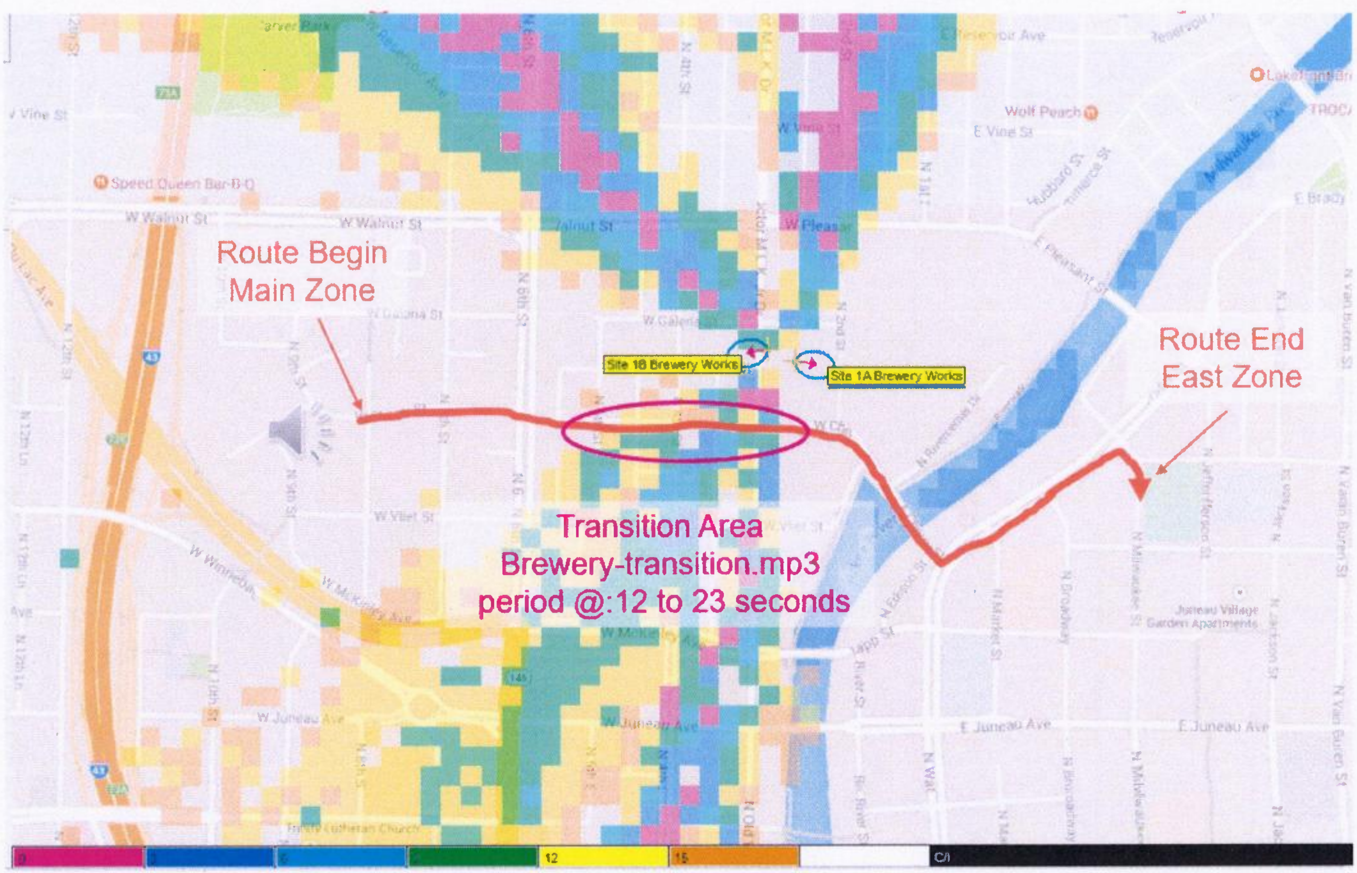


Figure 16: Hilton Node Transition Zone Drive Test

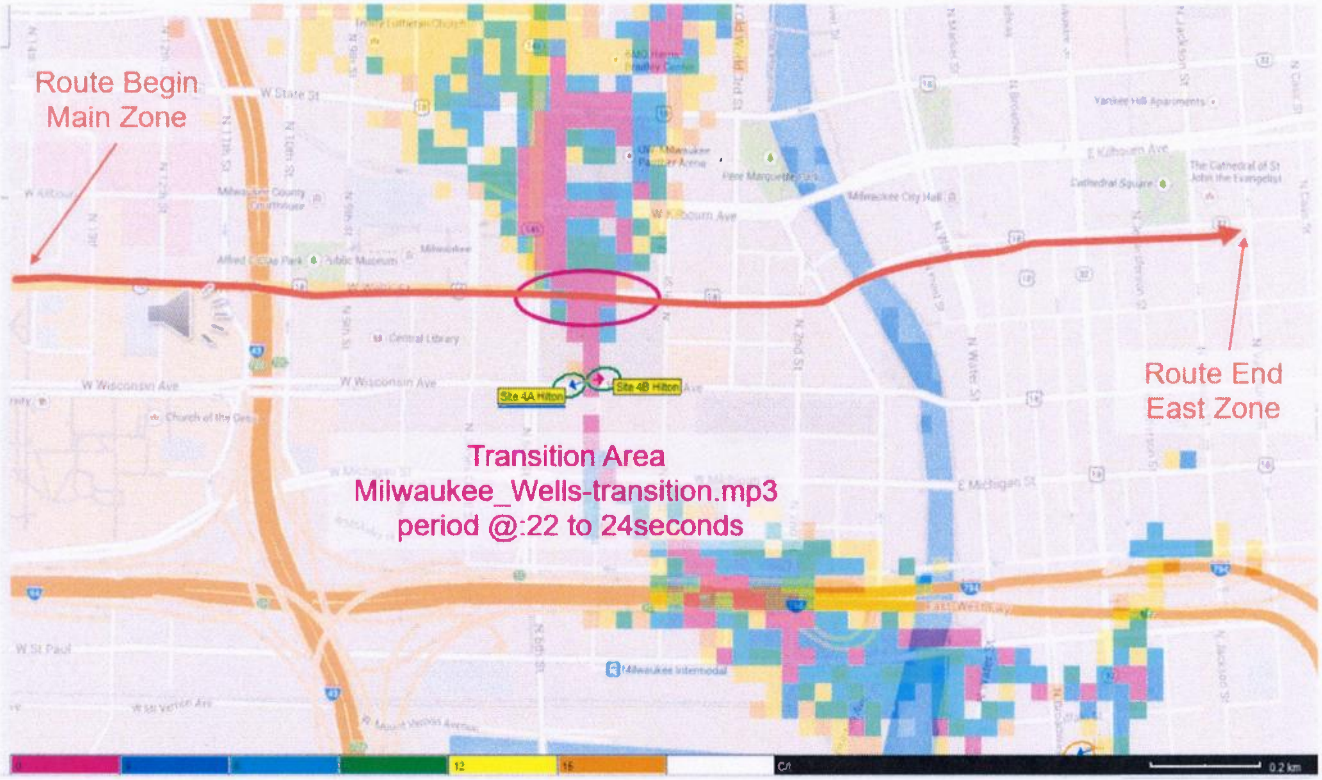
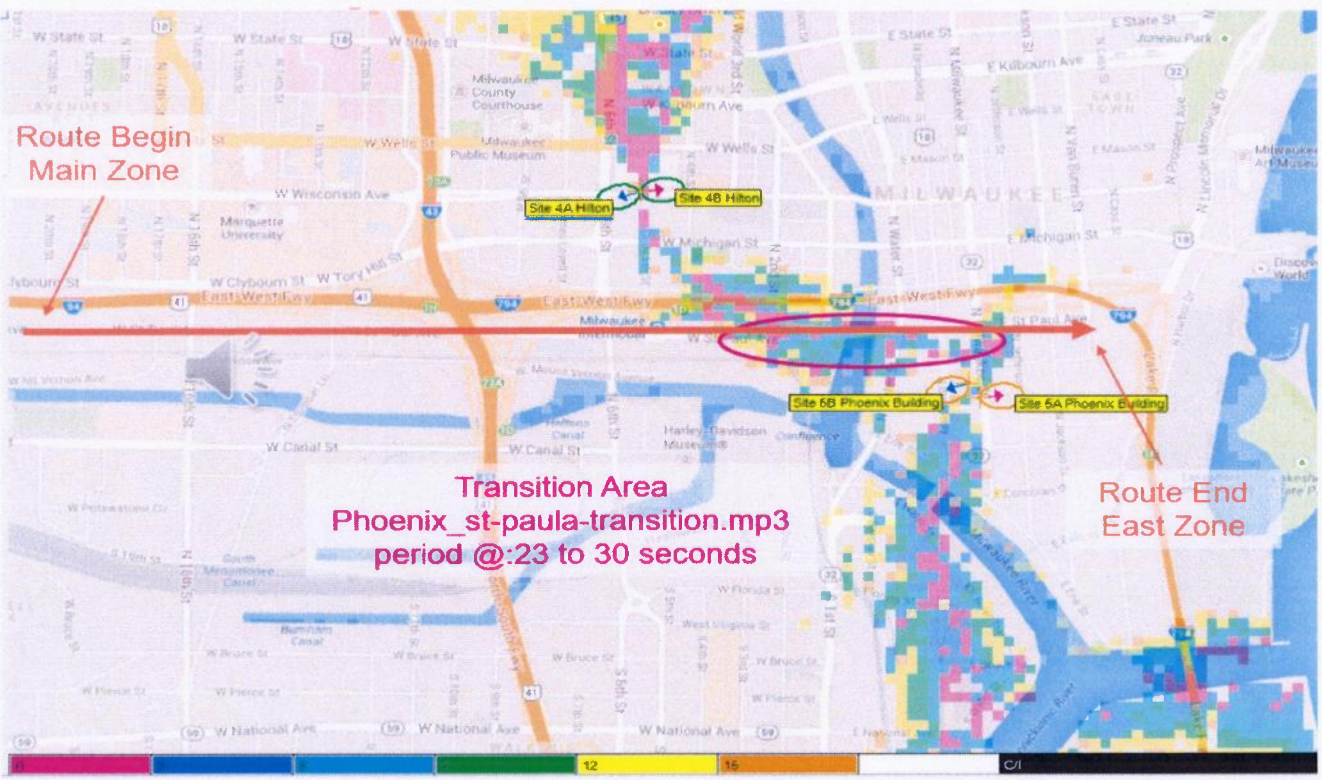


Figure 17: Hilton Node Transition Zone Drive Test



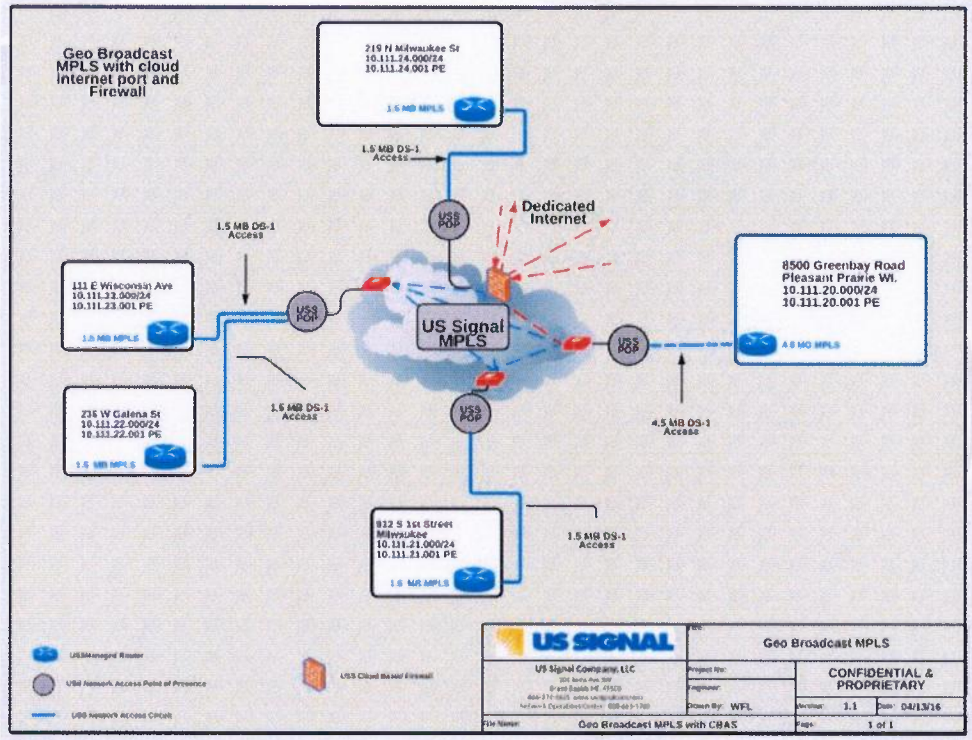
NETWORK INFRASTRUCTURE AND TARGETED SPOT INSERTION

AUDIO DISTRIBUTION NETWORK

Because this network was constructed from the ground up, on building top and tower co-locations, a method of sending distinct audio messages to the boosters was needed during both the simulcast Non-Targeted and Targeted spot times. This was accomplished using multiple audio streams. Two modes of operation were implemented in regards to spot insertion: One involves simulcasting, on the booster node network, the exact same spot as the main (WIIL(FM)) was broadcasting, the second was to simulcast a different (targeted) spot than the main was broadcasting. The goal is to determine relevant differences in audio quality during a receiver transition between the two zones, as this was the main goal of the testing.

Audio distribution from the Main WIIL(FM) Studio was achieved primarily with a U.S. Signal private MPLS network. The only exception to Figure 18 is that the audio distribution to the Brewery Node was achieved with a wireless link from the Hilton site, as there were problems with circuit extension at the Brewery Node.

Figure 18: MPLS Audio Distribution



ANALYSIS AND RATING OF THE AUDIO AND EFFECTIVENESS OF TARGETED SPOT DELIVERY WITH BOOSTERS

AUDIO SAMPLE RECORDINGS

In the WIIL(FM) service contour, the seven booster nodes create two coverage areas, in terms of RF isolation and segregated markets. Distinct Public Service Announcements (PSAs) were tested in the East zone as each market area was playing a different spot at the same time. For WIIL(FM), radio spots (non-commercial and commercial) start generally 3 times each hour. The test PSAs were 30-60 seconds in length each, and occurred up to 3 times per hour depending on spot availability.

Final zone transition testing occurred on 12/12/2016 to 12/14/2016. It is important to mention that 15 minutes or 30 minutes elapsed between spots, so drive distances had to be determined- typically 2-4 miles apart, and compensated by roads, construction delays, and alternate routes for high traffic or accidents. Typical test locations were on a west to east drive route so that the Main Zone, the Transition Area, and East Zone audio can all be listened to in one audio file.

At each of the measured transition route locations, each audio file attached with this report has the following format:

- Approximately 45 seconds in length.
- 15-20 seconds of audio before the Non-Targeted spot in the Main Zone.
- 2 to 11 seconds of transition audio.
- 15-20 seconds of audio of the Targeted PSA spot in the East Zone.

This format allows the listener to easily compare subjectively the Non-Targeted PSA reference spot audio to the Targeted spot audio.

From the reference audio, it is demonstrated that creating targeted, single frequency network (SFN) zones are achievable, even in relatively flat terrain with areas of high urbanization and high population densities.

It should be noted that this system was designed and constructed for concept and viability purposes for ZoneCasting. This is the third ZoneCasting test that has been presented to the FCC. The previous two tests were deemed acceptable. This third test successfully incorporated receiver mobility into the test plan.

Conclusion

Throughout the series of three experimental authorizations, GBS has continued to learn from testing and development of the ZoneCast design and implementation. GBS has refined the propagation model and interference prediction model with field tests using the Audemat FM-MC4 Measurement

Receiver and the Audemat "Goldenear" software to objectively quantify the interference zones, adjusting as necessary to improve performance and predictability.

GBS has unequivocally proven in this most recent testing the technical viability of using alternate programming material on boosters in designated zones to augment the information available to listeners in those areas. The test results have consistently proven that in a properly designed system, with multiple closely spaced booster "nodes", significant benefit can be derived in the designated ZoneCast areas while minimizing interference. Drive testing conducted during the experimental operation of WIIL (FM) has proven that while physics dictates that there will be some transition area which will contain undesirable artifacts, that area can be minimized to exist within only a few city blocks and take only a negligible amount of time to transverse in a mobile environment. This transition zone, based upon measurements, is likely to produce minimal listener "tune-out". Further, the benefits of the fully synchronized booster nodes during simulcast periods (which comprises the vast majority of the broadcast day), is likely to enhance listenership by increasing signal strength in many downtown buildings to that well above the signal strength otherwise available from the main transmitter alone.

After five years of testing and refinement of the Zonecast system, technical improvements and the art of implementation have progressed to the point where GBS believes it has been demonstrated that in both fixed and mobile environments, the public interest would be served by having targeted segmented ZoneCast programming available. GBS respectfully requests that, pursuant to the Rulemaking Request filed by GBS, 47CFR 74.1231(i) should be modified to allow for signals other than that of the primary station to be broadcast on boosters.

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APPENDIX ONE

APPENDIX TWO : NPR LABS/TOWSON UNIVERSITY RESEARCH DESCRIPTION

NPR Labs (National Public Radio) Research

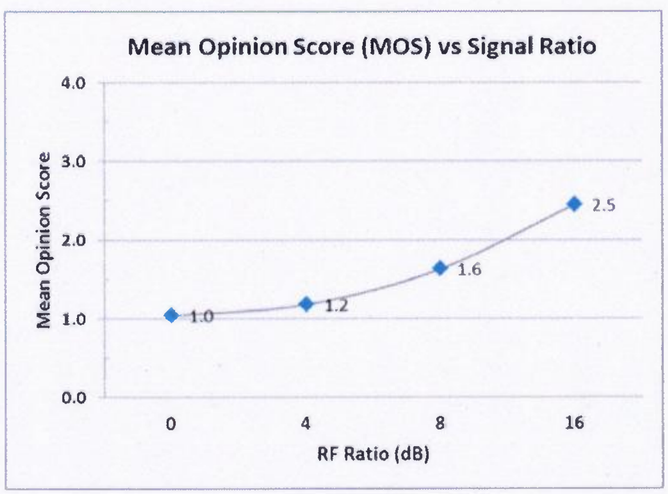
- Research Goal:

  Create Standardized System Design Criteria for Geo-Broadcast Solutions: MaxxCasting™ and ZoneCasting™ Networks
- RF Lab Simulations of Main Transmitter and MaxxCasting™ ZoneCasting™ Configurations
  - Both mobile (Rayleigh / Rician) multipath fading & fixed signals
  - Process audio with professional broadcast hardware
  - Received with standard consumer car and home radios

Geo Broadcast Solutions-NPR Labs Research

- Listener Tests
  - Measure consumers' opinions of ZoneCasting™ design parameters
  - Conducted at Towson University and designed by Dr. Ellyn Sheffield
  - Testing was held in two 7x8' rooms, set up to simulate a home listening environment and an automobile cabin
  - Listener keep-on, mean opinion scores recorded
  - 19,000 data points

Geo Broadcast Solutions-NPR Labs Research



- Listeners evaluated
  - Mono and Stereo modes
  - Speech, music, voiceover
  - Time-of-arrival between signals
  - RF ratios between signals
  - Listener participants were asked to rate the audio paralleling ITU-R five-grade impairment scale
    (1=bad, 2=poor, 3=fair, 4=good, 5=excellent)
  - For ZoneCasting spots in Mono, the average minimum threshold for acceptability was found at 16 dB C/I, at a MOS score of 2.5, under mobile multipath fading conditions.

APPENDIX THREE : FCC EXPERIMENTAL AUTHORIZATION

To be provided.

APPENDIX FOUR : REFERENCE STANDARDS RELEVANT TO THIS REPORT

FCC AUDIO DIVISION
http://www.fcc.gov/mb/audio/
The Media Bureau licenses commercial and noncommercial educational AM, FM, FM Translator, and FM Booster radio services, and also the noncommercial educational Low Power FM radio service. The Division provides legal analysis of broadcast, technical and engineering radio filings and recommends appropriate disposition of applications, requests for waivers, and other pleadings. Telecommunications falls under **Title 47** of the CFR. AM, FM, and TV broadcast stations fall under **Part 73 and 74** of Title 47.

INTERNATIONAL TELECOMMUNICATIONS UNION (ITU)
ITU Radiocommunication Sector
http://www.itu.int/ITU-R/index.html

ITU-R BS.1114-5: Systems for terrestrial digital sound broadcasting to vehicular, portable and fixed receivers in the frequency range 30-3,000 MHz
ITU-R BS.412-9 17, ANNEX 3: Protection ratio for FM sound broadcasting in the case of the same programme and synchronized signals
ITU-R BS.1387-1: Method for objective measurements of perceived audio quality
ITU-R BS.1284-1 General methods for the subjective assessment of sound quality

WORLDCAST SYSTEMS / AUDEMAT DIVISION MENTION REFERENCES
http://worldcastsystems.com/

CCIR [Recommendation 638] : Terms and definitions used in planning frequencies for audio and television Broadcasting – Protection ratio in Audio Frequency
CCIR [Recommendation 559-2] : Objective measuring of RF protection ratios in broadcasting – parameters taken into consideration
CCIR [Recommendation 559-2] : Objective measuring of RF protection ratios in broadcasting – Standardised noise spectrum – Colored noise signal used for generator modulation
CCIR [Recommendation 641] : Determining RF protection ratios in audio broadcasting at frequency modulation –Appendix 1 – Maximum deviation of measurement generator frequency
IUT-R [Recommendation BS.450-2] : Transmission standards for audio broadcasting at frequency modulation in metric waves
IUT-R [Recommendation 412-6] : Planning standards for audio broadcasting at frequency modulation in metric waves – Note 4 – Sinusoid signal power
IUT-R [Recommendation 412-7] : Planning standards for audio broadcasting at frequency modulation in metric waves – Appendix 4 – Measuring complete multiplex signal power and peak deviation of an FM audio broadcasting signal
IUT-R [Recommendation 642-1] : Limiters for high quality radio-phonic program signals AFNOR 97330 :Weighting curve representing average musical messages
CEPT/ERC : [Recommendation ERC 54-01 E] – Method of measuring the maximum frequency deviation of FM Broadcast emissions in the band 87,5 MHz to 108 MHz at monitoring stations
UIT-R [Recommendation 704] : Characteristics of reference receivers in audio broadcasting at frequency modulation, at end of planning
UIT-R [Recommendation 599] : Audio broadcasting reception antenna directivity