In addition to the main WWOJ (FM) broadcast transmitter, 3 booster locations were constructed for the purpose of this test.

MAIN	WWOJ, Avon Park, Florida	27° 30' 39"N, 81° 31' 54" W	10 kW ERP (C3)
BOOSTER #1	Zolfo Springs, Florida	27° 21' 59"N, 81° 47' 52" W	5 kW ERP
BOOSTER #2	Wauchula, Florida	27° 29' 24" N, 81 ° 50' 29" W	5 kW ERP
BOOSTER #3	Frostproof, Florida	27° 42' 41"N, 81° 33' 04" W	3 kW ERP

Table One: Booster Locations

In the WWOJ (FM) FCC defined service contour (60 dBμV/m), the three boosters create two distinct coverage areas, in terms of RF isolation and segregated markets. Distinct Public Service Announcements (PSAs) were tested as each market area was broadcasting a distinct PSA spot at the same time.

The tests as presented in this report were performed in December 2, 2011 to December 20, 2011 of 2011, after construction of the booster transmitters, the booster antenna arrays, the audio microwave distribution network, and modifications to the broadcast playout system were made to implement the targeted messaging concept.

The test market locations covered by the two zones consisted of three boosters, all of which were simulcast together. One zone consisted of two boosters in the Zolfo Springs / Wauchula FL market; the other zone consisted of one booster in the Frostproof, FL market. This test is unique in that it is tested in very flat terrain and used very directional FM antenna arrays. Given the favorable results obtained and presented in this report we believe this is a very significant actuality.

CONCLUSION

The results of the testing, which occurred on December 2, 2011 to December 20, 2011, demonstrate that not only is the concept technically feasible but it is also of great value to the future of terrestrial FM radio broadcasting. Specifically, different announcements were broadcast to separate and discreet listeners concurrently. The quality of the announcements was not impaired to any significant degree. The attached audio clips for each of the measurement locations are provided for subjective verification of these results.

SUMMARY OF TEST RESULTS

Conventionally planned broadcasting networks consist of transmitters with independent program signals and with individual radio frequencies. The allocation of the radio frequency for each transmitter and protected service and interference contours are defined by the FCC in Part 73 of Title 47 and FM Translator and Booster Rules in Part 74. Lazer Spots, LLC has developed a

proprietary (Lazer Spots™) system and technology that will allow a broadcast FM radio station to divide its signal into segments with the use of carefully engineered booster transmission points. This new concept would allow the broadcaster to run different audio messages, such as Public Service Announcements (PSAs) on different booster transmitters simultaneously, thereby creating additional time capacity for such announcements. It allows the ability to target their listeners with more specific (i.e. hyper-local) relevant information, as it increases valuable broadcast messaging time.

The Lazer Spot™ approach is considerably different from the conventional broadcast coverage enhancement-only approach in that the purpose is to broadcast specific Public Service Announcements (PSAs) to a specific geographical area and potentially demographical listening audience, for a limited amount of broadcast time. For example, in this test a 30 second Targeted spot was broadcast, typically 3 times per hour.

It is common for FM analog booster implementations to create some amount of interference. The Lazer Spots™ proprietary system is designed to i) minimize interference in general using its patent pending design technology and software and routing capabilities, and ii) placing the simulcast interference areas that occur where there exists diminutive population counts and demographically determined non-listeners of the specific broadcast station. It is also important to point out that the overall benefit of the targeted messaging approach far outweighs the relatively small interference that occurs with booster implementations, especially when the design is such that it is engineered to minimize this occurrence to the listening public.

In the WWOJ (FM) test, the submitted audio clips were recorded in the field from 12/2/2011 to 12/20/2011. Audio information was collected at 20 geographical locations and described in detail later in this report. At each of the 20 test locations, a measurement of the 'Non-Targeted', normal simulcast audio were made for a single PSA spot. It should be noted that the boosters used in this tested only transmitted RF power during the simulcast PSA spots, targeted and non-targeted, as normal operation of the station did not utilize boosters. For the Non-Targeted simulcast audio, the same PSA audio spot was broadcast that the main station WWOJ (FM) was broadcasting; 21 different PSA spots were broadcast in rotation in this manner. For the targeted simulcast PSA spot, a single reference PSA spot was simulcast on the boosters during the time that the main WWOJ(FM) transmitter was broadcasting a different PSA spot. This is referred to as the reference PSA 'Targeted' spot. The goal was to monitor and analyze the audio at the 20 test locations for quality of reception as compared to the Non-Targeted PSA spots.

The results in this report indicate an objective 'before and after' analysis of the Non-Targeted and Targeted Audio spots. The audio clips for each of the measurement locations is also provided with this report for subjective analysis, which correlate very well based on listener feedback. In fact, under no case could the Non-Targeted audio be considered imperceptible, as defined in this report under ITU-R definitions. In fact, for the measured tests the average statistical difference between the objective audio quality measurements for the Non-Targeted and Targeted Audio spots are a mere 0.6%. If the guidelines for quality measurements of rounding to the nearest tenth of a decimal were made as suggested by the ITU-R[1], then NO objective

[1] RECOMMENDATION ITU-R BS.1284-1*General methods for the subjective assessment of sound quality

perceptible difference is found on average for the WWOJ (FM) test. This continues on the favorable results of field testing completed by Lazer Spots, LLC.

FIELD TEST PROCEDURE

BOOSTER LOCATIONS

The WWOJ broadcast system has three boosters covering two distinct areas: Zolfo Springs / Wauchula FL and Frostproof, FL. The tests presented in this report were performed occurred on December 2-20 of 2011, after construction of the booster transmitters, the booster antenna arrays, the audio microwave distribution network, and modifications to the broadcast playout system were made to implement the targeted messaging concept.

MAIN	WWOJ, Avon Park, Florida	27° 30' 39"N, 81° 31' 54" W	10 kW ERP (C3)
BOOSTER #1	Zolfo Springs, Florida	27° 21' 59"N, 81° 47' 52" W	5 kW ERP
BOOSTER #2	Wauchula, Florida	27° 29' 24" N, 81 ° 50' 29" W	5 kW ERP
BOOSTER #3	Frostproof, Florida	27° 42' 41"N, 81° 33' 04" W	3 kW ERP

Table Two: Booster Locations

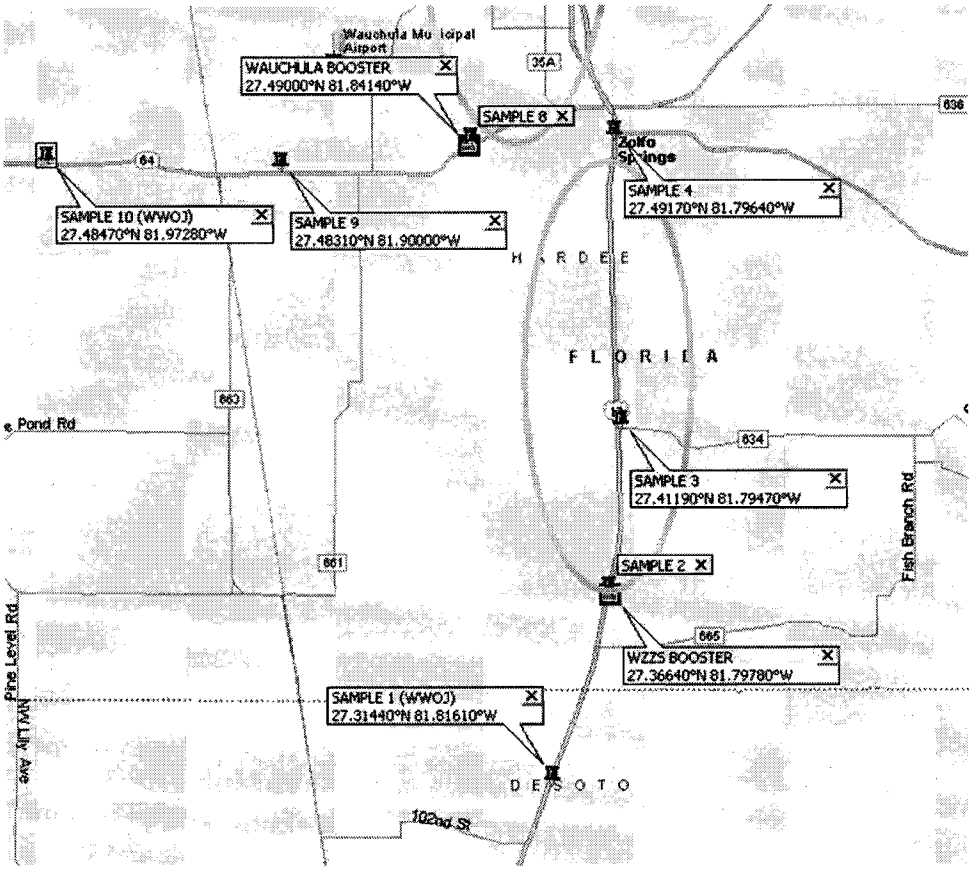


Figure One: Zolfo Spring Booster Test Locations

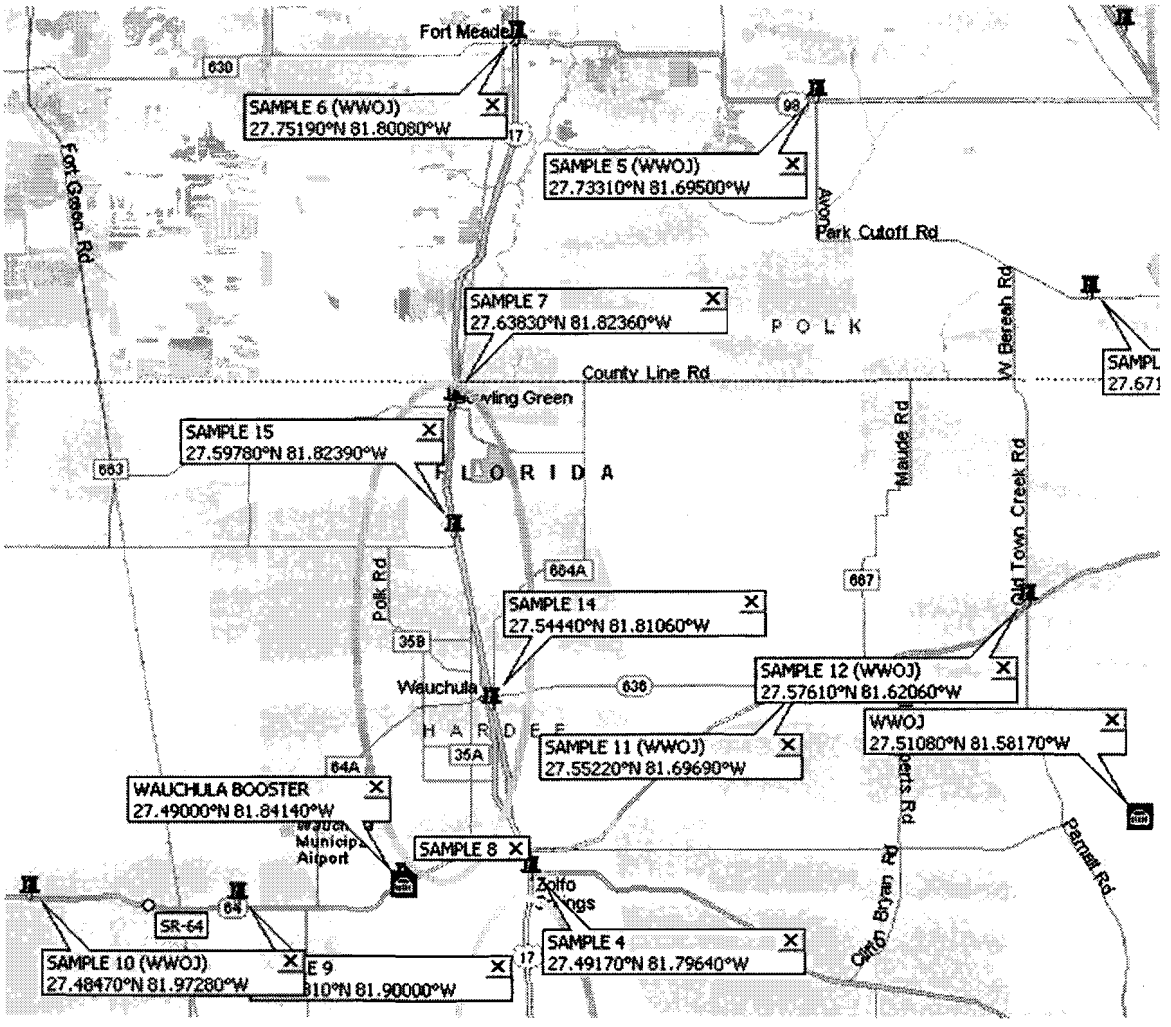


Figure Two: Wauchula Booster Test Locations

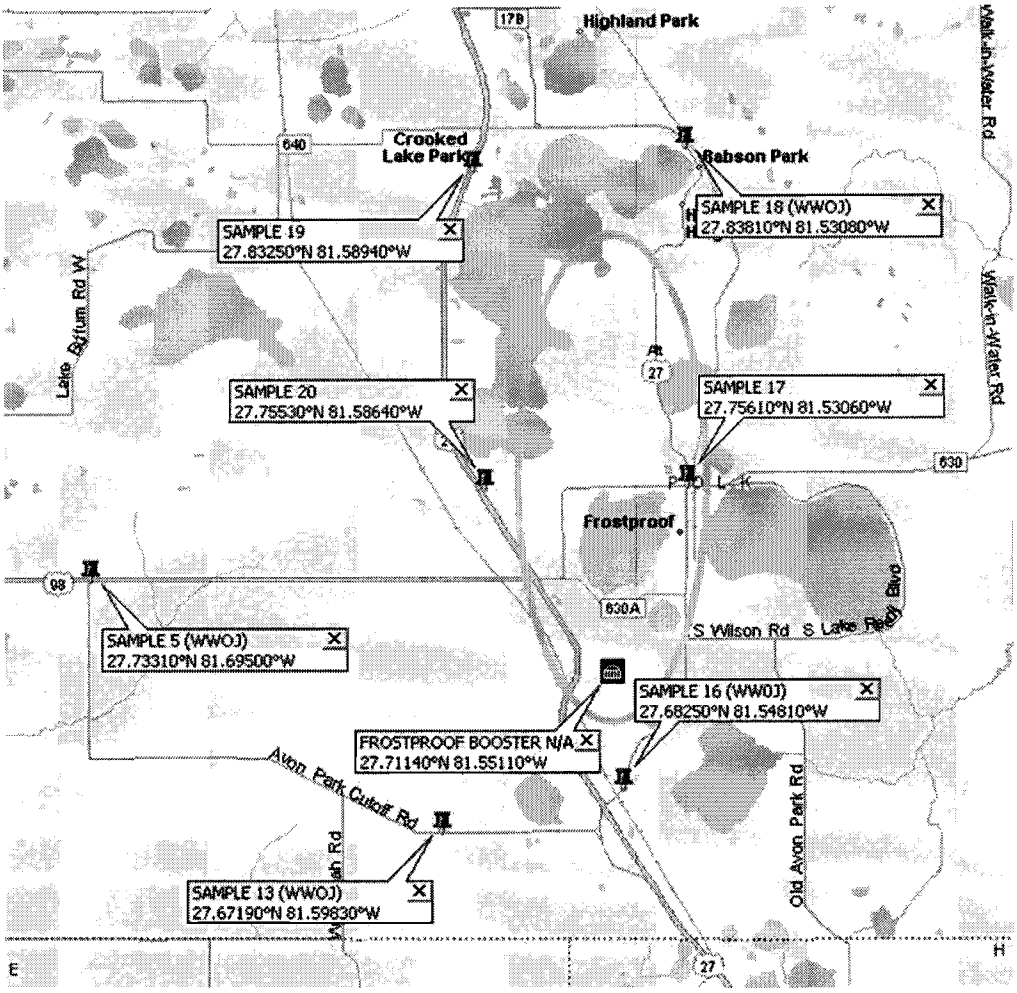


Figure Three: Frostproof Booster Test Locations

DRIVE TEST LOCATIONS

Preliminary testing occurred on 11/15/2011 and 12/01/2011 to determine appropriate test locations and drive distances between test locations. It is important to point out that 10 to 30 minutes elapsed between the PSA spots, so drive distances had to be determined- typically 5-10 miles apart, and compensated by roads, construction delays, and alternate routes for high traffic or accidents. A typical test location was in an empty large parking lot or open field with no close obstructions.

The 20 test locations were made in a stationary vehicle with sophisticated RF receiver and measurement software. Extreme care was taken to measure the Non-Targeted PSA spots and Targeted PSA spot (before and after) while the vehicle was within 1-1.5 meters each time, with the same vehicle orientation, and RF level within 1 dB.

MEASUREMENT LOCATIONS

Each of the 20 test locations was determined both the proximity to the closest booster and the estimated booster coverage zone that it existed. The following table indicates the distances from a test location to the boosters and main (WWOJ) transmitter.

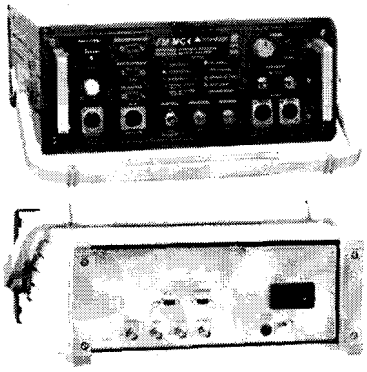
	LOCATION		DISTANCE (MILES) BETWEEN SAMPLE POINTS			
				BOOSTERS		MAIN
			ZOLFO SPRINGS	WAUCHULA	FROSTPROOF	WWOJ
SAMPLE 1	27°18'52"N	81°48'58"W	3.76	12.23	31.88	22.10
SAMPLE 2	27°21'58"N	81°47'53"W	0.00	8.95	28.22	19.13
SAMPLE 3	27°24'42"N	81°47'41"W	3.15	6.11	25.51	17.52
SAMPLE 4	27°29'24"N	81°50'28"W	8.66	2.76	21.35	16.28
SAMPLE 5	27°44'01"N	81°41'42"W	26.11	19.04	8.93	18.33
SAMPLE 6	27°45'07"N	81°48'03"W	26.64	18.27	15.52	23.43
SAMPLE 7	27°38'12"N	81°49'27"W	18.85	10.30	17.42	19.93
SAMPLE 8	27°29'24"N	81°50'28"W	8.95	0.00	23.45	19.04
SAMPLE 9	27°28'59"N	81°54'00"W	10.17	3.63	26.59	22.66
SAMPLE 10	27°29'05"N	81°58'12"W	13.49	8.06	30.20	27.10
SAMPLE 11	27°33'08"N	81°41'49"W	14.25	9.84	14.16	10.52
SAMPLE 12	27°34'34"N	81°37'14"W	18.11	14.78	10.27	7.07
SAMPLE 13	27°38'47"N	81°37'31"W	24.39	19.48	3.97	11.85
SAMPLE 14	27°32'40"N	81°48'38"W	12.32	4.21	19.63	17.25
SAMPLE 15	27°35'52"N	81°49'24"W	16.07	7.52	18.45	18.88
SAMPLE 16	27°40'57"N	81°32'53"W	26.67	22.35	2.00	11.90
SAMPLE 17	27°45'22"N	81°31'50"W	31.51	26.46	3.33	16.95
SAMPLE 18	27°50'17"N	81°31'51"W	36.46	30.65	8.84	22.61
SAMPLE 19	27°49'57"N	81°35'22"W	34.64	28.25	8.69	22.50
SAMPLE 20	27°45'19"N	81°35'11"W	29.83	24.08	3.72	17.22

Table Four: Booster Distance Locations

TEST MEASUREMENT EQUIPMENT AND RESULTS

The 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 was 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.



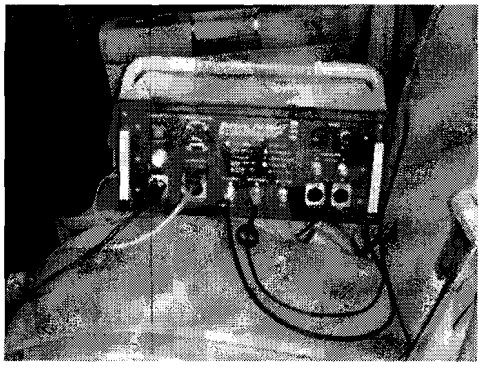


Figure Four and Five: Audemat FM-MC4™

An example of a GoldenEar™ multipath plot is shown for the Sebring WWOJ test locations:

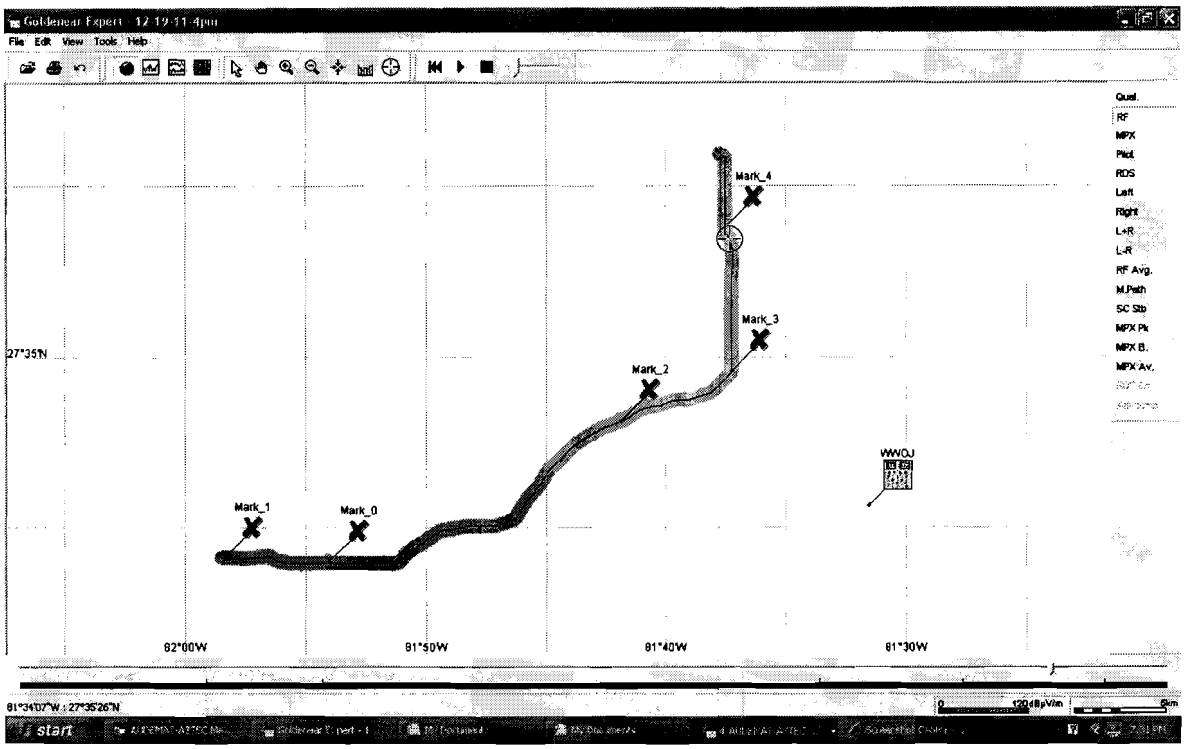


Figure Six: GoldenEar™ SLC Plot

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. They include:

- RF level
- MPX and sub-carriers (19 kHz Pilot)
- Demodulated audio signals (Left, Right, Left+Right, Left-Right)
- Stereo information.

From these raw signals, several calculated signals are deduced:

- Averaged RF level
- Multipath ratio
- Sub-carrier stability (variation ratio over nominal level)
- MPX exceeding (over nominal level)

The first signal processing is done within the FM-MC4™. The signal concerned by the acquisition is the Multiplex signal whose format is defined by a maximum pass-band of 100 kHz. This analog MPX signal is converted into a digital signal using an A/D converter. Sampling frequency is fixed at 256 kHz, which guarantees quantification of any signal up to theoretical maximum frequency of 128kHz. For subjective listening the audio output of the receiver was recorded digitally in a (CCIT 22.050 kHz, 8-bit, stereo, 43 Kbps sampling rate) WAV file format by the GoldenEar™ software.

In term of RF signal level, the Relative field: dBμV/m, mV/m is presented:

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 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.

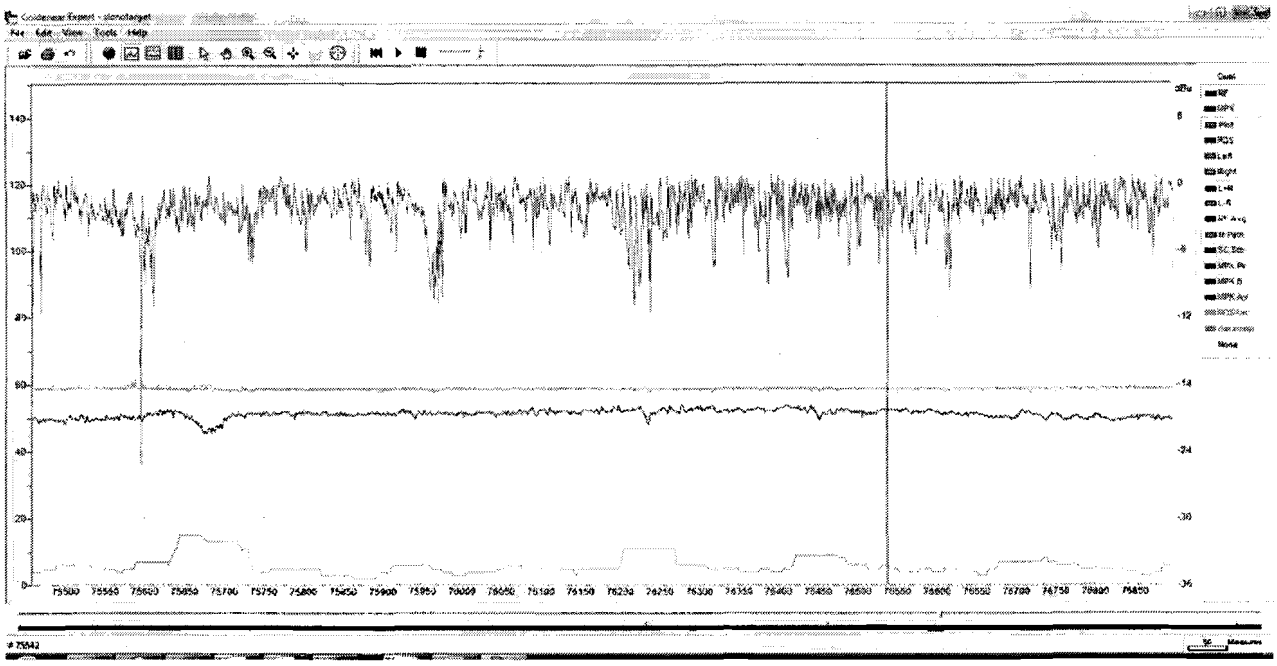


Figure Seven: GoldenEar™ Signal Display

MEASUREMENT VEHICLE

The measurement vehicle used in this test was a 2011 Jeep Liberty AWD. It was chosen because of the very large, flat metal roof with no obstructions, providing a ground plane to minimize pattern disturbances for the magnetic mount whip antenna. It should be noted that the FM-MC4™, antenna and cable were professionally calibrated at Audemat Labs in Paris on 6/18/2010.

Curb Weight (lbs)	4076
City (MPG)	16
Hwy (MPG)	22
Horsepower	210@5200
Torque (lb-ft)	235@4000
Wheelbase	106.1
Length (in.)	176.9
Width (in.)	72.3
Height (in.)	71.0

Figure Eight: Test Vehicle

RF MEASUREMENT RESULTS

The RF propagation of WWOJ (FM) was accurately measured and the data collected was used to tune the RF propagation model. The area of data collection and relative signal strength is indicated in the following figure.

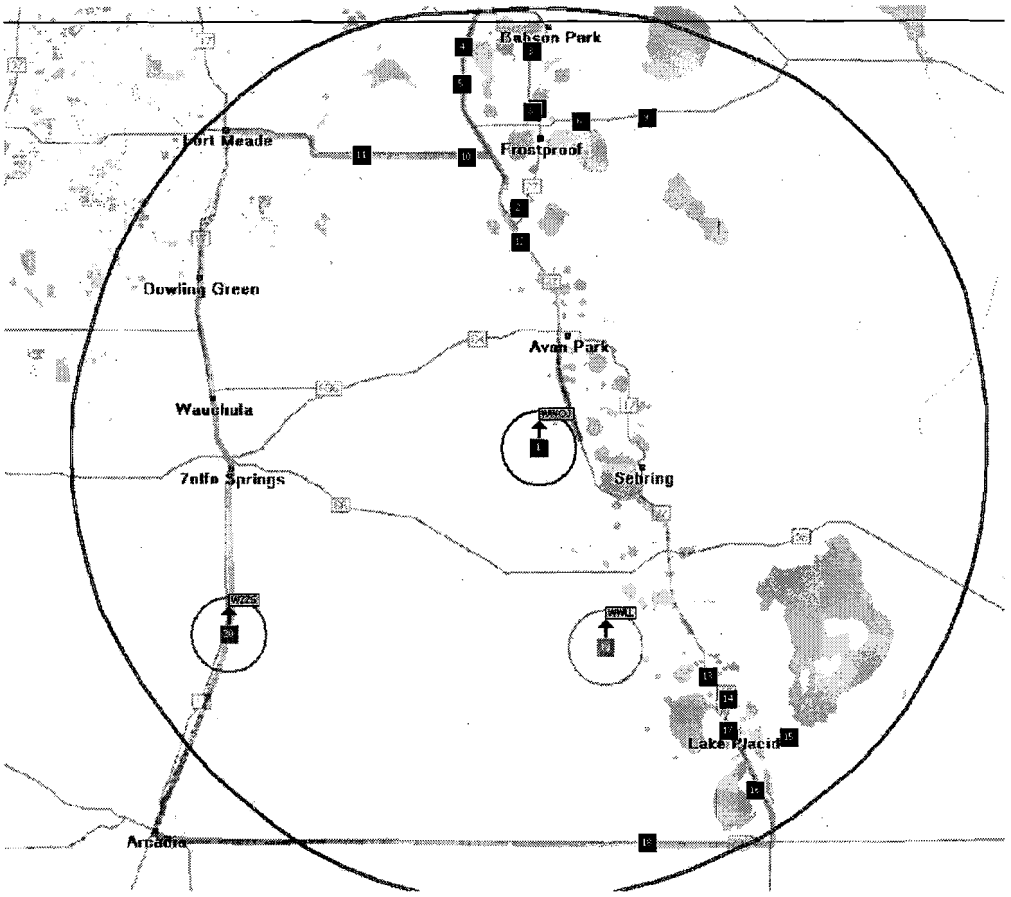


Figure Nine: RF Propagation Measurements for WWOJ

These measurements were imported into the Lazer Spots, LLC propagation model, generally based on the International Standard ITU-R 525/526[2] with sub-path attenuations. Given the flat terrain and minimal amount of obstructions, an accurate model was constructed after only a few correlation analyses which optimized the propagation model parameters:

[2] RECOMMENDATION ITU-R P.525-2 CALCULATION OF FREE-SPACE ATTENUATION (1978-1982-1994), RECOMMENDATION ITU-R P.526-10 Propagation by diffraction (ITU-R 202/3) (1978-1982-1992-1994-1995-1997-1999-2001-2003-2005-2007)

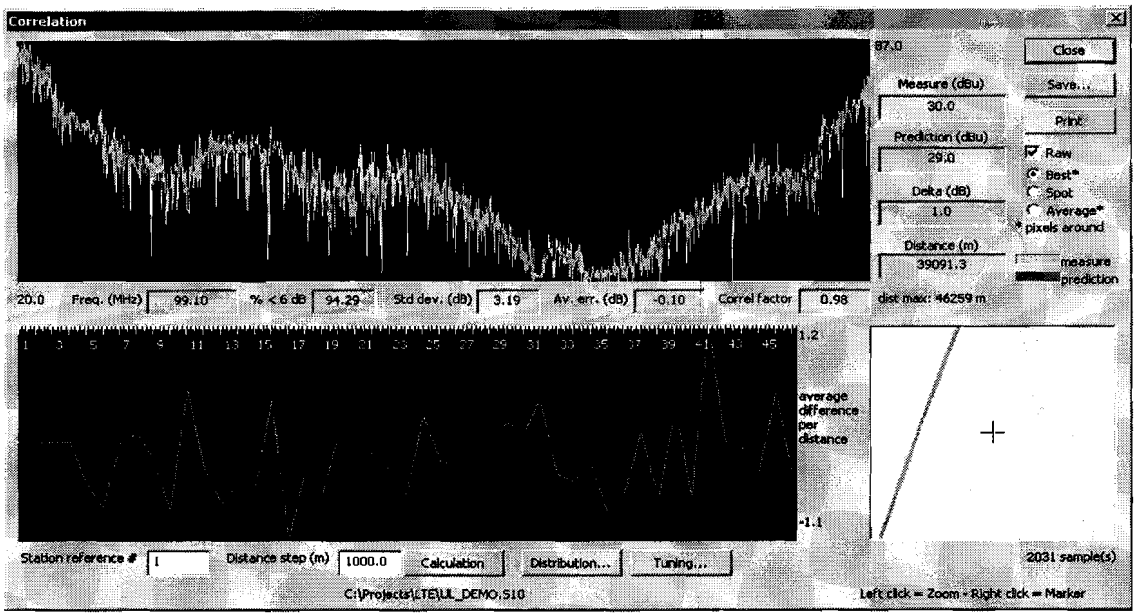


Figure Ten: WWOJ Final Correlation Analysis

The final prediction model had an average error of -0.1 dB and a standard deviation of 3.19 dB, with 94.29% 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.

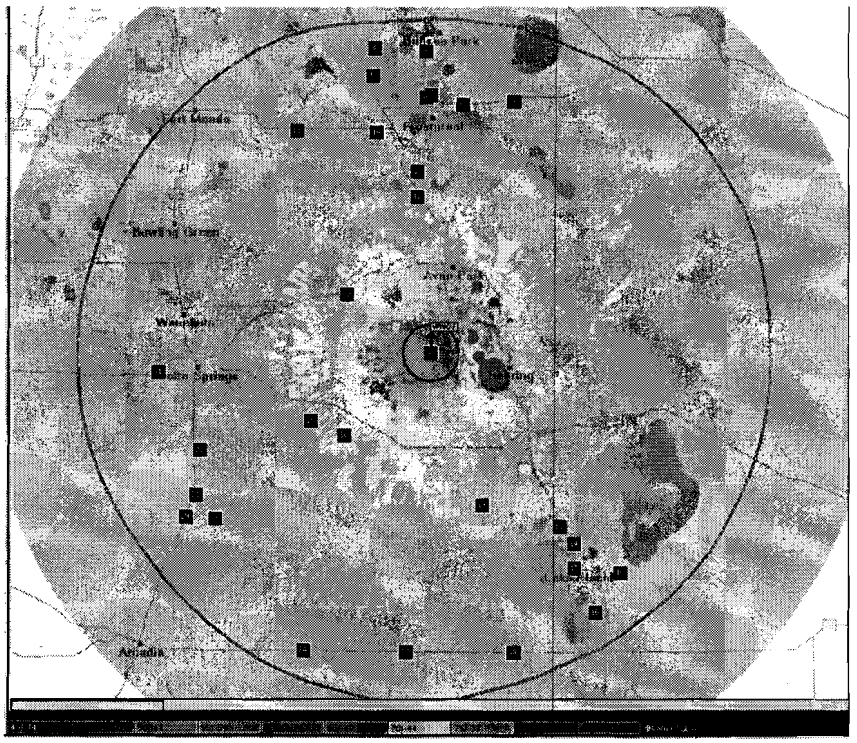


Figure 11: WWOJ Coverage

BOOSTER CONSTRUCTION

Three booster transmitters were constructed for the purposes of this test. All three used Harris ZX TRANSMITTERS™, INTRAPLEX™ and SYNCHROCAST3™ equipment, with a private IP data network for distributing linear uncompressed audio, and GPS for time synchronization and frequency stability.

Figure 12: Outdoor Harris Booster Enclosure

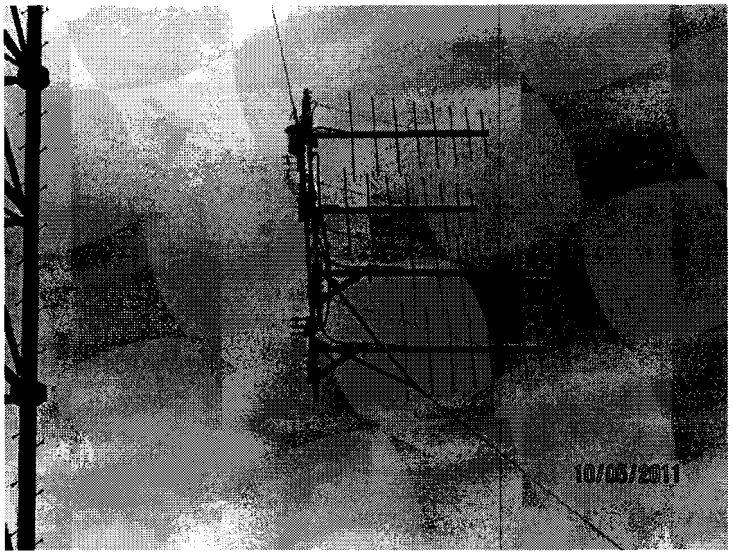


Figure 13: WWOJ FM Booster Antenna Array Being Installed

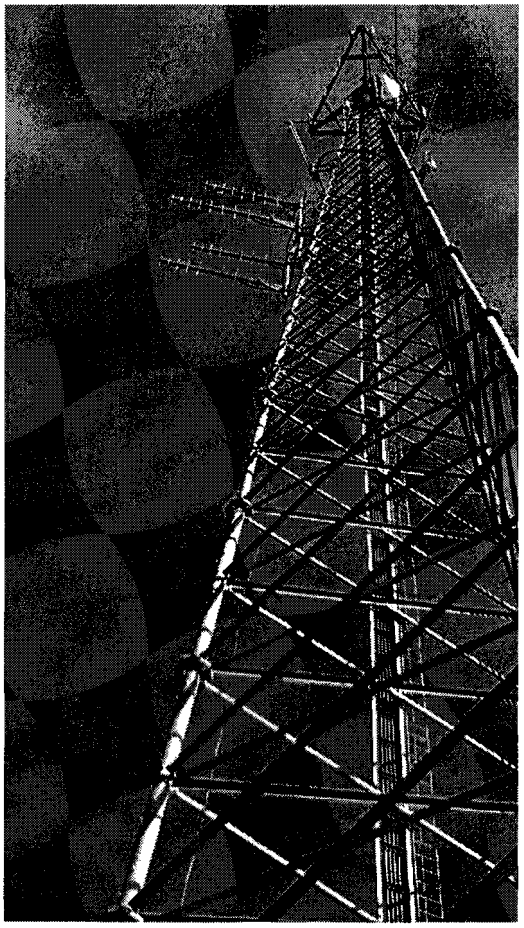


Figure 14: WWOJ Booster Antenna Array on Tower

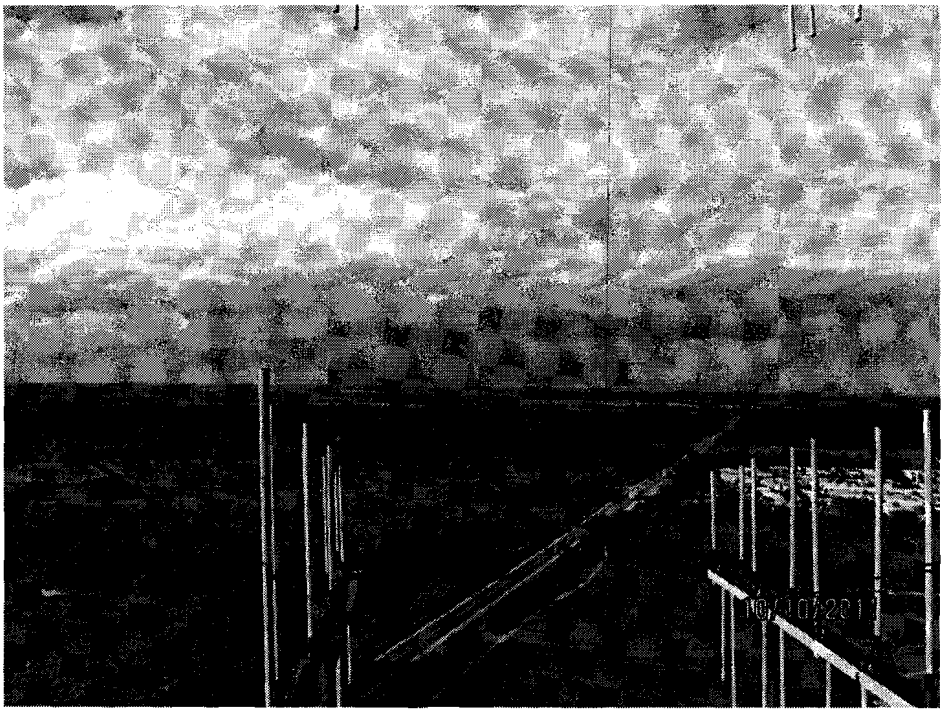


Figure 15: View from Zolfo Springs Booster Antenna Array

BOOSTER DATA

1.	Booster location:	Zolfo Springs, Florida
	Geographic coordinates:	27° 21' 59" N, 81° 47' 52" W (NAD 1927)
	Channel	256 (99.1 MHz)
	Effective radiated power:	Not to exceed 5 kilowatts (Max-DA, V only)
	Antenna type:	Composite array, Four Aldena, model ALP.08.02.712 log periodic antennas, 2 x 2 stack, directional
	Antenna orientation:	0° True
	Antenna height:	
	above ground:	64 meters
	above mean sea level:	81 meters
	above average terrain:	64 meters
2.	Booster location:	Wauchula, Florida
	Geographic coordinates:	27° 29' 24" N, 81° 50' 29" W (NAD 1927)
	Channel	256 (99.1 MHz)
	Effective radiated power:	Not to exceed 5 kilowatts (Max-DA, V only)
	Antenna type:	Composite array, Four Aldena, model ALP.08.02.712 log periodic antennas, 2 x 2 stack, directional
	Antenna orientation:	12° True
	Antenna height:	
	above ground:	72 meters
	above mean sea level:	96 meters
	above average terrain:	72 meters
3.	Booster location:	Frostproof, Florida
	Geographic coordinates:	27° 42' 41" N, 81° 33' 04" W (NAD 1927)
	Channel	256 (99.1 MHz)
	Effective radiated power:	Not to exceed 5 kilowatts (Max-DA, V only)
	Antenna type:	Composite array, Four Aldena, model ALP.08.02.712 log periodic antennas, 2 x 2 stack, directional
	Antenna orientation:	13° True
	Antenna height:	
	above ground:	38 meters
	above mean sea level:	76 meters
	above average terrain:	38 meters

RF ANALYSIS OF THE TEST AREA

Because of the booster placement, optimized for population coverage and flat terrain, it was desired to see if implementing targeted messaging correlated well with the substantial amount of RF engineering performed on this test, which was accomplished successfully as this report indicates.

60 dBu CONTOURS

The Broadcast (Part 73) propagation models are essentially simplified statistical methods of estimating field strength and coverage based only on a station's effective radiated power (ERP) and height above average terrain (HAAT). Since the terrain information is averaged, the model does not take into account specific individual localized obstructions or shadowing. Also, since the average used for this model only includes the terrain between three and 16 kilometers from the transmitter site, terrain obstructions outside of this range are ignored. This means that identical results will be calculated whether or not a transmitting antenna has clear line of sight or complete blockage by an obstruction in the first three kilometers portion of a path. Likewise, any terrain obstructions beyond 16 kilometers that block the line of sight to a more distant receiving antenna are ignored. The main use of this model is for license applications or other submissions to the FCC which specifically require the use of the methods described in Part 73.

Designated as F(50,50) (Estimated field strength exceeded at 50% of the potential receiver locations for at least 50% of the time at a receiving antenna height of 9.1 meters), the protected service contours for FM stations are the 54 dBμV/m for commercial Class B stations, 57 dBμV/m for commercial Class B1 stations, and 60 dBμV/m (1 mV/m) for commercial Class A, C3, C2, C1, and C stations, as well as 60 dBμV/m for all classes of noncommercial educational stations (including low power FM (LPFM) stations). City coverage for commercial FM stations is defined by the F(50,50) 70 dBμV/m contour, per Part 73.315. Comparatively, TIREM, Okumura, and Longley-Rice are more analytical models that consider a number of other factors, such as individual obstructions (either terrain or manmade), terrain roughness, Land Use Land Clutter (LULC) information, etc.

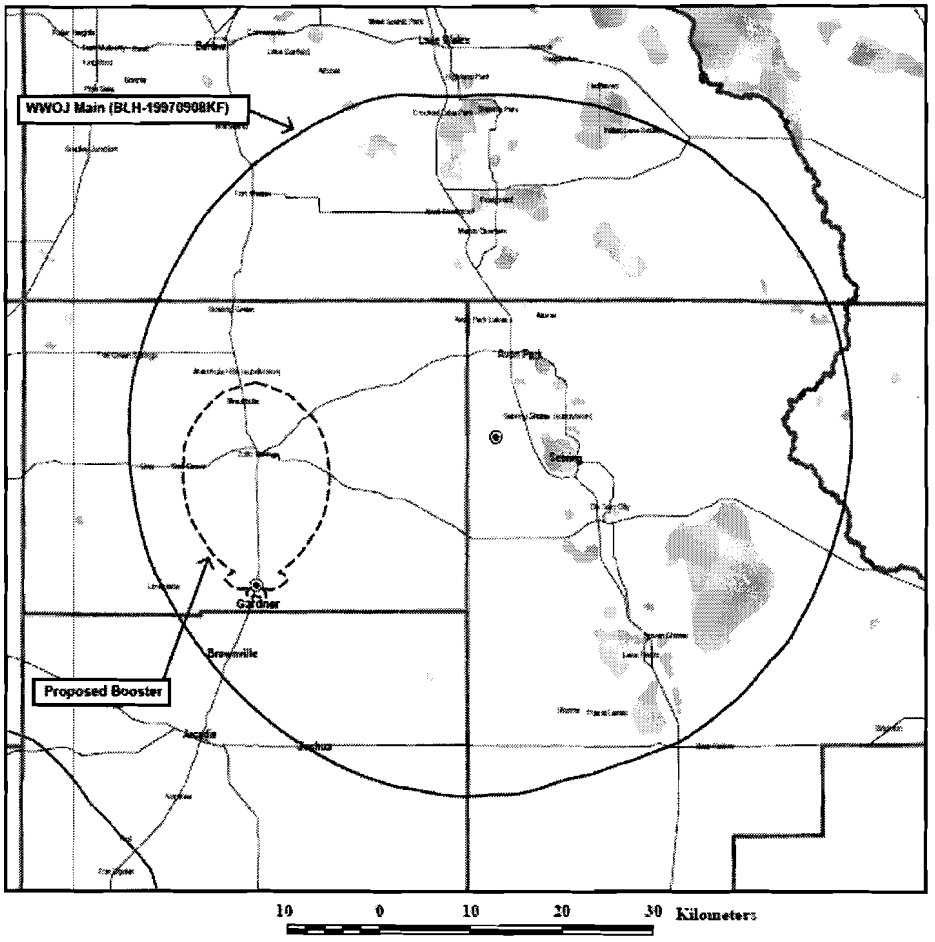


Figure 16: Zolfo Spring Booster 60 dBμV/m Service Contour

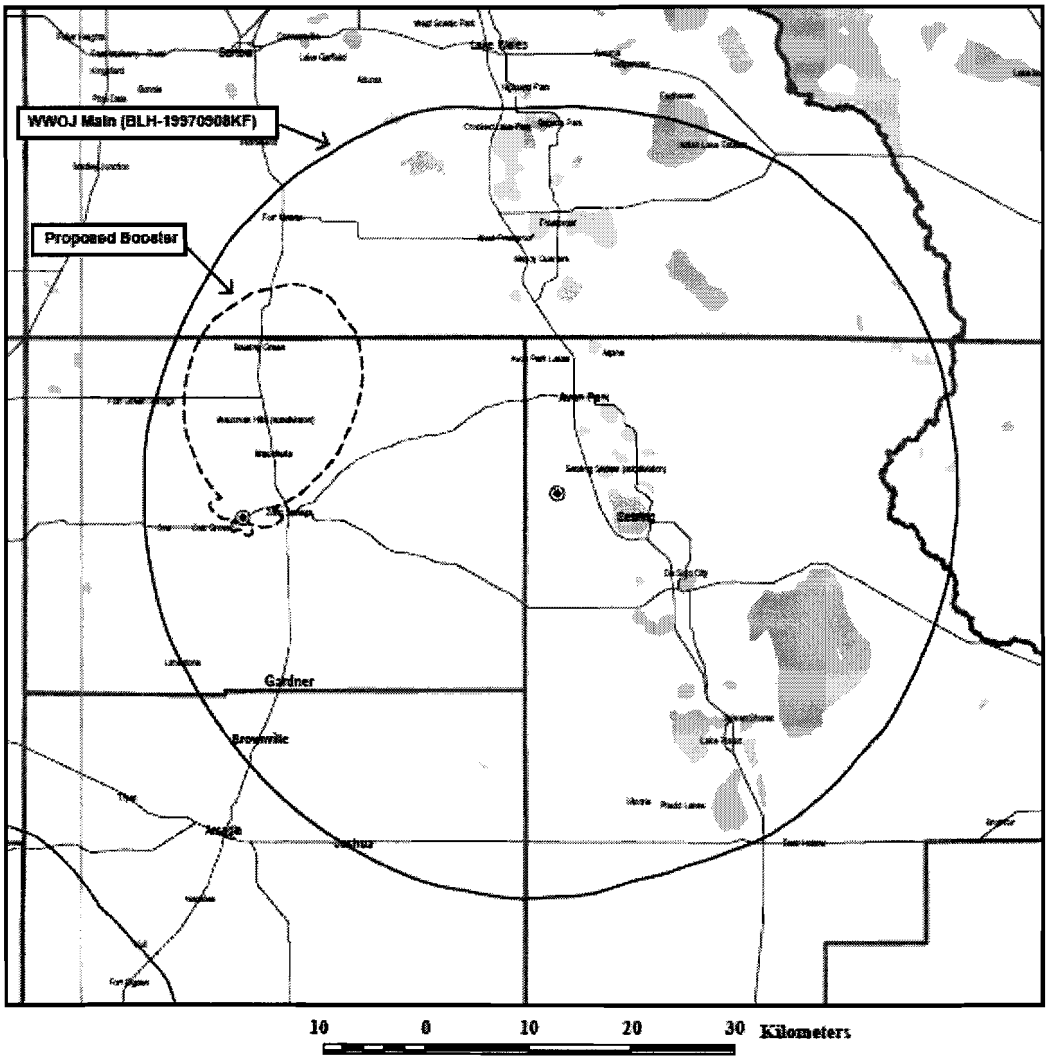


Figure 17: Wauchula Booster 60 dBμV/m Service Contour

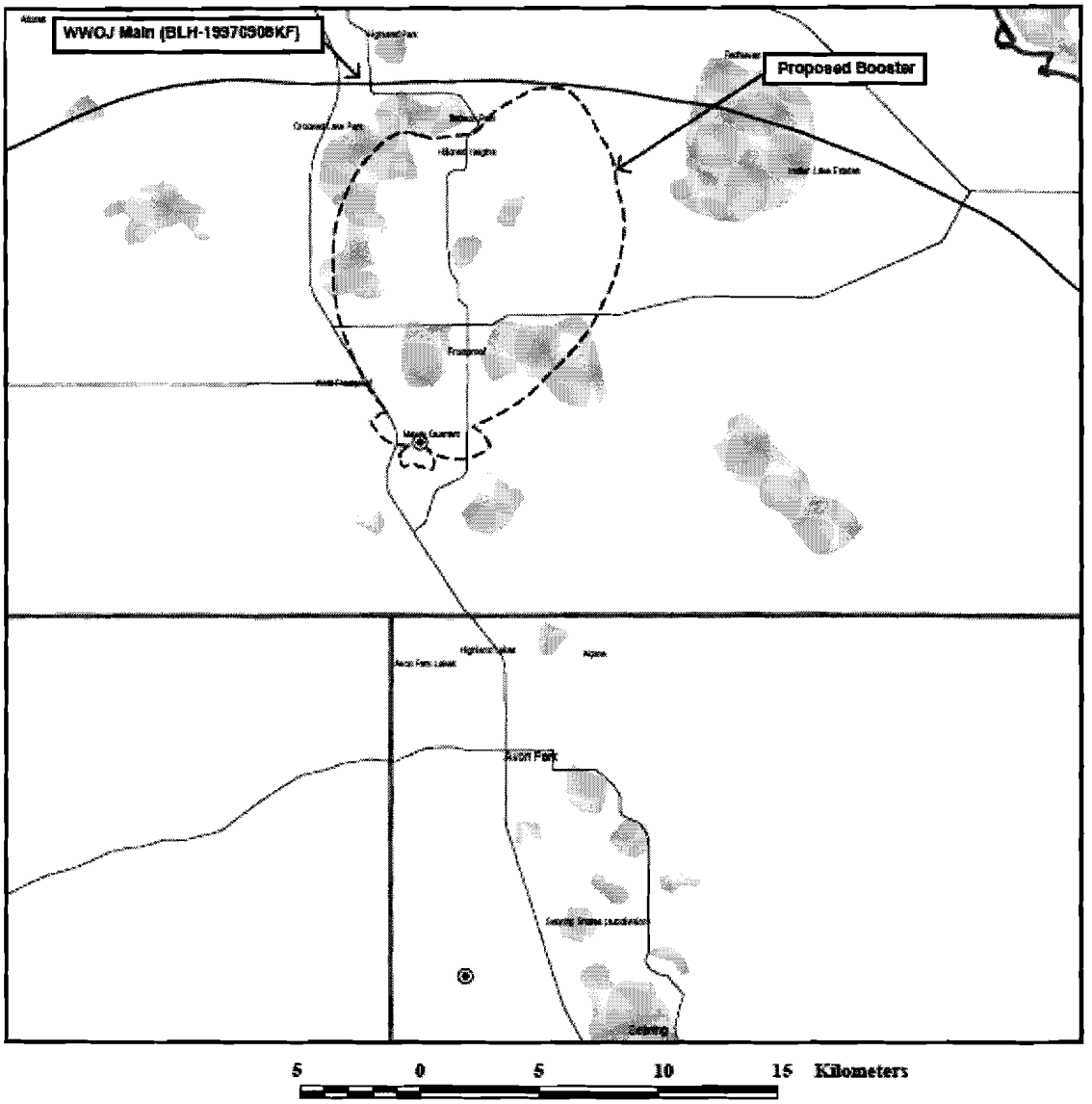


Figure 18: Frostproof Booster 60 dBμV/m Service Contour

NETWORK INFRASTRUCTURE AND TARGETED SPOT INSERTION

AUDIO DISTRIBUTION NETWORK

Because this network was constructed from the ground up, on tower co-locations, a method of sending distinct audio messages to the boosters was needed during both the simulcast Non-Targeted and Targeted PSA spot times. This was accomplished by constructing a separate 5.8 GHz Microwave wireless distribution network from the KZZS (FM) studio in Zolfo Springs to all three boosters. Additionally, implementation of control point infrastructure at the main studio (WWOJ (FM)), distribution of control signals through an IP network to the Lazer Spot control point, and then distribution of stored audio from the Laser Spot control point to the three booster locations over a private IP network occurred for the test. Two modes of operation occurred in regards to PSA spot insertion: One involved simulcasting, on the booster network, the exact same PSA spot as the main (WWOJ (FM)) was broadcasting, the second was to simulcast a different PSA spot than the main was broadcasting. The goal was to determine relevant differences in audio quality between the two methods and this was the main goal of the testing.

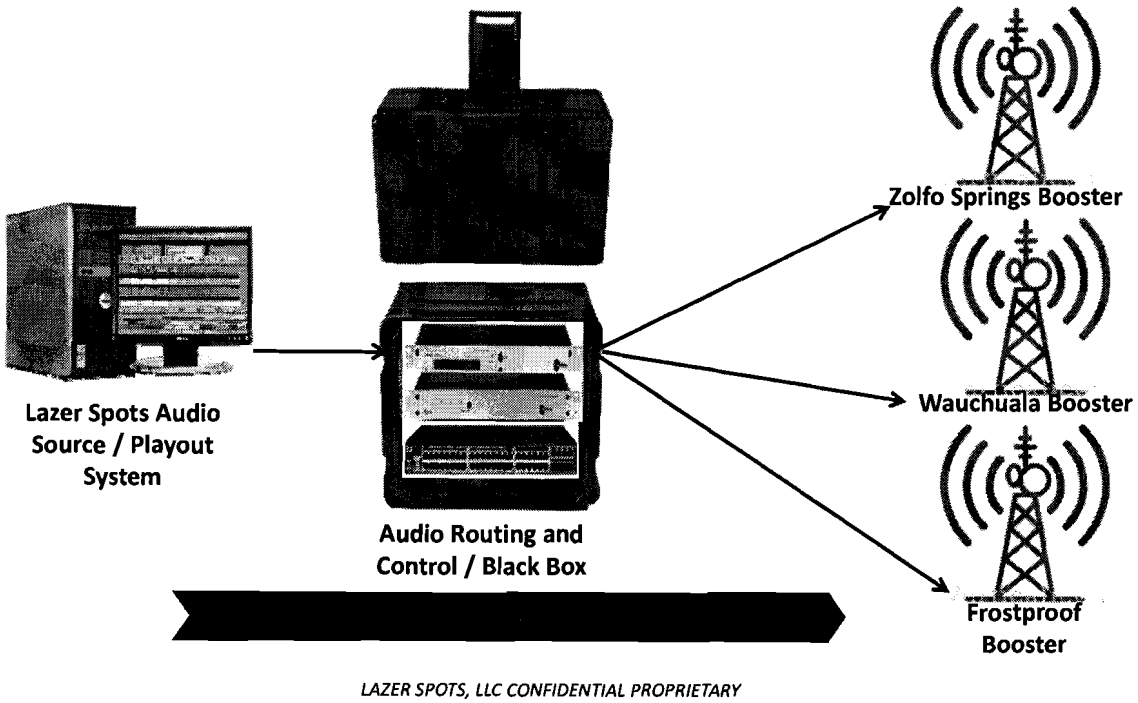


Figure 19: Audio and Microwave Distribution Network

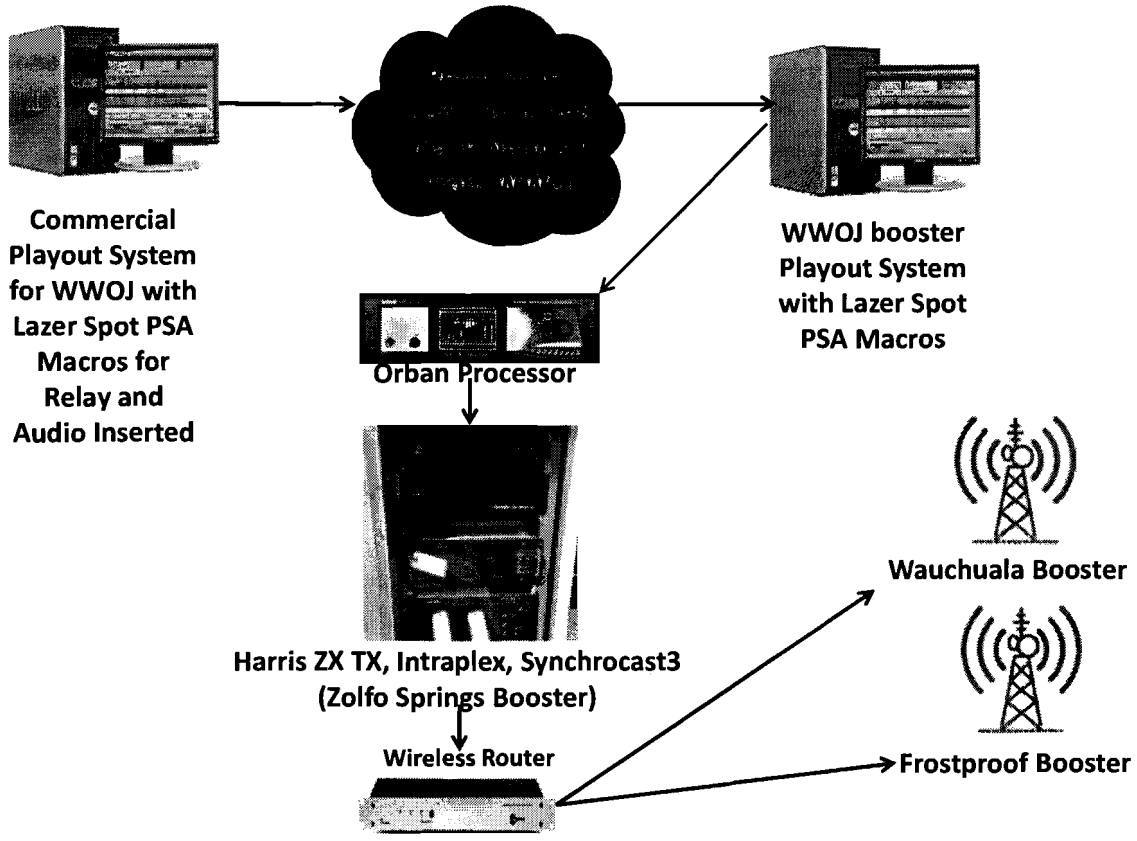


Figure 20: Audio and Microwave Distribution Network

THE LAZER SPOTS™ 'DBH CONTROL UNIT' (Patent Pending)

The Lazer Spots™ 'DBH Control Unit' is defined as a proprietary implementation of hardware and software that typically resides at the broadcast studio. The 'DBH Control Unit' design directs different audio feeds from new and existing automation and playout equipment (such as RCS -Prophet Systems, ENCO Systems, AudioVault-Broadcast Electronics, Scott Studios, Computer Concepts -Maestro, BSI Simian, WideOrbit- former Google automation, OMT Technologies –iMediatouch and others), through the 'DBH Control Unit' to different transmitter sites, while simultaneously turning the transmitters on and off (and/or increasing and decreasing the transmitters power) in synchronization with the new audio targeted audio feeds.

The 'DBH Control Unit' design is based on Ethernet, a mature technology which is the clear direction for audio routing. The major components use equipment which is 100% compatible with Ethernet networking standards, including Cisco networking equipment. The same network that switches and distributes live, linear audio targeted channels also carries GPIO signals, file transfers, and any other standard IP data.

The hardware and software that the 'DBH Control Unit' houses includes analog and digital input and output interfaces, General Purpose Input and Output (GPIO) logic interfaces, both trigger (TTL low-level voltage) and contact closure relays connections, routing software which controls consolidated access to all interfaces, and a Cisco Catalyst-Ethernet switch to connect interface nodes, PCs, WAN devices, and an internal playout system thru 10/100/1000 Mbps ports. The 'DBH Control Unit' performs timed updates (or via contact closure or audio detection) to reconfigure a few or many sources and destinations simultaneously. It also can provide the generation of Target spot audio if necessary.

ROUTING, SWITCHING, AND CONTROL FOR TARGETED SPOT DELIVERY

Each implementation of the 'DBH Control Unit' will vary in configuration depending on the broadcast studio audio equipment and STL interfaces. For WWOJ (FM), during the Targeted spot time (two to three times per hour), pre-produced 30 second Targeted spot audio streams were generated with a PC-based playout system. A relay trigger pulse from the existing on-air playout system to the 'DBH Control Unit' initiated the generation of Targeted audio playout streams. This was done by creating a script command in the existing playout system before each of the Targeted spots to pulse a relay that was connected to a trigger on the 'DBH Control Unit'. Once the trigger was pulsed, audio streams (the pre-produced Target spots) as well as GPIO control information were generated and output to an Ethernet switch/router at the IP network level.

The Ethernet switch/router interfaced directly with an IP Microwave distribution network using Harris Sychrocast 3™ IP equipment, with linear uncompressed audio. The network connected directly to a wireless router at the Zolfo Springs booster transmission site. At this site another wireless connection was made to the Wauchula booster and then to the Frostproof booster transmission site.

At the microwave connected booster sites, a digital IP relay device controlled the power amplifiers which received digital audio from the Harris Synchrocast 3™ stream by using the GPIO signals generated at the 'DBH Control Unit'.

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

AUDIO SAMPLE RECORDINGS

In the WWOJ (FM) service contour, the three boosters create two distinct coverage areas, in terms of RF isolation and segregated markets. As a comparative reference, each booster play the same Public Service Announcements (PSAs) as the main WWOJ (FM) transmitter at the same time, and then the same tests were performed with a different PSA spot than the main. For WWOJ (FM), radio spots (non-commercial and commercial) start approximately at: :26, :42, and