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Merrill Weiss Group LLC

Consultants in Electronic Media Technology / Management

**Technical Statement
Request for Program Test Authority
WFOX-TV, Channel 14, Jacksonville, FL
Cox Television Jacksonville, LLC
Construction Permit in File Number 0000034616
Facility ID 11909**

Introduction

Station WFOX-TV ("WFOX") was assigned to Channel 14 in the Post-Incentive Auction Spectrum Repack and holds a construction permit, in File Number 0000034616, for Facility ID 11909, on that channel at a site in Jacksonville, FL, known as the SBA Tower. Its principle operating parameters are 663 kW ERP, using a directional antenna at a radiation center height of 289 m above ground level and 295.4 m above mean sea level. WFOX-TV initially was assigned to Repack Transition Phase 7, which ended on January 17, 2020. WFOX was unable to meet the Phase 7 transition date, and a timely request was made to move the station to Phase 10 – a request the FCC granted. As the necessary work to meet the special conditions required of stations moving to Channel 14 continued, it became apparent that the end of Phase 10 also could not be achieved. The FCC granted a waiver, which currently is in effect, permitting WFOX-TV to continue operations on its existing Channel 32 facilities through an end date of September 8, 2020.

The work necessary to meet the special condition for operation on Channel 14 contained in the WFOX construction permit has been completed. As the Commission is aware, the process of locating and eliminating interference either directly from or triggered by Channel 14 signals into the Land Mobile Radio (LMR) spectrum positioned just below Channel 14 with no guard band can be a difficult and time-consuming process. The difficulty is only exacerbated when trying to achieve the necessary results when the necessary industry resources were dedicated to the spectrum repacking of nearly 1000 television stations. Cox Television Jacksonville, LLC, licensee of WFOX-TV, greatly appreciates the flexibility and support provided by the FCC and its staff in WFOX-TV's successful effort in resolving these issues and moving to Channel 14.

In the WFOX-TV Channel 14 Construction Permit, there is a Special Condition that reads as follows:

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During equipment tests, authorized by Section 73.1610 of the Commission's Rules, the permittee shall take adequate measures to identify and substantially eliminate objectionable interference that may be caused to existing land mobile radio facilities in the 460 to 470 MHz band. Documentation that objectionable interference will not be caused to existing land mobile radio facilities shall be submitted along with the request for Program Test Authority. Program tests shall not be commenced under Section 73.1620(a) of the Commission's Rules and may only be started after specific authority is granted by the Commission. An application for a license must be filed within 10 days after the start of program tests.

The information contained in this Technical Statement and its attachments is that needed to satisfy the requirements of the Special Condition.

Steps Taken

Three principal areas were identified that had to be successfully addressed if the outcome of broadcasting on Channel 14 with no interference to nearby LMR operations was to be achieved. Those three areas are the performance of the transmission system, the performance of the reception systems, and the generation of Passive Intermodulation (PIM) anywhere between the transmitter and any of the receivers. The transmission system required careful output (mask) filter design in combination with a transmitter having high-performance with respect to its out-of-band noise generation. Receivers required evaluation for adequate selectivity to "tune out" the Channel 14 signal power along with adequate linearity of any amplifiers used to avoid generating intermodulation products in the receiving systems. The environment required inspection to look for potential PIM generators and probing in several forms to determine whether PIM already was present.

The first area, the transmission system, naturally would be addressed as part of the design process prior to the Channel 14 system being available for testing. The last area, possible PIM generation, could be partially evaluated before the transmitter was available for testing but only could be conclusively analyzed when the high-power Channel 14 signal was broadcast over the air for testing purposes. The receivers, as a practical and cost matter, could be tested only after the Channel 14 signal actually was being transmitted. Consequently, the areas were prioritized to put the transmitter design first, to do as much evaluation of PIM generation as possible next, and to leave receiver testing for last – after the transmitter had been constructed and could be turned on. At the same time, it was recognized that contact with LMR operators would be necessary and that they should be identified and contacted as early in the process as reasonable.

WFOX and its consultant planned and executed an evaluation of the SBA Tower site to determine whether significant PIM generators were present. Tests were conducted in mid-April 2017. Substantial PIM was found being generated on and/or by the tower, with a visual inspection showing numerous potential sources of the problem. The PIM levels were strong enough and the visual findings plentiful enough that it was clear at the end of the evaluation that remediation of the tower would be required if any operations on Channel 14 were to take place at the SBA Tower site. As described below, WFOX contracted for the work, and the necessary PIM remediation at the SBA Tower site has been completed.

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In August 2017, WFOX contracted with RF Notifications LLC to identify and help establish communications with LMR licensees in the Jacksonville region. RF Notifications undertook to locate all LMR licensees listed in the FCC ULS database within 100 km of the WFOX transmitter site and sent written notification to all licensees that it found. It identified 3683 separate licensee/frequency pairs within the search area and mailed letters to all their licensees. The licensees were given the URL of a web site that RF Notifications set up to collect information on the LMR licensees and their licensed facilities – in particular, contact information to permit coordination of testing. RF Notifications sent a total of 975 letters to cover 594 unique call signs related to LMR operations within the 460 – 470 MHz band. It received through the website a total of 101 registrations of licensees covering 182 of the unique call signs. A copy of a Certificate of Mailing for the letters sent is in Attachment A hereto.

Following a number of delays that were beyond the control of WFOX and previously have been described to the Commission, in late December 2019, WFOX-TV conducted initial testing of the station's Channel 14 operations in cooperation with LMR technical personnel responsible for a couple of nearby broadband, multi-user receiving systems. These tests revealed severe interference problems related to the LMR reception systems at both locations – the SBA Tower, where WFOX-TV is located, and another nearby tower site located at Anders Blvd. Accordingly, WFOX began planning remediation steps for the receiving systems at both sites in conjunction with PIM remediation on the SBA Tower that already was in progress.

Given the large number of candidate interference cases identified in the RF Notifications information collection and LMR outreach processes, in early 2020, WFOX engaged Federal Engineering, Inc. (FE) to help analyze the data and cull the lists for potentially significant interference possibilities. FE mapped the locations of many of the LMR operations and found that there were three sites near the WFOX transmitter facility that had LMR master antenna receiving systems. WFOX had already identified two of those sites and had planned to replace the tower top input filter and amplifier systems (TTAs) there. The FE analysis indicated a potential need for an additional TTA system for the third such site, which belongs to American Tower Corporation (ATC) and is known as Newton Rd. Since the Newton Rd site is relatively close to the transmitter at the SBA Tower, it was assumed that interference would be likely there. Accordingly, the Newton Rd site was included in subsequent testing. Moreover, as soon as the first TTA replacement unit had been shown to perform as expected and before the second one was delivered, a third TTA unit was ordered, to be installed at Newton Rd at least as a precaution against possible future interference, even if none were found currently.

FE also evaluated the potential for interference from WFOX-TV on Channel 14 to all the other LMR operations within relevant distances of the WFOX transmitter site and not at the three nearby sites having master receiving antenna systems. Based on the provisions of §73.687(e)(4)(ii), requiring that the vertically polarized emissions of a Channel 14 facility on the receiving frequency of a licensed LMR station not exceed 17 dBu field strength when measured in a 30 kHz resolution bandwidth that fully contains the LMR receive channel, FE was able to eliminate all but six of the remaining LMR licenses using conservative analysis methods.

Technical Issues & Solutions

The effort to make the WFOX Channel 14 facility operate at its authorized power level of 663 kW ERP in close proximity to a number of master receive antenna LMR systems, along with even more single-

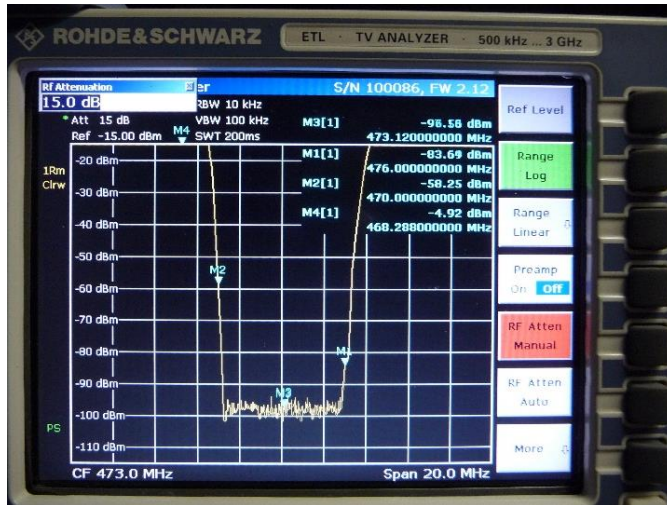


Figure 1 – Channel 19 Intermod Lobes of WJAX-TV After Signal Suppression of Approximately 100 dB to Enable Visibility & Measurement (6-poleMask Filter)

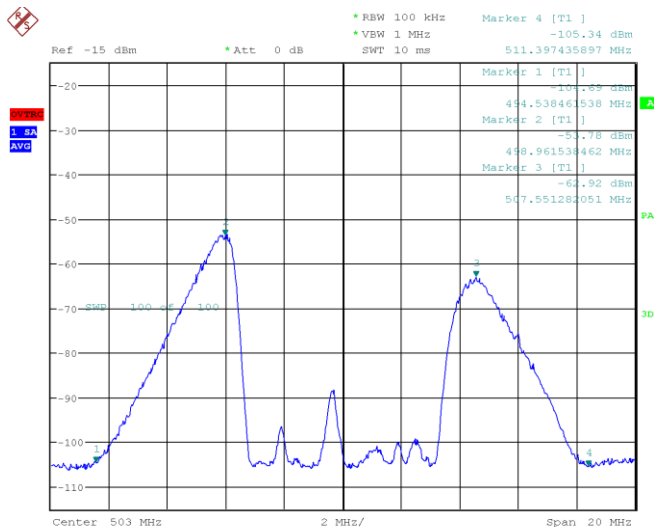


Figure 2 – Cascaded Bandstop Filters with >90 dB Channel Suppression (Channel 14 Shown as Example)

1 MW ERP. A pair of Channel 19 bandstop filters was used in cascade to suppress the Channel 19 signal level by roughly 90–100 dB, as shown in Figure 1 for a pair of Channel 14 bandstop filters of the same type.¹ By alternating insertion of attenuators and filters at the input of a high-dynamic-range spectrum

receiver systems, was divided into three aspects: the Channel 14 transmission facility, two types of reception facilities, and the paths between the transmitter and the receivers, which were known to include a significant number of PIM generators, at least on the SBA Tower where the WFOX antenna is located. Complicating matters, one of the master-antenna receiving systems was installed on the very same tower as the WFOX transmitter. Two other master-antenna receiving systems were about $\frac{3}{4}$ km and $1\frac{3}{4}$ km distant from the WFOX transmitter. All the master-antenna receiving systems had receiving antennas at elevations of 150 m (roughly 500 feet) Above Ground Level (AGL) and above. For reference, the WFOX transmitting antenna radiation center is at 293 m (roughly 961 feet) AGL.

As described above, PIM tests were conducted at the SBA Tower shortly after it was learned that WFOX would be moving to Channel 14. In conjunction with the PIM tests, a visual inspection was conducted, with tower crew members looking for signs that potential PIM generators were present. The facilities of WJAX-TV, which shared the same antenna and transmission line with WFOX and would continue to do so following the WFOX move to Channel 14, were used for all PIM testing. WJAX-TV operates on Channel 19 at

¹ The Channel 14 filters, used in another Channel 14-to-LMR interference case, demonstrate a suppression level in the stopband of over 90 dB, equal to the difference between the levels at markers M3 and M4. When M4 was set further into the passband, i.e., lower in frequency, where there was less loss in the filters, the suppression value indicated was greater.



Figure 3 – Loop Antenna Used as RF Probe When Seeking & Measuring PIM Noise Energy on Tower

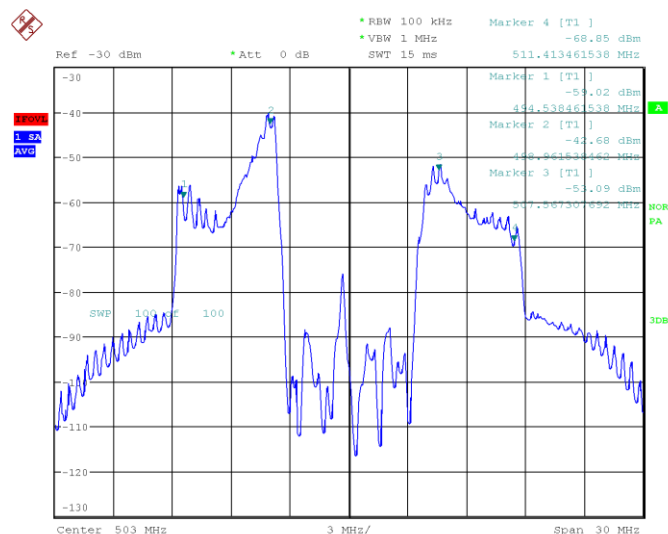


Figure 4 – Intermod Lobes with PIM Signature as Sampled using Loop Antenna as a Probe

analyzer, it became possible to see and measure the power, relative to the Channel 19 signal power, of the two “Intermod Lobes” that existed outside the filter stopband, at the top and bottom of the Channel 19 spectrum, as shown in Figure 2. It is worth noting that the mask filter used for Channel 19 was a conventional 6-pole type. The mask filter used by WFOV for Channel 14 is a 12-pole model with three cross-couplings; thus, its Intermod Lobes are at much lower levels relative to the channel power, as can be seen in Figure 9, discussed below.

The described method^{2, 3, 4} was applied to the transmission line and antenna through a directional coupler, and it was applied to numerous locations on the tower that were probed with a loop antenna of the sort shown in Figure 3. PIM that might be generated in the antenna or transmission line was evaluated by applying the measurement technique to the Reflected signal from the directional coupler. Any increase in power in the reflected Intermod Lobes relative to the reflected channel power would indicate the generation of PIM in the antenna or transmission line. None was found. Using the loop probe to feed the attenuator/filter/spectrum analyzer system permitted identifying the presence and approximate

locations of PIM generators on or near the tower. More than a few were found. Figure 4 shows the spectrum signature of one of them, as it appeared on the spectrum analyzer with the bandstop filter

² S. M. Weiss, G. Best, “Taming DTV Interference to Co-Sited Adjacent-Spectrum Users,” Proceedings of IEEE Broadcast Technology Symposium, October 21, 2011. (Won Matti S. Siukola Memorial Award for best conference presentation.)

³ S. M. Weiss, “Interference from Passive Intermodulation (PIM) – Keeping the Red Flag Flying,” Proceedings of IEEE Broadcast Technology Symposium, October 18, 2012. (Won Matti S. Siukola Memorial Award for best conference presentation.)

⁴ S. M. Weiss, “Specifying and Measuring Passive Intermodulation (PIM) Levels in RF Components and Systems at Broadcast Power Levels,” Proceedings of IEEE Broadcast Technology Symposium, October 10, 2013.



Figure 5 – Rusty Bolt Syndrome Is a Well-Known PIM Cause (Found on SBA Tower)



Figure 6 – Rusty Bolt Example Found in Transmission Line Support on SBA Tower

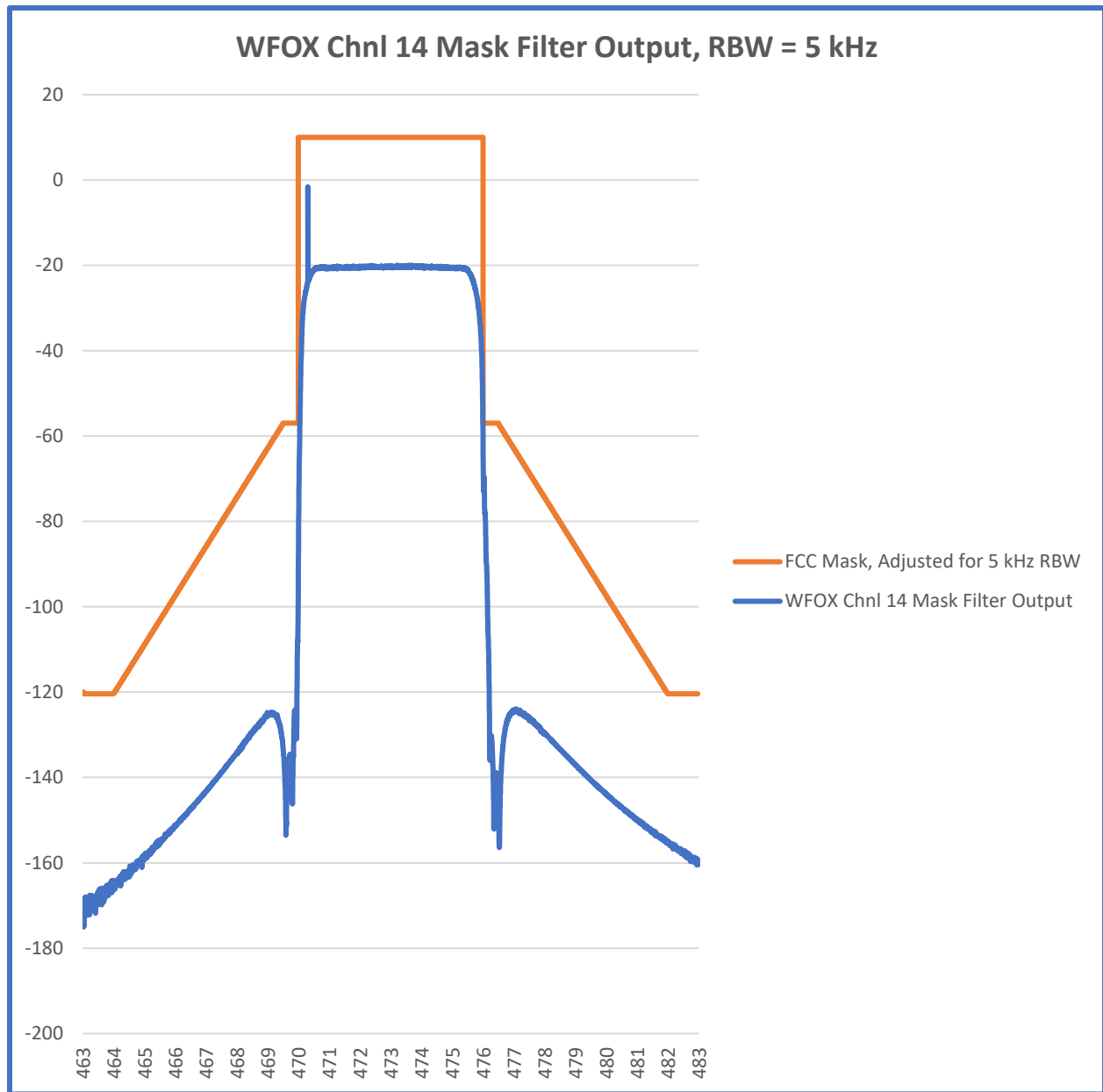


Figure 7 – Loose Connectors & Connectors with Broken Cable Connections, as Found at SBA Tower, Can Contribute to PIM Generation



Figure 8 – Rusty Mounting Hardware Can Lead to PIM as in This Mount on the SBA Tower

ahead of its input. The visual inspection of the tower by the tower crew also located numerous candidates for PIM generators. The tower crew had been trained to search for rust and other forms of corrosion (the so-called “rusty bolt syndrome”), interconnection of dissimilar metals, connectors that were not properly installed or protected from the weather, connectors that were not sufficiently torqued to make tight connections, unused antennas, unused cables, loose or rusty structural and mounting components, and so on. Many examples were found, a few of which are shown, pre-remediation, in Figure 8 –Figure 7. The result of the PIM measurements and the visual inspection was a determination that the tower would require significant remediation before it could be used for Channel



*Figure 9 – WFOX Channel 14 Mask Filter Output
Derived from Combination of Transmitter Output & Mask Filter Sweep.
(Note values normalized for 5 kHz Resolution Bandwidth.)*

14 operations. A set of instructions was provided to WFOX engineering personnel for use in defining a project scope for tower remediation (see Attachment B⁵).

To provide the cleanest possible signal on Channel 14 and in the adjacent spectrum, a new transmitter was installed, along with a 12-pole Channel 14 Mask Filter. A combination of a spectrum analyzer capture of the transmitter pre-filter output plus a network analyzer measurement of the mask filter

⁵ Memo to Shane Emery, Jim McGue / WFOX Television from S. Merrill Weiss; Date: April 19, 2017; Re: Passive Intermodulation (PIM) Remediation on SBA Tower.

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amplitude response is charted in Figure 9. As can be seen in the blue plot, there are three cross-couplings in the filter design, and they result in a region in the first $\frac{1}{2}$ MHz below Channel 14 where the noise from Channel 14 is reduced by roughly an extra 10 – 20 dB attenuation when compared to the in-band Channel 14 response and the lower-frequency out-of-band response. That reduction is designed to provide a region in which receiving filters can transition from their passbands to their reject bands. The result of the combination is discussed later in connection with a description of the design of a filter set for use at the inputs of master receiving antenna systems. For reference, the FCC spectrum mask described in §73.622(h)(1) is shown in orange, with the necessary correction factors applied to account for use of a 5 kHz resolution bandwidth (RBW), as provided in §73.622(h)(2).

When the transmission system was completed, an initial test was conducted with the technicians responsible for maintenance of two of the nearby LMR sites. The outcome of the test was that all communications into the receivers at the two sites experienced harmful interference. Spectrum plots

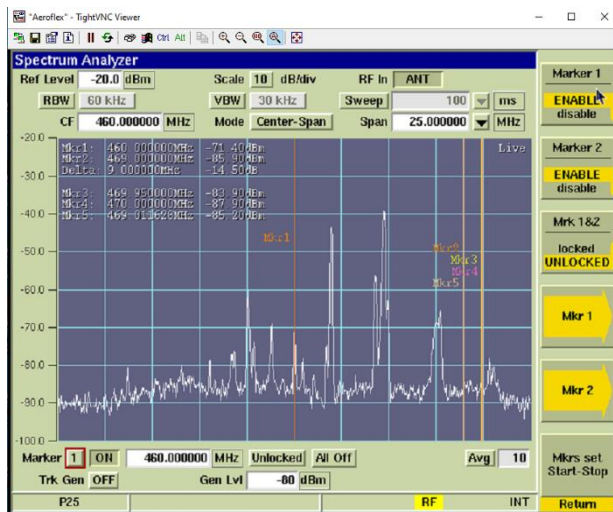


Figure 10 – SBA Tower, Channel 14 OFF,
CF = 465 MHz, Span = 25 MHz, RBW = 60 kHz

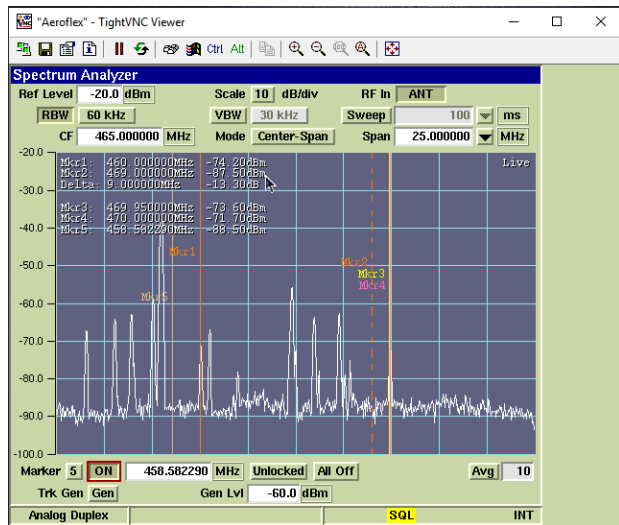


Figure 11 – Anders Blvd., Channel 14 OFF,
CF = 460 MHz, Span = 25 MHz, RBW = 60 kHz

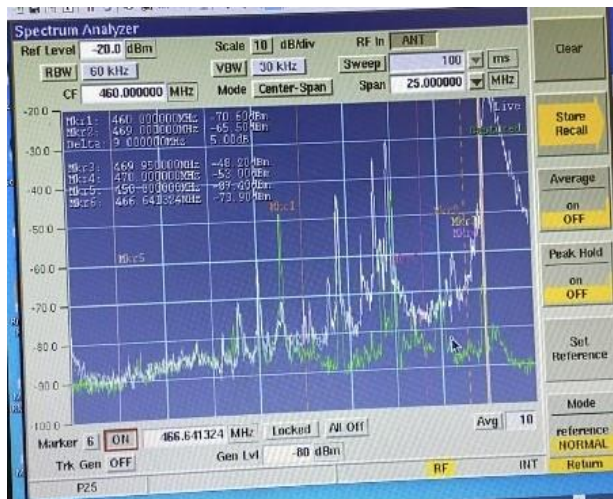


Figure 12 – SBA Tower, Channel 14 ON,
CF = 460 MHz, Span = 25 MHz, RBW = 60 kHz



Figure 13 – Anders Blvd., Channel 14 ON,
CF = 465 MHz, Span = 25 MHz, RBW = 60 kHz

taken at the two sites with Channel 14 turned off are shown in Figure 12 for the SBA Tower site and in Figure 13 for the Anders Blvd. site. Spectrum plots taken with Channel 14 turned on are shown in Figure 11 for the SBA Tower site and in Figure 10 for the Anders Blvd. site.

As is apparent from comparisons of the spectrum captures in Figures 10 and 11 with those in Figures 12 and 13, the noise floors at 470 MHz were raised by about 35 dB at the SBA Tower site and by about 55 dB at the Anders Blvd. site. (The green traces in Figures 12 and 13 show the peak hold levels with Channel 14 turned off.) The test results showed that complete PIM remediation of the SBA Tower was required and that design and implementation of filter and amplifier systems had to be undertaken to replace the existing TTAs on the several towers having master antenna receiving systems.

The fundamental filter design is shown in Figure 14. It comprises a notch filter at the bottom of Channel 14 to provide as steep an attenuation slope as can be achieved at a reasonable cost and in a moderate space, followed by a Channel 14 bandstop filter to reduce power in all but the bottom ½-MHz of the channel, followed by a low-loss coaxial band splitter to feed parallel bandpass filters for the 455 – 460 MHz and 465 – 470 MHz LMR receive bands, a low-noise amplifier (LNA) for each of the two LMR receive bands, another bandpass filter for each of the LMR receiver bands, and a power combiner to feed the signals from both LMR receive bands to a transmission line down the tower. Depending on each particular configuration, there was a distribution amplifier and a multicoupler arrangement on the ground to distribute the signals to a multiplicity of receivers.

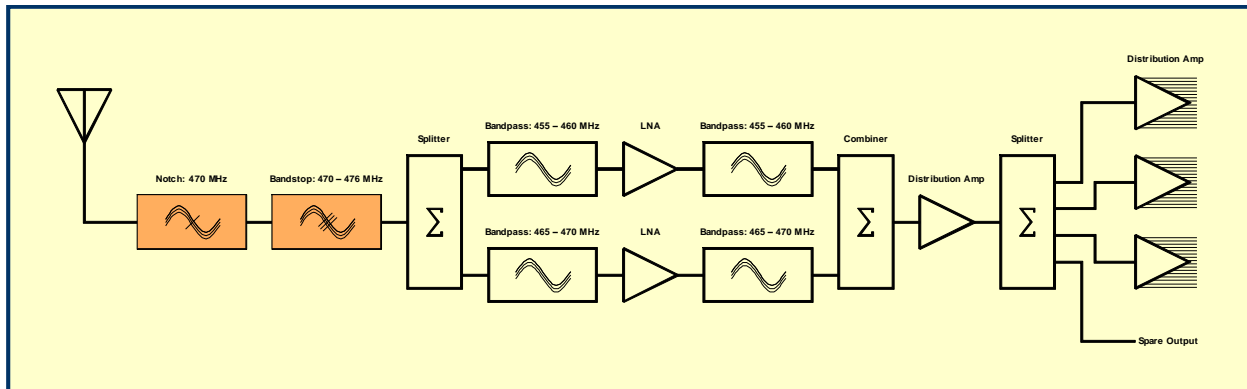


Figure 14 – Tower-Top Filter/Amplifier (TTA) & Receiver Multicoupler System Block Diagram

There were several considerations that were important to the design of the replacement TTA system. A major objective was to avoid any overloading of the amplifier at the system front end. This started with reducing the Channel 14 power level fed into the amplifier through design of the filter characteristics, and it finished with selection of an amplifier that could withstand high input levels while retaining its linearity. The filter amplitude response is shown in Figure 15. The amplifier was selected to have a very good Noise Figure (0.4 dB at 500 MHz.), a high third-order intercept ($IP3 = 40$ dB at 500 MHz), a high power output capability (1-dB compression output level = +22 dBm at 500 MHz), and adequate gain.

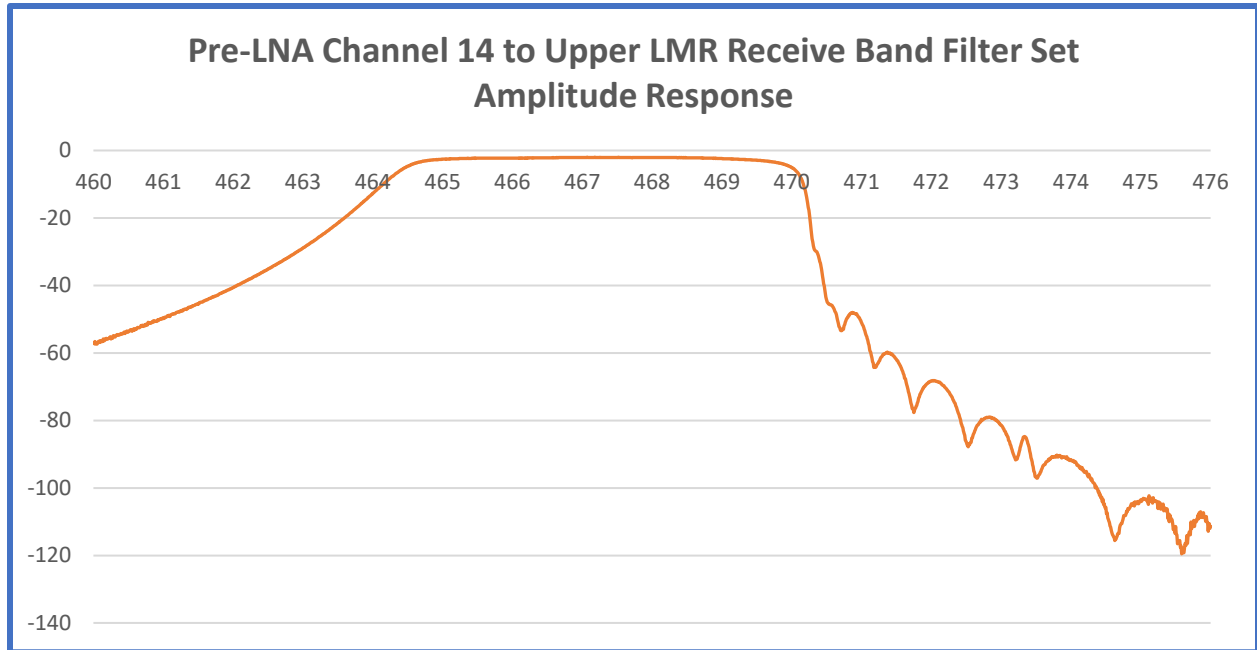


Figure 15 – Amplitude Response of Channel 14 to Upper LMR Receive Band Pre-LNA Filter Set

Performance of the cascaded notch filter, Channel 14 bandstop filter, and first upper LMR receive band bandpass filter in the TTA, which reduce Channel 14 signal power into the LNA, can be seen in Figure 15. Performance of the overall TTA system, including the several cascaded filters, band splitter, parallel bandpass filters for the two LMR receive bands, parallel LNAs, and output combiner is shown in Figure 16.

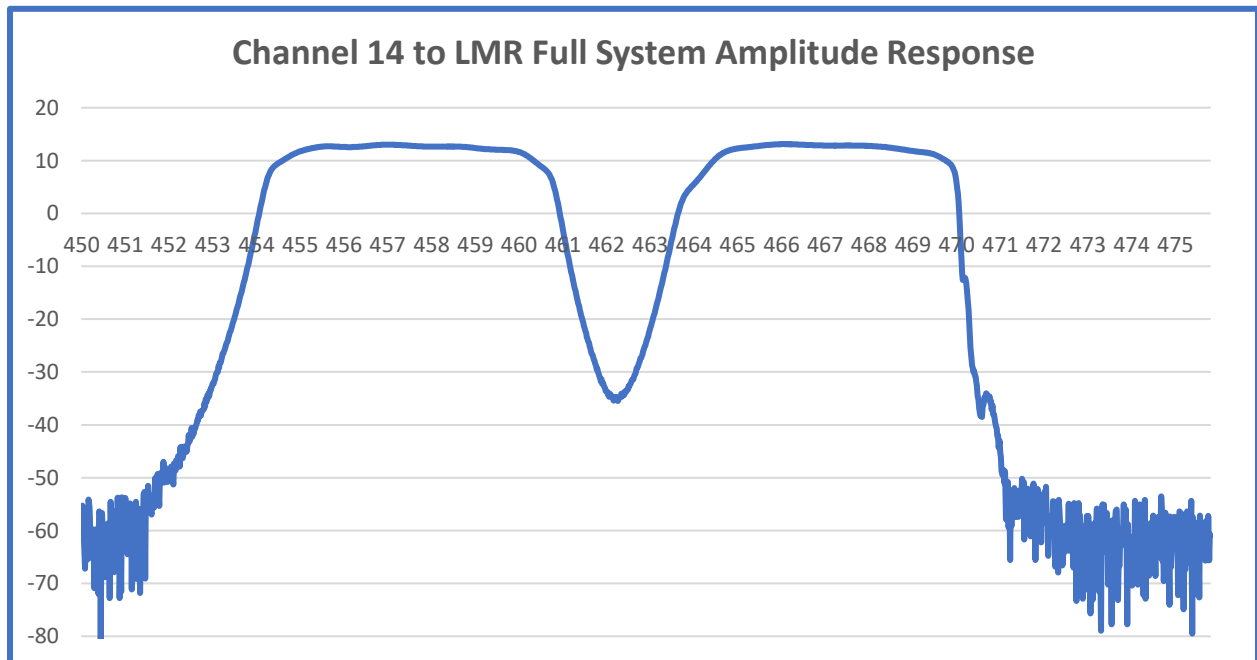


Figure 16 – Amplitude Response of Full Tower-Top Filter/Amplifier System Including LNA Gains

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The ultimate objective of the overall system, including the transmitter mask filter and the TTA filters and amplifiers, is to make it possible for LMR receivers to receive very weak signals in the 450 – 470 MHz band in the presence of strong Channel 14 signals. To achieve that result, the power spectrum of the transmitter and the frequency response of the receiving system were modeled together during the design process, and the power level of the Channel 14 signal delivered to the LNAs was calculated based on the worst case combination of receiving antenna gain and distance between the Channel 14 transmitter and the LMR receiver. To prove that the system was built and operating as designed, the WFOX signal was coupled directly from the Channel 14 transmitter output, through a directional coupler and attenuators to the TTA input. The TTA output then was observed and measured on a spectrum analyzer to determine if the hardware built produced the output predicted in the design process. They were close enough that there is no point here in presenting the design output separately from the real-world output, the latter of which is shown in Figure 17.

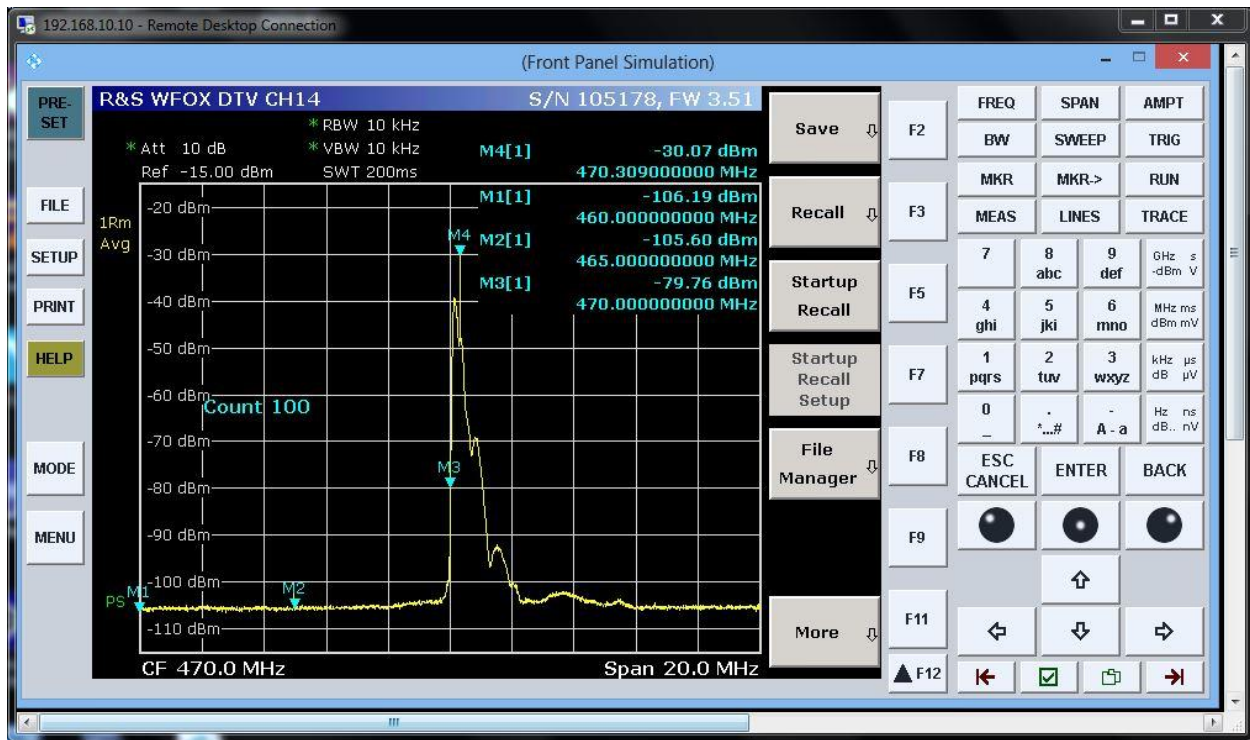


Figure 17 – Spectrum Analyzer Screen Capture of WFOX Channel 14 Signal through LMR TTA System

The post-mask-filter Channel 14 channel power from the directional coupler into the TTA system input was measured directly on the spectrum analyzer prior to connecting it to the TTA and, in the case that produced the output shown in Figure 17, measured -0.89 dBm. With the transmitter ERP at the 663-kW level authorized in the WFOX construction permit, received signal levels lower than that value are expected in most instances. As can be seen in the figure, there is no rise in the noise floor around the residual Channel 14 signal remaining after filtering, followed by amplification in the LNA. There are no signs of either intermodulation products or nonlinearity.

While the focus in the TTA development was on eliminating any interference in broadband master antenna receiving systems, other types of receiving systems are known to exist in the region around the WFOX transmitter site and beyond – for example, some that Federal Engineering identified. They are single receivers connected to individual antennas that may not have adequate filtering of their RF inputs to avoid overload from the WFOX Channel 14 signals or generation of internal intermodulation products involving signals on Channel 14. Typically, interference from Channel 14 in such cases can be eliminated with the addition of external bandstop filters to reduce signal power on Channel 14 or cavity filters to improve selectivity. Sometimes, replacement of LNAs can be required if they already are in use. Rarely, LNAs may need to be added to overcome the losses introduced by external filters. Early on in preparing for its Channel 14 transition, WFOX ordered a stock of Channel 14 bandstop filters to provide to LMR operators to help mitigate interference that might be found. In its more recent outreach to individual LMR operators whose facilities might be susceptible to such interference, WFOX has offered to provide the bandstop filters upon request. As of this writing, a small number of LMR operators have requested and received such filters. WFOX stands and will remain ready to supply and install such filters and/or other components, as necessary, if LMR operators identify themselves as receiving Channel 14 interference shown to originate with WFOX.

Results

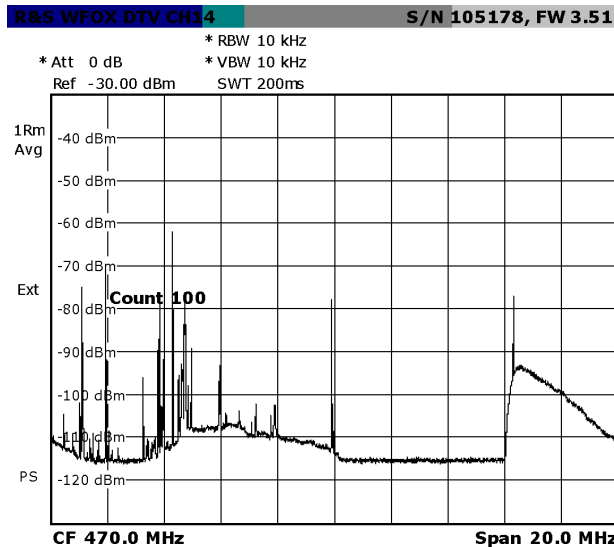
Following completion of the PIM remediation at the SBA Tower and delivery and installation of the first two TTA units, tests have been conducted at all three of the known master-antenna receiving sites: SBA Tower, Anders Blvd., and Newton Rd. Comparable series of spectrum plots were captured at the first two sites, where the TTA units had been replaced, and the most instructive of them are presented below. Spectrum plots also were captured at the third (Newton Rd.) site during one of the tests, but the formatting and parameter selections from those captures are somewhat different from those collected at the first two sites. Nevertheless, the most relevant of them will be presented. All the spectrum plots presented will be described and their significance explained. As the spectrum plots show, material interference has been eliminated wherever it has been identified.

In general, at the first two sites, Center Frequency of the spectrum plots is 470 MHz; Span is 20 MHz; Resolution Bandwidth is 10 kHz; Video Bandwidth is 10 kHz; and Trace Averaging is used and is 100×. In all cases, 2001 points were collected, resulting in sample points on integer multiples of 10 kHz – the RBW value. In most cases, spectrum is shown with Channel 14 OFF to the left and ON to the right. Following the first comparisons, there are several spectrum plots with 10× the resolution of the first groups. In those cases, Center Frequency is 470 MHz, Span is 2 MHz, RBW is 1 kHz, VBW is 10 kHz, Trace Averaging is 100×, and 2001 sample points again were collected, putting each point on an integer multiple of 1 kHz. In the first group, pairs will be ordered site-by-site.

It is important to recognize the effects of the multicouplers used by some systems to distribute the signals to multiple receivers. Typically, they comprise a gain stage at the ground-level end of a transmission line bringing signals down the tower, followed by several power dividers, in tiers to permit more outputs to be obtained. The gain of the amplifier on the ground must be sufficient to overcome the losses of the power dividers (typically 3½ dB for a 1×2 divider and 7½ dB for a 1×4 divider). Thus, a

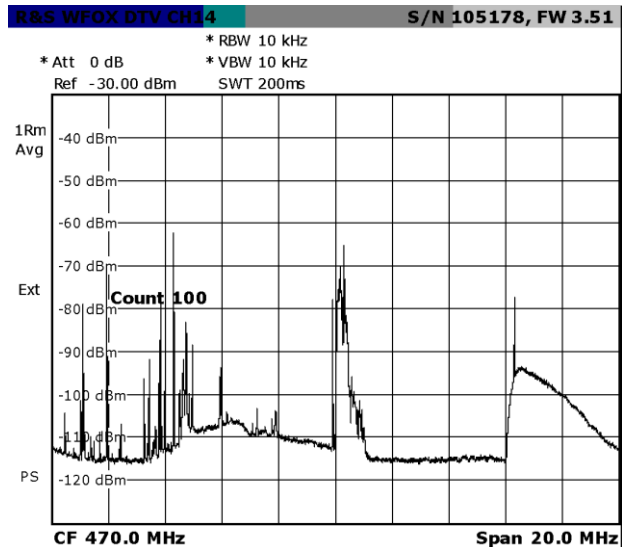
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power divider with 8 outputs (1×2×4) would have about 11 dB loss to be overcome by the amplifier, and a divider with 32 outputs (1×2×4×4) would have about 18½ dB loss to overcome. In each case, some extra gain should be present in the ground-based amplifier. For optimum operation of the overall system, the gain of the tower-top amplifier should be high enough to overcome losses in input filtering, output filtering, power combining, the transmission line down the tower, and the equivalent input noise of the ground-based amplifier. The last consideration is important to assure that it is the noise figure of the first amplifier that determines the signal-to-noise ratio of the overall receiving system, and that first amplifier is where it is most worth investing in low noise-figure performance. These precepts have been



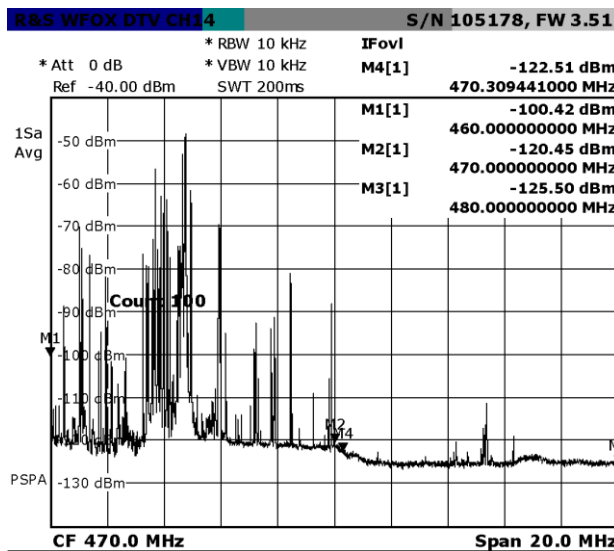
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Figure 18 –SBA Tower– Transmission Line Output, Channel 14 OFF; Note Channel 15 LPTV on Right



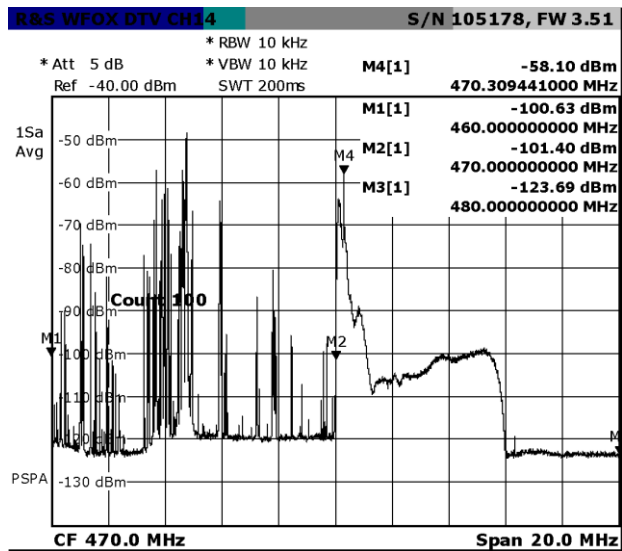
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Figure 19 – SBA Tower – Transmission Line Output, Channel 14 ON; Note Channel 15 LPTV on Right



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Figure 20 – Anders Blvd. – Transmission Line Output, Channel 14 OFF



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Figure 21 – Anders Blvd. – Transmission Line Output, Channel 14 ON

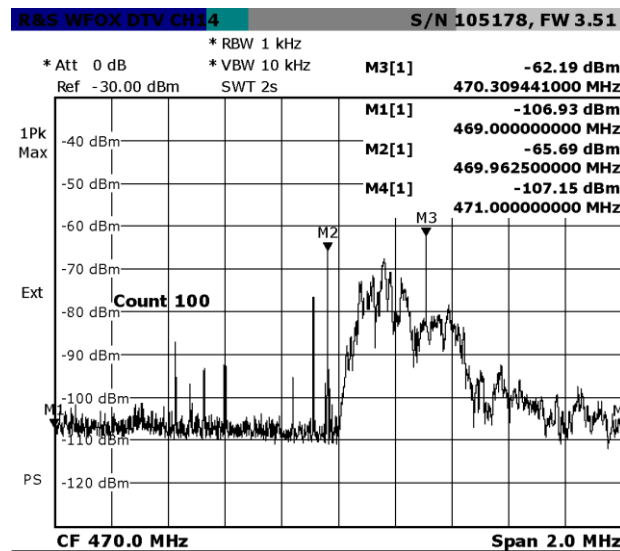
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followed in the designs of the subject receiving systems and are discussed with respect to the spectrum plots above.

Note in these spectrum plots that there is apparent intermodulation noise in the LMR receive band from 465 – 470 MHz that is present when Channel 14 is not. This appears to be due to intermod products generated by the LMR transmitters in the 460 – 465 MHz band, as indicated by the peak of the intermod noise close to the upper end of that region. The presence of Channel 14 has no effect on that intermod noise. Observations made at the time of the measurements indicated that the intermod peak just above 466 MHz went up and down with the number of LMR transmitters appearing on the air in the region below 465 MHz, which is noticeable in comparing the two plots.

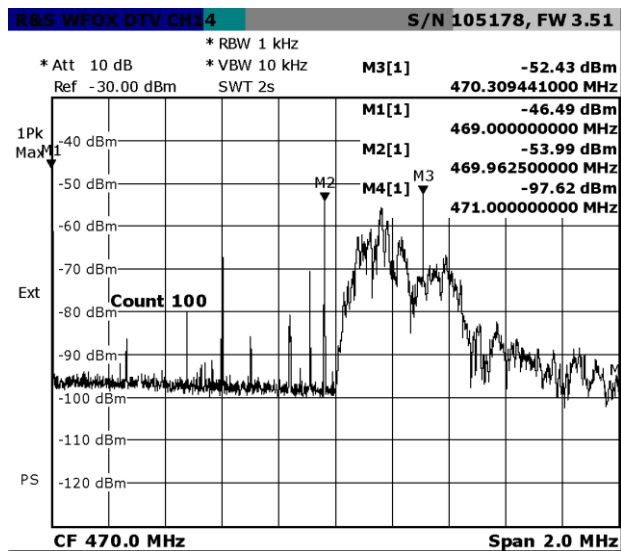
In Figures 20 and 21 it is possible to observe the effects of one of the bandpass filters that are on the outputs of the LNAs. In Figure 20, with Channel 14 off-air, the noise floor can be seen to drop just above 470 MHz, with the higher frequencies having a lower noise floor by about 5 dB. The roll-off represents the difference between the amplified noise of the LNA and the noise floor of the spectrum analyzer preamp, which is connected to the transmission line coming down the tower. The same effect is visible at about 463 MHz, which also is almost 5 dB lower than the noise floor between 465 – 470 MHz, but the effect of the output bandpass filter roll-off in that region is more visible in Figure 21.

Another factor of interest in designing and proving the operation of filters at the transition between the top of the 465 – 470 MHz LMR spectrum block and the bottom of TV Channel 14 is how close to the spectrum boundary LMR transmitters can operate and still be received at fixed receiving locations. To examine that question, plots were taken during operation of WFOV on Channel 14 using 1 kHz RBW and 2 MHz Span, with the same 2001 sample points, to have more resolution in the captured plots. The results at the SBA Tower are shown in Figures 22 and 23 for the transmission line output and for a



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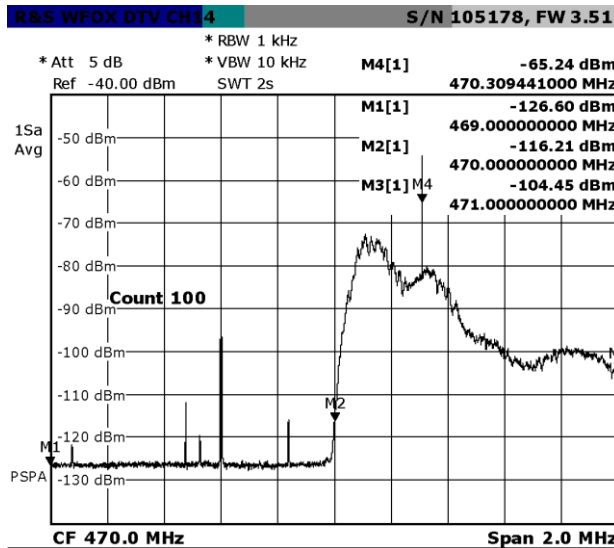
Figure 22 – SBA Tower Transmission Line Output, Channel 14 ON, LMR Spectrum Flat to 470 MHz



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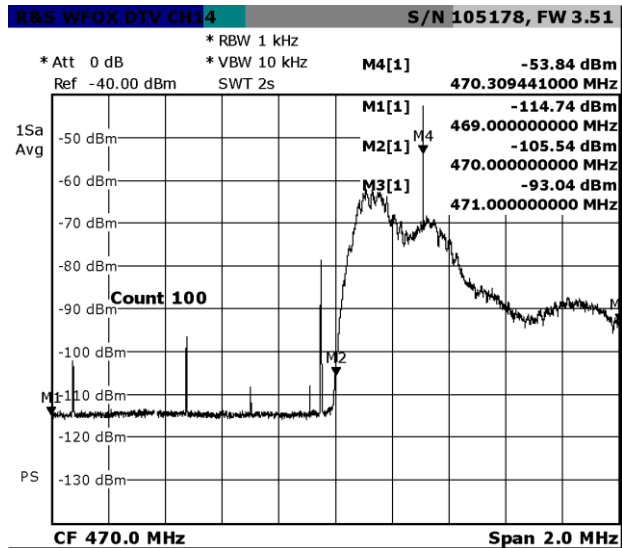
Figure 23 – SBA Tower Multicoupler Output, Channel 14 ON, LMR Spectrum Flat to 470 MHz

WFOV-TV Request for Channel 14 Program Test Authority



Date: 8.JUL.2020 02:36:54

Figure 24 – Anders Blvd. – Transmission Line Output, Channel 14 ON, LMR Spectrum Flat Almost to 470 MHz



Date: 8.JUL.2020 02:29:09

Figure 25 – Anders Blvd. – Multicoupler Output, Channel 14 ON, LMR Spectrum Flat Almost to 470 MHz

multicoupler output, respectively. The results at the Anders Blvd. site are shown in Figures 24 and 25 for the transmission line output and for a multicoupler output, respectively.

At the SBA Tower, at both the transmission line output and multicoupler output, the LMR upper receive band is flat up to 470 MHz, and a weak signal is visible just below that frequency in each case.

At the Anders Blvd. site, the Channel 14 received signal level is approximately 15 dB stronger than at the SBA Tower. As a result, there is a very slight rise in the noise floor of the LMR upper receive band of about 1 – 2 dB over the last few kHz approaching 470 MHz in the transmission line and multicoupler outputs. Such a small change in the noise floor is unlikely to have any deleterious effect on reception at even the highest frequencies within the LMR band.

The third site with a broadband master receiving antenna distribution system, the ATC site at Newton Rd., was tested by a technician for ATC during one of the test periods scheduled for testing of the new TTAs at the SBA Tower and Anders Blvd. sites. When the WFOV Channel 14 transmitter was turned on, a very small increase in the noise floor of the received spectrum, roughly in the region 467 – 470 MHz, was observed. While the increase was not sufficient to impact communications, it nevertheless was decided to proceed with installation of a replacement of the current TTA with one built to the new design to



Figure 26 – Newton Rd – Multicoupler Output, Channel 14 ON

WFOX-TV Request for Channel 14 Program Test Authority

preclude the potential occurrence of interference in the future, should conditions change. While the current system at Newton Rd would have been adequate for the foreseeable future, the technician making the measurements indicated that the current equipment unquestionably achieved acceptable performance in the presence of Channel 14 signals for an interim period until the current TTA can be replaced.

An example spectrum plot captured by the ATC technician during the test period is in Figure 26, in which the noise floor rise between 467 – 470 MHz appears to peak at about 3 dB. The plot uses 1-kHz VBW to smooth noise in the screen capture. RBW is 30 kHz, and Span is 25 MHz. As this is written, a replacement TTA for the Newton Rd site already has been delivered, and ATC's technician has been advised of the immediate availability of the TTA. As soon as ATC is ready and one of its approved tower crews is available, it will be installed. Based on performance tests of the unit prior to shipment, its performance is expected to be essentially the same as that obtained at the other two sites where TTAs of the same design have been installed so far. Testing of the newly installed TTA unit will be conducted with ATC and its technician at the time of installation to ensure that is the outcome.

Request for Program Test Authority

From the time of the assignment of its station WFOX-TV to Channel 14, Cox Television Jacksonville, LLC, has worked proactively, in good faith, to take all the steps necessary to identify potential and real interference to Land Mobile Radio licensees and their operations in the 460 – 470 MHz band in the region around its transmitter site in Jacksonville, FL. As shown in this Technical Statement, it has developed technical solutions to each of the conditions that could cause interference from its Channel 14 operations to LMR operations. It has conducted testing with all of those LMR licensees who agreed to participate, and it has provided numerous opportunities for such participation. In each case, WFOX-TV has provided the equipment, installation, and testing to demonstrate that any interference to LMR operations that could be caused by its operations on Channel 14 has been eliminated.

Cox Television Jacksonville, LLC, notes that some LMR licensees have declined to participate in joint facility testing. The fact that such LMR licensees have either failed or declined to participate in testing so that any possible cases of interference that might develop involving them could be proactively eliminated should not, however, be held against WFOX. Rather, it should be recognized by the FCC that the next step – WFOX moving from Channel 32 to Channel 14 – is a necessary one in the process of identifying all cases of interference and eliminating them. Cox Television Jacksonville, LLC, and its Station WFOX-TV recognize their responsibility to continue addressing any cases of interference brought to their attention after WFOX-TV transitions to Channel 14.

For all the reasons stated and explained herein, it now is in the public interest for the FCC to grant Program Test Authority to WFOX-TV for its move to Channel 14, as it has satisfied the Special Condition contained in its construction permit.

Attachment A – Communications with Land Mobile Radio Licensees & Operators

1. Cover Letter from RF Notifications to Jim McGue, RF Engineer, WFOX-TV
2. Certificate of Mailing
3. Mailing List



RF Notifications
2054 Kildaire Farm Rd. #405 Cary, NC 27518 919.368.6580 RFNotifications.com

Jim P. McGue
RF Engineer TV
Cox Media Group - WFOX
11700 Central Parkway #2
Jacksonville, FL 32224

May 12, 2019

Re: WFOX Land Mobile contact discovery project.

Dear Jim,

Accompanying this letter is the spreadsheet for you to share with whomever is charged with solving any Land Mobile interference that may arise when you begin testing. (The spreadsheet is sorted in different tabs, please see the "Read Me" tab first).

The goal of this exercise was two-fold:

- 1) Find the best, most knowledgeable, contact for each of the licenses between 460-470MHz within 100Km of the transmitter.
- 2) To show evidence of your sincere attempt and good faith effort to identify and work with Land Mobile licensees in the area.

As a quick summary, 975 letters were mailed to cover the 594 unique call signs within 100km of the transmitter, between the frequencies of 460-470 MHz (Note: you may notice the certificate of mailing indicates 976 Letters were mailed, one of these letters is a control letter we send to ourselves at RFN).

This mailing resulted in creating 101 good contacts covering 182 of the unique call signs (note: many call signs cover multiple frequencies).

Also, below you will find the Certificate of mailing and the mailing list.

Please let me know if you have any questions.

Sincerely,

Peter Sockett
CEO – RF Notifications



Certificate of Bulk Mailing — Domestic

Fee for Certificate

Up to 1,000 pieces (1 certificate for total number)

For each additional 1,000 pieces, or fraction thereof

Duplicate Copy ☐

Use
Current
Price List
(Notice 123)

Postage: Mailers must affix meter, PC Postage®,
or (uncollected) of total

neopostSM

03/18/2019

US POSTAGE \$008.55⁰

Accept
affixed



ZIP 32809
041M12252337

If paid by Permit Imprint, include the
PostalOne!® Transaction Number here:

Number of
Identical Weight
Pieces

Class of Mail

Postage for
Each Mailpiece
Paid

Number of
Pieces to the
Pound

976

F/C

Verified

38

Total Number of
Pounds

25.05

Total Postage Paid
for Mailpieces

488.00

Fee Paid

8.55

Mailed For
RF Notations

Mailed By
Action Mail Services, Inc.
2441 Orlando Central Parkway

Postmaster's Certification
Orlando, FL 32809

It is hereby certified that the number of mailpieces presented and the
associated postage and fee were verified. This certificate does not
provide evidence that a piece was mailed to a particular address.

(Postmaster or Designee)

WFOX-LM





Direct Mail Marketing
2441 Orlando Central Parkway
Orlando, FL 32809
407.855.9277

[illegible]



Direct Mail Marketing

2441 Orlando Central Parkway

Orlando, FL 32809

407.855.9277

[illegible]



Direct Mail Marketing
2441 Orlando Central Parkway
Orlando, FL 32809
407.855.9277

WFOX-LM	On-Site Communications, Inc.	5000-18 US Hwy 17 S #301	Fleming Island	FL	32003	Dale Loomis or 2-WAY Radio (lms) Administrator
WFOX-LM	On-Site Communications, Inc.	5000-18 US Hwy 17 S Ste 301	Fleming Island	FL	32003	Dale Loomis or 2-WAY Radio (lms) Administrator
WFOX-LM	On-Site Communications, Inc.	5000-18 US Hwy 17 S, Ste #301	Fleming Island	FL	32003	Dale Loomis or 2-WAY Radio (lms) Administrator
WFOX-LM	On-Site Communications, Inc.	5000-18 US Hwy 17 S, Ste 301	Fleming Island	FL	32003	Dale Loomis or 2-WAY Radio (lms) Administrator
WFOX-LM	On-Site Communications, Inc.	5000-18 US Hwy 17 S, Ste 301	Fleming Island	FL	32003	Dale Loomis or 2-WAY Radio (lms) Administrator
WFOX-LM	Southern Baptist Hospitals Of Florida Inc.	1771 Baptist City Dr	Orange Park	FL	32003-8501	DBA Baptist Emergency Center City or 2-WAY Radio (lms) Administrator
WFOX-LM	East West Partners Dba Eagle Landing	2105 Harbor Lake Dr	Orange Park	FL	32007-7950	Alan Slaughter-Vp Golf Course or 2-WAY Radio (lms) Administrator
WFOX-LM	Oldcastle Lawn & Garden	PO Box 460	Bostwick	FL	32007-0460	2-WAY Radio (lms) Administrator
WFOX-LM	Kingfisher Communications Llc	541669 US Highway I	Callahan	FL	32011	Daniel Whitfield or 2-WAY Radio (lms) Administrator
WFOX-LM	Kingfisher Communications Llc	541669 US Highway I	Callahan	FL	32011	Daniel Whitfield or 2-WAY Radio (lms) Administrator
WFOX-LM	Triad International Maintenance Corp.	102 SE Academic Ave	Lake City	FL	32025-2002	L.E. Hendrick or 2-WAY Radio (lms) Administrator
WFOX-LM	Florida Gateway College	149 SE College Pl	Lake City	FL	32025-2007	Mike Davis or 2-WAY Radio (lms) Administrator
WFOX-LM	Omni Amelia Island Llc	39 Beach Lagoon Rd	Amelia Island	FL	32034-5477	Radio Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	Summer Beach Amenities Venture	4700 Amelia Island Pkwy	Amelia Island	FL	32034-5501	John Price or 2-WAY Radio (lms) Administrator
WFOX-LM	The Ritz Carlton, Amelia Island	4750 Amelia Island Management	Amelia Island	FL	32034-5501	License Mgr or 2-WAY Radio (lms) Administrator
WFOX-LM	Nassau County School Board	1201 Atlantic Ave	Amelia Island	FL	32034-5501	License Mgr or 2-WAY Radio (lms) Administrator
WFOX-LM	The Semaphore Group	229 S 5th St	Fernandina Beach	FL	32034-3403	Sharyl Wood or 2-WAY Radio (lms) Administrator
WFOX-LM	Worldwide Terminals Fernandina, Llc	2245 Friendly Rd	Fernandina Beach	FL	32034-3905	Brian Kopp or 2-WAY Radio (lms) Administrator
WFOX-LM	Worldwide Terminals Fernandina, Llc	2245 Friendly Rd	Fernandina Beach	FL	32034-3905	Brian Kopp or 2-WAY Radio (lms) Administrator
WFOX-LM	Myers Tractor Service Inc.	2424 Russell Rd	Fernandina Beach	FL	32034-8641	Rhonda Potat or 2-WAY Radio (lms) Administrator
WFOX-LM	Amelia River Golf Club Llc	4477 Buccaneer Trl	Fernandina Beach	FL	32034-8656	John Myers or 2-WAY Radio (lms) Administrator
WFOX-LM	Ligno Tech Florida	6 Gum St	Fernandina Beach	FL	32034-5301	Charis Moule or 2-WAY Radio (lms) Administrator
WFOX-LM	Rocktem Cp Llc	600 N 8th St	Fernandina Beach	FL	32034-4280	James J Hughes or 2-WAY Radio (lms) Administrator
WFOX-LM	Kingfisher Communications Llc	626 S 8th St	Fernandina Beach	FL	32034-3319	Michale Rundlett or 2-WAY Radio (lms) Administrator
WFOX-LM	Fernandina Beach High School	435 Citrona Dr	Fernandina Beach	FL	32034-3764	Daniel Whitfield or 2-WAY Radio (lms) Administrator
WFOX-LM	Omni Hotels & Resorts	200 Sea March Rd	Amelia Island	FL	32034-2741	2-WAY Radio (lms) Administrator
WFOX-LM	Amelia Island Plantation	PO Box 3000	Fernandina Beach	FL	32035-3000	Karen Moon or 2-WAY Radio (lms) Administrator
WFOX-LM	Sea Ray Boats Inc.	100 Sea Ray Dr	Palm Coast	FL	32037	Kevin Kelly or 2-WAY Radio (lms) Administrator
WFOX-LM	Clay County Of	2519 St Rd 16w	Green Cove Springs	FL	32043	Captain Bernita A. Bush or 2-WAY Radio (lms) Administrator
WFOX-LM	Clay County Fire Rescue	2519 St Rd 16w	Green Cove Springs	FL	32043	2-WAY Radio (lms) Administrator
WFOX-LM	Clay County School District	925 Center St	Green Cove Springs	FL	32043-2705	2-WAY Radio (lms) Administrator
WFOX-LM	Clay County Port Inc.	PO Box 477	Hilliard	FL	32043-0477	Roger Zeigler or 2-WAY Radio (lms) Administrator
WFOX-LM	Estep, James P	PO Box 1421	Hilliard	FL	32043-0477	Roger Zeigler or 2-WAY Radio (lms) Administrator
WFOX-LM	James P. Estep	PO Box 1421	Hilliard	FL	32046-1421	James Estep or 2-WAY Radio (lms) Administrator
WFOX-LM	Union County School Board	55 SW 6th St	Lake Butler	FL	32054-2599	2-WAY Radio (lms) Administrator
WFOX-LM	West Fraser Inc.	PO Box 68	Lake Butler	FL	32054-0068	Mark Duncan or 2-WAY Radio (lms) Administrator
WFOX-LM	New Millennium Buildings Systems, Llc	1992 NW Biscorn Norris Dr	Lake City	FL	32055-4888	Safety Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Bakers Communications, Inc.	270 Highway 17 N Unit 6	Lake City	FL	32056	Tom Macfarlane or 2-WAY Radio (lms) Administrator
WFOX-LM	Bakers Electronics & Communications, Inc.	PO Box 3179	Lake City	FL	32056-3179	Doig Baker or 2-WAY Radio (lms) Administrator
WFOX-LM	Triad International Maintenance Corp.	PO Box 1909	Lake City	FL	32056-1909	L.E. Hendrick or 2-WAY Radio (lms) Administrator
WFOX-LM	Bakers Communications, Inc.	PO Box 3179	Lake City	FL	32056-3179	Doig Baker or 2-WAY Radio (lms) Administrator
WFOX-LM	Baker County Emergency Services	1190 W Macclenny Ave	Macclenny	FL	32063-4458	David Richardson or 2-WAY Radio (lms) Administrator
WFOX-LM	Don Rice Communications, Inc.	PO Box 65399	Orange Park	FL	32065-0007	Suzanne Jenkins or 2-WAY Radio (lms) Administrator
WFOX-LM	Don Rice Communications, Inc.	PO Box 65399	Orange Park	FL	32065-0007	Suzanne Jenkins or 2-WAY Radio (lms) Administrator
WFOX-LM	Don Rice Communications, Inc.	PO Box 65399	Orange Park	FL	32065-0007	Suzanne Jenkins or 2-WAY Radio (lms) Administrator
WFOX-LM	Moosehaven	1701 Park Ave	Orange Park	FL	32073-4900	Executive Director or 2-WAY Radio (lms) Administrator
WFOX-LM	Orange Park Medical Ctr	2001 Kingsley Ave	Orange Park	FL	32073-5156	Rich Ward, Director Of Safety or 2-WAY Radio (lms) Administrator
WFOX-LM	On-Site Communications Inc.	350 Eldridge Ave Ste 2	Orange Park	FL	32073-2964	Dale Loomis or 2-WAY Radio (lms) Administrator
WFOX-LM	Jacksonville Greyhound Racing and Poker	455 Park Ave	Orange Park	FL	32073-3101	Stan Chafin or 2-WAY Radio (lms) Administrator
WFOX-LM	F & T Apparel, Llc	600 Wells Rd	Orange Park	FL	32073-2926	Anthony Herko or 2-WAY Radio (lms) Administrator
WFOX-LM	Heart To Heart Christian Academy	8247 Ramona Blvd W	Jacksonville	FL	32221-1520	Vice Principal or 2-WAY Radio (lms) Administrator
WFOX-LM	Marsh Creek Club Corp.Oration	169 Marshside Dr	St Augustine	FL	32080-5856	John Hewins or 2-WAY Radio (lms) Administrator
WFOX-LM	Valley Ridge Academy	105 Greenleaf Dr	Ponte Vedra	FL	32081-8500	Troy Wilson or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Communications Services	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Communications Services	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Comm	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Communications Services	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Communications Services	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Communication Services	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Palm Valley Academy	700 Bobcat Ln	Ponte Vedra	FL	32081-5160	Principal or 2-WAY Radio (lms) Administrator
WFOX-LM	Ronald G Ingram	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Plantation At Ponte Vedra	101 Tabby Ln	Ponte Vedra	FL	32082-4018	Radio Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	Ponte Vedra Inn & Club	230 San Juan Dr	Ponte Vedra	FL	32082-1816	Supt or 2-WAY Radio (lms) Administrator
WFOX-LM	Philro Comm	297 River Run Blvd	Ponte Vedra	FL	32081-0627	Ronald Ingram or 2-WAY Radio (lms) Administrator
WFOX-LM	Sawgrass Marriott Golf Resort & Spa	1000 Pga Tour Blvd	Ponte Vedra Beach	FL	32082-3036	2-WAY Radio (lms) Administrator



Direct Mail Marketing
2441 Orlando Central Parkway
Orlando, FL 32809
407.855.9277

WFOX-LM	Sawgrass Country Club	10034 Golf Club Dr	Ponte Vedra Beach	FL	32082-3562	Director Of Golf Greg Lecker or 2-WAY Radio (lms) Administrator
WFOX-LM	Tournament Player Club Sawgrass	110 Championship Way	Ponte Vedra Beach	FL	32082-5050	John D Phillips or 2-WAY Radio (lms) Administrator
WFOX-LM	TPC Sawgrass	110 Pigeon Blvd	Ponte Vedra Beach	FL	32082-3046	Brian Riddle or 2-WAY Radio (lms) Administrator
WFOX-LM	Ponte Vedra Inn & Club	2000 Ponte Vedra Blvd	Ponte Vedra Beach	FL	32082-1820	Jay Reister or 2-WAY Radio (lms) Administrator
WFOX-LM	M.I. Partnership	25655 Marsh Landing Pkwy	Ponte Vedra Beach	FL	32082-1919	Ellen McClure or 2-WAY Radio (lms) Administrator
WFOX-LM	The Lodge At Ponte Vedra Beach Ltd Dba The Lodge & Club	607 Ponte Vedra Blvd	Ponte Vedra Beach	FL	32082-2782	Heather Chambers or 2-WAY Radio (lms) Administrator
WFOX-LM	Van Zante Corp Oration	38 Hope St	Saint Augustine	FL	32084-3216	Mr. William Van Zante or 2-WAY Radio (lms) Administrator
WFOX-LM	W & A Van Zante Corp Oration	38 Hope St	Saint Augustine	FL	32084-3216	Mr. William Van Zante or 2-WAY Radio (lms) Administrator
WFOX-LM	Ripley's Entertainment Inc.	255 State Road 207	Saint Augustine	FL	32084-3216	Edward C Ludwig or 2-WAY Radio (lms) Administrator
WFOX-LM	Saint Joseph Academy	3657 Gaines Rd	Saint Augustine	FL	32084	Robert Wilson or 2-WAY Radio (lms) Administrator
WFOX-LM	Saint Johns County Of	40 Orange St	Saint Augustine	FL	32084-8503	Gia M. Reynolds, Communications or 2-WAY Radio (lms) Administrator
WFOX-LM	St. Johns County School District	420 N Orange St	Saint Augustine	FL	32084-3633	Tim Lundquist or 2-WAY Radio (lms) Administrator
WFOX-LM	Webster School	228 NE McCloskey Ave	Lake City	FL	32084-0665	Mike Oliver or 2-WAY Radio (lms) Administrator
WFOX-LM	Savage Services/Pcs Sales	400 Health Park Blvd	Saint Augustine	FL	32055-6416	Mike Green or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler Hospital	400 Health Park Blvd	Saint Augustine	FL	32086-5700	Bill Douglas or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler Hospital	400 Health Park Blvd	Saint Augustine	FL	32086-5700	Bill Douglas or 2-WAY Radio (lms) Administrator
WFOX-LM	Hydro Aluminum North America	200 Riviera Blvd	Saint Augustine	FL	32086-7801	Tommy Jones or 2-WAY Radio (lms) Administrator
WFOX-LM	TJ Communications	2575 US Highway 1 S Ste C	Saint Augustine	FL	32086-6178	Tommy Jones or 2-WAY Radio (lms) Administrator
WFOX-LM	Gamble Rogers Middle School	6250 US Highway 1 S	Saint Augustine	FL	32086-7685	Mike Ponce or 2-WAY Radio (lms) Administrator
WFOX-LM	KeyStone Camp and Conference Center - The Salvation Army	6381 SE 9th Ave	Starke	FL	32091-7516	Sam Wytkoop or 2-WAY Radio (lms) Administrator
WFOX-LM	Bradford County Of	945-C N Temple Ave	Starke	FL	32091-2110	Emergency Services or 2-WAY Radio (lms) Administrator
WFOX-LM	Bradford County Emergency Services	945-C N Temple Ave	Starke	FL	32091-2110	Tim McCarthy or 2-WAY Radio (lms) Administrator
WFOX-LM	ST J Golf Management, Llc	205 Saint Johns Golf Dr	Saint Augustine	FL	32092-1053	Supt or 2-WAY Radio (lms) Administrator
WFOX-LM	Slammer & Squire Golf Course	305 Wgwy Blvd	Saint Augustine	FL	32092-0609	Supt or 2-WAY Radio (lms) Administrator
WFOX-LM	State Of Florida Disabled Veterans Administration	4650 Sr 16	Saint Augustine	FL	32092	Clyde E Lassen State Veterans Home or 2-WAY Radio (lms) Administrator
WFOX-LM	Life Care St Johns Inc.	235 Townview Drive	Saint Augustine	FL	32092-3521	Stan Reddish or 2-WAY Radio (lms) Administrator
WFOX-LM	Picolata Crossing Elem. School	2675 Paccetti Rd	Saint Augustine	FL	32092-3602	Supt or 2-WAY Radio (lms) Administrator
WFOX-LM	King & Bear Golf Course	2680 Oakgrove Ave	Saint Augustine	FL	32092-2719	Jeffrey Ollasani or 2-WAY Radio (lms) Administrator
WFOX-LM	Atrium Hotels, Lp Dba Renaissance World Golf Resort Hotel	500 S Legacy Trl	Saint Augustine	FL	32084-8611	Sheriffs Office or 2-WAY Radio (lms) Administrator
WFOX-LM	Saint Johns County Of	4015 Lewis Speedway	Saint Augustine	FL	32095-5706	Office Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	St Augustine - St John County Airport Authority	4796 US Highway 1 N	Saint Augustine	FL	32095-5706	Edward R Wueller or 2-WAY Radio (lms) Administrator
WFOX-LM	St Augustine-St. Johns County Airport Authority	4796 US Highway 1 N	Saint Augustine	FL	32095-5706	Superintendent or 2-WAY Radio (lms) Administrator
WFOX-LM	The Palencia Club	1879 N Loop Pkwy	Saint Augustine	FL	32095-5706	Cindy Hollingsworth or 2-WAY Radio (lms) Administrator
WFOX-LM	St. Augustine Airport Authority	4796 US Highway 1 N	Saint Augustine	FL	32097-5447	Wiley Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Florida State College At Jacksonville	76346 William Burgess Rd	Yulee	FL	32097-5447	Wiley Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Florida State College At Jacksonville	76346 William Burgess Rd	Yulee	FL	32097-5447	Wiley Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Nassau County	95135 Nassau Place	Yulee	FL	32097-5447	Wiley Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Nassau, County Of	96135 Nassau Pl Ste 4	Yulee	FL	32097-8635	Director Of Ops and Tech or 2-WAY Radio (lms) Administrator
WFOX-LM	Nassau County	96135 Nassau Pl Ste 4	Yulee	FL	32097-8635	Director Of Ops and Tech or 2-WAY Radio (lms) Administrator
WFOX-LM	Nassau County Jail	96135 Nassau Pl	Yulee	FL	32097-8635	Director Of Ops and Tech or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler County Board Of County Commissioners	1769 E Moody Blvd Bldg 3	Bunnell	FL	32110-5991	Jarrold Shupe or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler County Board Of County Commissioners	1769 E Moody Blvd Bldg 3	Bunnell	FL	32110-5991	Jarrold Shupe or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler County Public Schools	1769 E Moody Blvd Bldg 2	Bunnell	FL	32110-5991	Mike Metz or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler County School Board	1769 E Moody Blvd Bldg 2	Bunnell	FL	32110-5991	Legal or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler County Public Schools	Hwy 100 East	Bunnell	FL	32110-5991	Legal or 2-WAY Radio (lms) Administrator
WFOX-LM	University Of Florida	2556 W Highway 318	Citra	FL	32114-2817	Ilas Research or 2-WAY Radio (lms) Administrator
WFOX-LM	Daytona State College	1200 W International Speedway Blvd	Daytona Beach	FL	32114-2817	Brenda Merritt Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Apco International Inc. Licensing Service 071111 Jm	351 N Williamson Blvd	Daytona Beach	FL	32114-1112	Christine Phelps or 2-WAY Radio (lms) Administrator
WFOX-LM	Apco International Inc.	351 N Williamson Blvd	Daytona Beach	FL	32114-1112	Katherine Reynolds or 2-WAY Radio (lms) Administrator
WFOX-LM	Puam, County Of	410 S State Road 19	Palatka	FL	32177-3941	Department Of Emergency Services or 2-WAY Radio (lms) Administrator
WFOX-LM	Radio One, Inc.	933 Beville Rd Bldg 103A	South Daytona	FL	32119-1758	Bill Dubnick or 2-WAY Radio (lms) Administrator
WFOX-LM	Daytona State College	1200 W International Speedway Blvd	Daytona Beach	FL	32114-2817	Brenda V Merritt-Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Adena Meat Products Limited Partnership	19798 NE Highway 315	Fort Mc Coy	FL	32134-7601	Stephen Morgan or 2-WAY Radio (lms) Administrator
WFOX-LM	Palm Coast City Of - Utility Department	2 Utility Dr	Palm Coast	FL	32137-7366	Jim A. Hogan or 2-WAY Radio (lms) Administrator
WFOX-LM	Palm Coast City Of	200 Ocean Crest Dr	Palm Coast	FL	32137-7366	Jim Hogan/Utility Dept. or 2-WAY Radio (lms) Administrator
WFOX-LM	The Club At Hammock Beach Llc	3525 Colbert Ln	Palm Coast	FL	32137-3272	Jackie Van Middlesworth or 2-WAY Radio (lms) Administrator
WFOX-LM	Grand Haven Golf Club	3535 Pirate Nation Way	Palm Coast	FL	32137-9203	Golf Course Superintendent or 2-WAY Radio (lms) Administrator
WFOX-LM	Matanzas High School	5400 E State Highway 100	Palm Coast	FL	32145-5538	Eric Hight or 2-WAY Radio (lms) Administrator
WFOX-LM	Tater Farms Llc	9350 Hastings Blvd	Hastings	FL	32145-5538	Eric Hight or 2-WAY Radio (lms) Administrator
WFOX-LM	Tater Farms Llc	1425 Rymfire Dr	Hastings	FL	32145-5538	Eric Hight or 2-WAY Radio (lms) Administrator
WFOX-LM	Rymfire Elementary School	53 Easthampton Blvd	Palm Coast	FL	32164-3439	Dennis Migliaro or 2-WAY Radio (lms) Administrator
WFOX-LM	Cypress Knoll Golf Club	5400 E State Highway 100	Palm Coast	FL	32164-6260	Superintendent or 2-WAY Radio (lms) Administrator
WFOX-LM	Flagler County Schools	60 Memorial Medical Pkwy	Palm Coast	FL	32164-2399	Indian Trails Middle School or 2-WAY Radio (lms) Administrator
WFOX-LM	Florida Hospital Flagler	300 Plantation Bay Drive	Ormond Beach	FL	32164-5980	HFH Facilities Director or 2-WAY Radio (lms) Administrator
WFOX-LM	Plantation Bay Country Club	3400 Club House Dr	Ormond Beach	FL	32174	Supt or 2-WAY Radio (lms) Administrator
WFOX-LM	Halifax Plantation Golf Management Inc. Dba Halifax Golf Course	3400 Club House Dr	Ormond Beach	FL	32174	Jonathan Needham or 2-WAY Radio (lms) Administrator
WFOX-LM	Halifax Plantation Golf Club	6609 Commonwealth Ave	Jacksonville	FL	32254-2217	Margie Payne or 2-WAY Radio (lms) Administrator



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WFOX-LM	Sysco South Rdc	12421 NW 173rd St	Alachua	FL	32615-6025	Bill Griffin or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Nanotherapeutics Mdm Adm Facility	13200 NW Nano Ct	Alachua	FL	32615-8726	Jim Emery or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Lindsay Precast Inc.	13365 Southern Precast Dr	Alachua	FL	32615-8548	Ron C Lindsay or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Lindsay Precast Inc.	13365 Southern Precast Dr	Alachua	FL	32615-8548	Kim Langford or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Michael Systems Inc. Dba McDonalds Of Alachua	16016 NW Us Hwy 441	Alachua	FL	32615	Michael Stretcher or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Alachua, City Of	15100 NW 142nd Ter	Alachua	FL	32615-5344	Roland Director or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Shance Llc	PO Box 1466	Gainesville	FL	32627-1466	Amy Sweeney or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Sanders, Philip D	1611 Kaufen Powell Rd	Hawthorne	FL	32640-4242	Philip Sanders or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Edgar Minerals, Inc.	651 Keuka Rd	Hawthorne	FL	32640-5944	Ehs Manager or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Alachua County Sheriff's Office	1100 SE 27th St	Gainesville	FL	32641-8835	Ryan Lee, Supervisor or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Alachua County Sheriff's Office	1100 SE 27th St	Gainesville	FL	32641-8835	Ryan Lee or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Alachua County Sheriff's Office	2621 SE Hawthorne Rd	Gainesville	FL	32641-7546	Ryan Lee Supervisor or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Alachua County Sheriff's Office	18586 NW 238th St	High Springs	FL	32643-7436	Bruce Gillingham or 2-WAY Radio (Mrs) Administrator
WFOX-LM	City Of High Springs	18586 NW 238th St	High Springs	FL	32643-7436	Bruce Gillingham or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Golden Peanut (adm) - R77	25 NE Railroad Ave	High Springs	FL	32643-6802	Stacey Gay or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Gainesville Regional Utilities-Deerhaven	10001 NW 13th St	Gainesville	FL	32653-7864	Joey Fowler or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Jungle Friends Primate Sanctuary, Inc.	13915 N State Road 121	Gainesville	FL	32653-7509	Karl Bagnall or 2-WAY Radio (Mrs) Administrator
WFOX-LM	H.B. Fuller Gnv	1913 NW 60th Ln	Gainesville	FL	32653-1648	Matthew Smith or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Ladycomm	517 Sachs Road	Melrose	FL	32666	Jeff Grant or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Ladycomm	8445 Lilly Lake Rd	Melrose	FL	32666-8845	Thomas Grant or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Ladycomm	PO Box 1721	Melrose	FL	32666-1721	Thomas J Grant or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Ladycomm	PO Box 1721	Melrose	FL	32666-1721	Thomas Grant or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Grant, Dana	PO Box 1721	Melrose	FL	32666-1721	Dana Grant or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Easton Newberry Sports Complex	24880 NW 16th Ave	Newberry	FL	32669-2504	Carl Greene or 2-WAY Radio (Mrs) Administrator
WFOX-LM	School Board Of Alachua County Dba Newberry Elementary	25705 SW 15th Ave	Newberry	FL	32669-2554	Tania Roland or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Argos Rmx Llc	4000 NW County Road 235	Newberry	FL	32669-2380	Michael Greene or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Straughlin Farms Inc.	11325 NE Us Highway 301	Waldo	FL	32694-4328	Radio Manager or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Dynafire, Inc.	109 Concord Dr Ste B	Casselberry	FL	32707-3219	Kenneth L. Hoffman or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Signature Flight Support Corp.Orlation	201 S Orange Ave Ste 1100	Orlando	FL	32801-3478	Tom Vlek or 2-WAY Radio (Mrs) Administrator
WFOX-LM	TRS Wireless, Inc.	1711 S Division Ave	Orlando	FL	32805-4727	2-WAY Radio (Mrs) Administrator
WFOX-LM	TRS Wireless, Inc.	1711 S Division Ave	Orlando	FL	32805-4727	Timothy Bennett or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Coastal Construction Products, Llc	5051 L B McLeod Rd Ste D	Orlando	FL	32811-7400	Bruce Garrott or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Coastal-gcp, Llc	5051 L B McLeod Rd Ste D	Orlando	FL	32811-7400	Bruce Garrott or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Paul Miozza or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Paul Miozza or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Bill Dubnick or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Bill Dubnick or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Andy Buddenhagen or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	David Macdonald or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Tom Milazo or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Bill Dubnick or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32819-8988	Bill Dubnick or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One, Inc.	7041 Grand National Dr Ste 116	Orlando	FL	32822-5148	Chad Elliott or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Express Scripts Holding Company	6272 Lee Vista Blvd	Orlando	FL	32904-1514	Tim Downey or 2-WAY Radio (Mrs) Administrator
WFOX-LM	T A Radio Communications, Inc.	700 S John Rodas Blvd Ste C1	Melbourne	FL	32934-9105	Joshua McCoy or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Data Flow Systems, Inc.	605 N John Rodas Blvd	Melbourne	FL	32934-9105	Don Schultze or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Data Flow Systems, Inc.	605 N John Rodas Blvd	Melbourne	FL	32934-9105	Don Schultze or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Express Radio	10850 Willes Rd	Coral Springs	FL	33076-2011	Jose Rivera or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Federated Department Stores Inc.	7100 NW 32nd Ave	Miami	FL	33147-6672	2-WAY Radio (Mrs) Administrator
WFOX-LM	Red Apple At Baymeadows, Llc	6245 N Federal Hwy F15	Fort Lauderdale	FL	33308-1998	President or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Red Apple Development, Llc	6245 N Federal Hwy F15TH	Fort Lauderdale	FL	33308-1998	PM Of Development or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Sei Wireless Solutions, Llc	5397 Orange Dr Ste 101	Davie	FL	33314-3802	Brooke Lloyd or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Sei Wireless Solutions, Llc	5397 Orange Dr Ste 101	Davie	FL	33314-3802	Bob Scott or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Sei Wireless Solutions, Llc	5397 Orange Dr Ste 101	Fort Lauderdale	FL	33314-3802	Alex Thornberry or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Sei Wireless Solutions, Llc	5397 Orange Dr Ste 101	Fort Lauderdale	FL	33314-3802	Alex Thornberry or 2-WAY Radio (Mrs) Administrator
WFOX-LM	The Red Apple School Inc.	800 Corporate Dr Ste 124	Fort Lauderdale	FL	33334-3618	Project Manager or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Red Apple At Mandarin, Llc - C/O Duval Charter School @ Mandarin	800 Corporate Dr Ste 124	Fort Lauderdale	FL	33334-3618	PM Of Development or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Red Apple At Mandarin, Llc - C/O Duval Charter School @ Southside	800 Corporate Dr Ste 124	Fort Lauderdale	FL	33334-3618	PM Of Development or 2-WAY Radio (Mrs) Administrator
WFOX-LM	JM Family Enterprises, Inc.	300 Jim Moran Blvd	Deerfield Beach	FL	33442-1726	Scott Rauscher or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Simplexgrinnell, Lp	1830 Park Ln S	Jupiter	FL	33458-8077	Daniel Staub or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Clean Earth Of Southern Florida	1240 Fowmoor St	Moore Haven	FL	33471-9201	Larry Miller or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Pride Enterprises	223 Morrison Rd	Brandon	FL	33511-4835	Jennifer Beck or 2-WAY Radio (Mrs) Administrator
WFOX-LM	National Orders Inc.	3926 W South Ave Ste B	Tampa	FL	33614-6552	Jonathan Mendez or 2-WAY Radio (Mrs) Administrator
WFOX-LM	National Orders	3926 W South Ave	Tampa	FL	33614-6552	Ryan Owens or 2-WAY Radio (Mrs) Administrator
WFOX-LM	National Orders, Inc.	4821 N Grady Ave	Tampa	FL	33614-6552	Ryan Owens or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Radio One	4902 Creekside Dr Ste E	Clearwater	FL	33614-6552	Ryan Owens or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Public Super Markets Inc.	PO Box 32024	Lakeland	FL	33760-4033	Sean Epperson or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Vulcan Materials	14341 Allico Rd	Fort Myers	FL	33802-2024	FTS Telecom or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Fast Radios	4100 Corporate Square Blvd, Suite 124	Naples	FL	33913	2-WAY Radio (Mrs) Administrator
WFOX-LM	Ashtin Communications	380 SE 61st Ct	Ocala	FL	34104	William Richards or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Oak Run Development	10983 SW 89th Ave	Ocala	FL	34472-3332	Darrin Davis or 2-WAY Radio (Mrs) Administrator
WFOX-LM	Hi-Wire Communications	9622 Doctor Baker Rd	Groveland	FL	34481-9722	Mike DeBello or 2-WAY Radio (Mrs) Administrator
WFOX-LM				FL	34736-8922	John Gaw or 2-WAY Radio (Mrs) Administrator



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WFOX-LM	Wayne Automatic Fire Sprinklers, Inc.	222 Capitol Ct	Ocoee	FL	34761-3019	Jerry Bateman or 2-WAY Radio (lms) Administrator
WFOX-LM	Wayne Automatic Fire Sprinklers, Inc.	222 Capitol Ct	Ocoee	FL	34761-3019	Jerry Bateman or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlantic Aviation-Stuart, LLC	2240 SE Witham Field Dr	Stuart	FL	34996-4506	David Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Alcomm Wireless, Inc.	4116 1st Ave N	Birmingham	AL	35222-1506	Licensing Department or 2-WAY Radio (lms) Administrator
WFOX-LM	Alcomm Wireless, Inc.	4116 1st Ave N	Birmingham	AL	35222-1506	2-WAY Radio (lms) Administrator
WFOX-LM	Alcomm Wireless	8400 Airport Blvd	Mobile	AL	36608-9603	Dan Lensch or 2-WAY Radio (lms) Administrator
WFOX-LM	Gat Airline Ground Support, Inc.	10 Burton Hills Blvd	Nashville	TN	37215-6105	Julie Pinkerton or 2-WAY Radio (lms) Administrator
WFOX-LM	Corrections Corp. Of America	505 Riverfront Pkwy	Chattanooga	TN	37402-1609	Larry Dugger or 2-WAY Radio (lms) Administrator
WFOX-LM	3 H Hotel Group	1201 Crutchfield St	Chattanooga	TN	37406-2328	Don Thurman or 2-WAY Radio (lms) Administrator
WFOX-LM	Mobile Communications America, Inc.	PO Box 160	Columbia	TN	38027-0160	Salvatore Signorelli or 2-WAY Radio (lms) Administrator
WFOX-LM	Fedex Ground	PO Box 38881	Germantown	TN	38183-0881	2-WAY Radio (lms) Administrator
WFOX-LM	Railcom	3005 Highway 80 W	Jackson	MS	39209-7202	Barclay Willey or 2-WAY Radio (lms) Administrator
WFOX-LM	Saks 0637, 0644, 0659, 0821, 7818, 7822	300 E. Market St., Suite 100 Att: Legal	Louisville	KY	40202	Executive Director or 2-WAY Radio (lms) Administrator
WFOX-LM	WG San Pablo Sh, LLC	2200 Outer Loop	Louisville	KY	40219-3565	Ups Gns Pte Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	United Parcel Service, Inc.	2200 Outer Loop	Louisville	KY	40219-3565	Troy Gritton or 2-WAY Radio (lms) Administrator
WFOX-LM	United Parcel Service, Inc.	2200 Outer Loop Road	Louisville	KY	40219	Troy Gritton or 2-WAY Radio (lms) Administrator
WFOX-LM	United Parcel Service, Inc.	4242 Reynolds Dr	Hilland	OH	43026-1260	Danielle Brown or 2-WAY Radio (lms) Administrator
WFOX-LM	Ohio Semitronics Of Ca, Inc.	180 E Broad St	Columbus	OH	43215-3707	General Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	Orange Park Mall Llc	1810 Summit Commerce Park	Twinsburg	OH	44087-2300	Thomas Vodka or 2-WAY Radio (lms) Administrator
WFOX-LM	RGH Enterprises, Inc.	30400 Solon Rd	Solon	OH	44139-3416	Brian McNamara or 2-WAY Radio (lms) Administrator
WFOX-LM	Aclara Technologies Llc	30400 Solon Rd	Solon	OH	44139-3416	Brian McNamara or 2-WAY Radio (lms) Administrator
WFOX-LM	Aclara	30400 Solon Rd	Solon	OH	44139-3416	Brian McNamara or 2-WAY Radio (lms) Administrator
WFOX-LM	Aclara Technologies Llc	30400 Solon Rd	Solon	OH	44139-3416	Brian McNamara or 2-WAY Radio (lms) Administrator
WFOX-LM	First Student Inc.	600 Vine St Ste 1400	Cincinnati	OH	45202-2426	Ron Behrman or 2-WAY Radio (lms) Administrator
WFOX-LM	First Student Inc.	600 Vine St Ste 1400	Cincinnati	OH	45202-2426	Thomas Warman or 2-WAY Radio (lms) Administrator
WFOX-LM	Dog, Inc.	7450 Montgomery Rd Ste 400	Cincinnati	OH	45236-4100	Joe Williamson or 2-WAY Radio (lms) Administrator
WFOX-LM	Dog, Inc.	7450 Montgomery Rd Ste 400	Cincinnati	OH	45236-4100	Joe Williamson or 2-WAY Radio (lms) Administrator
WFOX-LM	Ikea Property, Inc. Dia Ikea Jacksonville #537	11400 Ikea Way	Fibers	IN	46037-9824	Chris Scheiber or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlas License Company	176 Logan St Ste 227	Noblesville	IN	46060-1437	Kelly Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlas License Company	176 Logan St Ste 227	Noblesville	IN	46060-1437	Kelly Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlas License Company & Data Services	176 Logan St Ste 227	Noblesville	IN	46060-1437	Kelly Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlas License Company	176 Logan St Ste 227	Noblesville	IN	46060-1437	Kelly Smith or 2-WAY Radio (lms) Administrator
WFOX-LM	St. Augustine Premium Outlets (spg #7884)	PO Box 7033	Indianapolis	IN	46207-7033	FCC License Support or 2-WAY Radio (lms) Administrator
WFOX-LM	Avenues 9087	PO Box 7033	Indianapolis	IN	46207-7033	FCC License Support or 2-WAY Radio (lms) Administrator
WFOX-LM	St. John's Town Center #4693	PO Box 7033	Indianapolis	IN	46207-7033	FCC License Support or 2-WAY Radio (lms) Administrator
WFOX-LM	St. Augustine Premium Outlets #7884	PO Box 7033	Indianapolis	IN	46207-7033	FCC License Support or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlas License Company & Data Services	7202 N Shadeland Ave Ste 215	Indianapolis	IN	46250-2031	Linda Simons or 2-WAY Radio (lms) Administrator
WFOX-LM	Atlas License Company & Data Services	7202 N Shadeland Ave Ste 215	Indianapolis	IN	46250-2031	Linda Simons or 2-WAY Radio (lms) Administrator
WFOX-LM	Enkel America	2900 Inwood Dr	Columbus	IN	47201-9758	Beth Lewis or 2-WAY Radio (lms) Administrator
WFOX-LM	Consourse, Inc.	2130 Austin Ave	Rochester Hills	MI	48309-3667	Mike Hilverding or 2-WAY Radio (lms) Administrator
WFOX-LM	Magnetek, Inc.	N49 W13650 Campbell Dr	Menomonee Falls	WI	53051	Jeff Bruce or 2-WAY Radio (lms) Administrator
WFOX-LM	Baycom Inc.	2040 Radisson St	Green Bay	WI	54302-2054	John Kummars or 2-WAY Radio (lms) Administrator
WFOX-LM	Baycom Inc.	2040 Radisson St	Green Bay	WI	54302-2054	John Kummars or 2-WAY Radio (lms) Administrator
WFOX-LM	Advanced Wireless Communications	20809 Kensington Blvd	Lakeville	MN	55044-8353	Jenise Johnson or 2-WAY Radio (lms) Administrator
WFOX-LM	Advanced Wireless Communications	20809 Kensington Blvd	Lakeville	MN	55044-8353	Jenise Johnson or 2-WAY Radio (lms) Administrator
WFOX-LM	Advanced Wireless Communications	20809 Kensington Blvd	Lakeville	MN	55044-8353	Jenise Johnson or 2-WAY Radio (lms) Administrator
WFOX-LM	Advanced Wireless Communications	20855 Kensington Blvd	Lakeville	MN	55044-8353	Jenise Johnson or 2-WAY Radio (lms) Administrator
WFOX-LM	American Time & Signal Co	140 3rd St	Dassel	MN	55325-4511	Tim Leung or 2-WAY Radio (lms) Administrator
WFOX-LM	American Tim	140 3rd St	Dassel	MN	55325-4511	Kersten Pink or 2-WAY Radio (lms) Administrator
WFOX-LM	American Time	140 3rd St	Dassel	MN	55325-4511	Tim Leung or 2-WAY Radio (lms) Administrator
WFOX-LM	American Time	140 3rd St	Dassel	MN	55325-4511	Tim Leung or 2-WAY Radio (lms) Administrator
WFOX-LM	Professional Wireless Comms	451 Cliff Rd E Ste 101	Burnsville	MN	55337-1675	Dave Stone or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Stores T 669	33 S 6th St	Minneapolis	MN	55402-3601	CC24H or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Store T 645	1000 Nicolllet Mall Tpn 0910	Minneapolis	MN	55403	Joan Anderberg or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Stores T 646	1000 Nicolllet Mail Tpn 0910	Minneapolis	MN	55403	Joan Anderberg or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Stores T 646	1000 Nicolllet Mail Tpn 0910	Minneapolis	MN	55403	Joan Anderberg or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Stores T 646	1000 Nicolllet Mail Tpn 0910	Minneapolis	MN	55403	Joan Anderberg or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Stores Inc.	PO Box 1392	Minneapolis	MN	55440-9471	Joan Anderberg, Tpn 0910 or 2-WAY Radio (lms) Administrator
WFOX-LM	Target Stores Inc.	PO Box 9471	Minneapolis	MN	55440-9471	Joan Anderberg, Tpn 0910 or 2-WAY Radio (lms) Administrator
WFOX-LM	Delta Air Lines Inc.	7208 34th Ave S	Minneapolis	MN	55450-1106	David Mitchell or 2-WAY Radio (lms) Administrator
WFOX-LM	Mayo Clinic	200 1st St SW	Rochester	MN	55905-0002	Jeffrey Tri or 2-WAY Radio (lms) Administrator
WFOX-LM	Mayo Foundation	200 1st St SW	Rochester	MN	55905-0001	Telecommunications Jeffrey L Tri or 2-WAY Radio (lms) Administrator
WFOX-LM	Mayo Clinic Jacksonville	200 1st St SW	Rochester	MN	55905-0001	Telecommunications: Attn: Jeff Tri or 2-WAY Radio (lms) Administrator
WFOX-LM	Panasonic System Solutions Company	5201 Tollview Dr #E1-D9	Rolling Meadows	IL	60008-3727	Jeff Rader or 2-WAY Radio (lms) Administrator
WFOX-LM	Panasonic System Solutions Company	5201 Tollview Dr #E1-D9	Rolling Meadows	IL	60008-3727	Jeff Rader or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	Buffalo Grove	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	Buffalo Grove	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	Buffalo Grove	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	Buffalo Grove	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator



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WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Visiplex, Inc.	1287 Barclay Blvd	IL	60089-4514	FCC Coordinator or 2-WAY Radio (lms) Administrator
WFOX-LM	Great Lakes Dredge & Dock Co	2122 York Rd Ste 200	IL	60523-1923	Ed Hickey or 2-WAY Radio (lms) Administrator
WFOX-LM	Communications Direct	735 Hunter Dr Ste F	IL	60510-4407	Roger Folkerts or 2-WAY Radio (lms) Administrator
WFOX-LM	TTX Company	101 N Wacker Dr	IL	60606-1784	FCC License Manager / M. Commenerator or 2-WAY Radio (lms) Administrator
WFOX-LM	United Airlines	233 S Wacker Dr Ste 710	IL	60606-6462	Pete Inc.ani, Manager, Ground Radio or 2-WAY Radio (lms) Administrator
WFOX-LM	Illinois Cooperative Association Inc.	11596 Illinois Hwy 1	IL	61344	Jacob Fever or 2-WAY Radio (lms) Administrator
WFOX-LM	Center Point Terminal Company	8235 Forsyth Blvd Ste 400	MO	63105-1621	Rick Van Cleave or 2-WAY Radio (lms) Administrator
WFOX-LM	Bright House Networks, Llc	12405 Powerscourt Dr	MO	63131-3673	Alexis Anderten or 2-WAY Radio (lms) Administrator
WFOX-LM	Charter Communications	12405 Powerscourt Dr	MO	63131-3673	Alexis Anderten or 2-WAY Radio (lms) Administrator
WFOX-LM	O'Reilly Automotive	PO Box 1156	MO	65801-1156	Sandra Wilkerson or 2-WAY Radio (lms) Administrator
WFOX-LM	O'Reilly Automotive	233 S Patterson Ave	MO	65802-2298	Sandra Wilkerson or 2-WAY Radio (lms) Administrator
WFOX-LM	O'Reilly Auto Parts	233 S Patterson Ave	MO	65802-2210	Sandra Wilkerson or 2-WAY Radio (lms) Administrator
WFOX-LM	Radio Comm. Specialists (rsc)	3107 E Chestnut Expy Ste F	MO	65802-2506	Jewell Windell or 2-WAY Radio (lms) Administrator
WFOX-LM	Rayfield Communications, Inc.	2018 W Woodland St	MO	65807-5912	2-WAY Radio (lms) Administrator
WFOX-LM	Kansas Towers Inc.	6480 Road 18	KS	67735-9000	Justin Bentzinger or 2-WAY Radio (lms) Administrator
WFOX-LM	Kansas Towers, Inc.	6480 Road 18	KS	67735-9000	Justin Bentzinger or 2-WAY Radio (lms) Administrator
WFOX-LM	Air Methods	5307 Lindbergh Dr	NE	68110-2835	2-WAY Radio (lms) Administrator
WFOX-LM	Prudential Financial	751 Broad St	NE	68110-2835	2-WAY Radio (lms) Administrator
WFOX-LM	Prudential Financial	751 Broad St	NE	68110-2835	2-WAY Radio (lms) Administrator
WFOX-LM	Prudential Financial	751 Broad St	NE	68110-2835	2-WAY Radio (lms) Administrator
WFOX-LM	Wal-Mart Stores East Lp	702 SW 8th St	TX	75235	Dwight Nield or 2-WAY Radio (lms) Administrator
WFOX-LM	Brink's Inc. Incorporated	555 Dividend Dr Ste 100	TX	75235	Dwight Nield or 2-WAY Radio (lms) Administrator
WFOX-LM	Ans Spectrum Holdings, Llc	4009 Distribution Dr Ste 200	TX	75238-1645	Gary Weber or 2-WAY Radio (lms) Administrator
WFOX-LM	Top Golf Usa, Inc.	1720 Lakewood Dr Ste 100	TX	75238-1645	Gary Weber or 2-WAY Radio (lms) Administrator
WFOX-LM	Southwest Airlines	8750 N Central Expy Ste 1200	TX	75231-6480	Lloyd Carmack or 2-WAY Radio (lms) Administrator
WFOX-LM	Continental Wireless, Inc.	Hdq-7pd	TX	75235	Dwight Nield or 2-WAY Radio (lms) Administrator
WFOX-LM	Continental Wireless, Inc.	10455 Vista Park Rd	TX	75238-1645	Gary Weber or 2-WAY Radio (lms) Administrator
WFOX-LM	Continental Wireless, Inc.	10455 Vista Park Rd	TX	75238-1645	Gary Weber or 2-WAY Radio (lms) Administrator
WFOX-LM	Addison Law	5400 Lyndon B Johnson Fwy Ste 1325	TX	75240-1021	2-WAY Radio (lms) Administrator
WFOX-LM	Dave & Busters	PO Box 542617	TX	75354-2617	Shari Thompson or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Operating Lp	PO Box 559001	TX	75355-9001	Shoja Anvari or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Wireless Worldwide	PO Box 559001	TX	75355-9001	Brad Warren or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Operating Lc	PO Box 559001	TX	75355-9001	Trudy Guileres or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Wireless Worldwide	PO Box 559001	TX	75355-9001	Stephanie Anderson or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Wireless Worldwide	PO Box 559001	TX	75355-9001	Trudy Guileres or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Wireless Worldwide	PO Box 559001	TX	75355-9001	Brad Warren or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Operating Lc	PO Box 559001	TX	75355-9001	Stephanie Anderson or 2-WAY Radio (lms) Administrator
WFOX-LM	Bearcom Operating Lc	PO Box 559001	TX	75355-9001	Stephanie Anderson or 2-WAY Radio (lms) Administrator
WFOX-LM	Crosspoint Communications	501 Duncan Perry Rd	TX	76011-5414	Steve Cantrell or 2-WAY Radio (lms) Administrator
WFOX-LM	DFW Communications, Inc.	501 Duncan Perry Rd	TX	76011-5414	Kyle Harty or 2-WAY Radio (lms) Administrator
WFOX-LM	Harbortouch Of Southlake	700 E State Highway 114	TX	76092-5236	Tim Smick or 2-WAY Radio (lms) Administrator
WFOX-LM	American Airlines	13800 Airport Fwy	TX	76155-2224	Jarrett Taubman or 2-WAY Radio (lms) Administrator
WFOX-LM	American Airlines Group, Inc.	13800 Airport Fwy	TX	76155-2224	Greg Leggett or 2-WAY Radio (lms) Administrator
WFOX-LM	Michaels Stores Inc.	860 Westport Pkwy	TX	76177-4528	Loss Prevention Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	Primerflight Aviation Services	3500 N Terminal Rd Ste E2-102	TX	77032-5573	Matthew Barry or 2-WAY Radio (lms) Administrator
WFOX-LM	Texas Bigfoot Communications	5829 W Sam Houston Pkwy N	TX	77041-4745	Adam Nguyen or 2-WAY Radio (lms) Administrator
WFOX-LM	Texas Bigfoot Communications	5829 W Sam Houston Pkwy N	TX	77041-4745	Adam Nguyen or 2-WAY Radio (lms) Administrator
WFOX-LM	Texas Bigfoot Communications	5829 W Sam Houston Pkwy N	TX	77041-4745	Adam Nguyen or 2-WAY Radio (lms) Administrator
WFOX-LM	Houston Communications Inc.	1105 Industrial Blvd	TX	77478-2833	Jesse Flores or 2-WAY Radio (lms) Administrator
WFOX-LM	Vanguard Resources	6500 Us Highway 281 N	TX	78070-5907	Ricky Powers or 2-WAY Radio (lms) Administrator
WFOX-LM	Lenderlife Network Inc.	710 S Ash St	CO	80246-1989	Manager or 2-WAY Radio (lms) Administrator
WFOX-LM	Dee Polley	216 Middlefork Rd	ID	83622-8076	Dee Polley or 2-WAY Radio (lms) Administrator
WFOX-LM	Lone Peak Licensing, Llc	PO Box 1336	UT	84020-1336	Joyce Raymundo or 2-WAY Radio (lms) Administrator
WFOX-LM	Lone Peak Licensing, Llc	PO Box 1336	UT	84020-1336	Joyce Raymundo or 2-WAY Radio (lms) Administrator
WFOX-LM	Lone Peak Licensing, Llc	PO Box 1336	UT	84020-1336	Joyce Raymundo or 2-WAY Radio (lms) Administrator
WFOX-LM	Jcpenny Shared Services Center	M/S 835	UT	84117-0503	Doug Thompson or 2-WAY Radio (lms) Administrator
WFOX-LM	Cara Enterprises, Inc.	PO Box 17503	UT	84117-0503	Doug Thompson or 2-WAY Radio (lms) Administrator



Direct Mail Marketing

2441 Orlando Central Parkway

Orlando, FL 32809

407.855.9277

[illegible]



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97217-3524 Chuck Nelson or 2-WAY Radio (Mrs) Administrator
97401-4008 2-WAY Radio (Mrs) Administrator
97401-6009 2-WAY Radio (Mrs) Administrator
98101-4407 Corporate Loss Prevention or 2-WAY Radio (Mrs) Administrator
98101-4407 Corporate Loss Prevention or 2-WAY Radio (Mrs) Administrator
98101-4407 Radio Manager or 2-WAY Radio (Mrs) Administrator
98124-2207 Freq Mgt Svcs, M/C 2T-22 or 2-WAY Radio (Mrs) Administrator
98134-1108 Tim Roehl or 2-WAY Radio (Mrs) Administrator
98134-2409 Kenneth Quinones or 2-WAY Radio (Mrs) Administrator
98421-2905 Kurt Harsh or 2-WAY Radio (Mrs) Administrator
98421-2904 Kurt Harsh or 2-WAY Radio (Mrs) Administrator

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Portland
Eugene
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Tacoma
Tacoma

5055 N Greeley Ave
1365 Oak St
871 Country Club Rd Ste A
1700 7th Ave Ste 1000
1700 7th Ave Ste 1000
1700 7th Ave Ste 1000
PO Box 3707
1131 SW Klickitat Way
5209 E Marginal Way S
1675 Lincoln Ave Bldg 950
1675 Lincoln Ave

WFOX-LM Adidas Group
WFOX-LM Fit
WFOX-LM Fit
WFOX-LM Nordstrom Inc. #789
WFOX-LM Nordstrom Inc. #756
WFOX-LM Nordstrom Inc.
WFOX-LM The Boeing Company
WFOX-LM SSA Marine, Inc. Dba Talleyrand Marine Terminal
WFOX-LM Manson Construction & Engineering Company
WFOX-LM Apm Terminals Tacoma, LLC
WFOX-LM Apm Terminals North America, Inc.

Attachment B – PIM Remediation on SBA Tower

1. Memo from Merrill Weiss Group LLC to Shane Emery, Jim McGue / WFOX-TV
 - Re: Passive Intermodulation (PIM) Remediation on SBATower
 - Dated: April 19, 2017

227 Central Avenue
Metuchen, NJ 08840-1242
(732) 494-6400 Phone
(732) 494-6401 Fax

Merrill Weiss Group LLC

Consultants in Electronic Media Technology / Management

Memorandum

To: Shane Emery, Jim McGue / WFOX Television

From: Merrill Weiss

Date: April 19, 2017

Re: Passive Intermodulation (PIM) Remediation on SBA Tower

We recently conducted testing for Passive Intermodulation (PIM) generation in the WFOX RF transmission system and on and surrounding the SBA tower on which the WFOX transmitting antenna is located. We found that the WFOX RF system is clean, with no evidence of PIM generation. We found that generation of PIM has begun at certain locations on the tower and that many other places on the tower have begun to rust or otherwise corrode, which is one of the principal causes of PIM generation. It is to be expected that the level of PIM on the tower will continue to rise over time unless something is done to remediate it. It generally is much easier to stop PIM before it starts than it is to fix later, after it has gotten out of control.

Given that WFOX will be moving to Channel 14 under FCC orders as part of the Spectrum Repack following the recently-concluded Spectrum Incentive Auction, it will be imperative that the generation of PIM be cleaned up and eliminated on the SBA tower if WFOX is to continue to operate there successfully. The reason for this is that PIM causes the generation of noise in adjacent channels, and Channel 14 is immediately adjacent to the Land Mobile band at 450 – 470 MHz, which, in the worst case, can include life safety services. PIM from Channel 14 operations can wipe out reception in the Land Mobile band and is impossible to filter out at either the transmitter or receiver. As a consequence, the FCC normally includes in broadcast television construction permits for Channel 14 a requirement that the permittee demonstrate that interference will not be caused to nearby Land Mobile operations before a license will be granted.

To remediate the tower, we suggest a two-step process: First is to thoroughly inspect every inch of the tower to determine and document photographically exactly what needs to be done. Second is to apply the necessary component replacements, corrosion removal, surface treatments, and the like. Our recommendation is to use Peter Simpson and his crew, who are local, and who can

Passive Intermodulation (PIM) Remediation on SBA Tower

be engaged through Tower King II, to do the work. Peter did the tower work for us over the last week and knows the tower, understands the types of problems that need remediation, and is quite capable of doing the job.

To outline the sorts of corrections that will be needed, following is a list, in no particular order, of the types of issues that are known to cause PIM and the corrections that must be applied:

- The tower itself can be a PIM generator. RF current flows through component junctions that are rusted or otherwise corroded will be the most likely source of such PIM. Therefore, each bolted or welded junction must be inspected and, if rust or other corrosion is found, remediated. Bolted junctions include leg flanges and face bracing components. Rusted bolts, washers, and nuts must be replaced with galvanized components of the required strength according to the tower manufacturer's specifications or those of a structural engineer. Painting over such components should be avoided because it obscures the existence of rust or other corrosion and makes observation of the corrosion more difficult when the tower is inspected in the future.
- The mounts and other supporting structures for the broadcast antennas on the tower are susceptible to rust and other forms of corrosion, as are some elements of the antennas themselves. Therefore, the broadcast antennas should be inspected with the objective of locating any rust or other corrosion that is present. In particular, attention should be paid to junctions between dissimilar metals and to electromagnetic materials (e.g., iron, steel, and copper). Depending upon what is found and where, the remediation to be applied must be determined on a case-by-case basis.
- Galvanized threaded rod rusts, as do the couplers, washers, and nuts applied to it. All galvanized threaded rod on the tower must be replaced with stainless steel rod and associated components. This includes rods in antenna mounts, those used to support or position transmission lines, and any others on the tower, whether they have begun to rust yet or not.
- Galvanized mounting plates and clamps (such as those used to mount whip antennas, support poles, and the like) also rust. Typically they are installed using galvanized threaded rod or bolts, along with galvanized washers and nuts. All of these components must be replaced with stainless steel hardware.
- Unused land mobile antennas can be PIM generators. All unused land mobile antennas must be removed from the tower, along with all of their mounting hardware.
- Unused/disconnected transmission lines can be PIM generators, and the transmission lines can spread PIM from one part of the tower to another, making it very difficult to localize the source of the PIM. All unused/disconnected transmission lines and all of their mounting hardware must be removed from the tower.
- Generic Type-N connectors are well known as PIM generators. Antennas, transmission lines and jumpers outfitted with Type-N connectors must have their connectors replaced with 7-16 DIN connectors to the extent possible. For antennas, that means replacing the

antennas with equivalent antennas that have 7-16 DIN connectors. If no acceptable (to the service operator) equivalent antenna is available, then the jumper should be replaced with one having a low-PIM N-connector on one end and a 7-16 DIN connector on the other end. All transmission lines must be terminated with 7-16 DIN connectors. Jumpers must be used to connect large transmission lines to antennas or other equipment.

- All connector-to-cable physical junctions must be straight and protected with heavy-duty shrink tubing, to provide both support and water-tightness. Exposed connector interfaces and surfaces must be wrapped with watertight rubber tape, or equivalent.
- All transmission lines and jumpers must be physically supported so that they cannot bend or whip in the wind. This must be done to prevent the bending and breaking of cable shields, which can lead to corrosion and, in turn, to PIM generation.
- All ground connections must be clean and tight, with no rust or other corrosion in or near the junction between the ground strap, cable, or lug and the ground block, ground bar, or tower frame. Rusted or corroded lugs must be replaced.
- All supporting structures for equipment mounted on the tower must be clean of rust and corrosion, in particular in any junctions between surfaces and/or fasteners. Painted structures should be replaced with either stainless steel (preferred) or galvanized components, depending upon what is available for the purpose. Painted structures are to be avoided so that the presence of rust or corrosion can be observed easily during future inspections, which will be required at regular intervals and may be conducted using UAVs.
- Any shields (such as for protection from weather or workers) must be treated in the same manner as supporting structures discussed in the bullet immediately above.
- All hose and pipe straps must be stainless steel. Any that are not must be replaced.
- All cables, wires, and chains hanging loose from the tower must be removed.
- The safety climb must be stainless steel and must be replaced with a stainless steel cable if it is not stainless already.
- The shock absorber at the top of the safety climb should be replaced with one that is designed and specified for low PIM generation, if available. If such a shock absorber is not available, then one should be selected based on its design and the materials used in it. In particular, dissimilar metals should not be in contact, electromagnetic materials should not be used, and certain types of plating should be avoided.
- All electrical conduits, couplers, junction boxes, electrical outlets and other types of connectors, cover plates, and mounting hardware must be rust- and corrosion-free. Any that show rust or other corrosion must be replaced. In cases of major replacements, use of plastic components rated for outdoor use and sun exposure should be the first choice.
- All electrical connections on the tower must be inspected and all electrical connectors (i.e., wire nuts and crimp connectors) tightened.
- Fencing on and around the property can be a source of PIM if rust or other corrosion exists on, or particularly between, elements of the fence. We understand from an SBA

Passive Intermodulation (PIM) Remediation on SBA Tower

employee (Scott) that the fencing at the site is to be replaced in the near future. Fencing materials should be chosen to avoid rusting and corrosion for the long term, likely meaning use of heavy-duty coated fence wire. In addition, all posts, support rods, frames, and other components exhibiting any rust or other corrosion should be replaced with heavily galvanized materials.

Many of the issues described in the list above were observed easily on the SBA tower during a recent PIM measurement project. Others likely are present but were not seen because a thorough inspection was not the objective of the effort. Many of the remediation processes should be applied whether or not the specific related causes of PIM are present – as a precautionary measure, since they eventually will occur.

Should there be questions about any of the described types of PIM generation and sources or the remediation methods for them, please do not hesitate to ask. Should others occur to you, please do pass them along so that they can be added to the list. I also will be forwarding a copy of this memo to Peter Eckmann in case he has any additions to what I have included.

cc: Peter Eckmann
Jim Kauffman
Dave Siegler