

**ENGINEERING STATEMENT**

The engineering data contained herein have been prepared on behalf of CBS RADIO EAST INC., licensee of commercial FM station WNEW-FM, Channel 274B (102.7 MHz) in New York, New York, in support of this Application for License to operate with a new auxiliary facility on the broadcast tower atop the Empire State Building under FCC authorization BXPB-20170522ABM. The purpose of this exhibit is to provide operating parameters for the facility, address conditions that the Commission placed on the referenced construction permit, and request Program Test Authority.

Below is a tabulation of operating parameters for the WNEW-FM auxiliary facility:

Transmitter Power Output	9.10 dBk / 8.1 kW
Line Loss from Transmitter to Combiner	0.19 dB
Combiner Loss and Line Loss to Antenna	1.18 dB
Antenna Gain	0.78 dB
ERP	8.51 dBk / 7.1 kW

Antenna Make and Model: ERI 1184-3CP-2

Number of Bays: 3

Bay Spacing: 0.70 wavelengths (80 inches)

Electrical Beam Tilt: 0 degrees

Power Gain: 1.196

Transmission Line to Combiner: 162' of 3-1/8" diameter rigid plus 15' of 1-5/8" heliax

Attached hereto are reports of the intermodulation/spurious emission measurements of the new combiner/antenna system, conducted by the manufacturer and a power density survey of the upper levels of the Empire State Building, conducted by this firm. These reports conclude that the proposed facility meets the Commission's Rules in both regards.

I declare, under penalty of perjury, that the foregoing statements and attached engineering exhibits, which were prepared by me or under my immediate supervision, are true and correct to the best of my knowledge and belief.

A handwritten signature in blue ink, appearing to read 'K. T. Fisher', with a stylized, elongated final letter.

KEVIN T. FISHER

October 10, 2017

October 6, 2017

Subject: 3<sup>rd</sup> Order Intermodulation Product Report and Findings

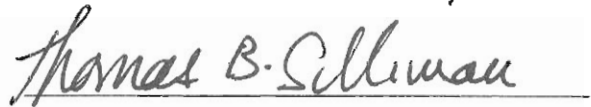
To: Empire State Building, Hanson Engineering, Kevin Fischer

On the nights of September 27<sup>th</sup> and 28<sup>th</sup> of 2017, 3<sup>rd</sup> order inter-modulation product measurements were measured at the Empire State Building while 19 broadcast stations were operating into an auxiliary combiner and antenna RF system. Nick Paulin (Engineer) and Zach Condi (Engineering Technician) conducted the measurements along with Tom Silliman, P.E.

The measurements made were found to be within compliance required by (CFR) Title 47 Section 73.317(b)-(d) and the findings are contained within the following report.



Nick Paulin



Tom Silliman, P.E.



*Thomas Silliman*  
October 6, 2017

# **Report Of**

# **Intermodulation Product Findings**

## ***EMPIRE STATE BUILDING AUXILIARY MASTER FM BROADCAST FACILITY NEW YORK, NEW YORK***

**WBMP 92.3 MHz. ~ WPAT-FM 93.1 MHz.  
WNYC-FM 93.9 MHz. ~ WPLJ 95.5 MHz.  
WXNY-FM 96.3 MHz. ~ WQHT 97.1 MHz.  
WSKQ-FM 97.9 MHz. ~ WEPN-FM 98.7 MHz.  
WBAI 99.5 MHz. ~ WHTZ 100.3 MHz.  
WCBS-FM 101.1 MHz. ~ WFAN-FM 101.9 MHz.  
WNEW-FM 102.7 MHz. ~ WKTU 103.5 MHz.  
WAXQ 104.3 MHz. ~ WWPR-FM 105.1 MHz.  
WQXR-FM 105.9 MHz. ~ WLTW 106.7 MHz.  
WBLS 107.5 MHz.**

**Project# 34901**

*October 4, 2017*

**Electronics Research Inc.  
7777 Gardner Road  
Chandler, Indiana 47610  
Phone (812) 925-6000 Fax (812) 925- 4030**

# TABLE OF CONTENTS

## Report of Findings for Intermodulation Product Measurements

Page 3-4.....	Introduction
Page 5 .....	Carrier Reference Levels
Page 5 .....	Table of Third Order Products Expected
Page 7- 15.....	Intermodulation Product Measurements
Page 16 .....	Conclusion
Page 17 .....	Affidavit

## Exhibits Accompanying This Report

<b>EXHIBIT A</b> .....	Antenna and Combiner Specification Sheet and Drawing
A-1.....	Drawing Depicting Antenna
A-2.....	ERI Antenna Specification Sheet
A-3.....	Drawing Depicting Branch Combiner
A-4.....	ERI Combiner Specification Sheet
A-5.....	Theoretical Vertical Plane Relative Field Antenna Plots
<b>EXHIBIT B-1</b> .....	Intermodulation Product Measurement Equipment Layout
B-2.....	Broadcasting Scheme of the Multiplexed System

## REPORT OF FINDINGS

### EMPIRE STATE BUILDING AUXILIARY MASTER FM BROADCAST FACILITY NEW YORK, NEW YORK

**Introduction:** This report of findings is based on data collected at the Empire State Building Auxiliary FM broadcast facility located in New York, NY. The report includes measurements offered as proof that the combined operations of WBMP (92.3 MHz.), WPAT-FM (93.1 MHz.), WNYC-FM (93.9 MHz.), WPLJ (95.5 MHz.), WXNY-FM (96.3 MHz.), WQHT (97.1 MHz.), WSKQ-FM (97.9 MHz.), WEPN-FM (98.7 MHz.), WBAI (99.5 MHz.), WHTZ (100.3 MHz.), WCBS-FM (101.1 MHz.), WFAN-FM (101.9 MHz.), WNEW-FM (102.7 MHz.), WKTU (103.5 MHz.), WAXQ (104.3 MHz.), WWPR-FM (105.1 MHz.), WQXR-FM (105.9 MHz.), WLTW (106.7 MHz.), and WBSL (107.5 MHz.) transmitters are in compliance with the FCC Rules and Regulations as required by the Code of Federal Regulations (CFR) Title 47 section 73.317 paragraph (b) through (d). In brief, the collection of measurements presented in this report shows that all possible third order inter-modulation (IM) products generated by this combined system are less than the maximum allowable level as required by section 73.317 (b) through (d). Nick Paulin, and Zach Condi of Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized herein on September 27<sup>th</sup> and 28<sup>th</sup>, 2017.

**The following exhibits are provided:**

Exhibit A:

- A-1 Drawing Depicting Antenna.
- A-2 1184-3CP-2 Antenna Specification Sheet.
- A-3 Drawing Depicting Combined Scheme.
- A-4 Combiner Specification Sheet.
- A-5 Theoretical Vertical Plane Relative Field Antenna Plots

Exhibit B:

- B-1 Equipment Employed in Intermodulation Product Measurement.
- B-2 Broadcasting Scheme of the Combiner Systems.

Table 1. Carrier Reference Levels.

Table 2. Calculated Third Order Products.

Table 3. Intermodulation Analysis Measurements.

**Exhibits Accompanying Report:** Exhibit A provides comprehensive information on both antenna and filters used by these radio stations. Exhibit B illustrates the broadcasting scheme of each station, the layout of the equipment used to isolate and measure potential intermodulation products and forward carrier reference levels. Found within Table 1 are the narrow band carrier frequency measurements that provide relative output signal levels for the IM analysis. Table 2 lists the calculated third order products that can be generated from FM transmitters broadcasting from the combined system. The IM Analysis Measurements, in Table 3, provides detailed information obtained from the product frequency investigation.

**The Nature of Intermodulation Products (IM):** Intermodulation products result from inadequate transmitter-to-transmitter isolation. Intermodulation products are commonly generated from radio stations operating into multiplexed facilities and congested antenna broadcast sites. The mechanics associated with the phenomenon have been well documented. When two or more transmitters are coupled to each other, new spectral components are produced by the mixing of the station frequencies in the active circuits of each transmitter. The common term used to describe this phenomenon is third order product denoted by the mathematical expression  $[2(F_1)-(F_2)]$ , where  $F_1$  signifies the frequency of the transmitter that is generating the intermodulation product, and  $F_2$  signifies the frequency causing the interference.

**The Multiplexed System:** These measurements were taken with all FM stations operating from the combined antenna system. The WBMP, WPAT-FM, WNYC-FM, WPLJ, WXNY-FM, WQHT, WSKQ-FM, WEPN-FM, WBAI, WHTZ, WCBS-FM, WFAN-FM, WNEW-FM, WKTU, WAXQ, WWPR-FM, WQXR-FM, WLTV, and WBLT combined system is fundamentally comprised of antenna, feed line and combiner units. The 1184-3CP-2 antenna, 780-8 Constant Impedance units, and rigid feedline, are products of Electronics Research, Inc. Refer to Exhibit B-1, for an illustration of the Broadcasting Scheme of these stations.

To accomplish the aggregation of nineteen transmitter signals into common antenna feeds and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of ERI Model 780-8 Constant Impedance combiner modules were installed. Specifically, the combiner utilizes nine ERI Model 780-8 Constant Impedance modules feeding into the left hand CP input to the antenna (Feed "A") and ten ERI Model 780-8 Constant Impedance modules feeding into the right hand CP input to the antenna (Feed "B"). Interconnecting "U-links" are used to connect the modules wideband output to the wideband input of the next module. The combiner, fully assembled, exhibited transmitter port-to-port isolation in excess of -42 dB. Other performance measurements, such as match, loss, group-delay, etc, revealed that the multiplexer unit was in proper working condition. Refer to Exhibit A-4 for the Combiner Specification Sheet.

**The IM Investigation:** Directional Couplers were placed at key locations throughout the combiner to monitor and maintain combiner performance. All couplers furnished with the system are factory calibrated and capable of delivering accurate and repeatable RF measurements. To facilitate the taking of the measurements, the couplers located at the antenna outputs of the combined system was used. Care was taken in the selection of the measurement location, to insure the measurements would be made far removed from transmitters and any filtering used to reduce broadcast emissions. The couplers selected would normally be used for antenna reflection measurements and thus would provide greater than 30 dB directivity and a forward signal sample of -49 dB.

The forward ports of the couplers were used for sampling the outgoing carrier levels and IM products. The IM sampled signal was fed by shielded cable into a Band Pass Filter where all extraneous energy was steeply attenuated. Various attenuation pads were used, when needed, on the band pass filter and/or the Spectrum Analyzer to ensure an adequate signal level for measurements without overloading the measurement equipment. A IFR Model 2399A Spectrum Analyzer serial# 02113071 was employed to record the level of all signals investigated. A Copper Mountain Model S5048 Vector Network Analyzer serial# 15077029 was used for selective tuning of the Band Pass Filter. The IFR Spectrum Analyzer was also used to measure the close in spectral attenuation of each carrier and wide band search for any anomalies that may need further investigation. See attached Exhibit B-1 for an illustration of the measurement equipment.

Prior to recording measurements, all pertinent broadcasting equipment including Transmitters, Multiplexer, Feed Line and Antenna were adjusted to optimal performance. Also, it was confirmed before taking any measurements that all transmitters were operating at the listed power levels on the Antenna Specification Sheet. From the equipment setup described above, the relative output signal level of each stations forward carrier was made. The resulting signal levels of these measurements are listed in Table 1, column labeled "Adjusted Level". This level will be used as the reference level for possible IM products of each carrier and was necessary to confirm that no significant levels of spurious energy, referenced to each carrier, were present from any transmitter operating from the multiplexed system.

**Table 1 - Carrier Reference Levels.**

<b>Carrier Frequency (MHz)</b>	<b>Pad One (dB)</b>	<b>Bandpass Filter Loss (dB)</b>	<b>Measured Level (dBm)</b>	<b>Adjusted Level (dBm)</b>	<b>Notes</b>
<b>WBMP 92.3</b>	<b>20</b>	<b>-</b>	<b>-2.1</b>	<b>17.9</b>	
<b>WPAT-FM 93.1</b>	<b>20</b>	<b>-</b>	<b>-3.89</b>	<b>16.11</b>	
<b>WNYC-FM 93.9</b>	<b>20</b>	<b>-</b>	<b>-2.14</b>	<b>17.86</b>	
<b>WPLJ 95.5</b>	<b>20</b>	<b>-</b>	<b>-2.27</b>	<b>17.73</b>	
<b>WXNY-FM 96.3</b>	<b>20</b>	<b>-</b>	<b>-1.9</b>	<b>18.1</b>	
<b>WQHT 97.1</b>	<b>20</b>	<b>-</b>	<b>-2.07</b>	<b>17.93</b>	
<b>WSKQ-FM 97.9</b>	<b>20</b>	<b>-</b>	<b>-2.00</b>	<b>18.00</b>	
<b>WEPN-FM 98.7</b>	<b>20</b>	<b>-</b>	<b>-1.81</b>	<b>18.19</b>	
<b>WBAI 99.5</b>	<b>20</b>	<b>-</b>	<b>-3.71</b>	<b>16.29</b>	
<b>WHTZ 100.3</b>	<b>20</b>	<b>-</b>	<b>-2.45</b>	<b>17.55</b>	
<b>WCBS-FM 101.1</b>	<b>20</b>	<b>-</b>	<b>-1.88</b>	<b>18.12</b>	
<b>WFAN-FM 101.9</b>	<b>20</b>	<b>-</b>	<b>-4.21</b>	<b>15.79</b>	
<b>WNEW-FM 102.7</b>	<b>20</b>	<b>-</b>	<b>-1.58</b>	<b>18.42</b>	
<b>WKTU 103.5</b>	<b>20</b>	<b>-</b>	<b>-2.01</b>	<b>17.99</b>	
<b>WAXQ 104.3</b>	<b>20</b>	<b>-</b>	<b>-1.01</b>	<b>18.99</b>	
<b>WWPR-FM 105.1</b>	<b>20</b>	<b>-</b>	<b>-1.51</b>	<b>18.49</b>	
<b>WQXR-FM 105.9</b>	<b>20</b>	<b>-</b>	<b>-10.85</b>	<b>9.15</b>	
<b>WLTW 106.7</b>	<b>20</b>	<b>-</b>	<b>-0.56</b>	<b>19.44</b>	
<b>WBLS 107.5</b>	<b>20</b>	<b>-</b>	<b>-3.07</b>	<b>16.93</b>	

Predictable third-order products due to system harmonics mixed with all on-site interfering frequencies that could be generated from the multiplexed system are calculated and listed in Table 2.



**Table 2 - Third Order Products.**

	92.3	93.1	93.9	95.5	96.3	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	103.5	104.3	105.1	105.9	106.7	107.5
92.3	---	93.9	95.5	98.7	100.3	101.9	103.5	105.1	106.7	108.3	109.9	111.5	113.1	114.7	116.3	117.9	119.5	121.1	122.7
93.1	91.5	---	94.7	97.9	99.5	101.1	102.7	104.3	105.9	107.5	109.1	110.7	112.3	113.9	115.5	117.1	118.7	120.3	121.9
93.9	90.7	92.3	---	97.1	98.7	100.3	101.9	103.5	105.1	106.7	108.3	109.9	111.5	113.1	114.7	116.3	117.9	119.5	121.1
95.5	89.1	90.7	92.3	---	97.1	98.7	100.3	101.9	103.5	105.1	106.7	108.3	109.9	111.5	113.1	114.7	116.3	117.9	119.5
96.3	88.3	89.9	91.5	94.7	---	97.9	99.5	101.1	102.7	104.3	105.9	107.5	109.1	110.7	112.3	113.9	115.5	117.1	118.7
97.1	87.5	89.1	90.7	93.9	95.5	---	98.7	100.3	101.9	103.5	105.1	106.7	108.3	109.9	111.5	113.1	114.7	116.3	117.9
97.9	86.7	88.3	89.9	93.1	94.7	96.3	---	99.5	101.1	102.7	104.3	105.9	107.5	109.1	110.7	112.3	113.9	115.5	117.1
98.7	85.9	87.5	89.1	92.3	93.9	95.5	97.1	---	100.3	101.9	103.5	105.1	106.7	108.3	109.9	111.5	113.1	114.7	116.3
99.5	85.1	86.7	88.3	91.5	93.1	94.7	96.3	97.9	---	101.1	102.7	104.3	105.9	107.5	109.1	110.7	112.3	113.9	115.5
100.3	84.3	85.9	87.5	90.7	92.3	93.9	95.5	97.1	98.7	---	101.9	103.5	105.1	106.7	108.3	109.9	111.5	113.1	114.7
101.1	83.5	85.1	86.7	89.9	91.5	93.1	94.7	96.3	97.9	99.5	---	102.7	104.3	105.9	107.5	109.1	110.7	112.3	113.9
101.9	82.7	84.3	85.9	89.1	90.7	92.3	93.9	95.5	97.1	98.7	100.3	---	103.5	105.1	106.7	108.3	109.9	111.5	113.1
102.7	81.9	83.5	85.1	88.3	89.9	91.5	93.1	94.7	96.3	97.9	99.5	101.1	---	104.3	105.9	107.5	109.1	110.7	112.3
103.5	81.1	82.7	84.3	87.5	89.1	90.7	92.3	93.9	95.5	97.1	98.7	100.3	101.9	---	105.1	106.7	108.3	109.9	111.5
104.3	80.3	81.9	83.5	86.7	88.3	89.9	91.5	93.1	94.7	96.3	97.9	99.5	101.1	102.7	---	105.9	107.5	109.1	110.7
105.1	79.5	81.1	82.7	85.9	87.5	89.1	90.7	92.3	93.9	95.5	97.1	98.7	100.3	101.9	103.5	---	106.7	108.3	109.9
105.9	78.7	80.3	81.9	85.1	86.7	88.3	89.9	91.5	93.1	94.7	96.3	97.9	99.5	101.1	102.7	104.3	---	107.5	109.1
106.7	77.9	79.5	81.1	84.3	85.9	87.5	89.1	90.7	92.3	93.9	95.5	97.1	98.7	100.3	101.9	103.5	105.1	---	108.3
107.5	77.1	78.7	80.3	83.5	85.1	86.7	88.3	89.9	91.5	93.1	94.7	96.3	97.9	99.5	101.1	102.7	104.3	105.9	---

Using the equipment previously described, the IM product measurements were recorded and are listed in Table 3. The signal levels Referenced to the carriers are calculated and listed in the column labeled “Level Referenced to Carrier”.

Refer to Exhibit B-2 for a layout of the measurement equipment.

**Table 3 – Intermodulation Measurements**

<b>Carrier Reference Measurements</b>											
Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
	92.3	B		20			-2.10	17.90	17.90		
	93.1	A		20			-3.89	16.11	16.11		
	93.9	B		20			-2.14	17.86	17.86		
	95.5	A		20			-2.27	17.73	17.73		
	96.3	B		20			-1.90	18.10	18.10		
	97.1	A		20			-2.07	17.93	17.93		
	97.9	B		20			-2.00	18.00	18.00		
	98.7	A		20			-1.81	18.19	18.19		
	99.5	B		20			-3.71	16.29	16.29		
	100.3	A		20			-2.45	17.55	17.55		
	101.1	B		20			-1.88	18.12	18.12		
	101.9	A		20			-4.21	15.79	15.79		
	102.7	B		20			-1.58	18.42	18.42		
	103.5	A		20			-2.01	17.99	17.99		
	104.3	B		20			-1.01	18.99	18.99		
	105.1	A		20			-1.51	18.49	18.49		
	105.9	B		20			-10.85	9.15	9.15		
	106.7	A		20			-0.56	19.44	19.44		
	107.5	B		20			-3.07	16.93	16.93		
<b>Intermodulation Product Measurements</b>											
77.1	92.3	B	107.5	0	2.75	2.75	-99.6	-96.85	17.9	-114.75	
77.9	92.3	B	106.7	0	2.95	2.95	-97.8	-94.85	17.9	-112.75	
78.7	92.3	B	105.9	0	2.87	2.87	-98.6	-95.73	17.9	-113.63	
78.7	93.1	A	107.5	0	2.87	2.87	-100.1	-97.23	16.11	-113.34	
79.5	93.1	A	106.7	0	2.62	2.62	-99.4	-96.78	16.11	-112.89	
79.5	92.3	B	105.1	0	2.62	2.62	-99	-96.38	17.9	-114.28	
80.3	93.1	A	105.9	0	2.81	2.81	-98.7	-95.89	16.11	-112.00	
80.3	92.3	B	104.3	0	2.81	2.81	-99	-96.19	17.9	-114.09	
80.3	93.9	B	107.5	0	2.81	2.81	-99	-96.19	17.86	-114.05	
81.1	92.3	B	103.5	0	2.7	2.7	-99.5	-96.8	17.9	-114.70	
81.1	93.1	A	105.1	0	2.7	2.7	-98.3	-95.6	16.11	-111.71	
81.1	93.9	B	106.7	0	2.7	2.7	-99.5	-96.8	17.86	-114.66	
81.9	92.3	B	102.7	0	2.65	2.65	-99.2	-96.55	17.9	-114.45	
81.9	93.1	A	104.3	0	2.65	2.65	-100.3	-97.65	16.11	-113.76	
81.9	93.9	B	105.9	0	2.65	2.65	-99.2	-96.55	17.86	-114.41	
82.7	92.3	B	101.9	0	2.53	2.53	-98.7	-96.17	17.9	-114.07	
82.7	93.1	A	103.5	0	2.53	2.53	-99.2	-96.67	16.11	-112.78	
82.7	93.9	B	105.1	0	2.53	2.53	-98.7	-96.17	17.86	-114.03	
83.5	93.1	A	102.7	0	2.67	2.67	-99.03	-96.36	16.11	-112.47	
83.5	92.3	B	101.1	0	2.67	2.67	-99.8	-97.13	17.9	-115.03	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
83.5	95.5	A	107.5	0	2.67	2.67	-99.03	-96.36	17.73	-114.09	
83.5	93.9	B	104.3	0	2.67	2.67	-99.8	-97.13	17.86	-114.99	
84.3	93.1	A	101.9	0	2.81	2.81	-99.5	-96.69	16.11	-112.80	
84.3	92.3	B	100.3	0	2.81	2.81	-99.1	-96.29	17.9	-114.19	
84.3	95.5	A	106.7	0	2.81	2.81	-99.5	-96.69	17.73	-114.42	
84.3	93.9	B	103.5	0	2.81	2.81	-99.1	-96.29	17.86	-114.15	
85.1	92.3	B	99.5	0	2.61	2.61	-98.9	-96.29	17.9	-114.19	
85.1	93.1	A	101.1	0	2.61	2.61	-97.8	-95.19	16.11	-111.30	
85.1	95.5	A	105.9	0	2.61	2.61	-97.8	-95.19	17.73	-112.92	
85.1	96.3	B	107.5	0	2.61	2.61	-98.9	-96.29	18.1	-114.39	
85.1	93.9	B	102.7	0	2.61	2.61	-98.9	-96.29	17.86	-114.15	
85.9	92.3	B	98.7	0	2.65	2.65	-98.5	-95.85	17.9	-113.75	
85.9	93.1	A	100.3	0	2.65	2.65	-99.3	-96.65	16.11	-112.76	
85.9	96.3	B	106.7	0	2.65	2.65	-98.5	-95.85	18.1	-113.95	
85.9	93.9	B	101.9	0	2.65	2.65	-98.5	-95.85	17.86	-113.71	
85.9	95.5	A	105.1	0	2.65	2.65	-99.3	-96.65	17.73	-114.38	
86.7	92.3	B	97.9	0	2.56	2.56	-98.5	-95.94	17.9	-113.84	
86.7	93.1	A	99.5	0	2.56	2.56	-98.7	-96.14	16.11	-112.25	
86.7	96.3	B	105.9	0	2.56	2.56	-98.5	-95.94	18.1	-114.04	
86.7	97.1	A	107.5	0	2.56	2.56	-98.7	-96.14	17.93	-114.07	
86.7	95.5	A	104.3	0	2.56	2.56	-98.7	-96.14	17.73	-113.87	
86.7	93.9	B	101.1	0	2.56	2.56	-98.5	-95.94	17.86	-113.80	
87.5	93.1	A	98.7	0	2.86	2.86	-98.8	-95.94	16.11	-112.05	
87.5	97.1	A	106.7	0	2.86	2.86	-98.8	-95.94	17.93	-113.87	
87.5	92.3	B	97.1	0	2.86	2.86	-98.9	-96.04	17.9	-113.94	
87.5	95.5	A	103.5	0	2.86	2.86	-98.8	-95.94	17.73	-113.67	
87.5	96.3	B	105.1	0	2.86	2.86	-98.9	-96.04	18.1	-114.14	
87.5	93.9	B	100.3	0	2.86	2.86	-98.9	-96.04	17.86	-113.90	
88.3	93.1	A	97.9	0	2.66	2.66	-92.4	-89.74	16.11	-105.85	
88.3	97.1	A	105.9	0	2.66	2.66	-92.4	-89.74	17.93	-107.67	
88.3	92.3	B	96.3	0	2.66	2.66	-91.7	-89.04	17.9	-106.94	
88.3	95.5	A	102.7	0	2.66	2.66	-92.4	-89.74	17.73	-107.47	
88.3	96.3	B	104.3	0	2.66	2.66	-91.7	-89.04	18.1	-107.14	
88.3	93.9	B	99.5	0	2.66	2.66	-91.7	-89.04	17.86	-106.90	
88.3	97.9	B	107.5	0	2.66	2.66	-91.7	-89.04	18	-107.04	
89.1	92.3	B	95.5	0	2.58	2.58	-97.7	-95.12	17.9	-113.02	
89.1	93.1	A	97.1	0	2.58	2.58	-98.2	-95.62	16.11	-111.73	
89.1	95.5	A	101.9	0	2.58	2.58	-98.2	-95.62	17.73	-113.35	
89.1	96.3	B	103.5	0	2.58	2.58	-97.7	-95.12	18.1	-113.22	
89.1	97.1	A	105.1	0	2.58	2.58	-98.2	-95.62	17.93	-113.55	
89.1	93.9	B	98.7	0	2.58	2.58	-97.7	-95.12	17.86	-112.98	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
89.1	97.9	<b>B</b>	106.7	0	2.58	2.58	-97.7	-95.12	18	<b>-113.12</b>	
89.9	93.1	<b>A</b>	96.3	0	2.64	2.64	-98.1	-95.46	16.11	<b>-111.57</b>	
89.9	96.3	<b>B</b>	102.7	0	2.64	2.64	-90.4	-87.76	18.1	<b>-105.86</b>	
89.9	97.1	<b>A</b>	104.3	0	2.64	2.64	-98.1	-95.46	17.93	<b>-113.39</b>	
89.9	93.9	<b>B</b>	97.9	0	2.64	2.64	-90.4	-87.76	17.86	<b>-105.62</b>	
89.9	95.5	<b>A</b>	101.1	0	2.64	2.64	-98.1	-95.46	17.73	<b>-113.19</b>	
89.9	97.9	<b>B</b>	105.9	0	2.64	2.64	-90.4	-87.76	18	<b>-105.76</b>	
89.9	98.7	<b>A</b>	107.5	0	2.64	2.64	-98.1	-95.46	18.19	<b>-113.65</b>	
90.7	92.3	<b>B</b>	93.9	0	2.85	2.85	-93.6	-90.75	17.9	<b>-108.65</b>	
90.7	93.1	<b>A</b>	95.5	0	2.85	2.85	-97.5	-94.65	16.11	<b>-110.76</b>	
90.7	96.3	<b>B</b>	101.9	0	2.85	2.85	-93.6	-90.75	18.1	<b>-108.85</b>	
90.7	97.1	<b>A</b>	103.5	0	2.85	2.85	-97.5	-94.65	17.93	<b>-112.58</b>	
90.7	95.5	<b>A</b>	100.3	0	2.85	2.85	-97.5	-94.65	17.73	<b>-112.38</b>	
90.7	98.7	<b>A</b>	106.7	0	2.85	2.85	-97.5	-94.65	18.19	<b>-112.84</b>	
90.7	93.9	<b>B</b>	97.1	0	2.85	2.85	-93.6	-90.75	17.86	<b>-108.61</b>	
90.7	97.9	<b>B</b>	105.1	0	2.85	2.85	-93.6	-90.75	18	<b>-108.75</b>	
91.5	97.1	<b>A</b>	102.7	0	2.32	2.32	-95.4	-93.08	17.93	<b>-111.01</b>	
91.5	92.3	<b>B</b>	93.1	0	2.32	2.32	-89	-86.68	17.9	<b>-104.58</b>	
91.5	95.5	<b>A</b>	99.5	0	2.32	2.32	-95.4	-93.08	17.73	<b>-110.81</b>	
91.5	96.3	<b>B</b>	101.1	0	2.32	2.32	-89	-86.68	18.1	<b>-104.78</b>	
91.5	98.7	<b>A</b>	105.9	0	2.32	2.32	-95.4	-93.08	18.19	<b>-111.27</b>	
91.5	99.5	<b>B</b>	107.5	0	2.32	2.32	-89	-86.68	16.29	<b>-102.97</b>	
91.5	93.9	<b>B</b>	96.3	0	2.32	2.32	-89	-86.68	17.86	<b>-104.54</b>	
91.5	97.9	<b>B</b>	104.3	0	2.32	2.32	-89	-86.68	18	<b>-104.68</b>	
92.3	93.1	<b>A</b>	93.9	0	2.61	2.61	-96	-93.39	16.11	<b>-109.50</b>	
92.3	97.1	<b>A</b>	101.9	0	2.61	2.61	-96	-93.39	17.93	<b>-111.32</b>	
92.3	95.5	<b>A</b>	98.7	0	2.61	2.61	-96	-93.39	17.73	<b>-111.12</b>	
92.3	96.3	<b>B</b>	100.3	0	2.61	2.61	-98	-95.39	18.1	<b>-113.49</b>	
92.3	99.5	<b>B</b>	106.7	0	2.61	2.61	-98	-95.39	16.29	<b>-111.68</b>	
92.3	93.9	<b>B</b>	95.5	0	2.61	2.61	-98	-95.39	17.86	<b>-113.25</b>	
92.3	97.9	<b>B</b>	103.5	0	2.61	2.61	-98	-95.39	18	<b>-113.39</b>	
92.3	98.7	<b>A</b>	105.1	0	2.61	2.61	-96	-93.39	18.19	<b>-111.58</b>	
93.1	95.5	<b>A</b>	97.9	0	2.68	2.68	-98	-95.32	17.73	<b>-113.05</b>	
93.1	96.3	<b>B</b>	99.5	0	2.68	2.68	-91.7	-89.02	18.1	<b>-107.12</b>	
93.1	97.1	<b>A</b>	101.1	0	2.68	2.68	-98	-95.32	17.93	<b>-113.25</b>	
93.1	99.5	<b>B</b>	105.9	0	2.68	2.68	-91.7	-89.02	16.29	<b>-105.31</b>	
93.1	100.3	<b>A</b>	107.5	0	2.68	2.68	-98	-95.32	17.55	<b>-112.87</b>	
93.1	97.9	<b>B</b>	102.7	0	2.68	2.68	-91.7	-89.02	18	<b>-107.02</b>	
93.1	98.7	<b>A</b>	104.3	0	2.68	2.68	-98	-95.32	18.19	<b>-113.51</b>	
93.9	93.1	<b>A</b>	92.3	0	2.51	2.51	-96.4	-93.89	16.11	<b>-110.00</b>	
93.9	96.3	<b>B</b>	98.7	0	2.51	2.51	-94.6	-92.09	18.1	<b>-110.19</b>	
93.9	97.1	<b>A</b>	100.3	0	2.51	2.51	-96.4	-93.89	17.93	<b>-111.82</b>	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
93.9	95.5	A	97.1	0	2.51	2.51	-96.4	-93.89	17.73	<b>-111.62</b>	
93.9	97.9	B	101.9	0	2.51	2.51	-94.6	-92.09	18	<b>-110.09</b>	
93.9	98.7	A	103.5	0	2.51	2.51	-96.4	-93.89	18.19	<b>-112.08</b>	
93.9	99.5	B	105.1	0	2.51	2.51	-94.6	-92.09	16.29	<b>-108.38</b>	
94.7	96.3	B	97.9	0	2.28	2.28	-80.4	-78.12	18.1	<b>-96.22</b>	
94.7	97.1	A	99.5	0	2.28	2.28	-88.3	-86.02	17.93	<b>-103.95</b>	
94.7	100.3	A	105.9	0	2.28	2.28	-88.3	-86.02	17.55	<b>-103.57</b>	
94.7	101.1	B	107.5	0	2.28	2.28	-80.4	-78.12	18.12	<b>-96.24</b>	
94.7	95.5	A	96.3	0	2.28	2.28	-88.3	-86.02	17.73	<b>-103.75</b>	
94.7	98.7	A	102.7	0	2.28	2.28	-88.3	-86.02	18.19	<b>-104.21</b>	
94.7	99.5	B	104.3	0	2.28	2.28	-80.4	-78.12	16.29	<b>-94.41</b>	
94.7	93.9	B	93.1	0	2.28	2.28	-80.4	-78.12	17.86	<b>-95.98</b>	
94.7	97.9	B	101.1	0	2.28	2.28	-80.4	-78.12	18	<b>-96.12</b>	
95.5	97.1	A	98.7	0	2.31	2.31	-87.8	-85.49	17.93	<b>-103.42</b>	
95.5	101.1	B	106.7	0	2.31	2.31	-83.2	-80.89	18.12	<b>-99.01</b>	
95.5	96.3	B	97.1	0	2.31	2.31	-83.2	-80.89	18.1	<b>-98.99</b>	
95.5	98.7	A	101.9	0	2.31	2.31	-87.8	-85.49	18.19	<b>-103.68</b>	
95.5	99.5	B	103.5	0	2.31	2.31	-83.2	-80.89	16.29	<b>-97.18</b>	
95.5	100.3	A	105.1	0	2.31	2.31	-87.8	-85.49	17.55	<b>-103.04</b>	
95.5	93.9	B	92.3	0	2.31	2.31	-83.2	-80.89	17.86	<b>-98.75</b>	
95.5	97.9	B	100.3	0	2.31	2.31	-83.2	-80.89	18	<b>-98.89</b>	
96.3	97.1	A	97.9	0	2.15	2.15	-89.1	-86.95	17.93	<b>-104.88</b>	
96.3	101.1	B	105.9	0	2.15	2.15	-93.2	-91.05	18.12	<b>-109.17</b>	
96.3	99.5	B	102.7	0	2.15	2.15	-93.2	-91.05	16.29	<b>-107.34</b>	
96.3	100.3	A	104.3	0	2.15	2.15	-89.1	-86.95	17.55	<b>-104.50</b>	
96.3	97.9	B	99.5	0	2.15	2.15	-93.2	-91.05	18	<b>-109.05</b>	
96.3	98.7	A	101.1	0	2.15	2.15	-89.1	-86.95	18.19	<b>-105.14</b>	
96.3	101.9	A	107.5	0	2.15	2.15	-89.1	-86.95	15.79	<b>-102.74</b>	
97.1	95.5	A	93.9	0	2.78	2.78	-88.6	-85.82	17.73	<b>-103.55</b>	
97.1	96.3	B	95.5	0	2.78	2.78	-86.6	-83.82	18.1	<b>-101.92</b>	
97.1	99.5	B	101.9	0	2.78	2.78	-86.6	-83.82	16.29	<b>-100.11</b>	
97.1	100.3	A	103.5	0	2.78	2.78	-88.6	-85.82	17.55	<b>-103.37</b>	
97.1	101.1	B	105.1	0	2.78	2.78	-86.6	-83.82	18.12	<b>-101.94</b>	
97.1	97.9	B	98.7	0	2.78	2.78	-86.6	-83.82	18	<b>-101.82</b>	
97.1	98.7	A	100.3	0	2.78	2.78	-88.6	-85.82	18.19	<b>-104.01</b>	
97.1	101.9	A	106.7	0	2.78	2.78	-88.6	-85.82	15.79	<b>-101.61</b>	
97.9	97.1	A	96.3	0	2.61	2.61	-91.6	-88.99	17.93	<b>-106.92</b>	
97.9	100.3	A	102.7	0	2.61	2.61	-91.6	-88.99	17.55	<b>-106.54</b>	
97.9	101.1	B	104.3	0	2.61	2.61	-90.7	-88.09	18.12	<b>-106.21</b>	
97.9	95.5	A	93.1	0	2.61	2.61	-91.6	-88.99	17.73	<b>-106.72</b>	
97.9	98.7	A	99.5	0	2.61	2.61	-91.6	-88.99	18.19	<b>-107.18</b>	
97.9	99.5	B	101.1	0	2.61	2.61	-90.7	-88.09	16.29	<b>-104.38</b>	
97.9	101.9	A	105.9	0	2.61	2.61	-91.6	-88.99	15.79	<b>-104.78</b>	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
97.9	102.7	<b>B</b>	107.5	0	2.61	2.61	-90.7	-88.09	18.42	<b>-106.51</b>	
98.7	96.3	<b>B</b>	93.9	0	2.13	2.13	-91.3	-89.17	18.1	<b>-107.27</b>	
98.7	97.1	<b>A</b>	95.5	0	2.13	2.13	-86.9	-84.77	17.93	<b>-102.70</b>	
98.7	100.3	<b>A</b>	101.9	0	2.13	2.13	-86.9	-84.77	17.55	<b>-102.32</b>	
98.7	101.1	<b>B</b>	103.5	0	2.13	2.13	-91.3	-89.17	18.12	<b>-107.29</b>	
98.7	95.5	<b>A</b>	92.3	0	2.13	2.13	-86.9	-84.77	17.73	<b>-102.50</b>	
98.7	99.5	<b>B</b>	100.3	0	2.13	2.13	-91.3	-89.17	16.29	<b>-105.46</b>	
98.7	102.7	<b>B</b>	106.7	0	2.13	2.13	-91.3	-89.17	18.42	<b>-107.59</b>	
98.7	97.9	<b>B</b>	97.1	0	2.13	2.13	-91.3	-89.17	18	<b>-107.17</b>	
98.7	101.9	<b>A</b>	105.1	0	2.13	2.13	-86.9	-84.77	15.79	<b>-100.56</b>	
99.5	101.1	<b>B</b>	102.7	0	2.36	2.36	-87.1	-84.74	18.12	<b>-102.86</b>	
99.5	96.3	<b>B</b>	93.1	0	2.36	2.36	-87.1	-84.74	18.1	<b>-102.84</b>	
99.5	98.7	<b>A</b>	97.9	0	2.36	2.36	-92.2	-89.84	18.19	<b>-108.03</b>	
99.5	100.3	<b>A</b>	101.1	0	2.36	2.36	-92.2	-89.84	17.55	<b>-107.39</b>	
99.5	102.7	<b>B</b>	105.9	0	2.36	2.36	-87.1	-84.74	18.42	<b>-103.16</b>	
99.5	103.5	<b>A</b>	107.5	0	2.36	2.36	-92.2	-89.84	17.99	<b>-107.83</b>	
99.5	97.9	<b>B</b>	96.3	0	2.36	2.36	-87.1	-84.74	18	<b>-102.74</b>	
99.5	101.9	<b>A</b>	104.3	0	2.36	2.36	-92.2	-89.84	15.79	<b>-105.63</b>	
100.3	97.1	<b>A</b>	93.9	0	2.36	2.36	-81.8	-79.44	17.93	<b>-97.37</b>	
100.3	101.1	<b>B</b>	101.9	0	2.36	2.36	-91.6	-89.24	18.12	<b>-107.36</b>	
100.3	96.3	<b>B</b>	92.3	0	2.36	2.36	-91.6	-89.24	18.1	<b>-107.34</b>	
100.3	99.5	<b>B</b>	98.7	0	2.36	2.36	-91.6	-89.24	16.29	<b>-105.53</b>	
100.3	103.5	<b>A</b>	106.7	0	2.36	2.36	-81.8	-79.44	17.99	<b>-97.43</b>	
100.3	97.9	<b>B</b>	95.5	0	2.36	2.36	-91.6	-89.24	18	<b>-107.24</b>	
100.3	98.7	<b>A</b>	97.1	0	2.36	2.36	-81.8	-79.44	18.19	<b>-97.63</b>	
100.3	101.9	<b>A</b>	103.5	0	2.36	2.36	-81.8	-79.44	15.79	<b>-95.23</b>	
100.3	102.7	<b>B</b>	105.1	0	2.36	2.36	-91.6	-89.24	18.42	<b>-107.66</b>	
101.1	97.1	<b>A</b>	93.1	0	2.63	2.63	-90.7	-88.07	17.93	<b>-106.00</b>	
101.1	99.5	<b>B</b>	97.9	0	2.63	2.63	-87.4	-84.77	16.29	<b>-101.06</b>	
101.1	100.3	<b>A</b>	99.5	0	2.63	2.63	-90.7	-88.07	17.55	<b>-105.62</b>	
101.1	103.5	<b>A</b>	105.9	0	2.63	2.63	-90.7	-88.07	17.99	<b>-106.06</b>	
101.1	104.3	<b>B</b>	107.5	0	2.63	2.63	-87.4	-84.77	18.99	<b>-103.76</b>	
101.1	98.7	<b>A</b>	96.3	0	2.63	2.63	-90.7	-88.07	18.19	<b>-106.26</b>	
101.1	101.9	<b>A</b>	102.7	0	2.63	2.63	-90.7	-88.07	15.79	<b>-103.86</b>	
101.1	102.7	<b>B</b>	104.3	0	2.63	2.63	-87.4	-84.77	18.42	<b>-103.19</b>	
101.9	97.1	<b>A</b>	92.3	0	2.88	2.88	-82.9	-80.02	17.93	<b>-97.95</b>	
101.9	100.3	<b>A</b>	98.7	0	2.88	2.88	-82.9	-80.02	17.55	<b>-97.57</b>	
101.9	101.1	<b>B</b>	100.3	0	2.88	2.88	-92.2	-89.32	18.12	<b>-107.44</b>	
101.9	104.3	<b>B</b>	106.7	0	2.88	2.88	-92.2	-89.32	18.99	<b>-108.31</b>	
101.9	97.9	<b>B</b>	93.9	0	2.88	2.88	-92.2	-89.32	18	<b>-107.32</b>	
101.9	98.7	<b>A</b>	95.5	0	2.88	2.88	-82.9	-80.02	18.19	<b>-98.21</b>	
101.9	99.5	<b>B</b>	97.1	0	2.88	2.88	-92.2	-89.32	16.29	<b>-105.61</b>	
101.9	102.7	<b>B</b>	103.5	0	2.88	2.88	-92.2	-89.32	18.42	<b>-107.74</b>	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
101.9	103.5	A	105.1	0	2.88	2.88	-82.9	-80.02	17.99	<b>-98.01</b>	
102.7	100.3	A	97.9	0	2.27	2.27	-91.2	-88.93	17.55	<b>-106.48</b>	
102.7	101.1	B	99.5	0	2.27	2.27	-87.6	-85.33	18.12	<b>-103.45</b>	
102.7	104.3	B	105.9	0	2.27	2.27	-87.6	-85.33	18.99	<b>-104.32</b>	
102.7	105.1	A	107.5	0	2.27	2.27	-91.2	-88.93	18.49	<b>-107.42</b>	
102.7	99.5	B	96.3	0	2.27	2.27	-87.6	-85.33	16.29	<b>-101.62</b>	
102.7	103.5	A	104.3	0	2.27	2.27	-91.2	-88.93	17.99	<b>-106.92</b>	
102.7	97.9	B	93.1	0	2.27	2.27	-87.6	-85.33	18	<b>-103.33</b>	
102.7	101.9	A	101.1	0	2.27	2.27	-91.2	-88.93	15.79	<b>-104.72</b>	
103.5	101.1	B	98.7	0	3.1	3.1	-92.7	-89.6	18.12	<b>-107.72</b>	
103.5	105.1	A	106.7	0	3.1	3.1	-83.6	-80.5	18.49	<b>-98.99</b>	
103.5	98.7	A	93.9	0	3.1	3.1	-83.6	-80.5	18.19	<b>-98.69</b>	
103.5	99.5	B	95.5	0	3.1	3.1	-92.7	-89.6	16.29	<b>-105.89</b>	
103.5	100.3	A	97.1	0	3.1	3.1	-83.6	-80.5	17.55	<b>-98.05</b>	
103.5	102.7	B	101.9	0	3.1	3.1	-92.7	-89.6	18.42	<b>-108.02</b>	
103.5	104.3	B	105.1	0	3.1	3.1	-92.7	-89.6	18.99	<b>-108.59</b>	
103.5	97.9	B	92.3	0	3.1	3.1	-92.7	-89.6	18	<b>-107.60</b>	
103.5	101.9	A	100.3	0	3.1	3.1	-83.6	-80.5	15.79	<b>-96.29</b>	
104.3	101.1	B	97.9	0	2.31	2.31	-90.5	-88.19	18.12	<b>-106.31</b>	
104.3	105.1	A	105.9	0	2.31	2.31	-90.1	-87.79	18.49	<b>-106.28</b>	
104.3	100.3	A	96.3	0	2.31	2.31	-90.1	-87.79	17.55	<b>-105.34</b>	
104.3	103.5	A	102.7	0	2.31	2.31	-90.1	-87.79	17.99	<b>-105.78</b>	
104.3	98.7	A	93.1	0	2.31	2.31	-90.1	-87.79	18.19	<b>-105.98</b>	
104.3	101.9	A	99.5	0	2.31	2.31	-90.1	-87.79	15.79	<b>-103.58</b>	
104.3	102.7	B	101.1	0	2.31	2.31	-90.5	-88.19	18.42	<b>-106.61</b>	
104.3	105.9	B	107.5	0	2.31	2.31	-90.5	-88.19	9.15	<b>-97.34</b>	
105.1	99.5	B	93.9	0	2.36	2.36	-92.7	-90.34	16.29	<b>-106.63</b>	
105.1	100.3	A	95.5	0	2.36	2.36	-83.3	-80.94	17.55	<b>-98.49</b>	
105.1	101.1	B	97.1	0	2.36	2.36	-92.7	-90.34	18.12	<b>-108.46</b>	
105.1	103.5	A	101.9	0	2.36	2.36	-83.3	-80.94	17.99	<b>-98.93</b>	
105.1	104.3	B	103.5	0	2.36	2.36	-92.7	-90.34	18.99	<b>-109.33</b>	
105.1	98.7	A	92.3	0	2.36	2.36	-83.3	-80.94	18.19	<b>-99.13</b>	
105.1	101.9	A	98.7	0	2.36	2.36	-83.3	-80.94	15.79	<b>-96.73</b>	
105.1	102.7	B	100.3	0	2.36	2.36	-92.7	-90.34	18.42	<b>-108.76</b>	
105.1	105.9	B	106.7	0	2.36	2.36	-92.7	-90.34	9.15	<b>-99.49</b>	
105.9	101.1	B	96.3	0	2.21	2.21	-86.8	-84.59	18.12	<b>-102.71</b>	
105.9	104.3	B	102.7	0	2.21	2.21	-86.8	-84.59	18.99	<b>-103.58</b>	
105.9	105.1	A	104.3	0	2.21	2.21	-90.5	-88.29	18.49	<b>-106.78</b>	
105.9	99.5	B	93.1	0	2.21	2.21	-86.8	-84.59	16.29	<b>-100.88</b>	
105.9	101.9	A	97.9	0	2.21	2.21	-90.5	-88.29	15.79	<b>-104.08</b>	
105.9	102.7	B	99.5	0	2.21	2.21	-86.8	-84.59	18.42	<b>-103.01</b>	
105.9	103.5	A	101.1	0	2.21	2.21	-90.5	-88.29	17.99	<b>-106.28</b>	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
106.7	100.3	<b>A</b>	93.9	0	3.05	3.05	-91	-87.95	17.55	<b>-105.50</b>	
106.7	101.1	<b>B</b>	95.5	0	3.05	3.05	-93.4	-90.35	18.12	<b>-108.47</b>	
106.7	104.3	<b>B</b>	101.9	0	3.05	3.05	-93.4	-90.35	18.99	<b>-109.34</b>	
106.7	105.1	<b>A</b>	103.5	0	3.05	3.05	-91	-87.95	18.49	<b>-106.44</b>	
106.7	99.5	<b>B</b>	92.3	0	3.05	3.05	-93.4	-90.35	16.29	<b>-106.64</b>	
106.7	102.7	<b>B</b>	98.7	0	3.05	3.05	-93.4	-90.35	18.42	<b>-108.77</b>	
106.7	103.5	<b>A</b>	100.3	0	3.05	3.05	-91	-87.95	17.99	<b>-105.94</b>	
106.7	101.9	<b>A</b>	97.1	0	3.05	3.05	-91	-87.95	15.79	<b>-103.74</b>	
106.7	105.9	<b>B</b>	105.1	0	3.05	3.05	-93.4	-90.35	9.15	<b>-99.50</b>	
107.5	105.1	<b>A</b>	102.7	0	2.34	2.34	-92.1	-89.76	18.49	<b>-108.25</b>	
107.5	100.3	<b>A</b>	93.1	0	2.34	2.34	-92.1	-89.76	17.55	<b>-107.31</b>	
107.5	102.7	<b>B</b>	97.9	0	2.34	2.34	-95.3	-92.96	18.42	<b>-111.38</b>	
107.5	103.5	<b>A</b>	99.5	0	2.34	2.34	-92.1	-89.76	17.99	<b>-107.75</b>	
107.5	104.3	<b>B</b>	101.1	0	2.34	2.34	-95.3	-92.96	18.99	<b>-111.95</b>	
107.5	106.7	<b>A</b>	105.9	0	2.34	2.34	-92.1	-89.76	19.44	<b>-109.20</b>	
107.5	101.9	<b>A</b>	96.3	0	2.34	2.34	-92.1	-89.76	15.79	<b>-105.55</b>	
107.5	105.9	<b>B</b>	104.3	0	2.34	2.34	-95.3	-92.96	9.15	<b>-102.11</b>	
108.3	101.1	<b>B</b>	93.9	0	2.24	2.24	-93	-90.76	18.12	<b>-108.88</b>	
108.3	105.1	<b>A</b>	101.9	0	2.24	2.24	-87.7	-85.46	18.49	<b>-103.95</b>	
108.3	100.3	<b>A</b>	92.3	0	2.24	2.24	-87.7	-85.46	17.55	<b>-103.01</b>	
108.3	103.5	<b>A</b>	98.7	0	2.24	2.24	-87.7	-85.46	17.99	<b>-103.45</b>	
108.3	104.3	<b>B</b>	100.3	0	2.24	2.24	-93	-90.76	18.99	<b>-109.75</b>	
108.3	107.5	<b>B</b>	106.7	0	2.24	2.24	-93	-90.76	16.93	<b>-107.69</b>	
108.3	101.9	<b>A</b>	95.5	0	2.24	2.24	-87.7	-85.46	15.79	<b>-101.25</b>	
108.3	102.7	<b>B</b>	97.1	0	2.24	2.24	-93	-90.76	18.42	<b>-109.18</b>	
108.3	105.9	<b>B</b>	103.5	0	2.24	2.24	-93	-90.76	9.15	<b>-99.91</b>	
108.3	106.7	<b>A</b>	105.1	0	2.24	2.24	-87.7	-85.46	19.44	<b>-104.90</b>	
109.1	101.1	<b>B</b>	93.1	0	2.17	2.17	-95.2	-93.03	18.12	<b>-111.15</b>	
109.1	103.5	<b>A</b>	97.9	0	2.17	2.17	-96.7	-94.53	17.99	<b>-112.52</b>	
109.1	104.3	<b>B</b>	99.5	0	2.17	2.17	-95.2	-93.03	18.99	<b>-112.02</b>	
109.1	105.1	<b>A</b>	101.1	0	2.17	2.17	-96.7	-94.53	18.49	<b>-113.02</b>	
109.1	107.5	<b>B</b>	105.9	0	2.17	2.17	-95.2	-93.03	16.93	<b>-109.96</b>	
109.1	102.7	<b>B</b>	96.3	0	2.17	2.17	-95.2	-93.03	18.42	<b>-111.45</b>	
109.1	105.9	<b>B</b>	102.7	0	2.17	2.17	-95.2	-93.03	9.15	<b>-102.18</b>	
109.1	106.7	<b>A</b>	104.3	0	2.17	2.17	-96.7	-94.53	19.44	<b>-113.97</b>	
109.9	101.1	<b>B</b>	92.3	0	2.26	2.26	-97.5	-95.24	18.12	<b>-113.36</b>	
109.9	104.3	<b>B</b>	98.7	0	2.26	2.26	-97.5	-95.24	18.99	<b>-114.23</b>	
109.9	105.1	<b>A</b>	100.3	0	2.26	2.26	-97.1	-94.84	18.49	<b>-113.33</b>	
109.9	101.9	<b>A</b>	93.9	0	2.26	2.26	-97.1	-94.84	15.79	<b>-110.63</b>	
109.9	102.7	<b>B</b>	95.5	0	2.26	2.26	-97.5	-95.24	18.42	<b>-113.66</b>	
109.9	103.5	<b>A</b>	97.1	0	2.26	2.26	-97.1	-94.84	17.99	<b>-112.83</b>	
109.9	105.9	<b>B</b>	101.9	0	2.26	2.26	-97.5	-95.24	9.15	<b>-104.39</b>	
109.9	106.7	<b>A</b>	103.5	0	2.26	2.26	-97.1	-94.84	19.44	<b>-114.28</b>	



Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
109.9	107.5	<b>B</b>	105.1	0	2.26	2.26	-97.5	-95.24	16.93	<b>-112.17</b>	
110.7	104.3	<b>B</b>	97.9	0	2.15	2.15	-97.5	-95.35	18.99	<b>-114.34</b>	
110.7	105.1	<b>A</b>	99.5	0	2.15	2.15	-97.9	-95.75	18.49	<b>-114.24</b>	
110.7	103.5	<b>A</b>	96.3	0	2.15	2.15	-97.9	-95.75	17.99	<b>-113.74</b>	
110.7	106.7	<b>A</b>	102.7	0	2.15	2.15	-97.9	-95.75	19.44	<b>-115.19</b>	
110.7	107.5	<b>B</b>	104.3	0	2.15	2.15	-97.5	-95.35	16.93	<b>-112.28</b>	
110.7	101.9	<b>A</b>	93.1	0	2.15	2.15	-97.9	-95.75	15.79	<b>-111.54</b>	
110.7	105.9	<b>B</b>	101.1	0	2.15	2.15	-97.5	-95.35	9.15	<b>-104.50</b>	
111.5	105.1	<b>A</b>	98.7	0	2.27	2.27	-97.4	-95.13	18.49	<b>-113.62</b>	
111.5	102.7	<b>B</b>	93.9	0	2.27	2.27	-98.2	-95.93	18.42	<b>-114.35</b>	
111.5	103.5	<b>A</b>	95.5	0	2.27	2.27	-97.4	-95.13	17.99	<b>-113.12</b>	
111.5	104.3	<b>B</b>	97.1	0	2.27	2.27	-98.2	-95.93	18.99	<b>-114.92</b>	
111.5	106.7	<b>A</b>	101.9	0	2.27	2.27	-97.4	-95.13	19.44	<b>-114.57</b>	
111.5	107.5	<b>B</b>	103.5	0	2.27	2.27	-98.2	-95.93	16.93	<b>-112.86</b>	
111.5	101.9	<b>A</b>	92.3	0	2.27	2.27	-97.4	-95.13	15.79	<b>-110.92</b>	
111.5	105.9	<b>B</b>	100.3	0	2.27	2.27	-98.2	-95.93	9.15	<b>-105.08</b>	
112.3	105.1	<b>A</b>	97.9	0	2.15	2.15	-98.3	-96.15	18.49	<b>-114.64</b>	
112.3	104.3	<b>B</b>	96.3	0	2.15	2.15	-98.6	-96.45	18.99	<b>-115.44</b>	
112.3	107.5	<b>B</b>	102.7	0	2.15	2.15	-98.6	-96.45	16.93	<b>-113.38</b>	
112.3	102.7	<b>B</b>	93.1	0	2.15	2.15	-98.6	-96.45	18.42	<b>-114.87</b>	
112.3	105.9	<b>B</b>	99.5	0	2.15	2.15	-98.6	-96.45	9.15	<b>-105.60</b>	
112.3	106.7	<b>A</b>	101.1	0	2.15	2.15	-98.3	-96.15	19.44	<b>-115.59</b>	
113.1	103.5	<b>A</b>	93.9	0	2.14	2.14	-96.7	-94.56	17.99	<b>-112.55</b>	
113.1	104.3	<b>B</b>	95.5	0	2.14	2.14	-98	-95.86	18.99	<b>-114.85</b>	
113.1	105.1	<b>A</b>	97.1	0	2.14	2.14	-96.7	-94.56	18.49	<b>-113.05</b>	
113.1	107.5	<b>B</b>	101.9	0	2.14	2.14	-98	-95.86	16.93	<b>-112.79</b>	
113.1	102.7	<b>B</b>	92.3	0	2.14	2.14	-98	-95.86	18.42	<b>-114.28</b>	
113.1	105.9	<b>B</b>	98.7	0	2.14	2.14	-98	-95.86	9.15	<b>-105.01</b>	
113.1	106.7	<b>A</b>	100.3	0	2.14	2.14	-96.7	-94.56	19.44	<b>-114.00</b>	
113.9	105.1	<b>A</b>	96.3	0	2.08	2.08	-98.6	-96.52	18.49	<b>-115.01</b>	
113.9	103.5	<b>A</b>	93.1	0	2.08	2.08	-98.6	-96.52	17.99	<b>-114.51</b>	
113.9	105.9	<b>B</b>	97.9	0	2.08	2.08	-98.1	-96.02	9.15	<b>-105.17</b>	
113.9	106.7	<b>A</b>	99.5	0	2.08	2.08	-98.6	-96.52	19.44	<b>-115.96</b>	
113.9	107.5	<b>B</b>	101.1	0	2.08	2.08	-98.1	-96.02	16.93	<b>-112.95</b>	
114.7	104.3	<b>B</b>	93.9	0	2.1	2.1	-98.2	-96.1	18.99	<b>-115.09</b>	
114.7	105.1	<b>A</b>	95.5	0	2.1	2.1	-98.6	-96.5	18.49	<b>-114.99</b>	
114.7	103.5	<b>A</b>	92.3	0	2.1	2.1	-98.6	-96.5	17.99	<b>-114.49</b>	
114.7	106.7	<b>A</b>	98.7	0	2.1	2.1	-98.6	-96.5	19.44	<b>-115.94</b>	
114.7	107.5	<b>B</b>	100.3	0	2.1	2.1	-98.2	-96.1	16.93	<b>-113.03</b>	
114.7	105.9	<b>B</b>	97.1	0	2.1	2.1	-98.2	-96.1	9.15	<b>-105.25</b>	
115.5	104.3	<b>B</b>	93.1	0	2.09	2.09	-97.9	-95.81	18.99	<b>-114.80</b>	
115.5	106.7	<b>A</b>	97.9	0	2.09	2.09	-98.6	-96.51	19.44	<b>-115.95</b>	
115.5	107.5	<b>B</b>	99.5	0	2.09	2.09	-97.9	-95.81	16.93	<b>-112.74</b>	

Product Frequency (MHz)	Transmitter Frequency (MHz)	Combiner / TX Line Side (A – B)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Measured Level (dBm)	Adjusted Level (dBm)	Carrier Reference Level (dBm)	Level Referenced to Carrier (dBm)	Notes*
115.5	105.9	<b>B</b>	96.3	0	2.09	2.09	-97.9	-95.81	9.15	<b>-104.96</b>	
116.3	105.1	<b>A</b>	93.9	0	2.15	2.15	-98.6	-96.45	18.49	<b>-114.94</b>	
116.3	104.3	<b>B</b>	92.3	0	2.15	2.15	-98.9	-96.75	18.99	<b>-115.74</b>	
116.3	107.5	<b>B</b>	98.7	0	2.15	2.15	-98.9	-96.75	16.93	<b>-113.68</b>	
116.3	105.9	<b>B</b>	95.5	0	2.15	2.15	-98.9	-96.75	9.15	<b>-105.90</b>	
116.3	106.7	<b>A</b>	97.1	0	2.15	2.15	-98.6	-96.45	19.44	<b>-115.89</b>	
117.1	105.1	<b>A</b>	93.1	0	2.32	2.32	-98.4	-96.08	18.49	<b>-114.57</b>	
117.1	107.5	<b>B</b>	97.9	0	2.32	2.32	-99.5	-97.18	16.93	<b>-114.11</b>	
117.1	106.7	<b>A</b>	96.3	0	2.32	2.32	-98.4	-96.08	19.44	<b>-115.52</b>	
117.9	105.1	<b>A</b>	92.3	0	2.17	2.17	-98.7	-96.53	18.49	<b>-115.02</b>	
117.9	105.9	<b>B</b>	93.9	0	2.17	2.17	-98.4	-96.23	9.15	<b>-105.38</b>	
117.9	106.7	<b>A</b>	95.5	0	2.17	2.17	-98.7	-96.53	19.44	<b>-115.97</b>	
117.9	107.5	<b>B</b>	97.1	0	2.17	2.17	-98.4	-96.23	16.93	<b>-113.16</b>	
118.7	107.5	<b>B</b>	96.3	0	2.11	2.11	-98.6	-96.49	16.93	<b>-113.42</b>	
118.7	105.9	<b>B</b>	93.1	0	2.11	2.11	-98.6	-96.49	9.15	<b>-105.64</b>	
119.5	106.7	<b>A</b>	93.9	0	2.12	2.12	-98.9	-96.78	19.44	<b>-116.22</b>	
119.5	107.5	<b>B</b>	95.5	0	2.12	2.12	-98.7	-96.58	16.93	<b>-113.51</b>	
119.5	105.9	<b>B</b>	92.3	0	2.12	2.12	-98.7	-96.58	9.15	<b>-105.73</b>	
120.3	106.7	<b>A</b>	93.1	0	2.01	2.01	-98.4	-96.39	19.44	<b>-115.83</b>	
121.1	107.5	<b>B</b>	93.9	0	2.33	2.33	-98.4	-96.07	16.93	<b>-113.00</b>	
121.1	106.7	<b>A</b>	92.3	0	2.33	2.33	-98.6	-96.27	19.44	<b>-115.71</b>	
121.9	107.5	<b>B</b>	93.1	0	2.4	2.4	-98.3	-95.9	16.93	<b>-112.83</b>	
122.7	107.5	<b>B</b>	92.3	0	1.98	1.98	-98.7	-96.72	16.93	<b>-113.65</b>	

The Spectrum Analyzer was used to check the close in spectral attenuation of the carrier to confirm the operation of the transmitters are in compliance with Sections (b) and (c) of the FCC Rules and Regulations.

As a final proof of the systems IM Product performance, a wide band search was undertaken using the Spectrum Analyzer. The purpose for this measurement was to look for suspicious anomalies that may warrant further investigation. My search ranged the complete frequency span of the receiver and resulted in no additional investigations.

**Conclusion:** Based upon my observations and measurements taken on September 27<sup>th</sup> and 28<sup>th</sup>, 2017 as summarized in this document, I, Mark Steapleton, find the subject system, specifically the transmitter and filter system for the operation of WBMP, WPAT-FM, WNYC-FM, WPLJ, WXNY-FM, WQHT, WSKQ-FM, WEPN-FM, WBAI, WHTZ, WCBS-FM, WFAN-FM, WNEW-FM, WKTU, WAXQ, WWPR-FM, WQXR-FM, WLTW, and WBLS into the antenna to be in proper working order. Furthermore, based on the measured data, it is my opinion that there are no inter-modulation products in excess of 80 dB below carrier levels generated from or within the station operating on the installed system. Based on this recorded data, I conclude that all stations operating into the Auxiliary Master Antenna System are in compliance with the requirements of Section 73.317 paragraph (b) through (d) of the FCC Rules and Regulations.

Respectfully submitted,  
Electronics Research, Inc.

Mark Steapleton, Field Service Manager

State of Indiana)  
 ) SS:  
 County of Warrick)

# AFFIDAVIT

I, Mark Steapleton, hereby declare that the following statements are true and correct to the best of my knowledge and belief :

- 1.) I am a Field Service Manager for Electronics Research, Inc (“ERI”) and have been employed by ERI for 37 years. I am familiar with and have assisted in the design, manufacturing and installation of FM Antennas and FM Multiplexers in my long tenure with ERI.
- 2.) I have either prepared and/or directly supervised the preparation of all technical information contained in this Report of Findings and to my knowledge to be accurate and true.
- 3.) ERI has been requested by Empire State Reality Trust Inc. on behalf of radio Stations WBMP, WPAT-FM, WNYC-FM, WPLJ, WXNY-FM, WQHT, WSKQ-FM, WEPN-FM, WBAI, WHTZ, WCBS-FM, WFAN-FM, WNEW-FM, WKTU, WAXQ, WWPR-FM, WQXR-FM, WLTW, and WBSL in New York, NY. to prepare this Report Of Findings.

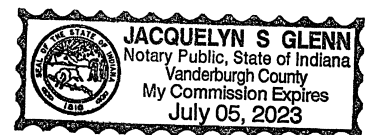
Mark Steapleton; Field Service Manager

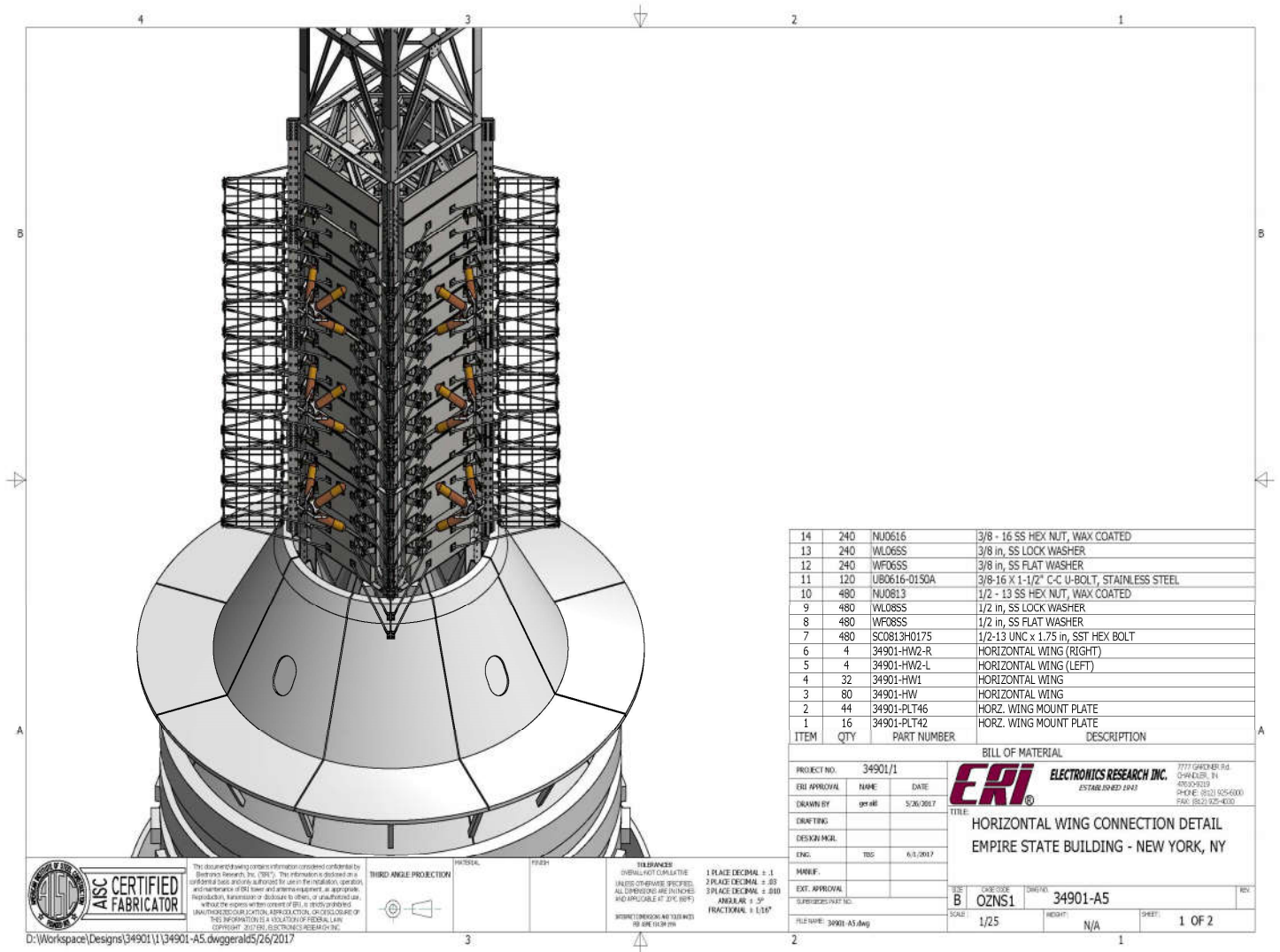
Mack Steapleton

*Subscribed and sworn to before me on this 4th, day of October, 2017.*

Jacquelyn Glenn; Notary Public  
My commission expires July 5, 2023

Jacquelyn S. Green





**A-2 ERI Antenna Specification Sheet**TRANSMISSION SITE  
NEW YORK, NEW YORK**General Specifications**

Antenna Type ..... High Power FM-Broadcast, Suitable for Multiplexing  
 Model Number ..... 1184-3CP-2  
 Number of Bay Levels ..... Three  
 Polarization..... Circular

**Electrical Specifications**

Antenna Input Power Capability (for each input) ..... 60 kW Max <sup>(1)</sup>  
 Operating Frequency Band ..... 92.3 to 107.5 Megahertz.  
 VSWR. .... <1.20:1 @ Operating Frequencies<sup>(2)</sup>  
 Azimuthal Pattern Circularity ..... Better Than +/- 2dB From RMS ( Free Space )  
 Power Split .... 50/50 ( Horizontal & Vertical )

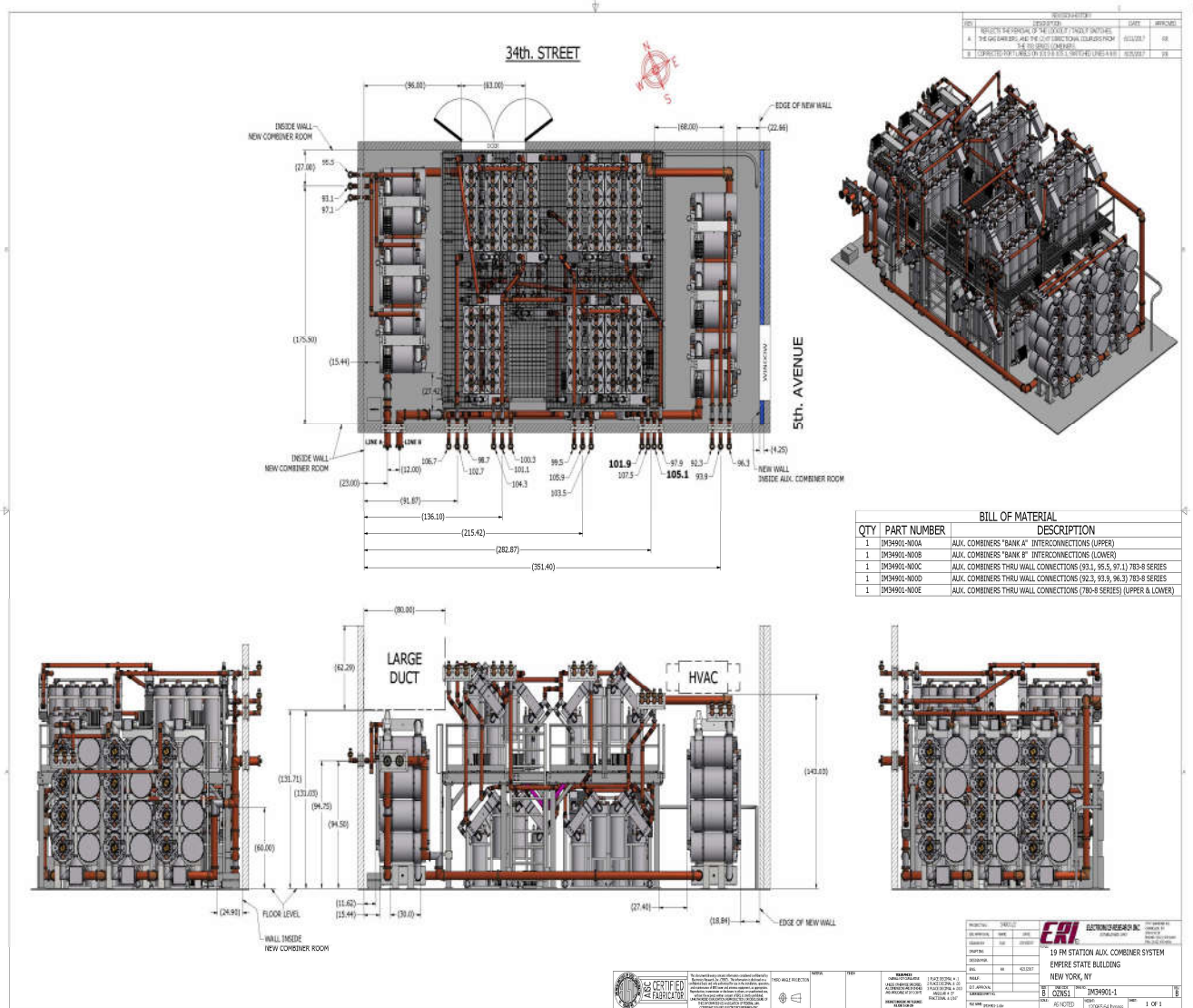
## Frequency Specific Information:

<u>Frequency</u>	<u>Beam Tilt</u>	<u>First Null Fill</u>	<u>Second Null Fill</u>	<u>Power Gain</u>	<u>Filter Loss</u> <sup>(2)</sup>	<u>Combiner Input TPO (kW)</u>
92.3	0.0°	9.5 %	0 %	1.09	-0.321	9.07
93.1	0.0°	9.6 %	0 %	1.10	-0.313	5.50
93.9	0.0°	9.6 %	0 %	1.10	-0.366	7.24
95.5	0.0°	9.7 %	0 %	1.12	-0.364	8.00
96.3	0.0°	9.7 %	0 %	1.13	-0.398	10.20
97.1	0.0°	9.7 %	0 %	1.14	-0.386	8.00
97.9	0.0°	9.8 %	0 %	1.14	-0.556	9.75
98.7	0.0°	9.8 %	0 %	1.15	-0.587	8.76
99.5	0.0°	9.9 %	0 %	1.16	-0.587	5.46
100.3	0.0°	9.9 %	0 %	1.17	-0.600	8.27
101.1	0.0°	9.9 %	0 %	1.18	-0.620	8.00
101.9	0.0°	10.0 %	0 %	1.18	-0.641	8.49
102.7	0.0°	10.0 %	0 %	1.19	-0.674	8.78
103.5	0.0°	10.0 %	4.7 %	1.20	-0.690	8.75
104.3	0.0°	10.0 %	5.0 %	1.21	-0.702	9.00
105.1	0.0°	10.1 %	5.2 %	1.22	-0.705	9.40
105.9	0.0°	10.1 %	5.3 %	1.22	-0.731	0.91
106.7	0.0°	10.1 %	5.5 %	1.23	-0.715	9.76
107.5	0.0°	10.1 %	5.7 %	1.24	-0.775	5.88

**Mechanical Specifications**

Antenna Feed System ..... Dual Input  
 Input Connector ..... 6 1/8"-50 Ohm EIA Flanged  
 Element Deicing ..... None  
 Interbay Spacing ..... 80" Center to Center  
 Array Length..... 23 Feet 9 inches

- 1) Power Capability Has Been Rated Assuming an Operating Transmission VSWR of 1.5:1
- 2) Losses Taken From Actual Combiner.





**A-4 ERI Combiner Specification Sheet**

TRANSMISSION SITE

NEW YORK, NEW YORK

**General Specifications:**

Multiplexer Type ..... Constant Impedance Combiner  
Number of Combining Units ..... Ten for Right Hand CP and Nine for Left hand CP  
Injected Port to Injected Port Isolation..... < - 42 dB  
Output Connector..... 6 1/8 "50 Ohm EIA (Flanged)  
Output Power (Designed) ..... 120 kW<sup>(1)</sup>  
Heat Removal ..... Natural Convection  
Physical Arrangement..... All Components Rack Mounted

**Injected Port Specifications:**

Frequency Assignment ..... 92.3 to 107.5 MHz.  
Power Rating, Each Injected Port (Designed)..... 7.8 kW  
Input Connector ..... 3 1/8" 50 Ohm EIA (Flanged)  
VSWR..... < 1.09:1 @ +/-200 KHz.<sup>(2)</sup>  
Group Delay ..... Less than 75 ns Overall Variation, Carrier @ +/- 150 KHz.  
Insertion Loss (Measured):

92.3 MHz.....	- 0.321 dB
93.1 MHz.....	- 0.313 dB
93.9 MHz.....	- 0.366 dB
95.5 MHz.....	- 0.364 dB
96.3 MHz.....	- 0.398 dB
97.1 MHz.....	- 0.386 dB
97.9 MHz.....	- 0.556 dB
98.7 MHz.....	- 0.587 dB
99.5 MHz.....	- 0.587 dB
100.3 MHz.....	- 0.600 dB
101.1 MHz.....	- 0.620 dB
101.9 MHz.....	- 0.641 dB
102.7 MHz.....	- 0.674 dB
103.5 MHz.....	- 0.690 dB
104.3 MHz.....	- 0.702 dB
105.1 MHz.....	- 0.705 dB
105.9 MHz.....	- 0.731 dB
106.7 MHz.....	- 0.715 dB
107.5 MHz.....	- 0.775 dB

1) Power Rating Listed is as Designed Only. Actual Power Capabilities May Vary.

2) When Terminated in 50 Ohm Resistive Load.

# EXHIBIT A – 5

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 59 of 114

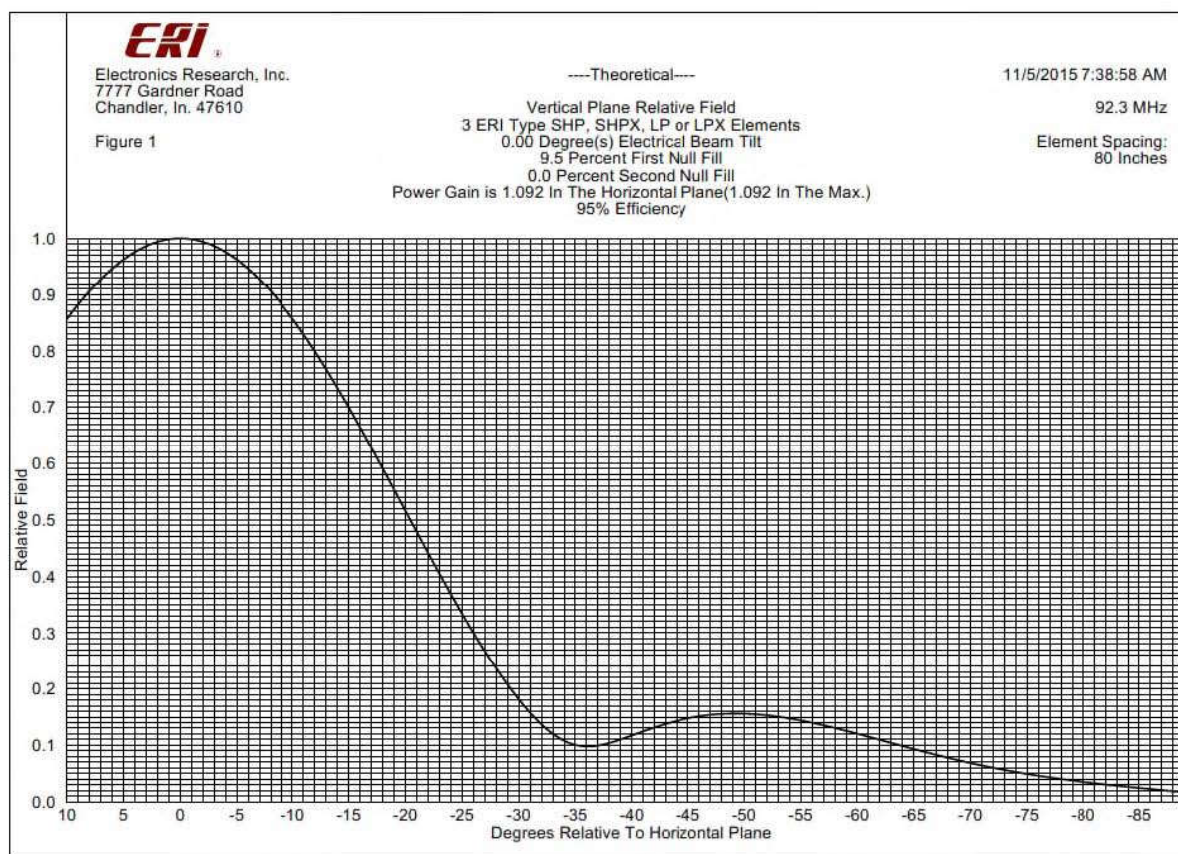


Figure 25 WBMP (FM), 92.3 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

ELECTRONICS RESEARCH INC. **ERI**

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 60 of 114

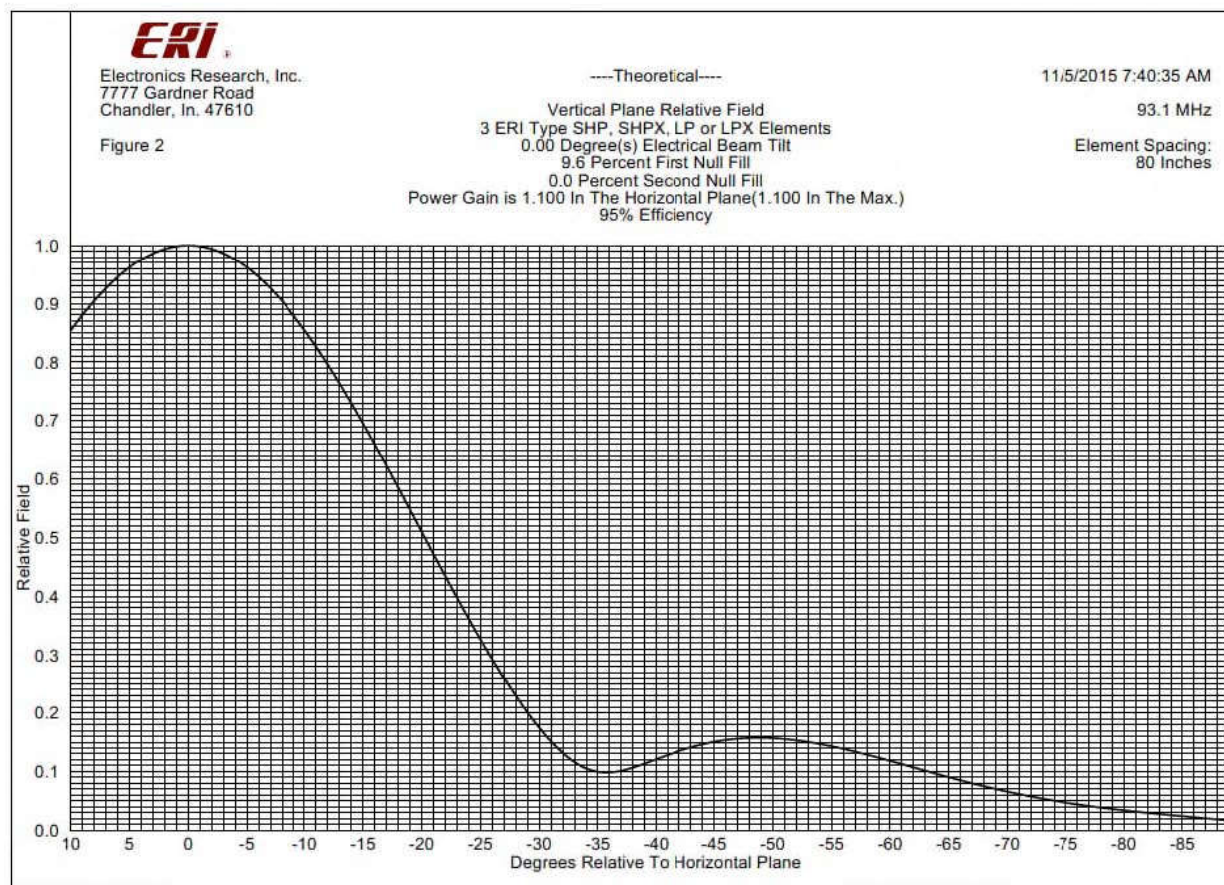


Figure 26 WPAT-FM, 93.1 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 61 of 114

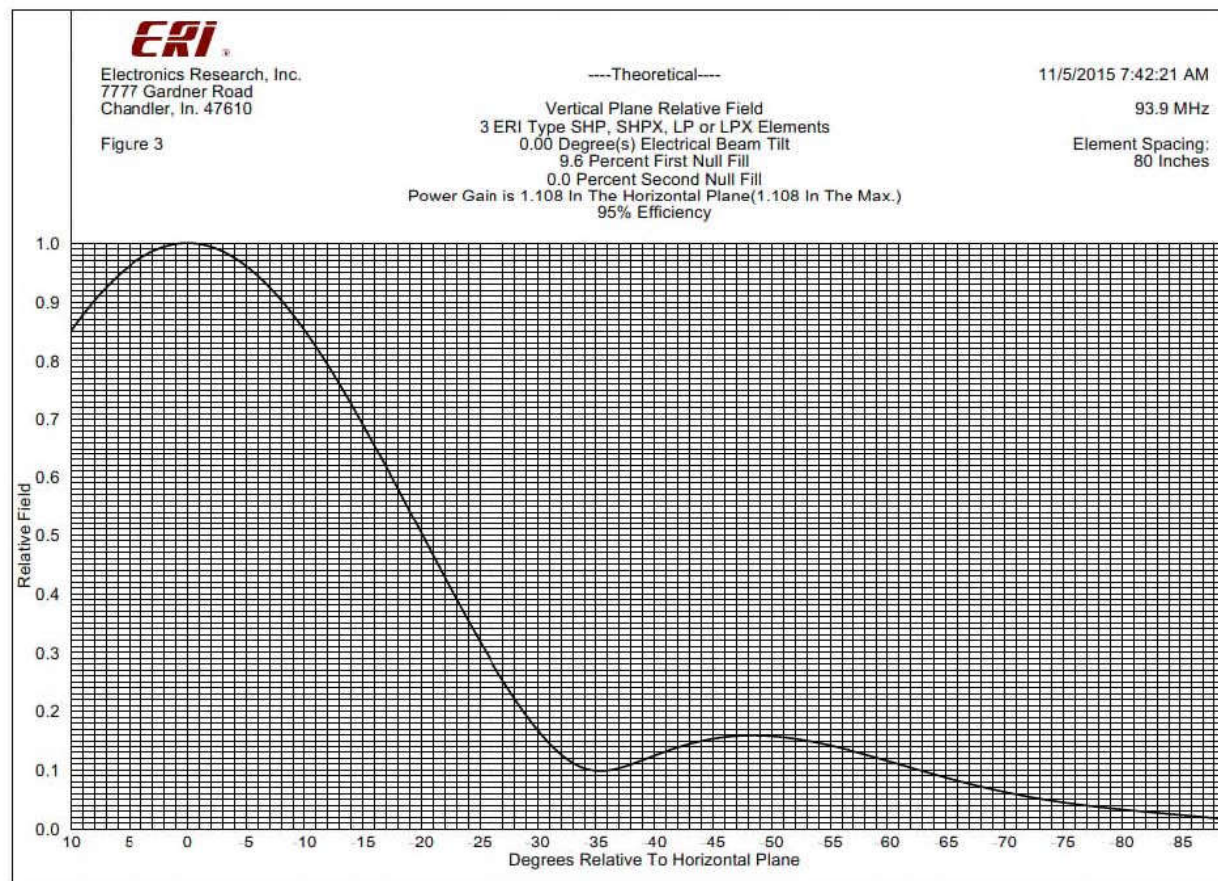


Figure 27 WNYC-FM, 93.9 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 62 of 114

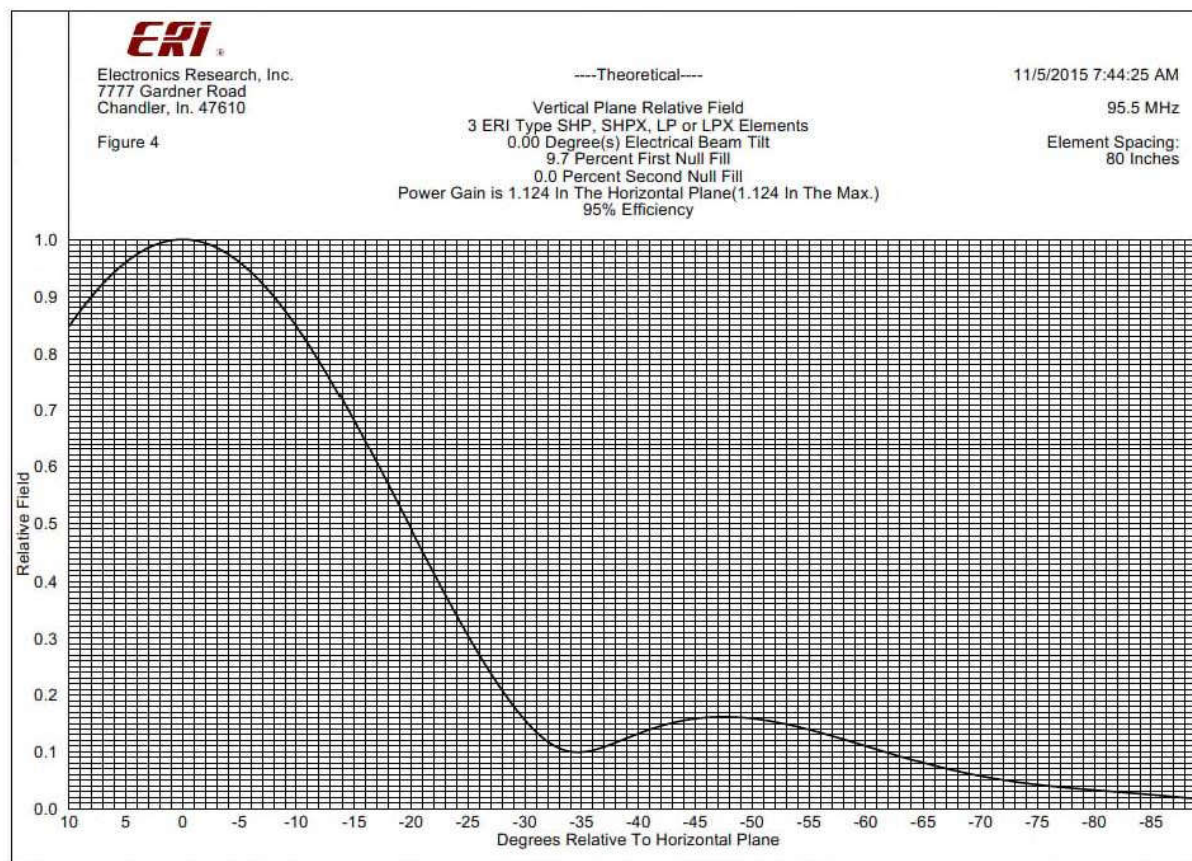


Figure 28 WPLJ (FM), 95.5 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 63 of 114

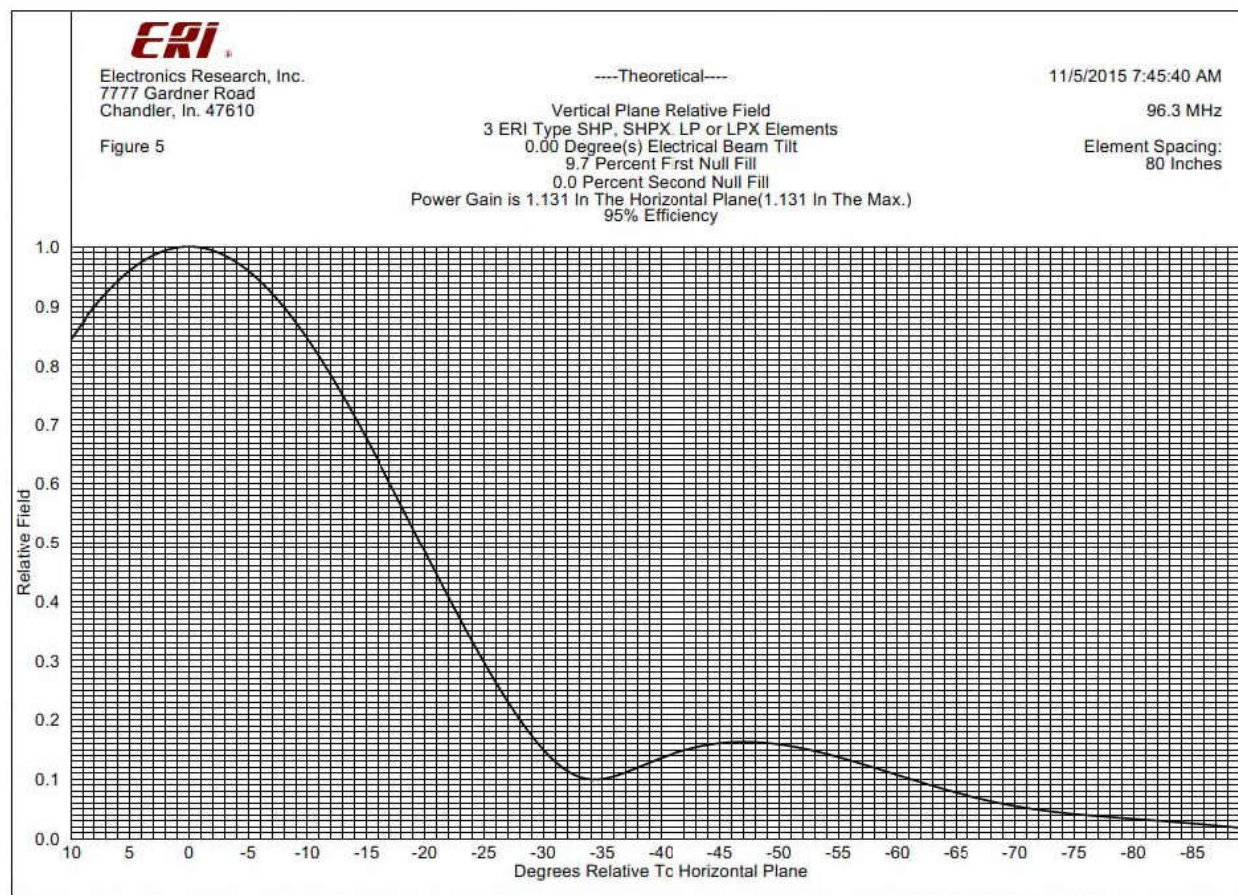


Figure 29 WXNY-FM, 96.3 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 64 of 114

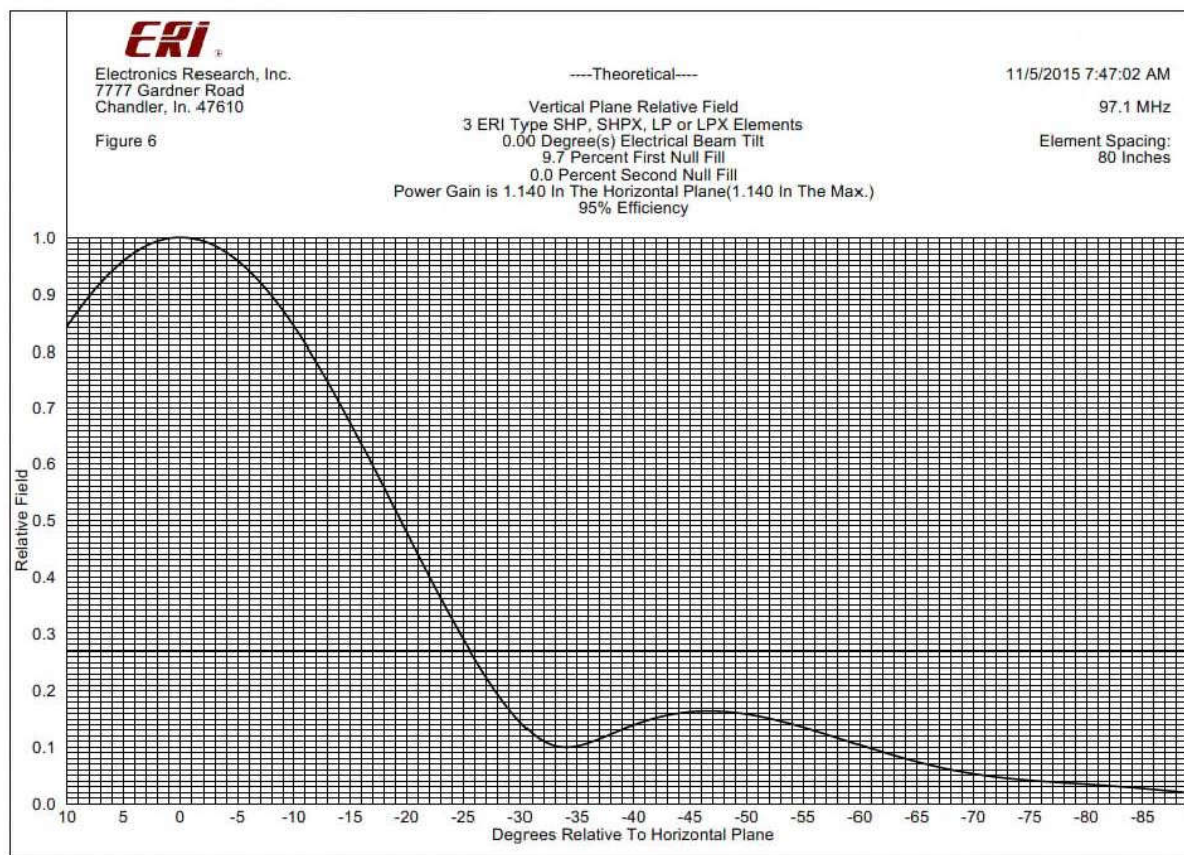


Figure30 WQHT (FM), 97.1 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 65 of 114

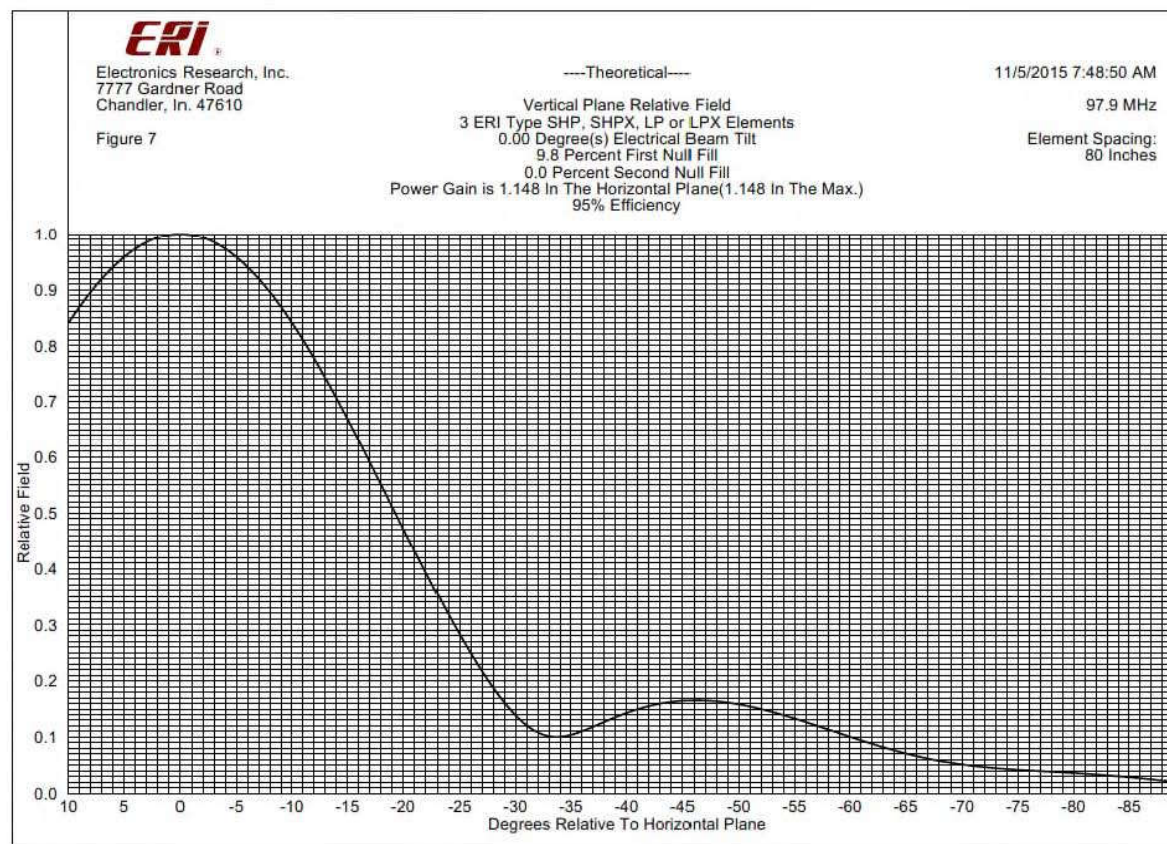


Figure 31 WSKQ-FM, 97.9 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 66 of 114

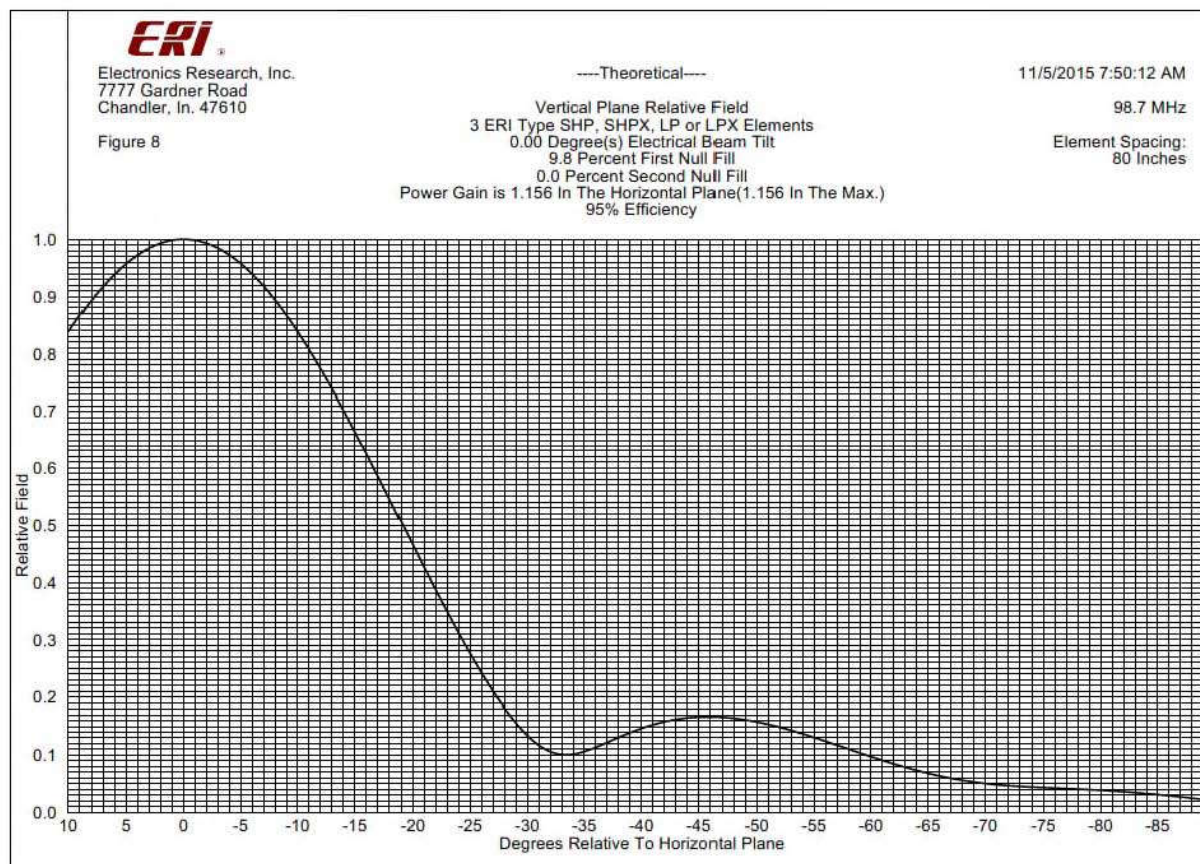


Figure 32 WEPN-FM, 98.7 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 67 of 114

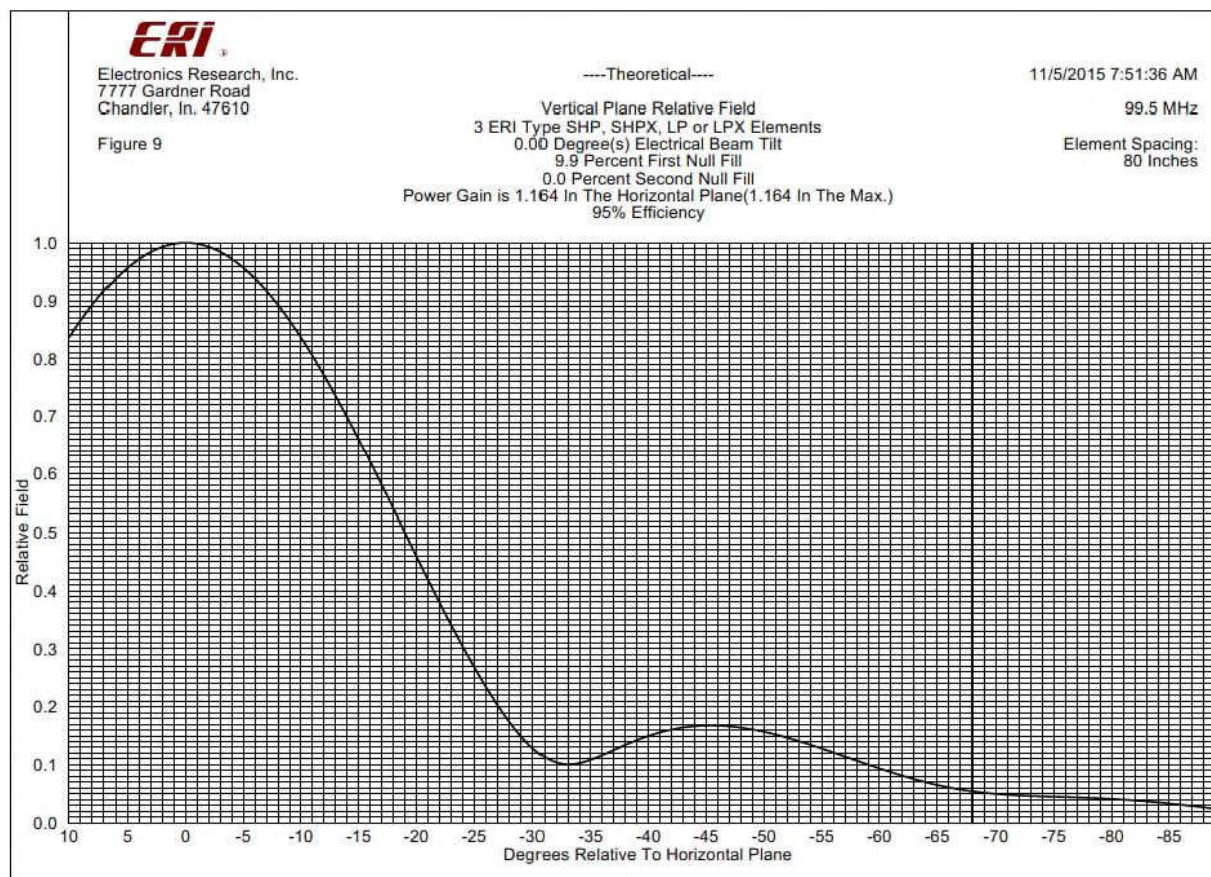


Figure 33 WBAI (FM), 99.5 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 68 of 114

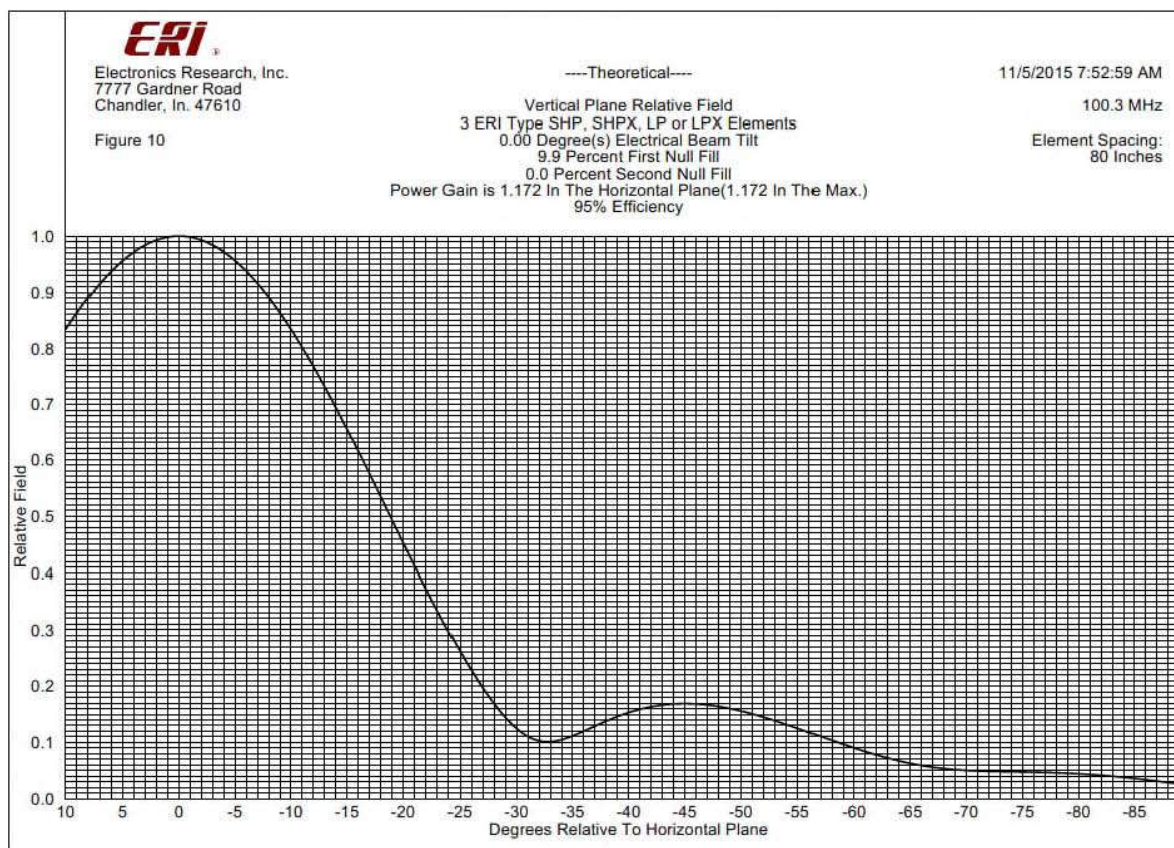


Figure 34 WHTZ (FM), 100.3 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 69 of 114

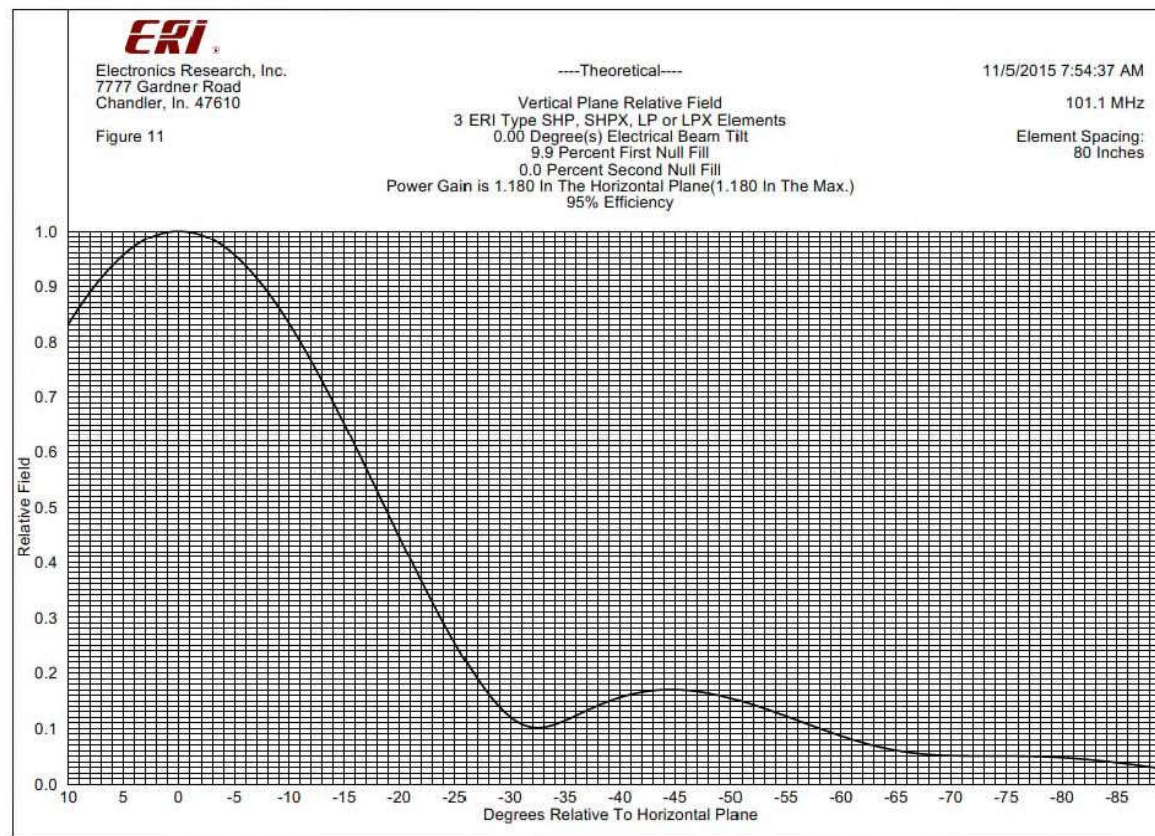


Figure 35 WCBS-FM, 101.1 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 70 of 114

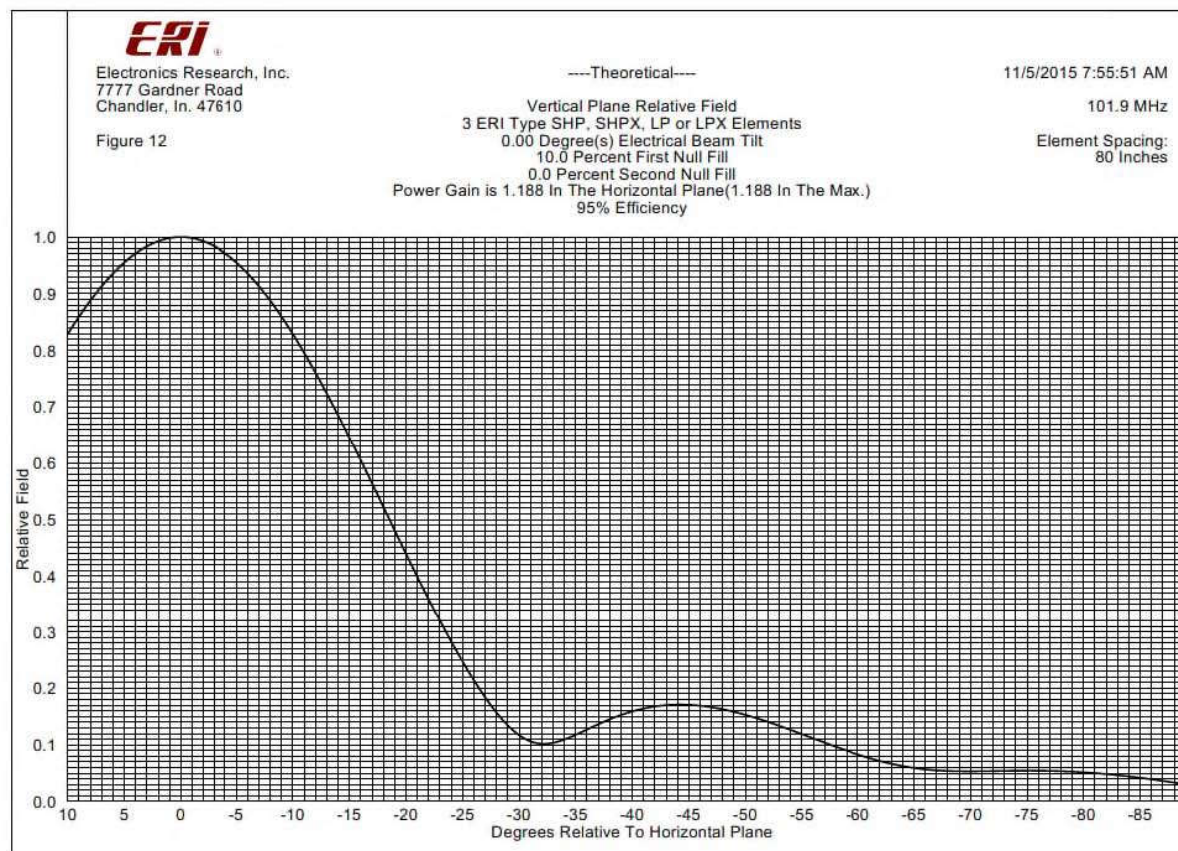


Figure 36 WFAN-FM, 101.9 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 71 of 114

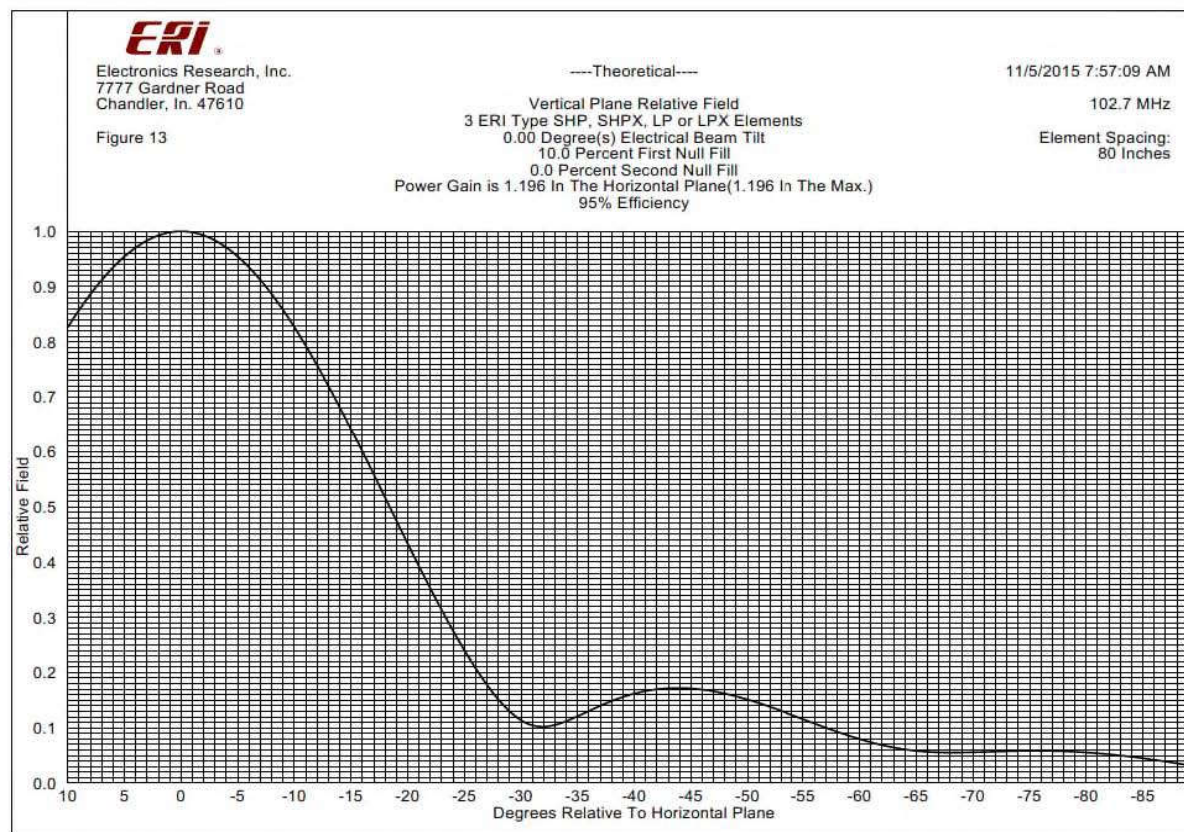


Figure 37 WNEW-FM, 102.7 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 72 of 114

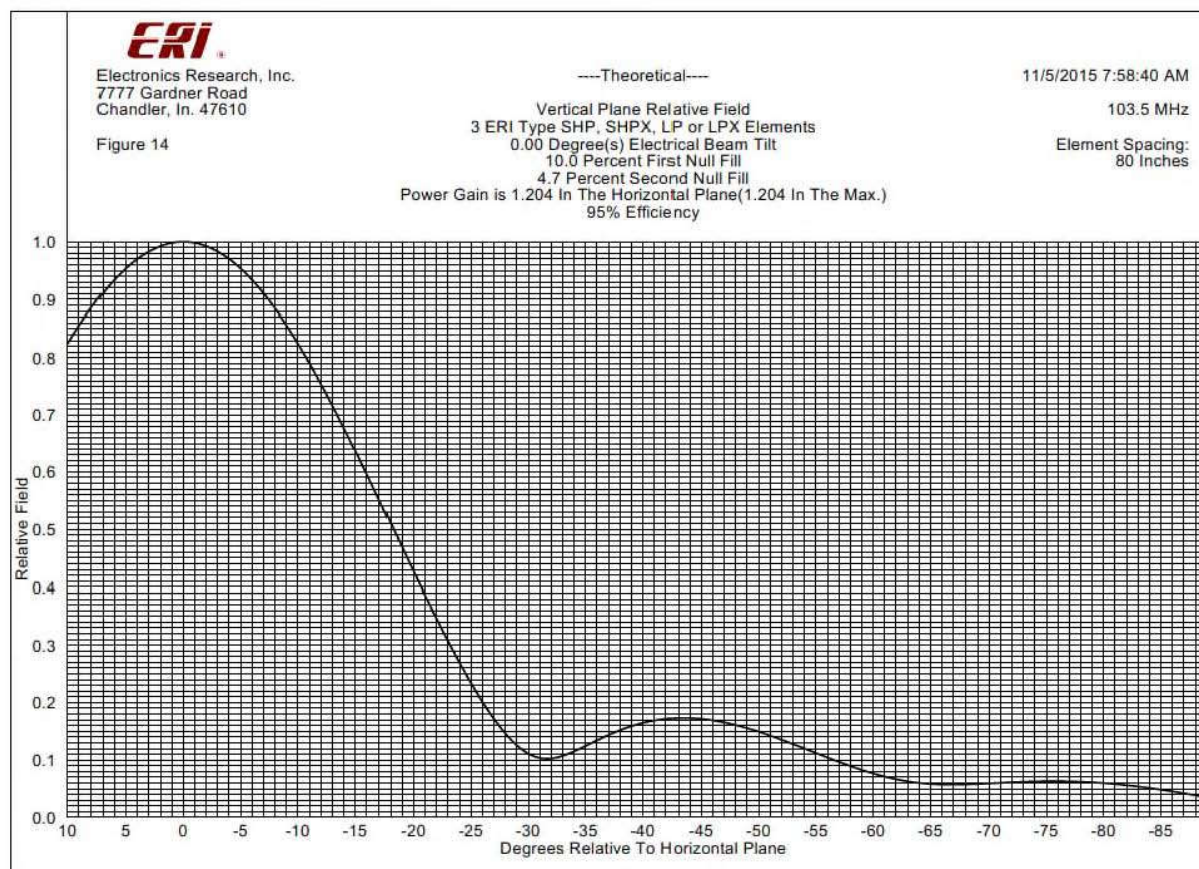


Figure 38 WKTU (FM), 103.5 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

ELECTRONICS RESEARCH, INC. **ERI**

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 73 of 114

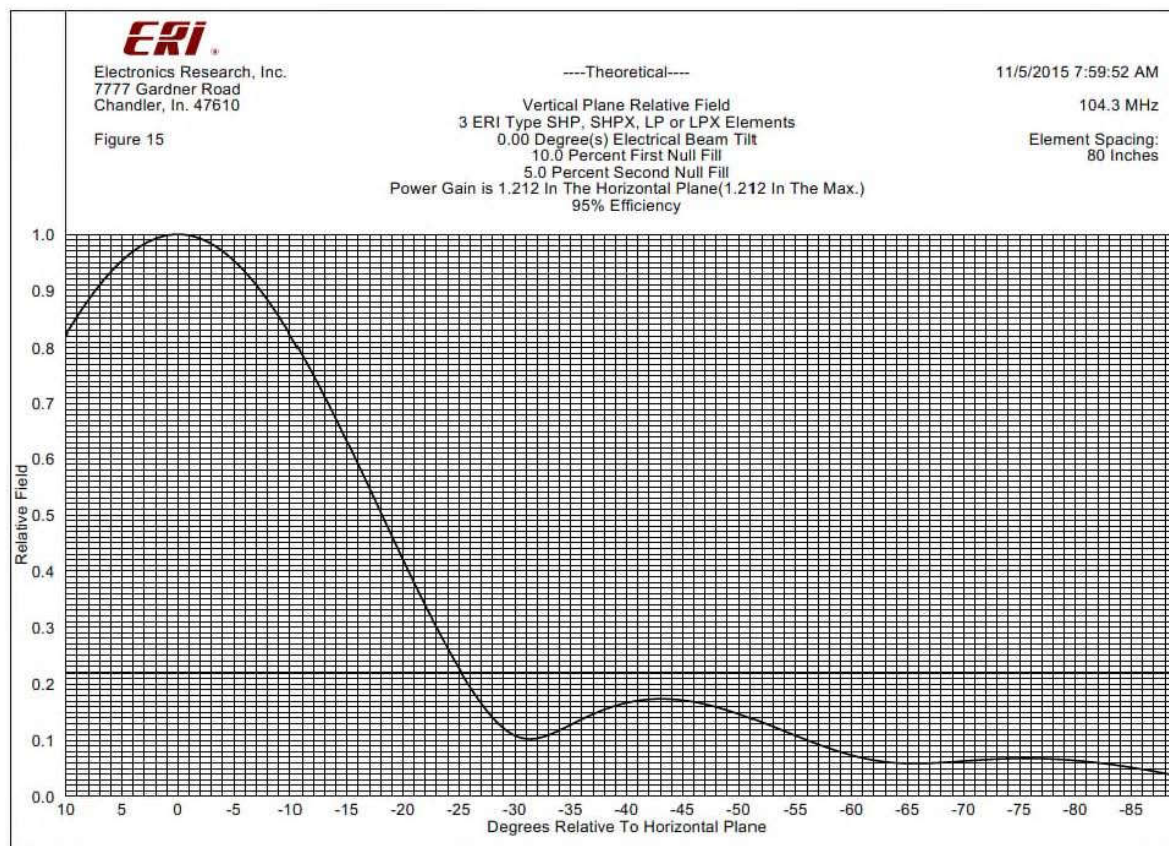


Figure 39 WAXQ (FM), 104.3 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 74 of 114

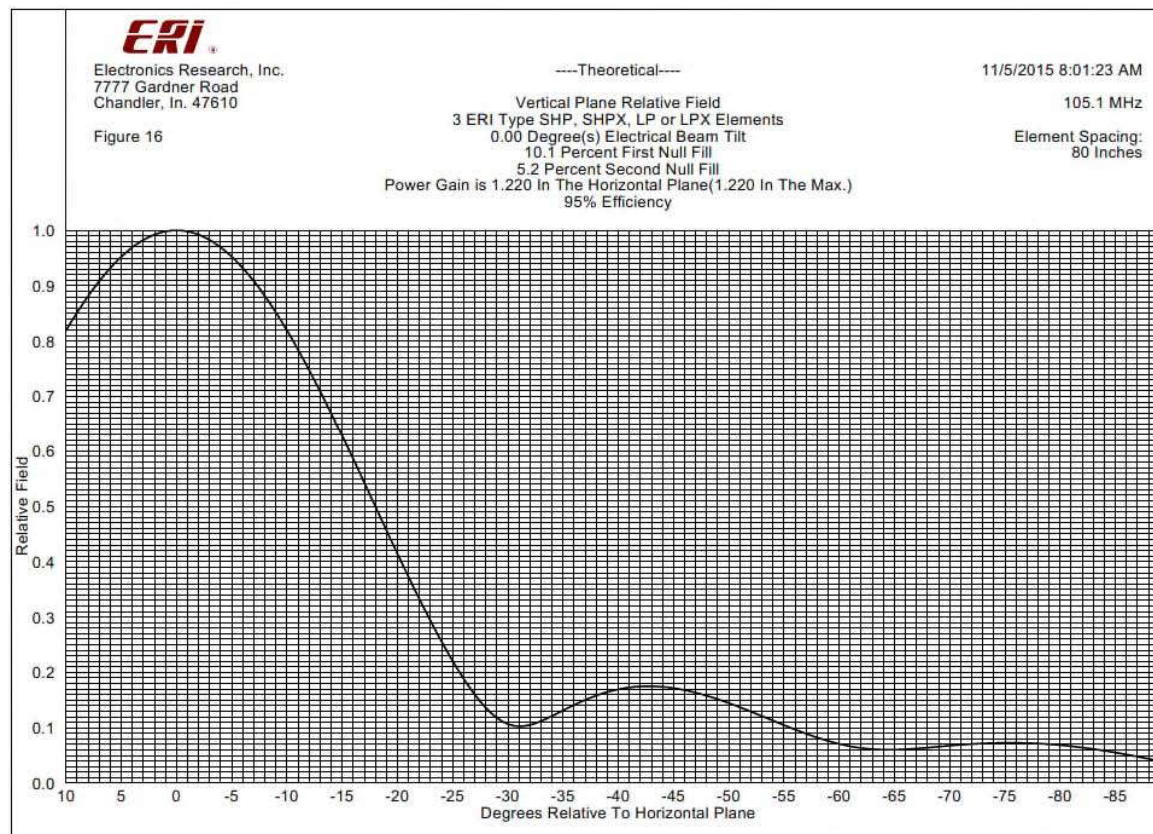


Figure 40 WWPR-FM, 105.1 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 75 of 114

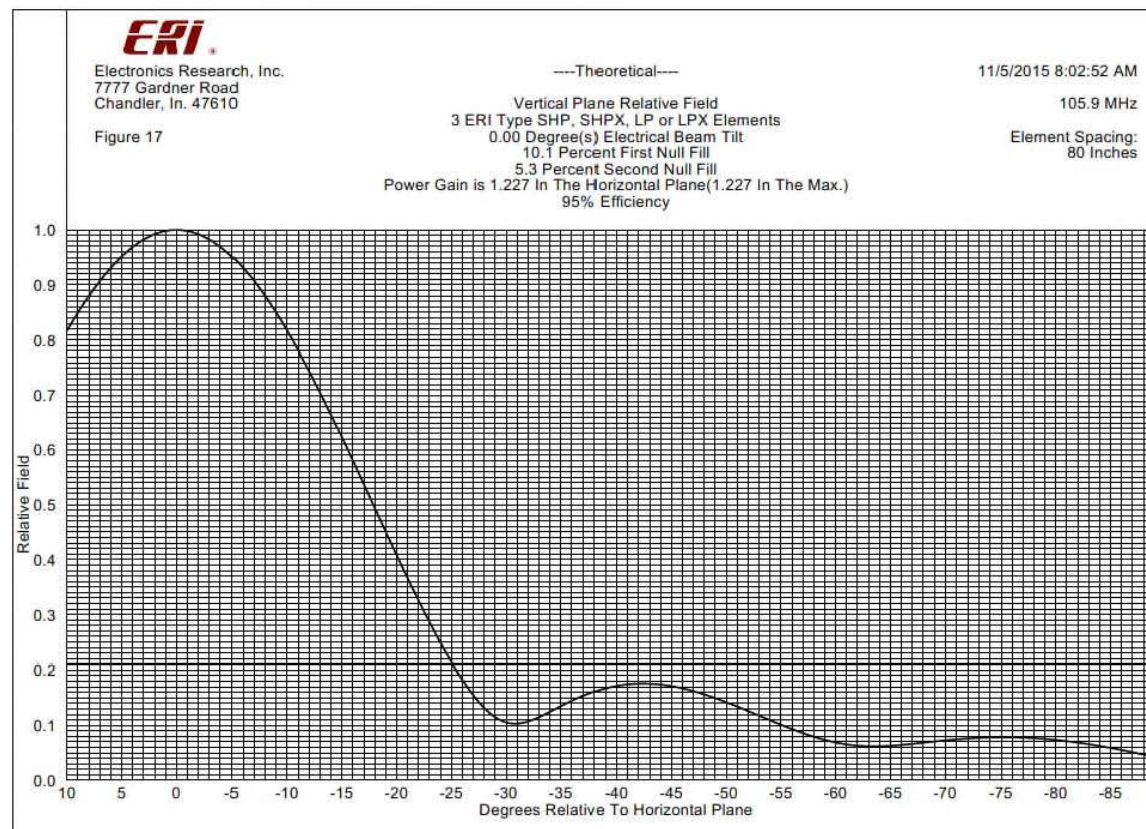


Figure 41 WQXR-FM, 105.9 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 76 of 114

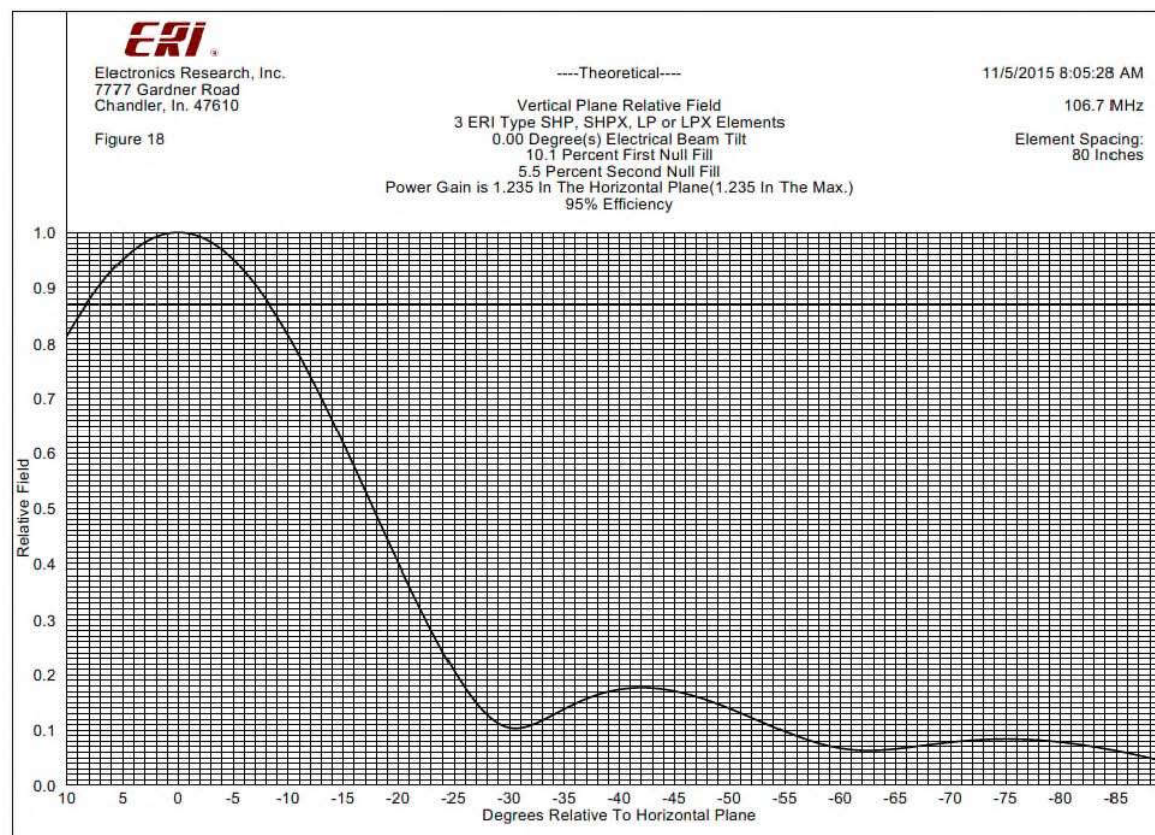


Figure 42 WLTW (FM), 106.7 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.



The Empire State Building  
Auxiliary Master FM Antenna and Auxiliary FM Channel Combiner System

Tower Reconfiguration Project  
June 29, 2016  
Page 77 of 114

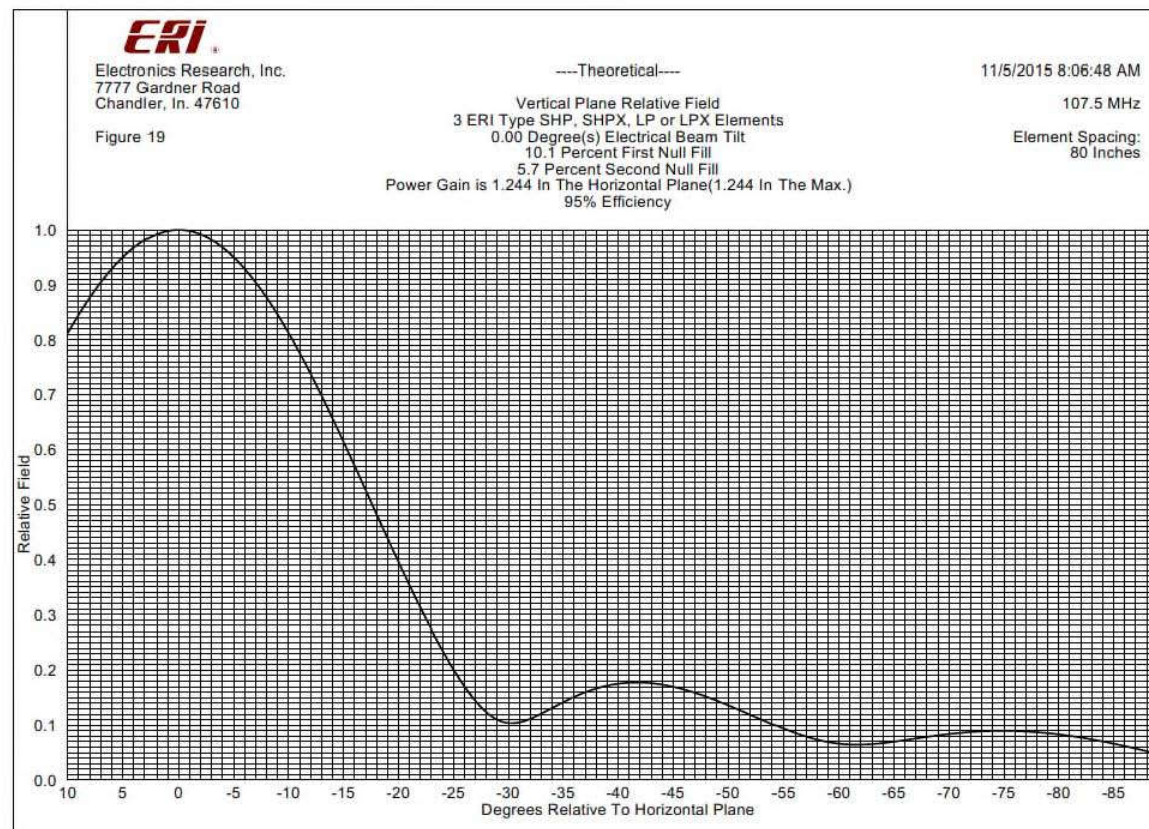
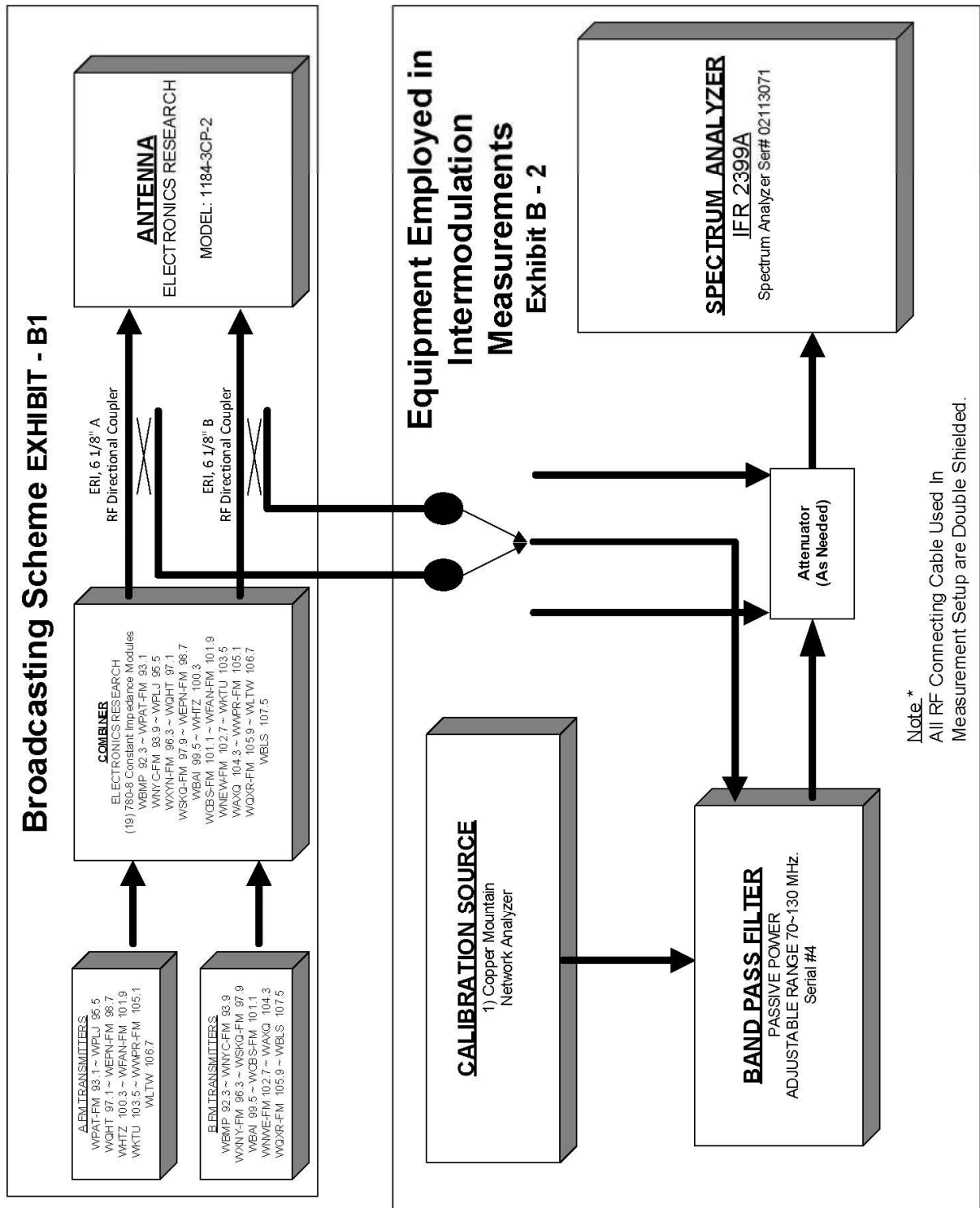


Figure 43 WBLS (FM), 107.5 MHz, calculated vertical plane pattern for ERI 1184 Series Auxiliary Master FM Antenna.

## Broadcasting Scheme and Equipment Employed in Intermodulation Measurements



**POWER DENSITY SURVEY OF EMPIRE STATE BUILDING DURING OPERATION OF NEW  
AUXILIARY MASTER FM ANTENNA**

The engineering data contained herein have been prepared on behalf of the FM broadcast stations that have been recently authorized by the FCC to operate with an auxiliary master antenna mounted on the lower portion of the tower atop the Empire State Building. The purpose of this exhibit is to report on the results of a power density survey that this firm conducted on September 28<sup>th</sup>, 2017, while all stations were operating from the new antenna in test mode. This survey is a requirement for licensing of the new system and, as such, appears as a condition on the FCC construction permit for many of the stations.

We conclude from this study that all areas of the upper portions of the Empire State Building, both controlled and uncontrolled environments, meet the Commission's human exposure requirements with respect to non-ionizing electromagnetic radiation while all FM stations are operating on the new Master FM Auxiliary antenna with their authorized effective radiated power levels and all other television and non-broadcast communications facilities are operating normally.

On the above date, we conducted a power density study of various areas on the Empire State Building. These areas included: the 86<sup>th</sup> Floor Observatory deck, the 102<sup>nd</sup> Floor Observatory, the 103<sup>rd</sup> Floor (interior and exterior), and the 104<sup>th</sup> Floor. In conducting this study, we utilized a Narda NBM-550 power density meter with a shaped-response probe. At any given location, this meter samples the RF energy from each source it identifies and applies the FCC exposure guideline for that facility's frequency. It then sums the contributions from all sources and displays the result as a total percentage of the allowable limit for controlled environments.



If the area is considered to be an uncontrolled environment, the value on the meter is simply multiplied by a factor of five (the difference between the controlled and uncontrolled maximum permissible exposure guidelines, or MPEs).

We begin each survey with a sweep of the entire measurement area of a particular level of the building, breaking the site into defined sections, and recording the maximum RF value in each section. In places where we find maximum RF values that approach or exceed the MPE for that type of area (controlled or uncontrolled), we take a more defined approach.

The FCC's exposure guidelines are based on whole-body absorption of RF, as opposed to exposure to "hot spots", which do not have a significant effect on overall temperature increase in the human body, the chief biological effect of RF on humans. Therefore, the use of spatial averaging techniques is not only appropriate, but considered to be more applicable to actual human exposure to such signals. In employing this technique, the probe is moved vertically from ankle-level to a point approximately six feet above ground and incorporates the point where the maximum RF value was previously found to exist. During this event, the meter averages the RF values measured throughout the vertical space, which represents total body absorption of RF at that location. In some cases, multiple spatial averages are taken in the same location, but with the probe head oriented at different azimuths to account for signal reflections from nearby structures and the meter user. As long as the spatial average (or the average of multiple spatial averages) is below the applicable MPE for that area, the measurement location is considered to be compliant with the Commission's exposure guidelines.

We also used a Narda SRM-3000 selective power density meter at various times throughout the study. This meter samples the RF energy at a given location and determines the relative contribution of each of the stations of interest. Prior to the study, we programmed the

meter to include all of the broadcast stations operating from the Empire State Building.

Typically, we take a measurement with this meter at the same location where we had previously taken a spatial average with the other power density meter (where the maximum RF level at a given point approached or exceeded the MPE).

Figure 1 is a tabulation of all FM stations that presently operate from the Empire State Building, and were operating from the new FM master auxiliary antenna during the aforementioned power density survey. Television stations presently operating from the Building are listed in Figure 2.

Figure 3 is a diagram of the 86<sup>th</sup> Floor Observatory deck. We have divided the deck into 81 distinct measurement cells. We found that the maximum recorded RF value on the Observation Deck was only 25.4 percent of the Commission's maximum permissible exposure guideline for uncontrolled (public) areas. Most of the other measurements on this portion of the Building were well below this peak value.

The 102<sup>nd</sup> Floor Observatory was also found to be well within the FCC's tolerances for public exposure to RF energy. The maximum power density value we found on this level was only 3.8 percent of the exposure limit for uncontrolled environments.

The other areas of the building that were measured on this evening can be considered to be "controlled" environments. The 103<sup>rd</sup> and 104<sup>th</sup> Floors can only be accessed through locked doors and windows, and if access to any area that has RF exposure levels between the public exposure limit and the occupational exposure limit is required, the worker will have had RF safety awareness training prior to accessing the area.

We find that with the new FM auxiliary antenna illuminated, all internal areas on the 103<sup>rd</sup> and 104<sup>th</sup> Floors meet the exposure limits for uncontrolled environments, while the exterior

parapet on the 103<sup>rd</sup> Floor meets the limits for controlled, or occupational, exposure to non-ionizing electromagnetic energy.

Further, the station owner will take whatever precautionary steps are necessary, such as reducing power or leaving the air temporarily, to ensure that workers operating in the vicinity of the auxiliary antenna are not exposed to excessive non-ionizing radiation. The Empire State Building has a specific RF safety protocol it implements for tower workers when this antenna is illuminated.

In conclusion, and as stipulated herein, I believe that all areas of the building that are accessible to the public and workers are compliant with the FCC's guidelines for human exposure to non-ionizing electromagnetic radiation, when the new FM auxiliary antenna is illuminated with all of the authorized stations.

A handwritten signature in blue ink, appearing to read 'K. T. Fisher', with a stylized flourish at the end.

Kevin T. Fisher  
President, Smith and Fisher, LLC

October 4, 2017

Figure 1

FM STATION NEW AUXILIARY OPERATION ON EMPIRE STATE BUILDING

<u>Call Sign</u>	<u>Channel</u>	<u>Frequency (MHz)</u>	<u>Power (kW)</u>	<u>FCC CP Grant Date</u>
WBMP	222B	92.3	7.1	6/1/2017
WPAT-FM	226B	93.1	4.0	8/18/2017
WNYC-FM	230B	93.9	6.2	6/26/2017
WPLJ	238B	95.5	7.6	6/26/2017
WXNY-FM	242B	96.3	7.1	6/22/2017
WQHT	246B	97.1	7.6	6/26/2017
WSKQ-FM	250B	97.9	7.1	8/28/2017
WEPN-FM	254B	98.7	7.1	5/25/2017
WBAI	258B	99.5	4.0	Pending
WHTZ	262B	100.3	7.1	6/26/2017
WCBS-FM	266B	101.1	7.6	6/26/2017
WFAN-FM	270B	101.9	7.1	6/1/2017
WNEW-FM	274B	102.7	7.1	6/26/2017
WKTU	278B	103.5	7.1	6/15/2017
WAXQ	282B	104.3	7.1	6/26/2017
WWPR-FM	286B	105.1	7.1	6/26/2017
WQXR-FM	290B1	105.9	0.7	5/25/2017
WLTW	294B	106.7	7.1	6/8/2017
WBLS	298B	107.5	5.0	5/25/2017



Figure 2

TELEVISION STATIONS OPERATING FROM THE EMPIRE STATE BUILDING

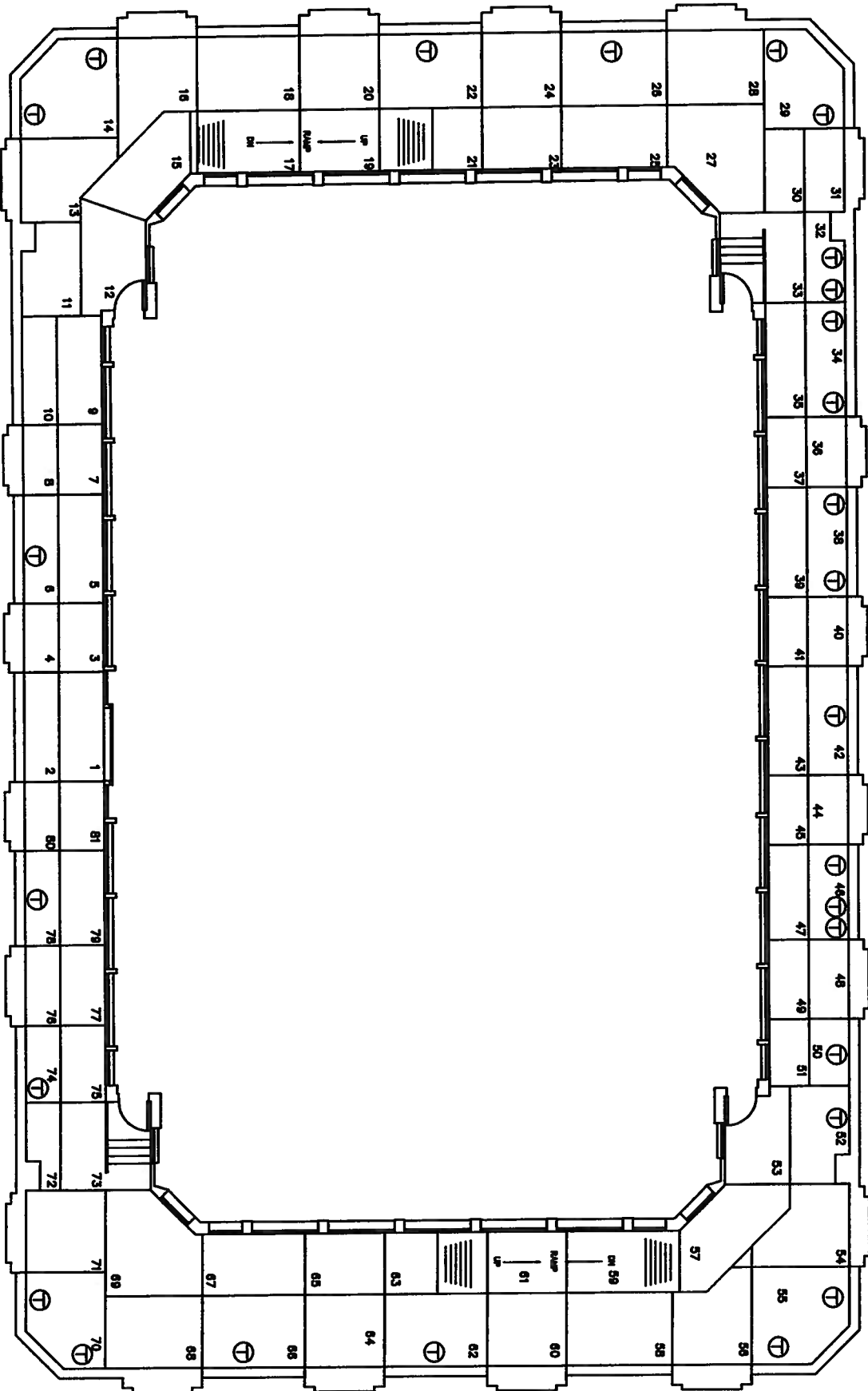
<u>Call Sign</u>	<u>Channel</u>	<u>Freq.</u> <u>(MHz)</u>	<u>Licensed</u> <u>Power</u> <u>(Kw)</u>	<u>Actual</u> <u>Power</u> <u>(Kw)</u>	<u>RCAMSL</u> <u>(Meters)</u>	<u>Loc. On</u> <u>Bldg.</u>	<u>FCC</u> <u>Auth.</u>
WABC-DT	7	174-180	34	34	418	Tower (L-10)	Lic.
WPIX-DT	11	198-204	7.5	7.5	418	Tower (L-10)	Lic.
WNET-DT	13	210-216	9.3	9.3	418	Tower (L-10)	Lic.
WMBC-DT	18	494-500	90	90	323	82 E-NE	Lic. (DTS)
WDVB-CD	23	524-530	7.0	7.0	314	81 W	Lic.
WNBC-DT	28	554-560	200	200	410	Tower (L-0)	Lic.
WFUT-DT	30	566-572	200	200	442	Tower (L-15)	Lic.
WPXN-DT	31	572-578	180	180	373	Mooring Mast	Lic
WCBS-DT	33	584-590	284	284	410	Tower (L-0)	Lic.
WWOR-DT	38	614-620	170	170	410	Tower (L-0)	CP
WXTV-DT	40	626-632	300	300	437	Tower (L-15)	Lic.
WNYW-DT	44	650-656	990	990	381	Mooring Mast	Lic.
WEBR-CD	49	680-686	1	1	322	81 SW	Lic.



FIFTH AVENUE

FIGURE 3

33rd STREET



34th STREET

86th FLOOR

