

**Exhibit 10**

**Statement E**

**APPLICATION FOR STATION LICENSE**

**Covering FCC Construction Permit BPH-20171115AAK**

**KYGO-FM Denver, Colorado - Facility ID 30829  
Bonneville International Corporation**

Prepared by

Garrison C. Cavell

**CAVELL, MERTZ & ASSOCIATES, INC.**

SEPTEMBER 10, 2018

**Exhibit 10 - Statement E**  
**APPLICATION FOR STATION LICENSE**  
**Supporting FCC Construction Permit BPH-20171115AAK**  
**KYGO-FM Denver, Colorado (Facility ID 30829)**

**Introduction and Summary**

This Statement has been prepared on behalf of *Bonneville International Corporation*, (“Bonneville”), licensee of Station KYGO-FM, Denver, Colorado. *Bonneville* holds a Construction Permit, FCC File Number BPH-20171115AAK, authorizing the relocation of FM Station KYGO-FM to a common antenna site with an accompanying change in class from Class C to Class C0.

The construction authorized in the Construction Permit (“CP”) has now been completed; Installation and adjustment of the RF filtering and combining systems necessary to operate with the authorized new facilities into the site’s master FM antenna system have been accomplished. As such, this facility is now able to operate in compliance with the terms and conditions of its CP and all applicable FCC Rules and policies. *Program Test Authority* (“PTA”) is herein respectfully requested on behalf of *Bonneville*.

**Satisfaction of CP Conditions**

The KYGO-FM Construction Permit is subject to 13 **Special Operating Conditions or Restrictions** (“Conditions”), which are discussed in the following paragraphs. *All of these Conditions are complied with, as of the filing of this Application.* Specifically:

**FCC Special Operating Condition 1** stipulates that:

*“Upon grant of a license application to cover this construction permit, the assignment will be downgraded as follows:*

<i>Community</i>	<i>Channel No.</i>
<i>Denver, CO</i>	<i>Add 253C0, Delete 253C.”</i>

*Bonneville* requested this change in Class, agrees with the downgrade, and accepts the Condition as written.

**FCC Special Operating Condition 2** stipulates that:

*“The permittee shall submit a copy of the vertical plane radiation pattern for the beam tilt antenna with the FCC 302-FM, Application for FM Broadcast Station License.”*

Attached herewith as **Exhibit 10 – Attachment I** is a copy of the vertical plane radiation pattern as supplied by the antenna manufacturer. It is also provided in the attached antenna Proof-of-Performance document.

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**FCC Special Operating Condition 3** requires that:

*“The permittee/licensee in coordination with other users of the site must reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency electromagnetic fields in excess of FCC guidelines.”*

Bonneville, in conjunction and cooperation with other site users, agrees to reduce power or cease operation as necessary to protect persons having access to the site, tower, and antenna system from levels of radiofrequency electromagnetic energy that may be in excess of the published FCC Guidelines.

**FCC Special Operating Condition 4** specifies that:

*BEFORE PROGRAM TESTS COMMENCE, sufficient measurements shall be made to establish that the operation authorized in this construction permit is in compliance with the spurious emissions requirements of 47 CFR Sections 73.317(b) through 73.317(d). All measurements must be made with all stations simultaneously utilizing the shared antenna. These measurements shall be submitted to the Commission along with the FCC 302-FM, Application for License.*

Attached herewith as **Exhibit 10 – Attachment II** is a report prepared by the antenna manufacturer’s field installation team following completion of adjustments to the site’s filtering and combining systems. As demonstrated therein, all pertinent FCC spurious emissions requirements have been met.

These measurements and this Exhibit are attached to FCC Form 302-FM which is being supplied in support of the permittee’s Application for License. This this Special Operating Condition is satisfied.

**FCC Special Operating Condition 5** specifies that:

*Upon commencement of program tests in accordance with 47 C.F.R. § 73.1620, the licensee must cease use of the auxiliary facility authorized by BLH-19981120KE due to a violation of 47 C.F.R. § 73.1675(a)(1). Alternatively, the licensee may seek modification of the auxiliary facility in accordance with § 73.1675(c)(1) to bring it into compliance with § 73.1675(a)(1)<sup>1</sup>. Documentation of compliance with this condition must be submitted with the FCC Form 302-FM application for license.*

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<sup>1</sup> FCC Rule Section 73.1675 addresses Auxiliary antennas. Paragraph (a)(1) (ii) of that Rule states:

*“An auxiliary antenna is one that is permanently installed and available for use when the main antenna is out of service for repairs or replacement. An auxiliary antenna may be located at the same transmitter site as the station’s main antenna or at a separate site. The service contour of the auxiliary antenna may not extend beyond the following corresponding contour for the main facility:*

*FM stations: The 1.0 mV/m field strength contours.”*

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*Bonneville* has determined that the above concern can be easily resolved by reducing the Licensed Auxiliary facility's ERP from 19.5 kW to 10 kW without making any other changes. Accordingly, an application has been filed by *Bonneville* (see FCC File Number BMLH-20180906ABL) requesting a modification of the KYGO-FM Auxiliary station license to reduce its ERP to 10 kW, as permitted under FCC Rule §73.1675(c)(1).

A grant of the Auxiliary Facility modification request will assure compliance with "Condition 5" of the KYGO-FM main facility Construction Permit. Further, *Bonneville* herein affirms that it will not operate the KYGO-FM auxiliary facility until the modification of license application has been granted for operation at the lower power level. The above two actions together essentially provide documentation of compliance with CP Condition 5.

**FCC Special Operating Condition 6** specifies that:

*"THE AUTOMATIC PROGRAM TEST PROVISIONS OF 47 CFR SECTION 73.1620 DO NOT APPLY IN THIS CASE. A FORMAL REQUEST FOR PROGRAM TEST AUTHORITY MUST BE FILED IN CONJUNCTION WITH FCC 302-FM, APPLICATION FOR FM BROADCAST STATION LICENSE, BEFORE PROGRAM TESTS WILL BE AUTHORIZED. This request must contain documentation which demonstrates compliance with the following special operating condition(s):"*

This response to this condition constitutes a formal *Request for Program Test Authority*. It is provided in conjunction with FCC Form 302-FM (Application for FM Broadcast Station License). This Exhibit (**Exhibit 10**) provides documentation demonstrating compliance with all thirteen of the Special Operating Conditions listed in Construction Permit Number BPH-20171115AAK.

**FCC Special Operating Condition 7** requires that:

*"The permittee/licensee shall, upon completion of construction and during the equipment test period, make proper radiofrequency electromagnetic (RF) field strength measurements throughout the transmitter site area, including all nearby towers, to determine if there are any areas that exceed the FCC guidelines for human exposure to RF fields. If necessary, a fence must be erected at such distances and in such a manner as to prevent the exposure of humans to RF fields in excess of the FCC Guidelines (OET Bulletin No. 65, Edition 97-01, August 1997). The fence must be a type which will preclude casual or inadvertent access, and must include warning signs at appropriate intervals which describe the nature of the hazard. Any areas within the fence found to exceed the recommended guidelines must also be clearly marked with appropriate visual warning signs."*

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Attached herewith as **Exhibit 10 – Attachment III** is a report provided by Jay M. Jacobsmeyer, P.E. addressing all of the items referenced in the above Special Operating Condition (SOC). As demonstrated therein, this SOC is appropriately satisfied.

**FCC Special Operating Condition 8** stipulates that:

*“BEFORE PROGRAM TESTS ARE AUTHORIZED, permittee shall submit the results of a complete proof-of-performance to establish the horizontal plane radiation patterns for both the horizontally and vertically polarized radiation components. This proof-of-performance may be accomplished using the complete full size antenna, or individual bays therefrom, mounted on a supporting structure of identical dimensions and configuration as the proposed structure, including all braces, ladders, conduits, coaxial lines, and other appurtenances; or using a carefully manufactured scale model of the entire antenna, or individual bays therefrom, mounted on an equally scaled model of the proposed supporting structure, including all appurtenances. Engineering exhibits should include a description of the antenna testing facilities and equipment employed, including appropriate photographs or sketches and a description of the testing procedures including scale factor, measurements frequency, and equipment calibration.”*

A complete proof-of-performance (“proof”) was accomplished by the antenna system manufacturer, Electronics Research Incorporated (“ERI”), to establish the horizontal plane radiation patterns for both the horizontally and vertically polarized radiation components. A copy of the proof, including supporting information, graphs, sketches and tabulations, is included herewith as **Exhibit 10 – Attachment IV** thus satisfying this condition.

**FCC Special Operating Condition 9** states that:

*BEFORE PROGRAM TESTS ARE AUTHORIZED, permittee must submit a certification executed by a licensed surveyor showing that the FM directional antenna system has been oriented at the azimuth(s) specified in the directional antenna proof of performance. This certification must include a description of the method used by the surveyor to determine the azimuth(s) of the installed directional antenna system and the accuracy of that determination.*

Attached herewith as **Exhibit 10 – Attachment V** is a statement provided by a surveyor licensed in the State of Colorado, *L.G. Chambers, PLS* of Chambers Consulting, Inc. certifying as to the orientation of the as-installed Master Antenna at 69° 37’ 07” (or 69.6° True), essentially meeting the desired orientation after rounding. (This system antenna also is specified as the common antenna for KOSI (FM), KIMN (FM), and KXKL-FM; the specified orientation of the antenna is 70° True for all of the facilities using this antenna.)

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**FCC Special Operating Condition 10** states that:

*“BEFORE PROGRAM TESTS ARE AUTHORIZED, permittee/licensee shall submit an affidavit that the installation of the directional antenna system was overseen by a qualified engineer. This affidavit shall include a certification by the engineer that the antenna was installed pursuant to the manufacturer's instructions and list the qualifications of the certifying engineer.”*

Attached herewith as **Exhibit 10 – Attachment VI** is the stamped engineer’s certification provided by *Jay M. Jacobsmeyer, P.E.*, of Pericle Communications Company, certifying that he oversaw the installation of the directional antenna system as required in the above Condition.

**FCC Special Operating Condition 11** requires that:

*BEFORE PROGRAM TESTS ARE AUTHORIZED, the permittee must submit an exhibit demonstrating that the measured directional antenna pattern complies with the appropriate community coverage provisions of 47 CFR Sections 73.315 or 73.515 (See 47 CFR Section 73.316(c)(2)(ix)(B)).*

Attached herewith as **Exhibit 10 – Attachment VII** is a coverage map showing the predicted 70 dBμ contours of the composite pattern, the measured H-pol pattern, and the measured V-pol pattern along with the bounds of the principal community of license, Denver, Colorado. As demonstrated therein, Denver is completely encompassed by the coverage patterns developed from this facility, thus satisfying this CP Condition.

**FCC Special Operating Condition 12** states that:

*The RMS of the composite measured relative field horizontal plane directional antenna pattern must encompass at least 85% of the RMS of the composite relative field horizontal plane directional antenna pattern authorized by this construction permit.*

**Exhibit 10 – Attachment IV** provides the manufacturer’s proof-of-performance for the antenna system, as discussed earlier in this Statement. Page 4 of **Attachment IV** provides the manufacturer’s statement that the composite horizontal plane directional pattern has an RMS that is greater than 85% of the filed composite (envelope) pattern. As such, this CP Condition is satisfied.

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**FCC Special Operating Condition 13** states that:

*The relative field strength of neither the measured horizontally nor vertically polarized radiation component shall exceed at any azimuth the value indicated on the composite radiation pattern authorized by this construction permit.*

*“A relative field strength of 1.0 on the composite radiation pattern herein authorized corresponds to the following effective radiated power:*

*100 kilowatts*

*Principal minima and their associated field strength limits:*

*210 to 290 degrees True (clockwise): 0.2 kilowatt”*

Attached herewith as **Exhibit 10 – Attachment VIII** is a polar plot demonstrating that the measured horizontal polarization (H-pol) and the measured vertical polarization (V-pol) patterns do not exceed the authorized composite (envelope) pattern.

**Exhibit 10 – Attachment VIII-A** provides a tabulation of the composite pattern, along with the H-pol and V-pol patterns, demonstrating that neither polarization exceeds the composite pattern, as is also confirmed in supplied Proof-of-Performance. Thus, the first part of this condition is satisfied.

Regarding the second part of the above Condition, it contains what is believed to be a typographical error. The field value specified in the underlying Application for Construction Permit (FCC Form 301) is 0.2. Therefore calculated maximum ERP allowed in the pattern minima (from 210° through 290° True) would be 4.0 kW, (assuming that a Field of 1.0 equals 100 kW). However, the above Condition states that the pattern minima and their associated field strength limits should be 0.2 kW, which is incorrect; it is believed that the minima field value of 0.2 was erroneously inputted instead of the correct ERP value of 4.0 kW. If necessary, it is requested that this condition be corrected.

The tabulation on the following page is responsive to the second part of the above Special Operating Condition, when the corrected pattern minima value is employed. As is demonstrated therein, the realized measured field strengths for either the vertically or horizontally polarized fields do not exceed the 0.2 field (4.0 kW) value within the span from 210° to 290° True.



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Bearing (°T)	FCC 301 Composite/Envelope Pattern (Field)	Proof Value Measured Horiz. Pol. (Field)	Proof Value Measured Vert. Pol. (Field)	Max ERP (H or V Pol) From Proof Measured Data	Max ERP From 301 Envelope Field Pattern
210°	0.2	0.166	0.081	2.765 kW	4.0 kW
220°	0.2	0.160	0.052	2.562 kW	4.0 kW
230°	0.2	0.126	0.055	1.597 kW	4.0 kW
240°	0.2	0.101	0.131	1.720 kW	4.0 kW
250°	0.2	0.094	0.177	3.144 kW	4.0 kW
260°	0.2	0.081	0.132	1.736 kW	4.0 kW
270°	0.2	0.091	0.056	0.832 kW	4.0 kW
280°	0.2	0.123	0.074	1.520 kW	4.0 kW
290°	0.2	0.125	0.148	2.202 kW	4.0 kW

As demonstrated in the above and in **Exhibit 10 - Attachments VIII and VIII-A**, it is believed that Special Operating Condition 13 has been satisfied.

#### **Summary and Conclusions**

**Exhibit 10**, with its attachments, provides the requested documentation showing compliance with the Special Operating Conditions listed in the KYGO-FM Construction Permit (FCC File Number BPH-20171115AAK). This Exhibit is uploaded to FCC Form 302-FM - Application for FM Station License, in the FCC's CDBS electronic filing system, thereby satisfying the requirement that the documentation be submitted at the time of the filing of this Application for License.

#### **Certification**

These application materials have been prepared on behalf of ***Bonneville International Corporation*** by the undersigned or under his direction and are true and correct to the best of his information, knowledge and belief. Mr. Cavell's qualifications are a matter of record before the FCC.

Respectfully submitted,



Garrison C. Cavell    September 10, 2018  
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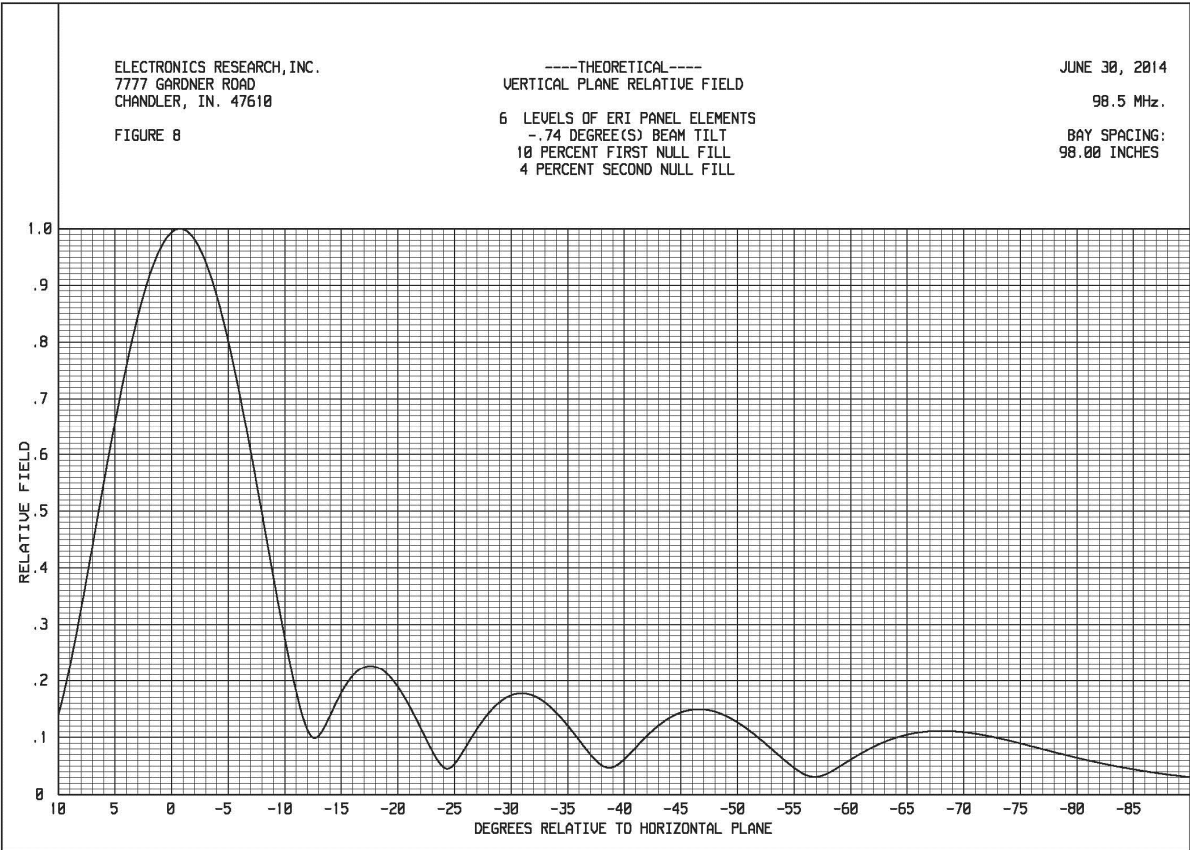
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**Attachment I**

**Vertical Plane Pattern**

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**Attachment 1: Vertical Plane Relative Field Plot of 98.5 MHz.**



**Exhibit 10**

**Attachment II**

**Spurious Emissions / Intermodulation Products Report**

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Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**

# **Report Of Intermodulation Product Findings**

**KYGO-FM 98.5 MHz. Denver, CO.  
KIMN 100.3 MHz. Denver, CO.  
KOSI-FM 101.1 MHz. Denver, CO.  
KXKL-FM 105.1 MHz. Denver, CO.**

**Project# 32544H**

*August 13, 2018*

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## Exhibits Accompanying This Report

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A-1 .....	Drawing Depicting Antenna
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<b>EXHIBIT B-1</b> .....	Intermodulation Product Measurement Equipment Layout
B-2 .....	Broadcasting Scheme of the Multiplexed System

**REPORT OF FINDINGS**  
**KYGO-FM / KIMN / KOSI-FM / KXKL-FM**  
98.5 MHz. / 100.3 MHz. / 101.1 MHz. / 105.1 MHz.

**Introduction:** This report of findings is based on data collected at the KYGO-FM, KIMN, KOSI-FM and KXKL-FM broadcast facility located in Mt. Morrison, Colorado. The report includes measurements offered as proof that the combined operations of KYGO-FM (98.5 MHz.), KIMN (100.3 MHz.), KOSI-FM (101.1 MHz.), and KXKL-FM (105.1 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 multiplexed system are less than the maximum allowable level as required by section 73.317 (b) through (d). Jeff Taylor of Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized herein on August 13, 2018.

**The following exhibits are provided:**

Exhibit A:

- A-1 Drawing Depicting Antenna.
- A-2 1182-6CP-DA-SP Antenna Specification Sheet.
- A-3 Drawing Depicting Multiplexed Scheme.
- A-4 Multiplexer 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 Multiplexed 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 multiplexed 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 KYGO-FM, KIMN, KOSI-FM, and KXKL-FM multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The 1182-6CP-DA-SP (antenna), combiner units, and the 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 four transmitter signals into a common antenna feed and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of a 783-8 Constant Impedance Combiner was installed. Specifically, the combiner uses one ERI Model 783-6 Constant Impedance module for frequency (105.1 MHz.), and three 783-8 Constant Impedance modules for frequencies (98.5 MHz., 100.3 MHz. and 101.1 MHz.). An interconnecting "u-link" is required to complete the combiner which is illustrated in the attached Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of -64 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 the multiplexer's 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 coupler located at the antenna output of the multiplexed system was used. Care was taken in the selection of the measurement location to ensure that the measurements would be made far removed from transmitters and any filtering used to reduce broadcast emissions. The coupler selected would normally be used for antenna reflection measurements and thus would provide greater than -46 dB directivity and a forward signal sample of -57 dB.

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 FIM71 to ensure an adequate signal level for measurements without overloading the measurement equipment. A Potomac Instruments FIM-71 Field Strength Receiver Serial # 686 was employed to record the level of all signals investigated. To facilitate the selective tuning of the Receiver and Band Pass Filter a Wavetek Model 3000 Serial # 5362199 signal generator was used. A Rhode & Schwarz ZVL3 Spectrum Analyzer Serial # 100396 was 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 A-2 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 both transmitters were operating at maximum power. 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>Scale Range (dB)</b>	<b>Scale Reading (dB)</b>	<b>Adjusted Level (dBm)</b>	<b>Notes</b>
<b>98.5</b>	<b>3</b>	<b>120</b>	<b>6.7</b>	<b>116.3</b>	
<b>100.3</b>	<b>3</b>	<b>120</b>	<b>6.8</b>	<b>116.2</b>	
<b>101.1</b>	<b>3</b>	<b>120</b>	<b>6.4</b>	<b>116.6</b>	
<b>105.1</b>	<b>3</b>	<b>120</b>	<b>7.5</b>	<b>115.5</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.**

<b>Interfering Frequencies</b>	<b>Carrier Frequencies</b>			
	<b>98.5</b>	<b>100.3</b>	<b>101.1</b>	<b>105.1</b>
KYGO-FM 98.5 MHz.	----	102.1	103.7	111.7
KIMN 100.3 MHz.	96.7	----	101.9	109.9
KOSI-FM 101.1 MHz.	95.9	99.5	----	109.1
KXKL-FM 105.1 MHz.	91.9	95.5	97.1	----

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**

IM Measurements Taken at Mt. Morrison, CO.											
Product Frequency (MHz)	Transmitter Frequency (MHz)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Full Scale Range (dBμ)	Scale Reading (dBμ)	Adjusted Level (dBμ)	Carrier Reference Level (dBμ)	Level Referenced to Carrier (dB)	Notes*
<b>Transmitter Mixes</b>											
	<b>98.5</b>	<b>Ref.</b>	<b>3</b>		<b>3</b>	<b>120</b>	<b>6.7</b>		<b>116.3</b>		
	<b>100.3</b>	<b>Ref.</b>	<b>3</b>		<b>3</b>	<b>120</b>	<b>6.8</b>		<b>116.2</b>		
	<b>101.1</b>	<b>Ref.</b>	<b>3</b>		<b>3</b>	<b>120</b>	<b>6.4</b>		<b>116.6</b>		
	<b>105.1</b>	<b>Ref.</b>	<b>3</b>		<b>3</b>	<b>120</b>	<b>7.5</b>		<b>115.5</b>		
91.9	98.5	105.1	3	9.1	12.1	20	15.8	16.3	116.3	-100.0	
95.5	100.3	105.1	3	9.9	12.9	20	3.7	29.2	116.2	-87.0	
95.9	98.5	101.1	3	9.8	12.8	20	1.2	31.6	116.3	-84.7	
96.7	98.5	100.3	3	9.9	12.9	20	1.4	31.5	116.3	-84.8	
97.1	101.1	105.1	3	9.4	12.4	20	1.3	31.1	116.6	-85.5	
99.5	100.3	101.1	9	9.9	18.9	20	3.4	35.5	116.2	-80.7	Local KQMT
101.9	101.1	100.3	12	10.1	22.1	20	6.7	35.4	116.6	-81.2	Local KXWA
102.1	100.3	98.5	9	10.1	19.1	20	13.7	25.4	116.2	-90.8	
103.7	101.1	98.5	3	10.2	13.2	20	1.2	32	116.6	-84.6	
109.1	105.1	101.1	3	10.8	13.8	20	4.1	29.7	115.5	-85.8	
109.9	105.1	100.3	3	10.8	13.8	20	10.9	22.9	115.5	-92.6	
111.7	105.1	98.5	3	11.1	14.1	20	4.5	29.6	115.5	-85.9	

The Spectrum Analyzer was used to check the close in spectral attenuation of the carrier to confirm the operation of the transmitter is 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 August 13, 2018 as summarized in this document, I, Jeff Taylor, find the subject system, specifically the transmitter and filter system for the operation of KYGO-FM, KIMN, KOSI-FM, and KXKL-FM 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 KYGO-FM, KIMN, KOSI-FM, and KXKL-FM 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.

Jeff Taylor, Field Technician

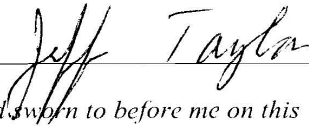
State of Indiana)  
 ) SS:  
County of Warrick)

**AFFIDAVIT**

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

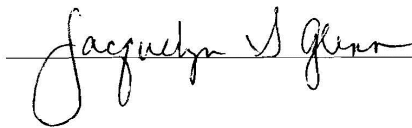
- 1.) I am a Field Technician for Electronics Research, Inc ("ERI ") and have been employed by ERI for 22 years. I am familiar with and have assisted in the design, manufacturing and installation of FM Antennas and FM Multiplexers in my long tenure with ERI.
- 2.) I have either prepared and/or directly 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 KSE Radio Ventures on behalf of Stations KIMN and KXKL-FM, and also Bonneville International Corporation on behalf of Stations KYGO-FM and KOSI-FM in Denver, Colorado to prepare this Report Of Findings.

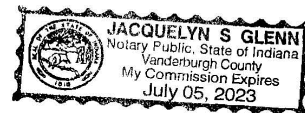
Jeff Taylor; Field Technician



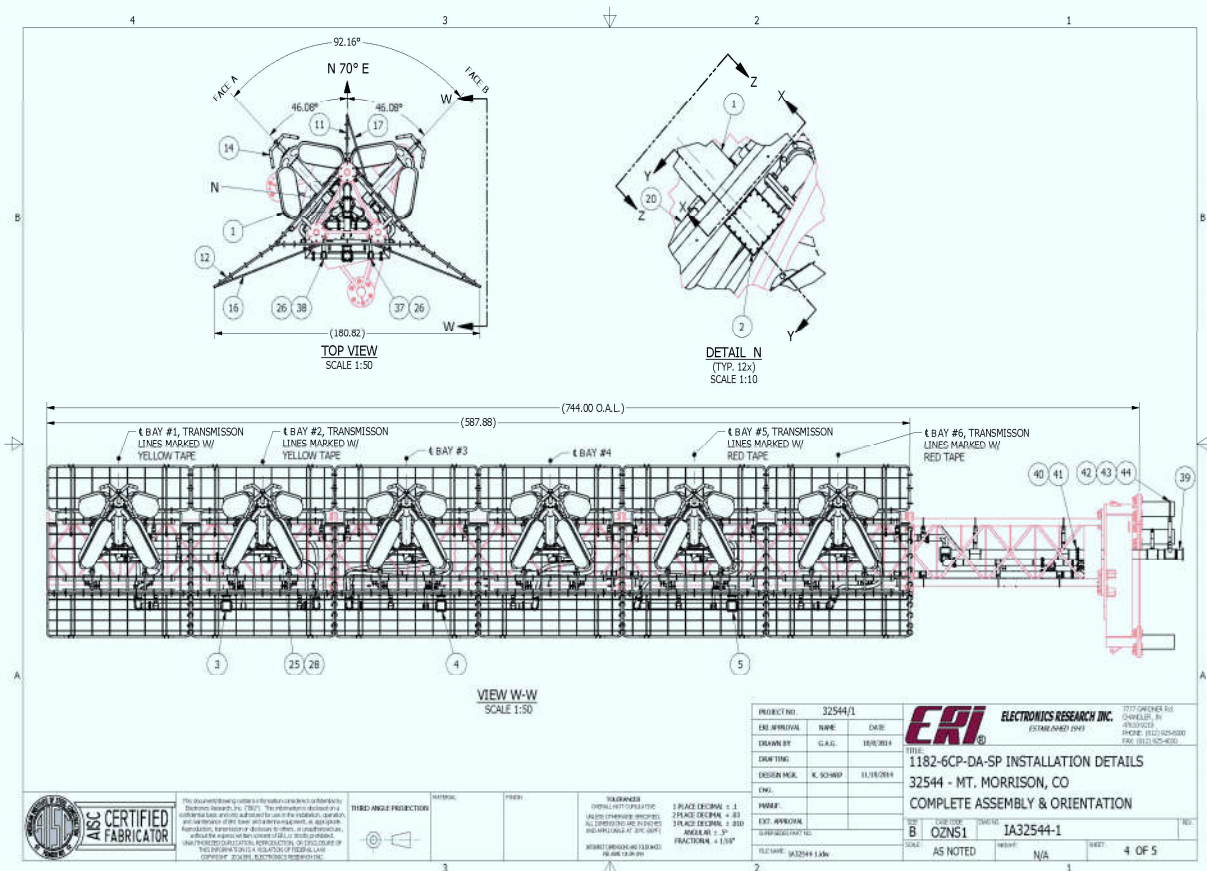
*Subscribed and sworn to before me on this 17th, day of August, 2018.*

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





# EXHIBIT, A-1



**A-2 ERI Antenna Specification Sheet****MULTIPLEXED TRANSMISSION SITE****MT. MORRISON, COLORADO****General Specifications**

Antenna Type ..... High Power FM-Broadcast, Suitable For Multiplexing  
 Model Number ..... 1082-6CP-DA  
 Number of Bay Levels ..... Six  
 Polarization ..... Circular Polarized

**Electrical Specifications**

Antenna Input Power Capability ..... 56 kW Max <sup>(1)</sup>  
 Operating Frequency Band ..... 98.5 ~ 105.1 Megahertz.  
 VSWR ..... <1.08:1 @ Operating Frequencies<sup>(2)</sup>  
 Azimuthal Pattern Circularity ..... Better Than +/- 1dB From RMS ( Free Space )  
 Power Split ..... 50/50 ( Horizontal & Vertical )  
 Frequency Specific Information:

<u>Frequency</u>	<u>Station ERP</u>	<u>Beam Tilt</u>	<u>First Null Fill</u>	<u>Second Null Fill</u>	<u>Power Gain</u>	<u>Line Loss</u> <sup>(3)</sup>	<u>Filter Loss</u> <sup>(4)</sup>	<u>Computed Filter Input</u>
98.5	100 kW	-0.74°	10.0 %	4.0 %	7.503	-0.072 dB	-.198 dB	14.183 kW
100.3	100 kW	-0.74°	9.9 %	4.4 %	7.514	-0.074 dB	-.299 dB	14.500 kW
101.1	100 kW	-0.74°	10.0 %	4.0%	7.602	-0.074 dB	-.314 dB	14.382 kW
105.1	100 kW	-0.74°	9.9 %	4.5%	8.244	-0.075 dB	-.171 dB	12.837 kW

**Mechanical Specifications**

Antenna Feed System.....Fed with One 6 1/8" Line  
 Input Connector ..... 6 1/8"-50 Ohm EIA Flanged  
 Element Deicing.....Radomes  
 Interbay Spacing..... 98" Center to Center  
 Array Length ..... 48.33 Feet  
 Construction Material ( Antenna ) ..... Brass and Stainless Steel  
 Construction Material ( Mounting ) ..... Custom Mounting

1) Power Capability Has Been Rated Assuming an Operating Transmission VSWR of 1.5:1

2) VSWR Specification Achieved After On Site Tuning For User Specific Frequencies.

3) Line Loss Assumes A Feed Run of 150 Feet of 6 1/8" ERI Macxline.

4) Losses Taken From Actual Combiner.





**A-4 ERI Combiner Specification Sheet****MULTIPLEXED TRANSMISSION SITE****MT. MORRISON, COLORADO****General Specifications:**

Multiplexer Type ..... 783-6 & 783-8 Constant Impedance Combiner  
Number of Combining Units ..... Four  
Injected Port to Injected Port Isolation ..... < -64 dB  
Output Connector ..... 6 1/8 "50 Ohm EIA (Flanged)  
Output Power (Designed) ..... 56 kW<sup>(1)</sup>

Heat Removal ..... Convection Cooling  
Physical Arrangement ..... All Components Rack Mounted by Customer

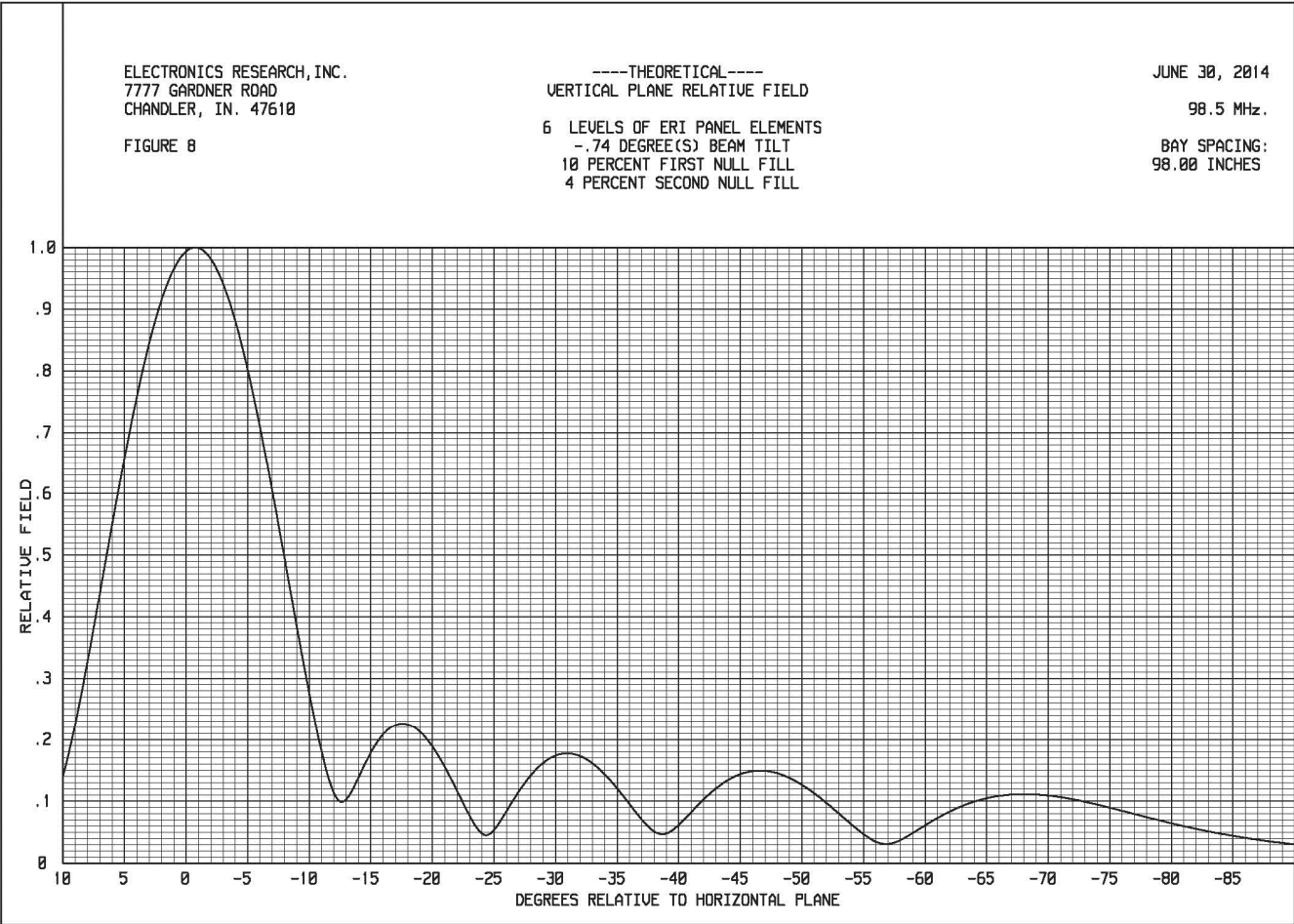
**Injected Port Specifications:**

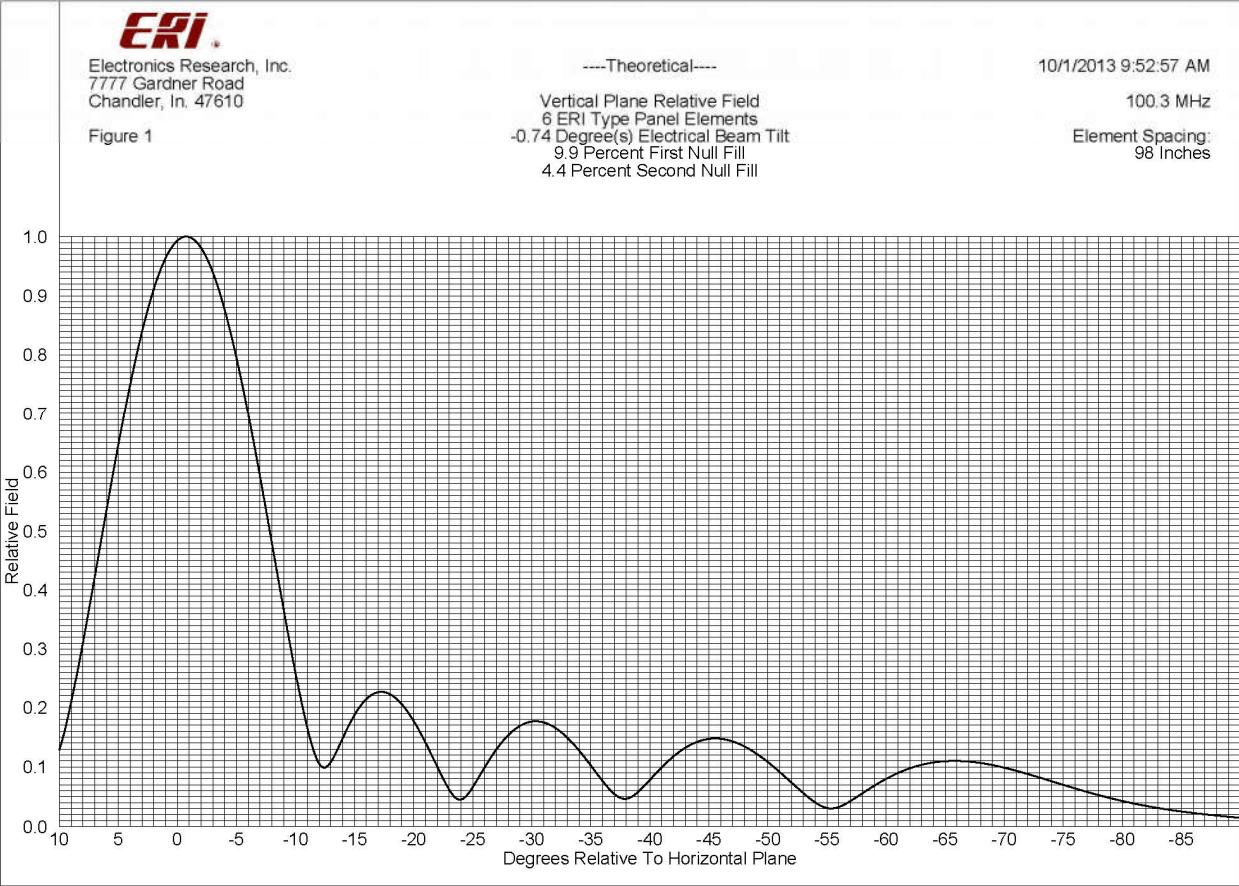
Frequency Assignment ..... 98.5 ~ 100.3 ~ 101.1 ~ 105.1 MHz.  
Power Rating, Each Injected Port (Designed) ..... 14.1 kW for 98.5 MHz., & 14.5 kW for 100.3 MHz.  
Power Rating, Each Injected Port (Designed) ..... 14.3 kW for 101.1 MHz., & 12.8 kW for 105.1 MHz.  
Input Connector ..... 3-1/8" 50 Ohm EIA (Flanged).  
VSWR.....< 1.07:1 @ +/-200 KHz.<sup>(2)</sup>  
Group Delay ..... Less than 250 ns Overall Variation, Carrier @ +/- 150 KHz.  
Insertion Loss (Measured):

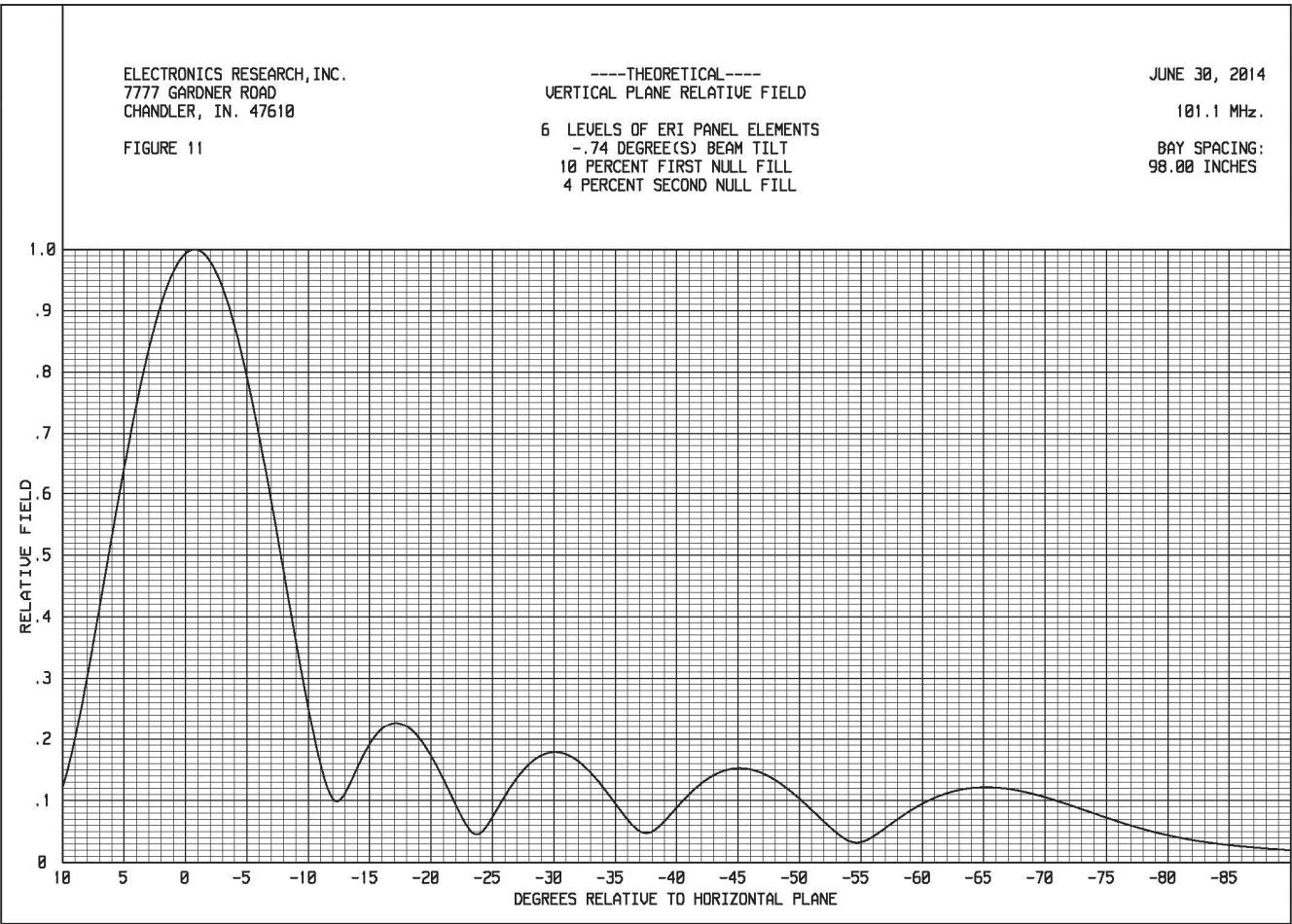
98.5 MHz. .... - 0.198 dB  
100.3 MHz. .... - 0.299 dB  
101.1 MHz. .... - 0.314 dB  
105.1 MHz. .... - 0.171 dB

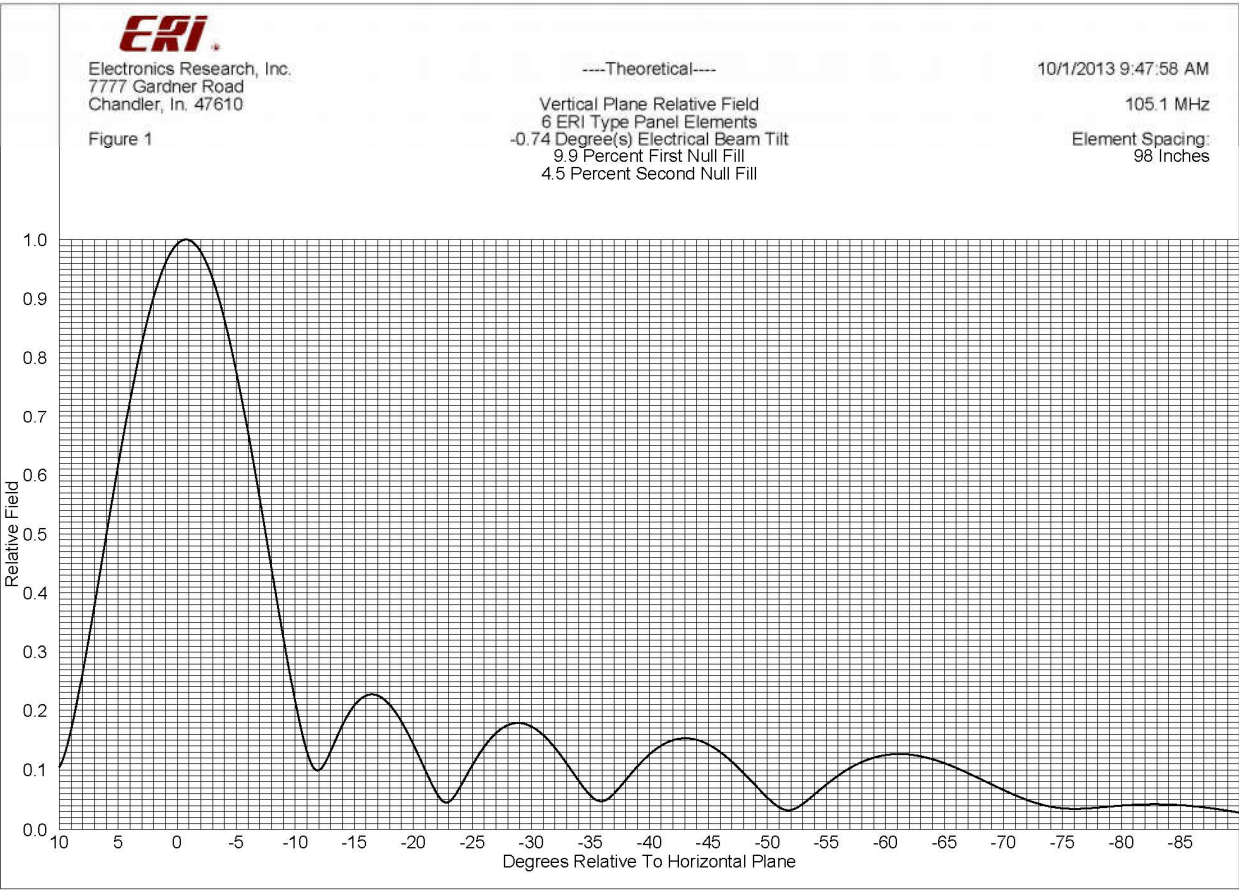
1) Power Rating Listed is as Designed Only. Actual Power Capabilities May Vary.

2) When Terminated in 50 Ohm Resistive Load.



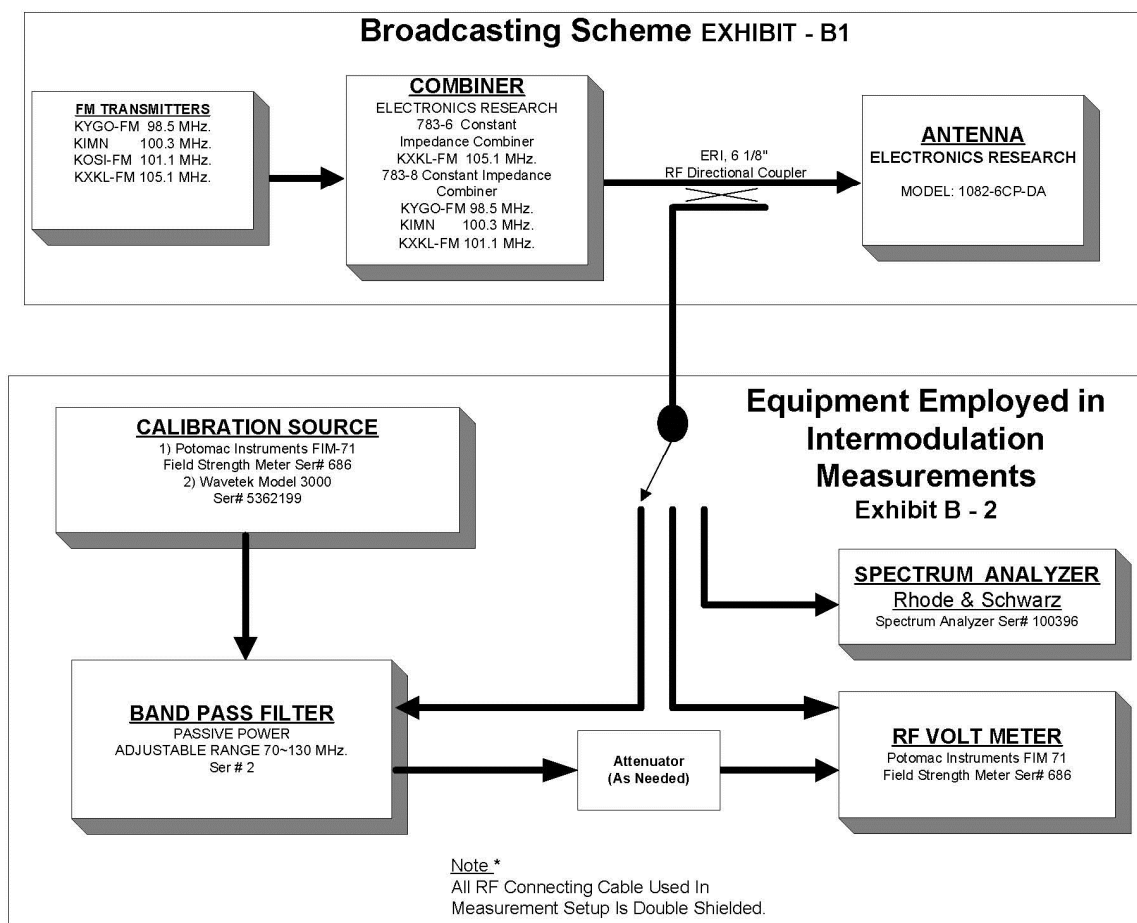






# Broadcasting Scheme and Equipment Employed in Intermodulation Measurements

EXHIBIT B



**Exhibit 10**

**Attachment III**

**Maximum Permissible RF Exposure Measurement Report**

**APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**



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# Maximum Permissible Exposure (MPE) Survey for KYGO-FM (98.5 MHz) on Mt. Morrison, CO

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August 21, 2018

## For Bonneville International Corporation

55 North 300 West, 2nd Floor  
Salt Lake City, UT 84101  
FCC File #BPH-20171115AAK



Jay M. Jacobsmeyer, P.E.  
7222 Commerce Center Drive, Suite 180  
Colorado Springs, CO 80919  
(303) 759-5111  
[jacobsmeyer@pericle.com](mailto:jacobsmeyer@pericle.com)

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# **Maximum Permissible Exposure (MPE) Survey For KYGO-FM (98.5 MHz) on Mt. Morrison, CO**

## **1.0 Executive Summary**

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This report documents a Maximum Permissible Exposure (MPE) survey to satisfy Special Operating Conditions or Restrictions #7 of FCC Construction Permit #BPH-20171115AAK:

“The permittee/licensee must, upon completion of construction and during the equipment test period, make proper radiofrequency electromagnetic (RF) field strength measurements throughout the transmitter site area, including all nearby towers, to determine if there are any areas that exceed the FCC guidelines for human exposure to RF fields. If necessary, a fence must be erected at such distances and in such a manner as to prevent the exposure of humans to RF fields in excess of the FCC Guidelines (OET Bulletin No. 65, Edition 97-01, August 1997). The fence must be a type which will preclude casual or inadvertent access, and must include warning signs at appropriate intervals which describe the nature of the hazard. Any areas within the fence found to exceed the recommended guidelines must be clearly marked with appropriate visual warning signs.”

The applicant, KYGO-FM, has constructed a transmitter facility on Mt. Morrison in Jefferson County, Colorado at 39° 40' 24.40" N 105° 13' 2.50" W (NAD 27) and 7,720' AMSL. The antenna is a directional master FM antenna.

An MPE survey was conducted on August 14, 2018 using a broadband exposure meter and following methods recommended in OET-65 [2] and ANSI C95.3-2010 [3]. At the time of this survey, three other stations were also operating from the master FM antenna, all at full licensed power: 100.3 MHz, 105.1 MHz and 101.1 MHz (TPOs verified on site). Measurements were collected at ground level, on the roof of the transmitter building and inside the transmitter building. All measurements at ground level outside the perimeter fence were well below the FCC general population exposure limit. The highest reading was recorded at ground level inside the fence and roughly 100' north of the tower at 92% of occupational, which is above the FCC general population exposure limit but below the occupational limit. Only personnel falling into the occupational category are allowed to enter this area.

The tower facility is enclosed by two perimeter fences: the main fence and the fence extension. The main fence, which includes the transmitter building, ice bridge and tower, is an 8' high chain link fence topped with three strands of barbed wire. The main fence is designed to prevent access to areas that may exceed the FCC occupational limit. The fence extension is a 4' high, 5 strand plain wire fence and is designed to provide a barrier to the public and to indicate areas that may exceed the general population exposure limit. RF Notice signs (Blue) and RF Caution signs (Yellow) are posted on the fence extension and main fence, respectively, to indicate to the public

that levels inside the fence may exceed the general population limit or the occupational limit.

Personnel who do not automatically fall into the occupational exposure category are not allowed to work inside the main fence unless escorted. The entire perimeters of the main fence and the fence extension were inspected during the MPE survey and fence integrity is intact in both cases. Blue RF Notice signs are posted conspicuously on the fence extension. The sole vehicle gate is locked at all times when personnel are not working on the site. There is no evidence of hiking trails through or near the facility. The facility is located on private land, is remote from populated areas, and is accessible by a road owned by the site owner. The lower gate on Grapevine Road is located 2.2 miles west of the site and prevents unauthorized vehicle traffic.

We can therefore conclude that the facility complies with FCC rule parts 1.1307-1.1310 governing human exposure to radio frequency energy.

## 2.0 FCC Exposure Limits and Compliance

---

2.1 FCC Exposure Standards. To protect the public from harmful exposure, the FCC requires its licensees to comply with its published radio frequency exposure standards, found in Parts 1.1307 through 1.1310 of Title 47 of the Code of Federal Regulations [5]. FCC exposure limits are based on voluntary standards published by the American National Standards Institute (ANSI) and the National Council on Radiation Protection and Measurement (NCRP). Jefferson County's exposure standards and the FCC's are essentially the same.

The term radio frequency *radiation* is often used to describe the fields emitted by radio antennas, but we must distinguish between the non-ionizing radiation from radio waves and the ionizing radiation from much higher frequency sources such as X-rays. It is physically impossible for radio frequency sources to cause ionization in the human body. Consequently, there is no similarity between the biological effects of ionizing radiation (X-rays) and non-ionizing radiation (radio waves).

We must also distinguish radio frequency fields from extremely low frequency (ELF) fields such as those associated with 60 Hz power lines. ELF fields do not readily radiate from their source and are an entirely different phenomenon.

FCC rules apply different standards for occupational, or *controlled* environments and general population, or *uncontrolled* environments. The definitions of controlled and uncontrolled environments are as found in the FCC rules [5]:

**Controlled Environment** - "Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also

apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.”

**Uncontrolled Environment** - “General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.”

By virtue of its rural location on private property, the Mt. Morrison antenna site is a controlled environment and the occupational limit applies. Specifically, the FCC requires that accessible areas that exceed the general population exposure limit in controlled areas (if any) be posted so that the public is (1) aware of the potential for exposure and (2) can control their exposure. There is no compelling reason for the public to be trespassing on the property, but if trespassing, they can easily avoid these areas to get back to adjacent public or private property. To ensure that areas that exceed the general population limit are clearly marked, the site owner has fenced these areas with a 4’ high, 5 strand, plain wire fence with blue RF Notice signs as shown in Figure 1.



Figure 1 - Fence Extension and Blue RF Notice Sign

The transmitter building and tower are fenced with a more substantial 8' high chain link fence topped with three strands of barbed wire. This fence is designed to prevent unauthorized access to the tower, ice bridge and building. See Figure 2.



Figure 2 - Main Fence and Vehicle Gate

For controlled environments, the FCC sets a limit of 1 milliwatt/cm<sup>2</sup> in the VHF band (30-300 MHz). In the lower UHF band (300 MHz - 1.5 GHz), the FCC limit is a function of frequency and is given by the expression  $f/300$  milliwatts/cm<sup>2</sup>, where  $f$  is the frequency in MHz. In the FM and television broadcast bands, the general population limit is exactly a factor of five below the occupational limit. For uncontrolled environments, the FCC sets a standard of 0.2 milliwatt/cm<sup>2</sup> in the VHF band (30-300 MHz) which includes the FM broadcast band. In this band, the general population limit is exactly a factor of five below the occupational limit. The FCC exposure standards are plotted as functions of frequency in Figure 3.



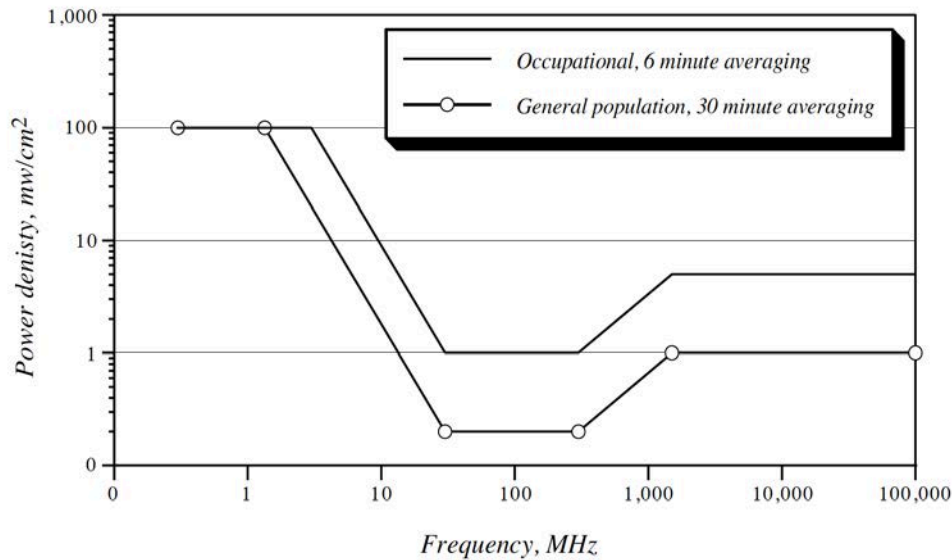


Figure 3 - FCC Exposure Standards  
(Plane wave equivalent E-field power density values)

The human body does not react to high power densities instantaneously and short-term exposure to levels exceeding FCC power density limits does not necessarily exceed the FCC exposure limits. The FCC limits are for whole-body exposure averaged over a period of 6 minutes for controlled environments and 30 minutes for uncontrolled environments [1], [2], [5]. For example, if a radio technician is exposed to a power density of 0.5 milliwatts/cm<sup>2</sup> for a period of 4 minutes and then enters a field of 1.5 milliwatts/cm<sup>2</sup> for a period of 2 minutes, the average exposure in the six minute period is 0.83 milliwatts/cm<sup>2</sup> which is below the FCC limit for controlled environments.

Although other Federal agencies enforce and may even publish RF exposure standards (e.g., OSHA), the governing standard for communications sites is the FCC standard. The FCC prepared an easy-to-read publication explaining its RF exposure policy [6]. This publication is available from the FCC web site at [www.fcc.gov](http://www.fcc.gov).

**2.2 Ensuring Compliance.** If the radio site has a single transmitter, one can ensure compliance by comparing the predicted power density to the FCC standard for the transmitter frequency. When the site has multiple transmitters operating over a wide range of frequencies, it becomes more difficult to ensure compliance. For example, if a tower has a paging antenna at 929 MHz and an FM broadcast antenna at 99.9 MHz, which standard do we apply for occupational exposure, 3.1 mW/cm<sup>2</sup> or 1.0 mW/cm<sup>2</sup>?

In these situations, the FCC directs that a fraction of the standard be computed for each source. If the sum of the fractions is less than 1.0, the site is in compliance. Mathematically, this

requirement is stated as

$$Q = \sum_{i=1}^M \frac{S_i}{S_{FCC}(f_i)} \leq 1.0 \quad (1)$$

where  $M$  = the number of radiating antennas at the site,  $S_i$  = the average power density from antenna  $i$ ,  $f_i$  = the operating frequency of antenna  $i$ , and  $S_{FCC}(f_i)$  = the FCC power density limit for frequency  $f_i$ .

On congested sites, a non-compliance condition may be caused by numerous transmitters belonging to many different licensees. The FCC recognizes that it may be impractical to assign responsibility to every transmitter contributing to the measured power density, so the Commission employs a 5% rule in these situations. In other words, only those stations that contribute 5% or more of the applicable exposure standard are responsible for correcting the problem. This rule is reproduced below from 47 CFR 1.1307(b)(3) (Oct. 1, 2017):

“(3) In general, when the guidelines specified in Sec. 1.1310 are exceeded in an accessible area due to the emissions from multiple fixed transmitters, actions necessary to bring the area into compliance are the shared responsibility of all licensees whose transmitters produce, at the area in question, power density levels that exceed 5% of the power density exposure limit applicable to their particular transmitter or field strength levels that, when squared, exceed 5% of the square of the electric or magnetic field strength.”

### 3.0 Measurement Approach and Results

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Spatial average power density measurements were collected at over 50 locations in the vicinity of the transmit antenna, ERI Model 1182-6CP-DA-SP. This antenna is a 6-bay panel antenna with two antenna elements per bay, oriented toward 70 degrees true with a cardioid azimuth pattern. Vertical distance between radiating elements is short spaced (less than one wavelength) to achieve an array pattern with greatly reduced downward radiation. See Figure 4 for a photo of the master FM antenna.

The KYGO 98.5-FM transmitter was verified to be operating at 14.2 kW during the survey which corresponds to 100% transmitter power output and an ERP of 100 kW (directional, with downtilt). The other three stations sharing the antenna, 100.3, 105.1 and 101.1, were also verified to be operating at full power during the survey.



Figure 4 - ERI Master FM Antenna (observer is facing southwest)

The MPE survey was accomplished on August 14, 2018 by Jay Jacobsmeyer (*Pericle*) with Bonneville chief engineer Brad Hart present. Measurements were conducted in accordance with the guidelines published in ANSI C95.3-2010 [3] and FCC Bulletin OET-65 [2]. The survey was accomplished with the test equipment listed in Table 1.

Table 1 - Test Equipment Used in Survey		
Instrument	Serial Number	Cal. Due (2 yr.)
Wandel & Goltermann (W&G) EMR-300	B-0053	February 24, 2019
Wandel & Goltermann Type 25.1 Probe, 300 kHz - 40 GHz	B-0053	February 24, 2019



The FCC standard is a whole-body average exposure standard, so the measurements must be taken over a volume comparable to that occupied by a standing adult. The W&G probe and meter record power density as percent of the FCC controlled environment standard. The W&G meter also performs an automatic average as the user sweeps the volume of interest. To perform a spatial average with the W&G meter, we used either a vertical straight line method (for levels well below FCC limits) or the zig-zag method (for levels approaching the FCC limit) shown in Figure 5.

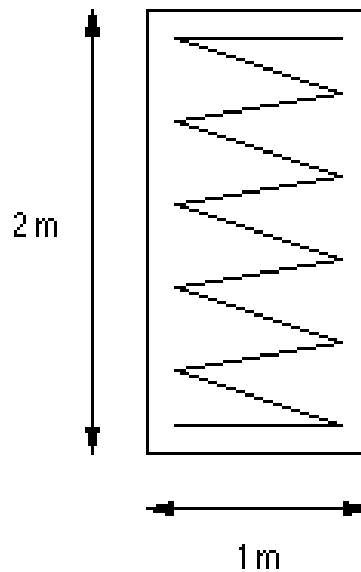


Figure 5 - Zig-zag method for automatic spatial averaging

Measurements were always taken at least 20 cm from reflecting objects in accordance with ANSI C95.3-2010.

Over 50 measurements were collected. Measurement values are shown in Figure 6 (red font) in units of percent of FCC occupational exposure limit. Note that the FCC general population limit is exactly a factor of five below the occupational limit, so measurement values below 20% in Figure 6 are below the general population limit. All locations outside the fence extension measured less than the general population exposure limit (20% of occupational) and all locations inside the main fence measured below the occupational limit. Locations inside the building measured below 1% of occupational. Note that locations near the building, including the parking area, are low by design due to the azimuth pattern. Also note that measured power densities are strongly dependent on terrain and that the fence extension was purposely placed on lower terrain to ensure lower power densities on its perimeter.

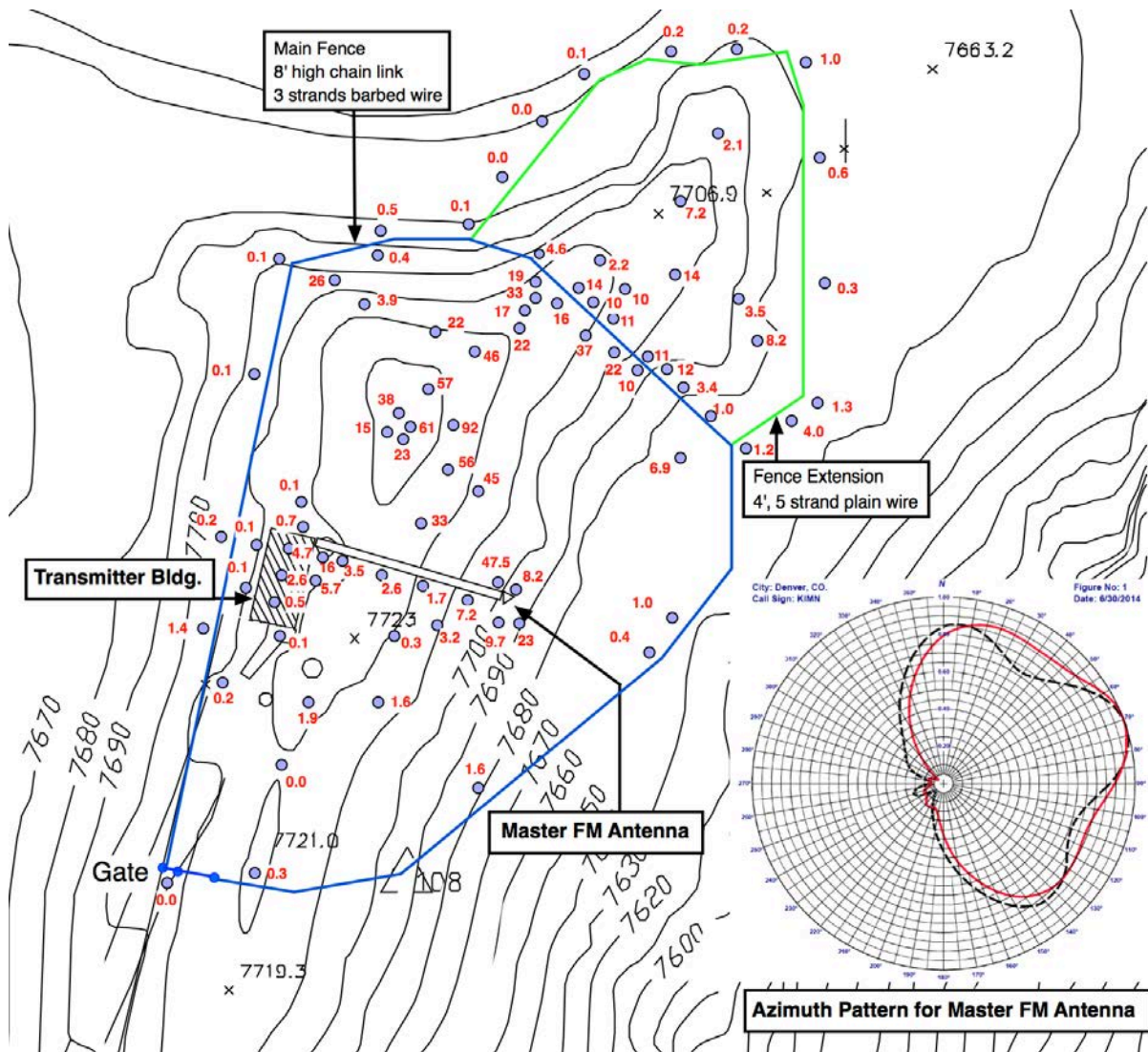


Figure 6 - Measurement Values (Percent of Occupational Limit)

#### 4.0 Conclusions and Recommendations

Spatial average exposure measurements were collected at over 50 locations in the vicinity of the transmit antenna, including the rooftop of the transmitter building. All measurements outside the fence extension are below the FCC general population exposure limit. We can conclude that the facility complies with FCC Rule Parts 1.1307-1.1310 governing human exposure to radio frequency energy.

At the time of the survey on August 14, 2018, we found that additional RF Caution signs should be posted so that it is more clear to the general population where there is risk of exposure to

radio frequency power densities exceeding the occupational exposure limit. RF Notice signs were already posted on the fence extension in accordance with FCC guidelines on the day of the MPE survey.

New RF Caution Signs should be posted at the following locations:

- On the tower at its base
- On the vehicle gate
- On the main fence along its entire perimeter, roughly every 20'-30'

See Figure 7 for examples of RF Notice and RF Caution signs.

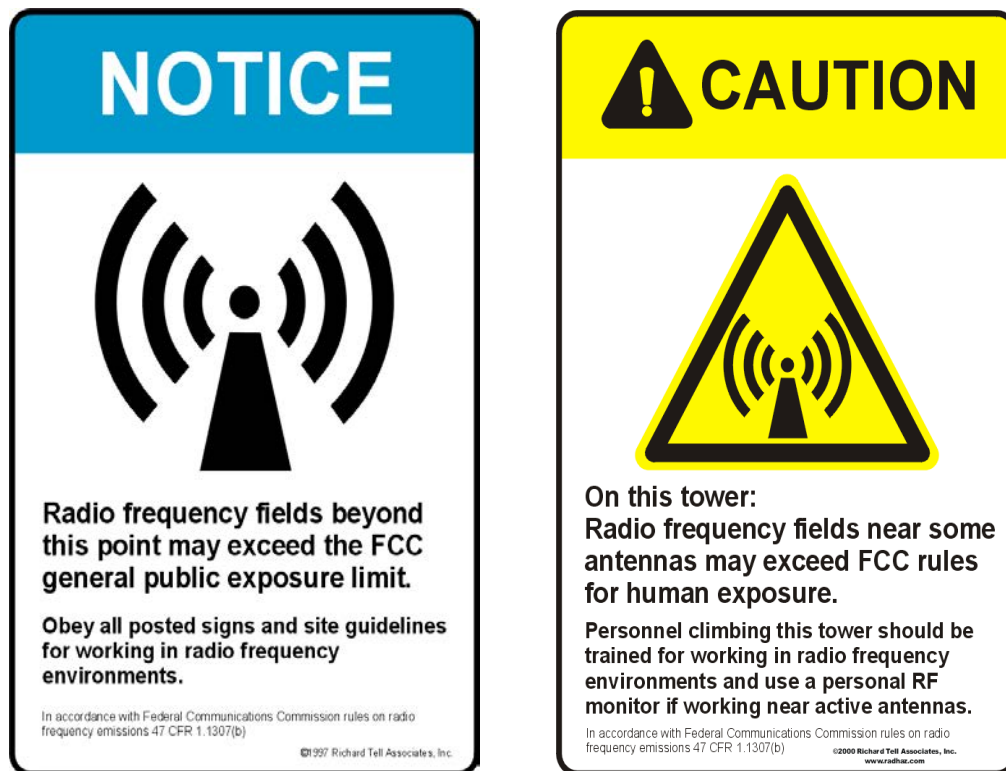


Figure 7 - RF Notice and RF Caution Signs (Available from Tessco and other distributors)

We understand that the site manager and Chief Engineer of KYGO-FM have ensured these RF Caution signs are installed at time of this writing (August 21, 2018).

## 5.0 References

---

- [1] ANSI C95.1-2005, "Safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz."
- [2] OET Bulletin No. 65, FCC, "Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields," Edition 97-01, August 1997.
- [3] ANSI C95.3-2010, "Recommended practice for the measurement of hazardous electromagnetic fields - RF and microwave."
- [4] ANSI C95.2-1999, "American National Standard radio frequency radiation hazard warning symbol."
- [5] Code of Federal Regulation, Title 47, Parts 1.1307 - 1.1310, October 1, 2017.
- [6] OET-56, "Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields," August 1999.

## 6.0 Engineer's Statement

---

Mt. Morrison  
Jefferson County, CO

This Maximum Permissible Exposure (MPE) survey addressed electromagnetic radiation in the from 300 kHz to 300 GHz. Fields from extremely low frequency (ELF) sources, such as those emitted by 60 Hz electrical distribution lines, were not measured. Also, induced and contact radio frequency currents were not measured.

Tower climbers should carry portable power density meters (e.g., Nardalert™) to verify that transmitter powers have been reduced to safe levels before working in the vicinity of high power transmit antennas. Transmission line lockouts are available at this site and should be used when working on the tower.

Measurements were conducted according to procedures described in OET-65, ANSI C95.3-2010 and the user's manual for the meter used. Our conclusions are limited to those locations actually measured or predicted. All measurements were conducted with test equipment assumed to be calibrated and working properly. If new high power transmitters are installed at the site, measured power densities will change.

This survey shows that the new 98.5-FM transmitter facility complies with FCC guidelines for human exposure to radio frequency energy.

All representations contained herein are true to the best of my knowledge. I am a radio engineer with over 35 years experience. I hold a Bachelor of Science degree in Electrical Engineering from Virginia Tech and a Master of Science degree in Electrical Engineering from Cornell University. I am a corporate officer and stockholder of Pericle Communications Company and a Registered Professional Engineer in the State of Colorado.

Signed this 21st day of August, 2018.



Jay M. Jacobsmeyer, P.E., President  
CO PE License #28768  
Pericle Communications Company

**Exhibit 10**

**Attachment IV**

**Antenna System Proof-of-Performance**

**APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**



## ***Directional Antenna System for KYGO, Denver, Colorado***

September 14, 2017

Electronics Research Inc. is providing a custom fabricated multiplexed directional antenna system that is specially designed to meet the FCC requirements and the general needs of radio station KYGO.

The antenna is the ERI model 1182-6CP-DA-SP configuration. The circular polarized system consists of 98" spaced bays using two driven circular polarized radiating element per bay. The antenna was mounted on the North 70 degrees East tower leg with bracketry to provide an antenna orientation of North 70 degrees East. The antenna was tested on a 42" lambda tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 98.5 megahertz, which is the center of the FM broadcast channel assigned to KYGO.

The other FM stations that will be transmitting from this directional antenna are KVOD @ 88.1 MHz, KUVO @ 89.3 MHz, KCFR-FM @ 90.1 MHz and KXKL @ 105.1 MHz., KIMN @ 100.3, KOSI @ 101.1

Pattern measurements were made on a sixty-acre antenna pattern range that is owned and operated by Electronics Research, Inc. The tests were performed under the direction of Thomas B. Silliman, president of Electronics Research, Inc. Mr. Silliman has the Bachelor of Electrical Engineering and the Master of Electrical Engineering degrees from Cornell University and is a registered professional engineer in the states of Indiana, Maryland and Minnesota.



# Directional Antenna System For KYGO, Denver, Colorado

(Continued)

## DESCRIPTION OF THE TEST PROCEDURE

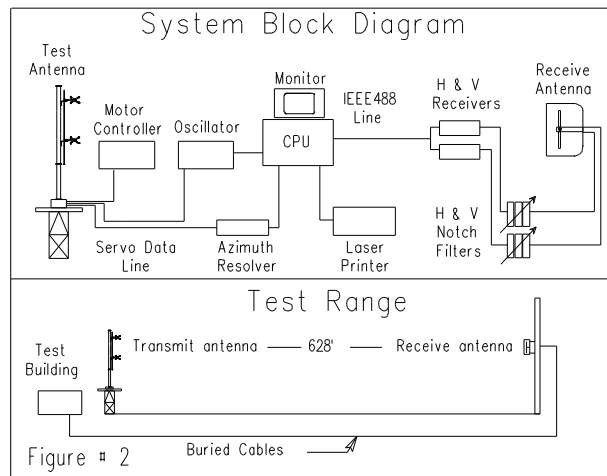
The test antenna consisted of one bay of the circular polarized system. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna. All devices included in the test model were properly grounded during all tests.

The power distribution and phase relationship to the antenna elements was adjusted in order to achieve the directional radiation patterns for both horizontal and vertical polarization components.

The proof-of-performance was accomplished using a 42" ERI tower with identical dimension and configuration including all braces, ladders, conduits, coaxial lines and other appurtenances that are included in the actual aperture at which the antenna will be installed. The structure was erected vertically on a turntable mounted on a non-metallic building with the antenna centered vertically on the structure, making the center of radiation of the test approximately 30 feet above ground. The turntable is equipped with a motor drive and a US Digital angle position indicator. The resolution of this angle position indicator is one-hundredth of a degree.

The antenna under test was operated in the transmitting mode and fed from a HP8657D signal generator. The frequency of the signal source was set at 98.5 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

A broadband horizontal and vertical dipole system, located approximately 628 feet from the test antenna, was used to receive the emitted test signals. The dipole system was mounted at the same height above terrain as the center of the antenna under test.





# Directional Antenna System For KYGO, Denver, Colorado

(Continued)

The signals received by the dipole system were fed to the test building by way of two buried Heliac cables to a Rohde & Schwarz measuring receiver. This data was interfaced to a laser jet printer by means of a computer system. Relative field strength was plotted as a function of azimuth.

The measurements were performed by rotating the test antenna in a counter-clockwise direction and plotting the received signal on polar coordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

## CONCLUSIONS

The circular polarized system consists of six 98" spaced bays using two driven circular polarized radiating element per bay. The power distribution and phase relationship will be fixed when the antenna is manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The 1182-6CP-DA-SP array is to be mounted on the North 70 degrees East tower leg of the 42" ERI tower at a bearing of North 70 degrees East. Blue prints provided with the antenna will show the proper antenna orientation alignment. The antenna alignment procedure should be directed by a licensed surveyor as prescribed by the FCC.

Figure #1 represents the measured individual horizontal and vertical components, the composite maximum of either the horizontal or vertical component at any azimuth and the FCC filed envelope pattern. The horizontal plane relative field list for the composite pattern and the individual H & V components are shown as Figure #1 & 1A respectively. The actual measured pattern does not exceed the authorized FCC composite pattern at any azimuth. A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach 100.000 kilowatts (20.000 dBk).

The RMS of the vertically polarized horizontal plane component does not exceed the RMS of the horizontally polarized horizontal plane component.

Directional Antenna System  
For  
KYGO, Denver, Colorado

(Continued)

The composite horizontal and vertical maximum relative field pattern obtained from the measured data as shown on Figure #1 has an RMS that is greater than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 55 feet 10 inches.

The directional antenna should not be mounted on the top of an antenna tower that includes a top-mounted platform larger than the cross-sectional area of the tower in the horizontal plane. No obstructions other than those that are specified by the blue prints supplied with the antenna are to be mounted within 75 ft. horizontally of the system.

The vertical distance to the nearest obstruction should be a minimum of 10 ft. from the directional antenna. Metallic guy wires should be a minimum distance of forty feet horizontally from the antenna.

ELECTRONICS RESEARCH, INC.

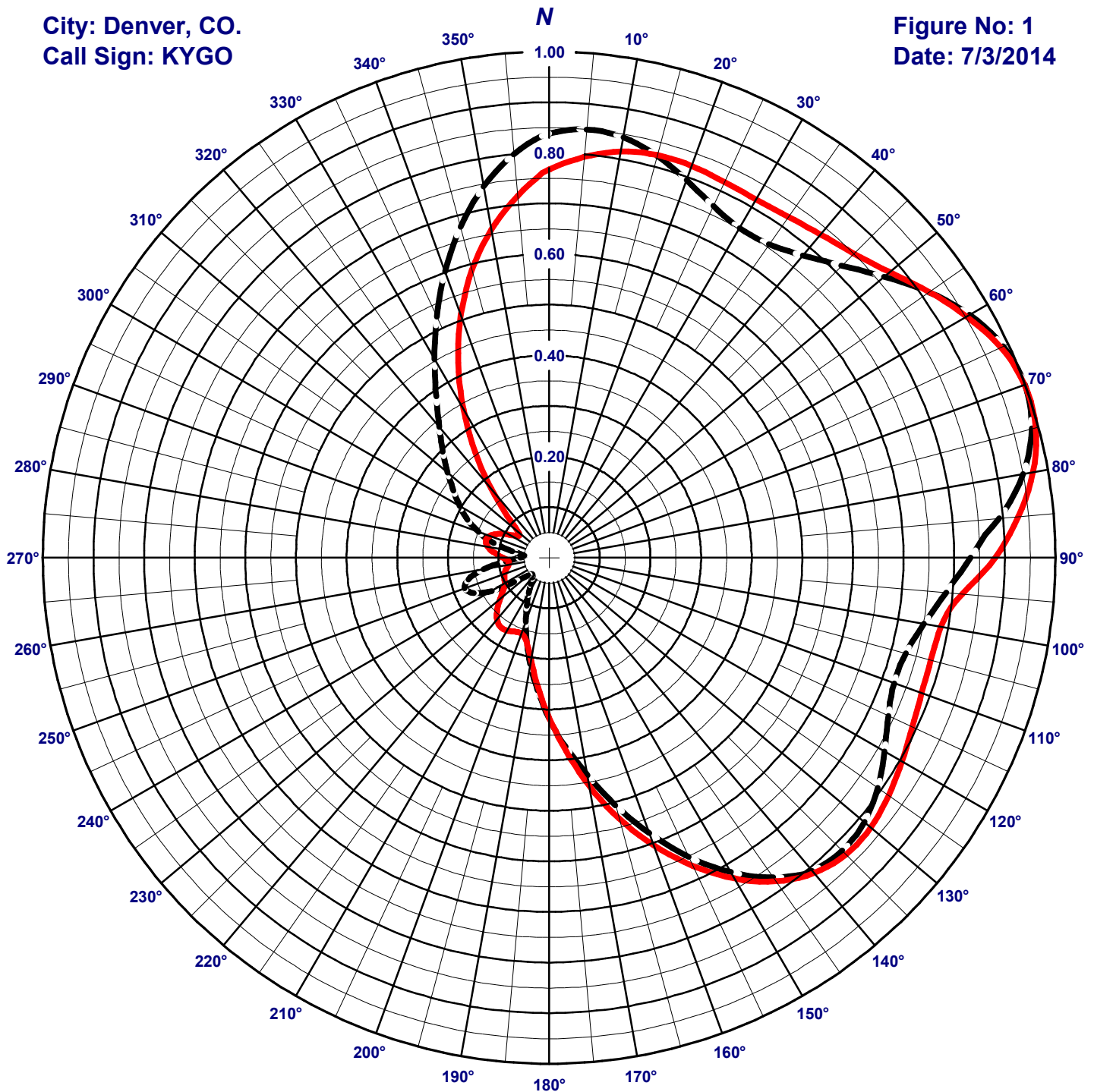
A handwritten signature in black ink, reading "Tom Scharf". The signature is written in a cursive style with a large, stylized "T" and "S".

The Microsoft Word document on file electronically at Electronic Research, Inc. governs the specifications, scope, and configuration of the product described. All other representations whether verbal, printed, or electronic are subordinate to the master copy of this document on file at ERI.

# ERI<sup>®</sup> Horizontal Plane Relative Field Pattern

City: Denver, CO.  
Call Sign: KYGO

Figure No: 1  
Date: 7/3/2014



Frequency: 98.5 MHz  
Antenna Type: 1182-6CP-DA-SP  
Antenna Orientation: 70° True  
Antenna Mounting: Custom  
Tower Type 42" Lambda

**VERTICAL**  
RMS: .604  
Maximum: 1 @ 70°  
Minimum: .046 @ 226°

**HORIZONTAL**  
RMS: .605  
Maximum: 1 @ 71°  
Minimum: .073 @ 307°

Measured patterns of the horizontal and vertical components.

# ERI® Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1

Date: 7/3/2014

Station: KYGO

Antenna: 1182-6CP-DA-SP

Location: Denver, CO.

Antenna Orientation: 70° True

Frequency: 98.5 MHz

Number of Bays: 6

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.838	70.250	18.466	Vertical	180°	0.318	10.098	10.043	Vertical
5°	0.849	72.162	18.583	Vertical	185°	0.263	6.893	8.384	Vertical
10°	0.843	71.102	18.519	Vertical	190°	0.214	4.562	6.592	Vertical
15°	0.824	67.883	18.318	Horizontal	195°	0.172	2.971	4.729	Horizontal
20°	0.824	67.834	18.315	Horizontal	200°	0.160	2.550	4.066	Horizontal
25°	0.819	67.083	18.266	Horizontal	205°	0.161	2.603	4.155	Horizontal
30°	0.818	66.838	18.250	Horizontal	210°	0.166	2.765	4.417	Horizontal
35°	0.823	67.687	18.305	Horizontal	215°	0.167	2.791	4.457	Horizontal
40°	0.834	69.541	18.422	Horizontal	220°	0.160	2.562	4.085	Horizontal
45°	0.850	72.324	18.593	Horizontal	225°	0.145	2.098	3.218	Horizontal
50°	0.878	77.105	18.871	Horizontal	230°	0.126	1.597	2.033	Horizontal
55°	0.916	83.855	19.235	Horizontal	235°	0.110	1.218	0.857	Horizontal
60°	0.959	92.046	19.640	Vertical	240°	0.131	1.720	2.355	Vertical
65°	0.990	97.914	19.908	Vertical	245°	0.165	2.713	4.335	Vertical
70°	1.000	100.000	20.000	Vertical	250°	0.177	3.144	4.974	Vertical
75°	0.995	99.005	19.957	Horizontal	255°	0.165	2.719	4.343	Vertical
80°	0.970	94.167	19.739	Horizontal	260°	0.132	1.736	2.396	Vertical
85°	0.930	86.454	19.368	Horizontal	265°	0.085	0.729	-1.370	Vertical
90°	0.882	77.710	18.905	Horizontal	270°	0.091	0.832	-0.801	Horizontal
95°	0.819	67.028	18.263	Horizontal	275°	0.108	1.176	0.706	Horizontal
100°	0.786	61.739	17.906	Horizontal	280°	0.123	1.520	1.818	Horizontal
105°	0.781	60.934	17.849	Horizontal	285°	0.129	1.674	2.238	Horizontal
110°	0.783	61.313	17.876	Horizontal	290°	0.148	2.202	3.429	Vertical
115°	0.791	62.630	17.968	Horizontal	295°	0.178	3.154	4.989	Vertical
120°	0.805	64.764	18.113	Horizontal	300°	0.203	4.141	6.171	Vertical
125°	0.819	67.020	18.262	Horizontal	305°	0.230	5.309	7.250	Vertical
130°	0.829	68.774	18.374	Horizontal	310°	0.261	6.833	8.346	Vertical
135°	0.829	68.776	18.374	Horizontal	315°	0.297	8.801	9.445	Vertical
140°	0.814	66.187	18.208	Horizontal	320°	0.338	11.412	10.574	Vertical
145°	0.781	60.981	17.852	Horizontal	325°	0.389	15.147	11.803	Vertical
150°	0.732	53.563	17.289	Horizontal	330°	0.453	20.481	13.113	Vertical
155°	0.672	45.146	16.546	Horizontal	335°	0.525	27.589	14.407	Vertical
160°	0.605	36.580	15.632	Horizontal	340°	0.601	36.168	15.583	Vertical
165°	0.534	28.487	14.546	Horizontal	345°	0.677	45.779	16.607	Vertical
170°	0.458	21.016	13.226	Horizontal	350°	0.745	55.440	17.438	Vertical
175°	0.384	14.721	11.679	Horizontal	355°	0.800	64.048	18.065	Vertical

Horizontal Polarization:

Maximum: 7.503 (8.752 dB)

Horizontal Plane: 7.406 (8.696 dB)

Maximum ERP: 100.000 kW

Vertical Polarization:

Maximum: 7.503 (8.752 dB)

Horizontal Plane: 7.406 (8.696 dB)

Maximum ERP: 100.000 kW

Total Input Power: 13.329 kW

Reference: KYGO1M.FIG

This list shows the the maximum azimuth values of either the horizontal or vertical components.

# ERI<sup>®</sup> Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1A

Date: 7/3/2014

Station: KYGO

Antenna: 1182-6CP-DA-SP

Location: Denver, CO.

Antenna Orientation: 70° True

Frequency: 98.5 MHz

Number of Bays: 6

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.768	58.924	17.703	0.838	70.250	18.466	180°	0.316	9.994	9.997	0.318	10.098	10.043
5°	0.795	63.170	18.005	0.849	72.162	18.583	185°	0.256	6.561	8.169	0.263	6.893	8.384
10°	0.815	66.389	18.221	0.843	71.102	18.519	190°	0.206	4.240	6.273	0.214	4.562	6.592
15°	0.824	67.883	18.318	0.822	67.616	18.301	195°	0.172	2.971	4.729	0.171	2.921	4.656
20°	0.824	67.834	18.315	0.794	63.013	17.994	200°	0.160	2.550	4.066	0.135	1.810	2.576
25°	0.819	67.083	18.266	0.767	58.819	17.695	205°	0.161	2.603	4.155	0.104	1.090	0.374
30°	0.818	66.838	18.250	0.752	56.586	17.527	210°	0.166	2.765	4.417	0.081	0.649	-1.879
35°	0.823	67.687	18.305	0.757	57.249	17.578	215°	0.167	2.791	4.457	0.063	0.397	-4.017
40°	0.834	69.541	18.422	0.780	60.817	17.840	220°	0.160	2.562	4.085	0.052	0.267	-5.734
45°	0.850	72.324	18.593	0.817	66.679	18.240	225°	0.145	2.098	3.218	0.047	0.218	-6.622
50°	0.878	77.105	18.871	0.864	74.584	18.726	230°	0.126	1.597	2.033	0.055	0.300	-5.225
55°	0.916	83.855	19.235	0.915	83.739	19.229	235°	0.110	1.218	0.857	0.084	0.708	-1.498
60°	0.952	90.691	19.576	0.959	92.046	19.640	240°	0.101	1.024	0.103	0.131	1.720	2.355
65°	0.984	96.834	19.860	0.990	97.914	19.908	245°	0.098	0.952	-0.213	0.165	2.713	4.335
70°	0.999	99.850	19.993	1.000	100.000	20.000	250°	0.094	0.888	-0.516	0.177	3.144	4.974
75°	0.995	99.005	19.957	0.986	97.318	19.882	255°	0.088	0.774	-1.111	0.165	2.719	4.343
80°	0.970	94.167	19.739	0.950	90.344	19.559	260°	0.081	0.663	-1.783	0.132	1.736	2.396
85°	0.930	86.454	19.368	0.892	79.565	19.007	265°	0.081	0.653	-1.851	0.085	0.729	-1.370
90°	0.882	77.710	18.905	0.832	69.276	18.406	270°	0.091	0.832	-0.801	0.056	0.318	-4.970
95°	0.819	67.028	18.263	0.787	61.933	17.919	275°	0.108	1.176	0.706	0.049	0.244	-6.129
100°	0.786	61.739	17.906	0.752	56.489	17.520	280°	0.123	1.520	1.818	0.074	0.547	-2.616
105°	0.781	60.934	17.849	0.729	53.175	17.257	285°	0.129	1.674	2.238	0.113	1.280	1.071
110°	0.783	61.313	17.876	0.725	52.559	17.206	290°	0.125	1.562	1.937	0.148	2.202	3.429
115°	0.791	62.630	17.968	0.739	54.634	17.375	295°	0.111	1.239	0.932	0.178	3.154	4.989
120°	0.805	64.764	18.113	0.765	58.529	17.674	300°	0.091	0.833	-0.795	0.203	4.141	6.171
125°	0.819	67.020	18.262	0.792	62.804	17.980	305°	0.075	0.558	-2.536	0.230	5.309	7.250
130°	0.829	68.774	18.374	0.813	66.042	18.198	310°	0.080	0.640	-1.936	0.261	6.833	8.346
135°	0.829	68.776	18.374	0.819	67.027	18.262	315°	0.116	1.353	1.311	0.297	8.801	9.445
140°	0.814	66.187	18.208	0.808	65.250	18.146	320°	0.178	3.166	5.005	0.338	11.412	10.574
145°	0.781	60.981	17.852	0.771	59.490	17.744	325°	0.254	6.472	8.110	0.389	15.147	11.803
150°	0.732	53.563	17.289	0.718	51.495	17.118	330°	0.338	11.458	10.591	0.453	20.481	13.113
155°	0.672	45.146	16.546	0.652	42.521	16.286	335°	0.425	18.095	12.576	0.525	27.589	14.407
160°	0.605	36.580	15.632	0.580	33.594	15.263	340°	0.510	25.983	14.147	0.601	36.168	15.583
165°	0.534	28.487	14.546	0.506	25.625	14.087	345°	0.588	34.606	15.391	0.677	45.779	16.607
170°	0.458	21.016	13.226	0.436	19.023	12.793	350°	0.658	43.293	16.364	0.745	55.440	17.438
175°	0.384	14.721	11.679	0.375	14.069	11.483	355°	0.718	51.490	17.117	0.800	64.048	18.065

Horizontal Polarization:

Maximum: 7.503 (8.752 dB)

Horizontal Plane: 7.406 (8.696 dB)

Maximum ERP: 100.000 kW

Vertical Polarization:

Maximum: 7.503 (8.752 dB)

Horizontal Plane: 7.406 (8.696 dB)

Maximum ERP: 100.000 kW

Total Input Power: 13.329 kW

Reference: KYGO1M.FIG

This list shows the azimuth values for the horizontal and vertical components.

ELECTRONICS RESEARCH, INC.  
7777 GARDNER ROAD  
CHANDLER, IN. 47610

FIGURE 8

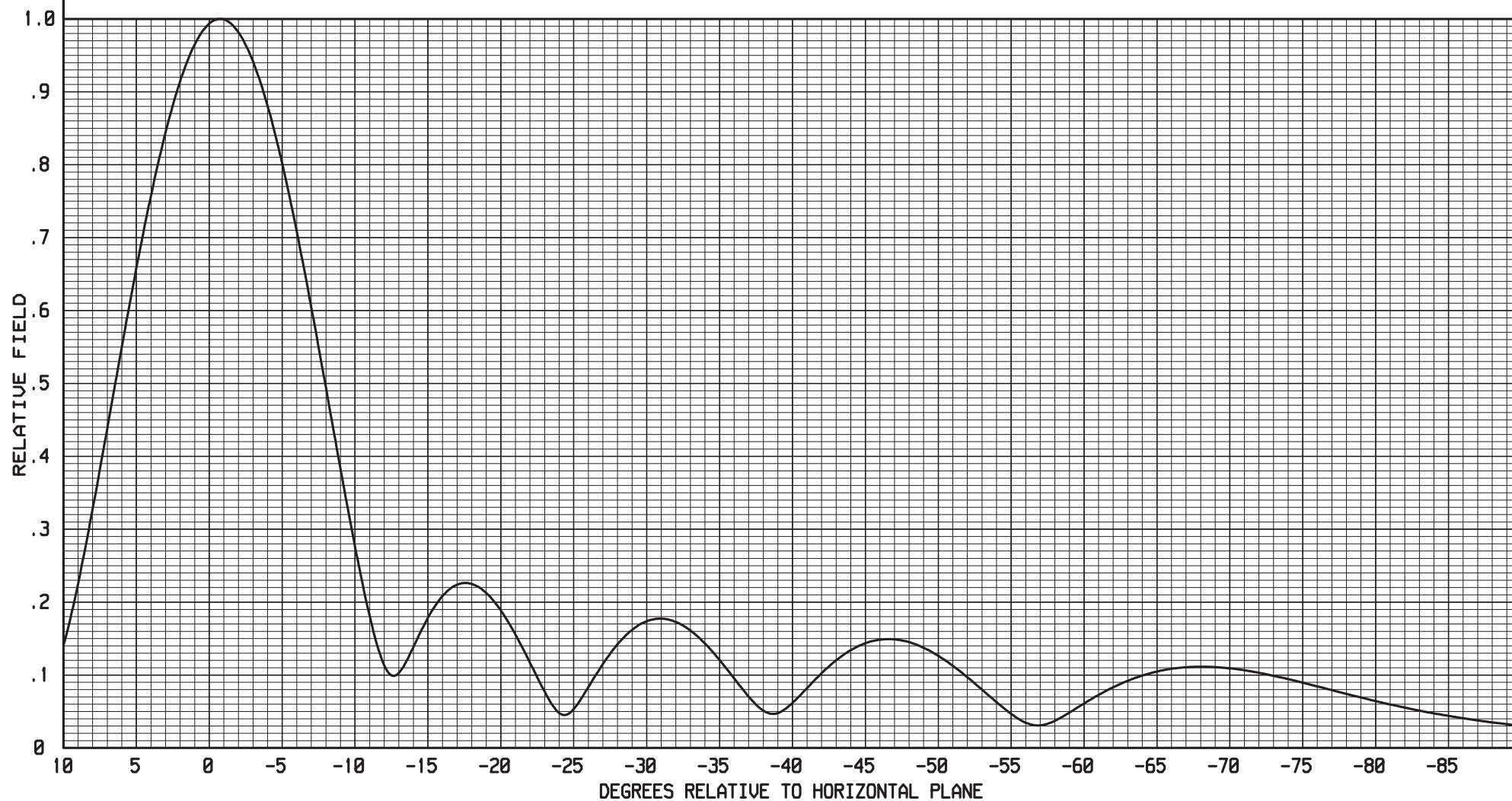
-----THEORETICAL-----  
VERTICAL PLANE RELATIVE FIELD

6 LEVELS OF ERI PANEL ELEMENTS  
-.74 DEGREE(S) BEAM TILT  
10 PERCENT FIRST NULL FILL  
4 PERCENT SECOND NULL FILL

JUNE 30, 2014

98.5 MHz.

BAY SPACING:  
98.00 INCHES



ELECTRONICS RESEARCH, INC.

7777 GARDNER ROAD

CHANDLER, IN. 47610

FIGURE 8

JUNE 30, 2014

ERI PANEL ELEMENTS ANTENNA

98.5 MHZ. 6 LEVELS SPACED 98 INCHES

THETA	FIELD
DEGREES	VALUE

90	.0194
89.75	.0198
89.5	.0201
89.25	.0205
89	.0209
88.75	.0213
88.5	.0216
88.25	.022
88	.0224
87.75	.0228
87.5	.0232
87.25	.0236
87	.0241
86.75	.0245
86.5	.0249
86.25	.0254
86	.0259
85.75	.0263
85.5	.0268
85.25	.0273
85	.0279
84.75	.0284
84.5	.0289
84.25	.0295
84	.0301
83.75	.0307
83.5	.0314
83.25	.032
83	.0327
82.75	.0335
82.5	.0342
82.25	.035
82	.0358
81.75	.0366
81.5	.0375
81.25	.0384
81	.0393
80.75	.0403
80.5	.0413
80.25	.0423
80	.0434
79.75	.0445
79.5	.0456
79.25	.0468
79	.048
78.75	.0492
78.5	.0505
78.25	.0518
78	.0532
77.75	.0545

77.5	.0559
77.25	.0574
77	.0588
76.75	.0603
76.5	.0618
76.25	.0634
76	.0649
75.75	.0665
75.5	.0681
75.25	.0698
75	.0714
74.75	.0731
74.5	.0748
74.25	.0765
74	.0782
73.75	.0799
73.5	.0816
73.25	.0833
73	.085
72.75	.0867
72.5	.0884
72.25	.0902
72	.0918
71.75	.0935
71.5	.0952
71.25	.0968
71	.0985
70.75	.1
70.5	.102
70.25	.103
70	.105
69.75	.106
69.5	.108
69.25	.109
69	.11
68.75	.112
68.5	.113
68.25	.114
68	.115
67.75	.116
67.5	.117
67.25	.118
67	.119
66.75	.12
66.5	.12
66.25	.121
66	.122
65.75	.122
65.5	.122
65.25	.123
65	.123
64.75	.123
64.5	.123
64.25	.122
64	.122
63.75	.122
63.5	.121
63.25	.12
63	.12
62.75	.119
62.5	.118



## MM6DA8.TAB

62.25	.116
62	.115
61.75	.114
61.5	.112
61.25	.11
61	.109
60.75	.107
60.5	.105
60.25	.102
60	.1
59.75	.0975
59.5	.0949
59.25	.0921
59	.0893
58.75	.0863
58.5	.0832
58.25	.08
58	.0767
57.75	.0733
57.5	.0699
57.25	.0664
57	.0628
56.75	.0592
56.5	.0556
56.25	.052
56	.0485
55.75	.0451
55.5	.0419
55.25	.039
55	.0364
54.75	.0344
54.5	.033
54.25	.0323
54	.0325
53.75	.0335
53.5	.0353
53.25	.0378
53	.0408
52.75	.0443
52.5	.0482
52.25	.0523
52	.0567
51.75	.0612
51.5	.0658
51.25	.0704
51	.0751
50.75	.0798
50.5	.0845
50.25	.0892
50	.0938
49.75	.0983
49.5	.103
49.25	.107
49	.111
48.75	.115
48.5	.119
48.25	.123
48	.127
47.75	.13
47.5	.133
47.25	.136

47	.139
46.75	.142
46.5	.144
46.25	.146
46	.148
45.75	.15
45.5	.151
45.25	.152
45	.153
44.75	.153
44.5	.154
44.25	.153
44	.153
43.75	.152
43.5	.151
43.25	.15
43	.148
42.75	.146
42.5	.144
42.25	.141
42	.138
41.75	.135
41.5	.131
41.25	.127
41	.123
40.75	.119
40.5	.114
40.25	.11
40	.105
39.75	.0993
39.5	.0939
39.25	.0884
39	.0829
38.75	.0774
38.5	.0719
38.25	.0666
38	.0616
37.75	.057
37.5	.0532
37.25	.0502
37	.0483
36.75	.0477
36.5	.0485
36.25	.0506
36	.054
35.75	.0584
35.5	.0635
35.25	.0692
35	.0753
34.75	.0817
34.5	.0883
34.25	.0949
34	.102
33.75	.108
33.5	.115
33.25	.121
33	.127
32.75	.133
32.5	.139
32.25	.145
32	.15

31.75	.155
31.5	.159
31.25	.163
31	.167
30.75	.17
30.5	.173
30.25	.175
30	.177
29.75	.179
29.5	.18
29.25	.18
29	.18
28.75	.179
28.5	.178
28.25	.176
28	.174
27.75	.171
27.5	.167
27.25	.163
27	.159
26.75	.154
26.5	.148
26.25	.142
26	.136
25.75	.129
25.5	.122
25.25	.114
25	.106
24.75	.0979
24.5	.0896
24.25	.0812
24	.0729
23.75	.065
23.5	.0577
23.25	.0516
23	.0473
22.75	.0455
22.5	.0466
22.25	.0505
22	.0567
21.75	.0645
21.5	.0733
21.25	.0829
21	.0928
20.75	.103
20.5	.113
20.25	.123
20	.134
19.75	.143
19.5	.153
19.25	.162
19	.171
18.75	.179
18.5	.187
18.25	.194
18	.201
17.75	.207
17.5	.212
17.25	.217
17	.221
16.75	.224

16.5	.226
16.25	.227
16	.228
15.75	.227
15.5	.226
15.25	.223
15	.22
14.75	.216
14.5	.211
14.25	.205
14	.198
13.75	.19
13.5	.181
13.25	.172
13	.162
12.75	.151
12.5	.141
12.25	.13
12	.12
11.75	.111
11.5	.104
11.25	.1
11	.0997
10.75	.104
10.5	.113
10.25	.125
10	.141
9.75	.159
9.5	.18
9.25	.202
9	.225
8.75	.25
8.5	.275
8.25	.301
8	.328
7.75	.355
7.5	.382
7.25	.41
7	.438
6.75	.466
6.5	.494
6.25	.522
6	.55
5.75	.577
5.5	.605
5.25	.632
5	.658
4.75	.684
4.5	.709
4.25	.734
4	.758
3.75	.781
3.5	.803
3.25	.824
3	.844
2.75	.863
2.5	.882
2.25	.899
2	.914
1.75	.929
1.5	.942

## MM6DA8.TAB

1.25	.954
1	.965
.75	.974
.5	.982
.25	.989
0	.994
-.25	.997
-.5	.999
-.75	1
-1	.999
-1.25	.997
-1.5	.993
-1.75	.988
-2	.982
-2.25	.974
-2.5	.964
-2.75	.954
-3	.941
-3.25	.928
-3.5	.914
-3.75	.898
-4	.881
-4.25	.863
-4.5	.843
-4.75	.823
-5	.802
-5.25	.78
-5.5	.757
-5.75	.733
-6	.708
-6.25	.683
-6.5	.657
-6.75	.631
-7	.604
-7.25	.577
-7.5	.55
-7.75	.522
-8	.494
-8.25	.466
-8.5	.438
-8.75	.41
-9	.383
-9.25	.355
-9.5	.328
-9.75	.302
-10	.276
-10.25	.251
-10.5	.226
-10.75	.203
-11	.181
-11.25	.161
-11.5	.142
-11.75	.126
-12	.113
-12.25	.104
-12.5	.0996
-12.75	.0993
-13	.103
-13.25	.109
-13.5	.118
-13.75	.128

-14	.138
-14.25	.149
-14.5	.159
-14.75	.169
-15	.179
-15.25	.187
-15.5	.195
-15.75	.202
-16	.208
-16.25	.214
-16.5	.218
-16.75	.221
-17	.224
-17.25	.226
-17.5	.226
-17.75	.226
-18	.225
-18.25	.223
-18.5	.22
-18.75	.217
-19	.213
-19.25	.207
-19.5	.202
-19.75	.195
-20	.188
-20.25	.181
-20.5	.173
-20.75	.164
-21	.155
-21.25	.146
-21.5	.137
-21.75	.127
-22	.117
-22.25	.107
-22.5	.0967
-22.75	.0868
-23	.0772
-23.25	.0682
-23.5	.06
-23.75	.053
-24	.048
-24.25	.0454
-24.5	.0455
-24.75	.0484
-25	.0534
-25.25	.0599
-25.5	.0673
-25.75	.0752
-26	.0833
-26.25	.0915
-26.5	.0996
-26.75	.107
-27	.115
-27.25	.122
-27.5	.129
-27.75	.136
-28	.142
-28.25	.148
-28.5	.153
-28.75	.158
-29	.162

-29.25	.166
-29.5	.169
-29.75	.172
-30	.174
-30.25	.175
-30.5	.177
-30.75	.177
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-31.75	.175
-32	.173
-32.25	.171
-32.5	.168
-32.75	.165
-33	.161
-33.25	.157
-33.5	.153
-33.75	.148
-34	.143
-34.25	.138
-34.5	.132
-34.75	.127
-35	.121
-35.25	.114
-35.5	.108
-35.75	.102
-36	.0954
-36.25	.089
-36.5	.0826
-36.75	.0764
-37	.0704
-37.25	.0647
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-37.75	.0549
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-38.5	.047
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-39.25	.0501
-39.5	.0533
-39.75	.0572
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-40.25	.0665
-40.5	.0716
-40.75	.0768
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-42.75	.116
-43	.12
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-43.75	.131
-44	.134
-44.25	.137

-44.5	.139
-44.75	.142
-45	.144
-45.25	.145
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-48.75	.14
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-49.5	.132
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-50	.126
-50.25	.123
-50.5	.12
-50.75	.116
-51	.113
-51.25	.109
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-54.25	.0586
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-55.25	.0432
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-57.75	.0349
-58	.0372
-58.25	.0398
-58.5	.0426
-58.75	.0455
-59	.0485
-59.25	.0516
-59.5	.0547



-59.75	.0578
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-60.25	.064
-60.5	.067
-60.75	.0699
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-61.25	.0755
-61.5	.0781
-61.75	.0807
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-62.75	.09
-63	.0921
-63.25	.0941
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-64.5	.102
-64.75	.104
-65	.105
-65.25	.106
-65.5	.107
-65.75	.108
-66	.109
-66.25	.109
-66.5	.11
-66.75	.11
-67	.111
-67.25	.111
-67.5	.111
-67.75	.111
-68	.111
-68.25	.111
-68.5	.111
-68.75	.111
-69	.111
-69.25	.111
-69.5	.11
-69.75	.11
-70	.109
-70.25	.109
-70.5	.108
-70.75	.107
-71	.107
-71.25	.106
-71.5	.105
-71.75	.104
-72	.103
-72.25	.102
-72.5	.101
-72.75	.1
-73	.099
-73.25	.0978
-73.5	.0967
-73.75	.0956
-74	.0944
-74.25	.0932
-74.5	.092
-74.75	.0907

-75	.0895
-75.25	.0882
-75.5	.087
-75.75	.0857
-76	.0844
-76.25	.0831
-76.5	.0818
-76.75	.0805
-77	.0793
-77.25	.078
-77.5	.0767
-77.75	.0754
-78	.0741
-78.25	.0729
-78.5	.0716
-78.75	.0703
-79	.0691
-79.25	.0679
-79.5	.0667
-79.75	.0655
-80	.0643
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-80.75	.0608
-81	.0596
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-81.5	.0574
-81.75	.0563
-82	.0553
-82.25	.0542
-82.5	.0532
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-83.5	.0493
-83.75	.0483
-84	.0474
-84.25	.0465
-84.5	.0456
-84.75	.0448
-85	.0439
-85.25	.0431
-85.5	.0423
-85.75	.0415
-86	.0407
-86.25	.04
-86.5	.0392
-86.75	.0385
-87	.0378
-87.25	.0371
-87.5	.0364
-87.75	.0357
-88	.035
-88.25	.0344
-88.5	.0337
-88.75	.0331
-89	.0325
-89.25	.0319
-89.5	.0313
-89.75	.0307
-90	.0302

# Directional Antenna System for KYGO, Denver, Colorado

(Continued)

## ANTENNA SPECIFICATIONS

Antenna Type: 1182-6CP-DA-SP  
Frequency: 98.5 MHz  
Number of Bays: Six

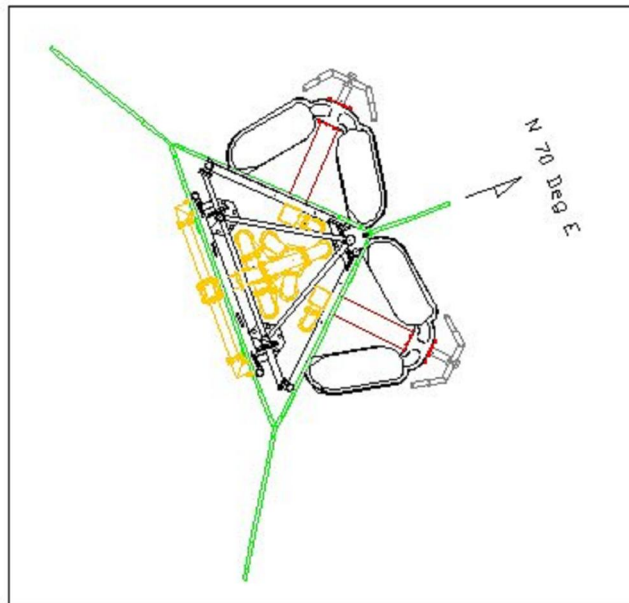
## MECHANICAL SPECIFICATIONS

Mounting: Custom  
System length: 48 ft 4 inches  
Aperture length required: 55 ft 10 inches  
Orientation: 70° true  
Input flange to the antenna 6 1/8" female.

## ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP:	100.000 kW (20.000 dBk)
Horizontal maximum power gain:	7.503 (8.752 dB)
Horizontal plane H pol gain:	7.406 (8.696 dB)
Maximum vertical ERP:	100.000 kW (20.000 dBk)
Vertical maximum power gain:	7.503 (8.752 dB)
Horizontal plane V pol gain:	7.406 (8.696 dB)
Total input power:	13.329 kW (11.248 dBk)



**Exhibit 10**

**Attachment V**

**Antenna Orientation – Land Surveyor's Report**

**APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**

# CHAMBERS CONSULTING, INC.

Land Surveying-Planning  
chaconinc@chamberscon.com

L.G. "Gus" Chambers, PLS  
Jamee Rogers Chambers, AICP  
303-697-0650

805 Bear Creek Avenue  
Mail: P.O. Box 339  
Morrison, CO 80465-0339

To Whom It May Concern:  
From: L. G. "Gus" Chambers, PLS  
Colorado Registration No. 16099  
Date: December 5, 2015  
Subject: FCC Azimuth Determination

On December 3, 2015 I established a four point baseline, centered along the direction of the upper element of the transmitter tower. My GPS contractor made observations at all four of the rebar baseline points and, after processing, I determined an azimuth of  $69^{\circ}37'07''$ .

The methodology was GPS RTK using a one point localization with WGS84 North as the basis of rotation. A Leica system 1200 GPS was used for these observations. We also determined the east wall of the transmitter building to have an azimuth  $11^{\circ}55'40''$ .



**Exhibit 10**

**Attachment VI**

**Engineer's Certification**

**APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**

**Bonneville International Corporation**

Application for License to Cover CP, KYGO-FM, 98.5 MHz


F.C.C. File Number BPH-20171115AAK

**ENGINEER'S CERTIFICATION**

I, Jay M. Jacobsmeyer, P.E. of Denver, Colorado do hereby certify that I specified and personally oversaw the installation of the KYGO(FM) directional antenna referenced in the instant application. I have also recently inspected the combiner installation of this master FM antenna system. I can certify that the antenna and combiner system is installed in compliance with all manufacturer's instructions and standards of good engineering practice.

I further certify that I am an experienced and qualified licensed professional engineer with 25 years experience engineering FM and TV broadcast antenna systems and I have supervised the installation of several directional FM antennas. I am the principal in Pericle Communications Company and my qualifications are a matter of record with the Federal Communications Commission.

Signed this 17th day of August, 2018.



Jay M. Jacobsmeyer, P.E.

7222 Commerce Center Drive, Suite 180

Colorado Springs, CO 80919

(303) 759-5111

jacobsmeyer@pericle.com

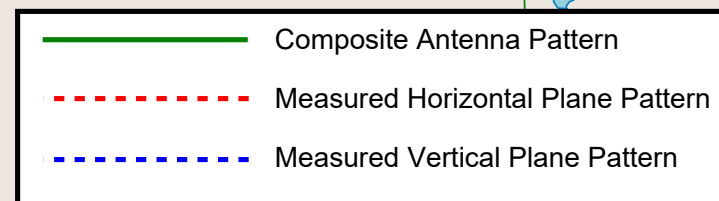
**Exhibit 10**

**Attachment VII**

**Principal Community Coverage**

**APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**



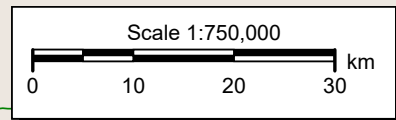


Principal Community  
Denver, CO

**EXHIBIT 10 - ATTACHMENT VII**  
**PRINCIPAL COMMUNITY COVERAGE**  
**PREDICTED 70 dB $\mu$  CONTOURS**

*Prepared September 2018 for*  
**Bonneville International Corporation**  
KYGO-FM Denver, CO Facility ID 30829  
Chan 253C0 98.5 MHz 100 kW (MAX-DA) 341 m HAAT

**Cavell, Mertz & Associates, Inc.**  
Manassas, Virginia

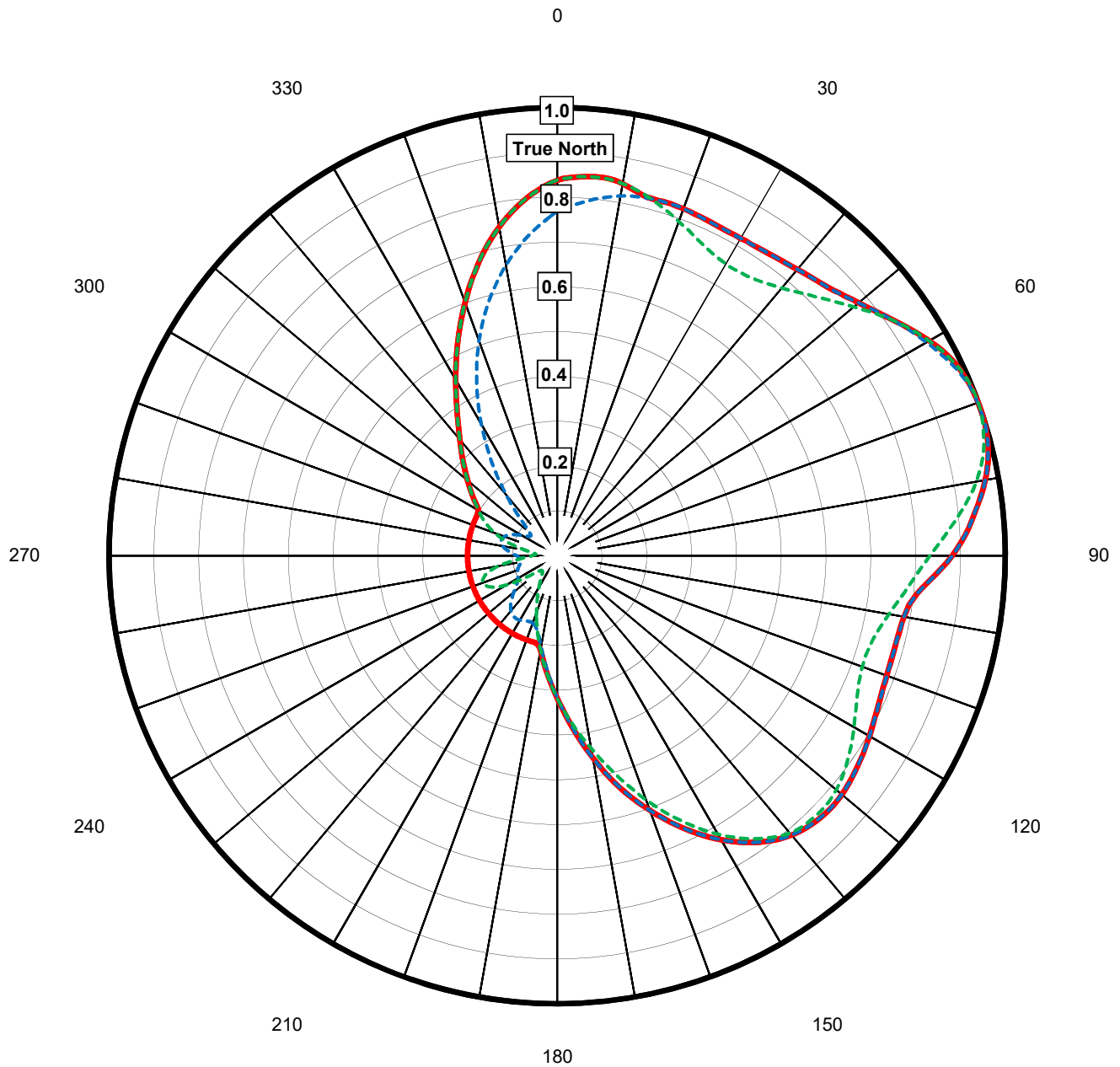


**Exhibit 10**

**Attachment VIII and VIII-A**

**Demonstration that the Measured Horizontally Polarized  
And Vertically Polarized Patterns  
Do Not Exceed the Authorized Composite (Envelope) Pattern**

**APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)**



**KYGO-FM Relative Field Pattern Comparison**

**Red Solid** = "Composite" Envelope Pattern

**Blue Dashed** = Measured Horizontal Polarization

**Green Dashed** = Measured Vertical Polarization

**Exhibit 10 - Attachment VIII**  
**Horizontal Plane Pattern Comparison**  
**(Maximum field of 1.0 equals 100 kW)**

prepared September 2018 for

**Bonneville International Corporation**

KYGO-FM Denver, Colorado

FCC Facility ID 30829

Ch. 253C0 98.5 MHz 100 kW (MAX-DA) 341 m

**Cavell, Mertz & Associates, Inc.**  
 Manassas, Virginia

## Exhibit 10

### Attachment VIII-A

## Horizontal Plane Pattern Comparison

APPLICATION FOR STATION LICENSE  
Supporting FCC Construction Permit BPH-20171115AAK  
KYGO-FM Denver, Colorado (Facility ID 30829)

Bearing (Degrees T)	Composite (Envelope) Pattern Field	Horizontal Polarization Field	Vertical Polarization Field	Does H-Pol Exceed Composite?	Does V-Pol Exceed Composite?	Bearing (Degrees T)	Composite (Envelope) Pattern Field	Horizontal Polarization Field	Vertical Polarization Field	Does H-Pol Exceed Composite?	Does V-Pol Exceed Composite?
0°	0.838	0.768	0.838	No	No	180°	0.318	0.316	0.318	No	No
5°	0.849	0.795	0.849	No	No	185°	0.263	0.256	0.263	No	No
10°	0.843	0.815	0.843	No	No	190°	0.214	0.206	0.214	No	No
15°	0.824	0.824	0.822	No	No	195°	0.200	0.172	0.171	No	No
20°	0.824	0.824	0.794	No	No	200°	0.200	0.160	0.135	No	No
25°	0.819	0.819	0.767	No	No	205°	0.200	0.161	0.104	No	No
30°	0.818	0.818	0.752	No	No	210°	0.200	0.166	0.081	No	No
35°	0.823	0.823	0.757	No	No	215°	0.200	0.167	0.063	No	No
40°	0.834	0.834	0.780	No	No	220°	0.200	0.160	0.052	No	No
45°	0.850	0.850	0.817	No	No	225°	0.200	0.145	0.047	No	No
50°	0.878	0.878	0.864	No	No	230°	0.200	0.126	0.055	No	No
55°	0.916	0.916	0.915	No	No	235°	0.200	0.110	0.084	No	No
60°	0.959	0.952	0.959	No	No	240°	0.200	0.101	0.131	No	No
65°	0.990	0.984	0.990	No	No	245°	0.200	0.098	0.165	No	No
70°	1.000	0.999	1.000	No	No	250°	0.200	0.094	0.177	No	No
75°	0.995	0.995	0.986	No	No	255°	0.200	0.088	0.165	No	No
80°	0.970	0.970	0.950	No	No	260°	0.200	0.081	0.132	No	No
85°	0.930	0.930	0.892	No	No	265°	0.200	0.081	0.085	No	No
90°	0.882	0.882	0.832	No	No	270°	0.200	0.091	0.056	No	No
95°	0.819	0.819	0.787	No	No	275°	0.200	0.108	0.049	No	No
100°	0.786	0.786	0.752	No	No	280°	0.200	0.123	0.074	No	No
105°	0.781	0.781	0.729	No	No	285°	0.200	0.129	0.113	No	No
110°	0.783	0.783	0.725	No	No	290°	0.200	0.125	0.148	No	No
115°	0.791	0.791	0.739	No	No	295°	0.200	0.111	0.178	No	No
120°	0.805	0.805	0.765	No	No	300°	0.203	0.091	0.203	No	No
125°	0.819	0.819	0.792	No	No	305°	0.230	0.075	0.230	No	No
130°	0.829	0.829	0.813	No	No	310°	0.261	0.080	0.261	No	No
135°	0.829	0.829	0.819	No	No	315°	0.297	0.116	0.297	No	No
140°	0.814	0.814	0.808	No	No	320°	0.338	0.178	0.338	No	No
145°	0.781	0.781	0.771	No	No	325°	0.389	0.254	0.389	No	No
150°	0.732	0.732	0.718	No	No	330°	0.453	0.338	0.453	No	No
155°	0.672	0.672	0.652	No	No	335°	0.525	0.425	0.525	No	No
160°	0.605	0.605	0.580	No	No	340°	0.601	0.510	0.601	No	No
165°	0.534	0.534	0.506	No	No	345°	0.677	0.588	0.677	No	No
170°	0.458	0.458	0.436	No	No	350°	0.745	0.658	0.745	No	No
175°	0.384	0.384	0.375	No	No	355°	0.800	0.718	0.800	No	No