



ENGINEERING STATEMENT
IN SUPPORT OF
REQUEST FOR EXPERIMENTAL AUTHORIZATION
FOR
ATSC 3.0 OPERATION
BOARD OF TRUSTEES, MICHIGAN STATE UNIVERSITY
WKAR-TV
EAST LANSING, MI

Background

Board of Trustees, Michigan State University (MSU), the licensee of WKAR, East Lansing, MI (Facility ID: 6104) was granted Special Temporary Authority (LMS File#0000053377)^{1/} to operate an experimental facility on Ch. 35, a vacant channel in its market, in order to evaluate the new ATSC 3.0 standard. The facility has been used to test the various options (components/modes/techniques) in the ATSC 3.0 standard to gain a better understanding of how ATSC 3.0 compares to the current ATSC 1.0 broadcast standard and how ATSC 3.0 could be used for broadcast services in the future.

^{1/} MSU has subsequently filed for a renewal of the experimental STA which is still pending (LMS File#0000063984).

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CORPORATE OFFICE
1475 NORTH 200 WEST
NEPHI, UT 84648

TEL: (435) 623-8601
FAX: (435) 623-8610

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6197 MILLER RD.
SWARTZ CREEK, MI 48473

TEL: (810)-226-0750



As identified by MSU in its previous filings regarding the request for STA, use of Ch. 35 was contingent on the transition of WAQP (Saginaw, MI) from its current channel to Ch. 36 in Phase 3, as the experimental operation on Ch. 35 is predicted to cause interference above 0.5% to the WAQP Ch. 36 post-transition operation. The testing period for Phase 3 begins on April 13, 2019. Therefore, the experimental ATSC 3.0 operation must move to another channel to avoid interference. The best available alternative channel appears to be Ch. 32 and MSU is seeking a new experimental STA to change from Ch. 35 to Ch. 32.

Channel/Antenna System/Tower

MSU intends to operate the STA facility on Ch. 32 from the WKAR tower (ASR#1265362) with the following parameters:

Ch. 32 STA Operation

Coordinates: 42° 42' 06.9" N (NAD83)
84° 24' 47.8" W
ERP: 70.0 kW (DA)
RCAMSL: 411.5m

The facility will continue utilizing the existing directional ERI I230ECW-8-23 side-mounted broadband antenna (azimuth and elevation pattern data attached hereto). The antenna is elliptically polarized, but the vertically polarized radiation does not exceed the horizontally polarized component in any azimuth.

Should the Commission grant MSU authority to operate the experimental facility on Ch. 32, MSU plans to transition from Ch. 35 to Ch. 32 by May 2019. MSU recognizes that it can only continue operation on Ch. 32 until Phase 8, at which time WDIV-TV (Detroit, MI) will move to

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Ch. 32. The proposed experimental operation on Ch. 32 is predicted to cause interference above 0.5% to the WDIV-TV Ch. 32 post-transition operation; therefore, prior to the Phase 8 testing phase (starting 1/18/2020), MSU will either apply to use an alternative channel for its experimental ATSC 3.0 operation or cease operation entirely.

Interference

Both pre-repack and post-repack transition interference check studies were run using the FCC TVStudy software (Version 2.2.5) for the proposed experimental facility parameters (summary results for each study are attached hereto). The summary results of the pre-repack transition study show that the proposed facility is predicted to cause more than 0.5% new interference only to the pending maximization application for WFQX-TV (Ch. 32 at Cadillac, MI). [Note: interference cases have been highlighted in yellow in the attached summary results of the interference studies.]

Since the pending WFQX-TV maximization application (LMS File#0000035809) has not yet been granted, the proposed experimental facility on Ch. 32 will not cause WFQX-TV interference above the 0.5% limit until its maximized facility has been constructed and is operational. MSU has discussed its proposed operation with the licensee of WFQX-TV and it plans to coordinate the experimental operation on Ch. 32 with them so that its facility will not cause any interference should the pending WFQX-TV maximization application be granted and the licensee builds-out the maximized facility.

The summary results of the post-repack transition study show that the proposed facility is predicted to cause more than 0.5% new interference to WDIV-TV (Ch. 32 at Detroit, MI) and the pending maximization application for WFQX-TV (Ch. 32 at Cadillac, MI). WDIV-TV has been assigned Phase 8 for its post-transition construction date, so the proposed experimental facility on

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Ch. 32 will not cause any interference to WDIV-TV until the Phase 8 testing date of January 18, 2020 at the earliest. As mentioned above, MSU will either apply to use an alternative channel for its experimental ATSC 3.0 operation or cease operation entirely prior to the start of the Phase 8 testing date in order to avoid this interference issue.

The proposed facility will comply with all FCC out-of-band emission requirements for full-service DTV stations through the use of a mask filter. MSU will make a good faith effort to identify and notify local health care facilities within the predicted service area of its proposed operation on Ch. 32.

Environmental/RFR

This report addresses only the conditions specified in 47CFR1.1307 that deal with Radio Frequency Radiation. Any other non-RFR conditions that might require the preparation of an EA are beyond the scope of this report; since the structure is existing and registered, such conditions should not be an issue requiring further consideration.

The location of the proposed post-incentive auction facility is assumed to currently be “in compliance” with FCC guidelines for human exposure to RFR (as defined in OET-65). The worst case ground level RFR contributed to the site by this proposal in public areas is calculated to be 0.006462 mW/cm^2 , which is less than 5% of the MPE for public exposure (0.387333 mW/cm^2) at Ch. 32 (578-584 MHz). The contribution to the overall RFR from the proposed facility is negligible and, therefore, the site will remain “in compliance” with FCC guidelines.

MSU agrees to comply with the Commission’s requirements regarding power adjustments or cessation of operation as may be necessary to ensure a compliant environment for worker

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access. Workers will be trained on RFR issues and encouraged to wear personal RFR monitors when on the structure. The tower base is enclosed by a locked security fence and appropriate signage warning of potential RFR hazards is posted.

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SWARTZ CREEK, MI 48473

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TVStudy Interference Study - WKAR Ch. 32 Pre-Transition Experimental Operation

Study created: 2019.03.26 15:24:14

Study build station data: LMS TV 2019-03-24

Proposal: WKAR-TV D32 DT EXP EAST LANSING, MI
 File number: KARC32-ERIr230-70k-Pre
 Facility ID: 6104
 Station data: User record
 Record ID: 1412
 Country: U.S.
 Zone: I

Build options:
 Protect pre-transition records not on baseline channel

Search options:
 Non-U.S. records included
 All post-transition APP, CP, and baseline records excluded

Stations potentially affected by proposal:

IX	Call	Chan	Svc	Status	City, State	File Number	Distance
No	WANE-TV	D31	DT	LIC	FORT WAYNE, IN	BLCDT20090622ACE	189.7 km
No	WICD	D32	DT	LIC	CHAMPAIGN, IL	BLANK0000059351	413.2
No	WMEU-CD	D32	DC	LIC	CHICAGO, IL	BLDTA20131212ABK	280.3
No	WSPY-LD	D32	LD	LIC	LA SALLE, IL	BLANK0000016586	361.7
Yes	WFQX-TV	D32	DT	LIC	CADILLAC, MI	BLCDT20091217ACU	176.2
Yes	WFQX-TV	D32	DT	APP	CADILLAC, MI	BLANK0000035809	176.2
No	WJMN-TV	D32	DT	LIC	ESCANABA, MI	BLANK0000063727	431.3
Yes	WXMI	D32	LD	CP	GRAND RAPIDS, MI	BLANK0000053427	111.0
No	WBWM-LP	N32z	TX	LIC	MOUNT PLEASANT, MI	BLTTL20001220ABG	101.5
No	W32EL-D	D32	LD	CP	ST. IGNACE, MI	BNPDTL20100223ADT	351.9
No	WNLO	D32	DT	APP	BUFFALO, NY	BLANK0000036123	448.2
No	WNLO	D32	DT	LIC	BUFFALO, NY	BLANK0000053502	448.9
No	WUTV	D32	DT	APP	BUFFALO, NY	BLANK0000064271	448.2
No	WOUB-TV	D32	DT	LIC	ATHENS, OH	BLANK0000068360	421.6
No	W32ED-D	D32	LD	CP	CANTON, OH	BLANK0000013880	357.8
No	WRAP-LP	D32	LD	CP	CLEVELAND, OH	BLANK0000001539	267.6
No	WRAP-LP	D32	LD	APP	CLEVELAND, OH	BLANK0000058798	312.5
No	WRAP-LP	N32-	TX	LIC	CLEVELAND, OH	BLTTL20110902ABQ	269.7
No	WWRD-LP	N32+	TX	LIC	DAYTON, OH	BLTTL20071011AAP	337.0
No	W32DS-D	D32	LD	LIC	MAPLEWOOD, OH	BLDTT20110104ABK	239.0
No	WYFX-LD	D32	LD	CP	YOUNGSTOWN, OH	BLANK0000053007	361.5
No	W32DH-D	D32	LD	LIC	ERIE, PA	BLDTL20101122AHG	364.8
No	WIFS	D32	DT	LIC	JANESVILLE, WI	BLCDT20040930BHL	415.0
No	W33DC-D	D33	LD	CP	FORT WAYNE, IN	BNPDTL20091228AAX	194.1
No	WHPS-CD	D33	DC	LIC	DETROIT, MI	BLDTA20150115AAJ	113.0
No	WOHO-CD	D33	DC	LIC	HOLLAND, MI	BLDTA20120316ACT	126.5
No	WUHO-LP	N36+	TX	LIC	KALAMAZOO, MI	BLTTL20060103ABT	112.1
No	CIII-DT-22D33		DT	LIC	STEVENSON, ON	BLANKCANADA222	173.6

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

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 NEPHI, UT 84648

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Channel: D32
Latitude: 42 42 6.90 N (NAD83)
Longitude: 84 24 47.80 W
Height AMSL: 411.5 m
HAAT: 297.0 m
Peak ERP: 70.0 kW
Antenna: ERI I230ECW-8 Ch. 35 230.0 deg
Elev Pattn: Generic

40.5 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	0.847 kW	154.7 m	44.7 km
45.0	3.54	140.1	50.9
90.0	0.567	143.1	41.9
135.0	37.8	134.6	61.5
180.0	59.2	140.0	64.0
225.0	56.1	142.0	63.9
270.0	61.9	149.1	65.0
315.0	47.6	151.1	63.9

Database HAAT does not agree with computed HAAT
Database HAAT: 297 m Computed HAAT: 144 m

**Proposal is within coordination distance of Canadian border
Distance to Canadian border: 117.2 km

Distance to Mexican border: 2086.5 km

Conditions at FCC monitoring station: Allegan MI
Bearing: 265.7 degrees Distance: 126.5 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 267.8 degrees Distance: 1752.8 km

Study cell size: 2.00 km
Profile point spacing: 1.00 km

Maximum new IX to full-service and Class A: 0.50%
Maximum new IX to LPTV: 2.00%

****MX with BLANK0000035809 APP scenario 1, 2.82% interference caused**

---- Below is IX received by proposal KARC32-ERIr230-70k-Pre ----

****MX with BLANK0000035809 APP scenario 2, 3.82% interference received**

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6197 MILLER RD.
SWARTZ CREEK, MI 48473

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TVStudy Interference Study - WKAR Ch. 32 Post-Transition Experimental Operation

Study created: 2019.03.25 16:33:10

Study build station data: LMS TV 2019-03-24

Proposal: WKAR-TV D32 DT EXP EAST LANSING, MI
 File number: KARC32-ERIr230-70k-32519
 Facility ID: 6104
 Station data: User record
 Record ID: 1411
 Country: U.S.
 Zone: I

Search options:
 Non-U.S. records included

Stations potentially affected by proposal:

IX	Call	Chan	Svc	Status	City, State	File Number	Distance
No	WNIT	D31	DT	CP	SOUTH BEND, IN	BLANK0000024784	189.8 km
No	WNIT	D31	DT	BL	SOUTH BEND, IN	DTVBL41671	189.8
Yes	WMYD	D31	DT	CP	DETROIT, MI	BLANK0000034676	105.4
Yes	WMYD	D31	DT	BL	DETROIT, MI	DTVBL74211	105.4
No	WMKG-CD	D31	DC	CP	MUSKEGON, MI	BLANK0000034413	155.6
No	WMKG-CD	D31	DC	BL	MUSKEGON, MI	DTVBL33869	154.1
No	WICD	D32	DT	LIC	CHAMPAIGN, IL	BLANK0000059351	413.2
No	WSPY-LD	D32	LD	LIC	LA SALLE, IL	BLANK0000016586	361.7
No	WLPD-CD	D32	DC	CP	PLANO, IL	BLANK0000034861	316.5
No	WLPD-CD	D32	DC	BL	PLANO, IL	DTVBL189058	316.5
Yes	WANE-TV	D32	DT	CP	FORT WAYNE, IN	BLANK0000034806	189.7
No	WANE-TV	D32	DT	BL	FORT WAYNE, IN	DTVBL39270	189.6
Yes	WFQX-TV	D32	DT	LIC	CADILLAC, MI	BLCDT20091217ACU	176.2
Yes	WFQX-TV	D32	DT	APP	CADILLAC, MI	BLANK0000035809	176.2
Yes	WDIV-TV	D32	DT	CP	DETROIT, MI	BLANK0000027872	101.8
Yes	WDIV-TV	D32	DT	BL	DETROIT, MI	DTVBL53114	101.8
No	WJMN-TV	D32	DT	LIC	ESCANABA, MI	BLANK0000063727	431.3
Yes	WXMI	D32	LD	CP	GRAND RAPIDS, MI	BLANK0000053427	111.0
No	WBWM-LP	N32z	TX	LIC	MOUNT PLEASANT, MI	BLTTL20001220ABG	101.5
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No	WWRD-LP	N32+	TX	LIC	DAYTON, OH	BLTTL20071011AAP	337.0
No	W32DS-D	D32	LD	LIC	MAPLEWOOD, OH	BLDTT20110104ABK	239.0
No	WOCB-CD	D32	DC	BL	MARION, OH	DTVBL9939	288.7
No	WYFX-LD	D32	LD	CP	YOUNGSTOWN, OH	BLANK0000053007	361.5
No	W32DH-D	D32	LD	LIC	ERIE, PA	BLDTL20101122AHG	364.8
No	WTMJ-TV	D32	DT	CP	MILWAUKEE, WI	BLANK0000034843	287.3
No	WTMJ-TV	D32	DT	BL	MILWAUKEE, WI	DTVBL74098	287.3
No	W33DC-D	D33	LD	CP	FORT WAYNE, IN	BNPDTL20091228AAX	194.1
No	WOHO-CD	D33	DC	LIC	HOLLAND, MI	BLDTA20120316ACT	126.5
No	WOKZ-CD	D33	DC	CP	KALAMAZOO, MI	BLANK0000027731	110.3
No	WOKZ-CD	D33	DC	BL	KALAMAZOO, MI	DTVBL36841	110.3

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 1475 NORTH 200 WEST
 NEPHI, UT 84648

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No	WUHO-LP	N36+	TX	LIC	KALAMAZOO, MI	BLTTL20060103ABT	112.1
No	CIII-DT-22D33		DT	LIC	STEVENSON, ON	BLANKCANADA222	173.6

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

Channel: D32
Latitude: 42 42 6.90 N (NAD83)
Longitude: 84 24 47.80 W
Height AMSL: 411.5 m
HAAT: 297.0 m
Peak ERP: 70.0 kW
Antenna: ERI I230ECW-8 Ch. 35 230.0 deg
Elev Pattn: Generic

40.5 dBu contour:

Azimuth	ERP	HAAT	Distance
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45.0	3.54	140.1	50.9
90.0	0.567	143.1	41.9
135.0	37.8	134.6	61.5
180.0	59.2	140.0	64.0
225.0	56.1	142.0	63.9
270.0	61.9	149.1	65.0
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**Proposal is within coordination distance of Canadian border

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Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:

Bearing: 267.8 degrees Distance: 1752.8 km

Study cell size: 2.00 km

Profile point spacing: 1.00 km

Maximum new IX to full-service and Class A: 0.50%

Maximum new IX to LPTV: 2.00%

****MX with BLANK0000035809 APP scenario 1, 2.57% interference caused**
**MX with BLANK0000035809 APP scenario 2, 2.57% interference caused
**MX with BLANK0000035809 APP scenario 3, 2.60% interference caused
**MX with BLANK0000035809 APP scenario 4, 2.60% interference caused
**MX with BLANK0000035809 APP scenario 5, 2.57% interference caused
**MX with BLANK0000035809 APP scenario 6, 2.57% interference caused
**MX with BLANK0000035809 APP scenario 7, 2.60% interference caused
**MX with BLANK0000035809 APP scenario 8, 2.60% interference caused
**MX with BLANK0000035809 APP scenario 9, 2.59% interference caused

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**MX with BLANK0000035809 APP scenario 10, 2.59% interference caused
 **MX with BLANK0000035809 APP scenario 11, 2.61% interference caused
 **MX with BLANK0000035809 APP scenario 12, 2.61% interference caused
 **MX with BLANK0000035809 APP scenario 13, 2.59% interference caused
 **MX with BLANK0000035809 APP scenario 14, 2.59% interference caused
 **MX with BLANK0000035809 APP scenario 15, 2.61% interference caused
 **MX with BLANK0000035809 APP scenario 16, 2.61% interference caused
 **IX check failure to BLANK0000027872 CP scenario 1, 2.47% interference caused
 **IX check failure to BLANK0000027872 CP scenario 2, 2.47% interference caused
 **IX check failure to BLANK0000027872 CP scenario 3, 2.47% interference caused
 **IX check failure to BLANK0000027872 CP scenario 4, 2.47% interference caused
 **IX check failure to BLANK0000027872 CP scenario 5, 2.43% interference caused
 **IX check failure to BLANK0000027872 CP scenario 6, 2.43% interference caused
 **IX check failure to BLANK0000027872 CP scenario 7, 2.43% interference caused
 **IX check failure to BLANK0000027872 CP scenario 8, 2.43% interference caused
 **IX check failure to DTVBL53114 BL scenario 1, 2.44% interference caused
 **IX check failure to DTVBL53114 BL scenario 2, 2.44% interference caused
 **IX check failure to DTVBL53114 BL scenario 3, 2.45% interference caused
 **IX check failure to DTVBL53114 BL scenario 4, 2.45% interference caused
 **IX check failure to DTVBL53114 BL scenario 5, 2.41% interference caused
 **IX check failure to DTVBL53114 BL scenario 6, 2.41% interference caused
 **IX check failure to DTVBL53114 BL scenario 7, 2.41% interference caused
 **IX check failure to DTVBL53114 BL scenario 8, 2.41% interference caused

---- Below is IX received by proposal KARC32-ERIr230-70k-325 ----

Proposal receives 22.89% interference from scenario 1
 Proposal receives 22.89% interference from scenario 2
 Proposal receives 22.89% interference from scenario 3
 Proposal receives 22.89% interference from scenario 4
 Proposal receives 21.80% interference from scenario 5
 Proposal receives 21.80% interference from scenario 6
 Proposal receives 21.80% interference from scenario 7
 Proposal receives 21.80% interference from scenario 8
 **MX with BLANK0000035809 APP scenario 9, 23.75% interference received
 **MX with BLANK0000035809 APP scenario 10, 23.75% interference received
 **MX with BLANK0000035809 APP scenario 11, 23.75% interference received
 **MX with BLANK0000035809 APP scenario 12, 23.75% interference received
 **MX with BLANK0000035809 APP scenario 13, 22.66% interference received
 **MX with BLANK0000035809 APP scenario 14, 22.66% interference received
 **MX with BLANK0000035809 APP scenario 15, 22.66% interference received
 **MX with BLANK0000035809 APP scenario 16, 22.66% interference received

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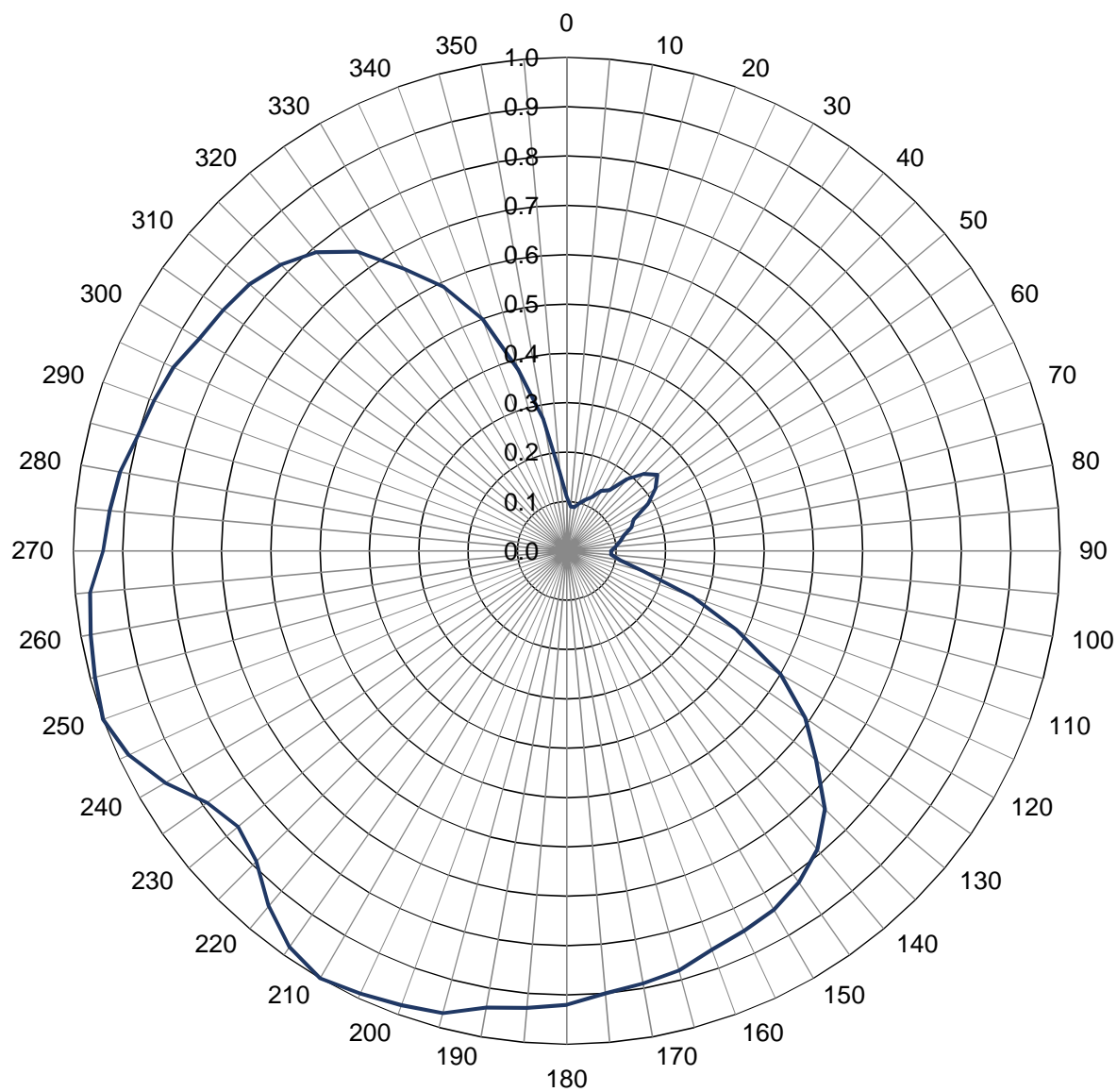
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Azimuth Pattern

Type:	i230WC-H-32	Polarization:	Horizontal
Directivity:	2.06 numeric (3.14 dB)	Frequency:	32 (ATSC)
Peak(s) at:		Location:	East Lansing, MI
		NOTE: Pattern shape and directivity may vary with channel and mounting configuration.	

Relative Field



Tabulated Data for Azimuth PatternType: i230WC-H-32

Angle	Field	dB
0	0.110	-19.17
2	0.100	-20.00
4	0.090	-20.92
6	0.090	-20.92
8	0.080	-21.94
10	0.090	-20.92
12	0.090	-20.92
14	0.090	-20.92
16	0.100	-20.00
18	0.110	-19.17
20	0.110	-19.17
22	0.100	-20.00
24	0.110	-19.17
26	0.120	-18.42
28	0.130	-17.72
30	0.140	-17.08
32	0.150	-16.48
34	0.150	-16.48
36	0.160	-15.92
38	0.180	-14.89
40	0.190	-14.42
42	0.210	-13.56
44	0.220	-13.15
46	0.230	-12.77
48	0.230	-12.77
50	0.240	-12.40
52	0.230	-12.77
54	0.230	-12.77
56	0.220	-13.15
58	0.210	-13.56
60	0.190	-14.42
62	0.180	-14.89
64	0.160	-15.92
66	0.150	-16.48
68	0.150	-16.48
70	0.140	-17.08
72	0.130	-17.72
74	0.120	-18.42
76	0.110	-19.17
78	0.100	-20.00
80	0.110	-19.17
82	0.110	-19.17
84	0.100	-20.00
86	0.090	-20.92
88	0.090	-20.92
90	0.090	-20.92

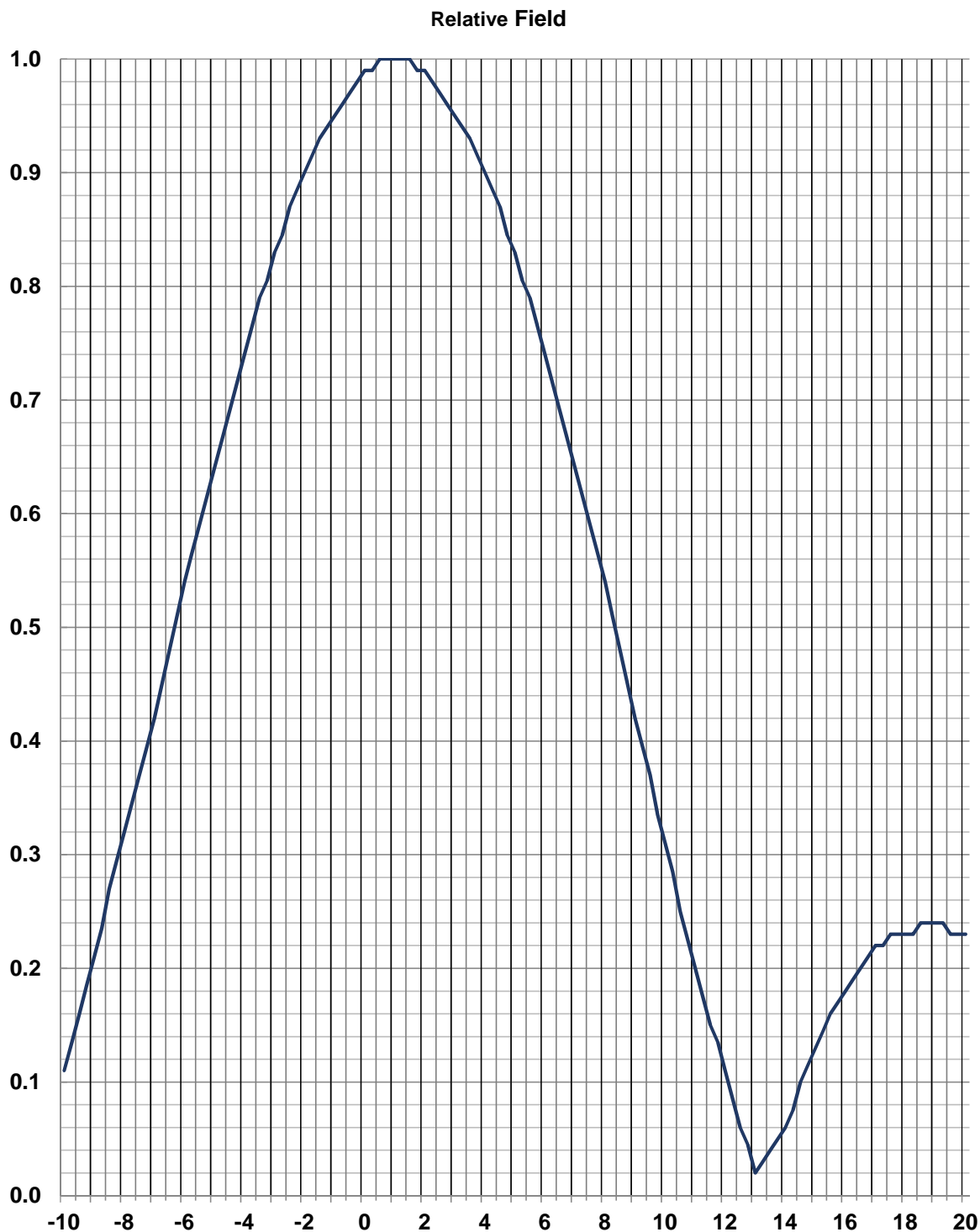
Angle	Field	dB
92	0.080	-21.94
94	0.090	-20.92
96	0.090	-20.92
98	0.100	-20.00
100	0.110	-19.17
102	0.140	-17.08
104	0.150	-16.48
106	0.180	-14.89
108	0.230	-12.77
110	0.270	-11.37
112	0.320	-9.90
114	0.360	-8.87
116	0.400	-7.96
118	0.460	-6.74
120	0.500	-6.02
122	0.540	-5.35
124	0.580	-4.73
126	0.600	-4.44
128	0.630	-4.01
130	0.660	-3.61
132	0.690	-3.22
134	0.720	-2.85
136	0.750	-2.50
138	0.770	-2.27
140	0.790	-2.05
142	0.810	-1.83
144	0.820	-1.72
146	0.830	-1.62
148	0.840	-1.51
150	0.840	-1.51
152	0.850	-1.41
154	0.850	-1.41
156	0.850	-1.41
158	0.860	-1.31
160	0.860	-1.31
162	0.870	-1.21
164	0.880	-1.11
166	0.880	-1.11
168	0.890	-1.01
170	0.890	-1.01
172	0.890	-1.01
174	0.900	-0.92
176	0.900	-0.92
178	0.910	-0.82
180	0.920	-0.72
182	0.920	-0.72

Angle	Field	dB
184	0.930	-0.63
186	0.930	-0.63
188	0.940	-0.54
190	0.940	-0.54
192	0.960	-0.35
194	0.960	-0.35
196	0.970	-0.26
198	0.980	-0.18
200	0.980	-0.18
202	0.990	-0.09
204	0.990	-0.09
206	0.990	-0.09
208	1.000	0.00
210	1.000	0.00
212	0.990	-0.09
214	0.980	-0.18
216	0.970	-0.26
218	0.960	-0.35
220	0.940	-0.54
222	0.920	-0.72
224	0.900	-0.92
226	0.890	-1.01
228	0.880	-1.11
230	0.870	-1.21
232	0.880	-1.11
234	0.890	-1.01
236	0.900	-0.92
238	0.920	-0.72
240	0.940	-0.54
242	0.960	-0.35
244	0.970	-0.26
246	0.980	-0.18
248	0.990	-0.09
250	1.000	0.00
252	1.000	0.00
254	0.990	-0.09
256	0.990	-0.09
258	0.990	-0.09
260	0.980	-0.18
262	0.980	-0.18
264	0.970	-0.26
266	0.960	-0.35
268	0.960	-0.35
270	0.940	-0.54
272	0.940	-0.54
274	0.930	-0.63

Angle	Field	dB
276	0.930	-0.63
278	0.920	-0.72
280	0.920	-0.72
282	0.910	-0.82
284	0.900	-0.92
286	0.900	-0.92
288	0.890	-1.01
290	0.890	-1.01
292	0.890	-1.01
294	0.880	-1.11
296	0.880	-1.11
298	0.870	-1.21
300	0.860	-1.31
302	0.860	-1.31
304	0.850	-1.41
306	0.850	-1.41
308	0.850	-1.41
310	0.840	-1.51
312	0.840	-1.51
314	0.830	-1.62
316	0.820	-1.72
318	0.810	-1.83
320	0.790	-2.05
322	0.770	-2.27
324	0.750	-2.50
326	0.720	-2.85
328	0.690	-3.22
330	0.660	-3.61
332	0.630	-4.01
334	0.600	-4.44
336	0.580	-4.73
338	0.540	-5.35
340	0.500	-6.02
342	0.460	-6.74
344	0.400	-7.96
346	0.360	-8.87
348	0.320	-9.90
350	0.270	-11.37
352	0.230	-12.77
354	0.180	-14.89
356	0.150	-16.48
358	0.140	-17.08
360	0.110	-19.17

Elevation Pattern

Type:	i230WC-08-32	Polarization:	Horizontal
Directivity:		Frequency:	32 (ATSC)
Main Lobe:	5.54 numeric (7.43 dB)	Location:	East Lansing, MI
Horizontal:	5.43 numeric (7.34 dB)	Beam Tilt:	1.00 degrees



Tabulated Data for Elevation PatternType: i230WC-08-32

-5 to 10 degrees in 0.25 degree increments.

10 to 90 degrees in 0.50 degree increments.

Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-5.00	0.640	-3.88	6.25	0.715	-2.91	25.00	0.150	-16.48	47.50	0.110	-19.17	70.00	0.040	-27.96
-4.75	0.665	-3.54	6.50	0.690	-3.22	25.50	0.140	-17.08	48.00	0.110	-19.17	70.50	0.040	-27.96
-4.50	0.690	-3.22	6.75	0.665	-3.54	26.00	0.140	-17.08	48.50	0.110	-19.17	71.00	0.040	-27.96
-4.25	0.715	-2.91	7.00	0.640	-3.88	26.50	0.130	-17.72	49.00	0.120	-18.42	71.50	0.040	-27.96
-4.00	0.740	-2.62	7.25	0.615	-4.22	27.00	0.120	-18.42	49.50	0.120	-18.42	72.00	0.040	-27.96
-3.75	0.765	-2.33	7.50	0.590	-4.58	27.50	0.110	-19.17	50.00	0.120	-18.42	72.50	0.040	-27.96
-3.50	0.790	-2.05	7.75	0.565	-4.96	28.00	0.110	-19.17	50.50	0.120	-18.42	73.00	0.040	-27.96
-3.25	0.805	-1.88	8.00	0.540	-5.35	28.50	0.100	-20.00	51.00	0.120	-18.42	73.50	0.040	-27.96
-3.00	0.830	-1.62	8.25	0.510	-5.85	29.00	0.100	-20.00	51.50	0.120	-18.42	74.00	0.040	-27.96
-2.75	0.845	-1.46	8.50	0.480	-6.38	29.50	0.090	-20.92	52.00	0.110	-19.17	74.50	0.040	-27.96
-2.50	0.870	-1.21	8.75	0.450	-6.94	30.00	0.090	-20.92	52.50	0.110	-19.17	75.00	0.030	-30.46
-2.25	0.885	-1.06	9.00	0.420	-7.54	30.50	0.090	-20.92	53.00	0.110	-19.17	75.50	0.030	-30.46
-2.00	0.900	-0.92	9.25	0.395	-8.07	31.00	0.090	-20.92	53.50	0.110	-19.17	76.00	0.030	-30.46
-1.75	0.915	-0.77	9.50	0.370	-8.64	31.50	0.090	-20.92	54.00	0.100	-20.00	76.50	0.030	-30.46
-1.50	0.930	-0.63	9.75	0.335	-9.50	32.00	0.090	-20.92	54.50	0.100	-20.00	77.00	0.030	-30.46
-1.25	0.940	-0.54	10.00	0.310	-10.17	32.50	0.100	-20.00	55.00	0.090	-20.92	77.50	0.030	-30.46
-1.00	0.950	-0.45	10.50	0.250	-12.04	33.00	0.100	-20.00	55.50	0.090	-20.92	78.00	0.030	-30.46
-0.75	0.960	-0.35	11.00	0.200	-13.98	33.50	0.100	-20.00	56.00	0.090	-20.92	78.50	0.030	-30.46
-0.50	0.970	-0.26	11.50	0.150	-16.48	34.00	0.100	-20.00	56.50	0.090	-20.92	79.00	0.030	-30.46
-0.25	0.980	-0.18	12.00	0.110	-19.17	34.50	0.090	-20.92	57.00	0.080	-21.94	79.50	0.030	-30.46
0.00	0.990	-0.09	12.50	0.060	-24.44	35.00	0.090	-20.92	57.50	0.080	-21.94	80.00	0.030	-30.46
0.25	0.990	-0.09	13.00	0.020	-33.98	35.50	0.080	-21.94	58.00	0.070	-23.10	80.50	0.030	-30.46
0.50	1.000	0.00	13.50	0.040	-27.96	36.00	0.080	-21.94	58.50	0.070	-23.10	81.00	0.030	-30.46
0.75	1.000	0.00	14.00	0.060	-24.44	36.50	0.070	-23.10	59.00	0.070	-23.10	81.50	0.030	-30.46
1.00	1.000	0.00	14.50	0.100	-20.00	37.00	0.070	-23.10	59.50	0.070	-23.10	82.00	0.030	-30.46
1.25	1.000	0.00	15.00	0.130	-17.72	37.50	0.060	-24.44	60.00	0.060	-24.44	82.50	0.030	-30.46
1.50	1.000	0.00	15.50	0.160	-15.92	38.00	0.050	-26.02	60.50	0.060	-24.44	83.00	0.030	-30.46
1.75	0.990	-0.09	16.00	0.180	-14.89	38.50	0.040	-27.96	61.00	0.060	-24.44	83.50	0.020	-33.98
2.00	0.990	-0.09	16.50	0.200	-13.98	39.00	0.030	-30.46	61.50	0.060	-24.44	84.00	0.020	-33.98
2.25	0.980	-0.18	17.00	0.220	-13.15	39.50	0.020	-33.98	62.00	0.050	-26.02	84.50	0.020	-33.98
2.50	0.970	-0.26	17.50	0.230	-12.77	40.00	0.010	-40.00	62.50	0.050	-26.02	85.00	0.020	-33.98
2.75	0.960	-0.35	18.00	0.230	-12.77	40.50	0.010	-40.00	63.00	0.050	-26.02	85.50	0.020	-33.98
3.00	0.950	-0.45	18.50	0.240	-12.40	41.00	0.020	-33.98	63.50	0.050	-26.02	86.00	0.020	-33.98
3.25	0.940	-0.54	19.00	0.240	-12.40	41.50	0.030	-30.46	64.00	0.050	-26.02	86.50	0.020	-33.98
3.50	0.930	-0.63	19.50	0.230	-12.77	42.00	0.040	-27.96	64.50	0.050	-26.02	87.00	0.020	-33.98
3.75	0.915	-0.77	20.00	0.230	-12.77	42.50	0.050	-26.02	65.00	0.050	-26.02	87.50	0.020	-33.98
4.00	0.900	-0.92	20.50	0.220	-13.15	43.00	0.060	-24.44	65.50	0.050	-26.02	88.00	0.020	-33.98
4.25	0.885	-1.06	21.00	0.210	-13.56	43.50	0.060	-24.44	66.00	0.040	-27.96	88.50	0.020	-33.98
4.50	0.870	-1.21	21.50	0.200	-13.98	44.00	0.070	-23.10	66.50	0.040	-27.96	89.00	0.020	-33.98
4.75	0.845	-1.46	22.00	0.200	-13.98	44.50	0.080	-21.94	67.00	0.040	-27.96	89.50	0.020	-33.98
5.00	0.830	-1.62	22.50	0.190	-14.42	45.00	0.090	-20.92	67.50	0.040	-27.96	90.00	0.020	-33.98
5.25	0.805	-1.88	23.00	0.180	-14.89	45.50	0.090	-20.92	68.00	0.040	-27.96			
5.50	0.790	-2.05	23.50	0.170	-15.39	46.00	0.100	-20.00	68.50	0.040	-27.96			
5.75	0.765	-2.33	24.00	0.160	-15.92	46.50	0.100	-20.00	69.00	0.040	-27.96			
6.00	0.740	-2.62	24.50	0.150	-16.48	47.00	0.110	-19.17	69.50	0.040	-27.96			