

***COMPREHENSIVE TECHNICAL EXHIBIT
APPLICATION FOR CONSTRUCTION PERMIT***

**KDAO-CD - MARSHALLTOWN, IOWA
FACILITY ID: 46753**

MTN BROADCASTING, INC.

JUNE 2017

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6.27.2017

APPLICATION FOR CONSTRUCTION PERMIT

The following engineering statement and attached exhibits have been prepared for **MTN Broadcasting, Inc.** ("MTN"), licensee of class A digital television station KDAO-CD at Marshalltown, Iowa, and are in support of their application for construction permit.¹ This application is the initial construction permit application for KDAO-CD following the incentive auction. The technical parameters specified under this application are identical to those detailed in the Commission's post-repack table of allotments.

KDAO-CD currently operates on television channel 44 with an effective radiated power of 1.38 kilowatts, horizontally polarized, at a center of radiation of 322.6 meters above mean sea level utilizing a non directional antenna. KDAO-CD has been assigned channel 17 in the post-repack environment. MTN proposes operation on this channel with an effective radiated power of 0.78 kilowatts at a center of radiation of 322.6 meters above sea level utilizing a non-directional antenna. These parameters exactly replicate those specified in the Commission's table.

The antenna proposed for use by KDAO-CD is a Kathrein horizontally polarized model 75010272. This antenna, at the channel of operation, has an electrical beamtilt of 1.0 degrees. This is a "superturnstile" antenna, and is nominally non-directional. The datasheets from the manufacturer, as well as a locally generated vertical plane pattern based on the manufacturer's tabulation follow the text in this exhibit.

¹ The Facility ID for KDAO-CD at Marshalltown, Iowa is 46753.

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The closest FCC monitoring station to the proposed facility is the Grand Island, Nebraska station, and is 476 kilometers from the proposed site. This distance exceeds by a significant margin the suggested notification distances in Section 73.1030(c)(3) of the Commission's Rules. The proposed facility is not located within the West Virginia quiet zone area, and is 1051 kilometers from the Table Mountain receiving zone. The proposed facility is therefore not located within any area where coordination with the specified quiet zones would be required.

As a class A facility, KDAO-CD maintains a main studio. The main studio for the facility is co-located with the KDAO-CD transmitter site. The proposed facility would continue to comply with the applicable portions of the Commission's Rules relative to main studio location.

The proposed facility would not constitute a significant environmental impact, and is excluded from environmental processing. Implementation of the construction permit resulting from this application would not increase the existing environmental impact already present from the structure. The tower utilized by KDAO-CD does not require registration based on its location and height, as confirmed by *Towair*.

In addition, the proposed facility for KDAO-CD would not constitute an RF exposure hazard to persons in the vicinity of the structure. Using the equations in Supplement A of *OET Bulletin 65*, and assuming a relative field of 0.1 for downward angles, the calculated power density at two meters above ground is $0.07 \mu\text{W}/\text{cm}^2$ in the vicinity of the tower.

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In addition to KDAO-CD, the tower also supports the transmitting antennas for NCE FM station KRFH at Marshalltown, Iowa, and FM translator station K279AN at Marshalltown.² The contributions from these two facilities were calculated using the Commission's *FM Model* utility. For KRFH, the calculated power density is 126.3 $\mu\text{W}/\text{cm}^2$ at a distance of 11 meters from the tower base, while the calculated value for K279AN based on its licensed parameters is 1.41 $\mu\text{W}/\text{cm}^2$ at a distance of 58 meters from the tower base.

The aggregate power density for these three facilities is assumed to be the sum of the three contributors, and is assumed to occur at all locations in the vicinity of the structure. The resulting value is 127.8 $\mu\text{W}/\text{cm}^2$, which is less than the upper limit permissible under uncontrolled environment condition of the standard in the frequency range occupied by FM transmissions. This range is utilized for the purposes of this analysis since it is more restrictive than the range occupied by UHF television, and is the range in which the greatest contributor is located.

Finally, the tower utilized for KDAO-CD also serves as the transmitting antenna for AM station KDAO at Marshalltown, Iowa.³ That facility operates with an antenna input power of 250 Watts, and an antenna height of 84.9 electrical degrees at 1190 kHz. The tower is appropriately fenced at a distance of 3 meters from the tower base.

MTN certifies that it will coordinate with all users of the site to ensure that workers and other personnel are not exposed to levels of radiofrequency radiation in excess of the applicable safety

² The Facility ID for KRFH at Marshalltown, Iowa is 90503. The Facility ID for K279AN at Marshalltown, Iowa is 151684.

³ The Facility ID for KDAO at Marshalltown, Iowa is 46754.

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standards. Coordination activities will include, but are not necessarily limited to, a reduction in transmitter power or cessation of operation.

The preceding statement and attached exhibits have been prepared by me, or under my direction, and are true and accurate to the best of my belief and knowledge.



Above signature is digitized copy of actual signature
License Expires November 30, 2017

Jeremy D. Ruck, PE
June 27, 2017

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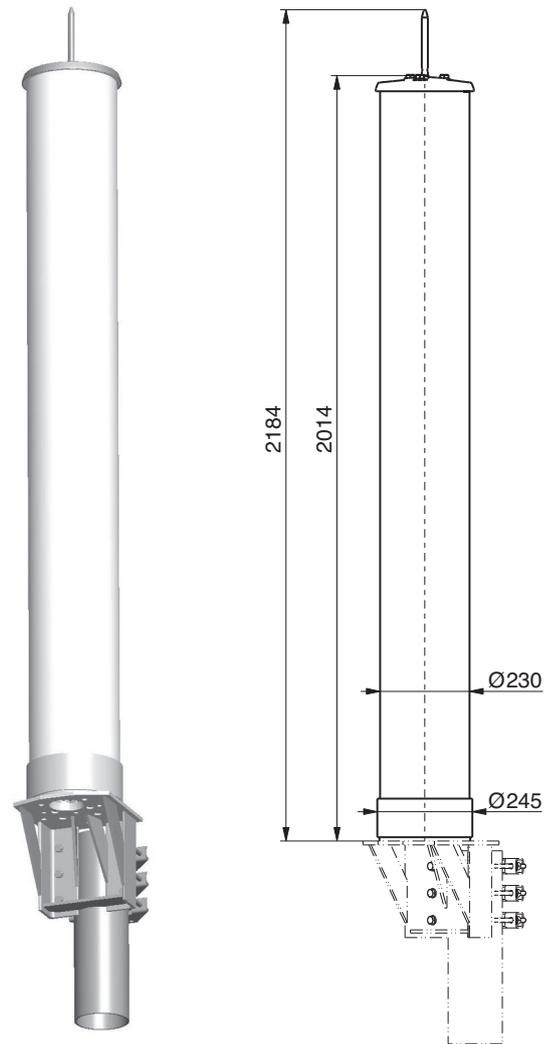
- Broadband omnidirectional antenna.

Order No.	75010272
Input	7-16 female
Max. power	1 kW (at 40 °C ambient temperature)
Frequency range	470 – 862 MHz
VSWR	< 1.15
Gain (at mid-band)	7.5 dBd
Vertical 3 dB beam width (at mid-band)	14°
Impedance	50 Ω
Polarization	Horizontal
Weight	24 kg
Wind load (at 160 km/h)	350 N
Max. wind velocity	225 km/h
Height	2014 mm

Material: Omnidirectional antenna in protective fiberglass radome with a diameter of 230 mm. Radome color: Light grey (RAL 7035). Flange: Hot-dip galvanized steel.

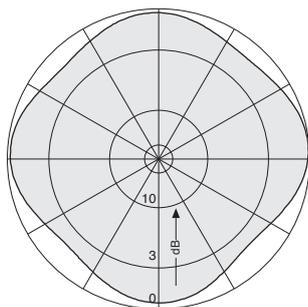
Attachment: Onto a fitting counterflange or to tubular masts by using the optional steel adapter 75310384 (to be ordered separately).

Grounding: Via mounting parts.

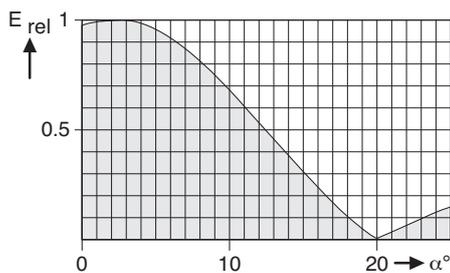


Picture shows antenna with optional steel adapter 75310384

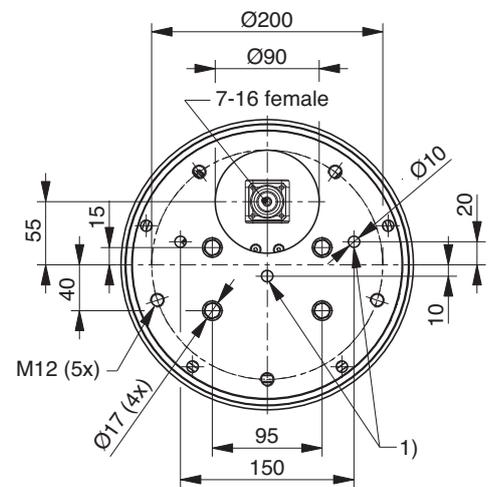
Radiation Patterns (at mid-band)



Horizontal Radiation Pattern



Vertical Radiation Pattern
2.5° electrical downtilt



1) drainage (3x)
Bottom view

936.4390/a Subject to alteration.

Mounting notes:

Cylindrical structures can show crosswind response due to vortex excitations.

According to EN 1991-1-4 or EN 1993-3-1 fatigue calculations are required for structures having cylindrical parts. So a fatigue analysis must be carried out by a stress engineer for the supporting structure (mast) with the antenna.

Antenna 75010272:

length of cylindrical part: 2.014 m
diameter of cylinder: 0.230 m

The antenna can be considered as a cantilever with uniform mass distribution and an additional mass at the bottom (flange level) of the antenna:
length: 2.014 m
stiffness E·I: $2.7 \cdot 10^5 \text{ Nm}^2$
mass per length: 12 kg/m
logarithmic decrement of damping: 0.07

The antenna is not fatigue critical in accordance with EN 1993-1-9.

Fixing: 5x M12 grade 8.8, tightening torque 70 Nm

Steel adapter 75310384:

The adapter of steel S235 can be considered as a beam with:
boundless length: 0.07 m
stiffness E·I: $4.2 \cdot 10^6 \text{ Nm}^2$
mass: 16 kg
logarithmic decrement of damping: 0.07

The adapter is fatigue critical. The relevant cross section data for fatigue calculations acc. EN 1993-1-9 are:
detail category: 80
modulus: 143 cm^3

Please note:

As a result of more stringent legal regulations and judgements regarding product liability, we are obliged to point out certain risks that may arise when products are used under extraordinary operating conditions.

The mechanical design is based on the environmental conditions as stipulated in ETS 300 019-1-4 and thereby respects the static mechanical load imposed on an antenna by wind at maximum velocity.

Extraordinary operating conditions, such as heavy icing or exceptional dynamic stress (e.g. strain caused by oscillating support structures), may result in the breakage of an antenna or even cause it to fall to the ground.

Cylindrical bodies can show crosswind response, which can cause the supporting structure to oscillate and to be damaged. Prismatic bodies, even with non-circular cross-section can show crosswind response, which can cause the supporting structure to oscillate (see EN 1991-1-4 or EN 1993-3-1).

These facts must be considered during the site planning process.

The maximum wind velocities listed should be understood in the sense of working values according to DIN and EN standards. These values include a safety factor (1.5) below the ultimate limit state (elastic limit or permanent deformation). For these wind velocities we guarantee the mechanical safety and the electrical integrity of our antennas.

The installation team must be properly qualified and also be familiar with the relevant national safety regulations. The details given in our data sheets have to be followed carefully when installing the antennas and accessories. The limits for the coupling torque of RF-connectors, recommended by the connector manufacturers must be obeyed.

Any previous datasheet issues have now become invalid.

Our quality assurance system and our environmental management system apply to the entire company and are certified by TÜV according to EN ISO 9001 and EN ISO 14001.



KDAO-CD Proposed Vertical Radiation Pattern

Angle	EREL	dBk ERP
-5.00	0.8730	-2.26
-4.00	0.9099	-1.90
-3.00	0.9408	-1.61
-2.00	0.9649	-1.39
-1.00	0.9829	-1.23
0.00	0.9966	-1.11
1.00	1.0000	-1.08
2.00	0.9988	-1.09
3.00	0.9886	-1.18
4.00	0.9750	-1.30
5.00	0.9506	-1.52
6.00	0.9247	-1.76
7.00	0.8923	-2.07
8.00	0.8521	-2.47
9.00	0.8091	-2.92
10.00	0.7630	-3.43
11.00	0.7120	-4.03
12.00	0.6599	-4.69
13.00	0.6039	-5.46
14.00	0.5476	-6.31
15.00	0.4903	-7.27
16.00	0.4315	-8.38
17.00	0.3724	-9.66
18.00	0.3151	-11.11
19.00	0.2509	-13.09
20.00	0.2049	-14.85
21.00	0.1528	-17.40
22.00	0.1036	-20.77
23.00	0.0571	-25.95
24.00	0.0132	-38.67
25.00	0.0262	-32.71
26.00	0.0624	-25.18
27.00	0.0951	-21.52
28.00	0.1237	-19.23
29.00	0.1486	-17.64
30.00	0.1708	-16.43
32.00	0.2030	-14.93
34.00	0.2213	-14.18
36.00	0.2296	-13.86
38.00	0.2252	-14.03
40.00	0.2143	-14.46
42.00	0.1988	-15.11
44.00	0.1752	-16.21
46.00	0.1542	-17.32
48.00	0.1299	-18.81
50.00	0.1019	-20.92
52.00	0.0841	-22.58
54.00	0.0637	-25.00
56.00	0.0494	-27.20
58.00	0.0431	-28.39
60.00	0.0435	-28.31
62.00	0.0486	-27.35
64.00	0.0563	-26.07
66.00	0.0627	-25.13
68.00	0.0684	-24.38
70.00	0.0735	-23.75
72.00	0.0770	-23.35
74.00	0.0799	-23.03
76.00	0.0818	-22.82
78.00	0.0834	-22.66
80.00	0.0845	-22.54
82.00	0.0845	-22.54
84.00	0.0849	-22.50
86.00	0.0857	-22.42
88.00	0.0853	-22.46
90.00	0.0861	-22.38

