

ENGINEERING STATEMENT

The engineering data contained herein have been prepared on behalf of the licensee of full-power digital television station KKAI-DT, Channel 29 in Kailua, Hawaii, in support of this Application for Construction Permit to make changes to the distributed transmission system (DTS) facility licensed in LMS-0000157950. It is proposed herein to reduce the effective radiated power of the DTS-1 (Pu'u Papa'a) facility. No change in the transmitter site location, antenna make/model/ or antenna height of this node is proposed.

This application also requests slight changes to the DTS-2 transmitter site on Mauna Kapu, the authorized antenna height and an increase in effective radiated power.

Below are proposed operating parameters for the main (DTS-1) and DTS-2 facilities:

KKAI-DT MAIN TRANSMITTER SITE (REFERENCE SITE)

Site Name : Pu'u Papa'a

Site Coordinates (NAD83) : 21-25-19.6 N, 157-45-27.1 W

Tower ASRN : 1246610

Ground Elevation : 141.7 meters

Overall Tower Height Above Ground : 35.4 meters

Antenna Radiation Center Above Ground : 25.9 meters

Antenna Radiation Center Above Mean Sea Level : 167.6 meters

Effective Radiated Power : 4.6 kW (H-only)

Antenna Make/Model : Aldena US-Peanut

Antenna ID : 1007391

Type : Horizontally Polarized, Directional

Electrical Beam Tilt : 0 degrees

Orientation : 0 degrees true

EXHIBIT A

KKAI-DT DTS-2 TRANSMITTER SITE

Site Name : Mauna Kapu

Site Coordinates (NAD83) : 21-24-11.8 N, 158-05-52.8 W

Tower ASRN : 1278248

Ground Elevation : 829.1 meters

Overall Tower Height Above Ground : 48.8 meters

Antenna Radiation Center Above Ground : 20.5 meters

Antenna Radiation Center Above Mean Sea Level : 849.6 meters

Effective Radiated Power : 39.6 kW

Antenna Make/Model : Aldena 6-bay (Very Narrow Cardioid Pattern)

Type : Horizontally Polarized, Directional

Electrical Beam Tilt : 0 degrees

Orientation : 100 degrees true

Exhibit B-1 is a map upon which the predicted service contours of the proposed KKAI-DT DTS-1 facility are plotted. As shown, the community of Kailua is completely encompassed by the 48 dBu city-grade service contour of the main (reference) KKAI-DT DTS-1 facility. Exhibit B-2 is a map upon which the predicted service contours of the newly proposed DTS-2 facility are plotted. Exhibit B-3 is a map which shows the combined coverage of the DTS-1 and DTS-2 facilities. Exhibit B-4 is the same map on which the licensed contours of DTS-1 and DTS-2 are plotted in relation to those proposed herein. From this map, it is clear that the new DTS facilities will cover all of the land area presently authorized to KKAI-DT, as required by Commission Rules.

EXHIBIT A

As shown in Exhibit B-5, the two DTS transmitter sites as well as the entire coverage of the KKAI-DT DTS facility proposed herein lies within the allowable 103-kilometer FCC Table of Distances arc extending from the KKAI-DT DTS-1 reference site.

Elevation and azimuth pattern information for the licensed KKAI-DT DTS-1 and DTS-2 antennas are provided in Exhibits C-1 and C-2, respectively.

We conducted a TVStudy interference study for the proposed DTS facility, using a cell size of 2 kilometers and increment spacing of 1.0 kilometer. The results are provided in Exhibit D. It concludes that the proposed KKAI-DT DTS facility on Channel 29 meets the Commission's *de minimis* interference criteria to all co-channel and adjacent-channel full-power and Class A facilities.

Power density calculations for both the main (reference) site and the DTS-2 sites appear in Exhibit E.

As a result of these showings, it is believed that the proposed DTS-2 facility meets all of the requirements of Section 73.626(f) of the Commission's DTS Rules as follows:

- (1) The combined coverage from the two DTS transmitters covers all of the presently authorized KKAI-DT service area.
- (2) All of the DTS facilities coverage is contained within the KKAI-DT Table of Distances area defined by the allowable 103-kilometer arc from the reference site.
- (3) Each DTS transmitter's coverage is contiguous with the other DTS transmitter's coverage.
- (4) The coverage from one or more DTS transmitter(s) is shown to provide principal community coverage over Kailua, Hawaii, as required by FCC Rules
- (5) The combined field strength of all the DTS transmitters in the network does not cause interference to another station in excess of the criteria specified in § 73.616.
- (6) Each DTS transmitter is located within the KKAI-DT Table of Distances area and/or its authorized service area.

EXHIBIT A

With respect to the Commission's concern about "loss" area created by proposed changes in licensed television facilities, please review the map in Exhibit B-4. From that map, we can see that the newly proposed DTS-2 facility's service contour is practically unchanged from that licensed. In addition, the proposed DTS-1 service contour's coverage over land is completely encompassed by the contour of proposed (and licensed) DTS-2 on Mauna Kapu. Therefore, this proposal creates no loss area with respect to the KKAI-DT DTS facility licensed by the FCC in LMS-0000157950.

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

A handwritten signature in blue ink, appearing to read "K. T. Fisher", with a stylized flourish at the end.

KEVIN T. FISHER

November 28, 2023

CONTOUR POPULATION

2020 U.S. CENSUS DATA

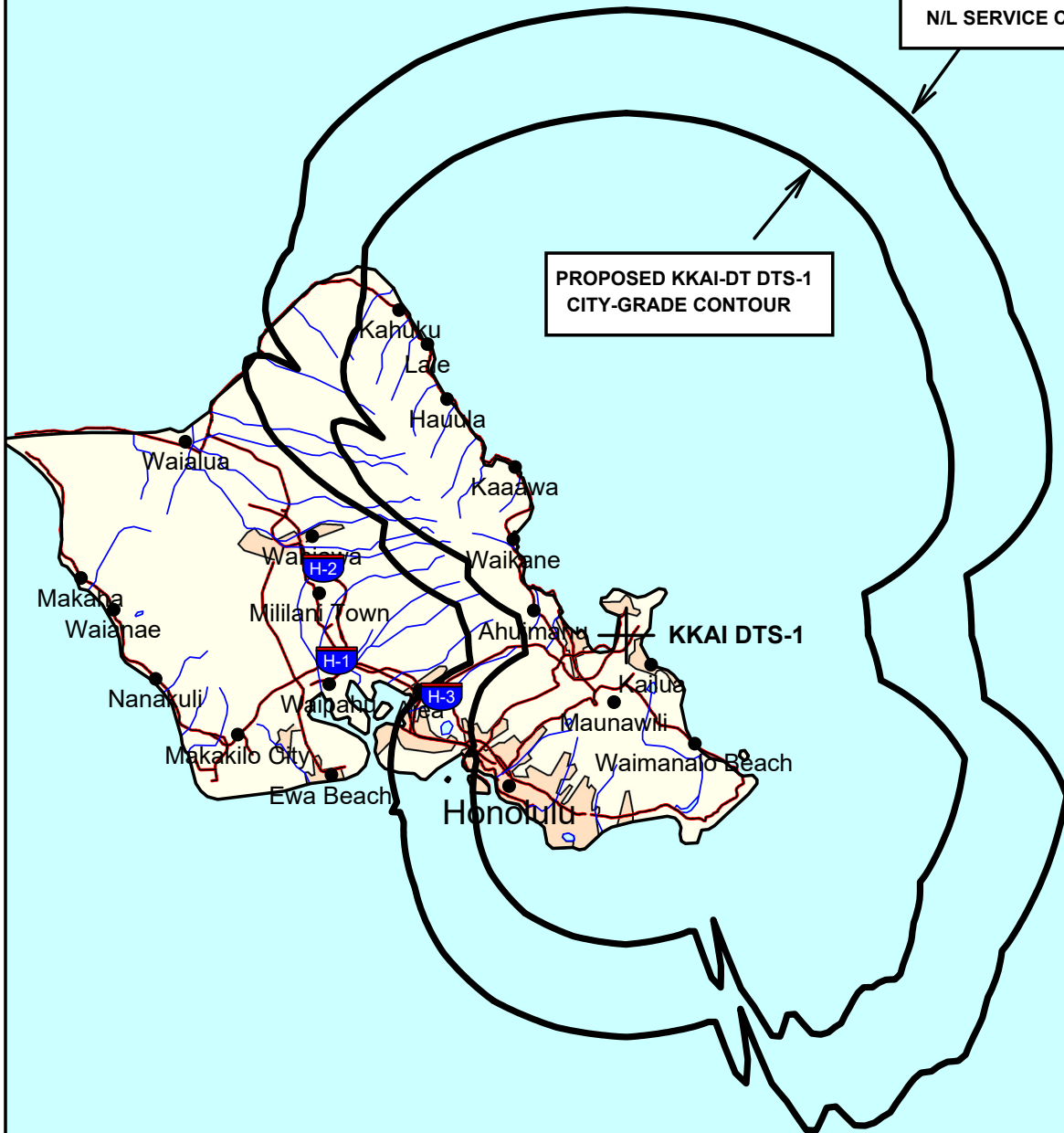
48 DBU (CITY GRADE) : 494,581 (205,530 HH)

N/L SERVICE : 568,999 (230,814 HH)

SMITH AND FISHER, LLC

**PROPOSED KKAI-DT DTS-1
N/L SERVICE CONTOUR**

**PROPOSED KKAI-DT DTS-1
CITY-GRADE CONTOUR**



Scale 1:600,000

0 6 12 18 mi

**EXHIBIT B-1
PREDICTED SERVICE CONTOURS
PROPOSED KKAI-DT DTS-1 FACILITY
CHANNEL 29 - KAILUA, HAWAII**

CONTOUR POPULATION

2020 U.S. CENSUS DATA

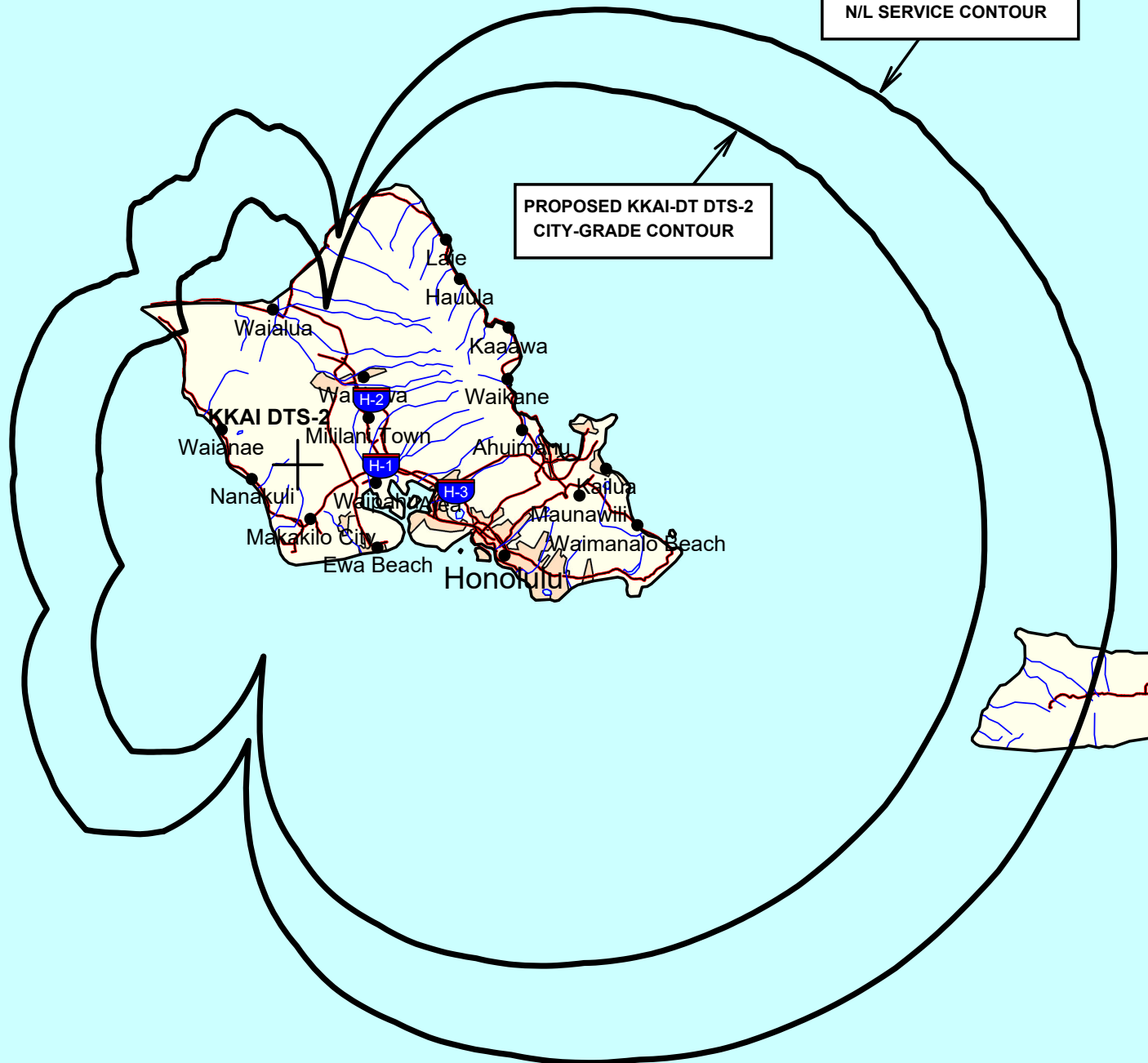
48 DBU (CITY GRADE) : 1,011,888 (368,736 HH)

N/L SERVICE : 1,016,839 (371,160 HH)

SMITH AND FISHER, LLC

**PROPOSED KKAI-DT DTS-2
N/L SERVICE CONTOUR**

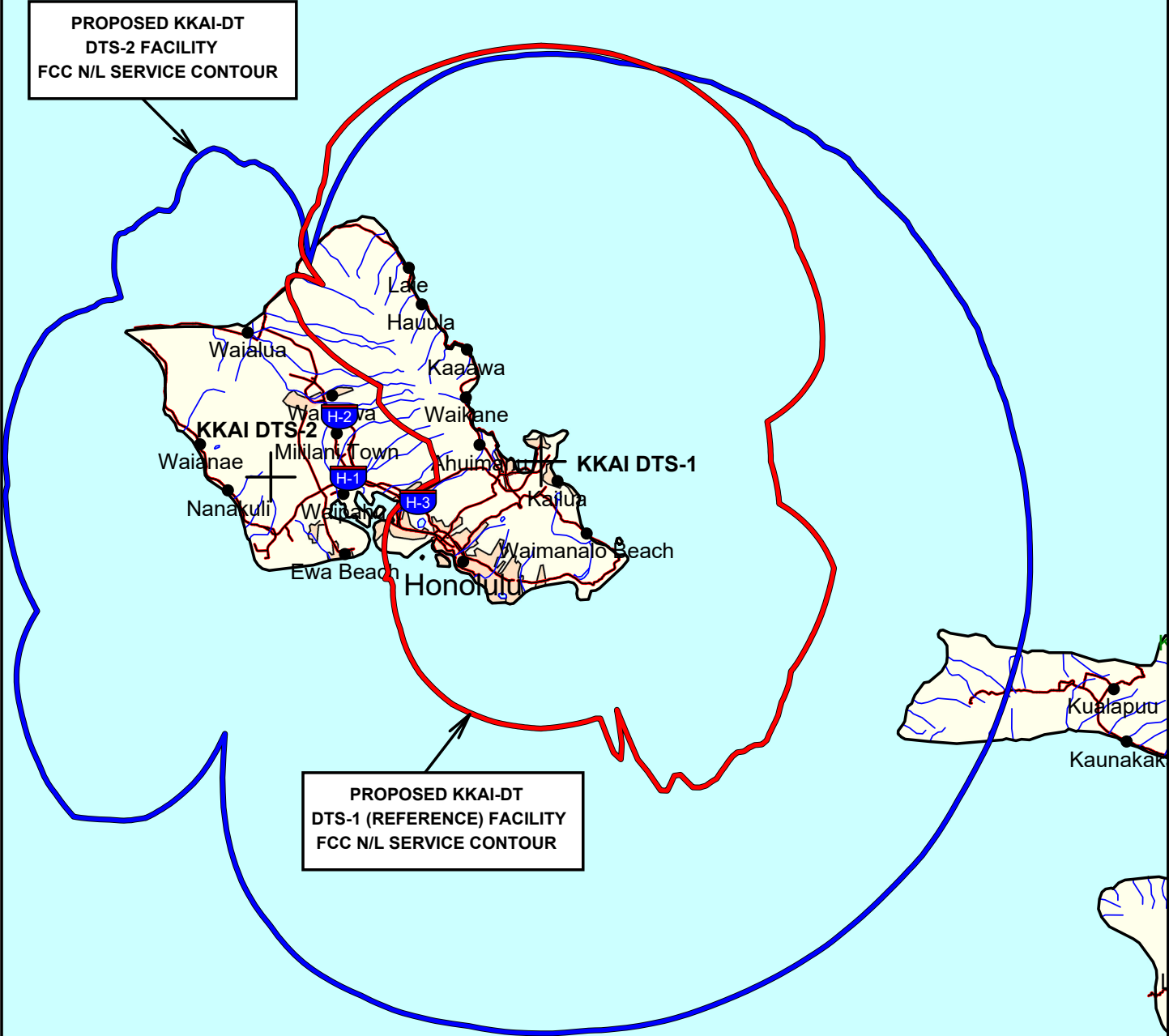
**PROPOSED KKAI-DT DTS-2
CITY-GRADE CONTOUR**



Scale 1:750,000

0 6 12 18 mi

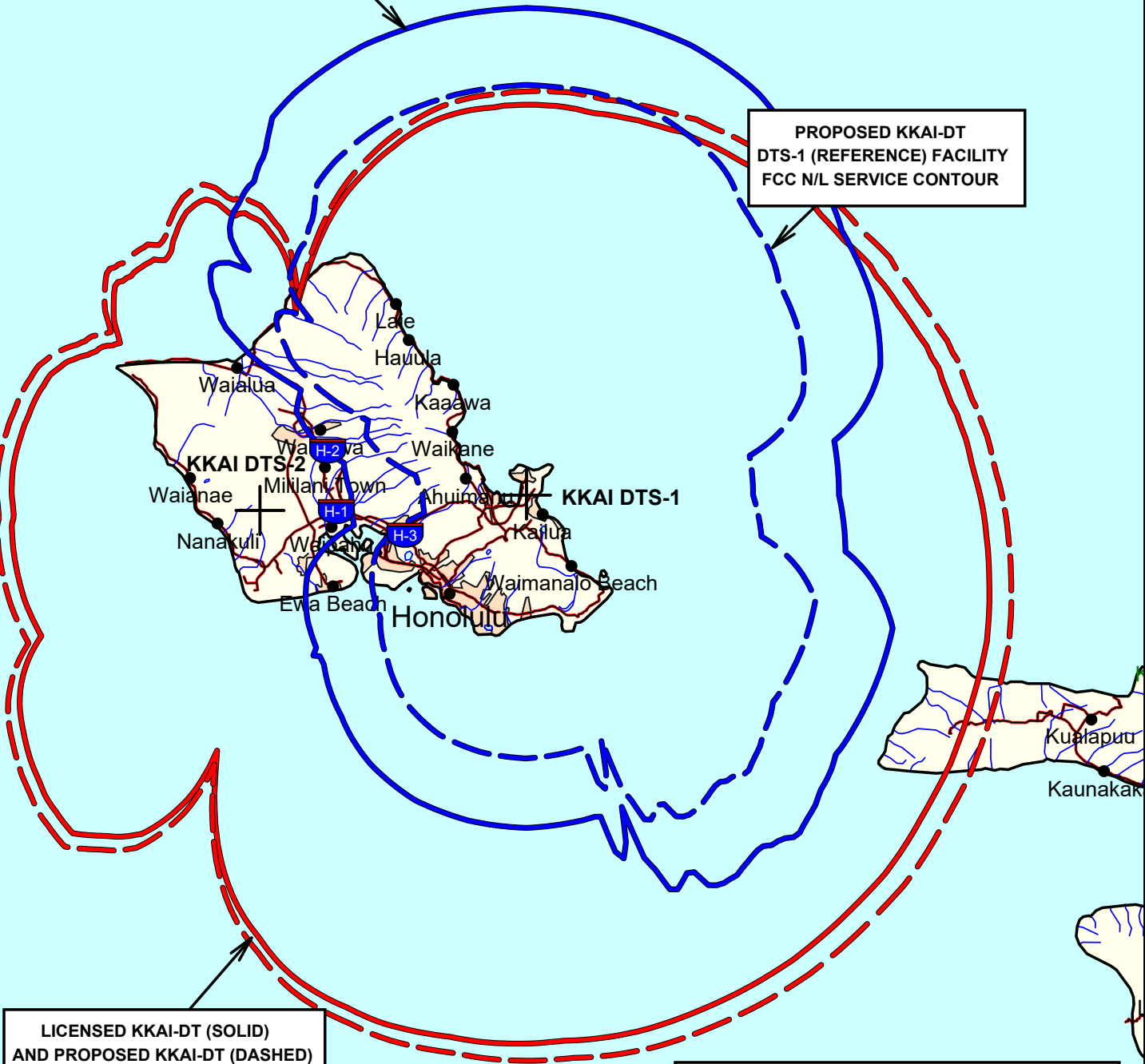
**EXHIBIT B-2
PREDICTED SERVICE CONTOURS
PROPOSED KKAI-DT DTS-2 FACILITY
CHANNEL 29 - KAILUA, HAWAII**



**EXHIBIT B-3
COMBINED KKAI-DT COVERAGE
PROPOSED KKAI-DT DTS FACILITIES
CHANNEL 29 - KAILUA, HAWAII**

LICENSED KKAI-DT
DTS-1 (REFERENCE) FACILITY
FCC N/L SERVICE CONTOUR

PROPOSED KKAI-DT
DTS-1 (REFERENCE) FACILITY
FCC N/L SERVICE CONTOUR



LICENSED KKAI-DT (SOLID)
AND PROPOSED KKAI-DT (DASHED)
DTS-2 FACILITY
FCC N/L SERVICE CONTOUR

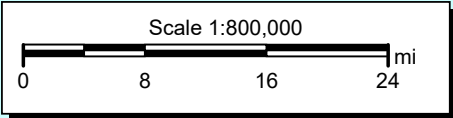


EXHIBIT B-4
COMBINED KKAI-DT COVERAGE
LICENSED AND PROPOSED
KKAI-DT DTS FACILITIES
CHANNEL 29 - KAILUA, HAWAII

FCC 103-KM TABLE OF DISTANCES
ARC FOR UHF DTS FACILITIES

PROPOSED KKAI-DT
MAUNA KAPU DTS-2 FACILITY
N/L SERVICE CONTOUR

Lāie
Waialua
Kaaawa
Makaha
Mānoa
Mililani Town
Wahiāe
Kalihi
Honolulu
KKAI DTS-1
KKAI DTS-2

PROPOSED KKAI-DT
DTS-1 FACILITY
N/L SERVICE CONTOUR

Kalawao
Kualapuu
Kaunakakai

Kaunakakai
Lanai City
Lahaina

Scale 1:1,200,000

0 10 20 30 mi

EXHIBIT B-5
PROPOSED KKAI-DT DTS
TRANSMITTER SITE LOCATION AND COVERAGE
WITHIN FCC 103-KM TABLE OF DISTANCES ARC

TX station: KKAJ-Main
Frequency: 563.00 MHz Gain solid
integration : enabled

Locality: US - Peanut

Antennas arrays data

Note: calculation of single antennas arrays data (without taking into account mutual effects)

A. Antennas array azimuth (°/N)	0	180
B. Number of antennas	4	4
C. Nominal power supply (W)	0.50	0.50
D. Losses (addit. + cables) (dB)	0.0	0.0
E. Effective power supply (W)	0.50	0.50
F. Theor. maximum gain (dBd)	16.62	16.62
G. Distribution losses (dB)	0.00	0.00
H. Nominal max gain F - G (dBd)	16.62	16.62
I. Compensation losses (dB)	0.00	0.00
J. Effec. max gain H - I (dBd)	16.62	16.62
K. Effec. max gain (times)	45.90	45.90
L. Effec. max power E * K (KW)	0.0229	0.0229
M. Max power depr. angle (°)	0.0	0.0
N. Max power az. angle (°)	0	180

Diagram in dBK calculated at horizon

Az. (°/N)	dBK	Az. (°/N)	dBK	Az. (°/N)	dBK	Az. (°/N)	dBK
0	-15.8	90	-36.4	180	-15.8	270	-36.4
10	-16.1	100	-35.1	190	-16.1	280	-35.1
20	-16.9	110	-27.6	200	-16.9	290	-27.6
30	-18.8	120	-26.6	210	-18.8	300	-26.6
40	-21.9	130	-25.9	220	-21.9	310	-25.9
50	-25.1	140	-21.9	230	-25.1	320	-21.9
60	-26.6	150	-18.8	240	-26.6	330	-18.8
70	-29.1	160	-17.0	250	-29.1	340	-17.0
80	-36.4	170	-16.2	260	-36.4	350	-16.2

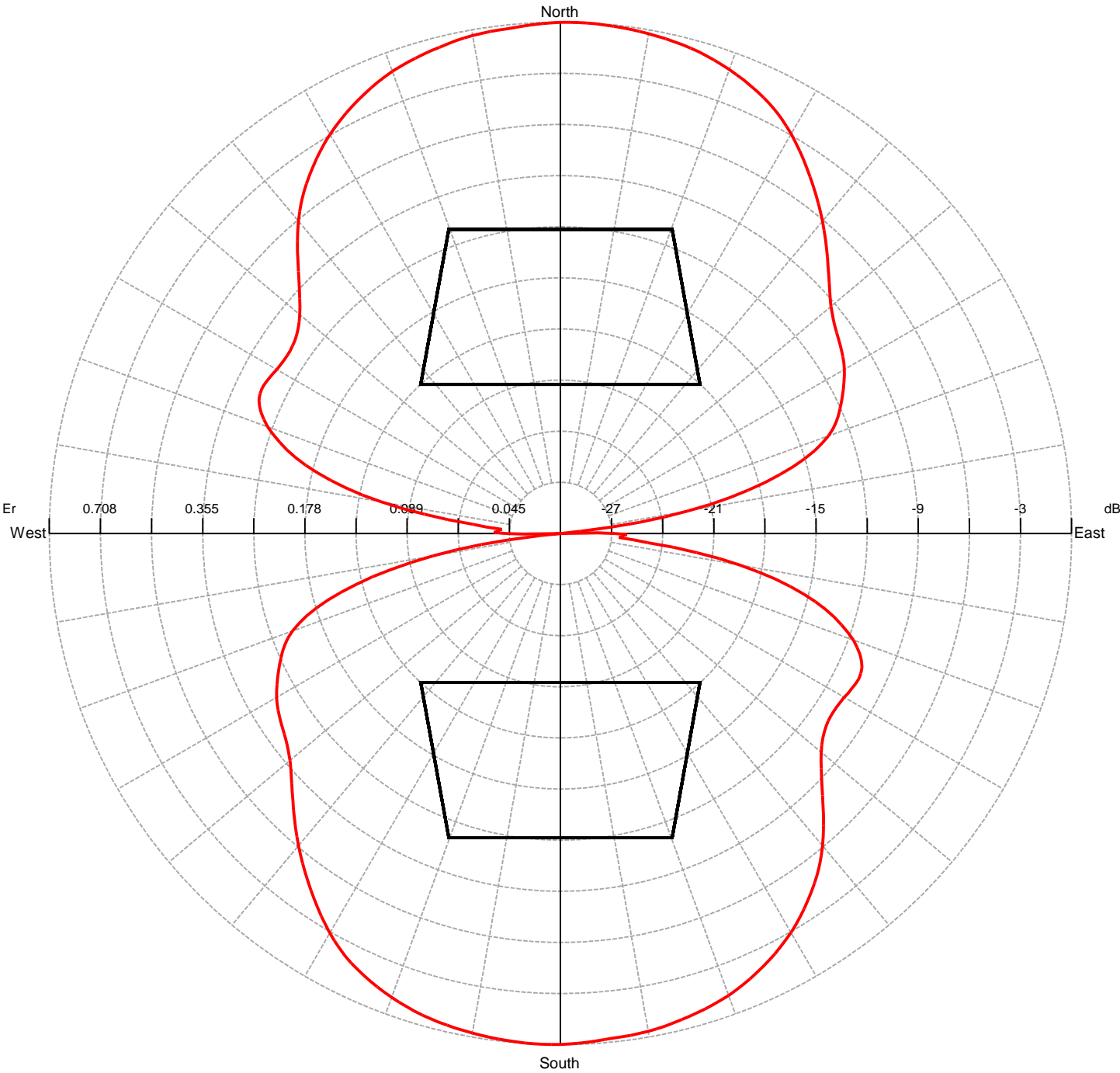
Diagram in dBK calculated at horizon
(without -20dB\’s lower limit vs maximum power)

Az. (°/N)	dBK	Az. (°/N)	dBK	Az. (°/N)	dBK	Az. (°/N)	dBK
0	-15.8	90	-42.6	180	-15.8	270	-42.6
10	-16.1	100	-35.1	190	-16.1	280	-35.1
20	-16.9	110	-27.6	200	-16.9	290	-27.6
30	-18.8	120	-26.6	210	-18.8	300	-26.6
40	-21.9	130	-25.9	220	-21.9	310	-25.9
50	-25.1	140	-21.9	230	-25.1	320	-21.9
60	-26.6	150	-18.8	240	-26.6	330	-18.8
70	-29.1	160	-17.0	250	-29.1	340	-17.0
80	-38.2	170	-16.2	260	-38.2	350	-16.2

TX station: KKAI-Main
Frequency: 563.00 MHz Gain
solid integration : enabled

Locality: US - Peanut

Horizontal diagram at 0.0° depres. (Total Antenna)

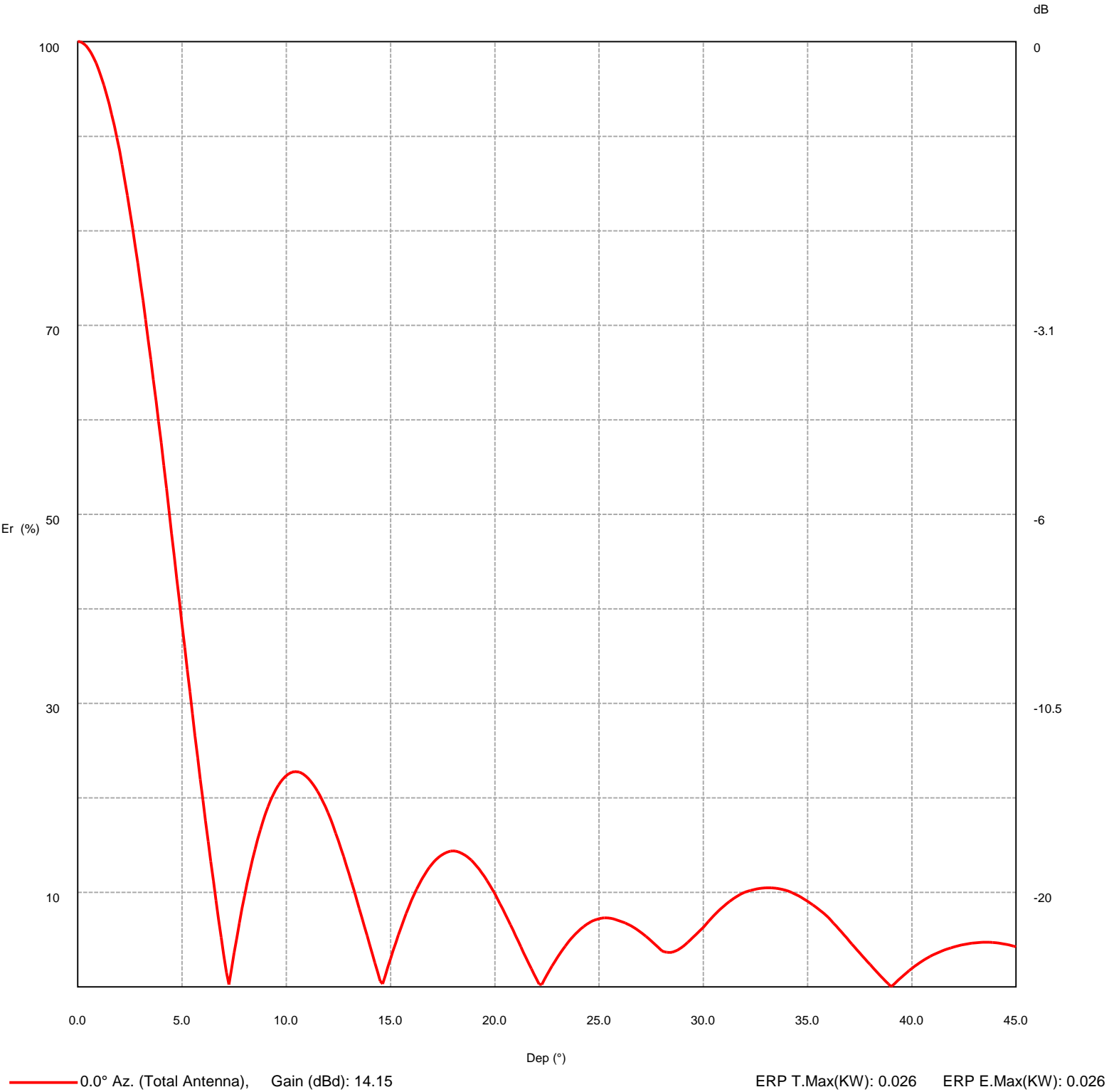


0.0° depres. (Total Antenna), Gain (dBd): 14.16 ERP T.Max(KW): 0.026 ERP E.Max(KW): 0.026

TX station: KKAI-Main
Frequency: 563.00 MHz Gain
solid integration : enabled

Locality: US - Peanut

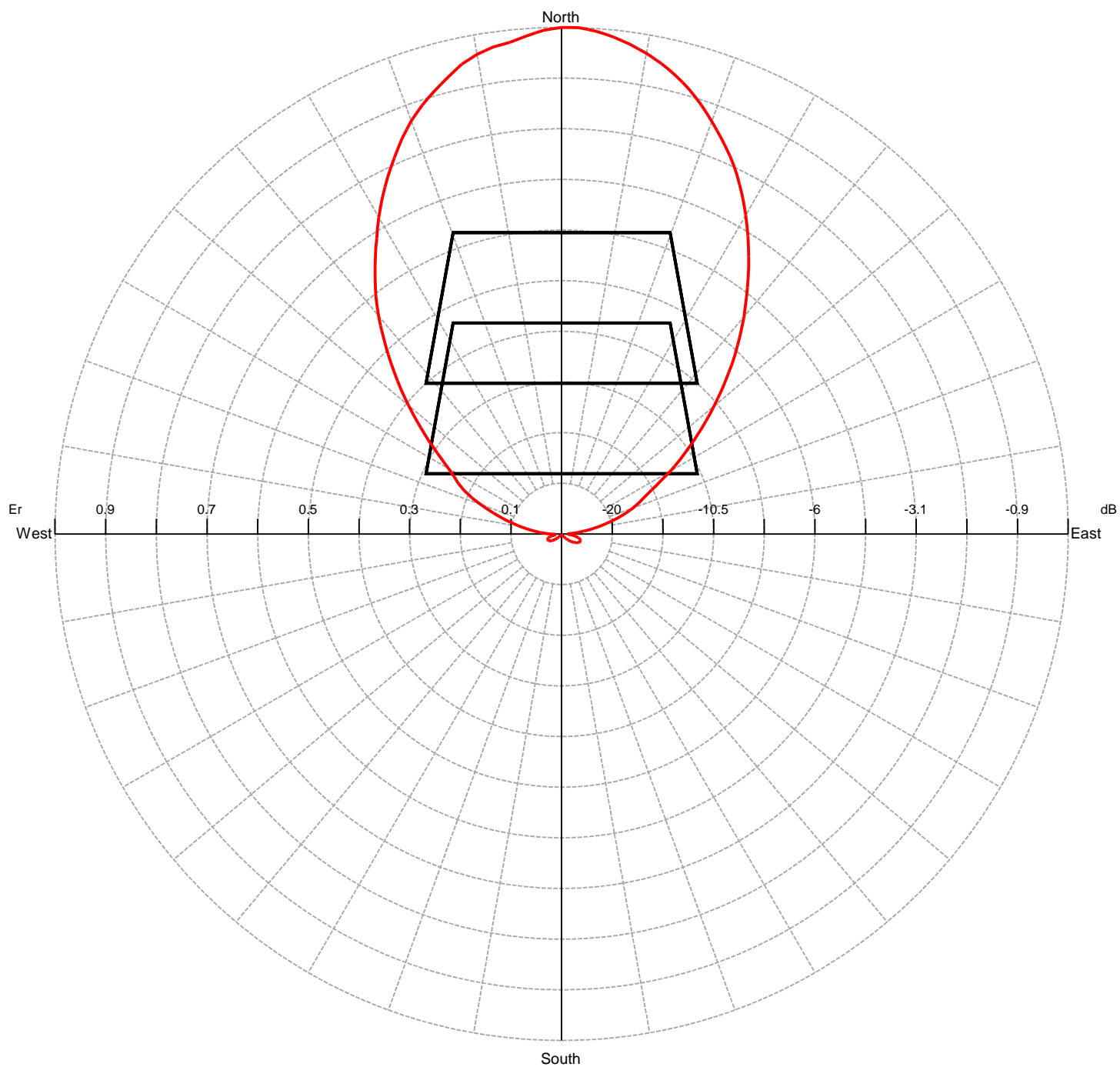
Vertical diagram at an azimuth of 0.0° degrees



TX station: Rachine
Frequency: 521.00 MHz
Gain solid integration : enabled

Locality: Very Narrow Cardioid - 6 bay

Horizontal diagram at 0.0° depres. (Total Antenna)



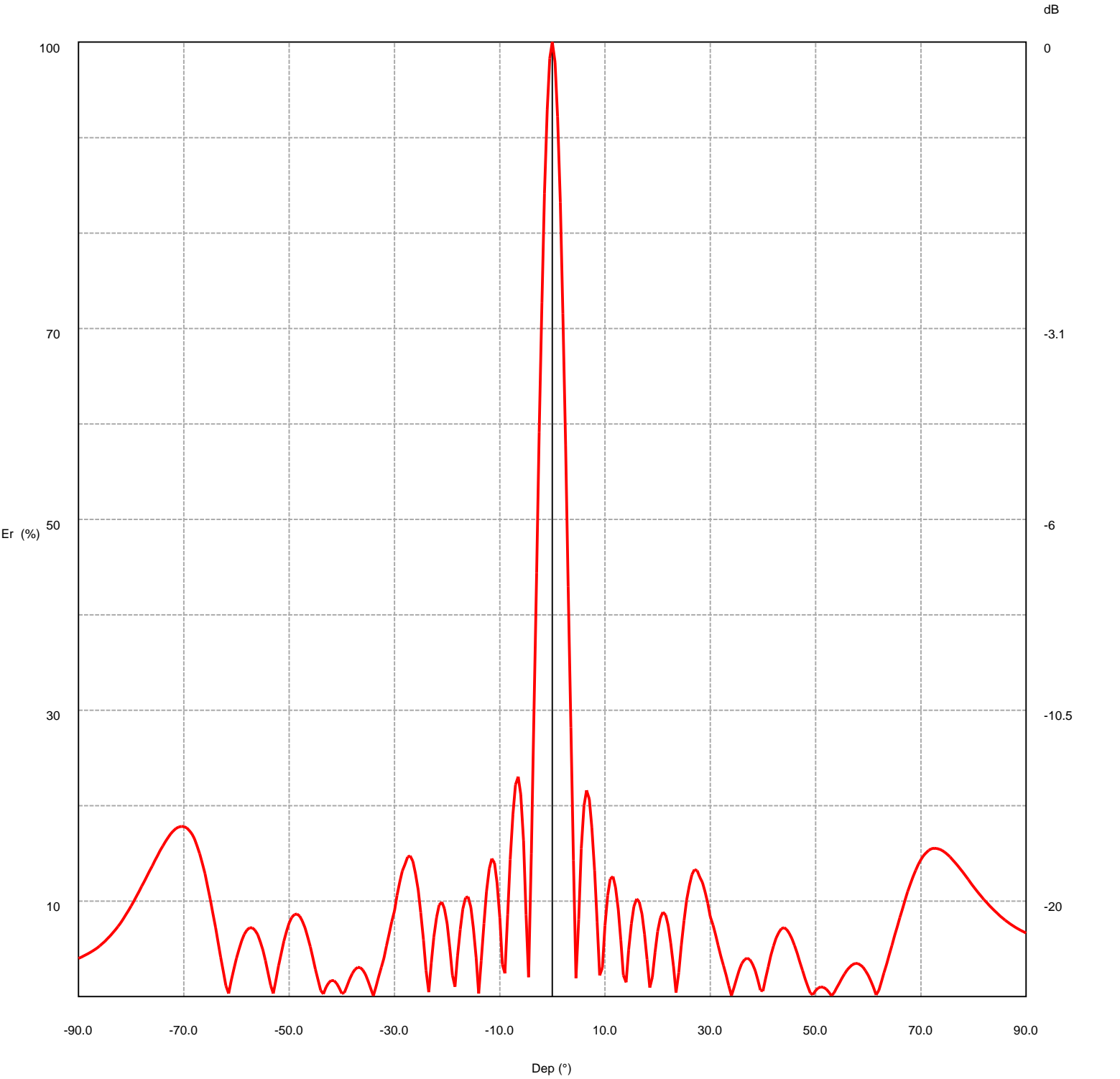
0.0° depres. (Total Antenna), Gain (dBd): 18.74

ERP T.Max(KW): 74.774 ERP E.Max(KW): 74.774

TX station: Rachine
Frequency: 521.00 MHz
Gain solid integration : enabled

Locality: Very Narrow Cardioid - 6 bay

Vertical diagram at an azimuth of 0.0° degrees



0.0° Az. (Total Antenna), Gain (dBd): 18.74 ERP T.Max(KW): 74.771 ERP E.Max(KW): 74.771

TVSTUDY INTERFERENCE ANALYSIS RESULTS
PROPOSED KKAI-DT DTS FACILITY
CHANNEL 29 – KAILUA, HAWAII

Study created: 2023.11.28 08:51:12

Study build station data: LMS TV 2023-11-20

Proposal: KKAI D29 DD LIC KAILUA, HI

File number: BLANK0000157950

Facility ID: 83180

Station data: User record

Record ID: 42

Country: U.S.

Zone: II

Ref. lat.: 21 25 19.60 N

Ref. long.: 157 45 27.10 W

DTS sites: 2

No protected stations found.

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied, DTS site # 1:

Channel: D29

Latitude: 21 25 19.60 N (NAD83)

Longitude: 157 45 27.10 W

Height AMSL: 167.6 m

HAAT: 76.3 m

Peak ERP: 4.60 kW

Antenna: Aldena-US-Peanut (ID 1007391) 0.0 deg

Elev Pattn: Generic

EXHIBIT D

40.2 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	4.60 kW	166.8 m	54.2 km
45.0	0.808	165.8	45.5
90.0	0.040	167.6	30.1
135.0	0.751	154.4	44.4
180.0	4.60	-10.3	35.0
225.0	0.808	-67.1	27.3
270.0	0.040	-107.1	13.9
315.0	0.751	140.4	43.5

Record parameters as studied, DTS site # 2:

Channel: D29

Latitude: 21 24 11.80 N (NAD83)

Longitude: 158 5 52.80 W

Height AMSL: 849.6 m

HAAT: 697.6 m

Peak ERP: 39.6 kW

Antenna: Aldena-6-Bay Very Narrow Cardioid (ID 1008174) 100.0 deg

Elev Pattn: Generic

40.2 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	0.036 kW	417.6 m	40.2 km
45.0	4.06	588.8	75.1
90.0	36.5	758.1	98.5
135.0	16.5	801.4	92.5
180.0	0.194	773.2	58.3
225.0	0.025	795.3	44.9
270.0	0.004	799.3	33.1
315.0	0.004	647.2	31.1

DTS proposal coverage is within reference facility and distance limit

Distance to Canadian border: 4195.4 km

Distance to Mexican border: 4151.1 km

EXHIBIT D

**Proposal is within coordination distance of FCC monitoring station

**Proposal exceeds field strength limit at FCC monitoring station

Conditions at FCC monitoring station: Waipahu HI

DTS site # 2 Bearing: 105.9 degrees Distance: 11.0 km

ERP: 37.7 kW HAAT: 805.2 m Field strength: 85.7 dBu, 19.2 mV/m

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:

DTS site # 1 Bearing: 54.7 degrees Distance: 5339.1 km

DTS site # 2 Bearing: 54.7 degrees Distance: 5369.1 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%

No IX check failures found.

EXHIBIT E

POWER DENSITY CALCULATION

PROPOSED KKAI-DT DTS FACILITY
CHANNEL 29 – KAILUA, HAWAII

Since the FCC considers the possible biological effects of RF transmissions in its environmental determinations, we have studied the matter with respect to this Kailua facility. Below are the calculations for the main and DTS-2 sites:

KKAI-DT DTS-1 (Reference) Site (Pu'u Papa'a)

Employing the methods set forth in OET Bulletin No. 65 and considering a main-lobe effective radiated power of 4.6 kW, an antenna radiation center 25.9 meters above ground, and a vertical relative field value of 10 percent at the steeper elevation angles for the proposed Aldena panel antenna, maximum power density two meters above ground of 0.0026 mW/cm^2 is calculated to occur near the northern and southern areas of the base of the tower. Since this is only 0.7 percent of the 0.37 mW/cm^2 reference for uncontrolled environments (areas with public access) surrounding a facility operating on Channel 29 (560-566 MHz), a grant of this proposal may be considered a minor environmental action with respect to public and occupational exposure to non-ionizing electromagnetic radiation.

Further, the station owner will take whatever precautionary steps are necessary, such as reducing power or leaving the air temporarily, to ensure that workers operating in the vicinity of the antenna are not exposed to excessive non-ionizing radiation.

EXHIBIT E

KKAI-DT DTS-2 Site (Mauna Kapu)

Employing the methods set forth in *OET Bulletin No. 65* and considering a main-lobe effective radiated power of 39.6 kW, an antenna radiation center 20.5 meters above ground, and the specific elevation pattern of the licensed Aldena 6-bay very narrow cardioid antenna, a maximum power density value two meters above ground of 0.094 mW/cm² is calculated to occur 6 meters east-southeast of the base of the tower. Since this is only 25.4 percent of the 0.37 mW/cm² reference for uncontrolled environments (areas with public access) surrounding a facility operating on Channel 29 (560-566 MHz), a grant of this proposal may be considered a minor environmental action with respect to public exposure to non-ionizing electromagnetic radiation.

Further, the station owner will take whatever precautionary steps are necessary, such as reducing power or leaving the air temporarily, to ensure that workers operating in the vicinity of the antenna are not exposed to excessive non-ionizing radiation.