

MEMORANDUM

To Victor Elizondo

cc: Keith Richins

From Jason Edwards

File

Date January 14, 2011

Ref Preliminary Path Study - Larimer County - Pole Mt-Crow Creek to Middle Bald

Attached is a system map, a profile and path calculation for one path in Colorado. The path design uses the MDR-8000 radio in the upper 6GHz band.

The following assumptions were used:

- Site coordinates are from the Customer. The site coordinates were provided using the North American Datum of 1983 (NAD83).
- Ground elevations at each site are taken from the USGS 30 meter terrain database.
- Profile data is from the USGS 30 meter database.
- Paths were designed for a good propagation area.
- Average tree heights of 75ft were used for this study.
- Centerlines used were selected by Alcatel-Lucent.
- The main antenna clearance criteria is:
 - 0.6 of the 1st Fresnel zone @ K=1.
- Paths were designed to a 2-way availability of 99.999 per year, using the 10⁻⁶ bit error rate threshold. Paths were also designed using a minimum fade margin to protect against obstruction fading and ducting conditions.

Alcatel-Lucent strongly recommends that a field survey be performed to verify site coordinates, path clearances and obstruction heights.

Attached is a copy of our 'Microwave Path Engineering Warranty' which should be included with any transmittals of feasibility studies, proposals and/or final designs and frequency coordination.

If you have any questions, please call.

Jason Edwards

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Microwave System Feasibility Report

Larimer County

Pole Mt-Crow Creek to Middle Bald

This report is intended to discover the feasibility of constructing a microwave system to meet the customer's needs as outlined to Alcatel-Lucent. It is based on customer supplied data unless noted otherwise. This information should be used solely to determine if a more formal engineering effort is worthwhile.

No equipment orders, site work, tower structural analysis, frequency coordination or similar activity should be based on this document.

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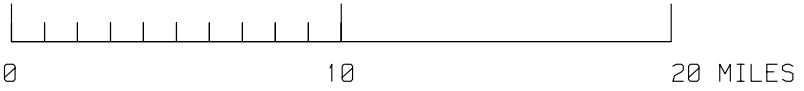
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POLE MT-CROW CREEK

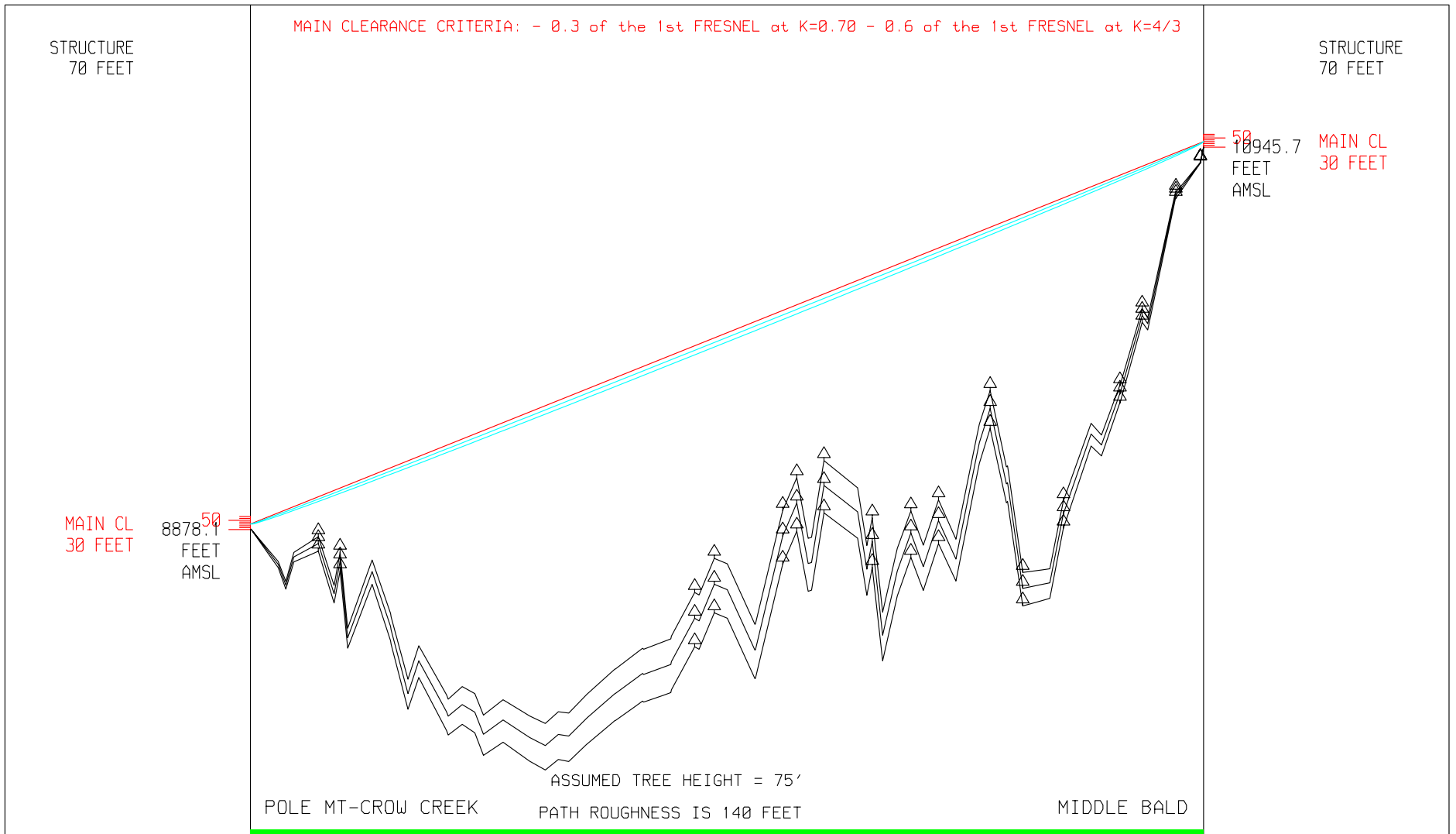
STATION NAME	LATITUDE	LONGITUDE	DATUM
1 POLE MT-CROW CREEK	N 41 14 00.0	W 105 26 33.2	NAD83
2 MIDDLE BALD	N 40 45 56.0	W 105 42 26.9	NAD83

35.1 MI

MIDDLE BALD



ALCATEL-LUCENT
LARIMER COUNTY
POLE MT-CROW CREEK TO MIDDLE BALD
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41-14-00.0 N 105-26-33.2 W 0 10 20 30 40-45-56.0 N 105-42-26.9 W

NAD83 AZIMUTH = 203.3 F = 6.7 GHZ DISTANCE IN MILES D = 35.12 MI AZIMUTH = 23.1 NAD83

<ul style="list-style-type: none"> — GROUND ELEVATION OF PROFILE — FRACTION OF 1ST FRESNEL ZONE — MAIN CENTERLINE/EVEN FRESNEL — DIVERSITY CL/ODD FRESNEL +++ TERRAIN OVER WATER — OBSTRUCTION OFF PATH 	<p>TERRAIN DATA BASE PROFILE FOR PRELIMINARY PLANNING ONLY</p> <p>DATA FROM: USGS 30-METER DATA</p> <p>K=.7</p> <p>K=4/3</p> <p>K=INFINITY</p>	<p>ALCATEL-LUCENT</p> <p>SYSTEM: LARIMER COUNTY</p> <p>ROUTE: POLE MT-CROW CREEK TO MIDDLE BALD</p> <p>FILE: Y:\CUSTOMER\FEASIBLE\LARIMER.CO\POLE_MT.CO\RECORD-2</p> <p>DATE: 14 Jan 2011 JE PAGE 1 OF 1</p>
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SYSTEM: LARIMER COUNTY
 ROUTE: POLE MT-CROW CREEK TO MIDDLE BALD
 FILE: Y:\CUSTOMER\FEASIBLE\LARIMER.CO\POLE_MT.CO\RECORD-1

Alcatel-Lucent Feasibility		POLE MT-CROW CREEK	MIDDLE BALD
EDWARDS		NAD83 41 14 00.0 N	NAD83 40 45 56.0 N
		105 26 33.2 W	105 42 26.9 W
GROUND ELEVATION	Feet	8878.1	10945.7
MAIN ANTENNA SIZE	Feet	6.0 PAD6-65B	6.0 PAD6-65B
MAIN ANTENNA GAIN	dBi	39.5	39.5
MAIN RADOME LOSS	dB	.5 FIBERGLASS	.5 FIBERGLASS
MAIN CENTERLINE	Feet	30.0	30.0
MAIN FEEDER LENGTH	Feet	210.0	60.0
MAIN FEED LOSS IN dB/100	Feet	1.3 E-65	1.3 E-65
MAIN FEEDER LOSS	dB	2.7	.8
PROTECT CHANNEL LOSS	dB	10.0	10.0
OTHER FEEDER LOSSES	dB	1.0	1.0
OTHER TRANSMIT LOSSES	dB	0.0	0.0
OTHER RECEIVE LOSSES	dB	1.0	1.0
CALCULATED EIRP	dBm	68.3	70.2
MAXIMUM EIRP (PART 101)	dBm	85.0	85.0
RADIO TYPE and FCC ID		MDR-8706E-12	
FREQUENCY BAND	MHz	6700	2M50D7W
PATH LENGTH	Miles	35.1	
MEAN ANNUAL TEMPERATURE	Deg F	41.6	
ABSOLUTE HUMIDITY	g/m^3	10.1	
CLIMATE FACTOR		.5	
ROUGHNESS FACTOR	Feet	140.0	
FREE SPACE LOSS	dB	144.0	
ABSORPTION LOSS	dB	.6	
DISPERSIVE FADE MARGIN	dB	70.0	
TRANSMIT POWER	dBm	33.0	HOT-STANDBY
ATPC POWER REDUCTION	dB	0.0	
MAXIMUM RECEIVED SIGNAL	dBm	-17.0	
RECEIVER THRESHOLD	dBm	-79.0	BER= 10-6
MAIN RECEIVED SIGNAL	dBm	-40.2	-40.2
THERMAL FADE MARGIN	dB	38.8	38.8
MINIMUM FADE MARGIN	dB	33.0	33.0
EXTERNAL INTERFERENCE FM	dB	N/A	N/A
FLAT FADE MARGIN	dB	38.8	38.8
SPACE DIV IMPROVE FACTOR	THERMAL	1.0	1.0
MULTIPATH OUTAGE SECONDS	THERMAL	83.3	83.3
SPACE DIV IMPROVE FACTOR	DIGITAL	1.0	1.0
MULTIPATH OUTAGE SECONDS	DIGITAL	.1	.1
TOTAL MULTIPATH 2-WAY	seconds	166.7	
UPFADE OUTAGE 2-WAY	seconds	0.0	
PATH AVAILABILITY 2-WAY	percent	99.9994715	166.7 sec
OUTAGE OBJECTIVE YEAR	percent	99.9990000	315.4 sec

- PRELIMINARY PATH DESIGN BASED ON TERRAIN DATA BASE
- CALCULATIONS VALID ONLY IF PATH HAS ADEQUATE CLEARANCE

MICROWAVE PATH ENGINEERING WARRANTY

FEASIBILITY STUDIES

Alcatel-Lucent provides feasibility studies of microwave radio paths in support of bidding efforts or when purchased by the Customer. Feasibility studies are performed using information provided by or on behalf of the Customer. Results of the feasibility study are provided to the Customer and may include (i) a system map, (ii) a path profile, (iii) path calculations, (iv) availability calculations, and (v) a technical report.

Feasibility studies are preliminary in nature and are not intended to represent a final design. Therefore, no guarantee is provided, and the Customer assumes all risks associated with installing any equipment based on a feasibility study.

PATH SURVEYS

Alcatel-Lucent offers microwave path surveying services to determine or verify site coordinates, ground elevation, on-path obstruction location and height, tower information, and other parameters required to engineer and implement a microwave radio link. The present and anticipated future effect of on-path obstructions, such as tree growth, is evaluated and incorporated into the path design where applicable. The results of the path survey are documented and a formal survey report or technical report, as required, is delivered to the Customer.

Alcatel-Lucent warrants that the geodetic coordinates are accurate to within 1-second of latitude and 1-second of longitude, that ground elevations are accurate to within 5-feet, and that on-path obstructions at critical points are identified and present heights are accurate to within 5-feet. Alcatel-Lucent warrants only the actual paths surveyed.

PATH DESIGN

Alcatel-Lucent offers path design services. The path design is based on formal field survey data gathered by Alcatel-Lucent path surveyors. Path designs include profiling a path to determine antenna centerline requirements, and path calculations to determine the antenna and radio types necessary to meet the Customer's availability objective.

Alcatel-Lucent will recommend antenna centerlines based on the range of K-factors expected to occur during an average year. The Fresnel zone clearance criteria used by Alcatel-Lucent for various K-factors are in line with current industry standards. In addition, paths are checked for susceptibility to obstruction fading outages using a standard Obstruction Fading model. Paths are also analyzed for ground-based reflections. After these calculations are completed, if the Customer's path availability objective has not been met, various countermeasures are recommended to improve path availability.

Path availability is determined using current industry accepted models for predicting outage times and diversity improvement factors associated with normal atmospheric multipath fading, up-fading, rain fading, and obstruction fading. Every effort is made by Alcatel-Lucent to anticipate the probable occurrence of abnormal propagation conditions based on historical documentation, experience, geographical location, and field survey data.

The final path design documentation will include one or more of the following, depending on the services purchased by the Customer: (i) a system map, (ii) a final path profile, (iii) final path calculations, (iv) final availability calculations, and (v) a technical report.

If a radio path using Alcatel-Lucent equipment is installed based on Alcatel-Lucent's recommended path design, then Alcatel-Lucent warrants that the radio path shall conform to the Customer's availability requirement for normal atmospheric multipath fading. Alcatel-Lucent will not be held responsible for excessive outages or degraded performance due to abnormal fading conditions. Abnormal fading conditions include, but are not limited to:

- Formation of extreme radio refractivity gradients associated with:
 - Exceptionally large temperature inversions
 - Abnormal temperature/humidity layers
 - Fog formation
 - Signal trapping caused by surface or atmospheric ducting
- Reflections from unidentifiable off-path terrain features or physical structures
- Rain fading due to rainfall rates that are in excess of the published rates or charts used to predict rain induced outages.

If Alcatel-Lucent suspects that abnormal propagation conditions are the cause of degraded system performance, Alcatel-Lucent will assist the Customer in verifying the conditions leading to the degraded system performance. After the problem has been identified, Alcatel-Lucent will support the Customer in identifying possible solutions to the problem and assess the incremental improvement expected from corrective actions. Implementation of corrective action to remedy this type of problem shall be the sole responsibility of the Customer.

FREQUENCY PLANNING

Alcatel-Lucent offers frequency planning services, including frequency selection, prior coordination, interference case resolution, and FCC license application documentation preparation. Alcatel-Lucent warrants that the interference studies will be conducted using industry-accepted methods, hardware, and software; and that the frequency database will be maintained as accurately as possible at the time of the study. Alcatel-Lucent will not be held responsible for interference cases that arise due to errors or omissions in the database. Upon completion of the frequency planning services, some or all of the following documentation is provided to the Customer:

- Prior Coordination Notice
- Frequency Coordination Data Sheet
- Supplemental Showing pursuant to FCC Rules Part 101.103(d)
- Completed FCC Form 601 License Application

In the event harmful frequency interference is detected during the acceptance testing of a radio installation and Alcatel-Lucent provided the frequency planning services, Alcatel-Lucent's total responsibility for correcting the problem is limited to selecting another frequency. If harmful interference occurs after the radio system has been installed and accepted, corrective action is the sole responsibility of the Customer.

WARRANTY

Alcatel-Lucent warrants its path surveys and path designs for a period of 12 months from the date of delivery of the study to the Customer. Alcatel-Lucent warrants its frequency planning for a period of 6 months from the date the path was prior coordinated. Except as further limited above, in the event of a proven breach of warranty, the Customer's sole remedy under this warranty shall be that Alcatel-Lucent will provide the labor and material to correct the error in the path survey or path design. In the event that such error is not directly related to Alcatel-Lucent's path engineering efforts, expenses for such labor and material shall be borne by the Customer.