Microwave System Path Survey Report
Riverside County, CA
Corona – Beacon

PROPRIETARY NOTICE: This document is the result of technical investigations made by the engineering staff of Nokia. The disclosure of the information herein may pertain to proprietary rights, and the furnishing of this document does not constitute an expressed or implied license to use such materials.

Nokia
601 Data Drive
Plano, Texas 75075-5802

Printed in the United States of America
TABLE OF CONTENTS

SYSTEM MAP

1.1 SCOPE OF WORK

1.2 METHOD OF SURVEY

1.3 CONSTRUCTION OF PATH PROFILES

SITE DESCRIPTIONS:

-- SITE TOPOGRAPHIC
-- SITE LOCATION MAP
-- SITE INFORMATION
-- SITE DRAWINGS
    SITE PLOT PLAN
    TOWER SKETCH
-- SITE PHOTOGRAPHS

PATH DESCRIPTION:

- PATH DESCRIPTION
- PATH PROFILE DATA
- PATH PHOTOGRAPHS

PATH DESIGN:

- ENGINEERING NOTES
- PATH PROFILE
- PERFORMANCE CALCULATIONS

WARRANTY
TABLE OF CONTENTS

SYSTEM MAP
1.1 SCOPE OF WORK
1.2 METHOD OF SURVEY
1.3 CONSTRUCTION OF PATH PROFILES

SITE DESCRIPTIONS:

1. Beacon Hill
2. Corona

PATH DESCRIPTIONS:

1. Beacon Hill to Corona
## MICROWAVE SYSTEM DATA

**RIVERSIDE COUNTY, CA**
**MURRIETA, CORONA SURVEY**

<table>
<thead>
<tr>
<th>STATION</th>
<th>FCC NUMBER</th>
<th>LATITUDE (DMS)</th>
<th>LONGITUDE (DMS)</th>
<th>ELEVATION (FEET)</th>
<th>TO STATION</th>
<th>FREQUENCY (GHZ)</th>
<th>ANTENNA CENTERLINE (FEET)</th>
<th>ESTIMATED WAVEGUIDE (FEET)</th>
<th>FORWARD AZIMUTH (DMS)</th>
<th>DISTANCE (MILES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEACON HILL</td>
<td>NONE FOUND</td>
<td>N 33 56 03.0</td>
<td>W 117 33 42.1</td>
<td>948</td>
<td>EXISTING</td>
<td>11.200</td>
<td>24</td>
<td>64</td>
<td>191 51 06</td>
<td>3.320</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CORONA PD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORONA</td>
<td>N/A</td>
<td>N 33 53 13.3</td>
<td>W 117 34 24.8</td>
<td>577</td>
<td>EXISTING</td>
<td>11.200</td>
<td>38</td>
<td>143</td>
<td>11 50 42</td>
<td>3.320</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BEACON HILL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.1 SCOPE OF WORK

This report describes a system path survey that was performed by Nokia in April, 2016 for Riverside County, CA.

The survey was conducted in order to obtain the data necessary to provide a preliminary transmission design which would meet the criteria for Riverside County, CA.

The data contained in this report reflects the path designs as known at the time of the survey, but may not reflect subsequent or final designs dictated by other factors such as environmental, construction, tower/zoning restrictions, FAA clearance, performance calculations, frequency coordination, anomalous fading conditions, etc.

1.2 METHOD OF SURVEY

Prior to beginning the actual field survey, available topographic maps for the area are obtained. These are supplemented by city, county and aeronautical maps where topographic mapping is unavailable or insufficient. The survey team selects and marks suitable locations in the area desired by the customer, and the site coordinates are accurately determined by hand held GPS and checked by plotting on the topographic maps data obtained from triangulation bearings to nearby trigonometric monuments or other prominent features. The elevations of the sites are determined using differential leveling, vertical angle trigonometric leveling or barometric altimetry techniques. When the vertical angle-trigonometric leveling technique is employed, the vertical angle from a known elevation to an identifiable object or flash is measured with a theodolite and the distance may be obtained using either electronic distance measuring equipment or map scaling. Using this data, the elevation of the object or flash can be calculated by trigonometric methods. The barometric altimetry technique uses precision surveying altimeters for which temperature and pressure corrections are applied.

Site features are noted with a sketch of the site area and then the proposed paths are traversed to determine the elevation and locations of the critical points. Critical point elevations are determined using the same techniques as those used for measuring the elevations of the sites. Terrain features of path areas that might affect propagation, both man-made and naturally occurring, are noted so that the maximum expected future height can be plotted on the path profiles.

The specific methods that were used to survey the locations and paths for this report have been indicated on the site and path information sheets.
1.3 CONSTRUCTION OF PATH PROFILES

To provide a precise analysis of the clearance available over obstacles, path data was compiled on a Path Data Sheet. This was then transferred to a computer generated profile which was used to plot terrain features, vegetation, and man-made obstructions in the area of the sites as well as underlying the path line. Structures shown with dotted lines are off-path obstructions (listed on the path data sheets in lower case letters as follows: T = trees, W = water, B = building, M = Mast, R = Water Tower. On-path and off-path obstructions are noted under comments as follows: - ON = on-path, - OFF = off-path). In cases where effectively transparent obstructions such as power lines were located on-path, they were shown as off-path obstructions on the path profiles, but noted as on-path in the path data sheets.

**MAIN ANTENNAS:**

The greater of:

100% Fresnel at $K = \frac{4}{3}$

or

0% Fresnel at $K = 0.50$

**DIVERSITY ANTENNA: (if applicable)**

60% FRESNEL at $K=1.333$

Where applicable, an additional 10’ or greater feet are allowed for future tree growth. The amount of future growth is at the discretion of the surveyor.
SITE DESCRIPTIONS
BEACON
HILL
MICROWAVE SITE INFORMATION

SITE NAME: BEACON HILL

SURVEYOR: SCOTT MEREDITH AND BARRY PHILLIPS
DATE: APRIL 2016 AND MARCH 2011

STREET ADDRESS: 200' WEST OF INT. 5TH ST. AND HORSELESS CARRIAGE DR.

CITY: NORCO, 92860
STATE: CALIFORNIA

COUNTY: RIVERSIDE
COUNTRY: U.S.A.

IF NOT IN A CITY: DISTANCE: N/A
AZIMUTH (TRUE): N/A

TO CITY OF: SITE LOCATED WITHIN NORCO

**GEODETIC COORDINATES (NAD 83)

LATITUDE: N 33 56 03.0
LONGITUDE: W 117 33 42.1

HOW DETERMINED: DUAL FREQUENCY (STARFIRE CORRECTED) GPS SOLUTION.
COMBINED WITH USGS 7.5 MIN. TOPO MAPS.

SITE ELEVATION AMSL: 948'

HOW DETERMINED: DUAL FREQUENCY (STARFIRE CORRECTED) GPS SOLUTION.
TRIG ELEVATIONS COMBINED WITH USGS 7.5 MIN. TOPO MAPS.

SITE DESCRIPTION: EXISTING SITE WITH S/S TOWER

EAST OF GROUND LEVEL WATER TANK.

SITE ACCESS DESCRIPTION: LOCKED GATE-200' WEST OF INT. 5TH ST. AND HORSELESS CARRIAGE DRIVE

1200' N. ON ACCESS ROAD TO LEVELED SITE
ROUGH ROAD IN WET CONDITIONS
BUILDING INFORMATION: EXISTING

COMMENTS: SEE SITE PLOT PLAN FOR DETAILS

ELECTRIC POWER: EXISTING

VOLTS: N/A
HERTZ: N/A

TOWER INFORMATION: EXISTING

HEIGHT: 120'
TYPE: SELF SUPPORT

AREA REQUIRED FOR 80% GUYING: N/A

COMMENTS:

EQUIPMENT/TOWER DISTANCE (WAVEGUIDE RUN): See System Data Sheet

AIRPORT INFORMATION: (ALL AIRPORTS WITHIN 10 MILES)

<table>
<thead>
<tr>
<th>AIRPORT</th>
<th>AZIMUTH TO AIRPORT (TRUE)</th>
<th>DISTANCE TO NEAREST RUNWAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORONA MUNI (PUB)</td>
<td>223.5</td>
<td>3.49</td>
</tr>
<tr>
<td>CHINO (PUB)</td>
<td>303.0</td>
<td>5.20</td>
</tr>
<tr>
<td>ONTARIO INTERNATIONAL (PUB)</td>
<td>351.5</td>
<td>8.41</td>
</tr>
<tr>
<td>FLABOB (PUB)</td>
<td>66.0</td>
<td>9.43</td>
</tr>
<tr>
<td>RIVERSIDE MUNI (PUB)</td>
<td>79.6</td>
<td>6.74</td>
</tr>
<tr>
<td>LAKE MATHEWS (PVT)</td>
<td>125.5</td>
<td>9.64</td>
</tr>
</tbody>
</table>

GENERAL COMMENTS: NONE
AMSL denotes Above Mean Sea Level
AGL denotes Above Ground Level
LOOKING NORTH / EAST

HIGHEST APPENDAGE 135' AGL
EXISTING 120' AGL S/S TOWER

WHIP ANT., 113' TO 128' AGL ON WEST FACE
WHIP ANT., 97' TO 112' AGL ON WEST FACE
WHIP ANT., 81' TO 96' AGL ON WEST FACE

EXIST. 4' ANT., C/L 21' AGL LOOKING TO GLEN AVON
EXIST. 3' ANT., C/L 21.7' AGL LOOKING TO BUENA VISTA
EXIST. 4' ANT., C/L 18' AGL LOOKING TO G. RIVER

GROUND = 948' AMSL
GROUND = 0' AGL

SCALE
1=20 FEET

RIVERSIDE COUNTY
BEACON HILL TOWER ELEVATION

AMSL denotes Above Mean Sea Level
AGL denotes Above Ground Level
BEACON HILL

LOOKING WESTERLY

LOOKING SOUTHERLY
BEACON HILL

COUNTY OF RIVERSIDE
SITE NAME: Beacon Hill
SITE NUMBER: NR-3703
FCC REGISTRATION NUMBER: Not Required

IN CASE OF EMERGENCY
951-955-3580
NO TRESPASSING

SITE SIGN

OUTSIDE WG PORTS
BEACON HILL

LOOKING NORTHERLY
CORONA
MICROWAVE SITE INFORMATION

SITE NAME: CORONA (PD)

SURVEYOR: SCOTT MEREDITH DATE: APRIL 2016

STREET ADDRESS: 730 PUBLIC SAFETY WAY, CORONA POLICE DEPT.

CITY: CORONA STATE: CALIFORNIA

COUNTY: RIVERSIDE COUNTRY: U.S.A.

IF NOT IN A CITY: DISTANCE: N/A AZIMUTH (TRUE): N/A

TO CITY OF: WITHIN THE CITY OF CORONA

**GEODETIC COORDINATES (NAD 83)

LATITUDE: N 33 53 13.3 LONGITUDE: W 117 34 24.8

HOW DETERMINED: DIFFERENTIAL GPS (NAVCOM STARFIRE), CHECKED AGAINST PLOTTED POSITION ON USGS TOPO MAP

SITE ELEVATION AMSL: 577'

HOW DETERMINED: DIFFERENTIAL GPS (NAVCOM STARFIRE), CHECKED AGAINST PLOTTED POSITION ON USGS TOPO MAP

SITE DESCRIPTION: PROPOSED ROOF MOUNTED ANTENNA

SITE ACCESS DESCRIPTION: PAVED ROADS ACCESS TO SITE ESCORT REQUIRED TO ACCESS SITE
BUILDING INFORMATION: EXISTING

COMMENTS: SEE SITE PLOT PLAN FOR DETAILS

ELECTRIC POWER: EXISTING

VOLTS: 110

HERTZ: 60

TOWER INFORMATION: PROPOSED ROOF MOUNTED ANTENNA

HEIGHT: 30.5'

TYPE: BUILDING TOP/ROOF MOUNT

AREA REQUIRED FOR 80% GUYING: N/A

COMMENTS: SEE TOWER DRAWING FOR DETAILS

EQUIPMENT/TOWER DISTANCE (WAVEGUIDE RUN): SEE SYSTEM DATA SHEET

AIRPORT INFORMATION: (ALL AIRPORTS WITHIN 10 MILES)

AIRPORT

AZIMUTH TO AIRPORT (TRUE)

DISTANCE TO NEAREST RUNWAY

N/A, EXISTING SITE

GENERAL COMMENTS: NONE
THIS PATH WILL HAVE REDUCED FUTURE GROWTH ON CONTROLLING PALM TREE. SEE PATH PHOTOS FOR DETAILS.

GROUND = 577' AMSL
GROUND = 0' AGL

PROPOSED POSITION OF 3' ANTENNA TO BEACON HILL
ANT. C/L 38' AGL.

SLOPING MAIN ROOF

UTILITY
A/C UNIT

EXISTING ROOF PENETRATION
EXISTING ROOF TRAY

ESTIMATED EQUIP. RACK ON GROUND FLOOR

PROPOSED WG DOG HOUSE

SCALE

15
0
15

Scale in Feet

RIVERSIDE COUNTY
CORONA
SITE PLOT PLAN

AMSL denotes Above Mean Sea Level
AGL denotes Above Ground Level
THIS PATH WILL HAVE REDUCED FUTURE GROWTH ON CONTROLLING PALM TREE. SEE PATH PHOTOS FOR DETAILS.

PROPOSED POSITION OF 3’ ANTENNA TO BEACON HILL ANT. C/L 38’ AGL.

SUGGESTED MOUNTING FOR ANTENNA NEEDS TO BE DESIGNED BY ENGINEER

GROUND = 577’ AMSL
GROUND = 0’ AGL

LOOKING NORTH

RIVERSIDE COUNTY
CORONA
BLDG. ELEVATION

AMSL denotes Above Mean Sea Level
AGL denotes Above Ground Level
LOOKING SOUTH

LOOKING NORTH. ARROW DENOTES PROPOSED POLE POSITION FOR ANTENNA TO BEACON HILL
LOOKING WESTERLY. ARROW DENOTES POSITION OF PROPOSED WG TRAY

RED ARROW DENOTES POSITION OF PROPOSED WG DOG HOUSE
CORONA PD

EXISTING WG ENTRY

PROPOSED POSITION OF NEW NOKIA RADIOS
DESCRIPTION(S) PATH
BEACON HILL TO CORONA
PATH DESCRIPTION

GENERAL DESCRIPTION OF TERRAIN FEATURES:
This path passes from an existing S/S tower at Beacon Hill to a proposed building roof mounted antenna at Corona. Terrain on this path decreases in elevation from the Beacon Hill site to Corona. The terrain is covered in a mix of desert scrub and mostly residential areas. No water was observed.

DETAILED DESCRIPTION OF TERRAIN FEATURES AND CRITICAL POINTS:

BEACON HILL TO CORONA

<table>
<thead>
<tr>
<th>MILEAGE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>Existing S/S tower at Beacon Hill. Please see tower sketch and SPP for details.</td>
</tr>
<tr>
<td>0.00 - 0.2</td>
<td>Decreasing terrain elevation. Terrain is covered in desert scrub.</td>
</tr>
<tr>
<td>0.2 to 1.36</td>
<td>Rolling terrain covered in desert scrub.</td>
</tr>
<tr>
<td>1.36 - 2.89</td>
<td>Residential areas with trees.</td>
</tr>
<tr>
<td>2.89 to 3.3</td>
<td>Commercial buildings. Large warehouse building observed at mile 3.3. This building will not be PATH CONTROLLING but should be monitored in the future for possible roof top construction.</td>
</tr>
<tr>
<td>3.26</td>
<td>Palm tree that is PATH CONTROLLING. Please note that with the centerline stated in this report at Corona, this path will have reduced future growth on this palm tree. It needs to be stated that this tree must remain trimmed or cut to reduce possible interference in the future. See path photos for details.</td>
</tr>
<tr>
<td>3.27</td>
<td>Off path palm tree. This tree is beyond the first Fresnel zone.</td>
</tr>
<tr>
<td>3.32</td>
<td>Proposed roof top antenna. See SPP and building elevation sketch for details.</td>
</tr>
</tbody>
</table>

Moving the final antenna location from the position shown in the SPP will significantly change the antenna center line and path clearance.
# Terrain Data - BEACON HILL TO CORONA FINAL

## BEACON HILL
- **State**: CA
- **Latitude**: 33 56 03.0 N
- **Longitude**: 117 33 42.1 W
- **True azimuth (°)**: 191 51 05.7
- **Calculated Distance (mi)**: 3.320
- **Profile Distance (mi)**: 3.320
- **Datum**: North American 1983
- **UTM zone**: 11N
- **Easting (km)**: 448.088
- **Northing (km)**: 3754.999
- **Elevation (ft)**: 948.00

## CORONA
- **State**: CA
- **Latitude**: 33 53 13.3 N
- **Longitude**: 117 34 24.8 W
- **True azimuth (°)**: 011 50 41.9
- **Calculated Distance (mi)**: 3.320
- **Profile Distance (mi)**: 3.320
- **Datum**: North American 1983
- **UTM zone**: 11N
- **Easting (km)**: 446.963
- **Northing (km)**: 3749.778
- **Elevation (ft)**: 577.00

<table>
<thead>
<tr>
<th>Distance (mi)</th>
<th>Elevation (ft)</th>
<th>Ground</th>
<th>Structure (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>948.00</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.007</td>
<td>948.00</td>
<td>AG</td>
<td>10.0 ft Building - EQUIPMENT SHELTER</td>
</tr>
<tr>
<td>0.034</td>
<td>914.57</td>
<td>AG</td>
<td>5.0 ft Tree - Start of Range</td>
</tr>
<tr>
<td>0.051</td>
<td>879.23</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.150</td>
<td>750.92</td>
<td>AG</td>
<td>End of Range</td>
</tr>
<tr>
<td>0.170</td>
<td>725.00</td>
<td>AG</td>
<td>30.0 ft Tree</td>
</tr>
<tr>
<td>0.204</td>
<td>711.84</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.255</td>
<td>729.22</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.272</td>
<td>728.87</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.340</td>
<td>699.39</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.442</td>
<td>691.90</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.476</td>
<td>691.28</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.663</td>
<td>669.54</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.731</td>
<td>673.50</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>0.880</td>
<td>668.00</td>
<td>AG</td>
<td>30.0 ft Building</td>
</tr>
<tr>
<td>0.901</td>
<td>679.21</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>1.037</td>
<td>677.63</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>1.122</td>
<td>692.84</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>1.292</td>
<td>626.57</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>1.360</td>
<td>659.00</td>
<td>AG</td>
<td>28.0 ft Building - Start of Range</td>
</tr>
<tr>
<td>1.564</td>
<td>601.01</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>1.615</td>
<td>592.80</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.057</td>
<td>589.96</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.108</td>
<td>590.00</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.193</td>
<td>586.82</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.346</td>
<td>581.85</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.397</td>
<td>585.63</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.414</td>
<td>587.15</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.516</td>
<td>572.13</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.550</td>
<td>570.06</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.669</td>
<td>571.88</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.754</td>
<td>594.00</td>
<td>AG</td>
<td>63.0 ft Tree - 53’ TREE + 10’ FG</td>
</tr>
<tr>
<td>2.788</td>
<td>595.00</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.805</td>
<td>594.44</td>
<td>AG</td>
<td></td>
</tr>
<tr>
<td>2.890</td>
<td>583.30</td>
<td>AG</td>
<td>End of Range</td>
</tr>
</tbody>
</table>
3.043 583.59 AG
3.077 590.91 AG
3.094 592.51 AG
3.111 593.13 AG
3.128 594.00 AG 29.7 ft Building - WAREHOUSE BUILDING
3.145 592.53 AG
3.196 582.35 AG
3.213 580.49 AG
3.230 579.01 AG
3.261 578.00 AG 45.0 ft Tree - 35' PALM TREE + 10' FG
3.275 577.00 AG 60.0 ft Tree - Off Path Structure
3.281 570.00 AG
3.298 574.67 AG
3.315 577.86 AG
3.320 577.00 AG

Ground Elevations - AMSL, Structure & Antenna Heights - AGL
Ground Type
PG - Poor, AG - Average, GG - Good, FW - Fresh Water, SW - Salt Water

Off Path Tree at 3.275 mi - 50 PALM TR 8' WEST
Distance Off Path (ft) 8.0
Ground Elevation (ft) 577.0
Structure Height (ft) 60.0
BEACON HILL TO CORONA
MILE 0.0 (BEACON HILL)

LOOKING TO CORONA, 6’ AGL

LOOKING TO CORONA, 6’ AGL
BEACON HILL TO CORONA
MILE 3.32 (CORONA)

LOOKING TO BEACON HILL, 33’ AGL

RED ARROW DENOTES PALM TREE THAT WILL HAVE LIMITED FUTURE GROWTH AND MUST REMAIN TRIMMED
BEACON HILL TO CORONA
MILE 3.261 (PALM TREE)

THIS PALM TREE MUST REMAIN TRIMMED OR BE REMOVED TO PREVENT FUTURE CLEARANCE ISSUES. THIS IS THE PATH CONTROLLING POINT
MAIN CLEARANCE CRITERIA: - GRAZING at K=1/2 - 1st FRESNEL ZONE at K=4/3

SEE SPP AT CORONA FOR ANTENNA LOCATION
THIS PATH HAS REDUCED FUTURE GROWTH ON PALM TREE AT MILE 3.261. MUST BE TRIMMED IN FUTURE

33-56-03.0 N 117-33-42.1 W
NAD83  AZIMUTH = 191.9  F = 11.2 GHz  DISTANCE IN MILES  D = 3.32 MI
33-53-13.3 N 117-34-24.8 W
NAD83

DATA FROM FIELD SURVEY UNLESS NOTED, TREES HAVE 10-FEET OF GROWTH ADDED

K=1/2
K=4/3
K=INFINITY

NOKIA
SYSTEM: RIVERSIDE COUNTY
ROUTE: CORONA TO BEACON HILL
FILE: Y:\CUSTOMER\FINAL\RIVERSIDE\CA\Marri_PD.CA\RECORD-5
DATE: 21 Apr 2016  SRT PAGE 1 OF 1
**PATH CALCULATIONS**

**SYSTEM:** County of Riverside

**ROUTE:** CORONA PD

**FILE:** Y:\CUSTOMER\FINAL\RIVRSIDE.CA\Murri_PD.CA\RECORD-4

**REF:** RAIN CURVE 64 - LOS ANGELES CALIFORNIA USA

<table>
<thead>
<tr>
<th>Nokia Final Design</th>
<th>BEACON HILL</th>
<th>CORONA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TROYER</td>
<td>NAD83 33 56 03.0 N</td>
<td>NAD83 33 53 13.3 N</td>
</tr>
<tr>
<td></td>
<td>117 33 42.1 W</td>
<td>117 34 24.8 W</td>
</tr>
</tbody>
</table>

| | | |
| GROUND ELEVATION | Feet | 948.0 | 577.0 |
| MAIN ANTENNA SIZE | Feet | 3.0 SC3-W100AC | 3.0 SC3-W100AC |
| MAIN ANTENNA GAIN | dBi | 38.6 | 38.6 |
| MAIN RADOME LOSS | dB | 0.0 PLASTIC | 0.0 PLASTIC |
| MAIN CENTERLINE | Feet | 24.0 | 38.0 |
| MAIN FEEDER LENGTH | Feet | 64.0 | 143.0 |
| MAIN FEEDER LOSS IN dB/100 | Feet | 2.8 E105 | 2.8 E105 |
| MAIN FEEDER LOSS | dB | 1.8 | 4.0 |
| PROTECT CHANNEL LOSS | dB | 11.7 | 11.7 |
| OTHER FEEDER LOSSES | dB | .9 | .9 |
| WET RADOME LOSS | dB | 2.3 | 2.3 |
| OTHER TRANSMIT LOSSES | dB | 2.1 | 2.1 |
| OTHER RECEIVE LOSSES | dB | 2.2 | 2.2 |
| CALCULATED EIRP | dBm | 64.3 | 62.1 |
| MAXIMUM EIRP (PART 101) | dBm | 85.0 | 85.0 |

| RADIO EQUIPMENT TYPE | 95MPR11-L128F10-52 |
| RADIO IDENTIFIER | 95MPR11-L128F10-52 |
| FREQUENCY BAND | MHz | 11200 10M0D7W |
| PATH LENGTH | Miles | 3.3 |
| MEAN ANNUAL TEMPERATURE | Deg F | 63.2 |
| ABSOLUTE HUMIDITY | g/m^3 | 11.0 |
| CLIMATE FACTOR | | 2.0 |
| ROUGHNESS FACTOR | Feet | 53.0 |
| POLARIZATION | | VERTICAL |
| FREE SPACE LOSS | dB | 128.0 |
| ABSORPTION LOSS | dB | .1 |
| DISPERSIVE FADE MARGIN | dB | 60.0 |
| TRANSMIT POWER | dBm | 30.5 HOT-STANDBY |
| ATPC POWER REDUCTION | dB | 0.0 |
| MAXIMUM RECEIVED SIGNAL | dBm | -22.0 |
| RECEIVER THRESHOLD | dBm | -78.5 BER= 10-6 |
| MAIN RECEIVED SIGNAL | dBm | -32.2 | -32.2 |
| THERMAL FADE MARGIN | dB | 46.3 | 46.3 |
| MINIMUM FADE MARGIN | dB | 22.0 | 22.0 |
| EXTERNAL INTERFERENCE FM | dB | N/A | N/A |
| FLAT FADE MARGIN | dB | 46.3 | 46.3 |
SYSTEM: County of Riverside
ROUTE: CORONA PD
FILE: Y:\CUSTOMER\FINAL\RIVRSIDE.CA\Murri_PD.CA\RECORD-4
REF: RAIN CURVE 64 - LOS ANGELES CALIFORNIA USA

<table>
<thead>
<tr>
<th>Nokia</th>
<th>Final Design</th>
<th>BEACON HILL</th>
<th>CORONA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TROYER</td>
<td>NAD83 33 56 03.0 N</td>
<td>NAD83 33 53 13.3 N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>117 33 42.1 W</td>
<td>117 34 24.8 W</td>
<td></td>
</tr>
</tbody>
</table>

| SPACE DIV IMPROVE FACTOR | THERMAL | 1.0 | 1.0 |
| MULTIPATH OUTAGE SECONDS | THERMAL | .5 | .5 |
| SPACE DIV IMPROVE FACTOR | DIGITAL | 1.0 | 1.0 |
| MULTIPATH OUTAGE SECONDS | DIGITAL | 0.0 | 0.0 |
| TOTAL MULTIPATH 2-WAY   | seconds | .9 |
| UPPFADE OUTAGE 2-WAY    | seconds | 0.0 |
| CRANE RAIN OUTAGE 2-WAY | seconds | 0.0 |
| PATH AVAILABILITY 2-WAY | percent | 99.9999970 | 1.0 sec |
| OUTAGE OBJECTIVE YEAR   | percent | 99.9999000 | 31.5 sec |

- CALCULATIONS VALID ONLY IF PATH HAS ADEQUATE CLEARANCE
WARRANTY OF WORK
MICROWAVE PATH ENGINEERING WARRANTY

FEASIBILITY STUDIES

Nokia 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 performance calculations, and (iv) a technical report.

Feasibility studies are preliminary in nature and are not intended to represent a final design. Therefore no representations, warranty or guarantee is implied or provided. Customer agrees to assume all risks associated with installing any equipment based on spiderweb maps, preliminary network and system maps, preliminary path profiles (including antenna size and location), path calculations (estimated performance), Google Earth, and topology studies normally presented with a feasibility study.

PATH SURVEYS (DETAILED SURVEY WITH REPORT)

Nokia offers detailed path surveying services to determine or verify site coordinates, site access, location, ground elevation, on-path obstruction location and height, tower information, proposed antenna centerline information, and other parameters required to engineer and implement a microwave radio link. The present and anticipated future effect of observable on-path obstructions, such as vegetation and buildings, are also evaluated and incorporated into the path design where applicable. Where appropriate, roof top access may be utilized in the survey effort. Existing towers are not climbed as a part of this activity.

The results of the path survey are documented and presented in a formal survey report or technical report, as required, to the Customer. Some items performed and included in a formal survey report may include: site location map, site topographic map, access information, site plot plans, existing tower elevation profile, site photographs, site and path observations, path terrain feature descriptions, critical point data, engineering notes, path profiles, and proposed performance calculations.

For detailed Path Surveys, Nokia warrants that geodetic coordinates are accurate to within +/- 1-second of latitude, +/- 1-second of longitude, ground elevations are accurate to within +/- 1 meter, and that heights of identified on-path obstructions at critical points are accurate to within 5-feet. Nokia warrants only the actual paths surveyed.

LINE OF SIGHT SURVEYS (LOS - CLEARANCE VERIFICATION)

Nokia offers a simplified microwave path survey service (from that described above) to determine “line of sight” (LOS) and adequate clearance conditions exist for a planned microwave link. This survey approach is best suited for urban and suburban environments. It can include driving the path as done in a traditional path survey, flashing the path, mirrors, or binoculars methodology. The line of sight survey may also ascertain site coordinates, site access and location, ground elevation, on-path obstruction location and height, tower information, proposed antenna centerline information, and other basic parameters required to
evaluate and design a microwave radio link. The present and anticipated future effect of observable onpath obstructions, such as existing vegetation and existing buildings, are evaluated and incorporated into the path design where applicable and appropriate. Where appropriate, roof top access may be utilized in the survey effort. Existing towers are not climbed as a part of this activity.

For line of sight (LOS) surveys, Nokia warrants that geodetic coordinates are accurate to within +/- 1-second of latitude, +/- 1-second of longitude, and ground elevations are accurate to within +/- 1 meter. Nokia warrants only the actual paths surveyed.

PATH DESIGN

Nokia offers path design services. Path design services are based on formal field survey data gathered by Nokia path surveyors and is warranted. 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 microwave link performance and availability objectives. Recommended antenna centerlines are determined for a range of K-factors expected to occur during an average year and by the Fresnel zone clearance criteria stipulated by Bell Laboratories. For areas where poor propagation conditions are known to exist, paths are assessed for susceptibility to obstruction fading outages using the Bell Laboratories Obstruction Fading (OBSFAD) model. Additionally, paths are analyzed for ground-based reflections.

Microwave link availability (path availability) is evaluated using current North American industry accepted models for predicting outage times and diversity improvement factors associated with normal atmospheric multipath fading (flat and dispersive), rain fading, and obstruction fading. Every effort is made by Nokia 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 performance calculations, and (iv) a technical report.

If a radio path using Nokia equipment is installed based on Nokia’s recommended path design, then Nokia warrants the radio path calculations shall conform to the Customer’s availability objective for normal atmospheric multipath fading. Nokia 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 unusual or unidentifiable on-path or off-path terrain features, physical structures, or atmospheric layers.

Rain fading due to rainfall rates that are in excess of the published rates or charts used to predict rain induced outages.
If Nokia suspects that abnormal propagation conditions are the cause of degraded system performance, Nokia will assist the Customer in verifying the conditions leading to the degraded system performance. After the problem has been identified, Nokia will support the Customer in identifying possible solutions to the problem and assess the incremental improvement expected from corrective actions. Any Implementation of corrective action to remedy this type of problem shall be the sole responsibility of the Customer.

FREQUENCY PLANNING

Nokia offers frequency planning services including frequency selection, prior coordination process, interference case resolution, and FCC license application documentation preparation and submittal. Nokia warrants that the interference studies will be conducted using industry-accepted North American methods, hardware, software and algorithms; and that the frequency database will be maintained as accurately as possible at the time of the study. Nokia 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 and Preparation

In the event harmful frequency interference is detected during the implementation of a microwave line in which Nokia provided the frequency planning services, Nokia’s total liability is limited to selection of an alternate frequency or frequencies. Should harmful interference occur after the microwave link is deemed operational and accepted, corrective action is the sole responsibility of the Customer.

WARRANTY

Nokia warrants its path surveys and path designs to be substantially free of engineering defects and errors for a period of 12 months from the date of delivery of the study to the Customer. Nokia warrants its line of sight surveys to be substantially free of engineering defects and errors for a period of 6 months from the date of delivery of the study to the Customer. Nokia warrants its frequency planning and Form 601 License Application preparation to be substantially free of engineering defects and errors 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 Nokia will provide the incremental labor and material beyond what would have been required during initial installation to correct for the particular error in the path survey or path design. In no case shall Nokia be held liable for any indirect damages including but not limited to incidental, consequential or loss of capital, data, revenue or profit. In the event that such error is not solely and directly related to Nokia’s path engineering efforts, expenses for such labor and material shall be borne by the Customer.