WaveRider

WaveRider Site Survey Guide

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Contents

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Site Survey Guide

1. Introduction

Overview

The WaveRider VAR Training program is designed to provide comprehensive Sales and Technical Training. The Site Survey Guide is provided as part of the Technical Training program, and details the necessary steps in performing a Site Survey.

The *WaveRider Site Survey Guide* is designed to be used as part of the following set of documentation:

- **NCL135 System Planner** - *WaveRider document* #9902VAR001
- **WaveRider Site Survey Guide** - *WaveRider document* #9902VAR002
- **VAR Installation Guide** - *WaveRider document* #9902VAR003
- **WaveRider Systems Approach** - *WaveRider document* #9902VAR004

2. Recommended Equipment and Material

The following is a recommended list of equipment for use in Site Survey activities.

1. Spectrum Analyser (3GHz)

   The Spectrum Analyser is arguably one of the most useful tools in the Installer's 'bag-of-tricks'. With this single piece of equipment, the Installer can measure Transmitter output and Receiver input signal levels, and evaluate the general RF environment during site survey or interference troubleshooting, etc.

2. Strobe Light, Flashlight, Mirror, Binoculars or Telescope

   Useful for evaluating Line-of-Sight conditions between potential sites

3. Measuring Tape, minimum 10m or 25ft length.
4. Topographic map(s) 1:50,000 or better. Alternatively, computer based Path Profile analysis software, e.g., PathLoss® with appropriate database.
5. Hand-held GPS unit, or compass
6. Altimeter or Elevation Gauge
7. Safety hat
8. Ladder

3. Site Survey

The Site Survey is a critical step in the successful deployment of an NCL135-based system. It is important in that it will yield a quick assessment of the feasibility of any given proposed site antenna and equipment location.

Using the Site Survey Checklist shown in section 3.1, enter the information as required.

1. Is the necessary physical space available for installing the NCL135?
   - Verify that the required space is available. The NCL135 is approximately 22cm x 24cm x 4cm, or 8¾ in. x 1¾ in. x 9½ in and requires a shelf or similar support.

2. Is this area readily accessible by Service and Installation personnel? If not, what are the restrictions, and are they acceptable to the operator / service contractor? Are access key(s) or contact with specific person(s) required?

3. Are building environmental codes prohibitive?
   - Be sure to check local by-laws for compliance.

4. What is the elevation above ground level (AGL) of the antennas at the intended locations?
   - This may be measured by altimeter (typically these devices are accurate to within 1 metre, bot must be calibrated frequently), or worst-case by simply counting number of floors in a building or sections on a tower, etc. This data is critical in assessing Fresnel zone clearances.

5. What are the geographic coordinates of the proposed sites?
   - An inexpensive hand-held GPS unit may be used to measure the co-ordinates and distance between sites accurate to within 50ft. This data is required for *link budget* calculations necessary in evaluating the feasibility of the proposed link.
   - Note that in the case of extremely short links of 1km or less, it is often easy to estimate distance quite accurately without the use of tools such as GPS units, and obvious when clear line-of-sight conditions exist. However, as a general rule, thorough documentation of site data including geographic co-ordinates is recommended.

6. Is Line-of-Sight available between the antennas?
   - Refer to Appendix C for detail on Fresnel zone geometry. For most reliable communication, the first Fresnel zone must be clear of all obstructions, *including ground*.

7. Is the proposed antenna location sufficiently far from objects in immediate vicinity?
   - For directional antennas, no objects (especially metallic ones) should be within 3 metres of the antenna main beam. For omni-directional antennas, the above applies in 360° direction.

8. Is the proposed mechanical antenna support adequate, or must additional work be done?

9. Is a physical cable run feasible?
    - Do access paths exist, or must holes be drilled through floors and/or ceiling?
    - What is the minimum length required to connect antenna and radio, and radio to network? Remember that transmission line loss (hence length) should be minimised.
    - What are the restrictions, if any, on cable size, and bend radius?

10. Is the environment (temperature, humidity, etc.) maintained within the operating requirements of the NCL135? Is heating or air-conditioning required?
    - The NCL135 requirements are:

      Operating Temperature range: min. 0º, max. +65ºC

      Humidity: 10% to 90%, non-condensing

11. Is Primary Power available where needed?
    - Nominal primary power is 110-220VAC, 50/60Hz. Although the use of a UPS is recommended, power circuits with known susceptibility to surges should be avoided.

12. Is existing grounding adequate, or must additional measures be taken?
    - Note that good grounding is especially important where the installation of the lightning arrestor is concerned. The ground should be attached within two (2) feet of the first entry point into the building or structure housing the NCL135 system. Typically, the ground used may be the building structural steel or existing lightning arrestor ground conductors. *Do not use water pipes, gas lines, or electrical system conduit*. **Be sure to check the local electrical code for governing regulations**.
    - In cases where the ground conditions are in question, a ground resistance measurement must be done. This requires specialised equipment and is best performed by the appropriate contractor.

3.1 Site Survey Checklist

Site Name: _____ Site Address: _____

Site Latitude: Deg.: _____ Min: _____ Sec.: _____

Site Longitude: Deg.: _____ Min: _____ Sec.: _____

Site Access hours: _____ Access route: _____ (year-round?)

Contact Name: _____

Tel. No.: _____

Attach Floor Plan Sketch to scale, indicating proposed location of equipment

Site Photograph available? Yes___ No___

Is grounding adequate? _____(Especially important for lightning arrestor installation at transmission line entry point into building)

Indicate (on sketch) proposed grounding connections.

Is primary power provision adequate? Yes___ No____ TBD___

Indicate (on sketch) proposed primary power connection point.

Is Line-of-Sight available to facing site(s)? Yes___ No____ TBD ___

Sketch on scale map, the location of possible obstructions. Use a GPS unit to identify location of each potential obstruction, including coordinates and distance from one of the antenna sites.

Horizon Photograph in direction of facing site____

Ground elevation AMSL _____ m. / ft.

Height of antenna AGL, at proposed location on tower_____ m. / ft.

Height of Tower AGL, if used[1]: _____ m. / ft.

Site Agreement required? Yes___ No____ TBD ___

Approval to install antenna required? Yes___ No____

Nearest Airport _____km / miles

Estimated Transmission Line length _____ m. / ft.

Indicate Transmission line proposed routing on layout drawing.

10baseT Cable length required _____ m. / ft.

List any possible cable routing difficulty (e.g., bend-radius limitations)_____

Is temperature environment within NCL135 specification limits? Yes___ No____ TBD ___

Recommended:

Site Noise Level _____ dBm, maximum level across 2400 to 2483.5MHz band (Spectrum Analyser measurement required, using an omni-directional antenna of known gain)

- Note any spot-frequency interference

[1] *Note that if a new tower is to be installed, prior local regulatory approval may be required.*

APPENDIX A: System/Site Survey Questionnaire

System Topology: Point-to-Point (P2P)____
Point-to-Multipoint (P2MP)____
Multipoint (MP)____
How many Remote Sites?____

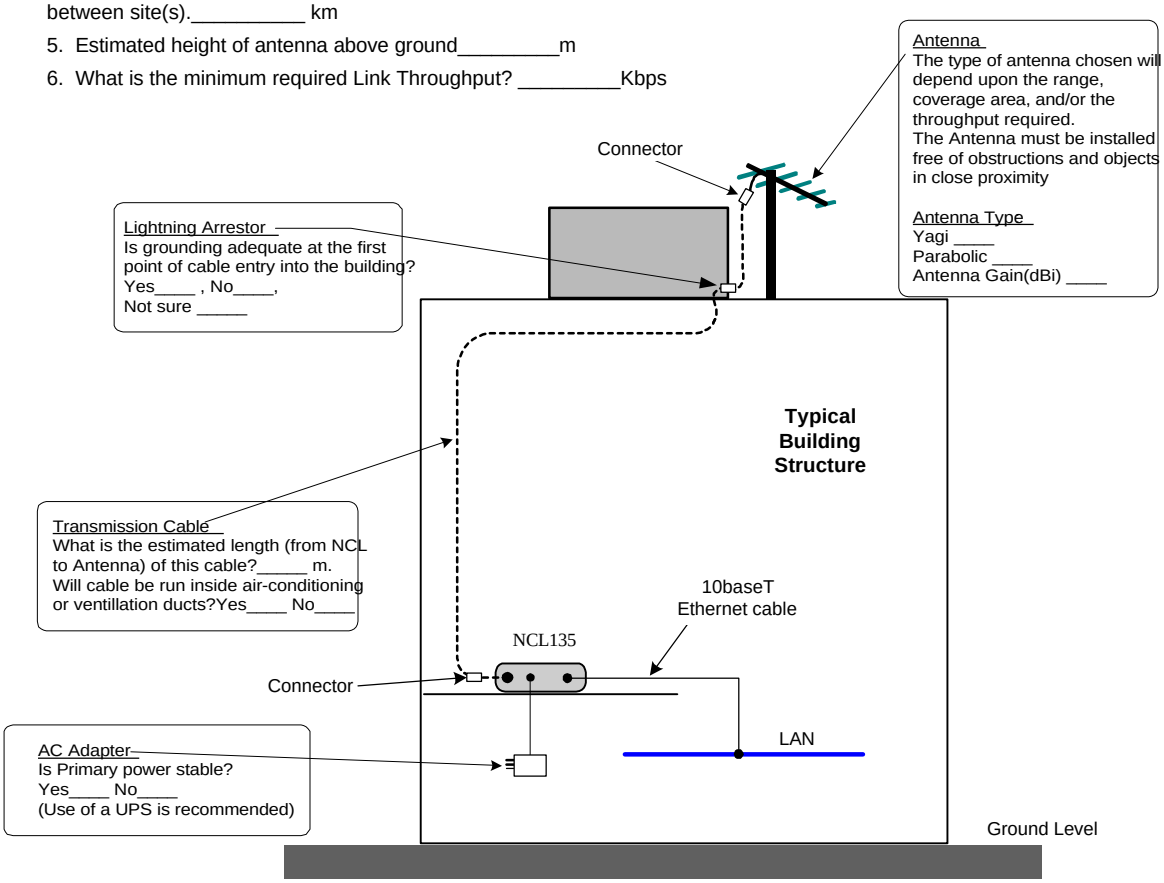
Date:_____

For each site, please provide:

1. Site Name _____
2. Is this a Master or Station (remote) Site? Mstr._____, Stn.____
3. The information indicated below.
4. The site latitude_____ and longitude_____

(If Latitude and Longitude are not available, provide an accurate estimate of the distance between site(s)._____ km

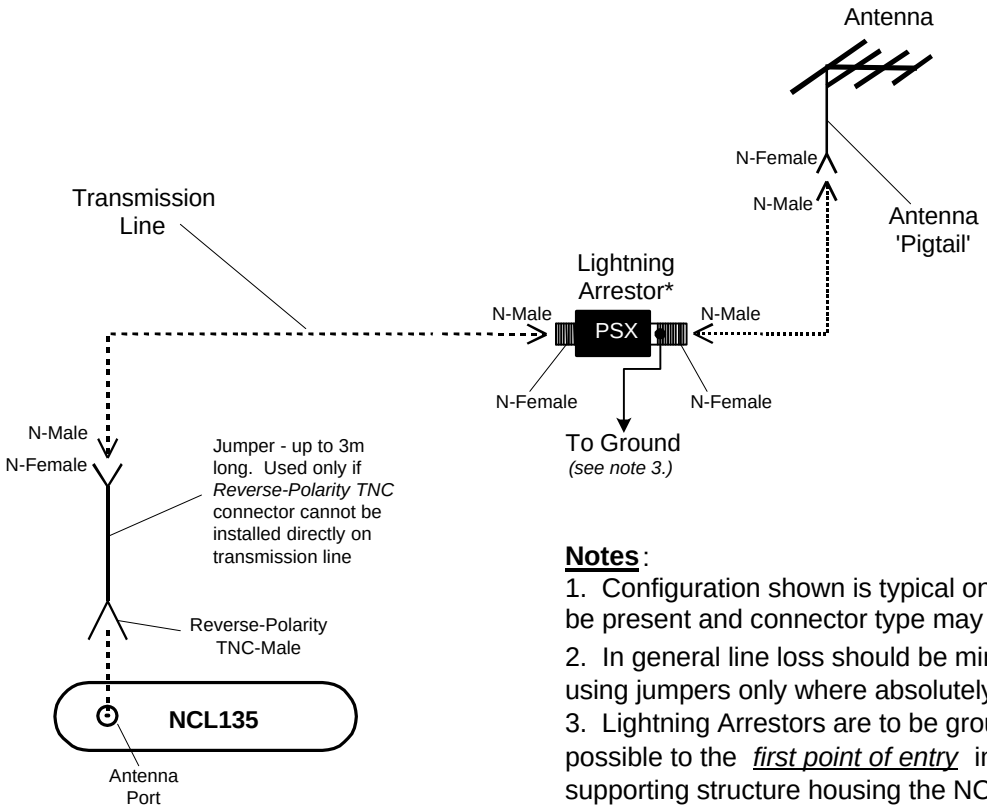
5. Estimated height of antenna above ground_____m
6. What is the minimum required Link Throughput? _____Kbps



Important Information:
The following additional details *MUST* be considered in the process of planning and implementing an NCL135 System:

- *Antenna support details and wind loading*
- *Tower requirements (if any)*
- *Transmission cable routing (bend-radius limitations,etc.)*
- *Grounding facilities*
- *Lightning protection*
- *Line-of-Sight (Fresnel Zone clearance) confirmation*
- *Environmental (HVAC) considerations for NCL135*
- *Local Electrical Code restrictions*
- *Local Communications Regulatory Authority Restrictions*
- *Site Access restrictions (for Support purposes)*

APPENDIX B: Typical Transmission Line Configuration



Notes:

1. Configuration shown is typical only. Antenna pigtail may not be present and connector type may differ from that shown.
2. In general line loss should be minimized. This implies using jumpers only where absolutely necessary.
3. Lightning Arrestors are to be grounded as close as possible to the *first point of entry* into the building or supporting structure housing the NCL135 / Network.
4. *Recommended Lightning Arrestor is Polyphaser ***Micro PSX*** model.

APPENDIX C: FRESNEL ZONES

The radius of the first Fresnel zone at any point X along a path connecting two sites, distance d_1, d_2 km from the respective sites, is given by:

$$r_1(m) = 17.3\sqrt{\frac{d_1 d_2}{F_{GHz} D_{km}}}$$

where,

D = Total Path Length in km,

F = Frequency in GHz,

d = distance to length in km

Further, the radius r_n of the n^{th} Fresnel Zone is given by,

$$r_n(m) = r_1\sqrt{n}$$