

## Executive Summary

### Guilford County Schools: Public Safety Benchmark Study

#### 1. Objective

To assess existing coverage within 112 sites belonging to Guilford County Schools for first responder radios operating on Guilford Simulcast and High Point Simulcast radio systems.

#### 2. Summary of Results

Of the 112 sites tested, 105 sites had some portion of a building that tested outside of the threshold noted in the NC510 2018 Fire Code (NC Sec 510.4). Of these 105 sites currently not in compliance with NC510, 64 sites had some portion of the building well below threshold such that Mobile Communications designates these sites as “Critical”. Of the remaining 41 sites out of compliance, 8 sites were noted as being outside of the NC510 initial coverage requirement, but Mobile Communications does not recommend a bi-directional amplifier (BDA) for these sites because they are likely to pass post-installation acceptance testing as is. This is due to initial coverage requirements being more stringent than what is required during post-installation acceptance testing (NC Sec 510.5.3); and therefore, these sites will not necessarily see an improvement in coverage as the result of installing a BDA system within the building.

#### 3. Initial Benchmark Testing Method

Technicians used PCTel scanners worn on backpacks to gather signal strength readings for each of the control channels and alternate control channels corresponding to the simulcast systems. Since the control channel is always active, the signal strength of the control channel can be used to characterize the signal strength of any of the associated talk channels within the building.

Floor plans were loaded into a tablet connected to the scanner. As the technicians walked the building, they would use the tablet to mark their location on the appropriate floor plan. Data logging software on the tablet would then tag the signal strength readings from the scanner with x-y coordinates such that each sample is logged to a particular spot on the floor plans.

Post processing software was then used to prepare the output maps presented in the individual reports. Samples gathered at an interval of every 300 milliseconds were averaged into plot points spaced anywhere from 600 milliseconds apart to 1800 milliseconds apart. This was done both to average out “outliers” and make the resulting output maps easier to read.

## 4. Interpreting Reports

The NC510 2018 Fire Code establishes a threshold for minimum signal strength at -95 dBm over 95% of the coverage area or better. This threshold is borrowed from International Fire Code and is referred to as the “IFC 510 threshold” in the reports. Building floors that meet -95 dBm for 95% of plot points or better are designated as “Passing.” Samples that test at -95 dBm or better will be designated as yellow (-90 to -95 dBm), light green (-80 to -90 dBm), or dark green (greater than -80 dBm).

For the reports, a second threshold is designated at a signal strength of -105 dBm. Samples below -105 dBm are designated as black while samples between -95 dBm and -105 dBm are designated as red. Building floors that fail the IFC threshold of -95 dBm signal strength over 95% of the area, but meet the -105 dBm threshold over 95% of the area are designated as “Marginal.” Building floors that fail the -105 dBm threshold over 95% of the area are designated as “Critical.” It’s important to note that a designation of either “Marginal” or “Critical” represents a failure to meet the NC510 Fire Code signal strength requirements.

The obvious follow up question at this point is, “what does ‘Marginal’ and ‘Critical’ mean for the radio user?” Because handsets transmit at much less power than tower radios (typically 5 watts vs. 150 watts), the IFC threshold can be thought of as the point at which radio communication, particularly the uplink path (from radio handset to tower), may degrade below “Excellent.” On the other hand, users in an area below the -105 dBm threshold are in an area of the building where the handset is verging on the point that the radio cannot resolve the incoming signal, or downlink path. It is highly probably in these areas that radio communication will be lost completely.

It is important to note that Radio Frequency (RF) signals by nature are inherently *random*. Elements in the environment that are constantly changing influence RF signals such that it is impossible to interpret individual measurements as absolute, static values. When looking at the output maps in the reports, note trends rather than individual samples. A single sample that measures below -105 dBm among a group of samples that measure above -95 dBm should be considered an outlier rather than an indication that there is an issue at that spot. The reverse is also true. A single “good” sample among a group of “poor” samples is not necessarily an indication that communication is good in that single isolated spot.

Finally, note some reports have data for multiple control channels – particularly for sites near High Point and Jamestown. These sites may be near towers for both Guilford Simulcast and High Point Simulcast. In terms of designating a floor “Passing,” “Marginal” or “Critical,” we used the best-case control channel.

[GCS Public Safety Benchmark Study](#)

If there is a requirement to have both Simulcast systems within the building, or one versus the other, then the individual output maps should be looked at. Alternatively, the excel pivot table provided as a separate file shows the percentage below threshold for both control channels when applicable.

Report by:

Andy Roberts

RF Engineer, Longent

April 9<sup>th</sup>, 2020

## Appendix A: Lists by Status

### **Passing Schools:**

Brooks Global Studies  
Jackson Middle  
Kirkman Park  
Elementary  
Montlieu Academy  
Murphey Academy  
Peck Elementary  
Penn-Griffin

### **Marginal, (BDA not recommended):**

Allen Jay Elementary  
Archer Elementary  
Ferndale Middle  
Jones Elementary  
Oak Hill Elementary  
Pruette SCALE  
Union Hill Elementary  
Wiley Elementary

### **Marginal:**

Academy at Lincoln  
Allen Jay Middle  
Andrews High

## GCS Public Safety Benchmark Study

Eastern Middle  
Fairview Elementary  
Florence Elementary  
Frazier  
General Greene  
Gibsonville Elementary  
Gillespie Park Elementary  
Haynes Inman  
High Point Central High  
Jamestown Elementary  
Kiser Middle  
Morehead Elementary  
Northern High  
Northwood Elementary  
Oak View  
Parkview Elementary  
Pilot Elementary  
Ragsdale High  
Sedgefield Elementary  
Southern Elementary  
Southern High  
Southwest Elementary  
Southwest Middle  
Sternberger  
Summerfield Elementary  
Sumner Elementary  
Triangle Lake Montessori  
Vandalia Elementary  
Washington Montessori  
Welborn Academy

### **Critical:**

Academy at Smith  
Alamance Elementary  
Alderman Elementary  
Allen Middle  
Bessemer Elementary  
Bluford Elementary  
Brightwood Elementary  
Brown Summit Middle

## GCS Public Safety Benchmark Study

C J Greene  
Claxton Elementary  
Colfax  
Cone Elementary  
Doris Henderson  
Dudley High  
Eastern High  
Falkener Elementary  
Foust Elementary  
Gateway Education Center  
Grimsley High  
Guilford Elementary  
Hairston Middle  
Herbin Metz Education Center  
Hunter Elementary  
Irving Park Elementary  
Jamestown Middle  
Jefferson Elementary  
Jesse Wharton Elementary  
Johnson St. Global  
Joyner Elementary  
Kernodle Middle  
Lindley Elementary  
Madison Elementary  
Mcleansville Elementary  
McNair Elementary  
Mendenhall Middle  
Millis Road Elementary  
Monticello-Brown Summit  
Nathanael Greene Elementary  
Northeast High  
Northeast Middle  
Northern Elementary  
Northern Middle  
Northwest High  
Northwest Middle  
Oak Ridge Elementary  
Page High  
Pearce Elementary  
Pleasant Garden Elementary  
Rankin Elementary

GCS Public Safety Benchmark Study

Reedy Fork Elementary  
SCALE - GSO  
Sedalia Elementary  
Shadybrook Elementary  
Simkins Elementary  
Smith High  
Southeast High  
Southeast Middle  
Southern Middle  
Southwest High  
Stokesdale Elementary  
Swann Middle  
Weaver Academy  
Western High  
Western Middle