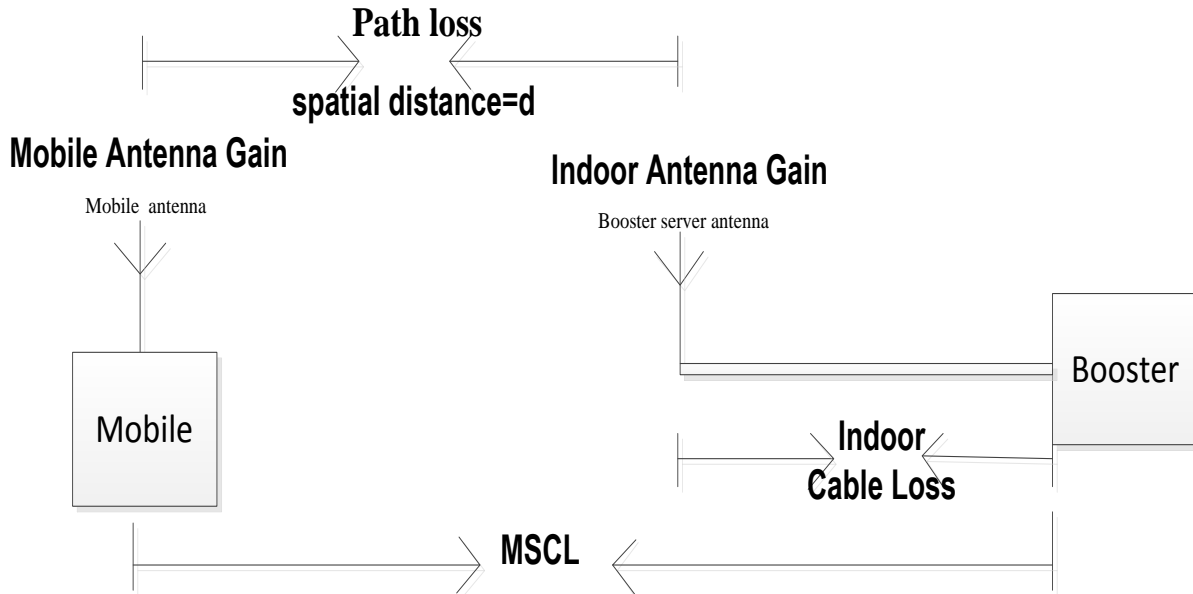


# 1 Explanation of MSCL



**Figure 1**

$$\text{MSCL} = \text{Path loss} + \text{Indoor Cable Loss} - \text{Mobile Antenna Gain} - \text{Indoor Antenna Gain} + \text{Polarity Loss} \dots\dots ①$$

## 1.1 Decibel version of free-space propagation loss equation:

$$\text{Path loss (dB)} = 20Lgf + 20LgD + 32.45 \dots\dots ② \text{ or } \text{Path loss (dB)} = 20Lgf + 20Lgd - 27.55 \dots\dots ③$$

f (MHz), D (m), d (km), D=1000d.

### 1.1.1 Operation Frequency

At PCS (1850-1915) f (MHz) =1850

At Cellular (824-849) f (MHz) =824

At LTE-A (698-716) f (MHz) =698

At LTE-V (776-787) f (MHz) =776

At AWS (2110-2155) f (MHz) =2110

### 1.1.2 Minimum Separation Distances for MSCL Calculation or Measurements d (m)

Minimum Separation Distances for MSCL Calculation or Measurements d (m)	
Indoor server antenna types	Minimum Separation Distances d (m)
Ceiling Mounted (i.e., Dome-type) Antennas	2
Wall Mounted (i.e., Panel or other type) Antennas	1
Table Top Antennas	1

Note:

Wall Mounted (i.e., Panel or other type) Antennas: Alternatively, if a manufacturer clearly specifies a minimum separation distance to consumer devices in the installation manual or other user documentation provided with the booster, a reasonable minimum separation distance could be up to 6 feet (or 2 meters) horizontally removed from the antenna. In this case, the user would be required to ensure this minimum separation distance for all CMRS devices authorized for use with this booster.

## 1.2 Mobile Antenna Gain

Mobile Antenna Gain=0dBi

## 1.3 Indoor Cable Loss And Indoor Antenna Gain

Indoor Cable Loss and Indoor Antenna Gain are listed in the separate submitted file of Force-550 Antenna Kitting.

## 1.4 Polarity Loss

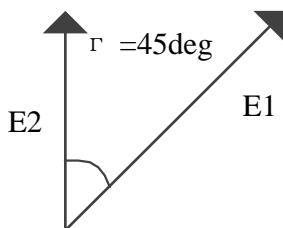
$$\text{Polarity Loss dB} = 10\text{Log} \left( \frac{E1}{E2} \right)^2 \text{ dB} = \text{PL dB}$$

$$\text{PL dB} = 10\text{Log} \left( \frac{E1^2}{(E1 \sin(45\text{deg}))^2} \right) \text{ dB} = 20\text{Log} \left( \frac{1}{\sin(45\text{deg})} \right) \text{ dB} = 3.01\text{dB}$$

Where:

E1 = Maximum Possible Magnitude of the Electric Field from the Mobile Device.

E2 = Magnitude of the electric field from the Mobile device with a 45deg polarity mismatch =  $E1 \sin(\theta)$ .



## 2 MSCL Calculations

Force-550					
Outdoor Antenna					
Outdoor Antenna	Outdoor Antenna Gain				
	At LTE-A and LTE-V (698-787MHz) (dBi)	At 800MHz (dBi)	At 1900MHz (dBi)	At 1700MHz(dBi)	At 2100MHz (dBi)
CM200	3	3	5	5	5
CM288W or Galaxy 5412-P	3	3	4	4	4
CM288W	3	3	4	4	4
MAX GAIN	3	3	5	5	5
Outdoor Cable					
Outdoor Cable	Outdoor Cable Loss				
	At LTE-A and LTE-V (698-787MHz) (dBi)	At 800MHz (dBi)	At 1900MHz (dBi)	At 1700MHz(dBi)	At 2100MHz (dBi)
CM174- 10FT 10Feet	3.8	4.3	8.8	6.98	8.96
CM240- 40FN 40Feet	3.52	3.98	6.52	6.12	6.92
MIN LOSS	3.52	3.98	6.52	6.12	6.92
Indoor Antenna					
Indoor Antenna	Indoor Antenna Gain				
	At LTE-A and LTE-V (698-787MHz) (dBi)	At 800MHz (dBi)	At 1900MHz (dBi)	At 1700MHz(dBi)	At 2100MHz (dBi)
CM110W	1.1	1.1	3	3	3
CM248W	7	7	10	10	10
CM120W	1.2	1.2	3	3	3
MAX GAIN	7	7	10	10	10

Indoor Cable					
Indoor Cable	Indoor Cable Loss				
	At LTE-A and LTE-V (698-787MHz) (dBi)	At 800MHz (dBi)	At 1900MHz (dBi)	At 1700MHz(dBi)	At 2100MHz (dBi)
CM174-10FT 10Feet	3.8	4.3	8.8	6.98	8.96
CM240-20FN 20Feet	2.06	2.29	3.56	3.36	3.76
MIN LOSS	2.06	2.29	3.56	3.36	3.76

MSCL Calculations of Force-550					
MSCL					
Operation Frequency (MHz)	Path loss (dB)	Indoor Antenna Gain (dBi)	Indoor Cable Loss (dB)	Polarity Loss (dB)	MSCL (dB)
PCS (1850-1915)	37.8	10	3.56	3.0	34.3
Cellular (824-849)	30.8	7	2.29	3.0	29.0
LTE (698-716)	29.3	7	2.06	3.0	27.4
LTE (776-787)	30.2	7	2.06	3.0	28.3
AWS (1710-1755)	37.1	10	3.36	3.0	33.5
Separation Distances (m)	1				