

Mobile Station Coupling Losses (MSCL)

June 26, 2020
 FCCID: PWO460062

The following formulas were used to calculate MSCL with a 2 m path loss and a 45 degree polarity mismatch between the inside antenna and the mobile device for EUT model 460062 signal booster:

$$MSCL (dB) = Path Loss (dB) + Polarity Loss (dB) - G_t - G_r$$

$$Path Loss (dB) = 20 \log(d) + 20 \log(f) - 27.55$$

$f = \text{frequency MHz}$

$d = \text{Distance from transmitter to receiver antenna (meters)}$

$$Polarity Loss (dB) = 20 \log\left(\frac{E_1}{E_2}\right)$$

$$Polarity Loss = 20 \log\left(\frac{E_1}{E_1 \sin(\tau)}\right), \tau = 45^\circ$$

$E_1 = \text{Maximum possible magnitude of the Electric Field from Mobile Device}$

$E_2 = \text{Magnitude of the electric field from the Mobile Device with a } 45^\circ \text{ polarity mismatch}$

$$E_2 = E_1 \sin(\tau)$$

$G_t = \text{UE Transmitter Antenna Gain}$

$G_r = \text{Signal Booster Server Antenna Gain}$



Path Loss Evaluation

$$Path Loss (dB) = 20 \log(d) + 20 \log(f) - 27.55$$

$f = \text{frequency in MHz}$

$d = \text{Distance from transmitter to receiver antenna (meters)}$

Frequency Range (MHz)	f (MHz)	d (m)	Constant (dB)	Path Loss (dB)
698-716	707	2	27.55	35.4
776-787	781.5	2	27.55	36.3
824-849	836.5	2	27.55	36.9
1710-1785	1747.5	2	27.55	43.3
1850-1915	1882.5	2	27.55	44.0

Polarity Loss Evaluation

$$\text{Polarity Loss (dB)} = 20 \log \left(\frac{E_1}{E_2} \right)$$

$$\text{Polarity Loss (dB)} = 20 \log \left(\frac{E_1}{E_1 \sin(\tau)} \right), \quad \tau = 45^\circ$$

E_1 = Maximum possible magnitude of the Electric Field from Mobile Device

E_2 = Magnitude of the electric field from the Mobile Device with a 45° polarity mismatch

$$E_2 = E_1 \sin(\tau)$$

$$\text{Polarity Loss} = 20 \log \left(\frac{1}{\sin \left(\frac{\pi}{180} \right)} \right) = 3.01 \text{ dB}$$

UE Transmitter Antenna Gain Evaluation

$$G_t = \text{UE Transmitter Antenna Gain} = 0 \text{ dBi}$$

Signal Booster Server Antenna Gain Evaluation

Component	Type	Product Number	Gain (dBi) / Loss (dB)					
			B12 700 MHz	B13 700 MHz	B5 800 MHz	B4 1700 MHz	B2 1900 MHz	B4 2200 MHz
Indoor Cable	Wilson 400 (60ft)	952360	2.3	2.3	2.5	3.7	3.9	4.3
	RG-11 (50 ft)	951150	2.1	2.1	2.2	3.7	4.0	4.4
Server Antenna	Dome	304412, 19	2	2	2	4	4	4
	Panel	311135, 55	5.2	5.2	4.4	10.1	10.6	8.2

Minimum MSCL Evaluation

Maximum antenna gain and minimum coax loss was selected to calculate “worst case” limit for MSCL

	B12 700 MHz	B13 700 MHz	B5 800 MHz	B4 1700 MHz	B2 1900 MHz
Path Loss (dB)	35.4	36.3	36.9	43.3	44.0
Polarity Loss (dB)	3.01	3.01	3.01	3.01	3.01
UE Antenna Gain (dBi)	0	0	0	0	0
Server Antenna Gain (dBi)	5.2	5.2	4.4	10.1	10.6
Server Coax Loss (dB)	2.1	2.1	2.2	3.7	3.9
Minimum MSCL (dB)	35.31	36.21	37.71	39.91	40.31

END OF REPORT