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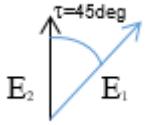
Mobile Station Coupling Losses (MSCL)

August 17, 2020
FCCID: PWO460066

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 460066 signal booster:

$$\boldsymbol{MSCL\ (dB) = Path\ Loss\ (dB) + Polarity\ Loss\ (dB) - G_t - G_r}$$

$$Path\ Loss\ (dB) = 20\log(d) + 20\log(f) - 27.55$$
$$f = frequency\ MHz$$
$$d = Distance\ from\ transmetter\ to\ receiver\ antenna\ (meters)$$



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

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

$$E_1 = Maximum\ possible\ magnitude\ of\ the\ Electric\ Field\ from\ Mobile\ Device$$
$$E_2 = Magnitude\ of\ the\ electric\ field\ from\ the\ Mobile\ Device\ with\ a\ 45°\ polarity\ mismatch$$
$$E_2 = E_1\sin(\tau)$$
$$G_t = UE\ Transmitter\ Antenna\ Gain$$
$$G_r = Signal\ Booster\ Server\ Antenna\ Gain$$

Path Loss Evaluation

$$Path\ Loss\ (dB) = 20\log(d) + 20\log(f) - 27.55$$
$$f = frequency\ in\ MHz$$
$$d = Distance\ from\ transmetter\ to\ receiver\ antenna\ (meters)$$

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

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Polarity Loss Evaluation

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

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

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

UE Transmitter Antenna Gain Evaluation

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

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
Server Cable	N/A	N/A	0	0	0	0	0	0
Server Antenna	Omni	311236	2	2.2	2.7	1.7	2.7	3.5
		311159	2	1.9	2.3	0.2	1.7	0.2

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)	2	2.2	2.7	1.7	2.7
Server Coax Loss (dB)	0	0	0	0	0
Minimum MSCL (dB)	**36.41**	**37.11**	**37.21**	**44.61**	**44.31**

END OF REPORT