

Mobile Station Coupling Loss (MSCL)

Originator: Khaled Bathich
Approver: Raimo Jacobi
Function:
Location: Dabendorf, Germany

Change History

Version	Date	Status	Handled by	Comments
0.1	22-Feb-17	draft	Khaled Bathich	
1.0	28-Feb-17	release	Raimo Jacobi	
2.0	22-Mar-17	review	Khaled Bathich	

To whom it may concern,

In this application, a near-field coupling antenna is fixed-mounted in the vehicle where the wireless device (mobile phone) can be put onto it. The coupling antenna is connected to the server port of the booster through a coaxial cable. The distance between the wireless device and the coupling antenna is then too small. Therefore, the free-space path loss formula cannot be used for calculation of MSCL since it only applies to far-field applications to ensure spherical spreading of the electromagnetic waves. Furthermore, measurements in a chamber will provide much higher coupling loss than that in the actual application (near-field coupling). The MSCL calculations submitted are based on a measurement of the minimum MSCL, which results from adding the minimum near-field coupling factor to the minimum coaxial cable loss.

The minimum near-field coupling factor was measured for 14 different near-field coupling antenna configuration. The measurement was performed using different commercial mobile phones (up to 30 different mobile phones) put onto the near-field coupling antenna in all possible locations. The output power of the mobile phone was measured, and the difference to the reference power level obtained directly from the mobile phone was used as near-field coupling factor. The minimum value of the coupling factor for all possible locations was then considered to be the minimum near-field coupling loss for the current mobile phone/coupling antenna configuration for each frequency band of operation. Similar automated measurements were performed for the mobile phones put onto each near-field coupling antenna. The absolute minimum value was then added to the minimum coaxial loss to result in MSCL value for each near-field coupling antenna. In the MSCL calculation report the MSCL results of 14 different near-field coupling antennas that were used together with the booster are documented. The values calculated represent the worst-case scenario for MSCL.

The following near-field coupling antenna (cradle) kit options that can be installed together with the LTE/UMTS/GSM Compensator (LTE-MBC-NAR):

1. Laird Phonebox (8S0.035.502)
2. Laird Phonebox (4M0.035.502.A)
3. Laird Phonebox (4K0.035.502)
4. Laird Phonebox (4N0.035.502)
5. Laird Phonebox (4N0.035.497)
6. Laird Phonebox (4N0.035.502.A)
7. Laird Phonebox (8W0.035.502.C)
8. Laird Phonebox (80A.035.502.A)
9. Laird Phonebox (80A.035.502.B)
10. Laird Phonebox (4K0.035.773)
11. Laird Phonebox (4N0.035.773)
12. Laird Phonebox (80A.035.773)
13. Laird Phonebox (9P1.035.502)
14. Laird Phonebox (95B.035.773)

Yours sincerely,

Khaled Bathich

Name: Dr. Khaled Bathich
 Title: Radio Frequency (RF) Design Engineer
 Tel: +49 3377 316 339
 e-mail: khaled.bathich@lairdtech.com

List of operational frequency bands supported by the Laird NAR Compenser:

Operational Frequency Band	Uplink Frequency Range (MHz)
12	698-716
13	777-787
5	824-849
4	1710-1755
2	1850-1910

List of cradle kit options:

1. Laird Phonebox (8S0.035.502)

Operational Frequency Band	12	13	5	4	2
Min. Cradle Coupling Loss (dB)	5.00	5.00	5.00	6.40	6.40
Min. Coax. Cable Loss (dB)	3.42	3.42	3.68	5.62	5.62
MSCL (dB)	8.42	8.42	8.68	12.02	12.02

2. Laird Phonebox (4M0.035.502.A)

Operational Frequency Band	12	13	5	4	2
Min. Cradle Coupling Loss (dB)	8.00	8.00	8.00	5.20	5.20
Min. Coax. Cable Loss (dB)	2.23	2.23	2.39	3.66	3.66
MSCL (dB)	10.23	10.23	10.39	8.86	8.86

3. Laird Phonebox (4K0.035.502, 4N0.035.502, 4N0.035.497, 4N0.035.502.A, 8W0.035.502.C, 80A.035.502.A, 80A.035.502.B)

Operational Frequency Band	12	13	5	4	2
Min. Cradle Coupling Loss (dB)	7.10	7.10	7.10	9.50	9.50
Min. Coax. Cable Loss (dB)	1.79	1.79	1.93	2.94	2.94
MSCL (dB)	8.89	8.89	9.03	12.44	12.44

4. Laird Phonebox (4K0.035.773, 4N0.035.773, 80A.035.773)

Operational Frequency Band	12	13	5	4	2
Min. Cradle Coupling Loss (dB)	9.20	9.20	9.20	10.50	10.50
Min. Coax. Cable Loss (dB)	1.79	1.79	1.93	2.94	2.94
MSCL (dB)	10.99	10.99	11.13	13.44	13.44

5. Laird Phonebox (9P1.035.502)

Operational Frequency Band	12	13	5	4	2
Min. Cradle Coupling Loss (dB)	4.00	4.00	4.00	5.80	5.80
Min. Coax. Cable Loss (dB)	2.87	2.87	3.08	4.71	4.71
MSCL (dB)	6.87	6.87	7.08	10.51	10.51

6. Laird Phonebox (95B.035.773)

Operational Frequency Band	12	13	5	4	2
Min. Cradle Coupling Loss (dB)	4.40	4.40	4.40	6.30	6.30
Min. Coax. Cable Loss (dB)	2.87	2.87	3.08	4.71	4.71
MSCL (dB)	7.27	7.27	7.48	11.01	11.01

Conclusion: With RF connector losses, the absolute minimum coupling loss (MSCL) for all cradle types and in all operational frequency bands is 7 dB.