

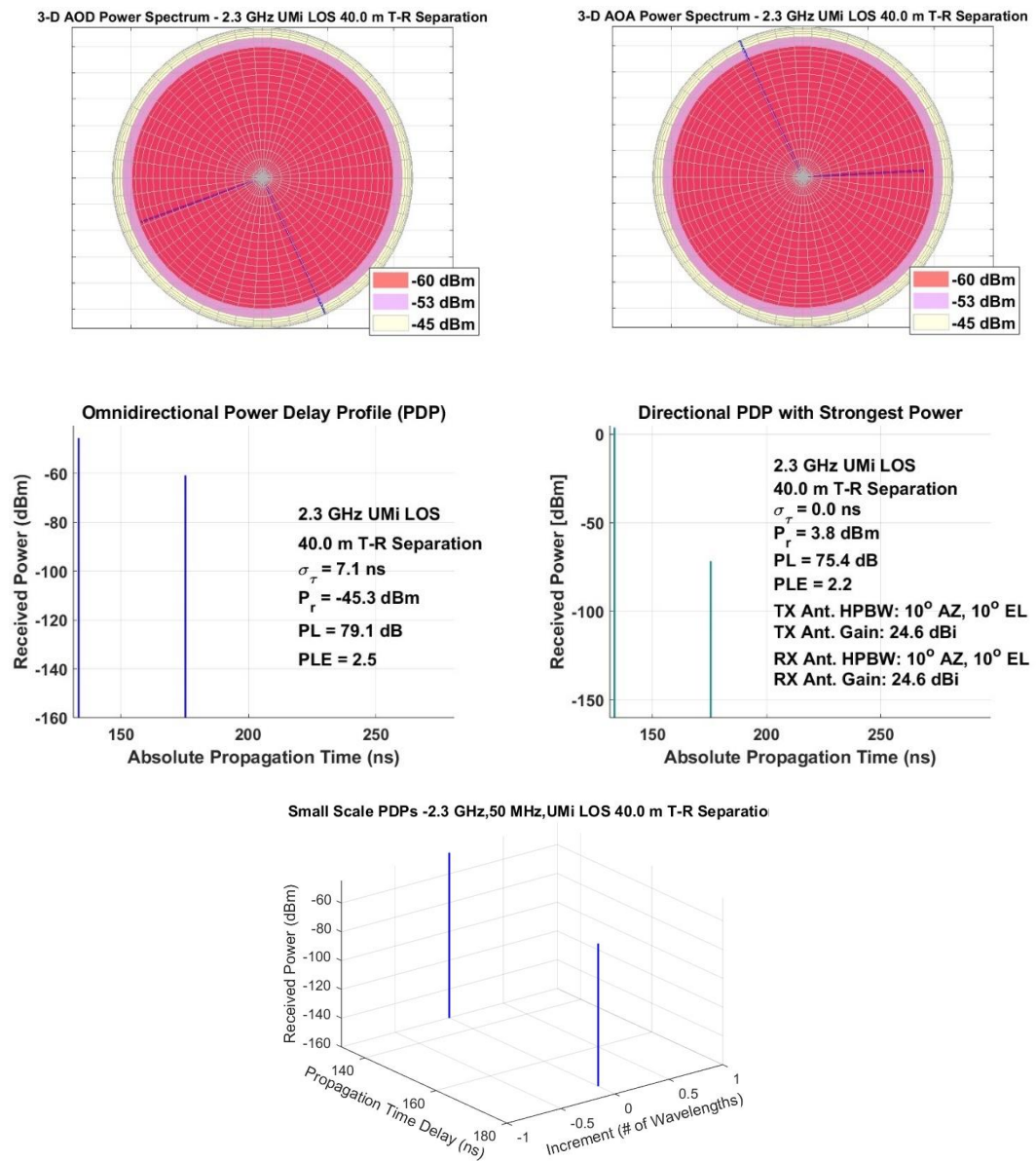
DAFTAR PUSTAKA

- Admaja, A. F. S. (2015). Kajian Awal 5G Indonesia (5G Indonesia Early Preview). *Buletin Pos Dan Telekomunikasi*, 13(2), 97. <https://doi.org/10.17933/bpostel.2015.130201>
- Alfaresi, B., Barlian, T., & Muhandanus. (2020). Analisa Path Loss Radio Jaringan 5G frekuensi High band 26 GHz dengan Model 3GPP ETSI. *Jurnal Fokus Elektroda*, 05(01), 5–10. <http://ojs.uho.ac.id/index.php/jfe/>
- Cao, Z., Li, F., Van Den Boom, H. P. A., Tangdiongga, E., & Koonen, A. M. J. (2013). Optical true-time-delay microwave beam-steering with 1 Gb/s wireless transmission for in-building networks. *IET Conference Publications*, 2013(622 CP), 240–242. <https://doi.org/10.1049/cp.2013.1353>
- Darlis, A. R., Yunita, T., & Suryana, J. (2010). *Pengukuran Model Propagasi Outdoor dan Indoor Sistem WiMAX 2 . 3GHz di Lingkungan Kampus ITB*. April, 28–29.
- Dehon, A. (2015). Fundamental underpinnings of reconfigurable computing architectures. *Proceedings of the IEEE*, 103(3), 355–378. <https://doi.org/10.1109/JPROC.2014.2387696>
- Febian, A., Adaniah, R., Ariyanti, S., Kusumawati, D., Kiki, E., & Aziz, A. (2018). *Studi Lanjutan 5G Indonesia 2018 Spektrum Outlook dan Use Case untuk Layanan 5G Indonesia*. <http://balitbangsdm.kominfo.go.id>
- Haneda, K., Zhang, J., Tan, L., Liu, G., Zheng, Y., Asplund, H., Li, J., Wang, Y., Steer, D., Li, C., Balercia, T., Lee, S., Kim, Y., Ghosh, A., Thomas, T., Nakamura, T., Kakishima, Y., Imai, T., Papadopoulos, H., ... Ghosh, A. (2016). 5G 3GPP-like channel models for outdoor urban microcellular and macrocellular environments. *IEEE Vehicular Technology Conference, 2016-July*. <https://doi.org/10.1109/VTCSpring.2016.7503971>
- Hidayat, R. (2017). Analisis Potensi Kunci Teknologi 5G Untuk Implementasi Optimal Di Jawa Barat Key Potential Analysis of 5G Technology for Optimal Implementation in West Java. *CR Journal*, 3(2), 115–131.
- Ju, S., Kanhere, O., Xing, Y., & Rappaport, T. S. (2019). A millimeter-wave channel simulator NYUSIM with spatial consistency and human blockage. *2019 IEEE Global Communications Conference, GLOBECOM 2019 - Proceedings*, 1–6. <https://doi.org/10.1109/GLOBECOM38437.2019.9013273>
- Kutty, S., & Sen, D. (2016). Beamforming for Millimeter Wave Communications: An Inclusive Survey. *IEEE Communications Surveys and Tutorials*, 18(2), 949–973. <https://doi.org/10.1109/COMST.2015.2504600>
- Lin, H., Zhou, C., Tian, Y., Siegrist, T., Ma, B., Nakamura, S., Mukai, T., Senoh, M., Stranks, S. D., Wood, S. M., Wojciechowski, K., Deschler, F., Saliba, M., Khandelwal, H., Patel, J. B., Elston, S. J., Herz, L. M., Johnston, M. B., Schenning, A. P. H. J., ... Yin, L. (2019). The 5G Guide: A Reference for Operators. *Applied Physics Express*, 7(1), 2703–2710.
- Masa, M. A., Abdurrahman, T. S. D., Basalamah, A., Rahman, M. N., Lahmado, H., & Afdhal, A. (2023). Analisis Potensi Teknologi Jaringan 5G Area Sulawesi Selatan. *Jambura Journal of Electrical and Electronics Engineering*, 5(1), 41–47. <https://doi.org/10.37905/jjee.v5i1.16870>
- Masoudi, M. (1999). Vortex motion influencing sphere heating-Reynolds analogy

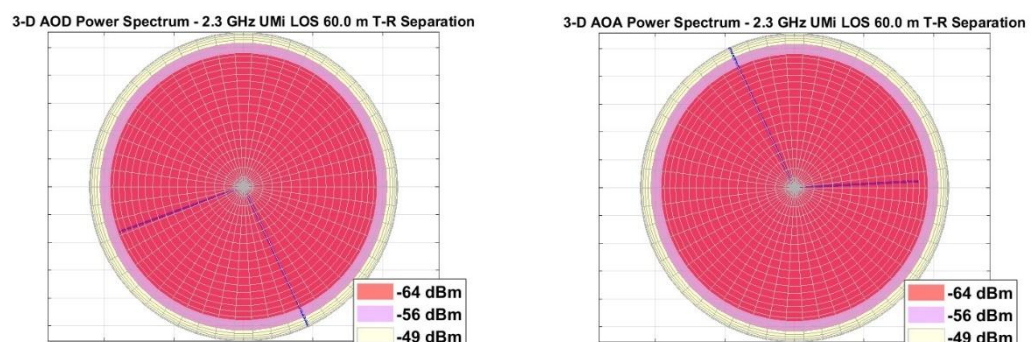
- revisited. *International Journal of Heat and Mass Transfer*, 42(18), 3529–3531. [https://doi.org/10.1016/S0017-9310\(99\)00018-6](https://doi.org/10.1016/S0017-9310(99)00018-6)
- Nugraha, T. A., & Hikmaturokhman, A. (2017). Simulasi Penggunaan Frekuensi Milimeter Wave Untuk Komunikasi. *Jurnal Infotel*, 9(1), 24. <http://ejournal.st3telkom.ac.id/index.php/infotel/article/view/144>
- Ofcom. (2017). Update on 5G spectrum in the UK Statement. 8 February 2017, February, 1–19. https://www.ofcom.org.uk/__data/assets/pdf_file/0021/97023/5G-update-08022017.pdf
- Rappaport, T. S., Sun, S., Mayzus, R., Zhao, H., Azar, Y., Wang, K., Wong, G. N., Schulz, J. K., Samimi, M., & Gutierrez, F. (2013). Millimeter wave mobile communications for 5G cellular: It will work! *IEEE Access*, 1(January), 335–349. <https://doi.org/10.1109/ACCESS.2013.2260813>
- Rappaport, T. S., Sun, S., & Shafi, M. (2017). Investigation and comparison of 3GPP and NYUSIM channel models for 5G wireless communications. *IEEE Vehicular Technology Conference*, 2017-Septe, 1–5. <https://doi.org/10.1109/VTCFall.2017.8287877>
- Sudhamani, C., Roslee, M., Chuan, L. L., Waseem, A., Osman, A. F., & Jusoh, M. H. (2023). Performance Analysis of a Millimeter Wave Communication System in Urban Micro, Urban Macro, and Rural Macro Environments. *Energies*, 16(14). <https://doi.org/10.3390/en16145358>
- Sulyman, A., Nassar, A., Samimi, M., Maccartney, G., Rappaport, T., & Alsanie, A. (2014). Radio propagation path loss models for 5G cellular networks in the 28 GHZ and 38 GHZ millimeter-wave bands. *IEEE Communications Magazine*, 52(9), 78–86. <https://doi.org/10.1109/MCOM.2014.6894456>
- Sun, S., Maccartney, G. R., & Rappaport, T. S. (2017). A novel millimeter-wave channel simulator and applications for 5G wireless communications. *IEEE International Conference on Communications*, 10(May). <https://doi.org/10.1109/ICC.2017.7996792>
- Sun, S., Rappaport, T. S., Rangan, S., Thomas, T. A., Ghosh, A., Kovacs, I. Z., Rodriguez, I., Koymen, O., Partyka, A., & Jarvelainen, J. (2016). Propagation path loss models for 5G urban micro-and macro-cellular scenarios. *IEEE Vehicular Technology Conference*, 2016-July(May). <https://doi.org/10.1109/VTCSpring.2016.7504435>
- Xu, H., Shi, C., Zhang, W., & Yang, Y. (2016). Field testing, modeling and comparison of multi frequency band propagation characteristics for cellular networks. *2016 IEEE International Conference on Communications, ICC 2016*, 1–5. <https://doi.org/10.1109/ICC.2016.7510961>
- Yoliadi, D. N. (2022). Comparison of Capture Power of Wajanbolic Antenna with Parabolic Directional Antenna to the Distance of Capture Wireless LAN Signal 2.4 GHz. *SMARTICS Journal*, 8(2), 43–51. <https://doi.org/10.21067/smartics.v8i2.7006>
- Zakaria, Y., & Ivanek, L. (2018). Analysis of channel propagation models based on calculated and measured data. *12th International Conference ELEKTRO 2018*, 2018 ELEKTRO Conference Proceedings, 231, 1–5. <https://doi.org/10.1109/ELEKTRO.2018.8398348>

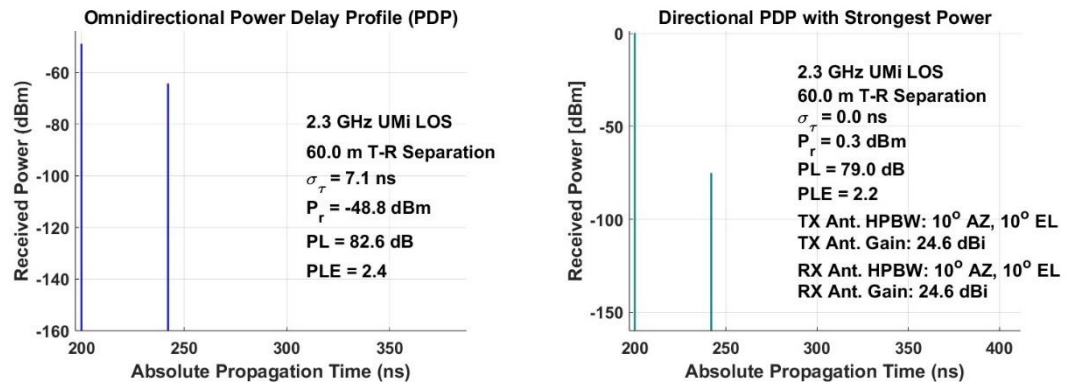
Lampiran 1 Output Hasil Simulasi NYUSIM Simulator Jarak 40 Meter – 200 Meter Kondisi LOS.

Jarak 40 Meter

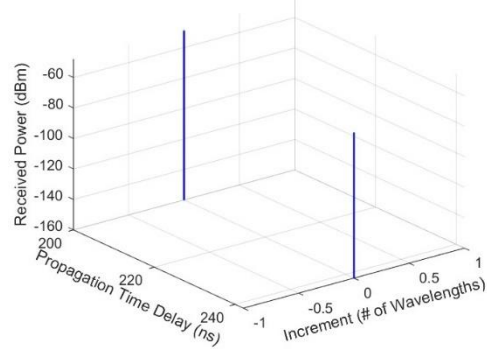


Jarak 60 Meter

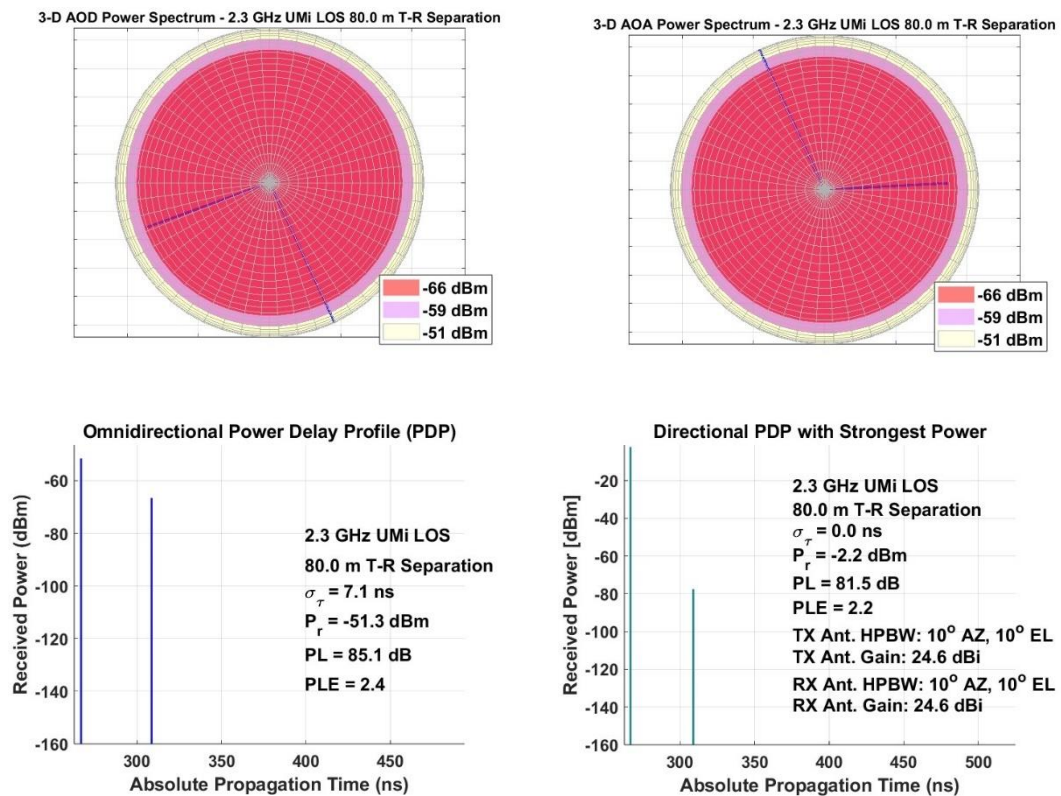




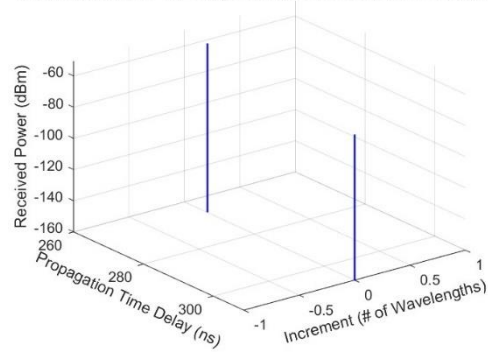
Small Scale PDPs -2.3 GHz,50 MHz,UMi LOS 60.0 m T-R Separatio



Jarak 80 Meter

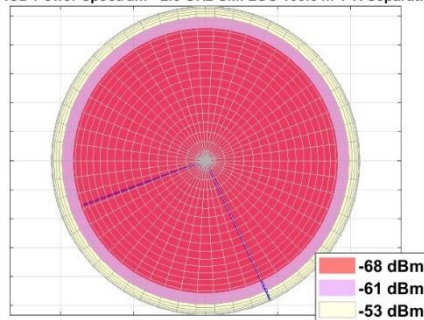


Small Scale PDPs -2.3 GHz,50 MHz,UMi LOS 80.0 m T-R Separatio

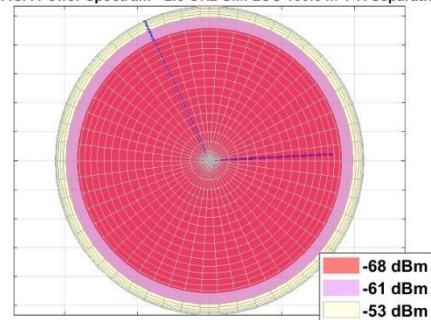


Jarak 100 Meter

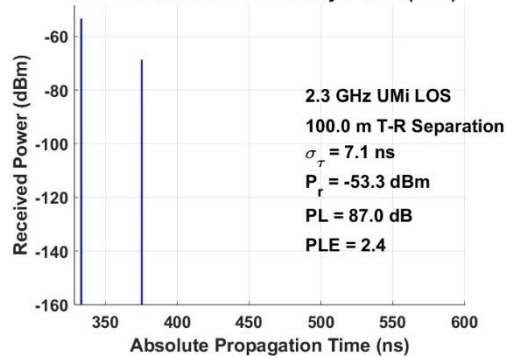
3-D AOD Power Spectrum - 2.3 GHz UMi LOS 100.0 m T-R Separation



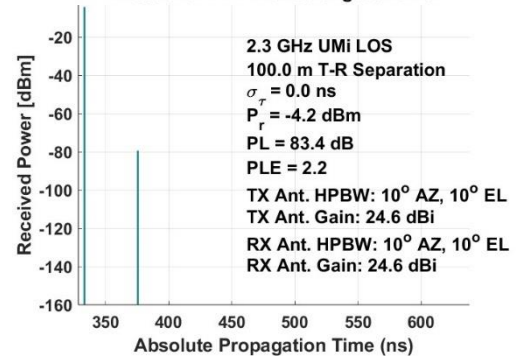
3-D AOA Power Spectrum - 2.3 GHz UMi LOS 100.0 m T-R Separation



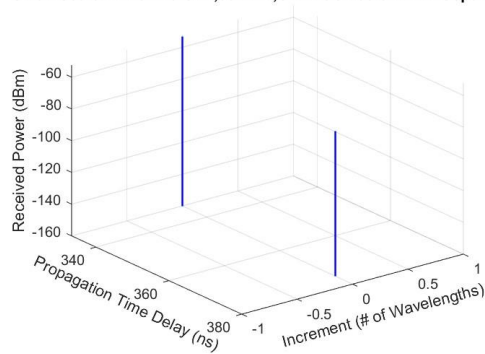
Omnidirectional Power Delay Profile (PDP)



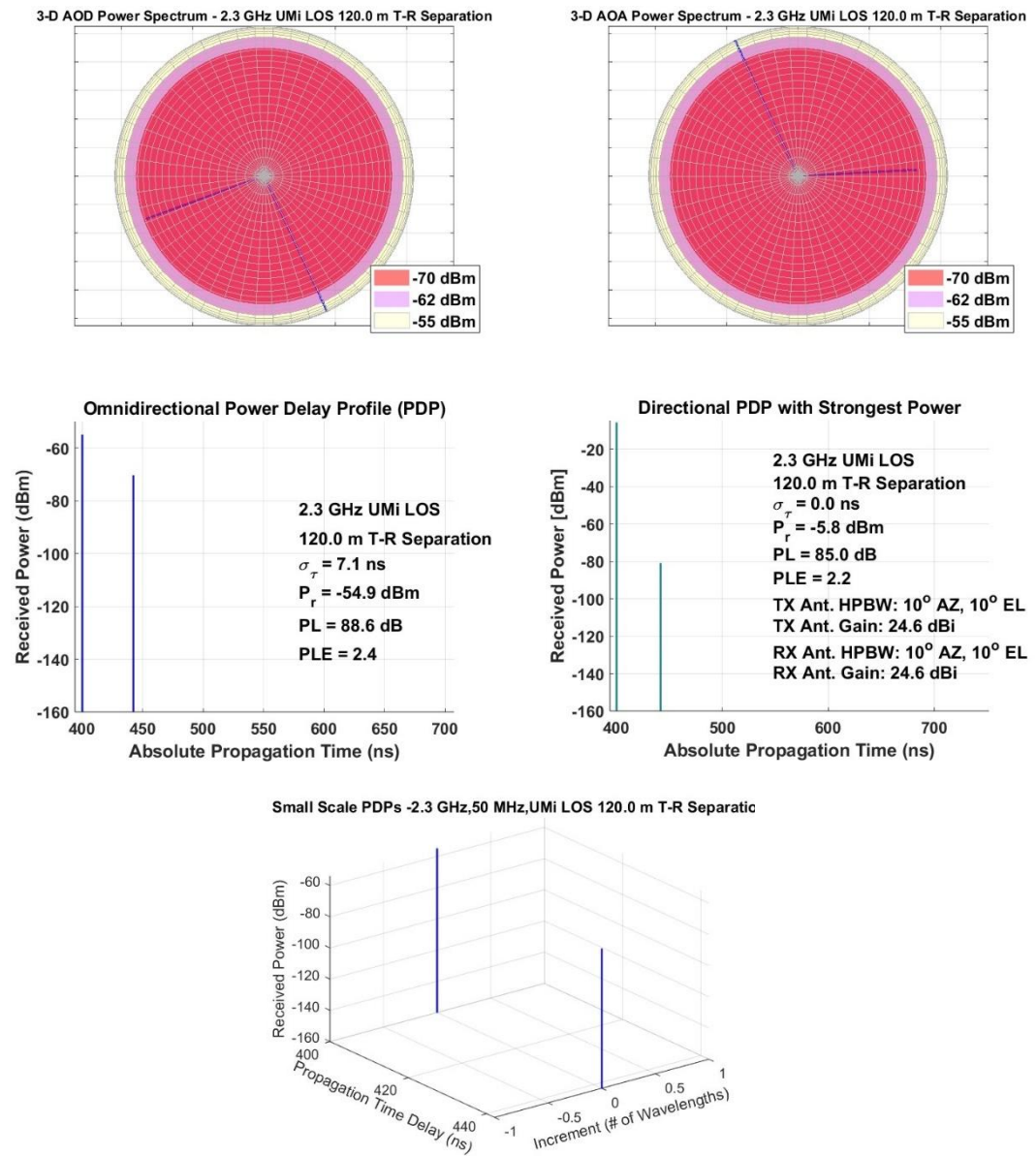
Directional PDP with Strongest Power



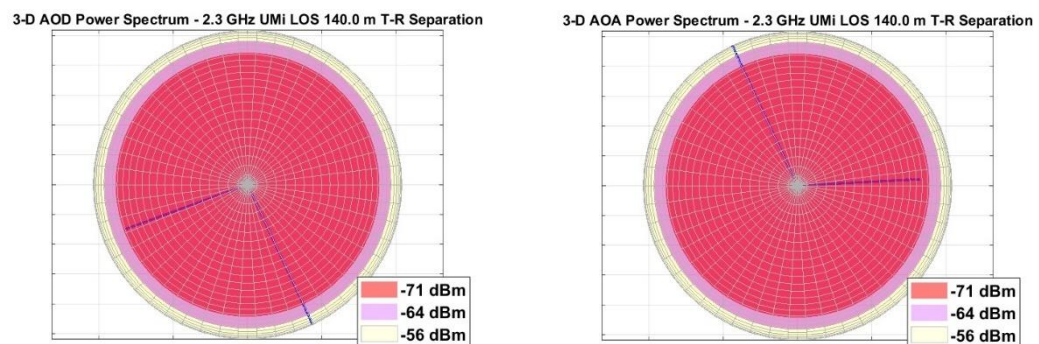
Small Scale PDPs -2.3 GHz,50 MHz,UMi LOS 100.0 m T-R Separatic

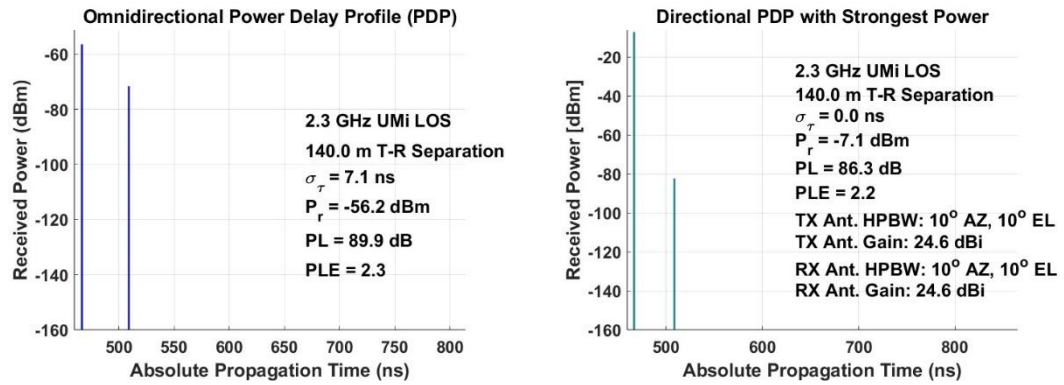


Jarak 120 Meter

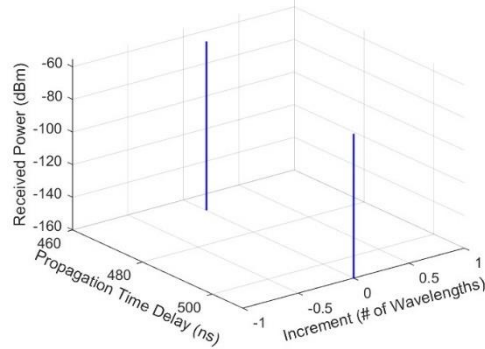


Jarak 140 Meter

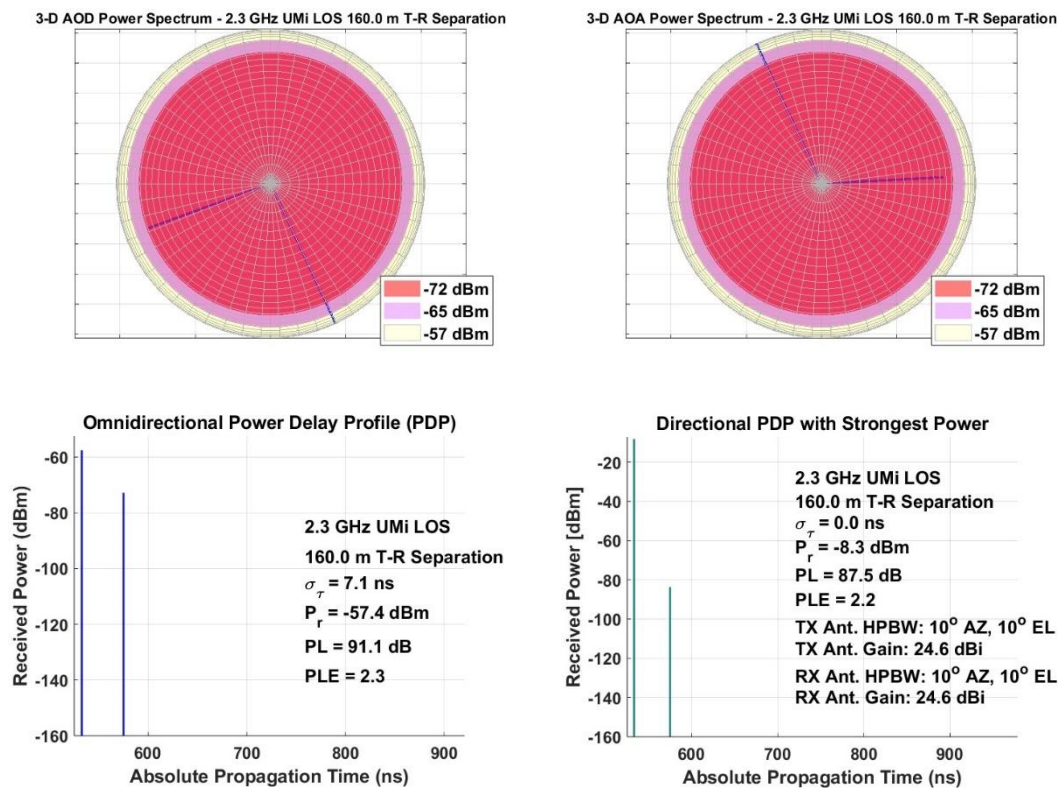




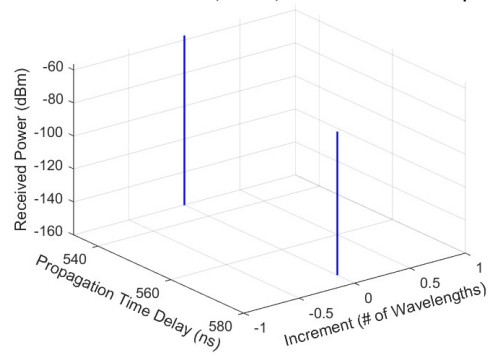
Small Scale PDPs -2.3 GHz,50 MHz,UMi LOS 140.0 m T-R Separatic



Jarak 160 Meter

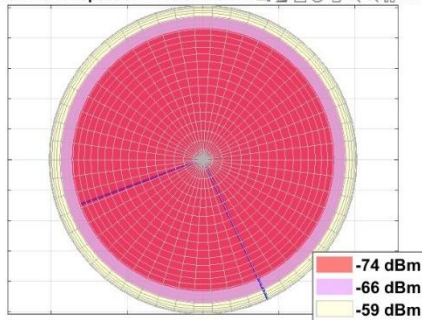


Small Scale PDPs -2.3 GHz,50 MHz,UMi LOS 160.0 m T-R Separatic

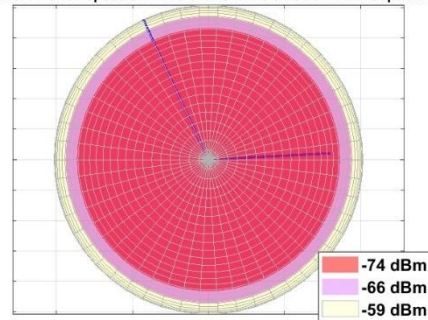


Jarak 180 Meter

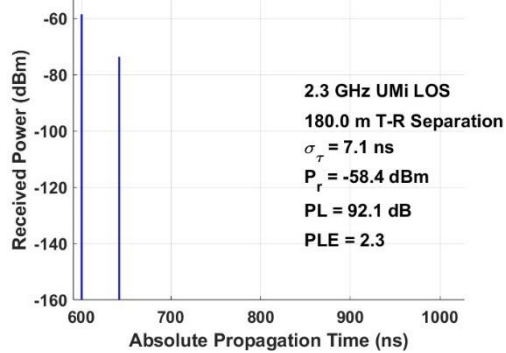
3-D AOD Power Spectrum - 2.3 GHz UMi L



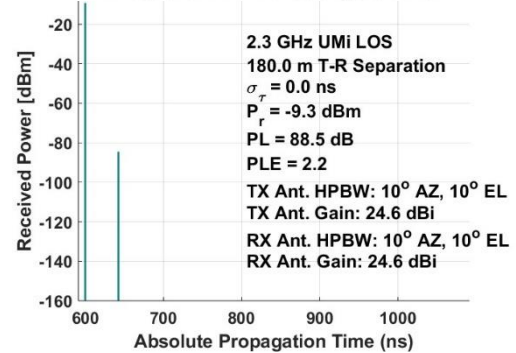
3-D AOA Power Spectrum - 2.3 GHz UMi LOS 180.0 m T-R Separation



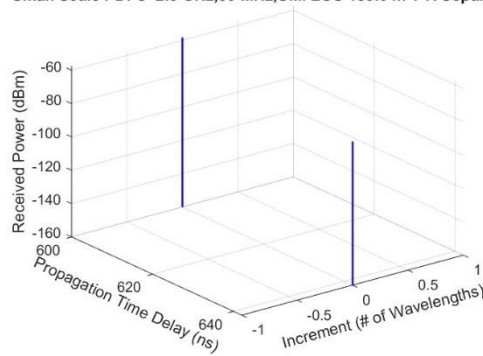
Omnidirectional Power Delay Profile (PDP)



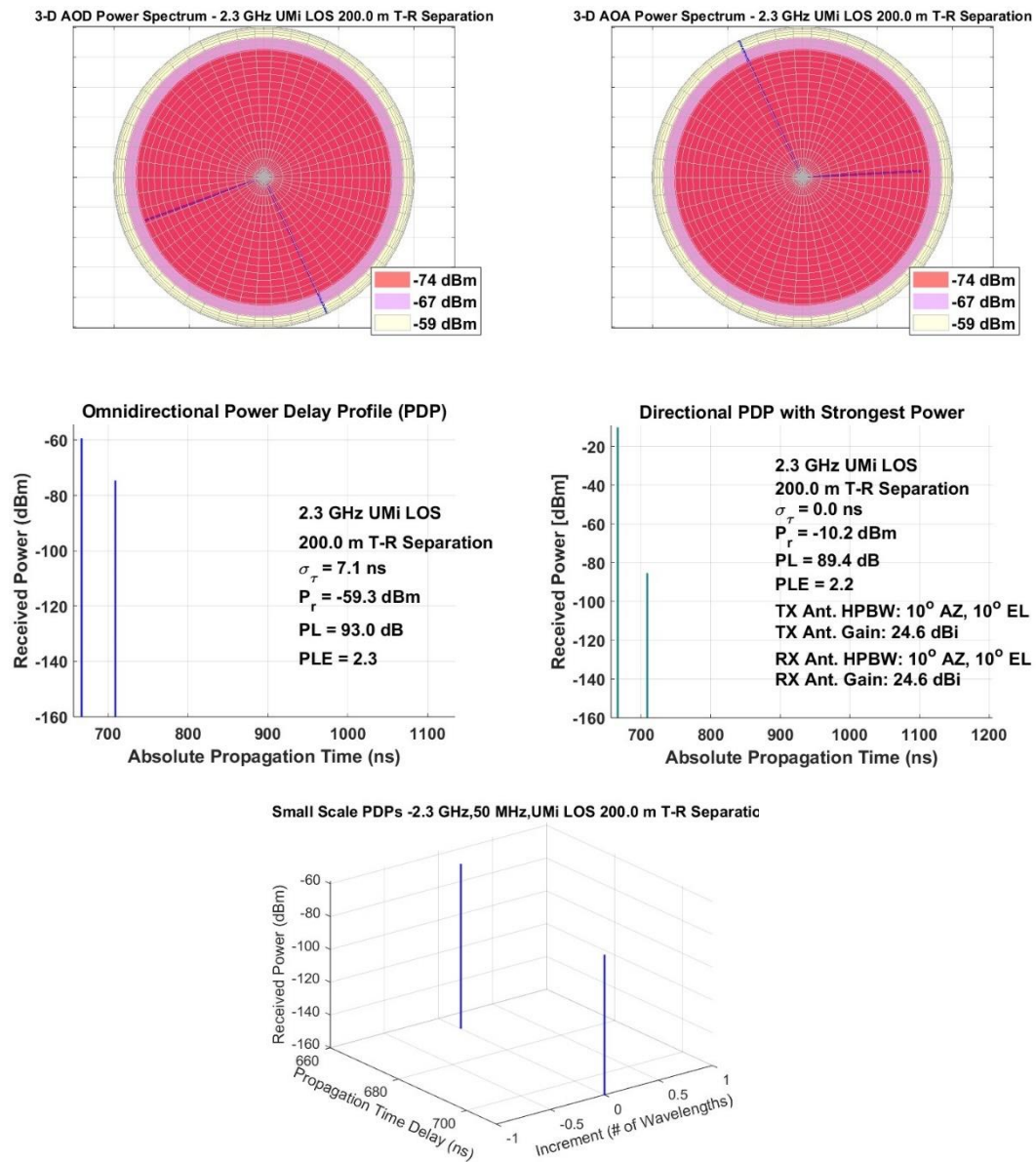
Directional PDP with Strongest Power



Small Scale PDPs -2.3 GHz,50 MHz,UMi LOS 180.0 m T-R Separatic



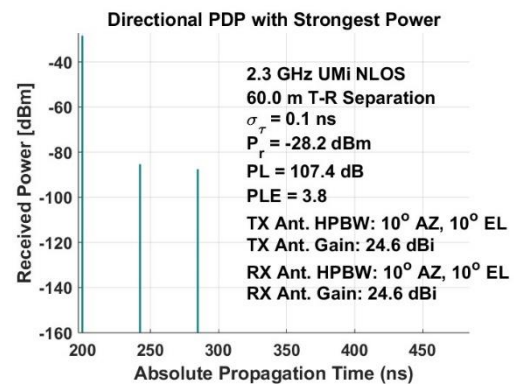
Jarak 200 Meter



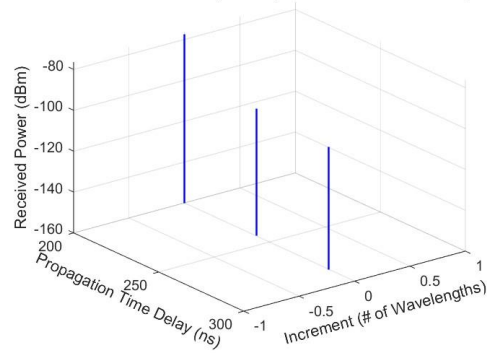
Lampiran 2 Output Hasil Simulasi NYUSIM Simulator Jarak 40 Meter – 200 Meter Kondisi NLOS.

Jarak 40 Meter



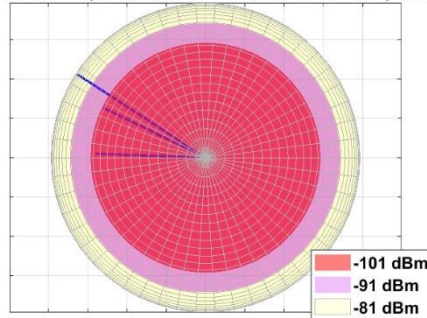


Small Scale PDPs -2.3 GHz,50 MHz,UMi NLOS 60.0 m T-R Separatic

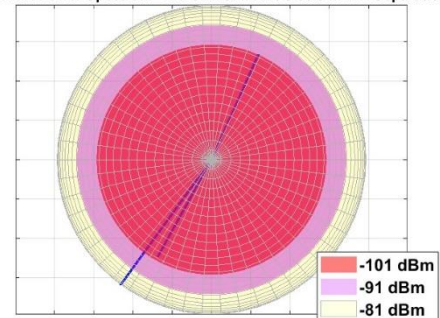


Jarak 80 Meter

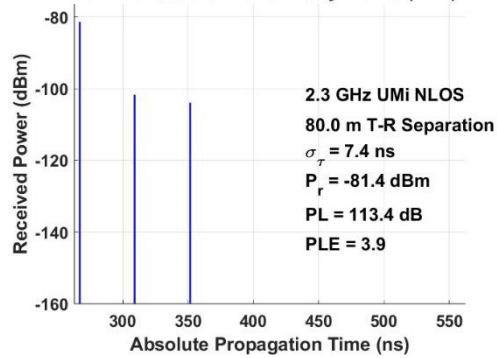
3-D AOD Power Spectrum - 2.3 GHz UMi NLOS 80.0 m T-R Separation



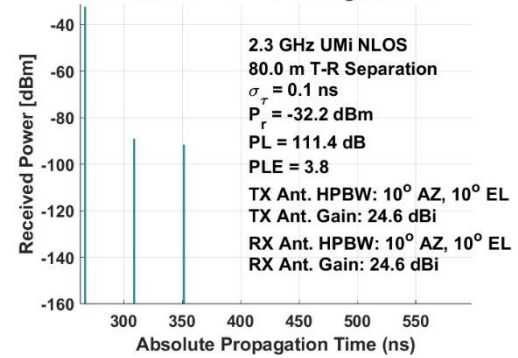
3-D AOA Power Spectrum - 2.3 GHz UMi NLOS 80.0 m T-R Separation



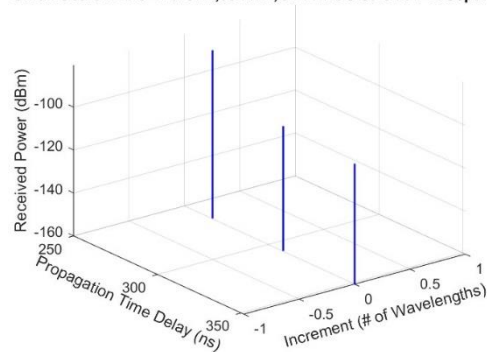
Omnidirectional Power Delay Profile (PDP)



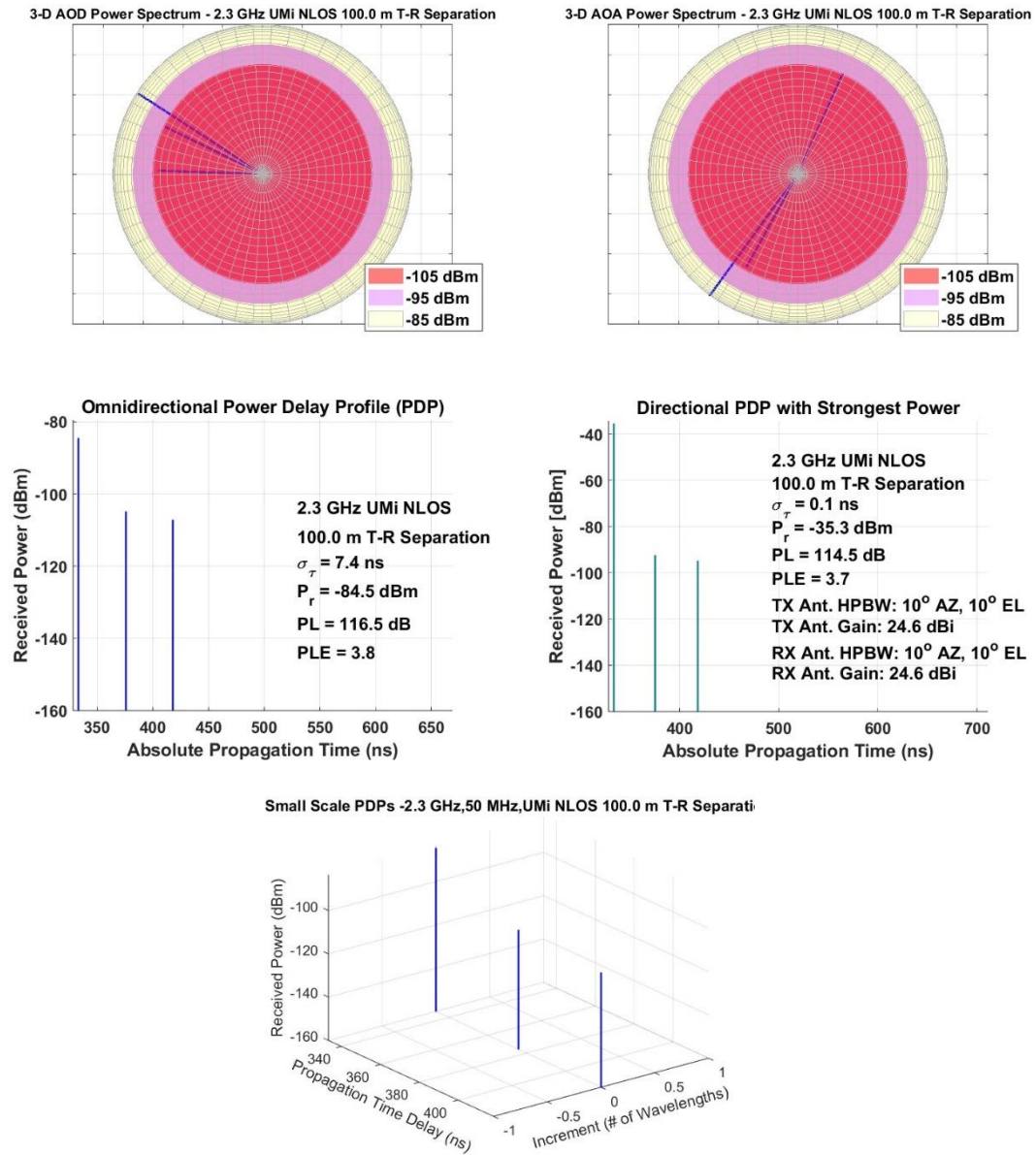
Directional PDP with Strongest Power



Small Scale PDPs -2.3 GHz,50 MHz,UMi NLOS 80.0 m T-R Separatic

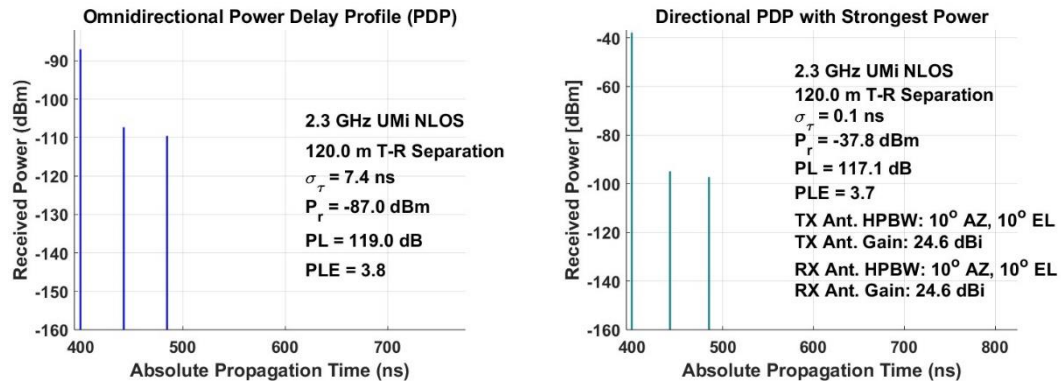


Jarak 100 Meter

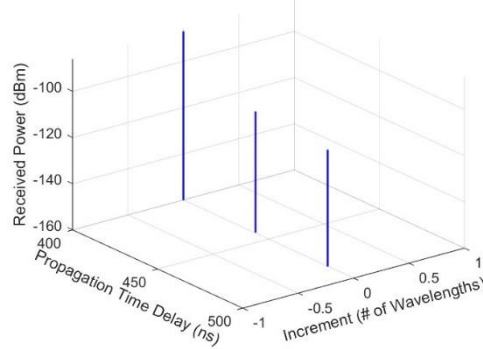


Jarak 120 Meter

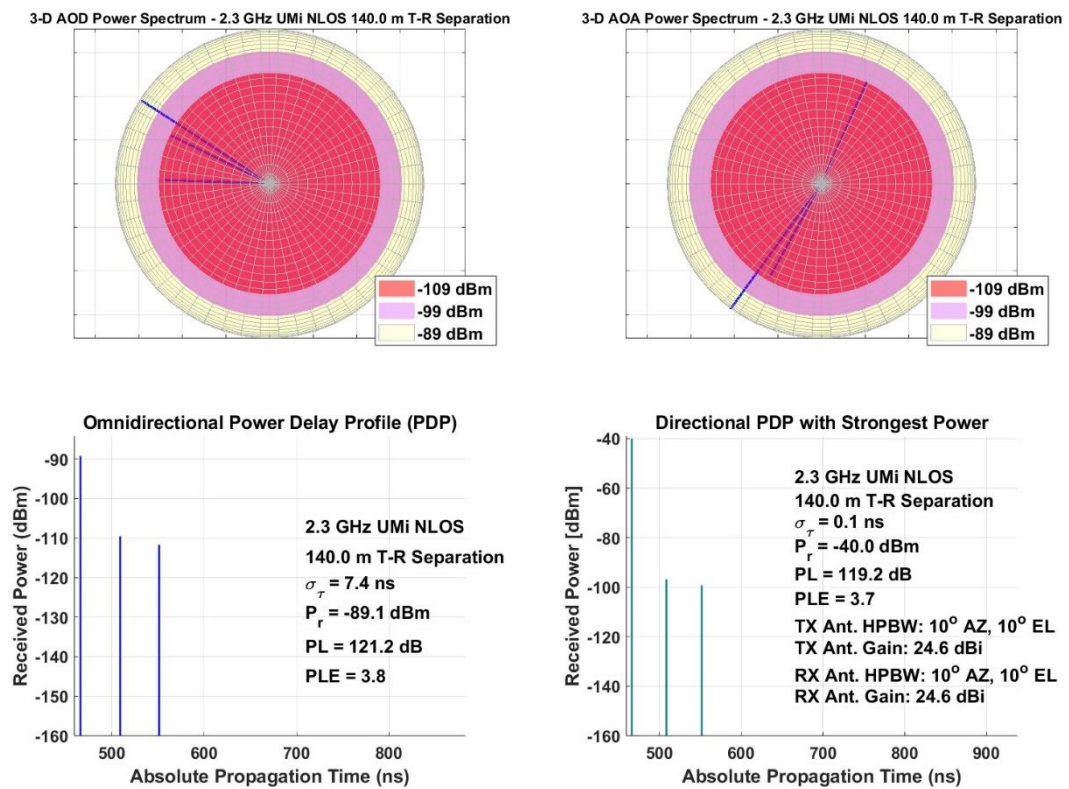




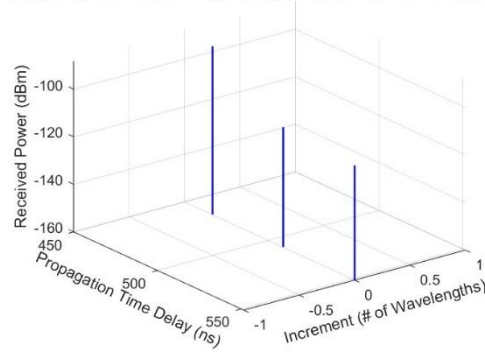
Small Scale PDPs -2.3 GHz,50 MHz,UMi NLOS 120.0 m T-R Separati



Jarak 140 Meter

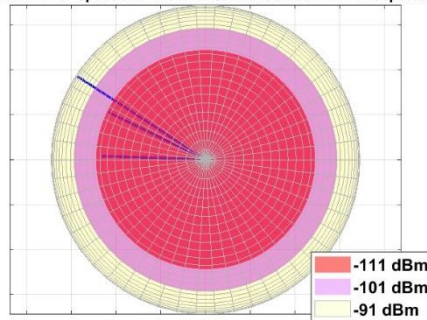


Small Scale PDPs -2.3 GHz,50 MHz,UMi NLOS 140.0 m T-R Separati

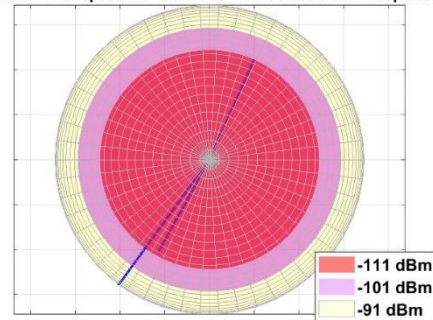


Jarak 160 Meter

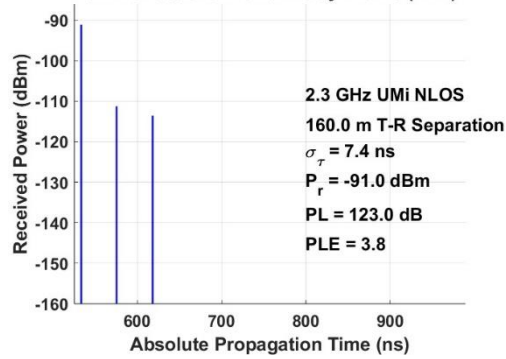
3-D AOD Power Spectrum - 2.3 GHz UMi NLOS 160.0 m T-R Separation



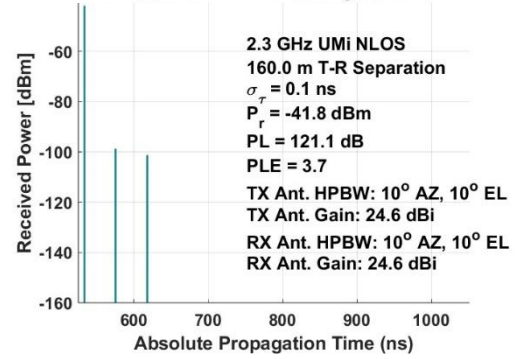
3-D AOA Power Spectrum - 2.3 GHz UMi NLOS 160.0 m T-R Separation



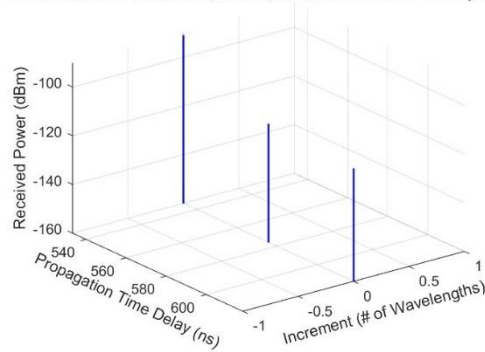
Omnidirectional Power Delay Profile (PDP)



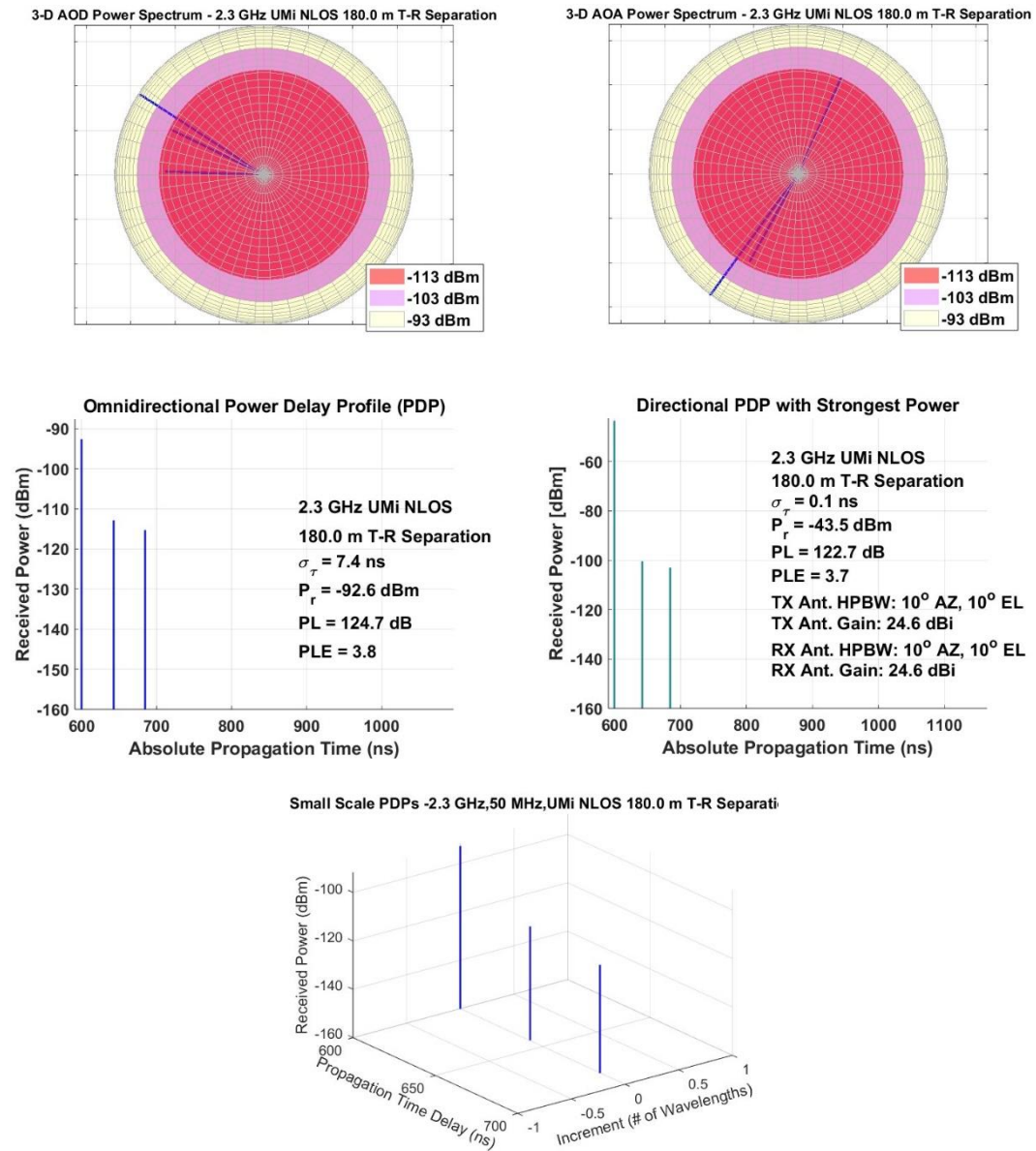
Directional PDP with Strongest Power



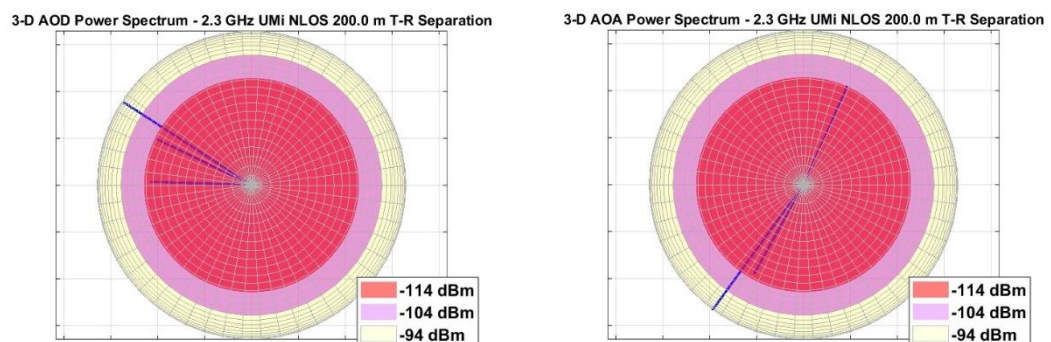
Small Scale PDPs -2.3 GHz,50 MHz,UMi NLOS 160.0 m T-R Separati

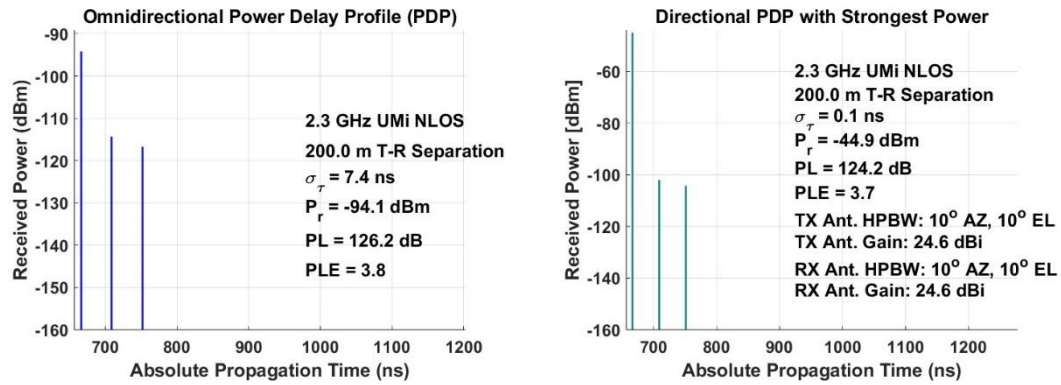


Jarak 180 Meter

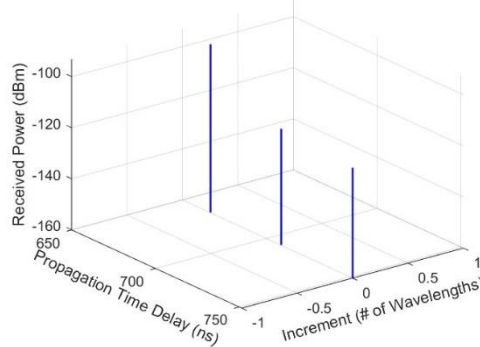


Jarak 200 Meter





Small Scale PDPs -2.3 GHz,50 MHz,UMi NLOS 200.0 m T-R Separati



Lampiran 3 NYUSIM Simulator

Tampilan Awal NYUSIM Simulator

Figure 1

File

NYUSIM
Sub-THz and Millimeter-Wave Channel Simulator

Version 4.0 March 2023

1. To begin the simulator, click Start
2. Set your input parameters below or Upload File
3. Select a folder to save files
4. Click Run
5. To run another simulation, click Reset, and repeat Steps 2-4

Channel Parameters

Scenario: UMi
Frequency (0.5-150 GHz): 28 GHz
RF Bandwidth (0-800 MHz): 800 MHz
Distance Range Option (Standard (10-500 m)): Standard (10-500 m)
Environment: LOS
TX Separation Distance: Lower Bound: 10 m, Upper Bound: 50 m
TX Power (0-50 dBm): 30 dBm
Base Station Height: 35 m
User Terminal Height: 1.5 m
Number of RX Locations: 1

Barometric Pressure: 1013.25 mbar
Humidity (0-100%): 50 %
Temperature: 20 °C
Polarization: Ce-Pol
Rain Rate (0-150 mm/hr): 0 mm/hr
Foliage Loss: No
Distance Within Foliage: 0 m
Foliage Attenuation: 0.4 dB/m
Outdoor to Indoor (OI2): Penetration Loss
OI2 Loss Type: Low Loss

Antenna Properties

TX Array Type: ULA
RX Array Type: ULA
Number of TX Antenna Elements: 1
Number of RX Antenna Elements: 1
TX Antenna Spacing (in wavelength, 0.1-100): 0.5
RX Antenna Spacing (in wavelength, 0.1-100): 0.5
Number of TX Antenna Elements Per Row: 1
Number of RX Antenna Elements Per Row: 1
TX Antenna Azimuth HPBW (7°-360°): 10 °
RX Antenna Azimuth HPBW (7°-360°): 10 °
TX Antenna Elevation HPBW (7°-45°): 10 °
RX Antenna Elevation HPBW (7°-45°): 10 °

Spatial Consistency Parameters

Spatial consistency: ☒ On ☐ Off
Correlation Distance of Shadow Fading (5-60 m): 10 m
Update Distance: 1 m
Correlation Distance of LOS/NLOS Condition (5-60 m): 15 m
Moving direction (0°-360°): 45 °
User Track Type: Linear
User Velocity (1-30 m/s): 1 m/s
Moving Distance (1-100 m): 40 m
Side Length (Only for Hexagon track): 10 m
Orientation (Only for Hexagon track): Clockwise
Segment Transitions: Yes

Human Blockage Parameters

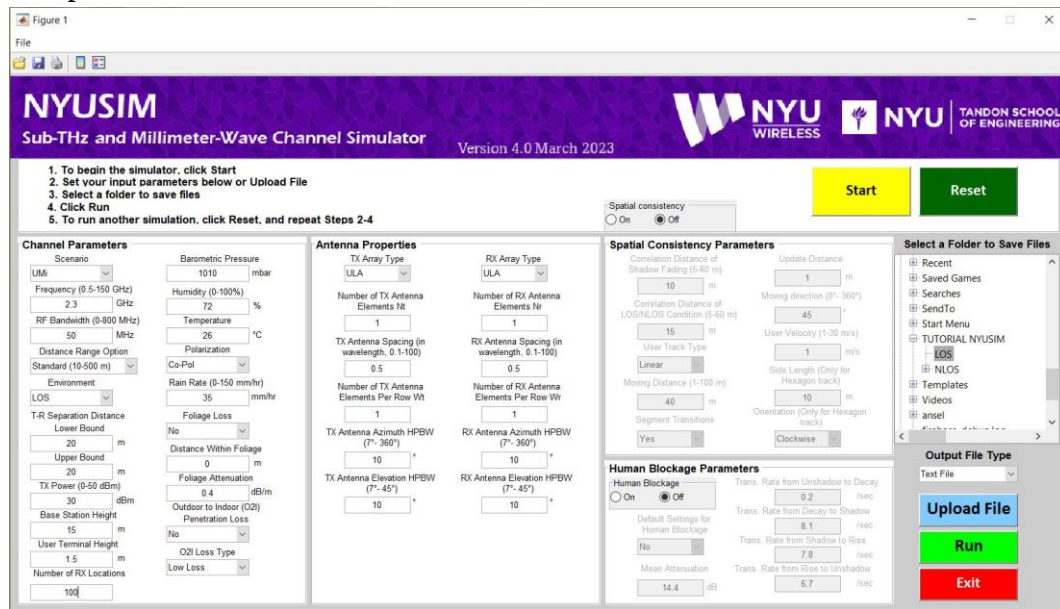
Human Blockage: ☒ On ☐ Off
Trans. Rate from Unshadow to Decay: 0.2 /sec
Trans. Rate from Decay to Shadow: 8.1 /sec
Trans. Rate from Shadow to Rise: 7.8 /sec
Trans. Rate from Rise to Unshadow: 6.7 /sec
Mean Attenuation: 14.4 dB

Select a Folder to Save Files
C:\Users\

Output File Type
Text File

Upload File
Run
Exit

Tampilan Setelah Memasukkan Parameter



Tampilan Output NYUSIM Simulator

