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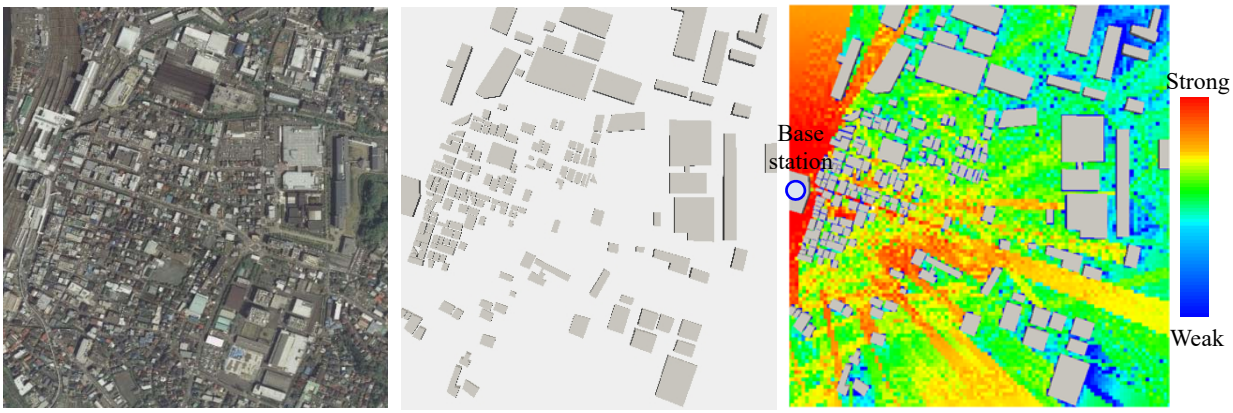
Mitsubishi Electric Develops Solution to Visualize Radio Waves to Support IoT System

Enables optimal placement of wireless equipment to be designed fast and inexpensively

TOKYO, May 24, 2017 – Mitsubishi Electric Corporation (TOKYO: 6503) has developed a radio wave visualization solution for ascertaining, with high speed and high precision, the intensity of radio waves when designing the optimal placement of wireless communication equipment. The solution rapidly simulates electromagnetic fields and visualizes the results, eliminating the timely and costly need for technicians to calculate and design wireless equipment placement. The solution is expected to greatly support the introduction of IoT systems across cities and in tunnels, offices and other local environments.



Aerial photo of target area[1] 3D model of city[2] Simulation results[2]

[1] Aerial photo from Japan's Geospatial Information Authority that provides height information about buildings and other structures that impact radio wave intensity
[2] 3D model created from aerial photos and overlain with radio wave intensity information

Main Characteristics

1) Predicts radio wave attenuation and visualizes radio waves with speed and precision

To ascertain radio wave intensity without requiring actual measurements, Mitsubishi Electric's solution constructs a 3D model of the target area by using aerial photos and other sources to determine the heights of structures that affect radio wave intensity.

To visualize radio waves fast and precisely, Mitsubishi Electric developed a technology that dramatically reduces the calculation time to a mere 1/100th of existing methods. The technology incorporates the ray-trace technique for measuring radio wave intensity and a statistical model of radio wave attenuation characteristics extracted from a database of actual radio wave measurements.

The target area is then classified into 1) unobstructed zones where radio waves arrive directly from transmission antennas, 2) zones where waves arrive after being reflected or refracted (bent around a structure) one time and 3) other zones where reflection or diffraction occur multiple times. An appropriate statistical model is then applied to each zone.

The statistical models are constructed by actually measuring radio wave intensities in a number of areas in each zone, such as offices and commercial facilities. In a comparison with existing statistical models used commonly worldwide, Mitsubishi Electric has determined that its new statistic model achieves the highest precision.

Comparison with previous statistical models[3]

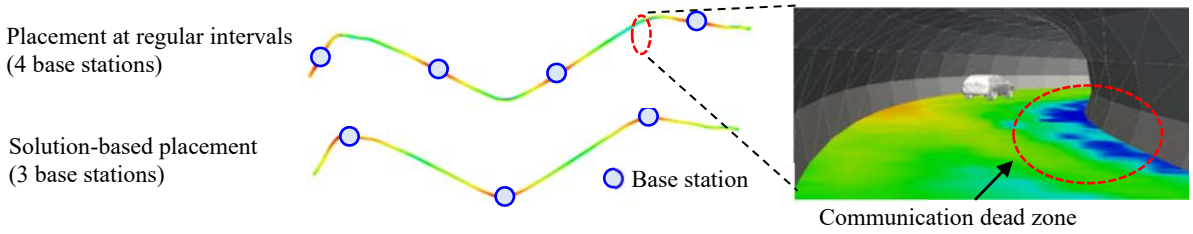
Statistical model	ITU-R P.1238[4]	ITU-R M.2135[5]	WINNER II[6]	Mitsubishi Electric
Standard deviation	6.1 dB	4.3 dB	9.3 dB	3.7 dB

[3] The Institute of Electronics, Information and Communication Engineers Transactions on Communications, Vol. J99-B, No.9, pp.684-692, 2016.
[4] ITU-R Recommendations, P.1238-7, "Propagation data and prediction methods for the planning of indoor radio communication systems and radio local area networks in the frequency range 300MHz to 100GHz"
[5] Report ITU-R M2135-1, "Guidelines for evaluation of radio interface technologies for IMT-Advanced"
[6] WINNER II D1.1.2 V1.2, "WINNER II Channel Models"

2) Reduces time and cost of optimally placing wireless equipment for IoT systems

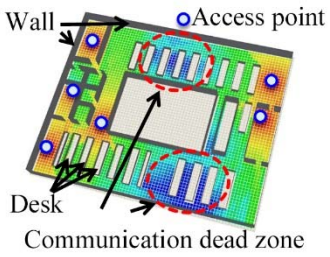
(1) Placement of base stations in tunnels

Simply positioning base stations at regular intervals inside a tunnel can result in an unnecessary number of base stations, and it does not necessarily eliminate poor reception along the insides of curves (blue zone in figure below). Mitsubishi Electric's solution resolves these problems, for example, reducing the number of base stations to three from four in the figure below.

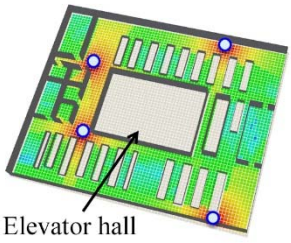


(2) Placement of wireless LAN access points

The figures below are an example of the placement design for wireless LAN access points in an office. The initial placement uses many access points and has dead zones, whereas Mitsubishi Electric's solution for visualizing radio waves reduces the access points from 6 to 4 and eliminates the dead zones.



Initial placement



Optimal placement

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About Mitsubishi Electric Corporation

With over 90 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,238.6 billion yen (US$ 37.8 billion*) in the fiscal year ended March 31, 2017. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 112 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2017