The HISTORY and FUTURE of Wi-Fi
Learn more about IEEE 802.11 testing:
www.rohde-schwarz.com/wlan
HOME AND OFFICE NETWORKS
M2M AND IoT NETWORKS
ROOM AND DESK AREA NETWORKS
VEHICLE NETWORKS
WaveLAN, the starting point for Wi-Fi development, was used for wirelessly connecting cashing machines.
802.11 b
Higher speed physical layer extension in the 2.4 GHz band
Spatial streams 1x1 SISO
Modulation type CCK
Channel bandwidth 22 MHz
Bands 2.4 GHz
Transmission/access method CSMA/DSSS
Need for faster speed and better distance coverage.
802.11 a
High speed physical layer in the 5 GHz band
Spatial streams 1x1 SISO
Modulation type 64QAM
Channel bandwidth 20 MHz
Bands 5 GHz
Transmission/access method CSMA/OFDM
802.11 g
Further higher data rate extension
Spatial streams 1x1 SISO
Modulation type 64QAM
Channel bandwidth 20 MHz
Bands 2.4 GHz
Transmission/access method CSMA/OFDM
The ability to connect to the internet via mobile devices and the rising number of smart-phones on the market required the introduction of features like MIMO.
www
802.11 n
Enhancements for higher throughput (HT)
Spatial streams 4x4 SU-MIMO
Modulation type 64QAM
Channel bandwidth 40 MHz
Bands 2.4/5 GHz
Transmission/access method CSMA/OFDM
More and more people wanted Wi-Fi at home and at work. High speed Wi-Fi was therefore required in the 5 GHz spectrum to relieve the over-crowded 2.4 GHz spectrum.
802.11 ac
Enhancements for very high throughput (VHT)
Spatial streams 8x8 DL-MU-MIMO
Modulation type 256QAM
Channel bandwidth 160 MHz
Bands 5 GHz
Transmission/access method CSMA/OFDM
Multi-antenna transceiver methods
The evolution from SISO to single-user and multi-user MIMO was essential to meet data throughput demands.
Single input single output (SISO)
Use of a single antenna on access points and devices for sequential communications of the access point with connected devices, applying a carrier sense multiple access (CSMA) scheme to control spectrum access.
Single-user multiple input multiple output (SU-MIMO)
Use of multiple antennas to improve data throughput, applying a carrier sense multiple access (CSMA) scheme to control spectrum access.
Multi-user MIMO
Based on OFDMA, MU-MIMO allows simultaneous communications of stations in parallel. Beamforming enables multiple users to apply individual MIMO schemes at the same time to ensure efficient communi-cations.
Provide Wi-Fi based car-to-car communications to enable emerging intelligent traffic services.
802.11 p
Wireless access in vehicular environments
Spatial streams 1x1 SISO
Modulation type 64QAM
Channel bandwidth 10 MHz
Bands 5.9 GHz
Transmission/access method CSMA/OFDM
Meet today's and tomorrow's rising demands on V2X communications on the way to fully autonomous vehicles.
802.11 bd
Enhancements for next generation vehicular (NGV)
Spatial streams 2x2 SU-MIMO
Modulation type 256QAM
Channel bandwidth 10, 20 MHz
Bands 5.9/60 GHz
Transmission/access method CSMA/OFDM
Designed for in-room/desk network applications requiring very high data rates such as for HD video streaming.
HD.
802.11 ad
Directional multi-gigabit (DMG) in the 60 GHz band
Spatial streams 1x1 SISO
Modulation type 64QAM
Channel bandwidth 2.16 MHz
Bands 60 GHz
Transmission/access method CSMA/SC
Achieves up to 20 Gbit/s throughput and enables extended distances for enlarged application space.
802.11 ay
Enhanced DMG (EDMG) in bands above 45 GHz
Spatial streams 8x8 MU-MIMO
Modulation type 64QAM
Channel bandwidth 8.64 MHz
Bands > 45 GHz
Transmission/access method CSMA/OFDM
Enables use of the sub GHz spectrum for IoT and remote internet applications.
The heavy use of Wi-Fi meant that a new approach was required. OFDMA allows multiple devices to communicate simultaneously.
802.11 af
Television very high throughput (TVHT)
Spatial streams 4x4 DL-MU-MIMO
Modulation type 256QAM
Channel bandwidth 6/7/8 MHz
Bands sub GHz
Transmission/access method CSMA/OFDM
802.11 ah
Sub 1 GHz License exempt
Spatial streams 4x4 DL-MU-MIMO
Modulation type 256QAM
Channel bandwidth 1/2/4/8/16 MHz
Bands sub GHz
Transmission/access method CSMA/OFDM
802.11 ax
Enhancement for high efficiency (HE) Wi-Fi
Spatial streams 8x8 MU-MIMO
Modulation type 1024QAM
Channel bandwidth 160 MHz
Bands 2.4/5/6 GHz
Transmission/access method CSMA/OFDM/OFDMA
The advent of home office and schooling as well as industrial applications require improved data throughput, reduced latency and efficiency.
802.11 be
Enhancements for extreme high throughput (EHT)
Spatial streams 16x16 MU-MIMO
Modulation type 4096QAM
Channel bandwidth 320 MHz
Bands 2.4/5/6 GHz
Transmission/access method CSMA/OFDM/OFDMA
Test and measurement solutions from Rohde & Schwarz
R&S®CMW270 wireless connectivity tester
The non-cellular expert designed for testing Wi-Fi access points (AP) and stations (STA) in signaling and non-signaling mode.
R&S®CMW100 communications manufacturing test set
Ultra-compact, non-signaling tester optimized for production line testing including 4G, 5G and Wi-Fi 6 wireless technologies.
R&S®SMW200A vector signal generator
The fine art of signal generation – supports Wi-Fi modulation at full bandwidth and enables MIMO testing with real-time fading.
R&S®SMBV100B vector signal generator
The new benchmark in its class with up to 500 MHz modulation bandwidth and perfect accuracy even at high output power levels.
R&S®FSW signal and spectrum analyzer
Setting standards in innovation and usability for testing Wi-Fi devices with 800 MHz real-time analysis bandwidth.
R&S®FSVA3000 signal and spectrum analyzer
The right choice for Wi-Fi 6E spectrum and signal analysis in R&D. Supports 400 MHz analysis bandwidth.
R&S®TS8997 regulatory test system for wireless devices
Testing of wireless devices operating in the ISM bands in line with ETSI and FCC standards.
R&S®DST200 RF diagnostic chamber
Ideal environment for RF analysis during development. Supports a wide range of radiated test applications for Wi-Fi devices.
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