Mini-TP Test System

WiFi Performance Test Expert

Support WiFi(station and AP)/LTE/5G/BT device Throughput(TP) test, WiFi Model B Chanel Emulation, Muti-communication mode coexistence test for Throughput and Sensitivity, RVR（Rate vs Range）etc., also compatible with **TRP-398** and test item published by mobile operators.

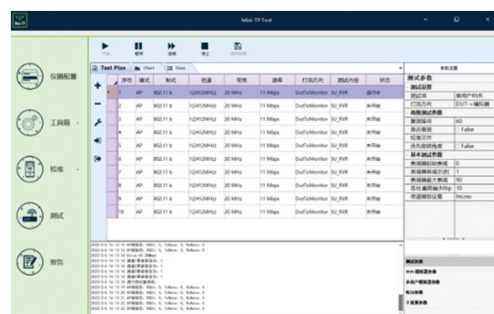www.hwa-tech.com

Hwa-Tech
Mini-TP

Function Introduction

■ Wireless Communication Standard： WiFi a/b/g/n/ac/ax(could also upgrade to 6E/WiFi7) /Bluetooth/LTE/5G

■ Test Frequency： 400MHz–7.5GHz

■ MIMO OTA： 2×2/4×4/8×8 throughput test; Single or 4/9/12/16/32/64 stations are optional. The system also supports AP and Station test mode.

■ A variety of test scenarios are available to be selected and that make the performance test of WiFi terminals closer to real use. Support WiFi throughput test, Desense test, TR-398 test, Bluetooth device and headset test, and actual AP/end-to-end test under Model B channel model (WiFi indoor channel model).

■ Independent Research and Development (Independent Intellectual Property Rights), provide cost-effective performance test solution for WiFi device, system include WiFi channel emulator, WiFi test antenna (log-periodic antenna with good Antenna Correlation), antenna could easily adjust to point to any direction or switch H/V polarization, I-generator to generate different interference signal or structure WiFi traffic situation.

■ Single/Muti WiFi emulator open to control different parameters, such as MCS, power, NSS, OFDMA、 Beamforming etc., so customer could test throughput in adjustable mode and fixed parameters mode.

■ Bluetooth TWS test can be completed without hardware addition, and real AP/Station can be selected to test.

■ Mini-TP S+ combine Throughput test and 3D pattern test in one cabinet to cost down customers invest.

■ The system has been used by a Chinese operator to be one of their certification tests for their purchased AP equipment.

Mini-TP Test System

Mini-TP test system is a test system specially launched by Hwa-Tech for WiFi terminal performance test. The system complies with AP device test specifications of TRP-398 and could meet the test reqirement of China Mobile or other operators. In addition, Mini-TP test system could be used not only in the throughout performance test, but also in different test scenarios simulation for mobile phones, tablet computers, monitoring equipment, TVs, Bluetooth headsets, Bluetooth hearing aids and other IoT terminals.

Traditional Throughput test use commercial AP has many defects cannot be solve:

1、AP cannot control all the parameters and fixed parameters test.(AP has adjust parameters controlled by underlying software), if customer want to test one certain rate/parameters, AP cannot support.

2、Bad repeatability. Most of Throughput test by AP could reach test result in 10%.but Hwa-tech WiFi emulator provide test result in 3% with golden sample;

3、The test result of tradition test method could not consist with actual use, maybe test good in Lab but have poor behavior on site. Mini-TP provide Model B Channel emulator to recurrent Signal's Multipath transmission and time delay in cabinet; I-generator modify imitate the complex interference such as 2/3/4G, WiFi, BT etc. during Throughput test. So engineer could do more tests in Lab, thus make Lab test more meaningful.

Mini-TP System Technical Parameters

	Mini-TP S	Mini-TP S+	Mini-TP M
Chamber			
Dimension(H*W*D)	1000*1400*800mm	1500*1080*1500mm	1600*1200*1200mm
Shielding Performance	2-8GHz>80dB		
Test Distance	0.45m	0.45m (Throughput) 0.6m (3D pattern)	0.6m
Maximum Weight of DUT	15/30kg		
Phi Angular Resolution (Turntable)	0.1°		
Rotation Speed (Turntable)	15°/s		
Test Antennas			
Number of Antennas	4/8 Throughput+ 1 Interference antenna	4/8 Throughput+ 1 Interference (3D pattern) +4(3D Pattern)	20 Throughput +1 Interference
Antenna Frequency Range	2-7.5GHz (WiFi/Bluetooth) 400MHz-7.5GHz (Interference&3D Pattern)		
Test Equipment			
WiFi Simulator	1/4 Users		1/4/9/12/16/32 Users
Interference Sources	Support BT, Zigbee, GSM, WCDMA, LTE, continuous wave, pulse, microwave oven and other interference signal generation		
Multi-channel Attenuator/ Channel Emulator	Number of Channels: 4 Attenuation Step: 0.25dB Accuracy: 0.1dB Built-in IEEE 802.11 Model B channel model, Built-in switches can meet LOS conditions		Number of Channels: 4/9/12/16 optional Attenuation Step: 0.5dB Accuracy: 0.1dB

Hwa-Tech Mini-TP

Features of the Mini-TP ①

■ The test environment specially designed for WiFi products and makes test results more accurate and stable

01

In order to avoid test result distortion caused by poor antenna correlation, Mini-TP special design WiFi Snoop (log-periodical antenna) to do TP test. In order to avoid test result distortion caused by poor antenna correlation, Hwa-Tech specially designed WiFi Snoop to do TP test.

WiFi Snoop is a single-polar log-periodic antenna, even if the antennas are close in rows, its antenna correlation is low and will not be coupled to each other, so it can be used in scenarios that simulate large-scale users. In addition, the antenna is fixed on ball transfer so that it could arbitrarily adjust its polarization direction. Basing on this ability, the antennas could adjust according to the terminal placement and antenna position, then the system could simulate any antenna direction.

02 **High-performance absorber**

The chamber is small size so require high performance absorber, 15cm high EPP absorbing material is selected as the anechoic wall absorbing material. This kind of absorbing material does not remove toner, so that its service life is usually more than 15 years with no decrease of absorption efficiency. EPP absorbing material ensure the system have a long-term stable test environment.。


JCP-100
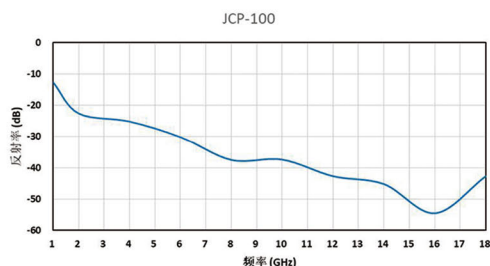
03 **The throughput repeatability is within 3%, and the power value at the inflection point is better than 0.5dB**

Due to the highly stable test environment and Hwa-Tech self-developed WiFi simulator WEU-6, the system could ensure that the throughput test repeatability is better than 3%, and the inflection point power value is also highly consistent, which is far better than the throughput repeatability of the router test by 10%.

The figure below shows the throughput repeatability curve for multiple measurements:
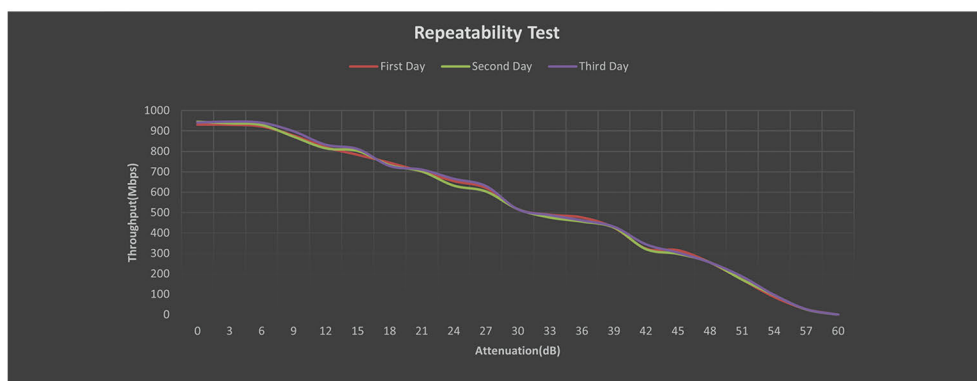
Features of the Mini-TP ②

## ■ The test results are highly compatible with the real environment

01 **The test system has both a ModelB channel model and an InLoss (chamber with no reflection) signal propagation Chanel emulation**

Model B Channel Model describe WiFi signal propagation indoor, this model have 2 clusters and 11 paths signal transmission, every path of signal have excess delay as 10ns,all of these construction WiFi signal's reflect and refraction in doors, Model B is the the leading example of WiFi Channel Model. Mini-TP test system use Model B Channel Emulator to simulate the muti-path and time delay for WiFi DUT and make test result have good repeatability, Channel emulator also have programmable attenuator with 90dB range to simulate DUT in different test distance.

May 2004   doc:IEEE 802.11-03/940r2
Appendix C-Model B

Tap index		1	2	3	4	5	6	7	8	9
Excess delay [ns]		0	10	20	30	40	50	60	70	80
Cluster1	Power [dB]	0	-5.4	-10.8	-16.2	-21.7				
AoA	AoA [°]	4.3	4.3	4.3	4.3	4.3				
AS (recevier)	AS [°]	14.4	14.4	14.4	14.4	14.4				
AoD	AoD [°]	225.1	225.1	225.1	225.1	225.1				
AS (recevier)	AS [°]	14.4	14.4	14.4	14.4	14.4				
Cluster1	Power [dB]			-3.2	-6.3	-9.4	-12.5	-15.6	-18.7	-21.8
AoA	AoA [°]			118.4	118.4	118.4	118.4	118.4	118.4	118.4
AS (recevier)	AS [°]			25.2	25.2	25.2	25.2	25.2	25.2	25.2
AoD	AoD [°]			106.5	106.5	106.5	106.5	106.5	106.5	106.5
AS (recevier)	AS [°]			25.4	25.4	25.4	25.4	25.4	25.4	25.4

The following figure shows the throughput curve of an 802.11ax device as it passes through different channel models.:
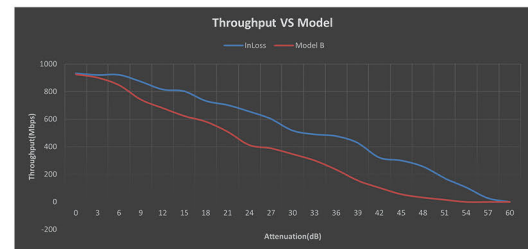

02 **Multi-communication coexistence and WiFi Traffic simulation**

In order to better simulate the coexistence of interference signals and WiFi signals in actual application scenarios, the system supports signal recording and playback. The signals such as BT, Zigbee, Lora and other signals could be directly captured in the dark room environment. The interference source can be packet captured and playback WiFi interference to simulates practical application scenarios.

For multi-band interference can also build-ed by adding background APs with multi-users simulator. The interference signal can act independently on any test item, such as RVR test, directionality test, etc.

The figure shows the throughput vs Range(link loss increase) of the DUT in two scene(WiFi traffic background and no interference):
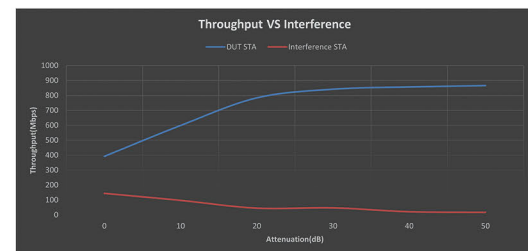

03 **By configuring the parameters such as MCS and NSS opened by the WiFi simulator, the performance at the user's required rate can be accurately tested**

The router equipment in market is a highly algorithmically optimized product, and its specific physical layer parameters such as MCS, NSS, power, channel and other parameters are mostly unmodifiable. This makes the results of direct testing by AP unable to reflect DUT's real performance at a specific rate. For different application scenarios, accurate MCS and throughput rate correspondence is usually required.

For example, if a video monitor clarity is 1080p and its picture clarity requires a transmission rate of 30M/s, Mini-TP system could simulate a clear test by specifying MCS to achieve the inflection point value of the required performance, but adaptive routers on the market could not do that.
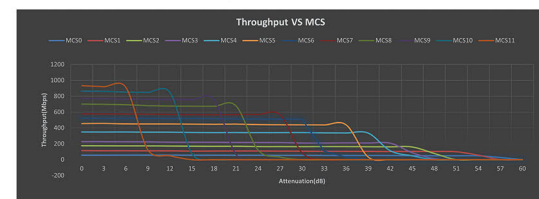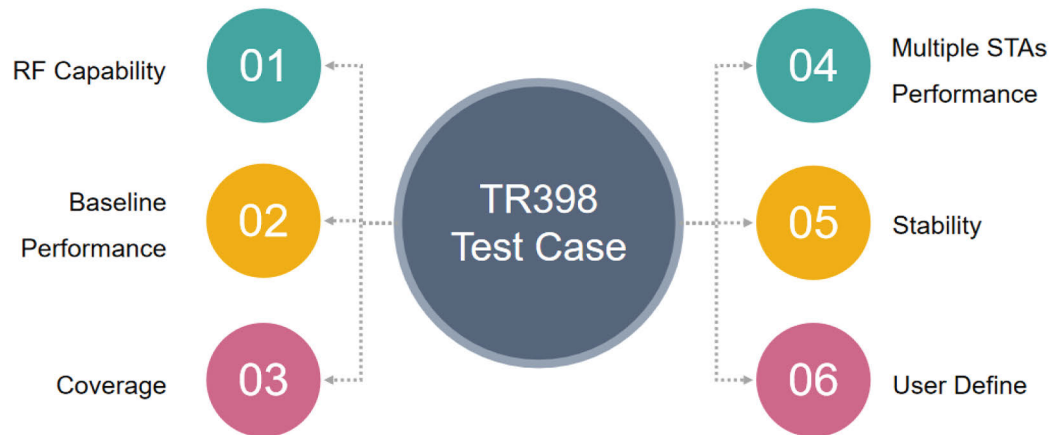
Features of the Mini-TP ③

Flexible and comprehensive test item support

01 The test environment specially designed for WiFi products and could makes the test results more accurate and stable

RF Capability — **01** — TR398 Test Case — **04** Multiple STAs Performance

Baseline Performance — **02** — TR398 Test Case — **05** Stability

Coverage — **03** — **06** User Define

02 **SISO OTA test could be selected**

The addition of SISO OTA probe test options (antenna bracket, dual-polarization test probe set, switch box) can expand the standard OTA system based on the Mini-TP test system and complete OTA test items such as EIRP, EIRS, 3D pattern.
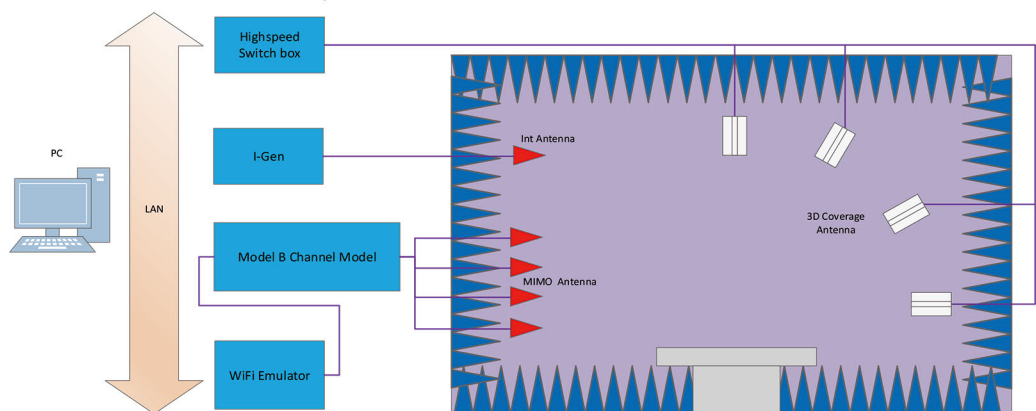
03 **Compatible with Bluetooth and other IoT terminal testing**

Bluetooth headsets or other IoT terminals can be used as peer devices to control the power of Bluetooth signals by adjusting the attenuation value between the terminal and the measured object
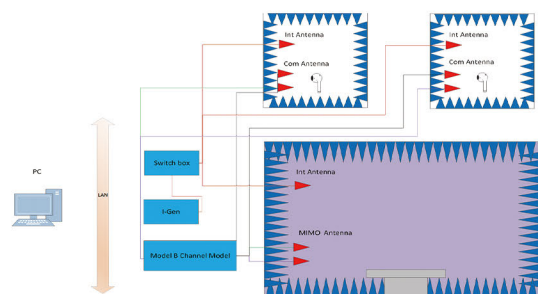
04 **Scalable upgrade LTE, 5G NR Throughput testing**

By adding LTE and NR testers to the system, the Throughput VS Attenuation, Throughput Stability and other items can be tested

Test Items

WiFi Test Items

Test Items	TR-398 Standard	Test Environment	DUT
RVR,Rate vs RANGE	√	Single User	AP,STA
Throughput vs Model B		Single User	AP,STA
Throughput vs Interference		Single User	AP,STA
Throughput vs Orientation		Single User	AP,STA
Sensitivity	√	Single User	AP,STA
Max Throughput	√	Single User	AP,STA
Automatic Channel Selection Test	√	Single User + Test AP/WiFi Emulator	AP
Roaming		Single User + Test AP/WiFi Emulator	STA
Spatial Consistency Test	√	Single User	AP,STA
Long Term Stability Test	√	Single User	AP,STA
Wireshark Capture		Single User	AP,STA
WiFi Traffic Reply		Single User	AP,STA
Fixed MCS Test		Single User	AP,STA
Multiple STAs Performance Test	√	Muti-Users	AP
Multiple Association /Disassociation Stability Test	√	Muti-Users	AP
Downlink MU-MIMO Performance Test	√	Muti-Users	AP
OFDMA Test		Muti-Users	AP
Airtime Fairness Test	√	Muti-Users	AP
Dual-band Throughput Test	√	Muti-Users	AP
AP Coexistence Test	√	Muti-Users+Test AP/WiFi Emulato	AP
Bidirectional Throughput Test	√	Single User	AP

LTE/5G Test Items

Rate vs Range
Throughput vs Interference
Throughput vs Orientation

3D Pattern Test Items

EIRP 3D
EIRS 3D
3D Pattern

Mini-TP Test Accessories ①

▍Single User WiFi Simulator WEU-6

The single-user simulator supports 802.11a/b/g/n/ac/ax and other standards and could simulate AP/Station. It also supports all MAC layer and physical layer parameter configuration.

▍Multi-user WiFi Simulator MEU-16

The multi-user simulator could support the simulation of up to 16 station users. Each user could freely configure parameters to simulate the access scenarios of different types of terminals. The built-in management module could uniformly manage control and configure all Station users, and realize the synchronization of test data and test time from hardware. The management module is preset with a wealthy of test scripts. In conjunction with the multi-channel attenuator, the multi-user test items of the TR-398 can be easily realized. The number of stations and operating modes can be freely configured according to user needs, upgradable to 32 stations.

▍Model-B Channel Emulator

Frequency Range: 400~7.5GHz

Model-B Channel Emulator built-in 4 independent channels. Each channel could simulate IEEE802.11 Model B channel model and freely switch InLoss and Model B models according to test needs. 90dB high-precision attenuator is equipped in the channel so the power of the test signal could be accurately controlled.

Mini-TP Test Accessories ②

■ Multi-channel Attenuator ATT-16

Frequency Range: 0.5~8GHz

The system could be configured with 4 channels, 12 channels, 16 channels and other different configurations. With single-user/multi-user WiFi simulator, the system could achieve accurate adjustment of test power. After calibration, the power accuracy can be controlled within ±0.1dB。

■ Sources of Interference Signals I-Generator

Frequency Range: 0.4~6GHz

It could realize the recording and playback of interference signals; user could freely adjust the power and frequency of interference signals. The interference source is built-in WiFi, BT, Zigbee, GSM, WCDMA, LTE, microwave oven, continuous wave, pulse signal and other different interference signals.

■ WiFi Test Antenna WiFi Snoop

■ Dipole Calibration Antenna

DP11(2.1~3.3GHz), DP13(4.6~6GHz), DP14(6GHz~7.5GHz)

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