SP8630 Integration Test System

Product Overview

Starpoint SP8630 is the world's first NB-IoT terminal conformance test solution, which fully supports all the terminal conformance test requirements specified in 3GPP TS36.521 and TS36.523, including **RF/RRM Conformance Test** and **Protocol Conformance Test**. It comprehensively leads global certification process (GCF TP No. 200).

Besides the conformance tests, SP8630 also supports **Power Consumption Test**, **Throughput Test**, and **telecom operators' Enterprise Standards Test**. All in one system!

SP8630 can be widely used during the terminal developing, testing, certificating, deploying and maintaining. The application scenarios include chipset/module R&D, regression test, type approval, network entrance test, operator purchasing test, product launch verification, product quality surveillance test, etc.

As SP8630 has more comprehensive functions and consists of much fewer hardware/software than conventional mobile phone test system, it is the most appropriate test solution for IoT terminals and the internet of things industry.

With the help of SP8630, tests will be implemented more quickly, accurately and effectively.

Core Competence

- ✓ **Focusing on Cellular IoT Test Requirements**

  (Including NB-IoT, eMTC and their technical evolutions)

- ✓ **Mature and Stable Hardware/Software Platform**

- ✓ **The World's Leading R&D/Verification Progress**

- ✓ **The Most Comprehensive Test Solution for Certification**

- ✓ **Efficient Testing**

- ✓ **High Cost-effective**

- ✓ **Test Easy, Test Happy**

Functions

✧ Protocol Conformance Test

Protocol conformance test is defined by 3GPP and specified in TS36.523-1. It is used to verify the communication layers' functions of DUT.

SP8630 supports all the 3GPP cellular IoT protocol conformance test items, including Idle Mode Operations test, MAC test, RLC test, PDCP test, RRC test, EMM-CIOT test, ESM-CIOT test, SMS test as listed below:

TC No.	Test Case Name
22.1.1	NB-IoT / Control Plane CIoT EPS optimisation for EPS services
22.1.2	NB-IoT / Control Plane and User Plane CIoT EPS optimisations
22.2.1	NB-IoT / PLMN selection of RPLMN, HPLMN/EHPLMN, UPLMN and OPLMN / Automatic mode
22.2.2	NB-IoT / PLMN selection of RPLMN, HPLMN/EHPLMN, UPLMN and OPLMN / Manual mode
22.2.3	NB-IoT / PLMN selection / Periodic reselection / MinimumPeriodicSearchTimer
22.2.4	NB-IoT / Cell selection / Qrxlevmin and Qqualmin / Serving cell becomes non-suitable (S<0 or barred or Srxlev > 0 and Squal < 0)
22.2.5	NB-IoT / Cell reselection / Qhyst, Qoffset, Treselection and Cell-specific reselection parameters
22.2.6	NB-IoT / Cell reselection using cell status and cell reservations / Access control class 0 to 9
22.2.7	NB-IoT / Cell reselection using cell status and cell reservations / Access control class 11 to 15
22.2.8	NB-IoT / Cell reselection in shared network environment
22.2.9	NB-IoT / Inter-frequency cell reselection
22.2.10	NB-IoT / Cell reselection / MFBI
22.3.1.1	NB-IoT / RACH Procedure/Preamble Selected by MAC/Temporary C-RNTI
22.3.1.2	NB-IoT / Correct Handling of DL MAC PDU/Assignment/HARQ process / TimeAlignmentTimer expiry
22.3.1.3	NB-IoT / Correct Handling of UL MAC PDU/Assignment/HARQ process/Padding
22.3.1.4	NB-IoT / Correct handling of MAC control information / Buffer status
22.3.1.5	NB-IoT / DRX operation / Long cycle configured / Parameterrxs configured by RRC/ DRX command MAC control element reception / eDRX
22.3.1.6	NB-IoT / DL-SCH /UL-SCH transport block size selection / DCI format N1/ N0
22.3.2.1	NB-IoT / AM RLC / Correct use of sequence numbering / Concatenation and reassembly /Polling for status
22.3.2.2	NB-IoT / AM RLC / Receiver status triggers
22.3.2.3	NB-IoT / AM RLC / In sequence delivery of upper layers PDUs/ Different numbers of length indicators
22.3.2.4	NB-IoT / AM RLC / Re-segmentation RLC PDU / SO, FI, LSF/ Re-transmission of RLC PDU
22.3.2.5	NB-IoT / AM RLC / Segmentation and Reassembly / AMD PDU reassembly Re-ordering,from AMD PDU segments / FI, SO and LSF
22.3.3.1	NB-IoT / Maintenance of PDCP sequence numbers / User plane / RLC AM
22.3.3.2	NB-IoT / Integrity protection / Ciphering and deciphering / Correct functionality of EPS AS and UP encryption algorithms / SNOW3G

22.3.3.3	NB-IoT / Integrity protection / Ciphering and deciphering / Correct functionality of EPS AS and UP encryption algorithms / AES
22.3.3.4	NB-IoT / Integrity protection / Ciphering and deciphering / Correct functionality of EPS AS and UP encryption algorithms / ZUC
22.3.3.5	NB-IoT / PDCP re-establishment / stored UE AS context is used and drb-ContinueROHC is configured
22.3.3.6	NB-IoT / PDCP discard
22.4.1	NB-IoT / Paging for notification of BCCH modification in idle mode / eDRX cycle longer than the modification period
22.4.2	NB-IoT / Paging for connection in idle mode / Multiple paging records
22.4.4	NB-IoT / Paging with systemInfoModification / AB active for AC 0 to 9
22.4.5	NB-IoT / Paging with systemInfoModification / AB active for AC 11 to 15
22.4.6	NB-IoT / Paging for notification of BCCH modification in idle mode / Direct indication for SI update
22.4.7	NB-IoT / RRC connection establishment / Reject with extendedWait/ RRC connection release / Success / With extendedWait
22.4.8	NB-IoT / RRC connection establishment / Access Barring for UE with AC 0 to 9 / MO exception data
22.4.9	NB-IoT / RRC connection establishment / Access Barring for UE with AC 11 to 15 / MO exception data
22.4.11	NB-IoT / RRC connection release / Redirection to another NB-IoT frequency
22.4.12	NB-IoT / RRC connection release / Redirection to another NB-IoT band
22.4.13	NB-IoT / UE capability transfer / Success
22.4.14	NB-IoT / RRC Connection Establishment / Multi-Carrier
22.4.15	NB-IoT / RRC connection suspend-resume / Success / different cell
22.4.16	NB-IoT / RRC connection suspend-resume / Failure / Network reject/ T300 timeout
22.4.17	NB-IoT / RRC connection reconfiguration / Radio bearer establishment / Success / Dedicated bearer / ROHC configured under UP
22.4.18	NB-IoT / RRC connection reconfiguration / SRB reconfiguration / Success
22.4.19	NB-IoT / Radio link failure / T301 expiry/ T311 expiry
22.4.20	NB-IoT / Radio link failure / RRC connection re-establishment reject
22.4.21	NB-IoT / Radio link failure / Radio link recovery while T310 is running
22.4.22	NB-IoT / Radio link failure / T311 expiry / Dedicated RLF timer
22.4.23	NB-IoT / Radio link failure / T310 expiry / Dedicated RLF timer (CP CIoT)
22.5.1	NB-IoT / UE in NB-S1 mode supporting CIoT Optimizations and Network not supporting User Plane Optimization / Authentication not accepted by the network, GUTI used, authentication reject and re-authentication / Authentication not accepted by the UE, SQN failure / Network failing the authentication check / Authentication not accepted by the UE, non-EPS authentication unacceptable
22.5.2	NB-IoT / UE in NB-S1 mode supporting CIoT Optimizations and Network not supporting User Plane Optimization / NAS security mode command with null ciphering algorithm accepted by the UE / NAS security mode command with not matching replayed security capabilities not accepted by the UE / NAS security mode command with EIA0 not accepted by the UE
22.5.3	NB-IoT / Identification procedure / IMEI / IMEISV requested / NW initiated detach Re-attach required / UE initiated detach Abnormal case Change of cell into a new tracking area / UE initiated detach Abnormal case Detach and EMM common procedure collision

22.6.4	NB-IoT / UE requested bearer resource modification error handling (Resource modification not accepted by the network / Cause #36 "regular deactivation" / BEARER RESOURCE MODIFICATION REJECT message including cause #43 "unknown EPS bearer context" / Collision of a UE requested bearer resource modification procedure and EPS bearer context deactivation procedure / Expiry of timer T3481
22.6.5	NB-IoT / UE requested PDN connectivity procedure not accepted / UE requested PDN connectivity accepted　Dual priority T3396 override UE requested PDN connectivity accepted / Dual priority / T3346 override

✧ RF Conformance Test

RF conformance test is defined by 3GPP and specified in TS36.521-1. It is used to verify the RF part and physical layer algorithms of DUT.

SP8630 supports all the 3GPP cellular IoT RF conformance test items, including Transmitting Characteristics test, Receiving Characteristics test and Demodulation Performance test as listed below:

TC No.	Test Case Name
6.2.2F	UE Maximum Output Power for UE category NB1
6.2.3F	Maximum Power Reduction (MPR) for UE category NB1
6.2.5F	Configured UE Transmitted Output Power for UE category NB1
6.3.2F	Minimum Output Power for UE category NB1
6.3.3F	Transmit OFF power for UE category NB1
6.3.4F.1	General ON/OFF time mask for UE category NB1
6.3.4F.2	NPRACH time mask for UE category NB1
6.3.5F.1	Power Control Absolute power tolerance for UE category NB1
6.3.5F.2	Power Control Relative power tolerance for UE category NB1
6.3.5F.3	Aggregate power control tolerance for category NB1
6.5.1F	Frequency Error for UE category NB1
6.5.2.1F.1	Error Vector Magnitude (EVM) for UE category NB1
6.5.2.2F	Carrier Leakage for UE category NB1
6.5.2.3F	In-band emissions for non allocated RB for UE category NB1
6.6.1F	Occupied Bandwidth for UE category NB1
6.6.2.1F	Spectrum Emission Mask for UE category NB1
6.6.2.3F	Adjacent Channel Leakage power Ratio for UE category NB1
6.6.3F.1	Transmitter Spurious emissions for UE category NB1
6.6.3F.2	Spurious emission band UE co-existence for UE category NB1
6.7F	Transmit intermodulation for UE category NB1
7.3F.1	Reference sensitivity level without repetitions for UE category NB1
7.3F.2	Reference sensitivity level with repetitions for UE category NB1
7.4F	Maximum input level for UE category NB1
7.5F	Adjacent Channel Selectivity (ACS) for UE category NB1

7.6.1F	In-band blocking for UE category NB1
7.6.2F	Out-of-band blocking for UE category NB1
7.7F	Spurious response for UE category NB1
7.8.1F	Wide band Intermodulation for UE category NB1
8.12.1.1.1	Demodulation of NPDSCH (Cell-Specific Reference Symbols) in In-band mode for Category NB1
8.12.1.1.2	Demodulation of NPDSCH (Cell-Specific Reference Symbols) in Standalone/ Guard-band mode for Category NB1
8.12.2.1.1	Demodulation of NPDCCH in standalone / Guard band mode Single antenna performance for Category NB1
8.12.2.1.2	Demodulation of NPDCCH in In-band mode Transmit Diversity performance for Category NB1

✧ **RRM Conformance Test**

RRM conformance test is defined by 3GPP and specified in TS36.521-3. It is used to verify the radio resource management performance of DUT.

SP8630 supports all the 3GPP cellular IoT RRM conformance test items, including RRC_IDLE State Mobility test, RRC_CONNECTED State Mobility test (only applicable to eMTC), RRC Connection Mobility Control test, Timing and Signalling Characteristics test, UE Measurements Procedures test (only applicable to eMTC) and Measurement Performance Requirements test (only applicable to eMTC) as listed below:

TC No.	Test Case Name
4.2.18	HD-FDD Cell Re-selection Intra frequency case for Category NB1 UE In-Band mode under Normal Coverage
6.1.15	HD-FDD Intra-frequency RRC Re-establishment for category NB1 UE in In-Band mode under normal coverage
6.1.16	HD-FDD Inter-frequency RRC Re-establishment for category NB1 UE in In-Band mode under Enhanced Coverage
7.1.17	HD-FDD Transmit Timing Accuracy Test for Category NB1 UE In-Band mode under Normal Coverage
7.1.18	HD-FDD Transmit Timing Accuracy Test for Category NB1 UE In-band mode under Enhanced Coverage
7.2.9	HD-FDD UE Timing Advance Adjustment Accuracy Test for Category NB1 UE in Standalone Mode under Enhance Coverage
7.3.60	HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 In-band mode in normal coverage
7.3.61	HD-FDD Radio Link Monitoring Test for Out-of-sync in DRX for UE category NB1 In-band mode in Enhanced Coverage
7.3.62	HD-FDD Radio Link Monitoring Test for In-sync with DRX for UE Category NB1 In-Band mode in Enhanced Coverage
7.3.63	HD-FDD Radio Link Monitoring Test for In-sync with DRX for UE Category NB1 In-Band mode in Normal Coverage
7.3.64	HD-FDD Radio Link Monitoring Test for In-sync without DRX for UE Category NB1 In-Band mode in Normal Coverage
7.3.65	HD-FDD Radio Link Monitoring Test for In-sync without DRX for UE Category NB1 In-Band mode in Enhanced Coverage

✧ **Power Consumption Test**

Low power consumption is very important characteristics for LPWAN especially NB-IoT terminals. The basic performance requirements are mentioned in 3GPP TR45.820.

In response to the testing challenges, SP8630 pre-defines tens of scenarios to simulate each key behaviors between network and NB-IoT/eMTC terminal, such as PSM, eDRX, TAU, downlink/uplink data transfer under different coverage levels. And it supports small current measurement with accuracy up to 100 fA. Using SP8630, power consumption test for CIoT terminals can be implemented completely.

✧ **Throughput Test**

SP8630 can provide throughput test scenarios which fulfill the major telecom operators' requirements. The scenarios cover UDP and TCP protocol, and test the terminal's UL/DL throughput under a variety of configurations and environments including CP/UP mode, single-tone/multi-tone, interference, etc.

System Configuration

[Major Hardware]

No.	Hardware Components	Test Requirements				
		Protocol Conformance	RF Conformance	RRM Conformance	Power Consumption	Throughput
1	System Server *(Management computer of the system on which UI and test case software implemented)*	●	●	●	●	●
2	SP8315 Wireless Test Set (1st) *(Used to simulate 1~2 active cells)*	●	●	●	●	●
3	SP8315 Wireless Test Set (2nd) *(Used to simulate more active cells during protocol conformance testing, or to generate vector interfer during RF conformance testing, or to simulate LTE inband cells during RRM conformance testing)*	●	●	●		
4	VSP6010 *(Spectrum Analyzer)*		●			
5	AV1464A *(Signal Generator)*		●			
6	RFS200 RF Switching Box		●			
7	Keithley2601B Power Supply *(Used to power terminal under test, or to meter current/power during power consumption testing)*	○	○	○	●	○

[Software]

No.	Software Components	Test Requirements				
		Protocol Conformance	RF Conformance	RRM Conformance	Power Consumption	Throughput
1	Operation Management Software *(User interface software of integration test system, used for managing all system equipment, creating and running test plans, checking runtime log, creating test report, executing system calibration, etc.)*	●	●	●	●	●
2	Protocol Conformance Test Case Software	●				
3	RF Conformance Test Case Software		●			
4	RRM Conformance Test Case Software			●		
5	Terminal Power Consumption Test Case Software				●	
6	Terminal Throughput Test Case Software					●
7	Channel Emulator Software *(Used to provide channel fading environment for downlink signals of SP8315 Wireless Test Set including multi-path and doppler, etc.)*		●	●		●

Specifications

Weight	System Server: 9kg SP8315: 20.5kg VSP6010: 21kg AV1464A: 19.5kg RFS200: 14.5kg Keithley2601B: 5.5kg **Total (including 37U rack and): < 250kg**

Dimensions	System Server:
	    43cm (W) ×9cm (H) ×38cm (D)
	SP8315:
	    42.5cm (W) ×21.5cm (H) ×52cm (D)
	Rack (excluding mounting arm):
	    60cm (W) ×185cm (H) ×80cm (D)

Voltage and Frequency	100~240V, 50~60Hz
Rated Power	System Server: 300W SP8315: 300W VSP6010: 300W AV1464A: 300W RFS200: 100W Keithley2601B: 240W **Total: <2500W**
Operating Temperature	+10 ℃ ~ +35 ℃
Operating Humidity	20% ~ 80% (non-condensing)
RF Connector	N-type female Impedance: 50Ω nominal
GUI	Windows 7