



LTE-Advanced RF Conformance Test System ME7873LA

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1. Summary of Conformance Test

What is the Conformance Test?

Conformance Test: CT

The CT is a 3GPP-defined test case consisting of a set of fundamental tests. For RF testing, test specifications are defined TS34.121 (W-CDMA) or TS36.521(LTE). Passing these tests certifies that the DUT is 3GPP compliant.

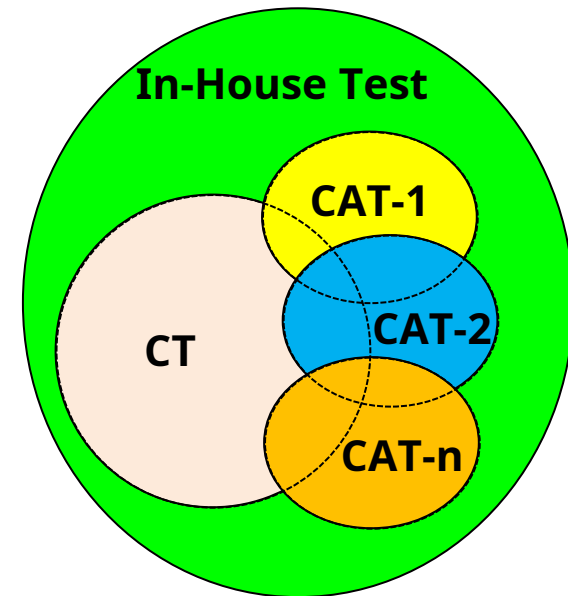
<Reference>

Carrier Acceptance Test: CAT

The CAT is a CT with actual carriers (base stations). Because the 3GPP standard has a nearly infinite permutation of parameters, connectivity with actual base stations must be verified. The CAT is formulated for each carrier (base station) based on service details offered by carriers and base station vendors.

In-House Test:

This in-house test is performed by UE vendors for quality assurance of their products. UE vendors create their own unique tests based on the design functions and data.



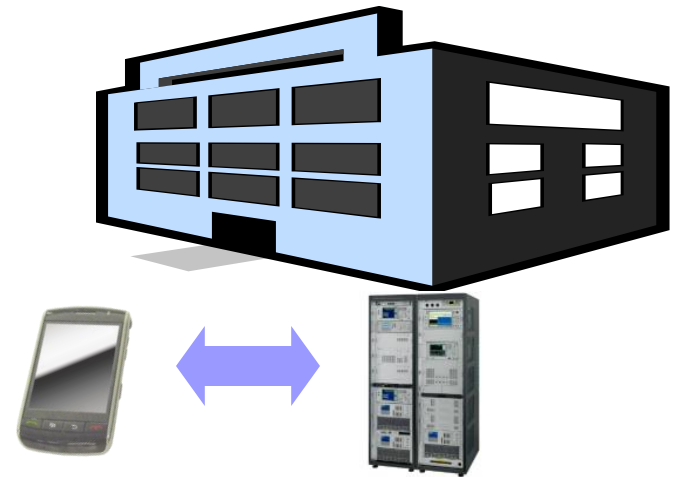
How Does the CT Fit Overall Product Verification?

- Network problems caused by non-compliant terminals not permitted
- Standard compliance important
- Conformance Test required for design inspection



Testing Real Network

- Proves terminal works with current
 - ◆ Network equipment
 - ◆ Configurations
 - ◆ Services



Conformance Testing

- Ensures terminal still works when:
 - ◆ Network equipment upgraded
 - ◆ New services added
 - ◆ Network architecture evolves

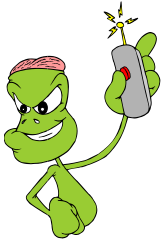
Who Should Do the Conformance Testing?



- Mobile terminal manufacturers
 - ◆ Proving to customers (network operators) that mobile terminals standard compliant



- Chipset and software component manufacturers supplying components or reference designs to mobile phone integrators
 - ◆ Proving that chipset designs standard compliant



- Specialist test houses
 - ◆ Offering conformance test and validation to manufacturers



- Network operators
 - ◆ Performing acceptance testing and QA

Race to Introduce LTE Service

3GPP Specifications Still Evolving

How to Test Conformance?

Which regulation version should we comply with?

What test range required for “Conformance?”

Who approves?

Where is CT done?

Possible in own facilities?



Define International Rule and Procedures!

GCF (Global Certification Forum)

PTCRB(PCS Type Certification Review Board)

GCF(Global Certification Forum)

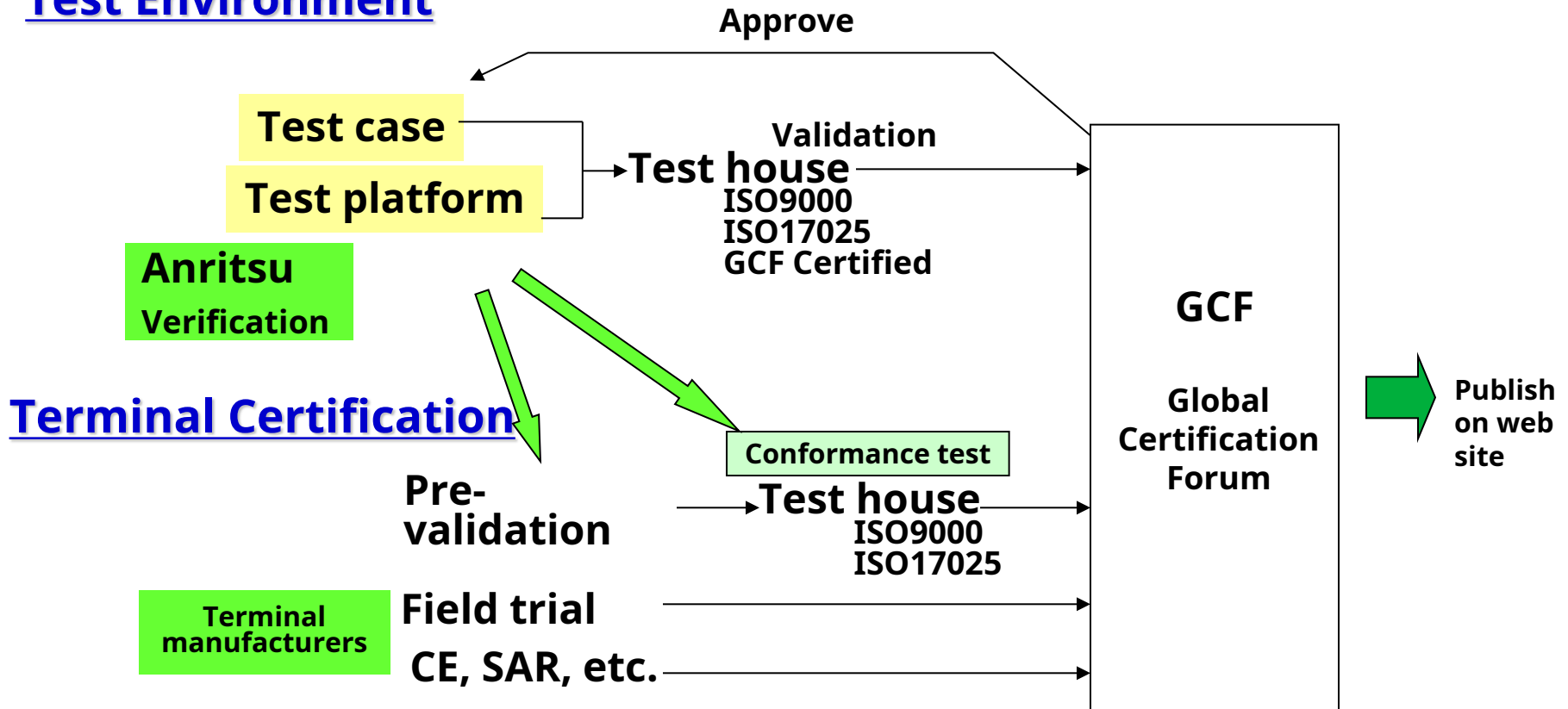
PTCRB(PCS Type Certification Review Board)

- The GCF and PTCRB were formed by network operators and UE manufacturers to provide consistent standards for product conformance testing.
- It is a forum where various parties, test houses, test equipment companies, operators, and manufacturers can make declarations, present evidence, and receive approval.
- The GCF itself does not perform any validation or conformance testing.
- The GCF also approves test equipment (**Conformance Test System**) that is 3GPP compliant.



TP/TC Approval and Mobile Terminal Certification

Test Environment



2. Anritsu **Conformance Test System**

Anritsu LTE Conformance Test Products

<RF/RRM Conformance Tests>

ME7873LA

LTE-Advanced RF Conformance
Test System



TS 36.521-1/-3
TS34.121-1

<Protocol Conformance Tests>

ME7834LA

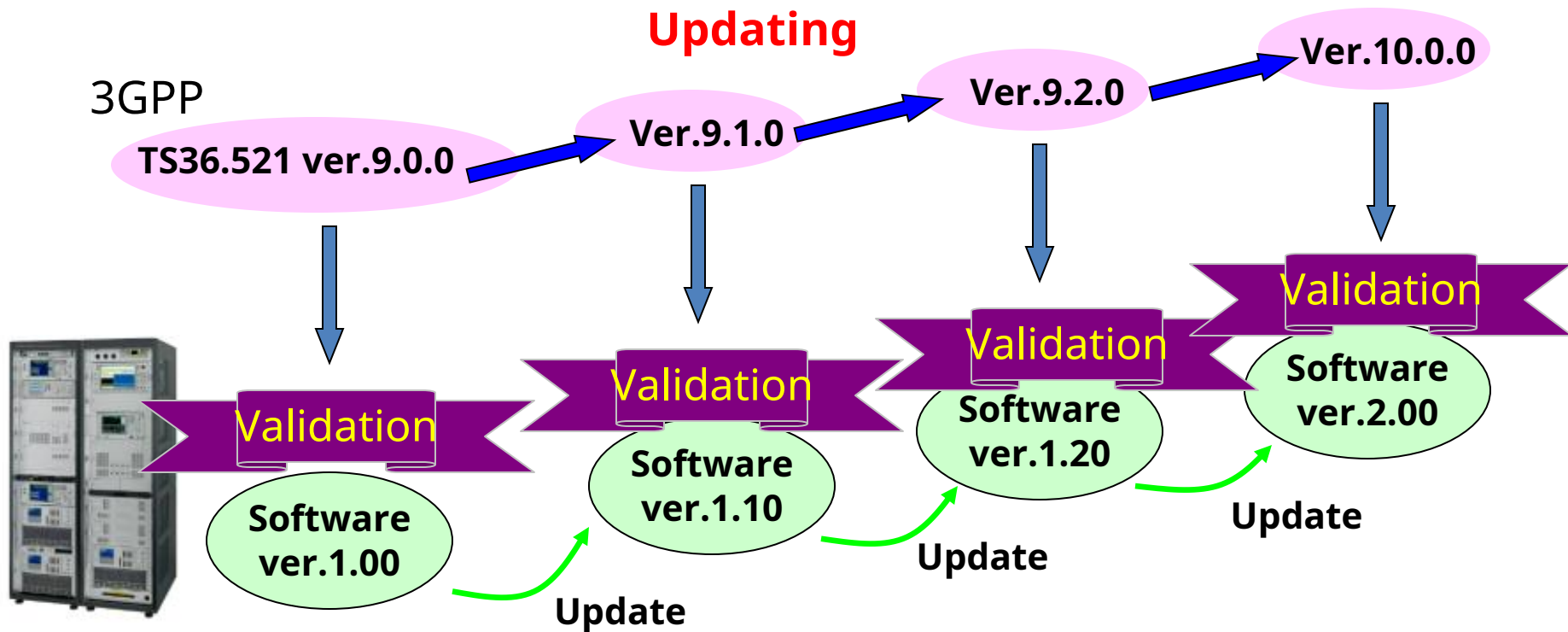
LTE Mobile Device Test Platform



TS 36.523-1
TS 34.123
TS 34.229
TR 37.901

Updating 3GPP Compliance

3GPP specification is updated every 3 months and the ME7873LA Test System follows the update.



Contribution to the GCF

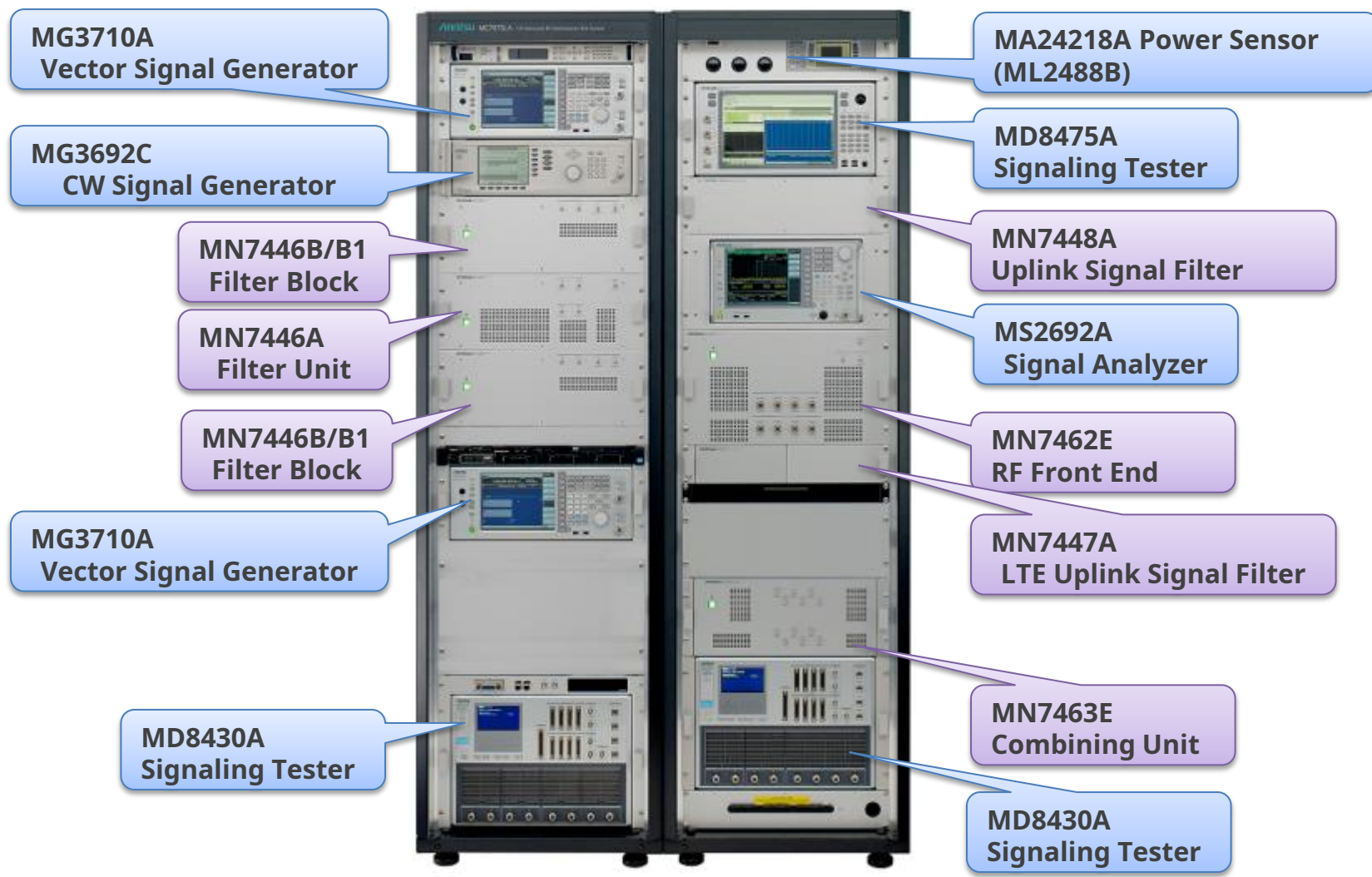
- **GCF/PTCRB holds meetings every 3 months (usually in January, April, July, and October) where members discuss applicable standards for actual service management, their priority, and approval of Conformance Test Systems.**
- **Anritsu is currently working on validation of the ME7873LA/ME7834LA in collaboration with test houses every 3 months when GCF/PTCRB meetings are held. After validation, the test houses apply for GCF/PTCRB approval of validated test cases.**
- **The ME7873LA is the leading RF test system, with most GCF/PTCRB Approved Test Cases in leading-edge items like LAA, FDD/Joint 4CA/5CA (As of June. 2018).
The future policy is to acquire validation quickly.**

ME7873LA LTE-Advanced RF Conformance Test System

- **Automated system for running 3GPP TS36.521 and TS34.121-1 compliant conformance tests.**
- **GCF/PTCRB-approved test system for measuring items defined by E-UTRA RF/RRM Rel-8 to Rel-13, and W-CDMA Rel-99 to Rel-8 test cases.**
- **Band options support FDD Band 1-14, 17-21, 24-32, 66, 71 / TDD Band 33-42, 48 and LAA Band 46.**

ME7873LA

LTE-Advanced RF Conformance Test System



Features

- **World First: 3DL CA PTCRB Approval (at September 2015)**
- **World First: 5DL CA PTCRB Approval (at June 2018)**
- **Full 3GPP compliance**
- **Support TS36.521 LTE and TS34.121 W-CDMA**
- **Reduce Down Time Using the Tunable Filter**
- **RED(R&TTE)*¹ Test**
- **LTE to CDMA2000/TD-SCDMA InterRAT Test**
- **Support Cellular IoT**
- **Operator Acceptance Test**
- **Global Support**
- **Upgradeable from ME7873F/L**

***1: Compliant with the European ETSI-defined RED(R&TTE) RF TRx test items.**

Scalable Test System

Conformance Test Function

LTE Conformance Test

TS36.521-1 LTE TRX/Performance
TS36.521-3 LTE RRM
TS34.121-1 LTE RRM(LTE/W-CDMA Inter-RAT)
TS34.122 LTE RRM(LTE/TD-SCDMA Inter-RAT)

FDD / TDD
FDD + TDD

8x2MIMO, 4x4MIMO
TM9

Inter-RAT
(W-CDMA, GSM,
CDMA2000, TD-SCDMA)

LAA

CAT-M1, NB-IoT

Carrier Aggregation
(DL 2CA / 3CA / 4CA / 5CA , UL 2CA)

W-CDMA Conformance Test

TS34.121-1 TRX/Performance/RRM

Regulatory Test Function

RED(R&TTE) Test

ETSI EN 301 908-13

Operator Acceptance Test Function

Frequency Band

Selectable Band Option

Adapt Frequency range
450 – 6000MHz
using tunable filter.

Standard Function

Temperature Chamber
Control

DC Power Supply
Control



Upgrade from ME7873L

Customers using the ME7873L can optimize their investment by adding LTE-A functions to make the most of existing equipment.

ME7873L
LTE TRX/Perf/RRM



MS2692A



MG3710A



MD8430A



ML2488B



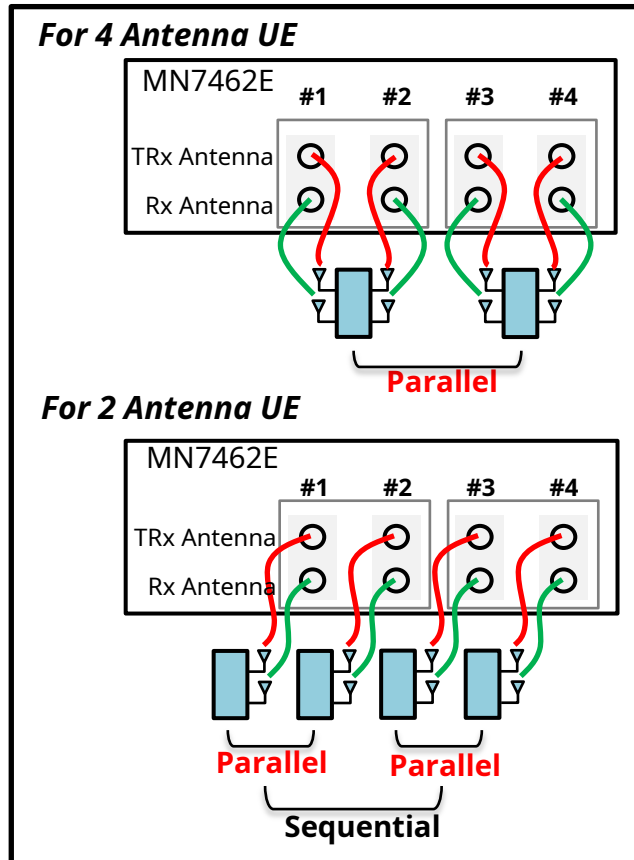
Upgrade

ME7873LA
LTE-A TRX/Perf/RRM



Parallel Test Function

Using Parallel test function, 2UEs are tested simultaneously. (*1, *2)
This function helps reduce the total test time.



- Independently control UE1 and UE2
- Control multiple DC power supply and temperature chamber
- Operate two UEs by one PC or two PCs
- Share Tx Tester, SG and interference unit
- Optimize test order to minimize test time

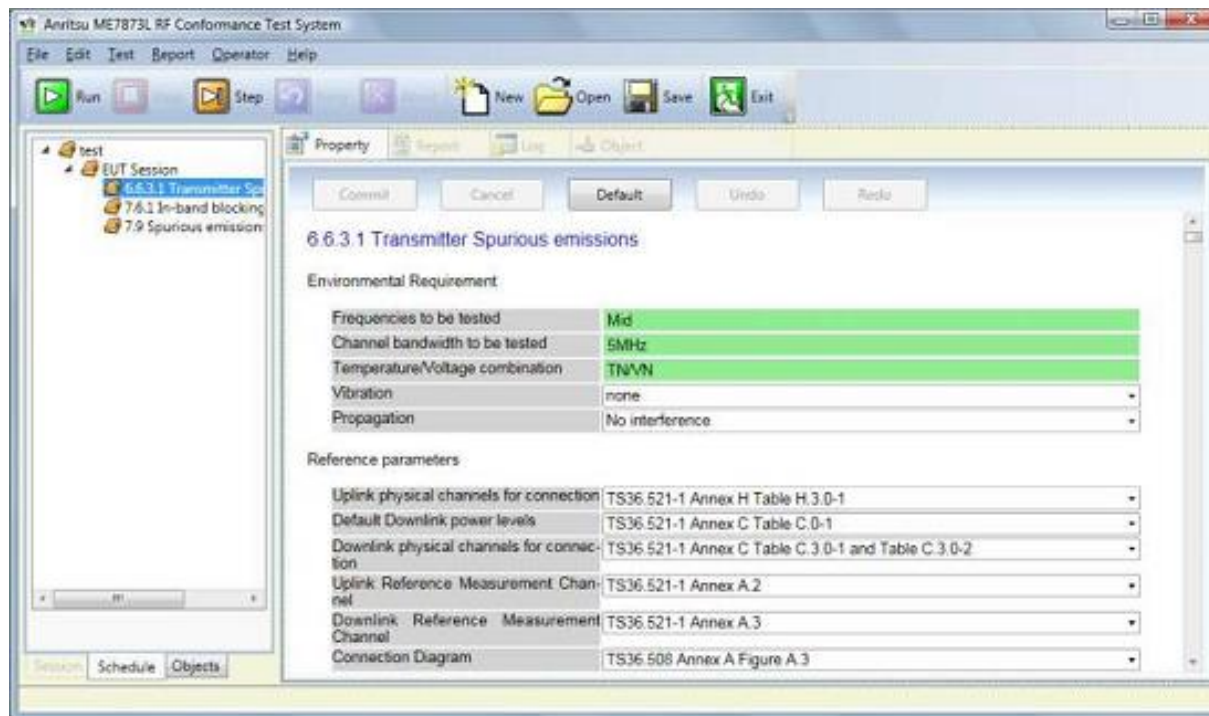
***1: Some equipment are needed for parallel test function.**

***2: Some test cases are not supported parallel test function.**

R&D Functions (1/8)

◆ Change parameters, such as level and frequency

Default parameters are set to 3GPP-standard values. Parameters, such as level, frequency, and RBs are changed easily by the control software. Non-default parameters are displayed in green.



R&D Functions (2/8)

◆ Real-time SS Log Trace

An SS log is displayed automatically when measurement starts. Real-time confirmation of message exchanges between the SS and terminal supports effective operation verification.

Normal Example

```
SS Sequence Display MX843090A
Clear All Scroll Lock

SRSConfigException.CyclicShift : 0
SchedReqException.Scheduling Request : SETUP
SchedReqException.SR_PUCCH_ResourceIndex : 41
SchedReqException.SR_ConfigIndex : 30
SchedReqException.DSR_TransMax : 4
EquivalentPLMN : Not Used
PreambleTimeout : 180000
RcvTimeout : 180000
Timeout : 1000

Wait 'PRACH Preamble' (event type1)
Received 'PRACH Preamble' (EVENT_RA_PREAMBLE_GROUP_A)
Send 'PRACH Response'
Received 'RRC Connection Request' (EVENT_UL_SCH_SETUP_REQ)
Send 'RRC Connection Setup'
Received 'UCI HARQ-ACK (EVENT_DL_ACK_SETUP_CNF)'
Received 'RRC Connection Setup Complete'
Send 'DL Information Transfer / IDENTITY REQUEST'
Received 'UL Information Transfer / IDENTITY RESPONSE'
IMSI=001010123456789
```

Abnormal Example

```
SS Sequence Display MX843090A
Clear All Scroll Lock

UECapRequest : REQUEST
ASReleaseVer : Release 8
UECategory : 0
NAS_Integrity : ACTIVE
IntegrityAlgorithm : AUTO
Parameter_K : 00112233445566778899aabbccddeeff
UsimAlgorithm : XOR
Filter Coefficient : FC4
ReportModeAperiodic : NOT_SPECIFIED
CQIReportException.CQI_ReportPeriodic : NOT_PRESENT
MaxHARQTx_UL : 1
ReportingBSRTimer : 320
DRXConfig : RELEASE
TimeAlignmentTimer : infinity
SRSConfigException.SRS_Dedicated : NOT_PRESENT
SchedReqException.Scheduling Request : NOT_PRESENT
EquivalentPLMN : Not Used
PreambleTimeout : 60000
RcvTimeout : 60000
Timeout : 1000

Wait 'PRACH Preamble' (event type1)
Not receiving 'PRACH Preamble' (EVENT_RA_PREAMBLE_GROUP_A)
Error End
```

R&D Functions (3/8)

◆ SS Log display function

An SS log is created automatically for each measurement item when measurement finishes. The logs can be checked using viewer software bundled with the ME7873LA to troubleshoot test problems between the UE and test platform.

The screenshot displays the MD8430/MD8480 Signalling Tester Trace Log Viewer software. The main window shows a list of signaling events with columns for No., PHY MAC RLC PDCP TE RRC NAS, BTS, Primitive, Channel, Message, and Progress Time. The events range from 241 to 295. Event 287 is highlighted, showing 'LTE_PDCP_DATA_IND' and 'RRC CONNECTION SETUP COMPLETE'.

No.	PHY MAC RLC PDCP TE RRC NAS	BTS	Primitive	Channel	Message	Progress Time
241		LTE_1	LTE_CPHY_UL_CONFIG_REQ	LTE_UL_SCH	0	00:00:02.529
242		LTE_1	LTE_CMACH_CONFIG_REQ	LTE_UL_SCH	0	00:00:02.530
243		LTE_1	LTE_PHY_PDCCH_IND	LTE_UL_RACH	0	00:01:46.506
253		LTE_1	LTE_PHY_DATA_IND	LTE_UL_SCH	0	00:01:46.519
254		LTE_1	LTE_MAC_DATA_IND	LTE_UL_CCCH	0	00:01:46.519
257		LTE_1	LTE_RLC_DATA_IND	LTE_UL_CCCH	0	00:01:46.520
263		LTE_1	LTE_RLC_DATA_REQ	LTE_DL_CCCH	0	00:01:46.525
265		LTE_1	LTE_MAC_DATA_REQ	LTE_DL_CCCH	0	00:01:46.525
268		LTE_1	LTE_CPHY_UL_CONFIG_REQ	LTE_UL_SCH	0	00:01:46.534
269		LTE_1	LTE_CMACH_CONFIG_REQ	LTE_UL_SCH	0	00:01:46.535
274		LTE_1	LTE_PHY_PDCCH_IND	LTE_UL_RACH	0	00:01:46.546
282		LTE_1	LTE_PHY_DATA_IND	LTE_UL_SCH	0	00:01:46.559
283		LTE_1	LTE_MAC_DATA_IND	LTE_UL_DCCH	0	00:01:46.559
286		LTE_1	LTE_RLC_DATA_IND	LTE_UL_DCCH	0	00:01:46.560
287		LTE_1	LTE_PDCP_DATA_IND	LTE_UL_DCCH	0	00:01:46.560
292		LTE_1	LTE_PDCP_DATA_REQ	LTE_DL_DCCH	0	00:01:46.565
293		LTE_1	LTE_RLC_DATA_REQ	LTE_DL_DCCH	0	00:01:46.565
295		LTE_1	LTE_PHY_DATA_IND	LTE_UL_SCH	0	00:01:46.575

The detailed view of message 287 shows the following fields:

Field	Value	Type
UL-DCCH-Message		SEQUENCE
message	c1	CHOICE
c1	rrcConnectionSetupCom...	CHOICE
rrcConnectionSetupComplete		SEQUENCE
rrc-TransactionIdentifier	0	INTEGER
criticalExtensions	c1	CHOICE

The sequence display at the bottom shows the following data:

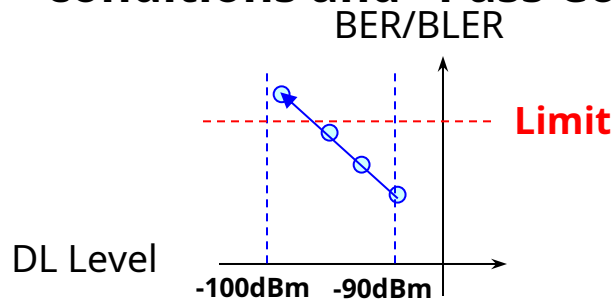
Set_RFConnector
RF Type: Sub
INDEPENDENT_4RF

R&D Functions (4/8)

◆ Search mode function

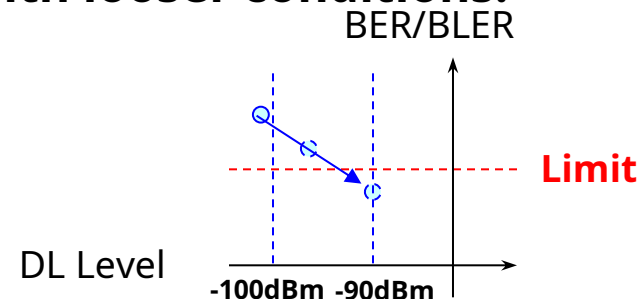
To develop reliable UE terminals with stable performance, the performance limits must be confirmed. The Search mode function performs tests while changing conditions to confirm UE performance.

The ME7873LA can measure in two ways: “Fail Condition” with tight conditions and “Pass Condition” with looser conditions.



Fail Condition

It changes to severer measurement conditions, such as downlink and interference signal levels, and SNR, etc., at fixed steps.



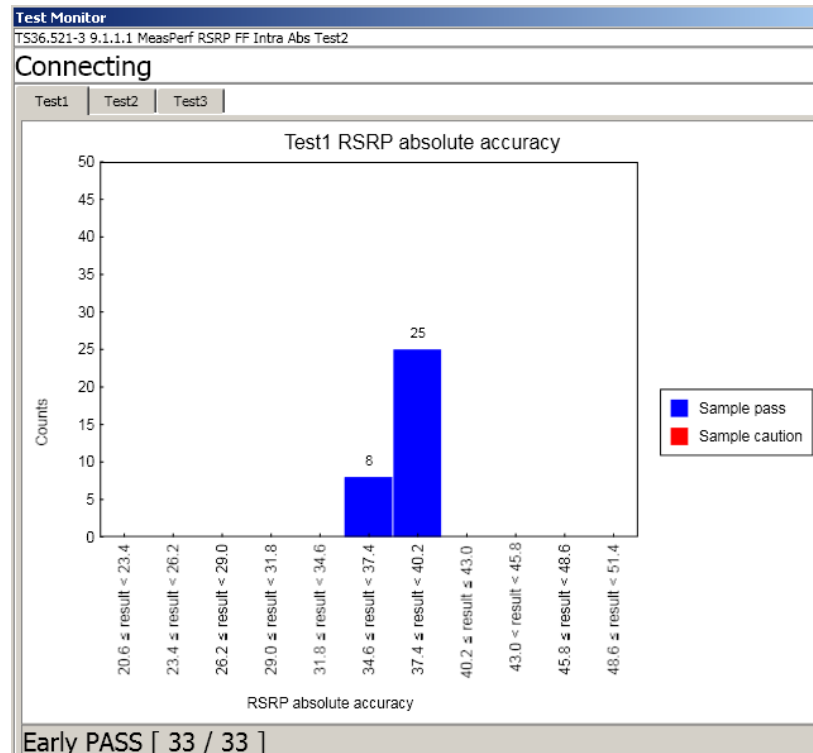
Pass Condition

It changes to easier measurement conditions, such as downlink and interference signal levels, and SNR, etc., at fixed steps.

R&D Functions (5/8)

◆ RRM Graphical Tool

Test items and results are displayed in real time as a histogram showing the UE operation trends at a glance.



R&D Functions (6/8)

◆ Auto re-measurement function for Fail test

When multiple items are tested by one sequence file, Fail items are re-measured automatically.

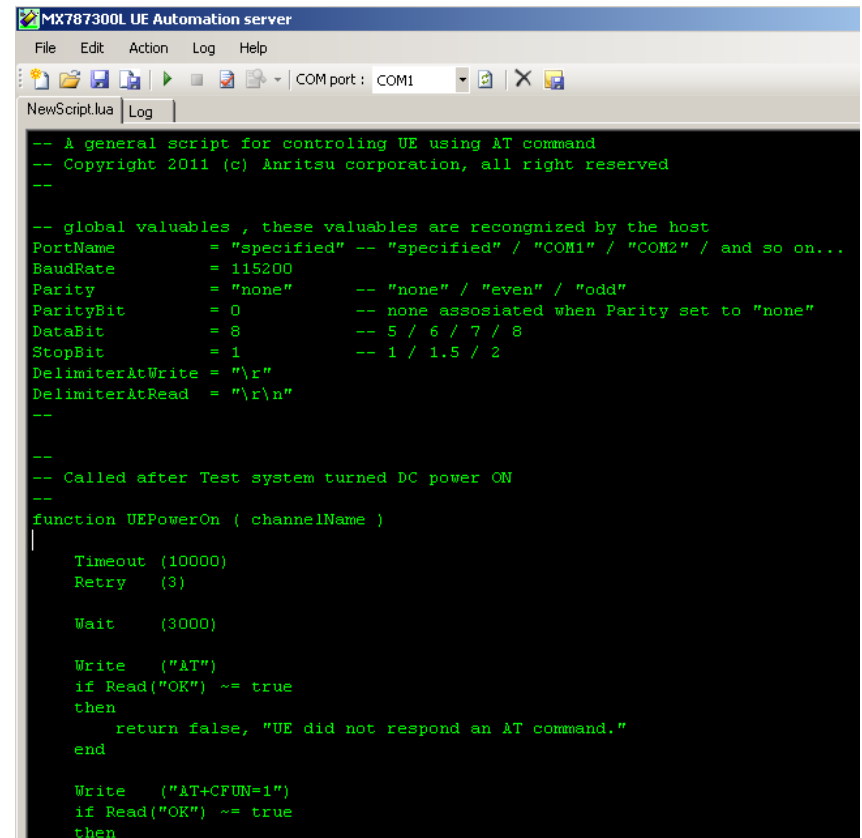
◆ Auto-measurement optimization to minimize measurement time

When multiple items are tested by one sequence file, the test system automatically measures in the order that minimizes measurement times.

R&D Functions (7/8)

◆ UE Automation Tool

The UE Automation tool is a standard function. Customers can use it to send AT commands, simplifying automated measurement of various terminal types.



```
-- MX787300L UE Automation server
File Edit Action Log Help
COM port : COM1
NewScript.lua Log

-- A general script for controlling UE using AT command
-- Copyright 2011 (c) Anritsu corporation, all right reserved
--

-- global valuables , these valuables are recongnized by the host
PortName      = "specified" -- "specified" / "COM1" / "COM2" / and so on...
BaudRate      = 115200
Parity        = "none"      -- "none" / "even" / "odd"
ParityBit     = 0           -- none associated when Parity set to "none"
DataBit       = 8           -- 5 / 6 / 7 / 8
StopBit       = 1           -- 1 / 1.5 / 2
DelimiterAtWrite = "\r"
DelimiterAtRead  = "\r\n"

--

-- Called after Test system turned DC power ON
--

function UEPowerOn ( channelName )
    Timeout (10000)
    Retry   (3)

    Wait    (3000)

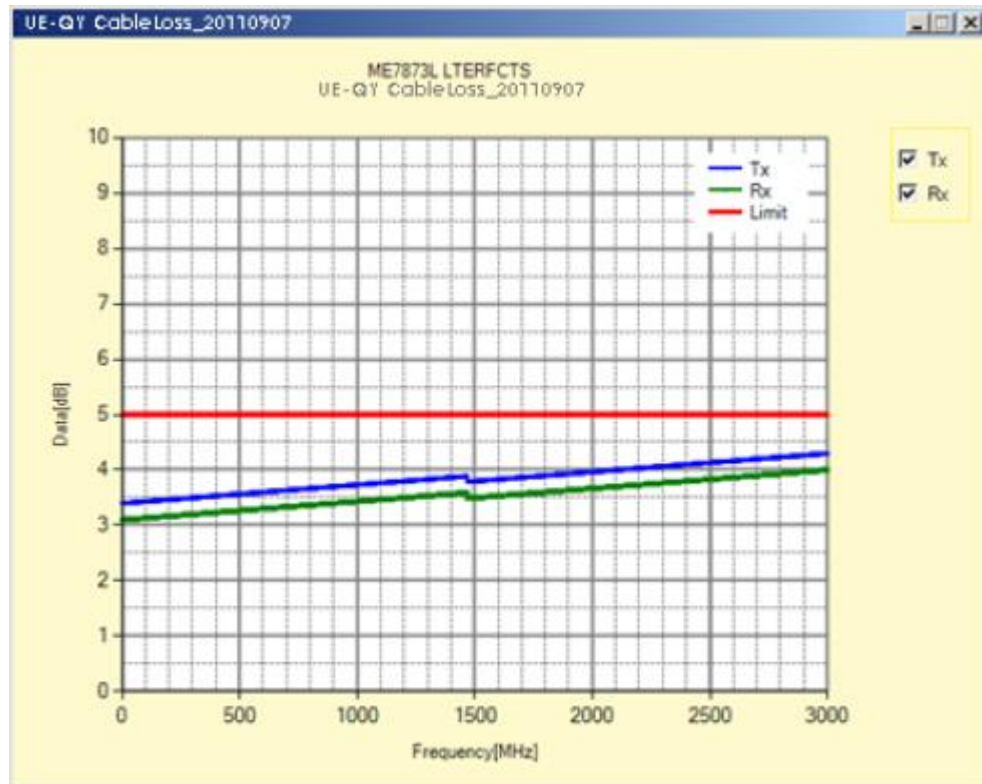
    Write   ("AT")
    if Read("OK") ~= true
    then
        return false, "UE did not respond an AT command."
    end

    Write   ("AT+CFUN=1")
    if Read("OK") ~= true
    then
```

R&D Functions (8/8)

◆ Cable Loss Measurement Tool

This tool measures the frequency characteristics of the RF cable connecting the ME7873LA and UE for use as cable loss data.



Test Result Format

Measurement results are saved to the server PC automatically in html, xml, or csv format.

6.2.2 UE Maximum Output Power

3GPP TS36.521-1 Version 8.4.0 (2009-12)

Test case verdict: PASS

Test case information

Test case	6.2.2 UE Maximum Output Power
Test case limitation	none
Test specification	3GPP TS36.521-1
Test specification version	Version 8.4.0 (2009-12)
Test case software	MX787311L-003 LTE TRX Test Case Confirmation Package1
Test case software version	Version 2.0.0 (2010-03)
Test case verdict	PASS
Test case session ID	5a5e99de-2192-4b9e-8e88-d04573e4a551

Test case result summary

Band	LTE FDD 1
Vibration	none
Parameter	Low(25,100),Mid(200,100),High(575,800)
Channel BW	5MHz,Highest(20MHz)
Voltage	Normal(3.80V)
Temperature	Normal(25.0°C)

Verdict		Voltage/Temperature Combination
Parameter	Channel BW	IN/VN
Low	5MHz	PASS
Low	Highest	PASS
Mid	5MHz	PASS
Mid	Highest	PASS
High	Highest	PASS
High	5MHz	PASS

Test case configurations

Test case detail

PASS	LTE FDD 1 (none,Low(25)/Nominal(5MHz)/VN(3.80V)/TN(25.0°C)
PASS	LTE FDD 1 (none,Low(100)/Highest(20MHz)/VN(3.80V)/TN(25.0°C)
PASS	LTE FDD 1 (none,Mid(200)/Nominal(5MHz)/VN(3.80V)/TN(25.0°C)
PASS	LTE FDD 1 (none,Mid(100)/Highest(20MHz)/VN(3.80V)/TN(25.0°C)
PASS	LTE FDD 1 (none,High(500)/Highest(20MHz)/VN(3.80V)/TN(25.0°C)
PASS	LTE FDD 1 (none,High(575)/Nominal(5MHz)/VN(3.80V)/TN(25.0°C)

HTML

```

<?xml version="1.0" encoding="UTF-8"?>
<TestLog>
  <UnderMeasureDataSet>
    <TestCaseTraceLog>
      <SequenceName>NewSequence.xml</SequenceName>
      <DateTime>2010-03-30T13:06:37+09:00</DateTime>
      <TestSeqNumber>1</TestSeqNumber>
      <Band>LTE FDD 1</Band>
      <TestSeqNumber>1</TestSeqNumber>
      <DetailHeadSeqNumber>1</DetailHeadSeqNumber>
      <DetailHeadPetrySeqNumber>0</DetailHeadPetrySeqNumber>
      <ProcessType>10</ProcessType>
      <LogSeqNumber>1</LogSeqNumber>
      <GenerationTime>30/03/2010 13:06:37</GenerationTime>
      <Duration />
      <SendData>Send</SendData>
      <ReceiveData />
      <MessageType>6.2.2 UE Maximum Output Power Testbase log (LTE FDD 1/TN(25.0°C)/Low(25)/Nominal(5MHz)/VN(3.80V))
    </TestCaseTraceLog>
  </UnderMeasureDataSet>
  <TestCaseTraceLog>
    <SequenceName>NewSequence.xml</SequenceName>
    <DateTime>2010-03-30T13:06:37+09:00</DateTime>
    <TestSeqNumber>1</TestSeqNumber>
    <Band>LTE FDD 1</Band>
    <TestSeqNumber>1</TestSeqNumber>
    <DetailHeadSeqNumber>1</DetailHeadSeqNumber>
    <DetailHeadPetrySeqNumber>0</DetailHeadPetrySeqNumber>
    <ProcessType>20</ProcessType>
    <LogSeqNumber>1</LogSeqNumber>
    <GenerationTime>30/03/2010 13:06:37</GenerationTime>
    <Duration>00:00:00</Duration>
    <SendData>TCI</SendData>
    <ReceiveData />
    <MessageType>Starting pre-procedure...</MessageType>
  </TestCaseTraceLog>

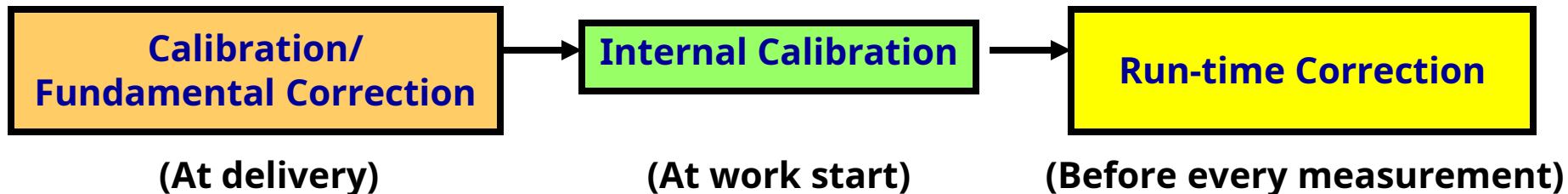
```

XML

Calibration and Correction

The measurement system uncertainty at each test procedure must comply with the 3GPP standards. The ME7873LA has the following three calibration and correction functions to assure compliance.

- Fundamental correction at delivery
- Internal calibration at work start
- Run-time correction before each measurement



3. Support Service Proposal

Support Service Outline

The support service includes hardware and software from operation to maintenance to assure stable ME7873LA operation.

Technical Support

- **Technical support**
 - Operational technical support and troubleshooting
- **Customer system status management**
 - Understand customer's system status on regular basis for quick response

Operability
UP

Software Update

- **3GPP follow up**
 - Update ME7873LA according to 3GPP standards
- **Validation**
 - Acquire validation for GCF-defined target 3GPP standard

Utility
UP

Calibration

- **Calibration service**
 - Calibration at customer's site
 - System calibration to assure reliable measurement accuracy
 - Correction, calibration and result report

Reliability
KEEP

Hardware Maintenance

- **Repair service**
 - Hardware repair
 - Backup loan unit during repair
- **Regular checks**
 - Regularly checks of electrical parts that may degrade with time

Maintainability
UP

4. Summary

Anritsu offers a future-proof conformance test system with wide scalability and high reliability

Reliability

- ❑ Full 3GPP compliance (GCF Approved Test System)
- ❑ Various correction/calibration functions to improve measurement reliability

Evolving

- ❑ Fast and flexible response to new technology
- ❑ Updates to evolving 3GPP standard

Scalability

- ❑ Measurement functions implemented selectively
- ❑ Operating bands implemented selectively
- ❑ Future-proof upgrades based on existing platform

Appendix1

System Installation

Customer Supplied Parts (1/2)

● DC Power Supply

The following models is required when controlling the power supply using the ME7873LA.

Model	Name	pcs	Manufacturer
N6700C	Mainframe	1	Keysight Technologies, Inc
N6732B ^{*1}	8 V, 6.25 A, 50 W DC Power Module	4 ^{*2}	
N6709C	Low-Profile MPS Mainframe Rack Mount Kit	1	

***1:** At rack mounting, the maximum current is 2 A. To draw more than 2 A of current, use a separate cable to supply DC to the terminal. However, since this will prevent rack mounting, decide on the installation location for the DC power supply in advance.

When using a power supply other than the N6732B, ask the power supply manufacture for details.

***2:** Four modules are required when testing up to four mobiles continuously.

If the number of power supply modules installed is less than 4, filler panel kit N6708A is required for filling empty slots.

In addition, the following equipment can also be controlled. However, since rack-mounting is not possible when using the 2306-PJ, decide on the installation location for the DC power supply in advance.

Model	Name	pcs	Manufacturer
2306-PJ	Dual-Channel Battery/Charger Simulator with 500mA Range	2 ^{*3}	Keithley Instruments

***3:** Two sets of the 2306-PJ are required when testing up to four mobiles continuously.

Customer Supplied Parts (2/2)

● Temperature Chamber

One of the following equipment is required to control the temperature chamber from the ME7873LA.

Model	Name	Manufacturer
SH-241 ^{*1}	Temperature & Humidity Chamber	ESPEC Corp.
SH-242 ^{*1}	Temperature & Humidity Chamber	
VT4002 ^{*2}	EMC Shielding with Temperature	Votsch Industrietechnik GmbH
105 ^{*1}	Benchtop Temperature Chamber	TestEquity
107 ^{*1}	Benchtop Temperature Chamber	
115 ^{*1}	Temperature Chamber	

***1: GPIB Cable (Double-Shield, 2m) is required to control this chamber automatically.**

***2: USB-RS232C Converter Cable (2m) is required to control this chamber automatically.**

Delivery (1/2)

- **Delivery Time**

3 months (changes with stock situation)

- **Onsite Installation**

Anritsu engineer visits delivery site to perform system setup calibration. Required time varies with system composition

- ◆ **System Setup (assembly, wiring, software installation)**
- ◆ **System Correction**
- ◆ **UE Functional Tests**
- ◆ **System Performance Tests**
- ◆ **Explanation at Delivery Acceptance**

Delivery (2/2)

● Support After Delivery

The following warranty is offered for free of charge after product delivery.

Duration

- ◆ **Newly Purchased: 1 year (from next month after installation)**
- ◆ **Upgrade: 3 month (from next month after installation)**

Support Contents

- ◆ **Hardware guarantee: Repair faults for all products in the system and re-calibration if needed**

Support service applies to new hardware and software. Guarantee for customer-provided parts follows the upgrade guarantee on condition of calibrating each instrument.

Hardware guarantee in upgrading is applied only when a hardware is added or modified.

Free-of-charge guarantee period extendable by charged service contract.

System Installation Environment

The system installation environment must meet the following specifications.

Items	Condition	Remarks
Size	2Racks configuration 1140 (W) x 1980 (H) x 797 (D) mm 3Racks configuration 1710 (W) x 1980 (H) x 797 (D) mm	Except prongs. A space of 300 mm is required in both the back and side faces for heat release. The required indoor height is 2200 mm or more. *1
Weight	830 kg or less	*2
Power Supply	100 to 120, or 200 to 240 Vac	From 4 to 6 outlets are required
Wattage	4400VA or less (Min conf.) 7700VA or less (Max conf.)	*3
Temperature Range	15° to 35°C*4 (Operating) 0° to 50°C (Storage)	Accuracy is guaranteed under the performance environment of the temperature +/- 10°C during correction.

***1:** Secure using hooks at rack top recommended. Basic calibration at acceptance inspection must meet this requirement.

***2:** The installation location must be able to safely bear the above floor loads plus 100 kg for basic calibration equipment at acceptance inspection.

***3:** Sufficient power (600 VA) for basic calibration at acceptance inspection as well as for ME7873LA must be supplied.

***4:** Basic calibration at acceptance inspection must meet this requirement. Use in air-conditioned room recommended for stable measurement.

