Formal Functional Test Designs:

Bridging The Gap Between Test Requirements and Test Specifications

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Section 333

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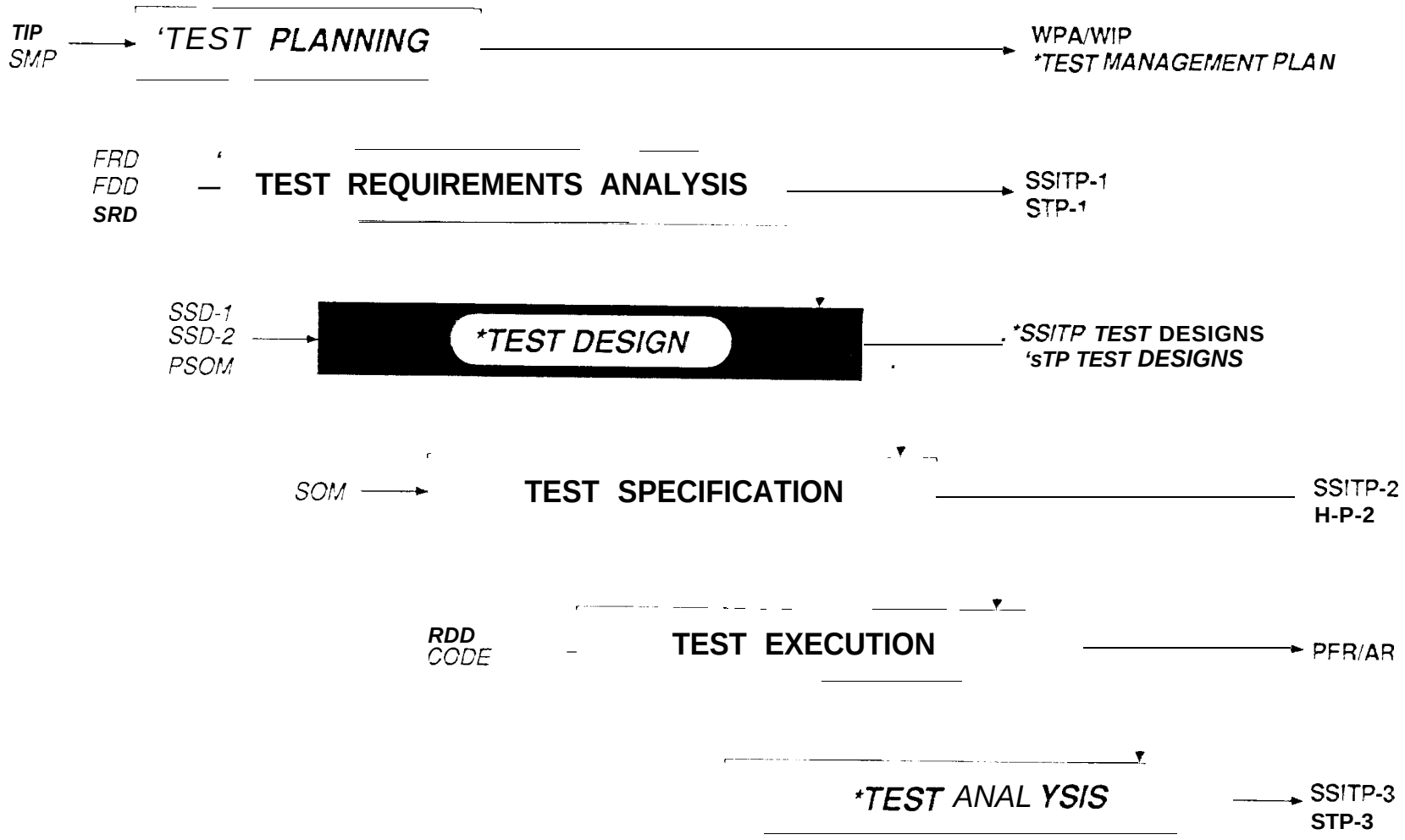
Formal Functional Test Designs
Bridging The Gap Between
Test Requirements and Test Design

AGENDA

- Testing Life Cycle
- Purpose of Test Design Phase
- Test Design Methods
- Category–Partition Method
  - Background
  - Functional Decomposition
  - Category Analysis
  - Partition Value Analysis
  - Partition Constraint Analysis
- Example Application
- Test Representation Language (TRL)
- TRL Summary
- Example Application With TRL
- Block V Receiver Sample Test Requirement
- Block V Receiver Sample Test Design

FORMAL FUNCTIONAL TEST DESIGNS

TESTING LIFECYCLE

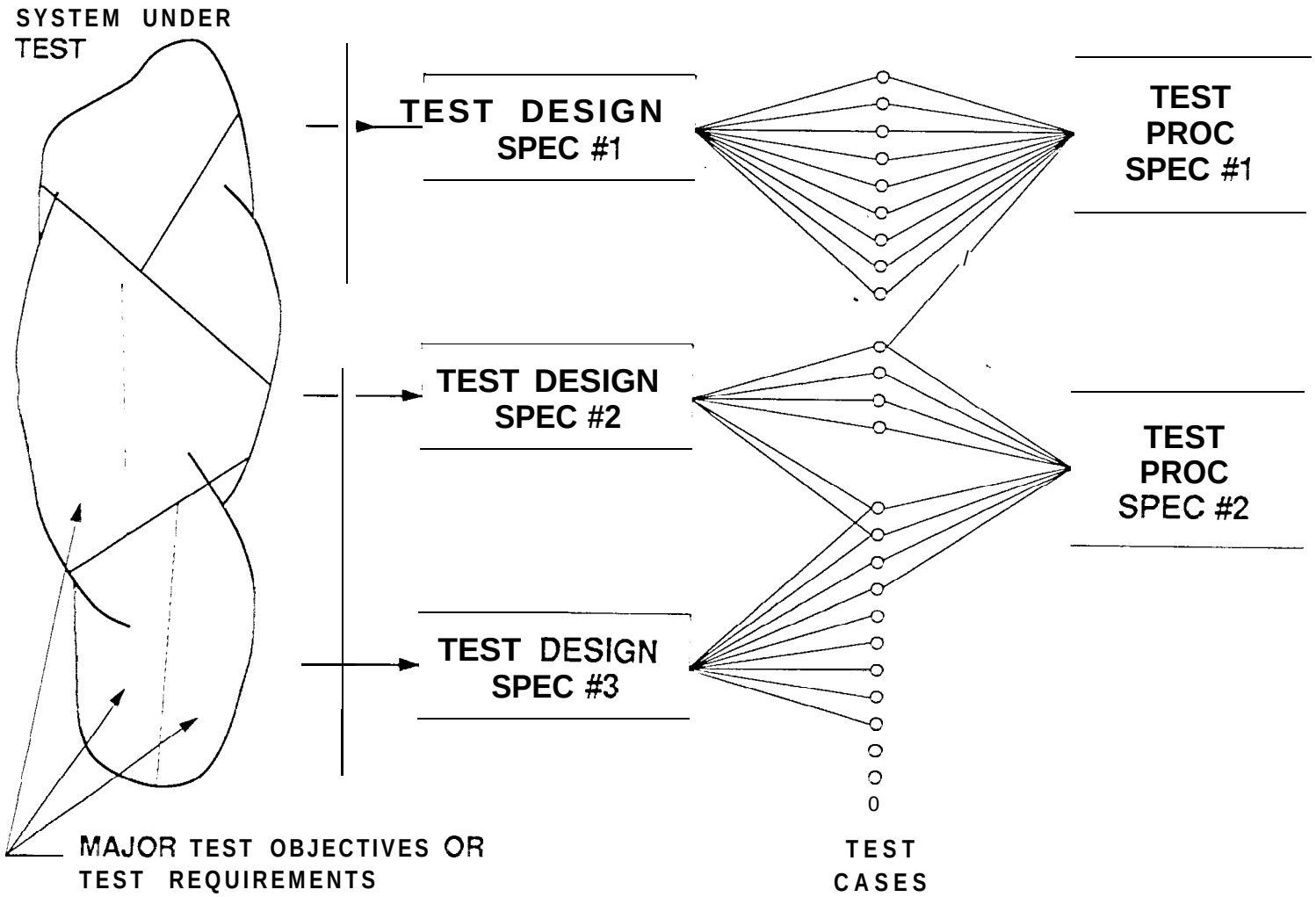


LEGEND: *D-4000 INPUT* D-4000 PHASE OR OUTPUT **PHASE OR OUTPUT NOT DEFINED IN D-4000*

FORMAL FUNCTIONAL TEST DESIGNS

PURPOSE OF TEST DESIGN PHASE

TO CONCEIVE AND SPECIFY THE ENVIRONMENTAL AND SYSTEM ATTRIBUTES THAT VERIFY REQUIREMENTS AND MEET OBJECTIVES



JMH 9/29/92

From: Software Quality Engineering, 1989

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Formal Functional Test Designs

Test Design Methods

Most Common Methods of Test Design Specification

- **Representative set of "normal" cases selected**
- **Generate all permutations and then eliminate invalid cases**
- **Generate test cases ad-hoc**

Category Partition With Test Representation Language (TRL)

- **Can generate all cases or just "normal" ones**
- **Allows rapid elimination of undesired test cases**
- **Confidence that all important test cases are generated**
- **Easy specification and review of test set designs**

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Category–Partition Method

- **Background**
  - Ostrand and Balcer, 1988
    Siemens Research Corporation
  - **Similar to other specification-based techniques**
  - **Unique because it provides a systematic approach and a method for formal test specifications .**
- **Method**
  - **Functional Decomposition**
  - **Category Analysis**
  - **Partition Value Analysis**
  - **Partition Constraint Analysis**

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Category–Partition Method (cont.)

Functional Decomposition

- Decompose specification into functional units to be tested independently
- Identify parameters that affect the behavior of the system for each functional unit
- Types of parameters
  - user input
  - input form external interface
  - environmental input
  - output to program/user
  - output to environment
  - change in program or environment state
  - sequence of events
- Examples
  - sort integer array in either ascending or descending order

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Category–Partition Method (cont.)

Category Analysis

- **Properties or characteristics of a parameter**

  Example: parameter ARRAY

  Properties: size, values, value arrangement

- **Identify major categories for each parameter**

- **Note how the functional unit behaves with respect to the category**

- **Often exposes ambiguous, contradictory, or missing descriptions of behavior**

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Category-Partition Method (cont.)

Partition Value Analysis

- Group of category values that have the same overall effect on functional behavior
- Partition each category into distinct choices
- Include all possible kinds of values
- Choose values to maximize error detection

  boundary values (valid and invalid)
  special cases (0, 1, -1,2, . ..)
  special interactions (program to program, program to environment)

- Partitions are used to build each test case

  Example
  Category: Array Size
  Partition Values:
  0
  1
  2 to Upper Bound minus 1
  Upper Bound
  greater than Upper Bound

Category–Partition Method (cont.)

Partition Constraint Analysis

Constraints refine the test representation to a set that is technically effective and economically feasible

- Types of constraints on values

pre-conditions:	a condition or state that must co-occur for this partition to be used in a test case
post-condition:	a condition or state that is set when this partition value is used in a test case
limit:	limit the use of this partition value to a certain number of valid test cases
error:	this partition value represents an error that should be used in a test case only once

- Don't care values may need to be added to some of the categories when all values are constrained

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Example Application of Method

Functional Specification

- Sort integer array in either ascending or descending order

Functional Decomposition

- Parameters: Array, indication of sort order, result

Category Analysis

- array size
  array values
  value arrangement
  sort order
  result

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Example Application of Method (cont.)

Partition Value Analysis

Category	Partitions
1. array size	1. 0, 1, 2 to Upper Bound minus 1, Upper Bound, greater than Upper Bound
2. array values	2. all zero, all same but non-zero, all negative, all positive, mixed ±0
3. value arrangement	3. minimum before max, maximum before min
4. sort order	4. unspecified, ascending, descending
5. result	5. error notification, array unchanged, array in ascending order, array in descending order

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Example Application of Method (cont.)

Partition Constraint Analysis

Partition Values	Constraints
1. array size	
• O, greater than upper bound	• error-occurs once
• 1, 2 to upper bound minus 1, upper bound	• no constraints
2. array values	
• all zero, all same but non-zero all negative, all positive, mixed ±0	• 2 c = size c upper bound
• don't care	• if error or size = 1
3. value arrangement	
. minimum before max, maximum before min	• 2 <= size< = upper bound, values are not all the same
• don't care	• if error or size = 1 or values are all the same
4. sort order	
• unspecified	• error--occurs once but only if no other errors occur
• ascending, descending	• 2 c = size <= upper bound, values are not all the same
• don't care	• if error or size = 1 values are all the same
5. result	
• error notification	• if error
• array unchanged	• size = 1 or values are all the same
. array n ascending order	• sort order = ascending
• array n descending order	• sort order = descending

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Test Representation Language (TRL)

- Formal test specification language to be used with the Category-Partition Method
- Concise and uniform representation of test set design
- Produces individual test cases from a short test representation
- TRL processor reads the formal specification and creates test case descriptions based on the categories, sample values, and constraints. Available for DOS, SPARC, or in Generic "C".
- Allows test representations to be easily created and subsequently analyzed
- Can be easily modified to adapt to changes in functional specification, or a desire for fewer or more test cases
- Can be used in test plans and procedures for systems, programs, and modules

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Formal Functional Test Designs
TRL Summary

Character or Keyword	Purpose and/or Usage
*	Indicates a comment line.
DESCRIPTION	Indicates the starting of a description block that will be included in test cases.
PARAMETERS	Indicates the beginning of parameter specifications.
NAME	Specifies the name of a parameter or category.
TYPE	Indicates the type of category.
SAMPLES	Indicates beginning of a samples block defining the partition values and constraints.
[	Beginning of sample value constraint field.
]	End of sample value constraint field.
IF	Field identifier indicating that pre-condition constraints are listed in the current field. Comma (,) is used for logical AND, exclamation (!) for logical NOT.

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Formal Functional Test Designs

TRL Summary (cont.)

Character or Keyword	Purpose and/or Usage
SET	Field identifier indicating that post-condition constraints are listed in the current field.
LIMIT m	Field identifier indicating that the number of test cases involving this partition value should be limited to m. If m is unspecified, the limit is one test case.
LABEL	Field identifier indicating that the specified label should be listed for this partition value.
ERROR n	Field identifier indicating that the sample value is an error exit. The error can be specified using the optional n.
MESSAGE n	Indicates that a message block follows corresponding to the errors in the partition values. The message number can be specified using the optional n.
Command Line Options	For performing "count only," writing results into separate files, and for including pre/post conditions in output.

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Example Application of Method With TRL

Functional Unit

- **Sort integer array in either ascending or descending order**

Step 1. Apply Category–Partition Method to obtain Categories and Partition values

Add in DESCRIPTION, PARAMETERS, NAME, TYPE, SAMPLES, and sample values for unconstrained representation.

Number of test cases = 1440

Step 2. Determine which Partition values are errors and their corresponding messages

Add in [ERROR] indication and MESSAGE lines

Number of test cases= 651

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Example Application of Method With TRL (cont.)

Step 3. **Determine Pre and Post condition constraints or partition values.**

Add in [IF] and [SET] fields

Number of test cases= 32

Step 4. **Modify test representation as needed ‘**

Add in [LIMIT] and [LABEL]

Number of test cases = 24

```
*****************************************************************************
*                    STEP 4.  ADD [LIMIT] AND [LABEL]                       *
*****************************************************************************
*

DESCRIPTION
*
        Test Representation for SORT requirement.
        File Name:        SORT I-4. TRL
        Version:          1.4   Errors/Messages/Conditions/Limits/Labels
        Last Modified:    7/22/91
        Modified By:      J. Hops

*
*
PARAMETERS

        TYPE     Input-Categories for Parameter: Array

                 NAME     array size
                 SAMPLES
                 *
                 * 5 partitions
                 *

                    O (array unspecified) '     [ERROR 1]
                                                 SET error, dent-care]
                                                 LABEL error condition ]
                    1 (degenerate array)         SET size_1,dont_care ]
                                                 LABEL degenerate array]
                    2 to Upper Bound minus 1     SET size_ok ]
                                                 LABEL valid]
                    Upper Bound                  SET size__ok ]
                                                 LABEL valid upper bound)
                    greater than Upper Bound     ERROR 2]
                                                 SET error, dont_care]
                                                 LABEL invalid array size]
                 *

                 MESSAGE 1
                    Array size of O is invalid or array size is unspecified.
                    Array size is greater than the Upper Bound of sizes
                 *
                 *

                 NAME     array values
                 SAMPLES
                 *
                 * 5 partitions, 1 don't care
                 *

                    all O's                      [IF size_ok]
                                                 [SET all_same,dont_care]
                    all the same but not O       [IF size_ ok]
                                                 [SET all_same,dont_care]
                    all negative                 [IF size_ ok] [SET min_max]
                                                 [LIMIT 4]
                    all positive                 [IF size_ok] [SET min_max]
                                                 [LIMIT 4]
                    mixed +/-/0                  [IFsize_ok] [SET min_max]
                    don't care                   [IF dent_ care]
                 *
```

```
NAME      value arrangement
SAMPLES
*
*      2 partitions, 1 don't care
*
    minimum before max [IF size_ok, min_max]
    maximum before min [IF size_ok, min_max]
    don't care         [IF dont_care]
*
```

TYPE Input-Parameter: Sort Order

```
NAME      sort order
SAMPLES
*
*      3 partitions, 1 don't care
*
    ascending                [IF size_ok, min_max] [ SET ascend]
    descending               [IF size-ok, min_max] [ SET descend)
    unspecified      [ERROR3][IF size_ ok]
                             [SET error, dent-care]
    don't care               [IF dent-care]
*

MESSAGE
    Sort order is not specified
*
```

TYPE Output to program or change in state

```
NAME     result
SAMPLES
*
*      4 partition values
*
     error notification          [IF error]
     array unchanged             [IF dent-_care]
     array in ascending order [IF ascend, min_max]
     array in descending order [IF descend, min_max]
*
```

NAME:
1.4.2;5

TITLE:
Signal Path Routing-PVM_B1

INPUT/OUTPUT:

BODY:

```
*
*
DESCRIPTION
*
PURPOSE :

        Verify that all valid input and ouput signal path combinations can be
        configured.  For Build 1: verify that RCP can select the IF input
        port, and that the correct signal is processed through the system.

PASS CRITERIA:
a.      BVR provides IF distribution and switching [SFRD 3.2.9]
        [Build 1&2: IF switching at RCP; Build 3: IF distribution
        via IFD and cabling]
b.      [Build 2] At least 2 RCP's are allowed on a given front-end
        simultaneously.[SFRD 3.2.10]
c.      [Build 2] BVR provides graphical display to DMC of subsystem
        configuration.[SFRD 7.2.26]
d.      An invalid request causes the routing to remain unchanged.
        [derived]
e.      Displays [Build 1], and logs [Build 2]  reflect signal routing as
        commanded. [derived]
f.      [Build 2] the command is accepted in any link status mode from RMT
        and/or CMC [derived]
g.      [Build 2] BVR is designed for unattended operation
        (does not need to be operated from RMT).[SFRD 7.1.1]
h.      [Build 2] BVR accepts operator directives from DMC.[SFRD 7.2.1]
i.      BVR acknowledges, and executes operator directives
        (including multiple simultaneous functions).[SFRD 7.2.1]
j.      [Build 2] The status of the execution of an operator directive is reported to
        DMC as per 890-133.[SFRD 7.2.2]
k.      The BVR can be configured and operated according to a series of
        low-level directives.[SFRD 7.2.10]
l.      BVR operation can be modified according to a series of low-level
        commands or directives.[SFRD 7.2.11]
m.      [Build 2] The status of the execution of a directive includes the
        completion of a DMC directive.[SFRD 7.2.16]
n.      [Build 2] The BVR can be controlled from the DMC for normal activities
        including pre-track and post track functions.[SFRD 9.1.1]


*
*Categories and Partitions
*
PARAMETERS
```

```
TYPE    SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

        NAME    RCP Operability Status (set via board installation)
        SAMPLES
        *
        *
                NORMAL - operational        [SET normal]
                                            [IF req valid]
                DEGRADED - marginal         [SET degraded, not normal]
                                            [IF req valid]
                FAILED - out of service     [SET failed, not normal]
                                            [IF req valid]
                don't care                  [IF !req valid][SET normal]
*
        NAME    Test Signal Ouput connected to RCP IF Port (stated below)
        SAMPLES
        *
        *
        IF1     [IF normal, req valid] [SET in a]
        IF2     [IF normal, req valid] [SET in b]
        IF3     [IF normal, req valid] [SET in c]
        don't care [IF !req valid]
        don't care [IF not normal]

        NAME    Test Signal Ouput Frequency Setting (stated below)
        SAMPLES
        *
        *
        SET Test Signal Frequency to 250001000   [IF normal, req valid, in a]
        SET Test Signal Frequency to 250002000   [IF normal, req valid, in b]
        SET Test Signal Frequency to 250003000   [IF normal, req valid, in c]
        don't care [IF !req valid]
        don't care [IF not normal]


TYPE    '1'1 STEX ECUTION ACTION

        NAME    Operator Directive validity
        SAMPLES
        *
        *
        request syntax is valid                 [SET req valid]
        request syntax is invalid               [IF normal] [ERROR]
*
        MESSAGE 1
        Operator Directive Syntax is in error or undefined RCP/Input Port


        NAME    Operator Directive History
        SAMPLES
        *
        *
        directive expected to change current setting     [IF normal, req valid]
                                                         [SET change]
        directive NOT expected to change current setting [IF normal, req valid]
```

```
                                                    [SET unchanged
        don't care                                  [IF !req valid
                                                    [SET unchanged
        don't care                                  [IF not normal   [SET unchanged]
*

        NAME    Operator Directive Option: RCP Id.
        SAMPLES
        *
        *
        1
*

        NAME    Operator Directive Option: RCI   I input channels
        SAMPLES
        *
        SET 1 F]          [IF normal, req valid   SET wanta]
        SET 11'2          [It' normal, req va 1 id   SET want b]
        SET I F 3         [IF normal, req valid   SET want cl
        don't care [IF !req val id]
        don't care [IF not normal ]
        *

'1' YR  '1'1S1' ANALYSIS AND EXPECTED RESULTS

        NAME    RMT Response decor (i i ng t c Di sp I ay
        SAMPLES
        *
        *
        rejected directive, configuration unchanged [IF !req valid]
        cannot perform because RCP not normal           [IF req valid, not normal]
        complete - configuration change reflects directive setup [IF normal, req valid, change]
        complete - configuration unchanged and reflects directive setup [IF normal, req valid, unchanged]


        NAME    Expected Frequency at all 4 BB Ports according to Spectrum Analyzer
        SAMPLES
        *

                DC signal, 0 Hz         [IF in a, !want a][LIMIT 2]
                DC signal, 0 Hz         [IF in b, !want b][LIMIT 2]
                DC signal, 0 Hz;        [IF in c, !want c][LIMIT 2]
                1000 Hz                 [IF in a, want a]
                2000 Hz                 [IF in b, want b]
                3000 Hz                 [IF in c, want c]
                unchanged - output derived from last valid configuration [IF !req valid]
                don't care [IF not normal]
```

TITLE:
TRL Test Cases for TS: 1.4.2 Signal Path Routing - (Build 1)

BODY:
Description:

PURPOSE:

Verify that all valid input and ouput signal path combinations can be configured. For Build 1: verify that RCP can select the IF input port, and that the correct signal is processed through the system.

PASS CRITERIA:

a. BVR provides IF distribution and switching [SFRD 3.2.9] [Build 1&2: IF switching at RCP; Build 3: IF distribution via IFD and cabling]

b. [Build 2] At least 2 RCP's are allowed on a given front-end simultaneously.[SFRD 3.2.10]

c. [Build 2] BVR provides graphical display to DMC of subsystem configuration.[SFRD 7.2.26]

d. An invalid request causes the routing to remain unchanged. [derived]

e. Displays [Build 1], and logs [Build 2] reflect signal routing as commanded. [derived]

f. [Build 2] the command is accepted in any link status mode from RMT and/or CMC [derived]

g. [Build 2] BVR is designed for unattended operation (does not need to be operated from RMT).[SFRD 7.1.1]

h. [Build 2] BVR accepts operator directives from DMC.[SFRD 7.2.1]

i. BVR acknowledges, and executes operator directives (including multiple simultaneous functions).[SFRD 7.2.1]

j. [Build 2] The status of the execution of an operator directive is reported to DMC as per 890-133.[SFRD 7.2.2]

k. The BVR can be configured and operated according to a series of low-level directives.[SFRD 7.2.10]

l. BVR operation can be modified according to a series of low-level commands or directives.[SFRD 7.2.11]

m. [Build 2] The status of the execution of a directive includes the completion of a DMC directive.[SFRD 7.2.16]

n. [Build 2] The BVR can be controlled from the DMC for normal activities including pre-track and post track functions.[SFRD 9.1.1]

****

Case # 1
Label: 1.1.1.1.1.1.1.3.4

PARAMETERS:

SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

RCP Operability Status (set via board installation] - >
- > NORMAL - operational

```
          Test Signal Ouput connected to RCP  F Port (stated below)      >
          =====>   IF1

          Test Signal Ouput Frequency Setting (stated below)      >
          =====>   SET Test Signal Frequency to 250001000

   TEST EXECUTION ACTION

          Operator Directive validity =     >
          =====>   request syntax is valid

          Operator Directive History =====>
          =====>   directive expected to change current setting

          Operator Direct ve  Option:RCP  d. =====>
               >   1

          Operator Direct ve Opt ion: RCP  F input channe s =     >
               >   SET IF

   TEST ANALYSIS AND EXPECTED RESU TS

          RMT Response according  o Display =  >
          =  >   complete - con iguration change reflects directive setup

          Expected Frequency at a l 4 BB Ports according to Spectrum Analyzer =  >
          =  >   1000 Hz

No error conditions exist.


**********************************
Case #       2
Label:       1.1.1.1.1.1.2.3.1

PARAMETERS:

   SETUP OF BVR H/W SUBASSEMBL IE S AND '1'1S'1 SIGNA L GF NERATOR

          RCP Operability Status (set via boa d installation] =     >
          =  >   NORMAL - operational

          Test Signal Ouput connected to RCP  F Port  (stated below) =     >
          =  >   IF1

          Test Signal Ouput Frequency Setting (stated below) =  >
          =  >   SET Test Signal Frequency to 250001000

   TEST EXECUTION ACTION

          Operator Direct ve validity =     >
          =  >   reques  syntax is val d

          Operator Direct ve History =  >
          =  >   direct ve expected to change current setting
```

```
        Operator Directive Option: RCP Id.    ===>
        =====>   1

        Operator Directive Option: RCP IF input channels      >
        =====>   SET IF2

   TEST ANALYSIS AN[) EXPECTED RESULTS

        RMT Response according to Display      >
             >   complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer =====>
        =====>   DC signal, 0 Hz

No error conditions exist


**********************************
Case #       3
Label:       1.1.1.1.1.1.3.3.1

PARAMETERS :

   SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

        RCP Operability Status (set via board installation] =     >
        =====>   NORMAL - operational

        Test Signal Ouput connected to RCP IF Port (stated below)      >
          ===>   IF1

        Test Signal Ouput Frequency Setting (stated below) =     >
          ===>   SET Test Signal Frequency to 250001000

   TEST EXECUTION ACTION

        Operator Directive validity      >
             >   request syntax is valid

        Operator Directive History =====>
        =====>   directive expected to change current setting

        Operator Directive Option: RCP Id.      >
             >  1

        Operator Directive Option: RCP IF input channels =     >
        =====>   SET IF3

   TEST ANALYSIS ANI) EXPECTED RESULTS

        RMT Response according to Display =====>
        =====>   complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer =     >
        =====>   DC signal, 0 Hz
```

No error conditions exist.

```
**********************************
Case #        4
Label:        1 .1.1.1.7,1.1.4.4

PARAMETERS :

   SETUP OF B VR H/W SUBASSEMBLIES ANI) TEST SIGNAL GENERATOR

           R CP OperabilityStatus (set vid board installation)        >
                >   NORMAI - operationa I

           Test Signal Ouput connected to RCP IF Port (stated below)  >
           >   IF1

           Test Signal Ouput Frequency Setting (stated below)      >
           >   SET Test Signal Frequency to 250001000

   TEST EXECUTION ACTION

           Operator Directive validity    >
           >   request syntax is valid

           Operator Directive History     >
           >   directive NOT expected to change current setting

           Operator Directive Option: RCP Id.    >
           >   1

           Operator Directive Option: RCP IF input channels    >
           >   SET IF1

   TEST ANALYSIS AND EXPECTED RESULTS

           RMT Response according to Display      >
           >   complete - configuration unchanged and reflects directive setup

           Expected Frequency at all 4 BB Ports according to Spectrum Analyzer    >
           >   1000 Hz

No error conditions exist.

**********************************
Case #        5
Label:        1.2.2.1.1.1.1.3.2

PARAMETERS:

   SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

           RCP Operability Status (set via board installation       >
           >   NORMAL - operational
```

```
        Test Signal Ouput connected to RCP IF Port (stated below)      >
        =    >   IF2

        Test Signal Ouput Frequency Setting (stated below) =    >
        =    >   SET Test Signal Frequency to 250002000

   TEST EXECUTION ACTION

        Operator Directive validity      >
             >   request syntax is valid

        Operator Directive History =    >
        =    >   directive expected to change current setting

        Operator Directive option: RCP Id.      >
             >   1

        Operator Directive Option: RCP IF input channels =    >
        =    >   SET IF1

   TEST ANALYSIS AND EXPECTED RESULTS

        RMT Response according to Display =    >
        =    >   complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer =    >
        =    >   DC signal, 0 Hz

No error conditions exist


**********************************
Case #       6
Label:       1.2.2.1.1.1.2.3.5

PARAMETERS :

   SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

        RCP Operability Status (set via board installation) =    >
        =    >   NORMAL - operational =

        Test Signal Ouput connected to RCP IF Port (stated below) =    >
        =    >   IF2

        Test Signal Ouput Frequency Setting (stated below) =    >
        =    >   SET Test Signal Frequency to 250002000

   TEST EXECUTION ACTION

        Operator Directive validity =    >
        =    >   request syntax is valid

        Operator Directive History =    >
        =    >   directive expected to change current setting
```

```
        Operator Directive Option: RCP Id. ---->
        ----> 1

        Operator Directive Option: RCP IF input channels ---->
        ----> SET IF2

   TEST ANALYSIS ANI) EXPECTED 1{1S1111'S

        RMT Response according to Display ---->
        ----> complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer ---->
        ----> 2000 Hz

No error conditions exist


**********************************
Case #       7
Label:       1.2.2.1.1.1.3.3.2

PARAMETERS :

   SETUP OF BVR n/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

        RCP Operability Status (set via board installation) ---->
        ----> NORMAL - operational

        Test Signal Ouput connected to RCP IF Port (stated below) ---->
        ----> IF2

        Test Signal Ouput Frequency Setting (stated below) ---->
        ----> SET Test Signal Frequency to 250002000

   TEST EXECUTION ACTION

        Operator Directive validity ---->
        ----> request syntax is valid

        Operator Directive History ---->
        ----> directive expected to change current setting

        Operator Directive Option: RCP Id. ---->
             > 1

        OperatorDirective Option: RCP IF input channels ---->
             > SET IF3

   TEST ANALYSIS ANI) EXPECTED RESULTS

        RMT Response according to Display ---->
        ----> complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer ---->
        ----> DC signal, 0 Hz
```

```
No error conditions exist


**********************************
Case #        8
Label:        1.2.2.1.2.1.2.4.5

PARAMETERS:

   SETUP OF BVR n/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

           RCP Operability Status (set via board installation) =  ==>
           ====>   NORMAL - operational

           Test Signal Ouput connected to RCP IF Port (stated below) =    >
           =====>   IF2

           Test Signal Ouput Frequency Setting (stated below) =    >
           ====>   SET Test Signal Frequency to 250002000

   TEST EXECUTION ACTION

           Operator Directive validity =  >
           =====>   request syntax is valid

           Operator Directive History =    >
           ====>   directive NOT expected to change current setting

           Operator Directive Option: RCP Id. =  >
           ====>   1

           Operator Directive Option: RCP IF input channels =  >
           ====>   SET IF2

   TEST ANALYSIS AND EXPECTED 1{1S111)'1'S

           RMT Response according to Display =  >
           =====>   complete - configuration unchanged and reflects directive setup

           Expected Frequency at all 4 BB Ports according to Spectrum Analyzer    >
           ====>   2000 Hz

No error conditions exist .


**********************************
Case #        9
Label:        1.3.3.1.1.1.1.3.3

PARAMETERS:

   SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

           RCP Operability Status (set via board installation)
           ====>   NORMAL - operational
```

```
        Test Signal Ouput connected to RCP IF Port (stated below) ==>
        =====>   IF3

        Test Signal Ouput Frequency Setting (stated below) ====>
        =====>   SET Test Signal Frequency to 250003000

  TEST EXECUTION ACTION

        Operator Directive validity =====>
        =====>   request syntax is valid

        Operator Directive History ==>
            =>   directive expected to change current setting

        Operator Directive Option: RCP Id. ====>
        =====>   1

        Operator Directive Option: RCP IF input channels ==>
        =====>   SET IF1

  '1'1S'1 ANALYSIS ANI) EXPECTED RESULTS

        RMT Response according to Display =====>
        =====>   complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyze ==>
        =====>   DC signal, 0 Hz;

No error conditions exist.


**********************************
Case #       10
Label:       1.3.3.1.1.1.2.3.3

PARAMETERS:

  SETUP OF BVR n/W SUBASSEMBLIES ANI) TEST SIGNAL GENERATOR

        RCP Operability Status (set via board installation) ==>
        ====>   NORMAL - operational

        Test Signal Ouput connected to RCP IF Port (stated below) ==>
        =====>   IF3

        Test Signal Ouput Frequency Setting (stated below) ====>
            =>   SET Test Signal Frequency to 250003000

  TEST EXECUTION ACTION

        Operator Directive validity ====>
        =====>   request syntax is valid

        Operator Directive History ====>
        =====>   directive expected to change current setting
```

```
        Operator Directive Option: RCP Id. ====>
        ====>   1

        operator DirectiveOpt ion: RCP IF input channels      >
            >   SET IF2

   '11', S'1' ANALYSIS ANI) E XP ECTED RESULTS

        RMT Response according to Display ====>
        =====>   complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer ====>
        =====>   DC signal, 0 Hz;

No error conditions exist


**********************************
Case #       11
Label:       1.3.3.1.1.1.3.3.6

PARAMETERS :

   SETUP 01" B VR  n/W  SUBASSEMBLIES ANI) TESTSIGNALGENERATOR

        RCP Operability Status (set via board installation] ====>
        ====>   NORMAL - operational

        Test Signal Ouput connected to RCP IF Port (stated below) ====>
        ====>   IF3

        Test Signal Ouput Frequency Setting (stated below) ====>
        =====>   SET Test Signal Frequency to 250003000

   TEST E XECUTION ACTION

        Operator Directive validity ====>
        ====>   request syntax is valid

        Operator Directive History ====>
        ====>   directive expected to change current setting

        Operator Directive Option:  RCP Id.      >
            >   1

        Operator Directive Option: RCP IF input channels ====>
        ====>   SET IF3

   TE ST ANA LYSIS ANI) E XPECTED R E SULTS

        RMT Response according to Display ====>
        ====>   complete - configuration change reflects directive setup

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer      >
        ====>   3000 Hz
```

No error cond ions ex st

****
Case # 12
Label: 1.3.3.1.2 3 4 6

PARAMETERS:

SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

RCP Operability Status (set via board is a ation] ->
-> NORMAL - operational

Test Signal Ouput connected to RCP IF Por (stated below) ->
-> IF3

Test Signal Ouput Frequency Setting (stated below) >
-> SET Test Signal Frequency to 250003000

TEST EXECUT ON ACTION

Operator Directive validity >
-> request syntax is valid

Operator Directive History >
-> directive NOT expected to change current set ng

Operator Directive Option: RCP Id. >
-> 1

Operator Directive Option: RCP F input channels ->
-> SET IF3

TEST ANALYSIS AND EXPECTED RESULTS

RMT Response accord ng to Display >
-> complete - configuration unchanged and ref ects direct ve setup

Expected Frequency at al 4 BB Ports accord ng to Spectrum Analyzer >
-> 3000 Hz

No error cond ons exist.

****
Case # 13
Label: 2.5 5 .4 .5.2.8

PARAMETERS:

SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

RCP Operability Sta us (set v a board nstallation
-> DEGRADED margina

```
        Test Signal Ouput connected to RCP IF Port (stated below) ---  >
        ----> don't care

        Test Signal Ouput Frequency Setting (stated below) ---  >
        --- > don't care

  '[ ESTE XECUT IONACTION

        Oper ator Directive validity      >
             > request syntax is valid

        operator DirectiveHistory      >
             > don't Care

        Operator Directive Option: RCP Id. ---->
        ---> ]

        Operator Directive Option: RCP IF input channels -     >
        ---> don't care

  TEST ANALYSIS ANI) EXPICTEDRESULTS

        RMT Response according to Display -     >
        ---- > cannot perform because RCP not normal

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer -     >
        --- > don't care

Noerror condit ions exis t


**********************************
Case #       14
Label:       3.5.5.1.4.1.5.2.8

P AR AMETERS:

  SETUP OF BVR H/W SUBASSEMBLIES AND '1 ESTS IGNAL GENERATOR

        RCP Operability Status (set via board installation] ---->
        -  > FAILED - out of service

        Test Signal Ouput connected to RCP IF Port (stated below)      >
        --->  don't care

        Test Signal Ouput Frequency Setting (stated below)      >
        --->  don't care

  TEST EXECUTION ACTION

        Operator Directive validity -  ->
        ---- > request syntax is valid

        Operator Directive History -  ->
        --- > don't care
```

```
        Operator Directive Option:RCPId.        >
            >   1

        Operator Directive Option: RCP IF input channels =      >
        =====>   don't care

   TEST ANALYSIS AND EXPECTED RESULTS

        RMT Response according to Display ===   >
        =====>   cannot perform because RCP not normal

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer       >
            >   don't care

No error conditions exist.


**********************************
Case #       15
Label:       4.4.4.2.3.1.4.1.7

PARAMETERS:

   SETUP OF BVR H/W SUBASSEMBLIES AND TEST SIGNAL GENERATOR

        RCP Operability Status (set via board installation)       >
            >   don't care

        Test Signal Ouput connected to RCP IF Port (stated below) =      >
        =    >   don't care

        Test Signal Ouput Frequency Setting (stated below)       >
        =    >   don't care

   '1'1S'1 EXECUTION ACTION

        OperatorDirective validity       >
            >   request syntax is invalid

        Operator Directive History       >
            >   don't care

        Operator Directive Option: RCP Id. ===   >
        ===>   1

        Operator Directive Option: RCP IF input channels       >
        =    >   don't care

   '1'1'S'1' ANALYSIS ANI) EXPECTED 1{1,S[11'1'S

        RMT Response according to Display ===   >
          =>   rejected directive, configuration unchanged

        Expected Frequency at all 4 BB Ports according to Spectrum Analyzer =   >
        =====>   unchanged - output derived from last valid configuration
```

Error #1: Operator Directive Syntax is in error or undefined RCP/Input Port

So ftTest

Release Level: 3.1 Release Date: 5/91

SoftTest is a PC based tool that provides automated support for requirements based testing for any application, language, or hardware environment, SoftTest aids the testing process in four major areas, It aids in validating system requirements by identifying all of the system's elementary functions and logical inconsistencies in the requirements specification. SoftTest will then determine the necessary tests that will ensure that 100% of system's functionality is tested. The tool also aids in project management by providing functional coverage analysis and archiving of both new and existing test libraries, SoftTest provides quantitative measurements of the testing process allowing quantifiable completion criteria for the testing process.

SoftTest is the only test tool currently available that utilizes a mathematically rigorous technique for designing and evaluating functional test cases. This technique, called Cause-Effect graphing, is on the same time tested algorithms that engineers use to test hardware logic circuits. The success of these algorithms can be seen in the consistently high quality that we see in the integrated circuit industry,

Information Date: 4/9 1

Vendor:
Bender & Associates
484 Magnolia Avenue
P.O.Box 849
larkspur, CA94939
415*927*5863

Date First **Sold:** 1987
Current **Users:** 100+
Price **$2,500**
Annual Maintenance: 20%
Training Supplied: No
Trial Available: No
Documentation Supplied: Yes
Demo Available: Yes

Class	Descriptors	Test Activity Supported
Test Management	Test Case Generator	Test Design Test Planning
Hardware Supported	**Language Supported**	**0/S Required**
IBM PC	Language Independent	PC/MS-DOS

T

Release level: B2.02 **Release Date:** 1/91

T is a tool that automatically generates test case input data from requirements information. T verifies the testability of requirements, generates test cases, documents test caes, traces between requirements and test cases, and reports metrics for requirements coverage (Passed requirements/Total requirements).

1' is a specification based test case generator. It uses cause effect graphing, equivalence class partitioning, boundary value analysis. function testing, error guessing, and fault directed test design techniques,

Information Date: 8/91

Vendor:
Programming Environments, Inc.
4043 State Hwy 33
Tinton Falls, NJ 07753
908•918•0110

Date First Sold: 1987
Current Users: 280+
Price $7,000
Annual Maintenance: 15%
Training Supplied: *Yes*
Trial Available: **No**
Documentation Supplied: Yes
Demo Available: **Yes**

Class	Descriptors	Test Activity Supported
Multi-Dimensional	Requirements Coverage Analyzer Requirements Verifier Test Data Generator	Test Development
Hardware Supported	**Language Supported**	**0/S Required**
Apollo AT&T 3B DEC VAX HP3000 & 9000 IBM PC	Language Independent	***0s2*** PC/MS DOS UNIX VMS

CONTACT VENDOR FOR PRICING & MAINTENANCE INFORMATION