A Company

Reference	Areference
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Test Plan

Example Module Test Plan

Introduction

This document details the test plan for the Example Module design (UUT) to be manufactured at Example Company in Germany.

The Example UUT is a high-power Bluetooth transmitter with a universal IO interface. The device uses an Atmel SAM3 Arm processor and TI SOC Bluetooth communications IC. The device is connected via a single Samtec MEC8 20way edge connector interface and is powered by a 3V to 3.6V supply with a maximum 100mA current draw.

The UUT is 80mm x 80mm and have 4 mounting point and each edge.

Other useful information on the UUT and its function

Reference documents

RF-Ti-cMOD-r1.9.X.X_BlockDiagram_RevB.PDF

RF-Ti-cMOD-r1.9.X.X_Schematic_RevD.PDF

RF-Ti-cMOD-1.9.X .X_Gerber_RevB.PDF

RF-Ti-cMOD-r1.9.X.X_3D_STEP_RevC.PDF

Assumptions

Customer supplies pre-tested special test firmware as per section <UUT Test Firmware Communications> and <UUT Test Firmware Tasks>

Customer provides a Data Transmitter device & firmware as per section <Data Transmitter>

Appropriate test points (<=32mil Diameter) will be provided on the UUT bottom side only for test contacting, with a test point pitch of greater than 1.5mm.

Test Overview

The UUT will have the below tests completed:

- Initial low voltage current test (checks for excessive current at initial power-up)
- Programming test (Download Test firmware)
- UUT Power at lowest voltage
- UUT Power at highest voltage
- Test firmware communications
- Oscillator test / module IO at speed tests
- Module IO test (including shorts tests between external IOs)
- Communications test (Using the Data Transmitter)
- PDet voltage test UUT in CW Transmit Mode
- RF power test – Straight Through (No PA)
- RF power test – Via PA
- Frequency test
- Final Programming and Verification

Each UUT within a 4up panel shall be powered/tested individually, one at a time, to reduce the test complexity and because RF interference could occur between the closely coupled RF devices.

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Test Hardware

The test hardware shall be completely enclosed in the test fixture where possible and shall not exceed 600mm x 600mm footprint.

The test hardware must contain clearly marked indicators for ‘Pass’ and ‘Fail’ at the front of the test unit.

The test hardware must contain indicators for when each of the 4 UUT is powered

Test Software and Sequencer

The test software will be based around the Marvin AT-Easy platform and will generate individual reports, per UUT, recorded against the read serial number.

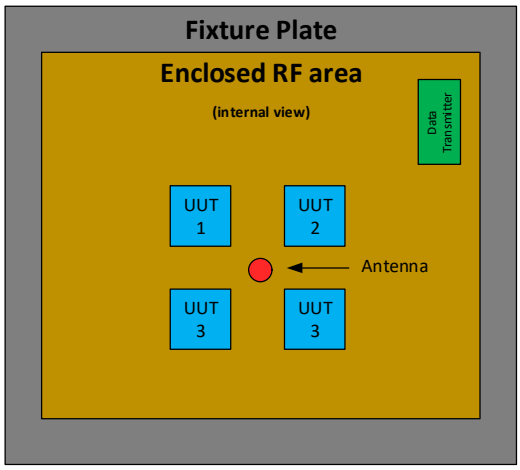
Each test will be separate such that it can be selected or deselected from the test sequencer (Supervisor Level).

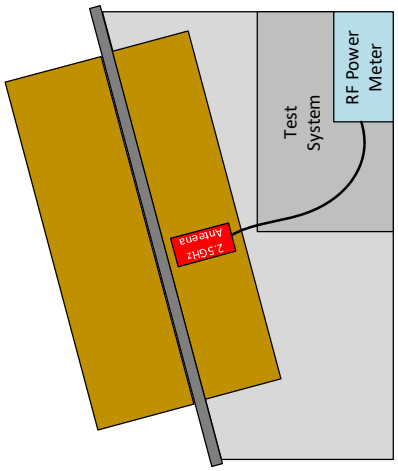
The software shall make full use of the J-Safe architecture of the J-Testr.

Test Mechanics

The UUT will be tested using a ‘Bed of Nails’ within a RF shielded area to isolate external RF interference as much as possible. The RF enclosure will incorporate RF absorbing material to minimize the effect of reflections on measurements.

A single RF antenna will be mounted, inside the RF enclosure, roughly central to all UUTs to maximize signal reception and reduce signal strength variation.





Serial Number

The serial number shall be obtained from the unique ID of the processor chip via a SW command

The read serial number must be used in the test report name, appended with the time/date of the test to allow a single UUT to be tested multiple times and allows for a report to exist for each time a UUT is tested.

If the unit fails before the ID is read a default temporary name will be used instead.

Test Report

The test report must contain all items tested with details as listed below:

Name within the test group (i.e. UUT 1)

- Name of test
- Test result
- Test limits

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UUT Test Firmware Communications

The UUT test firmware will perform tests, as detailed in section <Test Procedure and Results>, upon receipt of a single character/byte received at pin B5 of the UUT Arm processor.

The UART shall be set-up as below:

9600 Baud

8 Data Bits

1 Stop bit

No Parity

No Flow control

The test firmware will be continuously listening for 'action' characters (capital letter) and then action the required test immediately on receipt. The test firmware will echo the command character, as its lower-case version, from UART TX pin B6 of the UUT main processor.

All Signals will be 3.3V CMOS.

UUT Test Firmware Tasks

Char	Task	Note
A	Output frequency, derived from 16Mhz clock, on pin: UART_RTS – 2MHz	Connection At Speed Test (16MHz Oscillator Test)
B	Output frequency, derived from 16Mhz clock, on pins: MOD10_19 – 8MHz MOD10_22 – 4MHz MOD10_23 – 2MHz MOD10_24 – 1MHz	Connection At Speed Test
C	Output frequency, derived from 16Mhz clock, on pins: MOD10_25 – 8MHz MOD10_26 – 4MHz MOD10_27 – 2MHz MOD10_28 – 1MHz	Connection At Speed Test
D	Set only UART_RTS to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
E	Set only MOD10_19 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
F	Set only MOD10_22 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
G	Set only MOD10_23 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
H	Set only MOD10_24 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
I	Set only MOD10_25 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
J	Set only MOD10_26 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
K	Set only MOD10_27 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
L	Set only MOD10_28 to output '1' (All other IOs to Input with pull down)	Connect/Shorts Test
M	Start the receiver test and report result on UART_RTS pin within 1.5 seconds of acknowledging the command request	RX Testing

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	0 = Fail 1 = Pass	
N	Set UUT to output CW at maximum power	TX Testing
X	Reset the UUT to Default Condition	
Y	Read the Device ID in Human readable format (response = \r\n"123456789AB"\r\n"y")	Serial Number

Firmware Default Condition

All I/Os (i.e. UART_RTS + MOD10_19 – MOD10_28) set to inputs

RF power off

Firmware looking for commands on UART RX and UART TX idle (high).

Data Transmitter

The Data Transmitter will be inside the RF shielded area and must be able to be shutdown to avoid unnecessary noise generation inside the RF chamber when UUT RF power measurements are being taken.

The Data Transmitter will be a standard UUT Unit with special firmware that has the following operation:

The Data Transmitter is set-up to repeatable transmit a specific data packet, with a specific time interval between each packet, such that a UUT can count the number of successfully received packets within any given time window.

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Test Procedure and Results

Programming test

Setup
The UUT will be powered up to a voltage of 3000mV +/- 20mV

Task
Program the UUT via the Arm processors SWD Port

Result
Pass = Programming successful

Fail = Programmer un-successful

Coverage
Processor powered and functional, SWDIO and SWDCLK lines are connected

Power test at low voltage

Setup
The UUT will be set to a voltage of 3000mV +/- 20mV

Task
UUT current measured with an accuracy of +/- 2mA

Result
20mA<result>30mA

Coverage
No component power issues or resistive short at minimum voltage

Power test at high voltage

Setup
The UUT will be increased to a voltage of 3600mV +/- 20mV

Task
UUT current measured with an accuracy of +/- 2mA

Result
20mA<result>30mA

Coverage
No component power issues or resistive short at high voltage

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Communications and UART_RTS at speed test

Setup

UUT supply to be set to 3000mV +/- 20mV

Character 'A' will be communicated to the UUT to initiate the test

Task

Successful return of the task character in lower case

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 2MHz at the UART_RTS pin

Result

1,999,950Hz<result>2,000,030Hz

Post Test Actions

Character 'X' will be communicated to the UUT to reset the UUT to its default state

Coverage

UART communications

UART_RTS pin at Speed

Communications and MOD10_19 to MOD10_24 at speed test

Setup

UUT supply to be set to 3000mV +/- 20mV

Character 'B' will be communicated to the UUT to initiate the test

Task

Successful return of the task character in lower case

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 8MHz at the MOD10_19 pin

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 4MHz at the MOD10_22 pin

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 2MHz at the MOD10_23 pin

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 1MHz at the MOD10_24 pin

Results

7,999,880Hz<result>8,000,120Hz

3,999,940Hz<result>4,000,060Hz

1,999,970Hz<result>2,000,030Hz

999,985Hz<result>1,000,015Hz

Post Test Actions

Character 'X' will be communicated to the UUT to reset the UUT to its default state

Coverage

UART Communications

MOD10_19 pin at Speed

MOD10_22 pin at Speed

MOD10_23 pin at Speed

MOD10_24 pin at Speed

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Communications and MOD10_25 to MOD10_28 at speed test

Setup

UUT Supply to be set to of 3000mV +/- 20mV

Character 'C' will be communicated to the UUT to initiate the test

Task

Successful return of the task character in lower case

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 8MHz at the MOD10_25 pin

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 4MHz at the MOD10_26 pin

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 2MHz at the MOD10_27 pin

The UUT will be measured, with 10ppm tolerance, to be outputting a frequency of 1MHz at the MOD10_28 pin

Results

7,999,880Hz<result>8,000,120Hz

3,999,940Hz<result>4,000,060Hz

1,999,970Hz<result>2,000,030Hz

999,985Hz<result>1,000,015Hz

Post Test Actions

Character 'X' will be communicated to the UUT to reset the UUT to its default state

Coverage

UART communications

MOD10_25 pin at Speed

MOD10_26 pin at Speed

MOD10_27 pin at Speed

MOD10_28 pin at Speed

Connection and short test UART_RTS

Setup

UUT Supply to be set to 3000mV +/- 20mV

Character 'D' will be communicated to the UUT to initiate the test

Task

Successful return of the task character in lower case

Check that only UART_RTS is logic high

Results

Pass = UART_RTS is high

Fail = Any other pin is high

Post Test Actions

Character 'X' will be communicated to the UUT to reset the UUT to its default state

Coverage

UART_RTS connection and shorts to other IO lines

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Connection and short test MOD10_xx

Setup

UUT Supply to be set to 3000mV +/- 20mV

Character '*' will be communicated to the UUT to initiate the test

* See <UUT Test Firmware Tasks> for relevant task command character

Task

Successful return of the task character in lower case

Check that only MOD10_xx is logic high

Results

Pass = MOD10_xx is high

Fail = Any other pin is high

Post Test Actions

Character 'X' will be communicated to the UUT to reset the UUT to its default state

Coverage

MOD10_xx connection and shorts to other lines

Receiver communications test

Setup

UUT Supply to be set to 3000mV +/- 20mV

Data Transmitter supply set to 3500mV +/- 20Mv and turned 'on'

Character 'M' will be communicated to the UUT to initiate the test

Task

Successful return of the task character in lower case

The UUT will receive packets from the Data Transmitter and indicate Pass '1' or Fail '0' at the UART_RTS pin within 1.5 seconds of acknowledging the command request

Result

UART_RTS = '1' = Pass // UART_RTS = '0' = Fail

Post Test Actions

Data Transmitter supply to be turned 'Off'

Character 'X' will be communicated to the UUT to reset the UUT to its default state

Coverage

UUT receive capability

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RF power and frequency test

Setup

UUT Supply to be set to 3000mV +/- 20mV

Character ‘N’ will be communicated to the UUT to initiate the test

Task

Successful return of the task character in lower case

The UUT will be permanently outputting a CW RF signal at the strongest power available.

The test system will measure:

RF power in db +/- 1db

RF Frequency in MHz +/- 100Hz

UUT current in mA +/- 2mA

Result

dB characterised by UUT position (Limits will be set based on characterisations)

2421.95MHz<result>2422.05MHz

60mA<result>70mA

Post Test Actions

Character ‘X’ will be communicated to the UUT to reset the UUT to its default state

Coverage

RF signal path

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Functional Firmware Verification Test

Setup

UUT Supply to be set to 3000mV +/ 20mV

Functional firmware downloaded

Baud rate changed to 115200

Verification firmware version

Task

After downloading of the function firmware, reset the UUT with a full power cycle and apply an appropriate power up delay greater than 100ms

Send the below string to the UUT:

"\r\nVersion?\r\n"

Wait approximately 100ms for a response

Expected return string:

"\r\nGood\r\n\r\nVersionString\r\n"

Extract 'VersionString' from the returned data, as appropriate, using the preceding and proceeding '/r/n' pairs

Compare extracted 'VersionString' with the required version number

Result

UUT read 'version' matches the programmed firmware version number.

Post Test Actions

De-power the UUT

Coverage

Function firmware correctly downloaded

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