Test specification

[VODAFONE][DCIW378]

ACTIVITY	*PROJECT*	*TYPE*
HE2022	DCIW378	Specifications

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OBJECT/ABSTRACT

This document outlines the various tests and controls to be applied on the board DCIW378 Vodafone

Part 1. Evolutions

Version	Date	Author	Motive and type of modification
0.1	July 2nd 2024	GUBLER Camille	First draft
1.0	September 27th 2024	GUBLER Camille	Update Wifi – BT tests

Part 2. Summary

Part 3. Introduction

This paper presents the different tests and inspections to be applied in factory on [VODAFONE][DCIW378] board.

Main features of the set-top-box are:

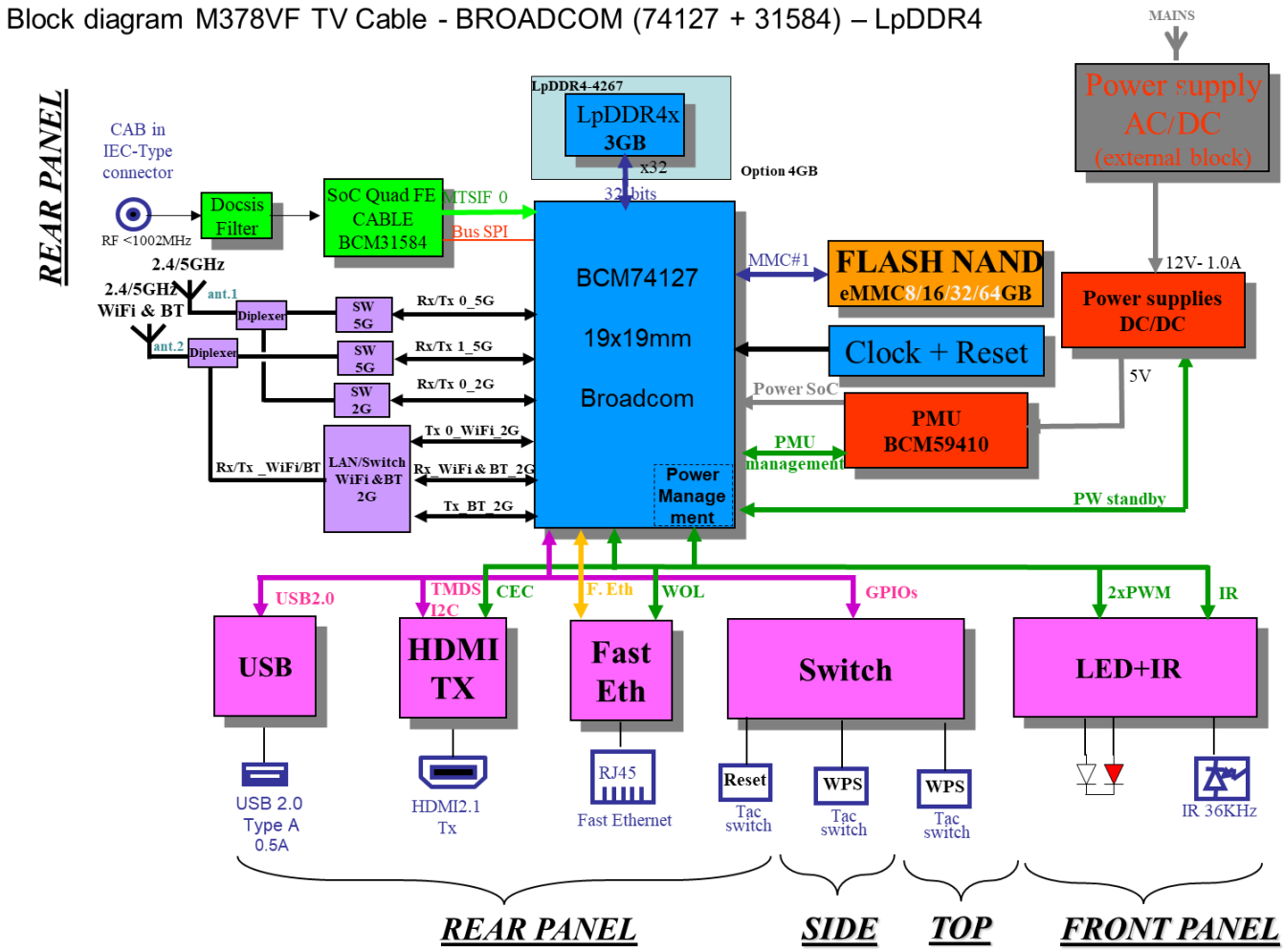
- 100M Ethernet
- 4xDVBC FrontEnd
- Wi-Fi 2.4/5GHz
- USBA 2.0 rear panel
- Front Panel (R + W + IR)
- Bluetooth 5.0

Reference documents:

Name	Reference
Schematic	R43 3000526178 000 01
CIU	254110297 CIU M378 VF CAB-3Bis
CIE	254110304 CIE M378 VF CAB-3Bis

Part 4. Hardware Architecture

4.1 Synoptic for STB Board



Part 5. Test conditions

The tests described in this document shall be performed at a normal operating temperature.

Groups of tests:

- A first group of tests shall be performed at the ICT test bench.
- A second group of tests shall be performed at functional test benches (SagemTests software)
- A third group of tests and finally the last shall be performed with the final middleware.

The test bench will issue the test commands trough the serial link interface.

Part 6. In Circuit Test

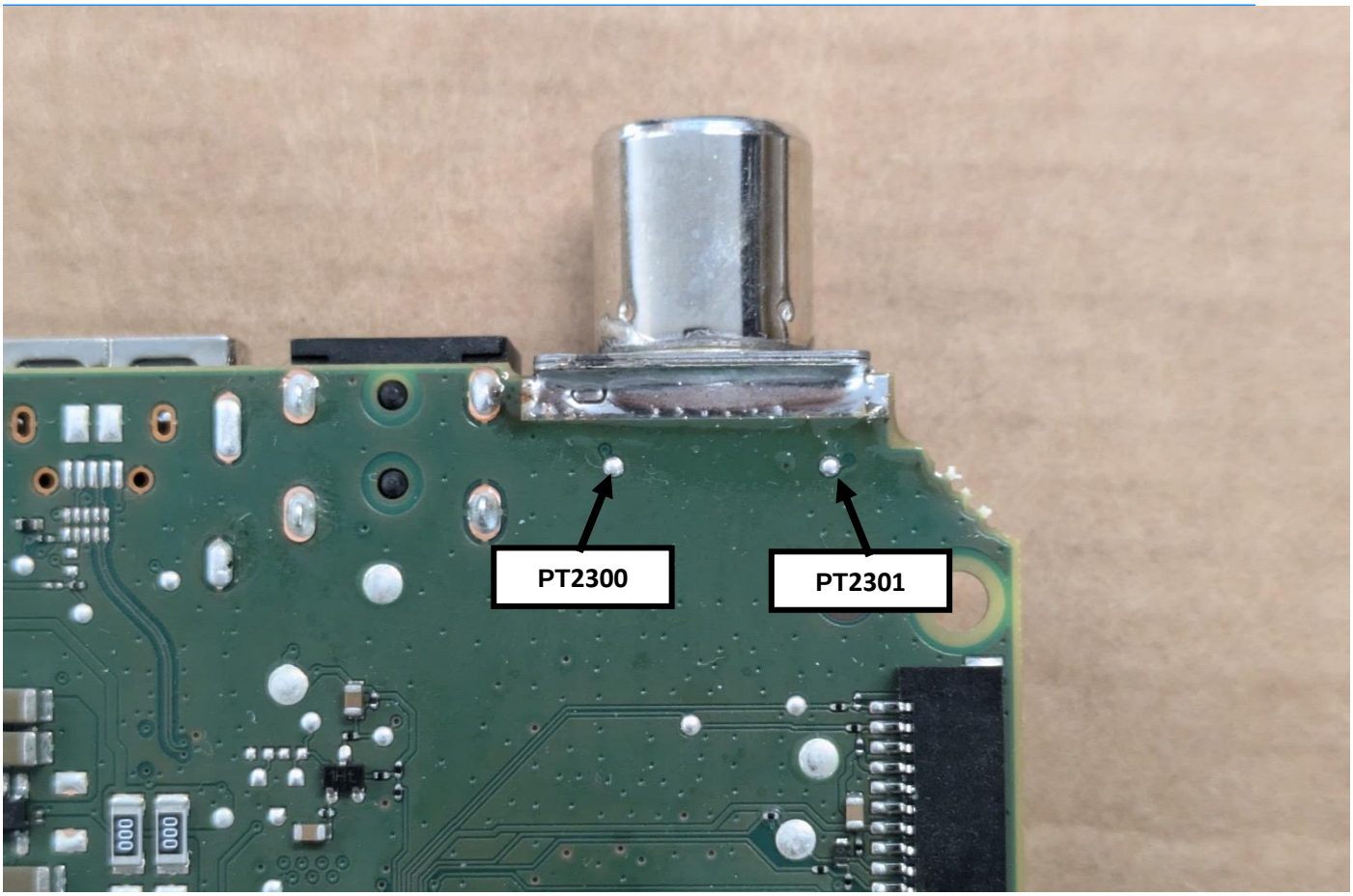
6.1 Power Controls

				Measure		
Power Signal	**Test Point**	**Function**	**Voltage**	**Min**	**Max**	**Unit**
P12V	PT1500	Input Power	12V	11.5	12.5	V
AON_5.0V	PT15300	Main board	5V	4.75	5.25	V
P3V3C_FE	PT1520	FrontEnd	3.3V	3.13	3.46	V
P1V8C_FE	PT15950	FrontEnd	1.8V	1.71	1.89	V
P1VC_FE	PT16100	FrontEnd	1V	0.86	1.05	V
D0.8V_AVS_STB_CORE	PT15102	SoC	0.80V	0.69	0.885	V
D0.95V_AVS_CPU_CORE	PT15103	SoC	0.95V	0.69	1.03	V
D0.8V	PT15104	SoC	0.8V	0.76	0.84	V
D1.8V	PT15105	SoC	1.8V	1.71	1.89	V
AON_0.8V	PT15108	SoC	0.8V	0.76	0.84	V
AON_1.8V	PT15110	SoC	1.8V	1.71	1.89	V
D1.8V_LPDDR4	PT15109	DDR	1.8V	1.71	1.89	V
AON_3.6V	PT15107	SoC	3.6V	3.42	3.78	V
D0.6V_LPDDR4	PT15101	DDR	0.6V	0.54	0.66	V
D1.1V_LPDDR4	PT15100	DDR	1.1V	1.04	1.16	V

6.2 Continuity test for the FE connector on TOP side

Check the continuity between PT2300/PT2301 and GND.

		Measure		
Signal	**Test Point**	**Min**	**Max**	**Unit**
GND	PT2300	/	2	Ω
GND	PT2301	/	2	Ω



Part 7. Startup sequence

Board startup sequence control

Flash programming is not performed at the ICT anymore. Therefore the boot of the board needs to be checked.

The operator must ensure that the board boots correctly by checking this point:

- The Sagemtest prompt must appear on the serial link.

Part 8. Functional tests

The following tests will be performed on the functional test benches at the factory.

They are based on SagemTests test software.

8.1 SPECIFIC [50120] [FEDVB-C] [M378 VF CAB-3Bis DE]

M377 VF CAB-3 DE FE DVB-C test procedure history:

Version	Date	Author	Motive and type of modification
01	28/11/2022	DISSAUX Timothé	Document creation
02	27/11/2023	DISSAUX Timothé	Frequency change from 858MHz to 850 MHz due to electromagnetic pollution in the factory measurement setup

8.1.1 INTRODUCTION

The functional test uses the demodulator indicators according to the different stimuli at the input of the front-end.

The tests will be carried out over the VHF and UHF frequencies for several DVB-C modes and must be performed on each of the available frontend units.

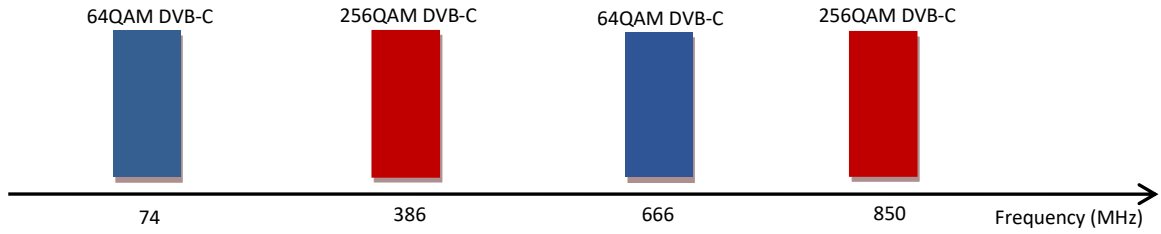
All tests listed in this part 8.1 shall be performed during the prototype validation process.

After verifying that CP & CPK are good for 5000 products, the test coverage can be limited to the mandatory tests highlighted in green.

Important remark:
The test bench must be well controlled and calibrated to avoid signal propagation problems.

8.1.2 TEST SIGNAL CONDITIONS

Euro cable TV frequency band occupation:



64QAM DVB-C test signal characteristics	
Modulation	64QAM
Symbol rate	6.952MSps
Roll-off	0.15
Input power	-66dBm
Carrier to Noise ratio	26dB

256QAM DVB-C test signal characteristics	
Modulation	256QAM
Symbol rate	6.952MSps
Roll-off	0.15
Input power	-55dBm
Carrier to Noise ratio	32dB

8.1.3 TESTS

Test#1

Frequency 74MHz / 64QAM DVB-C test signal		Min	Max	Unit
Test_1_BER	FEDVB-C 74MHz : Viterbi BER	50	2000	.10-7
Test_1_UNCOR	FEDVB-C 74MHz : Uncorrected blocks	0	0	
Test_1_RSSI	FEDVB-C 74MHz : RSSI	-69	-63	dBm
Test_1_CN	FEDVB-C 74MHz : Carrier-to-Noise Ratio	25	27	dB
Test_1_FO	FEDVB-C 74MHz : Frequency Offset	-20	20	kHz
Test_1_RO	FEDVB-C 74MHz : Rate Offset	-50	50	ppm

Test#2

Frequency 386MHz / 256QAM DVB-C test signal		Min	Max	Unit
Test_2_BER	FEDVB-C 386MHz : Viterbi BER	50	2000	.10-7
Test_2_UNCOR	FEDVB-C 386MHz : Uncorrected blocks	0	0	
Test_2_RSSI	FEDVB-C 386MHz : RSSI	-58	-52	dBm
Test_2_CN	FEDVB-C 386MHz : Carrier-to-Noise Ratio	31	33	dB
Test_2_FO	FEDVB-C 386MHz : Frequency Offset	-20	20	kHz
Test_2_RO	FEDVB-C 386MHz : Rate Offset	-50	50	ppm

Test#3

Frequency 666MHz / 64QAM DVB-C test signal		Min	Max	Unit
Test_3_BER	FEDVB-C 666MHz : Viterbi BER	50	2000	.10-7
Test_3_UNCOR	FEDVB-C 666MHz : Uncorrected blocks	0	0	
Test_3_RSSI	FEDVB-C 666MHz : RSSI	-69	-63	dBm
Test_3_CN	FEDVB-C 666MHz : Carrier-to-Noise Ratio	25	27	dB
Test_3_FO	FEDVB-C 666MHz : Frequency Offset	-20	20	kHz
Test_3_RO	FEDVB-C 666MHz : Rate Offset	-50	50	ppm

Test#4

Frequency 850MHz / 256QAM DVB-C test signal		Min	Max	Unit
Test_4_BER	FEDVB-C 850MHz : Viterbi BER	50	2000	.10-7
Test_4_UNCOR	FEDVB-C 850MHz : Uncorrected blocks	0	0	
Test_4_RSSI	FEDVB-C 850MHz : RSSI	-58	-52	dBm
Test_4_CN	FEDVB-C 850MHz : Carrier-to-Noise Ratio	31	33	dB
Test_4_FO	FEDVB-C 850MHz : Frequency Offset	-20	20	kHz
Test_4_RO	FEDVB-C 850MHz : Rate Offset	-50	50	ppm

8.1.1 GetPid test

The STB has to be locked on a valid cable frequency in order to perform this test.

Next, send the FE_GetPID command and check that the return value is aligned with the limits below.

		Min	Max	Unit
Test_PID	PID information on locked frequency	1	1	

8.2 FUNCTIONAL TEST [50241] [AVOS] [HDMI] [GENERIC]

Template's history:

Version	Date	Author	Motive and type of modification
01	July 29th, 2013	CONRATH Arnaud/PETER Alexis	Document's creation (based on Spec_test_ECGI421_MAJ0406.doc)
02	December 16th, 2016	BERBEN Christophe	UHD version
03	May 31st, 2021	GUILLEMOT Romain	Add CEC Test
04	April 25th, 2023	BERBEN Christophe	Update HDMI HOTPLUG chapter

8.2.1 Test principle

HDMI output is tested with a UHD "Video Test generator / analyser".

Important warning :
Detail of HDMI testing is not available in tracacom database.
The "HDMI" test flag covers both I²C and video pattern tests.

8.2.2 RQT_SHW_HDMI_I2C: HDMI OUT – I2C test

The aim of this test is to check the I²C communication link between the set-top-box and the receiver. The set-top-box send an EDID (Extended display identification data) request and check the EDID content provided by the HDMI analyser.

SagemTests command issued
HDMI_ReceiverEdid

Expected result

```
[SAGEMTESTS] GENERAL DTV MONITOR INFORMATIONS
[SAGEMTESTS] Manufacturer Name : QDI
[SAGEMTESTS] Serial Number : 5
[SAGEMTESTS] EDID Ver.1 Rev.3
[SAGEMTESTS] AUDIO/VIDEO DTV MONITOR INFORMATIONS
[SAGEMTESTS]
Established Timings Description :
[SAGEMTESTS] TIMING 640x480 60Hz
[SAGEMTESTS]
Standard Timings Description :
[SAGEMTESTS]
Detailed Timings Description :
[SAGEMTESTS] |PxlClk   |HActPx |HBlkPx |VActLn |VBlkLn |HSyOff |HSyWdt |VSyOff |VSyWdt |HImgSz |VImgSz |HBordr
       |VBordr |IsItrd |IsHPos |IsVPos |
[SAGEMTESTS] |-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+----
---+-------+-------+-------+-------+
[SAGEMTESTS] |7425    |1920   |280    |540    |22     |88     |44     |2      |5      |708    |398    |0      |0
       |1      |1      |1      |

[SAGEMTESTS] |PxlClk   |HActPx |HBlkPx |VActLn |VBlkLn |HSyOff |HSyWdt |VSyOff |VSyWdt |HImgSz |VImgSz |HBordr
       |VBordr |IsItrd |IsHPos |IsVPos |
[SAGEMTESTS] |-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+----
---+-------+-------+-------+-------+
[SAGEMTESTS] |2700    |720    |138    |480    |45     |16     |62     |9      |6      |531    |398    |0      |0
       |0      |0      |0      |

[SAGEMTESTS] EDID Extension n 1 :
[SAGEMTESTS] HDMI supported by Sink
[SAGEMTESTS] Unkown stream content
[SAGEMTESTS] NumofAudioChannels : 2
[SAGEMTESTS] AudioSupported     : 7
[SAGEMTESTS] MaxBitRate         : 7
[SAGEMTESTS] IsUnderscanSink  : 0
[SAGEMTESTS] IsBasicAudioSupported   : 1
[SAGEMTESTS] IsYCbCr444       : 1
[SAGEMTESTS] IsYCbCr422       : 1
[SAGEMTESTS] NativeFormatNum  : 1
[SAGEMTESTS] |PxlClk   |HActPx |HBlkPx |VActLn |VBlkLn |HSyOff |HSyWdt |VSyOff |VSyWdt |HImgSz |VImgSz |HBordr
       |VBordr |IsItrd |IsHPos |IsVPos |Audio  |
[SAGEMTESTS] |-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+----
---+-------+-------+-------+-------+-------+
```

```
[SAGEMTESTS] => HDMI_ReceiverEdid - PASSED <=
```

Measures

		Min	Max	Unit
HDMI	HDMI OUT : EDID and video pattern test flag	1	1	none

8.2.3 RQT_SHW_HDMI_VIDEO-ANALYSIS: HDMI OUT - Video pattern analysis

The set-top-box generates a pseudo random pattern on the HDMI link that is checked by a HDMI analyser.

The algorithm used to generate the video pattern has been provided by the video generator, in order to ensure that the pattern generated is the one expected by the analyser.

Test is OK if all the pixels of the video pattern have the appropriate RGB value.

Measures

		Min	Max	Unit
HDMI	HDMI OUT : EDID and video pattern test flag	1	1	none

8.2.4 RQT_SHW_HDMI_CEC: HDMI OUT – CEC test

Plug a CEC-able TV to the STB

Below commands sends a simple standard CEC packet to the TV and checks correct return.

FT_HDMI_CEC

8.2.5 RQT_SHW_HDMI_HOTPLUG: HDMI OUT – Hot Plug detect test

HOTPLUG test is now considered as an implicit test.

The HOTPLUG test is considered as factory tested if SagemTests software is running OK and if video displayed is OK (BAV tests).

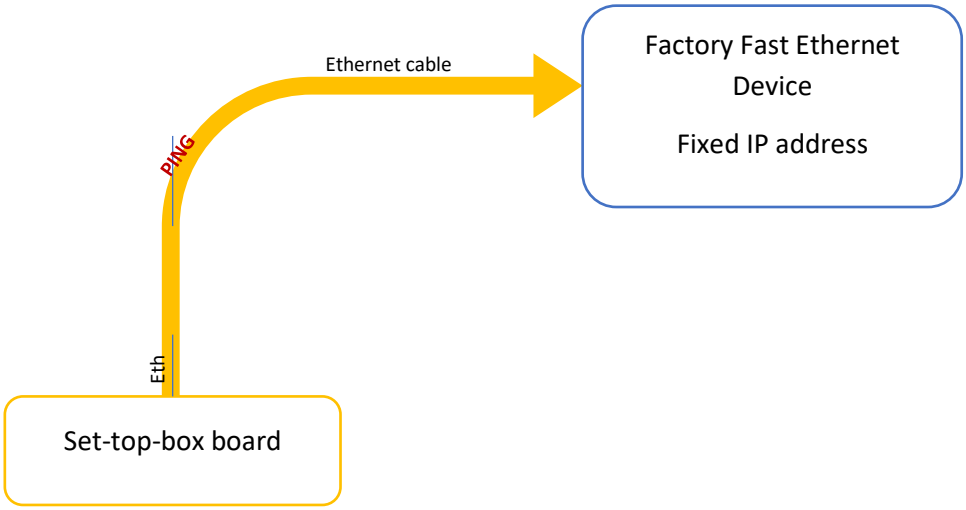
8.3 FUNCTIONAL TEST [50310] [ETHERNET] [GENERIC]

Template's history :

Version	Date	Author	Motive and type of modification
01	July 21th, 2015	COFFINET Arnaud	Document's creation

8.3.1 Test principle

The aim of this test is to verify the Ethernet link between the set-top-box-board and one Fast Ethernet device located on the factory network. Therefore, the set-top-box sends a ping to this device and measure the time response as described on the following scheme.



8.3.2 RQT_SHW_ETH_PING: Ethernet ping

Ping from the set-top-box to one of the factory server.

The following steps must be performed:

1) cable connexion test : FT_ETH_CheckConnectTxRx
2) ping test :
   a) ifconfig <interface> <address_STB>
   b) ping -s 65500 -c 1 <address_Device> -w4

Measures:

		Min	Max	Unit
BWD_Ethernet_Ping_PC	Ethernet ping through GTW board	0	30	ms

RQT_END

8.4 FUNCTIONAL TEST [50510] [USB2] [GENERIC]

Template's history :

Version	Date	Author	Motive and type of modification
01	July 29th, 2013	CONRATH Arnaud/PETER Alexis	Document's creation (based on Spec_test_ECGI421_MAJ0406.doc)

8.4.1 Introduction

This document describes how **detection test** and **read test** are performed.

Please note that the USB presence test can also be performed during autotest.

8.4.2 Tests principle

The prerequisite for the USB test is to connect one USB device (pen-drive) to each USB port of the set-top-box and to boot-up the STB. The test will then start automatically and the Functional Tester can retrieve the result of this test.

The USB interface of the decoder is compatible with USB 2.0 High speed. Therefore, it should be tested at this specific baud rate.

8.4.3 RQT_SHW_USB_DETECTION: USB Device detection test

Connect a USB device on (at least) one USB connector. SagemTests software checks that one USB device has been connected on each USB host.

TT command reference: FT_USB_CheckDevice
(https://sp.comon/sites/URD44/Metiers_et_techno._URD44/TT/Appli%20de%20Test%207108/FT_USB_CheckDevice.aspx)

Measures

		Min	Max	Unit
BPO_bUsb	USB device detection test	1	1	none

RQT_END

8.4.4 RQT_SHW_USB_READING: USB Reading test

The aim of this test is to check the transfer rate of one file located on an USB 2.0 certified pendrive.

A transfer of at least 10 MBytes is required.

The test result will be sent by the TT to the tester.

Measures:

		Min	Max	Unit
GEN_bUsbTransfer	USB transfer test	1	1	none

RQT_END

8.4.5 RQT_SHW_USB_OVER-CURRENT: USB over current management check.

The aim of this test is to check that over-current is properly detected by software.

Depending on the equipment of the board, the maximum current delivered by the USB port can be either 500 mA or 1 A.

The following table shows whether the over-current is detected or not depending on the charge and the equipment

Charge	Current (theoretical)	Max current = 500 mA	Max current = 1 A
10 Ohm +/- 5% (6 W)	500 mA	Over-Current not detected	Over-Current not detected
5 Ohm +/- 5% (6 W)	1000 mA	Over-Current detected	Over-Current not detected
1 Ohm +/- 5% (6 W)	N/A	Over-Current detected	Over-Current detected

The test should be performed with the three configurations above.

			Min	Max	Unit
GEN_bUsbCurrent500mA	USB : over-current check 500 mA	Must never be in over-current	1	1	none
GEN_bUsbCurrent1A	USB : over-current check 1 A	Over-current or not depending on the HW config	1	1	none
GEN_bUsbCurrentOver1A	USB : over-current check over 1 A	Must always be in over-current	1	1	none

RQT_END

8.5 FUNCTIONAL TEST [50610] [FRONT PANEL] [INFRARED] [GENERIC]

Template's history:

Version	Date	Author	Motive and type of modification
01	August 24, 2015	COFFINET Arnaud	Document's creation

8.5.1 RQT_SHW_FPANEL_INFRARED: Front-panel infrared receiver test

The set-top-box will receive different key codes from an IR dongle, at 36kHz.

The test must check that each different key code has been decoded.

Measures

		Min	Max	Unit
BPO_blr	Front-panel : IR	1	1	none

RQT_END

1.1 FUNCTIONAL TEST [50612] [FRONT PANEL] [SWITCH] [GENERIC]

Template's history:

Version	Date	Author	Motive and type of modification
01	July 5th 2024	GUBLER Camille	Document's creation

8.5.2 RQT_SHW_FPANEL_SWITCH: Front-Panel switches test

Important remark :
This test must be performed on an assembled product.

This test relates to mechanical buttons.

There are three buttons:

-Rear panel button "reset",

-Side button "standby",

-Side button "pairing".

All the buttons must be tested : press and release (activate/deactivate) actions must be detected.

```
TT>  FT_DetectSwitches ENABLE
[SAGEMTESTS] Start Detection of Switches
[SAGEMTESTS] => FT_DetectSwitches - PASSED <=
TT> [SAGEMTESTS] switch scfpin hex code = 0094
[SAGEMTESTS] switch 1 pressed
[SAGEMTESTS] switch 1 released
[SAGEMTESTS] switch scfpin hex code = 0094
[SAGEMTESTS] switch 1 pressed
[SAGEMTESTS] switch 1 released
[SAGEMTESTS] switch scfpin hex code = 0095
[SAGEMTESTS] switch 2 pressed
[SAGEMTESTS] switch 2 released
FT_DetectSwitches DISABLE
[SAGEMTESTS] End of Detection
[SAGEMTESTS] => FT_DetectSwitches - PASSED <=
```

Measures

		Min	Max	Unit
BPO_bBoutons	Front-panel : Switch test	1	1	none

8.6 FUNCTIONAL TEST [50614] [FRONT PANEL] [LED] [GENERIC]

Template's history:

Version	Date	Author	Motive and type of modification
01	July 5th 2024	GUBLER Camille	Document's creation

8.6.1 RQT_SHW_FPANEL_LEDQ: Front-Panel LED

Important remark :
This test must be performed on an assembled product.

Sagemtest switches off the 2 leds (mono white and red).

Sagemtest switches on the red led.

The operator checks that the red led is turn on.

Sagemtest switches off the red led and switches on the white led.

The operator checks that the white led is turn on.

8.7 SPECIFIC [51400] [BLUETOOTH] [M378 VF CAB-3BIS]

M378 VF CAB-3BIS Bluetooth test procedure history:

Version	Date	Author	Motive and type of modification
01	04/07/2024	POLLEUX Vincent	Document creation
02	23/09/2024	DISSAUX Timothé	Adapting TX/RX targets to the M378 VF CAB-3BIS board

8.7.1 INTRODUCTION

This document aims to explain Bluetooth test procedure for the M378 VF CAB-3BIS mainboard. The Bluetooth 4.0 standard merges the Bluetooth 2.0 (Bluetooth regular with DH1, DH3, DH5) standard, the Enhanced Data Rate (EDR with 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5) and the Bluetooth Low Energy (BLE).

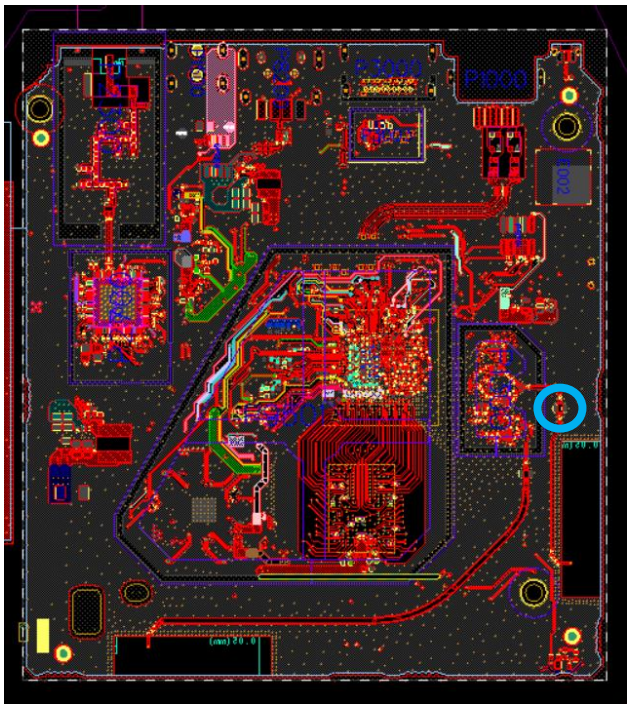
All tests listed in this part 8.1 shall be performed during the prototype validation process.

After verifying that CP & CPK are good for 5000 products, the test coverage can be limited to the mandatory tests highlighted in green.

8.7.2 BOARD DESCRIPTION

The M378 VF CAB-3BIS board is using a BCM74127 Chipset for Bluetooth 5.0.

The picture below shows the location of the Bluetooth antenna and the test switch connector.



8.7.3 LAUNCHING BLUETOOTH DRIVER

To activate the test driver, get the procedure relative to the board.

The PC communicates with the Bluetooth chipset.

Verify that the Bluetooth FW is aligned with the following configuration:

Firmware: BCM4362A2 UART 37.4 MHz wlbga_REF_sLNA_iLNA_stb_class2 STB_BCM4362A2_100.007 V7

BR target power level: 5

BLE target power level: 5

8.7.4 CONDUCTED TESTS – BLUETOOTH

TX tests

For all listed frequencies and modulations, we measure/verify Output Power, Mask margin compliance, EVM, Freq tolerance and LO leakage for each RF chain.

- Test TX_BR : 1-DH5 PRBS

	Frequency	**2402MHz**	Modulation	**1-DH5 PRBS**
	Target	Min	Max	Unit
Power	4	**0.5**	**7**	dBm
Frequency drift	NA	**-40**	**+40**	kHz
Max drift rate	NA		**20**	kHz/50µs
Frequency deviation df2	NA	**115**		kHz
	Frequency	**2480MHz**	Modulation	**1-DH5 PRBS**
	Target	Min	Max	Unit
Power	5	**1.5**	**8**	dBm
Frequency drift	NA	**-40**	**+40**	kHz
Max drift rate	NA		**20**	kHz/50µs
Frequency deviation df2	NA	**115**		kHz

- Test TX_EDR : 3-DH5 PRBS

	Frequency	**2402MHz**	Modulation	**3-DH5 PRBS**
	Target	Min	Max	Unit
Power	4	**0**	**7.5**	dBm
Frequency stability w0+wi	NA	**-75**	**+75**	kHz

- Test TX_BLE : LE 1M PRBS

	Frequency	**2402MHz**	Modulation	**LE 1M PRBS**
	Target	Min	Max	Unit
Power	4	**0.5**	**7**	dBm
Frequency drift	NA	**-125**	**+125**	kHz
Max drift rate	NA		**20**	kHz/50µs
Frequency deviation df2	NA	**185**		kHz
	Frequency	**2480MHz**	Modulation	**LE 1M PRBS**
	Target	Min	Max	Unit
Power	5	**1.5**	**8**	dBm
Frequency drift	NA	**-125**	**+125**	kHz
Max drift rate	NA		**20**	kHz/50µs
Frequency deviation df2	NA	**185**		kHz

For all listed frequencies and modulations, measurements shall comply with BER/PER limits.

- Test RX_BR : 1-DH5 PRBS

	Frequency	**2480MHz**	Modulation	**1-DH5 PRBS**
	Target	Min	Max	Unit
BER at RX Power -88dBm	NA	**0**	**0.1**	%

- Test RX_EDR : 3-DH5 PRBS

	Frequency	**2402MHz**	Modulation	**3-DH5 PRBS**
	Target	Min	Max	Unit
BER at RX Power -86dBm	NA	**0**	**0.1**	%

- Test RX_BLE : LE 1M PRBS (with dirty TX Whitening ON)

	Frequency	**2442MHz**	Modulation	**LE 1M PRBS**
	Target	Min	Max	Unit
PER at RX Power -91dBm	NA	**0**	**30**	%

8.7.5 RADIATED TESTS – BLUETOOTH

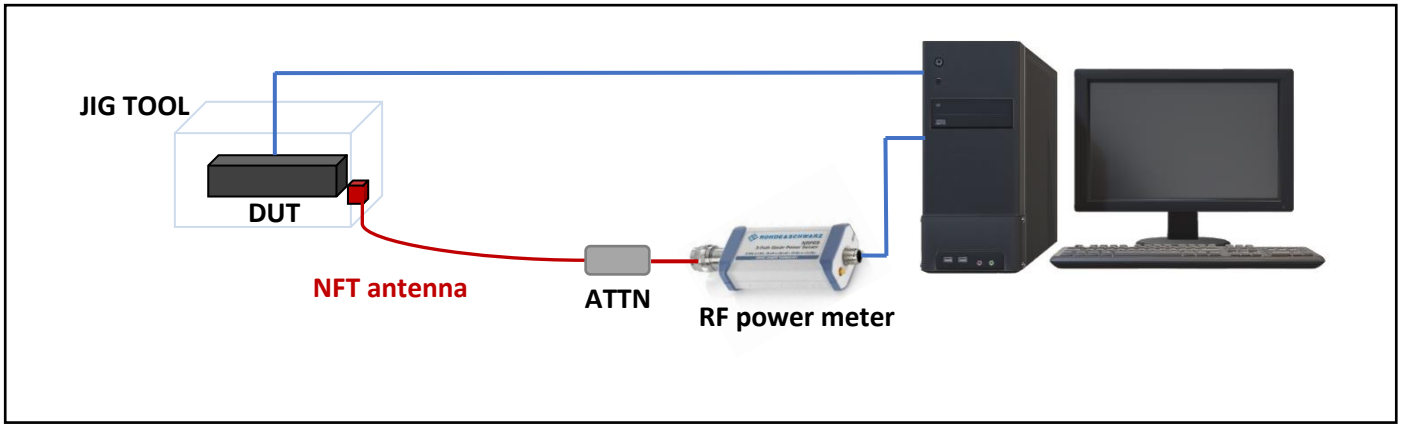
The radiated test consists in performing a RF near field power measurement to ensure the Bluetooth antenna is correctly connected.

Setup

The M378 VF CAB-3BIS product must be positioned into a jig tool, equipped with an NFT antenna.
On the other hand, the test antenna is connected to a RF power meter. This NFT antenna must be placed as close as possible from the product.

The power meter must be preliminary calibrated and configured to perform measurement at the test frequency.
To configure Bluetooth transmission, DUT shall be connected to the test computer.

TEST SETUP



Power measurement

- ⇨ Send the commands to the DUT to activate continuous TX transmission in BDR mode, at 2402MHz (CH0) and +5dBm output power level at chip level.
- ⇨ Measure the RF power level at the NFT antenna port.
- ⇨ Check that the value complies with the limits in the table below.

		Target	Min	Max	Unit
Power measurement		**P***	**P-5**	**P+5**	dBm

* With P, the average power level found on production lines with the dedicated jig tool.

8.8 SPECIFIC [51411] [WIFI-2.4G] [M378 VF CAB-3BIS]

M378 VF CAB-3BIS Wi-Fi test procedure history:

Version	Date	Author	Motive and type of modification
01	04/07/2024	POLLEUX Vincent	Document creation
02	20/09/2024	DISSAUX Timothé	Adapting TX/RX targets to the M378 VF CAB-3BIS board

8.8.1 INTRODUCTION

This document aims to explain Wi-Fi test procedure for the M378 VF CAB-3BIS mainboard.

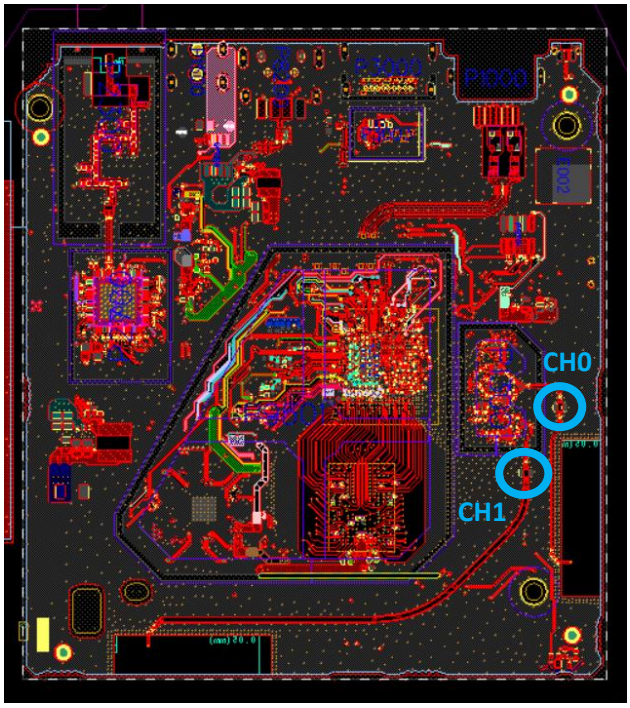
All tests listed in this part 8.1 shall be performed during the prototype validation process.

After verifying that CP & CPK are good for 5000 products, the test coverage can be limited to the mandatory tests highlighted in green.

8.8.2 BOARD DESCRIPTION

The M378 VF CAB-3BIS board is using a BC74127 Chipset equipped with 1x RTC6617U Core0 path & 1x RTC6603U RF on Core1 path for the 2.4GHz Wi-Fi part.

The picture below shows the configuration of all antennas and all chains.



8.8.3 LAUNCHING WIFI DRIVER

To activate the test driver, get the procedure relative to the board.

The PC communicates with the Wi-Fi chipset.

8.8.4 CONDUCTED TESTS – Wi-Fi 2.4GHz

TX tests

For all listed frequencies and modulations, we measure/verify Output Power, Mask margin compliance, EVM, Freq tolerance and LO leakage for each RF chain.

- Test TX_2G_1 : MCS0 HT20 (mode 802.11n)

	Frequency	**2412MHz**	Modulation	**MCS0 HT20**
	Target	Min	Max	Unit
Power	17.5	**15.5**	**19.5**	dBm
EVM	NA	**NA**	**-5**	dB
MASK (1)	NA	**PASS**	**PASS**	-
Frequency tolerance	NA	**-25**	**+25**	ppm
LO Leakage	NA	**-99**	**-15**	dB

(1) should comply with IEEE80211n

- Test TX_2G_2 : MCS7 HT20 (mode 802.11n)

	Frequency	**2437MHz**	Modulation	**MCS7 HT20**
	Target	Min	Max	Unit
Power	15.5	**13.5**	**17.5**	dBm
EVM	NA	**NA**	**-28**	dB
MASK (1)	NA	**PASS**	**PASS**	-
Frequency tolerance	NA	**-25**	**+25**	ppm
LO Leakage	NA	**-99**	**-15**	dB
	Frequency	**2462MHz**	Modulation	**MCS7 HT20**
	Target	Min	Max	Unit
Power	15.5	**13.5**	**17.5**	dBm
EVM	NA	**NA**	**-28**	dB
MASK (1)	NA	**PASS**	**PASS**	-
Frequency tolerance	NA	**-25**	**+25**	ppm
LO Leakage	NA	**-99**	**-15**	dB

(1) should comply with IEEE80211n

- Test TX_2G_3 : HE-MCS9 HT20 (mode 802.11ax)

	Frequency	**2472MHz**	Modulation	**HE-MCS9 HT20**
	Target	Min	Max	Unit
Power	13.5	**11.5**	**15.5**	dBm
EVM	NA	**NA**	**-32**	dB
MASK (1)	NA	**PASS**	**PASS**	-
Frequency tolerance	NA	**-25**	**+25**	ppm
LO Leakage	NA	**-99**	**-32**	dB

(1) should comply with IEEE80211ax

For all listed frequencies and modulations, we measure PER for each channel.

- Test RX_2G_1 : MCS0 HT20

	Frequency	**2412MHz**	Modulation	**MCS0 HT20**
	Target	Min	Max	Unit
PER at RX Power -90dBm	NA	**0**	**10**	%

- Test RX_2G_2 : MCS7 HT20

	Frequency	**2437MHz**	Modulation	**MCS7 HT20**
	Target	Min	Max	Unit
PER at RX Power -72dBm	NA	**0**	**10**	%

- Test RX_2G_3 : HE-MCS9 HT20

	Frequency	**2472MHz**	Modulation	**HE-MCS9 HT20**
	Target	Min	Max	Unit
PER at RX Power -68dBm	NA	**0**	**10**	%

8.8.5 RADIATED TESTS – Wi-Fi 2.4GHz

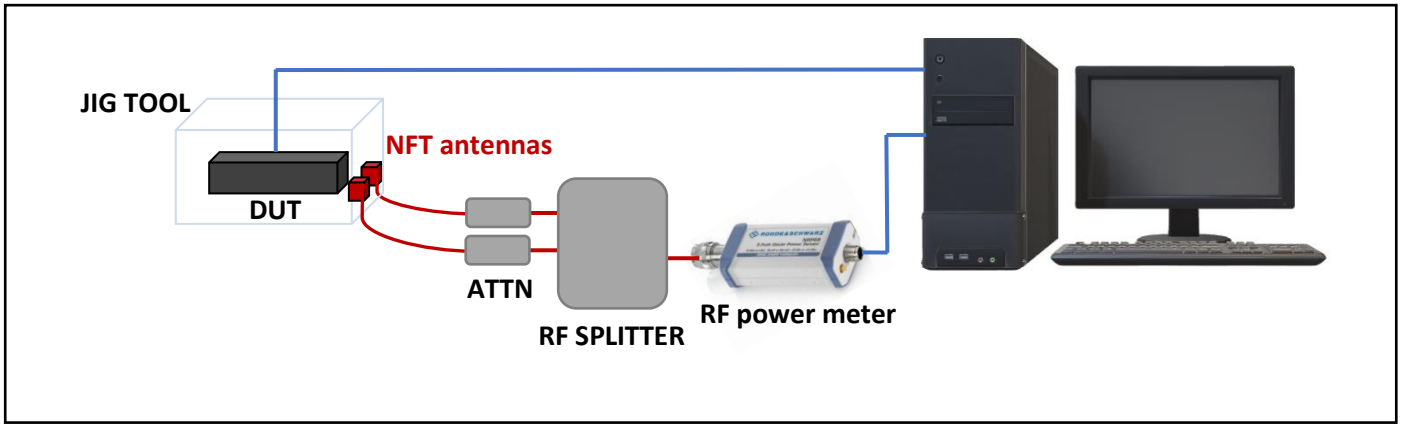
The radiated test consists in performing a RF near field power measurement to ensure the Wi-Fi antennas are correctly connected.

Setup

The M378 VF CAB-3BIS product must be positioned into a jig tool, equipped with an NFT antennas.
On the other hand, the test antennas are connected to a RF power meter. These NFT antennas must be placed as close as possible from the product.

The power meter must be preliminary calibrated and configured to perform measurement at the test frequency.
To configure Wi-Fi transmission, DUT shall be connected to the test computer.

TEST SETUP



Power measurement

- ⇨ Send the commands to the DUT to activate continuous TX transmission in MCS0 HT20, at 2412MHz (CH1) and +15dBm power level at chipset level.
- ⇨ Measure the RF power level at the NFT antenna ports.
- ⇨ Check that the values comply with the limits in the table below.
- ⇨ Repeat the 3 previous actions for each 2.4GHz Wi-Fi antennas.

		Target	Min	Max	Unit
Power measurement		**P***	**P-5**	**P+5**	dBm

* With P, the average power level found on production lines with the dedicated jig tool.

8.9 SPECIFIC [51421] [WIFI-5G] [M378 VF CAB-3BIS]

M378 VF CAB-3BIS Wi-Fi test procedure history:

Version	Date	Author	Motive and type of modification
01	04/07/2024	Vincent POLLEUX	Document creation
02	20/09/2024	DISSAUX Timothé	Adapting TX/RX targets to the M378 VF CAB-3BIS board

8.9.1 INTRODUCTION

This document aims to explain Wi-Fi test procedure for the M378 VF CAB-3BIS mainboard.

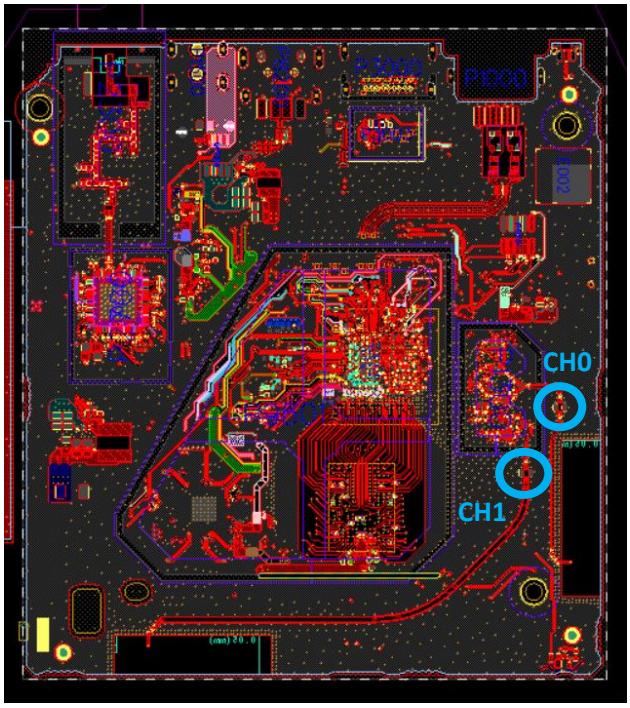
All tests listed in this part 8.1 shall be performed during the prototype validation process.

After verifying that CP & CPK are good for 5000 products, the test coverage can be limited to the mandatory tests highlighted in green.

8.9.2 BOARD DESCRIPTION

The M378 VF CAB-3BIS board is using a BCM74127 Chipset equipped with 2x RTC6608O RF switch for the 5GHz Wi-Fi part.

The picture below shows the configuration of all antennas and all chains.



8.9.3 LAUNCHING WIFI DRIVER

To activate the test driver, get the procedure relative to the board.

The PC communicates with the Wi-Fi chipset.

8.9.4 CONDUCTED TESTS – Wi-Fi 5GHz

TX tests

For all listed frequencies and modulations, we measure/verify Output Power, Mask margin compliance, EVM, Freq tolerance and LO leakage for each RF chain.

- Test TX_5G_1 : MCS0 vHT20 (mode 802.11ac)

	Frequency	**5180MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
Power	16.5	**14.5**	**18.5**	dBm
EVM	NA	**NA**	**-5**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-17.5**	dB

(1) should comply with IEEE80211ac

- Test TX_5G_2 : MCS9 vHT40 (mode 802.11ac)

	Frequency	**5230MHz**	Modulation	**MCS9 vHT40**
	Target	Min	Max	Unit
Power	10.5	**8.5**	**12.5**	dBm
EVM	NA	**NA**	**-32**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-20.6**	dB

(1) should comply with IEEE80211ac

- Test TX_5G_3 : HE-MCS0 vHT80 (mode 802.11ax)

For All Listed Frequencies and Modulation, we measure Output Power, EVM and Freq Accuracy on each channel on each antenna.

	Frequency	**5530MHz**	Modulation	**HE-MCS0 vHT80**
	Target	Min	Max	Unit
Power	15.5	**13.5**	**17.5**	dBm
EVM	NA	**NA**	**-5**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-32**	dB
	Frequency	**5690MHz**	Modulation	**HE-MCS0 vHT80**
	Target	Min	Max	Unit
Power	15.5	**13.5**	**17.5**	dBm
EVM	NA	**NA**	**-5**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-32**	dB

(1) should comply with IEEE80211ax

- Test TX_5G_4 : HE-MCS11 vHT80 (mode 802.11ax)

For All Listed Frequencies and Modulation, we measure Output Power, EVM and Freq Accuracy on each channel on each antenna.

	Frequency	**5290MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
Power	7.5	**5.5**	**9.5**	dBm
EVM	NA	**NA**	**-35**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-32**	dB
	Frequency	**5530MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
Power	7.5	**5.5**	**9.5**	dBm
EVM	NA	**NA**	**-35**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-32**	dB
	Frequency	**5690MHz**	Modulation	**HE-MCS11 vHT80**
	Target	**Min**	**Max**	Unit
Power	7.5	**5.5**	**9.5**	dBm
EVM	NA	**NA**	**-35**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-32**	dB
	Frequency	**5775MHz**	Modulation	**HE-MCS11 vHT80**
	Target	**Min**	**Max**	Unit
Power	7.5	**5.5**	**9.5**	dBm
EVM	NA	**NA**	**-35**	dB
MASK (1)	NA	**0**	**NA**	dB
Frequency tolerance	NA	**-20**	**+20**	ppm
LO Leakage	NA	**-99**	**-32**	dB

(1) should comply with IEEE80211ax

RX tests

- Test RX_5G_1 : MCS0 vHT20 (mode 802.11ac)

	Frequency	**5180MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -87dBm	NA	**0**	**10**	%
	Frequency	**5500MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -87dBm	NA	**0**	**10**	%
	Frequency	**5700MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -87dBm	NA	**0**	**10**	%
	Frequency	**5825MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -87dBm	NA	**0**	**10**	%

- Test RX_5G_2: HE-MCS11 vHT80 (mode 802.11ax)

	Frequency	**5210MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
PER RX Power -52dBm	NA	**0**	**10**	%
	Frequency	**5530MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
PER RX Power -52dBm	NA	**0**	**10**	%
	Frequency	**5775MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
PER RX Power -52dBm	NA	**0**	**10**	%

8.9.5 RADIATED TESTS – Wi-Fi 5GHz

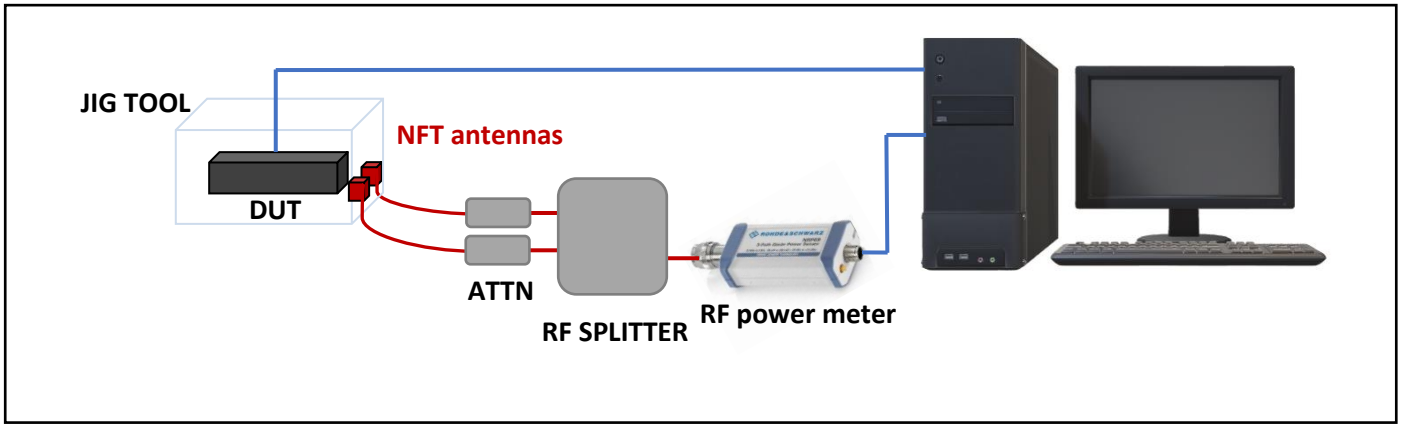
The radiated test consists in performing a RF near field power measurement to ensure the Wi-Fi antennas are correctly connected.

Setup

The M378 VF CAB-3BIS product must be positioned into a jig tool, equipped with an NFT antennas.
On the other hand, the test antennas are connected to a RF power meter. These NFT antennas must be placed as close as possible from the product.

The power meter must be preliminary calibrated and configured to perform measurement at the test frequency.
To configure Wi-Fi transmission, DUT shall be connected to the test computer.

TEST SETUP



Power measurement

- ⇨ Send the commands to the DUT to activate continuous TX transmission in MCS0 HT20, at 5180MHz (CH36) and +15dBm power level at chipset level.
- ⇨ Measure the RF power level at the NFT antenna ports.
- ⇨ Check that the values comply with the limits in the table below.
- ⇨ Repeat the 3 previous actions for each 5GHz Wi-Fi antennas.

		Target	Min	Max	Unit
Power measurement		**P***	**P-5**	**P+5**	dBm

* With P, the average power level found on production lines with the dedicated jig tool.

Part 9. Final tests with application

9.1 Decode audio / vidéo.

Connect the decoder to the Factory portal for testing and check the correct audio and video decoding. This test will be performed by **visual inspection** of the operator.

9.1.1 Decode test MPEG2.

Select an MPEG2 stream from the Factory portal and check the correct audio and video decoding.

9.1.2 Decode test H264.

Connect the decoder to the arrival of H.264 streams called "Europages" on the screen and check the correct audio and video decoding. This flow test has the advantage of high stress and allows the decoder to quickly identify defective products. This test will be performed by **visual inspection** of the operator.

9.1.3 Decode test 4K.

Select an UHD 4K stream from the Factory portal and check the correct audio and video decoding.

9.2 Test Descrambling.

- TBD

Part 10. OQC Tests

Tests by sampling

10.1 No reg Test

This test routine will test, with application software, the STB/VSB to prevent drift of process (BCM or Sagemcom).

Four products will be collected daily and placed on a wall in a test oven at 40°C. These products will be placed on a 4K stream during a period of 48 hours.

We will check the audio / video quality and robustness when zapping.

10.2 Audio / Video decoding tests

During the tests 4K video stream is used and the following output must be tested:

- HDMI output for video