Test specification

[ORANGE][DTIW377]

ACTIVITY	PROJECT	TYPE
HE2022	DTIW377	Specification

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OBJECT/ABSTRACT

This document outlines the various tests and controls to be applied on the board DTIW377 Orange

Part 1. Evolutions

Version	Date	Author	Motive and type of modification
0.1	Dec 12th 2022	GUILLEMOT Romain	First draft

Part 2.   Introduction

This paper presents the different tests and inspections to be applied in factory on [ORANGE][DTIW377] board.

Main features of the set-top-box are:

- 100M Ethernet
- Wi-Fi 2.4/5GHz
- Bluetooth 5.0
- USBA 2.0 rear panel
- Front Panel LED : Orange
- Rear panel button + Bottom cover button

   Additional options:
- uSD card reader
- 2 top microphones
- Side-panel privacy slider, with LED
- White LED + RGB LED
- 1x mid-range audio amplifier

   Reference documents:

Name	Reference
Schematic	R43 3000504328 02
CIU	254008273 CIU M377O-1
CIE	254008281 CIE M377O-1

Name	Reference
Schematic	R43 3000507923 01
CIU	254023754 CIU M377O-2
CIE	254023767 CIE M377O-2

Part 3.   Hardware Architecture

3.1 Synoptic for STB Board

Diagram Block M377O
Orange –Poland; France
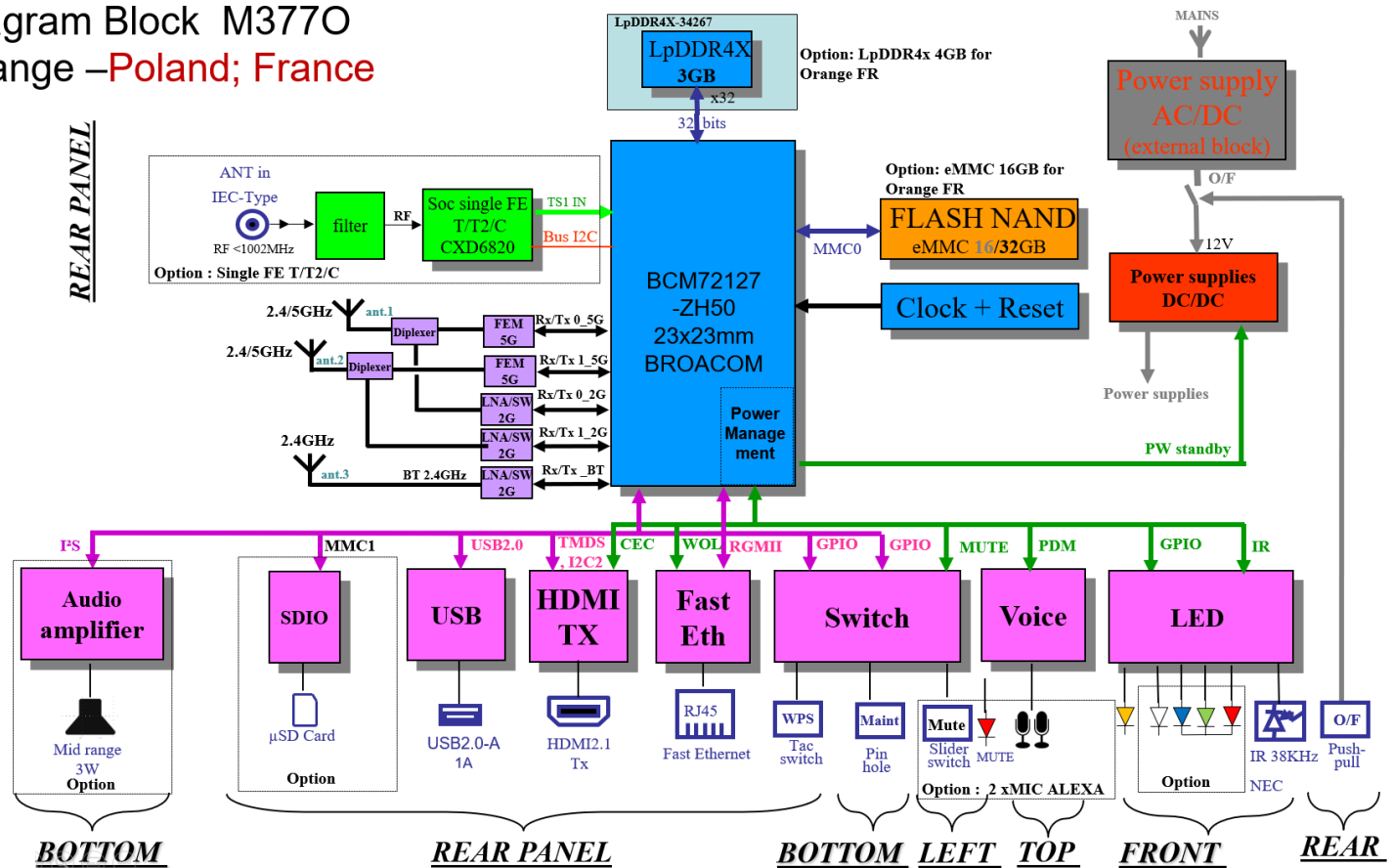
Part 4.   Test conditions

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 5.   In Circuit Test

5.1 Power Controls

Power Signal	Test Point	Function	Voltage	Measure		
				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	PT1510	FrontEnd	1.8V	1.71	1.89	V
P1VC_FE	PT16100	FrontEnd	1V	0.95	1.05	V
D0.8V_AVS_STB_CORE	PT15102	SoC	0.80V	0.69	0.86	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
P3V3C	PT15106	SoC	3.3V	3.13	3.46	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_3.3V	PT15107	SoC	3.3V	3.13	3.46	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

Part 6. 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 7.   Functional tests

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

They are based on SagemTests test software.

7.1 SPECIFIC [50170] [FEDVB-TT2] [M393GENA]

M3xx FE DVB-T/T2 test procedure history:

Version	Date	Author	Motive and type of modification
01	03/02/2020	EVRARD Ludovic	Document creation
02	22/06/2021	CHARDEL Pascal	Test level (Test#1) and C/N tolerance update
03	16/11/2021	GUILLEMOT Romain	Add getpid command

7.1.1 INTRODUCTION

This document aims to explain DTV DVB T/T2 Front End test procedure for the M377O mainboard.

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 and for DVB-T and DVB-T2 modes and must be performed on each of the available frontend units.
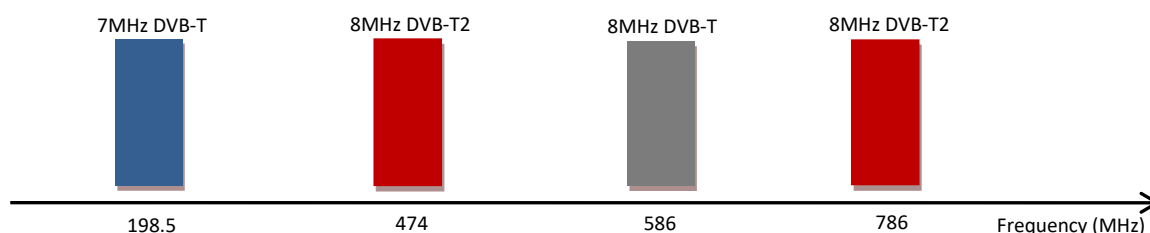
After verifying that CP & CPK are good for 5000 products, the test coverage can be limited to the mandatory tests highlighted in green.

Important remark:

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

7.1.2 T/T2 TEST SIGNAL CONDITIONS

Terrestrial frequency band occupation:

7MHz DVB-T test signal characteristics	
Bandwidth	7MHz
FFT	8K
Modulation	64QAM
Code rate	3/4
Guard interval	1/4
Input power	-68dBm
Carrier to Noise ratio	18.3dB

8MHz DVB-T test signal characteristics	
Bandwidth	8MHz
FFT	8K
Modulation	64QAM
Code rate	2/3
Guard interval	1/8
Input power	-70dBm
Carrier to Noise ratio	17.1dB

8MHz DVB-T2 test signal characteristics	
Bandwidth	8MHz
FFT	32KE
Modulation	256QAM
Code rate	3/5
Guard interval	1/128
Pilot Pattern	PP7
Input power	-70dBm
Carrier to Noise ratio	18.3dB
FFT Extended	Yes
Constellation rotation	Yes
PAPR	TR-PAPR
SISO/MIMO	SISO
FEC Frame length	64800
Input Mode	Mode A
TFS	No
High efficiency mode	HEM
FEF	Not used
Auxiliary streams	Not used

7.1.3 T/T2 TESTS

Test#1

Frequency 198.5MHz / 7MHz DVB-T test signal		Min	Max	Unit
Test_1_BER	FEDVB-TT2 198.5MHz : Viterbi BER	50	2000	.10-7
Test_1_UNCOR	FEDVB-TT2 198.5MHz : Uncorrected blocks	0	0	
Test_1_RSSI	FEDVB-TT2 198.5MHz : RSSI	-71	-65	dBm
Test_1_CN	FEDVB-TT2 198.5MHz : Carrier-to-Noise Ratio	16	20	dB
Test_1_FO	FEDVB-TT2 198.5MHz : Frequency Offset	-20	20	kHz
Test_1_RO	FEDVB-TT2 198.5MHz : Rate Offset	-50	50	ppm

Test#2

Frequency 474MHz / 8MHz DVB-T2 test signal		Min	Max	Unit
Test_2_UNCOR	FEDVB-TT2 474MHz : Uncorrected blocks	0	0	
Test_2_RSSI	FEDVB-TT2 474MHz : RSSI	-73	-67	dBm
Test_2_CN	FEDVB-TT2 474MHz : Carrier-to-Noise Ratio	16	21	dB
Test_2_FO	FEDVB-TT2 474MHz : Frequency Offset	-20	20	kHz
Test_2_RO	FEDVB-TT2 474MHz : Rate Offset	-50	50	ppm

Test#3

Frequency 586MHz / 8MHz DVB-T test signal		Min	Max	Unit
Test_3_BER	FEDVB-TT2 586MHz : Viterbi BER	50	2000	.10-7
Test_3_UNCOR	FEDVB-TT2 586MHz : Uncorrected blocks	0	0	
Test_3_RSSI	FEDVB-TT2 586MHz : RSSI	-73	-67	dBm
Test_3_CN	FEDVB-TT2 586MHz : Carrier-to-Noise Ratio	15	19	dB
Test_3_FO	FEDVB-TT2 586MHz : Frequency Offset	-20	20	kHz
Test_3_RO	FEDVB-TT2 586MHz : Rate Offset	-50	50	ppm

Test#4

Frequency 786MHz / 8MHz DVB-T2 test signal		Min	Max	Unit
Test_4_UNCOR	FEDVB-TT2 786MHz : Uncorrected blocks	0	0	
Test_4_RSSI	FEDVB-TT2 786MHz : RSSI	-73	-67	dBm
Test_4_CN	FEDVB-TT2 786MHz : Carrier-to-Noise Ratio	16	20	dB
Test_4_FO	FEDVB-TT2 786MHz : Frequency Offset	-20	20	kHz
Test_4_RO	FEDVB-TT2 786MHz : Rate Offset	-50	50	ppm

7.1.4 GetPid test

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

		Min	Max	Unit
FE_GetPid	Get PID information on locked frequency	1	1	none

7.2 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

7.2.1 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.

7.2.2 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

7.2.3 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

7.2.4 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

7.2.5 RQT_SHW_HDMI_HOTPLUG: HDMI OUT – Hot Plug detect test

> **Important warning:**
> The test of the Hot Plug detect part of the HDMI cable is not defined yet.

7.3 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

7.3.1 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.
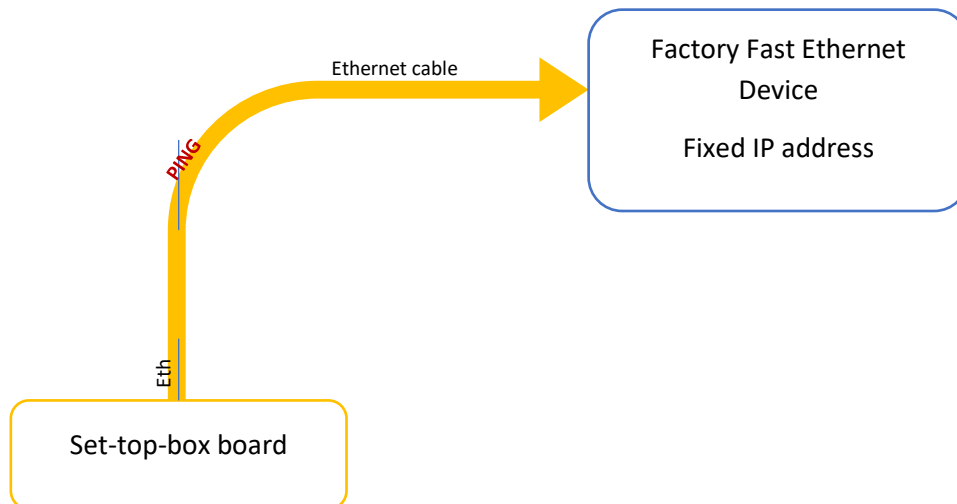
7.3.2 RQT_SHW_ETH_PING: Ethernet ping

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

7.4 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)

7.4.1 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.

7.4.2 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.

7.4.3 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

7.4.4 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

7.4.5 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

7.5 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

7.5.1 RQT_SHW_FPANEL_INFRARED: Front-panel infrared receiver test

The set-top-box will receive different key codes from an IR dongle, at 38kHz.

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

Measures

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

RQT_END

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

Template's history :

Version	Date	Author	Motive and type of modification
01	March 26th 2021	BERBEN Christophe	Document's creation

7.6.1   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:

-Bottom button "reset"

-Rear button "pairing"

-Side slider "privacy"

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

7.7 FUNCTIONAL TEST [50614] [FRONT PANEL] [LEDS]

Template's history :

Version	Date	Author	Motive and type of modification
01	Feb 25th 2021	GUILLEMOT Romain	Document's creation

7.7.1   RQT_SHW_FPANEL_LEDQ: Front-Panel LED

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

Sagemtest switches off the different leds (orange + white *(option)* +RGB *(option)*).

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 green led

The operator checks that the green led is turn on.

….

7.8FUNCTIONAL TEST [51310] [CHIPSET SECURITY] [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 on ICP DSIW88-4 CNL)

Important remark :

Chipset and product security is not part of the present document,

but is fully describded in the FCC document.

7.9 SPECIFIC [51400] [BLUETOOTH] [M377O-1]

M377O-1 Bluetooth test procedure history:

Version	Date	Author	Motive and type of modification
01	12/12/2022	POLLEUX Vincent	Document creation

7.9.1 INTRODUCTION

This document aims to explain Bluetooth test procedure for the M377O-1 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 7.1 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.

7.9.2 BOARD DESCRIPTION

The M377O-1 board is using a BCM72127 Chipset for Bluetooth 5.0.

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

Bluetooth test point
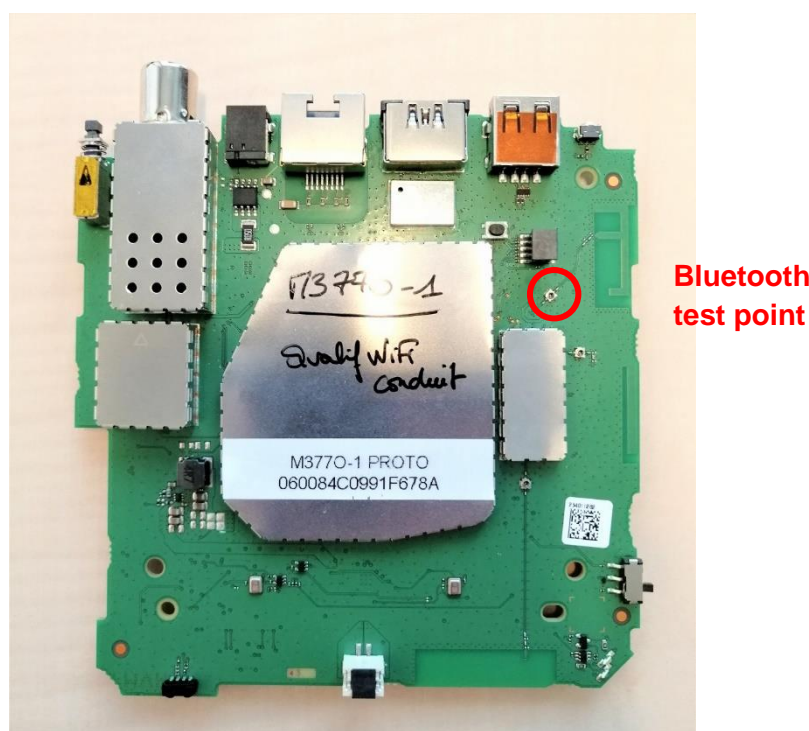
7.9.3 LAUNCHING BLUETOOTH DRIVER

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: STB_BCM4375B1_100.010_4375B1_UART_37_4MHz_fcbga_ipa_ref_stbda_class2.hcd

BR target power level: 5

BLE target power level: 5

7.9.4 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

RX tests

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 -95dBm	NA	**0**	**0.1**	%

- Test RX_EDR : 3-DH5 PRBS

	Frequency	**2402MHz**	Modulation	**3-DH5 PRBS**
	Target	Min	Max	Unit
BER at RX Power -85dBm	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 -95dBm	NA	**0**	**30**	%

7.9.5 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 M377O-1 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
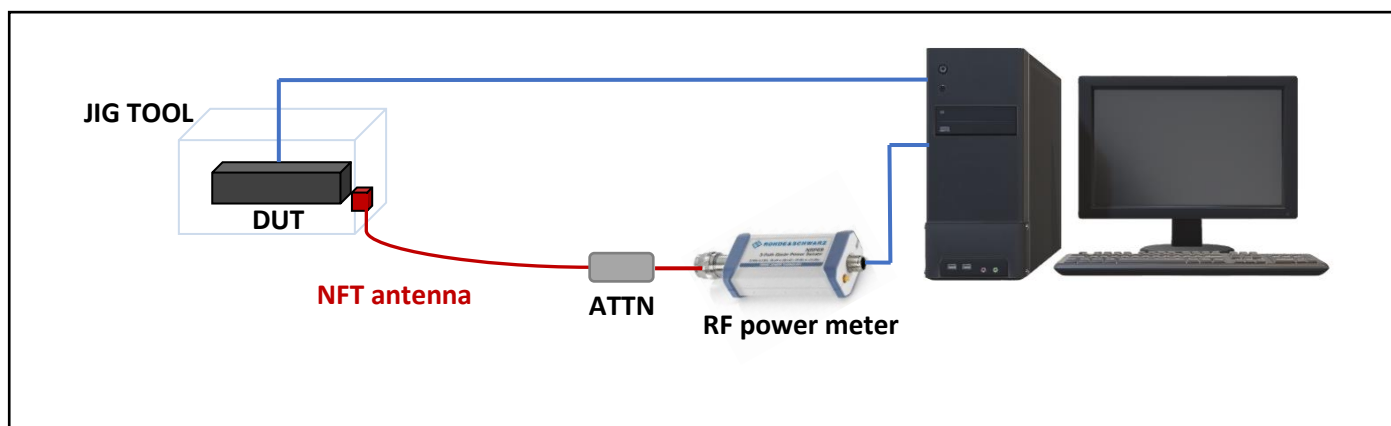
Power measurement
⇨ Send the commands to the DUT to activate continuous TX transmission in BDR mode, at 2402MHz (CH0) and +5dBm output power level at chip level.
⇨ Measure the RF power level at the NFT antenna port.
⇨ Check that the value complies with the limits in the table below.

		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.

7.10   SPECIFIC [51411] [WIFI-2.4G] [M377O-1]

M377O-1 Wi-Fi test procedure history:

Version	Date	Author	Motive and type of modification
01	12/12/2022	POLLEUX Vincent	Document creation

7.10.1 INTRODUCTION

This document aims to explain Wi-Fi test procedure for the M377O-1 mainboard.

All tests listed in this part 7.1 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.

7.10.2 BOARD DESCRIPTION

The M377O-1 board is using a BC72127 Chipset equipped with 2x RTC6603U RF switch for the 2.4GHz Wi-Fi part.

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

7.10.3 LAUNCHING WIFI DRIVER

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

The PC communicates with the Wi-Fi chipset.

7.10.4 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	16.5	14.5	18.5	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	13.5	11.5	15.5	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	13.5	11.5	15.5	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	12.5	10.5	14.5	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

RX tests

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 -91dBm	NA	**0**	**10**	%

- Test RX_2G_2 : MCS7 HT20

	Frequency	**2437MHz**	Modulation	**MCS7 HT20**
	Target	Min	Max	Unit
PER at RX Power -71dBm	NA	**0**	**10**	%

- Test RX_2G_3 : HE-MCS9 HT20

	Frequency	**2472MHz**	Modulation	**HE-MCS9 HT20**
	Target	Min	Max	Unit
PER at RX Power -67dBm	NA	**0**	**10**	%

7.10.5 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.
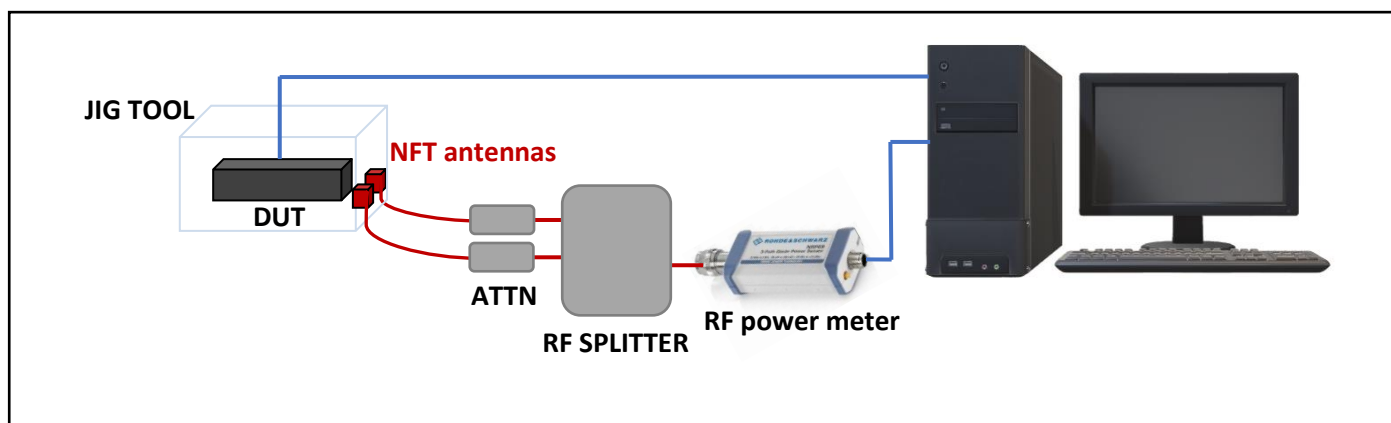
Setup

The M377O-1 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.

7.11 SPECIFIC [51421] [WIFI-5G] [M377O-1]

M377O-1 Wi-Fi test procedure history:

Version	Date	Author	Motive and type of modification
01	12/12/2022		Document creation

7.11.1 INTRODUCTION

This document aims to explain Wi-Fi test procedure for the M377O-1 mainboard.

All tests listed in this part 7.1 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.

7.11.2 BOARD DESCRIPTION

The M377O-1 board is using a BCM72127 Chipset equipped with 2x RTC7658 FEMs for the 5GHz Wi-Fi part.

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

7.11.3 LAUNCHING WIFI DRIVER

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

The PC communicates with the Wi-Fi chipset.

7.11.4 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	18.5	16.5	20.5	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	14.5	12.5	16.5	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	17.5	15.5	19.5	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	17.5	15.5	19.5	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	11.5	**9.5**	**13.5**	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	11.5	**9.5**	**13.5**	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	11.5	**9.5**	**13.5**	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	11.5	**9.5**	**13.5**	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 -94dBm	NA	**0**	**10**	%
	Frequency	**5500MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -94dBm	NA	**0**	**10**	%
	Frequency	**5700MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -94dBm	NA	**0**	**10**	%
	Frequency	**5825MHz**	Modulation	**MCS0 vHT20**
	Target	Min	Max	Unit
PER RX Power -94dBm	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 -57dBm	NA	**0**	**10**	%
	Frequency	**5530MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
PER RX Power -57dBm	NA	**0**	**10**	%
	Frequency	**5775MHz**	Modulation	**HE-MCS11 vHT80**
	Target	Min	Max	Unit
PER RX Power -57dBm	NA	**0**	**10**	%

7.11.5 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.
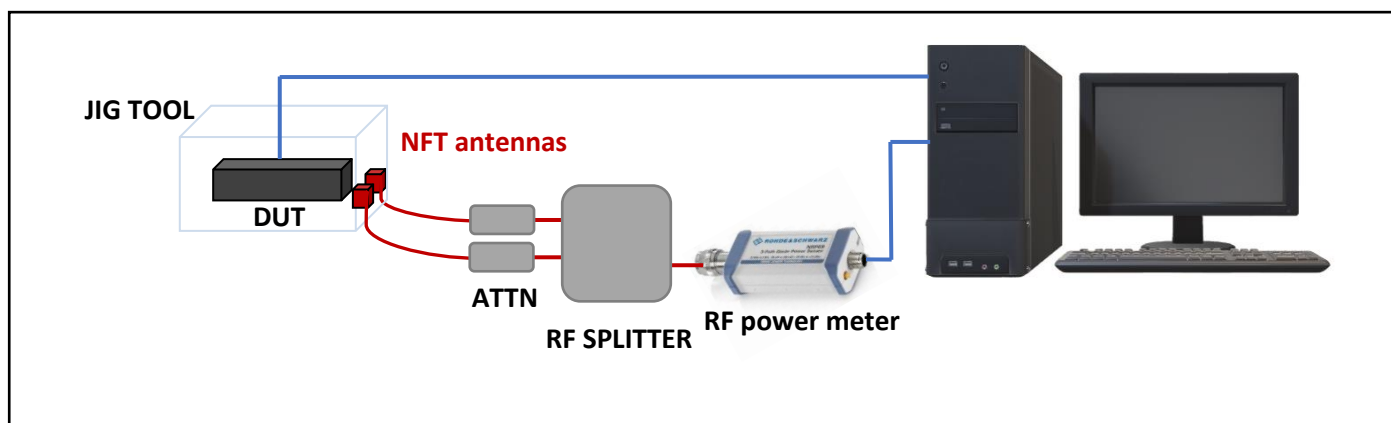
Setup

The M377O-1 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 8.   Final tests with application

8.1 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.

8.1.1   Decode test MPEG2.

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

8.1.2   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.

8.1.3   Decode test 4K.

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

8.2 Test Descrambling.

-   TBD

Part 9.   OQC Tests

Tests by sampling

9.1 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.

9.2 Audio / Video decoding tests

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

- HDMI output for video