LTE Chip Solutions for Every Device Type

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US60L user's guide 1.1

Legal Notices

Document Revision History

Revision	Date	Description
1	April 2015	Initial Revision
1.1	June 2015	Update with loss from cable Digikey 931-1193-ND & generic clean-up

Referenced Documents

Revision	Date	Document Name	Document Title
1	Nov 2015	Colibri_4G-EZ_LR4130_ATCommands_ReferenceManual_Rev1	Colibri Platform LR4.1.3.0 AT Commands Reference Manual
2.1	Nov 2015	Troubleshooting_guide_Rev2.1	Troubleshooting guide
1	Feb 2015	Sequans-DMTool-InstallGuide-Rev1	DM Tool Install Guide

Table of Contents

1. Introduction

This document is a dedicated set of instructions for using the US60L evaluation kit. It comes as a complement to the "Troubleshooting guide" which is a more generic set of instructions for any Sequans-based solution.

It is valid for Sequans LTE solutions based on UE4.1.3.0 onwards (with SW builds LR4.1.3.0 onwards).

It can be used for lab or field testing purpose.

2. Set-up description

The DUT is delivered as an evaluation kit with the US60L soldered on an M.2 board, connected to a main board.

Depending on the testing type that will be executed, the user may need additional RF cables (lab test or IOT testing), USB cable (for connection to the laptop, valid for any type of testing), a pair of antennas (for field or lab over-the-air testing), and a 2FF SIM card.

Please refer to "Appendix A" for some illustrations on how to connect the RF cables, the USB cable and insert a 2FF SIM card.

Prior to following the instructions below, please check that you have been provided with a USB driver (file format like ATT_413021962_2015_11_18.exe) and a DM Tool (file format like sqn4gdm_setup_12274exe_2015_11_16.exe)

3. General instructions

The DUT has been previously screened and flashed in FFF (FW From Flash) mode: the FW will be executed from the module, rather than from the host driving the DUT.

Please follow the recommendation in the "Appendix B", if you want to upgrade to a new firmware.

Prior to any operation, please make sure that you

- Install the Sequans driver and tools on the host PC. Instructions are provided in the "Troubleshooting guide", section "2. USB drivers installation" (using the executable ATT_413021962_2015_11_18.exe)
- Connect the DUT according to "Appendix A" (RF cable, USB cable, SIM insertion…)

Now the device should be ready to operate. You may want to install the DM (Diagnostic and Monitoring) tool to assist you in the monitoring and debugging activities while using US60L. The DM tool installation guide can help you through this process. The Troubleshooting guide can help you through the DM tool usage.

Prior to any other operation (lab or field on AT&T network), please

- Check if device configuration is correctly set for the AT&T test type, using following commands using ACM COM port (with configuration 115200-8-n-1)

- By default it should set to **ATT** testing (See "Colibri_4G-EZ_LR4130_ATCommands_ReferenceManual_Rev1" for detailed AT command settings – the Troubleshooting guide can help you understand where to type in AT instructions on the DM tool)
  - AT+SQNCTM?
  - AT+SQNAUTOCONNECT?
  - AT+CEMODE?
- You should read
  - \> AT+SQNCTM?
  - \> SQNCTM: ATT
  - \> AT+ SQNAUTOCONNECT?
  - \> 1
  - \> AT+ CEMODE?
  - \> +CEMODE: 2
- If the configuration is not as expected, using following commands, to set the correct one
  - AT+SQNCTM="ATT"
  - AT^RESET
    - Wait till reboot is completed
  - AT+SQNAUTOCONNECT=1,1
  - AT^RESET
    - Wait till reboot is completed
  - AT+CEMODE=2
  - AT^RESET
    - Wait till reboot is completed

3.1 Typical lab test setup overview
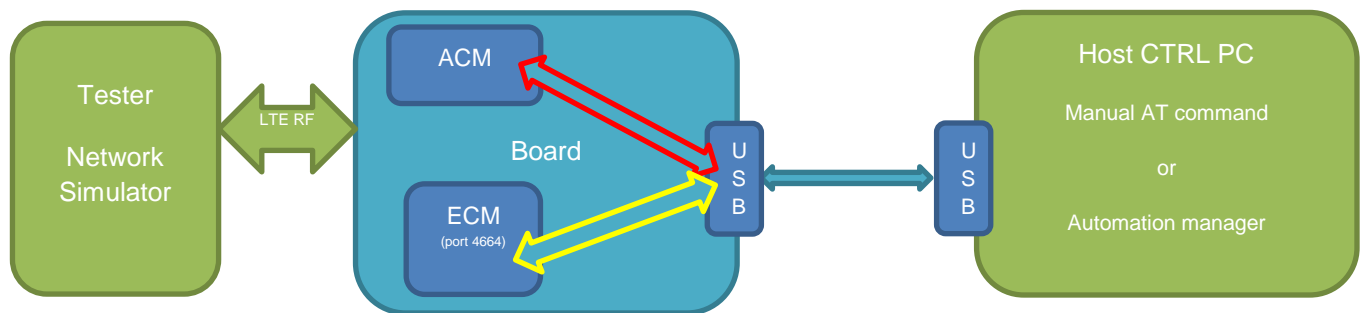
Above is a diagram of the normal setting of Conformance test for a US60L-based device in FFF mode. The tester includes a network simulator and a host PC controller with automation manager (Green part).

The host PC is connected to the DUT using USB interface.

Several network interface ports are available on the DUT

- 2 ECM (Ethernet) with IP 192.168.15.1 and 192.168.16.1
- 1 x ACM(serial) with dedicated COM port number

The automation manager can control the UE by sending AT command through ECM or ACM over USB

- ECM with IP address 192.168.16.1 port 4664 (Yellow line)
- ACM serial with speed 115200 and dedicated COM port number (Red line).

The specific automation scripts are provided by Sequans and can be used by the certification lab.

Appendix A – DUT Cabling

Please connect the device according to the following illustrations.

The Main RF cable from the tester side must be connected to the Primary Antenna connector (TX/RX), and Diversity RF cable to the Secondary antenna connector (RX).

The SIM card must be inserted as illustrated below

The USB cable for data connection and for powering up the DUT must be connected as illustrated below.

US60L_Setup_Instruction_R01

Appendix B – Firmware upgrade

 In order to upgrade the firmware (FFF Mode), please follow these steps

1- Connect the device on a WINDOWS PC, and wait 1 min during the device enumeration.

2- Open a web browser, and enter the URL http://192.168.15.1/

3- Enter the login "root", and the password "root" in order to access to the web ui
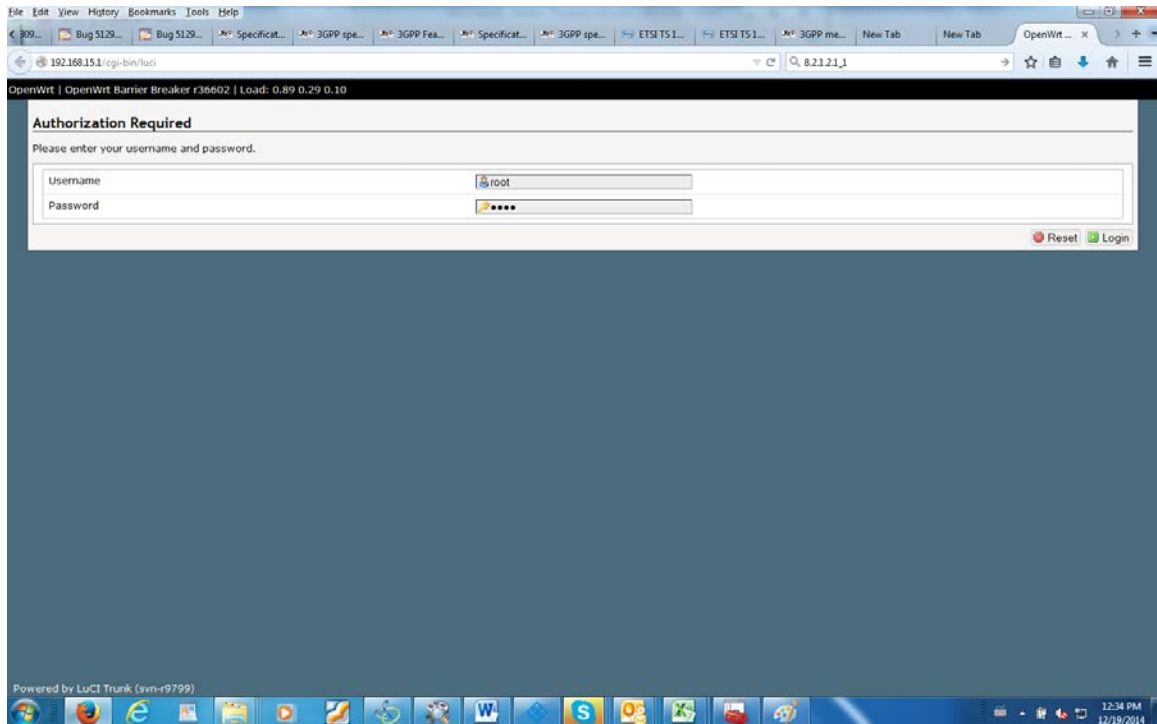
4- Click on "system" and on "backup/flash firmware", and untick "Keep settings"

5- Click on "browse" and select the .sfp file to flash (for example US60L_ECM-ACM-ECM-SQNIMS-ATT-REL10-WO-B17_LR4.1.3.0-21909.sfp)

6- Click on "Flash image"

US60L_Setup_Instruction_R01
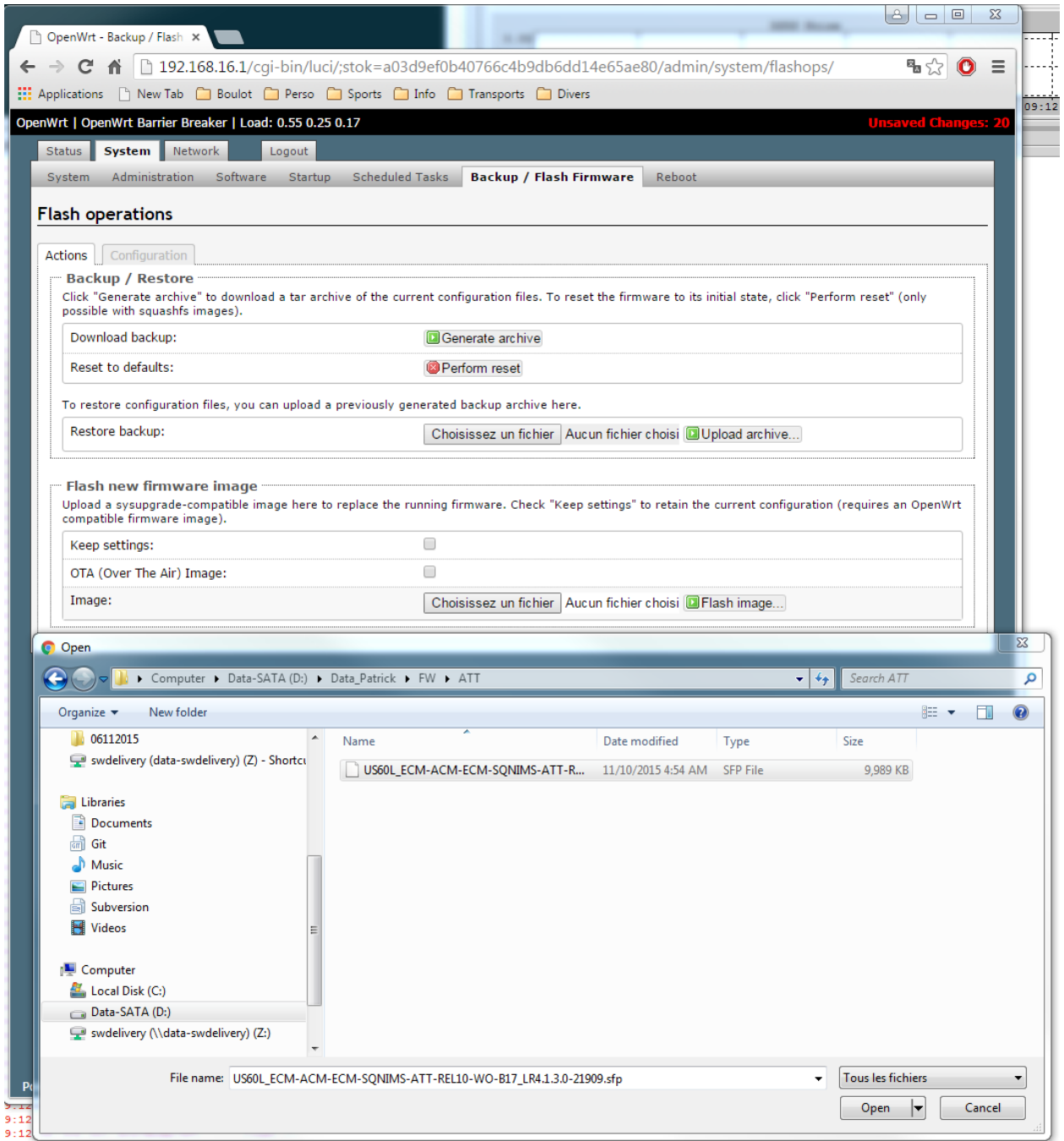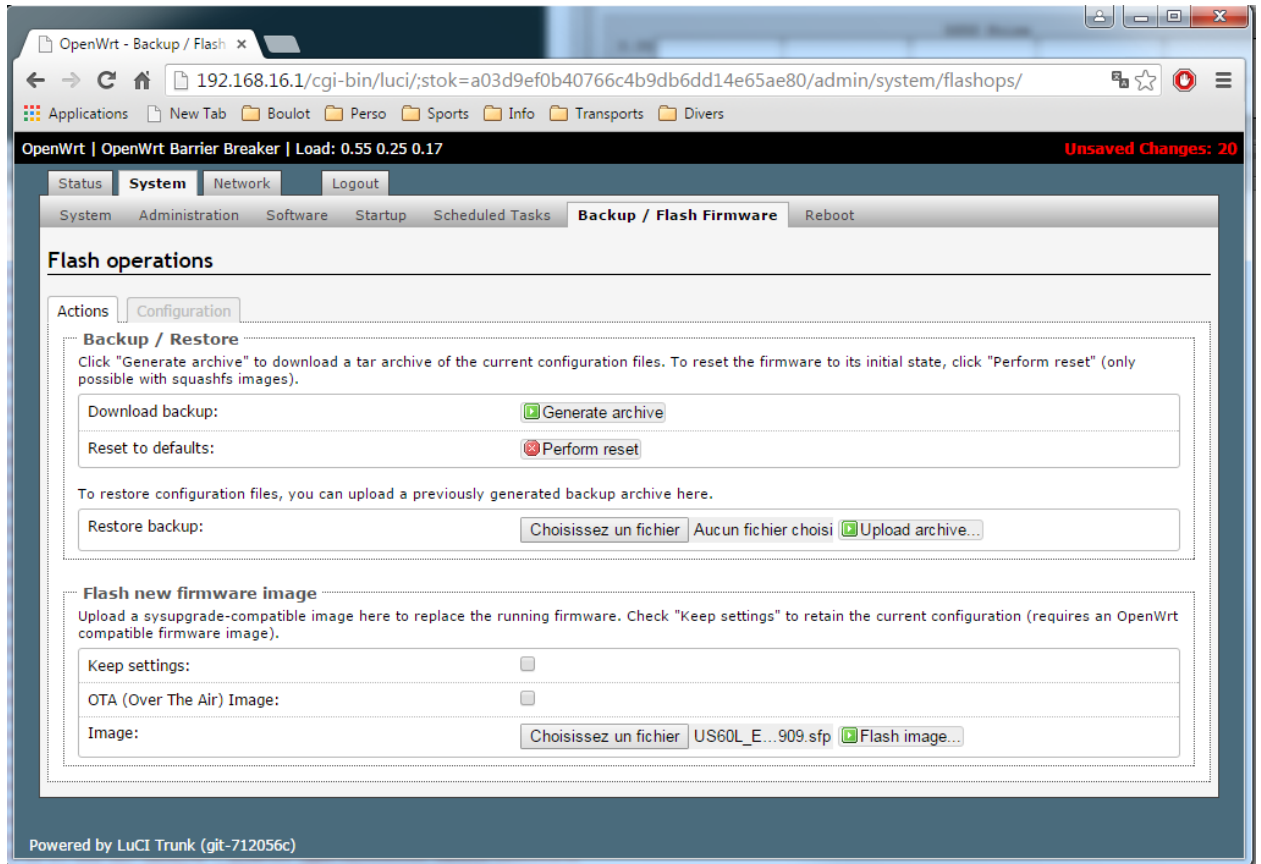
7- A new page with checksum will appear 2 min after the clicking of "flash firmware". Confirm the flash and wait for 2 min.
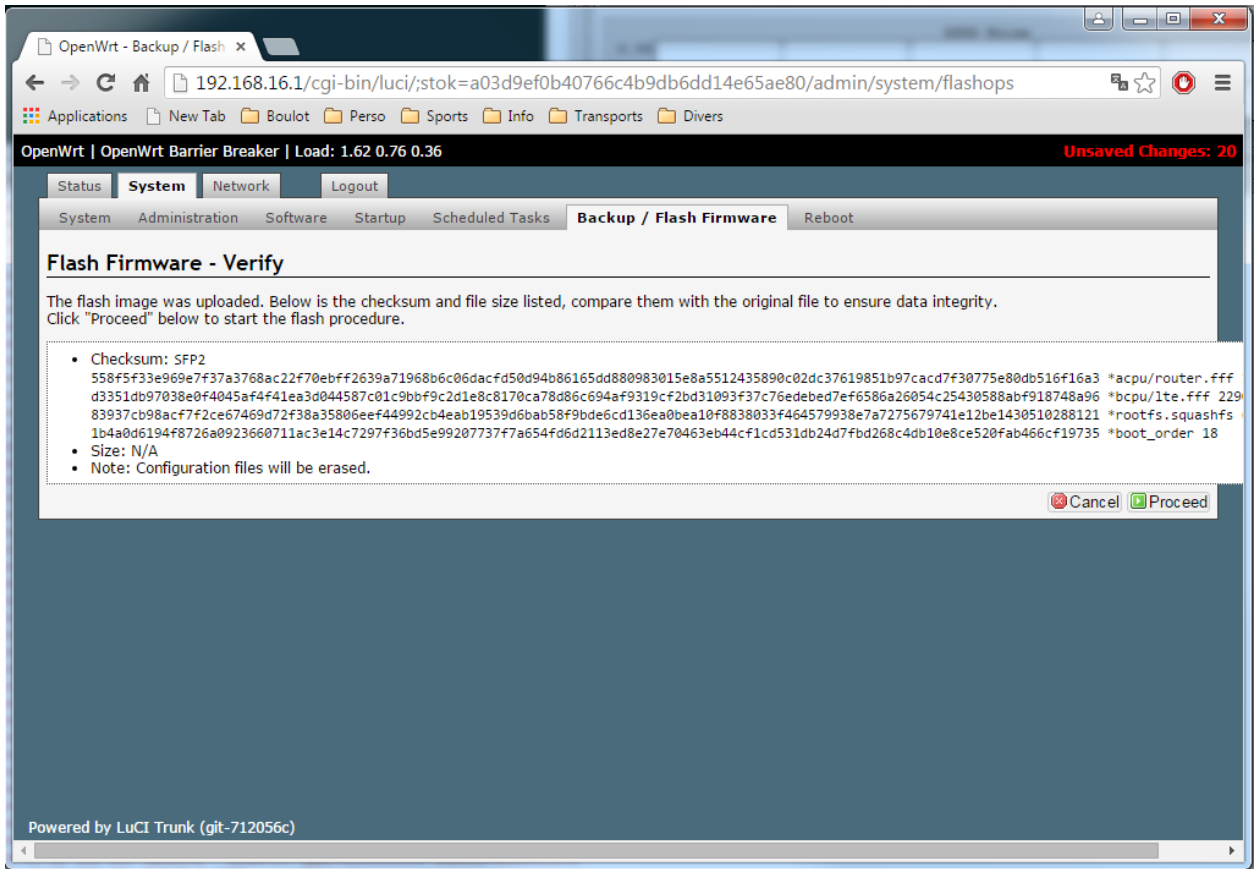
8- Click on "Proceed".

9- Wait: the board will restart

10- The target is now flashed

11- Configure the settings defined in the "general instruction" topic of this document

US60L_Setup_Instruction_R01

Appendix C – RF cable loss values for lab testing

The DUTs prepared for the certification have been calibrated at the **M2** antenna port, hence the new small grey cable which is not seen, as the samples have been closed need to be added as extra loss.

This cable is identified as **Digikey 931-1193-ND**
Please see below the datasheet, which shows a graph of the insertion loss of the cable.

Cable loss values

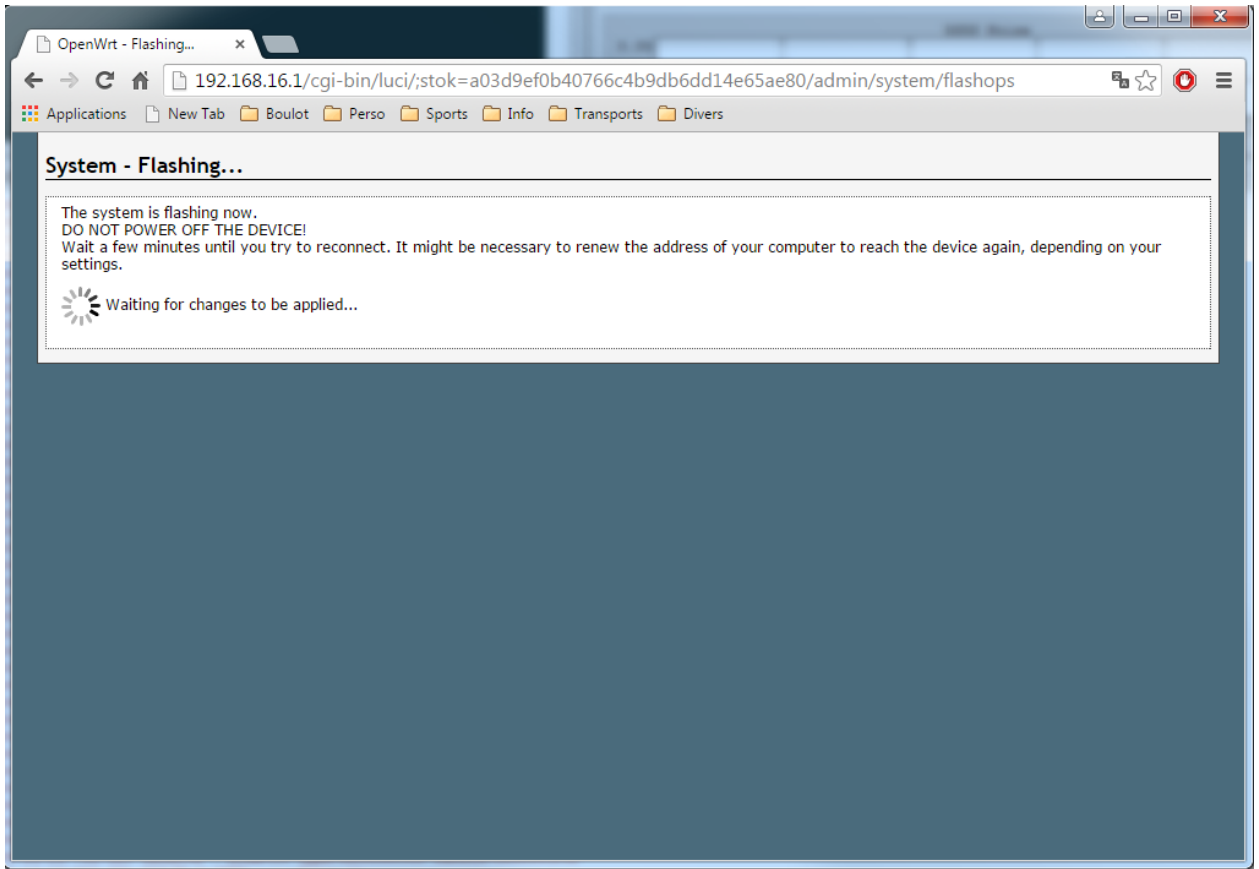To ease process, please use the table below, either R&S platform or Anritsu platform is being used for testing.

Frequency(GHz)	Cable Loss(dB)
0.00	0.00
0.10	0.10
0.30	0.20
0.50	0.39
0.75	0.38
0.78	0.36
1.71	0.55
1.76	0.55
2.11	0.61
2.16	0.61
3.00	0.83
3.10	0.74

Cable datasheet
The datasheet of the cables is available
under http://taoglas.com/images/product_images/original_images/CAB.S01.pdf

Insertion loss data extract below

1. Cable Insertion Loss
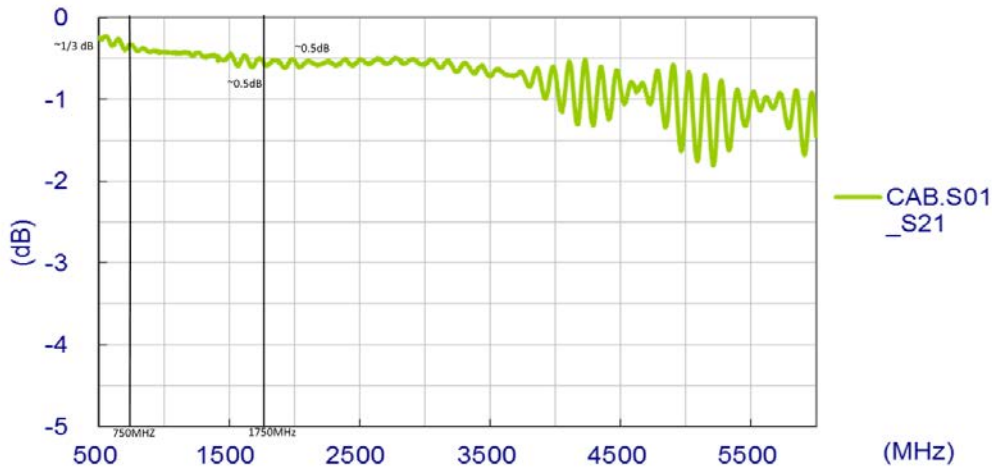
Cable loss measurement method with MXA/MXG

Cable insertion loss has been verified using two setups:

1) Measurement to SMA connectors

2) Measurement to SMA connectors including Digikey 931-1193-ND (referred to as "M.2 RF cable" in the figure below)

Analyzer is MXA MY 474 20141.

Generator is MXG MY 473 80 239.

Corresponding measurement are reported below. It correlates with the datasheet.

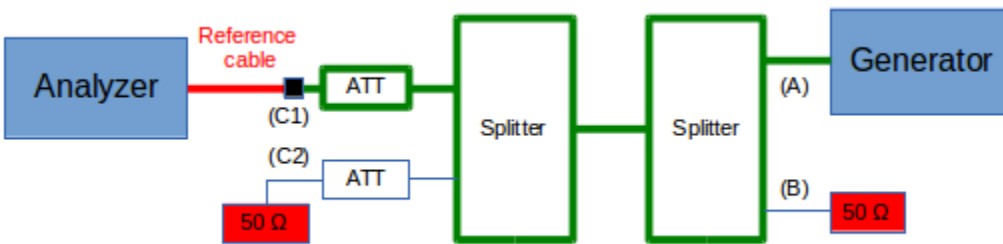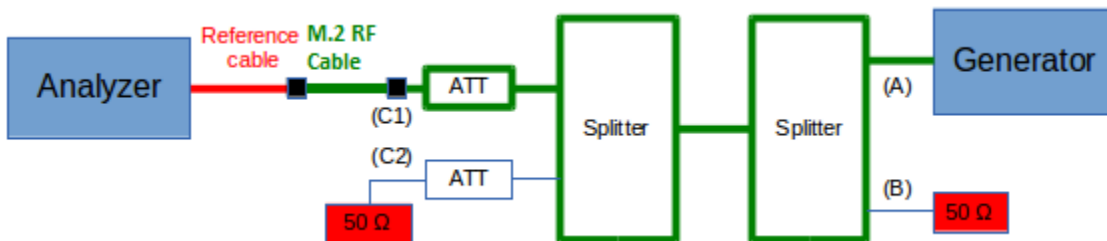| Frequency	Measurment to SMA connector	Measurment to SMA connector, including Digikey 931-1193-ND	Delta (Digikey 931-1193-ND)	
750000	13,55	13,93	-0.38	
760000	13,57	13,96	-0.39	
770000	13,61	13,99	-0.38	
780000	13,65	14,01	-0.36	
1710000	14,39	14,94	-0.55	
1720000	14,38	14,95	-0.57	
1730000	14,4	14,96	-0.56	-0.55 average value
1740000	14,43	14,98	-0.55	
1750000	14,43	14,97	-0.54	
1760000	14,44	14,97	-0.53	
1770000	14,46	14,99	-0.53	
2100000	14,89	15,53	-0.64	
2110000	14,89	15,47	-0.58	
2120000	14,86	15,43	-0.57	
2130000	14,93	15,46	-0.53	-0.605 average value
2140000	15,03	15,6	-0.57	
2150000	15,01	15,72	-0.71	
2160000	14,99	15,66	-0.67	

Appendix D – FCC regulations

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTE: FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

The product using this module must also comply with the maximum antenna gain to meet FCC EMC and RF exposure related limits. The modular grant lists those maximum gain values.

The OEM integrator needs show that the product hosting this module needs to be compliant with radiated and conducted emissions limits for unintentional radiators (digital devices) per 15B testing (limits in part 15.107 and 15.109, respectively).

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: **2AAGMUS60L**".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- o Reorient or relocate the receiving antenna.

- o Increase the separation between the equipment and receiver.

- o Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- o Consult the dealer or an experienced radio/TV technician for help.