

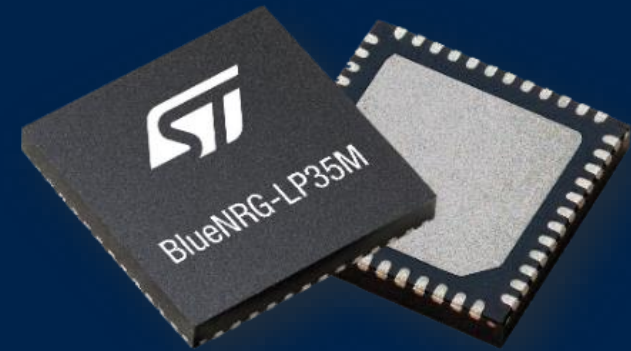


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BlueNRG-LP

BT & regional certification

EMEA application



- Any product using Bluetooth needs to get Bluetooth Compliance Certification.
- Moreover, in order to sell Bluetooth low energy product in regional countries, equipment needs to comply with the associated RF regulatory requirements (FCC) for North America, CE European Commission (R&TTE), IC (Industry Canada), Japan, Korea, Australia, etc.
- This document is listing:
 - ✓ Bluetooth certification requirements & estimated costs
 - ✓ Regional certification & estimated costs
 - ✓ ST recommendation and proposals for certification

BT certification

Bluetooth SIG qualification process

- All products using Bluetooth must complete the Bluetooth Qualification process.
<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing>
- Qualification process can follow either:
 - ✓ **Path 1 (listing without testing)**
Product based on an existing End Product (BLE module) or variant of an already qualified design.

Path 1: Qualification Process with No Required Testing

- ✓ **Path 2 (testing and listing)**
Product is a new design based on BlueNRG-LP.

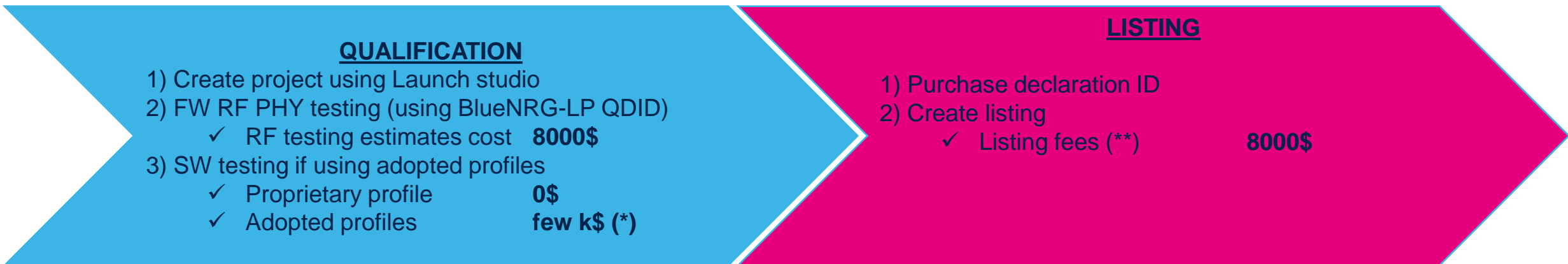
Path 2: Qualification Process with Required Testing

Below table is summarizing BlueNRG-LP QDIDs.

	BlueNRG-LP (QFN & WLCSP) BT5.2
QDID (PHY)	150274 (Component) BT5.2
QDID (Stack)	151645 Stack 3.0 (DK1.0) BT5.2

Path 2 : qualification and listing

- For new design based on BlueNRG-LP, qualification testing and listing must be considered.
<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing>
- Qualification process requires RF/SW testing in a Bluetooth Qualification Test Facility (BQTF) and listing.
 - ✓ RF testing : refer ST testing recommendation slides 8 & 9.
 - ✓ SW testing : required only if using Adopted BLE profile/service (heart rate profile, glucose meter profiles etc.)
- Below charts gives a quick overview for qualification and listing process & estimated associated costs.
<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing/qualification-listing-fees>



(*) Pending number and adopted profile used

(**) Note fees reduced to 4000\$ if SIG member

Where is done the BT qualification?

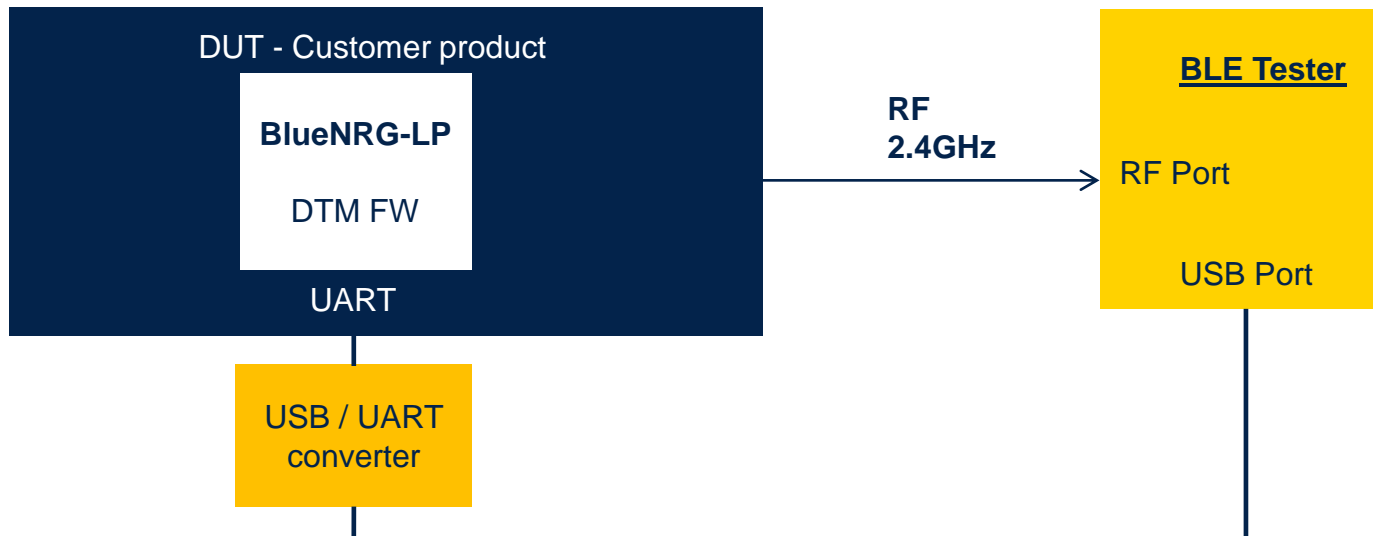
- Qualification testing process must be done in an official Bluetooth Qualification Test Facility (BQTF)
- A Bluetooth Qualification Test Facility (BQTF) is formally recognized by the Bluetooth SIG as competent to perform those Bluetooth qualification conformance tests.
- List of official BQTF is available on Bluetooth website.
<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing/qualification-test-facilities>.
- Other test houses (used for example for CE certification) can act as middleman with those BQTF.

SW & HW recommendation for BLE RF testing

- ST BLE stack is supporting few APIs customer should use in order to set the product in required mode:
 - ✓ HCI_LE_RECEIVER_TEST : allow to set the product in Rx continuous mode at dedicated frequency.
 - ✓ HCI_LE_TRANSMITTER_TEST : allow to set the product in Tx modulated mode at dedicated frequency.
 - ✓ HCI_LE_TEST_END : allow to stop the transmitter test or receiver text command.
 - ✓ HCI_RESET : allow to reset the device.
 - ✓ HCI_HAL_TONE_START : allow to set product in Tx continuous non modulated mode at dedicated frequency
 - ✓ HCI_HAL_TONE_STOP : allow to stop the tone start command.
- Direct Test Mode is mandatory for BLE certification : solution described in next slide must be used.
- Customer should then prepare its DUT so that:
 - ✓ BlueNRG-LP is flashed with DTM FW as described in next slide.
 - ✓ BlueNRG-LP UART tests points are present on product PCB
 - ✓ BLE tests are done in conducted mode only so RF cable should be implemented instead of antenna (ensure solid grounding connection)

DTM : Direct Test Mode

- BT tester is sending HCI commands directly to board under test.
- Dedicated FW (Vcom) must be set in host MCU
 - ✓ DTM project is available with STSW-NRGLP-DK package
 - ✓ DTM must be re-built according HW configuration (HS Xtal, LS Xtal, SMPS etc.)



Notes :

1. If using standard DTM FW, DUT will send vendor command after reset that may be wrongly interpreted by BLE tester. Solution can then be to compile and flash DTM binary in Link Layer only (LL_ONLY pre-processor option available in DTM code)
2. Some testers may not support DTM default UART baud rate (921600 by default). Solution can then be to compile and flash DTM binary with different UART baud rate (e.g. UART_BAUDRATE=115200 in pre-processing options)

Regional certification

Regional RF certification

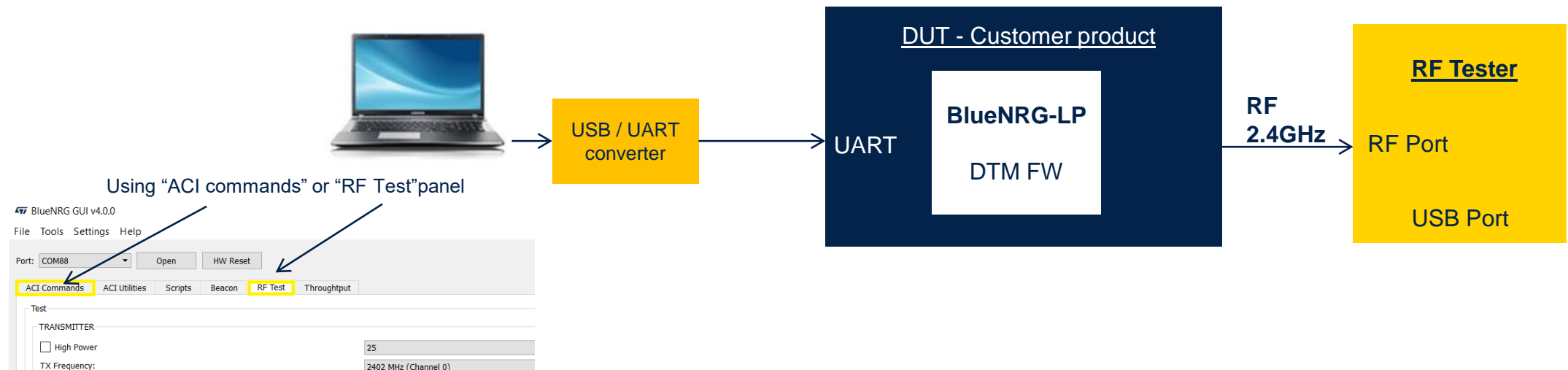
- In order to sell Bluetooth low energy product in regional countries, equipment needs to comply with the associated RF regulatory requirements:
 - ✓ FCC (Federal Communications Committee) for North America
 - ✓ CE European Commission (R&TTE)
 - ✓ IC (Industry Canada).
 - ✓ China etc.
- Regional certification are HW dependent (antenna, layout etc.).
When using chipset (BlueNRG-LP), customer must handle full regional certification.
ST just provides evidence that those chipsets are compliant with this certification
- Below link is providing RF requirements for all countries
<https://ctech.ul.com/en/services/global-market-access-gma/global-radio-type-approvals/>

SW & HW recommendation for regional RF testing

- Customer could use solution 1 or solution 2 described in next slides.
 - ✓ Solution 1 through our GUI is the recommended one most simple.
 - ✓ Solution 2 can be used when difficult to access UART test points or because such test FW was already implemented in customer FW production test for example.
- Customer should then provide DUT to test house so that:
 - ✓ BlueNRG-LP is flashed with DTM FW (solution 1) or dedicated test FW (solution 2).
 - ✓ RF test can be done in conducted or radiated mode.
 - For conducted tests RF cable should be implemented instead of antenna (ensure solid grounding connection)
 - ✓ A short doc could be provided to test house in order to explain operator:
 - How powering up the product
 - How installing and use our GUI if needed
 - How setting the product in Rx or Tx mode (Rx, Tx max power low channel, Tx max power mid channel, Tx max power high channel etc.)

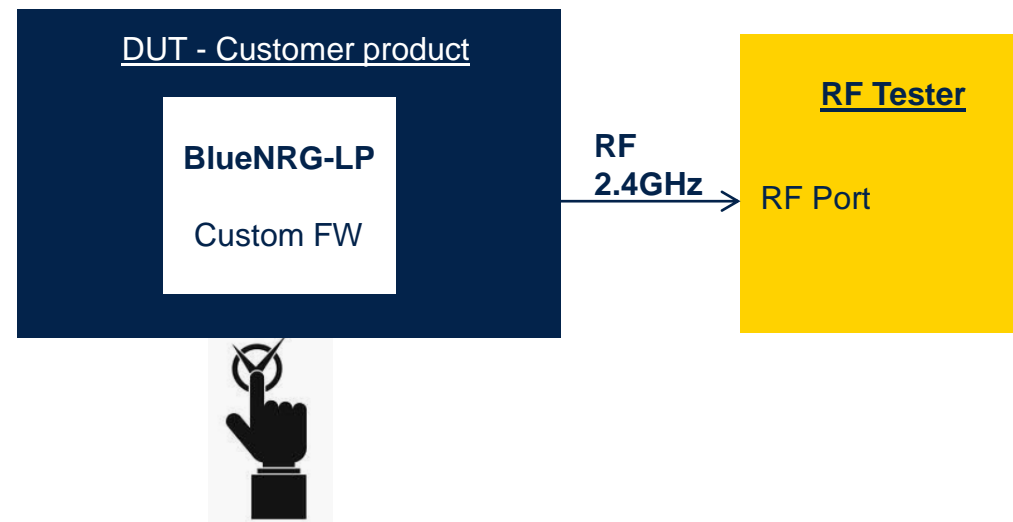
Solution 1 : using our GUI

- An operator using PC with our GUI is needed to send dedicated ACI/HCI tests commands.
- Dedicated FW (DTM) must be set in host MCU
 - ✓ PC GUI is available under [STSW-BNRGUI](#) at st.com
 - ✓ DTM project is available with [STSW-NRGLP-DK](#) package
 - ✓ DTM must be re-built according HW configuration (HS Xtal, LS Xtal, SMPS etc.)



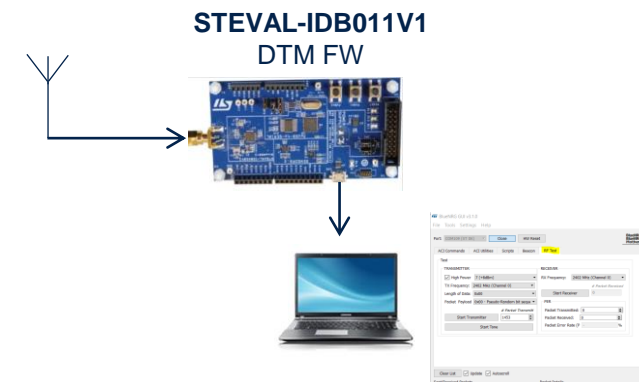
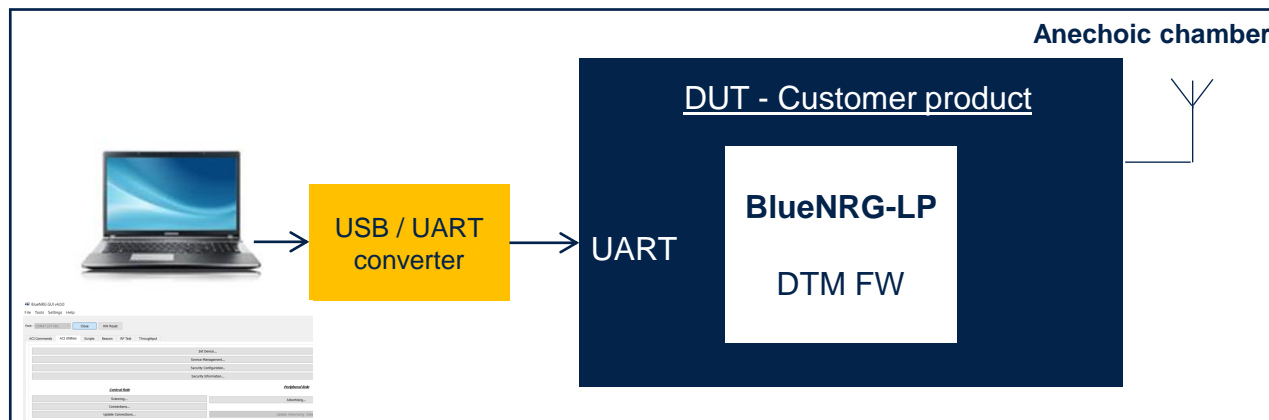
Solution 2 : dedicated SW

- It is also possible for customers to do a specific application SW test that will set the product in dedicated test mode through specific action.
- For example:
 - ✓ Press 5 seconds on button 1 creates DUT entering in test mode
 - ✓ Press button 1 again : DUT enters Rx mode through HCI_LE-RECEIVER_TEST command
 - ✓ Press button 1 again : DUT enters in Tx mode (max power, channel low) through HCI_LE_TRANSMITTER_TEST
 - ✓ Press button 1 again : DUT enters in Tx mode (max power, mid channel) through HCI_LE_TRANSMITTER_TEST
 - ✓ Etc..



Immunity test (1)

- For regional certification, test house may ask to check final product is able to sustain BLE communication under RF stress such as blocking.
- Suggested setup could be as below.
 - ✓ Device under test host microcontroller is flashed with Vcom and connected to PC GUI tool as per solution 1.
 - ✓ BlueNRG-LP (for example) ST evaluation kit is also used outside anechoic chamber. Eval kit is flashed with DTM FW and connected also to a PC GUI tool.

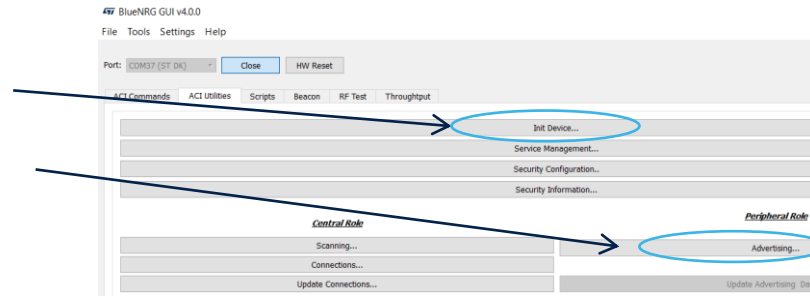


- Thanks to ACI Utilities panel, you can quickly establish a BLE link between DUT and ST eval kit (see next slide).

Immunity test (2)

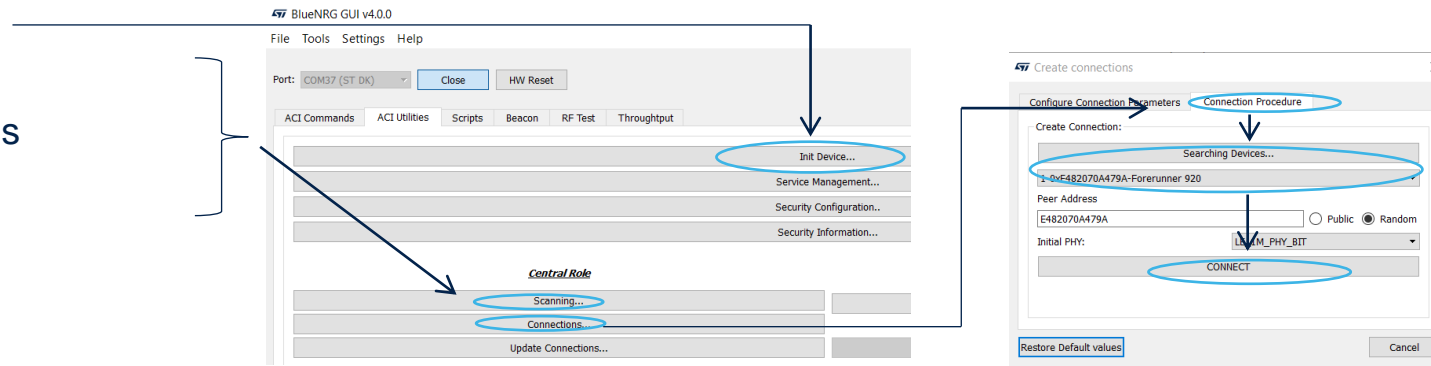
1 DUT : Advertise

- Init device
- Start advertising



2 STEVAL-IDB011V1 : scan and connect

- Init device
- Scanning
- Connections
- Connect



3 STEVAL-IDB011V1 : Monitor if disconnection happens

- If link with DUT is broken, disconnection event will appear

Sent/Received Packets		Packet
N.	Time	Type
1442	09:01:1...	Job finished
1443	09:01:1...	ACI_GAP_PROC_COMPLETE...
1444	09:01:1...	HCI_LE_META_EVENT
1445	09:01:3...	HCI_DISCONNECTION_CO...



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Thank you

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