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BLT2450
WebSockets API

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History

Date	Author	Change
30.05.2022	TALRA	Initial
16.09.2022	TALRA	Updating API

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1 Purpose

The BLT2450 tester can be controlled using a WebSocket based API which makes it easy to integrate the device in many different platforms such as Mathlab, LabVIEW, Python, JavaScript, node.js or .NET. In order to use the BLT2450 WebSocket API (BWA), the BLT2450 WebSocket Server (BWS) must be installed and running.

In addition to accessing BLT2450 testers, the BWA also supports controlling devices under test (DUT) having a DTM compatible interface [3].

2 Terms and definitions

BLT2450	Arendi Bluetooth Tester
BWS	BLT2450 WebSocket Server
BWA	BLT2450 WebSocket API
DUT	Device Under Test
DTM	Direct Test Mode
API	Application Programming Interface
dB	Ratio in decibels
dBm	Power in decibles, relative to 1mW
API	Application Programming Interface

2.1 References

[1] WebSocket specification: https://datatracker.ietf.org/doc/html/rfc6455
[2] JSON specification: https://www.rfc-editor.org/rfc/rfc4627#section-2
[3] DTM Specification: See Bluetooth Specification Version 4.0, Vol. 6, Part F

3 Overview

The BLT2450 WebSocket server must be running on the workstation, where the BLT2450 tester and DUT are connected to. Any WebSocket capable client can then access the BLT2450 WebSocket API (BWA) to control all attached tester and DUT.

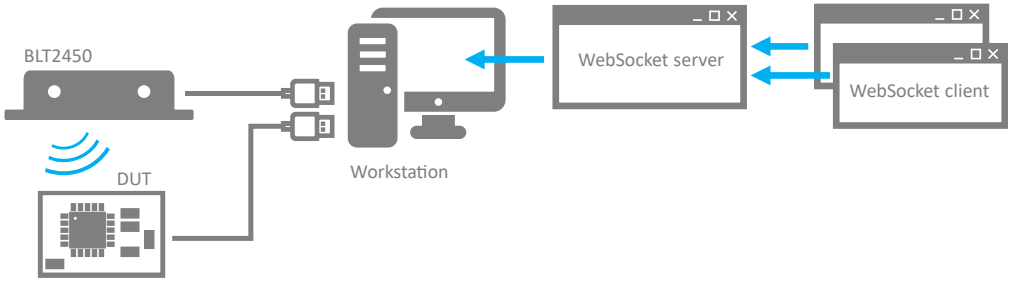

Image 1 Typical setup: Running a BLT2450 WebSocket server on a workstation

3.1 Server address

Once started, the server is accessible under ws://localhost:5000/blt24. Only one server instance can be running at at time while multiple clients are allowed to connect and perform actions as long as they don't disrupt each other.

3.2 Requests

Requests are messages sent by clients and received by the server. Requests can be generated at any time and are generally responded by the server sending an apropriate indication. There will be no handshakes and the server response may be generated once the requested operation has completed.

3.3 Indications

Indications are messages sent from the server and received by all connected clients. Indications such as ListIndications can be generated after a client has requested the operation or without a preceding request (e.g. BLT2450 was attached or removed).

4 API

All API messages must be JSON encoded and containing data is case sensitive.

4.1 Message structure

Every message must have a "type" field containing a string of the message type. Most messages contain additional data which is stored in the "data" field.

A typical message looks like the example below:

```
{
  "type":"TesterModeIndication",
  "data":{
    "serialNumber":"E02573369A2B-09",
    "mode":1}
}
```

4.2 Tester commands

4.2.1 TesterListRequest

This message can be sent by any client to request a list of all currently available BLT2450 tester. Upon reception, the server will respond with a TesterListIndication (see below).

Property	Value, content	Description
type:string	"TesterListRequest"	

4.2.2 TesterListIndication

This message is sent to all clients whenever the list of BLT2450 has changed or when the list was requested with TesterListRequest.

Property	Value, content	Description
type:string	"TesterListIndication"	Message type
data:devices:Tester[]	[Tester1, Tester2,..]	Array of all available Tester (see definitions below)

Tester

Property	Value, example	Description
serialNumber:string	"E02573369A2B-09"	Tester serial number

productName:string	"BLT2450"	Tester product name
hardwareId:number	9	
hardwareVersionMajor:number	3	
hardwareVersionMinor:number	0	
firmwareVersionMajor:number	9	
firmwareVersionMinor:number	10	
mode:TesterMode	Number representing current tester mode	See TesterMode definitions 4.4.1
dtmMode:DtmMode	See DtmMode definitions 4.4.24.4.1	
attenuationDb:number		

4.2.3 TesterModeRequest

This message can be sent by any client to set a specific BLT2450 into the defined operation mode

Property	Value, content	Description
type:string	"TesterModeRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.mode:TesterMode	Number representing desired tester mode	See TesterMode definitions 4.4.1

4.2.4 TesterModeIndication

This message is sent to all clients whenever the operation mode of a BLT2450 has changed (usually after a TesterModeRequest was issued).

Property	Value, content	Description
type:string	"TesterModeIndication"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.mode:TesterMode	Number representing current tester mode	See TesterMode definitions 4.4.1

4.2.5 TesterDtmStartTxRequest

This message can be sent by any client to start DTM Tx test on the specified BLT2450 tester. If the tester is available and in Dtm mode, the server will respond with a TesterDtmModeIndication, otherwise the message will be ignored.

Property	Value, content	Description
type:string	"TesterDtmStartTxRequest"	Message type

data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.channel:number	Dtm channel number	See TesterMode definitions 4.4.1
data.length:number	1, 2, 3…37 (default)	See DtmLength definitions
data.pattern:BitPattern	0, 1, 2, 3	See DtmPattern definitions
data.phy:Phy	1 (default), 2, 3, 4	See Phy definitions
data.powerDbm:TxPower	0 (default)	See TxPower definitions. Leave undefined to start Tx test without modifying the current tx power.
data.attenuationDb: number	0, 0.25, 0.5, … 119.75, 120	Attenuation in 0.25 dB steps. Leave undefined to start Tx test without modifying the current attenuation.

4.2.6 TesterDtmStartRxRequest

This message can be sent by any client to start DTM Rx test on the specified BLT2450 tester. If the tester is available and in Dtm mode, the server will respond with a TesterDtmModeIndication, otherwise the message will be ignored.

Property	Value, content	Description
type:string	"TesterDtmStartRxRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.channel:number	0, 1, 2 .. 39	See DtmChannel definitions
data.length:number	1, 2, 3…37 (default)	See DtmLength definitions
data.pattern:BitPattern	0, 1, 2, 3	See DtmPattern definitions
data.phy:Phy	1 (default), 2, 3, 4	See Phy definitions
data.intervalMs:number	1000 (default)	Measurement interval in ms
data.attenuationDb: number	0, 0.25, 0.5, … 119.75, 120	Attenuation between 0 and 120 dB in 0.25 dB steps

4.2.7 TesterDtmResultIndication

This message is sent by the server whenever new DTM measurement data from a tester is available. The indication is periodically generated with the interval defined in the TesterDtmStartRxRequest.

Property	Value, content	Description
type:string	"TesterDtmResultIndication"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.count:number		Number of received DTM packets
data.intervalMs:number		Time spent waiting for DTM packets in ms
data.per:number	0 .. 100	Packet Error Rate in %

4.2.8 TesterDtmStopRequest

This message can be sent by any client to stop a running DTM Tx or Rx test on the specified BLT2450 tester. If the tester is available and in Dtm mode, the server will respond with a TesterDtmModeIndication, otherwise the message will be ignored.

Property	Value, content	Description
type:string	"TesterDtmStopRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester

4.2.9 TesterDtmModeIndication

This message is sent to all clients whenever the DTM mode of a BLT2450 has changed (usually after TesterDtmStartTxRequest, TesterDtmStartRxRequest or TesterDtmStopRequest was issued).

Property	Value, content	Description
type:string	"TesterDtmModeIndication"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.mode:number	Number representing current DTM mode	See DtmMode definitions

4.2.10 TesterAttenuationSetRequest

This message can be sent by any client to set the attenuation of a specific BLT2450. If the tester is in Attenuator mode, its attenuation will be set accordingly and a TesterAttenuationIndication is generated. Otherwise this message will be ignored.

Property	Value, content	Description
type:string	"TesterAttenuationSetRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.attenuationDb: number	0, 0.25, 0.5, … 119.75, 120	Attenuation between 0 and 120 dB in 0.25 dB steps

4.2.11 TesterAttenuationIndication

This message is sent to all clients whenever the attenuation of a BLT2450 in Attenuator mode has changed (usually after a TesterAttenuationSetRequest was issued).

Property	Value, content	Description
type:string	"TesterModeIndication"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.attenuationDb: number	0, 0.25, 0.5, … 119.75, 120	Attenuation between 0 and 120 dB in 0.25 dB steps

4.2.12 TesterGeneratorStartRequest

This message can be sent by any client to start the generator output of a specific BLT2450. If the tester is in Generator mode, its output will be set accordingly and a TesterGeneratorIndication is generated. Otherwise this message will be ignored.

Property	Value, content	Description
type:string	"TesterGeneratorStartRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.channel:number	0, 1, 2 .. 39	See DtmChannel definitions
data.powerDbm:number	0 (default) .. -120	The desired output power in dBm

4.2.13 TesterGeneratorPowerSetRequest

This message can be sent by any client to set the generator output of a specific BLT2450. If the tester is in Generator active mode, its output will be set accordingly and a TesterGeneratorIndication is generated. Otherwise this message will be ignored.

Property	Value, content	Description
type:string	"TesterGeneratorPowerSetRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.powerDbm:number	0 (default) .. -120	The desired output power in dBm

4.2.14 TesterGeneratorStopRequest

This message can be sent by any client to stop the generator output of a specific BLT2450. If the tester is in Generator mode, its output will be stopped and a TesterGeneratorIndication is generated. Otherwise this message will be ignored.

Property	Value, content	Description
type:string	"TesterGeneratorStopRequest"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester

4.2.15 TesterGeneratorIndication

This message is sent to all clients whenever the generator settings of a BLT2450 in Generator mode has changed (usually after a TesterGeneratorStartRequest, TesterGeneratorStopRequest or TesterGeneratorPowerSetRequest was issued).

Property	Value, content	Description
type:string	"TesterModeIndication"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.active:bool	true / false	True when generator output is switched on
data.channel:number	0 (default) .. 39	Current channel (see DtmChannel definition)
data.powerDbm:number	0 (default) .. -120	The current output power in dBm

4.3 DUT commands

4.3.1 DutListRequest

This message can be sent by any client to request a list of all currently available DUTs. Upon reception, the server will respond with a DutListIndication (see below).

Property	Value, content	Description
type:string	"DutListRequest"	

4.3.2 DutListIndication

This message is sent to all clients whenever the list of DUTs has changed or when the list was requested with DutListRequest. Note that DutListIndication contains a list of all potential DUTs, i.e. all devices available on the workstation that appear as either "real" or virtual COM ports. It is the responsibility of the client software to decide which devices actually are DTM compatible and may be treated like a DUT.

Property	Value, content	Description
type:string	"DutListIndication"	Message type
data:devices:Dut[]	[Dut1, Dut2,..]	Array of all available Dut (see definitions below)

Dut

Property	Value, example	Description
identifier:string	"COM3"	DUT identifier string
description:string	"CDC UART Port (COM3)"	DUT description string
connectionStatus:number		See ConnectionStatus definition
baudrate:number		
handshake:number	0	
parity:number	0	
specification:number	3	See Specification definition
dtmMode:number	Number representing current DUT DTM mode	See DtmMode definitions

4.3.3 DutConnectRequest

This message can be sent by any client to open the UART connection of a DUT with the provided arguments. After a DUT connection has been opened, the server responds with a DutConnectionIndication. It is the responsibility of the client software to make sure that the provided arguments match the DUT settings and that only DTM compatible devices are used.

Property	Value, content	Description
type:string	"DutConnectRequest"	
data.identifier:string	"COM3"	DUT identifier string
data.baudrate:number	19200 (default)	
data.handshake:number	0 (default)	See Handhake definitions
data.parity:number	0 (default)	See Parity definitions
data.specification:number	3 (default)	See Specification definitions
data.protocol:number	1 (default)	See Protocol definitions

4.3.4 DutDisconnectRequest

This message can be sent by any client to close the UART connection of a DUT. After a DUT connection has been closed, the server responds with a DutConnectionIndication.

Property	Value, content	Description
type:string	"DutDisconnectRequest"	
data.identifier:string	"COM3"	DUT identifier string

4.3.5 DutConnectionIndication

This message is sent to all clients whenever the connection status of DUTs has changed (usually after a DutConnectRequest or DutDisconnectRequest was issued)

Property	Value, content	Description
type:string	"DutConnectionIndication"	
data.identifier:string	"COM3"	DUT identifier string
data.baudrate:number	19200 (default)	
data.handshake:number	0 (default)	See Handhake definitions
data.parity:number	0 (default)	See Parity definitions
data.specification:number	3 (default)	See Specification definitions
data.protocol:number	1 (default)	See Protocol definitions
connectionStatus:number		See ConnectionStatus definition

4.3.6 DutDtmStartTxRequest

This message can be sent by any client to start DTM Tx test on the specified DUT. If the DUT is available and in Dtm mode, the server will respond with a DutDtmModeIndication, otherwise the message will be ignored.

Property	Value, content	Description

type:string	"DutDtmStartTxRequest"	Message type
data.identifier:string	"COM3"	DUT identifier string
data.channel:number	Dtm channel number	See TesterMode definitions 4.4.1
data.length:number	1, 2, 3…37 (default)	See DtmLength definitions
data.pattern:BitPattern	0, 1, 2, 3	See DtmPattern definitions
data.phy:Phy	1 (default), 2, 3, 4	See Phy definitions

4.3.7 DutDtmStartRxRequest

This message can be sent by any client to start DTM Rx test on the specified DUT. If the DUT is available and in Dtm mode, the server will respond with a DutDtmModeIndication, otherwise the message will be ignored.

Property	Value, content	Description
type:string	"DutDtmStartRxRequest"	Message type
data.identifier:string	"COM3"	DUT identifier string
data.channel:number	0, 1, 2 .. 39	See DtmChannel definitions
data.length:number	1, 2, 3…37 (default)	See DtmLength definitions
data.pattern:BitPattern	0, 1, 2, 3	See DtmPattern definitions
data.phy:Phy	1 (default), 2, 3, 4	See Phy definitions
data.intervalMs:number	1000 (default)	Measurement interval in ms

4.3.8 DutDtmResultIndication

This message is sent by the server whenever new DTM measurement data from a DUT is available. The indication is periodically generated with the interval defined in the DutDtmStartRxRequest.

Property	Value, content	Description
type:string	"TesterDtmResultIndication"	Message type
data.serialNumber:string	"E02573369A2B-09"	Serial number of the tester
data.count:number		Number of received DTM packets
data.intervalMs:number		Time spent waiting for DTM packets in ms
data.per:number	0 .. 100	Packet Error Rate in %

4.3.9 DutDtmStopRequest

This message can be sent by any client to stop a running DTM Tx or Rx test on the specified DUT. If the DUT is available and in Dtm mode, the server will respond with a DutDtmModeIndication, otherwise the message will be ignored.

Property	Value, content	Description
type:string	"DutDtmStopRequest"	Message type

data.identifier:string	"COM3"	DUT identifier string

4.3.10 DutDtmModeIndication

This message is sent to all clients whenever the DTM mode of a DUT has changed (usually after DutDtmStartTxRequest, DutDtmStartRxRequest or DutDtmStopRequest was issued).

Property	Value, content	Description
type:string	"DutDtmModeIndication"	Message type
data.identifier:string	"COM3"	DUT identifier string
data.mode:number	Number representing current DTM mode	See DtmMode definitions

4.4 Definitions

4.4.1 TesterMode

The BLT2450 can operate in any of the following modes:

Name	Value	Description
Idle	0	The tester is not yet activated
Dtm	1	The tester is operating in DTM mode
Attenuator	2	The tester is operating in Attenuator mode
PowerMeter	3	The tester is operating in PowerMeter mode
Generator	4	The tester is operating in Generator mode
Ble	5	The tester is operating in BLE mode

4.4.2 DtmMode

In DTM mode, the BLT2450 and DUT can operate in any of the following modes:

Name	Value	Description
Idle	0	No tests running
Rx	1	RX test running
Tx	2	TX test running

4.4.3 DtmChannel

The following channels can be selected for DTM tests:

Name	Value	Frequency
Ch0	0	2402 MHz
Ch1	1	2404 MHz
Ch2	2	2406 MHz
Ch3	3	2408 MHz
Ch4	4	2410 MHz
Ch5	5	2412 MHz
Ch6	6	2414 MHz
Ch7	7	2416 MHz
Ch8	8	2418 MHz
Ch9	9	2420 MHz

Ch10	10	2422 MHz
Ch11	11	2424 MHz
Ch12	12	2426 MHz
Ch13	13	2428 MHz
Ch14	14	2430 MHz
Ch15	15	2432 MHz
Ch16	16	2434 MHz
Ch17	17	2436 MHz
Ch18	18	2438 MHz
Ch19	19	2440 MHz
Ch20	20	2442 MHz
Ch21	21	2444 MHz
Ch22	22	2446 MHz
Ch23	23	2448 MHz
Ch24	24	2450 MHz
Ch25	25	2452 MHz
Ch26	26	2454 MHz
Ch27	27	2456 MHz
Ch28	28	2458 MHz
Ch29	29	2460 MHz
Ch30	30	2462 MHz
Ch31	31	2464 MHz
Ch32	32	2466 MHz
Ch33	33	2468 MHz
Ch34	34	2470 MHz
Ch35	35	2472 MHz
Ch36	36	2474 MHz
Ch37	37	2476 MHz
Ch38	38	2478 MHz

Ch39	39	2480 MHz

4.4.4 DtmLength

The DtmLength field defines the number of bytes to use during DTM test

Name	Min	Max	Default
DtmLength	0	37	37

4.4.5 DtmPattern

This field defines the bit pattern to use during DTM test

Name	Value	Description
Prbs9	0	Pseudo-random bit stream (default)
FourOneFourZero	1	Repeated 11110000
OneZero	2	Repeated 10101010
VendorSpecific	3	Not standardized

4.4.6 Phy

This field defines the PHY to use during DTM test

Name	Value	Description
Phy1Mbps	1	1 Mbit (default)
Phy2Mbps	2	2 Mbit
PhyCodedS8	3	Coded S8, 125 kBit
PhyCodedS2	4	Coded S2, 500 kBit

4.4.7 Specification

This field defines the Bluetooth specification to use for DTM tests

Name	Value	Description
V4_0	0	Bluetooth Core Specification 4.0
V4_1	1	Bluetooth Core Specification 4.1
V4_2	2	Bluetooth Core Specification 4.2
V5_0	3	Bluetooth Core Specification 5.0
V5_1	4	Bluetooth Core Specification 5.1
V5_2	5	Bluetooth Core Specification 5.2

4.4.8 Protocol

This field defines the UART protocol to use for DTM tests

Name	Value	Description
Tester	0	Arendi specific protocol
TwoWire	1	Two Wire interface defined in Bluetooth core specification
TwoWireNordic	2	Two Wire interface with Nordic extensions
HCI	3	Host Controller Interface defined in Bluetooth core specification

4.4.9 Handshake

Defines the type of handshake used for UART communication

Name	Value	Description
None	0	No handshake
XOnXOff	1	
RequestToSend	2	
RequestToSendXonXoff	3	

4.4.10 Parity

This field defines the parity for UART communication

Name	Value	Description
None	0	No parity
Odd	1	Odd parity
Even	2	Even parity
Mark	3	
Space	4	

4.4.11 TxPower

This field defines the allowed RF output power settings in dBm

Name	Value	Description
Neg20Dbm	-20	-20 dBm

Neg16Dbm	-16	-16 dBm
Neg8Dbm	-8	-8 dBm
Neg4Dbm	-4	-4 dBm
Pos0Dbm	0	0 dBm (default)
Pos2Dbm	2	+2 dBm
Pos3Dbm	3	+3 dBm
Pos4Dbm	4	+4 dBm
Pos5Dbm	5	+5 dBm
Pos6Dbm	6	+6 dBm
Pos7Dbm	7	+7 dBm
Pos8Dbm	8	+8 dBm

4.4.12 ConnectionStatus

The connection status of a DUT can be one of the following:

Name	Value	Description
Disconnected	0	UART interface is closed
Connected	1	UART interface is open

5 Examples

5.1 Get BLT2450 list and set first tester to PowerMeter mode

Server	Direction	Client
	←	{ "type":"TesterListRequest" }
{ "type":"TesterListIndication", "data": [{ "serialNumber":"E02573369A2B-09", "productName":"BLT2450", "hardwareId":9, "hardwareVersionMajor":3, "hardwareVersionMinor":0, "firmwareVersionMajor":9, "firmwareVersionMinor":10, "mode":0, "dtmMode":0, "attenuationDb":0 }, { "serialNumber":"A34287422E3A-09", "productName":"BLT2450", … }] }	→	
	←	{ "type":"TesterModeRequest", "data": { "serialNumber":"E02573369A2B-09", "mode":3 } }
{ "type":"TesterModeIndication", "data": { "serialNumber":"E02573369A2B-09", "mode":3 } }	→	