

QN9090 PCB validation with Non Signaling Test Using IQxel-MW

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SECURE CONNECTIONS
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Purpose

Customer, Azurewave is designing QN9090 module. They have IQxel non-signaling equipment. Azurewave asks if QN9090 can be tested with IQxel. We co-work with ACE Solution Taiwan Co.Ltd. to Integrate QN9090 and IQxel to perform 1M bps, 2M bps and Frame error rate test. This document will address the QN9090 setup and IQxel connection setup. Finally we show the 1M bps, 2M bps and packet error rate results.

QN9090 Setup

- 1. Download the latest QN9090 SDK example code from NXP website. The latest version is 2.6.0 (Released 2020-01-22) .

Select Development Board

Search for your board or kit to get started.

Search by Name

Select a Board, Kit, or Processor

- Boards
 - QN9090DK6 (QN9090)**
- Kits
- Processors
 - QN9090

Name your SDK



The LPCXpresso family of boards provides a powerful and flexible development system for NXP's Cortex-M MCUs

Hardware Details

Board	QN9090DK6
Device	QN9090
Core Type / Max Freq	Cortex-M4 / 48MHz
Device Memory Size	640 KB Flash 152 KB RAM

Actions

Build MCUXpresso SDK



QN9090 Setup(Continued)

2. Import “ HCI_Black_Box “ example from MCUXpresso.

> qn9090dk6_hci_black_box_bm <Debug>
> qn9090dk6_heart_rate_sensor_bm

```
1339 /* Initialize MCU clock */
1340 hardware_init();
1341 OSA_TimeInit();
1342 OSA_TaskCreate(OSA_TASK(main_task),NULL);
1343 OSA_Start();
1344
1345 return 0;
```

- OSA_MsgQ
- OSA_Interru
- OSA_Interru
- OSA_Interru
- OSA_Interru
- OSA_Interru

Installed SDKs Properties Problems Progress Console Terminal Image Info Debugger Console

```
CDT Build Console [qn9090dk6_hci_black_box_bm]
building target: qn9090dk6_hci_black_box_bm.axf
Invoking: MCU Linker
arm-none-eabi-gcc -L"C:\nxp\MCUXpressoIDE_11.1.0_3209\QN9090 workspace\qn9090dk6_hci_black_box_b
Memory region      Used Size  Region Size  %age Used
Flash640:          166444 B    294624 B     56.49%
RAM0:               25356 B      87 KB       28.46%
RAM1:                0 GB      64 KB        0.00%
Finished building target: qn9090dk6_hci_black_box_bm.axf
```

Quickstart Panel Variables Breakpoints

MCUXpresso IDE - Quickstart Pane
Project: qn9090dk6_hci_black_box_bm [Debug]

Create or import a project

- New project..
- Import SDK example(s)...
- Import project(s) from file system...

```
make --no-print-directory post-build
Performing post-build steps
arm-none-eabi-size "qn9090dk6_hci_black_box_bm.axf"; python "../scripts/dk6_image_tool.py" qn90
text  data  bss  dec  hex filename
159312  7132  18316  184760  2d1b8 qn9090dk6_hci_black_box_bm.axf
No compatibility list
boot block offset =28a2c
Writing checksum 04036bfa to file qn9090dk6_hci_black_box_bm.axf
Writing CRC32 of header feee0175 to file qn9090dk6_hci_black_box_bm.axf
Binary size is 00028a4c (166476)
copy from `qn9090dk6_hci_black_box_bm.axf' [elf32-littlearm] to `qn9090dk6_hci_black_box_bm.bin'
```

QN9090 Setup (Continued)

3. Select either bm or freertos version

Import projects

Project name prefix: qn9090dk6 Project name suffix:

Use default location

Location: C:\nxp\MCUXpressoIDE_11.1.0_3209\QN9090 workspace\qn9090dk6 Browse...

Project Type **Project Options**

C Project C++ Project C Static Library C++ Static Library

SDK Debug Console Semihost UART Example default

Copy sources

Import other files

Examples

type to filter

Name	Description	Version
> <input type="checkbox"/> ble_fscibb		
> <input type="checkbox"/> bps		
> <input type="checkbox"/> cycl_pwrs		
> <input type="checkbox"/> cycl_scs		
> <input type="checkbox"/> glucose s		
▼ <input type="checkbox"/> hci_bb		
> <input type="checkbox"/> bm		
> <input type="checkbox"/> freertos		
> <input type="checkbox"/> health_t		
> <input type="checkbox"/> hid_device		
> <input type="checkbox"/> hid_host		

QN9090 Setup (Continued)

4. Compile and load "HCI_Black_Box" into QN9090 Target board.

```
Installed SDKs Properties Problems Progress Console Terminal Image Info Debugger Console
CDT Build Console [qn9090dk6_hci_black_box_bm]
11:13:58 **** Build of configuration Debug for project qn9090dk6_hci_black_box_bm ****
make -r -j8 all
Building target: qn9090dk6_hci_black_box_bm.axf
Invoking: MCU Linker
arm-none-eabi-gcc -L"C:\nxp\MCUXpressoIDE_11.1.0_3209\QN9090 workspace\qn9090dk6_hci_black_box_b
Memory region      Used Size  Region Size  %age Used
   Flash640:      166444 B    294624 B     56.49%
      RAM0:        25356 B      87 KB     28.46%
      RAM1:         0 GB      64 KB      0.00%
Finished building target: qn9090dk6_hci_black_box_bm.axf

make --no-print-directory post-build
Performing post-build steps
arm-none-eabi-size "qn9090dk6_hci_black_box_bm.axf"; python "../scripts/dk6_image_tool.py" qn90
  text  data  bss  dec  hex filename
159312  7132 18316 184760  2d1b8 qn9090dk6_hci_black_box_bm.axf
No compatibility list
boot block offset =28a2c
Writing checksum 04036bfa to file qn9090dk6_hci_black_box_bm.axf
Writing CRC32 of header feee0175 to file qn9090dk6_hci_black_box_bm.axf
Binary size is 00028a4c (166476)
copy from `qn9090dk6_hci_black_box_bm.axf' [elf32-littlearm] to `qn9090dk6_hci_black_box_bm.bin'

11:14:00 Build Finished. 0 errors, 0 warnings. (took 2s.204ms)
```

IQxel Overview

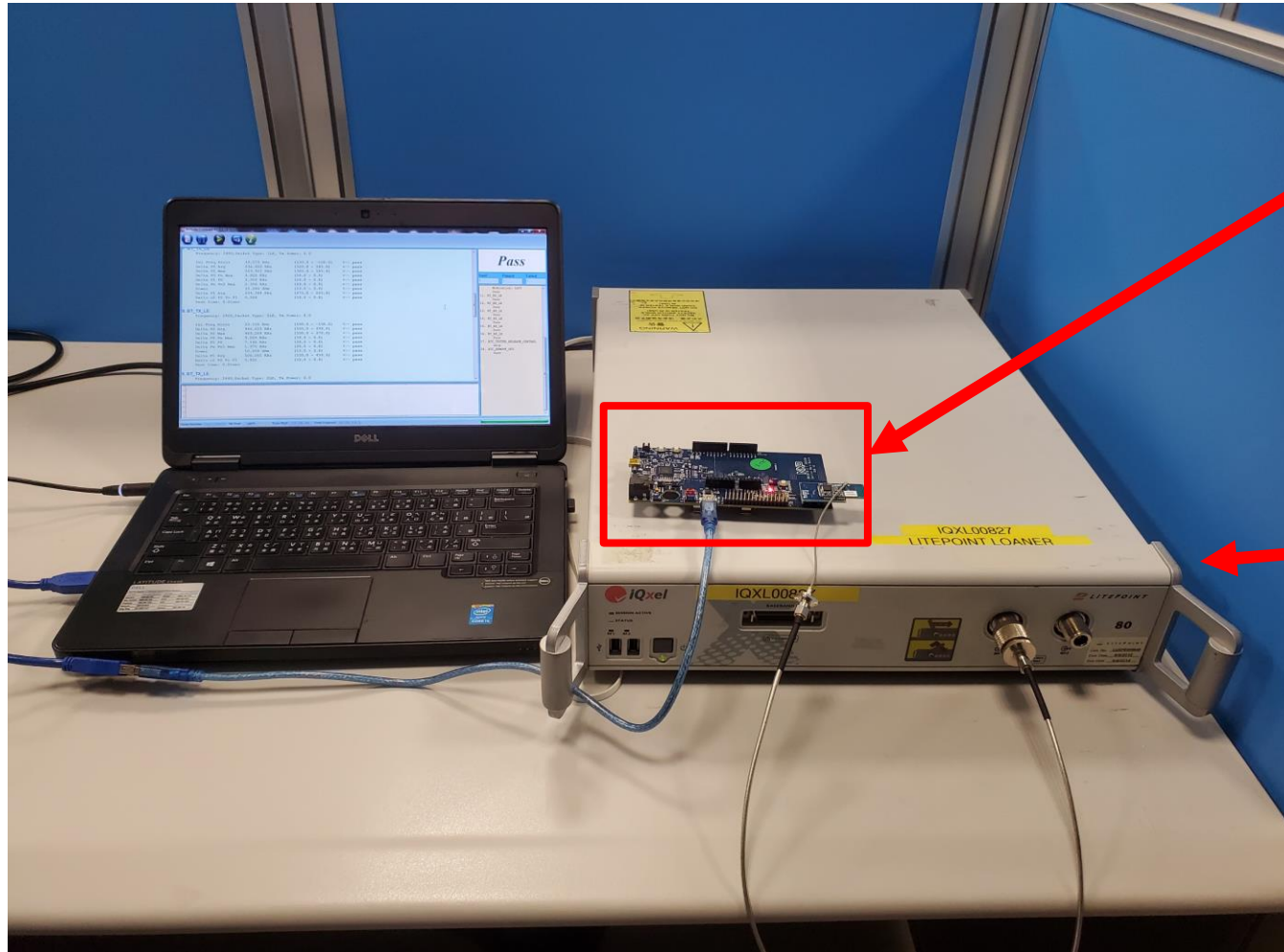
Front Panel :



Rear Panel :



QN9090 Connection Setup with IQxel



QN9090 Test Target

IQxel

Log of Test Results

ATSuite Compact V7.0.1 - E:\Coding\GUI\ATSuite_V7_0_1_BLE5_DTM_IQmeasure_3.1.2.20170623\ATSuite_V7_0_1_HCI_BT5_IQmeasure_3.1.2.20170623\Bin\Setup\test_flow_bt_ptm.txt

7. BT_TX_LE
Frequency: 2480, Packet Type: 1LE, Tx Power: 8.0

Ini Freq Error	19.573 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	236.083 KHz	(320.0 ~ 185.0)	<-- pass
Delta F2 Max	229.921 KHz	(320.0 ~ 185.0)	<-- pass
Delta F0 Fn Max	4.822 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	2.900 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	2.396 KHz	(20.0 ~ 0.0)	<-- pass
Power	10.006 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	254.344 KHz	(275.0 ~ 225.0)	<-- pass
Ratio of F2 To F1	0.928	(10.0 ~ 0.8)	<-- pass


Test time: 0.81sec

8. BT_TX_LE
Frequency: 2402, Packet Type: 2LE, Tx Power: 8.0

Ini Freq Error	23.559 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	466.629 KHz	(550.0 ~ 370.0)	<-- pass
Delta F2 Max	469.284 KHz	(550.0 ~ 370.0)	<-- pass
Delta F0 Fn Max	9.009 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	7.146 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	1.975 KHz	(20.0 ~ 0.0)	<-- pass
Power	10.209 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	506.201 KHz	(550.0 ~ 450.0)	<-- pass
Ratio of F2 To F1	0.922	(10.0 ~ 0.8)	<-- pass

Test time: 0.81sec

9. BT_TX_LE
Frequency: 2440, Packet Type: 2LE, Tx Power: 8.0



Pass

Total	Passed	Failed
1	1	0

Modulation: 0xF0

- 11. BT_RX_LE Pass
- 12. BT_RX_LE Pass
- 13. BT_RX_LE Pass
- 14. BT_RX_LE Pass
- 15. BT_RX_LE Pass
- 16. BT_RX_LE Pass
- 17. ATC_TESTER_RELEASE_CONTROL skip
- 18. ATC_REMOVE_DUT Pass

Serial Number: IQ1115A030 RF Port: LEFT Time Start: 07:36:58 Time Elapsed: 00:00:16.1

Log data details and its running steps

Start: 2020/04/06 07:36:58

1. ATC_CONNECT_TESTER

Serial number: IQ1115A0308

Test time: 0.54sec

2. ATC_INSERT_DUT

Technology: BT

DUT DLL: BT5_HCI_DUT.dll

DUT_VERSION=1.0.0 (2018-12-07)

Test time: 0.06sec

3. ATC_INITIALIZE_DUT

Technology: BT

DUT_NAME=HCI_BT5_DUT

Test time: 0.20sec

4. ATC_TESTER_OBTAIN_CONTROL

Test time: 0.00sec

Test Results at 2402 MHz, 1M bps

5. BT_TX_LE

Frequency: 2402, Packet Type: 1LE, Tx Power: 8.0

Ini Freq Error	21.106 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	232.533 KHz	(320.0 ~ 185.0)	<-- pass
Delta F2 Max	240.509 KHz	(320.0 ~ 185.0)	<-- pass
Delta F0 Fn Max	7.956 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	3.865 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	2.674 KHz	(20.0 ~ 0.0)	<-- pass
Power	10.219 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	254.217 KHz	(275.0 ~ 225.0)	<-- pass
Ratio of F2 To F1	0.915	(10.0 ~ 0.8)	<-- pass
Test time: 0.80sec			

Test Results at 2440MHz, 1M bps

6. BT_TX_LE

Frequency: 2440, Packet Type: 1LE, Tx Power: 8.0

Ini Freq Error	24.166 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	233.526 KHz	(320.0 ~ 185.0)	<-- pass
Delta F2 Max	228.962 KHz	(320.0 ~ 185.0)	<-- pass
Delta F0 Fn Max	10.779 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	7.689 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	3.148 KHz	(20.0 ~ 0.0)	<-- pass
Power	9.578 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	254.677 KHz	(275.0 ~ 225.0)	<-- pass
Ratio of F2 To F1	0.917	(10.0 ~ 0.8)	<-- pass
Test time: 0.84sec			

Test Results at 2480MHz, 1M bps

7. BT_TX_LE

Frequency: 2480, Packet Type: 1LE, Tx Power: 8.0

Ini Freq Error	19.573 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	236.083 KHz	(320.0 ~ 185.0)	<-- pass
Delta F2 Max	229.921 KHz	(320.0 ~ 185.0)	<-- pass
Delta F0 Fn Max	4.822 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	2.900 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	2.396 KHz	(20.0 ~ 0.0)	<-- pass
Power	10.006 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	254.344 KHz	(275.0 ~ 225.0)	<-- pass
Ratio of F2 To F1	0.928	(10.0 ~ 0.8)	<-- pass
Test time: 0.81sec			

Test Results at 2402MHz, 2M bps

8. BT_TX_LE

Frequency: 2402, Packet Type: 2LE, Tx Power: 8.0

Ini Freq Error	23.559 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	466.629 KHz	(550.0 ~ 370.0)	<-- pass
Delta F2 Max	469.284 KHz	(550.0 ~ 370.0)	<-- pass
Delta F0 Fn Max	9.009 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	7.146 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	1.975 KHz	(20.0 ~ 0.0)	<-- pass
Power	10.209 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	506.201 KHz	(550.0 ~ 450.0)	<-- pass
Ratio of F2 To F1	0.922	(10.0 ~ 0.8)	<-- pass
Test time: 0.81sec			

Test Results at 2440MHz, 2M bps

9. BT_TX_LE

Frequency: 2440, Packet Type: 2LE, Tx Power: 8.0

Ini Freq Error	20.719 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	468.293 KHz	(550.0 ~ 370.0)	<-- pass
Delta F2 Max	472.103 KHz	(550.0 ~ 370.0)	<-- pass
Delta F0 Fn Max	5.394 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	3.934 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	1.916 KHz	(20.0 ~ 0.0)	<-- pass
Power	9.563 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	507.097 KHz	(550.0 ~ 450.0)	<-- pass
Ratio of F2 To F1	0.923	(10.0 ~ 0.8)	<-- pass
Test time: 0.81sec			

Test Results at 2480MHz, 2M bps

10. BT_TX_LE

Frequency: 2480, Packet Type: 2LE, Tx Power: 8.0

Ini Freq Error	18.235 KHz	(150.0 ~ -150.0)	<-- pass
Delta F2 Avg	473.669 KHz	(550.0 ~ 370.0)	<-- pass
Delta F2 Max	483.023 KHz	(550.0 ~ 370.0)	<-- pass
Delta F0 Fn Max	3.200 KHz	(50.0 ~ 0.0)	<-- pass
Delta F1 F0	0.653 KHz	(20.0 ~ 0.0)	<-- pass
Delta Fn Fn5 Max	2.774 KHz	(20.0 ~ 0.0)	<-- pass
Power	9.996 dBm	(13.0 ~ 3.0)	<-- pass
Delta F1 Avg	511.666 KHz	(550.0 ~ 450.0)	<-- pass
Ratio of F2 To F1	0.926	(10.0 ~ 0.8)	<-- pass
Test time: 0.81sec			

1M Test Results at PER

11. BT_RX_LE

Frequency: 2402, Packet Type: 1LE, Rx Power: -60.0

PER 0.000 % (10.0 ~ 0.0) <-- pass

Test time: 1.63sec

12. BT_RX_LE

Frequency: 2440, Packet Type: 1LE, Rx Power: -60.0

PER 0.000 % (10.0 ~ 0.0) <-- pass

Test time: 1.63sec

13. BT_RX_LE

Frequency: 2480, Packet Type: 1LE, Rx Power: -60.0

PER 0.000 % (10.0 ~ 0.0) <-- pass

Test time: 1.62sec

2M Test Results at PER

14. BT_RX_LE

Frequency: 2402, Packet Type: 2LE, Rx Power: -60.0

PER 0.000 % (10.0 ~ 0.0) <-- pass

Test time: 1.63sec

15. BT_RX_LE

Frequency: 2440, Packet Type: 2LE, Rx Power: -60.0

PER 0.000 % (10.0 ~ 0.0) <-- pass

Test time: 1.62sec

16. BT_RX_LE

Frequency: 2480, Packet Type: 2LE, Rx Power: -60.0

PER 0.000 % (10.0 ~ 0.0) <-- pass

Test time: 1.63sec

Final Test Results Log

17. ATC_TESTER_RELEASE_CONTROL
Test time: 0.00sec

18. ATC_REMOVE_DUT
Remove DUT (Technology: BT)
Test time: 0.13sec

```
*****  
**** P A S S ****  
*****
```

End: 2020/04/06 07:37:14

Test Time: 00:16.0



THANK YOU!