

# Apollo3 SRRC BQB测试指导

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2018年7月16日



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# SRRC 测试流程及操作方法

- 将DUT板 UART 与 USB-to-Serial 转串口连线正确连接,然后DUT上电
- 打开BLE Connector软件, 选择正确的COM口后, 结合测试项发送如下HCI指令:

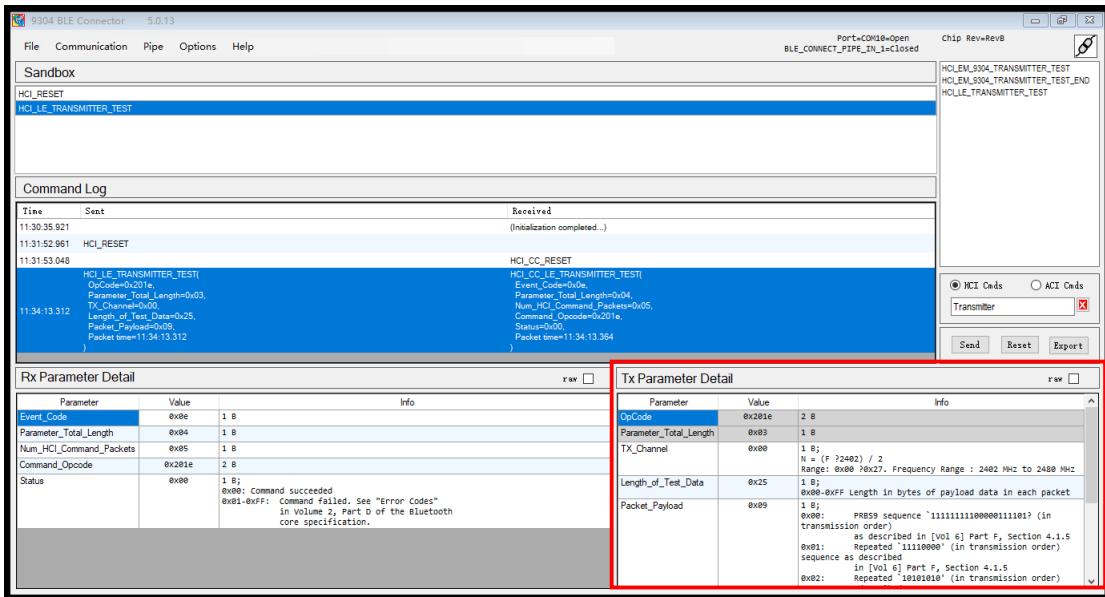
| 名称                              | 测试指令                    | 指令格式                 | 备注                                       |
|---------------------------------|-------------------------|----------------------|--|
| 复位                              | HCI_RESET               | 01 03 0C 00          | 复位指令                                     |
| 发送载波                            | HCI_LE_TRANSMITTER_TEST | 01 1E 20 03 XX 25 08 | “XX”为频道索引<br>“08”表示载波                    |
| 发送SRRC测试调制波<br>(duty cycle>98%) | HCI_LE_TRANSMITTER_TEST | 01 1E 20 03 XX 25 09 | “XX”为频道索引<br>“09”表示调制波形(duty cycle >98%) |
| 接收机测试                           | HCI_LE_RECEIVER_TEST    | 01 1D 20 01 XX       | “XX”为频道索引                                |
| 结束测试                            | HCI_LE_TEST_END         | 01 1F 20 00          | 每个测试结束均需执行一次                             |

- 每个项目测试完成后, 发送 HCI\_RESET 或者 HCI\_LE\_TEST\_END 结束此单项测试并开始下一个测试项。

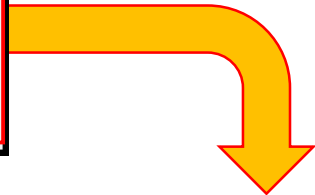




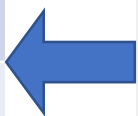
# 设置 DUT 进入连续调制波发送模式



SRRC测试输出功率、发射机杂散、调制频率范围时需要发射连续调制波 (duty cycle >98%) 测试0、19、39三个频点



| Parameter           | Value |
|---------------------|-------|
| TX_Channel          | 待测频点  |
| Length_of_Test_Data | 0x25  |
| Packet_Payload      | 0x09  |



| Parameter              | Value | Info   |
|------------------------|-------|--|
| Parameter_Total_Length | 0x03  | 1 B  |
| TX_Channel             | 0x00  | 1 B;<br>N = (F ?2402) / 2<br>Range: 0x00 ?0x27. Frequency Range : 2402 MHz to 2480 MHz   |
| Length_of_Test_Data    | 0x25  | 1 B;<br>0x00-0xFF Length in bytes of payload data in each packet   |
| Packet_Payload         | 0x09  | 1 B;<br>0x00: PRBS9 sequence `1111111100000111101?` (in transmission order)<br>as described in [Vol 6] Part F, Section 4.1.5<br>0x01: Repeated `11110000` (in transmission order) sequence as described in [Vol 6] Part F, Section 4.1.5<br>0x02: Repeated `10101010` (in transmission order) sequence as described in [Vol 6] Part F, Section 4.1.5 |



# 设置 DUT 进入接收模式

The screenshot shows the 9304 BLE Connector software interface. The Command Log displays the following entries:

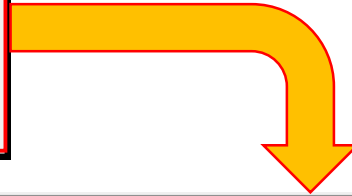
```

14:39:52.700      Sent      (Initialization completed...)
14:40:04.887 HCL_RESET HCL_CC_RESET
14:40:21.893 HCL_LE_RECEIVER_TEST HCL_CC_LE_RECEIVER_TEST
                OpCode=0x201d, Event_Code=0x0e,
                Parameter_Total_Length=0x01, Parameter_Total_Length=0x01,
                RX_Channel=0x00, Num_HCI_Command_Packets=0x05,
                Command_Opcode=0x201d, Command_Opcode=0x201d,
                Status=0x00, Status=0x00,
                Packet time=14:40:21.893 Packet time=14:40:21.929
    
```

Below the log, two 'Tx Parameter Detail' windows are shown. The right window is highlighted with a red border and contains the following data:

| Parameter              | Value  | Info   |
|------------------------|--------|--|
| OpCode                 | 0x201d | 2 B  |
| Parameter_Total_Length | 0x01   | 1 B  |
| RX_Channel             | 0x00   | 1 B;<br>N = (F ?2402) / 2<br>Range: 0x00 ?0x27. Frequency Range : 2402 MHz to 2480 MHz |

SRRC测试接收机杂散时进入接收模式  
测试0、19、39三个频点



| Parameter              | Value  | Info   |
|------------------------|--------|--|
| OpCode                 | 0x201d | 2 B  |
| Parameter_Total_Length | 0x01   | 1 B  |
| RX_Channel             | 0x00   | 1 B;<br>N = (F ?2402) / 2<br>Range: 0x00 ?0x27. Frequency Range : 2402 MHz to 2480 MHz |

| Parameter  | Value |
|------------|-------|
| RX_Channel | 待测频点  |



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# SRRC Test Cases & Requirements

| No. | Test Items                          | Requirement                                       | Channel for Testing | DUT Setup |
|-----|-------------------------------------|---|---------------------|-----------|
| 1   | Collateral emissions of transmitter | See table on page.10                              | Ch0, Ch19, Ch39     | >98%调制波   |
| 2   | Peak Output Power                   | $\leq 10$ dBm                                     | Ch0, Ch19, Ch39     | >98%调制波   |
| 3   | Collateral emissions of receiver    | Same as item No.1                                 | Ch0, Ch19, Ch39     | 接收模式      |
| 4   | Frequency Tolerance                 | $\pm 20$ ppm                                      | Ch0, Ch19, Ch39     | 发送载波      |
| 5   | Frequency range                     | EIRP $\leq -80$ dBm/Hz out of 2400-2483.5MHz band | Ch0, Ch39           | >98%调制波   |





# Limitation of Collateral Emissions

| Start Frequency (MHz) | Stop Frequency (MHz) | RBW (MHz) | Detector | Limit (dBm) |
|-----------------------|----------------------|-----------|----------|-------------|
| 1000                  | 2400                 | 1         | Peak     | -30         |
| 2400                  | 2435                 | 0.1       | Peak     | -33         |
| 2445                  | 2483.5               | 0.1       | Peak     | -33         |
| 2483.5                | 3400                 | 1         | Peak     | -30         |

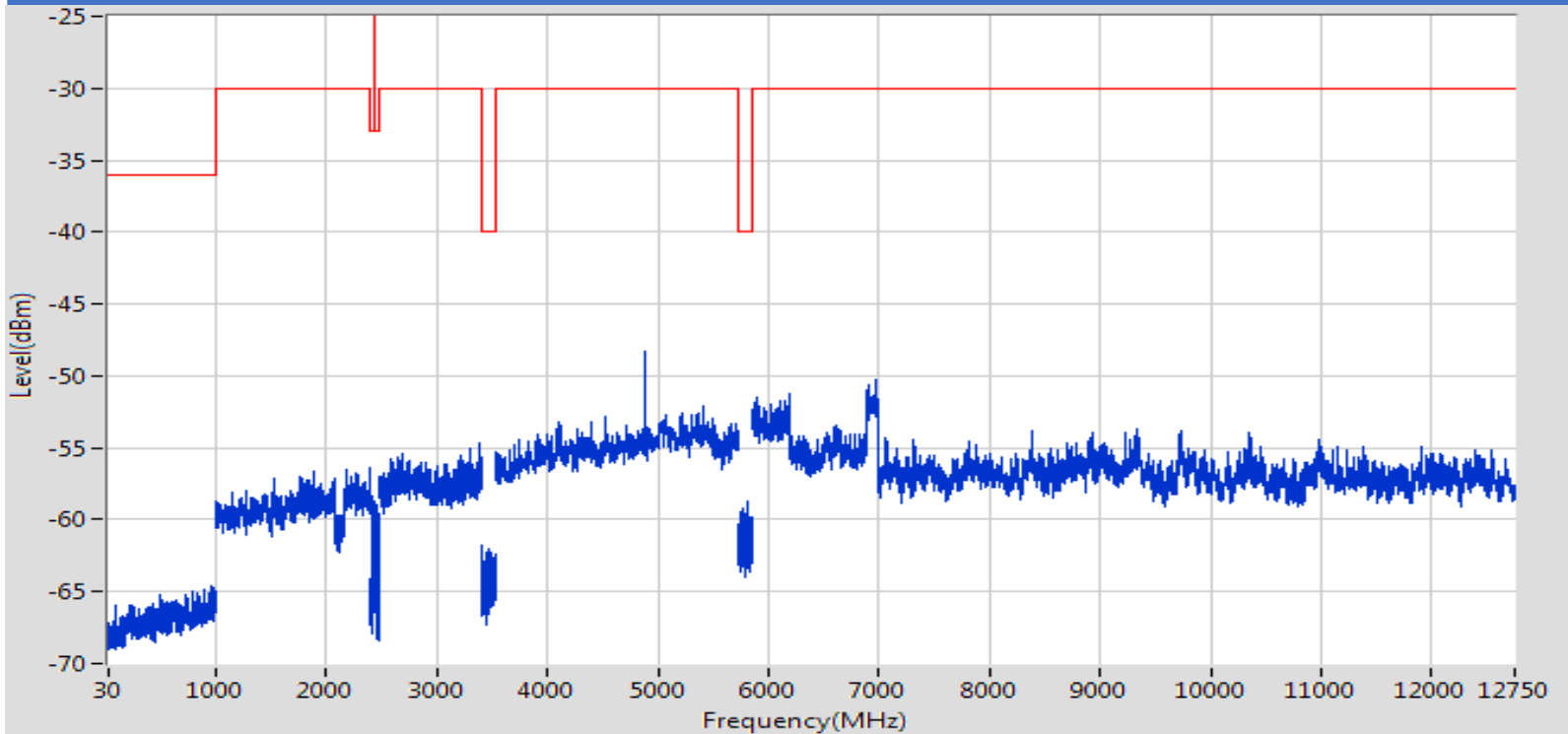
## ✓ Note:

- 频率范围测试主要注意0、39频点
  - 当测试2402MHz (Ch0)时, 左侧起始频率被设置到2397MHz, 右侧起始测量频率设置在 2407MHz.
  - 测试 2480MHz (Ch39)时, 右侧频率起始设置为 2483.5MHz.

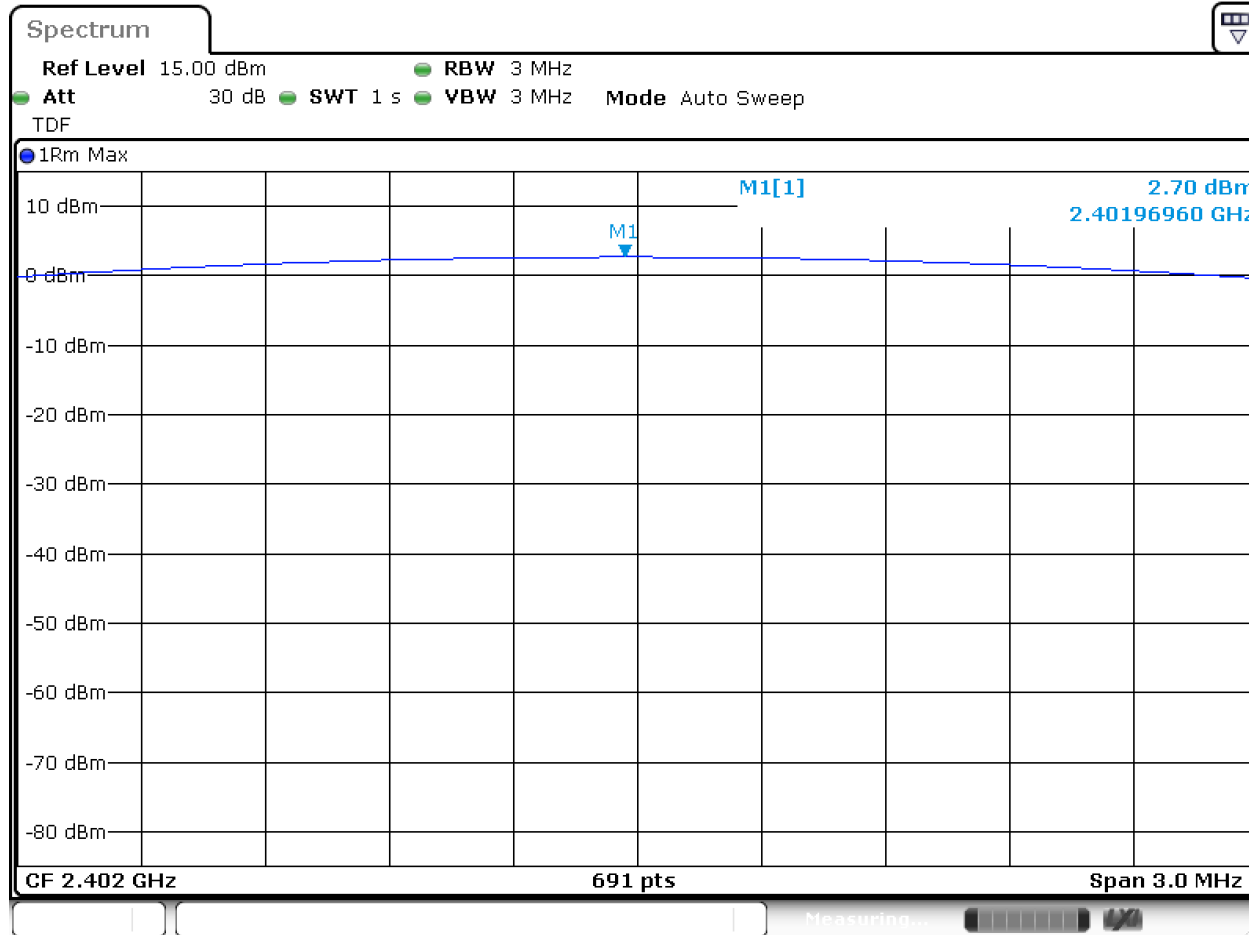


# Example-Collateral Emissions Test

| Start Frequency (MHz) | Stop Frequency (MHz) | RBW (MHz) | Detector | Frequency (MHz) | Power (dBm) | Limit (dBm) | Verdict | Sweep Point |
|-----------------------|----------------------|-----------|----------|-----------------|-------------|-------------|---------|-------------|
| 30                    | 1000                 | 0.1       | Peak     | 953.609         | -64.56      | -36         | Pass    | 691         |
| 1000                  | 2400                 | 1         | Peak     | 2400            | -56.42      | -30         | Pass    | 691         |
| 2400                  | 2435                 | 0.1       | Peak     | 2408.217        | -58.36      | -33         | Pass    | 691         |
| 2445                  | 2483.5               | 0.1       | Peak     | 2445.112        | -58.73      | -33         | Pass    | 691         |
| 2483.5                | 3400                 | 1         | Peak     | 3389.374        | -54.69      | -30         | Pass    | 691         |
| 3400                  | 3530                 | 1         | Peak     | 3408.478        | -61.8       | -40         | Pass    | 691         |
| 3530                  | 5725                 | 1         | Peak     | 4881.993        | -48.36      | -30         | Pass    | 691         |
| 5725                  | 5850                 | 1         | Peak     | 5811.775        | -58.73      | -40         | Pass    | 691         |
| 5850                  | 12750                | 1         | Peak     | 6974.7          | -50.27      | -30         | Pass    | 4001        |



# Example-Peak Output Power Test

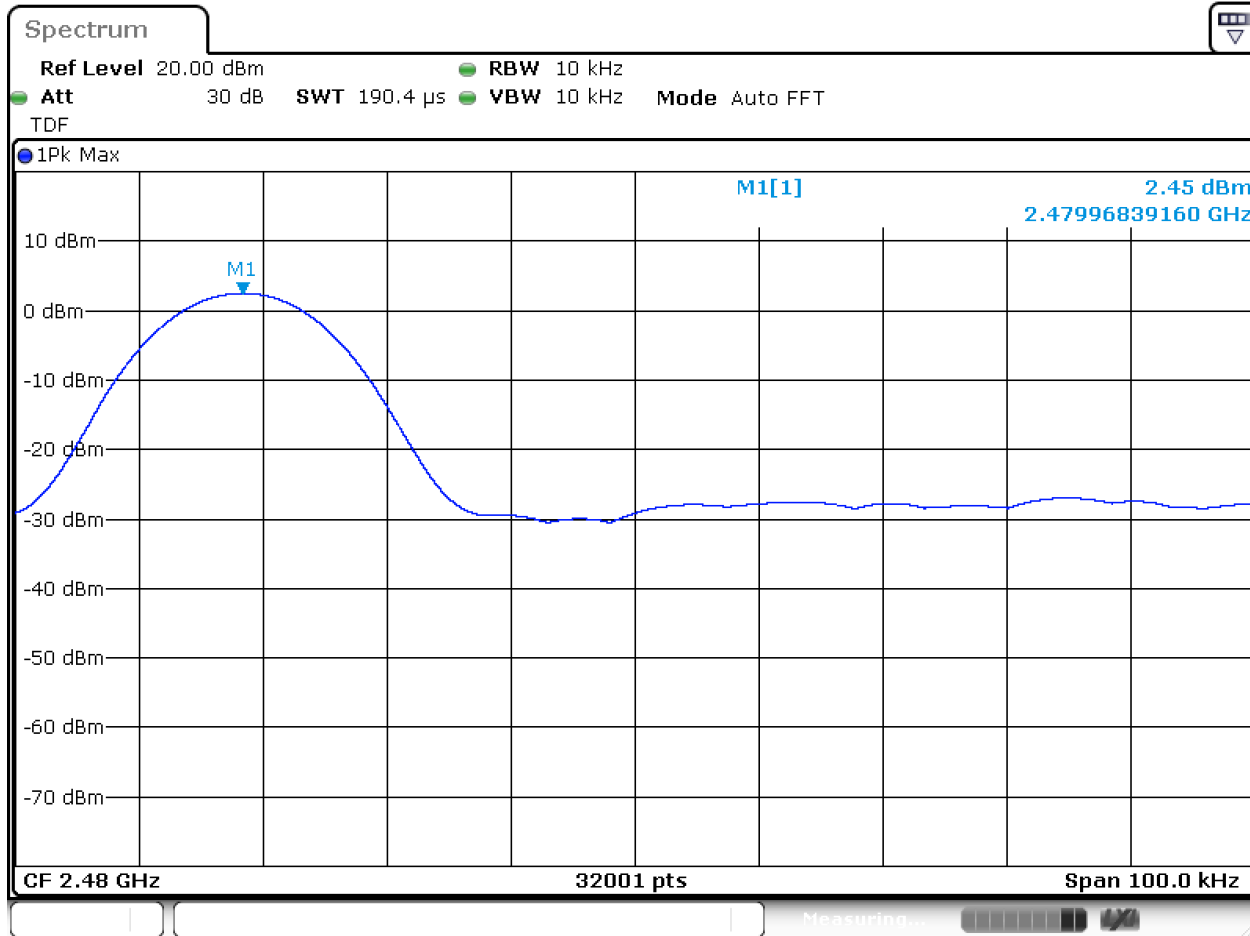


不超出10dBm  
即视为合格

Date: 13.JUL.2018 15:08:24



# Example-Frequency Tolerance Test

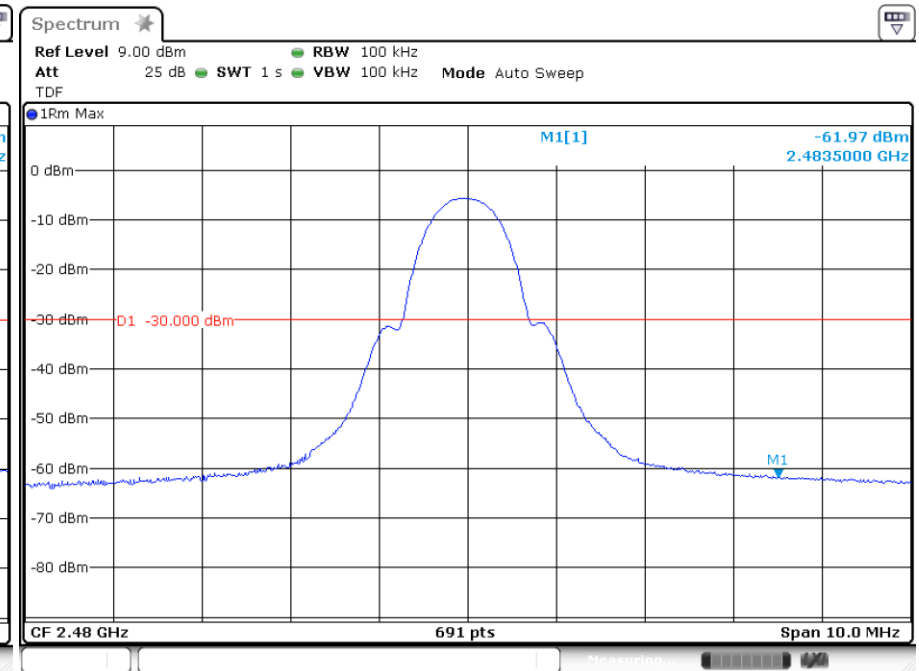
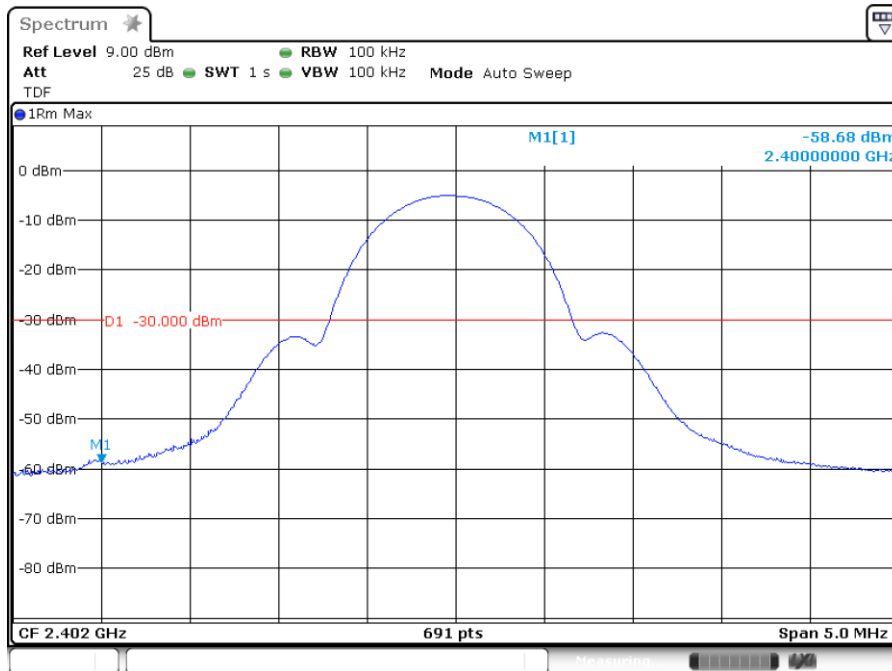


超出屏中范围  
即视为频偏超  
出20ppm，这  
类问题一般出  
现在BLE晶体频  
率未校准所致

Date: 13.JUL.2018 15:17:05



# Example-Frequency Range Test



Date: 13.JUL.2018 15:15:21

Date: 13.JUL.2018 15:14:30

| Start Frequency (MHz) | Stop Frequency (MHz) | RBW (MHz) | Detector | Frequency (MHz) | Power (dBm) | Limit (dBm) | Verdict | Sweep Point |
|-----------------------|----------------------|-----------|----------|-----------------|-------------|-------------|---------|-------------|
| 1000                  | 2400                 | 1         | Peak     | 2400            | -56.42      | -30         | Pass    | 691         |
| 2400                  | 2435                 | 0.1       | Peak     | 2408.217        | -58.36      | -33         | Pass    | 691         |
| 2445                  | 2483.5               | 0.1       | Peak     | 2445.112        | -58.73      | -33         | Pass    | 691         |
| 2483.5                | 3400                 | 1         | Peak     | 3389.374        | -54.69      | -30         | Pass    | 691         |



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# BQB 测试方法

- 将DUT板 UART 与 USB-to-Serial 转串口连线正确连接,然后DUT上电
- 在BQB测试软件中选择正确的COM口, 并开始测试
- 所有BQB测试项只需要Apollo3 DUT进入BQB DTM 模式即可自动完成所有测试, 无需手工输入测试指令
- Apollo3 BQB 测试主要进行RF PHY 的测试即可, 主要测试case在page 17(transmitter tests) and page 18 (receiver tests)中列出.



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# BQB-Transmitter Tests (TRM-LE)

| No. | Item                     | Test Case   | Channel for Testing   |
|-----|--------------------------|---|-----------------------|
| 1   | RF-PHY/TRM-LE/CA/BV-01-C | Output Power  | Ch0, 12, 19, 39       |
| 2   | RF-PHY/TRM-LE/CA/BV-03-C | In-band emissions,<br>uncoded data at 1 Ms/s                  | Ch0, 2, 12, 19, 37,39 |
| 3   | RF-PHY/TRM-LE/CA/BV-05-C | Modulation Characteristics,<br>uncoded data at 1 Ms/s         | Ch0, 12, 19, 39       |
| 4   | RF-PHY/TRM-LE/CA/BV-06-C | Carrier frequency offset and drift,<br>uncoded data at 1 Ms/s | Ch0, 12, 19, 39       |



# BQB-Receiver Tests (RCV-LE)

| No. | Item                     | Test Case  | Channel for Testing   |
|-----|--------------------------|--|-----------------------|
| 1   | RF-PHY/RCV-LE/CA/BV-01-C | Receiver sensitivity,<br>uncoded data at 1 Ms/s                        | Ch0, 12, 19, 39       |
| 2   | RF-PHY/RCV-LE/CA/BV-03-C | C/I and Receiver Selectivity<br>Performance,<br>uncoded data at 1 Ms/s | Ch0, 2, 12, 19, 37,39 |
| 3   | RF-PHY/RCV-LE/CA/BV-04-C | Blocking Performance,<br>uncoded data at 1 Ms/s                        | Ch12                  |
| 4   | RF-PHY/RCV-LE/CA/BV-05-C | Intermodulation Performance,<br>uncoded data at 1 Ms/s                 | Ch0, 12, 19, 39       |
| 5   | RF-PHY/RCV-LE/CA/BV-06-C | Maximum input signal level,<br>uncoded data at 1 Ms/s                  | Ch0, 12, 19, 39       |
| 6   | RF-PHY/RCV-LE/CA/BV-07-C | PER Report Integrity,<br>uncoded data at 1 Ms/s                        | Ch12, 19              |





The End

Thanks and best regards.