



Report No. : BLA-RF-201904-A38

TEST REPORT

Product Name : TWS Bluetooth earphones
Trade mark : N/A
Mode No. : In1912
Serial Number : N/A
Report Number : BLA-RF-201904-A38
Date of Issue : April. 26, 2019
Test standard : Item 19 of Article 2 Paragraph 1
Test result : PASS

Prepared for:

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Date: April. 26, 2019





2 Version

| Version No. | Date | Description |
|-------------|-----------------|-------------|
| 00 | April. 26, 2019 | Original |
| | | |
| | | |

3 Test Summary

| Test | Test Requirement | Limit/Severity | Result |
|-----------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Antenna Requirement | Item 19 of Article 2 Paragraph 1 | Notice 88 Appendix 43,B-1 (1)&(2) | PASS |
| Test frequency | Item 19 of Article 2 Paragraph 1 | Notice 88 Appendix 43, A-3 | PASS |
| Frequency Error | Item 19 of Article 2 Paragraph 1 | ±50 PPM or less | PASS |
| Occupied Bandwidth | Item 19 of Article 2 Paragraph 1 | 83.5 MHz or less | PASS |
| Spread-spectrum Bandwidth | Item 19 of Article 2 Paragraph 1 | 500 kHz or more | PASS |
| Antenna Power | Item 19 of Article 2 Paragraph 1 | Designated value: (1)FH, FH+DS , FH+OFDM 3mW/MHz (Used in the range of 427-2470.75MHz) (2) OFDM , DS other than (1) : 10mW/MHz (3) Other than (1) & (2) 10mW Tolerance: +20%,-80% | PASS |
| Spurious Emission of Tx | Item 19 of Article 2 Paragraph 1 | (1) Below 2387 MHz : -26dBm (2) 2387 to 2400 MHz : -16dBm (3) 2483.5 through 2496.5 MHz : -16dBm (4) Over 2496.5 MHz : -26dBm | PASS |
| Dwell Time | Item 19 of Article 2 Paragraph 1 | less than 0.4sec | PASS |
| Pseudorandom Frequency Hopping Sequence | Item 19 of Article 2 Paragraph 1 | Notice 88 Appendix 43, 44, 45 | PASS |
| Interference prevention capability | Item 19 of Article 2 Paragraph 1 | Notice 88 Appendix 43, 44, 45 | PASS |
| RF accessibility | Item 19 of Article 2 Paragraph 1 | Notice 88 Appendix 43, 44, 45 | PASS |
| Spurious Emission of Rx | Item 19 of Article 2 Paragraph 1 | (1) Below 1 GHz: -54dBm (2) 1GHz or higher: -47dBm | PASS |

Remark:

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means the product in transmitting status.

Rx: In this whole report Rx (or rx) means the product in receiving status.

RF: In this whole report RF means Radiated Frequency.

NTNV:

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5 General Information

5.1 Client Information

| | |
|--------------------------|---------------------------------------------------------------------|
| Applicant: | Dongguan Hele Electronics Co.,Ltd |
| Address of Applicant: | Dalingya Industrial Zone,Daojiao Town,Dongguan City,Guangdong,China |
| Manufacturer: | Dongguan Hele Electronics Co.,Ltd |
| Address of Manufacturer: | Dalingya Industrial Zone,Daojiao Town,Dongguan City,Guangdong,China |
| Factory: | Dongguan Hele Electronics Co.,Ltd |
| Address of Factory: | Dalingya Industrial Zone,Daojiao Town,Dongguan City,Guangdong,China |

5.2 General Description of EUT

| | |
|------------------------|--------------------------------------|
| Product Name: | TWS Bluetooth earphones |
| Model No.: | In1912 |
| Trade Mark: | N/A |
| Operating Frequency: | 2402 MHz to 2480 MHz |
| Conducted rated power: | F1D: 1.650mW/MHz G1D: 1.650mW/MHz |
| Number of Channels: | 79 Channels |
| Type of Modulation: | GFSK, ($\pi/4$)DQPSK, 8DPSK |
| Channel Separation: | 1 MHz |
| Dwell time | Per channel is less than 0.4s. |
| Antenna Type: | Integral antenna |
| Antenna gain: | 2.5dBi from 2402~2480MHz |
| Sample Type: | Portable production |
| Power Supply: | 3.7V |
| Sample Received Date: | April 15, 2019 |
| Sample tested Date: | April 15, 2019 to April 26, 2019 |

5.3 Description of Support Units

The EUT has been tested stand-alone..

5.4 Test Location

All tests were performed at:

Qianhai BlueAsia of Technical Services(Shenzhen) Co.,Ltd.

IOT Test Centre of BlueAsia No. 448 Bulong Road, Bantian Street, Longgang District, Shenzhen

Telephone: TEL: +86-755-2305 9481 FAX: +86-755-2305 9481

No tests were sub-contracted.

6 Equipment List

| Equipment | Manufacturer | Model | Serial No. | Due Date | Calibration body | Classification |
|---------------------------------|--------------|---------|------------|-----------|------------------|----------------|
| Signal Generator | Agilent | E8257D | MY44320250 | 2019.5.23 | GRGT | (c) |
| Communication test set test set | Anritsu | MT8852B | 0814003 | 2019.5.23 | GRGT | (c) |
| Spectrum Analyzer | Keysight | N9030A | MY52350152 | 2019.5.23 | GRGT | (c) |
| Signal Generator | Agilent | E4438C | MY45092582 | 2019.5.23 | GRGT | (c) |

Remark:

- (a) Calibration conducted by the National Institute of Information and Communications Technology (NICT) in Japan (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1) in JRL.
- (b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Act (Act No. 51 of 1992) .
- (c) Calibration conducted in countries except Japan, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).
- (d) Calibration, etc. conducted by using measuring instruments and other equipment listed in the right column of appended table No. 3, which shall have been given any type of calibration, etc. listed above from (a) to (C)

From JRL Article 24-2, paragraph 4, Item 2

Notice: Calibration duration for above equipments is 1 year.

7 Radio Technical Requirements Specification

Table 1: Radio Technical Requirements Specification for 2.4 GHz band wide-band low-power data communication system (Item 19 of Article 2 Paragraph 1)

| Items | Technical standard |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assigned frequency or designated frequency | 2400-2483.5MHz |
| Communication method | One-way communication, simplex, semi-duplex, or duplex operation of digital signal transmission including spread spectrum |
| Tolerance of frequency ($\times 10^{-6}$) | ± 50 PPM |
| Tolerance of occupied bandwidth | FH: 83.5MHz or less FH + OFDM: 83.5MHz or less Others: 26MHz or less FH + DS: 83.5MHz or less OFDM: 38MHz or less |
| Antenna power | Designated value (1) FH, FH+DS , FH+OFDM: 3mW/MHz (used in the range of 2427 - 2470.75 MHz) (2) OFDM , DS other than (1): 10mW/MHz (3) Other than (1) & (2): 10mW Tolerance : +20%,-80% |
| Antenna gain | 1) 12.14 dBi or less in principle 2) In case of directional antenna (1) FH, FH+DS or FH+OFDM using 2427-2470.75 MHz EIRP \leq 16.91 dBm/MHz (2) OFDM or DS other than (1) EIRP \leq 22.14 dBm/MHz (3) Other than (1) and (2): 22.14 dBm or less (4) OFDM OBW 26 - 38MHz: 19.14dBm/MHz (5) Half-power angle of directional antenna (e) in case of the item 2): $e \leq 360/A$ (The A is 10 in maximum.) |
| Tolerance of spurious emission intensity | (1) Below 2387 MHz: 2.5 μ W (2) 2387 to 2400 MHz: 25 μ W (3) 2483.5 through 2496.5 MHz: 25 μ W (4) Over 2496.5 MHz: 2.5 μ W |
| Spreading bandwidth | 500kHz or more |
| Limit of secondary radiated emissions | (1) Below 1 GHz: 4nW (2) 1 GHz or higher: 20nW |
| Interference prevention function | Shall have the function of automatic transmission and reception of identification sign. |
| Structure | Shall be of the structure that the RF and modulator sections excluding antenna cannot easily be opened. |
| Note | DS: Direct spread FH: Frequency hopping OFDM: Orthogonal frequency division multiplexing |

Note: The Technical Standards described here do not cover all of the regulated items.

7.1 Transmitter Requirements

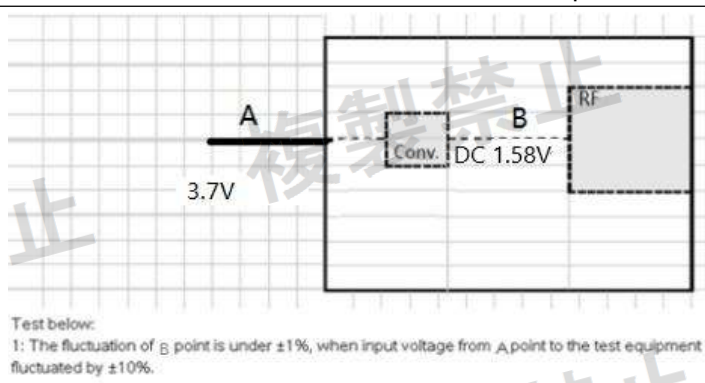
7.1.1 EUT test voltage and Frequency

7.1.1.1 EUT test voltage

Power Supply: DC 3.7V

Test voltage require: The power supply is by DC 3.7Vport charging. The supply voltage of RF part is varied within $\pm 1\%$, so the DC 3.7V is chosen in the test report.

Power Supply view:



Power Supply result:

The measurement result of the voltage fluctuation at RF circuit when 3.7V $\pm 10\%$.

| DC INPUT | DC1.58V |
|----------|---------|
| 4.07V | 1.58V |
| 3.7V | 1.58V |
| 3.33V | 1.58V |

| Test condition | Ambient | |
|----------------|-----------------------------------|------------|
| | Temperature($^{\circ}\text{C}$) | Voltage(V) |
| NTNV | 26 | 3.7 |
| N TLV | N/A | N/A |
| N THV | N/A | N/A |

7.1.1.2 Test frequency

| | | |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Test frequencies: | If the EUT can be set to 3 or more different (carrier) frequencies in 1 allocated band, testing shall be performed using the Lowest, Middle and the Highest frequency (L,M and H). If there are 2 or fewer frequencies, testing shall be performed with the available frequencies. | |
| Frequency range over which device operates | Number of frequencies | Location in the range of operation |
| 1 MHz or less | 1 | Middle |
| 1 to 10 MHz | 2 | 1 near top and 1 near bottom |
| More than 10 MHz | 3 | 1 near top, 1 near middle and 1 near bottom |

EUT channels and frequencies list:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 0 | 2402 | 20 | 2422 | 40 | 2442 | 60 | 2462 |
| 1 | 2403 | 21 | 2423 | 41 | 2443 | 61 | 2463 |
| 2 | 2404 | 22 | 2424 | 42 | 2444 | 62 | 2464 |
| 3 | 2405 | 23 | 2425 | 43 | 2445 | 63 | 2465 |
| 4 | 2406 | 24 | 2426 | 44 | 2446 | 64 | 2466 |
| 5 | 2407 | 25 | 2427 | 45 | 2447 | 65 | 2467 |
| 6 | 2408 | 26 | 2428 | 46 | 2448 | 66 | 2468 |
| 7 | 2409 | 27 | 2429 | 47 | 2449 | 67 | 2469 |
| 8 | 2410 | 28 | 2430 | 48 | 2450 | 68 | 2470 |
| 9 | 2411 | 29 | 2431 | 49 | 2451 | 69 | 2471 |
| 10 | 2412 | 30 | 2432 | 50 | 2452 | 70 | 2472 |
| 11 | 2413 | 31 | 2433 | 51 | 2453 | 71 | 2473 |
| 12 | 2414 | 32 | 2434 | 52 | 2454 | 72 | 2474 |
| 13 | 2415 | 33 | 2435 | 53 | 2455 | 73 | 2475 |
| 14 | 2416 | 34 | 2436 | 54 | 2456 | 74 | 2476 |
| 15 | 2417 | 35 | 2437 | 55 | 2457 | 75 | 2477 |
| 16 | 2418 | 36 | 2438 | 56 | 2458 | 76 | 2478 |
| 17 | 2419 | 37 | 2439 | 57 | 2459 | 77 | 2479 |
| 18 | 2420 | 38 | 2440 | 58 | 2460 | 78 | 2480 |
| 19 | 2421 | 39 | 2441 | 59 | 2461 | N/A | N/A |

Test frequencies are the lowest channel: 0 channel (2402 MHz), Middle channel, 39 channel (2441 MHz) and highest channel: 78 channel (2480 MHz).

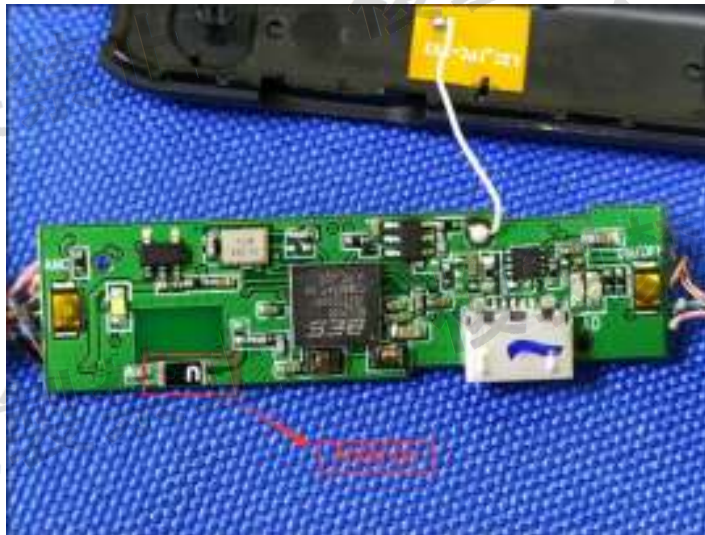
7.1.2 Antenna Requirement

Standard requirement

Applicable for equipment with an antenna terminal, including testing terminals) If an antenna connector is available, all relevant tests will be carried out conducted. If not, tests will be carried out in an anechoic room or with a suitable test-fixture.

EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.5dBi.



Result: An antenna connector is available; all relevant tests will be carried out conducted.

7.1.3 Frequency Error

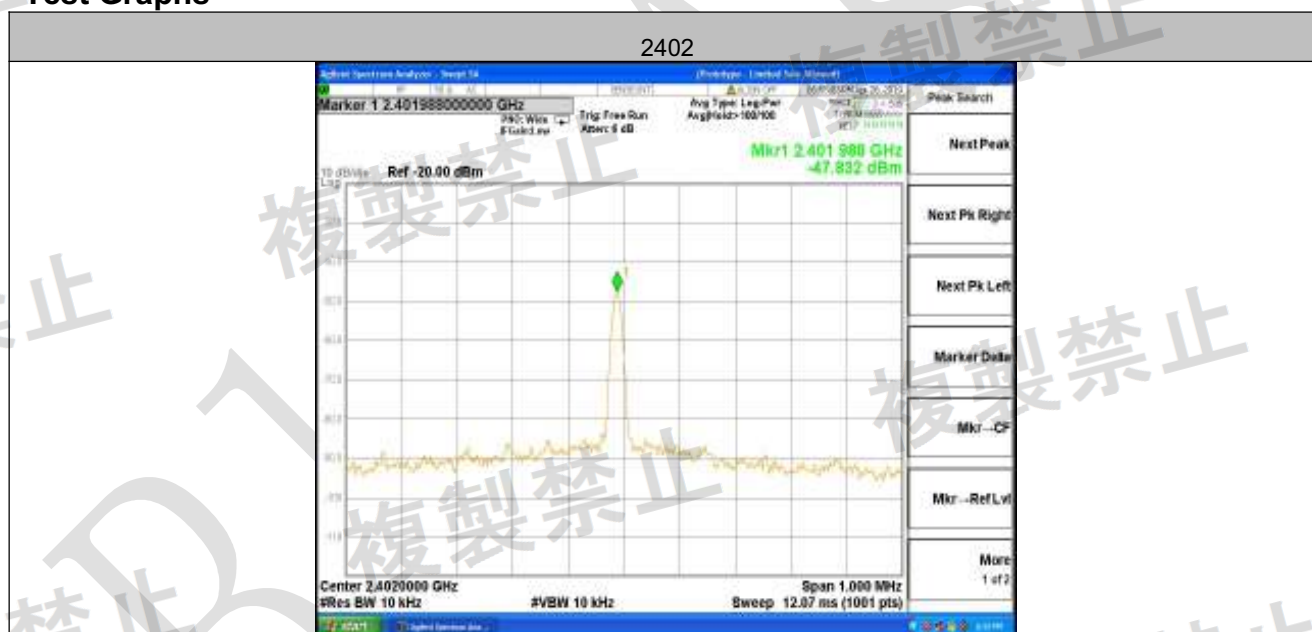
| | | | |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 | | |
| Test Method: | MIC Notice No.88 Appendix No.43 | | |
| EUT Operation: | | | |
| Ambient: | Temp.: 24°C | Humid.: 55% | Press.: 1010 mbar |
| Test Status: | Test the EUT in transmitting mode without modulation. Test in Channel lowest (2402MHz), middle (2441MHz) and highest (2480MHz), keep in continuously transmitting status. | | |
| Test Configuration: | | | |
| <div><div>EUT</div><div>Spectrum Analyzer</div></div> | | | |
| Test Conditions: | Frequency Counter or Spectrum Analyzer is used for measurement. | | |
| EUT conditions: | Modulation/Spread/Hopping off, CW Tx If EUT does not accept “Modulation OFF” mode in the measurement, you may use “Modulation ON” mode. In that case you can use the Max power Frequency as the measuring results. | | |
| Spectrum Analyzer conditions: | Frequency: Test Frequency Span 1MHz RBW 10KHz (Modulation ON), VBW 10KHz (Modulation ON), Sweep Time Auto Detector mode Positive peak Indication mode Max hold | | |
| Technical standard: | Tolerance of frequency: $\pm 50 \times 10^{-6}$ | | |
| Test result: | PASS | | |

Measurement Record:
Uncertainty: $\pm 10\text{Hz}$
Test Result

| Test channel | Test Frequency (MHz) | Result[ppm] | Limit[ppm] | Verdict |
|--------------|----------------------|-------------|------------|---------|
| Lowest | 2402 | -4.996 | ± 50 | PASS |
| Middle | 2441 | -5.326 | ± 50 | PASS |
| Highest | 2480 | -5.242 | ± 50 | PASS |

Note: The nominal frequency shall be confirmed by the applicant and test lab.

Result plot as follows:

Test Graphs


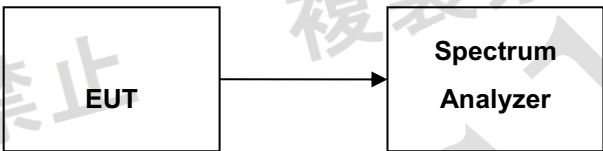
2441



2480



7.1.4 Occupied Bandwidth (99%)

| | |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 |
| Test Method: | MIC Notice No.88 Appendix No.43 |
| EUT Operation: | |
| Ambient: | Temp.: 24.0°C Humid.: 55% Press.: 1010mbar |
| Test Status: | Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below. |
| Test Configuration: |  <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre> |
| EUT conditions: | Modulation/Spread/Hopping on, PN9 Modulation Tx For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. |
| Spectrum Analyzer conditions: | Frequency: Test Frequency Span 120MHz (FHSS), RBW 1MHz VBW 1MHz Sweep Time Auto detector mode Positive peak Indication mode Max hold OBW 99% |
| Technical standard: | FH : 83.5MHz |
| Test result: | PASS |

Measurement Record:

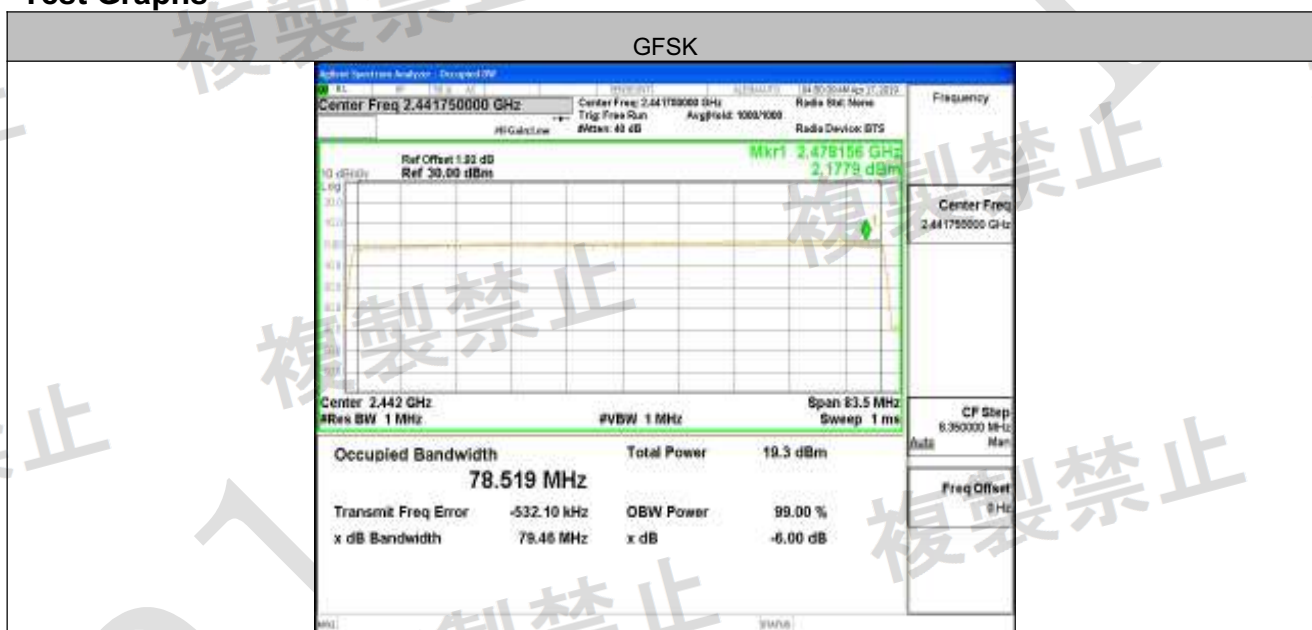
Uncertainty: $\pm 10\text{KHz}$

Test Result

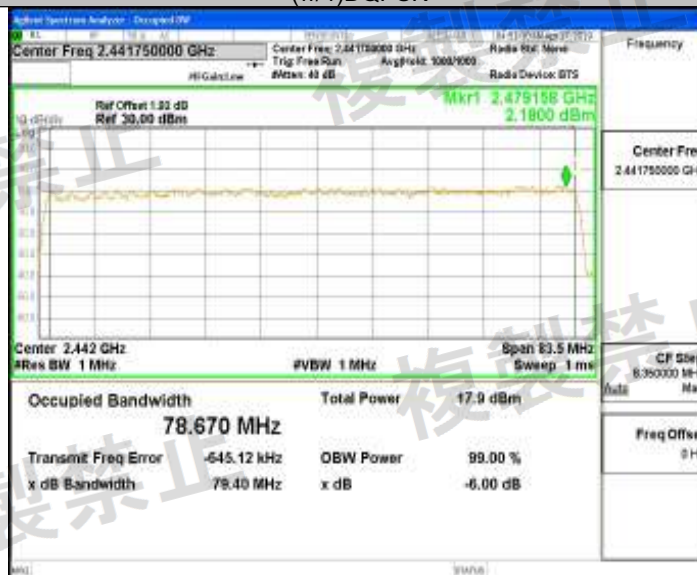
| TestCondition | TestMode | Channel | Result [MHz] | Limit [MHz] | Verdict |
|---------------|-----------------|---------|--------------|-------------|---------|
| NTNV | GFSK | Hop | 78.519 | ≤ 83.5 | PASS |
| | $(\pi/4)$ DQPSK | Hop | 78.670 | ≤ 83.5 | PASS |
| | 8DPSK | Hop | 78.454 | ≤ 83.5 | PASS |

Result plot as follows:

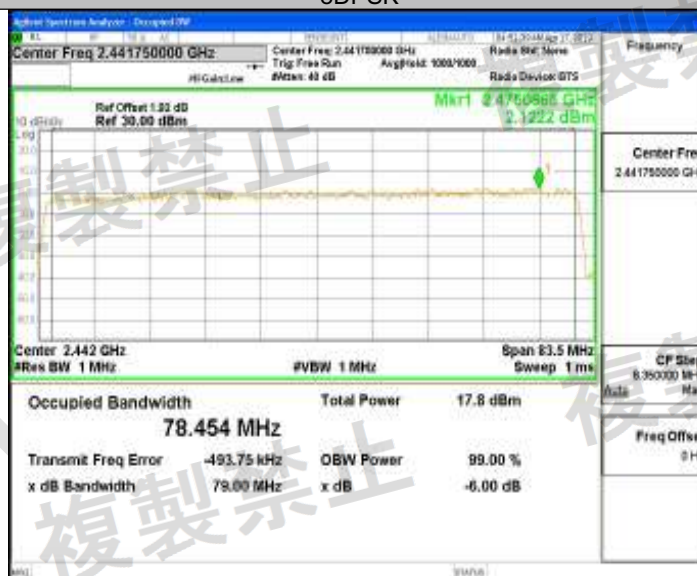
Test Graphs



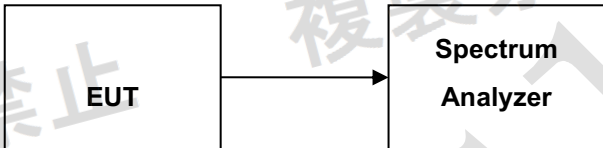
($\pi/4$)DQPSK



8DPSK



7.1.5 Spread spectrum Bandwidth (90%)

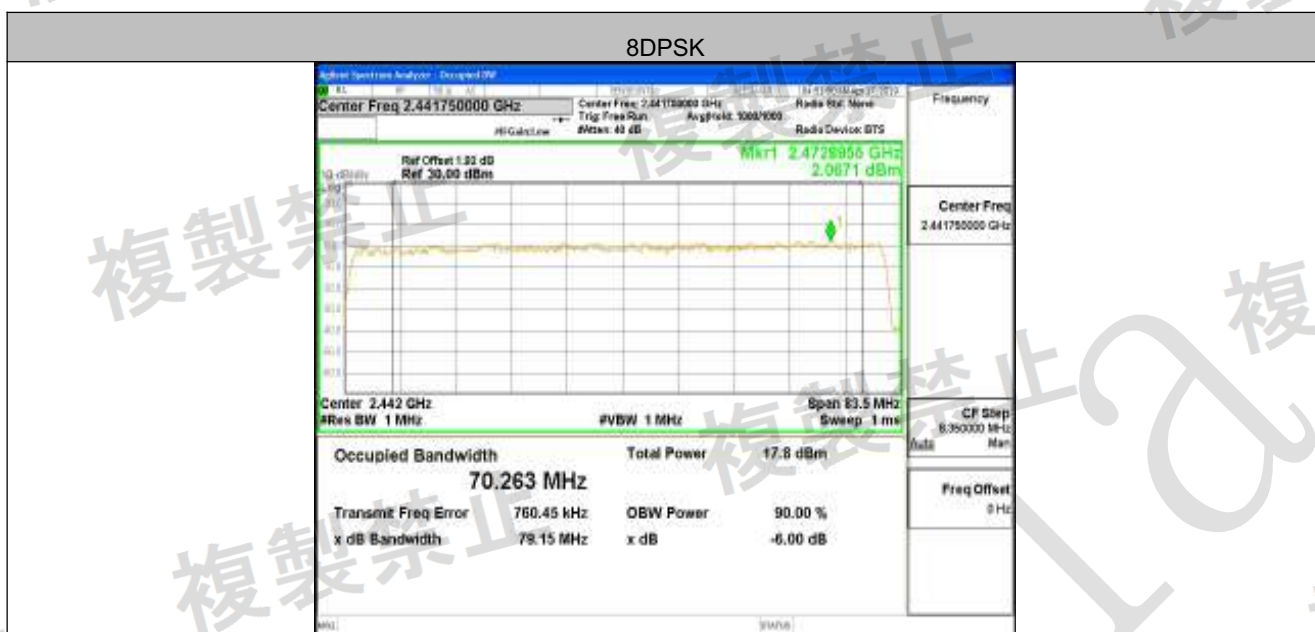
| | | | |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 | | |
| Test Method: | MIC Notice No.88 Appendix No.43 | | |
| EUT Operation: | | | |
| Ambient: | Temp.: 24.0°C | Humid.: 55% | Press.: 1010 mbar |
| Test Status: | Pre-Scan has been conducted to determine the worst-case mode formal possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).Following channel(s) was (were) selected for the final test as listed below. | | |
| Test Configuration: |  <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre> | | |
| EUT conditions: | Modulation/Spread/Hopping on, PN9 Modulation Tx For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. | | |
| Spectrum Analyzer conditions: | Frequency: Test Frequency Span 120MHz (FHSS), RBW 1MHz VBW 1MHz Sweep Time Auto detector mode Positive peak Indication mode Max hold OBW 90% | | |
| Technical standard: | 500kHz or more | | |
| Test result: | PASS | | |

Measurement Record:
Uncertainty: $\pm 10\text{KHz}$
Test Result

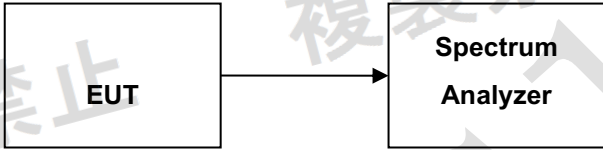
| TestCondition | TestMode | Channel | Result [MHz] | Limit [MHz] | Verdict |
|---------------|-----------------|---------|--------------|-------------|---------|
| NTNV | GFSK | Hop | 70.080 | ≥ 0.5 | PASS |
| | $(\pi/4)$ DQPSK | Hop | 69.954 | ≥ 0.5 | PASS |
| | 8DPSK | Hop | 70.263 | ≥ 0.5 | PASS |

Result plot as follows:

Test Graphs

7.1.6 Antenna Power

| | | | |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 | | |
| Test Method: | MIC Notice No.88 Appendix No.43 | | |
| EUT Operation: | | | |
| Ambient: | Temp.: 24°C | Humid.: 55% | Press.: 1010mbar |
| Test Status: | Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below. | | |
| Test Configuration: |  <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre> | | |
| EUT conditions: | Modulation/Spread/Hopping on, PN9 Modulation Tx For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. | | |
| Spectrum Analyzer conditions(FHSS): | Frequency: Test Frequency Span 120MHz RBW 1MHz VBW 1MHz Sweep Time Auto Detector mode Positive peak Indication mode Max hold | | |
| Technical standard: | Antenna Power (1) FH, FH+DS , FH+OFDM 3mW/MHz or less (used in the range of 2427-2470.75 MHz) (2) OFDM , DS other than (1) 10mW/MHz or less (3) Other than (1) & (2) 10mW or less Tolerance: +20% -80% | | |
| Test result: | PASS | | |

Measurement Record:
Uncertainty: ± 10 kHz / ± 1 dB
Test Result

| Antenna Power | | | | | | |
|---------------|------------|---------|---------|---------------|--------------|---------|
| TestCondition | TestMode | Antenna | Channel | Result(W/MHz) | Limit(W/MHz) | Verdict |
| NTNV | GFSK | Ant1 | 2402 | 0.739 | ≤ 3 | PASS |
| | | | 2441 | 1.215 | ≤ 3 | PASS |
| | | | 2480 | 1.661 | ≤ 3 | PASS |
| | (π/4)DQPSK | Ant1 | 2402 | 0.733 | ≤ 3 | PASS |
| | | | 2441 | 1.207 | ≤ 3 | PASS |
| | | | 2480 | 1.652 | ≤ 3 | PASS |
| | 8DPSK | Ant1 | 2402 | 0.733 | ≤ 3 | PASS |
| | | | 2441 | 1.232 | ≤ 3 | PASS |
| | | | 2480 | 1.670 | ≤ 3 | PASS |

| Tolerance | | | | | | | | |
|----------------|------------|---------|---------|---------------|--------------------|------------|------------|---------|
| Test Condition | Test Mode | Antenna | Channel | Power (W/MHz) | RatedPower (W/MHz) | Result (%) | Limit (%) | Verdict |
| NTNV | GFSK | Ant1 | 2402 | 0.739 | 1.650 | -55.21 | -80 to +20 | PASS |
| | | | 2441 | 1.215 | 1.650 | -26.36 | -80 to +20 | PASS |
| | | | 2480 | 1.661 | 1.650 | 0.67 | -80 to +20 | PASS |
| | (π/4)DQPSK | Ant1 | 2402 | 0.733 | 1.650 | -55.58 | -80 to +20 | PASS |
| | | | 2441 | 1.207 | 1.650 | -26.85 | -80 to +20 | PASS |
| | | | 2480 | 1.652 | 1.650 | 0.12 | -80 to +20 | PASS |
| | 8DPSK | Ant1 | 2402 | 0.733 | 1.650 | -55.58 | -80 to +20 | PASS |
| | | | 2441 | 1.232 | 1.650 | -25.33 | -80 to +20 | PASS |
| | | | 2480 | 1.670 | 1.650 | 1.21 | -80 to +20 | PASS |

Remark:

Conducted rated power: 1.650mW/MHz

Tolerance (%) :[(test value- rate power)/rater power]*100

Test Graphs

GFSK_2402



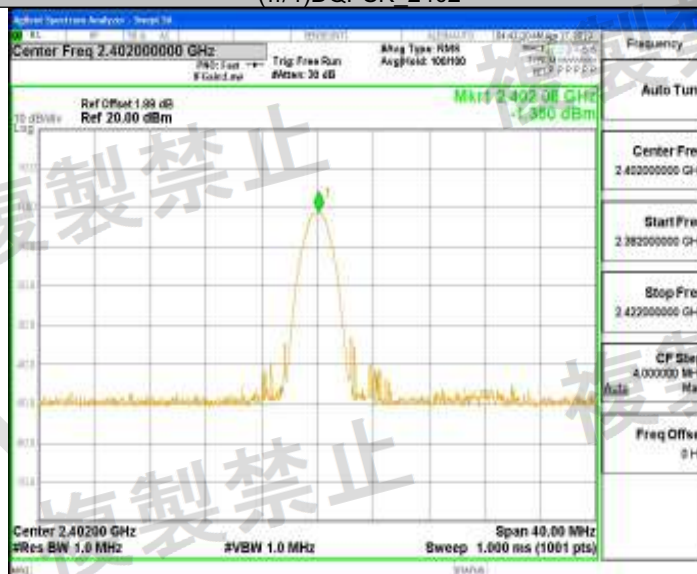
GFSK_2441



GFSK_2480



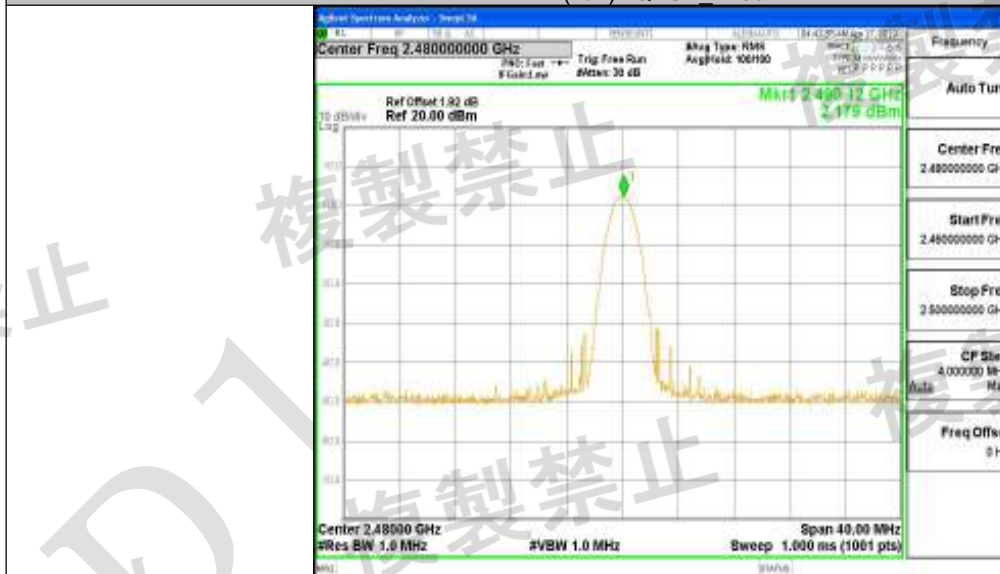
($\pi/4$)DQPSK_2402



($\pi/4$)DQPSK_2441



($\pi/4$)DQPSK_2480

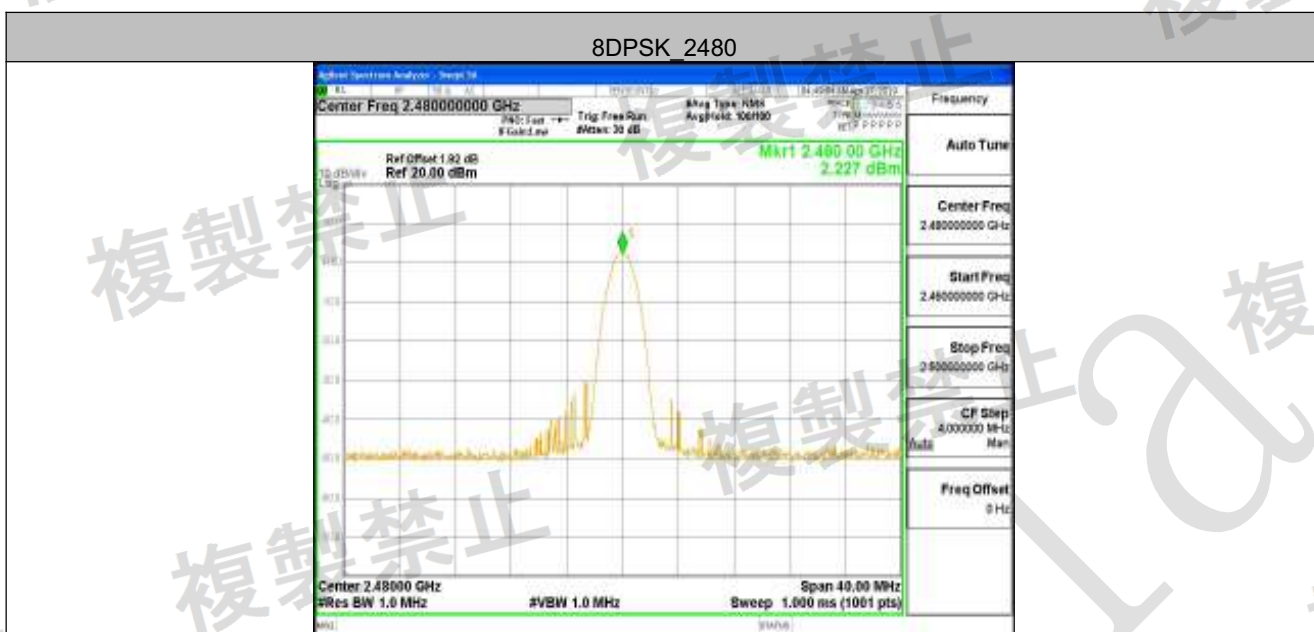


8DPSK_2402



8DPSK_2441





7.1.7 Spurious Emissions of Tx

| | | | |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 | | |
| Test Method: | MIC Notice No.88 Appendix No.43 | | |
| EUT Operation: | | | |
| Ambient: | Temp.: 24°C | Humid.: 55% | Press.: 1010 mbar |
| Test Status: | Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below. | | |
| Test Configuration: |  <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre> | | |
| EUT conditions: | Modulation/Spread/Hopping on, PN9 Modulation Tx For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. | | |
| Measurement Procedure: | Step1 All spurious are measured from 30MHz to 13GHz by peak mode. Step2 IF the value measured by Step1 is 2dB or less, measure in average mode. | | |
| Spectrum Analyzer conditions(Step 1): | Frequency: 30MHz – 2400MHz , 2483.5MHz –13GHz RBW 1000kHz (30 – 1GHz) , 1000KHz (over 1GHz) VBW 1000kHz (30 – 1GHz) , 1000KHz (over 1GHz) Sweep Time Auto detector mode Positive peak Indication mode Max hold | | |
| Spectrum Analyzer conditions(Step 2): | Frequency: Spurious Frequency Span 0Hz RBW 1MHz VBW 1MHz Sweep Time Auto Detector mode Sample Indication mode Max hold | | |
| Technical standard: | (1) Below 2387 MHz : 2.5μW/MHz (2) 2387 to 2400 MHz : 25μW/MHz (3) 2483.5 through 2496.5 MHz : 25μW/MHz (4) Over 2496.5 MHz : 2.5μW/MHz | | |
| Test result: | PASS | | |

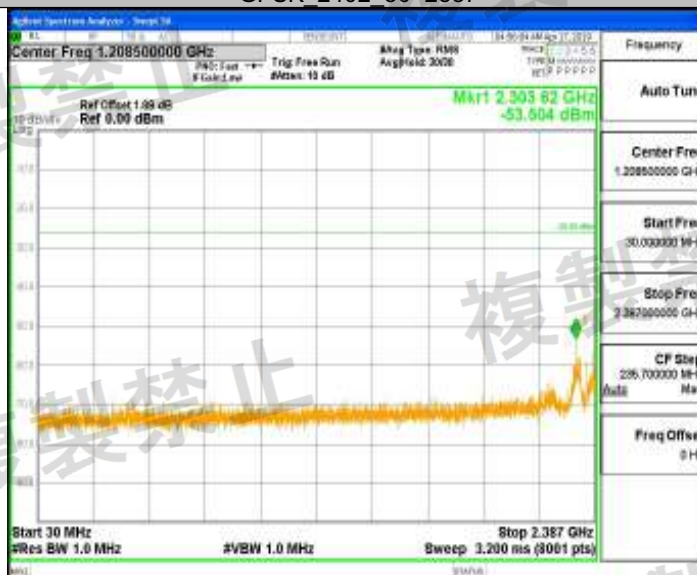
Measurement Record:
Uncertainty: ±1dB
Test Result

| TestCondition | TestMode | Channel | Freq.Range [MHz] | Result [dBm] | Limit [dBm] | Verdict |
|---------------|------------|---------|---------------------|-----------------|----------------|---------|
| NTNV | GFSK | 2402 | 30~2387 | -53.504 | <=-26 | PASS |
| | | | 2387~2400 | -43.692 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -47.034 | <=-16 | PASS |
| | | | 2496.5~13000 | -40.193 | <=-26 | PASS |
| | | 2441 | 30~2387 | -51.261 | <=-26 | PASS |
| | | | 2387~2400 | -56.273 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -47.400 | <=-16 | PASS |
| | | | 2496.5~13000 | -39.221 | <=-26 | PASS |
| | | 2480 | 30~2387 | -50.248 | <=-26 | PASS |
| | | | 2387~2400 | -54.599 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -50.499 | <=-16 | PASS |
| | | | 2496.5~13000 | -37.896 | <=-26 | PASS |
| | (π/4)DQPSK | 2402 | 30~2387 | -57.095 | <=-26 | PASS |
| | | | 2387~2400 | -36.812 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -49.930 | <=-16 | PASS |
| | | | 2496.5~13000 | -42.363 | <=-26 | PASS |
| | | 2441 | 30~2387 | -53.399 | <=-26 | PASS |
| | | | 2387~2400 | -56.683 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -48.402 | <=-16 | PASS |
| | | | 2496.5~13000 | -39.669 | <=-26 | PASS |
| | | 2480 | 30~2387 | -51.969 | <=-26 | PASS |
| | | | 2387~2400 | -55.415 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -45.135 | <=-16 | PASS |
| | | | 2496.5~13000 | -41.040 | <=-26 | PASS |
| | 8DPSK | 2402 | 30~2387 | -56.202 | <=-26 | PASS |
| | | | 2387~2400 | -37.186 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -48.739 | <=-16 | PASS |
| | | | 2496.5~13000 | -40.893 | <=-26 | PASS |
| | | 2441 | 30~2387 | -54.730 | <=-26 | PASS |
| | | | 2387~2400 | -57.513 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -48.880 | <=-16 | PASS |

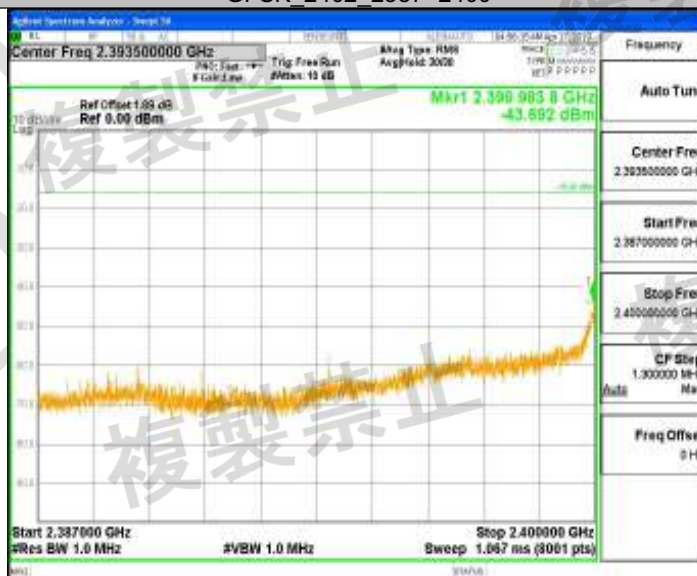
| | | | | | | |
|--|--|------|---------------|---------|-------|------|
| | | 2480 | 2496.5~13000 | -41.749 | <=-26 | PASS |
| | | | 30~2387 | -53.217 | <=-26 | PASS |
| | | | 2387~2400 | -55.217 | <=-16 | PASS |
| | | | 2483.5~2496.5 | -41.166 | <=-16 | PASS |
| | | | 2496.5~13000 | -38.305 | <=-26 | PASS |

Test Graphs

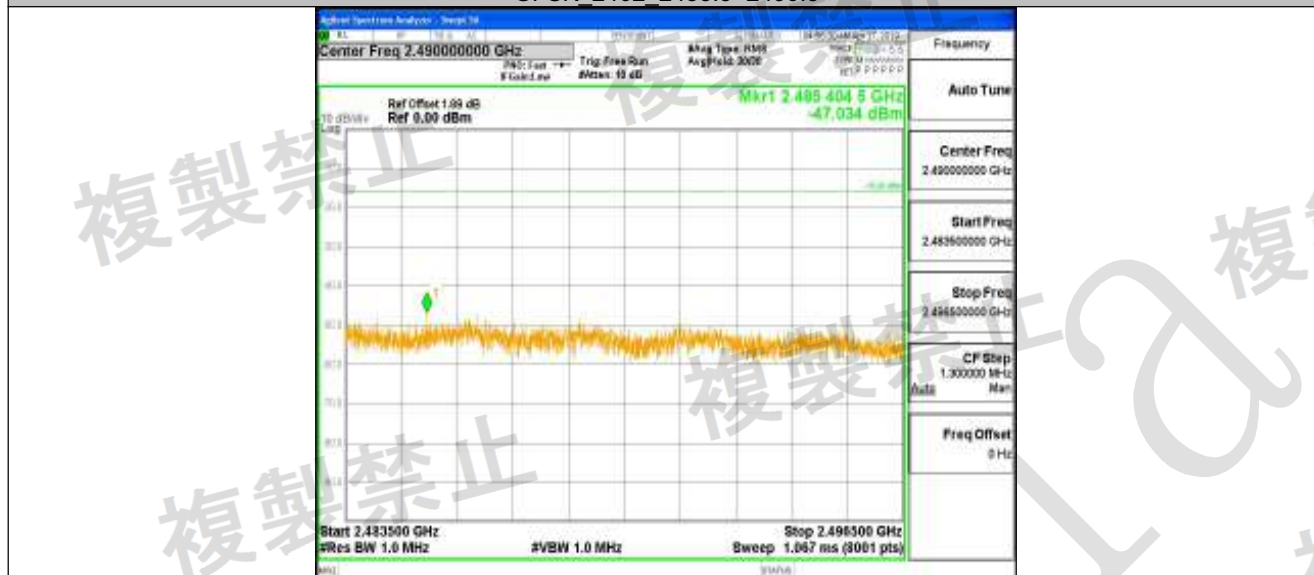
GFSK_2402_30~2387



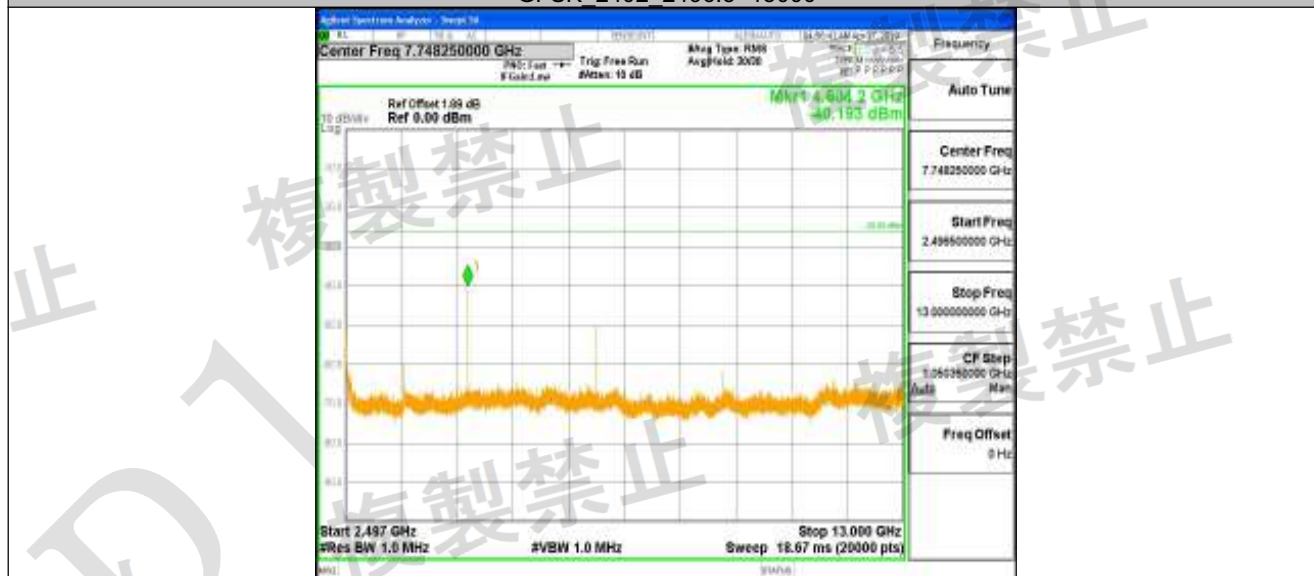
GFSK_2402_2387~2400



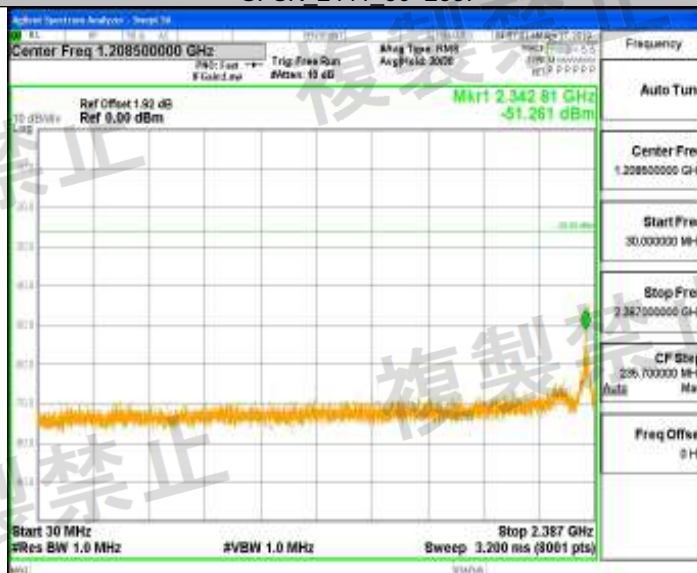
GFSK 2402 2483.5~2496.5



GFSK 2402 2496.5~13000



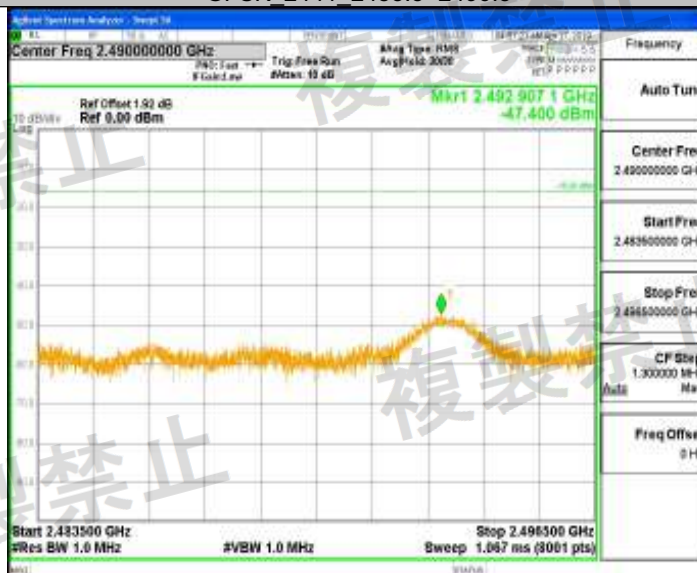
GFSK 2441 30~2387



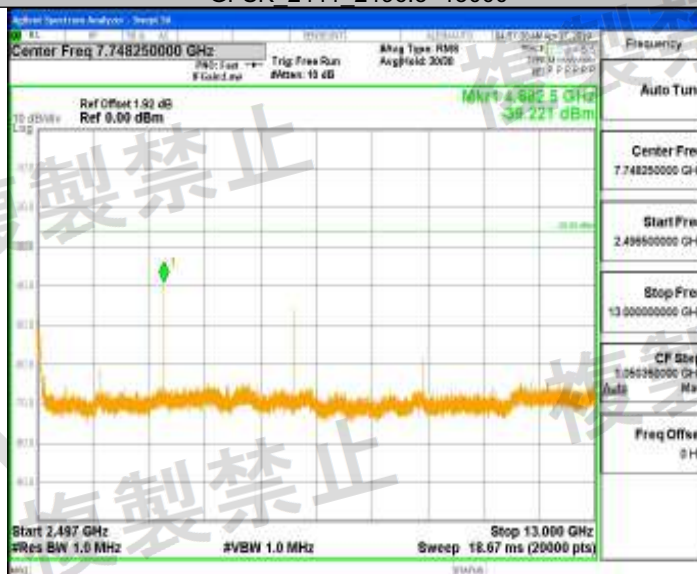
GFSK 2441 2387~2400



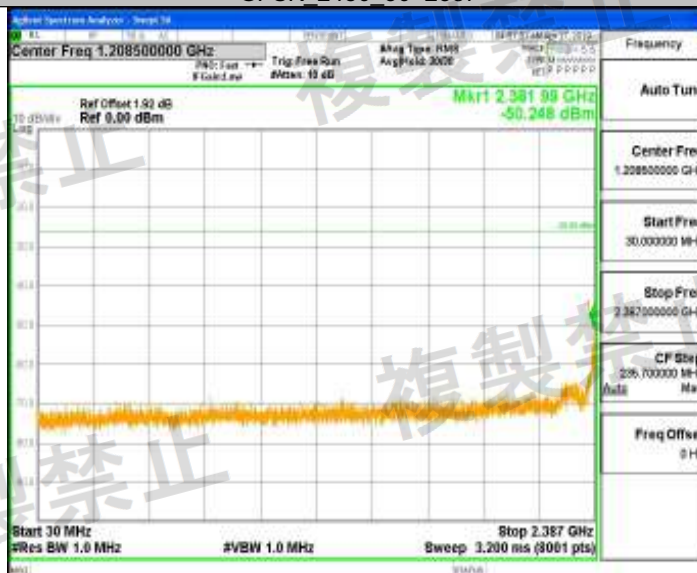
GFSK 2441 2483.5~2496.5



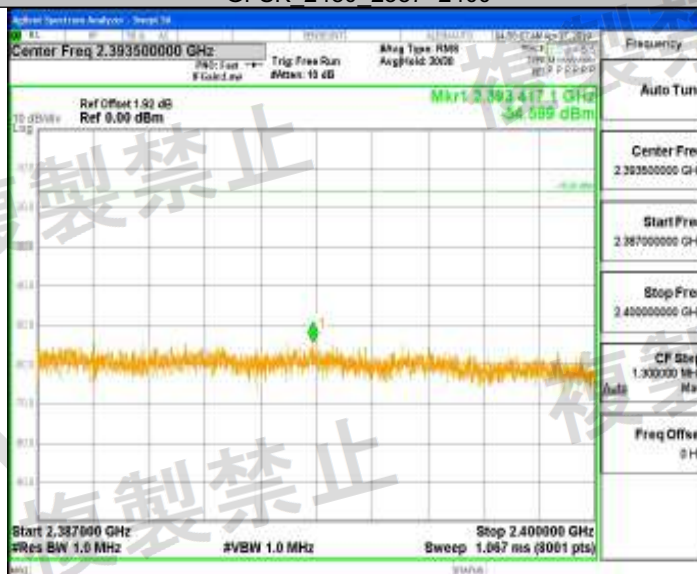
GFSK 2441 2496.5~13000



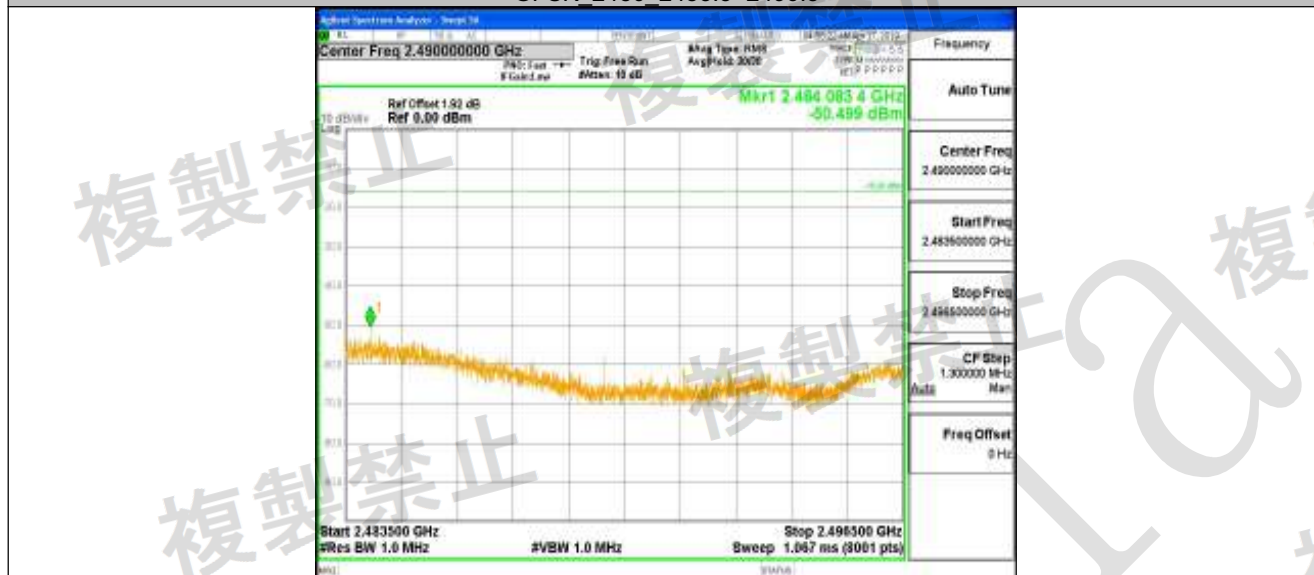
GFSK 2480 30~2387



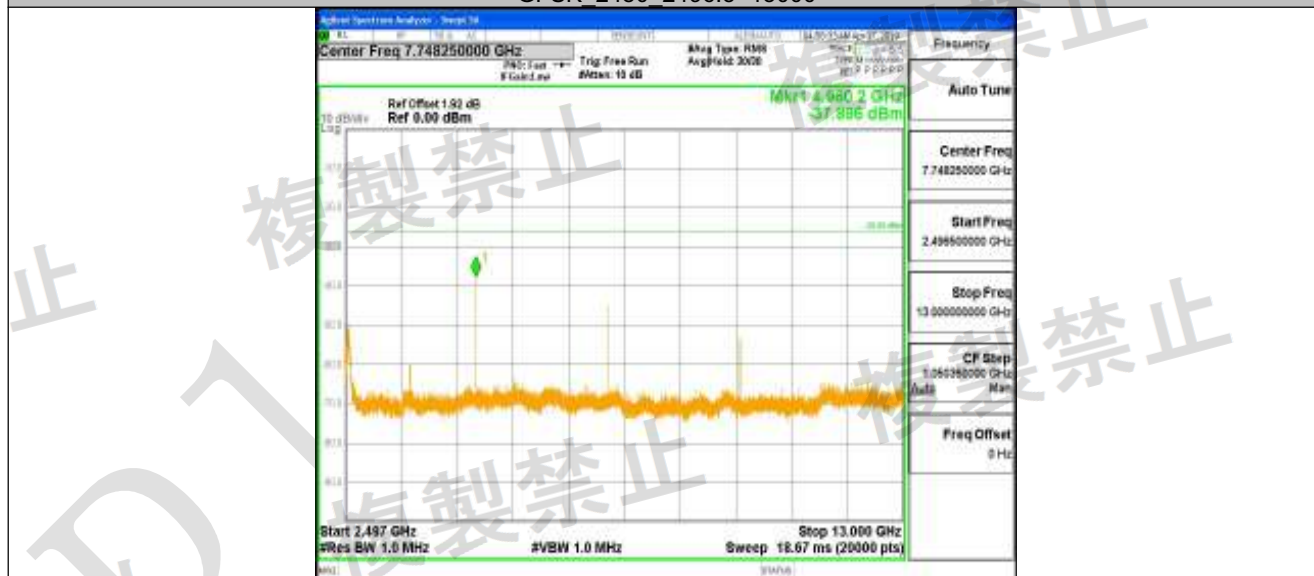
GFSK 2480 2387~2400



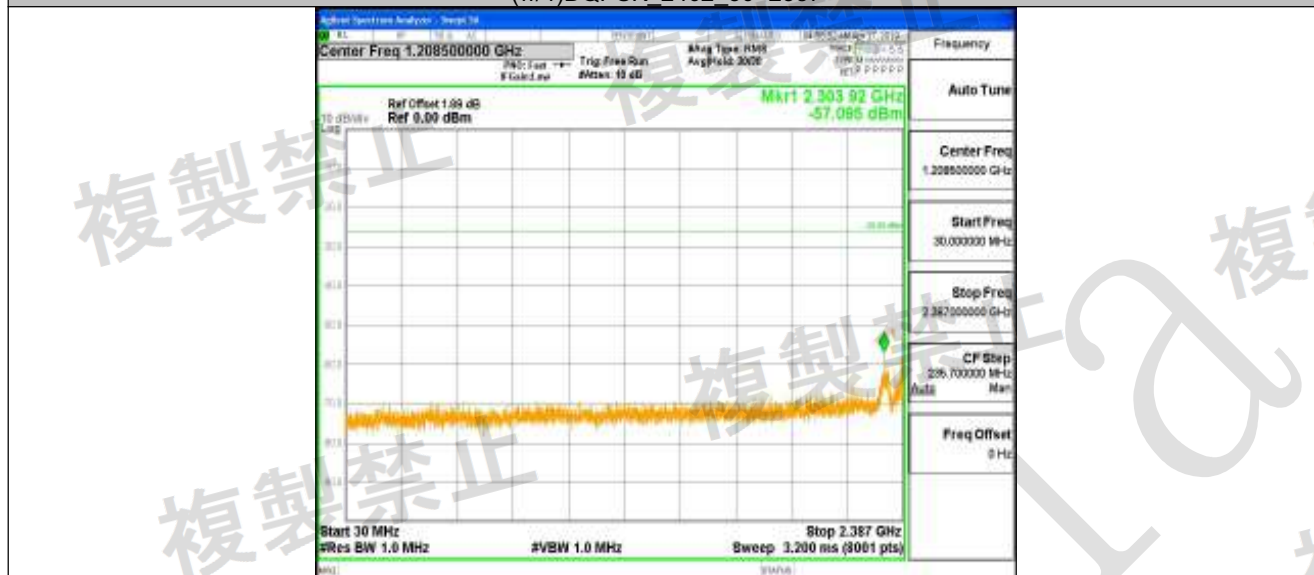
GFSK 2480 2483.5~2496.5



GFSK 2480 2496.5~13000



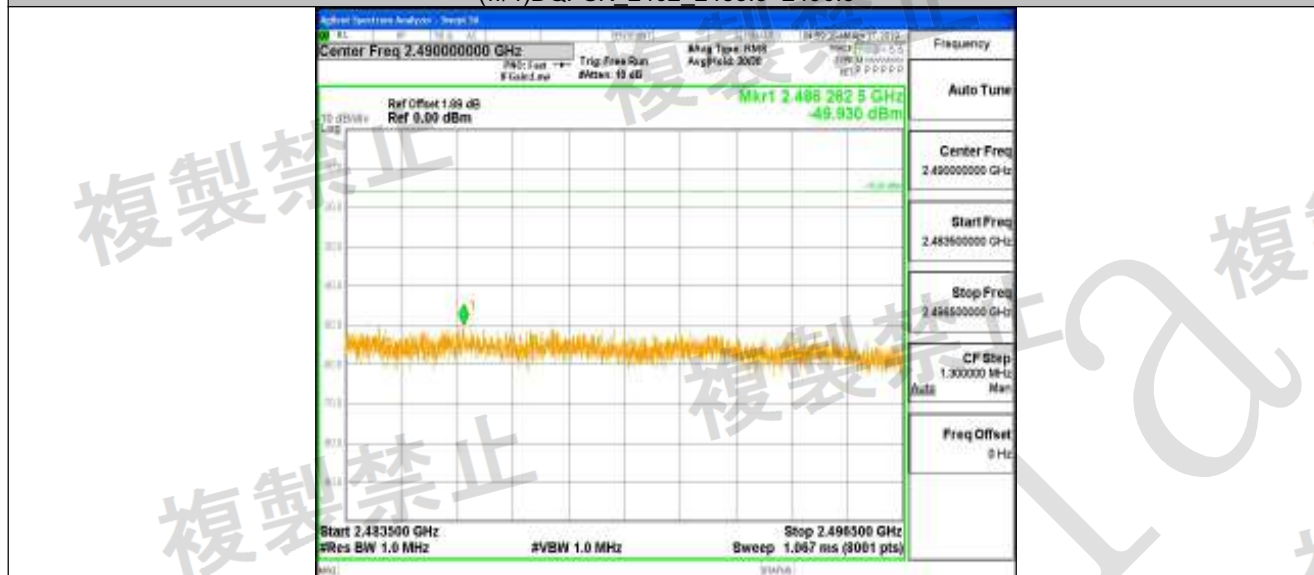
($\pi/4$)DQPSK_2402_30~2387



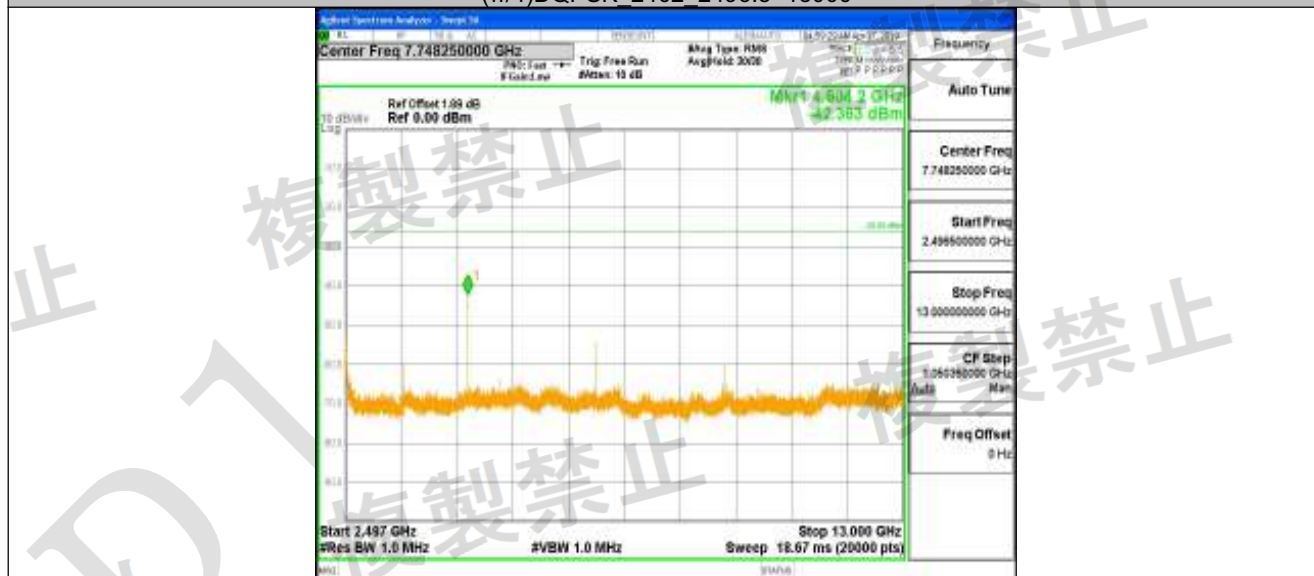
($\pi/4$)DQPSK_2402_2387~2400



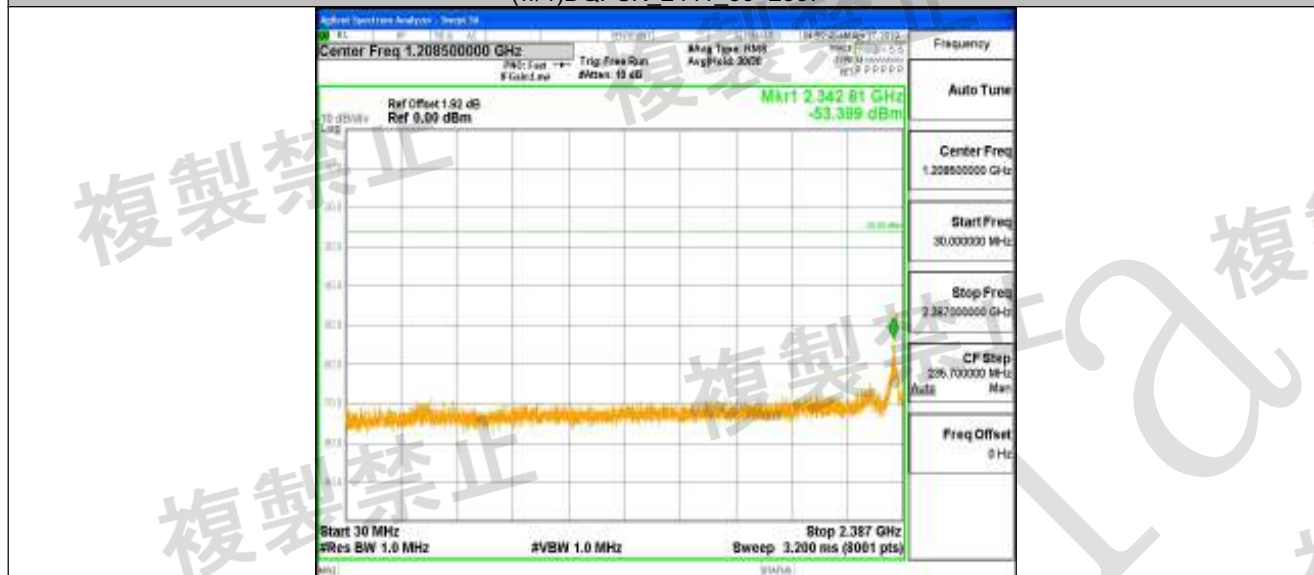
($\pi/4$)DQPSK 2402 2483.5~2496.5



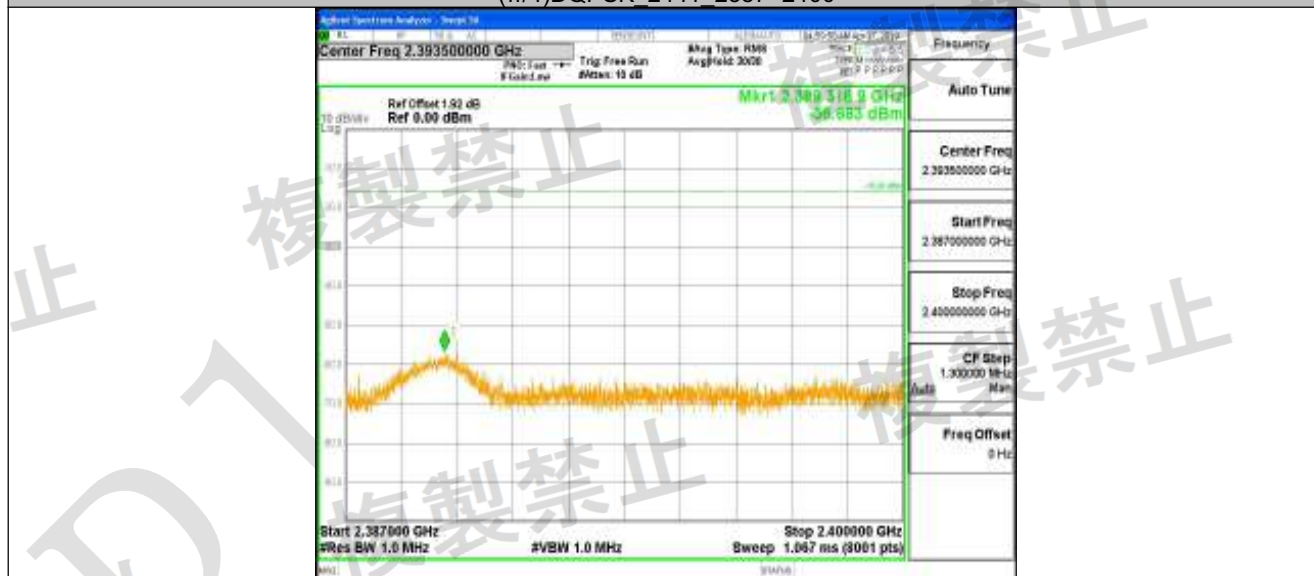
($\pi/4$)DQPSK 2402 2496.5~13000



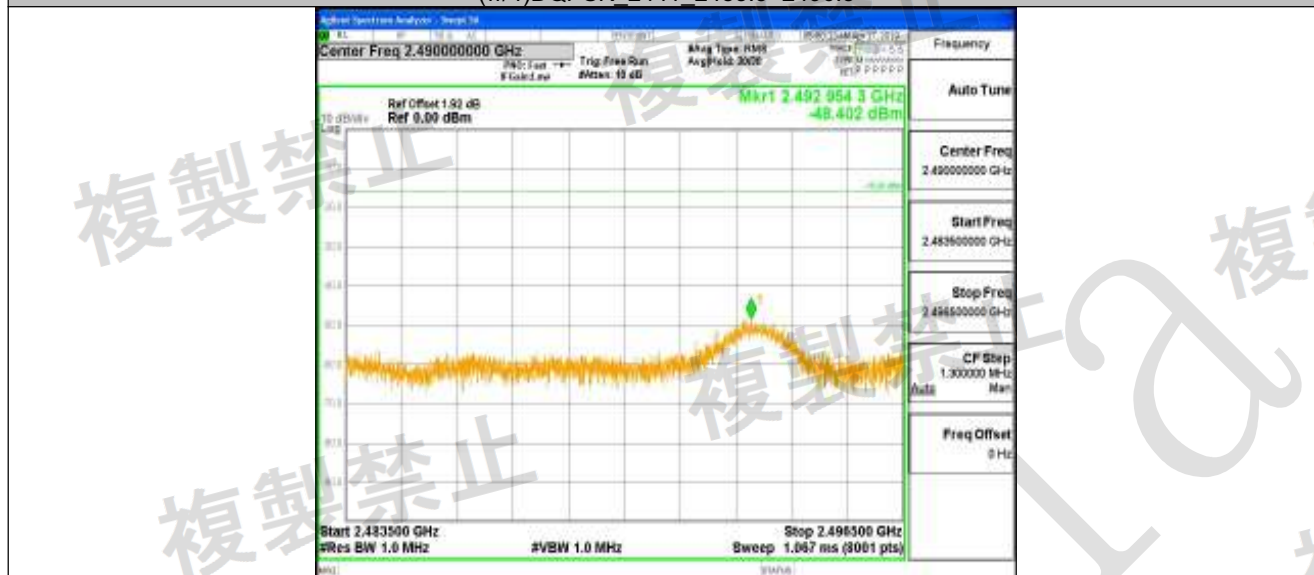
($\pi/4$)DQPSK 2441 30~2387



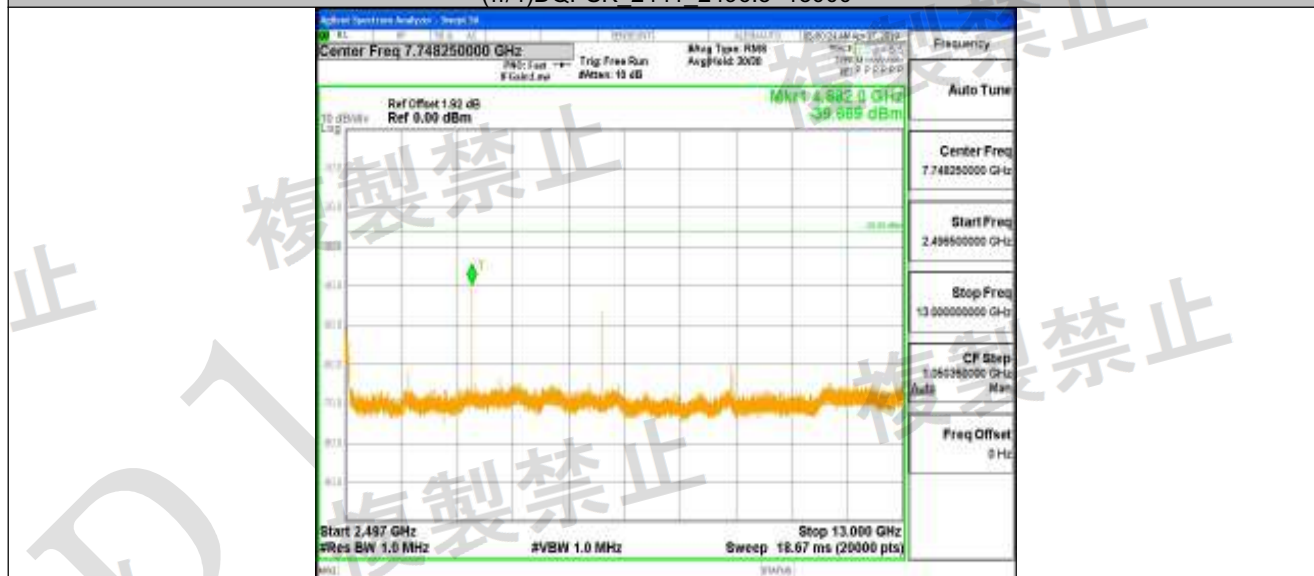
($\pi/4$)DQPSK 2441 2387~2400



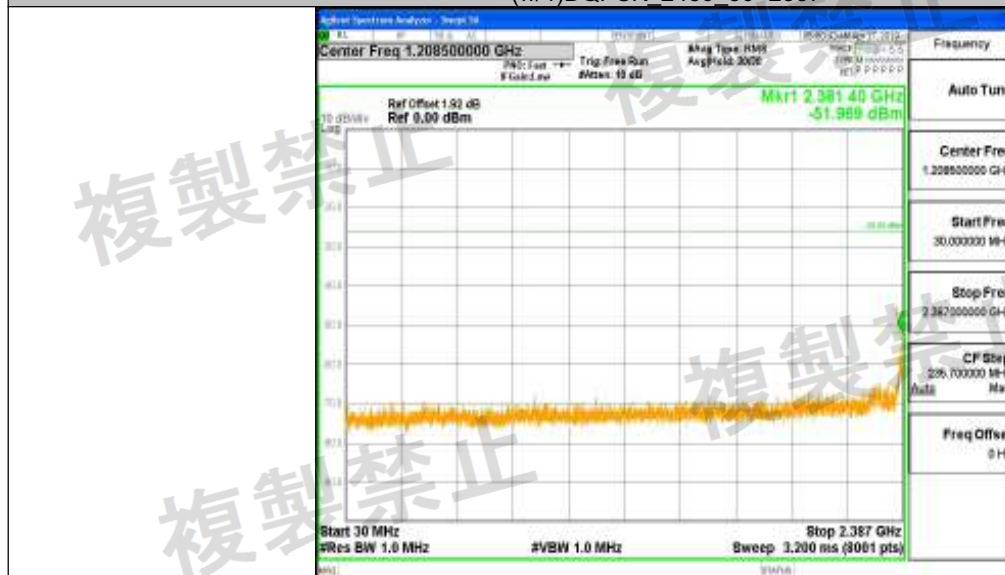
($\pi/4$)DQPSK 2441 2483.5~2496.5



($\pi/4$)DQPSK 2441 2496.5~13000



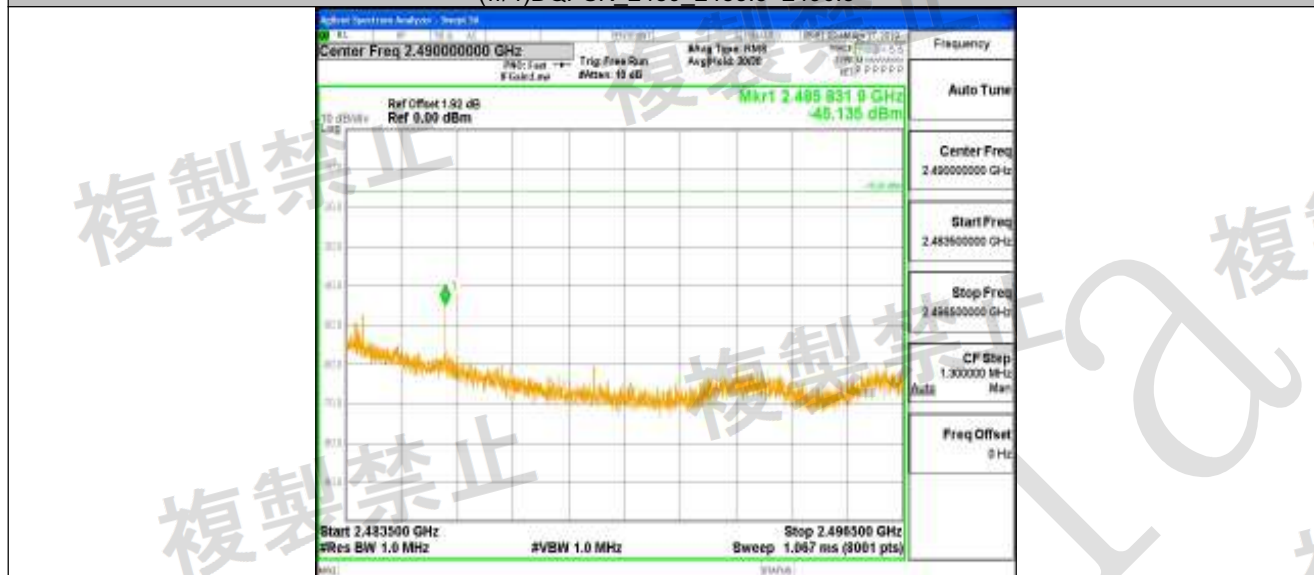
($\pi/4$)DQPSK 2480 30~2387



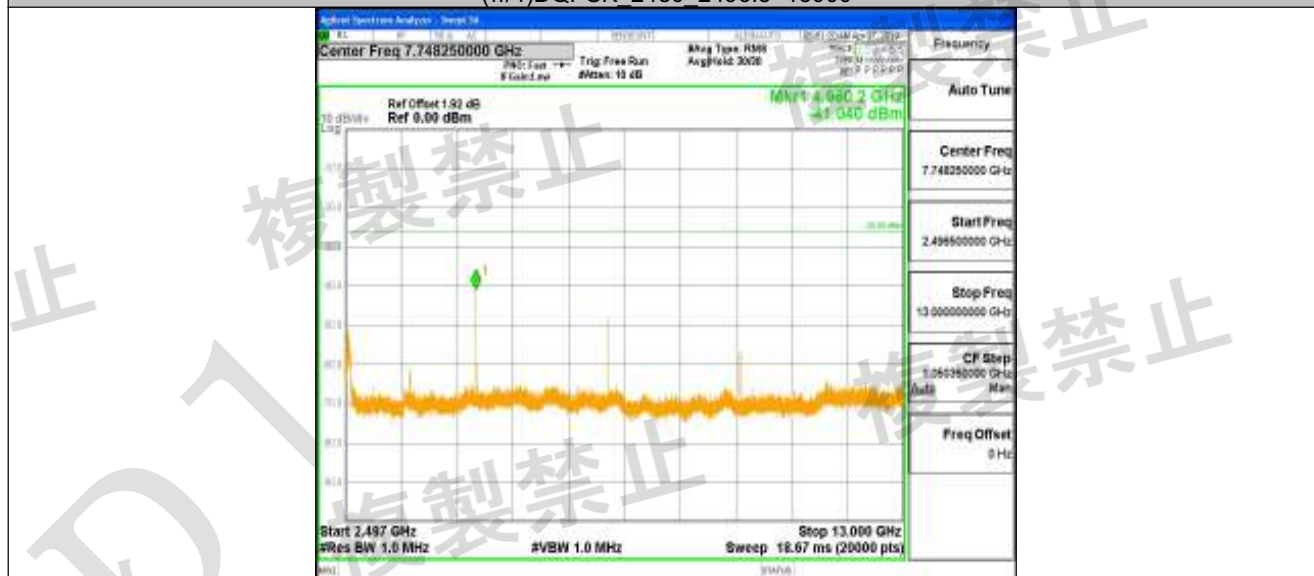
($\pi/4$)DQPSK 2480 2387~2400



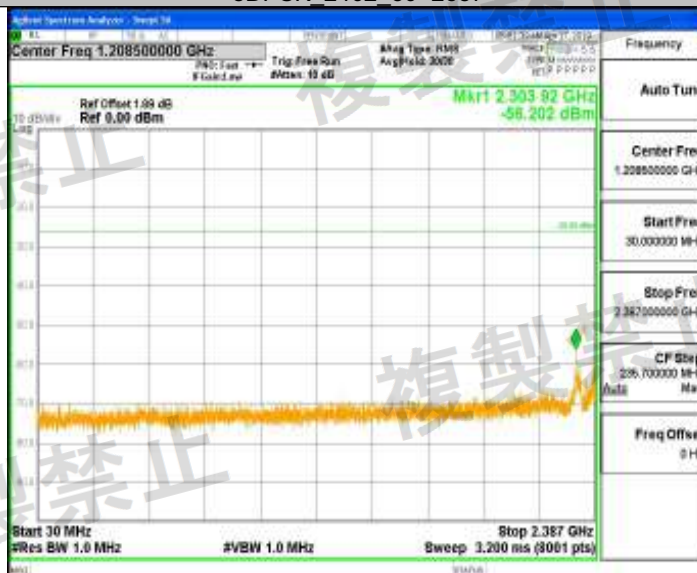
($\pi/4$)DQPSK 2480 2483.5~2496.5



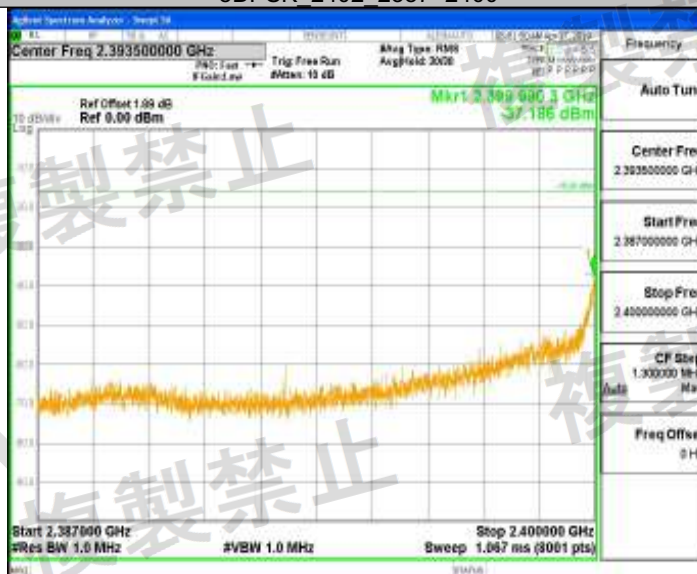
($\pi/4$)DQPSK 2480 2496.5~13000



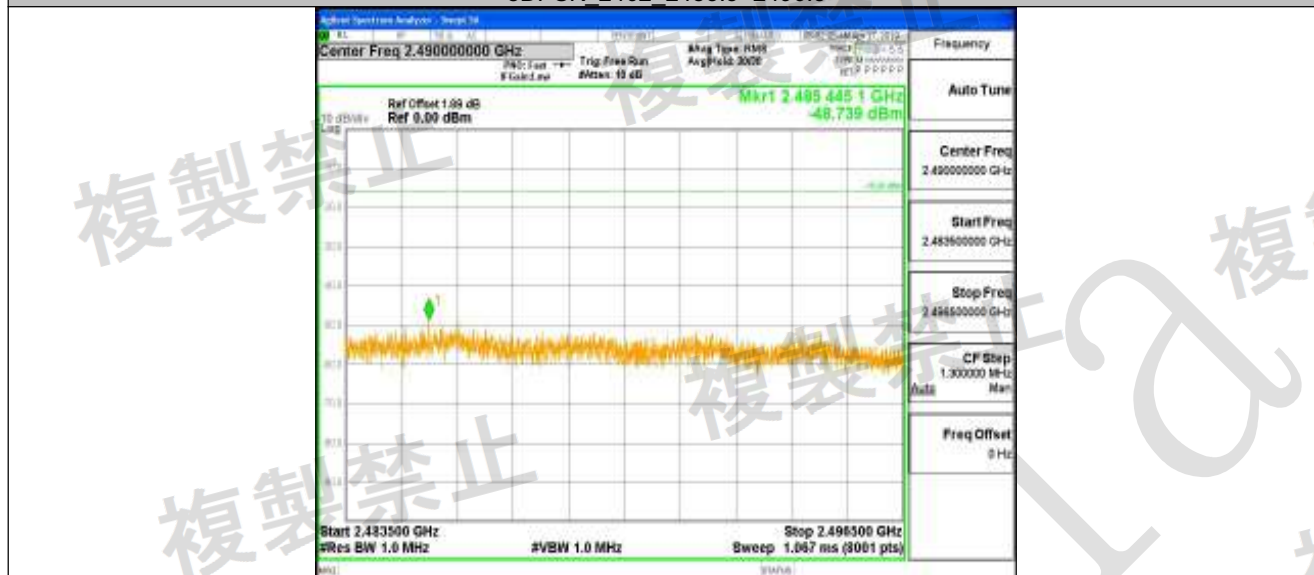
8DPSK_2402_30~2387



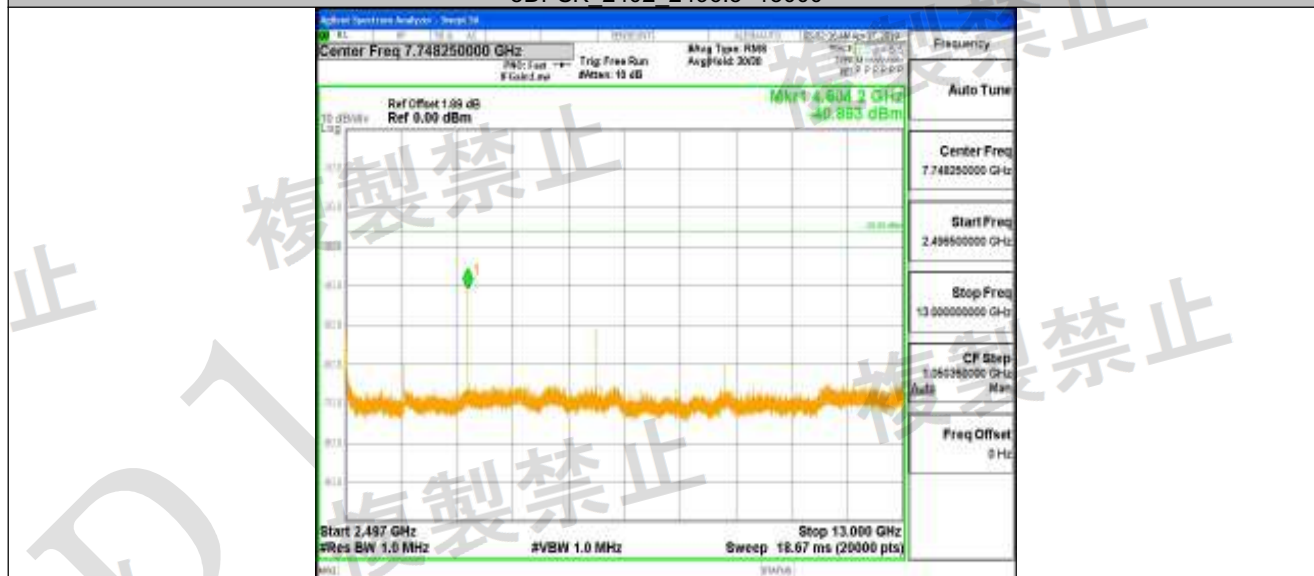
8DPSK_2402_2387~2400



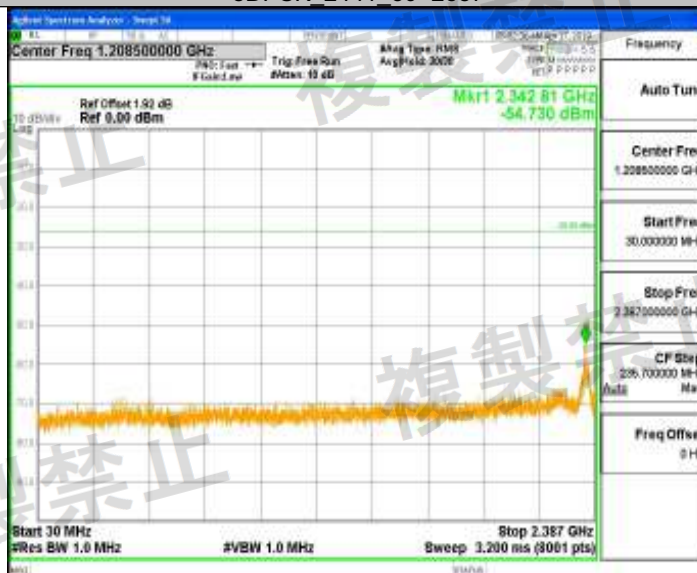
8DPSK 2402 2483.5~2496.5



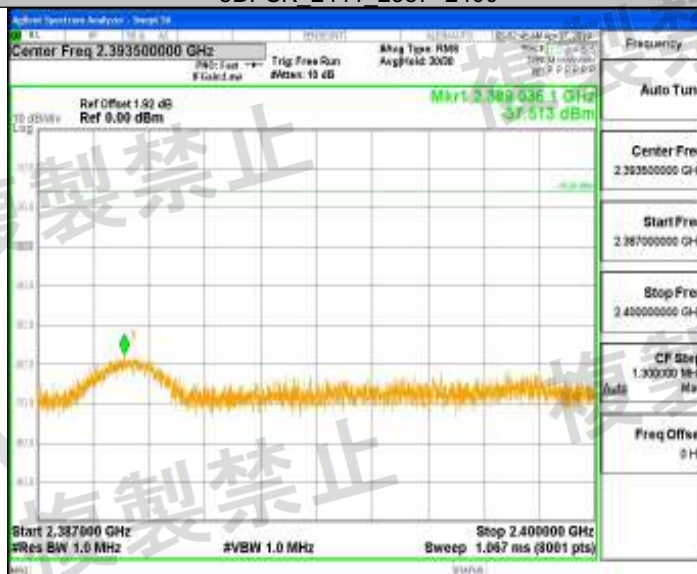
8DPSK 2402 2496.5~13000



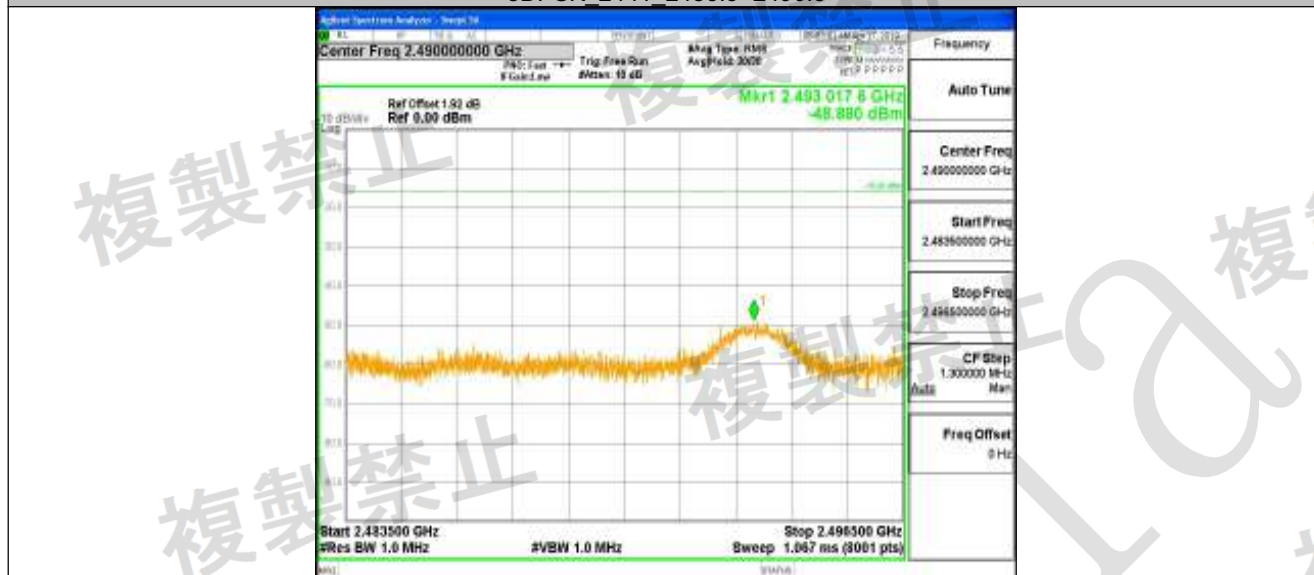
8DPSK 2441 30~2387



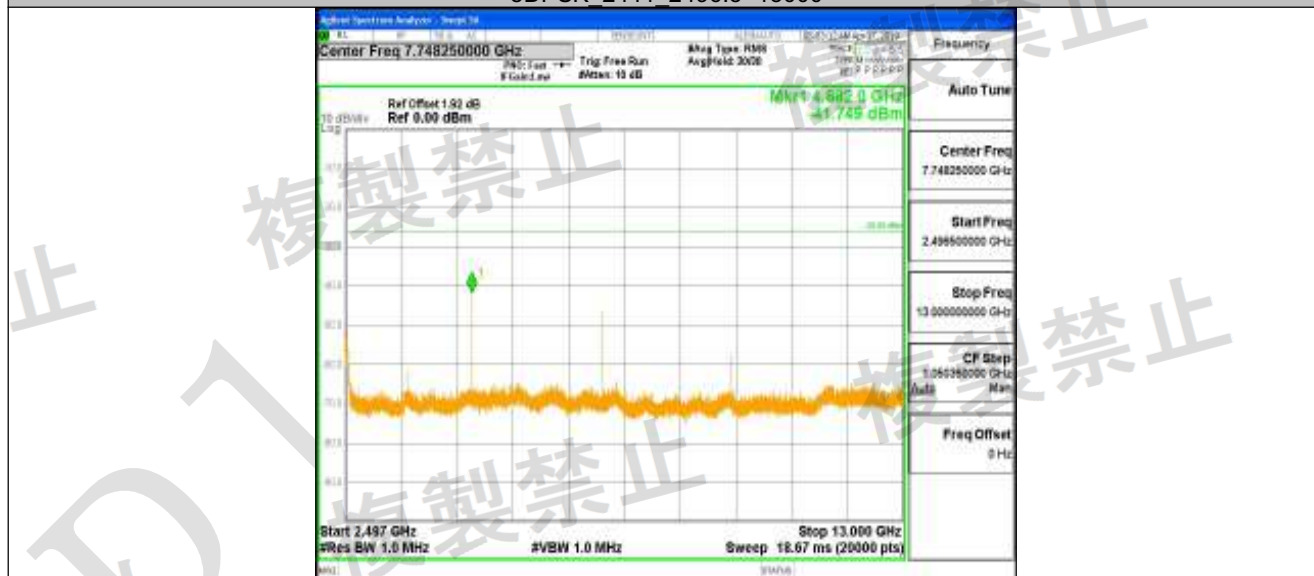
8DPSK 2441 2387~2400



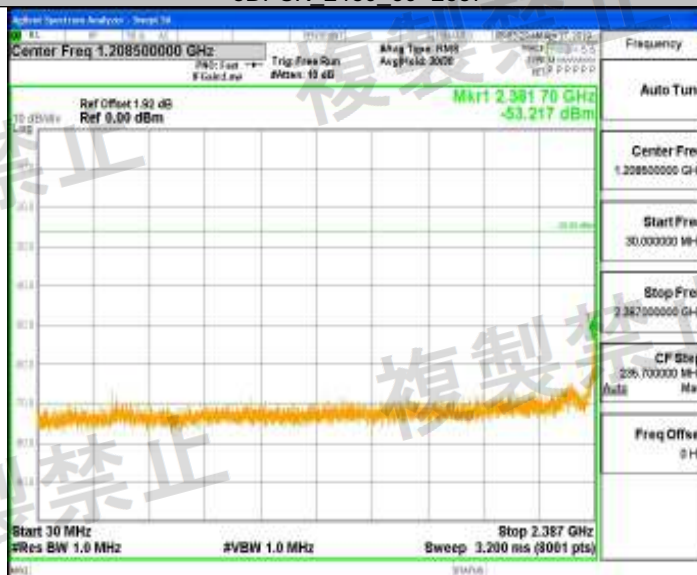
8DPSK 2441 2483.5~2496.5



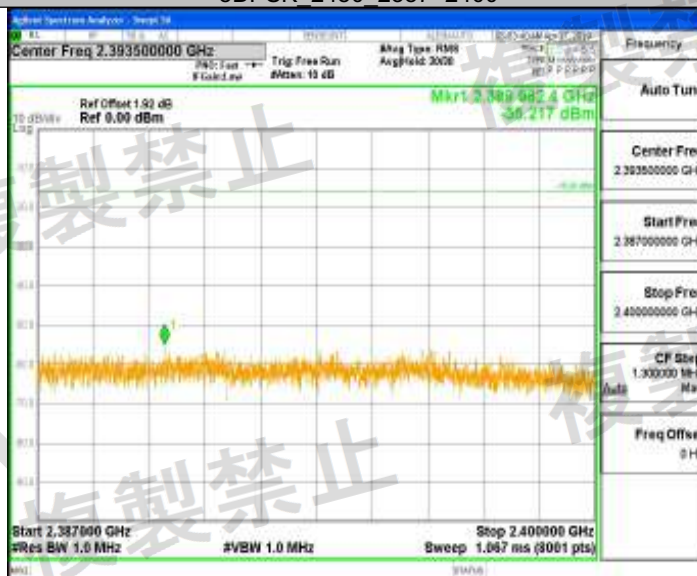
8DPSK 2441 2496.5~13000



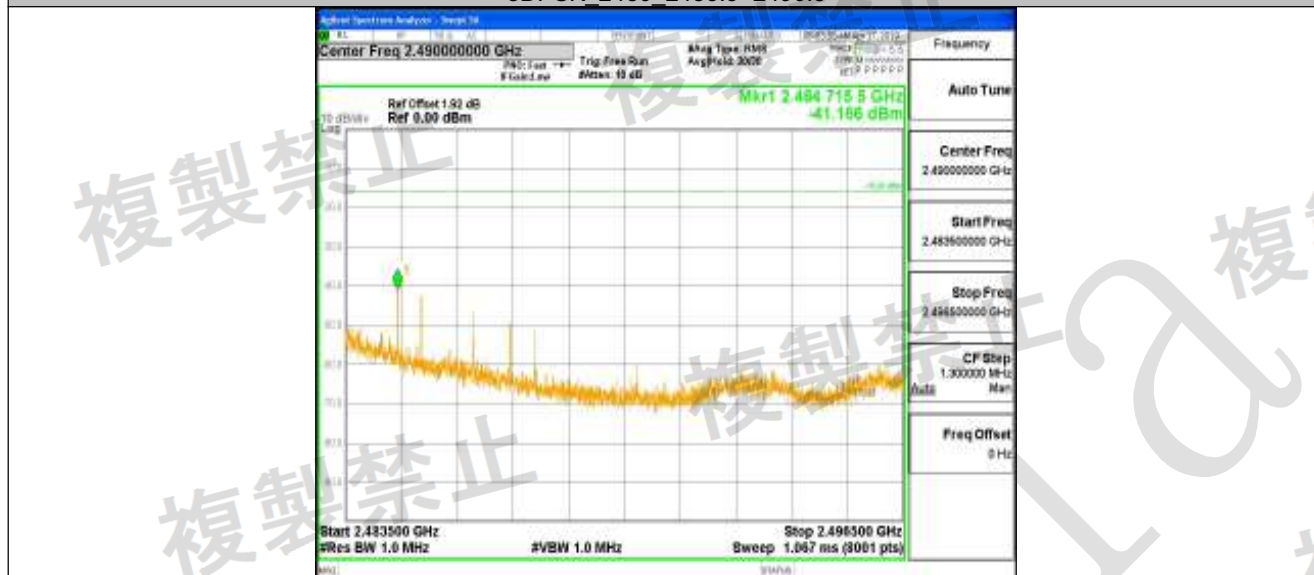
8DPSK 2480 30~2387



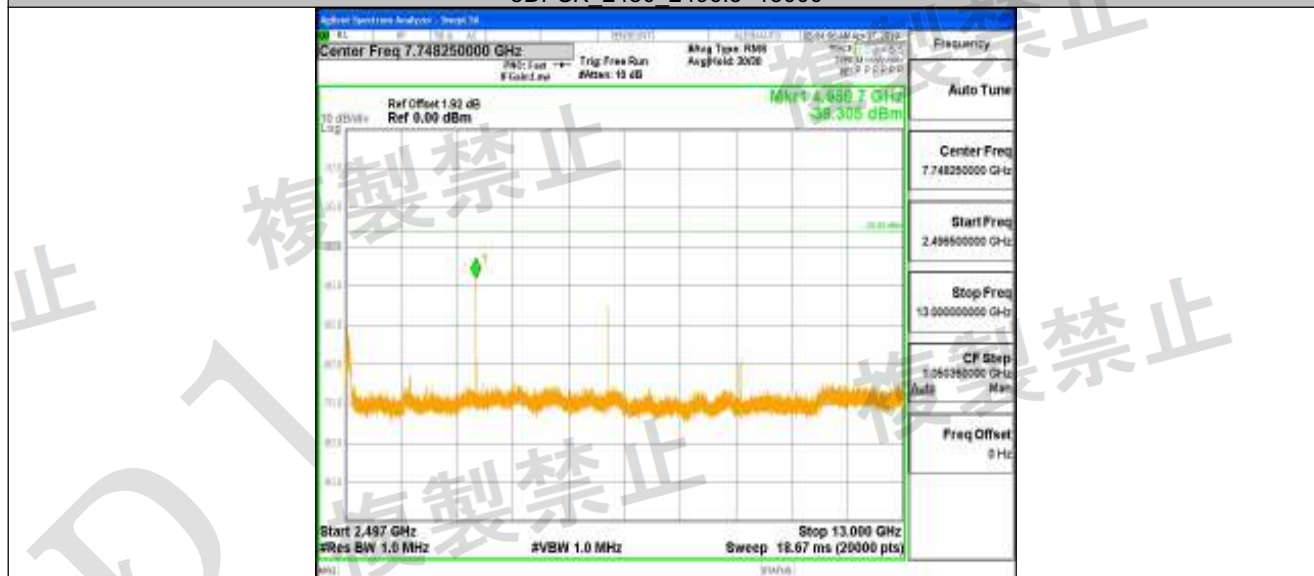
8DPSK 2480 2387~2400



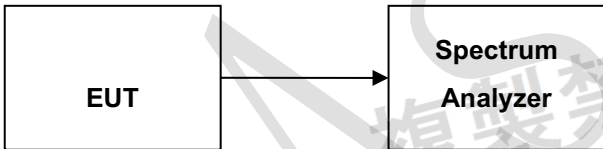
8DPSK 2480 2483.5~2496.5



8DPSK 2480 2496.5~13000



7.1.8 Dwell Time

| | | | |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 | | |
| Test Method: | MIC Notice No.88 Appendix No.43 | | |
| EUT Operation: | | | |
| Ambient: | Temp.: 24°C | Humid.: 55% | Press.: 1010 mbar |
| Test Status: | <p>Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.</p> <p>Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode</p> | | |
| Test Configuration: |  <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre> | | |
| EUT conditions: | <p>Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode</p> <p>For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.</p> | | |
| Spectrum Analyzer conditions: | <p>Frequency: Test Frequency (fixed hopping frequency)</p> <p>Span 0 Hz</p> <p>RBW 1 MHz</p> <p>VBW 1 MHz</p> <p>Sweep Time EUT condition</p> <p>Trigger Video Trigger</p> <p>Measures the Transmission time of 1 burst (sec)</p> <p>Measures the Burst cycle (sec)</p> | | |
| Calculation procedure : | <p>Dwell time = (0.4(s) x [spreading rate] x [Transmission time of 1 burst(s)]) / ([burst cycle(s)] x [No. of hopping channel])</p> <p>Note:</p> <p>* Spreading rate = [Spread bandwidth (actual measurement value)] / [Transmission rate]</p> | | |
| Technical standard: | Less than 0.4 sec | | |
| Test result: | PASS | | |

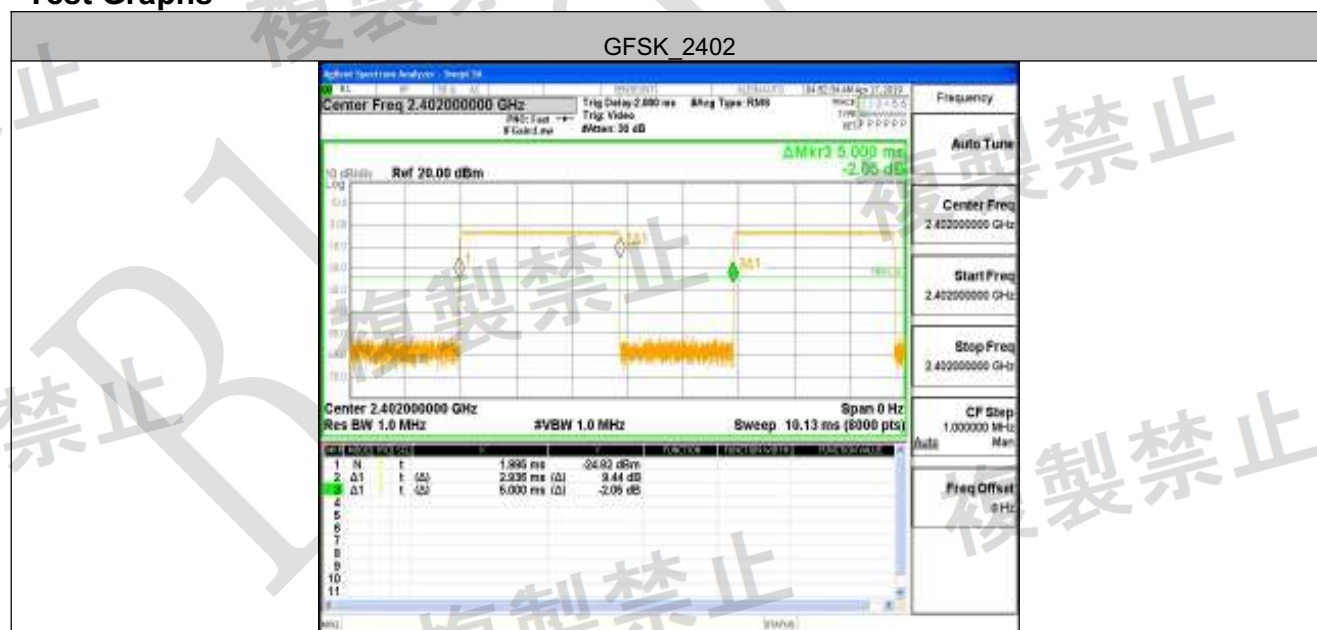
| TestCondition | TestMode | Channel | Spread bandwidth | Result [s] | Limit [s] | Verdict |
|---------------|------------|---------|---------------------|---------------|--------------|---------|
| NTNV | GFSK | 2402 | 70.080 | 0.208 | <0.4 | PASS |
| | | 2441 | 70.080 | 0.208 | <0.4 | PASS |
| | | 2480 | 70.080 | 0.208 | <0.4 | PASS |
| | (π/4)DQPSK | 2402 | 69.954 | 0.208 | <0.4 | PASS |
| | | 2441 | 69.954 | 0.208 | <0.4 | PASS |
| | | 2480 | 69.954 | 0.208 | <0.4 | PASS |
| | 8DPSK | 2402 | 70.263 | 0.210 | <0.4 | PASS |
| | | 2441 | 70.263 | 0.209 | <0.4 | PASS |
| | | 2480 | 70.263 | 0.209 | <0.4 | PASS |

Remark: Calculated method: Dwell time=(0.4(s) x [spreading rate] x [Transmission time of 1 burst(s)])/([burst cycle(s)] x [No. of hopping channel])

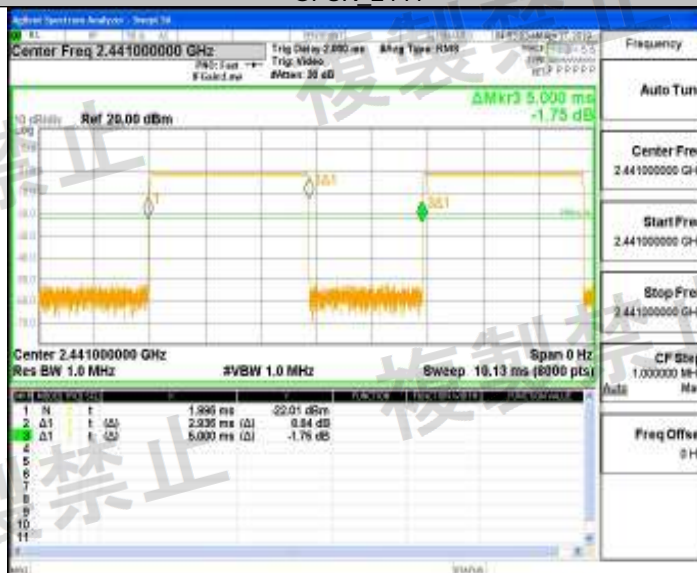
Note: Spreading rate=[Spread bandwidth (actual measurement value)]/[Transmission rate]

Transmission rate is 1.0 Mbps.

Test Graphs



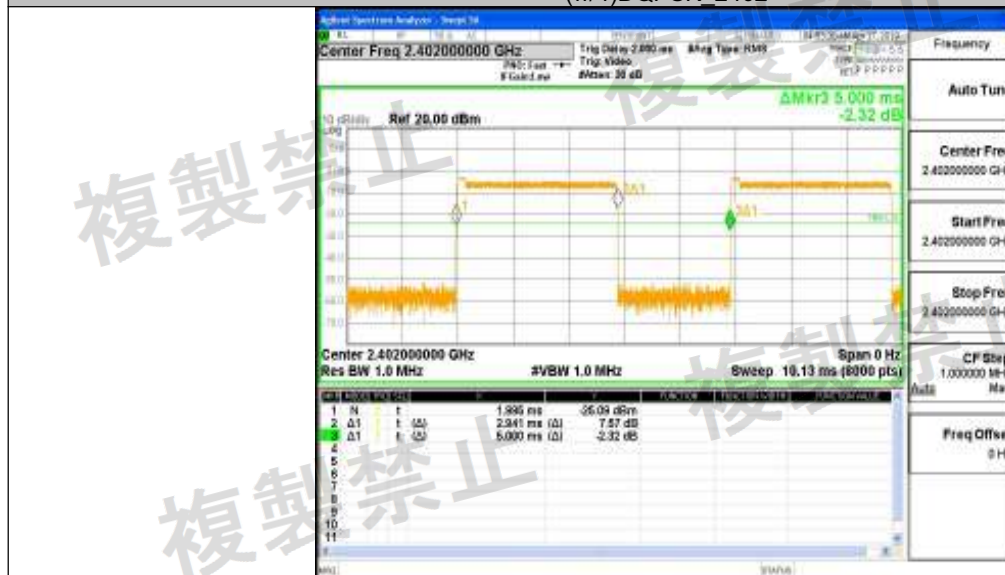
GFSK_2441



GFSK_2480



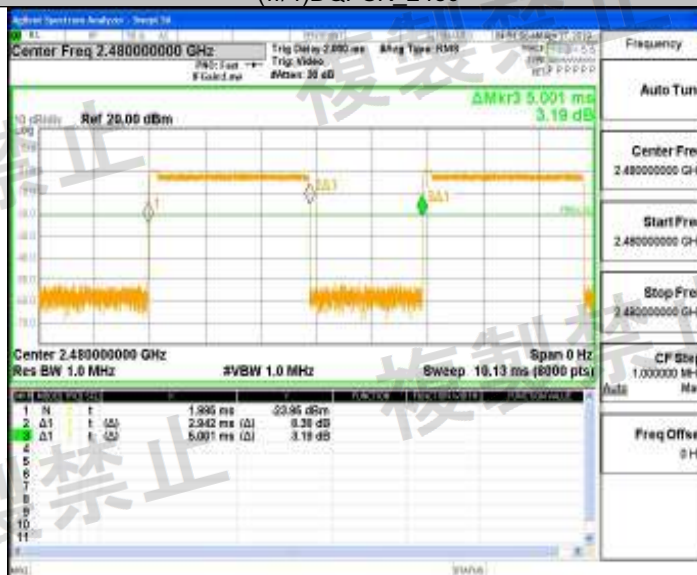
($\pi/4$)DQPSK 2402



($\pi/4$)DQPSK 2441



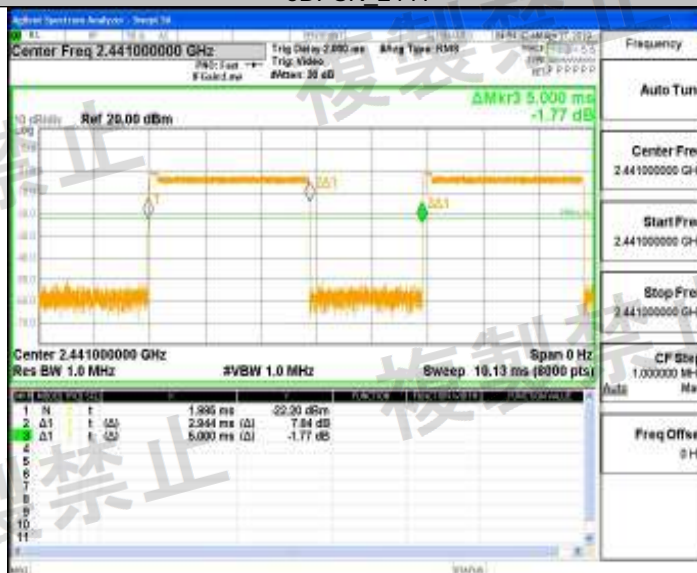
($\pi/4$)DQPSK 2480



8DPSK 2402



8DPSK_2441



8DPSK_2480



7.1.9 Pseudorandom Frequency Hopping Sequence

Standard requirement

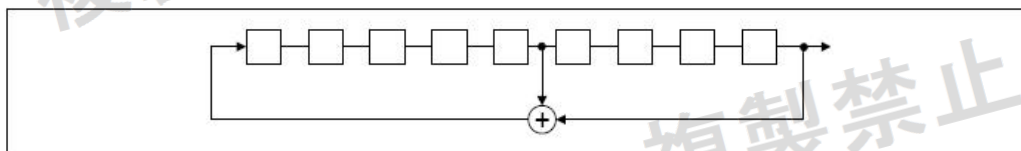
Article 2, Item (19) Notice 88 Appendix 43, 44, 45 requirement:

The EUT shall have the capability to transmit or to receive the MAC identification automatically, so that sender and receiver shall exclude other equipment.

EUT Pseudorandom Frequency Hopping Sequence

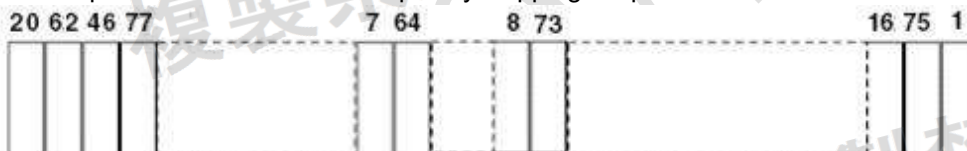
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



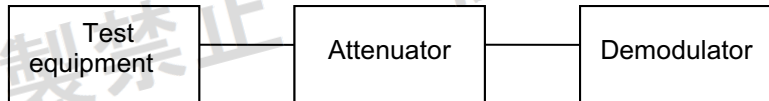
Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

7.1.10 Interference prevention function

1) Measurement system diagram

(1) When transmitting identification code



2) Condition of measuring instrument

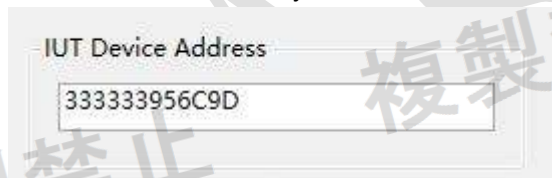
- (1) Demodulator must be able to demodulate the transmitting signal emitted by test equipment and to indicate the identification code.

3) Condition of test equipment The mode of normal use.

4) Measuring operation procedure

- (1) When test equipment has the function to transmit identification code automatically:

- A) Transmit the predetermined identification code from test equipment.
- B) Confirm the transmitted identification code by demodulator.



IUT Device Address

333333956C9D

- 5) Test result: The unit does meet the requirements (Good).

Test result: PASS

7.1.11 RF accessibility

Standard requirement

Article 49-20, paragraph 1 (a)

The EUT shall be constructed in such a way that sensitive RF parts, (like modulation and oscillator parts) cannot be reached easily by the user. These parts shall be covered by soldered metal caps or glue or by other mechanical covers. If the covers are fixed with screws, these shall be not the common type(s) like a Phillips, but special versions like Torx, so that the user cannot open the device with common tools.

PCB board is made using the surface mount technology.



7.2 Receiver Requirements

7.2.1 Spurious Emissions of Rx

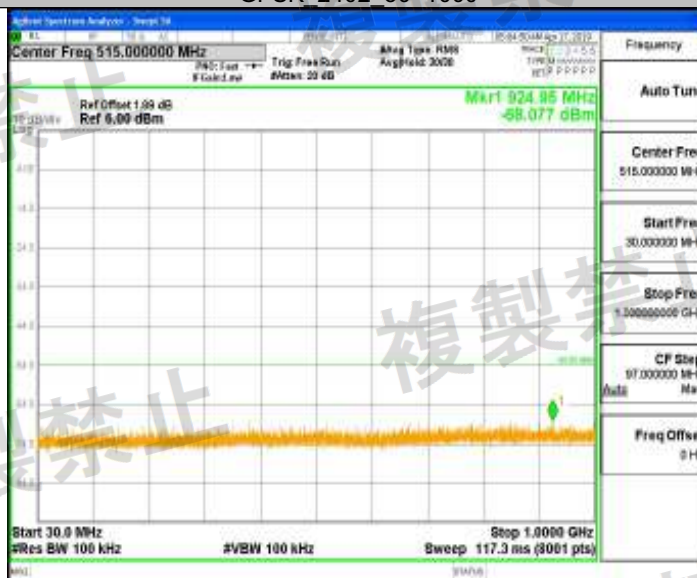
| | | | |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|
| Test Requirement: | Item 19 of Article 2 Paragraph 1 | | |
| Test Method: | MIC Notice No.88 Appendix No.43 | | |
| EUT Operation: | | | |
| Ambient: | Temp.: 24°C | Humid.: 55% | Press.: 1010 mbar |
| Test Status: | Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below. | | |
| Test Configuration: |  <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre> | | |
| EUT conditions: | Rx | | |
| Measurement Procedure: | Step1 All spurious are measured from 30MHz to 13 GHz by peak mode. Step2 If the value measured by Step1 is 2dB or less, measure in average mode. | | |
| Spectrum Analyzer conditions(Step 1): | Frequency: 30MHz – 2400MHz , 2483.5MHz –13GHz RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz) VBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz) Sweep Time Auto detector mode Positive peak Indication mode Max hold | | |
| Spectrum Analyzer Conditions(Step 2): | Frequency: Spurious Frequency Span 0 Hz RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz) VBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz) Sweep Time Auto detector mode Sample Indication mode Max hold | | |
| Technical standard: | (1) Below 1 GHz : 4 nW or less (2) 1 GHz and over : 20 nW or less | | |
| Test result: | PASS | | |

Test Result

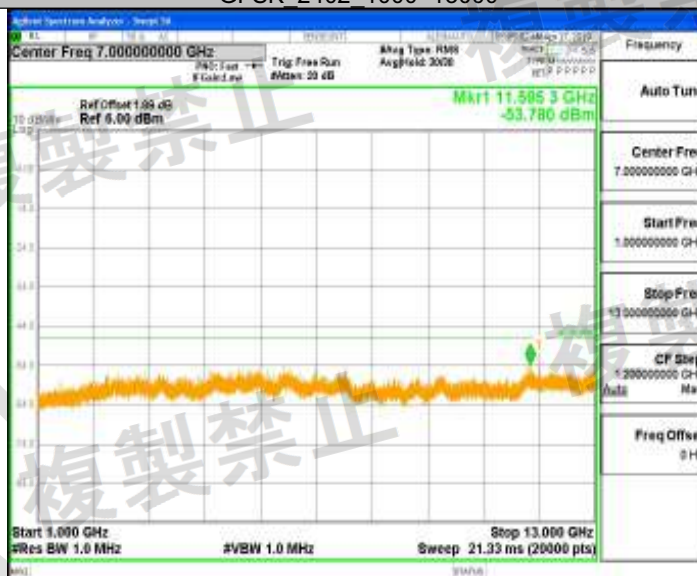
| TestCondition | TestMode | Channel | Freq.Range [MHz] | Result [dBm] | Limit [dBm] | Verdict |
|---------------|------------|---------|---------------------|-----------------|----------------|---------|
| NTNV | GFSK | 2402 | 30~1000 | -68.077 | <=-54 | PASS |
| | | | 1000~13000 | -53.780 | <=-47 | PASS |
| | | 2441 | 30~1000 | -68.003 | <=-54 | PASS |
| | | | 1000~13000 | -54.717 | <=-47 | PASS |
| | | 2480 | 30~1000 | -68.218 | <=-54 | PASS |
| | | | 1000~13000 | -54.297 | <=-47 | PASS |
| | (π/4)DQPSK | 2402 | 30~1000 | -67.923 | <=-54 | PASS |
| | | | 1000~13000 | -54.199 | <=-47 | PASS |
| | | 2441 | 30~1000 | -68.139 | <=-54 | PASS |
| | | | 1000~13000 | -54.679 | <=-47 | PASS |
| | | 2480 | 30~1000 | -67.357 | <=-54 | PASS |
| | | | 1000~13000 | -53.702 | <=-47 | PASS |
| | 8DPSK | 2402 | 30~1000 | -68.409 | <=-54 | PASS |
| | | | 1000~13000 | -54.561 | <=-47 | PASS |
| | | 2441 | 30~1000 | -68.605 | <=-54 | PASS |
| | | | 1000~13000 | -52.694 | <=-47 | PASS |
| | | 2480 | 30~1000 | -66.508 | <=-54 | PASS |
| | | | 1000~13000 | -53.810 | <=-47 | PASS |

Test Graphs

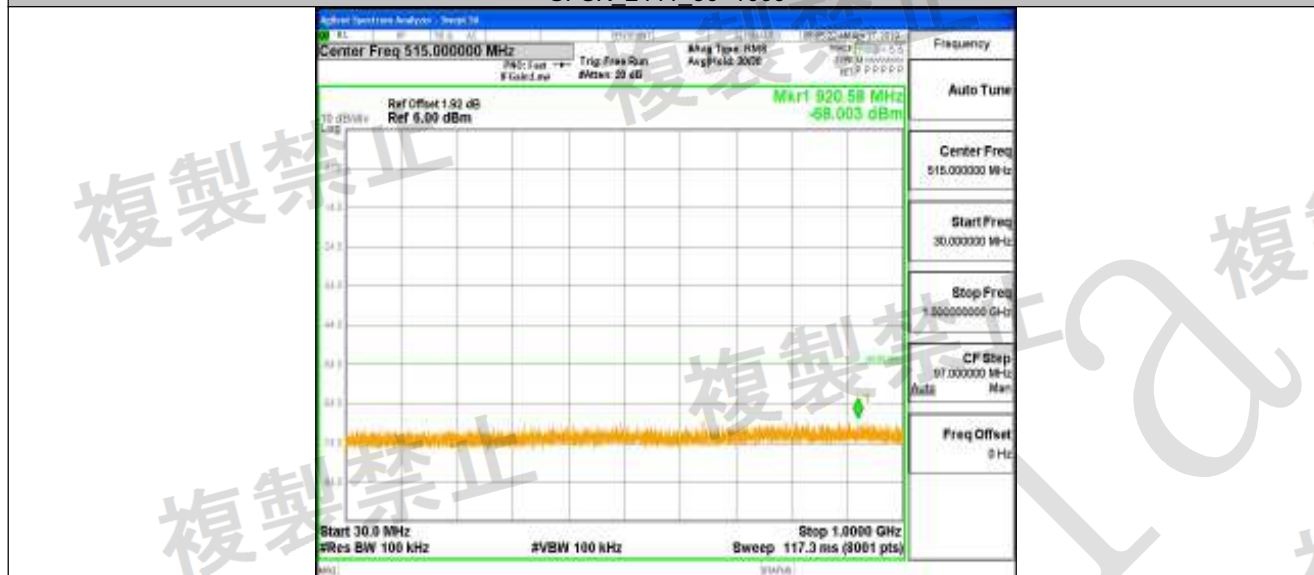
GFSK 2402 30~1000



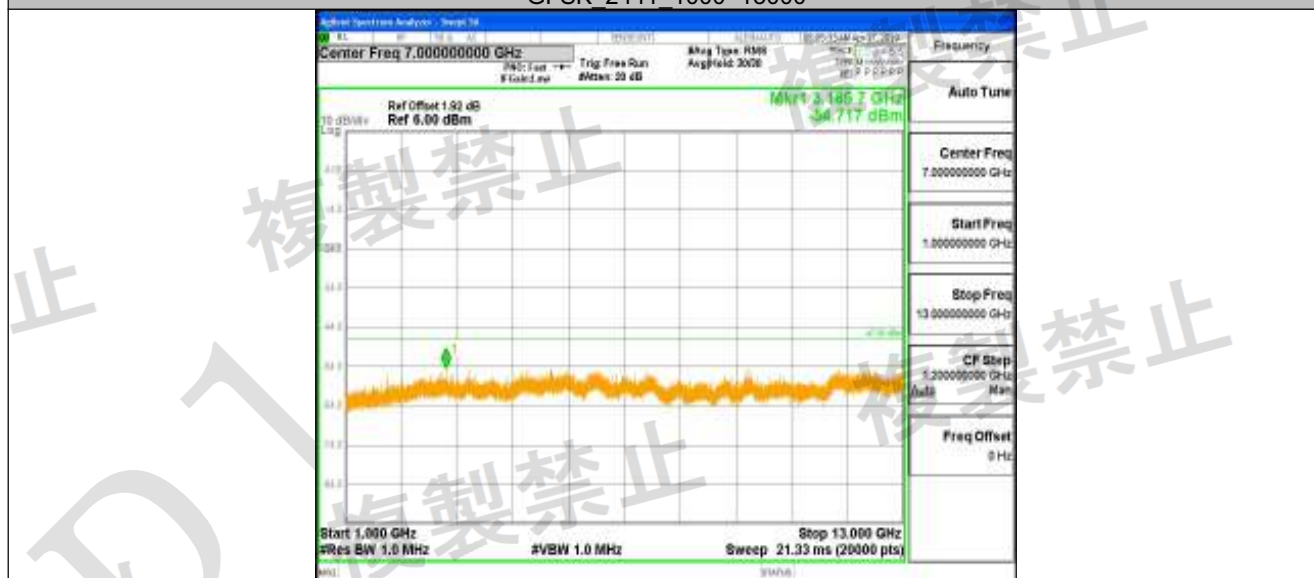
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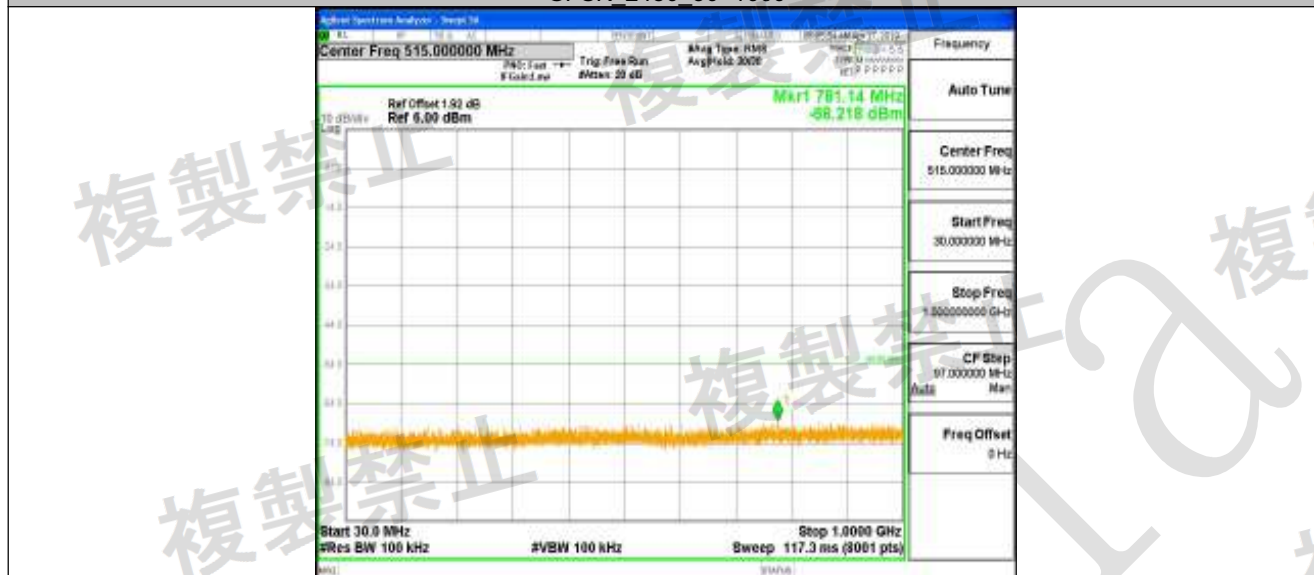
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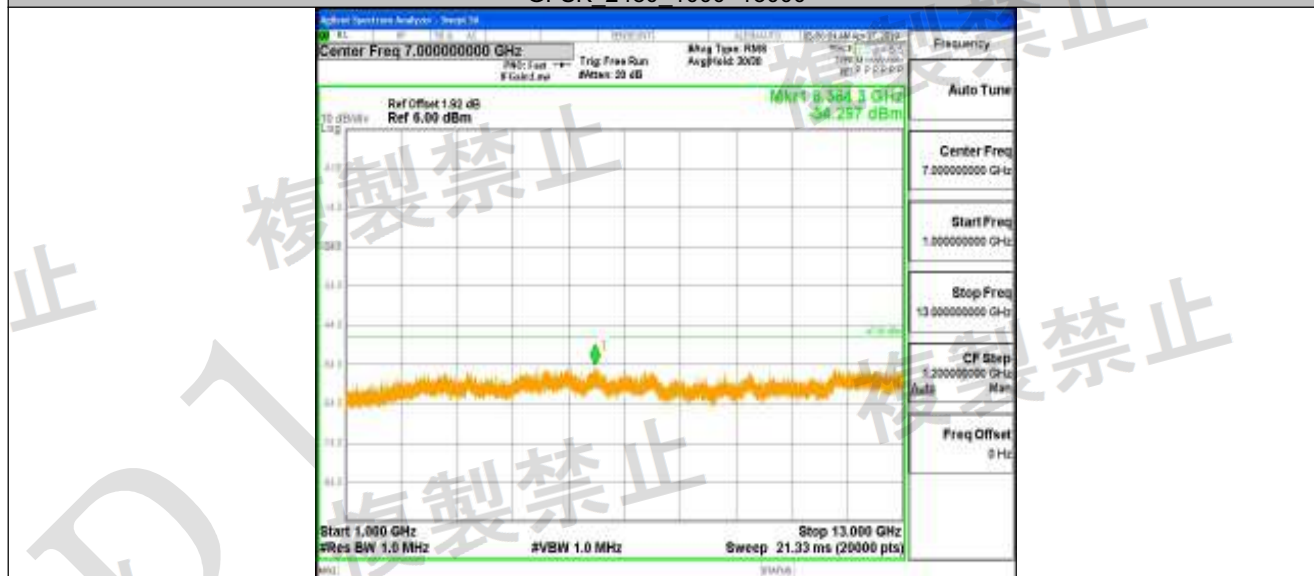
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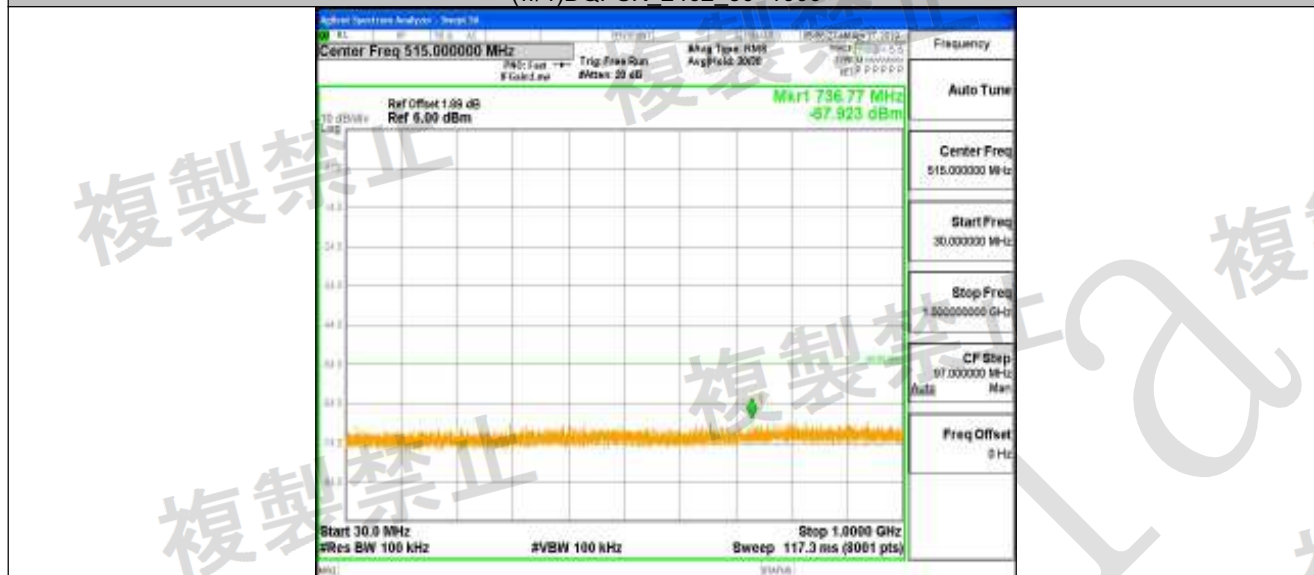
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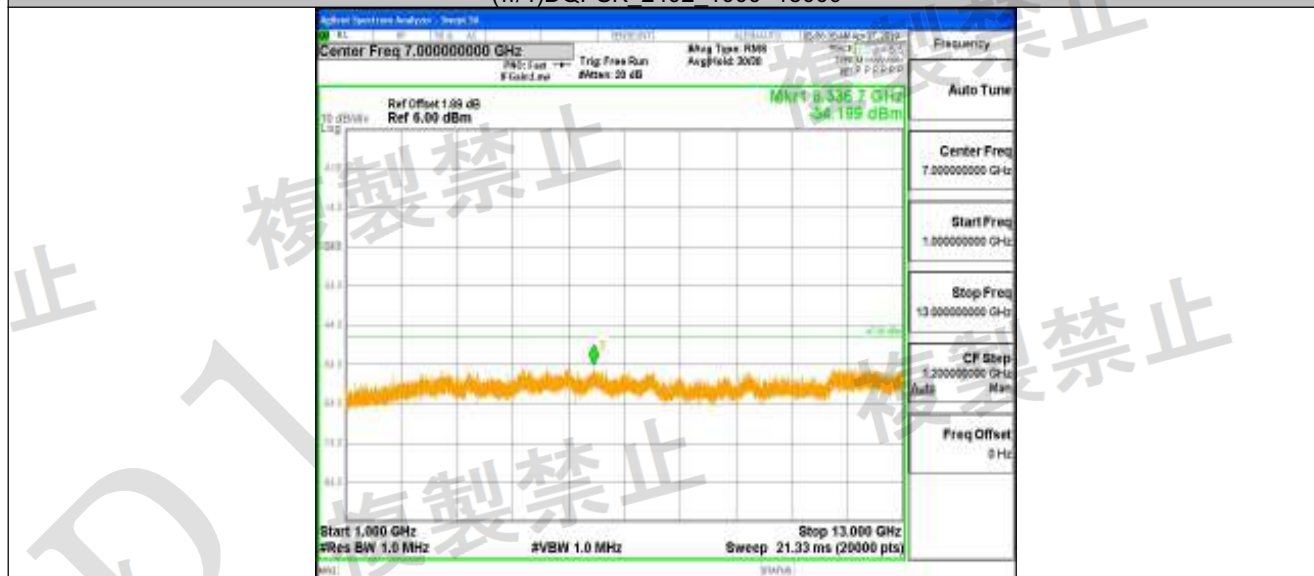
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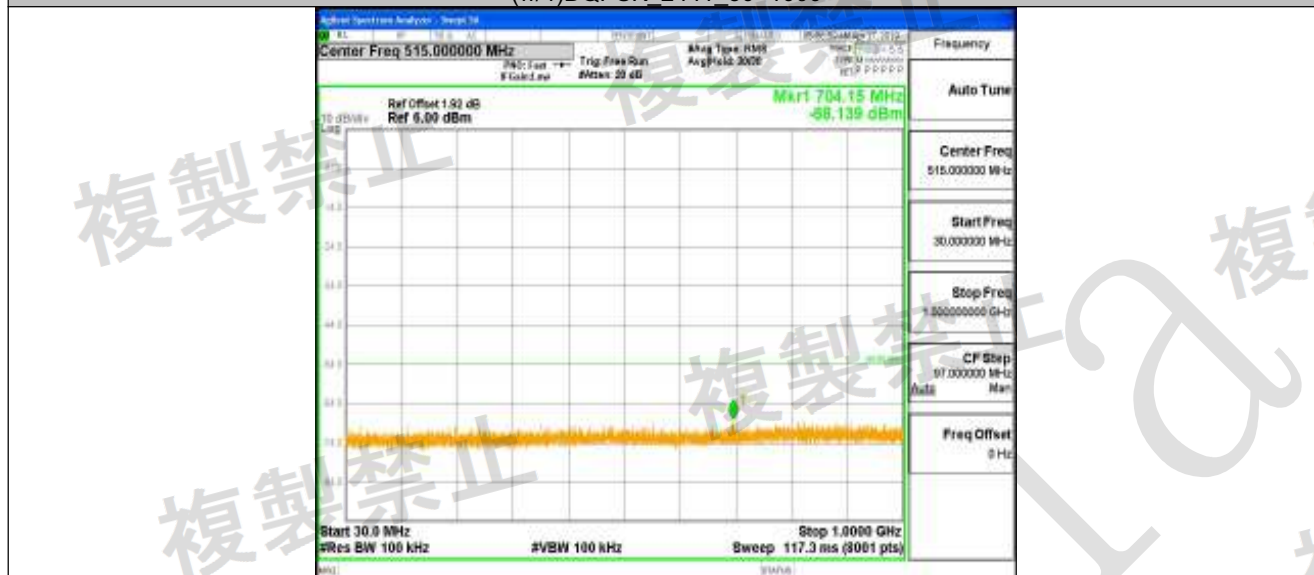
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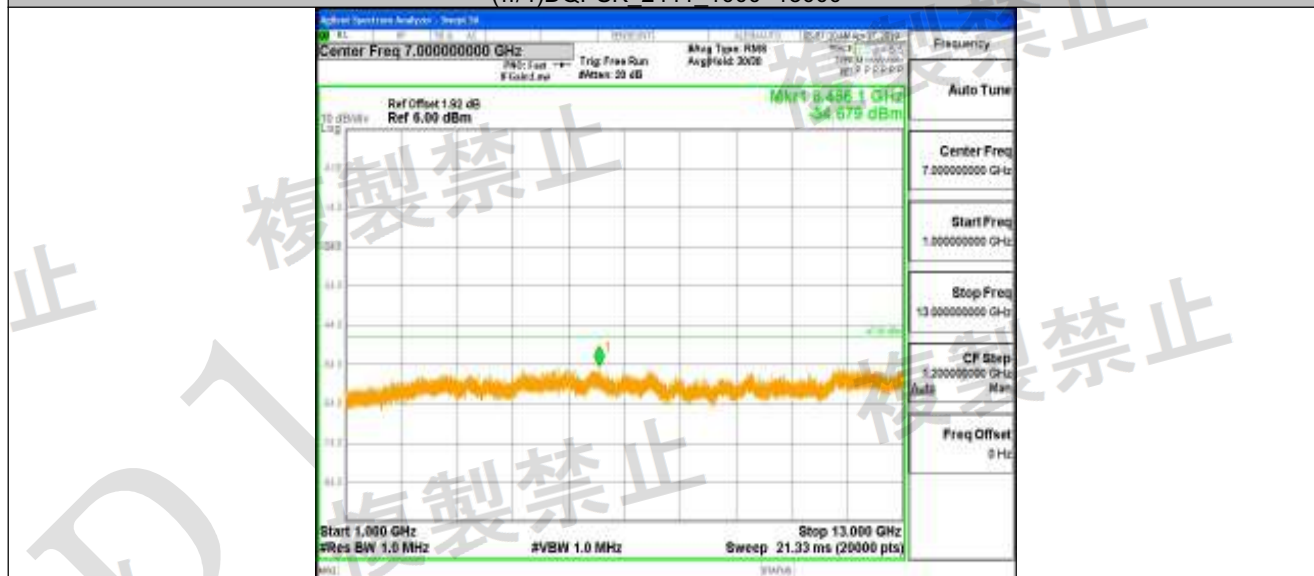
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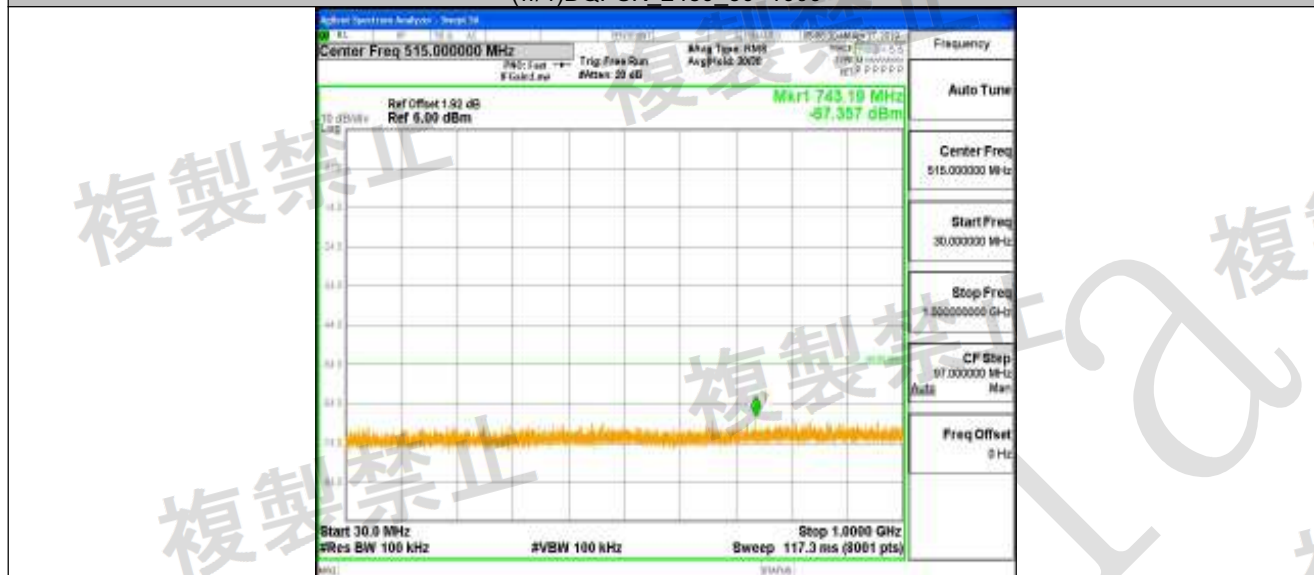
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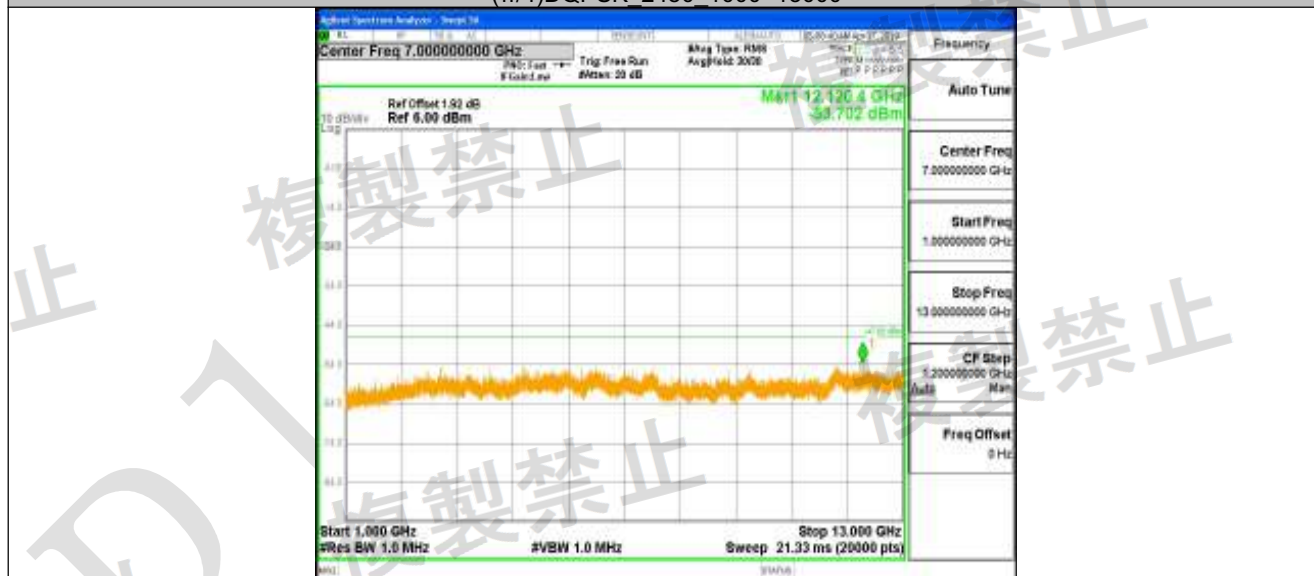
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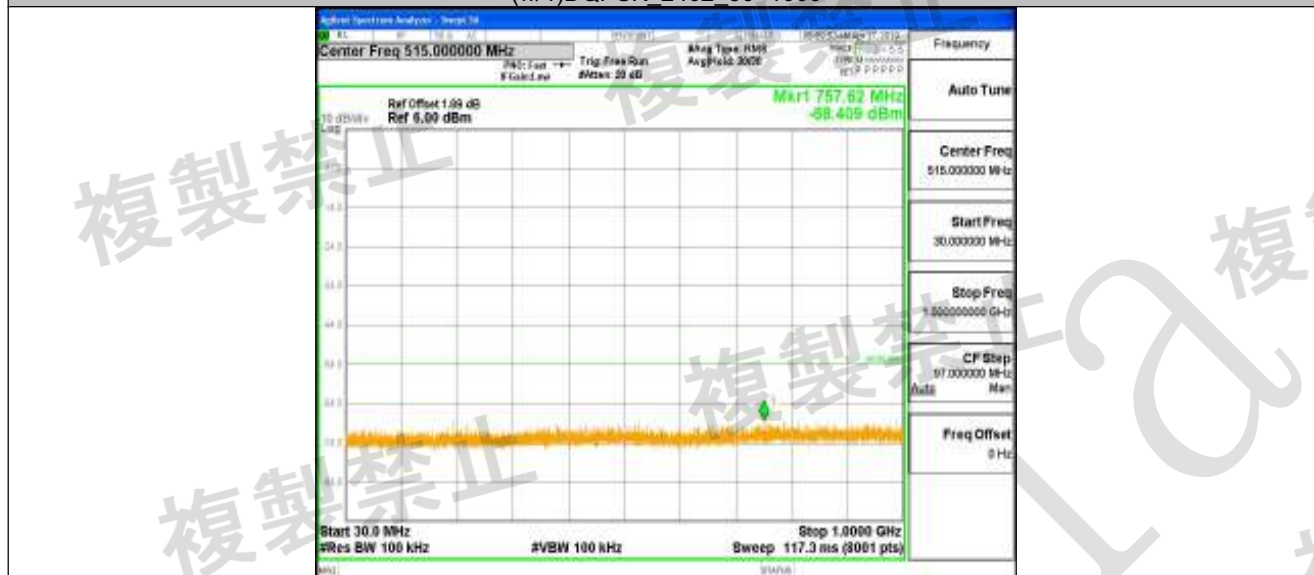
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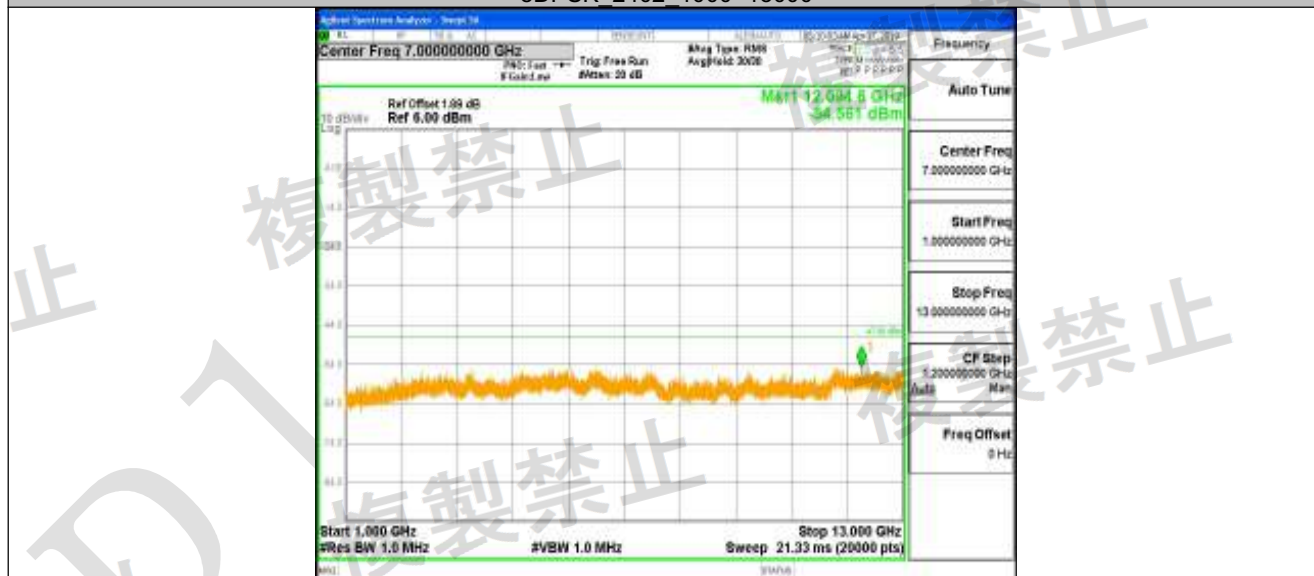
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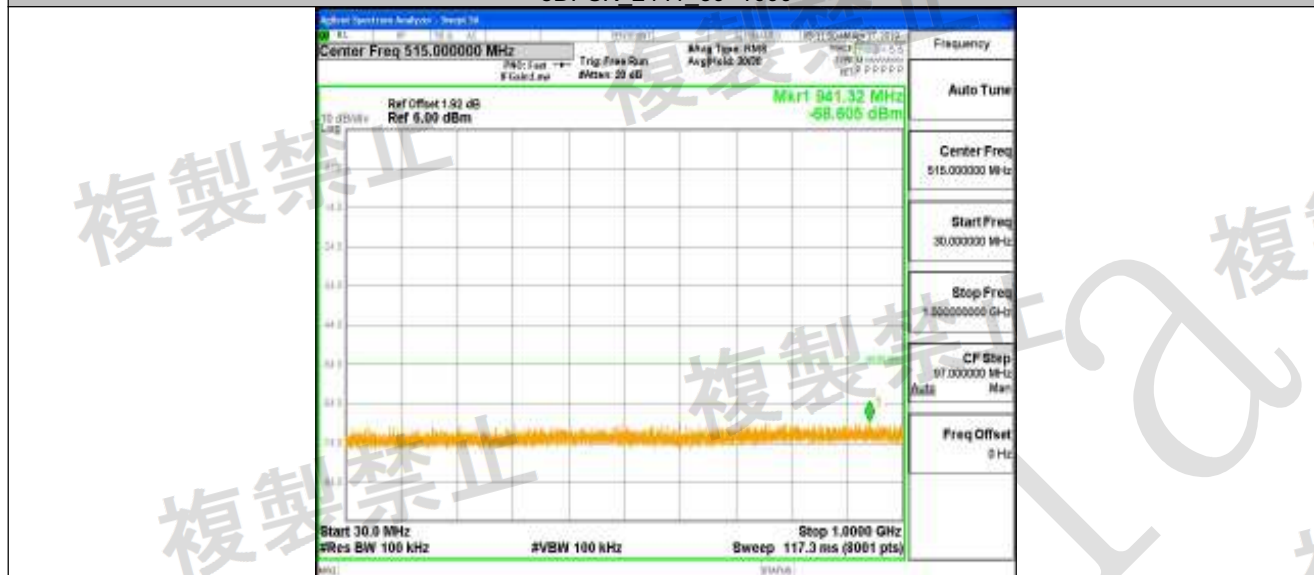
($\pi/4$)DQPSK 2402 30~1000



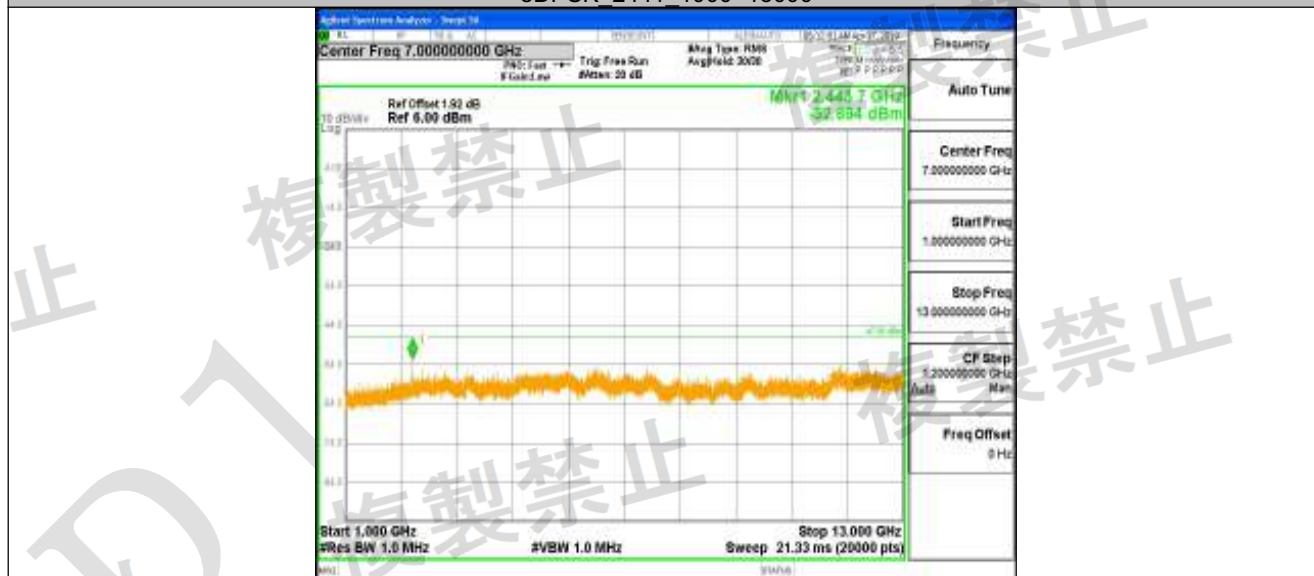
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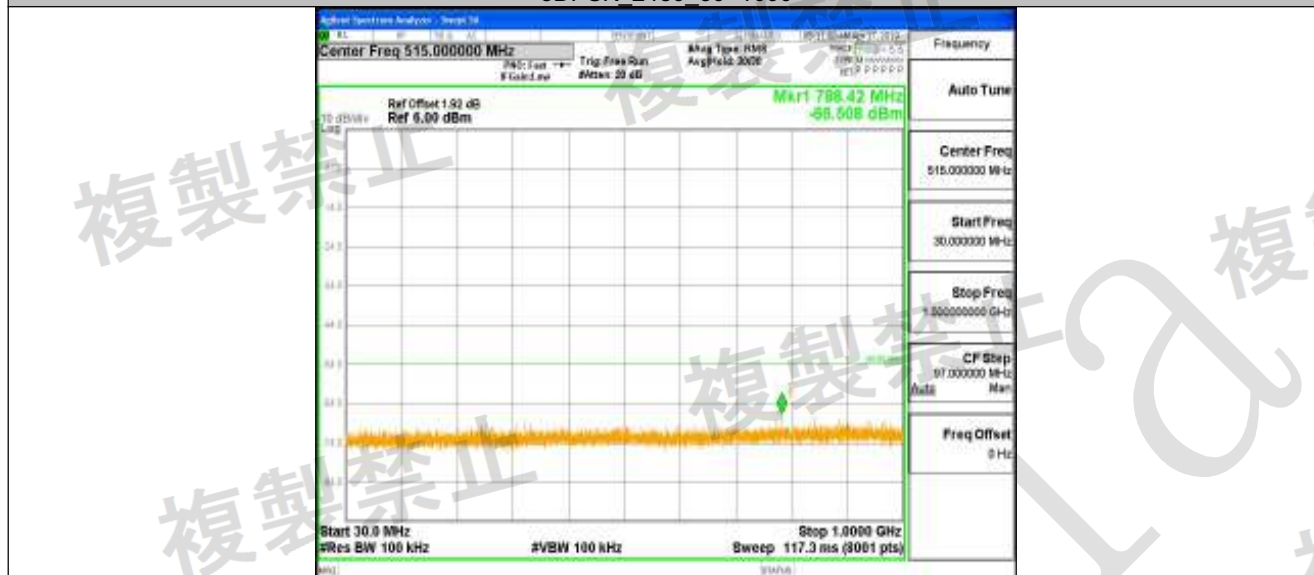
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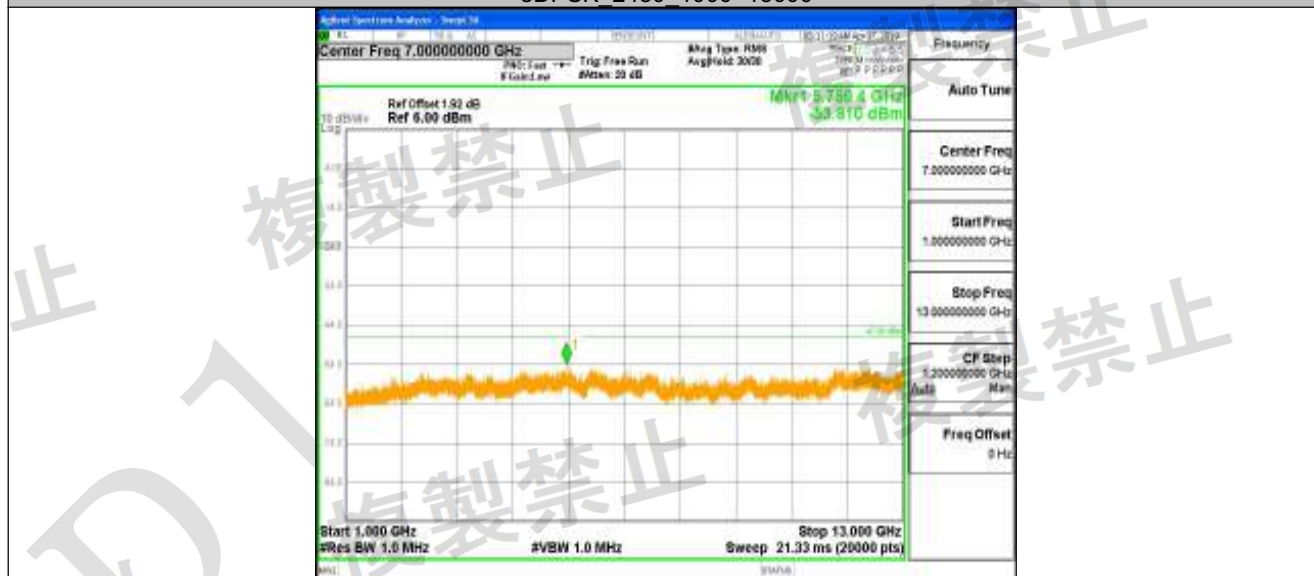
8DPSK_2441_1000~13000



8DPSK_2480_30~1000



8DPSK_2480_1000~13000



8 Photographs

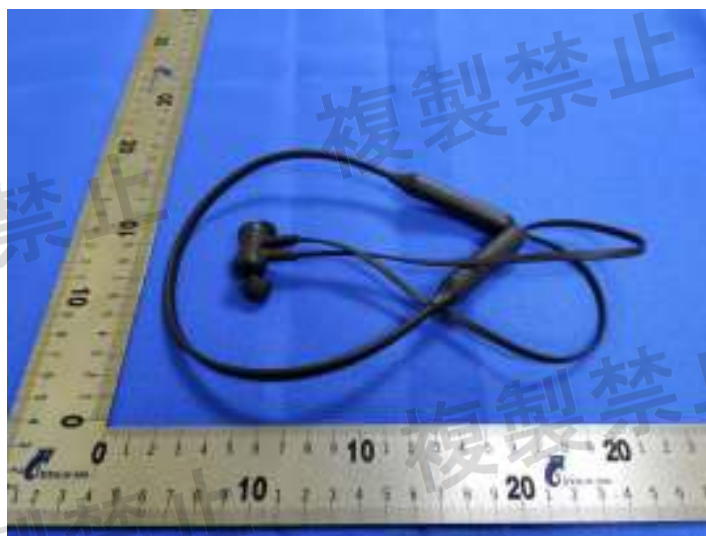
8.1 EUT Constructional Details



View of Product-1



View of Product-2



View of Product-3



View of Product-4



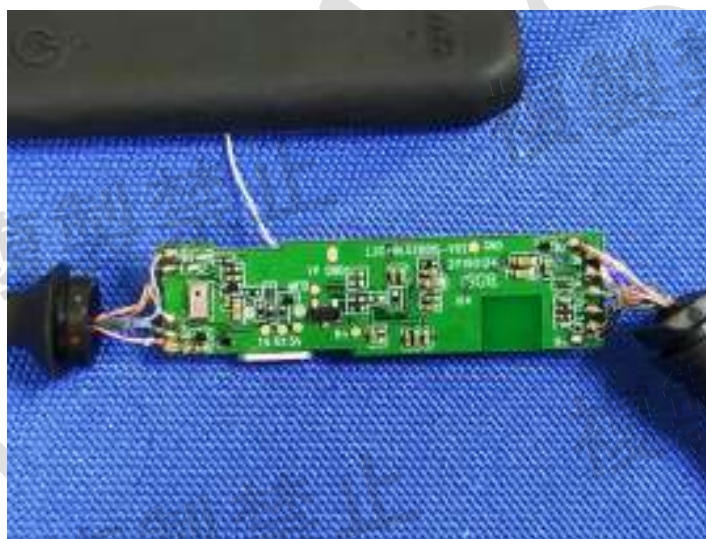
View of Product-5



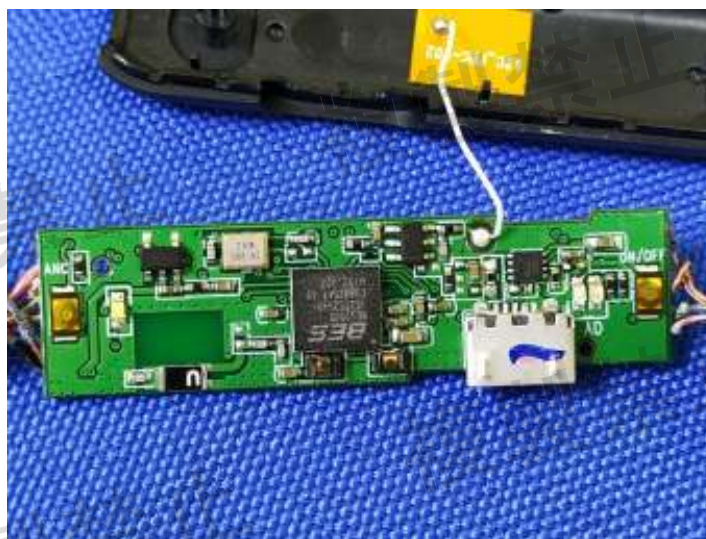
View of Product-6



View of Product-7



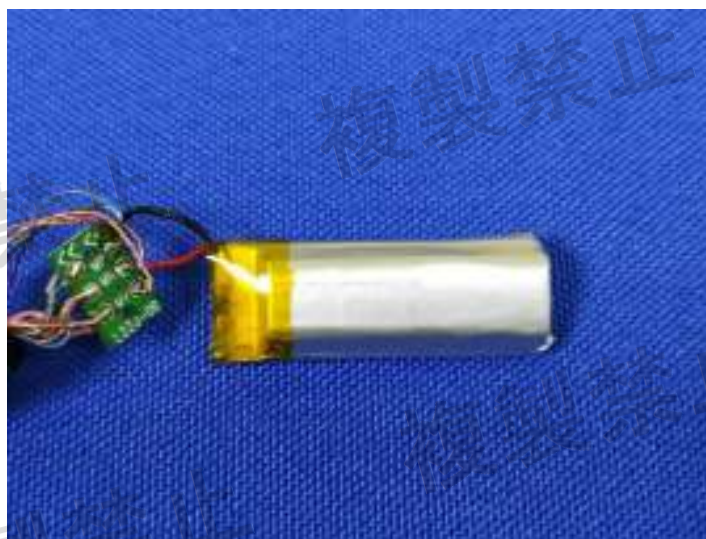
View of Product-8



View of Product-9



View of Product-10



View of Product-11

*** End of Report ***

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