

# FCC PART 15C TEST REPORT FOR CERTIFICATION

## On Behalf of

Continental Automotive GmbH

### CAR RADIO

Model Number: CRD4512UBA-OR

Additional Model: CR4512UBA-OR, TR4512UBA-OR, CRD4512UBA/AGC,

CR4512UBA/AGC, CR4511UA-OR, CRD4512UBA/KOM,

CRD4512UBA/CLA, CR4512UBA/CLA, CRD4512UBA/SDF,

CR4512UBA/SDF, CRD4612UBA, CR4612UBA, CRD4612UBA/KOM,

CRD4612UBA/PRI

FCC ID: Y7O-CRD4512UBA-OR

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
| Prepared for:            | Continental Automotive GmbH                                         |
|                          | Philipsstrasse 1, Wetzlar, Germany 35576                            |
|                          |                                                                     |
| Prepared By:             | EST Technology Co., Ltd.                                            |
|                          | Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China |
| Tel: 86-769-83081888-808 |                                                                     |

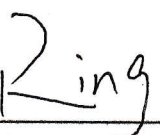
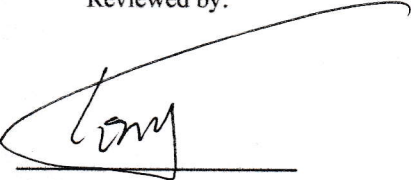
|                 |                       |
|-----------------|-----------------------|
| Report Number:  | ESTE-R1904023         |
| Date of Test:   | Mar. 11~Apr. 08, 2019 |
| Date of Report: | Apr. 10, 2019         |

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**EST Technology Co., Ltd.**

|                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                      |                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Applicant:</b>                                                                                                                                                                                 | Continental Automotive GmbH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                      |                       |
| <b>Address:</b>                                                                                                                                                                                   | Philipsstrasse 1, Wetzlar, Germany 35576                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                      |                       |
| <b>Manufacturer:</b>                                                                                                                                                                              | Continental Automotive GmbH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                      |                       |
| <b>Address:</b>                                                                                                                                                                                   | Philipsstrasse 1, Wetzlar, Germany 35576                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                      |                       |
| <b>E.U.T:</b>                                                                                                                                                                                     | CAR RADIO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                      |                       |
| <b>Model Number:</b>                                                                                                                                                                              | CRD4512UBA-OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                      |                       |
| <b>Additional Model:</b>                                                                                                                                                                          | CR4512UBA-OR, TR4512UBA-OR, CRD4512UBA/AGC, CR4512UBA/AGC, CR4511UA-OR, CRD4512UBA/KOM, CRD4512UBA/CLA, CR4512UBA/CLA, CRD4512UBA/SDF, CR4512UBA/SDF, CRD4612UBA, CR4612UBA, CRD4612UBA/KOM, CRD4612UBA/PRI<br>(Except for the trademark and model name, the rest is identical.)                                                                                                                                                                                                                                                              |                                                                                                                                      |                       |
| <b>Power Supply:</b>                                                                                                                                                                              | DC 12V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                      |                       |
| <b>Test Voltage:</b>                                                                                                                                                                              | DC 12V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                      |                       |
| <b>Trade Name:</b>                                                                                                                                                                                | Continental, AGCO, KUBOTA, Komatsu Forest, Claas, SDF, PRINOTH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                      |                       |
| <b>Date of Receipt:</b>                                                                                                                                                                           | Mar. 11, 2019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Date of Test:</b>                                                                                                                 | Mar. 11~Apr. 08, 2019 |
| <b>Test Specification:</b>                                                                                                                                                                        | FCC Rules and Regulations Part 15 Subpart C:2018<br>ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                      |                       |
| <b>Test Result:</b>                                                                                                                                                                               | <p>The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements.</p> <p>This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.</p> |                                                                                                                                      |                       |
| <b>Prepared by:</b>                                                                                                                                                                               | <b>Reviewed by:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Date:</b> Apr. 10, 2019                                                                                                           |                       |
| <br>Ring / Assistant                                                                                           | <br>Tony / Engineer                                                                                                                                                                                                                                                                                                                                                                                                                                        | <br>Approved by: _____<br>International Manager |                       |
| <b>Other Aspects:</b>                                                                                                                                                                             | None.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                      |                       |
| Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                      |                       |
| This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                      |                       |

## 1. GENERAL INFORMATION

### 1.1. Description of Device (EUT)

|                     |   |                                                          |
|---------------------|---|----------------------------------------------------------|
| Product Name        | : | CAR RADIO                                                |
| FCC ID              | : | Y7O-CRD4512UBA-OR                                        |
| Model Number        | : | CRD4512UBA-OR                                            |
| Operation frequency | : | 2402MHz~2480MHz                                          |
| Number of channel   | : | 79                                                       |
| Antenna             | : | Internal antenna (Antenna Gain: 0 dBi)                   |
| Modulation          | : | BT BDR: GFSK<br>BT EDR: $\pi/4$ -DQPSK<br>BT EDR: 8-DPSK |
| Sample Type         | : | Prototype production                                     |

## 2. SUMMARY OF TEST

### 2.1. Summary of test result

| Description of Test Item                      | Standard                                                                        | Results |
|-----------------------------------------------|---------------------------------------------------------------------------------|---------|
| Maximum Peak Output Power                     | FCC Part 15: 15.247(b)(1)<br>KDB 558074                                         | PASS    |
| 20dB Bandwidth                                | FCC Part 15: 15.247a1<br>KDB 558074                                             | PASS    |
| Carrier Frequency Separation                  | FCC Part 15: 15.247(a)(1)<br>KDB 558074                                         | PASS    |
| Number Of Hopping Channel                     | FCC Part 15: 15.247(a)(1)(iii)<br>KDB 558074                                    | PASS    |
| Dwell Time                                    | FCC Part 15: 15.247(a)(1)(iii)<br>KDB 558074                                    | PASS    |
| Radiated Emissions                            | FCC Part 15: 15.209<br>FCC Part 15: 15.247(d)<br>ANSI C63.10:2013<br>KDB 558074 | PASS    |
| Band Edge Compliance                          | FCC Part 15: 15.247(d)<br>KDB 558074                                            | PASS    |
| Power Line Conducted Emissions                | FCC Part 15: 15.207<br>ANSI C63.10:2013<br>KDB 558074                           | N/A     |
| Antenna requirement                           | FCC Part 15: 15.203                                                             | PASS    |
| Note: KDB 558074 D01 15.247 Meas Guidance v05 |                                                                                 |         |

## 2.2. Test Facilities

EMC Lab : Certificated by CNAS, CHINA  
Registration No.: L5288  
Date of registration: November 13, 2017

Certificated by FCC, USA  
Designation Number: CN1215  
Test Firm Registration Number: 722932  
Date of registration: November 21, 2017

Certificated by A2LA, USA  
Registration No.: 4366.01  
Date of registration: November 07, 2017

Certificated by Industry Canada  
CAB identifier No.: CN0035  
Date of registration: January 04, 2019

Certificated by VCCI, Japan  
Registration No.: R-13663; C-14103  
Date of registration: July 25, 2017  
This Certificate is valid until: July 24, 2020

Certificated by TUV Rheinland, Germany  
Registration No.: UA 50413872 0001  
Date of registration: July 31, 2018

Certificated by TUV/PS, Shenzhen  
Registration No.: SCN1017  
Date of registration: January 27, 2011

Certificated by Intertek ETL SEMKO  
Registration No.: 2011-RTL-L2-64  
Date of registration: April 28, 2011

Certificated by Nemko, Hong Kong  
Registration No.: 175193  
Date of registration: May 4, 2011

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

### 2.3. Measurement uncertainty

| Test Item                                                  | Uncertainty                       |
|------------------------------------------------------------|-----------------------------------|
| Uncertainty for Conduction emission test                   | $\pm 3.48\text{dB}$               |
| Uncertainty for spurious emissions test<br>(30MHz-1GHz)    | $\pm 4.60\text{ dB(Polarize: H)}$ |
|                                                            | $\pm 4.68\text{ dB(Polarize: V)}$ |
| Uncertainty for spurious emissions test<br>(1GHz to 18GHz) | $\pm 4.96\text{dB}$               |
| Uncertainty for radio frequency                            | $7 \times 10^{-8}$                |
| Uncertainty for conducted RF Power                         | $0.20\text{dB}$                   |
| Uncertainty for Power density test                         | $0.26\text{dB}$                   |

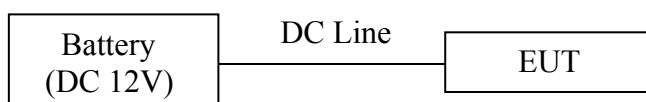
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 2.4. Assistant equipment used for test

2.4.1. N/A

### 2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into Bluetooth test mode by software before test.



(EUT: CAR RADIO)

## 2.6. Test mode

The test software was used to control EUT work in Continuous TX mode, and select test channel, wireless mode

| Mode                                                                                                   | Channel | Frequency |
|--------------------------------------------------------------------------------------------------------|---------|-----------|
| GFSK                                                                                                   | Low     | 2402MHz   |
|                                                                                                        | Middle  | 2441MHz   |
|                                                                                                        | High    | 2480MHz   |
| 8-DPSK                                                                                                 | Low     | 2402MHz   |
|                                                                                                        | Middle  | 2441MHz   |
|                                                                                                        | High    | 2480MHz   |
| Note:GFSK,8-DPSK, $\pi/4$ -DQPSK modes all have been tested , only worse case GFSK,8-DPSK is reported. |         |           |

## 2.7. Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| 1           | 2402            | 2           | 2403            | 3           | 2404            | 4           | 2405            |
| 5           | 2406            | 6           | 2407            | 7           | 2408            | 8           | 2409            |
| 9           | 2410            | 10          | 2411            | 11          | 2412            | 12          | 2413            |
| 13          | 2414            | 14          | 2415            | 15          | 2416            | 16          | 2417            |
| 17          | 2418            | 18          | 2419            | 19          | 2420            | 20          | 2421            |
| 21          | 2422            | 22          | 2423            | 23          | 2424            | 24          | 2425            |
| 25          | 2426            | 26          | 2427            | 27          | 2428            | 28          | 2429            |
| 29          | 2430            | 30          | 2431            | 31          | 2432            | 32          | 2433            |
| 33          | 2434            | 34          | 2435            | 35          | 2436            | 36          | 2437            |
| 37          | 2438            | 38          | 2439            | 39          | 2440            | 40          | 2441            |
| 41          | 2442            | 42          | 2443            | 43          | 2444            | 44          | 2445            |
| 45          | 2446            | 46          | 2447            | 47          | 2448            | 48          | 2449            |
| 49          | 2450            | 50          | 2451            | 51          | 2452            | 52          | 2453            |
| 53          | 2454            | 54          | 2455            | 55          | 2456            | 56          | 2457            |
| 57          | 2458            | 58          | 2459            | 59          | 2460            | 60          | 2461            |
| 61          | 2462            | 62          | 2463            | 63          | 2464            | 64          | 2465            |
| 65          | 2466            | 66          | 2467            | 67          | 2468            | 68          | 2469            |
| 69          | 2470            | 70          | 2471            | 71          | 2472            | 72          | 2473            |
| 73          | 2474            | 74          | 2475            | 75          | 2476            | 76          | 2477            |
| 77          | 2478            | 78          | 2479            | 79          | 2480            | -           | -               |

## 2.8. Test Equipment

### 2.8.1. For conducted emission test

| Equipment                | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
|--------------------------|-----------------|--------------|------------|------------------|------------|-----------|
| EMI Test Receiver        | Rohde & Schwarz | ESHS30       | 832354     | CEPREI           | June 15,18 | 1 Year    |
| Artificial Mains Network | Rohde & Schwarz | ENV216       | 101260     | CEPREI           | June 15,18 | 1 Year    |
| Pulse Limiter            | Rohde & Schwarz | ESH3-Z2      | 101100     | CEPREI           | June 15,18 | 1 Year    |
| Test Software            | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |

### 2.8.2. For radiated emission test(9 kHz-30MHz)

| Equipment           | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
|---------------------|-----------------|--------------|------------|------------------|------------|-----------|
| EMI Test Receiver   | Rohde & Schwarz | ESR7         | 101780     | CEPREI           | June 15,18 | 1 Year    |
| Active Loop Antenna | SCHWARZB ECK    | FMZB 1519B   | 1519B-088  | N/A              | Aug. 01,18 | 1 Year    |
| Test Software       | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |

### 2.8.3. For radiated emissions test (30-1000MHz)

| Equipment         | Manufacturer    | Model No.    | Serial No. | Calibration Body | Last Cal.  | Next Cal. |
|-------------------|-----------------|--------------|------------|------------------|------------|-----------|
| EMI Test Receiver | Rohde & Schwarz | ESR7         | 101780     | CEPREI           | June 15,18 | 1 Year    |
| Bilog Antenna     | Teseq           | CBL 6111D    | 27090      | CEPREI           | June 15,18 | 1 Year    |
| Test Software     | Audix           | e3-6.111221a | N/A        | N/A              | N/A        | N/A       |

### 2.8.4. For radiated emission test(above 1GHz)

| Equipment                    | Manufacturer    | Model No.    | Serial No.    | Calibration Body | Last Cal.  | Next Cal. |
|------------------------------|-----------------|--------------|---------------|------------------|------------|-----------|
| Horn Antenna                 | SCHWARZB ECK    | BBHA 9120 D  | BBHA9120D1002 | CEPREI           | June 18,18 | 1 Year    |
| Horn Antenna                 | SCHWARZB ECK    | BBHA9170     | BBHA9170242   | CEPREI           | June 18,18 | 1 Year    |
| Signal Amplifier             | SCHWARZB ECK    | BBV9718      | 9718-212      | CEPREI           | June 15,18 | 1 Year    |
| Spectrum Analyzer            | Rohde & Schwarz | FSV          | 103173        | CEPREI           | June 15,18 | 1 Year    |
| PSA Series Spectrum Analyzer | Agilent         | E4447A       | MY50180031    | CEPREI           | June 15,18 | 1 Year    |
| Test Software                | Audix           | e3-6.111221a | N/A           | N/A              | N/A        | N/A       |

## 2.8.5. For connect EUT antenna terminal test

| Equipment         | Manufacturer    | Model No. | Serial No.     | Calibration Body | Last Cal.  | Next Cal. |
|-------------------|-----------------|-----------|----------------|------------------|------------|-----------|
| Spectrum Analyzer | Rohde & Schwarz | FSV       | 103173         | CEPREI           | June 15,18 | 1 Year    |
| Spectrum Analyzer | Agilent         | E4408B    | MY44211<br>139 | CEPREI           | June 15,18 | 1 Year    |

### 3. MAXIMUM PEAK OUTPUT POWER

#### 3.1. Limit

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset employing at least 75 non-overlapping hopping channels; shall not exceed 0.125 W if the hopset employing at greater than or equal to 15 and less than 75 non-overlapping hopping channels.

#### 3.2. Test Procedure

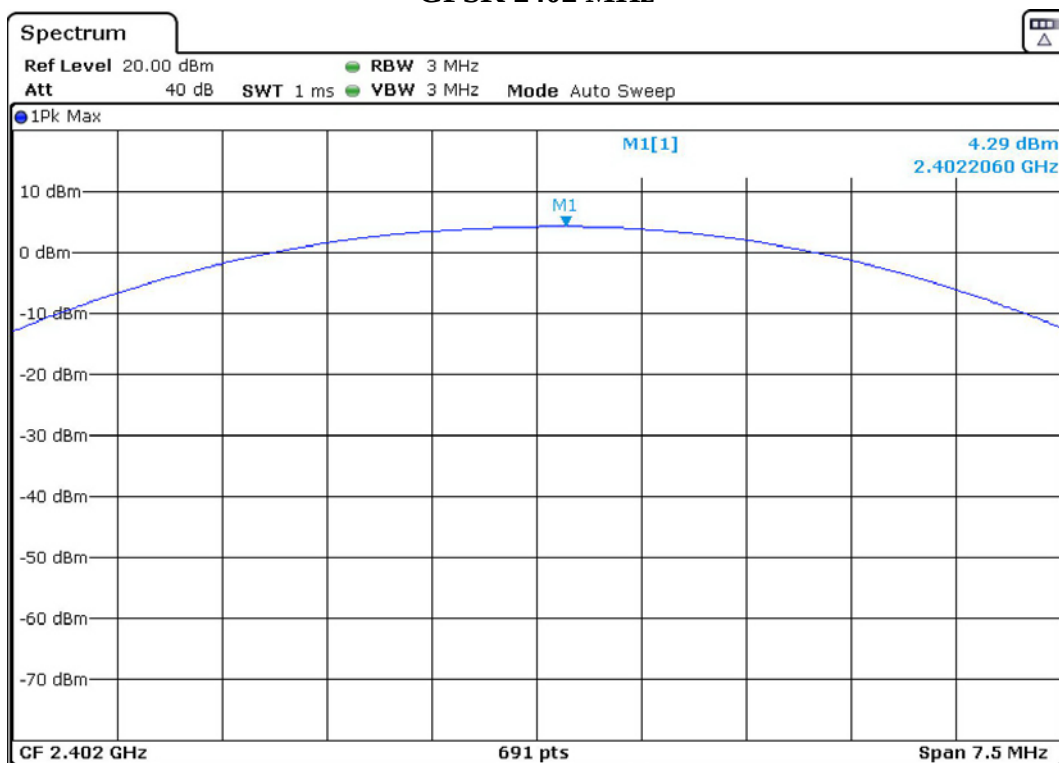
The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable.

#### 3.3. Test Result

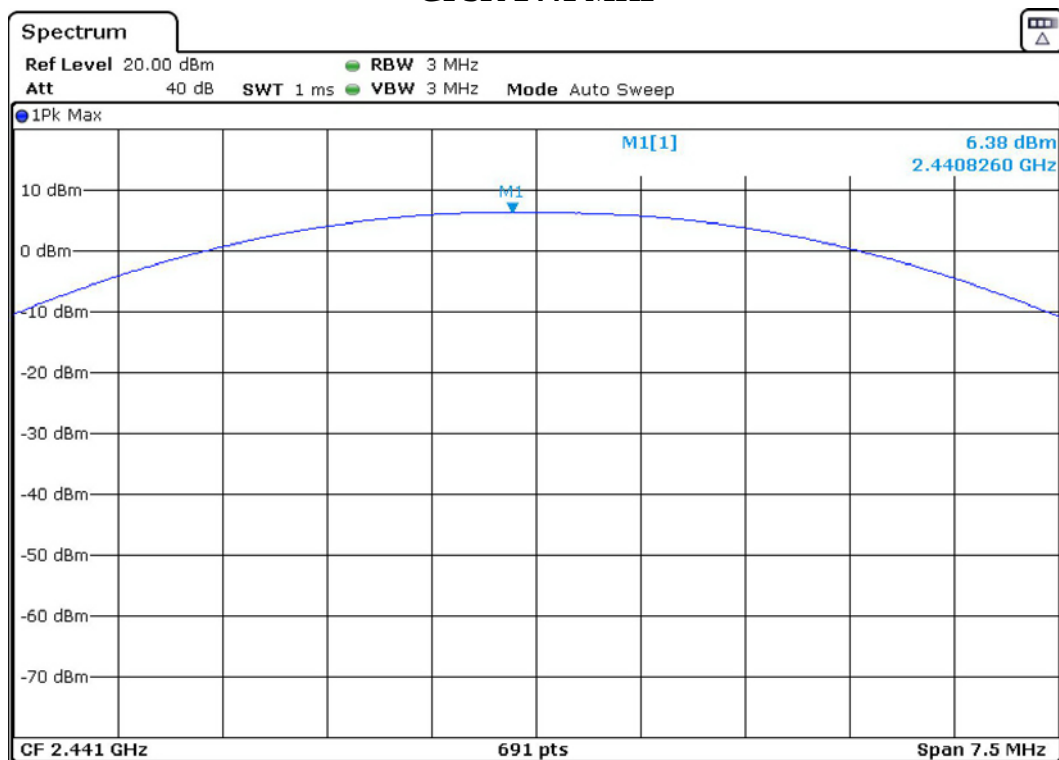
| EUT: CAR RADIO        |            |                    |       |                  |            |
|-----------------------|------------|--------------------|-------|------------------|------------|
| M/N: CRD4512UBA-OR    |            |                    |       |                  |            |
| Test date: 2019-03-20 |            | Test site: RF site |       | Tested by: Seven |            |
| Mode                  | Freq (MHz) | Result (dBm)       | Limit |                  | Conclusion |
|                       |            |                    | dBm   | W                |            |
| GFSK                  | 2402       | 4.29               | 30.00 | 1                | Pass       |
|                       | 2441       | 6.38               | 30.00 | 1                | Pass       |
|                       | 2480       | 6.69               | 30.00 | 1                | Pass       |
| 8-DPSK                | 2402       | 2.24               | 30.00 | 1                | Pass       |
|                       | 2441       | 4.83               | 30.00 | 1                | Pass       |
|                       | 2480       | 5.21               | 30.00 | 1                | Pass       |

## 3.4. Test Data

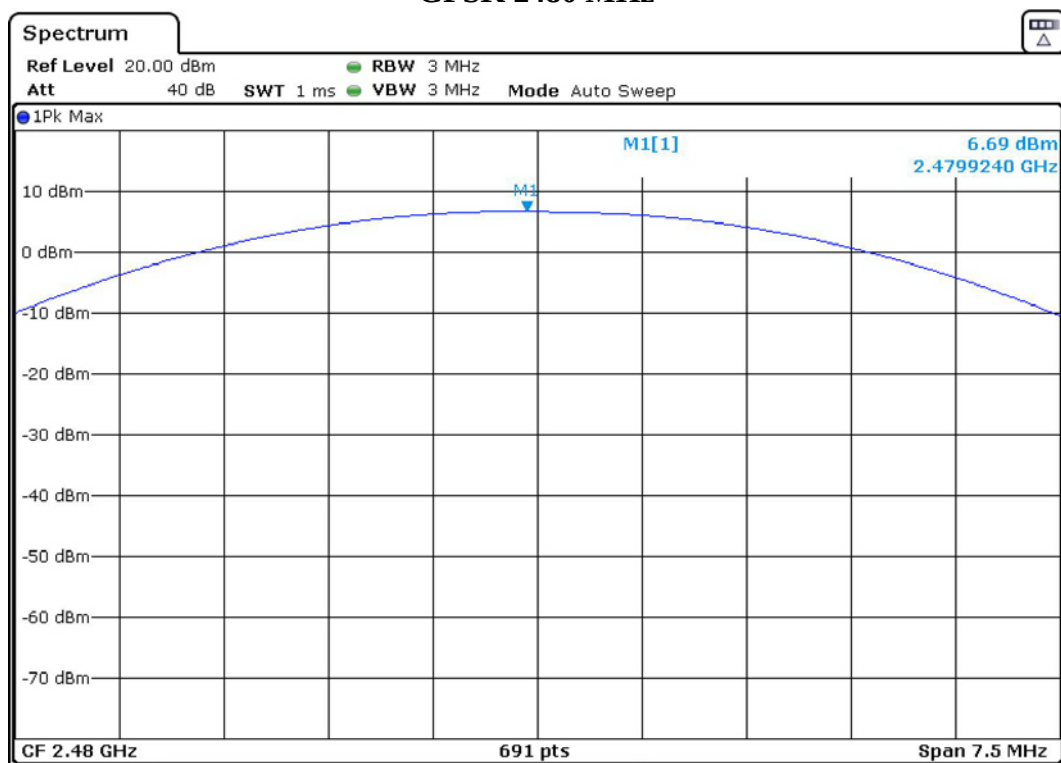
## GFSK 2402 MHz



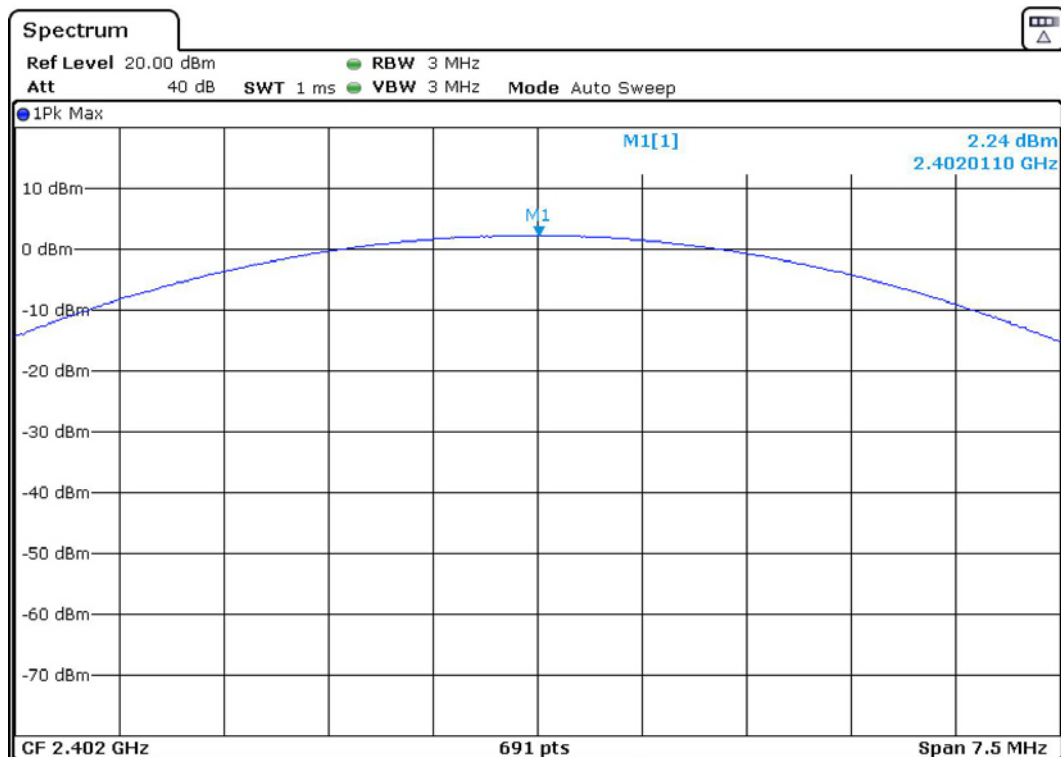
## GFSK 2441 MHz



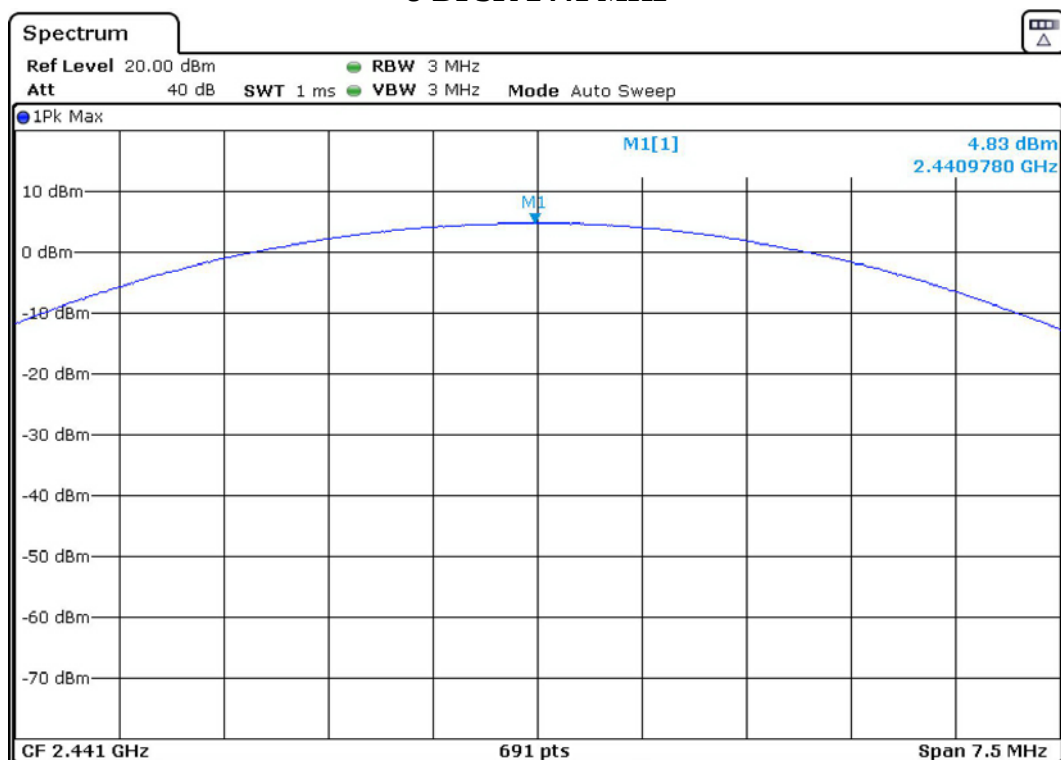
## GFSK 2480 MHz



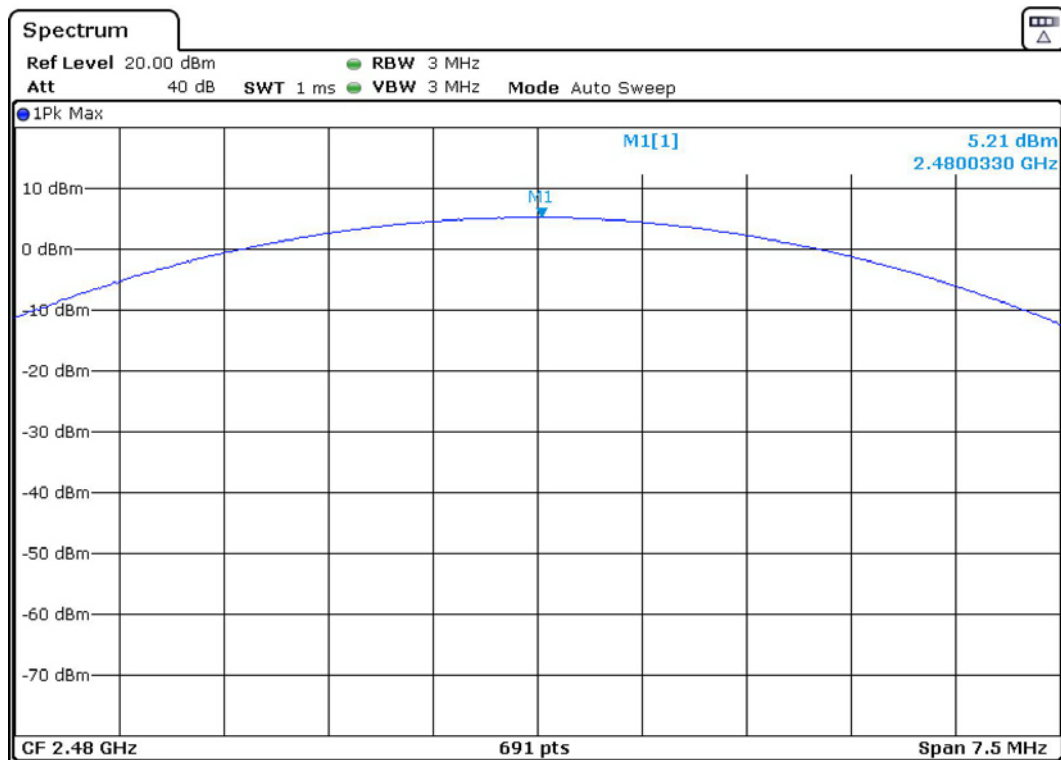
## 8-DPSK 2402 MHz



## 8-DPSK 2441 MHz



## 8-DPSK 2480 MHz



## 4. 20 DB BANDWIDTH

### 4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 4.2. Test Procedure

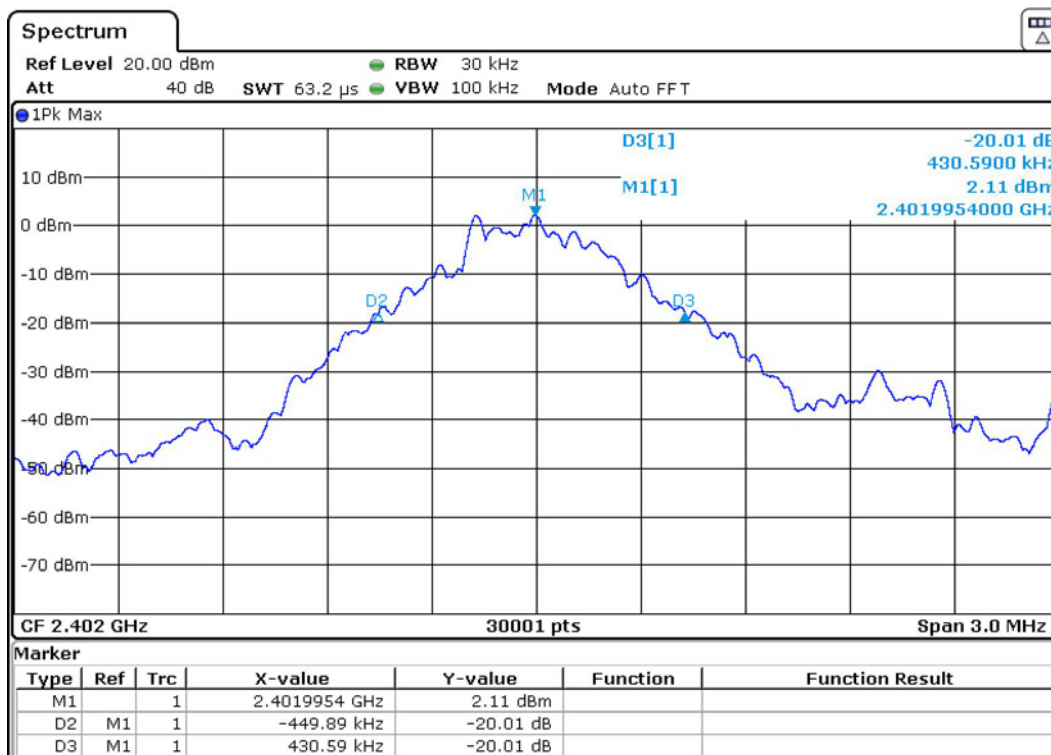
The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

### 4.3. Test Result

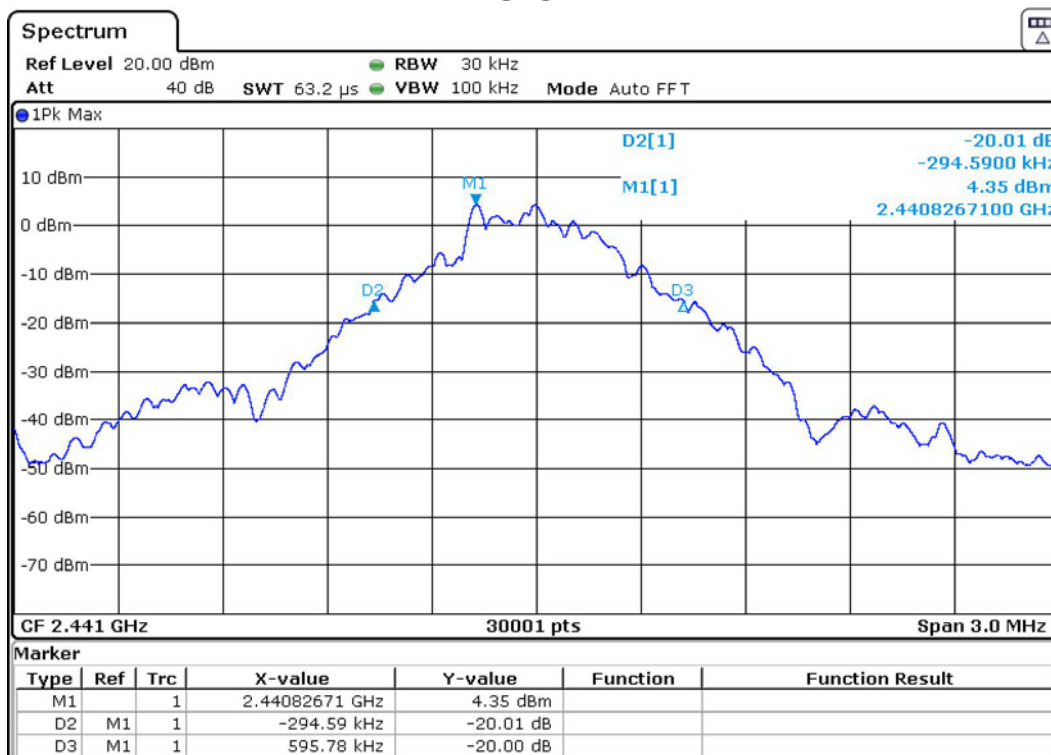
| EUT: CAR RADIO        |            |                      |             |                  |
|-----------------------|------------|----------------------|-------------|------------------|
| M/N: CRD4512UBA-OR    |            |                      |             |                  |
| Test date: 2019-03-20 |            | Test site: RF site   |             | Tested by: Seven |
| Mode                  | Freq (MHz) | 20dB Bandwidth (MHz) | Limit (kHz) | Conclusion       |
| GFSK                  | 2402       | 0.88048              | /           | PASS             |
|                       | 2441       | 0.89037              | /           | PASS             |
|                       | 2480       | 0.89007              | /           | PASS             |
| 8-DPSK                | 2402       | 1.20666              | /           | PASS             |
|                       | 2441       | 1.20766              | /           | PASS             |
|                       | 2480       | 1.20736              | /           | PASS             |

## 4.4. Test Data

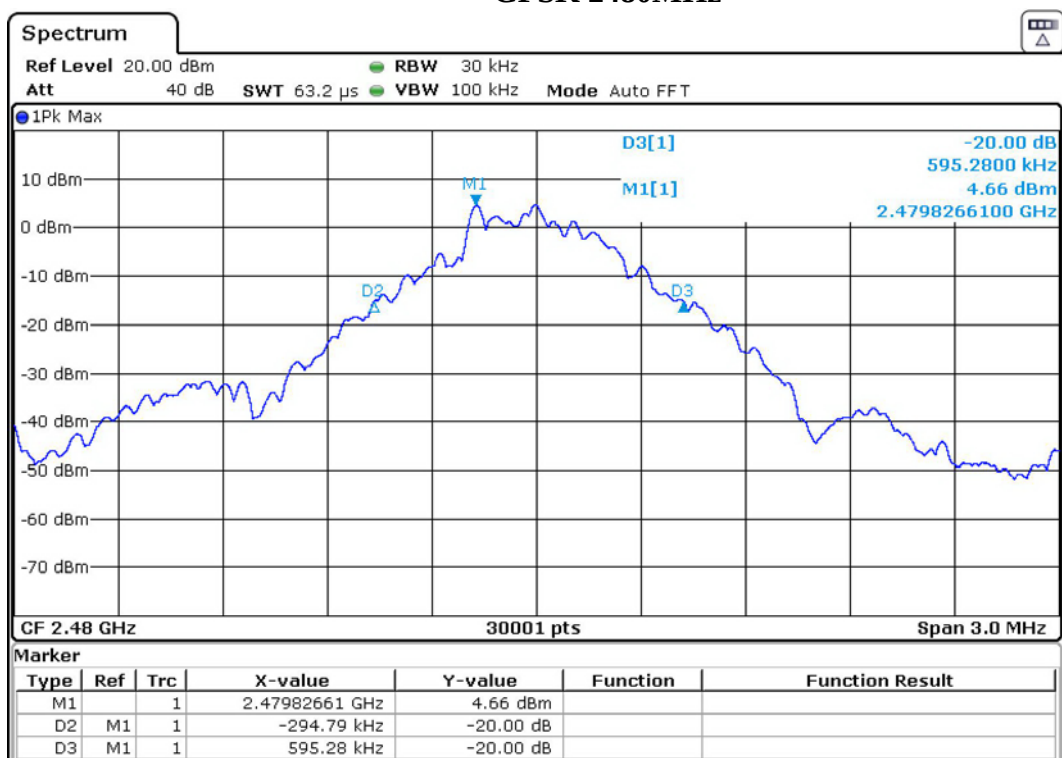
## GFSK 2402MHz



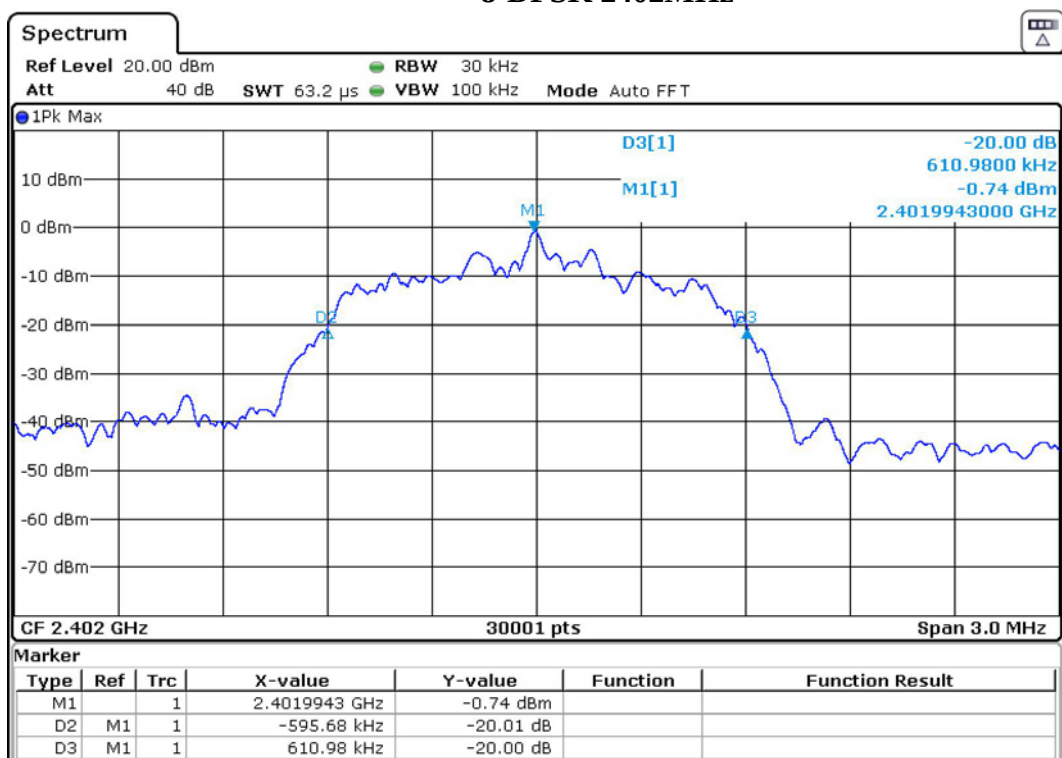
## GFSK 2441MHz



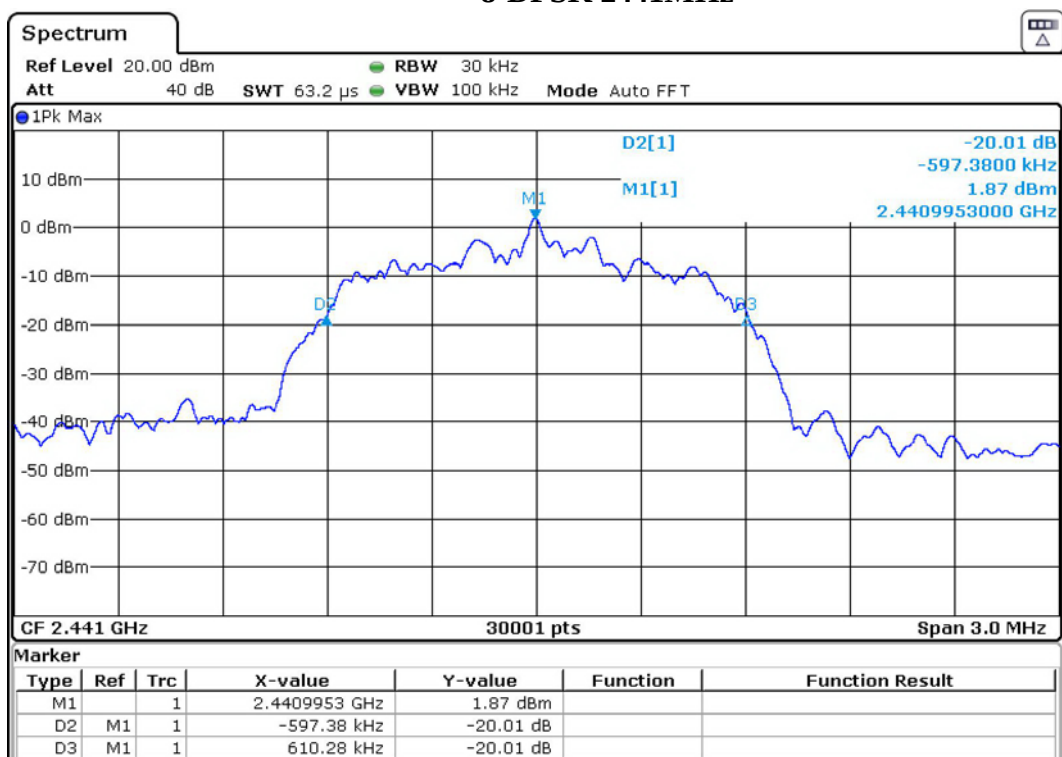
## GFSK 2480MHz



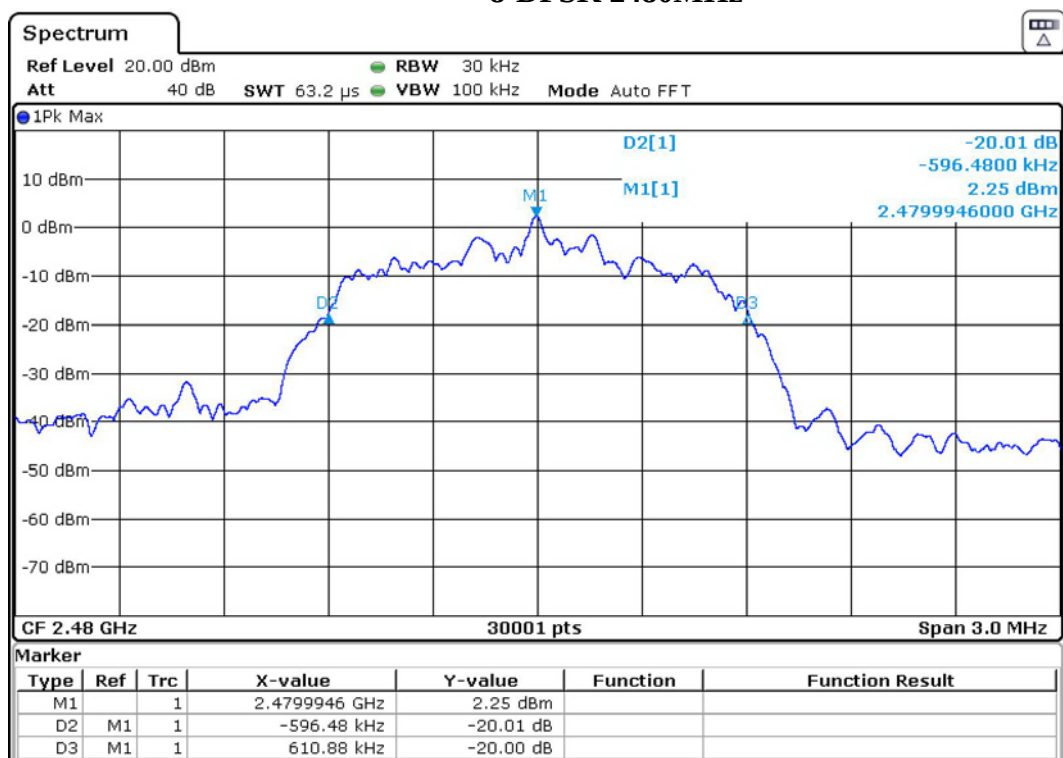
## 8-DPSK 2402MHz



## 8-DPSK 2441MHz



## 8-DPSK 2480MHz



## 5. CARRIER FREQUENCY SEPARATION

### 5.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

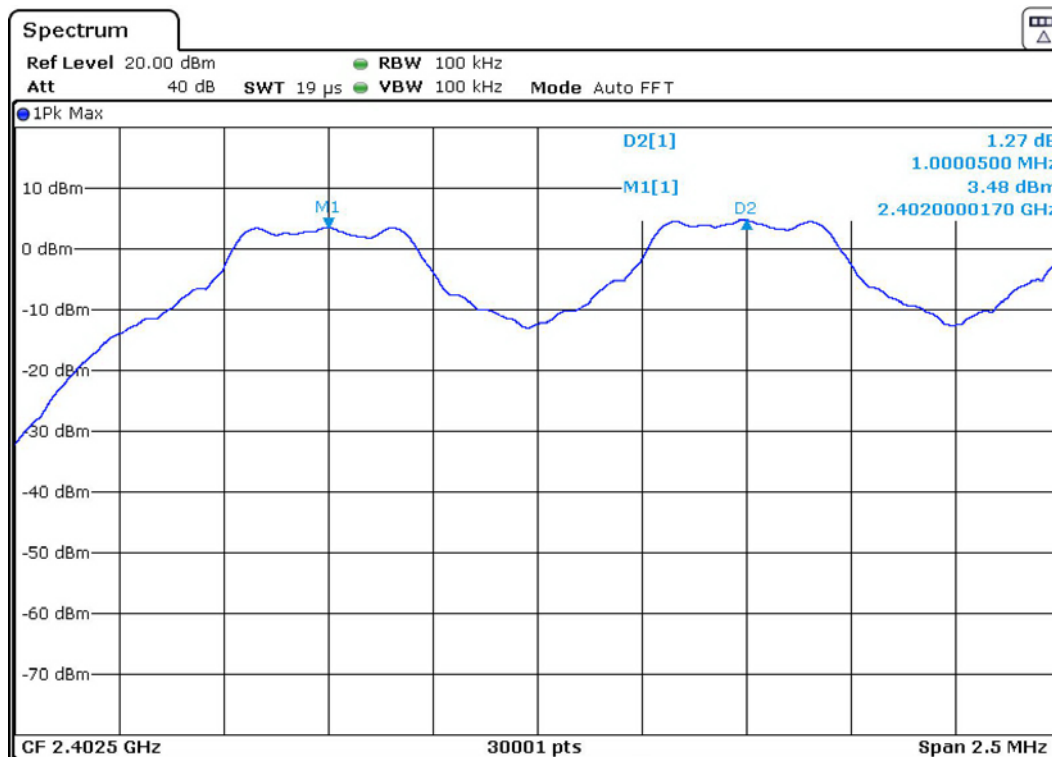
### 5.2. Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable. The carrier frequency was measured by spectrum analyzer with 100kHz RBW and 100kHz VBW.

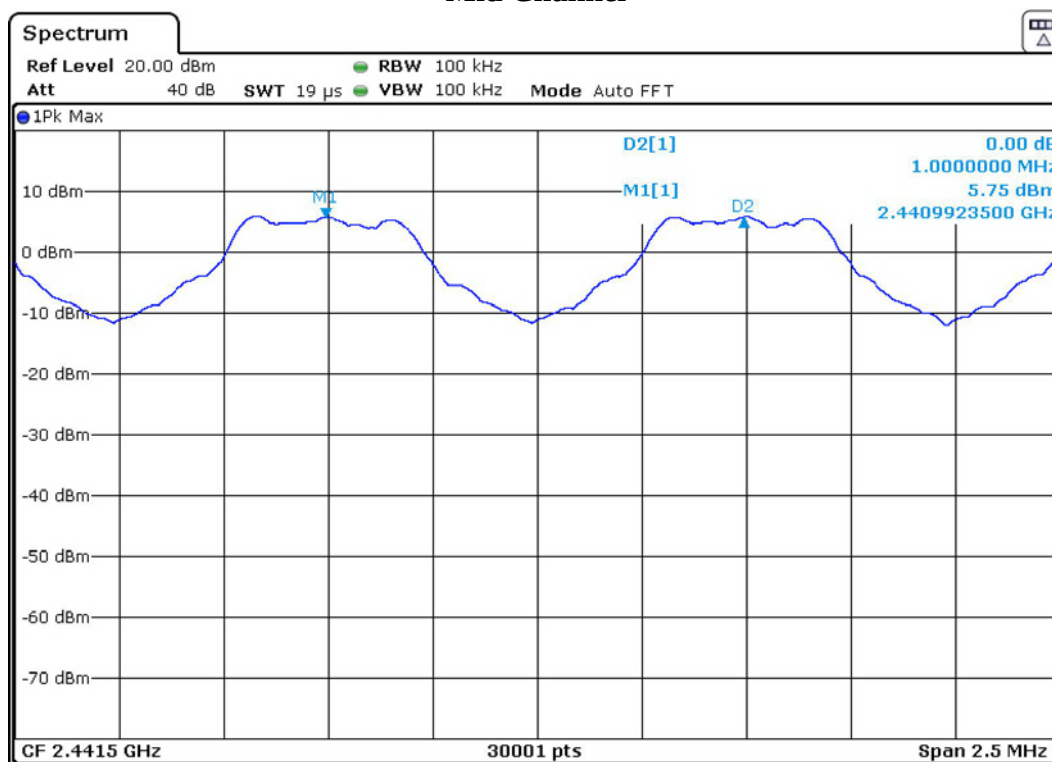
### 5.3. Test Result

| EUT: CAR RADIO        |         |                          |                                                               |                  |
|-----------------------|---------|--------------------------|---------------------------------------------------------------|------------------|
| M/N: CRD4512UBA-OR    |         |                          |                                                               |                  |
| Test date: 2019-03-20 |         |                          | Test site: RF site                                            | Tested by: Seven |
| Mode                  | Channel | Channel separation (MHz) | Limit (MHz)                                                   | Conclusion       |
| GFSK                  | Low CH  | 1.00005                  | 0.88048                                                       | PASS             |
|                       | Mid CH  | 1.00000                  | 0.89037                                                       | PASS             |
|                       | High CH | 1.00000                  | 0.89007                                                       | PASS             |
| 8-DPSK                | Low CH  | 1.00000                  | > 2/3 of the 20dB Bandwidth or 25[kHz]( whichever is greater) | PASS             |
|                       | Mid CH  | 1.00000                  |                                                               | PASS             |
|                       | High CH | 1.00000                  |                                                               | PASS             |

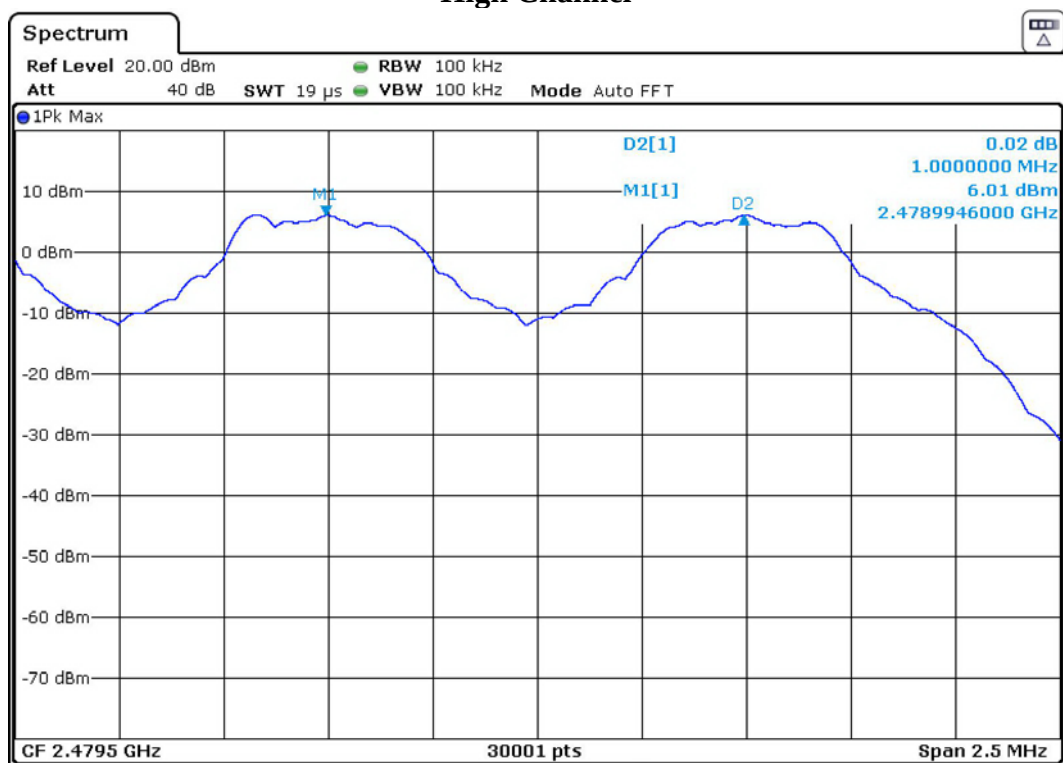
## 5.4. Test Data

GFSK  
Low Channel

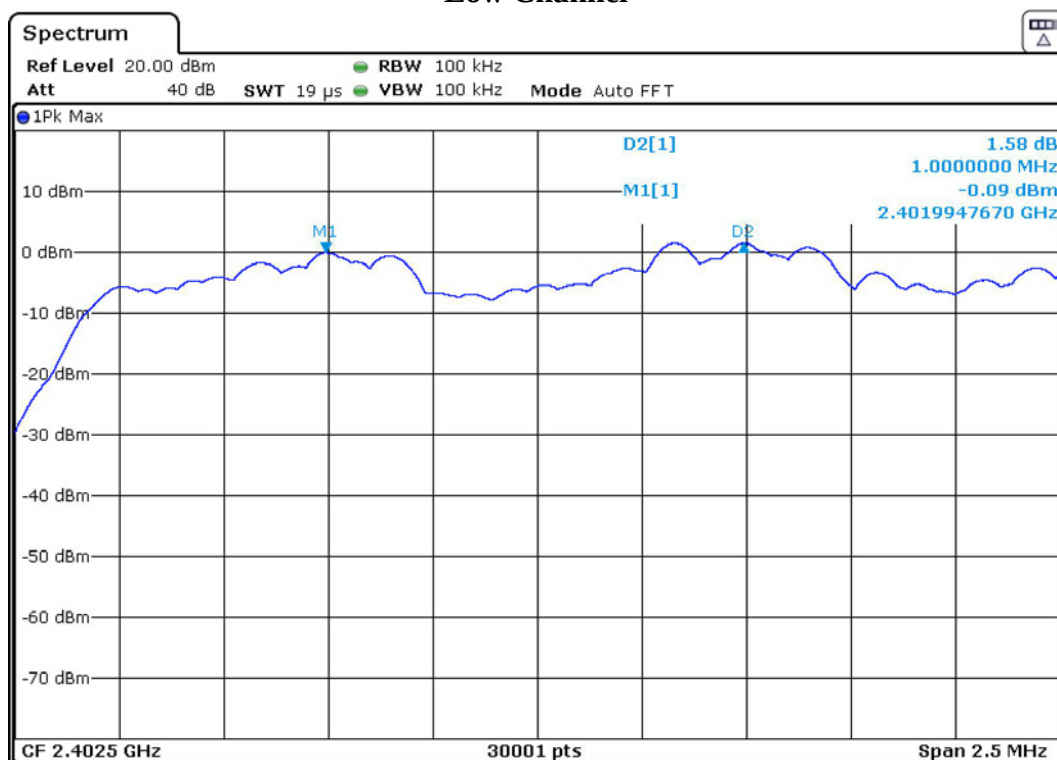
## Mid Channel



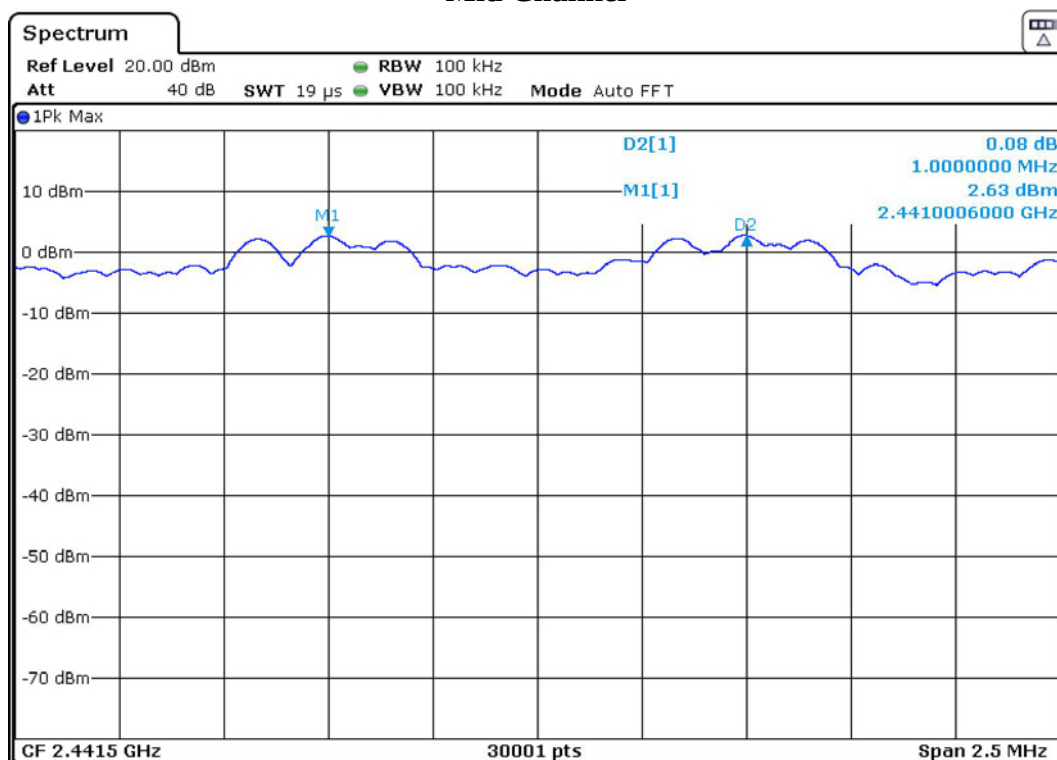
## High Channel



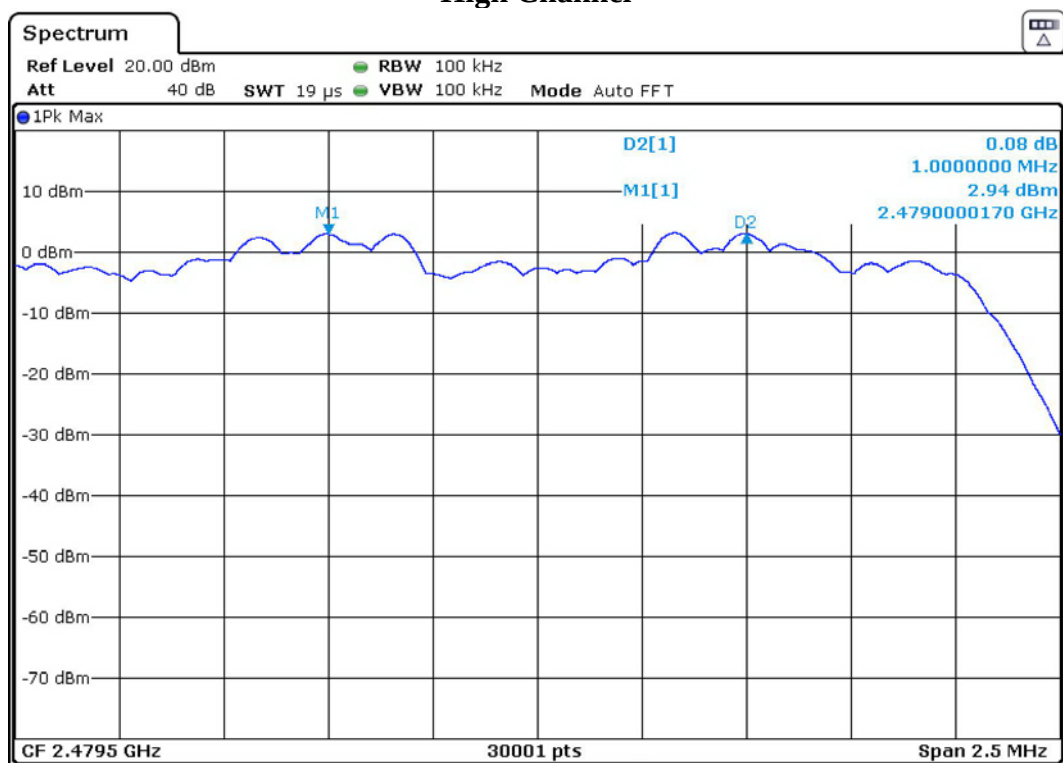
## 8-DPSK Low Channel



## Mid Channel



## High Channel



## 6. NUMBER OF HOPPING CHANNEL

### 6.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

### 6.2. Test Procedure

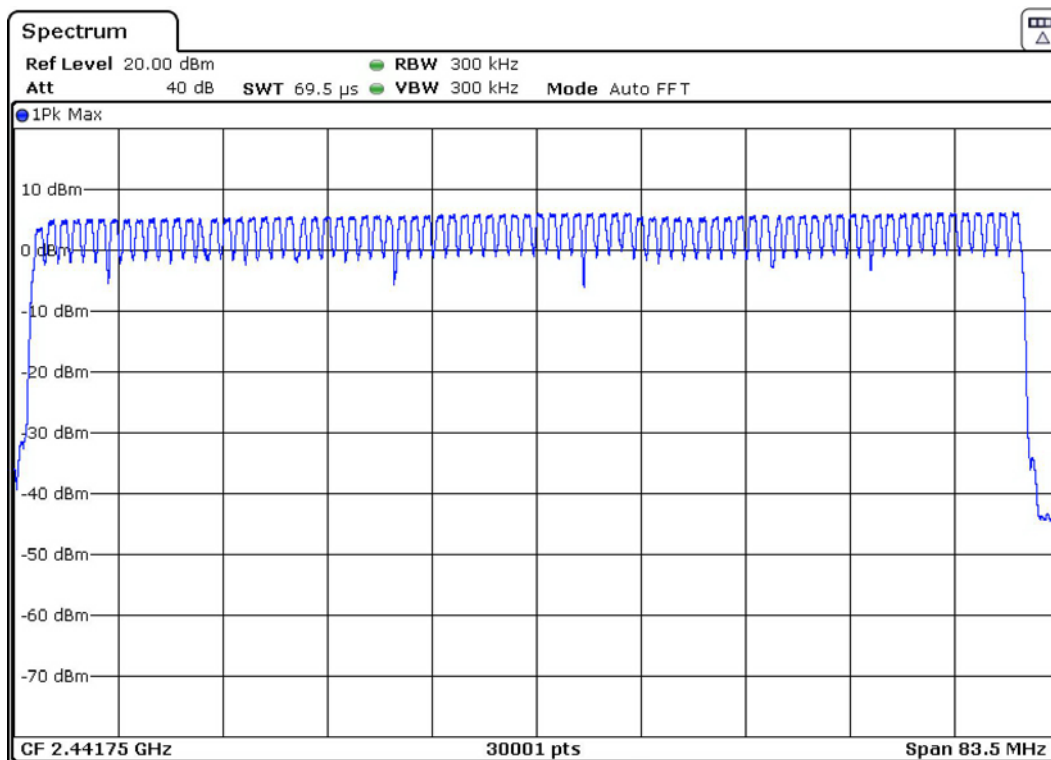
The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable. The number of hopping channel was measured by spectrum analyzer with 300kHz RBW and 300kHz VBW.

### 6.3. Test Result

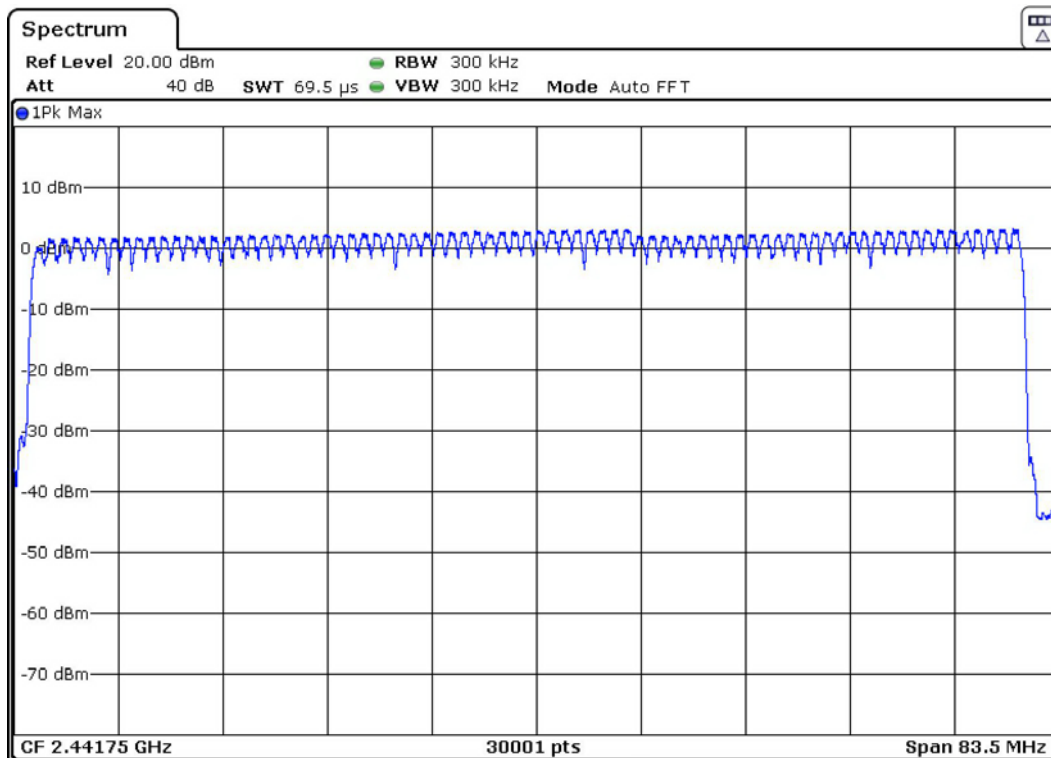
|                       |                           |                    |                  |
|-----------------------|---------------------------|--------------------|------------------|
| EUT: CAR RADIO        |                           |                    |                  |
| M/N: CRD4512UBA-OR    |                           |                    |                  |
| Test date: 2019-03-20 |                           | Test site: RF site | Tested by: Seven |
| Mode                  | Number of hopping channel | Limit              | Conclusion       |
| GFSK                  | 79                        | >15                | PASS             |
| 8-DPSK                | 79                        | >15                | PASS             |

## 6.4. Test Data

## GFSK



## 8-DPSK



## 7. DWELL TIME

### 7.1. Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 7.2. Test Procedure

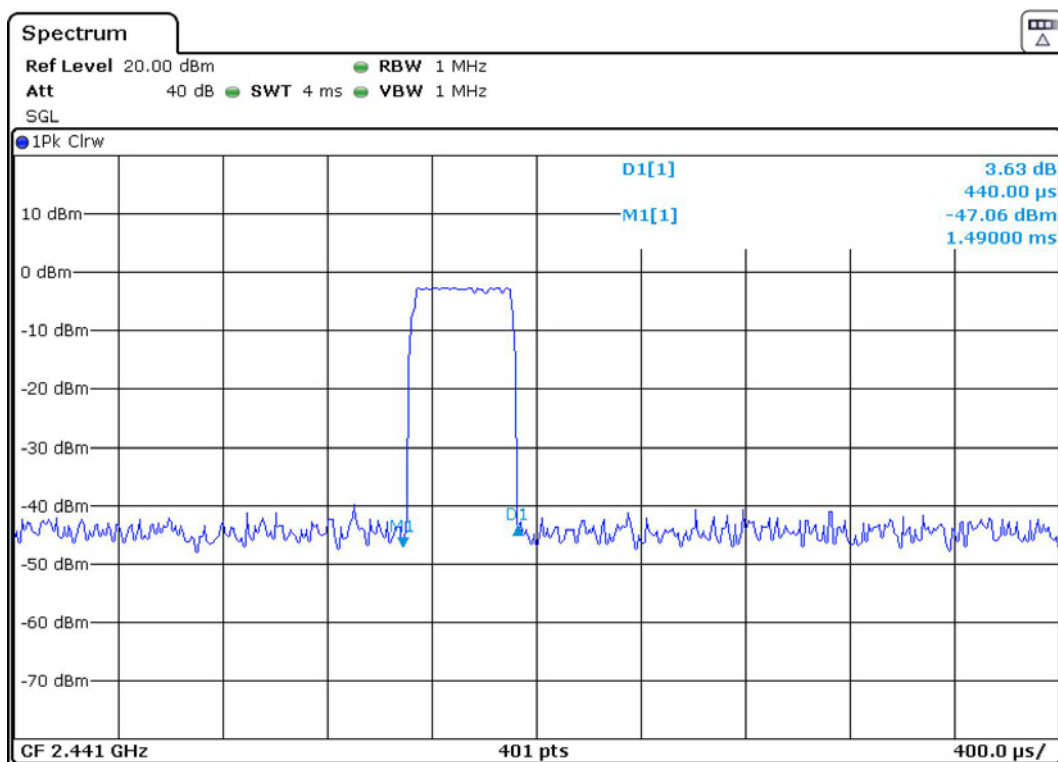
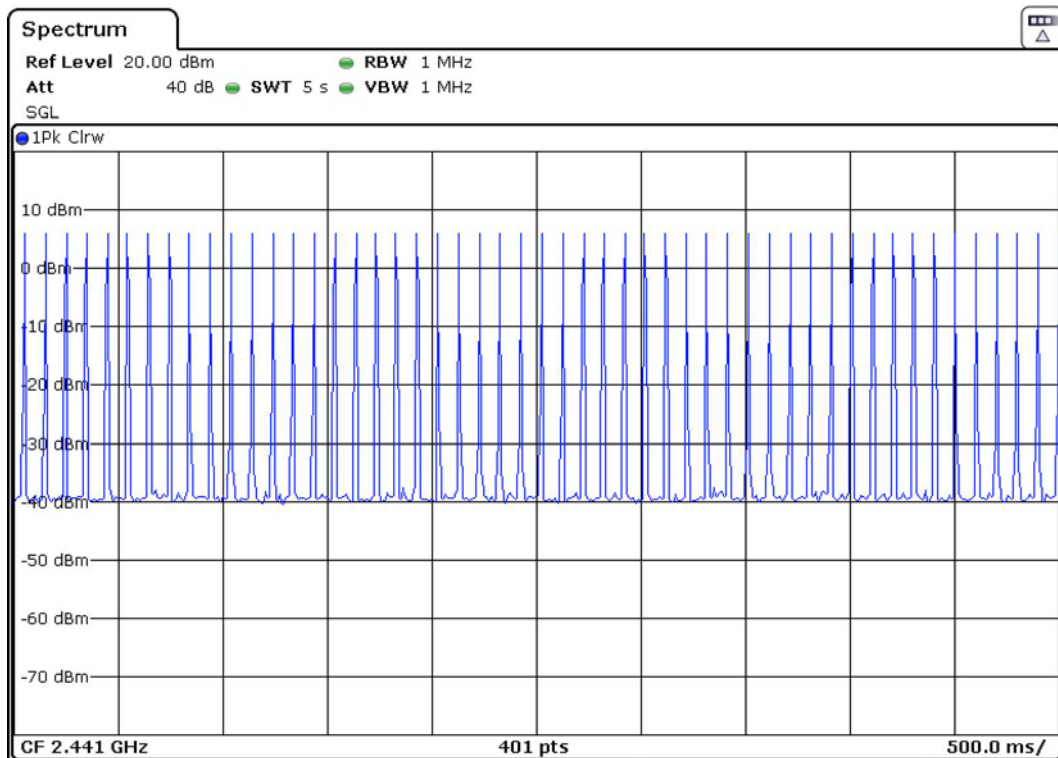
1. The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: Centered Frequency = measured channel, RBW = 1MHz, VBW= 1MHz, Frequency Span = 0 Hz.
4. Set sweep time properly to capture the entire dwell time per hopping channel.
5. Set detector type to Peak and trace mode to Max Hold and make the measurement.
6. Repeat step 3-5 until all channels measured were complete.

### 7.3. Test Result

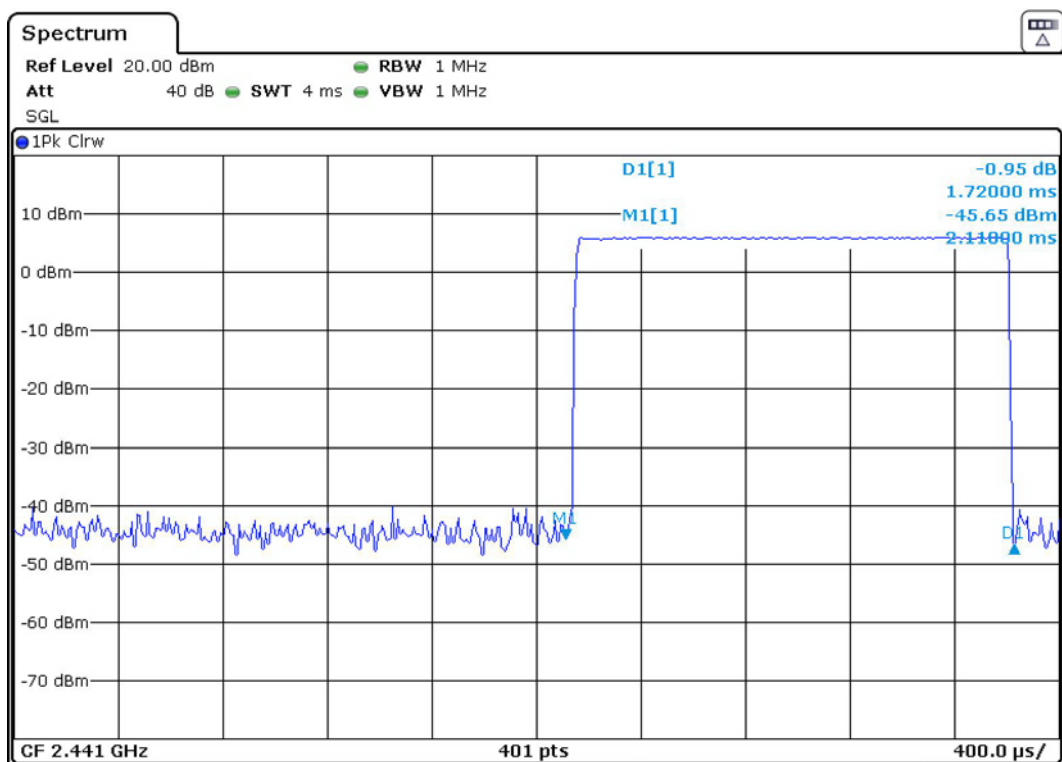
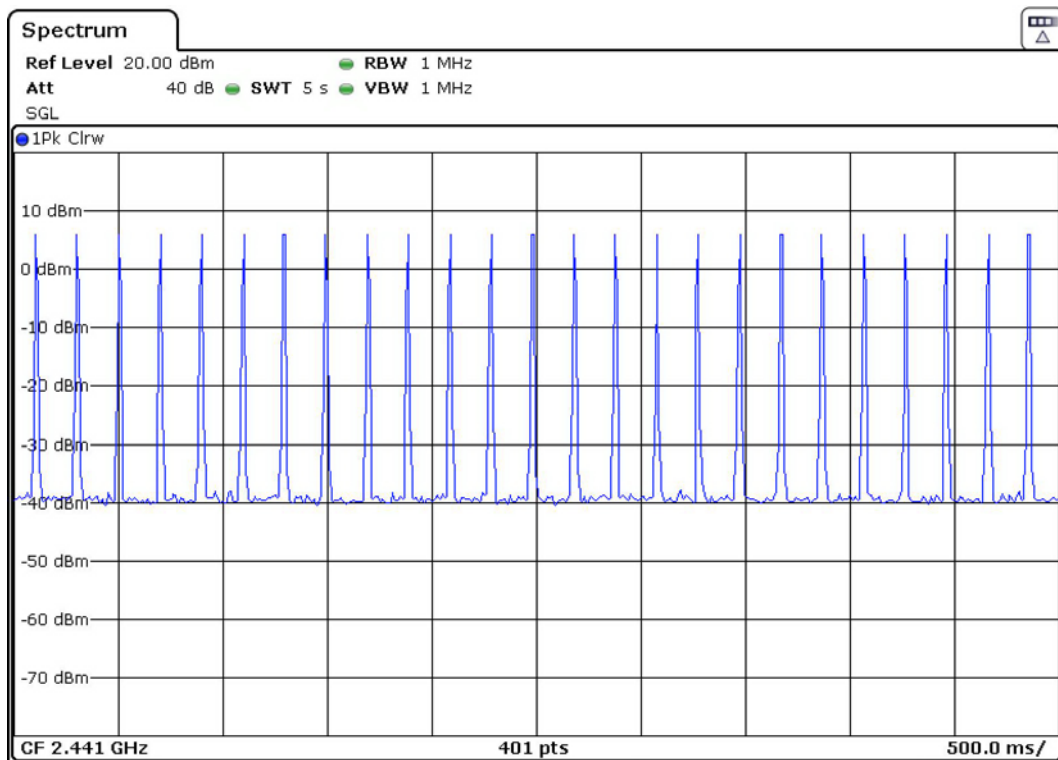
| EUT: CAR RADIO                                                  |                |                    |                    |                  |        |            |
|-----------------------------------------------------------------|----------------|--------------------|--------------------|------------------|--------|------------|
| M/N: CRD4512UBA-OR                                              |                |                    |                    |                  |        |            |
| Test date: 2019-03-20                                           |                | Test site: RF site |                    | Tested by: Seven |        |            |
| Mode                                                            | Hopping number | Measure time (s)   | Burst on time (ms) | Dwell time (ms)  | Limit  | Conclusion |
| GFSK DH1                                                        | 50             | 5                  | 0.44               | 139.04           | <400ms | PASS       |
| GFSK DH3                                                        | 25             | 5                  | 1.72               | 271.76           | <400ms | PASS       |
| GFSK DH5                                                        | 17             | 5                  | 2.95               | 316.95           | <400ms | PASS       |
| 8-DPSK 3DH1                                                     | 50             | 5                  | 0.46               | 145.36           | <400ms | PASS       |
| 8-DPSK 3DH3                                                     | 25             | 5                  | 1.71               | 270.18           | <400ms | PASS       |
| 8-DPSK 3DH5                                                     | 17             | 5                  | 2.97               | 319.10           | <400ms | PASS       |
| Dwell time = Hopping number/measure time *0.4*79*burst on time. |                |                    |                    |                  |        |            |

## 7.4. Test Data

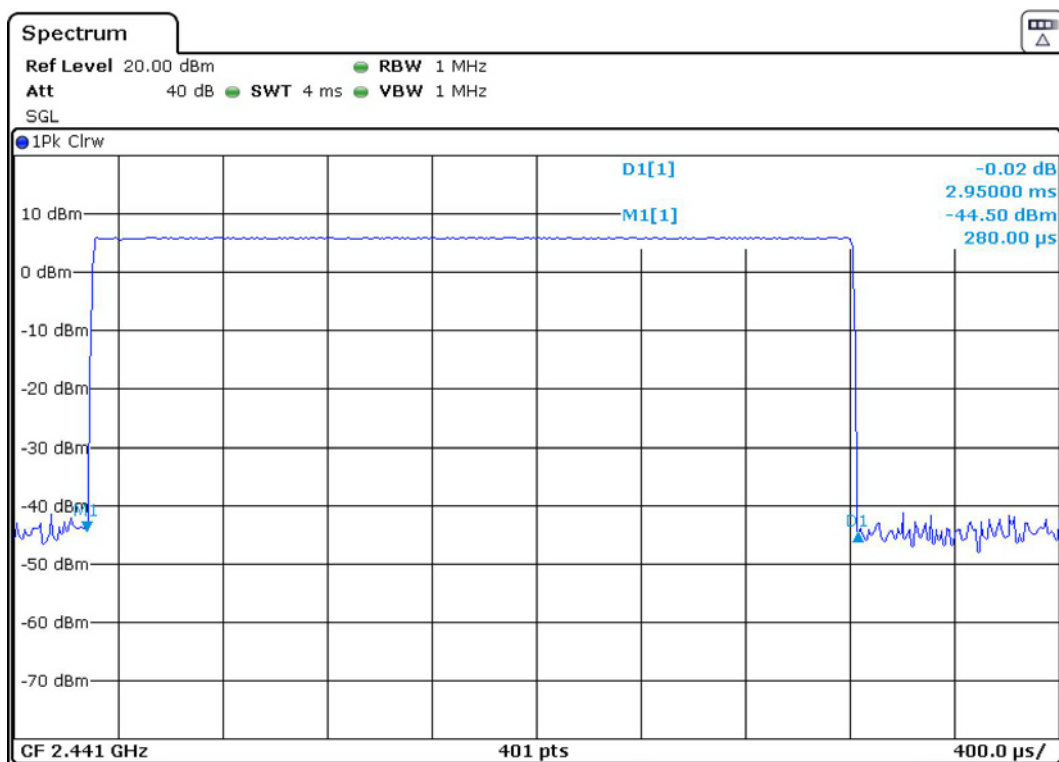
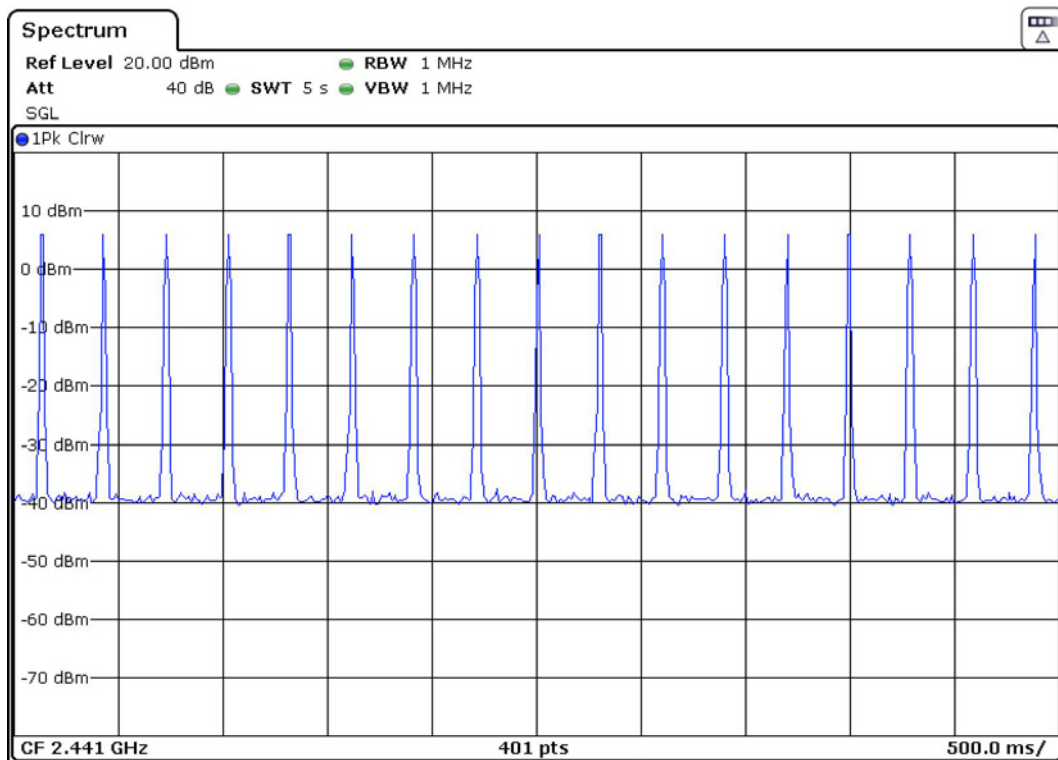
## GFSK DH1



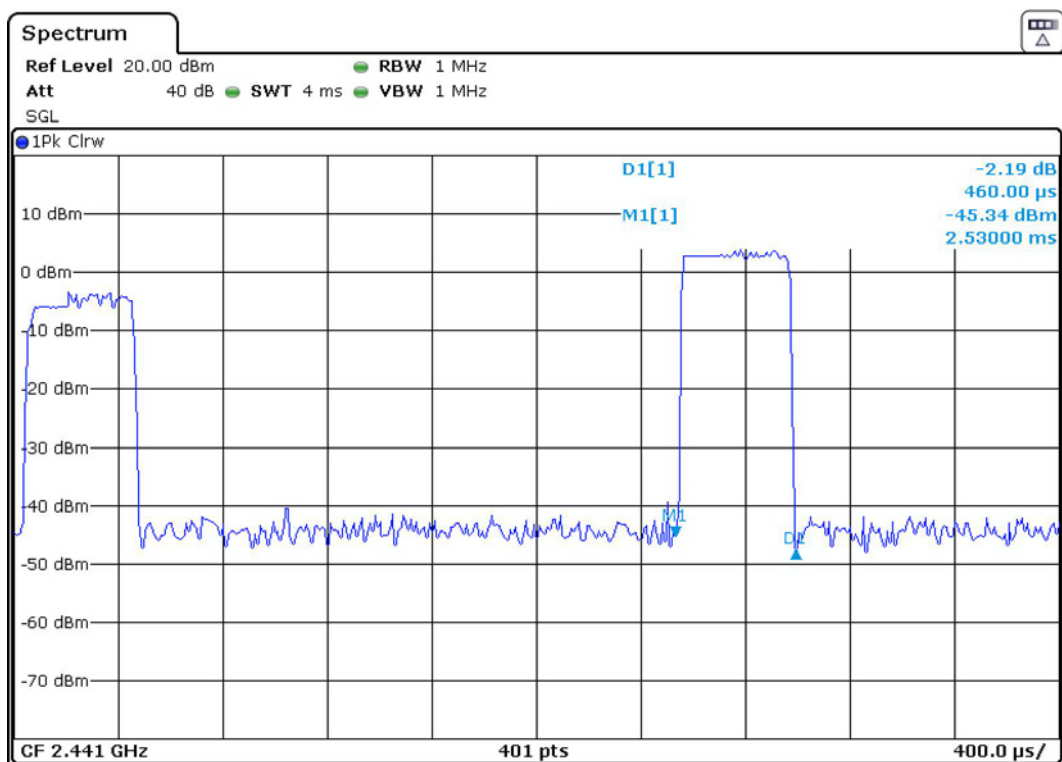
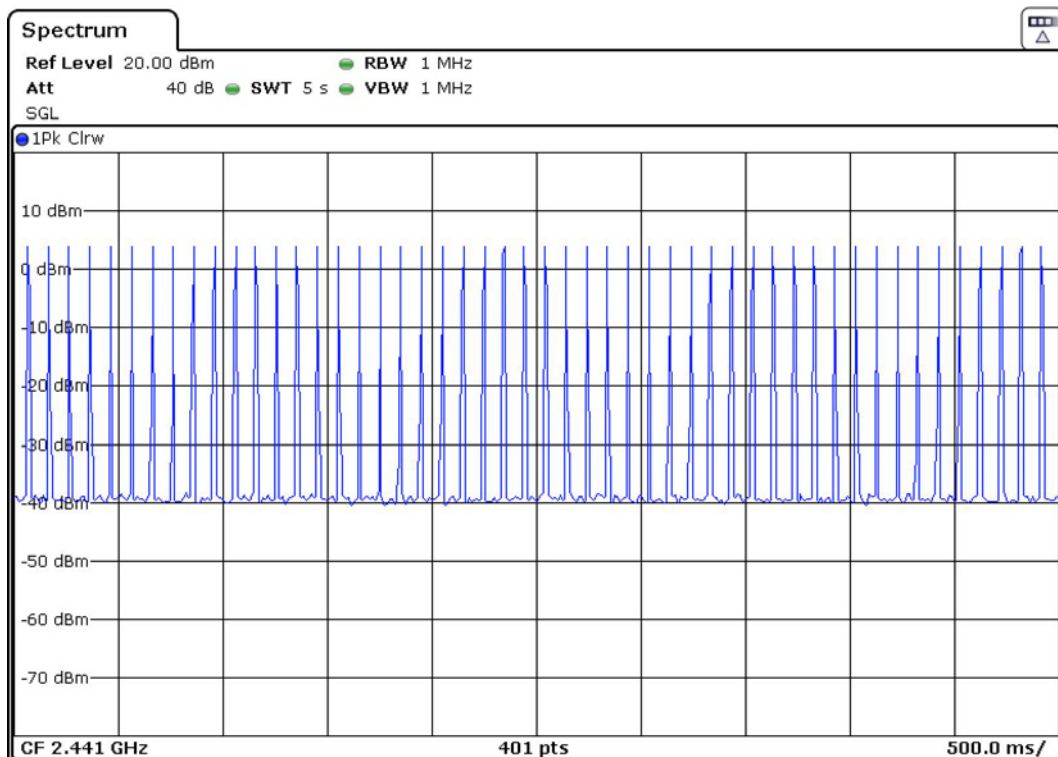
## GFSK DH3



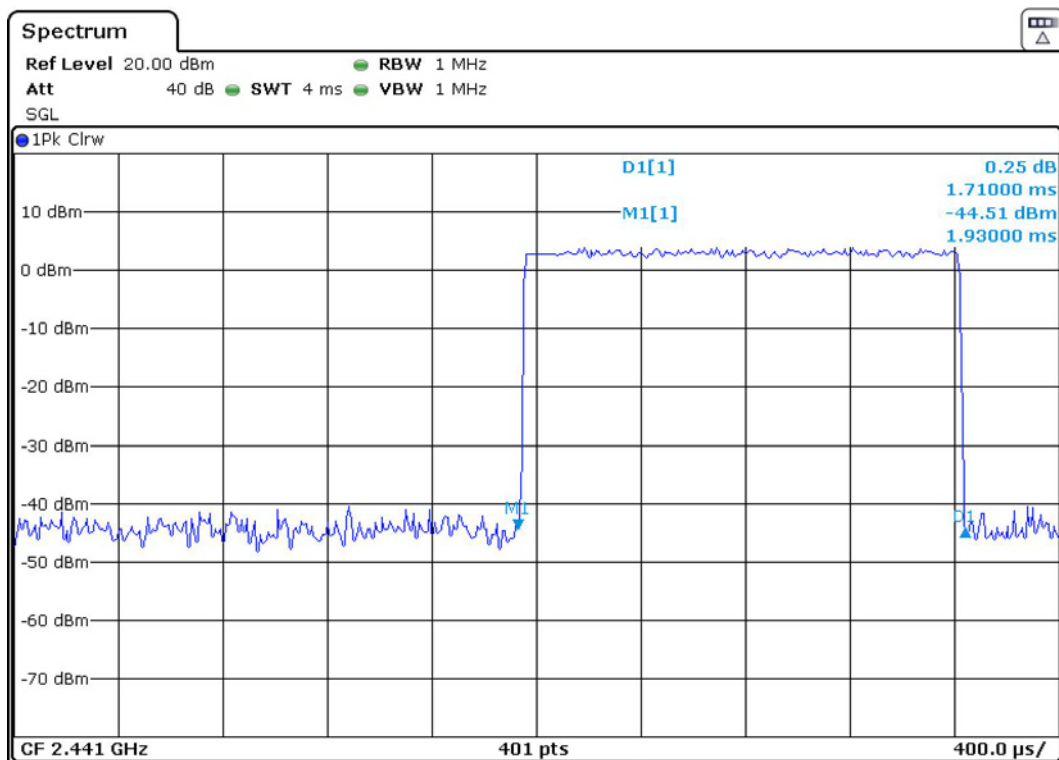
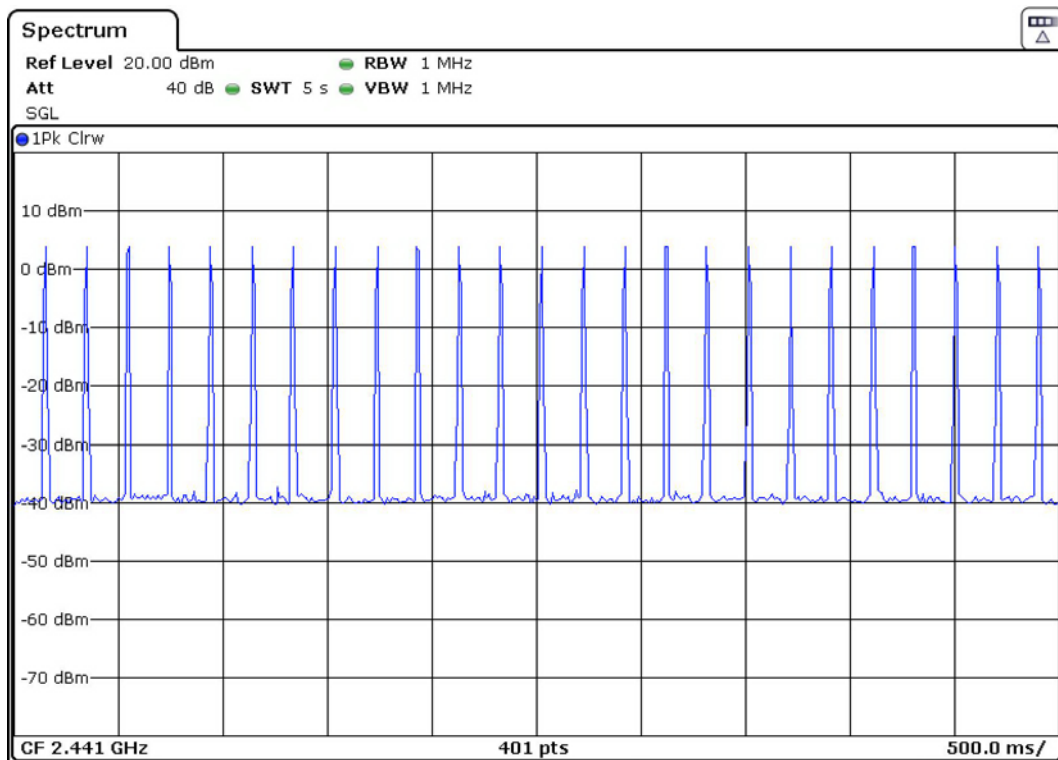
## GSFK DH5



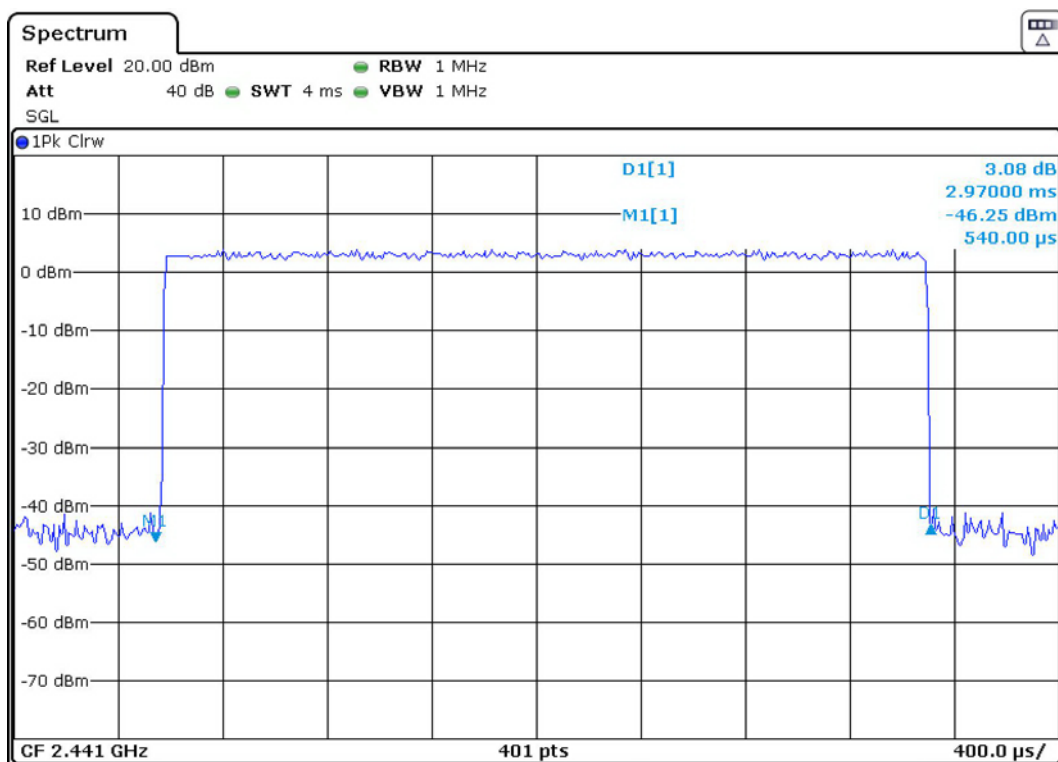
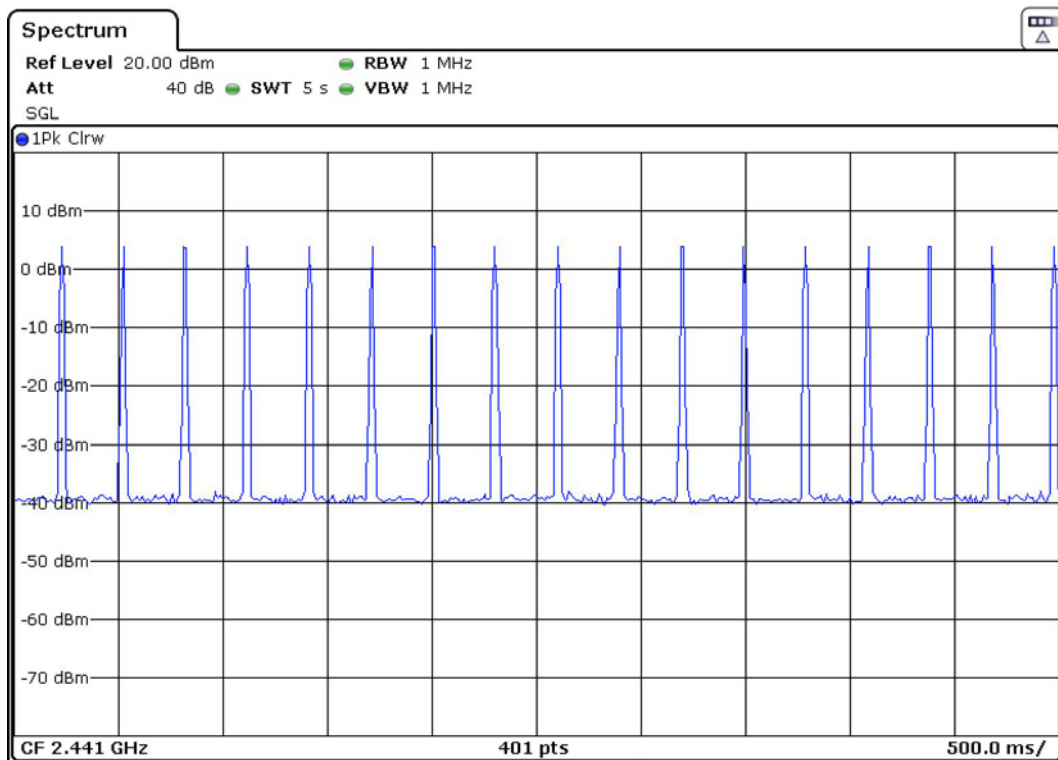
## 8-DPSK 3DH1



## 8-DPSK 3DH3



## 8-DPSK 3DH5



## 8. RADIATED EMISSIONS

### 8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

#### 15.205 Restricted frequency band

| MHz                        | MHz                   | MHz             | GHz              |
|----------------------------|-----------------------|-----------------|------------------|
| 0.090 - 0.110              | 16.42 - 16.423        | 399.9 - 410     | 4.5 - 5.15       |
| <sup>1</sup> 0.495 - 0.505 | 16.69475 - 16.69525   | 608 - 614       | 5.35 - 5.46      |
| 2.1735 - 2.1905            | 16.80425 - 16.80475   | 960 - 1240      | 7.25 - 7.75      |
| 4.125 - 4.128              | 25.5 - 25.67          | 1300 - 1427     | 8.025 - 8.5      |
| 4.17725 - 4.17775          | 37.5 - 38.25          | 1435 - 1626.5   | 9.0 - 9.2        |
| 4.20725 - 4.20775          | 73 - 74.6             | 1645.5 - 1646.5 | 9.3 - 9.5        |
| 6.215 - 6.218              | 74.8 - 75.2           | 1660 - 1710     | 10.6 - 12.7      |
| 6.26775 - 6.26825          | 108 - 121.94          | 1718.8 - 1722.2 | 13.25 - 13.4     |
| 6.31175 - 6.31225          | 123 - 138             | 2200 - 2300     | 14.47 - 14.5     |
| 8.291 - 8.294              | 149.9 - 150.05        | 2310 - 2390     | 15.35 - 16.2     |
| 8.362 - 8.366              | 156.52475 - 156.52525 | 2483.5 - 2500   | 17.7 - 21.4      |
| 8.37625 - 8.38675          | 156.7 - 156.9         | 2690 - 2900     | 22.01 - 23.12    |
| 8.41425 - 8.41475          | 162.0125 - 167.17     | 3260 - 3267     | 23.6 - 24.0      |
| 12.29 - 12.293             | 167.72 - 173.2        | 3332 - 3339     | 31.2 - 31.8      |
| 12.51975 - 12.52025        | 240 - 285             | 3345.8 - 3358   | 36.43 - 36.5     |
| 12.57675 - 12.57725        | 322 - 335.4           | 3600 - 4400     | ( <sup>2</sup> ) |

#### 15.209 Limit

| Frequency (MHz) | Field Strength( $\mu\text{V/m}$ ) | Distance(m) |
|-----------------|-----------------------------------|-------------|
| 0.009-0.490     | 2400/F(kHz)                       | 300         |
| 0.490-1.705     | 24000/F(kHz)                      | 30          |
| 1.705-30        | 30                                | 30          |
| 30-88           | 100                               | 3           |
| 88-216          | 150                               | 3           |
| 216-960         | 200                               | 3           |
| Above 960       | 500                               | 3           |

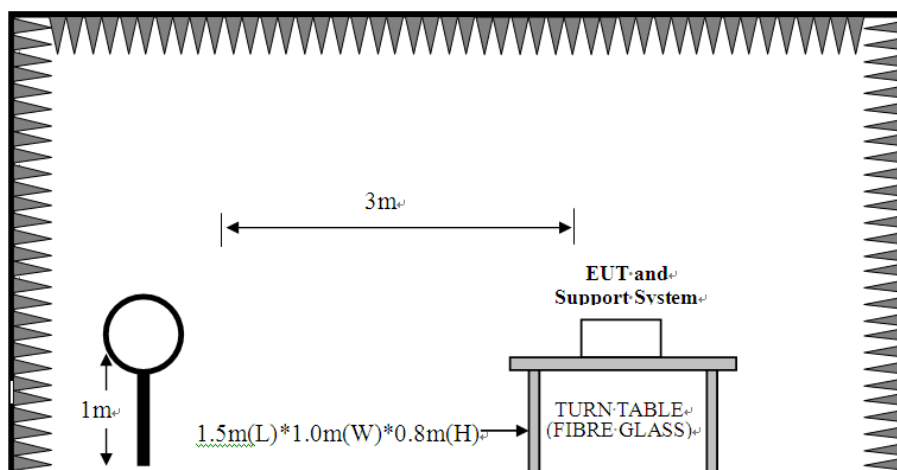
Remark : (1) Emission level  $\text{dB}\mu\text{V} = 20 \log \text{Emission level } \mu\text{V/m}$

(2) The smaller limit shall apply at the cross point between two frequency bands.

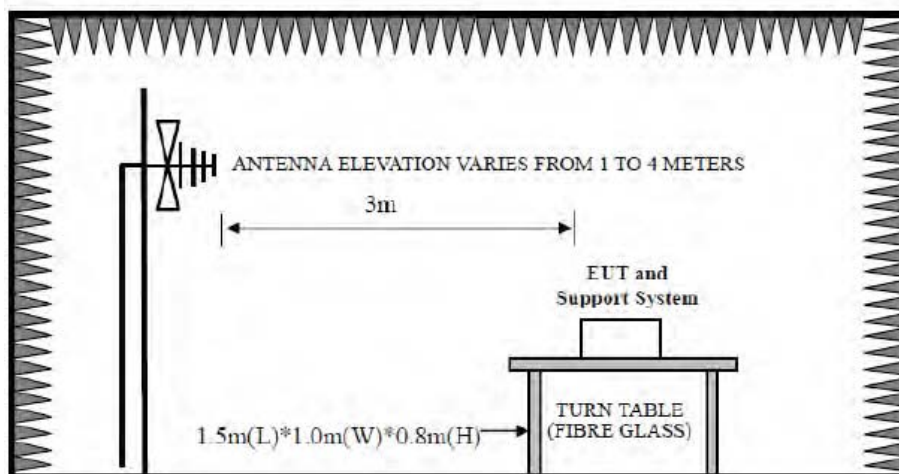
(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

## 8.2. Block Diagram of Test setup

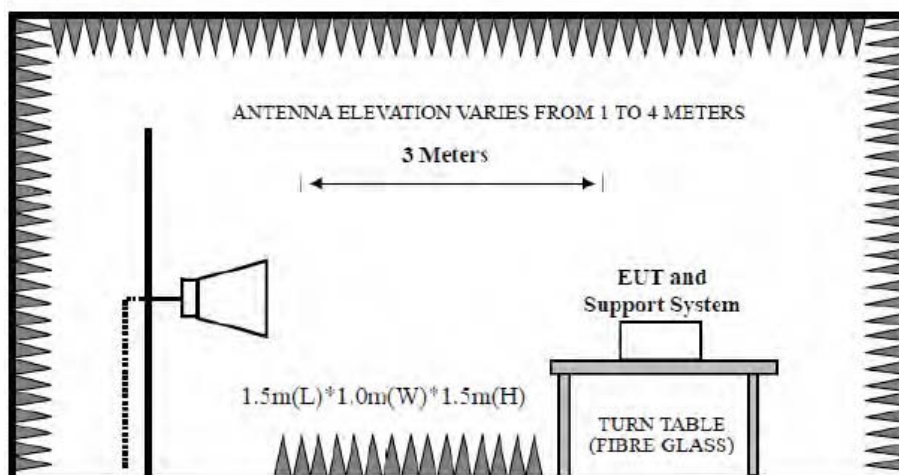
9kHz~30MHz



30~1000MHz



Above 1GHz



### 8.3. Test Procedure

EUT was placed on a turn table, which is 0.8 meter high above ground for 9kHz~1000MHz test, and which is 1.5 meter high above ground for above 1GHz test. The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

The test frequency analyzer system was set to Peak Detect (300Hz RBW in 9kHz to 150kHz and 10kHz RBW in 150kHz to 30MHz) Function and Specified Bandwidth with Maximum Hold Mode.

The bandwidth of the EMI test receiver (R&S ESVS10) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 1MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz

PEAK detector, 1MHz/1MHz for PAEK measurement,

PEAK detector, 1MHz/10Hz for Average measurement

The frequency range from 30MHz to 10th harmonic (25GHz) are checked.

### 8.4. Test Result

Pass

Note: 1、For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

2、The frequency 2402MHz、2441MHz and 2480MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

3、GFSK is worst state

## 8.5. Test Data

9 kHz – 30 MHz

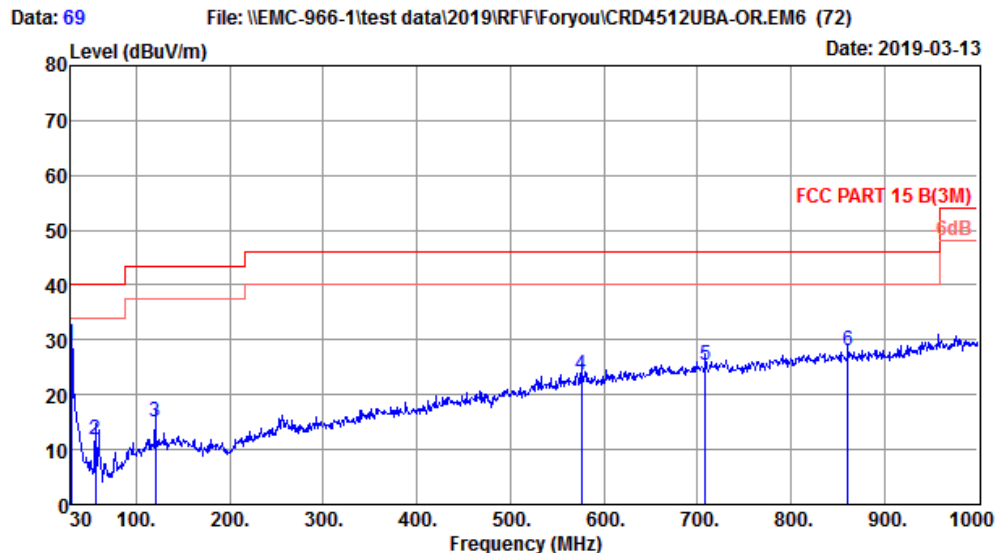
Pass

Note: The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

30 MHz – 1000 MHz

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Site no. : 1# 966 Chamber Data no. : 69  
Dis. / Ant. : 3m 37062 Ant. pol. : VERTICAL  
Limit : FCC PART 15 B(3M)  
Env. / Ins. : Temp:19.2';Humi:48.5%;Press:101.9kPa  
Engineer : ZERO  
EUT : CAR RADIO  
Power : DC 12V  
M/N : CRD4512UBA-OR  
Test Mode : TX Mode

|   | Freq.<br>(MHz) | ANT<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Reading<br>(dBuV) | Emission<br>Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|---|----------------|-------------------------|-----------------------|-------------------|-------------------------------|-------------------|----------------|--------|
| 1 | 30.00          | 18.50                   | 0.14                  | 10.60             | 29.24                         | 40.00             | 10.76          | QP     |
| 2 | 56.19          | 5.70                    | 0.36                  | 5.61              | 11.67                         | 40.00             | 28.33          | QP     |
| 3 | 120.21         | 11.40                   | 0.94                  | 2.67              | 15.01                         | 43.50             | 28.49          | QP     |
| 4 | 576.11         | 19.76                   | 2.91                  | 1.06              | 23.73                         | 46.00             | 22.27          | QP     |
| 5 | 709.00         | 21.59                   | 3.31                  | 0.60              | 25.50                         | 46.00             | 20.50          | QP     |
| 6 | 861.29         | 23.41                   | 3.77                  | 0.94              | 28.12                         | 46.00             | 17.88          | QP     |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
2. Margin= Limit - Emission Level.  
3. The emission levels that are 20dB below the official limit are not reported.

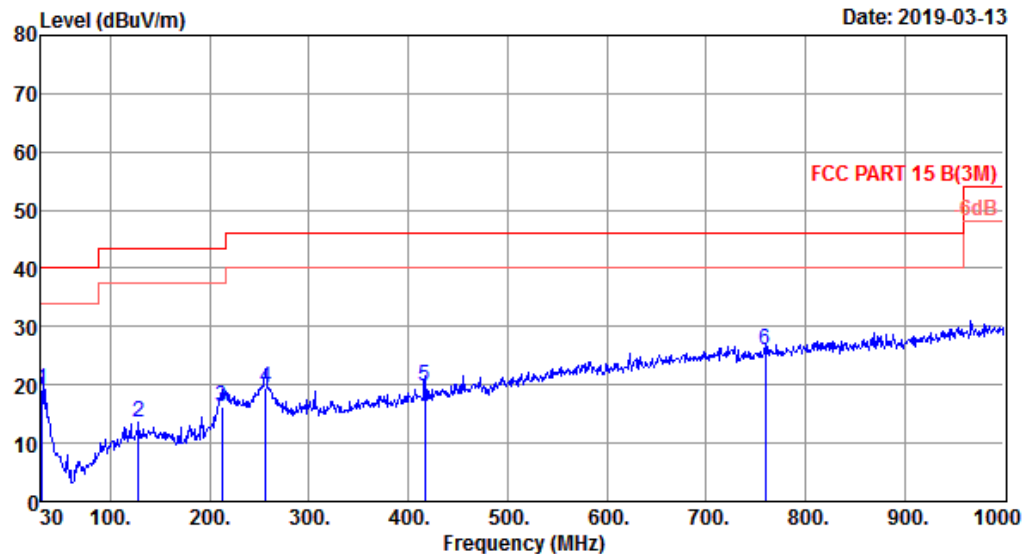
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Fax: +86-769-83081878

Data: 70

File: \\EMC-966-1\\test data\\2019\\RF\\Foryou\\CRD4512UBA-OR.EM6 (72)

Date: 2019-03-13



Site no. : 1# 966 Chamber Data no. : 70  
 Dis. / Ant. : 3m 37062 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15 B(3M)  
 Env. / Ins. : Temp:19.2'; Humi:48.5%; Press:101.9kPa  
 Engineer : ZERO  
 EUT : CAR RADIO  
 Power : DC 12V  
 M/N : CRD4512UBA-OR  
 Test Mode : TX Mode

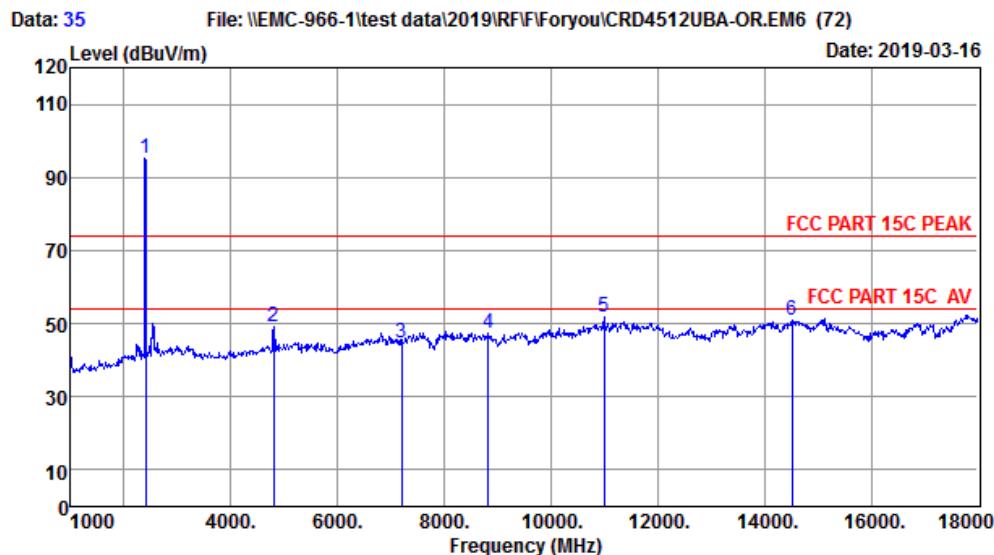
|   | Freq.<br>(MHz) | ANT<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Reading<br>(dBuV) | Emission<br>Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|---|----------------|-------------------------|-----------------------|-------------------|-------------------------------|-------------------|----------------|--------|
| 1 | 30.97          | 17.50                   | 0.14                  | 1.60              | 19.24                         | 40.00             | 20.76          | QP     |
| 2 | 127.97         | 11.72                   | 0.96                  | 0.90              | 13.58                         | 43.50             | 29.92          | QP     |
| 3 | 212.36         | 8.96                    | 1.37                  | 5.89              | 16.22                         | 43.50             | 27.28          | QP     |
| 4 | 256.01         | 13.30                   | 1.67                  | 4.64              | 19.61                         | 46.00             | 26.39          | QP     |
| 5 | 417.03         | 16.51                   | 2.19                  | 0.94              | 19.64                         | 46.00             | 26.36          | QP     |
| 6 | 759.44         | 22.26                   | 3.64                  | 0.16              | 26.06                         | 46.00             | 19.94          | QP     |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. Margin= Limit - Emission Level.  
 3. The emission levels that are 20dB below the official limit are not reported.

## 1000-18000MHz

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Site no. : 1# 966 Chamber Data no. : 35  
 Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa  
 Engineer : Seven  
 EUT : CAR RADIO  
 Power : DC 12V  
 M/N : CRD4512UBA-OR  
 Test Mode : GFSK TX 2402Mhz

|   | Freq.<br>(MHz) | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp<br>Factor<br>(dB) | Reading<br>(dBuV) | Emission<br>Level<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) | Remark |
|---|----------------|--------------------------|-----------------------|-----------------------|-------------------|-------------------------------|--------------------|----------------|--------|
| 1 | 2402.00        | 27.26                    | 4.03                  | 33.23                 | 97.02             | 95.08                         | 74.00              | -21.08         | Peak   |
| 2 | 4804.00        | 31.16                    | 6.02                  | 33.38                 | 45.27             | 49.07                         | 74.00              | 24.93          | Peak   |
| 3 | 7206.00        | 36.05                    | 7.37                  | 31.47                 | 32.86             | 44.81                         | 74.00              | 29.19          | Peak   |
| 4 | 8820.00        | 36.50                    | 8.71                  | 30.75                 | 32.98             | 47.44                         | 74.00              | 26.56          | Peak   |
| 5 | 10996.00       | 40.00                    | 10.20                 | 31.51                 | 33.02             | 51.71                         | 74.00              | 22.29          | Peak   |
| 6 | 14515.00       | 41.05                    | 11.94                 | 31.24                 | 29.18             | 50.93                         | 74.00              | 23.07          | Peak   |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.  
 2. Margin= Limit - Emission Level.  
 3. The emission levels that are 20dB below the official limit are not reported.

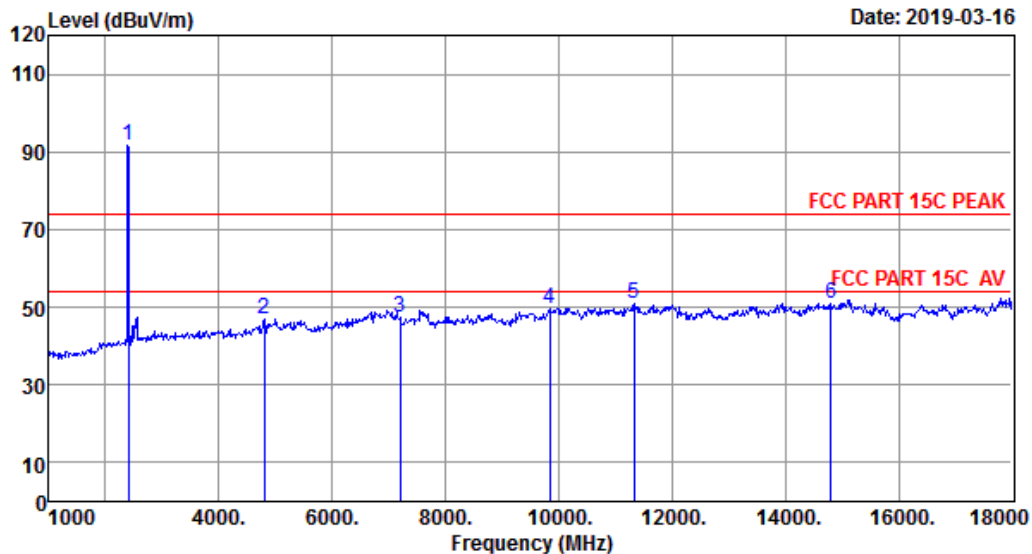
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Fax: +86-769-83081878

Data: 36

File: \\EMC-966-1\test data\2019\RF\Foryou\CRD4512UBA-OR.EM6 (72)

Date: 2019-03-16



Site no. : 1# 966 Chamber Data no. : 36  
 Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : Temp:27.3'; Humi:54%; Press:101.52kPa  
 Engineer : Seven  
 EUT : CAR RADIO  
 Power : DC 12V  
 M/N : CRD4512UBA-OR  
 Test Mode : GFSK TX 2402Mhz

|   | Freq.<br>(MHz) | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp<br>Factor<br>(dB) | Reading<br>(dBuV) | Emission<br>Level<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) | Remark |
|---|----------------|--------------------------|-----------------------|-----------------------|-------------------|-------------------------------|--------------------|----------------|--------|
| 1 | 2402.00        | 27.26                    | 4.03                  | 33.23                 | 93.50             | 91.56                         | 74.00              | -17.56         | Peak   |
| 2 | 4804.00        | 31.16                    | 6.02                  | 33.38                 | 43.13             | 46.93                         | 74.00              | 27.07          | Peak   |
| 3 | 7206.00        | 36.05                    | 7.37                  | 31.47                 | 35.40             | 47.35                         | 74.00              | 26.65          | Peak   |
| 4 | 9840.00        | 38.19                    | 9.35                  | 33.18                 | 35.36             | 49.72                         | 74.00              | 24.28          | Peak   |
| 5 | 11336.00       | 39.76                    | 9.97                  | 30.65                 | 31.75             | 50.83                         | 74.00              | 23.17          | Peak   |
| 6 | 14804.00       | 41.02                    | 12.23                 | 30.33                 | 28.05             | 50.97                         | 74.00              | 23.03          | Peak   |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.  
 2. Margin= Limit - Emission Level.  
 3. The emission levels that are 20dB below the official limit are not reported.

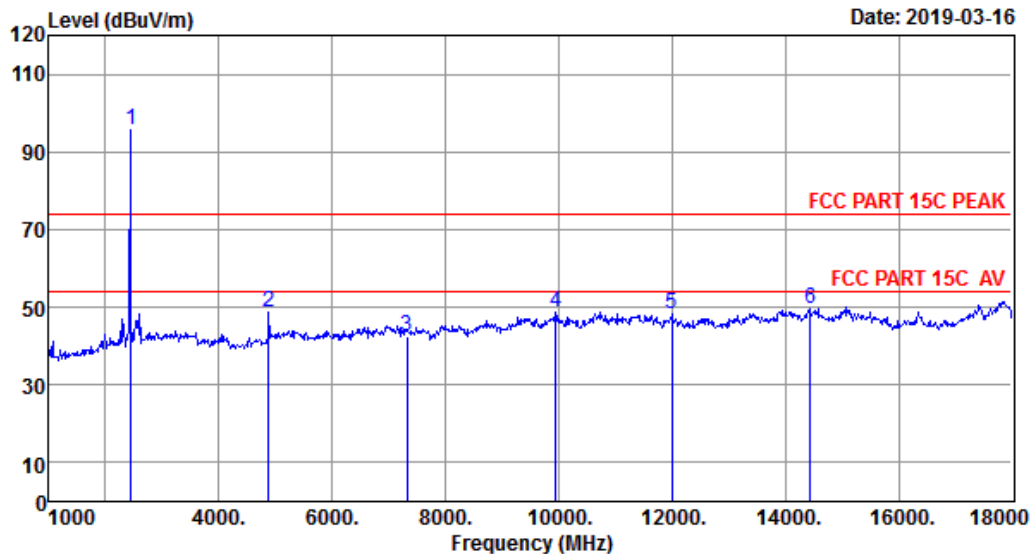
## EST Technology

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Data: 37

File: \\EMC-966-1\test data\2019\RF\Foryou\CRD4512UBA-OR.EM6 (72)

Date: 2019-03-16



Site no. : 1# 966 Chamber Data no. : 37  
 Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : Temp:27.3'; Humi:54%; Press:101.52kPa  
 Engineer : Seven  
 EUT : CAR RADIO  
 Power : DC 12V  
 M/N : CRD4512UBA-OR  
 Test Mode : GFSK TX 2441MHz

|   | Freq.<br>(MHz) | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp<br>Factor<br>(dB) | Reading<br>(dBuV) | Emission<br>Level<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) | Remark |
|---|----------------|--------------------------|-----------------------|-----------------------|-------------------|-------------------------------|--------------------|----------------|--------|
| 1 | 2441.00        | 27.33                    | 4.03                  | 33.39                 | 97.62             | 95.59                         | 74.00              | -21.59         | Peak   |
| 2 | 4882.00        | 31.39                    | 6.10                  | 33.02                 | 44.30             | 48.77                         | 74.00              | 25.23          | Peak   |
| 3 | 7323.00        | 36.19                    | 7.62                  | 31.20                 | 29.94             | 42.55                         | 74.00              | 31.45          | Peak   |
| 4 | 9942.00        | 38.40                    | 9.35                  | 32.92                 | 34.07             | 48.90                         | 74.00              | 25.10          | Peak   |
| 5 | 11999.00       | 39.30                    | 10.80                 | 30.20                 | 28.28             | 48.18                         | 74.00              | 25.82          | Peak   |
| 6 | 14447.00       | 41.06                    | 12.05                 | 30.92                 | 27.59             | 49.78                         | 74.00              | 24.22          | Peak   |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.  
 2. Margin= Limit - Emission Level.  
 3. The emission levels that are 20dB below the official limit are not reported.

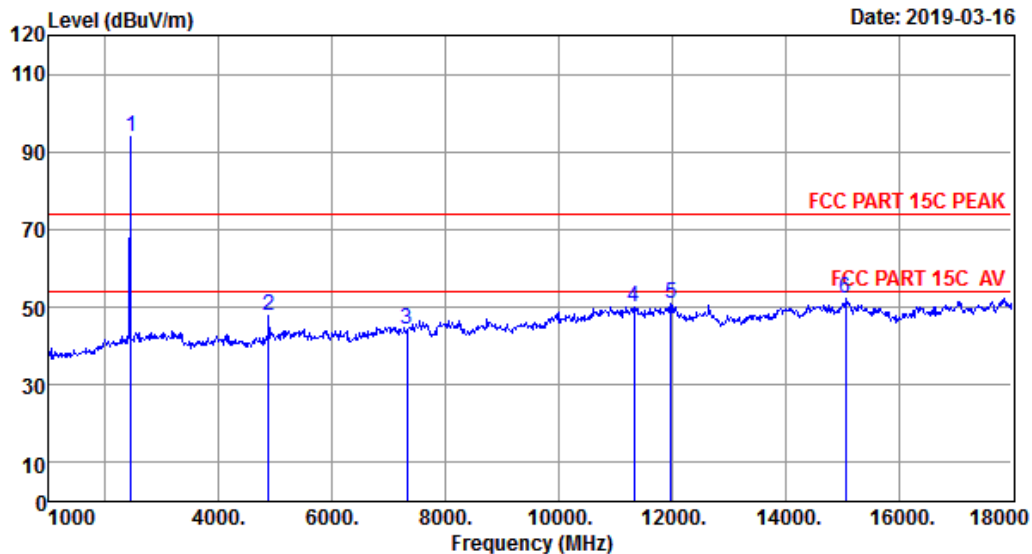
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Data: 38

File: \\EMC-966-1\test data\2019\RF\F\Foryou\CRD4512UBA-OR.EM6 (72)

Date: 2019-03-16



Site no. : 1# 966 Chamber Data no. : 38  
 Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : Temp:27.3'; Humi:54%; Press:101.52kPa  
 Engineer : Seven  
 EUT : CAR RADIO  
 Power : DC 12V  
 M/N : CRD4512UBA-OR  
 Test Mode : GFSK TX 2441MHz

|   | Freq.<br>(MHz) | Ant.<br>Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Amp<br>Factor<br>(dB) | Reading<br>(dBuV) | Emission<br>Level<br>(dBuV/m) | Limits<br>(dBuV/m) | Margin<br>(dB) | Remark |
|---|----------------|--------------------------|-----------------------|-----------------------|-------------------|-------------------------------|--------------------|----------------|--------|
| 1 | 2441.00        | 27.33                    | 4.03                  | 33.39                 | 95.83             | 93.80                         | 74.00              | -19.80         | Peak   |
| 2 | 4882.00        | 31.39                    | 6.10                  | 33.02                 | 43.14             | 47.61                         | 74.00              | 26.39          | Peak   |
| 3 | 7323.00        | 36.19                    | 7.62                  | 31.20                 | 31.77             | 44.38                         | 74.00              | 29.62          | Peak   |
| 4 | 11336.00       | 39.76                    | 9.97                  | 30.65                 | 30.99             | 50.07                         | 74.00              | 23.93          | Peak   |
| 5 | 11982.00       | 39.31                    | 10.76                 | 30.25                 | 31.01             | 50.83                         | 74.00              | 23.17          | Peak   |
| 6 | 15059.00       | 40.82                    | 12.15                 | 31.09                 | 30.41             | 52.29                         | 74.00              | 21.71          | Peak   |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.  
 2. Margin= Limit - Emission Level.  
 3. The emission levels that are 20dB below the official limit are not reported.