# TEST REPORT

| DT&C Co., Ltd.<br>42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea<br>Tel : 031-321-2664, Fax : 031-321-1664 | Report No : DRTFCC1605-0066<br>Pages:(1) / (93) page | Dt&C |
|---|---|---|

1. Customer
   - Name : Hyundai MOBIS Co., Ltd.
   - Address : 203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977
2. Use of Report : FCC & IC Original Grant
3. Product Name (FCCID, IC) : DIGITAL CAR AVN SYSTEM (TQ8-ACBB0G3AN, 5074A-ACBB0G3KN)
4. Date of Test : 2016-04-08 ~ 2016-04-14
5. Test Method Used: FCC Part 15 Subpart C.247
   RSS-247 Issue 1 (2015-05), RSS-GEN Issue 4 (2014-11)
6. Testing Environment : See appended test report
7. Test Result : ☒ Pass ☐ Fail

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

| Affirmation | Tested by<br>Name : JungWoo Kim (Signature) | Technical Manager<br>Name : GeunKi Son (Signature) |
|---|---|---|

**2016 . 05 . 11 .**

**DT&C Co., Ltd.**

* If this test report is required to confirmation of authenticity, please contact to report@dtnc.net

# Test Report Version

| Test Report No. | Date | Description |
|---|---|---|
| DRTFCC1605-0066 | May 11, 2016 | Initial issue |
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# 1. General Information

## 1.1 Testing Laboratory

| **DT&C Co., Ltd.** | | | |
|---|---|---|---|
| **Standard** | | **Site number** | **Address** |
| **FCC** | ☒ | **165783** | 42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935 |
| | ☐ | **804488** | 42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935 |
| | ☐ | **596748** | 42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935 |
| | ☐ | **678747** | 683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080 |
| **IC** | ☒ | **5740A-3** | 42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935 |
| | ☐ | **5740A-2** | 683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080 |
| www.dtnc.net | | | |
| Telephone | : | + 82-31-321-2664 | |
| FAX | : | + 82-31-321-1664 | |

## 1.2 Details of Applicant

| | | |
|---|---|---|
| Applicant | : | Hyundai MOBIS Co., Ltd. |
| Address | : | 203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977 |
| Contact person | : | Seung Hoon Choe |

## 1.3 Description of EUT

| | |
|---|---|
| **EUT** | DIGITAL CAR AVN SYSTEM |
| **Model Name** | FCC: ACBB0G3AN<br>IC: ACBB0G3KN |
| **Add Model Name** | FCC: ACB10G3AX, ACB10G3GG, ACB11G3GG, ACB10G3BN, ACB10G3GE, ACB10G3GL<br>IC: ACB10G3KN |
| **Serial Number** | Identical prototype |
| **Hardware version** | 4.0 |
| **Software version** | 1.0 |
| **Power Supply** | DC 14.4 V |
| **Frequency Range** | 2402 MHz ~ 2480 MHz |
| **Modulation Technique** | GFSK, π/4-DQPSK, 8DPSK |
| **Number of Channels** | 79 |
| **Antenna Type** | Internal Antenna |
| **Antenna Gain** | PK : -0.10 dBi |

## 1.4 Declaration by the applicant / manufacturer

- NA

## 1.5 Information about the FHSS characteristics

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following :
  - A) The hopping sequence is pseudorandom
  - B) All channels are used equally on average
  - C) The receiver input bandwidth equals the transmit bandwidth
  - D) The receiver hops in sequence with the transmit signal
- 15.247(g) : In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h) : In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection / hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h) : The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

## 1.6 Test conditions

| **Ambient Condition** | |
|---|---|
| ▪ Temperature | +22 ℃ ~ +24 ℃ |
| ▪ Relative Humidity | 34 % ~ 39 % |

## 1.7 Test Equipment List

| Type | Manufacturer | Model | Cal.Date (yy/mm/dd) | Next.Cal.Date (yy/mm/dd) | S/N |
|---|---|---|---|---|---|
| MXA Signal Analyzer | Agilent | N9020A | 15/09/14 | 16/09/14 | MY50200834 |
| DIGITAL MULTIMETER | Agilent | 34401A | 16/01/05 | 17/01/05 | US36099541 |
| DC Power Supply | SM techno | SDP30-5D | 16/01/05 | 17/01/05 | 305DLJ204 |
| Bluetooth Tester | TESCOM | TC-3000B | 15/06/26 | 16/06/26 | 3000B640046 |
| P-Series Power Meter Wideband Power Sensor | Agilent | N1911A | 15/10/20 | 16/10/20 | MY53360016 |
| | | N1921A | | | MY53360018 |
| Power Splitter | Anritsu | K241B | 15/06/25 | 16/06/25 | 017060 |
| Thermohygrometer | BODYCOM | BJ5478 | 16/04/22 | 17/04/22 | 120612-2 |
| Vector Signal Generator | Rohde Schwarz | SMBV100A | 16/01/05 | 17/01/05 | 255571 |
| Signal Generator | Rohde Schwarz | SMF100A | 15/06/29 | 16/06/29 | 102341 |
| LOOP Antenna | Schwarzbeck | FMZB1513 | 16/04/22 | 18/04/22 | 1513-128 |
| TRILOG Broadband Test-Antenna(30MHz-1GHz) | SCHWARZBECK | VULB9160 | 14/07/31 | 16/07/31 | 9160-3363 |
| Horn Antenna(1~18GHz) | ETS-LINDGREN | 3115 | 15/02/09 | 17/02/09 | 9202-3820 |
| Horn Antenna | A.H.Systems | SAS-574 | 15/04/30 | 17/04/30 | 154 |
| EMI TEST RECEIVER | R&S | ESR7 | 15/10/19 | 16/10/19 | 101109 |
| High-pass filter (3GHz) | Wainwright Instruments | WHKX3.0 | 16/01/06 | 17/01/06 | 12 |
| High-pass filter (8GHz) | Wainwright Instruments | WHNX6-6320-8000-26500-40CC | 15/09/23 | 16/09/23 | 1 |
| Low Noise Pre Amplifier(10kHz-1GHz) | tsj | MLA-010K01-B01-27 | 16/03/10 | 17/03/10 | 1844539 |
| PreAmplifier | Agilent | 8449B | 16/02/24 | 17/02/24 | 3008A00370 |

## 1.8 Summary of Test Results

| FCC Part RSS Std. | Parameter | Limit (Using in 2400~ 2483.5 MHz) | Test Condition | Status Note 1 |
|---|---|---|---|---|
| 15.247(a) RSS-247(5.1) | Carrier Frequency Separation | >= 25 kHz or<br>>= Two thirds of the 20 dB BW, whichever is greater. | Conducted | C |
| | Number of Hopping Frequencies | >= 15 hops | | C |
| | 20 dB Bandwidth | N/A | | C |
| | Dwell Time | =< 0.4 seconds | | C |
| 15.247(b) RSS-247(5.4) | Transmitter Output Power | **For FCC**<br>=< 1 Watt , if CHs >= 75<br>Others =< 0.125 W<br>**For IC**<br>if CHs >= 75<br>=< 1 Watt For Conducted Power<br>=< 4 Watt For e.i.r.p,<br>Others<br>=< 0.125 W For Conducted Power.<br>=< 0.5 Watt For e.i.r.p | | C |
| 15.247(d) RSS-247(5.5) | Conducted Spurious Emissions | The radiated emission to any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density. | | C |
| RSS Gen(6.6) | Occupied Bandwidth (99 %) | N/A | | C |
| 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10) | Radiated Spurious Emissions | FCC 15.209 Limits<br>RSS-Gen 8.9 | Radiated | C Note2 |
| 15.207 RSS-Gen(8.8) | AC Conducted Emissions | FCC 15.207 Limits | AC Line Conducted | NA Note3 |
| 15.203 RSS-Gen(8.3) | Antenna Requirements | FCC 15.203 | - | C |

Note 1 : **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable

Note 2 : This test item was performed in each axis and the worst case data was reported.

Note 3: This device is installed in a car. Therefore the power source is a battery of car.

Note 4 : The sample was tested according to the following specifications :

- ANSI C63.10-2013

## 1.9 Conclusion of worst-case and operation mode

The EUT has three type of modulation (GFSK, π/4DQPSK and 8DPSK).

Therefore all applicable requirements were tested with all the modulations.

The field strength of spurious emission was measured in three orthogonal EUT positions (X-axis, Y-axis and Z-axis).

Tested frequency information,

- Hopping Function : Enable

| | TX Frequency (MHz) | RX Frequency (MHz) |
|---|---|---|
| **Hopping Band** | 2402 ~ 2480 | 2402 ~ 2480 |

- Hopping Function : Disable

| | TX Frequency (MHz) | RX Frequency (MHz) |
|---|---|---|
| **Lowest Channel** | 2402 | 2402 |
| **Middle Channel** | 2441 | 2441 |
| **Highest Channel** | 2480 | 2480 |

# 2. Maximum Peak Output Power Measurement

## 2.1 Test Setup

Refer to the APPENDIX I.

## 2.2 Limit

### ▣ FCC Requirements

The maximum peak output power of the intentional radiator shall not exceed the following :

1. §15.247(a)(1), 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.
2. §15.247(b)(1), For frequency hopping systems operating in the 2400 – 2483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725 – 5805 MHz band : 1 Watt.

### ▣ IC Requirements

1. RSS-247(5.4), For FHSS operating in the band 2400 - 2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels

## 2.3 Test Procedure

1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ;
   Span = approximately 5 times of the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 20 dB BW
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

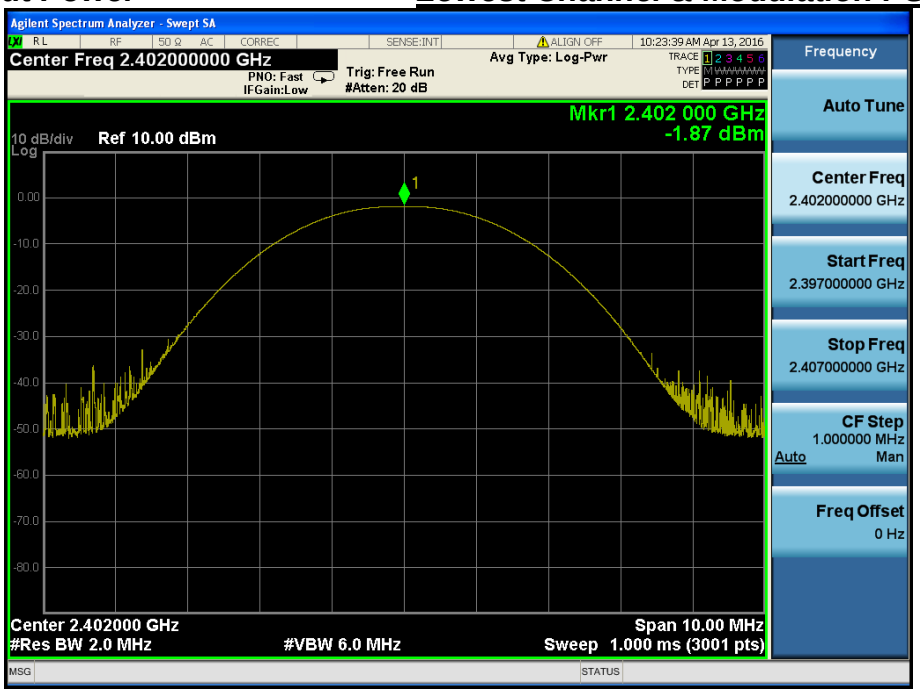
## 2.4 Test Results

| Modulation | Tested Channel | Frame Average Output Power | | Peak Output Power | |
|---|---|---|---|---|---|
| | | dBm | mW | dBm | mW |
| ***GFSK*** | **Lowest** | -2.63 | 0.546 | -1.87 | 0.650 |
| | **Middle** | **-2.44** | **0.570** | **-1.52** | **0.705** |
| | **Highest** | -2.52 | 0.560 | -1.82 | 0.658 |
| ***π/4DQPSK*** | **Lowest** | -4.33 | 0.369 | -1.16 | 0.766 |
| | **Middle** | **-4.17** | **0.383** | -0.76 | 0.839 |
| | **Highest** | -4.28 | 0.373 | **-0.46** | **0.899** |
| ***8DPSK*** | **Lowest** | -4.27 | 0.374 | -0.10 | 0.977 |
| | **Middle** | **-4.06** | **0.393** | **0.31** | **1.074** |
| | **Highest** | -4.19 | 0.381 | 0.04 | 1.009 |

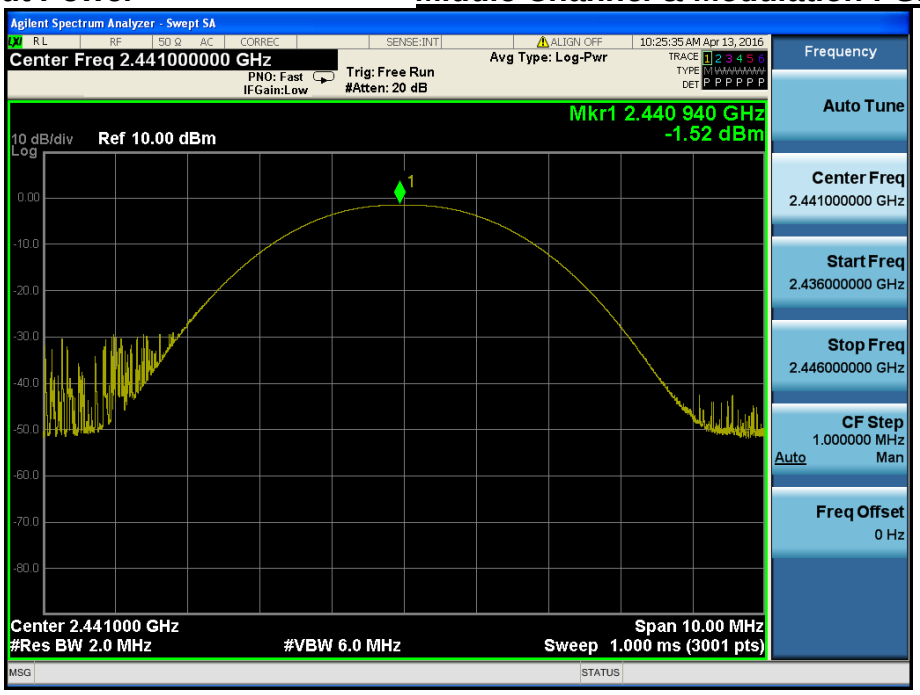
Note 1 : Average output power was using the average power meter for reference only.

Note 2 : See next pages for actual measured spectrum plots.

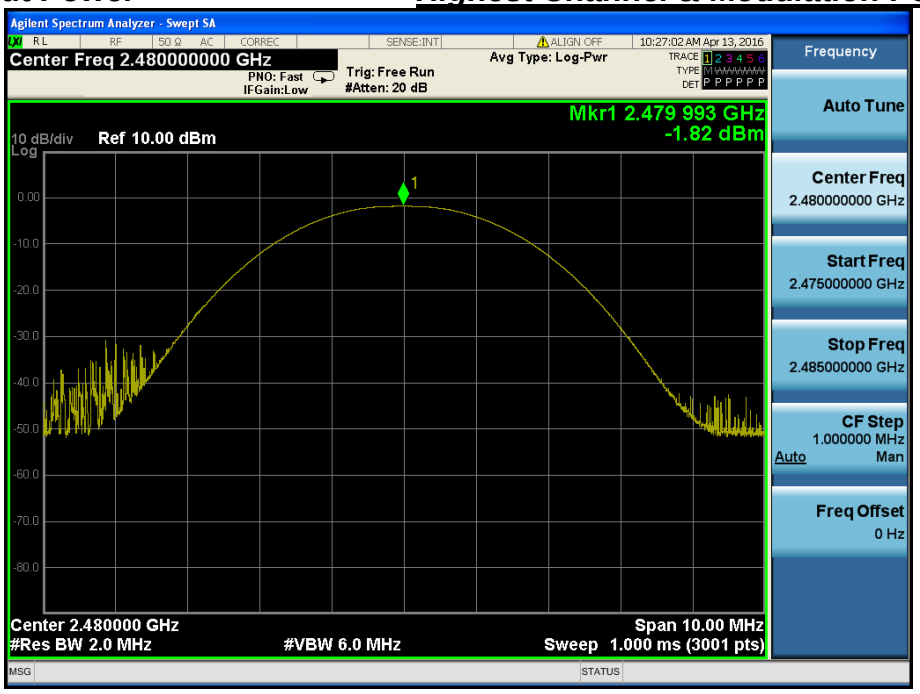
## Peak Output Power ***Lowest Channel & Modulation : GFSK***



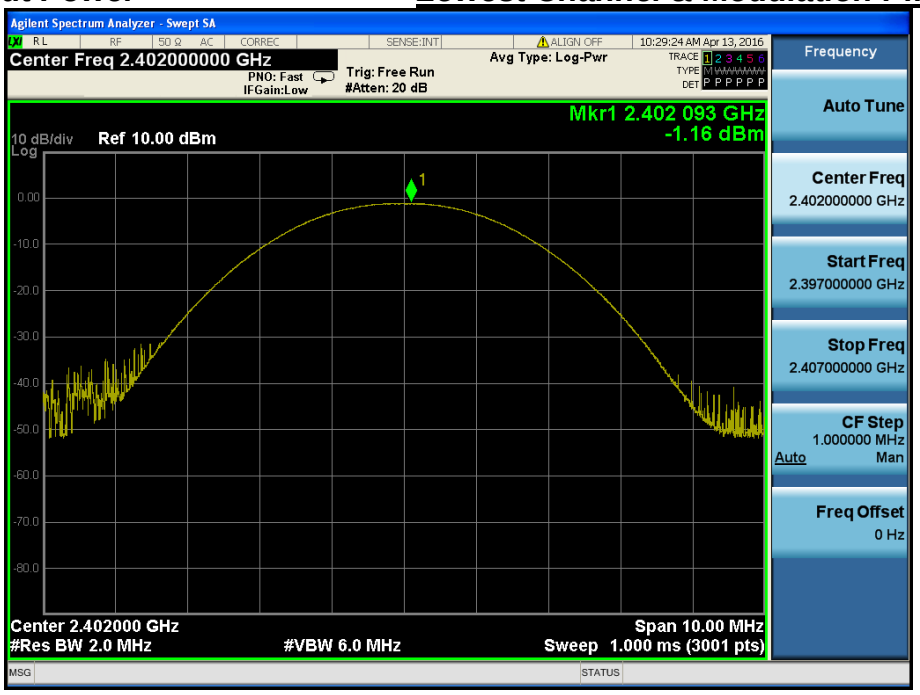

## Peak Output Power ***Middle Channel & Modulation : GFSK***



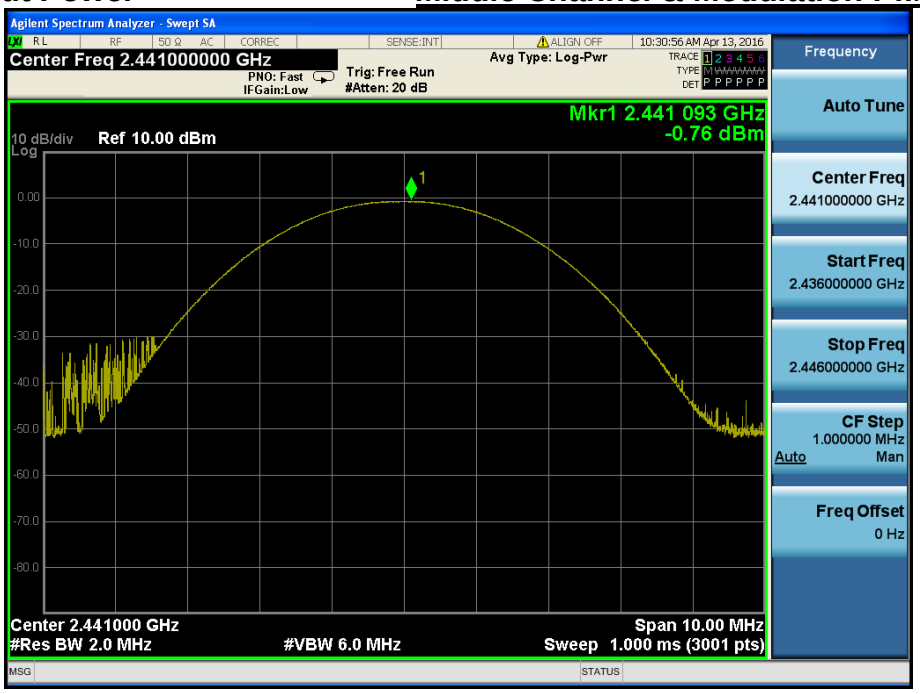
## Peak Output Power ***Highest Channel & Modulation : GFSK***



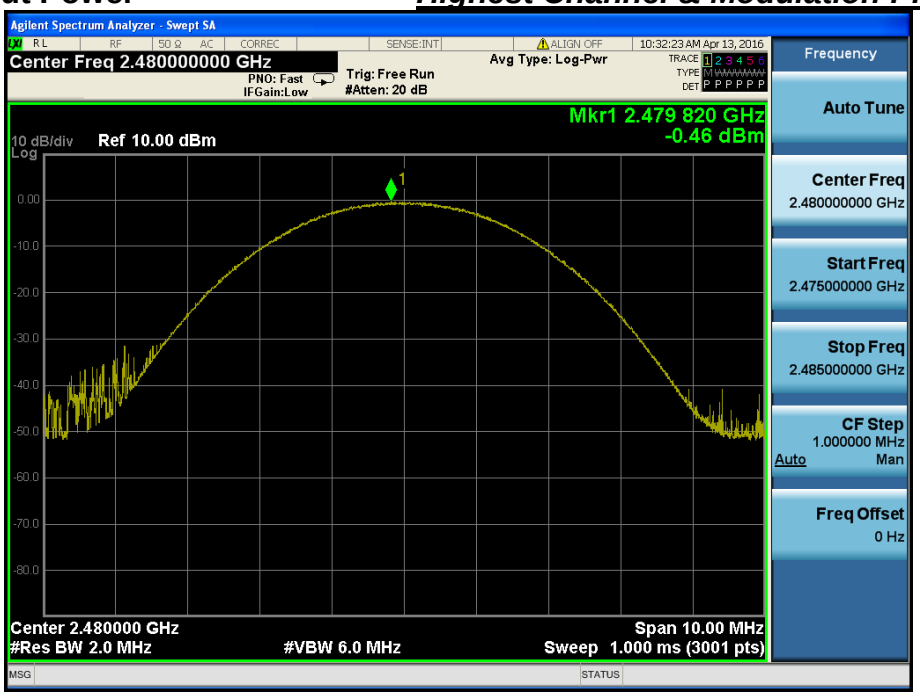

## Peak Output Power ***Lowest Channel & Modulation : π/4DQPSK***



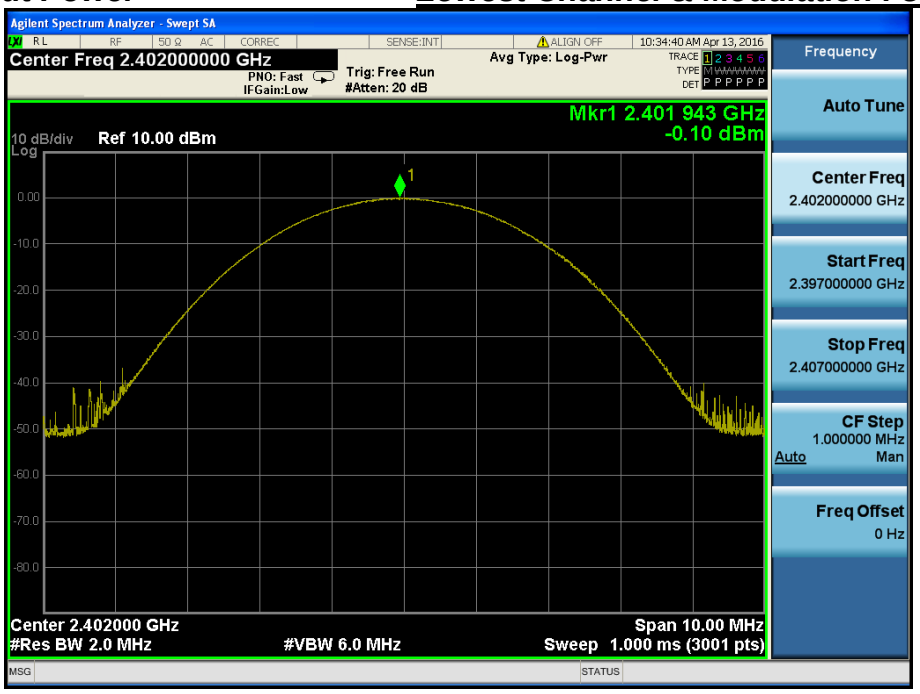
## Peak Output Power *Middle Channel & Modulation : π/4DQPSK*



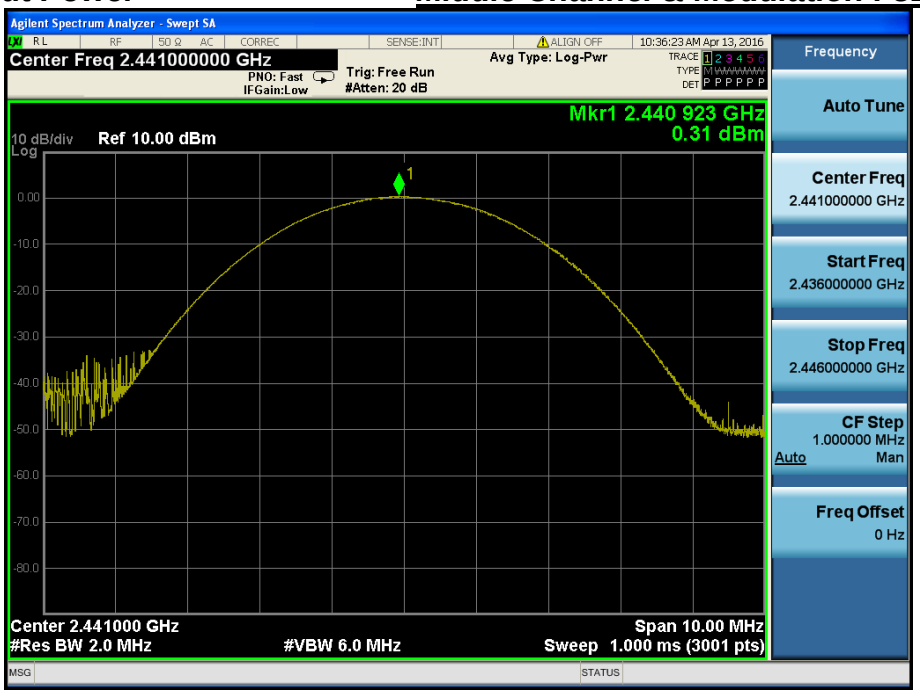
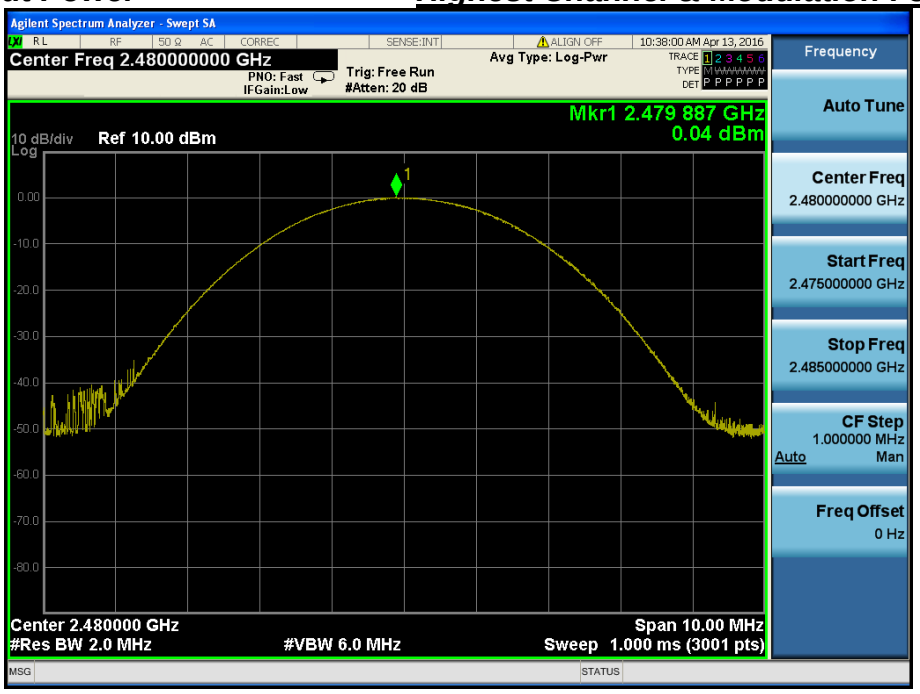

## Peak Output Power *Highest Channel & Modulation : π/4DQPSK*



## Peak Output Power *Lowest Channel & Modulation : 8DPSK*




## Peak Output Power *Middle Channel & Modulation : 8DPSK*



## Peak Output Power ***Highest Channel & Modulation : 8DPSK***