


TEST REPORT

<p>DT&C Co., Ltd. 42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel : 031-321-2664, Fax : 031-321-1664</p>	<p>Report No : DRTFCC1605-0059 Pages:(1) / (85) page</p>	
<p>1. Customer</p> <ul style="list-style-type: none"> • Name : Hyundai MOBIS Co., Ltd. • Address : 203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977 <p>2. Use of Report : FCC Original Grant</p> <p>3. Product Name (FCCID) : DIGITAL CAR AVN SYSTEM (TQ8-AN215B1GG)</p> <p>4. Date of Test : 2016-03-28 ~ 2016-04-05</p> <p>5. Test Method Used: FCC Part 15 Subpart C.247</p> <p>6. Testing Environment : See appended test report</p> <p>7. Test Result : <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail</p> <p>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.</p>		
<p>Affirmation</p>	<p>Tested by Name : JaeJin Lee (Signature)</p>	<p>Technical Manager Name : GeunKi Son (Signature)</p>
<p style="text-align: center;">2016 . 05 . 03 .</p> <p style="text-align: center;">DT&C Co., Ltd.</p>		

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

Test Report Version

Test Report No.	Date	Description
DRTFCC1605-0059	May. 03, 2016	Initial issue

Table of Contents

1. General Information	4
1.1 Testing Laboratory	4
1.2 Details of Applicant	4
1.3 Description of EUT	5
1.4 Declaration by the applicant / manufacturer	5
1.5 Information about the FHSS characteristics	6
1.6 Test conditions	6
1.7 Test Equipment List.....	7
1.8 Summary of Test Results.....	8
1.9 Conclusion of worst-case and operation mode.....	9
2. Maximum Peak Output Power Measurement	10
2.1 Test Setup	10
2.2 Limit.....	10
2.3 Test Procedure.....	10
2.4 Test Results	11
3. 20 dB BW	17
3.1 Test Setup	17
3.2 Limit.....	17
3.3 Test Procedure.....	17
3.4 Test Results	17
4. Carrier Frequency Separation	23
4.1 Test Setup	23
4.2 Limit.....	23
4.3 Procedure.....	23
4.4 Test Results	23
5. Number of Hopping Frequencies	28
5.1 Test Setup	28
5.2 Limit.....	28
5.3 Procedure.....	28
5.4 Test Results	28
6. Time of Occupancy (Dwell Time).....	34
6.1 Test Setup	34
6.2 Limit.....	34
6.3 Test Procedure.....	34
6.4 Test Results	34
7. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission	39
7.1 Test Setup	39
7.2 Limit.....	39
7.3. Test Procedures.....	40
7.3.1. Test Procedures for Radiated Spurious Emissions	40
7.3.2. Test Procedures for Conducted Spurious Emissions.....	41
7.3.3. Test Plot	41
7.4. Test Results	42
7.4.1. Radiated Emissions.....	42
7.4.2. Conducted Spurious Emissions	46
8. Transmitter AC Power Line Conducted Emission	70
8.1 Test Setup	70
8.2 Limit.....	70
8.3 Test Procedures.....	70
8.4. Test Results	70
9. Antenna Requirement.....	71
10. Occupied Bandwidth (99 %)	72
10.1 Test Setup	72
10.2 Limit.....	72
10.3 Test Procedure.....	72
10.4 Test Results	72
APPENDIX I.....	73
APPENDIX II.....	74

1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.		
Standard	Site number	Address
FCC	<input checked="" type="checkbox"/> 165783	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 804488	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 596748	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 678747	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
IC	<input type="checkbox"/> 5740A-3	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 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	AN215B1GG
Add Model Name	AN212B1MG, AN216B1GG, AN213B1GG, AN214B1GG, AN210B1UG
Serial Number	Identical prototype
Hardware version	4.5
Software version	1.0
Power Supply	DC 14.4 V
Frequency Range	2402 MHz ~ 2480 MHz
Modulation Technique	GFSK, $\pi/4$ -DQPSK, 8DPSK
Number of Channels	79
Antenna Type	Internal Antenna
Antenna Gain	PK : -2.95 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 °C ~ +25 °C
▪ Relative Humidity	38 % ~ 41 %

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 Technologies	N9020A	15/09/09	16/09/09	MY46471248
MXA Signal Analyzer	Agilent Technologies	N9020A	16/01/06	17/01/06	MY46471445
Digital Multimeter	Agilent Technologies	34401A	16/01/05	17/01/05	US36099541
DC Power Supply	HP	66332A	16/01/05	17/01/05	US37471368
DC Power Supply	SM techno	SDP30-5D	15/09/23	16/09/23	305DMG305
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
BlueTooth Tester	TESCOM	TC-3000B	16/01/06	17/01/06	3000B770243
Power Splitter	Anritsu	K241B	15/10/20	16/10/20	1701061
Thermohygrometer	BODYCOM	BJ5478	15/05/08	16/05/08	120612-2
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	16/03/10	17/03/10	1844539
PreAmplifier	Agilent Technologies	8449B	16/02/24	17/02/24	3008A00370
Loop Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
TRILOG Broadband Test-Antenna	Schwarzbeck	VULB 9161	14/07/10	16/07/10	4070
Horn Antenna	ETS-LINDGREN.	3115	15/02/09	17/02/09	9202-3820
Horn Antenna	A.H.Systems.	SAS-574	15/09/03	17/09/03	155
High-pass filter	Wainwright Instruments	WHKX3.0	16/01/06	17/01/06	12
EMI TEST RECEIVER	Rohde Schwarz	ESR7	15/10/19	16/10/19	101109
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A/ MA2411B	15/06/25	16/06/25	1338004/ 1306053

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 \geq 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 ≤ 1 Watt , if CHs ≥ 75 Others ≤ 0.125 W For IC if CHs ≥ 75 ≤ 1 Watt For Conducted Power ≤ 4 Watt For e.i.r.p, Others ≤ 0.125 W For Conducted Power. ≤ 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.	Radiated	C
RSS Gen(6.6)	Occupied Bandwidth (99 %)	N/A		NA
15.247(d) 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10)	Radiated Spurious Emissions	FCC 15.209 Limits RSS-Gen 8.9	Radiated	C
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	NA Note 2
15.203 RSS-Gen(8.3)	Antenna Requirements	FCC 15.203	-	C
<p>Note 1 : C = Comply NC = Not Comply NT = Not Tested NA = Not Applicable</p> <p>Note 2: This device is installed in a car. Therefore the power source is a battery of car.</p> <p>Note 3 : The sample was tested according to the following specifications :</p> <p>- ANSI C63.10-2013</p>				

1.9 Conclusion of worst-case and operation mode

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

Therefore all applicable requirements were tested with all the modulations.

The field strength of spurious emission was measured in X-axis EUT positions.

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

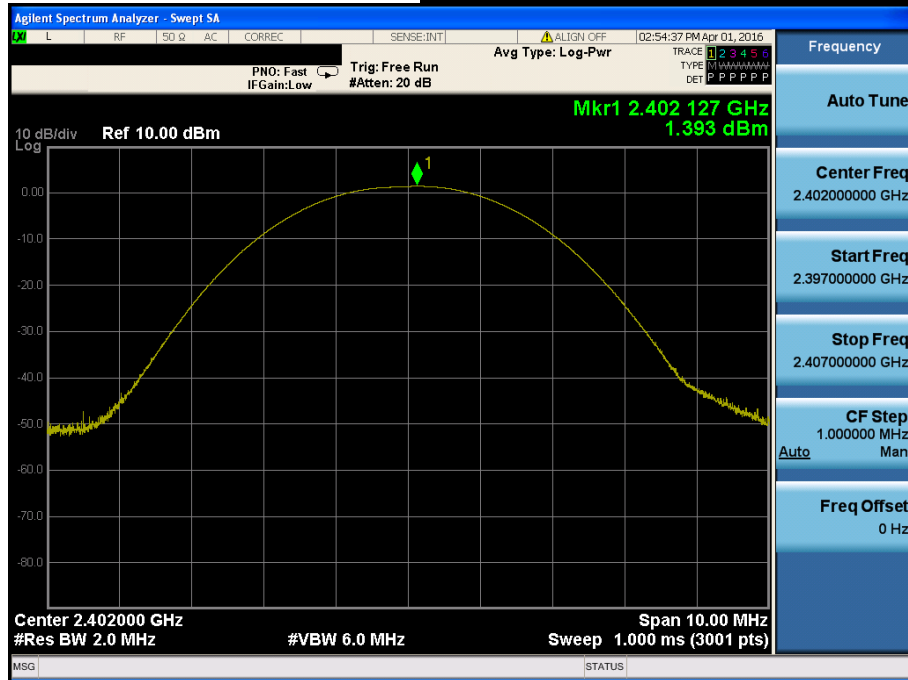
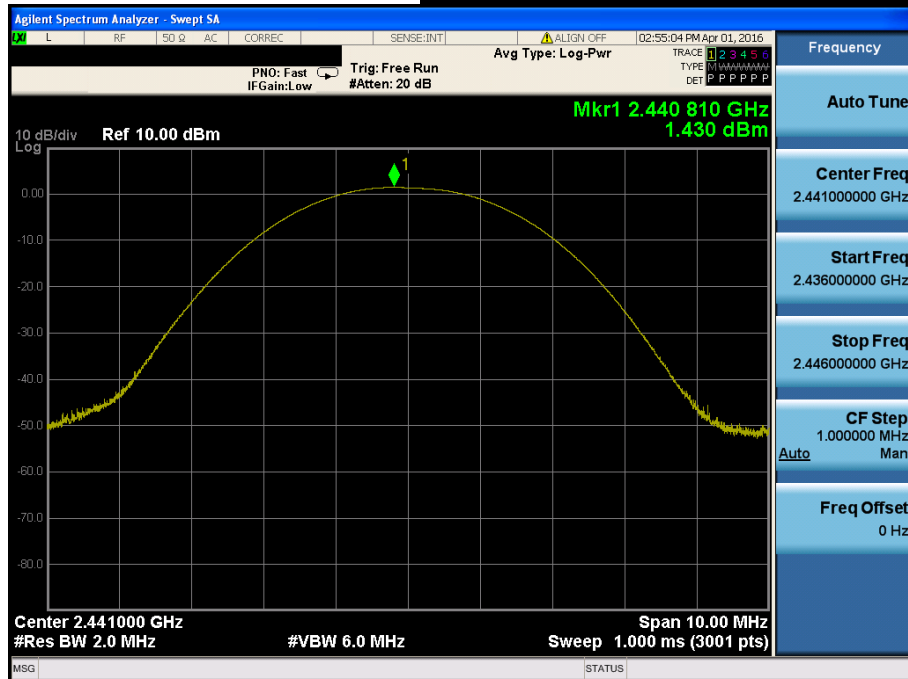
1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
2. The bandwidth of the fundamental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

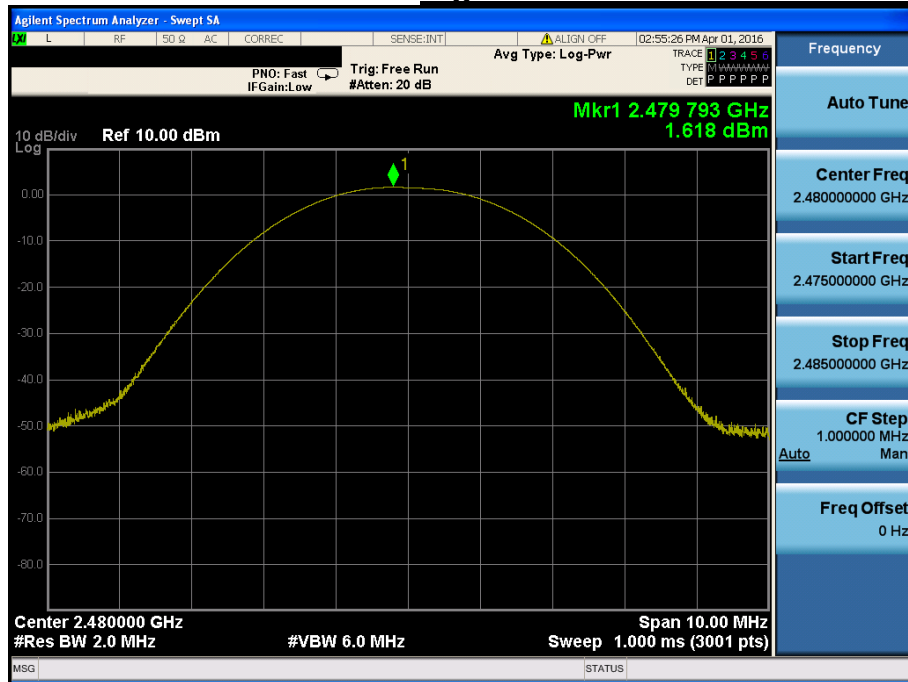
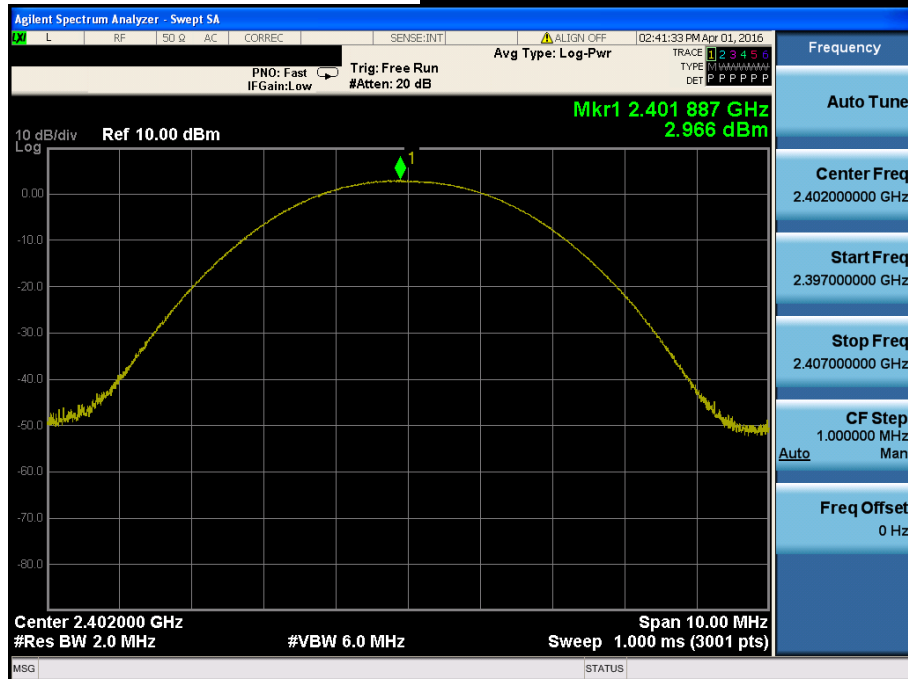
2.4 Test Results

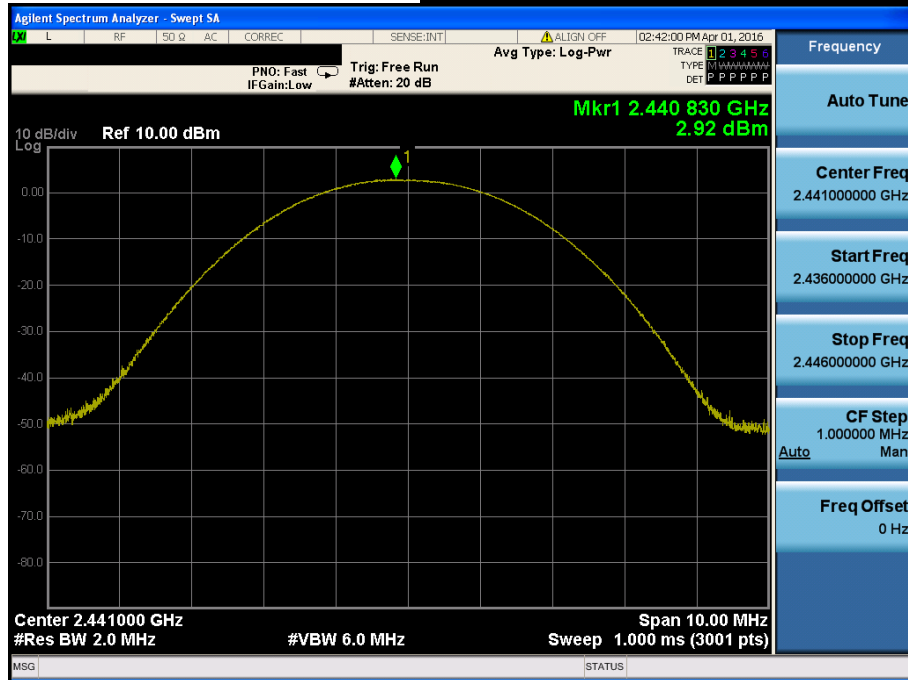
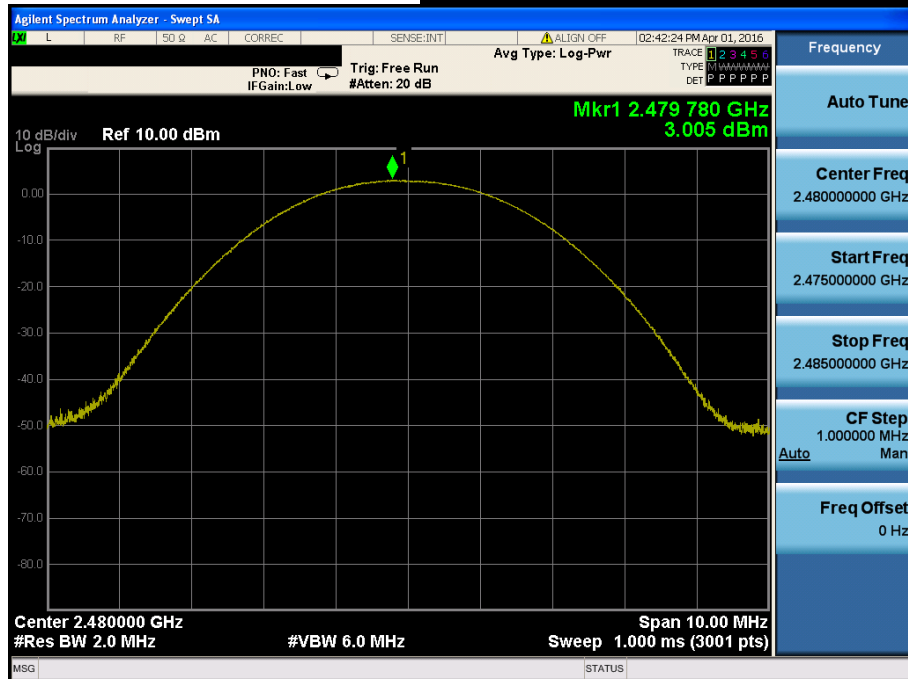
Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
<u>GFSK</u>	Lowest	0.43	1.104	1.39	1.378
	Middle	0.49	1.119	1.43	1.390
	Highest	0.51	1.125	1.62	1.451
<u>$\pi/4$DQPSK</u>	Lowest	0.37	1.089	2.97	1.980
	Middle	0.29	1.069	2.92	1.959
	Highest	0.39	1.094	3.01	1.998
<u>8DPSK</u>	Lowest	0.41	1.099	3.28	2.128
	Middle	0.38	1.091	3.26	2.118
	Highest	0.43	1.104	3.34	2.155

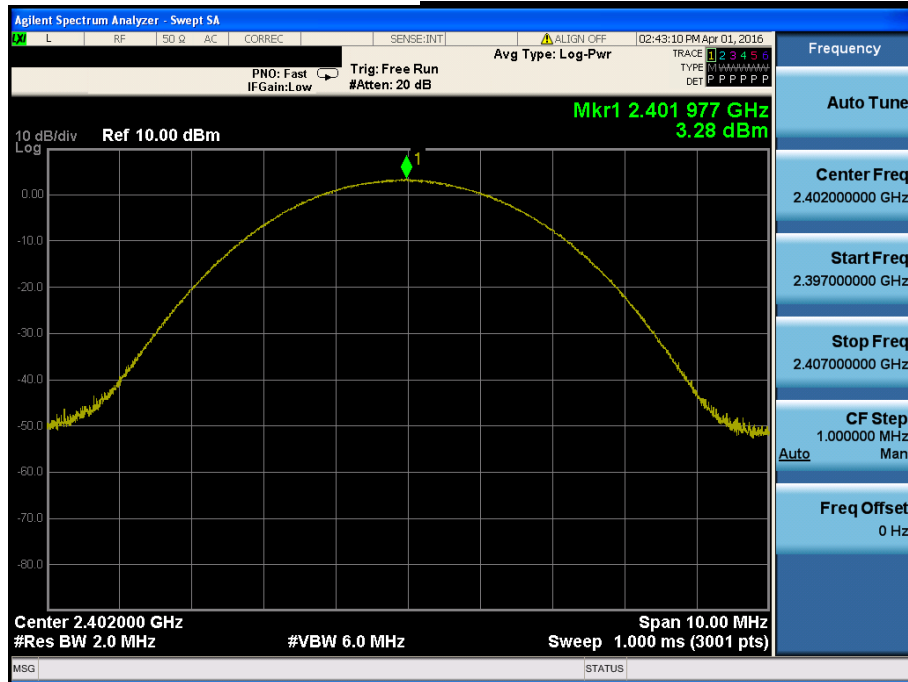
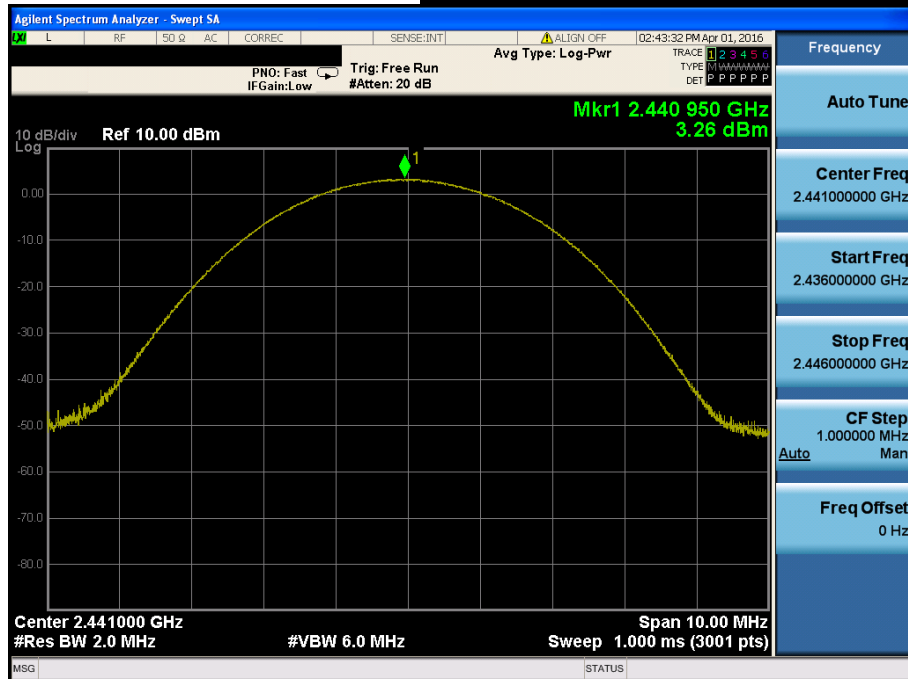
Note 1 : Average output power was using the average power meter for reference only.

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 : $\pi/4$ DQPSK**

Peak Output Power***Middle Channel & Modulation : $\pi/4$ DQPSK*****Peak Output Power*****Highest Channel & Modulation : $\pi/4$ DQPSK***

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



Peak Output Power

Highest Channel & Modulation : 8DPSK

