Report No.: DRTFCC2004-0100

## 9 kHz ~ 25 GHz Data (Modulation : $\pi/4DQPSK$ ) \_ MN: ADB10S2AN0

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.42	V	Х	PK	49.76	5.23	N/A	N/A	54.99	74.00	19.01
2389.42	V	Х	AV	49.76	5.23	-24.79	N/A	30.20	54.00	23.80
4804.17	V	Х	PK	50.28	1.47	N/A	N/A	51.75	74.00	22.25
4804.17	V	X	AV	50.28	1.47	-24.79	N/A	26.96	54.00	27.04

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.92	V	Х	PK	50.33	2.02	N/A	N/A	52.35	74.00	21.65
4881.92	V	X	AV	50.33	2.02	-24.79	N/A	27.56	54.00	26.44

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.90	V	Х	PK	49.47	5.79	N/A	N/A	55.26	74.00	18.74
2483.90	V	Х	AV	49.47	5.79	-24.79	N/A	30.47	54.00	23.53
4960.00	V	Х	PK	49.47	2.17	N/A	N/A	51.64	74.00	22.36
4960.00	V	X	AV	49.47	2.17	-24.79	N/A	26.85	54.00	27.15

#### Note.

- 1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result

- Calculation of distance factor =  $20 \log(\text{ applied distance})$  required distance ) =  $20 \log(1 \text{ m / 3 m})$  = -9.54 dB When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
- 3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
  - Time to cycle through all channels =  $\Delta t = T$  [ms] X 20 minimum hopping channels , where T = pulse width = **2.88 ms**
  - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2
  - The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms
  - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log(5.76 / 100) = -24.79 dB
- 4. Sample Calculation.

Report No.: DRTFCC2004-0100

### 9 kHz ~ 25 GHz Data (Modulation : 8DPSK) \_ MN: ADB10S2AN0

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.33	V	Х	PK	49.14	5.23	N/A	N/A	54.37	74.00	19.63
2389.33	V	Χ	AV	49.14	5.23	-24.79	N/A	29.58	54.00	24.42
4804.29	V	Χ	PK	49.69	1.47	N/A	N/A	51.16	74.00	22.84
4804.29	V	Х	AV	49.69	1.47	-24.79	N/A	26.37	54.00	27.63

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.70	V	Х	PK	49.86	2.02	N/A	N/A	51.88	74.00	22.12
4881.70	V	Χ	AV	49.86	2.02	-24.79	N/A	27.09	54.00	26.91

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.72	V	Х	PK	48.81	5.79	N/A	N/A	54.60	74.00	19.40
2483.72	V	Χ	AV	48.81	5.79	-24.79	N/A	29.81	54.00	24.19
4959.67	V	Х	PK	49.33	2.17	N/A	N/A	51.50	74.00	22.50
4959.67	V	Χ	AV	49.33	2.17	-24.79	N/A	26.71	54.00	27.29

#### Note.

- 1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log( applied distance / required distance ) =  $20 \log(1 \text{ m / 3 m}) = \frac{-9.54 \text{ dB}}{4 \text{ m}}$  When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
- 3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
  - Time to cycle through all channels =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.88 ms**
  - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2
  - The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms
  - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log( 5.76 / 100 )** = **-24.79 dB**
- 4. Sample Calculation.

## 9 kHz ~ 25 GHz Data (Modulation : <u>GFSK</u>) \_ MN: ADB40S2AN

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.74	V	Х	PK	49.47	5.24	N/A	N/A	54.71	74.00	19.29
2389.74	V	Х	AV	49.47	5.24	-24.79	N/A	29.92	54.00	24.08
4803.77	V	Х	PK	49.29	1.47	N/A	N/A	50.76	74.00	23.24
4803.77	V	Х	AV	49.29	1.47	-24.79	N/A	25.97	54.00	28.03

Report No.: DRTFCC2004-0100

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.03	V	Χ	PK	50.04	2.03	N/A	N/A	52.07	74.00	21.93
4882.03	V	X	AV	50.04	2.03	-24.79	N/A	27.28	54.00	26.72

#### Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.75	V	Х	PK	49.60	5.79	N/A	N/A	55.39	74.00	18.61
2483.75	V	Χ	AV	49.60	5.79	-24.79	N/A	30.60	54.00	23.40
4959.81	V	Χ	PK	49.06	2.17	N/A	N/A	51.23	74.00	22.77
4959.81	V	Χ	AV	49.06	2.17	-24.79	N/A	26.44	54.00	27.56

#### • Note.

- 1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log( applied distance / required distance ) =  $20 \log(1 \text{ m / 3 m}) = \frac{-9.54 \text{ dB}}{4 \text{ m}}$  When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
- 3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
  - Time to cycle through all channels =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.88 ms**
  - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2
  - The Worst Case Dwell Time = T [ms]  $\times$  H' = 2.88 ms X 2 = 5.76 ms
  - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log( 5.76 / 100 ) = -24.79 dB
- 4. Sample Calculation.

# 9 kHz ~ 25 GHz Data (Modulation : π/4DQPSK) \_ MN: ADB40S2AN

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.34	V	Х	PK	50.47	5.23	N/A	N/A	55.70	74.00	18.30
2389.34	V	Х	AV	50.47	5.23	-24.79	N/A	30.91	54.00	23.09
4803.63	V	Х	PK	49.37	1.47	N/A	N/A	50.84	74.00	23.16
4803.63	٧	X	AV	49.37	1.47	-24.79	N/A	26.05	54.00	27.95

Report No.: DRTFCC2004-0100

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.63	V	Х	PK	51.07	2.02	N/A	N/A	53.09	74.00	20.91
4881.63	V	X	AV	51.07	2.02	-24.79	N/A	28.30	54.00	25.70

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2484.03	V	Х	PK	49.77	5.79	N/A	N/A	55.56	74.00	18.44
2484.03	V	Х	AV	49.77	5.79	-24.79	N/A	30.77	54.00	23.23
4960.17	V	Х	PK	49.78	2.17	N/A	N/A	51.95	74.00	22.05
4960.17	V	X	AV	49.78	2.17	-24.79	N/A	27.16	54.00	26.84

#### Note.

- 1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result

- Calculation of distance factor =  $20 \log(\text{ applied distance})$  required distance ) =  $20 \log(1 \text{ m / 3 m})$  = -9.54 dB When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
- 3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
  - Time to cycle through all channels =  $\Delta t = T$  [ms] X 20 minimum hopping channels , where T = pulse width = **2.88 ms**
  - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2
  - The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms
  - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log(5.76 / 100) = -24.79 dB
- 4. Sample Calculation.

Report No.: DRTFCC2004-0100

### 9 kHz ~ 25 GHz Data (Modulation : 8DPSK) \_ MN: ADB40S2AN

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2387.99	V	Х	PK	49.50	5.22	N/A	N/A	54.72	74.00	19.28
2387.99	V	Х	AV	49.50	5.22	-24.79	N/A	29.93	54.00	24.07
4804.09	V	Χ	PK	49.51	1.47	N/A	N/A	50.98	74.00	23.02
4804.09	V	Х	AV	49.51	1.47	-24.79	N/A	26.19	54.00	27.81

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.75	V	Х	PK	49.35	2.02	N/A	N/A	51.37	74.00	22.63
4881.75	V	Х	AV	49.35	2.02	-24.79	N/A	26.58	54.00	27.42

#### Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.85	V	Х	PK	49.76	5.79	N/A	N/A	55.55	74.00	18.45
2483.85	V	Х	AV	49.76	5.79	-24.79	N/A	30.76	54.00	23.24
4959.92	V	Х	PK	49.47	2.17	N/A	N/A	51.64	74.00	22.36
4959.92	V	Χ	AV	49.47	2.17	-24.79	N/A	26.85	54.00	27.15

#### Note.

- 1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result

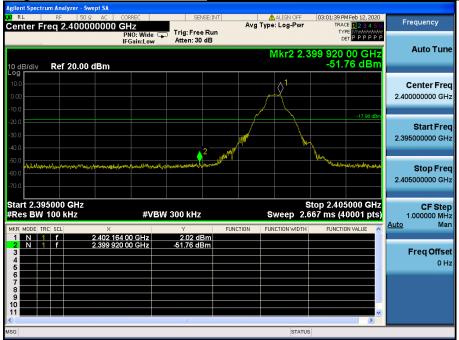
- Calculation of distance factor = 20 log( applied distance / required distance ) =  $20 \log(1 \text{ m / 3 m}) = \frac{-9.54 \text{ dB}}{4 \text{ m}}$  When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
- 3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
  - Time to cycle through all channels =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.88 ms**
  - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2
  - The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms
  - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log( 5.76 / 100 )** = **-24.79 dB**
- 4. Sample Calculation.



## 7.4.2. Conducted Spurious Emissions

Low Band-edge <u>Lowest Channel & Modulation : GFSK</u>

Report No.: DRTFCC2004-0100

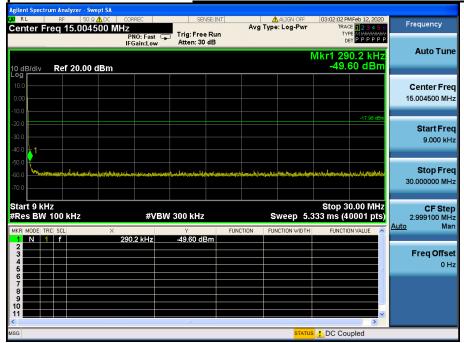




















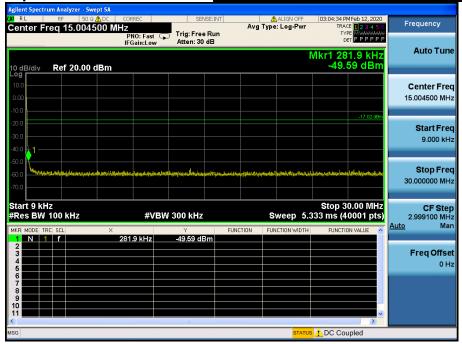




## Middle Channel & Modulation : GFSK



## Conducted Spurious Emissions <u>Middle Channel & Modulation : GFSK</u>



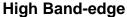




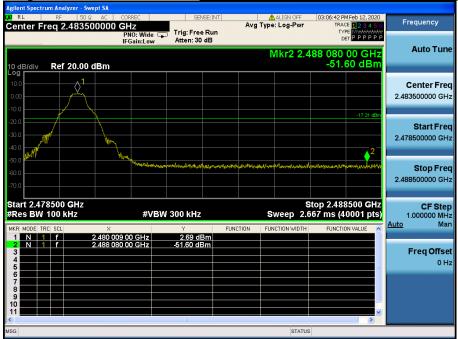








## Highest Channel & Modulation: GFSK



Report No.: DRTFCC2004-0100

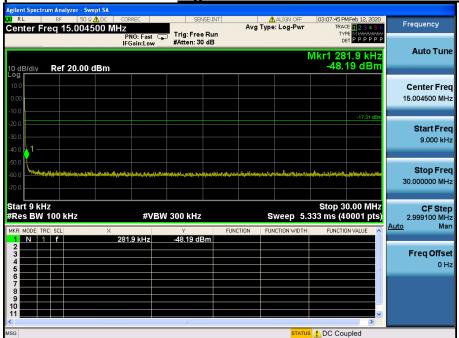
## **High Band-edge**

## Hopping mode & Modulation : GFSK













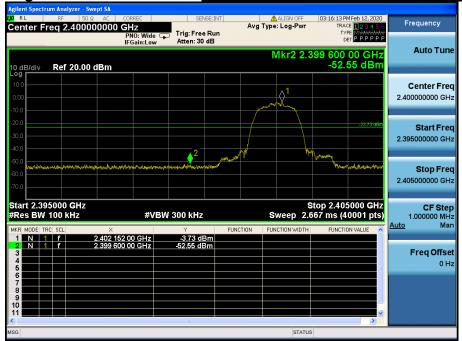
Report No.: DRTFCC2004-0100





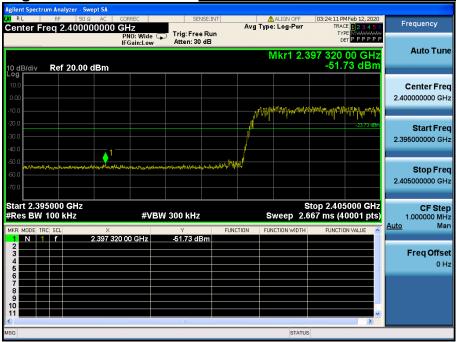
## Low Band-edge

## Lowest Channel & Modulation : π/4DQPSK



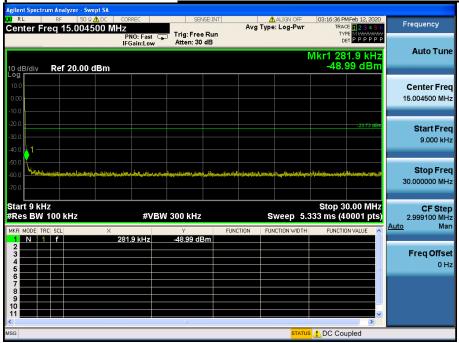
## Low Band-edge

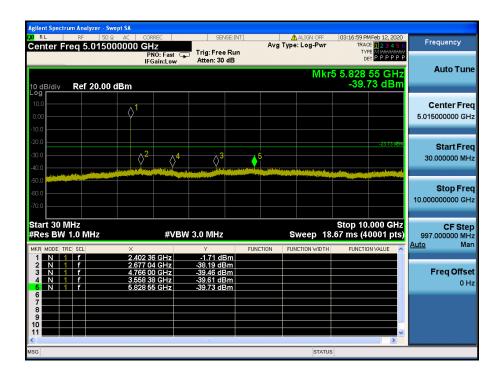
## Hopping mode & Modulation : π/4DQPSK





Conducted Spurious Emissions <u>Lowest Channel & Modulation : π/4DQPSK</u>







Lowest Channel & Modulation : π/4DQPSK **Conducted Spurious Emissions** 

Report No.: DRTFCC2004-0100



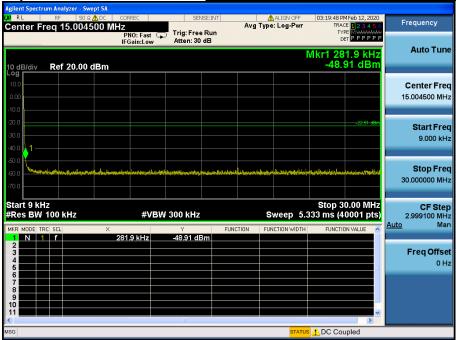


### Reference for limit

## Middle Channel & Modulation : π/4DQPSK



## Conducted Spurious Emissions <u>Middle Channel & Modulation : π/4DQPSK</u>





Conducted Spurious Emissions <u>Middle Channel & Modulation : π/4DQPSK</u>

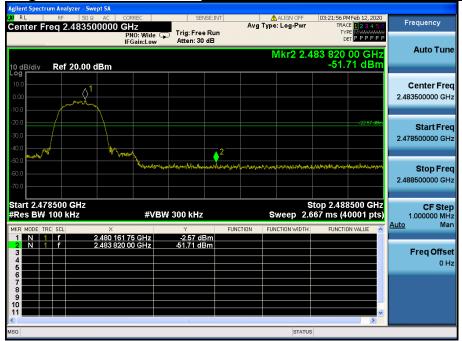






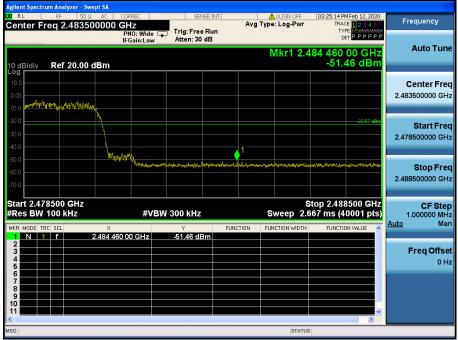


## Highest Channel & Modulation : π/4DQPSK



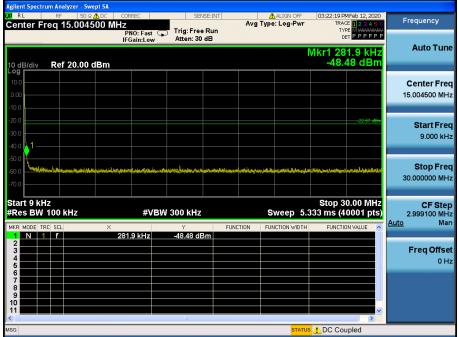
## **High Band-edge**

## Hopping mode & Modulation : π/4DQPSK













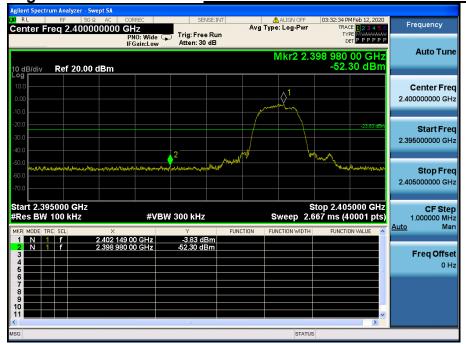






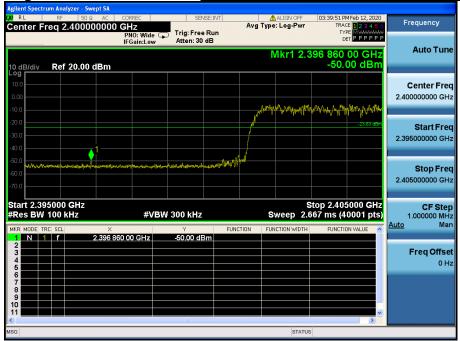


## **Lowest Channel & Modulation: 8DPSK**



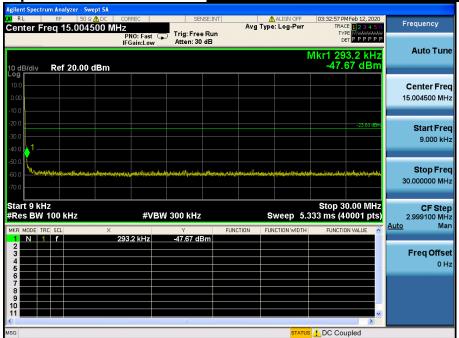
## Low Band-edge

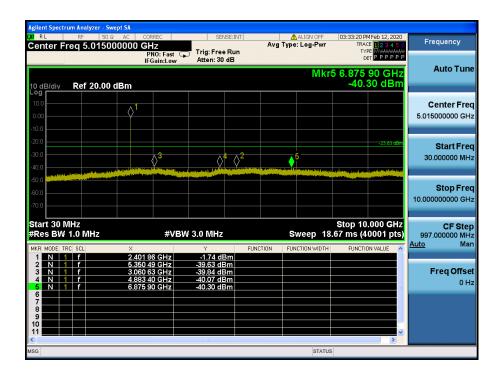
## **Hopping mode & Modulation: 8DPSK**





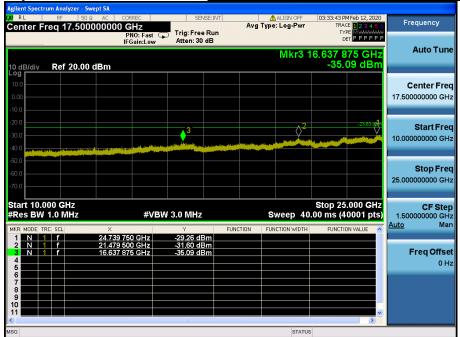












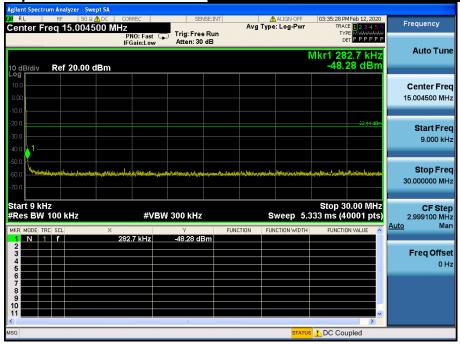


### Reference for limit

## Middle Channel & Modulation: 8DPSK

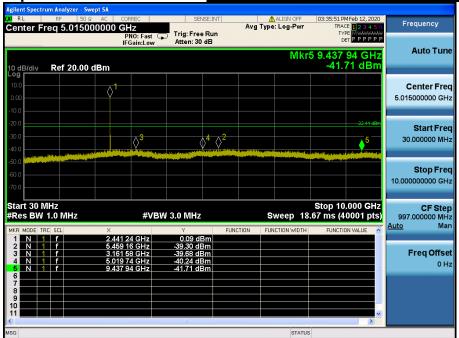


## Conducted Spurious Emissions <u>Middle Channel & Modulation : 8DPSK</u>







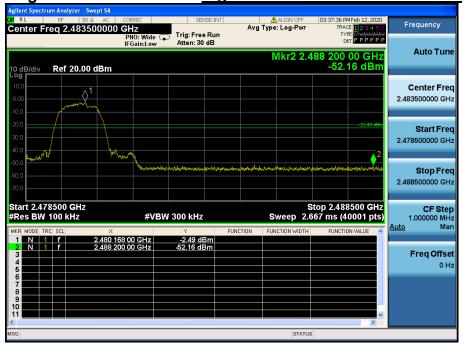






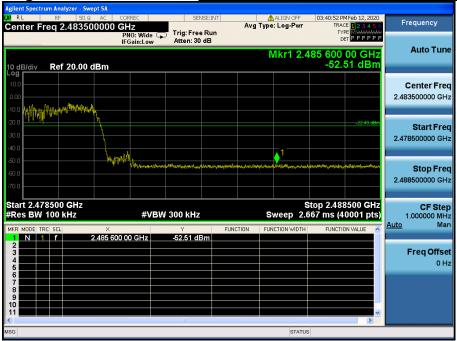


## Highest Channel & Modulation: 8DPSK



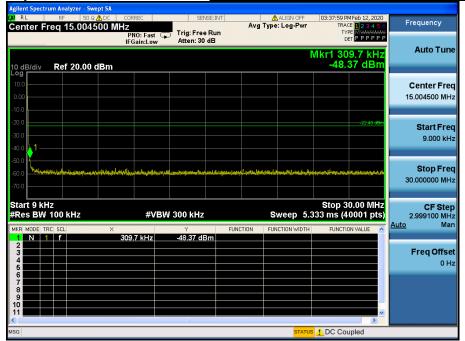
## **High Band-edge**

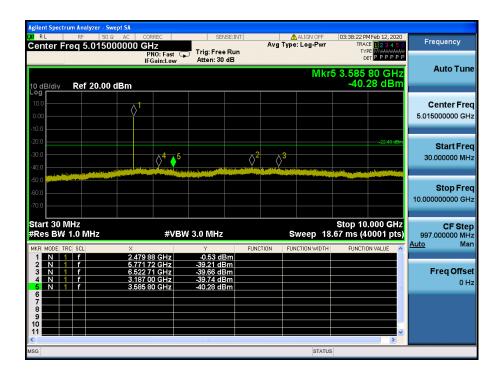
## Hopping mode & Modulation: 8DPSK



















## 8. Transmitter AC Power Line Conducted Emission

### 8.1 Test Setup

NA

#### 8.2 Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Report No.: DRTFCC2004-0100

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Fraguency Bongo (MHz)	Conducted Limit (dBuV)					
Frequency Range (MHz)	Quasi-Peak	Average				
0.15 ~ 0.5	66 to 56 *	56 to 46 *				
0.5 ~ 5	56	46				
5 ~ 30	60	50				

<sup>\*</sup> Decreases with the logarithm of the frequency

#### 8.3 Test Procedures

Conducted emissions from the EUT were measured according to the ANSI C63.10.

- 1. The test procedure is performed in a  $6.5 \text{ m} \times 3.5 \text{ m} \times 3.5 \text{ m} (L \times W \times H)$  shielded room. The EUT along with its peripherals were placed on a  $1.0 \text{ m} (W) \times 1.5 \text{ m} (L)$  and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
- 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
- 3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- 4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

#### 8.4 Test Results

NA



## 9. Antenna Requirement

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

Report No.: DRTFCC2004-0100

**Conclusion: Comply** 

The antenna is printed on the PCB. (Refer to Internal Photo file.) Therefore this E.U.T Complies with the requirement of §15.203

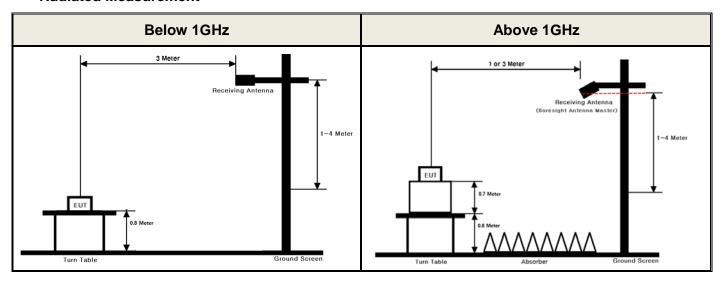
#### - Minimum Standard:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

## **APPENDIX I**

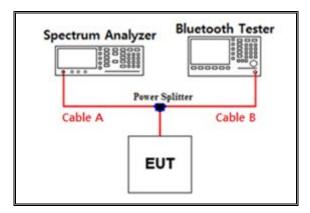
## Test set up diagrams

### Radiated Measurement



Report No.: DRTFCC2004-0100

### Conducted Measurement



#### Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)	
0.03	6.35	15	8.19	
1	6.76	20	8.27	
2.402 & 2.441 & 2.480	7.18	25	8.80	
5	7.27	-	-	
10	7.40	-	-	

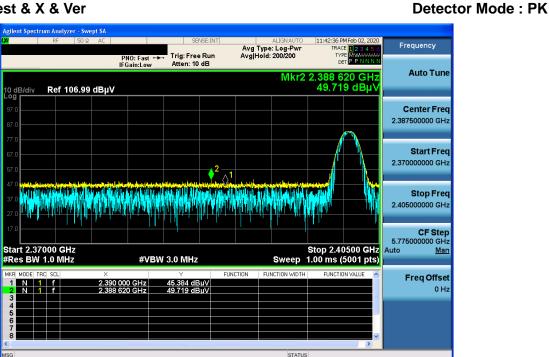
Note 1 : The path loss from EUT to Spectrum analyzer were measured and used for test.

Path loss ( S/A's Correction factor) = Cable A+ Power splitter

**APPENDIX II** 

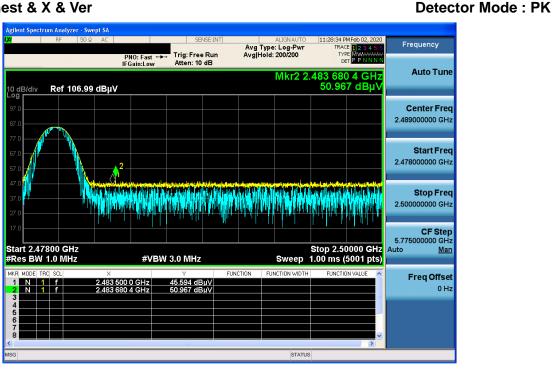
## Unwanted Emissions (Radiated) Test Plot \_ MN: ADB10S2AN0

#### GFSK & Lowest & X & Ver



Report No.: DRTFCC2004-0100

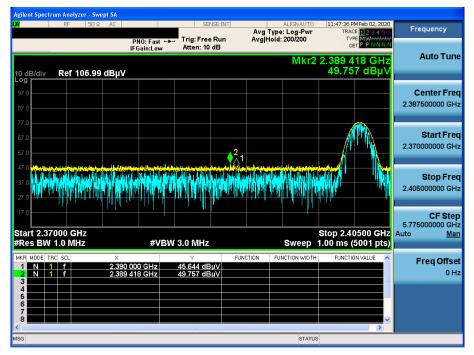
## GFSK & Highest & X & Ver





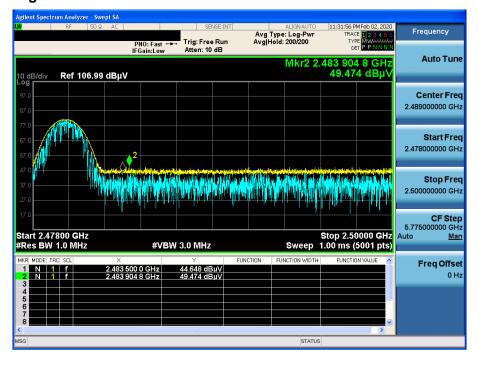
#### π/4DQPSK & Lowest & X & Ver

#### **Detector Mode: PK**



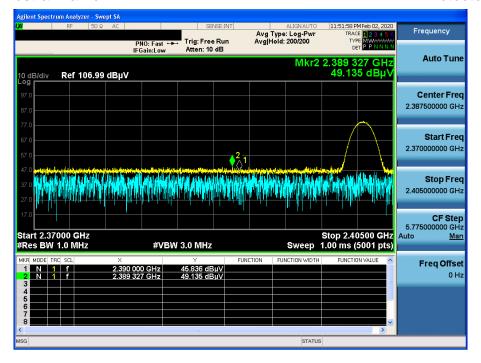
Report No.: DRTFCC2004-0100

## π/4DQPSK & Highest & X & Ver



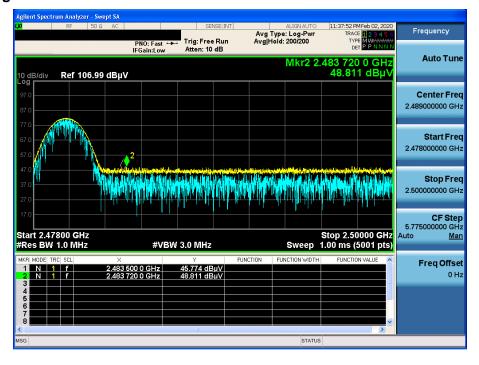
#### 8DPSK & Lowest & X & Ver

#### **Detector Mode: PK**



Report No.: DRTFCC2004-0100

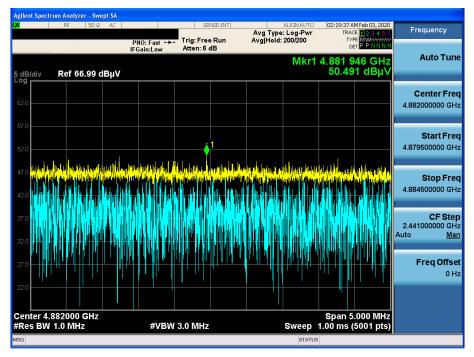
## 8DPSK & Highest & X & Ver



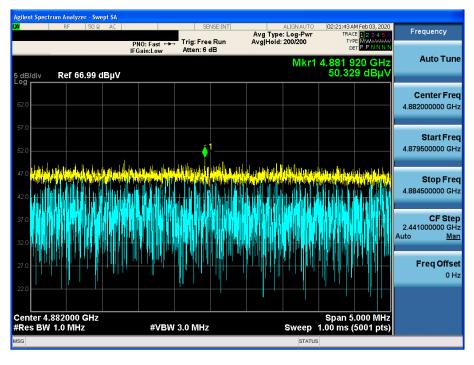


### GFSK & Middle & X & Ver

### **Detector Mode: PK**

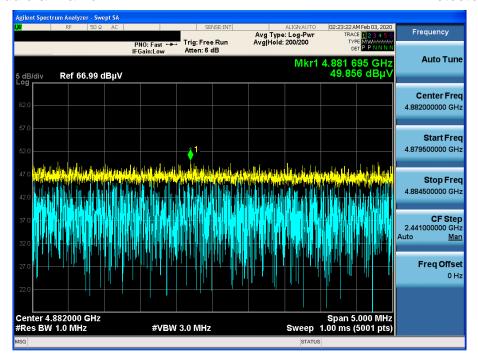


#### π/4DQPSK & Middle & X & Ver





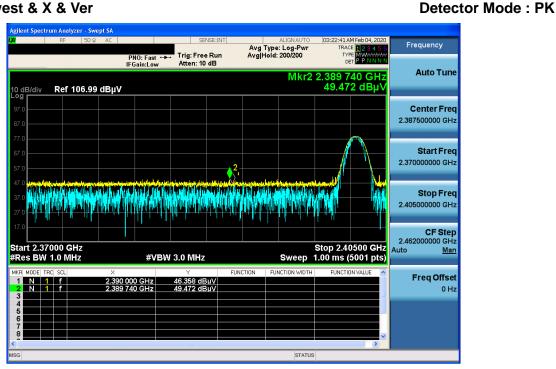
### 8DPSK & Middle & X & Ver



**Detector Mode: PK** 

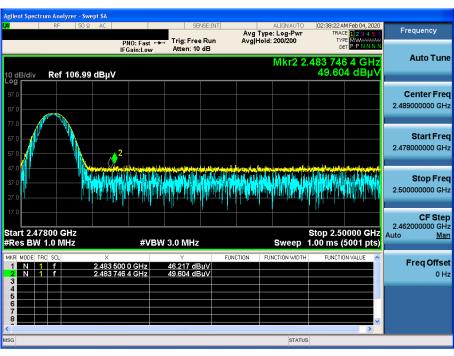
Unwanted Emissions (Radiated) Test Plot \_ MN: ADB40S2AN

#### GFSK & Lowest & X & Ver



Report No.: DRTFCC2004-0100

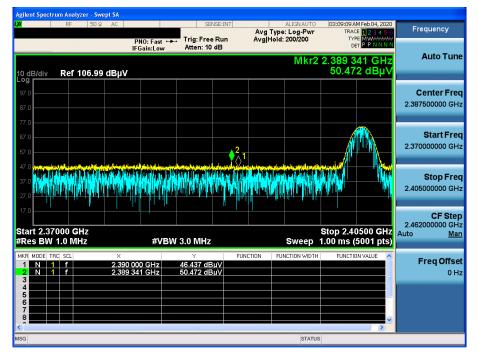
### GFSK & Highest & X & Ver



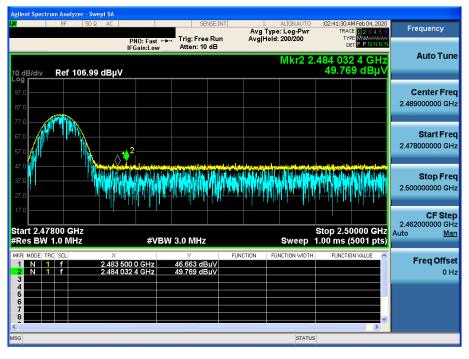


#### π/4DQPSK & Lowest & X & Ver

#### **Detector Mode: PK**



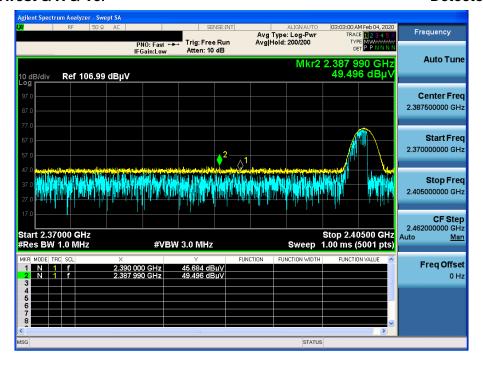
## π/4DQPSK & Highest & X & Ver



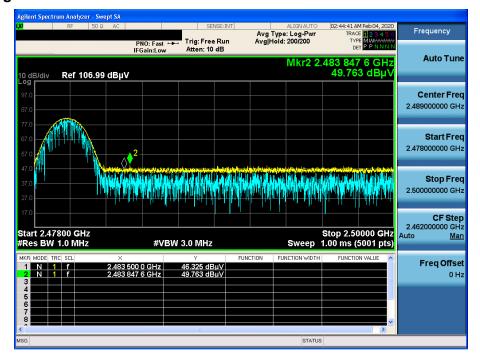


#### 8DPSK & Lowest & X & Ver

#### **Detector Mode: PK**



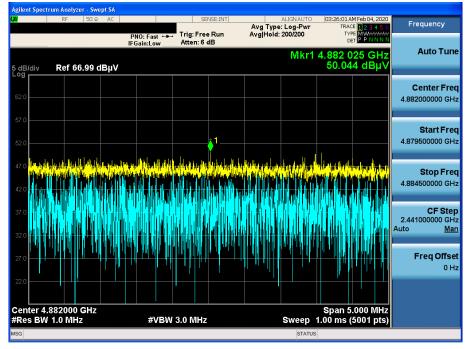
## 8DPSK & Highest & X & Ver



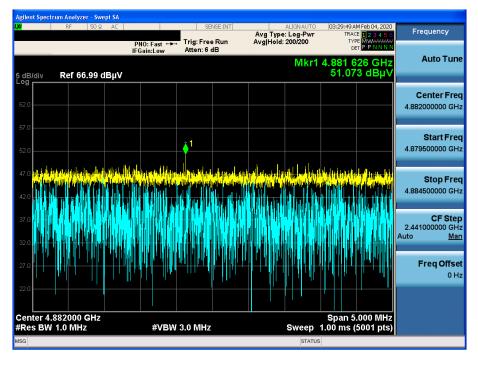


#### GFSK & Middle & X & Ver

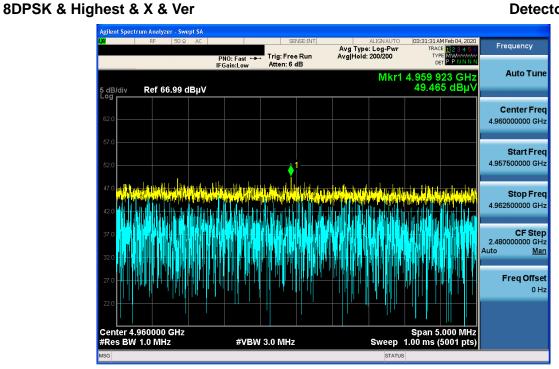
### **Detector Mode: PK**



#### π/4DQPSK & Middle & X & Ver



### **Detector Mode: PK**



Report No.: DRTFCC2004-0100