



# FCC TEST REPORT

**REPORT NO.:** RF990709E01B-1

**MODEL NO.:** ARS63-SB

**FCC ID:** PPD-ARS63SB

**RECEIVED:** July 13, 2010

**TESTED:** July 22 to 27, 2010

**ISSUED:** Aug. 04, 2010

**APPLICANT:** Atheros Communications, Inc.

**ADDRESS:** 5480 Great America Parkway, Santa Clara, CA  
95054

**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

**LAB ADDRESS:** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen,  
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan

**TEST LOCATION (1):** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen,  
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan

**TEST LOCATION (2):** No. 49, Ln. 206, Wende Rd., Shangshan Tsuen,  
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan

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## 1 CERTIFICATION

**PRODUCT :** Low Power 1x1 802.11 b/g/n (SDIO) + BT Combo Card  
**BRAND NAME :** Atheros  
**MODEL NO. :** ARS63-SB  
**APPLICANT :** Atheros Communications, Inc.  
**TESTED DATE :** July 22 to 27, 2010  
**TEST SAMPLE :** R&D SAMPLE  
**STANDARDS :** FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.4-2003  
Canada RSS-210 issue 7  
Canada RSS-Gen issue 2

The above equipment (Model: ARS63-SB) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and was in compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY :** Midoli Peng , **DATE:** Aug. 04, 2010  
( Midoli Peng, Specialist )

**TECHNICAL ACCEPTANCE :** Hank Chung , **DATE:** Aug. 04, 2010  
( Hank Chung, Deputy Manager )

**APPROVED BY :** May Chen , **DATE:** Aug. 04, 2010  
( May Chen, Deputy Manager )



## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: 47 CFR Part 15, Subpart C, Canada RSS-210/ RSS-GEN					
Standard Section			Test Type and Limit	Result	REMARK
RSS-210	RSS-Gen	47 CFR Part 15			
-	7.2.2	15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit Minimum passing margin is -13.82dB at 0.152MHz
A8.1(d)	-	15.247(a)(1)(I)-(ii)	Number of Hopping Frequency Used Spec.: At least 15 channels	PASS	Meet the requirement of limit
A8.1(d)	-	15.247(a)(1)(ii)	Dwell Time on Each Channel Spec. : Max. 0.4 second within 30 second	PASS	Meet the requirement of limit
A8.1(b)	-	15.247(a)(1)(I)-(ii)	Hopping Channel Separation Spec. : Min. 25 kHz or two-thirds of 20 dB bandwidth, which ever is greater	PASS	Meet the requirement of limit
-	4.6	15.247(a)(2)	Spectrum Bandwidth of a Frequency Hopping Spread Spectrum System	PASS	Report reference only
A8.4(2)	-	15.247(b)	Maximum Peak Output Power Spec.: max. 125mW	PASS	Meet the requirement of limit
A8.5	4.9	15.247(c)	Transmitter Radiated Emissions FCC Limit: Table 15.209 RSS-210 Limit: Table 2	PASS	Meet the requirement of limit Minimum passing margin is -1.8dB at 166.43MHz
-	6	-	Receiver Radiated Emissions RSS-210 Limit: Table 2	PASS	Meet the requirement of limit Minimum passing margin is -1.8dB at 166.43MHz
A8.5	-	15.247(c)	Band Edge Measurement	PASS	Meet the requirement of limit
	7.1.4	15.203	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.

## 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

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

Measurement	Value
Conducted emissions	2.45 dB
Radiated emissions (30MHz-1GHz)	3.76 dB
Radiated emissions (1GHz -18GHz)	2.19 dB
Radiated emissions (18GHz -40GHz)	2.55 dB



### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Low Power 1x1 802.11 b/g/n (SDIO) + BT Combo Card
MODEL NO.	ARS63-SB
FCC ID	PPD-ARS63SB
IC ID	4104A-ARS63SB
POWER SUPPLY	DC 3.3V from host equipment
MODULATION TYPE	GFSK, $\pi/4$ -DQPSK, 8DPSK
MODULATION TECHNOLOGY	FHSS
TRANSFER RATE	3/2/1 Mbits/s
OPERATING FREQUENCY	2402MHz ~ 2480MHz
NUMBER OF CHANNEL	79
MAXIMUM OUTPUT POWER	GFSK: 1.3 mW 8DPSK: 2.2 mW $\pi/4$ – DQPSK: 1.9 mW
ANTENNA TYPE	See item 3.2
ANTENNA CONNECTOR	See item 3.2
DATA CABLE	NA
I/O PORTS	NA
ASSOCIATED DEVICES	NA

**NOTE:**

1. There are Bluetooth technology and WLAN technology used for the EUT. <the WLAN test data please refer "RF990709E01B">
2. For radiated : The EUT's antenna was pre-tested under the following modes:

Test Mode	Description
Mode A	X-Y axis
Mode B	Y-Z axis
<b>Mode C</b>	<b>X-Z axis</b>

From the above modes, the worst case was found in **Mode C**. Therefore only the test data of the mode was recorded in this report.

3. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 3.2 DESCRIPTION OF ANTENNA

There is one set of antenna provided to this EUT, please refer to the following table:

Brand	Model	Gain(dBi) (included cable loss)	Antenna Type	Connector	Cable Loss(dB)	Cable Length
WNC	81-EBJ15.005	3.62	PIFA	IPEX	1.15	300mm

### 3.3 DESCRIPTION OF TEST MODES

Seventy-nine channels are provided to this EUT.

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



### 3.4 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

The device has several types and different accessory, therefore the worst case base on investigation by different combination for each test item and its data was recorded in this report.

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	PLC	RE < 1G	RE ≥ 1G	APCM	
-	√	√	√	√	-

Where **PLC**: Power Line Conducted Emission      **RE < 1G**: Radiated Emission below 1GHz  
**RE ≥ 1G**: Radiated Emission above 1GHz      **APCM**: Antenna Port Conducted Measurement

#### **Power Line Conducted Emission Test:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	78	FHSS	8DPSK	DH5

#### **Radiated Emission Test (Below 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Radiated Emission Test Blow 1GHz: The receiving mode has shown equal or better performance than Tx mode during the pre-scan and hence the Tx mode data is re-used for.
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	78	FHSS	8DPSK	DH5

**Radiated Emission Test (Above 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	DH5
Receiver	0, 39, 78	FHSS	-	-

**Conducted Out-Band Measurement:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 78	FHSS	GFSK	DH5
0 to 78	0, 78	FHSS	8DPSK	DH5
0 to 78	0, 78	FHSS	$\pi/4$ -DQPSK	DH5

**Antenna Port Conducted Measurement:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	DH5
0 to 78	0, 39, 78	FHSS	$\pi/4$ -DQPSK	DH5

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	20deg. C, 70%RH, 1013 hPa	120Vac, 60Hz	Frank Liu
RE<1G	24deg. C, 70%RH, 1013 hPa	120Vac, 60Hz	Eric Lee
PLC	26deg. C, 76%RH, 1013 hPa	120Vac, 60Hz	Eric Lee
APCM	25deg. C, 60%RH, 1013 hPa	120Vac, 60Hz	Rex Huang



### **3.5 GENERAL DESCRIPTION OF APPLIED STANDARDS**

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C. (15.247)**

**ANSI C63.4-2003**

**Canada RSS-210 issue 7**

**Canada RSS-Gen issue 2**

All test items have been performed and recorded as per the above standards.

### 3.6 DESCRIPTION OF SUPPORT UNITS

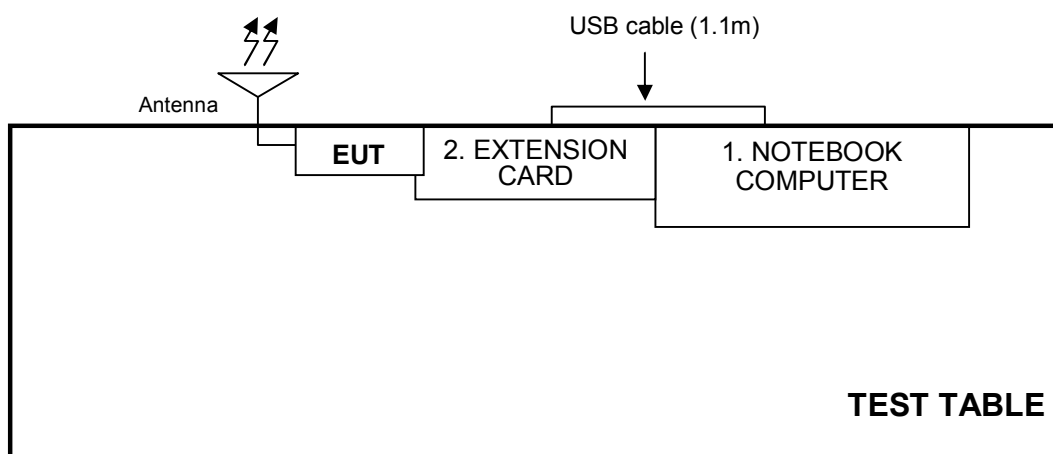
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP32LA	GSLB32S	FCC DoC
2	EXTENSION CARD	Atheros	NA	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA
2	NA

**NOTE:** All power cords of the above support units are non shielded (1.8m).

### 3.7 CONFIGURATION OF SYSTEM UNDER TEST





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## 4 TEST PROCEDURES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. All emanations from a class B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver	ESCS 30	100375	Mar. 09, 2010	Mar. 08, 2011
Line-Impedance Stabilization Network (for EUT)	NSLK 8127	8127-522	Sep. 23, 2009	Sep. 22, 2010
Line-Impedance Stabilization Network (for Peripheral)	ESH3-Z5	848773/004	Oct. 26, 2009	Oct. 25, 2010
RF Cable (JYEBAO)	5DFB	COBCAB-001	Nov. 24, 2009	Nov. 23, 2010
50 ohms Terminator	50	3	Oct. 28, 2009	Oct. 27, 2010
Software	BV ADT_Cond_V7.3.7	NA	NA	NA

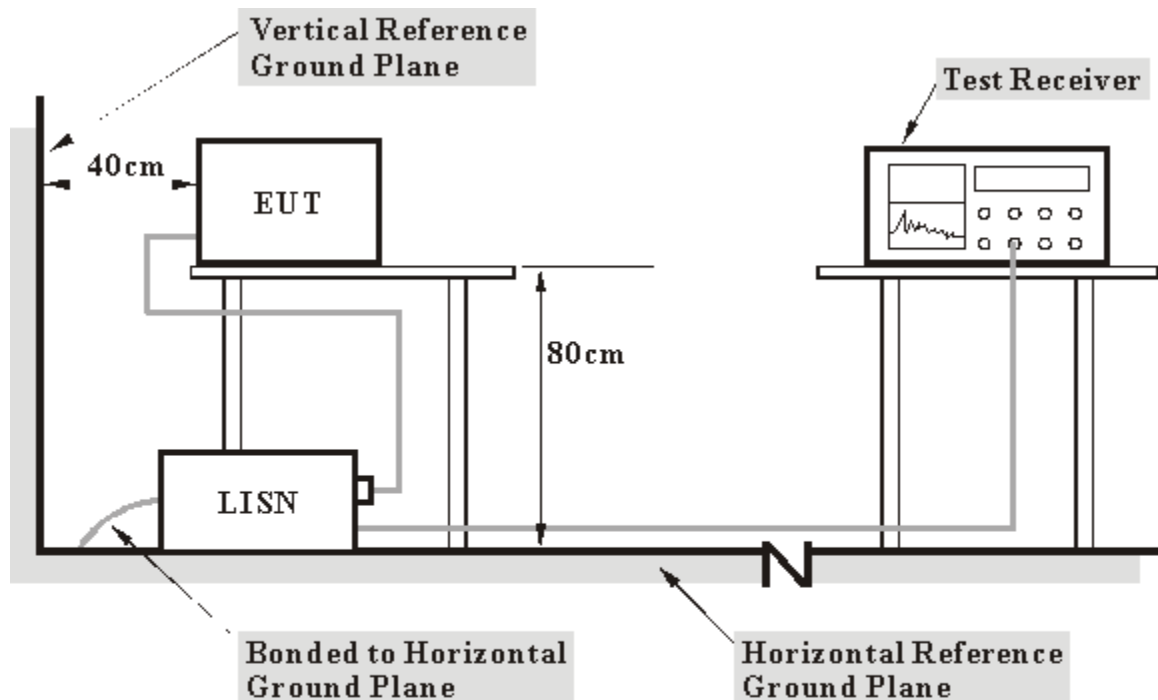
**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.

#### 4.1.3 TEST PROCEDURES

- a. The EUT/HOST was placed 0.4 meters from the conducting wall of the shielded room with EUT/HOST being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT/HOST were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits could not be reported

#### 4.1.4 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
  2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

#### 4.1.5 EUT OPERATING CONDITIONS

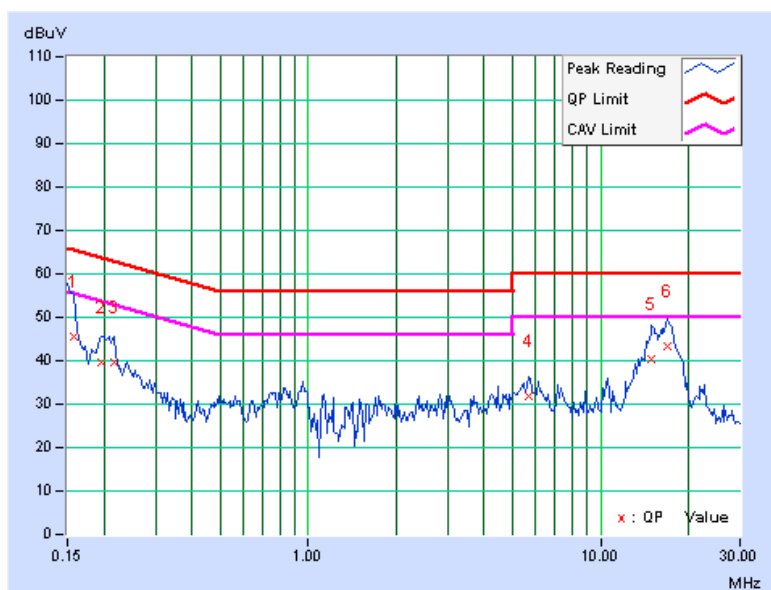
1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table.
2. The communication partner run test program “BtUART\_V1p5 BtUART.exe” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

### 4.1.6 TEST RESULTS

<b>PHASE</b>	Line (L)	<b>6DB BANDWIDTH</b>	9 kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.158	0.05	45.49	-	45.54	-	65.58	55.58	-20.03	-
2	0.197	0.05	39.59	-	39.64	-	63.74	53.74	-24.10	-
3	0.216	0.05	39.51	-	39.56	-	62.96	52.96	-23.39	-
4	5.676	0.23	31.46	-	31.69	-	60.00	50.00	-28.31	-
5	14.895	0.43	40.05	-	40.48	-	60.00	50.00	-19.52	-
6	16.949	0.46	42.91	-	43.37	-	60.00	50.00	-16.63	-

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.





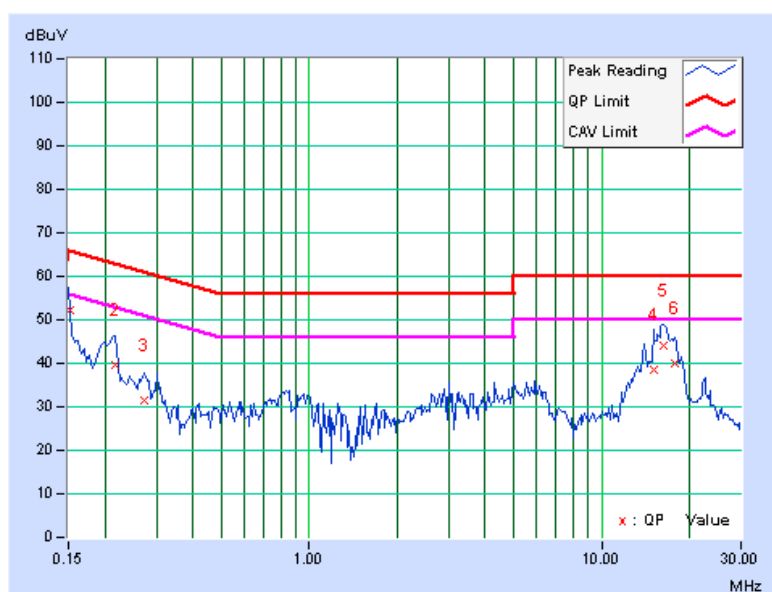


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<b>PHASE</b>	Neutral (N)	<b>6DB BANDWIDTH</b>	9 kHz
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.152	0.06	52.01	-	52.07	-	65.90	55.90	-13.82	-
2	0.216	0.06	39.65	-	39.71	-	62.96	52.96	-23.24	-
3	0.271	0.06	31.47	-	31.53	-	61.08	51.08	-29.55	-
4	15.023	0.44	38.20	-	38.64	-	60.00	50.00	-21.36	-
5	16.348	0.46	43.53	-	43.99	-	60.00	50.00	-16.01	-
6	17.859	0.49	39.55	-	40.04	-	60.00	50.00	-19.96	-

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.



## 4.2 NUMBER OF HOPPING FREQUENCY USED

### 4.2.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 hopping frequencies, and should be equally spaced.

### 4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

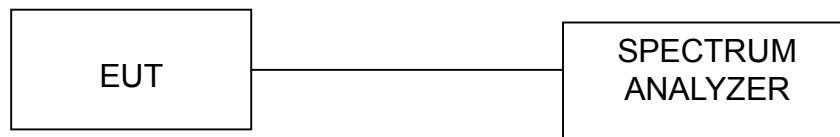
### 4.2.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.2.5 TEST SETUP



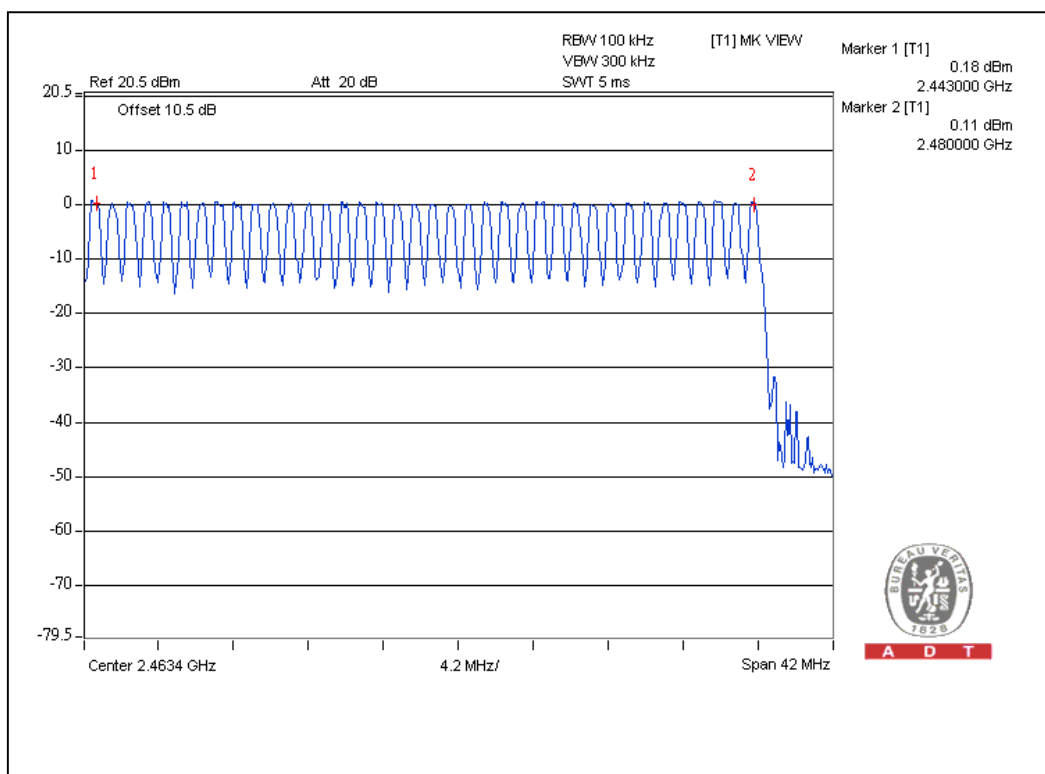
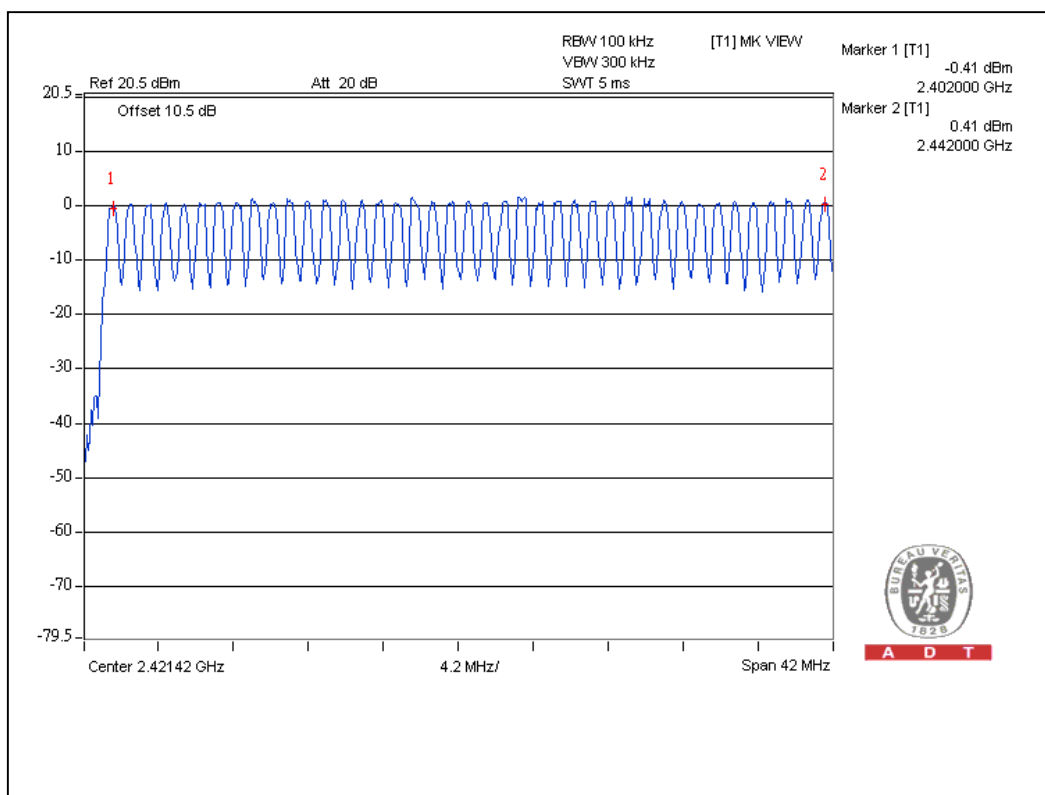
#### 4.2.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to next pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



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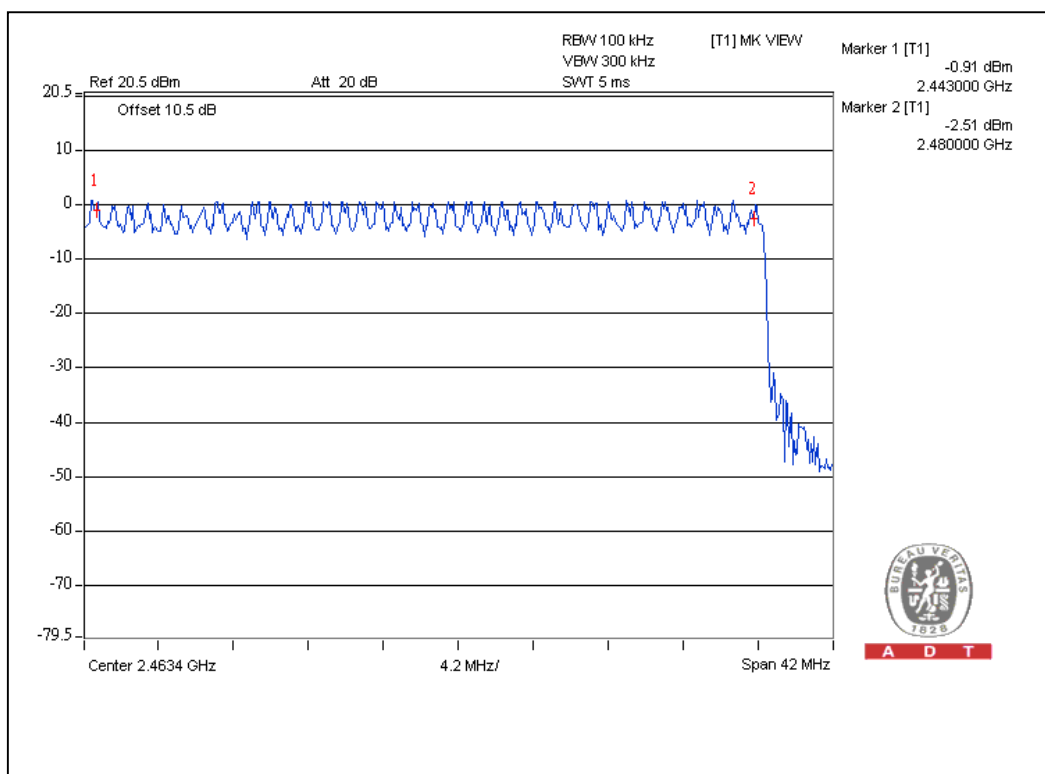
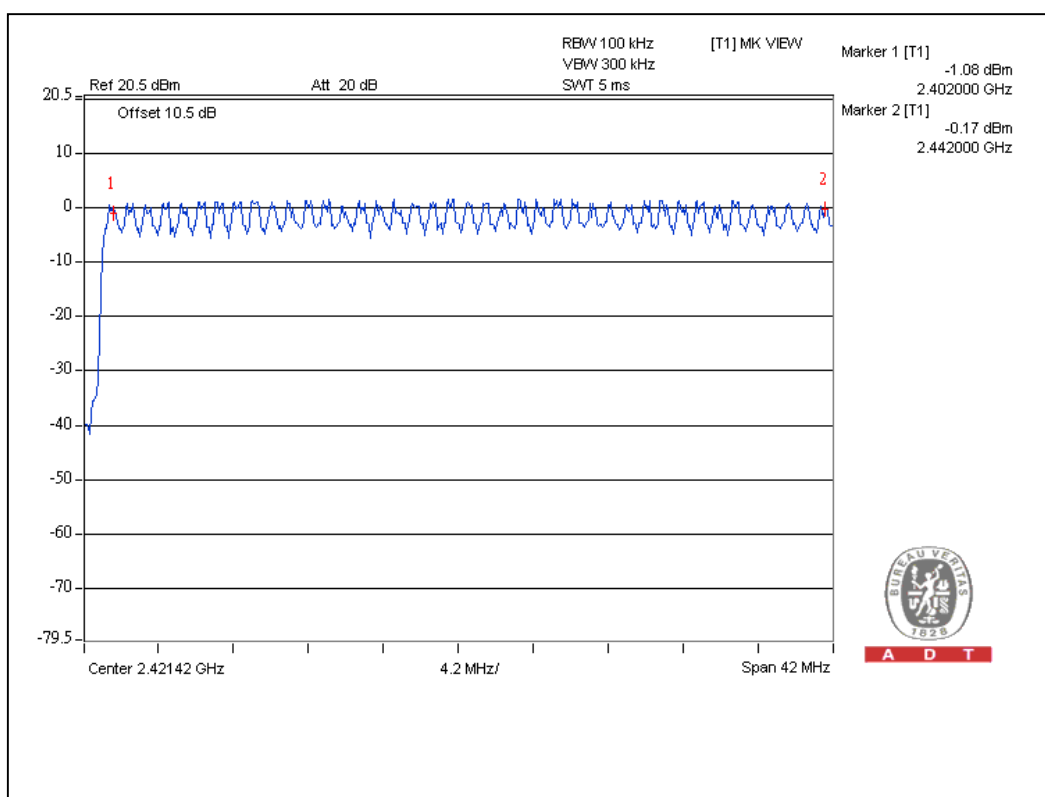
### For GFSK:





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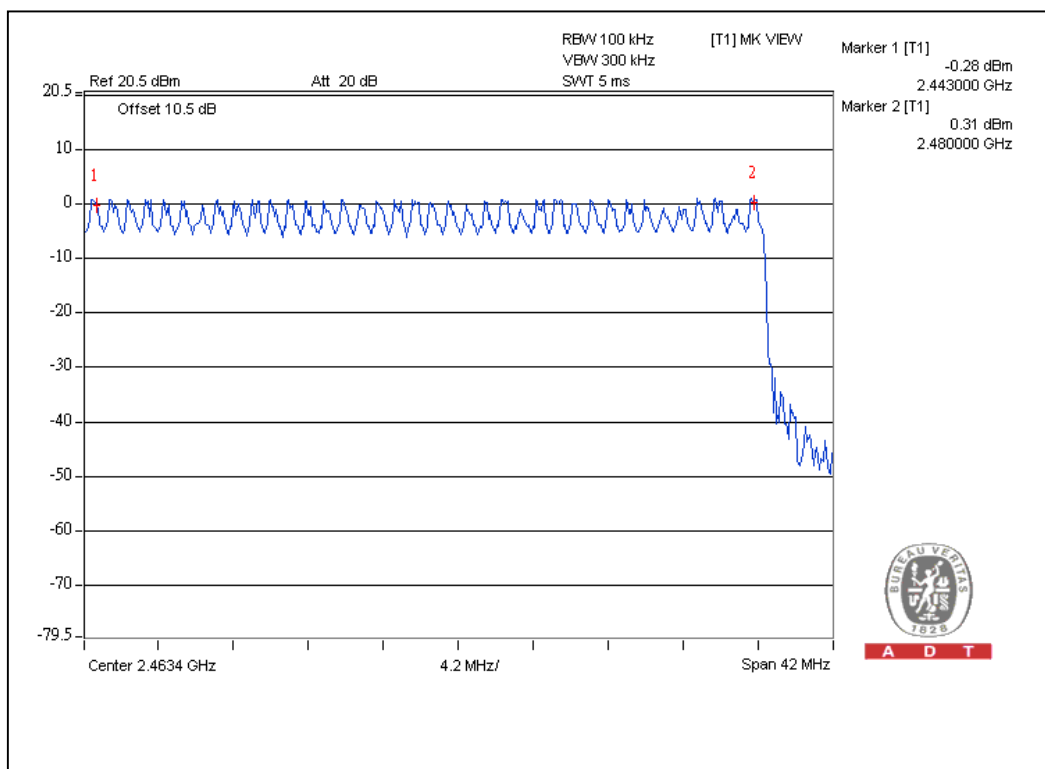
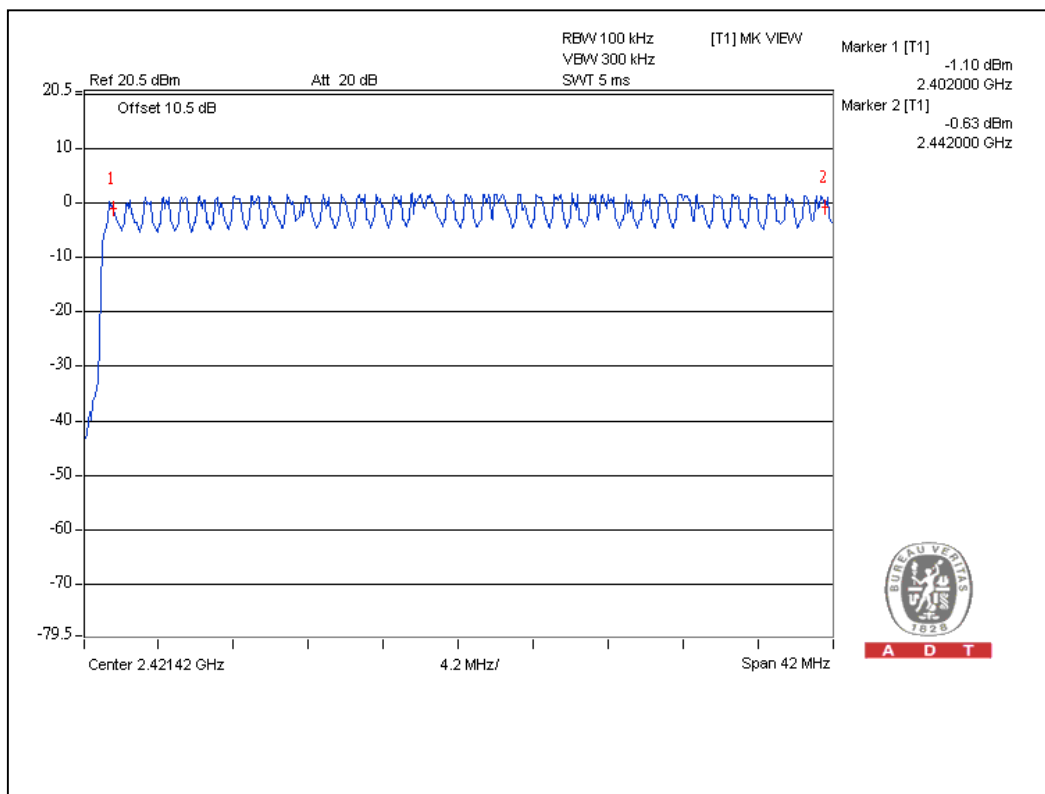
### For 8DPSK:





A D T

### For $\pi/4$ -DQPSK :



### 4.3 DWELL TIME ON EACH CHANNEL

#### 4.3.1 LIMIT OF DWELL TIME USED

For FHSS, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 31.6 second period. For hybrid systems, the average time of occupancy on any frequency should not exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

#### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.3.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.3.5 TEST SETUP



#### 4.3.6 TEST RESULTS

**For GFSK:**

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	51 (times / 5 sec) *6.32=322.32 times	0.468	150.8	400
DH3	26 (times / 5 sec) *6.32=164.32 times	1.674	275.1	400
DH5	17 (times / 5 sec) *6.32=107.44 times	2.920	313.7	400

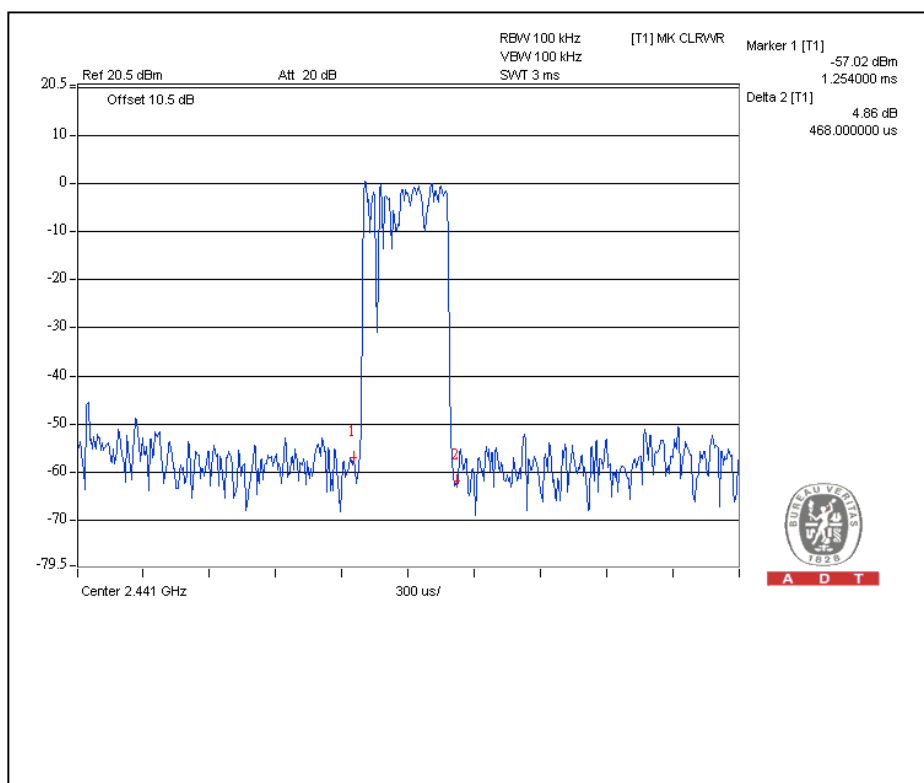
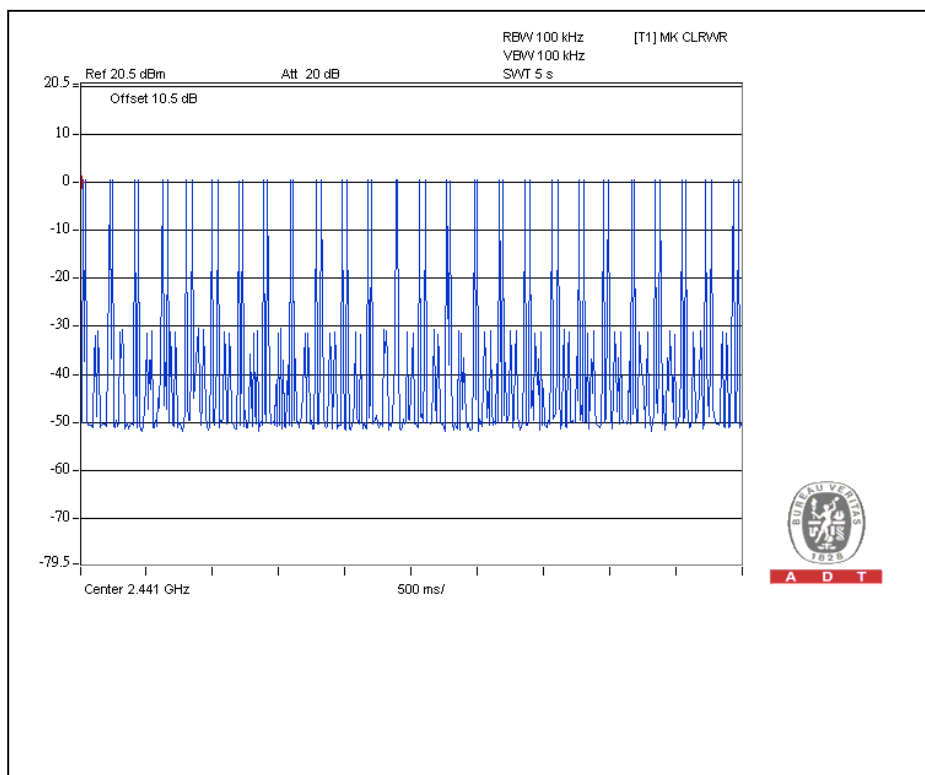
Test plots of the transmitting time slot are shown on next three pages.





A D T

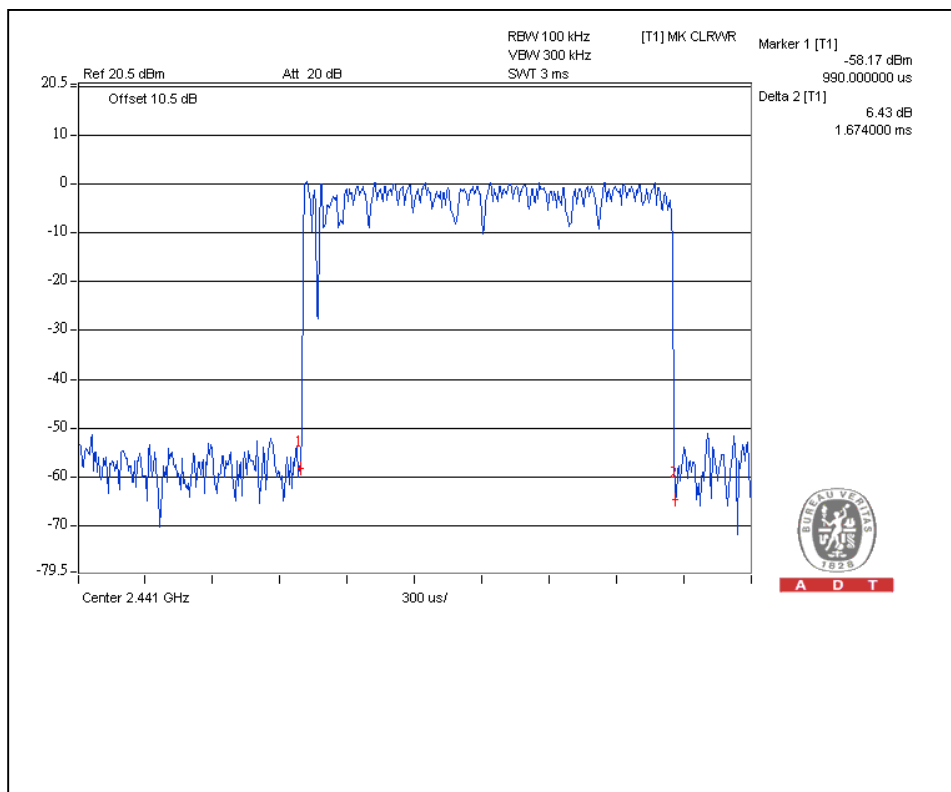
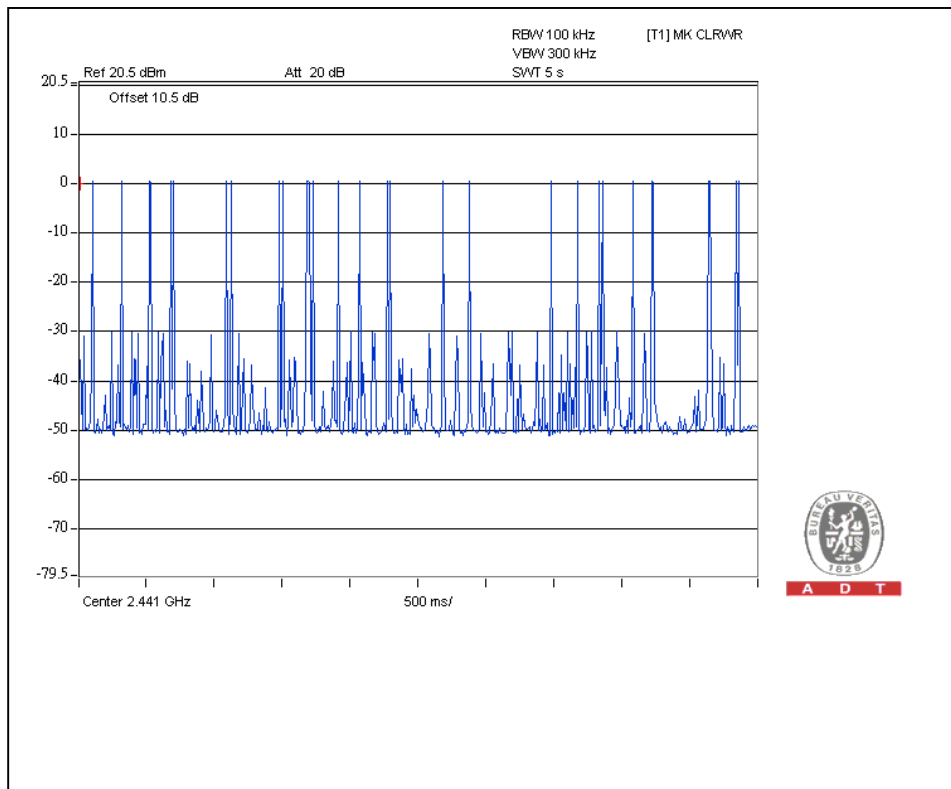
# DH1





A D T

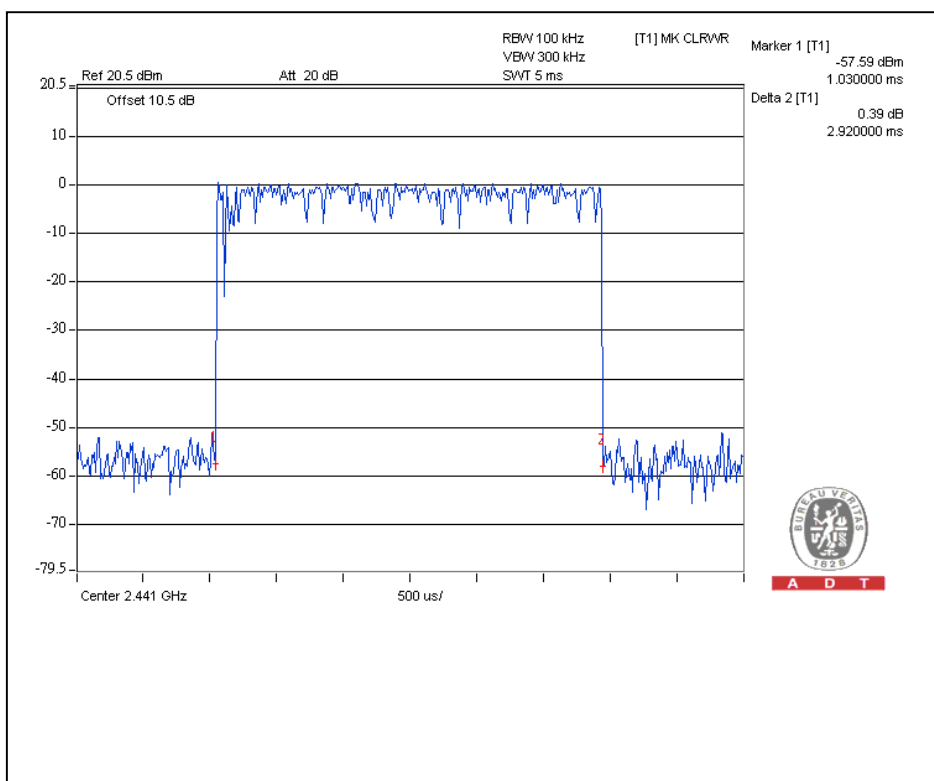
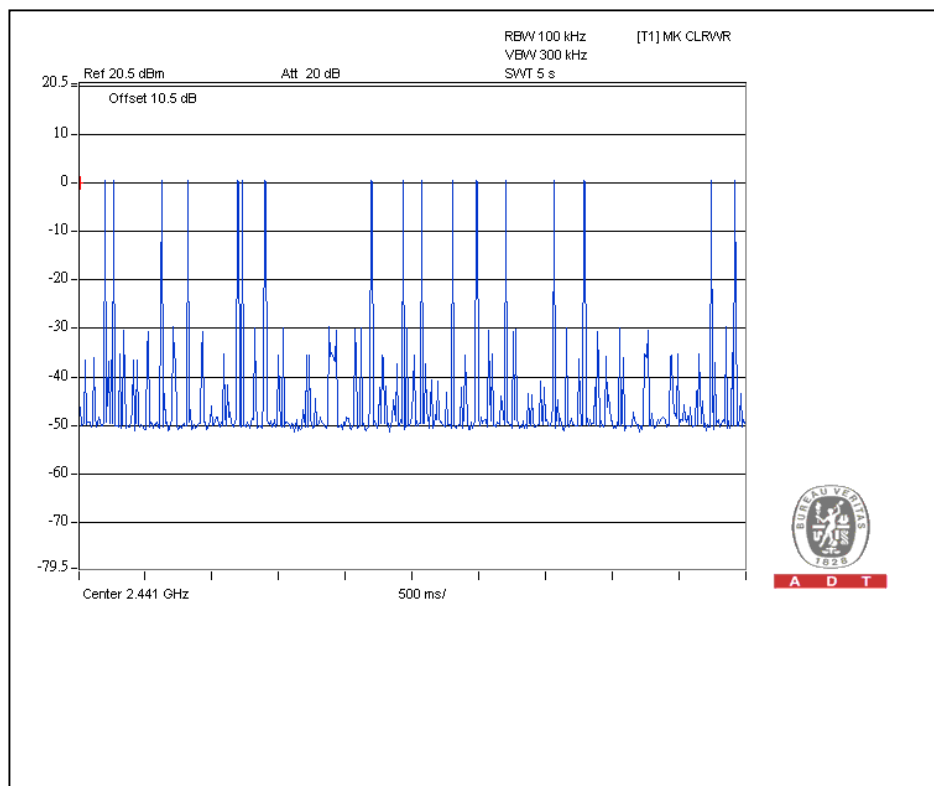
# DH3





A D T

# DH5





A D T

**For 8DPSK :**

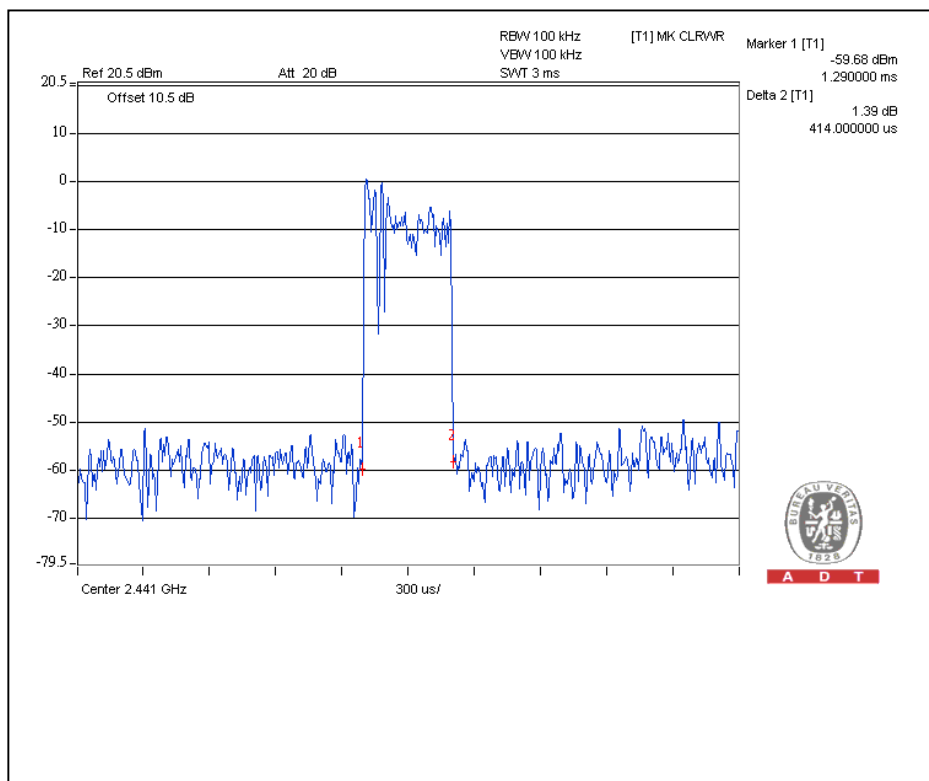
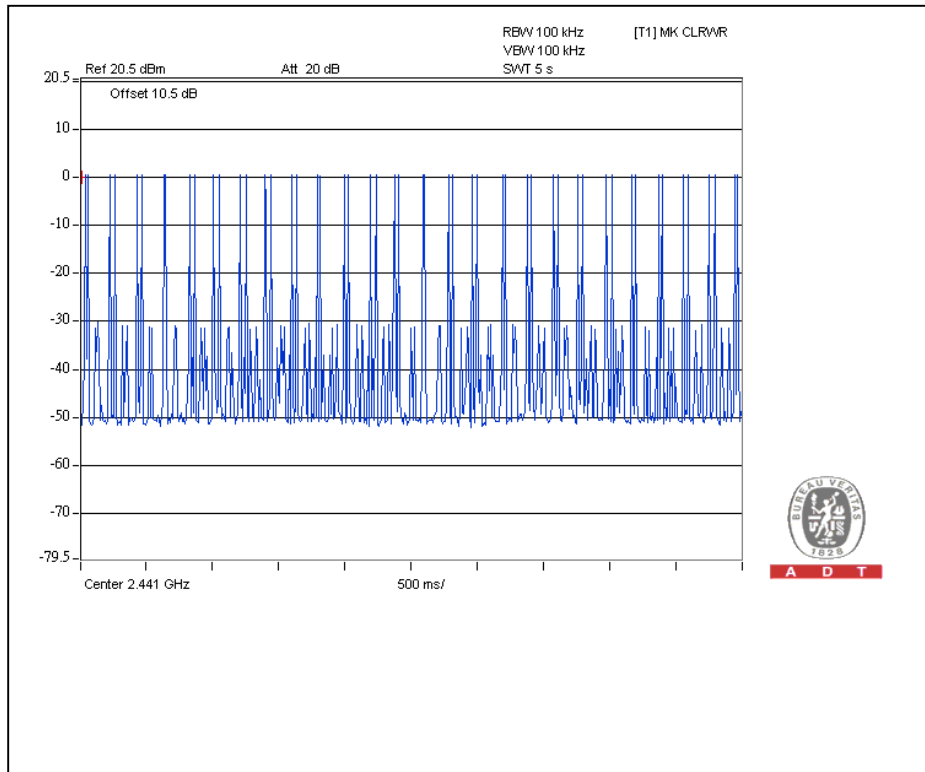
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *6.32=316 times	0.414	130.8	400
DH3	26 (times / 5 sec) *6.32=164.32 times	1.674	275.1	400
DH5	18 (times / 5 sec) *6.32=113.76 times	2.970	337.9	400

Test plots of the transmitting time slot are shown on next three pages.



A D T

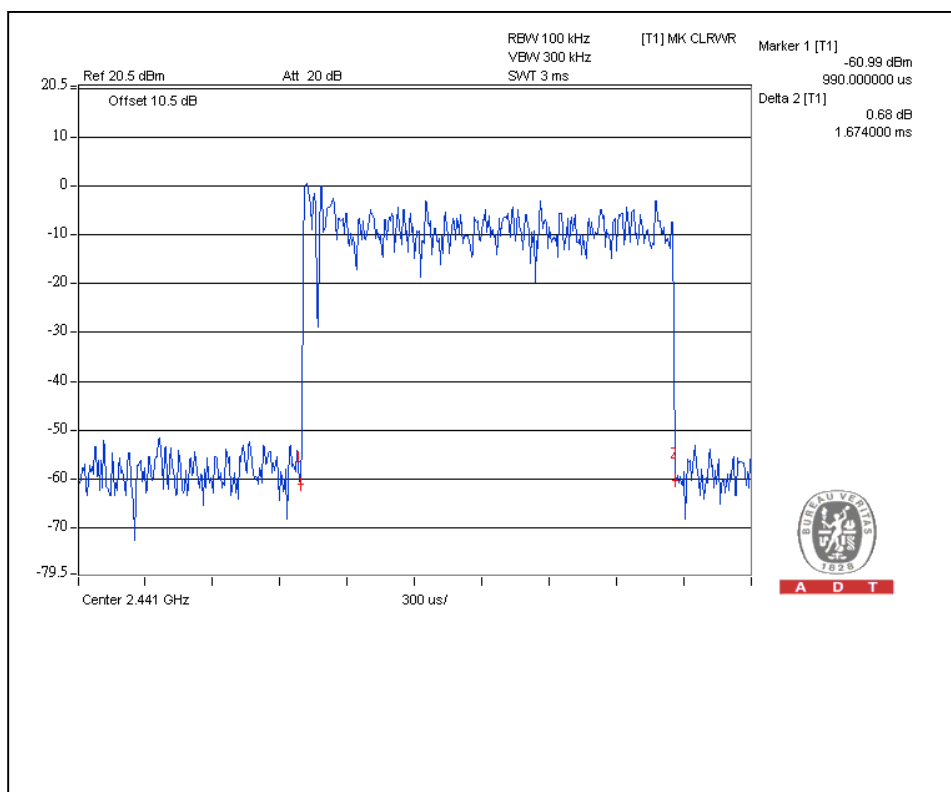
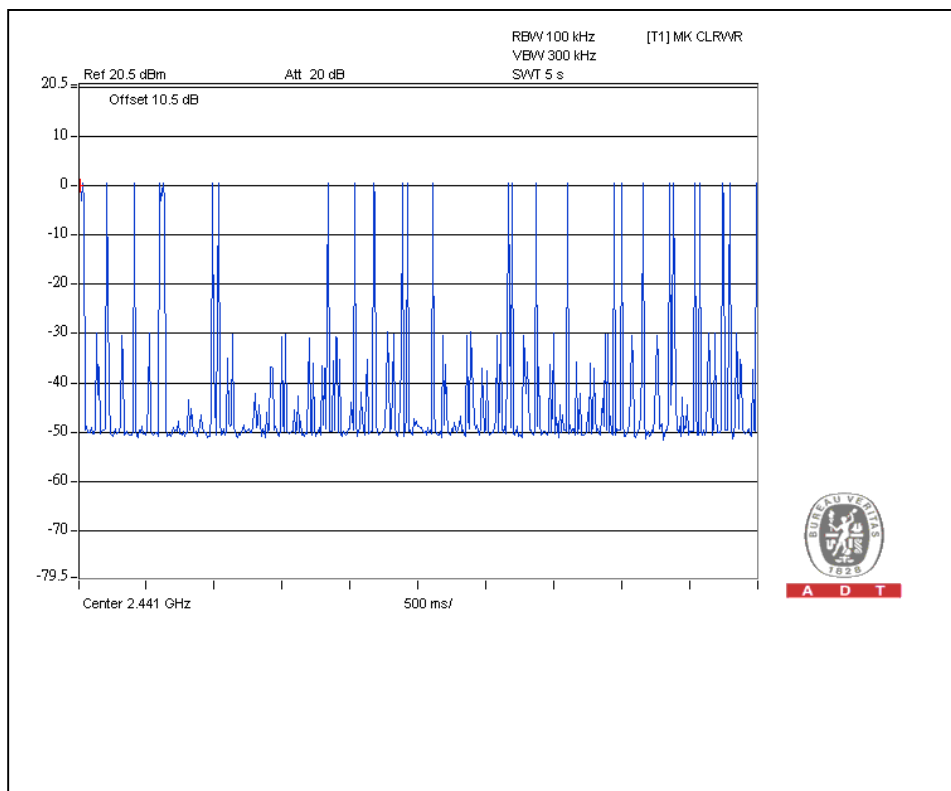
# DH1





A D T

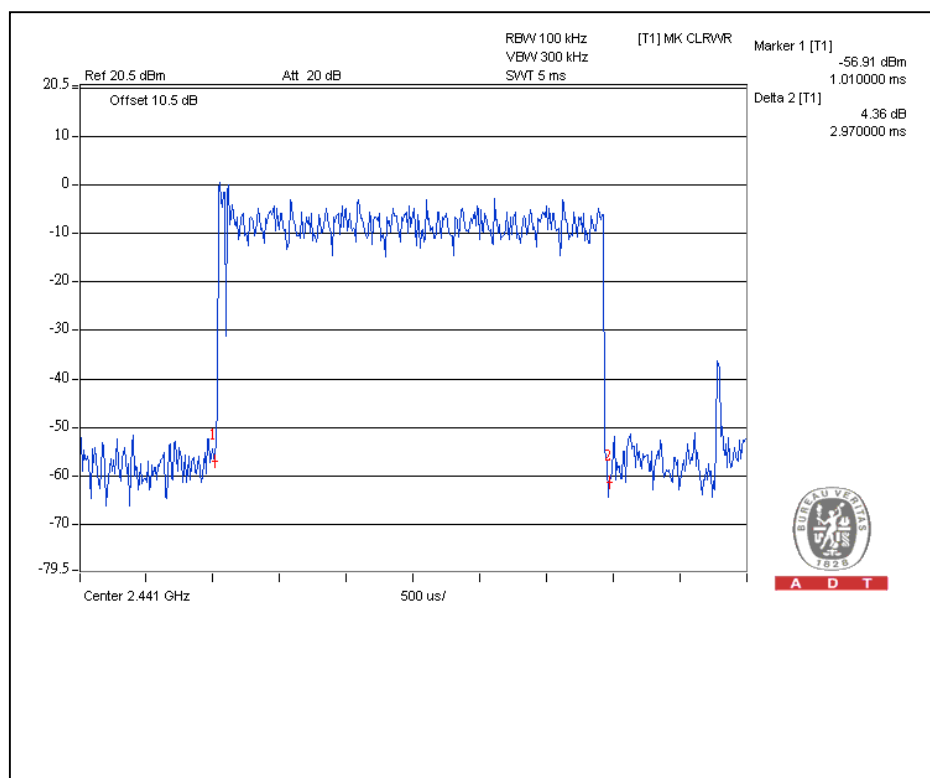
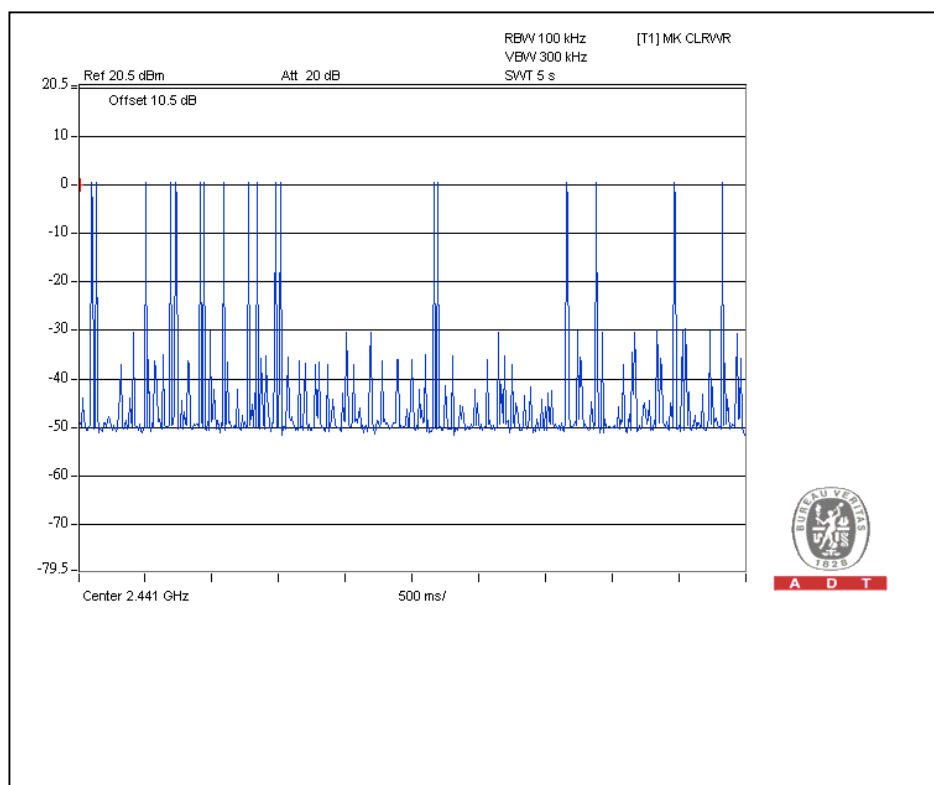
# DH3





A D T

# DH5





A D T

For  $\pi/4$  – DQPSK :

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *6.32=316 times	0.462	146.0	400
DH3	25 (times / 5 sec) *6.32=158 times	1.674	264.5	400
DH5	17 (times / 5 sec) *6.32=107.44 times	2.990	321.2	400

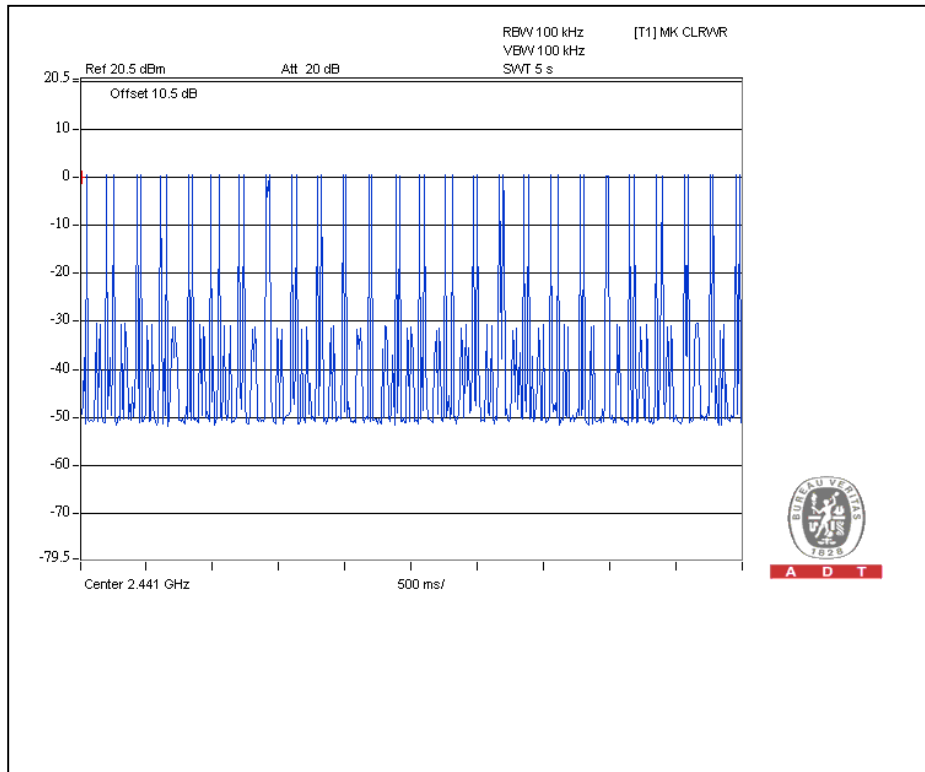
Test plots of the transmitting time slot are shown on next three pages.



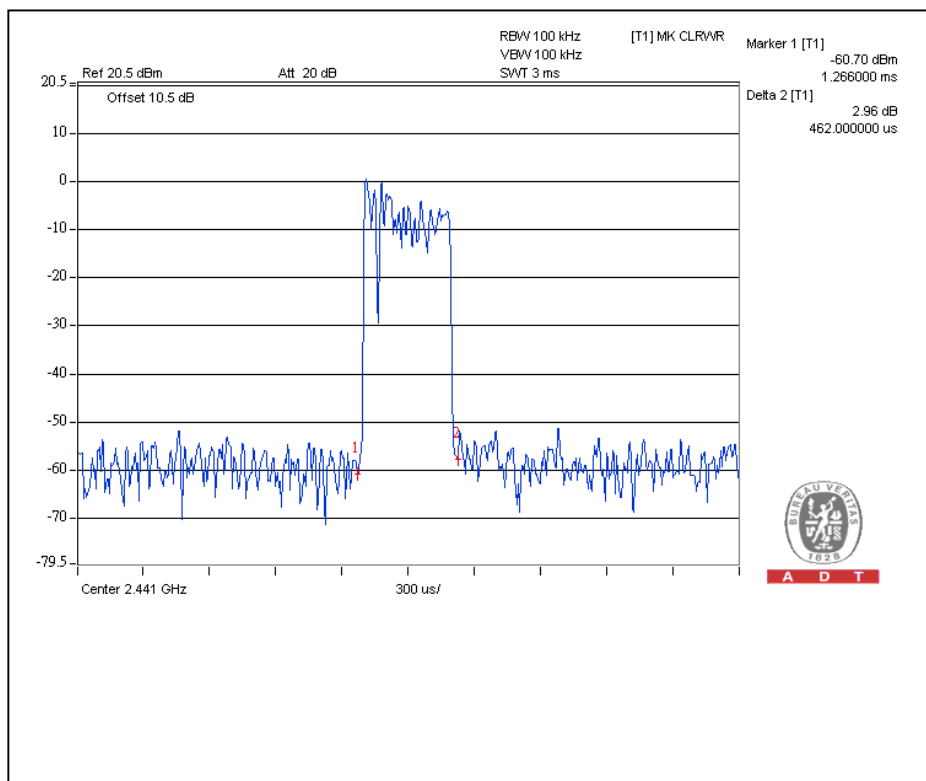


A D T

# DH1



A D T

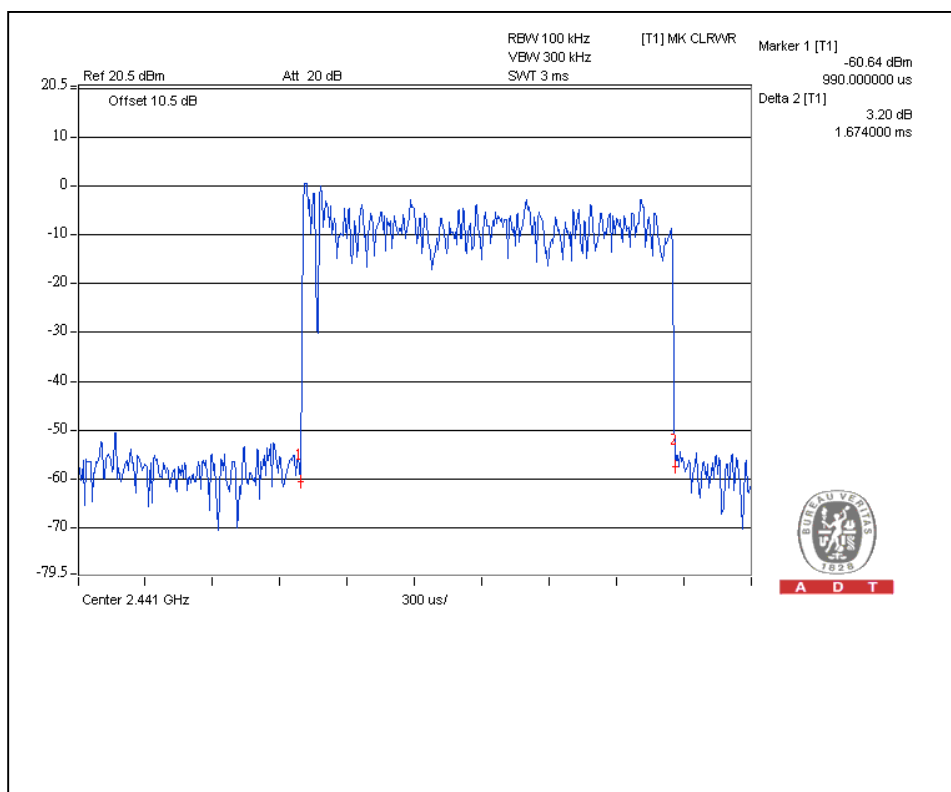
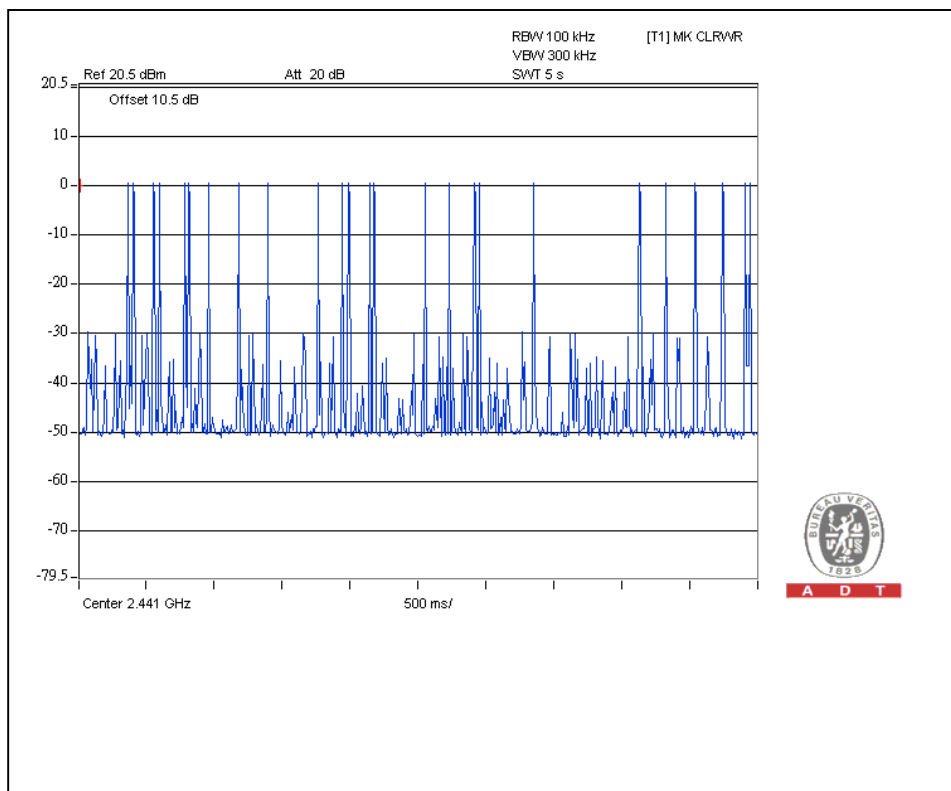


A D T



A D T

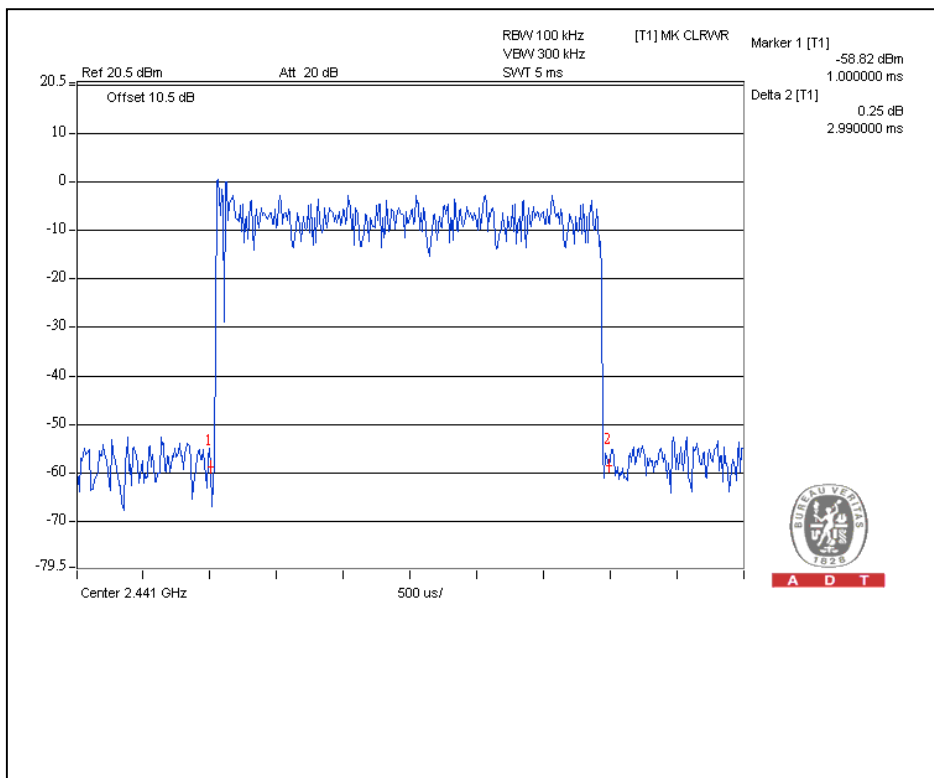
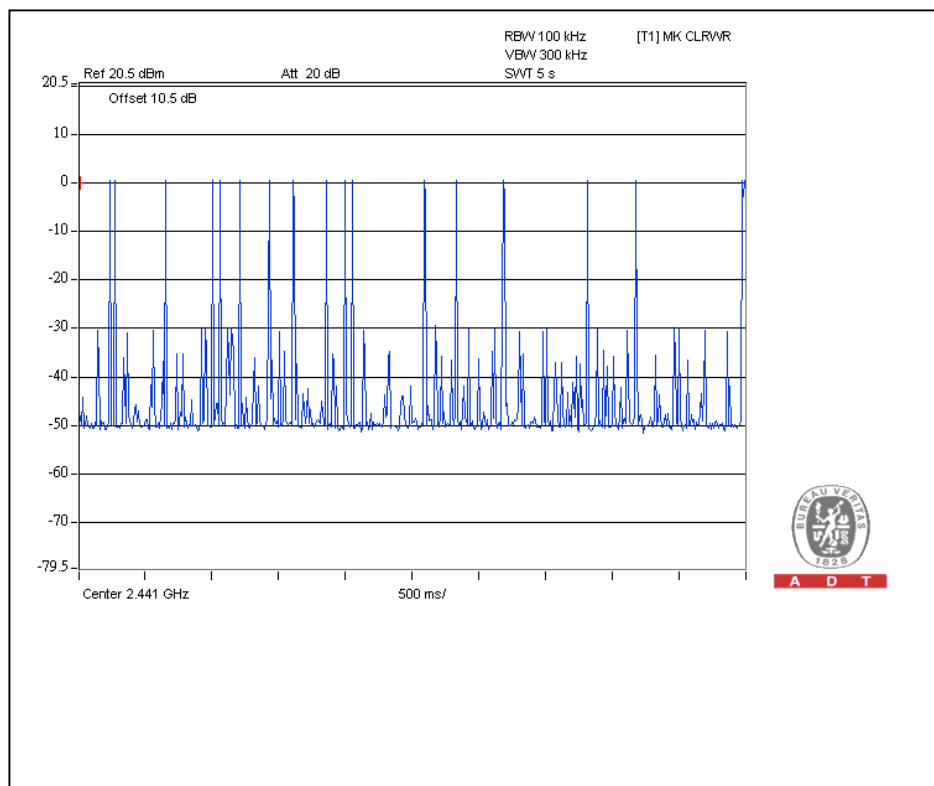
# DH3





A D T

# DH5



## 4.4 CHANNEL BANDWIDTH

### 4.4.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the two-thirds 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

### 4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

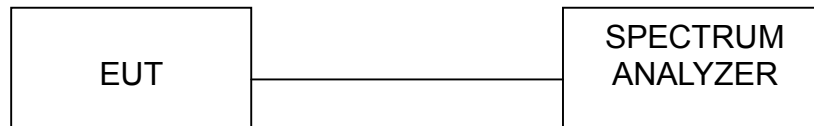
### 4.4.3 TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.4.5 TEST SETUP



#### 4.4.6 EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.



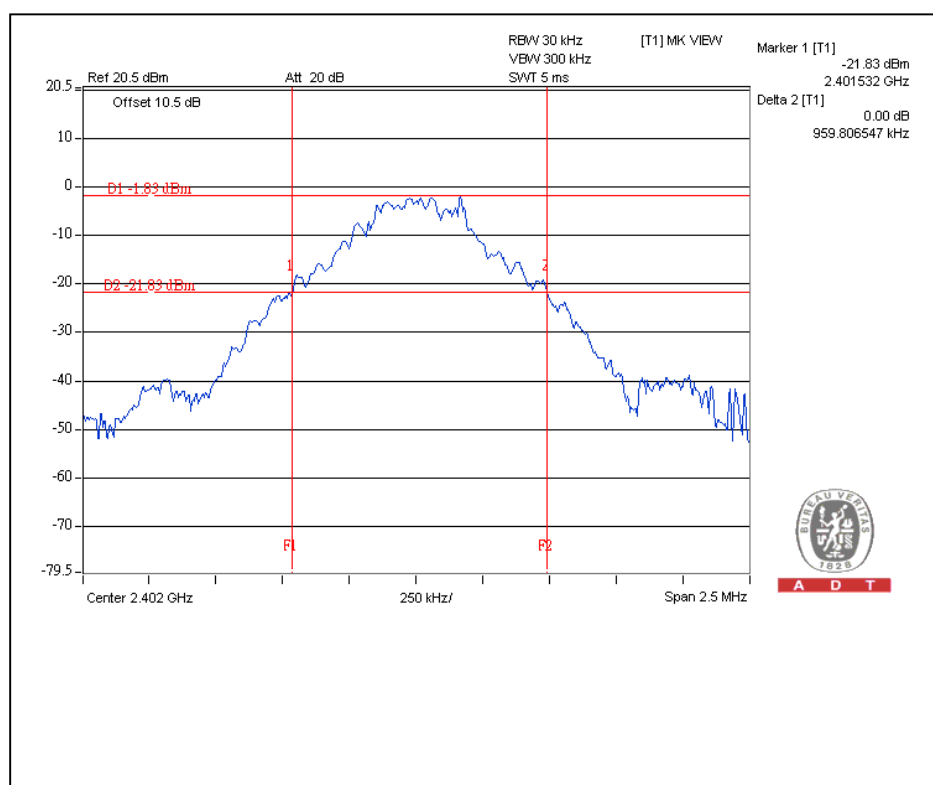
A D T

### 4.4.7 TEST RESULTS

For GFSK:

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.95
39	2441	0.94
78	2480	0.95

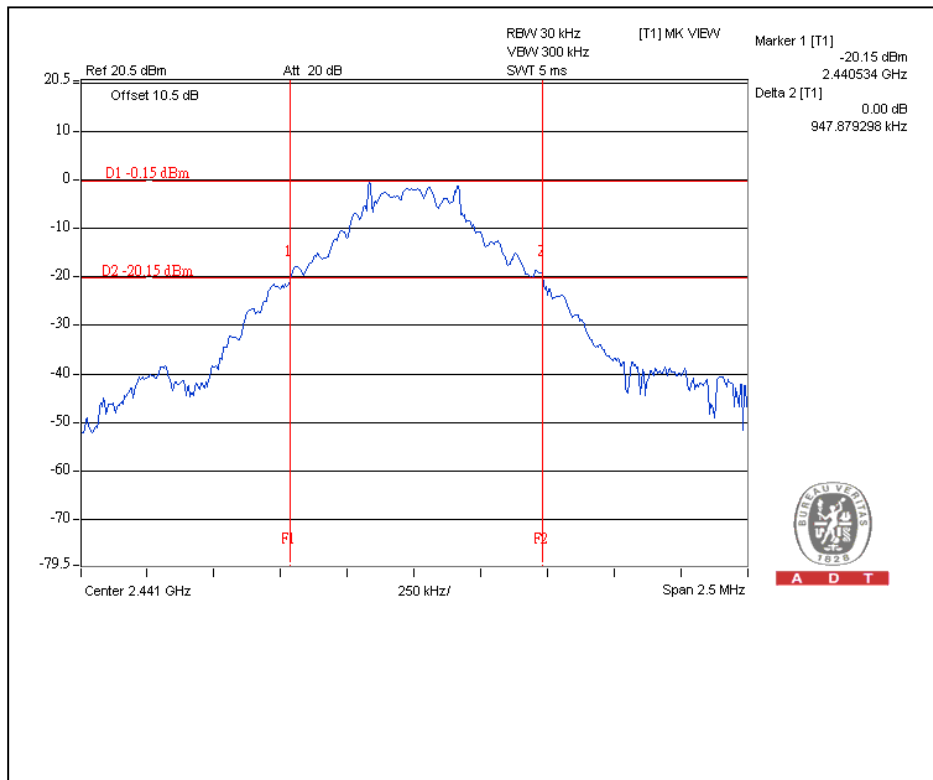
### Channel 0





A D T

### Channel 39



### Channel 78



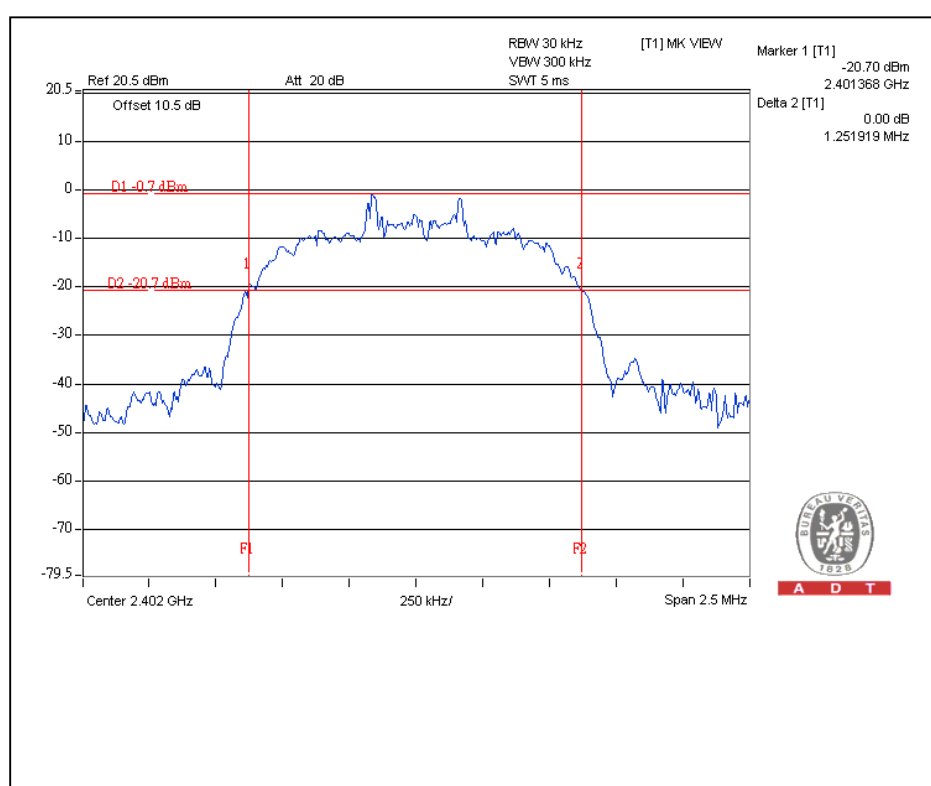


A D T

For 8DPSK:

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.25
39	2441	1.28
78	2480	1.29

### Channel 0

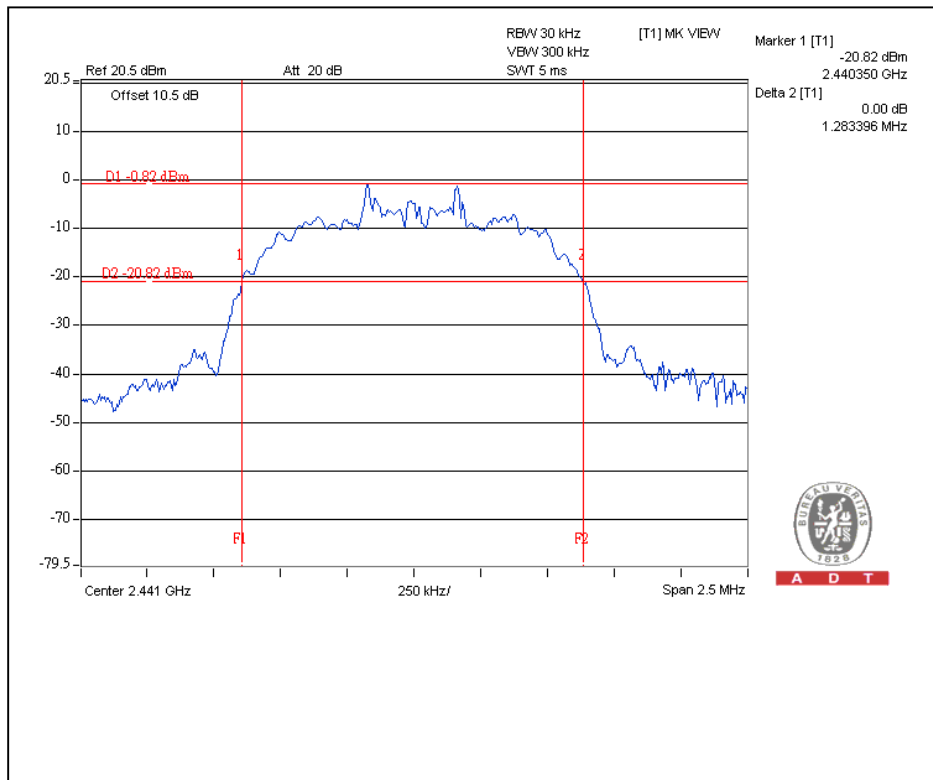




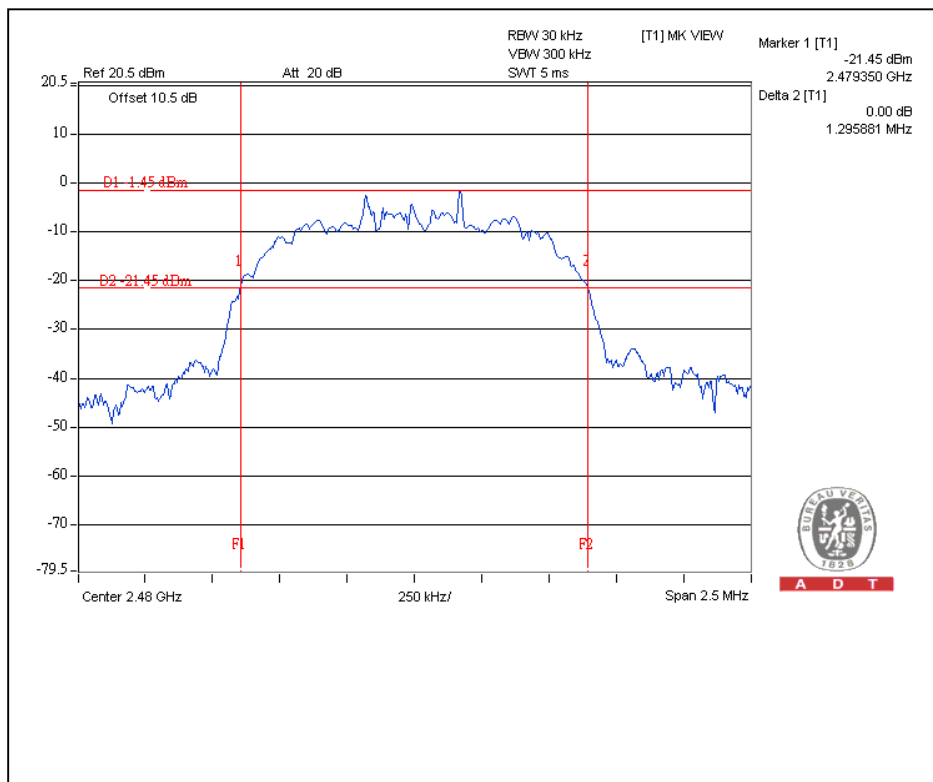


A D T

### Channel 39



### Channel 78



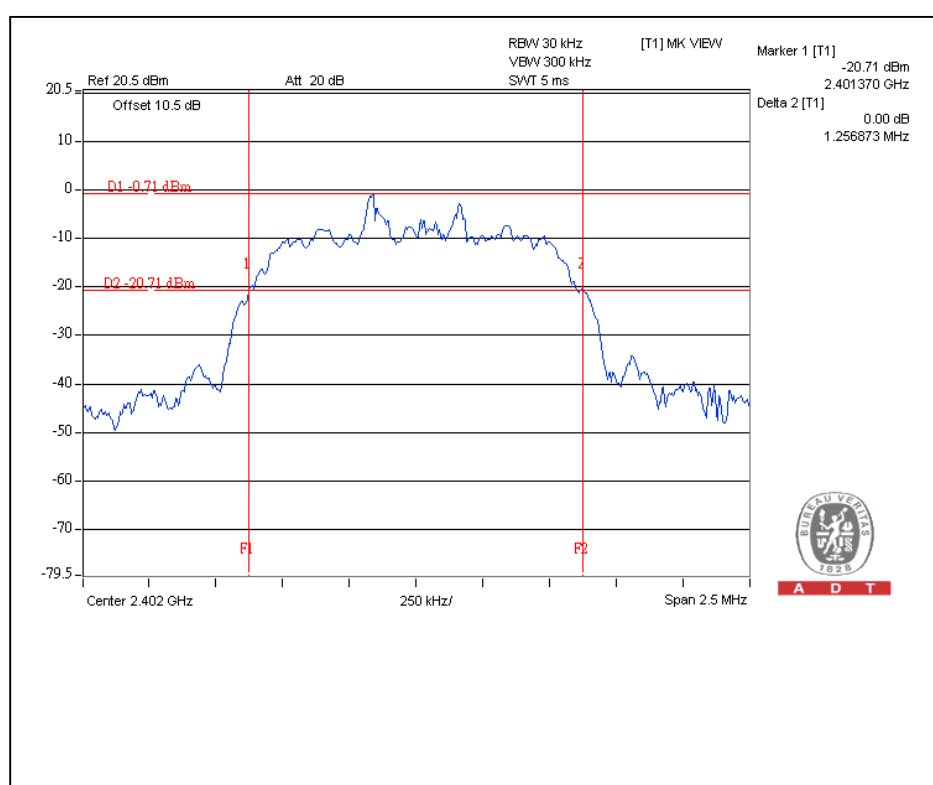


A D T

For  $\pi/4$ -DQPSK:

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.25
39	2441	1.27
78	2480	1.26

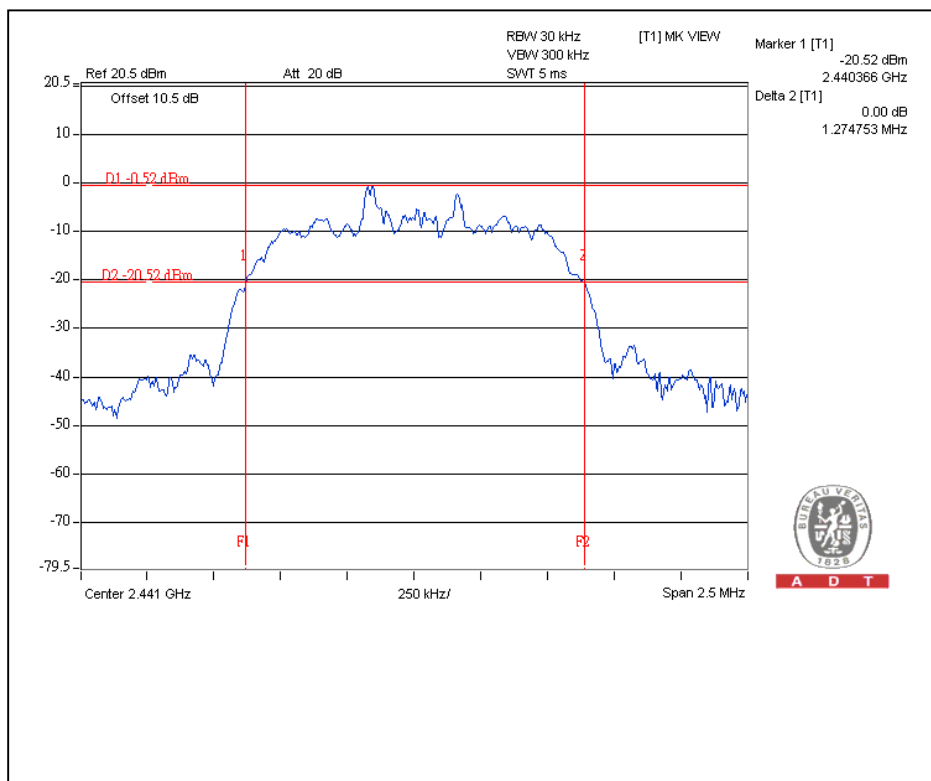
### Channel 0



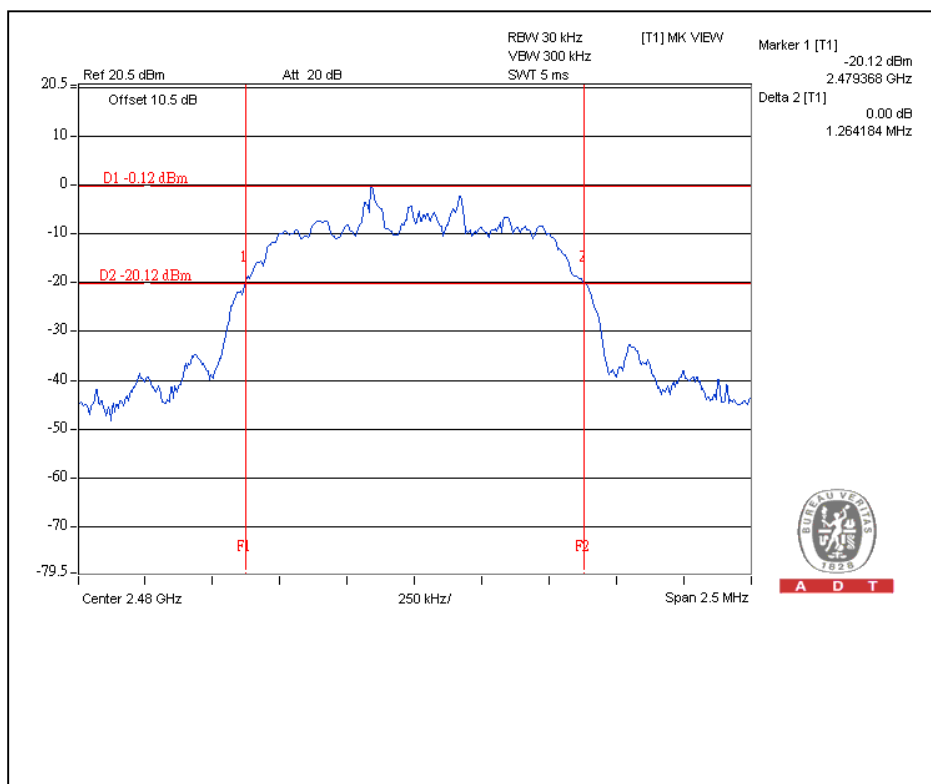


A D T

### Channel 39



### Channel 78



## 4.5 HOPPING CHANNEL SEPARATION

### 4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25 kHz or two-thirds of 20dB hopping channel bandwidth (whichever is greater).

### 4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 4.5.3 TEST PROCEDURES

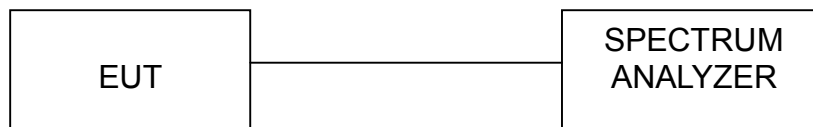
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.



#### 4.5.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.5.5 TEST SETUP





A D T

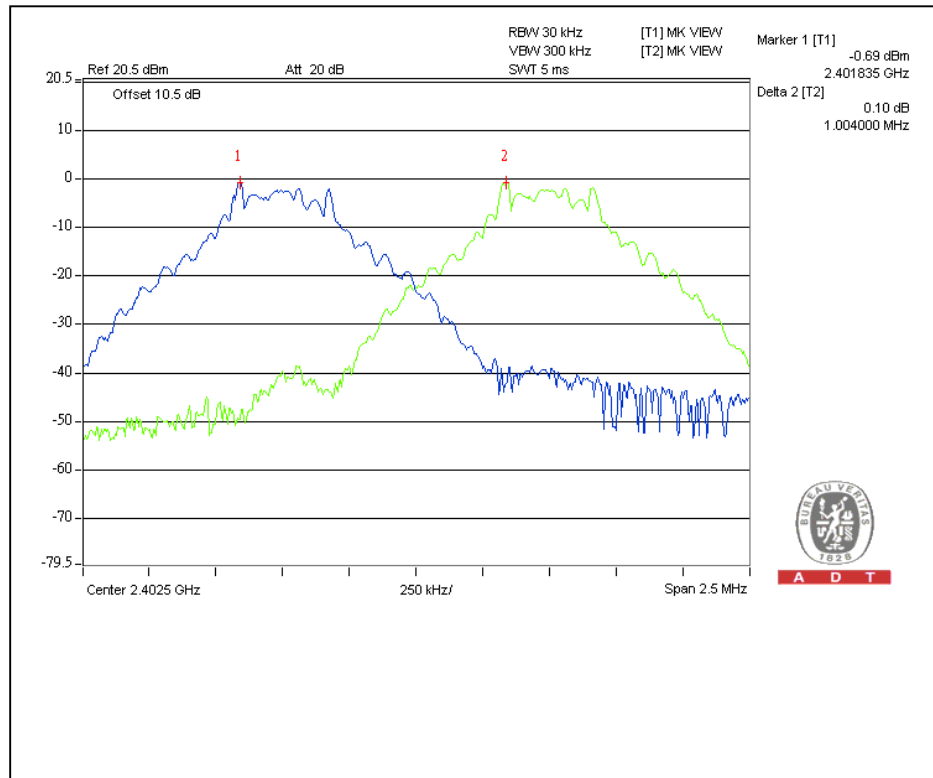
### 4.5.6 TEST RESULTS

#### For GFSK

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.004	0.633	PASS
39	2441	1.005	0.627	PASS
78	2480	1.007	0.633	PASS

The minimum limit is two-thirds of 20dB bandwidth. Test results please refer to below pages.

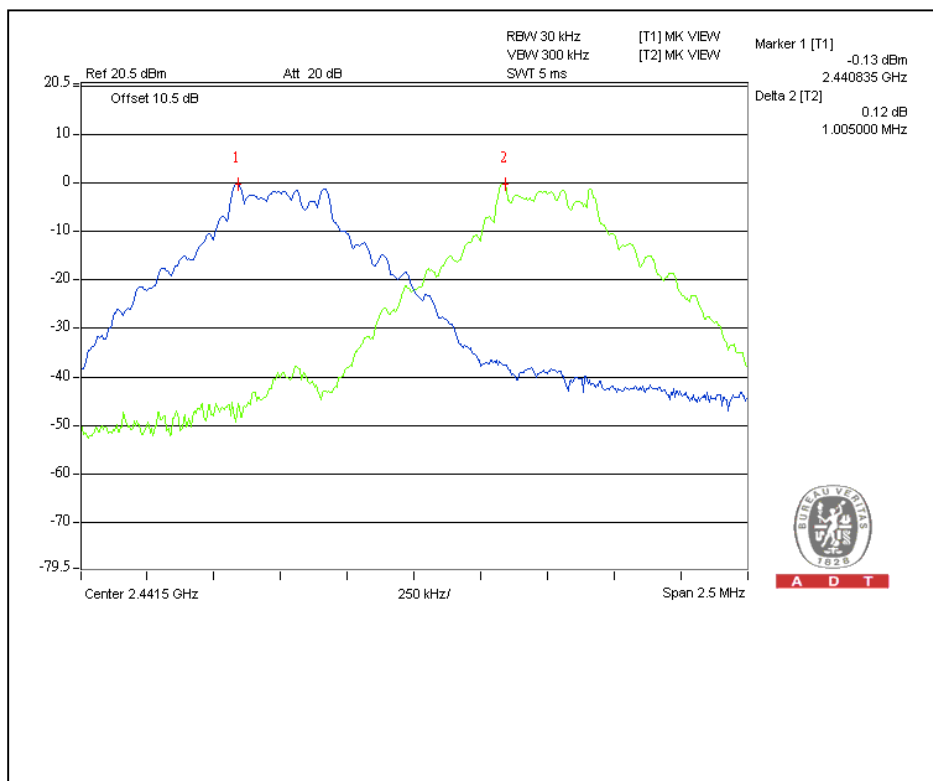
#### Channel 0



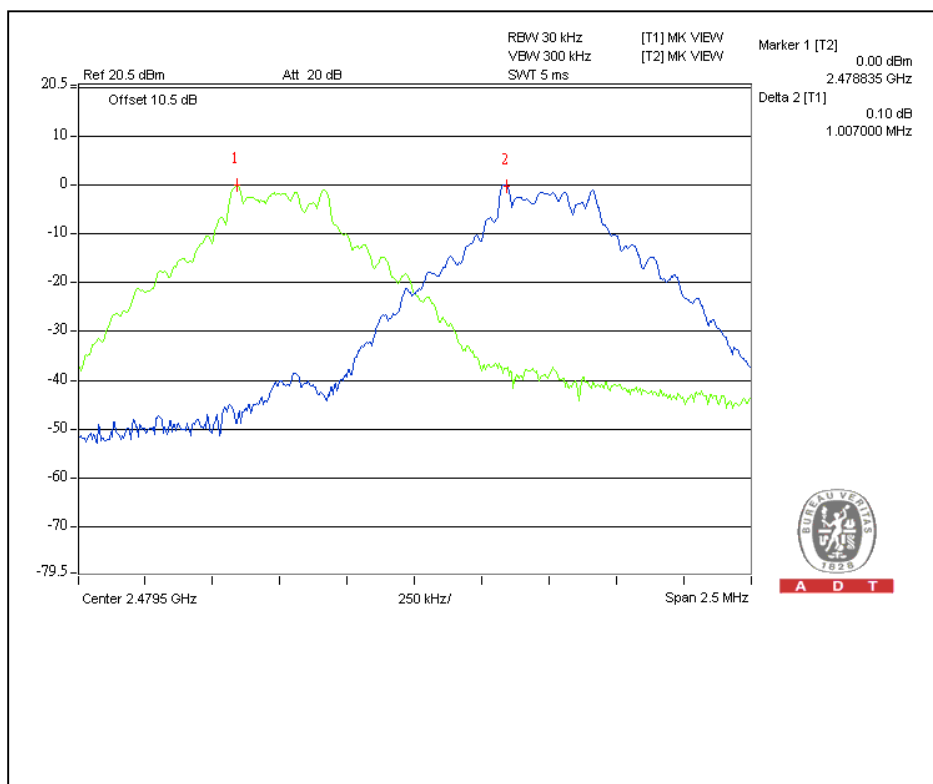


A D T

### Channel 39



### Channel 78





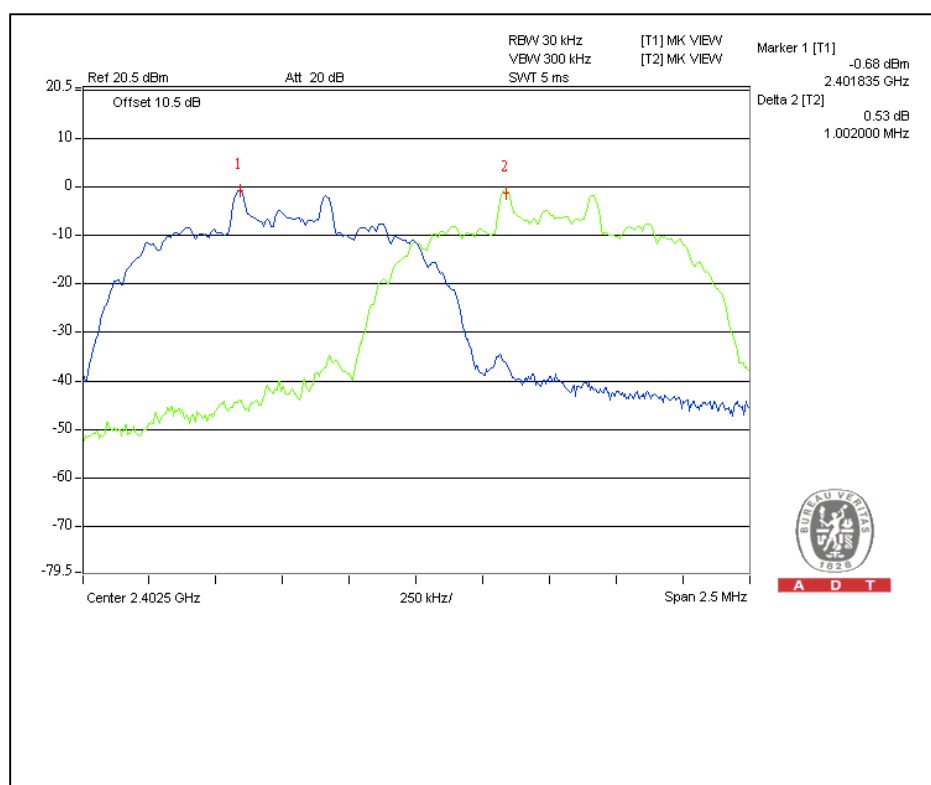
A D T

### For 8DPSK

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.002	0.833	PASS
39	2441	1.006	0.853	PASS
78	2480	1.007	0.860	PASS

The minimum limit is two-thirds of 20dB bandwidth. Test results please refer to below pages.

### Channel 0

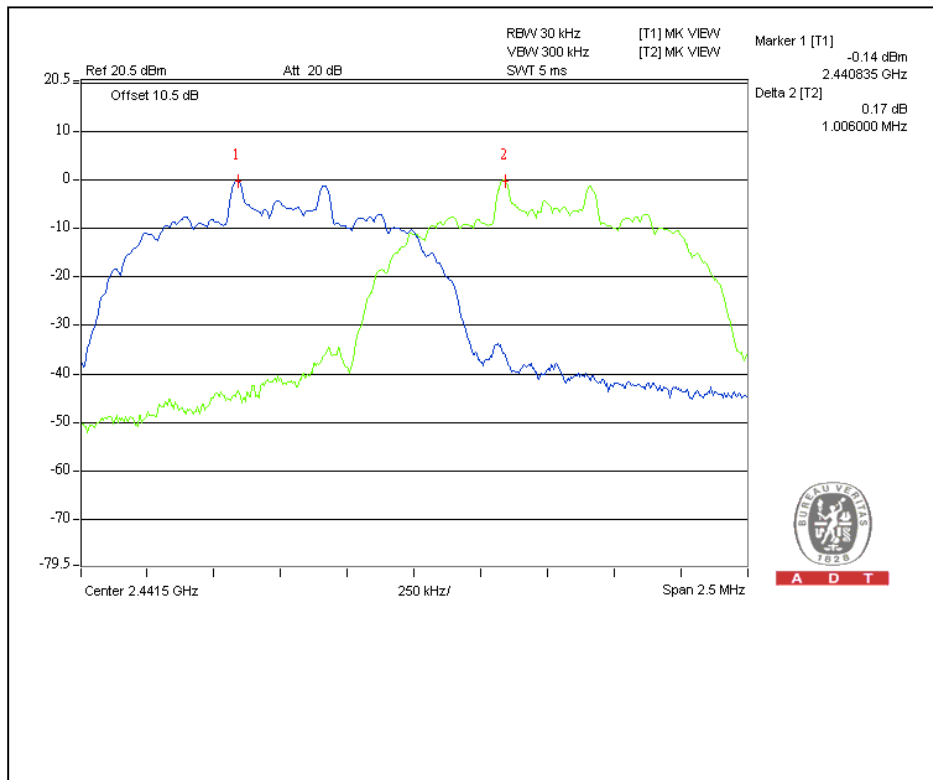




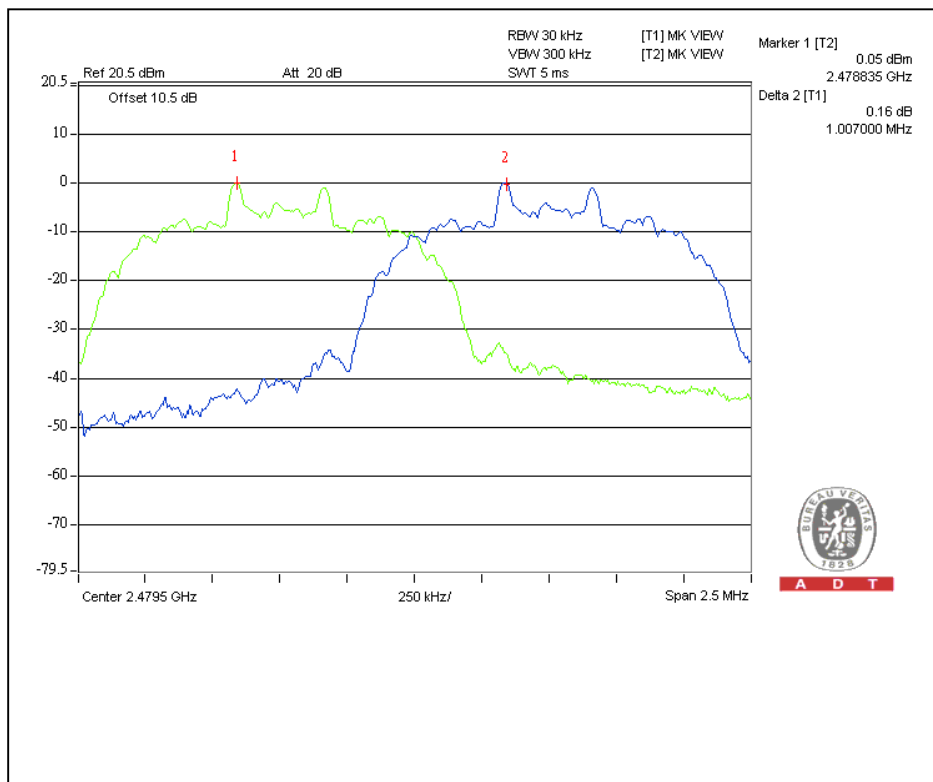


A D T

### Channel 39



### Channel 78





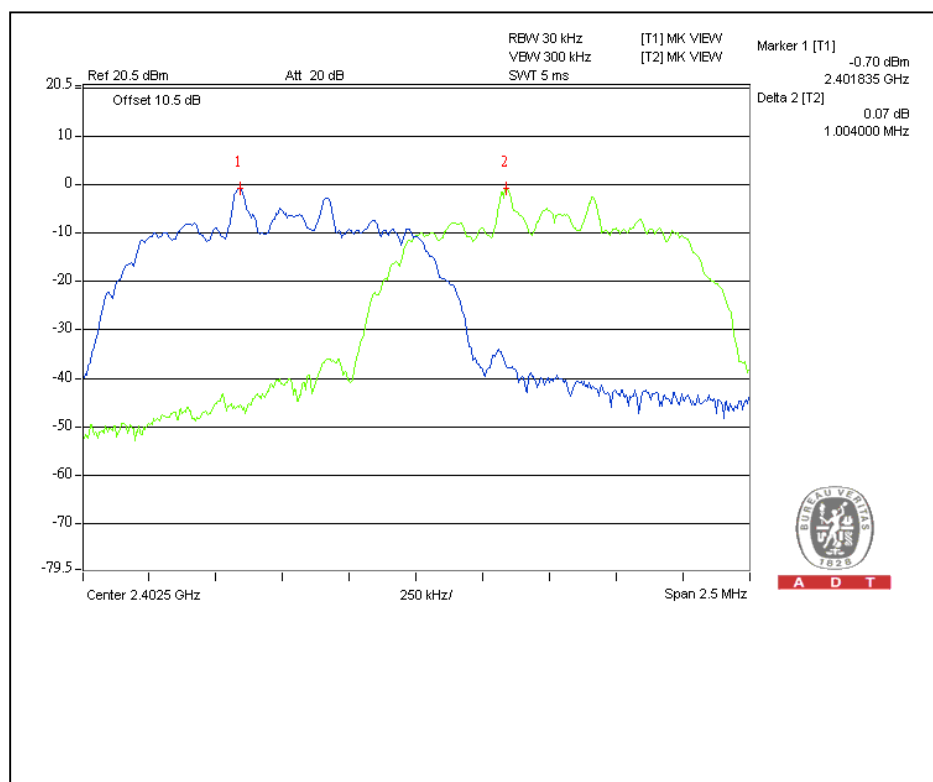
A D T

### For $\pi/4$ -DQPSK

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.004	0.833	PASS
39	2441	1.003	0.847	PASS
78	2480	1.003	0.840	PASS

The minimum limit is two-thirds of 20dB bandwidth. Test results please refer to below pages.

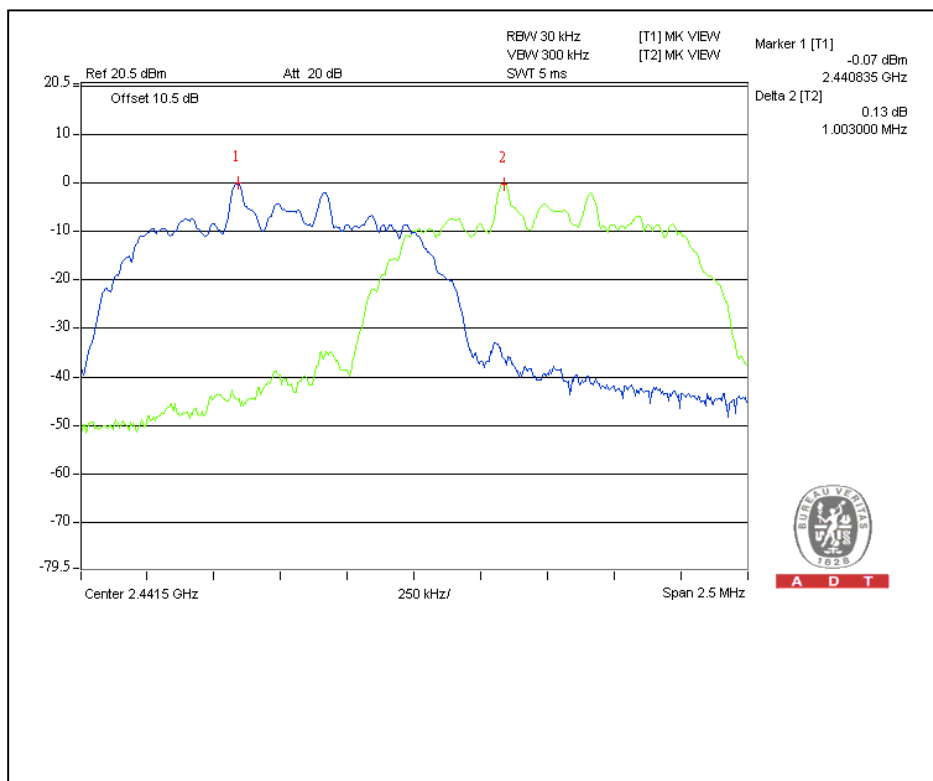
### Channel 0



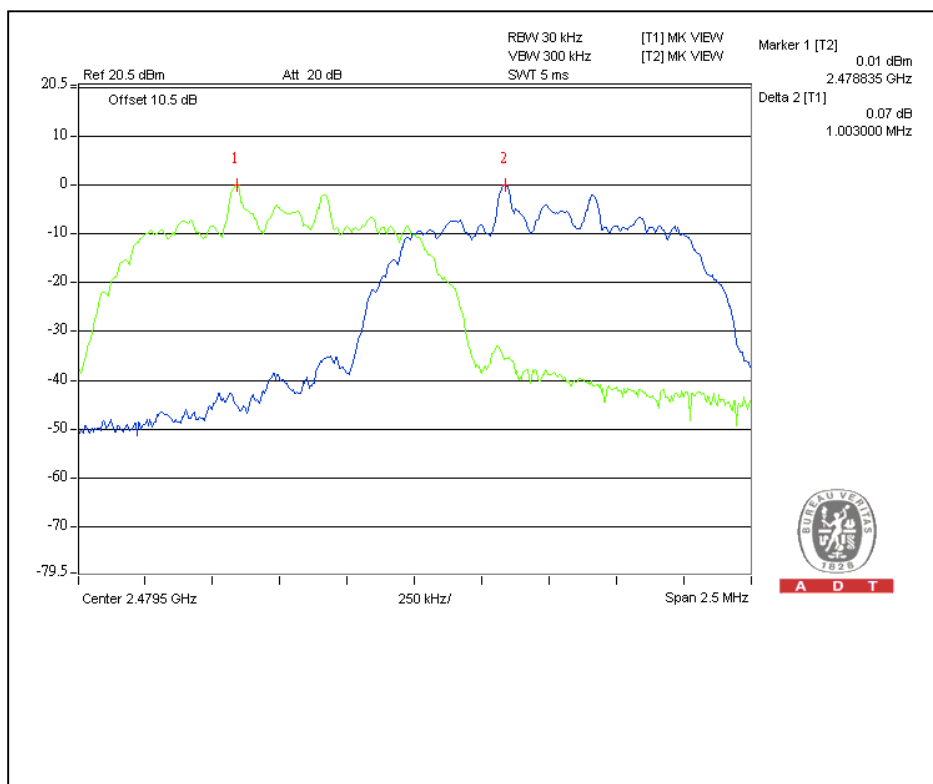


A D T

### Channel 39



### Channel 78



## 4.6 MAXIMUM PEAK OUTPUT POWER

### 4.6.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Limit is 125mW.

### 4.6.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

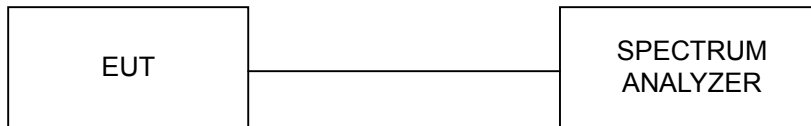
### 4.6.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 10 MHz VBW.
4. Measure the captured power within the band and recording the plot.
5. Repeat above procedures until all frequencies measured were complete.

### 4.6.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.6.5 TEST SETUP



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

#### 4.6.6 EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.



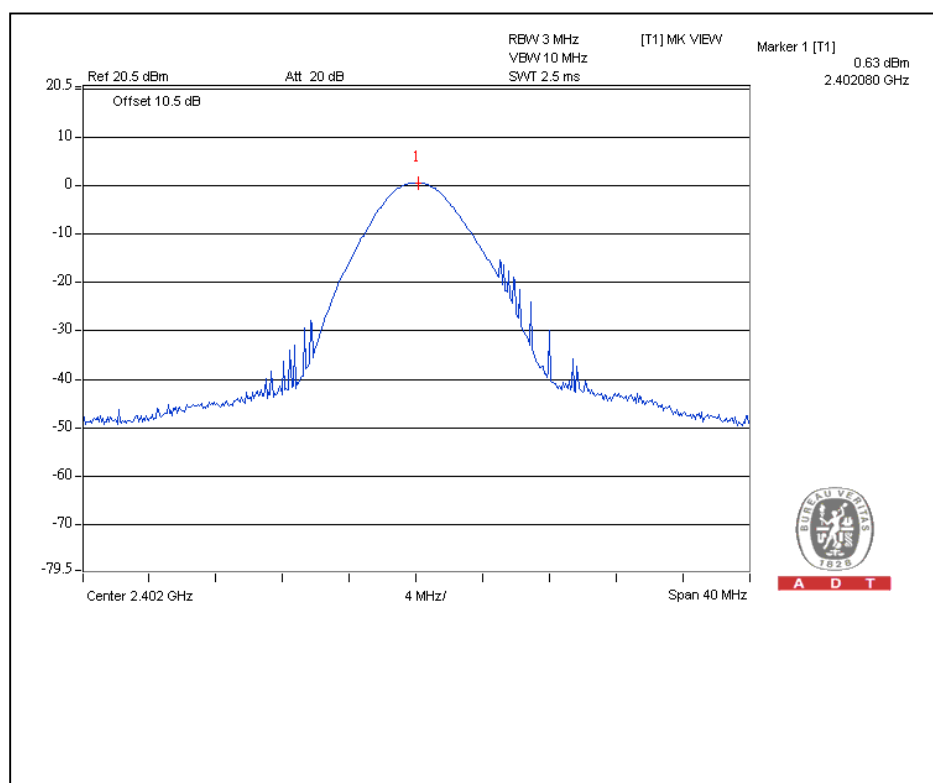
A D T

#### 4.6.7 TEST RESULTS

##### For GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	1.10	0.6	125	PASS
39	2441	1.30	1.2	125	PASS
78	2480	1.30	1.3	125	PASS

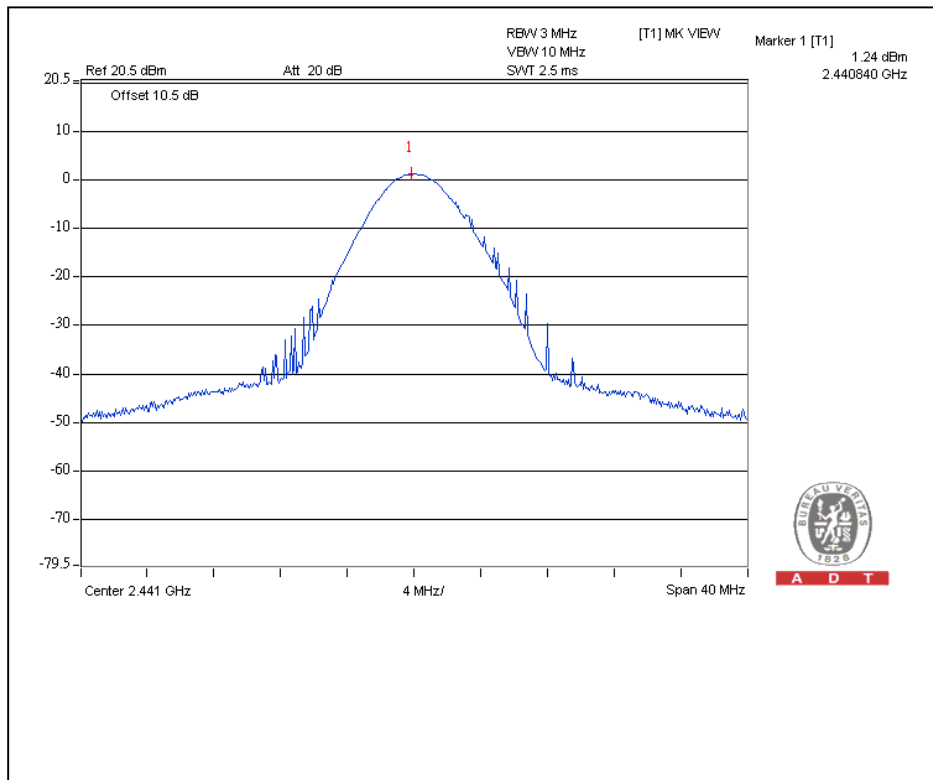
##### Channel 0



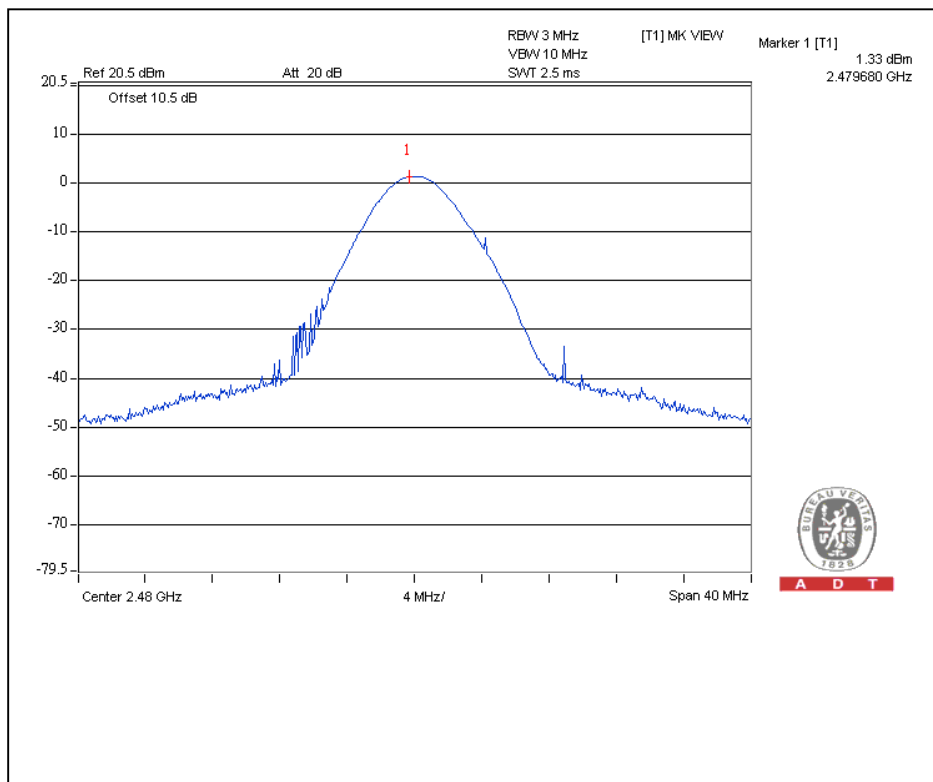


A D T

### Channel 39



### Channel 78



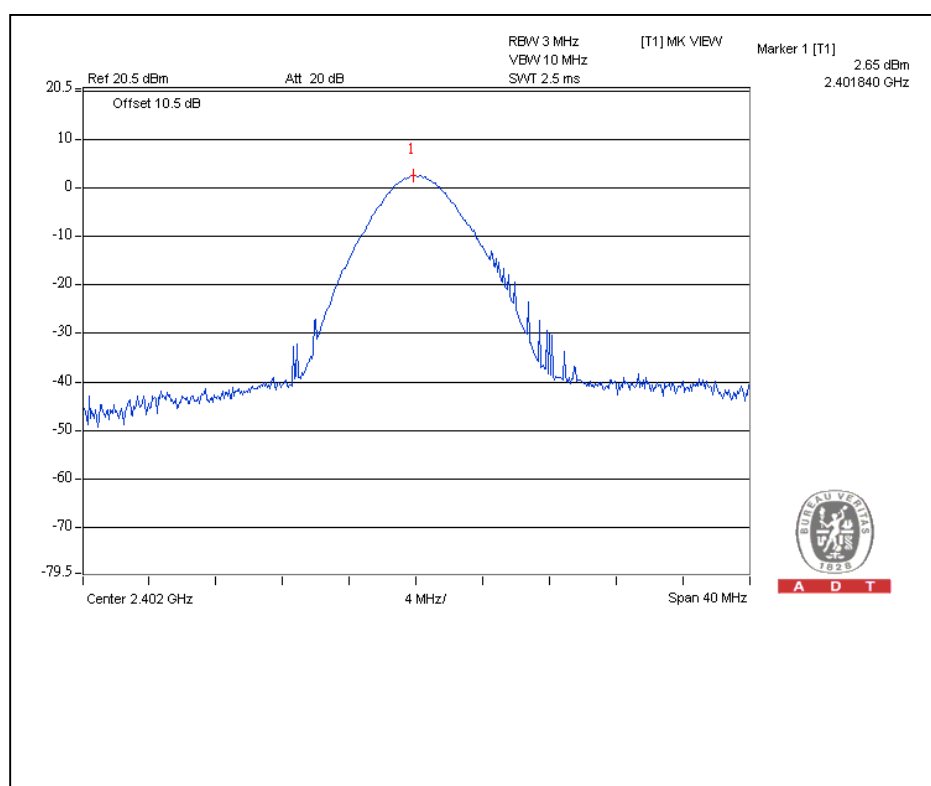


A D T

### For 8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	1.9	2.7	125	PASS
39	2441	2.1	3.3	125	PASS
78	2480	2.2	3.5	125	PASS

### Channel 0

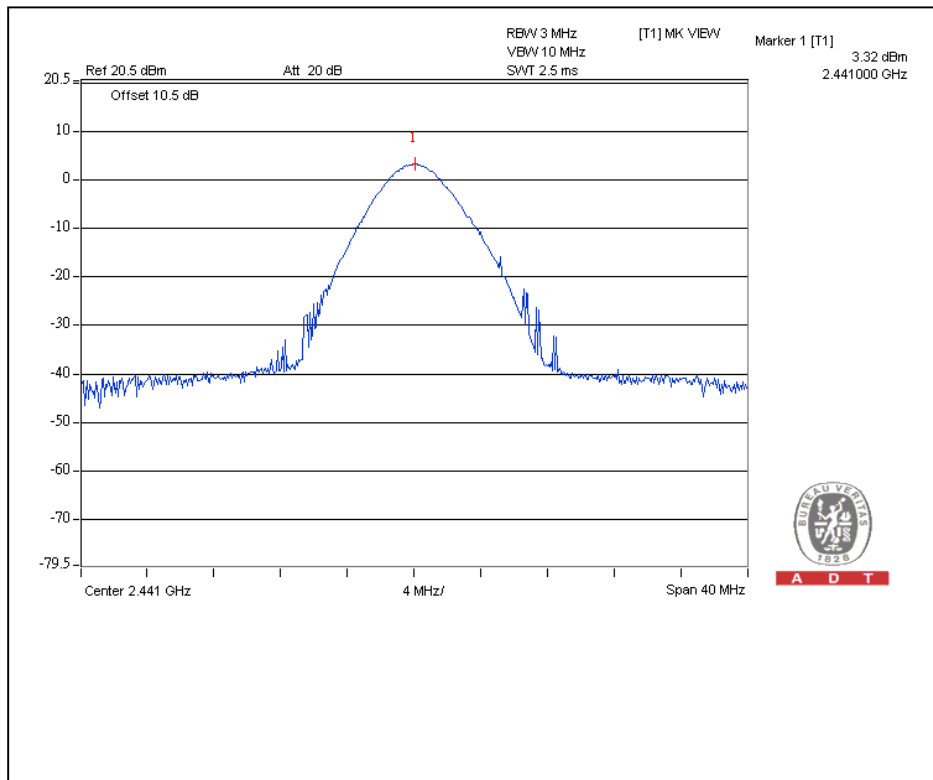




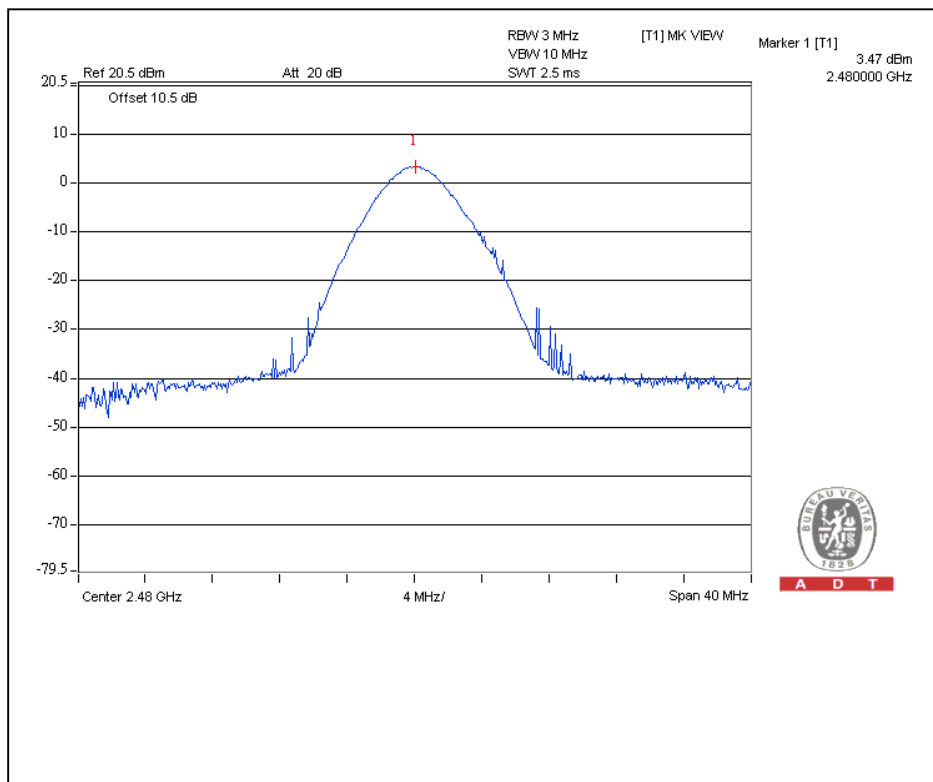


A D T

### Channel 39



### Channel 78



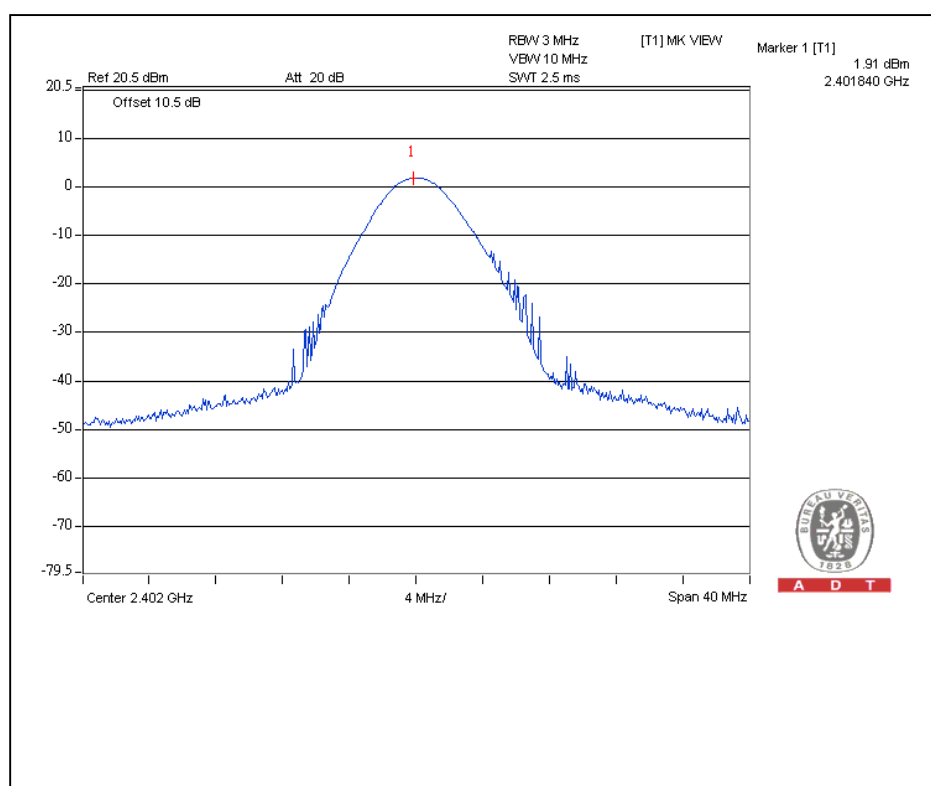


A D T

### For $\pi/4$ -DQPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (mW)	PASS/FAIL
0	2402	1.5	1.9	125	PASS
39	2441	1.8	2.5	125	PASS
78	2480	1.9	2.7	125	PASS

### Channel 0

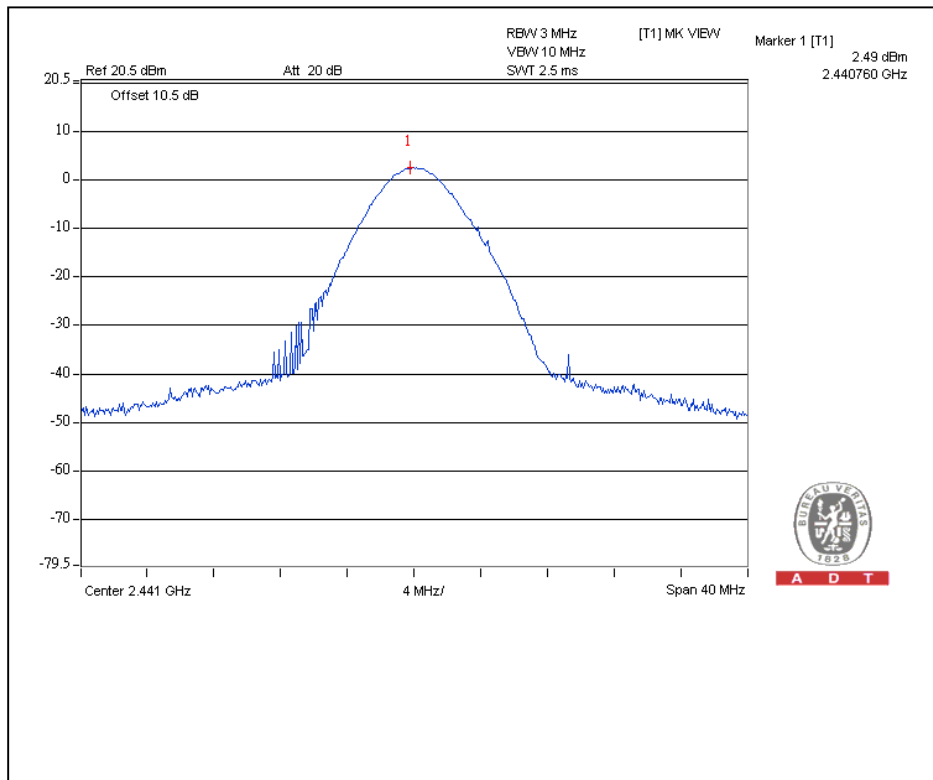


A D T

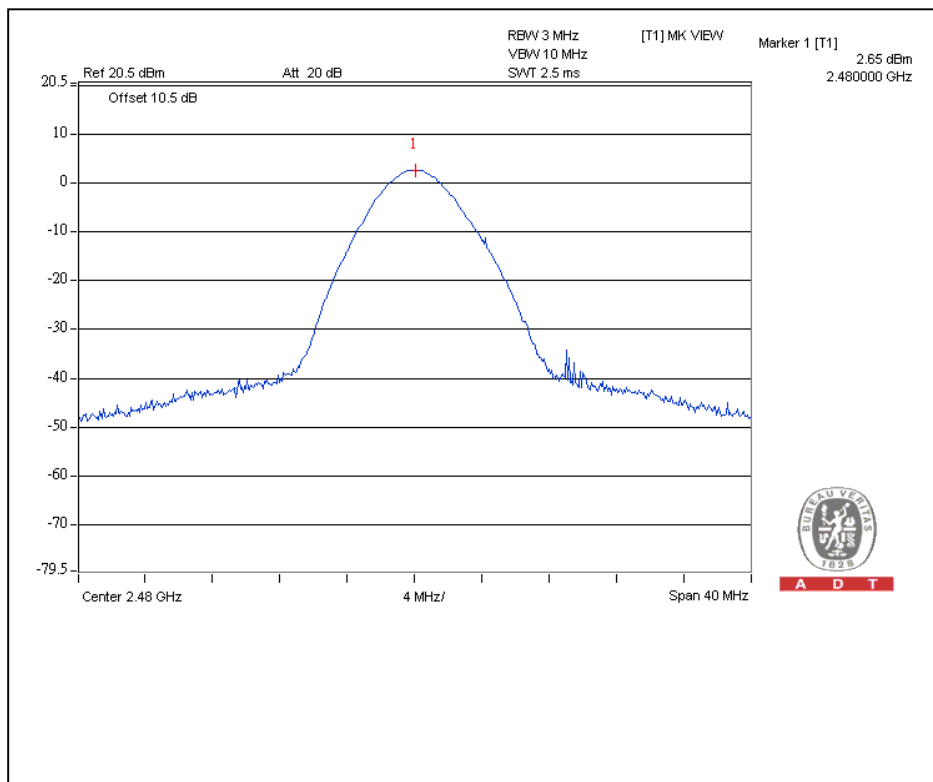


A D T

### Channel 39



### Channel 78



## 4.7 RADIATED EMISSION MEASUREMENT

### 4.7.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209(RSS-210 table 2&3) as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



A D T

#### 4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Agilent Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010
Agilent Pre-Selector	N9039A	MY46520310	Aug. 18, 2009	Aug. 17, 2010
Agilent Signal Generator	N5181A	MY49060347	July 18, 2010	July 17, 2011
LIG NEX1 Test Receiver	ER-265	L09068005	Aug. 31, 2009	Aug. 30, 2010
Mini-Circuits Pre-Amplifier	ZFL-1000VH2B	AMP-ZFL-04	Nov. 18, 2009	Nov. 17, 2010
Agilent Pre-Amplifier	8449B	3008A02465	Mar. 01, 2010	Feb. 28, 2011
Miteq Pre-Amplifier	AFS33-1800265 0-30-8P-44	881786	NA	NA
SCHWARZBECK Trilog Broadband Antenna	VULB 9168	9168-361	Sep. 30, 2009	Sep. 29, 2010
AISI Horn_Antenna	AIH.8018	0000220091110	Nov. 16, 2009	Nov. 15, 2010
SCHWARZBECK Horn_Antenna	BBHA 9170	9170-424	Sep. 30, 2009	Sep. 29, 2010
RF CABLE	NA	RF104-205 RF104-207 RF104-208	Dec. 24, 2009	Dec. 23, 2010
RF Cable	NA	CHHCAB_001	NA	NA
Software	ADT_Radiated_V8.7.05	NA	NA	NA
CT Antenna Tower & Turn Table	NA	NA	NA	NA

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.  
3. The test was performed in 966 Chamber No. H.  
4. The FCC Site Registration No. is 797305.  
5. The CANADA Site Registration No. is IC 7450H-3.

#### 4.7.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
  - a. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

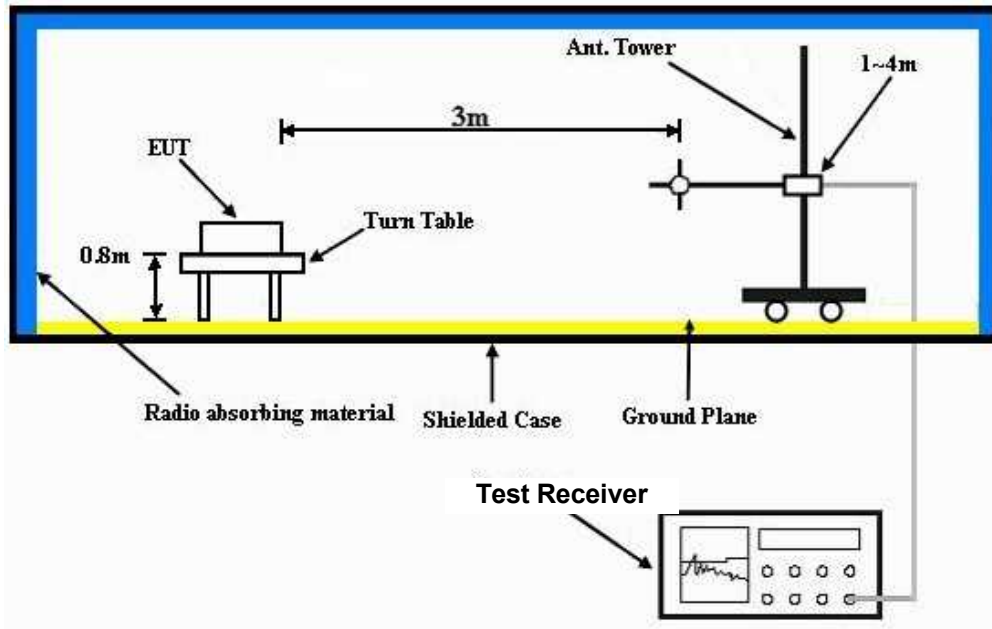
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

#### 4.7.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.7.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

#### 4.7.6 TEST RESULTS (FOR TRANSMITTER PART)

##### BELOW 1GHz WORST-CASE DATA : 8DPSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	24deg. C, 70%RH 1013 hPa	TESTED BY	Eric Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.70	33.9 QP	43.5	-9.6	1.75 H	360	23.95	9.95
2	115.00	34.0 QP	43.5	-9.5	1.50 H	358	21.93	12.07
3	133.20	34.0 QP	43.5	-9.5	2.25 H	0	20.30	13.70
4	150.00	35.0 QP	43.5	-8.5	1.50 H	360	20.70	14.30
5	<b>166.43</b>	<b>41.7 QP</b>	<b>43.5</b>	<b>-1.8</b>	<b>1.75 H</b>	<b>220</b>	<b>27.69</b>	<b>14.01</b>
6	200.00	37.2 QP	43.5	-6.3	1.25 H	0	25.99	11.21
7	248.20	40.0 QP	46.0	-6.0	1.25 H	281	27.11	12.89
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.80	37.7 QP	40.0	-2.3	1.00 V	291	24.19	13.51
2	100.00	26.7 QP	43.5	-16.8	1.00 V	28	16.74	9.96
3	149.83	33.3 QP	43.5	-10.2	1.25 V	360	19.00	14.30
4	167.00	35.0 QP	43.5	-8.5	2.25 V	312	21.02	13.98
5	248.90	33.9 QP	46.0	-12.1	1.00 V	217	20.99	12.91
6	365.36	31.8 QP	46.0	-14.2	1.75 V	360	14.93	16.89

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.





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**ABOVE 1GHz WORST-CASE DATA :**

**GFSK MODULATION**

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	58.0 PK	74.0	-16.0	1.76 H	112	26.79	31.21
2	2390.00	45.0 AV	54.0	-9.0	1.76 H	112	13.79	31.21
3	*2402.00	102.6 PK			1.75 H	112	71.35	31.25
4	*2402.00	64.9 AV			1.75 H	112	33.65	31.25
5	4804.00	53.4 PK	74.0	-20.6	1.00 H	193	14.05	39.35
6	4804.00	37.6 AV	54.0	-16.4	1.00 H	193	-1.75	39.35

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.1 PK	74.0	-17.9	1.07 V	54	24.89	31.21
2	2390.00	44.5 AV	54.0	-9.5	1.07 V	54	13.29	31.21
3	*2402.00	97.1 PK			1.07 V	58	65.85	31.25
4	*2402.00	59.6 AV			1.07 V	58	28.35	31.25
5	4804.00	55.0 PK	74.0	-19.0	1.00 V	129	15.65	39.35
6	4804.00	38.6 AV	54.0	-15.4	1.00 V	129	-0.75	39.35

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	101.6 PK			1.69 H	113	70.25	31.35
2	*2441.00	64.0 AV			1.69 H	113	32.65	31.35
3	4882.00	51.3 PK	74.0	-22.7	1.02 H	291	11.65	39.65
4	4882.00	37.9 AV	54.0	-16.1	1.02 H	291	-1.75	39.65
5	7323.00	53.9 PK	74.0	-20.1	1.01 H	32	9.78	44.12
6	7323.00	37.5 AV	54.0	-16.5	1.01 H	32	-6.62	44.12
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	96.5 PK			1.00 V	321	65.15	31.35
2	*2441.00	59.1 AV			1.00 V	321	27.75	31.35
3	4882.00	53.9 PK	74.0	-20.1	1.02 V	121	14.25	39.65
4	4882.00	38.5 AV	54.0	-15.5	1.02 V	121	-1.15	39.65
5	7323.00	53.4 PK	74.0	-20.6	1.28 V	244	9.28	44.12
6	7323.00	37.2 AV	54.0	-16.8	1.28 V	244	-6.92	44.12

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	101.4 PK			1.74 H	129	69.95	31.45
2	*2480.00	63.9 AV			1.74 H	129	32.45	31.45
3	2483.50	59.3 PK	74.0	-14.7	1.74 H	129	27.84	31.46
4	2483.50	45.2 AV	54.0	-8.8	1.74 H	129	13.74	31.46
5	4960.00	50.8 PK	74.0	-23.2	1.04 H	283	10.83	39.97
6	4960.00	37.8 AV	54.0	-16.2	1.04 H	283	-2.17	39.97
7	7440.00	53.2 PK	74.0	-20.8	1.01 H	64	8.96	44.24
8	7440.00	37.6 AV	54.0	-16.4	1.01 H	64	-6.64	44.24

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	96.3 PK			1.14 V	342	64.85	31.45
2	*2480.00	59.3 AV			1.14 V	342	27.85	31.45
3	2483.50	56.8 PK	74.0	-17.2	1.15 V	342	25.34	31.46
4	2483.50	44.9 AV	54.0	-9.1	1.15 V	342	13.44	31.46
5	4960.00	53.2 PK	74.0	-20.8	1.00 V	360	13.23	39.97
6	4960.00	38.1 AV	54.0	-15.9	1.00 V	360	-1.87	39.97
7	7440.00	53.6 PK	74.0	-20.4	1.27 V	251	9.36	44.24
8	7440.00	37.4 AV	54.0	-16.6	1.27 V	251	-6.84	44.24

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.

## 8DPSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.4 PK	74.0	-16.6	1.87 H	46	26.19	31.21
2	2390.00	44.5 AV	54.0	-9.5	1.87 H	46	13.29	31.21
3	*2402.00	102.3 PK			1.87 H	46	71.05	31.25
4	*2402.00	63.7 AV			1.87 H	46	32.45	31.25
5	4804.00	55.1 PK	74.0	-18.9	1.05 H	12	15.75	39.35
6	4804.00	38.2 AV	54.0	-15.8	1.05 H	12	-1.15	39.35
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.2 PK	74.0	-17.8	1.08 V	57	24.99	31.21
2	2390.00	44.1 AV	54.0	-9.9	1.08 V	57	12.89	31.21
3	*2402.00	97.8 PK			1.08 V	57	66.55	31.25
4	*2402.00	59.1 AV			1.08 V	57	27.85	31.25
5	4804.00	54.4 PK	74.0	-19.6	1.00 V	231	15.05	39.35
6	4804.00	37.9 AV	54.0	-16.1	1.00 V	231	-1.45	39.35

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* ”: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	102.4 PK			1.82 H	54	71.05	31.35
2	*2441.00	63.9 AV			1.82 H	54	32.55	31.35
3	4882.00	52.1 PK	74.0	-21.9	1.17 H	136	12.45	39.65
4	4882.00	37.3 AV	54.0	-16.7	1.17 H	136	-2.35	39.65
5	7323.00	54.2 PK	74.0	-19.8	1.03 H	23	10.08	44.12
6	7323.00	37.3 AV	54.0	-16.7	1.03 H	23	-6.82	44.12
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2441.00	97.2 PK			1.07 V	49	65.85	31.35
2	*2441.00	58.6 AV			1.07 V	49	27.25	31.35
3	4882.00	51.4 PK	74.0	-22.6	1.01 V	242	11.75	39.65
4	4882.00	36.8 AV	54.0	-17.2	1.01 V	242	-2.85	39.65
5	7323.00	54.2 PK	74.0	-19.8	1.07 V	109	10.08	44.12
6	7323.00	37.4 AV	54.0	-16.6	1.07 V	109	-6.72	44.12

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	102.1 PK			1.84 H	59	70.65	31.45
2	*2480.00	63.7 AV			1.84 H	59	32.25	31.45
3	2483.50	58.7 PK	74.0	-15.3	1.83 H	49	27.24	31.46
4	2483.50	45.1 AV	54.0	-8.9	1.83 H	49	13.64	31.46
5	4960.00	51.4 PK	74.0	-22.6	1.21 H	26	11.43	39.97
6	4960.00	36.9 AV	54.0	-17.1	1.21 H	26	-3.07	39.97
7	7440.00	53.1 PK	74.0	-20.9	1.02 H	47	8.86	44.24
8	7440.00	37.4 AV	54.0	-16.6	1.02 H	47	-6.84	44.24

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	97.3 PK			1.08 V	53	65.85	31.45
2	*2480.00	58.8 AV			1.08 V	53	27.35	31.45
3	2483.50	56.6 PK	74.0	-17.4	1.08 V	53	25.14	31.46
4	2483.50	44.9 AV	54.0	-9.1	1.08 V	53	13.44	31.46
5	4960.00	50.2 PK	74.0	-23.8	1.04 V	249	10.23	39.97
6	4960.00	36.1 AV	54.0	-17.9	1.04 V	249	-3.87	39.97
7	7440.00	53.7 PK	74.0	-20.3	1.06 V	107	9.46	44.24
8	7440.00	37.2 AV	54.0	-16.8	1.06 V	107	-7.04	44.24

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. “ \* “: Fundamental frequency.



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### 4.7.7 TEST RESULTS (FOR RECEIVER PART)

#### BELOW 1GHz WORST-CASE DATA :

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	24deg. C, 70%RH 1013 hPa	TESTED BY	Eric Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.70	33.9 QP	43.5	-9.6	1.75 H	360	23.95	9.95
2	115.00	34.0 QP	43.5	-9.5	1.50 H	358	21.93	12.07
3	133.20	34.0 QP	43.5	-9.5	2.25 H	0	20.30	13.70
4	150.00	35.0 QP	43.5	-8.5	1.50 H	360	20.70	14.30
5	166.43	41.7 QP	43.5	-1.8	1.75 H	220	27.69	14.01
6	200.00	37.2 QP	43.5	-6.3	1.25 H	0	25.99	11.21
7	248.20	40.0 QP	46.0	-6.0	1.25 H	281	27.11	12.89
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.80	37.7 QP	40.0	-2.3	1.00 V	291	24.19	13.51
2	100.00	26.7 QP	43.5	-16.8	1.00 V	28	16.74	9.96
3	149.83	33.3 QP	43.5	-10.2	1.25 V	360	19.00	14.30
4	167.00	35.0 QP	43.5	-8.5	2.25 V	312	21.02	13.98
5	248.90	33.9 QP	46.0	-12.1	1.00 V	217	20.99	12.91
6	365.36	31.8 QP	46.0	-14.2	1.75 V	360	14.93	16.89

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.



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ABOVE 1GHz WORST-CASE DATA :

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 7.5GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	3480.00	50.6 PK	74.0	-23.4	1.00 H	159	16.49	34.11
2	3480.00	41.9 AV	54.0	-12.1	1.00 H	159	7.79	34.11
3	6405.33	54.2 PK	74.0	-19.8	1.00 H	134	11.98	42.22
4	6405.33	43.6 AV	54.0	-10.4	1.00 H	134	1.38	42.22
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	3480.00	50.3 PK	74.0	-23.7	1.00 V	330	16.19	34.11
2	3480.00	41.8 AV	54.0	-12.2	1.00 V	330	7.69	34.11
3	6405.33	54.0 PK	74.0	-20.0	1.00 V	124	11.78	42.22
4	6405.33	43.4 AV	54.0	-10.6	1.00 V	124	1.18	42.22

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.





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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 7.5GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	3480.00	51.6 PK	74.0	-22.4	1.04 H	157	17.49	34.11
2	3480.00	42.1 AV	54.0	-11.9	1.04 H	157	7.99	34.11
3	6509.30	54.3 PK	74.0	-19.7	1.00 H	124	11.93	42.37
4	6509.30	43.9 AV	54.0	-10.1	1.00 H	124	1.53	42.37
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	3480.00	50.1 PK	74.0	-23.9	1.00 V	321	15.99	34.11
2	3480.00	41.6 AV	54.0	-12.4	1.00 V	321	7.49	34.11
3	6509.30	54.1 PK	74.0	-19.9	1.00 V	113	11.73	42.37
4	6509.30	43.7 AV	54.0	-10.3	1.00 V	113	1.33	42.37

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 7.5GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 70%RH 1013 hPa	TESTED BY	Frank Liu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	3480.00	52.1 PK	74.0	-21.9	1.01 H	129	17.99	34.11
2	3480.00	42.4 AV	54.0	-11.6	1.01 H	129	8.29	34.11
3	6613.30	54.6 PK	74.0	-19.4	1.01 H	127	11.92	42.68
4	6613.30	44.1 AV	54.0	-9.9	1.01 H	127	1.42	42.68
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	3480.00	50.2 PK	74.0	-23.8	1.01 V	313	16.09	34.11
2	3480.00	41.7 AV	54.0	-12.3	1.01 V	313	7.59	34.11
3	6613.30	54.3 PK	74.0	-19.7	1.00 V	124	11.62	42.68
4	6613.30	43.9 AV	54.0	-10.1	1.00 V	124	1.22	42.68

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.

## 4.8 CONDUCTED OUT-BAND EMISSION MEASUREMENT

### 4.8.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz RBW).

### 4.8.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	Aug. 03, 2009	Aug. 02, 2010

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

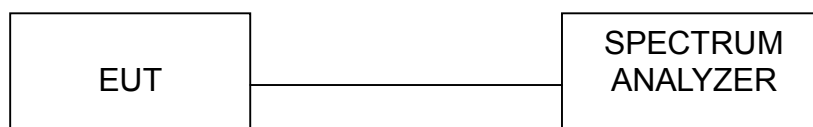
### 4.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set RBW a of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### 4.8.4 DEVIATION FROM TEST STANDARD

No deviation

### 4.8.1 TEST SETUP



### 4.8.5 EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.



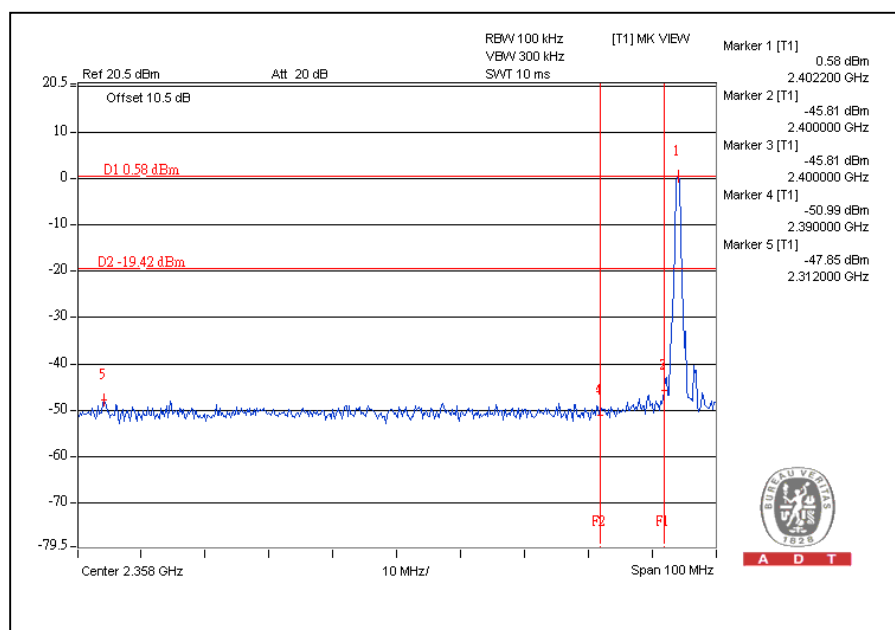
A D T

## 4.8.6 TEST RESULTS

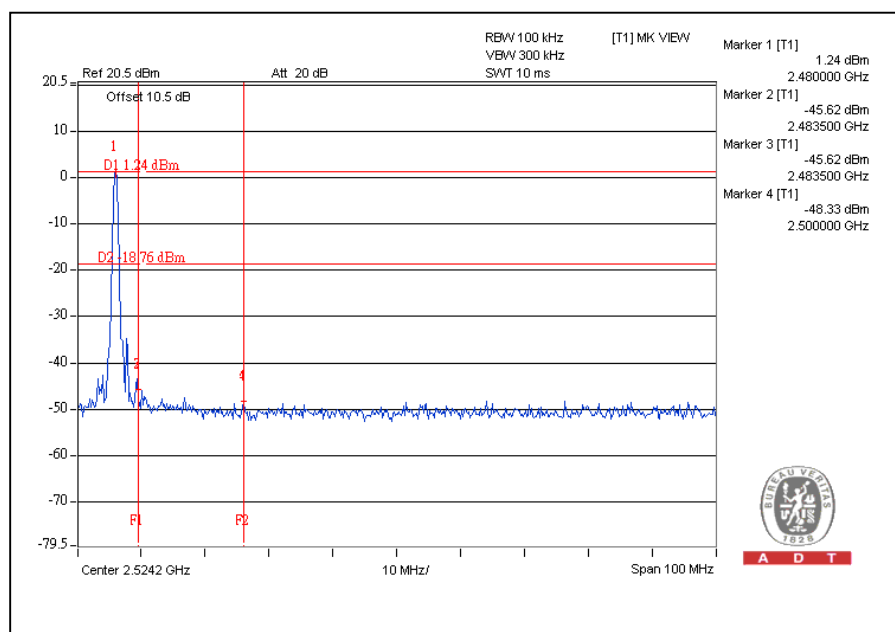
Emissions radiated outside of the specified frequency bands, please refer following pages for met the requirement of the general radiated emission limits in § 15.209.

For GFSK Modulation Type:

CH0



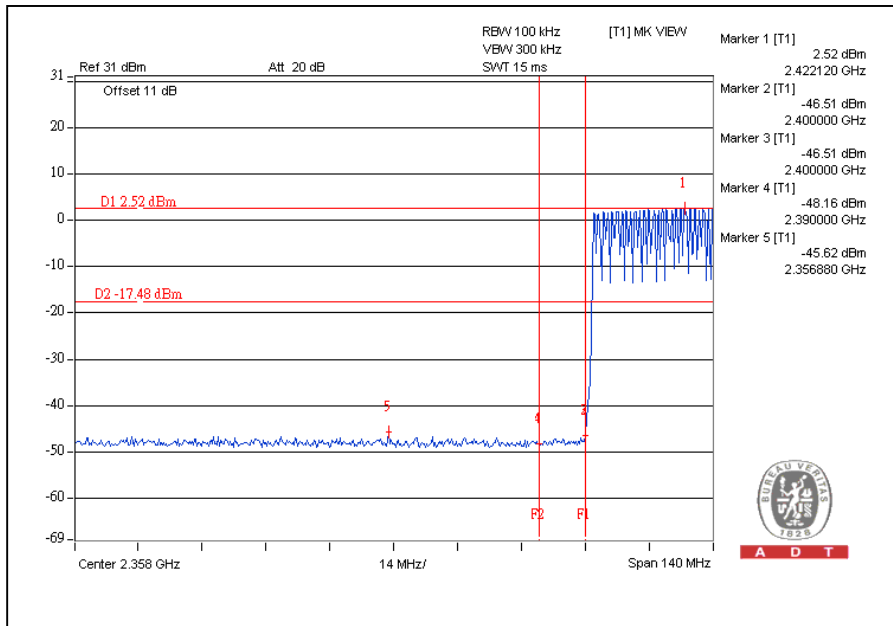
CH78



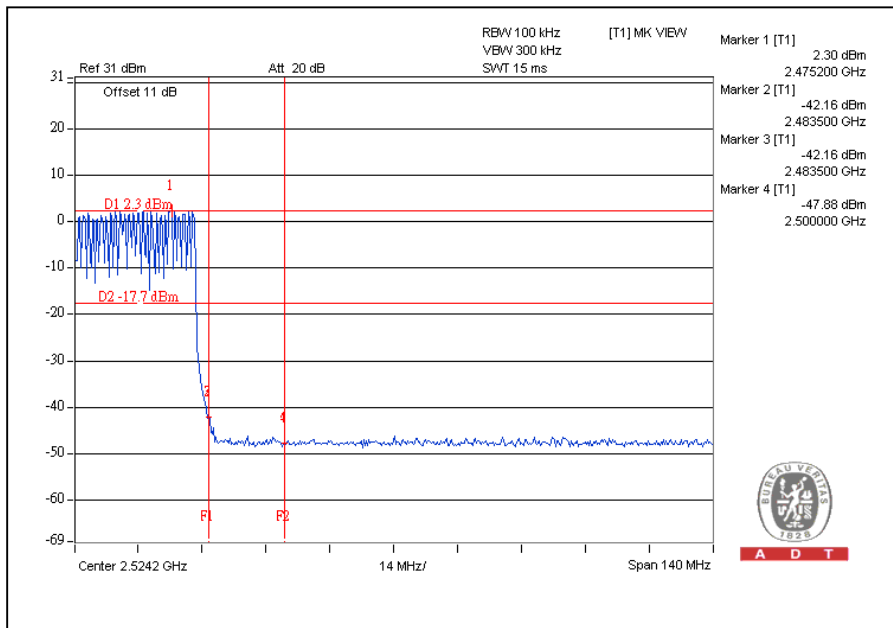


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### CH0



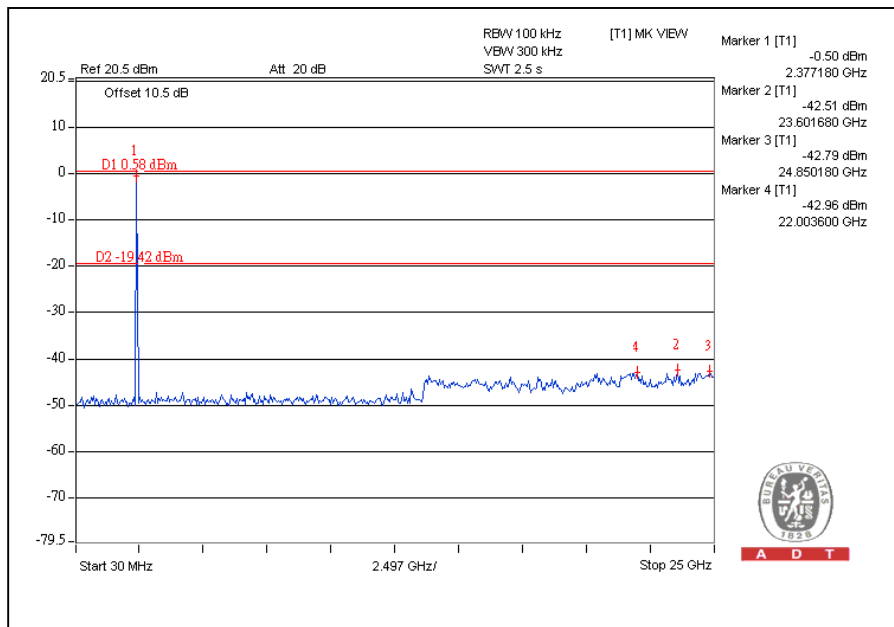
### CH78





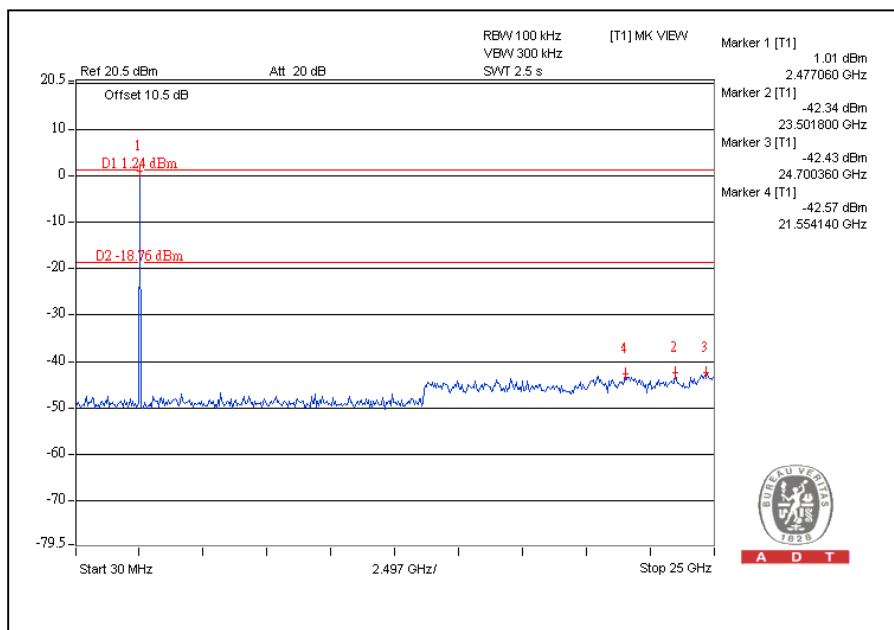
A D T

### CH0



A D T

### CH78



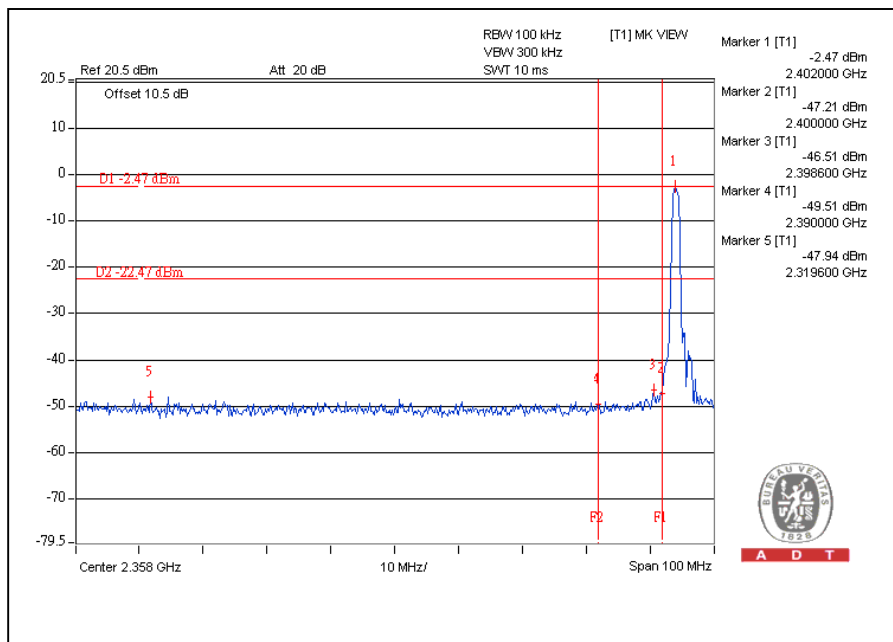
A D T



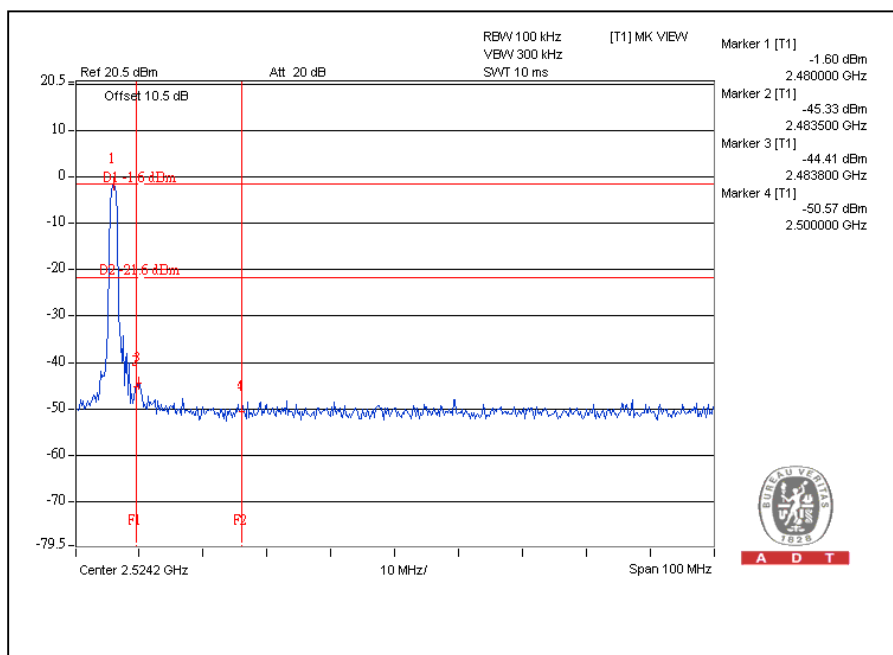
A D T

## For 8DPSK Modulation Type:

### CH0



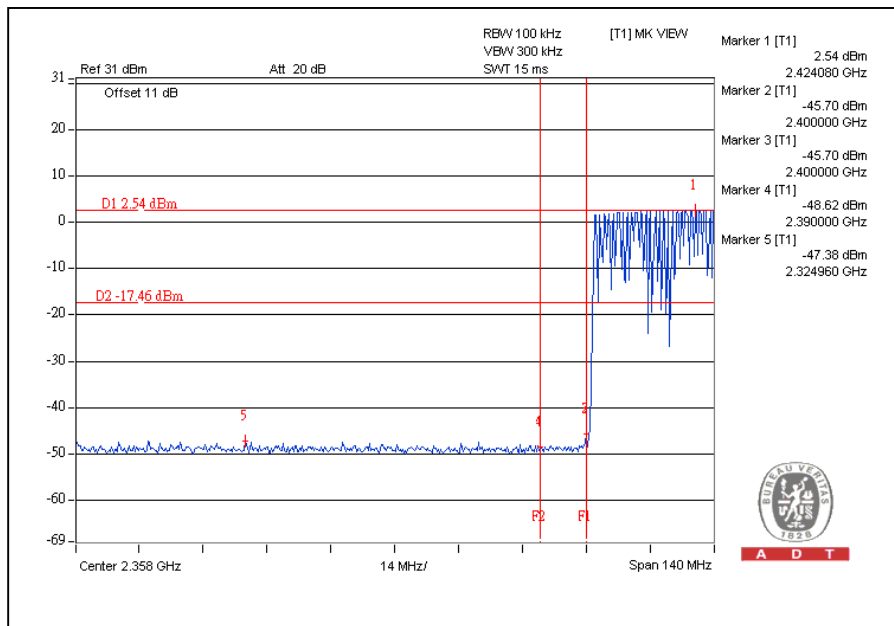
### CH78



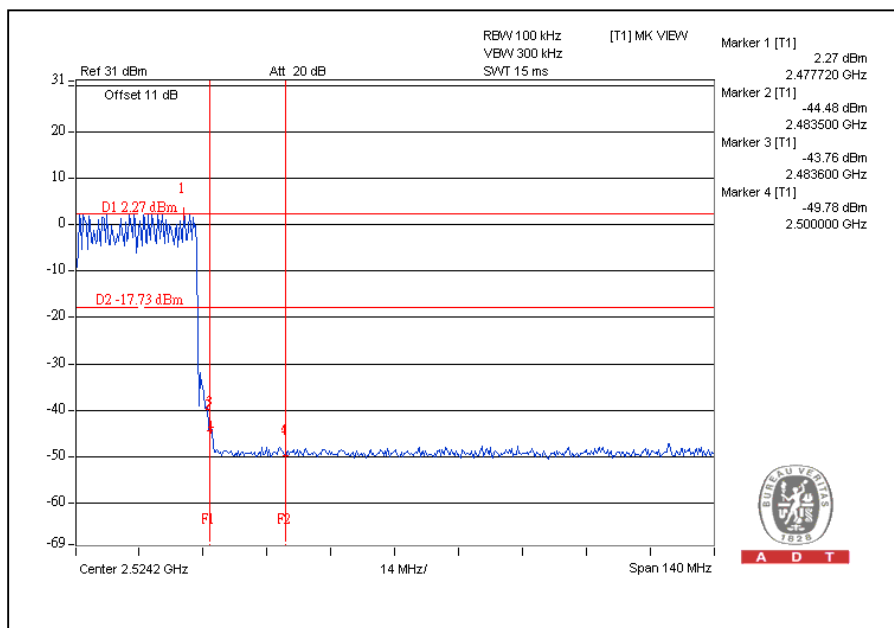


A D T

### CH0



### CH78

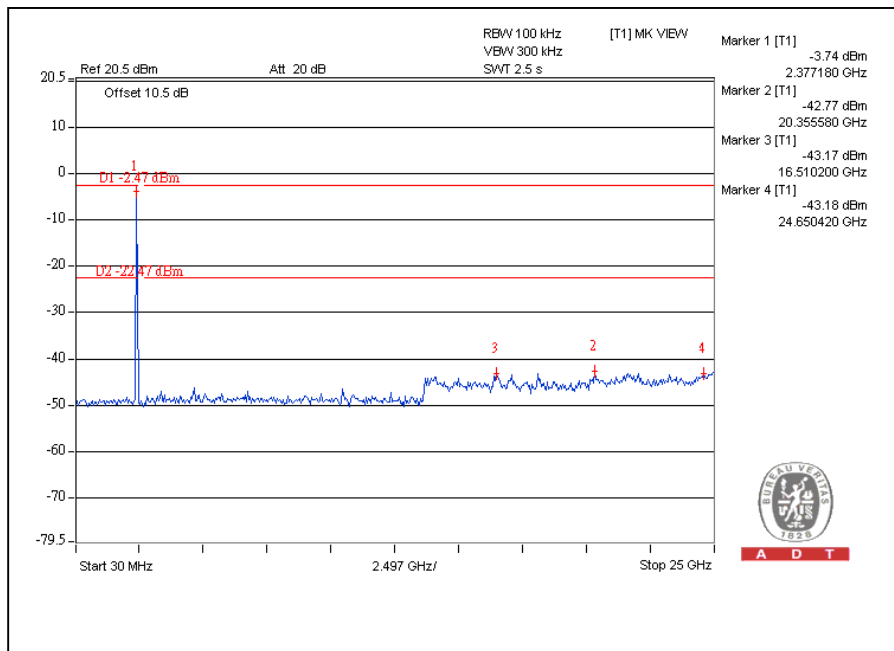




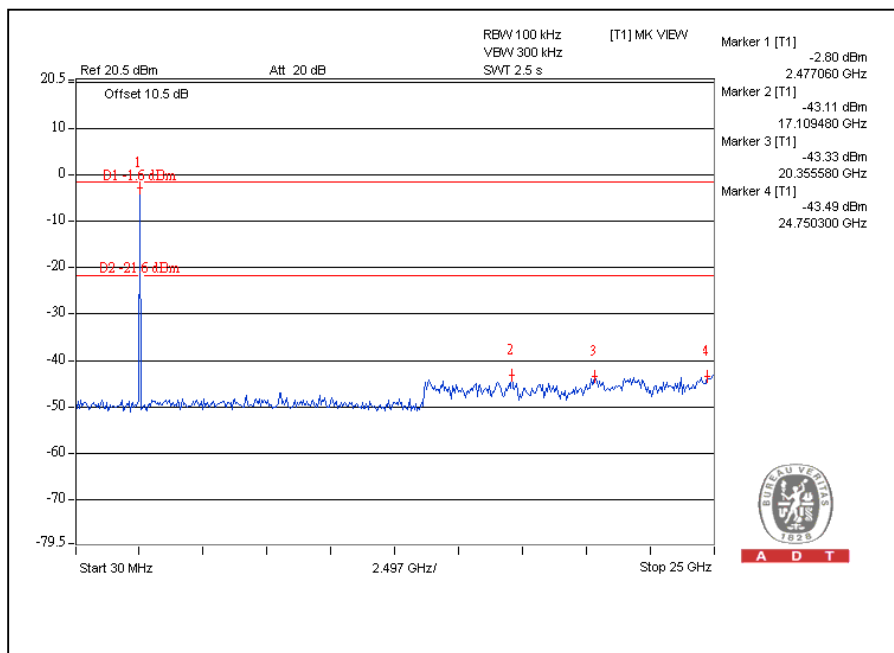


A D T

### CH0



### CH78

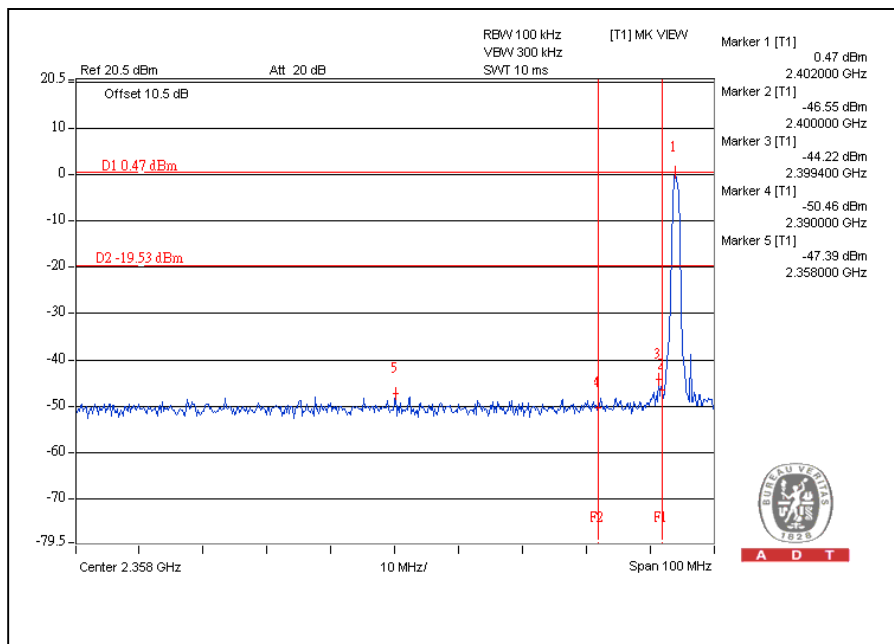




A D T

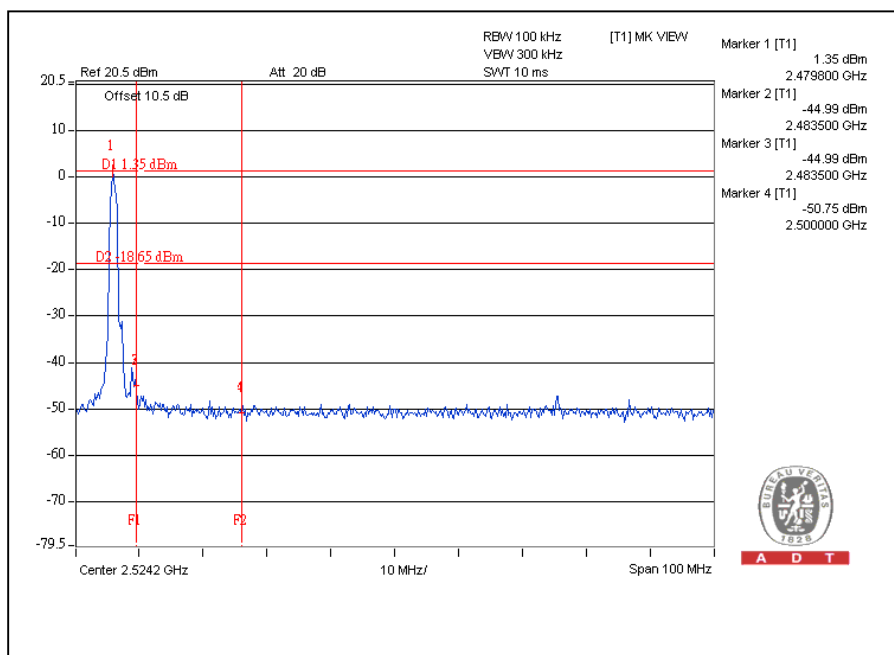
### For $\pi/4$ -DQPSK Modulation Type:

#### CH0



A D T

#### CH78

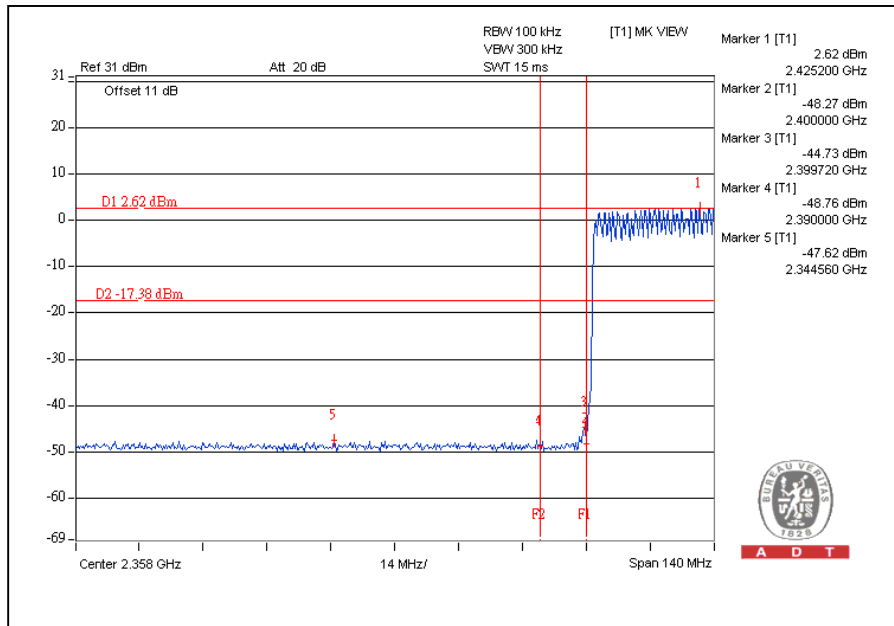


A D T

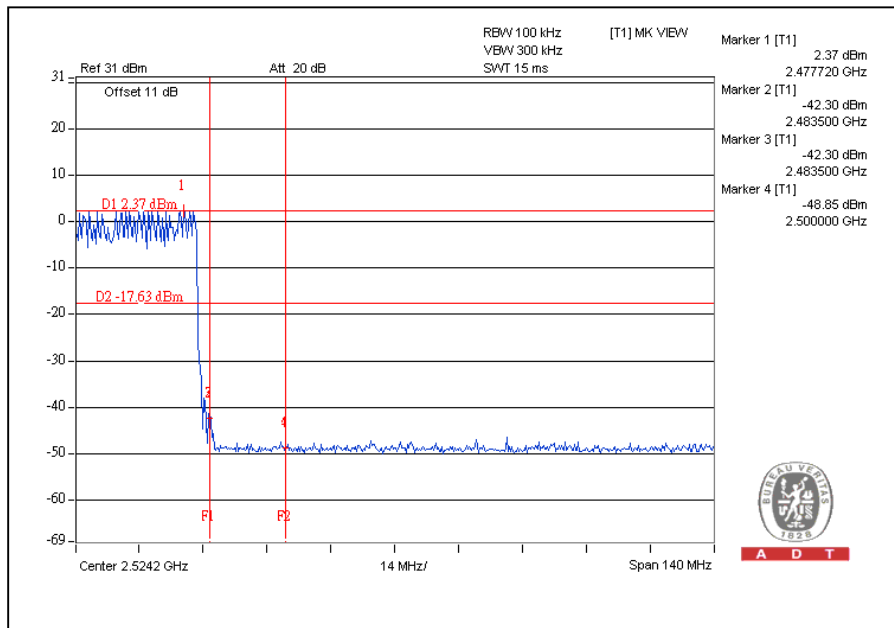


A D T

### CH0



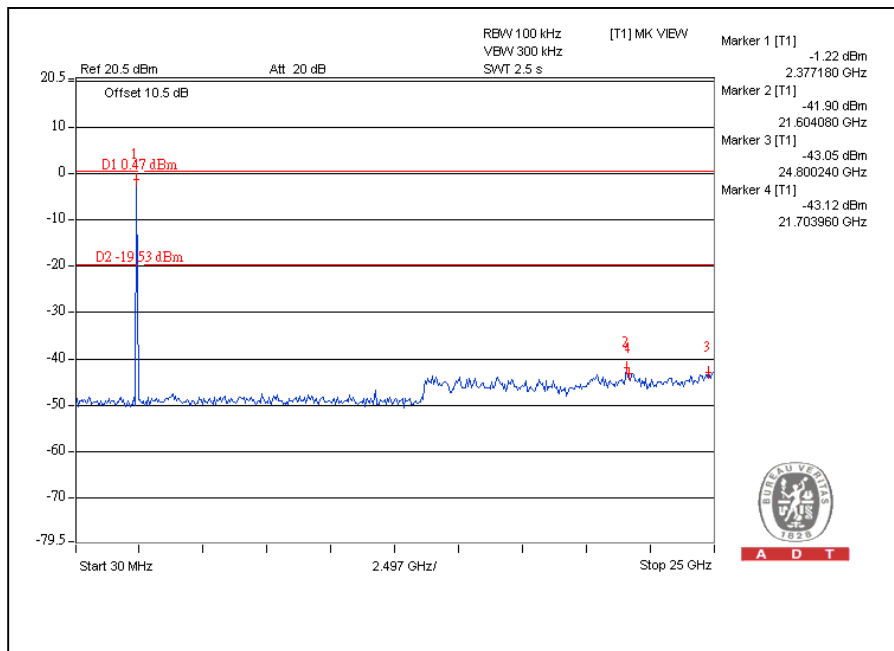
### CH78





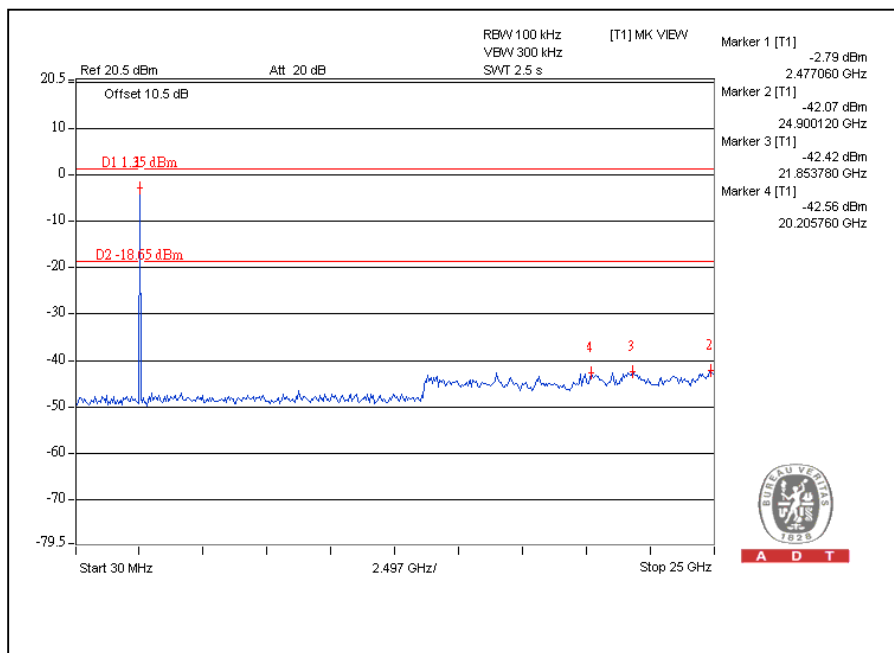
A D T

### CH0



A D T

### CH78



A D T



## 5 INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025:

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: [www.adt.com.tw/index.5/phtml](http://www.adt.com.tw/index.5/phtml).  
If you have any comments, please feel free to contact us at the following:

**Linko EMC/RF Lab:**

Tel: 886-2-26052180

Fax: 886-2-26052943

**Hsin Chu EMC/RF Lab:**

Tel: 886-3-5935343

Fax: 886-3-5935342

**Hwa Ya EMC/RF/Safety/Telecom Lab:**

Tel: 886-3-3183232

Fax: 886-3-3185050

**Email:** [service@adt.com.tw](mailto:service@adt.com.tw)

**Web Site:** [www.adt.com.tw](http://www.adt.com.tw)

The address and road map of all our labs can be found in our web site also.

## **6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.

--- END ---