

FCC TEST REPORT

FCC ID: 2ADACNGC-1

Product : Intel Braswell Fanless Mini PC

Model Name : NGC-1

Brand : MINIX

Report No. : PT800156160119E-FC04

Prepared for

MINIX TECHNOLOGY LIMITED

Unit 01, 15/F, Chevalier Commercial Center, No.8 Wang Hoi Road, Kowloon Bay, Kowloon,
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Prepared by

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TEST RESULT CERTIFICATION

Applicant's name : MINIX TECHNOLOGY LIMITED
Address : Unit 01, 15/F, Chevalier Commercial Center, No.8 Wang Hoi Road, Kowloon Bay, Kowloon, Hong Kong
Manufacture's name : XIANGUAN ELECTRONICS LIMITED
Address : 13F., Building B, Haisong Edifice, Tairan 9th Rd., Futian District, Shenzhen, China 518040
Product name : Intel Braswell Fanless Mini PC
Model name : NGC-1
Standards : FCC CFR47 Part 15 Section 15.247
Test procedure : ANSI C63.10:2013, DA 00-705
Test Date : Jan. 13 - Feb. 29, 2016
Date of Issue : Feb. 29, 2016
Test Result : Pass

This device described above has been tested by PTS, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	PASS

Remark:

N/A: Not Applicable



3 General Information

3.1 General Description of E.U.T.

Product Name	:	Intel Braswell Fanless Mini PC
Model Name	:	NGC-1
Model Description	:	N/A
Bluetooth Version	:	V4.2
Operating frequency	:	For BT3.0: 2402-2480MHz, 79 channels
	:	For BLE: 2402-2480MHz, 40 channels
Antenna Type:	:	Detachable R-SMA Antenna
Antenna Gain:	:	5.0dBi; For BT only the antenna 2 transmit signal
Type of Modulation	:	For BT3.0: GFSK, Pi/4DQPSK, 8DPSK
	:	For BLE: GFSK
Power supply	:	DC 12.0V



3.2 Channel List

BT3.0							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	-	-

3.3 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting	2402MHz	2441MHz	2480MHz
Hopping	2402-2480MHz		
Tests Carried Out Under FCC part 15.207			
Test Item	Test Mode		
Conduction Emission, 0.15MHz to 30MHz	BT Communication		



4 Equipment During Test

4.1 Equipments List

RF Conducted Test							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	Aug.04, 2015	Aug.03, 2016	1 year
2	EXA Signal Analyzer	Keysight	N9010A	MY50520207 526B25MPB W7X	Aug.04, 2015	Aug.03, 2016	1 year
3	EMI Test Receiver	R&S	ESCI	101155	July 15, 2015	July 14, 2016	1 year
Radiated Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde&Schwarz	ESCI	101417	July 15, 2015	July 14, 2016	1 year
2	Trilog Broadband Antenna	SCHWARZECK	VULB9160	9160-3355	July 15, 2015	July 14, 2016	1 year
3	Amplifier	EM	EM-30180	060538	July 15, 2015	July 14, 2016	1 year
4	Horn Ant (1G-18GHz)	SCHWARZECK	BBHA9120D	9120D-1246	July 15, 2015	July 14, 2016	1 year
5	Horn Ant (18G-40GHz)	SCHWARZECK	BBHA 9170	9170-181	June 6, 2015	June 5, 2016	1 year
Conducted Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	R&S	ESCI	101155	July 15, 2015	July 14, 2016	1 year
2	LISN	SCHWARZECK	NSLK 8128	8128-289	July 15, 2015	July 14, 2016	1 year
3	Cable	LARGE	RF300	-	July 15, 2015	July 14, 2016	1 year



4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10 ⁻⁶
Bandwidth	± 1.5 x 10 ⁻⁶
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB

5 Conducted Emission

Test Requirement: : FCC CFR 47 Part 15 Section 15.207

Test Method: : ANSI C63.4:2014

Test Result: : PASS

Frequency Range: : 150kHz to 30MHz

Class/Severity: : Class B

Limit: : 66-56 dB μ V between 0.15MHz & 0.5MHz
 : 56 dB μ V between 0.5MHz & 5MHz
 : 60 dB μ V between 5MHz & 30MHz

Detector: : Peak for pre-scan (9kHz Resolution Bandwidth)

5.1 E.U.T. Operation

Operating Environment :

Temperature: : 25.5 °C

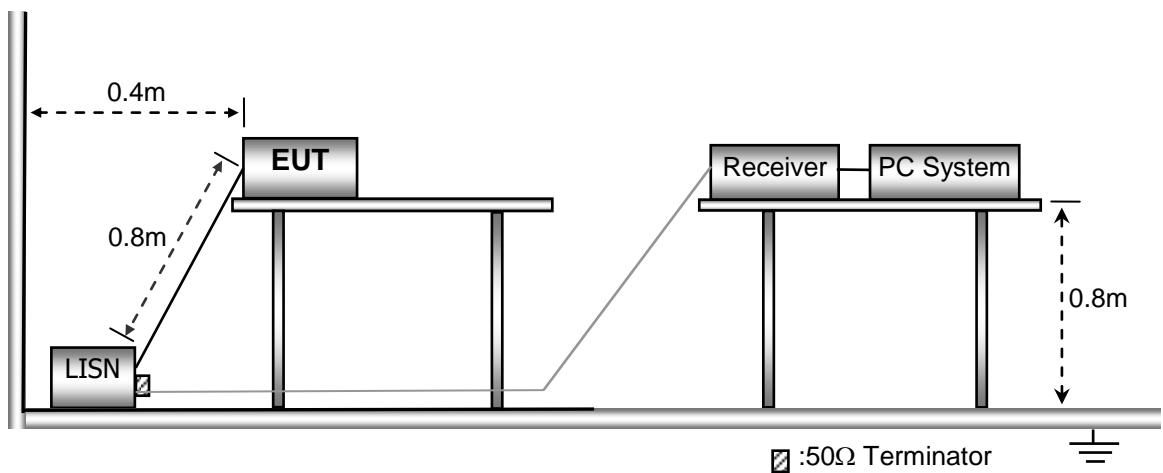
Humidity: : 51 % RH

Atmospheric Pressure: : 101.2kPa

EUT Operation : : Refer to section 3.3

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



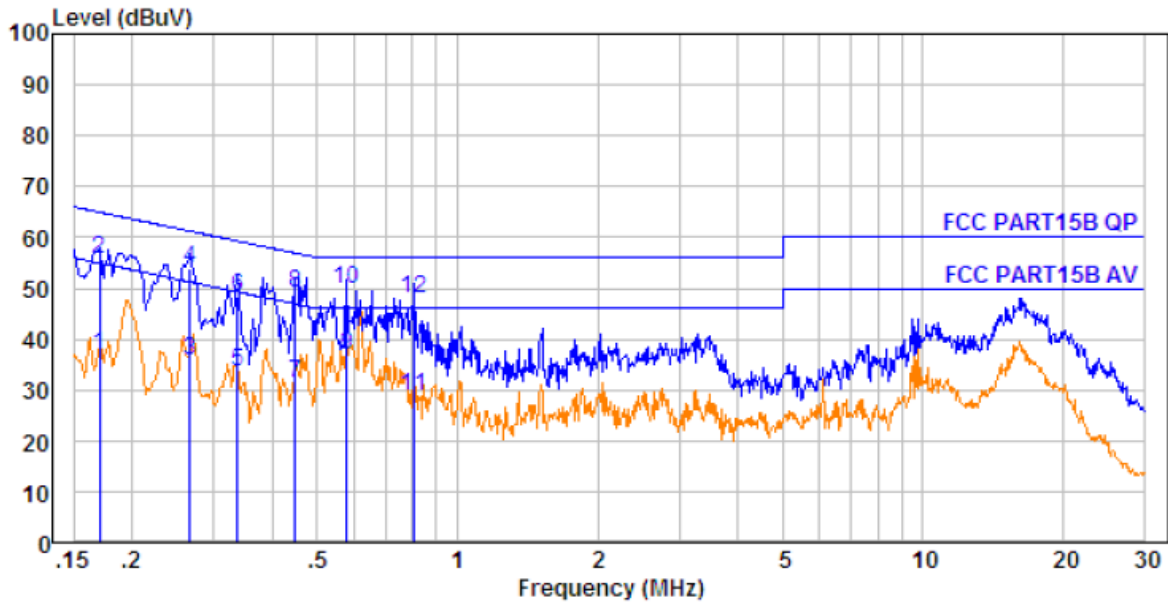


5.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.4 Conducted Emission Test Result

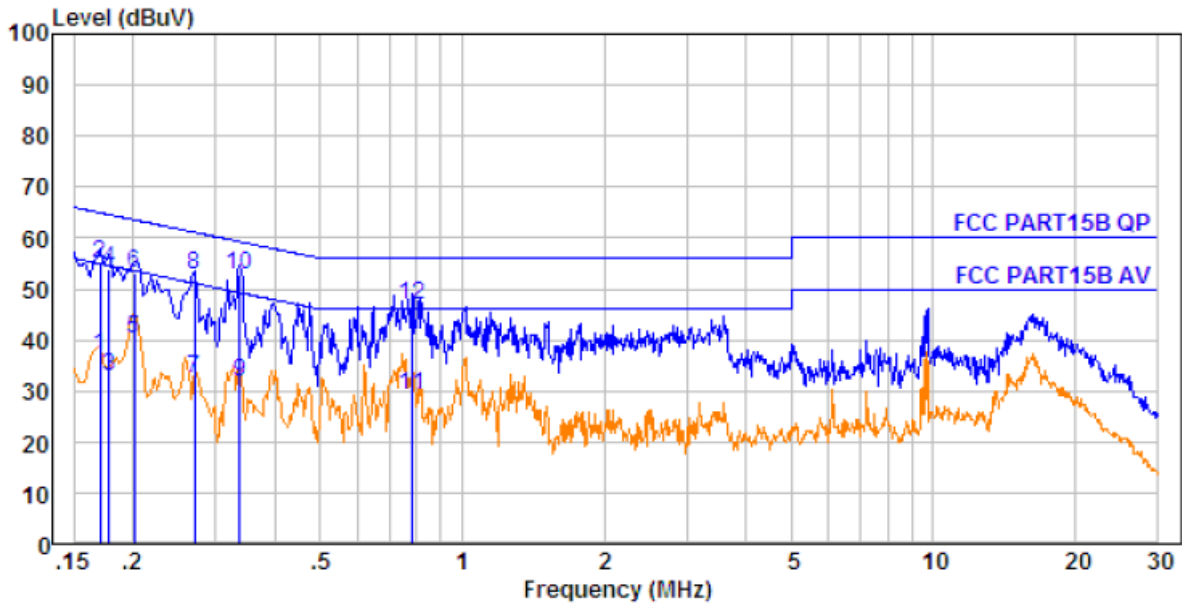
Live line-120V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBUV	Emission Level dBUV	Limit dBUV	Over Limit dB	Remark
1.	0.170	10.60	0.60	25.65	36.85	54.94	-18.09	Average
2.	0.170	10.60	0.60	44.65	55.85	64.94	-9.09	QP
3.	0.266	10.62	0.60	24.51	35.73	51.25	-15.52	Average
4.	0.266	10.62	0.60	42.51	53.73	61.25	-7.52	QP
5.	0.337	10.63	0.60	22.28	33.51	49.27	-15.76	Average
6.	0.337	10.63	0.60	37.28	48.51	59.27	-10.76	QP
7.	0.449	10.64	0.60	19.95	31.19	46.89	-15.70	Average
8.	0.449	10.64	0.60	37.95	49.19	56.89	-7.70	QP
9.	0.579	10.66	0.60	25.47	36.73	46.00	-9.27	Average
10.	0.579	10.66	0.60	38.47	49.73	56.00	-6.27	QP
11.	0.809	10.66	0.60	17.53	28.79	46.00	-17.21	Average
12.	0.809	10.66	0.60	36.53	47.79	56.00	-8.21	QP



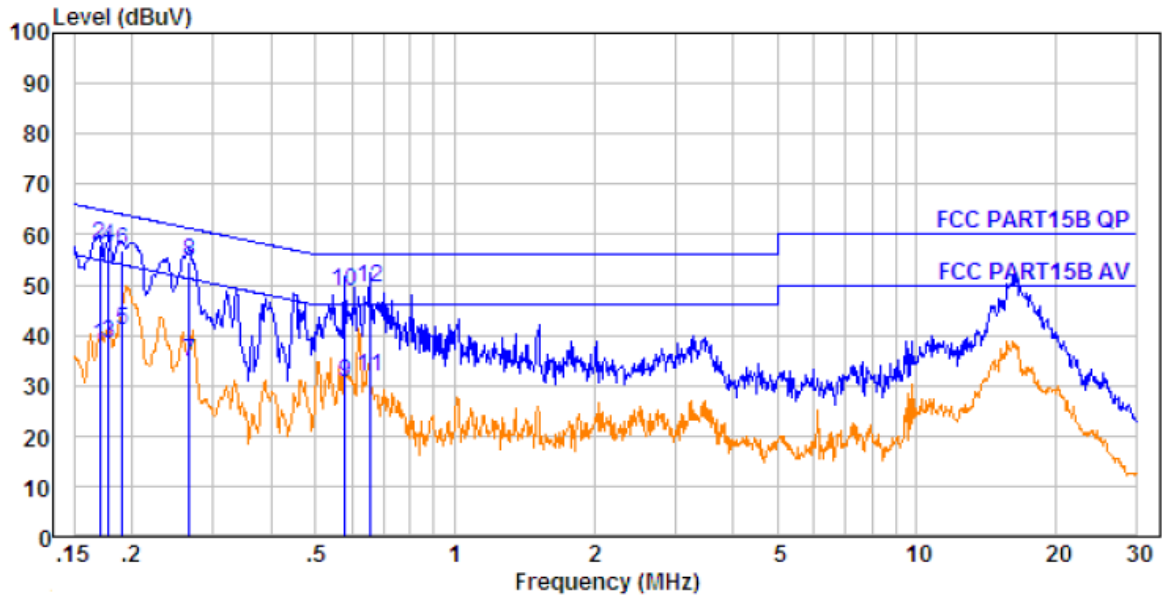
Neutral line-120V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBUV	Emission Level dBUV	Limit dBUV	Over Limit dB	Remark
1.	0.170	10.60	0.60	25.68	36.88	54.94	-18.06	Average
2.	0.170	10.60	0.60	43.68	54.88	64.94	-10.06	QP
3.	0.178	10.61	0.60	21.66	32.87	54.59	-21.72	Average
4.	0.178	10.61	0.60	42.66	53.87	64.59	-10.72	QP
5.	0.202	10.61	0.60	29.05	40.26	53.54	-13.28	Average
6.	0.202	10.61	0.60	42.05	53.26	63.54	-10.28	QP
7.	0.270	10.62	0.60	21.42	32.64	51.12	-18.48	Average
8.	0.270	10.62	0.60	41.42	52.64	61.12	-8.48	QP
9.	0.337	10.63	0.60	20.37	31.60	49.27	-17.67	Average
10.	0.337	10.63	0.60	41.37	52.60	59.27	-6.67	QP
11.	0.779	10.66	0.60	17.73	28.99	46.00	-17.01	Average
12.	0.779	10.66	0.60	35.73	46.99	56.00	-9.01	QP



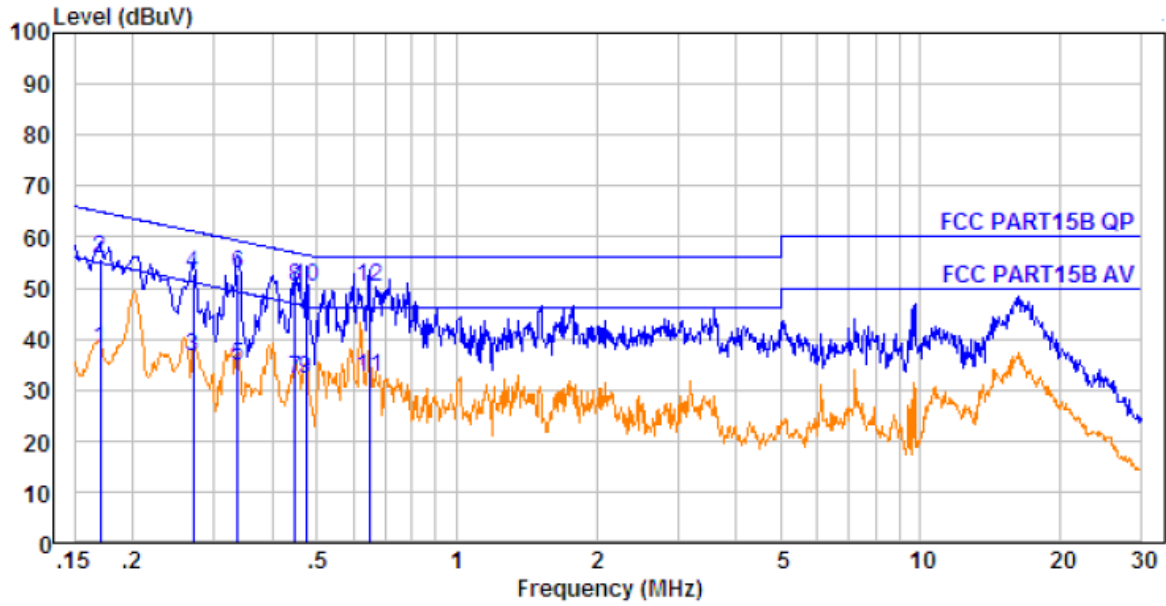
Live line-240V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBUV	Emission Level dBUV	Limit dBUV	Over Limit dB	Remark
1.	0.170	10.60	0.60	26.65	37.85	54.94	-17.09	Average
2.	0.170	10.60	0.60	46.65	57.85	64.94	-7.09	QP
3.	0.178	10.61	0.60	27.34	38.55	54.59	-16.04	Average
4.	0.178	10.61	0.60	46.34	57.55	64.59	-7.04	QP
5.	0.190	10.61	0.60	29.62	40.83	54.02	-13.19	Average
6.	0.190	10.61	0.60	45.62	56.83	64.02	-7.19	QP
7.	0.266	10.62	0.60	23.51	34.73	51.25	-16.52	Average
8.	0.266	10.62	0.60	43.51	54.73	61.25	-6.52	QP
9.	0.579	10.66	0.60	19.47	30.73	46.00	-15.27	Average
10.	0.579	10.66	0.60	37.47	48.73	56.00	-7.27	QP
11.	0.654	10.66	0.60	20.31	31.57	46.00	-14.43	Average
12.	0.654	10.66	0.60	38.31	49.57	56.00	-6.43	QP



Neutral line-240V:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBUV	Emission Level dBUV	Limit dBUV	Over Limit dB	Remark
1.	0.170	10.60	0.60	26.68	37.88	54.94	-17.06	Average
2.	0.170	10.60	0.60	44.68	55.88	64.94	-9.06	QP
3.	0.270	10.62	0.60	25.42	36.64	51.12	-14.48	Average
4.	0.270	10.62	0.60	41.42	52.64	61.12	-8.48	QP
5.	0.337	10.63	0.60	23.37	34.60	49.27	-14.67	Average
6.	0.337	10.63	0.60	41.37	52.60	59.27	-6.67	QP
7.	0.449	10.64	0.60	21.04	32.28	46.89	-14.61	Average
8.	0.449	10.64	0.60	39.04	50.28	56.89	-6.61	QP
9.	0.474	10.64	0.60	20.94	32.18	46.45	-14.27	Average
10.	0.474	10.64	0.60	38.94	50.18	56.45	-6.27	QP
11.	0.647	10.66	0.60	21.10	32.36	46.00	-13.64	Average
12.	0.647	10.66	0.60	39.10	50.36	56.00	-5.64	QP



6 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: : ANSI C63.10:2013,DA 00-705
 Test Result: : PASS
 Measurement Distance: : 3m
 Limit: : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

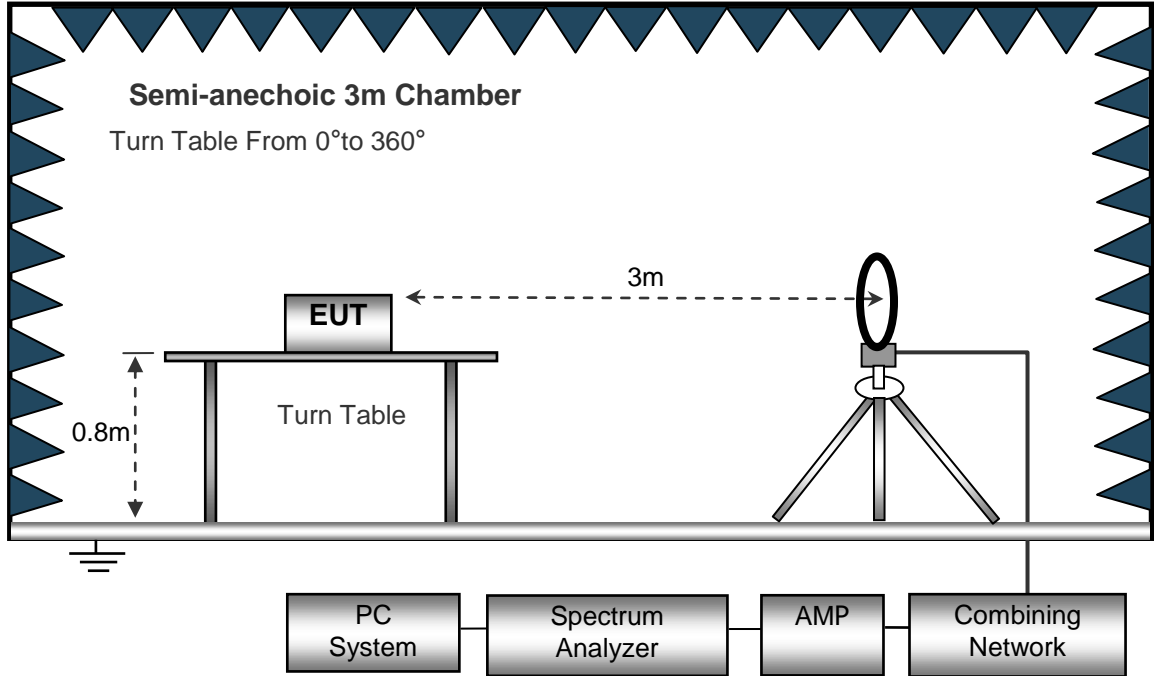
6.1 EUT Operation

Operating Environment :
 Temperature: : 23.5 °C
 Humidity: : 51.1 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3

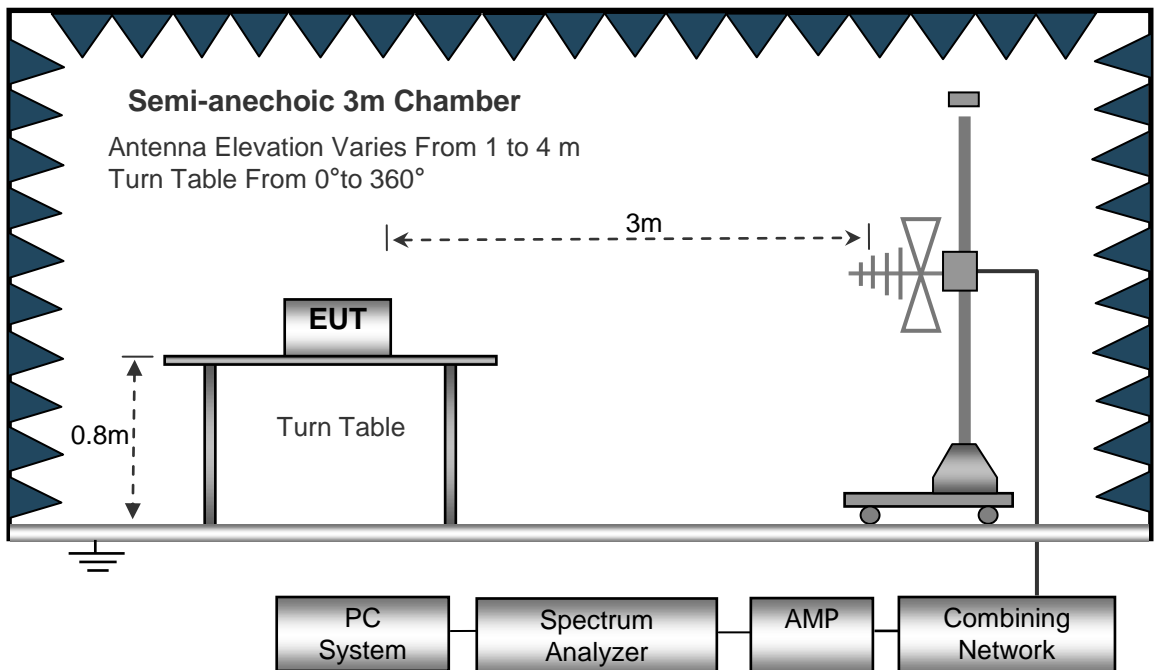
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

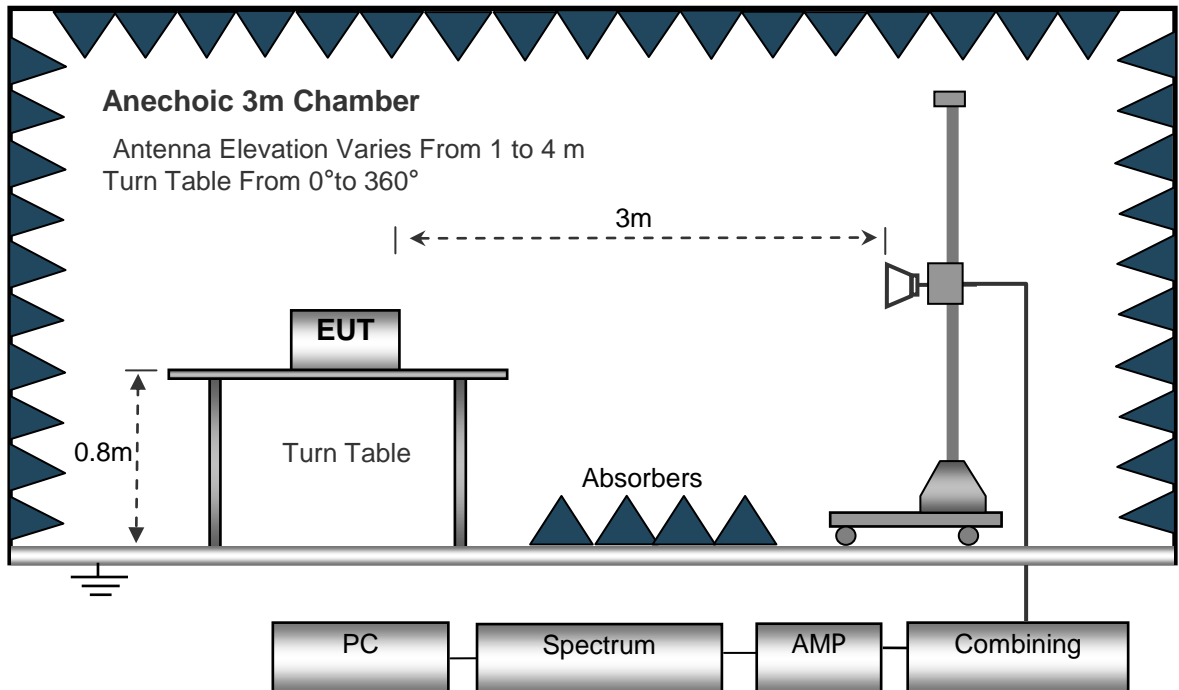
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



6.3 Spectrum Analyzer Setup

Below 30MHz

- Sweep Speed..... Auto
- IF Bandwidth.....10kHz
- Video Bandwidth10kHz
- Resolution Bandwidth10kHz

30MHz ~ 1GHz

- Sweep Speed..... Auto
- Detector.....PK
- Resolution Bandwidth100kHz
- Video Bandwidth300kHz

Above 1GHz

- Sweep Speed..... Auto
- Detector.....PK
- Resolution Bandwidth1MHz
- Video Bandwidth3MHz
- Detector.....Ave.
- Resolution Bandwidth1MHz
- Video Bandwidth10Hz



6.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



6.5 Summary of Test Results

Test Frequency: Below 30MHz

The measurements were more than 20 dB below the limit and not reported.

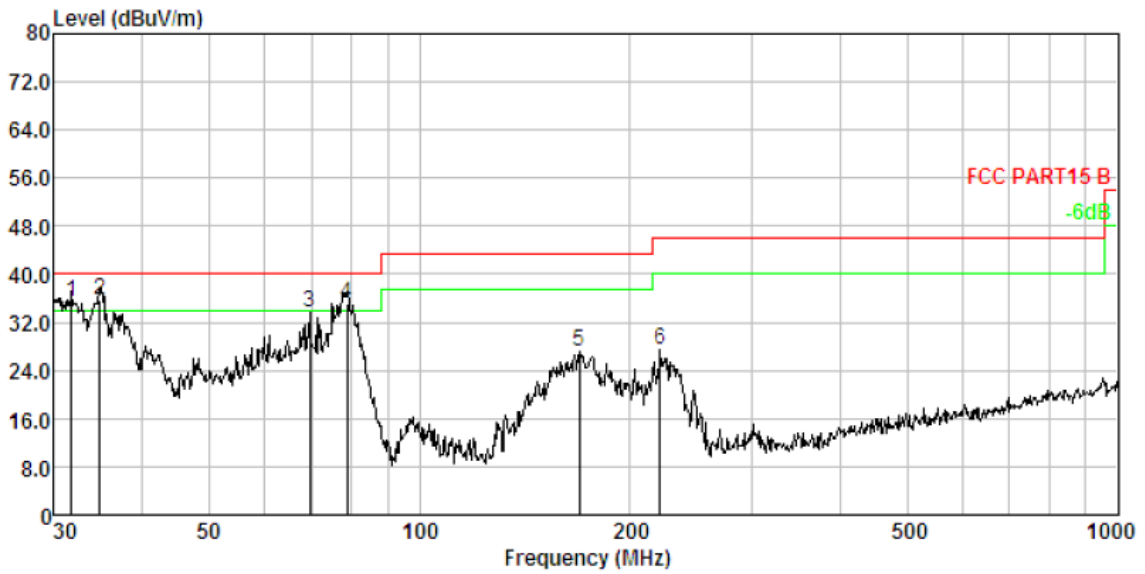
Test Frequency: 30MHz ~ 26.5GHz

Remark: only the worst data(GFSK modulation mode) were reported.



EUT :	Intel Braswell Fanless Mini PC	Model Name. :	NGC-1
Temperature :	20 °C	Relative Humidity :	48%
Pressure:	1010 hPa	Test Voltage :	DC 12V
Test Mode :	Mode 1		

Test plot for Horizontal:



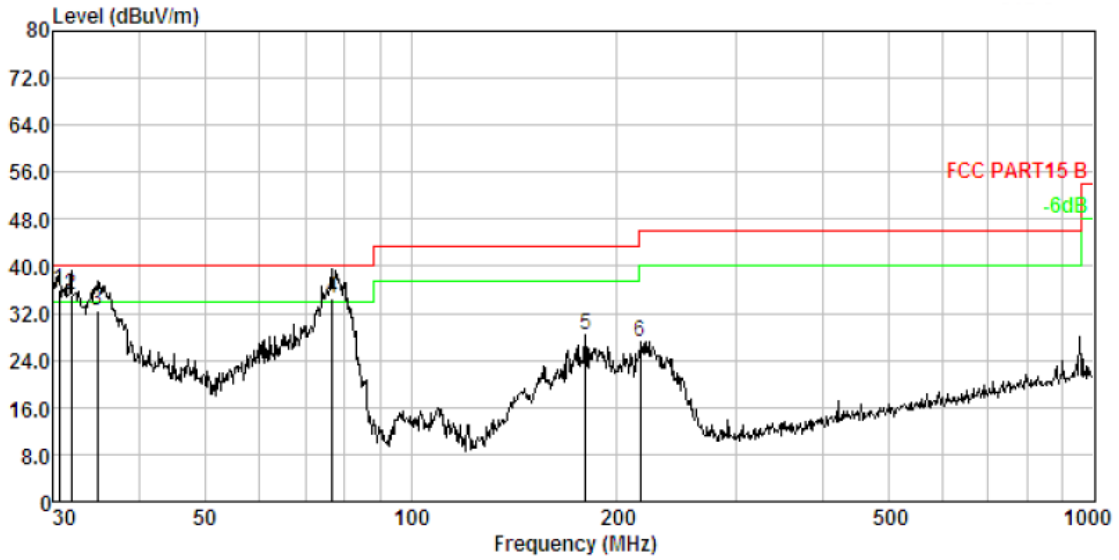
No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBUV	Preamp Factor dB	Emission Level dBUV/m	Limit dBUV/m	Over Limit dB	Remark
1.	31.731	1.11	13.23	50.98	29.99	35.33	40.00	-4.67	QP
2.	34.882	1.19	13.39	51.29	30.02	35.85	40.00	-4.15	QP
3.	69.600	1.82	10.13	51.85	30.26	33.54	40.00	-6.46	QP
4.	78.689	1.93	9.05	54.52	30.31	35.19	40.00	-4.81	QP
5.	169.599	2.62	13.35	41.62	30.57	27.02	43.50	-16.48	QP
6.	221.392	2.86	10.83	44.43	30.67	27.45	46.00	-18.55	QP

Remark:

Absolute Level= ReadingLevel+ Factor, Margin= Limit- Absolute Level



Test plot for Vertical:



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	30.531	1.07	13.24	51.62	29.98	35.95	40.00	-4.05	QP
2.	31.843	1.11	13.23	50.91	29.99	35.26	40.00	-4.74	QP
3.	34.760	1.19	13.38	47.90	30.02	32.45	40.00	-7.55	QP
4.	76.781	1.91	9.47	53.48	30.30	34.56	40.00	-5.44	QP
5.	180.017	2.68	12.44	43.68	30.59	28.21	43.50	-15.29	QP
6.	216.783	2.85	10.70	44.38	30.66	27.27	46.00	-18.73	QP

Remark:

Absolute Level= ReadingLevel+ Factor, Margin= Limit- Absolute Level



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel						
4804.00	54.53	PK	-1.06	53.47	74.00	-20.53
4804.00	41.55	Ave	-1.06	40.49	54.00	-13.51
7206.00	53.66	PK	1.33	54.99	74.00	-19.01
7206.00	45.41	Ave	1.33	46.74	54.00	-7.26
2333.64	61.78	PK	-13.19	48.59	74.00	-25.41
2333.64	49.15	Ave	-13.19	35.96	54.00	-18.04
2382.22	62.39	PK	-13.14	49.25	74.00	-24.75
2382.22	47.25	Ave	-13.14	34.11	54.00	-19.89
2497.44	63.06	PK	-13.08	49.98	74.00	-24.02
2497.44	48.12	Ave	-13.08	35.04	54.00	-18.96



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel						
4882.00	53.95	PK	-0.93	53.02	74.00	-20.98
4882.00	41.63	Ave	-0.93	40.70	54.00	-13.30
7323.00	52.57	PK	1.67	54.24	74.00	-19.76
7323.00	45.13	Ave	1.67	46.80	54.00	-7.20
2333.64	61.53	PK	-13.19	48.34	74.00	-25.66
2333.64	49.01	Ave	-13.19	35.82	54.00	-18.18
2382.22	62.30	PK	-13.14	49.16	74.00	-24.84
2382.22	47.78	Ave	-13.14	34.64	54.00	-19.36
2497.44	62.65	PK	-13.08	49.57	74.00	-24.43
2497.44	48.50	Ave	-13.08	35.42	54.00	-18.58



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
GFSK High Channel						
4960.00	54.14	PK	-0.87	53.27	74.00	-20.73
4960.00	41.77	Ave	-0.87	40.90	54.00	-13.1
7440.00	52.48	PK	1.84	54.32	74.00	-19.68
7440.00	44.93	Ave	1.84	46.77	54.00	-7.23
2333.64	61.4	PK	-13.19	48.21	74.00	-25.79
2333.64	49.13	Ave	-13.19	35.94	54.00	-18.06
2382.22	62.95	PK	-13.14	49.81	74.00	-24.19
2382.22	47.47	Ave	-13.14	34.33	54.00	-19.67
2497.44	62.94	PK	-13.08	49.86	74.00	-24.14
2497.44	48.32	Ave	-13.08	35.24	54.00	-18.76

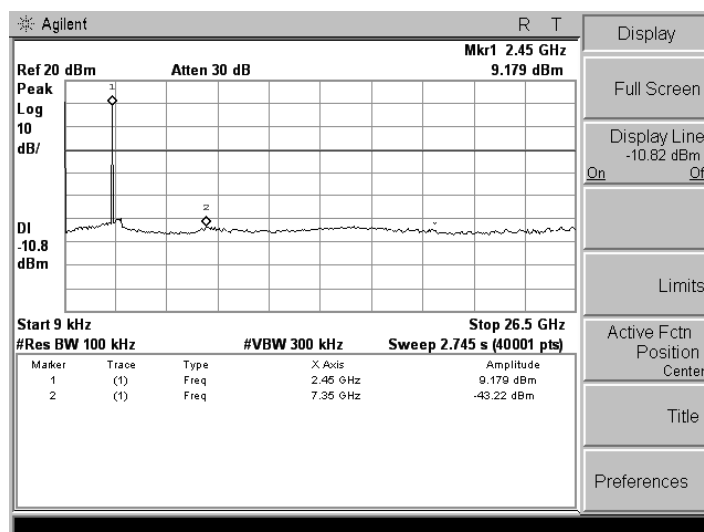
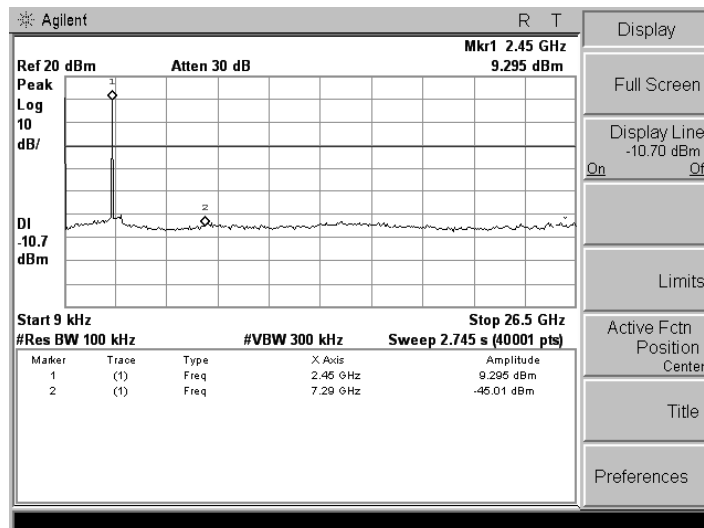
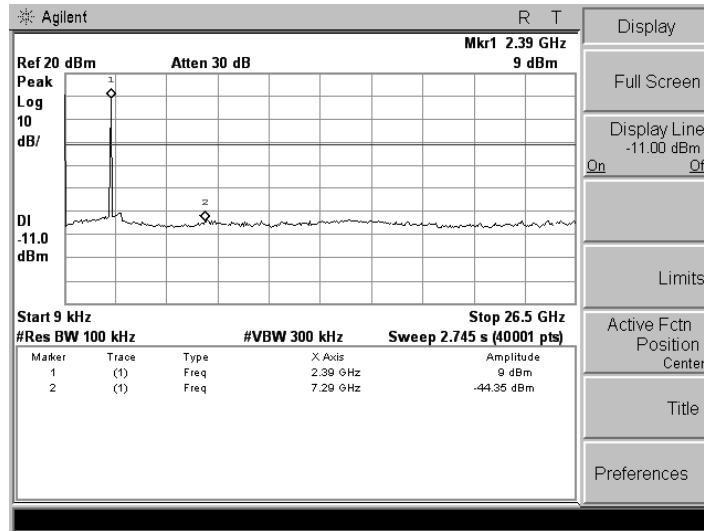
The measurements were more than 20 dB below the limit and not reported

Note:1. Measuring frequencies from 9k~40GHz, No emission found between lowest internal used/generated frequency to 30MHz.

2. Radiated emissions measured in frequency range from 9k~40GHz were made with an instrument using Peak detector mode.



Result of Conducted Spurious Emission of GFSK Mode:



Note: Only record the worst results.



Results of Restricted Band and Bandedge Test:

GFSK

Normal Voltage

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
operation frequency:2402							
V	2390.00	54.97	-3.62	51.35	74.00	-22.65	Pk
V	2390.00	39.28	-3.62	35.66	54.00	-18.34	AV
V	2400.00	56.40	-3.62	52.78	74.00	-21.22	Pk
V	2400.00	39.70	-3.62	36.08	54.00	-17.92	AV
V	4804.00	54.73	-1.06	53.67	74.00	-20.33	Pk
V	4804.00	41.00	-1.06	39.94	54.00	-14.06	AV
H	2390.00	54.84	-3.62	51.22	74.00	-22.78	Pk
H	2390.00	38.96	-3.62	35.34	54.00	-18.66	AV
H	2400.00	56.08	-3.62	52.46	74.00	-21.54	Pk
H	2400.00	40.40	-3.62	36.78	54.00	-17.22	AV
H	4804.00	54.27	-1.06	53.21	74.00	-20.79	Pk
H	4804.00	40.30	-1.06	39.24	54.00	-14.76	AV
Remark:							
Absolute Level= ReadingLevel+ Factor, Margin= Limit- Absolute Level							

GFSK

Normal Voltage

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
operation frequency:2480							
V	2483.50	55.45	-3.59	51.86	74.00	-22.14	Pk
V	2483.50	39.32	-3.59	35.73	54.00	-18.27	AV
V	4960.00	54.31	-0.87	53.44	74.00	-20.56	Pk
V	4960.00	40.63	-0.87	39.76	54.00	-14.24	AV
H	2483.50	55.48	-3.59	51.89	74.00	-22.11	Pk
H	2483.50	38.62	-3.59	35.03	54.00	-18.97	AV
H	4960.00	54.00	-0.87	53.13	74.00	-20.87	Pk
H	4960.00	41.69	-0.87	40.82	54.00	-13.18	AV
Remark:							
Absolute Level= ReadingLevel+ Factor, Margin= Limit- Absolute Level							

The measurements were more than 20 dB below the limit and not reported

Note: 1. Measuring frequencies from 9k~26.5GHz, No emission found between lowest internal used/generated frequency to 30MHz.

2. Radiated emissions measured in frequency range from 9k~26.5GHz were made with an instrument using Peak detector mode.

7 Band Edge Measurement

Test Requirement	:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	:	ANSI C63.10:2013,DA 00-705
Test Limit	:	Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode	:	Refer to section 3.3

7.1 Test Procedure

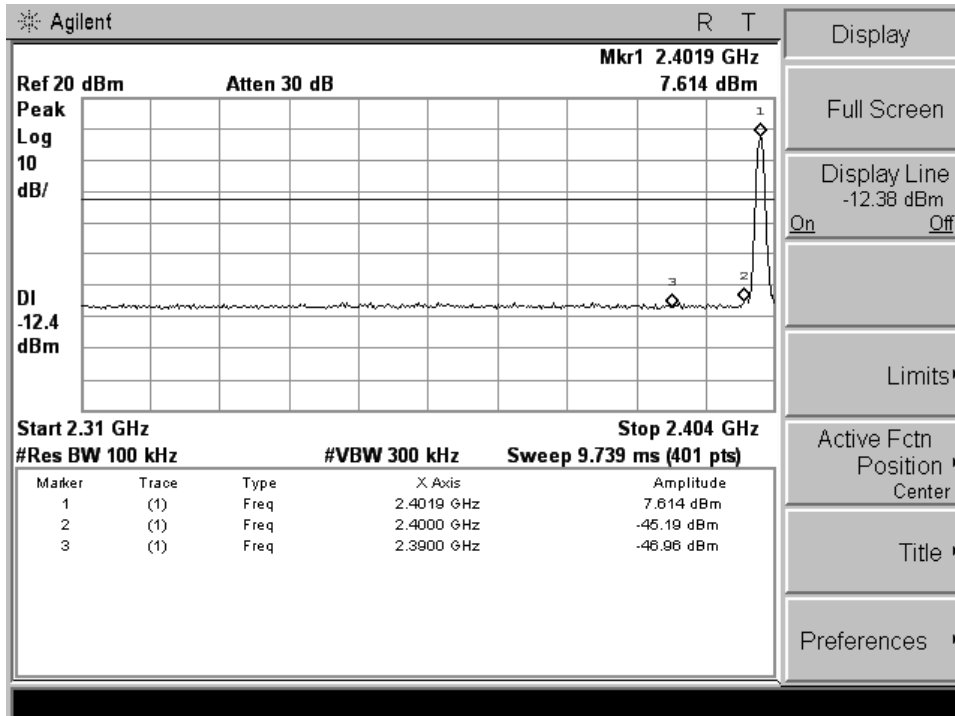
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

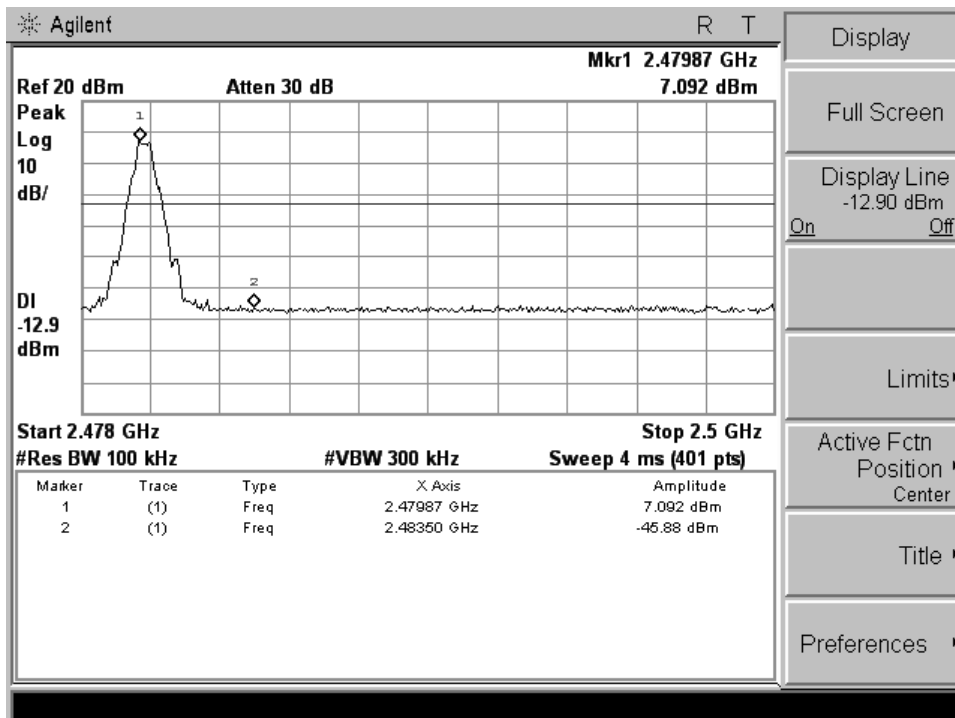


7.2 Test Result

GFSK Band edge-left side

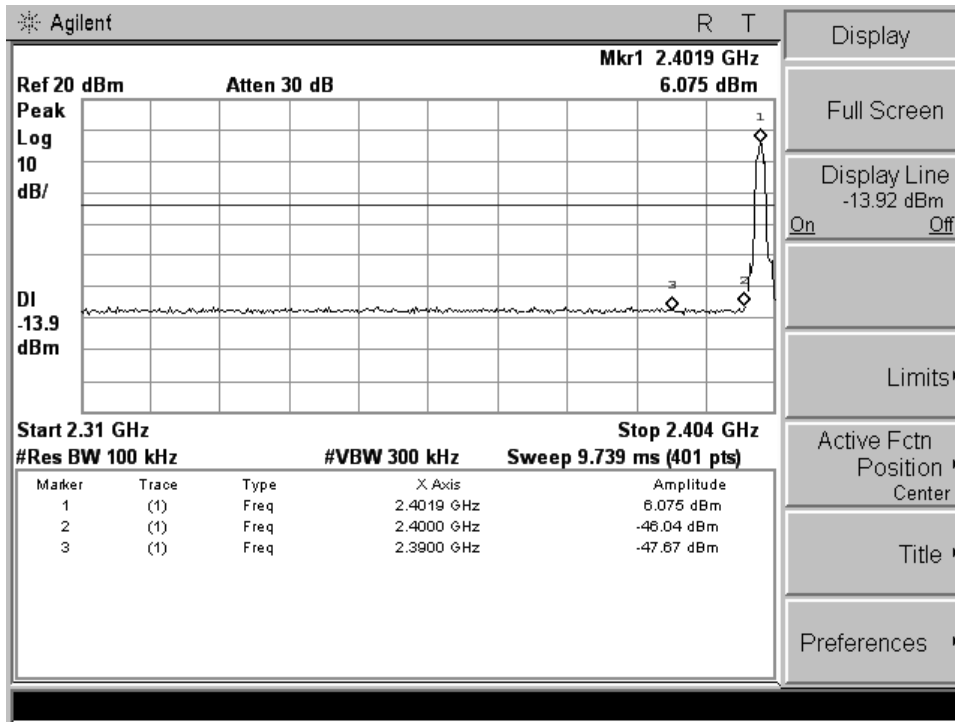


GFSK Band edge-right side

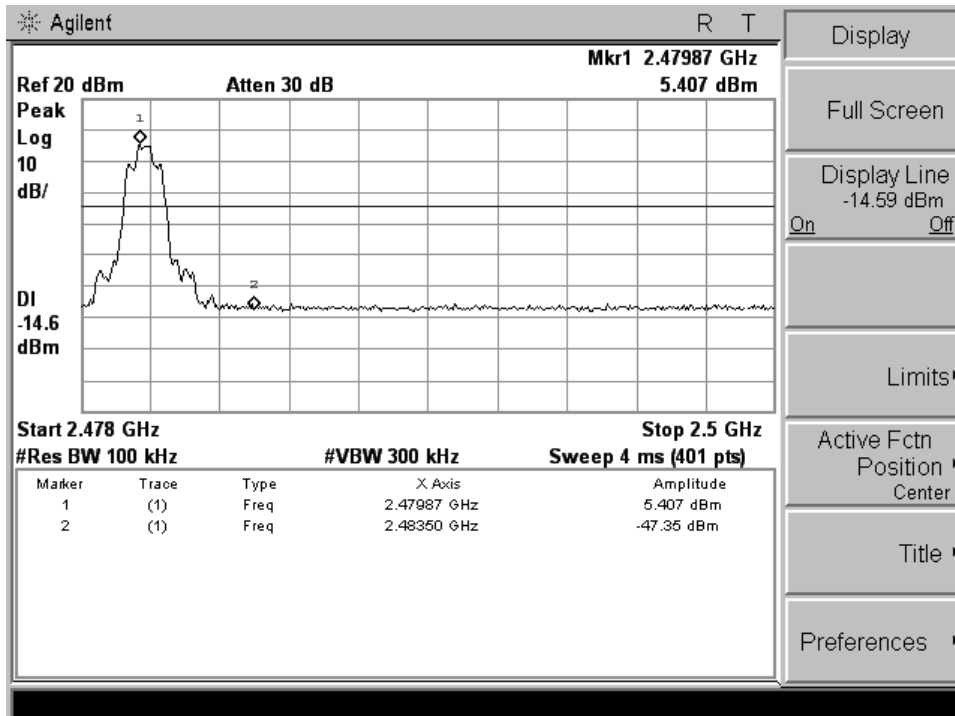




Pi/4 DQPSK Band edge-left side

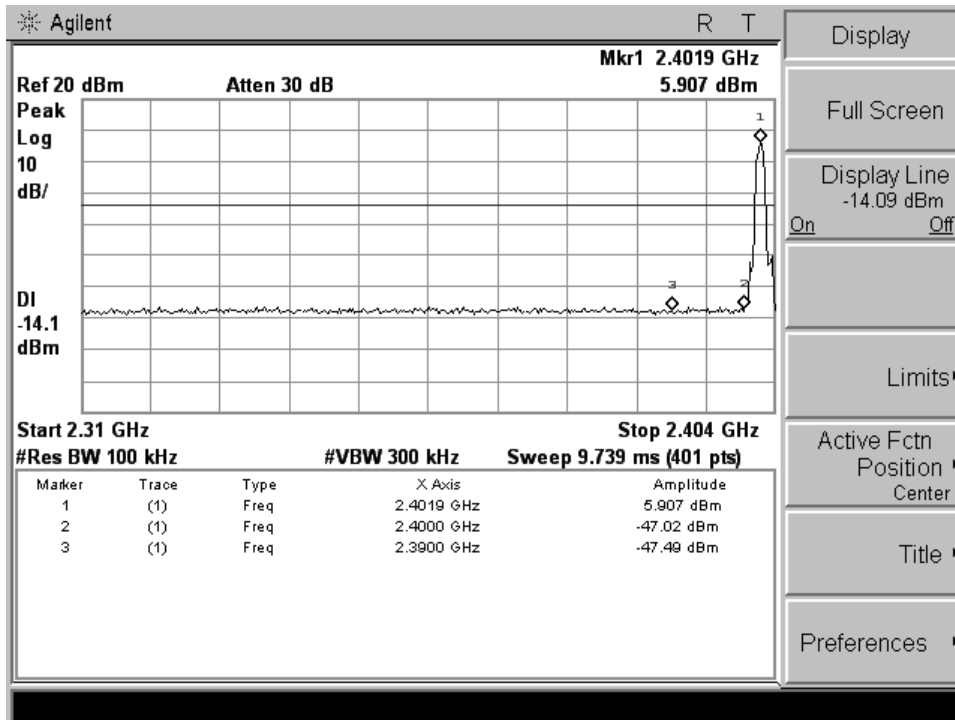


Pi/4 DQPSK Band edge-right side

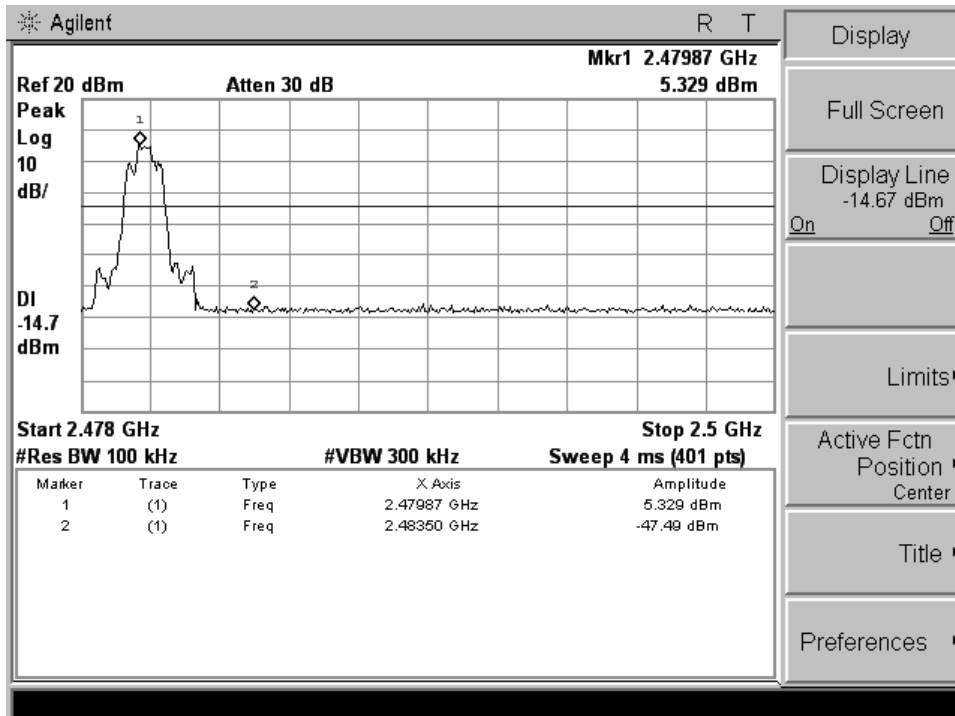




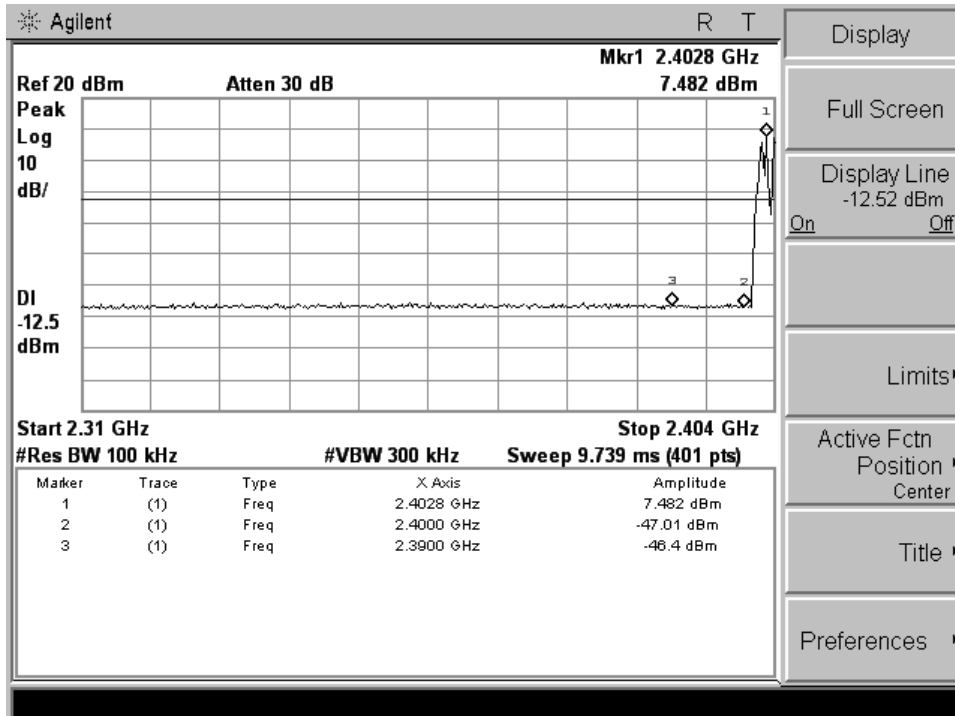
8DPSK Band edge-left side



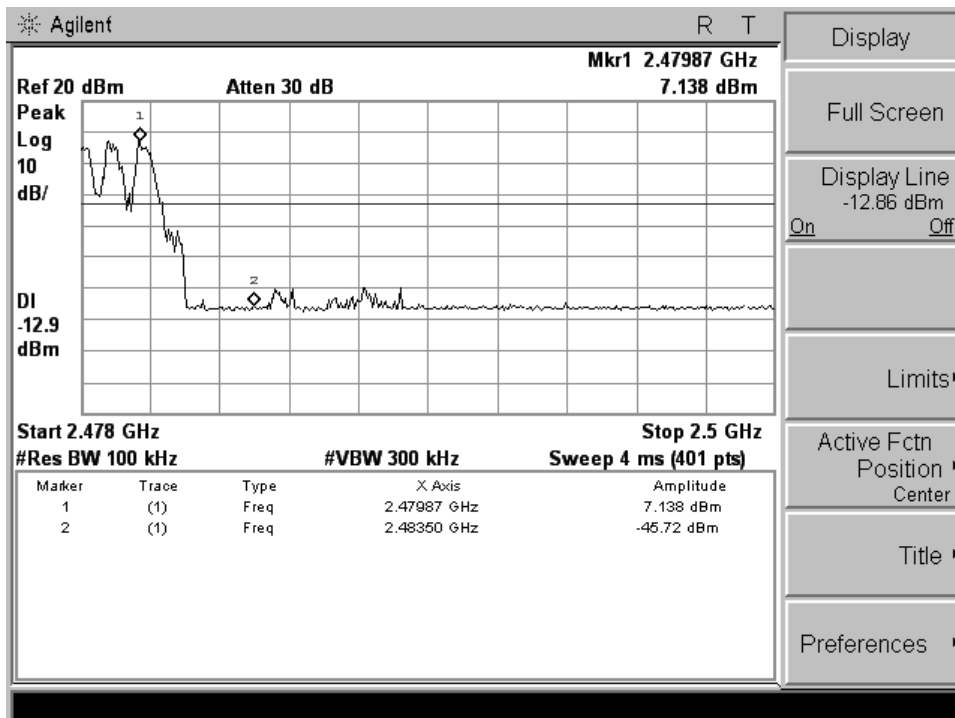
8DPSK Band edge-right side



GFSK Band edge-left side-Hopping mode

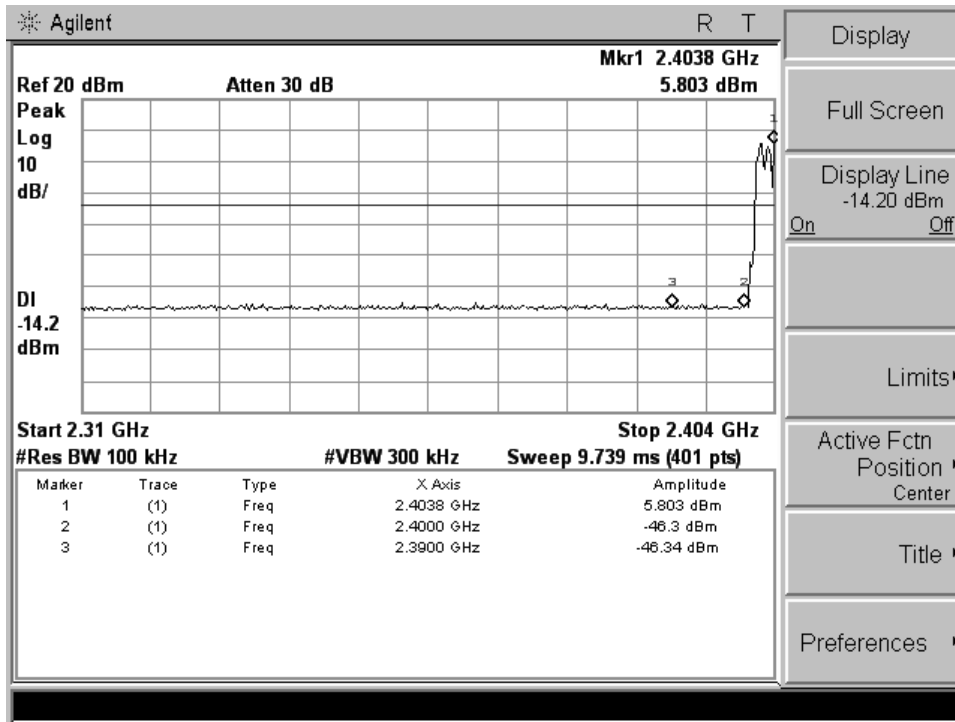


GFSK Band edge-right side-Hopping mode

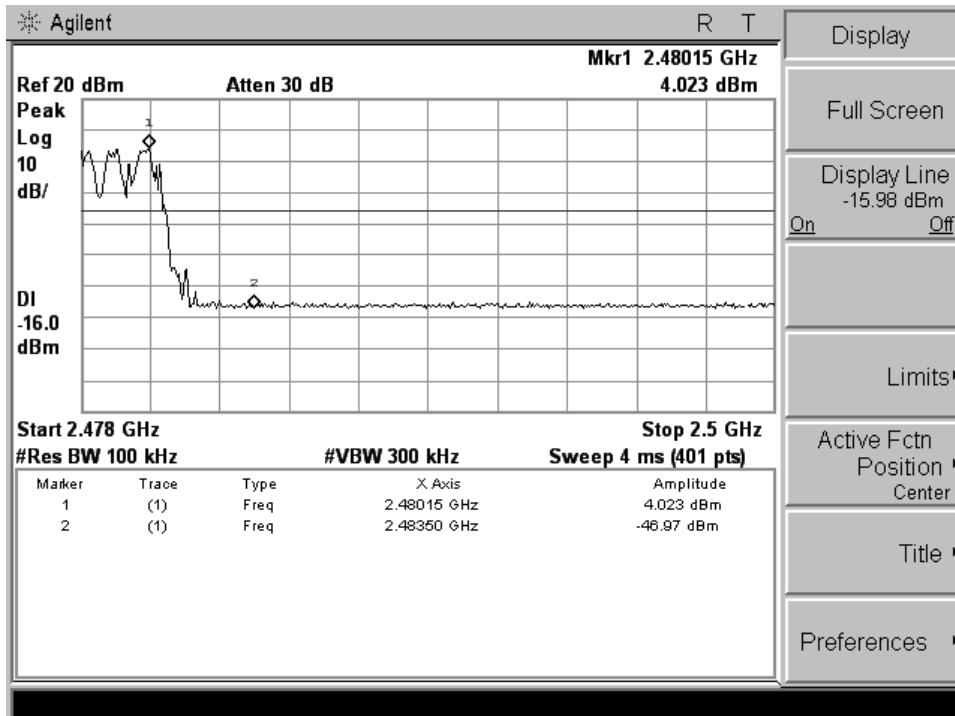




Pi/4 DQPSK Band edge-left side-Hopping mode

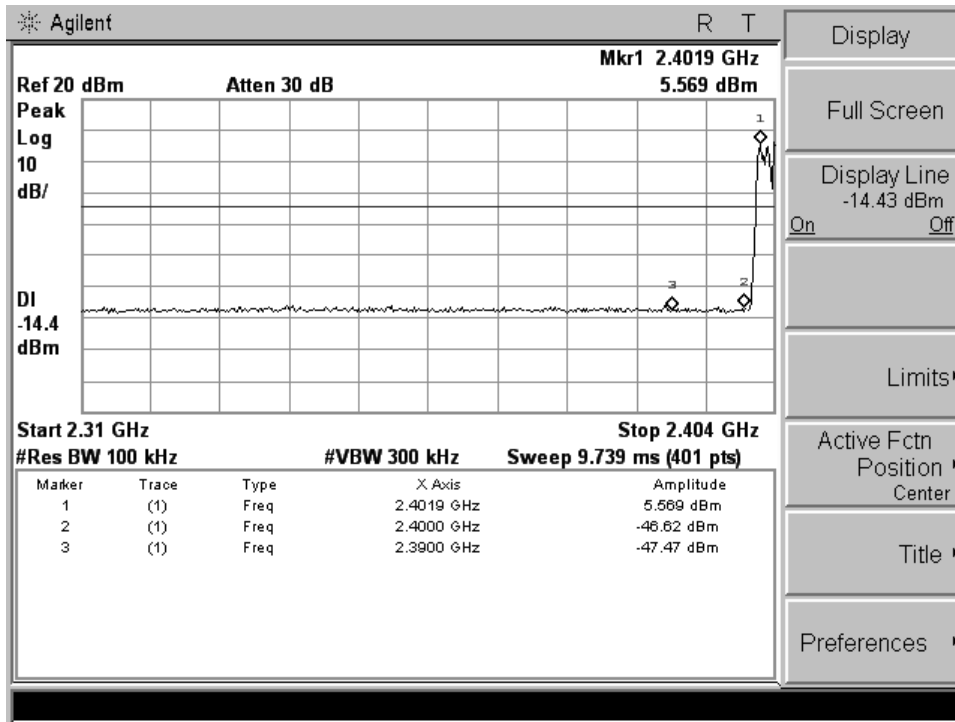


Pi/4 DQPSK Band edge-right side-Hopping mode

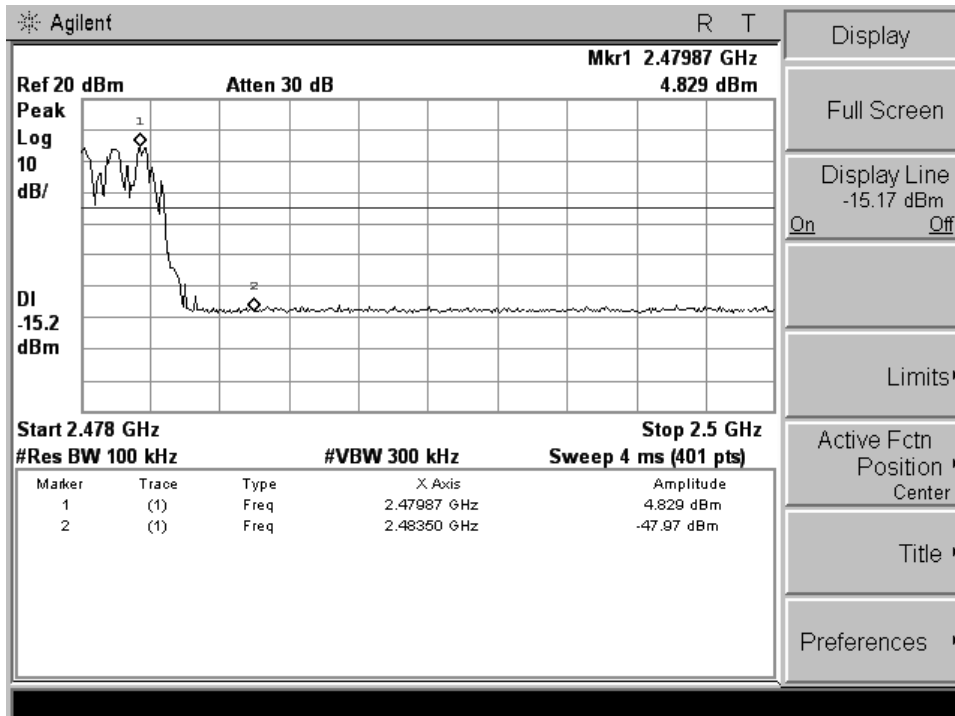




8DPSK Band edge-left side-Hopping mode



8DPSK Band edge-right side-Hopping mode





8 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247
 Test Method : ANSI C63.10:2013, DA 00-705
 Test Mode : Refer to section 3.3

8.1 Test Procedure

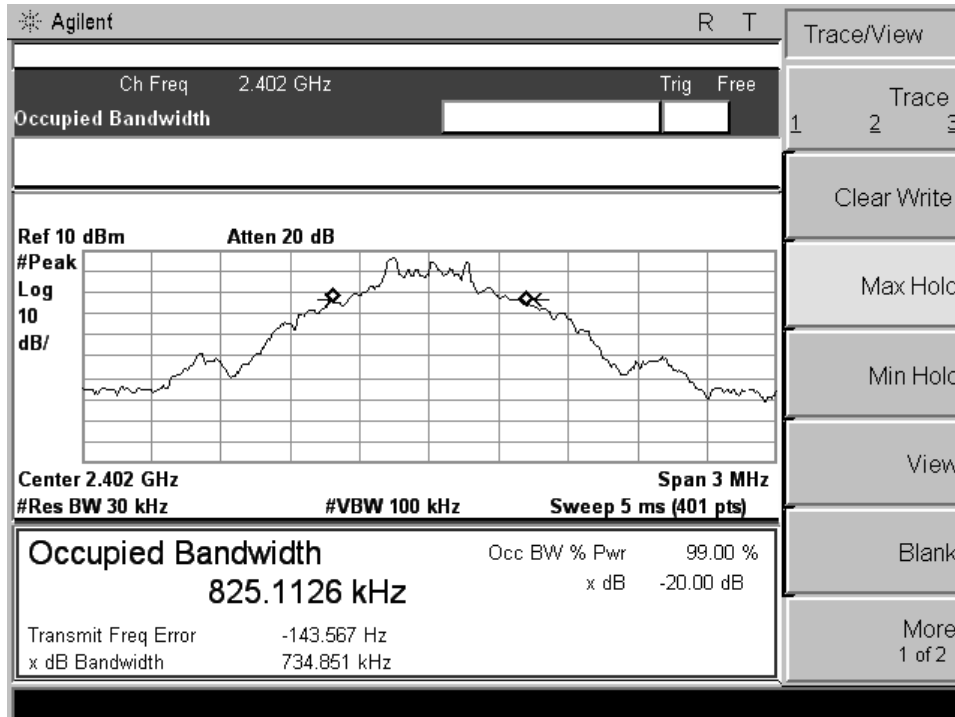
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

8.2 Test Result

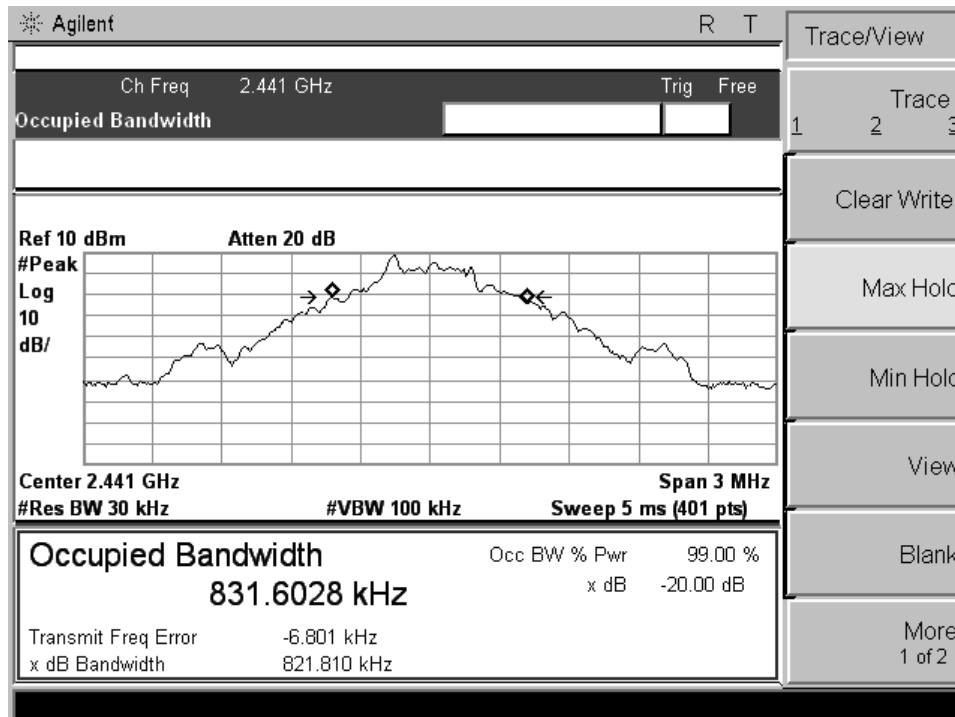
Modulation	Test Channel	Bandwidth(MHz)	Frequency Separation(MHz)	Limit
GFSK	Low	0.735	1.0	>=25 KHz or 20 dB BW
GFSK	Middle	0.822		>=25 KHz or 20 dB BW
GFSK	High	0.831		>=25 KHz or 20 dB BW
Pi/4 DQPSK	Low	1.132	1.0	>=25 KHz or 2/3 20 dB BW
Pi/4 DQPSK	Middle	1.129		>=25 KHz or 2/3 20 dB BW
Pi/4 DQPSK	High	1.126		>=25 KHz or 2/3 20 dB BW
8DPSK	Low	1.173	1.0	>=25 KHz or 2/3 20 dB BW
8DPSK	Middle	1.169		>=25 KHz or 2/3 20 dB BW
8DPSK	High	1.173		>=25 KHz or 2/3 20 dB BW



GFSK Low Channel

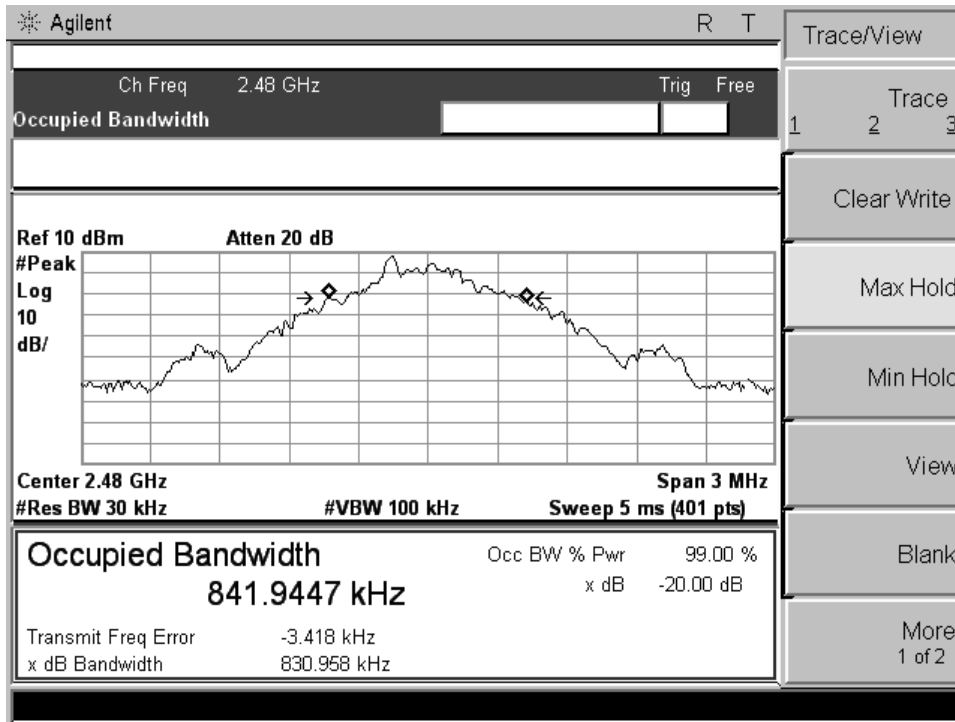


GFSK Middle Channel

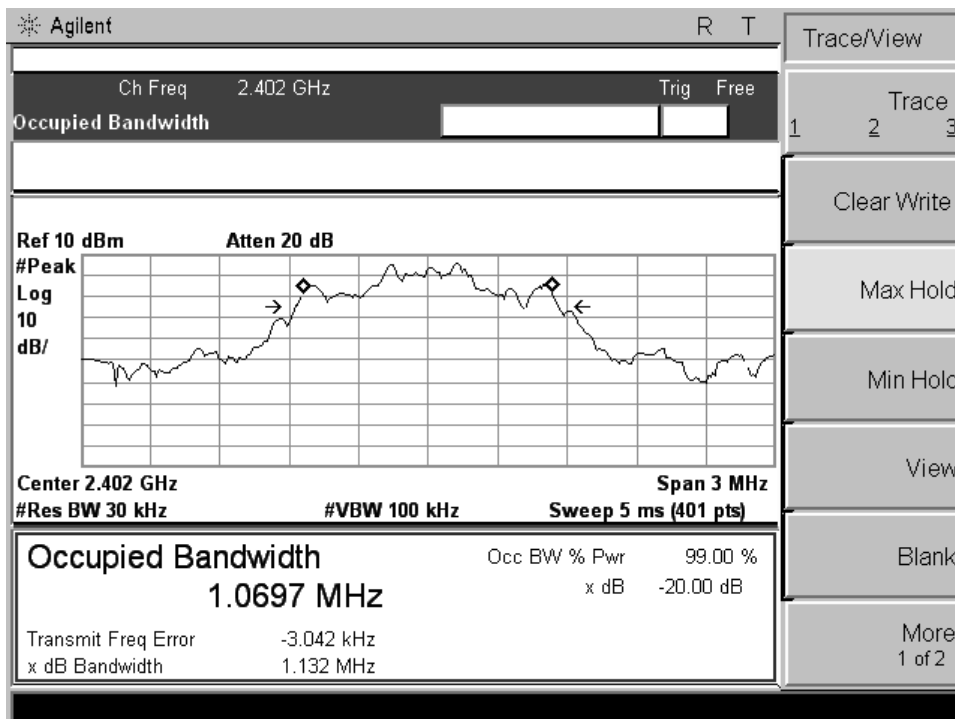




GFSK High Channel

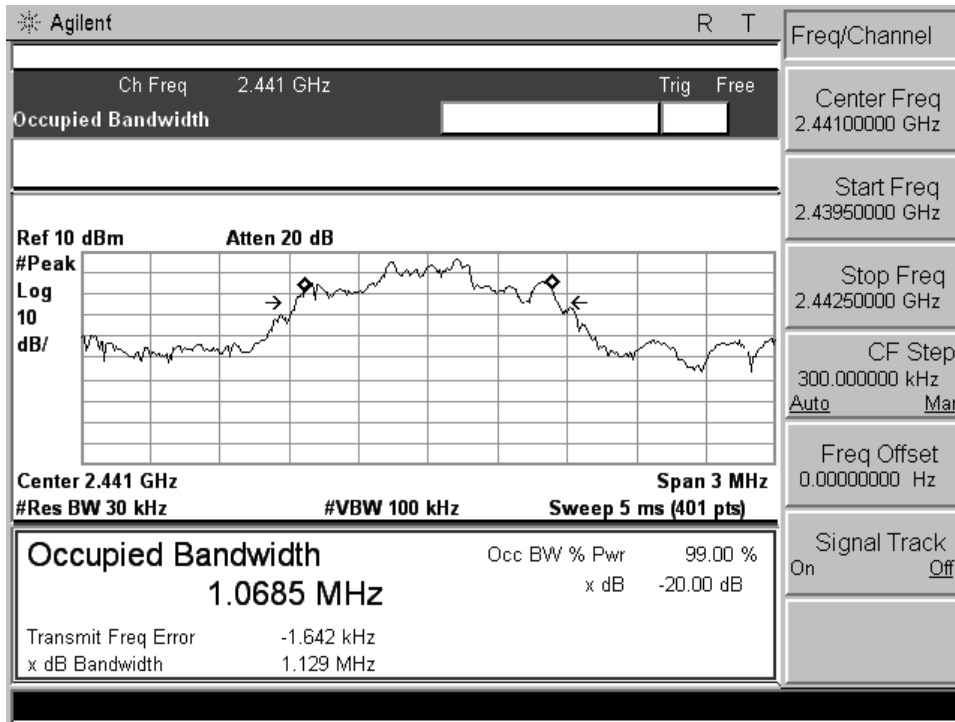


Pi/4DQPSK Low Channel

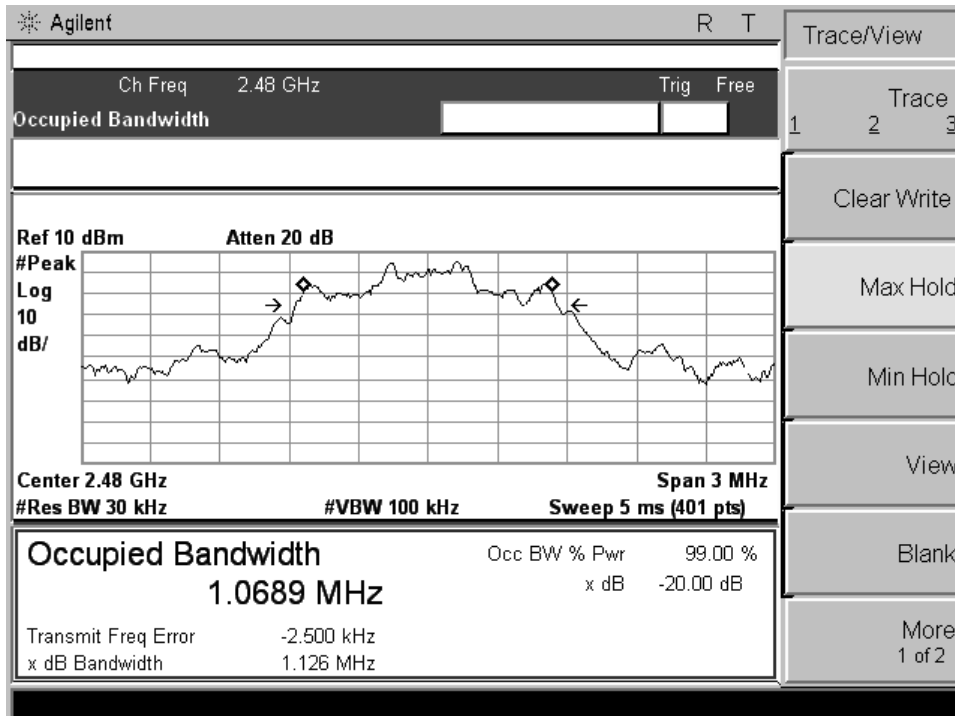




Pi/4DQPSK Middle Channel

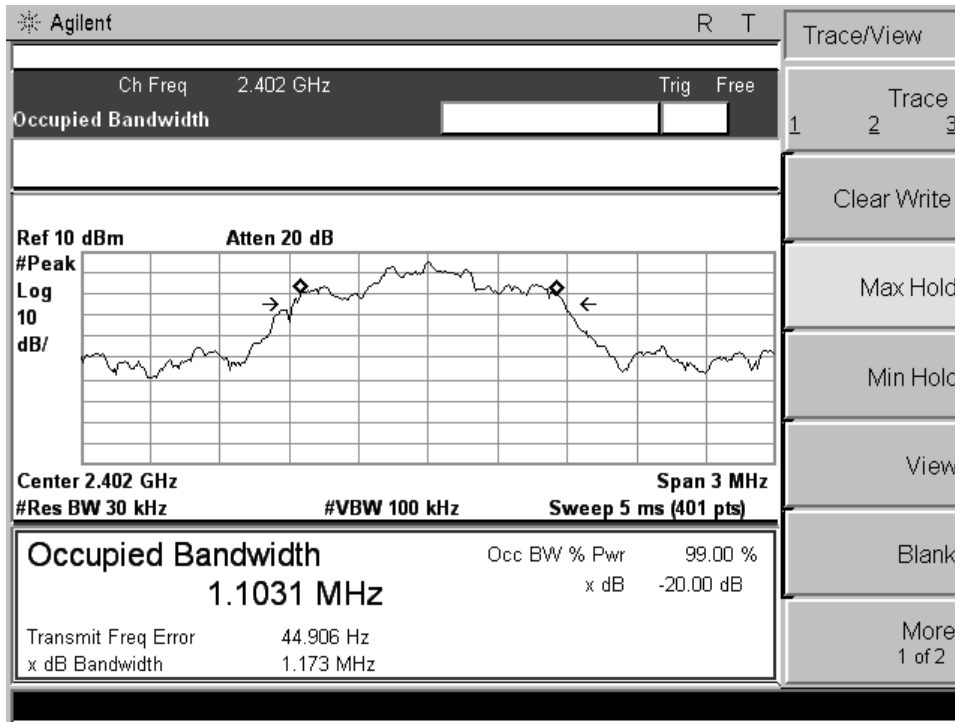


Pi/4DQPSK High Channel

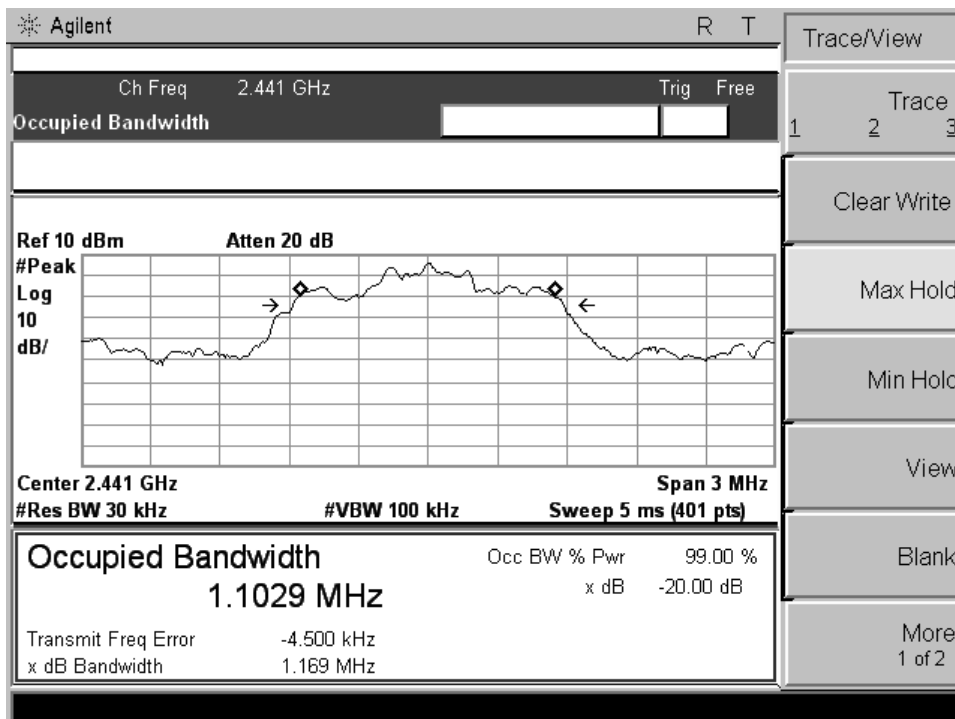




8DPSK Low Channel

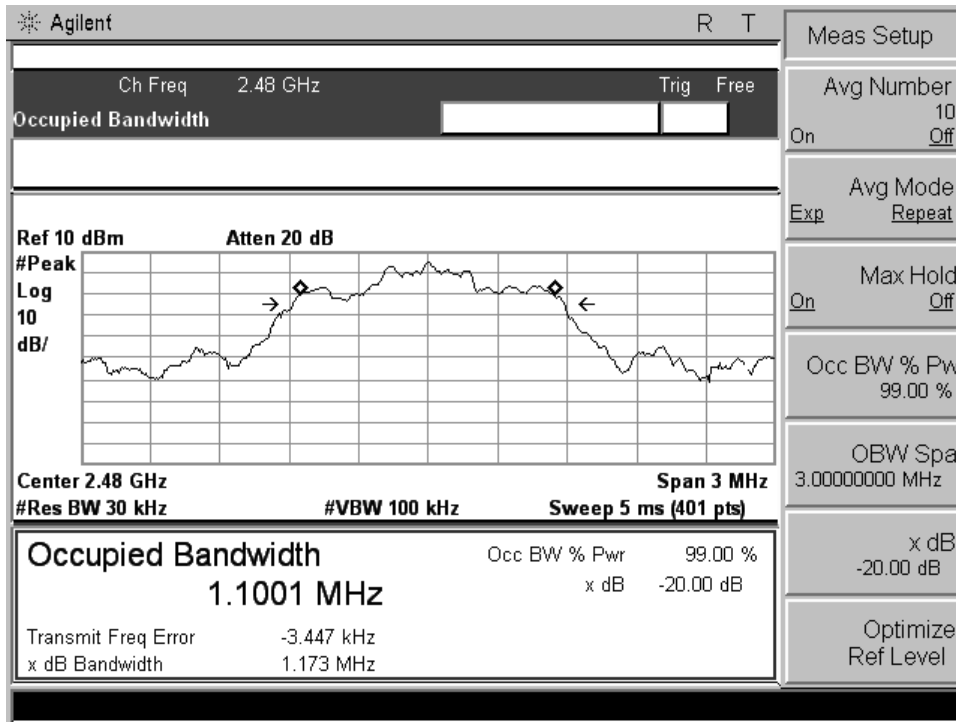


8DPSK Middle Channel





8DPSK High Channel



9 Maximum Peak Output Power

- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : ANSI C63.10:2013, DA 00-705
- Test Limit : Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
- Refer to the result “Number of Hopping Frequency” of this document. The 0.125watts (20.97 dBm) limit applies.
- Test Mode : Refer to section 3.3

9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyser: RBW = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

9.2 Test Result

Modulation	Test Channel	Output Power (dBm)	Correct Limit (dBm)
GFSK	Low	6.30	30.00
GFSK	Middle	6.01	30.00
GFSK	High	5.92	30.00
Pi/4 DQPSK	Low	4.88	20.97
Pi/4 DQPSK	Middle	5.44	20.97
Pi/4 DQPSK	High	4.42	20.97
8DPSK	Low	4.91	20.97
8DPSK	Middle	5.45	20.97
8DPSK	High	4.30	20.97



10 Hopping Channel Separation

- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : ANSI C63.10:2013, DA 00-705
- Test Limit : Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
- Test Mode : Hopping

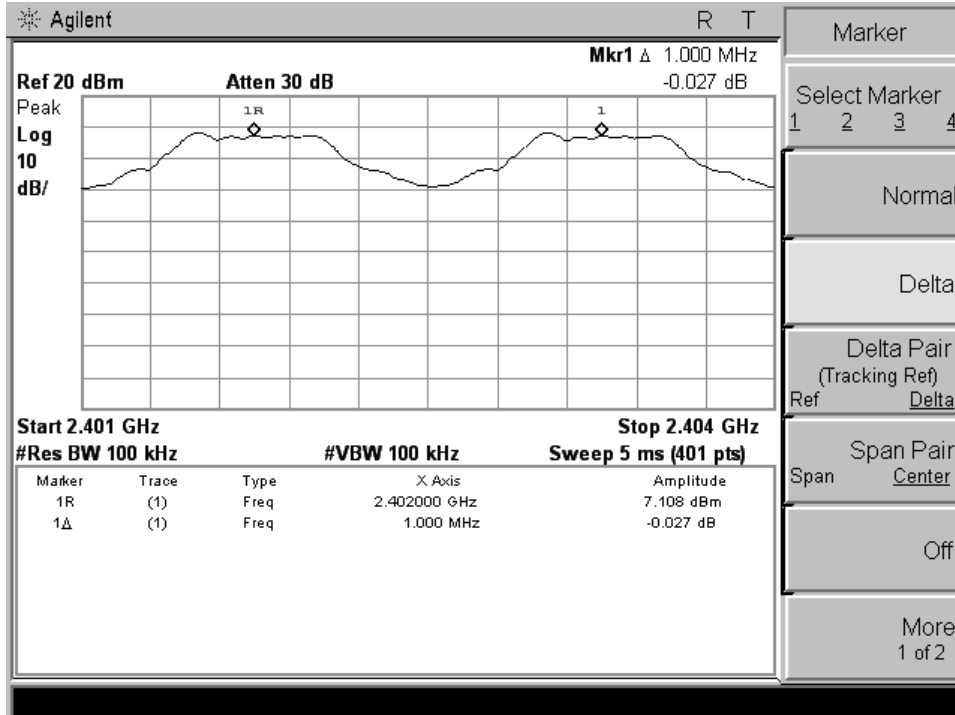
10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

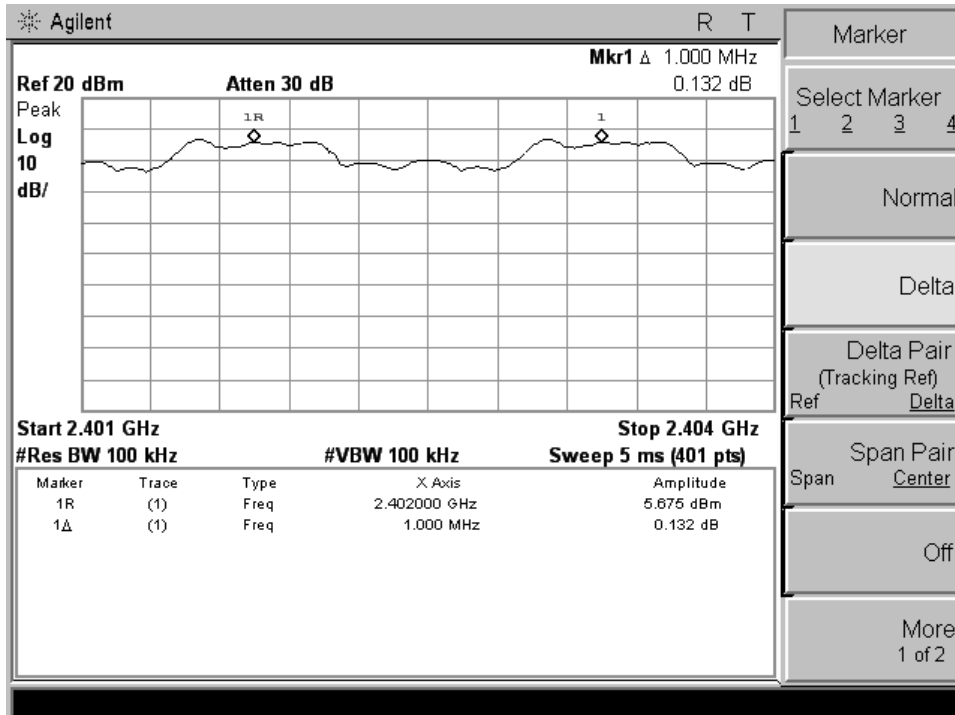
10.2 Test Result

Modulation	Separation (MHz)	Result
GFSK	1.000	PASS
Pi/4 DQPSK	1.000	PASS
8DPSK	1.000	PASS

Test plot of GFSK

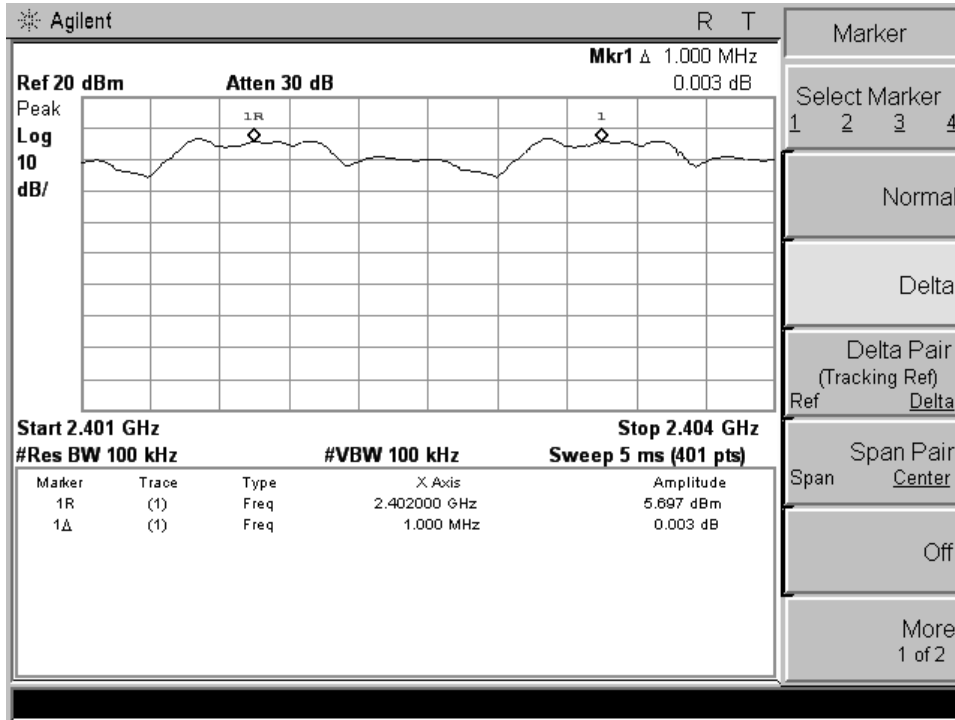


Test plot of Pi/4DQPSK





Test plot of 8DPSK





11 Number of Hopping Frequency

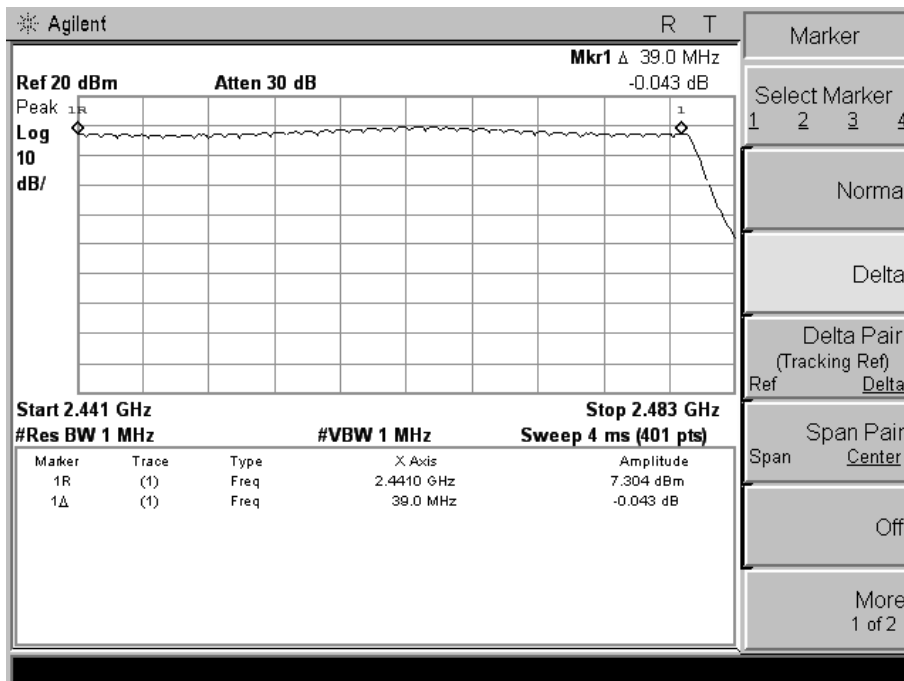
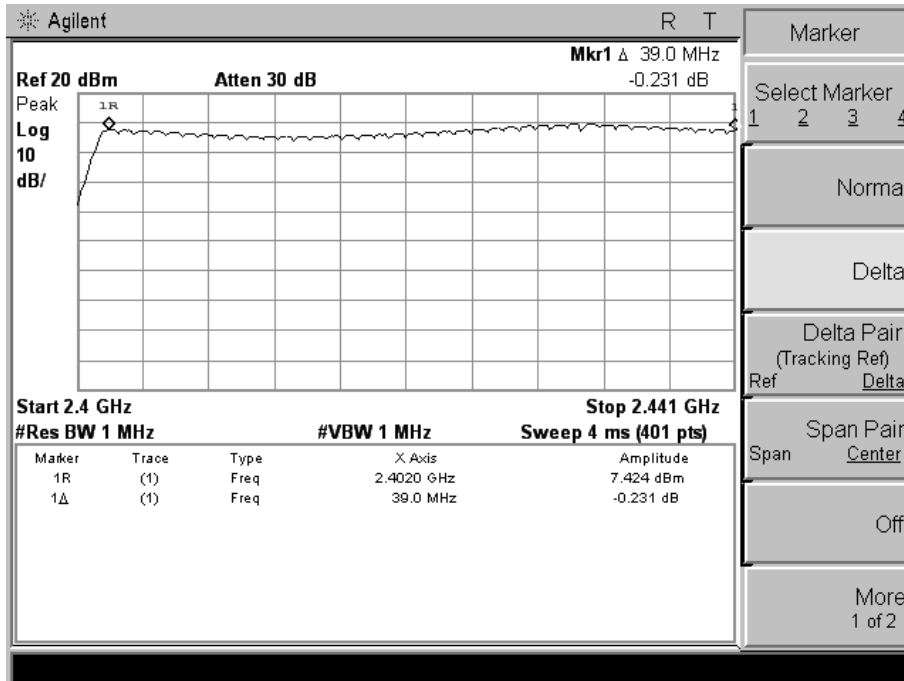
- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : ANSI C63.10:2013, DA 00-705
- Test Limit : Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
- Test Mode : Hopping(GFSK)

11.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

11.2 Test Result

Channel Number	Limit
79	≥15





12 Dwell Time

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, DA 00-705
Test Limit	: Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Test Mode	: Hopping
Remark	: The worst case(8DPSK,DH5) was recorded

12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

12.2 Test Result

DH5 Packet permit maximum $1600 / 79 / 6$ hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum $1600 / 79 / 4$ hops per second in each channel (3 time slots RX, 1 time slot TX).

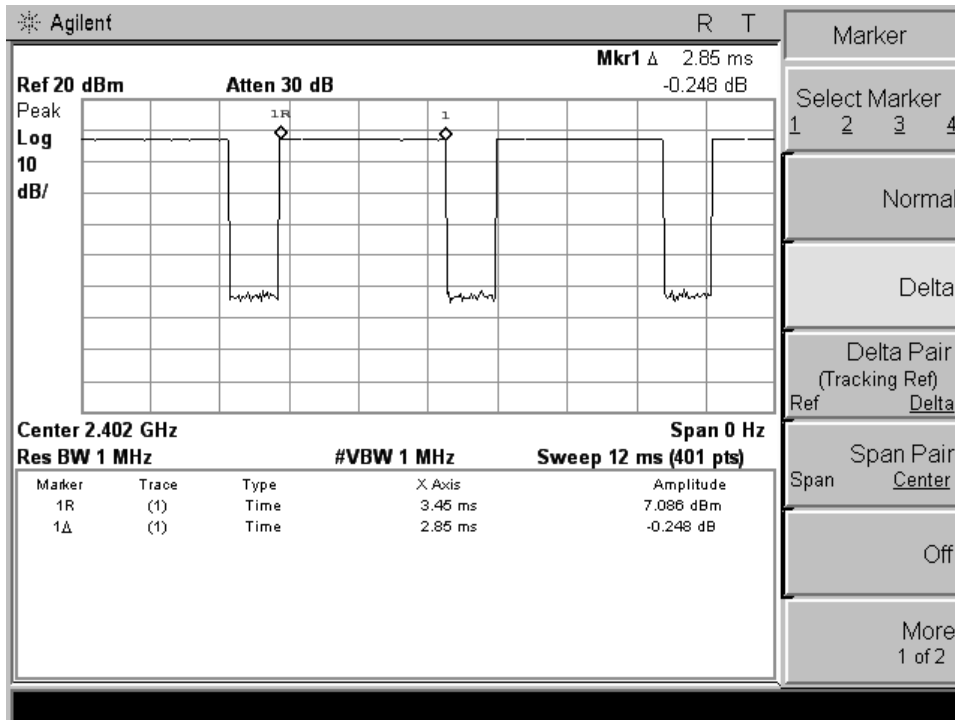
DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

Data Packet	Dwell Time(s)
3DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
3DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
3DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time. Only the worst data(DH5) were show as follow.	



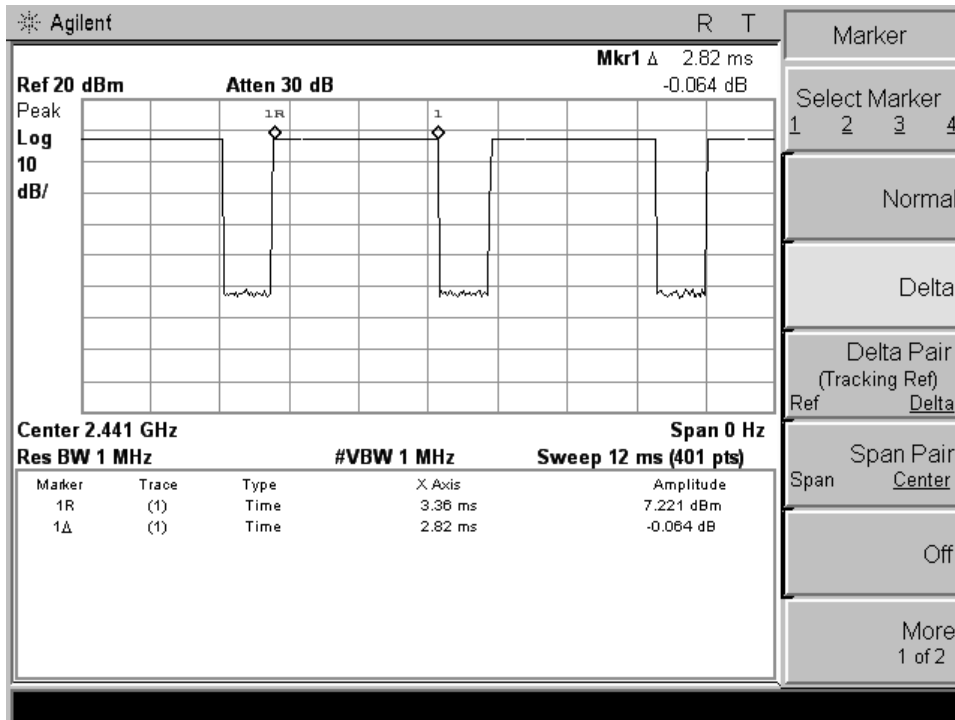
Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
8DPSK	3DH5	Low	2.850	0.3040	0.4
		middle	2.820	0.3008	0.4
		High	2.820	0.3008	0.4

8DPSK Low Channel

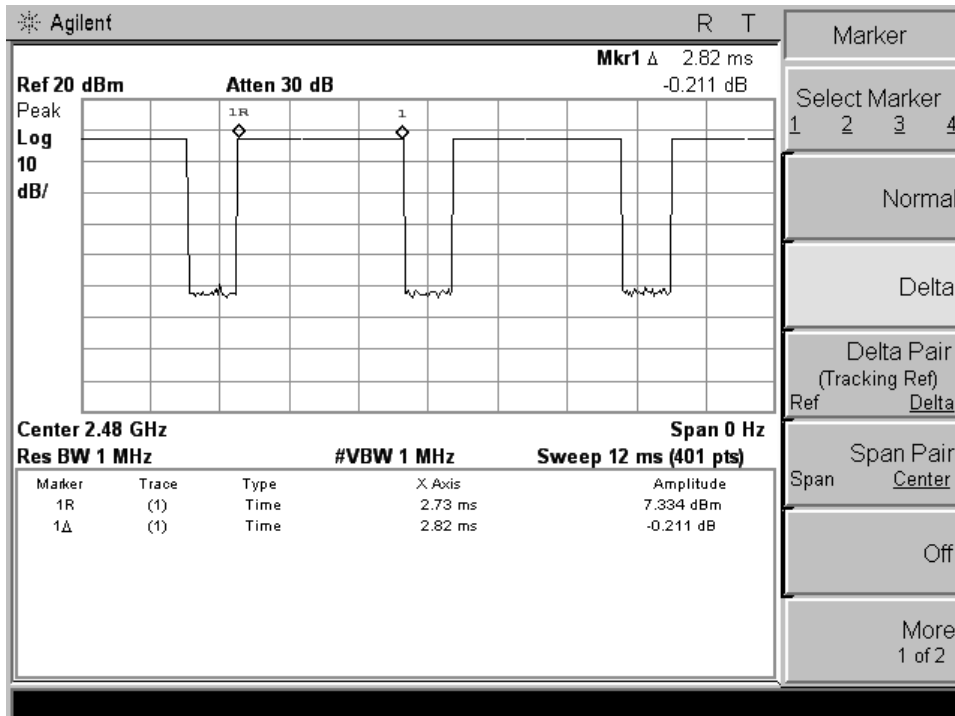




8DPSK Middle Channel



8DPSK High Channel





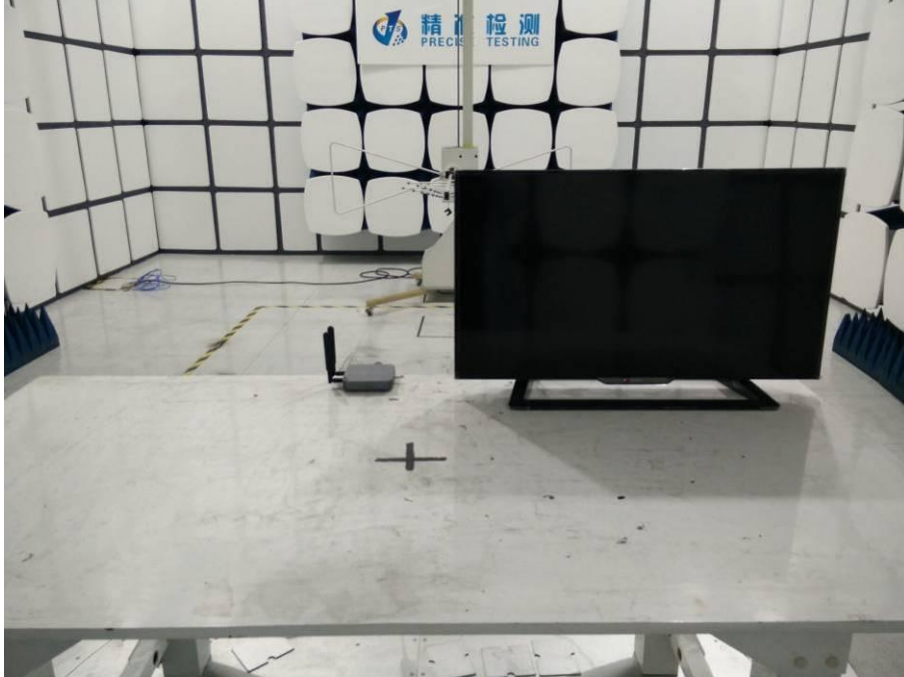
13 Antenna Requirement

According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an external antenna with RP-SMA connector, it meet the requirement of this section.

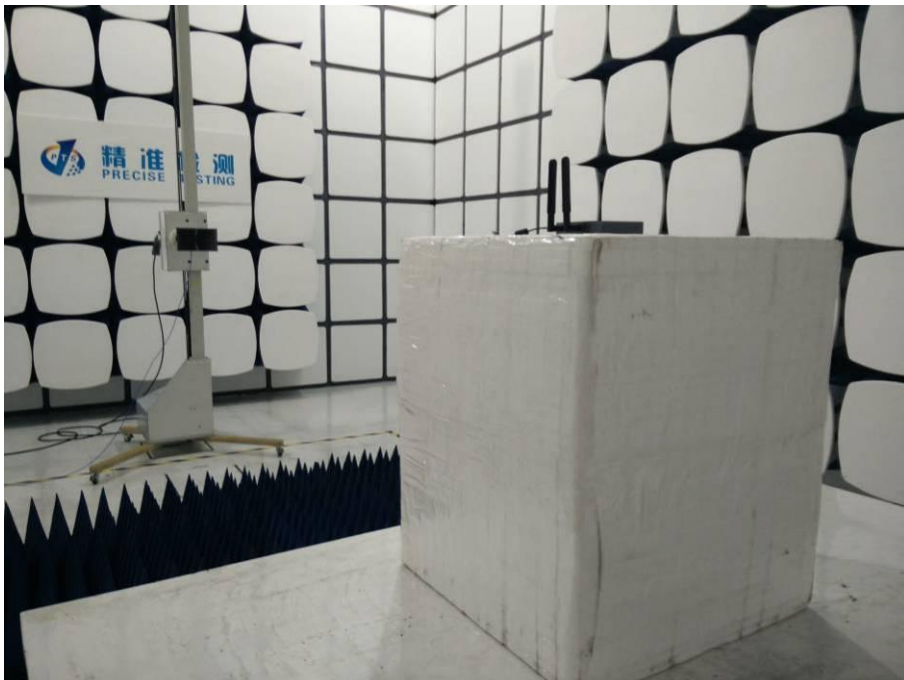


14 Test Setup

Spurious Emissions
From 30MHz-1000MHz



Above 1GHz



Conducted Emissions



*******THE END REPORT*******