RF TEST REPORT

Test item	:	DIGITAL CAR AUDIO SYSTEM
Model No.	:	ACBA0B2AN, ACBA0B2KN
Order No.	:	DEMC1304-01289, DEMC1304-01290
Date of receipt	:	2013-04-15
Test duration	:	2013-04-18 ~ 2013-04-23
Date of issue	:	2013-04-30
Use of report	:	FCC Original Grant

Applicant : HYUNDAI MOBIS CO., LTD.
80-9, Mabook-Dong, Giheung-Gu,Yongin-shi,Gyunggi-Do, 446-912, South Korea

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-080, Korea

Test specification	:	FCC Part 15 Subpart C 247 RSS-210Issue 8: 2010
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:	Witnessed by:	Reviewed by:
Engineer Chulmin Kim	N/A	Deputy General Manager Wonjung Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1304-0414	Apr. 30, 2013	Initial issue

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1.General Information

1.1 Testing Laboratory

Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-080, Korea
www.digitalemc.com
Telephone : + 82-31-321-2664
FAX : + 82-31-321-1664

1.2 Details of Applicant

Applicant	:	HYUNDAI MOBIS CO., LTD.
Address	:	80-9, Mabook-Dong, Giheung-Gu, Yongin-shi, Gyunggi-Do, 446-912, South Korea
Contact person	:	JongTae Kim
Phone No.	:	+82-31-260-0092

1.3 Description of EUT

Product	DIGITAL CAR AUDIO SYSTEM
Model Name	ACBA0B2AN, ACBA0B2KN Two models are same electrical and mechanical except followinginformation - FCC Model name: ACBA0B2AN(FCC ID:TQ8-ACBA0B2AN) - IC Model name: ACBA0B2KN (IC: 5074A-ACBA0B2KN)
Serial Number	Identical prototype
Power Supply	DC 14.4 V
Frequency Range	2402 ~ 2480MHz
Modulation Technique	GFSK, π/4-DQPSK, 8DPSK
Number of Channels	79
Antenna Type	PCB Antenna
Antenna Gain	-0.5 dBi(PK)

1.4. Declaration by the manufacturer

- N/A

1.5. Information about the FHSS characteristics:

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

1.6. Test Equipment List

Type	M/N	S/N	Manufacturer	Cal.Date (yyyy.mm.dd)	Next.Cal.Date (yyyy.mm.dd)
Multi-meter	34401A	3146A13475	HP	2013.02.27	2014.02.27
DC Power Supply	6622A	3448A03760	HP	2013.02.27	2014.02.27
Horn Antenna	3115	6419	ETS	2012.02.20	2014.02.20
Signal Analyzer	FSQ26	200445	Rohde Schwarz	2013.02.14	2014.02.14
Horn Antenna	SAS-574	154	A.H.Systems Inc.	2013.03.20	2015.03.20
Spectrum Analyzer	E4440A	MY45304199	Agilent Technologies	2012.09.18	2013.09.18
High-pass Filter	WHKX3.0	9	Wainwright Instruments	2012.09.17	2013.09.17
Bluetooth Tester	TC-3000B	3000B640046	TESCOM	2012.07.01	2013.07.01
Signal Generator	SMR20	101251	Rohde Schwarz	2013.02.28	2014.02.28
MXA Signal Analyzer	N9020A	MY49100833	Agilent	2013.01.08	2014.01.08
Thermohygrometer	BJ5478	120612-1	BODYCOM	2012.06.20	2013.06.20
Loop Antenna	FMZB1513	1513-128	Schwarzbeck	2012.09.24	2013.09.24
Power Splitter	K241B	016680	Anritsu	2013.03.07	2014.03.07
Amplifier (22dB)	8447E	2945A02865	H.P	2013.01.08	2014.01.08
Amplifier (30dB)	8449B	3008A00370	Agilent	2013.02.27	2014.02.27
EMI TEST RECEIVER	ESU	100014	R&S	2013.01.08	2014.01.08
BILOG ANTENNA	CBL6112B	2737	SCHAFFNER	2012.11.16	2014.11.16

1.7. Summary of Test Results

FCC Part RSS-210 & GEN	Parameter	Limit (Using in 2400~ 2483.5MHz)	Test Condition	Status Note 1
15.247(a) RSS-210(A8.1)	Carrier Frequency Separation	>= 20dB BW or >= Two-Thirds of the 20dB BW	Conducted	C
	Number of Hopping Frequencies	>= 15 hops		C
	20 dB Bandwidth	None		C
	Dwell Time	=< 0.4 seconds		C
15.247(b) RSS-210(A8.4)	Transmitter Output Power	=< 1Watt , if CHs >= 75 Others =<0.125W		C
15.247(d) RSS-210(A8.5)	Band-edge	The radiated emission to any 100 kHz of out-band shall be at least 20dB below the highest in-band spectral density.		C
	Conducted Spurious Emissions			C
15.205 15.209 RSS-210(A8.5)	RadiatedEmissions	FCC 15.209 Limits	Radiated	C
15.207 RSS-Gen(7.2.4)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	NA Note2
15.203 RSS-Gen(7.1.2)	Antenna Requirements	FCC 15.203	-	C

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

Note 2: This device is installed in a car. Therefore the power source is a battery of car.

Note 3:The sample was tested according to the following specification:
ANSI C63.4-2009, DA00-705, RSS-Gen Issue 3: 2010

1.8 Conclusion of worst-case and operation mode

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

Therefore all applicable requirements were tested with all the modulations.

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

Tested frequency information,

- Hopping Function: Enable

	TXFrequency(MHz)	RX Frequency(MHz)
Hopping Band	2402 ~ 2480	2402 ~ 2480

- Hopping Function: Disable

	TXFrequency(MHz)	RX Frequency(MHz)
Lowest Channel	2402	2402
Middle Channel	2441	2441
Highest Channel	2480	2480

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

2.1. Test Setup

Refer to the APPENDIX I.

2.2. Limit

According to §15.247(d), in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
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

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	3600 ~ 4400	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900	13.25 ~ 13.4	
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the DA 00-705 and ANSI C63.4:2009.

2.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. 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.
4. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 ㏈lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE ;

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

2.3.2. Test Procedures for Conducted Spurious Emissions

1.The transmitter output was connected to the spectrum analyzer.
2.The **reference level** of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑, VBW=300㎑.
3. The conducted spurious emission was performed using the spectrum analyzer's spurious measurement function from 30 MHz to 25 GHz with the 12 sub measurementranges. The each sub ranges were set as below.

RBW= 1 MHz, VBW= 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SPAN = MAX 3 GHz (Below 10 GHz) and MAX 5 GHz (Above 10 GHz) , BINS = 10001 (Each sub range below 10 GHz) and 20001 (Each sub range above 10 GHz)
LIMIT LINE = 20 dB below of the reference level of above measurement procedure. (RBW = 100 KHz , VBW = 300 KHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 KHz, VBW = 300 KHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 KHz BW.
Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

2.4. Test Results

Ambient temperature : 21℃
Relative humidity : 54%

2.4.1. Radiated Emission

9KHz ~ 25GHz Data(Modulation: ***GFSK***)

▪ Lowest Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detect or Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.96	V	X	PK	49.20	-2.67	N/A	N/A	46.53	74.00	27.47
2388.92	V	X	AV	36.49	-2.67	N/A	N/A	33.82	54.00	20.18
4803.89	V	X	PK	48.33	6.65	N/A	N/A	54.98	74.00	19.02
4803.92	V	X	AV	39.31	6.65	N/A	N/A	45.96	54.00	8.04

▪ Middle Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detect or Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.61	V	X	PK	48.28	6.78	N/A	N/A	55.06	74.00	18.94
4881.60	V	X	AV	40.34	6.78	N/A	N/A	47.12	54.00	6.88

▪ Highest Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detect or Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.66	V	X	PK	56.30	-2.39	N/A	N/A	53.91	74.00	20.09
2483.62	V	X	AV	49.80	-2.39	N/A	N/A	47.41	54.00	6.59
4959.55	V	X	PK	48.39	7.09	N/A	N/A	55.48	74.00	18.52
4959.53	V	X	AV	41.22	7.09	N/A	N/A	48.31	54.00	5.69

Note.

1. Measurement Distance = 3m
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG

Where,T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

Distance Factor = 20log(Measurement distance / The measured distance)^2

D.C.F = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data(Modulation: *π/4DQPSK*)

▪ Lowest Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.51	V	X	PK	57.20	-2.67	N/A	N/A	54.53	74.00	19.47
2388.50	V	X	AV	49.80	-2.67	N/A	N/A	47.13	54.00	6.87
4803.45	V	X	PK	45.01	6.65	N/A	N/A	51.66	74.00	22.34
4803.60	V	X	AV	32.80	6.65	N/A	N/A	39.45	54.00	14.55

▪ Middle Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.77	V	X	PK	44.33	6.78	N/A	N/A	51.11	74.00	22.89
4881.82	V	X	AV	32.90	6.78	N/A	N/A	39.68	54.00	14.32

▪ Highest Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.66	V	X	PK	61.30	-2.39	N/A	N/A	58.91	74.00	15.09
2483.62	V	X	AV	50.35	-2.39	N/A	N/A	47.96	54.00	6.04
4959.05	V	X	PK	44.99	7.09	N/A	N/A	52.08	74.00	21.92
4959.02	V	X	AV	33.24	7.09	N/A	N/A	40.33	54.00	13.67

Note.

1. Measurement Distance = 3m
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG

Where,T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

Distance Factor = 20log(Measurement distance / The measured distance)^2

D.C.F = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data(Modulation: ***8DPSK***)

▪ Lowest Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.83	V	X	PK	57.20	-2.67	N/A	N/A	54.53	74.00	19.47
2388.87	V	X	AV	49.80	-2.67	N/A	N/A	47.13	54.00	6.87
4803.88	V	X	PK	45.56	6.65	N/A	N/A	52.21	74.00	21.79
4803.84	V	X	AV	33.70	6.65	N/A	N/A	40.35	54.00	13.65

▪ Middle Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.11	V	X	PK	45.36	6.78	N/A	N/A	52.14	74.00	21.86
4882.10	V	X	AV	32.22	6.78	N/A	N/A	39.00	54.00	15.00

▪ Highest Channel

Freq. (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.54	V	X	PK	61.65	-2.39	N/A	N/A	59.26	74.00	14.74
2483.58	V	X	AV	50.12	-2.39	N/A	N/A	47.73	54.00	6.27
4959.69	V	X	PK	44.77	7.09	N/A	N/A	51.86	74.00	22.14
4959.70	V	X	AV	33.24	7.09	N/A	N/A	40.33	54.00	13.67

Note.

1. Measurement Distance = 3m
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG

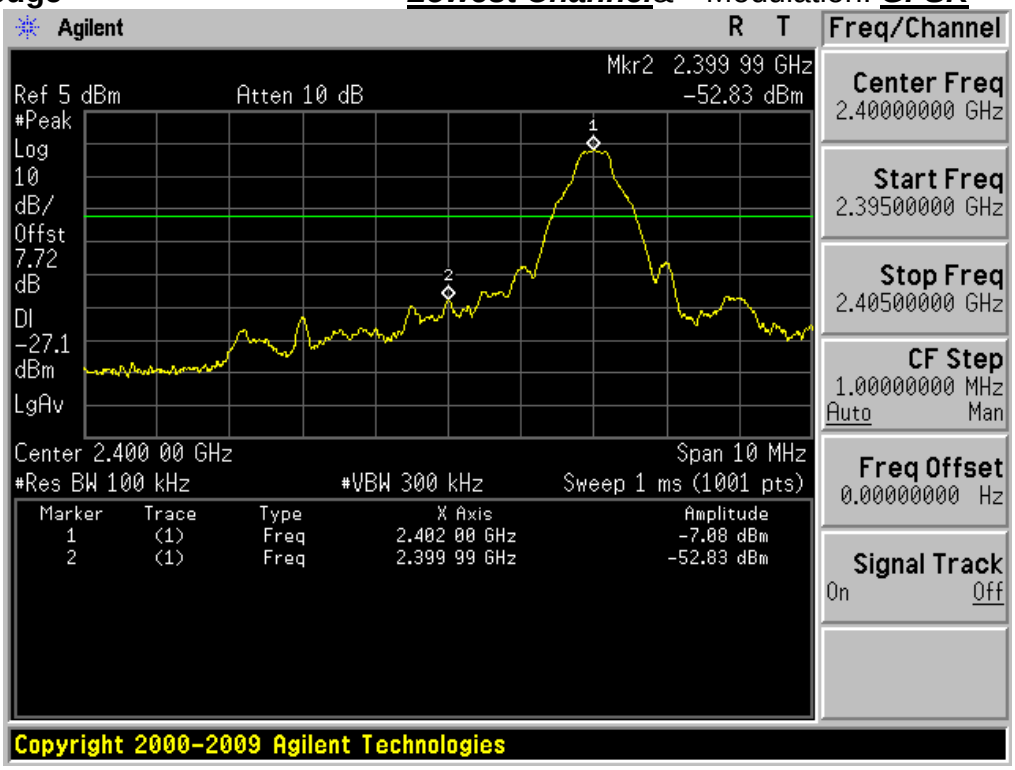
Where,T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

Distance Factor = 20log(Measurement distance / The measured distance)^2

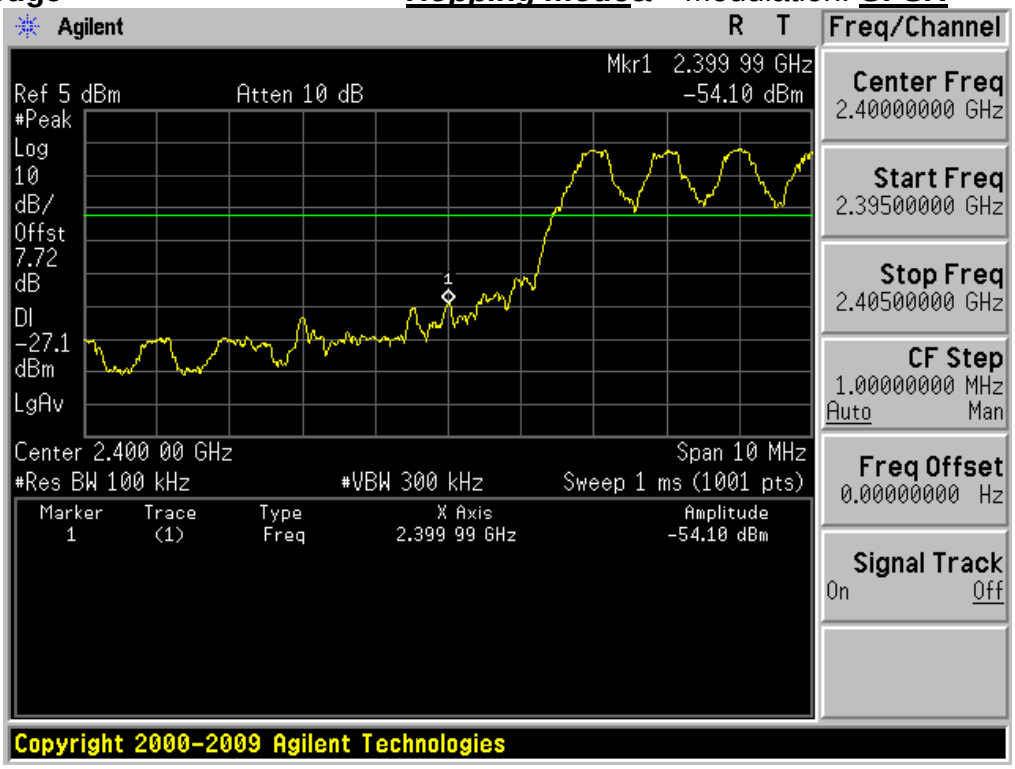
D.C.F = Duty Cycle Correction Factor.

2.4.2. Conducted Spurious Emissions

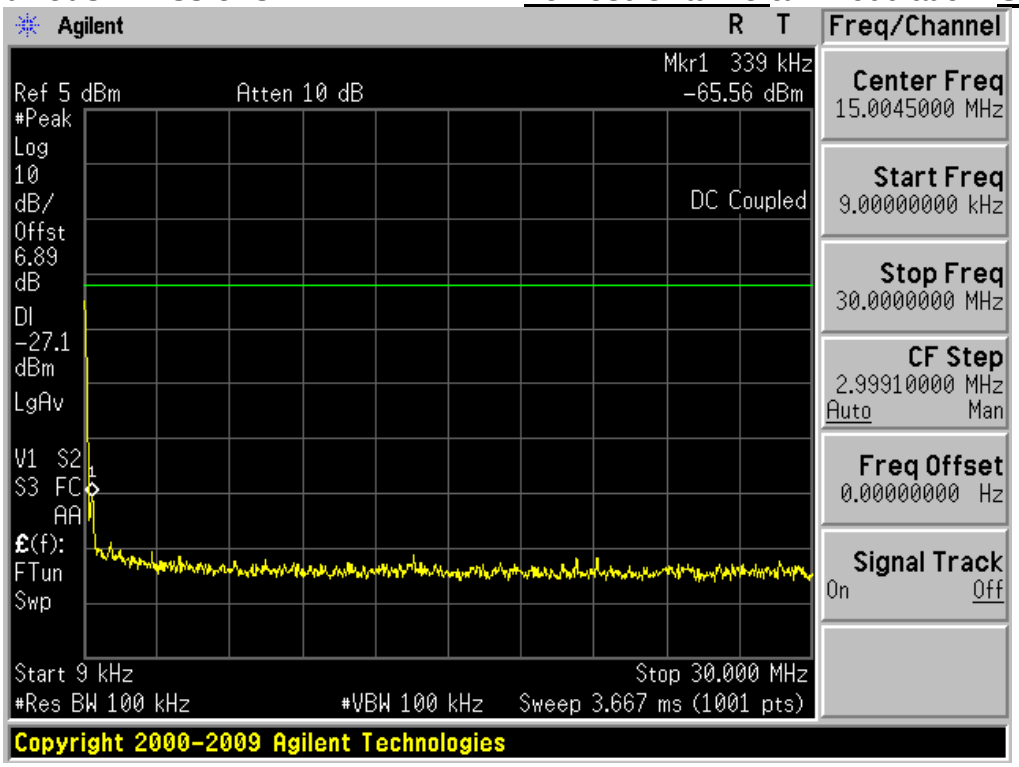
Low Band-edge ***Lowest Channel***& Modulation: ***GFSK***

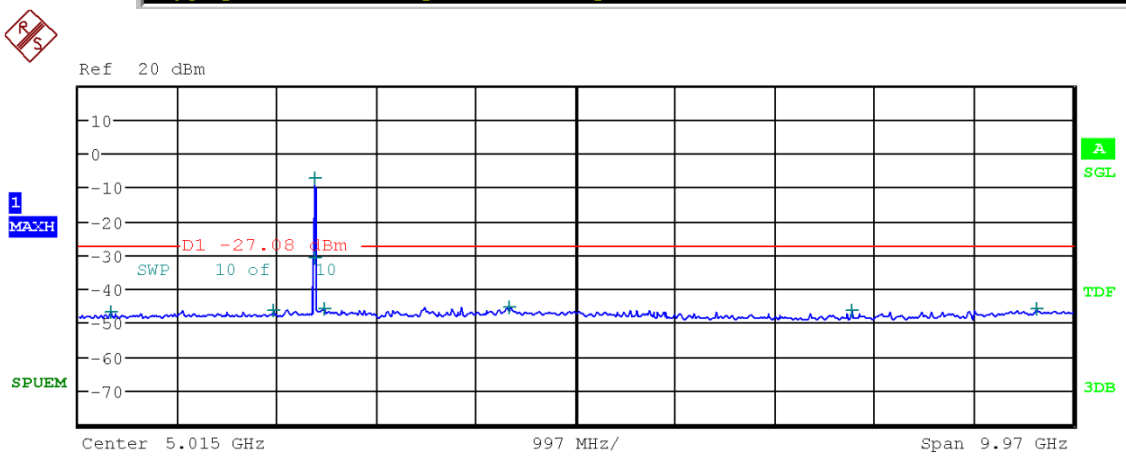


Low Band-edge ***Hopping mode***& Modulation: ***GFSK***

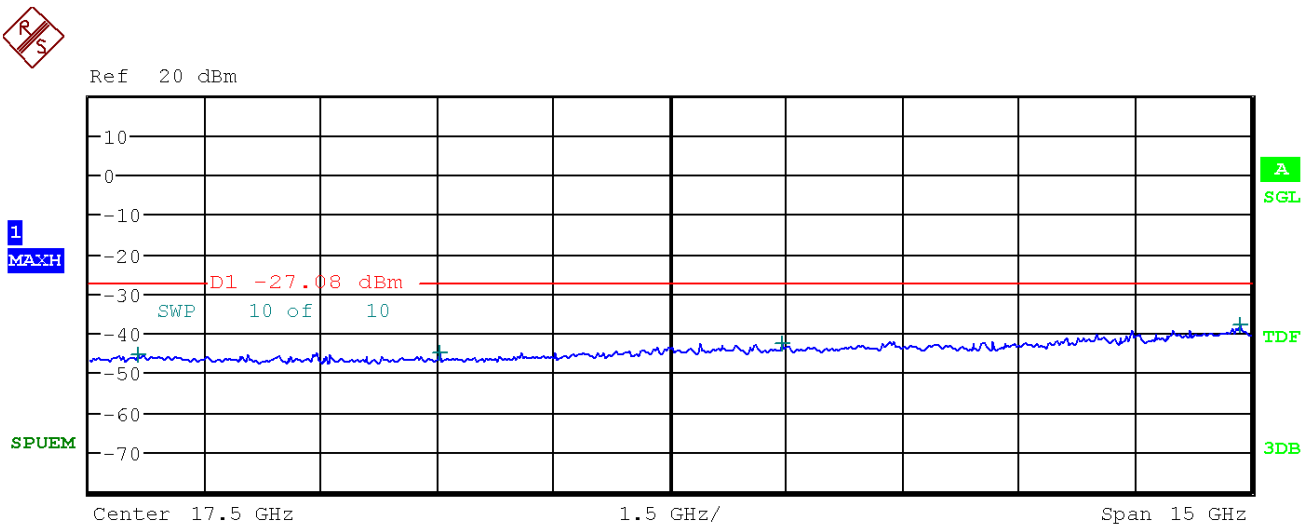


Conducted Spurious Emissions ***Lowest Channel***& Modulation: ***GFSK***



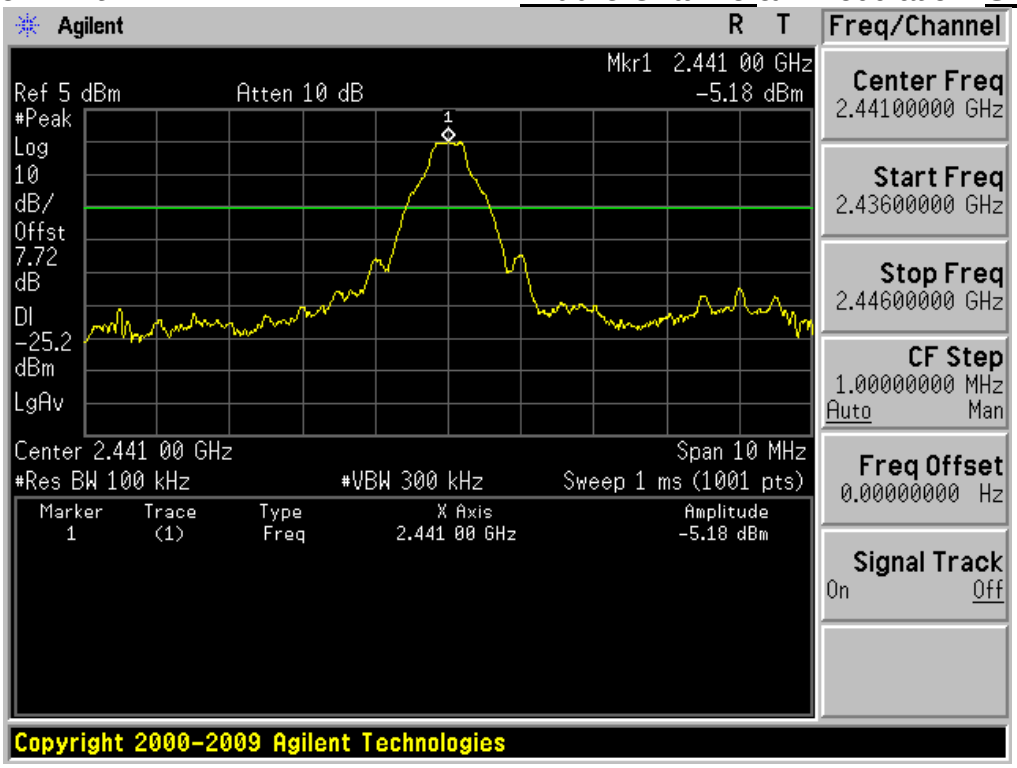


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	350.100000 M	-47.06	-200.00
1.000 G	2.000 G	1.00 M	1.979700 G	-46.43	-200.00
2.000 G	2.400 G	1.00 M	2.400000 G	-30.94	-200.00
2.400 G	2.483 G	1.00 M	2.402171 G	-7.47	-200.00
2.483 G	3.000 G	1.00 M	2.484481 G	-46.00	-200.00
3.000 G	6.000 G	1.00 M	4.351800 G	-45.57	-200.00
6.000 G	9.000 G	1.00 M	7.781400 G	-46.39	-200.00
9.000 G	10.000 G	1.00 M	9.638600 G	-46.17	-200.00

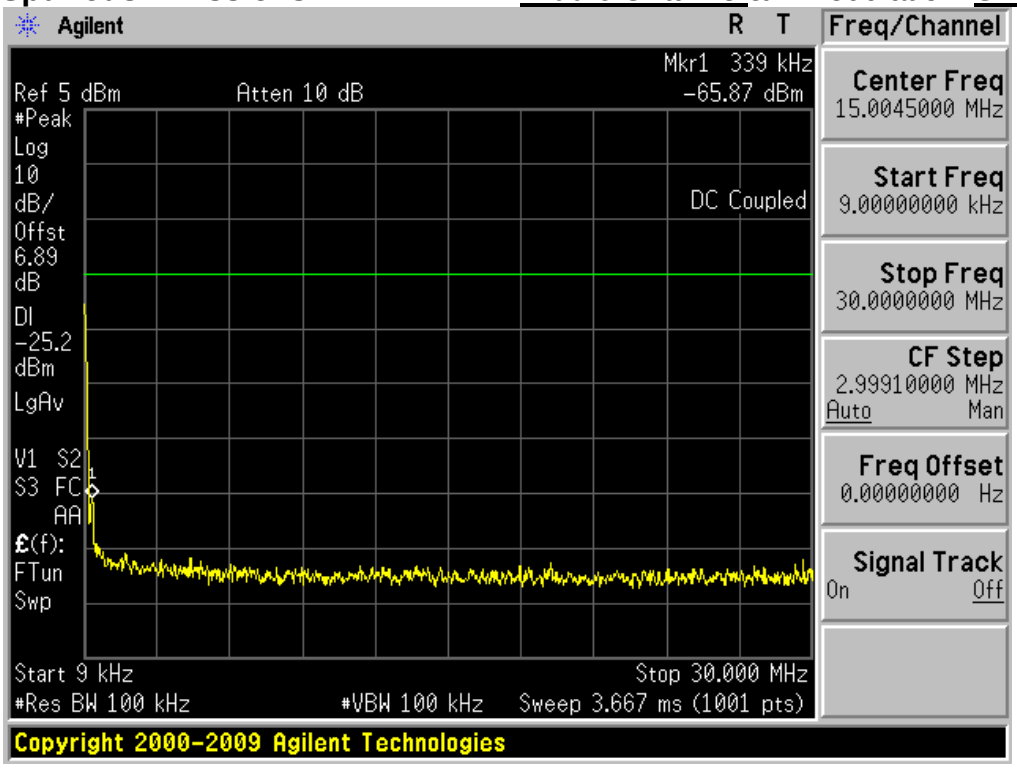


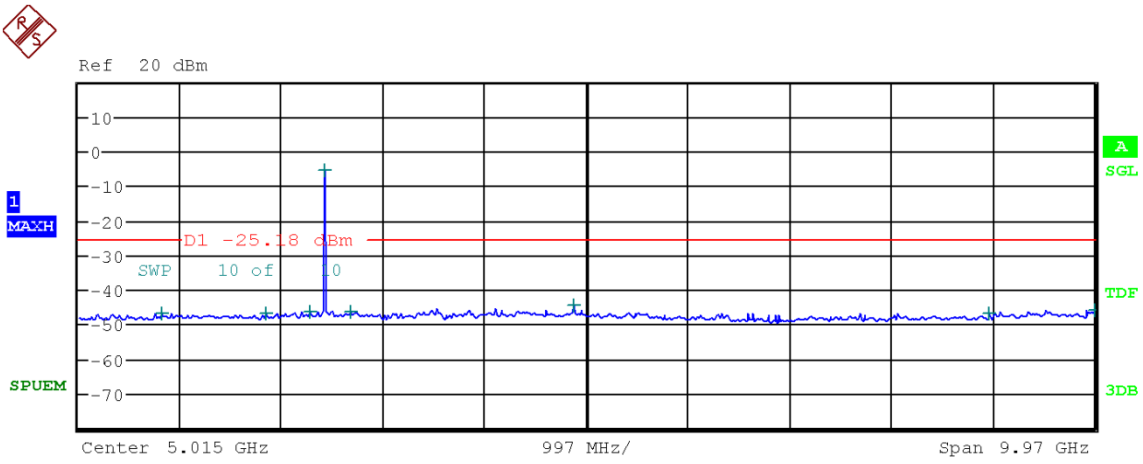
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	10.622700 G	-45.34	-200.00
12.000 G	15.000 G	1.00 M	14.512800 G	-44.92	-200.00
15.000 G	20.000 G	1.00 M	18.939000 G	-42.69	-200.00
20.000 G	25.000 G	1.00 M	24.849250 G	-37.76	-200.00

Reference for limit ***Middle Channel***& Modulation: ***GFSK***

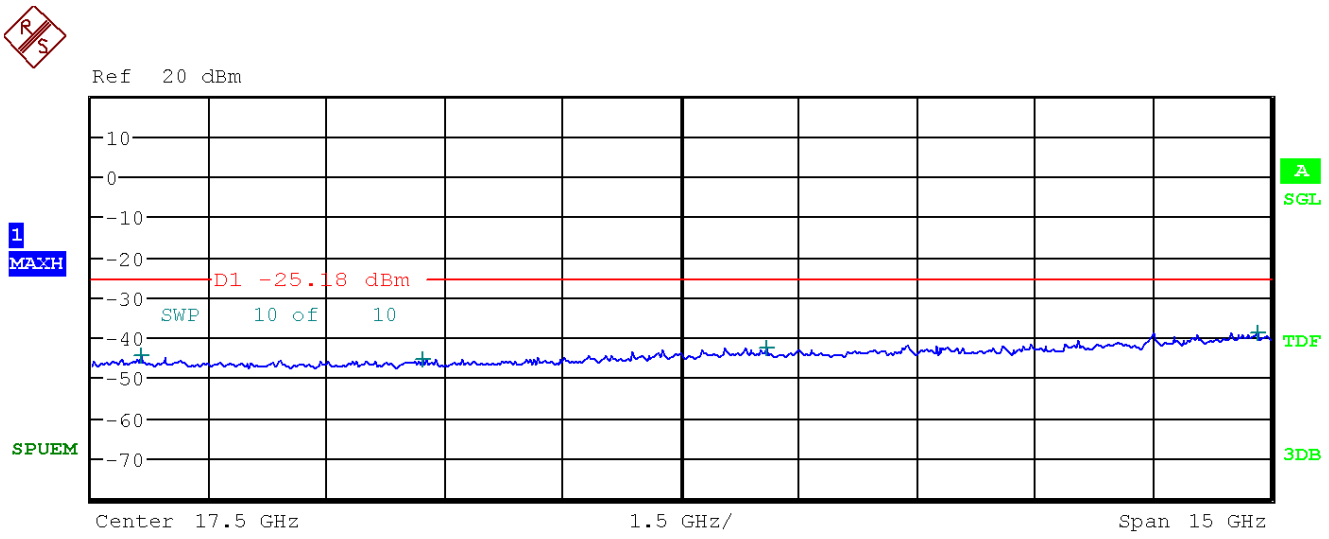


Conducted Spurious Emissions ***Middle Channel***& Modulation: ***GFSK***



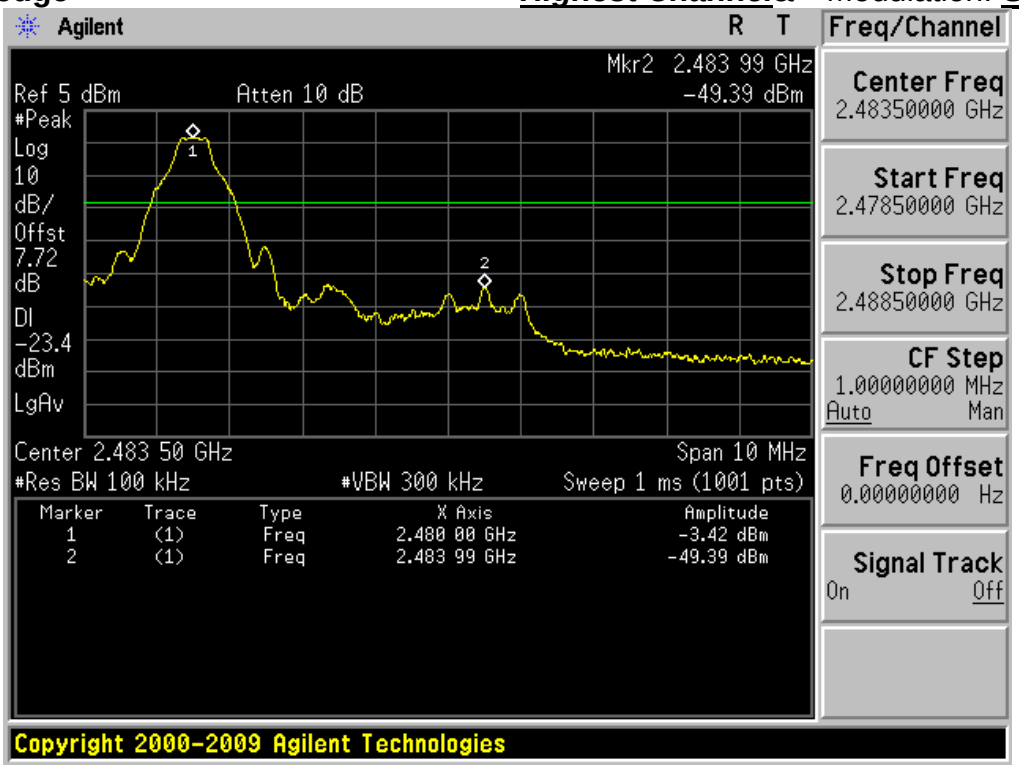


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	849.941000 M	-46.75	-200.00
1.000 G	2.000 G	1.00 M	1.869100 G	-46.93	-200.00
2.000 G	2.400 G	1.00 M	2.306280 G	-46.50	-200.00
2.400 G	2.483 G	1.00 M	2.440823 G	-5.46	-200.00
2.483 G	3.000 G	1.00 M	2.691753 G	-46.39	-200.00
3.000 G	6.000 G	1.00 M	4.882500 G	-44.56	-200.00
6.000 G	9.000 G	1.00 M	8.955300 G	-46.67	-200.00
9.000 G	10.000 G	1.00 M	9.995000 G	-46.04	-200.00

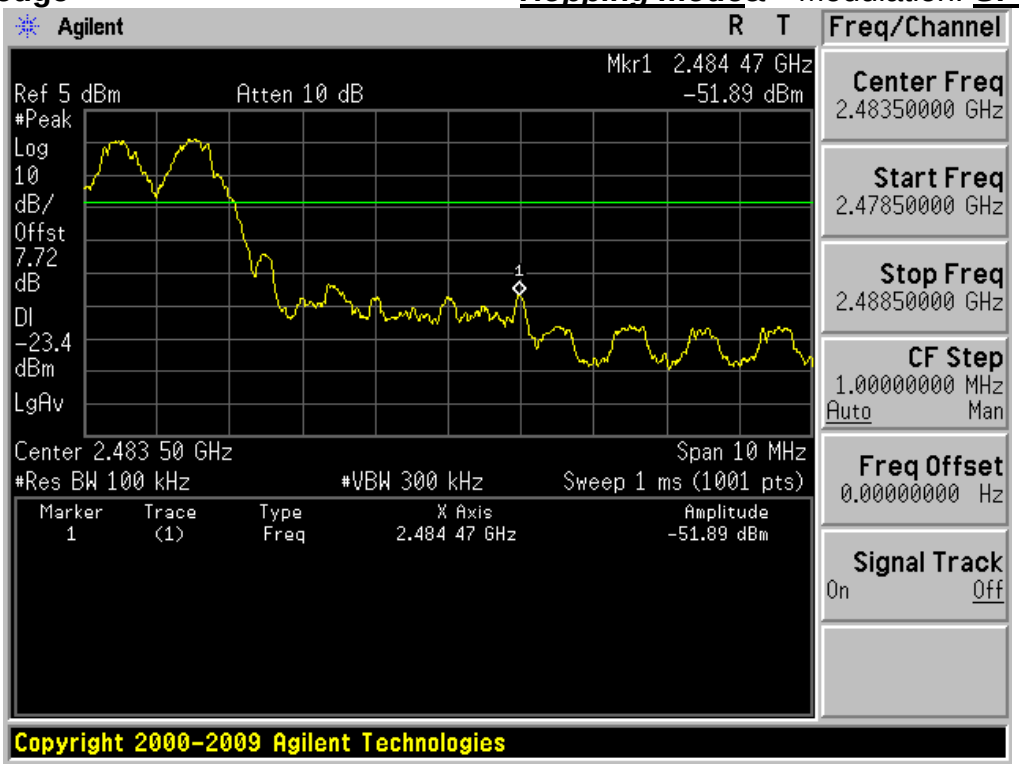


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	10.623500 G	-44.60	-200.00
12.000 G	15.000 G	1.00 M	14.209050 G	-45.39	-200.00
15.000 G	20.000 G	1.00 M	18.581250 G	-42.51	-200.00
20.000 G	25.000 G	1.00 M	24.826000 G	-38.75	-200.00

High Band-edge ***Highest Channel***& Modulation: ***GFSK***

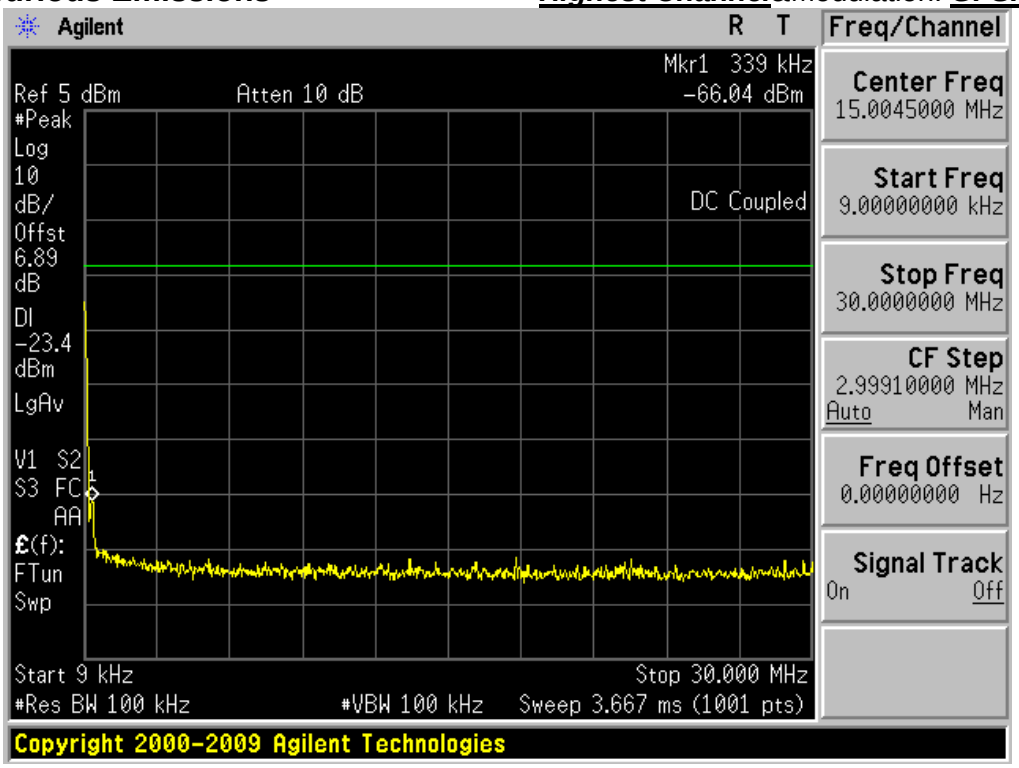


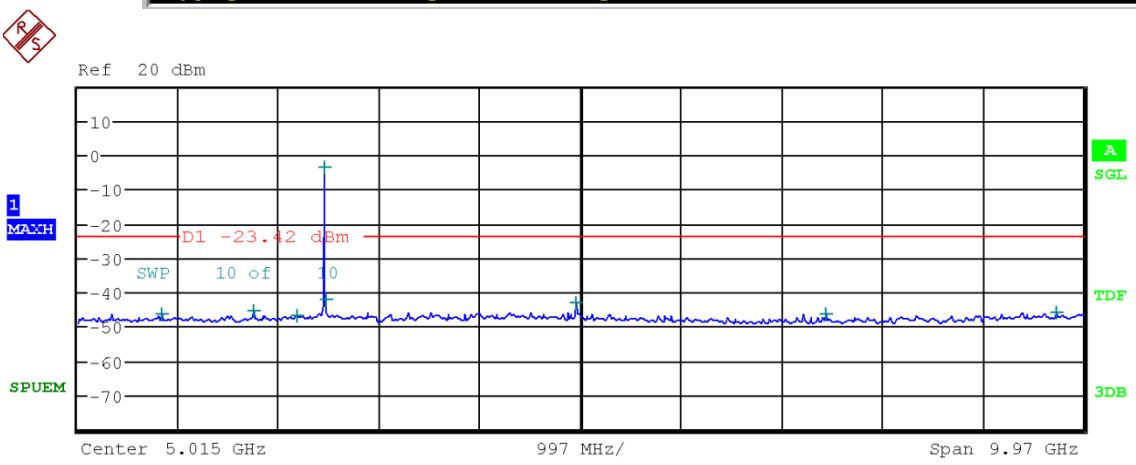
High Band-edge ***Hopping mode***& Modulation: ***GFSK***



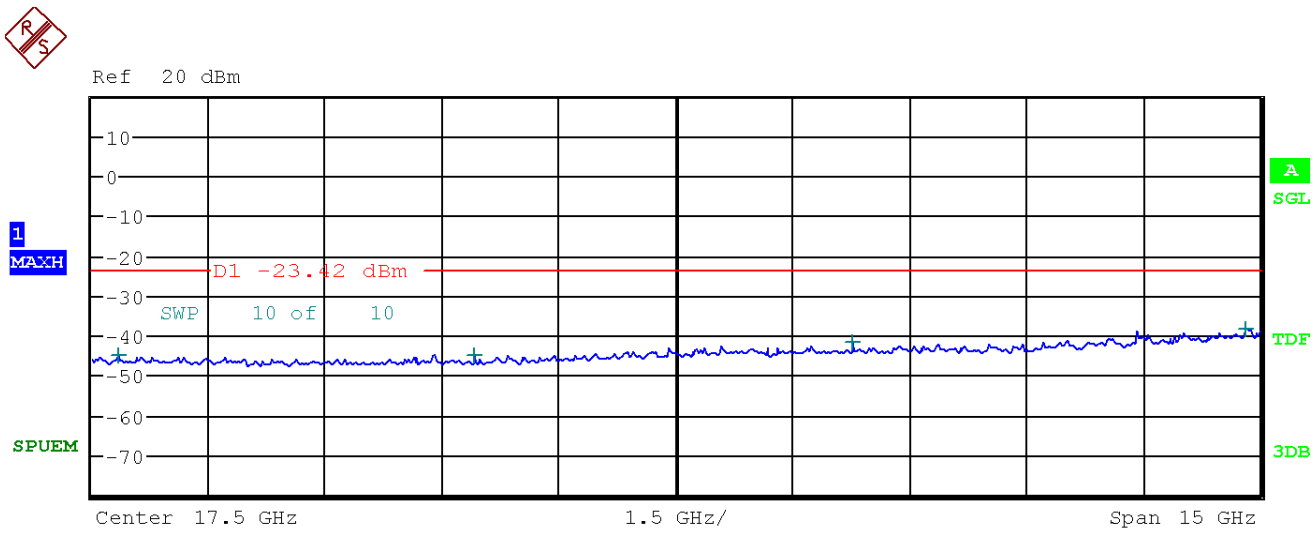
Conducted Spurious Emissions

Highest Channel&Modulation: ***GFSK***



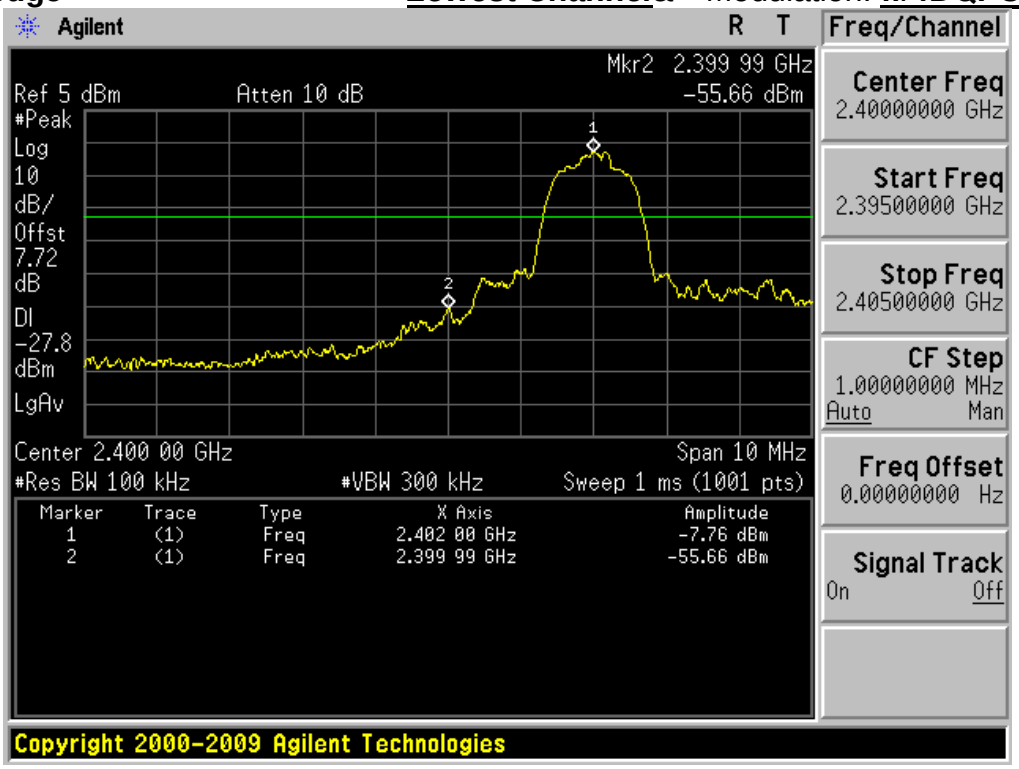


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	854.015000 M	-46.53	-200.00
1.000 G	2.000 G	1.00 M	1.764300 G	-45.27	-200.00
2.000 G	2.400 G	1.00 M	2.205840 G	-46.77	-200.00
2.400 G	2.483 G	1.00 M	2.479985 G	-3.84	-200.00
2.483 G	3.000 G	1.00 M	2.483655 G	-42.17	-200.00
3.000 G	6.000 G	1.00 M	4.960200 G	-43.25	-200.00
6.000 G	9.000 G	1.00 M	7.440300 G	-46.51	-200.00
9.000 G	10.000 G	1.00 M	9.722000 G	-45.82	-200.00

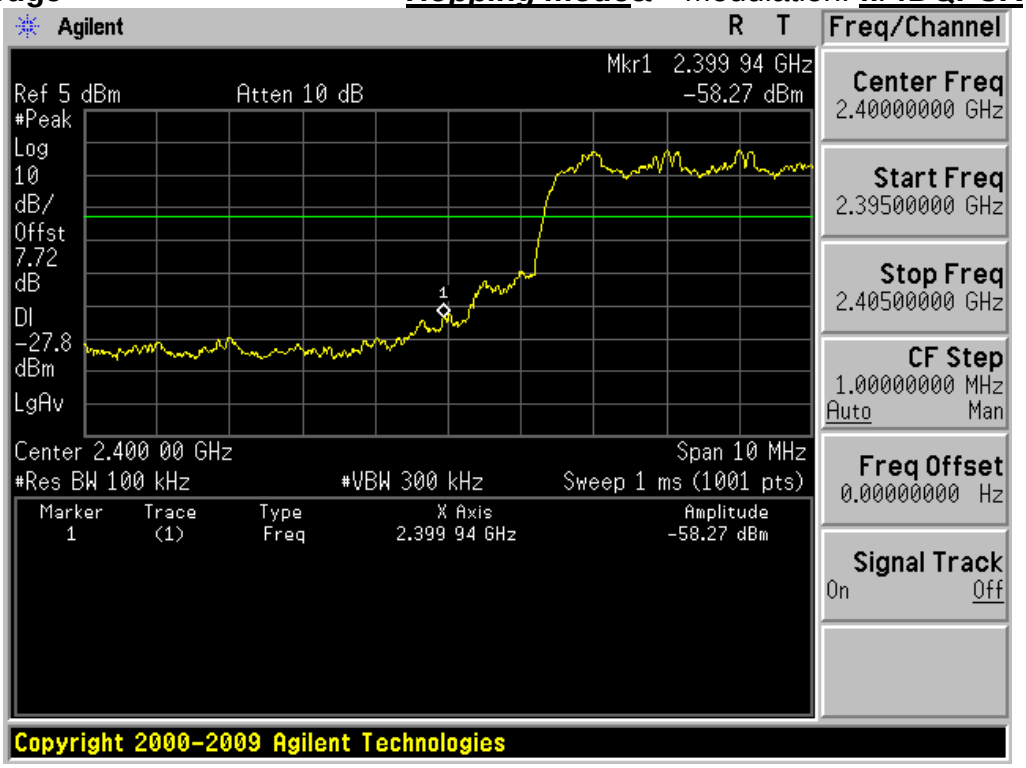


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	10.344700 G	-45.16	-200.00
12.000 G	15.000 G	1.00 M	14.915700 G	-45.06	-200.00
15.000 G	20.000 G	1.00 M	19.753250 G	-41.92	-200.00
20.000 G	25.000 G	1.00 M	24.814750 G	-38.38	-200.00

Low Band-edge ***Lowest Channel***& Modulation: ***π/4DQPSK***

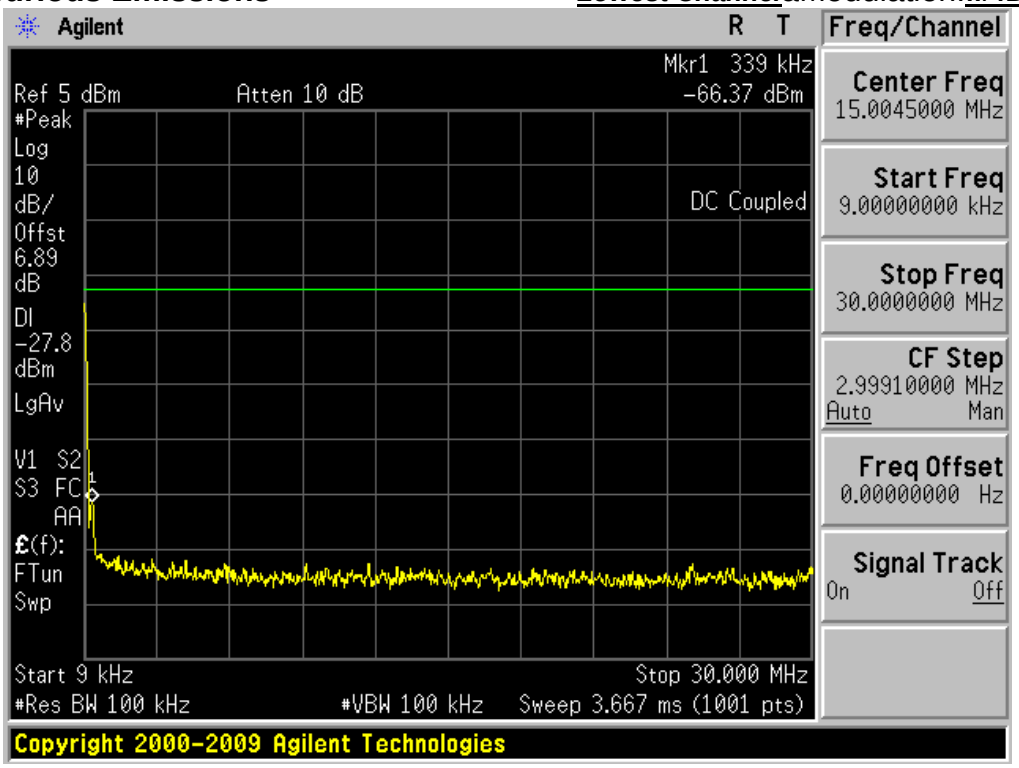


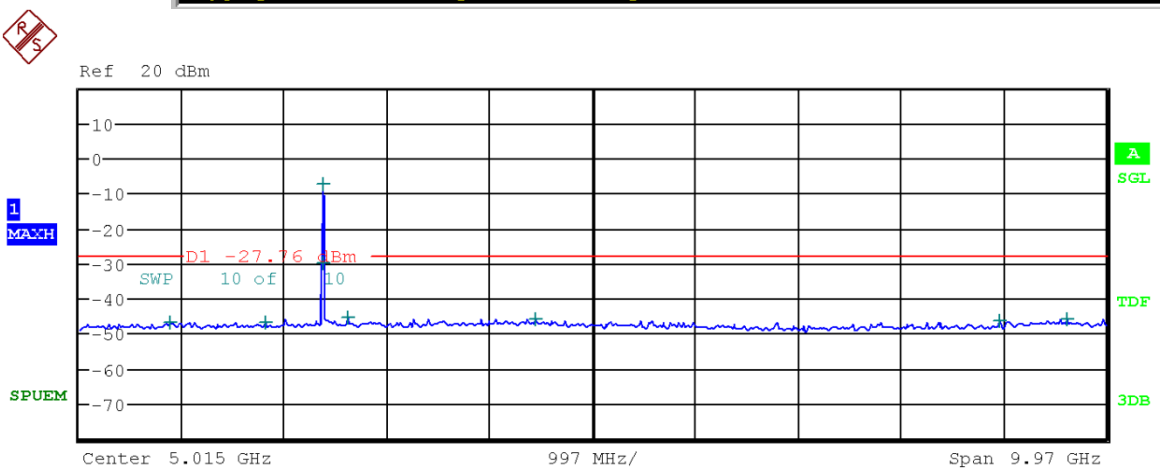
Low Band-edge ***Hopping mode***& Modulation: ***π/4DQPSK***



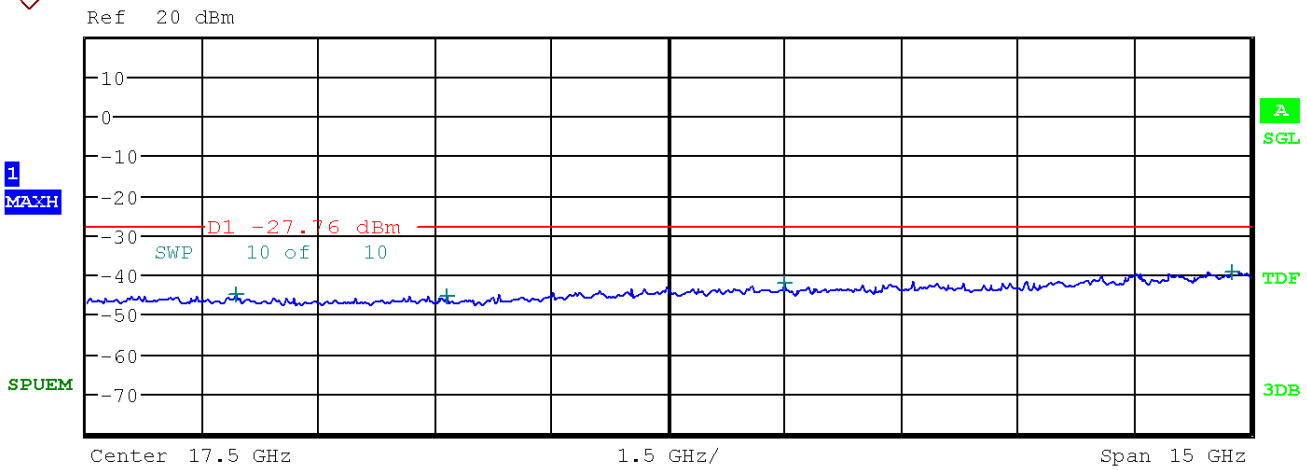
Conducted Spurious Emissions

Lowest Channel&Modulation:***π/4DQPSK***



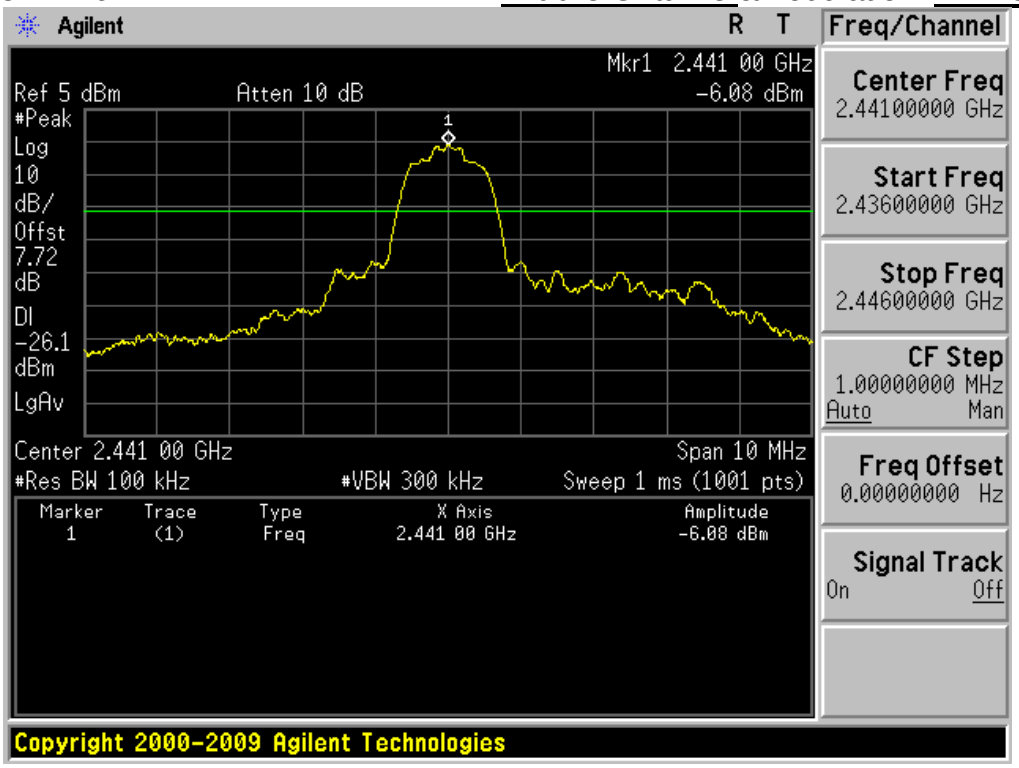


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	913.767000 M	-47.12	-200.00
1.000 G	2.000 G	1.00 M	1.838100 G	-46.84	-200.00
2.000 G	2.400 G	1.00 M	2.399960 G	-30.21	-200.00
2.400 G	2.483 G	1.00 M	2.401870 G	-7.47	-200.00
2.483 G	3.000 G	1.00 M	2.632717 G	-45.71	-200.00
3.000 G	6.000 G	1.00 M	4.454700 G	-45.81	-200.00
6.000 G	9.000 G	1.00 M	8.963100 G	-46.57	-200.00
9.000 G	10.000 G	1.00 M	9.623200 G	-45.85	-200.00

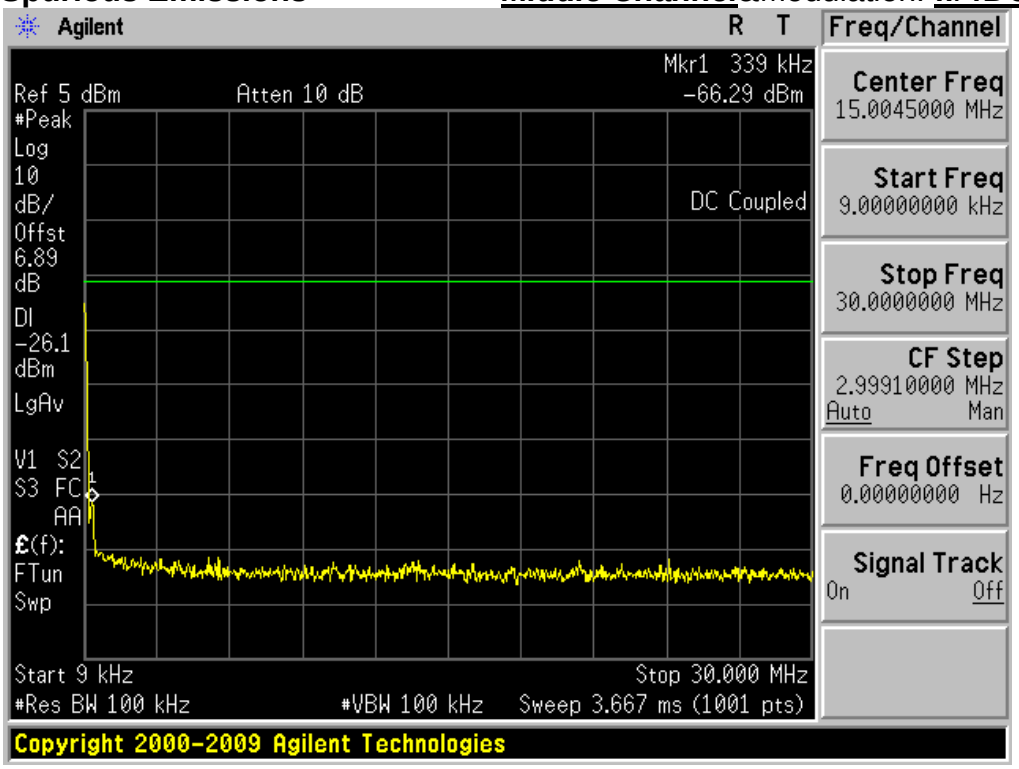


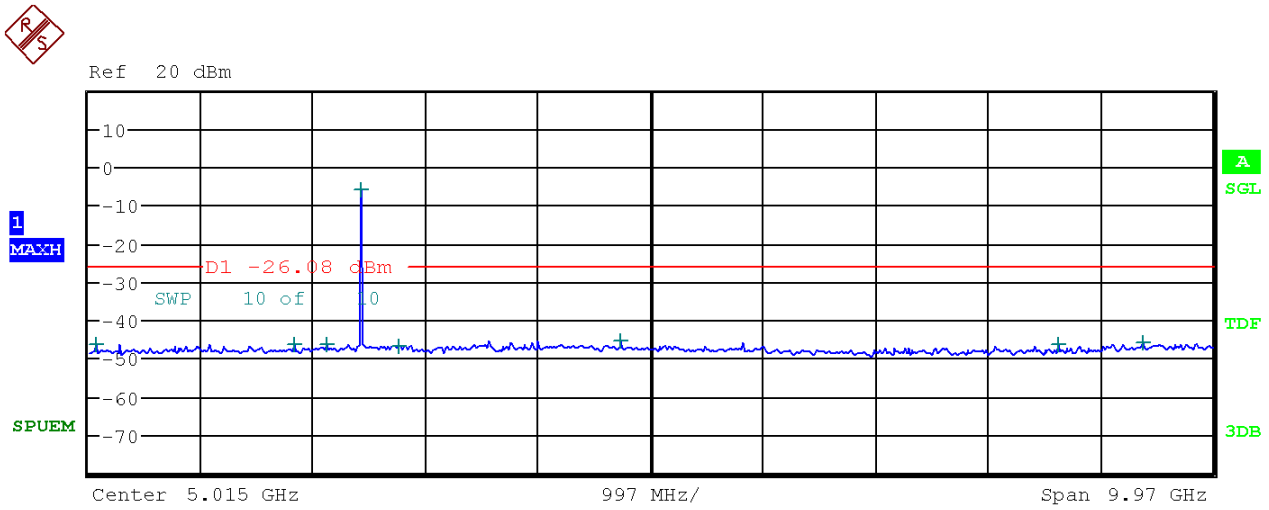
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	11.927100 G	-45.25	-200.00
12.000 G	15.000 G	1.00 M	14.649600 G	-45.27	-200.00
15.000 G	20.000 G	1.00 M	18.992000 G	-42.04	-200.00
20.000 G	25.000 G	1.00 M	24.750250 G	-39.24	-200.00

Reference for limit ***Middle Channel***&Modulation: ***π/4DQPSK***

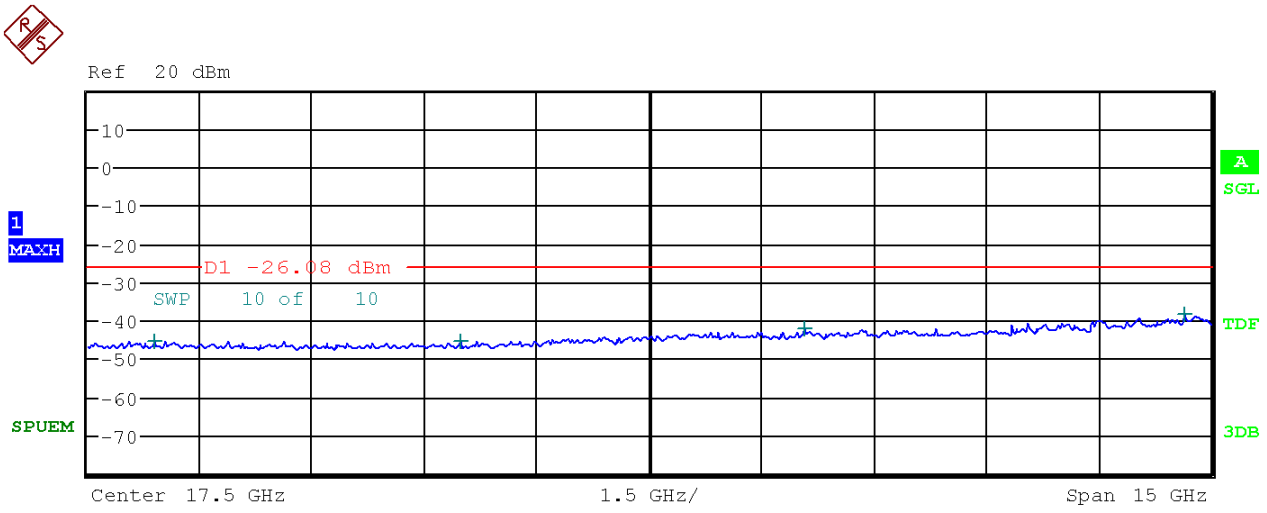


Conducted Spurious Emissions ***Middle Channel***&Modulation: ***π/4DQPSK***



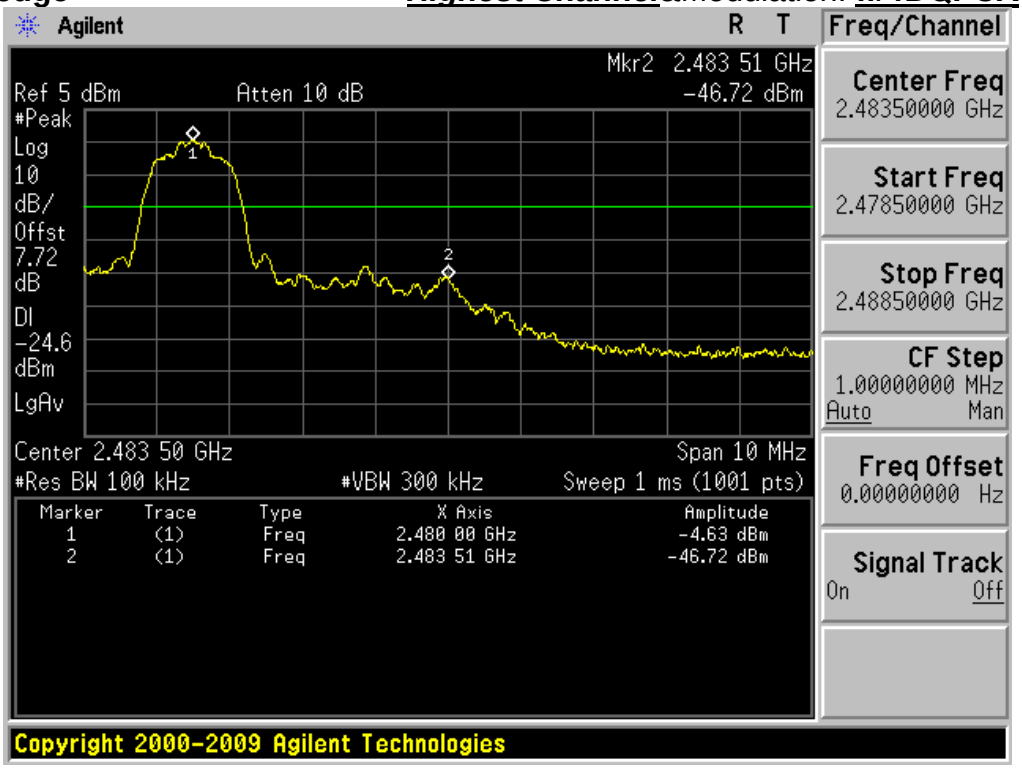


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	94.117000 M	-46.32	-200.00
1.000 G	2.000 G	1.00 M	1.846200 G	-46.45	-200.00
2.000 G	2.400 G	1.00 M	2.133640 G	-46.39	-200.00
2.400 G	2.483 G	1.00 M	2.441166 G	-6.09	-200.00
2.483 G	3.000 G	1.00 M	2.780384 G	-46.68	-200.00
3.000 G	6.000 G	1.00 M	4.743900 G	-45.51	-200.00
6.000 G	9.000 G	1.00 M	8.619000 G	-46.63	-200.00
9.000 G	10.000 G	1.00 M	9.375200 G	-46.16	-200.00

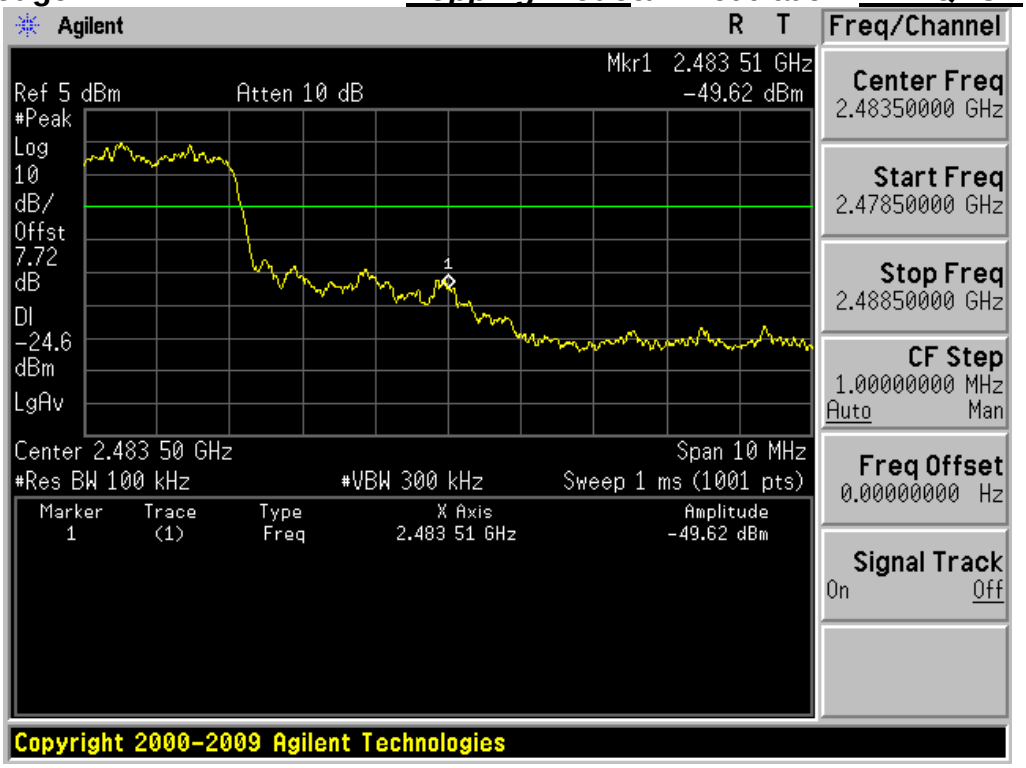


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	10.888700 G	-45.45	-200.00
12.000 G	15.000 G	1.00 M	14.985300 G	-45.60	-200.00
15.000 G	20.000 G	1.00 M	19.576250 G	-42.39	-200.00
20.000 G	25.000 G	1.00 M	24.629500 G	-38.48	-200.00

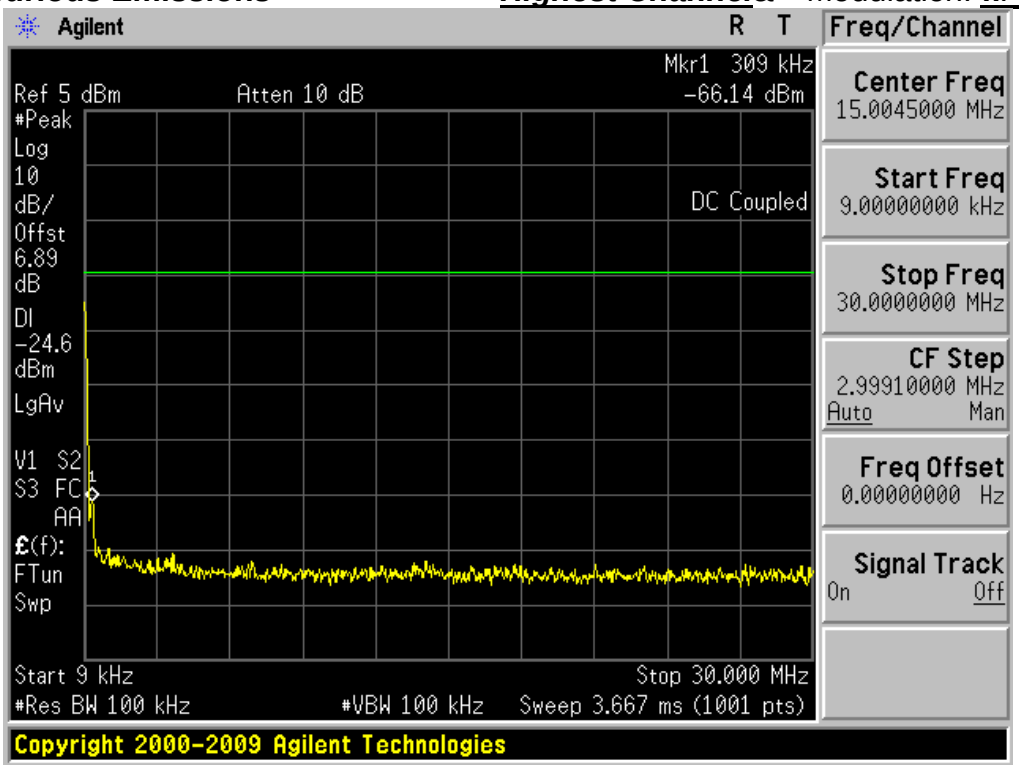
High Band-edge ***Highest Channel***&Modulation: ***π/4DQPSK***

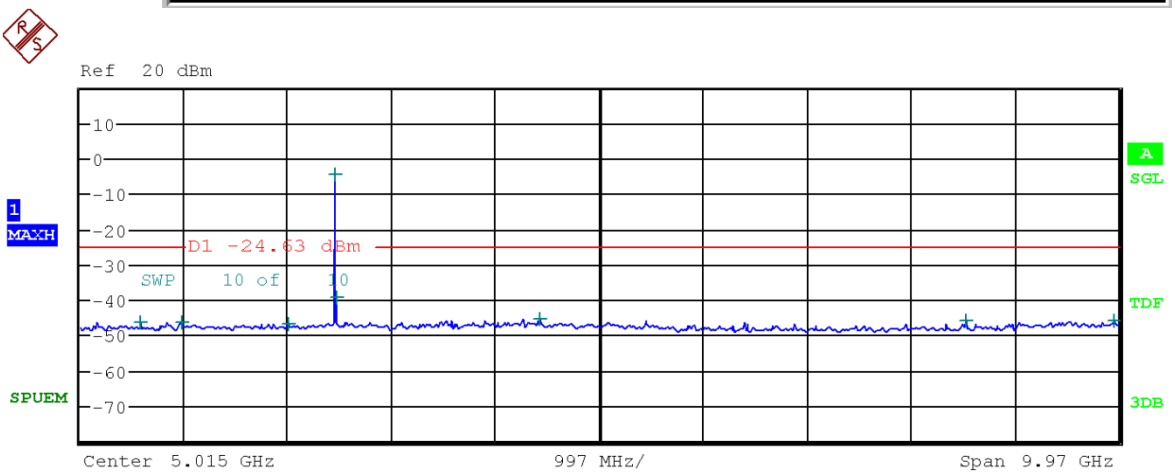


High Band-edge ***Hopping mode***& Modulation: ***π/4DQPSK***

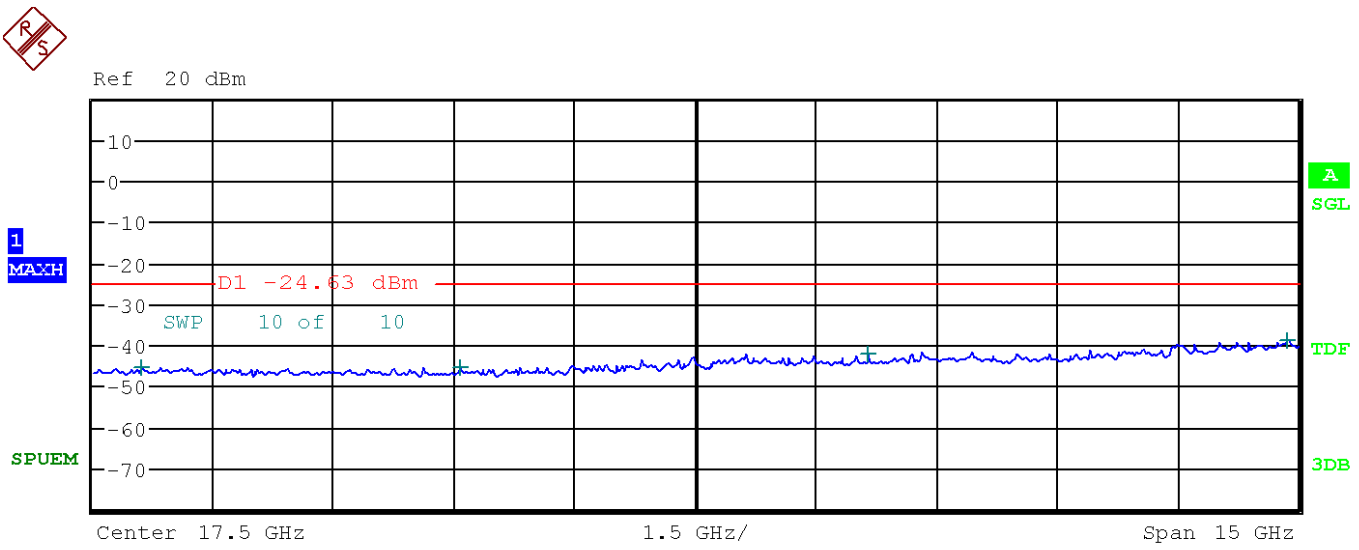


Conducted Spurious Emissions ***Highest Channel*** & Modulation: ***π/4DQPSK***



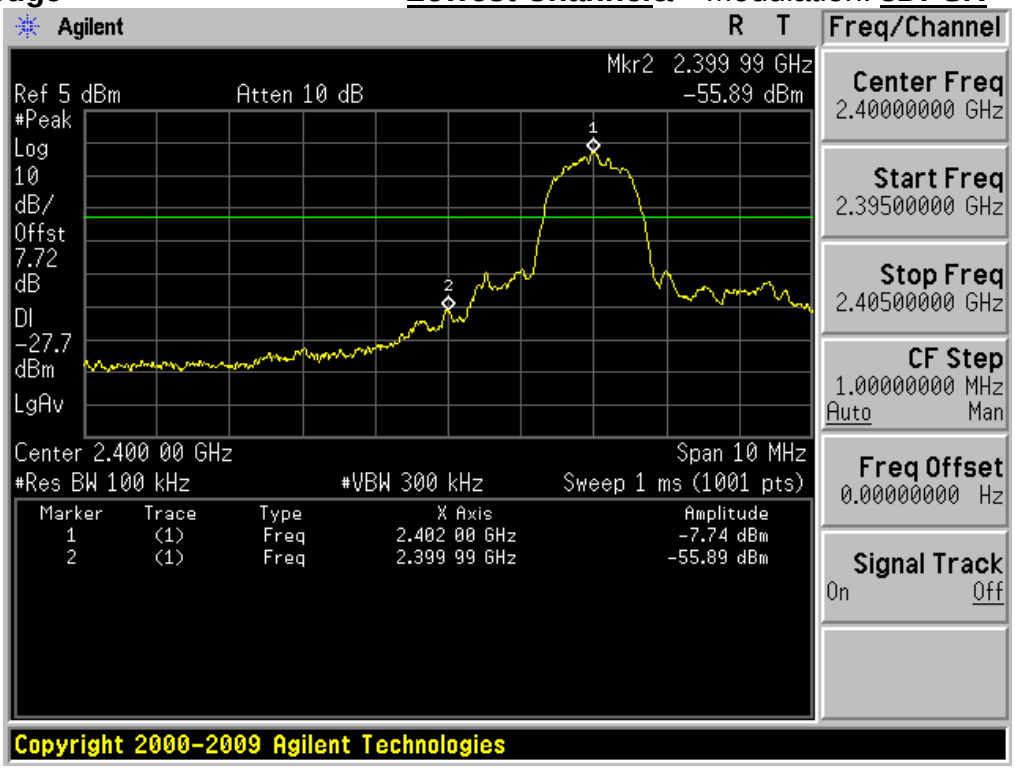


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	602.106000 M	-46.54	-200.00
1.000 G	2.000 G	1.00 M	1.006900 G	-46.63	-200.00
2.000 G	2.400 G	1.00 M	2.032640 G	-46.94	-200.00
2.400 G	2.483 G	1.00 M	2.480143 G	-4.83	-200.00
2.483 G	3.000 G	1.00 M	2.483603 G	-39.42	-200.00
3.000 G	6.000 G	1.00 M	4.438500 G	-45.43	-200.00
6.000 G	9.000 G	1.00 M	8.533500 G	-46.14	-200.00
9.000 G	10.000 G	1.00 M	9.949700 G	-46.10	-200.00

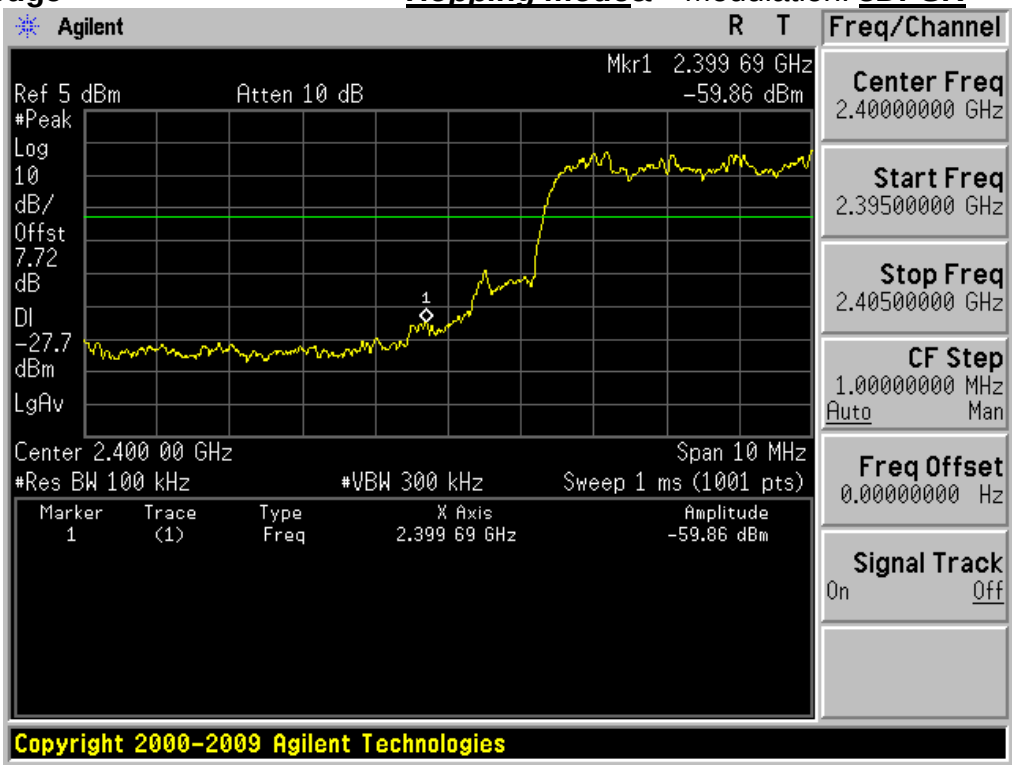


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	10.604400 G	-45.39	-200.00
12.000 G	15.000 G	1.00 M	14.573100 G	-45.26	-200.00
15.000 G	20.000 G	1.00 M	19.633250 G	-42.39	-200.00
20.000 G	25.000 G	1.00 M	24.860500 G	-38.74	-200.00

Low Band-edge ***Lowest Channel***& Modulation: ***8DPSK***

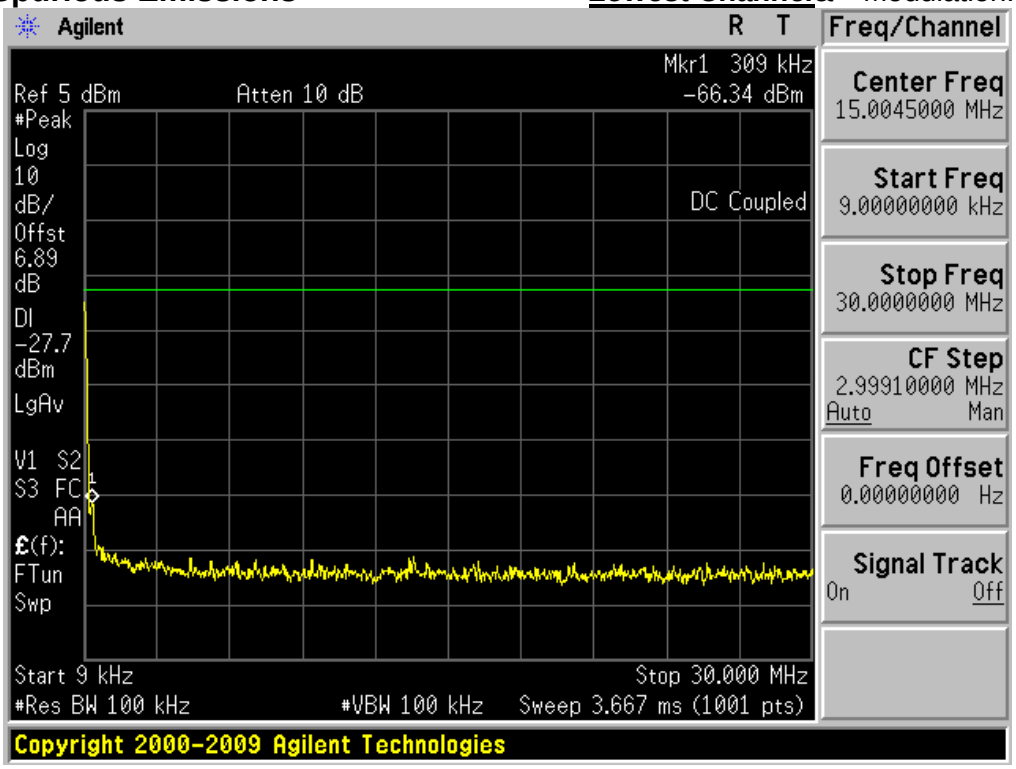


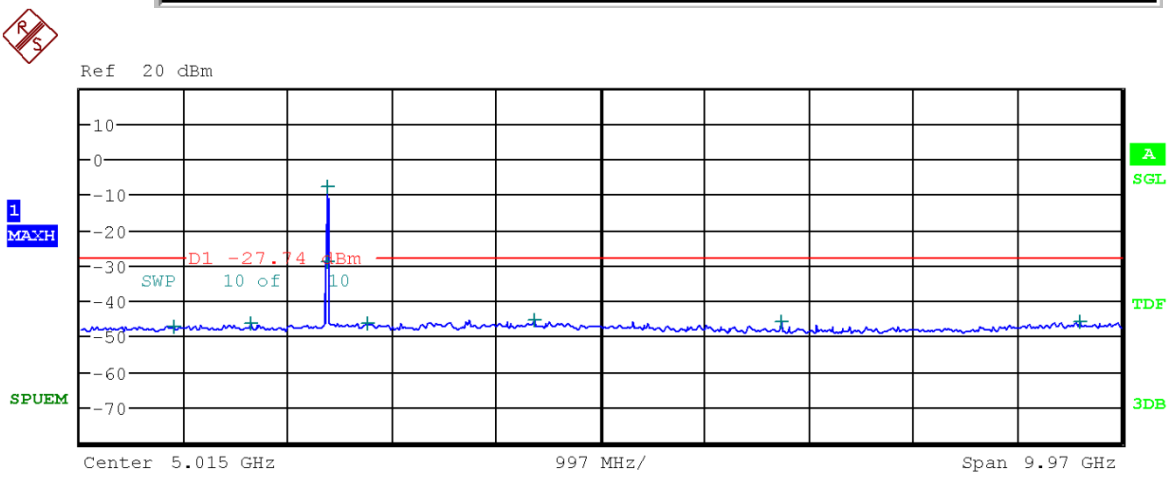
Low Band-edge ***Hopping mode***& Modulation: ***8DPSK***



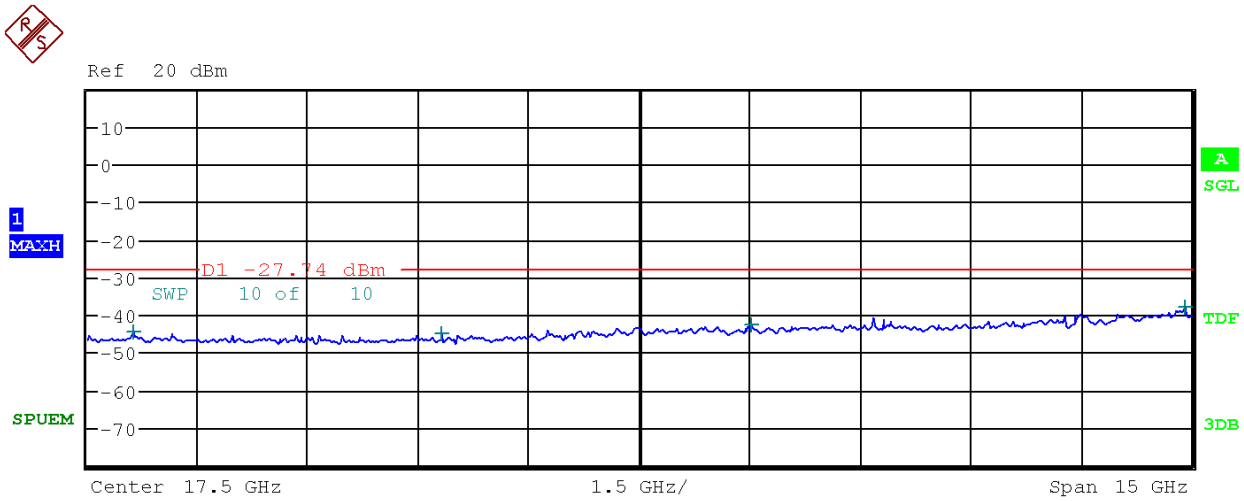
Conducted Spurious Emissions

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



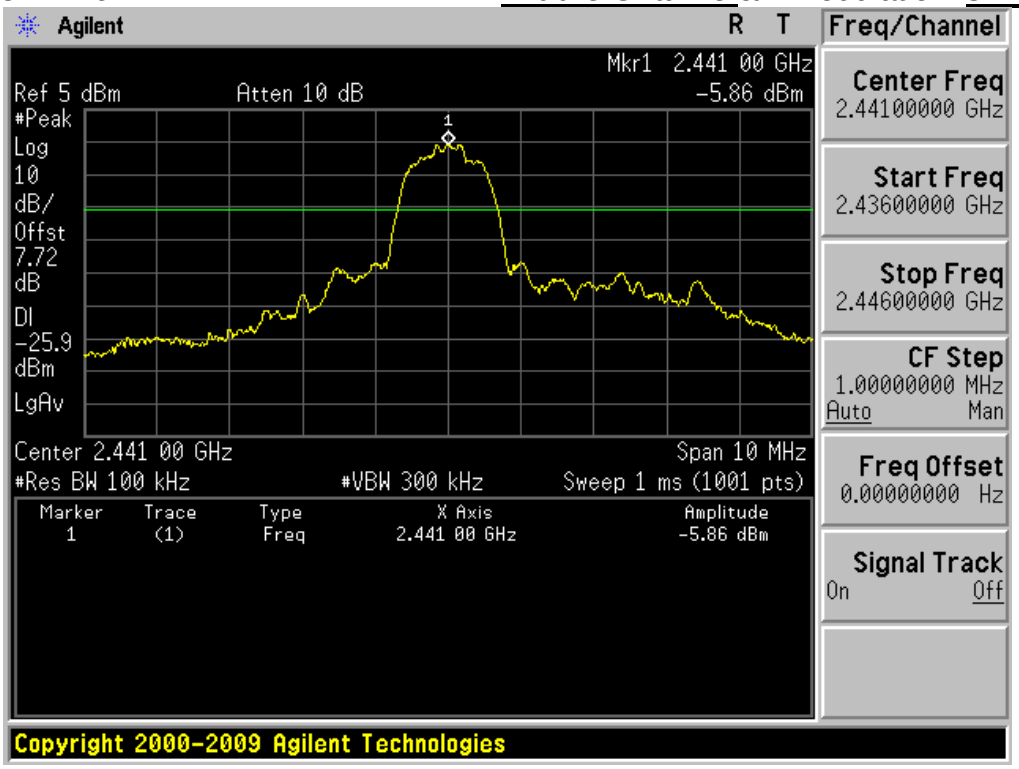


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	1.00 M	920.751000 M	-47.29	-200.00
1.000 G	2.000 G	1.00 M	1.656100 G	-46.48	-200.00
2.000 G	2.400 G	1.00 M	2.400000 G	-28.95	-200.00
2.400 G	2.483 G	1.00 M	2.401921 G	-7.87	-200.00
2.483 G	3.000 G	1.00 M	2.786014 G	-46.44	-200.00
3.000 G	6.000 G	1.00 M	4.370700 G	-45.57	-200.00
6.000 G	9.000 G	1.00 M	6.748200 G	-45.90	-200.00
9.000 G	10.000 G	1.00 M	9.604300 G	-46.05	-200.00

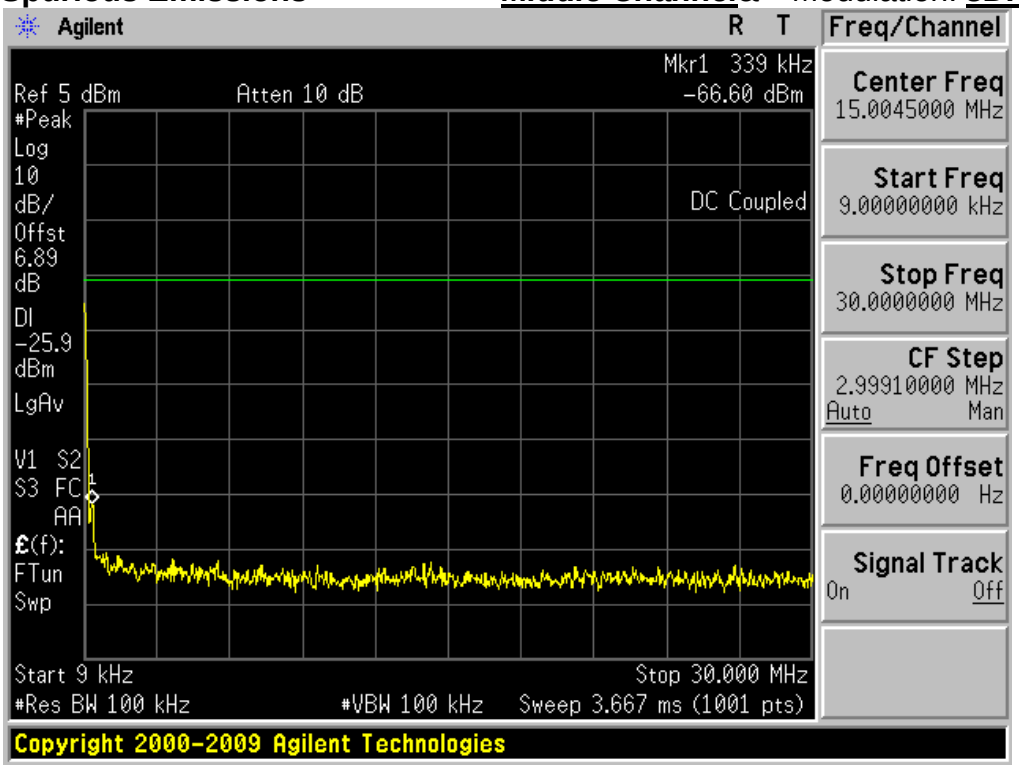


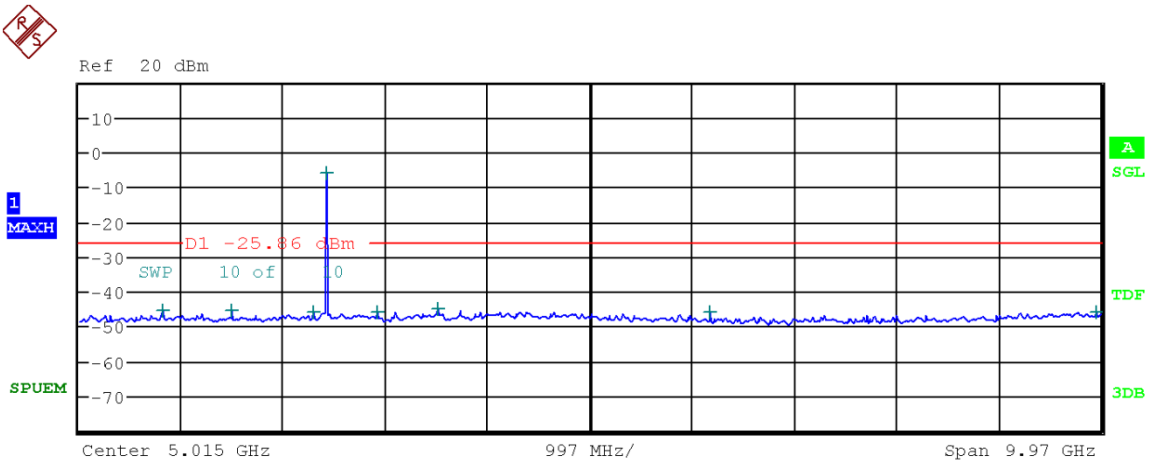
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
10.000 G	12.000 G	1.00 M	10.622600 G	-44.71	-200.00
12.000 G	15.000 G	1.00 M	14.806500 G	-45.04	-200.00
15.000 G	20.000 G	1.00 M	19.003750 G	-42.65	-200.00
20.000 G	25.000 G	1.00 M	24.904000 G	-38.18	-200.00

Reference for limit ***Middle Channel***& Modulation: ***8DPSK***

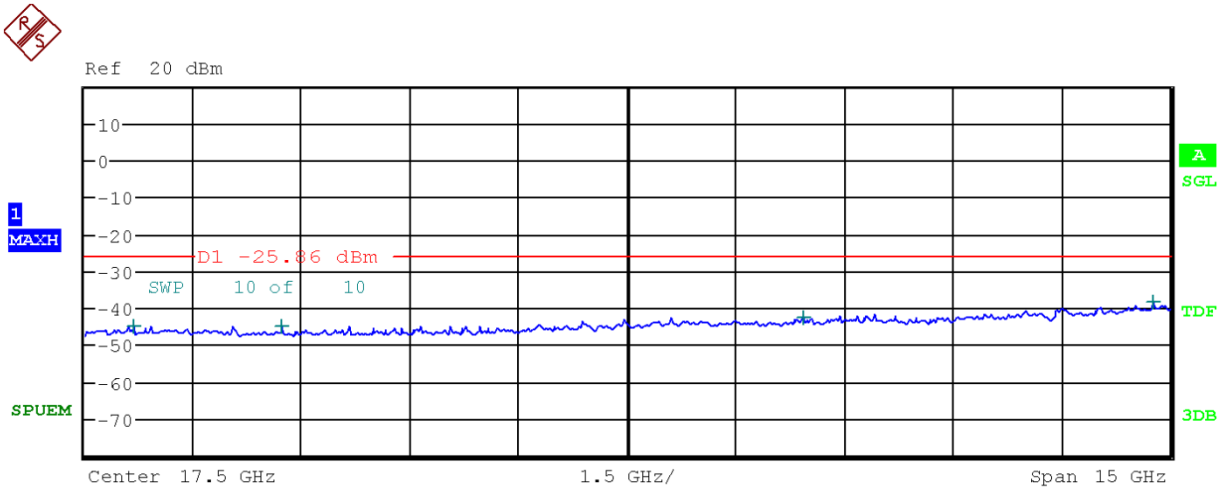


Conducted Spurious Emissions ***Middle Channel***& Modulation: ***8DPSK***



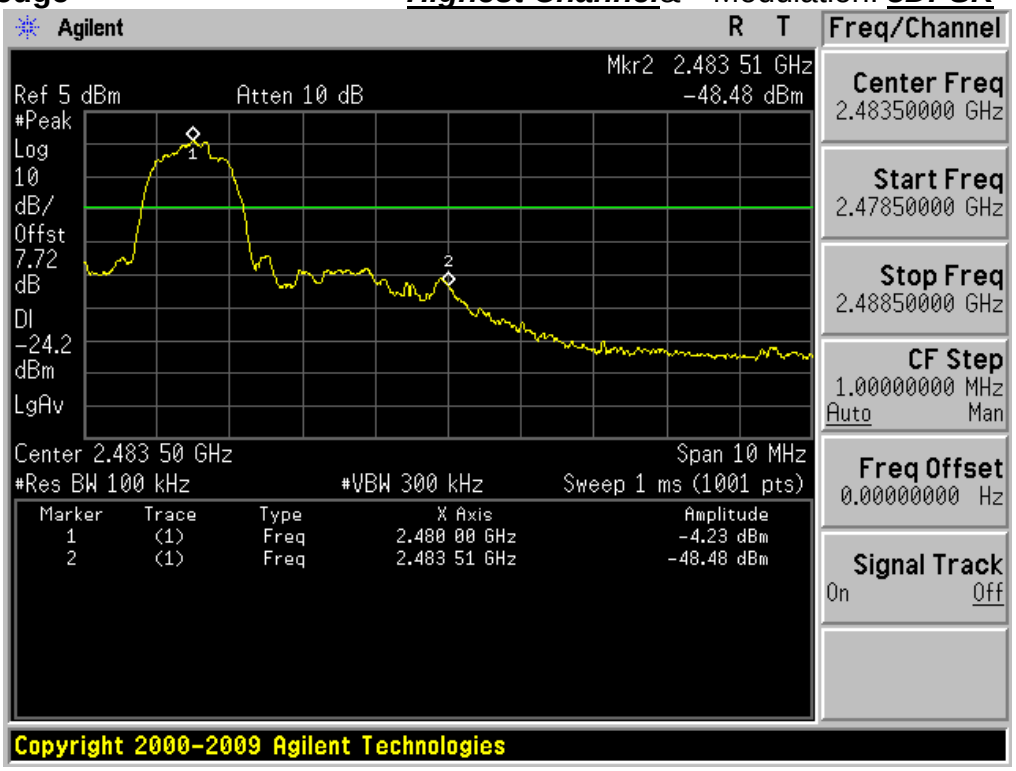


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	851.299000 M	-45.69	-200.00
1.000 G	2.000 G	1.00 M	1.518100 G	-45.64	-200.00
2.000 G	2.400 G	1.00 M	2.314920 G	-45.98	-200.00
2.400 G	2.483 G	1.00 M	2.440840 G	-5.90	-200.00
2.483 G	3.000 G	1.00 M	2.943392 G	-45.99	-200.00
3.000 G	6.000 G	1.00 M	3.535200 G	-45.10	-200.00
6.000 G	9.000 G	1.00 M	6.177000 G	-46.19	-200.00
9.000 G	10.000 G	1.00 M	9.948400 G	-46.07	-200.00



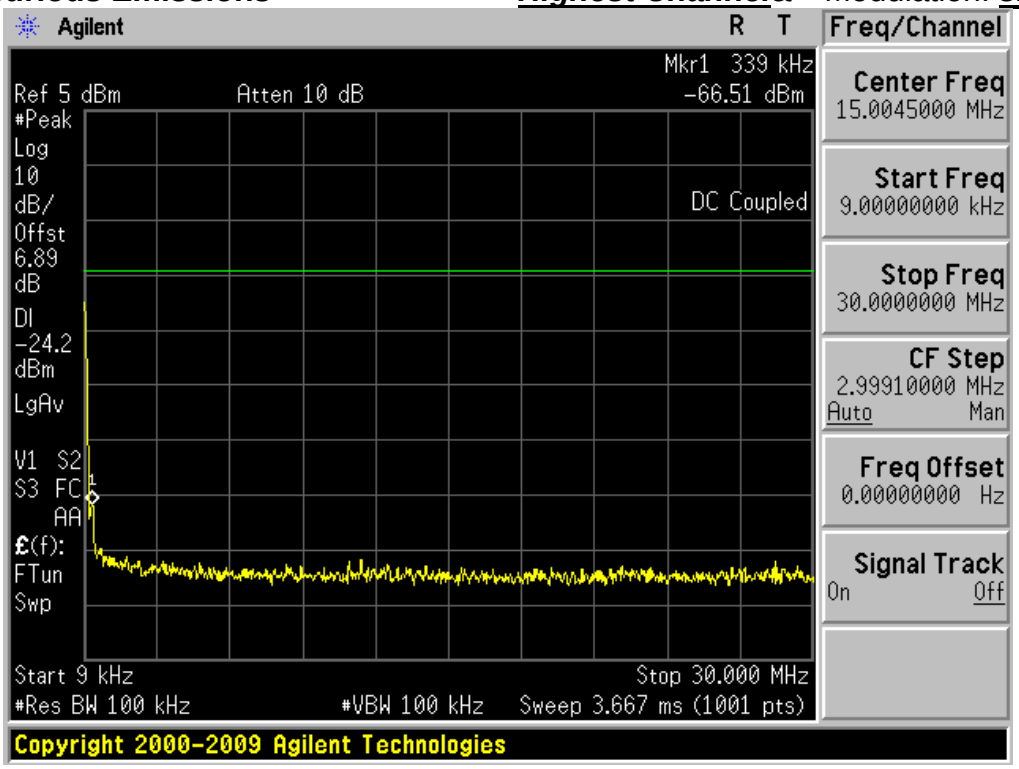
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	10.677200 G	-44.80	-200.00
12.000 G	15.000 G	1.00 M	12.707250 G	-44.95	-200.00
15.000 G	20.000 G	1.00 M	19.920000 G	-42.55	-200.00
20.000 G	25.000 G	1.00 M	24.764500 G	-38.42	-200.00

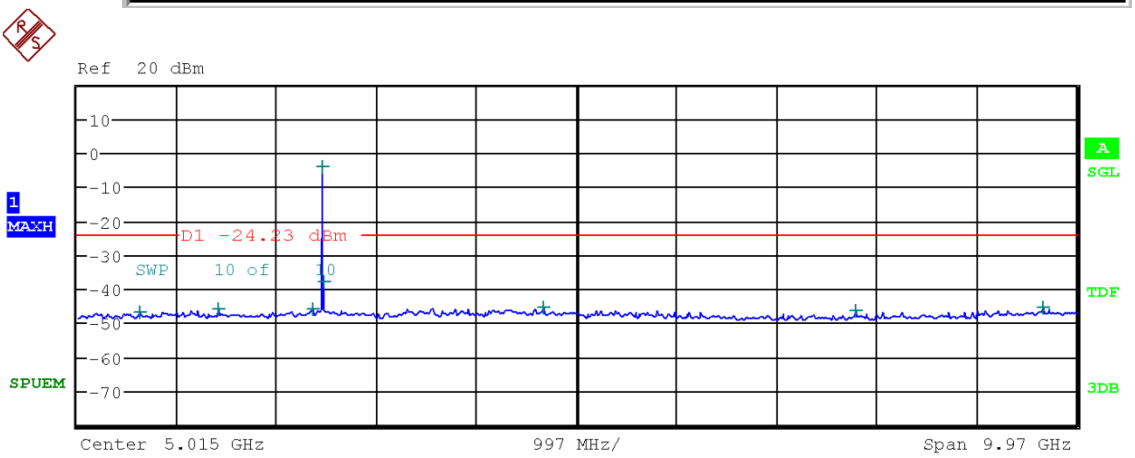
High Band-edge ***Highest Channel***& Modulation: ***8DPSK***



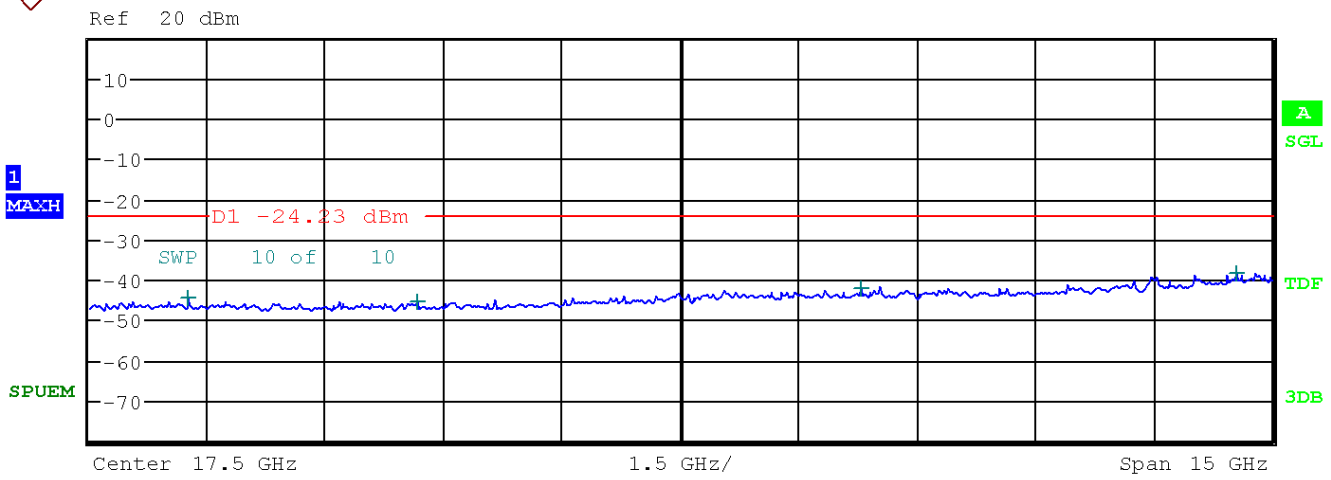
High Band-edge ***Hopping mode***& Modulation: ***8DPSK***

Conducted Spurious Emissions ***Highest Channel***& Modulation: ***8DPSK***





Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	1.00 M	657.881000 M	-47.04	-200.00
1.000 G	2.000 G	1.00 M	1.437700 G	-46.15	-200.00
2.000 G	2.400 G	1.00 M	2.382920 G	-45.83	-200.00
2.400 G	2.483 G	1.00 M	2.479993 G	-4.41	-200.00
2.483 G	3.000 G	1.00 M	2.483500 G	-37.93	-200.00
3.000 G	6.000 G	1.00 M	4.679700 G	-45.63	-200.00
6.000 G	9.000 G	1.00 M	7.790700 G	-46.64	-200.00
9.000 G	10.000 G	1.00 M	9.658000 G	-45.67	-200.00



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
10.000 G	12.000 G	1.00 M	11.261400 G	-44.33	-200.00
12.000 G	15.000 G	1.00 M	14.148600 G	-45.26	-200.00
15.000 G	20.000 G	1.00 M	19.773000 G	-42.08	-200.00
20.000 G	25.000 G	1.00 M	24.552750 G	-38.36	-200.00

3. Carrier Frequency Separation

3.1.Test Setup

Refer to the APPENDIX I.

3.2. Limit

Limit: >= 20dB BW or >= Two-Thirds of the 20dB BW

- Procedure:

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = wide enough to capture the peaks of two adjacent channels

RBW = 1% of the span Sweep = auto

VBW = ≥ RBW Detector function = peak

Trace = max hold

- Measurement Data: Comply

FH mode

Hopping Mode	Modulation Type	Peak of adjacent Channel (MHz)	Peak of center channel (MHz)	Test Result (MHz)
Enable	GFSK	2440.964	2441.969	1.005
	π/4DQPSK	2439.995	2440.997	1.002
	8DPSK	2439.998	2441.000	1.002

AFH mode

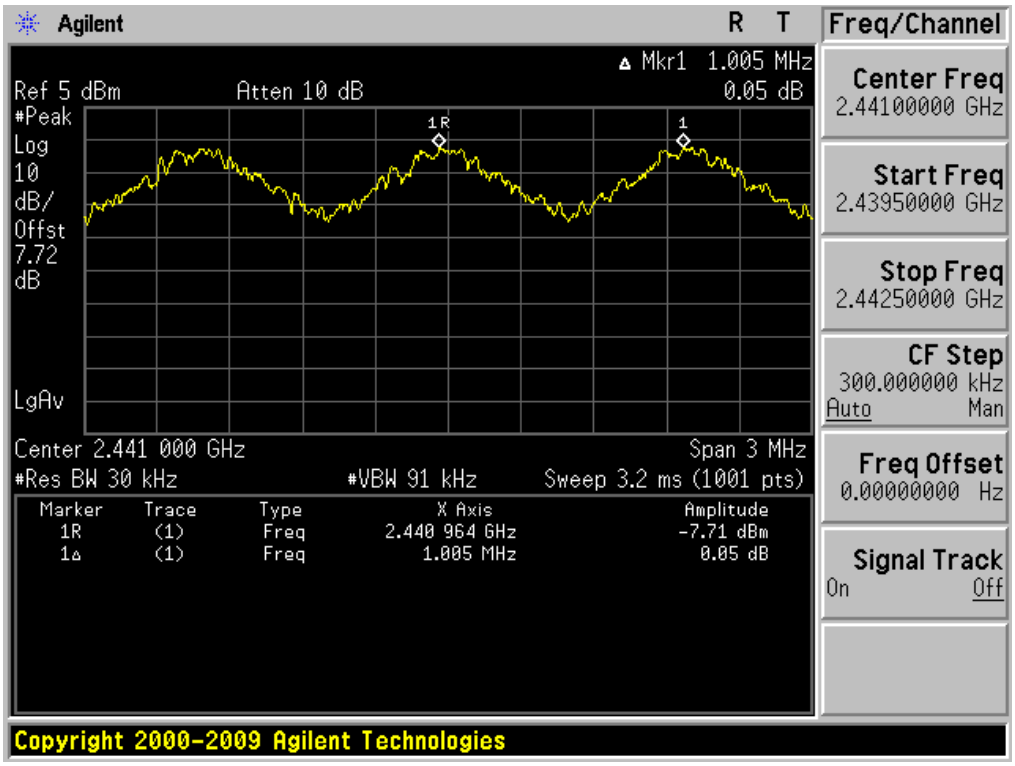
Hopping Mode	Modulation Type	Peak of adjacent Channel (MHz)	Peak of center channel (MHz)	Test Result (MHz)
Enable	GFSK	2410.997	2411.999	1.002
	π/4DQPSK	2410.982	2411.990	1.008
	8DPSK	2409.995	2410.997	1.002

Note 1: See next pages for actual measured spectrum plots.

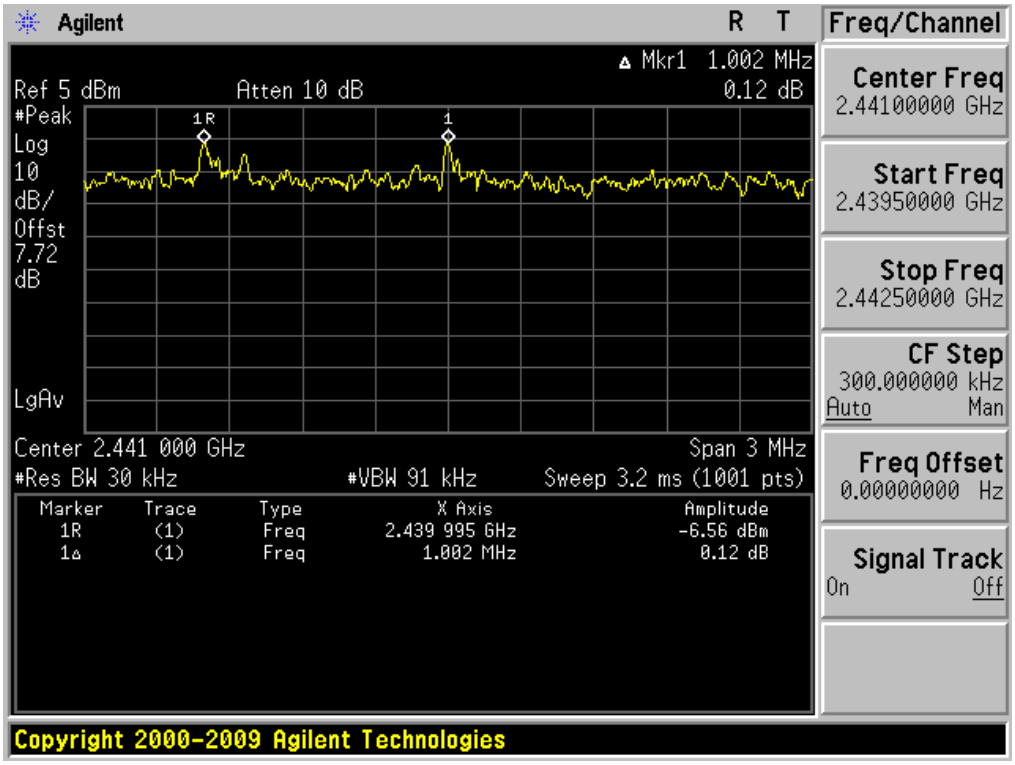
- **Minimum Standard:**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

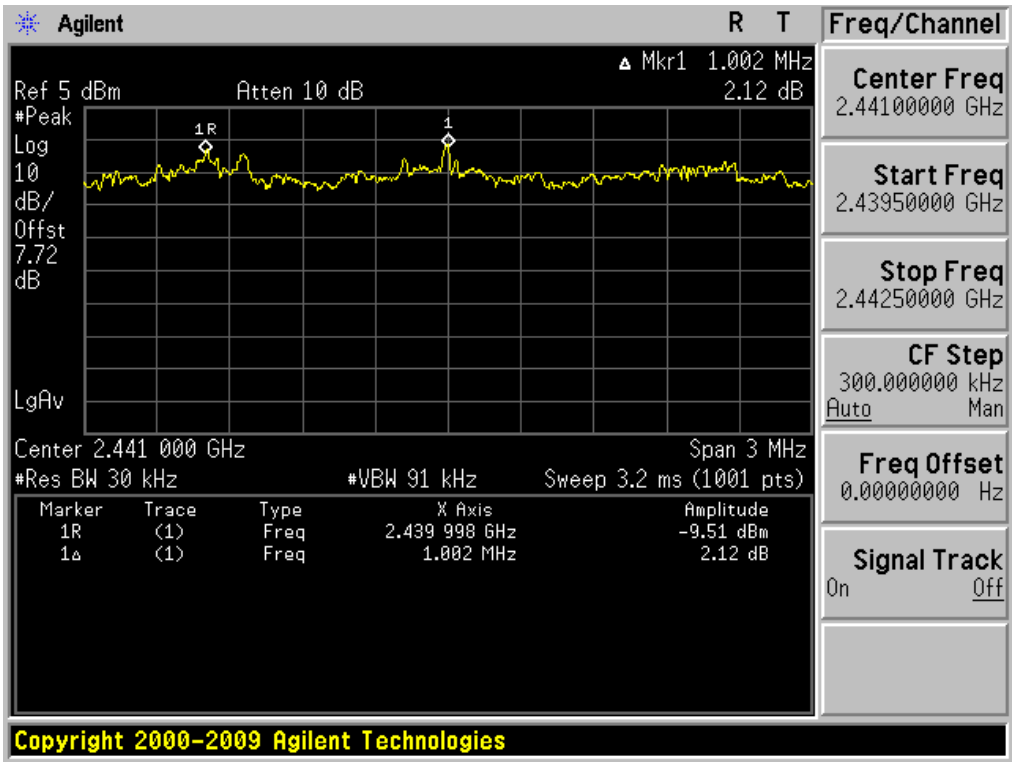
Carrier Frequency Separation (FH) Hopping mode: Enable&GFSK



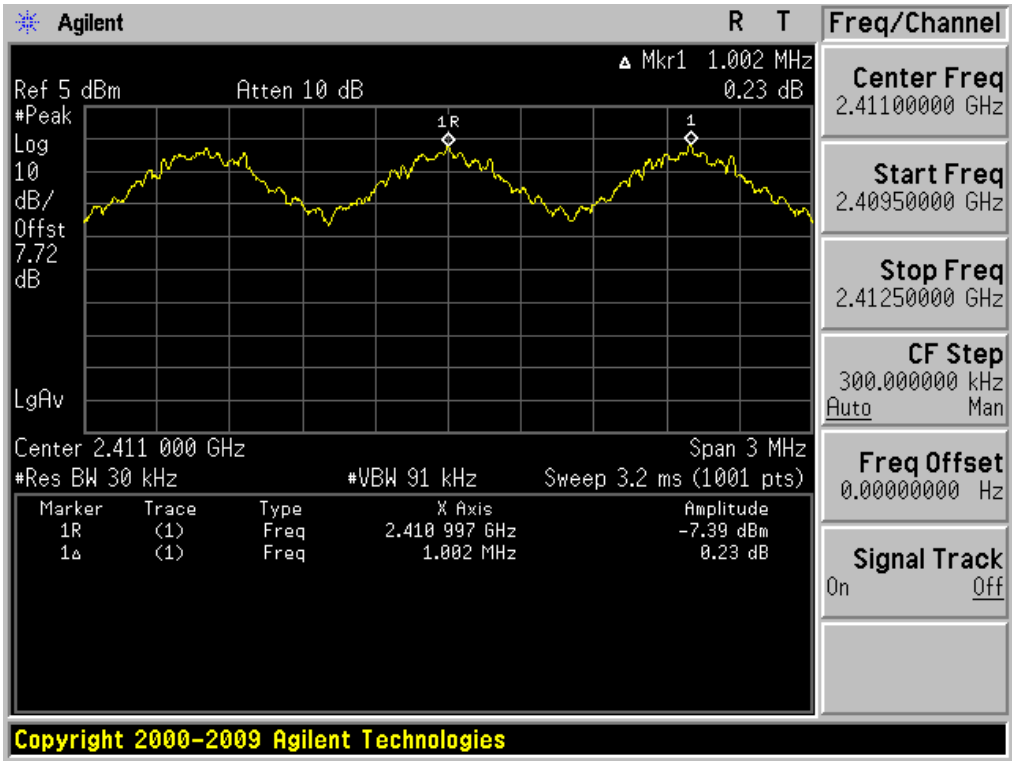
Carrier Frequency Separation (FH) Hopping mode: Enable&π/4DQPSK



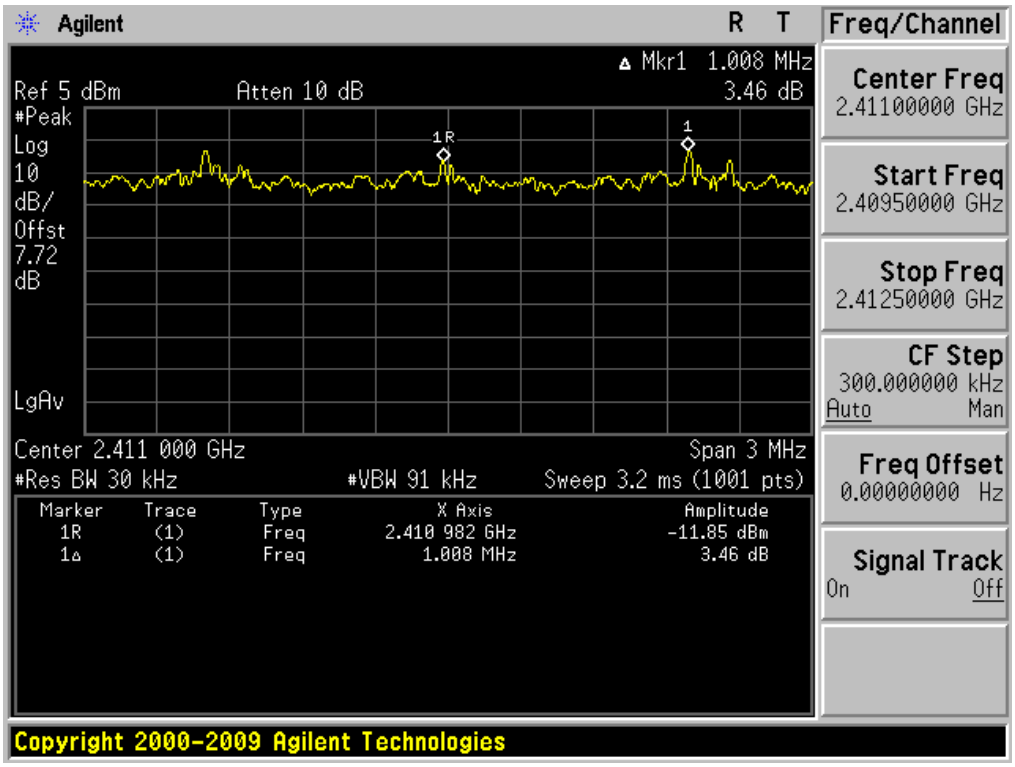
Carrier Frequency Separation (FH) Hopping mode: Enable&8DPSK



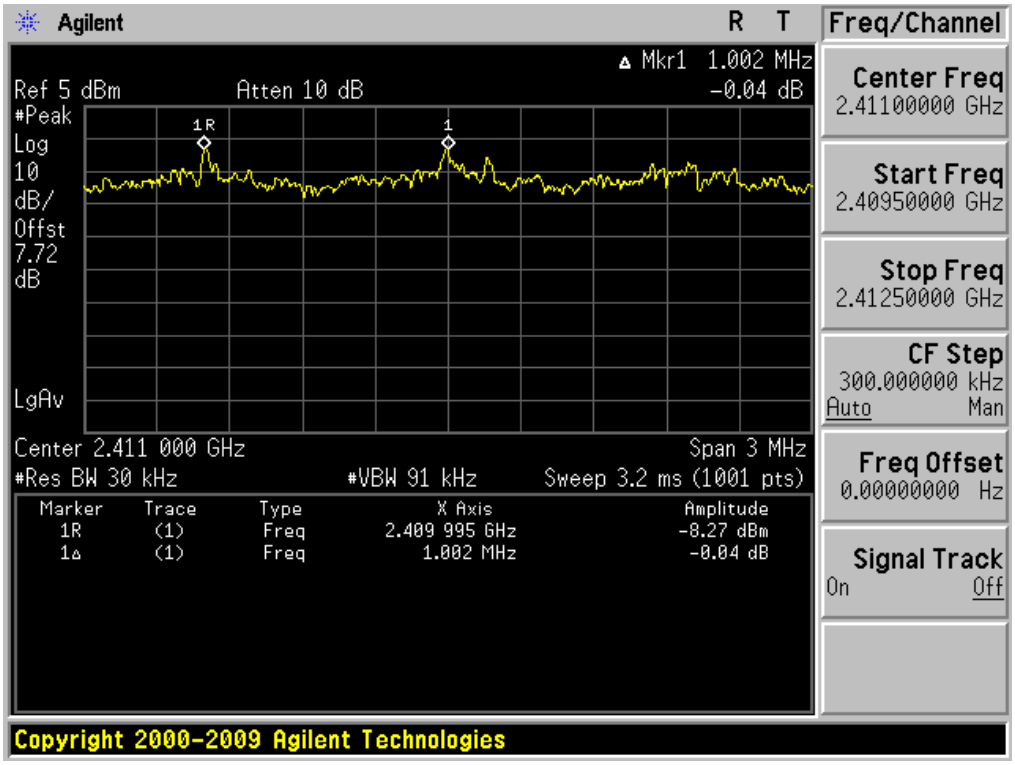
Carrier Frequency Separation (AFH) Hopping mode: Enable&GFSK



Carrier Frequency Separation (AFH) Hopping mode: Enable&π/4DQPSK



Carrier Frequency Separation (AFH) Hopping mode: Enable&8DPSK



4.Number of Hopping Frequencies

4.1.Test Setup

Refer to the APPENDIX I.

4.2. Limit

Limit: >= 15 hops

- Procedure:

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.
To get higher resolution, four frequency ranges within the 2400 ~ 2483.5 MHz FH band were examined.

The spectrum analyzer is set to:

Span = 25MHz For FH mode Plot 1: Start Frequency = 2389.5MHz, Stop Frequency = 2414.5 MHz
Plot 2: Start Frequency = 2414.5MHz, Stop Frequency = 2439.5 MHz
Plot 3: Start Frequency = 2439.5MHz, Stop Frequency = 2464.5 MHz
Plot 4: Start Frequency = 2464.5MHz, Stop Frequency = 2489.5 MHz
For AFH mode Plot 1: Start Frequency = 2396MHz, Stop Frequency = 2426 MHz

RBW = 1% of the span or more Sweep = auto
VBW = ≥ RBW Detector function = peak
Trace = max hold

- **Measurement Data: Comply**
- **FH mode**

Hopping mode	Test mode	Test Result (Total Hops)
Enable	GFSK	79
	π/4DQPSK	79
	8DPSK	79

- AFH mode

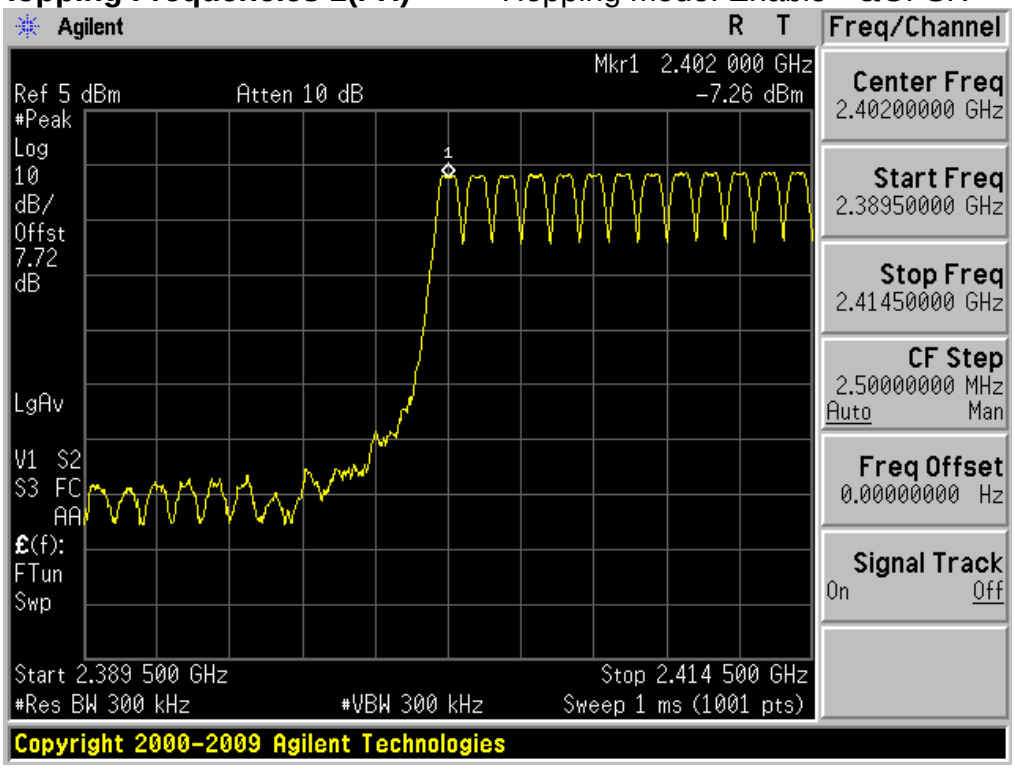
Hopping mode	Test mode	Test Result (Total Hops)
Enable	GFSK	20
	π/4DQPSK	20
	8DPSK	20

Note 1: See next pages for actual measured spectrum plots.

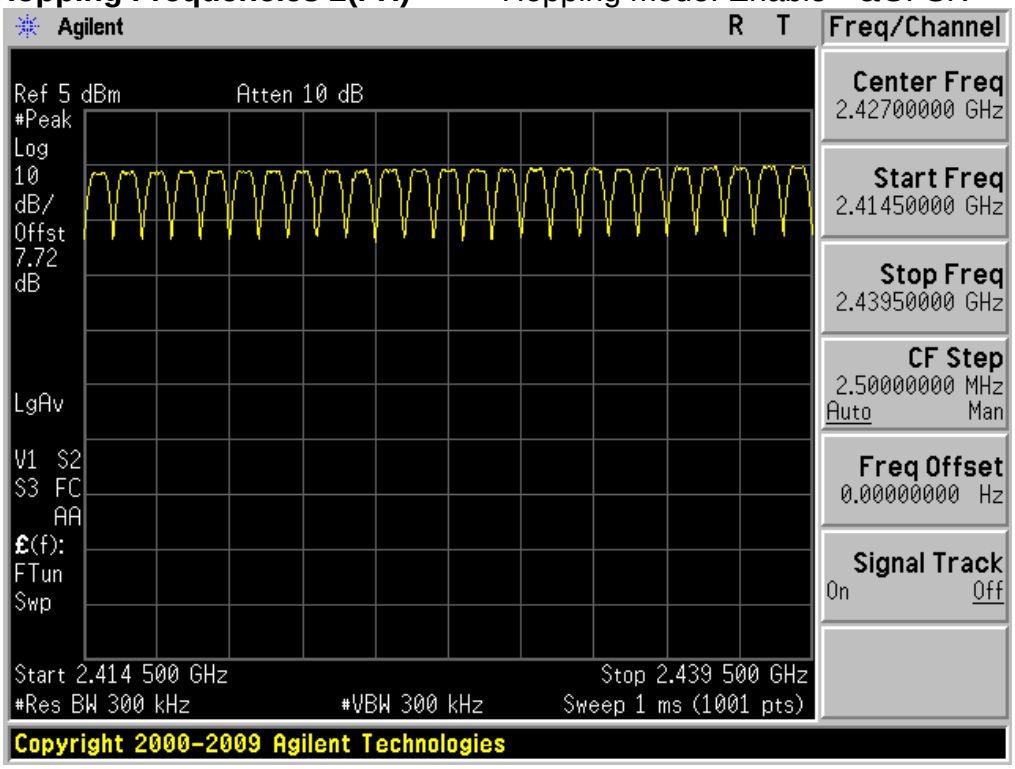
- Minimum Standard:

At least 15 hopes

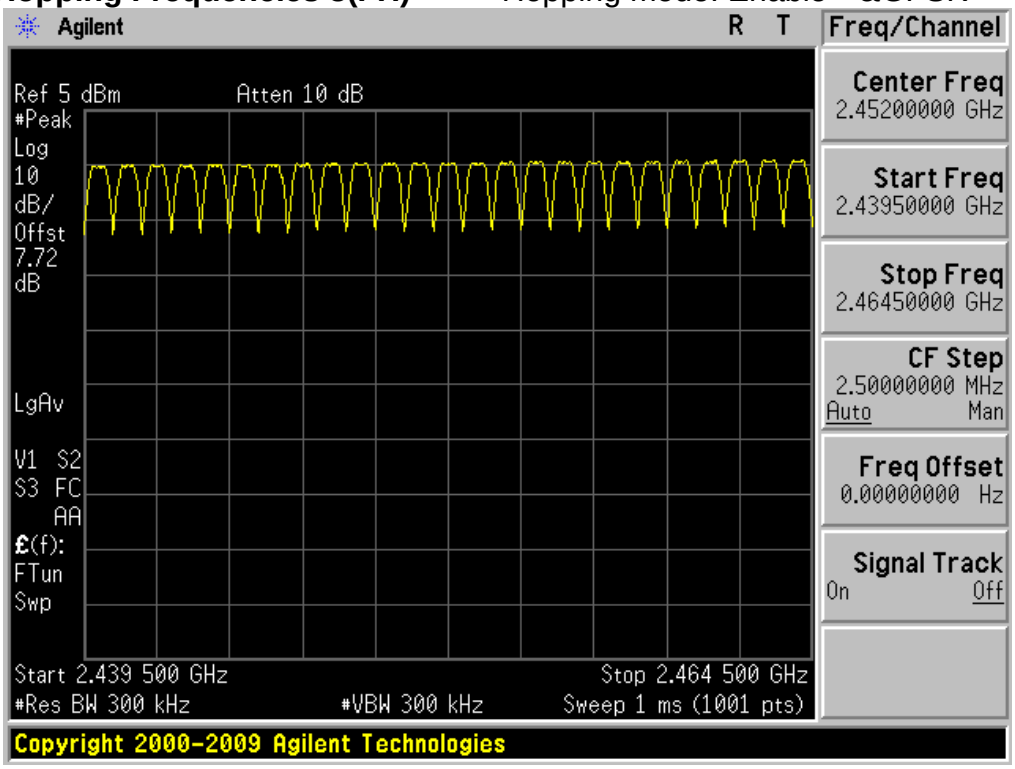
Number of Hopping Frequencies 1(FH) Hopping mode: Enable &GFSK



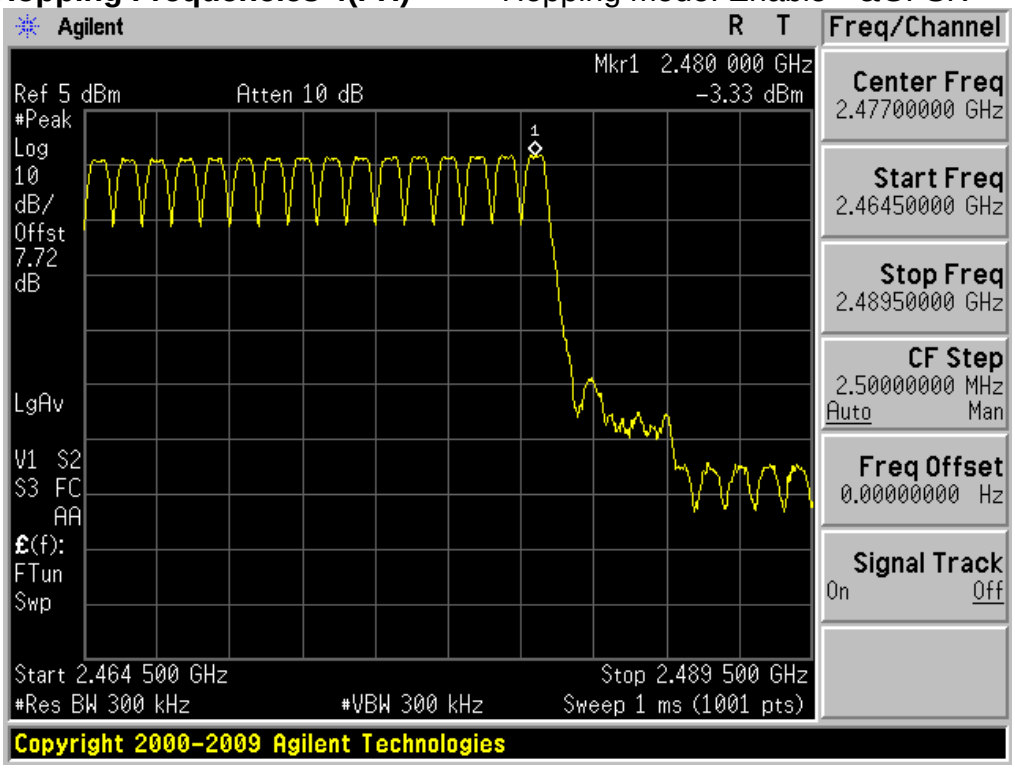
Number of Hopping Frequencies 2(FH) Hopping mode: Enable &GFSK



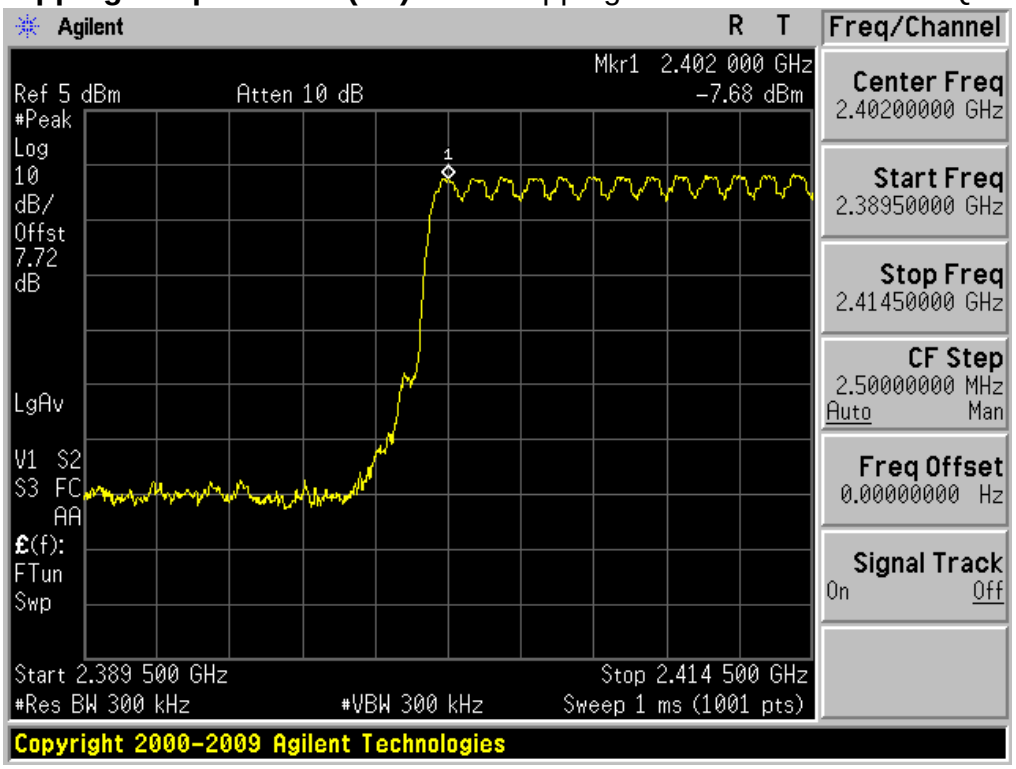
Number of Hopping Frequencies 3(FH) Hopping mode: Enable &GFSK



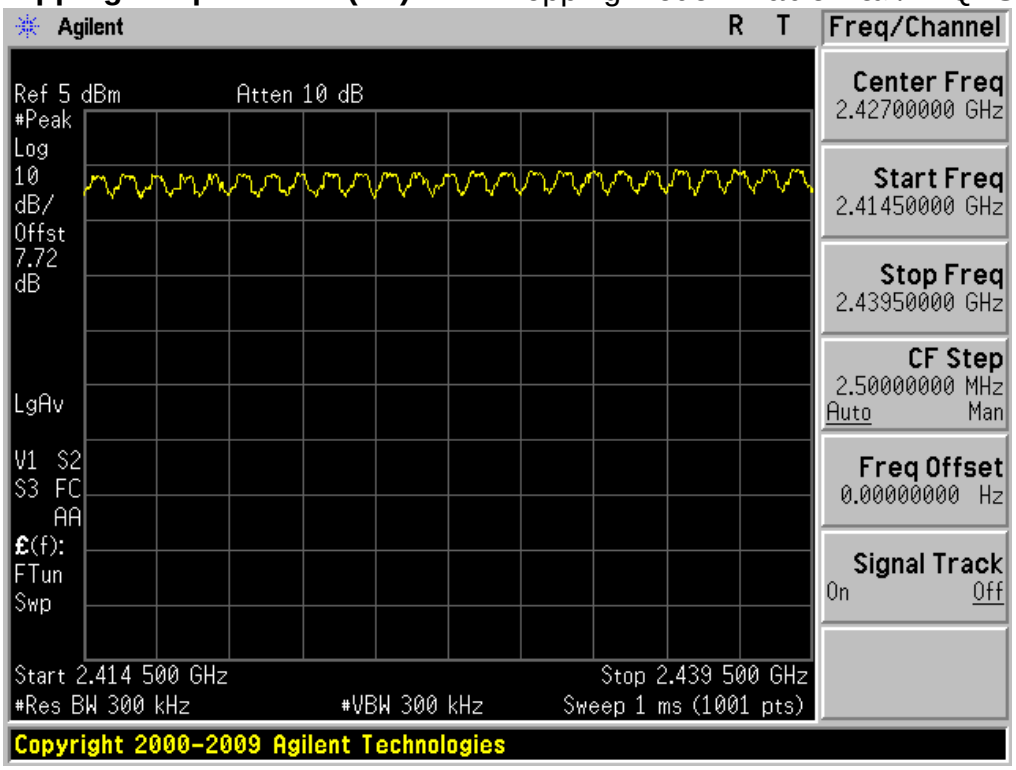
Number of Hopping Frequencies 4(FH) Hopping mode: Enable &GFSK



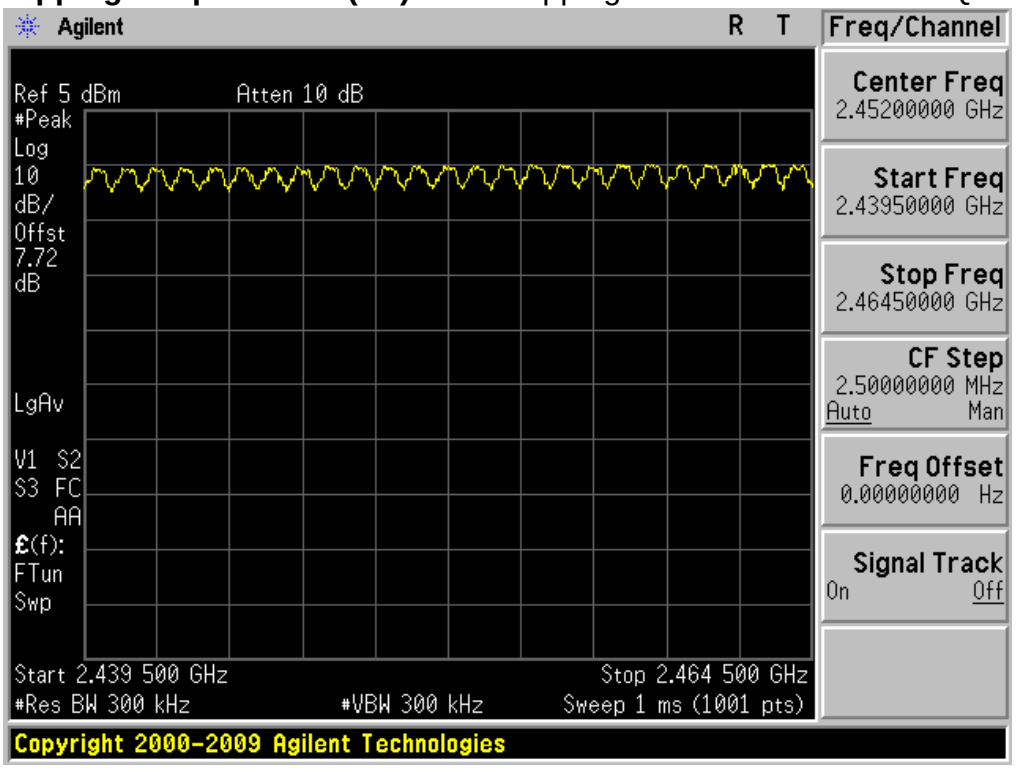
Number of Hopping Frequencies 1(FH) Hopping mode: Enable &π/4DQPSK



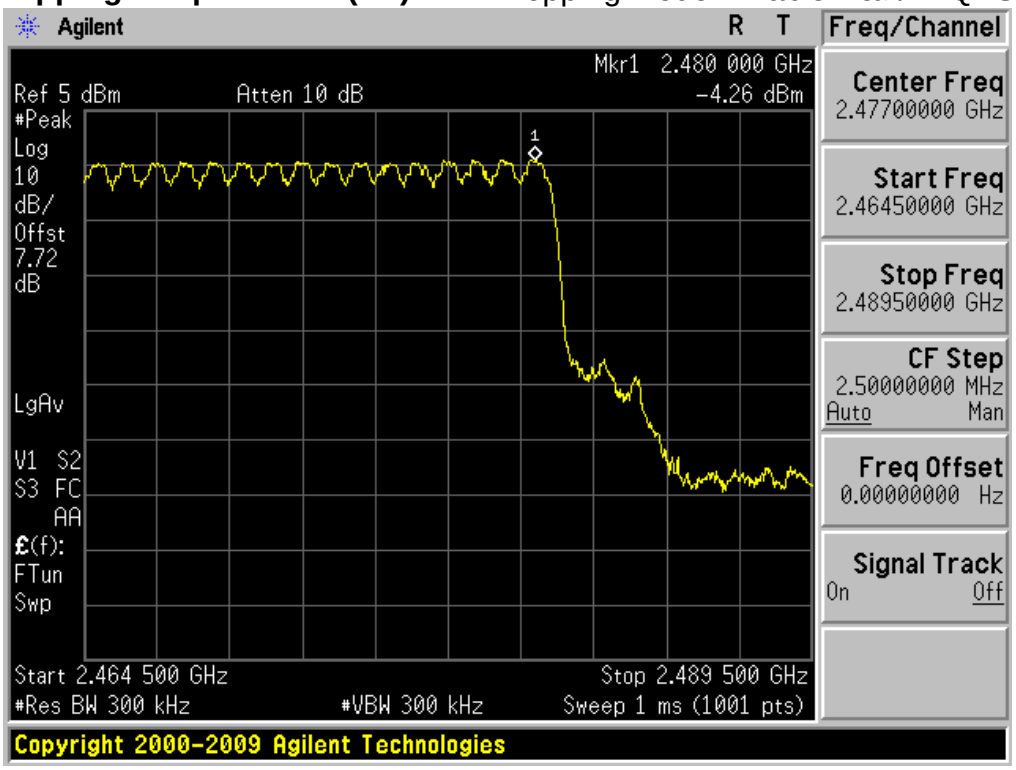
Number of Hopping Frequencies 2(FH) Hopping mode: Enable &π/4DQPSK



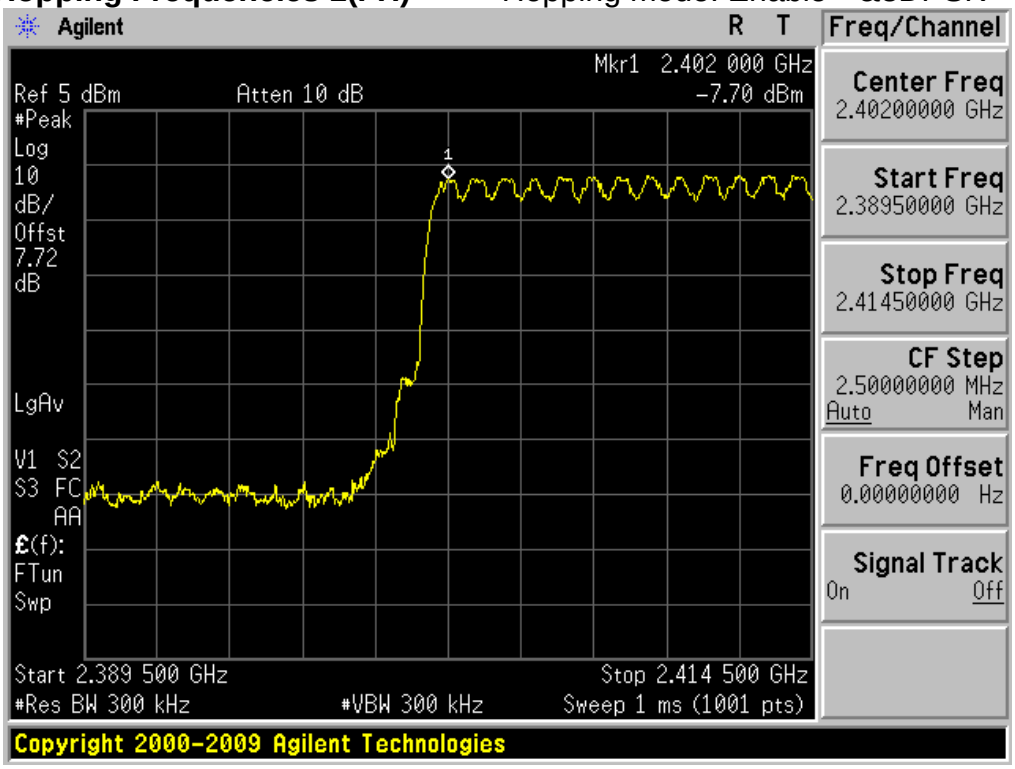
Number of Hopping Frequencies 3(FH) Hopping mode: Enable &π/4DQPSK



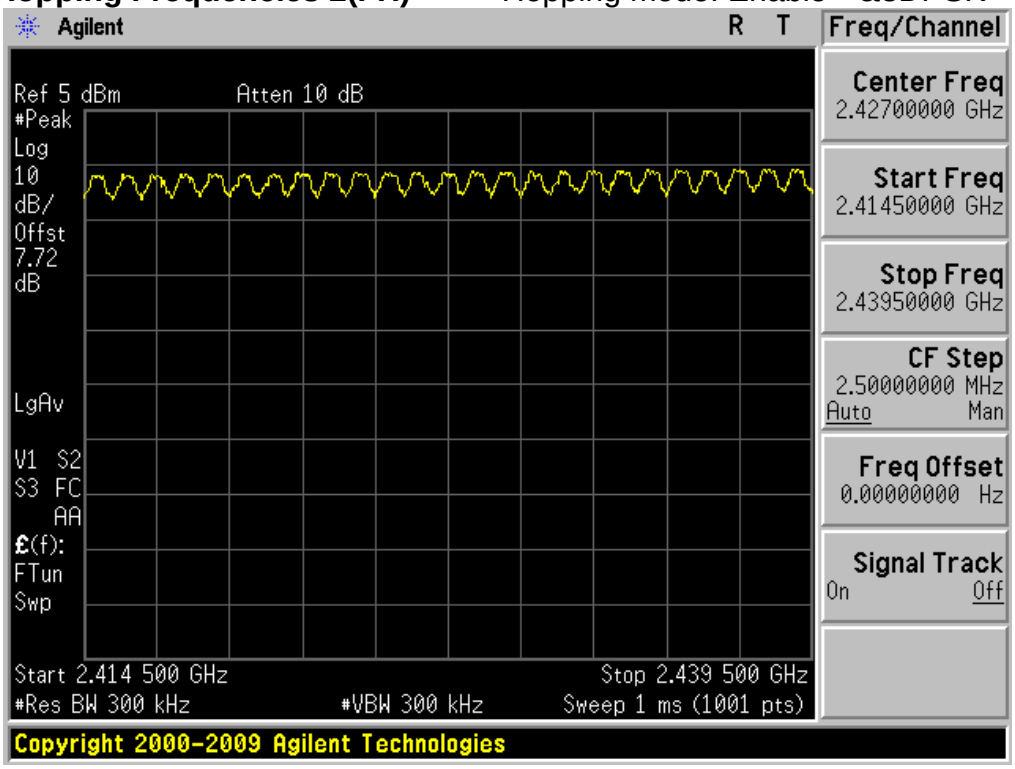
Number of Hopping Frequencies 4(FH) Hopping mode: Enable &π/4DQPSK



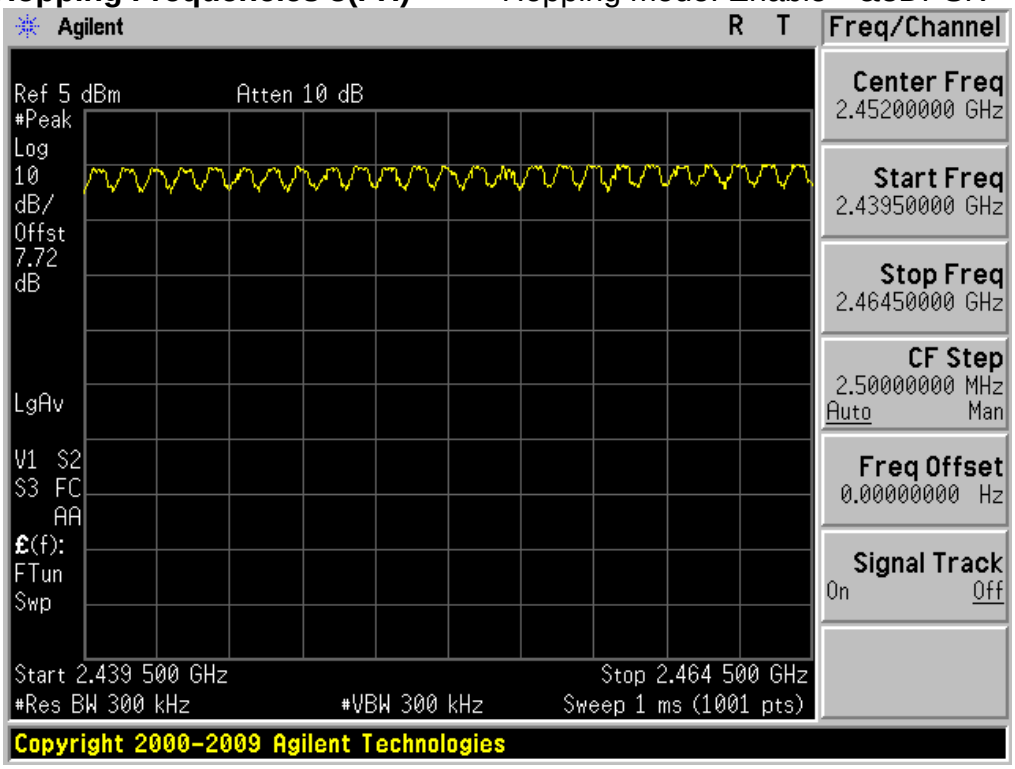
Number of Hopping Frequencies 1(FH) Hopping mode: Enable &8DPSK



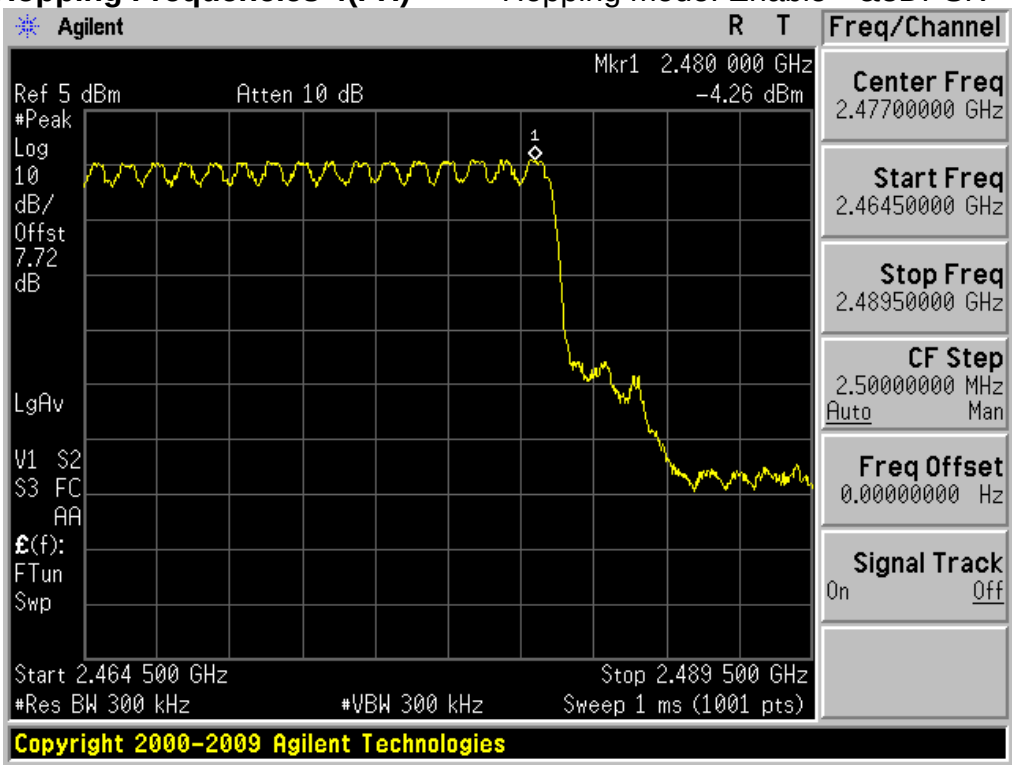
Number of Hopping Frequencies 2(FH) Hopping mode: Enable &8DPSK



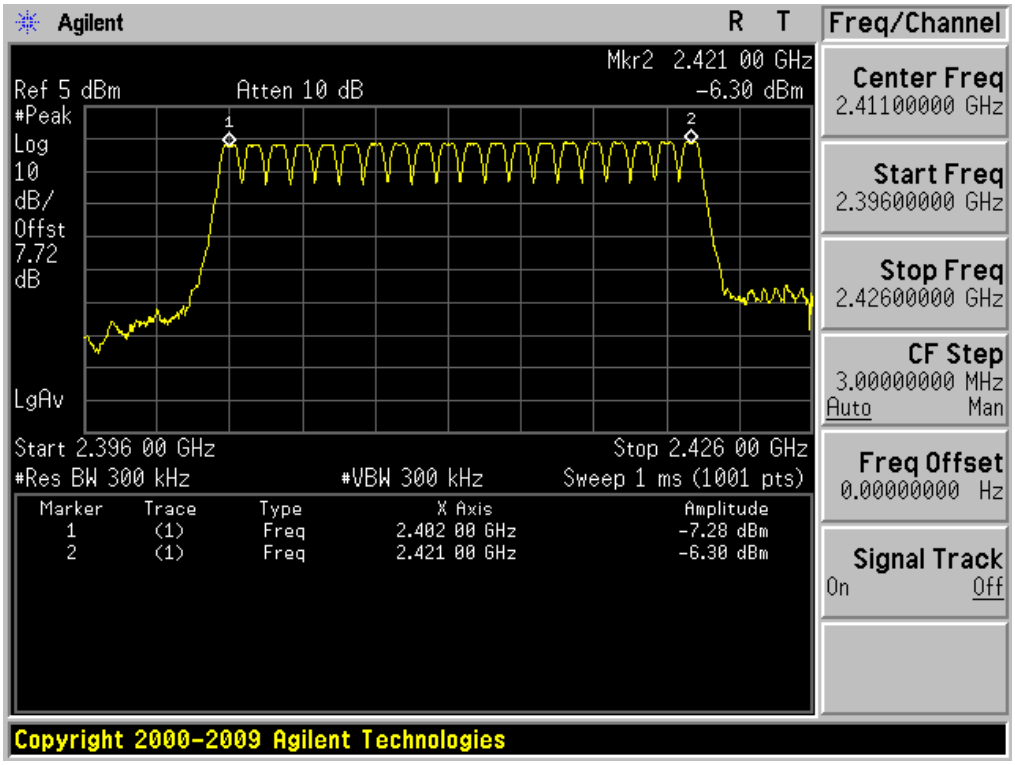
Number of Hopping Frequencies 3(FH) Hopping mode: Enable &8DPSK



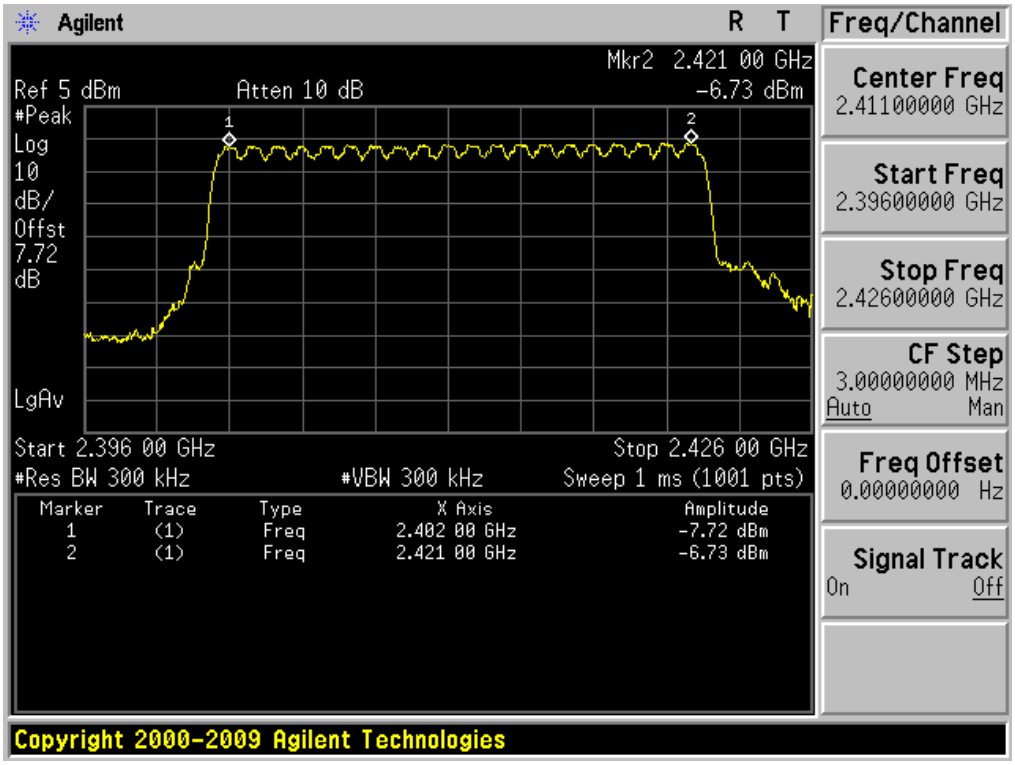
Number of Hopping Frequencies 4(FH) Hopping mode: Enable &8DPSK



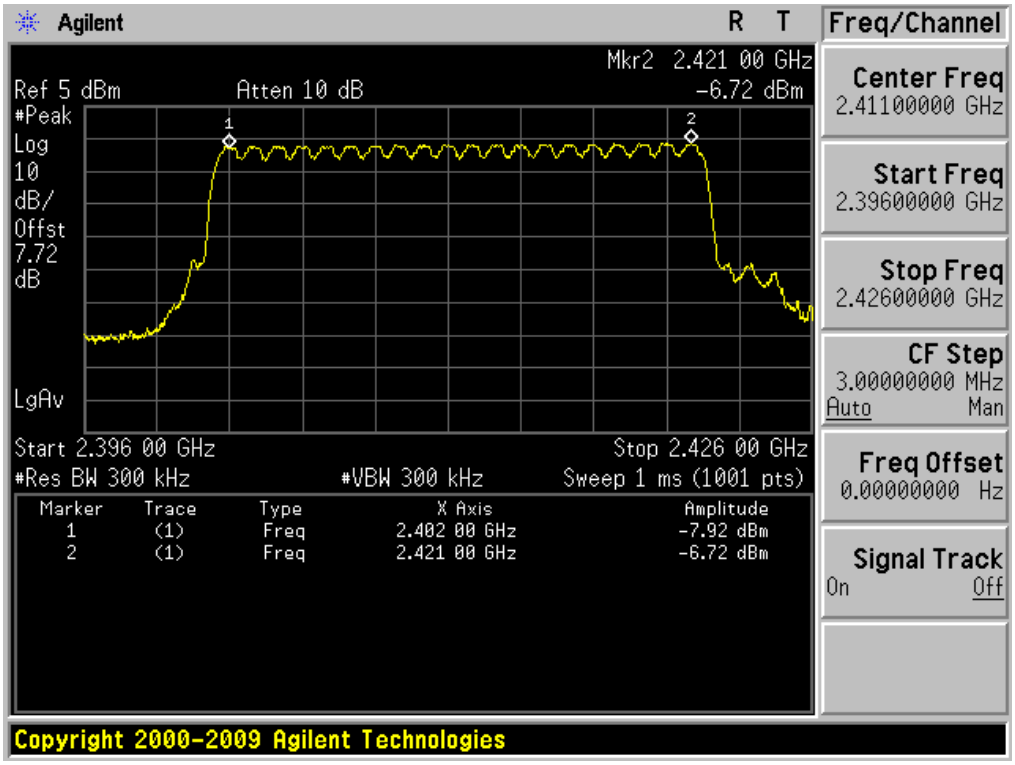
Number of Hopping Frequencies 1(AFH) Hopping mode: Enable &GFSK



Number of Hopping Frequencies 1(AFH) Hopping mode: Enable &π/4DQPSK



Number of Hopping Frequencies 1(AFH) Hopping mode: Enable &8DPSK



5. 20dBc BW

5.1. Test Setup

Refer to the APPENDIX I.

5.2. Limit

Limit: Not Applicable

5.3. Test Procedure

1. The 20dBcbandwidthwere measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW ≥ 1% of the 20 dB bandwidth, VBW ≥RBW, Span = 3㎒.

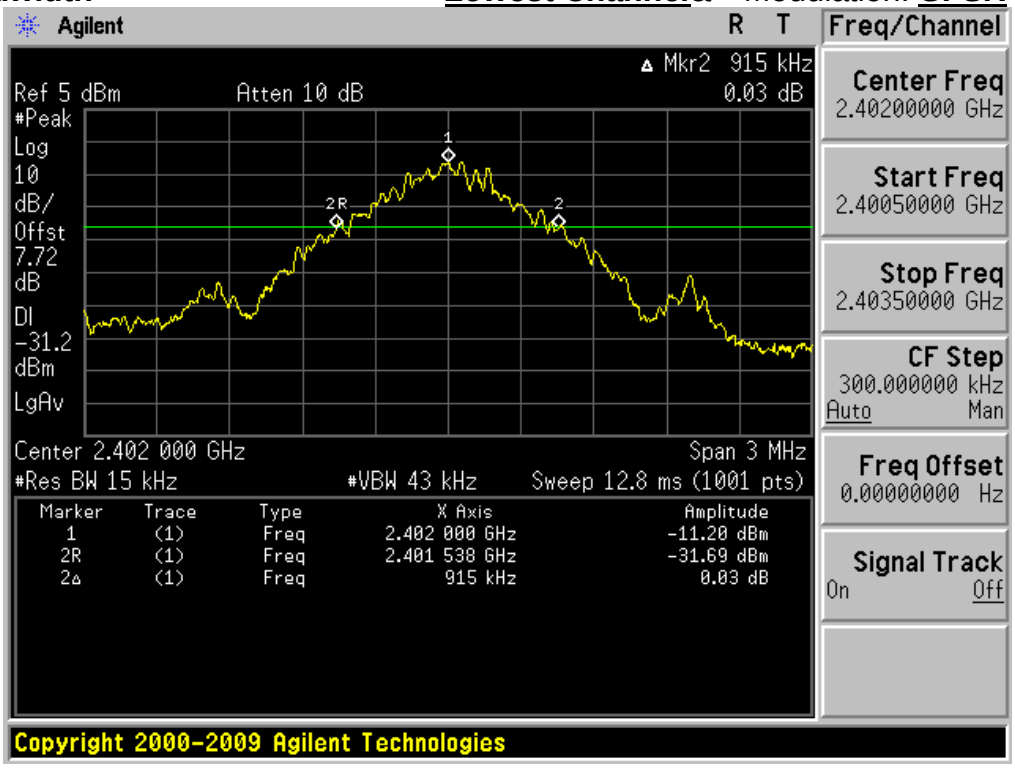
5.4. Test Results

Ambient temperature : 24°C
Relative humidity : 53%

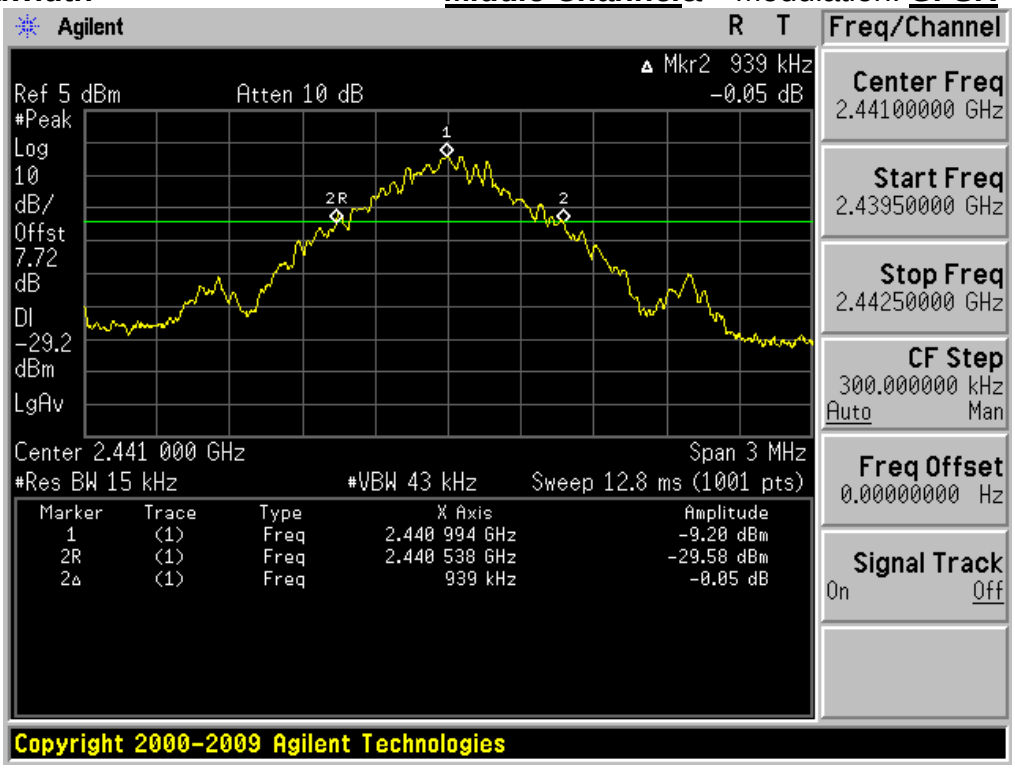
Modulation	Tested Channel	20dBc BW (MHz)
GFSK	**Lowest**	**0.915**
	Middle	**0.939**
	Highest	**0.906**
π/4DQPSK	**Lowest**	**1.245**
	Middle	**1.257**
	Highest	**1.260**
8DPSK	**Lowest**	**1.251**
	Middle	**1.251**
	Highest	**1.251**

Note 1: See next pages for actual measured spectrum plots.

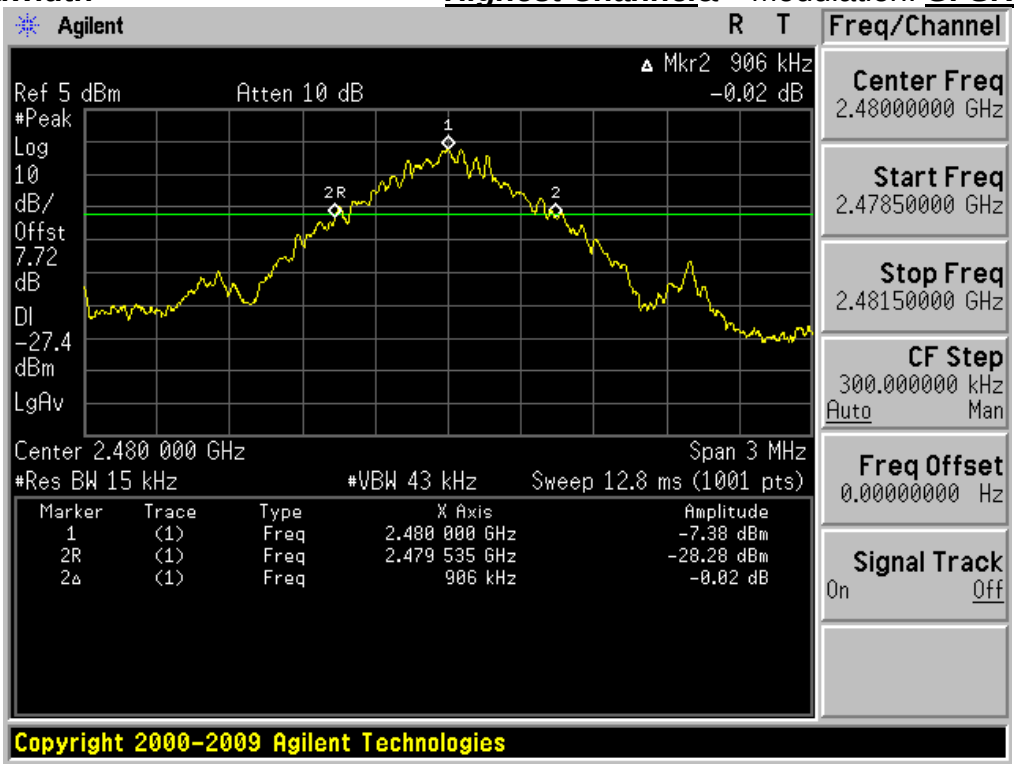
20dBc Bandwidth ***Lowest Channel***& Modulation: ***GFSK***



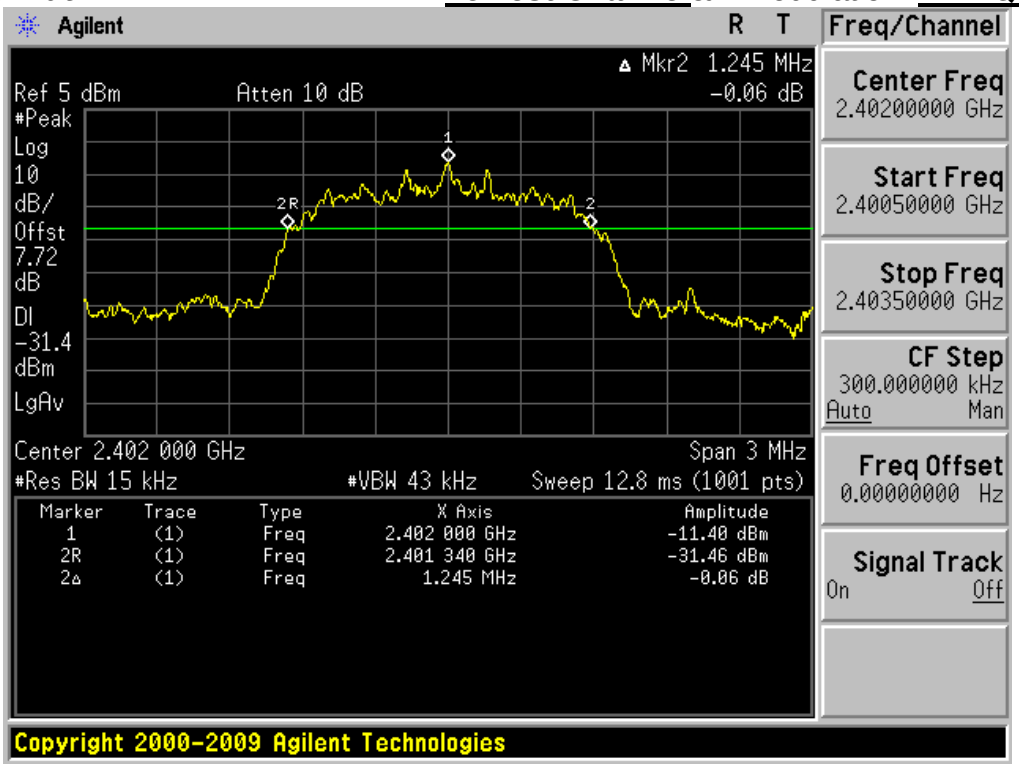
20dBc Bandwidth ***Middle Channel***& Modulation: ***GFSK***



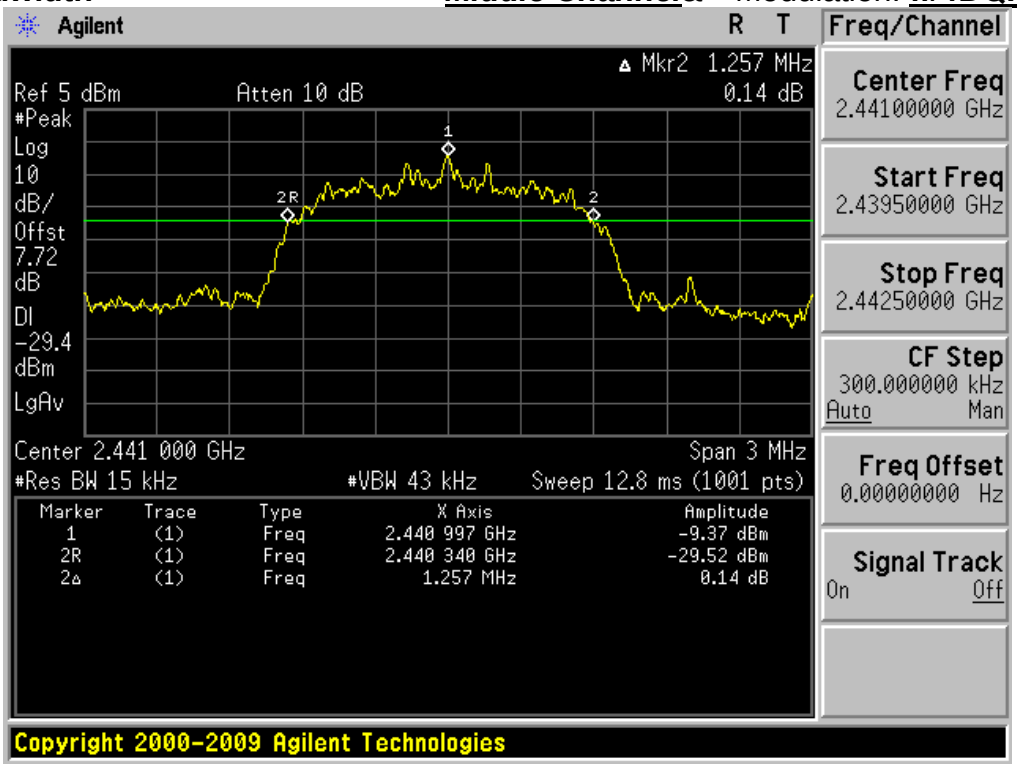
20dBc Bandwidth ***Highest Channel***& Modulation: ***GFSK***



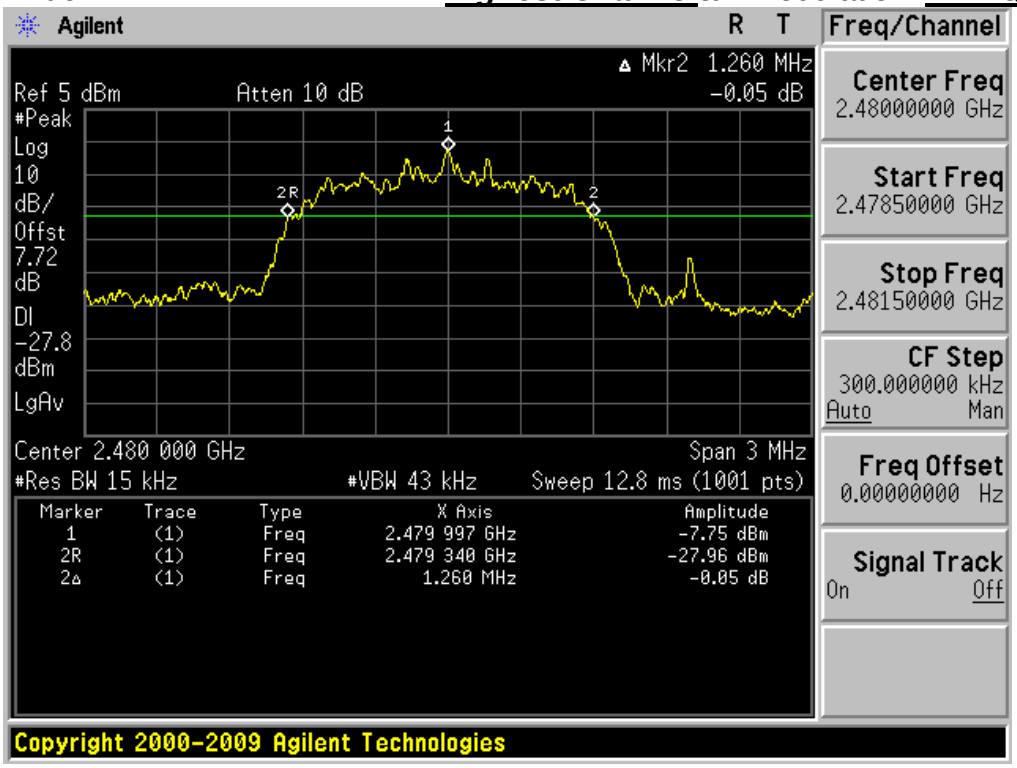
20dBc Bandwidth ***Lowest Channel***& Modulation: ***π/4DQPSK***



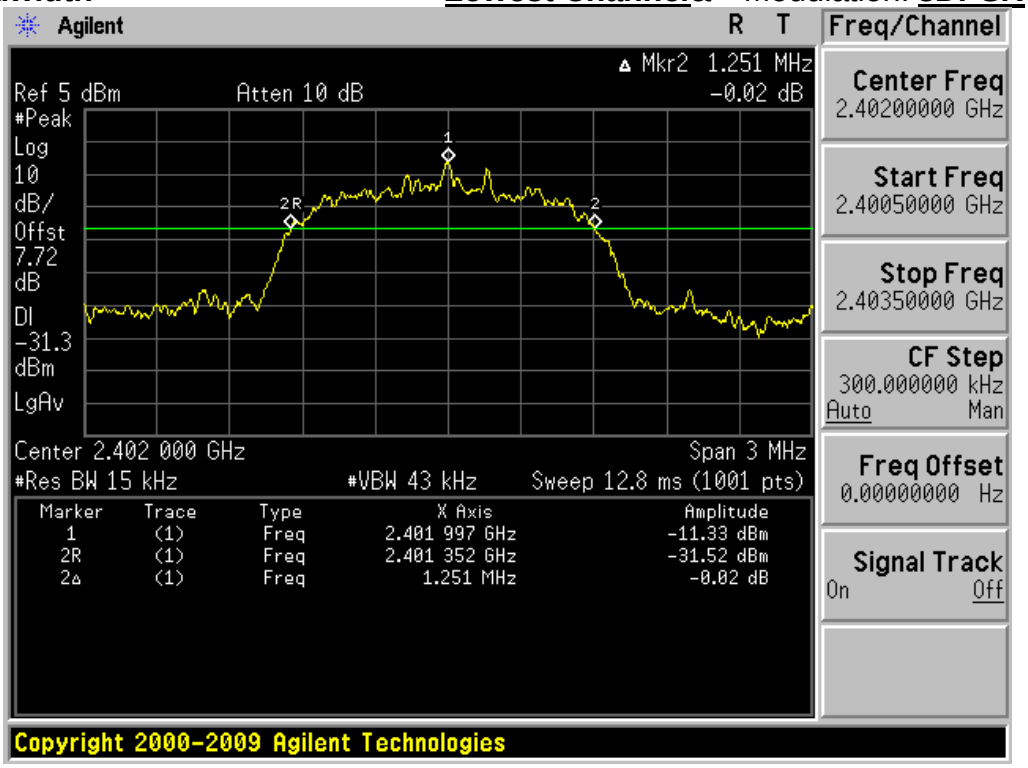
20dBc Bandwidth ***Middle Channel***& Modulation: ***π/4DQPSK***



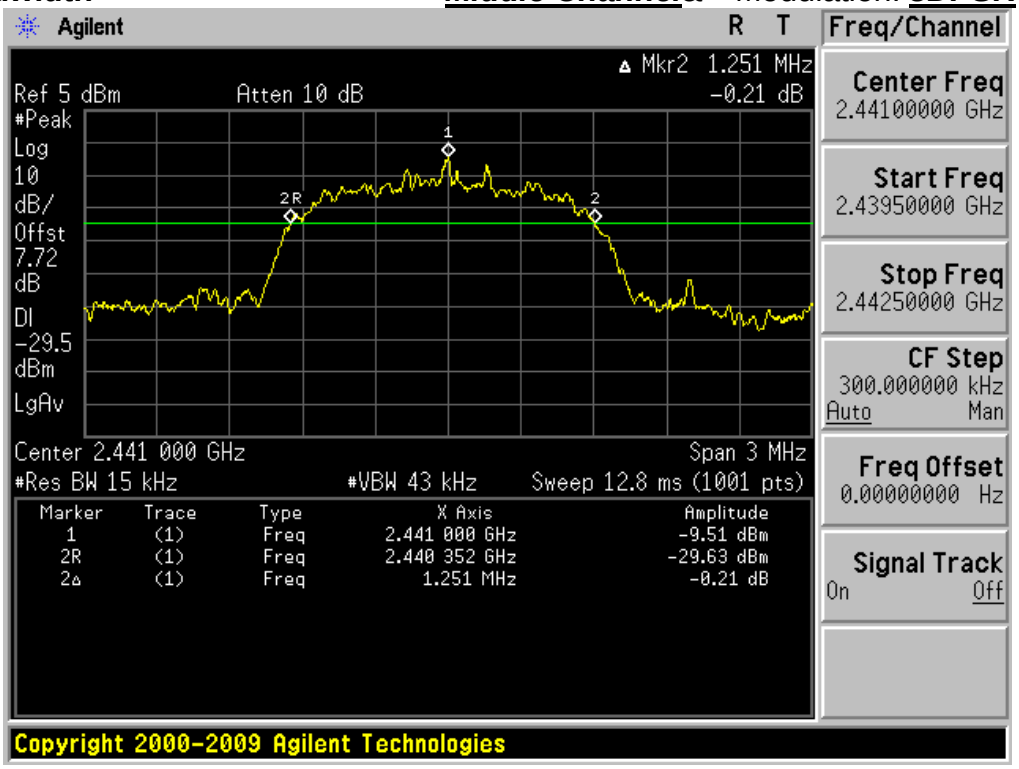
20dBc Bandwidth ***Highest Channel***& Modulation: ***π/4DQPSK***



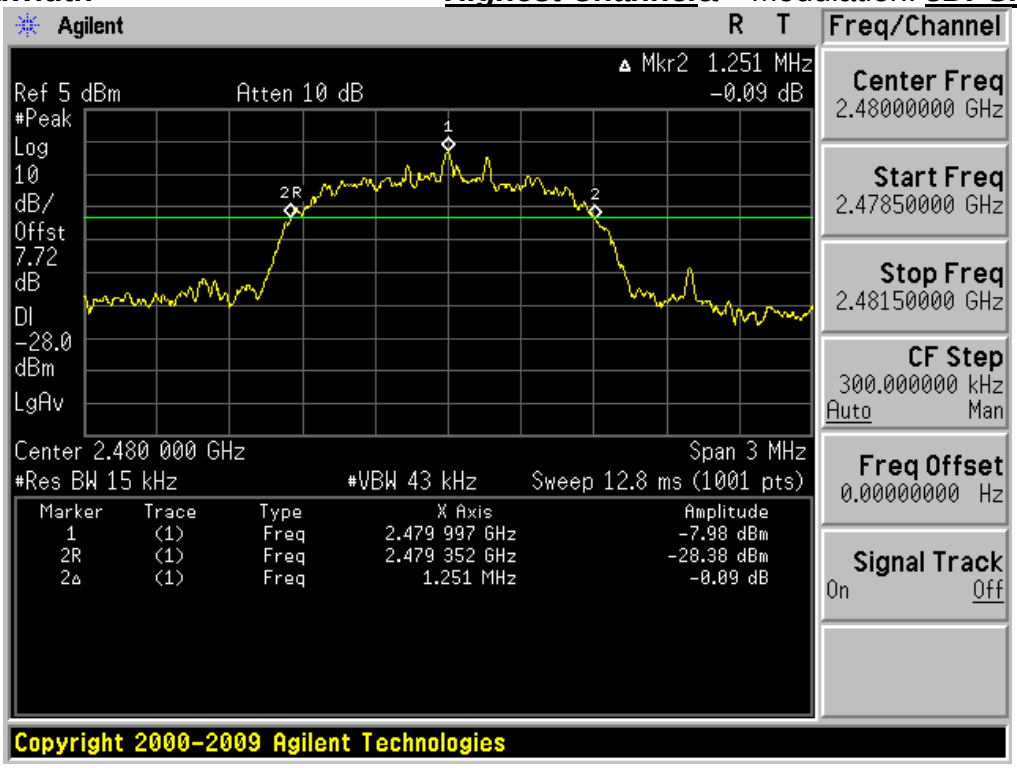
20dBc Bandwidth ***Lowest Channel***& Modulation: ***8DPSK***



20dBc Bandwidth ***Middle Channel***& Modulation: ***8DPSK***



20dBc Bandwidth ***Highest Channel***& Modulation: ***8DPSK***



6. Time of Occupancy (Dwell Time)

6.1. Test Setup

Refer to the APPENDIX I.

6.2. Limit

Limit: Not Applicable

6.3. Test Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = 2441 MHz
Span = zero
RBW = 1 MHz
VBW = ≥ RBW
Trace = max hold
Detector function = peak

6.4. Test Results

Ambient temperature : 24°C
Relative humidity : 53 %

- FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	79	2.90	3.75	0.309
	2 DH 5	79	2.90	3.75	0.309
	3 DH 5	79	2.90	3.75	0.309

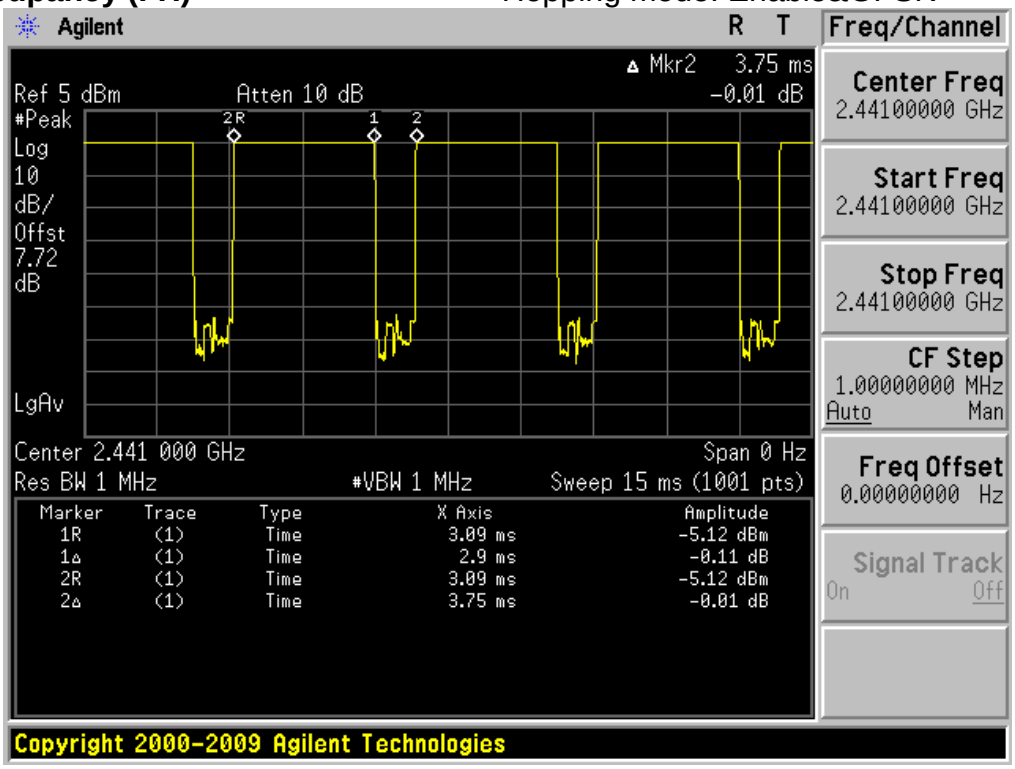
- AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	20	2.90	3.75	0.155
	2 DH 5	20	2.90	3.75	0.155
	3 DH 5	20	2.90	3.75	0.155

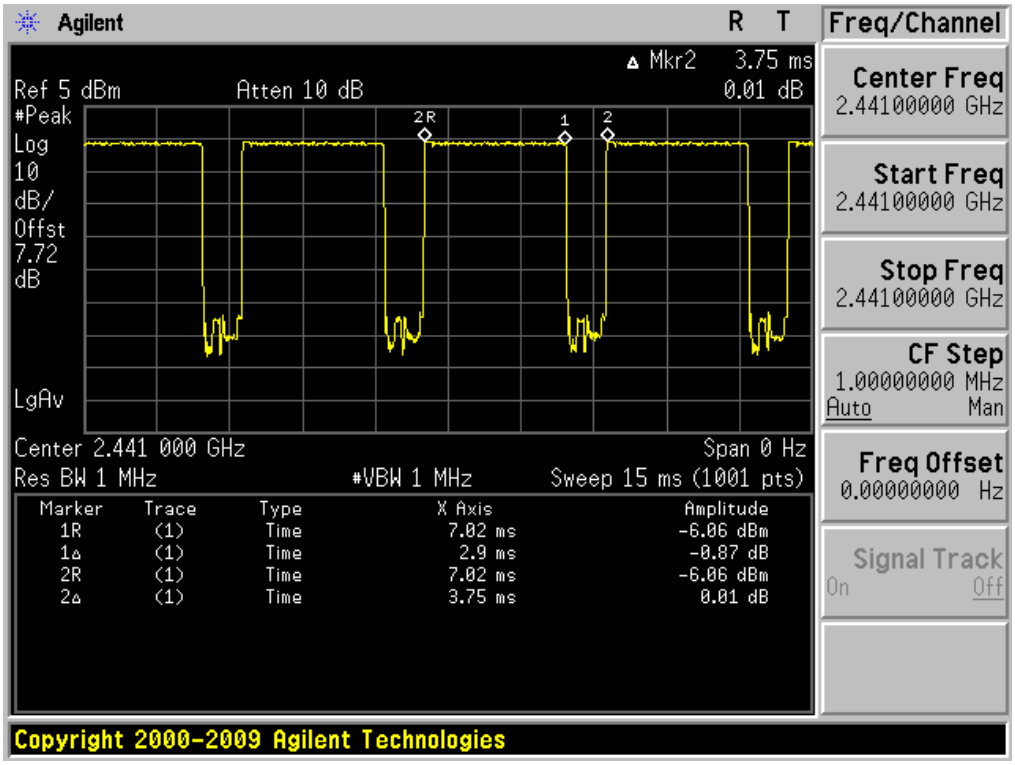
Note 1: $\text{Dwell Time} = 0.4 \times \text{Hopping channel} \times \text{Burst ON time} \times ((\text{Hopping rate} \div \text{Time slots}) \div \text{Hopping channel})$
- Time slots for DH5 = 6 slots(TX = 5 slot / RX = 1 slot)
- Hopping Rate = 1600 for FH mode & 800 for AFH mode

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

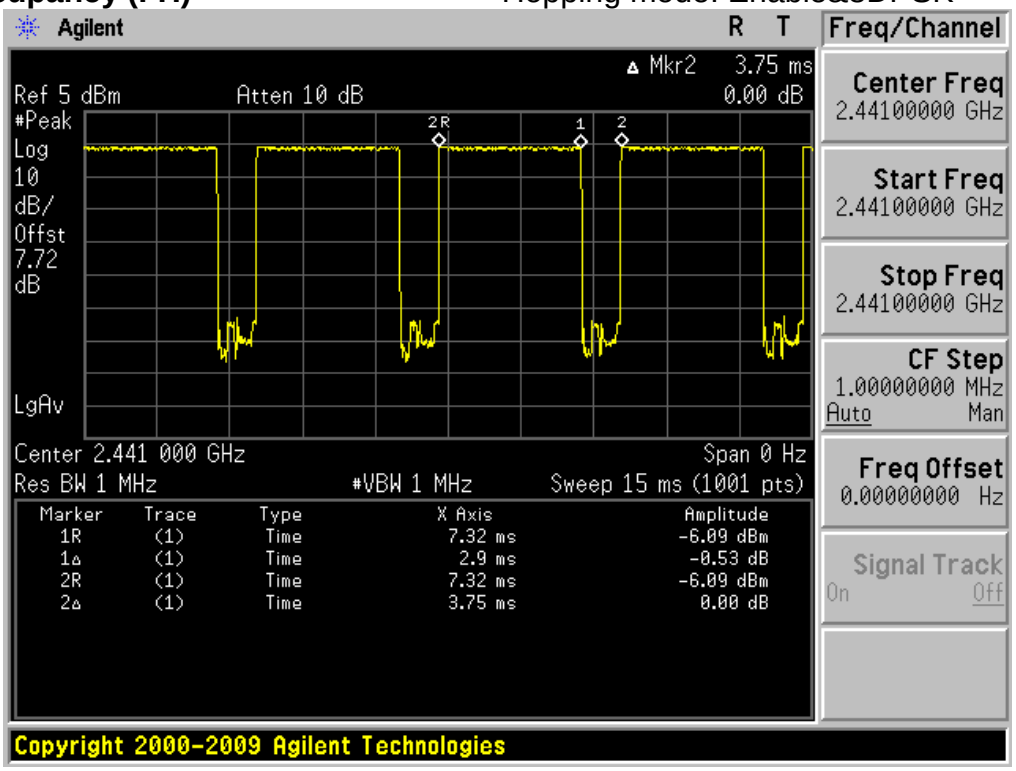
Time of Occupancy (FH) Hopping mode: Enable&GFSK



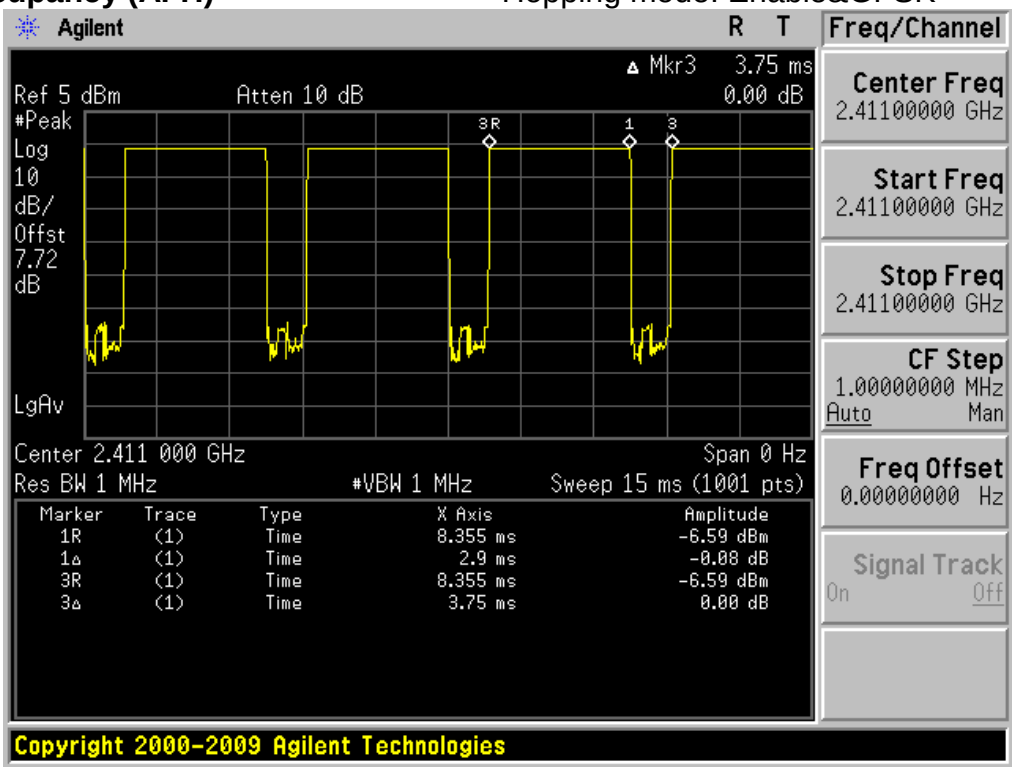
Time of Occupancy (FH) Hopping mode: Enable&π/4DQPSK



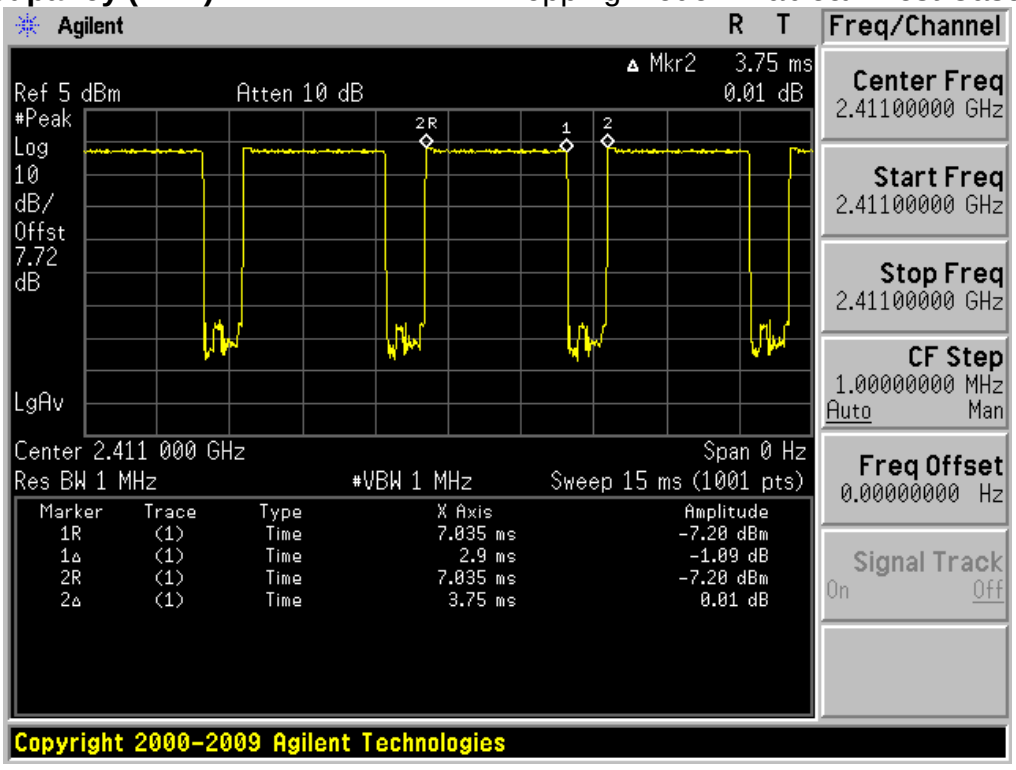
Time of Occupancy (FH) Hopping mode: Enable&8DPSK



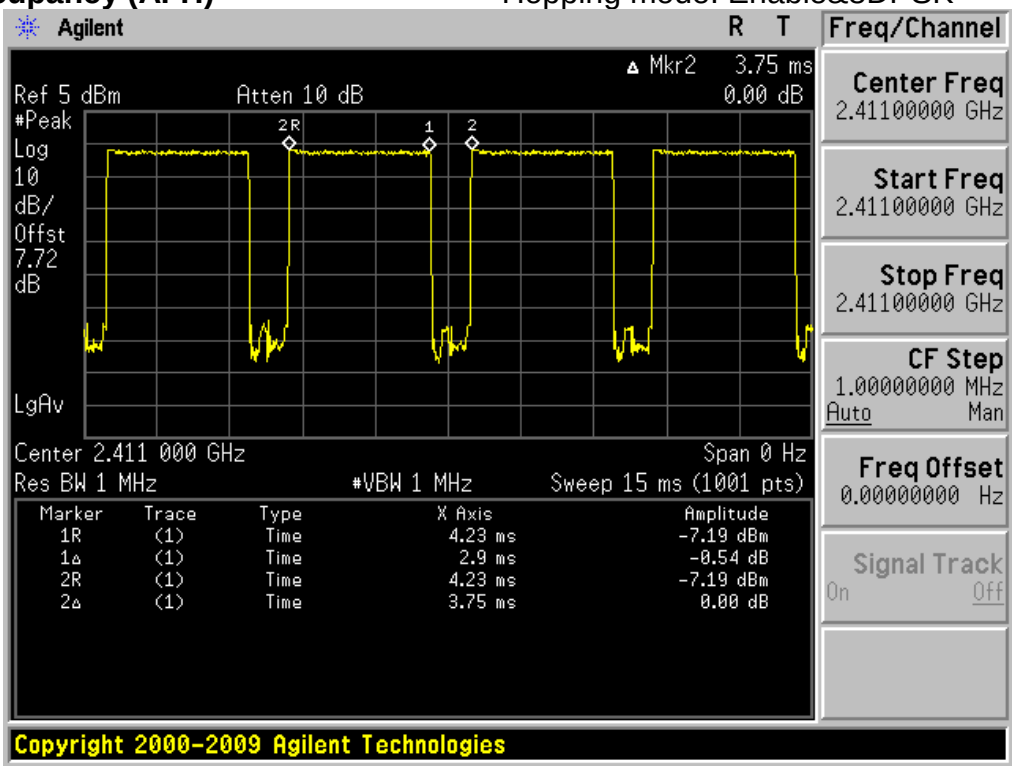
Time of Occupancy (AFH) Hopping mode: Enable&GFSK



Time of Occupancy (AFH) Hopping mode: Enable& Test Case 2



Time of Occupancy (AFH) Hopping mode: Enable&8DPSK



7. Maximum Peak Output Power Measurement

7.1. Test Setup

Refer to the APPENDIX I.

7.2. Limit

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

1. §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

2. §15.247(b)(1), For frequency hopping systems operating in the 2 400 – 2 483.5 ㎒ employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 – 5 805 ㎒ band: 1 Watt.

7.3. Test Procedure

1. The RF power output was measured with a Spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ;
   Span = approximately 5 times the 20 ㏈bandwidth, centered on a hopping channel
   RBW ≥ 20㏈BW
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

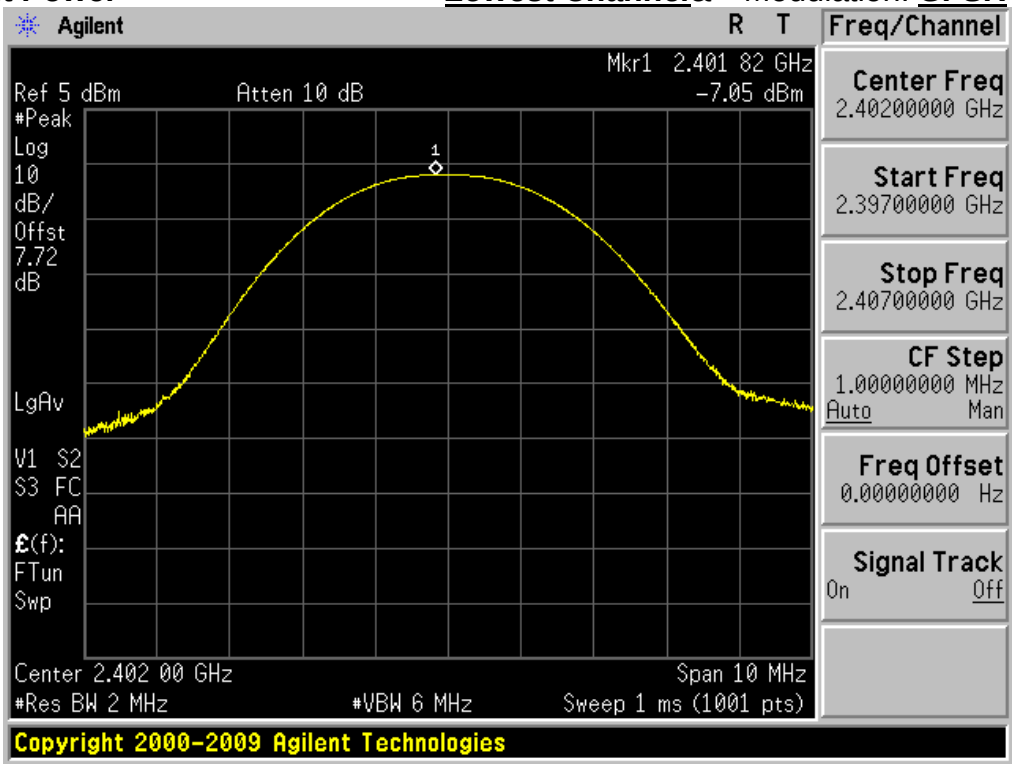
7.4. Test Results

Ambient temperature : 24°C
Relative humidity : 53 %

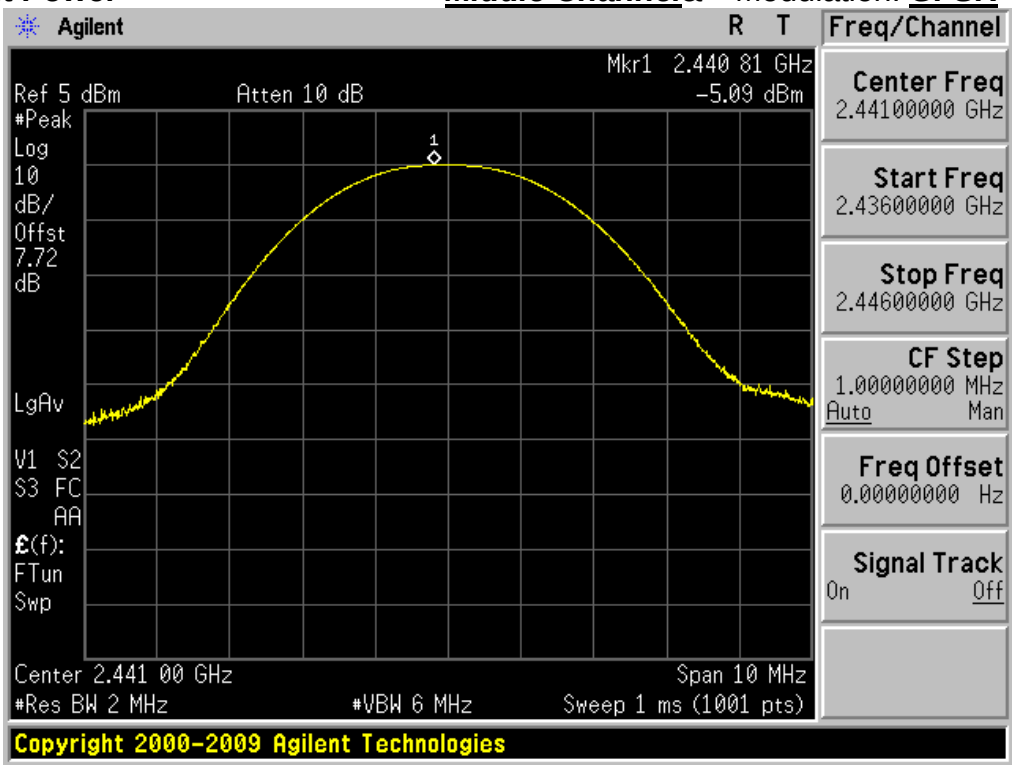
Modulation	Tested Channel	Peak Output Power	
		dBm	mW
GFSK	**Lowest**	-7.05	0.197
	Middle	-5.09	0.310
	Highest	**-3.33**	**0.465**
π/4DQPSK	**Lowest**	-7.43	0.181
	Middle	-5.55	0.279
	Highest	**-3.97**	**0.401**
8DPSK	**Lowest**	-7.14	0.193
	Middle	-5.25	0.299
	Highest	**-3.72**	**0.425**

Note 1: See next pages for actual measured spectrum plots.

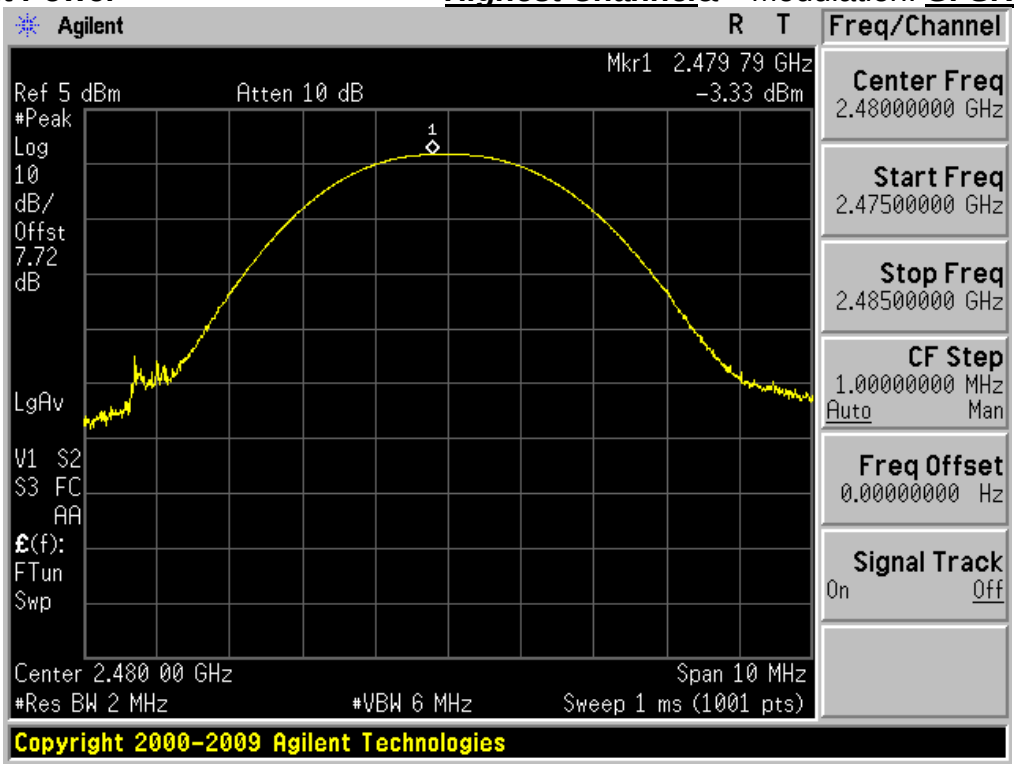
Peak Output Power ***Lowest Channel***& Modulation: ***GFSK***



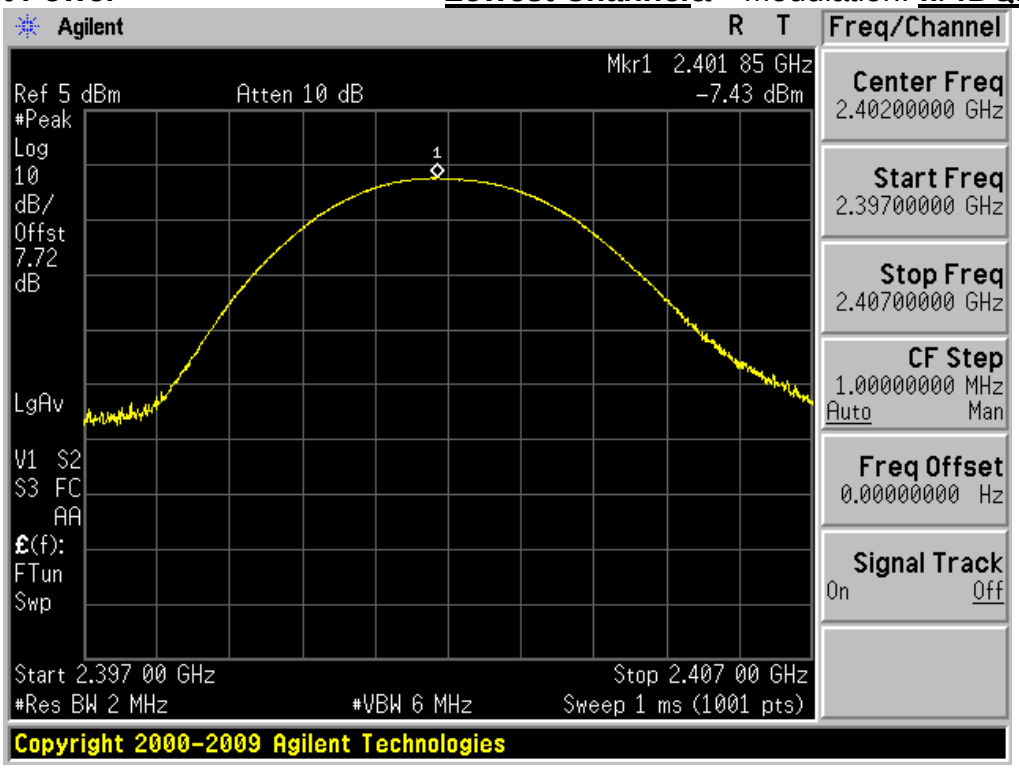
Peak Output Power ***Middle Channel***& Modulation: ***GFSK***



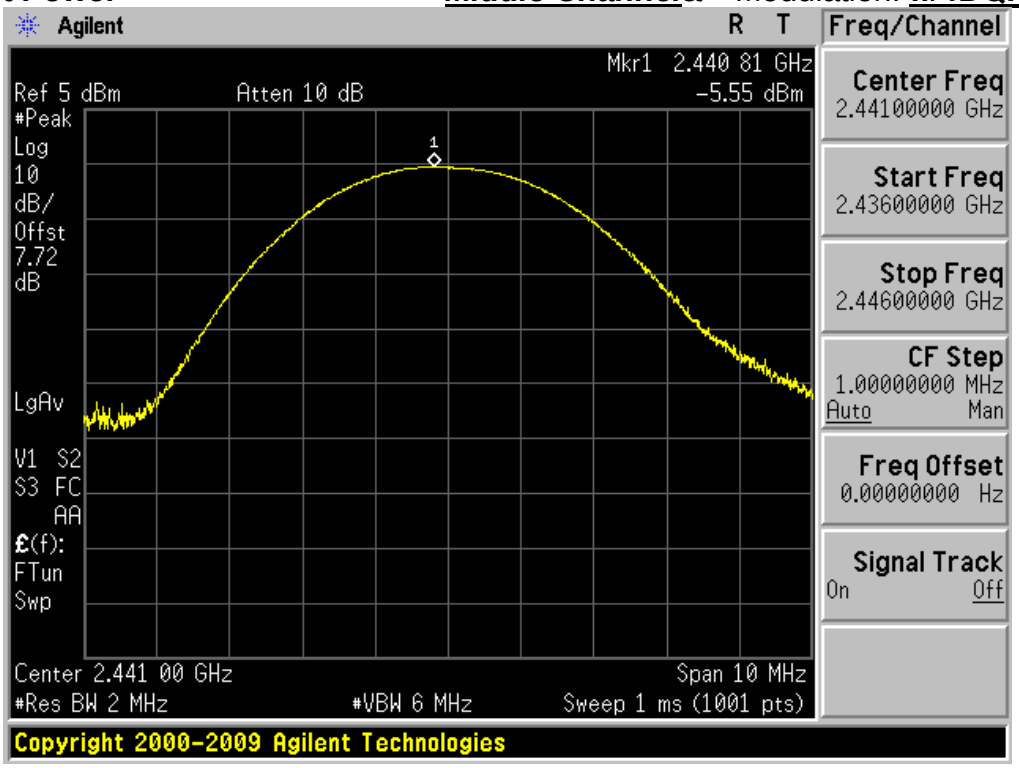
Peak Output Power ***Highest Channel***& Modulation: ***GFSK***



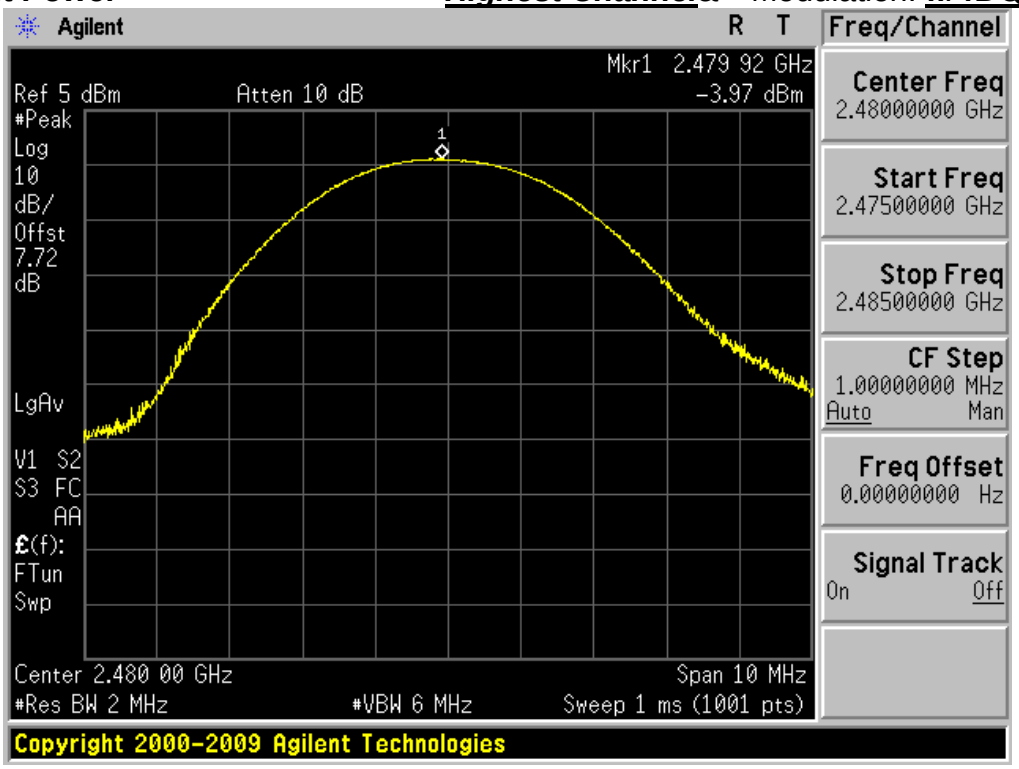
Peak Output Power ***Lowest Channel***& Modulation: ***π/4DQPSK***



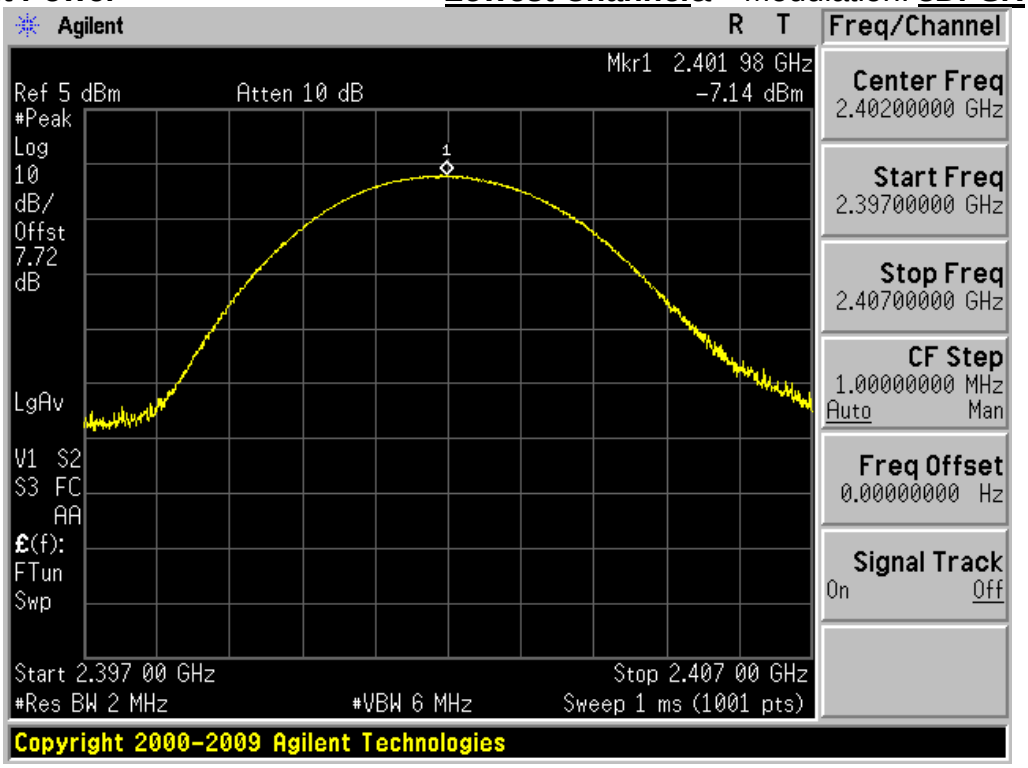
Peak Output Power ***Middle Channel***& Modulation: ***π/4DQPSK***



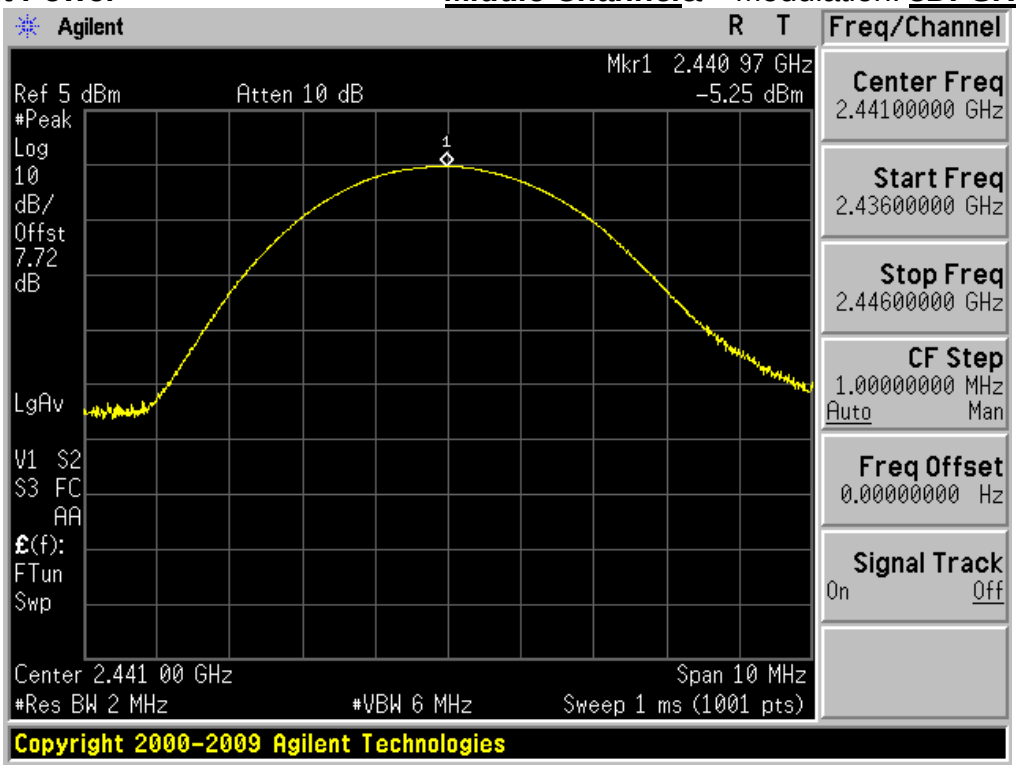
Peak Output Power ***Highest Channel***& Modulation: ***π/4DQPSK***



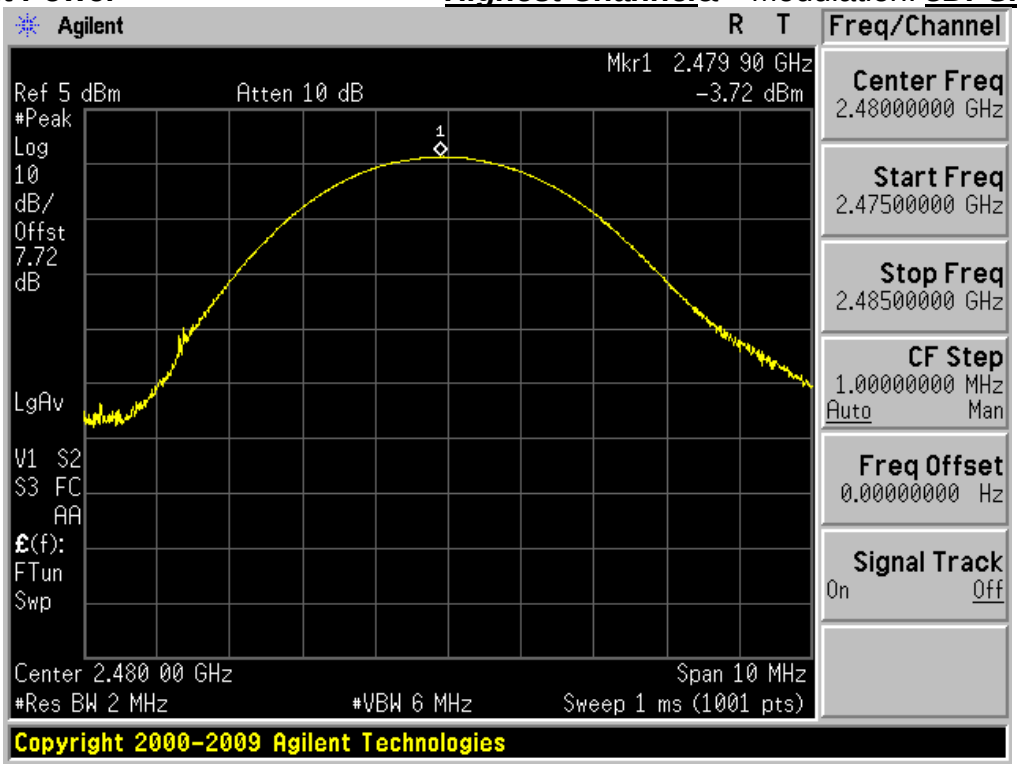
Peak Output Power ***Lowest Channel***& Modulation: ***8DPSK***



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



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



8. Transmitter AC Power Line Conducted Emission

8.1. Test Setup

Refer to test setup photo.

8.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

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

* Decreases with the logarithm of the frequency

8.3. Test Procedures

Conducted emissions from the EUT were measured according to the dictates of ANTE C63.4-209.

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

8.4. Test Results:NA

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

9. Antenna Requirement

▣ **Procedure:**

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

▣ **Conclusion: Comply**

Theantenna is PCB type. (Refer to Internal Photo file.)

▣ **Minimum Standard:**

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

10. Occupied Bandwidth(99%)

- Procedure:(RSS-Gen Issue 3)
- The 99% power bandwidth was measured with a calibrated spectrum analyzer.
- Spectrum analyzer plots are included on the following pages.

- Measurement Data: Comply

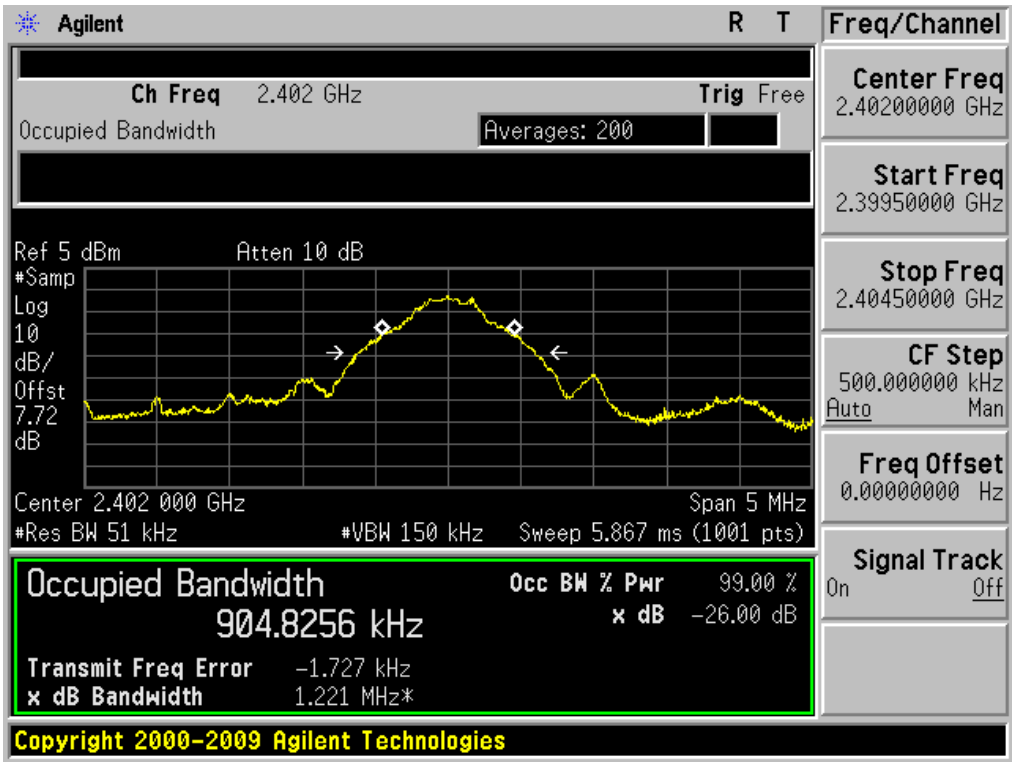
Test Mode	Tested Channel	Test Results (MHz)
GFSK	**Lowest**	0.905
	Middle	0.903
	Highest	**0.911**
π/4DQPSK	**Lowest**	**1.202**
	Middle	1.187
	Highest	1.198
8DPSK	**Lowest**	**1.202**
	Middle	1.198
	Highest	1.196

Note 1: See next pages for actual measured spectrum plots.

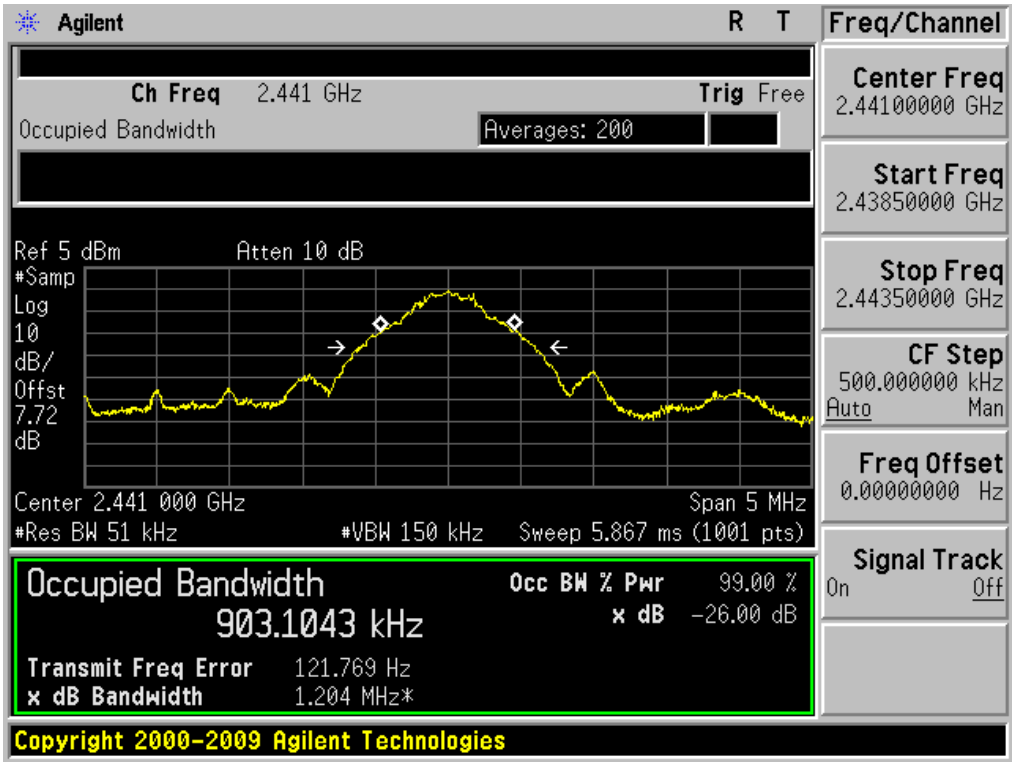
- **Minimum Standard:**

N/A

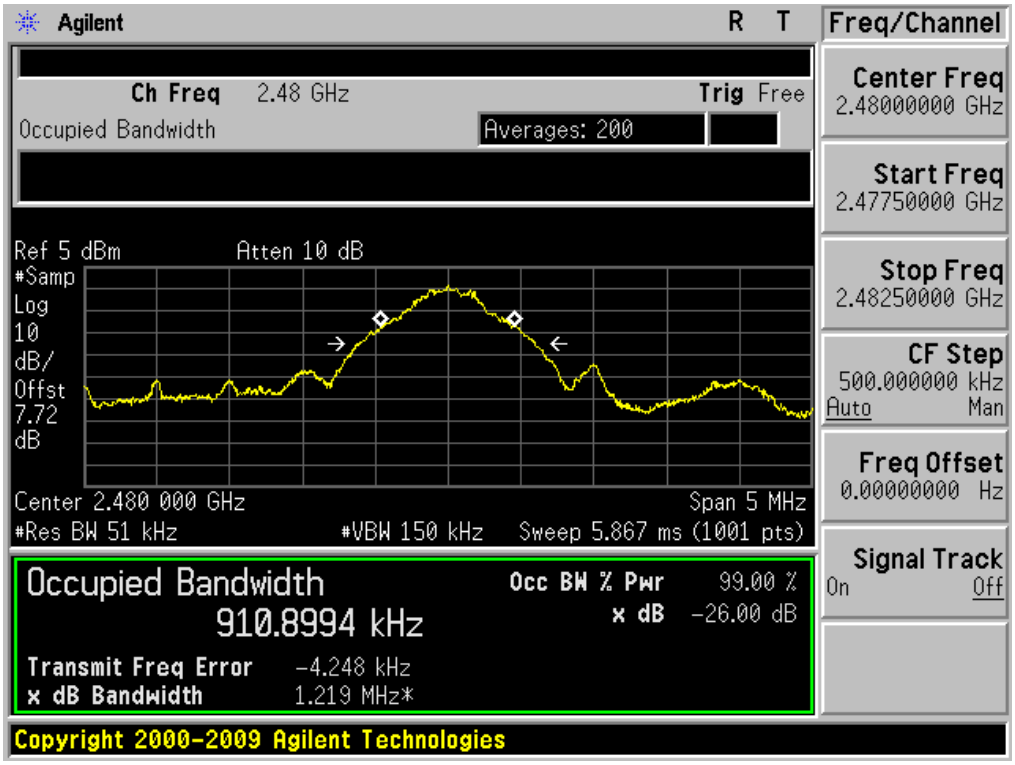
Occupied Bandwidth (99%) ***Lowest Channel*** & Modulation: ***GFSK***



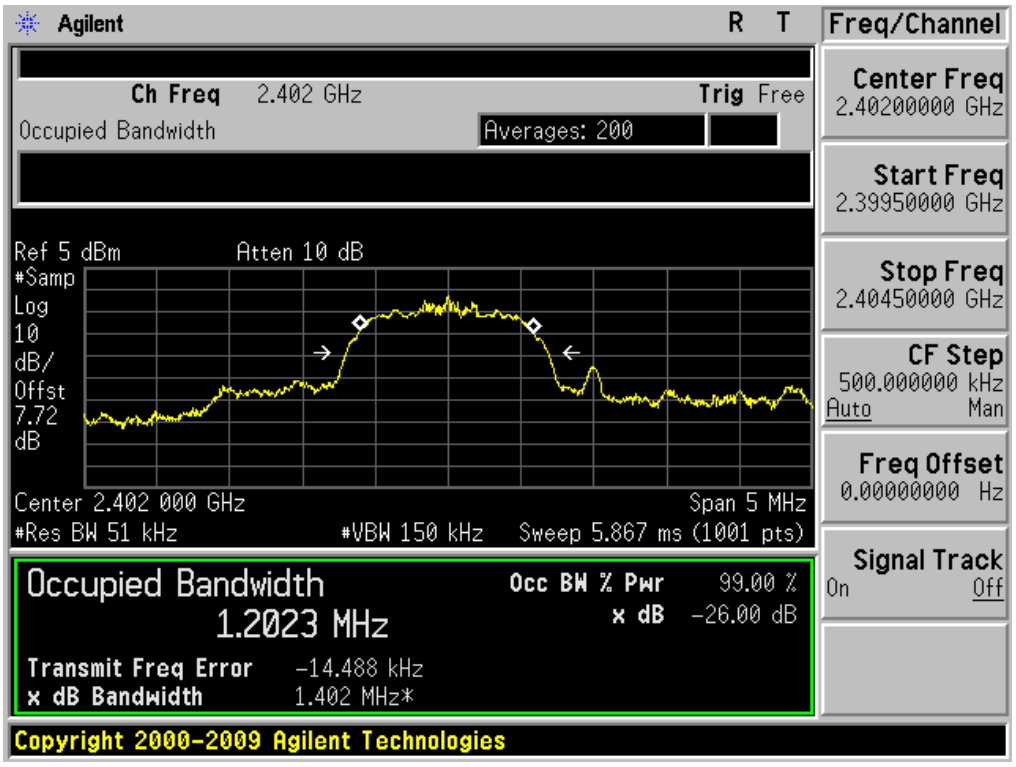
Occupied Bandwidth (99%) ***Middle Channel*** & Modulation: ***GFSK***



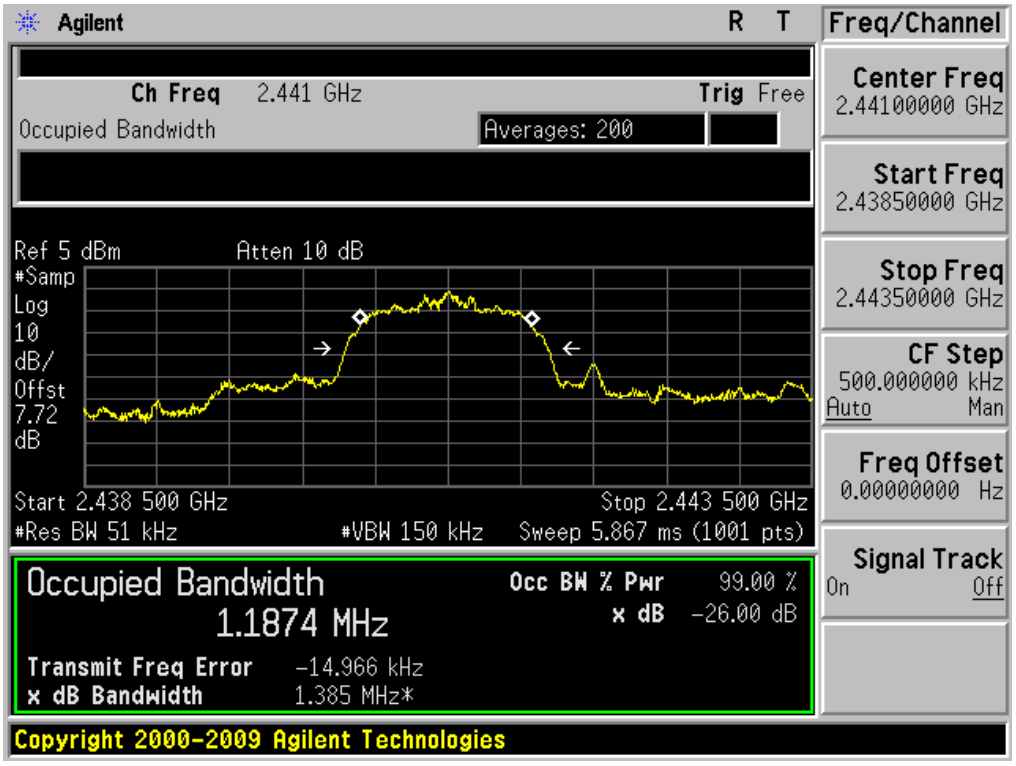
Occupied Bandwidth (99%) ***Highest Channel***& Modulation: ***GFSK***



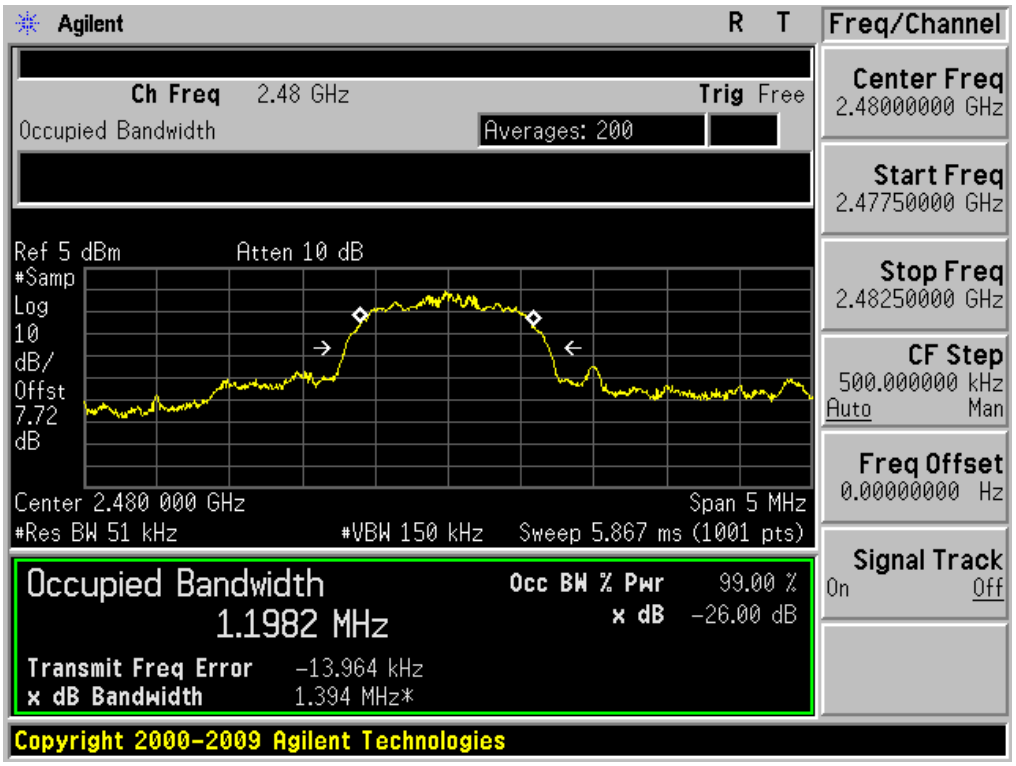
Occupied Bandwidth (99%) ***Lowest Channel***& Modulation: ***π/4DQPSK***



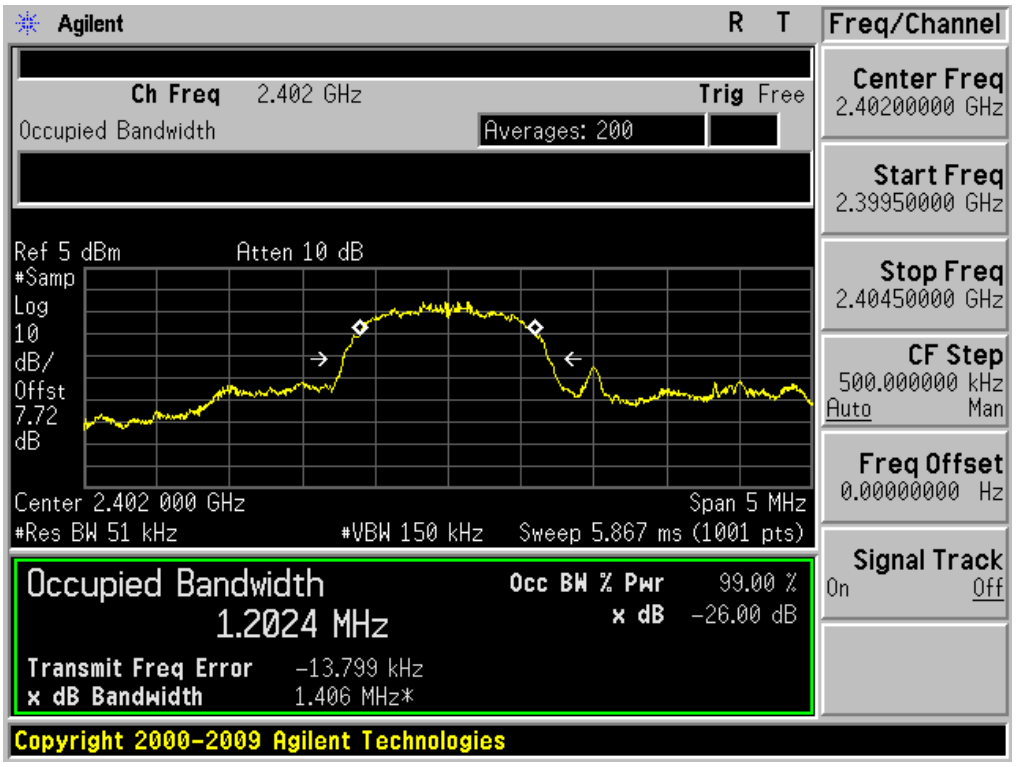
Occupied Bandwidth (99%) ***Middle Channel***& Modulation: ***π/4DQPSK***



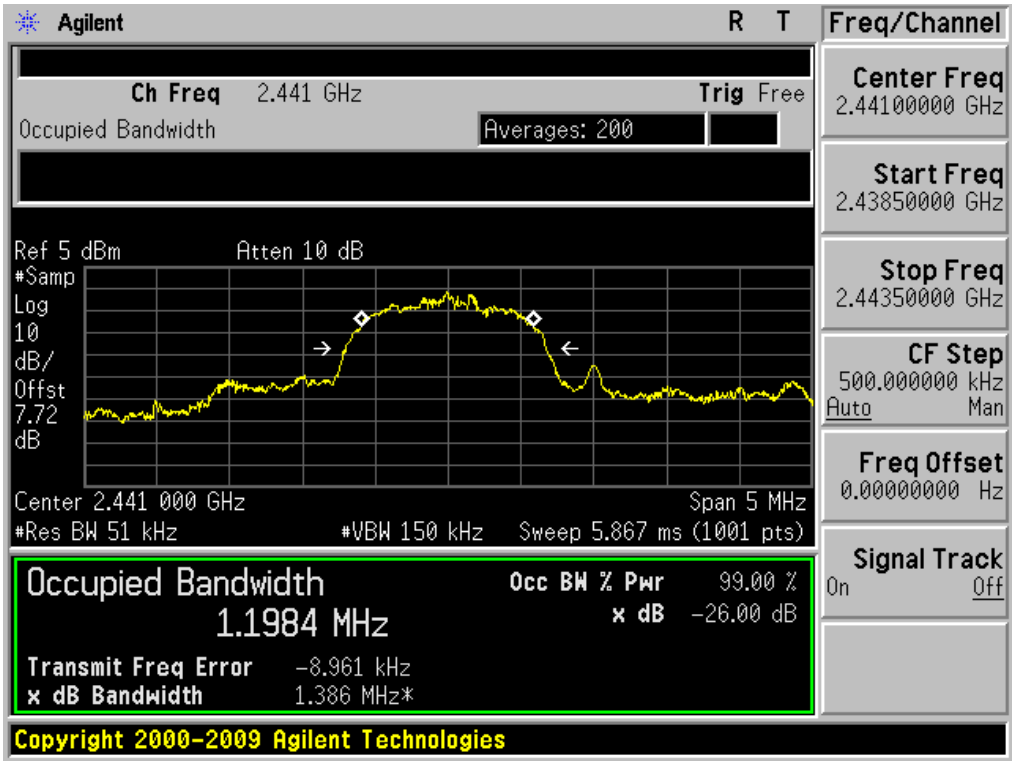
Occupied Bandwidth (99%) ***Highest Channel***& Modulation: ***π/4DQPSK***



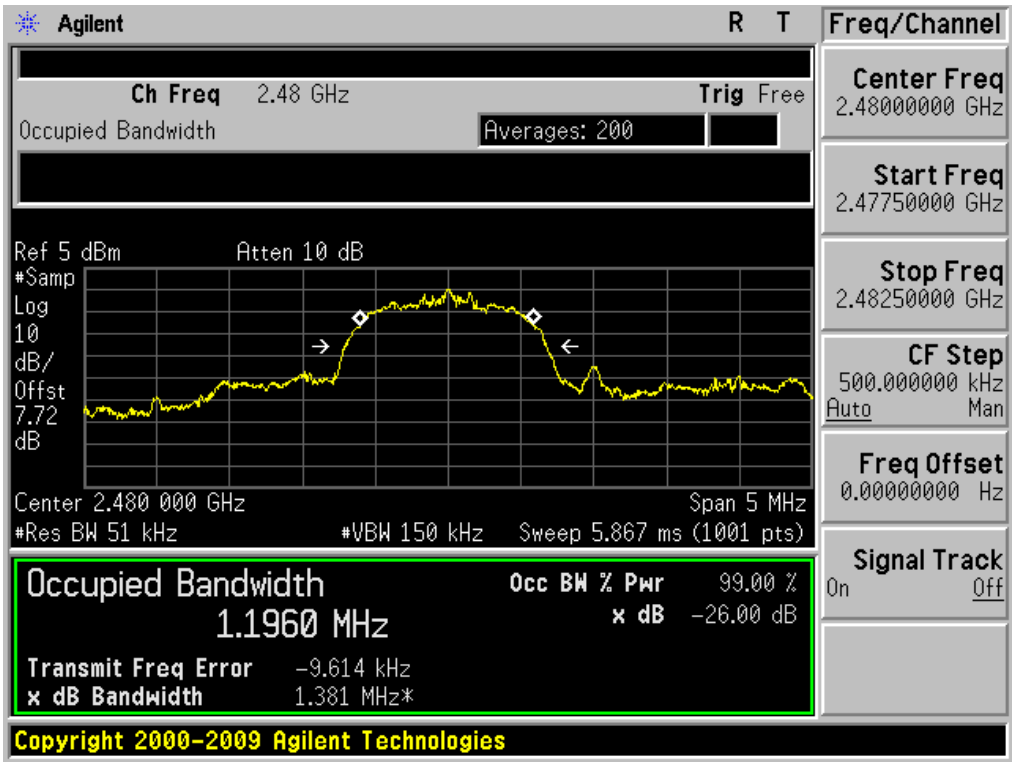
Occupied Bandwidth (99%) ***Lowest Channel***& Modulation: ***8DPSK***



Occupied Bandwidth (99%) ***MiddleChannel***& Modulation: ***8DPSK***



Occupied Bandwidth (99%) ***Highest Channel***& Modulation: ***8DPSK***

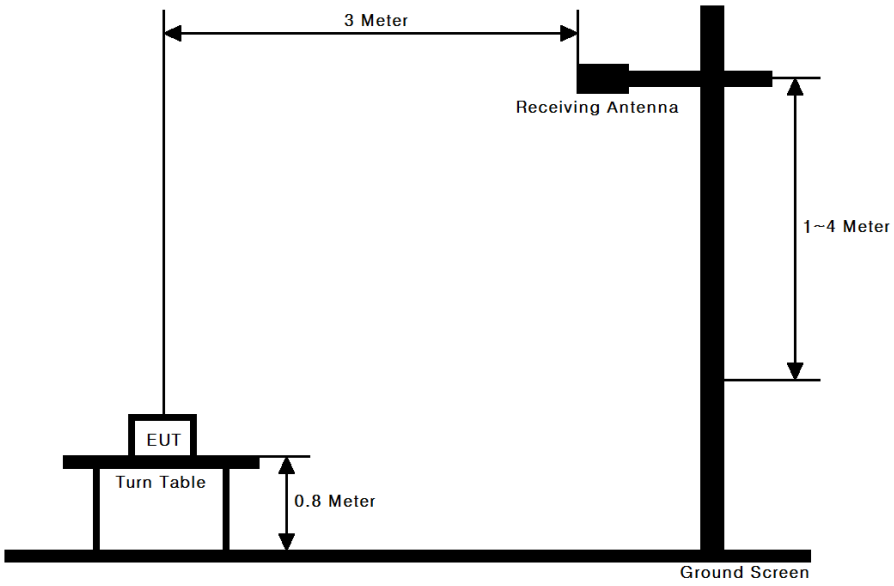


APPENDIX I

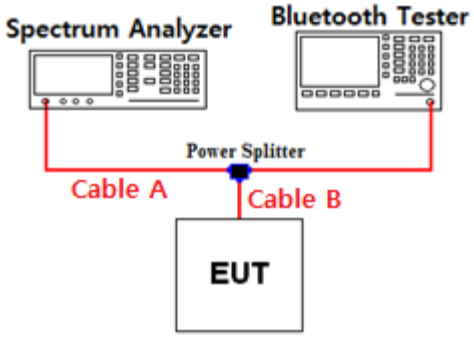
Test set upDiagrams&PathlossInformation

▪Radiated Measurement

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 25㎓ Emissions.



▪Conducted Measurement



Offset value information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.89	15	8.86
1	7.17	20	9.29
2.402 & 2.441 & 2.480	7.72	25	9.53
5	7.91	-	-
10	8.38	-	-

Note. 1: The path loss from EUT to Spectrum analyzer were measured and used for test.
Path loss (= S/A's Offset value) = Cable A + Power Splitter + Cable B
Note. 2: For conducted spurious emissions, the offset values were saved as the transducer factors on the spurious measurement function of the spectrum analyzer and the transducer factor of tested frequency is calculated and corrected automatically by the spectrum analyzer's measurement function.