TEST REPORT

of

FCC Part 15 Subpart B&C §15.247

FCC ID : BEJBL20DF

Equipment Under Test	:	Cellular/PCS GSM/EDGE/WCDMA Phone with BT
Model Name	:	BL20df
Serial No.	:	N/A
Applicant	:	LG Electronics Inc.
Manufacturer	:	LG Electronics Inc.
Date of Test(s)	:	2010.03.31 ~ 2010.04.02
Date of Issue	:	2010.04.05

In the configuration tested, the EUT complied with the standards specified above.

Tested By: Duke Ko **Date** 2010.04.05

Approved By Charles Kim **Date** 2010.04.05

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1. General Information

1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.
- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.
- Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

www.electrolab.kr.sgs.com
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2. Details of Applicant

Applicant : LG Electronics Inc.
Address : 60-39, Gasan-dong, Gumchon-gu, Seoul, 153-023, Korea
Contact Person : Han, Bong Hyo
Phone No. : +82 +2 2033 1108

1.3. Description of EUT

Kind of Product	Cellular/PCS GSM/EDGE/WCDMA Phone with Bluetooth
Model Name	BL20df
Serial Number	N / A
Power Supply	DC 3.7 V (Li-poly Battery)
Frequency Range	2 402 ~ 2 480 ㎒
Modulation Technique	GFSK, π/4DQPSK, 8DPSK
Number of Channels	79
Antenna Type	Integral Type (Chip Antenna)
Antenna Gain	-1.89 ㏈i

1.4. Declaration by the manufacturer

- N/A

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1.5. Information about the FHSS characteristics:

1.5.1. Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

1.5.2. Equal Hopping Frequency Use

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

1.5.3. System Receiver Input Bandwidth

Each channel bandwidth is 1 ㎒

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1.6. Test Equipment List

Equipment	Manufacturer	Model	Cal Due.
Signal Generator	R & S	SMR40	Sep. 25, 2010
Spectrum Analyzer	Agilent	E4440A	Mar. 31, 2011
Signal Generator	R & S	SMR40	Sep. 25, 2010
Mobile Test Unit	Agilent	E5515C	Mar. 31, 2011
Bluetooth Tester	TESOM	TC-3000B	Sep. 25, 2010
Directional Coupler	Narda	4226-20	Jan. 07, 2011
High Pass Filter	Wainwright	WHK3.0/18G-10SS	Sep. 29, 2010
DC power Supply	Agilent	U8002A	Jan. 06, 2011
Preamplifier	H.P.	8447F	Jul. 02, 2010
Preamplifier	Rohde & Schwarz	8449B	Mar. 31, 2011
Test Receiver	R & S	ESU26	Apr. 21, 2010
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	Jul. 22, 2010
Horn Antenna	Rohde & Schwarz	HF 906	Oct. 08, 2011
Antenna Master	EMCO	1050	N.C.R
Turn Table	Daeil EMC	DI-1500	N.C.R
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	Jan. 27, 2011
Two-Line V-Network	R & S	ENV216	Jan. 06, 2011
Test Receiver	R & S	ESHS10	Jul. 13, 2010
Anechoic Chamber	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N.C.R

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1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part15		
Section	**Test Item**	**Result**
15.205(a) 15.209 15.247(d)	Transmitter Radiated Spurious Emissions Conducted Spurious Emission	Complied
15.109(a)	Receiver Radiated Spurious Emission	Complied
15.247(a)(1)	20 dB Bandwidth	Complied
15.247(b)(1)	Maximum Peak Output Power	Complied
15.247(a)(1)	Frequency Separation	Complied
15.247(b)(1)	Number of Hopping Frequency	Complied
15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Complied

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1.8. Conclusion of worst-case and operation mode

The EUT has three type of modulation (GFSK, π/4DQPSK and 8DPSK). Each output power as following:

Modulation Type	Ouput power(dBm)	Output power(mW)	Symbol rate
GFSK(2 441 ㎒)	8.89	7.74	1 Mbps
π/4DQPSK(2 441 ㎒)	9.27	8.45	2 Mbps
8DPSK(2 441 ㎒)	9.30	8.51	3 Mbps

Therefore all applicable requirements were tested to the two type of higher output power modulation (GFSK and 8DPSK) at middle channel (2 441 ㎒).
The field strength of spurious emission was measured in three orthogonal EUT positions(x-axis, y-axis and z-axis). Worst case is z-axis.

1.9 Test report revision

Revision	Report number	Description
0	F690501/RF-RTL003709	Initial

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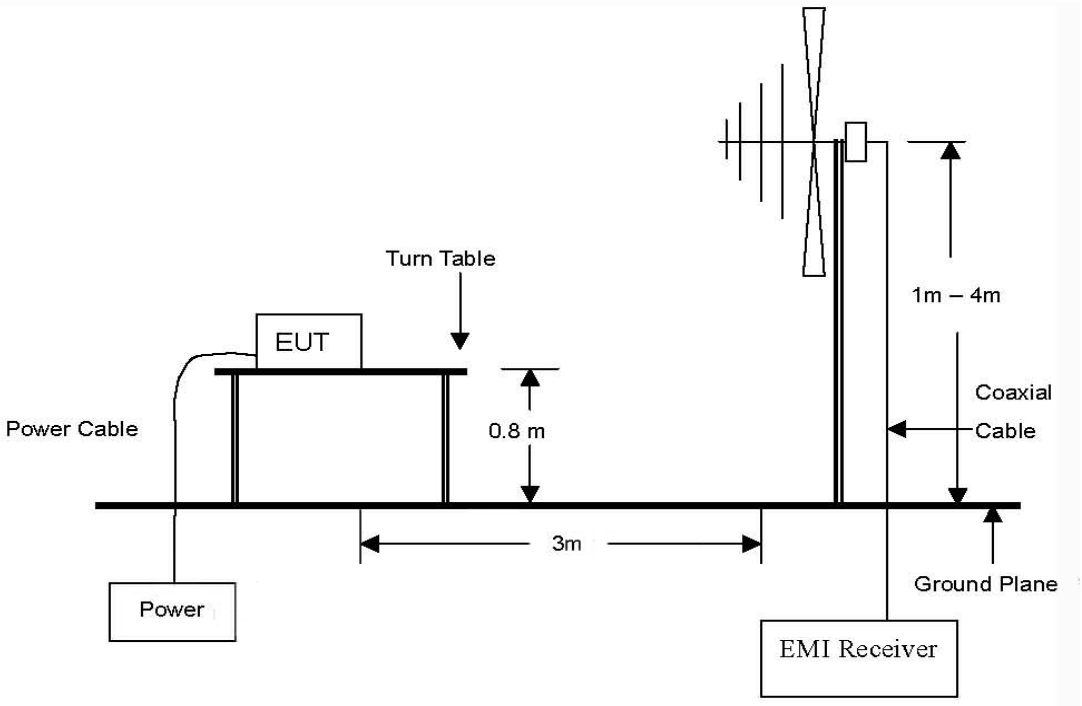
2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

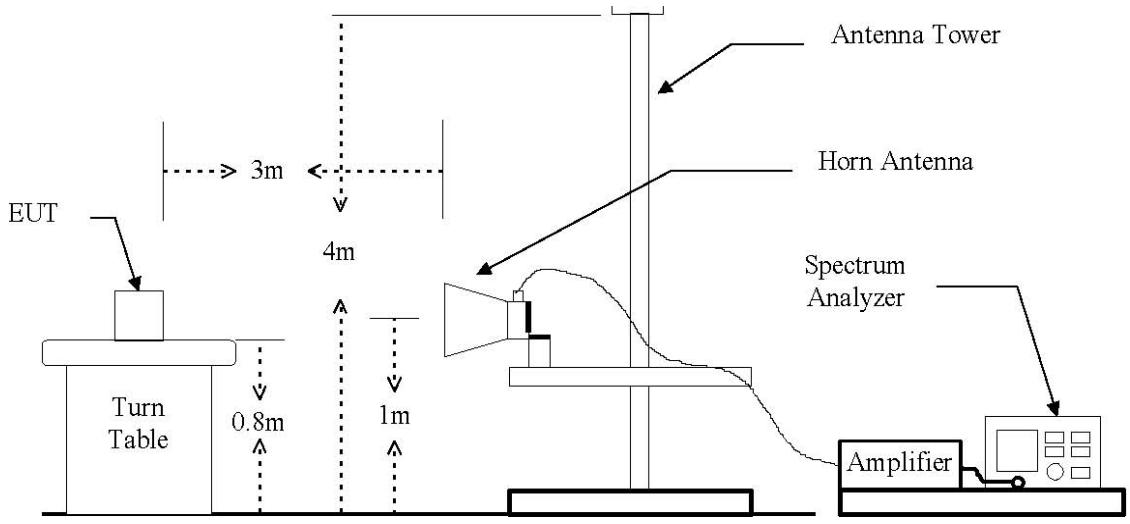
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 24 ㎓ Emissions.



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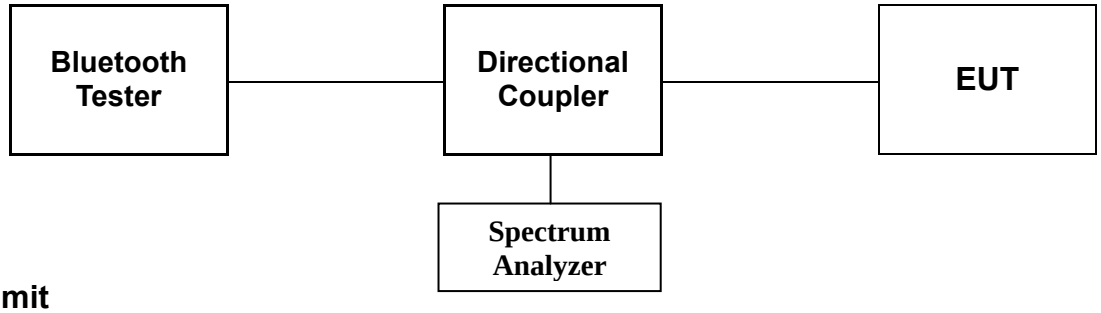
2.1.2. Conducted Spurious Emissions



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 R ㎳ 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 (㎒)	Distance (Meters)	Field Strength (㏈μV/m)	Field Strength (μV/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

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 Peak detection (PK) and 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 10 Hz 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 bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑, VBW=100 ㎑.

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2.4. Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

2.4.1. Spurious Radiated Emission (Worst case configuration_8DPSK mode)

The frequency spectrum from 30 ㎒ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP + CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
30.323	45.2	Peak	V	11.08	-27.75	28.5	40.0	11.5
47.622	44.0	Peak	V	12.14	-27.57	28.6	40.0	11.4
69.689	44.7	Peak	V	7.54	-27.34	24.9	40.0	15.1
108.004	38.8	Peak	H	11.18	-27.00	23.0	43.5	20.5
147.532	44.2	Peak	H	7.84	-26.68	25.4	43.5	18.1
186.170	42.3	Peak	H	9.84	-26.36	25.8	43.5	17.7
228.244	35.6	Peak	V	11.52	-26.00	21.1	46.0	24.9
Above 300.000	Not detected	-	-	-	-	-	-	-

Remark:

1. All spurious emission at channels are almost the same below 1 ㎓, so that middle channel was chosen at representative in final test.
2. Actual = Reading + AF + AMP + CL

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2.4.2. Spurious Radiated Emission

The frequency spectrum above 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈.

Operating Mode: GFSK

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*2 390.000	30.94	Peak	V	28.09	4.84	63.87	74.00	10.13
*2 390.000	17.37	Average	V	28.09	4.84	50.30	54.00	3.70

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP+CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
4 804.035	50.13	Peak	V	32.59	-27.78	54.94	74.00	19.06
4 804.035	36.69	Average	V	32.59	-27.78	41.50	54.00	12.50
Above 4 900.000	Not detected	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP+CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
4 882.290	52.74	Peak	V	32.90	-27.56	58.08	74.00	15.92
4 882.290	40.28	Average	V	32.90	-27.56	45.62	54.00	8.38
Above 4 900.000	Not detected	-	-	-	-	-	-	-

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C. High Channel (2 480 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.500	29.51	Peak	V	28.09	4.78	62.38	74.00	11.62
*2 483.500	16.86	Average	V	28.09	4.78	49.73	54.00	4.27

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4 959.674	55.34	Peak	V	33.22	-27.41	61.15	74.00	12.85
4 959.674	42.98	Average	V	33.22	-27.41	48.79	54.00	5.21
Above 5 000.000	Not detected	-	-	-	-	-	-	-

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Operating Mode: 8DPSK

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 390.000	30.46	Peak	V	28.09	4.84	63.39	74.00	10.61
*2 390.000	17.41	Average	V	28.09	4.84	50.34	54.00	3.66

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4 803.921	49.25	Peak	V	32.59	-27.78	54.06	74.00	19.94
4 803.921	35.44	Average	V	32.59	-27.78	40.25	54.00	13.75
Above 4 900.000	Not detected	-	-	-	-	-	-	-

B. Middle Channel (2 441 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4882.128	52.52	Peak	V	32.90	-27.56	57.86	74.00	16.14
4882.128	38.71	Average	V	32.90	-27.56	44.05	54.00	9.95
Above 4 900.000	Not detected	-	-	-	-	-	-	-

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C. High Channel (2 480 ㎒)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.500	31.94	Peak	V	28.09	4.78	64.81	74.00	9.19
*2 483.500	16.84	Average	V	28.09	4.78	49.71	54.00	4.29

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4 960.211	55.01	Peak	V	33.22	-27.41	60.82	74.00	13.18
4 960.211	41.23	Average	V	33.22	-27.41	47.04	54.00	6.96
Above 5 000.000	Not detected	-	-	-	-	-	-	-

Remarks ;

1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit.
5. Actual = Reading + AF + AMP + CL

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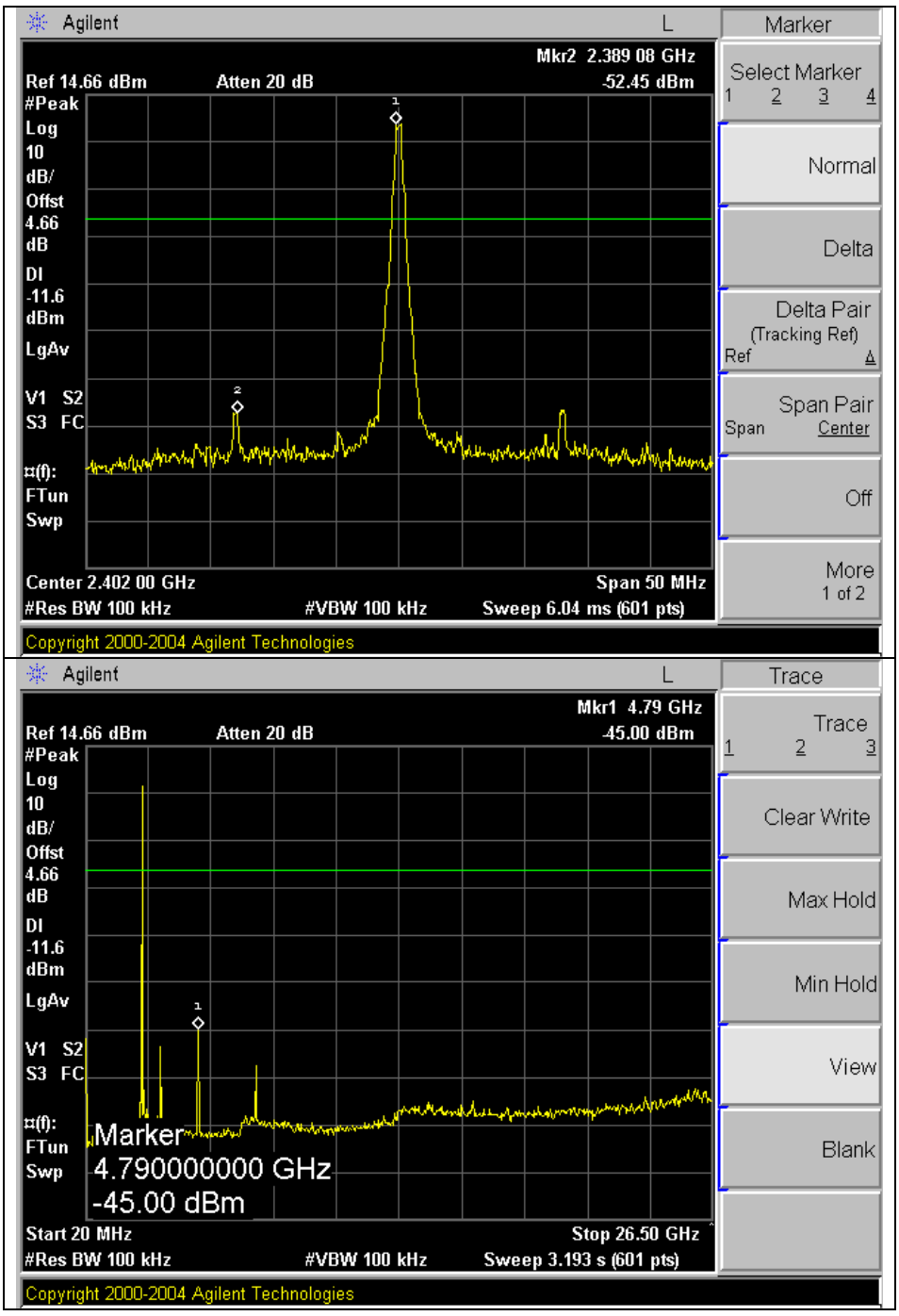
2.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

Operating Mode: GFSK

Low Channel



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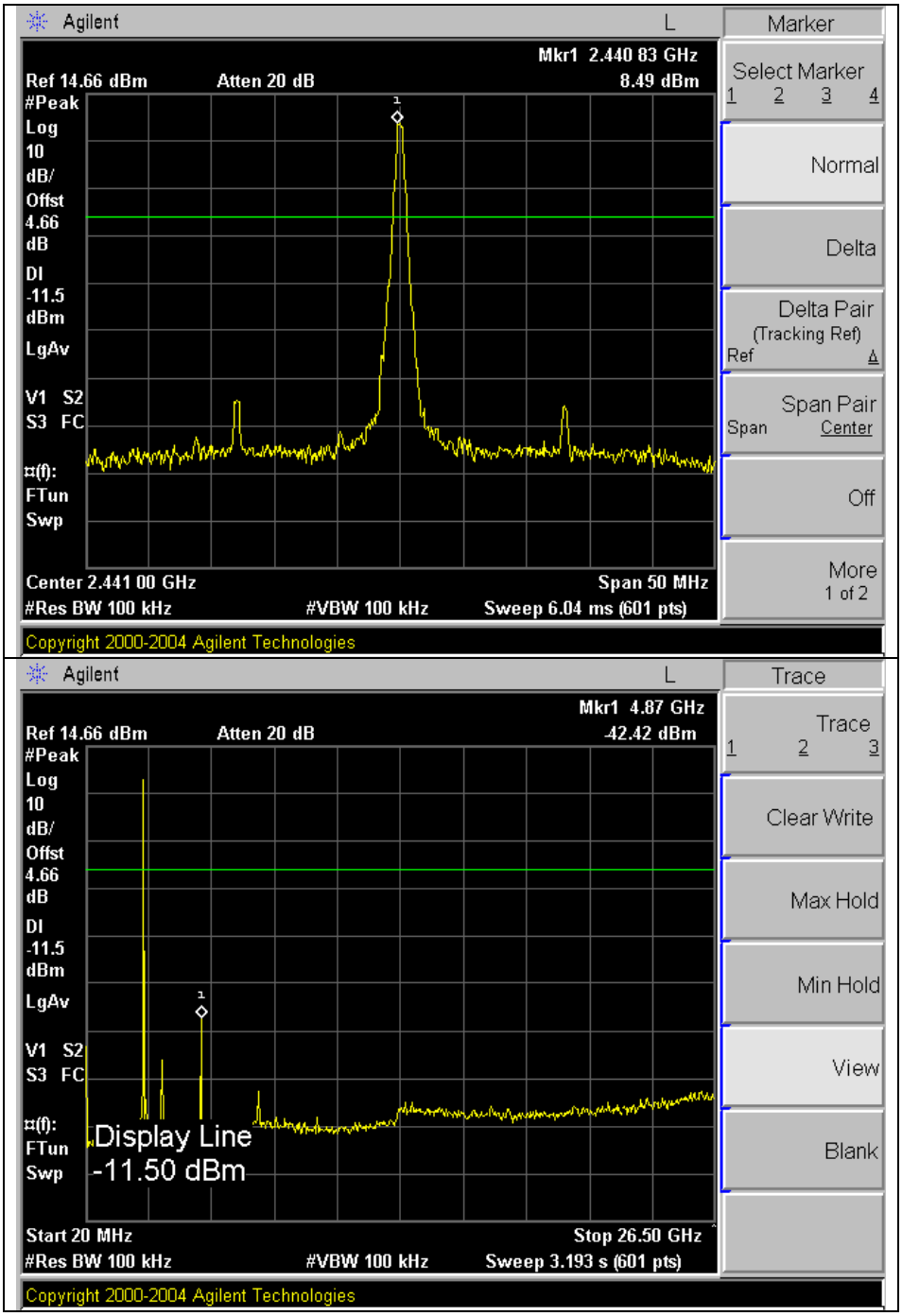
Middle Channel



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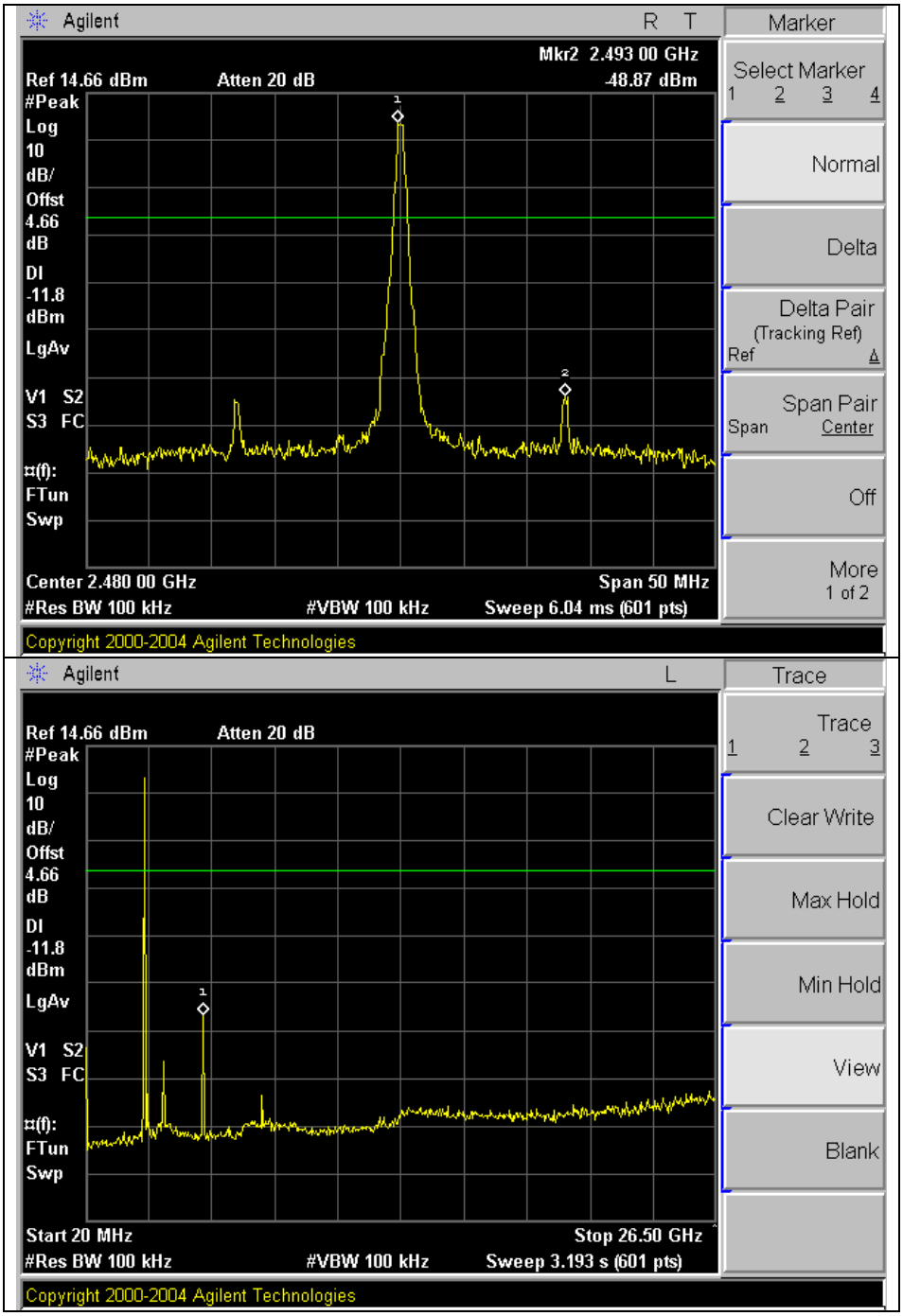
High Channel



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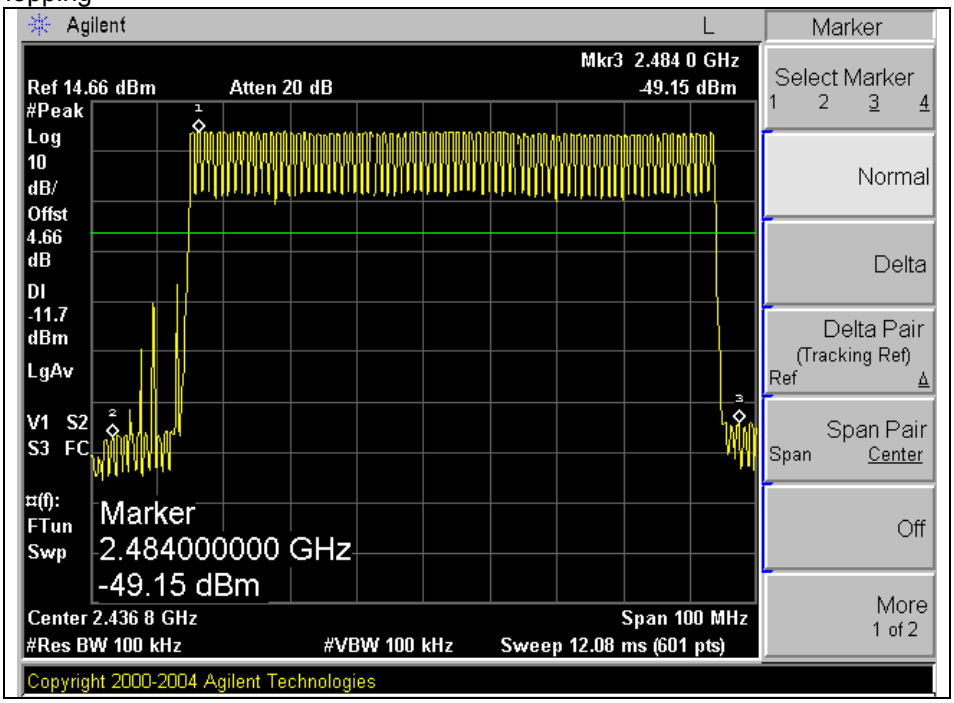
Bandedge at Hopping



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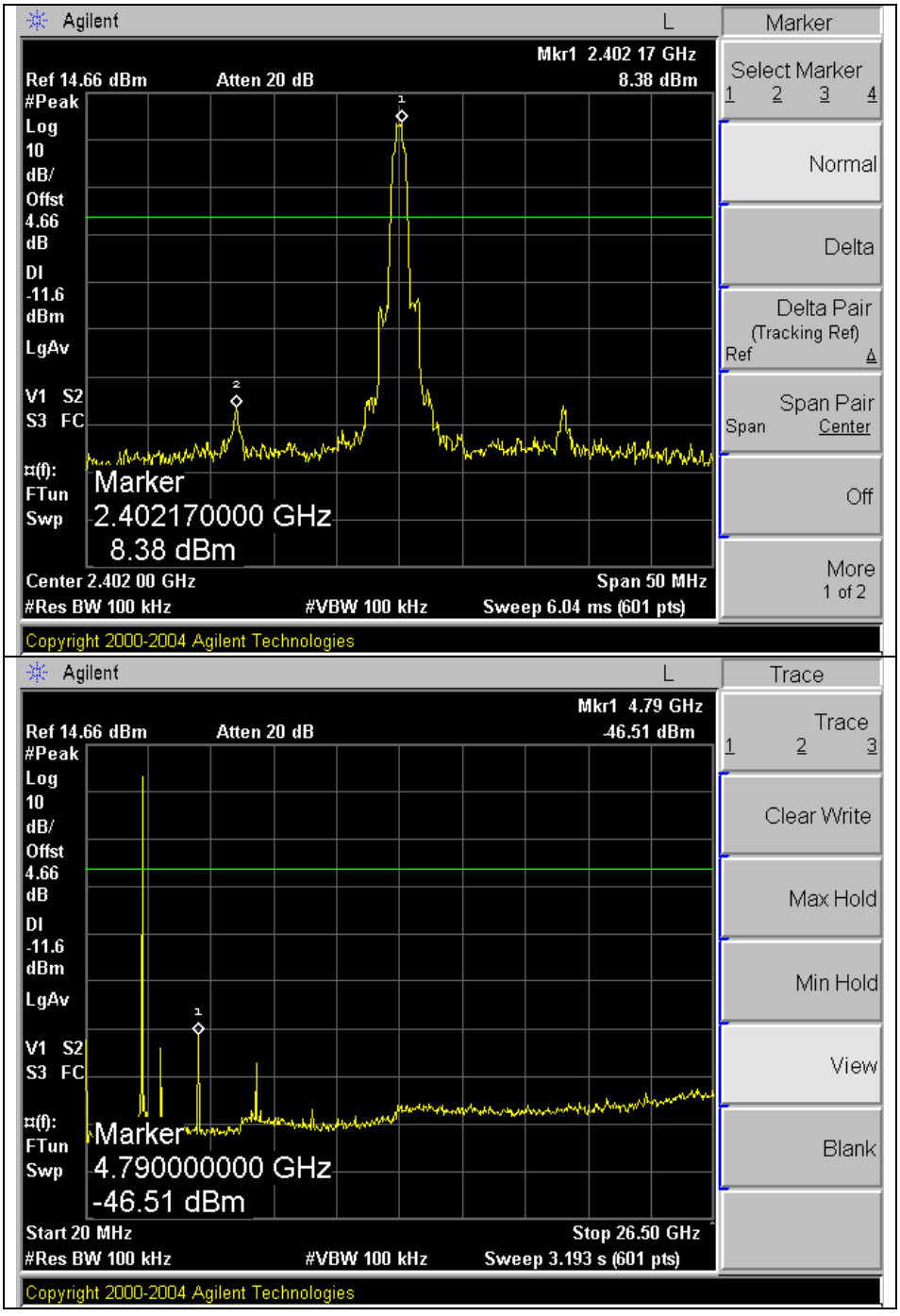
Operating Mode : 8DPSK
Low Channel



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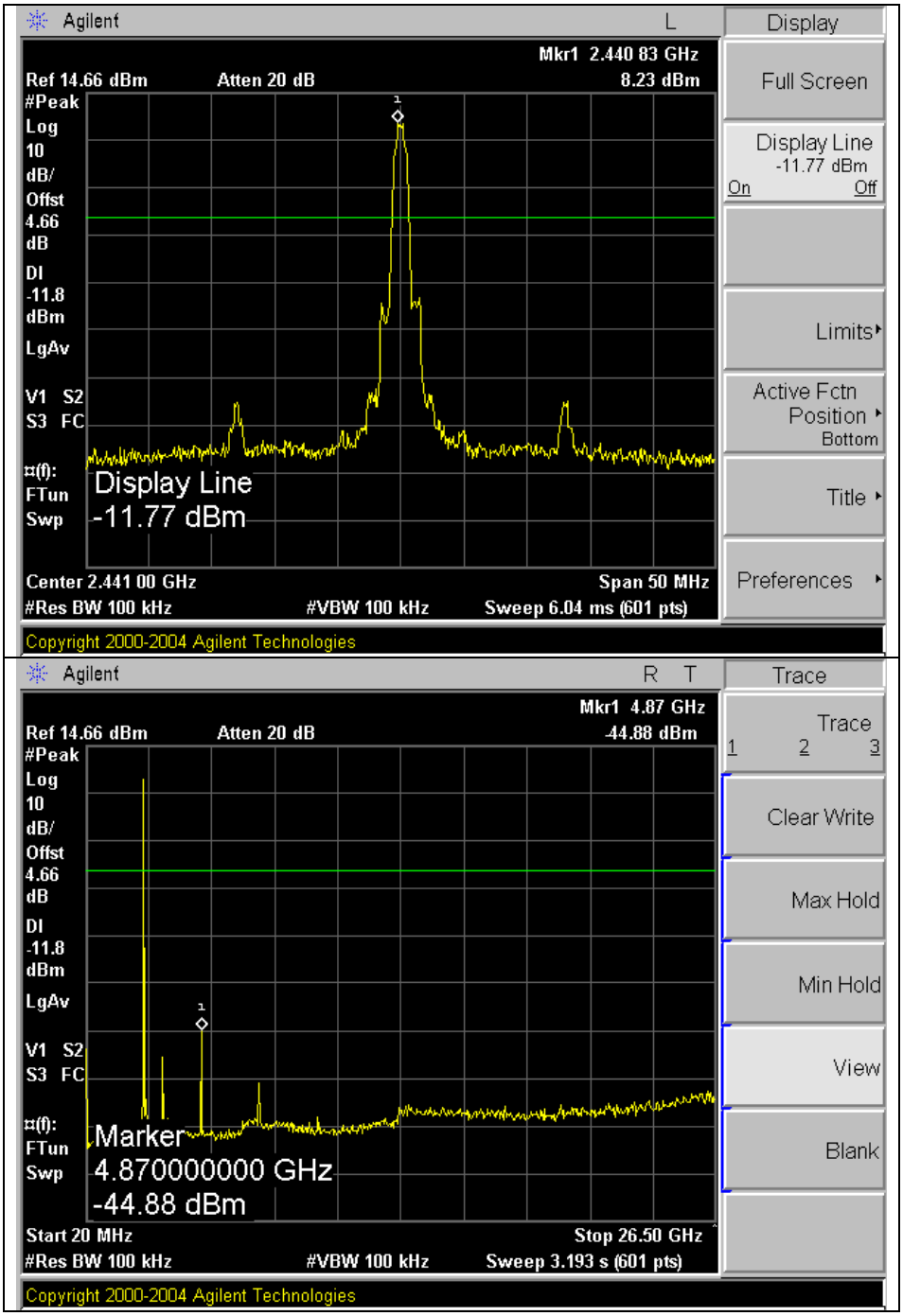
Middle Channel



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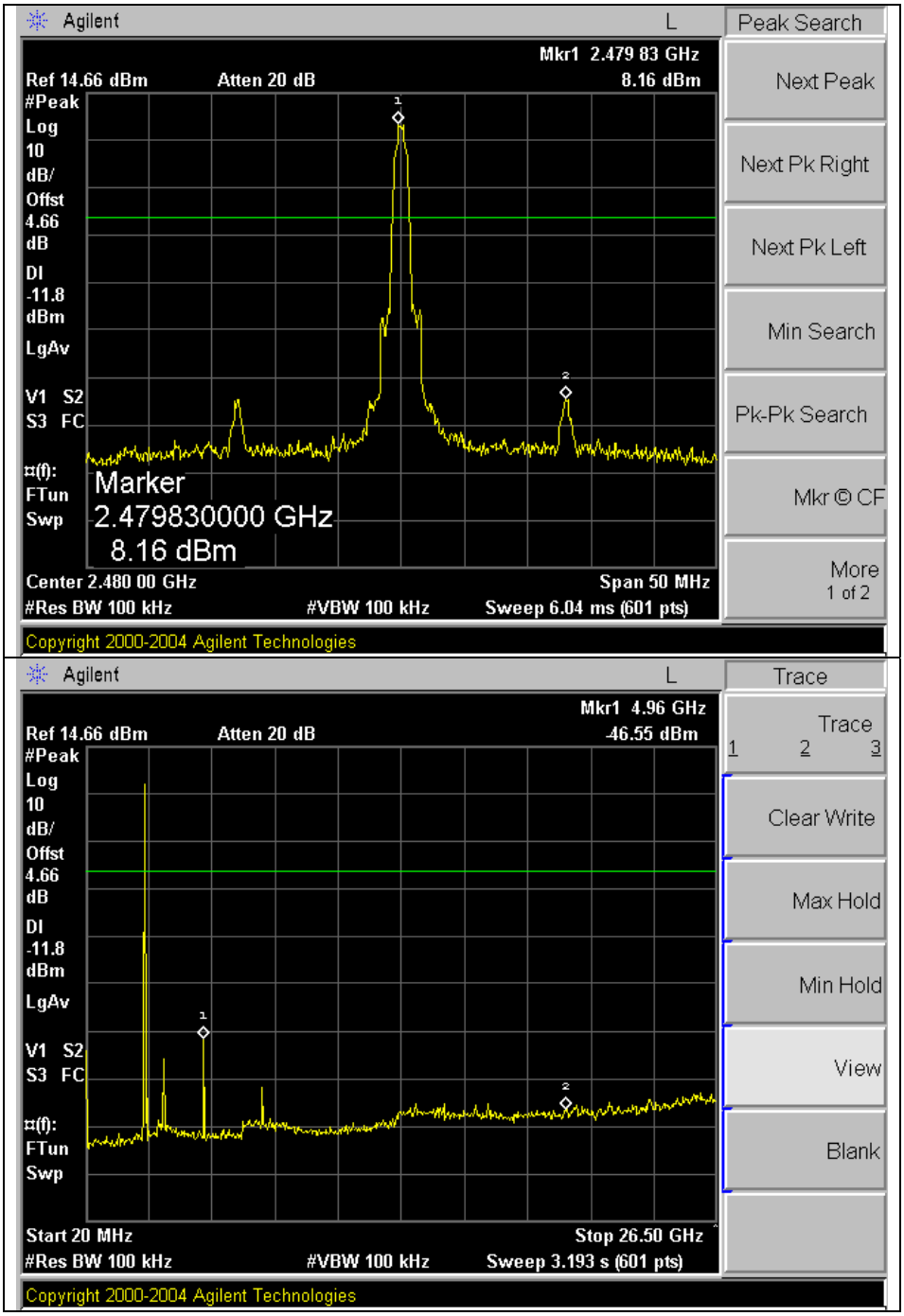
High Channel



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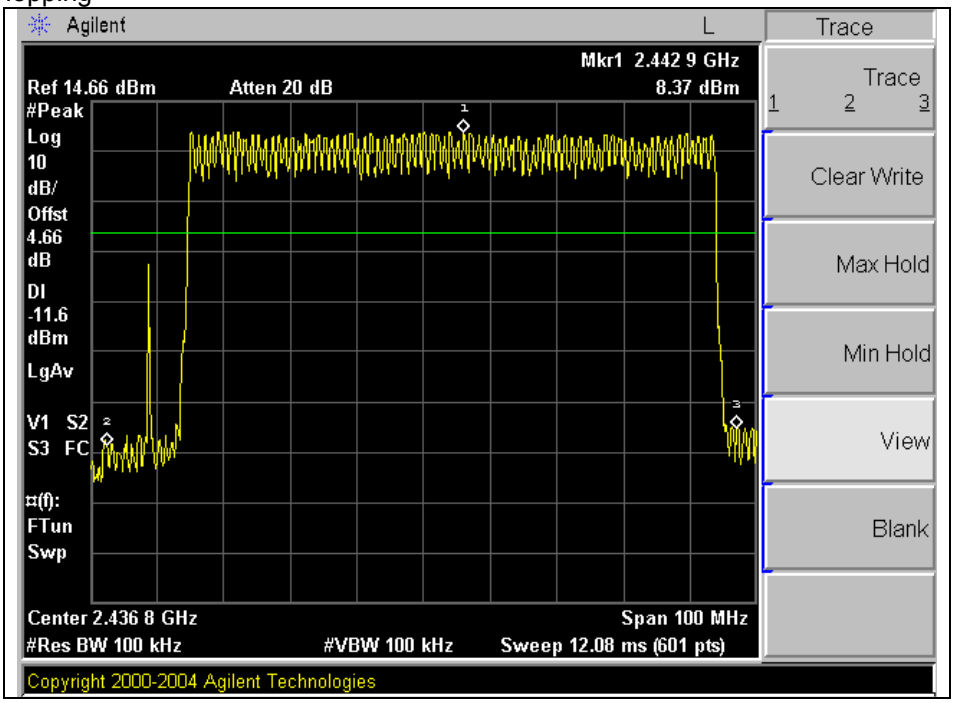
Bandedge at Hopping



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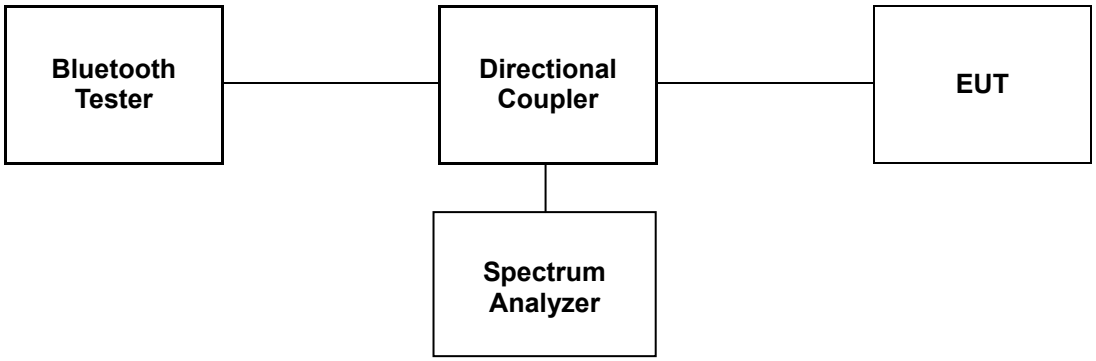
3. 20 dB Bandwidth Measurement

3.1. Test Setup



3.2. Limit

Limit: Not Applicable

3.3. Test Procedure

1. The 20 dB band width was measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20 dB band width of the emission was determined.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 10 ㎑, VBW = 10 ㎑, Span = 5 ㎒.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

3.4. Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

Operation Mode	Channel	Channel Frequency (㎒)	20 dB Bandwidth (㎒)
GFSK	Low	2 402	0.87
	Middle	2 441	0.87
	High	2 480	0.87
8DPSK	Low	2 402	1.22
	Middle	2 441	1.21
	High	2 480	1.21

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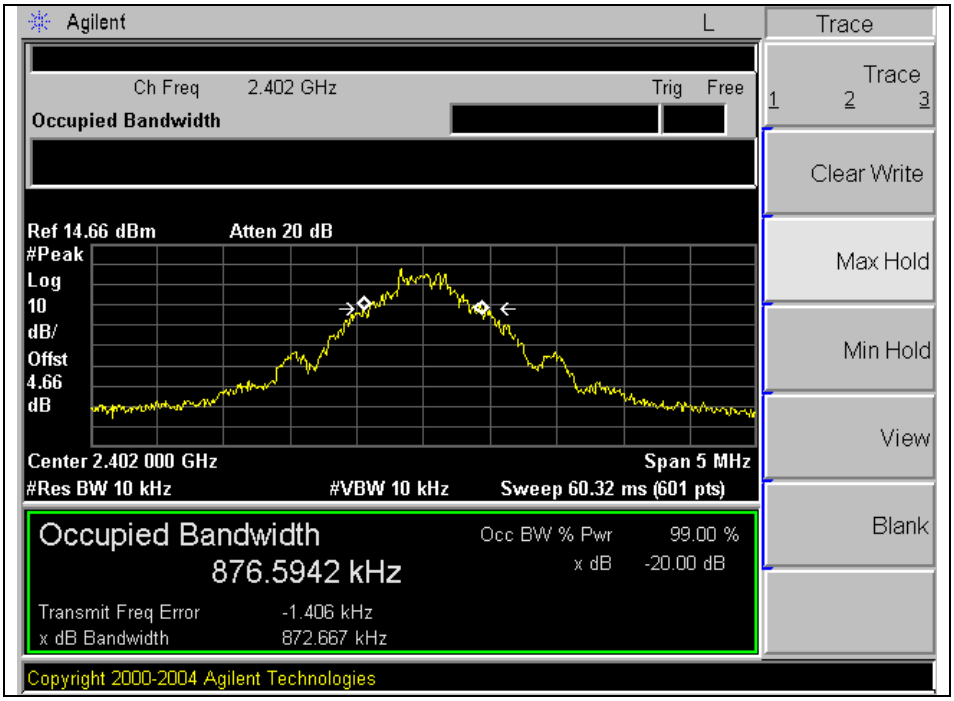
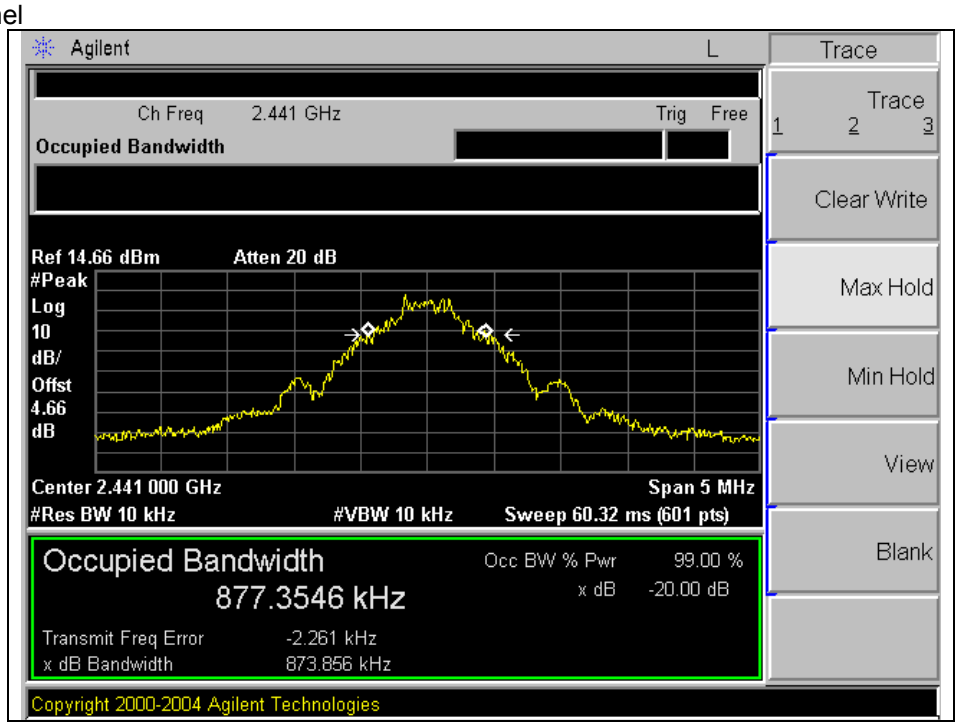
20 dB Bandwidth

Operating Mode: GFSK

Low Channel



Middle Channel



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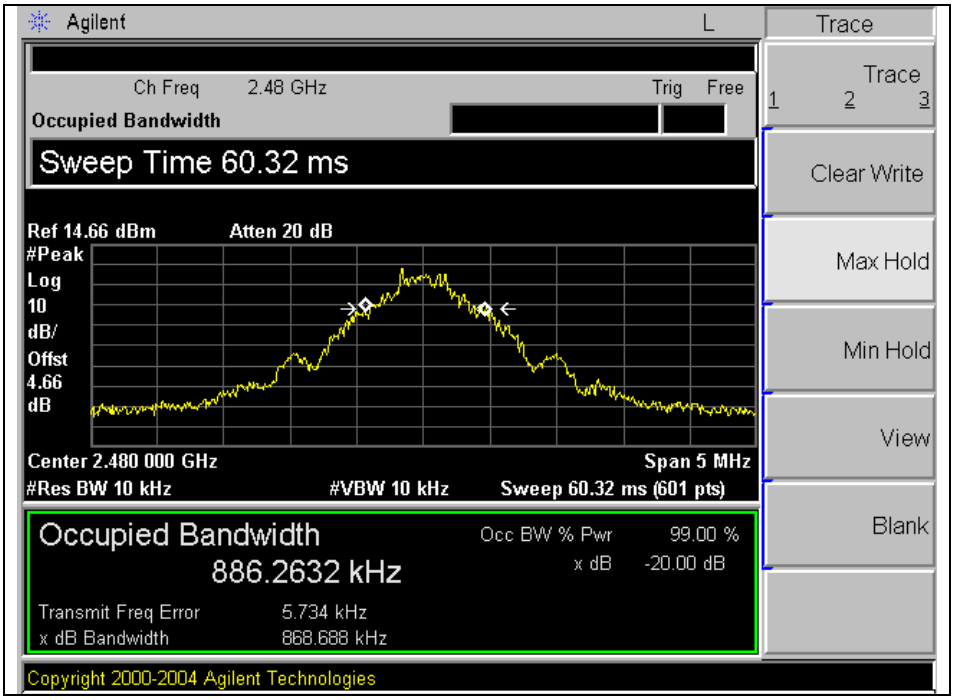
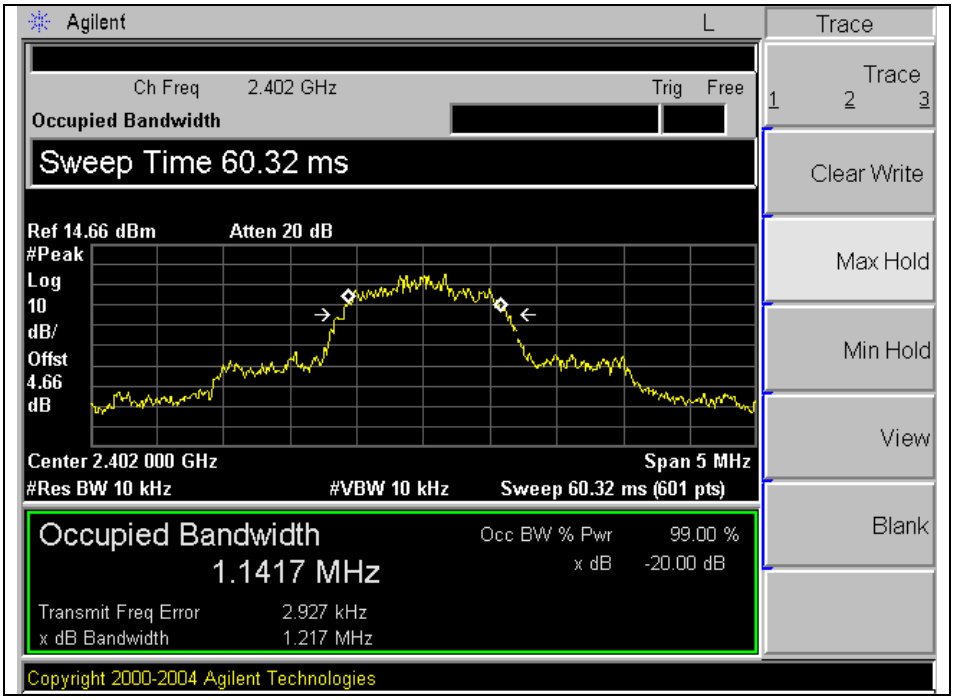
High Channel



Operating Mode: 8DPSK

Low Channel



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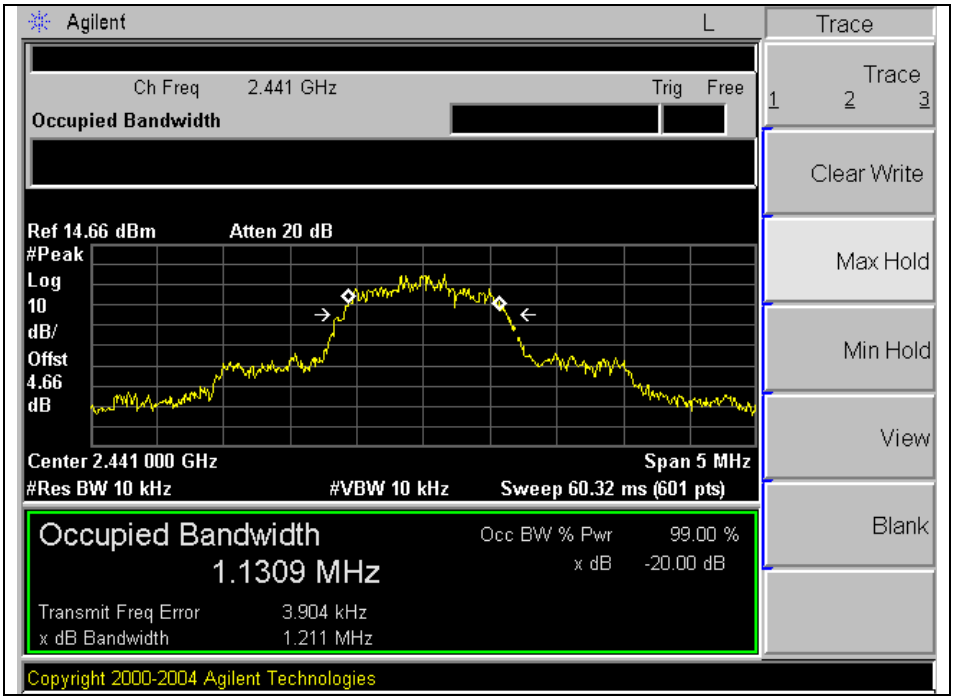
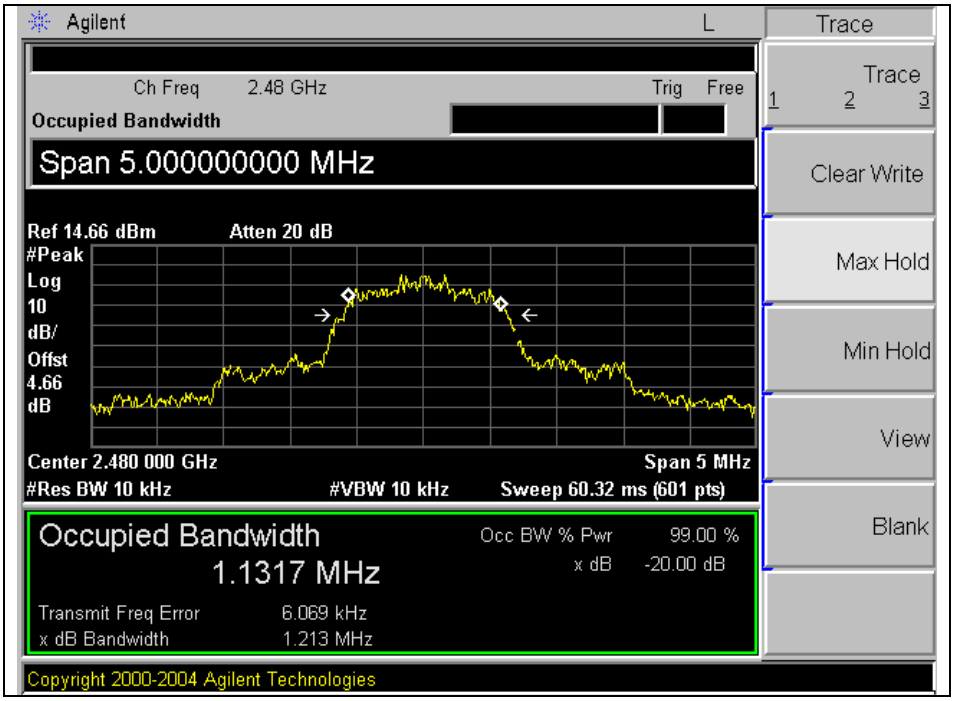
Middle Channel



High Channel



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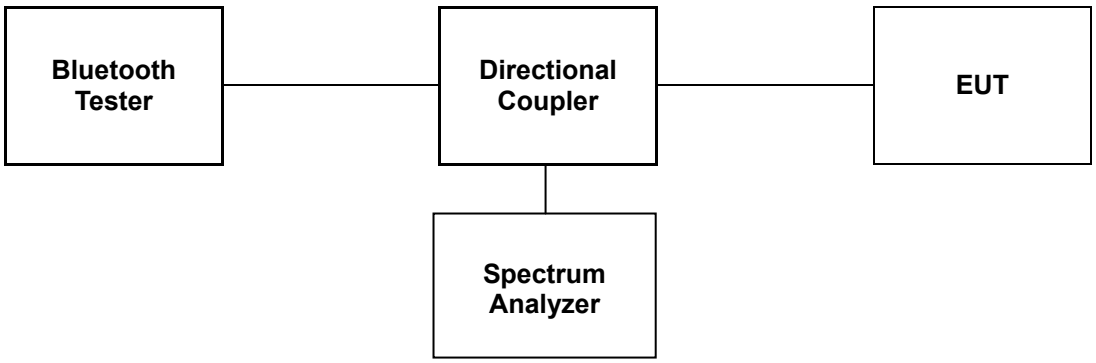
4. Maximum Peak Output Power Measurement

4.1. Test Setup



4.2. 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.

4.3. 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

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4.4. Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

Operation Mode	Channel	Channel Frequency (㎒)	Peak Power Output (dB m)	Peak Power Limit (dB m)
GFSK	Low	2 402	8.61	30.00
	Middle	2 441	8.89	30.00
	High	2 480	8.91	30.00
8DPSK	Low	2 402	9.17	20.97
	Middle	2 441	9.30	20.97
	High	2 480	9.15	20.97

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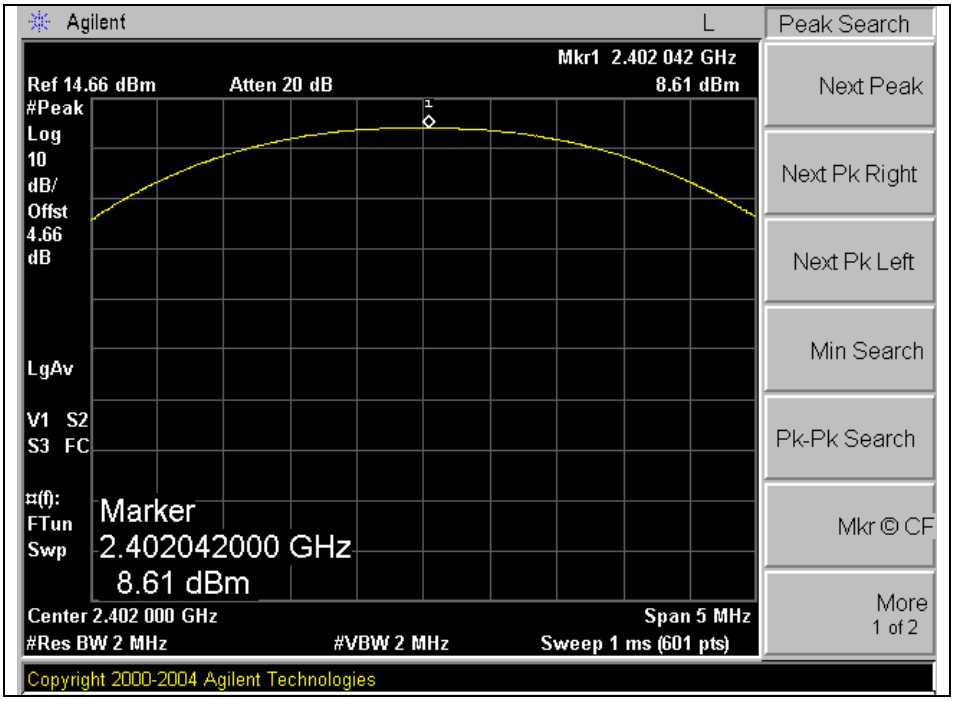
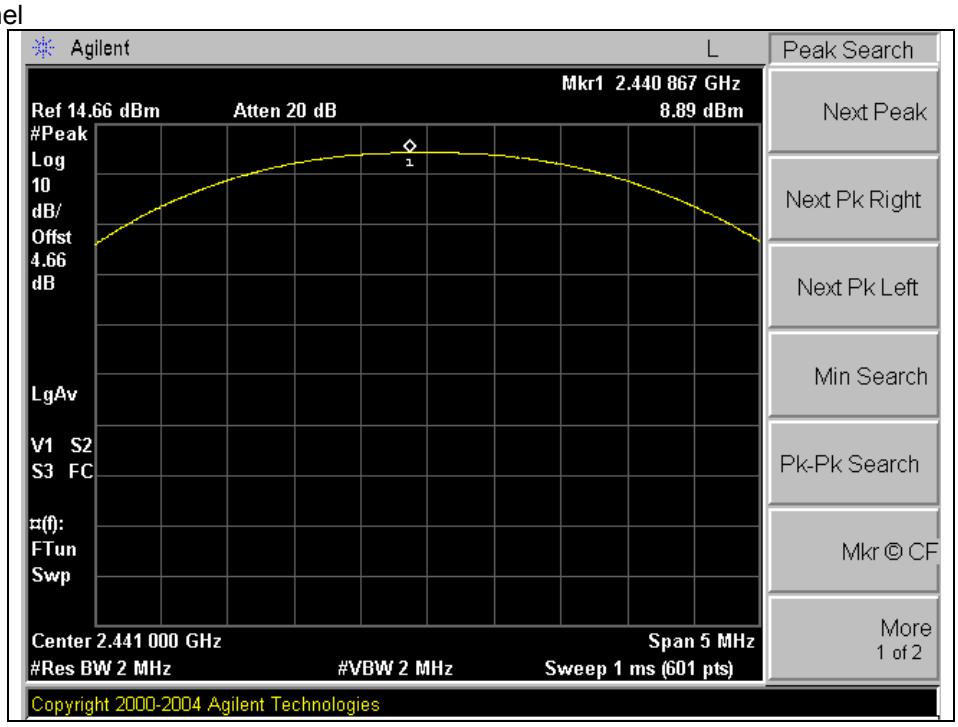
Operating Mode: GFSK

Low Channel



Middle Channel



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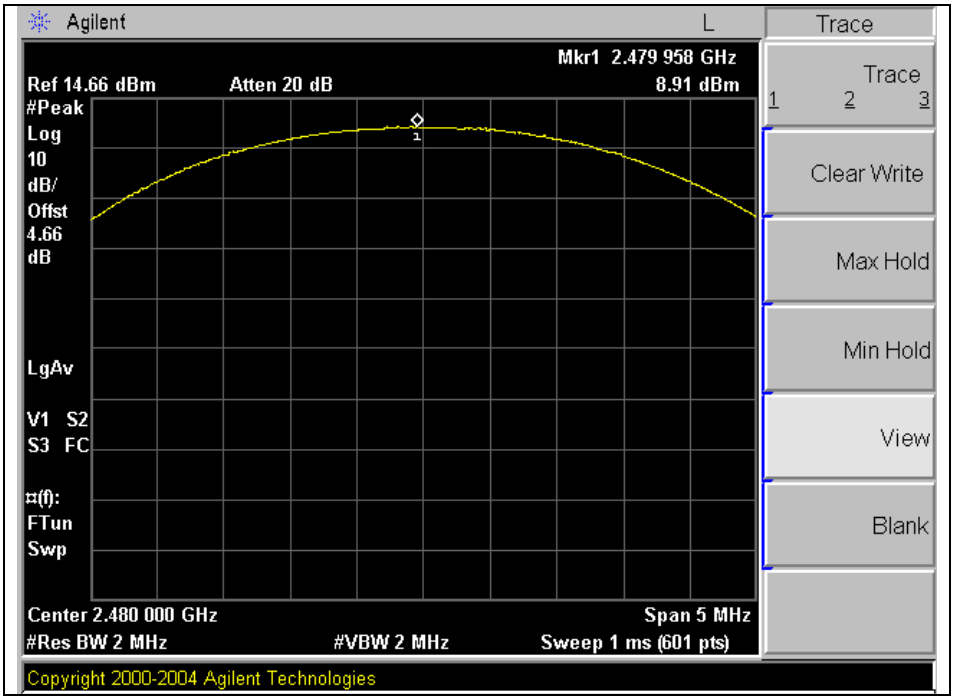
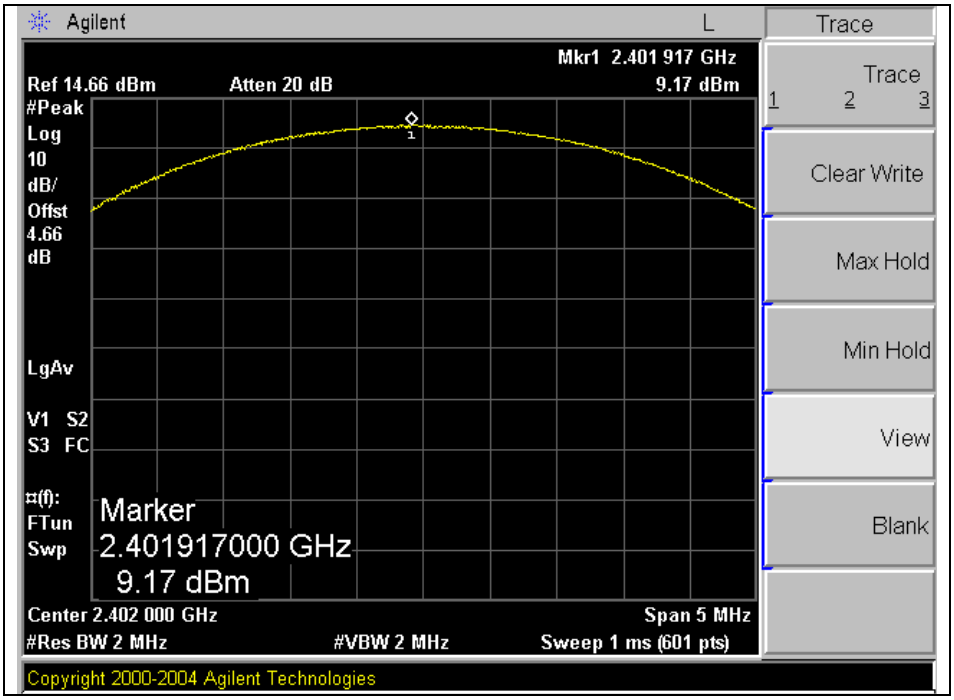
High Channel



Operating Mode : 8DPSK

Low Channel



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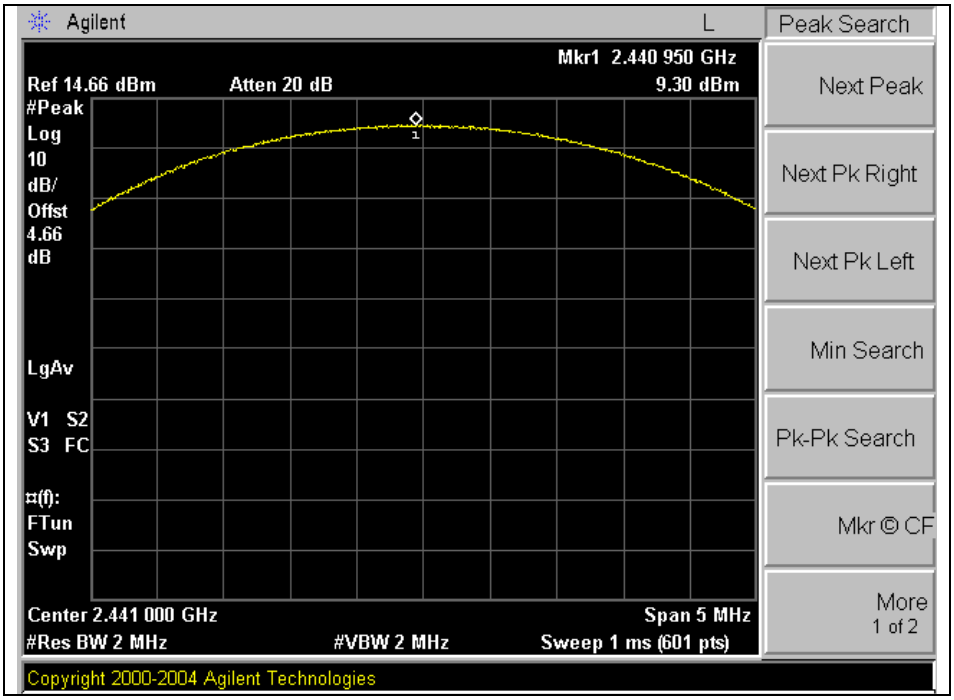
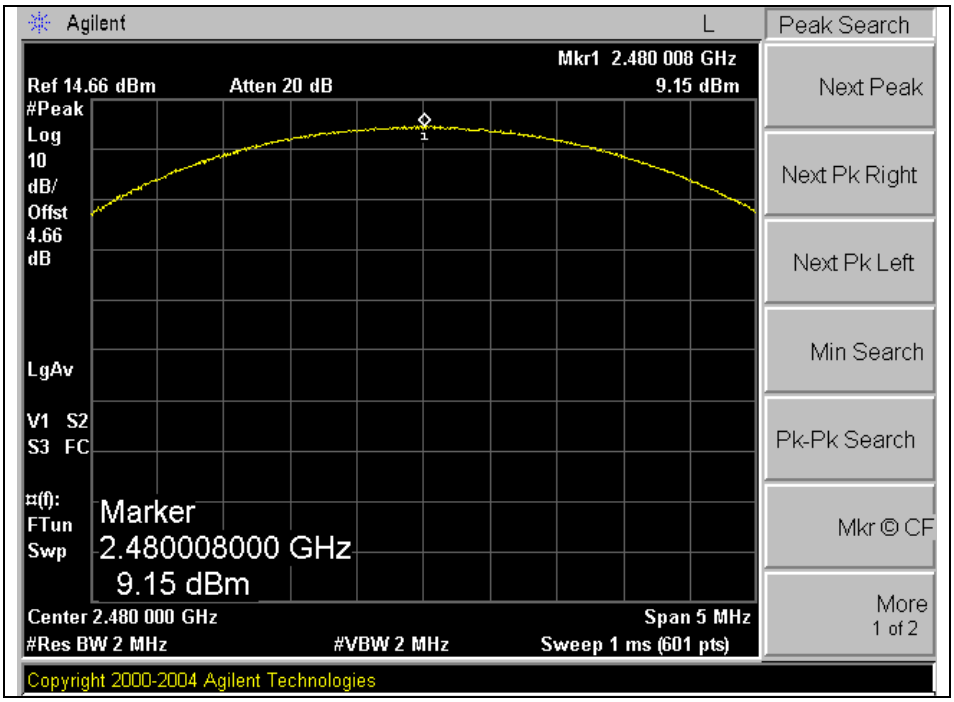
Middle Channel



High Channel



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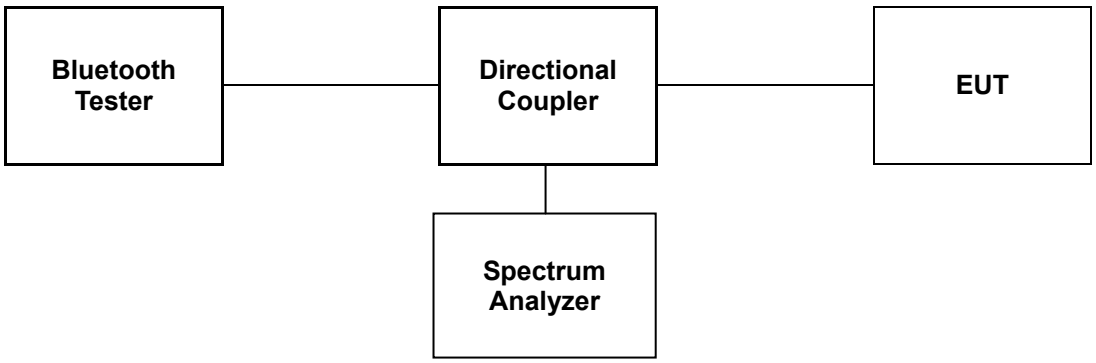
5. Hopping Channel Separation

5.1. Test Setup



5.2. Limit

§15.247(a)(1) Frequency hopping system operating in 2 400 – 2 483.5 ㎒. Band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-third of 20 ㏈ bandwidth of the hopping channel, whichever is is greater, provided the systems operate with an output power no greater than 125 ㎽.

5.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.
6. Set center frequency of spectrum analyzer = middle of hopping channel.
7. Set the spectrum analyzer as RBW = 100 ㎑, VBW = 100 ㎑, Span = 5 ㎒ and Sweep = auto.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

5.4. Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

Operation Mode	Channel (Middle)	Adjacent Hopping Channel Separation (㎑)	Two-third of 20 ㏈ Bandwidth (㎑)	Minimum Bandwidth (㎑)
GFSK	2 441 ㎒	1 000	580	25
8DPSK	2 441 ㎒	1 000	807	25

Note ;
20 ㏈ bandwidth measurement, the measured channel separation should be greater than two-third of 20 ㏈ bandwidth or Minimum bandwidth.

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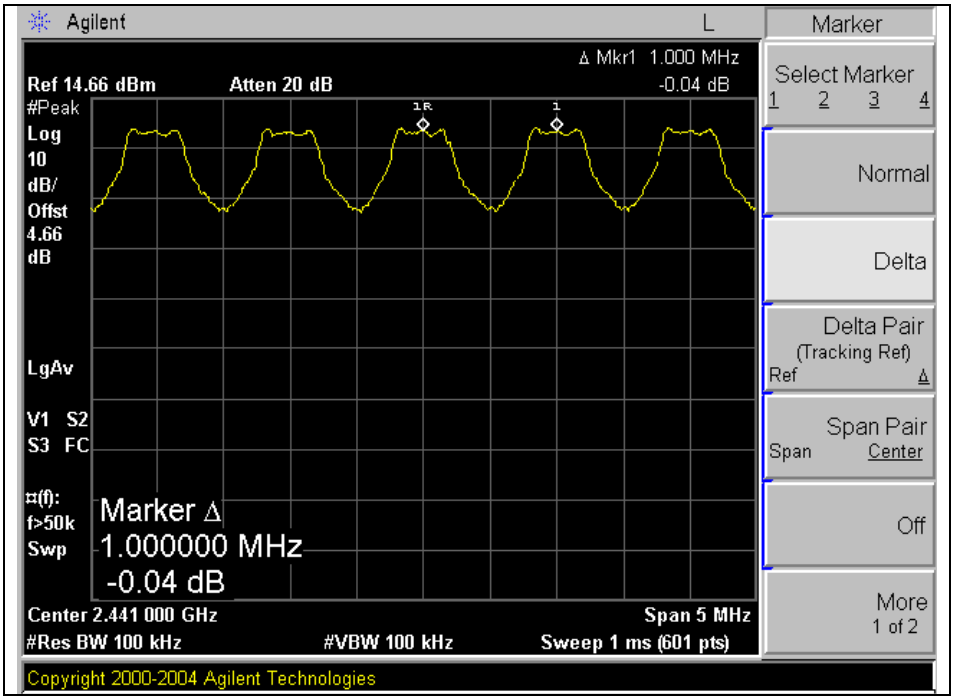
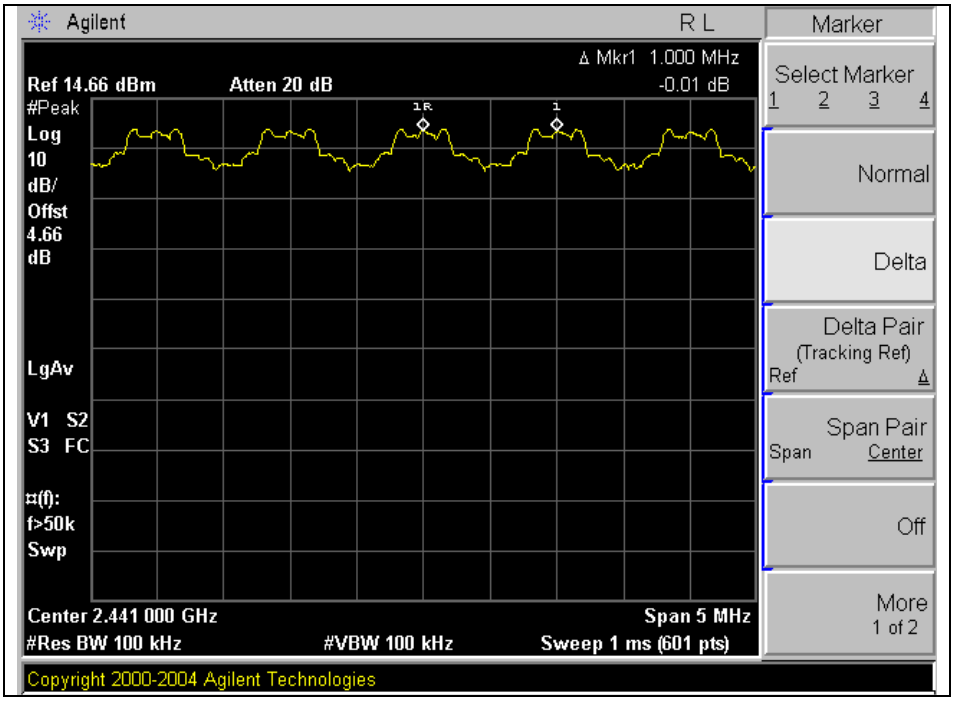
Operating Mode: GFSK



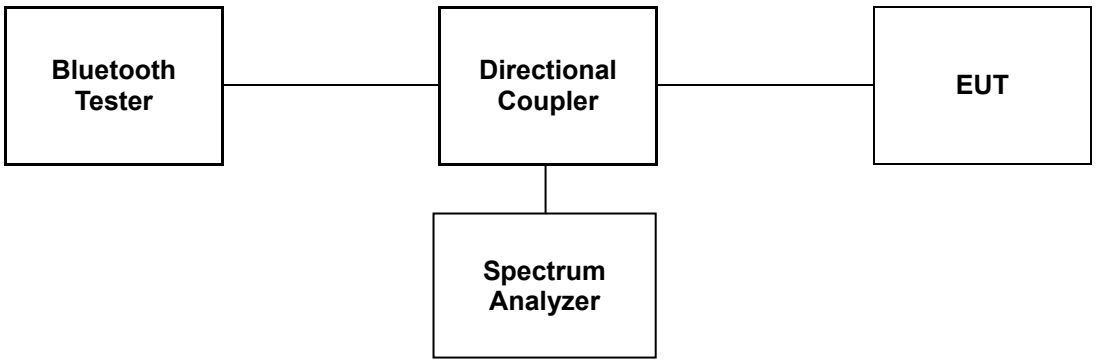
Operating Mode: 8DPSK



The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

6. Number of Hopping Frequency

6.1. Test Setup



6.2. Limit

§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.

6.3. Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna the port to the Spectrum analyzer
3. Set spectrum analyzer Start = 2400 ㎒, Stop = 2 441.5 ㎒, Sweep=auto and Start = 2 441.5 ㎒, Stop = 2483.5 ㎒, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=300 ㎑.
5. Max hold, view and count how many channel in the band.

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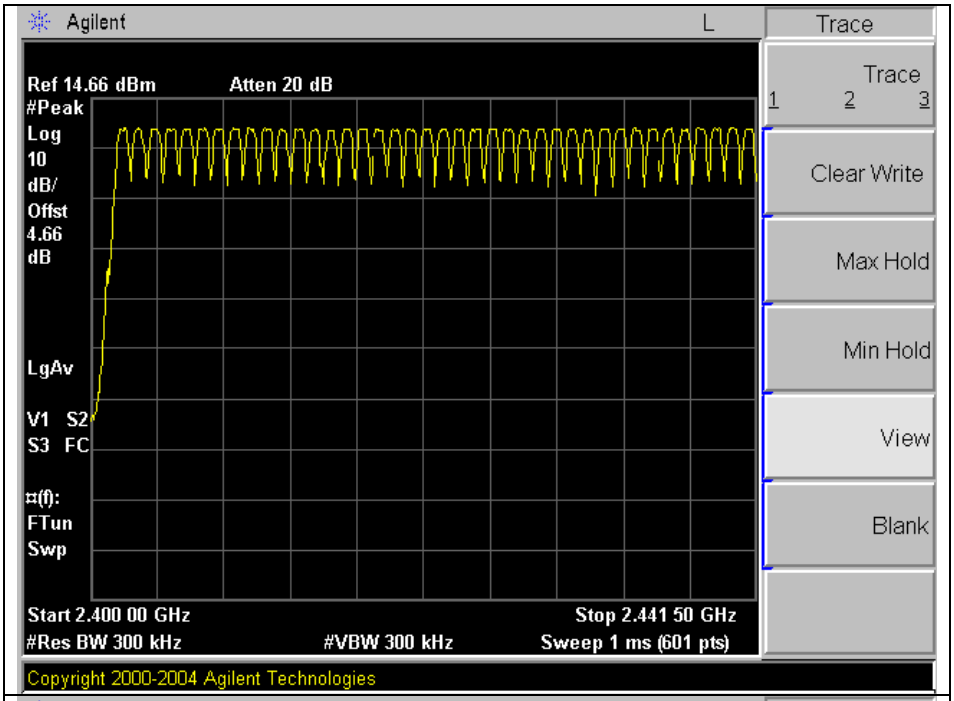
6.4. Test Results

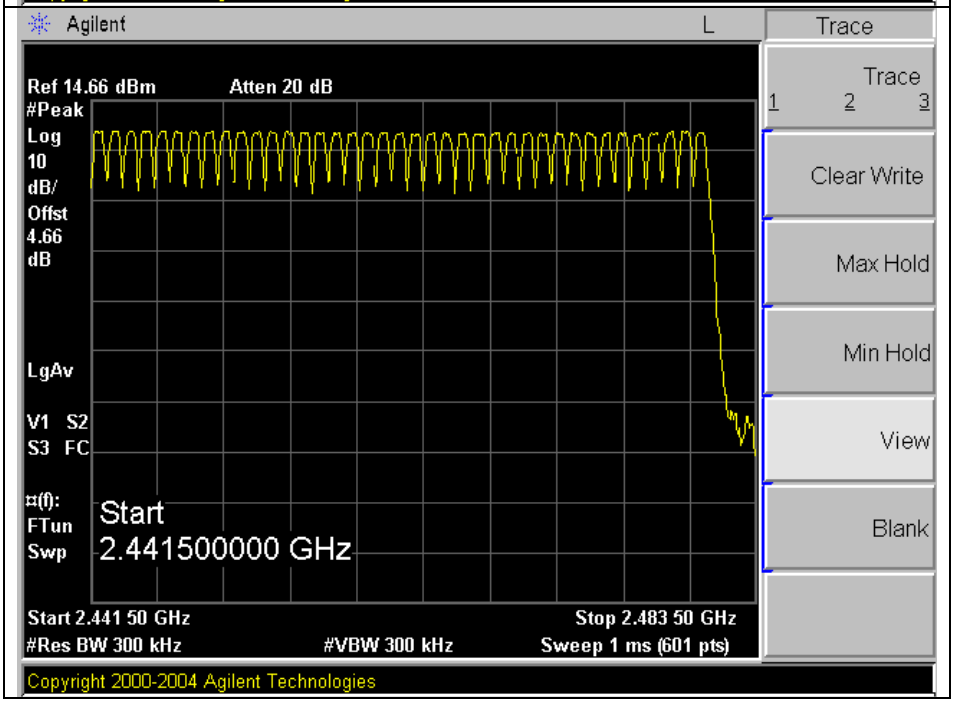
Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

Operation Mode	Number of Hopping Frequency	Limit
GFSK	79	≥ 75
8DPSK	79	≥ 75

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

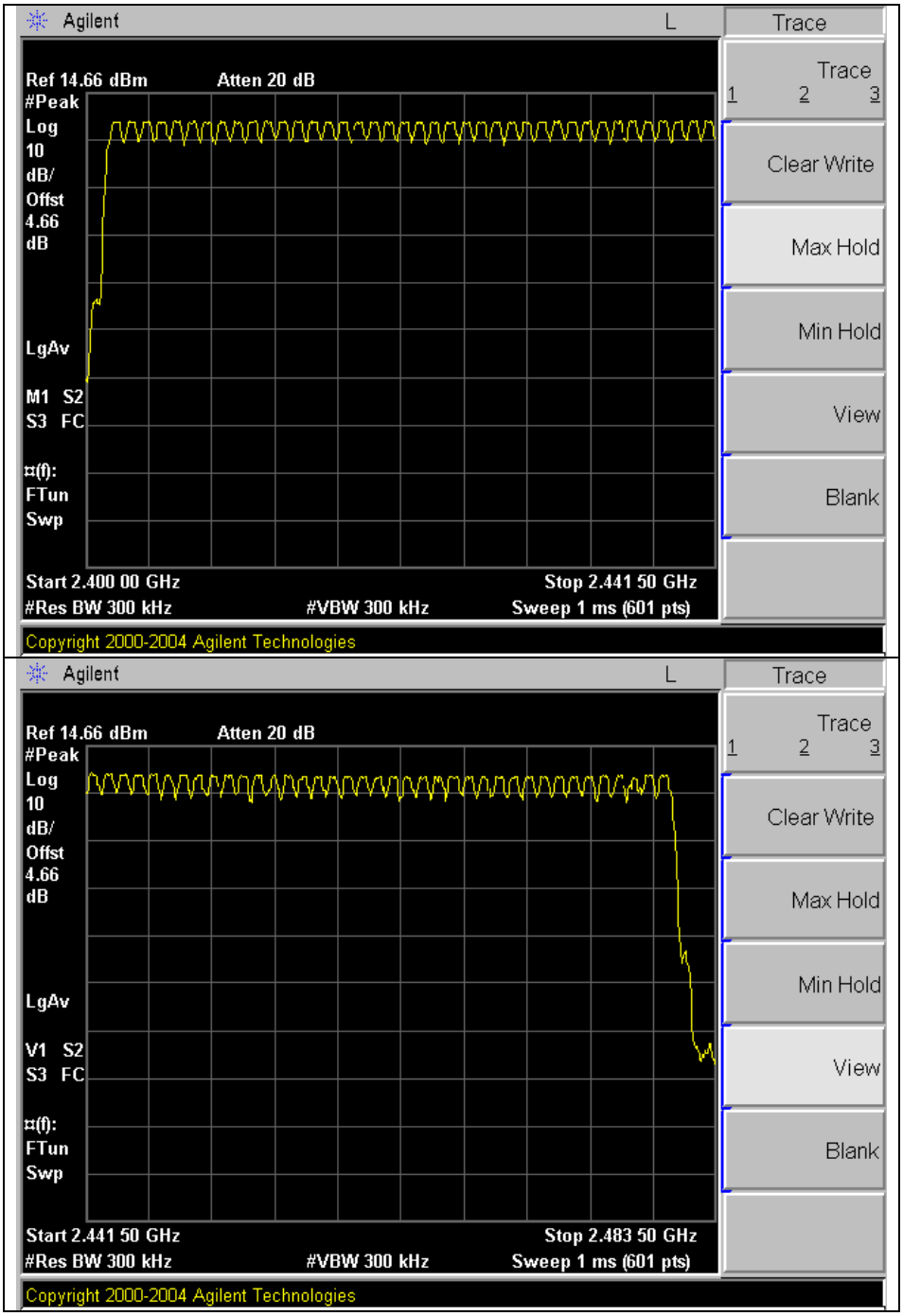
Operating Mode: GFSK





The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

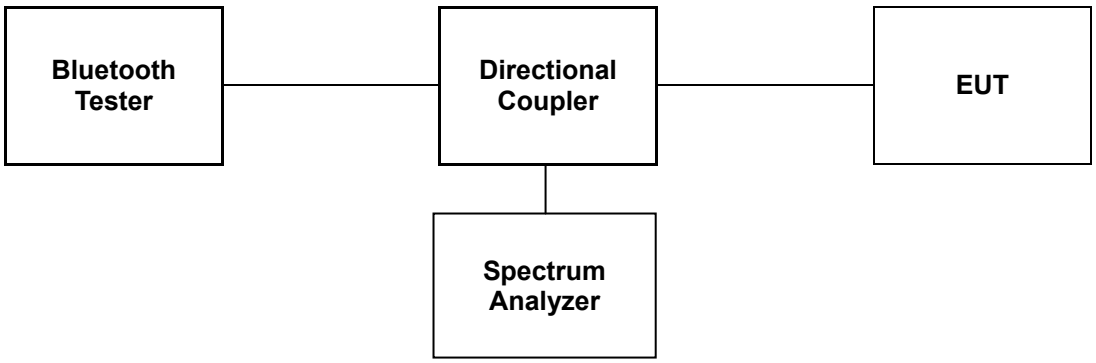
Operating Mode : 8DPSK



The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

7. Time Of Occupancy (Dwell Time)

7.1. Test Set up



7.2. Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2 400 – 2 483.5 ㎒ band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

A period time = 0.4(s) * 79 = 31.6(s)

7.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable.
3. Adjust the center frequency of spectrum analyzer on any frequency be measured and set spectrum analyzer to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.
6. The Bluetooth has 3 type of payload, DH1, DH3, DH5 and 3-DH1, 3-DH3, 3-DH5.The hopping rate is 1 600 per second.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

7.4. Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

Time of occupancy on the TX channel in 31.6sec
= time domain slot length × (hop rate ÷ number of hop per channel) × 31.6

7.4.1. Packet Type: DH1, 3-DH1

Operation Mode	Frequency	Dwell Time (㎳)	Time of occupancy on the Tx Channel in 31.6 sec (㎳)	Limit for time of occupancy on the Tx Channel in 31.6 sec (㎳)
GFSK	2 441 ㎒	0.38	121.6	400
8DPSK	2 441 ㎒	0.38	121.6	400

2 441 ㎒ : 0.38 (㎳) × [(1 600 ÷ 2) ÷79] ×31.6(s) = 121.6 (㎳)

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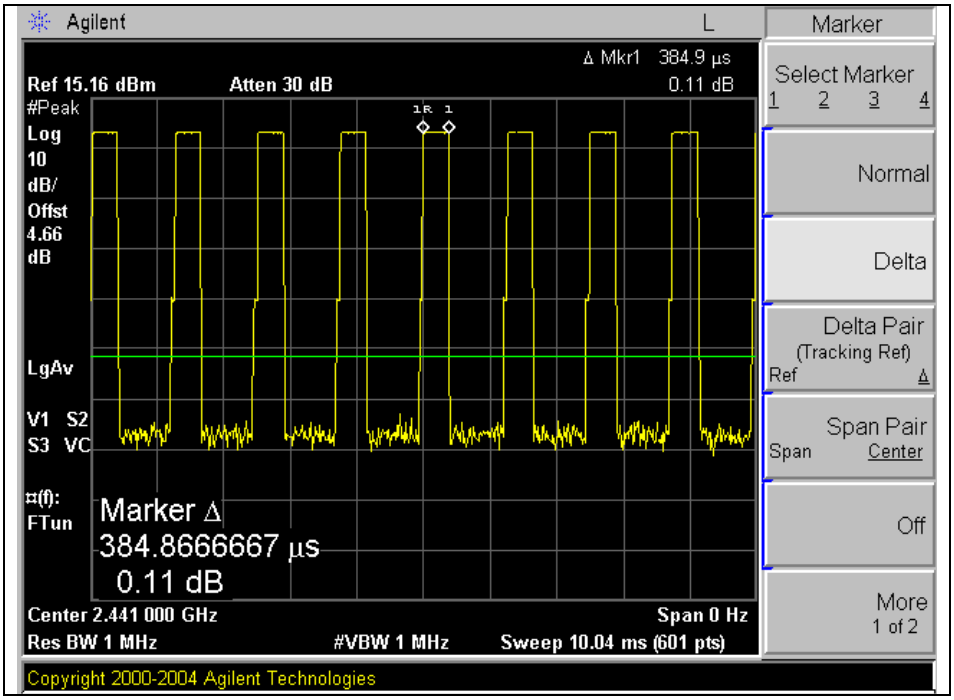
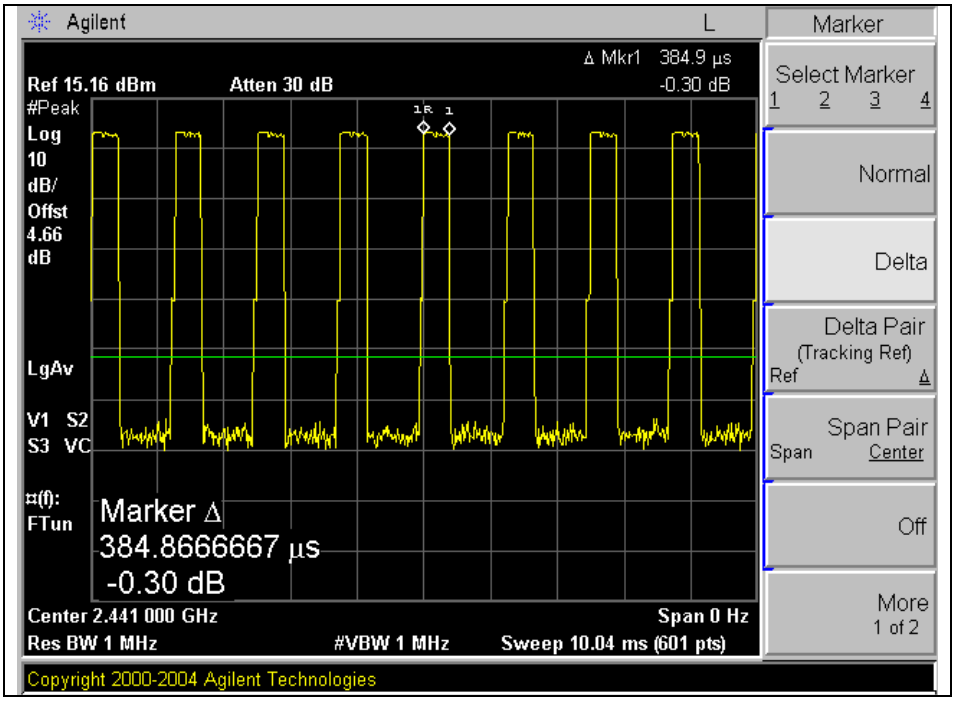
Operating Mode: GFSK



Operating Mode: 8DPSK



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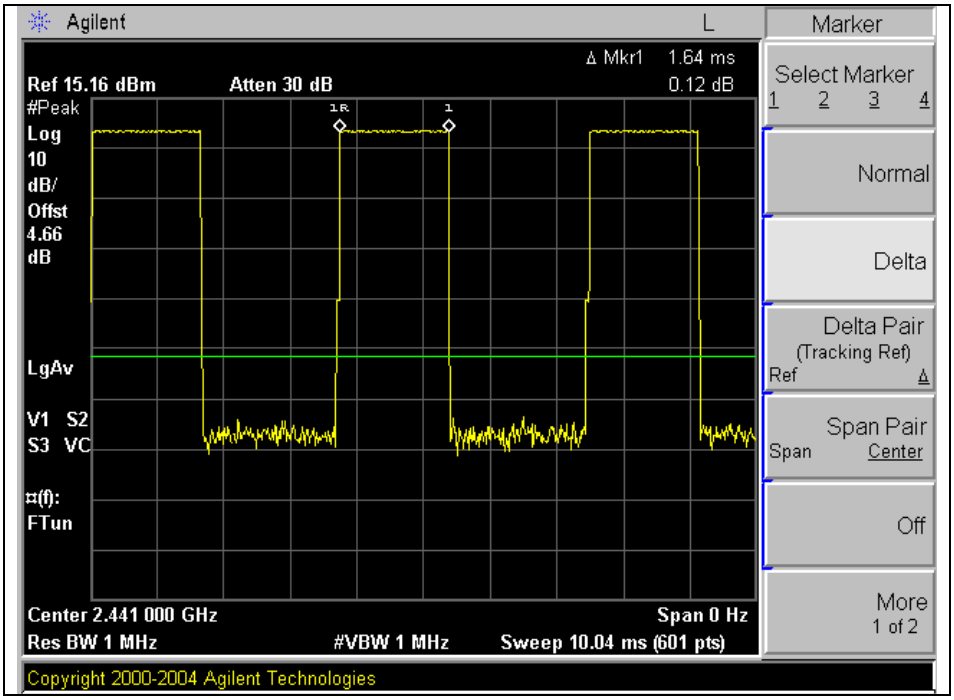
7.4.2. Packet Type: DH3, 3-DH3

Operation Mode	Frequency	Dwell Time (㎳)	Time of occupancy on the Tx Channel in 31.6 sec (㎳)	Limit for time of occupancy on the Tx Channel in 31.6 sec (㎳)
GFSK	2 441 ㎒	1.64	262.4	400
8DPSK	2 441 ㎒	1.64	262.4	400

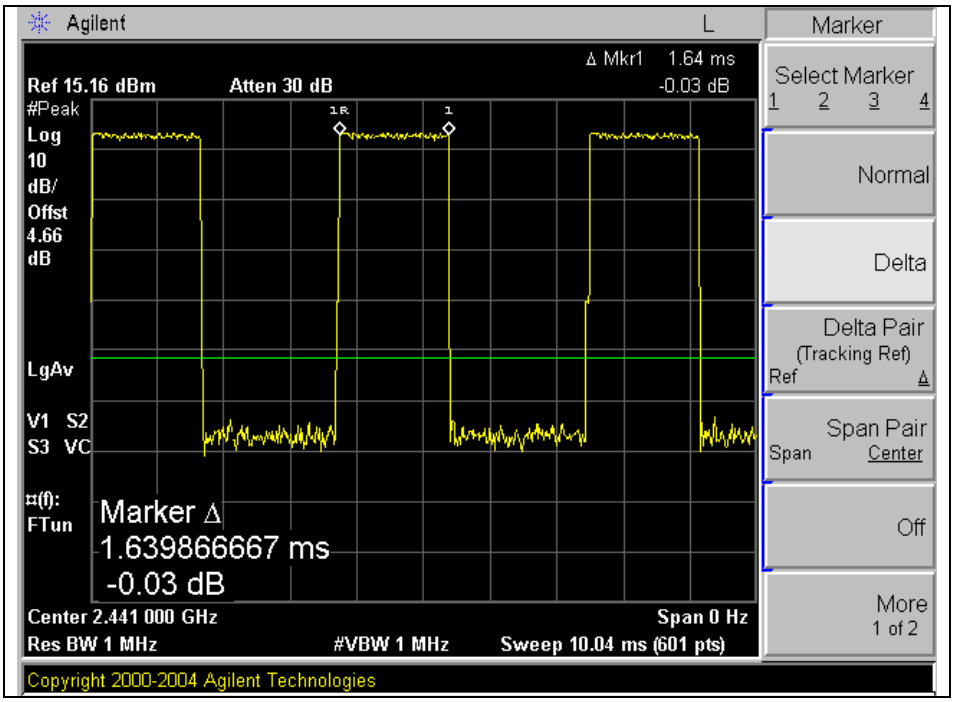
2 441 ㎒ : 1.64 (㎳) × [(1 600 ÷ 4) ÷ 79] ×31.6(s) = 262.4 (㎳)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

Operating Mode: GFSK



Operating Mode: 8DPSK



The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

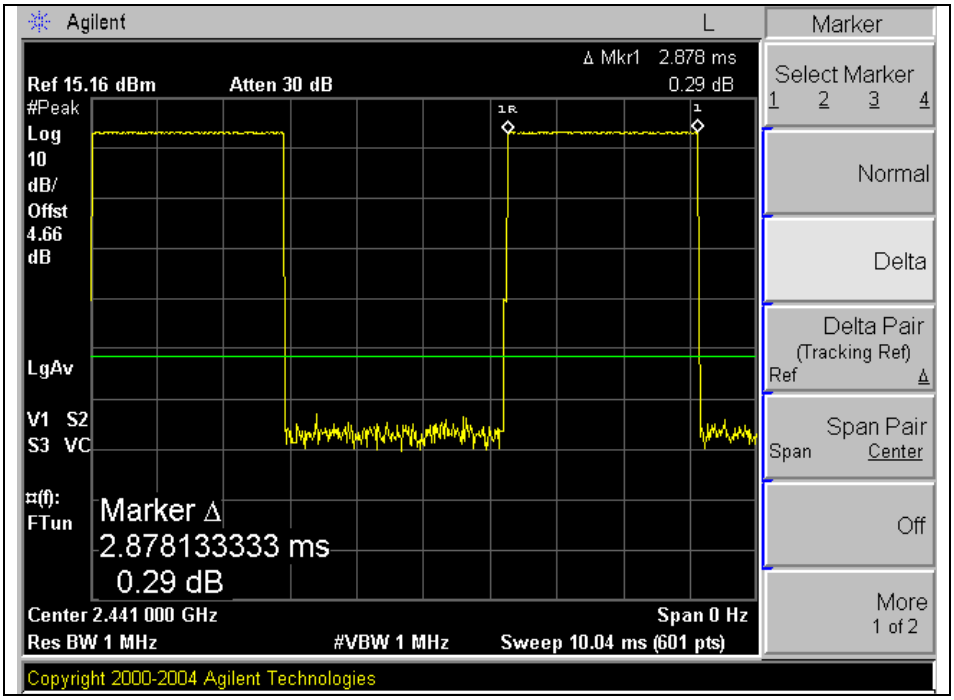
7.4.3. Packet Type: DH5, 3-DH5

Operation Mode	Frequency	Dwell Time (㎳)	Time of occupancy on the Tx Channel in 31.6 sec (㎳)	Limit for time of occupancy on the Tx Channel in 31.6 sec (㎳)
GFSK	2 441 ㎒	2.88	307.2	400
8DPSK	2 441 ㎒	2.89	308.3	400

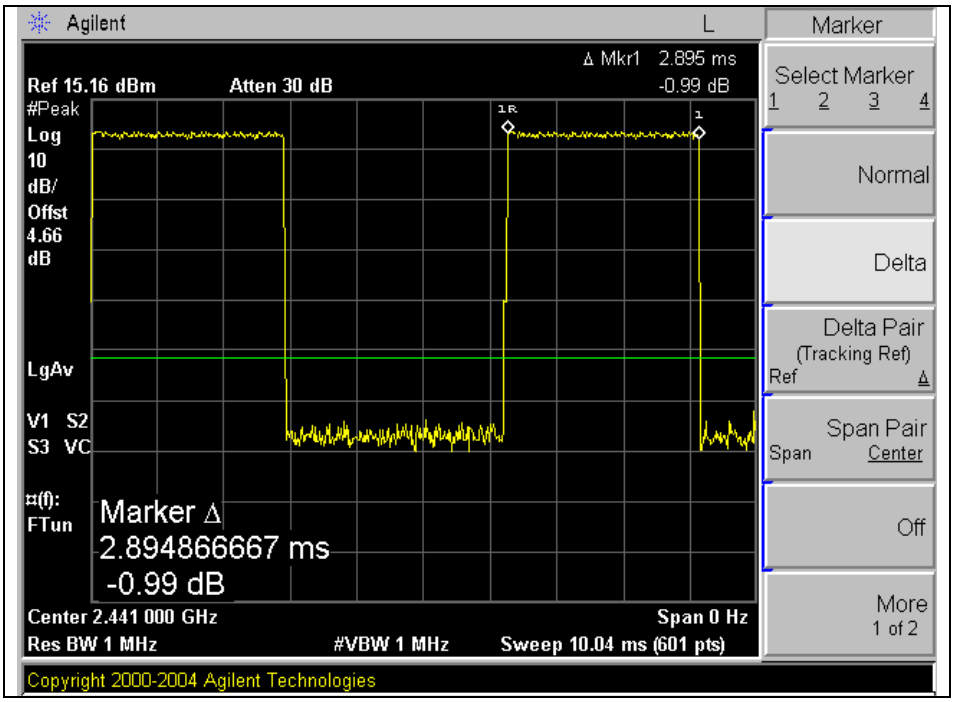
2 441 ㎒ : 2.88 (㎳) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 307.2 (㎳)
: 2.89 (㎳) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 308.3 (㎳)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

Operating Mode: GFSK



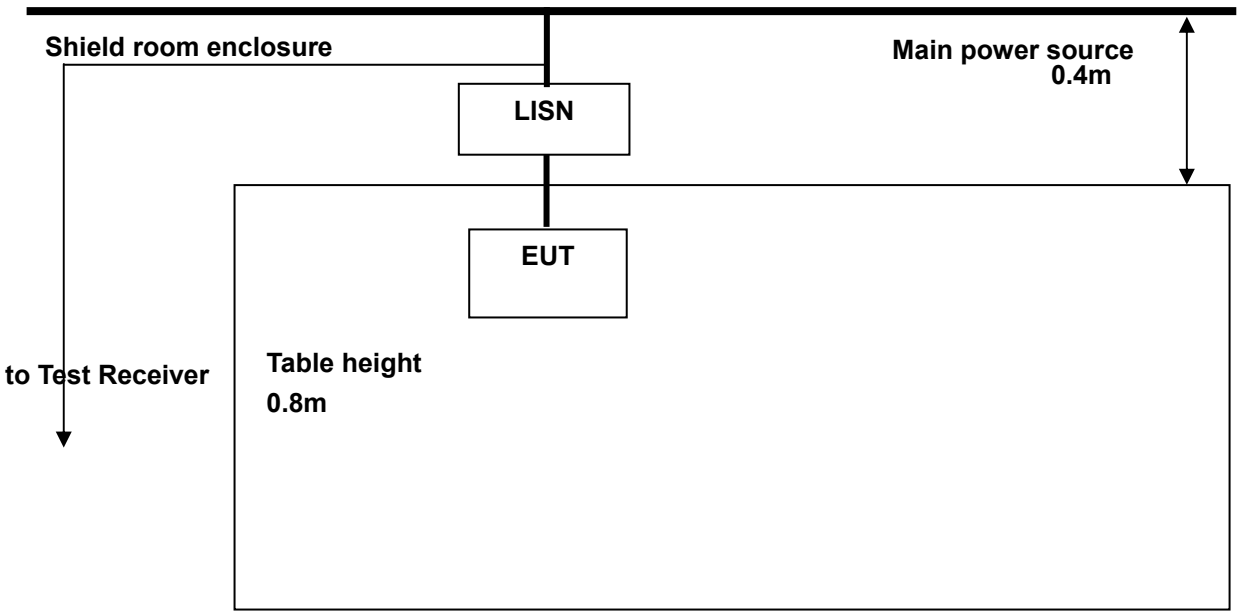
Operating Mode: 8DPSK



The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

8. Transmitter AC Power Line Conducted Emission

8.1. Test Setup



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 μH/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 of Emission (㎒)	Conducted limit (㏈μV)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

8.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5m × 3.6m × 3.6m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0m(W)× 1.5m(L) and 0.8m 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.

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8.4. Test Results (Worst case configuration_GFSK)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.
Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

FREQ. (㎒)	LEVEL(dB㎶)		LINE	LIMIT(dB㎶)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	47.3	34.2	H	66.00	56.00	18.7	21.8
0.39	37.8	28.9	H	58.17	48.17	20.4	19.3
0.87	33.6	25.2	H	56.00	46.00	22.4	20.8
19.46	23.4	15.3	H	60.00	50.00	36.6	34.7
0.15	44.7	31.3	N	66.00	56.00	21.3	24.7
0.38	38.3	29.6	N	58.28	48.28	20.0	18.7
0.43	37.2	28.8	N	57.25	47.25	20.1	18.5
1.08	33.5	25.5	N	56.00	46.00	22.5	20.5

Note ;
Line (H) : Hot
Line (N) : Neutral

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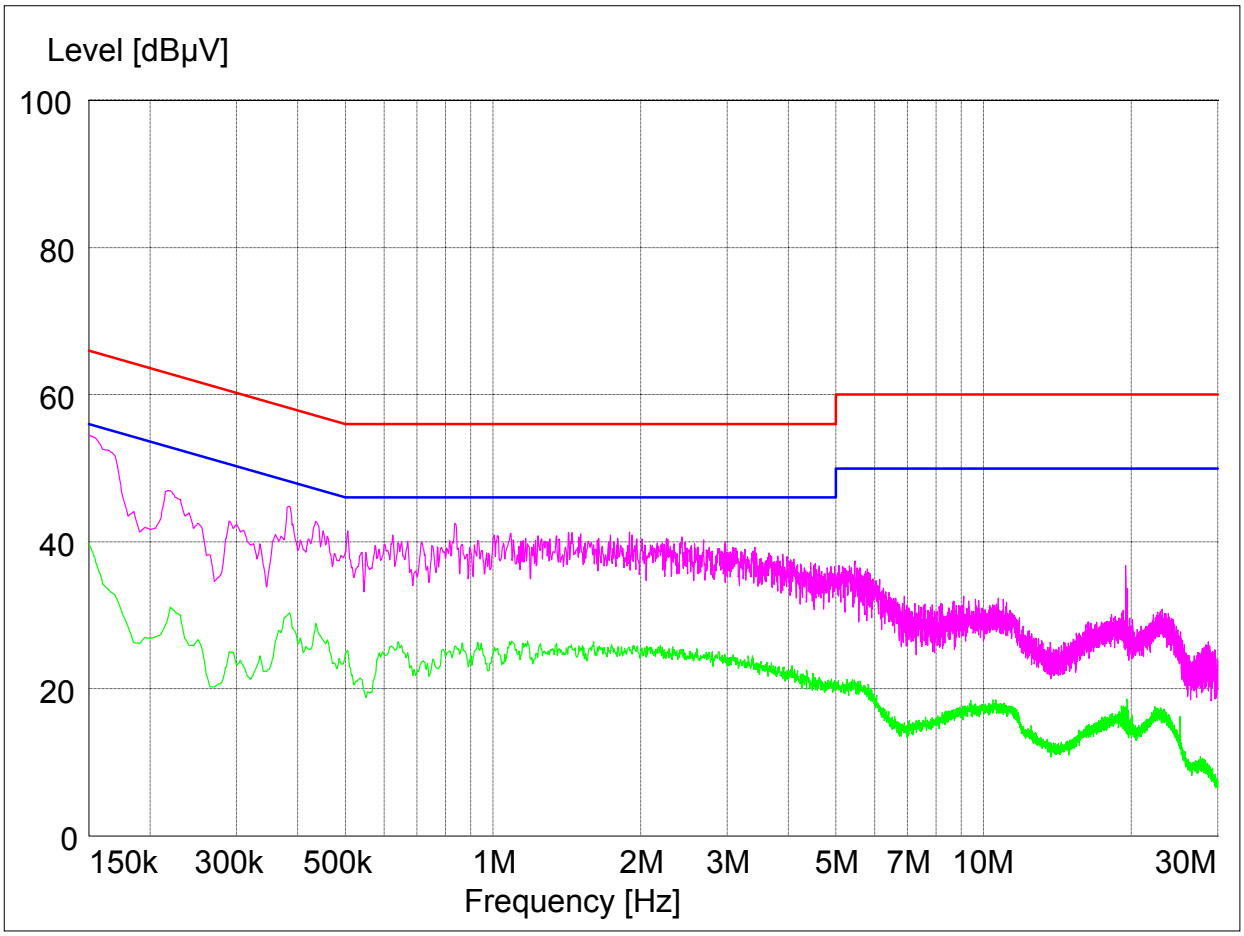
Plot of Conducted Power line

Test mode : (Hot)



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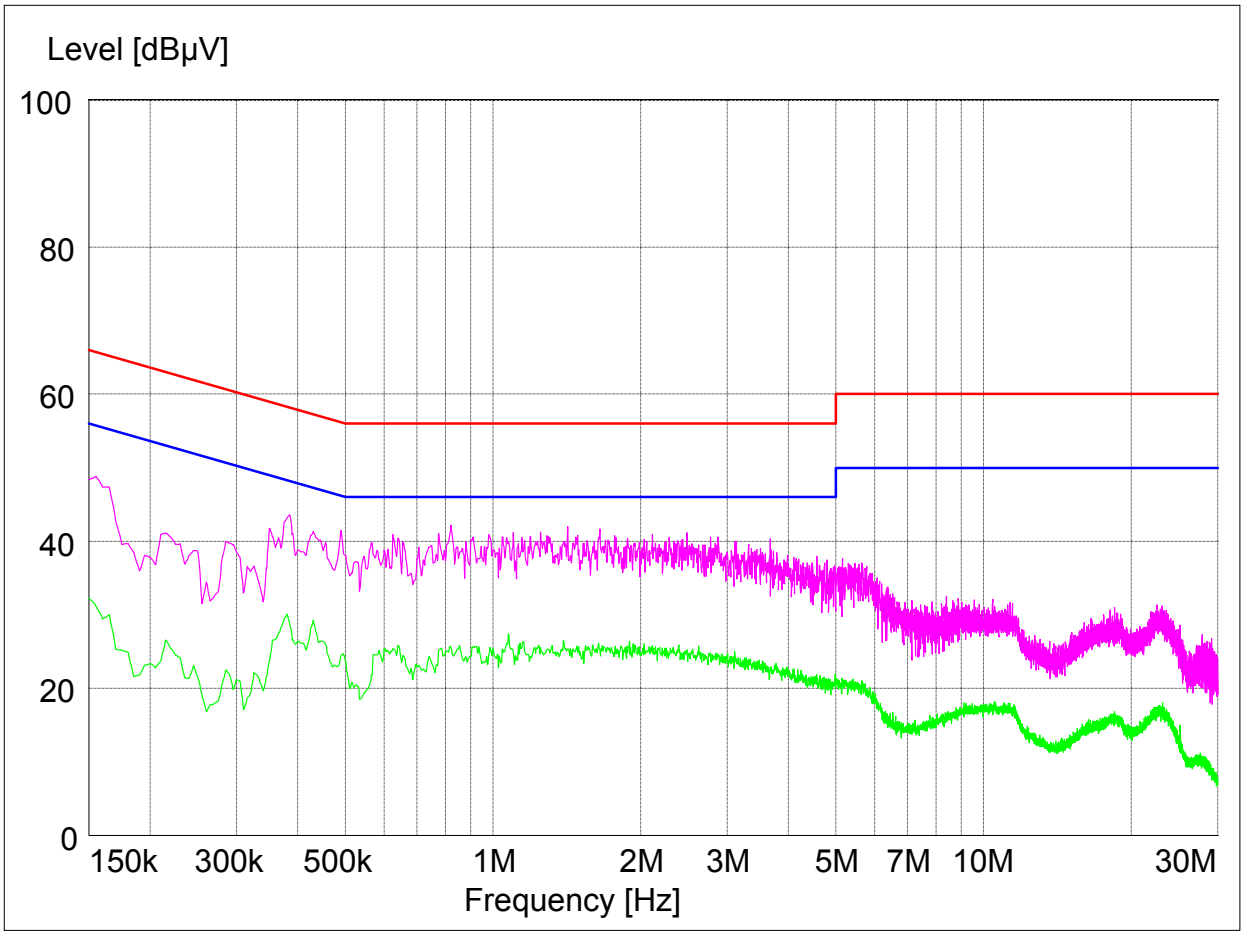
Test mode : (Neutral)



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9. Antenna Requirement

9.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, 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. And according to FCC 47 CFR Section §15.247 (b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

9.2. Antenna Connected Construction

Antenna used in this product is Integral type (Chip Antenna) gain of -1.89 dBi.

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