FCC - TEST REPORT

Report Number	:	**68.950.13.016.01**	Date of Issue:	25 Mar, 2013

Model	:	BT-400
Product Type	:	Bluetooth Headset
Applicant	:	Fujikon Industrial Co., Ltd.
Address	:	16/F Tower 1, Grand Central Plaza 138 Shatin Rural Committee Road, Shatin N.T. Hong Kong
Production Facility	:	Charter Media (Dongguan) Co., Ltd.
Address	:	Dabandi Industrial Zone, Daning District, Humen Town 523930 Dongguan City, Guangdong Province PEOPLE'S REPUBLIC OF CHINA

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	57

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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name:	Jiangsu TÜV Product Service Ltd. – Shenzhen Branch 6th Floor, H Hall, Culture Creative Park, No. 4001, Fuqiang Road, Futian District 518048, Shenzhen,P.R.C.
Telephone:	86 755 8828 6998
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Test Site 2

Company name:	Audix Technology (Shenzhen) Co., Ltd Block Shenzhen, Science & Industry Park, Nantou, Shenzhen, Guangdong, China
Telephone:	86 755 2663 9496
Fax:	86 755 2663 2877

3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product:	Bluetooth headset
Model no.:	BT-400
FCC ID:	TTC-BT-400
Brand Name:	
Options and accessories:	NIL
Rating:	3.7VDC (Supplied by Li-ion rechargeable battery) 5VDC (Charged by PC USB Port)
RF Transmission Frequency:	2402-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8-DPSK
Duty Cycle:	36.69%
Antenna Type:	Ceramic antenna
Antenna Gain:	0dBi
Description of the EUT:	The Equipment Under Test (EUT) is a wireless headset with Bluetooth function operating at 2.4GHz

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
NoteBook	Lenovo	X220	---

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2012 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

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5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C					
Test Condition	Pages	Test Site	Test Result		
			Pass	Fail	N/A
§15.207 Conducted emission AC power port	10	Site 2	☒	☐	☐
§15.247 (b) (1) Conducted peak output power	13	Site 2	☒	☐	☐
§15.247(d) Band edge compliance of RF emissions	14	Site 2	☒	☐	☐
§15.247(d) Spurious RF conducted emissions	23	Site 2	☒	☐	☐
§15.247(d) & §15.209 Spurious radiated emissions for transmitter	33	Site 2	☒	☐	☐
§15.247(a)(2) 6dB bandwidth*	---	---	☐	☐	☒
§15.247(e) & Power spectral density*	---	---	☐	☐	☒
§15.247(a)(1) 20dB bandwidth	37	Site 2	☒	☐	☐
§15.247(a)(1) Carrier frequency separation	43	Site 2	☒	☐	☐
§15.247(a)(1)(iii) Number of hopping frequencies	45	Site 2	☒	☐	☐
§15.247(a)(1)(iii) Dwell Time	47	Site 2	☒	☐	☐
§15.203 Antenna requirement	See note 1		☒	☐	☐

Remark: N/A – Not Applicable.
Note 1: The EUT uses a permanent ceramic antenna, which gain is 0dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: TTC-BT-400 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date: 14 Jan, 2013

Testing Start Date: 15 Jan, 2013

Testing End Date: 05 Feb, 2013

- Jiangsu TÜV Product Service Ltd. – Shenzhen Branch -

Reviewed by:	Prepared by:	Tested by:
Ken Li	Felix Li	Leo Li
EMC Project Manager	EMC Project Engineer	EMC Test Engineer

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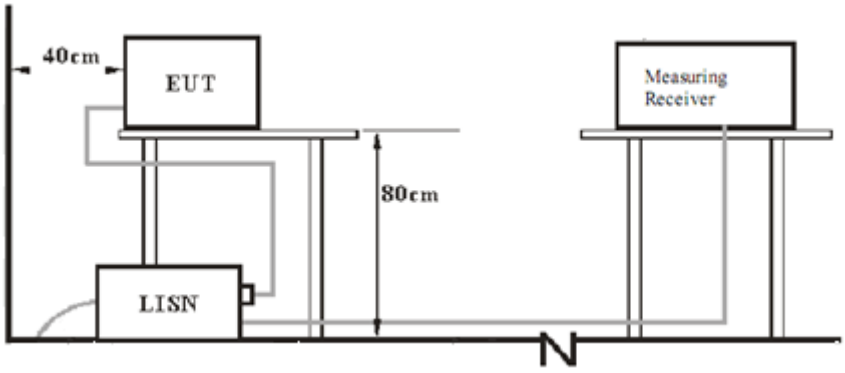
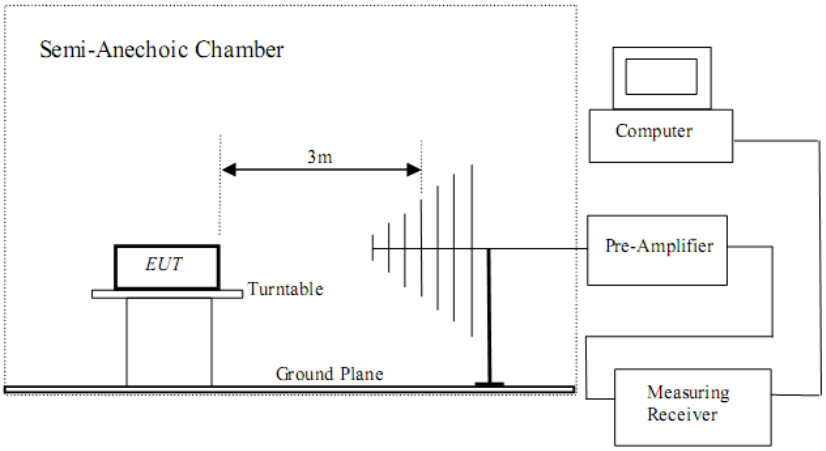
7 Test Setups

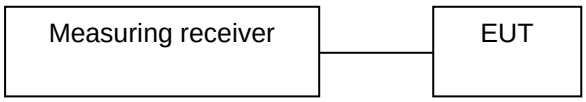
7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups



7.3 Conducted RF test setups



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8 List of Test Instruments

List of Test Instruments

ESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Spectrum	Agilent	E4446A	US44300459	May.08, 13
Amp	HP	8449B	3008A08495	May.08, 13
Antenna	EMCO	3115	9510-4580	May.17, 13
HF Cable	Hubersuhne	Sucoflex104	-	May.08, 13
Power Meter	Anritsu	ML2487A	6K00002472	May.08, 13
Power Sensor	Anritsu	MA2491A	033005	May.08, 13
Power meter	Agilent	436A	MY45100928	May.08, 13
Power Sensor	Agilent	8482B	MY41090514	May.08, 13
Power meter	Anritsu	ML2487A	6K00002472	May.08, 13
Power Sensor	Anritsu	ML2491A	032516	May.08, 13
Noise Figure	HP	8970B	3247U02193	May.08, 13
Noise Source	HP	346B	3318A13134	May.08, 13
Loop Antenna	Chase	HLA6120	1062	May.08, 13
Test Receiver	Rohde & Schwarz	ESHS10	838693/001	Oct.31, 13
L.I.S.N.#1	Rohde & Schwarz	ESH2-Z5	834066/011	Oct.31, 13
L.I.S.N.#3	Kyoritsu	KNW-242C	8-1920-1	May.08, 13
Terminator	Hubersuhner	50Ω	No. 1	May.08, 13
Terminator	Hubersuhner	50Ω	No. 2	May.08, 13
RF Cable	Fujikura	3D-2W	No.1	May.08, 13
Coaxial Switch	Anritsu	MP59B	M50564	May.08, 13
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100341	May.08, 13
Oscilloscope	Tektronix	TDS3052B	B026036	May.20, 13

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

According to §15.207, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

Remark: This test was carried out in all the test modes, here only the worst test result was shown.

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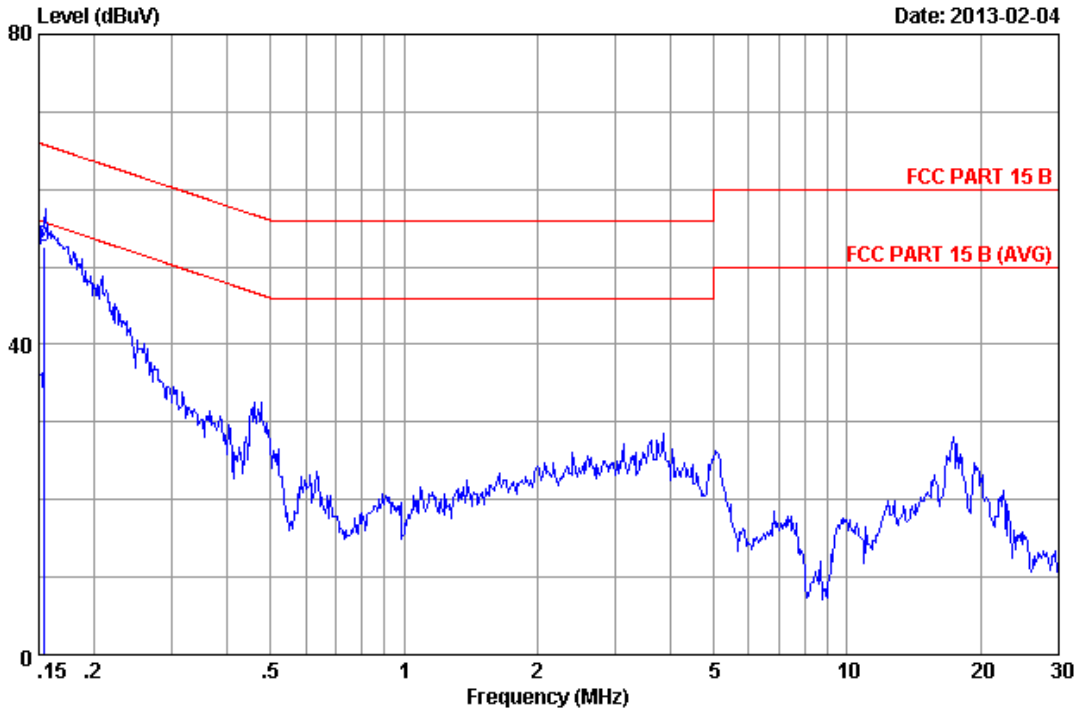
Conducted Emission

Product Type	:	Bluetooth headset
M/N	:	BT-400
Operating Condition	:	Charging and transmitting
Test specification		Live
Comment	:	AC 120V/60Hz



No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.15400	0.19	0.14	33.41	33.74	55.78	22.04	Average
2	0.15400	0.19	0.14	52.21	52.54	65.78	13.24	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
2.If the average limit is met when useing a quasi-peak detector.
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

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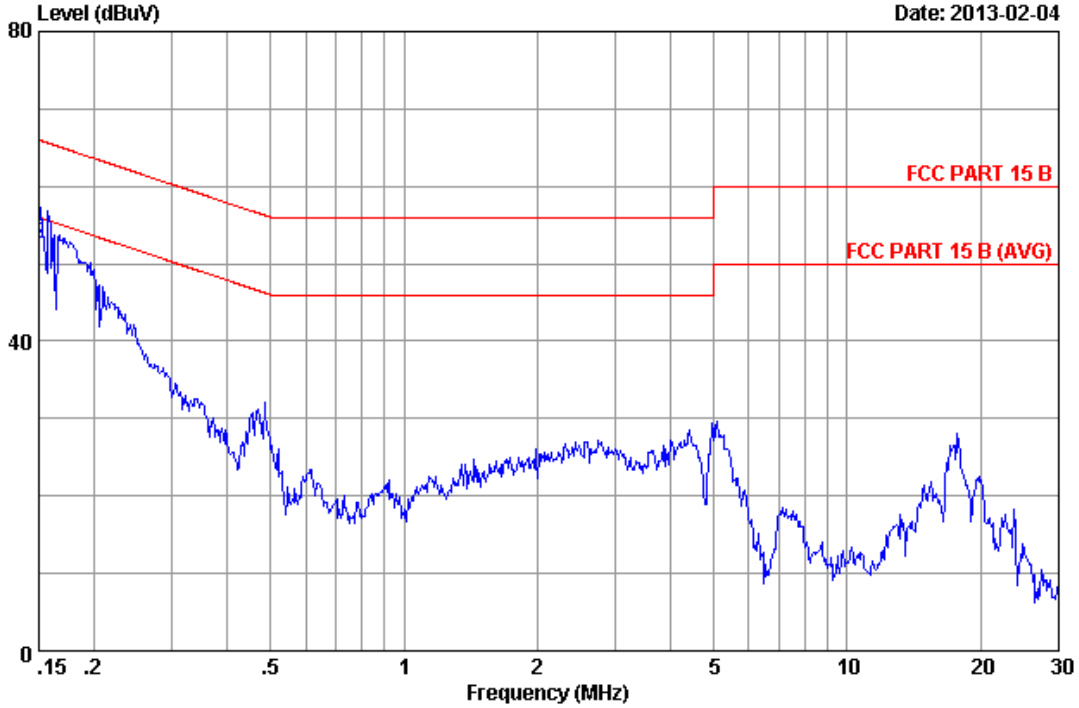
Conducted Emission

Product Type	:	Bluetooth headset
M/N	:	BT-400
Operating Condition	:	Charging and transmitting
Test specification		Neutral
Comment	:	AC 120V/60Hz



No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.15000	0.21	0.14	32.00	32.35	56.00	23.65	Average
2	0.15000	0.21	0.14	52.30	52.65	66.00	13.35	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
2.If the average limit is met when useing a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Conducted peak output power

Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	0.67	Pass
Middle channel 2441MHz	2.88	Pass
High channel 2480MHz	3.53	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	-3.61	Pass
Middle channel 2441MHz	-1.01	Pass
High channel 2480MHz	-0.37	Pass

Bluetooth Mode 8-DPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	0.70	Pass
Middle channel 2441MHz	0.06	Pass
High channel 2480MHz	0.58	Pass

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9.3 Band edge compliance of RF emissions

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation.RBW≥ 1% of the span, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section. Submit this plot.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow he trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit. Submit this plot.

Limits

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c))

Frequency MHz	Limit Average dBuV/m	Limit Peak dBuV/m
Below 2390 Above 2483.5	54	74

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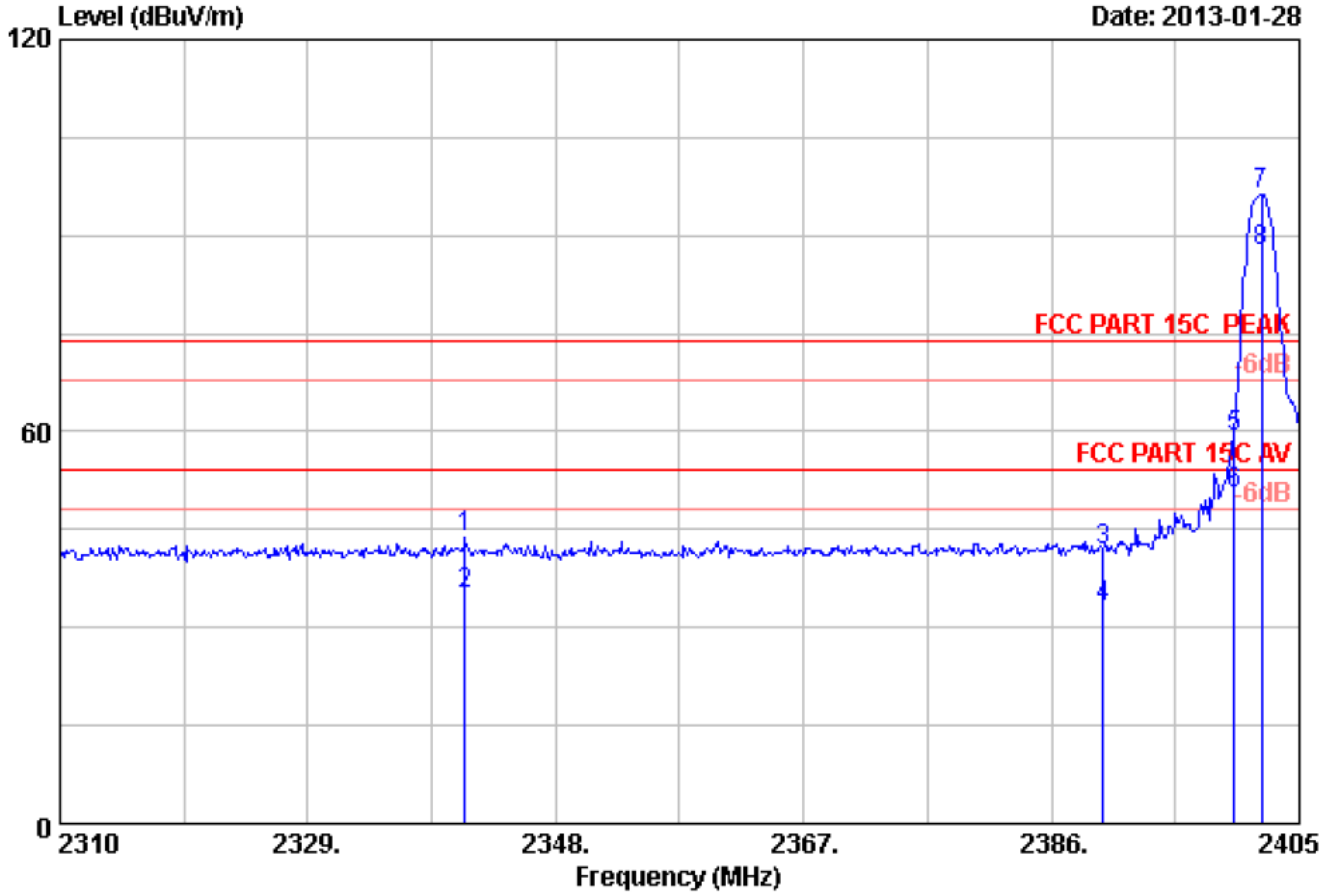
Band edge compliance of RF emissions

The EUTs have been tested under all modulation modes, only the worse case GFSK and 8-DPSK modulation test result are listed in the report.

Radiated measurement result:

Hopping off test data:
Bluetooth Mode GFSK Modulation Test Result:
Lower edge peak Plot:
Vertical:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2341.065	26.38	5.92	35.92	47.48	43.86	74.00	30.14	Peak
2	2341.065	26.38	5.92	35.92	38.78	35.16	54.00	18.84	Average
3	2390.000	26.70	6.00	35.92	44.90	41.68	74.00	32.32	Peak
4	2390.000	26.70	6.00	35.92	36.20	32.98	54.00	21.02	Average
5	2400.000	26.76	6.02	35.92	62.19	59.05	74.00	14.95	Peak
6	2400.000	26.76	6.02	35.92	53.49	50.35	54.00	3.65	Average
7	2402.150	26.77	6.02	35.92	99.35	96.22	74.00	-22.22	Peak
8	2402.150	26.77	6.02	35.92	90.65	87.52	54.00	-33.52	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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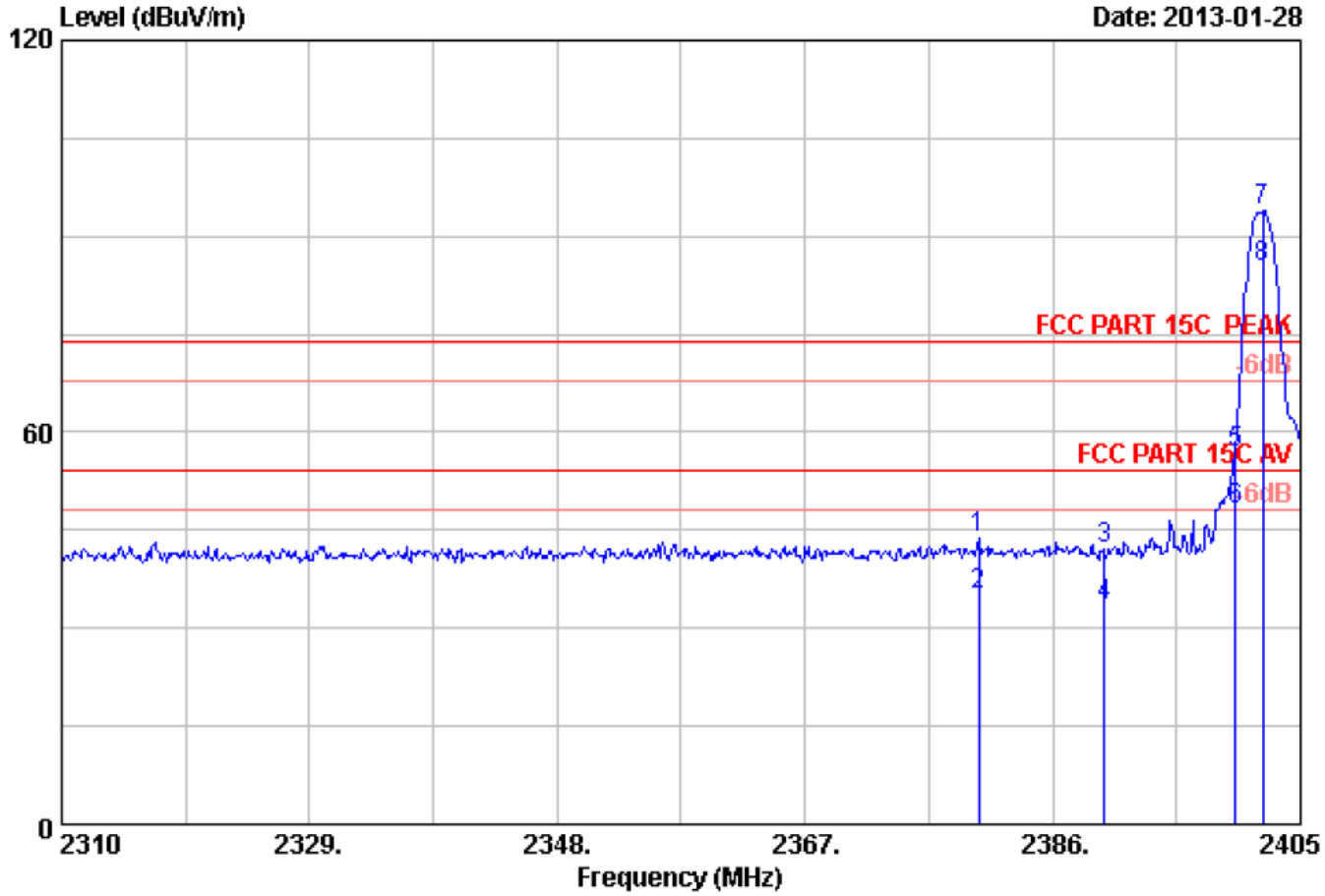
Band edge compliance of RF emissions

Lower edge peak Plot:
Horizontal:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2380.300	26.63	5.98	35.92	46.94	43.63	74.00	30.37	Peak
2	2380.300	26.63	5.98	35.92	38.25	34.94	54.00	19.06	Average
3	2390.000	26.70	6.00	35.92	45.23	42.01	74.00	31.99	Peak
4	2390.000	26.70	6.00	35.92	36.53	33.31	54.00	20.69	Average
5	2400.000	26.76	6.02	35.92	59.97	56.83	74.00	17.17	Peak
6	2400.000	26.76	6.02	35.92	51.27	48.13	54.00	5.87	Average
7	2402.150	26.77	6.02	35.92	96.95	93.82	74.00	-19.82	Peak
8	2402.150	26.77	6.02	35.92	88.25	85.12	54.00	-31.12	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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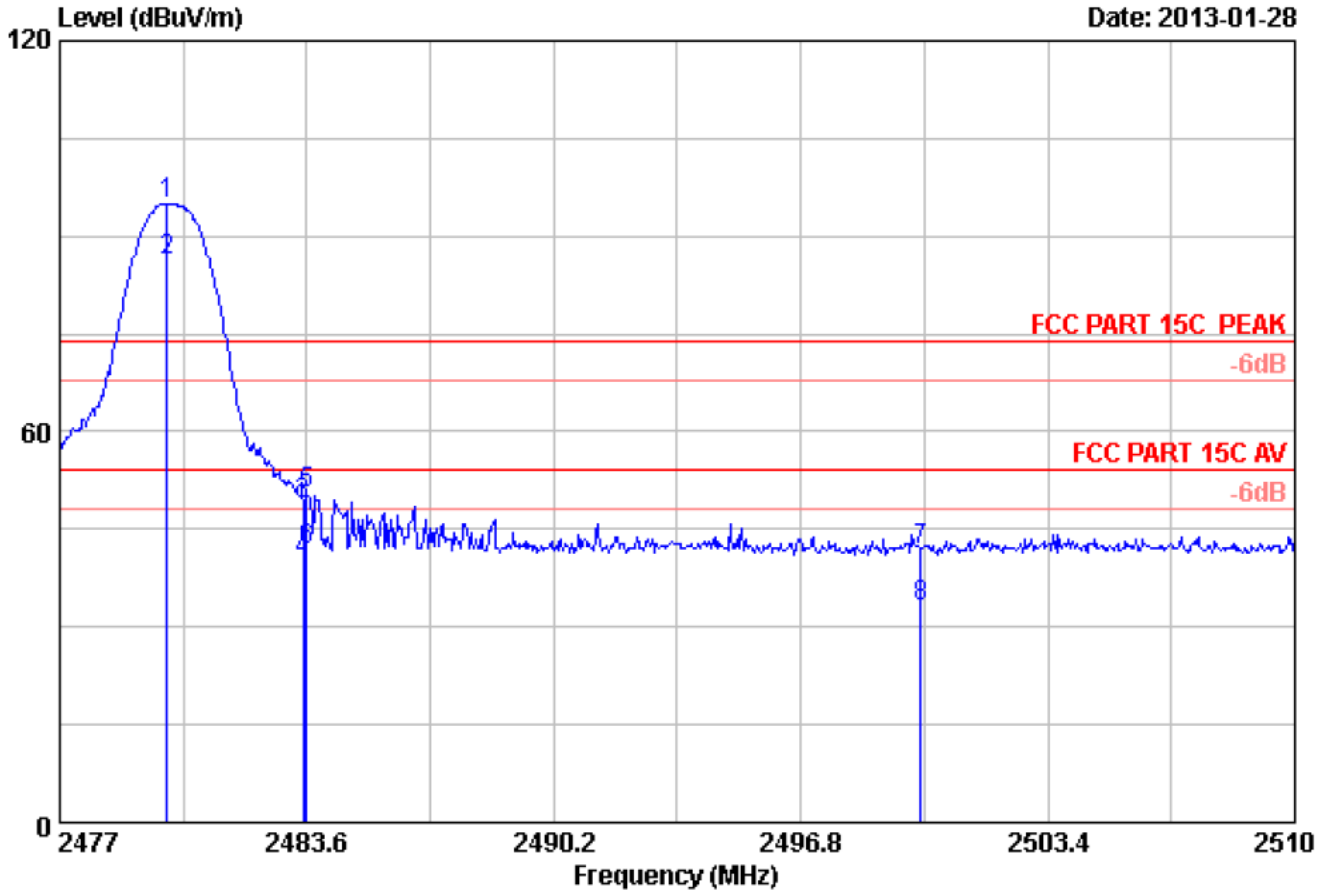
Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.871	27.27	6.15	35.92	97.54	95.04	74.00	-21.04	Peak
2	2479.871	27.27	6.15	35.92	88.84	86.34	54.00	-32.34	Average
3	2483.500	27.29	6.16	35.92	51.19	48.72	74.00	25.28	Peak
4	2483.500	27.29	6.16	35.92	42.49	40.02	54.00	13.98	Average
5	2483.600	27.30	6.16	35.92	52.79	50.33	74.00	23.67	Peak
6	2483.600	27.30	6.16	35.92	44.08	41.62	54.00	12.38	Average
7	2500.000	27.40	6.19	35.93	44.23	41.89	74.00	32.11	Peak
8	2500.000	27.40	6.19	35.93	35.53	33.19	54.00	20.81	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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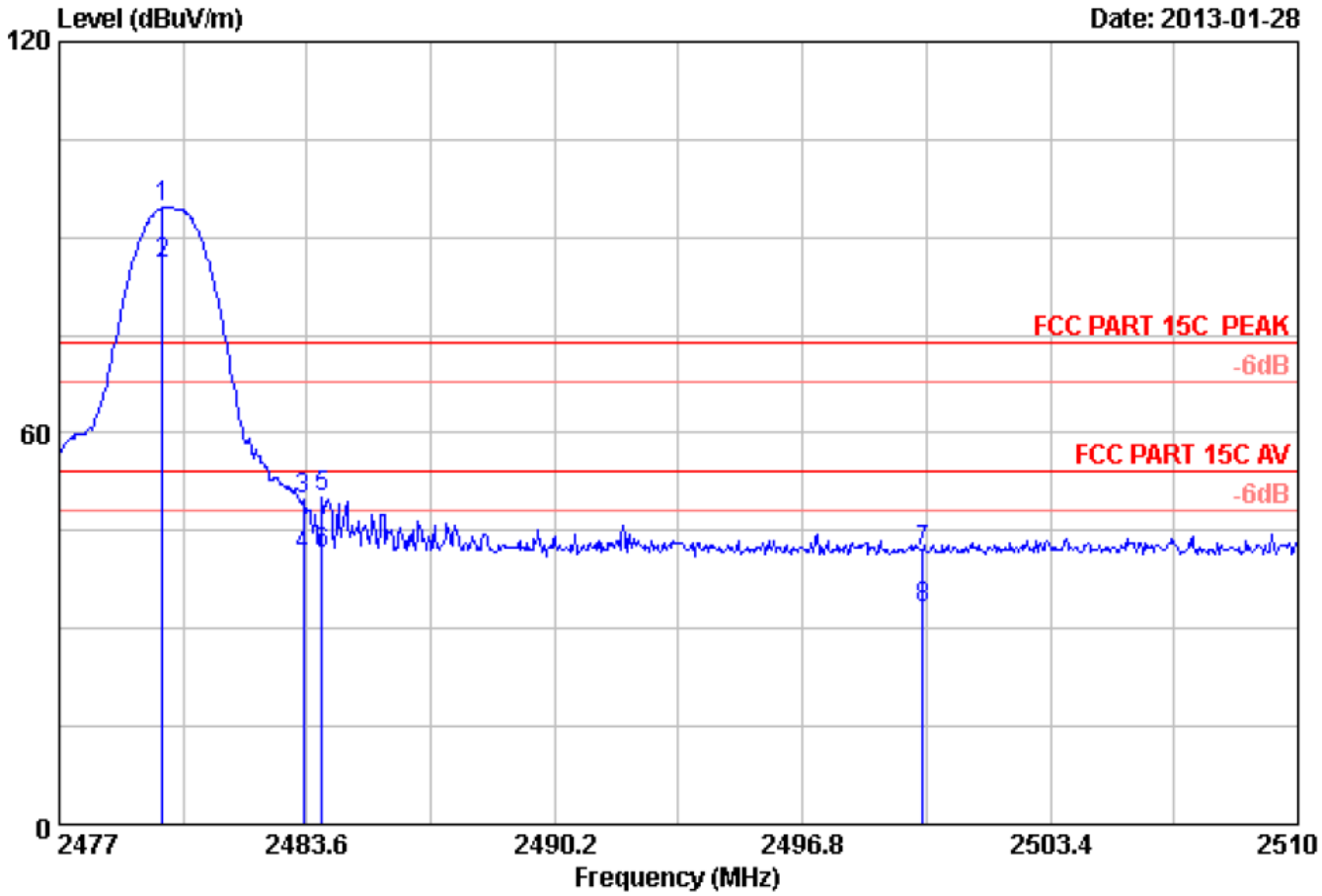
Band edge compliance of RF emissions

Upper edge peak Plot:
Horizontal:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.739	27.27	6.15	35.92	97.09	94.59	74.00	-20.59	Peak
2	2479.739	27.27	6.15	35.92	88.39	85.89	54.00	-31.89	Average
3	2483.500	27.29	6.16	35.92	52.24	49.77	74.00	24.23	Peak
4	2483.500	27.29	6.16	35.92	43.54	41.07	54.00	12.93	Average
5	2483.996	27.30	6.16	35.92	52.56	50.10	74.00	23.90	Peak
6	2483.996	27.30	6.16	35.92	43.85	41.39	54.00	12.61	Average
7	2500.000	27.40	6.19	35.93	44.01	41.67	74.00	32.33	Peak
8	2500.000	27.40	6.19	35.93	35.31	32.97	54.00	21.03	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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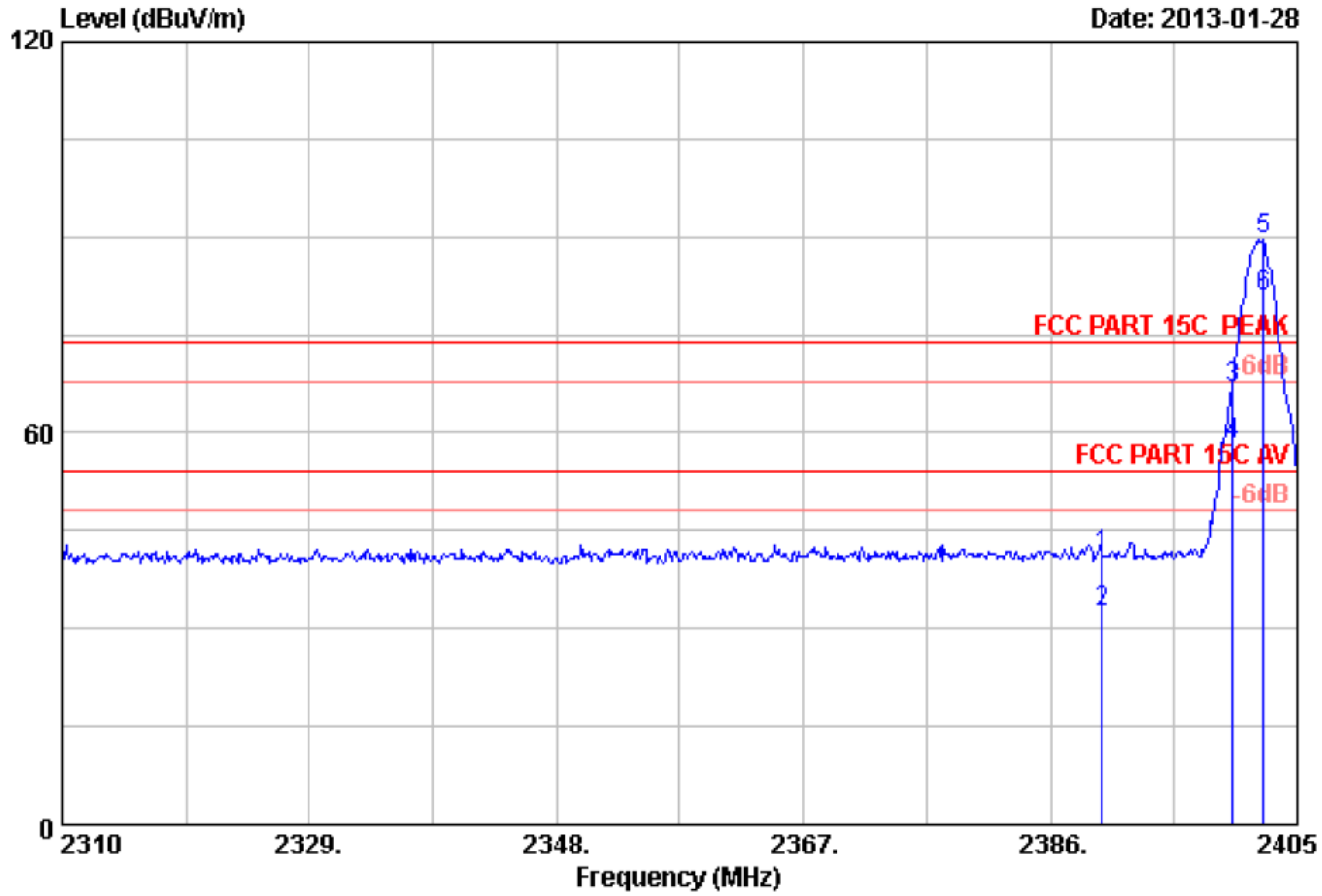
Band edge compliance of RF emissions

Bluetooth Mode 8-DPSK Modulation Test Result:
Lower edge peak Plot:
Vertical:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.000	26.70	6.00	35.92	44.22	41.00	74.00	33.00	Peak
2	2390.000	26.70	6.00	35.92	35.52	32.30	54.00	21.70	Average
3	2400.000	26.76	6.02	35.92	69.92	66.78	74.00	7.22	Peak
4	2400.000	26.76	6.02	35.92	61.22	58.08	54.00	-4.08	Average
5	2402.340	26.77	6.02	35.92	92.68	89.55	74.00	-15.55	Peak
6	2402.340	26.77	6.02	35.92	83.99	80.86	54.00	-26.86	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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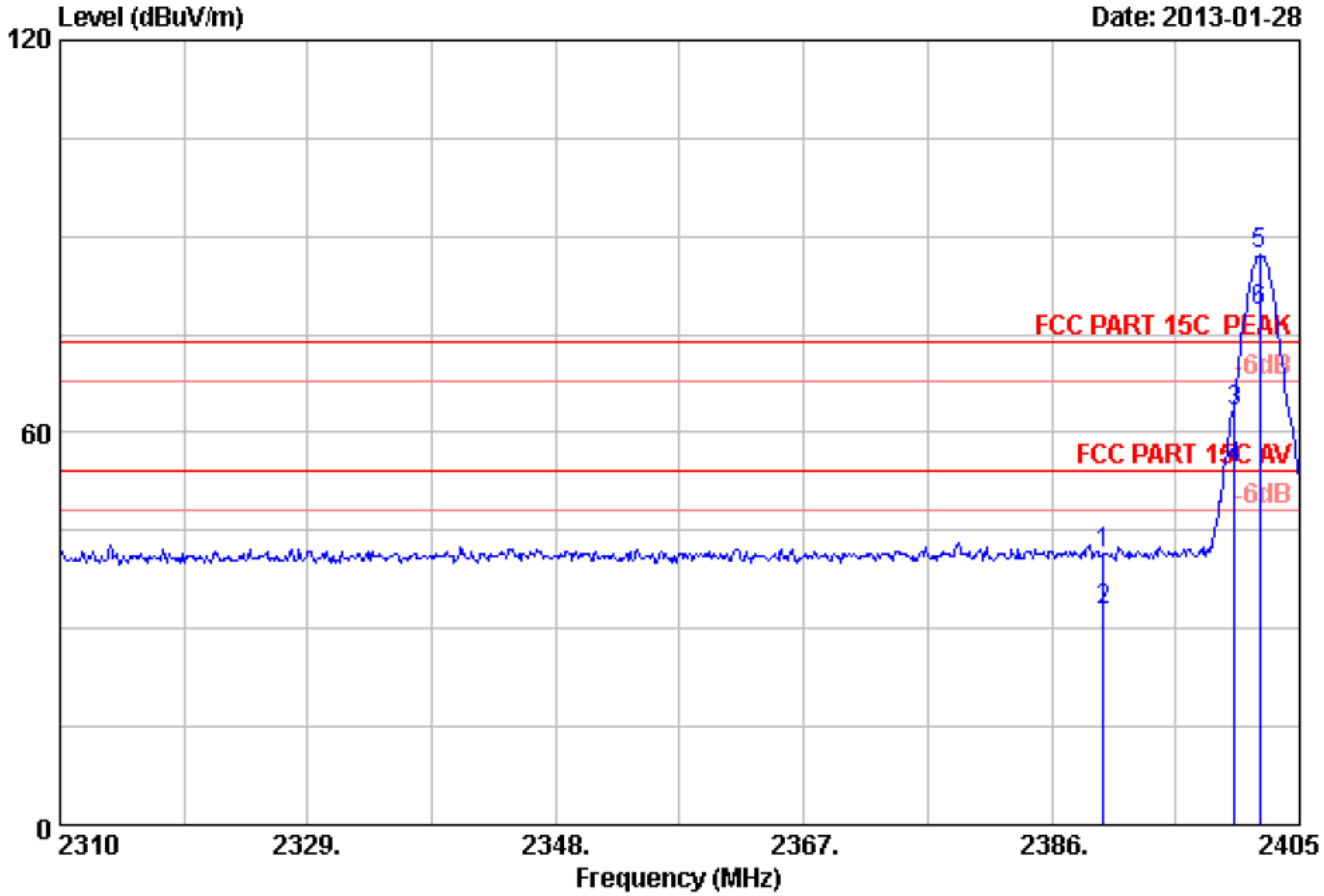
Band edge compliance of RF emissions

Lower edge peak Plot:
Horizontal:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.000	26.70	6.00	35.92	44.82	41.60	74.00	32.40	Peak
2	2390.000	26.70	6.00	35.92	36.12	32.90	54.00	21.10	Average
3	2400.000	26.76	6.02	35.92	66.29	63.15	74.00	10.85	Peak
4	2400.000	26.76	6.02	35.92	57.59	54.45	54.00	-0.45	Average
5	2401.960	26.77	6.02	35.92	90.48	87.35	74.00	-13.35	Peak
6	2401.960	26.77	6.02	35.92	81.78	78.65	54.00	-24.65	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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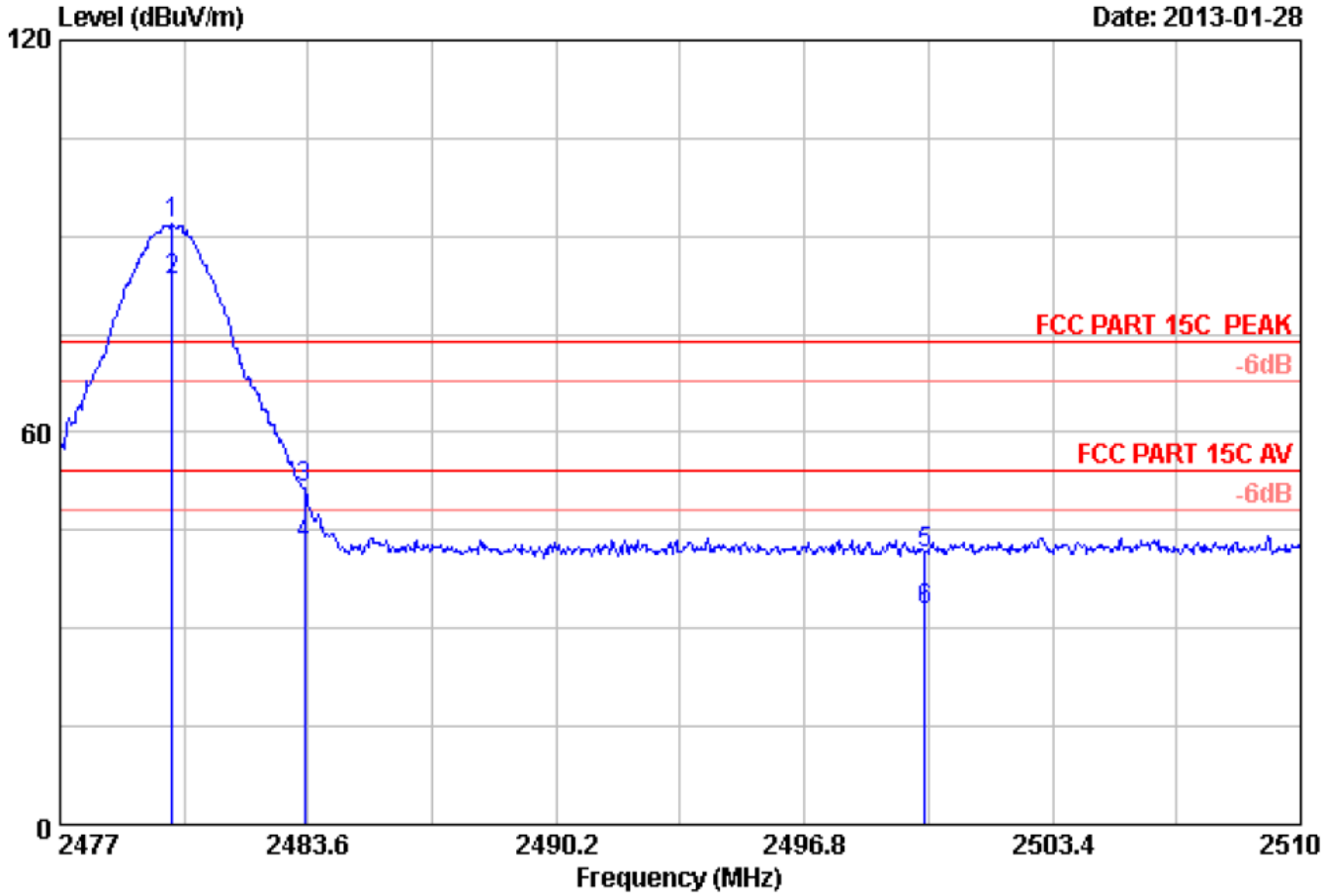
Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.970	27.27	6.15	35.92	94.31	91.81	74.00	-17.81	Peak
2	2479.970	27.27	6.15	35.92	85.61	83.11	54.00	-29.11	Average
3	2483.500	27.29	6.16	35.92	53.89	51.42	74.00	22.58	Peak
4	2483.500	27.29	6.16	35.92	45.19	42.72	54.00	11.28	Average
5	2500.000	27.40	6.19	35.93	43.95	41.61	74.00	32.39	Peak
6	2500.000	27.40	6.19	35.93	35.25	32.91	54.00	21.09	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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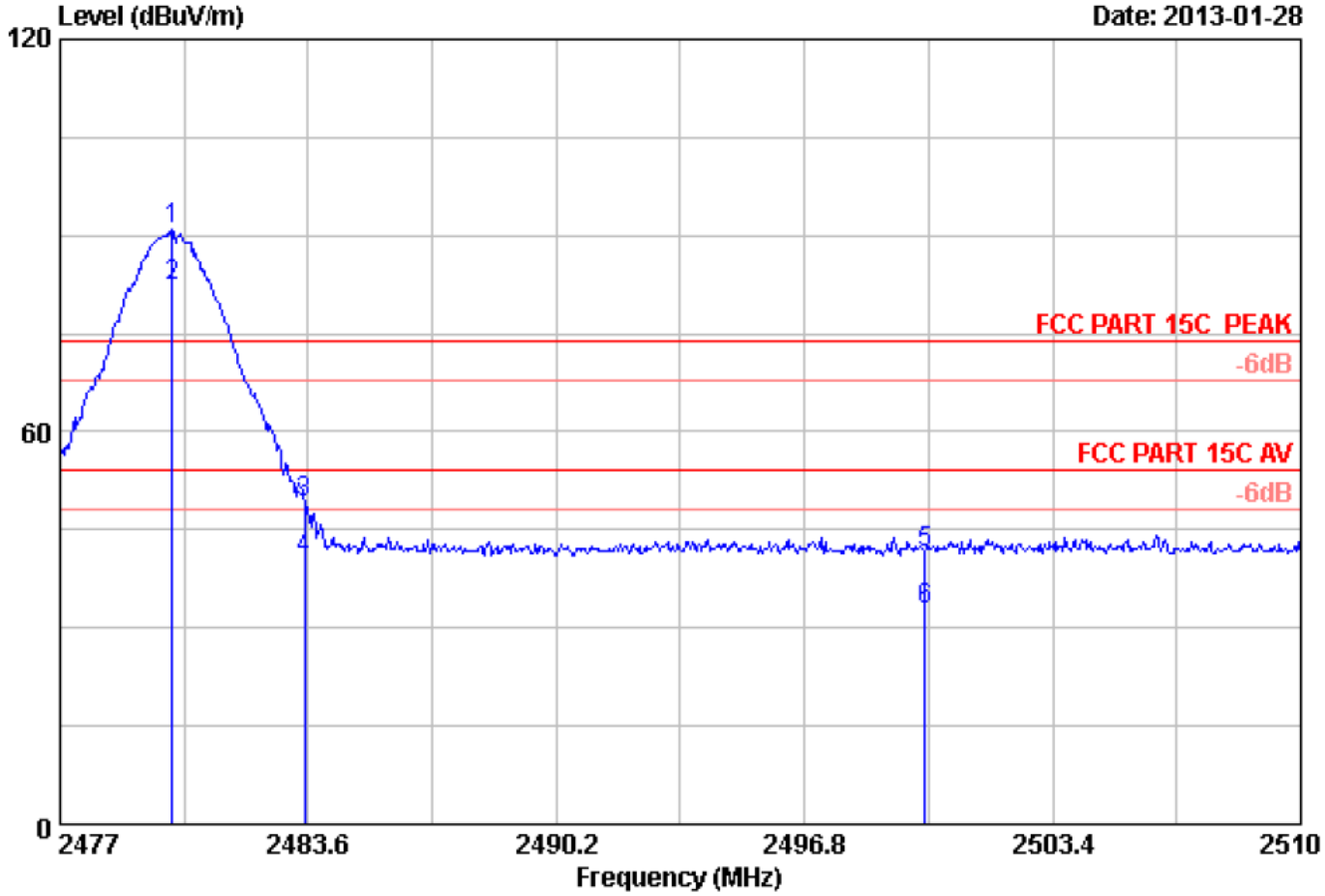
Band edge compliance of RF emissions

Upper edge peak Plot:
Horizontal:



	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.970	27.27	6.15	35.92	93.38	90.88	74.00	-16.88	Peak
2	2479.970	27.27	6.15	35.92	84.68	82.18	54.00	-28.18	Average
3	2483.500	27.29	6.16	35.92	51.70	49.23	74.00	24.77	Peak
4	2483.500	27.29	6.16	35.92	43.00	40.53	54.00	13.47	Average
5	2500.000	27.40	6.19	35.93	43.82	41.48	74.00	32.52	Peak
6	2500.000	27.40	6.19	35.93	35.12	32.78	54.00	21.22	Average

Remarks:
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

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9.4 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

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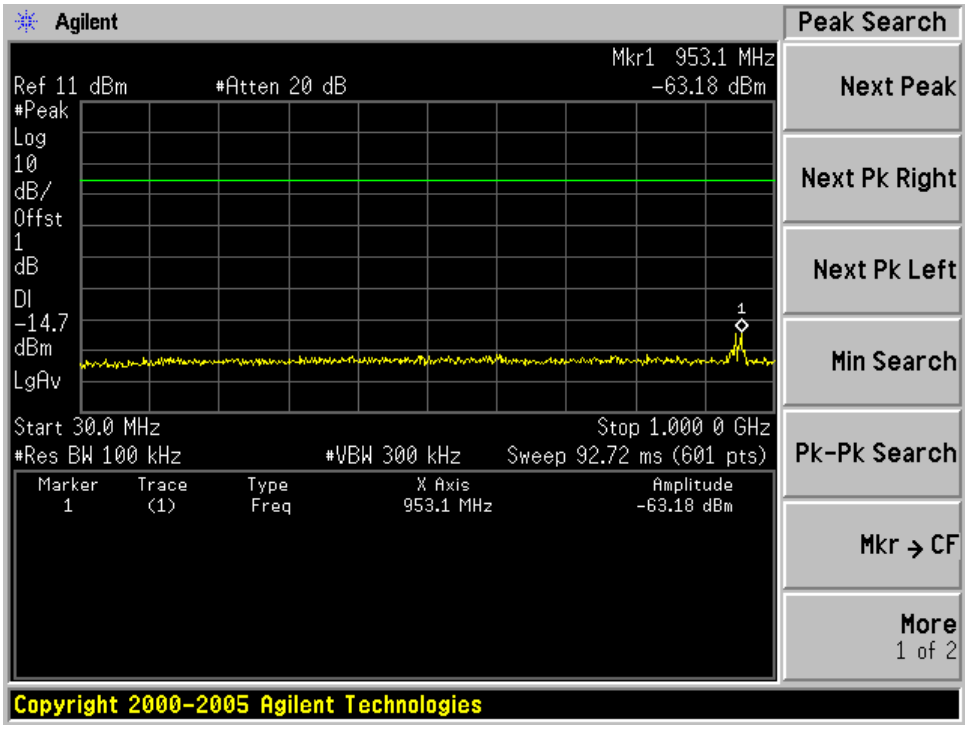
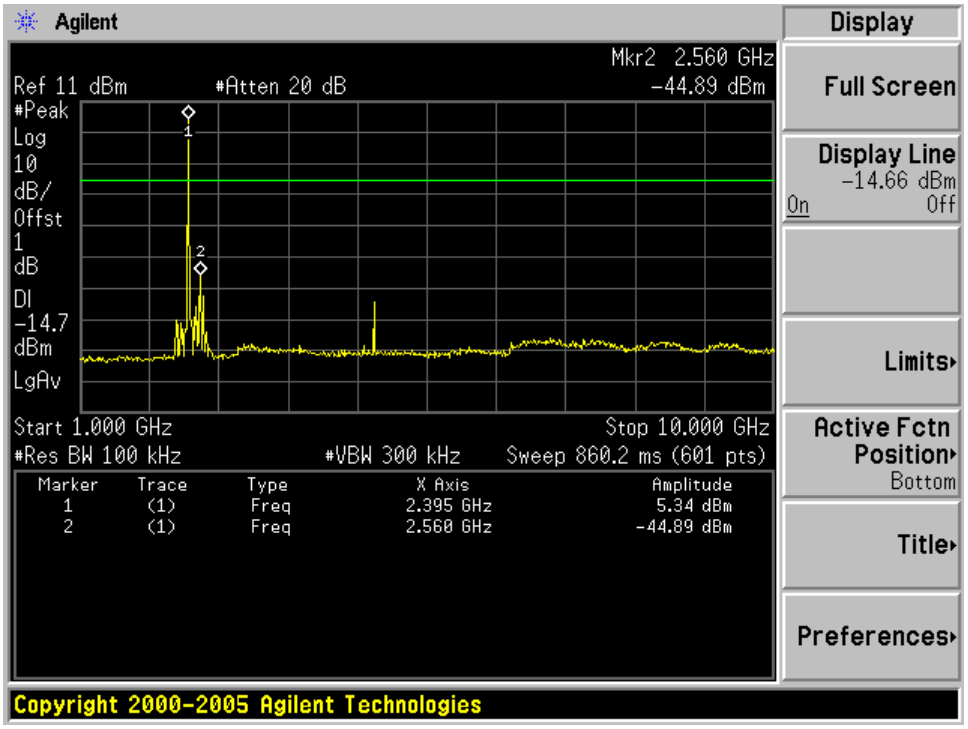
Spurious RF conducted emissions

The EUTs have been tested under all modulation modes, only the worst case GFSK and 8-DPSK modulation test result are listed in the report.

Bluetooth Mode GFSK Modulation Test Result:

2402MHz





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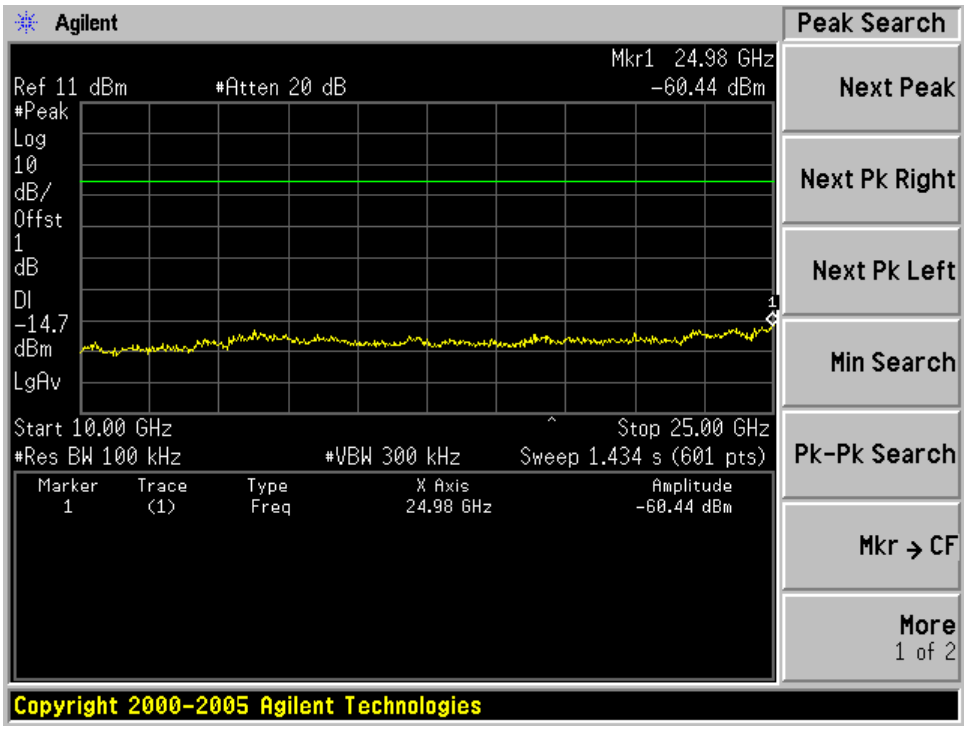
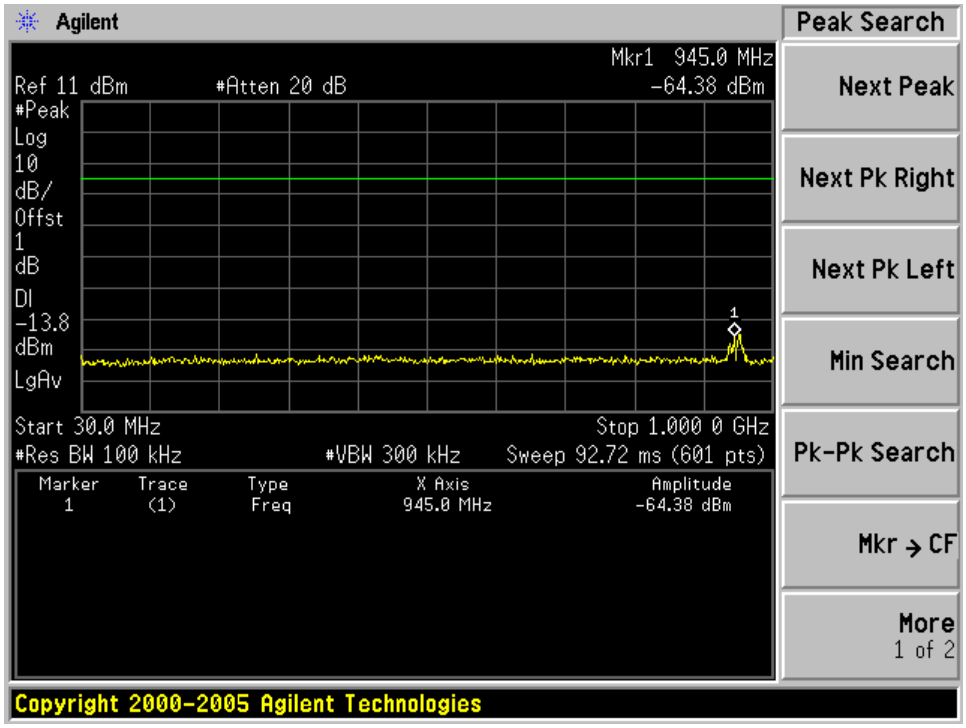
Spurious RF conducted emissions



2441MHz



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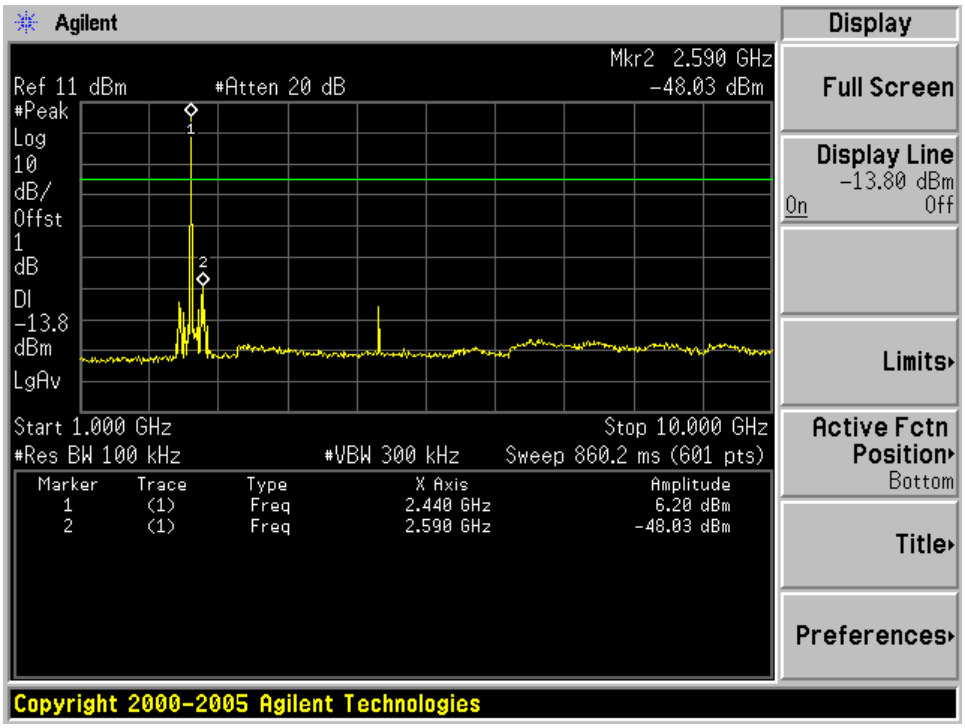
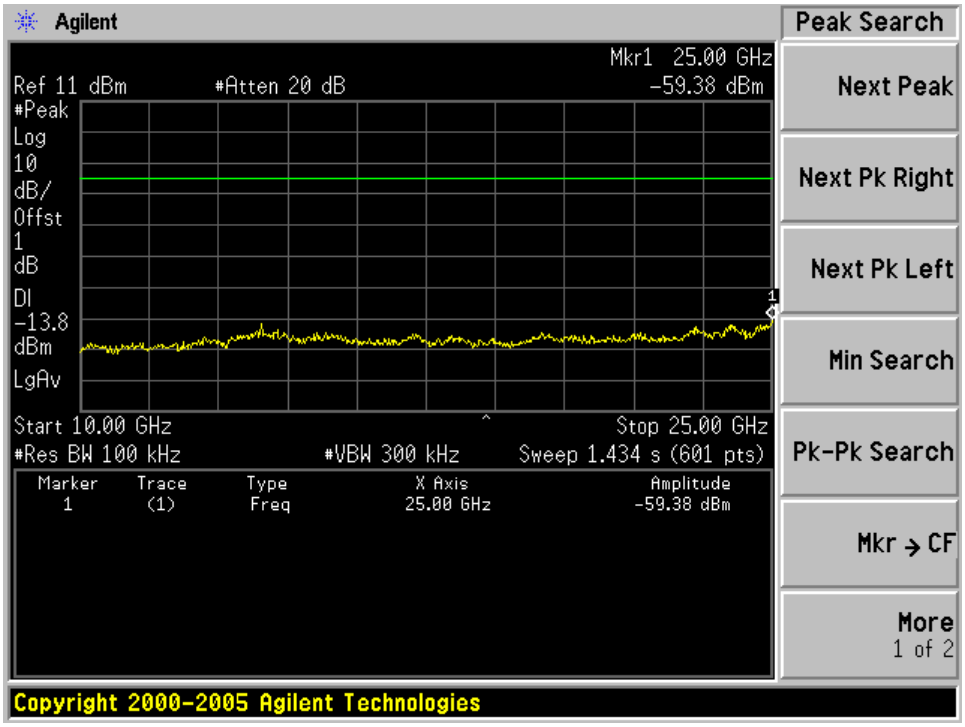
Spurious RF conducted emissions





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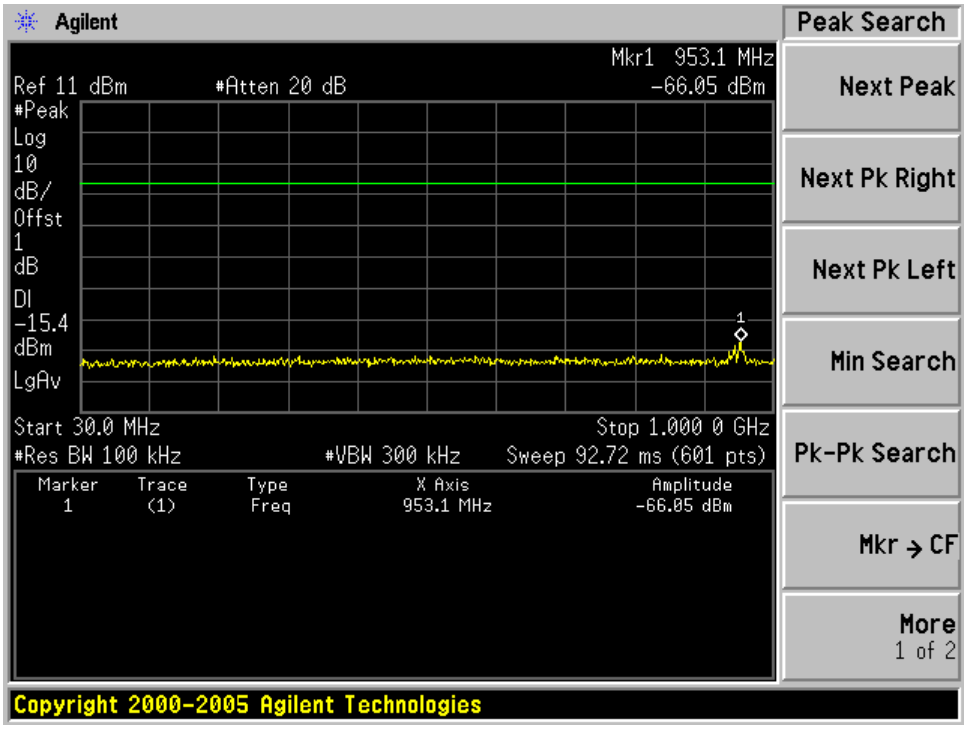
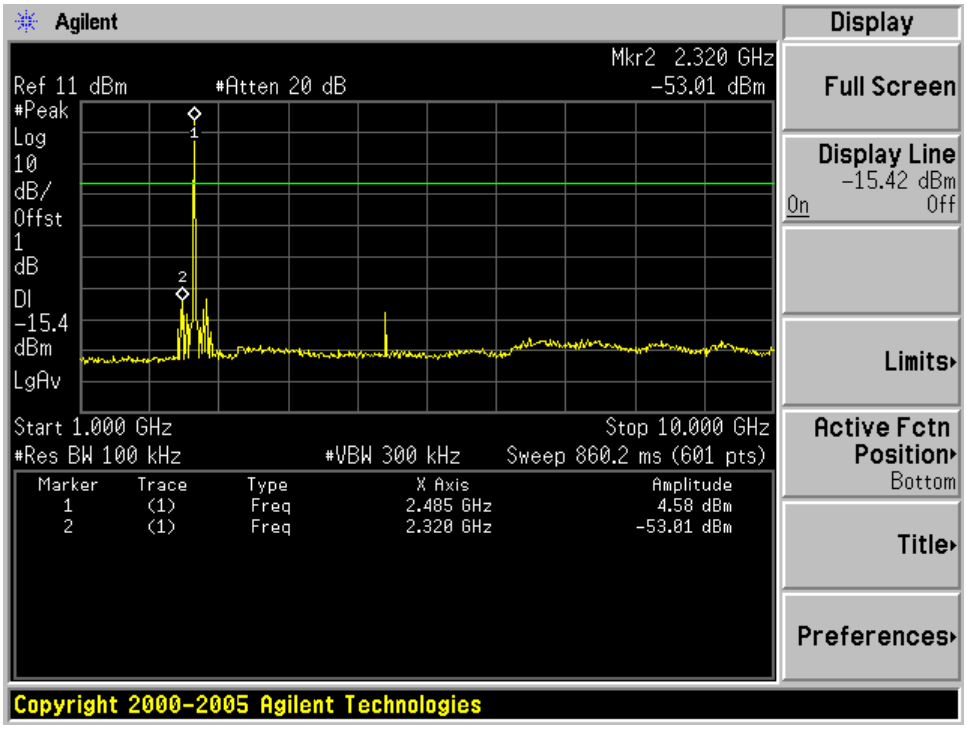
Spurious RF conducted emissions

2480MHz





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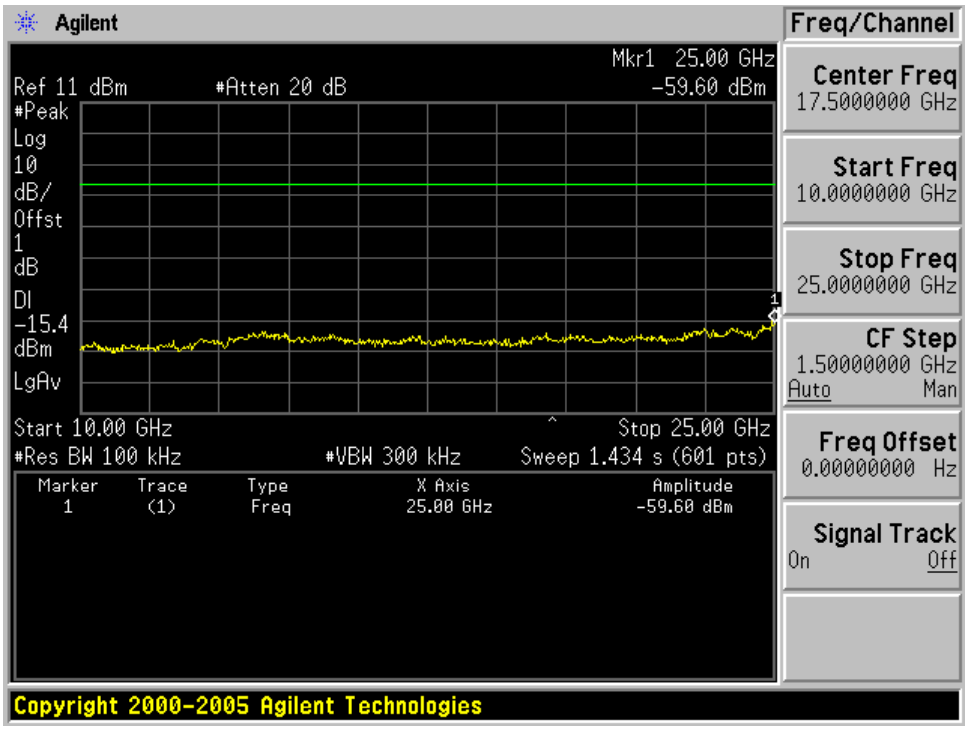
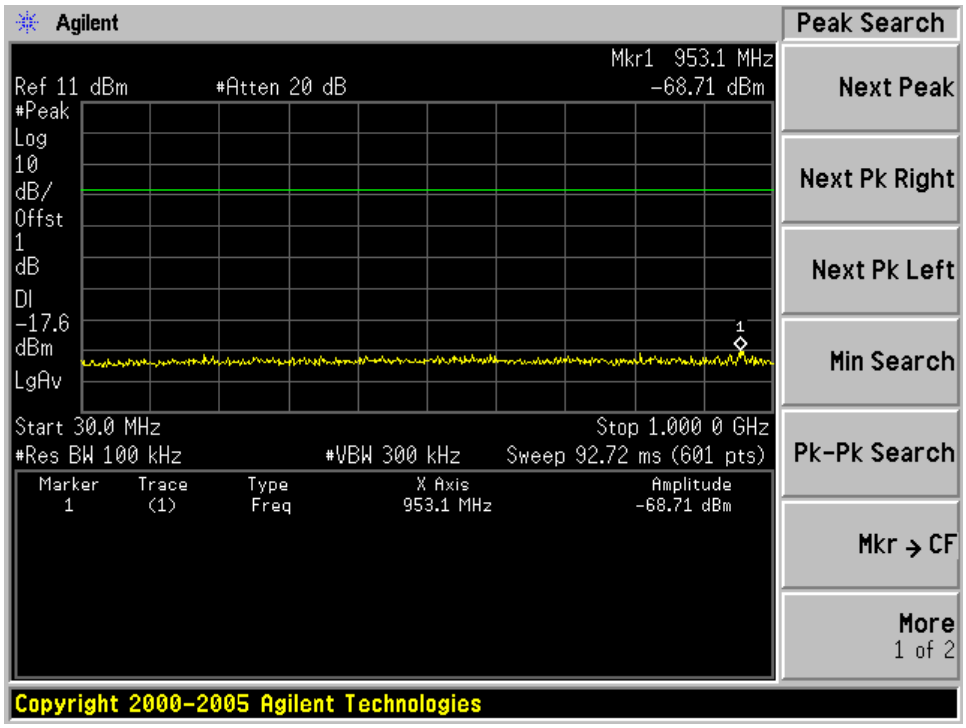
Spurious RF conducted emissions



Bluetooth Mode 8-DPSK Modulation Test Result:
2402MHz



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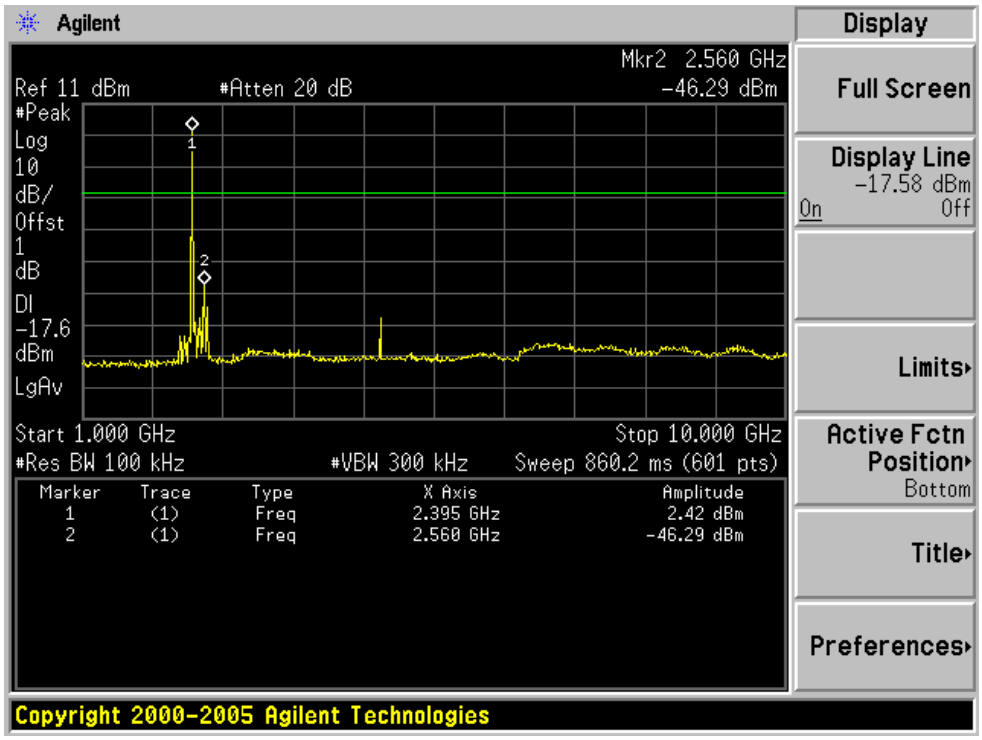
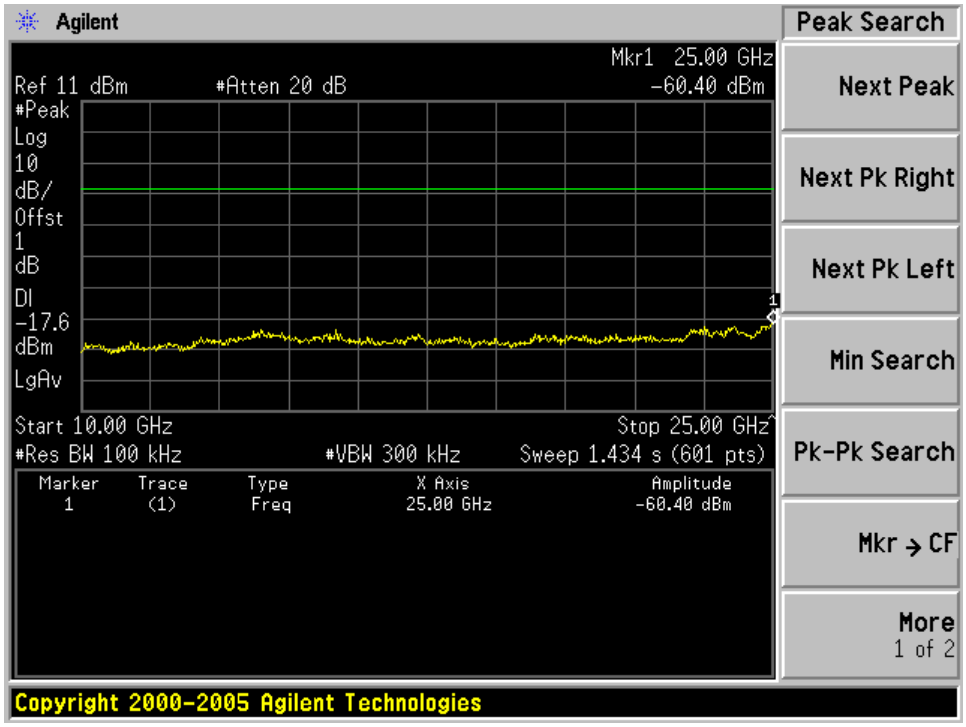
Spurious RF conducted emissions





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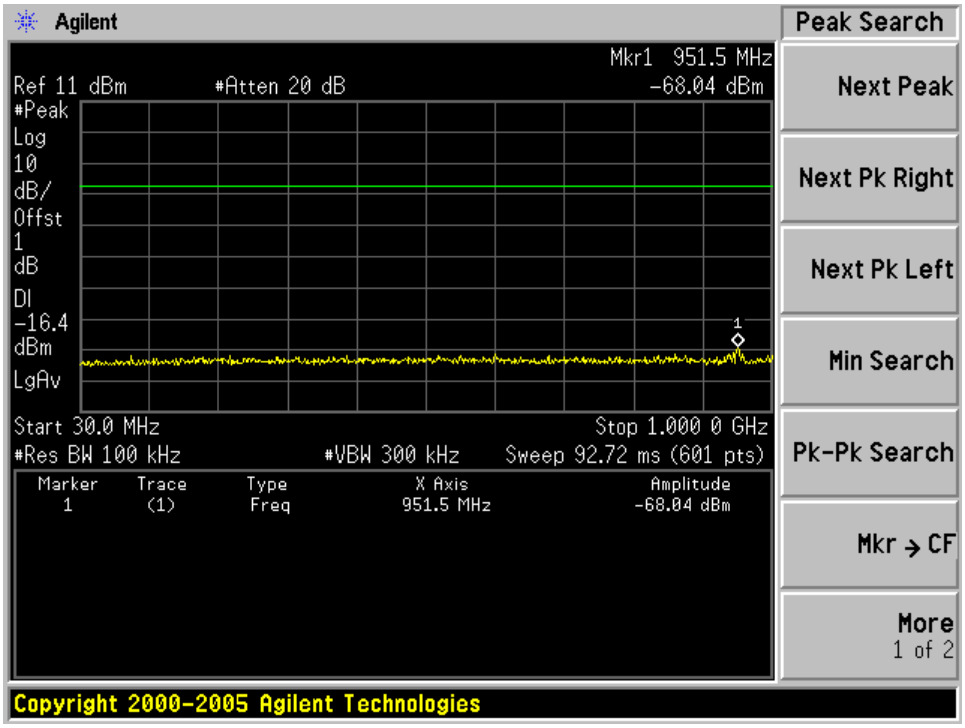
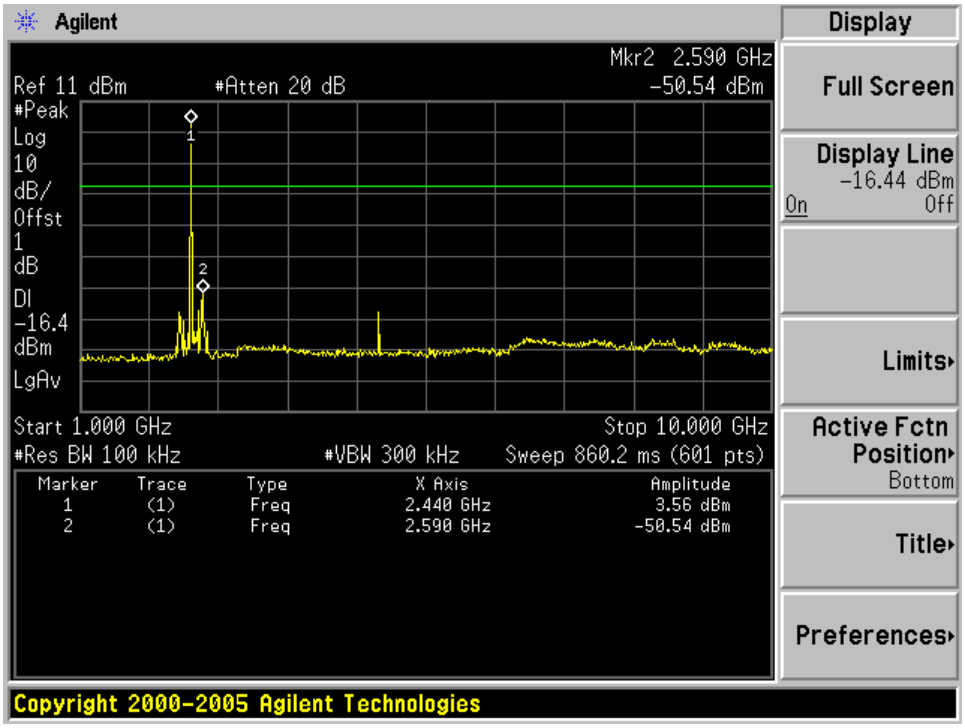
Spurious RF conducted emissions

2441MHz





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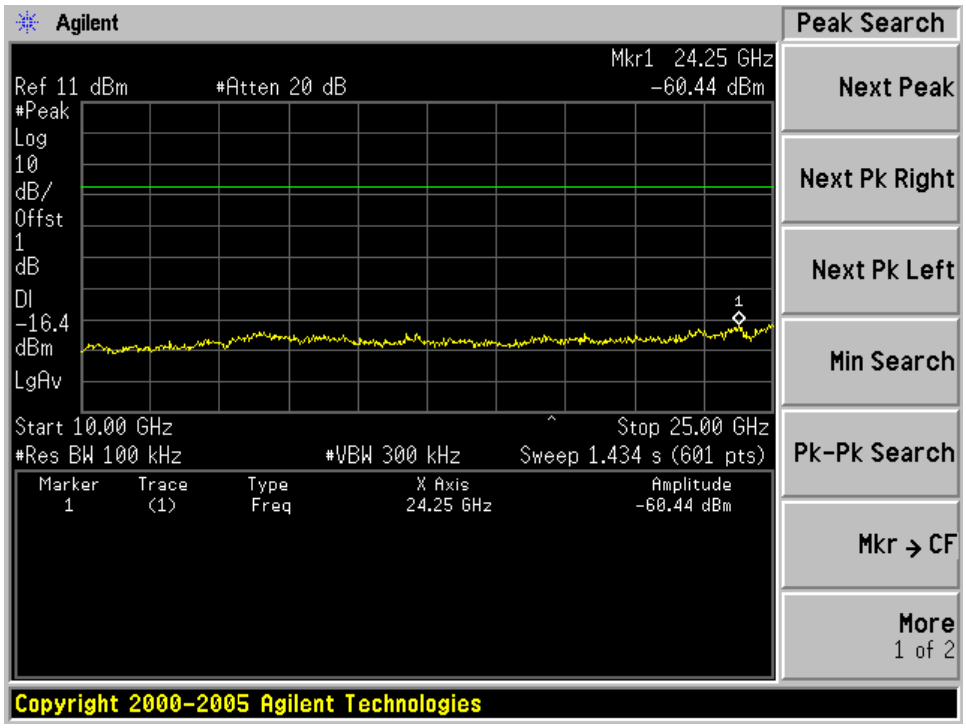
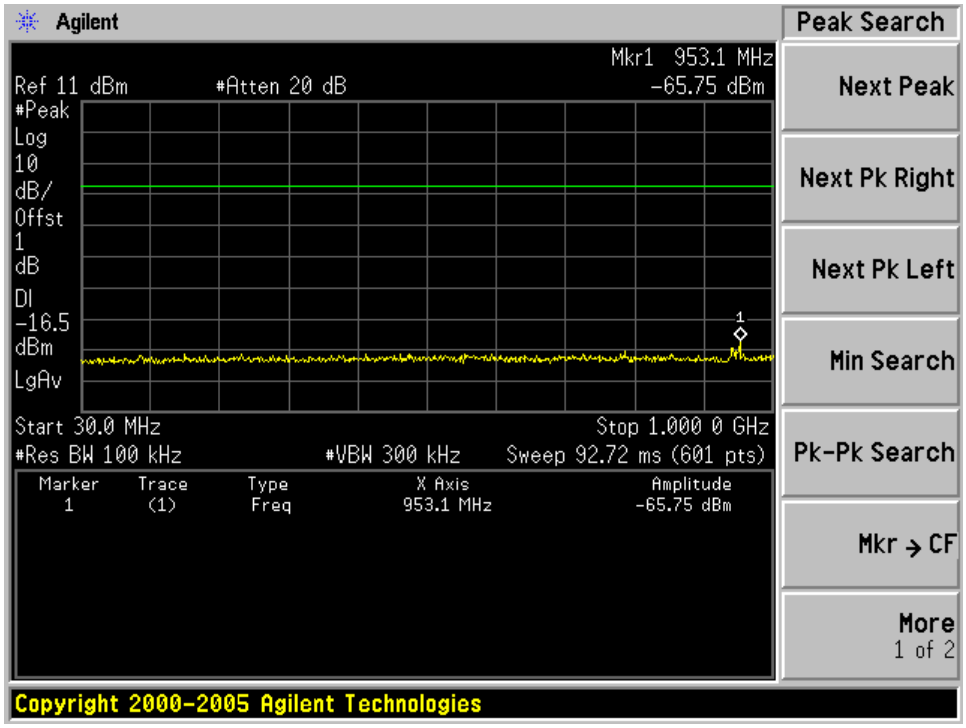
Spurious RF conducted emissions



2480MHz



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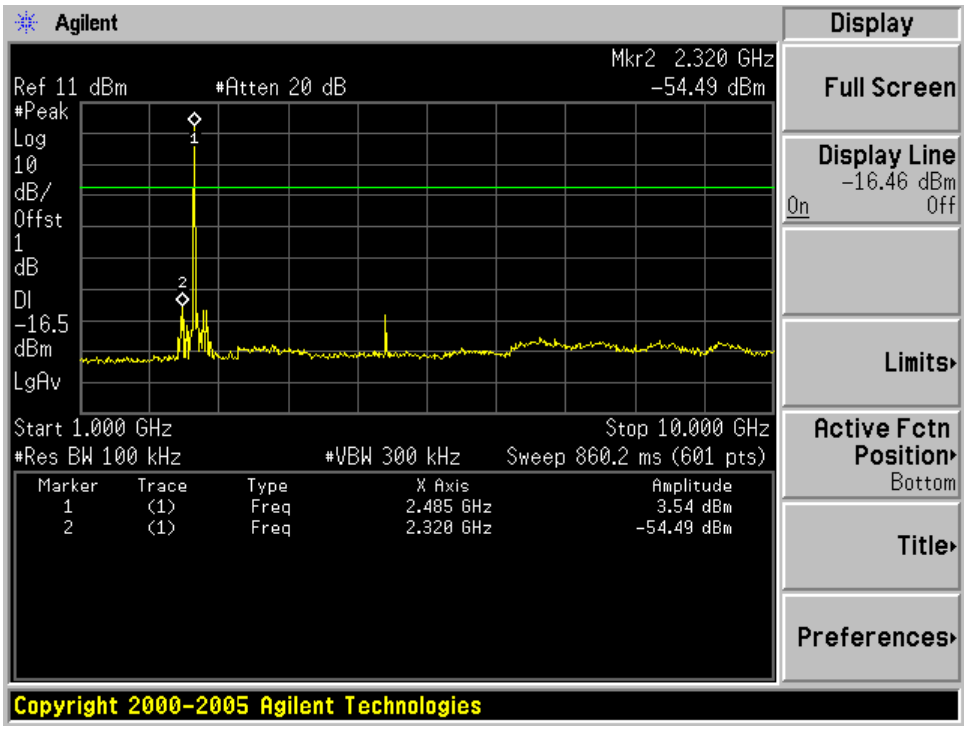
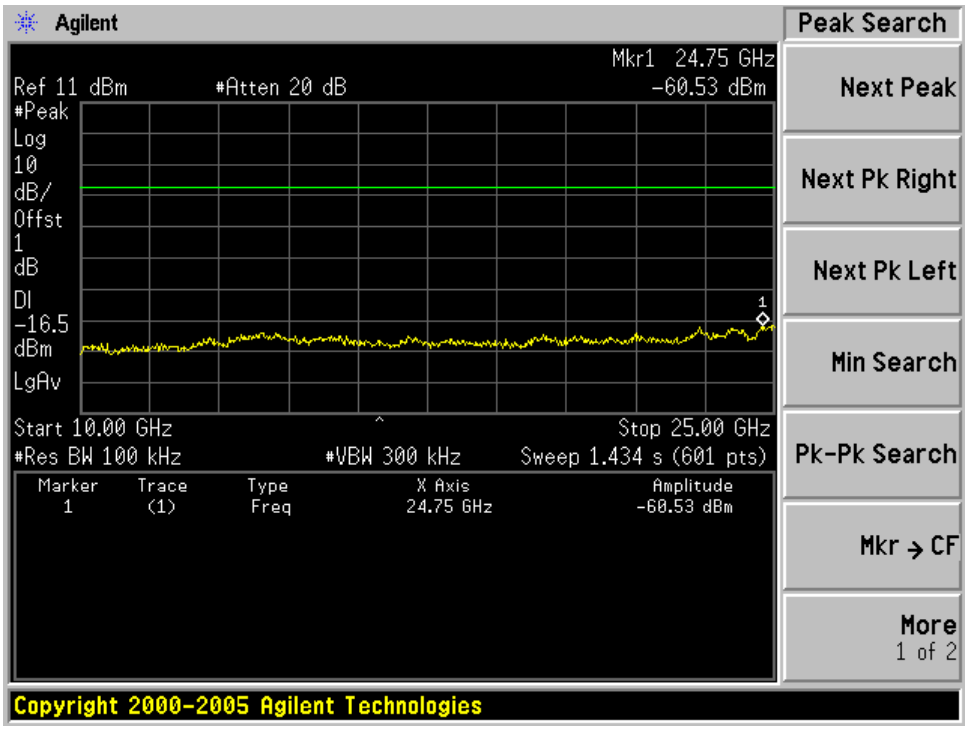
Spurious RF conducted emissions





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9.5 Spurious radiated emissions for transmitter

Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
   Span = wide enough to fully capture the emission being measured ,RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc.
   The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

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Spurious radiated emissions for transmitter

Remark: According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
The EUTs have been tested under all modulation modes, only the worse case GFSK and 8-DPSK modulation test result are listed in the report.

Transmitting spurious emission test result as below:

Bluetooth Mode GFSK Modulation 2402MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
303.54	12.89	1.16	0	42.58	29.45	Vertical	46.0	PK	Pass
303.54	12.89	1.29	0	45.46	32.33	Horizontal	46.0	PK	Pass
4804	32.47	8.67	35.72	41.9	47.32	Vertical	74.0	PK	Pass
4804	32.47	8.67	35.72	50.61	56.03	Vertical	54.0	AV	Pass
4804	32.47	8.67	35.72	38.97	44.39	Horizontal	74.0	PK	Pass
4804	32.47	8.67	35.72	47.68	53.10	Horizontal	54.0	AV	Pass
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

Bluetooth Mode GFSK Modulation 2441MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
4882	32.64	8.74	35.69	49.77	55.46	V	74	PK	Pass
4882	32.64	8.74	35.69	41.06	46.75	V	54	AV	Pass
4882	32.64	8.74	35.69	48.44	54.13	H	74	PK	Pass
4882	32.64	8.74	35.69	39.73	45.42	H	54	AV	Pass
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

Bluetooth Mode GFSK Modulation 2480MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
4960	32.81	8.81	35.66	48.85	54.81	V	74	PK	Pass
4960	32.81	8.81	35.66	40.14	46.1	V	54	AV	Pass
4960	32.81	8.81	35.66	47.81	53.77	H	74	PK	Pass
4960	32.81	8.81	35.66	39.10	45.06	H	54	AV	Pass
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

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Remark:

(1) QP Emission Level= Antenna Factor +Cable Loss + Reading
PK Emission Level= Antenna Factor +Cable Loss - Amp. factor + Reading
AV Emission Level= PK Emission Level+20log(dutycycle)

(2) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

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Spurious radiated emissions for transmitter

Bluetooth Mode 8-DPSK Modulation 2402MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
303.54	12.89	1.16	--	24.43	38.48	Vertical	46.0	PK	Pass
303.54	12.89	1.29	--	25.95	40.13	Horizontal	46.0	PK	Pass
4804	--	--	--	--	--	Vertical	--	--	Pass
4804	--	--	--	--	--	Vertical	--	--	Pass
4804	32.47	8.67	35.72	44.81	50.23	Horizontal	74	PK	Pass
4804	32.47	8.67	35.72	36.1	41.52	Horizontal	54	AV	Pass
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

Bluetooth Mode 8-DPSK Modulation 2441MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
4882	32.64	8.74	35.69	46.71	52.40	Vertical	74	PK	Pass
4882	32.64	8.74	35.69	38	43.69	Vertical	54	AV	Pass
4882	--	--	--	--	--	Horizontal	--	--	Pass
4882	--	--	--	--	--	Horizontal	--	--	Pass
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

Bluetooth Mode 8-DPSK Modulation 2480MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
4960	32.81	8.81	35.66	46.92	52.88	Vertical	74	PK	Pass
4960	32.81	8.81	35.66	38.21	44.17	Vertical	54	AV	Pass
4960	32.81	8.81	35.66	44.61	50.57	Horizontal	74	PK	Pass
4960	32.81	8.81	35.66	35.9	41.86	Horizontal	54	AV	Pass
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

Remark:

(1) QP Emission Level= Antenna Factor +Cable Loss + Reading
PK Emission Level= Antenna Factor +Cable Loss - Amp. factor + Reading
AV Emission Level= PK Emission Level+20log(dutycycle)

(2) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

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9.6 20 dB bandwidth

Test Method

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 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. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

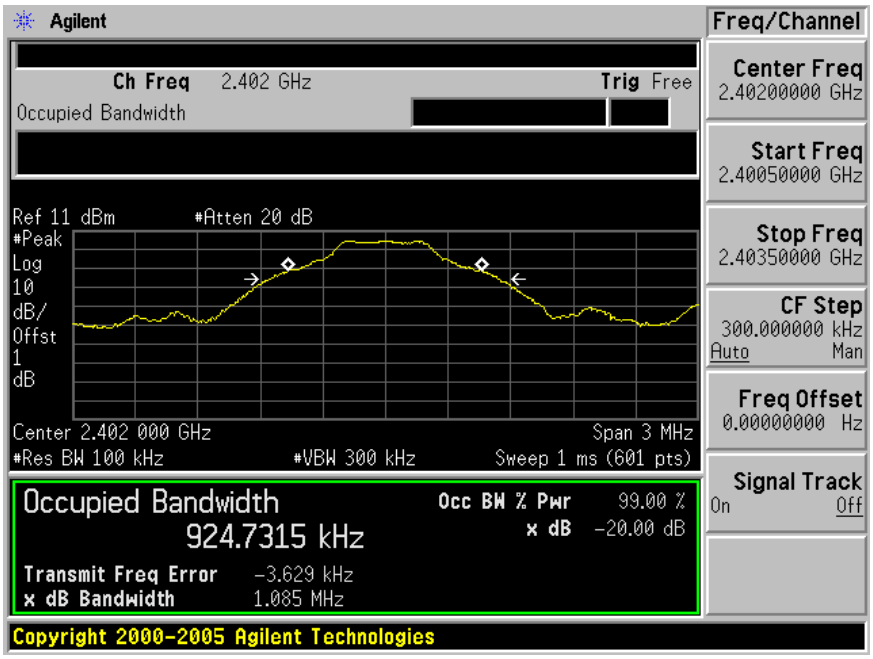
Limit

Limit [kHz]
N/A

20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1085	924.73	--	Pass
2441	1088	925.54	--	Pass
2480	1090	927.57	--	Pass



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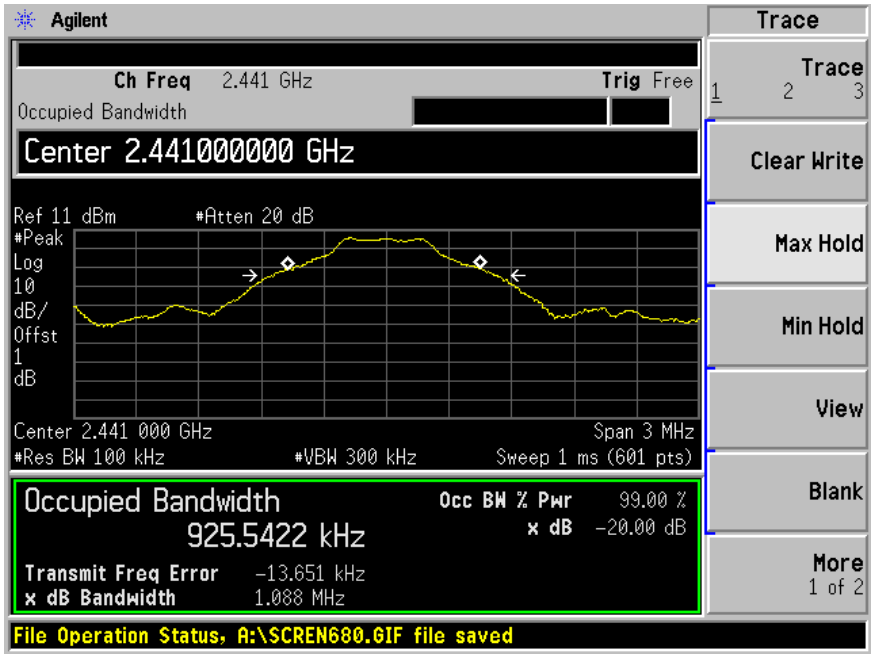
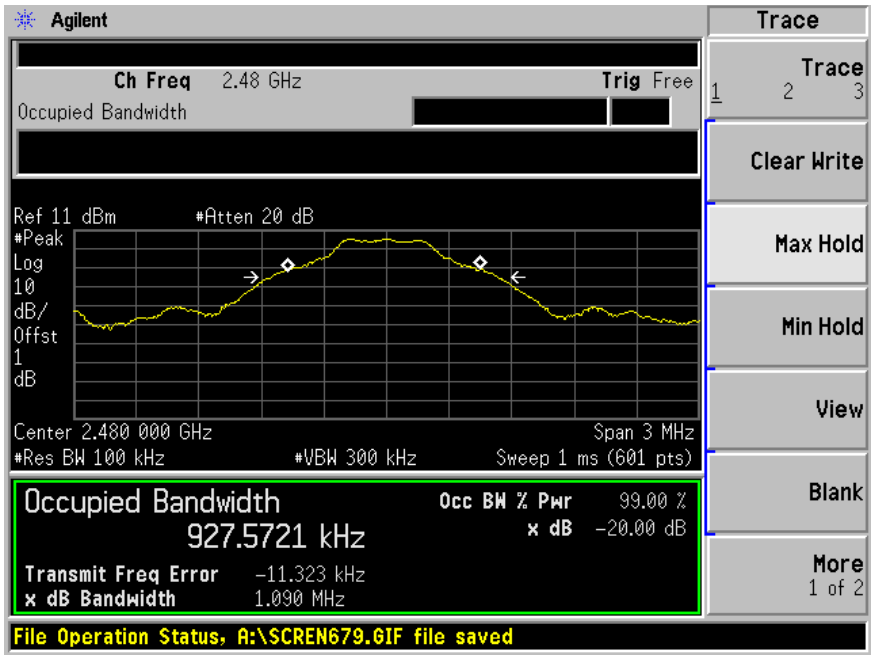
20 dB bandwidth and 99% Occupied Bandwidth





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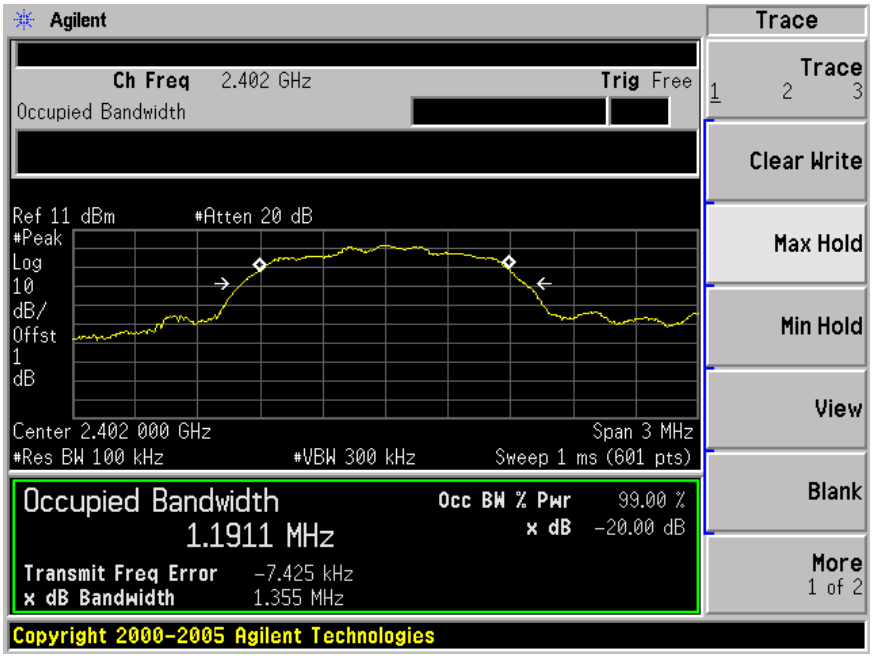
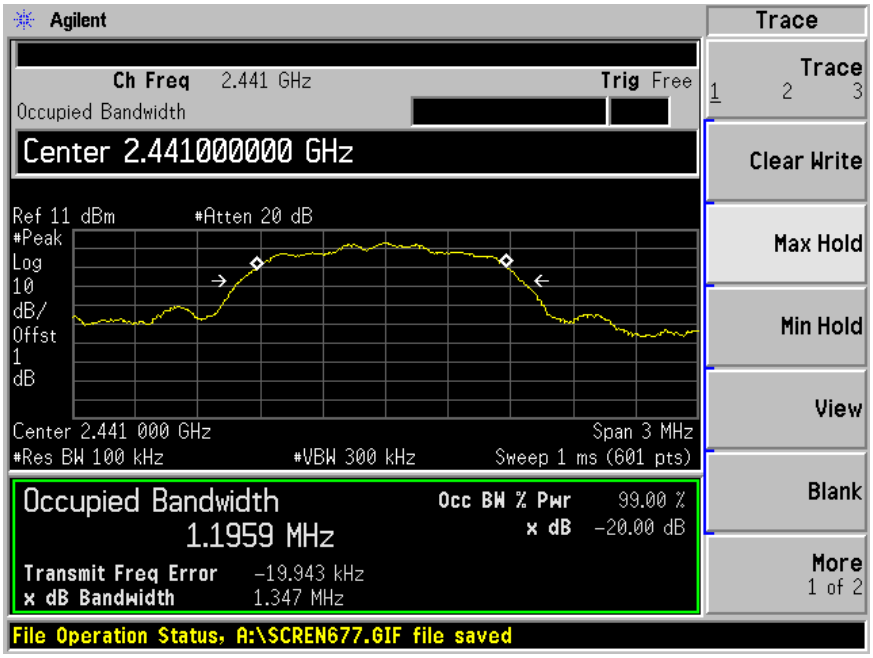
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1355	1191.1	--	Pass
2441	1347	1195.9	--	Pass
2480	1349	1198.0	--	Pass





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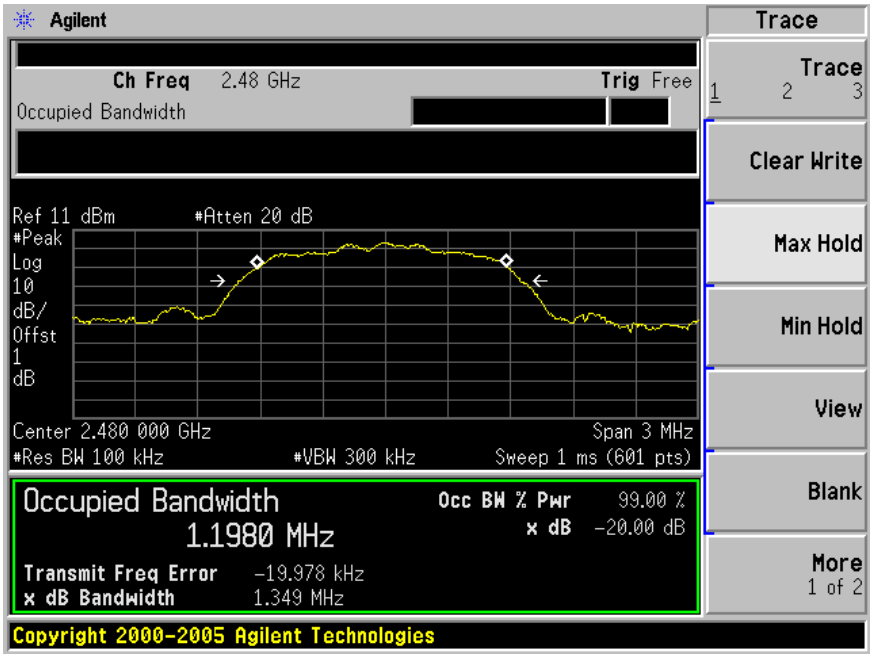
20 dB bandwidth and 99% Occupied Bandwidth



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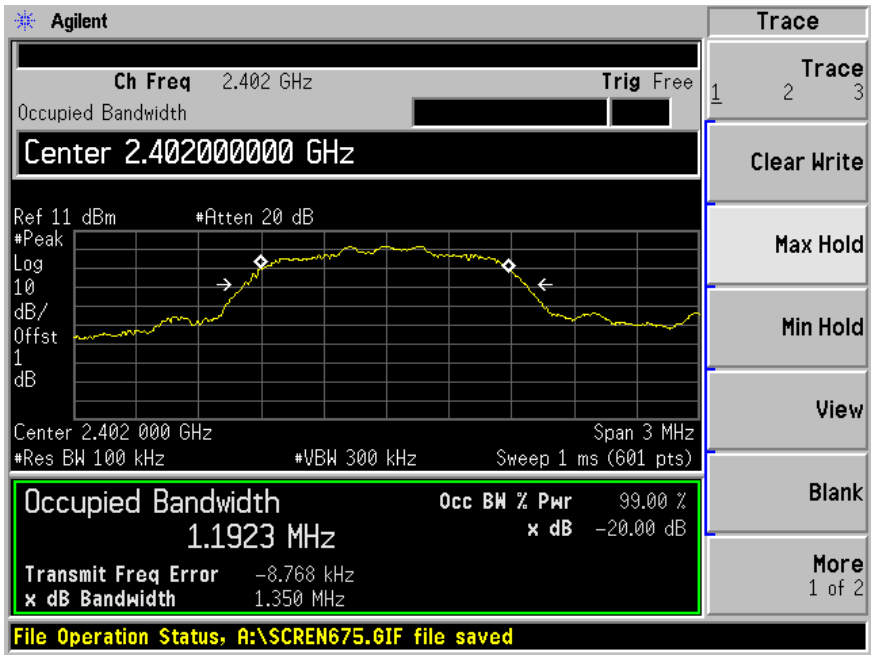
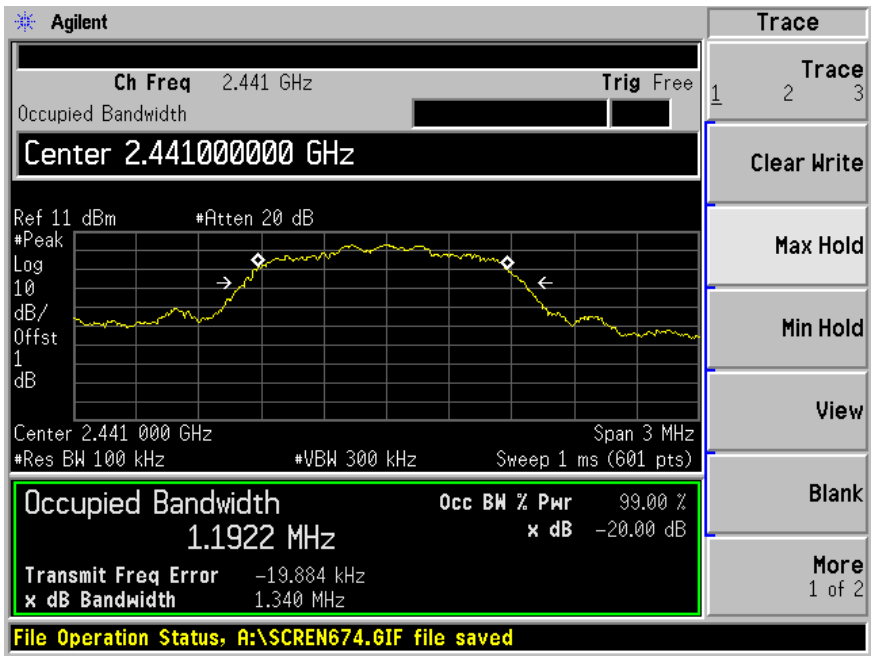
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode 8-DPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1350	1192.3	--	Pass
2441	1340	1192.2	--	Pass
2480	1351	1191.3	--	Pass





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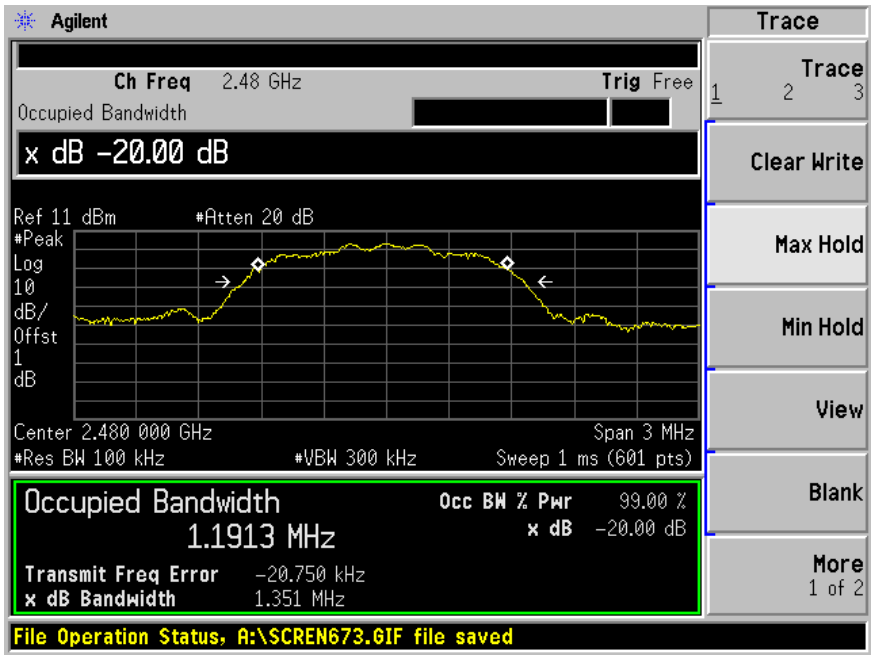
20 dB bandwidth and 99% Occupied Bandwidth



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9.7 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit kHz
⩾25KHz or 2/3 of the 20 dB bandwidth which is greater

GFSK Modulation Limit

Frequency MHz	2/3 of 20 dB Bandwidth kHz
2402	723.33
2441	725.33
2480	726.67

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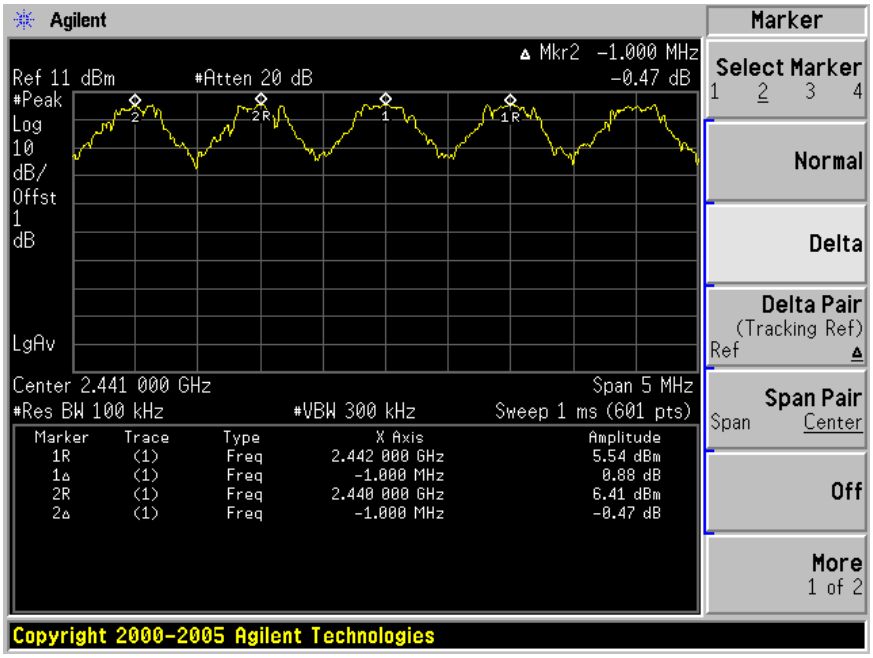
Carrier Frequency Separation

GFSK Modulation test result

Frequency MHz	Carrier Frequency Separation kHz	Result
2402	1000	Pass
2441	1000	Pass
2480	1000	Pass



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9.8 Number of hopping frequencies

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit number
⩾ 15

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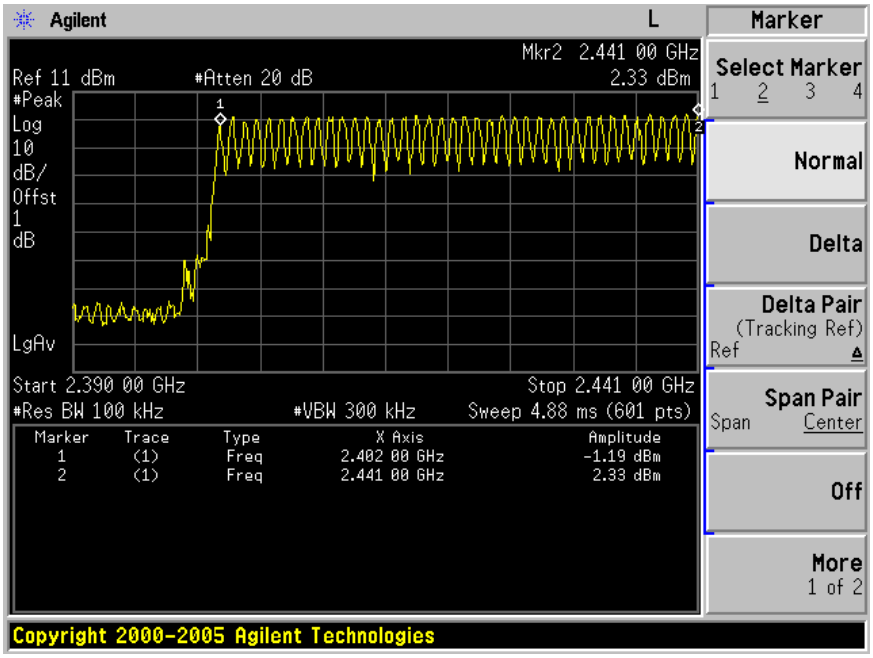
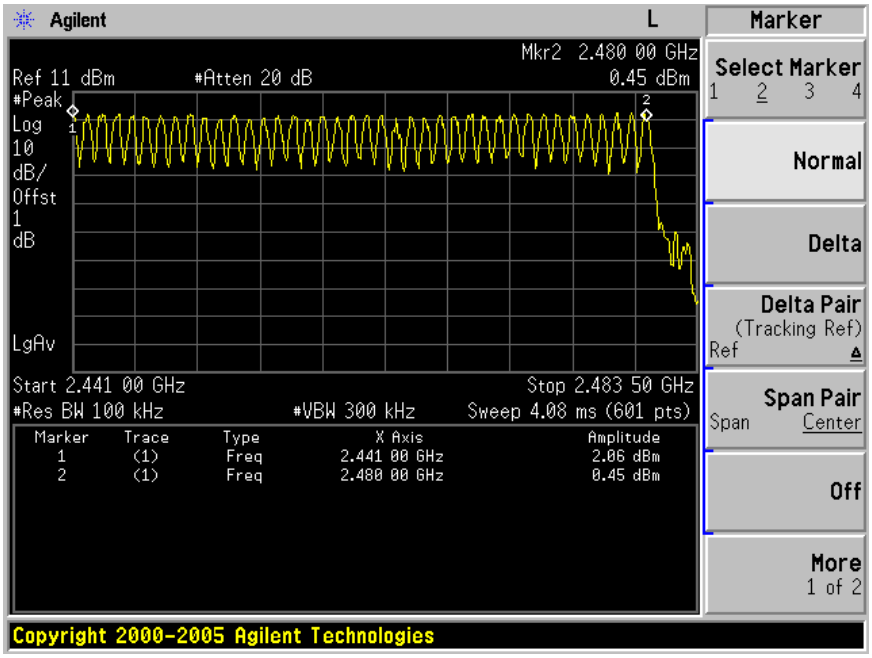
Number of hopping frequencies

Test result:

Number of hopping frequencies	Result
79	Pass





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9.9 Dwell Time

Test Method

1. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% of the 20 dB bandwidth, VBW ≥RBW, Sweep = auto,Detector function = peak
   Trace = max hold
2. Adjust the center frequency of spectrum analyzer on any frequency be measured.
3. Measure the Dwell Time by spectrum analyzer Marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

According to §15.247(a)(1)(iii), The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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Dwell Time

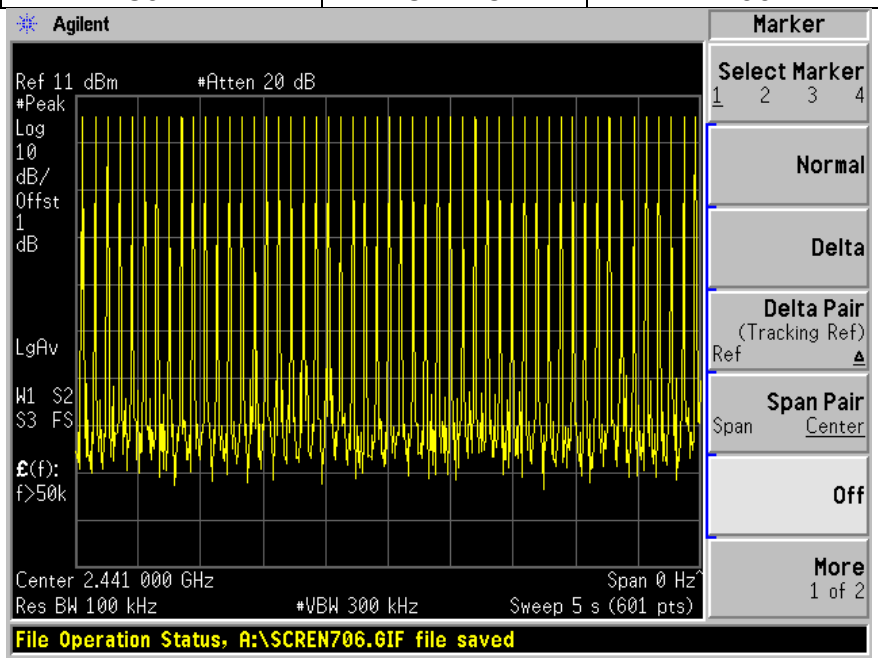
Dwell time

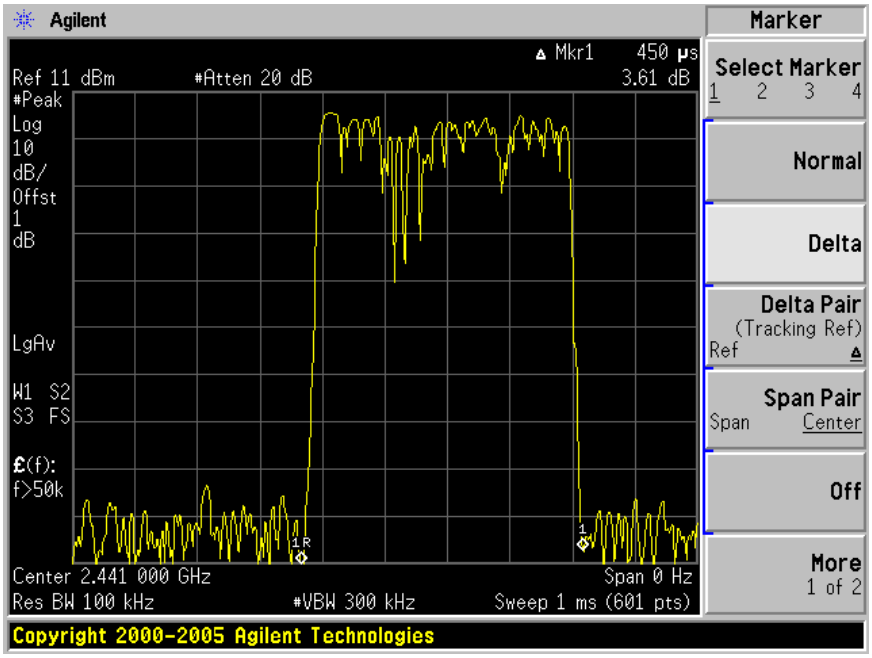
The maximum dwell time shall be 0,4 s.

Bluetooth Mode GFSK Modulation:

Test Result

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	450.0	145.04	< 400	Pass
DH3	1730	284.74	< 400	Pass
DH5	3017	324.15	< 400	Pass





DH1

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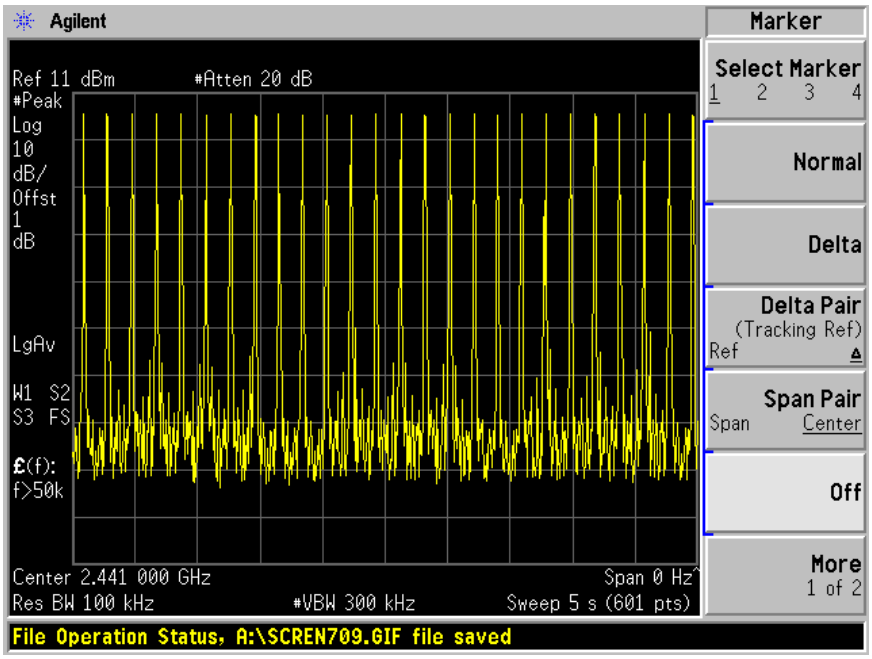
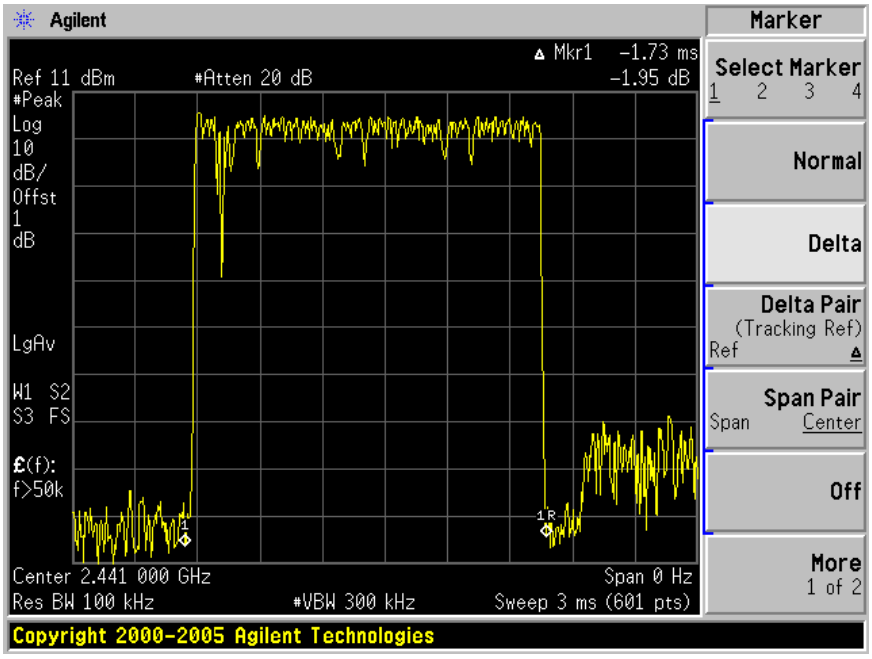
Dwell Time





DH3

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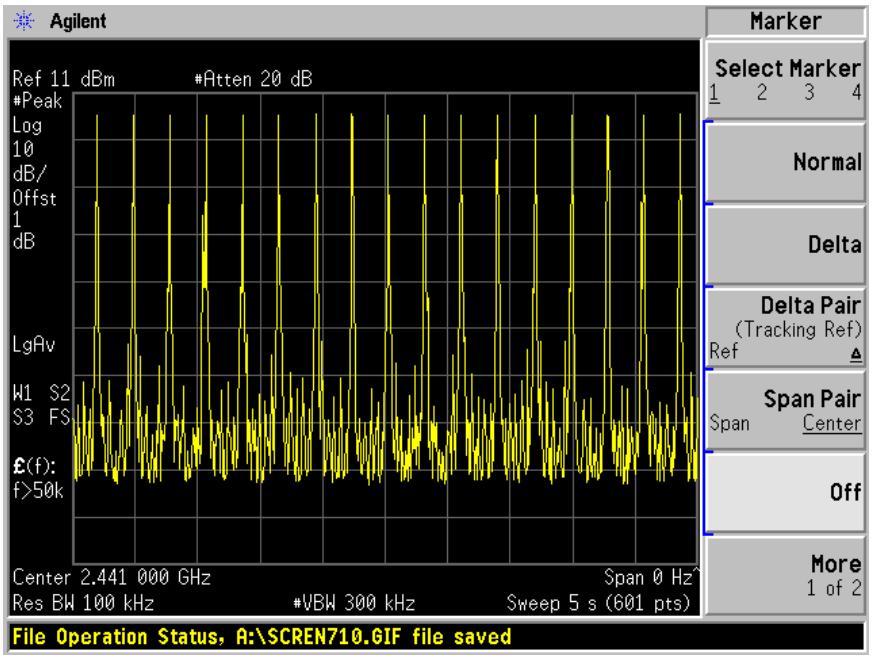
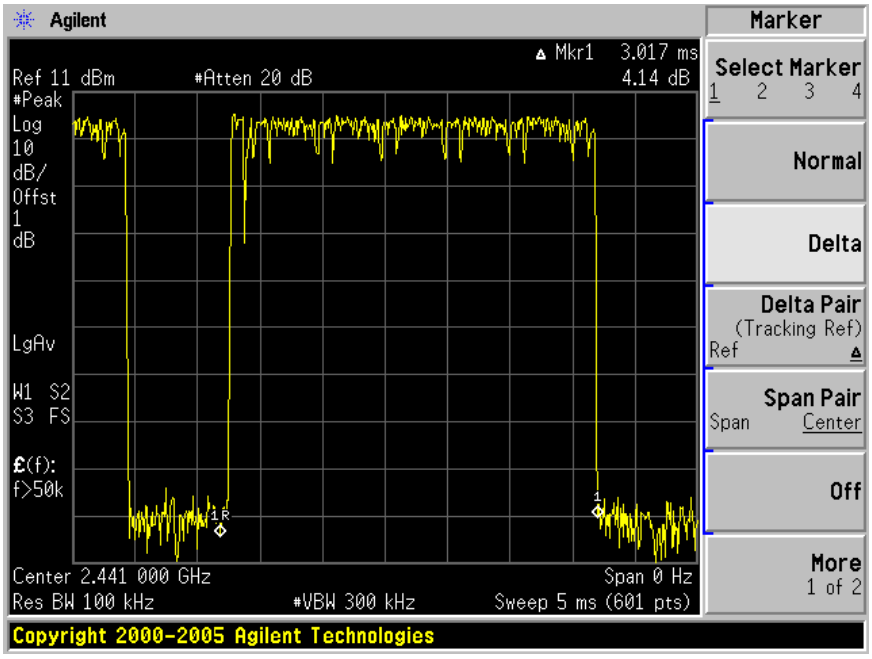
Dwell Time





DH5

Note:
A period time=79x0.4(s)=31.6(s)

DH1	time slot= 51(times)/5(s) *450(μs) *31.6(s)= 145.04(ms)
DH3	time slot= 26(times)/5(s) *1730 (μs) *31.6(s)= 284.74(ms)
DH5	time slot= 17(times)/5(s) *3017 (μs) *31.6(s)= 324.15(ms)

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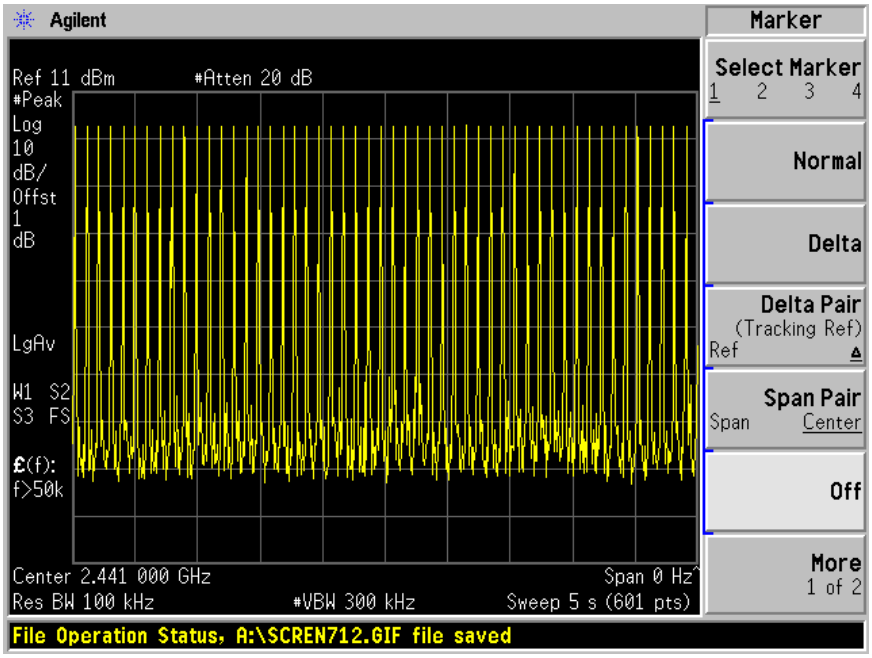
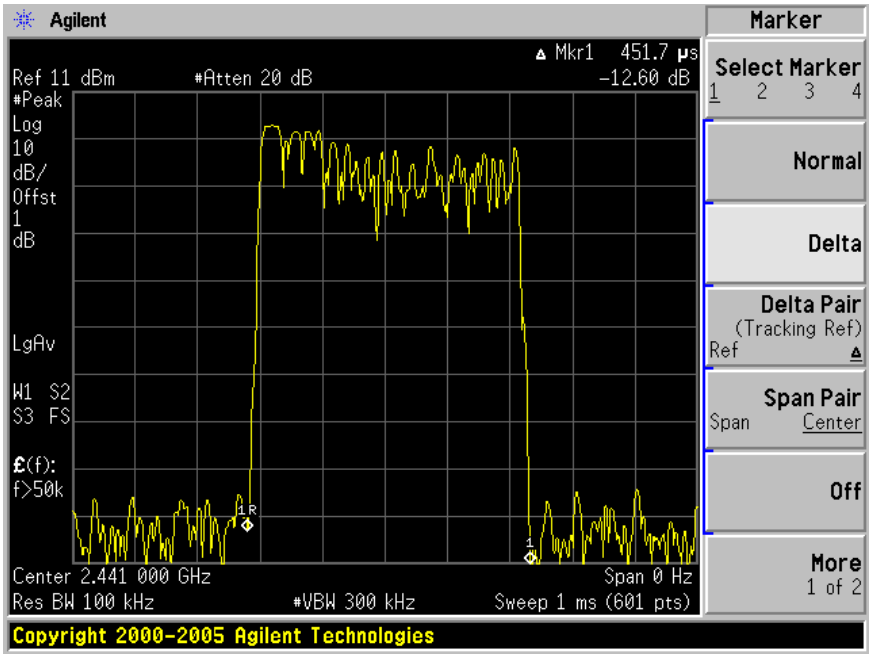
Bluetooth Mode π/4-DQPSK Modulation:

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	451.7	145.59	< 400	Pass
DH3	1725	272.55	< 400	Pass
DH5	2992	321.46	< 400	Pass





DH1

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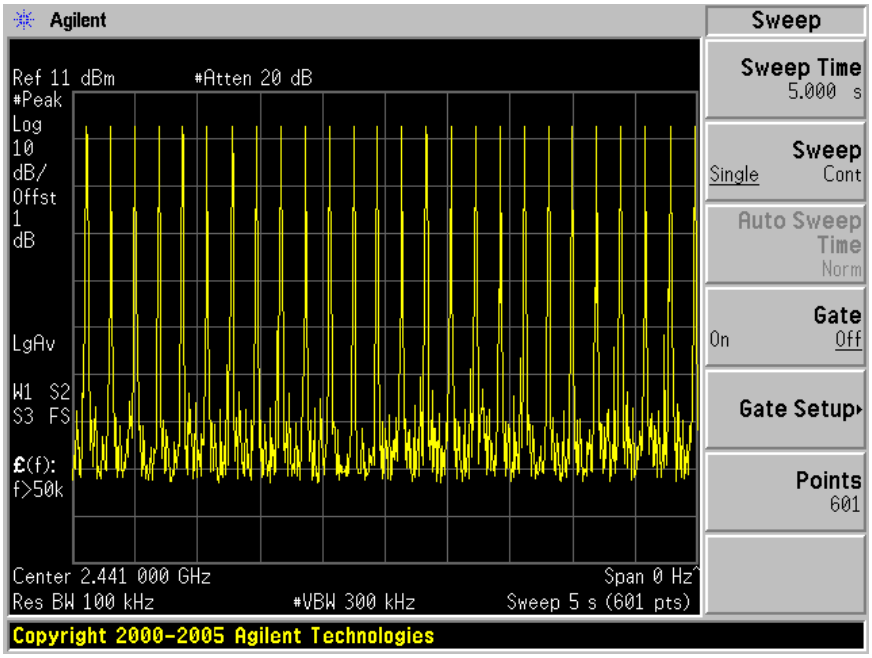

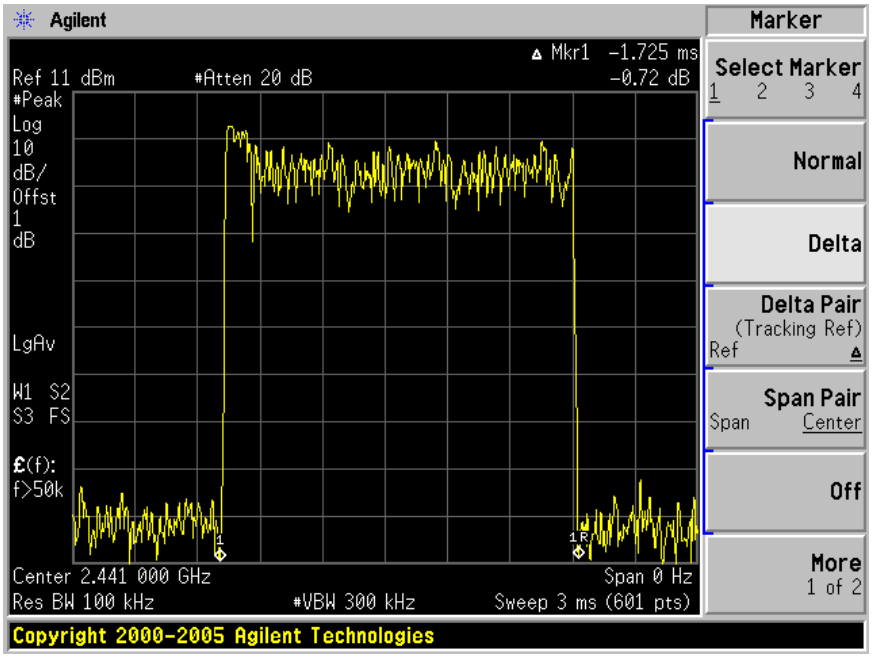

DH3

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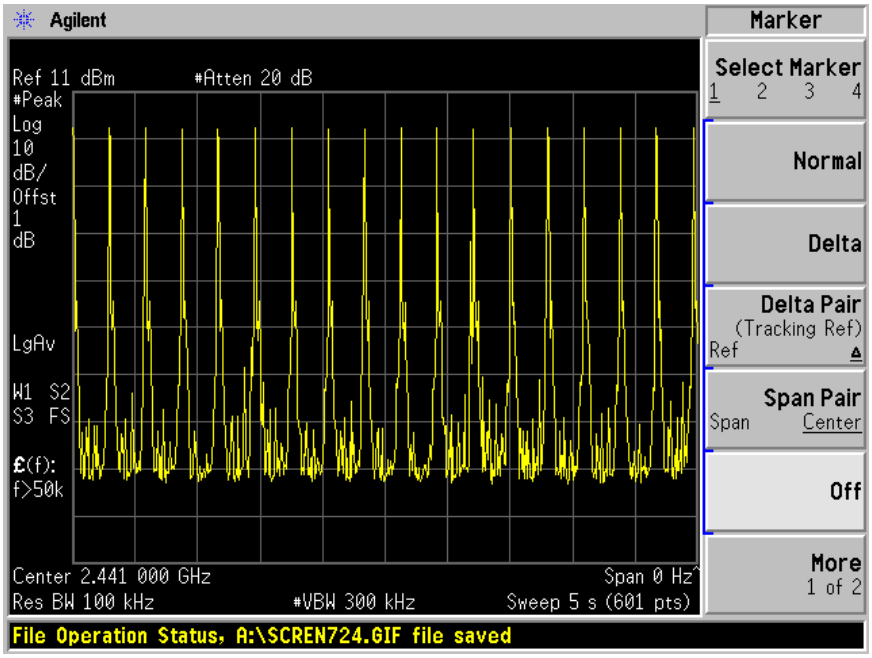

DH5

Note:
A period time=79x0.4(s)=31.6(s)

DH1	time slot= 51(times)/5(s) *451.7(μs) *31.6(s)= 145.59(ms)
DH3	time slot= 25(times)/5(s) *1725 (μs) *31.6(s)= 272.55(ms)
DH5	time slot= 17(times)/5(s) *2992(μs) *31.6(s)= 321.46(ms)

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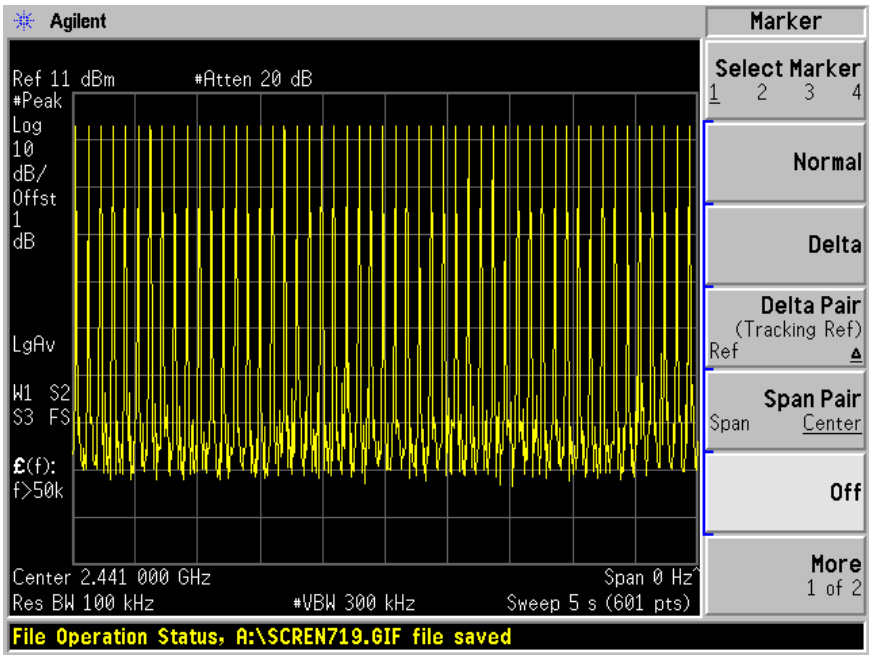
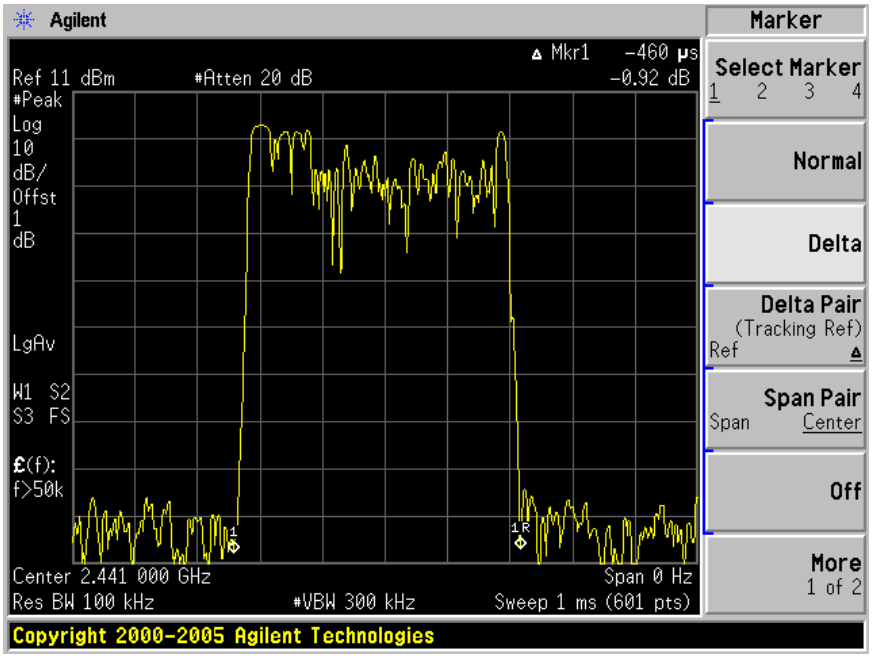
Bluetooth Mode 8-DPSK Modulation:

Test Result

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	460	148.27	< 400	Pass
DH3	1725	272.55	< 400	Pass
DH5	3042	326.83	< 400	Pass





DH1

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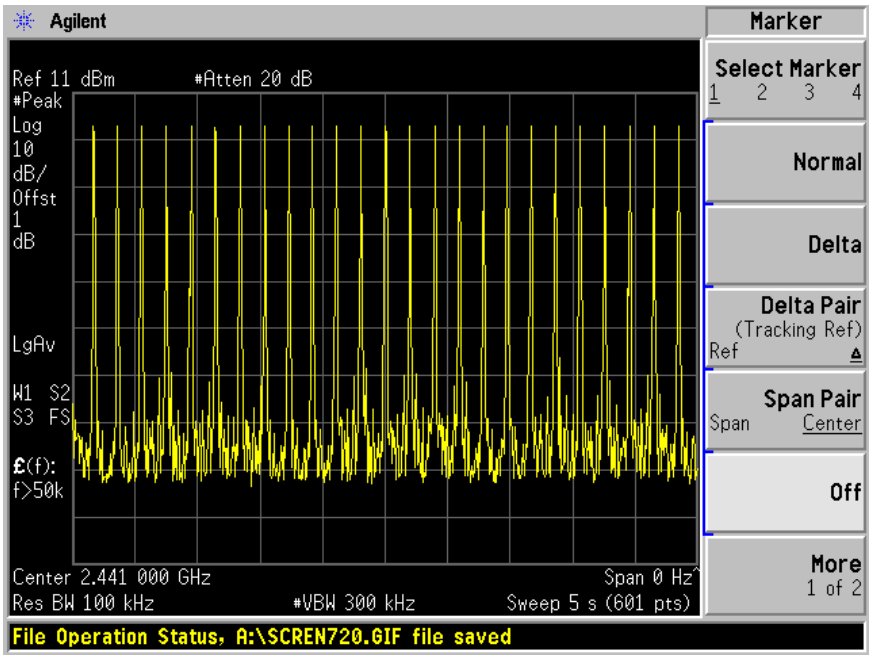

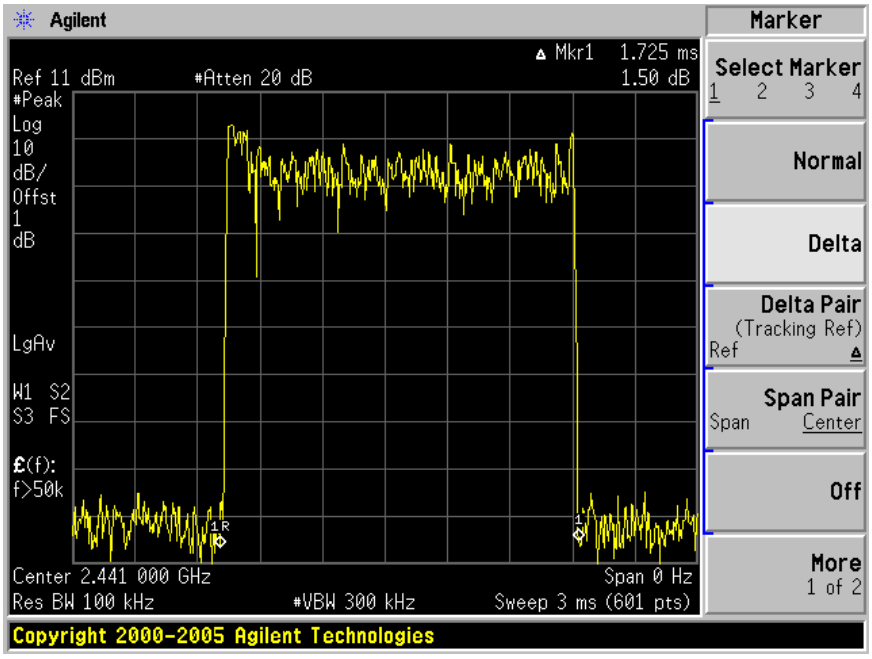

DH3

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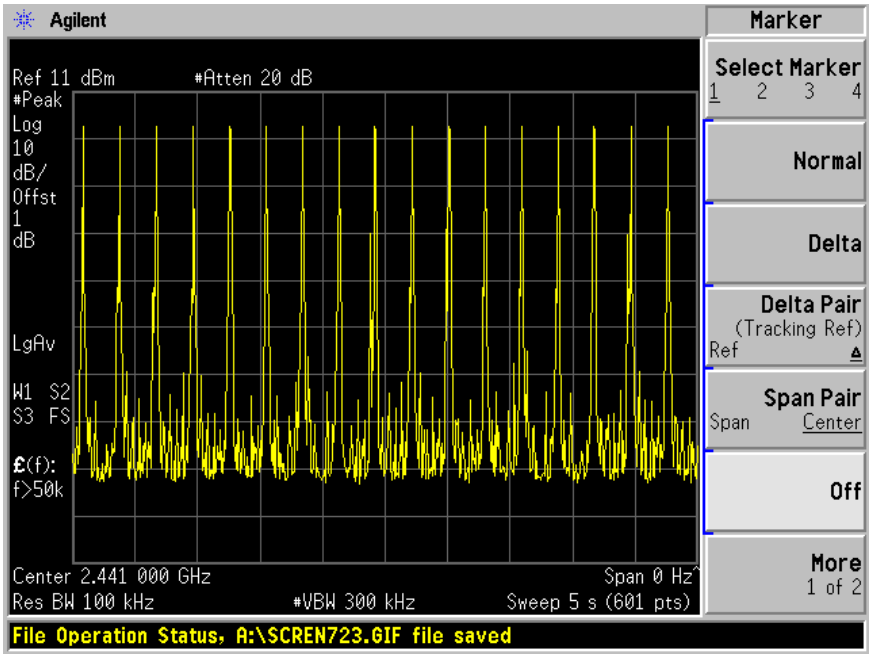

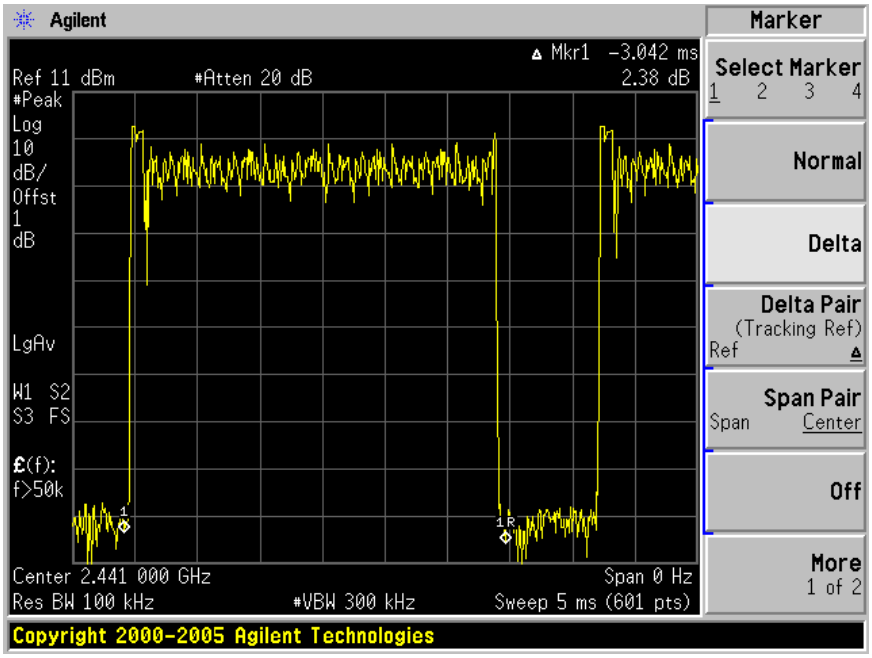

DH5

Note:
A period time=79x0.4(s)=31.6(s)

DH1	time slot= 51(times)/5(s) *440(μs) *31.6(s)= 148.27(ms)
DH3	time slot= 25(times)/5(s) *1710 (μs) *31.6(s)= 272.55(ms)
DH5	time slot= 17(times)/5(s) *2983 (μs) *31.6(s)= 326.83(ms)

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9 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items		Extended Uncertainty
RE	Field strength (dBμV/m)	U=4.32dB (30MHz-25GHz)
CE	Disturbance Voltage (dBμV)	U=2.4dB

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