FCC- TEST REPORT

Report Number	:	**68.950.12.144.01**	Date of Issue:	21 September 2012

Model	:	80-VFREEB(00353), 80-VFREES(00354), 80-VFREEW(00355)
Product Type	:	vFree On-Ear Bluetooth Headphone
Applicant	:	Velodyne Acoustics, Inc.
Address	:	345 Digital Drive Morgan Hill, CA 95037, United States
Production Facility	:	Charter Media (Dongguan) Co., Ltd.
Address	:	Dabandi Industrial Zone, Daning District, Humen Town, Dongguan City, Guangdong Province 523930, P. R. China

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	68

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2 Details about the Test Laboratory

Details about the Test Laboratory

Location 1:	Jiangsu TÜV Product Service Ltd. – Shenzhen Branch 6th Floor, H Hall, Century Craftwork Culture Square, No. 4001, Fuqiang Road, Futian District 518048, Shenzhen,P.R.C.
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299
Location 2:	Audix Technology (shenzhen) Co.,Ltd No. 6, Ke Feng Rd., 52 Block Shenzhen Science and 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: VFree On-Ear Bluetooth Headphone

Model no.: 80-VFREES(00354)

Brand Name: Velodyne

Options and accessories: NIL

Rating: 3.7VDC (Supplied by Li-ion rechargeable battery)
5VDC (Charged by PC USB Port)

RF Transmission Frequency: 2402-2480MHz

Antenna Gain: 0dBi

Description of the EUT: NIL

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
NoteBook	Lenovo	X200	---

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C, 10-1-2011 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 Result			Test Location
		Pass	Fail	N/A	
15.207 Conducted Emission AC Power Port	8	☒	☐	☐	Location 2
15.247 (b) (1) Conducted peak output power	12	☒	☐	☐	Location 2
15.247(d) Band edge compliance of RF emissions	14	☒	☐	☐	Location 2
15.247(d) Spurious RF conducted emissions	24	☒	☐	☐	Location 2
15.247(d) 15.209 Spurious radiated emissions	39	☒	☐	☐	Location 2
15.247(a)(1) 20dB bandwidth	43	☒	☐	☐	Location 2
15.247(a)(1) Carrier frequency separation	51	☒	☐	☐	Location 2
15.247(a)(1)(iii) Number of hopping frequencies	54	☒	☐	☐	Location 2
15.247(a)(1)(iii) Dwell Time	57	☒	☐	☐	Location 2

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: YRD-VF1 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

The difference between all models only lies in the colour of enclosure, 80-VFREEB(00353) is black, 80-VFREES(00354) is silver, 80-VFREEW(00355) is white, so all the tests were applied on 80-VFREES(00354), other models are deemed to fulfill relevant requirement without further testing.

All the configurations of the product were tested and only the worst test results are listed in the report.

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: 7 September 2012

Testing Start Date: 10 September 2012

Testing End Date: 18 September 2012

- Jiangsu TÜV Product Service Ltd. – Shenzhen Branch -

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

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7 Technical Requirement

7.1 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

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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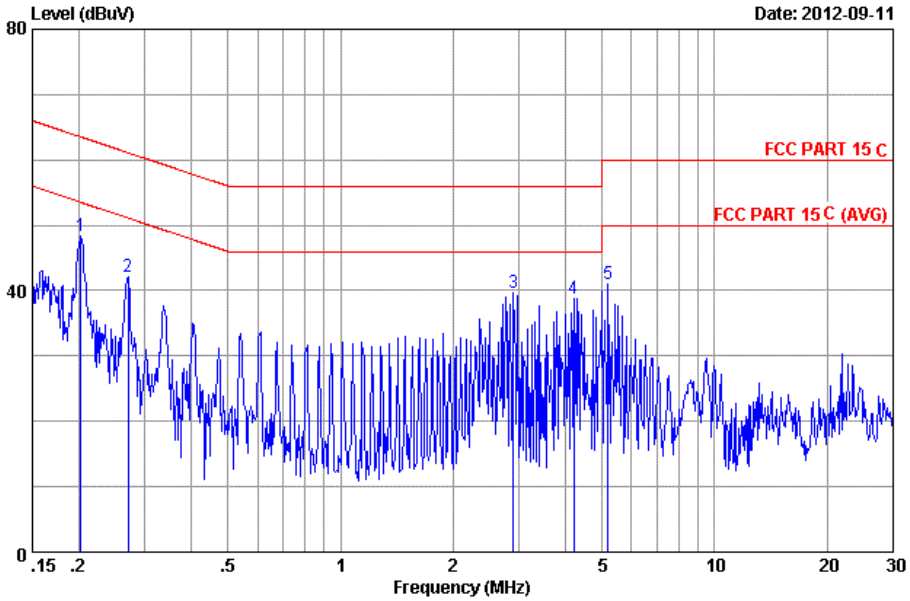
Conducted Emission

Product Type	:	vFree On-Ear Bluetooth Headphone
M/N	:	80-VFREES(00354)
Operating Condition	:	Charging and transmitting
Test Specification	:	Vertical
Comment	:	AC 120V/60Hz




```
Site no       :1#conduction                    Data No    :3
Dis./Ant.     :**   2012 ESH2-Z5 LINE
Limit         :FCC PART 15 B
Env./Ins.     :Temp:22.9'    Humi:52%          Engineer   :Alan_Chen
EUT           :Vfree On-ear
Power Rating  :AC 120V/60Hz
Test Mode     :Charging &transmitting
              :
              :
```

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.20181	0.15	9.94	38.29	48.38	63.54	15.16	QP
2	0.27009	0.15	9.95	31.99	42.09	61.12	19.03	QP
3	2.900	0.22	9.94	29.52	39.68	56.00	16.32	QP
4	4.202	0.24	9.94	28.68	38.86	56.00	17.14	QP
5	5.194	0.26	9.95	30.71	40.92	60.00	19.08	QP

```
Remarks: 1.Emission Level=LISN Factor+Cable Loss(Include 10dB pulse limit)
           +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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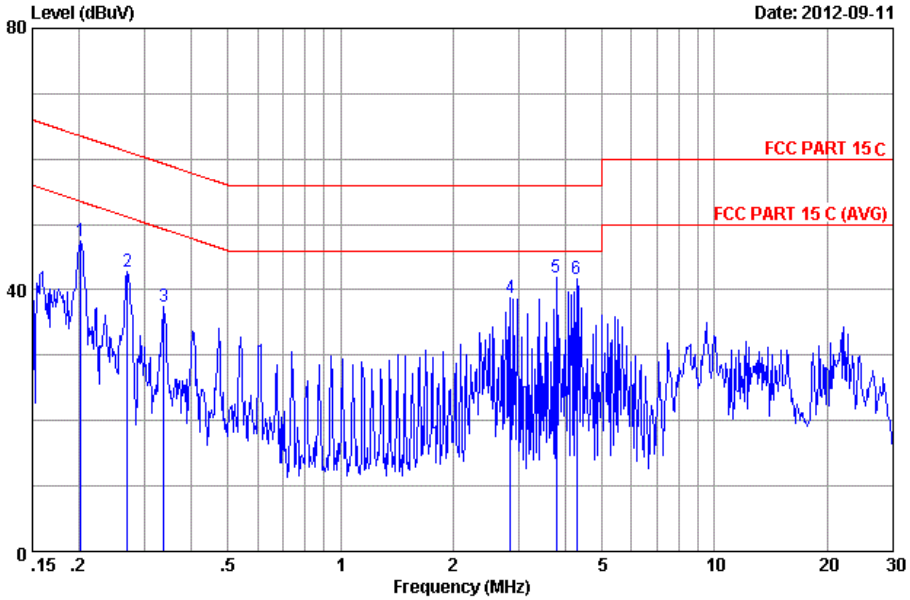
Conducted Emission

Product Type	:	vFree On-Ear Bluetooth Headphone
M/N	:	80-VFREES(00354)
Operating Condition	:	Charging and transmitting
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz




```
Site no       :1#conduction                    Data No    :4
Dis./Ant.     :**   2012 ESH2-Z5 NEUTRAL
Limit         :FCC PART 15 B
Env./Ins.     :Temp:22.9'    Humi:52%          Engineer   :Alan_Chen
EUT           :Vfree On-ear
Power Rating  :AC 120V/60Hz
Test Mode     :Charging &transmitting
              :
              :
```

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.20181	0.14	9.94	37.50	47.58	63.54	15.96	QP
2	0.26866	0.14	9.95	32.63	42.72	61.16	18.44	QP
3	0.33740	0.15	9.95	27.23	37.33	59.27	21.94	QP
4	2.839	0.22	9.94	28.62	38.78	56.00	17.22	QP
5	3.779	0.23	9.94	31.79	41.96	56.00	14.04	QP
6	4.269	0.24	9.94	31.56	41.74	56.00	14.26	QP

```
Remarks: 1.Emission Level=LISN Factor+Cable Loss(Include 10dB pulse limit)
           +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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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Spectrum	Agilent	E4407B	MY41440292	May.08, 13
Test Receiver	Rohde & Schwarz	ESVS10	834468/011	May.08, 13
Amplifier	HP	8447D	2648A04738	May.08, 13
Bilog Antenna	Schaffner	CBL6111C	2598	Dec.14, 12
RF Cable	MIYAZAKI	8D-FB	3# Chamber No.1	May.08, 13
Coaxial Switch	Anritsu	MP59B	M73989	May.08, 13

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7.2 Conducted peak output power

Test Method

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an Power meter
3. Add a correction factor to the display.

Limits for conducted peak output power measurements

Frequency Range MHz	Limit W	Limit dBm
2400-2483	≤1	≤30

Conducted peak output power

Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	3.48	Pass
Middle channel 2441MHz	3.38	Pass
High channel 2480MHz	-0.17	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	2.80	Pass
Middle channel 2441MHz	2.09	Pass
High channel 2480MHz	0.43	Pass

Bluetooth Mode 8-DPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	2.80	Pass
Middle channel 2441MHz	2.10	Pass
High channel 2480MHz	0.44	Pass

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Test Equipment

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL DUE DATE
Spectrum Analyzer	Agilent	E4446A	US44300459	May 08, 2013

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7.3 Band edge compliance of RF emissions

Test Method

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.4 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW and VBW to 1MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10Hz to measure the average radiated field strength.
The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW and VBW to 100kHz, to measure the conducted peak band edge.

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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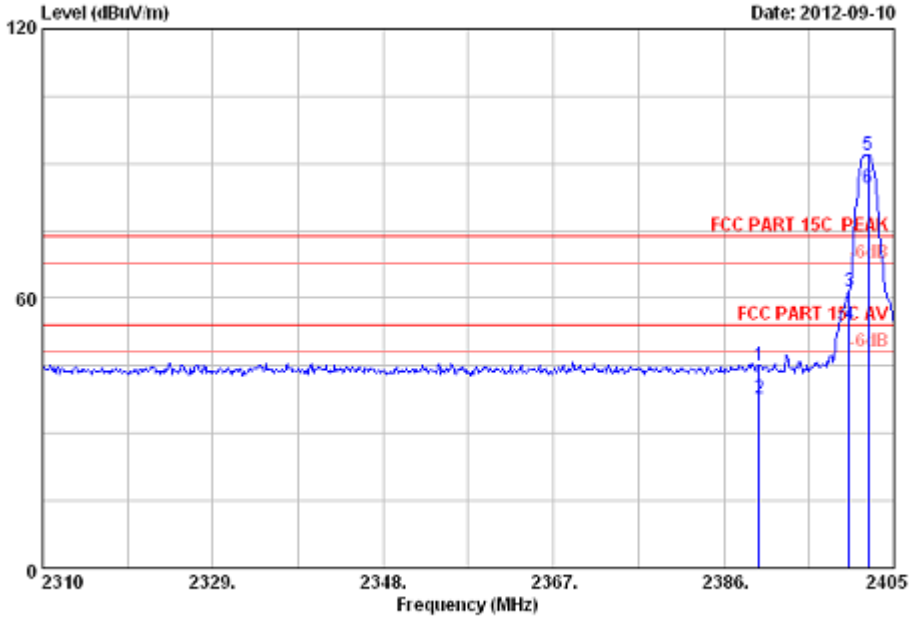
Band edge compliance of RF emissions

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

Bluetooth Mode GFSK Modulation Test Result:

Lower edge peak Plot:
Vertical:




```
Site no.      : 3m Chamber              Data no.   : 14
Dis. / Ant.   : 3m   2011 3115 4580     Ant. pol.  : VERTICAL
Limit         : FCC PART 15C  PEAK
Env. / Ins.   : 23*C/54%                Engineer   : Leo-Li
EUT           : vFree On-Ear Bluetooth Headphone
Power supply  : DC  3.7V
Test mode     : Tx Mode  GFSK 2402MHz
M/N           : 80-VFREES(00354)
```

	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	27.96	6.01	34.44	45.48	45.01	74.00	28.99	Peak
2	2390.000	27.96	6.01	34.44	38.17	37.70	54.00	16.30	Average
3	2400.000	27.96	6.01	34.44	62.05	61.58	74.00	12.42	Peak
4	2400.000	27.96	6.01	34.44	54.74	54.27	54.00	-0.27	Average
5	2402.150	27.96	6.01	34.44	92.42	91.95	74.00	-17.95	Peak
6	2402.150	27.96	6.01	34.44	85.11	84.64	54.00	-30.64	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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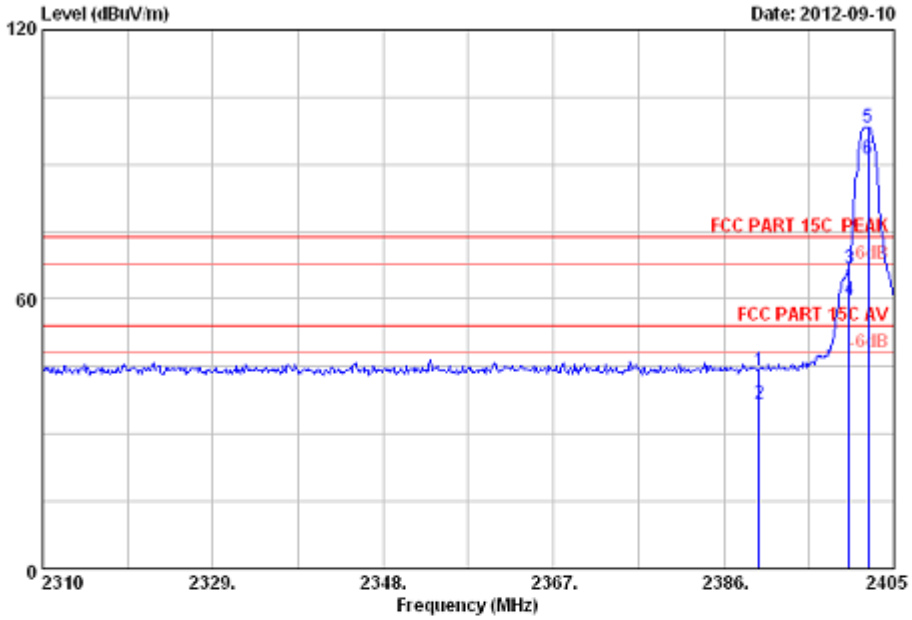
Band edge compliance of RF emissions

Lower edge peak Plot:
Horizontal:



Site no. : 3m Chamber Data no. : 13
Dis. / Ant. : 3m 2011 3115 4580 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23*C/54% Engineer : Leo-Li
EUT : vFree On-Ear Bluetooth Headphone
Power supply : DC 3.7V
Test mode : Tx Mode GFSK 2402MHz
M/N : 80-VFREES(00354)

	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	27.96	6.01	34.44	44.56	44.09	74.00	29.91	Peak
2	2390.000	27.96	6.01	34.44	37.25	36.78	54.00	17.22	Average
3	2400.000	27.96	6.01	34.44	67.46	66.99	74.00	7.01	Peak
4	2400.000	27.96	6.01	34.44	60.15	59.68	54.00	-5.68	Average
5	2402.150	27.96	6.01	34.44	98.91	98.44	74.00	-24.44	Peak
6	2402.150	27.96	6.01	34.44	91.60	91.13	54.00	-37.13	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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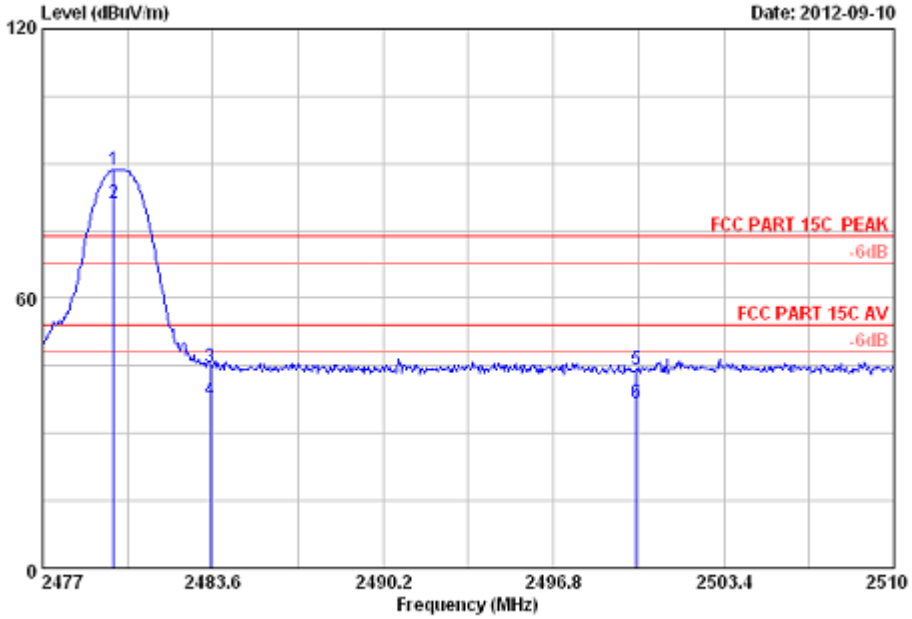
Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:




```
Site no.      : 3m Chamber              Data no.   : 19
Dis. / Ant.   : 3m   2011 3115 4580     Ant. pol.  : VERTICAL
Limit         : FCC PART 15C  PEAK
Env. / Ins.   : 23*C/54%                Engineer   : Leo-Li
EUT           : vFree On-Ear Bluetooth Headphone
Power supply  : DC  3.7V
Test mode     : Tx Mode  GFSK 2480MHz
M/N           : 80-VFREES(00354)
```

	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	28.08	6.15	34.45	88.84	88.62	74.00	-14.62	Peak
2	2479.739	28.08	6.15	34.45	81.54	81.32	54.00	-27.32	Average
3	2483.500	28.08	6.15	34.45	44.87	44.65	74.00	29.35	Peak
4	2483.500	28.08	6.15	34.45	37.57	37.35	54.00	16.65	Average
5	2500.000	28.10	6.18	34.45	44.14	43.97	74.00	30.03	Peak
6	2500.000	28.10	6.18	34.45	36.84	36.67	54.00	17.33	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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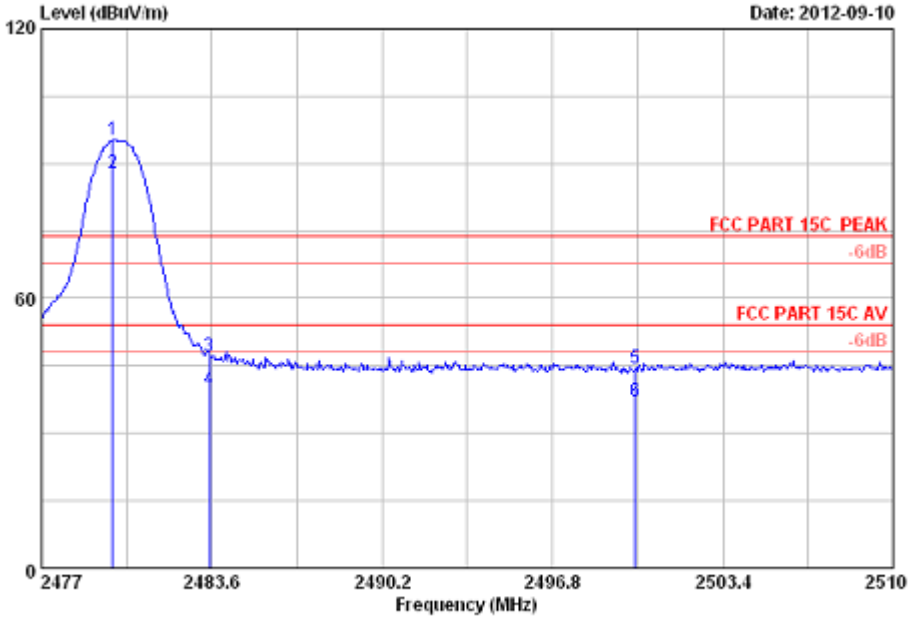
Band edge compliance of RF emissions

Upper edge peak Plot:
Horizontal:



Site no. : 3m Chamber Data no. : 20
Dis. / Ant. : 3m 2011 3115 4580 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23*C/54% Engineer : Leo-Li
EUT : vFree On-Ear Bluetooth Headphone
Power supply : DC 3.7V
Test mode : Tx Mode GFSK 2480MHz
M/N : 80-VFREES(00354)

	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	28.08	6.15	34.45	95.38	95.16	74.00	-21.16	Peak
2	2479.739	28.08	6.15	34.45	88.08	87.86	54.00	-33.86	Average
3	2483.500	28.08	6.15	34.45	47.37	47.15	74.00	26.85	Peak
4	2483.500	28.08	6.15	34.45	40.07	39.85	54.00	14.15	Average
5	2500.000	28.10	6.18	34.45	44.67	44.50	74.00	29.50	Peak
6	2500.000	28.10	6.18	34.45	37.34	37.17	54.00	16.83	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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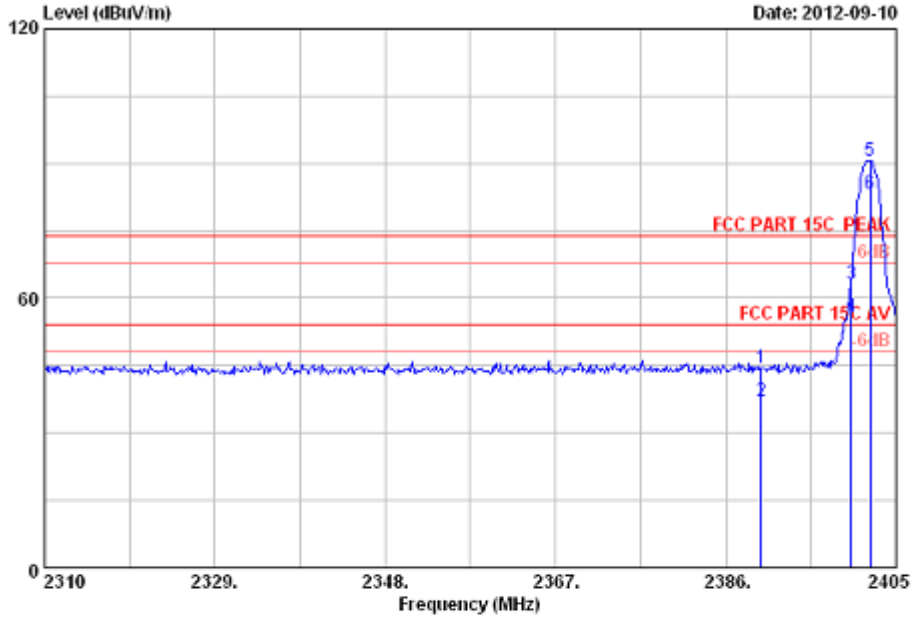
Band edge compliance of RF emissions

Bluetooth Mode 8-DPSK Modulation Test Result:

Lower edge peak Plot:
Vertical:



Site no. : 3m Chamber Data no. : 3
Dis. / Ant. : 3m 2011 3115 4580 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23*C/54% Engineer : Leo-Li
EUT : vFree On-Ear Bluetooth Headphone
Power supply : DC 3.7V
Test mode : Tx Mode 8-DPSK 2402MHz
M/N : 80-VFREES(00354)

	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	27.96	6.01	34.44	44.87	44.40	74.00	29.60	Peak
2	2390.000	27.96	6.01	34.44	37.56	37.09	54.00	16.91	Average
3	2400.000	27.96	6.01	34.44	63.61	63.14	74.00	10.86	Peak
4	2400.000	27.96	6.01	34.44	56.30	55.83	54.00	-1.83	Average
5	2402.150	27.96	6.01	34.44	91.08	90.61	74.00	-16.61	Peak
6	2402.150	27.96	6.01	34.44	83.77	83.30	54.00	-29.30	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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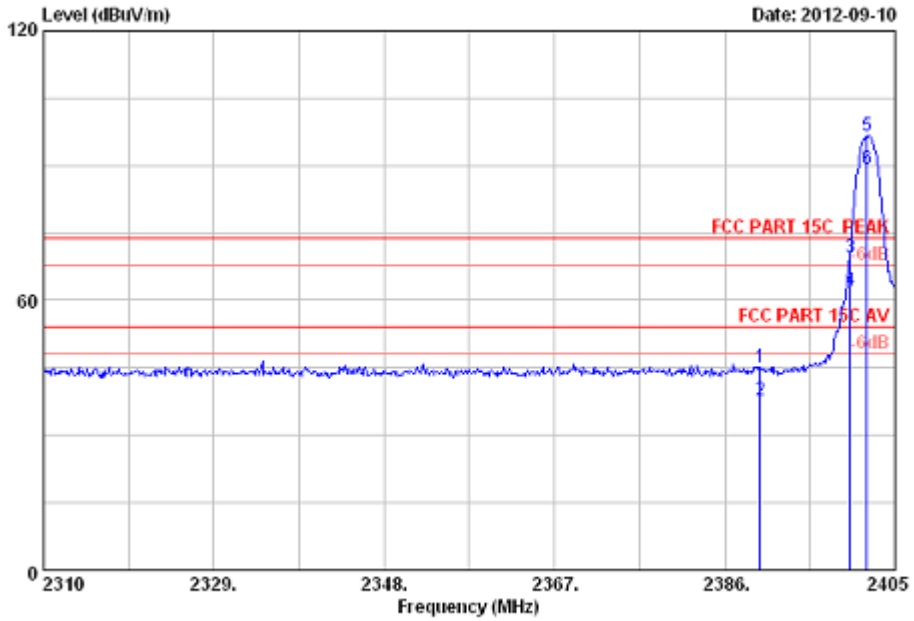
Band edge compliance of RF emissions

Lower edge peak Plot:
Horizontal:



Site no. : 3m Chamber Data no. : 4
Dis. / Ant. : 3m 2011 3115 4580 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23*C/54% Engineer : Leo-Li
EUT : vFree On-Ear Bluetooth Headphone
Power supply : DC 3.7V
Test mode : Tx Mode 8-DPSK 2402MHz
M/N : 80-VFREES(00354)

	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	27.96	6.01	34.44	45.49	45.02	74.00	28.98	Peak
2	2390.000	27.96	6.01	34.44	38.18	37.71	54.00	16.29	Average
3	2400.000	27.96	6.01	34.44	69.90	69.43	74.00	4.57	Peak
4	2400.000	27.96	6.01	34.44	62.59	62.12	54.00	-8.12	Average
5	2401.865	27.96	6.01	34.44	96.95	96.48	74.00	-22.48	Peak
6	2401.865	27.96	6.01	34.44	89.64	89.17	54.00	-35.17	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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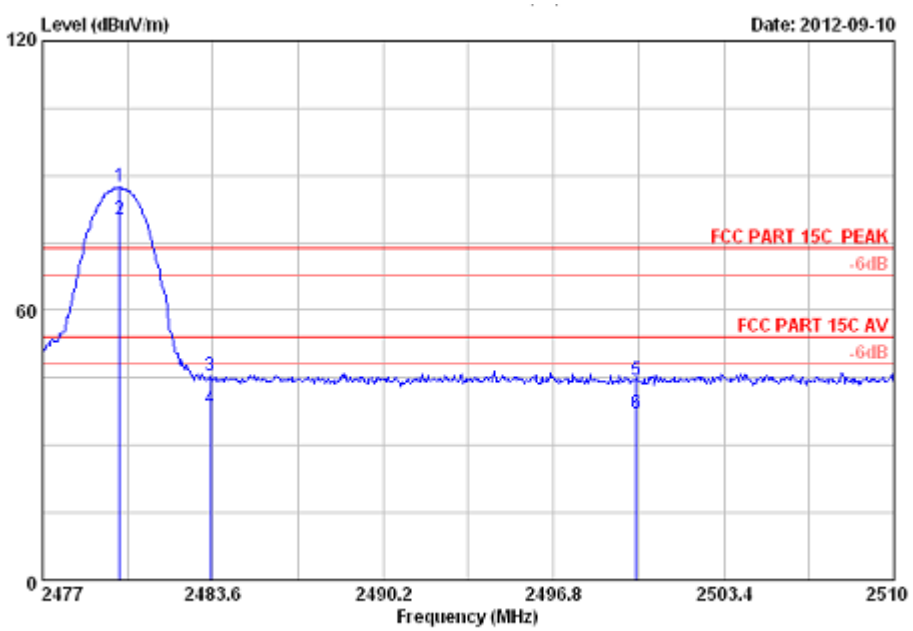
Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:



Site no. : 3m Chamber Data no. : 7
Dis. / Ant. : 3m 2011 3115 4580 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23*C/54% Engineer : Leo-Li
EUT : vFree On-Ear Bluetooth Headphone
Power supply : DC 3.7V
Test mode : Tx Mode 8-DPSK 2480MHz
M/N : 80-VFREES(00354)

	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	28.08	6.15	34.45	87.64	87.42	74.00	-13.42	Peak
2	2479.970	28.08	6.15	34.45	80.34	80.12	54.00	-26.12	Average
3	2483.500	28.08	6.15	34.45	45.53	45.31	74.00	28.69	Peak
4	2483.500	28.08	6.15	34.45	38.23	38.01	54.00	15.99	Average
5	2500.000	28.10	6.18	34.45	44.71	44.54	74.00	29.46	Peak
6	2500.000	28.10	6.18	34.45	37.41	37.24	54.00	16.76	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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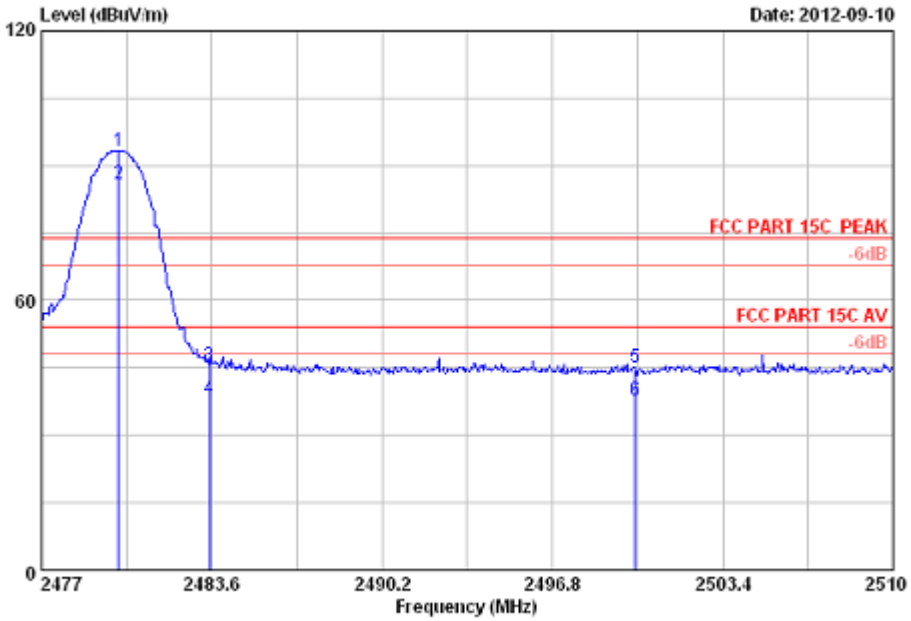
Band edge compliance of RF emissions

Upper edge peak Plot:
Horizontal:



Site no. : 3m Chamber Data no. : 8
Dis. / Ant. : 3m 2011 3115 4580 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
EUT : vFree On-Ear Bluetooth Headphone
Power supply : DC 3.7V
Test mode : Tx Mode 8-DPSK 2480MHz
M/N : 80-VFREES(00354)

	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	28.08	6.15	34.45	93.47	93.25	74.00	-19.25	Peak
2	2479.970	28.08	6.15	34.45	86.17	85.95	54.00	-31.95	Average
3	2483.500	28.08	6.15	34.45	45.70	45.48	74.00	28.52	Peak
4	2483.500	28.08	6.15	34.45	38.40	38.18	54.00	15.82	Average
5	2500.000	28.10	6.18	34.45	45.38	45.21	74.00	28.79	Peak
6	2500.000	28.10	6.18	34.45	38.08	37.91	54.00	16.09	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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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL DUE DATE
Spectrum	Agilent	E4446A	US44300459	May 08, 2013
Amp	HP	8449B	3008A02495	May 08, 2013
Antenna	EMCO	3115	9607-4877	May 17, 2013
Bilog Antenna	Schaffner	CBL6111C	2598	Dec.14, 2012
HF Cable	Hubersuhne	Sucoflex104	---	May 08, 2013

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7.4 Spurious RF conducted emissions

Test Method

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.
Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The resolution bandwidth(RBW) and the video bandwidth (VBW) of the spectrum analyzer were respectively set to 100kHz and 300kHz.

Limit

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

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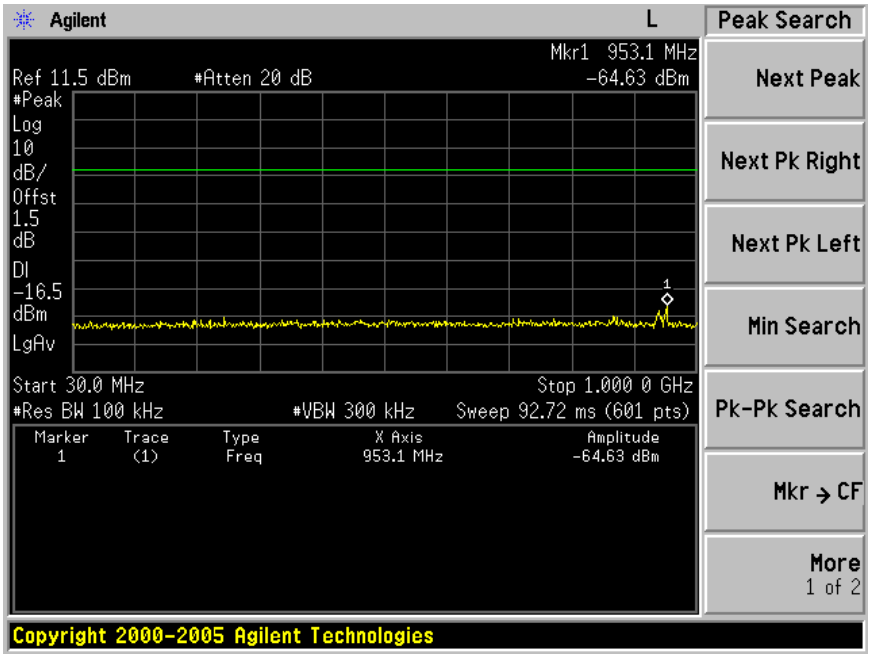
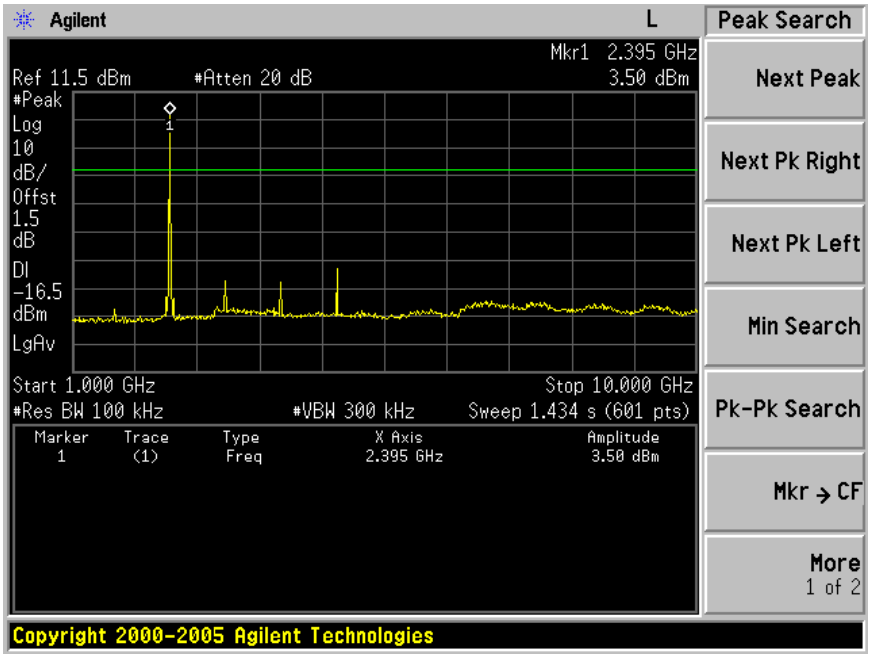
Spurious RF conducted emissions

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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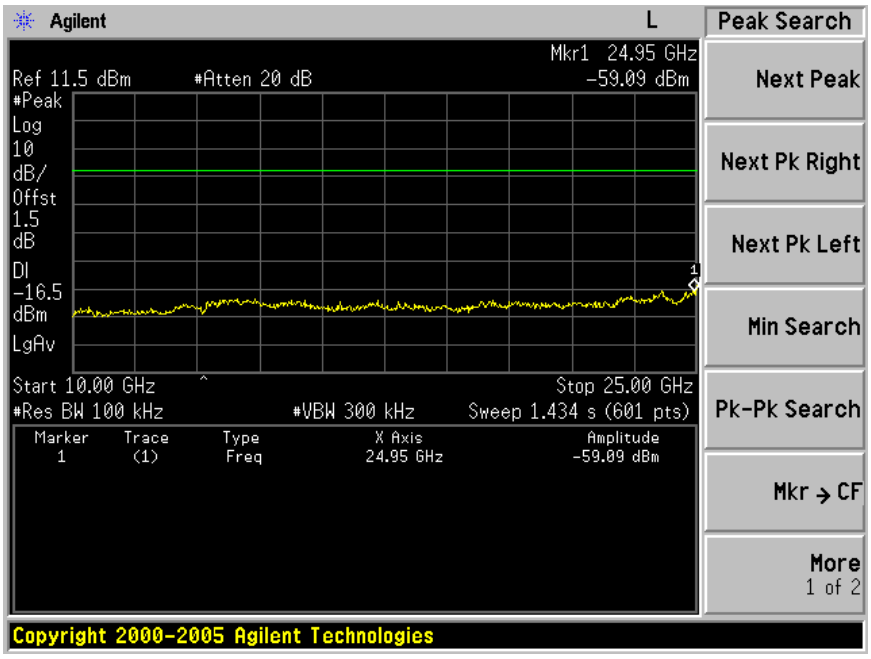

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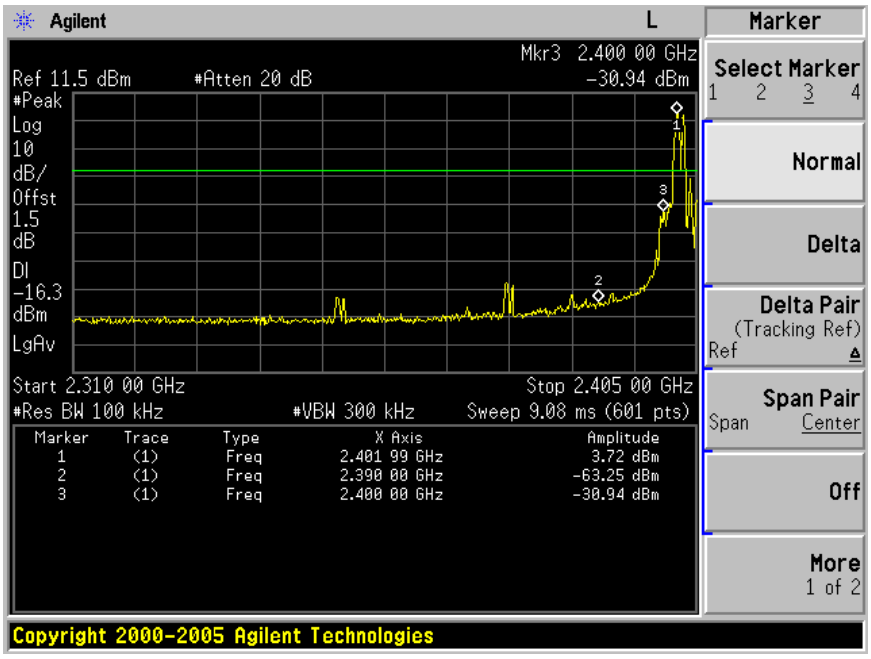

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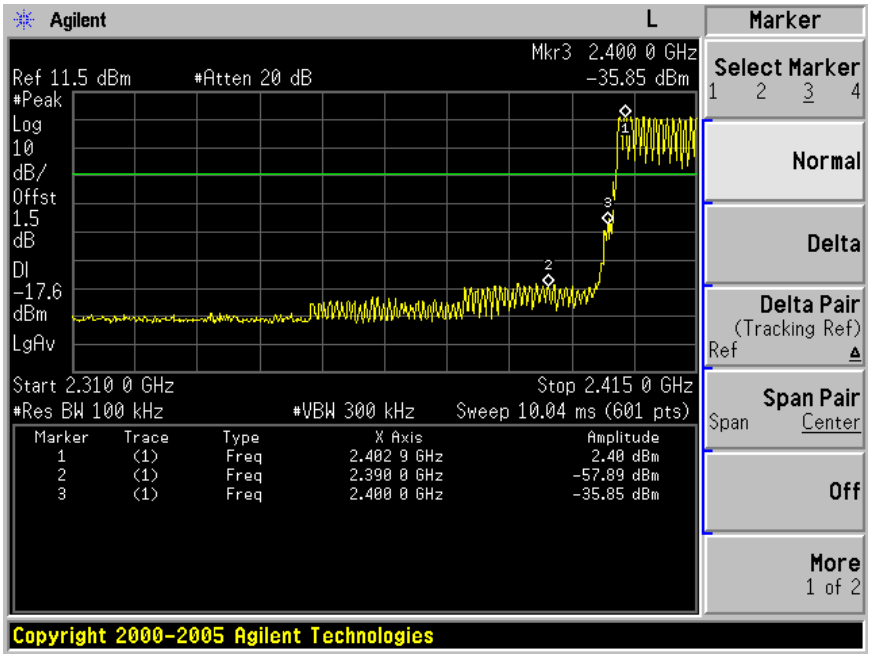
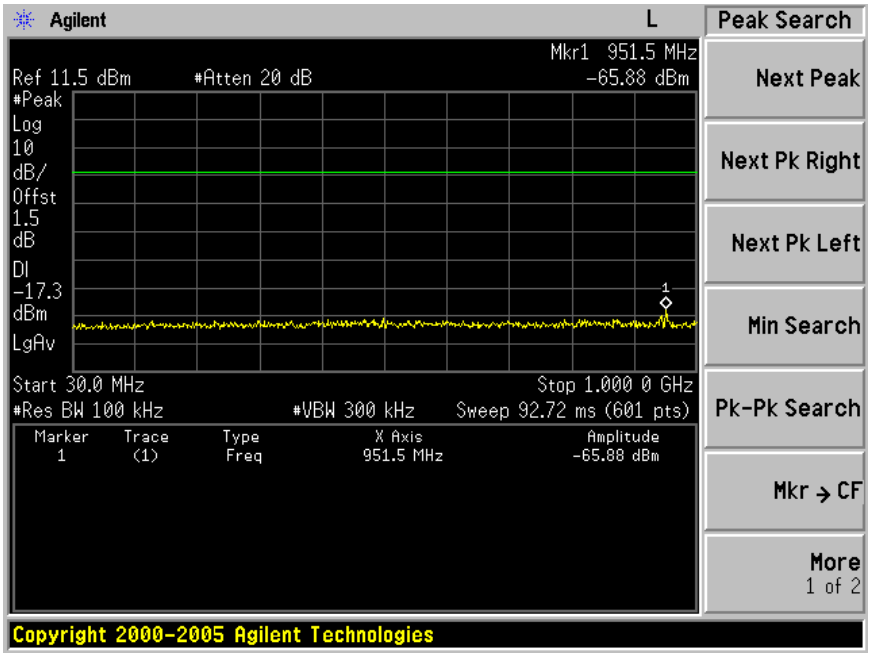
Spurious RF conducted emissions

Hopping on:



2441MHz



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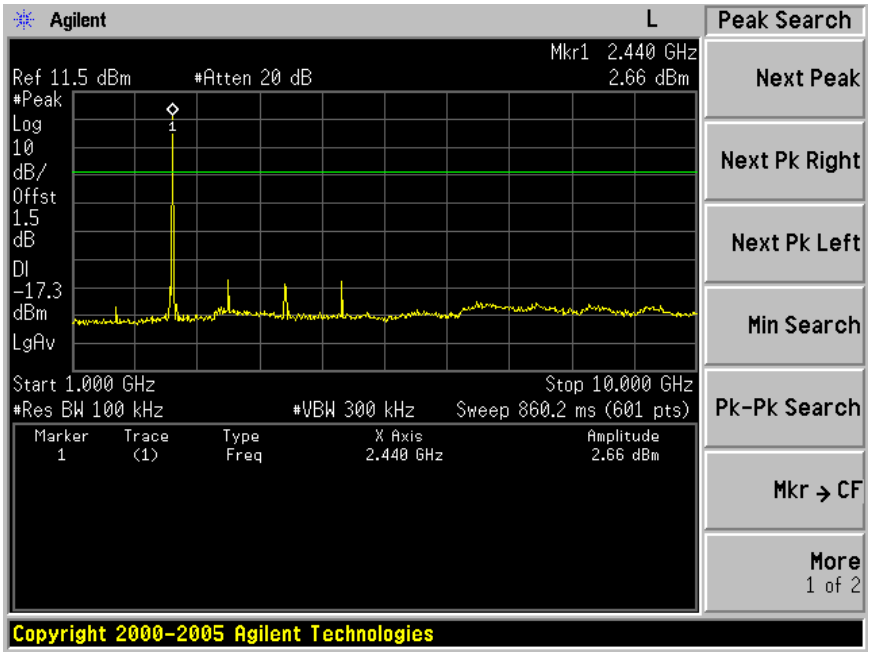
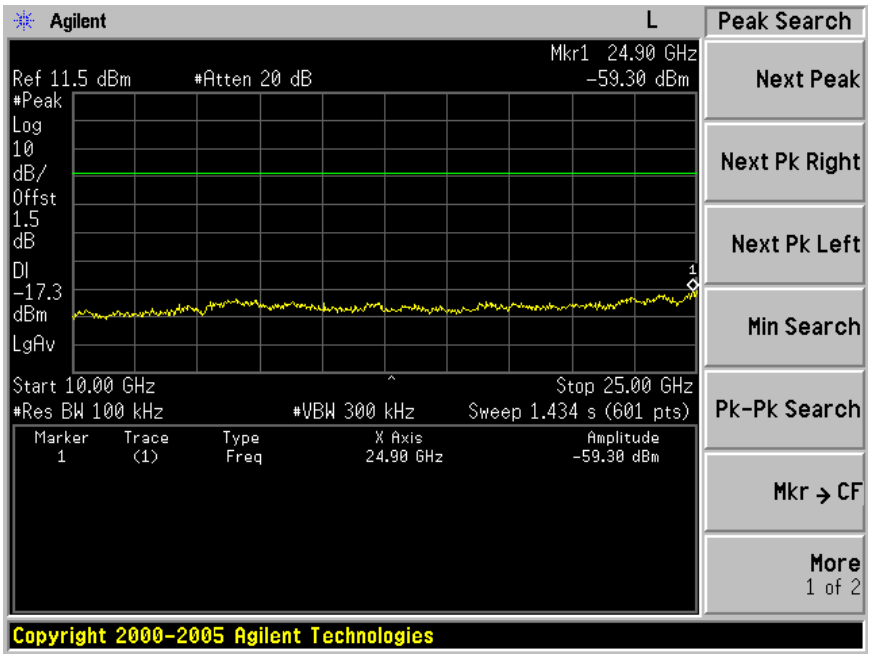
Spurious RF conducted emissions





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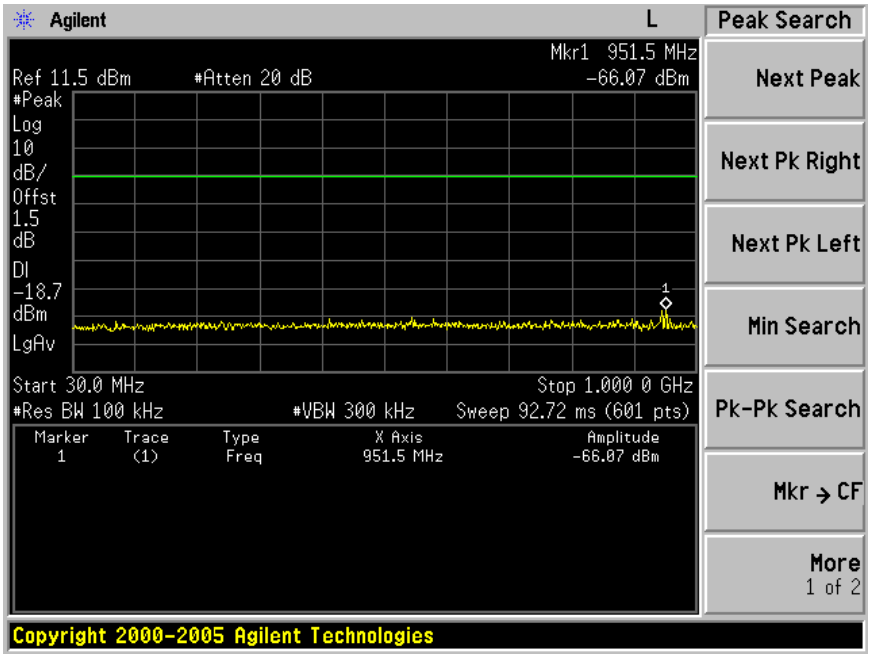
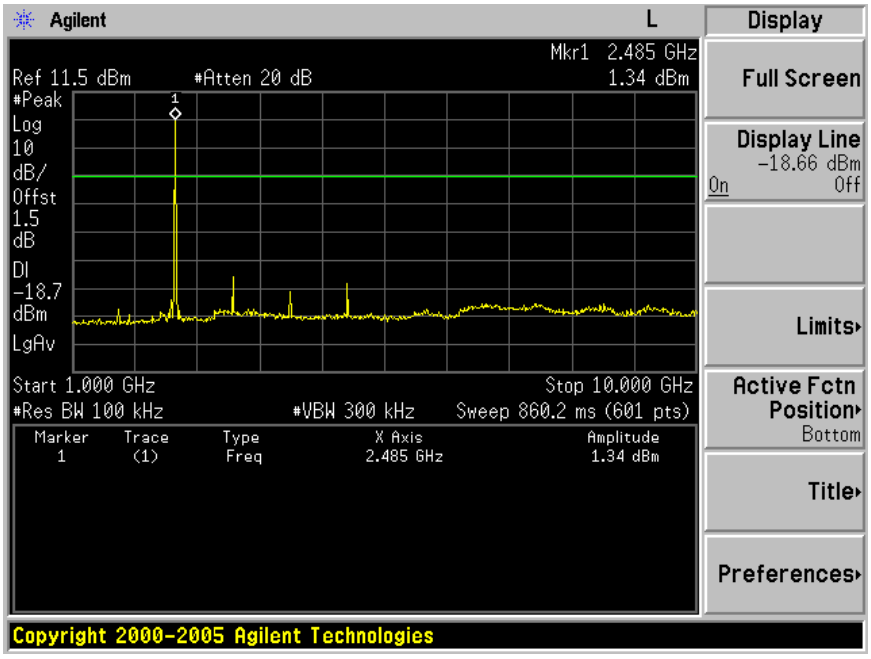
Spurious RF conducted emissions

2480MHz





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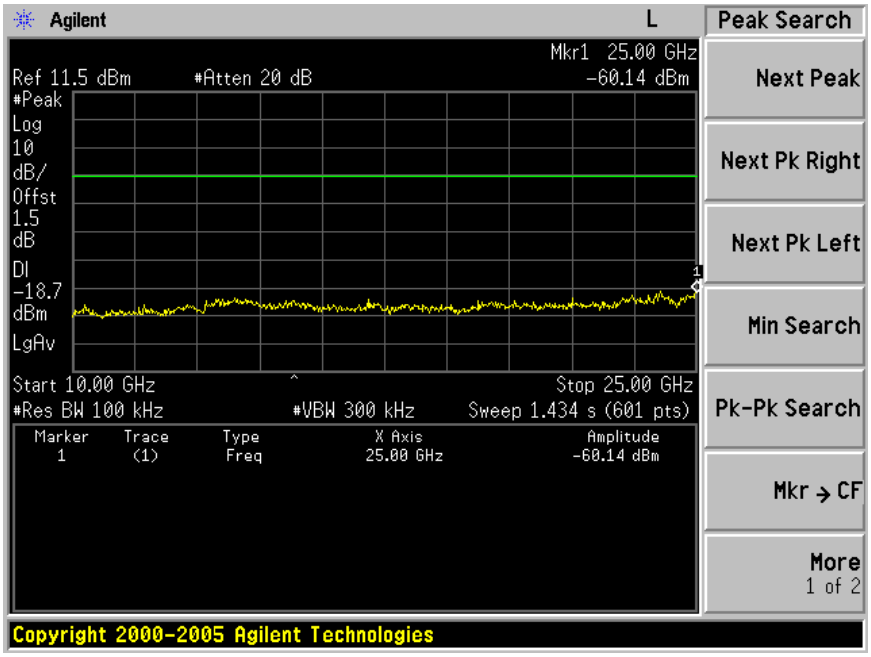
Spurious RF conducted emissions



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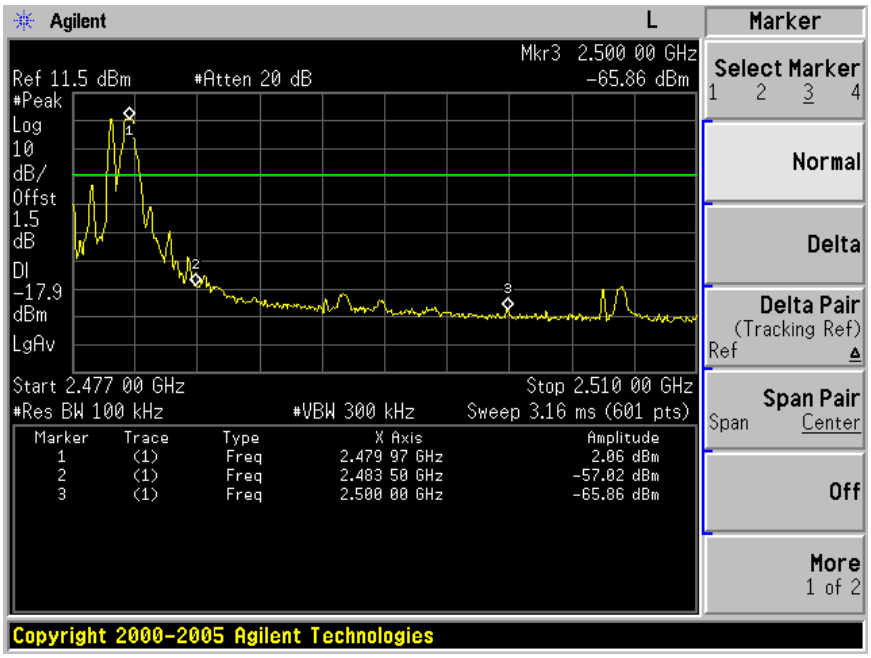

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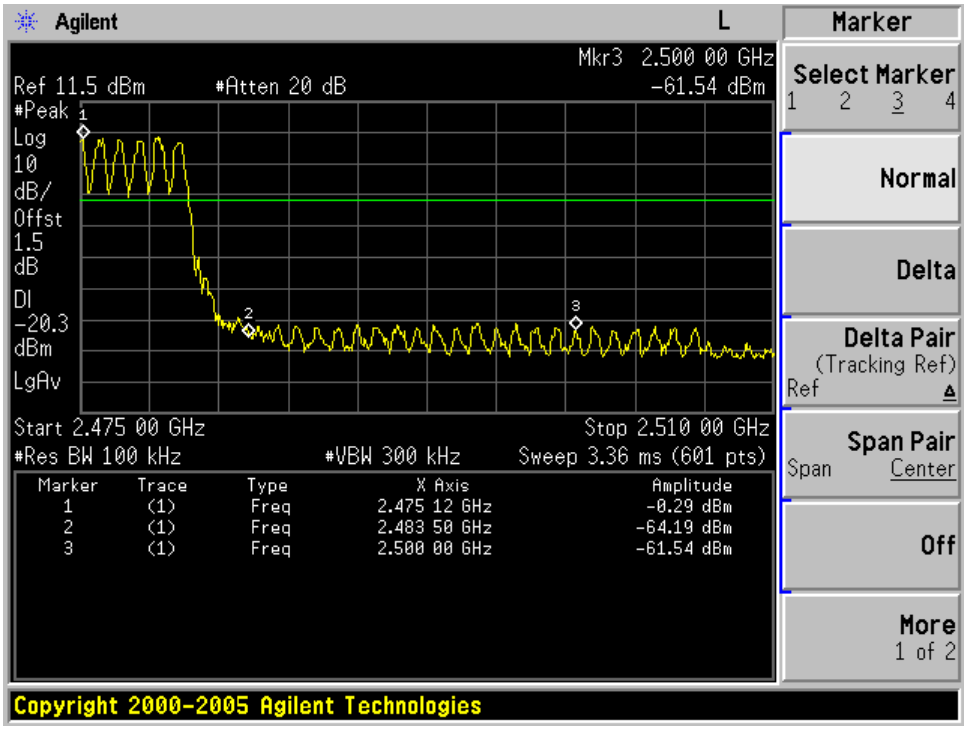
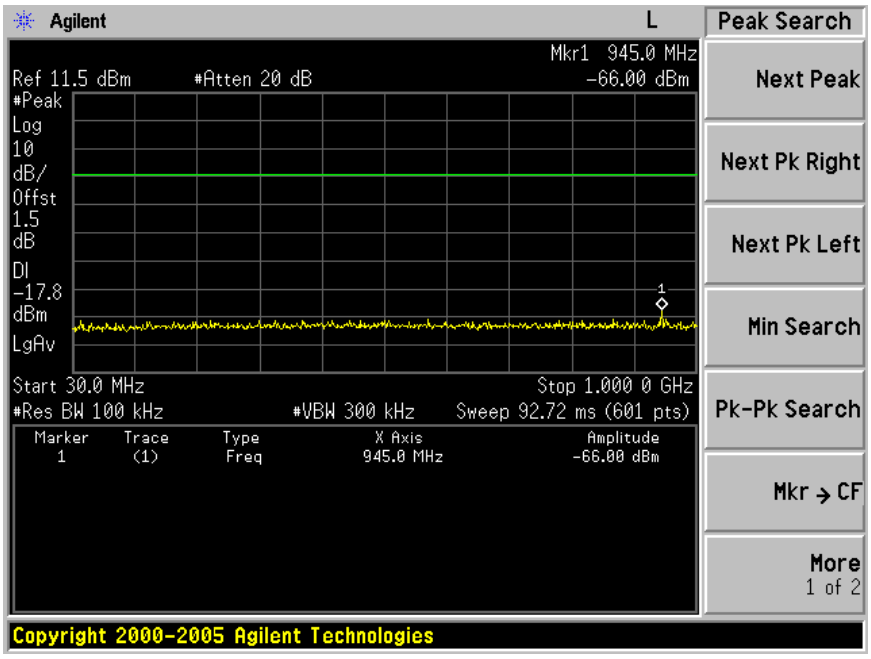
Spurious RF conducted emissions

Hopping on:



Bluetooth Mode 8-DPSK Modulation Test Result:
2402MHz



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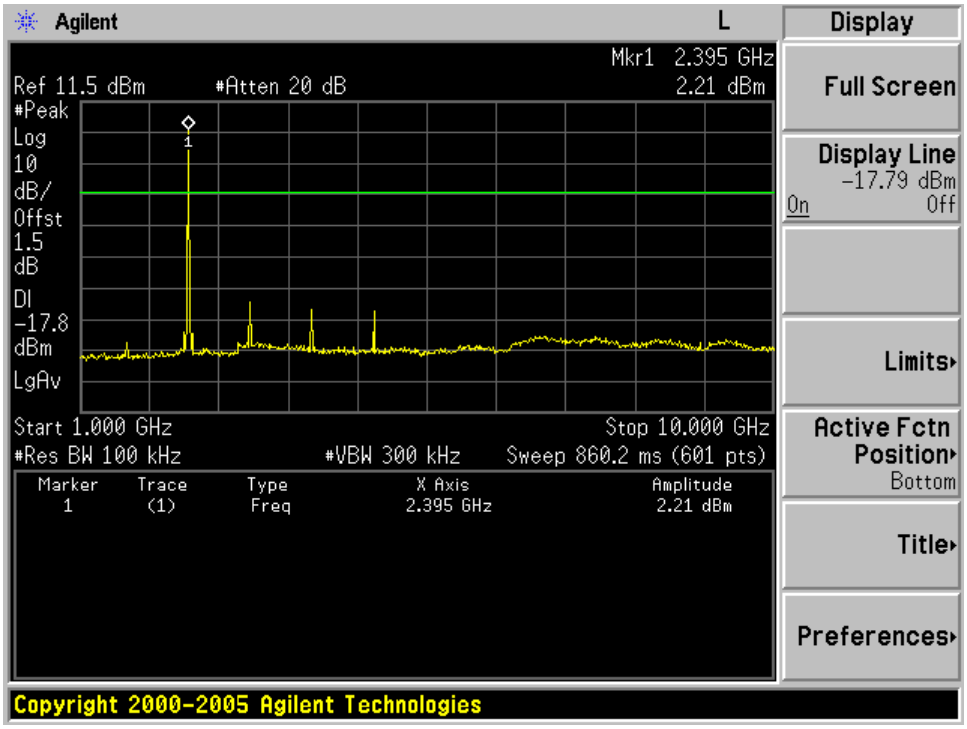
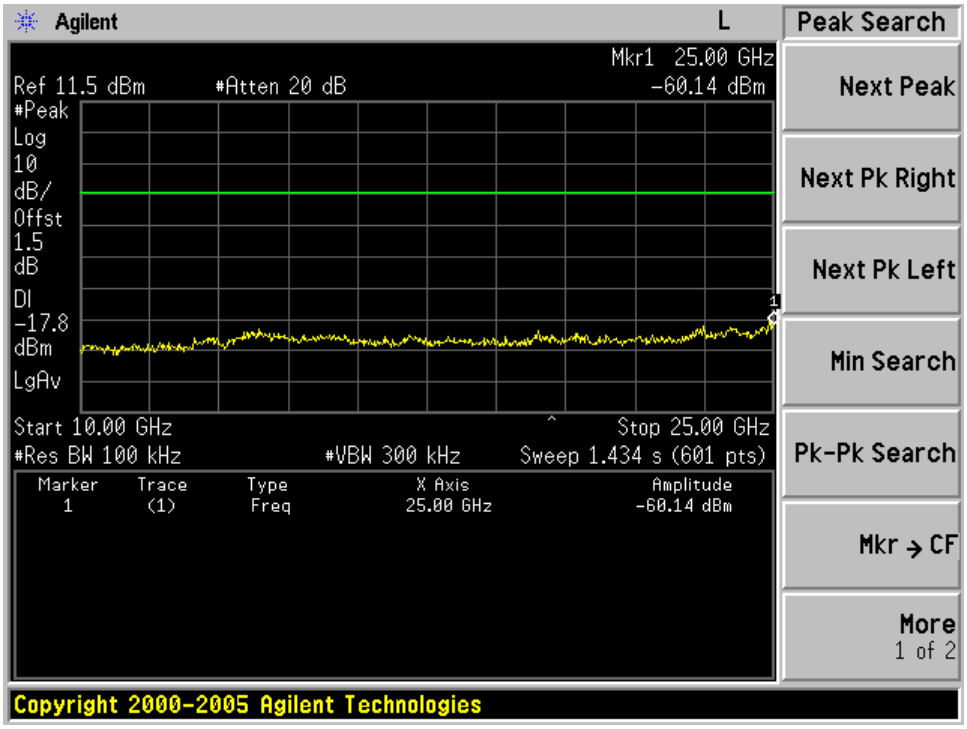
Spurious RF conducted emissions





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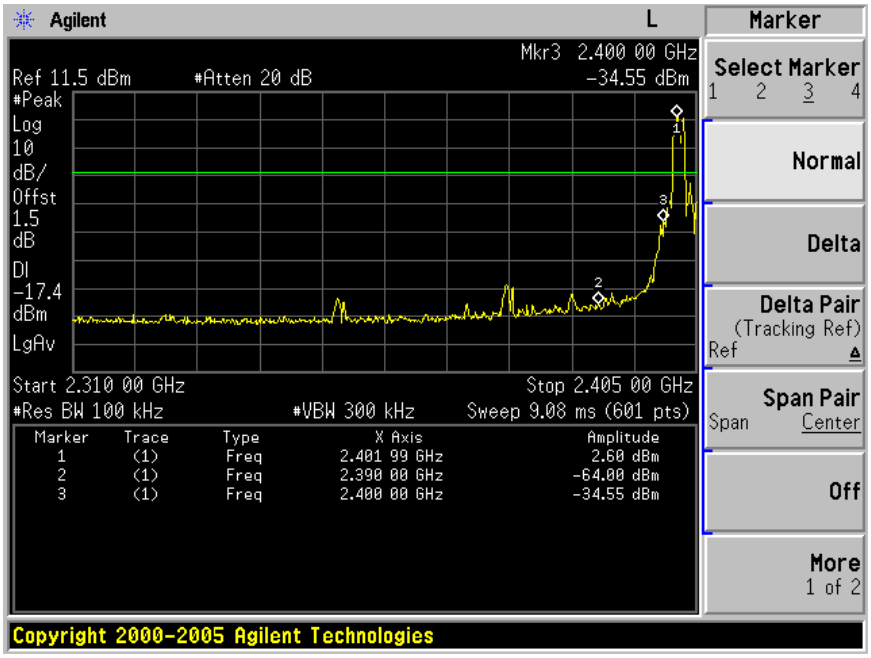
Spurious RF conducted emissions

Hopping off:



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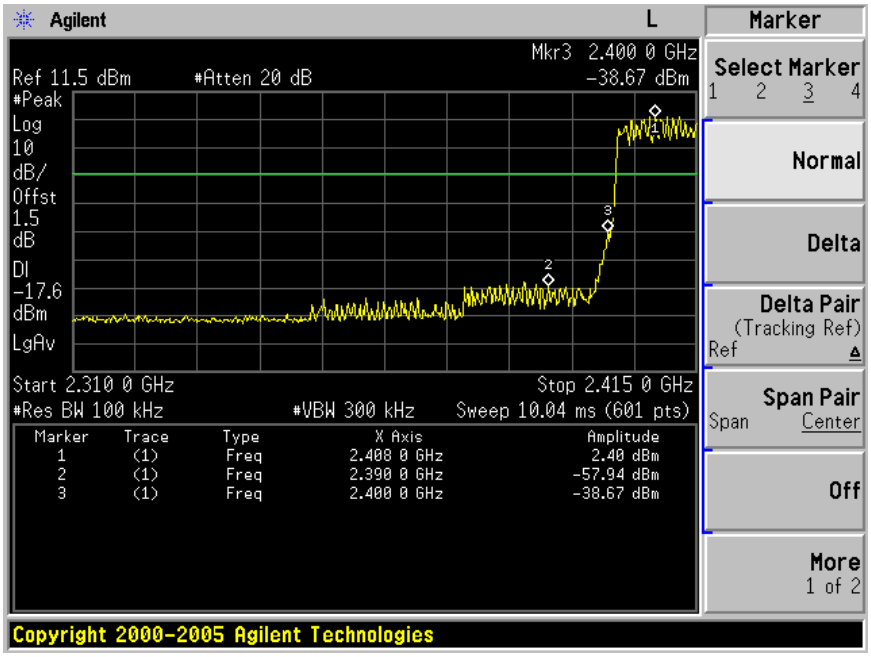

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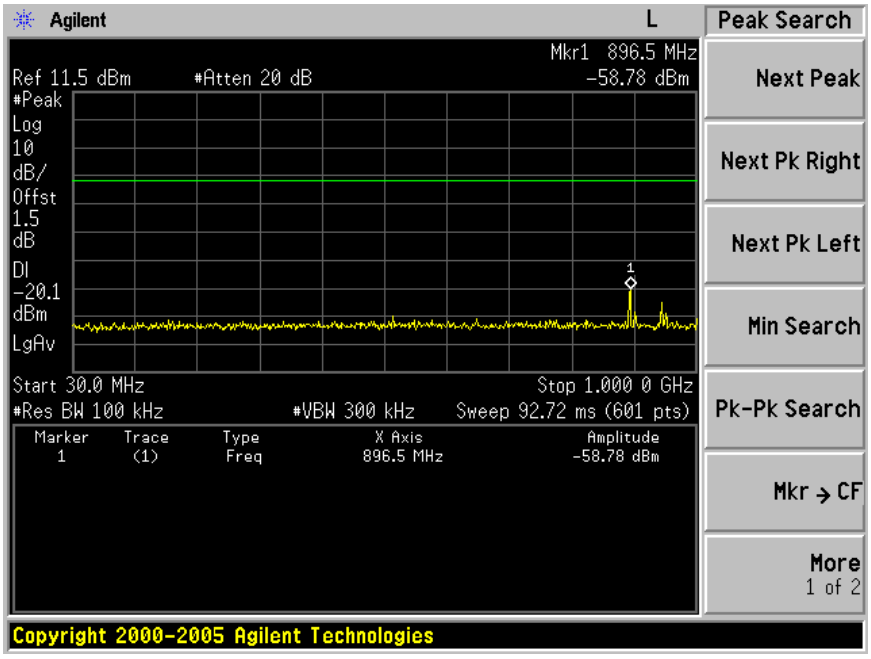
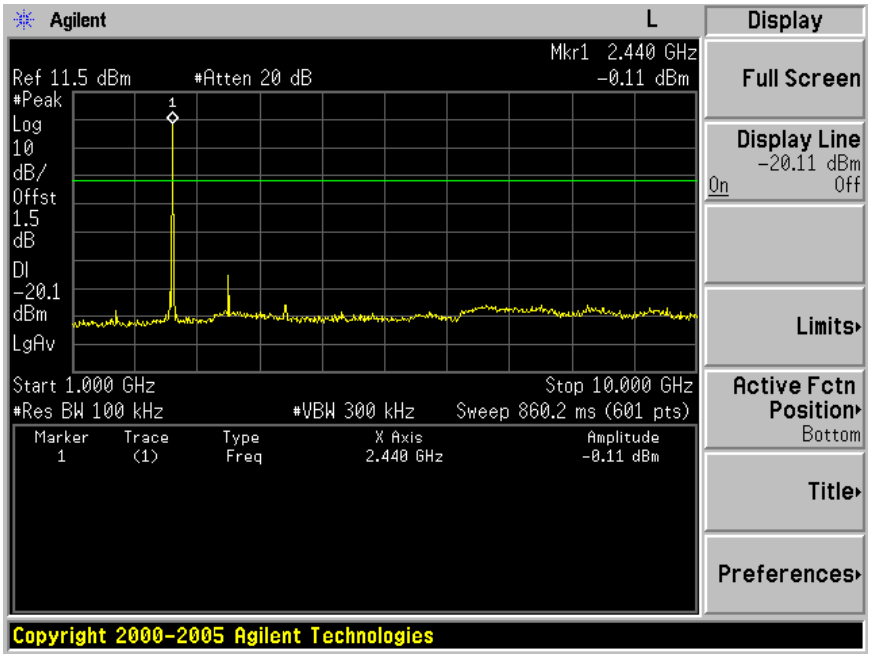
Spurious RF conducted emissions

2441MHz





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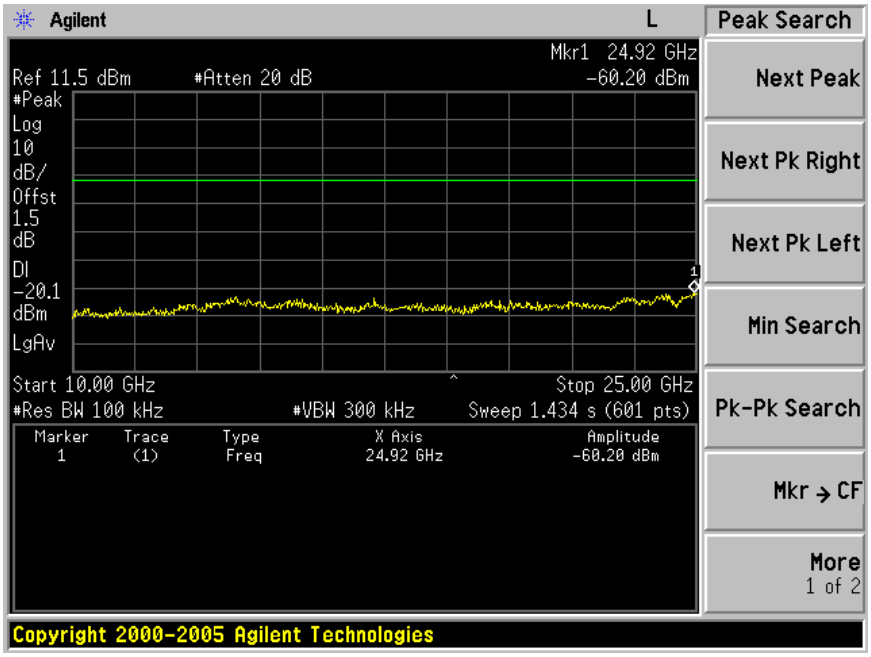
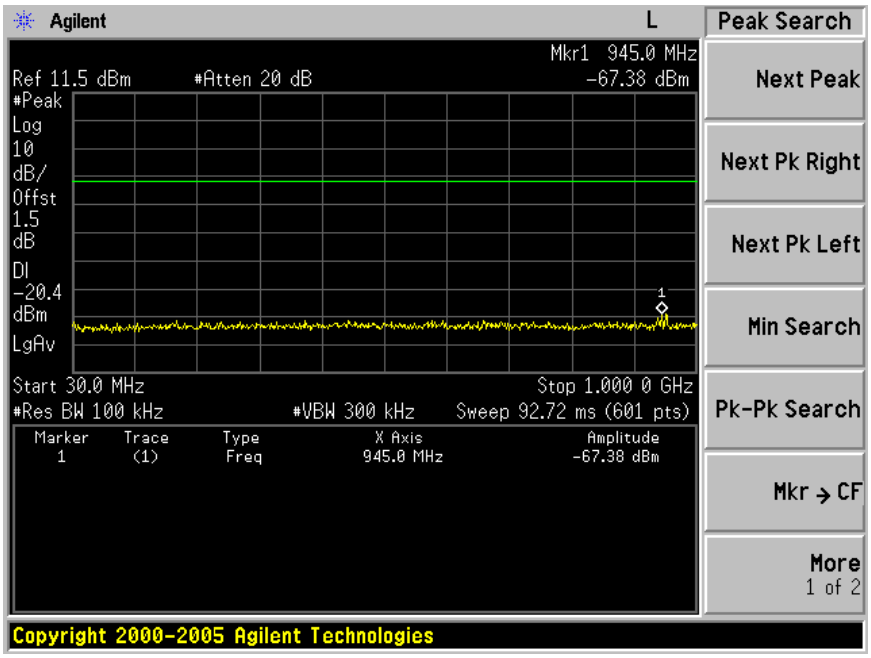
Spurious RF conducted emissions



2480MHz



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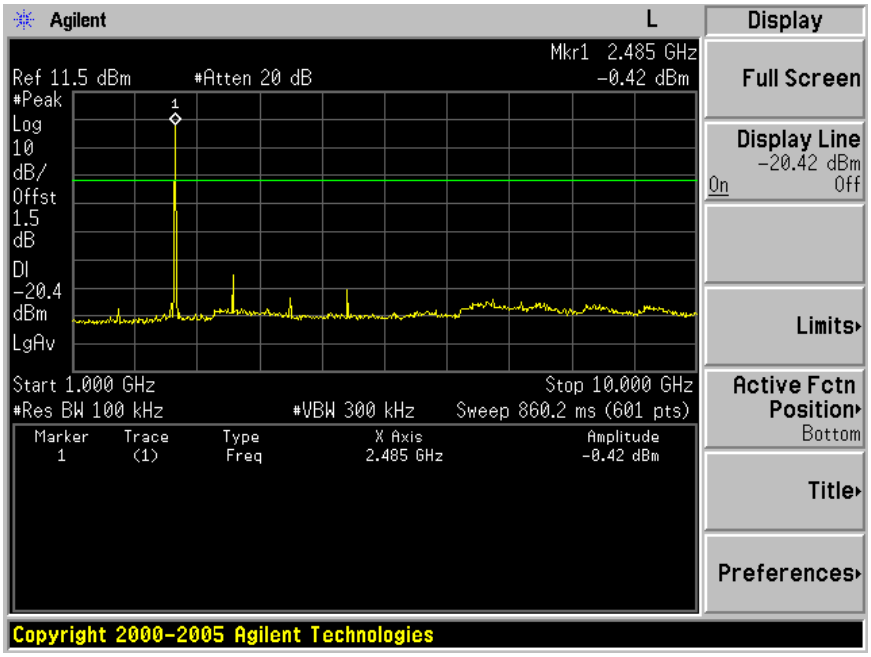
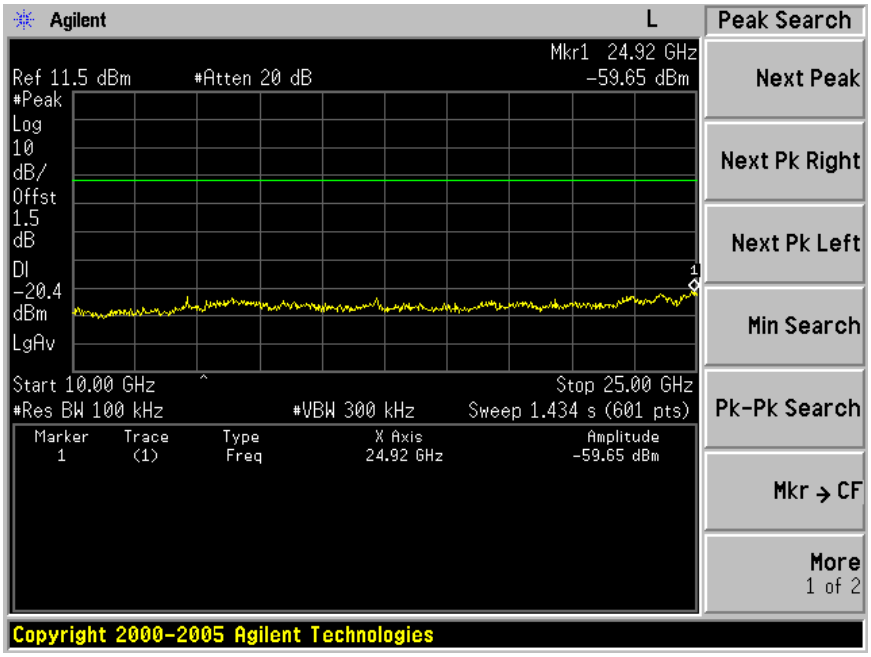
Spurious RF conducted emissions





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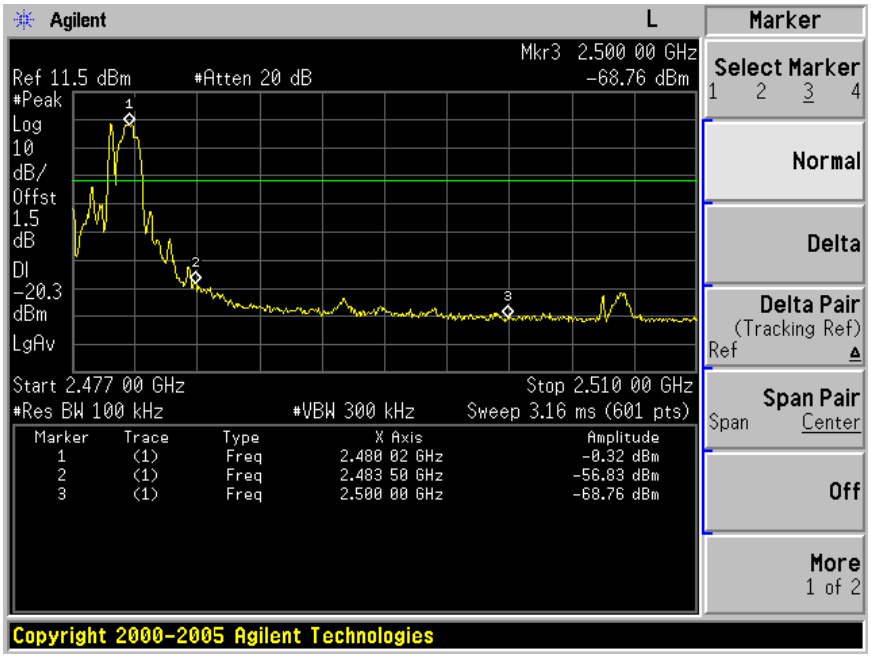
Spurious RF conducted emissions

Hopping off:



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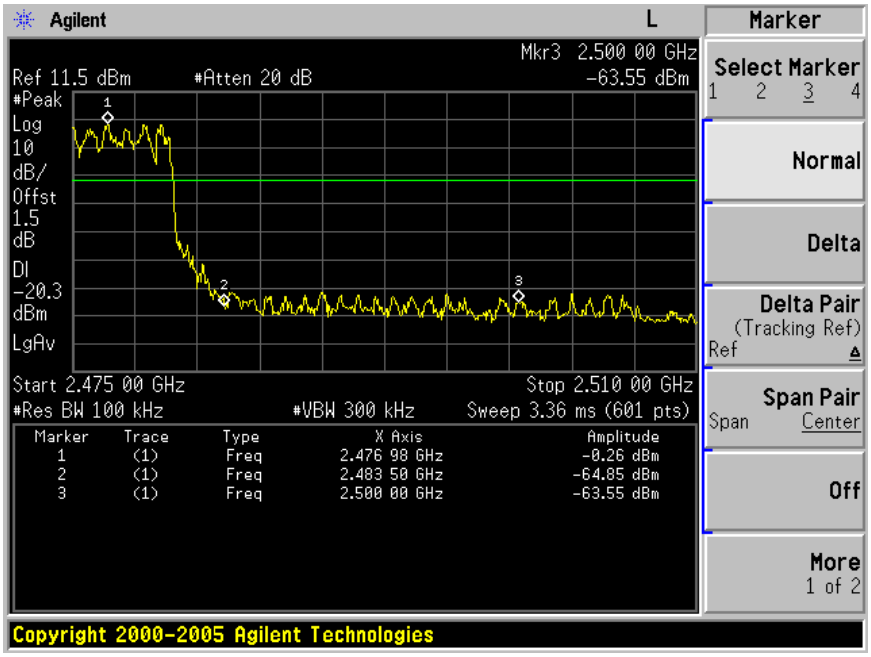

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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
Spectrum Analyzer	Agilent	E4446A	US44300459	May 08, 2013

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7.5 Spurious radiated emissions

Test Method

1 The EUT is placed on a turntable, which is 0.8m above ground plane.
2 The turntable shall be rotated for 360 degrees to determine the position of maximum emission level
3 EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4 Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5 Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

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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Radiated Emission

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 testing was applied on all the modes, only the worst case data was shown in the report.

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		
328.7	14.54	1.37	-	24.10	39.41	Vertical	46.0	QP	Pass
332.64	14.70	1.37	-	25.30	41.17	Horizontal	46.0	QP	Pass
1595.00	25.72	4.76	34.6	51.34	47.22	Vertical	74.0	PK	Pass
1595.00	25.72	4.76	34.6	48.57	44.45	Horizontal	74.0	PK	Pass
4804.000	-	-		-	-	-	-		-

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		
1629.00	25.86	4.78	34.59	50.17	46.22	Vertical	74.0	PK	Pass
1629.00	25.86	4.78	34.59	50.07	46.12	Horizontal	74.0	PK	Pass
4882.000	-	-		-	-	-	-	-	-

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		
1646.00	25.93	4.81	34.58	49.67	45.83	Vertical	74.0	PK	Pass
1646.00	25.93	4.81	34.58	46.17	42.33	Horizontal	74.0	PK	Pass
4960.000	-	-		-	-	-	-	-	-

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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Radiated Emission

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		
328.7	14.54	1.37	-	24.32	40.23	Vertical	46.0	QP	Pass
332.64	14.70	1.37	-	25.67	41.74	Horizontal	46.0	QP	Pass
1595.00	25.72	4.76	34.6	50.45	46.33	Vertical	74.0	PK	Pass
1595.00	25.72	4.76	34.6	47.43	43.31	Horizontal	74.0	PK	Pass
4804.00	-	-		-	-	-	-	-	-
4804.00	-	-		-	-	-	-	-	-

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		
1629.00	25.86	4.78	34.59	50.18	46.23	Vertical	74	PK	Pass
1629.00	25.86	4.78	34.59	48.87	44.92	Horizontal	74	PK	Pass
4882.00	-	-		-	-	-	-	-	-
4882.00	-	-		-	-	-	-	-	-

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		
1646.00	25.93	4.81	34.58	49.74	45.90	Vertical	74.0	PK	Pass
1646.00	25.93	4.81	34.58	46.76	42.92	Horizontal	74.0	PK	Pass
4960.00	-	-		-	-	-	-	-	-
4960.00	-	-		-	-	-	-	-	-

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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Test Equipment List

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL DUE DATE
Spectrum	Agilent	E4446A	US44300459	May 08, 2013
Amp	HP	8449B	3008A02495	May 08, 2013
Antenna	EMCO	3115	9607-4877	May 17, 2013
Bilog Antenna	Schaffner	CBL6111C	2598	Dec.14, 2012
HF Cable	Hubersuhne	Sucoflex104	---	May 08, 2013

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7.6 20 dB bandwidth

Test Method

1 Place the EUT on the table and set it in the transmitting mode.
2 Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3 Mark the peak frequency and –20dB (upper and lower) frequency.

Limit

Limit [kHz]
N/A

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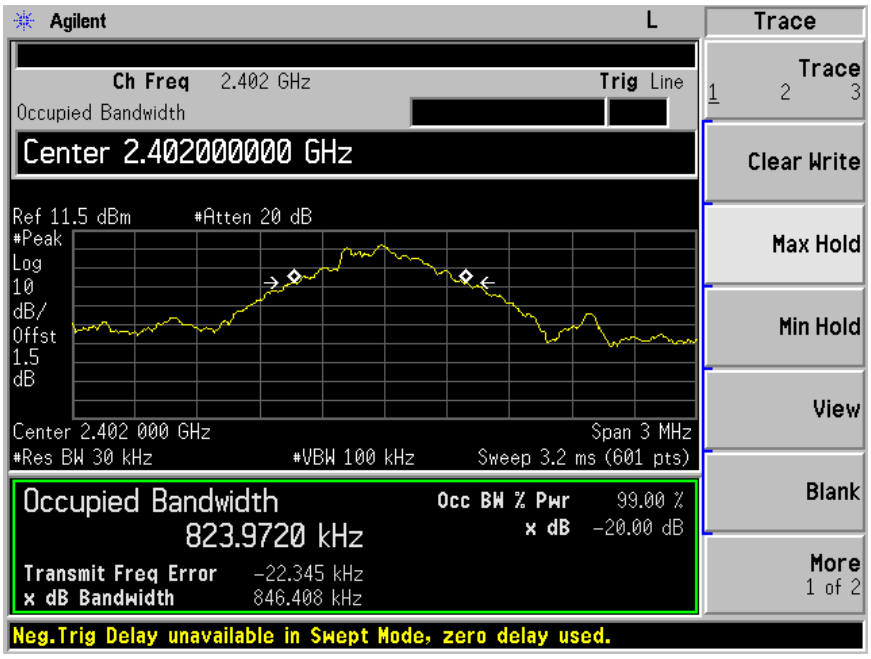
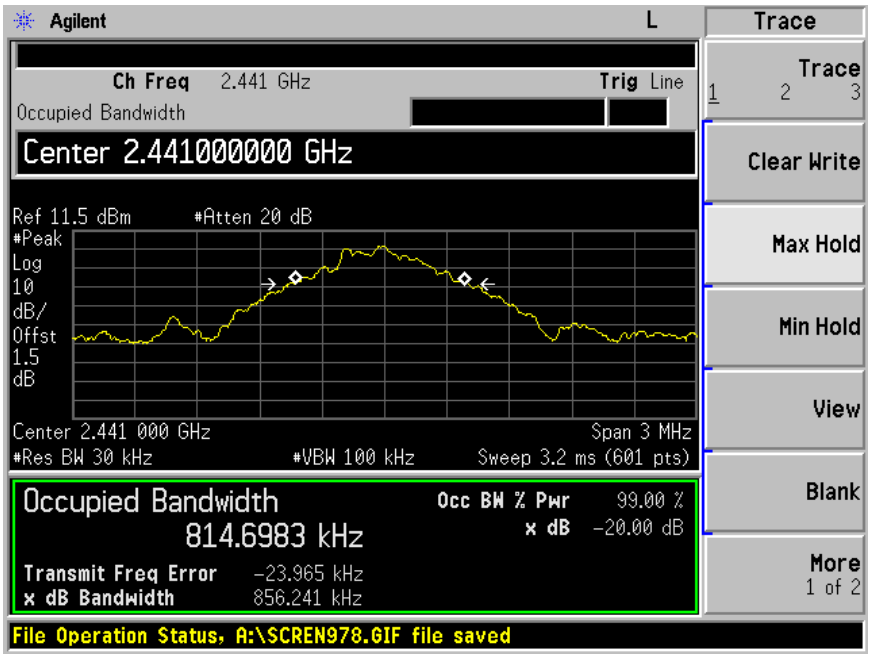
20 dB bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency MHz	Bandwidth kHz	Result
2402	823.9720	Pass
2441	814.6983	Pass
2480	829.1524	Pass





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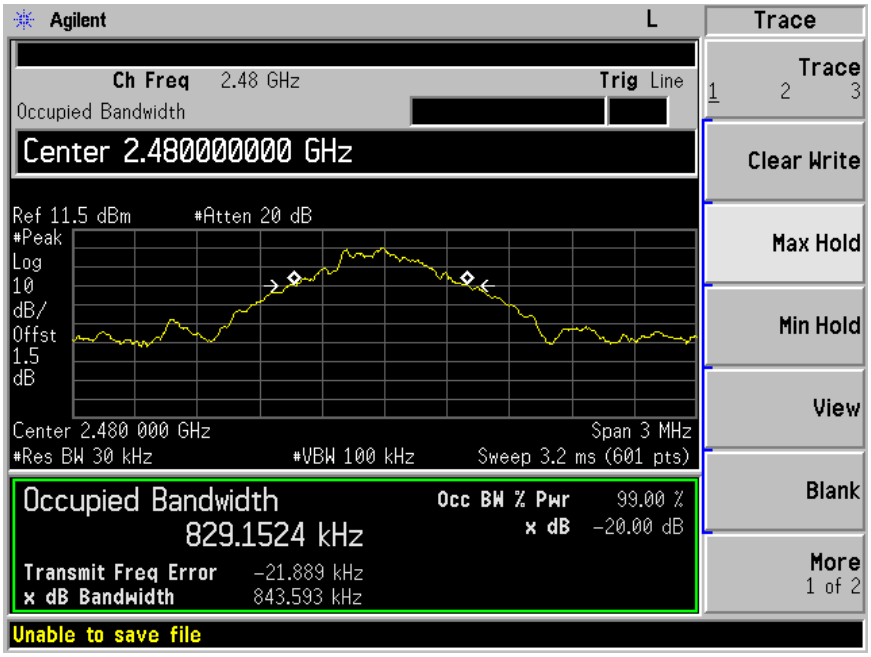
20 dB bandwidth



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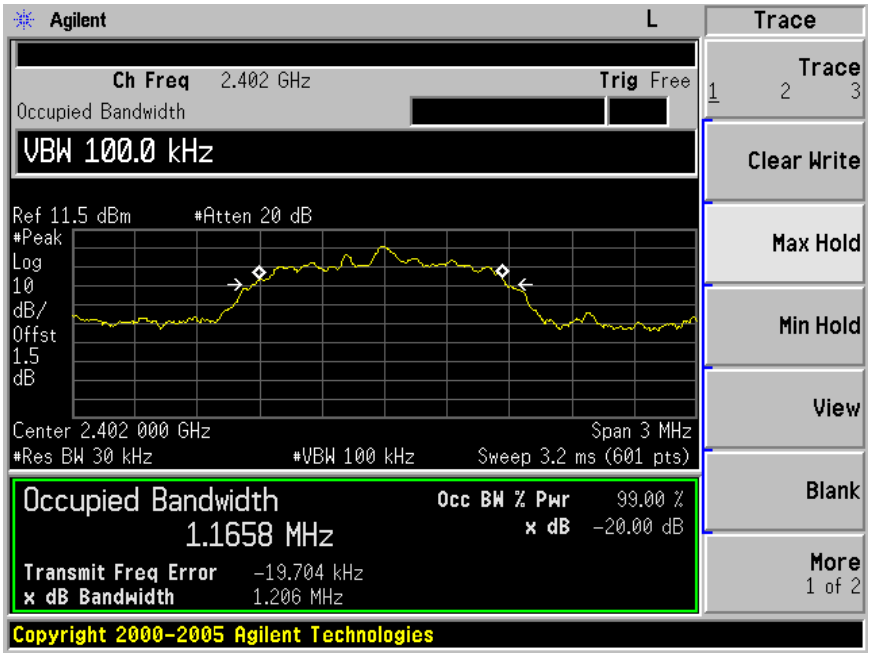
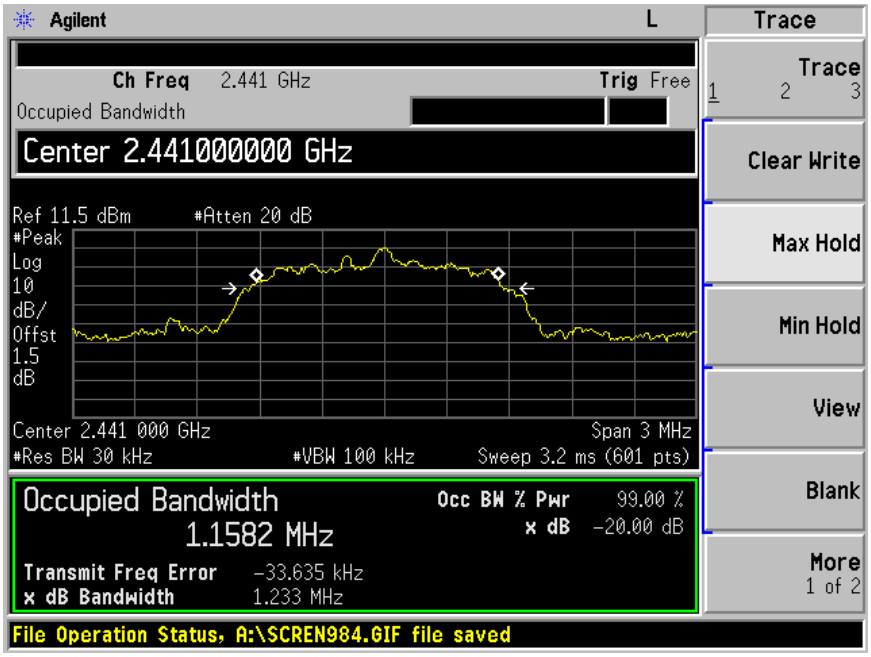
20 dB bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency MHz	Bandwidth kHz	Result
2402	1165.8	Pass
2441	1158.2	Pass
2480	1147.6	Pass





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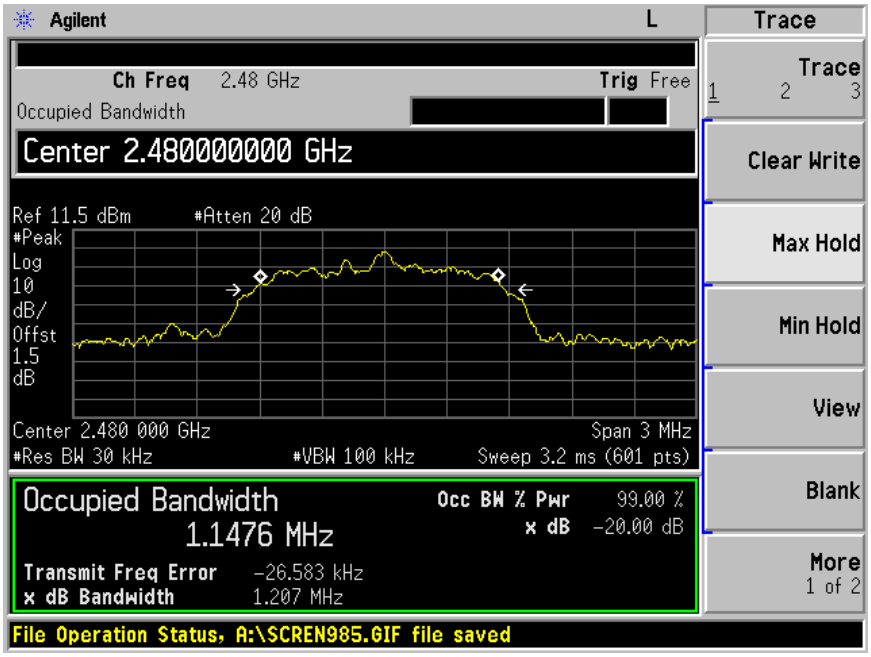
20 dB bandwidth



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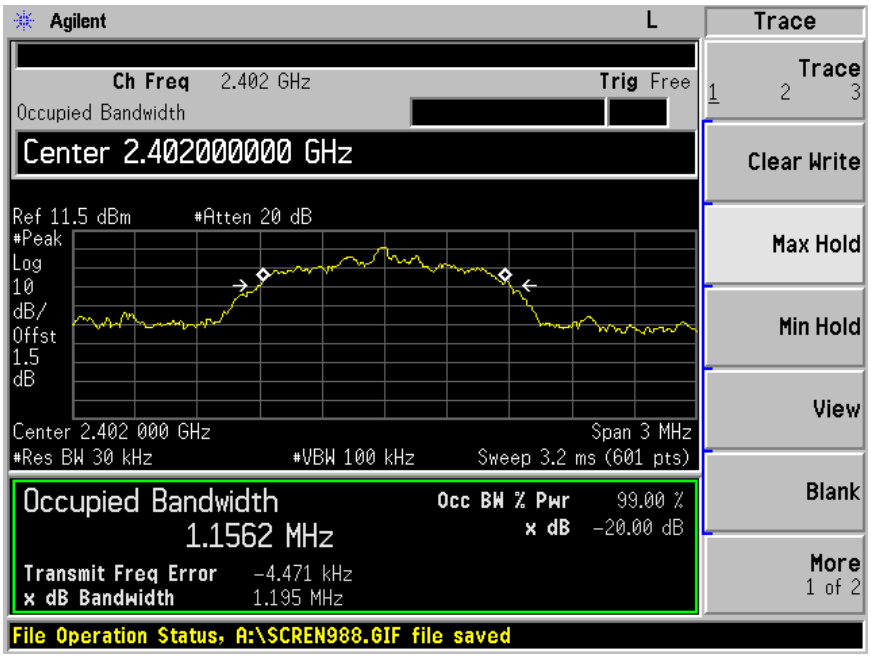
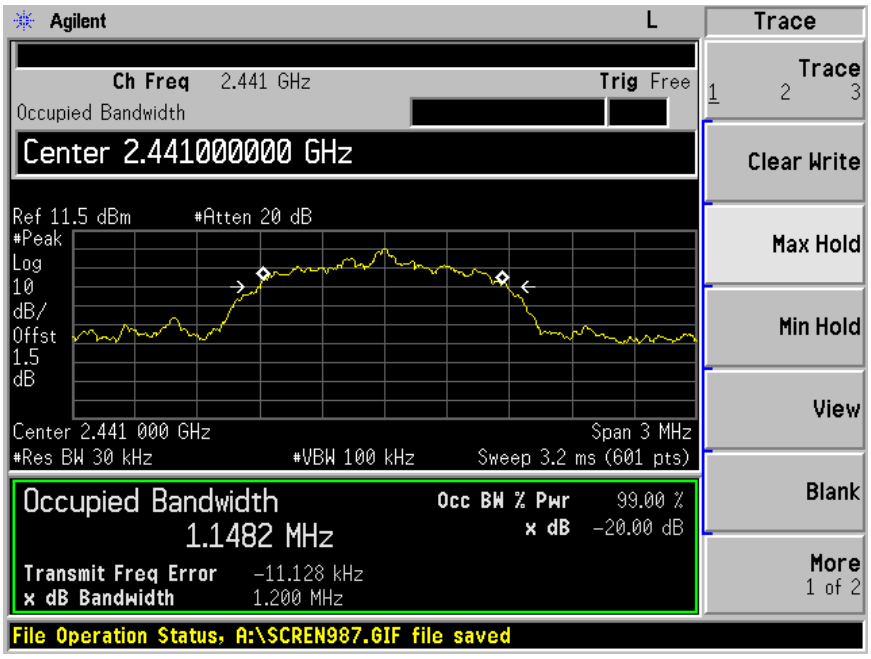
20 dB bandwidth

Bluetooth Mode 8-DPSK Modulation test result

Frequency MHz	Bandwidth kHz	Result
2402	1156.2	Pass
2441	1148.2	Pass
2480	1147.0	Pass





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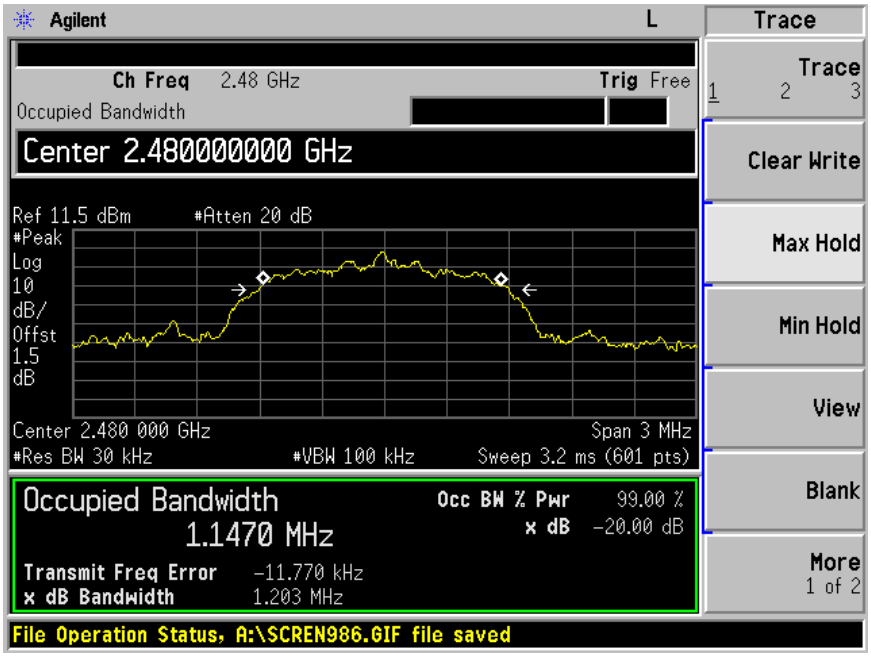
20 dB bandwidth



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Test Equipment

20 dB bandwidth Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
Spectrum Analyzer	Agilent	E4446A	US44300459	May 08, 2013

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7.7 Carrier Frequency Separation

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 100KHz; VBW: 100KHz; SPAN:5MHz
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	549.3147
2441	543.1322
2480	552.7683

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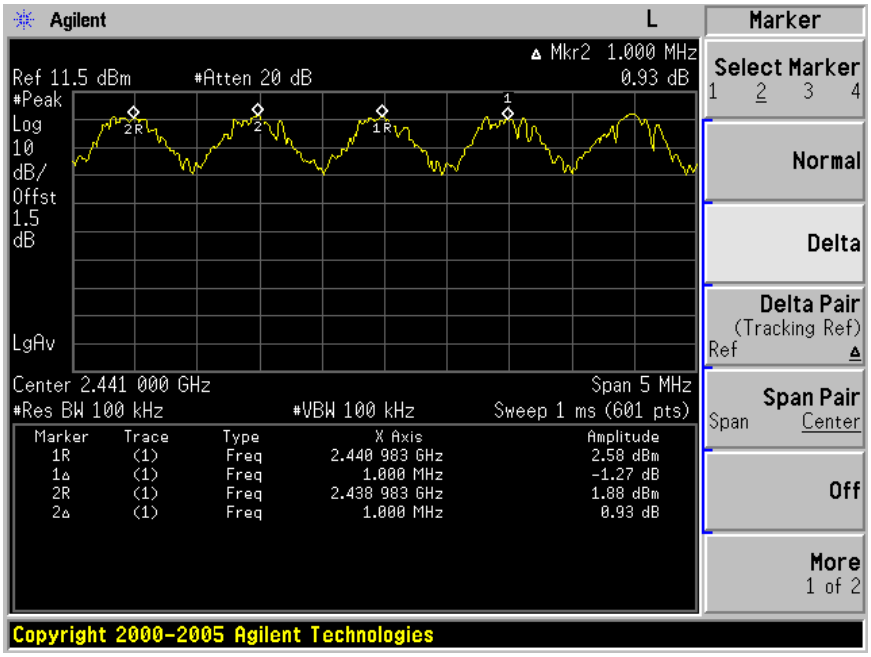
Carrier Frequency Separation

GFSK Modulation test result

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



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Test Equipment

Carrier Frequency Separation Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
Spectrum Analyzer	Agilent	E4446A	US44300459	May 08, 2013

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7.8 Number of hopping frequencies

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 100KHz; VBW: 100KHz
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
3. Repeat above procedures until all frequencies measured were complete.

Limit

Limit number
⩾ 15

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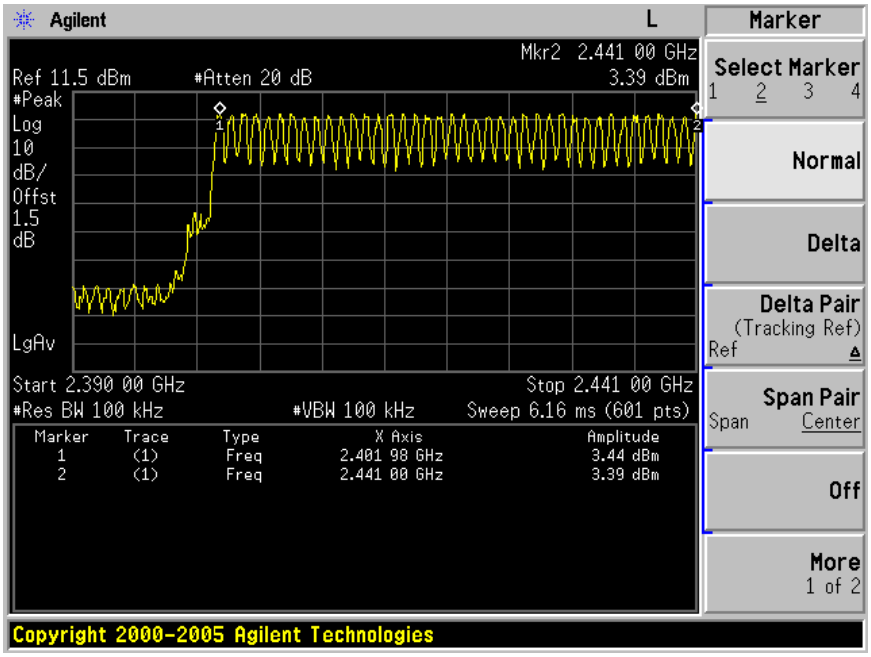
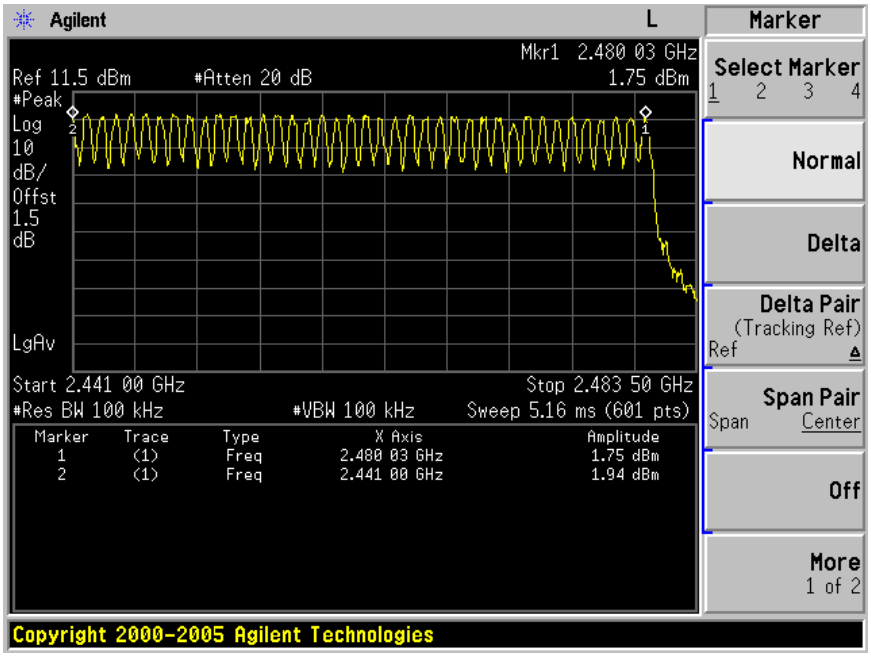
Number of hopping frequencies

Test result:

Number of hopping frequencies	Result
79	Pass





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Test Equipment

Number of hopping frequencies Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
Spectrum Analyzer	Agilent	E4446A	US44300459	May 08, 2013

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7.9 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
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

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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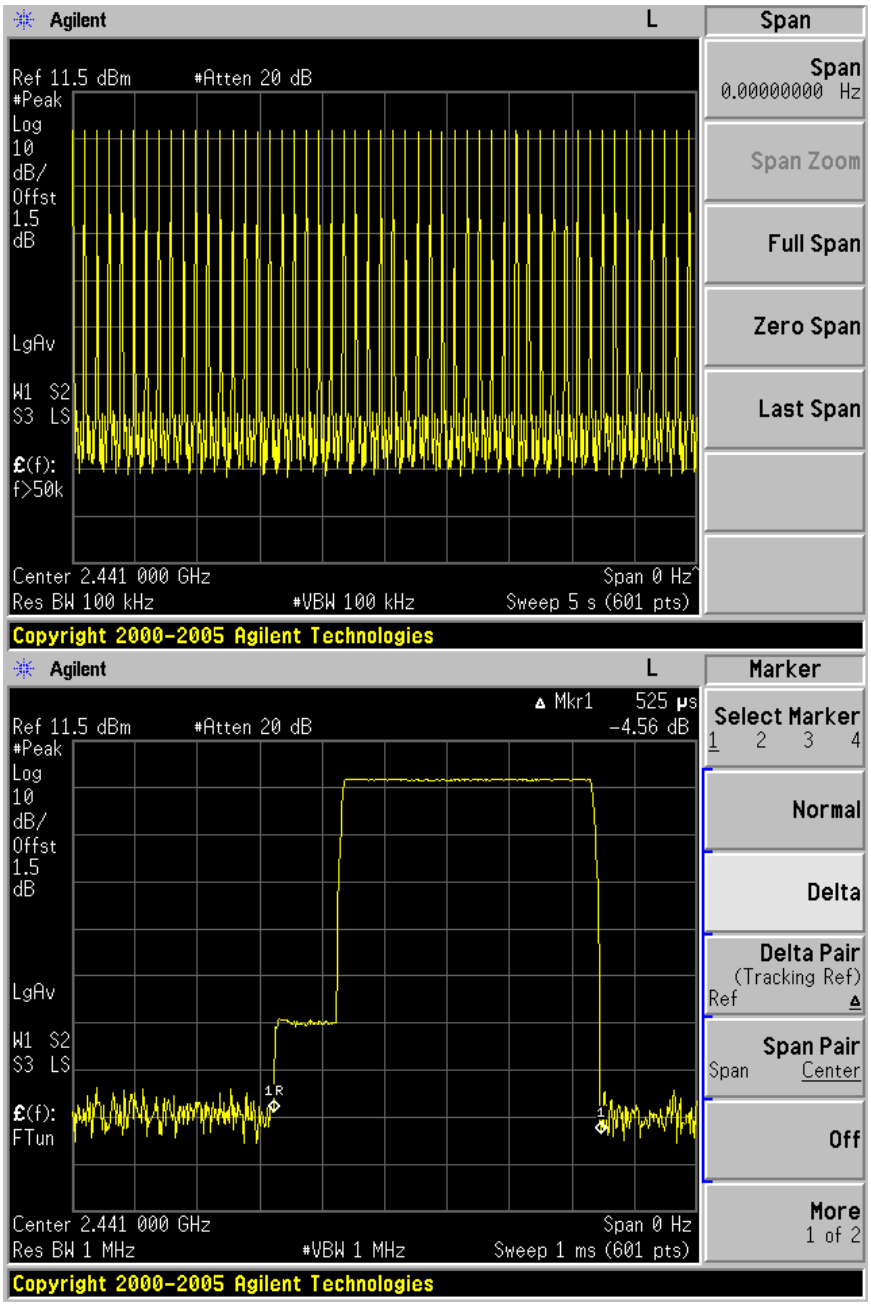
Dwell Time

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	525	169.22	< 400	Pass
DH3	1695	278.52	< 400	Pass
DH5	2942	316.09	< 400	Pass



DH1

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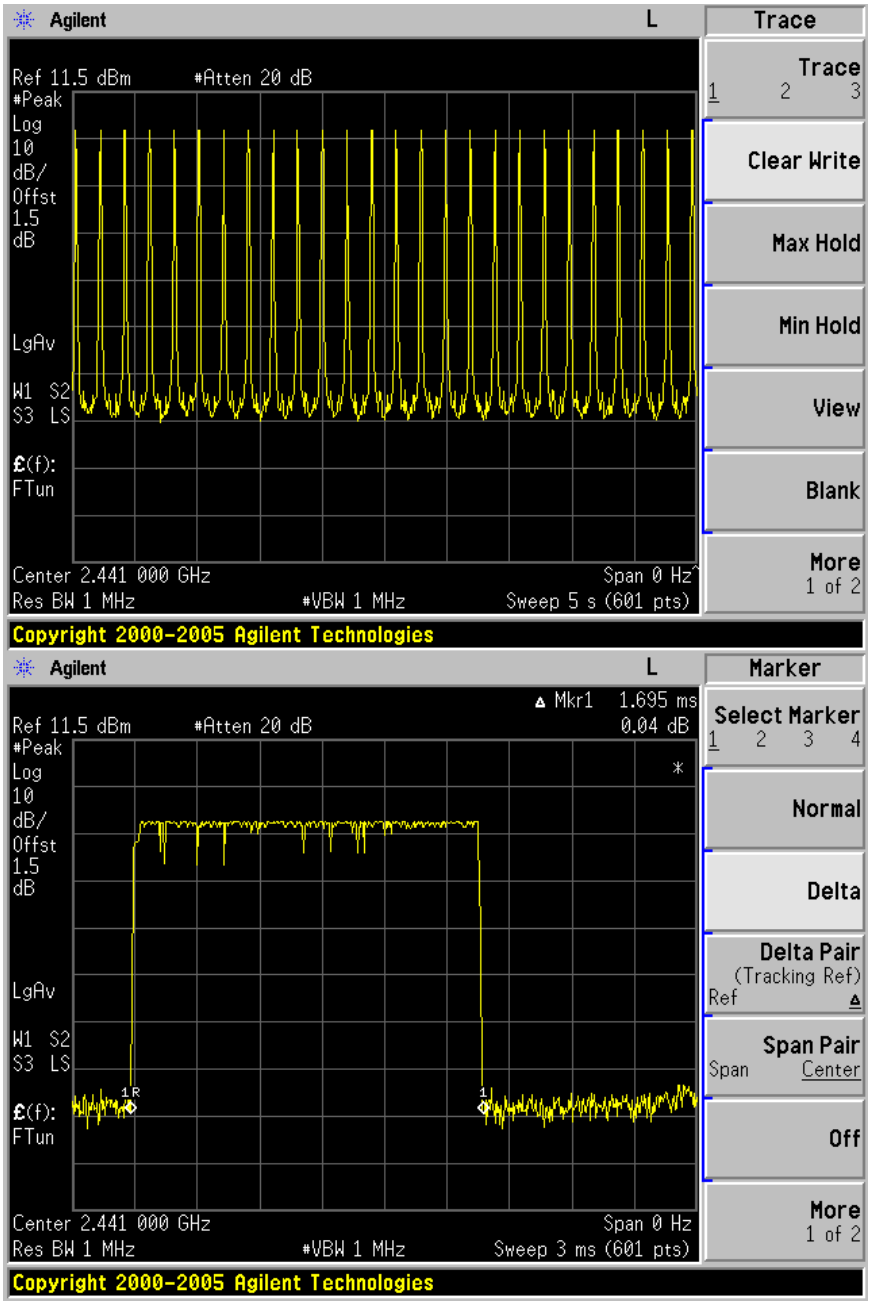
Dwell Time



DH3

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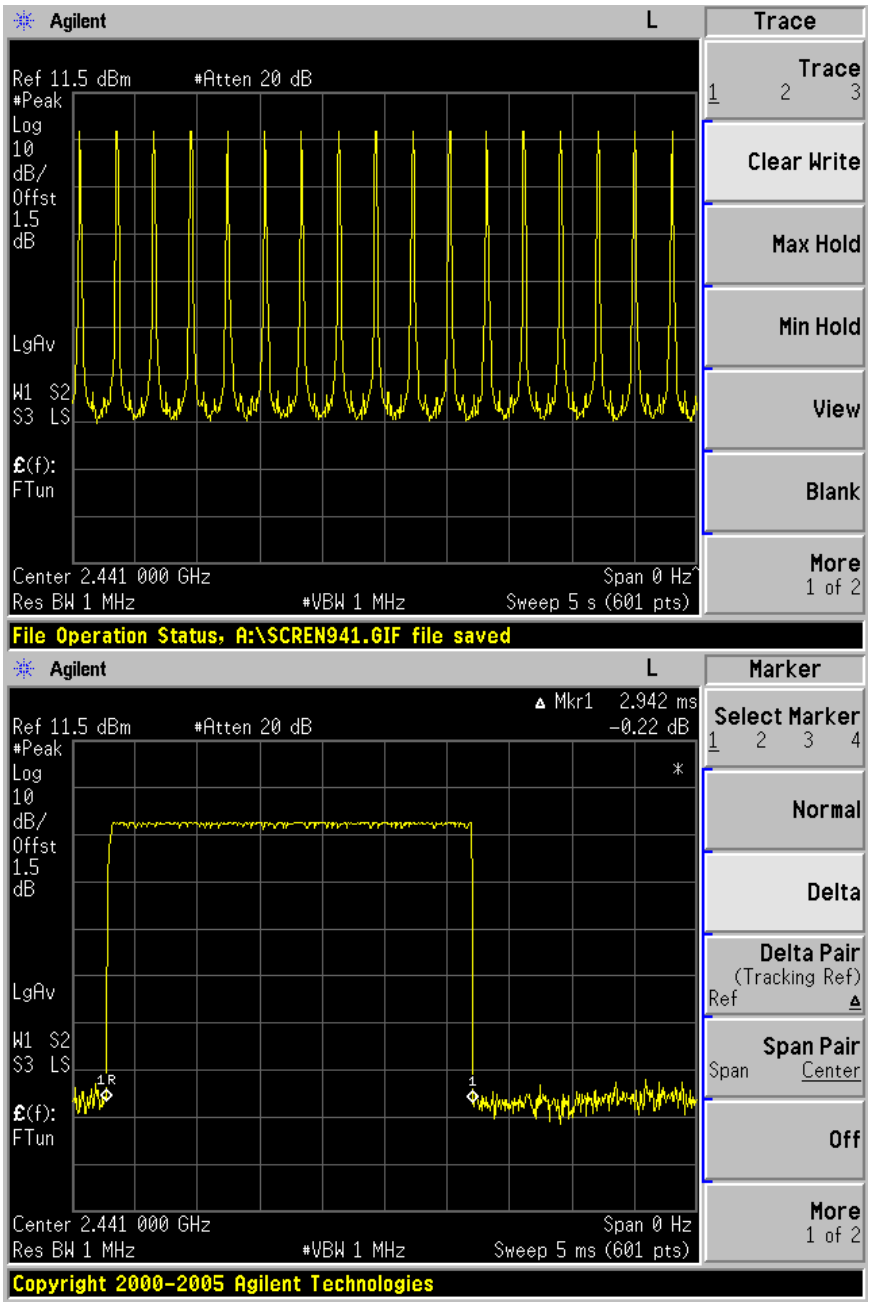
Dwell Time



DH5

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

DH1	time slot= 51(times)/5(s) *525.0 (μs) *31.6(s)= 169.22 (ms)
DH3	time slot= 26(times)/5(s) *1695 (μs) *31.6(s)= 278.52(ms)
DH5	time slot= 17(times)/5(s) *2942 (μs) *31.6(s)= 316.09 (ms)

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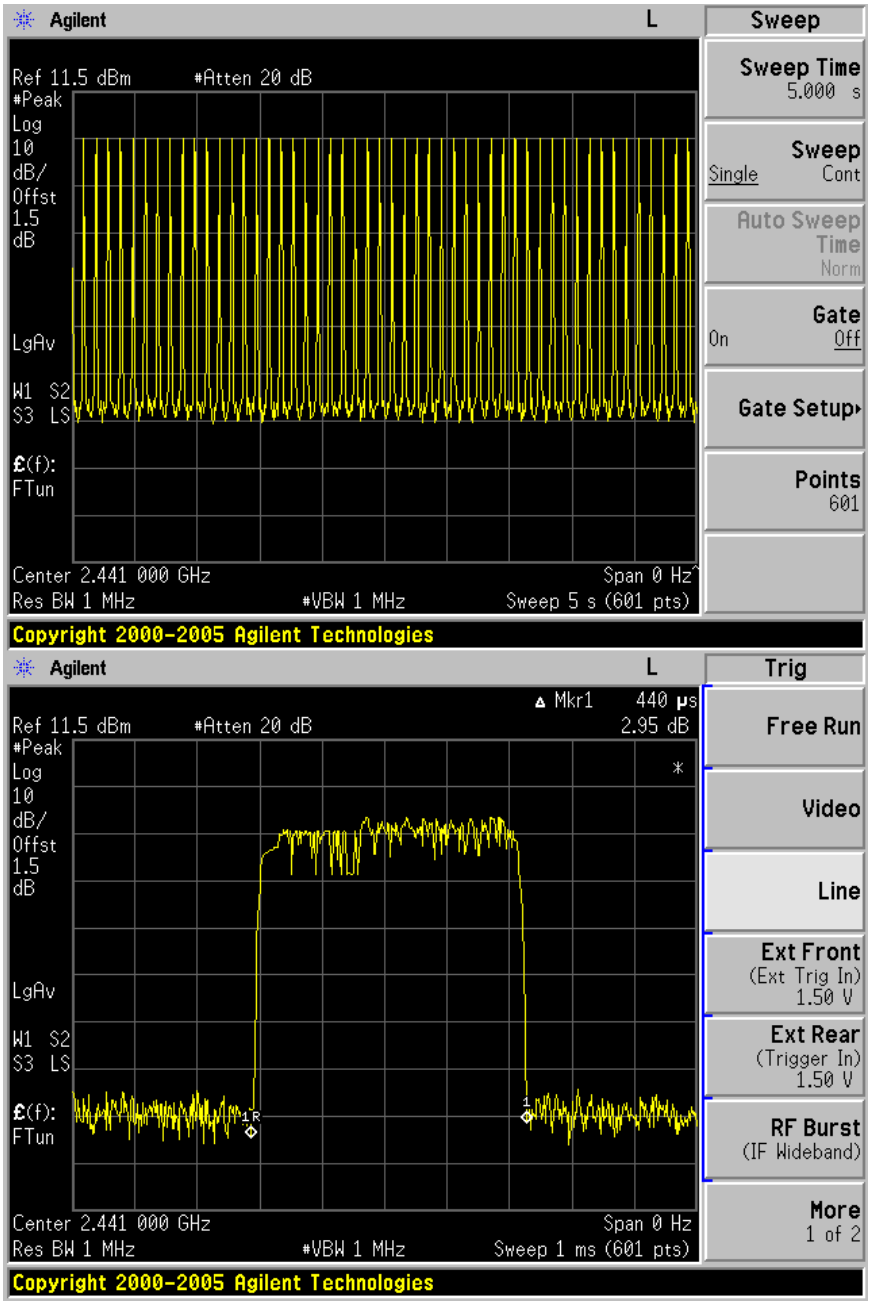
Bluetooth Mode π/4-DQPSK Modulation:

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	440	139.04	< 400	Pass
DH3	1710	270.18	< 400	Pass
DH5	2975	319.63	< 400	Pass



DH1

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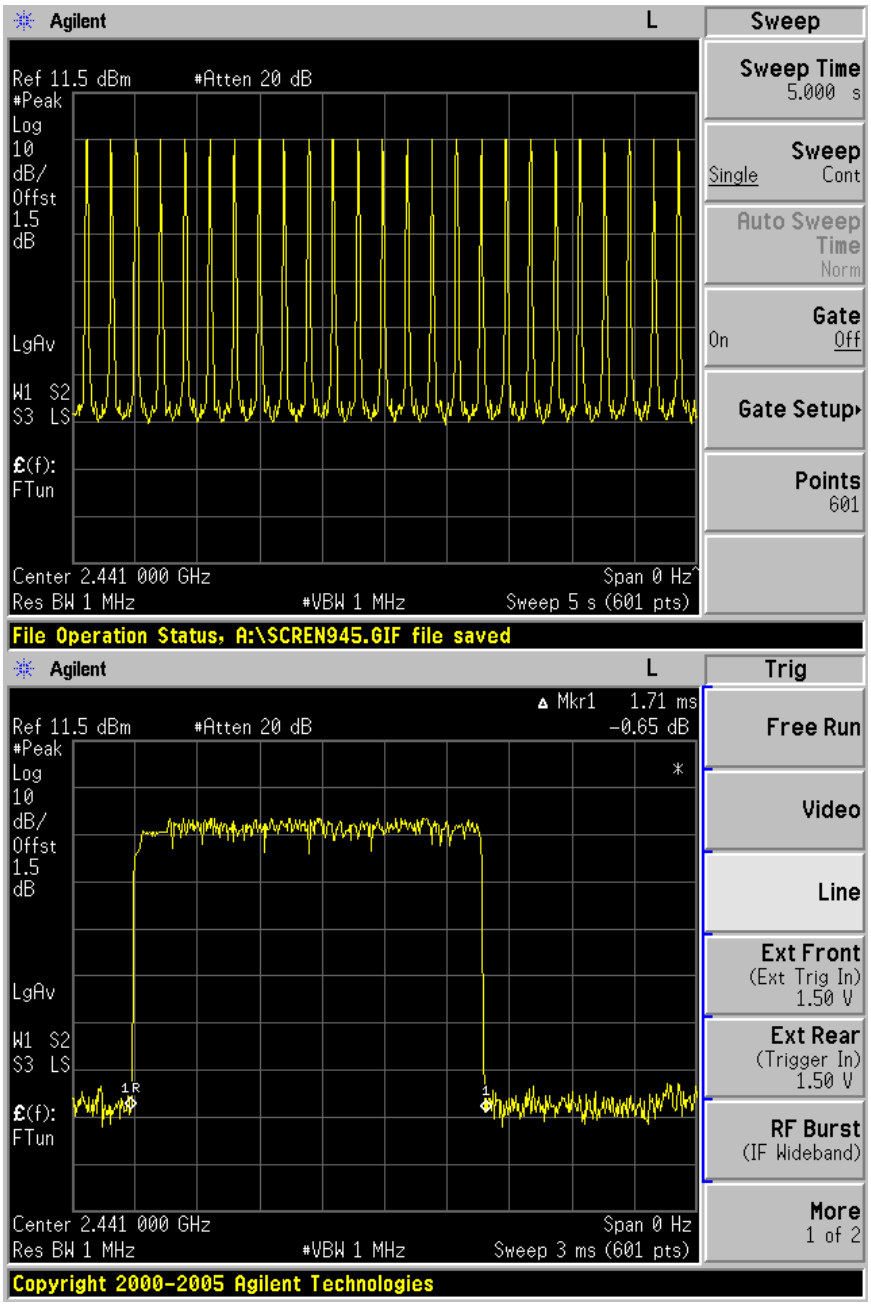

DH3

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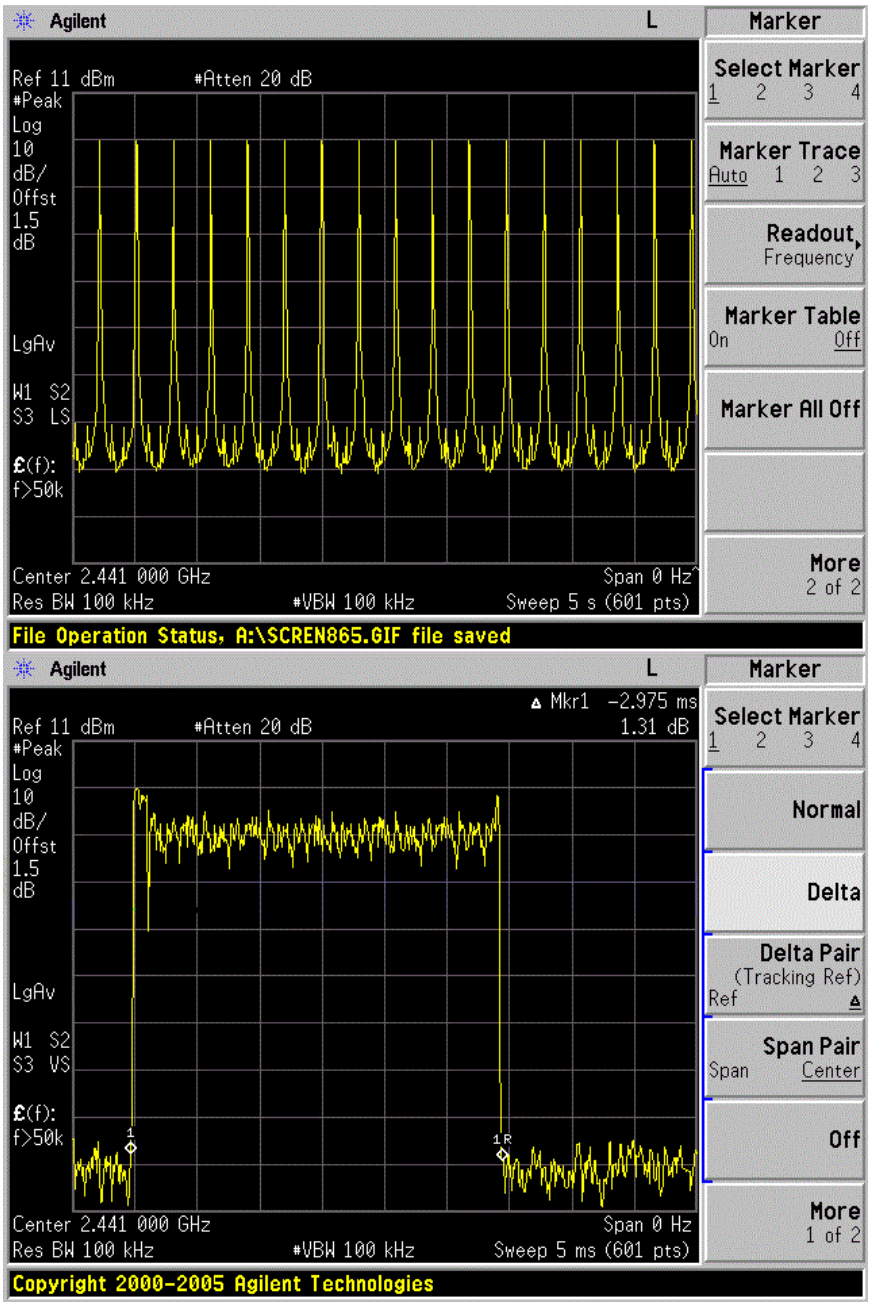

DH5

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

DH1 time slot= 50(times)/5(s) *440(μs) *31.6(s)= 139.04(ms)
DH3 time slot= 25(times)/5(s) *1710 (μs) *31.6(s)= 270.18(ms)
DH5 time slot= 17(times)/5(s) *2975 (μs) *31.6(s)=319.63 (ms)

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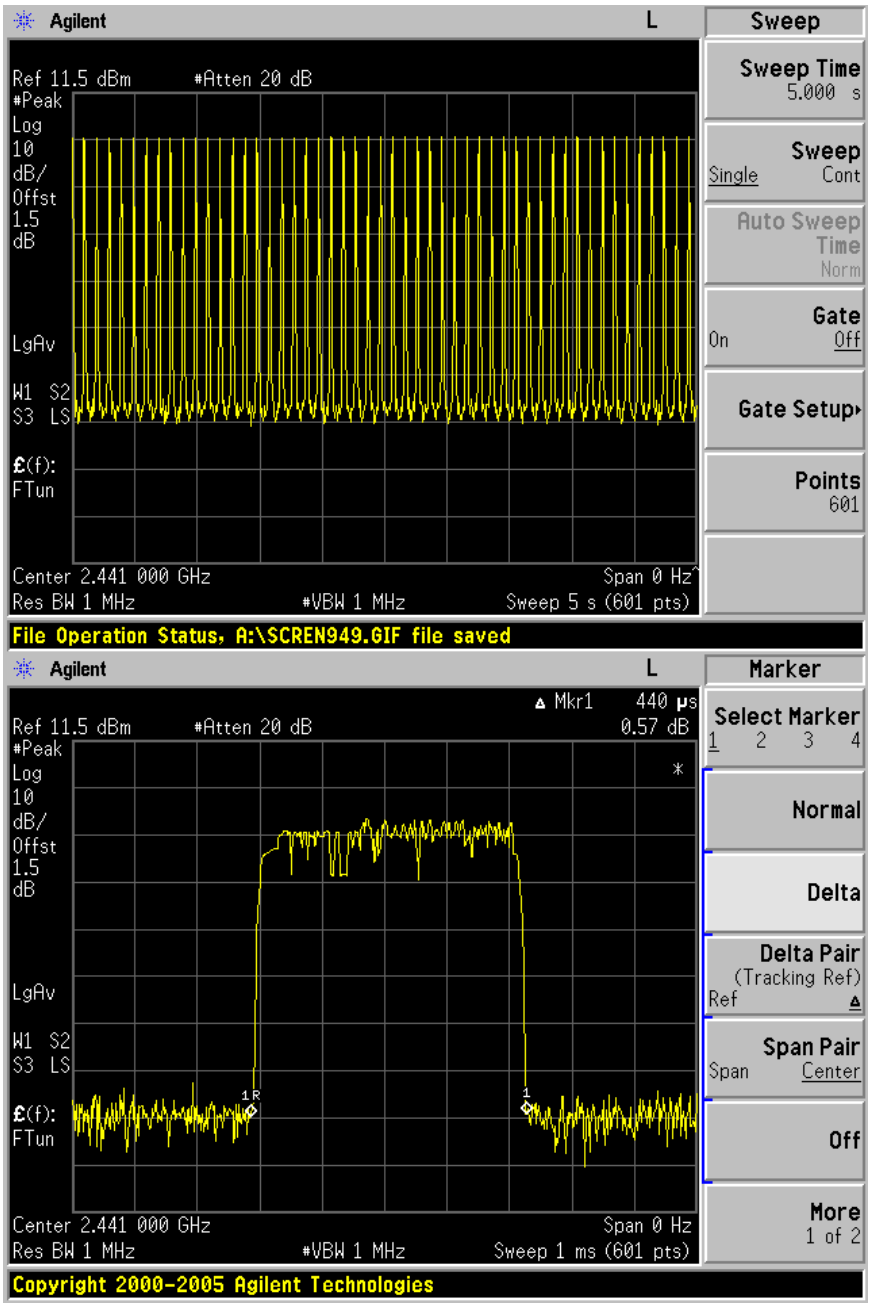
Bluetooth Mode 8-DPSK Modulation:

Test Result

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	440	141.82	< 400	Pass
DH3	1710	270.18	< 400	Pass
DH5	2983	320.49	< 400	Pass



DH1

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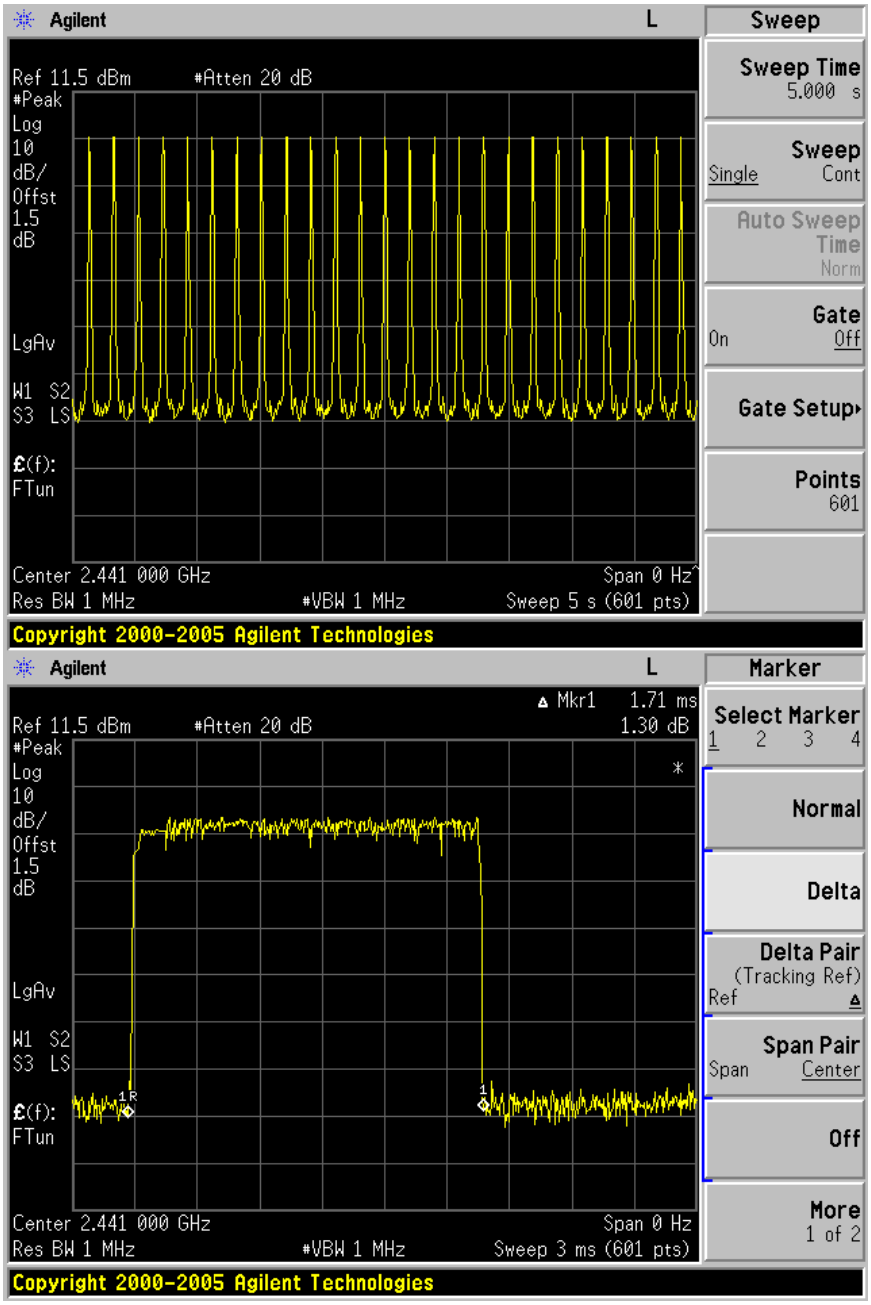

DH3

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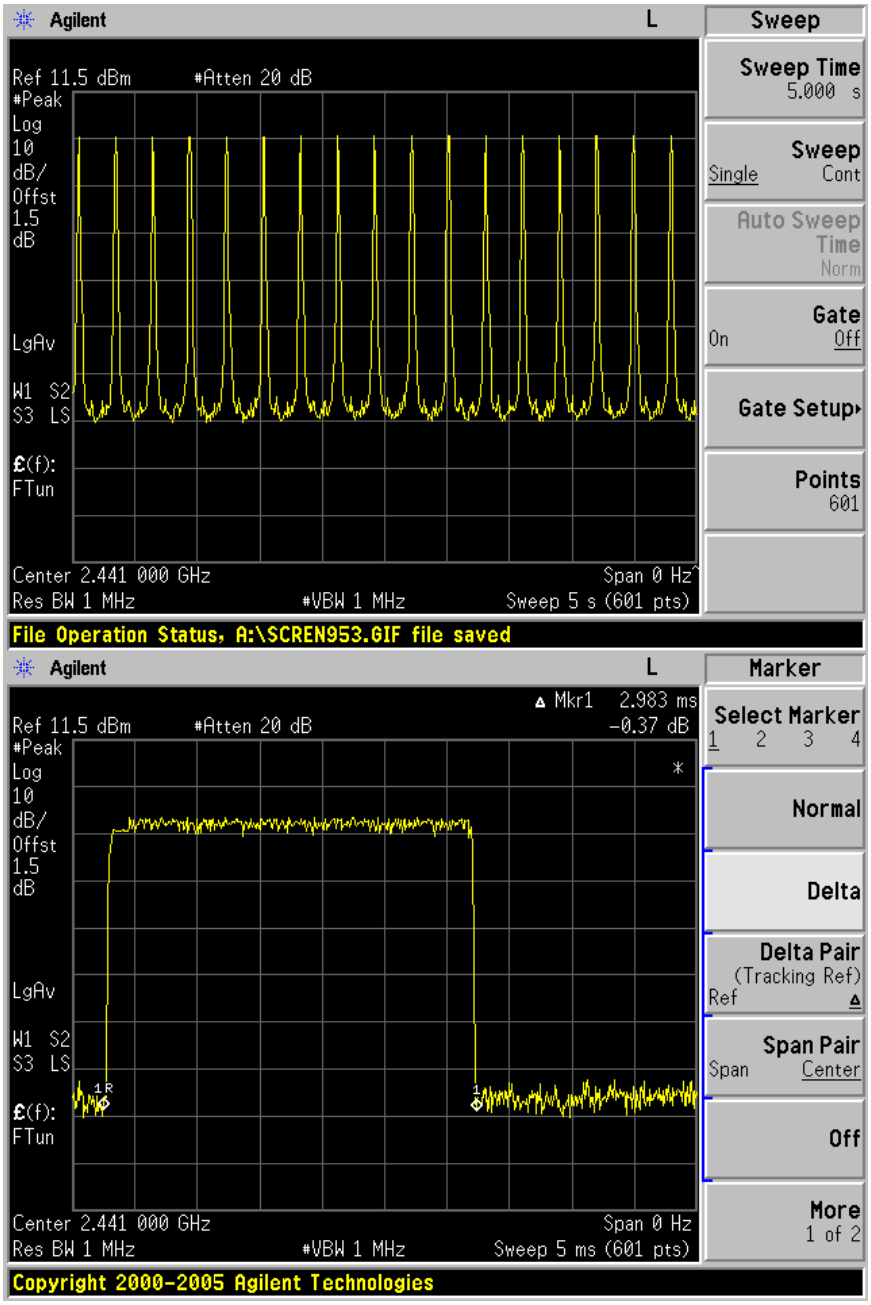

DH5

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

DH1	time slot= 51(times)/5(s) *440(μs) *31.6(s)= 141.82(ms)
DH3	time slot= 25(times)/5(s) *1710 (μs) *31.6(s)=270.18(ms)
DH5	time slot= 17(times)/5(s) *2983 (μs) *31.6(s)=320.49 (ms)

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Test Equipment

Dwell Time Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL.DUE.DATE
Spectrum Analyzer	Agilent	E4446A	US44300459	May 08, 2013

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8 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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