



FCC/IC - TEST REPORT

Report Number : **68.920.13.004.01** Date of Issue: January 28, 2013

Model : **SHB7000/28, SHB7000WT/28**

Product Type : Bluetooth Headset

Applicant : Philips Consumer Lifestyle

Address : 5/F, Philips Electronics Building 5 Science Park East Avenue,
Hong Kong Science Park, Shatin, New Territories, Hong Kong

Production Facility : Concord Electronic Factory

Address : 21, Ping'An Road, Shuikou, HuiCheng District,
Huizhou, GuangDing, China

Test Result : **Positive** **Negative**

Total pages including
Appendices : 66

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2 Details about the Test Laboratory

Details about the Test Laboratory

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Test Site 1

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Guangdong,
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Telephone: 86 755 2663 9496
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3 Description of the Equipment Under Test

Product:	Bluetooth Headset
Model no.:	SHB7000/28
FCC ID:	BOUSHB7000
IC ID:	135M-SHB7000
Brand Name:	Philips
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, $\pi/4$ -DQPSK, 8-DPSK
Duty Cycle:	34.8%
Antenna Type:	Dip type antenna
Antenna Gain:	-0.8dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Bluetooth Headset operated at 2.4GHz

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
MP4 Player	Apple	iPod touch	---



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
RSS-Gen Issue 3 December 2010	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 8 December 2010	RSS-210 — Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and C63.4 (2009).

5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C, RSS-Gen, RSS-210					
Test Condition			Pages	Test Site	Test Result
§15.207	RSS-GEN A7.2.4	Conducted emission AC power port	9	Site 2	Pass
§15.247 (b) (1)	RSS-210 A8.4	Conducted peak output power	12	Site 2	Pass
§15.247(d)	RSS-210 A8.5	Band edge compliance of RF emissions	13	Site 2	Pass
§15.247(d)	RSS-210 A8.5	Spurious RF conducted emissions	30	Site 2	Pass
§15.247(d) & §15.209	RSS-210 2.5 & RSSGEN 7.2.5 & RSSGEN 6.1	Spurious radiated emissions for transmitter and receiver	40	Site 2	Pass
§15.247(a)(2)	RSS-210 A8.2(a)	6dB bandwidth*	---	---	Not Applicable
§15.247(e)	RSS-210 A8.2(b)	Power spectral density*	---	---	Not Applicable
§15.247(a)(1)	RSS-210 A8.1(a) & RSSGEN 4.6.2	20dB bandwidth and 99% Occupied Bandwidth	44	Site 2	Pass
§15.247(a)(1)	RSS-210 A8.1(b)	Carrier frequency separation	51	Site 2	Pass
§15.247(a)(1)(iii)	RSS-210 A8.1(d)	Number of hopping frequencies	53	Site 2	Pass
§15.247(a)(1)(iii)	RSS-210 A8.1(c)	Dwell Time	55	Site 2	Pass
§15.203		Antenna requirement	See note 1		Pass

Note 1: The EUT uses a permanently ceramic antenna, which in accordance to §15.203, is considered sufficient to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: BOUSHB7000 & IC ID: 135M-SHB7000 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-210.

The difference between all models only lies in the colour of enclosure, SHB7000/28 is black, SHB7000WT/28 is white, so all the tests were applied on SHB7000/28, the other model is deemed to fulfill relevant requirement without further testing.

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: January 22, 2013

Testing Start Date: January 22, 2013

Testing End Date: January 25, 2013

- Jiangsu TÜV Product Service Ltd. – Shenzhen Branch -

Reviewed by:

Prepared by:

Tested by:



Phoebe Hu
EMC Project Manager



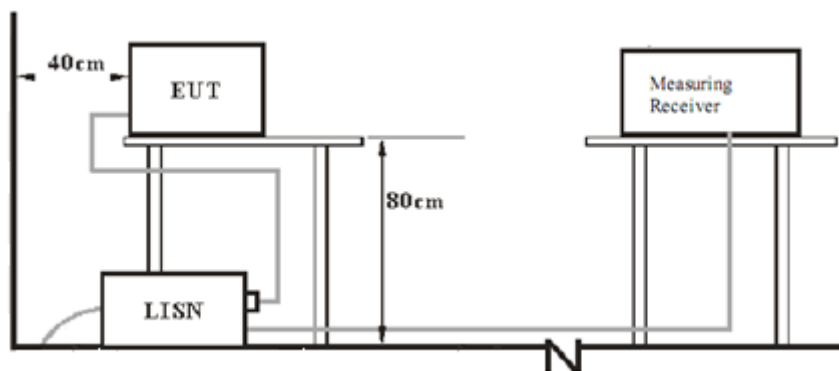
Felix Li
EMC Project Engineer



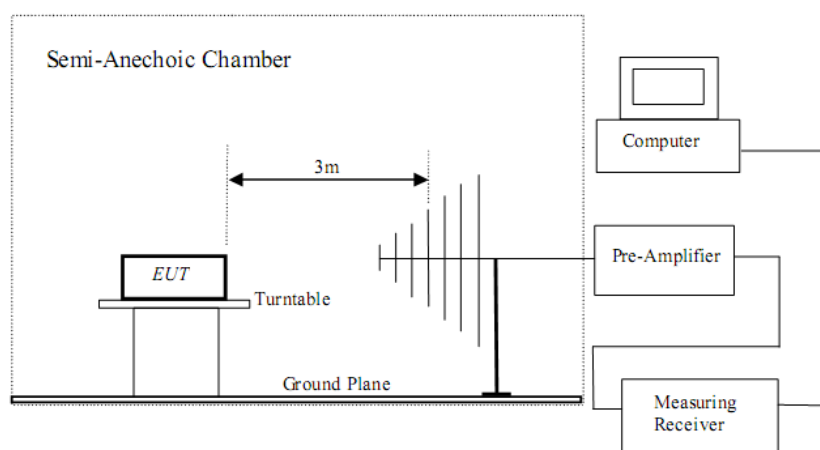
Leo Li
EMC Test Engineer

7 Test Setups

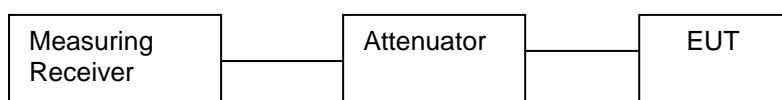
7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups



7.3 Conducted RF test setups



8 Technical Requirement

8.1 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 & RSS-GEN A7.2.4, conducted emissions limit as below:

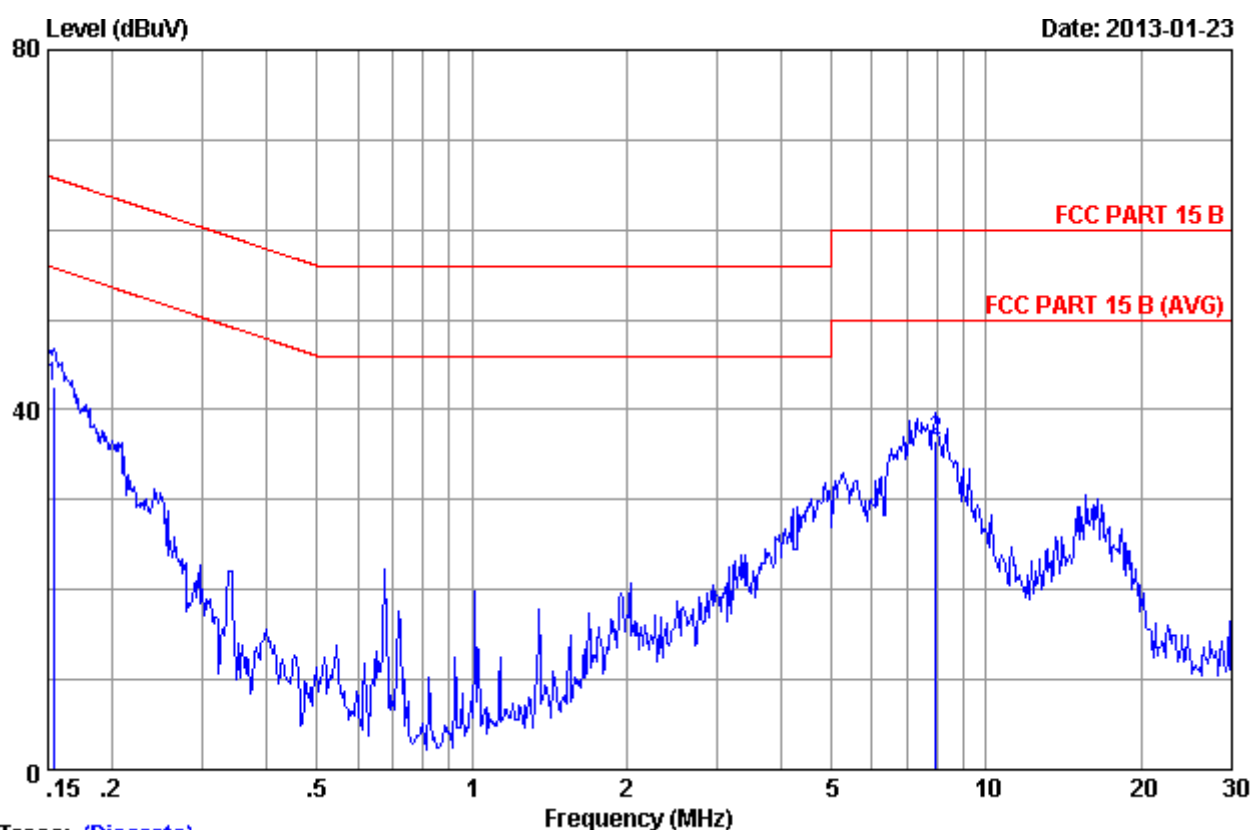
Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

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.

Conducted Emission

Product Type : Bluetooth Headset
 M/N : SHB7000/28
 Operating Condition : Charging and transmitting, DC 5V from PC USB Port
 Test Specification : Power Line, Live
 Comment : AC 120V/60Hz



Trace: (Discrete)

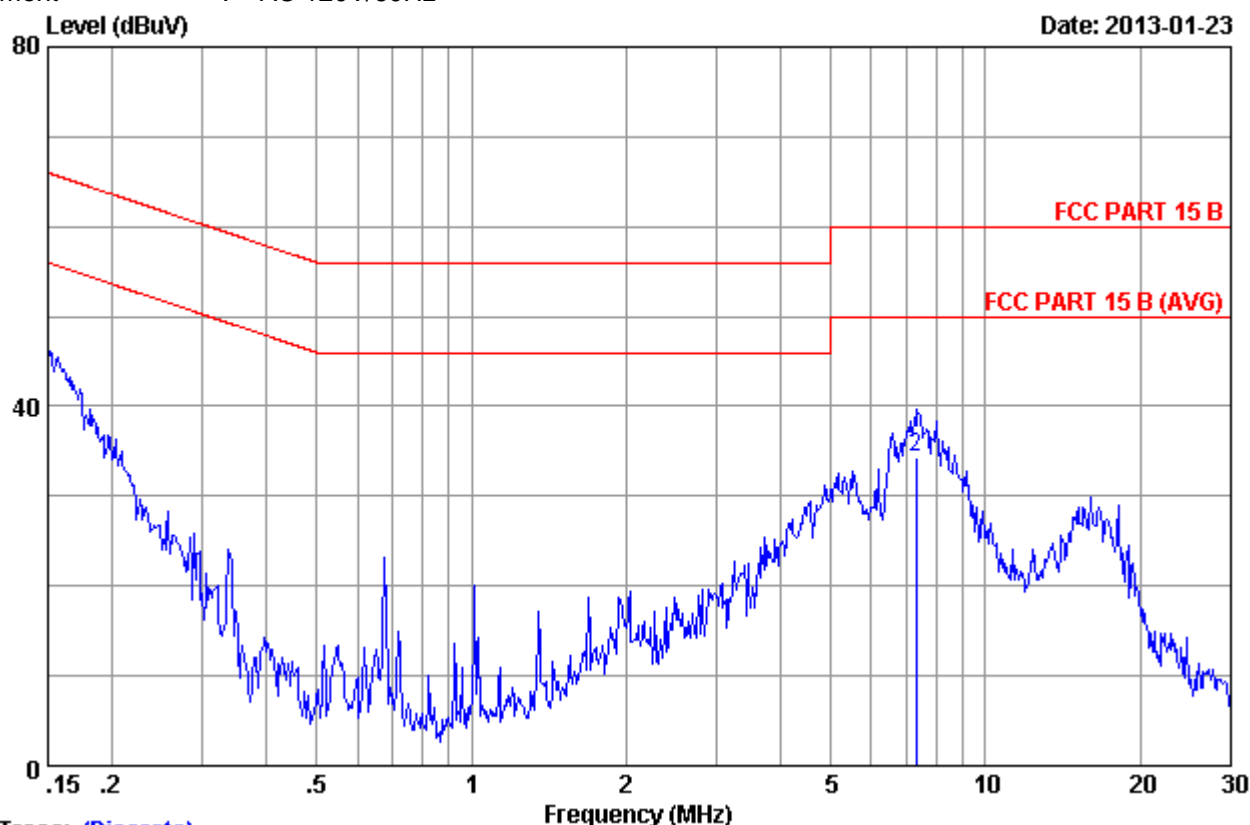
No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.15400	0.19	0.14	42.31	42.64	65.78	23.14	QP
2	7.976	0.40	0.16	36.00	36.56	60.00	23.44	QP

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

Conducted Emission

Product Type : Bluetooth Headset
 M/N : SHB7000/28
 Operating Condition : Charging and transmitting, DC 5V from PC USB Port
 Test Specification : Power Line, Neutral
 Comment : AC 120V/60Hz

Date: 2013-01-23



Trace: (Discrete)

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	38.90	39.25	66.00	26.75	QP
2	7.333	0.40	0.16	33.70	34.26	60.00	25.74	QP

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

8.2 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) and RSS-210 A8.4, 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	3.92	Pass
Middle channel 2441MHz	4.71	Pass
High channel 2480MHz	4.65	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	3.01	Pass
Middle channel 2441MHz	3.84	Pass
High channel 2480MHz	3.67	Pass

Bluetooth Mode 8-DPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	3.15	Pass
Middle channel 2441MHz	3.97	Pass
High channel 2480MHz	3.81	Pass

8.3 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. $RBW \geq 1\%$ of the span, $VBW \geq RBW$, 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 the 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) and RSS-210 A8.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen7.2.2, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

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

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.

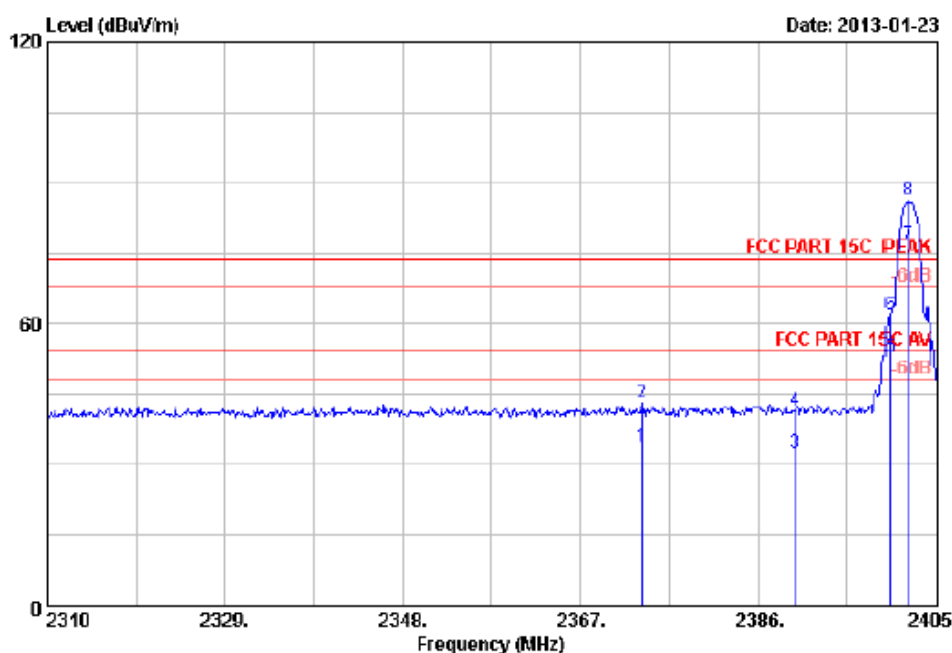
Radiated measurement result:

Hopping off test data:

Bluetooth Mode GFSK Modulation Test Result:

Lower edge peak Plot:

Vertical:



Site no. : 3m Chamber
 Dis. / Ant. : 3m 2012 3115 (4580)
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54%
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : GFSK 2402MHz Tx
 H/N :
 :
 :
 Date no. : 5
 Ant. pol. : VERTICAL
 Engineer : Leo-Li

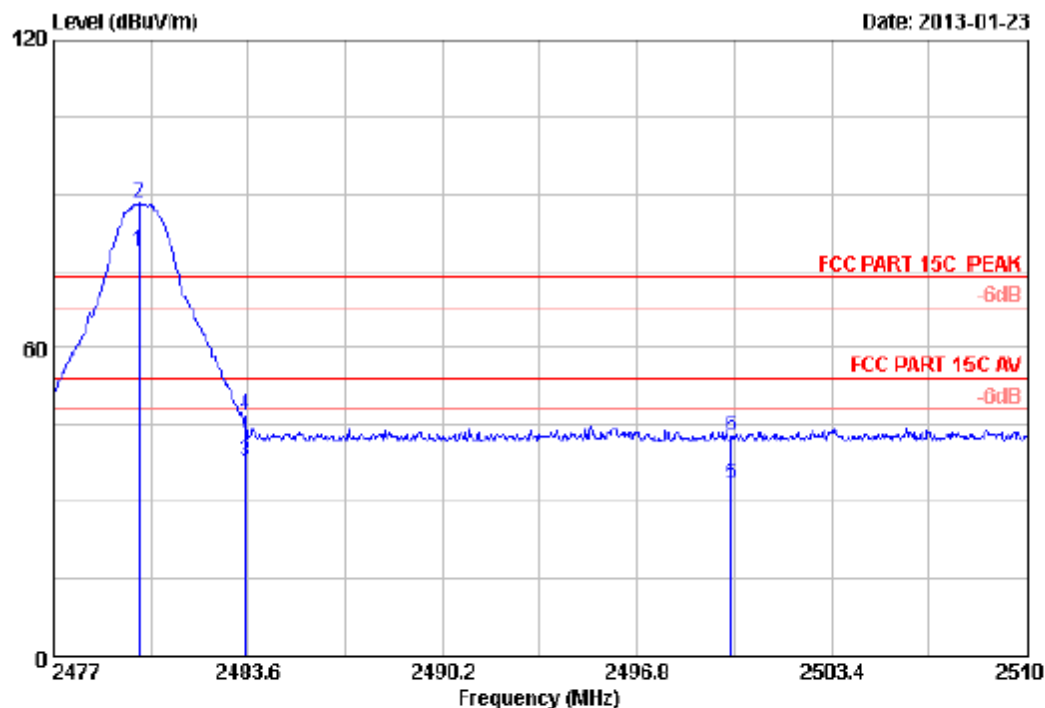
	Freq. [MHz]	Ant. Factor [dB/m]	Cable Loss [dB]	Imp. Factor [dB]	Reading [dBuV]	Emission Level [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Remark
1	2373.650	26.59	5.97	35.92	37.17	33.81	54.00	20.19	Average
2	2373.650	26.59	5.97	35.92	46.34	42.98	74.00	31.02	Peak
3	2390.000	26.70	6.00	35.92	35.57	32.35	54.00	21.65	Average
4	2390.000	26.70	6.00	35.92	44.74	41.52	74.00	32.48	Peak
5	2400.000	26.76	6.02	35.92	55.89	52.75	54.00	1.25	Average
6	2400.000	26.76	6.02	35.92	65.05	61.91	74.00	12.09	Peak
7	2401.960	26.77	6.02	35.92	80.06	76.93	54.00	-22.93	Average
8	2401.960	26.77	6.02	35.92	89.22	86.09	74.00	-12.09	Peak

Remarks:

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

Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:



```

Site no.      : 3m Chamber                Data no.   : 8
Dis. / Ant.  : 3m 2012 3115 (4580)       Ant. pol.  : VERTICAL
Limit        : FCC PART 15C PEAK
Env. / Ins.  : 23°C/54%                  Engineer   : Leo-Li
EUT         : SHB7000
Power supply : DC 3.7V
Test mode    : GFSK 2480MHz Tx
M/N         :
  
```

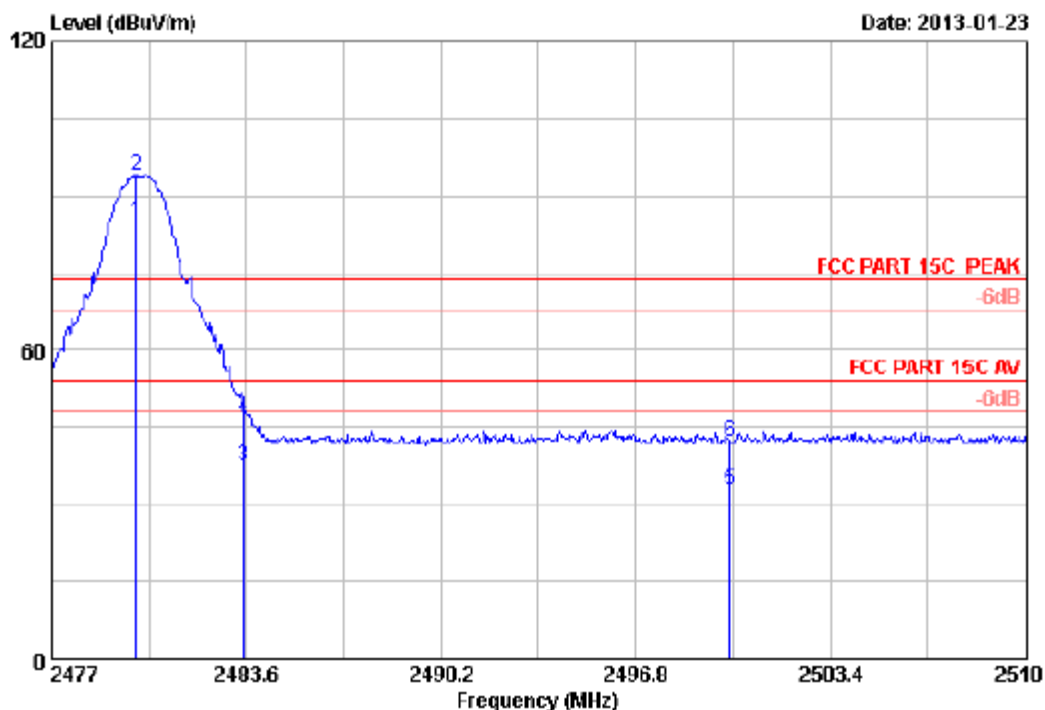
	Freq. [MHz]	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading [dBUV]	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dE)	Remark
1	2479.904	27.27	6.15	35.92	81.50	79.00	54.00	-25.00	Average
2	2479.904	27.27	6.15	35.92	90.66	88.16	74.00	-14.16	Peak
3	2483.500	27.29	6.16	35.92	40.20	37.73	54.00	16.27	Average
4	2483.500	27.29	6.16	35.92	49.36	46.89	74.00	27.11	Peak
5	2500.000	27.40	6.19	35.93	35.89	33.55	54.00	20.45	Average
6	2500.000	27.40	6.19	35.93	45.10	42.76	74.00	31.24	Peak

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.

Band edge compliance of RF emissions

Upper edge peak Plot:
Horizontal:



```

Site no.      : 3m Chamber           Data no.   : 7
Dis. / Ant.  : 3m 2012 3115 (4580)  Ant. pol.  : HORIZONTAL
Limit        : FCC PART 15C PEAK
Env. / Ins.  : 23°C/54%             Engineer   : Leo-Li
EUT         : SHB7000
Power supply : DC 3.7V
Test mode    : GFSK 2480MHz Tx
M/N         :
  
```

	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	87.33	84.83	54.00	-30.83	Average
2	2479.871	27.27	6.15	35.92	96.49	93.99	74.00	-19.99	Peak
3	2483.500	27.29	6.16	35.92	40.00	37.53	54.00	16.47	Average
4	2483.500	27.29	6.16	35.92	49.12	46.65	74.00	27.35	Peak
5	2500.000	27.40	6.19	35.93	35.25	32.91	54.00	21.09	Average
6	2500.000	27.40	6.19	35.93	44.42	42.08	74.00	31.92	Peak

Remarks:

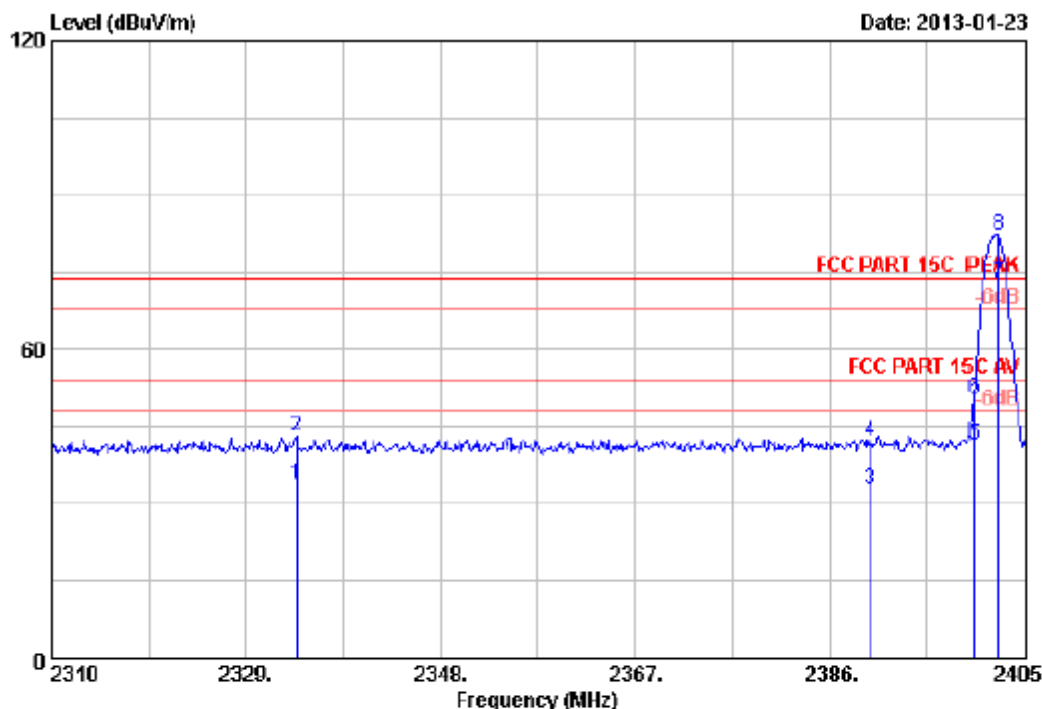
- Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
- The emission levels that are 20dB below the official limit are not reported.

Band edge compliance of RF emissions

Bluetooth Mode 8-DPSK Modulation Test Result:

Lower edge peak Plot:

Vertical:



Site no. : 3m Chamber Data no. : 19
 Dis. / Ant. : 3m 2012 3115 (4580) Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54% Engineer : Leo-Li
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : 8-DPSK 2402MHz Tx
 H/N :
 :

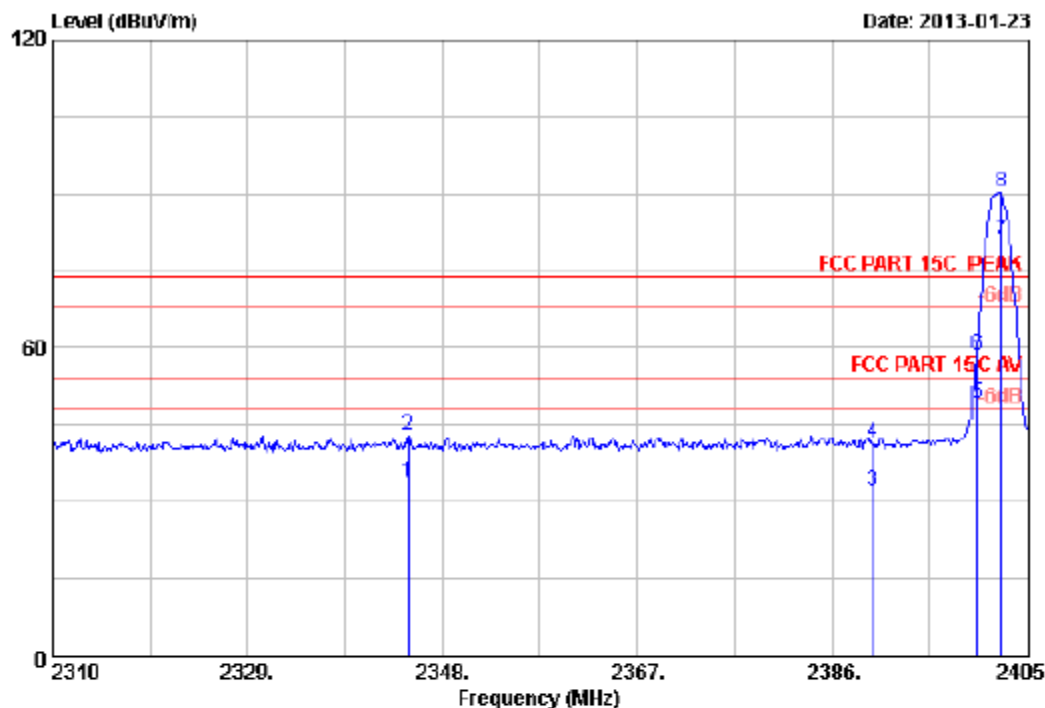
	Freq. [MHz]	Ant. Factor (dB/m)	Cable loss (dB)	Imp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2333.940	26.34	5.90	35.92	37.52	33.84	54.00	20.16	Average
2	2333.940	26.34	5.90	35.92	46.68	43.00	74.00	31.00	Peak
3	2390.000	26.70	6.00	35.92	36.04	32.82	54.00	21.18	Average
4	2390.000	26.70	6.00	35.92	45.20	41.96	74.00	32.02	Peak
5	2400.000	26.76	6.02	35.92	44.48	41.34	54.00	12.66	Average
6	2400.000	26.76	6.02	35.92	53.64	50.50	74.00	23.50	Peak
7	2402.340	26.77	6.02	35.92	76.12	72.99	54.00	-18.99	Average
8	2402.340	26.77	6.02	35.92	85.27	82.14	74.00	-8.14	Peak

Remarks:

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

Band edge compliance of RF emissions

Lower edge peak Plot:
Horizontal:



Site no. : 3m Chamber
 Dis. / Ant. : 3m 2012 3115 (4580)
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54%
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : 8-DPSK 2402MHz Tx
 H/N :
 :
 Date no. : 20
 Ant. pol. : HORIZONTAL
 Engineer : Leo-Li

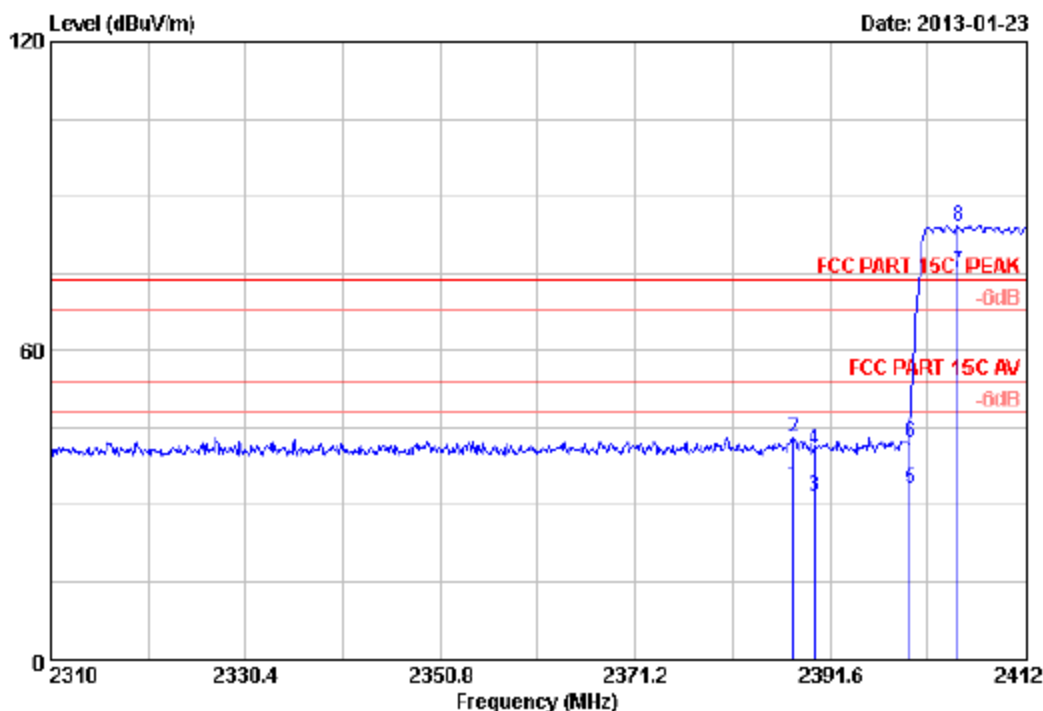
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Imp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2344.675	26.41	5.92	35.92	37.28	33.69	54.00	20.31	Average
2	2344.675	26.41	5.92	35.92	46.44	42.85	74.00	31.15	Peak
3	2390.000	26.70	6.00	35.92	35.98	32.16	54.00	21.84	Average
4	2390.000	26.70	6.00	35.92	44.54	41.32	74.00	32.68	Peak
5	2400.000	26.76	6.02	35.92	52.35	49.21	54.00	4.79	Average
6	2400.000	26.76	6.02	35.92	61.51	58.37	74.00	15.63	Peak
7	2402.340	26.77	6.02	35.92	84.19	81.06	54.00	-27.06	Average
8	2402.340	26.77	6.02	35.92	93.34	90.21	74.00	-16.21	Peak

Remarks:

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

Band edge compliance of RF emissions

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



Site no. : 3m Chamber Data no. : 22
 Dis. / Ant. : 3m 2012 3115 (4580) Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54% Engineer : Leo-Li
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : Hopping (GFSK)
 M/N :
 :

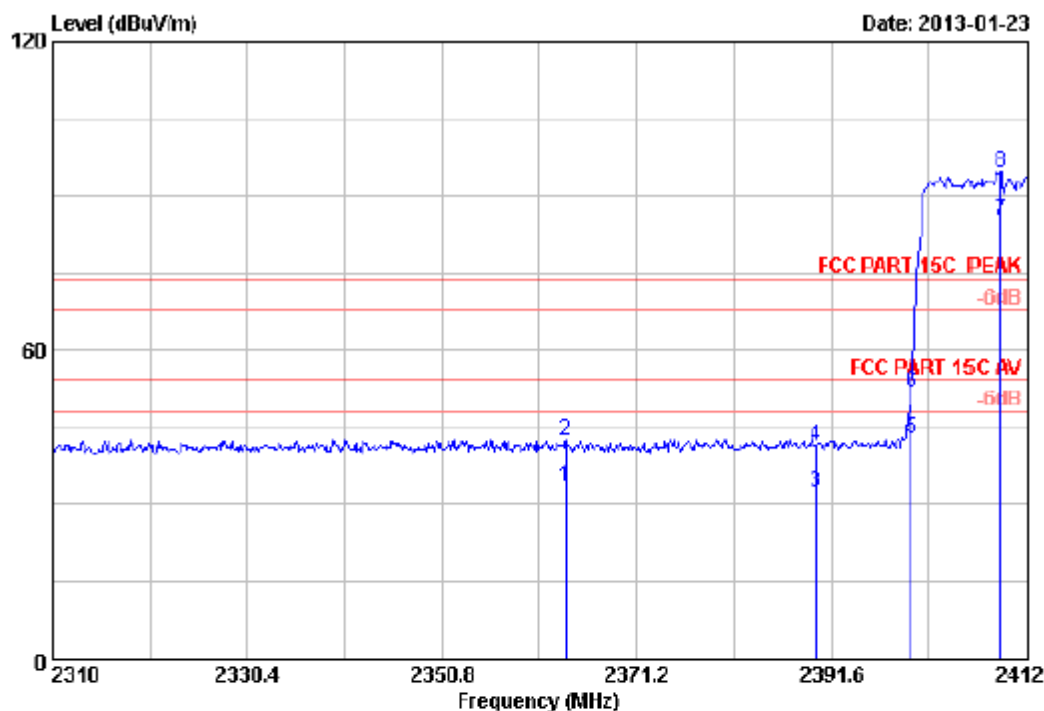
	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2387.724	26.68	6.00	35.92	37.09	33.85	54.00	20.15	Average
2	2387.724	26.68	6.00	35.92	46.25	43.01	74.00	30.99	Peak
3	2390.000	26.70	6.00	35.92	34.97	31.75	54.00	22.25	Average
4	2390.000	26.70	6.00	35.92	44.13	40.91	74.00	33.09	Peak
5	2400.000	26.76	6.02	35.92	36.08	32.94	54.00	21.06	Average
6	2400.000	26.76	6.02	35.92	45.24	42.10	74.00	31.90	Peak
7	2405.064	26.79	6.03	35.92	76.15	75.05	54.00	-21.05	Average
8	2405.064	26.79	6.03	35.92	87.31	84.21	74.00	-10.21	Peak

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.

Band edge compliance of RF emissions

Lower edge peak Plot:
Horizontal:



Site no. : 3m Chamber Date no. : Z1
 Dis. / Int. : 3m 2012 3115 (4580) Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54% Engineer : Leo-Li
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : Hopping (GFSK)
 N/N :
 :

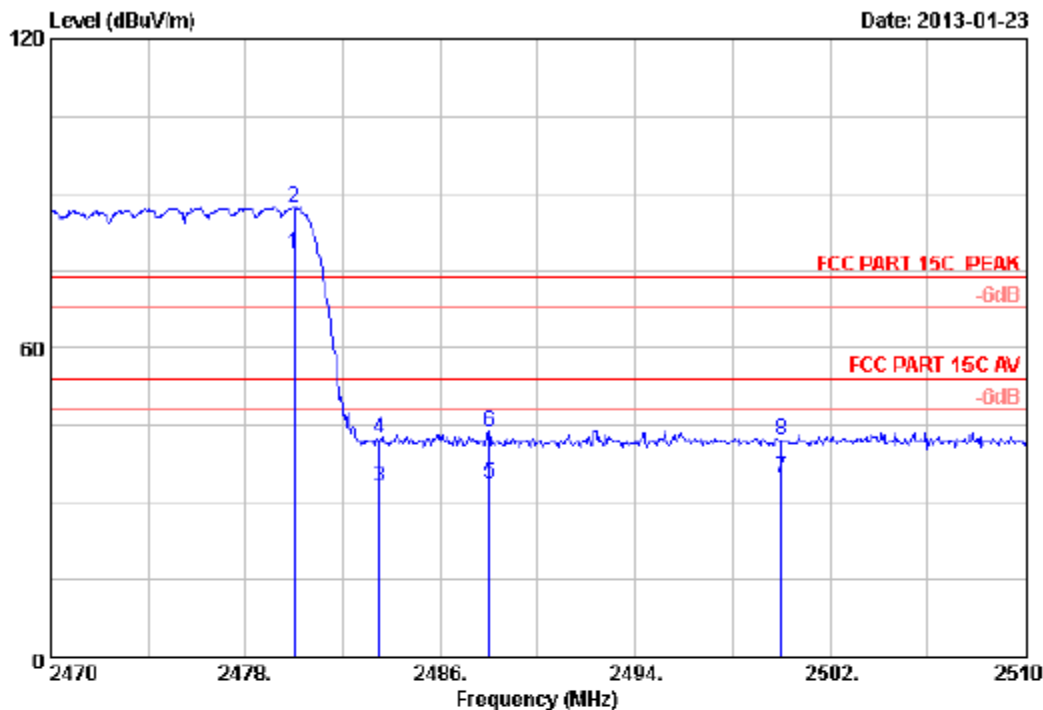
	Freq. [MHz]	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2363.754	26.53	5.96	35.92	36.79	33.36	54.00	20.64	Average
2	2363.754	26.53	5.96	35.92	45.95	42.52	74.00	31.48	Peak
3	2390.000	26.70	6.00	35.92	35.58	32.36	54.00	21.64	Average
4	2390.000	26.70	6.00	35.92	44.74	41.52	74.00	32.48	Peak
5	2400.000	26.76	6.02	35.92	45.93	42.79	54.00	11.21	Average
6	2400.000	26.76	6.02	35.92	55.09	51.95	74.00	22.05	Peak
7	2409.144	26.82	6.03	35.92	88.47	85.40	54.00	-31.40	Average
8	2409.144	26.82	6.03	35.92	97.63	94.56	74.00	-20.56	Peak

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.

Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:



Site no. : 3m Chamber Data no. : 23
 Dis. / Int. : 3m 2012 3115 (4580) Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54% Engineer : Leo-Li
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : Hopping (GFSK)
 N/N :
 :

	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	2480.000	27.27	6.15	35.92	80.56	78.06	54.00	-24.06	Average
2	2480.000	27.27	6.15	35.92	89.72	87.22	74.00	-13.22	Peak
3	2483.500	27.29	6.16	35.92	35.65	33.18	54.00	20.82	Average
4	2483.500	27.29	6.16	35.92	44.81	42.34	74.00	31.66	Peak
5	2488.000	27.32	6.17	35.92	36.08	33.65	54.00	20.35	Average
6	2488.000	27.32	6.17	35.92	46.37	43.94	74.00	30.06	Peak
7	2500.000	27.40	6.19	35.93	37.21	34.87	54.00	19.13	Average
8	2500.000	27.40	6.19	35.93	44.41	42.07	74.00	31.93	Peak

Remarks:

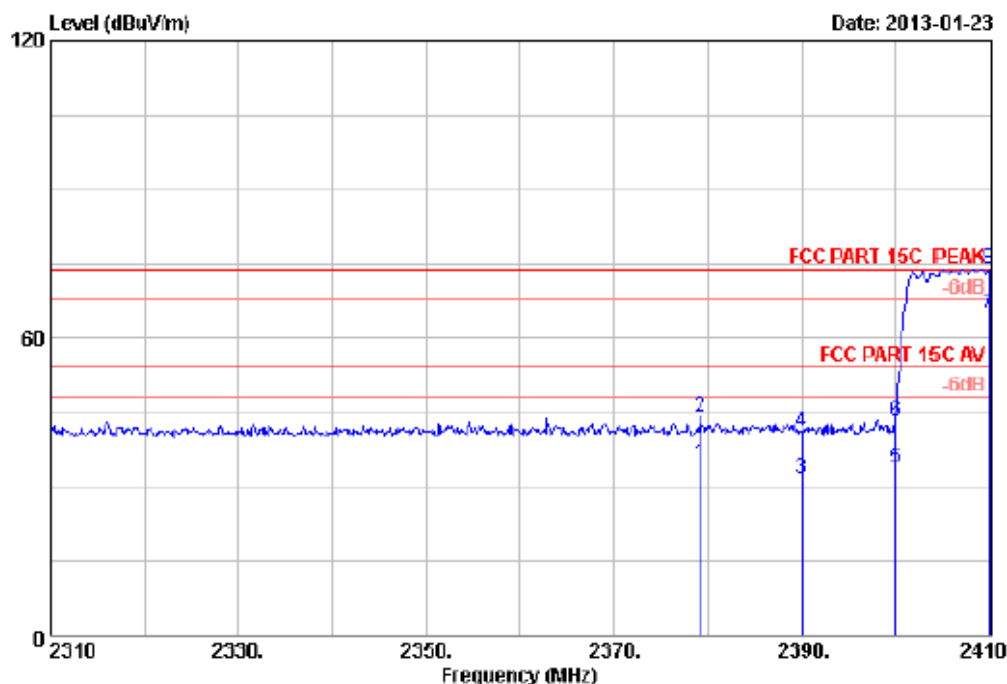
- Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
- The emission levels that are 20dB below the official limit are not reported.

Band edge compliance of RF emissions

Bluetooth Mode 8-DPSK Modulation Test Result:

Lower edge peak Plot:

Vertical:



Site no. : 3m Chamber Date no. : 27
 Dis. / Ant. : 3m 2012 3115 (4580) Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54% Engineer : Leo-Li
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : Hopping (8-DPSK)
 N/N :
 :

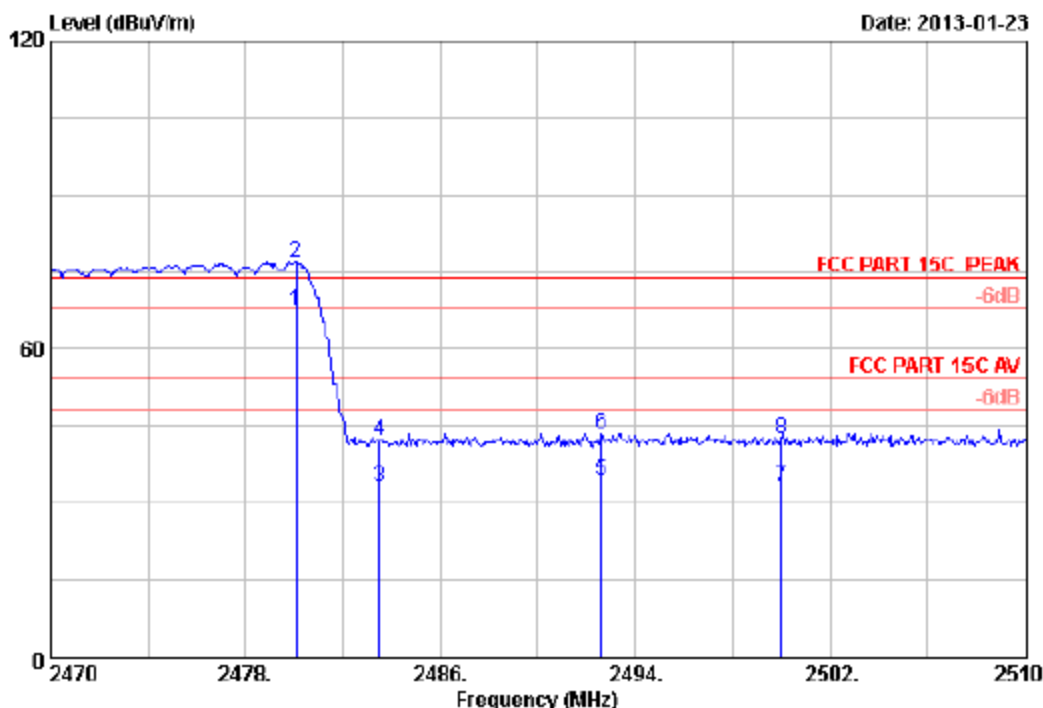
	Freq. [MHz]	Ant. Factor [dB/m]	Cable loss [dB]	Imp. Factor [dB]	Reading [dBuV]	Emission Level [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Remark
1	2379.200	26.63	5.98	35.92	38.18	34.87	54.00	19.13	Average
2	2379.200	26.63	5.98	35.92	47.34	44.03	74.00	29.97	Peak
3	2390.000	26.70	6.00	35.92	35.01	31.79	54.00	22.21	Average
4	2390.000	26.70	6.00	35.92	44.17	40.95	74.00	33.05	Peak
5	2400.000	26.76	6.02	35.92	37.03	33.89	54.00	20.11	Average
6	2400.000	26.76	6.02	35.92	46.19	43.05	74.00	30.95	Peak
7	2409.800	26.82	6.03	35.92	67.88	64.81	54.00	-10.81	Average
8	2409.800	26.82	6.03	35.92	77.03	73.96	74.00	0.04	Peak

Remarks:

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

Band edge compliance of RF emissions

Upper edge peak Plot:
Vertical:



Site no. : 3m Chamber Date no. : 26
 Dis. / Ant. : 3m 2012 3115 (4580) Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23°C/54% Engineer : Leo-Li
 EUT : SHB7000
 Power supply : DC 3.7V
 Test mode : Hopping (8-DPSK)
 N/N :
 :

	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	2480.080	27.27	6.15	35.92	70.17	67.67	54.00	-13.67	Average
2	2480.080	27.27	6.15	35.92	79.33	76.83	74.00	-2.83	Peak
3	2483.500	27.29	6.16	35.92	35.44	32.97	54.00	21.03	Average
4	2483.500	27.29	6.16	35.92	44.60	42.13	74.00	31.87	Peak
5	2492.600	27.35	6.17	35.92	36.78	34.38	54.00	19.62	Average
6	2492.600	27.35	6.17	35.92	45.94	43.54	74.00	30.46	Peak
7	2500.000	27.40	6.19	35.93	35.53	33.19	54.00	20.81	Average
8	2500.000	27.40	6.19	35.93	44.69	42.35	74.00	31.65	Peak

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.

8.4 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 \geq 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

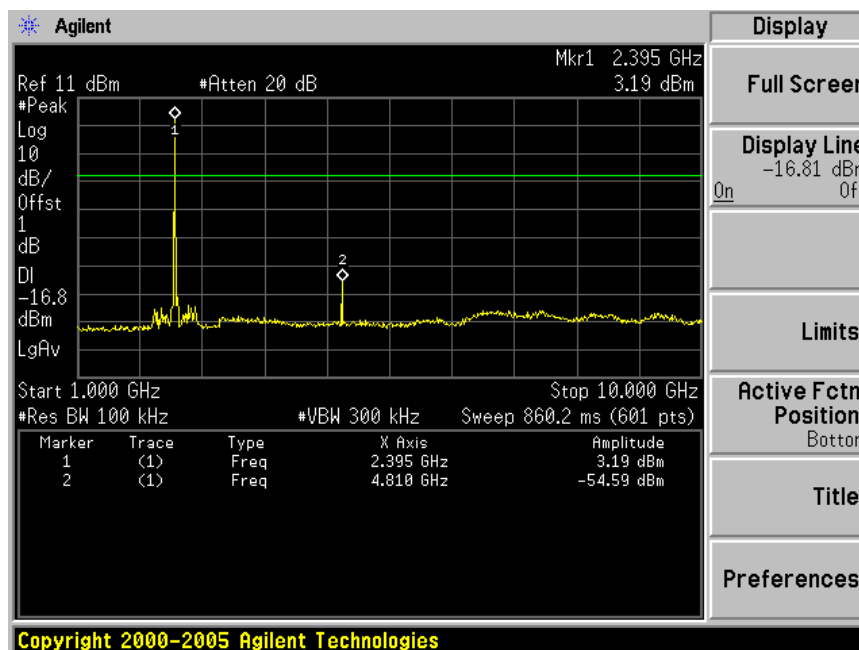
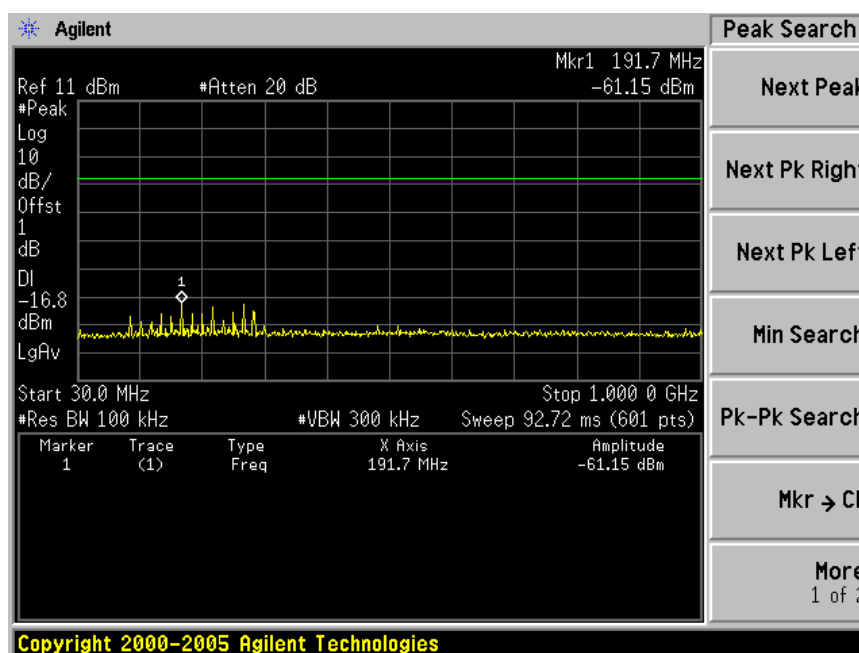
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

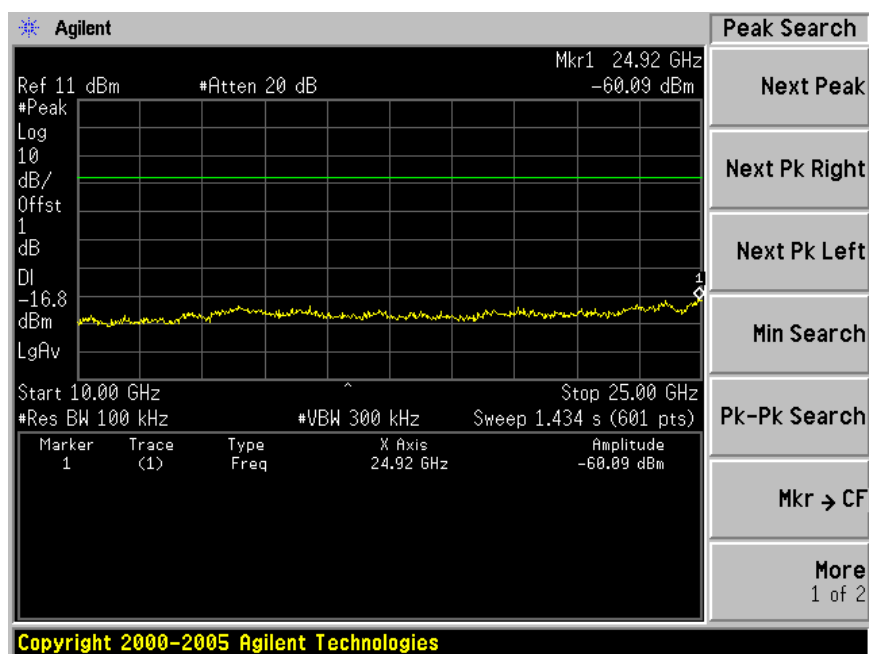
The EUTs have been tested under all modulation modes, only the worst case GFSK and 8-DPSK modulation test result are listed in the report.

Bluetooth Mode GFSK Modulation Test Result:

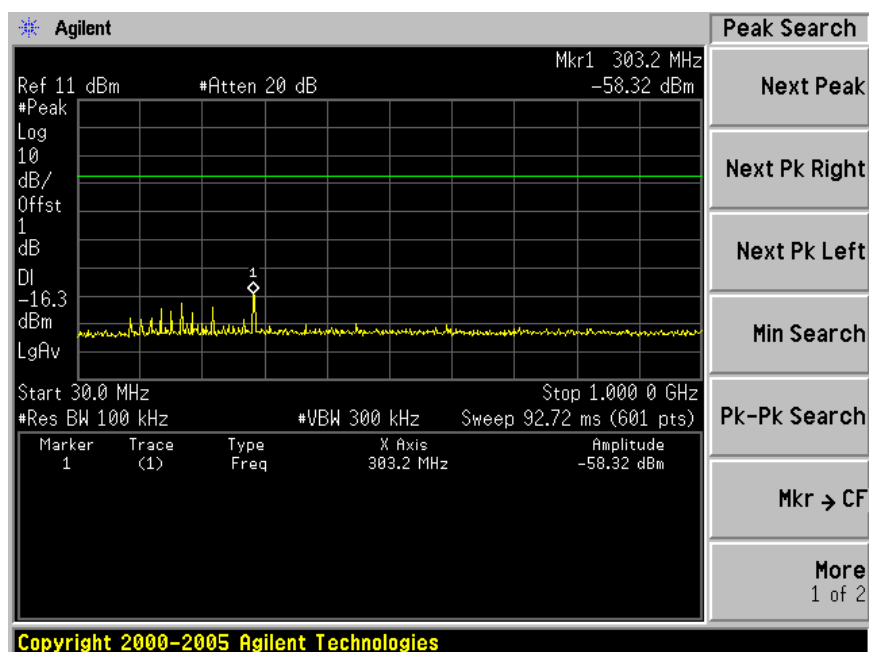
2402MHz



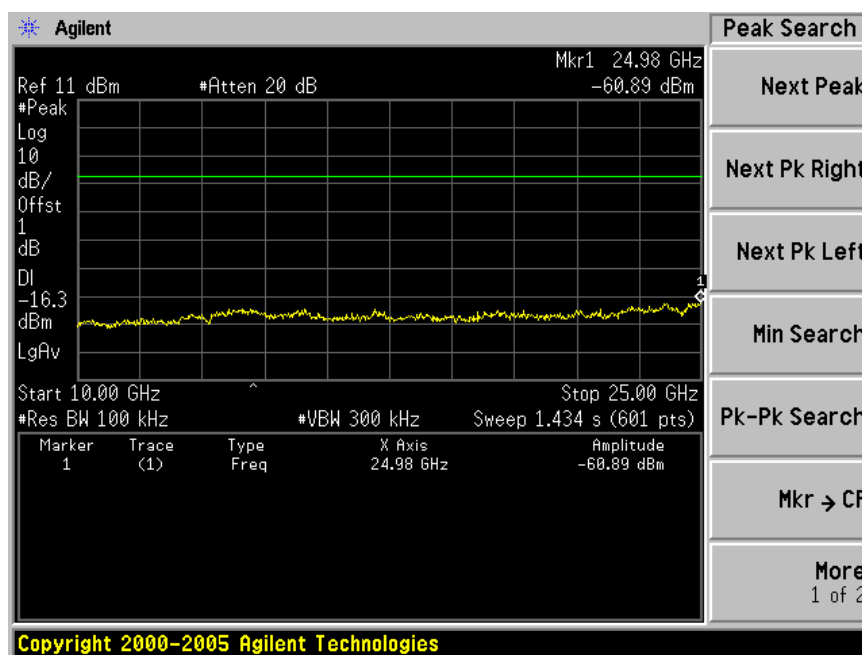
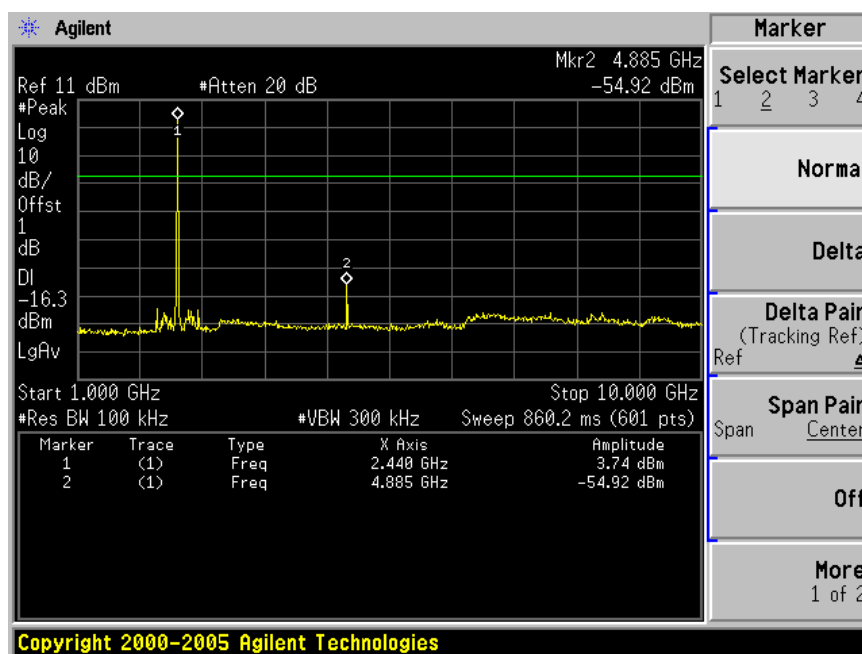
Spurious RF conducted emissions



2441MHz

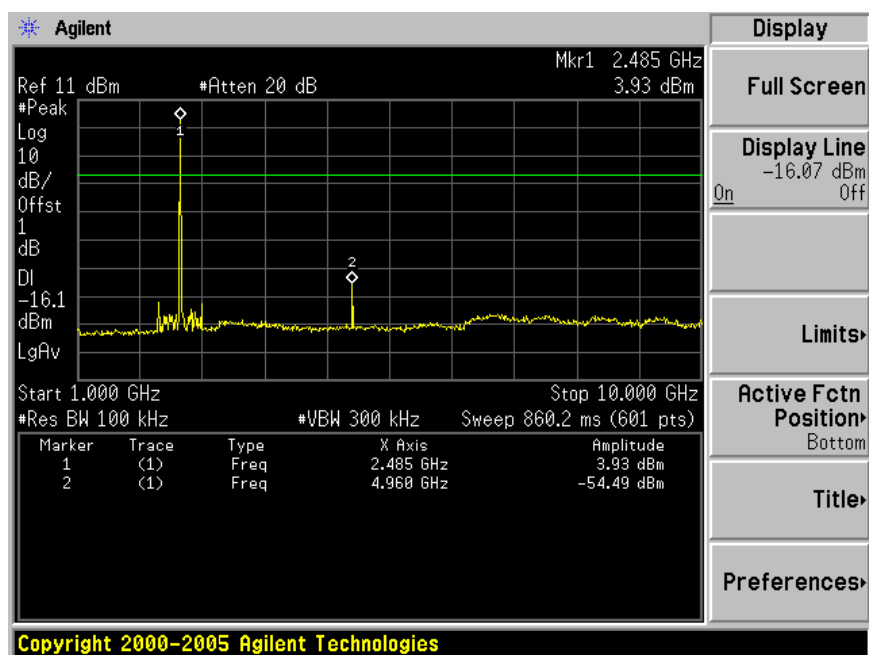
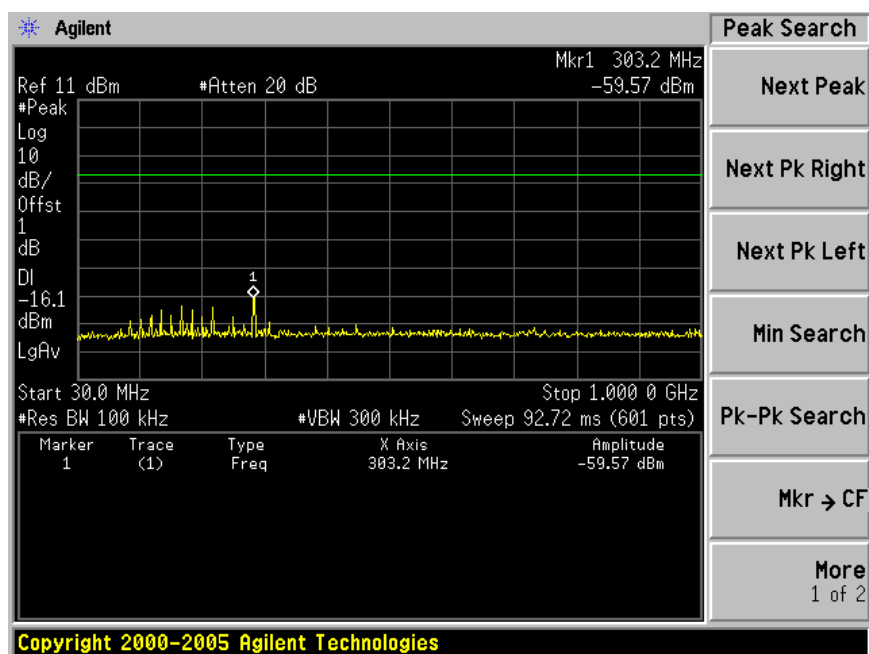


Spurious RF conducted emissions

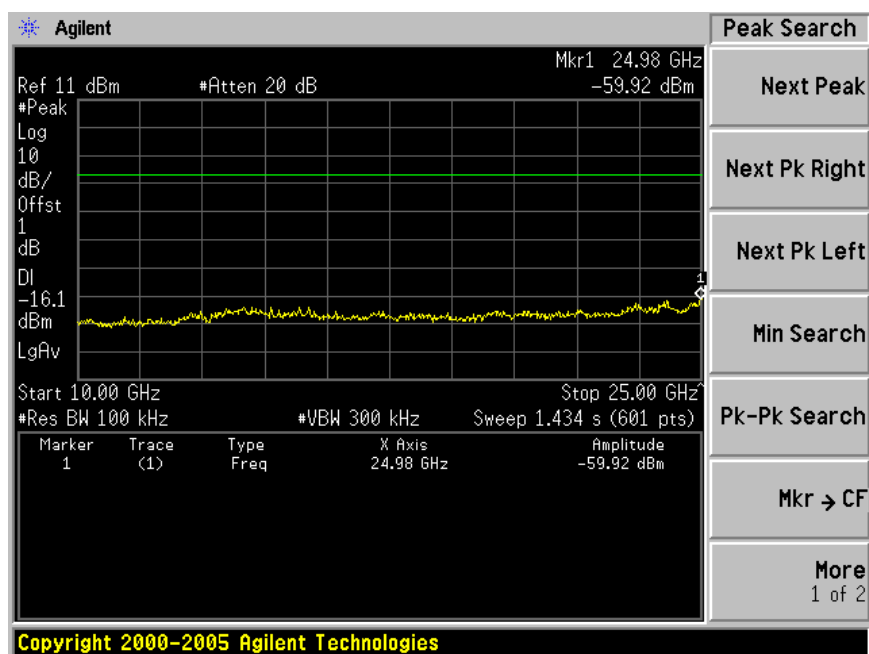


Spurious RF conducted emissions

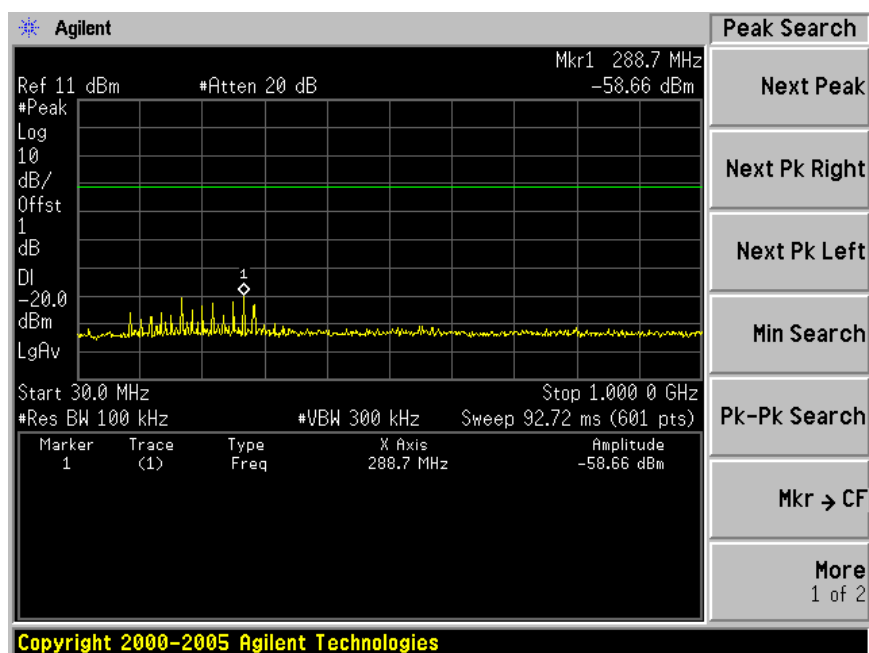
2480MHz



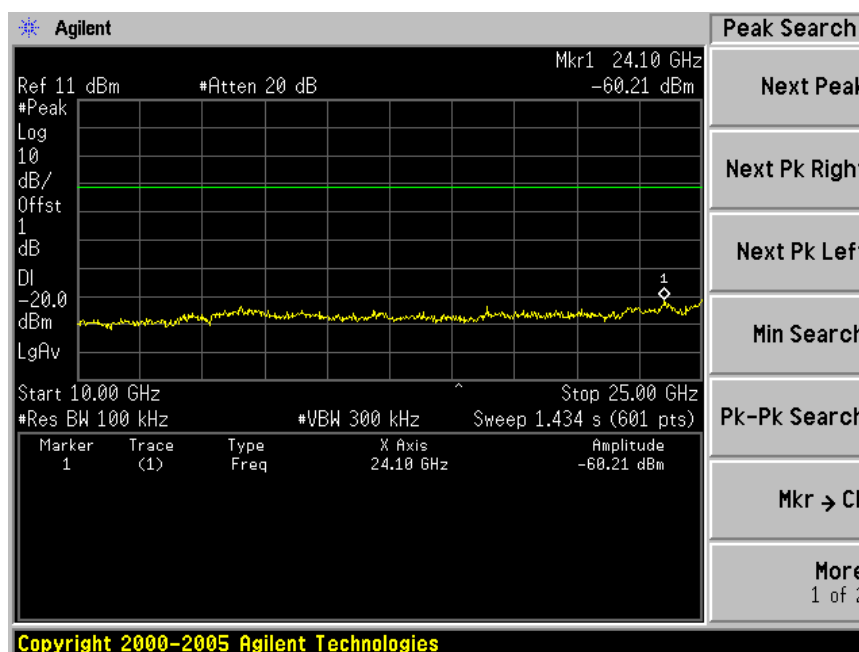
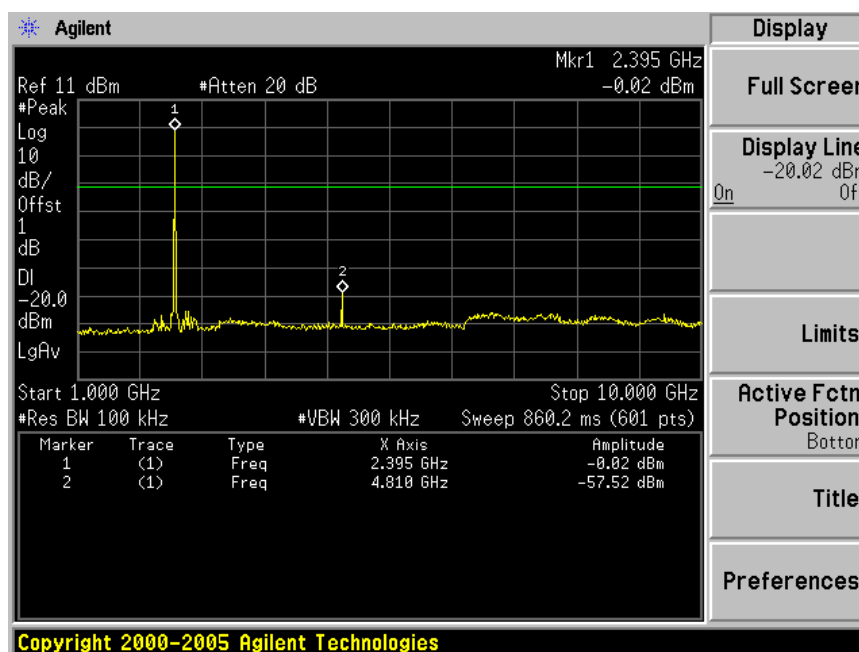
Spurious RF conducted emissions



Bluetooth Mode 8-DPSK Modulation Test Result:
2402MHz

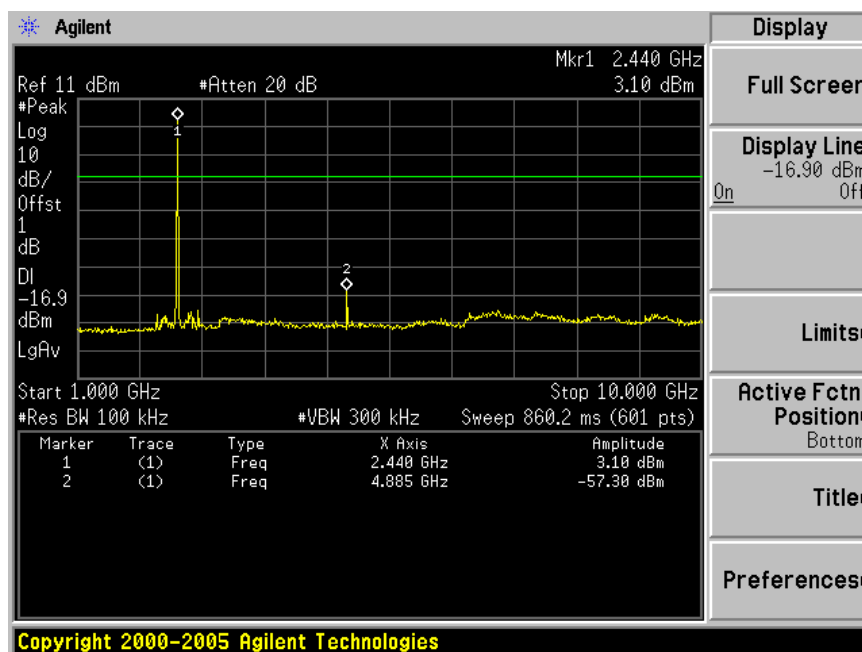
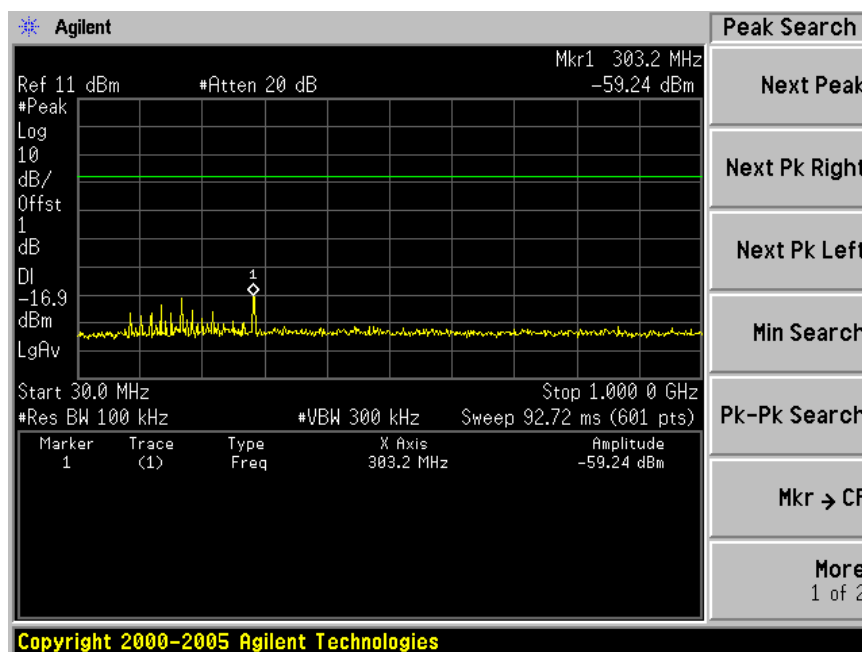


Spurious RF conducted emissions

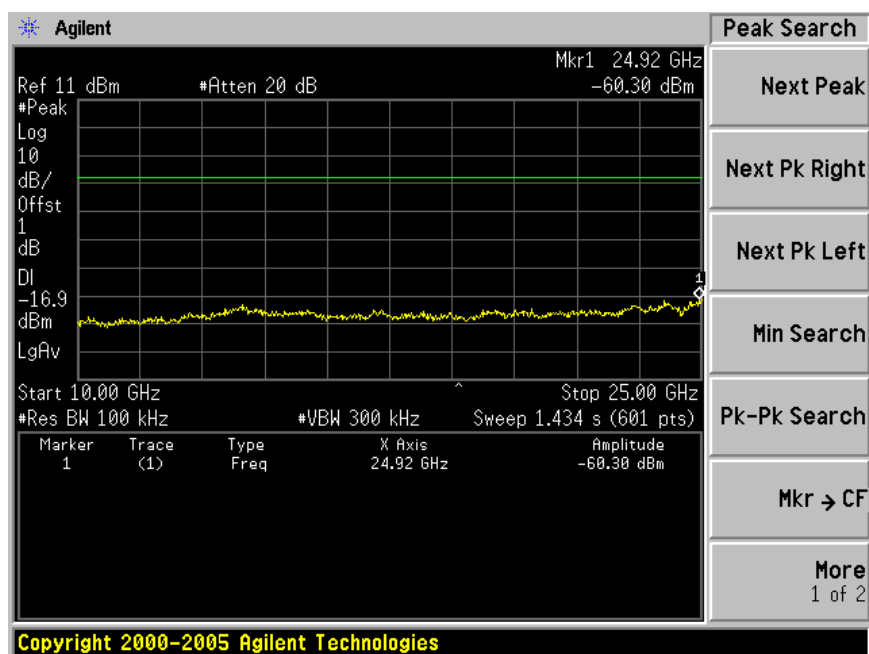


Spurious RF conducted emissions

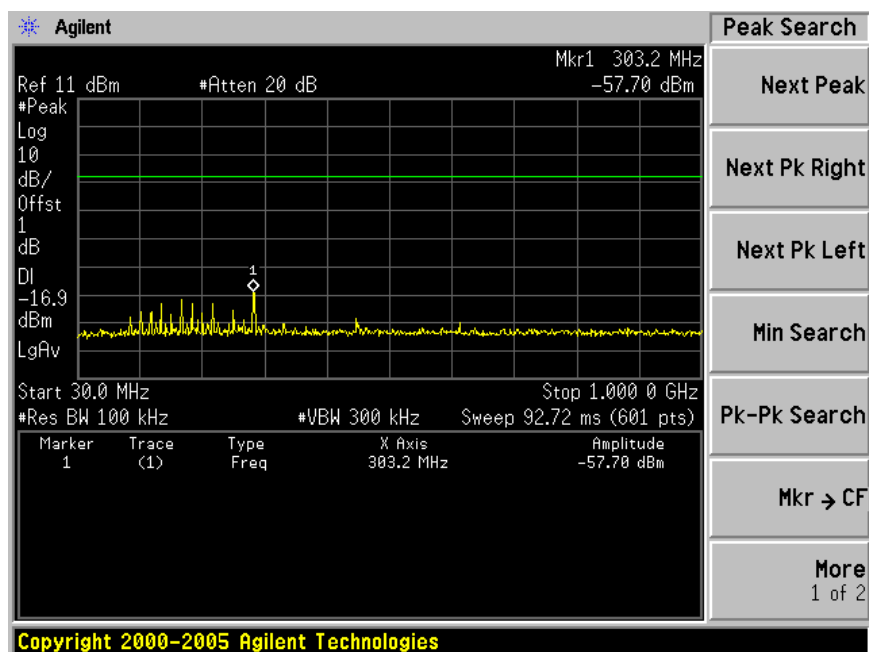
2441MHz



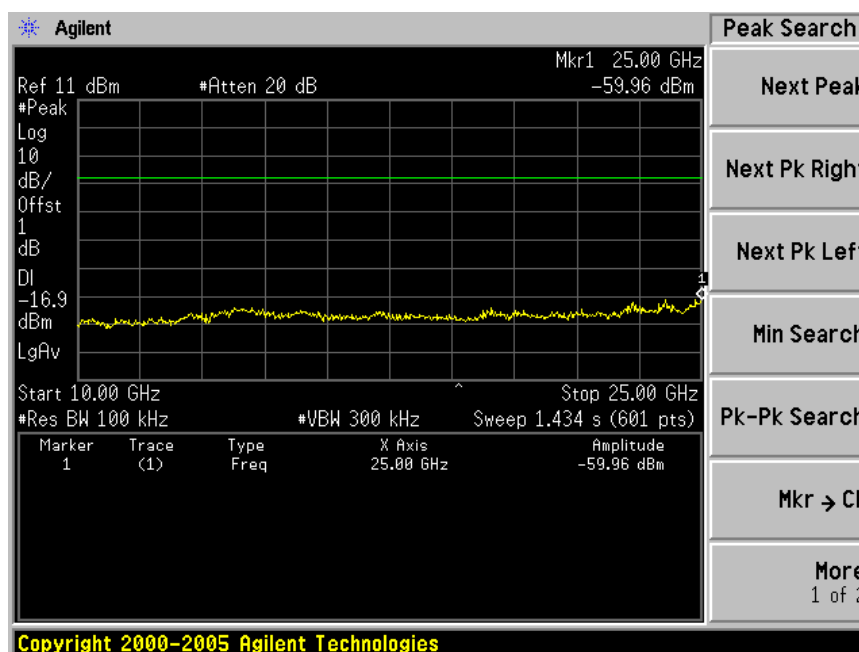
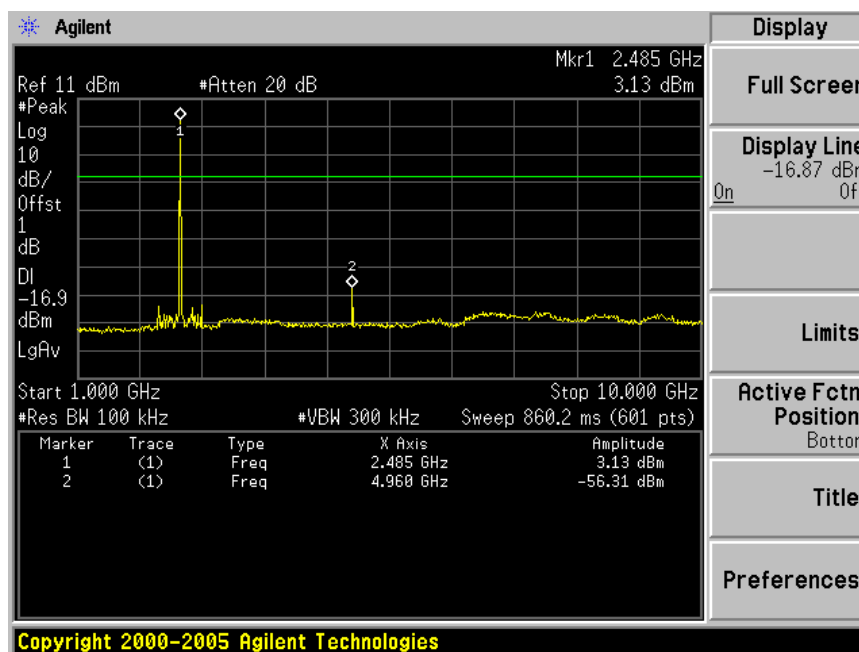
Spurious RF conducted emissions



2480MHz



Spurious RF conducted emissions



8.5 Spurious radiated emissions for transmitter and receiver

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 $f \geq 1\text{GHz}$, 100 kHz for $f < 1\text{GHz}$, VBW \geq 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 $20\log(\text{duty cycle}/100\text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/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

Spurious radiated emissions for transmitter and receiver

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 MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBuV/m	Detector	Result
68.800	11.05	0.69	-	2.7	14.44	Vertical	40	QP	Pass
63.950	11.99	0.69	-	9.54	22.22	Horizontal	40	QP	Pass
4804.000	32.47	8.67	35.72	45.67	51.09	Vertical	74.0	PK	Pass
4804.000	32.47	8.67	35.72	44.75	50.17	Horizontal	74.0	PK	Pass

Bluetooth Mode GFSK Modulation 2441MHz Test Result

Frequency MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBuV/m	Detector	Result
4882.000	32.64	8.74	35.69	45.37	51.06	Vertical	74.0	PK	Pass
4882.000	32.64	8.74	35.69	44.71	50.40	Horizontal	74.0	PK	Pass

Bluetooth Mode GFSK Modulation 2480MHz Test Result

Frequency MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBuV/m	Detector	Result
4960.000	32.81	8.81	35.66	46.28	52.24	Vertical	74.0	PK	Pass
4960.000	32.81	8.81	35.66	44.79	50.75	Horizontal	74.0	PK	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.

Spurious radiated emissions for transmitter and receiver

Bluetooth Mode 8-DPSK Modulation 2402MHz Test Result

Frequency MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBuV/m	Detector	Result
80.440	9.3	0.76	-	4.62	14.68	Vertical	40	QP	Pass
163.860	13.77	0.99	-	3.19	17.95	Horizontal	43.5	QP	Pass
4804.000	32.47	8.67	35.72	45.23	50.65	Vertical	74.0	PK	Pass
4804.000	32.47	8.67	35.72	44.98	50.40	Horizontal	74.0	PK	Pass

Bluetooth Mode 8-DPSK Modulation 2441MHz Test Result

Frequency MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBuV/m	Detector	Result
4882.000	32.64	8.74	35.69	45.36	51.05	Vertical	74	PK	Pass
4882.000	32.64	8.74	35.69	44.27	49.96	Horizontal	74	PK	Pass

Bluetooth Mode 8-DPSK Modulation 2480MHz Test Result

Frequency MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dBuV	Emission Level dBuV/m	Polarization	Limit dBuV/m	Detector	Result
4960.000	32.81	8.81	35.66	45.28	51.24	Vertical	74.0	PK	Pass
4960.000	32.81	8.81	35.66	44.35	50.31	Horizontal	74.0	PK	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.

Spurious radiated emissions for transmitter and receiver

Receiving spurious emission test result as below:

Frequency MHz	Antenna Factor dB/m	Cable Loss dB	Amp. Factor dB	Reading dB μ V	Emission Level dB μ V/m	Polarization	Limit dB μ V/m	Detector	Result
939.860	22.07	2.85	-	4.56	29.48	Vertical	46	QP	Pass
Above 1GHz*	-	-	-	-	-	-	-	-	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.

8.6 20 dB bandwidth and 99% Occupied 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

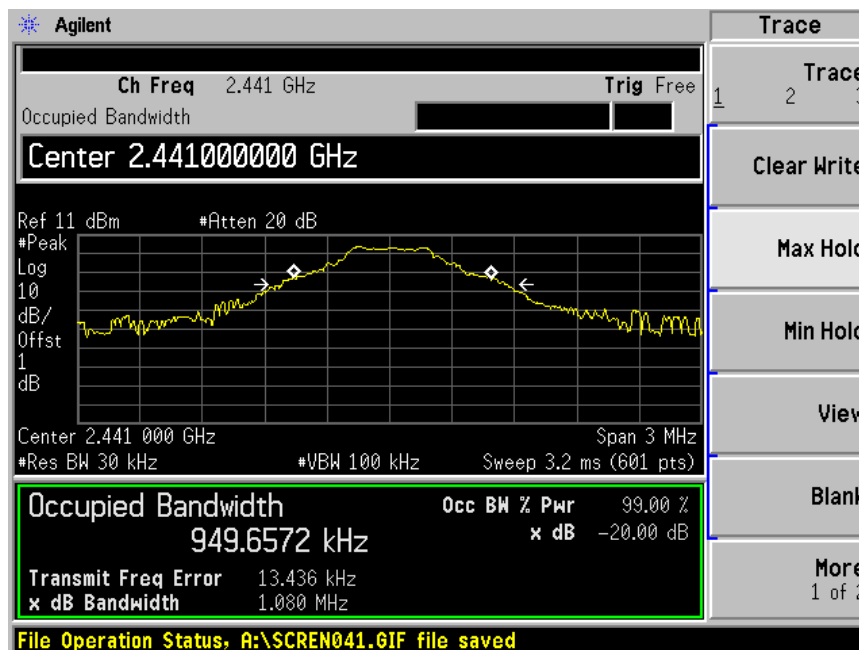
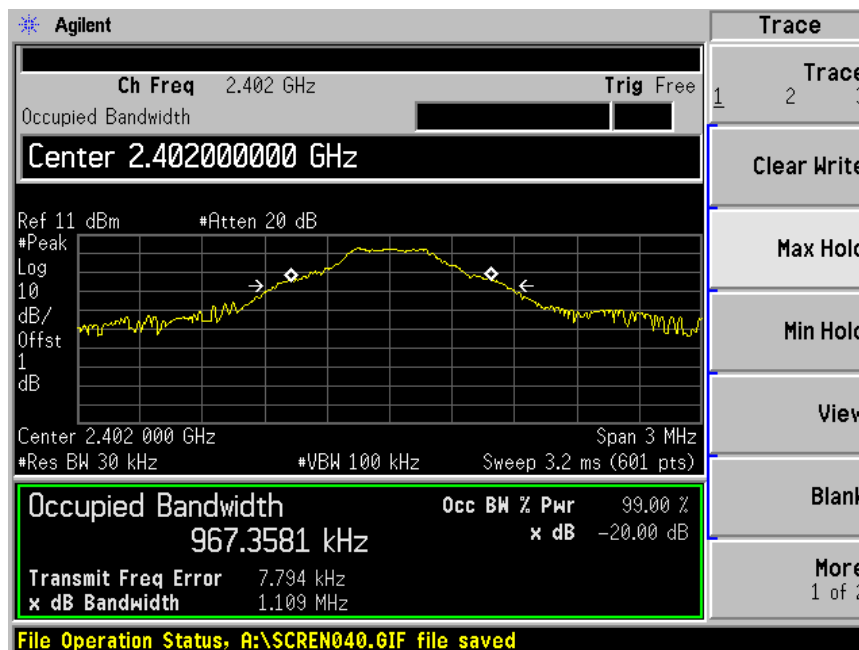
Limit [kHz]

N/A

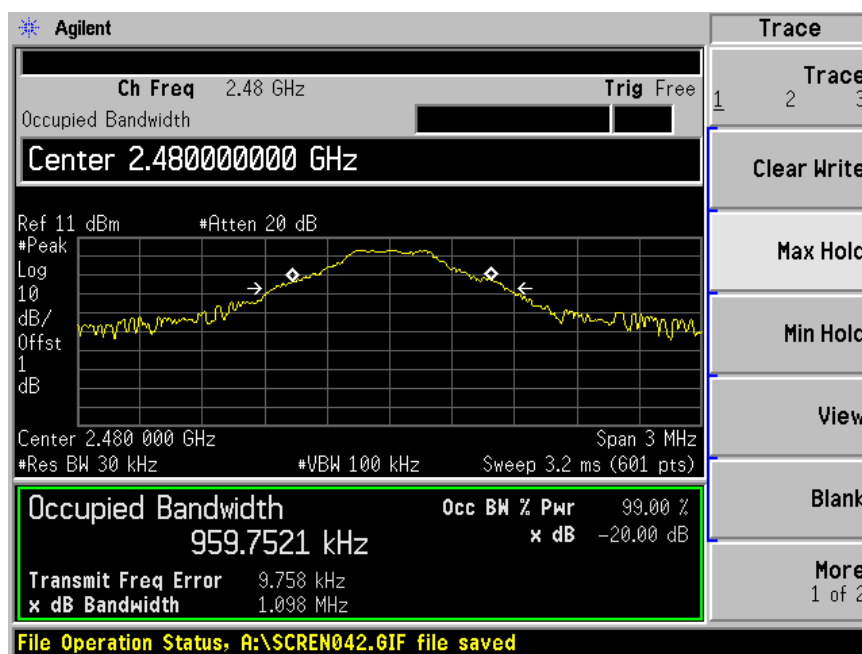
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1109.0	967.3581	--	Pass
2441	1080.0	949.6572	--	Pass
2480	1098.0	959.7521	--	Pass



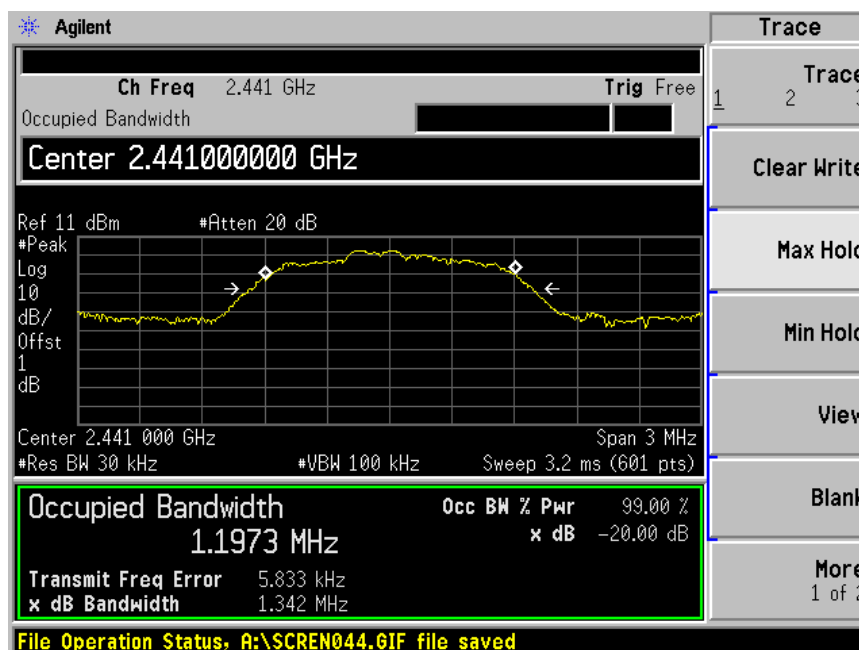
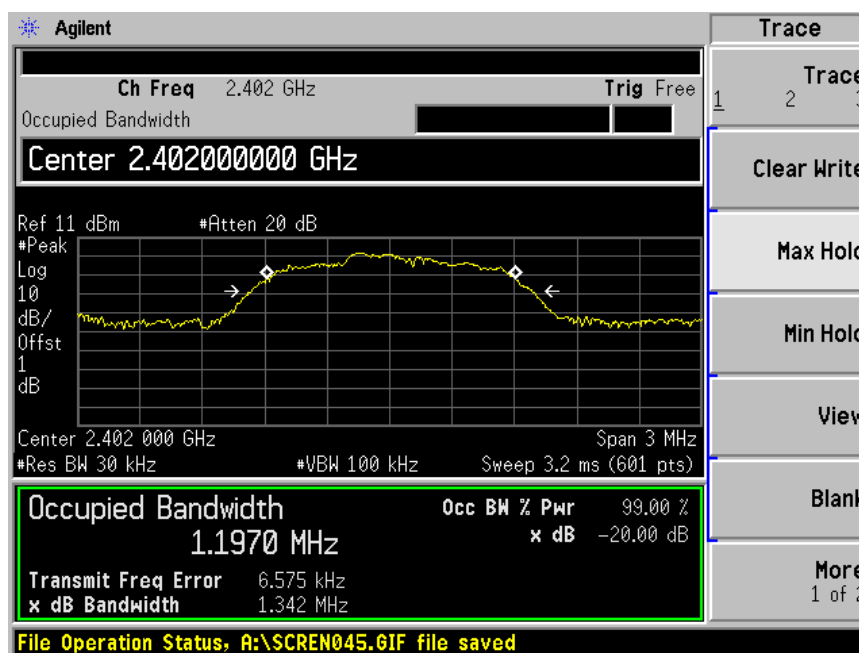
20 dB bandwidth and 99% Occupied Bandwidth



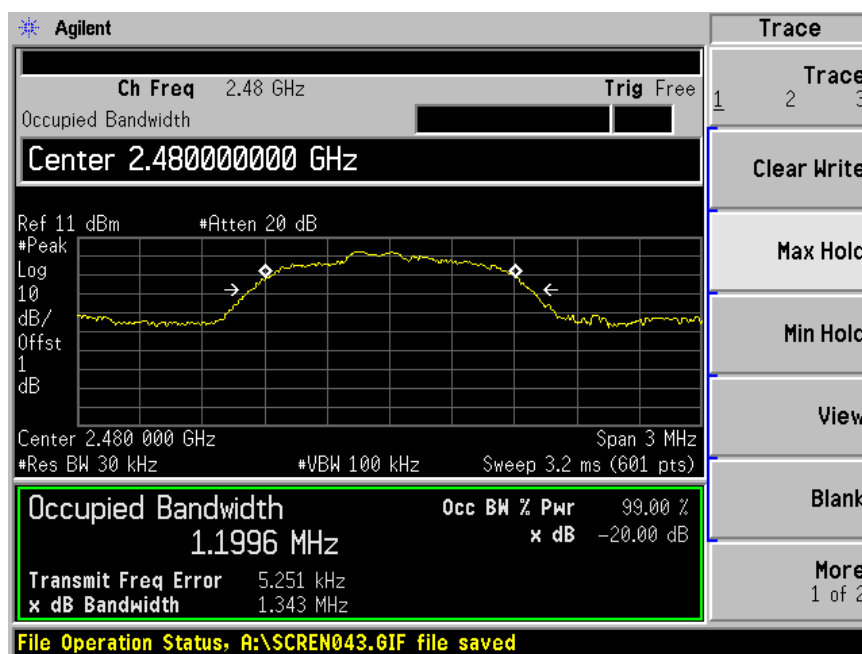
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode $\pi/4$ -DQPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1342.0	1197.0	--	Pass
2441	1342.0	1197.3	--	Pass
2480	1343.0	1199.6	--	Pass



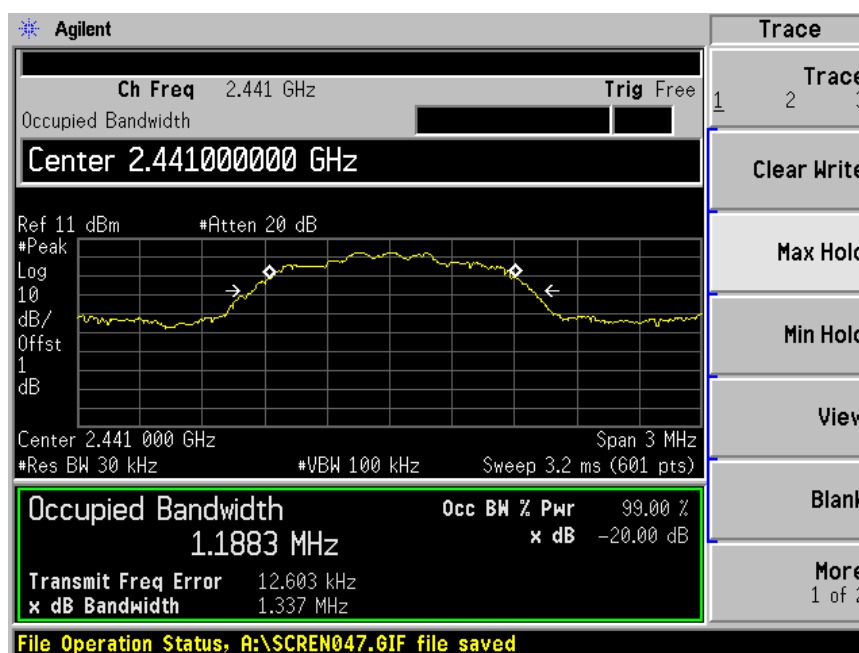
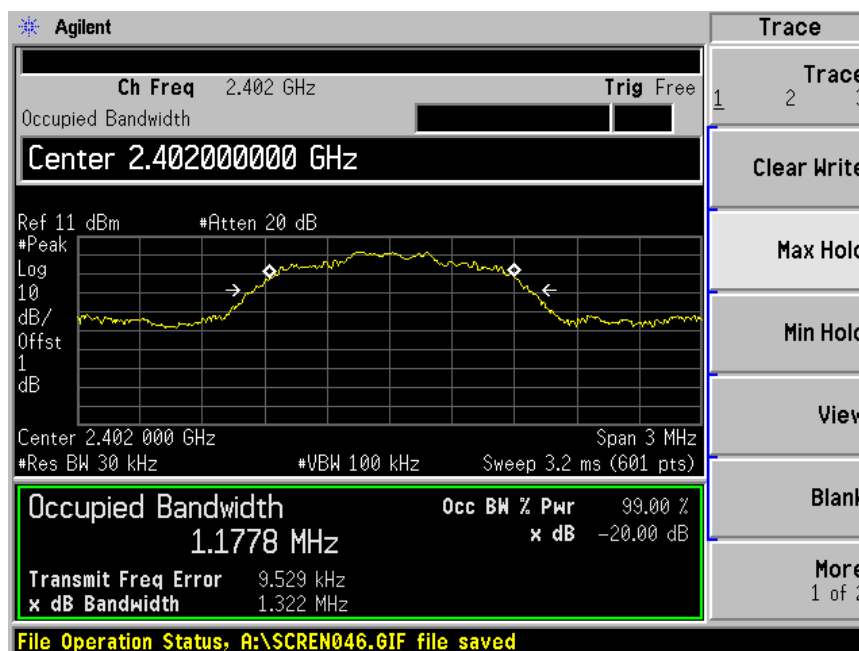
20 dB bandwidth and 99% Occupied Bandwidth



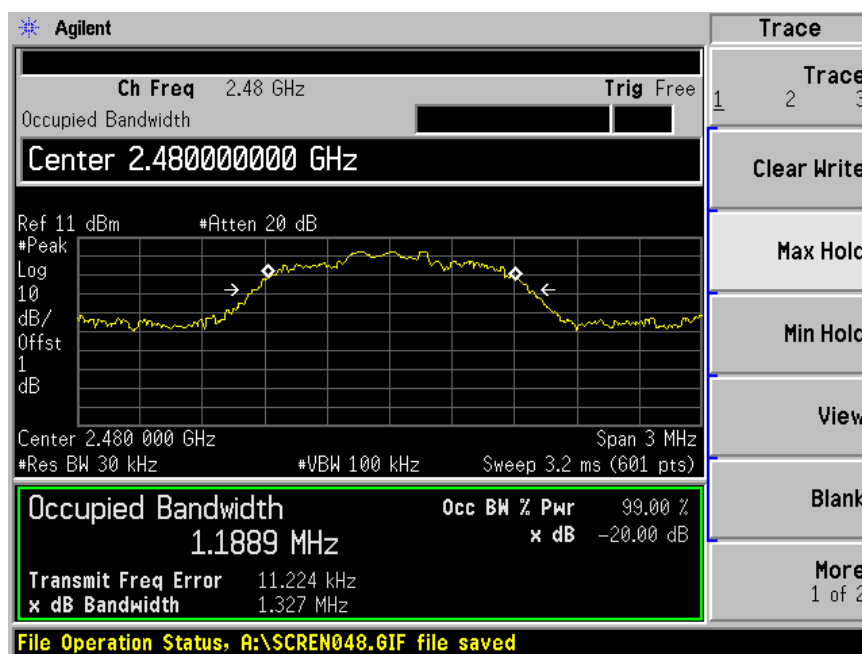
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode 8-DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1322.0	1177.8	--	Pass
2441	1337.0	1188.3	--	Pass
2480	1327.0	1188.9	--	Pass



20 dB bandwidth and 99% Occupied Bandwidth



8.7 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, RBW \geq 1% of the span, VBW) \geq 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

\geq 25KHz or 2/3 of the 20 dB bandwidth which is greater

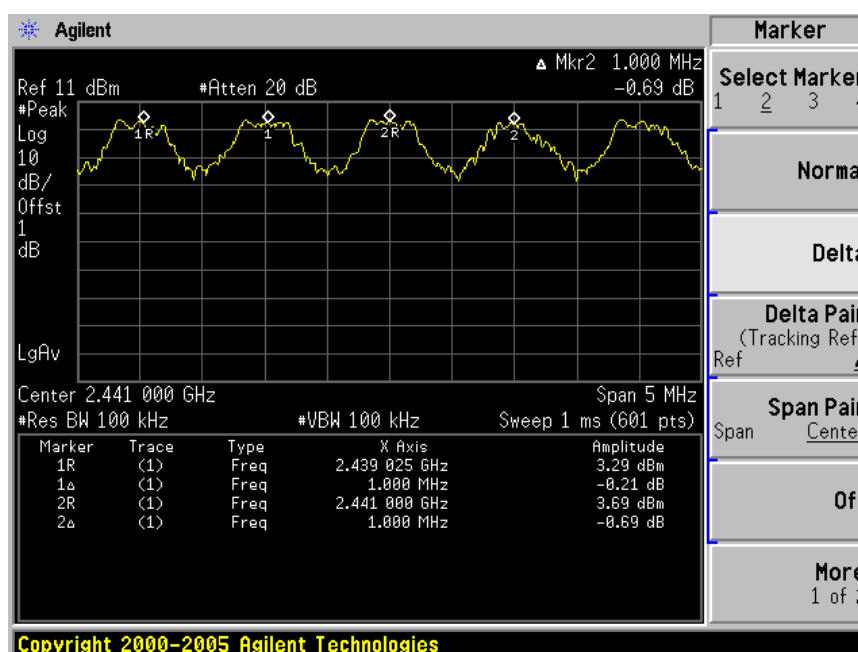
GFSK Modulation Limit

Frequency MHz	2/3 of 20 dB Bandwidth kHz
2402	549.3147
2441	543.1322
2480	552.7683

Carrier Frequency Separation

GFSK Modulation test result

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



8.8 Number of hopping frequencies

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, 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

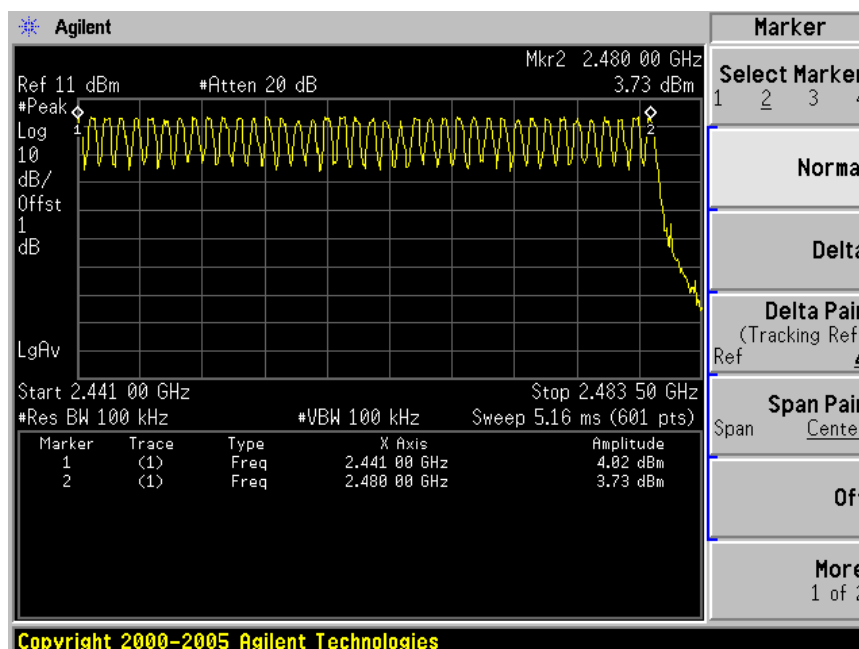
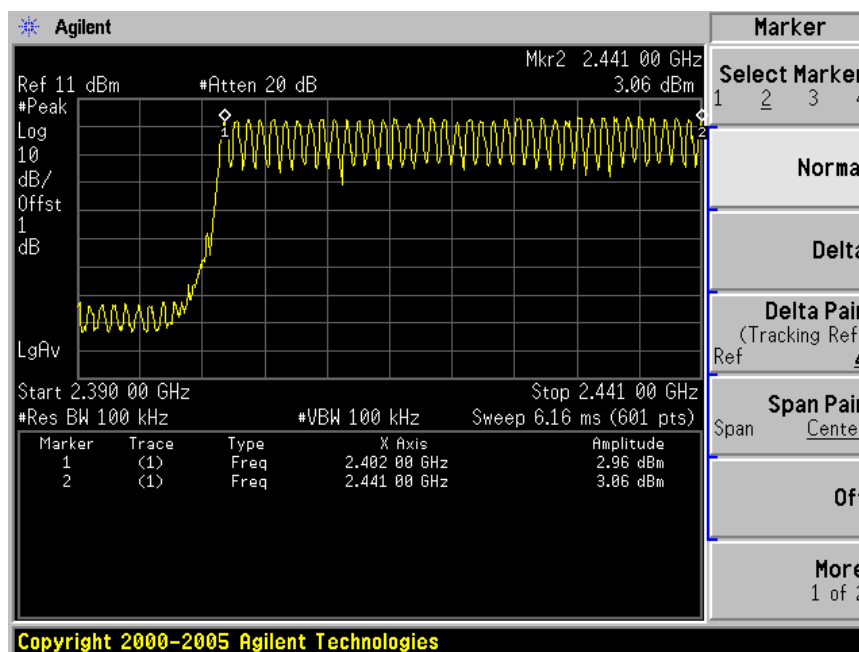
Limit
number

 ≥ 15

Number of hopping frequencies

Test result:

Number of hopping frequencies	Result
79	Pass



8.9 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

Limit

According to §15.247(a)(1)(iii) & RSS-210 A8.1(c) 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.

Dwell Time

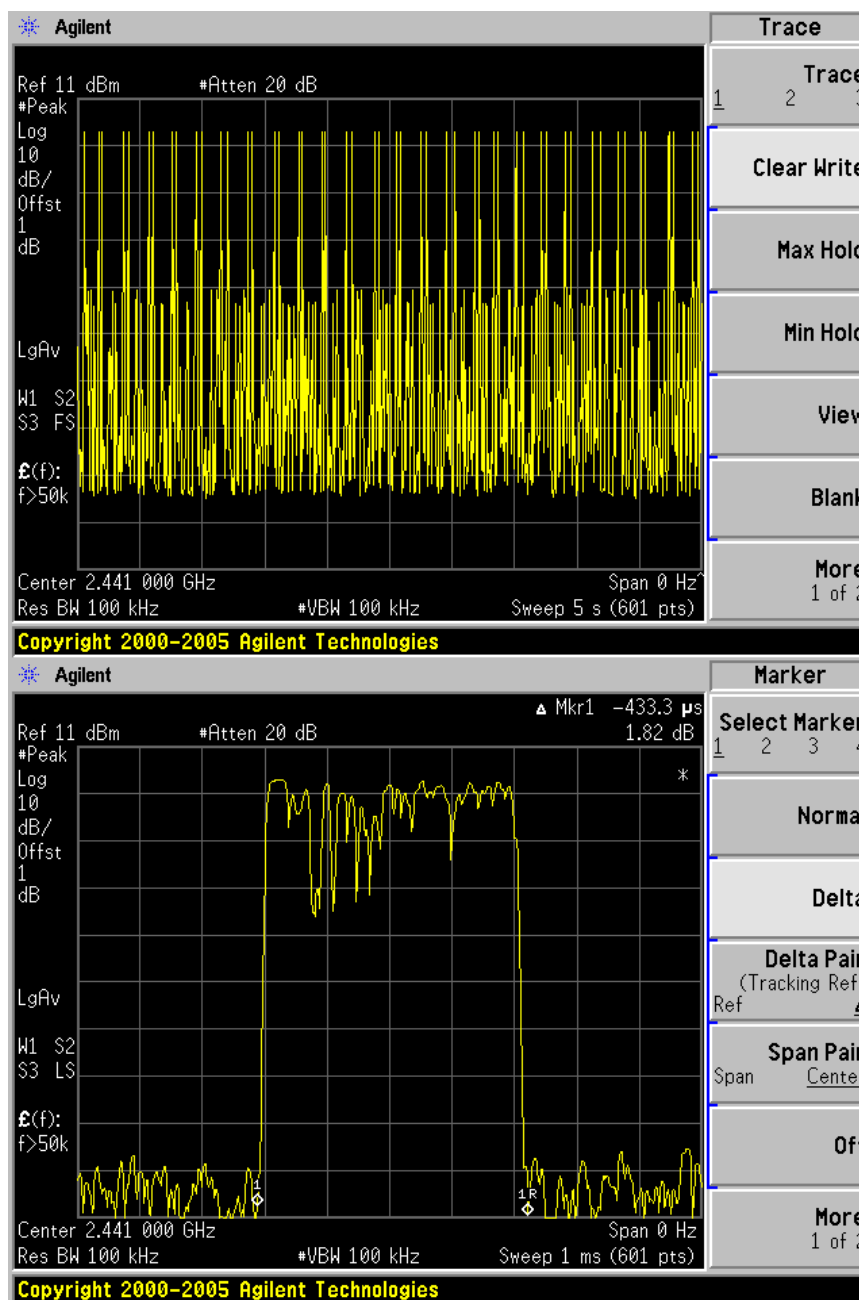
Dwell time

The maximum dwell time shall be 0,4 s.

Bluetooth Mode GFSK Modulation:

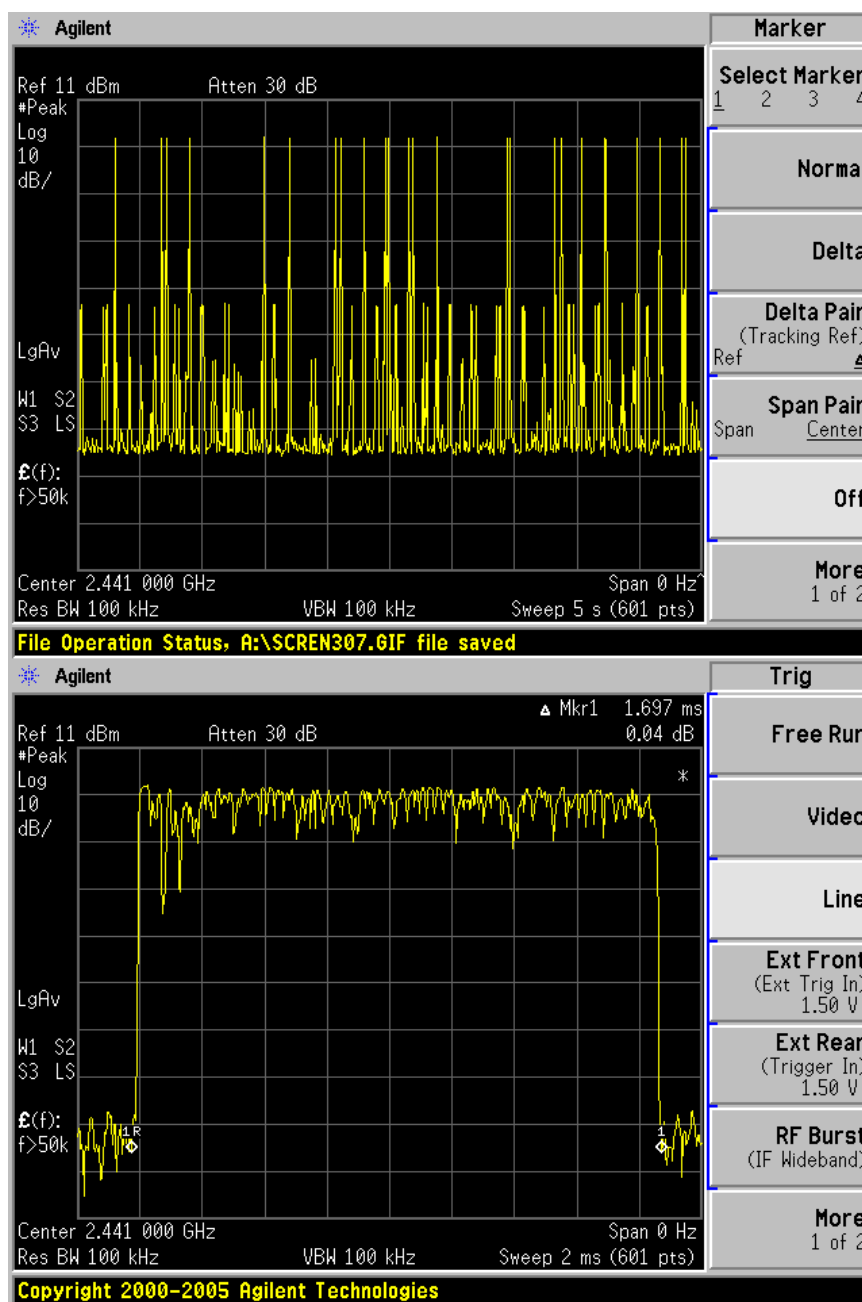
Test Result

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	433.3	139.66	< 400	Pass
DH3	1697	257.400	< 400	Pass
DH5	2942	241.714	< 400	Pass



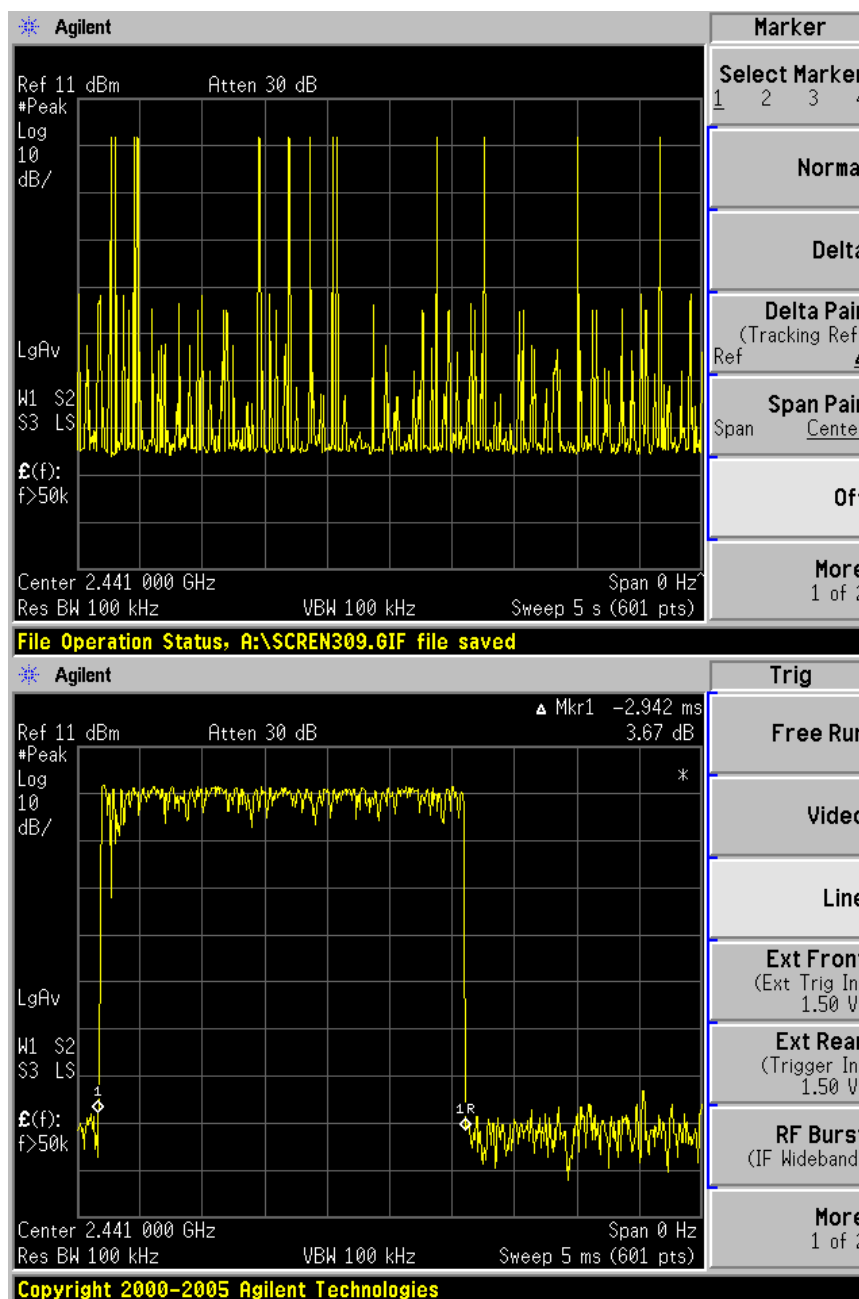
DH1

Dwell Time



DH3

Dwell Time



DH5

Note:

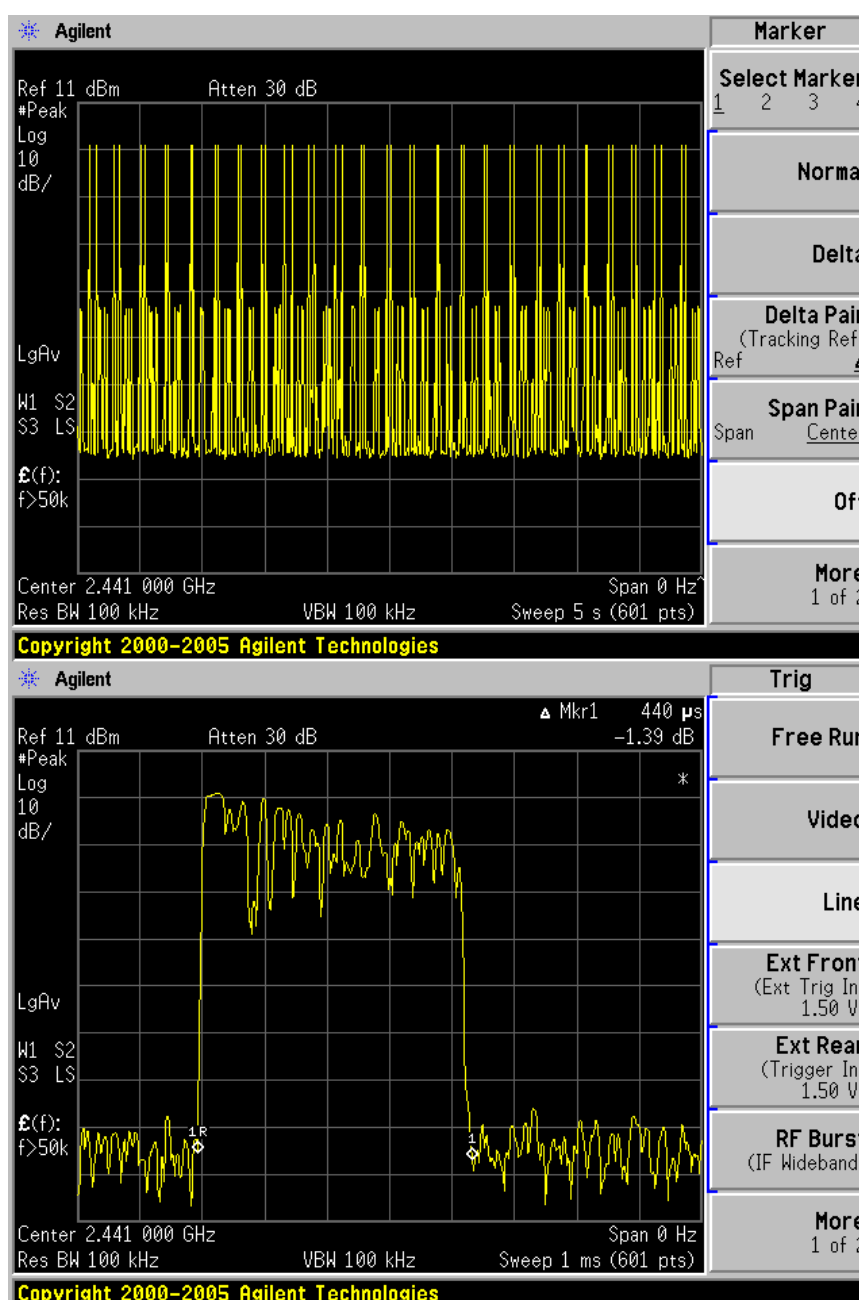
A period time=79x0.4(s)=31.6(s)

DH1	time slot= 51(times)/5(s) *433.3 (μs) *31.6(s)= 139.66 (ms)
DH3	time slot= 24(times)/5(s) *1697 (μs) *31.6(s)= 257.400(ms)
DH5	time slot= 13(times)/5(s) *2942 (μs) *31.6(s)= 241.714 (ms)

Dwell Time

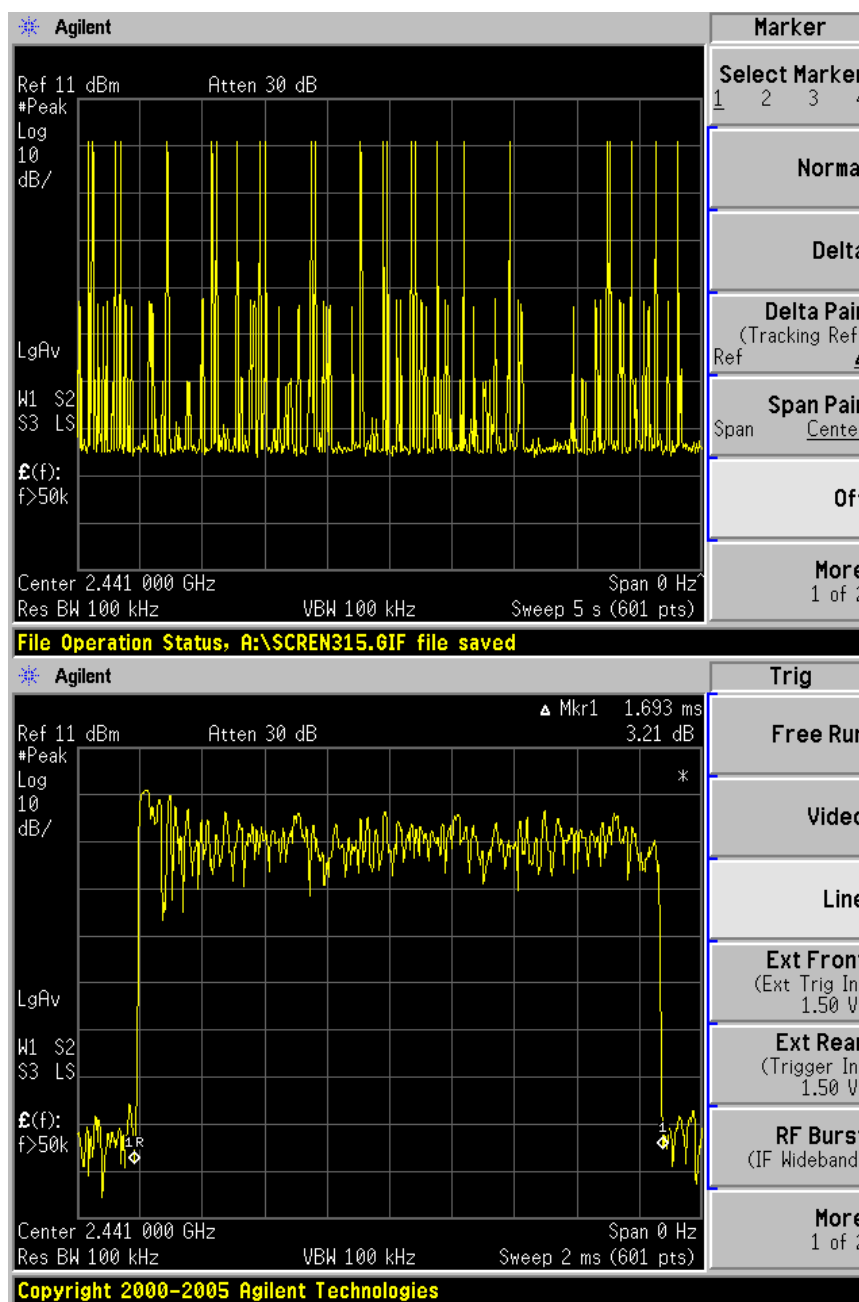
Bluetooth Mode $\pi/4$ -DQPSK Modulation:

Mode	Reading (μ s)	Test Result (ms)	Limit (ms)	Result
DH1	440	130.697	< 400	Pass
DH3	1693	267.494	< 400	Pass
DH5	2967	318.774	< 400	Pass



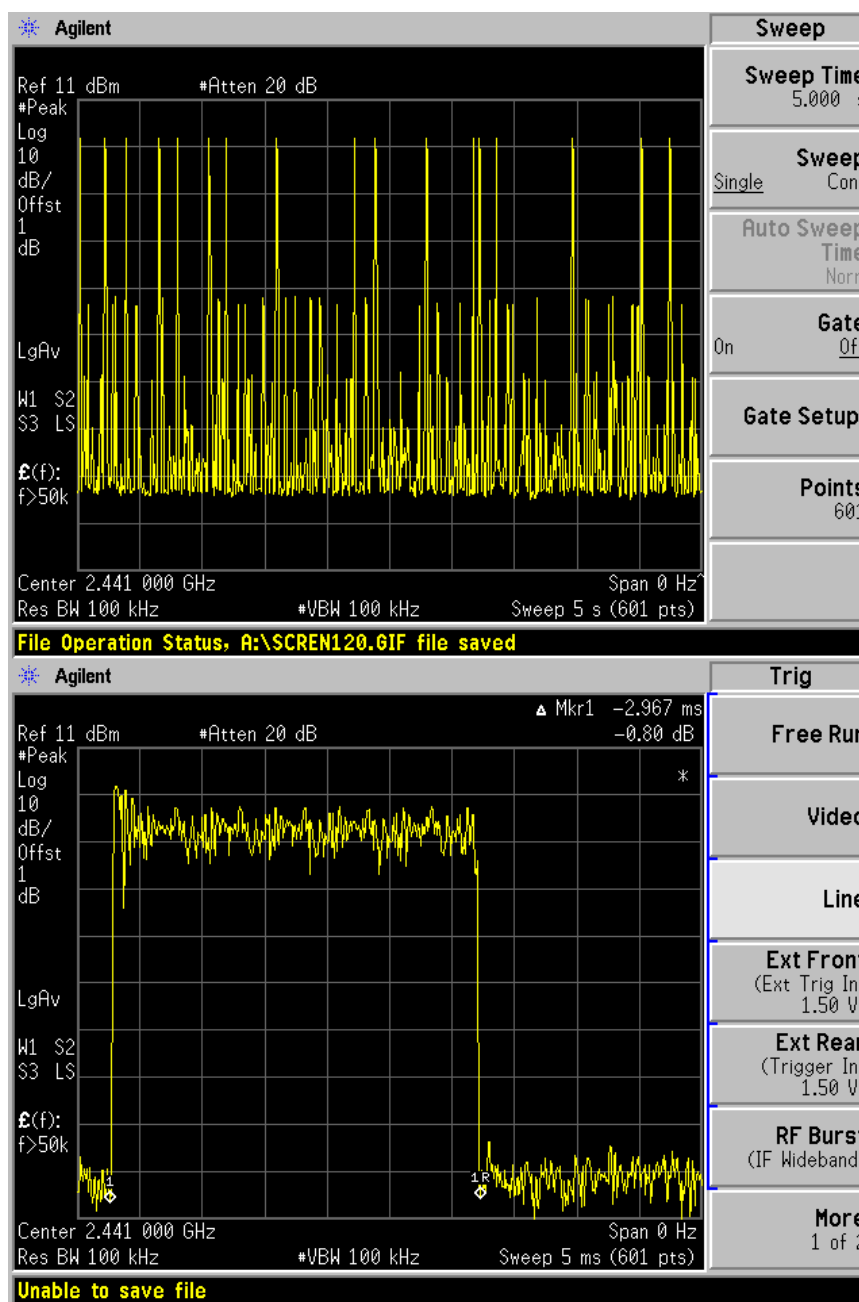
DH1

Dwell Time



DH3

Dwell Time



DH5

Note:

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

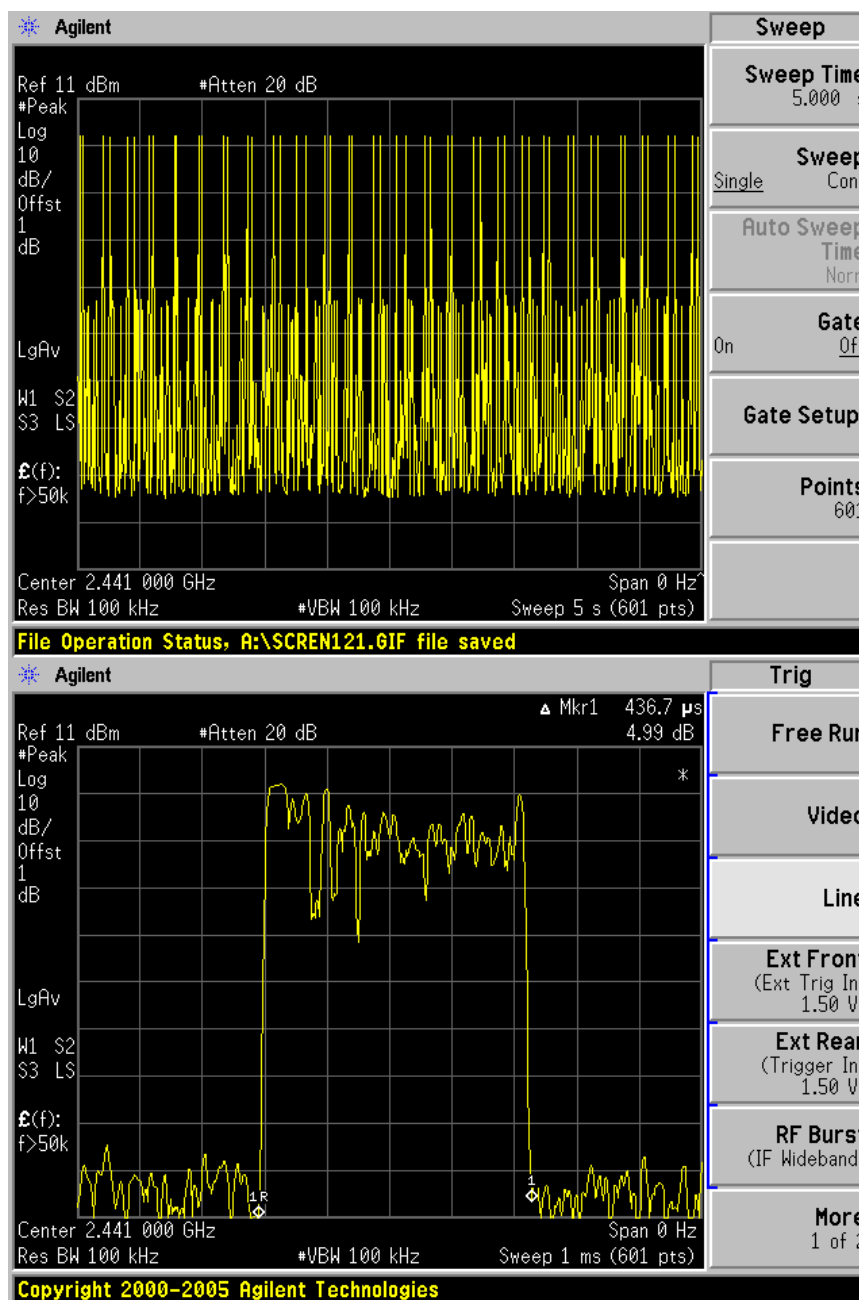
DH1	time slot= 47(times)/5(s) *440(μs) *31.6(s)= 130.697(ms)
DH3	time slot= 25(times)/5(s) *1693 (μs) *31.6(s)= 267.494(ms)
DH5	time slot= 17(times)/5(s) *2967 (μs) *31.6(s)=318.774 (ms)

Dwell Time

Bluetooth Mode 8-DPSK Modulation:

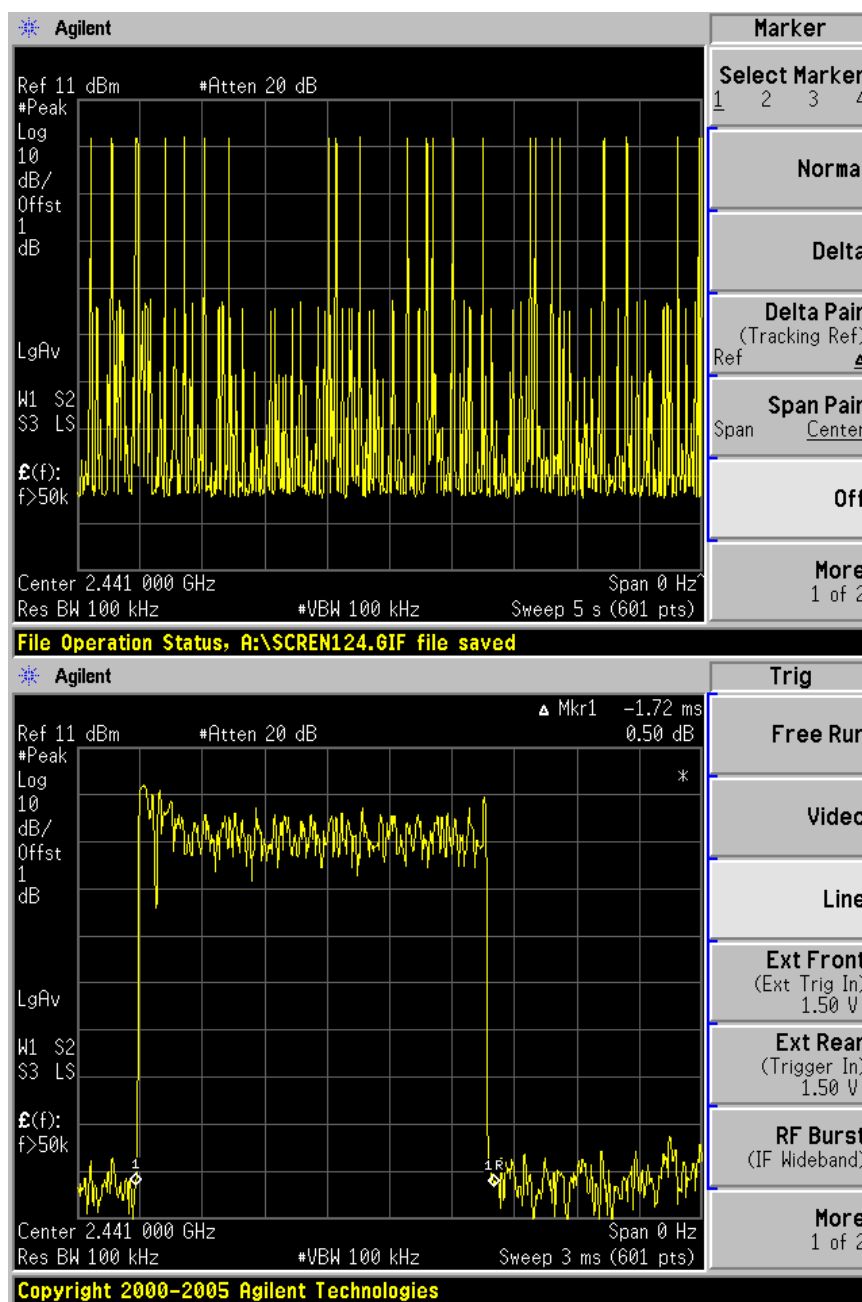
Test Result

Mode	Reading (μs)	Test Result (ms)	Limit (ms)	Result
DH1	436.7	140.757	< 400	Pass
DH3	1720	271.760	< 400	Pass
DH5	2967	356.277	< 400	Pass



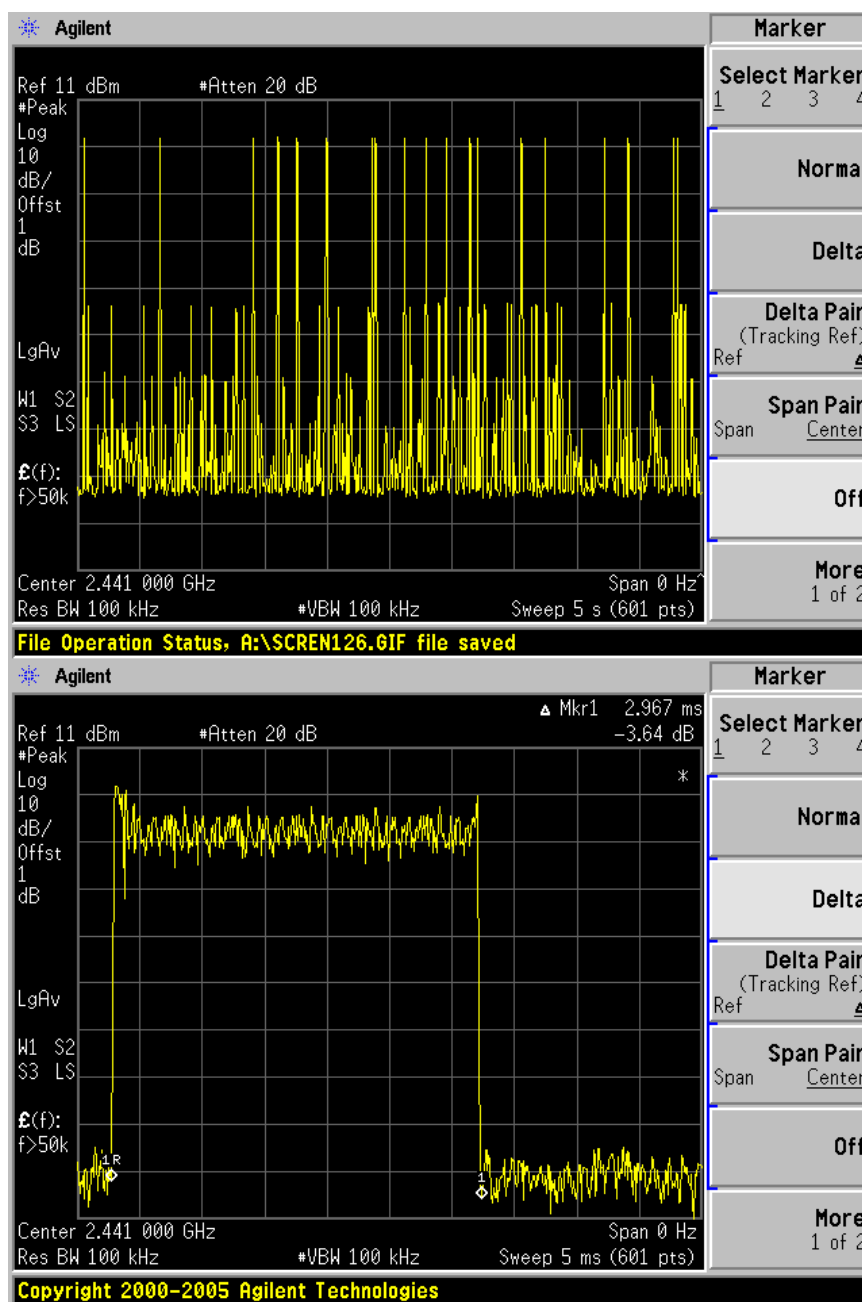
DH1

Dwell Time



DH3

Dwell Time



DH5

Note:

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

DH1	time slot= 51(times)/5(s) *436.7(μs) *31.6(s)= 140.757(ms)
DH3	time slot= 25(times)/5(s) *1720 (μs) *31.6(s)=271.760(ms)
DH5	time slot= 19(times)/5(s) *2967 (μs) *31.6(s)=356.277 (ms)

9 Test Equipment List

List of Test Instruments

DESCRIPTION	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.30, 13
L.I.S.N.#1	Rohde & Schwarz	ESH2-Z5	834066/011	Oct.30, 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

10 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 (dB μ V/m)	U=4.32dB (30MHz-25GHz)
CE	Disturbance Voltage (dB μ V)	U=2.4dB