TEST REPORT

FCC Part 15.247

Equipment under test	BLUETOOTH SPEAKER
Model name	JSDR50
FCC ID	2ADVL-JSDR50
IC Certification	-
Applicant	SHINHAN TECHNOLOGY CO.,LTD.
Manufacturer	SHINHAN TECHNOLOGY CO.,LTD.
Date of test(s)	2014.12.11 ~ 2014.12.20
Date of issue	2014.12.22

Issued to

SHINHAN TECHNOLOGY CO.,LTD.

195, Wonmi-ro,Wonmi-Gu,Bucheon-Shi,Gyeonggi-Do, KOREA

Issued by

KES Co., Ltd.

C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si,

Gyeonggi-do,431-716, Korea

473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

Test and report completed by :	**Report approval by :**
	
Byeong-Geol Chu Test engineer	Jeff Do Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2014.12.22	KES-RF-14T0061	Initial

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1. General information

Applicant:	SHINHAN TECHNOLOGY CO.,LTD.
Applicant address:	195, Wonmi-ro,Wonmi-Gu,Bucheon-Shi,Gyeonggi-Do, KOREA
Test site:	KES Co., Ltd.
Test site address:	C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do,431-716, Korea 473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
FCC/IC rule part(s):	15.247
Model:	JSDR50
FCC ID:	2ADVL- JSDR50
IC Certification:	-
Test device serial No.:	☐ Production ☒ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	BLUETOOTH SPEAKER
Frequency range	2402 ㎒ ~ 2480 ㎒
Modulation technique	FHSS
Number of channels	79
Antenna specification	Antenna type: PCB Peak gain: 1.66 ㏈i
Power source	DC 3.7 V (Rechargeable battery)

15.247(a)(1) that the rx input bandwidths shift frequencies in synchronization with the transmitted
15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

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

Equal hopping frequency use
The channels of this system will be used equally over the long-term distribution of the hopsets.

Example of a 79 hopping sequence in data mode:
02, 05, 31, 24, 20, 10, 43, 36, 30, 23, 40, 06, 21, 50, 44, 09, 71, 78, 01, 13, 73, 07, 70, 72, 35, 62, 42, 11, 41, 08, 16, 29, 60, 15, 34, 61, 58, 04, 67, 12, 22, 53, 57, 18, 27, 76, 39, 32, 17, 77, 52, 33, 56, 46, 37, 47, 64, 49, 45, 38, 69, 14, 51, 26, 79, 19, 28, 65, 75, 54, 48, 03, 25, 66, 05, 16, 68, 74, 59, 63, 55,

System receiver input bandwidth

Each channel bandwidth is 1 ㎒.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.2. Test configuration

The BLUETOOTH SPEAKER FCC ID: 2ADVL- JSDR50 was tested per the guidance of ANSI C63.10-2009 and DA 00-705. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

1.3. Frequency/channel operations

Ch.	Frequency (㎒)	Rate(Mbps)
00	2402	1,3
. .	. .	. .
39	2441	1,3
. .	. .	. .
78	2480	1,3

Preliminary tests were performed in different data rate and the highest power data rates(1 Mbps, 3 Mbps) were chosen for full test

Data rate	Channel (㎒)	1 Mbps(GFSK)	2 Mbps(π/4-DQPSK)	3 Mbps(8DPSK)
Output power(dBm)	2402	**1.548**	1.104	**1.297**
	2441	**4.758**	4.258	**4.342**
	2480	**4.252**	3.394	**3.569**

1.4. Information about derivative model

N/A

2. Summary of tests

Section in FCC Part 15	Test description	Test results
15.205, 15.209	Radiated restricted band and emission	Pass
15.207(d)	Conducted band edge and out of band emissions	Pass
15.247(a)(1)(iii)	20 dB bandwidth	Pass
15.247(b)(1)	Output power	Pass
15.247(a)(1)	Channel separation	Pass
15.247(a)(1)(iii)	Number of channels	Pass
15.247(a)(1)(iii)	Time of occupancy	Pass
15.207	AC conducted emissions	Pass
-	Occupied Bandwidth	N/A

Note:

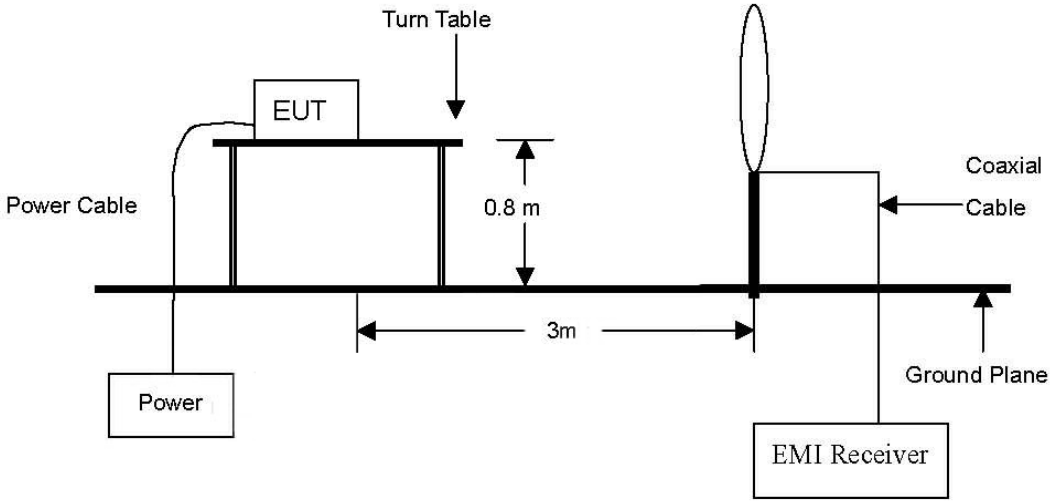
1. The EUT was tested per the guidance of DA 00-705. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing and/or AC line conducted testing.
2. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

3. Test results

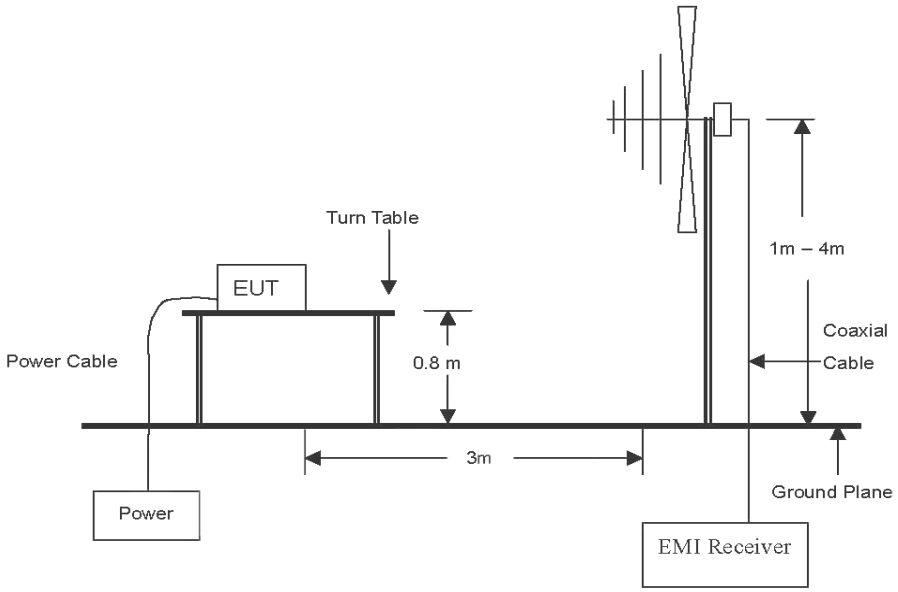
3.1. Radiated restricted band and emissions

Test setup

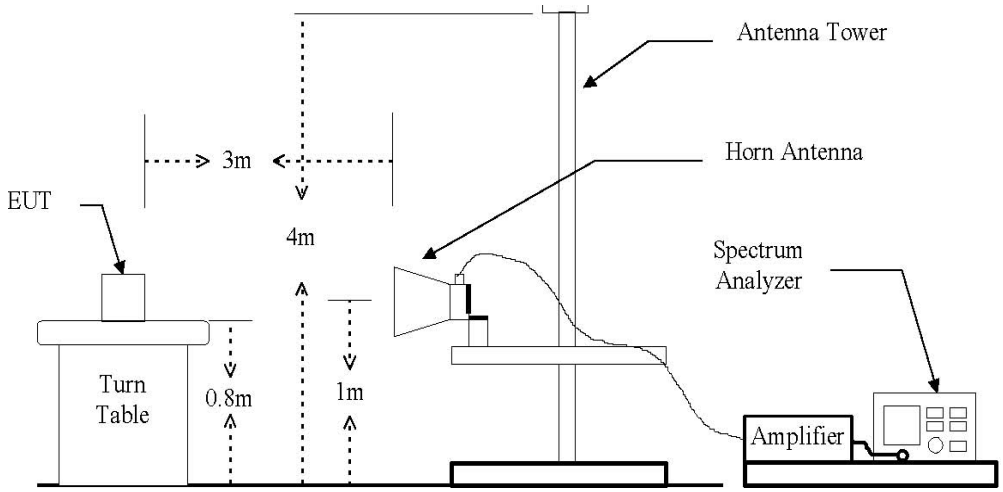
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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



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



Test procedure

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m 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. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. Average measurements > 1 ㎓ using RBW = 1 ㎒ and VBW = 10 ㎐. Peak measurements > 1 ㎓ using RBW = 1 ㎒ and VBW = 3 ㎒. Both average and peak measurements were made using a peak detector.

Note:

1. The spectrum is measured from 9 ㎑ to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1 ㎓. Above 1 ㎓, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of the respective limits were not reported.
2. When Average result is different from peak result over 20 ㏈ (over-averaging), according to 15.35 (c), as a “duty cycle correction factor”, pulse averaging with 20 log(duty cycle) has to be used.
3. Emissions below 18 ㎓ were measured at a 3 meter test distance while emissions above 18 ㎓ were measured at a 1 meter test distance with the application of a distance correction factor.
4. Average test would be performed if the peak result were greater than the average limit.
5. “*” means restricted band edge.
5. Field strength(㏈㎶/m) = Level(㏈㎶) + Correction factors(㏈/m) + Cable loss(㏈) + F_d(㏈)
6. Correction factors(㏈/m) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈)
7. Margin(㏈) = Limit(㏈㎶/m) - Field strength(㏈㎶/m)
8. $F_d = 40\log(D_m / D_s)$

   Where:

   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters

Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2 400 / F(㎑)
0.490 ~ 1.705	30	24 000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

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

Test results (Below 30 ㎒)

Mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 441 ㎒ (Worst case)
Channel:	39

Frequency (㎒)	Level (dB㎶)	Ant. Pol.	Correction factors (dB/m)	F_d (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
No signal detected							

Test results (Below 1 000 ㎒)

Mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 441 ㎒ (Worst case)
Channel:	39

Frequency (㎒)	Level (dB㎶)	Ant. Pol.	Correction factors (dB/m)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
131.9	16.41	V	14.49	30.90	43.50	12.60
192.5	21.54	V	13.55	35.09	43.50	8.41
279.0	20.56	H	16.49	37.05	46.00	8.95
481.0	8.45	H	22.81	31.26	46.00	14.74

Test results (Above 1 000 ㎒)

Mode: Bluetooth
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Operating frequency: 2 402 ㎒
Channel: 00

Frequency (㎒)	Level (dB㎶)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2358.35	44.74	Peak	H	3.46	48.20	74.00	25.80
2357.21	44.15	Peak	V	3.45	47.60	74.00	26.40
4803.63	48.34	Peak	H	13.54	61.88	74.00	12.12
4803.97	34.12	Avg	H	13.55	47.67	54.00	6.33
4804.15	53.11	Peak	V	13.55	66.66	74.00	7.34
4803.98	38.34	Avg	V	13.55	51.89	54.00	2.11

Mode: Bluetooth
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Operating frequency: 2 441 ㎒
Channel: 39

Frequency (㎒)	Level (dB㎶)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4882.00	43.41	Peak	H	14.06	57.47	74.00	16.53
4882.02	35.17	Avg	H	14.06	49.23	54.00	4.77
4882.03	46.92	Peak	V	14.06	60.98	74.00	13.02
4882.03	37.42	Avg	V	14.06	51.48	54.00	2.52

Mode: Bluetooth
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Operating frequency: 2 480 ㎒
Channel: 78

Frequency (㎒)	Level (dB㎶)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2485.72	44.50	Peak	H	4.19	48.69	74.00	25.31
2485.83	48.48	Peak	V	4.19	52.67	74.00	21.33
4959.95	40.80	Peak	H	14.58	55.38	74.00	18.62
4959.98	30.17	Avg	H	14.58	44.75	54.00	9.25
4959.85	41.66	Peak	V	14.57	56.23	74.00	17.77
4959.99	30.88	Avg	V	14.58	45.46	54.00	8.54

Mode: Bluetooth
Transfer rate: 3 Mbps
Distance of measurement: 3 meter
Operating frequency: 2 402 ㎒
Channel: 00

Frequency (㎒)	Level (dBμV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2359.21	45.45	Peak	H	3.46	48.91	74.00	25.09
2356.36	43.00	Peak	V	3.45	46.45	74.00	27.55
4804.06	41.52	Peak	H	13.55	55.07	74.00	18.93
4804.09	30.28	Avg	H	13.55	43.83	54.00	10.17
4804.08	45.91	Peak	V	13.55	59.46	74.00	14.54
4803.94	34.98	Avg	V	13.55	48.53	54.00	5.47

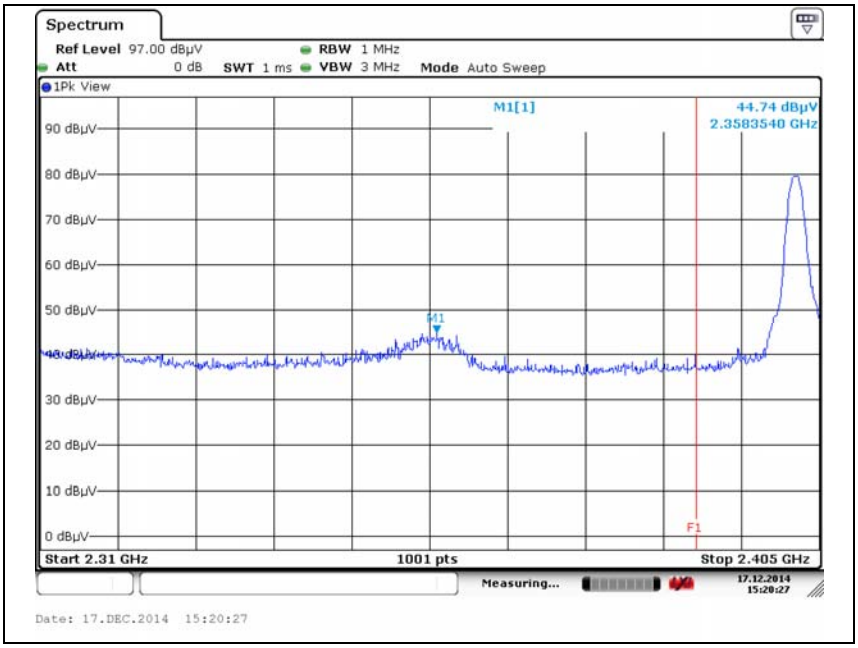
Mode: Bluetooth
Transfer rate: 3 Mbps
Distance of measurement: 3 meter
Operating frequency: 2 441 ㎒
Channel: 39

Frequency (㎒)	Level (dBμV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4882.33	39.10	Peak	H	14.06	53.16	74.00	20.84
4881.98	26.61	Avg	H	14.06	40.67	54.00	13.33
4881.97	42.68	Peak	V	14.06	56.74	74.00	17.26
4882.06	30.19	Avg	V	14.06	44.25	54.00	9.75

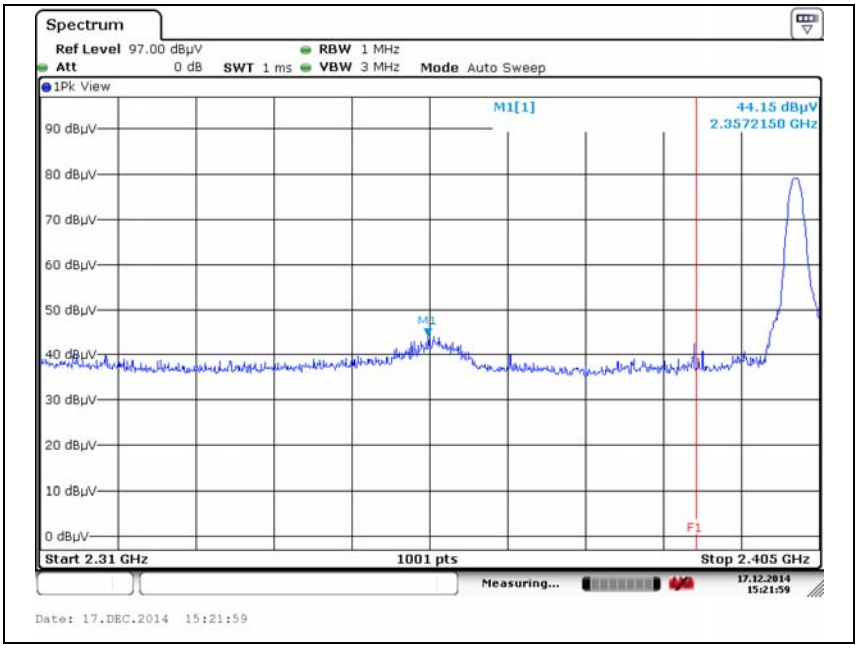
Mode: Bluetooth
Transfer rate: 3 Mbps
Distance of measurement: 3 meter
Operating frequency: 2 480 ㎒
Channel: 78

Frequency (㎒)	Level (dBμV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2485.94	44.41	Peak	H	4.19	48.60	74.00	25.40
2485.78	48.94	Peak	V	4.19	53.13	74.00	20.87
4960.30	36.51	Peak	H	14.58	51.09	74.00	22.91
4959.70	37.30	Peak	V	14.57	51.87	74.00	22.13

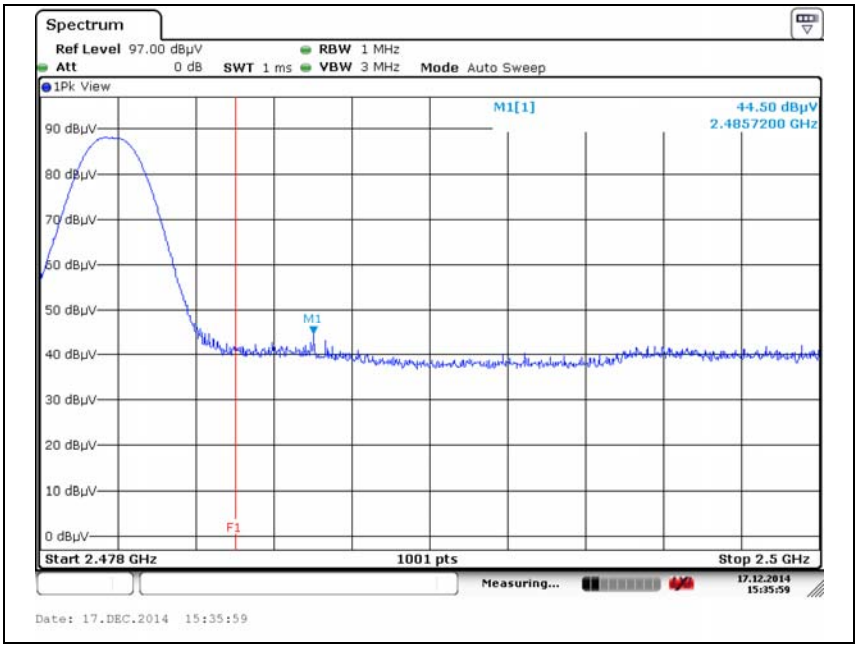
Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 ㎒
Channel:	00
Detected mode:	Peak, Hor



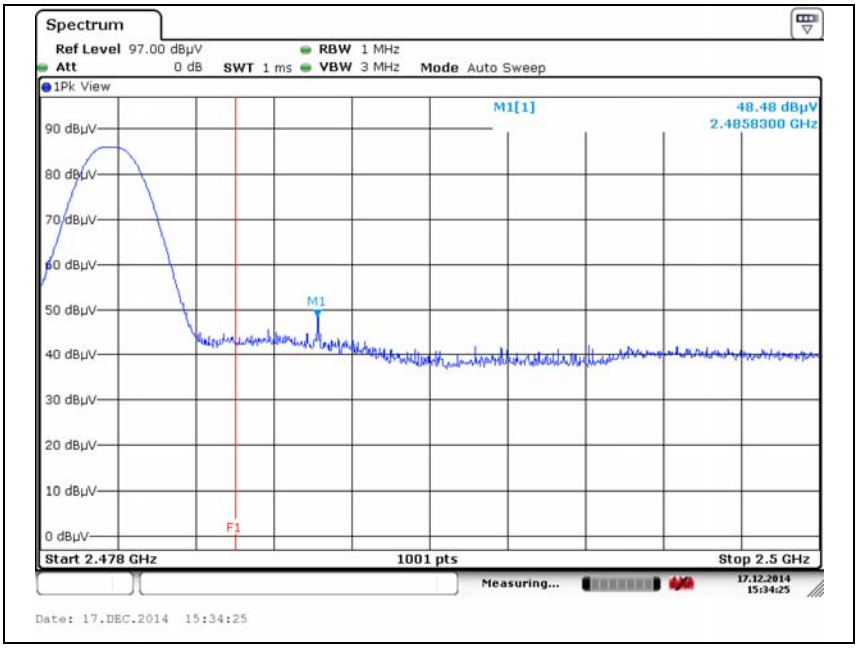
Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 ㎒
Channel:	00
Detected mode:	Peak, Ver



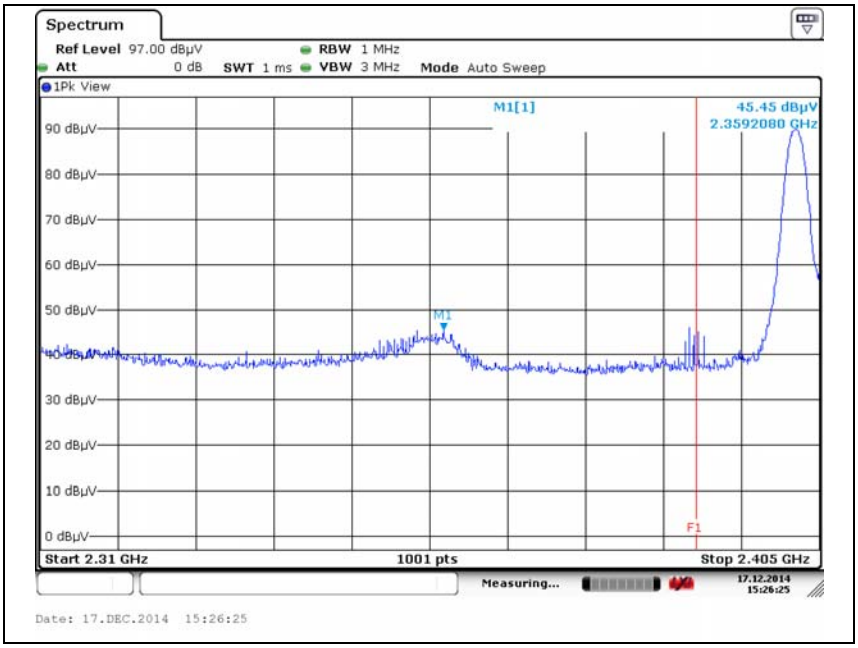
Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 ㎒
Channel:	78
Detected mode:	Peak, Hor



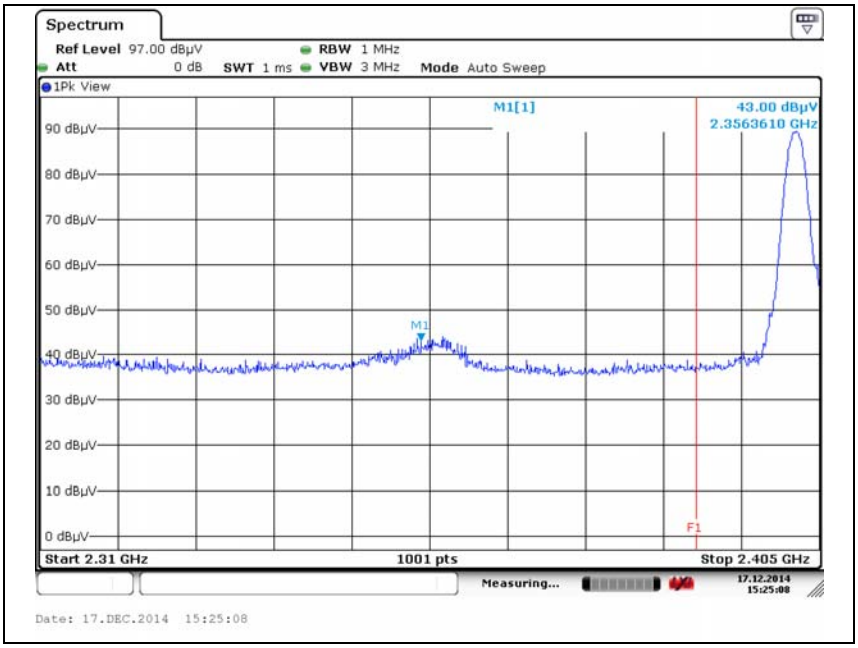
Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 ㎒
Channel:	78
Detected mode:	Peak, Ver



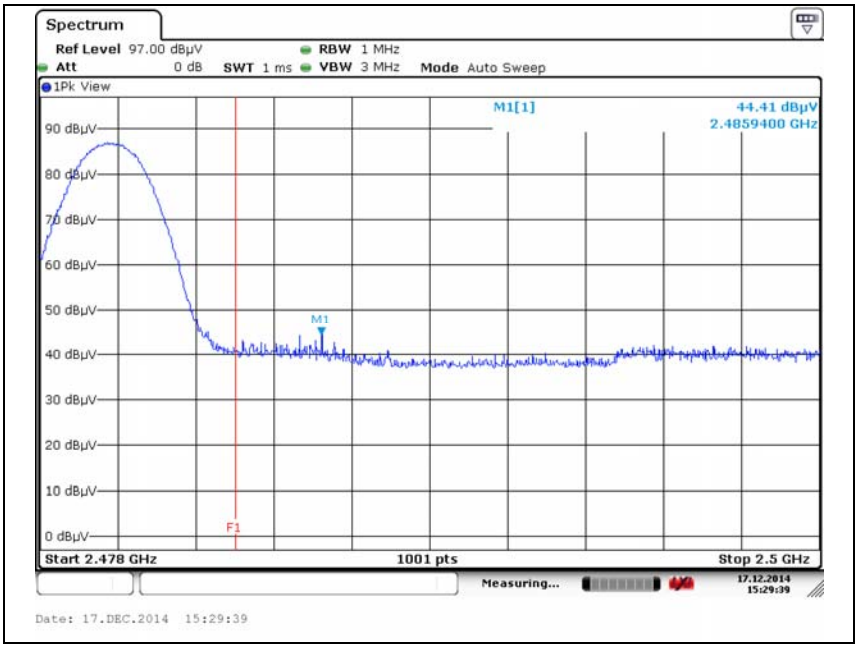
Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 ㎒
Channel:	00
Detected mode:	Peak, Hor



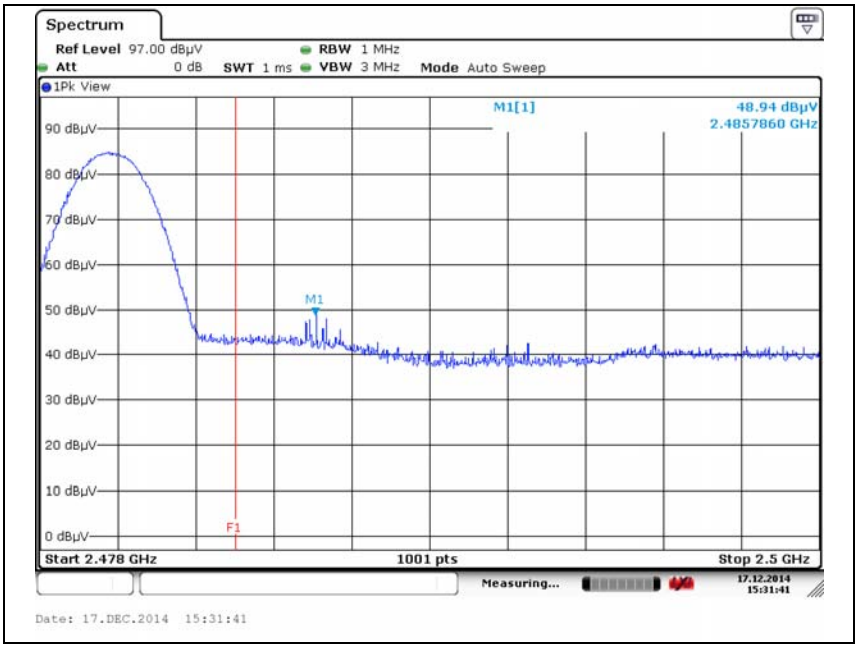
Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 ㎒
Channel:	00
Detected mode:	Peak, Ver



Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 ㎒
Channel:	78
Detected mode:	Peak, Hor

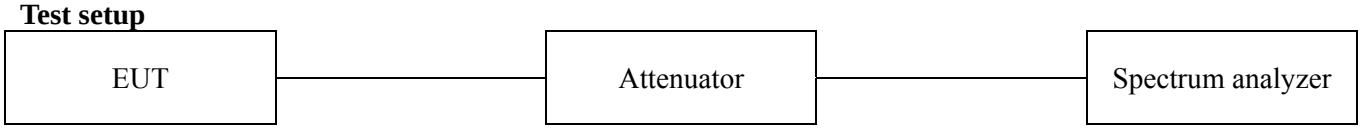


Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 ㎒
Channel:	78
Detected mode:	Peak, Ver



3.2. Conducted band edge and out of band emissions

Test setup



Test procedure
DA 00-705

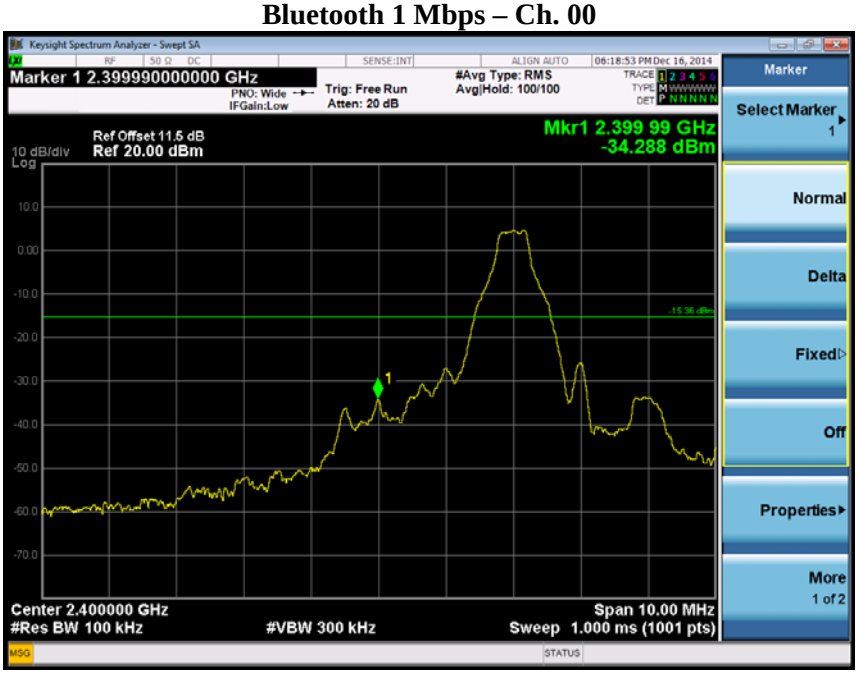
Test setting
1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions(e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
2. RBW = 100 ㎑
3. VBW ≥ 300 ㎑
4. Detector = Peak
5. Number of sweep points ≥ 2 × Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

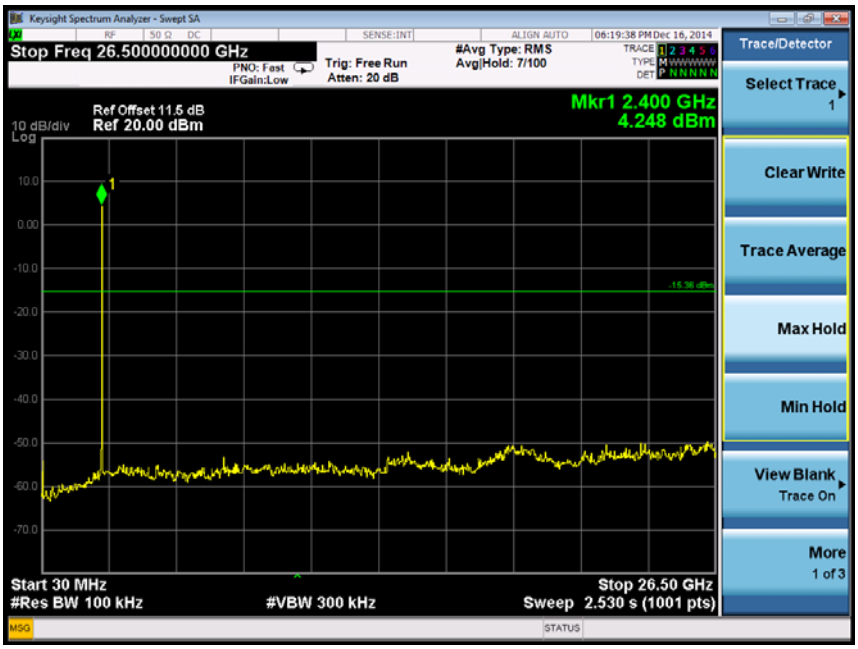
Limit

According to 15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))

According to RSS-210 A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Bluetooth 1 Mbps – Ch. 00





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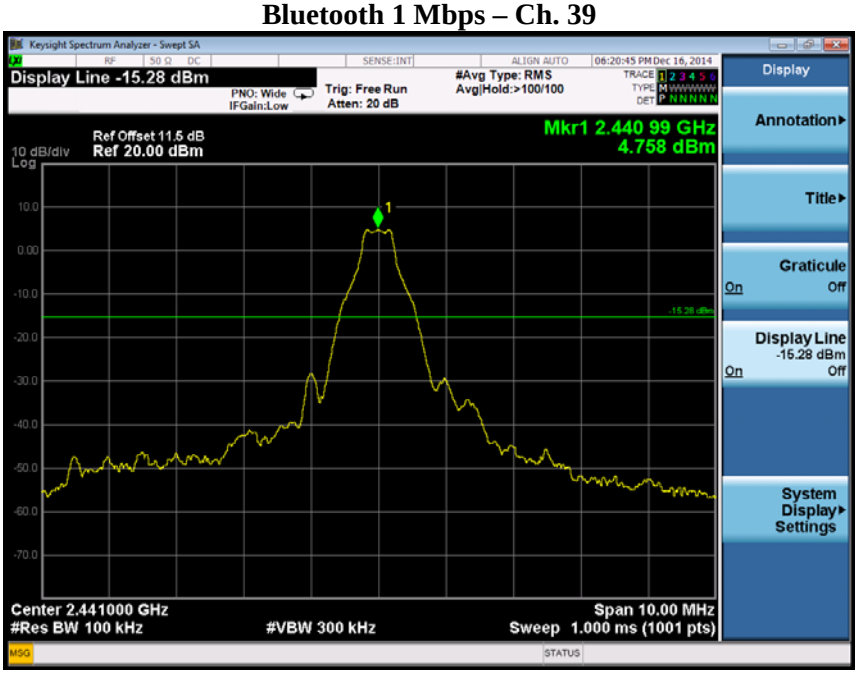
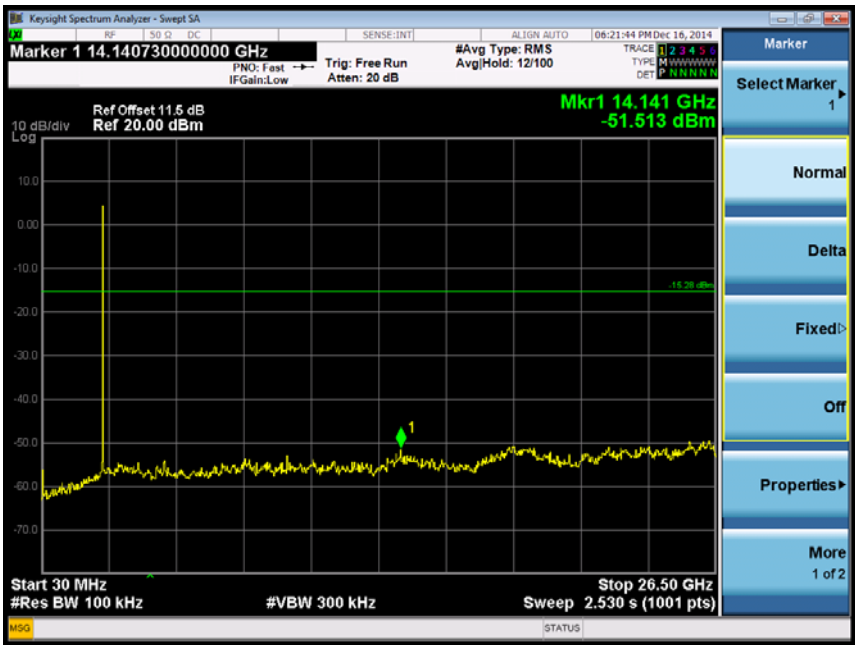
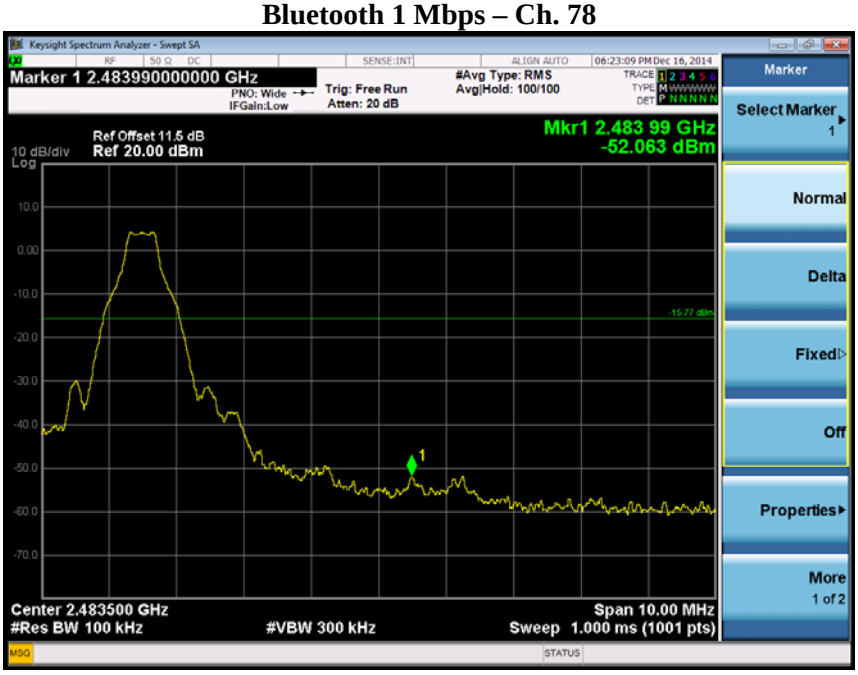
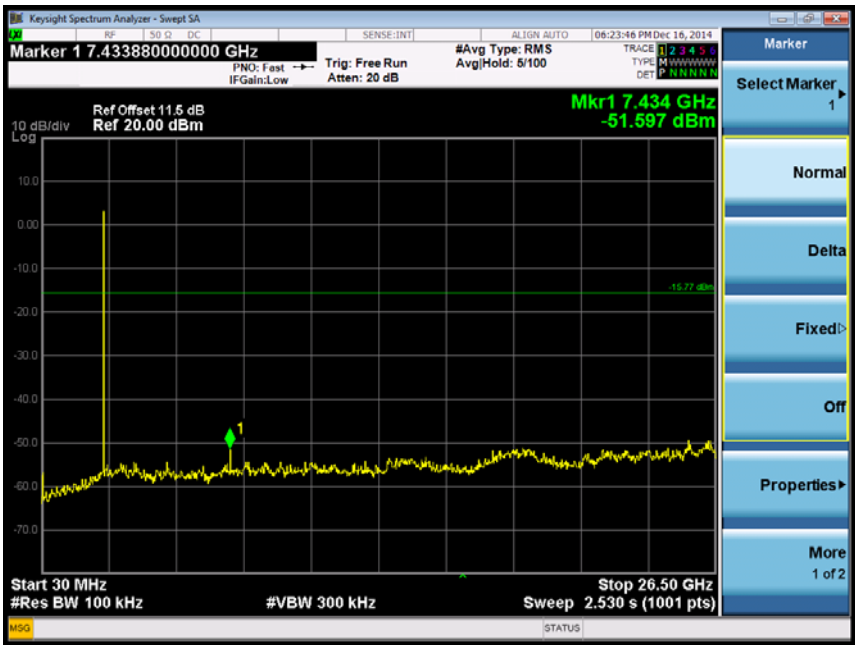


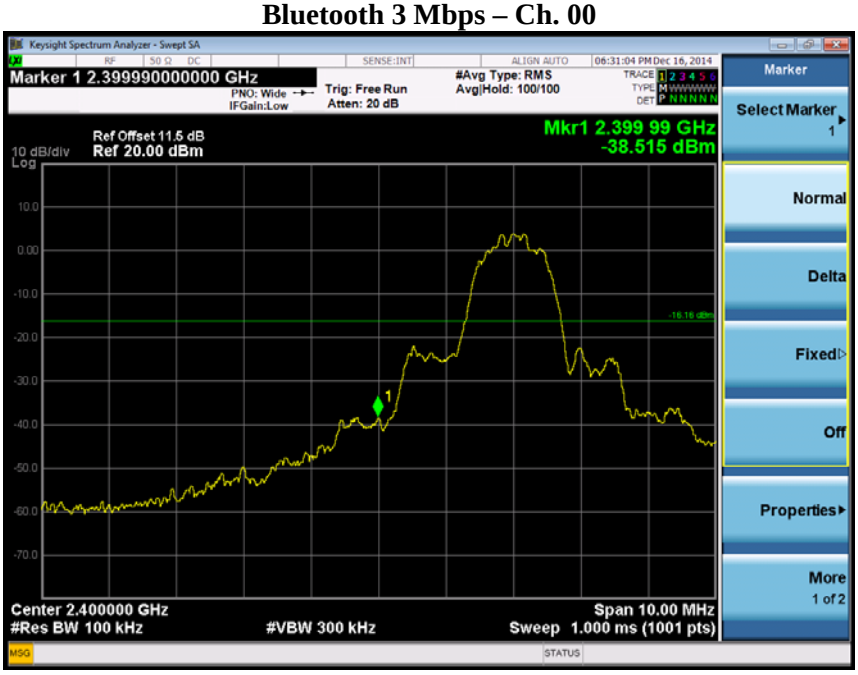


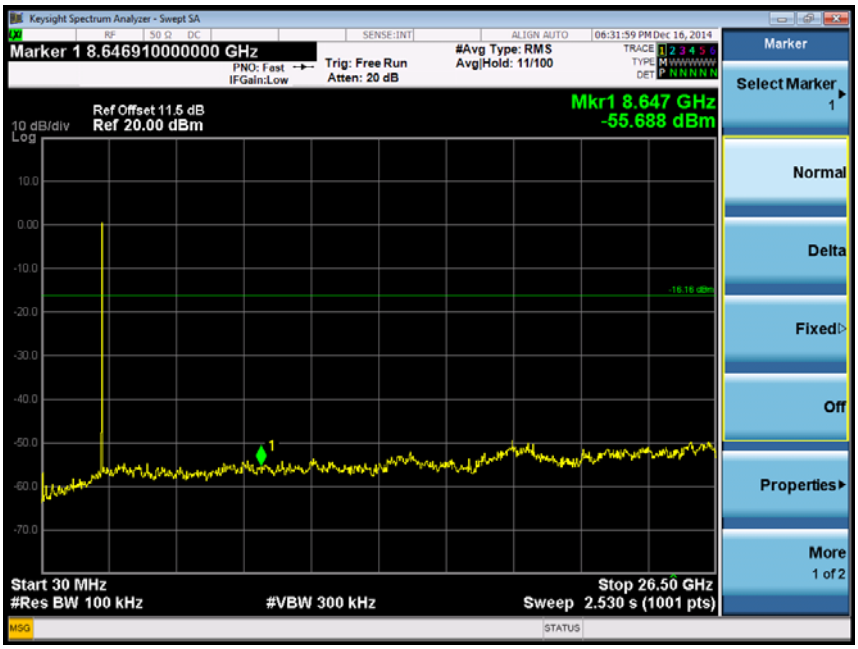
Bluetooth 1 Mbps – Ch. 78



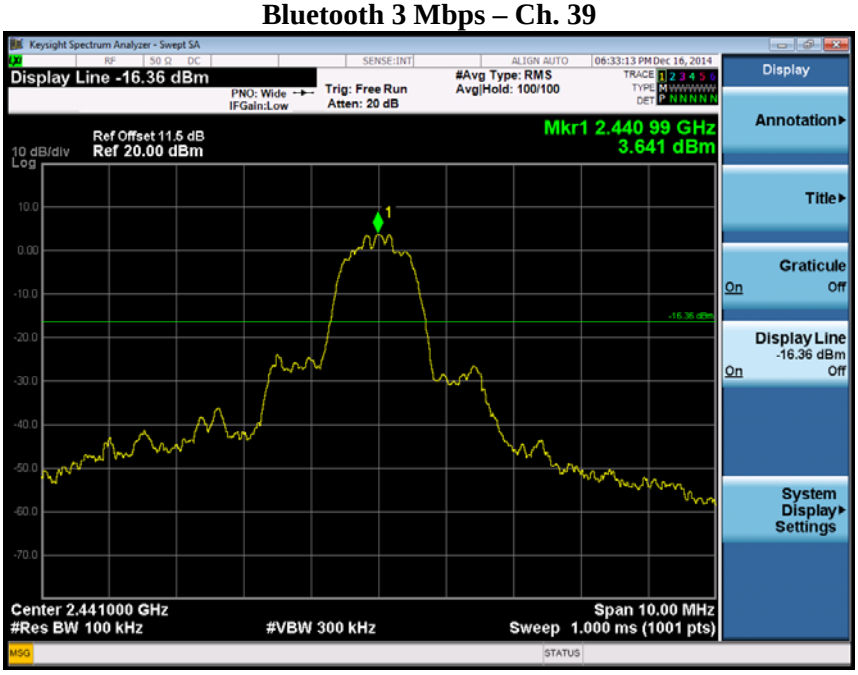


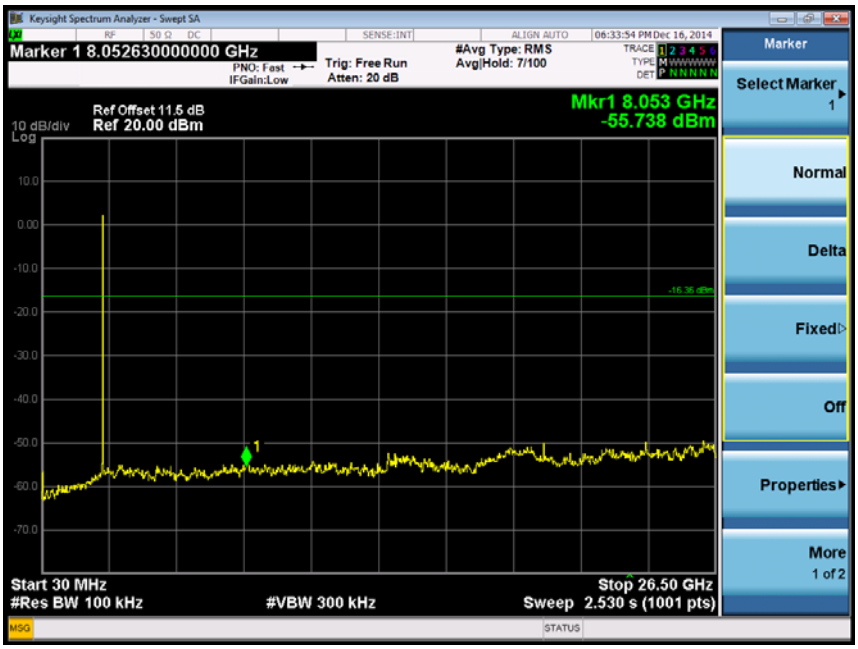
Bluetooth 3 Mbps – Ch. 00



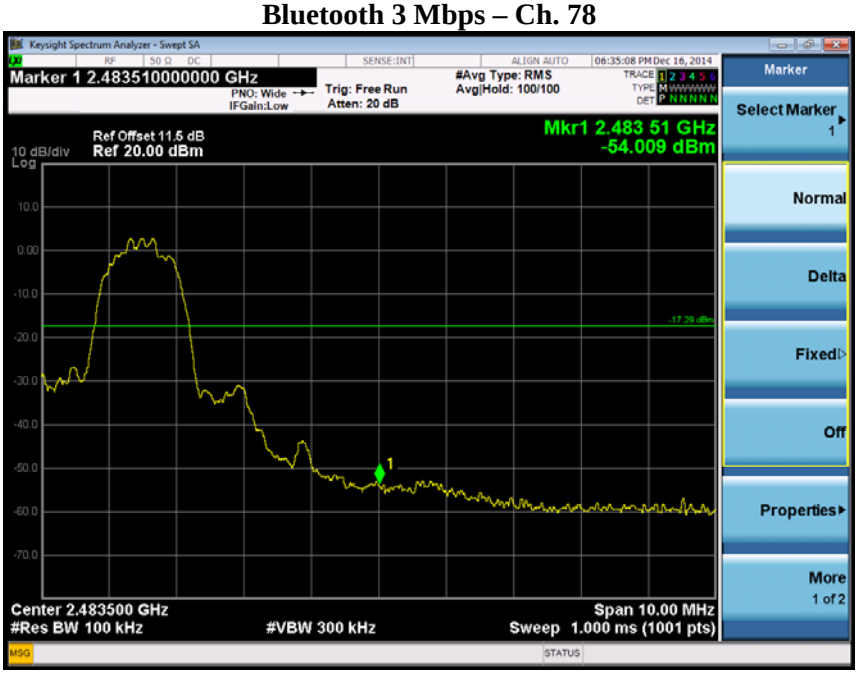


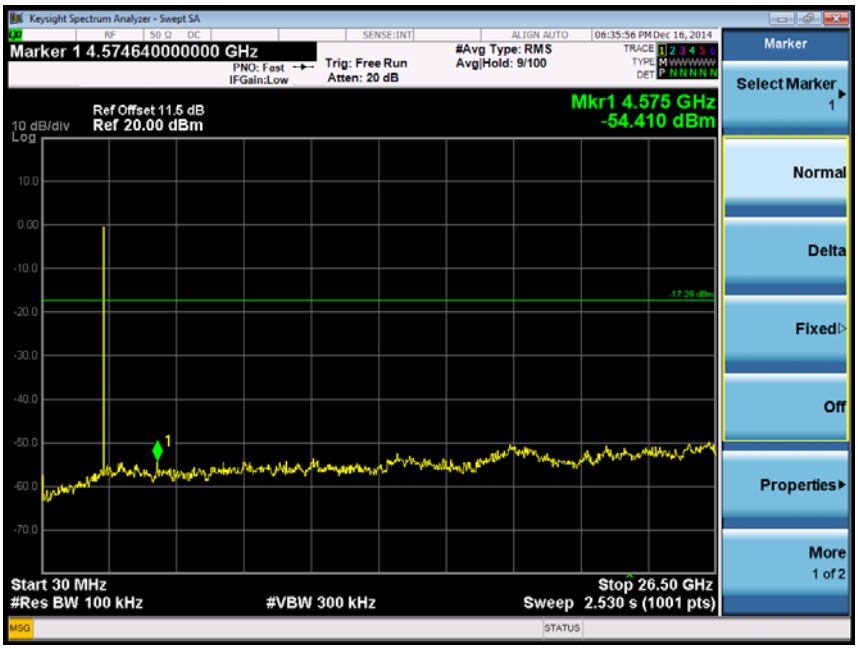
Bluetooth 3 Mbps – Ch. 39



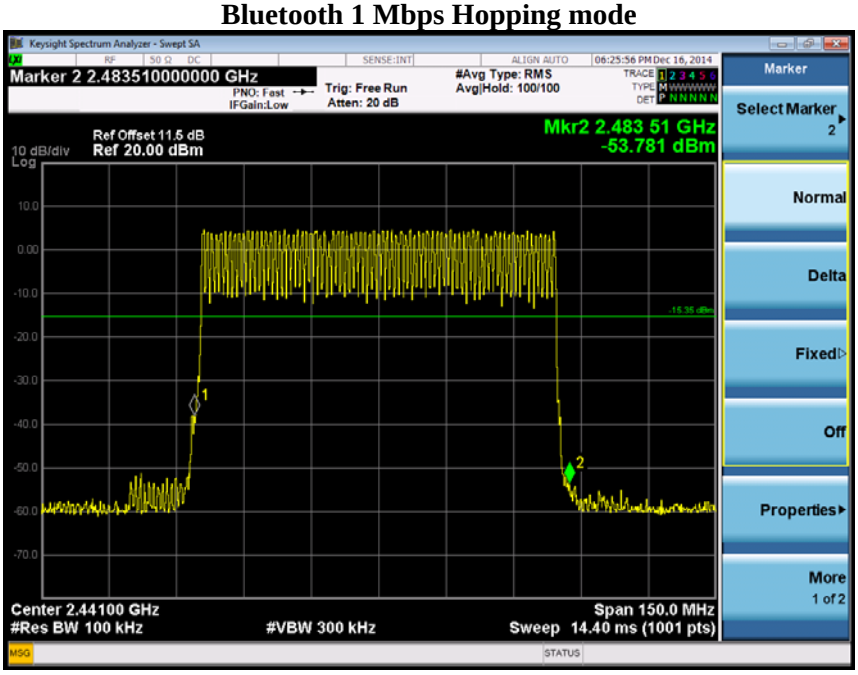


Bluetooth 3 Mbps – Ch. 78

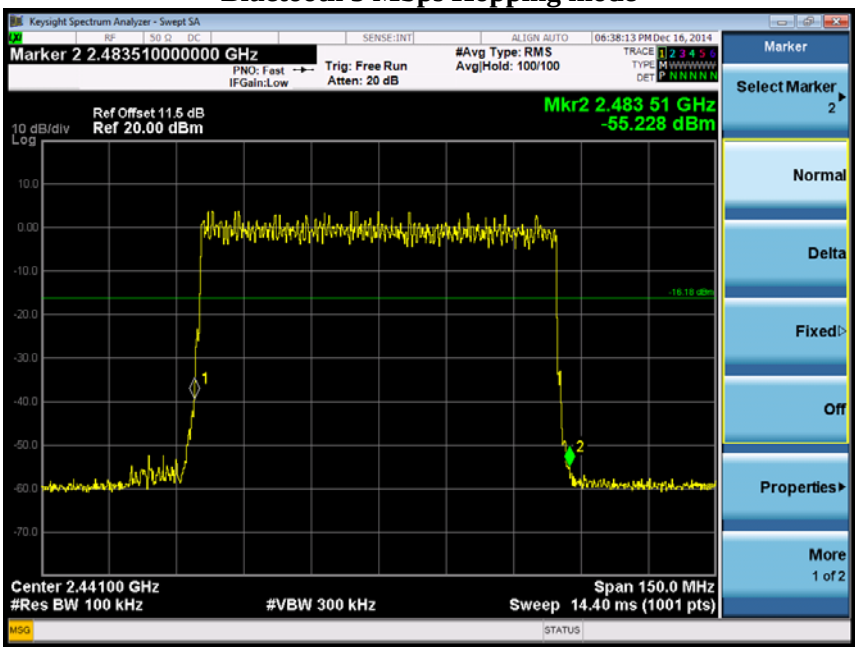




Bluetooth 1 Mbps Hopping mode

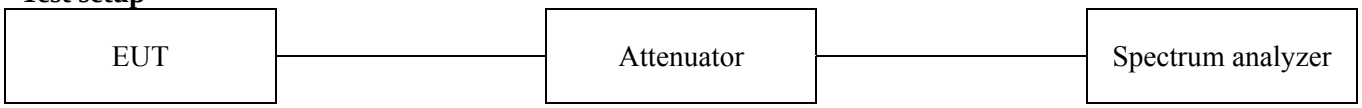


Bluetooth 3 Mbps Hopping mode



3.3. 20 dB bandwidth

Test setup



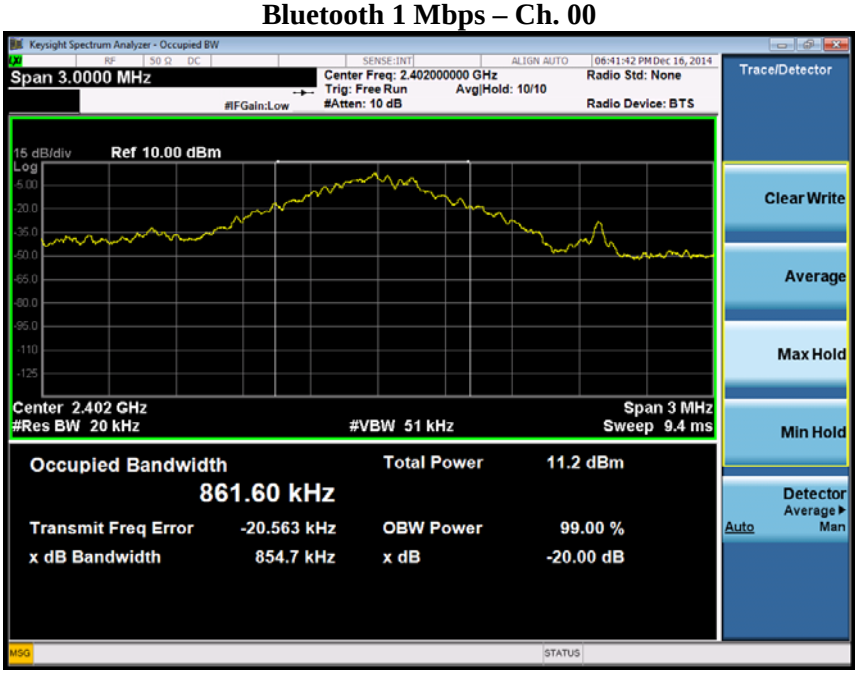
Test procedure
DA 00-075

Test setting
1. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
2. RBW ≥ 1% of the 20 dB bandwidth
3. VBW ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Sweep = auto couple
7. Trace mode = max hold

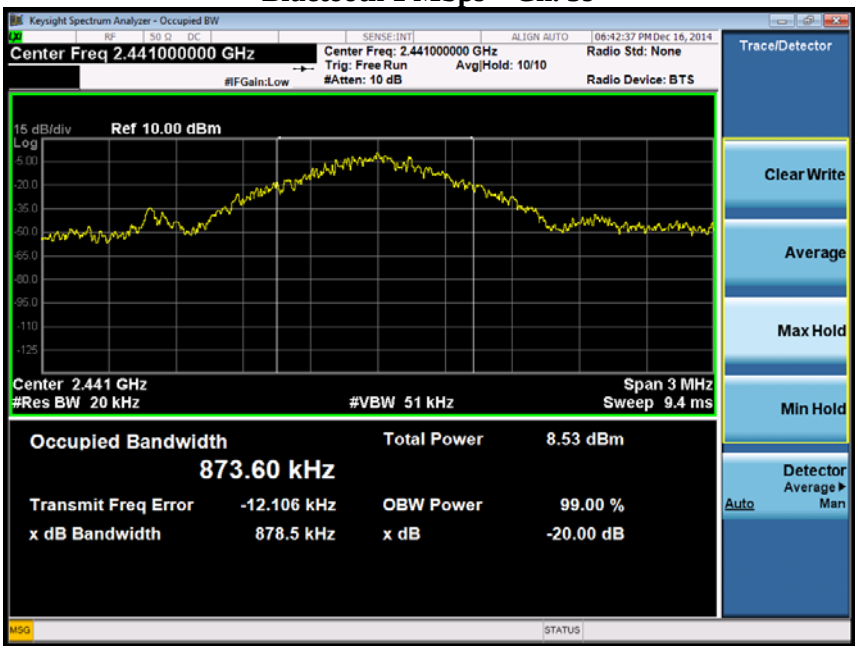
Limit
Not applicable

Frequency(㎒)	Channel no.	Data rate(Mbps)	Measured bandwidth(㎑)
2 402	00	1	0.854
2 441	39		0.878
2 480	78		0.917
2 402	00	3	1.252
2 441	39		1.301
2 480	78		1.250

Bluetooth 1 Mbps – Ch. 00

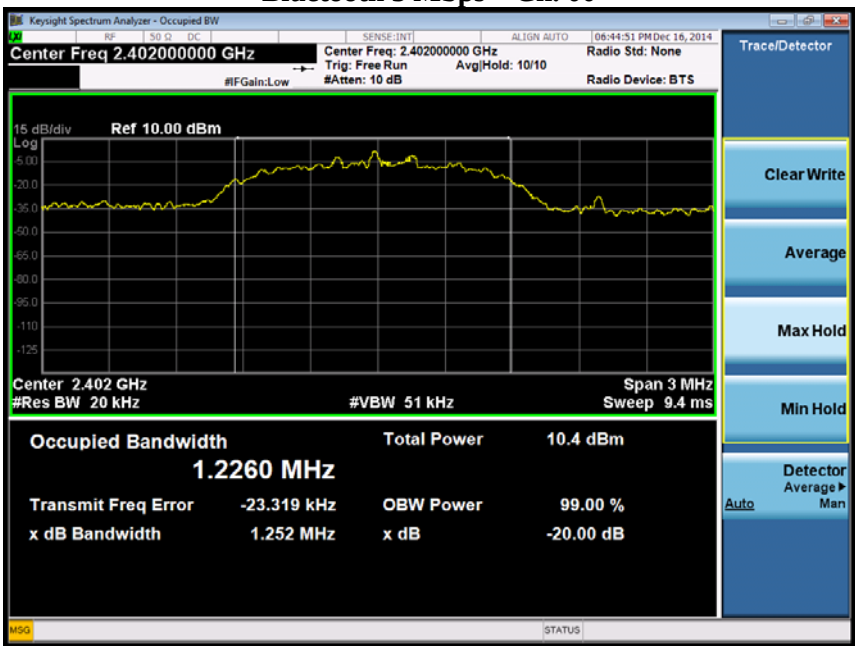


Bluetooth 1 Mbps – Ch. 39

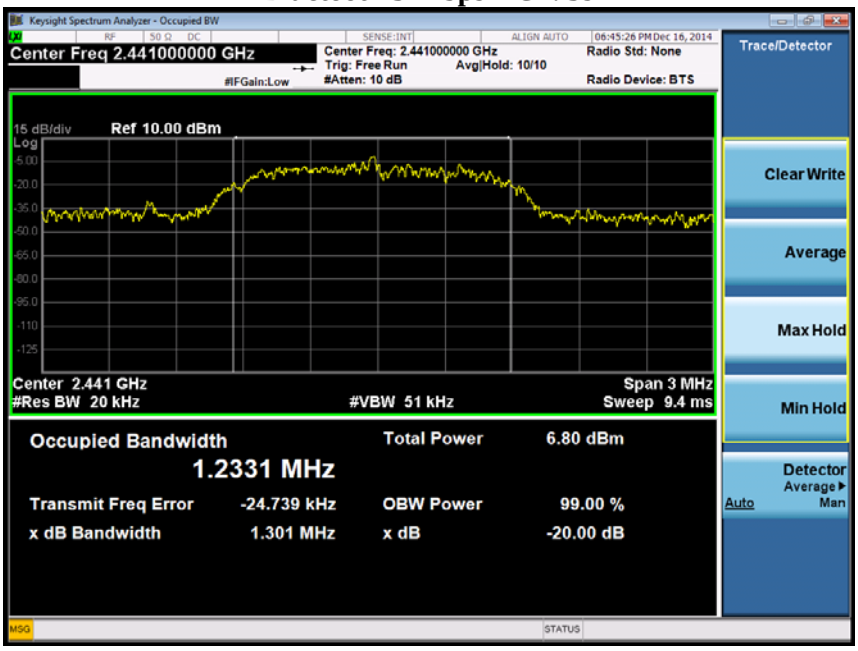


Bluetooth 1 Mbps – Ch. 78

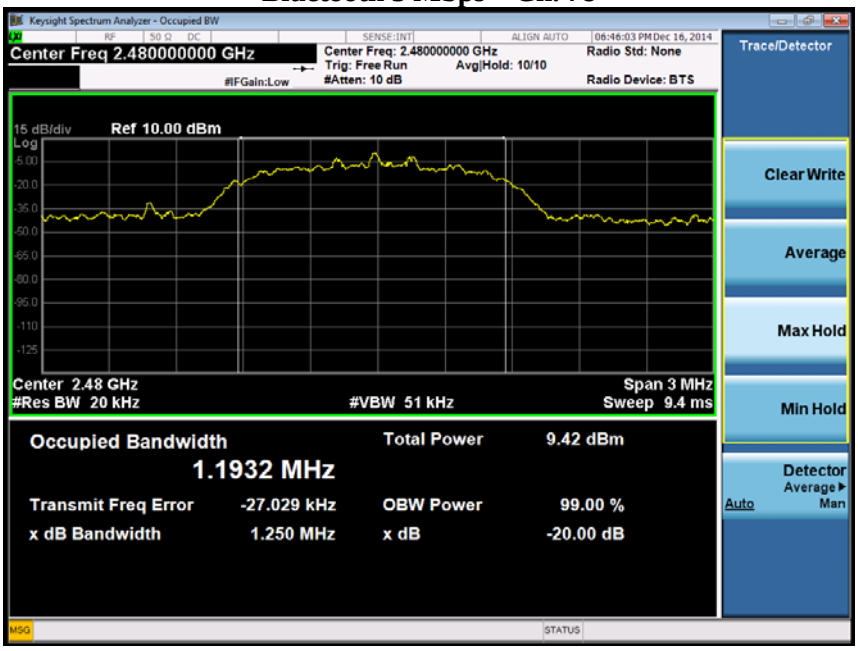
Bluetooth 3 Mbps – Ch. 00



Bluetooth 3 Mbps – Ch. 39

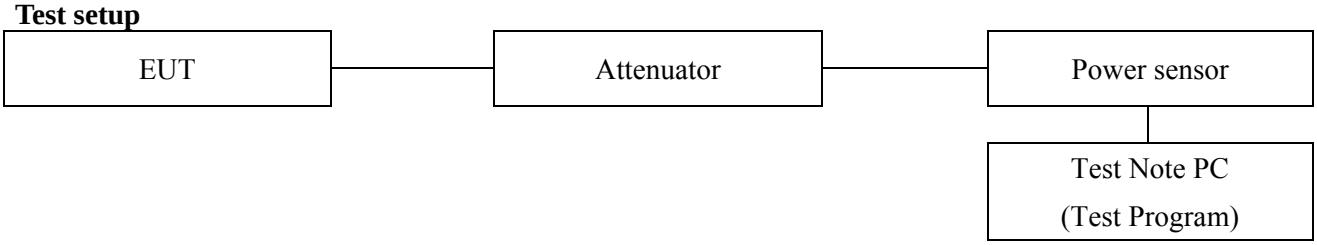


Bluetooth 3 Mbps – Ch. 78



3.4. Output power

Test setup



Test procedure

DA 00-075

Test setting

1. Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
2. RBW > the 20 dB bandwidth of the emission being measured
3. VBW ≥ RBW
4. Sweep = Auto
5. Detector function = Peak
6. Trace = Max hold

Limit

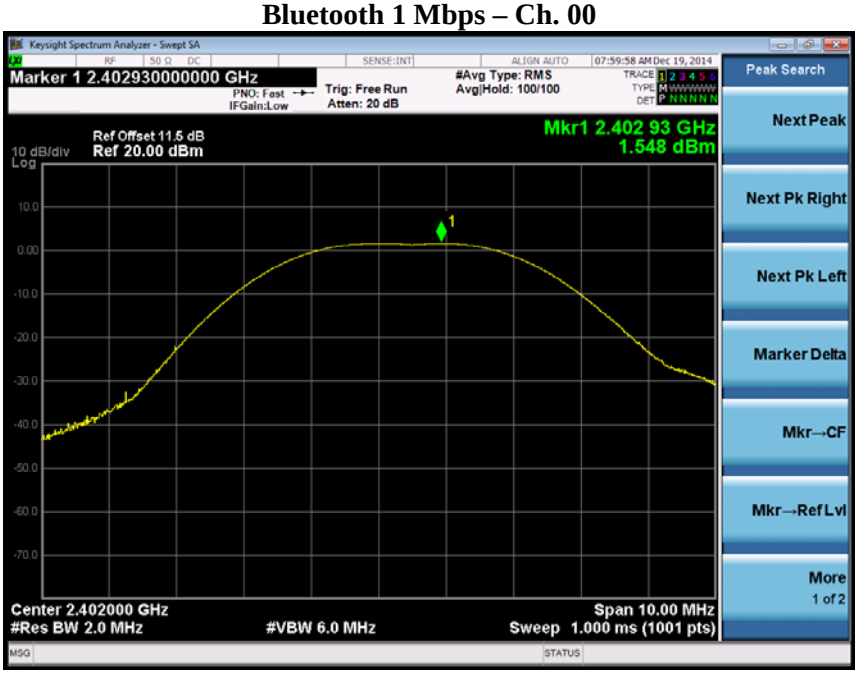
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

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

According to RSS-210 A8.4(2), for frequency hopping systems operating in the band 2400-2483.5 Hz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

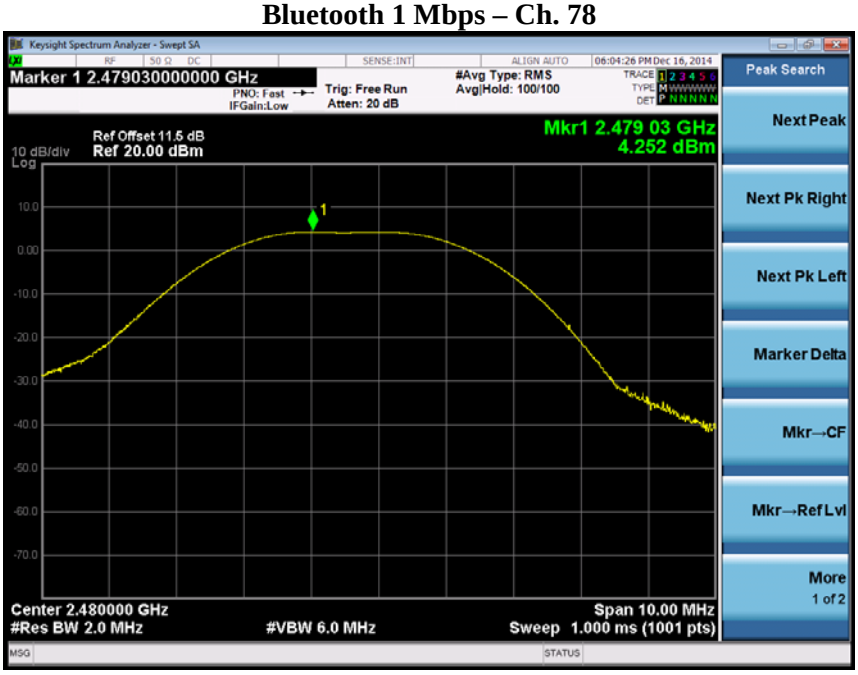
Frequency(㎒)	Channel no.	Data rate(Mbps)	Measured power(dBm)
2 402	00	1	1.548
2 441	39		4.758
2 480	78		4.252
2 402	00	3	1.297
2 441	39		4.342
2 480	78		3.569

Bluetooth 1 Mbps – Ch. 00

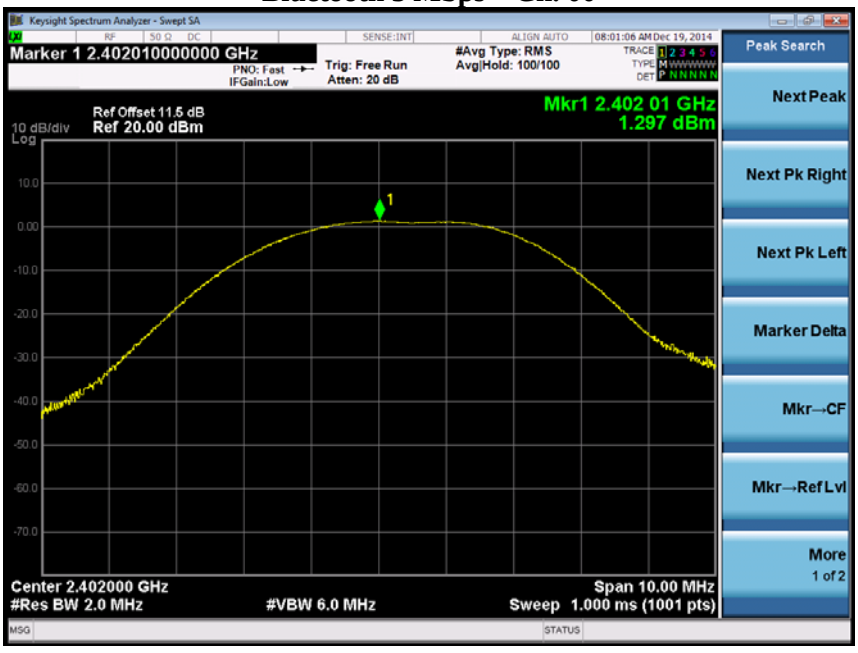


Bluetooth 1 Mbps – Ch. 39

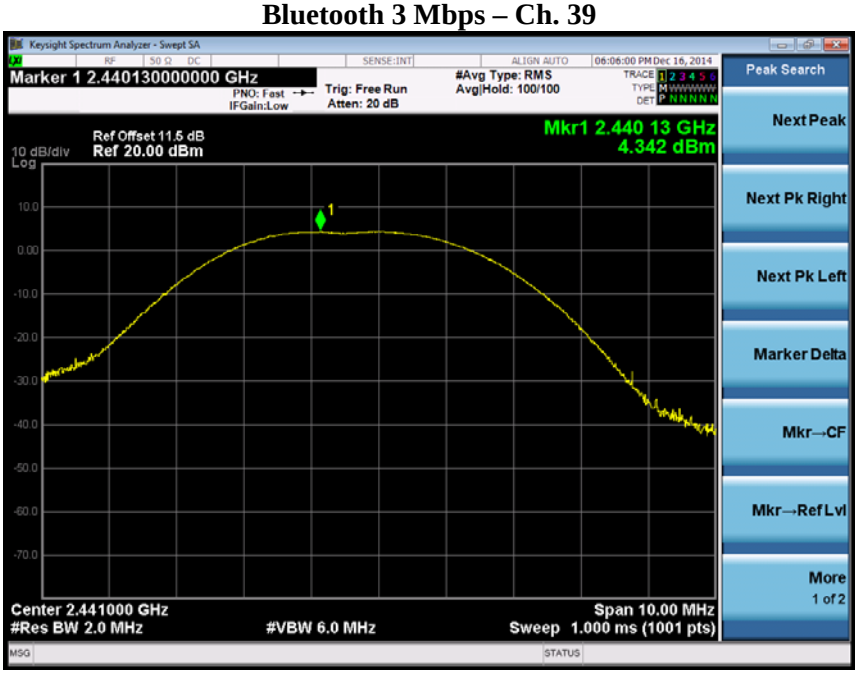
Bluetooth 1 Mbps – Ch. 78



Bluetooth 3 Mbps – Ch. 00



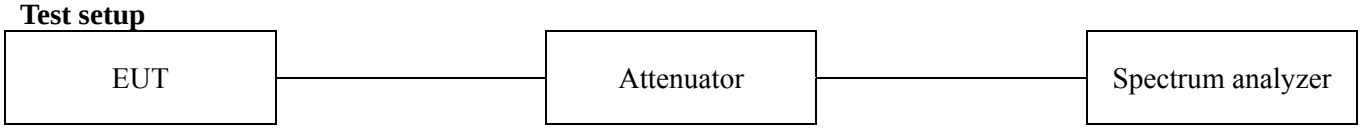
Bluetooth 3 Mbps – Ch. 39



Bluetooth 3 Mbps – Ch. 78

3.5. Carrier frequency separation

Test setup



Test procedure
DA 00-075

Test Setting
1. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
2. Span = wide enough to capture the peaks of two adjacent channels
3. Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
4. Video (or Average) Bandwidth (VBW) ≥ RBW
5. Sweep = auto
6. Detector function = peak
7. Trace = max hold

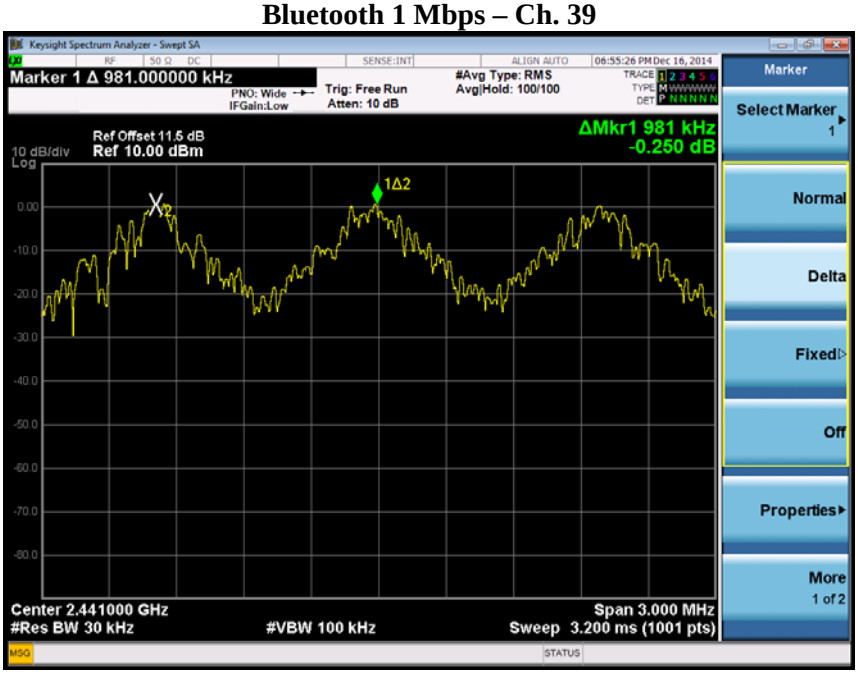
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

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

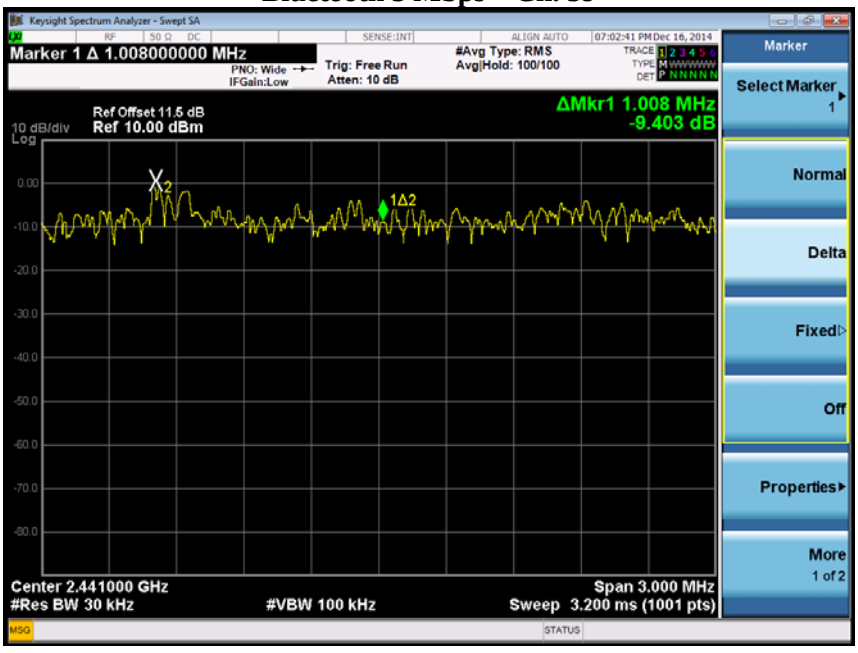
According to RSS-210 A8.1(b), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

Frequency(㎒)	Channel no.	Data rate(Mbps)	Channel Separation (㎒)
2 441	39	1	0.981
2 441	39	3	1.008

Bluetooth 1 Mbps – Ch. 39

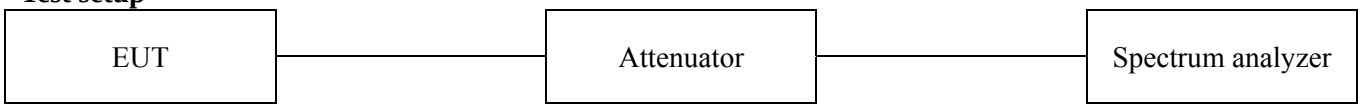


Bluetooth 3 Mbps – Ch. 39



3.6. Number of hopping frequency

Test setup



Test procedure
DA 00-075

Test setting
1. The EUT must have its hopping function enabled.
2. Frequency range: 2 400 ㎒ ~ 2 441.5 ㎒, 2 441.5 ㎒ ~ 2 483.5 ㎒
3. Span = the frequency band of operation
4. RBW = 500 ㎑ (≥ 1% of the span)
5. VBW = 1 ㎒ (≥ RBW)
6. Sweep = auto
7. Detector function = peak
8. Trace = max hold

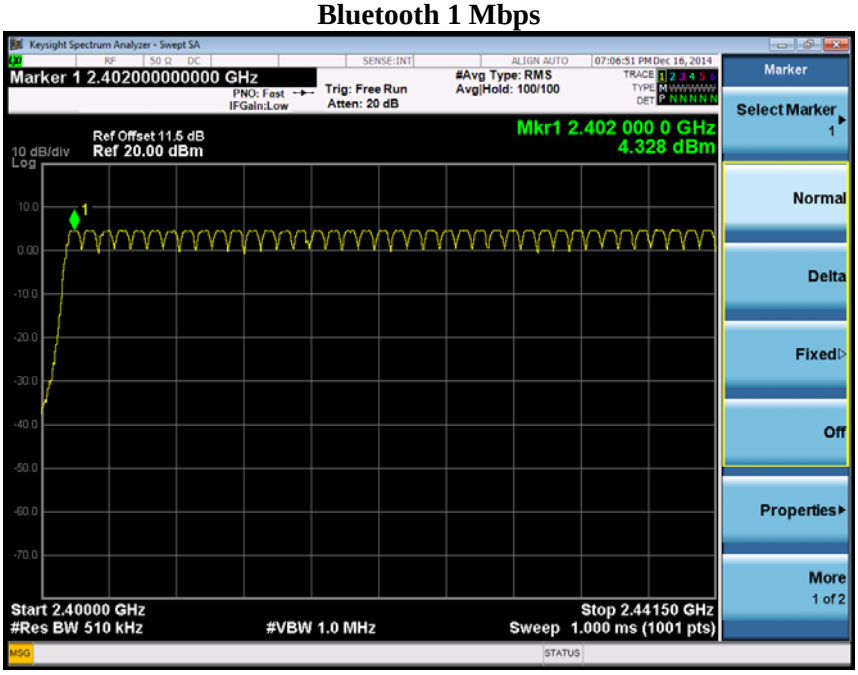
All the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

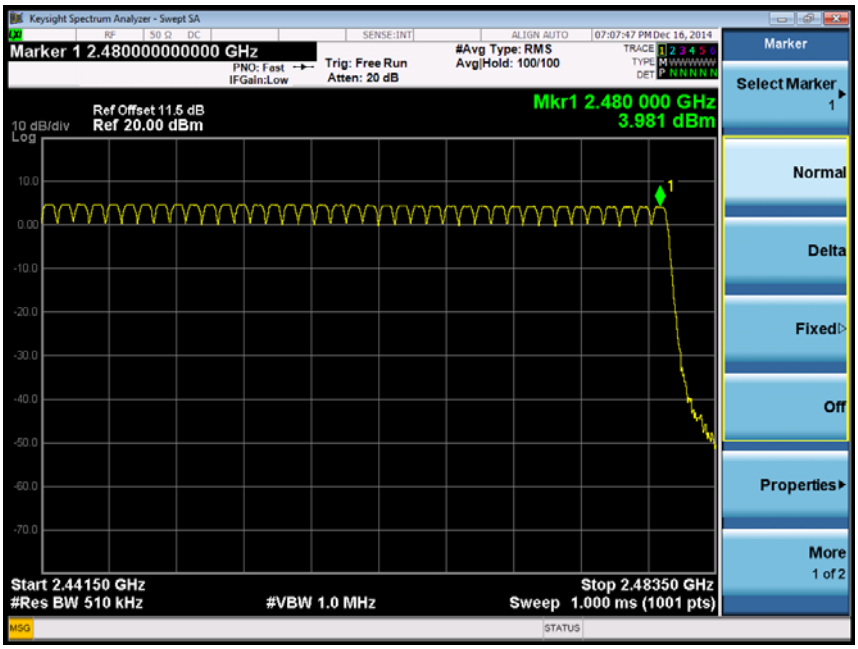
Limit
According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 ㎒ bands shall use at least 15 hopping frequencies.

According to RSS-210 A8.1(d), frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

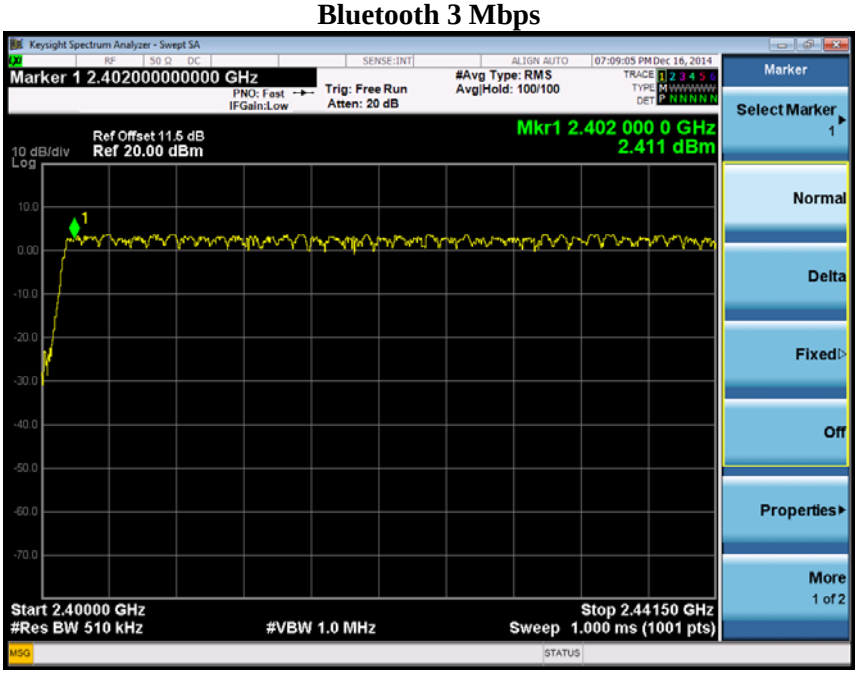
Data rate(Mbps)	Number of hopping frequency	Limit
1	79	≥ 15
3	79	≥ 15

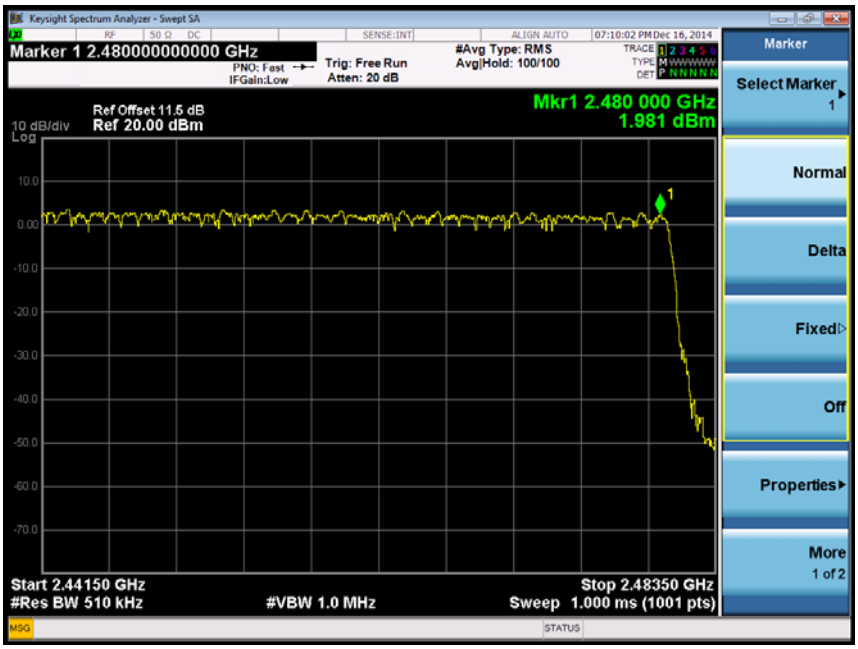
Bluetooth 1 Mbps





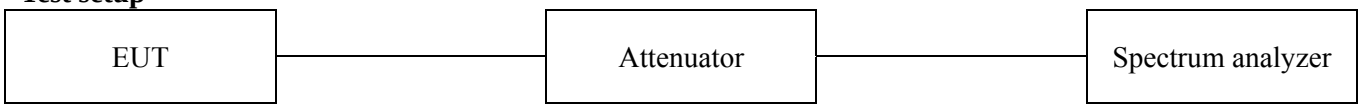
Bluetooth 3 Mbps





3.7. Time of occupancy

Test setup



Test procedure
DA 00-075

Test setting
1. The EUT must have its hopping function enabled.
2. Span = zero span, centered on a hopping channel
4. RBW = 1 ㎒
5. VBW = 1 ㎒ (≥ RBW)
6. Sweep = as necessary to capture the entire dwell time per hopping channel
7. Detector function = peak
8. Trace = max hold

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

According to RSS-210 A8.1(d), frequency hopping system operating in the 2 400 ~ 2 483.5 ㎒ band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

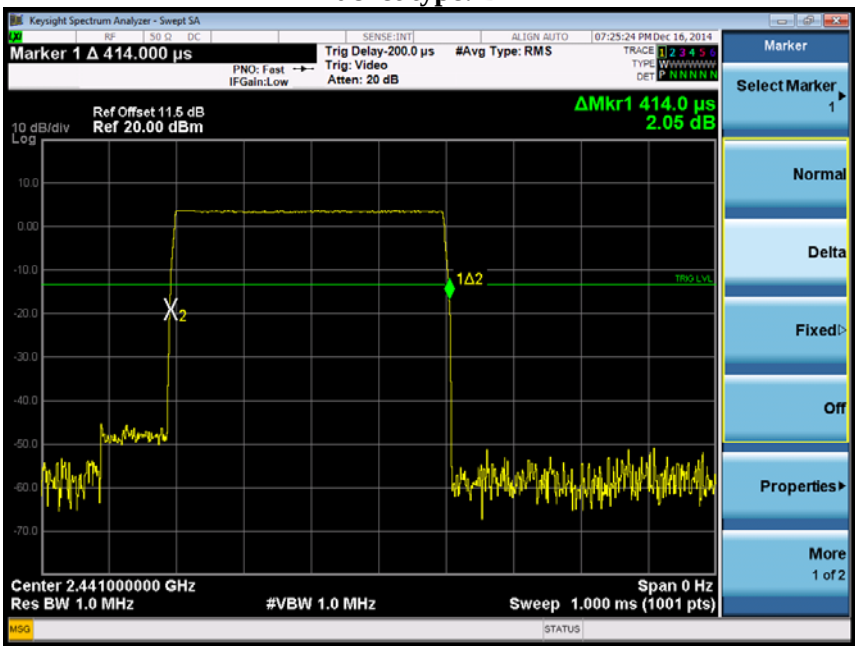
A period time = 0.4(s) × 79 = 31.6(s)

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

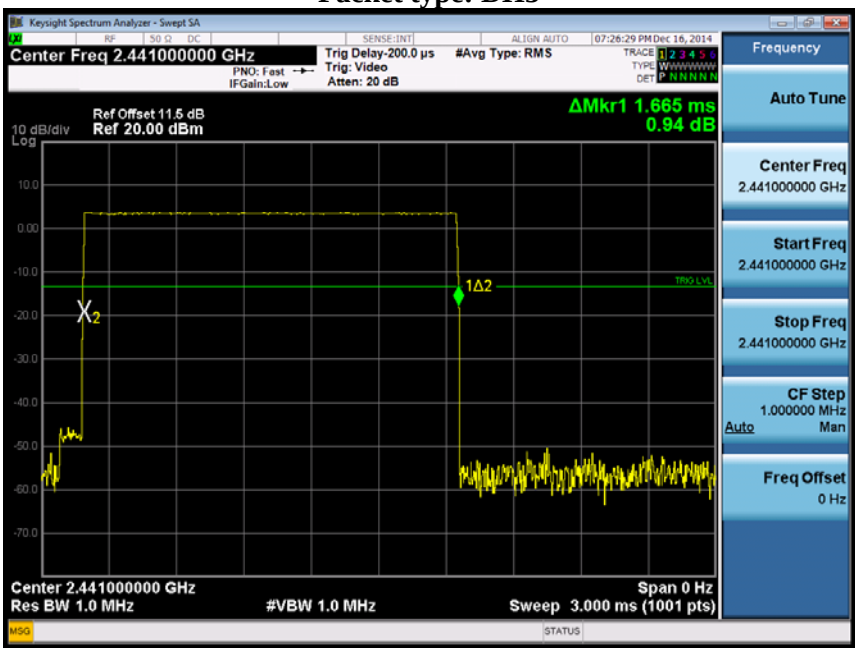
Packet type	Frequency (㎒)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 441	0.414	132.5	400
DH3	2 441	1.665	266.4	400
DH5	2 441	2.909	310.3	400
2-DH1	2 441	0.428	136.9	400
2-DH3	2 441	1.676	268.1	400
2-DH5	2 441	2.920	311.5	400

Note:
DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 132.5 (ms)
DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 266.4 (ms)
DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 310.3 (ms)
2-DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 136.9 (ms)
2-DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 268.1 (ms)
2-DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 311.5 (ms)

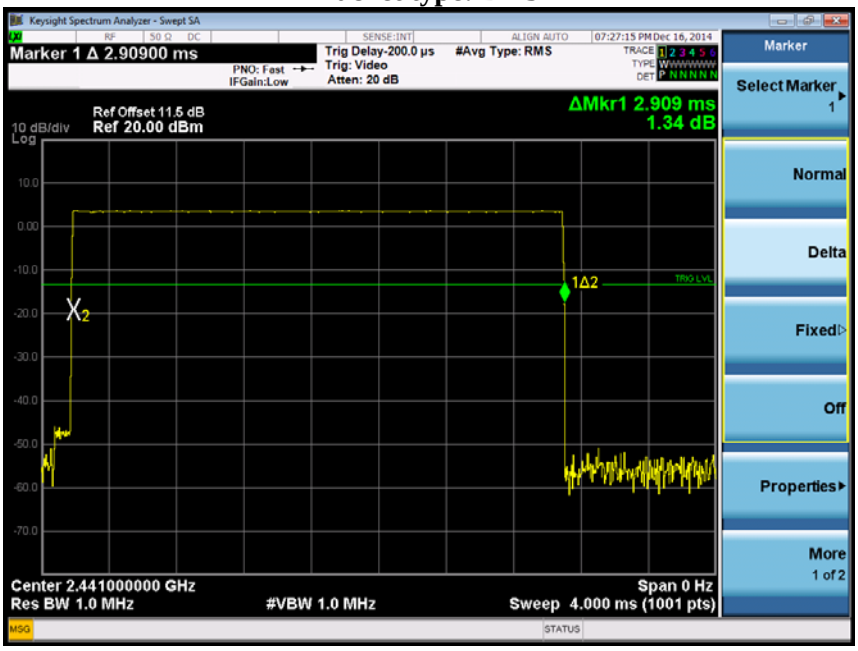
Packet type: DH1



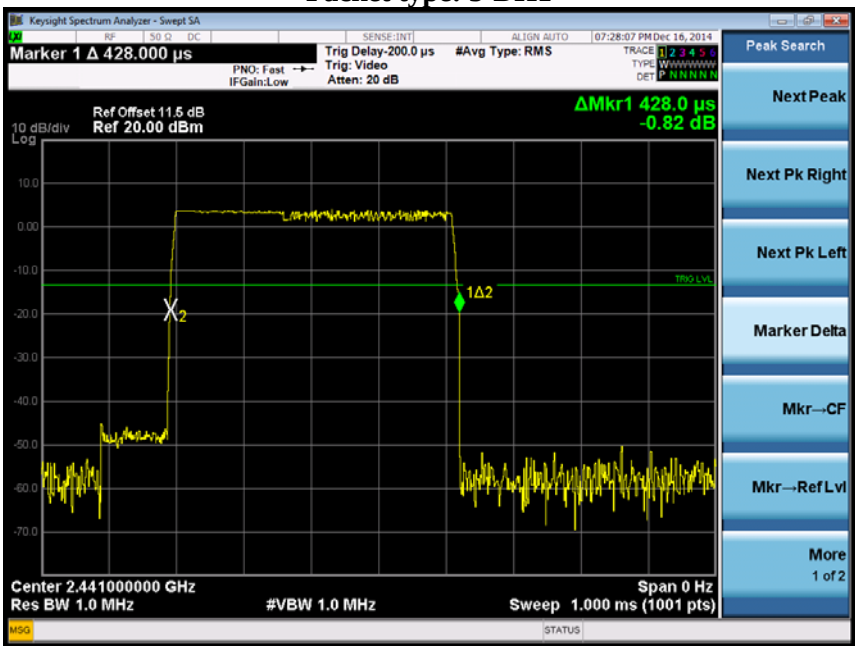
Packet type: DH3



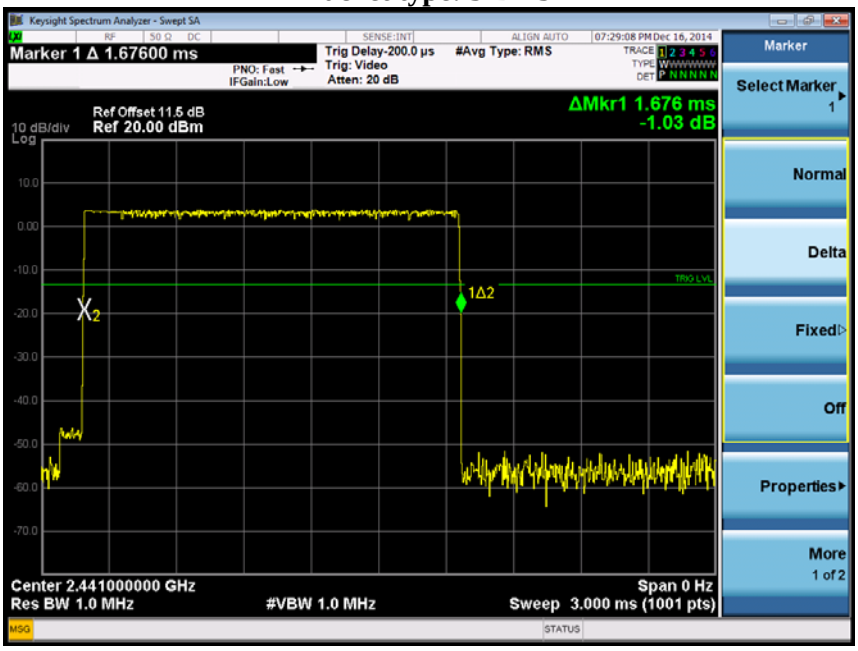
Packet type: DH5



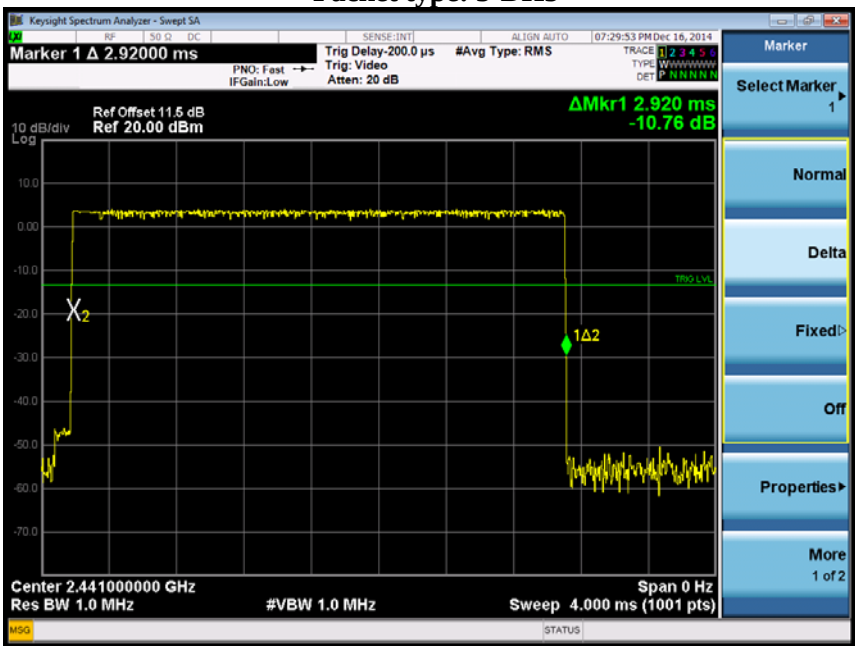
Packet type: 3-DH1



Packet type: 3-DH3



Packet type: 3-DH5



3.8. AC conducted emissions

Limit

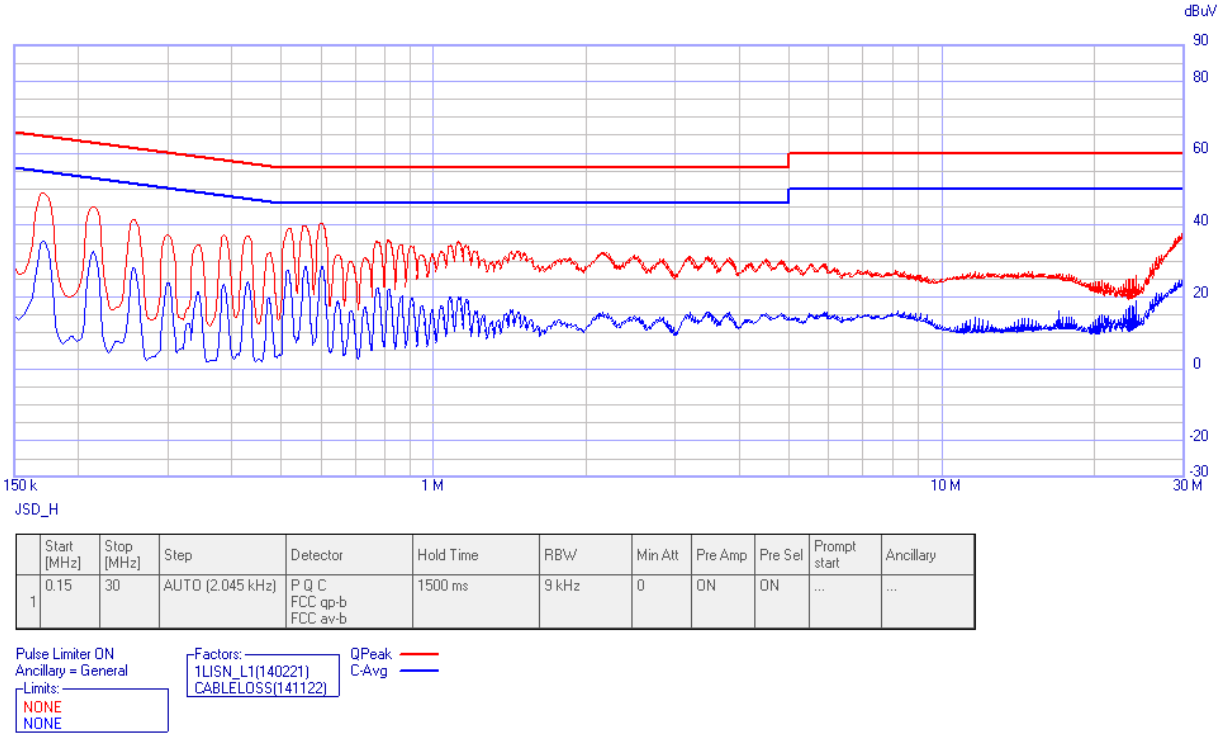
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following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

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

Note:

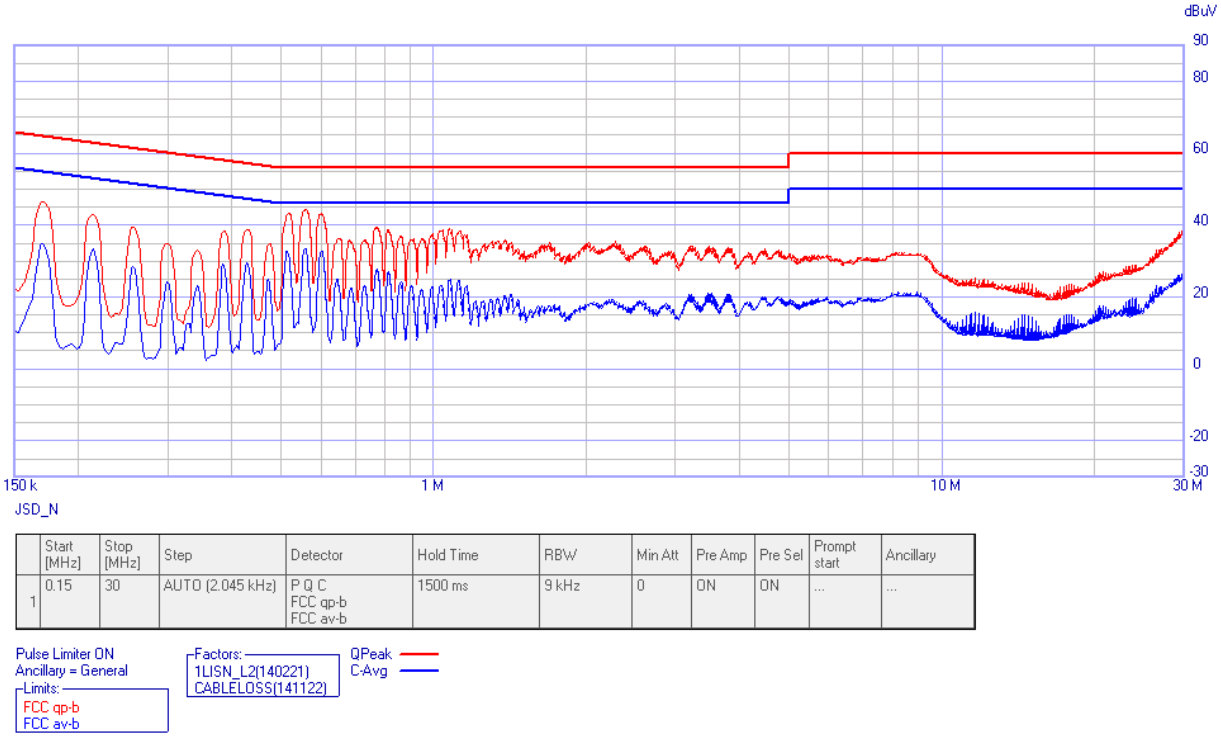
1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in GFSK mode using 1Mbps on Channel 39. The emissions found were not affected by the choice of channel used during testing.
2. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section 15.207 of the Title 47 CFR.
3. Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).
4. Deviations to the Specifications: None.

Test results



Frequency (㎒)	Result	
	QP (dB㎶)	CISPR-AVG (dB㎶)
0.17045	48.80	35.63
0.213395	45.08	32.53
0.25634	41.57	28.06
0.299285	37.18	23.91
0.38722	37.19	23.67
0.520145	39.09	26.09
0.556955	39.90	28.03
0.5999	40.62	28.00
0.814625	35.91	21.68
0.81667	35.91	21.68

Note; Hot Line
Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



Frequency (㎒)	Result	
	QP (dB㎶)	CISPR-AVG (dB㎶)
0.17045	46.37	34.87
0.213395	42.89	33.26
0.25634	39.36	28.61
0.38722	38.27	28.79
0.430165	38.77	29.17
0.5181	43.30	32.11
0.561045	44.31	32.18
0.5999	43.13	32.66
0.77168	39.31	27.21
0.773725	39.31	27.21

Note; Neutral Line
Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

Appendix A. Measurement equipment

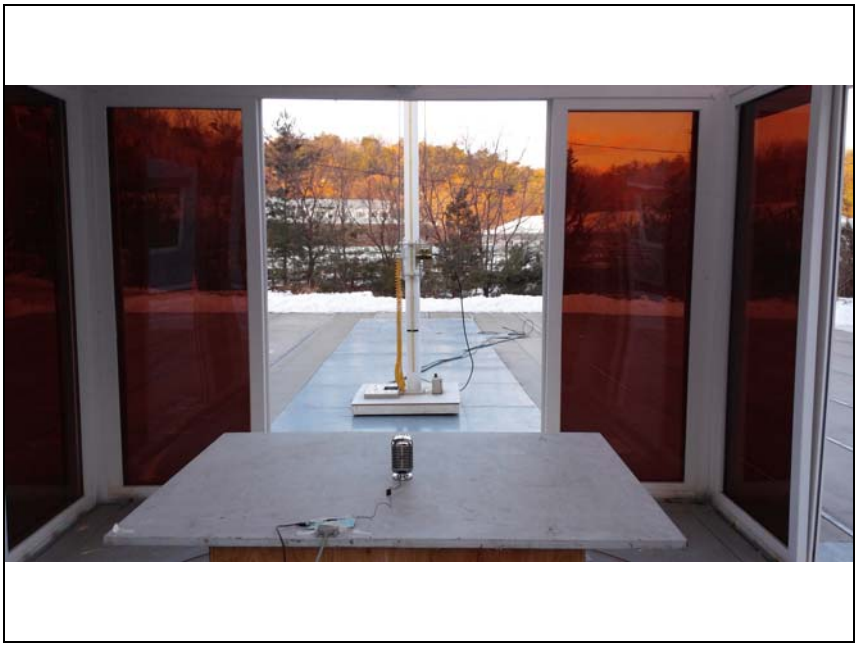
Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV30	100736	1 year	2015.07.24
Spectrum analyzer	Agilent	N9010A	MY51440103	1 year	2015.10.17
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2015.04.30
Attenuator	HP	8494B	2630A12857	1 year	2015.04.30
Loop Antenna	R&S	HFH2-Z2.335.4711.52	826532	2 years	2015.04.25
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-385	2 years	2015.05.09
Horn Antenna	A.H. System	SAS-571	414	2 years	2015.02.28
Horn antenna	Schwarzbeck	BBHA 9170	BBHA9170551	2 years	2015.09.04
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	1	1 year	2015.07.23
Preamplifier	HP	8447F	2805A02570	1 year	2015.04.30
Preamplifier	HP	8449B	3008A00538	1 year	2015.07.23
Preamplifier	Schwarzbeck	BBV 9721	9721-003	1 year	2015.09.04
EMI Test Receiver	R & S	ESVS10	826008/014	1 year	2015.04.09
EMI Receiver/Signal Analyzer	Narda S.T.S / PMM	PMM 9010F	020WW31006	1 year	2015.04.04
LISN	R&S	ENV216	101137	1 year	2015.02.21

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook Computer	Samsung Electronics Co., Ltd.	RV518	HTK991NC600207R

Appendix B. Test setup photo

Radiated spurious



AC conducted emission