FCC PART 15C TEST REPORT FOR CERTIFICATION

On Behalf of

ELECOM CO., LTD.

ELECOM TrackBall Mouse

M-DPT1MR; M-DPT1MRX

FCC ID: YWO-M-DPT1MR

Prepared for : ELECOM CO., LTD.
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Prepared By : Audix Technology (Shenzhen) Co., Ltd.
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Report Number : ACS-F18041
Date of Test : Jan.31~Mar.12,2018
Date of Report : Mar.13,2018

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TEST REPORT CERTIFICATION

Applicant : ELECOM CO., LTD.

Product : ELECOM TrackBall Mouse

FCC ID : YWO-M-DPT1MR

(A)Model No. : M-DPT1MR; M-DPT1MRX
(B) Serial No. : N/A
(C) Power Supply : DC 1.5V
(D) Test Voltage : DC 1.5V

Tested for comply with:
FCC CFR 47 Part 15 Subpart C

Test procedure used:
ANSI C63.10: 2013;

The device described above is tested by AUDIX TECHNOLOGY (SHENZHEN) CO., LTD. to confirm comply with all the FCC Part 15 Subpart C requirements. The test results are contained in this test report and AUDIX TECHNOLOGY (SHENZHEN) CO., LTD. is assumed full responsibility for the accuracy and completeness of these tests. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements. This report contains data that are not covered by the NVLAP accreditation.

This Report is made under FCC Part 2.1075. No modifications were required during testing to bring this product into compliance.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of AUDIX TECHNOLOGY (SHENZHEN) CO., LTD.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Date of Test : Jan.31~Mar.12,2018 Report of date: Mar.13,2018

Prepared by : Brave Zhang / Assistant

Reviewed by : Sunny Lu/ Deputy Manager

AUDIX® 信華科技（深圳）有限公司
Audix Technology (Shenzhen) Co., Ltd.
EMC 部門報告專用章
Stamp only for EMC Dept. Report
Signature:

Approved & Authorized Signer : David Jin / Manager

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT has been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	**Standard**	**Results**
Power Line Conducted Emission Test	FCC Part 15: 15.207 ANSI C63.10 :2013	N/A
Radiated Emission Test	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10 : 2013	PASS
Conducted Spurious Emissions	FCC Part 15: 15.247(a)(1) ANSI C63.10 : 2013	PASS
6dB Bandwidth Test	FCC Part 15: 15.215 ANSI C63.10 : 2013	PASS
Maximum Peak Output Power Test	FCC Part 15: 15.247(b)(1) ANSI C63.10 : 2013	PASS
Band Edge Compliance Test	FCC Part 15: 15.247(d) ANSI C63.10 : 2013	PASS
Power Spectral Density Test	FCC Part 15: 15.247(d) ANSI C63.10 : 2013	PASS

2. GENERAL INFORMATION

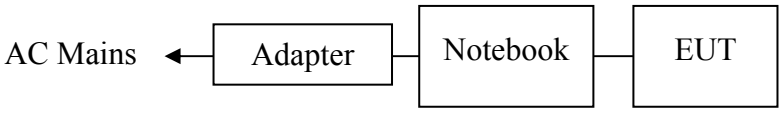
2.1. Description of Device (EUT)

Product	:	ELECOM TrackBall Mouse
Model No.	:	M-DPT1MR; M-DPT1MRX Models different only in model names.
FCC ID	:	YWO-M-DPT1MR
Radio	:	BT 4.0; General 2.4GHz wireless
Operation frequency	:	2402MHz-2480MHz; 2404MHz-2477MHz
Antenna	:	Internal Antenna, 2.805dBi
Modulation	:	GFSK
Applicant	:	ELECOM CO., LTD. 1-1 fushimi machi, 4-chome chuoku, □saka, Japan 541-8765
Manufacturer	:	ELECOM CO., LTD. 1-1 fushimi machi, 4-chome chuoku, osaka, Japan 541-8765
Factory	:	G.Tech Technology Ltd. No.8, Jinyuan 1st Road, High-tech Zone, Zhuhai City, Guangdong, China, 519085
USB Cable	:	Shielded, Detachable, 1.5m
Date of Test	:	Jan.31~Mar.12,2018
Date of Receipt	:	Jan.30,2018
Sample Type	:	Prototype production

2.2. Tested Supporting System Details

No.	Description	ACS No.	Manufacturer	Model	Serial Number
1.	Notebook	N/A	acer	ZOW	NVX7C
		Power Adapter: Manufacturer: LITEON, Model: PA-1900-32 Input: 100-240V~, 1.5A, 50/60Hz Output: 19V----4.74A Power Cord: Unshielded, Detachable, 1.8m			

2.3. Block Diagram of connection between EUT and simulators



(EUT: ELECOM TrackBall Mouse)

2.4. Test information

A Special Test Software was used to control EUT work in Continuous TX mode (GFSK modulation), and select test channel.

Tested mode, channel, and data rate information			
Mode	data rate (Mbps)	Channel	Frequency (MHz)
Tx Mode GFSK modulation	1	Low :CH 0	2402
	1	Middle: CH19	2440
	1	High: CH39	2480

2.5. Test Facility
Site Description

Name of Firm	:	Audix Technology (Shenzhen) Co., Ltd. No. 6, Kefeng Road, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China
EMC Lab.	:	Certificated by Industry Canada Registration Number: IC 5183A-1 Valid Date: May.07, 2020
	:	Certificated by DakkS, Germany Registration No: D-PL-12151-01-00 Valid Date: Dec.07, 2021
	:	Accredited by NVLAP, USA NVLAP Code: 200372-0 Valid Date: Mar.31, 2018
	:	Certificated by FCC, USA Designation No: CN5022 Valid Date: Mar.31, 2018

2.6. Measurement Uncertainty (95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Conduction emission test in No. 1 Conduction	3.6dB (150KHz to 30MHz)
Uncertainty for Radiation Emission test in 3m chamber	2.8dB (30~200MHz, Polarization: H)
	2.8dB (30~200MHz, Polarization: V)
	3.0dB (200M~1GHz, Polarization: H)
	3.0dB (200M~1GHz, Polarization: V)
Uncertainty for Radiation Emission test in 3m chamber	5.8dB (1~6GHz, Distance: 3m)
	5.8dB (6~18GHz, Distance: 3m)
	5.8dB (Above 18GHz, Distance: 3m)
Uncertainty for Radiated Spurious Emission test in RF chamber	3.6dB
Uncertainty for Conduction Spurious emission test	2.0dB
Uncertainty for Output power test	0.8dB
Uncertainty for Bandwidth test	83 kHz
Uncertainty for DC power test	0.1 %
Uncertainty for test site temperature and humidity	0.6℃
	3%

3. POWER LINE CONDUCTED EMISSION TEST

According to Paragraph (c) of FCC Part 15 section 15.207, Tests to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

4. RADIATED EMISSION MEASUREMENT

4.1. Test Equipments

Frequency range: 30~1000MHz

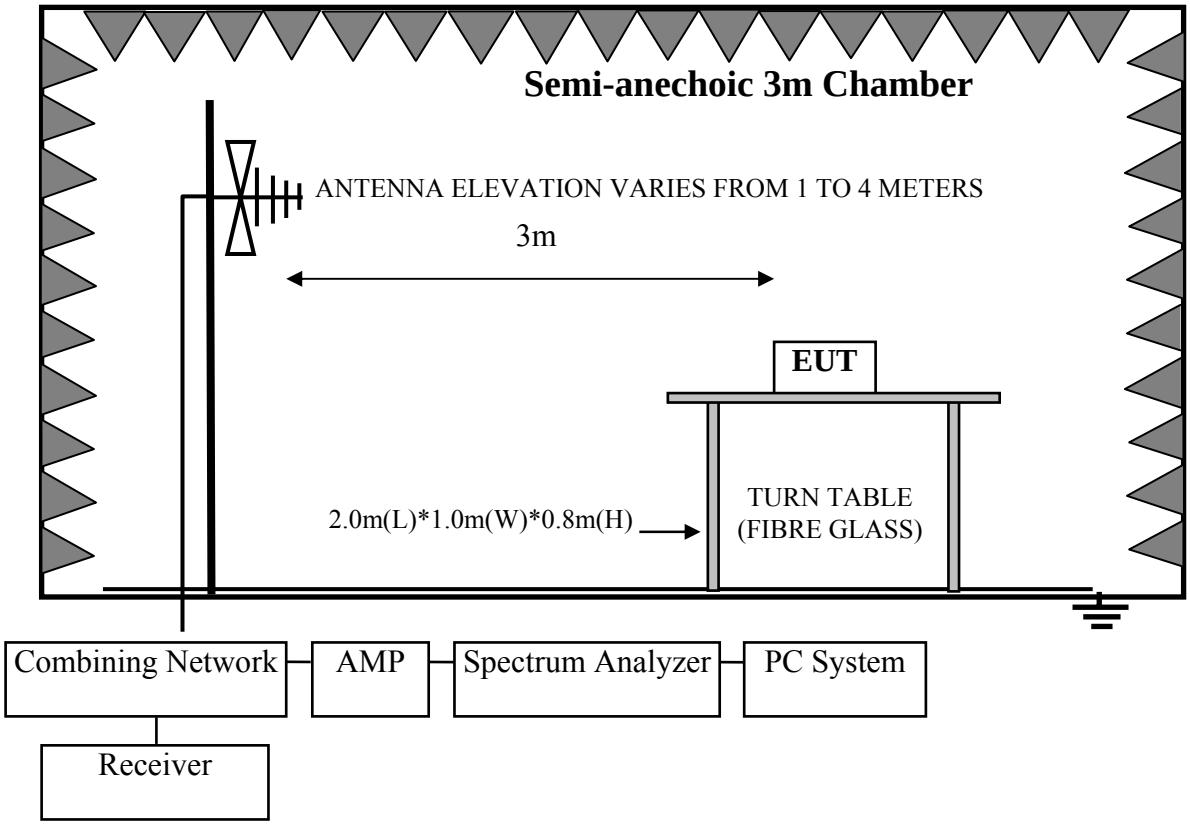
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3#Chamber	AUDIX	N/A	N/A	Mar.28,17	1 Year
2.	Spectrum Analyzer	Agilent	E7405A	MY45116588	Dec.19,17	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESR7	101547	Apr.22,17	1 Year
4.	Amplifier	HP	8447D	2648A04738	Apr.22,17	1 Year
5.	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	493	Jun.27.17	1 Year
6.	Loop Antenna	Chase	HLA6120	1062	Oct.15,17	1 Year
7.	RF Cable	MIYAZAKI	CFD400NL-LW	No.3	Sep.02.17	1 Year
8.	Coaxial Switch	Anritsu	MP59B	6201397222	Apr.22,17	1 Year
9.	Test Software	AUDIX	e3	6.2009-5-21a(n)	N/A	N/A
Note: N/A means Not applicable.						

Frequency range: above 1000MHz

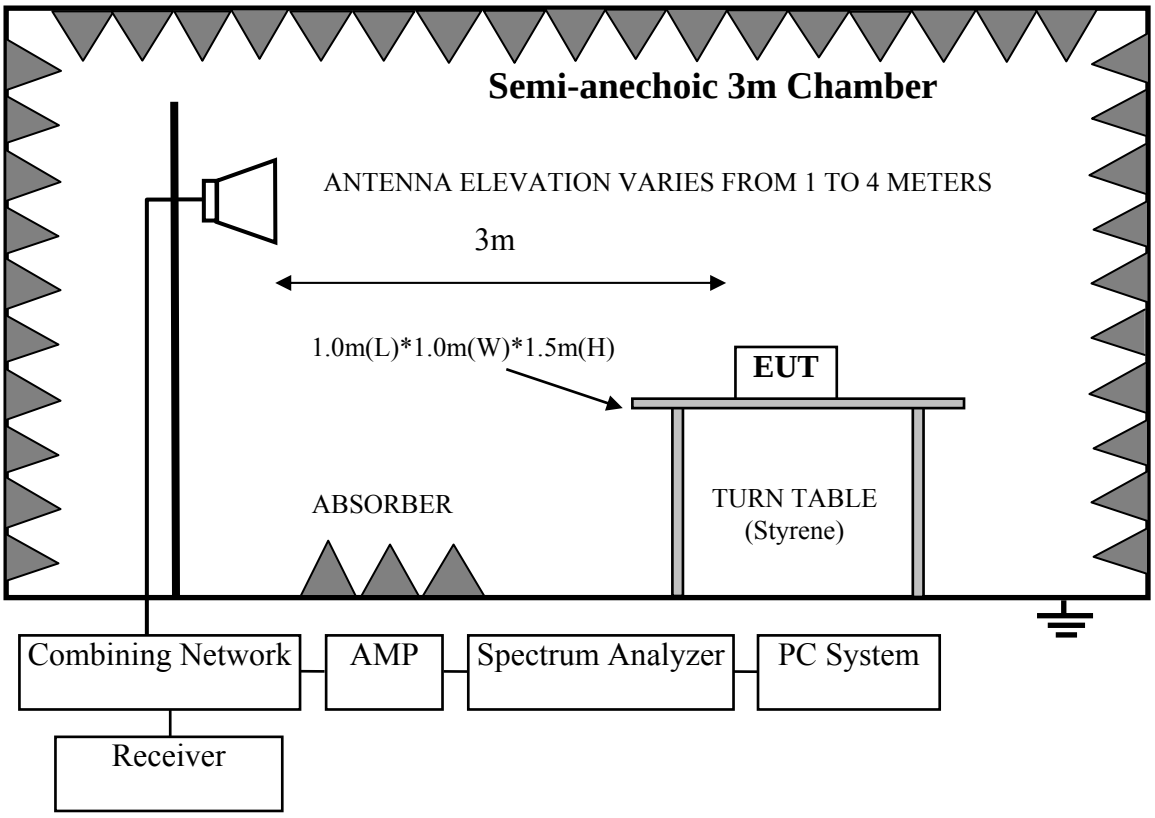
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3#Chamber	AUDIX	N/A	N/A	May.17,17	1 Year
2.	Spectrum Analyzer	Agilent	E7405A	MY45116588	Dec.19,17	1 Year
3.	Horn Antenna	ETS	3115	9510-4580	Dec.01,17	1 Year
4.	Horn Antenna	ETS	3116	00060089	Dec.01,17	1 Year
5.	Amplifier	Agilent	83017A	MY53270084	Dec.19,17	1 Year
6.	RF Cable	Hubersuhner	SUCOFLEX106	505239/6	Apr.22,17	1 Year
7.	Test Software	AUDIX	e3	6.2009-5-21a(n)	N/A	N/A
Note: N/A means Not applicable.						

4.2. Block Diagram of Test Setup

For frequency range 30MHz-1000MHz



For frequency range 1GHz-25GHz



4.3. Radiated Emission Limit Standard:

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000MHz	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remarks： (1) Emission level dBμV = 20 log Emission level μV/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

(4) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

4.4. EUT Configuration on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

4.4.1. ELECOM TrackBall Mouse (EUT)

Model No. : M-DPT1MR
Serial No. : N/A

4.5. Operating Condition of EUT

4.5.1. Setup the EUT and simulator as shown as Section 4.2.

4.5.2. Turn on the power of all equipments.

4.5.3. Let EUT work in Tx mode.

4.6. Test Procedure

Frequency below 30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

EUT and its simulators are placed on a turn table, which is 0.8 meter high above ground for frequency 30MHz~1000MHz, 1.5 meter high above ground for frequency above 1GHz and put the absorbing with 2.4m(L)*2.4m(W)*0.3m(H) on the ground . The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it.EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna for frequency 30MHz~1000MHz, and the Horm antenna is used as receiving antenna for frequency above 1GHz. Both horizontal and vertical polarization of the antenna is set on Test. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.10-2013 on radiated emission Test.

This test was performed with EUT in X, Y, Z position, and the worse case was found when EUT in X position as the test photo indicated.

The bandwidth of the EMI test receiver (R&S ESR7) is set at 120kHz for frequency range from 30MHz to 1000MHz.

The bandwidth of the Spectrum's RBW is set at 1MHz and VBW is set at 3MHz for peak emissions measurement above 1GHz.

This device is pulse Modulated, a duty cycle factor was used to calculated average level based measured peak level.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

4.7. Radiated Emission Test Results

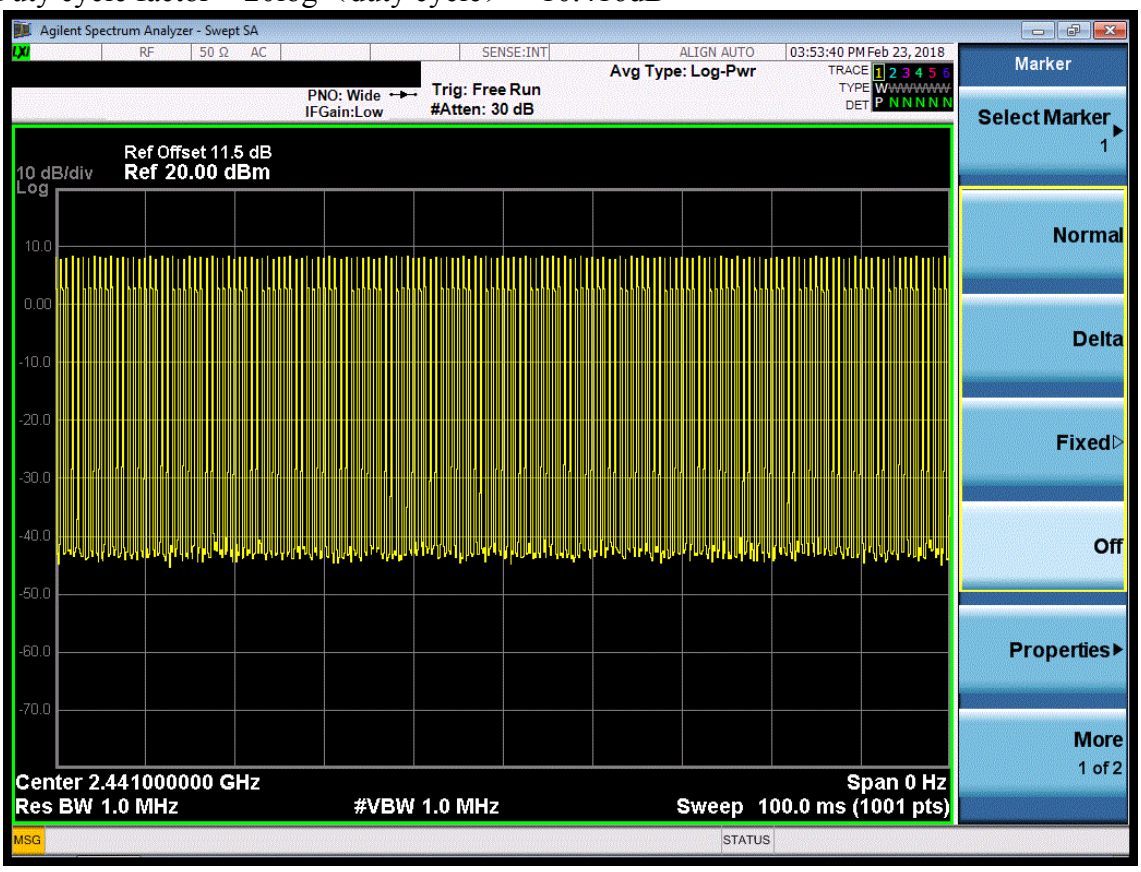
PASS.

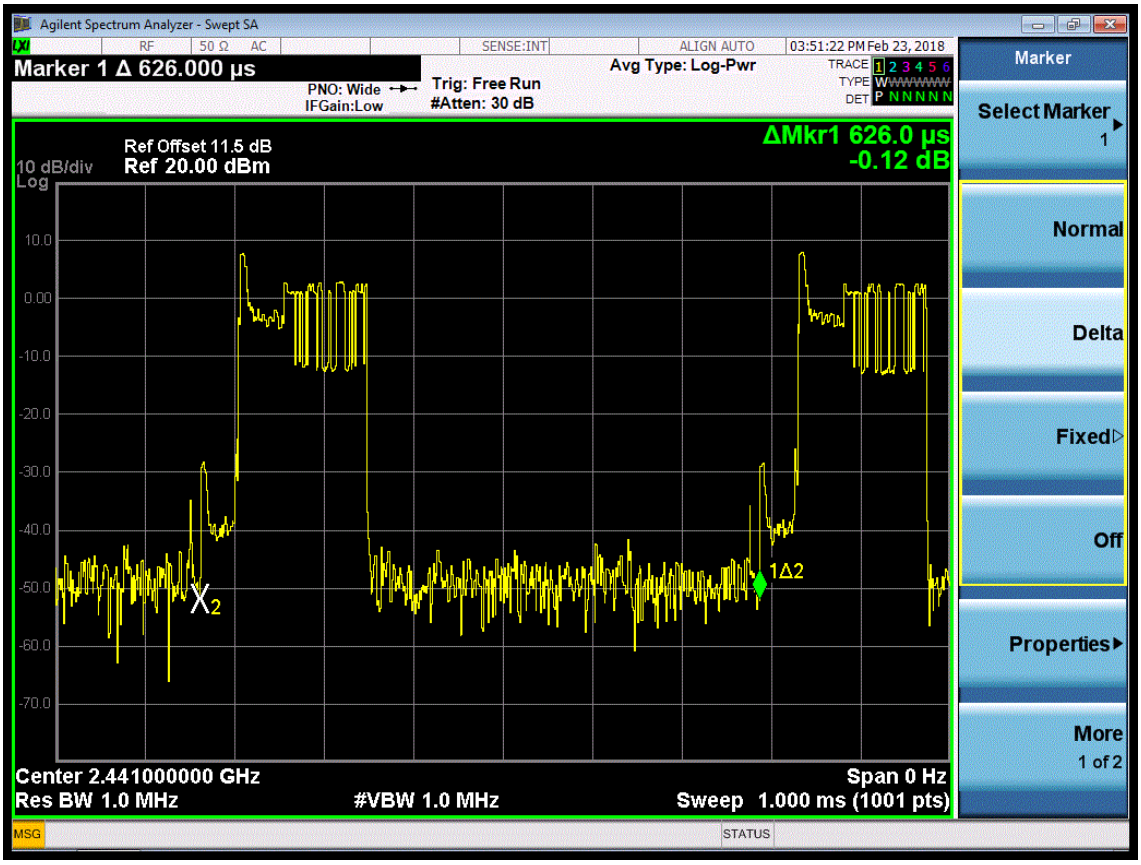
All the emissions from 30MHz to 25GHz were comply with the 15.209 Limit.

Note 1: The duty cycle factor for calculate average level is 10.416dB, and average limit is 20dB below peak limit, so if peak measured level comply with average limit, the average level was deemed to comply with average limit.

Note 2: The emissions (9kHz~30MHz) not reported for there is no emission be found.

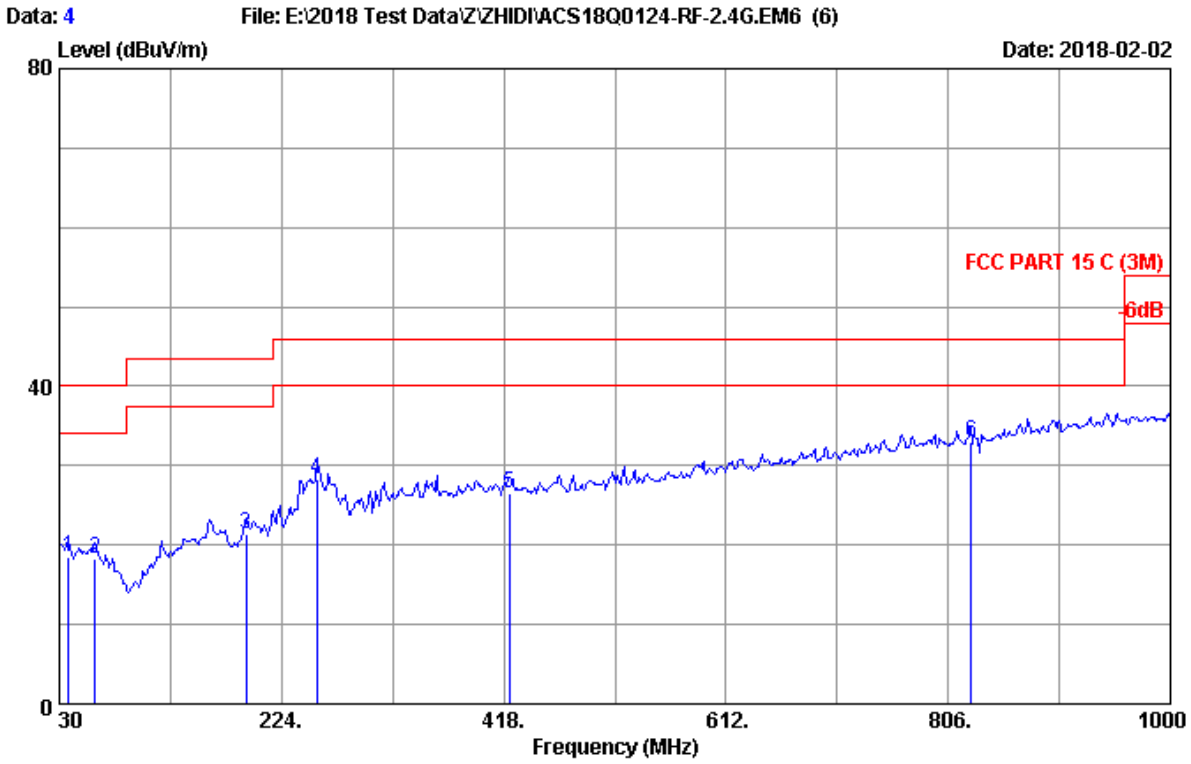
Duty cycle factor = 20log（duty cycle）= 10.416dB




Agilent Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
03:51:22 PM Feb 23, 2018
Marker 1 Δ 626.000 µs
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET P N N N N N
Ref Offset 11.5 dB
10 dB/div
Ref 20.00 dBm
Log
ΔMkr1 626.0 µs
-0.12 dB
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
X2
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 1.000 ms (1001 pts)
Marker
Select Marker 1
Normal
Delta
Fixed
Off
Properties
More 1 of 2
MSG
STATUS

Agilent Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
03:53:28 PM Feb 23, 2018
Marker 1 Δ 188.748 µs
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET P N N N N N
Ref Offset 11.5 dB
10 dB/div
Ref 20.00 dBm
Log
ΔMkr1 188.7 µs
-1.90 dB
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
X2
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 299.6 µs (1001 pts)
Marker
Select Marker 1
Normal
Delta
Fixed
Off
Properties
More 1 of 2
MSG
STATUS

Frequency: 30MHz~1GHz

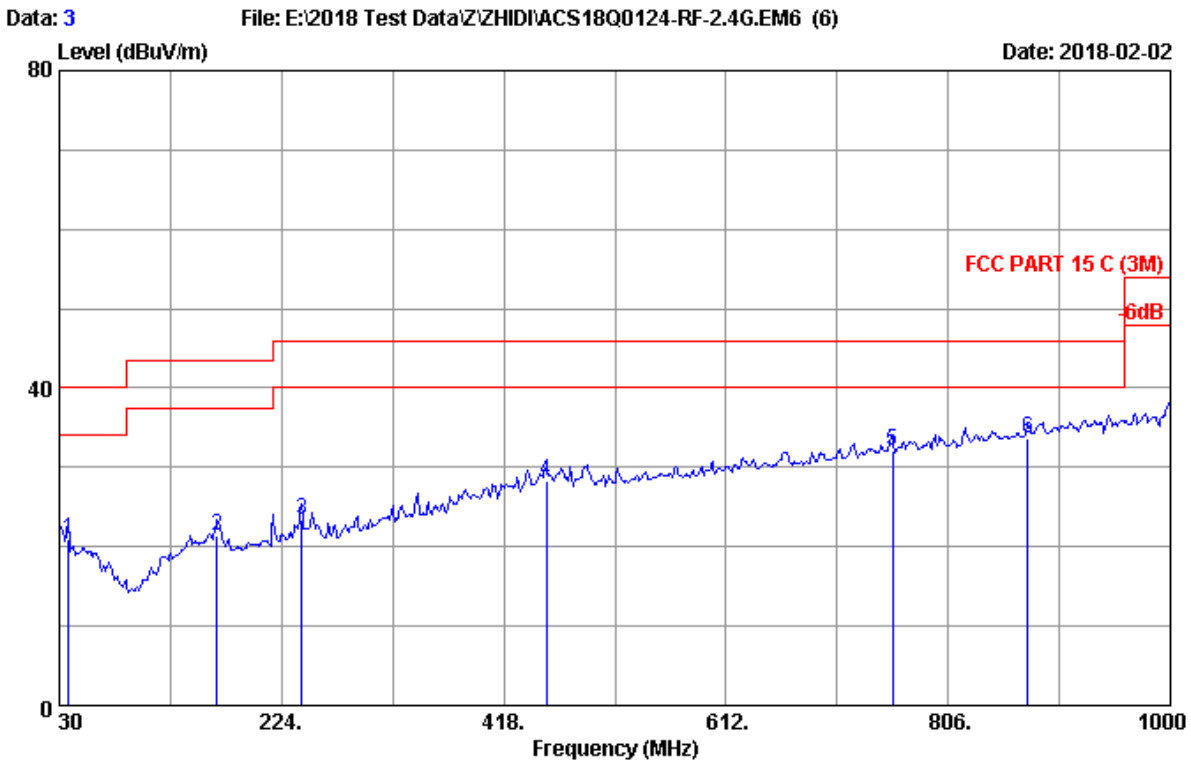


Site no. : 3m Chamber
Dis. / Ant. : 3m 2017 9168-493
Limit : FCC PART 15 C (3M)
Env. / Ins. : 23.6*C/52%
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC1.5V
Test Mode : BT4.0 TX Mode

Data no. : 4
Ant. pol. : HORIZONTAL
Engineer : Kayle

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	37.760	19.88	0.68	-2.13	18.43	40.00	21.57	QP
2	61.040	19.31	0.85	-1.91	18.25	40.00	21.75	QP
3	192.960	17.32	1.60	2.55	21.47	43.50	22.03	QP
4	255.040	18.48	1.98	7.95	28.41	46.00	17.59	QP
5	422.850	22.64	2.96	0.91	26.51	46.00	19.49	QP
6	826.370	28.69	4.66	-0.29	33.06	46.00	12.94	QP

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

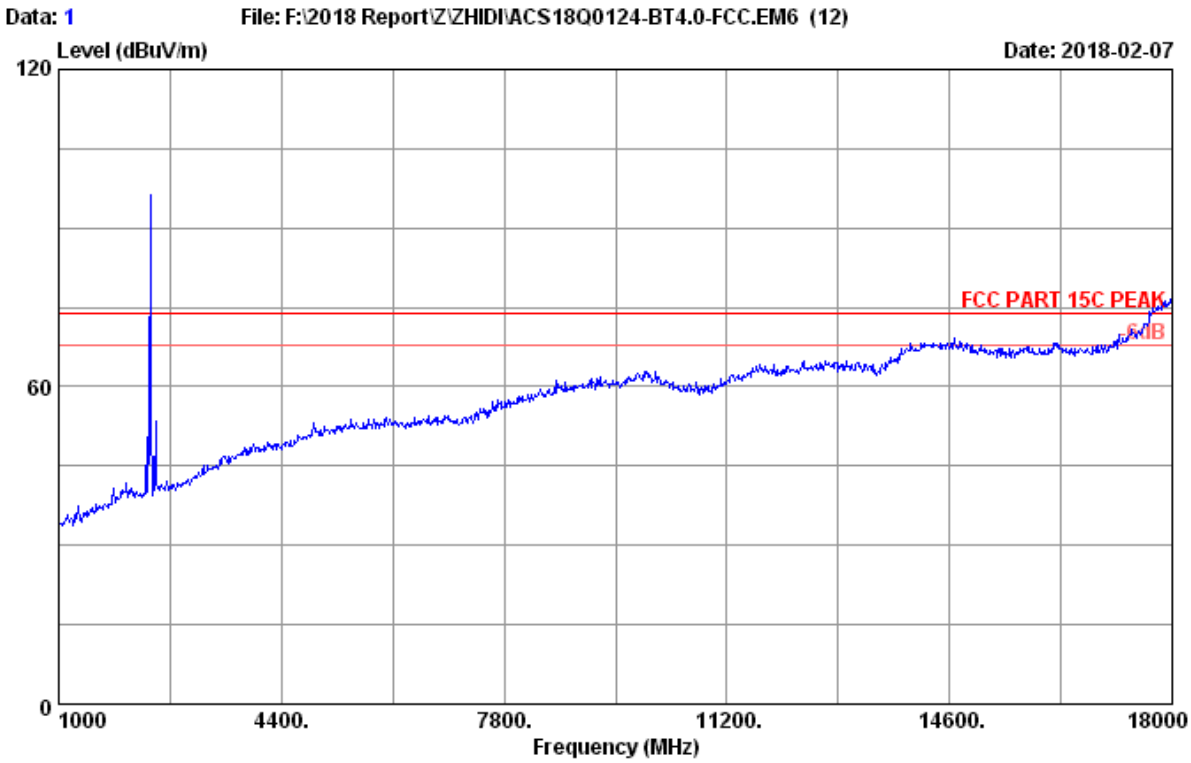


Site no. : 3m Chamber Data no. : 3
Dis. / Ant. : 3m 2017 9168-493 Ant. pol. : VERTICAL
Limit : FCC PART 15 C (3M)
Env. / Ins. : 23.6*C/52% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC1.5V
Test Mode : BT4.0 TX Mode

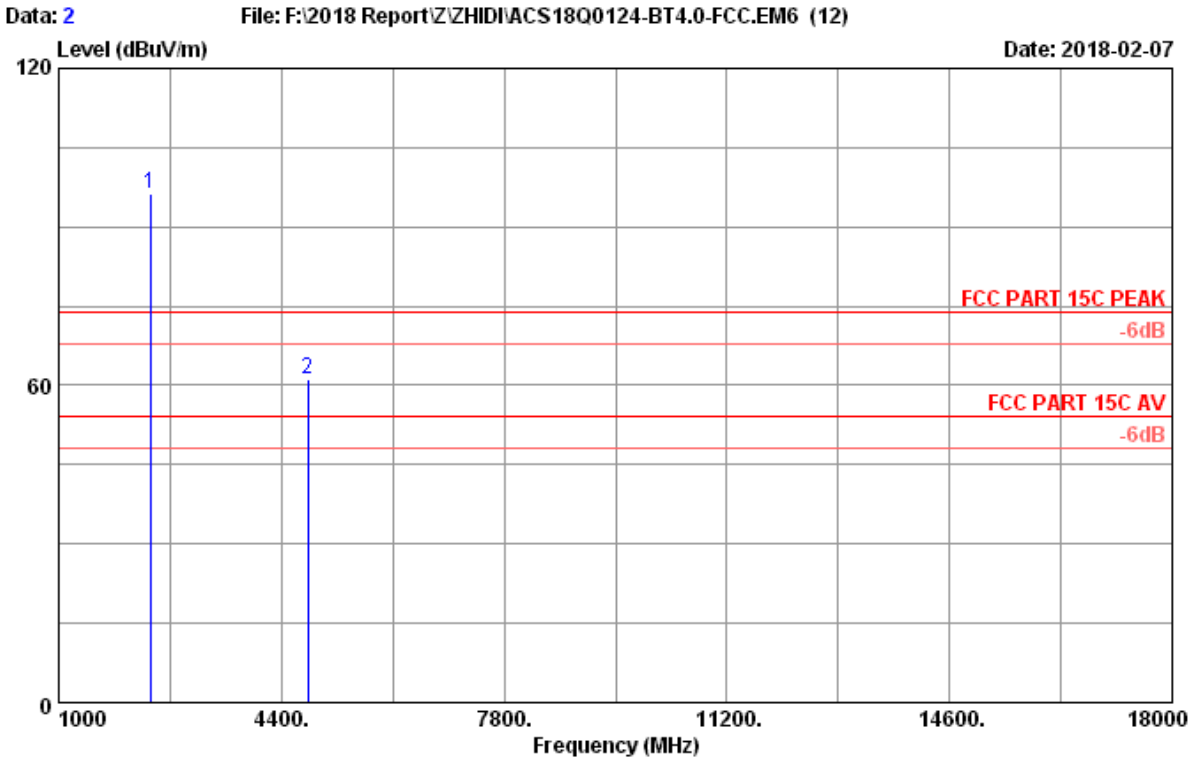
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	37.760	19.88	0.68	0.40	20.96	40.00	19.04	QP
2	167.740	19.09	1.47	0.77	21.33	43.50	22.17	QP
3	241.460	18.15	1.89	3.42	23.46	46.00	22.54	QP
4	454.860	23.24	3.05	1.90	28.19	46.00	17.81	QP
5	757.500	27.89	4.35	-0.11	32.13	46.00	13.87	QP
6	875.840	29.23	4.95	-0.50	33.68	46.00	12.32	QP

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

Frequency: 1GHz~18GHz




```
Site no.      : 3m Chamber                    Data no.   : 1
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : HORIZONTAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2402 Tx Mode
```

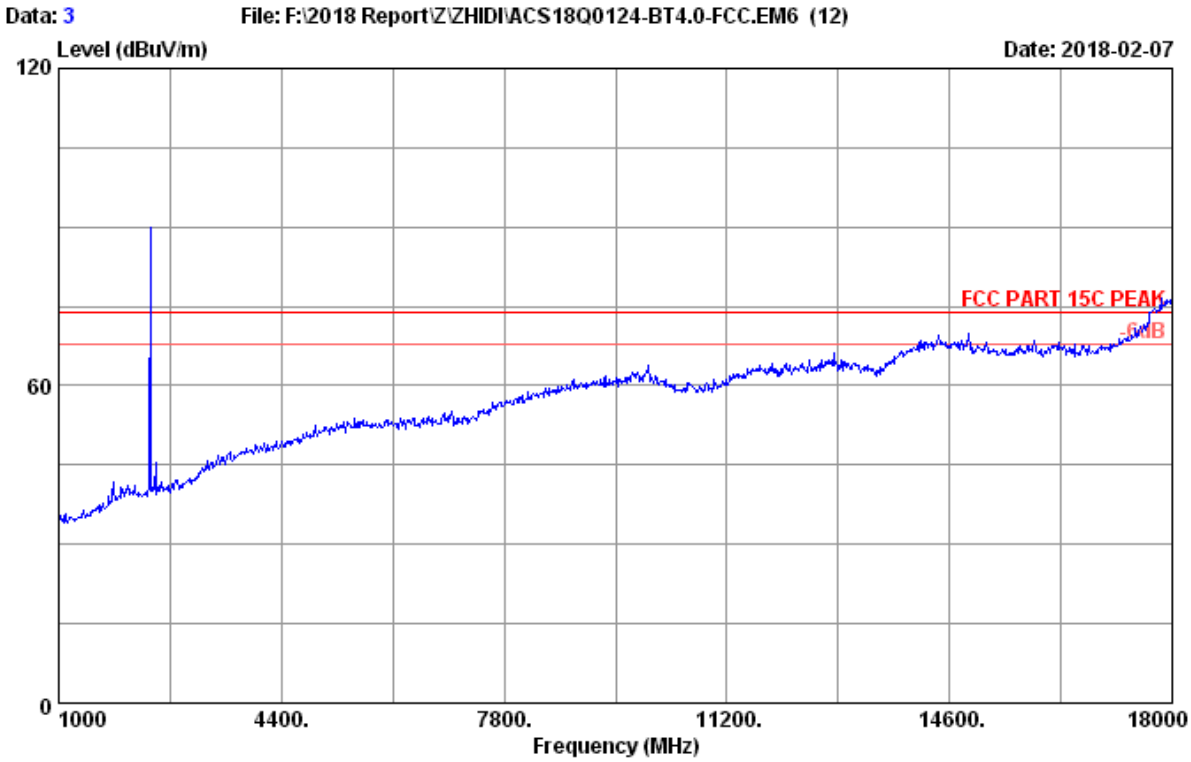



```
Site no.      : 3m Chamber                    Data no.   : 2
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : HORIZONTAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2402 Tx Mode
```

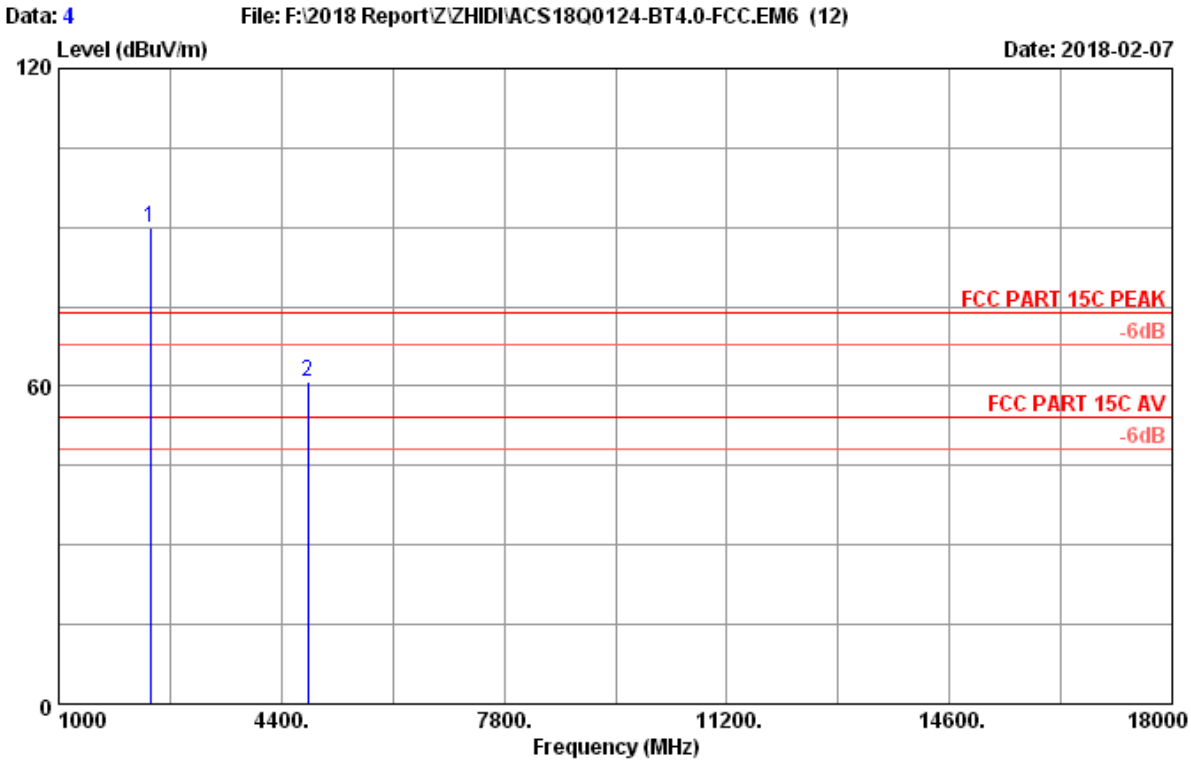
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.79	10.30	35.61	93.68	96.16	74.00	-22.16	Peak
2	4804.00	32.62	14.52	33.82	47.75	61.07	74.00	12.93	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
2402	96.16	10.416	85.744	94	Pass
4804	61.07	10.416	50.654	54	Pass




```
Site no.      : 3m Chamber                    Data no.   : 3
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2402 Tx Mode
```

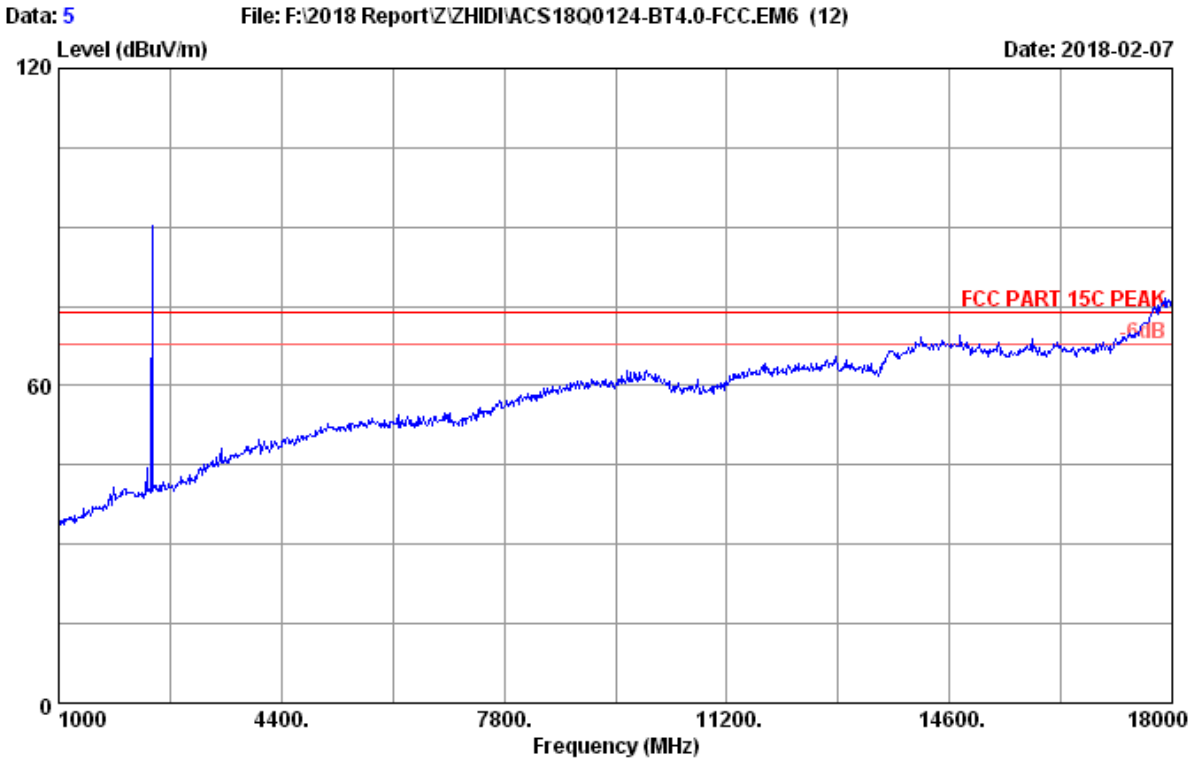


Site no. : 3m Chamber Data no. : 4
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.1*C/52.5% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 2402 Tx Mode

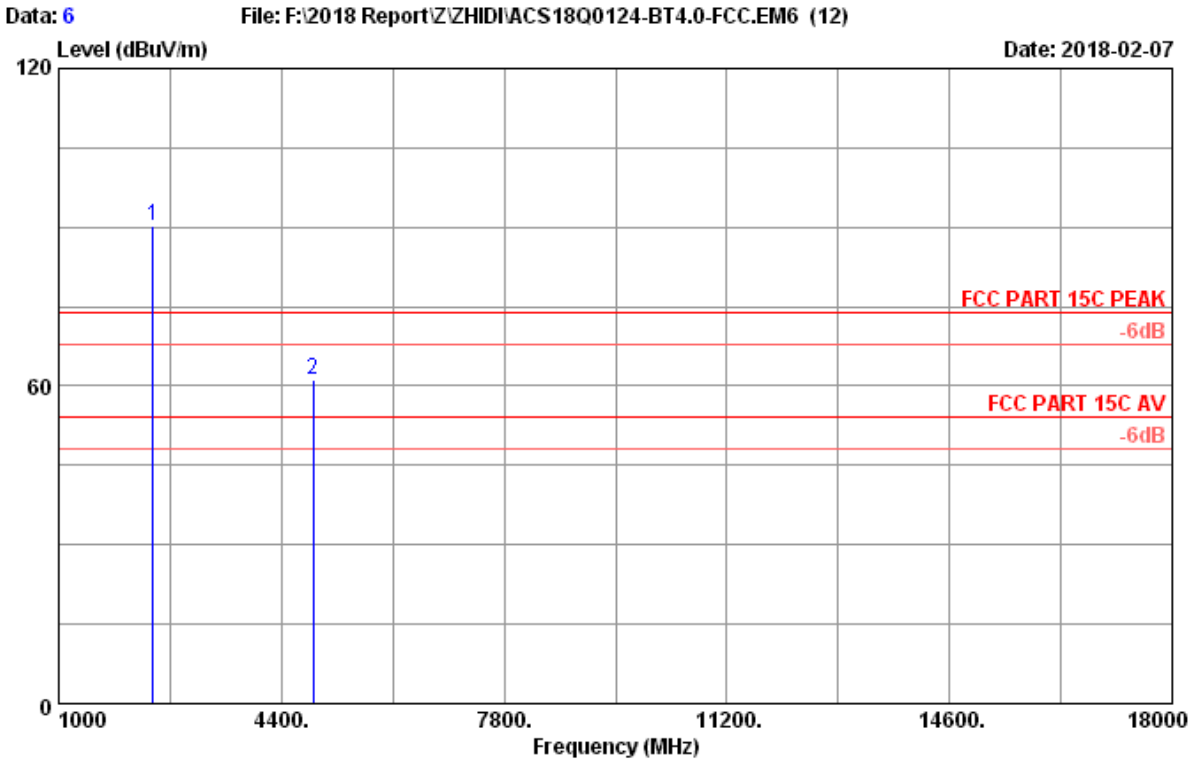
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.79	10.30	35.61	87.27	89.75	74.00	-15.75	Peak
2	4804.00	32.62	14.52	33.82	47.56	60.88	74.00	13.12	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
4804	60.88	10.416	50.464	54	Pass




```
Site no.      : 3m Chamber                    Data no.   : 5
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2440 Tx Mode
```

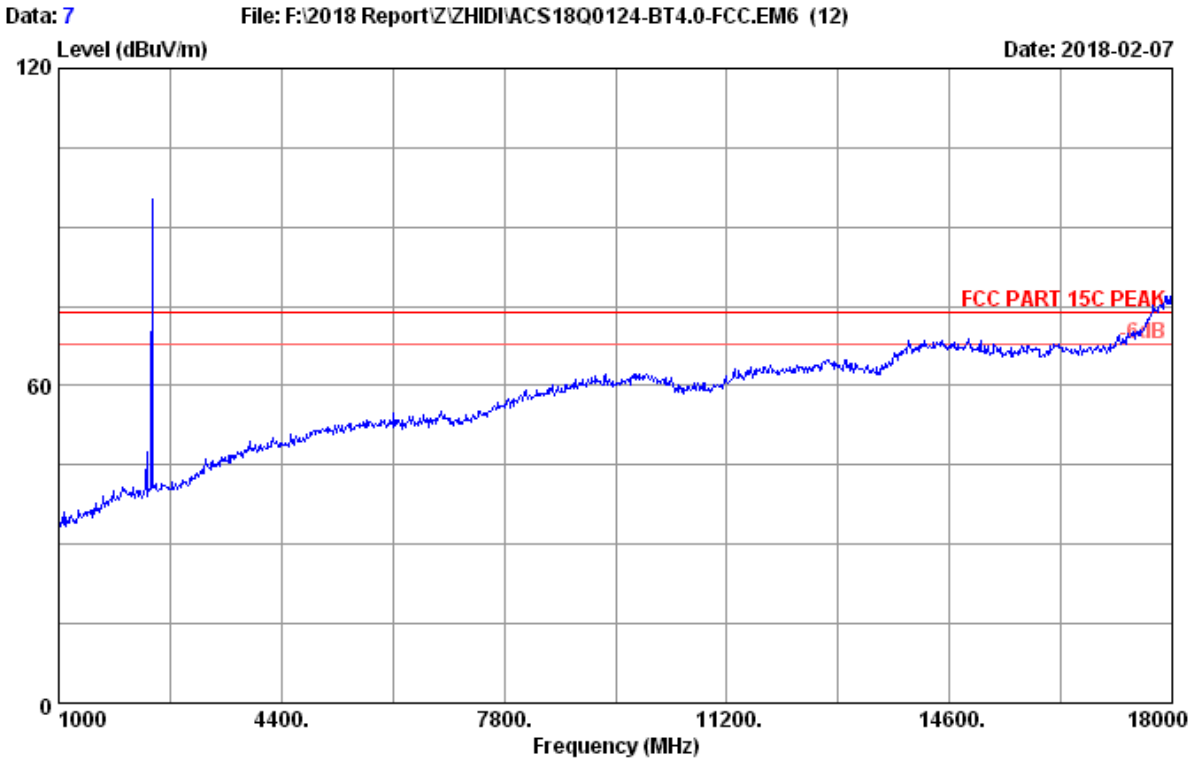


Site no. : 3m Chamber Data no. : 6
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.1*C/52.5% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 2440 Tx Mode

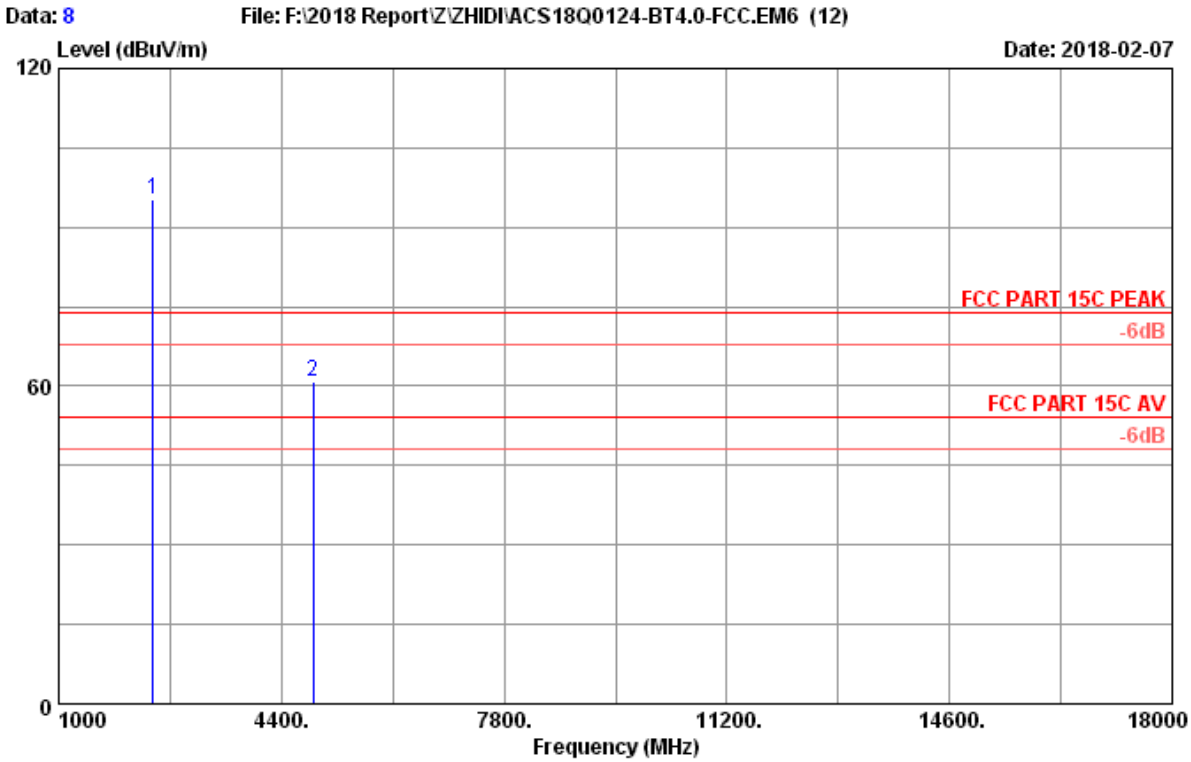
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	28.04	10.37	35.64	87.37	90.14	74.00	-16.14	Peak
2	4880.00	32.76	14.62	33.75	47.64	61.27	74.00	12.73	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
4880	61.27	10.416	50.854	54	Pass




```
Site no.      : 3m Chamber                    Data no.   : 7
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : HORIZONTAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2440 Tx Mode
```

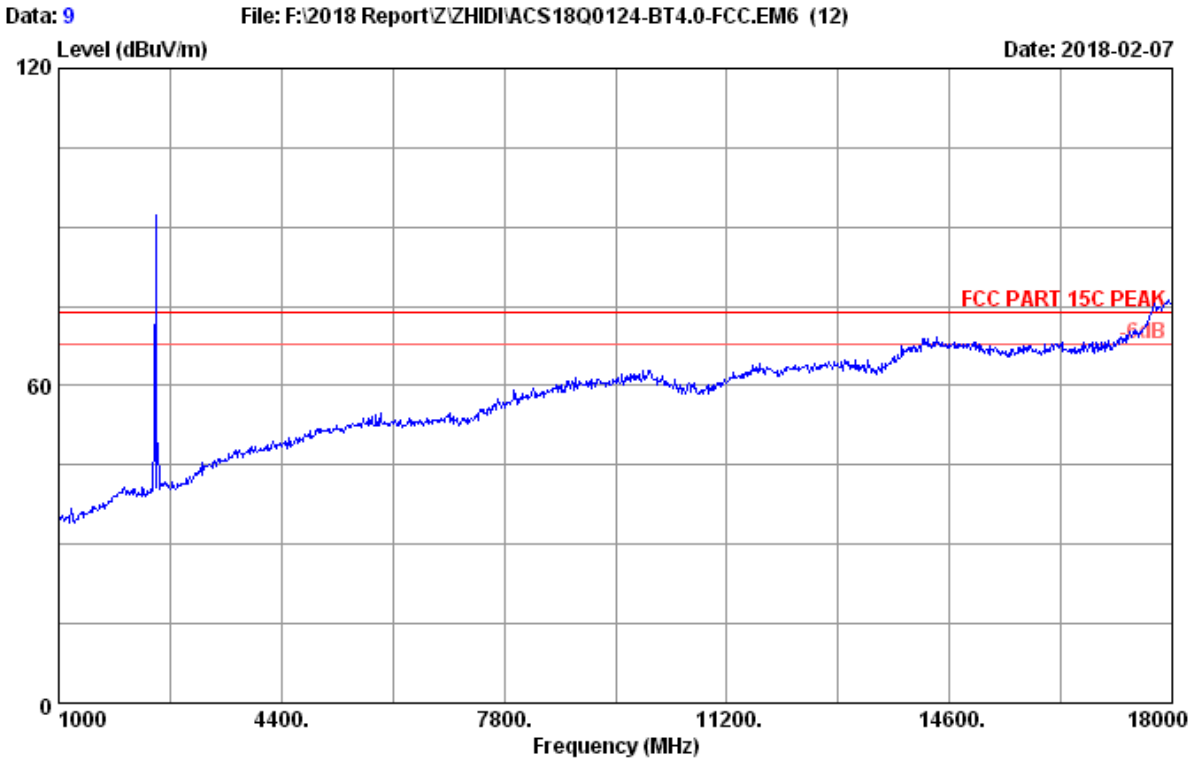


Site no. : 3m Chamber Data no. : 8
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.1*C/52.5% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 2440 Tx Mode

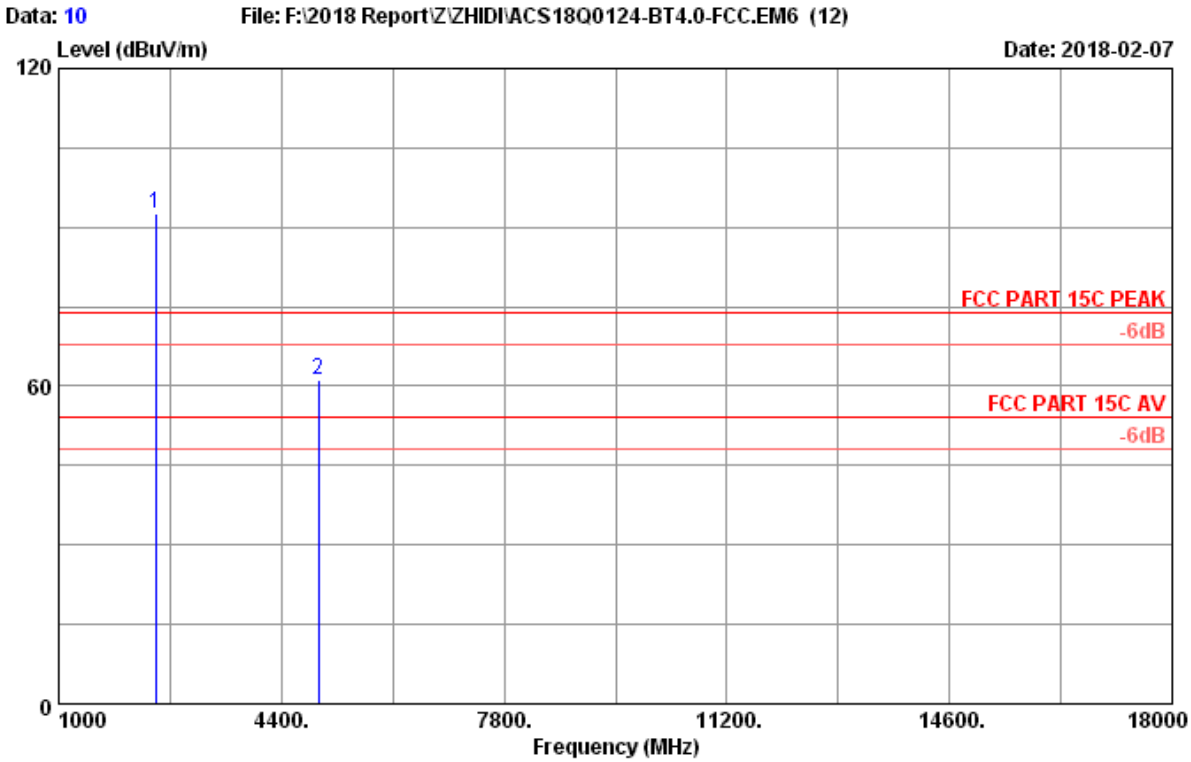
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	28.04	10.37	35.64	92.53	95.30	74.00	-21.30	Peak
2	4880.00	32.76	14.62	33.75	47.34	60.97	74.00	13.03	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
2440	95.30	10.416	84.884	94	Pass
4880	60.97	10.416	50.554	54	Pass




```
Site no.      : 3m Chamber                    Data no.   : 9
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : HORIZONTAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2480 Tx Mode
```

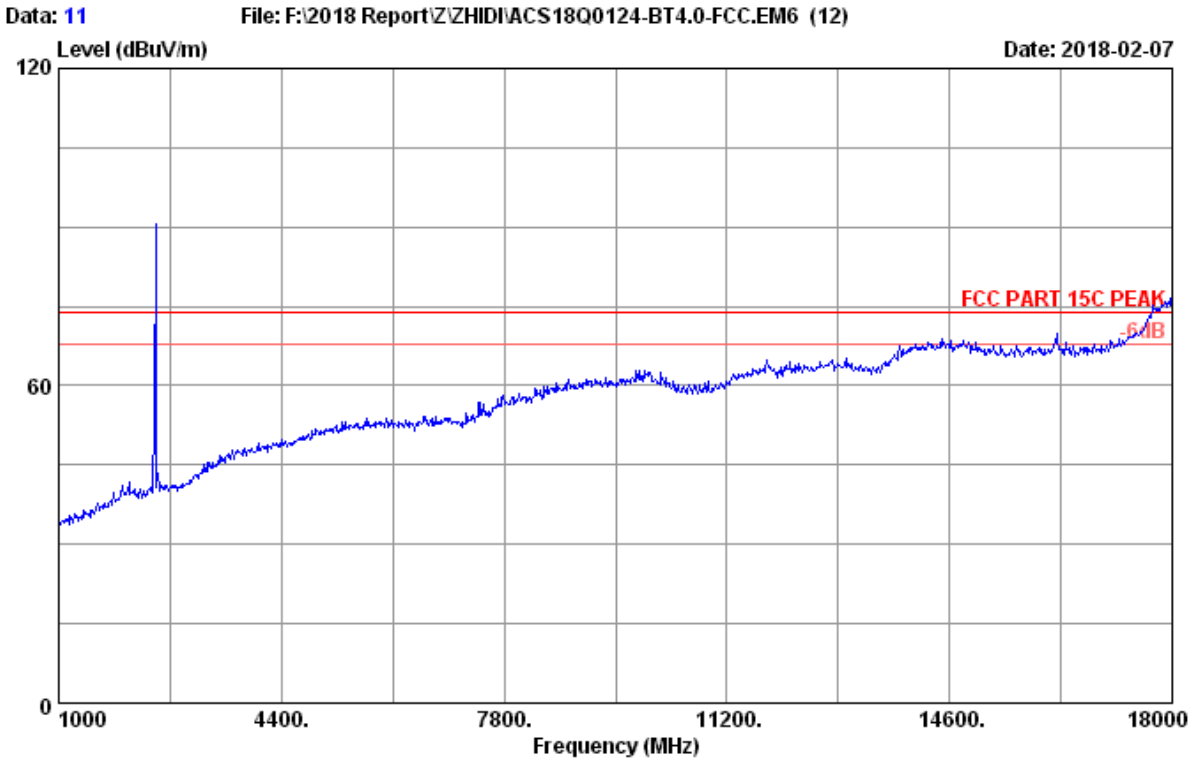



```
Site no.      : 3m Chamber                    Data no.   : 10
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : HORIZONTAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2480 Tx Mode
```

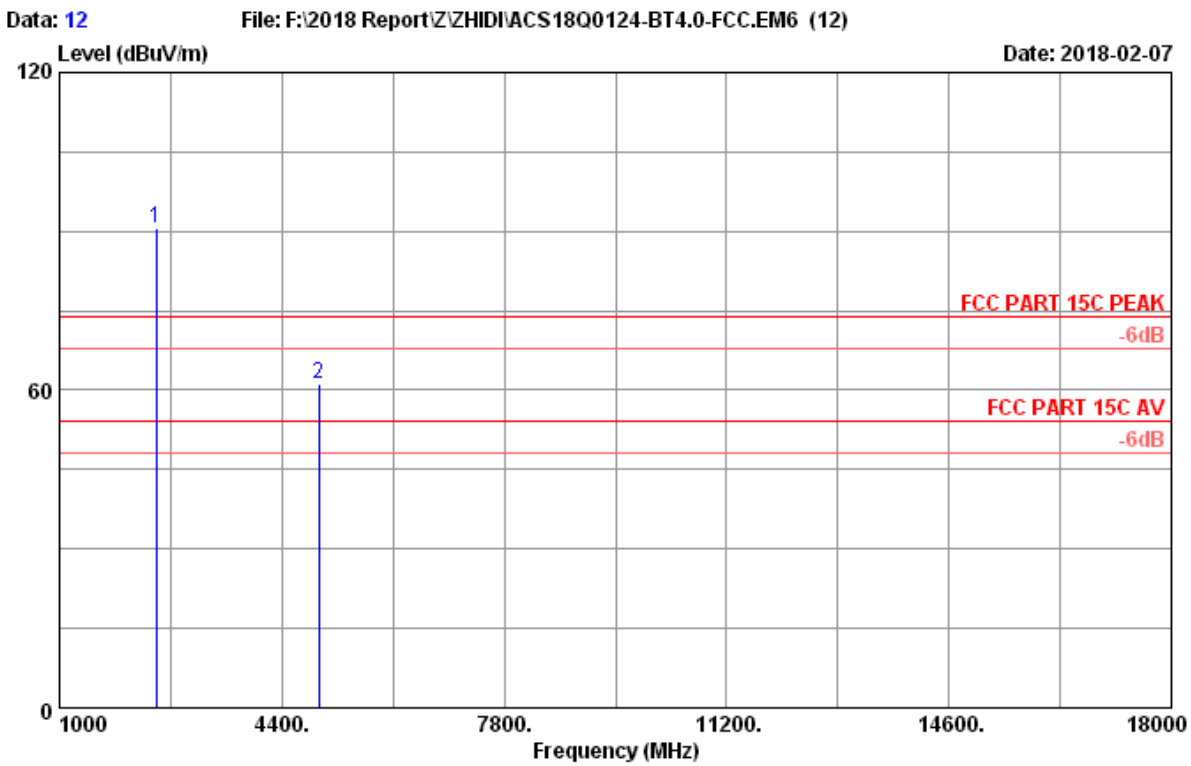
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	28.21	10.45	35.71	89.76	92.71	74.00	-18.71	Peak
2	4960.00	32.93	14.73	33.69	47.29	61.26	74.00	12.74	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
4960	61.26	10.416	50.844	54	Pass




```
Site no.      : 3m Chamber                    Data no.   : 11
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2480 Tx Mode
```




```
Site no.      : 3m Chamber                    Data no.   : 12
Dis. / Ant.   : 3m   2017 3115(4580)          Ant. pol.  : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.1*C/52.5%                  Engineer   : Kayle
EUT           : ELECOM TrackBall Mouse  M/N:M-DPT1MR
Power rating  : DC 1.5V
Test Mode     : BT4.0 2480 Tx Mode
```

No.	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	2480.00	28.21	10.45	35.71	87.52	90.47	74.00	-16.47	Peak
2	4960.00	32.93	14.73	33.69	47.24	61.21	74.00	12.79	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
4960	61.21	10.416	50.794	54	Pass

5. CONDUCTED SPURIOUS EMISSIONS

5.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52220804	Oct.14,17	1Year
2.	Attenuator(20dB)	Agilent	8491B	MY39262165	Oct.14,17	1 Year
3.	RF Cable	Marvelous Microwave Inc	SFL402105FLEX	NO.1	Oct.15,17	1 Year

5.2. Limit

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

5.3. Test Procedure

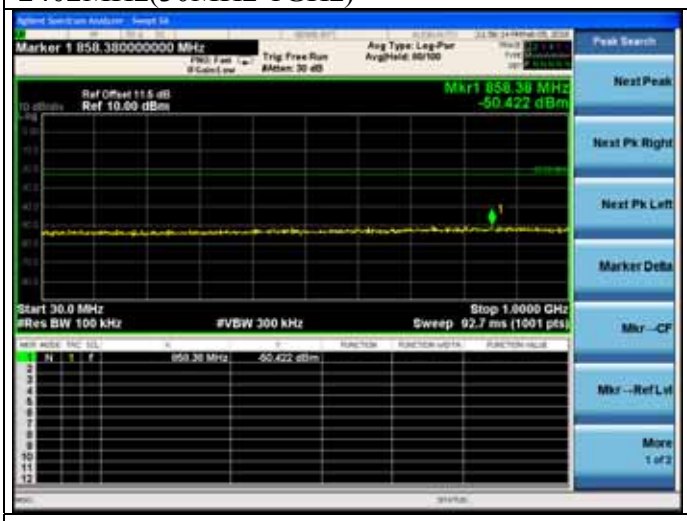
The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz and measure all the emissions With peak detector.

5.4. Test result

PASS (The testing data was attached in the next pages.)

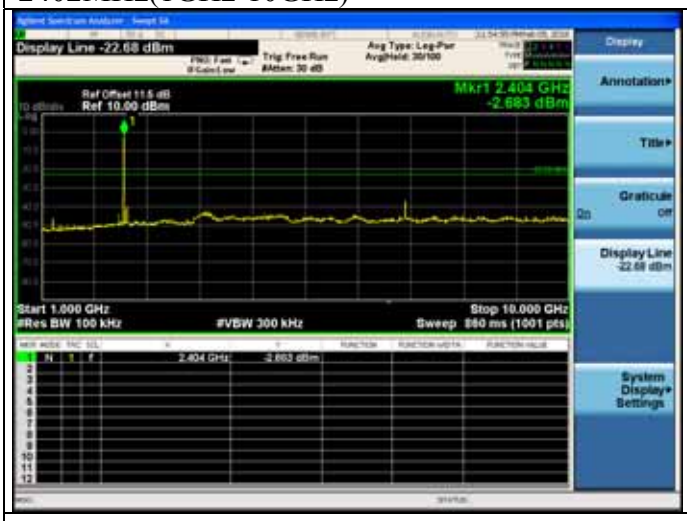
GFSK

2402MHz(30MHz-1GHz)



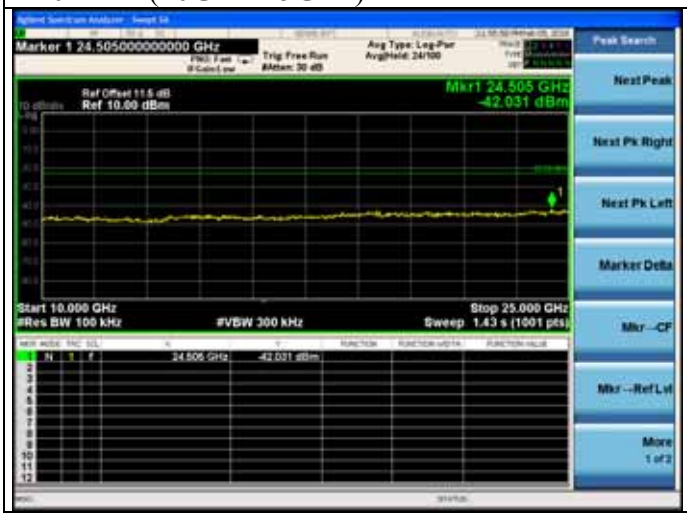
2402MHz(2.31GHz-2.405GHz)

2402MHz(1GHz-10GHz)



2440MHz(30MHz-1GHz)

2402MHz(10GHz-25GHz)

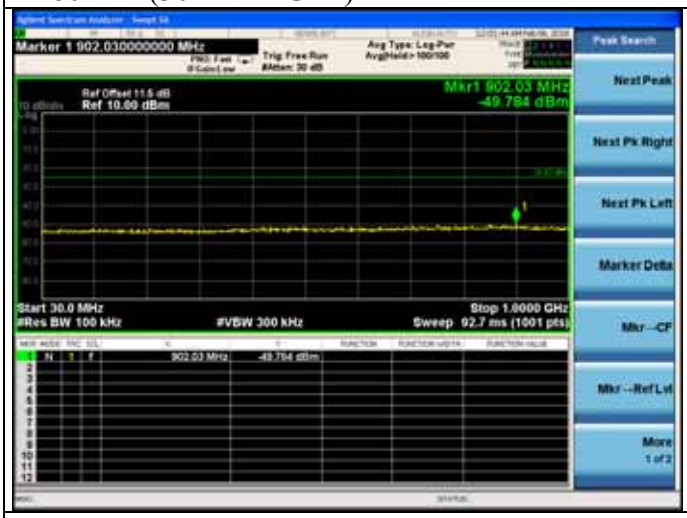


2440MHz(1GHz-10GHz)

2440MHz(10GHz-25GHz)

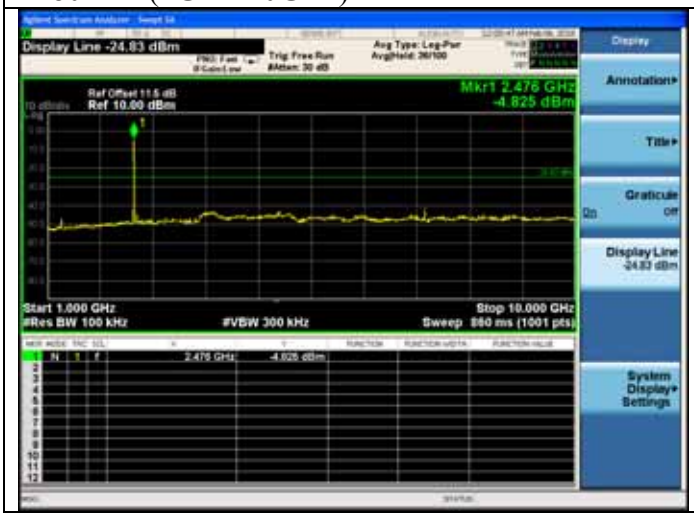
2480MHz(10GHz-25GHz)

2480MHz(30MHz-1GHz)



2480MHz(2.477GHz-2.51GHz)

2480MHz(1GHz-10GHz)



6. 6dB BANDWIDTH TEST

6.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
4.	Spectrum Analyzer	Agilent	N9010A	MY52220804	Oct.14,17	1Year
5.	Attenuator(20dB)	Agilent	8491B	MY39262165	Oct.14,17	1 Year
6.	RF Cable	Marvelous Microwave Inc	SFL402105FLEX	NO.1	Oct.15,17	1 Year

6.2. Limit

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

6.3. Test Procedure

The transmitter output was connected to a spectrum analyzer, The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW and 300KHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

6.4. Test Results

EUT:ELECOM TrackBall Mouse		
M/N: M-DPT1MR		
Test date:2018-02-05	Pressure: 102.5±1.0 kpa	Humidity: 52.3±3.0%
Tested by:Kayle	Test site: RF site	Temperature:22.1±0.6 ℃

Test Mode	Frequency (MHz)	6 dB bandwidth (MHz)	Limit (KHz)
GFSK	2402	1.170	≧500
	2440	1.027	≧500
	2480	1.155	≧500
Conclusion：PASS			

GFSK	
2402MHz	2480MHz
2440MHz	

7. MAXIMUM PEAK OUTPUT POWER TEST

7.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum	Agilent	N9030A	MY51380221	Oct.15,16	1Year
2.	Power meter	Anritsu	ML2487A	6K00002472	Apr.22,17	1Year
3.	Power sensor	Anritsu	MA2491A	0033005	Apr.22,17	1Year
4.	Attenuator (20dB)	Agilent	8491B	MY39262165	Apr.22,17	1 Year
5.	RF Cable	Marvelous Microwave Inc	SFL402105FLEX	NO.1	Oct.15,16	1 Year

7.2. Limit

For systems using digital modulation in the 2400—2483.5MHz, The Peak out put Power shall not exceed 1W(30dBm).

7.3. Test Procedure

Connected the EUT's antenna port to Power Sensor, and use power meter to test peak output power.

7.4. Test Results

EUT:ELECOM TrackBall Mouse		
M/N: M-DPT1MR		
Test date: 2018-02-02	Pressure: 102.5±1.0 kpa	Humidity: 52.3±3.0%
Tested by:Kayle	Test site: RF site	Temperature:22.1±0.6 ℃

Test Mode	Frequency (MHz)	Peak output Power （dBm）	Limit (dBm)
GFSK	2402	-2.329	30
	2440	-3.115	30
	2480	-3.881	30
Conclusion: PASS			

8. BAND EDGE COMPLIANCE TEST

8.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Amp	HP	8449B	3008A02495	Apr.22.17	1 Year
2.	Horn Antenna	ETC	MCTD 1209	DRH15F03006	Mar.15,17	1 Year
3.	RF Cable	Hubersuhner	SUCOFLEX104	274094&4+28610&2	Apr.22,17	1 Year

8.2. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

8.3. Test Procedure

For upper band emissions that are up to two bandwidths(2MHz) away (2483.5MHz to 2485.5MHz）from the band-edge use below produce:

1. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 100KHz and with a video bandwidth 300KHz. Record the peak levels of the fundamental emission and the relevant band-edge emission, Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
2. Subtract the delta measured in step (1) from the maximum field strengths measured in clause 4 .The resultant field strengths are then used to determine band-edge compliance as required by Section 15.205

   For emissions above two bandwidths away from the band-edge use below produce:

   1. The EUT is placed on a turntable, which is 0.8m above the ground plane and worked at highest radiated power.
   2. The turntable was 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 emission.
   4. Set the spectrum analyzer in the following setting in order to capture the lower and upperband-edges of the emission:

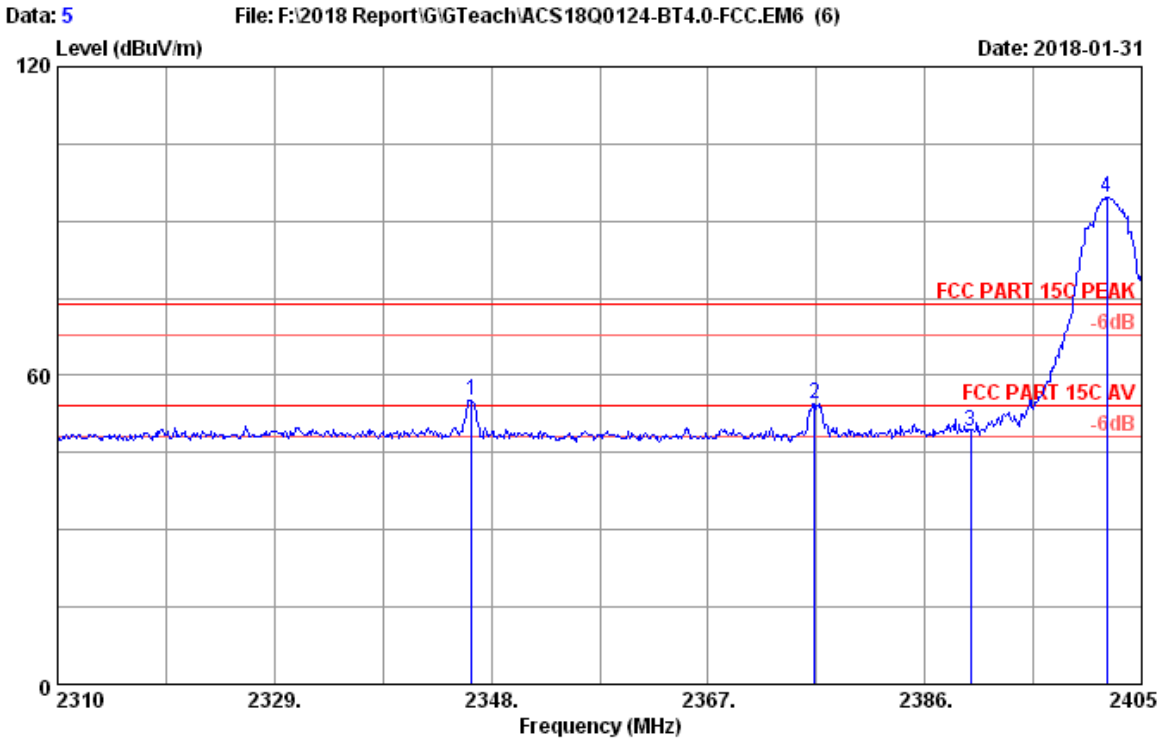
      (a) PEAK: RBW=1MHz ;VBW=3MHz, PK detector, Sweep=AUTO

      (b) This is pulse Modulation device a duty cycle factor was used to calculate average level based measured peak level.

8.4. Test Results

Pass (The testing data was attached in the next pages.)

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

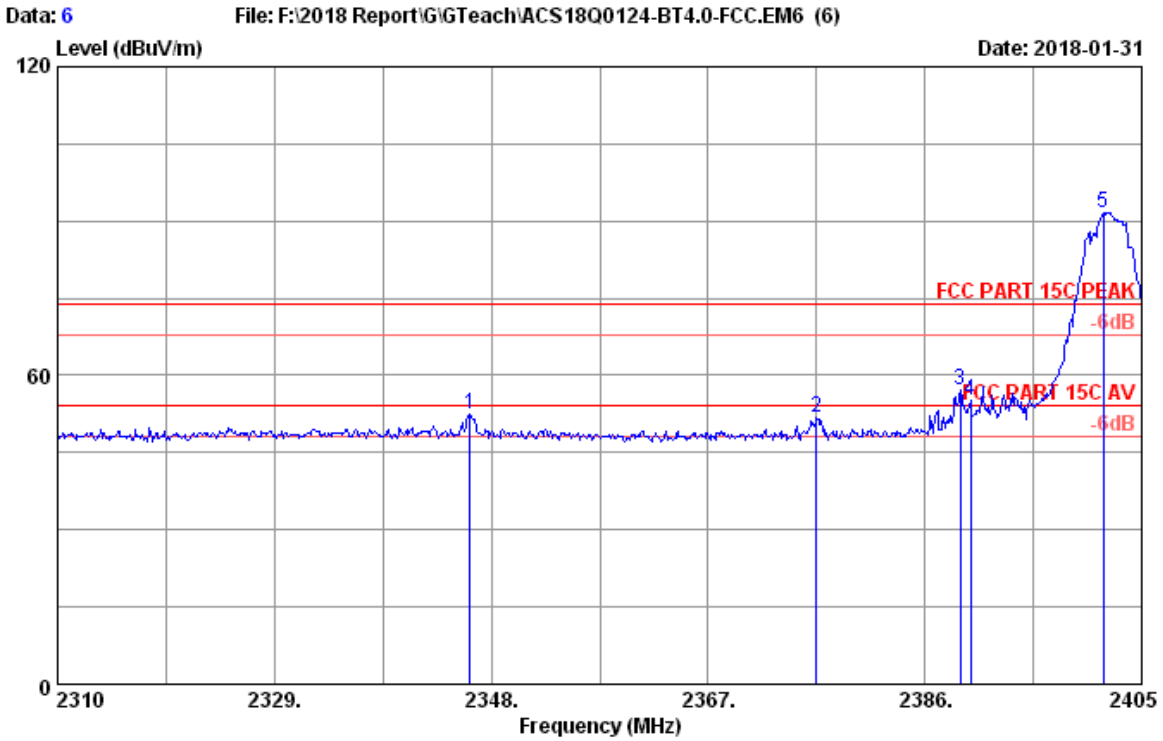


Site no. : 3m Chamber Data no. : 5
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.6*C/52.7% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 BLE 2402 Tx Mode

No.	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	2346.29	27.53	10.19	35.55	53.06	55.23	74.00	18.77	Peak
2	2376.31	27.70	10.26	35.58	52.25	54.63	74.00	19.37	Peak
3	2390.00	27.79	10.26	35.61	46.74	49.18	74.00	24.82	Peak
4	2401.96	27.79	10.30	35.61	91.99	94.47	74.00	-20.47	Peak

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

Frequency (MHz)	Peak level (dBuv/m)	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
2346.29	55.23	10.416	44.814	54	Pass
2376.31	54.63	10.416	44.214	54	Pass

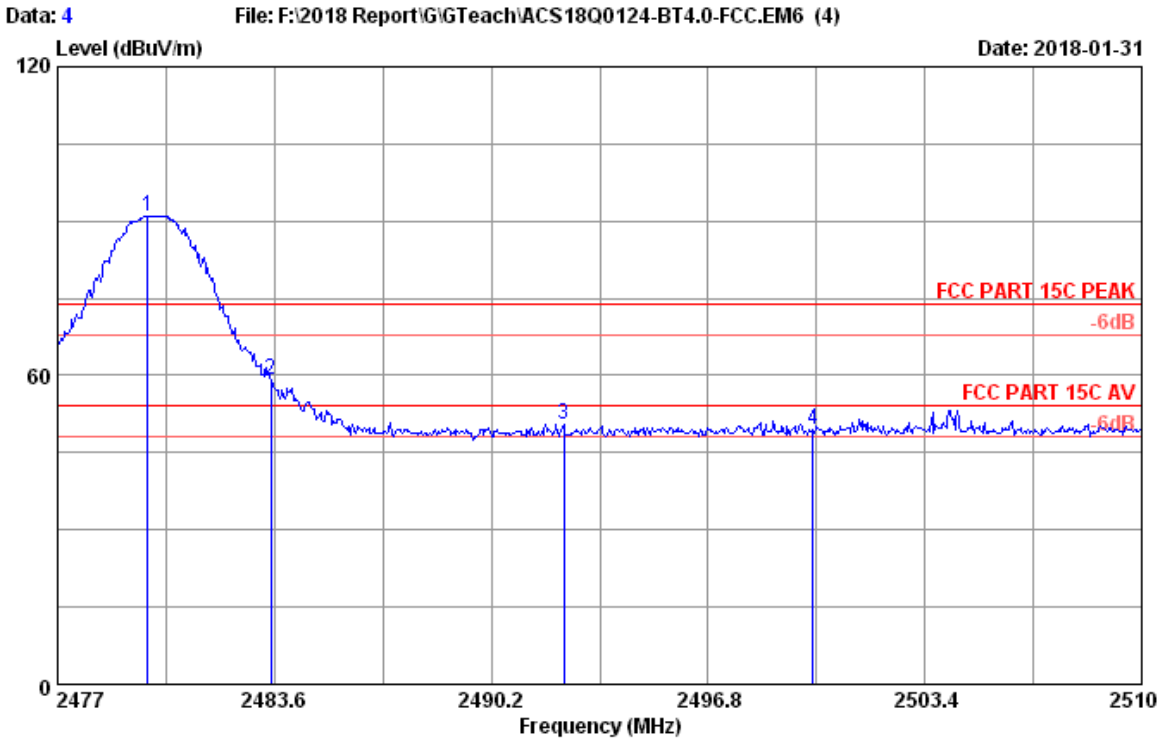


Site no. : 3m Chamber Data no. : 6
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.6*C/52.7% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 BLE 2402 Tx Mode

No.	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	2346.10	27.53	10.19	35.55	50.16	52.33	74.00	21.67	Peak
2	2376.50	27.70	10.26	35.58	49.54	51.92	74.00	22.08	Peak
3	2389.14	27.79	10.26	35.58	54.54	57.01	74.00	16.99	Peak
4	2390.00	27.79	10.26	35.61	52.87	55.31	74.00	18.69	Peak
5	2401.68	27.79	10.30	35.61	88.97	91.45	74.00	-17.45	Peak

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

Frequency (MHz)	Peak level (dBuv/m)	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
2389.14	57.01	10.416	46.594	54	Pass
2390.00	55.31	10.416	44.894	54	Pass

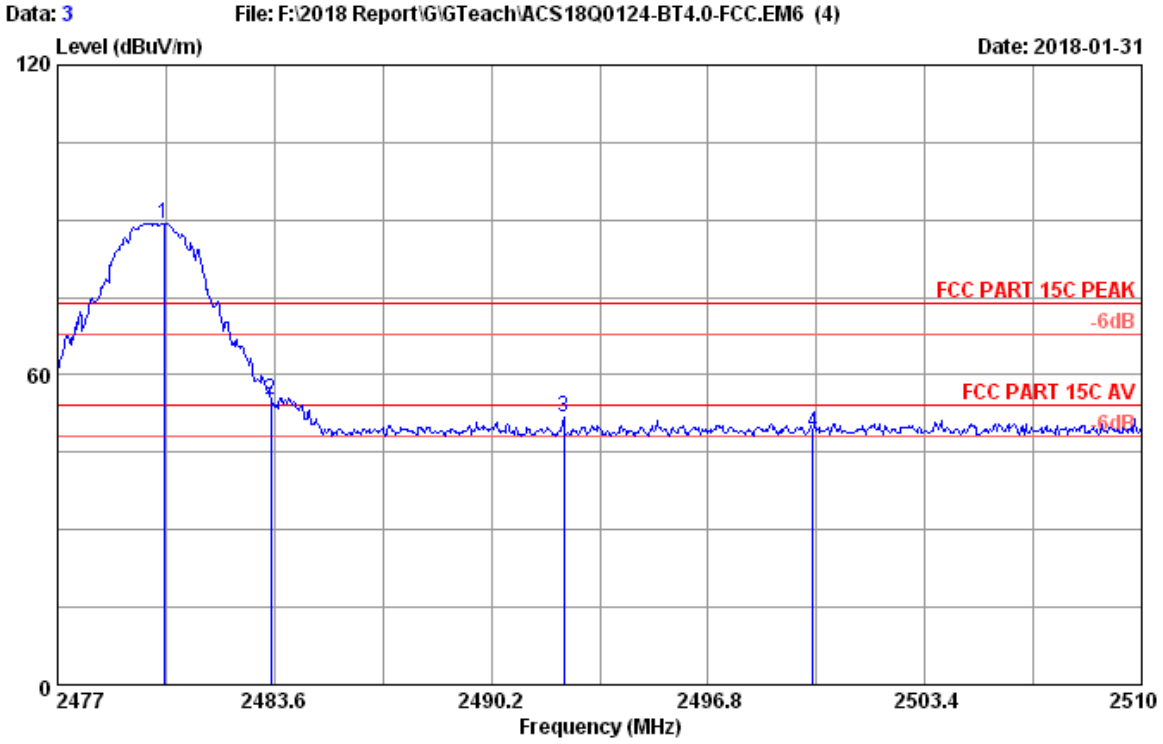


Site no. : 3m Chamber Data no. : 4
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.6*C/52.7% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 BLE 2480 Tx Mode

No.	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	2479.74	28.21	10.45	35.71	87.93	90.88	74.00	-16.88	Peak
2	2483.50	28.21	10.48	35.71	56.06	59.04	74.00	14.96	Peak
3	2492.41	28.30	10.48	35.74	47.42	50.46	74.00	23.54	Peak
4	2500.00	28.30	10.48	35.74	46.28	49.32	74.00	24.68	Peak

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

Frequency（MHz）	Peak level（dBuv/m）	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
2483.50	59.04	10.416	48.624	54	Pass



Site no. : 3m Chamber Data no. : 3
Dis. / Ant. : 3m 2017 3115(4580) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.6*C/52.7% Engineer : Kayle
EUT : ELECOM TrackBall Mouse M/N:M-DPT1MR
Power rating : DC 1.5V
Test Mode : BT4.0 BLE 2480 Tx Mode

No.	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	2480.23	28.21	10.45	35.71	86.26	89.21	74.00	-15.21	Peak
2	2483.50	28.21	10.48	35.71	52.03	55.01	74.00	18.99	Peak
3	2492.41	28.30	10.48	35.74	48.71	51.75	74.00	22.25	Peak
4	2500.00	28.30	10.48	35.74	45.84	48.88	74.00	25.12	Peak

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

Frequency (MHz)	Peak level (dBuv/m)	Duty cycle factor (dB)	AV level (dBuv/m)	Limit(dBuv/m)	Conclusion
2483.50	55.01	10.416	44.594	54	Pass

9. POWER SPECTRAL DENSITY TEST

9.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMC Analyzer	Agilent	N9030A	MY51380221	Sep.19,17	1 Year
2.	Attenuator (20dB)	Agilent	8491B	MY39262165	Apr.22,17	1 Year
3.	RF Cable	Marvelous Microwave Inc	SFL402105FLEX	NO.1	Oct.15,17	1 Year

9.2. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

9.3. Test Procedure

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.

9.4. Test Results

EUT:ELECOM TrackBall Mouse		
M/N: M-DPT1MR		
Test date:2018-03-12	Pressure: 102.5±1.0 kpa	Humidity: 52.3±3.0%
Tested by:Kayle	Test site: RF site	Temperature:22.1±0.6 ℃

Test Mode	Frequency (MHz)	Power density (dBm/3KHz)	Limit (dBm/3KHz)
GFSK	2402	-17.497	8
	2440	-16.198	8
	2480	-17.625	8
Conclusion：PASS			

GFSK	
2402MHz	2480MHz
2440MHz	

10. ANTENNA REQUIREMENT

10.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

10.2. Antenna Connected Construction

The antennas used for this product are Internal Antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.805dBi.

11. RADIO FRREQUENCY EXPOSURE COMPLIANCE

RESULT : PASS

Test standard : FCC KDB Publication 447498 D01 V06

Since maximum peak output power of the transmitter is<10mW, i.e.0.000004623mW<10mW, hence the EUT is excluded from SAR evaluation according to FCC KDB Publication 447498 D01: General RF Exposure Guidance V05.

12. DEVIATION TO TEST SPECIFICATIONS

[NONE]