



BUREAU VERITAS

Test Report No.: RF191025N036-1



# TEST REPORT

Applicant	ACCO Brands, Inc.
Address	1500 Fashion Island Blvd., 3rd Floor, San Mateo, CA 94404, USA

Manufacturer or Supplier	ACCO Brands, Inc.
Address	1500 Fashion Island Blvd., 3rd Floor, San Mateo, CA 94404, USA
Product	Pro Fit Ergo Vertical Trackball
Brand Name	Kensington
Model	M01480-M
Additional Model & Model Difference	N/A
Date of tests	Oct. 25, 2019 ~ Nov. 18, 2019

the tests have been carried out according to the requirements of the following standard:

**FCC Part 15, Subpart C, Section 15.247**

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Tested by Aaron Liang Project Engineer / EMC Department	Approved by David Huang Supervisor / EMC Department
	Date: Nov. 19, 2019

This report is governed by, and incorporates by reference, CPS Conditions of Service as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.



# TABLE OF CONTENTS

**RELEASE CONTROL RECORD .....4**

**1 SUMMARY OF TEST RESULTS .....5**

2 MEASUREMENT UNCERTAINTY .....5

**3 GENERAL INFORMATION.....6**

3.1 GENERAL DESCRIPTION OF EUT .....6

3.2 DESCRIPTION OF TEST MODES .....7

3.2.1. CONFIGURATION OF SYSTEM UNDER TEST .....7

3.2.2. Test Mode Applicability and tested channel detail .....7

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS.....10

3.4 DESCRIPTION OF SUPPORT UNITS .....10

**4 TEST TYPES AND RESULTS .....11**

4.1 RADIATED EMISSION MEASUREMENT.....11

4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT .....11

4.1.2 TEST INSTRUMENTS .....12

4.1.3 TEST PROCEDURES.....13

4.1.4 DEVIATION FROM TEST STANDARD .....14

4.1.5 TEST SETUP .....14

4.1.6 EUT OPERATING CONDITIONS .....15

4.1.7 TEST RESULTS.....16

4.2 6dB BANDWIDTH MEASUREMENT.....21

4.2.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT .....21

4.2.2 TEST INSTRUMENTS .....21

4.2.3 TEST PROCEDURE .....22

4.2.4 DEVIATION FROM TEST STANDARD .....22

4.2.5 TEST SETUP .....23

4.2.6 EUT OPERATING CONDITIONS .....23

4.2.7 TEST RESULTS.....24

4.3 CONDUCTED OUTPUT POWER .....25

4.3.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT .....25

4.3.2 TEST SETUP .....25

4.3.3 TEST INSTRUMENTS .....25

4.3.4 TEST PROCEDURES.....26

4.3.5 DEVIATION FROM TEST STANDARD .....26

4.3.6 EUT OPERATING CONDITIONS .....26



4.3.7	TEST RESULTS.....	26
4.3.7.1	MAXIMUM PEAK OUTPUT POWER.....	26
4.3.7.2	AVERAGE OUTPUT POWER (FOR REFERENCE) .....	26
4.4	POWER SPECTRAL DENSITY MEASUREMENT.....	27
4.4.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT .....	27
4.4.2	TEST SETUP.....	27
4.4.3	TEST INSTRUMENTS .....	27
4.4.4	TEST PROCEDURE .....	27
4.4.5	DEVIATION FROM TEST STANDARD.....	27
4.4.6	EUT OPERATING CONDITION.....	27
4.4.7	TEST RESULTS.....	28
4.5	OUT OF BAND EMISSION MEASUREMENT.....	29
4.5.1	LIMITS OF OUT OF BAND EMISSION MEASUREMENT.....	29
4.5.2	TEST SETUP.....	29
4.5.3	TEST INSTRUMENTS .....	29
4.5.4	TEST PROCEDURE .....	29
4.5.5	DEVIATION FROM TEST STANDARD.....	30
4.5.6	EUT OPERATING CONDITION.....	30
4.5.7	TEST RESULTS.....	31
<b>5</b>	<b>PHOTOGRAPHS OF THE TEST CONFIGURATION.....</b>	<b>34</b>
<b>6</b>	<b>APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....</b>	<b>35</b>



**BUREAU**  
**VERITAS**

Test Report No.: RF191025N036-1

## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF191025N036-1	Original release	Nov. 19, 2019



# 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Powered from battery
15.205 15.209	Radiated Emission	PASS	Meet the requirement of limit.
15.247(d)	Out of band Emission Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used

NOTE: Test Lab Information:

**Lab:** Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch

**Test Lab Address:** Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao'an District Shenzhen, Guangdong, 518108, People's Republic of China

# 2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	9kHz~30MHz	2.16dB
	30MHz ~ 1GMHz	3.74dB
	1GHz ~ 18GHz	4.66dB
	18GHz ~ 40GHz	4.67dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.



### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Pro Fit Ergo Vertical Trackball
<b>MODEL NO.</b>	M01480-M
<b>ADDITIONAL MODELS</b>	N/A
<b>FCC ID</b>	GV3M01480-M
<b>NOMINAL VOLTAGE</b>	DC 3V from Battery
<b>MODULATION TECHNOLOGY</b>	DTS
<b>MODULATION TYPE</b>	BT-LE(GFSK)
<b>OPERATING FREQUENCY</b>	2402-2480MHz
<b>PEAK OUTPUT POWER</b>	0.1714 mW (Max. Measured)
<b>ANTENNA TYPE</b>	PCB Antenna, with -1.89dBi gain
<b>I/O PORTS</b>	Refer to user's manual
<b>CABLE SUPPLIED</b>	N/A

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: 191025N036) for detailed product photo.



### 3.2 DESCRIPTION OF TEST MODES

40 channels are provided for BT-LE(GFSK):

CHANNEL	FREQ. (MHZ)						
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

#### 3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

#### 3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports

The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
A	√	√	-	√	DC 3.0V from New Battery

Where **RE<1G**: Radiated Emission below 1GHz      **RE≥1G**: Radiated Emission above 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

**NOTE:** No need to concern of Conducted Emission due to the EUT is powered by battery.



**RADIATED EMISSION TEST (BELOW 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	39	DTS	BT-LE	1

For the test results, only the worst case was shown in test report.

**RADIATED EMISSION TEST (ABOVE 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0,19, 39	DTS	BT-LE	1

**ANTENNA PORT CONDUCTED MEASUREMENT:**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	DTS	BT-LE	1



**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
RE<1G	25deg. C, 55%RH	DC 3V From Battery	Caden Lu
RE≥1G	25deg. C, 55%RH	DC 3V From Battery	Caden Lu
PLC	N/A	N/A	N/A
APCM	25deg. C, 60%RH	DC 3V From Battery	Aaron Liang



### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C, Section 15.247**

**558074 D01 15.247 Meas Guidance v05r02**

**ANSI C63.10-2013**

Note: All test items have been performed and recorded as per the above standards.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as a dependent unit together without any other necessary accessories or support units.



## 4 TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

**4.1.2 TEST INSTRUMENTS**

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESL6	1300.5001K06 -100262-eQ	Apr. 04, 19	Apr. 03, 20
Bilog Antenna	Sunol Sciences	JB6	A110712	Apr. 08, 19	Apr. 07, 20
Active Antenna	CMO-POWER	AL-130	121031	Mar. 27, 19	Mar. 26, 20
Signal Amplifier	HP	8447E	443008	Mar. 28, 19	Mar. 27, 20
3m Semi-anechoic Chamber	SAEMC	9m*6m*6m	N/A	Oct. 18,18	Oct. 17,21
Spectrum	Agilent	E4446A	MY46180622	8-May-19	7-May-20
MXA signal analyzer	Agilent	N9020A	MY49100060	Mar. 28, 19	Mar. 27, 20
Horn Antenna	COM-POWER	HAH-118	71259	Mar. 22, 19	Mar. 21, 20
Horn Antenna	COM-POWER	HAH-118	71283	Mar. 20, 19	Mar. 19, 20
SHF-EHF Horn	Schwarzbeck	BBHA9170	BBHA9170147	Jun. 30, 19	Jun. 29, 20
SHF-EHF Horn	Schwarzbeck	BBHA9170	BBHA9170242	Jun. 30, 19	Jun. 29, 20
AMPLIFIER	EM Electornic Corporation	EM01G26G	60613	Mar. 28, 19	Mar. 27, 20
AMPLIFIER	Emc Instruments Corporation	Emc012645	980077	Jan. 04, 19	Jan. 03,20
3m Semi-anechoic Chamber	SAEMC	9m*6m*6m	N/A	Oct. 18,18	Oct. 17,21
Test Software	EZ-EMC	ICP-03A1	N/A	N/A	N/A

**NOTE:**

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above1GHz if tested.
4. The FCC Site Registration No. is 749762.



### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
- g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

#### **NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
- 4.All modes of operation were investigated and the worst-case emissions are reported.
- 5.The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

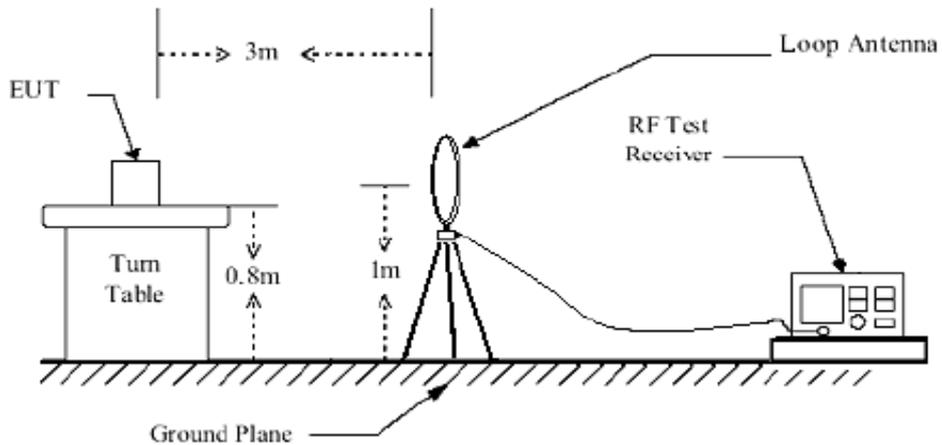


#### 4.1.4 DEVIATION FROM TEST STANDARD

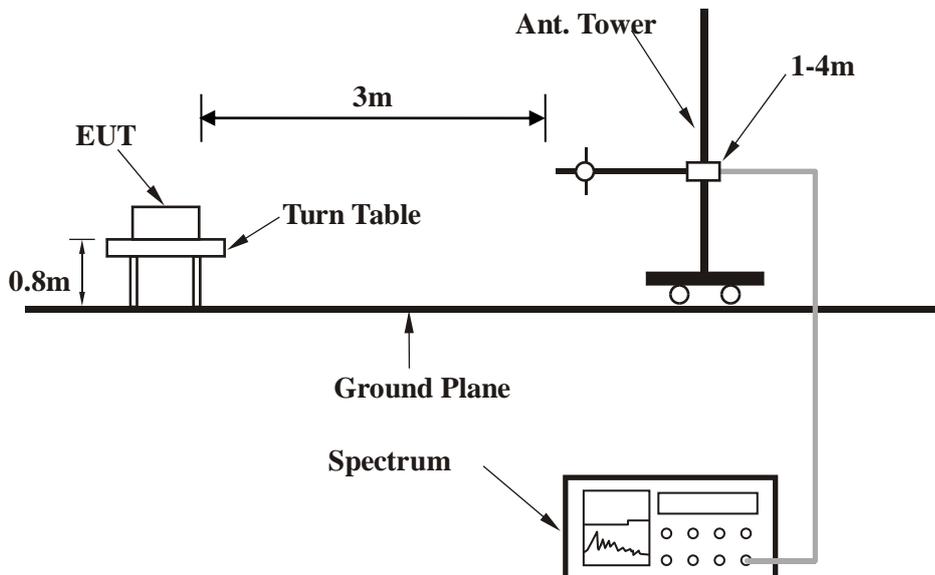
No deviation.

#### 4.1.5 TEST SETUP

##### Below 30MHz test setup



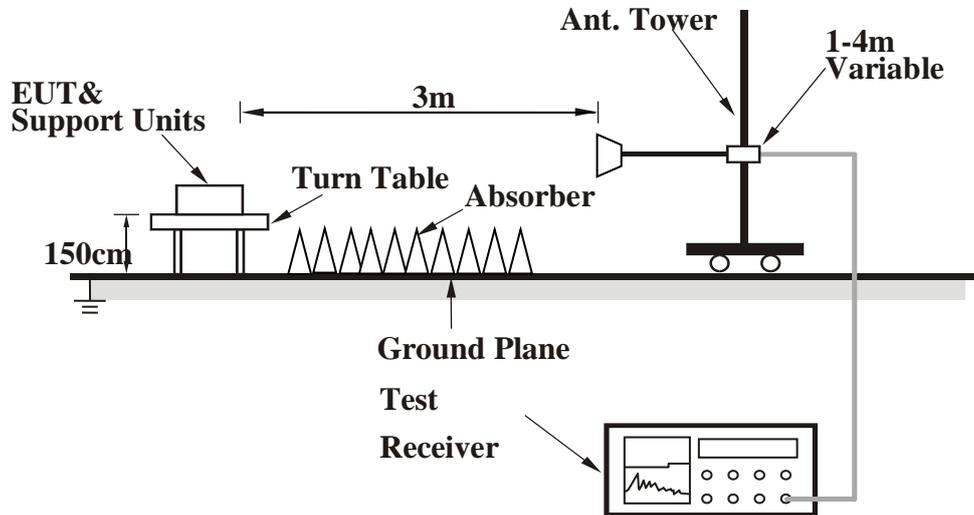
##### Below 1GHz test setup



**Note:** For the actual test configuration, please refer to the attached file (Test Setup Photo).



### Above 1GHz test setup



**Note:** For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- a. Set the EUT under full load condition and placed them on a testing table.
- b. Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the EUT in full functions.



### 4.1.7 TEST RESULTS

#### BELOW 1GHz WORST-CASE DATA:

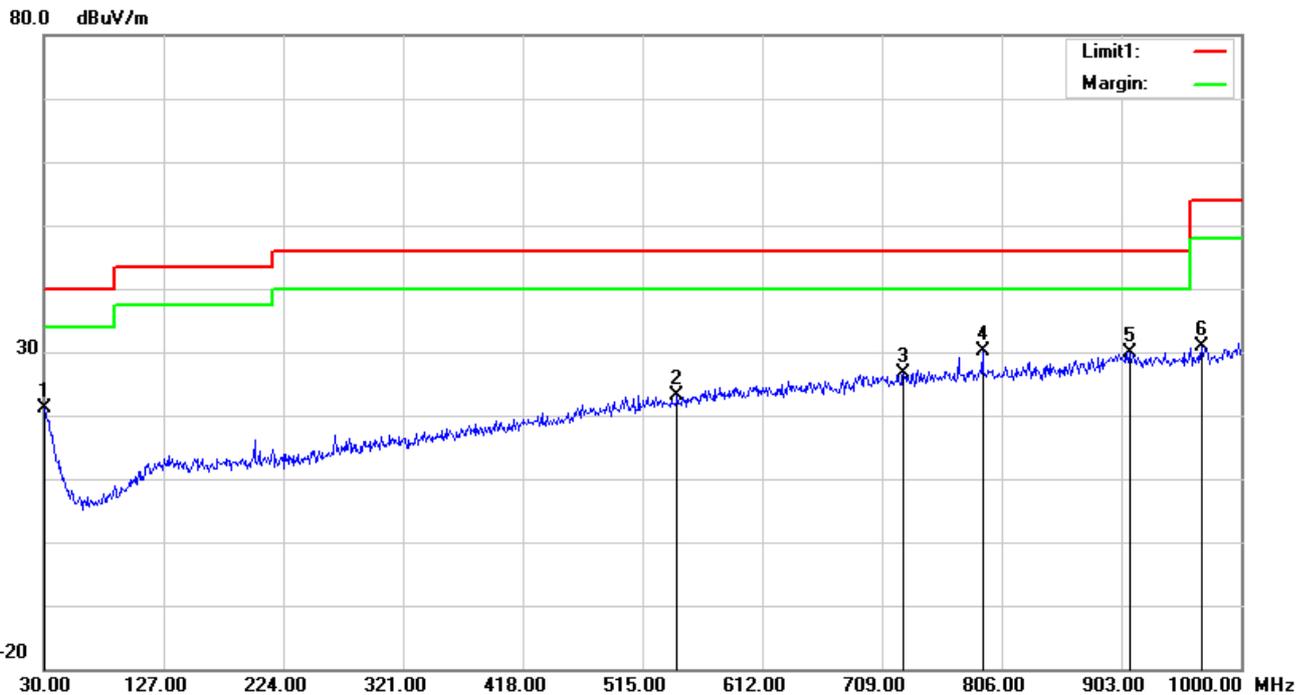
#### BT-LE (GFSK)

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 m										
No.	Frequency (MHz)	Reading (dBuV/m)	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	30.0000	23.18	20.10	22.28	0.13	21.13	40.00	-18.87	100	41
2	543.1300	23.29	19.27	21.71	2.25	23.10	46.00	-22.90	100	324
3	726.4600	23.88	21.61	21.30	2.45	26.64	46.00	-19.36	100	138
4	790.4800	26.73	22.11	21.17	2.54	30.21	46.00	-15.79	200	87
5	909.7900	24.29	23.70	20.86	2.66	29.79	46.00	-16.21	100	112
6	967.9900	25.09	23.70	20.75	2.72	30.76	54.00	-23.24	100	67

#### REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)-Pre-amplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



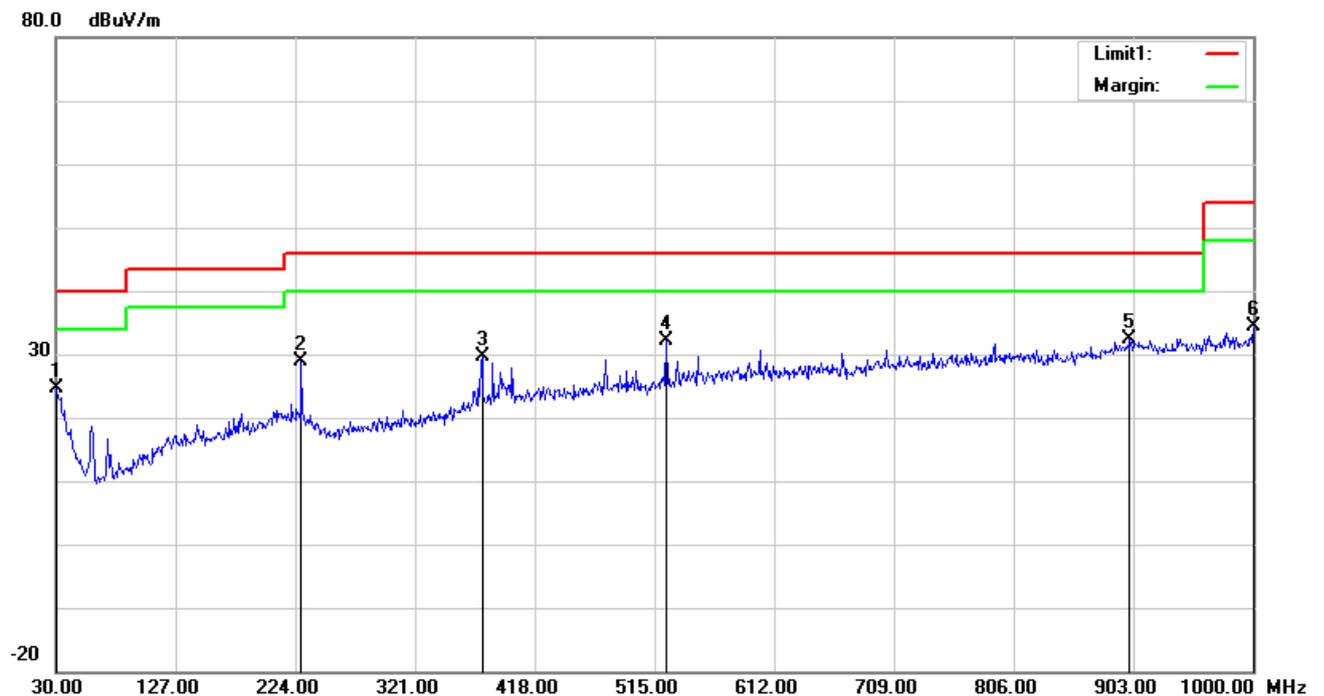


<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 m										
No.	Frequency (MHz)	Reading (dBuV/m)	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	30.0000	26.60	20.10	22.28	0.13	24.55	40.00	-15.45	100	339
2	228.8500	38.10	11.48	22.33	1.58	28.83	46.00	-17.17	100	316
3	375.3200	34.15	15.61	22.08	1.89	29.57	46.00	-16.43	100	313
4	524.7000	32.50	19.19	21.75	2.20	32.14	46.00	-13.86	100	278
5	900.0900	26.66	23.90	20.88	2.65	32.33	46.00	-13.67	100	129
6	1000.0000	27.90	24.40	20.69	2.76	34.37	54.00	-19.63	100	42

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)-Pre-amplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.





**ABOVE 1GHz TEST DATA:**

**BT-LF (GFSK)**

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

<b>ANTENNA POLARITY &amp; TEST DISTANCE: HORIZONTAL AT 3 M</b>									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2400	64.2	PK	74	-9.8	142	107	77.85	-13.65
2	2400	50.42	AV	54	-3.58	352	264	64.07	-13.65
3	*2402	87.2	PK			217	318	101.17	-13.97
4	*2402	86.9	AV			264	12	100.87	-13.97
5	4804	49.4	PK	74	-24.6	132	168	53.15	-3.75
6	4804	34.5	AV	54	-19.5	372	114	38.25	-3.75
<b>ANTENNA POLARITY &amp; TEST DISTANCE: VERTICAL AT 3 M</b>									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2400	61.24	PK	74	-12.76	392	327	74.89	-13.65
2	2400	45.52	AV	54	-8.48	233	101	59.17	-13.65
3	*2402	84.16	PK			119	255	98.13	-13.97
4	*2402	83.55	AV			338	171	97.52	-13.97
5	4804	48.67	PK	74	-25.33	389	13	52.42	-3.75
6	4804	34.26	AV	54	-19.74	304	217	38.01	-3.75

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.



CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440	88.26	PK			171	297	101.28	-13.02
2	*2440	87.61	AV			388	77	100.63	-13.02
3	4880	51.33	PK	74	-22.67	101	346	55.29	-3.96
4	4880	35.46	AV	54	-18.54	286	144	39.42	-3.96
5	3477	46.52	PK	74	-27.48	186	140	50.48	-3.96
6	3477	34.65	AV	54	-19.35	270	268	38.61	-3.96
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440	83.11	PK			207	243	96.13	-13.02
2	*2440	82.49	AV			142	208	95.51	-13.02
3	4880	51.21	PK	74	-22.79	318	57	55.17	-3.96
4	4880	35.24	AV	54	-18.76	316	56	39.2	-3.96
5	3221	45.01	PK	74	-28.99	313	102	48.97	-3.96
6	3221	33.2	AV	54	-20.8	134	207	37.16	-3.96

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* " : Fundamental frequency.



CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2483.5	54.2	PK	74	-19.8	233	106	67.85	-13.65
2	2495.51	34.6	AV	54	-19.4	393	171	48.25	-13.65
3	*2480	88.81	PK			311	147	102.78	-13.97
4	*2480	88.47	AV			295	49	102.44	-13.97
5	4960	51.83	PK	74	-22.17	156	151	55.58	-3.75
6	4960	35.62	AV	54	-18.38	155	266	39.37	-3.75
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2483.5	51.06	PK	74	-22.94	315	328	64.71	-13.65
2	2483.5	33.12	AV	54	-20.88	196	315	46.77	-13.65
3	*2480	84.95	PK			101	317	98.92	-13.97
4	*2480	84.22	AV			278	201	98.19	-13.97
5	4960	51.32	PK	74	-22.68	336	20	55.07	-3.75
6	4960	35.22	AV	54	-18.78	363	24	38.97	-3.75

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* " : Fundamental frequency.



## 4.2 6dB BANDWIDTH MEASUREMENT

### 4.2.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### 4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Wireless Connectivity Tester	R&S	CMW270	1201.0002K75	Nov. 29, 18	Nov. 28, 19
MXA VEXTOR SIGNAL	Agilent	n5182a	MY50140530	Mar. 28, 19	Mar. 27, 20
MXA signal analyzer	Agilent	n9020a	MY49100060	Mar. 28, 19	Mar. 27, 20
RF Control Unit	Tonscend	JS0806-2	188060112	Mar. 28, 19	Mar. 27, 20
Signal Generation	Agilent	E4421B	US40051152	Nov. 29, 18	Nov. 28, 19
DC Power Supply	Agilent	E3640A	MY40004013	Mar. 28, 19	Mar. 27, 20
Programmable Temperature & Humidity Chamber	Hongjin	HYC-TH-225 DH	DG-180746	Mar. 28, 19	Mar. 27, 20
Test System	Tonscend	JS 1120-3	N/A	N/A	N/A
Power Splitter	Weinschel	1580-1	TL177	Mar. 20, 19	Mar. 19, 20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	112012	Mar. 28, 19	Mar. 27, 20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	121393	Mar. 28, 19	Mar. 27, 20
Wireless Communication Test Set	ROHDE&SCHWARZ	CMW500	1201.0002K500-155842-Gd	Aug. 06, 19	Aug. 05, 20

**NOTE:**

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



#### 4.2.3 TEST PROCEDURE

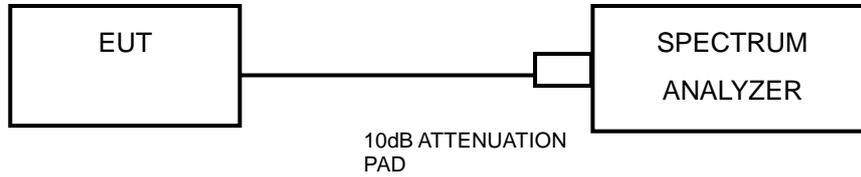
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.



#### 4.2.5 TEST SETUP



#### 4.2.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



### 4.2.7 TEST RESULTS

#### BT-LE (GFSK)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.670	0.5	PASS
19	2440	0.696	0.5	PASS
39	2480	0.666	0.5	PASS

#### WORSE PLOT



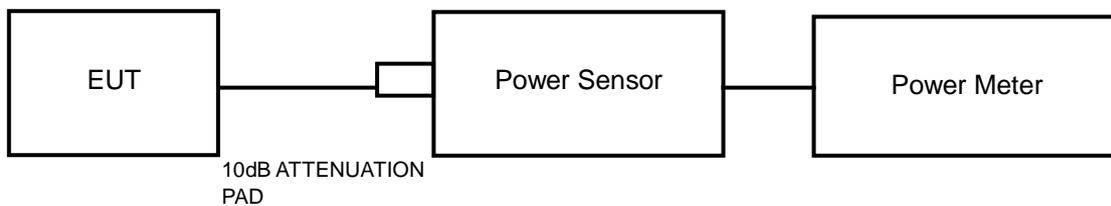


### 4.3 CONDUCTED OUTPUT POWER

#### 4.3.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

#### 4.3.2 TEST SETUP



#### 4.3.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Wireless Connectivity Tester	R&S	CMW270	1201.0002K75	Nov. 29, 18	Nov. 28, 19
MXA VEXTOR SIGNAL	Agilent	n5182a	MY50140530	Mar. 28, 19	Mar. 27, 20
MXA signal analyzer	Agilent	n9020a	MY49100060	Mar. 28, 19	Mar. 27, 20
RF Control Unit	Tonscend	JS0806-2	188060112	Mar. 28, 19	Mar. 27, 20
Signal Generation	Agilent	E4421B	US40051152	Nov. 29, 18	Nov. 28, 19
DC Power Supply	Agilent	E3640A	MY40004013	Mar. 28, 19	Mar. 27, 20
Programmable Temperature & Humidity Chamber	Hongjin	HYC-TH-225 DH	DG-180746	Mar. 28, 19	Mar. 27, 20
Test System	Tonscend	JS 1120-3	N/A	N/A	N/A
Power Splitter	Weinschel	1580-1	TL177	Mar. 20, 19	Mar. 19, 20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	112012	Mar. 28, 19	Mar. 27, 20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	121393	Mar. 28, 19	Mar. 27, 20
Wireless Communication Test Set	ROHDE&SCHWARZ	CMW500	1201.0002K500-155842-Gd	Aug. 06, 19	Aug. 05, 20

**NOTE:**1. The test was performed in RF Oven room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



#### 4.3.4 TEST PROCEDURES

A peak sensor was used on the output port of the EUT. A peak power meter was used to read the response of the peak power sensor. Record the peak power level.

#### 4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.3.7 TEST RESULTS

##### 4.3.7.1 MAXIMUM PEAK OUTPUT POWER

###### BT-LE (GFSK)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-8.19	0.1517	1	PASS
19	2440	<b>-7.66</b>	0.1714	1	PASS
39	2480	-7.78	0.1667	1	PASS

##### 4.3.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

###### BT-LE (GFSK)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)
0	2402	-5.97
19	2440	-5.6
39	<b>2480</b>	<b>-5.32</b>

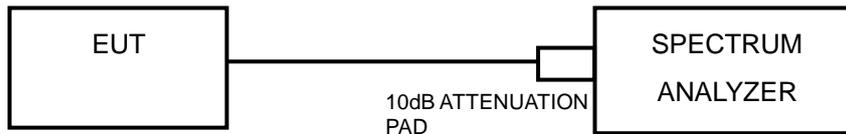


## 4.4 POWER SPECTRAL DENSITY MEASUREMENT

### 4.4.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

### 4.4.2 TEST SETUP



### 4.4.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

### 4.4.4 TEST PROCEDURE

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW  $\geq$  3 x RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.4.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

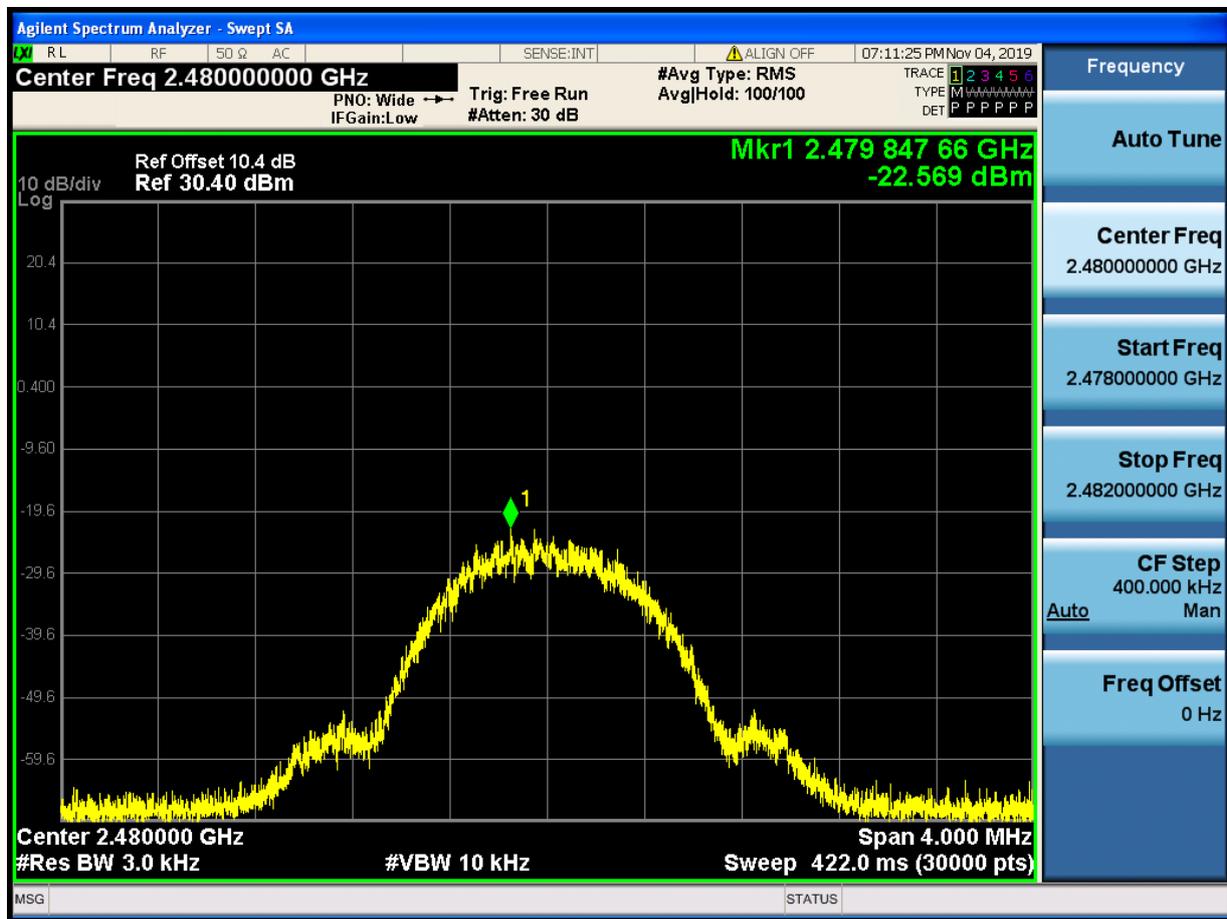


### 4.4.7 TEST RESULTS

#### BT-LE (GFSK)

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-23.986	8	PASS
19	2440	-22.728	8	PASS
39	2480	-22.569	8	PASS

#### WORSE PLOT



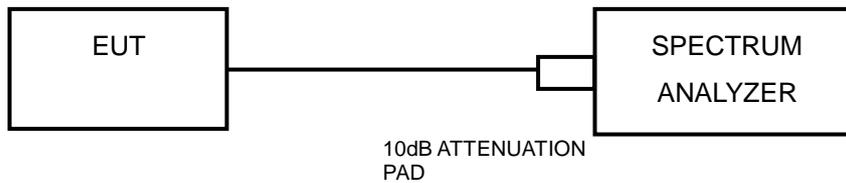


## 4.5 OUT OF BAND EMISSION MEASUREMENT

### 4.5.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 4.5.2 TEST SETUP



### 4.5.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

### 4.5.4 TEST PROCEDURE

#### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.



## MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.5.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



### 4.5.7 TEST RESULTS

#### BT-LE (GFSK)



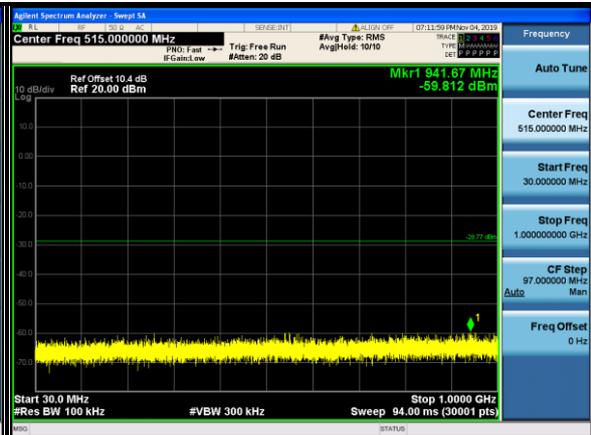


BUREAU VERITAS

Test Report No.: RF191025N036-1



CH 39



Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

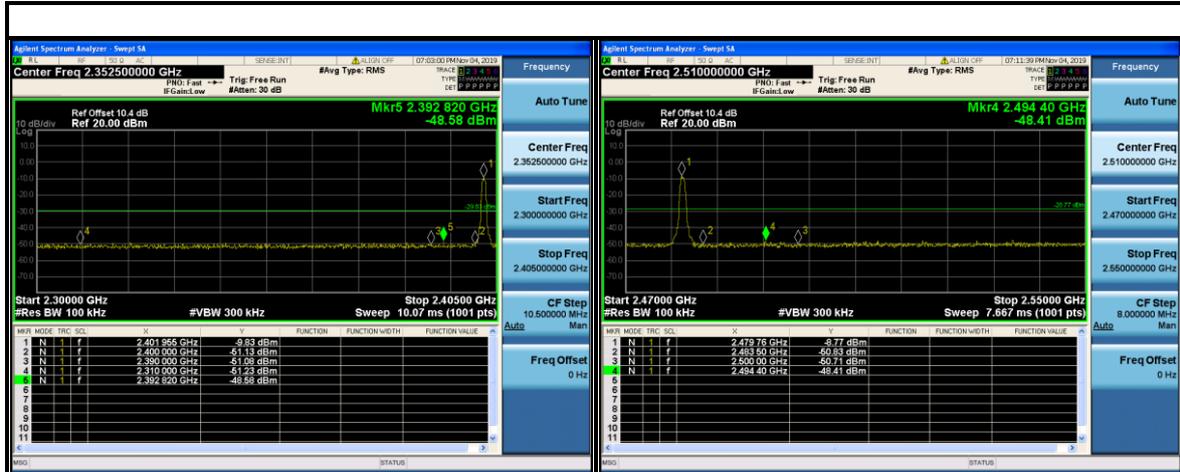
Tel: +86 769 8998 2098  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



**BUREAU  
VERITAS**

Test Report No.: RF191025N036-1

**Band Edge:**



Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

Tel: +86 769 8998 2098  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



Test Report No.: RF191025N036-1

## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



## **6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.

**---END---**