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FCC TEST REPORT

Report No: STS1502002F04

Issued for

DOPPIO MOBILE INTERNATIONAL LIMITED
1011A, 10/F., Harbour Centre Tower 1, No.1 Hok
Cheung St., Hung Hom, Kowloon, Hong Kong.

Product Name:	THUNDER PLUS
Brand Name:	doppio
Model No.:	DP5108
Series Model:	N/A
FCC ID:	N2GDP5108
Test Standard:	FCC Part 15.247

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Shenzhen STS Test Services Co., Ltd.

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**Report Revise Record**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan.30, 2015	Valid	Original Report





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1. VERIFICATION OF COMPLIANCE

Applicant	DOPPIO MOBILE INTERNATIONAL LIMITED
Address	1011A, 10/F., Harbour Centre Tower 1, No.1 Hok Cheung St., Hung Hom, Kowloon, Hong Kong.
Manufacturer	DOPPIO MOBILE (SHENZHEN) LIMITED
Address	Room313, 3th Floor, Building 10 Jiale Building, NO.11 YanNan Road,Futian District, Shenzhen
Product Designation	THUNDER PLUS
Brand Name	doppio
Test Model	DP5108
Date of test	Jan.05, 2015 to Jan.30, 2015
Deviation	None
Condition of Test Sample	Normal
Report Template	STSRT-US-BLE/RF

WE HEREBY CERTIFY THAT:

The above equipment was tested by Shenzhen STS Test Services Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with requirement of FCC Part 15 Rules requirement.

Testing Engineer :

(Jin Ming)

Report writing :

(Sunny zheng)

Authorized Signatory :

(Bovey Yang)





2. GENERAL INFORMATION

2.1 PRODUCT DESCRIPTION

The EUT is designed as “**THUNDER PLUS**”. It is designed by way of utilizing the FHSS technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480GHz
Bluetooth Version	V4.0
Modulation	GFSK
Number of channels	40 Channel(37 Hopping Channel,3 advertising Channel)
Antenna Designation	Integrated Antenna
Antenna Gain	0.8dBi
Hardware Version	P6120-02
Software Version	DP5108_DOPPIO_ONE
Power Supply	DC3.7V by Built-in Li-ion Battery

2.2 RELATED SUBMITTAL(S)/GRANT(S)

This submittal(s) (test report) is intended for **FCC ID: N2GDP5108** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.3 TEST METHODOLOGY

All measurements contained in this report were conducted with KDB 558074 D01 DTS Meas Guidance v03r02, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions. The EUT was tested in all three orthogonal planes and the worse case was showed.

2.4 TEST FACILITY

All measurement facilities used to collect the measurement data are located at Shenzhen STS Test Services Co., Ltd.

1/F, Building 2, Zhuoke Science Park, Chongqing Road, Fuyong, Bao'an District, Shenzhen, China

FCC Registration No.: 842334

2.5 SPECIAL ACCESSORIES

Refer to section 2.2.

2.6 EQUIPMENT MODIFICATIONS

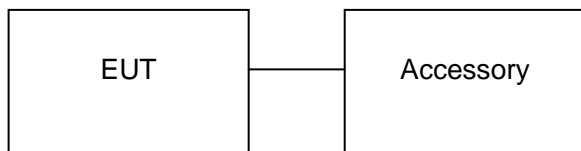
Not available for this EUT intended for grant.



3. SYSTEM TEST CONFIGURATION

3.1 CONFIGURATION OF TESTED SYSTEM

Configuration:



3.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Note
1	Mobile Phone	DP5108	FCCID:N2GDP5108	EUT
2	Adapter	DP5108	DC 5V/1A	Accessory
3	Battery	DP5108	DC 3.7V 4000mAh	Accessory
4	Earphone	DP5108	N/A	Accessory
5	USB Cable	DP5108	N/A	Accessory

ALL TEST EQUIPMENT LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Spectrum Analyzer	Agilent	E4407B	MY50140340	2014.10.25	2015.10.24
Test Receiver	R&S	ESCI	101427	2014.10.25	2015.10.24
Bilog Antenna	TESEQ	CBL6111D	34678	2014.10.27	2015.10.26
50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2014.06.06	2015.06.06
Horn Antenna	R&S	9120D	152265	2014.10.27	2015.10.26
Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2014.07.06	2015.07.05
Amplifier	EM	EM-30180	060538	2014.12.22	2015.12.21
Loop Antenna	ARA	PLA-1030/B	1029	2014.06.08	2015.06.07
Power Meter	Anritsu	ML2495A	1204003	2014.10.25	2015.10.24
Power Sensor	Anritsu	MA2411B	100309	2014.10.25	2015.10.24

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	102086	102086	2014.10.25	2015.10.24
LISN	R&S	ENV216	101242	2014.10.25	2015.10.24
LISN	EMCO	3810/2NM	000-23625	2014.10.25	2015.10.24
50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2014.06.06	2015.06.06
Passive Voltage Probe	R&S	ESH2-Z3	100196	2014.06.06	2015.06.06
Absorbing clamp	R&S	MDS-21	100668	2014.10.27	2015.10.26



4. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§15.209 §15.247(d)	Radiated Emission	Compliant
§15.247(d)	Band Edges	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247(b)	Conducted Power	Compliant
§15.247(e)	Maximum Conducted Output Power SPECTRAL Density	Compliant
§15.207	Line Conduction Emission	Compliant

5. DESCRIPTION OF TEST MODES

The EUT has been operated in three modulations: GFSK independently.

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Normal Operating (BT)

Note:

1. All the test modes can be supply by Built-in Li-ion battery, only the result of the worst case was recorded in the report if no any records.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. Eut is operating at its maximum duty cycle>or equal 98%



6. ANTENNA REQUIREMENT

6.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

6.2 EUT ANTENNA

The EUT antenna is unique Antenna. It comply with the standard requirement.





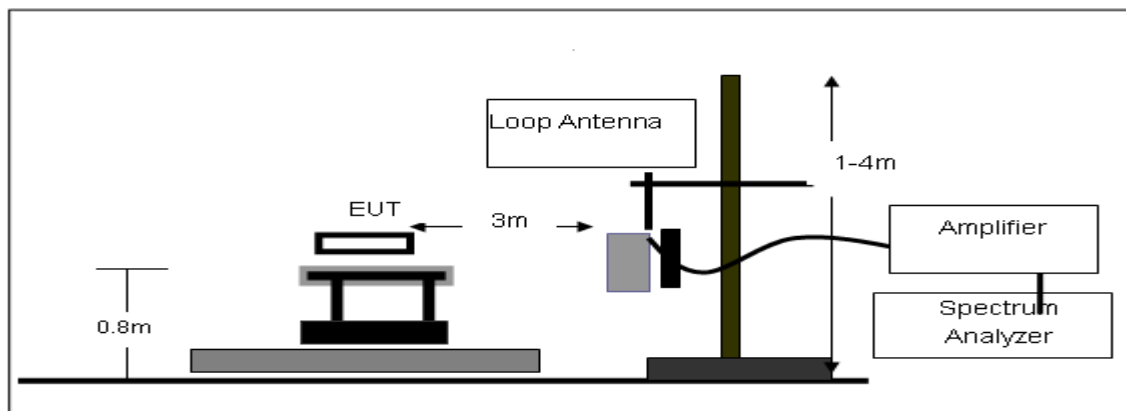
7. RADIATED EMISSION

7.1 MEASUREMENT PROCEDURE

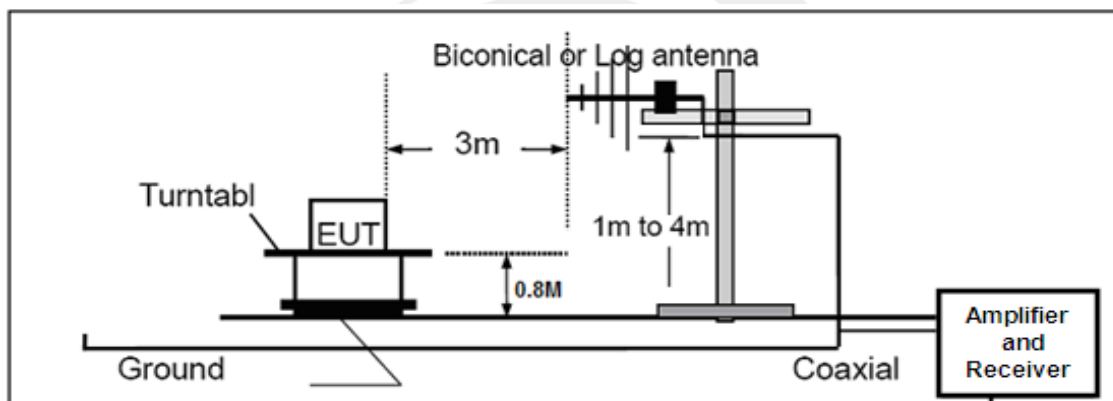
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

7.2 TEST SETUP

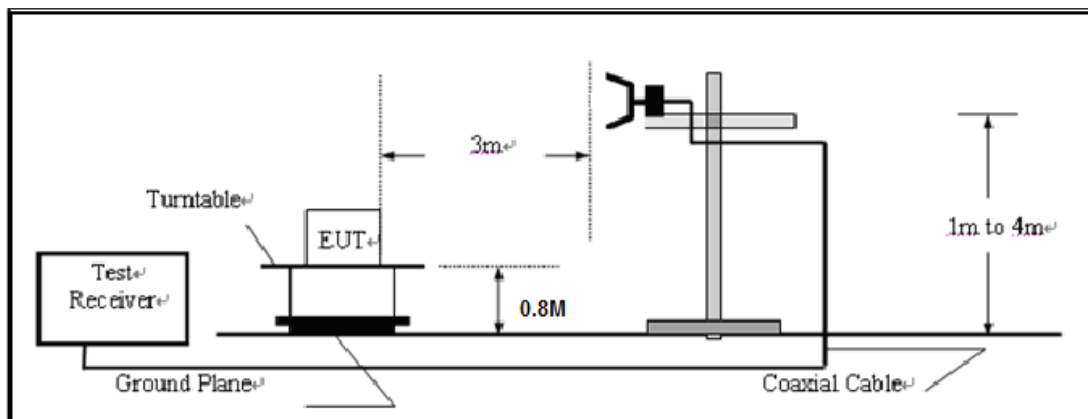
RADIATED EMISSION TEST SETUP 0.009MHz-30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz





7.3 LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/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

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier harmonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 1 MHz, AV=1 MHz / 10Hz

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

Note: All modes were tested For restricted band radiated emission, the test records reported below are the worst result compared to other modes.



7.4 TEST RESULT

RADIATED EMISSION BELOW 30MHZ

(Between 9KHz – 30 MHz)

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

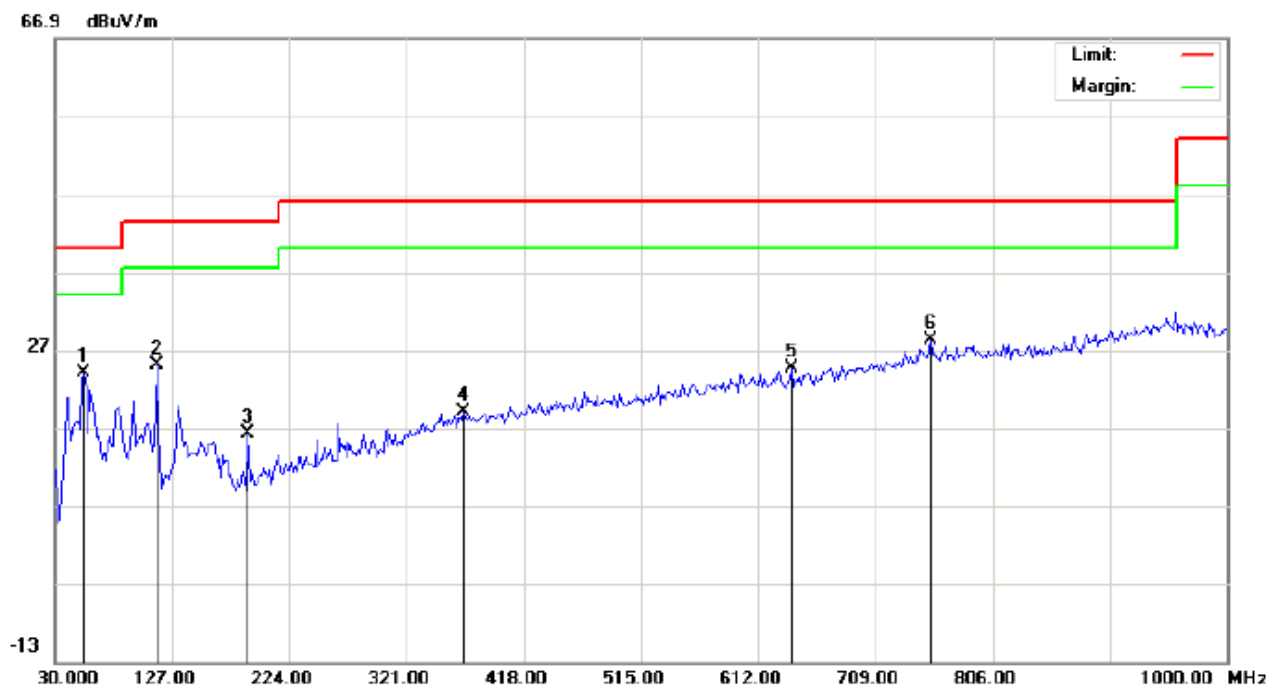
Limit line = specific limits(dBuv) + distance extrapolation factor.





RADIATED EMISSION BELOW 1GHZ

RADIATED EMISSION TEST- (30MHZ-1GHZ)-LOW CHANNEL-HORIZONTAL



Site: site #1

Polarization: Horizontal

Temperature: 26

Limit: FCC Class B 3M Radiation

Power: AC 120V/60Hz

Humidity: 60 %

EUT: THUNDER PLUS

Distance: 3m

M/N: DP5108

Mode: Low Channel TX

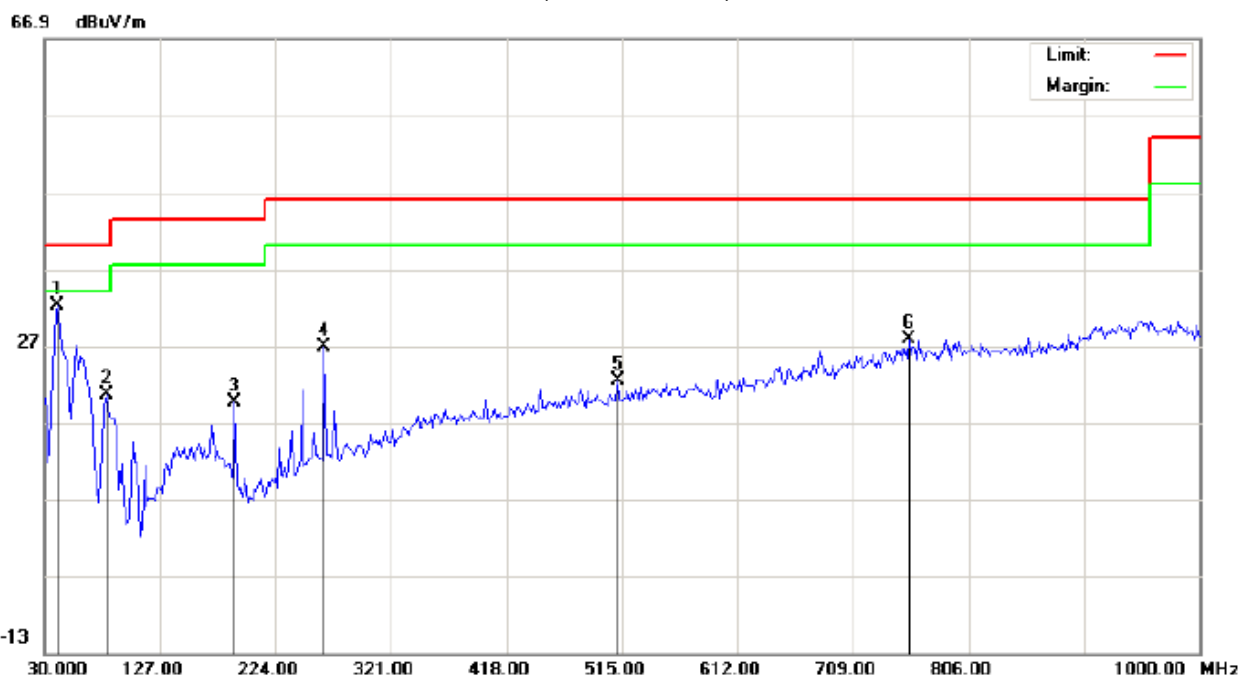
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	54.2500	12.79	11.20	23.99	40.00	-16.01	peak			
2		114.0667	13.46	11.45	24.91	43.50	-18.59	peak			
3		190.0500	4.68	11.54	16.22	43.50	-27.28	peak			
4		367.8833	0.11	18.86	18.97	46.00	-27.03	peak			
5		639.4833	0.87	23.82	24.69	46.00	-21.31	peak			
6		754.2667	1.47	26.69	28.16	46.00	-17.84	peak			

RESULT: PASS



RADIATED EMISSION TEST- (30MHZ-1GHZ)-LOW CHANNEL -VERTICAL



Site: site #1

Limit: FCC Class B 3M Radiation

EUT: THUNDER PLUS

M/N: DP5108

Mode: Low Channel TX

Note:

Polarization: Vertical

Power: AC 120V/60Hz

Distance: 3m

Temperature: 26

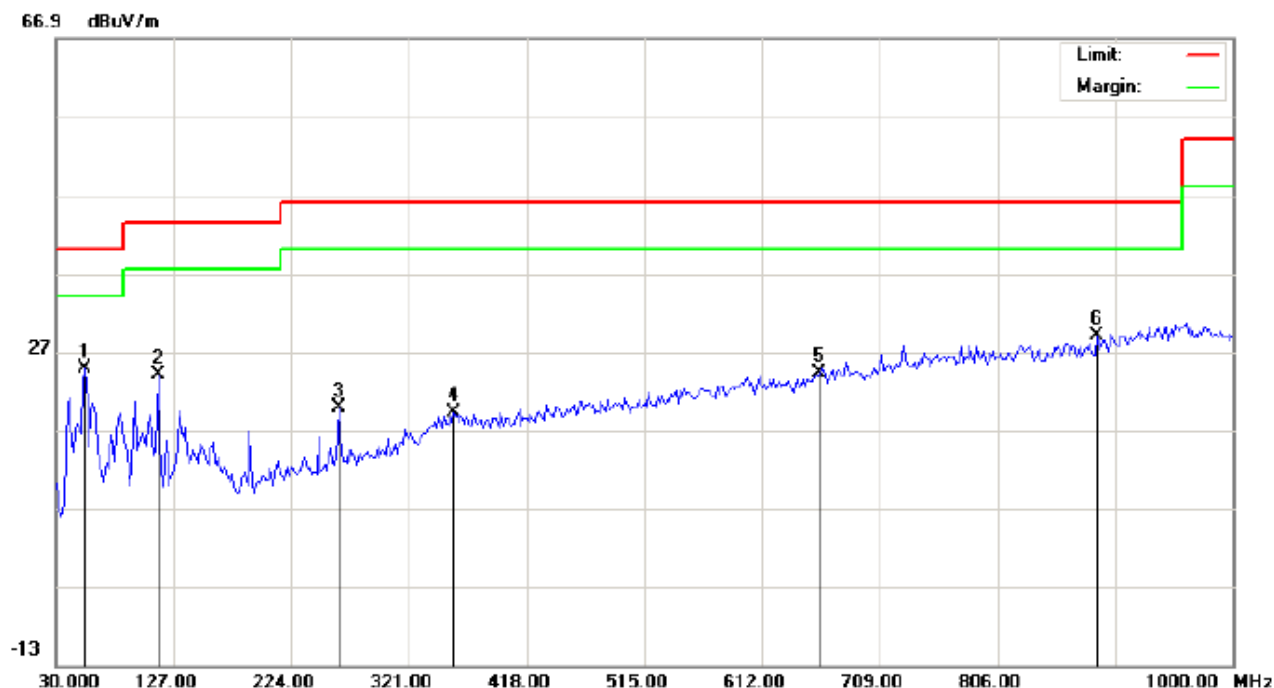
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	41.3167	23.45	8.81	32.26	40.00	-7.74	peak			
2		81.7333	18.11	2.42	20.53	40.00	-19.47	peak			
3		190.0500	8.16	11.52	19.68	43.50	-23.82	peak			
4		264.4167	12.54	14.34	26.88	46.00	-19.12	peak			
5		511.7667	0.86	21.45	22.31	46.00	-23.69	peak			
6		755.8833	1.01	26.71	27.72	46.00	-18.28	peak			

RESULT: PASS



RADIATED EMISSION TEST- (30MHZ-1GHZ)-MIDDLE CHANNEL-HORIZONTAL



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: THUNDER PLUS
M/N: DP5108
Mode: Middle Channel TX
Note:

Polarization: **Horizontal**
Power: AC 120V/60Hz
Distance: 3m

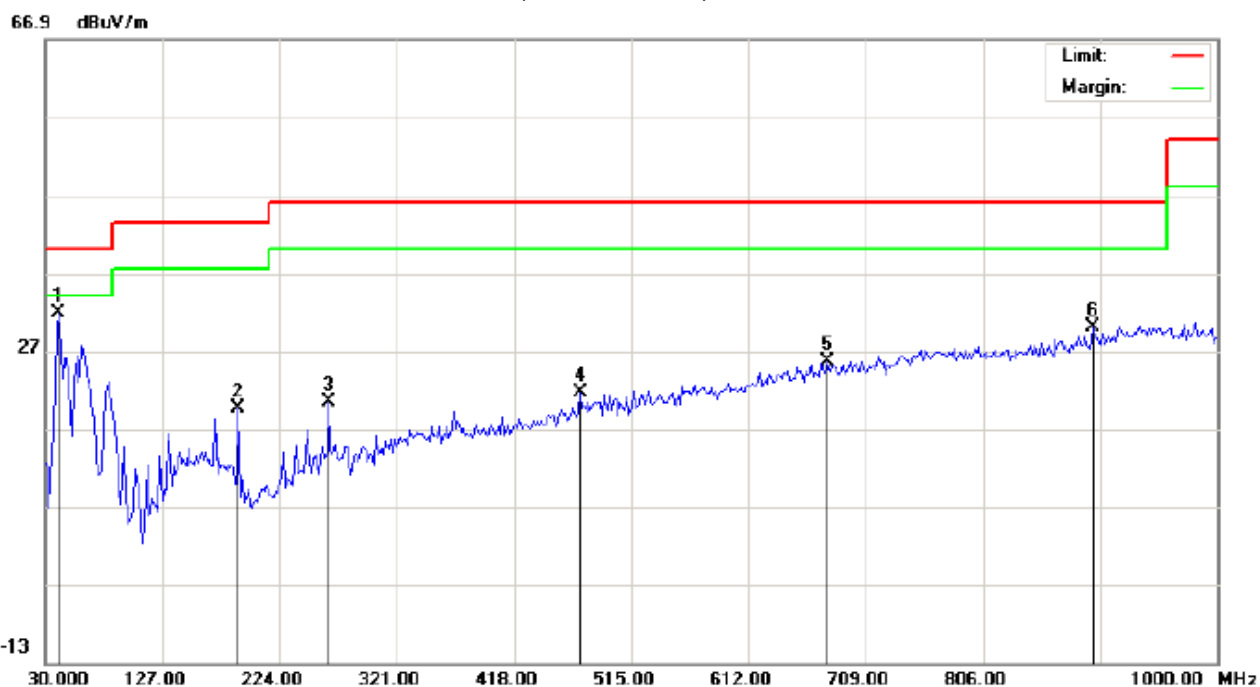
Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	54.2500	13.57	11.20	24.77	40.00	-15.23	peak			
2		114.0667	12.51	11.45	23.96	43.50	-19.54	peak			
3		262.8000	5.53	14.29	19.82	46.00	-26.18	peak			
4		358.1833	0.38	18.79	19.17	46.00	-26.83	peak			
5		658.8833	0.06	24.09	24.15	46.00	-21.85	peak			
6		888.4500	0.74	28.31	29.05	46.00	-16.95	peak			

RESULT: PASS



RADIATED EMISSION TEST- (30MHZ-1GHZ)- MIDDLE CHANNEL -VERTICAL



Site: site #1

Limit: FCC Class B 3M Radiation

EUT: THUNDER PLUS

M/N: DP5108

Mode: Middle Channel TX

Note:

Polarization: **Vertical**

Power: AC 120V/60Hz

Distance: 3m

Temperature: 26

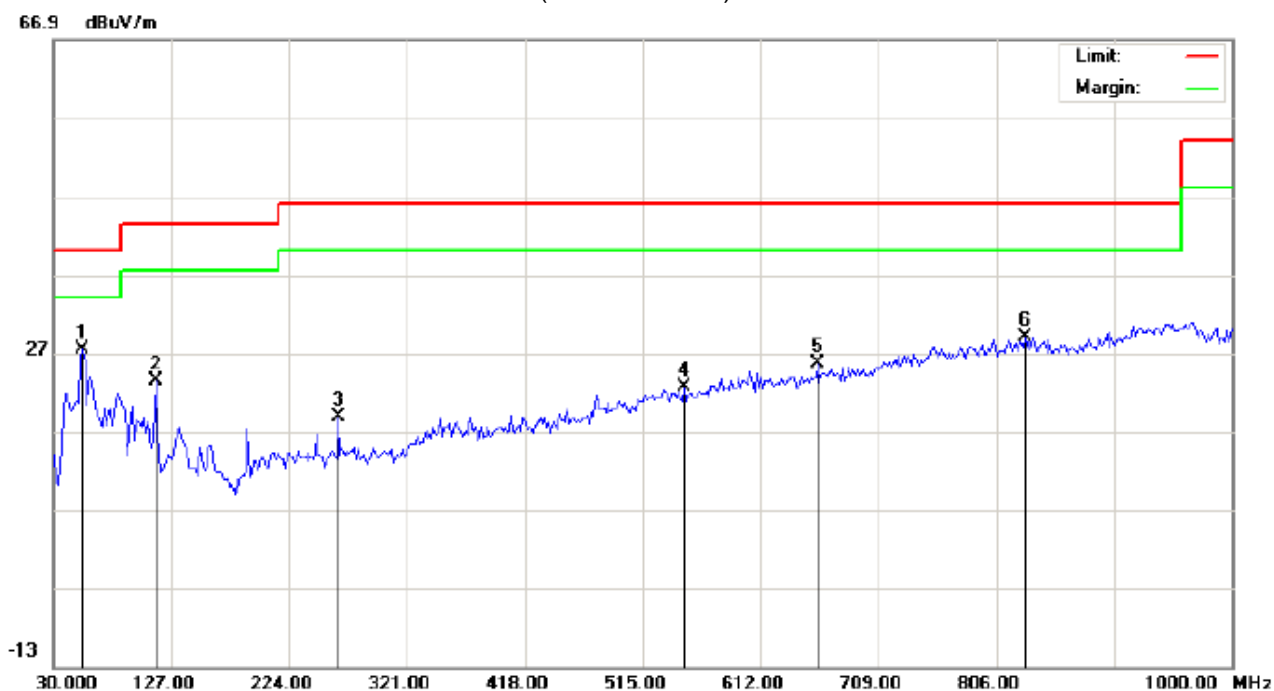
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	41.3167	23.03	8.81	31.84	40.00	-8.16	peak			
2		190.0500	8.08	11.52	19.60	43.50	-23.90	peak			
3		264.4167	6.05	14.34	20.39	46.00	-25.61	peak			
4		472.9667	0.73	20.84	21.57	46.00	-24.43	peak			
5		676.6667	0.97	24.56	25.53	46.00	-20.47	peak			
6		896.5333	1.46	28.52	29.98	46.00	-16.02	peak			

RESULT: PASS



RADIATED EMISSION TEST- (30MHZ-1GHZ)-HIGH CHANNEL-HORIZONTAL



Site: site #1

Limit: FCC Class B 3M Radiation

EUT: THUNDER PLUS

M/N: DP5108

Mode: High Channel TX

Note:

Polarization: **Horizontal**

Power: AC 120V/60Hz

Distance: 3m

Temperature: 26

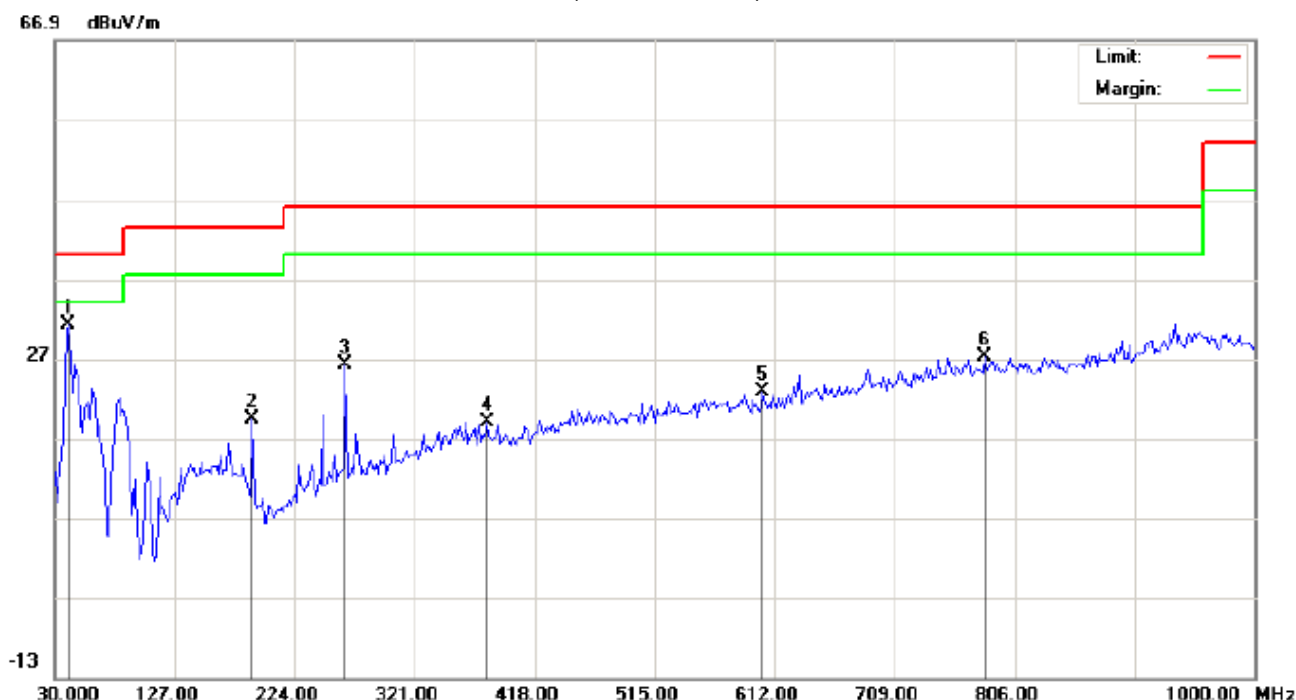
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	54.2500	16.17	11.20	27.37	40.00	-12.63	peak			
2		114.0667	11.99	11.45	23.44	43.50	-20.06	peak			
3		264.4167	4.45	14.34	18.79	46.00	-27.21	peak			
4		548.9500	0.11	22.45	22.56	46.00	-23.44	peak			
5		658.8833	1.58	24.09	25.67	46.00	-20.33	peak			
6		830.2500	1.70	27.31	29.01	46.00	-16.99	peak			

RESULT: PASS



RADIATED EMISSION TEST- (30MHZ-1GHZ)-HIGH CHANNEL -VERTICAL



Site: site #1

Limit: FCC Class B 3M Radiation

EUT: THUNDER PLUS

M/N: DP5108

Mode: High Channel TX

Note:

Polarization: **Vertical**

Power: AC 120V/60Hz

Distance: 3m

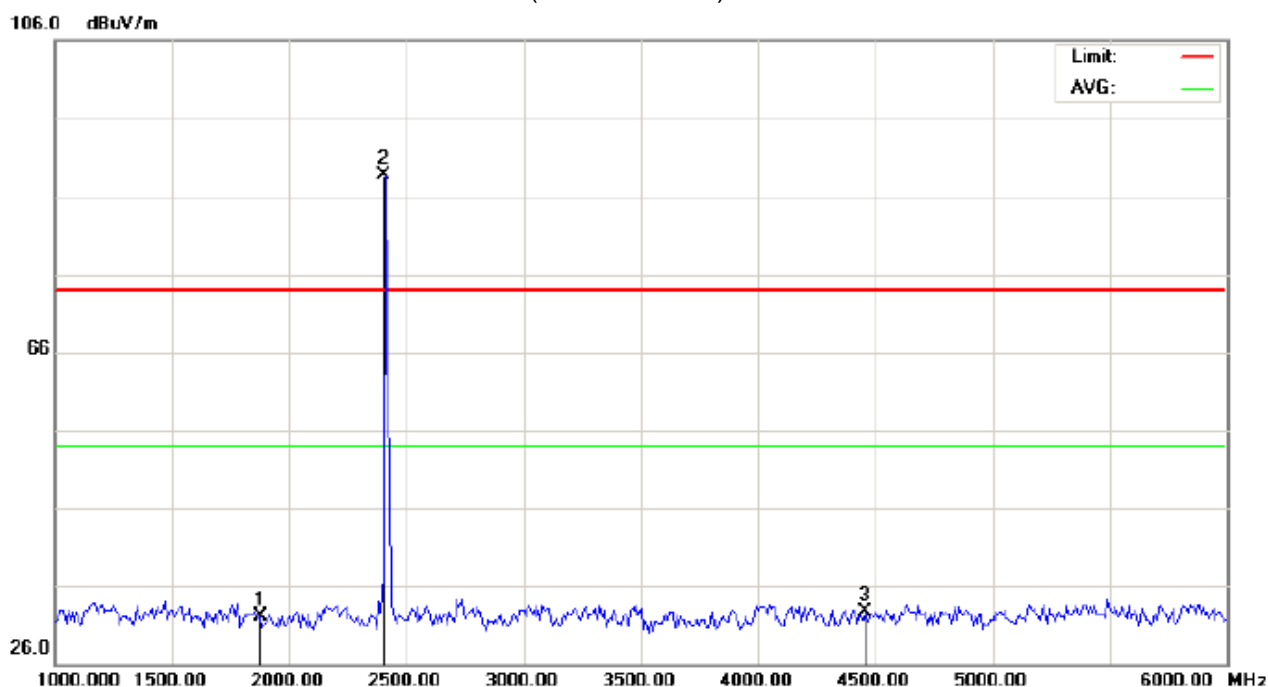
Temperature: 26

Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	41.3167	22.33	8.81	31.14	40.00	-8.86	peak			
2		190.0500	7.84	11.52	19.36	43.50	-24.14	peak			
3		264.4167	11.77	14.34	26.11	46.00	-19.89	peak			
4		379.2000	0.09	18.93	19.02	46.00	-26.98	peak			
5		602.3000	-0.03	22.78	22.75	46.00	-23.25	peak			
6		781.7500	0.10	27.07	27.17	46.00	-18.83	peak			

RESULT: PASS**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

**RADIATED EMISSION ABOVE 1GHZ****RADIATED EMISSION TEST- (ABOVE 1GHZ)-LOW CHANNEL-HORIZONTAL**

Site: site #1

Polarization: *Horizontal*

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: Low Channel TX

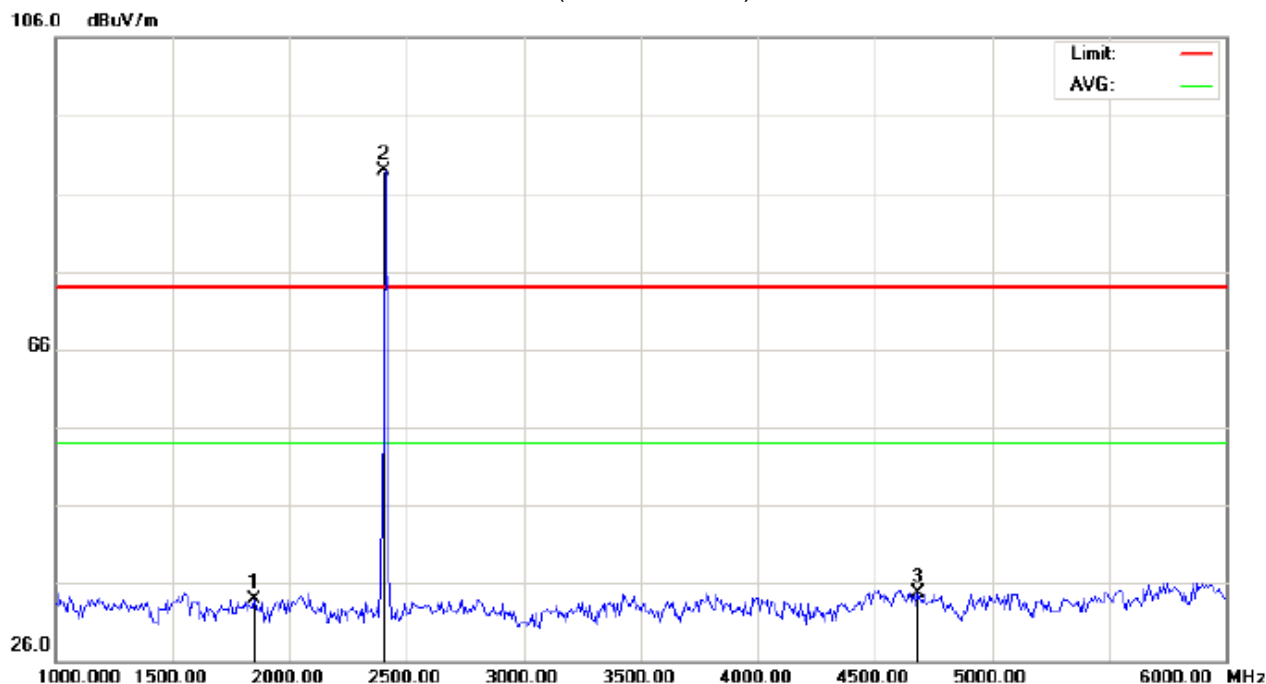
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1875.000	43.49	-11.43	32.06	74.00	-41.94	peak			
2	*	2402.000	98.33	-9.68	88.65	74.00	14.65	peak			
3		4458.333	36.02	-3.25	32.77	74.00	-41.23	peak			

RESULT: PASS



RADIATED EMISSION TEST-(ABOVE 1GHZ)-LOW CHANNEL-VERTICAL



Site: site #1

Polarization: **Vertical**

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: Low Channel TX

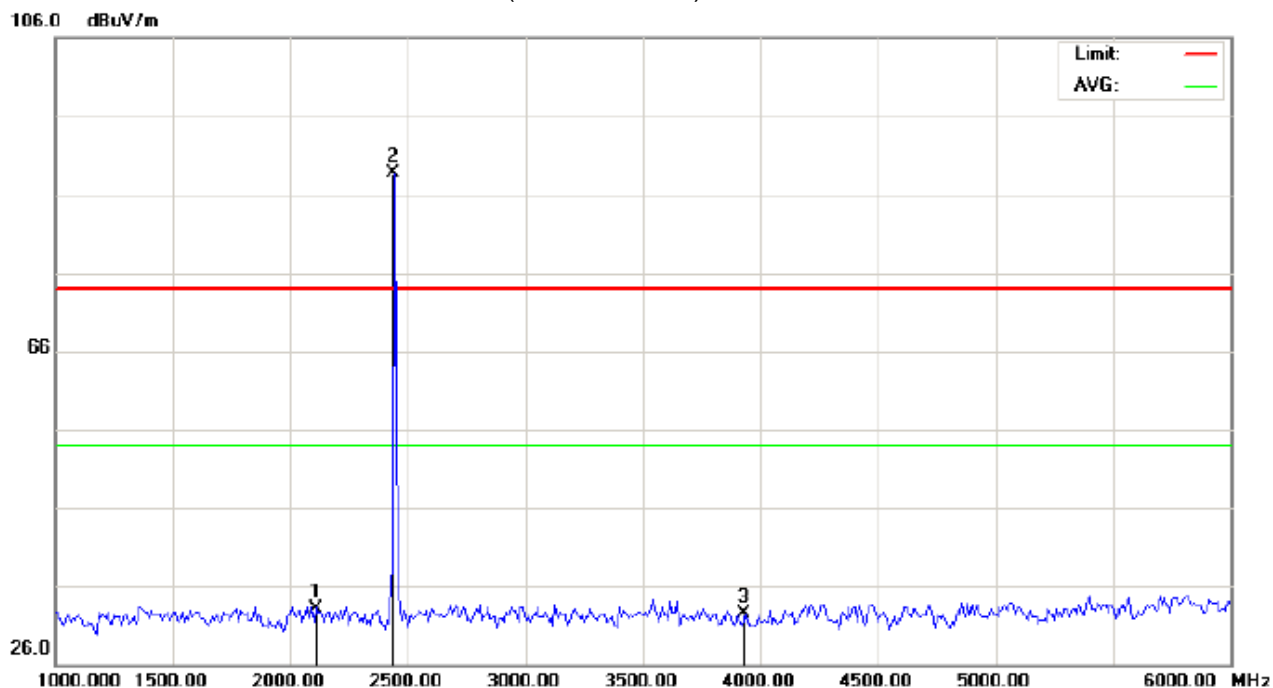
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1850.000	45.52	-11.70	33.82	74.00	-40.18	peak			
2	*	2402.000	98.58	-9.68	88.90	74.00	14.90	peak			
3		4683.333	37.25	-2.63	34.62	74.00	-39.38	peak			

RESULT: PASS



RADIATED EMISSION TEST-(ABOVE 1GHZ)-MIDDLE CHANNEL-HORIZONTAL



Site: site #1

Polarization: *Horizontal*

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: Middle Channel TX

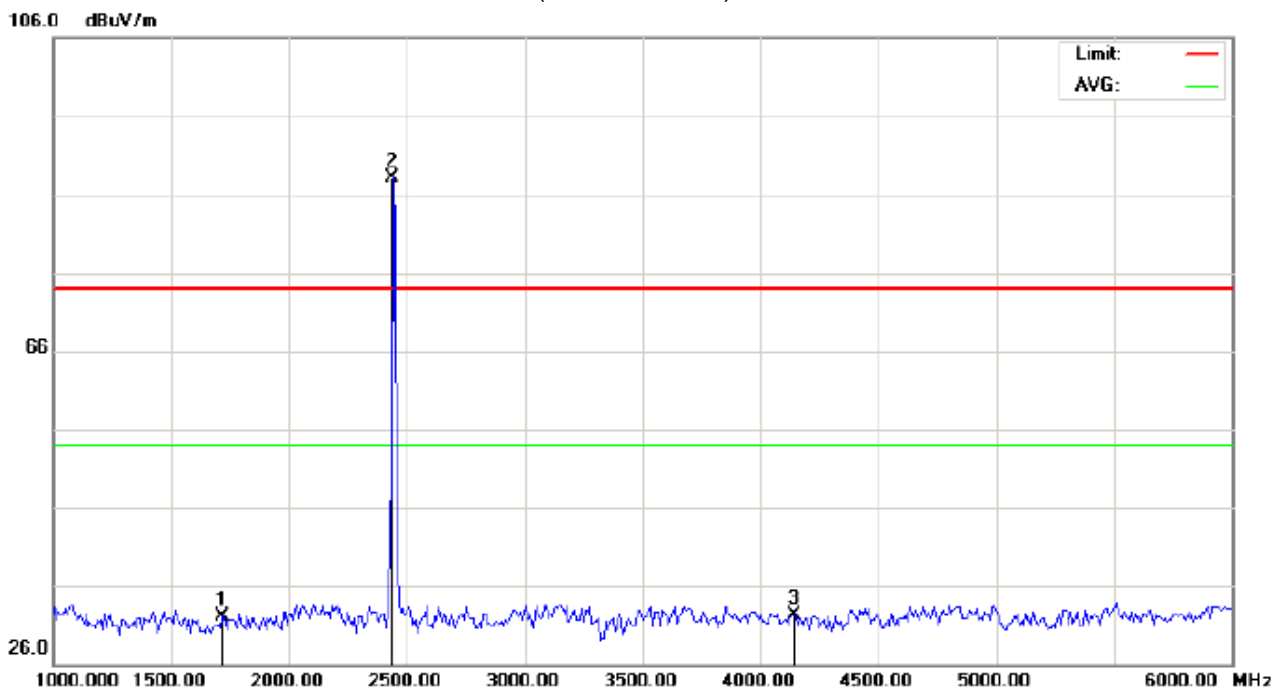
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2108.333	43.20	-10.00	33.20	74.00	-40.80	peak			
2	*	2440.000	98.38	-9.64	88.74	74.00	14.74	peak			
3		3933.333	37.74	-5.22	32.52	74.00	-41.48	peak			

RESULT: PASS



RADIATED EMISSION TEST-(ABOVE 1GHZ)-MIDDLE CHANNEL-VERTICAL



Site: site #1

Polarization: *Vertical*

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: Middle Channel TX

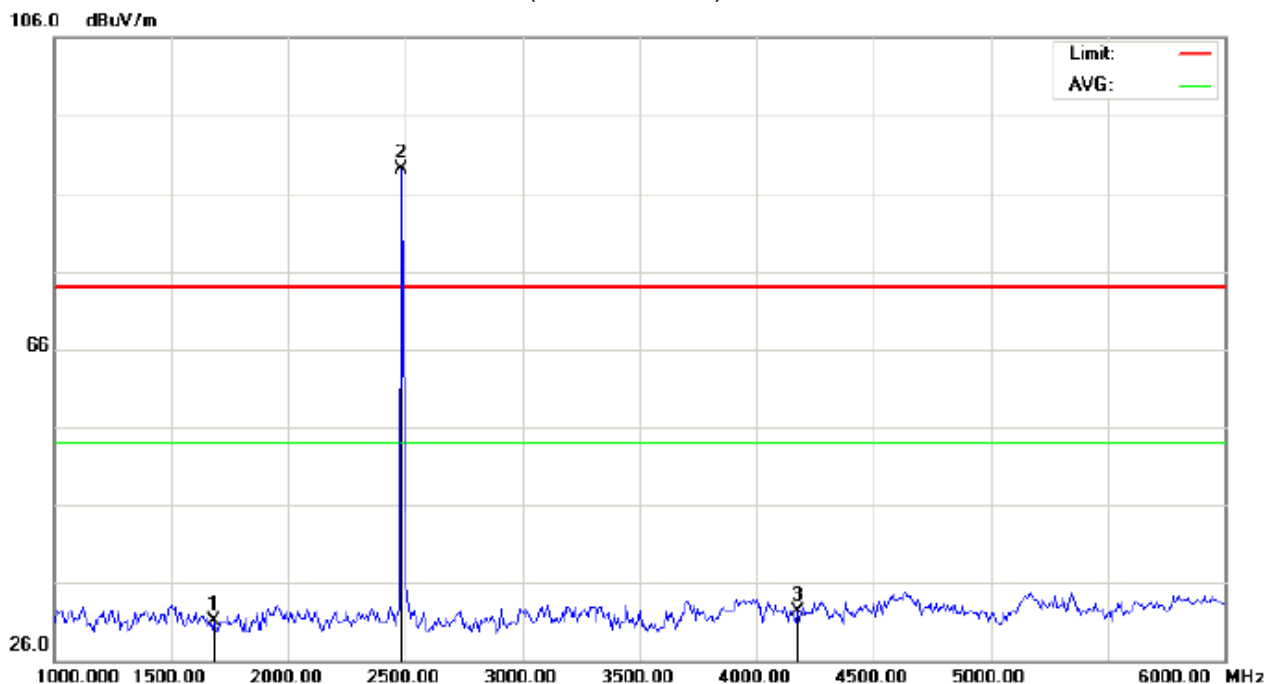
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1716.667	45.23	-13.10	32.13	74.00	-41.87	peak			
2	*	2440.000	97.81	-9.64	88.17	74.00	14.17	peak			
3		4141.667	36.71	-4.33	32.38	74.00	-41.62	peak			

RESULT: PASS



RADIATED EMISSION TEST-(ABOVE 1GHZ)-HIGH CHANNEL-HORIZONTAL



Site: site #1

Polarization: *Horizontal*

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: High Channel TX

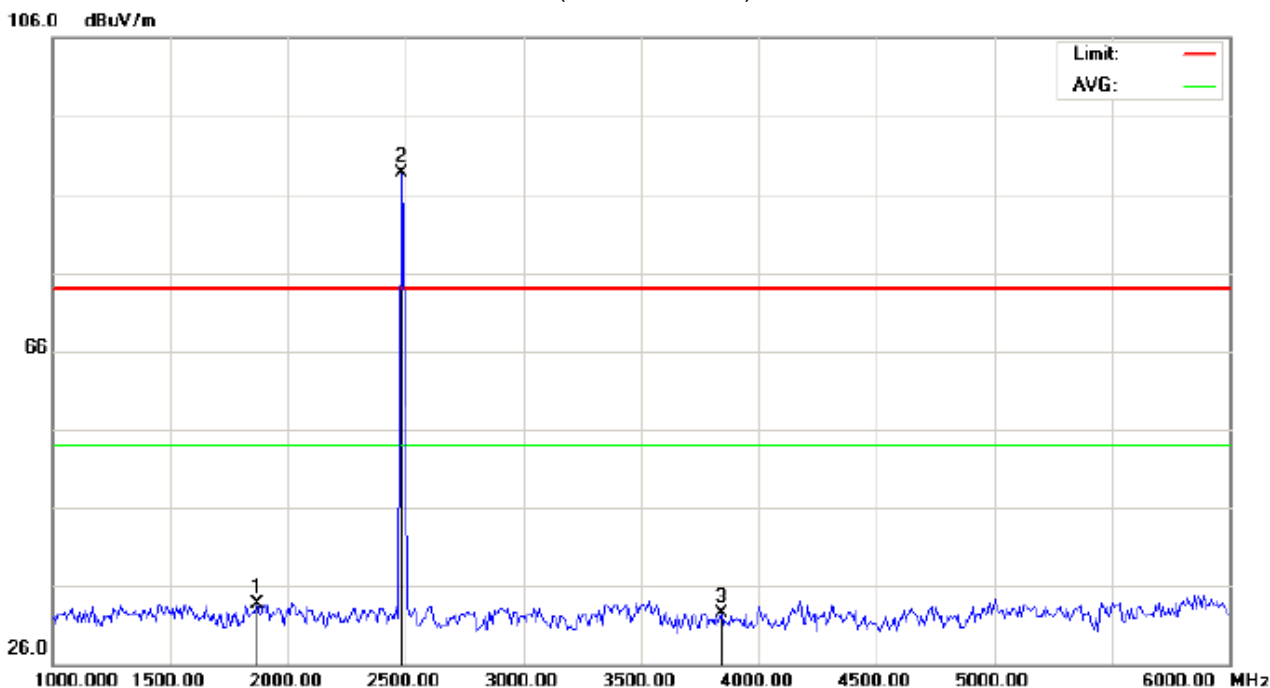
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1683.333	44.64	-13.45	31.19	74.00	-42.81	peak			
2	*	2480.000	98.67	-9.59	89.08	74.00	15.08	peak			
3		4175.000	36.49	-4.21	32.28	74.00	-41.72	peak			

RESULT: PASS



RADIATED EMISSION TEST-(ABOVE 1GHZ)-HIGH CHANNEL-VERTICAL



Site: site #1

Polarization: **Vertical**

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: High Channel TX

Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1866.667	45.29	-11.52	33.77	74.00	-40.23	peak			
2	*	2480.000	98.38	-9.59	88.79	74.00	14.79	peak			
3		3841.667	38.33	-5.79	32.54	74.00	-41.46	peak			

RESULT: PASS**Note:** 6~25GHz at least have 20dB margin. No recording in the test report.

Factor=Antenna Factor+ Cable loss-Amplifier gain,

Margin=Measurement-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

8. BAND EDGE EMISSION

8.1. MEASUREMENT PROCEDURE

1) Radiated restricted band edge measurements

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting

2) Conducted Emissions at the band edge

a) The transmitter output was connected to the spectrum analyzer

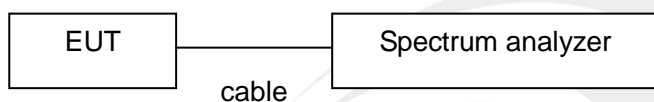
b) Set RBW=100kHz, VBW=300kHz

c) Suitable frequency span including 100kHz bandwidth from band edge

8.2. TEST SET-UP

Radiated same as 6.2

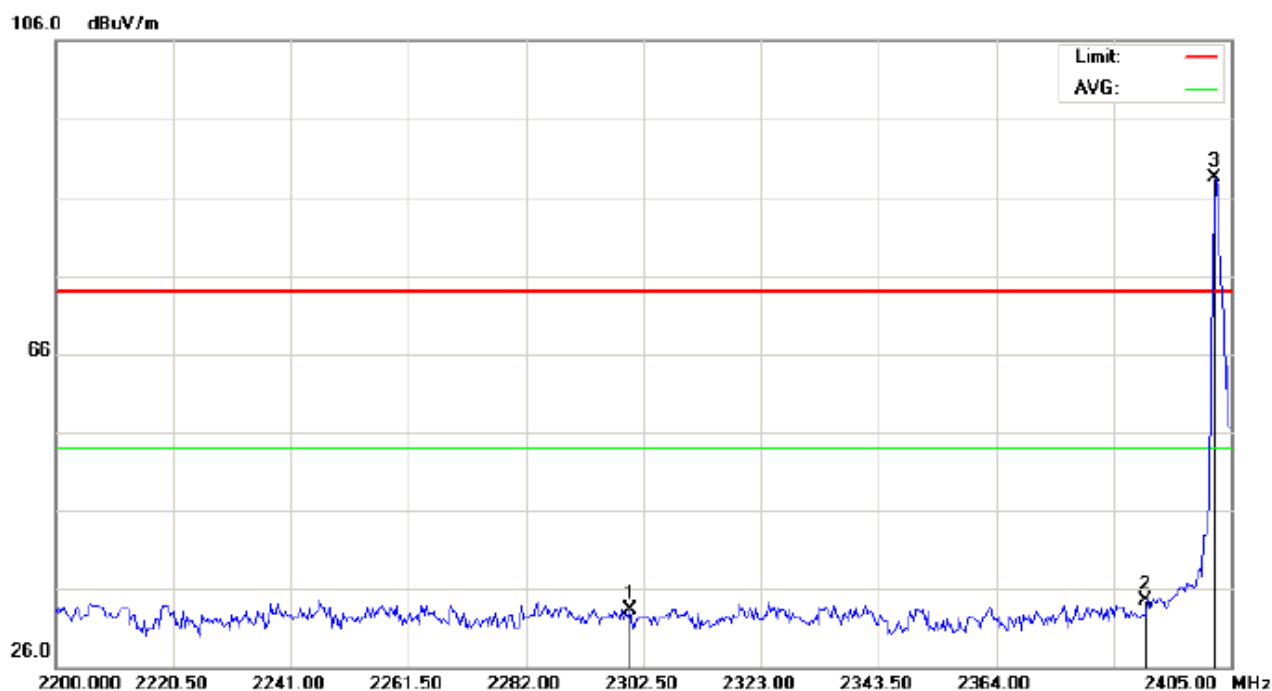
Conducted set up





8.3. Radiated Test Result

TEST PLOT OF BAND EDGE FOR LOW CHANNEL -Horizontal



Site: site #1

Polarization: *Horizontal*

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

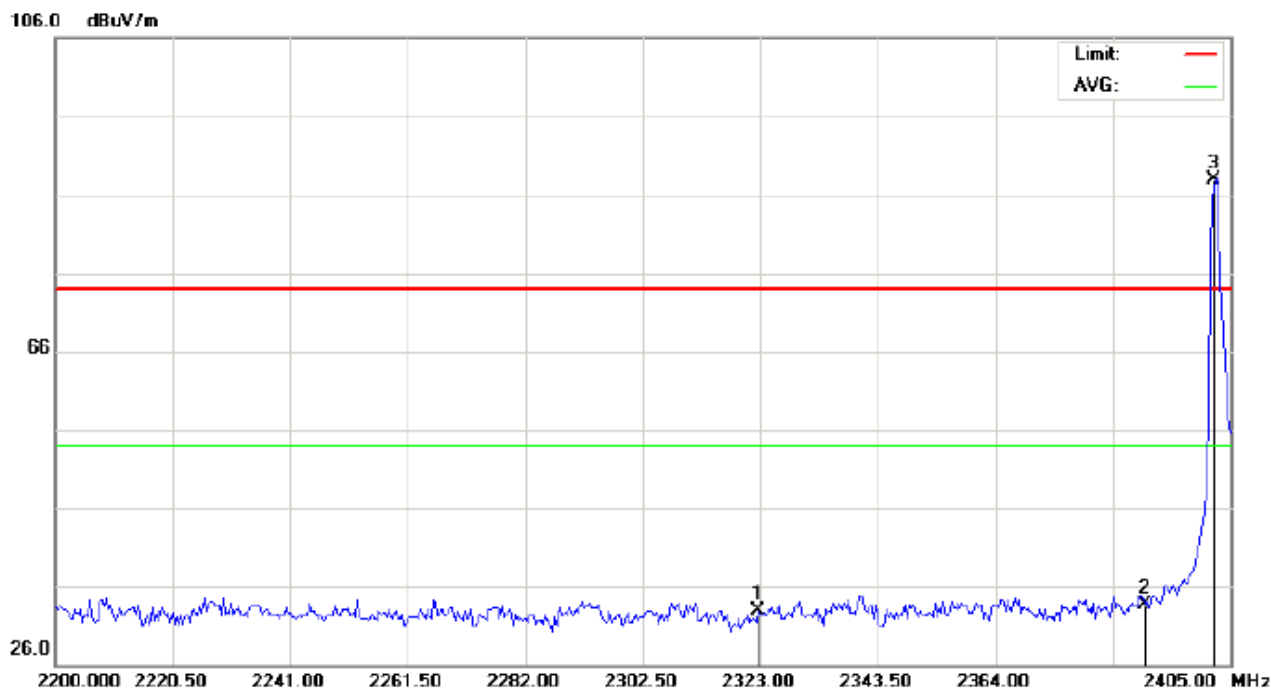
Mode: Low Channel TX

Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2300.108	43.09	-9.79	33.30	74.00	-40.70	peak			
2		2390.000	44.21	-9.69	34.52	74.00	-39.48	peak			
3	*	2402.000	98.24	-9.68	88.56	74.00	14.56	peak			



TEST PLOT OF BAND EDGE FOR LOW CHANNEL - Vertical



Site: site #1

Polarization: **Vertical**

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: Low Channel TX

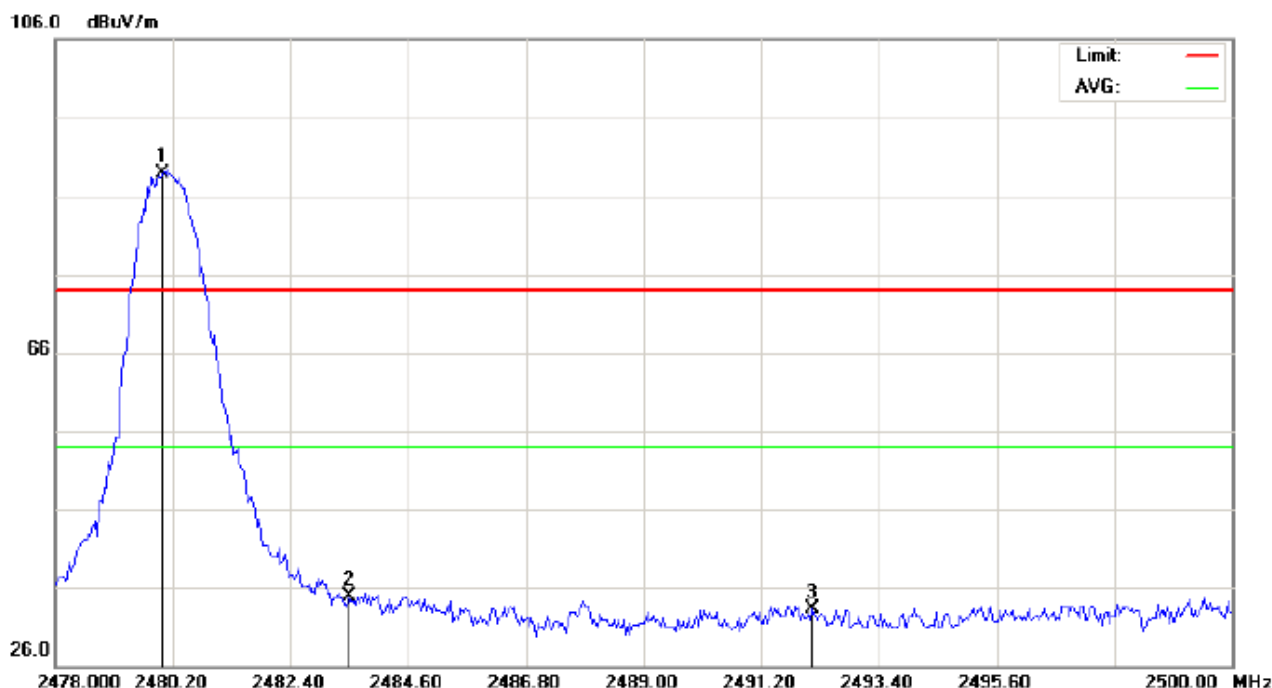
Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2322.658	42.75	-9.76	32.99	74.00	-41.01	peak			
2		2390.000	43.34	-9.69	33.65	74.00	-40.35	peak			
3	*	2402.000	97.49	-9.68	87.81	74.00	13.81	peak			

RESULT: PASS



TEST PLOT OF BAND EDGE FOR HIGH CHANNEL –Horizontal



Site: site #1

Polarization: *Horizontal*

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

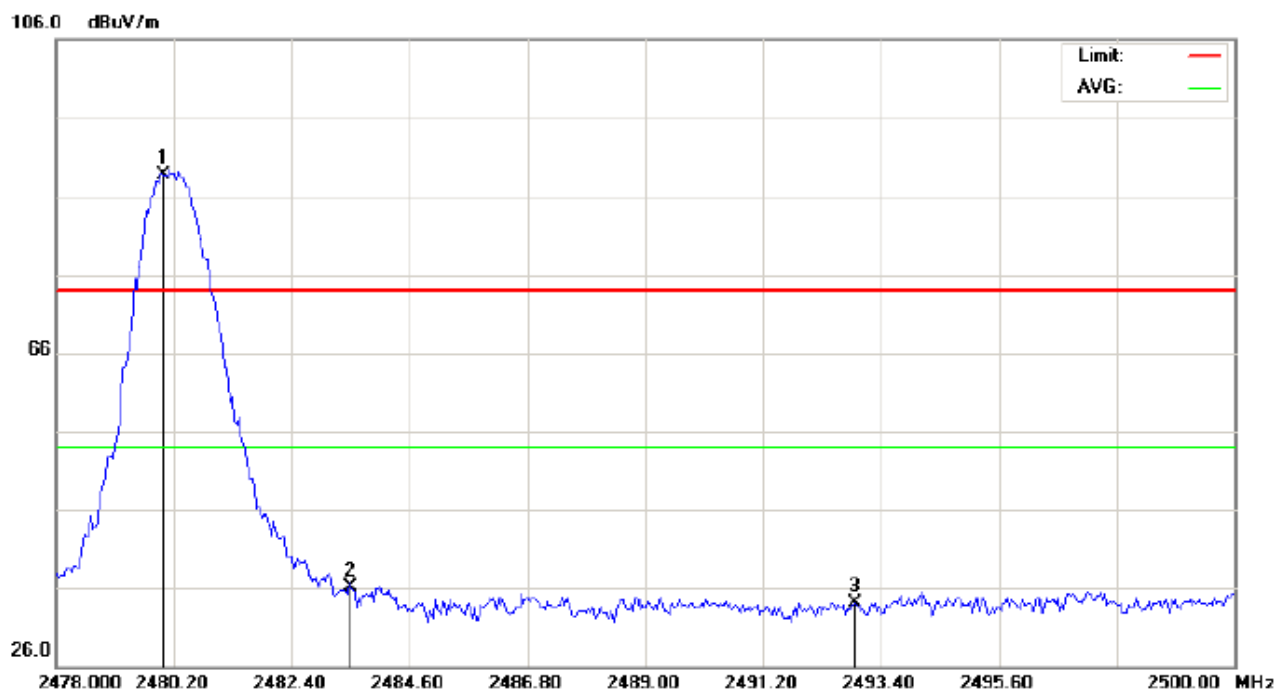
Mode: High Channel TX

Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	98.46	-9.59	88.87	74.00	14.87	peak			
2		2483.500	44.56	-9.59	34.97	74.00	-39.03	peak			
3		2492.153	42.88	-9.58	33.30	74.00	-40.70	peak			



TEST PLOT OF BAND EDGE FOR HIGH CHANNEL -Vertical



Site: site #1

Polarization: **Vertical**

Temperature: 26

Limit: FCC Class B 3M Radiation above 1GHZ(PK)

Power:

Humidity: 60 %

EUT: THUNDER PLUS

Distance:

M/N: DP5108

Mode: High Channel TX

Note:

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	98.26	-9.59	88.67	74.00	14.67	peak			
2		2483.500	45.62	-9.59	36.03	74.00	-37.97	peak			
3		2492.923	43.73	-9.58	34.15	74.00	-39.85	peak			

RESULT: PASS**Note:** The other modes radiation emission have enough 20dB margin.

Factor=Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

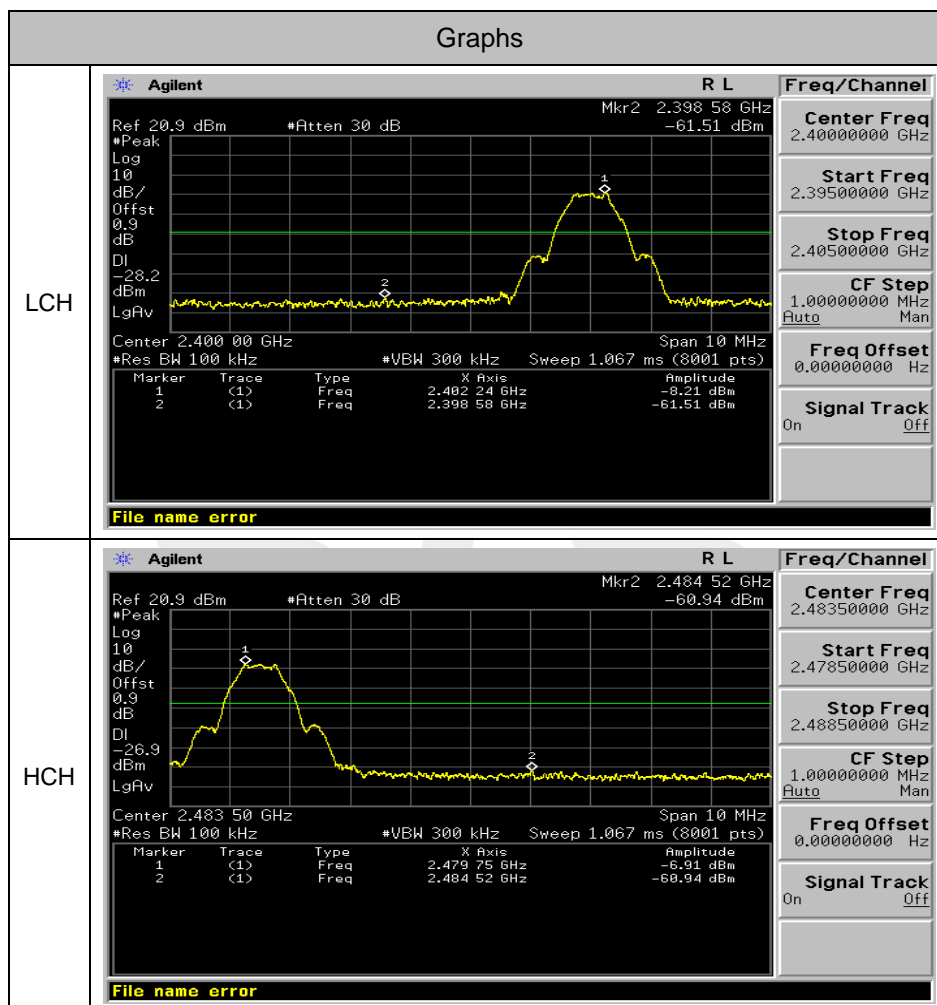
The "Factor" value can be calculated automatically by software of measurement system.



8.4. Conducted Test Result

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
BLE	LCH	-8.21	-61.511	-28.21	PASS
BLE	HCH	-6.91	-60.942	-26.91	PASS

Test Graph





9. 6DB BANDWIDTH

9.1. TEST EQUIPMENT LIST AND DETAILS

Equipment	Manufacturer	Model	Cal. Date	Cal. Due
PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	02/17/2014	02/16/2015
WIDEBAND REQUENCY ANTENNA	SCHWARZBECK	VULB9168	08/16/2014	08/15/2015

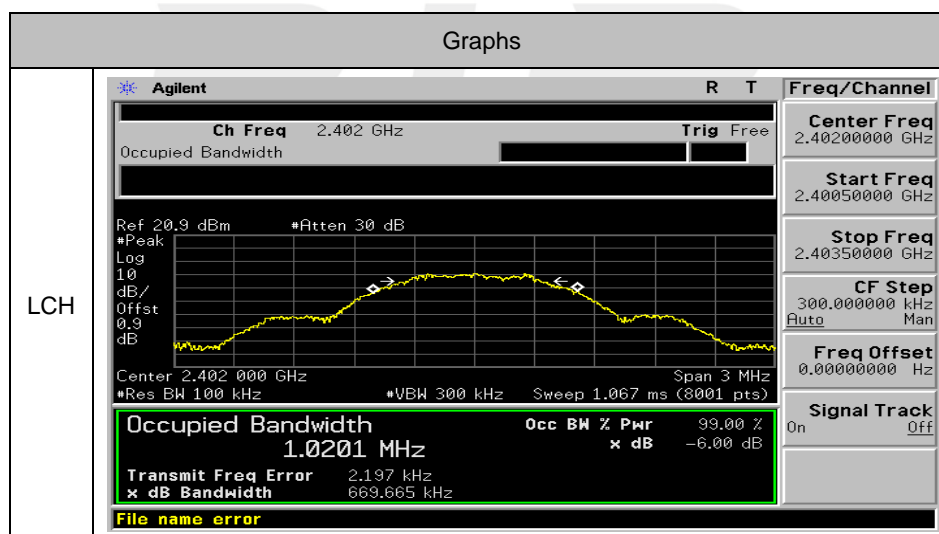
9.2. TEST PROCEDURE

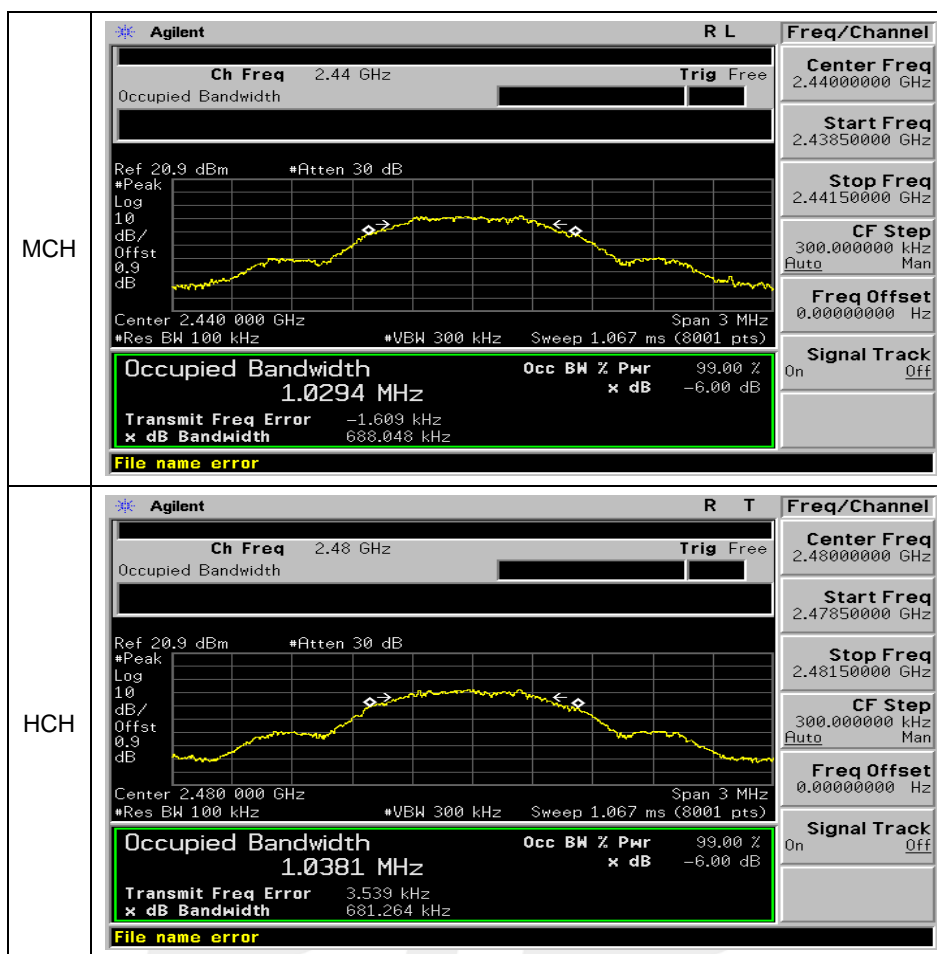
1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW \geq RBW.
4. Set SPA Trace 1 Max hold, then View.

9.3. SUMMARY OF TEST RESULTS/PLOTS

Mode	Channel	6dB Bandwidth [MHz]	OBW[MHz]	Verdict
BLE	LCH	0.6697	1.0201	PASS
BLE	MCH	0.6880	1.0294	PASS
BLE	HCH	0.6813	1.0381	PASS

Test Graph





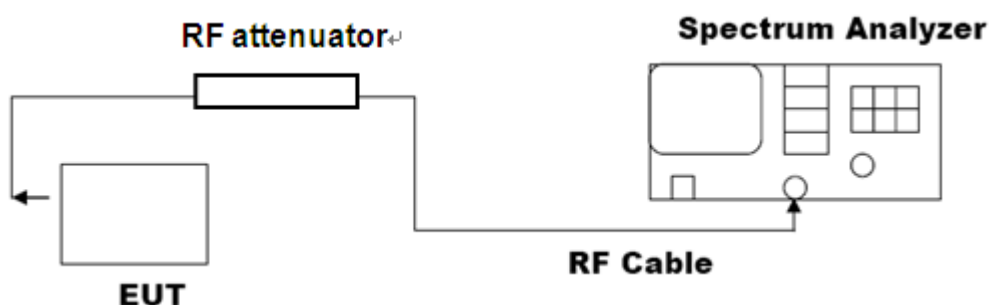
10. CONDUCTED OUTPUT POWER

10.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, middle and the bottom operation frequency individually.
3. Use the following spectrum analyzer settings:
Set the RBW \geq DTS bandwidth
Set the VBW \geq 3 x RBW
Set the span \geq 3 x RBW
Detector = peak
Sweep time = auto couple
Trace mode = max hold
4. Allow the trace to stabilize. Use peak marker function to determine the peak amplitude level
5. Record the result form the Spectrum Analyzer.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

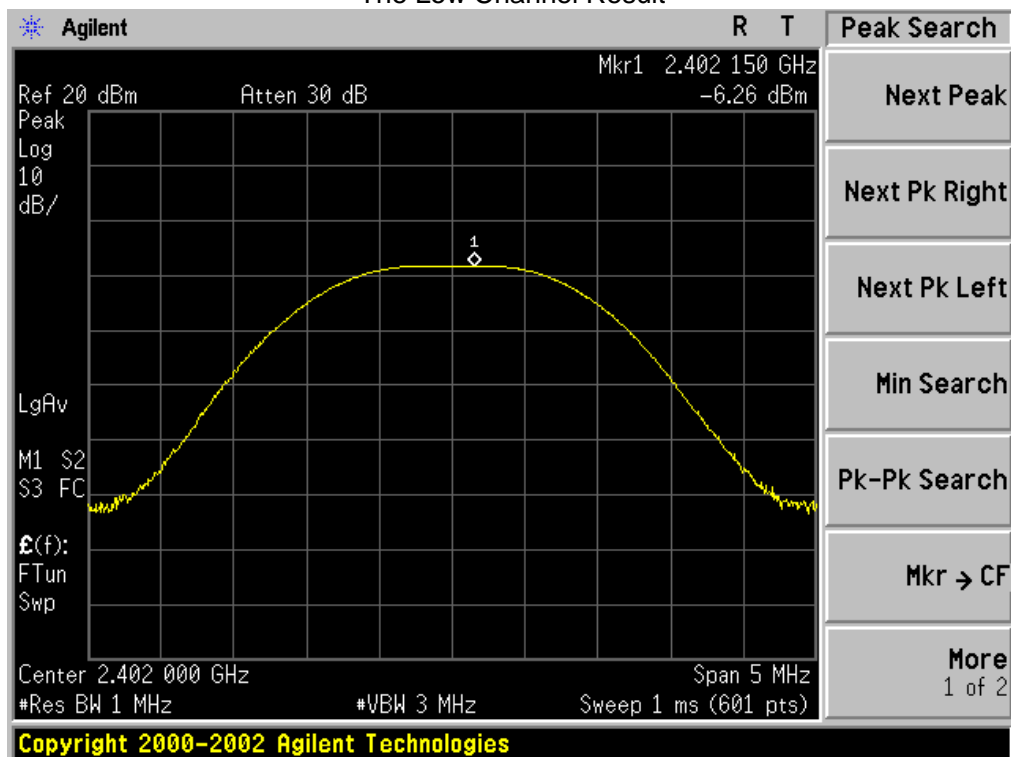


10.3. LIMITS AND MEASUREMENT RESULT

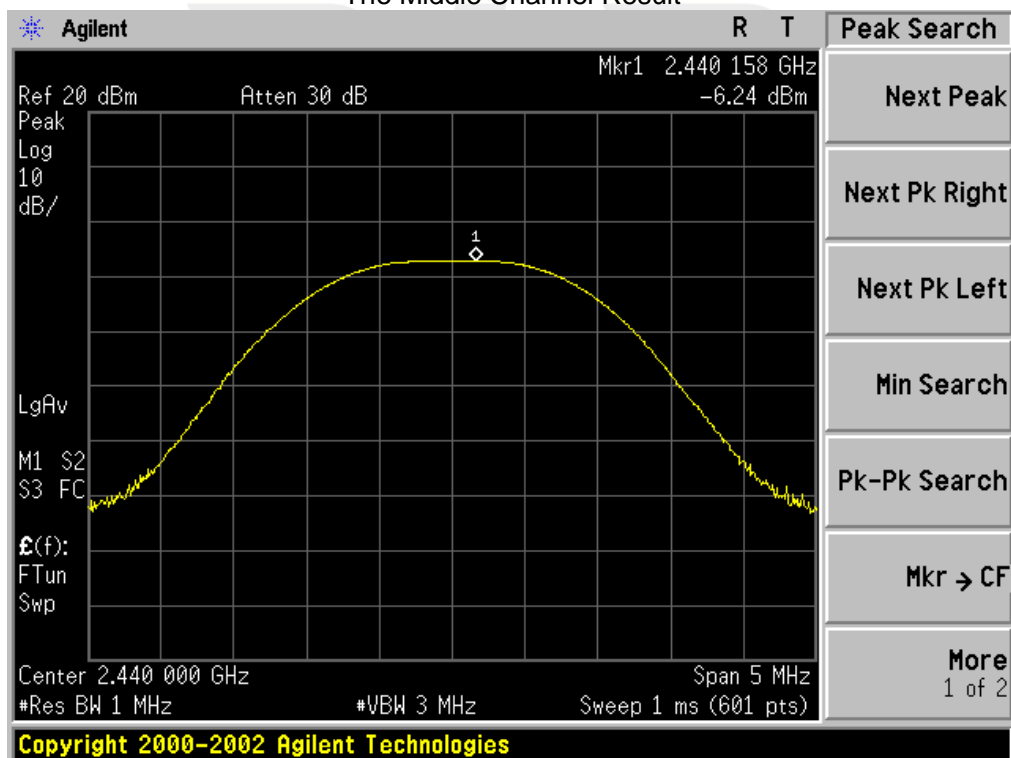
Channel	Peak Power (dBm)	Applicable Limits (dBm)	Pass/Fail
Low Channel	-6.26	30	Pass
Middle Channel	-6.24	30	Pass
High Channel	-6.92	30	Pass



The Low Channel Result

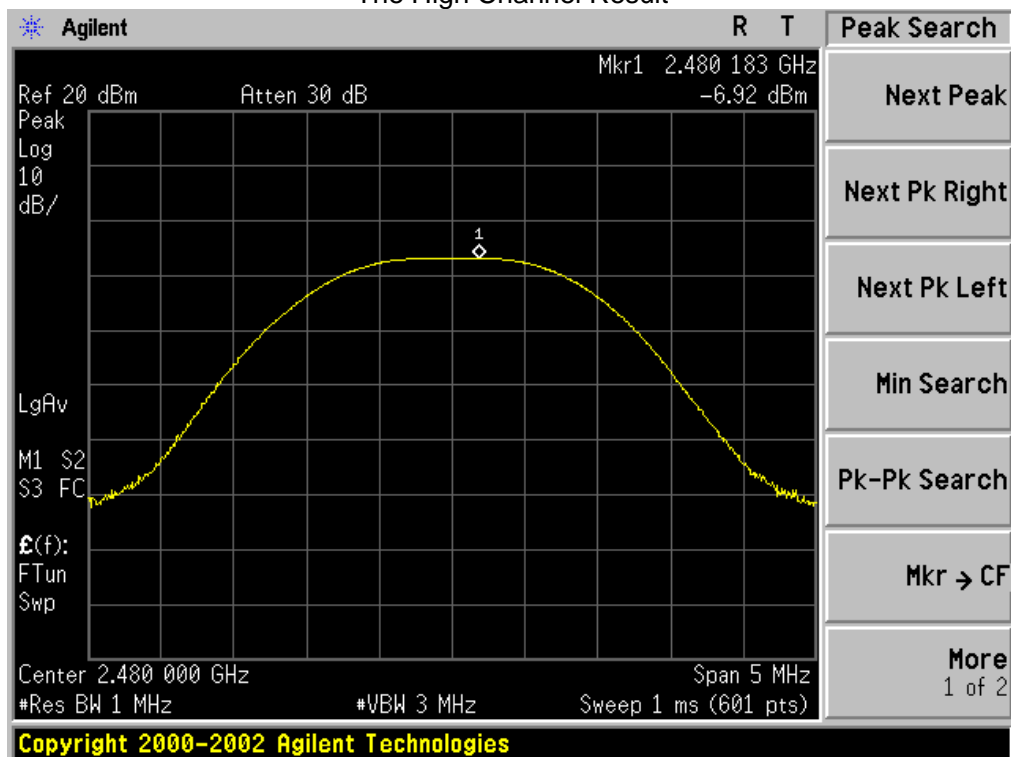


The Middle Channel Result





The High Channel Result



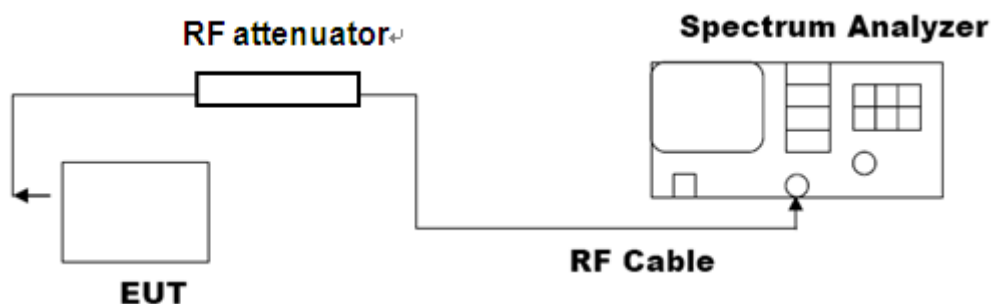
11. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

11.1 MEASUREMENT PROCEDURE

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

11.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



11.3 MEASUREMENT EQUIPMENT USED

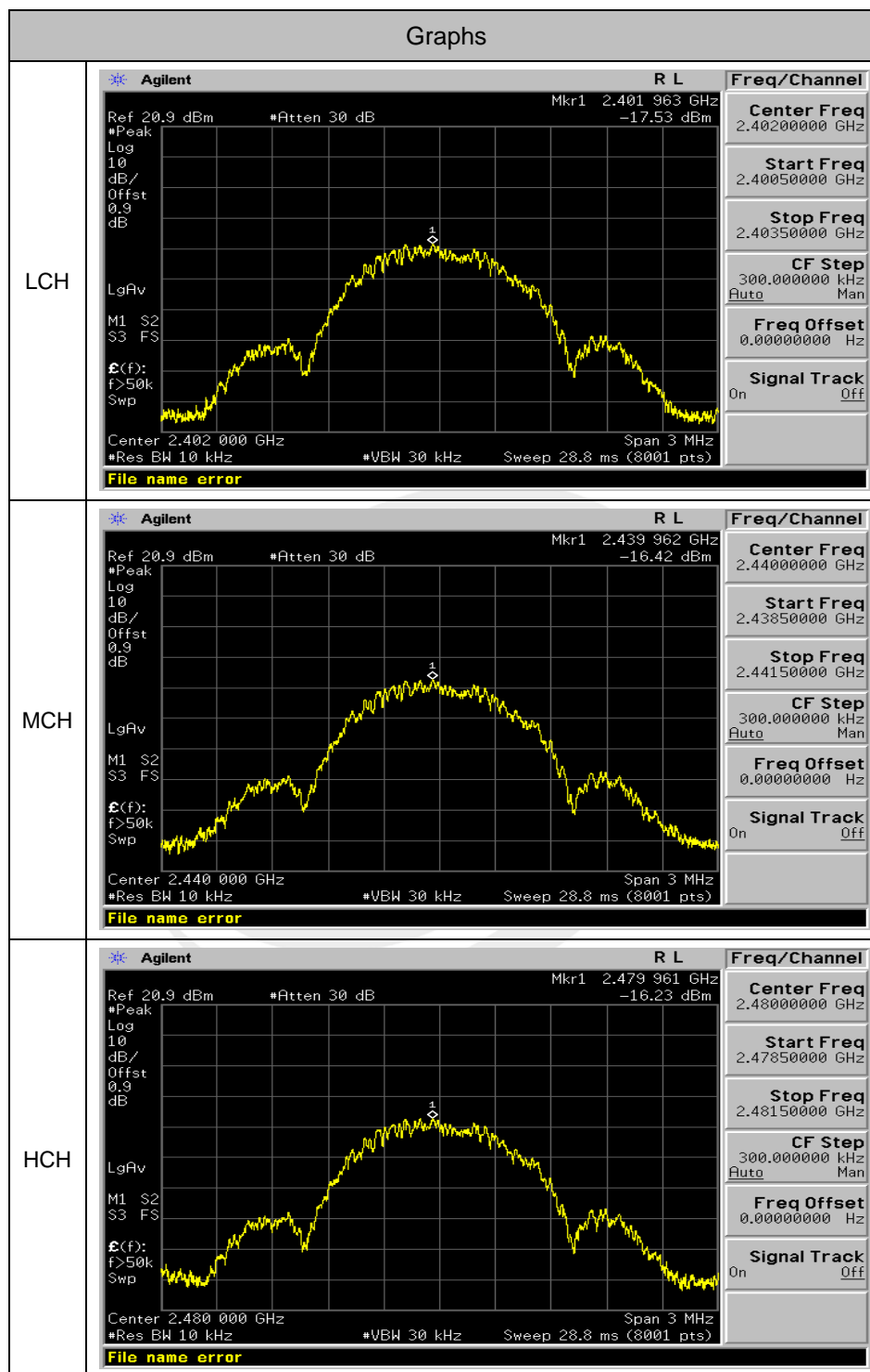
Equipment	Manufacturer	Model	Cal. Date	Cal. Due
PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	02/17/2014	02/16/2015
WIDEBAND REQUENCY ANTENNA	SCHWARZBECK	VULB9168	08/16/2014	08/15/2015

11.4 LIMITS AND MEASUREMENT RESULT

Mode	Channel	PSD [dBm]	Limit(dBm)	Verdict
BLE	LCH	-17.53	8	PASS
BLE	MCH	-16.42	8	PASS
BLE	HCH	-16.23	8	PASS



Test Graph



12. FCC LINE CONDUCTED EMISSION TEST

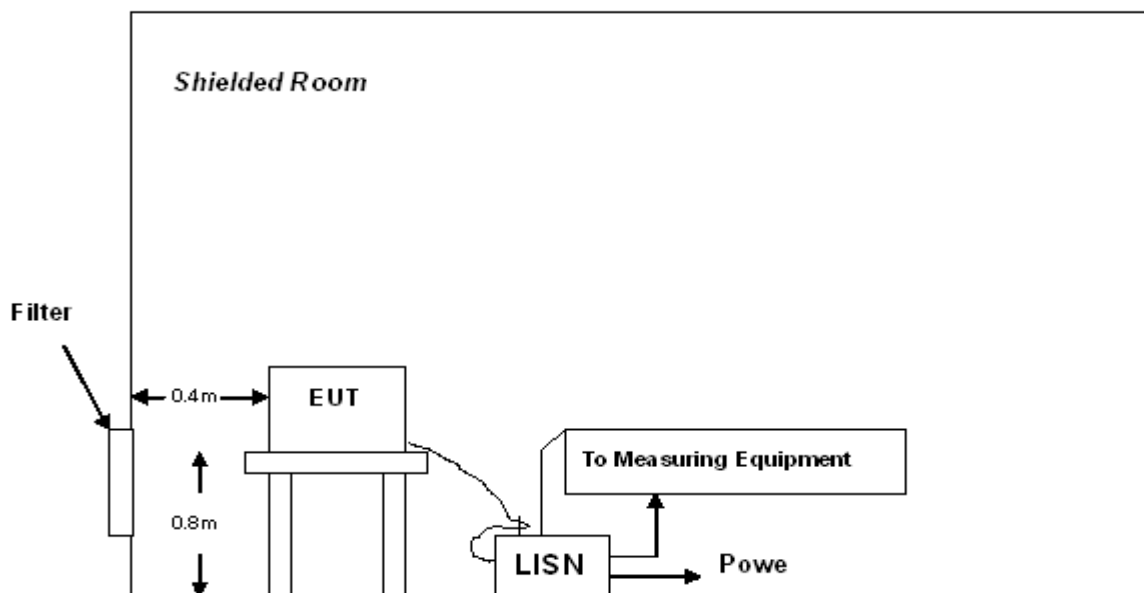
12.1 LIMITS

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

****Note:** 1. The lower limit shall apply at the transition frequency.

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz

12.2 TEST SETUP



A: Powered through filter



12.3 PRELIMINARY PROCEDURE

- 1) The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- 2) Support equipment, if needed, was placed as per ANSI C63.4.
- 3) All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
- 4) All support equipments received AC120V/60Hz power from a LISN, if any.
- 5) The EUT received power by adapter which received power by a LISN.
- 6) The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7) Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
- 8) During the above scans, the emissions were maximized by cable manipulation.
- 9) The following test mode(s) were scanned during the preliminary test.
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

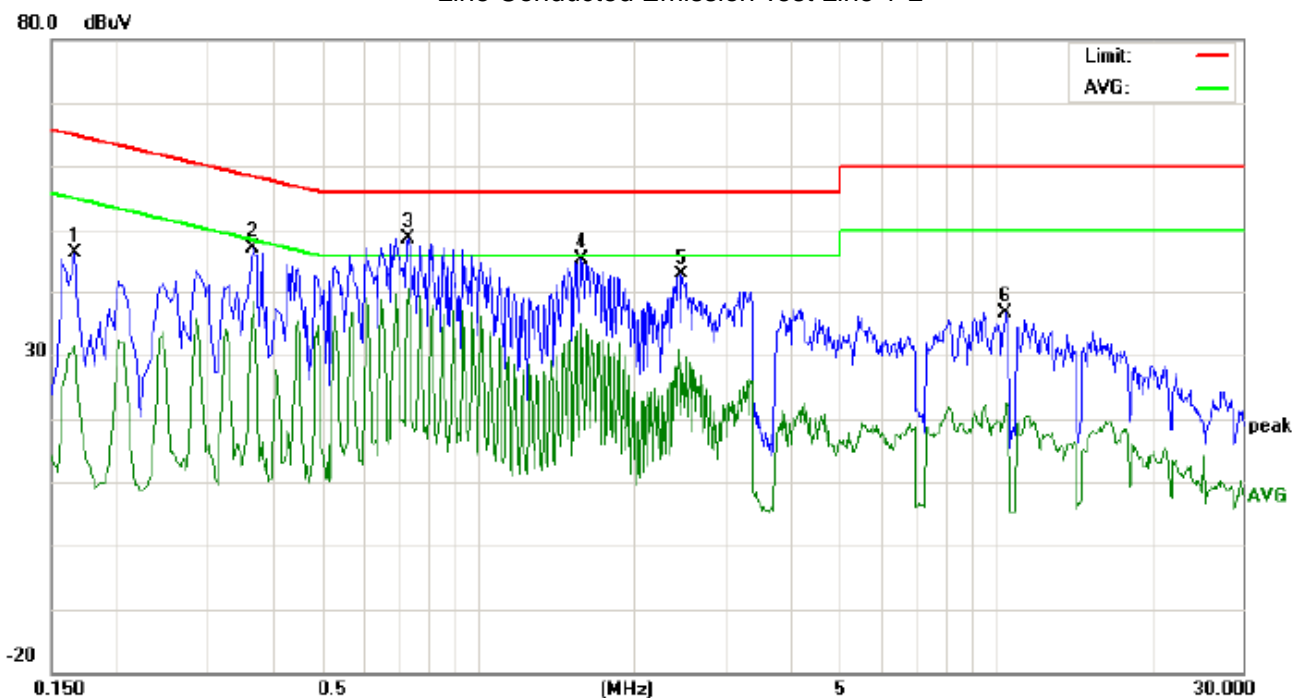
12.4 FINAL TEST PROCEDURE

- 10) EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
- 11) 2) A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
- 12) 3) The test data of the worst case condition(s) was reported on the Summary Data page.



12.5 TEST RESULT OF POWER LINE

Line Conducted Emission Test Line 1-L



Site: Conduction

Phase: L1

Temperature: 26

Limit: FCC Class B Conduction(QP)

Power: AC 120V/60Hz

Humidity: 60 %

EUT: THUNDER PLUS

M/N: DP5108

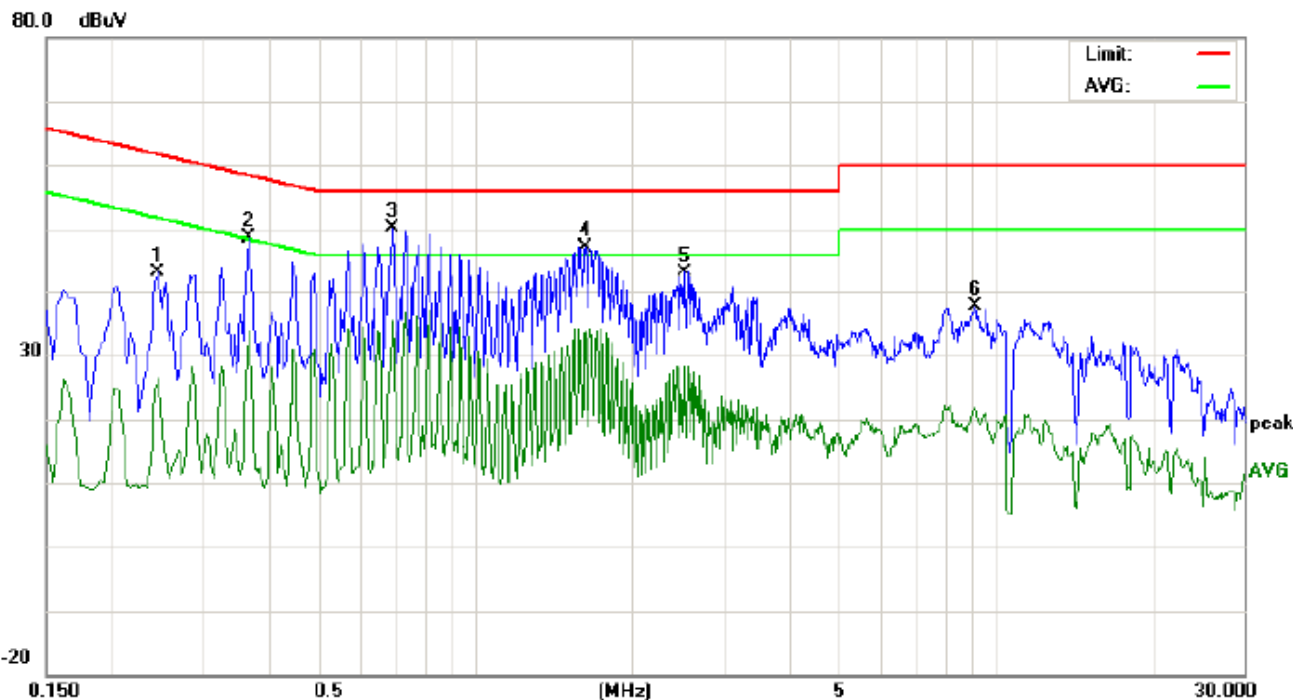
Mode: Normal Operating(BT)

Note:

No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG		Peak	QP	AVG	QP	AVG	QP	AVG		
1	0.1660	36.23		21.08	10.18	46.41		31.26	65.15	55.15	-18.74	-23.89	P	
2	0.3660	36.81		27.96	10.32	47.13		38.28	58.59	48.59	-11.46	-10.31	P	
3	0.7340	38.22		29.98	10.33	48.55		40.31	56.00	46.00	-7.45	-5.69	P	
4	1.5859	35.03		24.49	10.35	45.38		34.84	56.00	46.00	-10.62	-11.16	P	
5	2.4820	32.55		18.33	10.42	42.97		28.75	56.00	46.00	-13.03	-17.25	P	
6	10.4620	26.59		12.39	10.09	36.68		22.48	60.00	50.00	-23.32	-27.52	P	



Line Conducted Emission Test Line 1-N



Site: Conduction

Phase: **N**

Temperature: 26

Limit: FCC Class B Conduction(QP)

Power: AC 120V/60Hz

Humidity: 60 %

EUT: THUNDER PLUS

M/N: DP5108

Mode: Normal Operating(BT)

Note:

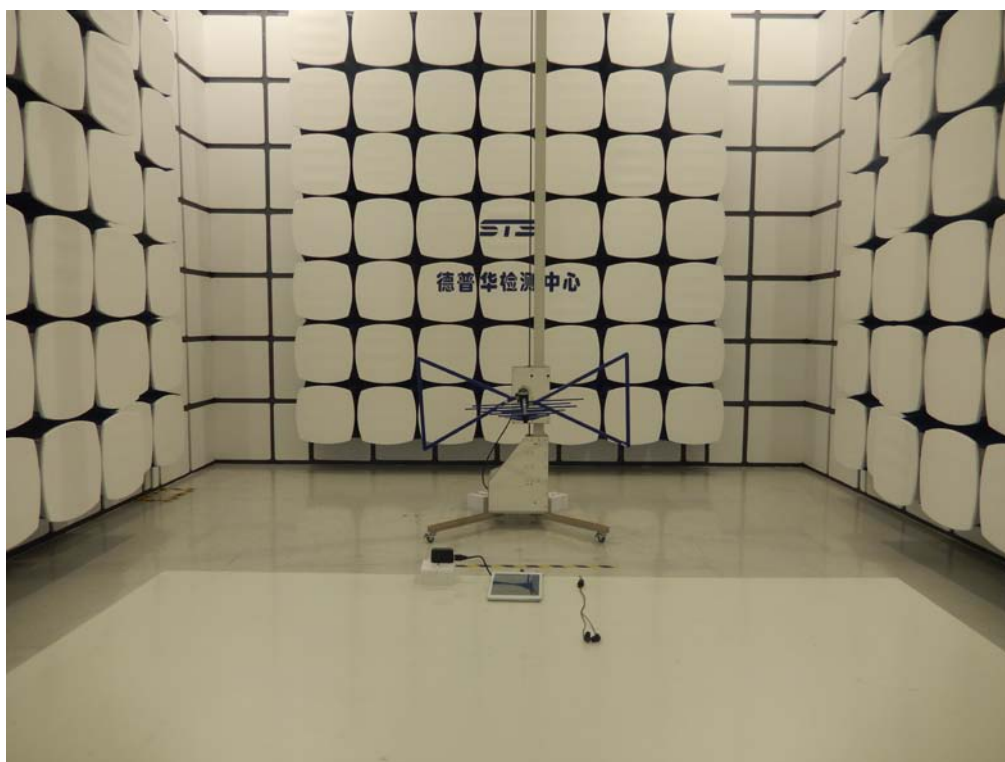
No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor dB	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG		Peak	QP	AVG	QP	AVG	QP	AVG		
1	0.2460	32.83		16.05	10.27	43.10		26.32	61.89	51.89	-18.79	-25.57	P	
2	0.3660	38.27		23.55	10.32	48.59		33.87	58.59	48.59	-10.00	-14.72	P	
3	0.6940	39.68		24.94	10.35	50.03		35.29	56.00	46.00	-5.97	-10.71	P	
4	1.6300	36.90		23.31	10.34	47.24		33.65	56.00	46.00	-8.76	-12.35	P	
5	2.5260	32.68		17.94	10.44	43.12		28.38	56.00	46.00	-12.88	-17.62	P	
6	9.1260	27.29		11.25	10.25	37.54		21.50	60.00	50.00	-22.46	-28.50	P	

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

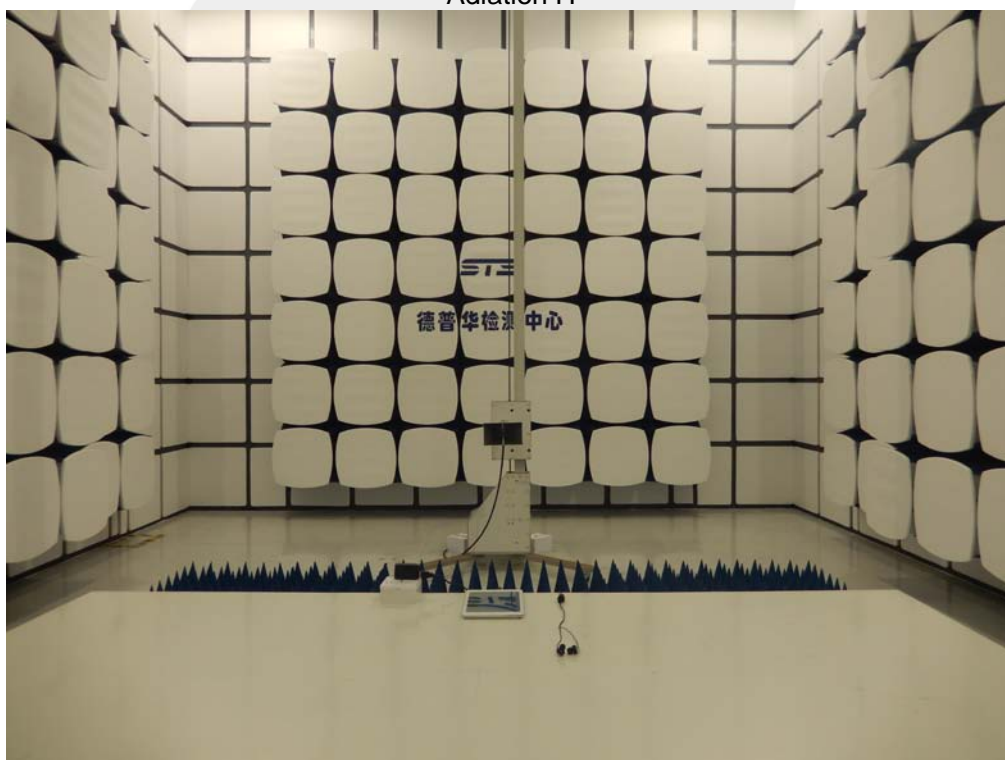
FCC LINE CONDUCTED EMISSION TEST SETUP



FCC RADIATED EMISSION TEST SETUP
radiation L



Adiation H



APPENDIX B: PHOTOGRAPHS OF EUT

TOTAL VIEW OF EUT



TOP VIEW OF EUT



BOTTOM VIEW OF EUT



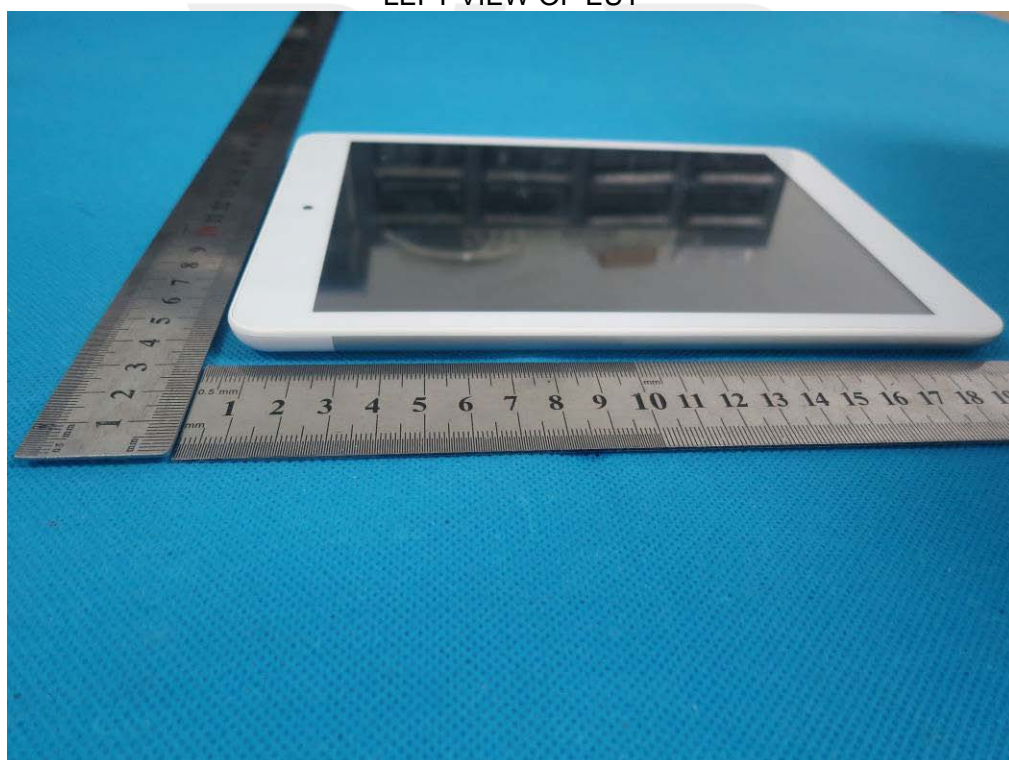
FRONT VIEW OF EUT



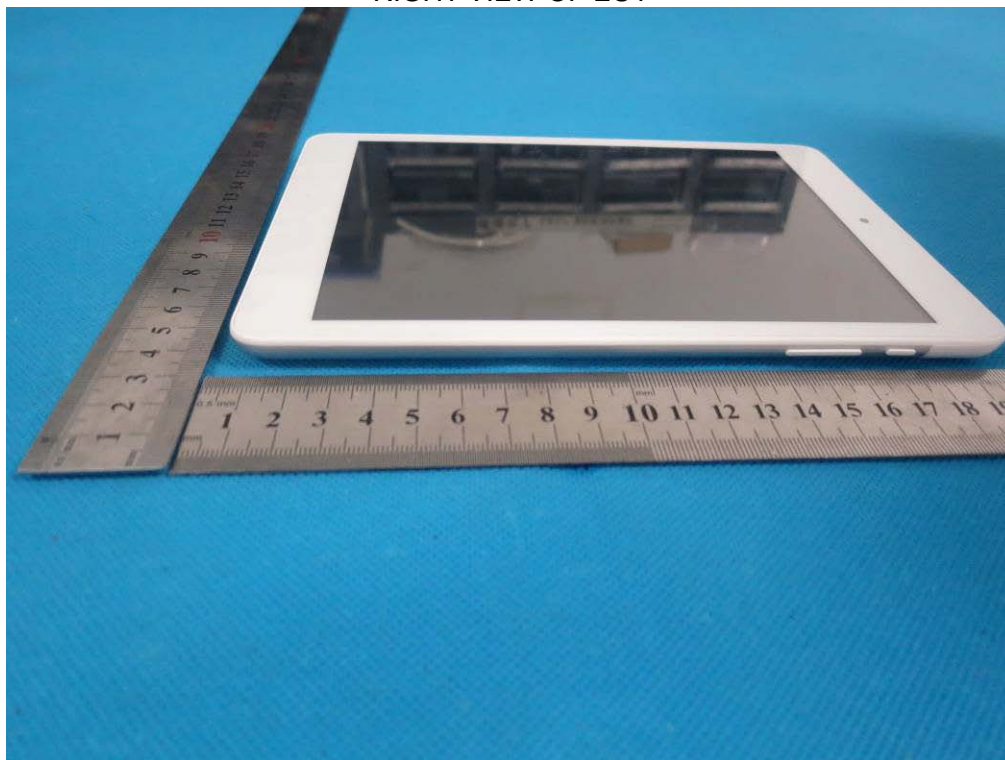
BACK VIEW OF EUT



LEFT VIEW OF EUT

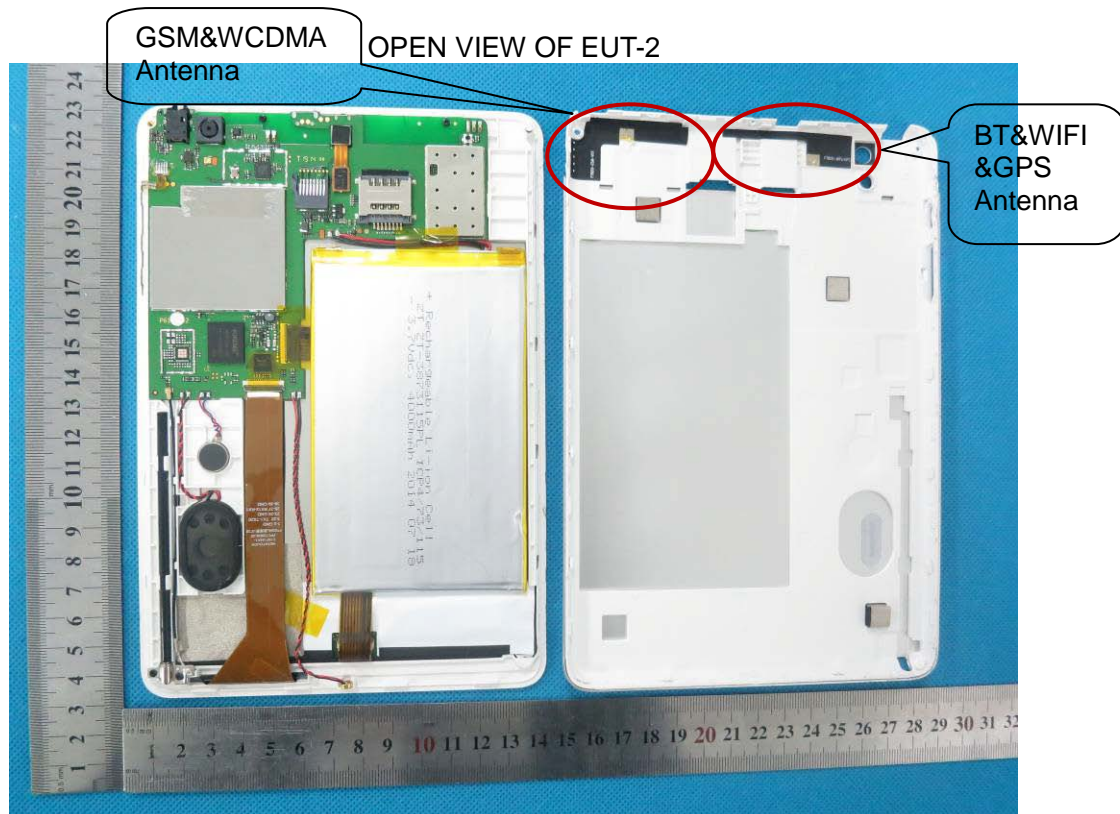


RIGHT VIEW OF EUT

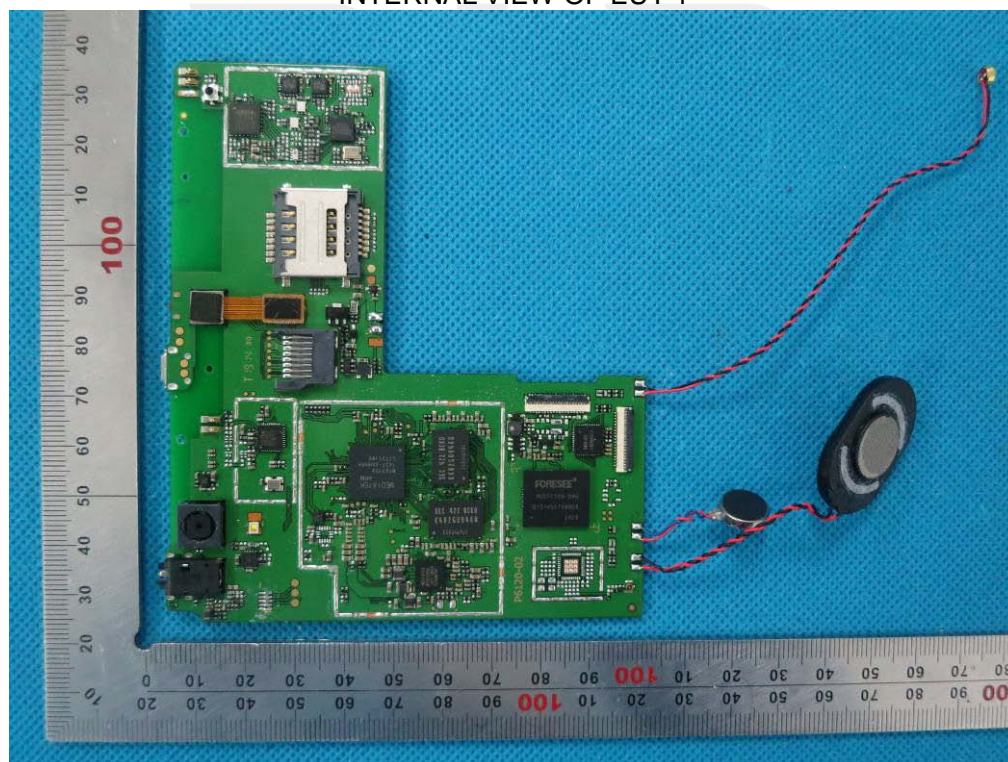


OPEN VIEW OF EUT-1

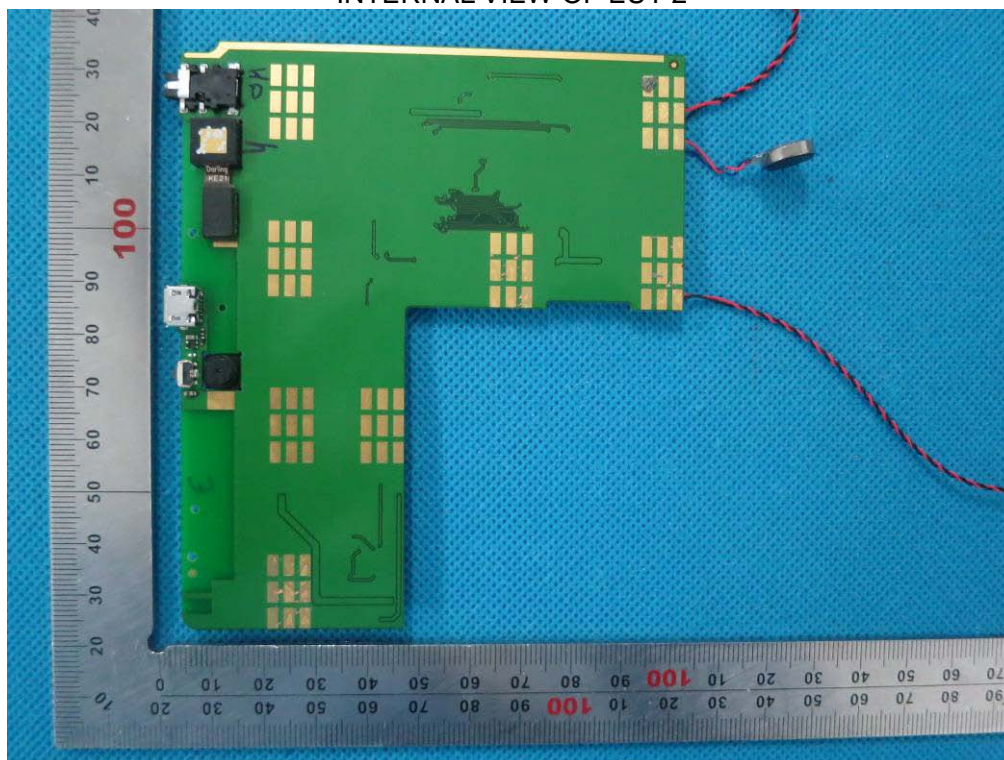




INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



----END OF REPORT----