



Test Report No.:  
**FCCSZ2023-0011-RF3**

## RF Test Report

**FCC ID** : O3Q10-8231  
**EUT** : Smart PDM assembly  
**MODEL** : 10-8231  
**BRAND NAME** : N/A  
**APPLICANT** : THERMASOL STEAMBATH CO.  
**Classification Of Test** : N/A

**CVC Testing Technology (Shenzhen) Co., Ltd.**



<b>Applicant</b>		Name: THERMASOL STEAMBATH CO. Address: 1958 STEAM WAY ROUND ROCK, TX 78665 USA	
<b>Manufacturer</b>		Name: Chengdu Vantron Technology Co., Ltd. Address: No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, P.R. China	
<b>Equipment Under Test</b>		Product Name: Smart PDM assembly Model/Type: 10-8231 Brand Name: N/A Serial NO.: N/A Sample NO.: 2-1	
Date of Receipt.	2023.10.05	Date of Testing	2023.10.05~2023.11.02
Test Specification		Test Result	
FCC Part 15, Subpart C, Section 15.247		PASS	
<b>Evaluation of Test Result</b>		The equipment under test was found to comply with the requirements of the standards applied.	
		Seal of CVC Issue Date: 2023.11.06	
Tested by:  <u>Liang Jiatong</u>  Name <u>Liang Jiatong</u> Signature	Tested by:  <u>Huang Meng</u>  Name <u>Huang Meng</u> Signature	Approved by:  <u>Dong Sanbi</u>  Name <u>Dong Sanbi</u> Signature	
<b>Other Aspects: NONE.</b>			
Abbreviations: OK, Pass = passed		Fail = failed N/A = not applicable EUT = equipment, sample(s) under tested	

This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC.



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**RELEASE CONTROL RECORD**

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCCSZ2023-0011-RF3	Original release	2023.11.06

## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REPORT SECTION
FCC 15.207	AC Power Conducted Emission	PASS	See section 3.1
--	Occupied Bandwidth Measurement	PASS	Appendix B of FCCSZ2023-0011-RF3-A1
FCC 15.247(a)(1)	Number of Hopping Frequency Used	PASS	Appendix F of FCCSZ2023-0011-RF3-A1
FCC 15.247(a)(1)	Hopping Channel Separation	PASS	Appendix D of FCCSZ2023-0011-RF3-A1
FCC 15.247(a)(1)	Dell Time of Each Channel	PASS	Appendix E of FCCSZ2023-0011-RF3-A1
FCC 15.247(a)(1)	20dB EMISSION BANDWIDTH	PASS	Appendix A of FCCSZ2023-0011-RF3-A1
FCC 15.247(b)	Conducted Output Power	PASS	Appendix C of FCCSZ2023-0011-RF3-A1
FCC 15.247(d), FCC 15.209, FCC 15.205	Radiated Emissions	PASS	See section 3.2
FCC 15.247(d)	Out of band Emission Measurement	PASS	Appendix G&H of FCCSZ2023-0011-RF3-A1
FCC 15.203 FCC 15.247(b)	Antenna Requirement	PASS	See section 3.10



## 1.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial Number	Cal. interval	Cal. Due
WIFI & Bluetooth Test System					/
Signal&Spectrum Analyzer	Rohde&Schwarz	FSV 30	104408	1 year	2024.5.21
#3Shielding room	MORI	443	N/A	3 year	2026.5.16
Wideband radio communication tester	Rohde&Schwarz	CMW 500	168778	1 year	2024.5.25
Analog signal Generator (100kHz ~ 40GHz)	Rohde&Schwarz	SMB 100A	181934	1 year	2024.5.21
Vector signal Generator (9kHz ~ 6GHz)	Keysight	N5182B	MY57301451	1 year	2024.4.25
Vector signal Generator (9kHz ~ 6GHz)	Rohde&Schwarz	SGT 100A	111724	1 year	2024.5.21
RF control unit(BT/WiFi)	Tonscend	JS0806-2-8CH	20E8060261	1 year	2024.5.21
Radiation Spurious(Above 1GHz)					/
Signal&Spectrum Analyzer	Rohde&Schwarz	FSV 40	101898	1 year	2024.5.21
EMI Test Receiver	Rohde&Schwarz	ESR3	102693	1 year	2024.5.25
Antenna(30MHz~1001MHz)	SCHWARZBECK	VULB 9168	1133	1 year	2024.2.21
Horn antenna(1GHz-18GHz)	ETS	3117	227611	1 year	2024.3.25
Horn antenna(18GHz-40GHz)	QMS	QMS-00880	22051	1 year	2024.3.25
3m anechoic chamber	MORI	966	CS0300011	3 year	2026.5.18
Filter group(RSE-BT/WiFi)	Rohde&Schwarz	WiFi /BT Variant 1	100820	1 year	2024.5.21
Filter group(RSE-Cellular)	Rohde&Schwarz	Cellular Variant 1	100768	1 year	2024.5.21
Preamplifier(10kHz-1GHz)	Rohde&Schwarz	SCU-01F	100299	1 year	2024.5.21
Preamplifier(1GHz-18GHz)	Rohde&Schwarz	SCU-18F	100799	1 year	2024.5.21
Preamplifier(1GHz-18GHz)	Rohde&Schwarz	SCU-18F	100801	1 year	2024.5.21
Preamplifier(18Gz-40GHz)	Rohde&Schwarz	SCU-40A	101209	1 year	2024.5.21
#2 control room	MORI	433	CS0300028	3 year	2024.5.21
Temperature and humidity meter	/	C193561517	C193561517	1 year	2024.5.21
Radiation Spurious(Below 1GHz)					/
EMI Test Receiver	Rohde&Schwarz	ESR 26	101718	1 year	2024.5.25
Loop antenna (8.3k~30MHz)	Rohde&Schwarz	HFH2-Z2E	100951	1 year	2024.5.26
Antenna(30MHz~1000MHz)	SCHWARZBECK	VULB 9168	1132	1 year	2024.2.14
3m anechoic chamber	MORI	966	CS0200019	3 year	2026.5.18
Attenuator	/	SJ-5dB	607684	1 year	2024.2.21
#1 control room	MORI	433	CS0300028	3 year	2026.5.16
Temperature and humidity meter	/	C193561473	CS0200071	1 year	2024.5.21
Conducted emission					/
EMI Test Receiver	Rohde&Schwarz	ESR3	102694	1 year	2024.5.25
limiter (10 dB)	Rohde&Schwarz	ESH3-Z2	102824	1 year	2024.5.16
Voltage probe	Rohde&Schwarz	CVP9222C	28	1 year	2024.5.16
Current probe	Rohde&Schwarz	EZ-17	101442	1 year	2024.5.21
ISN network	Rohde&Schwarz	ENV 81	100401	1 year	2024.5.16
ISN network	Rohde&Schwarz	ENV 81 Cat6	101896	1 year	2024.5.16
LISN (single-phase )	Rohde&Schwarz	ENV216	102569	1 year	2024.4.11
#1Shielding room	MORI	854	N/A	3 year	2026.5.16

## 1.2 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:

No.	Item	Measurement Uncertainty
1	Conducted emission test	+/-2.7 dB
2	Radiated emission 9kHz-30MHz	+/-5.6 dB
3	Radiated emission 30MHz-1GHz	+/-4.6 dB
4	Radiated emission 1GHz-18GHz	+/-4.4 dB
5	Radiated emission 18GHz-40GHz	+/-5.1 dB
6	Occupied Bandwidth	+/-1.86%

**Remark: 95% Confidence Levels, k=2.**

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

## 1.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab. of CVC Testing Technology (Shenzhen) Co., Ltd.

CABID:CN0137

Lab Address: No. 1301, Guanguang Road, Xinlan Community, Guanlan Street, Longhua District, Shenzhen City, Guangdong Province 518110 P.R.China

Post Code: 518110 Tel: 0755-23763060-8805

Fax: 0755-23763060 E-mail: sz-kf@cvc.org.cn

<http://www.cvc.org.cn>



## 2 GENERAL INFORMATION

### 2.1 GENERAL PRODUCT INFORMATION

PRODUCT	Smart PDM assembly
BRAND	N/A
TEST MODEL	10-8231
ADDITIONAL MODEL	N/A
POWER SUPPLY	DC 24V host unit
MODULATION TYPE	GFSK, $\pi/4$ DQPSK, 8DPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
PEAK OUTPUT POWER	6.04dBm (Max. Measured)
ANTENNA TYPE (Remark 5)	External antenna with gain 2.75dBi
FIX FREQUENCY SOFTWARE	adb
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

Note:

1. For 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. EUT photo refer to the report (Report NO.: FCCSZ2023-0011-E).
4. Since the above data and/or information is provided by the client, CVC is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.
5. The EUT have SISO function, provides 1 completed transmitter and 1 receiver.



## 2.2 OTHER INFORMATION

Operation frequency each of channel.

Operation Frequency Each of Channel							
For BT (GFSK, $\pi/4$ DQPSK, 8 DPSK)							
CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	<b>2402</b>	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	<b>78</b>	<b>2480</b>
19	2421	<b>39</b>	<b>2441</b>	59	2461		

1. The channels which were indicated in bold type of the above channel list were selected as representative test channel. Therefore only the data of the test channels were recorded in this report.

For BT (GFSK, $\pi/4$ DQPSK, 8 DPSK)					
DH5		2DH5		3DH5	
CHANNEL	POWER SETTING	CHANNEL	POWER SETTING	CHANNEL	POWER SETTING
0	9	0	---	0	9
39	9	39	---	39	9
78	9	78	---	78	9

2. By means of test software which provided by manufacture, the power levels during the tests were set

## 2.3 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 xaxis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TEST ITEMS				DESCRIPTION
	RSE<1G	RSE≥1G	PLC	APCM	
A	√	√	√	√	BT LINK

Where **RSE<1G**: Radiated Emission below 1GHz.**RSE≥1G**: Radiated Emission above 1GHz.

**PLC**: Power Line Conducted Emission.**APCM**: Antenna Port Conducted Measurement.

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

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

EUT CONFIGURE MODE	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0	FHSS	GFSK	DH5

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

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

EUT CONFIGURE MODE	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0, 39, 78	FHSS	GFSK	DH5
A	0, 39, 78	FHSS	8DPSK	3DH5



## **POWER LINE CONDUCTED EMISSION TEST:**

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

EUT CONFIGURE MODE	TESTED CONDITION
-	BT Link

## **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, antenna ports (if EUT with antenna diversity architecture), and packet types.
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0, 39, 78	FHSS	GFSK	DH5
A	0, 39, 78	FHSS	8DPSK	3DH5

## **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RSE<1G	24deg. C, 55%RH	DC 24V from host unit	Wang Zhiming
RSE≥1G	24deg. C, 55%RH	DC 24V from host unit	LiuYuan
PLC	24deg. C, 55%RH	DC 24V from host unit	Wang Zhiming
APCM	25deg. C, 58%RH	DC 24V from host unit	Liang Jiatong

## 2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

**FCC PART 15, Subpart C. Section 15.247**  
**KDB 558074 D01 15.247 Meas Guidance v05r02**  
**ANSI C63.10-2013**

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

## 2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support Equipment					
NO	Description	Brand	Model No.	Serial Number	Supplied by
1	Laptop	Lenovo	K4e-ARE120	MP20kshe	Lab
2	Adapter	MW	OWA-60U-24	CC37274540	Client
3	10' display assembly	N/A	10-8229	N/A	Client

Support Cable							
NO	Description	Quantity (Number)	Length (m)	Detachable (Yes/ No)	Shielded (Yes/ No)	Cores (Number)	Supplied by
1	HMDI+USB	N/A	N/A	yes	yes	N/A	Client

### 3 TEST TYPES AND RESULTS

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 Limit

Frequency (MHz)	Conducted Limits(dB $\mu$ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.

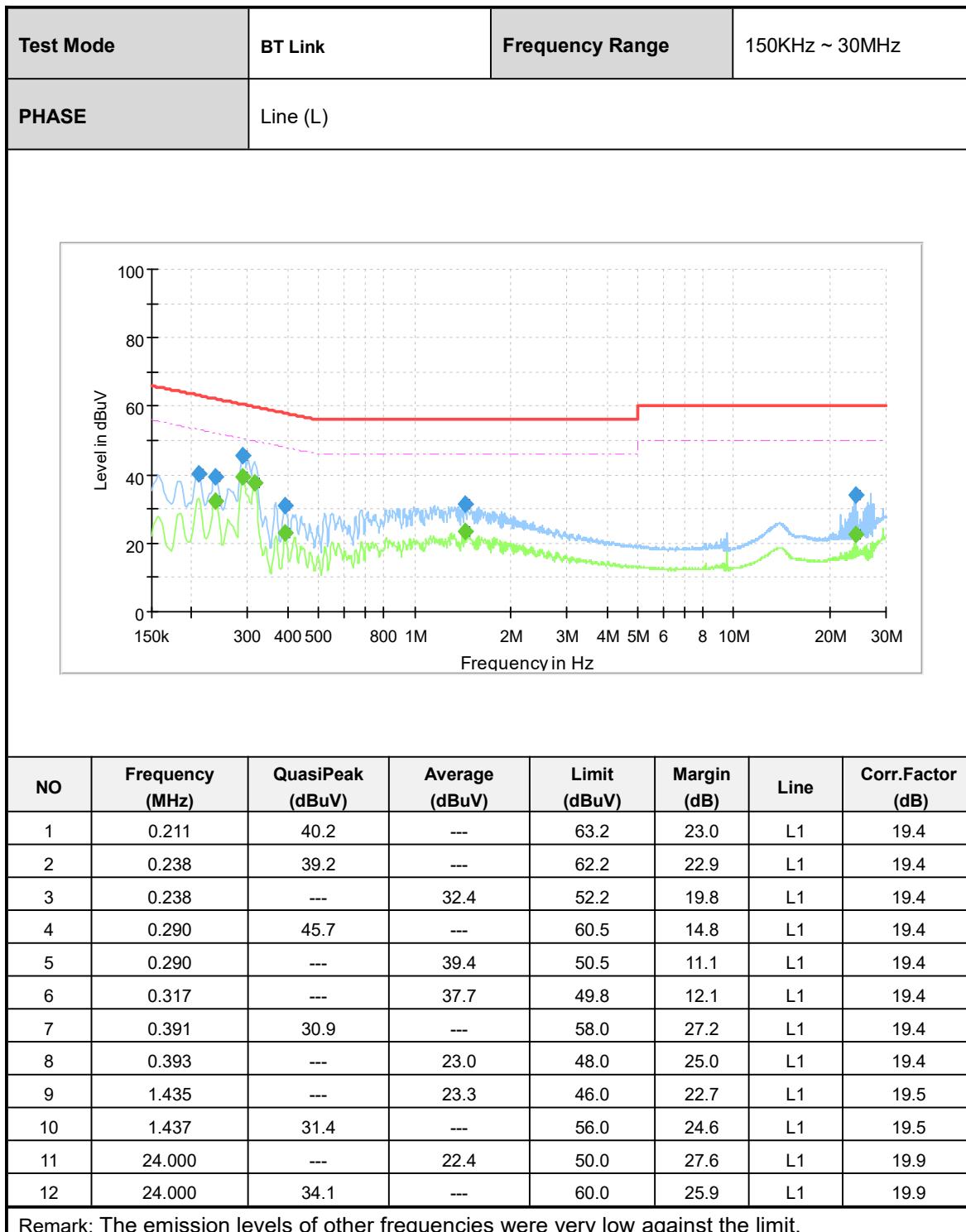
NOTE: 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

##### 3.1.2 Measurement procedure

- a. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the Test photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source. The equipment under test shall be placed on a support of non-metallic material, the height of which shall be 1.5m above the ground,
- b. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
- c. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

##### 3.1.3 Test setup

### 3.1.4 Test results





Test Mode	BT Link	Frequency Range	150KHz ~ 30MHz																																																																																																								
PHASE	Line (N)																																																																																																										
<table border="1"><thead><tr><th>NO</th><th>Frequency (MHz)</th><th>QuasiPeak (dBuV)</th><th>Average (dBuV)</th><th>Limit (dBuV)</th><th>Margin (dB)</th><th>Line</th><th>Corr.Factor (dB)</th></tr></thead><tbody><tr><td>1</td><td>0.182</td><td>38.1</td><td>---</td><td>64.4</td><td>26.3</td><td>N</td><td>19.5</td></tr><tr><td>2</td><td>0.211</td><td>40.7</td><td>---</td><td>63.2</td><td>22.5</td><td>N</td><td>19.5</td></tr><tr><td>3</td><td>0.211</td><td>---</td><td>34.5</td><td>53.2</td><td>18.7</td><td>N</td><td>19.5</td></tr><tr><td>4</td><td>0.238</td><td>40.2</td><td>---</td><td>62.2</td><td>22.0</td><td>N</td><td>19.4</td></tr><tr><td>5</td><td>0.238</td><td>---</td><td>33.6</td><td>52.2</td><td>18.6</td><td>N</td><td>19.4</td></tr><tr><td>6</td><td>0.290</td><td>---</td><td>40.5</td><td>50.5</td><td>10.0</td><td>N</td><td>19.4</td></tr><tr><td>7</td><td>0.292</td><td>46.5</td><td>---</td><td>60.5</td><td>13.9</td><td>N</td><td>19.4</td></tr><tr><td>8</td><td>0.317</td><td>---</td><td>38.8</td><td>49.8</td><td>11.0</td><td>N</td><td>19.4</td></tr><tr><td>9</td><td>1.435</td><td>31.1</td><td>---</td><td>56.0</td><td>24.9</td><td>N</td><td>19.5</td></tr><tr><td>10</td><td>1.435</td><td>---</td><td>23.1</td><td>46.0</td><td>22.9</td><td>N</td><td>19.5</td></tr><tr><td>11</td><td>14.044</td><td>24.8</td><td>---</td><td>60.0</td><td>35.2</td><td>N</td><td>20.1</td></tr><tr><td>12</td><td>14.177</td><td>---</td><td>17.9</td><td>50.0</td><td>32.1</td><td>N</td><td>20.1</td></tr></tbody></table>				NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)	1	0.182	38.1	---	64.4	26.3	N	19.5	2	0.211	40.7	---	63.2	22.5	N	19.5	3	0.211	---	34.5	53.2	18.7	N	19.5	4	0.238	40.2	---	62.2	22.0	N	19.4	5	0.238	---	33.6	52.2	18.6	N	19.4	6	0.290	---	40.5	50.5	10.0	N	19.4	7	0.292	46.5	---	60.5	13.9	N	19.4	8	0.317	---	38.8	49.8	11.0	N	19.4	9	1.435	31.1	---	56.0	24.9	N	19.5	10	1.435	---	23.1	46.0	22.9	N	19.5	11	14.044	24.8	---	60.0	35.2	N	20.1	12	14.177	---	17.9	50.0	32.1	N	20.1
NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)																																																																																																				
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11	14.044	24.8	---	60.0	35.2	N	20.1																																																																																																				
12	14.177	---	17.9	50.0	32.1	N	20.1																																																																																																				

Remark: The emission levels of other frequencies were very low against the limit.



## 3.2 RADIATED EMISSIONS

### 3.2.1 Limits

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). Other emissions shall be at least 20dB below the highest level of the desired power.

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.  
NOTE: 2. Emission level (dB<sub>uV/m</sub>) = 20 log Emission level (uV/m).  
NOTE: 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.

### 3.2.2 Measurement procedure

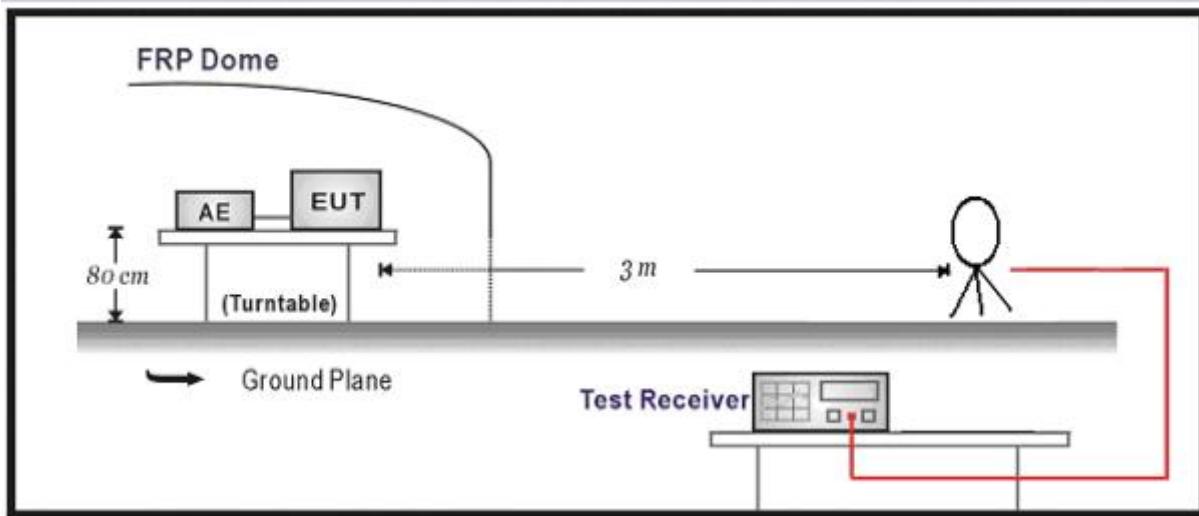
- a. The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving 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:**

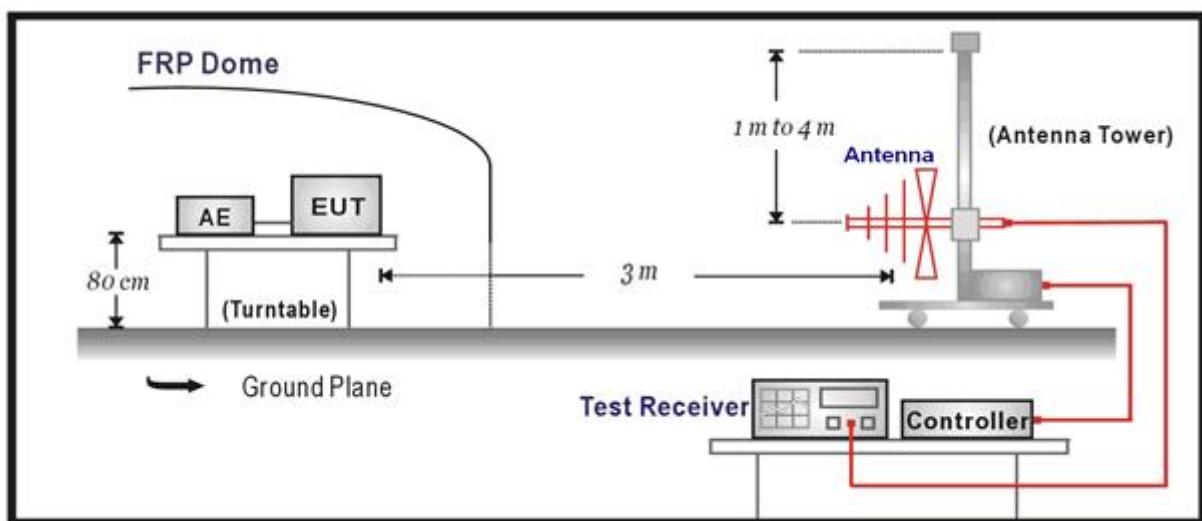
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution 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.

### 3.2.3 Test setup

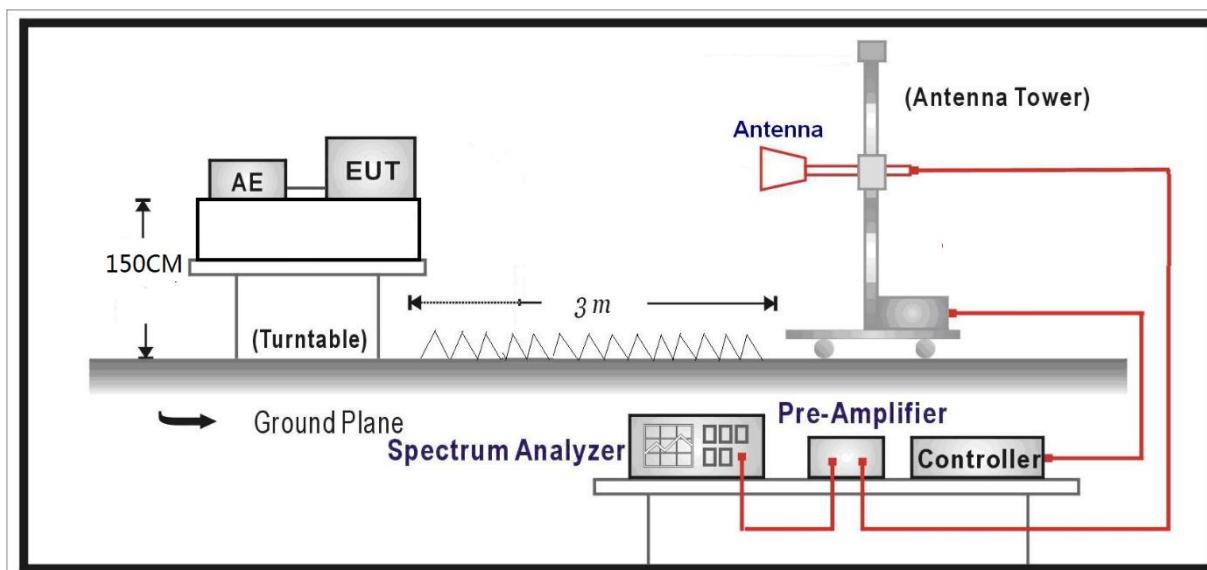
Below 30MHz Test Setup:



Below 1GHz Test Setup:

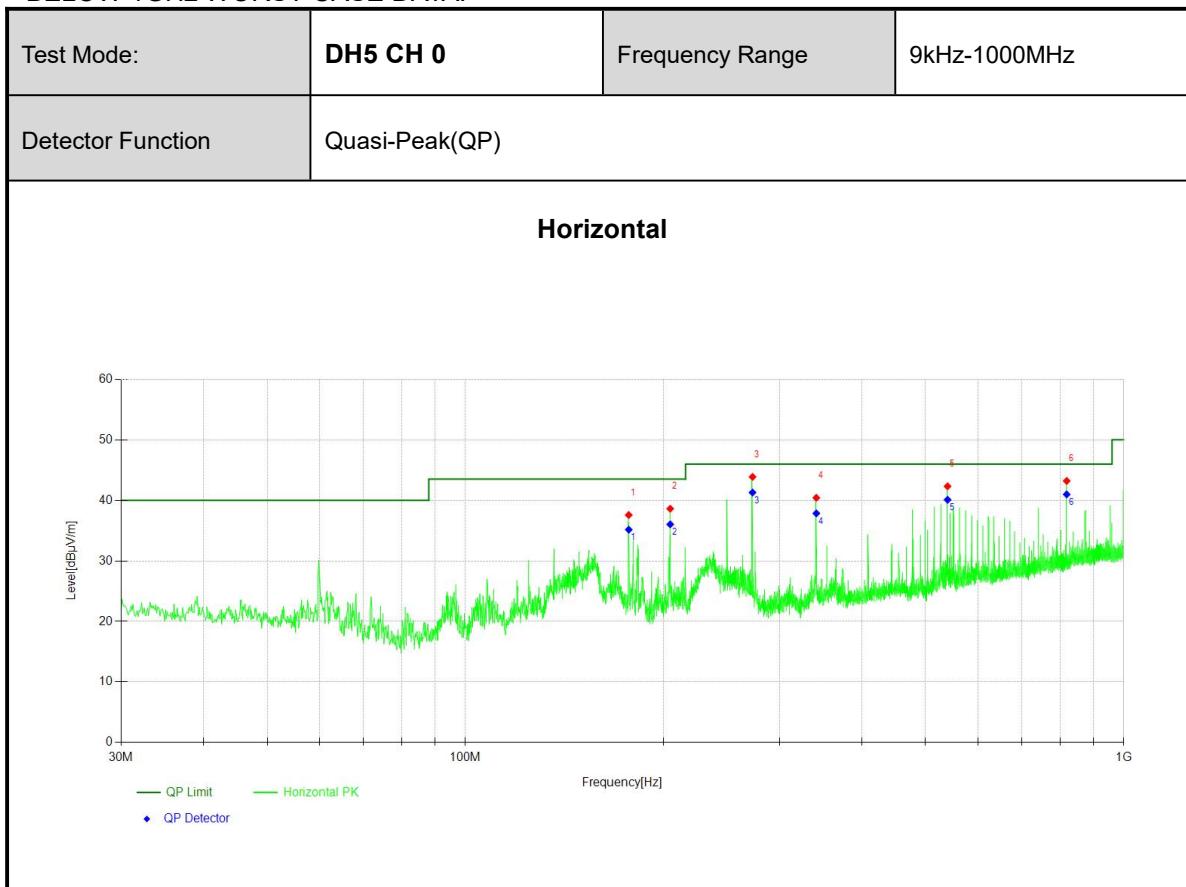


Above 1GHz Test Setup:



### 3.2.4 Test results

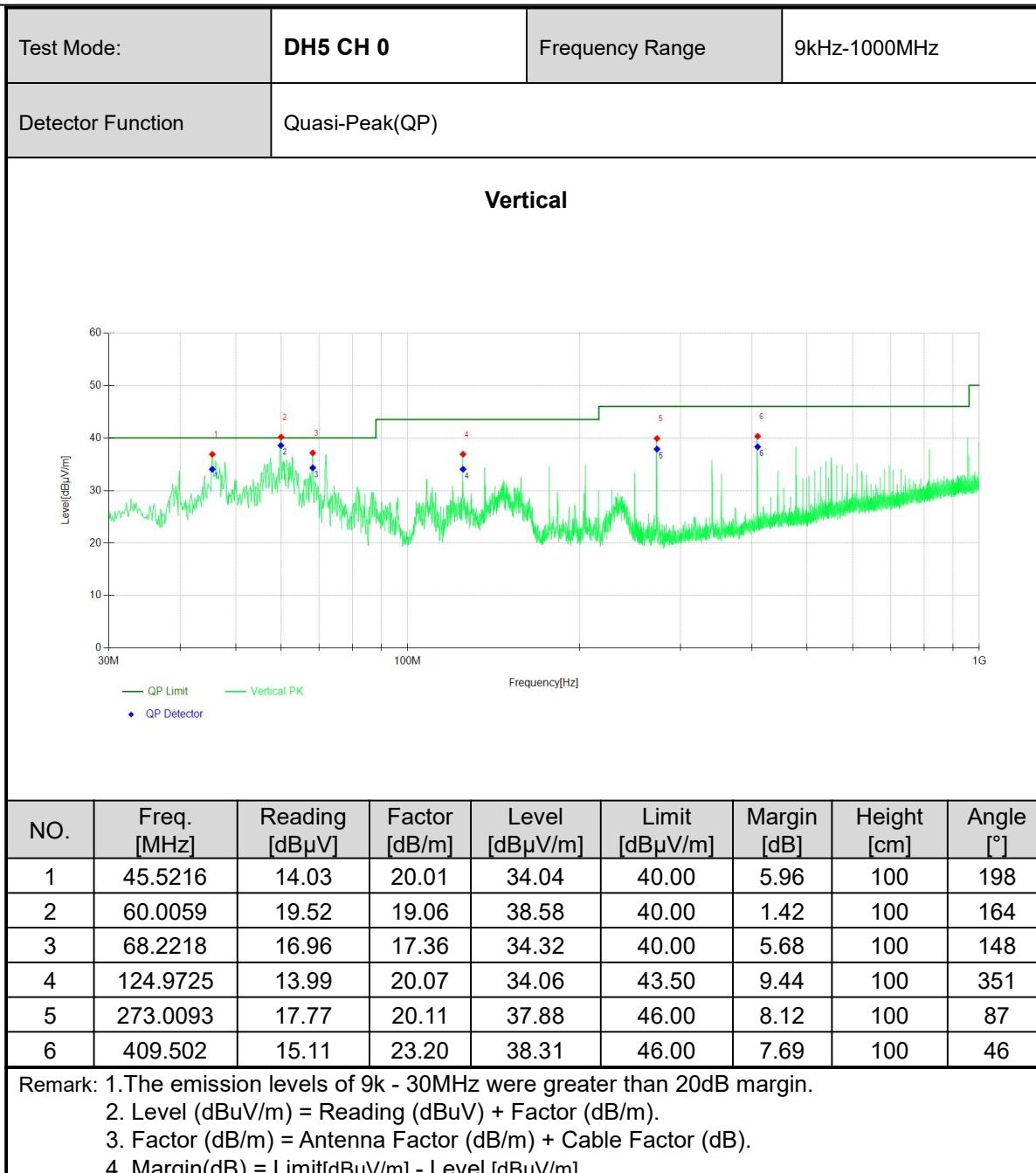
BELOW 1GHz WORST-CASE DATA:



NO.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [°]
1	177.0667	15.9	19.26	35.16	43.50	8.34	200	334
2	204.7145	18.56	17.48	36.04	43.50	7.46	200	293
3	273.0093	21.19	20.11	41.30	46.00	4.70	100	320
4	341.2071	15.87	21.98	37.85	46.00	8.15	100	269
5	539.98	14.33	25.77	40.10	46.00	5.90	200	10
6	818.9799	10.94	30.05	40.99	46.00	5.01	100	118

Remark:

1. The emission levels of 9k - 30MHz were greater than 20dB margin.
2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]



**ABOVE 1GHz DATA**

Channel	DH5 CH0	Frequency	2402MHz
Frequency Range	Above 1G	Detector Function	PK/AV

Suspected Data List										
N O.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2375.61	40.73	-0.27	40.46	54.00	13.54	200	234	AV	Horizontal
2	2376.98	51.33	-0.28	51.05	74.00	22.95	200	321	PK	Horizontal
3	2390.00	48.87	-0.15	48.72	74.00	25.28	100	281	PK	Horizontal
4	2390.00	40.01	-0.15	39.86	54.00	14.14	100	1	AV	Horizontal
5	2401.97	101.21	-0.04	101.17			100	308	AV	Horizontal
6	2402.13	101.54	-0.03	101.51			100	301	PK	Horizontal
7	4804.00	34.68	9.29	43.97	54.00	10.03	400	222	RMS	Horizontal
8	4804.00	41.89	9.29	51.18	74.00	22.82	400	342	PK	Horizontal
9	7205.67	35.29	12.82	48.11	74.00	25.89	300	358	PK	Horizontal
10	7205.67	27.85	12.82	40.67	54.00	13.33	300	358	RMS	Horizontal
11	9608.00	23.54	13.32	36.86	54.00	17.14	100	252	RMS	Horizontal
12	9608.00	31.95	13.32	45.27	74.00	28.73	100	212	PK	Horizontal
13	2379.82	40.01	-0.29	39.72	54.00	14.28	400	51	AV	Vertical
14	2380.51	50.60	-0.28	50.32	74.00	23.68	400	350	PK	Vertical
15	2390.00	48.95	-0.15	48.80	74.00	25.20	200	358	PK	Vertical
16	2390.00	39.23	-0.15	39.08	54.00	14.92	200	1	AV	Vertical
17	2401.93	99.44	-0.04	99.40			200	164	AV	Vertical
18	2402.15	99.79	-0.02	99.77			200	171	PK	Vertical
19	4804.00	42.16	9.29	51.45	74.00	22.55	400	80	PK	Vertical
20	4804.00	34.82	9.29	44.11	54.00	9.89	400	130	RMS	Vertical
21	7206.00	23.47	12.81	36.28	54.00	17.72	100	330	RMS	Vertical
22	7206.00	31.31	12.81	44.12	74.00	29.88	100	180	PK	Vertical
23	9608.00	31.69	13.32	45.01	74.00	28.99	100	50	PK	Vertical
24	9608.00	23.52	13.32	36.84	54.00	17.16	100	110	RMS	Vertical

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.

2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).

3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).

4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]

<b>Channel</b>		<b>DH5 CH39</b>	<b>Frequency</b>	2441MHz
<b>Frequency Range</b>		Above 1G	<b>Detector Function</b>	PK/AV

<b>Suspected Data List</b>										
N O.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [ $^{\circ}$ ]	Detector	Polarity
1	4882.00	44.48	9.83	54.31	74.00	19.69	400	231	PK	Horizonta
2	4882.00	34.75	9.83	44.58	54.00	9.42	400	212	RMS	Horizonta
3	7322.68	31.28	10.98	42.26	54.00	11.74	200	348	RMS	Horizonta
4	7322.68	37.96	10.98	48.94	74.00	25.06	200	348	PK	Horizonta
5	9764.00	30.69	13.23	43.92	74.00	30.08	200	315	PK	Horizonta
6	9764.00	23.26	13.23	36.49	54.00	17.51	200	236	RMS	Horizonta
7	4882.00	42.78	9.83	52.61	74.00	21.39	100	100	PK	Vertical
8	4882.00	34.59	9.83	44.42	54.00	9.58	100	90	RMS	Vertical
9	7323.00	32.44	10.96	43.40	74.00	30.60	300	290	PK	Vertical
10	7323.00	24.96	10.96	35.92	54.00	18.08	300	40	RMS	Vertical
11	9764.00	31.15	13.23	44.38	74.00	29.62	400	80	PK	Vertical
12	9764.00	22.86	13.23	36.09	54.00	17.91	400	150	RMS	Vertical

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.  
 2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).  
 3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).  
 4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]



Channel	DH5 CH78	Frequency	2480MHz
Frequency Range	Above 1G	Detector Function	PK/AV

Suspected Data List										
N O.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2479.79	99.55	0.32	99.87			300	248	PK	Horizonta
2	2480.17	99.20	0.32	99.52			300	248	RMS	Horizonta
3	2483.50	44.82	0.45	45.27	74.00	28.73	200	102	PK	Horizonta
4	2483.50	36.70	0.45	37.15	54.00	16.85	200	109	RMS	Horizonta
5	2487.91	37.81	0.63	38.44	54.00	15.56	300	0	RMS	Horizonta
6	2488.43	47.17	0.66	47.83	74.00	26.17	300	236	PK	Horizonta
7	4960.00	41.69	10.70	52.39	74.00	21.61	100	175	PK	Horizonta
8	4960.00	33.91	10.70	44.61	54.00	9.39	100	181	RMS	Horizonta
9	7439.69	28.58	9.73	38.31	54.00	15.69	400	359	RMS	Horizonta
10	7440.00	33.75	9.75	43.50	74.00	30.50	400	38	PK	Horizonta
11	9920.00	23.91	13.83	37.74	54.00	16.26	200	118	RMS	Horizonta
12	9920.00	31.22	13.83	45.05	74.00	28.95	200	85	PK	Horizonta
13	2479.81	100.71	0.32	101.03			200	342	PK	Vertical
14	2479.85	100.40	0.32	100.72			200	342	RMS	Vertical
15	2483.50	45.49	0.45	45.94	74.00	28.06	100	209	PK	Vertical
16	2483.50	37.57	0.45	38.02	54.00	15.98	100	315	RMS	Vertical
17	2484.17	47.69	0.47	48.16	74.00	25.84	100	156	PK	Vertical
18	2484.22	38.01	0.48	38.49	54.00	15.51	100	329	RMS	Vertical
19	4960.00	41.78	10.70	52.48	74.00	21.52	300	190	PK	Vertical
20	4960.00	33.92	10.70	44.62	54.00	9.38	300	200	RMS	Vertical
21	7440.00	31.85	9.75	41.60	74.00	32.40	100	220	PK	Vertical
22	7440.00	24.43	9.75	34.18	54.00	19.82	100	130	RMS	Vertical
23	9920.00	31.97	13.83	45.80	74.00	28.20	300	120	PK	Vertical
24	9920.00	23.26	13.83	37.09	54.00	16.91	300	30	RMS	Vertical

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.

2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).

3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).

4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]

<b>Channel</b>	<b>3DH5 CH0</b>	<b>Frequency</b>	2402MHz
<b>Frequency Range</b>	Above 1G	<b>Detector Function</b>	PK/AV

<b>Suspected Data List</b>										
N O.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2385.22	40.60	-0.21	40.39	54.00	13.61	100	110	AV	Horizonta
2	2387.51	50.64	-0.18	50.46	74.00	23.54	100	84	PK	Horizonta
3	2390.00	48.15	-0.15	48.00	74.00	26.00	100	334	PK	Horizonta
4	2390.00	39.30	-0.15	39.15	54.00	14.85	100	215	AV	Horizonta
5	2401.96	98.82	-0.04	98.78			400	314	AV	Horizonta
6	2402.00	100.51	-0.04	100.47			400	334	PK	Horizonta
7	4804.00	42.68	9.29	51.97	74.00	22.03	400	345	PK	Horizonta
8	4804.00	34.24	9.29	43.53	54.00	10.47	400	86	RMS	Horizonta
9	7206.00	32.10	12.81	44.91	74.00	29.09	300	111	PK	Horizonta
10	7206.00	24.19	12.81	37.00	54.00	17.00	300	289	RMS	Horizonta
11	9608.00	32.62	13.32	45.94	74.00	28.06	100	230	PK	Horizonta
12	9608.00	23.52	13.32	36.84	54.00	17.16	100	177	RMS	Horizonta
13	2377.56	40.44	-0.28	40.16	54.00	13.84	200	96	AV	Vertical
14	2377.63	50.82	-0.28	50.54	74.00	23.46	200	342	PK	Vertical
15	2390.00	48.84	-0.15	48.69	74.00	25.31	200	43	PK	Vertical
16	2390.00	38.68	-0.15	38.53	54.00	15.47	200	357	AV	Vertical
17	2402.00	98.72	-0.04	98.68			200	156	PK	Vertical
18	2402.07	96.12	-0.04	96.08			200	156	AV	Vertical
19	4804.00	42.74	9.29	52.03	74.00	21.97	200	13	PK	Vertical
20	4804.00	34.43	9.29	43.72	54.00	10.28	200	289	RMS	Vertical
21	7206.00	31.92	12.81	44.73	74.00	29.27	400	58	PK	Vertical
22	7206.00	23.45	12.81	36.26	54.00	17.74	400	124	RMS	Vertical
23	9608.00	32.41	13.32	45.73	74.00	28.27	300	300	PK	Vertical
24	9608.00	24.23	13.32	37.55	54.00	16.45	300	290	RMS	Vertical

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.

2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).

3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).

4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]

<b>Channel</b>		<b>3DH5 CH39</b>	<b>Frequency</b>		2441MHz			
<b>Frequency Range</b>		Above 1G	<b>Detector Function</b>		PK/AV			

<b>Suspected Data List</b>										
N O.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	4882.00	42.47	9.83	52.30	74.00	21.70	100	103	PK	Horizonta
2	4882.00	34.62	9.83	44.45	54.00	9.55	100	164	RMS	Horizonta
3	7323.00	24.41	10.96	35.37	54.00	18.63	400	217	RMS	Horizonta
4	7323.00	32.98	10.96	43.94	74.00	30.06	400	52	PK	Horizonta
5	9764.00	30.85	13.23	44.08	74.00	29.92	300	25	PK	Horizonta
6	9764.00	23.18	13.23	36.41	54.00	17.59	300	164	RMS	Horizonta
7	4882.00	42.53	9.83	52.36	74.00	21.64	300	210	PK	Vertical
8	4882.00	34.24	9.83	44.07	54.00	9.93	300	270	RMS	Vertical
9	7323.00	24.58	10.96	35.54	54.00	18.46	300	140	RMS	Vertical
10	7323.00	31.52	10.96	42.48	74.00	31.52	300	150	PK	Vertical
11	9764.00	29.99	13.23	43.22	74.00	30.78	100	280	PK	Vertical
12	9764.00	22.55	13.23	35.78	54.00	18.22	100	130	RMS	Vertical

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.  
 2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).  
 3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).  
 4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]



Channel	3DH5 CH78	Frequency	2480MHz
Frequency Range	Above 1G	Detector Function	PK/AV

Suspected Data List										
N O.	Freq. [MHz]	Reading [dB $\mu$ V]	Factor [dB/m]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2479.80	98.50	0.32	98.82			100	256	PK	Horizonta
2	2480.02	96.94	0.31	97.25			100	256	RMS	Horizonta
3	2483.50	37.10	0.45	37.55	54.00	16.45	300	150	RMS	Horizonta
4	2483.50	45.45	0.45	45.90	74.00	28.10	300	144	PK	Horizonta
5	2484.11	47.41	0.48	47.89	74.00	26.11	100	144	PK	Horizonta
6	2484.32	38.89	0.49	39.38	54.00	14.62	100	124	RMS	Horizonta
7	4960.00	42.16	10.70	52.86	74.00	21.14	400	237	PK	Horizonta
8	4960.00	33.85	10.70	44.55	54.00	9.45	400	38	RMS	Horizonta
9	7440.00	24.51	9.75	34.26	54.00	19.74	300	3	RMS	Horizonta
10	7440.00	32.14	9.75	41.89	74.00	32.11	300	192	PK	Horizonta
11	9920.00	31.44	13.83	45.27	74.00	28.73	300	286	PK	Horizonta
12	9920.00	23.44	13.83	37.27	54.00	16.73	300	91	RMS	Horizonta
13	2479.95	99.75	0.31	100.06			400	169	PK	Vertical
14	2480.11	97.85	0.31	98.16			400	334	RMS	Vertical
15	2483.50	47.60	0.45	48.05	74.00	25.95	300	334	PK	Vertical
16	2483.50	37.87	0.45	38.32	54.00	15.68	300	268	RMS	Vertical
17	2484.85	47.30	0.51	47.81	74.00	26.19	100	359	PK	Vertical
18	2485.70	37.89	0.55	38.44	54.00	15.56	100	314	RMS	Vertical
19	4960.00	42.10	10.70	52.80	74.00	21.20	200	60	PK	Vertical
20	4960.00	34.23	10.70	44.93	54.00	9.07	200	120	RMS	Vertical
21	7440.00	24.64	9.75	34.39	54.00	19.61	300	150	RMS	Vertical
22	7440.00	31.61	9.75	41.36	74.00	32.64	300	290	PK	Vertical
23	9920.00	29.96	13.83	43.79	74.00	30.21	200	30	PK	Vertical
24	9920.00	23.06	13.83	36.89	54.00	17.11	200	140	RMS	Vertical

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.

2. Level (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Factor (dB/m).

3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).

4. Margin(dB) = Limit[dB $\mu$ V/m] - Level [dB $\mu$ V/m]

### 3.3 NUMBER OF HOPPING FREQUENCY USED

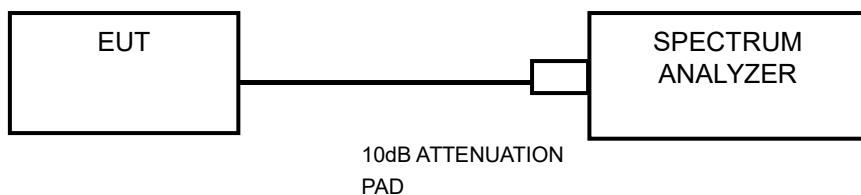
#### 3.3.1 Limits

At least 15 channels frequencies, and should be equally spaced.

#### 3.3.2 Measurement procedure

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were completed.

#### 3.3.3 Test setup



### 3.4 DWELL TIME ON EACH CHANNEL

#### 3.4.1 Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### 3.4.2 Measurement procedure

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Adjust the center frequency of SA on any frequency to be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- e. Repeat above procedures until all different time-slot modes have been completed.

#### 3.4.3 Test setup



### 3.5 20DB EMISSION BANDWIDTH

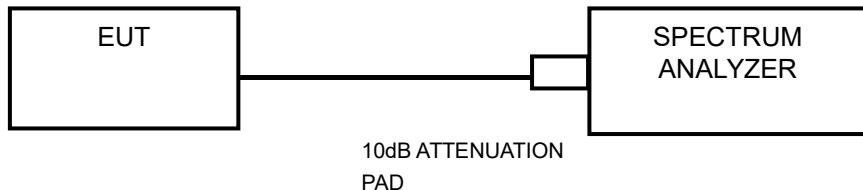
#### 3.5.1 Limits

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation

#### 3.5.2 Measurement procedure

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- d. Repeat above procedures until all frequencies measured were complete.

#### 3.5.3 Test setup



## 3.6 HOPPING CHANNEL SEPARATION

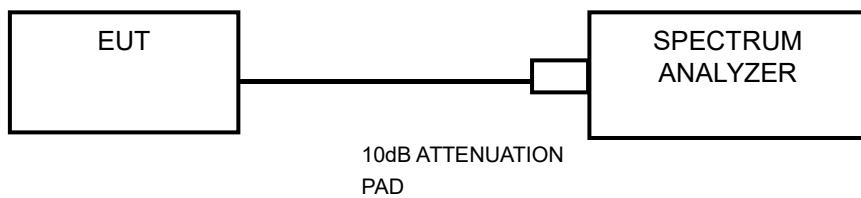
### 3.6.1 Limits

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

### 3.6.2 Measurement procedure

- a. Span: Wide enough to capture the peaks of two adjacent channels.
- b. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- c. Video (or average) bandwidth (VBW)  $\geq$  RBW.
- d. Sweep: Auto.
- e. Detector function: Peak.
- f. Trace: Max hold.
- g. Allow the trace to stabilize.

### 3.6.3 Test setup



## 3.7 CONDUCTED OUTPUT POWER

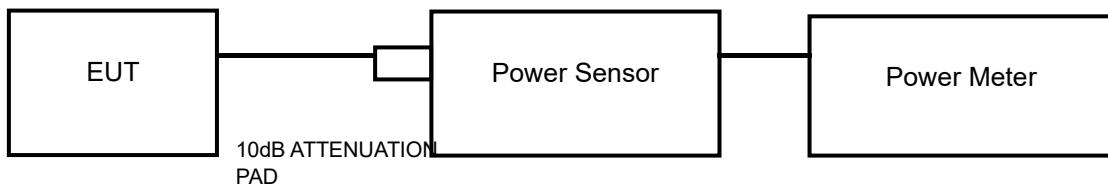
### 3.7.1 Limits(FCC)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

### 3.7.2 Measurement procedure

- a. A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor and set the detector to PEAK. Record the power level.
- b. An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power sensor and set the detector to AVERAGE. Record the power level.

### 3.7.3 Test setup



## 3.8 OUT OF BAND EMISSION MEASUREMENT

### 3.8.1 Limits

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

### 3.8.2 Measurement procedure

The transmitter output was connected to the spectrum analyzer via a low loss cable. of Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

### 3.8.3 Test setup



### 3.9 OCCUPIED BANDWIDTH MEASUREMENT

#### 3.9.1 Measurement procedure

The transmitter antenna output was connected to the spectrum analyzer through an attenuator. The resolution bandwidth shall be set to the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth. below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

#### 3.9.2 TEST SETUP



### **3.10 ANTENNA REQUIREMENT**

#### **3.10.1 LIMITS OFFREQUENCY STABILITY**

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 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **3.10.2 ANTENNA ANTI-REPLACEMENT CONSTRUCTION**

The antenna used for this product is External antenna and that no antenna other than that furnished by the responsible party shall be used with the device

#### **3.10.3 ANTENNA GAIN**

The maximum peak gain of the transmit antenna is 2.75 dBi.

## 4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Photos).

## 5 PHOTOGRAPHS OF THE EUT

Please refer to the attached file (External Photos report and Internal Photos).

## Important

- (1) The test report is valid without the official stamp of CVC;
- (2) Any part photocopies of the test report are forbidden without the written permission from CVC;
- (3) The test report is invalid without the signatures of Approval and Reviewer;
- (4) The test report is invalid if altered;
- (5) Objections to the test report must be submitted to CVC within 15 days.
- (6) Generally, commission test is responsible for the tested samples only.
- (7) As for the test result “-” or “N” means “not applicable”, “/” means “not test”, “P” means “pass” and “F” means “fail”

*\*\*The test data and test results given in this test report should only be used for purposes of scientific research, teaching and internal quality control when the CMA symbol is not presented.\*\**

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