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## TEST REPORT

### ETSI EN 300 328 V1.7.1 (2006-10)

Report Reference No.: CTL130619922-WR

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Date of issue: June 21, 2013

Testing Laboratory Name: Shenzhen CTL Electromagnetic Technology Co., Ltd.

Address: Zone B, 4/F, Block 20, Guangqian Industrial Park, Longzhu Road, Nanshan, Shenzhen 518055 China.

Applicant's name:

Address:

#### Test specification:

Standard: ETSI EN 300 328 V1.7.1: 2006-10

TRF Originator: Shenzhen CTL Electromagnetic Technology Co., Ltd.

Master TRF: Dated 2011-01

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Test item description: HEADPODS

Trade Mark:



Model/Type reference: PH-4028-BL

Modulation: FHSS

Ratings: DC 5V from USB/ DC 3.7V from battery

Operating Frequency Range: 2402~2480MHz

Channel Number: 79

Channel Space: 1MHz

Maximum Transmitter Power(EIRP): 1.68 dBm

Result: Positive

**TEST REPORT**

<b>Test Report No. :</b> CTL130619922-WR	June 21, 2013 Date of issue
------------------------------------------	--------------------------------

Equipment under Test : HEADPODS

Model /Type : PH-4028-BL

Listed Models : /

**Applicant** :

Address :

**Manufacturer** :

Address :

**Test Result** according to the standards on page 4:

**Positive**

The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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## 1. TEST STANDARDS

The tests were performed according to following standards:

[ETSI EN 300 328 V1.7.1 \(2006-10\)](#) — Electromagnetic compatibility and Radio spectrum Matters(ERM); Wideband transmission systems;Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques;Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive



## 2. S U M M A R Y

### 2.1. General Remarks

Date of receipt of test sample : June 19, 2013

Testing commenced on : June 19, 2013

Testing concluded on : June 21, 2013

### 2.2. Equipment Under Test

#### Power supply system utilised

Power supply voltage : ☐ 230V / 50 Hz ☐ 115V / 60Hz  
☐ 12 V DC ☐ 24 V DC  
☒ Other (specified in blank below)

DC 5V from USB/ DC 3.7V from battery

### 2.3. Short description of the Equipment under Test (EUT)

The device is a/an HEADPODS, work frequency at 2.4~2.4835GHz, support Bluetooth.

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

### 2.4. EUT operation mode

The EUT has been tested under typical operating condition. No software used to control the EUT for staying in transmitting and receiving mode for testing.

### 2.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

☐ - supplied by the manufacturer

☒ - supplied by the lab

☒ Notebook

Manufacturer: HP

Model No.: 4-1007TX

## 2.6. Performance level

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test relative to a performance criteria defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product. Examples of functions defined by the manufacturer to be evaluated during testing include, but are not limited to, the following:

- essential operational modes and states;
- tests of all peripheral access(hard disks, floppy disks, printers, keyboard, mouse, etc.);
- quality of software execution
- quality of data display and transmission
- quality of speech transmission

### Definition related to the performance level:

- based on the used product standard
- o based on the declaration of the manufacturer, requestor or purchaser





### 3. TEST ENVIRONMENT

#### 3.1. Address of the test laboratory

Bontek Compliance Testing Laboratory Ltd  
1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

#### 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

##### **FCC-Registration No.: 338263**

Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 338263, March 24, 2008.

##### **IC Registration No.: 7631A**

The 3m alternate test site of Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 7631A on March, 2011.

#### 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

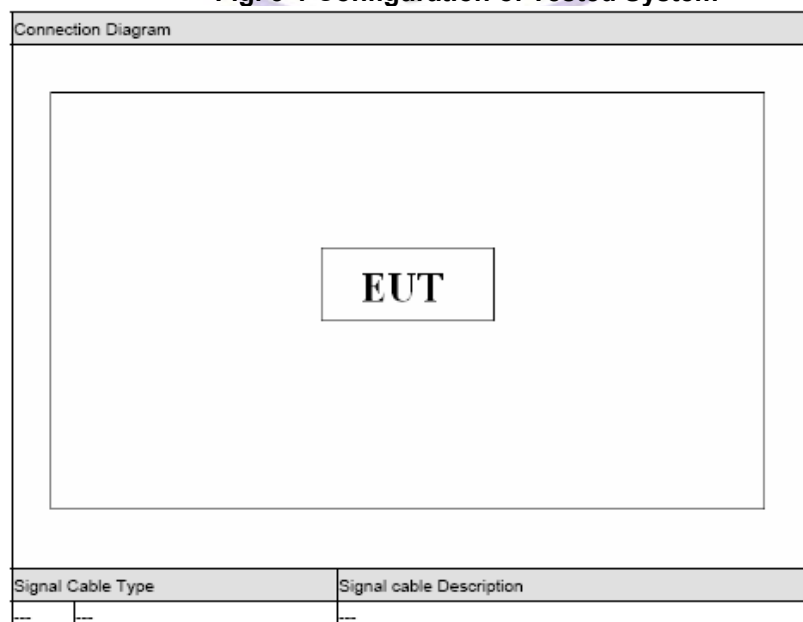
Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

#### 3.4. Configuration of Tested System

**Fig. 3-1 Configuration of Tested System**



### 3.5. Test Description

No deviations from the test standards

For BT function:

Performed Test Item	Normative References	Test Performed	Deviation
Equivalent Isotropic Radiated Power	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No
Maximum Spectral Power Density	ETSI EN 300 328 V1.7.1 (2006-10)	N/A	N/A
Frequency Range	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No
Transmitter Spurious Emissions	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No
Receiver Spurious Emissions	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No
Dwell Time	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No
Hopping Channel	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No
Hopping Sequence	ETSI EN 300 328 V1.7.1 (2006-10)	Yes	No

Note: The requirement of **Medium access protocol** has been implemented by manufacturer.

### 3.6. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Bontek Compliance Testing Laboratory Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Bontek laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	1~12.75GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.22dB	(1)

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



### 3.7. Equipments Used during the Test

Frequency Range					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Receiver	Rohde&Schwarz	ESI 26	100032	2013/04
2	Climate Chamber	ESPEC	EL-10KA	05107008	2013/04

Spurious Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	ULTRA-BROADBAND ANTENNA	ROHDE & SCHWARZ	HL562	100045	2013/04
2	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESI 26	100032	2013/04
3	RF TEST PANEL	ROHDE & SCHWARZ	TS / RSP	335021/ 0025	2013/04
4	TURNTABLE	ETS	2088	2151	2013/04
5	ANTENNA MAST	ETS	2075	2387	2013/04
6	HORN ANTENNA	ROHDE & SCHWARZ	HF906	100067	2013/04
6	EMI TEST SOFTWARE	ROHDE & SCHWARZ	ESK1	N/A	2013/04

Equivalent isotropically radiated power(EIRP)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Power Meter	AR	PM2002	304249	2013/04
2	Power Head	AR	PH2000	302541	2013/04
3	Climate Chamber	ESPEC	EL-10KA	06127003	2013/04
4	RF Cable	/	/	/	/

Mark: The Cal. Due is 1 year.

## **4. TEST CONDITIONS AND RESULTS**

### **4.1. ETSI EN 300 328 REQUIREMENTS**

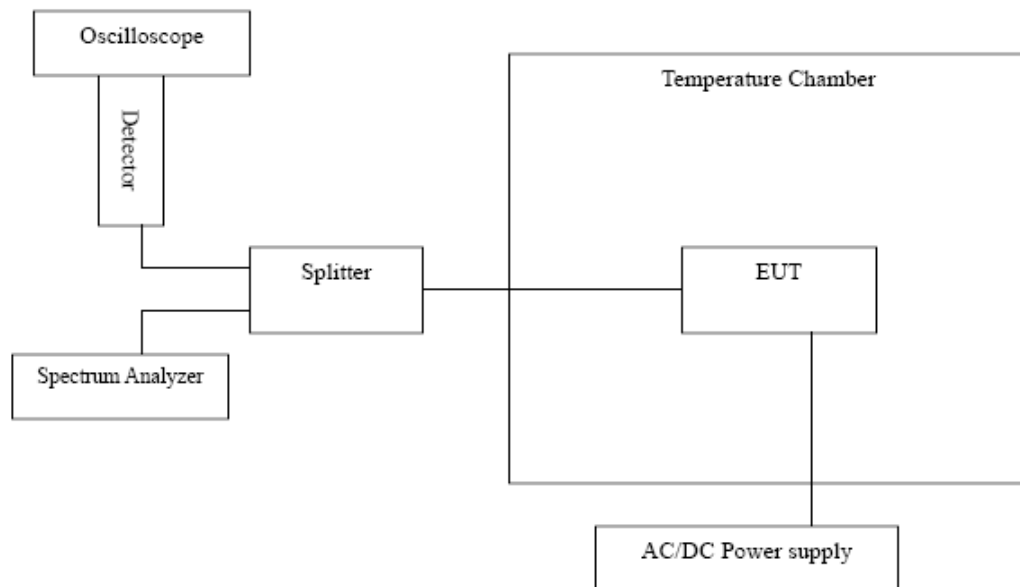
#### **4.1.1. Equivalent Isotropically Radiated Power**

##### **LIMIT**

According to ETSI EN 300 328 V1.7.1/2006-10 clause 4.3.1.2

Maximum EIR Limit
-10dBW/(100mW)/20dBm

##### **TEST CONFIGURATION**



##### **TEST PROCEDURE**

1. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.7.2.2 for the measurement method.

**TEST RESULTS**

Bluetooth mode				
		Measurement method: EIRP(Radiated)		
		Test Result		
Rel. Humidity: 65 %		Measured Power (dBm)	EIRP (dBm)	EIRP Limit (dBm)
Lowest Frequency: 2402MHz				
Tnom 25 ℃	Vnom 3.7 Vdc	-1.43	1.57	20
Tmin -20 ℃	Vmin 3.145 Vdc	-1.37	1.63	20
	Vmax 4.255 Vdc	-1.40	1.60	20
Tmax 55 ℃	Vmin 3.145 Vdc	-1.35	1.65	20
	Vmax 4.255 Vdc	-1.41	1.59	20
Middle Frequency: 2441MHz				
Tnom 25 ℃	Vnom 3.7 Vdc	-1.37	1.63	20
Tmin -20 ℃	Vmin 3.145 Vdc	-1.39	1.61	20
	Vmax 4.255 Vdc	-1.34	1.66	20
Tmax 55 ℃	Vmin 3.145 Vdc	-1.36	1.64	20
	Vmax 4.255 Vdc	-1.38	1.62	20
Highest Frequency: 2480MHz				
Tnom 25 ℃	Vnom 3.7 Vdc	-1.36	1.64	20
Tmin -20 ℃	Vmin 3.145 Vdc	-1.37	1.63	20
	Vmax 4.255 Vdc	-1.35	1.65	20
Tmax 55 ℃	Vmin 3.145 Vdc	-1.39	1.61	20
	Vmax 4.255 Vdc	-1.32	1.68	20
Test Result	Pass			

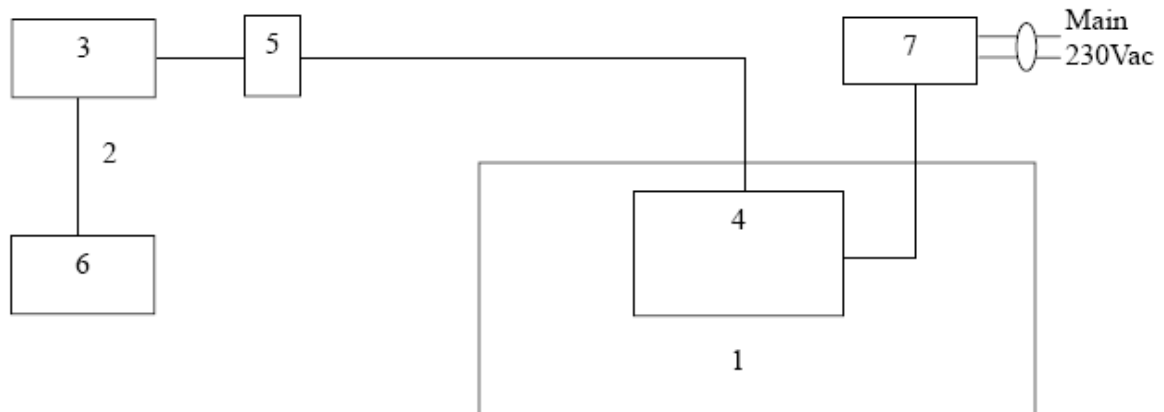
### 4.1.2. Maximum Spectral Power Density

#### LIMIT

According to ETSI EN 300 328 V1.7.1/2006-10 clause 4.3.2.2

Maximum spectral power density Limit
10mW/MHz(10dBm/MHz)

#### TEST CONFIGURATION



#### **Legend**

1. Wooden table
2. Test cable
3. Spectrum analyzer
4. EUT
5. DC block
6. Power meter
7. Power supply

#### TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.7.3 for the measurement method.

#### TEST RESULTS

For Bluetooth: It is not suitable to perform this test item as the requirements in this clause are only applicable to equipment using wide band modulations other than FHSS (e.g. DSSS, OFDM, etc.).

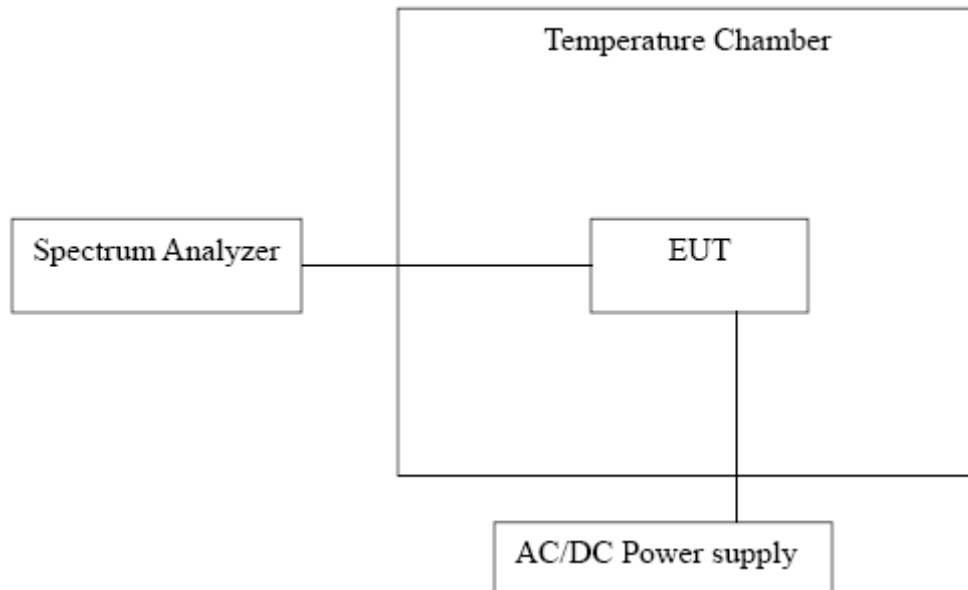
### 4.1.3. Frequency Range

#### LIMIT

According to ETSI EN 300 328 V1.7.1/2006-10 clause 4.3.3.2

Frequency range Limit	
$F_{\text{Low}} > 2.4\text{G}$	$F_{\text{High}} < 2.4835\text{GHz}$

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.7.4 for the measurement method.



**TEST RESULTS**

Bluetooth mode			
		Measurement method:    Conducted	
		Test Result	
Rel. Humidity: 65 %			
Lowest Frequency: 2402MHz		Measured Freq. (MHz)	Limit (MHz)
Tnom 25 ℃	Vnom 3.7 Vdc	2402.6	>2400.0
Tmin -20 ℃	Vmin 3.145 Vdc	2402.5	>2400.0
	Vmax 4.255 Vdc	2402.4	>2400.0
Tmax 55 ℃	Vmin 3.145 Vdc	2402.2	>2400.0
	Vmax 4.255 Vdc	2402.4	>2400.0
Highest Frequency: 2480MHz			
Tnom 25 ℃	Vnom 3.7 Vdc	2480.9	<2483.5
Tmin -20 ℃	Vmin 3.145 Vdc	2480.5	<2483.5
	Vmax 4.255 Vdc	2480.7	<2483.5
Tmax 55 ℃	Vmin 3.145 Vdc	2480.6	<2483.5
	Vmax 4.255 Vdc	2480.7	<2483.5
Test Result	Pass		

#### 4.1.4. Transmitter Spurious Emissions

##### LIMIT

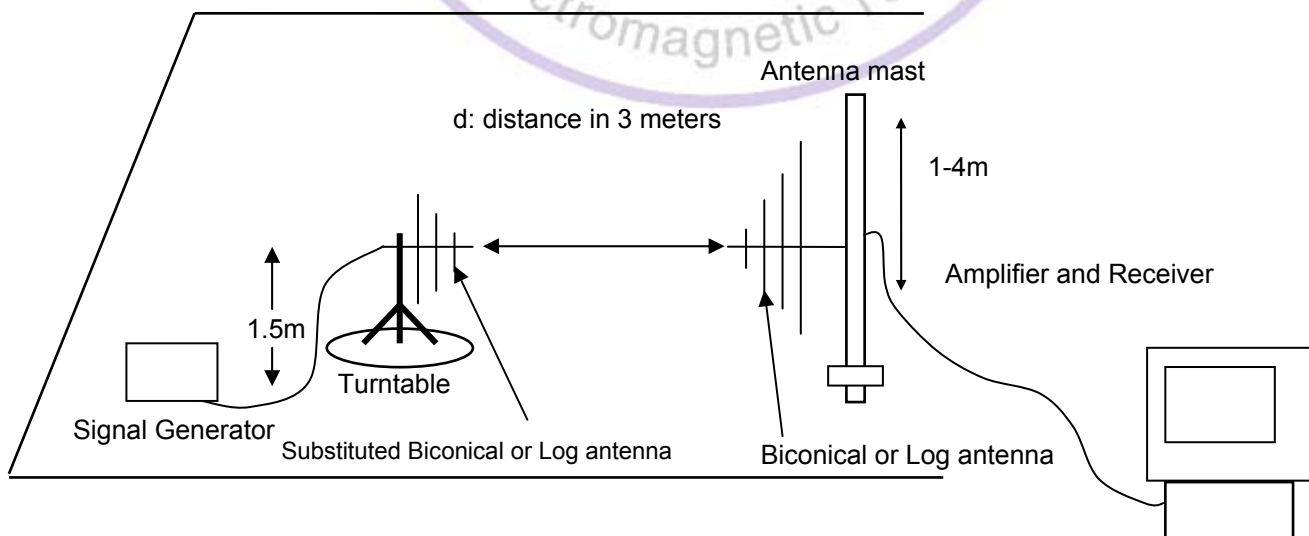
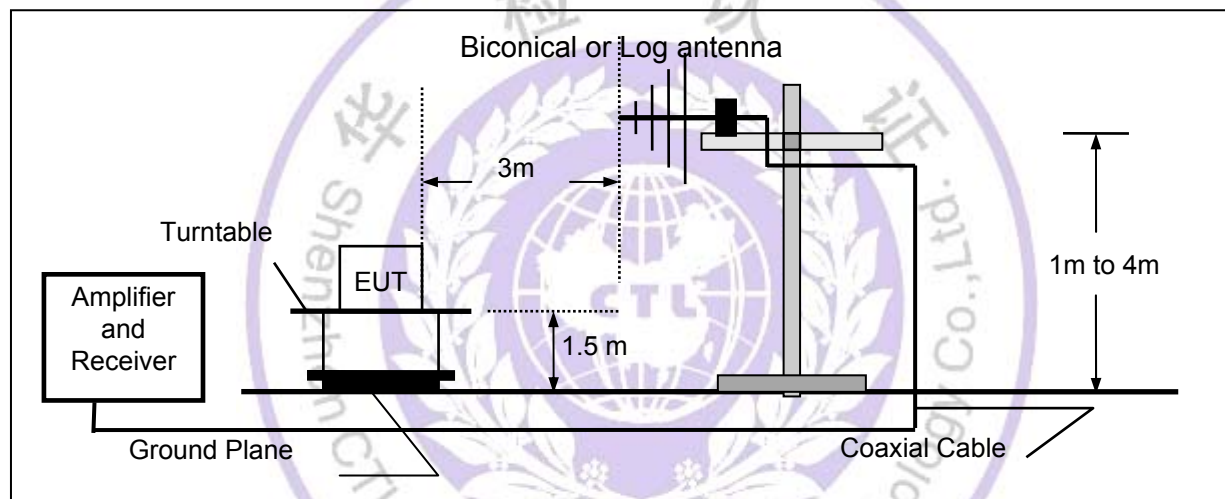
According to ETSI EN 300 328 V1.7.1/2006-10 clause 4.3.6.2

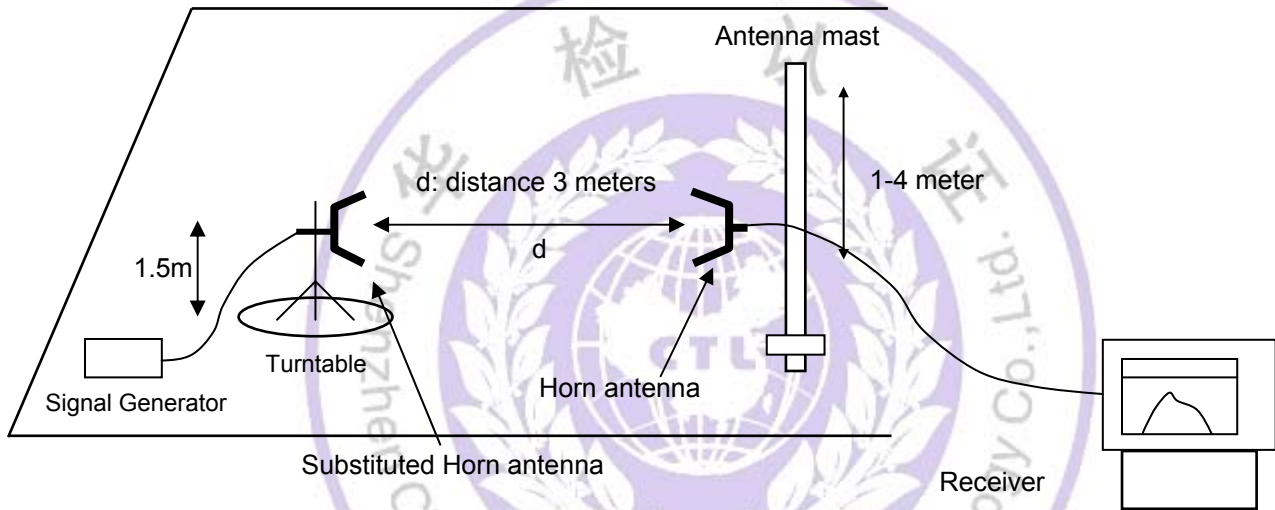
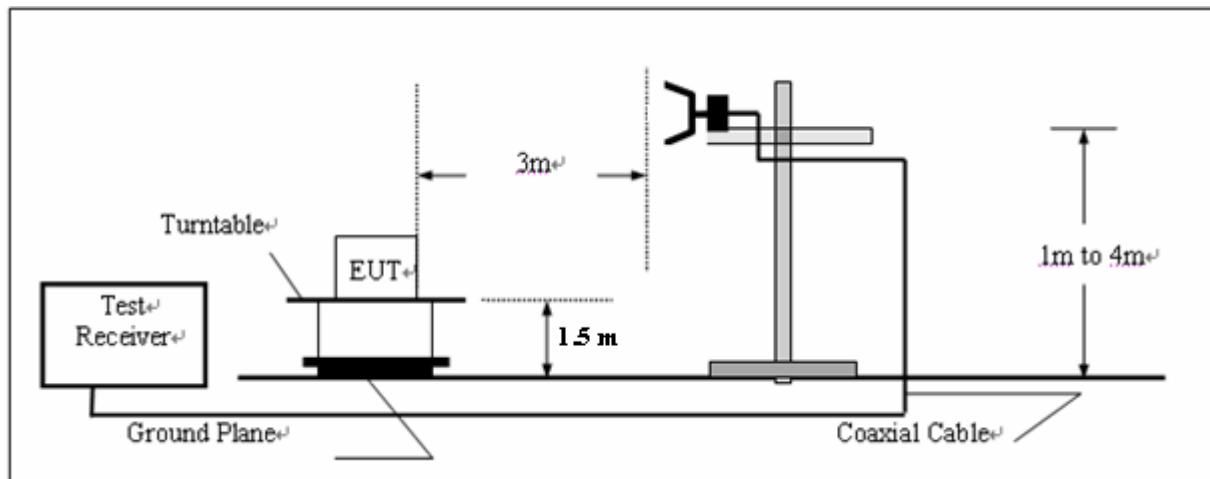
Frequency range	Limit when operating (dBm)	Limit when standby (dBm)
30MHz ~ 1GHz	-36	-57
Above 1GHz ~ 12.75GHz	-30	-47
1.8GHz ~ 1.9GHz 5.15GHz ~ 5.3GHz	-47	-47
Note: Note: All emissions detected are belong to narrowband emission at here.		

##### TEST CONFIGURATION

Effective Radiated Power measurement ( 30 MHz to 12.75 GHz )

Below 1GHz



**Above 1GHz****TEST PROCEDURE**

1. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.7.1) clause 5.7.5 for the measurement method.

**TEST RESULTS**

Bluetooth mode:				
		Measurement method: EIRP(Radiated)		
		Highest power TX mode		
Rel. Humidity: 65 %		Ambient Temp.: 25 °C		
Lowest Frequency: 2402MHz		Test Result		
Frequency range (MHz)	Res. Bandwidth (kHz)	Maximum Emission Observed (MHz)	Limit (dBm)	Margin (dB)
30 ~ 1000	100	-64.33	-36	30.33
1000 ~ 1800	1000	-60.07	-30	30.07
1800 ~ 1900	1000	-60.94	-47	13.94
1900 ~ 5150	1000	-61.15	-30	31.15
5150 ~ 5350	1000	-55.56	-47	8.56
5350 ~ 12750	1000	-51.37	-30	21.37
Highest Frequency: 2480MHz				
30 ~ 1000	100	-65.72	-36	29.72
1000 ~ 1800	1000	-63.29	-30	33.29
1800 ~ 1900	1000	-60.43	-47	13.43
1900 ~ 5150	1000	-60.24	-30	30.24
5150 ~ 5350	1000	-54.49	-47	7.49
5350 ~ 12750	1000	-50.19	-30	20.19
Test Result		Pass		

#### 4.1.5. Receiver Emissions

##### LIMIT

According to ETSI EN 300 328 V1.7.1/2006-10 clause 4.3.7.2

Frequency range	Limit (dBm)
30MHz ~ 1GHz	-57
Above 1GHz ~ 12.75GHz	-47
Note: All emissions detected are belong to narrowband emission at here.	

##### TEST CONFIGURATION

The same as described in section 4.1.4.

##### TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V.1.7.1) Sub-clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.7.1) Sub-clause 5.7.6 for the measurement method.

##### TEST RESULTS

Bluetooth mode:				
		Measurement method: EIRP(Radiated)		
		Highest power RX mode		
Rel. Humidity: 65 %		Ambient Temp.: 25 °C		
Lowest Frequency: 2402MHz		Test Result		
Frequency range (MHz)	Res. Bandwidth (kHz)	Maximum Emission Observed (MHz)	Limit (dBm)	Margin (dB)
30 ~ 1000	100	-68.36	-57	11.36
1000 ~ 12750	1000	-57.55	-47	10.55
Highest Frequency: 2480MHz				
30 ~ 1000	100	-66.34	-57	9.34
1000 ~ 12750	1000	-55.58	-47	8.58
Test Result		Pass		

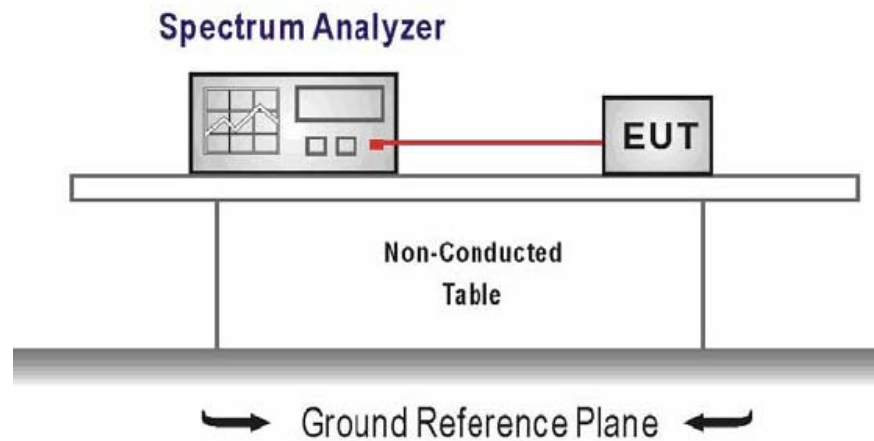


#### 4.1.6. Dwell Time

##### LIMIT

The maximum dwell time shall be 0.4 s.

##### TEST CONFIGURATION



##### TEST PROCEDURE

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1MHz

VBW  $\geq$  RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

##### TEST RESULTS

BOTTOM CHANNEL					
Mode	Frequency (MHz)	Spectrum Reading (uS)	Test Result (mS)	Limit (mS)	Pass / Fail
DH1	2402	410	131.2	400	Pass
DH3	2402	1670	267.2	400	Pass
DH5	2402	2920	311.5	400	Pass

MIDDLE CHANNEL					
Mode	Frequency (MHz)	Spectrum Reading (uS)	Test Result (mS)	Limit (mS)	Pass / Fail
DH1	2441	410	131.2	400	Pass
DH3	2441	1660	265.6	400	Pass
DH5	2441	2920	311.5	400	Pass

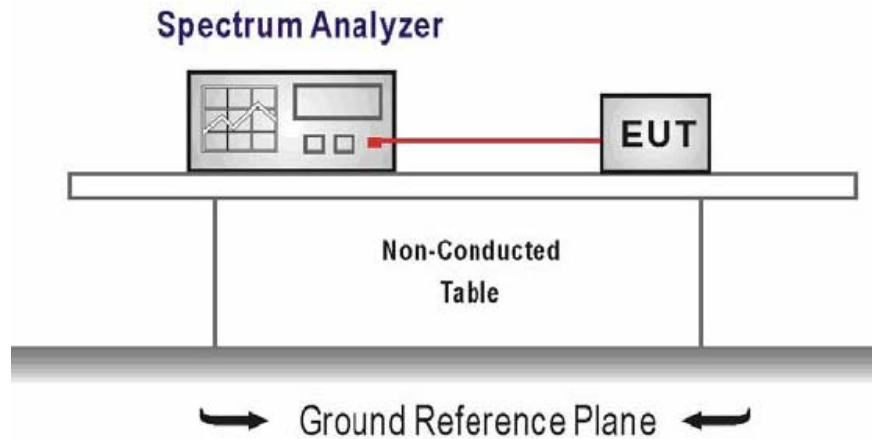
TOP CHANNEL					
Mode	Frequency (MHz)	Spectrum Reading (uS)	Test Result (mS)	Limit (mS)	Pass / Fail
DH1	2480	410	131.2	400	Pass
DH3	2480	1670	267.2	400	Pass
DH5	2480	2920	311.5	400	Pass

### 4.1.7. Hopping Channel

#### LIMIT

Non-adaptive Frequency Hopping systems shall make use of non-overlapping hopping channels separated by the channel bandwidth as measured at 20 dB below peak power. The hopping channels defined within a hopping sequence shall be at least 1 MHz apart (channel separation).

#### TEST CONFIGURATION



#### TEST PROCEDURE

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW  $\geq$  1% of the 20dB bandwidth

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

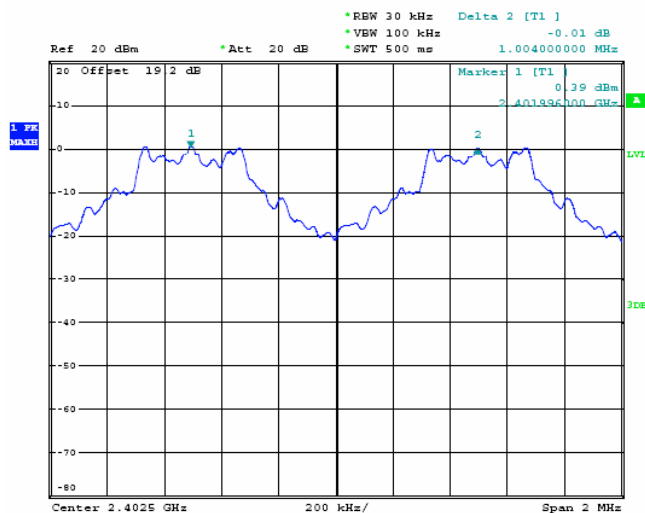
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize.

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

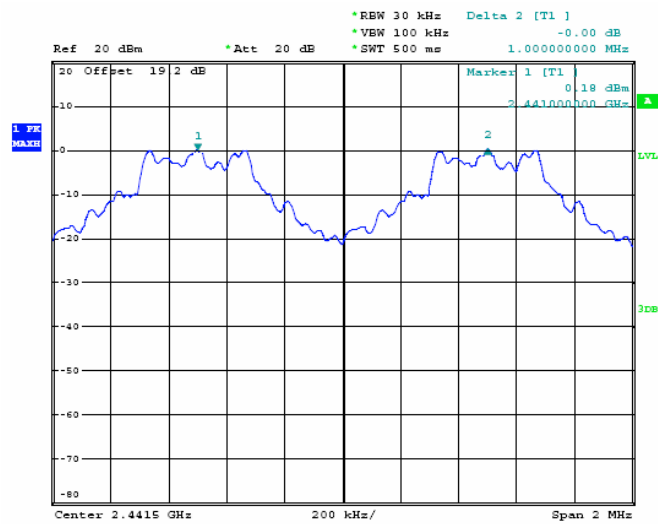
Repeat above procedure testing on the adjacent channel, and record all frequencies to determine the non-overlapping hopping channels and channel separation. If above values varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

#### TEST RESULTS

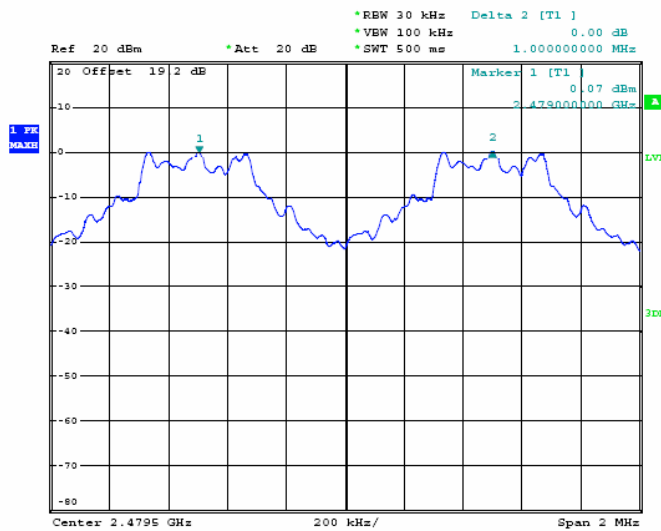
2402MHz



## 2441MHz



## 2480MHz



CTL Electromagnetic Technology

### 4.1.8. Hopping Sequence

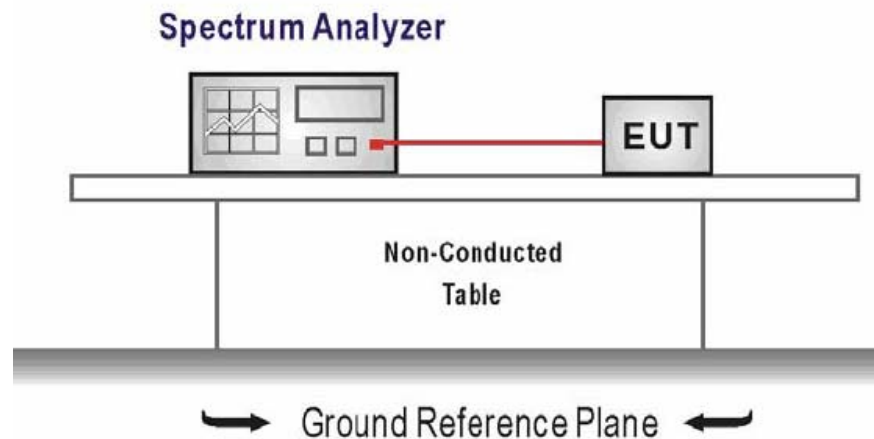
#### LIMIT

Non-adaptive Frequency Hopping systems shall make use of a hopping sequence(s) that contains at least 15 hopping channels.

Adaptive Frequency Hopping systems shall make use of a hopping sequence(s) that is capable of operating over a minimum of 90% of the band specified in table 1, from which at any give time a minimum of 20 hopping channels shall be used.

Each hopping channel of the hopping sequence shall be occupied at least once during a period not exceeding four times the product of the dwell time per hop and the number of channels.

#### TEST CONFIGURATION



#### TEST PROCEDURE

For Hopping Channel Number:

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW  $\geq$  1% of the span

VBW  $\geq$  RBW Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. It may prove necessary to bread the span up to sections, in order to clearly show all of the hopping frequencies.

For Hopping Sequence:

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1MHz

VBW  $\geq$  RBW

Sweet Time = 4 x dwell time per hop x the number of channels

Detector function = peak

Sweep mode = Single

Trace = max hold

#### TEST RESULTS

Hopping Channel Number					
ISM Band (MHz)	Operating Band (MHz)	Occupied Band (%)	Limit (%)	Channel Number	Limit
2400 - 2483.5	2402 - 2480	93.4%	$\geq 90\%$	79	$\geq 20$

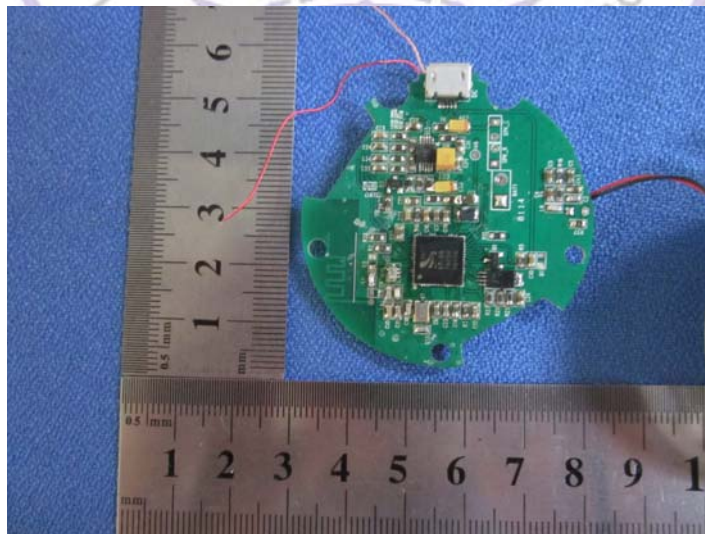
Hopping Sequence		
Occupancy Number	Limit	Result
$\geq 1$	$\geq 1$	Pass

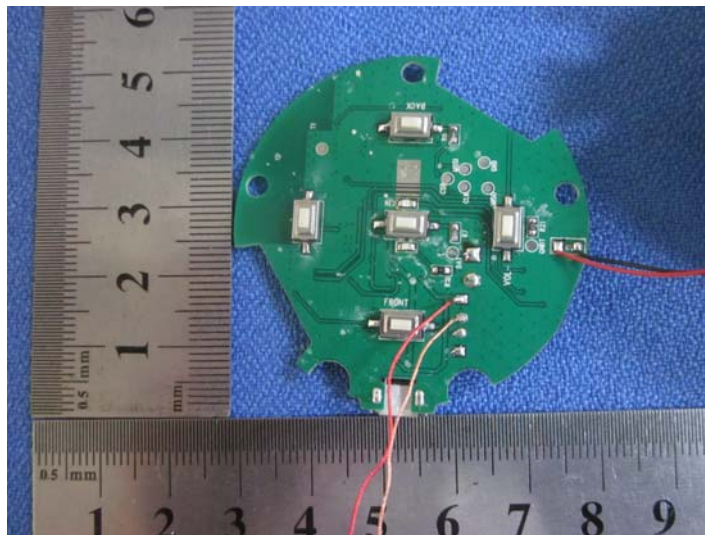
## 5. Test Setup Photos of the EUT





## 6. External and Internal Photos of the EUT





.....End of Report.....

