



# CMA Testing and Certification Laboratories

廠商會檢定中心

## TEST REPORT

Report No. : AU0037755(5) Date : 30 Jun 2016

Application No. : LU015484(0)

Applicant : Marathon Watch Company Limited  
30 Mural Street #10, Richmond Hill,  
Ontario, Canada, L4B 1B5

Sample Description : One(1) item of submitted sample stated to be Remote Temperature Sensor of  
Model No. CL030027A  
Sample registration No. : RU021870-006  
Radio Frequency : 433.95 MHz Transmitter  
Rating : 2 x 1.5V AA size batteries  
No. of submitted sample : Three (3) set (s)

Date Received : 11 May 2016

Test Period : 12 May 2016 to 21 May 2016.

Test Requested : FCC Part 15 Certificate (15.231)  
Industry Canada Interference Causing Equipment Standard RSS-210

Test Method : 47 CFR Part 15 (10-1-15 Edition), ANSI C63.10 – 2013  
Industry Canada RSS-Gen Issue 4


Test Engineer : Mr. LEUNG Shu-kan, Ken

Test Result : See attached sheet(s) from page 2 to 30.

Conclusion : The submitted sample was found to comply with requirement of FCC Part 15  
Subpart C and Industry Canada RSS-210 Issue 8.

For and on behalf of  
CMA Industrial Development Foundation Limited

Authorized Signature : \_\_\_\_\_

  
Mr. WONG Lap-pong, Andrew  
Manager  
Electrical Division

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FCC ID: 2AGNSCL030027  
IC: 20921-CL030027



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### 1 General Information

#### 1.1 General Description

The equipment under test (EUT) is a remote temperature sensor. It operates at 433.95MHz and the oscillation of MCU is generated by a crystal. The EUT is power by 2 x 1.5V AA sizes batteries. The MCU will measure the temperature and humidity. It will transmit the measured data to receiver wirelessly.

The brief circuit description is listed as follows:

- U1 and its associated circuit act as MCU
- X1 and its associated circuit act as oscillator
- LCD1 and its associated circuit act as display
- RT1 and its associated circuit act as thermistor



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### 1.2 Location of the test site

FCC Registered Test Site Number: 552221

Industry Canada Registered Test Site Number: 4093A

Radiated emissions measurements are investigated and taken pursuant to the procedures of ANSI C63.10 – 2013. A Semi-Anechoic Chamber Testing Site is set up for investigation and located at:

Ground Floor, Yan Hing Centre,  
9 – 13 Wong Chuk Yeung Street,  
Fo Tan, Shatin,  
New Territories,  
Hong Kong.

Conducted emissions measurements are investigated and also taken pursuant to the procedures of ANSI C63.10 – 2013. A shielded room is located at :

Ground Floor, Yan Hing Centre,  
9 – 13 Wong Chuk Yeung Street,  
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### 1.3 List of measuring equipment

Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date	Calibration Period
EMI Test Receiver	R&S	ESCI	100152	27 Sep 2016	1 Year
Spectrum Analyzer	R&S	FSV40	100628	09 Feb 2017	1 Year
Broadband Antenna	Schaffner	CBL6112B	2718	15 Mar 2017	2 Years
Loop Antenna	EMCO	6502	00056620	25 Jan 2018	2 Years
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-531	24 Nov 2016	2 Years
Broadband Pre-Amplifier	Schwarzbeck	BBV 9718	9718-119	24 Nov 2016	2 Years
Coaxial Cable	Schaffner	RG 213/U	N/A	18 May 2016	1 Years
Coaxial Cable	Suhner	RG 214/U	N/A	18 May 2016	1 Years
Coaxial Cable	Suhner	Sucoflex_104	N/A	13 Dec 2016	1 Years



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### 1.4 Measurement Uncertainty

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%.

#### Radiated emissions

Frequency	Uncertainty ( $U_{lab}$ )
30MHz ~ 200MHz (Horizontal)	4.83dB
30MHz ~ 200MHz (Vertical)	4.84dB
200MHz ~ 1000MHz (Horizontal)	4.87dB
200MHz ~ 1000MHz (Vertical)	5.94dB
1GHz ~ 6GHz	4.41dB
6GHz ~ 18GHz	4.64dB

#### Conducted emissions

Frequency	Uncertainty ( $U_{lab}$ )
150kHz~30MHz	2.64dB



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## 2 Description of the radiated emission test

### 2.1 Test Procedure

Radiated emissions measurements are investigated and taken pursuant to the procedures of ANSI C63.10 – 2013.

The equipment under test (EUT) was placed on a non-conductive turntable with dimensions of 1.5m x 1m and 0.8m high above the ground for below 1GHz measurement and 1.5m high above the ground for above 1GHz measurement. 3m from the EUT, a broadband antenna mounting on the mast received the signal strength. The turntable was rotated to maximize the emission level. The antenna was then moving along the mast from 1m up to 4m until no more higher value was found. Both horizontal and vertical polarization of the antenna were placed and investigated.

For below 30MHz, a loop antenna with its vertical plane is placed 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 1 m above the ground.

For 30MHz to 1GHz, broadband antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. And the reference point of antenna shall be 1 m above the ground.

For above 1GHz, horn antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. Preamplifier and High Pass filter was used for measurements. The reference point of antenna shall be 1 m above the ground.

The device was rotated through three orthogonal to determine which attitude and configuration produce the highest emission during measurement for Radiated Emission measurement.



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### 2.2 Test Result

Peak Detector data were measured unless otherwise stated.

“#” means emissions appear within the restricted bands shall follow the requirement of section 15.205 and RSS-Gen 8.10.

The frequencies from fundamental up to that tenth harmonics were investigated, and emissions more 20dB below limit were not reported. Thus, those highest emissions were presented in next page (section 2.3).

It was found that the EUT meet the FCC and RSS requirement.





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### 2.3 Radiated Emission Measurement Data

#### Radiated emission

#### pursuant to

#### the requirement of FCC Part 15 subpart C and RSS

##### Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	25	° C
Relative humidity:	60	%

Measurement: Peak

Operation mode: Transmission

RBW: 9kHz (below 30MHz), 120kHz (30MHz-1GHz), 1MHz (above 1GHz)

VBW: 30kHz (below 30MHz), 300kHz (30MHz-1GHz), 3MHz (above 1GHz)

Testing frequency range: 9kHz to 5GHz

Frequency (MHz)	Polarity (H/V)	Reading at 3m (dBμV)	Transducer Factor (dB/m)	Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
433.953	H	59.9	22.0	81.9	100.8	- 18.9
867.905	H	25.9	24.6	50.5	80.8	- 30.3
#1301.876	H	58.8	- 7.7	51.1	74.0	- 22.9
1735.843	H	61.4	- 7.8	53.6	80.8	- 27.2
2169.761	H	62.4	- 6.6	55.8	80.8	- 25.0
2603.679	V	51.3	- 4.2	47.1	80.8	- 33.7
3037.661	V	57.1	- 2.9	54.2	80.8	- 26.6
3471.626	V	58.2	- 2.9	55.3	80.8	- 25.5
#3905.582	V	50.1	- 1.8	48.3	74.0	- 25.7
#4339.395	V	42.7	- 0.7	42.0	74.0	- 32.0

Remark: Other emissions more than 20dB below the limit are not reported.



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### 2.3 Radiated Emission Measurement Data (Con't)

#### Radiated emission

#### pursuant to

#### the requirement of FCC Part 15 subpart C and RSS

Environmental conditions:

Parameter	Recorded value	
Ambient temperature:	25	° C
Relative humidity:	60	%

Measurement: Average

Operation mode: Transmission

Testing frequency range: 9kHz to 5GHz

Frequency (MHz)	Polarity (H/V)	Peak Field Strength at 3m (dBμV/m)	Average Factor (dB/m)	Average Value at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
433.953	H	81.9	- 6.1	75.8	80.8	- 5.0
867.905	H	50.5	- 6.1	44.4	60.8	- 16.4
#1301.876	H	51.1	- 6.1	45.0	54.0	- 9.0
1735.843	H	53.6	- 6.1	47.5	60.8	- 13.3
2169.761	H	55.8	- 6.1	49.7	60.8	- 11.1
2603.679	V	47.1	- 6.1	41.0	60.8	- 19.8
3037.661	V	54.2	- 6.1	48.1	60.8	- 12.7
3471.626	V	55.3	- 6.1	49.2	60.8	- 11.6
#3905.582	V	48.3	- 6.1	42.2	54.0	- 11.8
#4339.395	V	42.0	- 6.1	35.9	54.0	- 18.1

Remark: Other emissions more than 20dB below the limit are not reported.



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### **3 Description of the Line-conducted Test**

#### **3.1 Test Procedure**

Conducted emissions measurements are investigated and also taken pursuant to the procedures of ANSI C63.10 – 2013. The EUT was setup as described in the procedures, and both lines were measured.

#### **3.2 Test Result**

No measurement is required as the EUT is a battery-operated product.

#### **3.3 Graph and Table of Conducted Emission Measurement Data**

Not Applicable



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### **4 Photograph**

#### **4.1 Photographs of the Test Setup for Radiated Emission and Conducted Emission**

For electronic filing, the photos are saved with filename 2AGNSCL030027 TSup.pdf.

#### **4.2 Photographs of the External and Internal Configurations of the EUT**

For electronic filing, the photos are saved with filename 2AGNSCL030027 ExPho.pdf and 2AGNSCL030027 InPho.pdf.





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### 5 Supplementary document

The following document were submitted by applicant, and for electronic filing, the document are saved with the following filenames:

Document	Filename
ID Label/Location	LabelSmp.jpg
Block Diagram	BlkDia.pdf
Schematic Diagram	Schem.pdf
Users Manual	UserMan.pdf
Operational Description	OpDes.pdf

#### 5.1 Bandwidth

The plot saved in Appendices A6 and A7 shows the fundamental emission is confined in the specified band. The bandwidth requirement is  $0.25\% \times 433.95 = 1.085\text{MHz}$

#### 5.2 Duty cycle Calculation

Appendices A8 shows the plots of duty cycle

The pulse train is over 100ms, therefore need to find the 100ms period with most 'ON' time.

There are 2 different pulses in the pulse train

Time of pulse one: 5.8ms

Time of pulse two: 1.8ms

Number of pulse on in 100ms: 7

Number of pulse two in 100ms: 5

Duty cycle =  $(7 \times 5.8\text{ms} + 5 \times 1.8\text{ms}) / 100\text{ms} = 0.496$

Average factor =  $20 \times \log(0.496) = -6.1$

#### 5.3 Transmission Time

During of each transmission = 920 ms.



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The during of each transmission is confined with 1 second, and the required silent period is at least 10 second or 30 times of the during of transmission according to section 15.231(e) and RSS-210 A1.1.5. The plot saved Appendices A9 shows the EUT has at least 30-second silent period and thus met the FCC and RSS requirement.

### 5.4 Antenna requirement

Appendices A4 shows the antenna is permanently attached and cannot be changed. Therefore it fulfils the section 15.203 requirement



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### 6 Appendices

A1	Photos of the set-up of Radiated Emissions	3	pages
A2	Photos of External Configurations	2	pages
A3	Photos of Internal Configurations	4	pages
A4	ID Label/Location	1	page
A5	20dB Bandwidth Plot	1	page
A6	99% Bandwidth Plot	1	page
A7	Average Factor	2	pages
A8	Transmission Time	1	page



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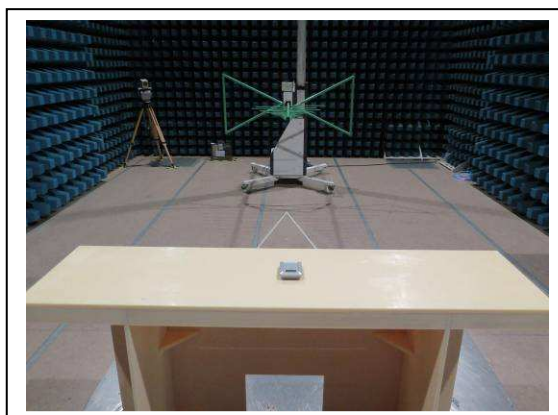
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### A1. Photos of the set-up of Radiated Emissions



(Front view, 30Hz – 1GHz)



(Back view, 30MHz – 1GHz)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew





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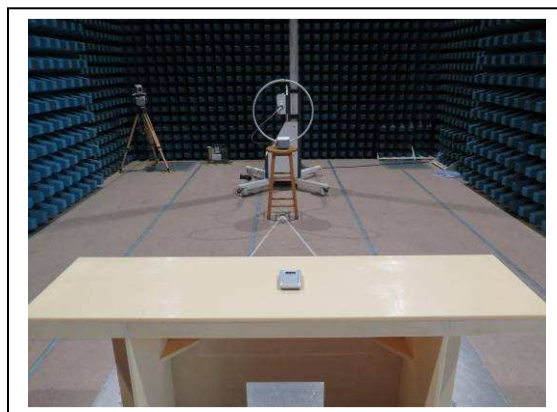
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Date : 30 Jun 2016

### A1. Photos of the set-up of Radiated Emissions



(Front view, 9kHz – 30MHz)



(Back view, 9kHz – 30MHz)

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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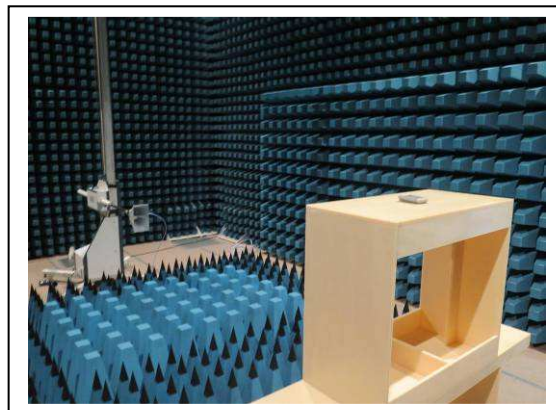
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## TEST REPORT

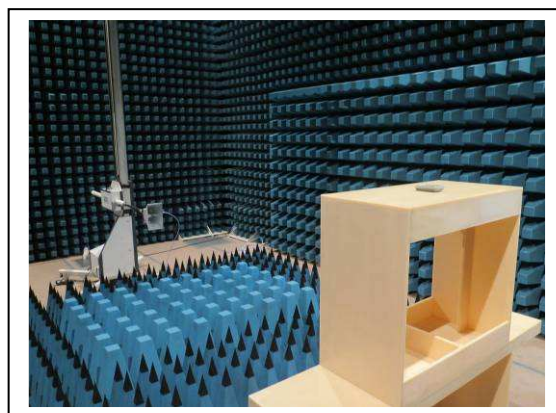
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Date : 30 Jun 2016

### A1. Photos of the set-up of Radiated Emissions



(Front view, above 1GHz)



(Back view, above 1GHz)

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Reviewed by:

Mr. WONG Lap-pong, Andrew



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### A2 Photos of External Configurations



External Configuration 1



External Configuration 2

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew





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### A2 Photos of External Configurations



External Configuration 3

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew





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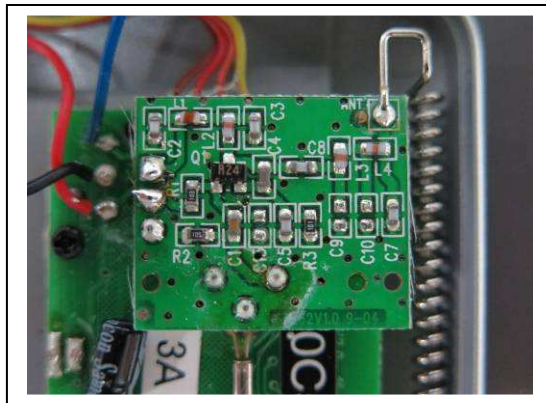
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## TEST REPORT

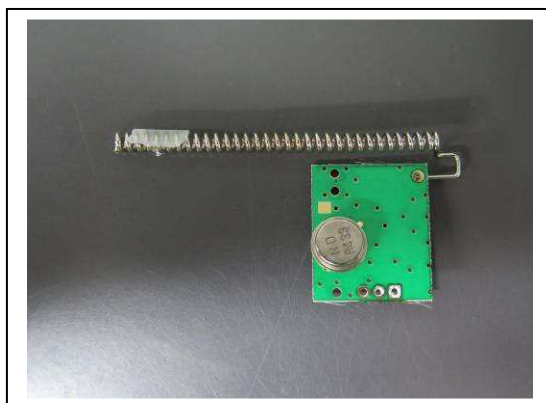
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### A3 Photos of Internal Configurations



Internal Configuration 1



Internal Configuration 2

Tested by:

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Reviewed by:

Mr. WONG Lap-pong, Andrew



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## TEST REPORT

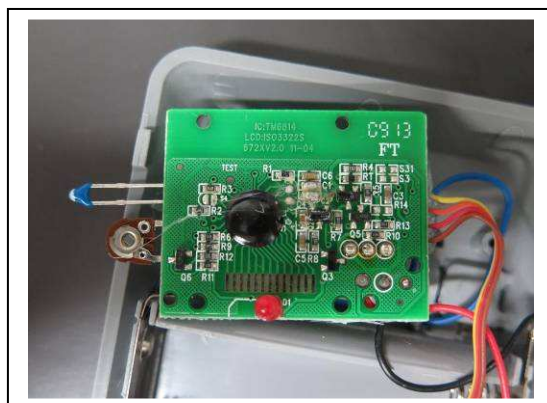
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### A3 Photos of Internal Configurations



Internal Configuration 3



Internal Configuration 4

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Reviewed by:

Mr. WONG Lap-pong, Andrew



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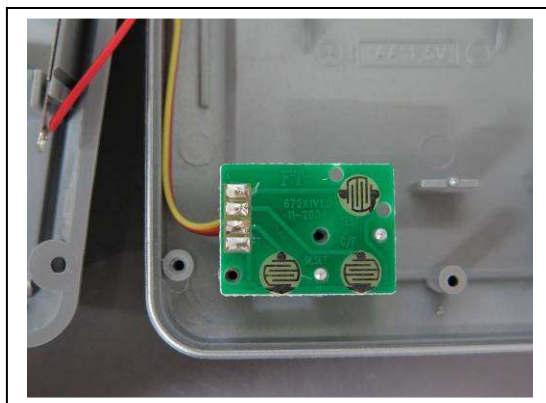
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## TEST REPORT

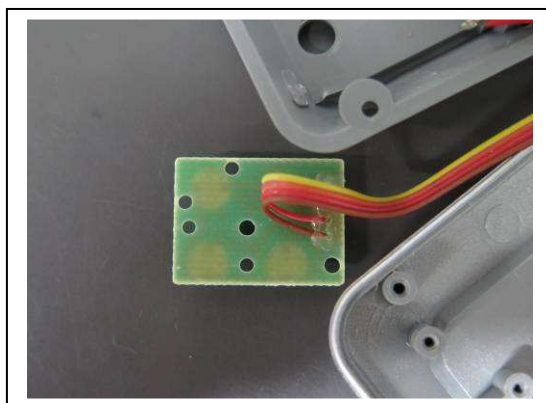
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### A3 Photos of Internal Configurations



Internal Configuration 5



Internal Configuration 6

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Reviewed by:

Mr. WONG Lap-pong, Andrew





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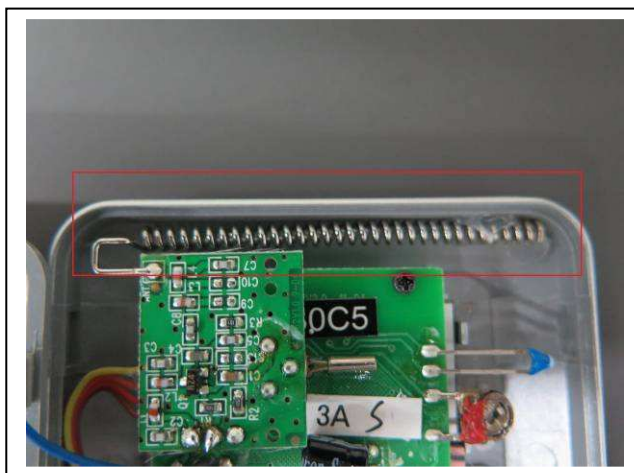
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### A3 Photos of Internal Configurations



EUT Antenna

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Mr. WONG Lap-pong, Andrew





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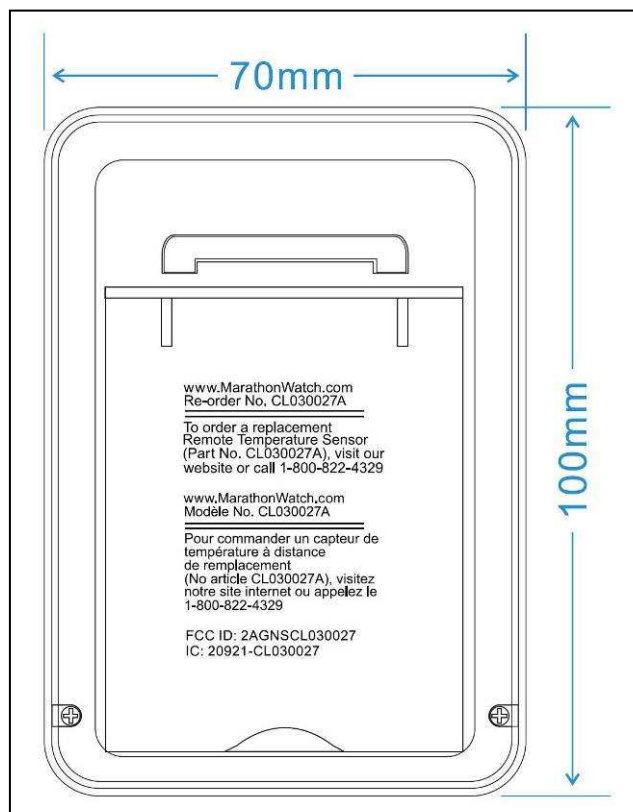
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### A4. ID Label / Location



ID Label

Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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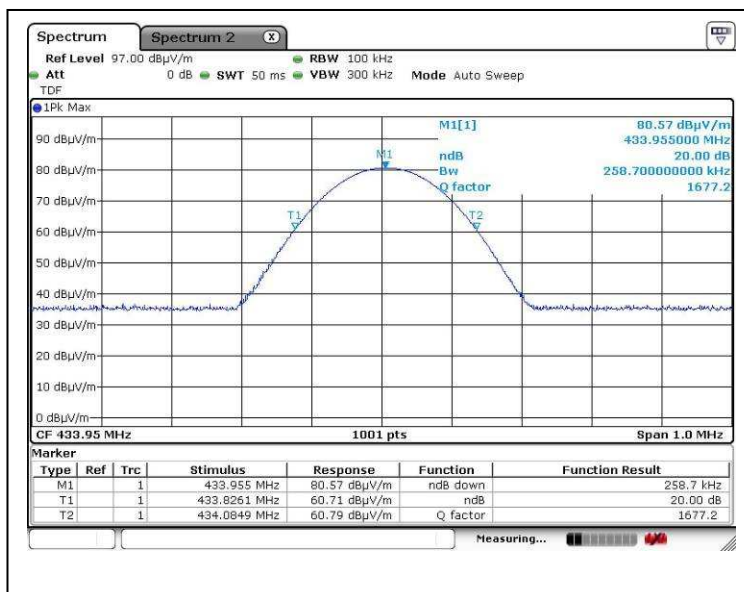
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### A5. 20dB Bandwidth Plot



Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew

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The screenshot displays a Spectrum Analyzer interface. At the top, the title bar reads "Spectrum 2" with a close button. Below the title bar, the "Ref Level" is set to 97.00 dBμV/m. The "Att" (Attenuation) is 0 dB, "SWT" (Sweep Time) is 50 ms, "VBW" (Video Bandwidth) is 300 kHz, and the "Mode" is "Auto Sweep". The "TDF" (Trace Display Format) is set to "IPk Max".

The main display area shows a frequency spectrum plot. The vertical axis (Y-axis) represents signal level in dBμV/m, ranging from 0 to 90. The horizontal axis (X-axis) represents frequency in MHz, with a "Span" of 1.0 MHz centered at "CF 433.95 MHz". The plot shows a noisy baseline with a prominent peak. The peak is labeled "M1[1]" and "Occ BW". The peak's frequency is 433.95000 MHz, and its level is 80.58 dBμV/m. The peak is also labeled "220.779220779 kHz".

At the bottom of the screen, there is a "Measuring..." status bar with a progress indicator and a red "X" icon.

Per

PR.

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CMA Industrial Development Foundation Limited

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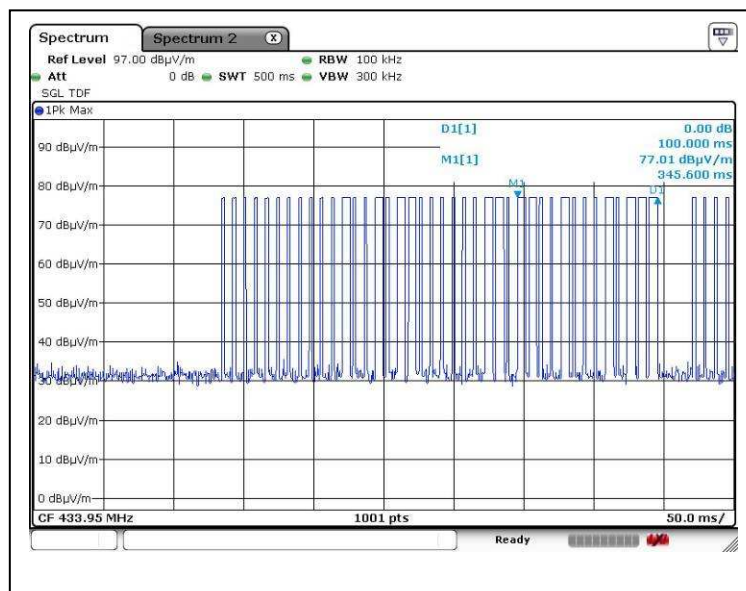
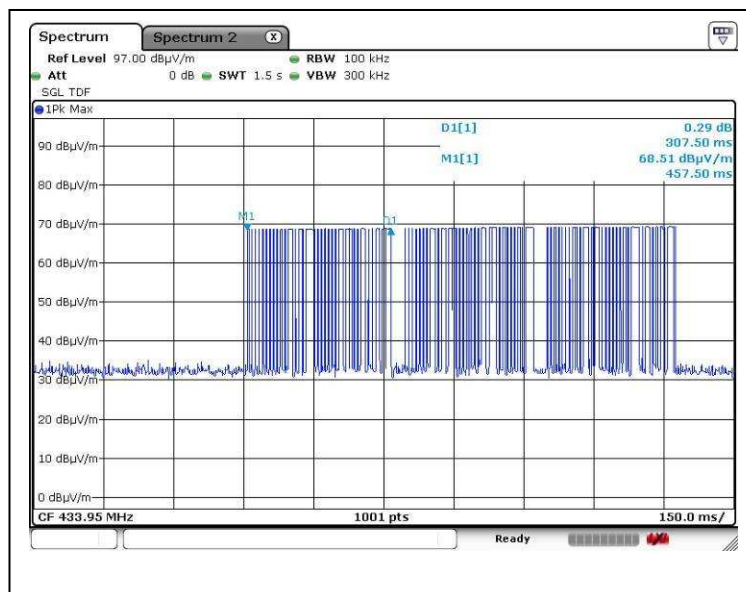
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### A7. Average Factor



Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew





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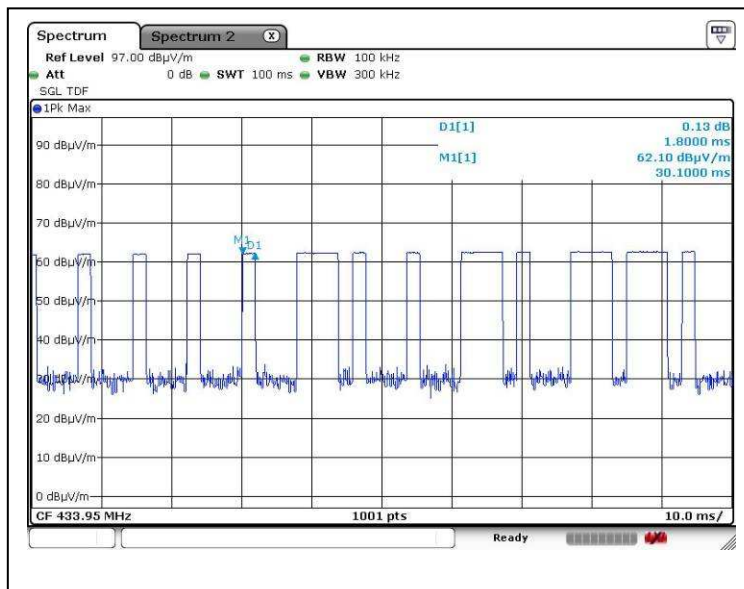
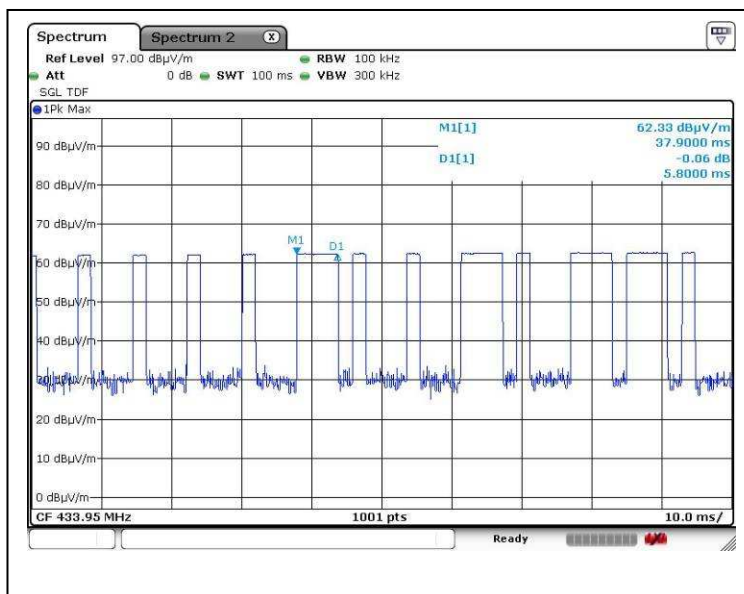
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### A7. Average Factor



Tested by:

Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew



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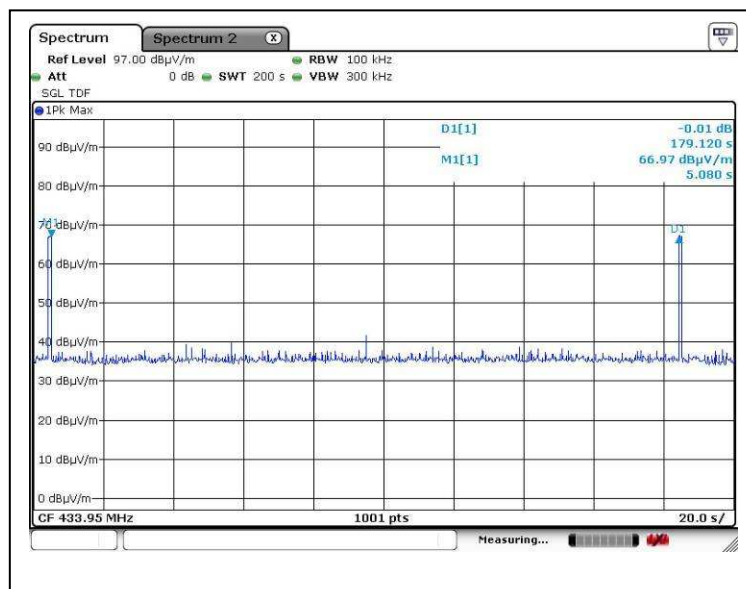
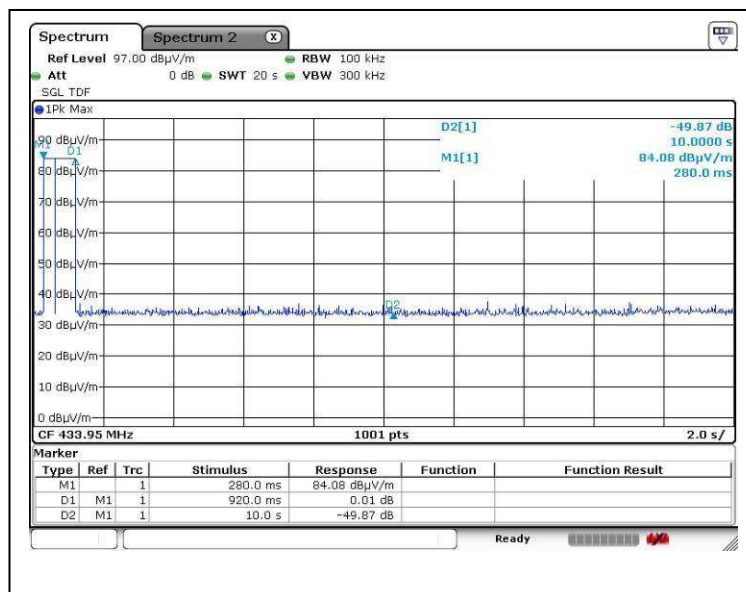
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### A8. Transmission Time



\*\*\*\*\* End of Report \*\*\*\*\*

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Mr. LEUNG Shu-kan, Ken

Reviewed by:

Mr. WONG Lap-pong, Andrew