

# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : W17NR-D061

AGR No. : A177A-358

Applicant : Umain Inc.  
Address : 9th fl. Nano Fab Centre(KAIST), Daehak-ro 291, Yuseong-gu, Daejeon, 34141  
South Korea

Manufacturer : Umain Inc.  
Address : 9th fl. Nano Fab Centre(KAIST), Daehak-ro 291, Yuseong-gu, Daejeon, 34141  
South Korea

Type of Equipment : UWB Radar Sensor

FCC ID. : 2AN8QUMI-HST-S1M-CT

Model Name : HST-S1M-CT

Serial number : N/A

Total page of Report : 8 pages (including this page)

Date of Incoming : October 11, 2017

Date of issue : November 16, 2017

## SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART F Section 15.521**

This test report only contains the result of a single test of the sample supplied for the examination.

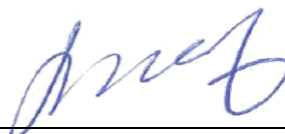
It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Jae-Ho Lee / Chief Engineer  
ONETECH Corp.

Approved by:



Keun-Young, Choi / Vice President  
ONETECH Corp.

## CONTENTS

**PAGE**

|                                                                                 |          |
|---------------------------------------------------------------------------------|----------|
| <b>1. VERIFICATION OF COMPLIANCE .....</b>                                      | <b>4</b> |
| <b>2. GENERAL INFORMATION.....</b>                                              | <b>5</b> |
| <b>2.1 PRODUCT DESCRIPTION.....</b>                                             | <b>5</b> |
| <b>2.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT. ....</b> | <b>5</b> |
| <b>3. EUT MODIFICATIONS.....</b>                                                | <b>5</b> |
| <b>4. MAXIMUM PERMISSIBLE EXPOSURE.....</b>                                     | <b>6</b> |
| <b>4.1 RF EXPOSURE CALCULATION .....</b>                                        | <b>6</b> |
| <b>4.2 EUT DESCRIPTION.....</b>                                                 | <b>7</b> |
| <b>4.3 CALCULATED MPE SAFE DISTANCE.....</b>                                    | <b>8</b> |

**Revision History**

| Issued Report No. | Issued Date       | Revisions     | Effect Section |
|-------------------|-------------------|---------------|----------------|
| W17NR-D061        | November 16, 2017 | Initial Issue | All            |
|                   |                   |               |                |
|                   |                   |               |                |

## 1. VERIFICATION OF COMPLIANCE

Applicant : Umain Inc.  
 Address : 9th fl. Nano Fab Centre(KAIST), Daehak-ro 291, Yuseong-gu, Daejeon, 34141 South Korea  
 Contact Person : Youngwhan Kim / CEO  
 Telephone No. : +82-42-825-9973  
 FCC ID : 2AN8QUMI-HST-S1M-CT  
 Model Name : HST-S1M-CT  
 Serial Number : N/A  
 Date : November 16, 2017

|                                                         |                                                |
|---------------------------------------------------------|------------------------------------------------|
| EQUIPMENT CLASS                                         | <b><i>UWB – ULTRA WIDEBAND TRANSMITTER</i></b> |
| E.U.T. DESCRIPTION                                      | UWB Radar Sensor                               |
| THIS REPORT CONCERNS                                    | Original Grant                                 |
| MEASUREMENT PROCEDURES                                  | ANSI C63.10: 2013                              |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                                 |
| KIND OF EQUIPMENT<br>AUTHORIZATION REQUESTED            | Certification                                  |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART F Section 15.521           |
| Modifications on the Equipment to Achieve<br>Compliance | None                                           |
| Final Test was Conducted On                             | 3 m, Semi Anechoic Chamber                     |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. GENERAL INFORMATION

### 2.1 Product Description

The Umain Inc., Model HST-S1M-CT (referred to as the EUT in this report) is an UWB Radar Sensor. Product specification information described herein was obtained from product data sheet or user's manual.

|                                                            |                    |
|------------------------------------------------------------|--------------------|
| DEVICE TYPE                                                | UWB Radar Sensor   |
| OPERATING FREQUENCY                                        | 4 000 MHz          |
| RF OUTPUT POWER                                            | 52.08 dB $\mu$ V/m |
| MODULATION TYPE                                            | MB-OFDM            |
| ANTENNA TYPE                                               | Monopole Antenna   |
| ANTENNA GAIN                                               | 6.11 dBi           |
| LIST OF EACH OSC. OR CRYSTAL.<br>FREQ.(FREQ. $\geq$ 1 MHz) | 32.768 kHz, 16 MHz |
| RATED SUPPLY VOLTAGE                                       | DC 5.0 V           |

### 2.2 Alternative type(s)/model(s); also covered by this test report.

-. None

## 3. EUT MODIFICATIONS

-. None

## 4. MAXIMUM PERMISSIBLE EXPOSURE

### 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are  $f/1500 \text{ mW/cm}^2$  for the frequency range between 300 MHz and 1 500 MHz and  $1.0 \text{ mW/cm}^2$  for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a  $1 \text{ mW/cm}^2$  exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

$S$  = Power density in  $\text{mW/cm}^2$ ,  $Z$  = Impedance of free space,  $377 \Omega$

$E$  = Electric field strength in  $\text{V/m}$ ,  $G$  = Numeric antenna gain, and  $d$  = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of  $\text{mW}$  and  $\text{cm}$ , using  $P (\text{mW}) = P (\text{W}) / 1 000$ ,  $d (\text{cm}) = 0.01 * d (\text{m})$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

$d$  = distance in  $\text{cm}$ ,  $P$  = Power in  $\text{mW}$ ,  $G$  = Numeric antenna gain, and  $S$  = Power density in  $\text{mW/cm}^2$

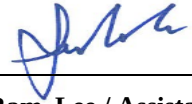
#### 4.2 EUT Description

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kind of EUT                    | UWB Radar Sensor                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Operating Frequency Band       | <input type="checkbox"/> Wireless Microphone: 494.000 MHz ~ 501.000 MHz<br>and 498.200 MHz ~ 505.200 MHz<br><input type="checkbox"/> WLAN: 2 412 MHz ~ 2 462 MHz<br><input type="checkbox"/> WLAN: 5 180 MHz ~ 5 240 MHz<br><input type="checkbox"/> WLAN: 5 745 MHz ~ 5 825 MHz<br><input type="checkbox"/> Bluetooth: 2 402 MHz ~ 2 480 MHz<br><input type="checkbox"/> Bluetooth BLE: 2 402 MHz ~ 2 480 MHz<br><input checked="" type="checkbox"/> UWB: 3 100 MHz ~ 4 800 MHz |
| MAX. RF OUTPUT POWER           | 52.38 dBuV/m (-52.32 dBm @ 1 m)                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Antenna Gain                   | 6.11 dBi                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Exposure<br>Evaluation Applied | <input checked="" type="checkbox"/> MPE<br><input type="checkbox"/> SAR<br><input type="checkbox"/> N/A                                                                                                                                                                                                                                                                                                                                                                          |

### 4.3 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

| Operating<br>Freq. Band<br>(MHz) | Operating Mode   | Target Power<br>W/tolerance | Max tune up<br>power |      | Antenna Gain |        | Power Density<br>(mW/cm <sup>2</sup> )<br>@ 20 cm<br>Separation | Limit<br>(mW/cm <sup>2</sup> ) |
|----------------------------------|------------------|-----------------------------|----------------------|------|--------------|--------|-----------------------------------------------------------------|--------------------------------|
|                                  |                  | (dBm)                       | (dBm)                | (mW) | Log          | Linear |                                                                 |                                |
| 3 100<br>~ 4 800                 | UWB<br>(MB-OFDM) | -52.82 ± 0.5                | -52.32               | 0.69 | 6.11         | 4.083  | 0.000 000 005                                                   | 1.00                           |



Tested by: Ha-Ram, Lee / Assistant Manager