

# IEC 62238 TEST REPORT

For

## Raymarine UK Limited

Raymarine UK Limited, Marine House, Cartwright Drive, Fareham,  
Hampshire, PO15 5RJ, England

**Model: RAY50**

|                                                                                                                                                                                                                                                                                                                  |                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                                                                                           | <b>Product Type:</b><br>Class D Digital Selective Calling device |
| <b>Test Engineer:</b> Candy Li                                                                                                                                                                                                                                                                                   | <i>Candy Li</i>                                                  |
| <b>Report Number:</b> RSZ141203001-01                                                                                                                                                                                                                                                                            |                                                                  |
| <b>Report Date:</b> 2015-01-30                                                                                                                                                                                                                                                                                   |                                                                  |
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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Raymarine UK Limited*'s product, model number: *RAY50* or the "EUT" in this report was a *RAY50 DSC Class D VHF Radio*, which was measured approximately: 173.75 mm (L) × 168 mm (W) × 88.5 mm (H), rated with input voltage: DC 12 V.

*\* All measurement and test data in this report was gathered from production sample serial number: 1412028 (Assigned by Shenzhen BACL). The EUT supplied by the applicant was received on 2014-12-03.*

### Objective

This test report is prepared on behalf of *Raymarine UK Limited* in accordance with IEC 62238.

### Related Submittal(s)/Grant(s)

No related submittal(s)

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the IEC 62238 First edition 2003-03, Maritime navigation and radiocommunication equipment and systems-VHF radiotelephone equipment incorporating Class "D" Digital Selective Calling (DSC)-Methods of testing and required test results.

### Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in a DSC mode in accordance with IEC 62238.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

| Manufacturer    | Description | Model  | Serial Number |
|-----------------|-------------|--------|---------------|
| DC Power Supply | MEAN WELL   | SP-320 | N/A           |

**SUMMARY OF TEST RESULTS**

| IEC 62238 Rules | Description of Test                                            | Results    |
|-----------------|----------------------------------------------------------------|------------|
| §7.4            | Vibration Test                                                 | Compliance |
| §7.5            | Temperature Tests                                              | Compliance |
| §8.14           | Test of Generated Call Sequences                               | Compliance |
| §9.13           | Multiple Watch Characteristics                                 | Compliance |
| §10.3           | DSC Receiver Adjacent Channel Selectivity                      | Compliance |
| §10.5           | DSC Receiver Intermodulation Response                          | Compliance |
| §10.8           | Verification of Correct Decoding of Various Types of DSC Calls | Compliance |
| §10.9           | Reaction to VTS and AIS Channel Management DSC Transmissions   | Compliance |
| §10.10          | Simultaneous Reception                                         | Compliance |

Note: a brief summary of the tests carried out in accordance with IEC 62238 standards.

## §7.4 VIBRATION TEST

### Applicable Standard

The vibration test shall be performed as in IEC 60945 clause 8.7.1,

### Limit:

The requirement of the performance check shall be met.

### Test Equipment List and Details

| Manufacturer | Description               | Model        | Calibration Date | Calibration Due Date |
|--------------|---------------------------|--------------|------------------|----------------------|
| H&P          | RF Communication Test Set | 8921A        | 2014-05-16       | 2015-05-16           |
| CMI          | Vibration Tester          | ACT2000-S06L | 2014-06-03       | 2015-06-03           |

### Test Data

#### Environmental Conditions

|                       |           |
|-----------------------|-----------|
| External Temperature: | 25 °C     |
| Relative Humidity:    | 50 %      |
| ATM Pressure:         | 101.0 kPa |

The testing was performed on 2015-01-26

#### Test Levels:

- 2Hz to 5Hz and up to 13.2Hz with and excursion of  $\pm 1.43\text{mm} \pm 10\%$  ( $9.8\text{m/s}^2$  maximum acceleration at 13.2Hz)
- Above 13.2Hz and up to 600Hz with a constant acceleration of 1g
- Nominal test voltage = +12Vdc

Endurance Test for 2 hour sat each resonant frequency or frequency with a g level  $\geq 5$  times the drive g level. If no resonant frequencies or frequency with a g level  $\geq 5$  times the drive g level are found endurance test shall be performed at 30Hz.

**Test Result:** Compliance.

## §7.5 TEMPERATURE TEST

### Applicable Standard

The dry heat cycle shall be performed as in IEC 60945. tests and performance checks at extreme power supply conditions shall be performed under the environmental conditions as follow:

| Environment | Normal power supply | Extreme power supply |
|-------------|---------------------|----------------------|
| Dry heat    | Performance test    | Performance check    |

### Limit:

The requirement of the performance check shall be met.

### Test Equipment List and Details

| Manufacturer | Description                    | Model    | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|----------|------------------|----------------------|
| H&P          | RF Communication Test Set      | 8921A    | 2014-05-16       | 2015-05-16           |
| ESPEC        | Temperature & Humidity Chamber | ESL-04KA | 2014-12-14       | 2015-12-14           |

### Test Data

#### Environmental Conditions

|                       |           |
|-----------------------|-----------|
| External Temperature: | 25 °C     |
| Relative Humidity:    | 50 %      |
| ATM Pressure:         | 101.0 kPa |

*The testing was performed from 2015-01-26 to 2015-01-28*

**Test Result:** Compliance. Please refer to following table.

| Environmental Conditions |                 | Temperature | Voltage (V <sub>DC</sub> ) | Test Period(Hour) | Results    |
|--------------------------|-----------------|-------------|----------------------------|-------------------|------------|
| Dry Heat                 | Storage Test    | 70±1℃       | -                          | 15                | Compliance |
|                          | Functional Test | 55±1℃       | 15.6                       | 15                | Compliance |
|                          |                 |             | 12.0                       | 15                | Compliance |
|                          |                 |             | 10.8                       | 15                | Compliance |

## §8.14 TEST OF GENNERATED CALL SEQUENCES

### Applicable Standard

According to IEC 62238, Clause 8.14

### Limit:

The requirement of ITU-R Recommendation M.493-10 regarding message composition and content shall be met.

The generated call shall be analysed with the calibrated apparatus for correct configuration of the signal format, including time diversity.

It shall be verified that, after transmission of a DSC call, the transmitter re-tunes to the original channel. However, in the case of a distress call, the transmitter shall tune to channel 16 and automatically select the maximum power.

### Test Equipment List and Details

| Manufacturer | Description                    | Model  | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|--------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B  | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A  | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920   | 1000003253    | 2014-09-06       | 2015-09-05           |
| Agilent      | Signal Generator               | E4422B | T-08-RM137    | 2014-01-22       | 2015-01-21           |

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 50 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Candy Li on 2015-01-26

**Test Result:** Compliance. Please refer to following table.

| Format specifier | Category | 1 <sup>st</sup> telecommand<br>(symbol No.) | 2 <sup>st</sup> telecommand<br>(symbol No.) |
|------------------|----------|---------------------------------------------|---------------------------------------------|
| Distress         | -        | 100                                         | 126                                         |
| All Ships        | Distress | 100                                         | 126                                         |
| All Ships        | Urgency  | 100                                         | 126                                         |
| All Ships        | Safety   | 100                                         | 126                                         |
| Individual       | Urgency  | 100                                         | 126                                         |
| Individual       | Safety   | 100                                         | 126                                         |
| Individual       | Routine  | 100                                         | 126                                         |
| Group            | Routine  | 100                                         | 126                                         |

## §9.13 MULTIPLE WATCH CHARACTERISTICS

### Applicable Standard

According to IEC 62238, Clause 9.13

Limit:

| Test Project                    | Requirement           |
|---------------------------------|-----------------------|
| Scanning Period                 | $\leq 2s$             |
| Dwell Time (Priority Channel)   | $\leq 150ms$          |
| Dwell Time (Additional Channel) | Between 850 ms and 2s |

### Test Equipment List and Details

| Manufacturer | Description                    | Model   | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|---------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B   | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A   | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B  | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A  | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920    | 1000003253    | 2014-09-06       | 2015-09-05           |
| ESPEC        | Temperature & Humidity Chamber | EL-10KA | 09107726      | 2014-11-01       | 2015-11-01           |

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 50 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Candy Li on 2015-01-26.

**Test Result:** Compliance. Please refer to following table.

| Test Conditions |                            | Scanning<br>Time(s) | Dwell on Priority<br>(ms) | Dwell on Additional<br>(s) |
|-----------------|----------------------------|---------------------|---------------------------|----------------------------|
| Temperature(°C) | Voltage (V <sub>DC</sub> ) |                     |                           |                            |
| -15             | 15.6                       | 1.630               | 80.1                      | 1.608                      |
| -15             | 12.0                       | 1.632               | 80.5                      | 1.601                      |
| -15             | 10.8                       | 1.631               | 80.5                      | 1.614                      |
| +25             | 12.0                       | 1.634               | 80.9                      | 1.615                      |
| +55             | 15.6                       | 1.632               | 80.3                      | 1.611                      |
| +55             | 12.0                       | 1.625               | 80.4                      | 1.606                      |
| +55             | 10.8                       | 1.621               | 80.6                      | 1.601                      |

**§10.3 DSC RECEIVER ADJACENT CHANNEL SELECTIVITY****Applicable Standard**

According to IEC 62238, Clause 10.3

**Limit:**

The bit error ratio shall be less than  $10^{-2}$

**Test Equipment List and Details**

| Manufacturer | Description                    | Model   | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|---------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B   | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A   | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B  | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A  | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920    | 1000003253    | 2014-09-06       | 2015-09-05           |
| ESPEC        | Temperature & Humidity Chamber | EL-10KA | 09107726      | 2014-11-01       | 2015-11-01           |
| Hyetra       | DSC Decoder/Encoder            | N/A     | N/A           | NCR              | NCR                  |

**Test Data****Environmental Conditions**

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 50 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Candy Li on 2015-01-26.

**Test Result:** Compliance. Please refer to following table.

| Test Conditions |                 | Bit Error Ratio     |                     |
|-----------------|-----------------|---------------------|---------------------|
| Temperature(°C) | Temperature(°C) | 156.525MHz          |                     |
|                 |                 | +25 kHz             | -25 kHz             |
| -15             | -15             | Less than $10^{-2}$ | Less than $10^{-2}$ |
| -15             | -15             |                     |                     |
| -15             | -15             |                     |                     |
| +25             | +25             |                     |                     |
| +55             | +55             |                     |                     |
| +55             | +55             |                     |                     |
| +55             | +55             |                     |                     |

Measurement uncertainty:  $\pm 1.6$  dB

## §10.5 DSC RECEIVER INTERMODULATION RESPONSE

### Applicable Standard

According to IEC 62238, Clause 10.5

### Limit:

The BER shall not exceed  $10^{-2}$

### Test Equipment List and Details

| Manufacturer | Description                    | Model   | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|---------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B   | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A   | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B  | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A  | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920    | 1000003253    | 2014-09-06       | 2015-09-05           |
| ESPEC        | Temperature & Humidity Chamber | EL-10KA | 09107726      | 2014-11-01       | 2015-11-01           |

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 23 °C     |
| Relative Humidity: | 43 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Candy Li on 2015-01-26.

**Test Result:** Compliance. Please refer to following table.

| Frequency Increments of Unwanted Signals | Bit Error Rate      |
|------------------------------------------|---------------------|
|                                          | 156.525 MHz         |
| +50/100 kHz                              | Less than $10^{-2}$ |
| -50/100 kHz                              | Less than $10^{-2}$ |

Measurement uncertainty:  $\pm 1.5$  dB

## §10.8 VERIFICATION OF CORRECT DECODING OF VARIOUS TYPES OF DSC CALLS

### Applicable Standard

According to IEC 62238, Clause 10.8

### Limit:

The requirement of ITU-R Recommendation M.493.13(5) regarding message composition and content shall be met.

### Test Equipment List and Details

| Manufacturer | Description                    | Model  | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|--------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B  | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A  | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920   | 1000003253    | 2014-09-06       | 2015-09-05           |

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 23 °C     |
| Relative Humidity: | 43 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Candy Li on 2015-01-27.

**Test Result:** Compliance. Please refer to following tables.

| Format specifier | Category | 1 <sup>st</sup> telecommand<br>(symbol No.) | 2 <sup>st</sup> telecommand<br>(symbol No.) |
|------------------|----------|---------------------------------------------|---------------------------------------------|
| Distress         | -        | 100                                         | 126                                         |
| All Ships        | Distress | 100                                         | 126                                         |
| All Ships        | Urgency  | 100                                         | 126                                         |
| All Ships        | Safety   | 100                                         | 126                                         |
| Individual       | Urgency  | 100                                         | 126                                         |
| Individual       | Safety   | 100                                         | 126                                         |
| Individual       | Routine  | 100                                         | 126                                         |
| Group            | Routine  | 100                                         | 126                                         |

|                                                                                                                                                               | Confirm (Y or N) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Confirm that the decoded call sequences at the output of the receiver have been examined for correct technical format, including error check characteristics: | Y                |
| Error found:                                                                                                                                                  | N                |
| Confirm that the checks have been made to ensure accordance between printer output and display:                                                               | Y                |
| Error found:                                                                                                                                                  | N                |
| It has been verified that the equipment is capable of switching to a channel identified in the DSC call:                                                      | Y                |

## §10.9 REACTION TO VTS AND AIS CHANNEL MANAGEMENT DSC TRANSMISSIONS

### Applicable Standard

According to IEC 62238, Clause 10.8

### Limit:

The equipment shall not sound an alarm, display a message (an accurate, informative display is permissible but not required), transmit a message a reponse or suggest a transmitted response, lock up, or require operator intervention.

### Test Equipment List and Details

| Manufacturer | Description                    | Model  | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|--------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B  | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A  | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920   | 1000003253    | 2014-09-06       | 2015-09-05           |

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 23 °C     |
| Relative Humidity: | 43 %      |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Candy Li on 2015-01-26.

**Test Result:** Compliance. Please refer to following table.

|                                                                                         | Confirm (Y or N) |
|-----------------------------------------------------------------------------------------|------------------|
| Not sound an alarm                                                                      | Y                |
| Not display a message (An accurate informative display is permissible but not required) | Y                |
| Not transmit a response                                                                 | Y                |
| Not suggest a transmitted response                                                      | Y                |
| Not lock up                                                                             | Y                |
| Not require operator intervention                                                       | Y                |

## §10.10 SIMULTANEOUS RECEPTION

### Applicable Standard

According to IEC 62238, Clause 10.8

### Limit:

| Test Project     | Requirement                            |
|------------------|----------------------------------------|
| SINAD Ratio (dB) | $\geq 20$ dB in presence of DSC Signal |
| Bit Error Rate   | $\leq 10^{-2}$                         |

### Test Equipment List and Details

| Manufacturer | Description                    | Model   | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------|---------|---------------|------------------|----------------------|
| H&P          | Modulation Analyzer            | 8901B   | 3438A05208    | 2014-06-03       | 2015-06-03           |
| Agilent      | RF Communication test set      | 8920A   | 3325U00859    | 2014-06-03       | 2015-06-03           |
| Agilent      | MXG X-Series Signal Generators | N5182B  | N/A           | 2014-06-03       | 2015-06-03           |
| Agilent      | Universal Frequency Center     | 53220A  | N/A           | 2014-10-09       | 2015-10-08           |
| Aeroflex     | Digital Radio Test Set         | 3920    | 1000003253    | 2014-09-06       | 2015-09-05           |
| ESPEC        | Temperature & Humidity Chamber | EL-10KA | 09107726      | 2014-11-01       | 2015-11-01           |
| Hyetra       | DSC Decoder/Encoder            | N/A     | N/A           | NCR              | NCR                  |

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 23 °C     |
| Relative Humidity: | 47 %      |
| ATM Pressure:      | 100.0 kPa |

The testing was performed by Candy Li on 2015-01-26

Test Mode: Transmitting

**Test Result:** Compliance. Please refer to following table.

| SINAD (dB) No DSC Signal | SINAD (dB) DSC Signal Applied | Bit Error Rate      |
|--------------------------|-------------------------------|---------------------|
| 44.3                     | 44.8                          | Less than $10^{-2}$ |

Measurement uncertainty:  $\pm 1.6$  dB

## EXHIBIT A- EUT PHOTOGRAPHS

EUT –All View



EUT –Label View (Main Part)



**EUT – Base Front View**



**EUT –Base Rear View**



**EUT –Base Top View**



**EUT –Base Bottom View**



**EUT –Base Left Side View**



**EUT –Base Right Side View**



**EUT – MIC Front View**



**EUT –MIC Rear View**



**EUT –Microphone Top View**



**EUT –Microphone Bottom View**



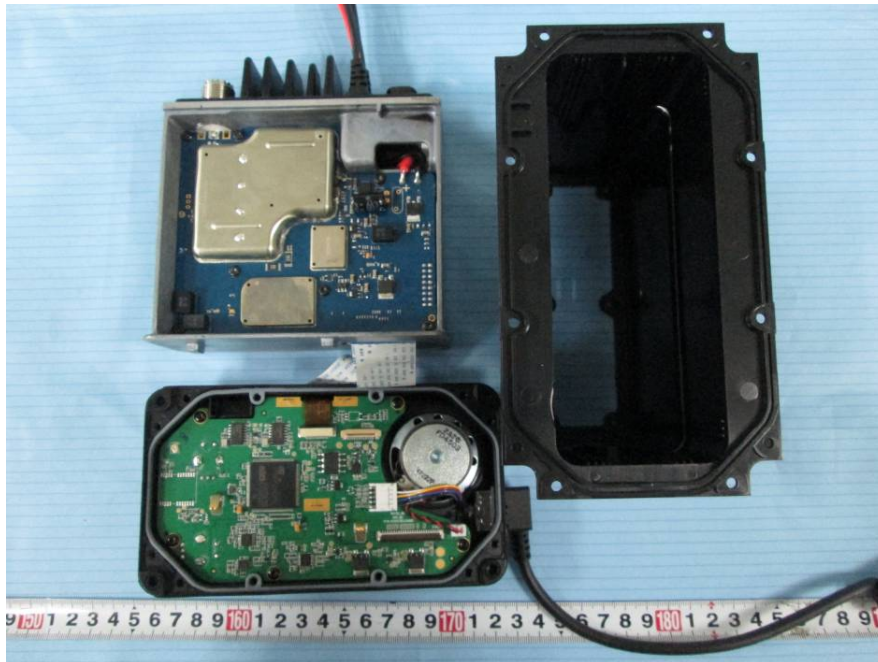
**EUT –Microphone Left Side View**



**EUT –Microphone Right Side View**



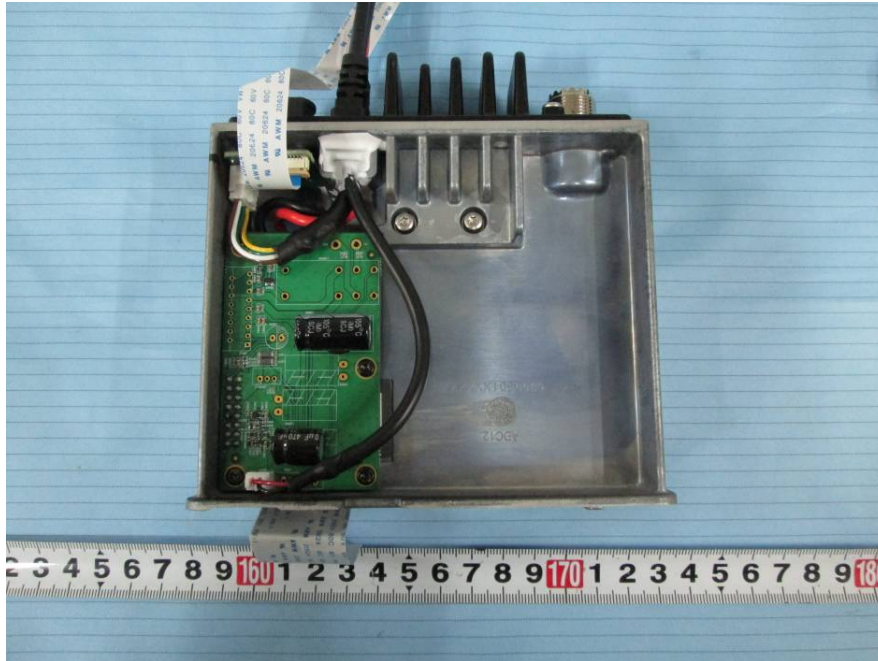
**EUT –Cover off View 1**



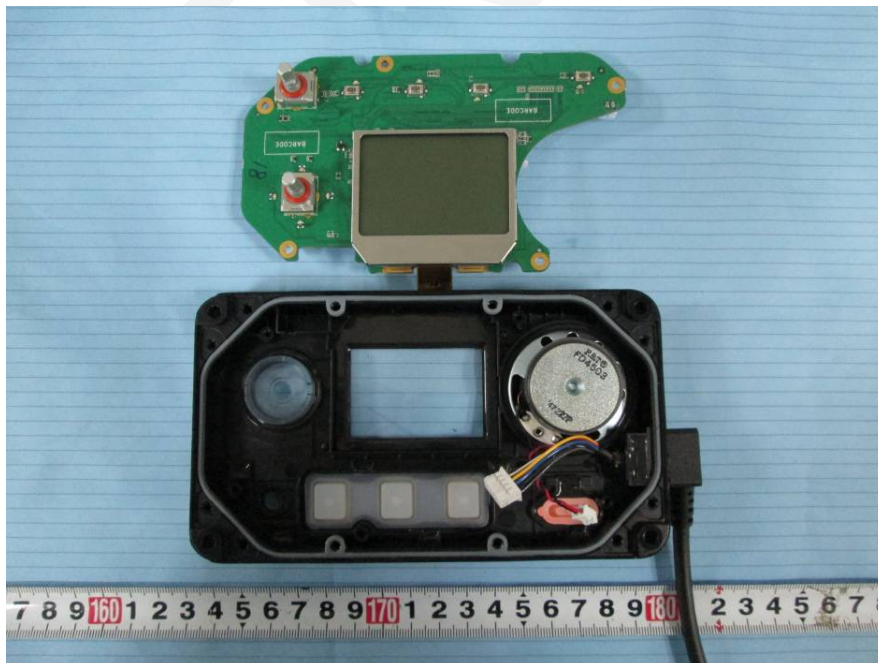
**EUT –Cover off View 2**



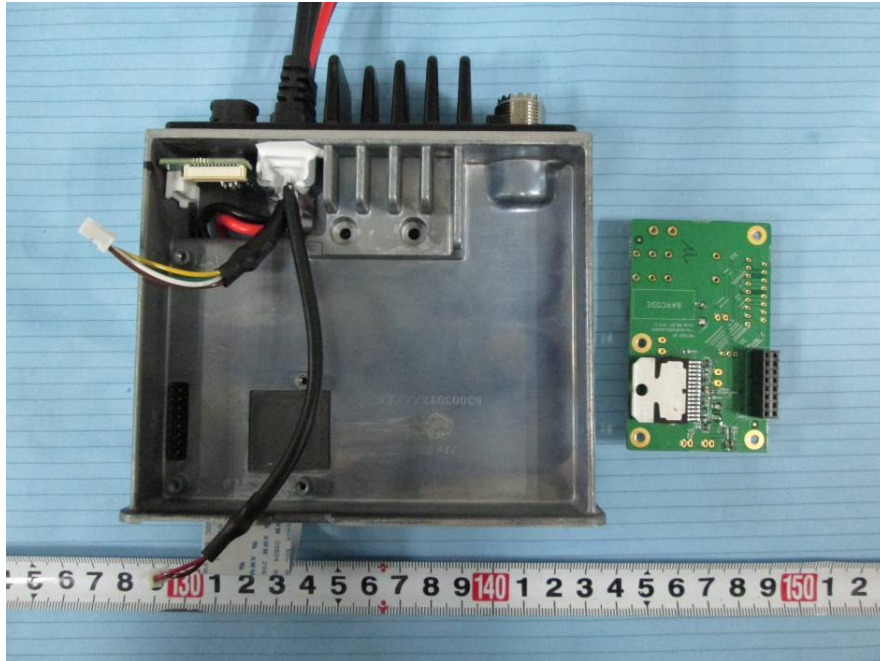
**EUT –Cover off View 3**



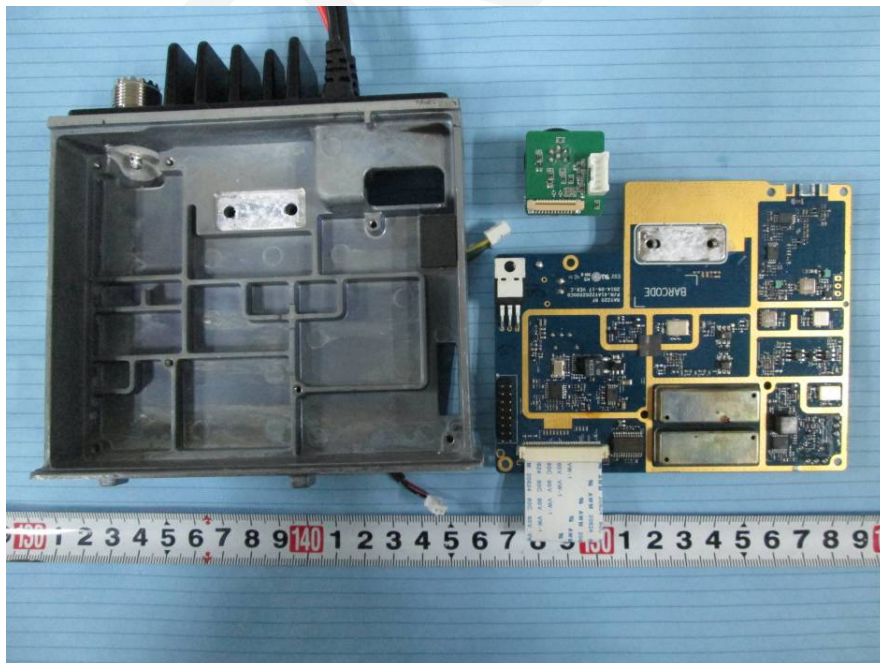
**EUT –Cover off View 4**



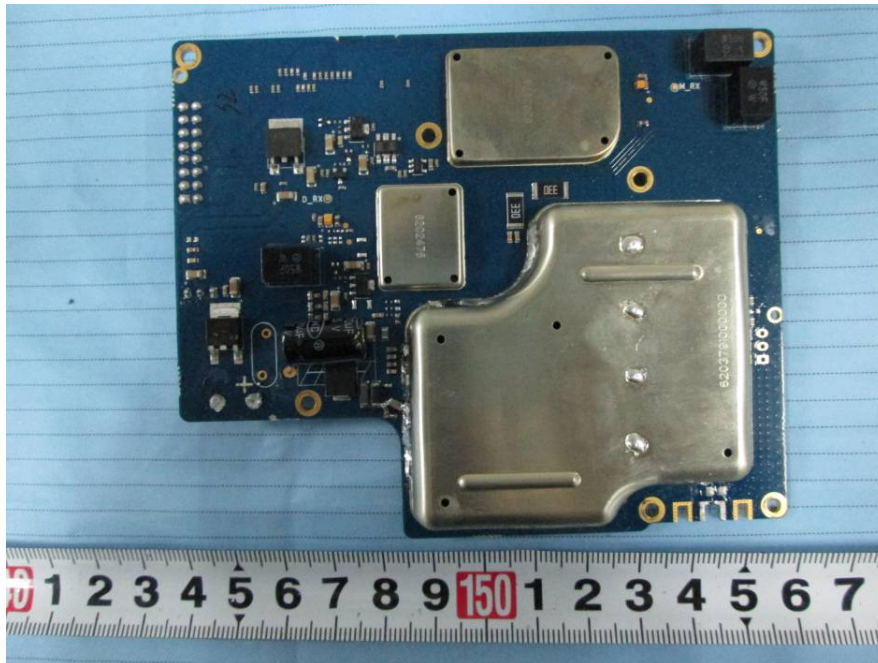
**EUT –Cover off View 5**



**EUT –Cover off View 6**



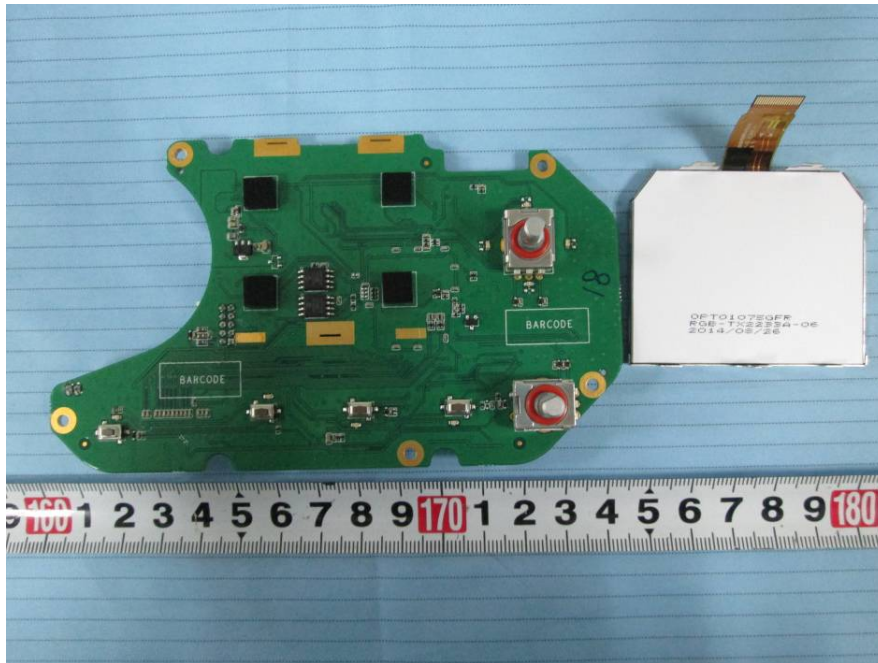
**EUT –Base Main Board 1Top View 1**



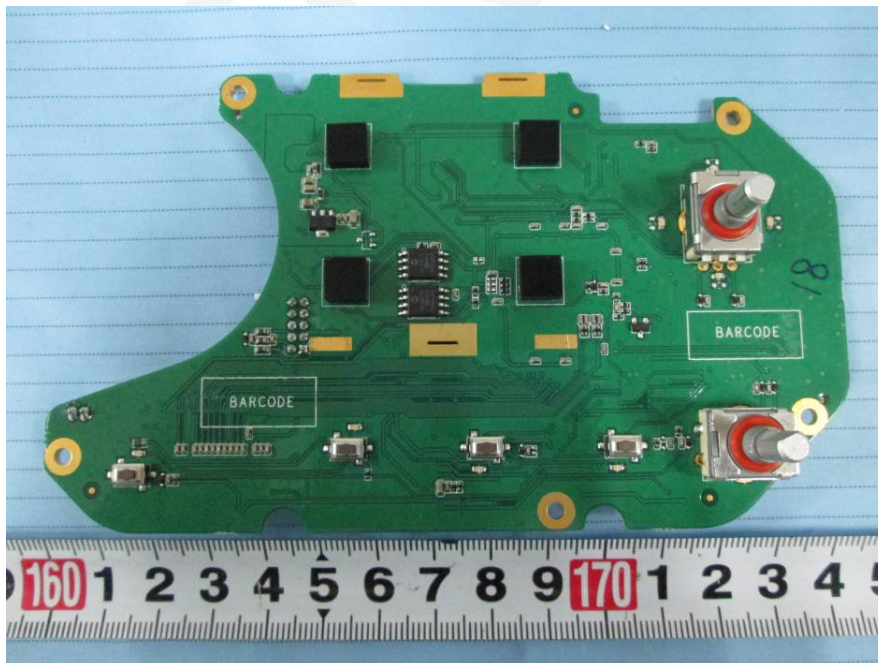
**EUT –Base Main Board 1 Bottom View 1**



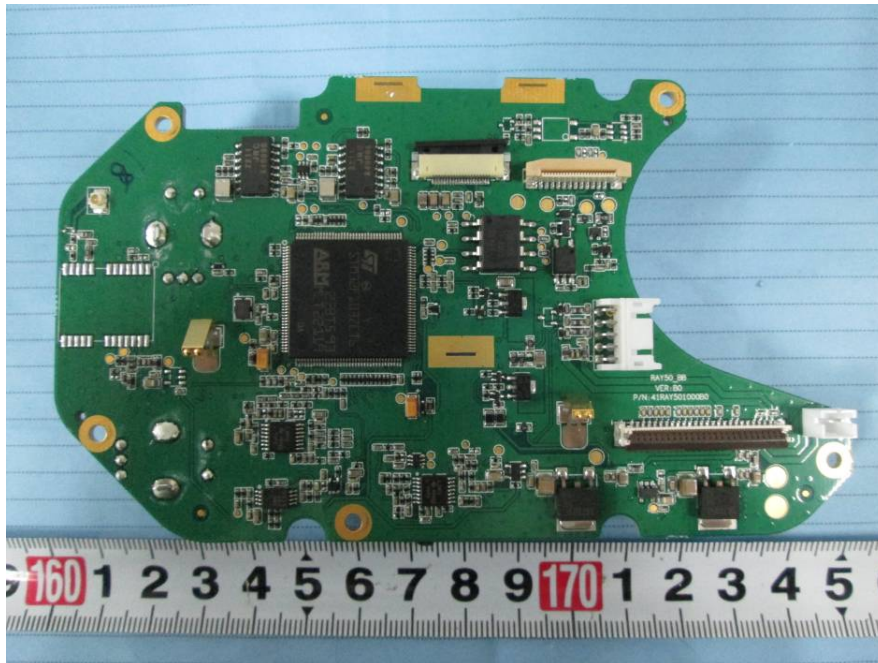
**EUT –The Connect Board 1 With LCD off View**



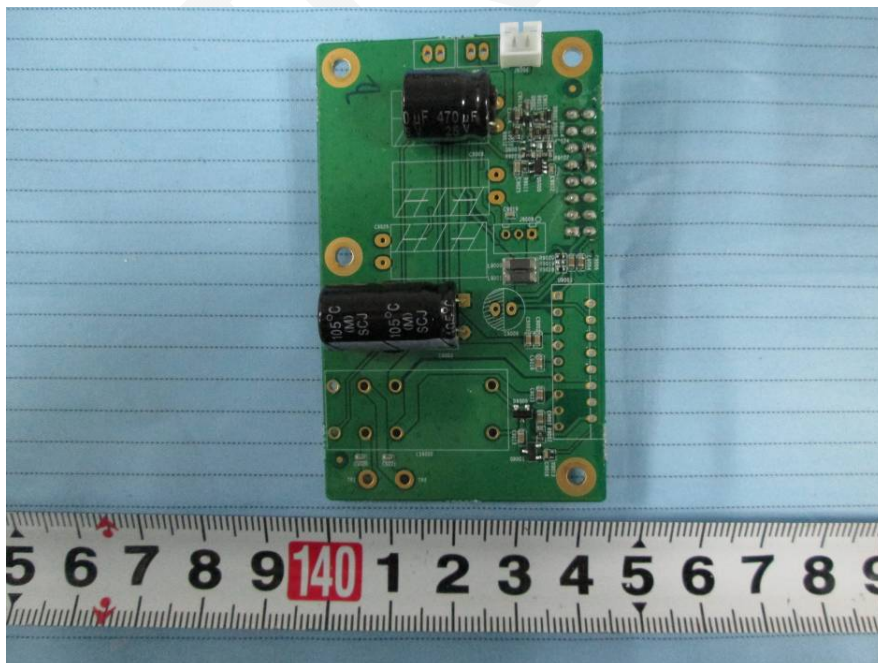
**EUT –The Connect Board 1 Top View**



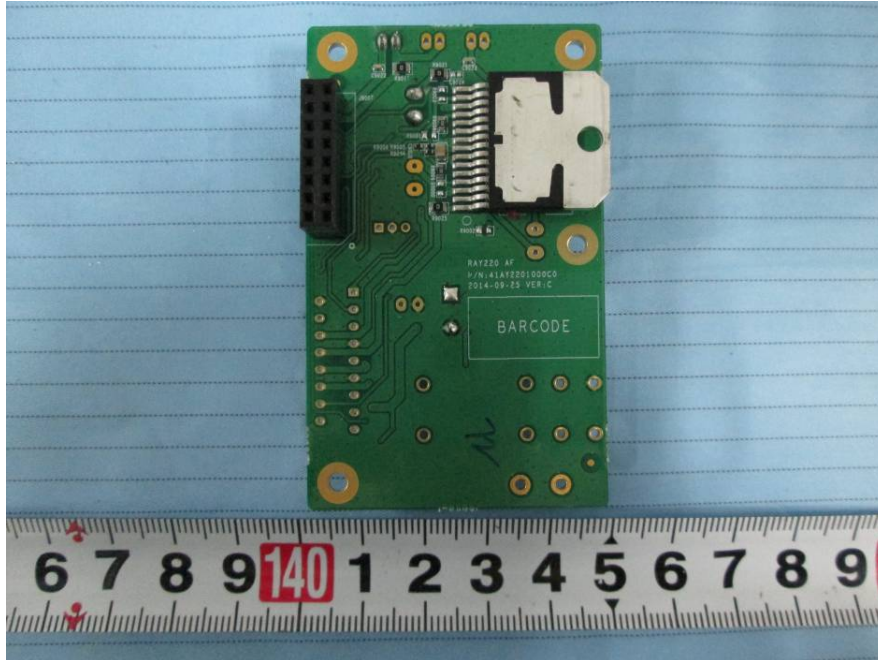
**EUT –The Connect Board 1 Bottom View**



**EUT –The Connect Board 2 Top View**



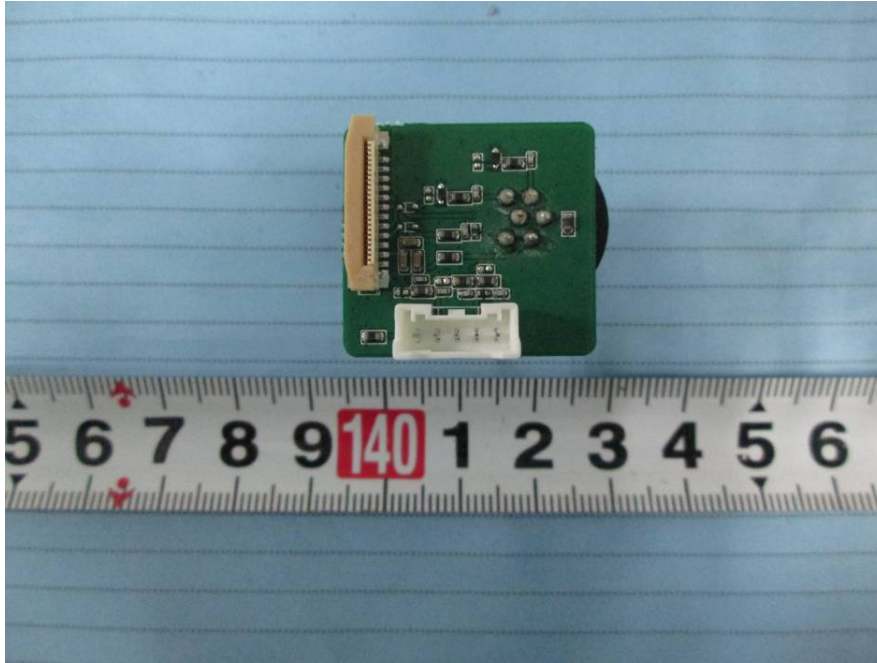
**EUT –The Connect Board 2 Bottom View**



**EUT –The Connect Board 3 Top View**



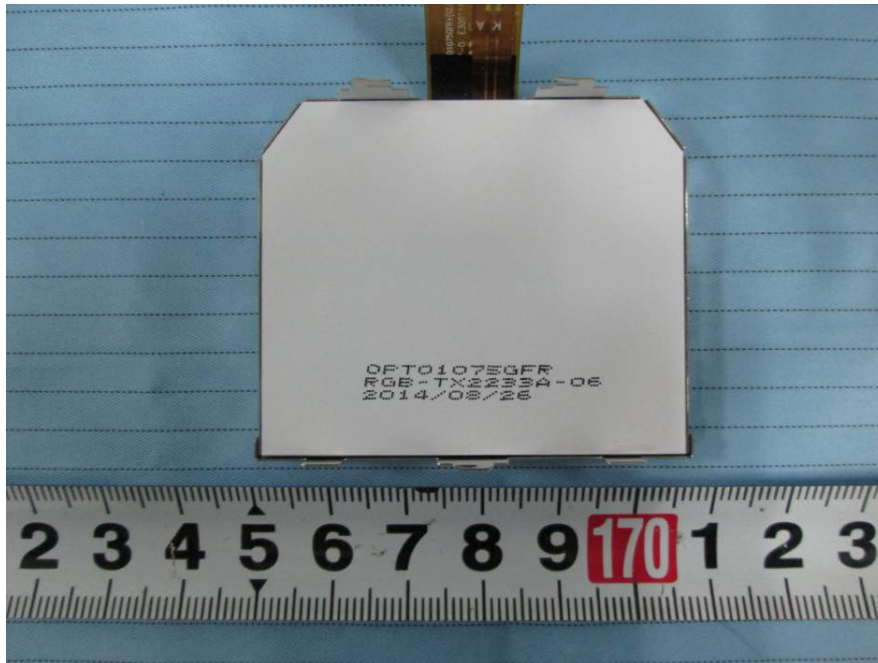
**EUT –The Connect Board 3 BottomView**



**EUT –LCD Screen Front View**



### EUT –LCD Screen Back View

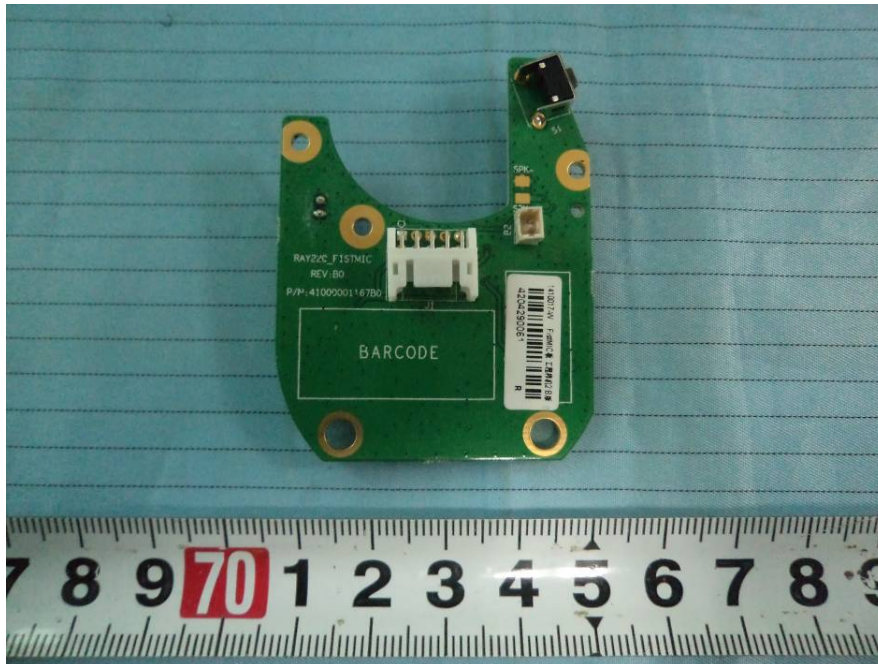


### EUT –Microphone Cover off View

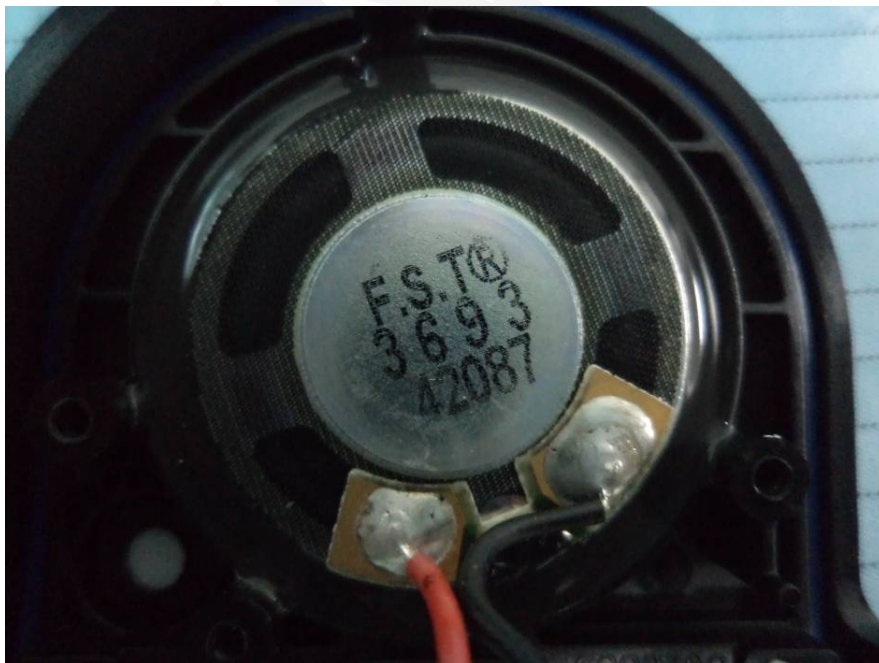


[illegible]

**EUT –Microphone Main Board Bottom View**



**EUT –Microphone Speaker View**



## EXHIBIT B - TEST SETUP PHOTOGRAPHS



\*\*\*\*\*END OF REPORT \*\*\*\*\*