IEC 62238
TEST REPORT

For

Raymarine UK Limited

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

Model: RAY70

Report Type:	**Product Type:**
Original Report	RAY70 DSC Class D VHF Radio

Test Engineer:	Candy Li
Report Number:	RSZ141203005-01
Report Date:	2015-01-29
Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Raymarine UK Limited*'s product, model number: *RAY70 (FCC ID: PJ5-RAY70/ IC: 4069B-RAY70D)* or the "EUT" in this report was a *RAY70 DSC Class D VHF Radio,* which was measured approximately: 204.6 mm (L) × 199.0 mm (W) × 98.5 mm (H), rated with input voltage: DC 12 V.

** All measurement and test data in this report was gathered from production sample serial number: 1412033 (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 Gennerated 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

According to IEC 62238, Clause 7.4

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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed on 2015-01-27

Test Levels:

- 2Hz to 5Hz and up to 13.2Hz with and excursion of ±1.43mm ± 10% (9.8m/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 ≥ 5 times the drive g level. If no resonant frequencies or frequency with a g level ≥ 5 times the drive g levelare found endurance test shall be performed at 30Hz.

Test Result: Compliance.

§7.5 TEMPERATURE TEST

Applicable Standard

According to IEC 62238, Clause 7.5

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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed from 2015-01-25 to 2015-01-27

Test Result: Compliance. Please refer to following table.

Environmental Conditions		Temperature	Voltage (V_{DC})	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 Recoomendation M.493-10 regarding message composition and content shell be met.

The generated call shall be anlaysed 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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

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

Test Result: Compliance. Please refer to following table.

Format specifier	Category	1st telecommand (symbol No.)	2st telecommand (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	≤2s
Dwell Time (Priority Channel)	≤150ms
Dwell Time (Additional Channel)	Betweeen 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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Candy Li on 2015-01-28.

Test Result: Compliance. Please refer to following table.

Test Conditions		Scanning Tine(s)	Dwell on Priority (ms)	Dwell on Additional (s)
Temperature(°C)	Voltage (V_{DC})			
-15	15.6	1.628	79.9	1.617
-15	12.0	1.627	80.2	1.624
-15	10.8	1.628	79.9	1.626
+25	12.0	1.626	80.3	1.626
+55	15.6	1.645	80.2	1.625
+55	12.0	1.628	80.1	1.624
+55	10.8	1.624	80.1	1.622

§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 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

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

Test Result: Compliance. Please refer to following table.

Test Conditions		Bit Error Ratio	
		156.525MHz	
Temperature(°C)	Temperature(°C)	+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		

Meausrement uncertainty: ± 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 ℃
Relative Humidity:	43 %
ATM Pressure:	101.0 kPa

The testing was performed by Candy Li on 2015-01-28.

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}

Meausrement uncertainty: ± 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 Reconmmendation 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 ℃
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 tables.

Format specifier	Category	1st telecommand (symbol No.)	2st telecommand (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 beenverified 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 10.9

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 ℃
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 10.10

Limit:

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

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 ℃
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}

Meausrement uncertainty: ± 1.6 dB

EXHIBIT A- EUT PHOTOGRAPHS

EUT –All View

EUT –Handset Front View

EUT –Handset Rear View

EUT –Handset Top View

EUT –Handset Bottom View

EUT –Handset Left Side View

EUT –Handset Right Side View

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 –Base Label View

EUT – MIC Front View

EUT –MIC Rear View

EUT –MIC Top View

EUT –MIC Bottom View

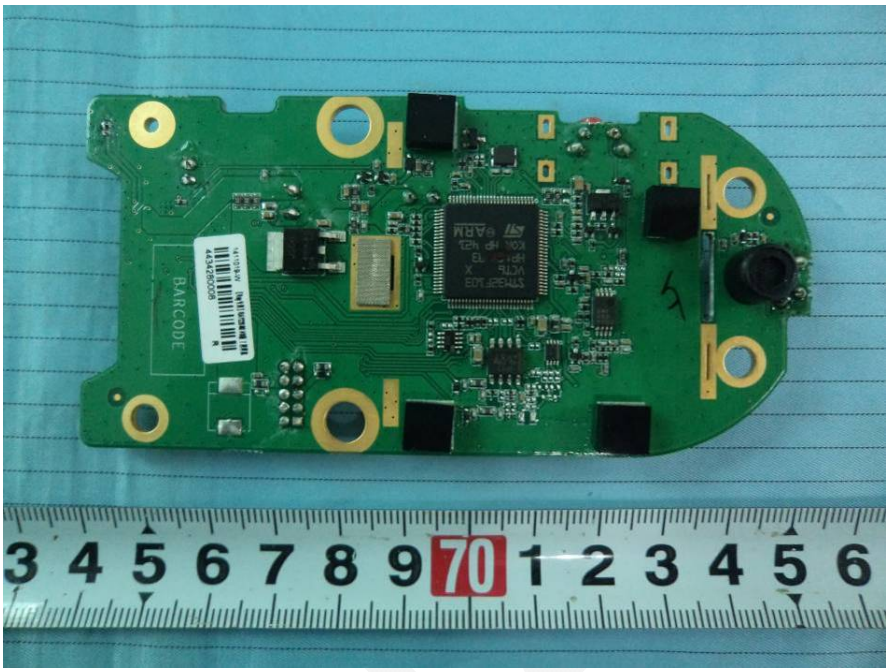
EUT –MIC Left Side View

EUT –MIC Right Side View

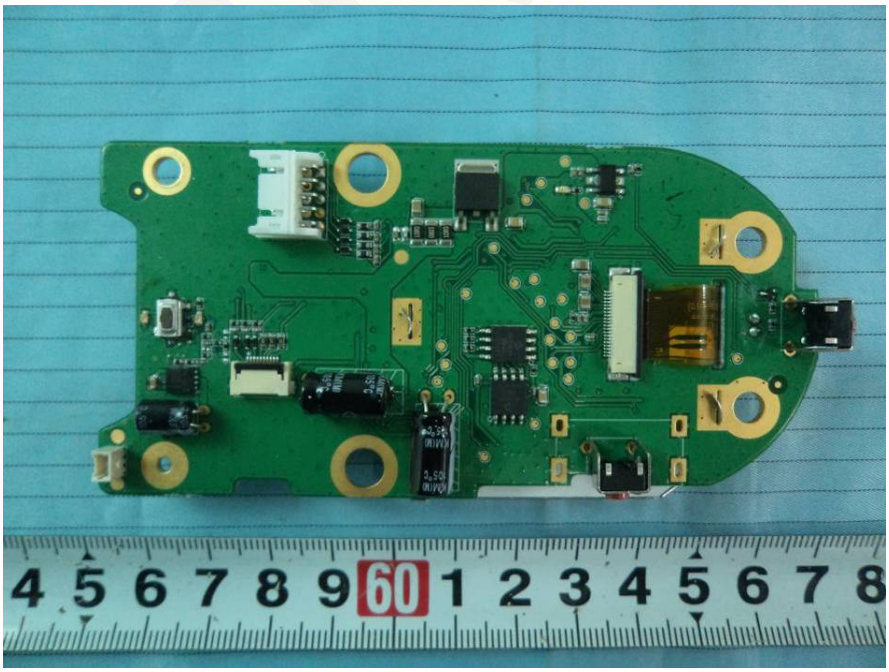
EUT – Handset Cover off View

EUT – Handset Main Board Top View 1

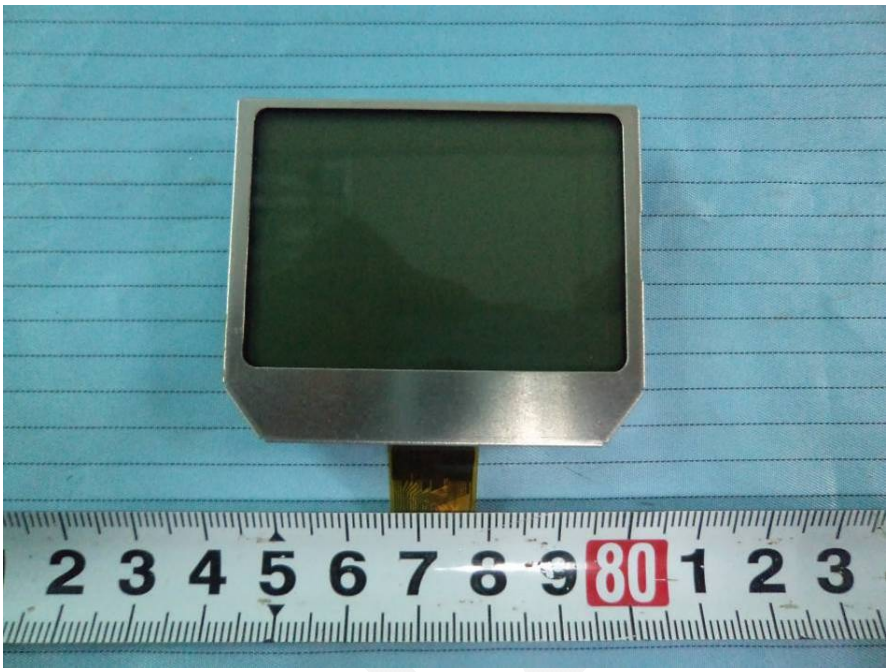
EUT – Handset Main Board Top View 2



EUT –Handset Main Board Bottom View

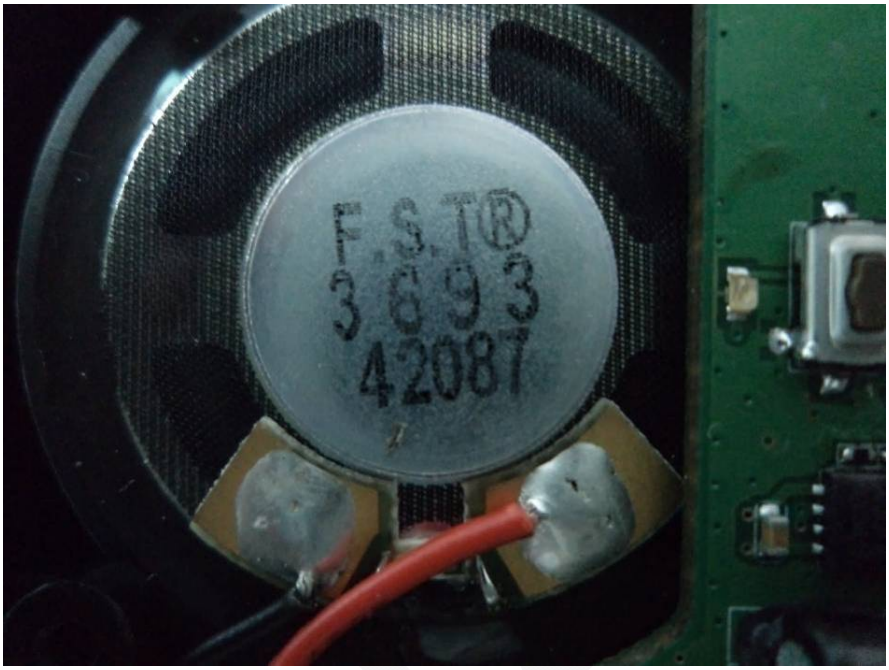


EUT – Handset LCD Screen Top View



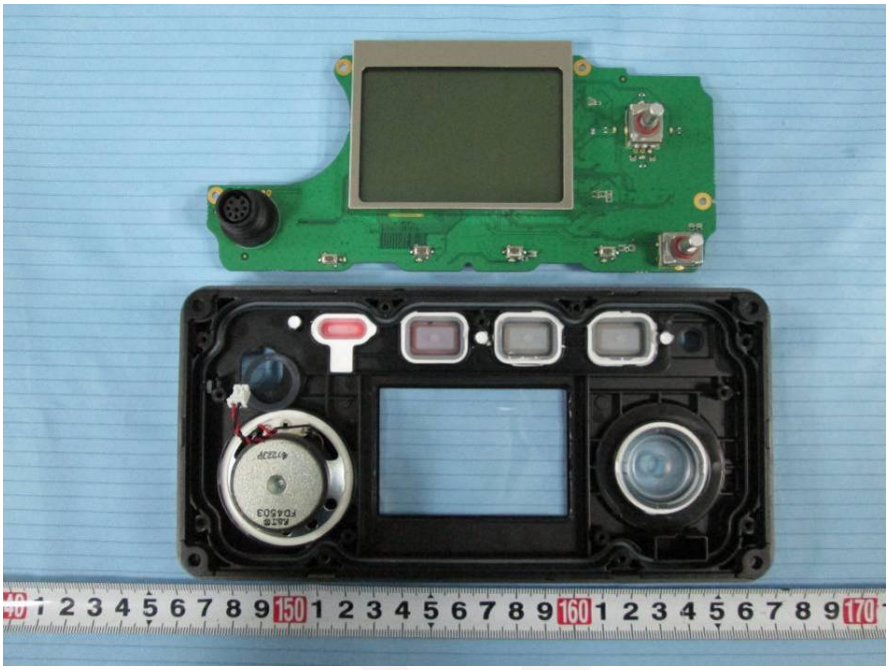
EUT –Handset LCD Screen Bottom View

EUT – Handset Speaker View

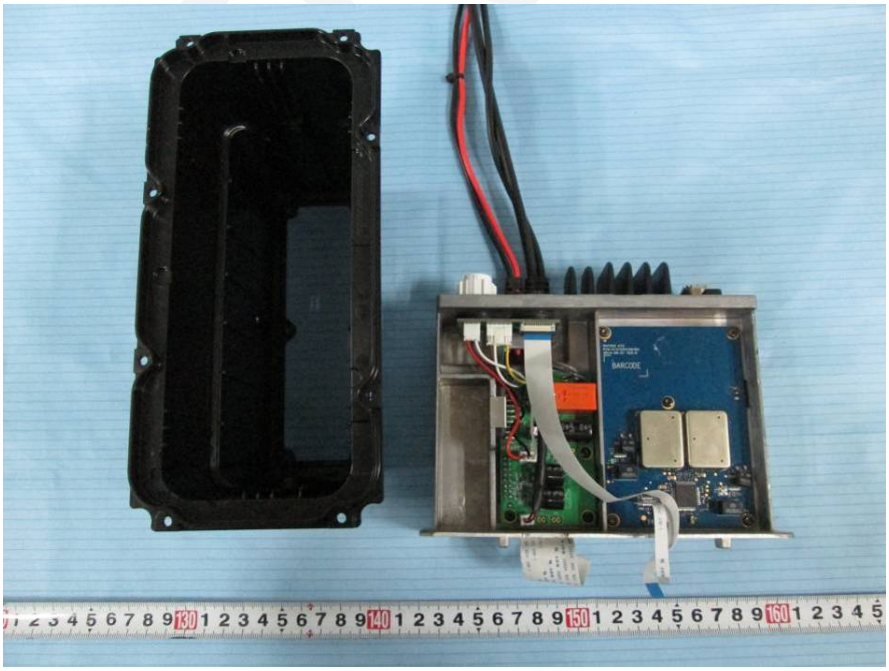


EUT – Base Cover off View 1

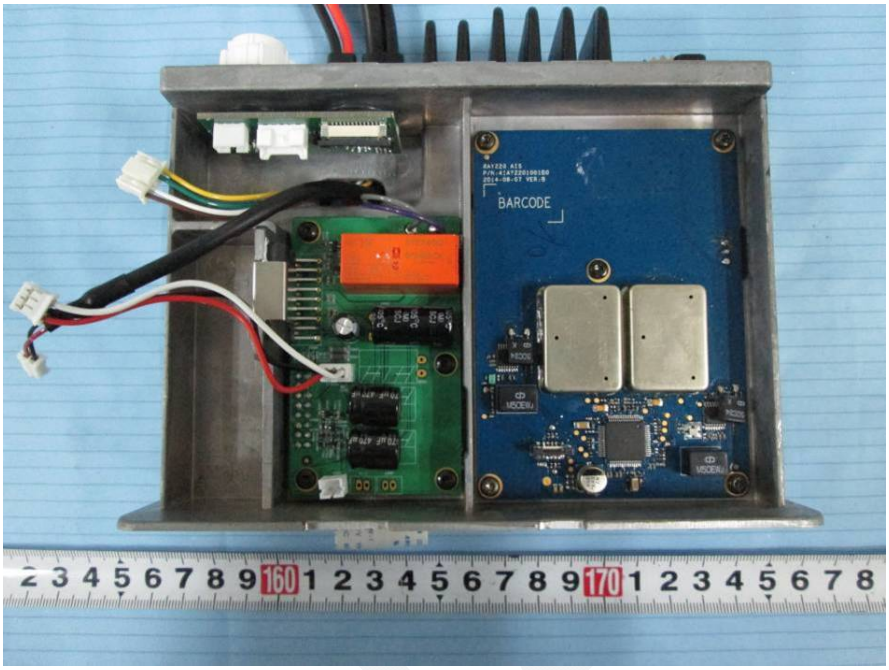
EUT – Base Cover off View 2



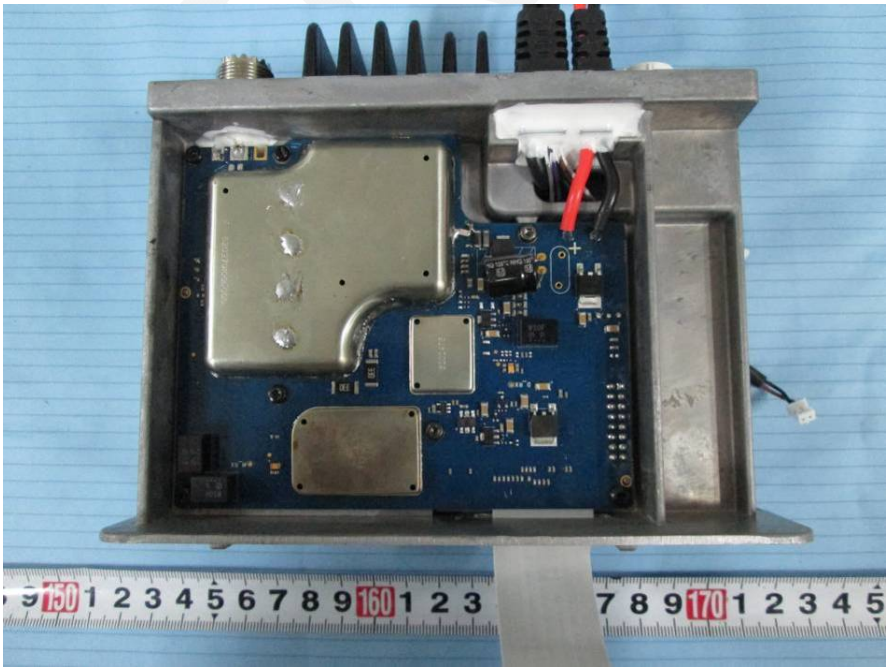
EUT – Base Cover off View 3



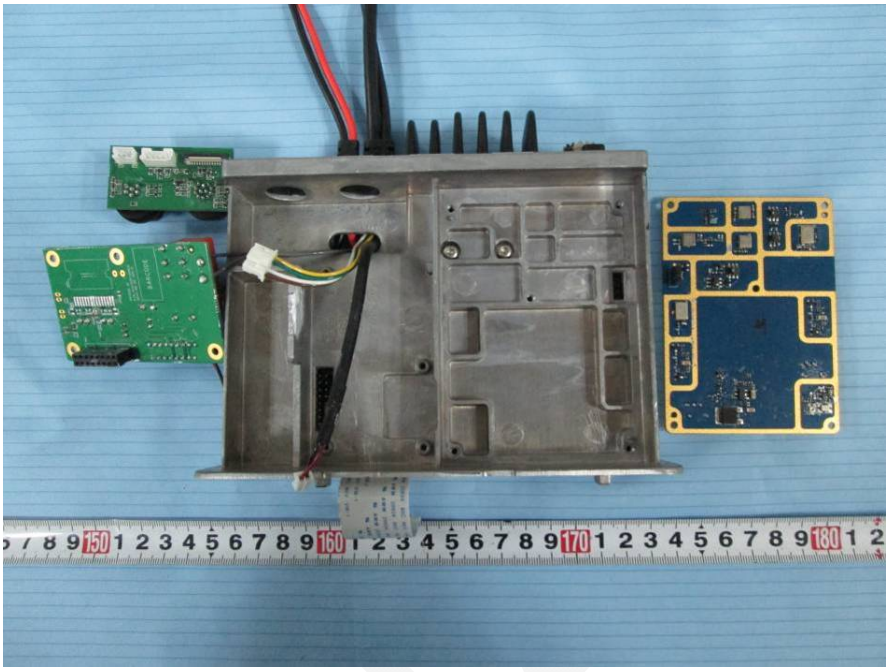
EUT – Base Cover off View 4



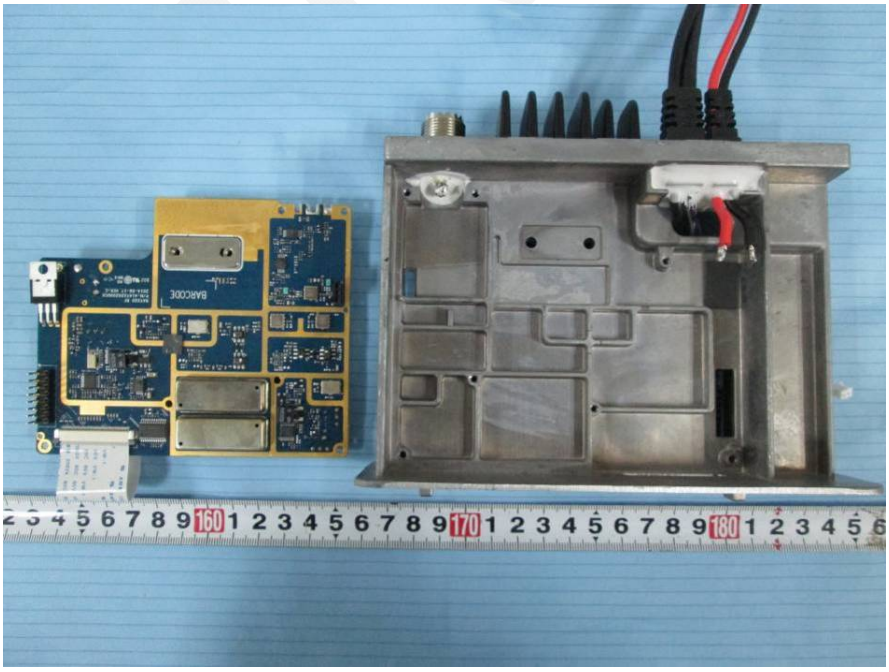
EUT – Base Cover off View 5



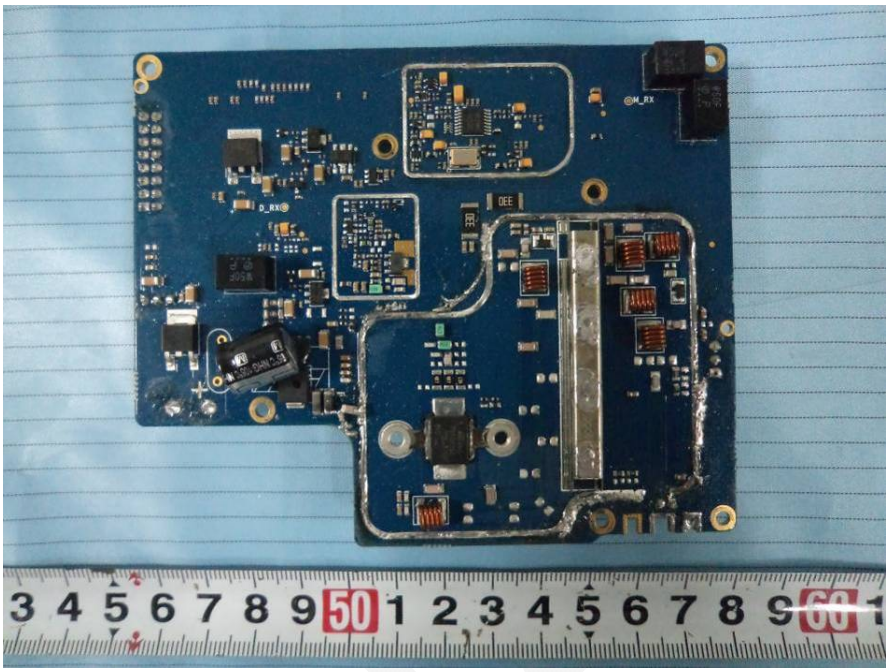
EUT – Base Cover off View 6



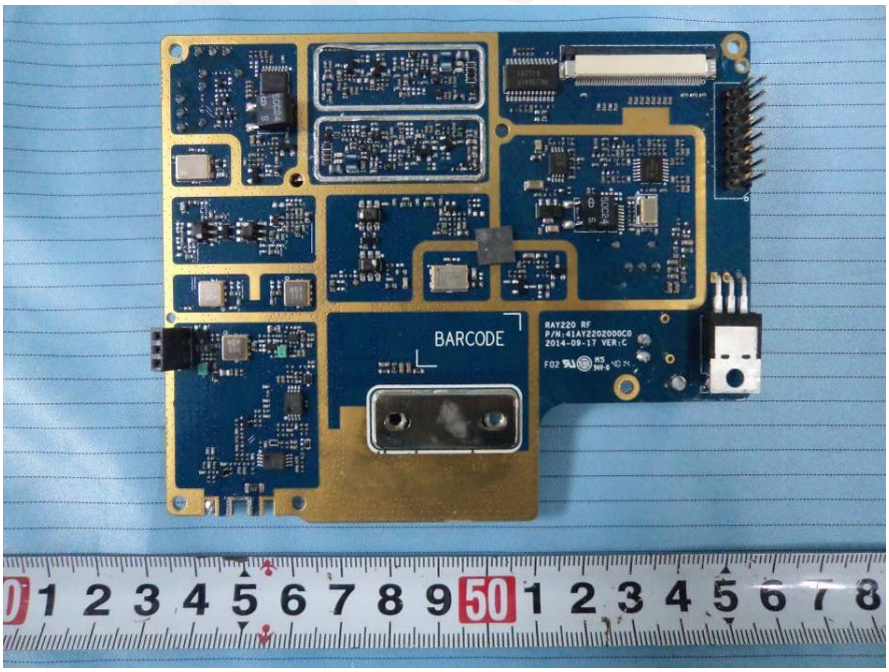
EUT – Base Cover off View 7



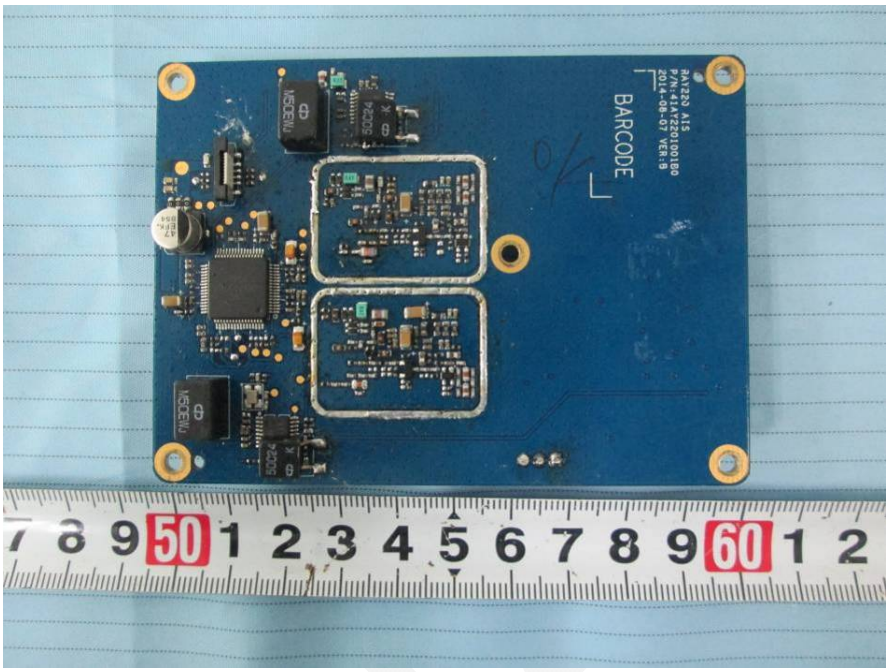
EUT –Base Main Board Top View



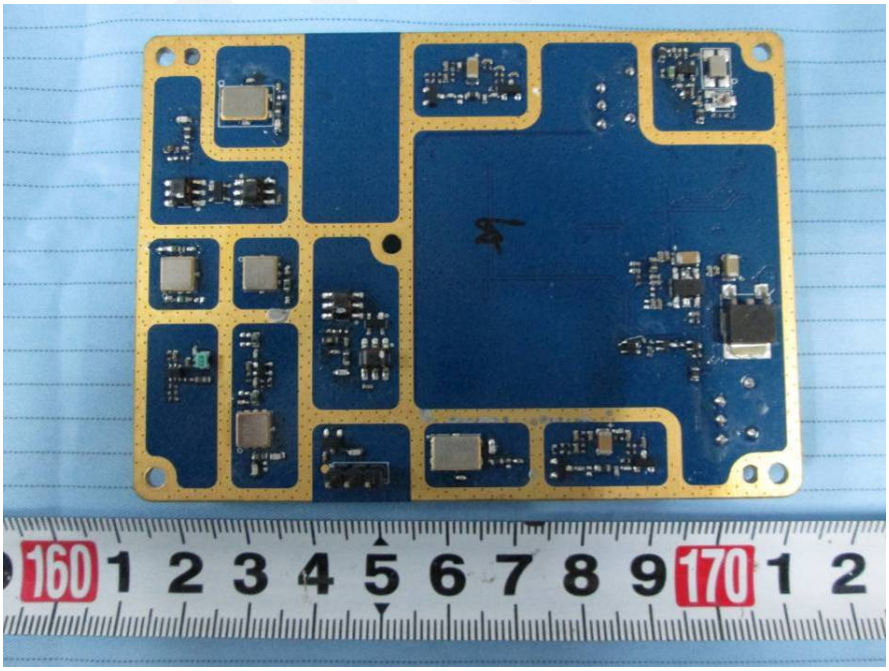
EUT –Base Main Board Bottom View



EUT –Base AIS Board Top View

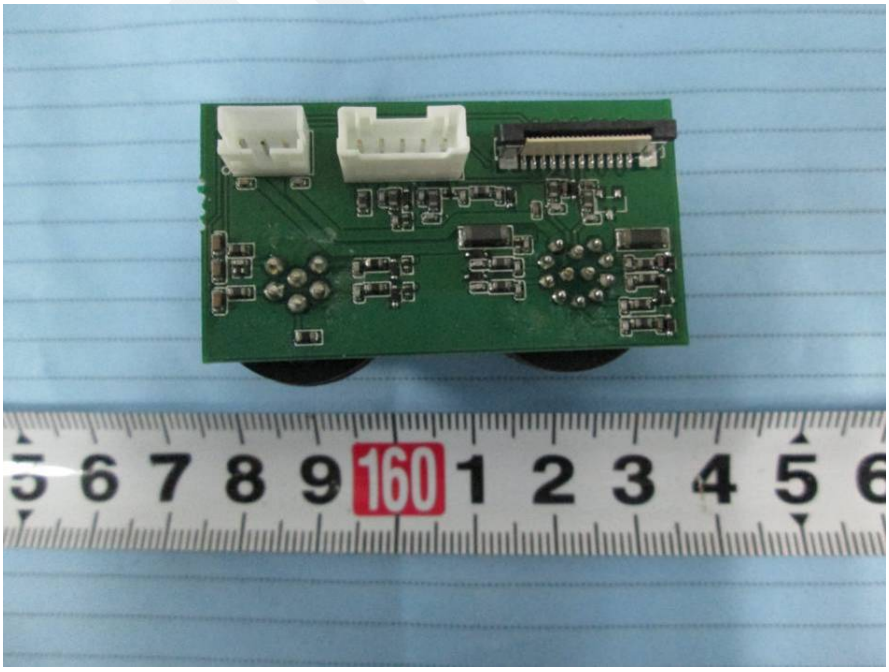


EUT –Base AIS Board Bottom View

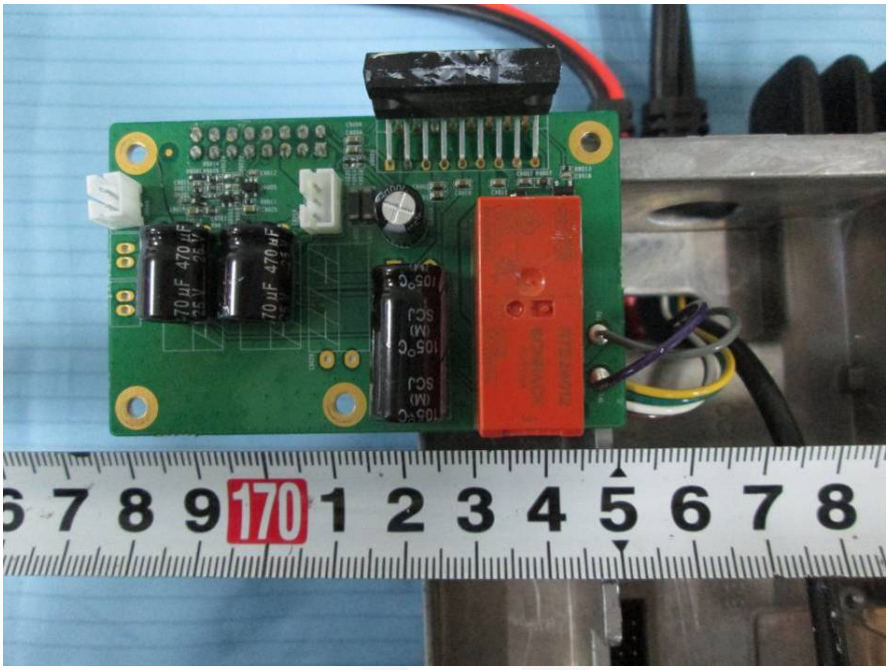


EUT – Base Connect Board 1 Top View

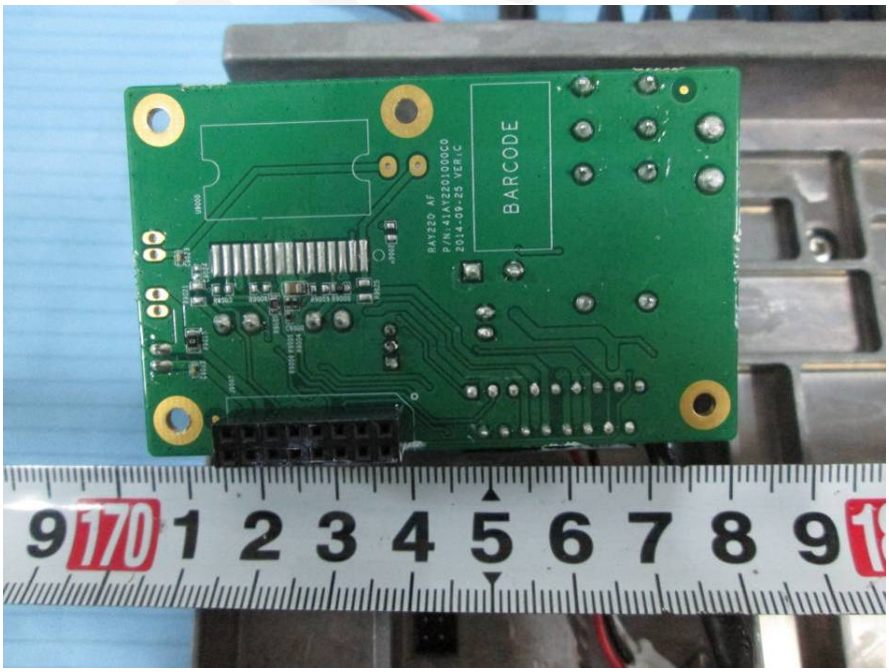
EUT – Base Connect Board 1 Bottom View



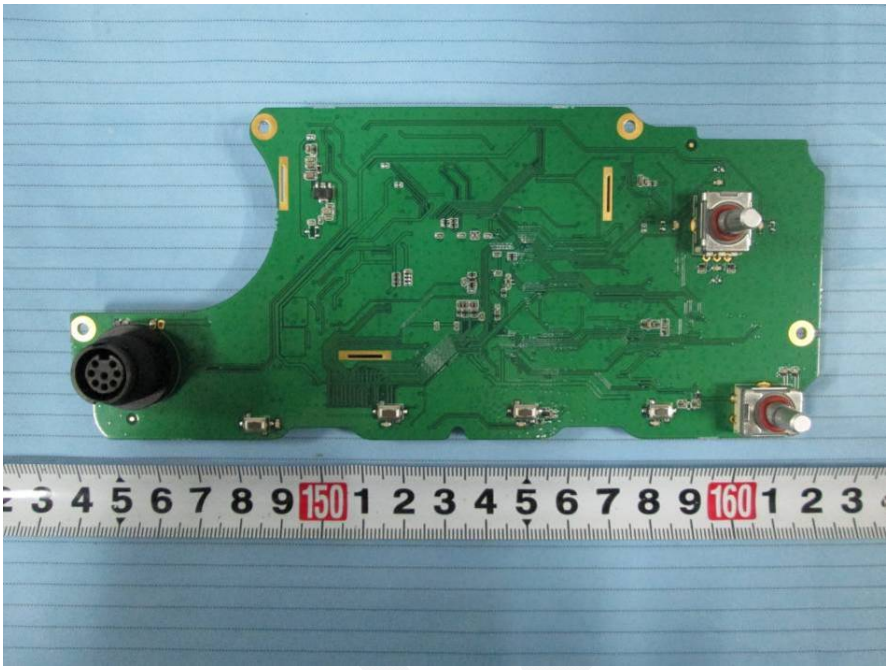
EUT –Base Connect Board 2 Top View



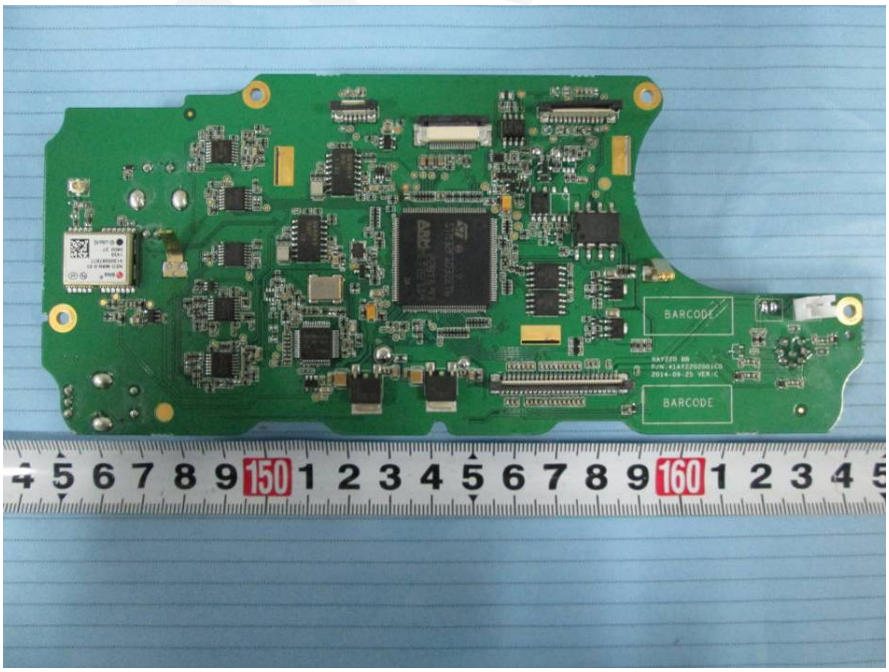
EUT –Base Connect Board 2 Bottom View



EUT –Base Control Board Top View

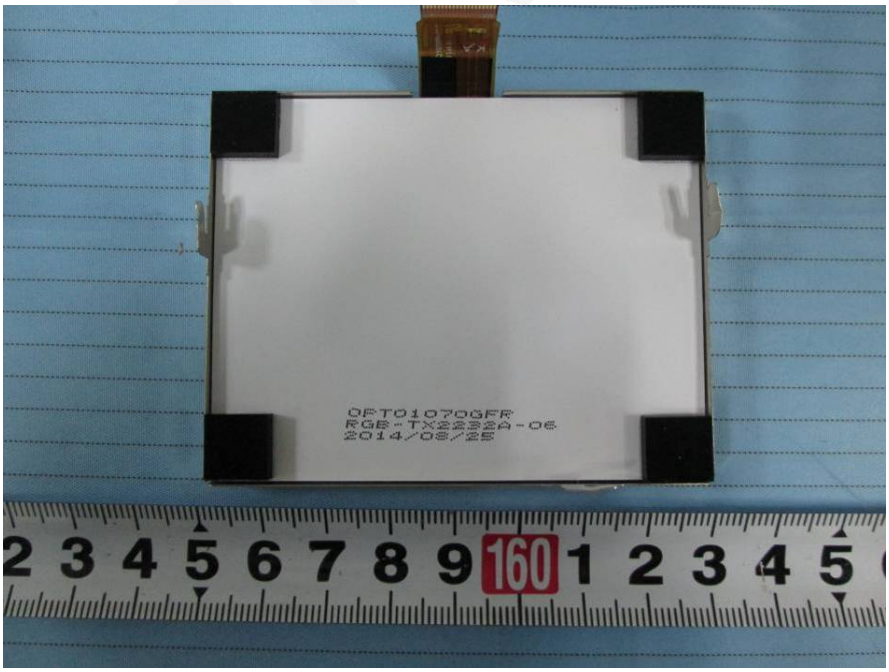


EUT –Base Control Board Bottom View

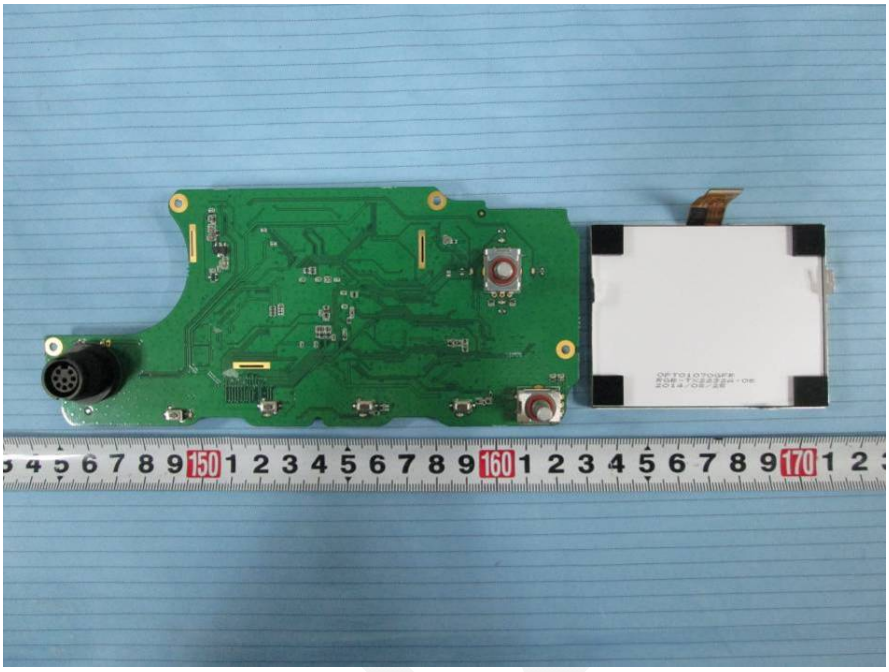


EUT –Base LCD Screen Top View

EUT –Base LCD Screen Bottom View

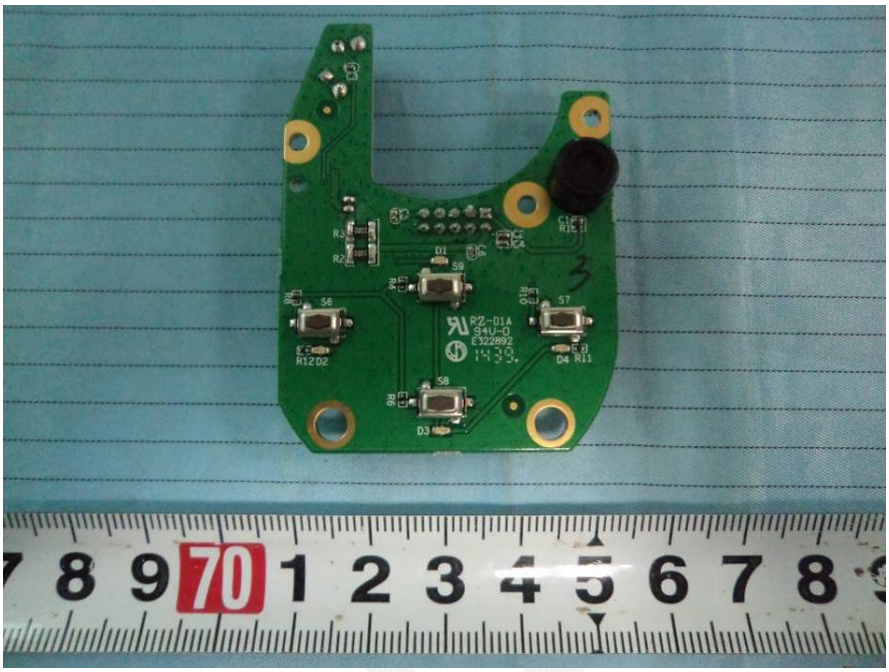


EUT –Base LCD Screen off View

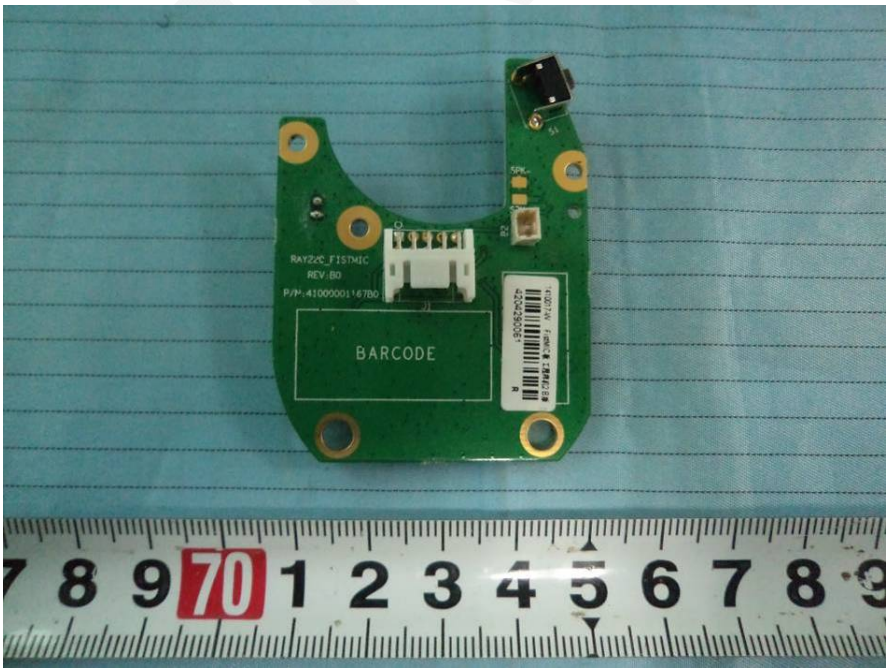


EUT –MIC Cover off View

EUT –MIC Main Board Top View



EUT –MIC Main Board Bottom View



EUT –MIC Speaker View

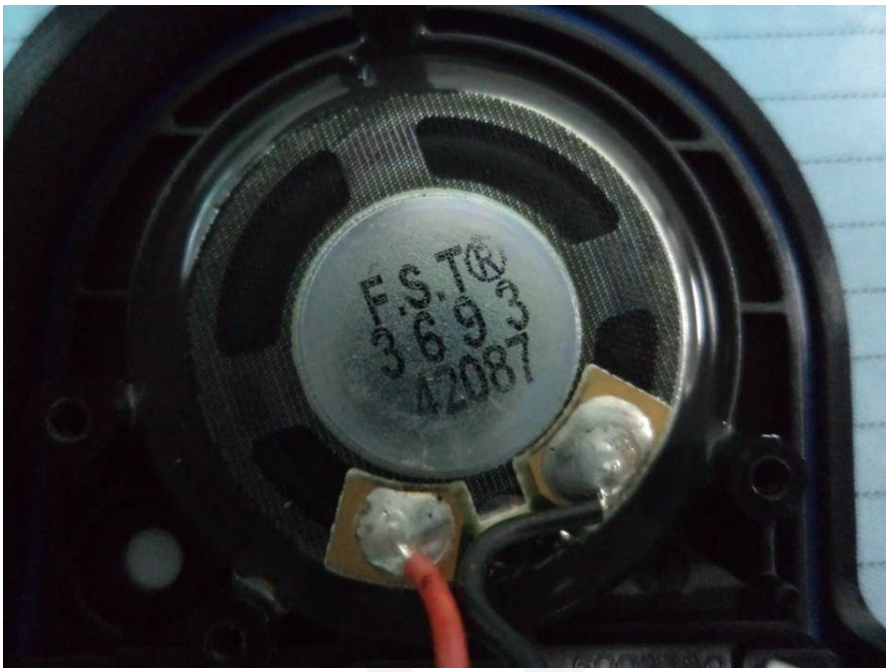


EXHIBIT B - TEST SETUP PHOTOGRAPHS

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