

# **Mobile FeliCa RF Performance Certification Specification**

Ver.2.5

November 1, 2018

**Mobile FeliCa Technical Communications Committee**

## Revision History

Ver. No.	Date issued	Description of Revisions
1.0	Oct. 1, 2012	First edition
1.1	Apr. 1, 2013	P1 New members of the Mobile FeliCa Technical Communications Committee are added. P5 Test fee is changed.
1.2	Sep. 1, 2013	P1 New members of the Mobile FeliCa Technical Communications Committee are added. P5 Notification operation of the Test Results is changed.
1.21	May 1, 2014	Address of Certification Administrator is changed
1.22	Jun. 1, 2014	The contact is changed from the Certification Administrator to the Certification Laboratory <ul style="list-style-type: none"> <li>• Application Form</li> <li>• Addition of Product Models</li> <li>• Notification of the Test Results</li> <li>• Contact for any questions</li> </ul>
2.0	Jan. 1, 2015	Changes are made to the following items since test items are added: <ul style="list-style-type: none"> <li>• Test fee</li> <li>• Test Period</li> <li>• Testing Reader/Writer and Communication Performance Measurement Software</li> <li>• Measurement Center Point, X-Axis Direction, and Y-Axis Direction of the Testing Reader/Writer</li> <li>• Performance Test with an Actual Terminal</li> </ul>
2.1	Mar.16, 2016	P4 Name of the Certification Administrator is changed. P9 Measurement condition is modified (30 minutes→10minutes) P10 Test type is modified (L-class Reader/writer is removed) P21 Pass criteria are modified. P32 Attachment C is modified
2.2	May 1, 2017	The Reader/Writer for testing is changed * RC-S462B is replaced to RC-S012B.
2.21	Jun. 1, 2017	Member of the Mobile FeliCa Technical Communications Committee is changed. Section 3.3, 3.4 are changed. Attachment A, B and C are changed.
2.3	Jan. 1, 2018	Section 6.5.1 is changed.
2.4	Jun. 1, 2018	Section 6.4.2 is removed S-Class reader/writer is moved to Section 6.5.1. Section 6.5.3.3.1 and 6.5.3.3.2 are added. Attachment A is changed Attachment D is added.

2.5	Nov. 1, 2018	Section 3.1 is changed. Attachment A and C are changed.
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## Preface

This document outlines the mobile FeliCa RF performance certification test (abbreviated to certification test hereafter).

The certification test verifies only the RF performance of the mobile products, and excludes protocols and other performance factors from testing.

Certification test details are based on discussions by members of the Mobile FeliCa Technical Communications Committee.

- The following companies are members of the Mobile FeliCa Technical Communications Committee:

AEON Co., Ltd.

East Japan Railway Company

FeliCa Networks, Inc.

KDDI Corporation

JCB Co., Ltd.

NTT Docomo, Inc.

Rakuten Edy, Inc.

Seven Card Service Co., Ltd.

Sony Imaging Products & Solutions Inc.

SoftBank Corp.

Sumitomo Mitsui Card Co., Ltd.

(Company names are in alphabetical order as of June 1, 2017.)

The following chapters specify the contents, methodology, evaluation criteria, test environment, and test procedures of the certification test.

## **1. Purpose of the Certification Test**

The certification test is intended to establish shared communication performance standards for FeliCa equipment and to create a mechanism for enhancing interoperability between FeliCa equipment. The overriding purpose of the certification test is to enable service providers and end users to receive the full benefit of services using FeliCa technology with assurance.

## **2. Positioning of the Certification Test**

The standards defined for the certification test do not certify the interoperability of marketed FeliCa equipment.

The certification test verifies product samples submitted by manufacturers in a testing environment specified for the certification test to determine whether the samples meet the communication performance standards defined for the certification test.

Therefore, achieving passing results in the certification test does not mean that all of the products in the same product series have been tested and have passed the certification test.

Warranties on the products tested shall conform to the warranty conditions originally established by the individual manufacturers.

## **3. Products to Be Tested**

### **3.1. Products Subject to Testing**

The certification test is intended for mobile products, in which FeliCa IC certified by FeliCa Networks is embedded.

### **3.2. Product Models to Be Tested**

Applicants for product testing must submit each model of a product for the certification test.

### **3.3. Updated Products**

A manufacturer must resubmit a product that has already passed the certification test if any hardware or software modifications that might affect FeliCa RF communication performance have been made to the product.

### **3.4. Addition of Product Models**

When a manufacturer adds a new product model to a product series whose models have already passed the certification test, the manufacturer need not submit the new model for certification testing if it has the same communication performance as the product that has already passed the certification test and the manufacturer can guarantee the fact. Instead, the manufacturer is only required to submit a Notice of Added Product Model form (see *Attachment B: Notice of Added Product Model*) for the new model.

For details, see *4.6 Addition of Product Models*.

## 4. Application

When applying for the certification test, please carefully note the following.

### 4.1. Application Details

#### ***Application deadline***

At least four weeks before the desired test date (product samples must be submitted at the same time)

#### ***Materials to be submitted***

- Mobile FeliCa RF Performance Certification Application form  
(See *Attachment A: Mobile FeliCa RF Performance Certification Application.*)
    - \* Apply to the Certification Laboratory
  
  - Test samples:
    - Three units of the product being tested (one maximum-frequency sample, one standard-frequency sample, and one minimum-frequency sample)
    - Three battery chargers
    - Accessories, if any, for each unit
- \* Submit to the Certification Laboratory

Note: Of all the manufactured units of the product being tested, the maximum-frequency sample must be the sample of the product that has minimally the highest resonance frequency value, the minimum-frequency sample must be the sample of the product that has the lowest resonance frequency value, and the standard-frequency sample must be the sample of the product that has a resonance frequency value between the highest resonance frequency value and the lowest resonance frequency value.

#### ***Certification Administrator***

Sony Imaging Products & Solutions Inc.

FeliCa Certification Section, Quality Management Department, FeliCa Business Division

#### ***Certification Laboratory (Subcontract Laboratory of Sony IP&S)***

Sony Global Manufacturing & Operations Corporation

Certification Test Team

Quality Assurance Department 1

Address: 8-4 Shiomi, Kisarazu-shi, Chiba Prefecture, 292-0834, JAPAN

Phone: +81-438-37-2404

E-mail: emcs-felica-kentei@jp.sony.com

#### ***Test fee***

The test fee is 550,000 yen, excluding tax.

If you have any questions, please contact the Certification Laboratory.

If you wish to retake the certification test on a sample of the same product, please submit a new certification test application.

## **4.2. Certification Test Start Date**

After the application for the certification test is received, the Certification Laboratory will notify the applicant within three business days of the day the test is to start.

## **4.3. Test Period**

If the test samples and other required materials are adequate and all measurement results meet pass-level requirements, the certification test will take eight business days, excluding the day on which the test samples are received.

## **4.4. Notification of the Test Results**

If the Certification Laboratory determines that any test results are below pass-level requirements, the Certification Laboratory will immediately report the test results to the applicant. The return of test samples to the applicant and their modification by the applicant are allowed only once for a submitted application.

Regardless of the test results, the Certification Laboratory will email the Certification Test Results Report to the applicant within three business days following the last day of the test period.

For products that pass the certification test, the Certification Laboratory will email the Mobile FeliCa RF Performance Certificate issued by Certification Administrator to the applicant about the seventh day following the last day of the test period.

## **4.5. Handling of Test Data and Submitted Product Samples**

The Certification Administrator and Certification Laboratory will handle the test data and information that it obtains as a result of certification testing in accordance with the Terms and Conditions for Mobile FeliCa RF Performance Certification Test (for the Mobile Product).

The Certification Laboratory will return the product samples submitted for testing to the applicant within seven business days following the last day of the test period.



#### **4.6. Addition of Product Models**

A manufacturer that adds a new product model to a product series whose models have already passed the certification test does not need to submit the new model for certification testing if (1) no modifications that might affect FeliCa RF communication performance have been made to the products since passed the test was last passed and (2) the manufacturer can guarantee that the new model has the same communication performance as the products that passed the test. If these conditions are met, the manufacturer need only submit a Notice of Added Product Model form (see *Attachment B: Notice of Added Product Model*) to add the new model. The product model for different Telecommunication Carrier is also available.

***Where to submit the Notice of Added Product Model form***

Certification Laboratory

***Application fee***

There is no application fee for adding product models.

## 5. Methodology

### 5.1. Test Environment

The certification test will be conducted in the following test environment:

Temperature: 20°C to 30°C

Relative humidity: 25% to 70%

### 5.2. Equipment Used in the Test

The following figure shows the equipment configuration used in the test.

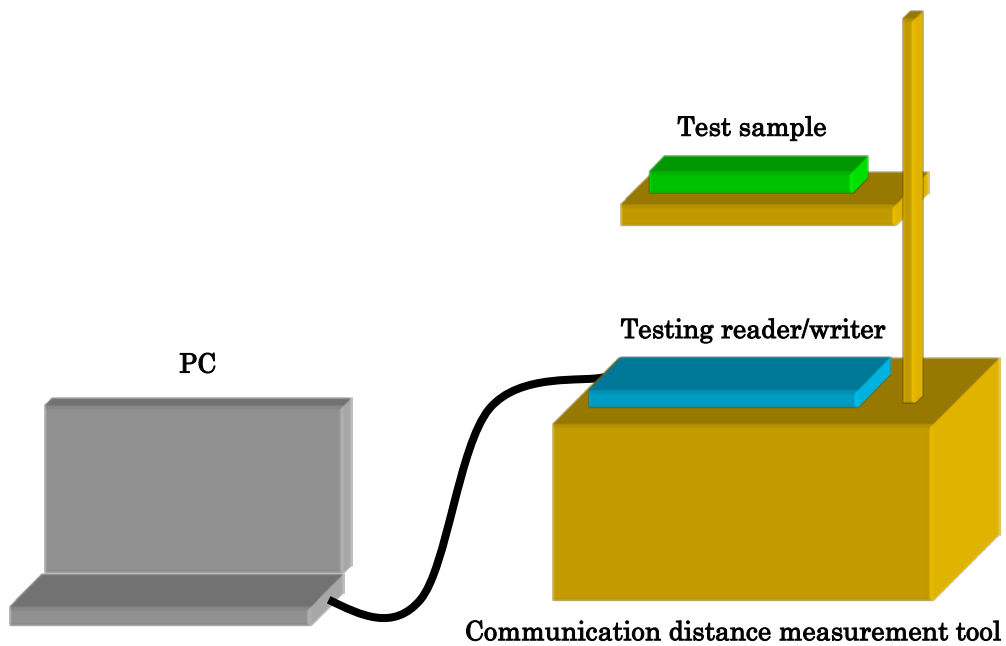



Figure 5-1 Equipment Configuration for the Test

### 5.3. Definitions of Terms Related to the Testing Method

The following table defines the terms related to the certification test.

Terms	Description
Measurement center point	<p>The measurement center point of the test sample is the intersection of the diagonals of a square imposed on the Mobile Contactless IC Communication Mark on the product.</p>  <p>is a trademark of FeliCa Networks, Inc.</p> <p>Figure 5-2 Measurement Center Point of the Test Sample</p> <p>The measurement center point of the testing reader/writer is described in <i>6.2 Measuring the Center Point, X-Axis Direction, and Y-Axis Direction of Testing Reader/Writer.</i></p>
Angle	<p>The 0-degree direction of the test sample is the longitudinal direction specified by the applicant (product manufacturer).</p> <p>The 90-degree direction is the direction that results from a 90-degree clockwise rotation from the 0-degree direction.</p>
X axis, Y axis	<p>The X axis is the axis that passes through the measurement center point and is parallel to the lines in the 0-degree direction. The positive direction of the X axis is the 0-degree direction. The Y axis is the axis that passes through the measurement center point and is perpendicular to the lines in the 0-degree direction.</p> <p>The positive directions of the X and Y axes of the testing reader/writer are described in <i>6.2 Measuring the Center Point, X-Axis Direction, and Y-Axis Direction of Testing Reader/Writer.</i></p>
Center	<p>In centering, the communication distance measuring tool is used to align the measurement center point of the test sample with that of the testing reader/writer.</p>
Offset	<p>Offset refers to moving the test sample in the X-axis direction (or Y-axis direction) parallel to the X axis (or Y axis).</p>
Maximum communication distance	<p>When the test sample and the testing reader/writer are moved closer together during measurement, the maximum communication distance is the distance at which the specified success rate is first obtained.</p>
Communication hole	<p>A communication hole is an area whose success rate is less than the specified level at a distance from 0mm to the maximum communication distance.</p> <p>Communication holes do not include areas with a width of less than 1mm.</p> <p>Note, however, that even an area with a width of less than 1 mm is regarded as a communication hole if the measured success rate of the area is below the specified level when the test sample is positioned at a distance of 0mm from the end-product reader/writer.</p>
Success rate	<p>The success rate is the ratio of successful communications to the number of Polling command executions. Unless otherwise specified, the success rate requirement specified for the certification test is at least 99% (communication must be successful at least 99 times while the Polling command is executed 100 times).</p>

## 5.4. Communication Performance Measurement Procedure

### *Measurement conditions*

To ensure stable measurement results, the test will begin 10 minutes after the testing reader/writer is turned on.

Also, the test will be conducted in an environment that eliminates effects caused by metallic objects, electrical interference, and other factors on FeliCa RF communication performance.

### *Measuring the communication distance and communication holes*

- (1) The test sample will be placed stably on the measuring surface of the testing reader/writer in close contact with the surface while its measurement center point is aligned with that of the testing reader/writer. The distance of the test sample in this position will be treated as 0mm. If the test sample cannot be placed in close contact with the measuring surface of the testing reader/writer, the test sample will be positioned on a plane that extends from the measuring surface of the testing reader/writer, creating the effect of close contact with the measuring surface.
- (2) The position of the test sample will be adjusted for centering, offset, and rotation.
- (3) The communication distance measurement tool will be used to move the test sample to a position where it exceeds the maximum communication distance.
- (4) The communication performance measurement software will be used to execute the Polling command from the testing reader/writer.
- (5) The communication distance measurement tool will be used to move the test sample downward in order to determine the maximum communication distance.
- (6) The test sample will be moved from the maximum communication distance to a distance of 0mm in 1mm steps to locate any communication holes.
- (7) Steps (2) to (6) will be repeated until measurement at all measurement points has been completed.

## 6. Test Items

### 6.1. Reader/Writer and Communication Performance Measurement Software for Testing

No.	Test Type	Testing reader/writer	Communication performance measurement software
1	Performance of communication with M-class reader/writer	Sony RC-S012B (Ordinary)	Communication performance test software (for serial interface)
2	Performance of communication with S-class reader/writer	Sony RC-S380 (Ordinary)	Communication performance test software (for USB interface)
3	Performance of communication with Edy terminal	Edy terminal for touch operation (Ordinary)	Polling checker
4	Performance of communication with Gate	Gate EG2 (RC-S470C) (maximum-, standard-, and minimum-frequency samples)	Communication performance test software (for serial interface)
5	Contact surface	Gate EG20 (RC-S011C) (maximum-, standard-, and minimum-frequency samples)	Communication performance test software (for serial interface)
6	Contact surface	Bus reader (RC-S470C) (maximum-, standard-, and minimum-frequency samples)	Communication performance test software (for serial interface)
7	Operation of car-mounted reader (VT-9271A)	Car-mounted reader (VT-9271A) (maximum-, standard-, and minimum-frequency samples)	Communication performance test software (for car-mounted reader (VT-9271A))
8	Operation of e-money terminal (VT-9290A-U)	E-money terminal (VT-9290A-U) (maximum-, standard-, and minimum-frequency samples)	Communication performance test software (for e-money terminal (VT-9290A-U))

Notes:

- For more information about Sony's reader/writers, contact an exclusive Sony distributor of FeliCa products.
- For the Edy terminal for touch operation and the polling checker, contact Rakuten Edy, Inc.
- For terminals and software for testing Suica, contact East Japan Railway Company.
- The testing reader/writers in the above table are products designed for use in Japan. Anyone who intends to use any of these products outside Japan must assume responsibility for compliance with the laws of the country where the product will be used.
- To automate measurement, communication performance measurement software turns on and off the carrier wave when the measurement point moves in the testing environment (excluding the tests for car-mounted reader (VT-9271A) and e-money terminal (VT-9290A-U)).

## 6.2. Measuring the Center Point, X-Axis Direction, and Y-Axis Direction of Testing Reader/Writer

This section describes measurement of the center point, X-axis direction, and Y-axis direction of each type of testing reader/writer.

### 6.2.1. RC-S012B Measurement Center Point, X-Axis Direction, and Y-Axis Direction

Measurement center point: The intersection of two diagonal lines traversing the RC-S012B's antenna board.

X-axis and Y-axis directions: Shown in Figure 6-1.

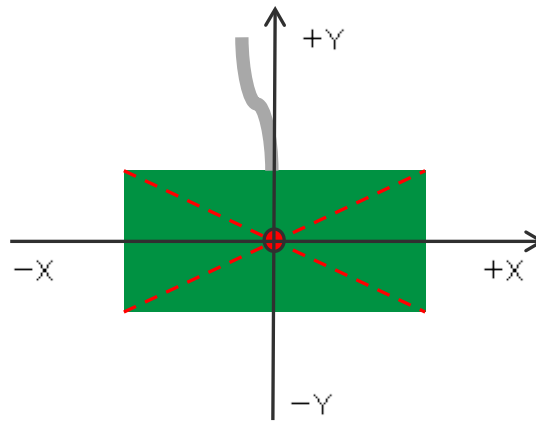


Figure 6-1 RC-012B X-Axis and Y-Axis Directions

### 6.2.2. RC-S380 Measurement Center Point, X-Axis Direction, and Y-Axis Direction

Measurement center point: Center of the circular section at the center of the RC-S380.

X-axis and Y-axis directions: Shown in Figure 6-2.

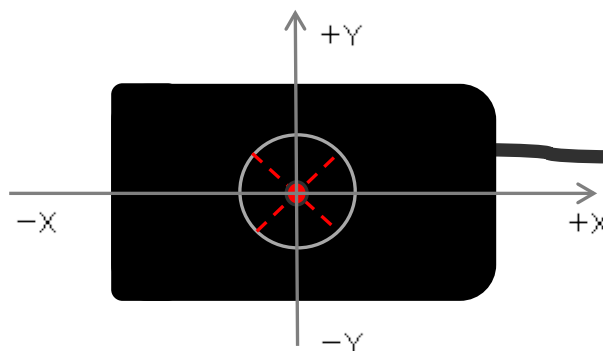


Figure 6-2 RC-S380 X-Axis and Y-Axis Directions

### 6.2.3. Measurement Center Point, X-Axis Direction, and Y-Axis Direction of the Edy Terminal for Touch Operation

Measurement center point: Shown in Figure 6-3.

X-axis and Y-axis directions: Shown in Figure 6-4.

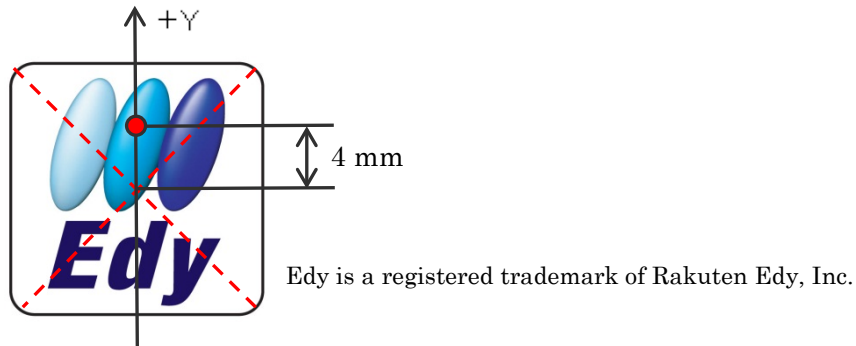


Figure 6-3 Measurement Center Point of the Edy Terminal for Touch Operation

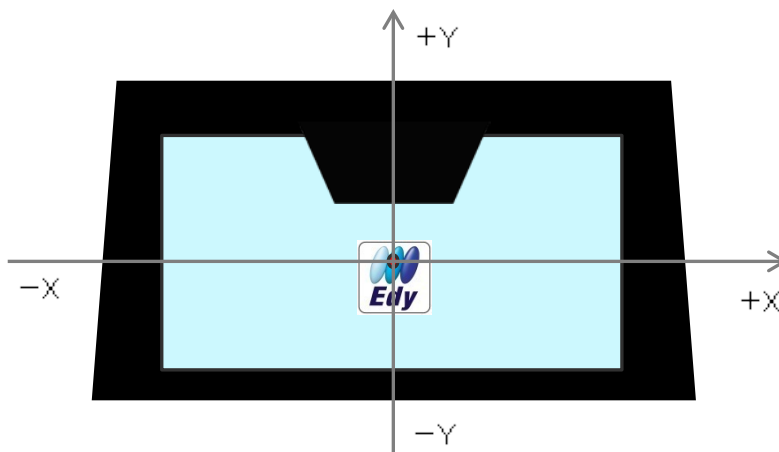


Figure 6-4 X-Axis and Y-Axis Directions of the Edy Terminal for Touch Operation

### 6.2.4. Measurement Center Point, X-Axis Direction, and Y-Axis Direction of Gate EG2 (RC-S470C)

The 0-degree direction of the test sample in relation to the reader/writer is the direction opposite to the microphone of the test sample.

Measurement center point: The center of the mobile contactless IC communication mark in the guidance display.

X-axis and Y-axis directions: Shown in Figure 6-5.

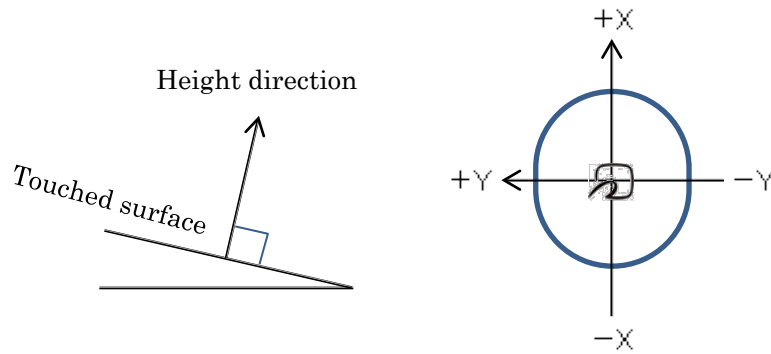


Figure 6-5 X-Axis and Y-Axis Directions of Gate EG2

### 6.2.5. Measurement Center Point, X-Axis Direction, and Y-Axis Direction of Gate EG20 (RC-S011C)

The 0-degree direction of the test sample in relation to the reader/writer is the direction opposite to the microphone of the test sample.

Measurement center point: The intersection of lines connecting triangle marks ( $\Delta$ ) in the guidance display.

X-axis and Y-axis directions: Shown in Figure 6-6.

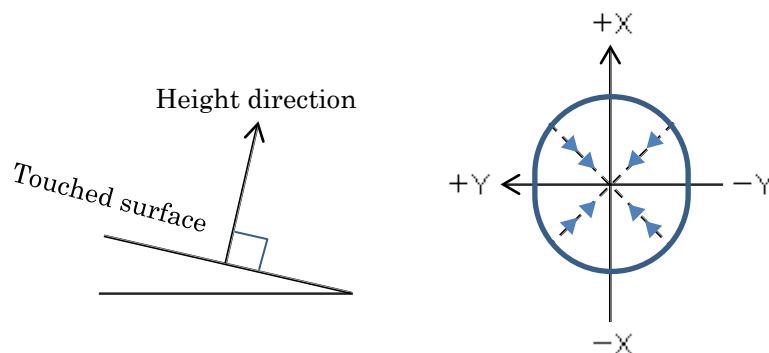


Figure 6-6 X-Axis and Y-Axis Directions of Gate EG20



### 6.2.6. Measurement Center Point, X-Axis Direction, and Y-Axis Direction of the Bus Reader (RC-S470C)

The 0-degree direction of the test sample in relation to the reader/writer is the direction opposite to the microphone of the test sample.

Measurement center point: The intersection of lines connecting triangle marks ( $\Delta$ ) in the guidance display.

X-axis and Y-axis directions: Shown in Figure 6-7.

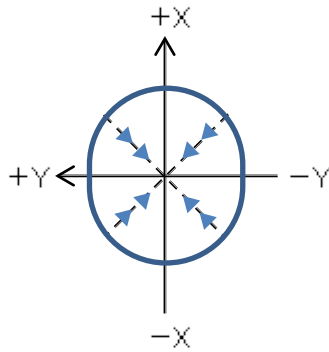


Figure 6-7 X-Axis and Y-Axis Directions of the Bus Reader/Writer Unit (RC-S470C)

### 6.2.7. Measurement Center Point, X-Axis Direction, and Y-Axis Direction of the Car-Mounted Reader (VT-9271A)

The 0-degree direction of the test sample in relation to the reader/writer is the direction opposite to the microphone of the test sample.

Measurement center point:

80mm from the left end of the metal plate and 70mm from the LED section when the reader/writer is at the left end.

80mm from the right end of the metal plate and 70mm from the LED section when the reader/writer is at the right end.

X-axis and Y-axis directions: Shown in Figure 6-8.

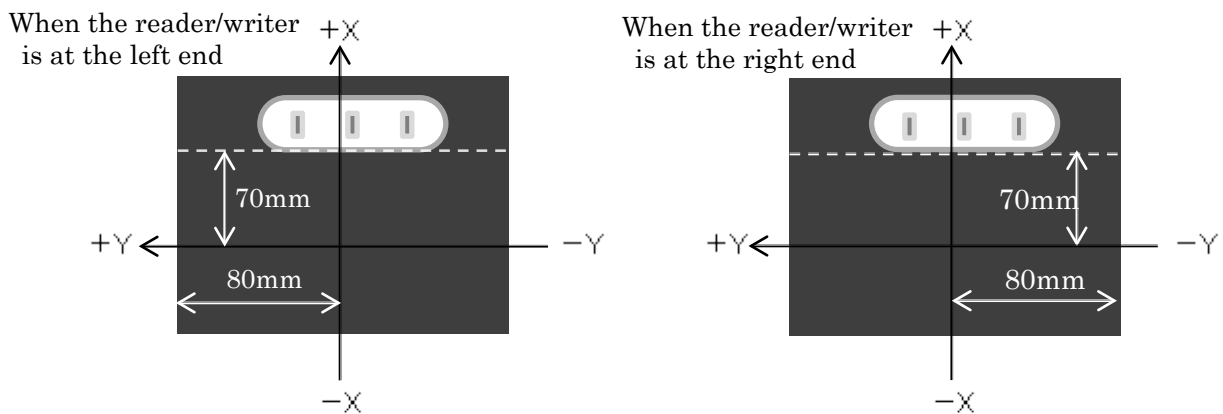


Figure 6-8 X-Axis and Y-Axis Directions of the Car-Mounted Reader (VT-9271A)

For measurement, all of the five car-mounted readers are used and the car-mounted reader to be measured is placed furthest from the main car-mounted reader with a power.

### 6.2.8. Measurement Center Point, X-Axis Direction, and Y-Axis Direction of the E-money Terminal (VT-9290A-U)

The 0-degree direction of the test sample in relation to the reader/writer is the direction opposite to the microphone of the test sample.

Measurement center point: 8mm off from the center of the guidance display in the -X direction

X-axis and Y-axis directions: Shown in Figure 6-9.

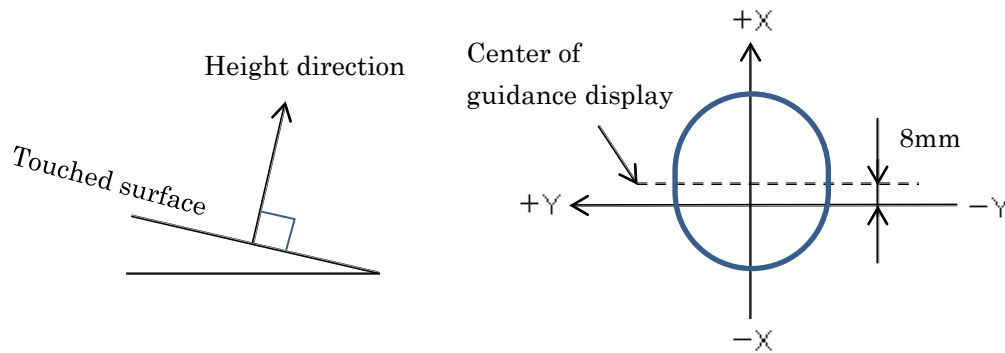


Figure 6-9 X-Axis and Y-Axis Directions of the E-money Terminal (VT-9290A-U)

### 6.3. Structure of the Certification Test

The certification test consists of two parts: a basic performance test and a performance test with an actual terminal.

The test sample passes the certification test when it meets the standards set for all test items.

### 6.4. Basic Performance Test

The basic performance test is conducted to verify that the test sample has the communication performance required for all mobile wallet services.

The basic performance test consists of the following type of testing:

- Performance of the communication with M-class reader/writer

#### 6.4.1. Performance of Communication with the M-Class Reader/Writer

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication distance (Center at 0 and 90 degree)	Maximum communication distance of 30mm or more at all measurement points
2	Communication holes (Center at 0 and 90 degree)	No communication hole at any measurement point within a distance of 0mm to 20mm

## 6.5. Performance Test with an Actual Terminal

The performance test with an actual terminal is conducted to verify that the test sample has the communication performance required for a specific service.

The performance test with an actual terminal consists of the following 3 types of testing:

- Performance of the communication with S-class reader/writer
- Performance of communication with an Edy terminal
- Performance of communication with a Suica terminal

### 6.5.1. Performance of Communication with the S-Class Reader/Writer

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication distance (Center, XY±10mm offset in X and Y directions at 0 degree)	There must be two or less communication holes point out of five points at center and XY±10mm at 0mm height of the reader/writer.

### 6.5.2. Performance of Communication with an Edy Terminal

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication distance (Center at 0 and 90 degree)	Maximum communication distance of 30mm or more
2	Communication holes (Center, XY±10mm offset in X and Y directions at 0 and 90 degree)	Center: There must be no communication holes within 6mm to 30mm height of the reader/writer. However, any communication holes of less than 3mm are allowed.  Center and offset *: There must be two or less communication holes point out of five points at center and XY±10mm at 0, 1, 2, 3, 4, 5mm height of the reader/writer. (See Figure 6-10, Figure 6-11)

Note: The success rate for this item shall be 95% or more.

\*Communication holes at center and offsets are judged just at each measurement point by the success rate without taking their height into consideration.

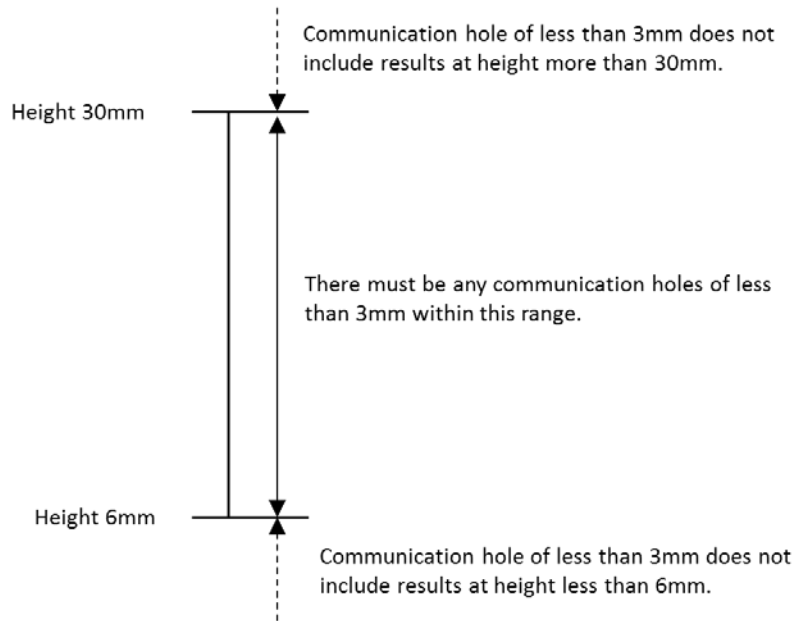


Figure 6-10 Example1: Pass/Fail Criteria for Center

Pass

Fail



Figure 6-11 Example2: Pass/Fail Criteria for Center, Offset

### 6.5.3. Performance of Communication with a Suica Terminal

#### 6.5.3.1. Measuring the Performance of Communication with a Gate

##### 6.5.3.1.1. Measuring the Maximum Communication Distance

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication distance (Center at 0 degree )	85mm or more with a standard-frequency reader/writer 80mm or more with a maximum-frequency reader/writer 75mm or more with a minimum-frequency reader/writer

Combination of test samples and testing reader/writers (Yes: Performed, -: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	—	Yes	Yes
Standard-frequency sample	—	Yes	—
Minimum-frequency sample	Yes	Yes	—

##### 6.5.3.1.2. Measuring Communication Holes - Measuring a Wide Range

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication holes (Center, X±10, 20, 30, 40, 50, 60, 70 mm (side lobes are not tested) at 0 degree)  *Side lobe: Communication area in the measured X plane in the direction opposite to X=0 mm from the termination of the communication area with its maximum area around X=0 mm (point where the positive and negative inclination of the boundary between the communication area and communication holes changes. See <i>Attachment D: Side lobe area</i> )	Center:  There must be no communication holes from the 0mm height to the maximum communication distance pass criteria for all reader/writers. However, any communication holes which are 2mm or less wide are allowed from the 30mm height to the maximum communication distance pass criteria.  Center and offset:  Within each rectangular area consisting of 9 points (3-by-3 matrix), three or more consecutive communication hole points shall not exist in the X-direction. The effective vertical range above each X point is from the 0mm point to the maximum communication distance point (which is the shorter of the maximum communication distance pass criteria and the maximum measured communication distance) for all reader/writers. (See Figure 6-12, Figure 6-13, Figure 6-14)

Note: The success rate shall be 100% when polling is performed 10 times for this item.

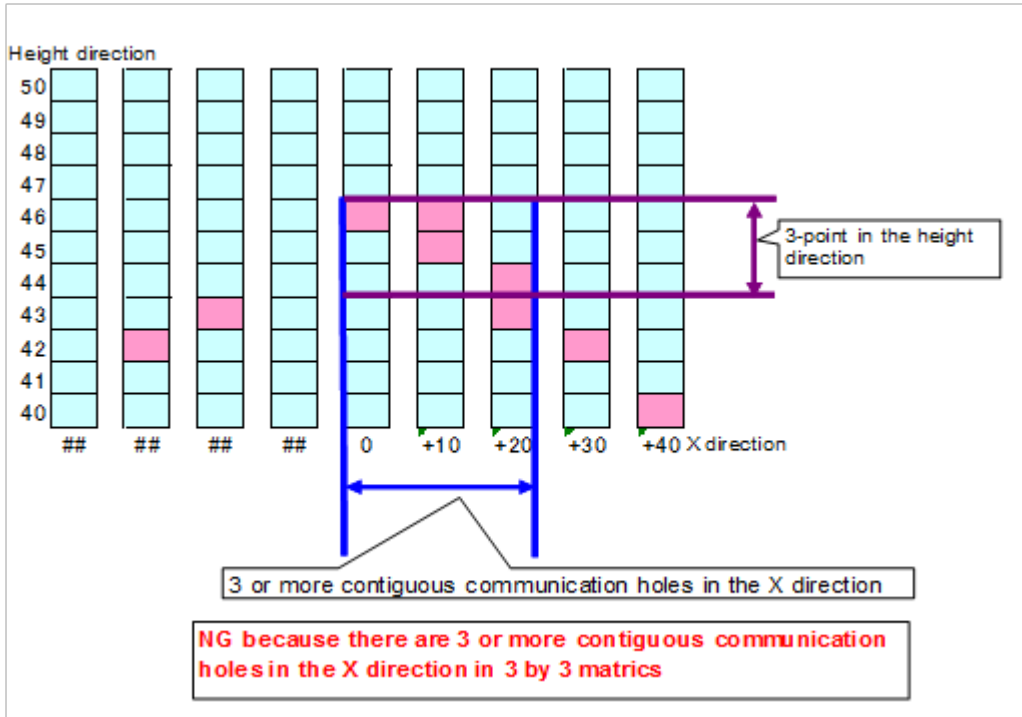


Figure 6-12 Enlarged View of the Communication Hole Graph (NG Pattern 1)

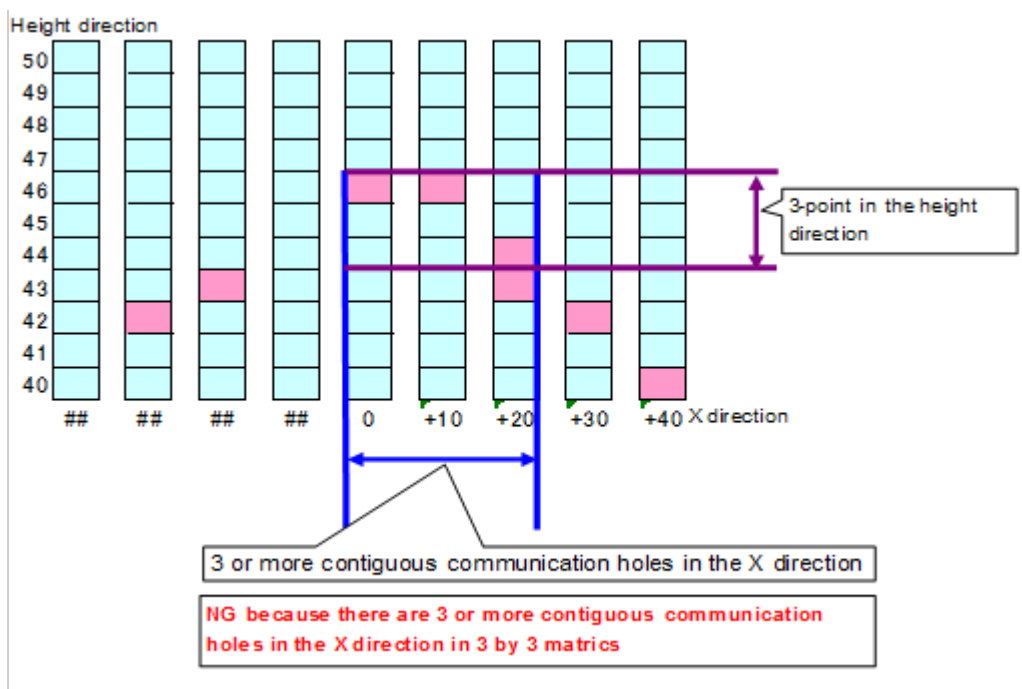


Figure 6-13 Enlarged View of the Communication Hole Graph (NG Pattern 2)



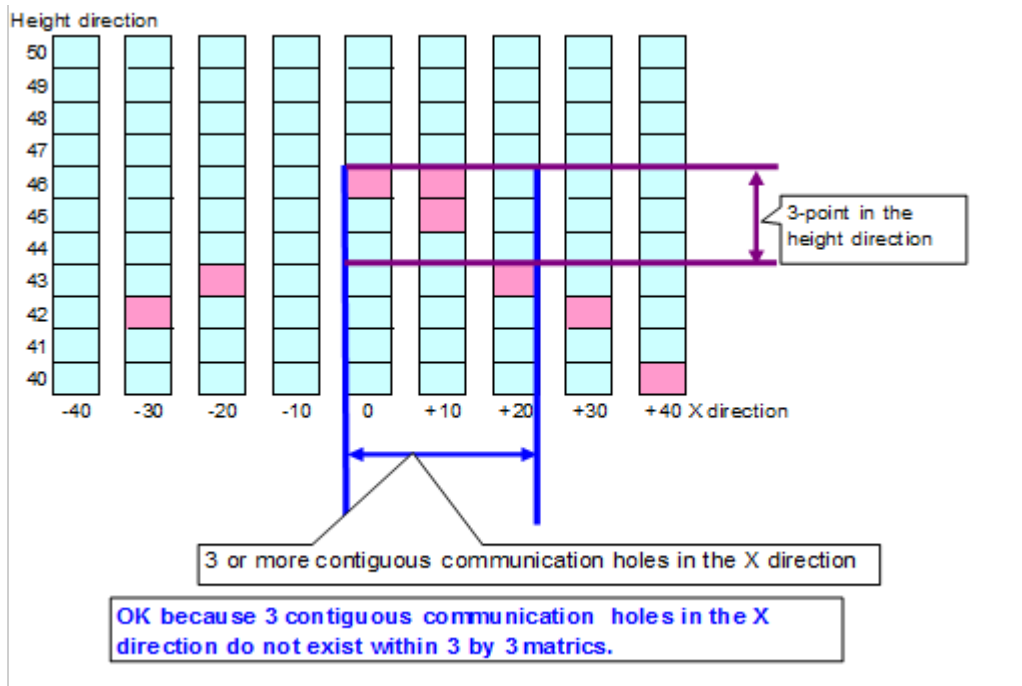


Figure 6-14 Enlarged View of the Communication Hole Graph (OK Pattern)

Combination of test samples and testing reader/writers (Yes: Performed, -: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	-	Yes	Yes
Standard-frequency sample	-	Yes	-
Minimum-frequency sample	Yes	Yes	-

### 6.5.3.1.3. Measuring Communication Holes - Measuring the Center Area

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication holes (Center, X±5, 10, 15, 20mm at 0 degree)	There must be no communication holes within 0mm to 20mm height of the reader/writer.  Note that, at a height of 0mm, not even one communication hole with a width of less than 1mm is allowed.

Combination of test samples and testing reader/writers (Yes: Performed, -: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	Yes	—	Yes
Standard-frequency sample	Yes	—	Yes
Minimum-frequency sample	Yes	—	Yes

### 6.5.3.2. Verifying the Contact Surface

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication holes (Center at 0 degree)	There must be no communication holes at 0mm height of the reader/writer.  Note that, at a height of 0mm, not even one communication hole with a width of less than 1mm is allowed.

Combination of test samples and testing reader/writers (Yes: Performed, -: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	Yes	—	Yes
Standard-frequency sample	—	Yes	—
Minimum-frequency sample	Yes	—	Yes

### 6.5.3.3. Verifying the Operation of the Car-Mounted Reader (VT-9271A)

For the test sample that uses the active load modulation (ALM) technology in the FeliCa RF communication, the communication performance measurement described in Section 6.5.3.3.1 and the out-of-range communication measurement described in Section 6.5.3.3.2 are performed. For the test sample that does not use the ALM technology, only the communication performance measurement described in Section 6.5.3.3.1 is performed.

#### 6.5.3.3.1. Measuring the Communication Performance

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication distance (Center at 0 degree)	The maximum communication distance shall be 15mm or more.
2	Communication holes (Center, XY±10mm at 0 degree)	Center: There must be no communication holes within 0mm to 15mm of the reader/writer. However, any communication holes of less than 3mm are allowed.  Center and offset: There must be no communication holes at 0mm height of the reader/writer. Two or less communication holes out of five points at center and XY±10mm are allowed.

Note: The success rate for this item shall be 95% or more.

Combination of test samples and testing reader/writers (Yes: Performed, -: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	Yes	—	Yes
Standard-frequency sample	—	Yes	—
Minimum-frequency sample	Yes	—	Yes

### 6.5.3.3.2. Out-of-Range Communication Measurement

This test tests the following items.

No.	Test Item	Pass criteria
1	<p>Out-of-range area (Center, XY±15mm at 0 degree)</p> <p>Test overview Place the test sample on the right side of the reader/writer, and send the Polling command from the left side of the reader/writer.</p> <p>Evaluation details It is checked if communication is not set up (the LED does not light) from an out-of-range area (left side of the reader/writer). The Polling command is executed 100 times. If communication is set up more than ten times from an out-of-range area, it is called "out-of-range communication setup".</p>	<p>There must be two or less out-of-range communication setup points out of five points at center and XY±15mm at 0mm and 10mm height of the reader/writer. (See Figure 6-15, Figure 6-16)</p>

Combination of test samples and testing reader/writers (Yes: Performed, -: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	-	-	-
Standard-frequency sample	-	Yes	-
Minimum-frequency sample	-	-	-

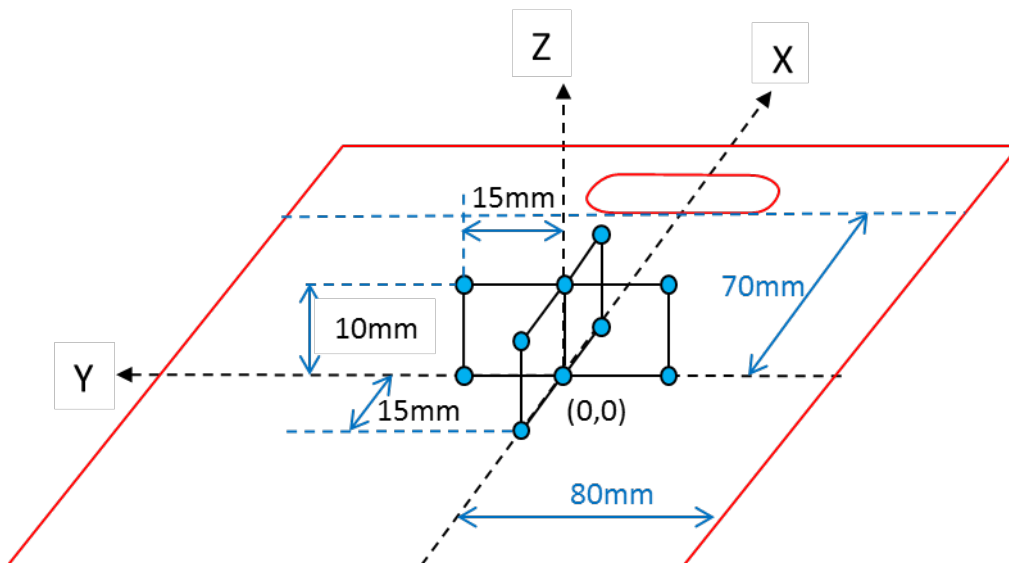


Figure 6-15 Out-of-range communication measurement points

- Pass point
- Fail point

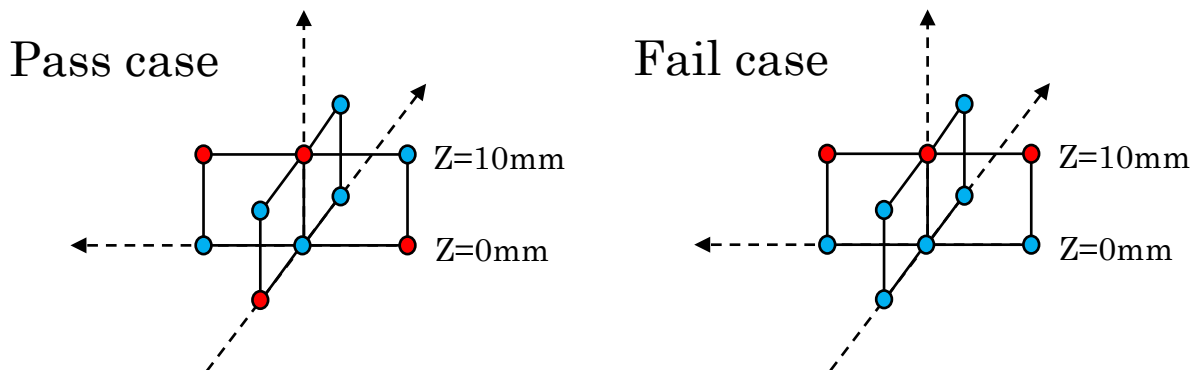


Figure 6-16 Pass/Fail criteria of Out-of-range communication measurement (example)

#### 6.5.3.4. Verifying the Operation of the E-money Terminal (VT-9290A-U)

This test tests the following items according to the measurement procedure described in *5.4 Communication Performance Measurement Procedure*.

No.	Test Item	Pass criteria
1	Communication distance (Center at 0 degree)	The maximum communication distance shall be 15mm or more.
2	Number of communication holes (Center, $XY \pm 10$ mm at 0 degree)	Center: There must be no communication holes within 0mm to 15mm of the reader/writer. However, any communication holes of less than 3mm are allowed.  Center and offset: There must be no communication holes at 0mm height of the reader/writer. Two or less communication holes out of five points at center and $XY \pm 10$ mm are allowed.

Note: The success rate for this item shall be 95% or more.

Combination of test samples and testing reader/writers (Yes: Performed, —: Not performed)

	Minimum-frequency reader/writer	Standard-frequency reader/writer	Maximum-frequency reader/writer
Maximum-frequency sample	Yes	Yes	Yes
Standard-frequency sample	Yes	Yes	Yes
Minimum-frequency sample	Yes	Yes	Yes

## Attachment A: Mobile FeliCa RF Performance Certification Application

### Mobile FeliCa RF Performance Certification Application

The company indicated below applies for the mobile FeliCa RF performance certification test. The company agrees to the terms set forth in the Terms and Conditions for Mobile FeliCa RF Performance Certification Test (for Mobile Product) attached to this document.

Date of application: \_\_\_\_\_

#### *Applicant information*

Company name: \_\_\_\_\_

#### **Applicant**

Applicant name: \_\_\_\_\_ Signature: \_\_\_\_\_ Email: \_\_\_\_\_

Department: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

#### **Authorization**

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

Department: \_\_\_\_\_

Title: \_\_\_\_\_

Remarks: \_\_\_\_\_

#### *Description of the product submitted for testing:*

Model: \_\_\_\_\_

RF IC model: \_\_\_\_\_

RF IC Firmware Version / L3 Cert. ID: \_\_\_\_\_

EDC function:  Used  Not used

The lab has to operate EDC ON setting:  Yes (\*Please provide the operating manual)  No

Active Load Modulation (ALM) function:  Used  Not used

Information regarding the measurement center point and antenna installation

Please indicate the following items in a drawing or photo.

- (1) Measurement center point: Numerically describe the location of the center point in relation to the outer edges of the test sample. (Also, clearly mark the center point on the actual test sample.)
- (2) 0-degree direction: Clearly indicate the 0-degree direction and X-axis and Y-axis directions of the test sample by arrows.
- (3) Antenna size: Clearly indicate the shape of the antenna, and numerically describe the outside dimensions of the antenna.
- (4) Antenna position: Numerically describe the location of the antenna in relation to the outer edges of the test sample.

Remarks: \_\_\_\_\_

*Request Maximum communication distance measuring (Additional fee: 80,000 yen.):*  Yes

***Desired certification test period:***

Planned product submission date:

Desired test end date:

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***Where to submit the application form:***

**Certification Laboratory (Subcontract Laboratory of Sony IP&S)**

Sony Global Manufacturing & Operations Corporation

Certification Test Team, Quality Assurance Department 1

Address: 8-4 Shiomi, Kisarazu-shi, Chiba Prefecture, 292-0834, JAPAN

Phone: +81-438-37-2404

E-mail: emcs-felica-kentei@jp.sony.com

## Attachment B: Notice of Added Product Model

### Notice of Added Product Model for Mobile FeliCa RF Performance Certification

The company indicated below applies for the addition of the new product model indicated below to the product series that has already obtained mobile FeliCa RF performance certification. The company guarantees that the new product model has the same communication performance as the product that has already obtained said certification.

Date of application: \_\_\_\_\_

#### *Applicant information*

Company name: \_\_\_\_\_

#### **Applicant**

Applicant name: \_\_\_\_\_ Signature: \_\_\_\_\_ Email: \_\_\_\_\_

Department: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

#### **Authorization**

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

Department: \_\_\_\_\_

Title: \_\_\_\_\_

Remarks: \_\_\_\_\_

#### *Information regarding the product that has already obtained performance certification*

Model: \_\_\_\_\_

Certification number: \_\_\_\_\_

Remarks: \_\_\_\_\_

#### *Information regarding the product model to be added*

Model: \_\_\_\_\_

Issuing the Mobile FeliCa RF Performance Certificate of added product model:  Yes  No

Remarks: \_\_\_\_\_

#### *Where to submit the application form:*

#### **Certification Laboratory (Subcontract Laboratory of Sony IP&S)**

Sony Global Manufacturing & Operations Corporation

Certification Test Team, Quality Assurance Department 1

E-mail: emcs-felica-kentei@jp.sony.com



## **Attachment C: Terms and Conditions**

### **Terms and Conditions for Mobile FeliCa RF Performance Certification Test (for Mobile Product)**

The following terms and conditions (the “Terms and Conditions”) apply with respect to the “Mobile FeliCa RF Certification Test” of your Product (hereinafter defined) conducted by Sony Imaging Products & Solutions Inc. (“Sony”). The Terms and Conditions apply to individual applications for the “Mobile FeliCa RF Certification Test” submitted on the Mobile FeliCa RF Performance Certification Test Application Form to which these Terms and Conditions are attached. These Terms and Conditions become an agreement with respect to the “Mobile FeliCa RF Certification Test” (the “Agreement”) between you and Sony upon Sony’s acceptance of your application for the “Mobile FeliCa RF Certification Test” submitted in accordance with Section 2.01 hereof.

#### **ARTICLE I. DEFINITIONS**

The following terms as used in these Terms and Conditions shall have the meanings set forth below.

- (a) “FeliCa IC” shall mean IC chips for Mobile Product that is certified by FeliCa Networks.
- (b) “Mobile Product” shall mean a mobile device (i) which has communication function and (ii) which is sold, rented, leased or otherwise provided with the trademarks of either Telecommunication Carriers, third party or your company.
- (c) “Telecommunication Carrier” shall mean a provider of trans receiver functionalities via mobile communication system to users of mobile devices that are sold, rented, leased or otherwise provided to them with such providers’ trademarks.
- (d) “Product” shall mean the Mobile Product in which FeliCa IC is embedded.
- (e) “Mobile FeliCa RF Certification Test” or “Test” shall mean the certification test conducted by Sony to determine whether your Product manufactured for a Telecommunication Carrier, third party or your company meets the standards and/ or requirements (the “Certification Standards”) for Mobile Products set forth in the “Mobile FeliCa RF Performance Certification Specification” (the “Certification Specification”) made by Mobile FeliCa Technical Communications Committee.

#### **ARTICLE II. CERTIFICATION TEST**

2.01 An application for the Mobile FeliCa RF Certification Test shall be made for each model of your Product, in accordance with the provisions of the Certification Specification, by filling out the “Mobile FeliCa RF Performance Certification Test Application Form” to which these Terms and Conditions are attached. Your application is deemed to be accepted unless it is rejected by Sony with reasonable cause within five (5) business days (of Sony in Japan) from the date of submission of your application.

2.02 You must submit three (3) samples of your Product. After the completion of the Mobile FeliCa RF Certification Test, Sony will return such samples to you. Sony shall not be responsible for any damages to the samples in connection with the Mobile FeliCa RF Certification Test of the Products performed by Sony.

2.03 Sony will, after the Agreement becomes effective and Sony receives the samples set forth in Section 2.02 above, promptly conduct the Mobile FeliCa RF Certification Test in accordance with the Certification Specification and notify you the results thereof. Upon passing of the Mobile FeliCa RF Certification Test, Sony will issue a pass certificate (the “Pass Certificate”) with respect to the specific model of the Product for which the samples were provided.

2.04 If (i) you request to add a new Product model which has not yet passed the Test but has the same communication performance under the same measurement conditions as the Product which has passed the Test to a Product series whose models have already passed the Test, by the form separately designated by Sony, and (ii) Sony approves such request by the form separately designated by Sony, then such a new Product model is deemed to have passed the Test without being Tested, provided that you warrant such sameness of the communication performance thereto.

2.05 The Pass Certificate shall be valid for ten (10) years from the date of issuance (the "Term"), unless invalidated by Sony pursuant to these Terms and Conditions. The Term will be indicated on the Pass Certificate. Provided that the Term of the Pass Certificate for a new Product model which has been added in as set forth the Section 2.04 (without being Tested) shall be the same period with the Term of the model of Products which has actually passed the Test.

### ARTICLE III. EFFECT OF THE PASS CERTIFICATE

3.01 During the Term of the Pass Certificate, you may publicly announce or indicate that the applicable model of the Product has passed the Mobile FeliCa RF Certification Test. Such announcement or indication must include the name of the certification test, the version of the Certification Specification and the applicable model name of the Product, all exactly as set forth on the Pass Certificate.

3.02 Sony reserves the right to cancel the rights granted to you under Section 3.01 immediately if you fail to comply with the requirements set forth in Section 3.01.

3.03 In response to your request in writing, Sony will list on its Web site your name along with the model name and other information of your Product that has passed the Mobile FeliCa RF Certification Test.

3.04 Your announcement or indication permitted under Section 3.01 shall be made only with respect to the model of the Product that has passed the Mobile FeliCa RF Certification Test.

3.05 Upon expiration or termination of the Term of the Pass Certificate, you will no longer have the rights granted to you under Section 3.01.

### ARTICLE IV. EXTENSION OF TERM

4.01 You may apply to extend the Term of the Pass Certificate by submitting to Sony the required data for the Product separately designated by Sony at least thirty (30) days prior to the applicable expiration date of the Term of the Pass Certificate. Sony will evaluate the submitted data and will notify you the results thereof. If the submitted data meets the Certification Standards, and unless any of the events set forth in Section 6.02 has occurred, Sony will issue a Pass Certificate whose Term is extended for another five (5) years. Thereafter, the Term may be re-extended in accordance with this Section 4.01.

4.02 If the data submitted pursuant to Section 4.01 does not meet the Certification Standards, you are no longer entitled to extend the Term of the Pass Certificate. Instead, you must re-apply for the Mobile FeliCa RF Certification Test in accordance with the provisions of Sections 2.01 through 2.04.

### ARTICLE V. FEES

5.01 In consideration for the completion of the Mobile FeliCa RF Certification Test, you shall pay to Sony

the fees in the amount of five hundred and fifty thousand (550,000) Japanese Yen (not including any applicable taxes). The payment of the fees and any applicable taxes shall be made to Sony in Japanese Yen by means of wire transfer remittance into a bank account designated by Sony, at least one (1) week prior to the estimated date of sample submission as designated by you in the “Mobile FeliCa RF Performance Certification Test Application Form”. Sony may withhold performance as set forth in Section 2.03 until receipt of such payment.

5.02 The fees for the extension of the Term of the Pass Certificate pursuant to Section 4.01 shall be fifty thousand (50,000) Japanese Yen (not including any applicable taxes). The payment of the fees and any applicable taxes shall be paid to Sony in Japanese Yen by wire transfer remittance into a bank account designated by Sony, within thirty (30) days after you have submitted to Sony the required data for the Product pursuant to Section 4.01. Sony may withhold performance as set forth in Section 4.01 until its receipt of such payment.

5.03 The fees paid to Sony hereunder are non-refundable.

## ARTICLE VI. CHANGES AND INVALIDATION

6.01 The Pass Certificate is valid only with respect to the Product model that is identical to the sample Product model that passed the Mobile FeliCa RF Certification Test. To obtain the Pass Certificate for any other Product model, you must separately apply for and pass the Mobile FeliCa RF Certification Test with respect to such other Product model.

6.02 If you make modifications to the Product, such modified Product is not deemed to be passed the Test and the Pass Certificate is no longer valid for such modified Product even if the model of the Product is the same as the Product which has passed the Test and you need to apply for the Test for such modified Product. Notwithstanding above, if (i) you notify Sony of such modification in the form separately designated by Sony and (ii) Sony, at its sole discretion, determined and approved that such modification does not affect the RF communication performance, and (iii) you warrant the same communication performance under the same measurement conditions as the Product without such modification, then you do not need to re-apply for the Test despite of the modification to the Product.

6.03 Sony may amend or update the Certification Standards at its discretion from time to time in part or in whole. In such event, Sony will update the version number of the Certification Specification, and you may, at your option, apply for the Mobile FeliCa RF Certification Test under the updated Certification Specification in order to obtain a Pass Certificate under the updated Certification Specification. However, any amendment or the update to the Certification Standards will not affect the validity of any Pass Certificate issued under previous version(s) of the Certification Specification.

6.04 If Sony finds that, as to any Product that has passed the Mobile FeliCa RF Certification Test, such Product made available in the market does not meet the Certification Standards applied at the time of the issuance of the relevant Pass Certificate, Sony may, at its option, invalidate such Pass Certificate.

6.05 Sony may reject any request for extension of the Term of the Pass Certificate pursuant to Section 4.01 if it has determined to terminate the offering of the Mobile FeliCa RF Certification Tests.

6.06 If you make any public announcement or indication with respect to your Product pursuant to Section 3.01 (i) without having re-applied or passed the Mobile FeliCa RF Certification Test even though you have made one or more modifications to your Product that require re-application for the Mobile FeliCa RF Certification Test pursuant to Section 6.01, or (ii) without notifying Sony of modification to the Product or without receiving Sony's approval pursuant to Section 6.02 or (iii) under any updated version of the Certification Specification when you

have not passed the Mobile FeliCa RF Certification Test under such updated version of the Certification Specification, Sony may, at its option, immediately invalidate the relevant Pass Certificate.

## ARTICLE VII. CONFIDENTIALITY

7.01 You and Sony (each, a “Party” and collectively, the “Parties”) shall each maintain as confidential and shall not disclose to any third party any technical, business or other proprietary information of the other Party disclosed during the course of the Mobile FeliCa RF Certification Test (the “Confidential Information”) without the prior written consent of such other Party, for three (3) years after such disclosure. Further, Sony will not use your Confidential Information for any purpose other than the purposes contemplated under these Terms and Conditions.

7.02 Notwithstanding the provisions of Section 7.01, such restrictions shall not apply to any portion of the Confidential Information which a Party can prove:

- (a) was part of the public domain at the time of disclosure;
- (b) was previously known to the receiving Party at the time of disclosure;
- (c) subsequently becomes part of the public domain through no fault of the receiving Party or its employees; or
- (d) is rightfully obtained by the receiving Party from a third party source without any restriction on disclosure or use; or
- (e) is independently ascertainable or developed by the receiving Party who have not had access to the Confidential Information.

## ARTICLE VIII. WARRANTIES AND LIMITATION OF LIABILITY

8.01 SONY MAKES NO REPRESENTATION OR WARRANTIES, EXPRESSLY OR BY IMPLICATION, STATUTORY OR OTHERWISE, IN CONNECTION WITH PASSING OF THE MOBILE FELICA RF CERTIFICATION TEST, INCLUDING BUT NOT LIMITED TO REPRESENTATIONS OR WARRANTIES OF QUALITY, FUNCTIONALITY, PERFORMANCE, SAFETY, UTILITY, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF YOUR PRODUCT.

8.02 IN NO EVENT SHALL SONY BE LIABLE TO YOU OR ANY THIRD PARTY FOR ANY DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OR LOSSES WHATSOEVER UNDER ANY CIRCUMSTANCES (INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION OR OTHER PECUNIARY LOSS) THAT ARISE IN CONNECTION WITH THE PRODUCTS THAT HAVE PASSED THE MOBILE FELICA RF CERTIFICATION TEST, EVEN IF SONY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

## ARTICLE IX. EXCLUSION OF ANTISOCIAL FORCES

9.01 Each of you and Sony represents to the other Party that at the time of the conclusion of this Agreement, the Party, its directors and corporate executive officers are not Antisocial Forces and warrants that they are not Antisocial Forces during the terms of this Agreement. Antisocial Forces hereinafter means that organized gangster crime groups defined in the section 2.02 of Act on Prevention of Unjust Acts by Organized Crime Group Members (“Act”) and organized gangster crime groups members defined in the section 2.06 of the Act, any crime syndicates or gangs, a quasi-member of any crime syndicates or gangs, individuals for whom left an organized gangster crime group within the past 5 years have not yet elapsed since leaving any crime syndicate or gang, quasi-members of any organized gangster crime groups (“boryokudan junkose-in”), an enterprised affiliated with

organized gangster crime groups (“boryokudasn kankei kigyō”) a crime syndicates or gangs. Corporate extortionists (“sokai-ya”) corporate swindler acting groups engaging in criminal activities under the pretext of conducting social movements or political activities (“shakai undou hyoubou goro”, “seiji katsudou hyoubou goro”), groups of individuals specialized in intellectual crimes (“tokushu chinou bouryoku shuudan”), individuals being in closely contact affiliated with to any organized gangster crime groups (“boryokudan missetsu-kankeisha”), crime syndicates or gangs, and any individual or a group of individuals being equivalent thereto.

9.02 Each of you and Sony also warrants that, in connection with this Agreement, it shall not, either by itself or by way of third parties, conduct any of the following acts: (i) violent demands, (ii) improper demands in excess of legal responsibilities, (iii) acts of violence or menacing statements in relation to a transaction, (iv) spreading of rumors, use of fraudulent means or use of obstruction to harm the reputation of the other party, or to obstruct the business of the other party; or (v) any other act equivalent to any of the previous items.

9.03 Each of you and Sony may terminate, in whole or in any part, of the Agreement without any demands or notice, if (a) the other Party breaches the representations and warranties above, or (b) you or Sony determines that performance of this Agreement helps or otherwise promote the activities of such Antisocial Forces.

9.04 Each of Sony and you shall not be liable to the other party for any damage arising out of termination of this Agreement in accordance with Section 9.03.

9.05 In the event that any of items set forth in Section 9.02 applies to Sony or you, the applicable party shall, upon the other party’s request, lose the benefit of time relating to any debt against such other party and immediately pay such debt.

## ARTICLE X. TERMINATION

10.01 Each Party reserves the right to terminate the Agreement immediately without any notice or demand in the event that:

- (a) the other Party is adjudicated a bankrupt, makes assignment for the benefit of its creditors; takes advantage of any insolvency act; or is the subject of a case for its liquidation or reorganization under any law;
- (b) the other Party breaches any provision of these Terms and Conditions and does not cure such breach within thirty (30) days after receipt of notice thereof; or
- (c) the other Party ceases to function as a going concern or to conduct its operations in the normal course of business.
- (d) the other Party uses the Mobile FeliCa RF Certification Test and/or Product illegally or against public policy.

10.02 Sony reserves the right to invalidate the Pass Certificate issued to you hereunder immediately without notice or demand in the event that you fail to make any payment required under the Agreement for more than two (2) months from the due date.

10.03 In the event that the Agreement becomes terminable by Sony under this Article X, all of your obligations under the Agreement shall immediately accelerate.

10.04 Articles VII, VIII, XII and Sections 10.03 and 10.04 shall survive any expiration or termination of the Agreement.

## ARTICLE XI. NO ASSIGNMENT

11.01 You may not assign transfer or mortgage any of your rights and obligations hereunder without the prior written consent of Sony.

## ARTICLE XII. MISCELLANEOUS

12.01 Sony may, at any time with prior notice to you, cease to conduct the Mobile FeliCa RF Certification Test or assign or transfer its rights and obligations hereunder with respect to the Mobile FeliCa RF Certification Test to a third party in part or in whole, and you shall not object to any of such assignment or transfer.

12.02 You must observe and comply with all relevant laws, ordinances, rules and regulations of relevant countries in performing your obligations and exercising your rights hereunder.

12.03 Sony may use subcontractors to conduct the Test provided that in such case, Sony shall cause such subcontractors to be bound by the confidentiality obligation as set forth Article VII of the Agreement.

12.04 These Terms and Conditions and the Agreement shall be governed by the laws of Japan. If any provision of these Terms and Conditions is held by a court or other tribunal of competent jurisdiction to be invalid or unenforceable, that provision of these Terms and Conditions shall be enforced to the maximum extent permissible so as to effect the intent of the parties hereto, and the remainder of these Terms and Conditions shall continue in full force and effect.

12.05 In the event of any dispute arising out of or in connection with these Terms and Conditions or the Agreement, which cannot be amicably settled by the Parties, the Parties shall submit any such disputes to the Tokyo District Court in Japan as the court of first instance. Any counter-claim shall be filed with the court with which the original action is filed. The Parties agree that the judgment, decree or order rendered by a court of last resort or a court of lower jurisdiction from which no appeal has been taken in Japan shall be final and binding upon both Parties.

Published on November 1, 2018

## Attachment D: Side lobe area

This section provides a supplementary explanation about the side lobe described in Section 6.5.3.1.2 “Measuring Communication Holes - Measuring a Wide Range”.

- Side lobe area

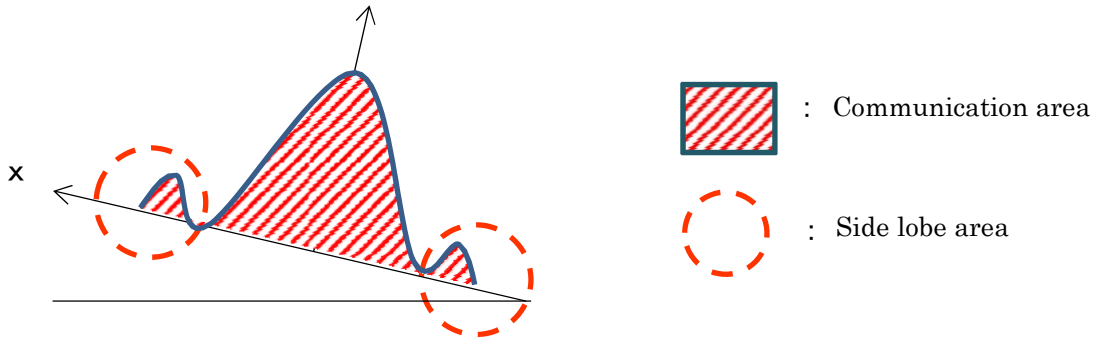


Figure 1 Side lobe area

- Boundary between the communication area and the side lobe area

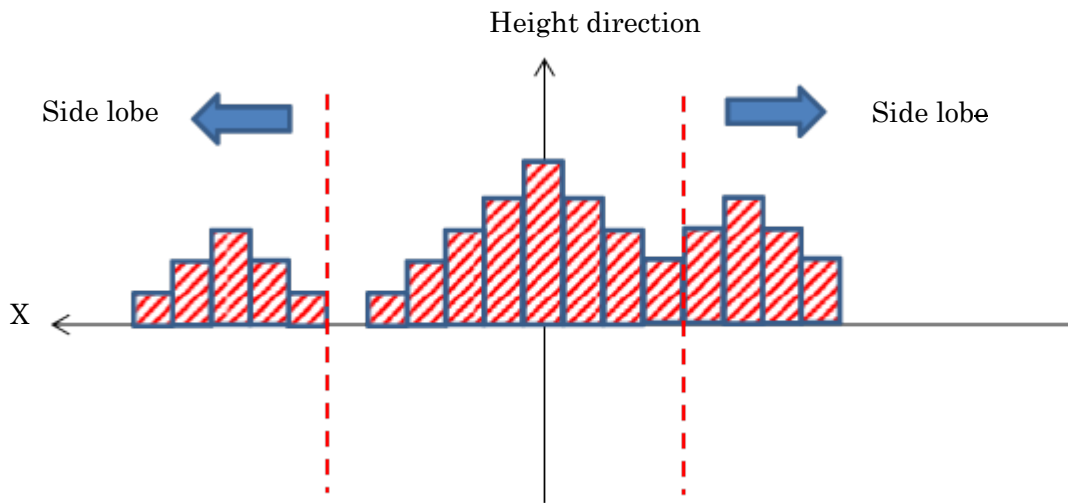


Figure 2 Boundary between the communication area and the side lobe area