Test Report

Test Report Number	EOTEL002
Applied Standard(s)	FCC Part15 Subpart C / IC RSS-210 / ANSI C63.4-2003
Date of Issue	26th November, 2013
Testing Laboratory **Address**	e-OHTAMA, LTD., Tokyo Laboratory 2-8-20 Kurigi, Asao-ku Kawasaki-shi, Kanagawa, Japan
Test Date(s)	17th 18th October, 2013
Product Name	Leak Noise Logger Logger
Model Number	LNL-1L
Serial Number	13034030
Applicant (Client) **Address**	FUJI TECOM INC. 2-20 Kanda Sakumacho, Chiyoda-ku, Tokyo, 101-0025, Japan
Manufacturer **Address**	FUJI TECOM INC. 2-20 Kanda Sakumacho, Chiyoda-ku, Tokyo, 101-0025, Japan

Test Result

The test result for the electromagnetic compatibility tests
as described in the section 1 to 2 and in this page was:

Pass

Tested by: Katsutoshi Hatanaka
Katsutoshi Hatanaka
Test Enginner

Approved by: Koji Imai
Koji Imai
Testing Group Leader

Checked box (☒) indicates that the listed condition, standard or equipment is applicable for this Report.
Blank box (☐) indicates that the listed condition, standard or equipment is not applicable for this Report.
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Test results of this report refer only to the EUT tested here.

Page

Cover Page....1
Table of Contents....2

1. Summary.... 3
   1.1 Terms and definitions 3
   1.2 Standard(s) and Result.... 3
   1.3 Deviations from Standard(s).... 3
   1.4 Antenna Requirements.... 3

2. Equipment Under Test (EUT).... 4
   2.1 General Descriptions 4
   2.2 Detailed Descriptions.... 4
   2.3 Labeling Requirements.... 4
   2.4 Measurement Condition 5

3. Test Data.... 6
   3.1 Test specification.... 6
   3.2 20dB Bandwidth / 99% Bandwidth.... 7
   3.3 Conditions for intentional radiators to comply with periodic operation 8
   3.4 Field strength of Emissions.... 9

4. Photographs of Test setup.... 14

5. Test facility 15
   5.1 Test Instruments.... 15
   5.2 Interconnecting Cables.... 15

1. Summary

1.1 Terms and definitions

AV
Average

DoC
Declaration of Conformity

EUT
Equipment Under Test

QP
Quasi-peak

1.2 Standard(s) and Result

Applied Standard(s)	Normative Reference(s)	Test Limit	FCC Part and RSS Section(s)	Result	Reference Clause No.
FCC Part15 Subpart C IC	20dB Bandwidth 99% Bandwidth	FCC 15.231 (c)L imits	15.215(c) N/A	Pass	3.2
	Conditions for intentional radiators to comply with periodic operation	FCC 15.231 (e)L imits	15.231(e)	Pass	3.3
	Field Strength	FCC 15.209 limits FCC 15.231 limits RSS-210 table A or B limits	15.231 (b)(e) RSS-210 A1.1	Pass	3.4

Table 1 Standard and result

1.3 Deviations from Standard(s)

There was no deviation from the standard.

1.4 Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."
The antennas of the FUJI TECOM.INC's Leak noise logger are permanently attached.
The connection to an outside antenna becomes the structure not to come off easily to fix it by a special screw.

Conclusion:
The FUJI TECOM INC. FCC ID: 2AARD0002 equipment complies with the requirement of §15.203.

2. Equipment Under Test (EUT)

2.1 General Descriptions

The loggers mounted with sensors are installed on the ancillary equipment of water pipeline such as valves, fire hydrants and air valves, and “minimum sound levels of water leak noise” are collected at a certain interval. The minimum sound levels recorded on the loggers are transmitted to the data collector via radio communication. The collected minimum sound levels are judged normal or abnormal based on the threshold in the management software and the results are displayed on the map. In addition, the respective logger data displayed in the graph can be compared, and ageing variation can be found. Therefore, faulty pipelines can be detected very effectively.

2.2 Detailed Descriptions

Product Name	Logger
Model Number	LNL-1L
Serial Number	13034030
Power Supply	DC 3.6V
Dimension	40.0mmΦ × 110.0mm(H)
Operating Frequency	429.250～429.475MHz
Equipment Category	Part15:Remote Control / Security Device Transceiver IC :Wireless Video or Data Device (54-806 MHz)
Normal Placement	Outdoor equipment
Condition of the EUT	Product
FCC ID	2AARD0002
Industry Canada Company Number and UPN Number	11320A-0002

Table 2 Dateiled Description

2.3 Labeling Requirements

§15.19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(b)(2).
Please see attachment for FCC ID label and label location.

Conclusion:

The FUJI TECOM,INC. FCC ID: 2AARD0002 equipment complies with the requirement of §15.19.

2.4 Measurement Condition

2.4.1 EUT Operation

The EUT was measured by transmitter mode continuously.

2.4.2 Configuration and Peripherals

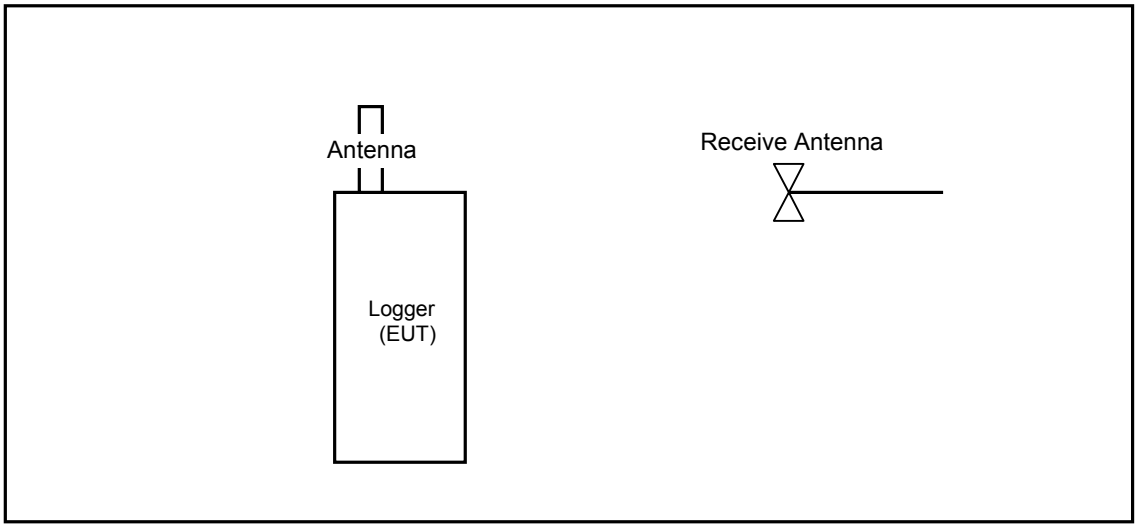


Figure 1 configuration and Peripherals

2.4.3 EUT

Mark	Description	Model number	Serial Number	FCC ID Code or DoC status	Manufacturer
1	Logger	LNL-1L	13034030	2AARD0002	FUJI TECOM.INC

Table 3 EUT

3.Test Data

3.1 Test specification

Standard	FCC Part15 Subpart C / IC RSS-210 / ANSI C63.4-2009
Tested Frequency	429.250～429.475MHz
Test Date	17th 18th October, 2013
Test Location	e-OHTAMA, LTD. Tokyo Laboratory Thermostatic chamber No.5
Test Engineer	Katsutoshi Hatanaka
Temperature	23.3 °C – 23.8 °C
Humidity	43.8% RH – 52.8% RH
Power Supply	DC 3.6V

Table 4 Test specification

3.2 20dB Bandwidth / 99% Bandwidth

3.2.1 Test Result

Pass

3.2.2 Test Detail

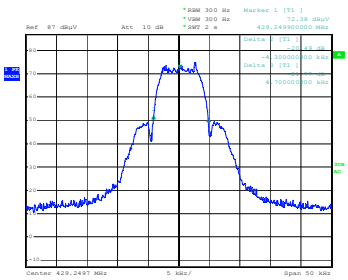
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices Operating above 70MHz and below 900MHz.For devices operating above 900MHz,the emission Shall be no wider than 0.5% of the center frequency.Bandwidth is determined at the points 20dB Down from the modulated carrier.

3.2.3 Test data

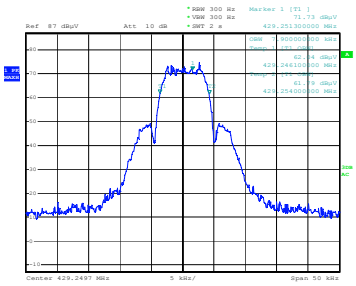
Measurement frequency (MHz)	Result(kHz)		Limits (kHz) Limits= frequency×0.25%
	20dB	99%	
429.250	9.00	7.90	1073.125
429.350	9.00	7.90	1073.375
429.475	8.90	8.00	1073.688

Table 5 20dB Bandwidth / 99% Bandwidth

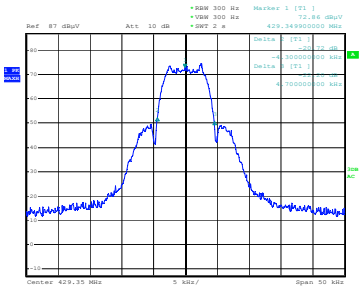
429.250MHz 20dB Bandwidth



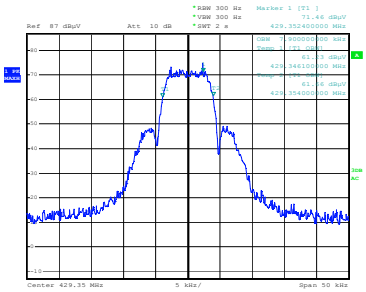
429.250MHz 99% Bandwidth



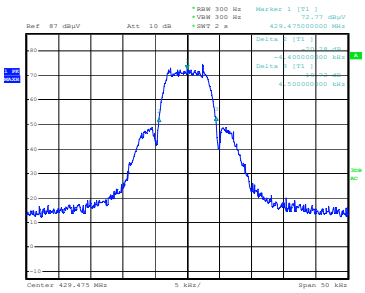
429.350MHz 20dB Bandwidth



429.350MHz 99% Bandwidth



429.475MHz 20dB Bandwidth



429.475MHz 99% Bandwidth

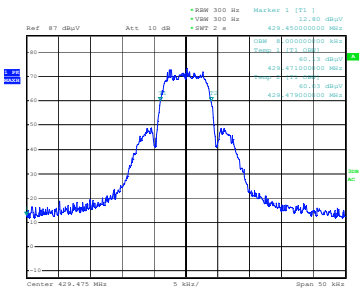


Figure 2 20dB Bandwidth / 99% Bandwidth

3.3 15.231(e) Conditions for intentional radiators to comply with periodic operation

3.3.1 Test Result

Pass

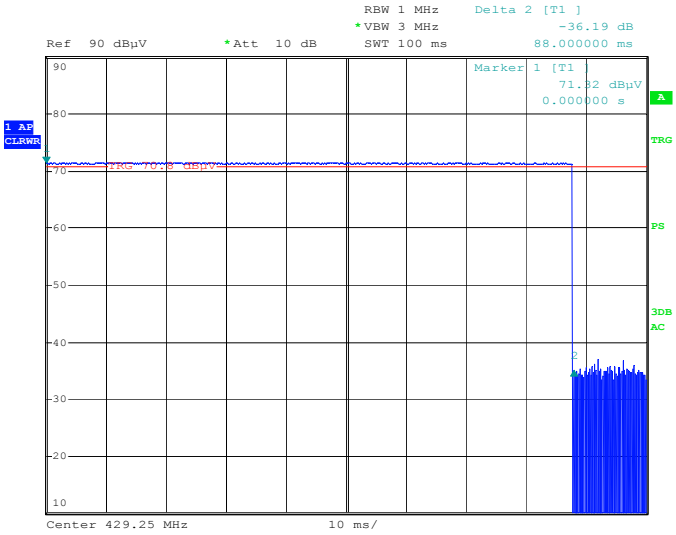
3.3.2 Test Detail

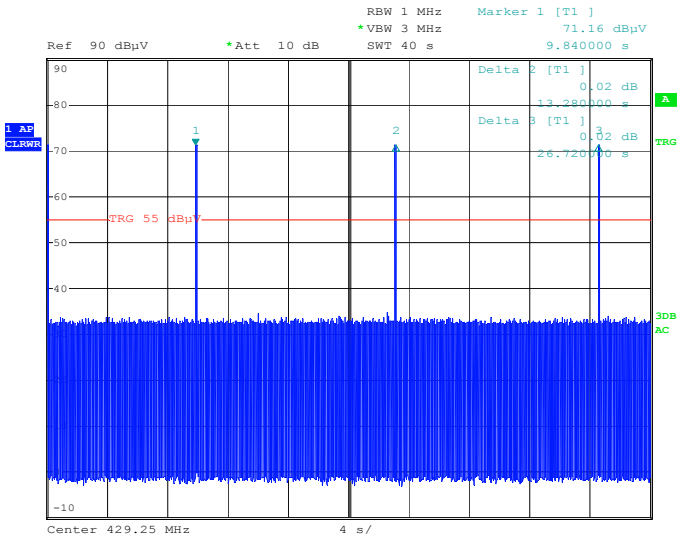
(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following.
In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

3.3.3 Test Data

Result		
Duration of transmission	Duration of each Transmission	
	1st	2nd
88.00ms	13.28s	13.44s

Table 6 Duration of transmission／Duration of each Transmission





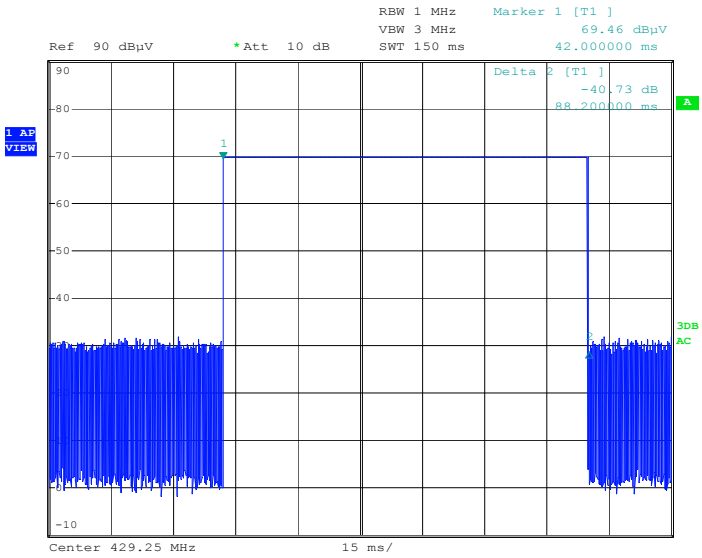


Figure 3 Duration of transmission／Duration of each Transmission

3.4 Field strength of emissions

3.4.1 Test Result

Pass

3.4.2 Test Detail

In addition to the provisions of 15.205,the field strength of emissions from intentional radiators operated under this section shall not exceed the following.

Fundamental frequency (MHz)	Field strength of fundamental		Field strength of spurious emissions	
	(μV/m)	(dBμV/m)	(μV/m)	(dBμV/m)
40.66-40.70	1,000	60	100	40
70-130	500	53.9	50	33.9
130-174	500 to 1,500*	53.9-63.5*	50 to 150*	33.9 to 43.5*
174-260	1,500	63.5	150	43.5
260-470	1,500 to 5,000*	63.5 to 73.9*	150 to 500*	43.5 to 53.9*
Above 470	5,000	73.9	500	53.9

＊Linear interpolations

Table 7 Field strength limits

Notes:

(1) The above field strength limits are specifield at a distance of 3 meters. The tighter limits apply at the band edges.

(2)Intentional radiators operating under the provisions of this section shall demonstrate comliance with the limits on the field strength of emissions,as shown in the above table,based on the average value of the measured emissions.AS an altemative,compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR qusai-peak detector. The specific method of measurement employed shall be specifild in the application for equipment authorization.If average emission apply.Further,compliance with the provisions of 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3)The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator.Spurious emissions shall be attenuated to the average(or,altematively,CISPR qusai-peak)limits shown in this table or to the general limits shown in 15.209,whichever limit permits a higher field strength.

3.4.3 Test data

Measurement frequency (MHz)	Emission Frequency (MHz)	Level (dBμV)	Factor (dB)	Turntable Angle (°)	Antenna Position (m)	EUT Pol. (H/V)	3m Field Strength (dBμV/m)		Limit(dBμV/m)		Margin(dB)	
							Average	Peak	Average	Average +20dB	Average	Peak
429.250	429.245	72.8	-1.7	231.0	1.26	V	71.1	71.4	72.7	92.7	1.6	21.3
	429.245	53.3	-1.7	117.0	1.03	H	51.6	51.9	72.7	92.7	21.1	40.8
429.350	429.343	73.1	-1.7	233.0	1.25	V	71.4	71.7	72.7	92.7	1.3	21.0
	429.343	53.8	-1.7	112.0	1.00	H	52.1	52.4	72.7	92.7	20.6	40.3
429.475	429.479	72.8	-1.7	222.0	1.19	V	71.1	71.4	72.7	92.7	1.6	21.3
	429.479	52.6	-1.7	114.0	1.07	H	50.9	51.2	72.7	92.7	21.8	41.5

Table 8 Field strength of fundamental results

Measurement frequency (MHz)	Emission Frequency (MHz)	Level (dBμV)	Factor (dB)	Turntable Angle (°)	Antenna Position (m)	EUT Pol. (H/V)	3m Field Strength (dBμV/m)		Limit (dBμV/m)		Margin(dB)	
							Average	Peak	Average	Average +20dB	Average	Peak
429.250	44.414	19.6	-6.3	0.0	3.35	V	13.3	13.6	40.0	60.0	26.7	46.4
	951.937	18.2	7.7	99.0	1.37	V	25.9	26.2	46.0	66.0	20.1	39.8
	3813.748	23.6	4.0	7.0	1.00	H	27.6	27.9	53.9	73.9	26.3	46.0
	4292.465	23.3	5.0	355.0	1.07	V	28.3	28.6	53.9	73.9	25.6	45.3
429.350	344.375	18.2	-3.3	351.0	2.18	V	14.9	15.2	43.5	63.5	28.6	48.3
	975.867	18.2	8.0	209.0	3.99	V	26.2	26.5	53.9	73.9	27.7	47.4
	4298.718	23.3	5.0	1.0	1.07	H	28.3	28.6	53.9	73.9	25.6	45.3
	4982.085	23.5	5.0	341.0	1.40	V	28.5	28.8	53.9	73.9	25.4	45.1
429.475	840.280	18.6	6.0	190.0	1.36	V	24.6	24.9	46.0	66.0	21.4	41.1
	962.881	18.2	7.8	347.0	1.07	H	26.0	26.3	53.9	73.9	27.9	47.6
	3869.459	23.5	4.0	186.0	1.29	V	27.5	27.8	53.9	73.9	26.4	46.1
	4193.628	23.4	4.8	335.0	1.33	H	28.2	28.5	53.9	73.9	25.7	45.4

Table 9 Field strength of spurious emissions results

Note :

(1)Measuring distance : 3m

(2)Antenna height variation : 1 - 4m

(3)Turn table position : 0 - 360°

(4)All measurements were performed using a Logperidodec Antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.
The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.

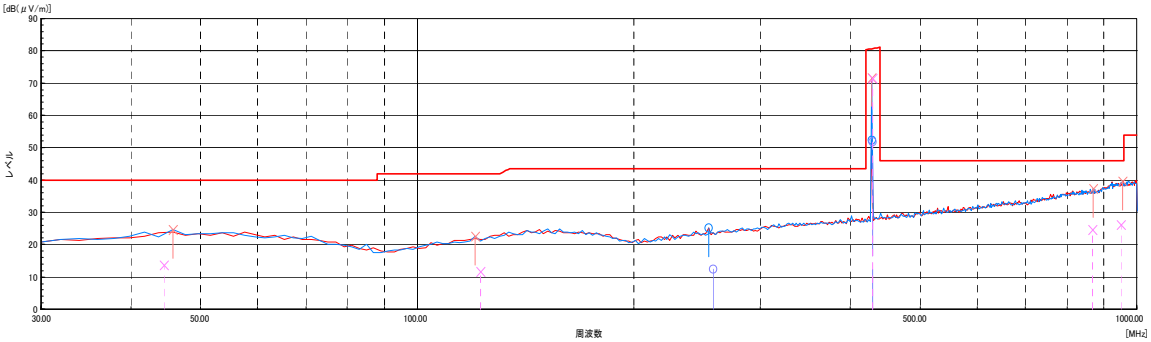
(5)Analyzer setting for measurements :

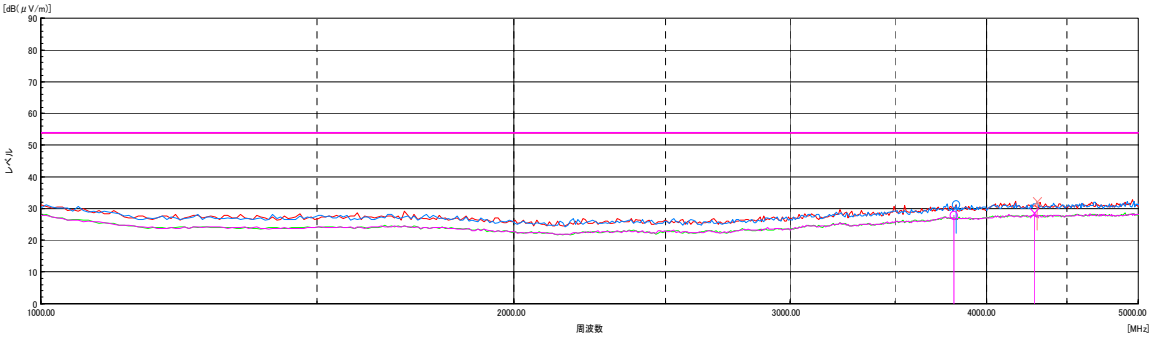
- 30 to 1000MHz : peak detector
- Above 1GHz : peak detector

(6) Factor [dB] = Antenna Factor[dB] + Cable Loss [dB] + Amp Factor [dB] +Duty Cycle Average Factor[dB]
Duty Cycle Average Factor[dB] =$20\log_{10}$ (* 96ms÷100ms) * Transmission time when a condition is the worst

(7)Margin [dB]= Limit [dB・V/m] -Field Strength Level [dB・V/m]

< Measurement frequency : 429.250MHz >





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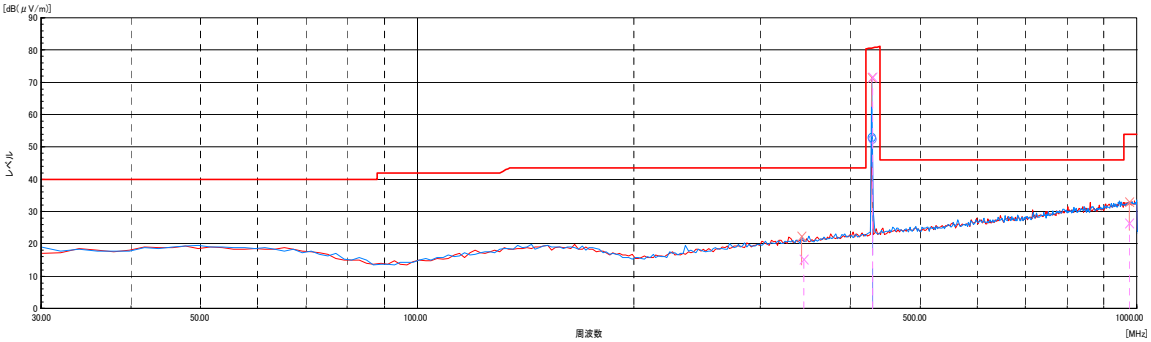
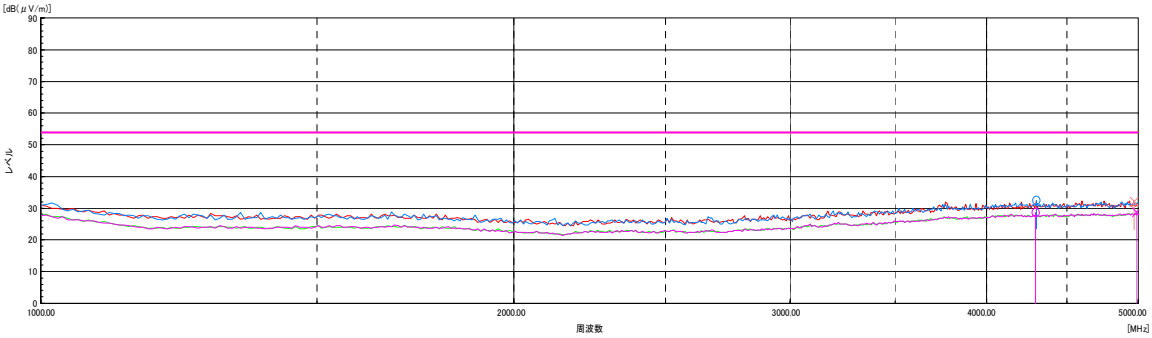
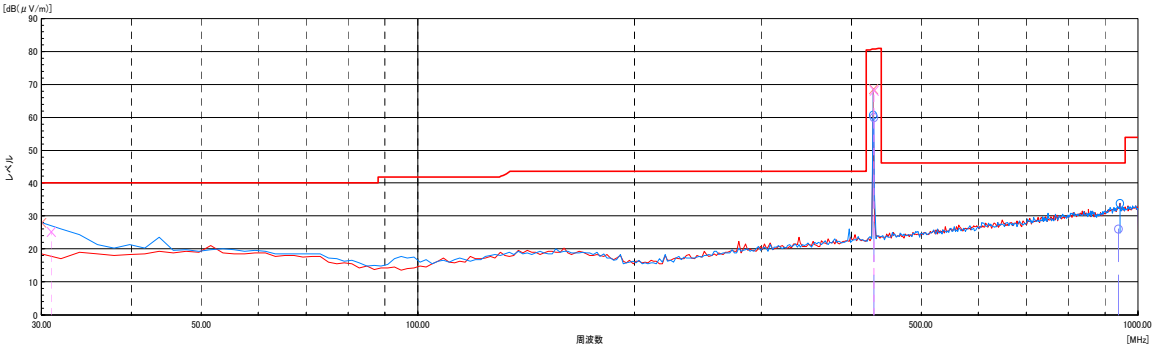




< Measurement frequency : 429.475MHz >



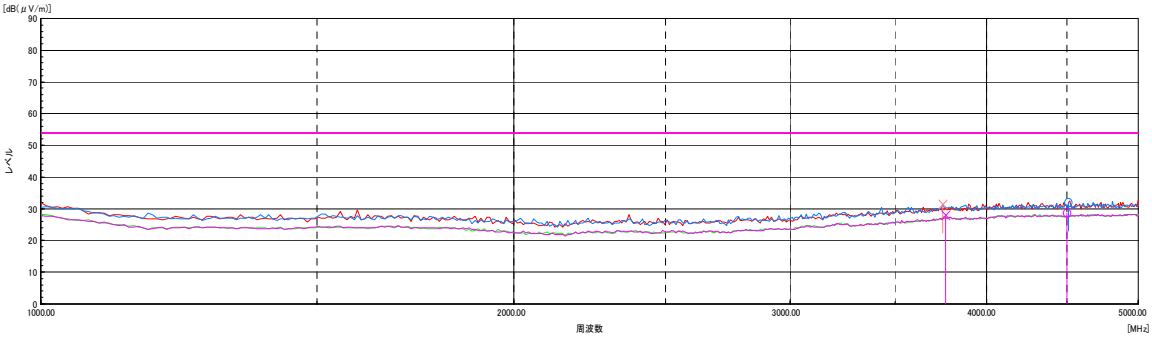


Figure 4 Field strength of emissions Plot

4. Photographs of Test Setup

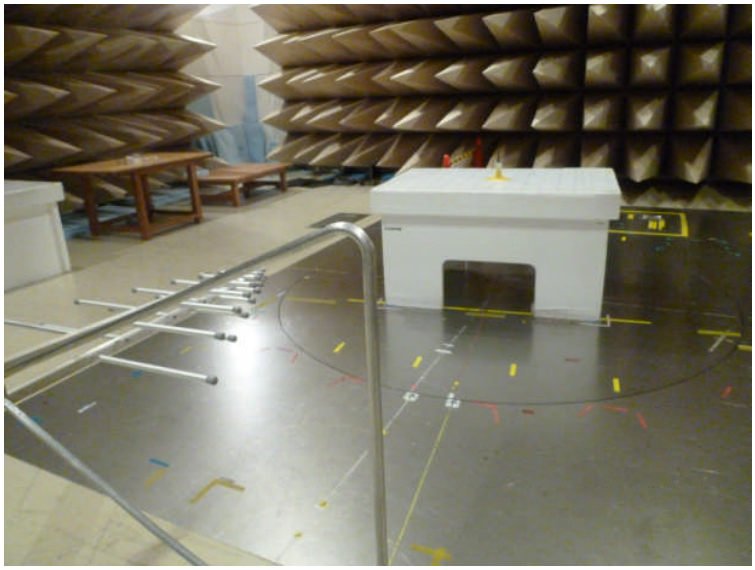


Photo1 Field strength emissions & Bandwidth (Antenna side)

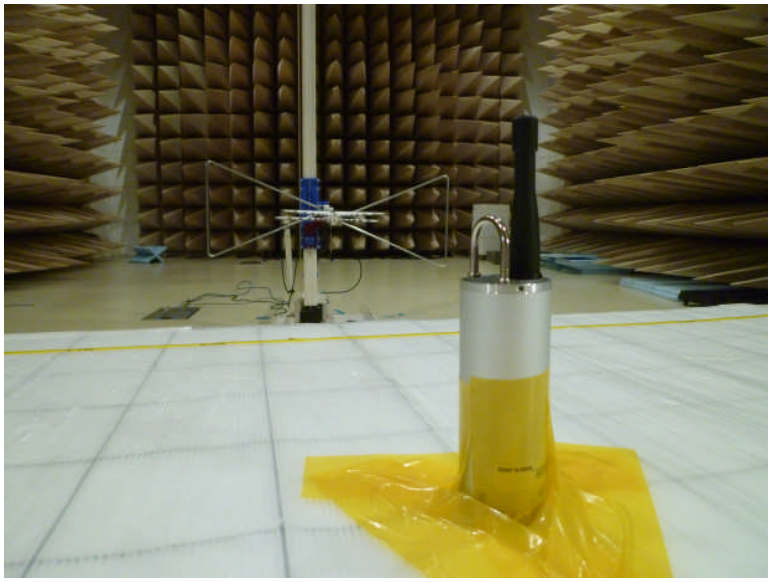


Photo2 Field strength emissions & Bandwidth (EUT side)

5.Test facility

5.1 Test Instruments

5.1.1 Field strength emissions & Bandwidth

Product Name	Manufacturer	Model Number	Serial Number	Calibration Date	Due Date
Spectrum analyzer Receiver	Rohde&Schwarz	ESIB40	100263	2013/9/17	2014/9/30
Pre-Amplifier	Hewlett Packard	8447D	2944A07182	2013/3/4	2014/3/31
Biconical Log Antenna	Schwarzbeck	VULB9160	9160-3189	2013/8/8	2014/8/31
Horn Antenna	ETS-LINDGREN	3117	00146463	2013/5/01	2014/5/31

Table 10 Field strength emissions & Bandwidth

5.2 Interconnecting Cables

Mark	Description	Length (m)	Shielded		Tested Port(s) (Note:1)	
			Cable	Connector	Applicable	Interface
1	Antenna cable	12.0	Shielded	Shielded	No	RF Signal

Note1: Tested port(s) required for applicable standard(s).

Remarks: The length described here is the length of the cable typically used in the tests, but different length of the cable may be used in some tests to satisfy the requirements for the test.

Table 11 Interconnecting Cables