



RADIO TEST REPORT

Test Report No. : 11370534H-A-R1

Applicant : Sumitomo Wiring Systems, Ltd.

Type of Equipment : UNIT ASSY, BCM

Model No. : HAR0001

FCC ID : 2AKB8HAR0001

Test regulation : FCC Part 15 Subpart C: 2016

Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11370534H-A. 11370534H-A is replaced with this report.

Date of test: October 6, 2016

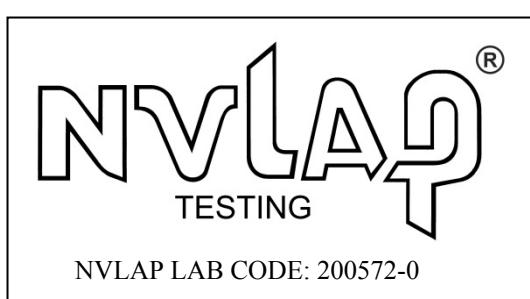
Representative test engineer:

Masafumi Niwa

Engineer
Consumer Technology Division

Approved by:

Motoya Imura
Engineer
Consumer Technology Division



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*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11370534H-A

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SECTION 1: Customer information

Company Name : Sumitomo Wiring Systems, Ltd.
Address : 1820 Nakanoike, Mikkaichi-cho, Suzuka-City, Mie Pref. 513-8631 JAPAN
Telephone Number : +81-59-382-8711
Facsimile Number : +81-59-383-3943
Contact Person : Masaya Oota

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : UNIT ASSY, BCM
Model No. : HAR0001
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12 V
Receipt Date of Sample : September 29, 2016
Country of Mass-production : United States of America , China , Thailand
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model No: HAR0001 (referred to as the EUT in this report) is the UNIT ASSY, BCM.

General Specification

Clock frequencies in the system : LF Transmitter: 9.000 MHz
RF Receiver: 24.305 MHz

Radio Specification

[LF Transmitter]

Radio Type : Transmitter
Frequency of Operation : 125 kHz
Modulation : OOK (ASK)
Method of Frequency Generation : Clock with a built-in IC
Antenna Type : Ferrite core winding type

[RF Receiver]*

Radio Type : Receiver
Frequency of Operation : 433.92 MHz
Method of Frequency Generation : Crystal
Receiver Bandwidth : 146 kHz

*The test of receiver part was performed separately from this test report, and the conformability is confirmed.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
 FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted Emission
 Section 15.209 Radiated emission limits, general requirements

* The revision on November 14, 2016, does not affect the test specification applied to the EUT.

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 8.8	<FCC> Section 15.207 <IC> RSS-Gen 8.8	-	N/A *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.12	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9	Radiated	N/A	3.2 dB 125 kHz 0 deg. PK with Duty factor	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.13	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9	Radiated	N/A	20.7 dB 368.986 MHz Horizontal, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

FCC Part 15.31 (e)

The test was performed with the New Battery (DC 12 V) and the EUT constantly provides the stable voltage to RF part through the regulator regardless of input voltage from New Battery. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99 % Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	N/A

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test distance	Radiated emission (+/-)	
	9 kHz - 30 MHz	
3m	3.8 dB	
10m	3.7 dB	

*Measurement distance

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

* Measurement distance

Radiated emission test(3 m)

[Electric Field Strength of Fundamental Emission]

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

[Electric Field Strength of Spurious Emission]

The data listed in this test report has enough margin, more than the site margin.

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3.5 Test Location

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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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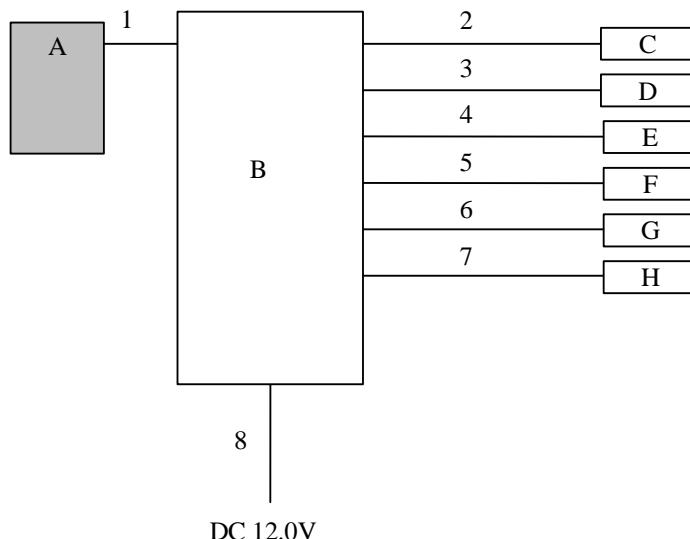
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Test mode	Remarks
Transmitting mode (Tx) 125 kHz	-

Justification : The system was configured in typical fashion (as a user would normally use it) for testing.

4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

* The EUT does not transmit simultaneously from multiple antennas.

* Antennas were evaluated with the worst duty respectively.

This test was set not to transmit data randomly from each antenna but to be transmitted from one antenna continuously as a Worst case. After pre-confirmation, as no difference was observed, Antenna M was selected for the representative.

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Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	UNIT ASSY, BCM	HAR0001	4	Sumitomo Wiring Systems, Ltd.	EUT
B	Checker Box	-	-	Sumitomo Wiring Systems, Ltd.	-
C	LF Antenna (FRDR)	38387-TVA-A310-M1	001	ALPS ELECTRIC CO., LTD.	-
D	LF Antenna (FRAS)	38387-TVA-A310-M1	002	ALPS ELECTRIC CO., LTD.	-
E	LF Antenna (TR)	38387-TVA-A310-M1	006	ALPS ELECTRIC CO., LTD.	-
F	LF Antenna (F)	38387-TVA-A310-M1	003	ALPS ELECTRIC CO., LTD.	-
G	LF Antenna (R)	38387-TVA-A310-M1	005	ALPS ELECTRIC CO., LTD.	-
H	LF Antenna (M)	38387-TVA-A310-M1	004	ALPS ELECTRIC CO., LTD.	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal Cable	2.9	Unshielded	Unshielded	-
2	Antenna Cable	3.3	Unshielded	Unshielded	-
3	Antenna Cable	3.3	Unshielded	Unshielded	-
4	Antenna Cable	3.3	Unshielded	Unshielded	-
5	Antenna Cable	3.3	Unshielded	Unshielded	-
6	Antenna Cable	3.3	Unshielded	Unshielded	-
7	Antenna Cable	3.3	Unshielded	Unshielded	-
8	DC Cable	2.0	Unshielded	Unshielded	-

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SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency : From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

The test was made with the detector (RBW / VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 9 kHz - 1 GHz
Test data : APPENDIX 1
Test result : Pass

Date: October 6, 2016

Test engineer: Masafumi Niwa

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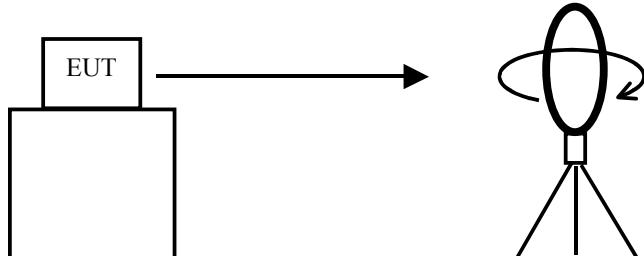
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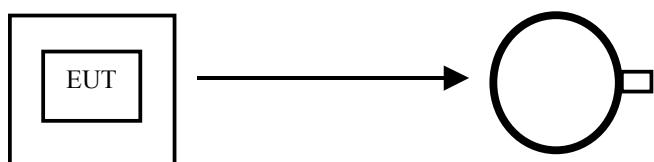
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

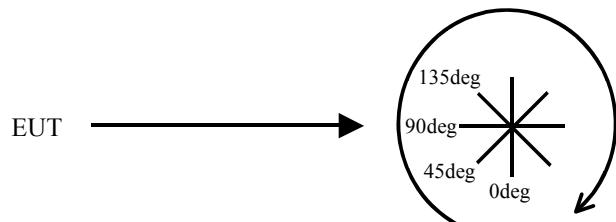


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

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SECTION 6: -26dB Bandwidth

Test Procedure

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	50 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 99% Occupied Bandwidth

Test Procedure

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %.
Peak hold was applied as Worst-case measurement.

Test data : APPENDIX 1
Test result : Pass

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APPENDIX 1: Test data

Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
 Order No. 11370534H
 Date 10/6/2016
 Temperature/ Humidity 23 deg. C / 70 % RH
 Engineer Masafumi Niwa
 Mode Tx 125 kHz M Antenna

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.12500	PK	109.2	19.6	-74.1	32.3	-	22.4	45.6	23.2	Fundamental
0	0.25000	PK	79.9	19.6	-74.0	32.3	-	-6.8	39.6	46.4	
0	0.37500	PK	77.0	19.6	-74.0	32.3	-	-9.7	36.1	45.8	
0	0.50000	QP	48.5	19.5	-34.0	32.3	-	1.7	33.6	31.9	
0	0.62500	QP	40.3	19.5	-34.0	32.3	-	-6.5	31.7	38.2	
0	0.75000	QP	32.4	19.5	-34.0	32.3	-	-14.4	30.1	44.5	
0	0.87500	QP	32.1	19.5	-34.0	32.3	-	-14.7	28.7	43.4	
0	1.00000	QP	32.5	19.5	-34.0	32.3	-	-14.3	27.6	41.9	
0	1.12500	QP	32.6	19.5	-34.0	32.3	-	-14.2	26.5	40.7	
0	1.25000	QP	30.6	19.5	-34.0	32.3	-	-16.2	25.6	41.8	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amprifier)

PK with Duty factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.125	PK	109.2	19.6	-74.1	32.3	0.0	22.4	25.6	3.2	
0	0.250	PK	79.9	19.6	-74.0	32.3	0.0	-6.8	19.6	26.4	
0	0.375	PK	77.0	19.6	-74.0	32.3	0.0	-9.7	16.1	25.8	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, duty factor was omitted.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.12500	PK	109.2	19.6	5.9	32.3	-	102.4	-	-	-Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

* All spurious emissions lower than this result.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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Radiated Emission above 30 MHz (Spurious Emission)

DATA OF RADIATED EMISSION TEST

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 Date : 2016/10/06

Report No. : 11370534H

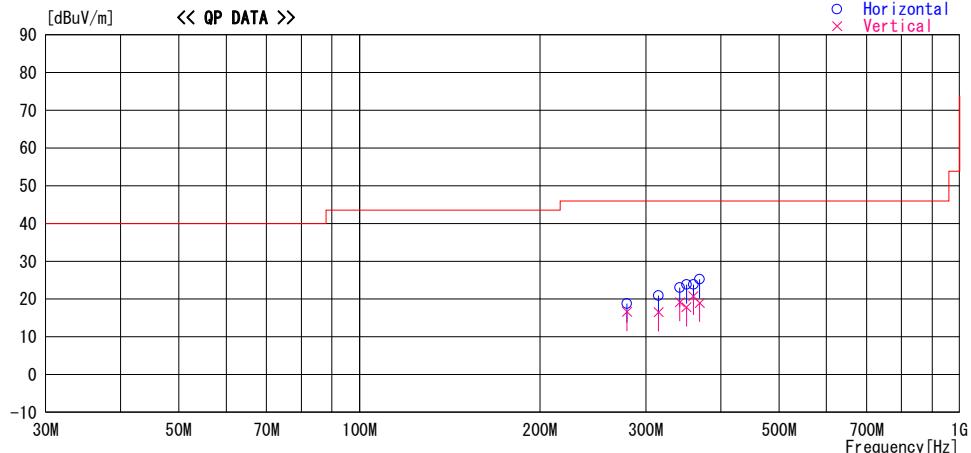
Temp. /Humi. : 23deg. C / 64% RH
 Engineer : Masafumi Niwa

Mode / Remarks : Tx 125 kHz M Antenna Worst Axis (Ant Hori: X, Vert: X / BCM Hori: X, Vert: X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK

Except for the data below : adequate margin data below the limits.

— Horizontal
 - - - Vertical
 ○ Horizontal
 × Vertical



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss& Factor	Level	Angle	Height	Polar.	Limit	Margin	Comment
			[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]	[dBuV/m]	[dB]		
278.987	28.0	QP	13.1	-22.3	18.8	56	104	Hori.	46.0	27.2	
278.983	25.8	QP	13.1	-22.3	16.6	272	135	Vert.	46.0	29.4	
314.982	28.9	QP	13.9	-21.9	20.9	279	100	Hori.	46.0	25.1	
314.986	24.5	QP	13.9	-21.9	16.5	245	170	Vert.	46.0	29.5	
341.982	30.2	QP	14.5	-21.7	23.0	241	100	Hori.	46.0	23.0	
341.982	26.4	QP	14.5	-21.7	19.2	97	100	Vert.	46.0	26.8	
350.854	30.9	QP	14.6	-21.6	23.9	321	100	Hori.	46.0	22.1	
350.856	24.8	QP	14.6	-21.6	17.8	266	100	Vert.	46.0	28.2	
359.980	30.7	QP	14.8	-21.6	23.9	215	100	Hori.	46.0	22.1	
359.989	27.6	QP	14.8	-21.6	20.8	243	112	Vert.	46.0	25.2	
368.986	31.8	QP	15.0	-21.5	25.3	143	103	Hori.	46.0	20.7	
368.980	25.5	QP	15.0	-21.5	19.0	58	100	Vert.	46.0	27.0	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-200MHz:BICONICAL, 200MHz-1000MHz:LOGPERIODIC, 1000MHz-HORN
 CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE + ATTEN - GAIN(AMP))

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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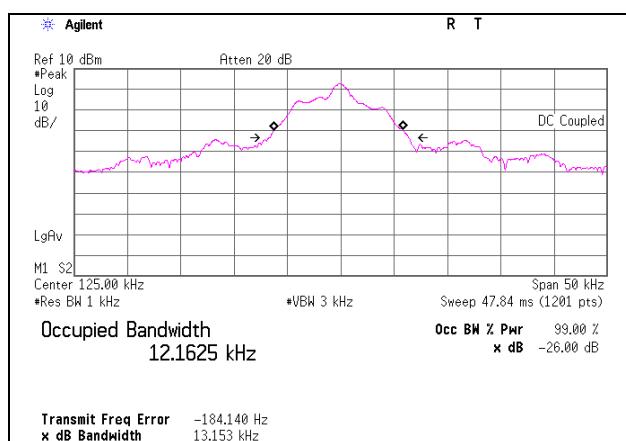
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-26 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 11370534H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date 10/6/2016
Temperature / Humidity 23 deg. C / 70 % RH
Engineer Masafumi Niwa
Mode Tx 125 kHz

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.153	12.1625



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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2015/10/07 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2016/09/15 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2015/10/11 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2016/01/30 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2016/07/26 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2016/04/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2016/03/24 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2016/01/13 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2015/10/24 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ suciform141-PE(1m)/ 421-010(1.5m)/RFM-E321(Switcher)	-/00640	RE	2016/07/26 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2016/06/20 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item:

RE: Spurious emission

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