



EMI TEST REPORT

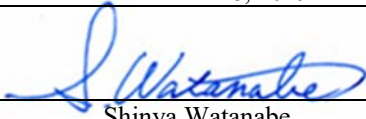
Test Report No. : 12812711H-B-R2

Applicant : SUBARU CORPORATION
Type of Equipment : Keyless Access with Push-Button Start System
Model No. : SU19S-1
FCC ID : Y8PSU19S-1
Test regulation : FCC Part 15 Subpart B: 2019
Test Result : Complied (Refer to SECTION 3.2)

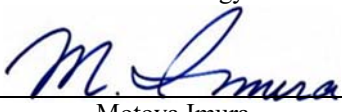
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. 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.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12812711H-B-R1. 12812711H-B-R1 is replaced with this report.

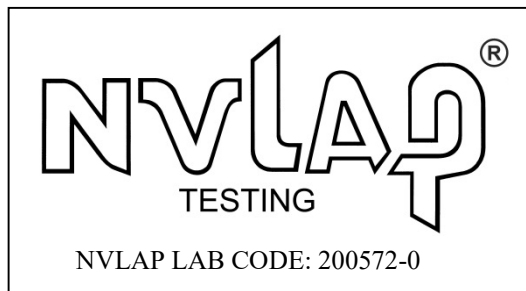
Date of test: June 12 and 18, 2019

Representative test engineer:


Shinya Watanabe
Engineer
Consumer Technology Division

Approved by:


Motoya Imura
Leader
Consumer Technology Division



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 12812711H-B

[illegible]

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SECTION 1: Customer information

Company Name	:	SUBARU CORPORATION
Address	:	1-1, Subaru-cho, ota-shi, Gunma-ken, 373-8555, Japan
Telephone Number	:	+81-276-26-3064
Facsimile Number	:	+81-276-26-3878
Contact Person	:	Kenichi Hanamata

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment	:	Keyless Access with Push-Button Start System
Model No.	:	SU19S-1
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample (Information from test lab.)	:	May 8, 2019
Country of Mass-production	:	Japan
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: SU19S-1 (referred to as the EUT in this report) is a Keyless Access with Push-Button Start System.

Radio Specification

[Transmitter]

Radio Type	:	Transmitter
Frequency of Operation	:	125 kHz
Frequency of Operation	:	134.2 kHz
Type of Modulation	:	OOK (A1D)
Oscillation circuit	:	Crystal
Power Supply	:	DC 12.0 V
Antenna	:	Antenna (TYPE 1) (*1) (*3) / (TYPE 2) (*2) *1: Maximum number of this antenna is 2. *2: Maximum number of this antenna is 4.
Antenna Specification	:	Ferrite antenna coil
Clock frequency (maximum)	:	8.000 MHz (CPU)

*3) The Antennas (TYPE 1) of this system have variations of model 1 and model 2.

The difference of these variations is only the outer shell, and the test was performed with the representative model 1.

[Receiver]

Radio Type	:	Receiver
Frequency of Operation	:	433.92 MHz
Oscillator frequency	:	30.265 MHz (Crystal)
Intermediate frequency	:	280 kHz
Type of Modulation	:	FSK
Type of receiving system	:	Super-heterodyne
Power Supply	:	DC 5.0 V
Antenna Type	:	Internal antenna (Inverted F antenna)
Voltage Controlled Oscillator	:	1734.540 MHz

FCC15.111(b)

The receiving antenna (of this EUT) is installed inside the EUT and cannot be removed (permanently attached). Therefore, Radiated emission test was performed.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart B
FCC Part 15 final revised on June 4, 2019 and effective July 5, 2019 except 15.258

Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

* The revision on June 4, 2019, does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result	Remarks
Conducted emission	FCC: ANSI C63.4: 2014 7. AC power - line conducted emission measurements	FCC:Part 15 Subpart B 15.107(a)	N/A	N/A	N/A	*1)
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8				
Radiated emission	FCC: ANSI C63.4: 2014 8. Radiated emission measurements	FCC: Part 15 Subpart B 15.109(a)	N/A	16.98 dB 70.539 MHz, Horizontal, QP	Complied a)	-
	IC: RSS-Gen 7	IC: RSS-Gen 7.1.2				
*Note: UL Japan, Inc’s EMI Work Procedure 13-EM-W0420.						
*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.						
a) Refer to APPENDIX 1 (data of Radiated Emission)						
Symbols:						
Complied		The data of this test item has enough margin, more than the measurement uncertainty.				
Complied#		The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.				

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.9 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz to 6 GHz	6 GHz to 18 GHz	10 GHz to 26.5 GHz	26.5 GHz to 40 GHz	1 GHz to 18 GHz
5.0 dB	5.3 dB	5.8 dB	5.8 dB	5.2 dB

* Measurement distance

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3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m 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

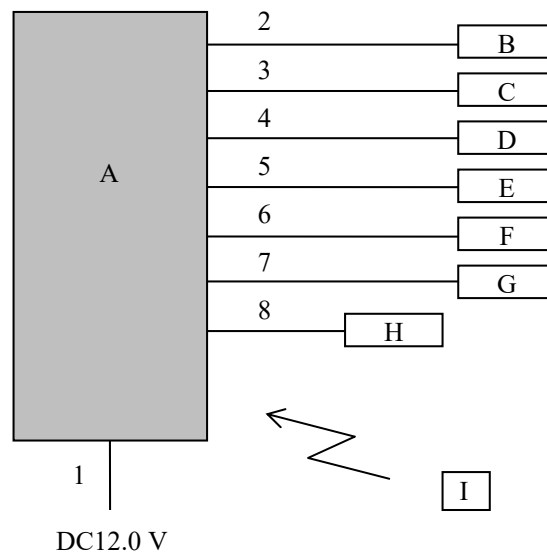
4.1 Operating Mode(s)

The mode is used: Receiving mode (Rx) 433.92 MHz

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

* It was confirmed by using checker that the EUT receives the signal from the transmitter (pair of EUT).

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Keyless Access with Push-Button Start System	SU19S-1	SU19S-0-1	SUBARU CORPORATION	EUT
B	Antenna	TYPE1 (No.1)	2DD0-25	SUBARU CORPORATION	-
C	Antenna	TYPE1 (No.2)	2DD0-26	SUBARU CORPORATION	-
D	Antenna	TYPE2 INSIDE 1	8RA-130	SUBARU CORPORATION	-
E	Antenna	TYPE2 INSIDE 2	8RA-129	SUBARU CORPORATION	-
F	Antenna	TYPE2 LUGGAGE 1	8RA-132	SUBARU CORPORATION	-
G	Antenna	TYPE2 LUGGAGE 2	8RA-131	SUBARU CORPORATION	-
H	Checker	-	001	SUBARU CORPORATION	-
I	Transmitter	-	-	SUBARU CORPORATION	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	Antenna Cable	3.0	Unshielded	Unshielded	-
3	Antenna Cable	3.0	Unshielded	Unshielded	-
4	Antenna Cable	3.0	Unshielded	Unshielded	-
5	Antenna Cable	3.0	Unshielded	Unshielded	-
6	Antenna Cable	3.0	Unshielded	Unshielded	-
7	Antenna Cable	3.0	Unshielded	Unshielded	-
8	Signal cable	3.0	Unshielded	Unshielded	-

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SECTION 5: Radiated Emission

5.1. Operating environment

Test place : No.2 and 3 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2. Test configuration

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 EUT was set on the edge of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

Photographs of the set up are shown in Appendix 3.

5.3. Test conditions

Frequency range : 30 MHz - 200 MHz (Biconical antenna) / 200 MHz - 1000 MHz (Logperiodic antenna)
1000 MHz - 10000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4. Test procedure

The height of the measuring antenna 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 with the Test Receiver.

The radiated emission measurements were made with the following detector function of the Test Receiver.

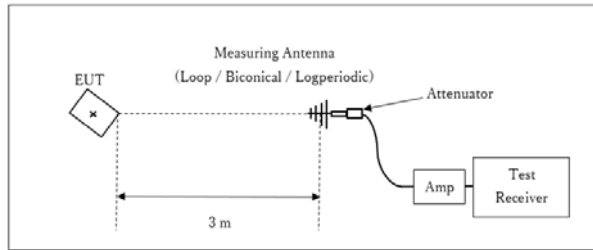
Frequency	Below 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.

Distance Factor: $20 \times \log (3.5 \text{ m} / 3 \text{ m}) = 1.34 \text{ dB}$

Figure 2: Test Setup

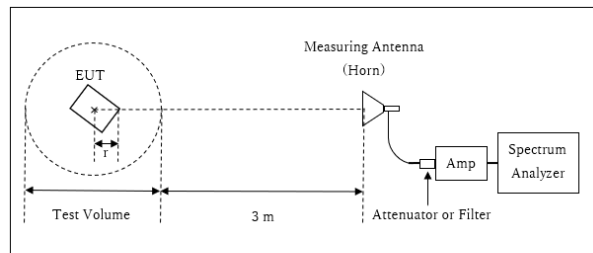
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log(3.5 \text{ m}^*/3.0 \text{ m}) = 1.34 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.5 \text{ m}$

Test Volume: 2 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.5 \text{ m}$

- The 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.

5.5. Test result

Summary of the test results: Pass

The limit is rounded down to one decimal place.

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

Date: June 12, 2019
June 16, 2019

Test engineer:

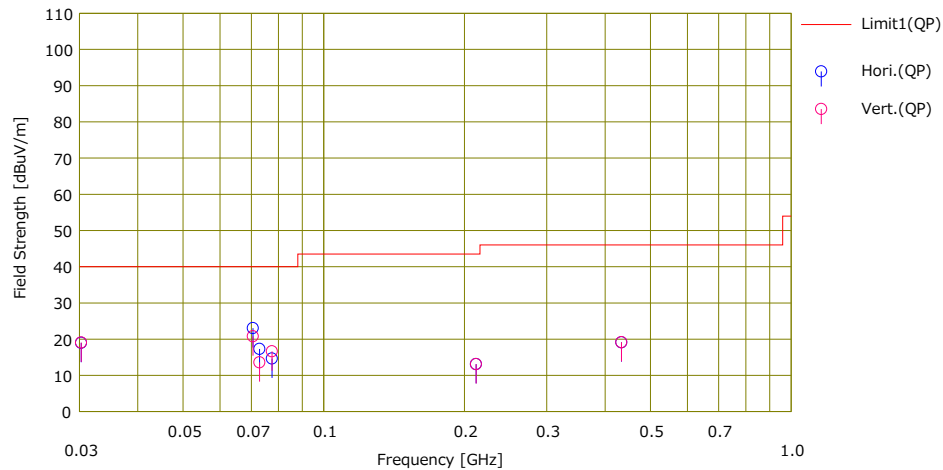
Shinya Watanabe
Takumi Shimada

APPENDIX 1: Test data

Radiated Emission

Report No. 12812711H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 12, 2019
Temperature / Humidity 23 deg. C / 61 % RH
Engineer Shinya Watanabe
(Below 1 GHz)
Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant. Type	Comment
		(QP)				(QP)	(QP)	(QP)					
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	30.265	24.84	17.94	6.71	30.53	18.96	40.00	21.04	Hori.	200	0	BA	
2	70.539	40.24	5.98	7.18	30.38	23.02	40.00	16.98	Hori.	222	170	BA	
3	72.888	34.46	6.00	7.20	30.37	17.29	40.00	22.71	Hori.	224	167	BA	
4	77.498	31.49	6.23	7.24	30.35	14.61	40.00	25.39	Hori.	230	159	BA	
5	211.855	23.40	11.01	8.26	29.56	13.11	43.50	30.39	Hori.	100	0	LA21	
6	433.640	23.17	16.16	9.60	29.82	19.11	46.00	26.89	Hori.	280	0	LA21	
7	30.265	24.92	17.94	6.71	30.53	19.04	40.00	20.96	Vert.	100	0	BA	
8	70.539	37.99	5.98	7.18	30.38	20.77	40.00	19.23	Vert.	100	69	BA	
9	72.888	30.75	6.00	7.20	30.37	13.58	40.00	26.42	Vert.	100	51	BA	
10	77.498	33.49	6.23	7.24	30.35	16.61	40.00	23.39	Vert.	100	216	BA	
11	211.855	23.37	11.01	8.26	29.56	13.08	43.50	30.42	Vert.	200	0	LA21	
12	433.640	23.20	16.16	9.60	29.82	19.14	46.00	26.86	Vert.	100	0	LA21	

* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

CHART: WITH FACTOR

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

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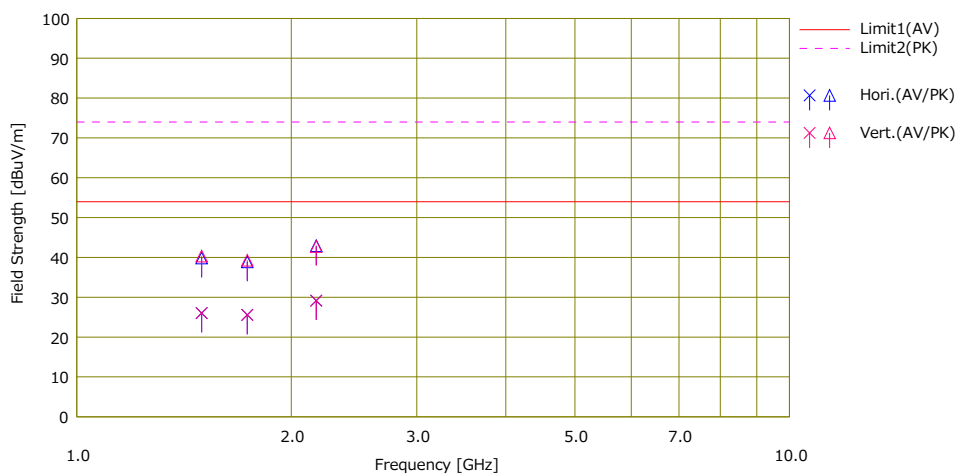
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Radiated Emission

Report No. 12812711H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 18, 2019
Temperature / Humidity 23 deg. C / 54 % RH
Engineer Takumi Shimada
(Above 1 GHz)
Mode Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	1496.903	31.10	44.90	25.85	3.22	34.15	26.02	39.82	54.00	74.00	27.98	34.18	Hori.	100	0	H20	
2	1734.540	30.30	43.60	25.46	3.37	33.57	25.56	38.86	54.00	74.00	28.44	35.14	Hori.	100	0	H20	
3	2168.200	30.00	43.80	28.36	3.64	32.85	29.15	42.95	54.00	74.00	24.85	31.05	Hori.	100	0	H20	
4	1496.903	31.10	45.40	25.85	3.22	34.15	26.02	40.32	54.00	74.00	27.98	33.68	Vert.	100	0	H20	
5	1734.540	30.30	44.00	25.46	3.37	33.57	25.56	39.26	54.00	74.00	28.44	34.74	Vert.	100	0	H20	
6	2168.200	30.00	43.60	28.36	3.64	32.85	29.15	42.75	54.00	74.00	24.85	31.25	Vert.	100	0	H20	

* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

CHART: WITH FACTOR

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

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APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/08/2019	04/30/2021	24
RE	141266	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	03/25/2019	03/31/2020	12
RE	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	03/05/2019	03/31/2020	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	05/10/2019	05/31/2020	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
RE	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/05/2019	03/31/2020	12
RE	141403	High Pass Filter 1.22-4.60GHz	Mini-Circuit	VHF-1200	10435	08/09/2018	08/31/2019	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	05/24/2019	05/31/2020	12
RE	141323	Coaxial cable	UL Japan	-	-	07/03/2018	07/31/2019	12
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/20/2018	12/31/2019	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/08/2019	02/29/2020	12
RE	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/08/2018	08/31/2019	12
RE	141578	Pre Amplifier	AGILENT	8447D	2944A10845	09/19/2018	09/30/2019	12
RE	141317	Coaxial Cable	Fujikura/Agilent	-	-	02/25/2019	02/29/2020	12
RE	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/05/2018	11/30/2019	12
RE	141265	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	03/25/2019	03/31/2020	12
RE	141427	Biconical Antenna	Schwarzbeck	VHA9103B	8031	04/12/2019	04/30/2020	12
RE	142228	Measure	KOMELON	KMC-36	-	-	-	-
RE	141556	Thermo-Hygrometer	CUSTOM	CTH-201	0003	12/05/2018	12/31/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	06/29/2018	06/30/2020	24
RE	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	06/15/2018	06/30/2019	12

*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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: Radiated emission

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