Statement for RF Exposure

Statement No.	**14392271H-R3**
Customer	**Sumitomo Electric Industries, Ltd.**
Description of EUT	**Pedestrian Sensor**
Model Number of EUT	**SWR-A001**
FCC ID	**2A8U2SWR-A001**
Test standard	**FCC Part 15 Subpart C**
Test result	**Complied**

[FCC rule]
§1.1310 Radiofrequency radiation exposure limits.
The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Table 1—Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

[About fundamental measurement (Average)]

Test Procedure
The test was performed based on "Procedures for testing millimeter-wave systems" of ANSI C63.10-2013.
The peak power were measured with an RF detector that has a detection bandwidth that encompasses the 57-71 GHz band and has a video bandwidth of at least 10 MHz.

The carrier levels were measured in the far field. The distance of the far field was calculated from follow equation.

$$r = \frac{2D^2}{\lambda}$$

where

r is the distance from the radiating element of the EUT to the edge of the far field, in m
D is the largest dimension of both the radiating element and the test antenna (horn), in m
Lambda is the wavelength of the emission under investigation [300/f (MHz)], in m

Frequency	Wavelength	Maximum Dimention			Far Field Boundary	Tested Distance
		EUT	Test Antenna	Maximum *D*	*r*	
[GHz]	*Lambda* [mm]	[m]	[m]	[m]	[m]	[m]
75	4.0	0.01090	0.03759	0.03759	0.707	0.75

The test was performed based on stages 1-4 following;
Stage 1:
Connect the measurement antenna for the fundamental frequency band to the mm-wave RF detector. Place the measurement antenna at a test distance that is in the far-field of the measurement antenna.
Place the measurement antenna in the main beam of the EUT then maximize the fundamental emission.
The maximum direction was searched under carefully since beam-widths are extremely narrow.
Record the peak voltage from DSO as DSO Reading.

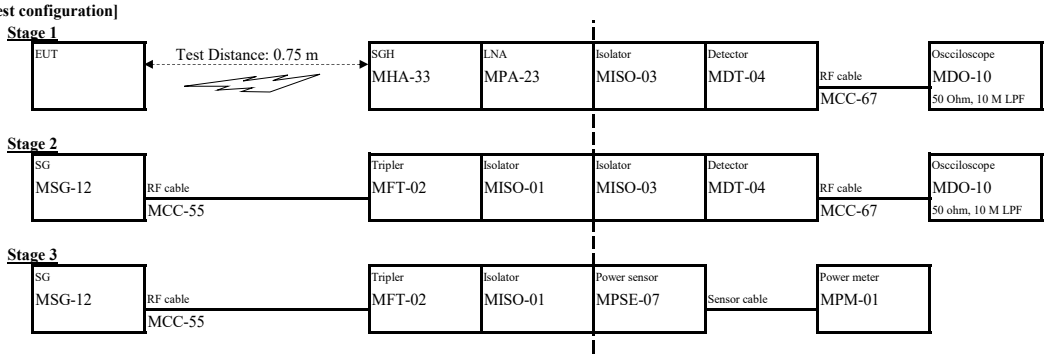
Stage 2:
Disconnect the measurement antenna from the RF input port of the instrumentation system.
Connect the mm-wave source to the RF input port of the instrumentation system.
The mm-wave source shall be unmodulated.
Adjust the frequency of the mm-wave source to the center of the frequency range occupied by the transmitter.
Adjust the amplitude of the mm-wave source such that the DSO indicates a voltage equal to the peak voltage recorded in Stage 1.
The output level of mm-wave source at this time is recorded as SG Reading.

Stage 3:
Disconnect the mm-wave source from the RF input port of the instrumentation system.
Without changing any settings, connect the mm-wave source to a wideband mm-wave power meter with a thermocouple detector or equivalent. Measure the power and record it as PM reading.

Stage 4:
Correct the peak substitution power at the input to the measurement instrument, as recorded in Stage 3, for any external gain and/or attenuation between the measurement antenna and the measurement instrument that was not included in the substitution power measurement.

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

[Test configuration]



Measurement range : **9 kHz to 200 GHz**
Test data : **APPENDIX**
Test result : **Pass**

EIRP

(Test data)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No. 2	No. 4
Date	September 15, 2022	September 30, 2022
Temperature / Humidity	20 deg. C / 61 % RH	21 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki	Junki Nagatomi
Mode	Tx Test mode / Normal operating mode	

Tx Test mode (Frequency sweep stop) Stage 1 Stage 2 Stage 3 Stage 4

Transmission Pattern	Test Antenna	Test Mode	Frequency [GHz]	DSO Reading (RMS) [mV]	S/G Setting Power [dBm]	P/M Reading [dBm]	LNA Gain [dB]	Rx Ant. Gain [dBi]	Tested Distance [m]	FSL [dB]	EIRP (Burst Average) Result [dBm]	EIRP (Burst Average) Result [mW]	Duty Factor *1) [dB]	EIRP (Timed Average) Result [dBm]	EIRP (Timed Average) Result [mW]
1	Tx 1	CW Low	61.02	51.3	18.16	-1.00	25.06	23.80	0.75	65.65	15.80	38.02	0	15.80	38.02
		CW Mid	61.13	47.8	17.87	-1.37	25.03	23.80	0.75	65.67	15.47	35.24	0	15.47	35.24
		CW High	61.25	47.0	17.56	-1.41	24.99	23.80	0.75	65.68	15.49	35.40	0	15.49	35.40
	Tx 3	CW Low	61.02	46.8	17.63	-1.52	25.06	23.80	0.75	65.65	15.28	33.73	0	15.28	33.73
		CW Mid	61.13	43.7	17.39	-1.86	25.03	23.80	0.75	65.67	14.98	31.48	0	14.98	31.48
		CW High	61.25	43.3	17.08	-1.87	24.99	23.80	0.75	65.68	15.03	31.84	0	15.03	31.84
2	Tx 1	CW Low	61.25	46.7	17.54	-1.47	24.99	23.80	0.75	65.68	15.43	34.91	0	15.43	34.91
		CW Mid	61.36	44.5	17.36	-1.60	24.95	23.80	0.75	65.70	15.36	34.36	0	15.36	34.36
		CW High	61.48	43.9	17.39	-1.50	24.91	23.80	0.75	65.72	15.51	35.56	0	15.51	35.56
	Tx 3	CW Low	61.25	44.0	17.20	-1.78	24.99	23.80	0.75	65.68	15.12	32.51	0	15.12	32.51
		CW Mid	61.36	43.3	17.22	-1.74	24.95	23.80	0.75	65.70	15.22	33.27	0	15.22	33.27
		CW High	61.48	42.9	17.27	-1.62	24.91	23.80	0.75	65.72	15.39	34.59	0	15.39	34.59

Normal operating mode (Reference) Stage 1 Stage 2 Stage 3 Stage 4

Transmission Pattern	Test Antenna	Test Mode	Frequency [GHz]	DSO Reading (RMS) [mV]	S/G Setting Power [dBm]	P/M Reading [dBm]	LNA Gain [dB]	Rx Ant. Gain [dBi]	Tested Distance [m]	FSL [dB]	EIRP (Burst Average) Result [dBm]	EIRP (Burst Average) Result [mW]	Duty Factor *2) [dB]	EIRP (Timed Average) Result [dBm]	EIRP (Timed Average) Result [mW]
1	Tx 1 / Tx 3	FMCW	61.13	45.1	17.56	-1.68	25.03	23.80	0.75	65.67	15.16	32.81	9.20	5.96	3.94
2	Tx 1 / Tx 3	FMCW	61.36	43.6	17.34	-1.63	24.95	23.80	0.75	65.70	15.33	34.12	9.20	6.13	4.10

Calculating formula:
FSL (Free Space path Loss) = 10 * log10((4 * Pi * Tested Distance / Lambda) ^2)
EIRP (Burst Average) = P/M Reading - Rx Ant. Gain - LNA Gain + FSL
EIRP (Timed Average) = EIRP (Burst Average) - Duty Factor

*1) Duty factor was taken “0” for Duty 100%.
*2) Duty Factor calculation is shown follows;

Computations of Normal operating mode for Burst Average calculations

Transmission Pattern	Test Antenna	Test Mode	Tx1 Chirp ON time *3) [us]	Tx3 Chirp ON time *3) [us]	Number of Chirp *3)	Total ON Time [ms]	Total ON+OFF Time [ms]	Duty Factor [dB]
1	Tx 1 / Tx 3	FMCW	47.038	47.029	256	12.041	100.002	9.20
2	Tx 1 / Tx 3	FMCW	47.027	47.028	256	12.039	100.003	9.20

Calculating formula:
Total ON time =(Tx1 Chirp ON time + Tx3 Chirp ON time) * Number of Chirp / 2
Duty factor = 10 * log (Total On + Off time / Total On time)

*3) Refer to Duty Cycle data page.

Duty Cycle

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 4
Date	October 4, 2022
Temperature / Humidity	20 deg. C / 60 % RH
Engineer	Yuichiro Yamazaki
Mode	Transmission Pattern 1 (Normal operating mode)

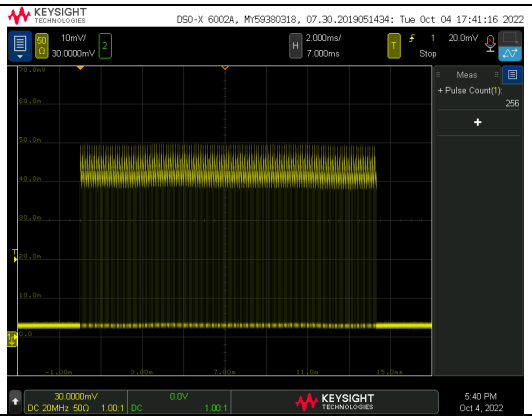
	Tx On + Tx Off time [ms]	Tx1 Chirp ON time [us]	Tx3 Chirp ON time [us]	Number of Chirp	Tx On time [ms]	Duty [%]
Measured	100.002	47.038	47.029	256	12.041	12.0

Calculating formula:

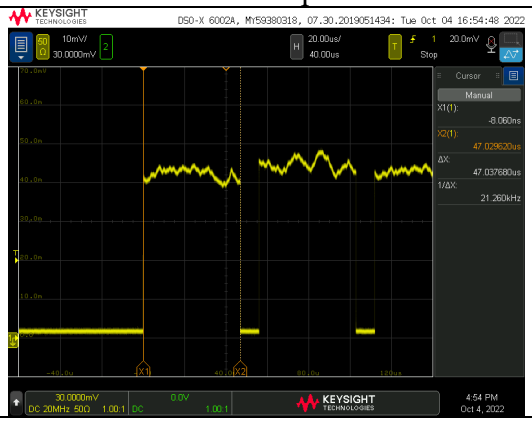
Tx On time = (Tx Chirp ON time +Tx3 Chirp ON time) * Number of Chirp / 2
Duty = (Tx On time / Tx On + Tx Off time) * 100

1cycle (Tx On + Tx Off)

Tx On



Tx1 1 Chirp ON



Tx3 1 Chirp ON

Duty Cycle

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No. 4
Date	October 4, 2022
Temperature / Humidity	20 deg. C / 60 % RH
Engineer	Yuichiro Yamazaki
Mode	Transmission Pattern 2 (Normal operating mode)

	Tx On + Tx Off time [ms]	Tx1 Chirp ON time [us]	Tx3 Chirp ON time [us]	Number of Chirp	Tx On time [ms]	Duty [%]
Measured	100.003	47.027	47.028	256	12.039	12.0

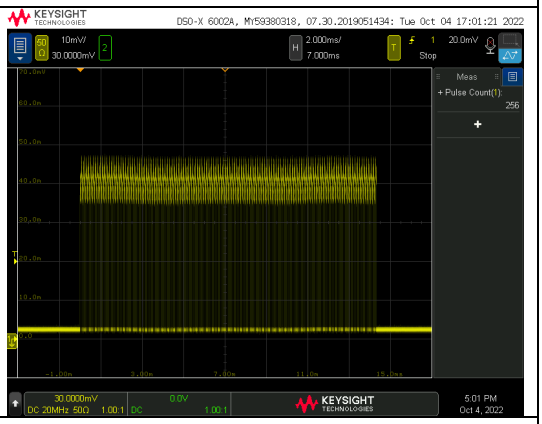
Calculating formula:

Tx On time = (Tx Chirp ON time +Tx3 Chirp ON time) * Number of Chirp / 2

Duty = (Tx On time / Tx On + Tx Off time) * 100

1cycle (Tx On + Tx Off)

Tx On



Tx1 1 Chirp ON

Tx3 1 Chirp ON

Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
MPE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/30/2022	24
MPE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/09/2021	24
MPE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2022	24
MPE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
MPE	MCC-55	141326	Microwave Cable	Suhner	SUCOFLEX101	2874(1m) / 2877(5m)	03/15/2022	12
MPE	MCC-67	141329	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	04/01/2022	12
MPE	MDO-10	211944	Digital Storage Oscilloscope	Keysight Technologies Inc	DSOX6002A	MY59380318	10/07/2021	12
MPE	MDT-04	142528	Detector	Millitech	DET-15-RPFW0	34	-	-
MPE	MFT-02	142545	Fullband Tripler	Millitech	MUT-15-LF000	19	-	-
MPE	MHA-33	180634	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-15-S1	17343-01	06/09/2022	12
MPE	MISO-01	142590	Waveguide Isolator	Keysight Technologies Inc	V365A	60004	-	-
MPE	MISO-03	142592	Waveguide Isolator	Millitech	FBI-15-RSES0	1858	-	-
MPE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
MPE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
MPE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/12/2022	12
MPE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12
MPE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
MPE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2021	12
MPE	MPA-23	142055	Power Amplifier	SAGE Millimeter, Inc.	SBP-5037532015-1515-N1	11599-01	03/04/2022	12
MPE	MPM-01	141801	Power Meter	Keysight Technologies Inc	E4417A	GB41290639	04/11/2022	12
MPE	MPSE-07	142238	Power sensor	Keysight Technologies Inc	V8486A	MY44420112	07/06/2022	12
MPE	MSG-12	141892	Signal Generator	Keysight Technologies Inc	E8257D	US49280311	11/22/2021	12

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

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

Test item:

MPE: Maximum Permissible Exposure

[Results]

Mode	Average EIRP* [mW]	Separation Distance [cm]	Power Density Result [mW/cm^2]	Power Density Limit [mW/cm^2]
Average Power	38.02	20	0.01	1

Calculating formula:
Power Density = Average EIRP / (4 * Pi * Separation Distance ^ 2)

This EIRP was measured in sufficient far field of 0.75 m distance and calculated at 20 cm.