

APPENDIX 2: Data of EMI test

Automatically deactivate

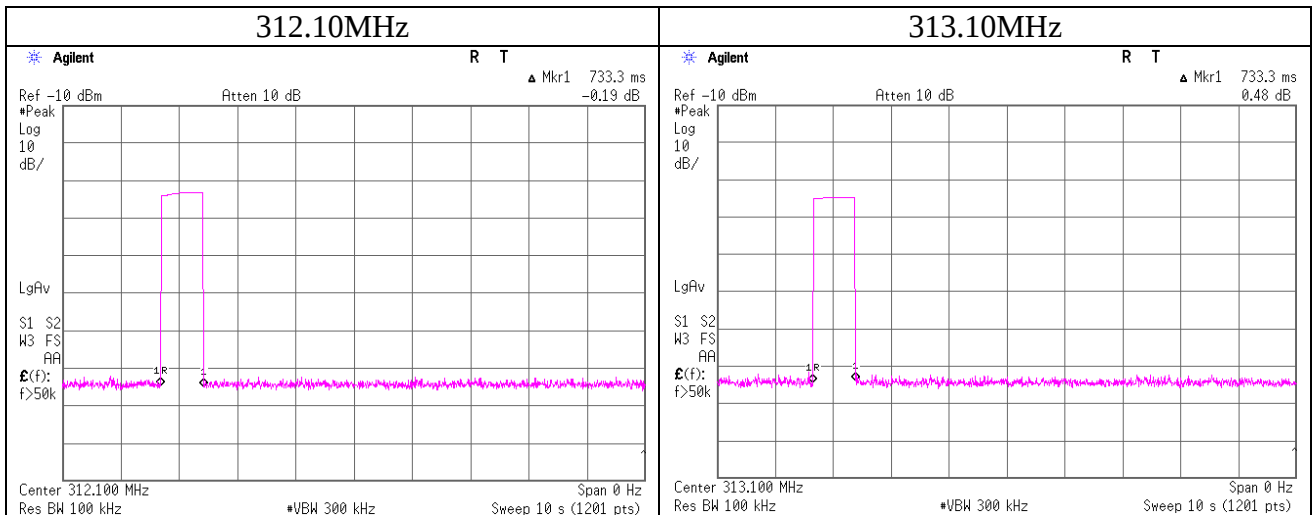
Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 31FE0144-HO-01
Date 02/02/2011
Temperature/ Humidity 22 deg.C./ 30%
Engineer Keisuke Kawamura
Mode Normal use mode

312.10MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.73	5.00	Pass

313.10MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.73	5.00	Pass



Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	31FE0144-HO-01
Date	02/02/2011
Temperature/ Humidity	22 deg.C./ 30%
Engineer	Keisuke Kawamura
Mode	Transmitting mode 312.10MHz

PK

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 Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
312.100	PK	74.1	70.0	15.5	10.0	31.8	-	67.8	63.7	95.4	27.6	31.7	Carrier
624.200	PK	32.6	30.0	19.7	11.9	32.0	-	32.2	29.6	75.4	43.2	45.8	Outside
936.300	PK	31.9	31.0	22.6	13.4	30.8	-	37.1	36.2	75.4	38.3	39.2	Outside
1248.400	PK	42.7	42.5	26.0	1.9	34.4	-	36.2	36.0	75.4	39.2	39.4	Outside
1560.500	PK	42.2	43.0	27.0	2.2	33.6	-	37.8	38.6	73.9	36.1	35.3	Inside
1872.600	PK	45.8	45.0	27.9	2.4	33.0	-	43.1	42.3	75.4	32.3	33.1	Outside
2184.700	PK	42.6	41.8	28.0	2.6	32.6	-	40.6	39.8	75.4	34.8	35.6	Outside
2496.800	PK	49.2	47.2	27.6	2.9	32.4	-	47.3	45.3	73.9	26.6	28.6	Inside
2808.900	PK	40.7	41.6	28.6	3.1	32.2	-	40.2	41.1	73.9	33.7	32.8	Inside
3121.000	PK	53.6	49.3	29.3	3.3	32.1	-	54.1	49.8	75.4	21.3	25.6	Outside

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

PK with Duty factor

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
		Hor	Ver					Hor	Ver		Hor	Ver	
312.100	PK	74.1	70.0	15.5	10.0	31.8	-5.3	62.5	58.4	75.4	12.9	17.0	Carrier
624.200	PK	32.6	30.0	19.7	11.9	32.0	-5.3	26.9	24.3	55.4	28.5	31.1	Outside
936.300	PK	31.9	31.0	22.6	13.4	30.8	-5.3	31.8	30.9	55.4	23.6	24.5	Outside
1248.400	PK	42.7	42.5	26.0	1.9	34.4	-5.3	30.9	30.7	55.4	24.5	24.7	Outside
1560.500	PK	42.2	43.0	27.0	2.2	33.6	-5.3	32.5	33.3	53.9	21.4	20.6	Inside
1872.600	PK	45.8	45.0	27.9	2.4	33.0	-5.3	37.8	37.0	55.4	17.6	18.4	Outside
2184.700	PK	42.6	41.8	28.0	2.6	32.6	-5.3	35.3	34.5	55.4	20.1	20.9	Outside
2496.800	PK	49.2	47.2	27.6	2.9	32.4	-5.3	42.0	40.0	53.9	11.9	13.9	Inside
2808.900	PK	40.7	41.6	28.6	3.1	32.2	-5.3	34.9	35.8	53.9	19.0	18.1	Inside
3121.000	PK	53.6	49.3	29.3	3.3	32.1	-5.3	48.8	44.5	55.4	6.6	10.9	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

* The test above 1GHz was performed with PK detect. Average emission measurements were not calculated with PK detect and Duty cycle factor since the PK measurement value did not exceed the AV limit.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 31FE0144-HO-01
Date 02/02/2011
Temperature/ Humidity 22 deg.C./ 30%
Engineer Keisuke Kawamura
Mode Transmitting mode 313.10MHz

PK

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 Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
313.100	PK	73.9	70.0	15.5	10.0	31.8	-	67.6	63.7	95.5	27.9	31.8	Carrier
626.200	PK	30.7	30.8	19.7	11.9	32.0	-	30.3	30.4	75.5	45.2	45.1	Outside
939.300	PK	32.4	31.6	22.6	13.4	30.8	-	37.6	36.8	75.5	37.9	38.7	Outside
1252.400	PK	43.7	43.5	26.0	1.9	34.4	-	37.2	37.0	75.5	38.3	38.5	Outside
1565.500	PK	42.6	42.9	27.1	2.2	33.6	-	38.3	38.6	73.9	35.6	35.3	Inside
1878.600	PK	44.8	44.5	27.9	2.4	32.9	-	42.2	41.9	75.5	33.3	33.6	Outside
2191.700	PK	42.4	42.1	28.0	2.7	32.6	-	40.5	40.2	75.5	35.0	35.3	Outside
2504.800	PK	49.2	46.6	27.6	2.9	32.4	-	47.3	44.7	75.5	28.2	30.8	Outside
2817.900	PK	41.5	41.9	28.6	3.1	32.2	-	41.0	41.4	73.9	32.9	32.5	Inside
3131.000	PK	53.5	48.8	29.3	3.3	32.1	-	54.0	49.3	75.5	21.5	26.2	Outside

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

PK with Duty factor

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
		Hor	Ver					Hor	Ver		Hor	Ver	
313.100	PK	73.9	70.0	15.5	10.0	31.8	-4.7	62.9	59.0	75.5	12.6	16.5	Carrier
626.200	PK	30.7	30.8	19.7	11.9	32.0	-4.7	25.6	25.7	55.5	29.9	29.8	Outside
939.300	PK	32.4	31.6	22.6	13.4	30.8	-4.7	32.9	32.1	55.5	22.6	23.4	Outside
1252.400	PK	43.7	43.5	26.0	1.9	34.4	-4.7	32.5	32.3	55.5	23.0	23.2	Outside
1565.500	PK	42.6	42.9	27.1	2.2	33.6	-4.7	33.6	33.9	53.9	20.3	20.0	Inside
1878.600	PK	44.8	44.5	27.9	2.4	32.9	-4.7	37.5	37.2	55.5	18.0	18.3	Outside
2191.700	PK	42.4	42.1	28.0	2.7	32.6	-4.7	35.8	35.5	55.5	19.7	20.0	Outside
2504.800	PK	49.2	46.6	27.6	2.9	32.4	-4.7	42.6	40.0	55.5	12.9	15.5	Outside
2817.900	PK	41.5	41.9	28.6	3.1	32.2	-4.7	36.3	36.7	53.9	17.6	17.2	Inside
3131.000	PK	53.5	48.8	29.3	3.3	32.1	-4.7	49.3	44.6	55.5	6.2	10.9	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*The test above 1GHz was performed with PK detect. Average emission measurements were not calculated with PK detect and Duty cycle factor since the PK measurement value did not exceed the AV limit.

-20dB and 99% Occupied Bandwidth

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 31FE0144-HO-01
Date 02/02/2011
Temperature/ Humidity 22 deg.C./ 30%
Engineer Keisuke Kawamura
Mode Transmitting mode

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.25 kHz
312.10MHz **313.10MHz**

-20dB Bandwidth [kHz]
69.51

-20dB Bandwidth [kHz]
68.77

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
69.51+68.77=138.28	780.25	Pass

The worst case limit was applied as Bandwidth limit.

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.25 kHz

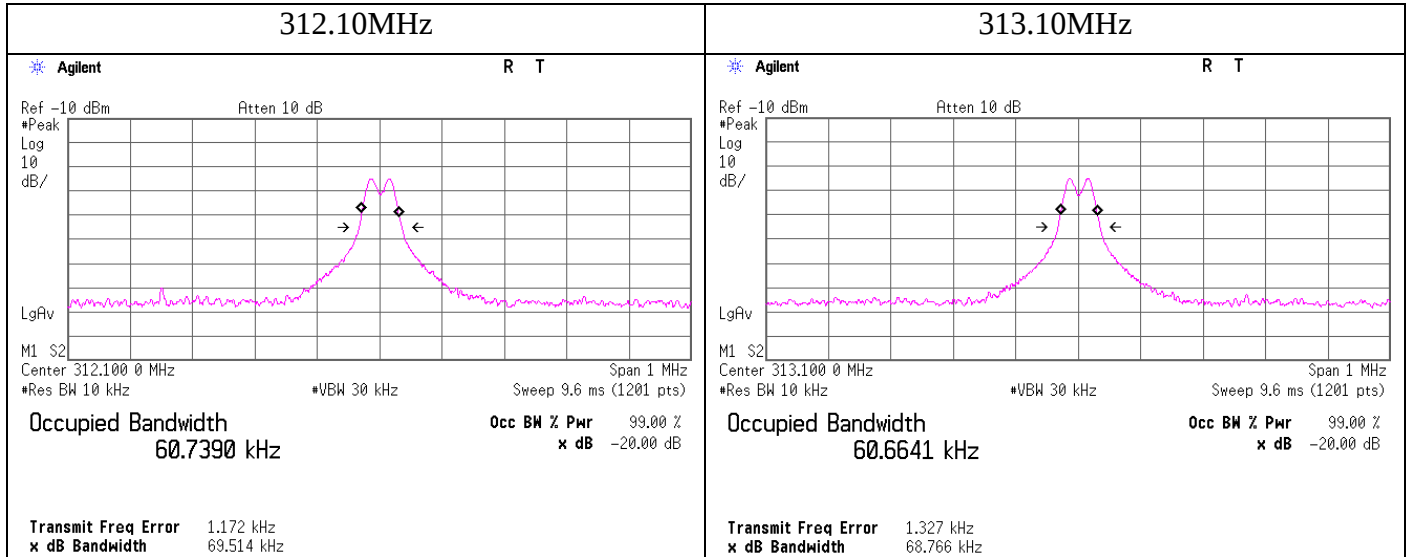
99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
60.74	780.25	Pass

Bandwidth Limit : Fundamental Frequency **313.10** MHz x 0.25% = 782.75 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
60.66	782.75	Pass

-20dB and 99% Occupied Bandwidth

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	31FE0144-HO-01
Date	02/02/2011
Temperature/ Humidity	22 deg.C./ 30%
Engineer	Keisuke Kawamura
Mode	Transmitting mode



Duty Cycle

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 31FE0144-HO-01
Date 02/02/2011
Temperature/ Humidity 22 deg.C./ 30%
Engineer Keisuke Kawamura
Mode Transmitting mode

312.10MHz

Type	Times	ON time(One pulse) [ms]	ON time(in 100ms) [ms]
A	38	0.750	28.50
B	66	0.392	25.85

*1)ON time(in 100ms) = Times * ON time(One pulse)

*2)The train of pulses was exceeding 100msec, and that sampled 100msec was the worst case against the puls

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
54.35	100.00	0.54	-5.3

*3)ON time = Type A's ON time (in 100ms) + Type B's ON time (in 100ms)

*4)Duty = $20\log_{10}(\text{ON time/Cycle})$

313.10MHz

Type	Times	ON time(One pulse) [ms]	ON time(in 100ms) [ms]
A	102	0.425	43.35
B	20	0.742	14.84

*1)ON time(in 100ms) = Times * ON time(One pulse)

*2)The train of pulses was exceeding 100msec, and that sampled 100msec was the worst case against the pulse t

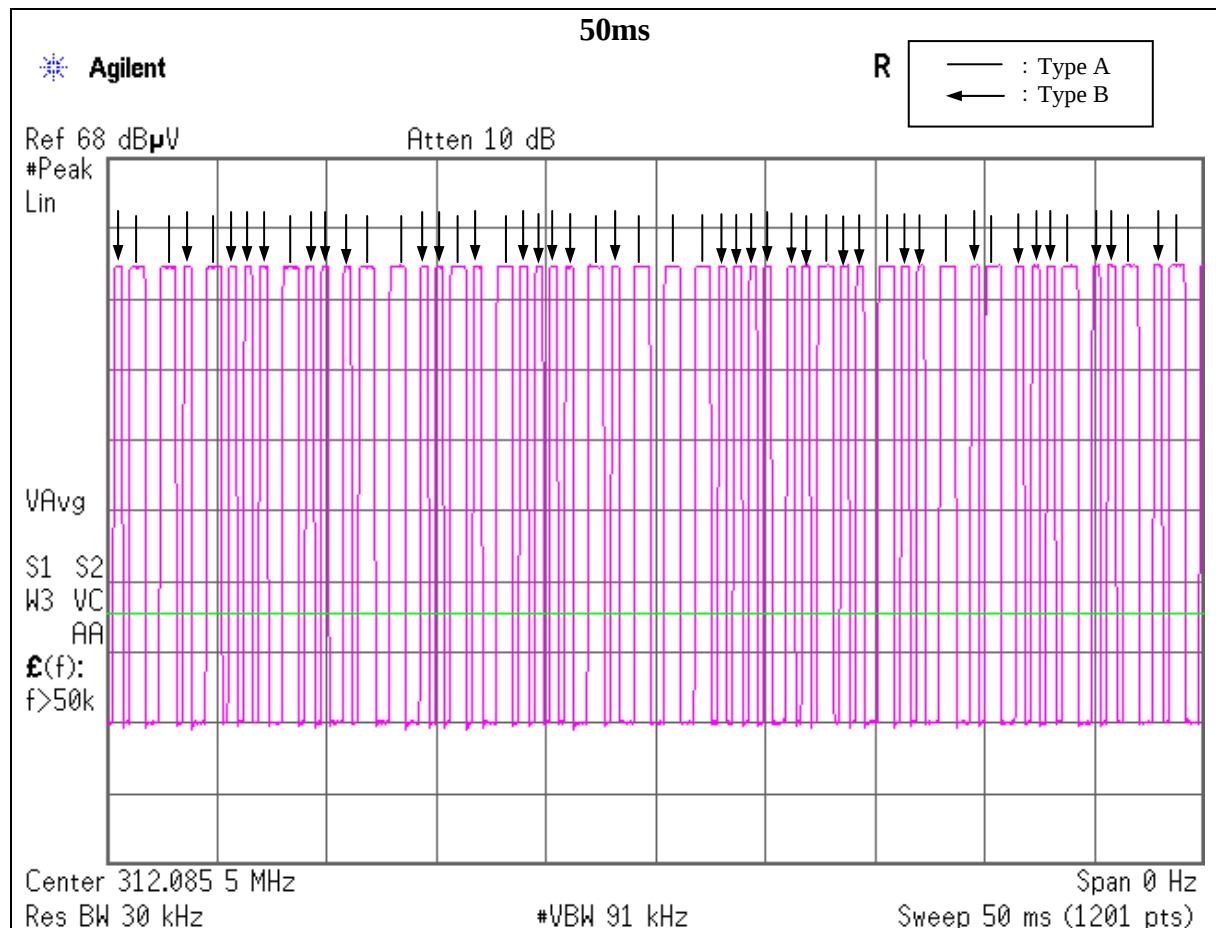
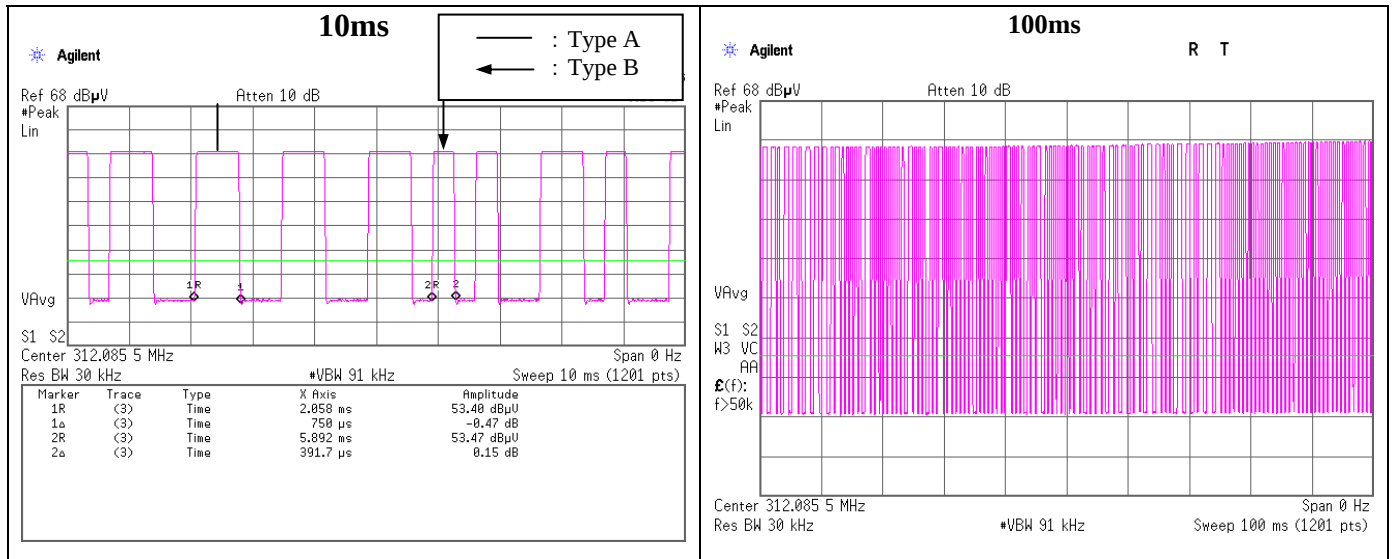
(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
58.19	100.00	0.58	-4.7

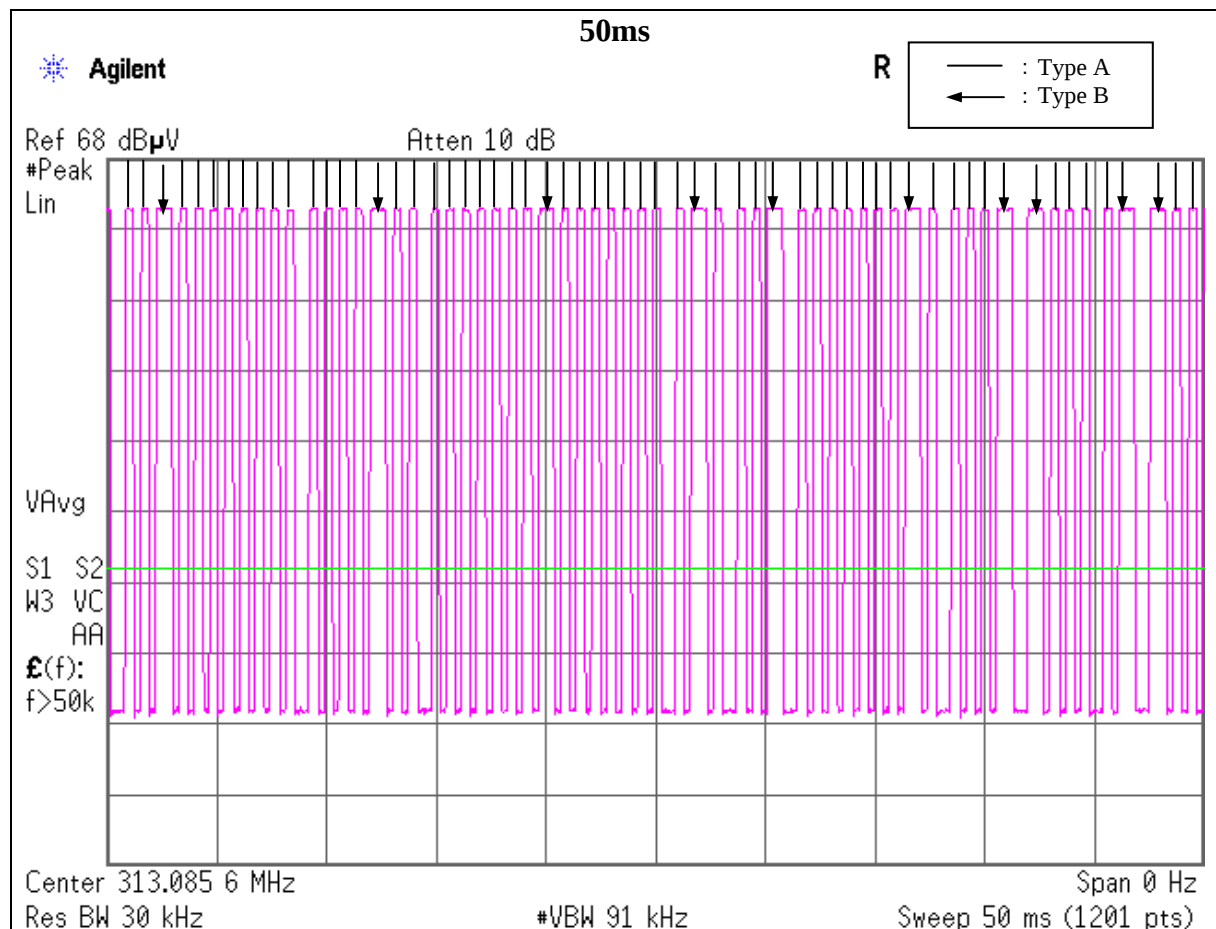
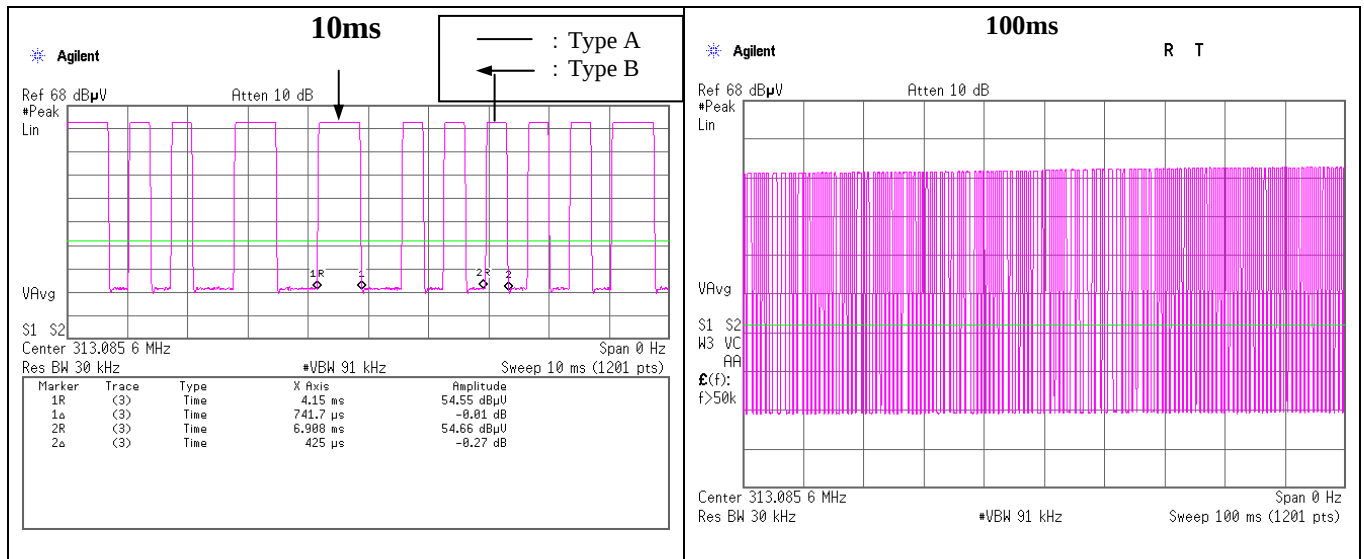
*3)ON time = Type A's ON time (in 100ms) + Type B's ON time (in 100ms)

*4)Duty = $20\log_{10}(\text{ON time/Cycle})$

Duty Cycle 312.10MHz



Duty Cycle 313.10MHz



Receiver Spurious Emission

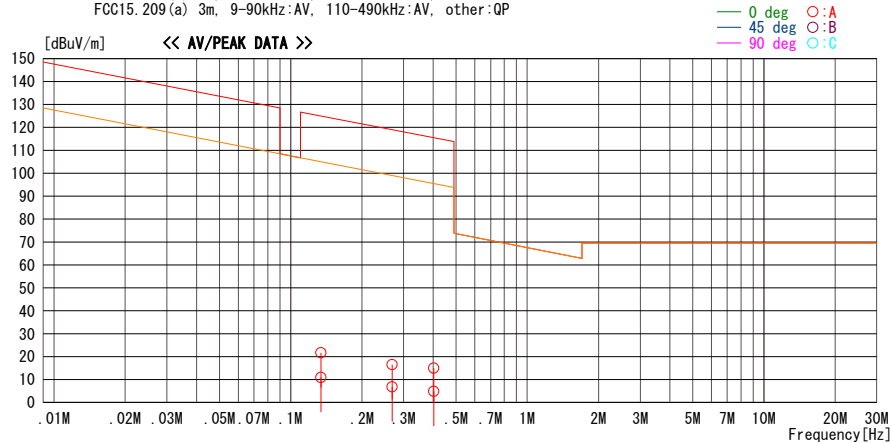
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2011/02/03

Report No. : 31FE0144-HO-01
Temp. / Humi. : 22deg. C. /30%
Engineer : Hiroyuki Furutaka

Mode / Remarks : LF Receiving Mode Worst axis-X

LIMIT : FCC15.209(a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
0.13420	27.8	PEAK	20.1	5.9	32.1	21.7	125.0	103.3	0	A	359
0.13420	17.0	AV	20.1	5.9	32.1	10.9	105.0	94.1	0	A	359
0.26840	22.7	PEAK	20.0	6.0	32.1	16.6	119.0	102.4	0	A	359
0.26840	12.9	AV	20.0	6.0	32.1	6.8	99.0	92.2	0	A	359
0.40260	21.2	PEAK	19.9	6.0	32.1	15.0	115.5	100.5	0	A	359
0.40260	11.1	AV	19.9	6.0	32.1	4.9	95.5	90.6	0	A	359

CHART: WITH FACTOR, ANT TYPE: LOOP, Except for the data below: adequate margin data below the limits.
CALCULATION: RESULT[dBuV] = READING[dBuV] + ANT FACTOR[dB] + LOSS[dB] (CABLE + ATTEN. - AMP.)

*Receiver spurious emission above 30MHz was below floor noise.

APPENDIX 3: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	2010/02/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2010/02/09 * 12
MJM-06	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2010/02/03 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2010/08/23 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2010/10/11 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2010/10/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2010/07/06 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2010/11/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2010/03/23 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2010/05/07 * 12
MCC-56	Microwave Cable	Suhner	SUCOFLEX104	174410(1m) / 284655(5m)	RE	2011/01/18 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2010/03/03 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2010/02/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2010/02/09 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2010/11/18 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2010/10/27 * 12
MLPA-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	RE	2010/12/08 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2010/07/21 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2010/07/20 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2010/03/05 * 12

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

All equipment is calibrated with traceable calibrations. Each calibration 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, 99% Occupied Bandwidth, -20dB bandwidth, Automatically deactivate and Duty cycle tests

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124