

APPENDIX 2: Data of EMI test

Automatically deactivate

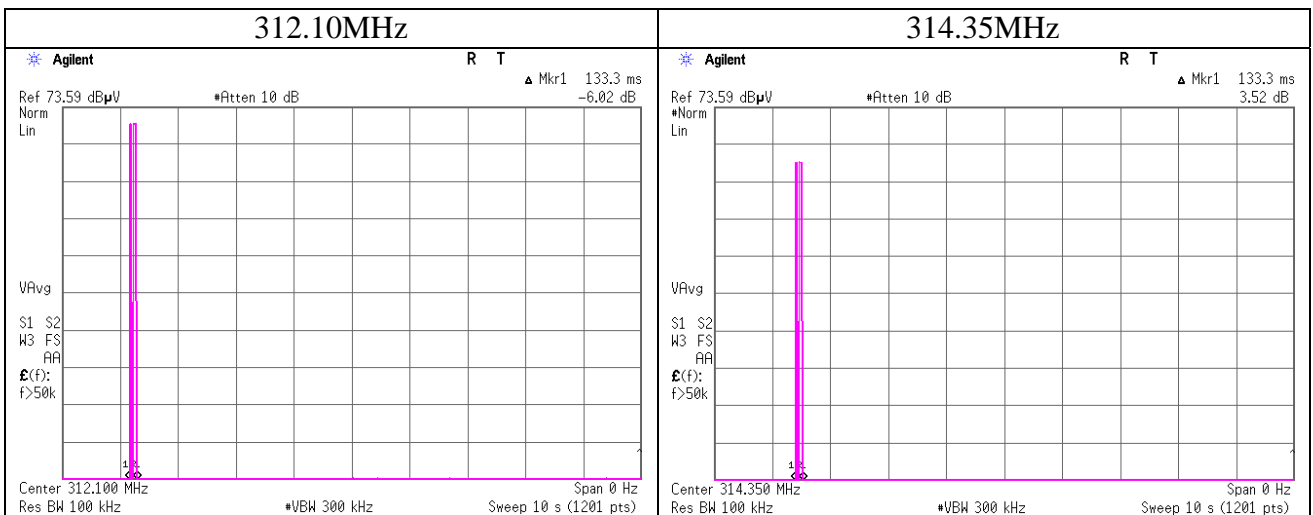
Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	31EE0217-HO-01
Date	02/07/2011
Temperature/ Humidity	22 deg.C./ 29%
Engineer	Motoya Imura
Mode	Normal use mode

312.10MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.133	5.00	Pass

314.35MHz

Time of Transmitting [sec]	Limit [sec]	Result
0.133	5.00	Pass



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

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 31EE0217-HO-01
Date : 02/07/2011
Temperature/ Humidity : 22 deg.C./ 29%
Engineer : Motoya Imura
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	66.3	62.3	16.0	9.7	31.9	-	60.1	56.1	95.4	35.3	39.3	Carrier
624.200	PK	33.0	33.4	20.5	11.6	32.1	-	33.0	33.4	75.4	42.4	42.0	Outside
936.300	PK	37.8	37.1	25.1	13.1	31.2	-	44.8	44.1	75.4	30.6	31.3	Outside
1248.400	PK	51.4	54.1	24.8	2.3	34.0	-	44.5	47.2	75.4	30.9	28.2	Outside
1560.500	PK	51.5	52.9	26.0	2.6	33.2	-	46.9	48.3	73.9	27.0	25.6	Inside
1872.600	PK	47.0	47.0	26.9	2.7	32.6	-	44.0	44.0	75.4	31.4	31.4	Outside
2184.700	PK	47.4	46.7	27.2	2.9	32.2	-	45.3	44.6	75.4	30.1	30.8	Outside
2496.800	PK	45.0	43.0	27.2	3.1	32.1	-	43.2	41.2	73.9	30.7	32.7	Inside
2808.900	PK	49.1	45.3	27.7	3.3	31.9	-	48.2	44.4	73.9	25.7	29.5	Inside
3121.000	PK	46.8	44.6	28.3	3.4	31.8	-	46.7	44.5	75.4	28.7	30.9	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	66.3	62.3	16.0	9.7	31.9	-9.7	50.4	46.4	75.4	25.0	29.0	Carrier
624.200	PK	33.0	33.4	20.5	11.6	32.1	-9.7	23.3	23.7	55.4	32.1	31.7	Outside
936.300	PK	37.8	37.1	25.1	13.1	31.2	-9.7	35.1	34.4	55.4	20.3	21.0	Outside
1248.400	PK	51.4	54.1	24.8	2.3	34.0	-9.7	34.8	37.5	55.4	20.6	17.9	Outside
1560.500	PK	51.5	52.9	26.0	2.6	33.2	-9.7	37.2	38.6	53.9	16.7	15.3	Inside
1872.600	PK	47.0	47.0	26.9	2.7	32.6	-9.7	34.3	34.3	55.4	21.1	21.1	Outside
2184.700	PK	47.4	46.7	27.2	2.9	32.2	-9.7	35.6	34.9	55.4	19.8	20.5	Outside
2496.800	PK	45.0	43.0	27.2	3.1	32.1	-9.7	33.5	31.5	53.9	20.4	22.4	Inside
2808.900	PK	49.1	45.3	27.7	3.3	31.9	-9.7	38.5	34.7	53.9	15.4	19.2	Inside
3121.000	PK	46.8	44.6	28.3	3.4	31.8	-9.7	37.0	34.8	55.4	18.4	20.6	Outside

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

The value obtained from the test on March 3, 2011 was used for Duty Factor in the above list.

*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.4 Semi Anechoic Chamber
Report No. 31EE0217-HO-01
Date 02/07/2011
Temperature/ Humidity 22 deg.C./ 29%
Engineer Motoya Imura
Mode Transmitting mode 314.35MHz

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	
314.350	PK	65.4	62.3	16.0	9.8	31.9	-	59.3	56.2	95.5	36.2	39.3	Carrier
628.700	PK	35.6	34.0	20.6	11.6	32.1	-	35.7	34.1	75.5	39.8	41.4	Outside
943.050	PK	39.9	34.2	25.3	13.1	31.2	-	47.1	41.4	75.5	28.4	34.1	Outside
1257.400	PK	53.5	56.6	24.9	2.3	33.9	-	46.8	49.9	75.5	28.7	25.6	Outside
1571.750	PK	51.1	52.0	26.0	2.6	33.2	-	46.5	47.4	73.9	27.4	26.5	Inside
1886.100	PK	46.9	47.0	26.9	2.7	32.5	-	44.0	44.1	75.5	31.5	31.4	Outside
2200.450	PK	47.8	47.2	27.2	2.9	32.2	-	45.7	45.1	73.9	28.2	28.8	Inside
2514.800	PK	43.6	43.1	27.2	3.1	32.1	-	41.8	41.3	75.5	33.7	34.2	Outside
2829.150	PK	49.3	46.5	27.7	3.3	31.9	-	48.4	45.6	73.9	25.5	28.3	Inside
3143.500	PK	46.4	47.8	28.4	3.4	31.8	-	46.4	47.8	75.5	29.1	27.7	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	
314.350	PK	65.4	62.3	16.0	9.8	31.9	-9.7	49.6	46.5	75.5	25.9	29.0	Carrier
628.700	PK	35.6	34.0	20.6	11.6	32.1	-9.7	26.0	24.4	55.5	29.5	31.1	Outside
943.050	PK	39.9	34.2	25.3	13.1	31.2	-9.7	37.4	31.7	55.5	18.1	23.8	Outside
1257.400	PK	53.5	56.6	24.9	2.3	33.9	-9.7	37.1	40.2	55.5	18.4	15.3	Outside
1571.750	PK	51.1	52.0	26.0	2.6	33.2	-9.7	36.8	37.7	53.9	17.1	16.2	Inside
1886.100	PK	46.9	47.0	26.9	2.7	32.5	-9.7	34.3	34.4	55.5	21.2	21.1	Outside
2200.450	PK	47.8	47.2	27.2	2.9	32.2	-9.7	36.0	35.4	53.9	17.9	18.5	Inside
2514.800	PK	43.6	43.1	27.2	3.1	32.1	-9.7	32.1	31.6	55.5	23.4	23.9	Outside
2829.150	PK	49.3	46.5	27.7	3.3	31.9	-9.7	38.7	35.9	53.9	15.2	18.0	Inside
3143.500	PK	46.4	47.8	28.4	3.4	31.8	-9.7	36.7	38.1	55.5	18.8	17.4	Outside

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

The value obtained from the test on March 3, 2011 was used for Duty Factor in the above list.

*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.4 Semi Anechoic Chamber
Report No.	31EE0217-HO-01
Date	02/07/2011
Temperature/ Humidity	22 deg.C./ 29%
Engineer	Motoya Imura
Mode	Transmitting mode

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.25 kHz
312.10MHz **314.35MHz**

-20dB Bandwidth [kHz]	-20dB Bandwidth [kHz]
68.74	69.52

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
68.74+69.52=138.26	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

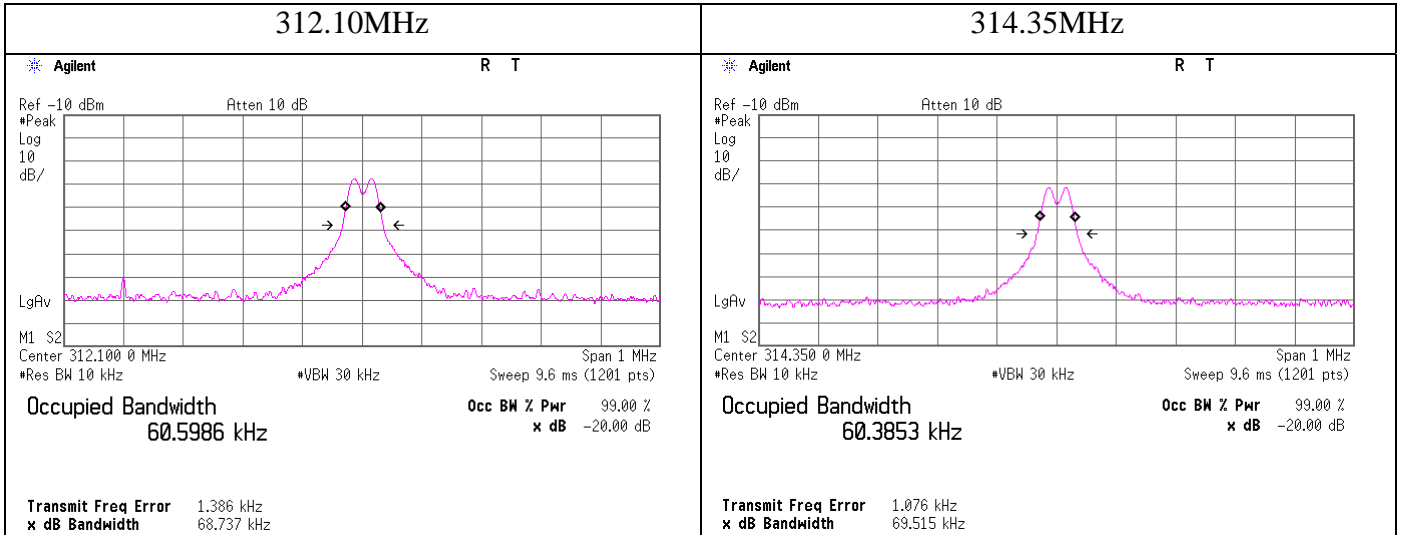
99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
60.60	780.25	Pass

Bandwidth Limit : Fundamental Frequency **314.35** MHz x 0.25% = 785.88 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
60.39	785.88	Pass

-20dB and 99% Occupied Bandwidth

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	31EE0217-HO-01
Date	02/07/2011
Temperature/ Humidity	22 deg.C./ 29%
Engineer	Motoya Imura
Mode	Transmitting mode



Duty Cycle

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	31EE0217-HO-01
Date	03/03/2011
Temperature/ Humidity	24 deg.C./ 39%
Engineer	Takayuki Shimada
Mode	Transmitting mode

312.10MHz

Type	Times	ON time(One pulse) [ms]	ON time(in 100ms) [ms]
A	46	0.380	17.480
B	18	0.727	13.086
C	2	1.013	2.026

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

*2)The sampled 100 msec was the worst case that is included in two burst transmissions time (P.21 chart "100ms").

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
32.59	100.00	0.33	-9.7

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

*4)Duty = 20log₁₀(ON time/Cycle)

314.35MHz

Type	Times	ON time(One pulse) [ms]	ON time(in 100ms) [ms]
A	46	0.380	17.480
B	18	0.727	13.086
C	2	1.013	2.026

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

*2)The sampled 100 msec was the worst case that is included in two burst transmissions time (P.22 chart "100ms").

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
32.59	100.00	0.33	-9.7

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

*4)Duty = 20log₁₀(ON time/Cycle)

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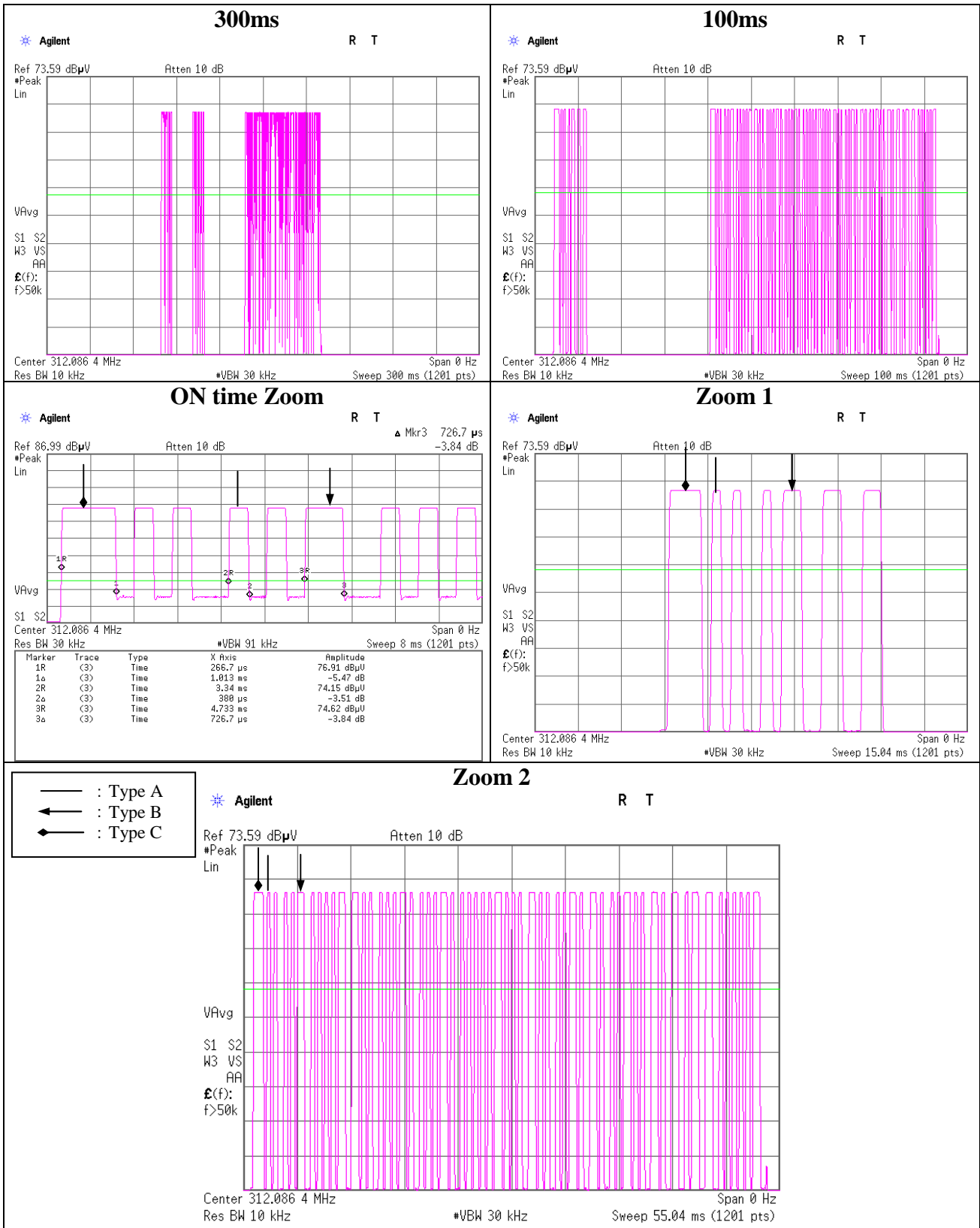
Head Office EMC Lab.

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

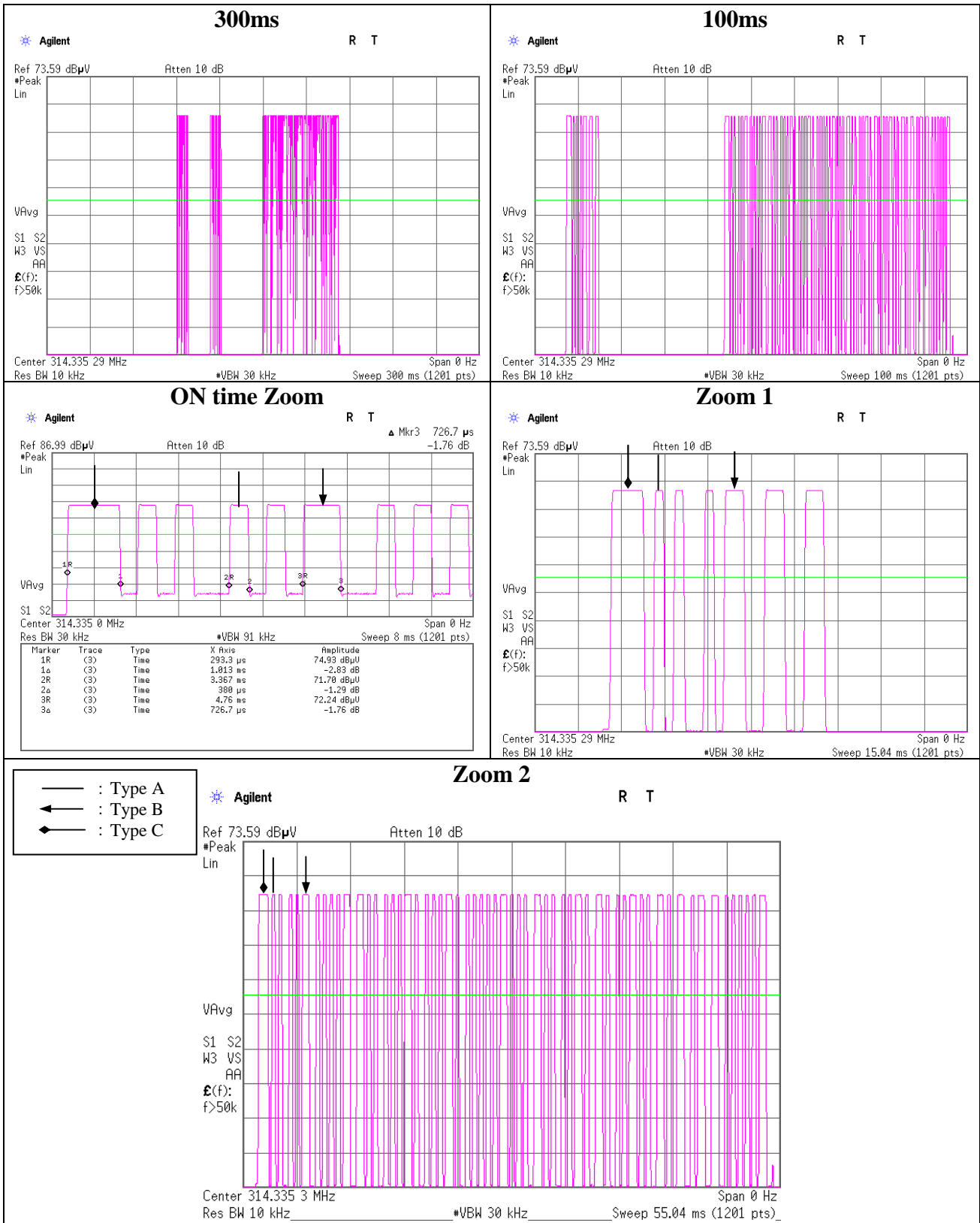
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Duty Cycle 312.10MHz



Duty Cycle 314.35MHz



Receiver Spurious Emission

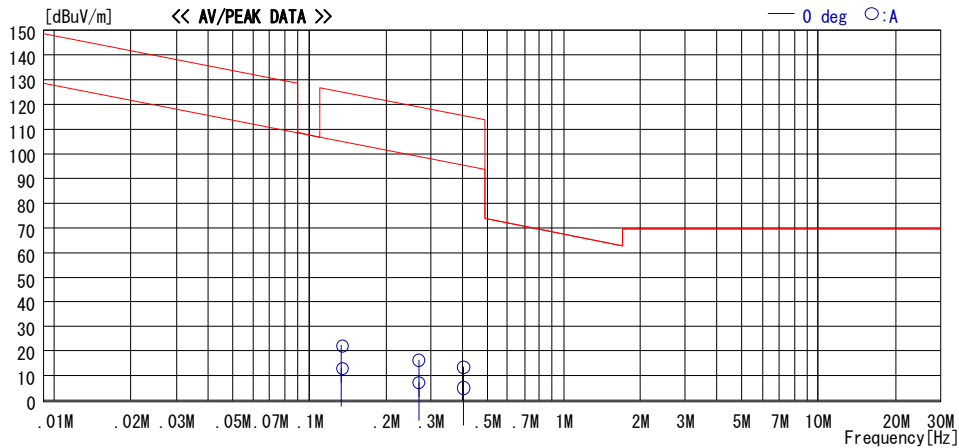
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber

Report No. : 31EE0217-H0-A
 Temp./ Humi. : 25deg. C. / 29%
 Engineer : Motoya Imura

Mode / Remarks : Rx 134.2KHz

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	28.8	PEAK	19.9	6.1	32.4	22.4	125.0	102.6	0	A	0 NS
0.13420	19.5	AV	19.9	6.1	32.4	13.1	105.0	91.9	0	A	0 NS
0.26840	23.0	PEAK	19.6	6.1	32.2	16.5	119.0	102.5	0	A	0 NS
0.26840	13.8	AV	19.6	6.1	32.2	7.3	99.0	91.7	0	A	0 NS
0.40260	20.0	PEAK	19.5	6.1	32.1	13.5	115.5	102.0	0	A	0 NS
0.40260	11.8	AV	19.5	6.1	32.1	5.3	95.5	90.2	0	A	0 NS

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 + ATTN. - 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-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2010/02/02 * 12 *1)
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2010/02/09 * 12 *1)
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	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
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2010/10/11 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2010/10/11 * 12
MCC-50	Coaxial cable	UL Japan	-	-	RE	2010/03/18 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2011/01/14 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2010/03/05 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2010/08/08 * 12
MCC-57	Microwave Cable	Suhner	SUCOFLEX104	267195/4(0.6m) / 292411(5m)	RE	2010/11/26 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2010/03/16 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2010/09/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2011/02/23 * 12
MJM-05	Measure	PROMART	SEN1955	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2010/11/30 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2010/04/19 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2010/10/15 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	RE	2010/02/22 * 12 *1)
MCC-30	Coaxial cable	UL Japan	-	-	RE	2010/07/20 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2010/03/23 * 12
MLPA-06	Loop Antenna	UL Japan	-	-	RE	Pre Check

*1) This test equipment was used for the tests before the expiration date of the calibration.

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.

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