

APPENDIX 2: Data of EMI test

Conducted emission

DATA OF CONDUCTED EMISSION TEST

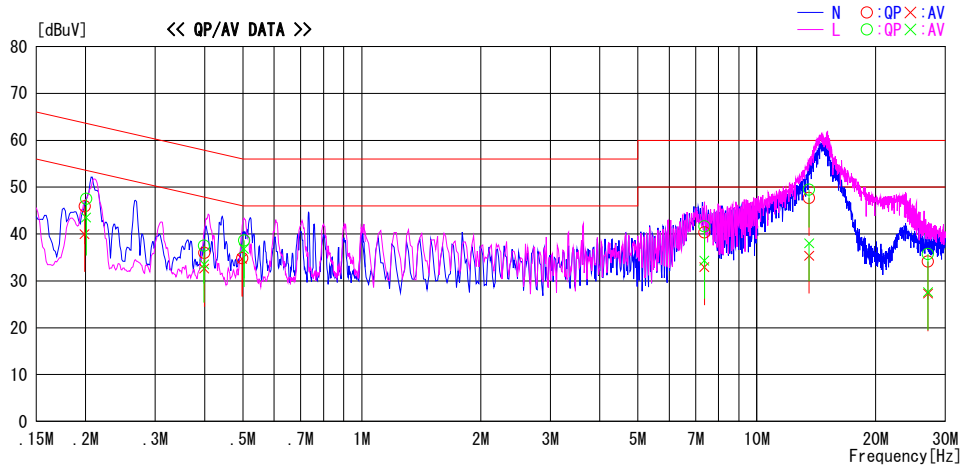
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2011/07/20

Report No. : 31EE0296-HO-04

Temp./Humi. : 24deg. C / 53% RH
Engineer : Kazuya Yoshioka

Mode / Remarks : Transmitting (Tx and Rx) without Tag mode

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.19880	32.8	26.9	13.1	45.9	40.0	63.7	53.7	17.8	13.7	N	
0.20065	34.2	30.2	13.3	47.5	43.5	63.6	53.6	16.1	10.1	L	
0.39870	24.2	20.2	13.3	37.5	33.5	57.9	47.9	20.4	14.4	L	
0.39930	22.7	19.3	13.3	36.0	32.6	57.9	47.9	21.9	15.3	N	
0.49760	21.5	21.4	13.3	34.8	34.7	56.0	46.0	21.2	11.3	N	
0.50326	25.3	23.5	13.3	38.6	36.8	56.0	46.0	17.4	9.2	L	
7.36304	26.5	19.1	13.8	40.3	32.9	60.0	50.0	19.7	17.1	N	
7.36516	27.8	20.5	13.8	41.6	34.3	60.0	50.0	18.4	15.7	L	
13.56000	33.4	21.1	14.3	47.7	35.4	60.0	50.0	12.3	14.6	N	
13.56000	35.2	23.7	14.3	49.5	38.0	60.0	50.0	10.5	12.0	L	
27.12000	19.4	12.6	14.7	34.1	27.3	60.0	50.0	25.9	22.7	N	
27.12000	21.0	12.9	14.7	35.7	27.6	60.0	50.0	24.3	22.4	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C. F [dB] (LISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

* Noises of digital parts were excluded since the EUT was class A device.

Fundamental emission and Spectrum Mask

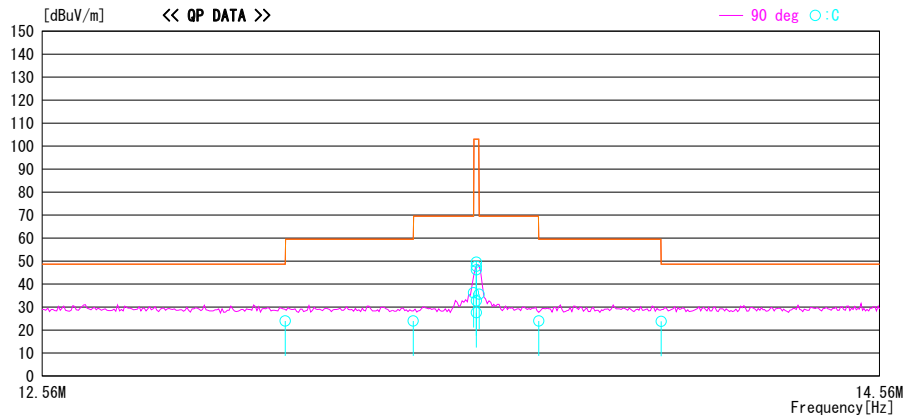
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2011/07/01

Report No. : 31EE0296-HO-04
 Temp./ Humi. : 22deg. C / 52% RH
 Engineer : Tomotaka Sasagawa

Mode / Remarks : Transmitting (Tx and Rx) without Tag mode, Worst axis(EUT:X/ANT:Z-axis)

LIMIT : FCC15.225 10m, 9-90kHz:PK, 110-490kHz:PK, other:QP
 FCC15.225 10m, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq. [MHz]	Reading [dBuV]	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
			[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
13.11000	29.8	QP	19.3	7.1	32.2	24.0	48.6	24.6	90	C	0
13.41000	29.8	QP	19.3	7.1	32.2	24.0	59.5	35.5	90	C	39
13.55300	42.0	QP	19.3	7.1	32.2	36.2	69.5	33.3	90	C	110
13.56000	38.6	QP	19.3	7.1	32.2	32.8	103.0	70.2	0	C	231
13.56000	53.5	QP	19.3	7.1	32.2	47.7	103.0	55.3	45	C	322
13.56000	55.4	QP	19.3	7.1	32.2	49.6	103.0	53.4	90	C	154
13.56000	52.1	QP	19.3	7.1	32.2	46.3	103.0	56.7	135	C	119
13.56000	33.4	QP	19.3	7.1	32.2	27.6	103.0	75.4	0	C	223
13.56700	41.5	QP	19.3	7.1	32.2	35.7	69.5	33.8	90	C	96
13.71000	29.8	QP	19.3	7.1	32.2	24.0	59.5	35.5	90	C	240
14.01000	29.7	QP	19.3	7.1	32.2	23.9	48.6	24.7	90	C	15

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

Supurious emission

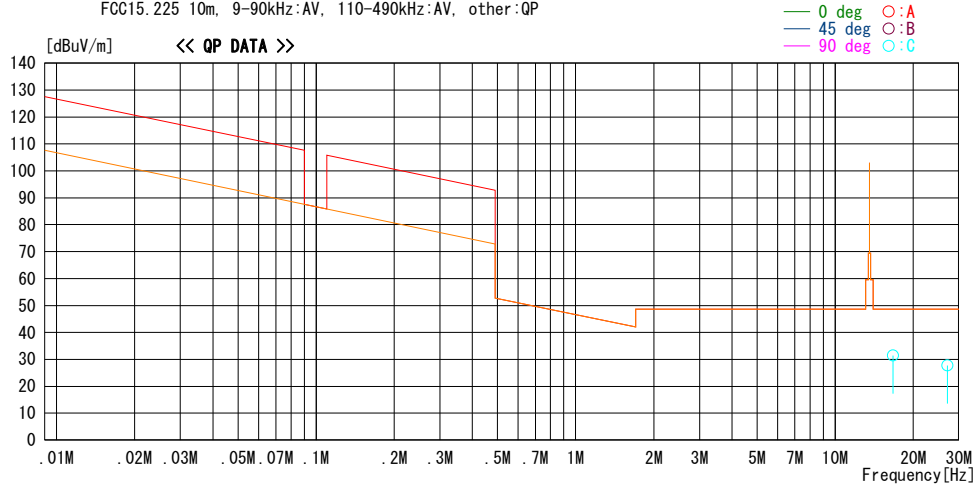
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
 Date : 2011/07/01

Report No. : 31EE0296-H0-04
 Temp./ Humi. : 22deg. C / 52% RH
 Engineer : Tomotaka Sasagawa

Mode / Remarks : Transmitting (Tx and Rx) without Tag mode, Worst axis(EUT:X/ANT:Z-axis)

LIMIT : FCC15.225 10m, 9-90kHz:PK, 110-490kHz:PK, other:QP
 FCC15.225 10m, 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]	
16.72000	36.9	QP	19.4	7.3	32.2	31.3	48.6	17.3	90	C	359
27.10000	32.1	QP	20.1	7.7	32.2	27.7	48.6	20.9	90	C	359

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

Spurious emission

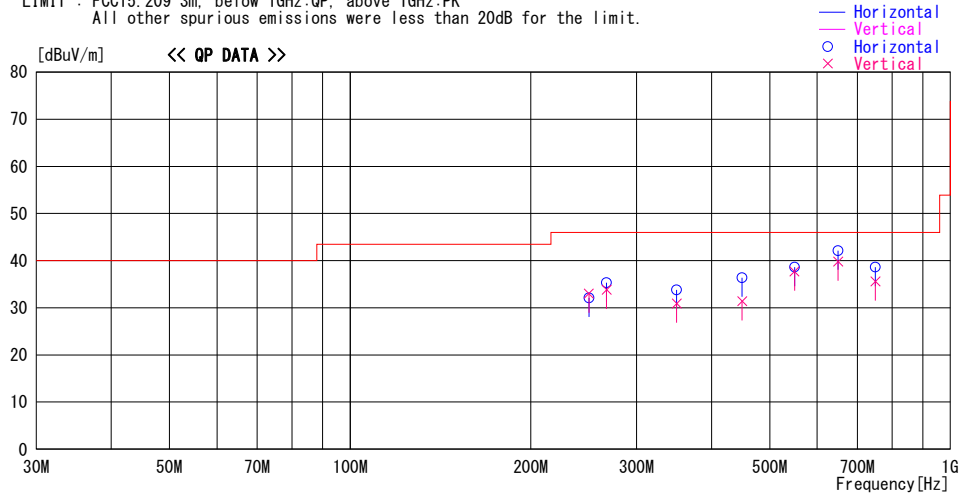
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2011/07/02

Report No. : 31EE0296-HO-04
Temp./Humi. : 24deg. C / 57% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Transmitting (Tx and Rx) without Tag mode, Worst axis (EUT:Z/ANT:Z)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
250.000	37.6	QP	17.3	-22.8	32.1	225	134	Hori.	46.0	13.9	
250.000	38.5	QP	17.3	-22.8	33.0	341	100	Vert.	46.0	13.0	
267.500	39.8	QP	18.1	-22.6	35.3	314	125	Hori.	46.0	10.7	
267.500	38.3	QP	18.1	-22.6	33.8	91	100	Vert.	46.0	12.2	
350.000	39.1	QP	16.7	-22.0	33.8	359	100	Hori.	46.0	12.2	
350.000	36.2	QP	16.7	-22.0	30.9	157	165	Vert.	46.0	15.1	
450.000	39.4	QP	18.4	-21.4	36.4	358	100	Hori.	46.0	9.6	
450.000	34.4	QP	18.4	-21.4	31.4	0	165	Vert.	46.0	14.6	
549.999	39.8	QP	19.6	-20.8	38.6	193	163	Hori.	46.0	7.4	
549.999	38.9	QP	19.6	-20.8	37.7	220	109	Vert.	46.0	8.3	
649.999	41.5	QP	21.1	-20.5	42.1	170	120	Hori.	46.0	3.9	
649.999	39.2	QP	21.1	-20.5	39.8	186	112	Vert.	46.0	6.2	
749.999	35.7	QP	22.5	-19.6	38.6	307	114	Hori.	46.0	7.4	
749.999	32.7	QP	22.5	-19.6	35.6	336	143	Vert.	46.0	10.4	

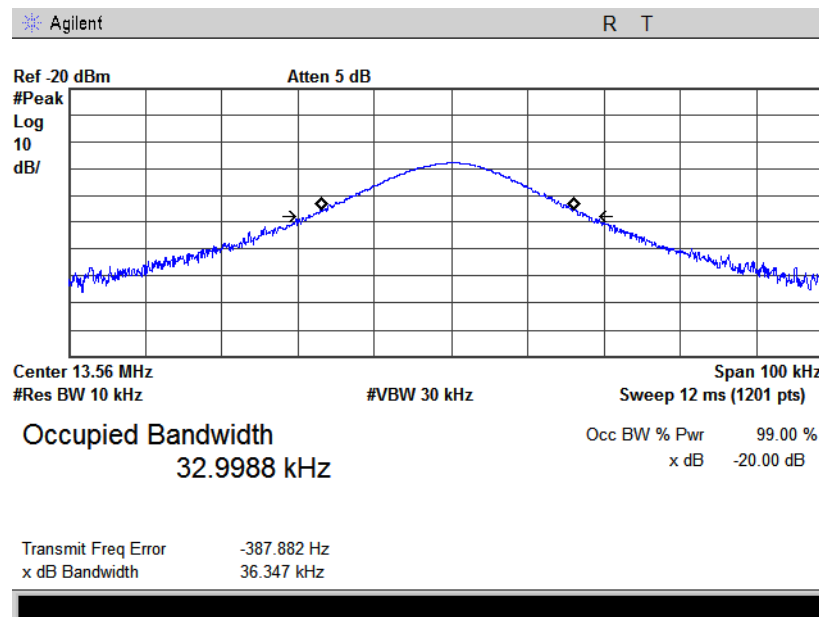
CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

* Noises of digital parts were excluded since the EUT was class A device.

20dB Bandwidth

Test place	Head Office EMC Lab. No.1 Semi Anechoic Chamber
Report No.	31EE0296-HO-04
Date	07/01/2011
Temperature/ Humidity	22 deg.C/ 52% RH
Engineer	Tomotaka Sasagawa
Mode	Transmitting (Tx and Rx) without Tag

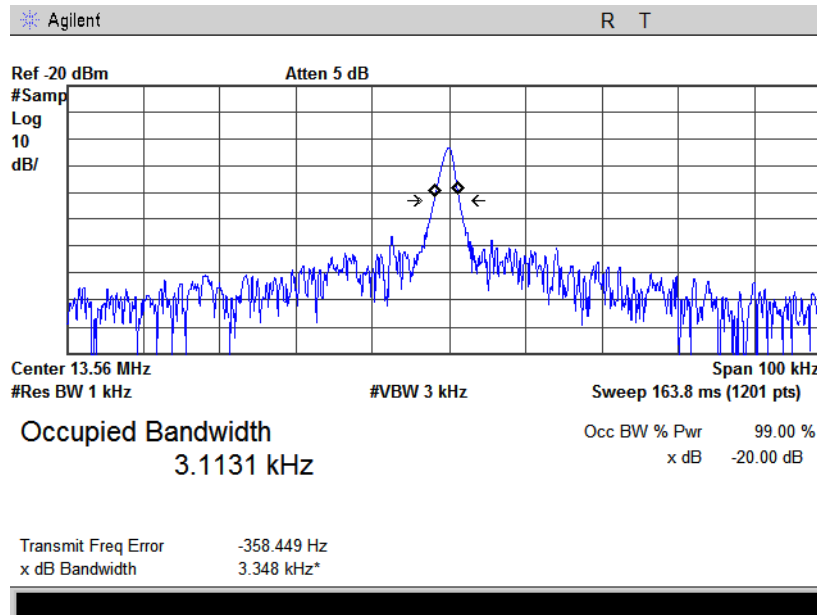
FREQ [MHz]	20dB Bandwidth [kHz]
13.56	36.35



99% Occupied Bandwidth

Test place	Head Office EMC Lab. No.1 Semi Anechoic Chamber
Report No.	31EE0296-HO-04
Date	07/01/2011
Temperature/ Humidity	22 deg.C / 52% RH
Engineer	Tomotaka Sasagawa
Mode	Transmitting (Tx and Rx) without Tag

FREQ [MHz]	99% Occupied Bandwidth [kHz]
13.56	3.11



Frequency Tolerance

Test place	Head Office EMC Lab. No.6 Shielded room
Report No.	31EE0296-HO-04
Date	07/01/2011
Temperature/ Humidity	26 deg.C / 59% RH
Engineer	Tomotaka Sasagawa
Mode	Tx Mod off

Test Condition deg.C	Test Timing Volts	Test Timing	Measured freq [MHz]	Freq error [MHz]	Result [ppm]	Limit (+/- 0.01%) [+/- ppm]	Margin [ppm]
20deg.C	276V	Power on	13.55998896	-0.00001104	-0.81	100.00	99.19
		on 2min.	13.55997819	-0.00002181	-1.61	100.00	98.39
		on 5min.	13.55997281	-0.00002719	-2.01	100.00	97.99
		on 10min.	13.55996818	-0.00003182	-2.35	100.00	97.65
	138V	Power on	13.56001417	0.00001417	1.04	100.00	98.96
		on 2min.	13.56000703	0.00000703	0.52	100.00	99.48
		on 5min.	13.56000303	0.00000303	0.22	100.00	99.78
		on 10min.	13.56000085	0.00000085	0.06	100.00	99.94
	120V	Power on	13.56000149	0.00000149	0.11	100.00	99.89
		on 2min.	13.55999665	-0.00000335	-0.25	100.00	99.75
		on 5min.	13.55999563	-0.00000437	-0.32	100.00	99.68
		on 10min.	13.55999579	-0.00000421	-0.31	100.00	99.69
	102V	Power on	13.56001810	0.00001810	1.33	100.00	98.67
		on 2min.	13.56000840	0.00000840	0.62	100.00	99.38
		on 5min.	13.56000488	0.00000488	0.36	100.00	99.64
		on 10min.	13.56000245	0.00000245	0.18	100.00	99.82
85V	Power on	13.55998863	-0.00001137	-0.84	100.00	99.16	
	on 2min.	13.55997978	-0.00002022	-1.49	100.00	98.51	
	on 5min.	13.55997479	-0.00002521	-1.86	100.00	98.14	
	on 10min.	13.55997066	-0.00002934	-2.16	100.00	97.84	
50deg.C.	120V	Power on	13.55990940	-0.00009060	-6.68	100.00	93.32
		on 2min.	13.55990479	-0.00009521	-7.02	100.00	92.98
		on 5min.	13.55990302	-0.00009698	-7.15	100.00	92.85
		on 10min.	13.55990131	-0.00009869	-7.28	100.00	92.72
40deg.C.	120V	Power on	13.55994251	-0.00005749	-4.24	100.00	95.76
		on 2min.	13.55993131	-0.00006869	-5.07	100.00	94.93
		on 5min.	13.55992905	-0.00007095	-5.23	100.00	94.77
		on 10min.	13.55992736	-0.00007264	-5.36	100.00	94.64
30deg.C.	120V	Power on	13.55998262	-0.00001738	-1.28	100.00	98.72
		on 2min.	13.55997187	-0.00002813	-2.07	100.00	97.93
		on 5min.	13.55996590	-0.00003410	-2.51	100.00	97.49
		on 10min.	13.55996287	-0.00003713	-2.74	100.00	97.26
20deg.C.	120V	Power on	13.56000149	0.00000149	0.11	100.00	99.89
		on 2min.	13.55999665	-0.00000335	-0.25	100.00	99.75
		on 5min.	13.55999563	-0.00000437	-0.32	100.00	99.68
		on 10min.	13.55999579	-0.00000421	-0.31	100.00	99.69
10deg.C.	120V	Power on	13.56004403	0.00004403	3.25	100.00	96.75
		on 2min.	13.56003646	0.00003646	2.69	100.00	97.31
		on 5min.	13.56003556	0.00003556	2.62	100.00	97.38
		on 10min.	13.56003637	0.00003637	2.68	100.00	97.32
0deg.C.	120V	Power on	13.56006414	0.00006414	4.73	100.00	95.27
		on 2min.	13.56006181	0.00006181	4.56	100.00	95.44
		on 5min.	13.56006022	0.00006022	4.44	100.00	95.56
		on 10min.	13.56005923	0.00005923	4.37	100.00	95.63
-10deg.C.	120V	Power on	13.56006174	0.00006174	4.55	100.00	95.45
		on 2min.	13.56006427	0.00006427	4.74	100.00	95.26
		on 5min.	13.56006517	0.00006517	4.81	100.00	95.19
		on 10min.	13.56006512	0.00006512	4.80	100.00	95.20
-20deg.C.	120V	Power on	13.56002141	0.00002141	1.58	100.00	98.42
		on 2min.	13.56003873	0.00003873	2.86	100.00	97.14
		on 5min.	13.56004240	0.00004240	3.13	100.00	96.87
		on 10min.	13.56004429	0.00004429	3.27	100.00	96.73
-30deg.C.	120V	Power on	13.56012225	0.00012225	9.02	100.00	90.98
		on 2min.	13.56006648	0.00006648	4.90	100.00	95.10
		on 5min.	13.56004488	0.00004488	3.31	100.00	96.69
		on 10min.	13.55999678	-0.00000322	-0.24	100.00	99.76

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	2011/03/01 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2011/02/23 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2011/02/15 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2010/10/27 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(AE)	2011/02/20 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE(EUT)	2011/02/22 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2011/01/05 * 12
MAT-67	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2011/02/22 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	CE	2010/07/21 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	14015723	FT	2010/08/03 * 12
MLPA-06	Loop Antenna	UL Japan	-	-	FT	Pre Check
EST-45	Universal Counter	Agilent	53132A	MY40008906	FT	2010/08/09 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	FT	2011/02/23 * 12
MMM-14	DIGITAL HiTESTER	Hioki	3805	070500641	FT	2011/06/06 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2010/07/02 * 12
MOS-01	Digital Humidity Indicator	N.T	NT-1800	MOS01	RE	2011/02/23 * 12
MJM-01	Measure	KDS	ES19-55	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2010/12/07 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2010/10/15 * 12
MCC-30	Coaxial cable	UL Japan	-	-	RE	2010/07/20 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/3D-2W(7.5m)/RG400u(1.5m)/RFM-E421(Switcher)	-/01068(Switcher)	RE	2011/01/16 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2011/03/04 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2010/11/05 * 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	2011/03/25 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2011/01/14 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2011/03/04 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2011/02/22 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	CE	2011/02/23 * 12
MJM-15	Measure	KOMELON	KMC-36	-	CE	-
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	CE	2010/08/23 * 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: CE: Conducted Emission
RE: Radiated Emission
FT: Frequency Tolerance

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