# APPENDIX 2: Data of EMI test

## Radiated Emission below 30MHz (Fundamental and Spurious Emission)

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DATA OF RADIATED EMISSION TEST

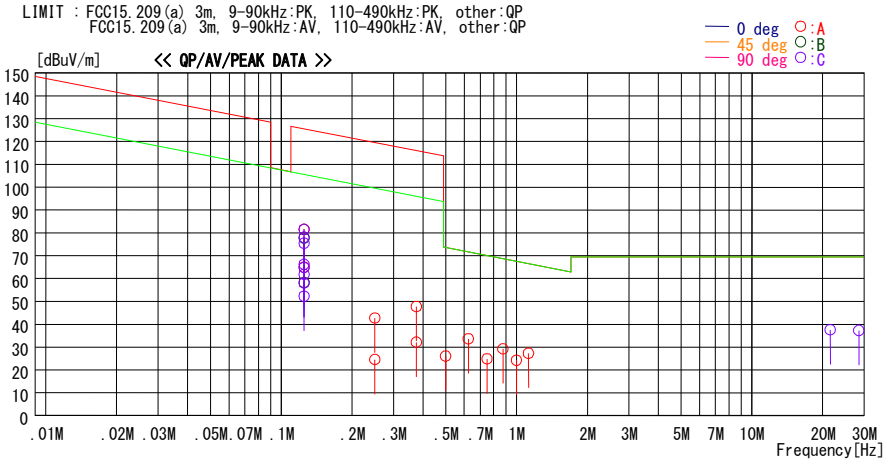
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2011/02/16

Report No. : 31EE0173-HO-02

Temp./ Humi. : 23deg. C. / 30%
Engineer : Motoya Imura

Mode / Remarks: Transmitting 125kHz

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. [MHz] | Reading [dBuV] | DET | Ant.Fac [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna [deg] | | Table [deg] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.12500 | 88.1 | PEAK | 19.9 | 6.0 | 32.4 | 81.6 | 125.7 | 44.1 | 0 | A | 36 | |
| 0.12500 | 84.3 | PEAK | 19.9 | 6.0 | 32.4 | 77.8 | 125.7 | 47.9 | 45 | B | 346 | |
| 0.12500 | 82.0 | PEAK | 19.9 | 6.0 | 32.4 | 75.5 | 125.7 | 50.2 | 90 | C | 80 | |
| 0.12500 | 84.5 | PEAK | 19.9 | 6.0 | 32.4 | 78.0 | 125.7 | 47.7 | 135 | C | 262 | |
| 0.12500 | 88.0 | PEAK | 19.9 | 6.0 | 32.4 | 81.5 | 125.7 | 44.2 | 180 | C | 321 | |
| 0.12500 | 72.8 | PEAK | 19.9 | 6.0 | 32.4 | 66.3 | 125.7 | 59.4 | Hor | C | 10 | |
| 0.12500 | 71.5 | AV | 19.9 | 6.0 | 32.4 | 65.0 | 105.7 | 40.7 | 0 | A | 36 | |
| 0.12500 | 64.9 | AV | 19.9 | 6.0 | 32.4 | 58.4 | 105.7 | 47.3 | 45 | B | 346 | |
| 0.12500 | 64.6 | AV | 19.9 | 6.0 | 32.4 | 58.1 | 105.7 | 47.6 | 90 | C | 80 | |
| 0.12500 | 68.3 | AV | 19.9 | 6.0 | 32.4 | 61.8 | 105.7 | 43.9 | 135 | C | 262 | |
| 0.12500 | 71.3 | AV | 19.9 | 6.0 | 32.4 | 64.8 | 105.7 | 40.9 | 180 | C | 321 | |
| 0.12500 | 58.8 | AV | 19.9 | 6.0 | 32.4 | 52.3 | 105.7 | 53.4 | Hor | C | 10 | |
| 0.25000 | 49.2 | PEAK | 19.7 | 6.1 | 32.2 | 42.8 | 119.6 | 76.8 | 0 | A | 36 | |
| 0.25000 | 31.0 | AV | 19.7 | 6.1 | 32.2 | 24.6 | 99.6 | 75.0 | 0 | A | 36 | |
| 0.37500 | 54.2 | PEAK | 19.6 | 6.1 | 32.2 | 47.7 | 116.1 | 68.4 | 0 | A | 82 | |
| 0.37500 | 38.6 | AV | 19.6 | 6.1 | 32.2 | 32.1 | 96.1 | 64.0 | 0 | A | 82 | |
| 0.50000 | 32.6 | QP | 19.5 | 6.1 | 32.1 | 26.1 | 73.6 | 47.5 | 0 | A | 36 | |
| 0.62500 | 40.1 | QP | 19.5 | 6.1 | 32.1 | 33.6 | 71.7 | 38.1 | 0 | A | 12 | |
| 0.75000 | 31.5 | QP | 19.4 | 6.1 | 32.1 | 24.9 | 70.1 | 45.2 | 0 | A | 36 | |
| 0.87500 | 35.9 | QP | 19.4 | 6.1 | 32.2 | 29.2 | 68.7 | 39.5 | 0 | A | 36 | |
| 1.00000 | 31.0 | QP | 19.4 | 6.1 | 32.2 | 24.3 | 67.6 | 43.3 | 0 | A | 36 | |
| 1.12500 | 34.0 | QP | 19.4 | 6.1 | 32.2 | 27.3 | 66.5 | 39.2 | 0 | A | 36 | |
| 21.51000 | 43.2 | QP | 19.9 | 6.7 | 32.2 | 37.6 | 69.5 | 31.9 | 90 | C | 272 | |
| 28.51200 | 43.3 | QP | 19.3 | 6.9 | 32.2 | 37.3 | 69.5 | 32.2 | 90 | C | 47 | |

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.)

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

# Radiated Emission above 30MHz (Spurious Emission)

## DATA OF RADIATED EMISSION TEST

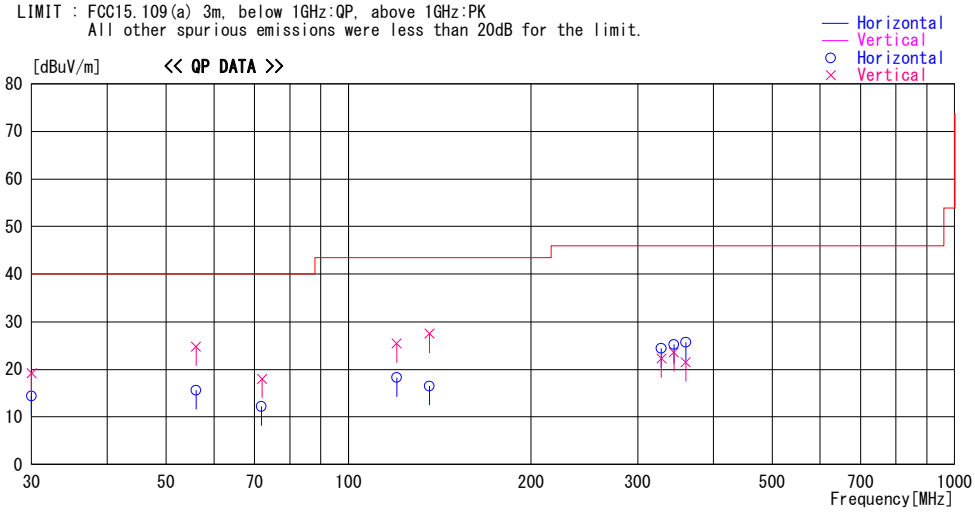
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2011/02/16

Report No. : 31EE0173-HO-02

Temp. / Humi. : 23deg.C / 30%
Engineer : Motoya Imura

Mode / Remarks : Transmitting 125kHz

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.




| Frequency [MHz] | Reading [dBuV] | DET | Antenna Factor [dB/m] | Loss& Gain [dB] | Level [dBuV/m] | Angle [Deg] | Height [cm] | Polar. | Limit [dBuV/m] | Margin [dB] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30.000 | 27.4 | QP | 16.9 | -25.1 | 19.2 | 359 | 100 | Vert. | 40.0 | 20.8 | |
| 30.000 | 22.6 | QP | 16.9 | -25.1 | 14.4 | 25 | 300 | Hori. | 40.0 | 25.6 | |
| 56.024 | 31.0 | QP | 9.3 | -24.7 | 15.6 | 355 | 277 | Hori. | 40.0 | 24.4 | |
| 56.024 | 40.2 | QP | 9.3 | -24.7 | 24.8 | 108 | 100 | Vert. | 40.0 | 15.2 | |
| 71.850 | 30.2 | QP | 6.5 | -24.5 | 12.2 | 14 | 167 | Hori. | 40.0 | 27.8 | |
| 72.040 | 35.9 | QP | 6.5 | -24.4 | 18.0 | 115 | 100 | Vert. | 40.0 | 22.0 | |
| 120.045 | 29.2 | QP | 12.8 | -23.7 | 18.3 | 240 | 294 | Hori. | 43.5 | 25.2 | |
| 120.045 | 36.3 | QP | 12.8 | -23.7 | 25.4 | 338 | 100 | Vert. | 43.5 | 18.1 | |
| 136.064 | 26.0 | QP | 14.1 | -23.6 | 16.5 | 212 | 234 | Hori. | 43.5 | 27.0 | |
| 136.064 | 37.0 | QP | 14.1 | -23.6 | 27.5 | 3 | 100 | Vert. | 43.5 | 16.0 | |
| 328.148 | 30.2 | QP | 15.9 | -21.7 | 24.4 | 58 | 108 | Hori. | 46.0 | 21.6 | |
| 328.148 | 28.1 | QP | 15.9 | -21.7 | 22.3 | 7 | 100 | Vert. | 46.0 | 23.7 | |
| 344.166 | 30.5 | QP | 16.3 | -21.6 | 25.2 | 130 | 129 | Hori. | 46.0 | 20.8 | |
| 344.166 | 28.9 | QP | 16.3 | -21.6 | 23.6 | 14 | 100 | Vert. | 46.0 | 22.4 | |
| 360.172 | 30.6 | QP | 16.6 | -21.5 | 25.7 | 123 | 128 | Hori. | 46.0 | 20.3 | |
| 360.166 | 26.4 | QP | 16.6 | -21.5 | 21.5 | 146 | 100 | Vert. | 46.0 | 24.5 | |

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)

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

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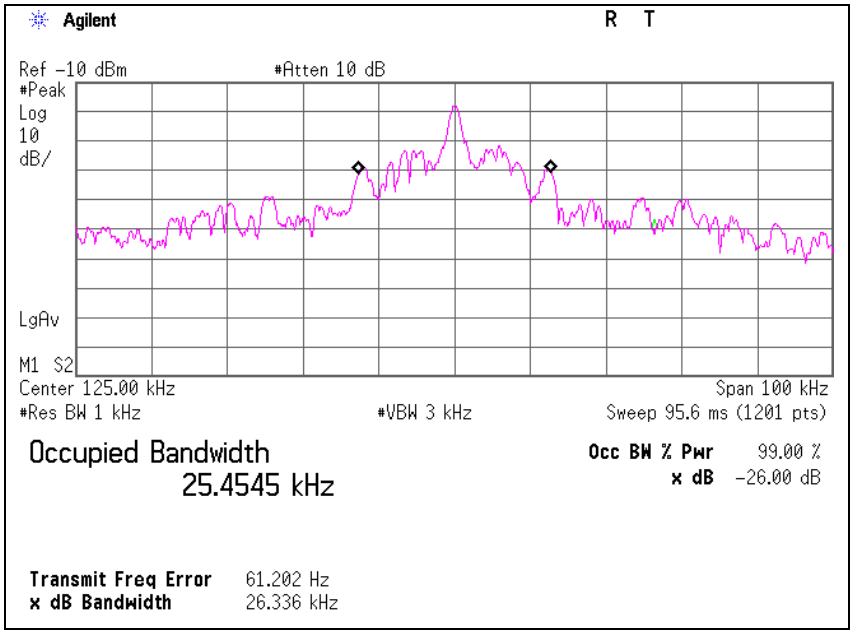
# -26dB Bandwidth

| | |
|---|---|
| Test place | Head Office EMC Lab. No.3 Semi Anechoic Chamber |
| Report No. | 31EE0173-HO-02 |
| Date | 02/16/2011 |
| Temperature/ Humidity | 23 deg.C./ 30% |
| Engineer | Motoya Imura |
| Mode | Transmitting 125kHz |

| FREQ [kHz] | -26dB Bandwidth [kHz] |
|---|---|
| 125 | 26.336 |



## 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-03 | Spectrum Analyzer | Agilent | E4448A | MY44020357 | RE | 2010/11/30 * 12 |
| MTR-08 | Test Receiver | Rohde & Schwarz | ESCI | 100767 | RE | 2010/08/23 * 12 |
| MLPA-01 | Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100017 | RE | 2010/10/15 * 12 |
| MCC-112 | Coaxial cable | Fujikura/Suhner/TSJ | 5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher) | -/00640 | RE | 2010/07/23 * 12 |
| MCC-30 | Coaxial cable | UL Japan | - | - | RE | 2010/07/20 * 12 |
| MPA-13 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | RE | 2010/03/23 * 12 |
| MAT-09 | Attenuator(6dB) | Weinschel Corp | 2 | BK7973 | RE | 2010/11/05 * 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 |

**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**