TEST REPORT

For

Pulse Radar Type Microwave Level Meter

In conformity with

FCC CFR 47 Part15 / RSS-210, RSS-Gen

Model: MWLM-PR26H7 / MWLM-PR26H3 / MWLM-PR26H1 / MWLM-PR26C1

FCC ID/ IC Certification No.: PVK-MWLM-PR26 / 10700A-MWLMPR26

Test Item: Pulse Radar Type Microwave Level Meter

Report No: ERY1305H14R1

Issue Date: May 14, 2013

Prepared for

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Prepared by

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History

Report No.	Date	Revisions	Issued By
ERY1305H14R1	May 14, 2013	Initial Issue	T. Hori

1 General information

1.1 Product description

Test item	: Pulse Radar Type Microwave Level Meter
Manufacturer	: Matsushima Machinery Laboratory Co., Ltd
Address	: 1-8-18 Norimatsu-Higashi Yahatanishi-ku, Kitakyuushu, Fukuoka, 807-0837 Japan
Model	: MWLM-PR26H7 / MWLM-PR26H3 / MWLM-PR26H1 / MWLM-PR26C1
FCC ID	: PVK-MWLM-PR26
IC Certification No	: 10700A-MWLMPR26
Serial numbers	: V12001801 / V12001802 / V12001803 / V12001804
Fundamental Operated Frequency	: Tx/Rx Freq. (25.5 GHz, 1ch)
Type of Modulation	: Pulse Modulation
RF Output Power	: -30.0 dBm
Antenna Gain	: MWLM-PR26H7 : 25.71 dBi, WLM-PR26H3 : 20.84 dBi MWLM-PR26H1 : 13.49 dBi, WLM-PR26C1 : 10.49 dBi
Receipt date of EUT	: March 11, 2013
Nominal power source voltages	: DC24.0V

1.2 Test(s) performed/ Summary of test result

Test specification(s)	: FCC CFR 47. Part 15 (October 1, 2010) / RSS-210 Issue 8, RSS-Gen Issue 3
Test method(s)	: ANSI C63.4: 2003
Test(s) started	: March 26, 2013
Test(s) completed	: May 14, 2013
Purpose of test(s)	: Grant for Certification of FCC / IC
Summary of test result	: Complied

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.
The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.
Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer : Toshimitsu Hori
T. Hori
EMC testing Department

Reviewer : T. Ikegami
T. Ikegami
Manager
EMC testing Department

1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at RF Technologies Ltd., located in 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948 .
The description of the test facilities has been filed under registration number 319924 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.
The list of all public test facilities is available on the Internet at http://www.fcc.gov.

Registered by Voluntary Control Council for Interference by Information Technology Equipment (VCCI)
Each registered facility number is as follows;
Test site: A-0045

Registered by Industry Canada (IC): The registered facility number is as follows;
Test site No. 1 (Semi-Anechoic chamber 3m): 6974A-1

Accredited by **National Voluntary Laboratory Accreditation Program** (NVLAP) for the emission tests stated in the scope of the certificate under Certificate Number 200780-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

NVLAP LAB CODE 200780-0

1.4 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in “Guide to the expression of uncertainty in measurement (GUM)” published by ISO. The Lab’s uncertainty is determined by referring UKAS Publication LAB34: 2002 “The Expression of Uncertainty in EMC Testing” and CISPR16-4-2: 2003 “Uncertainty in EMC Measurements”.
The uncertainty of the measurement result in the level of confidence of approximately 95% (k=2) is as follows;

Conducted emission: +/- 3.4dB (150 kHz – 30 MHz)
Radiated emission (9 kHz – 30 MHz): +/- 3.3 dB
Radiated emission (30 MHz - 1000 MHz): +/- 6.2 dB
Radiated emission (1GHz – 18 GHz): +/- 4.9 dB
Radiated emission (18 GHz – 26 GHz): +/- 5.1 dB

1.5 Summary of test results

1.5.1 Table of test summary

Requirement of;	Section in FCC15	Section in RSS210/ RSS-Gen	Result	Section in this report
1.5.1 Occupied Bandwidth (99%, 26dB)	15.303(c)	RSS-Gen 8	N/A	2.1, 2.2
1.5.2 Radiated Emissions	15.205(b)/15.209	RSS-Gen 7.2.2, 7.2.5 RSS210 A11.4	Complied	2.3
1.5.3 Transmitter output power	-	RSS-210 A11.2(c)	Complied	2.3.11
1.5.4 AC Power Line Conducted Emissions	15.207	RSS-Gen 7.2.4	Complied	2.4
1.5.5 RF Exposure	1.1310	RSS-102	Complied	2.5

Note: Transmitter and receivers are combination units. Receivers are co-located with transmitters.

1.6 Setup of equipment under test (EUT)

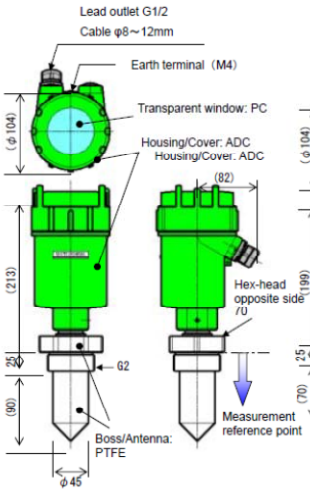
1.6.1 Test configuration of EUT

Equipment(s) under test:

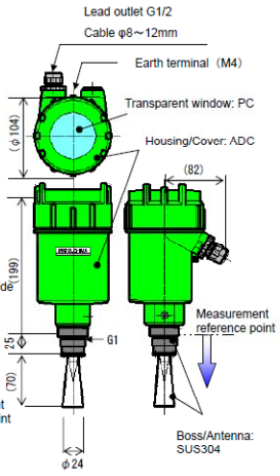
No.	Item	Manufacturer	Model No.	Serial No.	Remark
A1	Pulse Radar	Matsushima Machinery Laboratory Co., Ltd	MWLM-PR26H7	V12001801	EUT
A2	Pulse Radar	Matsushima Machinery Laboratory Co., Ltd	MWLM-PR26H3	V12001802	EUT
A3	Pulse Radar	Matsushima Machinery Laboratory Co., Ltd	MWLM-PR26H1	V12001803	EUT
A4	Pulse Radar	Matsushima Machinery Laboratory Co., Ltd	MWLM-PR26C1	V12001804	EUT

Note: These 4 models use same generator. The difference among four models is that an antenna is different.

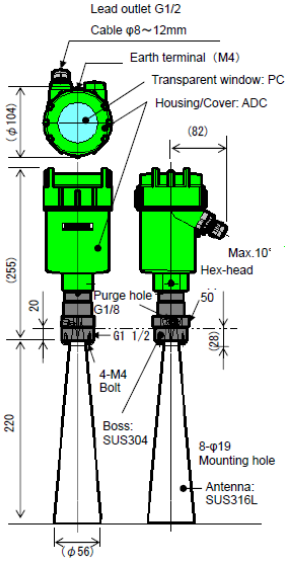
MWLM-PR26C1



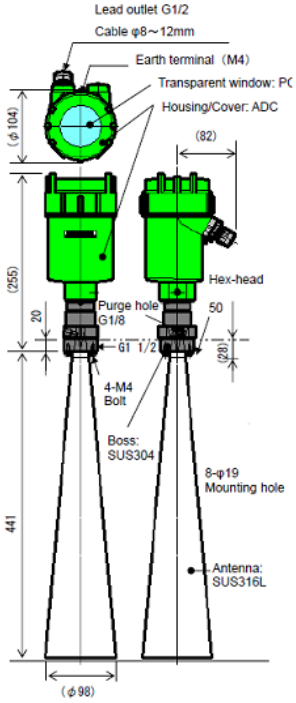
MWLM-PR26H1



MWLM-PR26H3



MWLM-PR26H7



Support Equipment(s):

No.	Item	Manufacturer	Model No.	Serial No.
B	HART	ProComSol, Ltd	HN-USB-ISO	411129
C	Personal Computer	DELL	LATITUDE D505	JT9KF1X
D	AC Adaptor	DELL	LA65NSO-00	PA-1650-06D3
E	DC Power Supply	Agilent	E3632A	MY400003027

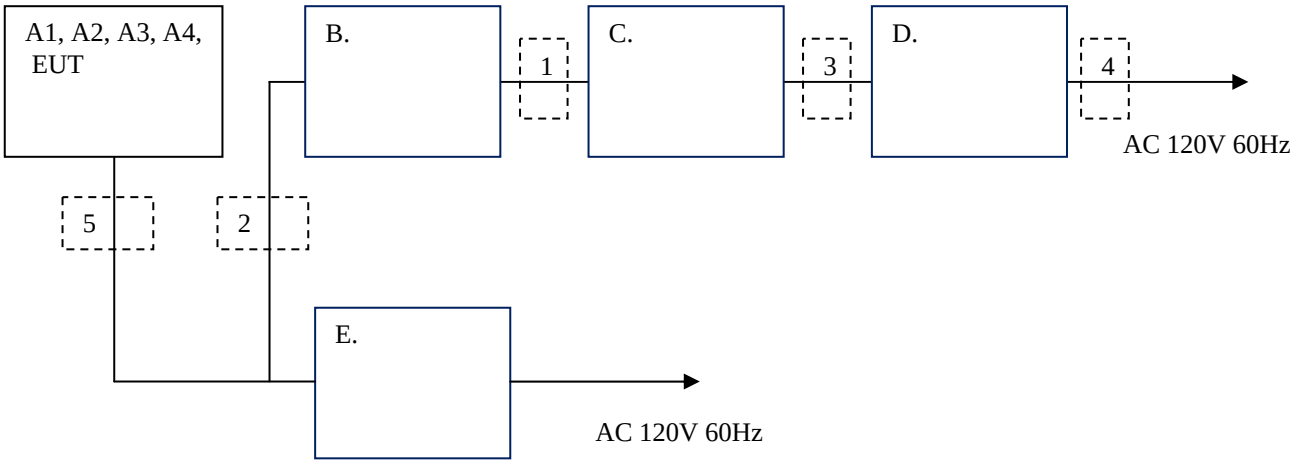
Connected cable(s):

No.	Item	Identification (Manufacturer e.t.c)	Shielded YES / NO	Ferrite Core YES / NO	Connector Type Shielded YES / NO	Length (m)
1	USB Cable	ProComSol, Ltd	No	No	No	0.4
2	HART Cable	ProComSol, Ltd	No	No	No	1.2
3	DC Cable	DELL	No	Yes	No	1.8
4	AC Cable	DELL	No	No	No	0.9
5	DC Cable	-	No	No	No	2.0

1.6.2 Operating condition:

Operating mode:
The EUT was tested under the following test mode prepared by the applicant:
Normal Operating mode

1.6.3 Setup diagram of tested system:



1.7 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

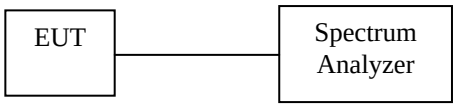
1.8 Deviation from the standard

No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Occupied Bandwidth (99%)

Test setup
Test setup is the following drawing.



Test procedure
Measurement procedures were implemented according to the method of ANSI C63.4: 2003.
The RBW is set to 100 kHz, and the VBW is same. The sweep time is coupled appropriate.
Span = 5 GHz, Detector = peak, Trace = Max hold

Limitation
There are no limitations.

Operating mode:
Normal Operating mode

Test equipment used (refer to List of utilized test equipment)

SA09R

Test results: OBW (99%)

Model No.	Occupied Bandwidth(GHz)
MWLM-PR26	1.9638

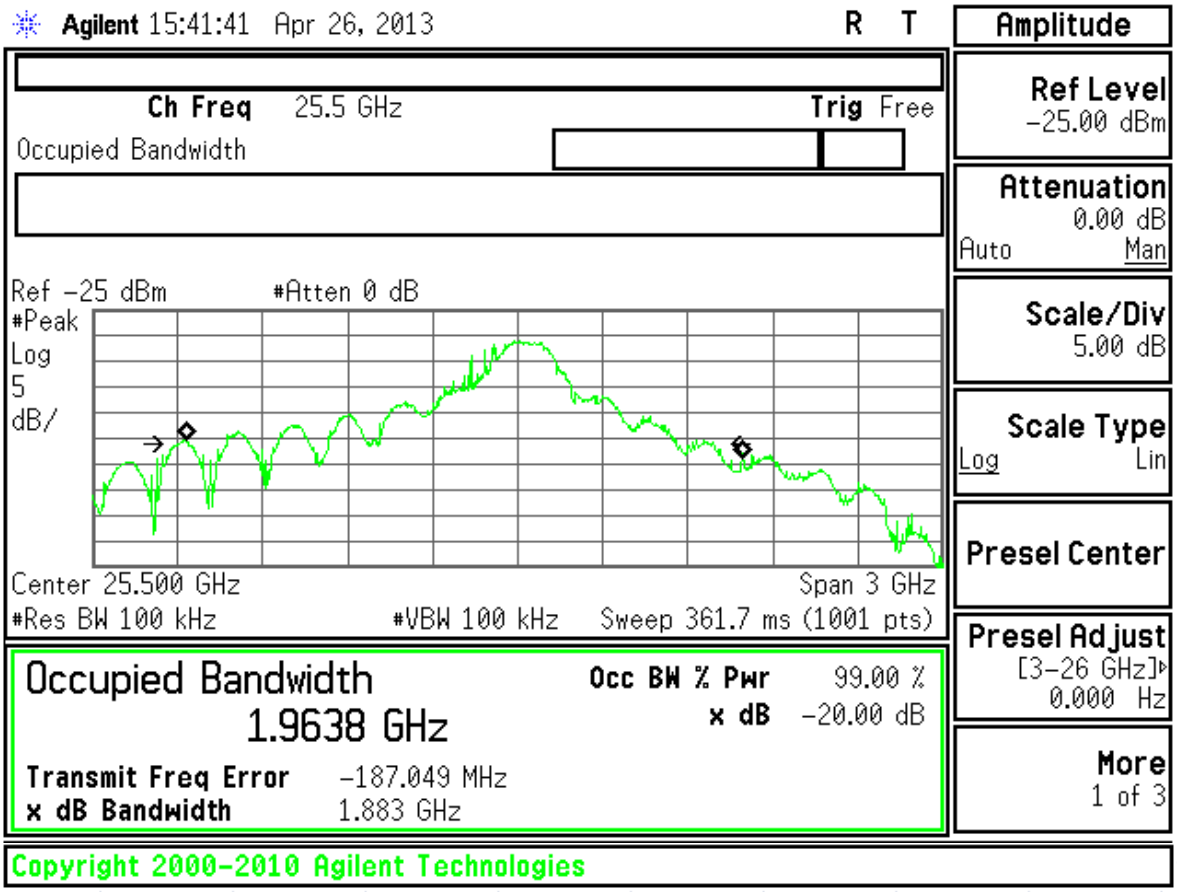
Note: These 4 models use same generator.

Test Data

Tested Date: April 26, 2013

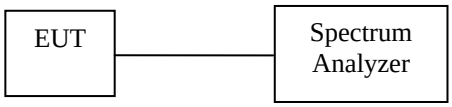
Temperature: 18 ˚C
Humidity: 45 %
Atmos. Press: 1016 hPa

MWLM-PR26



2.2 Occupied Bandwidth (26 dB)

Test setup
Test setup is the following drawing.



Test procedure
Measurement procedures were implemented according to the method of mm-wave procedure.
The RBW is set to 100 kHz, and the VBW is same. The sweep time is coupled appropriate.
Span = 5 GHz, Detector = peak, Trace = Max hold

Limitation
There are no limitations.

Operating mode:
Normal Operating mode

Test equipment used (refer to List of utilized test equipment)

SA09R

Test results: OBW (26 dB)

Model No.	Occupied Bandwidth(GHz)	F_L(GHz)	F_H(GHz)
MWLM-PR26	2.232	24.093	26.325

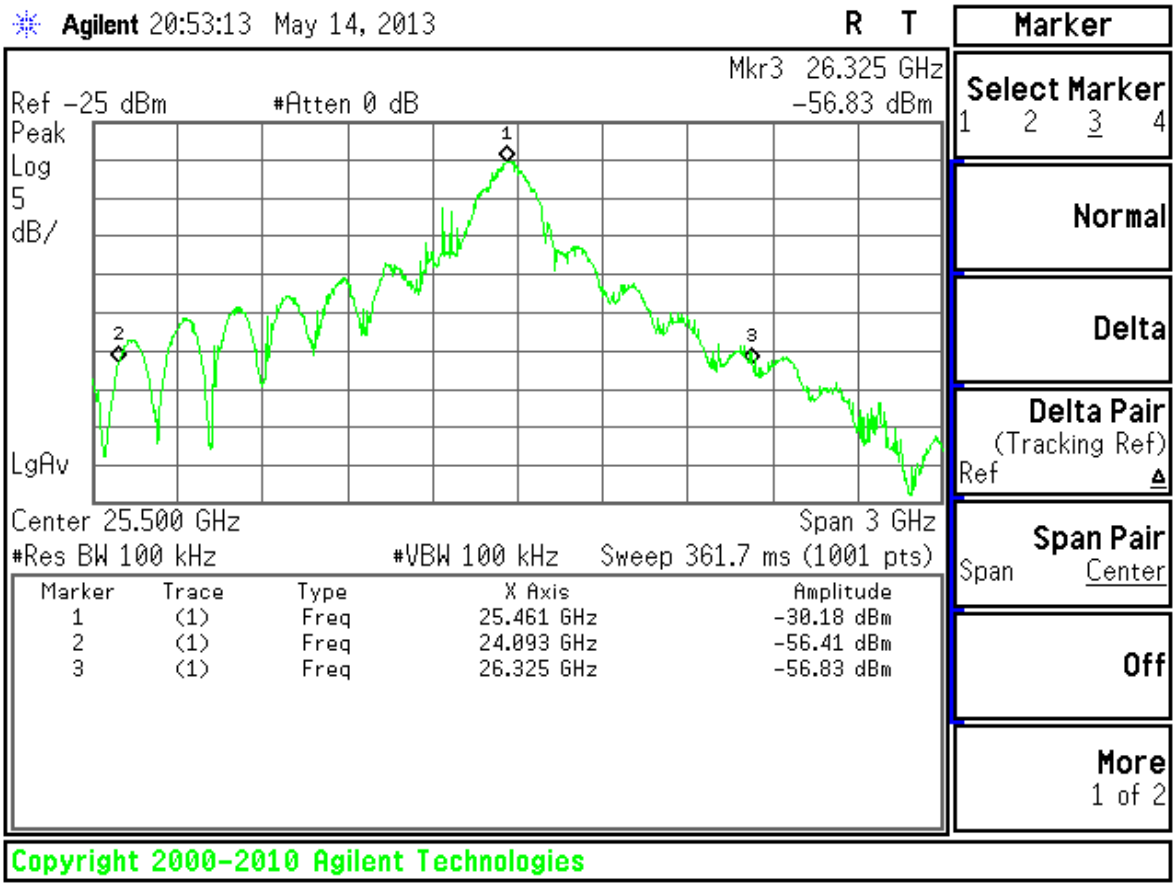
Note: These 4 models use same generator.

Test Data

Tested Date: May 14, 2013

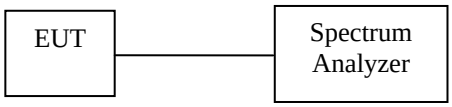
Temperature: 25 ˚C
Humidity: 60 %
Atmos. Press: 1013 hPa

MWLM-PR26



2.3 Occupied Bandwidth (10 dB)

Test setup
Test setup is the following drawing.



Test procedure
Measurement procedures were implemented according to the method of mm-wave procedure.
The RBW is set to 100 kHz, and the VBW is same. The sweep time is coupled appropriate.
Span = 3 GHz, Detector = peak, Trace = Max hold

Limitation
There are no limitations.

Operating mode:
Normal Operating mode

Test equipment used (refer to List of utilized test equipment)

SA09R

Test results: OBW (10 dB)

Model No.	Occupied Bandwidth(GHz)	F_L(GHz)	F_H(GHz)
MWLM-PR26	0.345	25.335	25.680

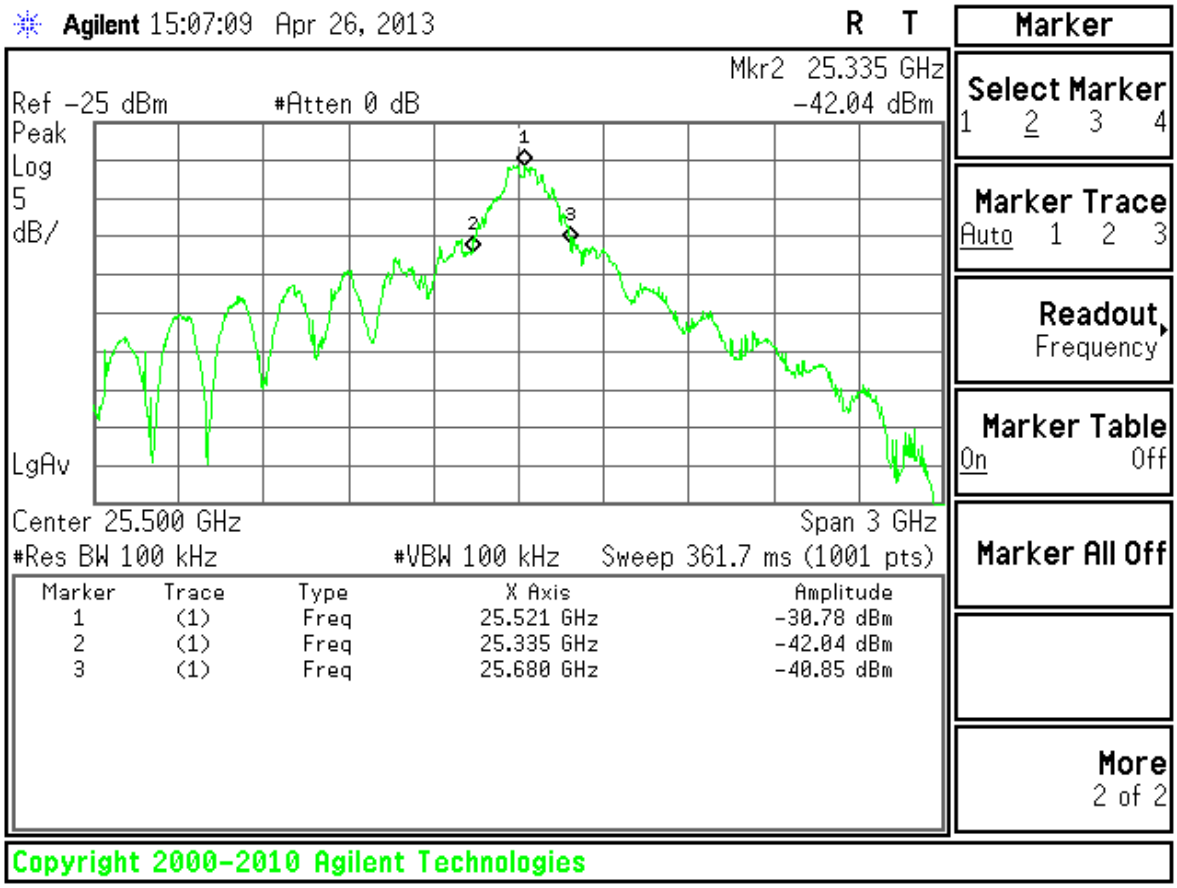
Note: These 4 models use same generator.

Test Data

Tested Date: April 26, 2013

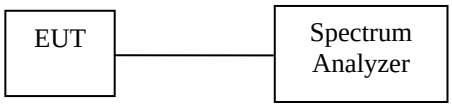
Temperature: 18 ˚C
Humidity: 45 %
Atmos. Press: 1016 hPa

MWLM-PR26



2.4 First nulls

Test setup
Test setup is the following drawing.



Test procedure
Measurement procedures were implemented according to the method of mm-wave procedure.
The RBW is set to 100 kHz, and the VBW is same. The sweep time is coupled appropriate.
Span = 3 GHz, Detector = peak, Trace = Max hold

Limitation
There are no limitations.

Operating mode:
Normal Operating mode

Test equipment used (refer to List of utilized test equipment)

SA09R

Test results: OBW (10 dB)

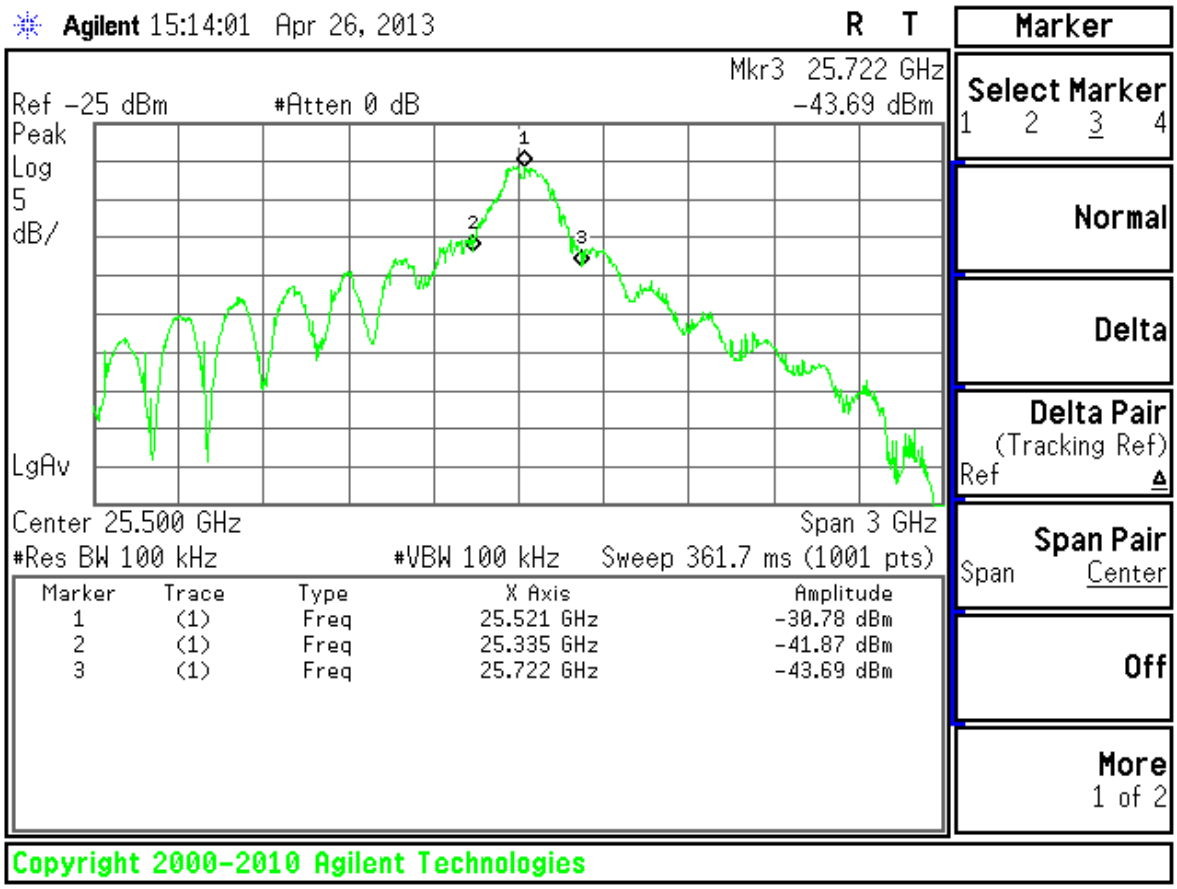
Model No.	Occupied Bandwidth(GHz)	F_L(GHz)	F_H(GHz)
MWLM-PR26	0.387	25.335	25.722

Note: These 4 models use same generator.

Test Data

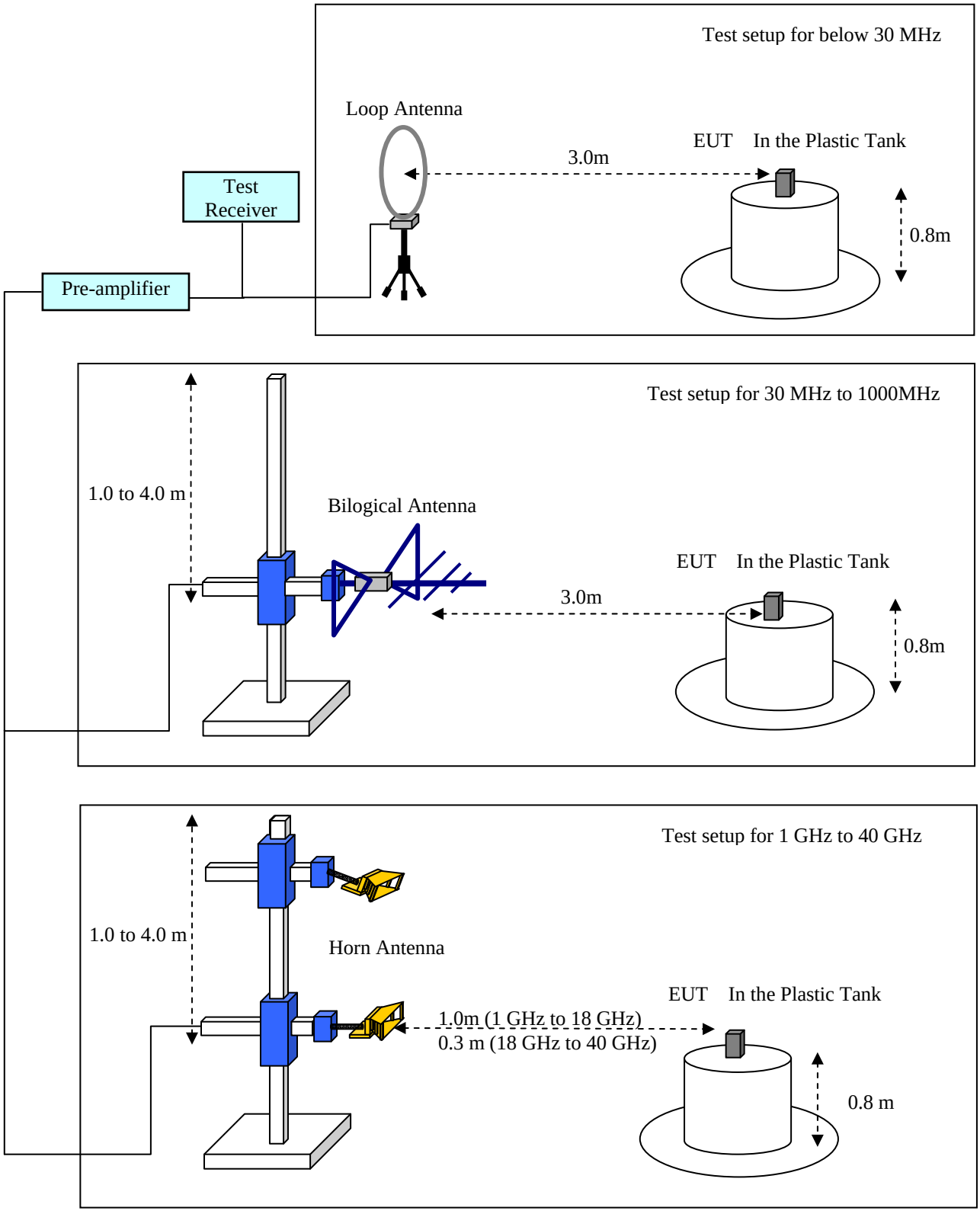
Tested Date: April 26, 2013

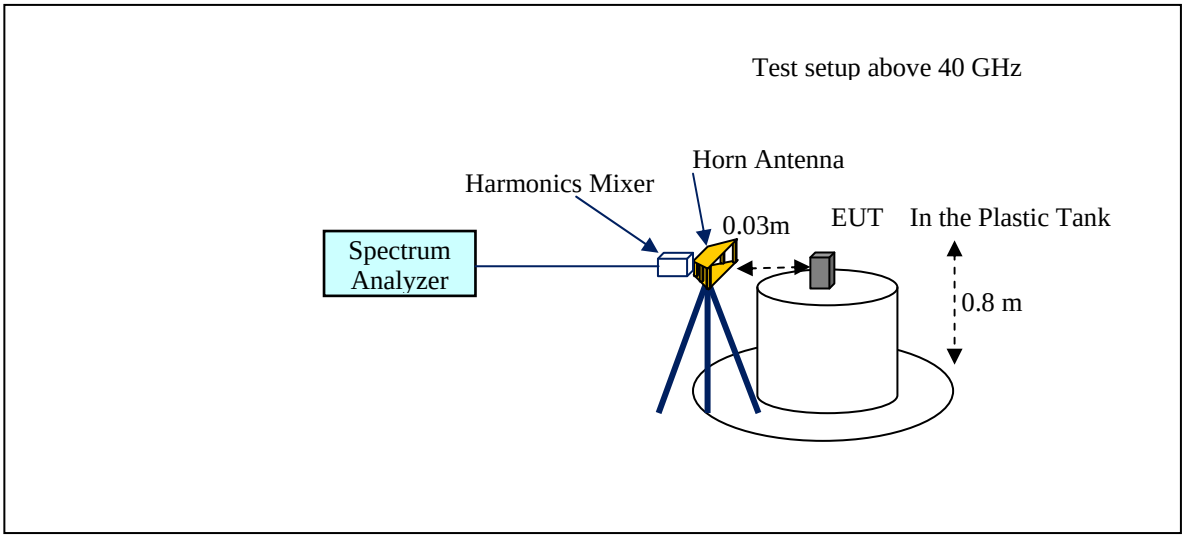
Temperature: 18 ˚C
Humidity: 45 %
Atmos. Press: 1016 hPa



2.5 Radiated emissions

Test setup
Test setup was implemented according to the method of ANSI C63.4: 2003 “General requirements for EUT equipment arrangements and operation”, clause 8.2 and Annex H.3 “Radiated emission measurements setup”.





Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003.
The EUT is place on a non-conducted table which is 0.8m height from a ground plane and the measurement antenna to EUT distance is 3 meters. The turn table is rotated for 360 degrees to determine the maximum emission level.
In the frequency range of 9 kHz to 30 MHz, a calibrated loop antenna was positioned with its plane vertical at the distance 3m from the EUT with an extrapolation of corrected distance factor and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna also needs to be positioned horizontally. The center of the loop shall be 1 m above the ground.
In the frequency above 30 MHz, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Test equipment consideration
Measurement system dynamic range is typically not sufficient at millimeter frequencies because of high instrument noise floor. As a result, the EUT was investigated by holding the test antenna in and around the closed tank at different RBWs, namely, 1MHz, 100 kHz, and 3 kHz RBWs, in order to find worst-casa emissions.
And then no radiated emissions wear detected, the noise floor levels were recorded and reported.

Tank dimensions follows:
Plastic tank: height 0.7 m, diameter: 0.5 m, Quality of the material: Polypropylene

Pulse De-sensitizing Factor and Duty Cycle

The Pulse width and Pulse data values provided by the manufacturer are used to calculate the Pulse Desensitizing Factor (PDF) and Duty cycle. The EUT Pulse width (τ_{eff}) = 4 ns; the EUT Pulse period(*T*) = 559 ns. The PDF is used to calculate the devices measured peak values.
The duty factor is used to calculate the average value from the peak value.

Pulse Repetition Frequency:
PRF = 1 / 559 ns = 1.788908 MHz

Pulse Desensitizing Factor (line spectrum mode):
PDF = 20 log (τ_{eff} / *T*) = 20 log (4 ns / 559 ns) = - 42.9 dB

Duty Cycle Factor:
DCF = 20 log (τ_{eff} / *T*) = 20 log (4 ns / 559 ns) = - 42.9 dB

Where τ_{eff} : Pulse width, *T*: Pulse Repetition Frequency

2 / (τ_{eff}) Bandwidth Calculation
The main lobe bandwidth is calculated by using 2 / (τ_{eff}) , where τ_{eff} the Pulse radar devices.
With τ_{eff} =4.8 ns, the main lobe bandwidth = 2 / (τ_{eff}) = 2 / (4 x 10^{-9}s) = 0.5 GHz

Field Strength Calculation

The final peak and average field strength was calculated using the following:
Peak result = Spectrum Analyzer reading (dBuV/m) + CF + PDF
Average result = Spectrum Analyzer reading (dBuV/m) + CF + PDF – DCF

Where:
C. Factor: Correction Factor
C. Factor [dB/m] = AF [dB/m] + CL [dB] – AG [dB]
AF: Antenna Factor [dB/m]
CL: Cable loss [dB]
AG: Amplifier gain [dB]
PDF: Pulse Desensitization Factor for in line Spectrum [dB]
DCF: Duty Cycle Factor [dB]

Applicable rule and limitation

FCC §15.205 restricted bands of operation
Except as shown in paragraph 15.205 (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.490 - 0.510	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(1)

15.205(b) except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC15.209(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 –216	150	3
216 – 960	200	3
Above 960	500	3

In the emission table above, the tighter limit applies at the band edges.
The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz.
Radiated emission limits in the above bands are based on measurements employing an average detector.

IC A11.4 (C) The leakage of the RF field outside the container at 3meters from the container walls shall not exceed the values outlined below:

Frequency band of operation	Frequency range within which the emission shall be measured	Maximum average e.i.r.p. outside tank enclosure inside the operating frequency range	Maximum average e.i.r.p. outside tank enclosure outside the operating frequency range
24.05 – 27 GHz	30 MHz to (f_H+ f_L)	-41.3 dBm (see Note)	-51.3 dBm

Note: The emission limits in the band 23.6 – 24GHz shall not exceed -70 dBm

Test results - Complied with requirement.

All measurements were made with the spectrum analyzer in peak max-hold mode. Since the main lobe of the carrier of the EUT was enclosed In the Plastic Tank, FCC measurements requiring 1 MHz RBW's were deemed impractical due to the fact that no radiated emissions were escaping from the closed tank; the EUT was investigated and measured using 3 kHz, 100 kHz, and 1 MHz RBWs. No reportable emissions were found; all emissions were at or below the noise floor of the instrumentation, hence the EUT complies with the limit.

Test Data

2.5.1 Below 30 MHz

Test equipment used (refer to List of utilized test equipment)

AC01(EM)	CL11	TR06	LP05

Tested Date: April 9, 2013

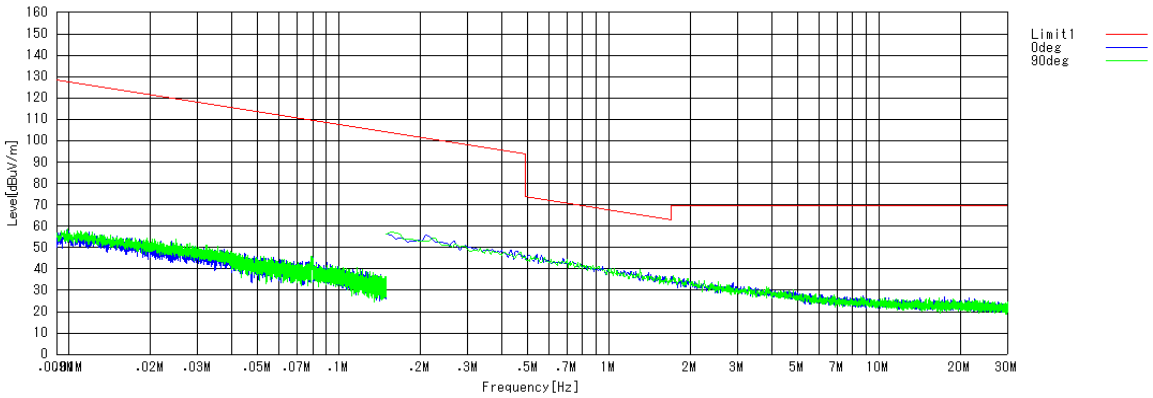
Temperature: 18 ˚C
Humidity: 40 %
Atmos. Press: 1010 hPa

Model Name: MWLM-PR26H7
Model Name: MWLM-PR26H3
Model Name: MWLM-PR26H1
Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 3 m
Between 0.009 – 0.15 MHz: RBW =200 Hz, VBW = 200 Hz
Final measurement is carried out with a receiver RBW of 200 kHz (QP)
Between 0.15 - 30 MHz: RBW = 10 kHz, VBW = 10 kHz
Final measurement is carried out with a receiver RBW of 9 kHz (QP)

There were no spurious emissions greater than noise floor.

Model Name: MWLM-PR26H7



2.5.2 Between 30 – 1000 MHz

Test equipment used (refer to List of utilized test equipment)

AC01(EM)	BI05	LA07	CL11	PR15	TR06

Tested Date: April 9, 2013

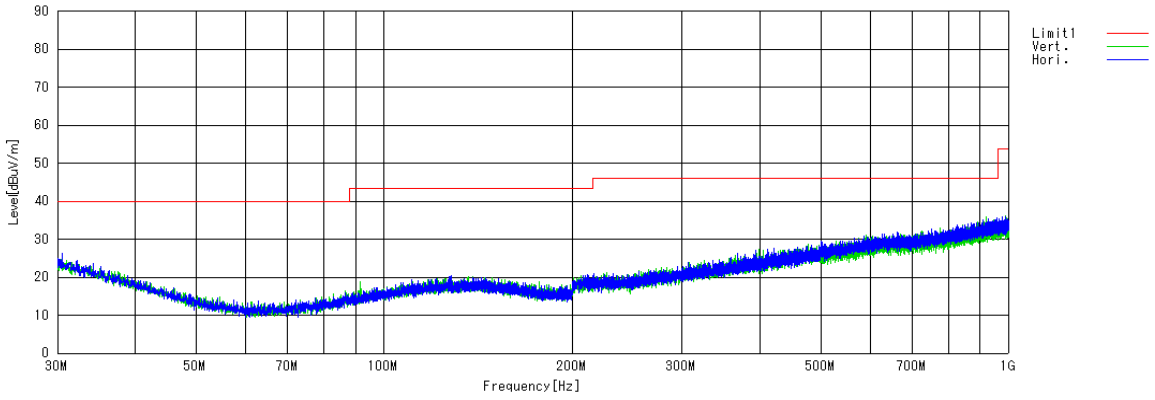
Temperature: 18 ˚C
Humidity: 40 %
Atmos. Press: 1010 hPa

Model Name: MWLM-PR26H7
Model Name: MWLM-PR26H3
Model Name: MWLM-PR26H1
Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 3 m
Between 30 - 1000 MHz: RBW =100 kHz, VBW = 100 kHz
Final measurement is carried out with a receiver RBW of 120 kHz (QP)

There were no spurious emissions greater than noise floor.

Model Name: MWLM-PR26H7



2.5.3 Between 1 GHz to 18 GHz (In the Plastic Tank)

Test equipment used (refer to List of utilized test equipment)

AC01(EG)	PR12	TR06	CL28	CL24	DH01

Tested Date: April 3, 2013

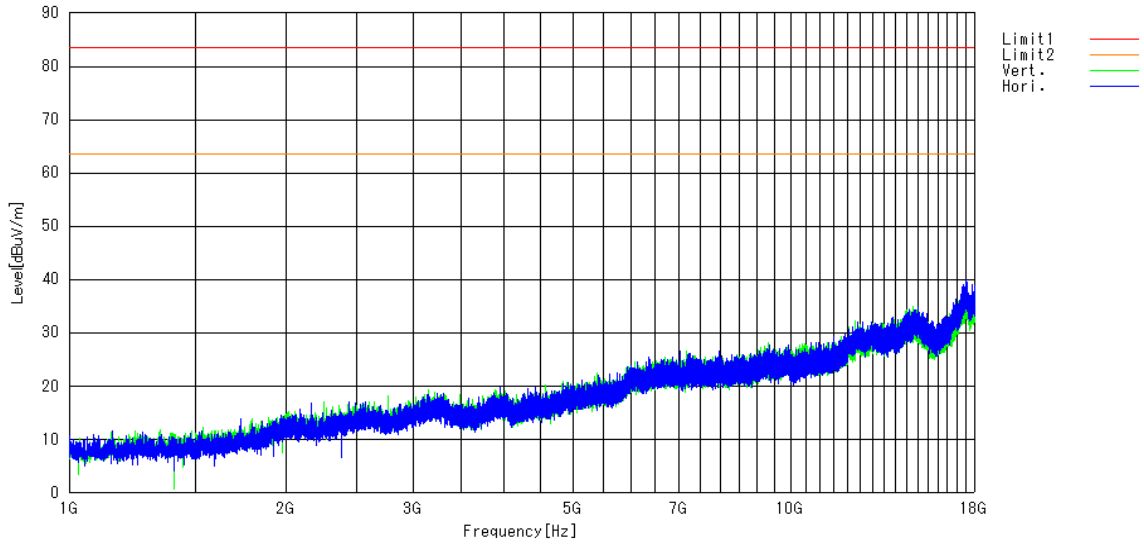
Temperature: 20 ˚C
Humidity: 58 %
Atmos. Press: 993 hPa

Model Name: MWLM-PR26H7
Model Name: MWLM-PR26H3
Model Name: MWLM-PR26H1
Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 1 m
FCC Limit = 53.9 dBuV/m@ 3m, 63.4 dBuV/m @ 1.0m
Calculation method: 20 log (3 / 1) = 9.5 dB 53.9 + 9.5 = 63.4 dBuV/m @ 1.0 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m, -41.8 dBm @ 1.0m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no spurious emissions greater than noise floor.

Model Name: MWLM-PR26H7



2.5.4 Between 18 GHz to 26 GHz (In the Plastic Tank)

Test equipment used (refer to List of utilized test equipment)

AC01(EG)	PR12	TR06	CL28	CL24	SH01

Tested Date: April 3, 2013

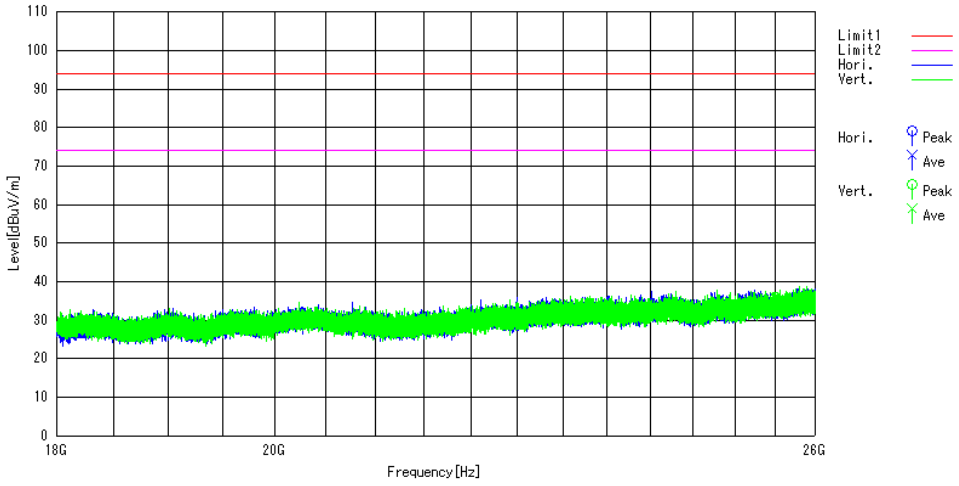
Temperature: 20 ˚C
Humidity: 58 %
Atmos. Press: 993 hPa

Model Name: MWLM-PR26H7

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (18 GHz -26 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	25500.00	21.8	14.2	78.9	36.0	93.9	73.9	15.0	37.9	Vert.
2	25500.00	21.8	14.2	78.9	36.0	93.9	73.9	15.0	37.9	Hori.

Calculation method
Peak Result = Reading + C. Fac + PDF = 21.8 + 14.2 + 42.9 = 78.9
Average Result = Reading + C. Fac + PDF – DFC = 21.8 + 14.2 + 42.9 – 42.9 = 36.0

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	25500.00	21.8	14.2	-79.2	-41.3	37.9	Vert.
2	25500.00	21.8	14.2	-79.2	-41.3	37.9	Hori.

Calculation method

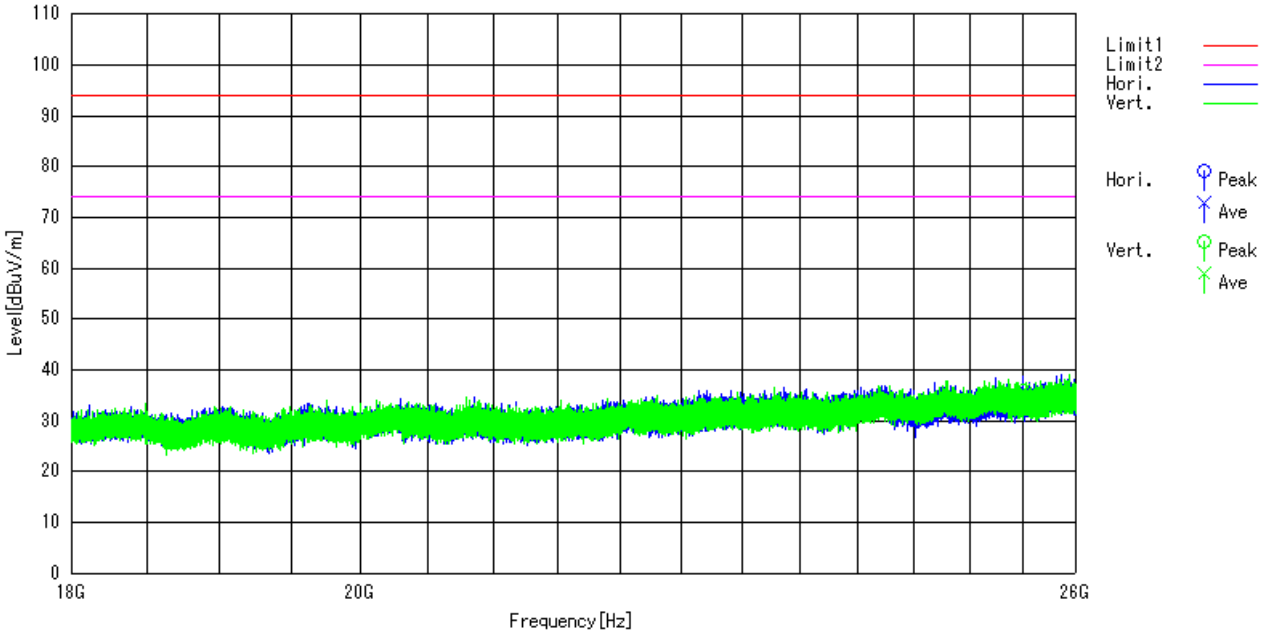
EIRP (dBm) = Resding (dBuV) + C. Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26H3

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (18 GHz -26 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	25500.00	21.7	14.2	78.8	35.9	93.9	73.9	15.1	38.0	Vert.
2	25500.00	21.7	14.2	78.8	35.9	93.9	73.9	15.1	38.0	Hori.

Calculation method
Peak Result = Reading + C. Fac + PDF = 21.7 + 14.2 + 42.9 = 78.8
Average Result = Reading + C. Fac + PDF – DFC = 21.7 + 14.2 + 42.9 – 42.9 = 35.9

IC Result

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	25500.00	21.7	14.2	-79.3	-41.3	38.0	Vert.
2	25500.00	21.7	14.2	-79.3	-41.3	38.0	Hori.

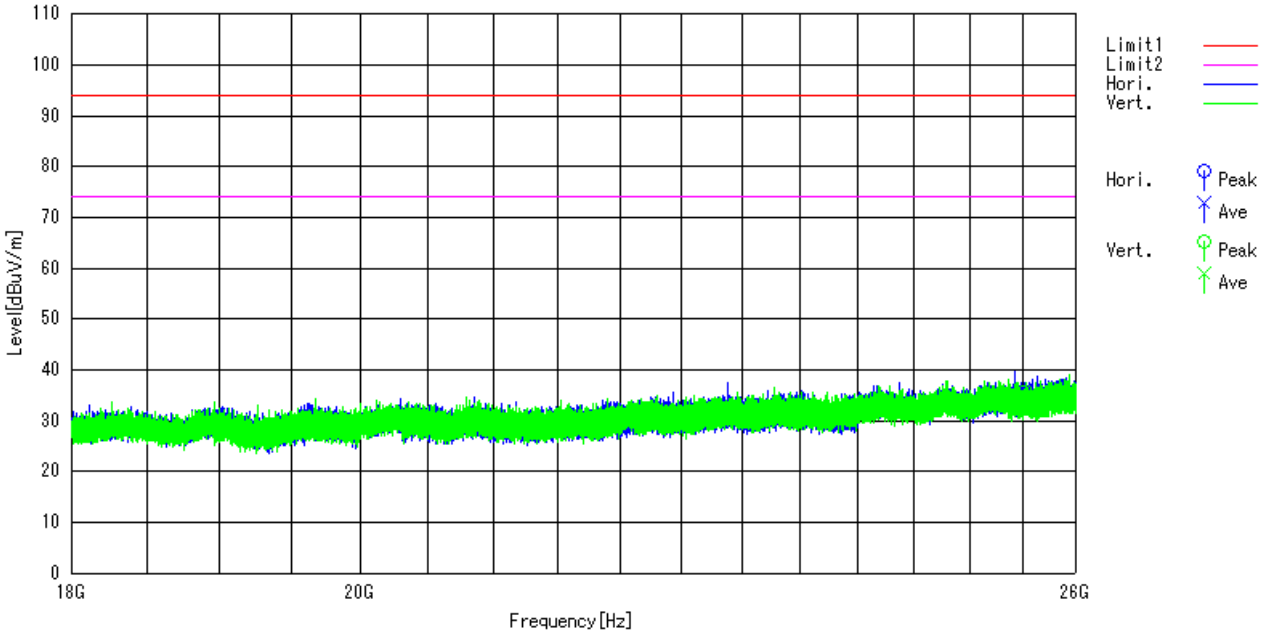
Calculation method
EIRP (dBm) = Resding (dBuV) + C. Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26H1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (18 GHz -26 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	25500.00	21.5	14.2	78.6	35.7	93.9	73.9	15.3	38.2	Vert.
2	25500.00	21.5	14.2	78.6	35.7	93.9	73.9	15.3	38.2	Hori.

Calculation method
Peak Result = Reading + C. Fac + PDF = 21.5 + 14.2 + 42.9 = 78.6
Average Result = Reading + C. Fac + PDF – DFC = 21.5 + 14.2 + 42.9– 42.9 = 35.7

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	25500.00	21.5	14.2	-79.5	-41.3	38.2	Vert.
2	25500.00	21.5	14.2	-79.5	-41.3	38.2	Hori.

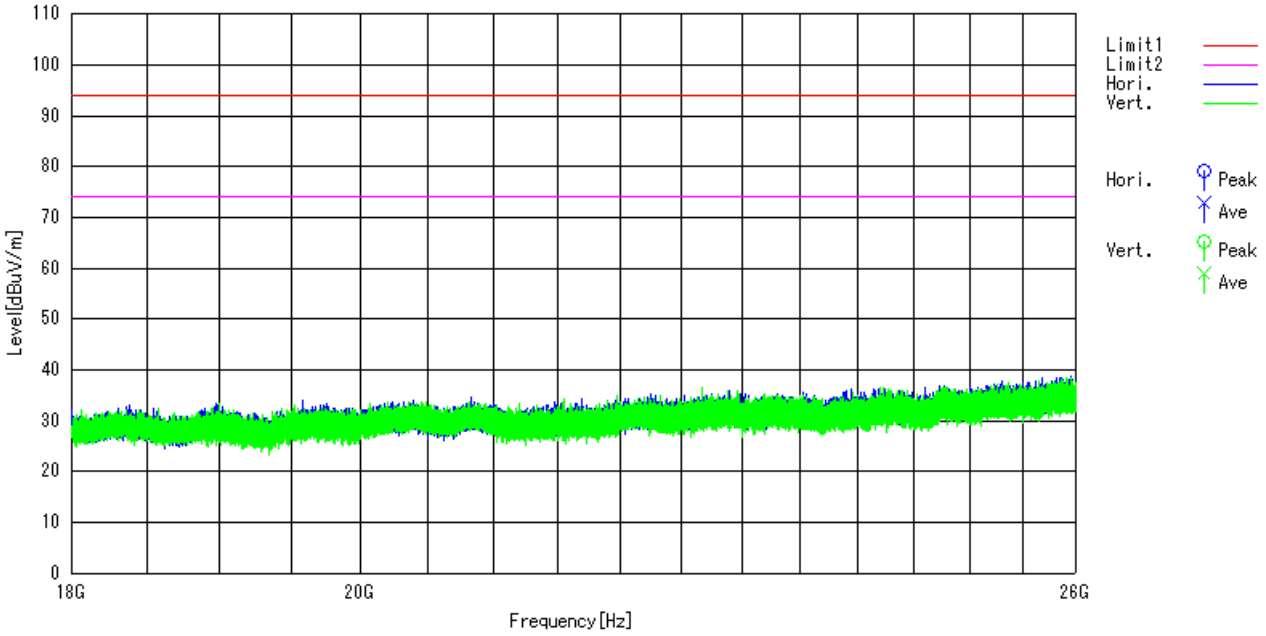
Calculation method
EIRP (dBm) = Resding (dBuV) + C. Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (18 GHz -26 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	25500.00	20.0	14.2	77.1	34.2	93.9	73.9	16.8	39.7	Vert.
2	25500.00	20.0	14.2	77.1	34.2	93.9	73.9	16.8	39.7	Hori.

Calculation method
Peak Result = Reading + C. Fac + PDF = 20.0 + 14.2 + 42.9 = 77.1
Average Result = Reading + C. Fac + PDF – DFC = 20.0 + 14.2 + 42.9 – 42.9 = 34.2

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	25500.00	20.0	14.2	-81.0	-41.3	39.7	Vert.
2	25500.00	20.0	14.2	-81.0	-41.3	39.7	Hori.

Calculation method
EIRP (dBm) = Resding (dBuV) + C. Fac (dB/m) + 20 log (0.3 m) -104.77

2.5.5 Between 26 GHz to 40 GHz (In the Plastic Tank)

Test equipment used (refer to List of utilized test equipment)

AC01	PR20	SA06	CL40	SH03

Test Result:

Tested Date: April 3, 2013

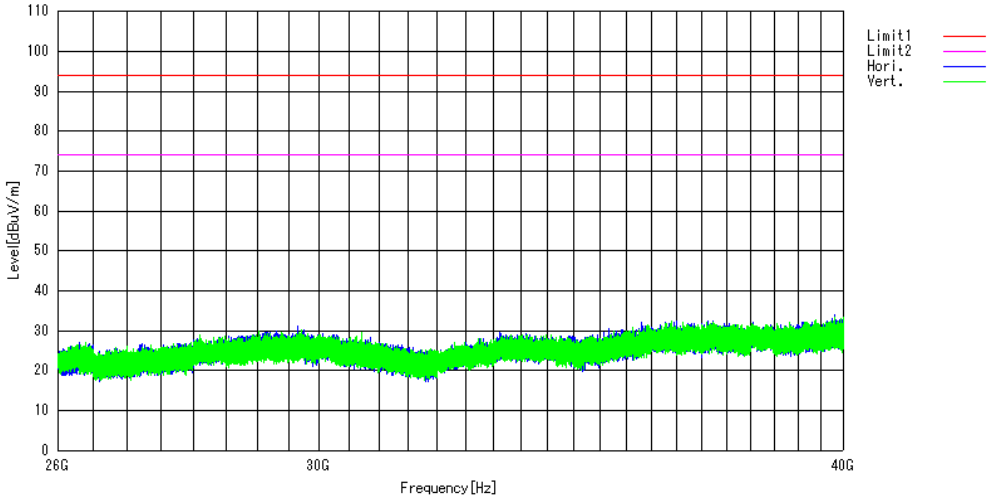
Temperature: 20 ˚C
Humidity: 58 %
Atmos. Press: 993 hPa

Model Name: MWLM-PR26H7

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (26 GHz -40 GHz)

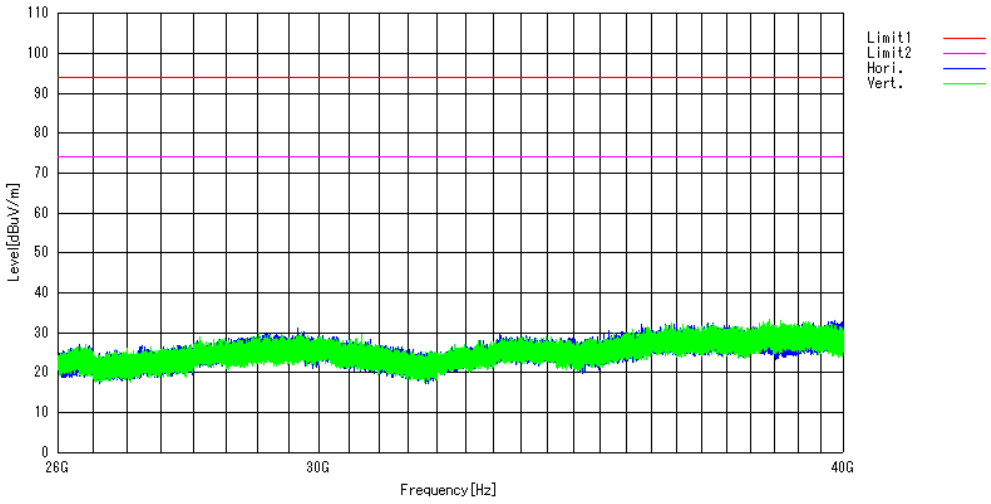


Model Name: MWLM-PR26H3

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (26 GHz -40 GHz)

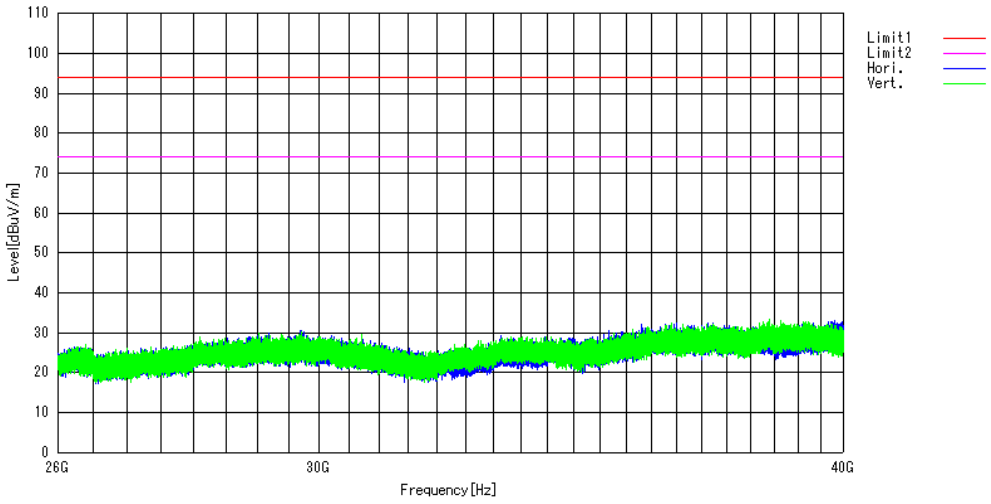


Model Name: MWLM-PR26H1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no emissions greater than noise floor.

Graphical express of test result (26 GHz -40 GHz)

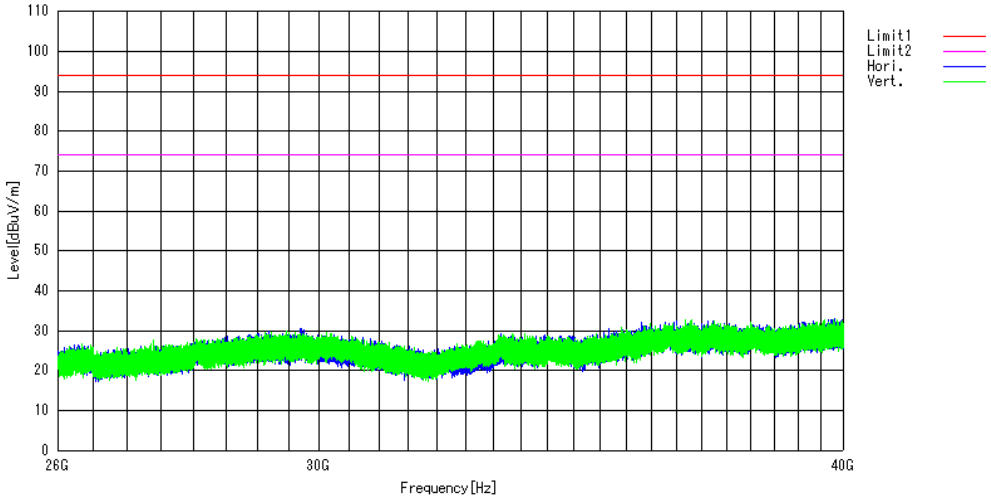


Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (outside the operating frequency range) = -51.3 dBm@ 3m,
IC Limit (inside the operating frequency range) = -41.3 dBm@ 3m,
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

There were no spurious emissions greater than noise floor.

Graphical express of test result (26 GHz -40 GHz)



2.5.6 Between 40 GHz to 60 GHz

Test equipment used (refer to List of utilized test equipment)

AC01(EG)	SH05	SA06	MX01R

Test Result:

Tested Date: April 30, 2013

Temperature: 20 ˚C
Humidity: 55 %
Atmos. Press: 1007 hPa

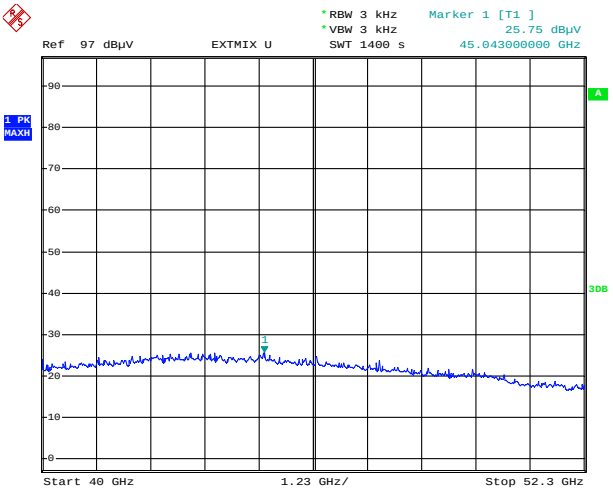
Limit:

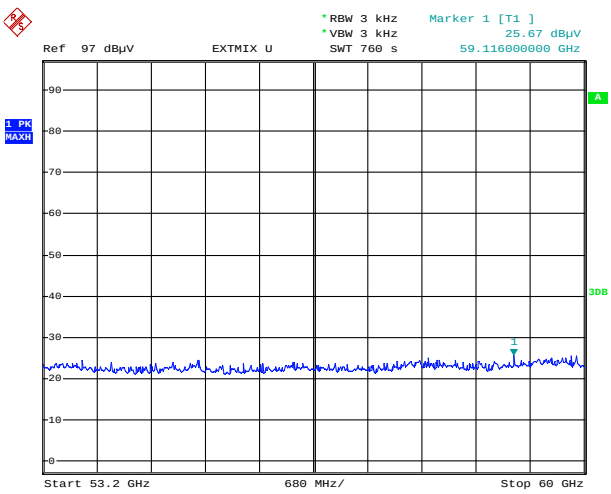
Above 960 MHz limit: 53.9 dBuV/m @3m
Measurement distance: 0.03m -> limit: 93.9 dBuV/m@0.03m
Calculation method: 20 log (3 / 0.03) = 40dB 53.9 + 40 = 93.9 dBuV/m@0.03 m

Model Name: MWLM-PR26H7
Model Name: MWLM-PR26H3
Model Name: MWLM-PR26H1
Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.03 m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

FCC measurements requiring 1 MHz RBW's were deemed impractical due to the fact that no radiated emissions were escaping from the closed tank; the EUT was investigated and measured using 3 kHz, and 1 MHz RBWs. No reportable emissions were found; all emissions were at or below the noise floor of the instrumentation, hence the EUT complies with the limit.





2.5.7 Between 60 GHz to 90 GHz

Test equipment used (refer to List of utilized test equipment)

AC01	SH07	SA06	MX02R

Limit:

Above 960 MHz limit: 53.9 dBuV/m @3m
Measurement distance: 0.03m -> limit: 93.9 dBuV/m@0.03m
Calculation method: 20 log (3 / 0.03) = 40dB 53.9 + 40 = 93.9 dBuV/m@0.03 m

Test Result:

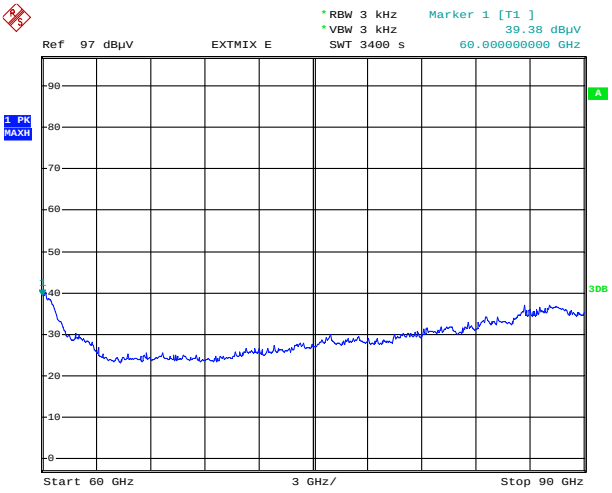
Tested Date: April 30, 2013

Temperature: 20 ˚C
Humidity: 55 %
Atmos. Press: 1007 hPa

Model Name: MWLM-PR26H7
Model Name: MWLM-PR26H3
Model Name: MWLM-PR26H1
Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.03 m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

FCC measurements requiring 1 MHz RBW's were deemed impractical due to the fact that no radiated emissions were escaping from the closed tank; the EUT was investigated and measured using 3 kHz, and 1 MHz RBWs. No reportable emissions were found; all emissions were at or below the noise floor of the instrumentation, hence the EUT complies with the limit.



2.5.8 Between 90 GHz to 110 GHz

Test equipment used (refer to List of utilized test equipment)

AC01	SH09	SA06	MX03R

Limit:

Above 960 MHz limit: 53.9 dBuV/m @3m
Measurement distance: 0.03m -> limit: 93.9 dBuV/m@0.03m
Calculation method: 20 log (3 / 0.03) = 40dB 53.9 + 40 = 93.9 dBuV/m@0.03 m

Tested Date: April 30, 2013

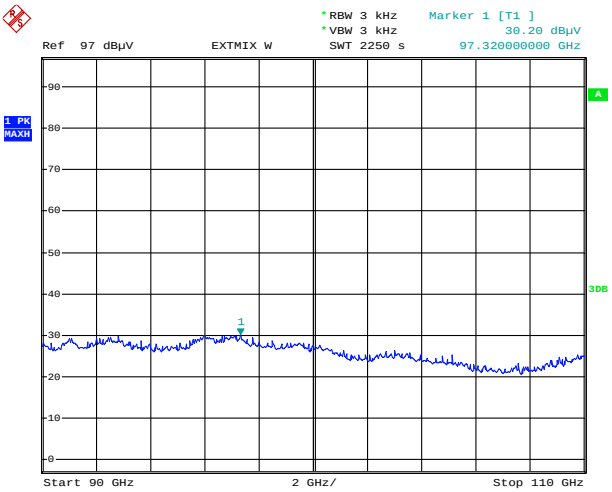
Temperature: 20 ˚C
Humidity: 55 %
Atmos. Press: 1007 hPa

Model Name: MWLM-PR26H7
Model Name: MWLM-PR26H3
Model Name: MWLM-PR26H1
Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.03 m
RBW = 3 kHz, VBW = 3 kHz
Detector = Maximum peak

FCC measurements requiring 1 MHz RBW's were deemed impractical due to the fact that no radiated emissions were escaping from the closed tank; the EUT was investigated and measured using 3 kHz, and 1 MHz RBWs. No reportable emissions were found; all emissions were at or below the noise floor of the instrumentation, hence the EUT complies with the limit

.



2.5.9 Restricted bands 22.01 GHz – 23.12 GHz (In the Plastic Tank)

Test equipment used (refer to List of utilized test equipment)

AC01(EG)	PR20	SA06	CL40	SH03

Tested Date: April 3, 2013

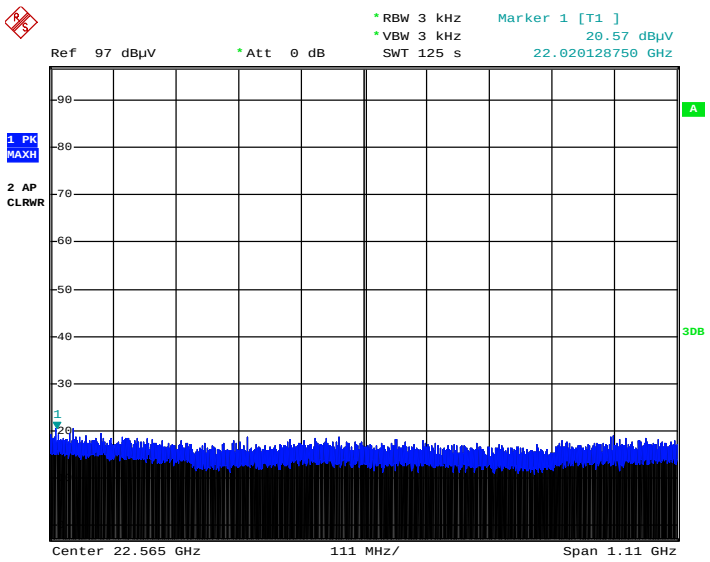
Temperature: 20 ˚C
Humidity: 58 %
Atmos. Press: 993 hPa

Model Name: MWLM-PR26H7

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (22.01 GHz – 23.12 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	22020.129	20.6	13.4	76.9	34.0	93.9	73.9	17.0	39.9	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 20.6 + 13.4 + 42.9 = 76.9
Average Result = Reading + C. Fac + PDF – DFC = 20.6 + 13.4 + 42.9 – 42.9 = 34.0

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	22020.129	20.6	13.4	-81.2	-70.0	11.2	Vert.

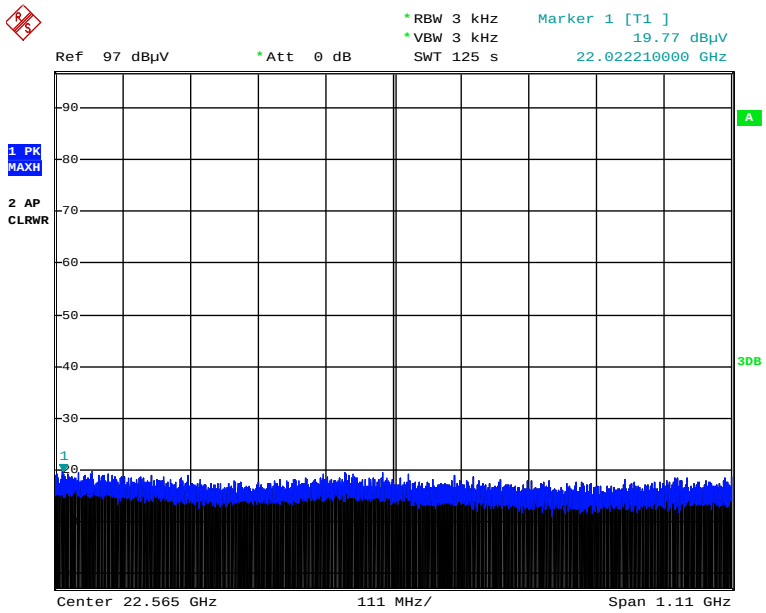
Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26H3

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (22.01 GHz – 23.12 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	22022.100	19.8	13.4	76.1	33.2	93.9	73.9	17.8	40.7	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 19.8 + 13.4 + 42.9 = 76.1
Average Result = Reading + C. Fac + PDF – DFC = 19.86 + 13.4 + 42.9 – 42.9 = 33.2

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	22022.100	19.8	13.4	-82.0	-70.0	12.0	Vert.

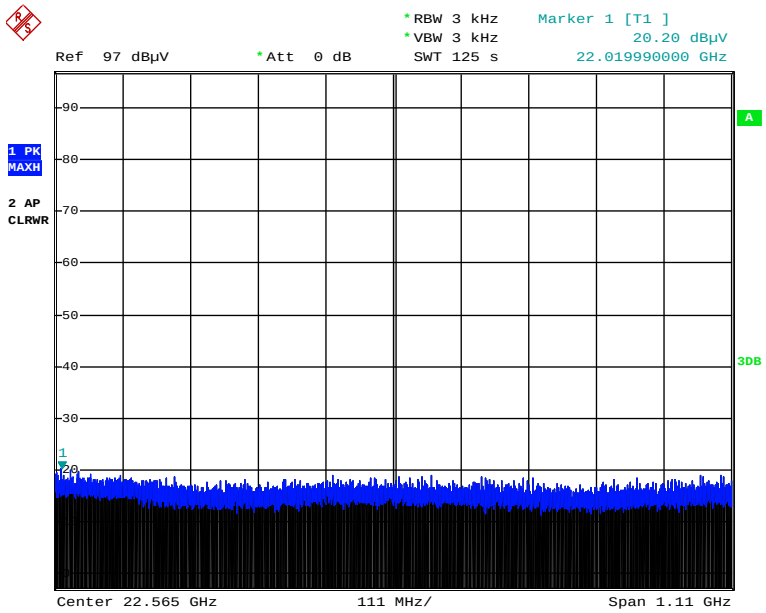
Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26H1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (22.01 GHz – 23.12 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	22019.990	20.2	13.4	76.50	33.6	93.9	73.9	17.4	40.3	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 20.2 + 13.4 + 42.9 = 76.50
Average Result = Reading + C. Fac + PDF – DFC = 20.2 + 13.4 + 42.9 – 42.9 = 33.6

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	22019.990	20.2	13.4	-81.6	-70.0	11.6	Vert.

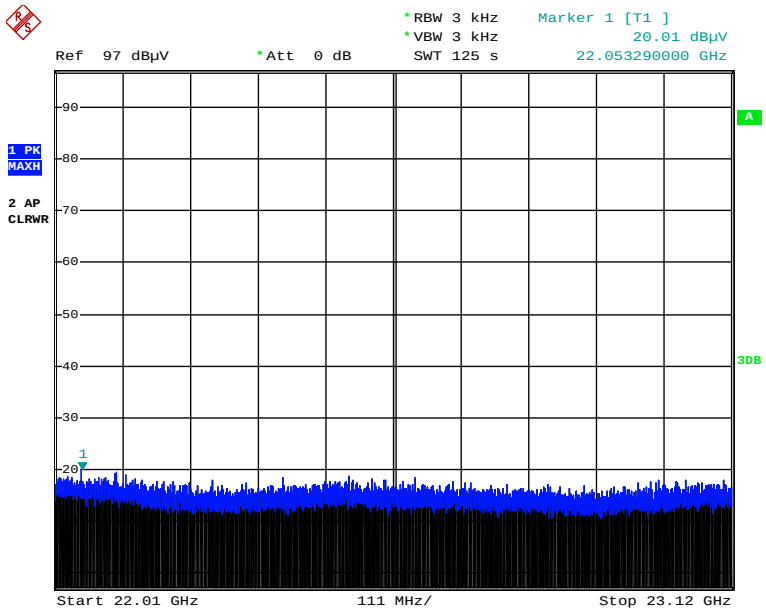
Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (22.01 GHz – 23.12 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin dB	Antenna Polarization
1	22053.290	20.0	13.4	76.3	33.4	93.9	73.9	17.6	40.5	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 20.0 + 13.4 + 42.9 = 76.3
Average Result = Reading + C. Fac + PDF – DFC = 20.0 + 13.4 + 42.9 – 42.9 = 33.4

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Av] dBm	Limit[Av] dBm	Margin dB	Antenna Polarization
1	22053.290	20.0	13.4	-61.8	-50.0	11.8	Vert.

Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

2.5.10 Restricted bands 23.6 GHz – 24.0 GHz (In the Plastic Tank)

Test equipment used (refer to List of utilized test equipment)

AC01(EG)	PR20	SA06	CL28	CL24	SH03

Tested Date: April 3, 2013

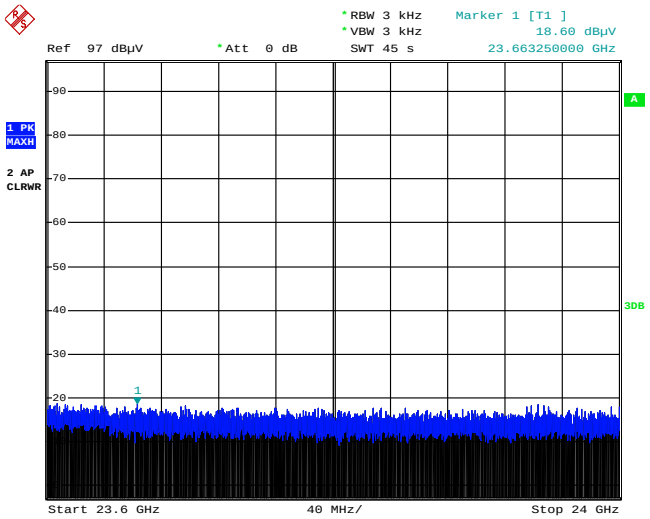
Temperature: 20 ˚C
Humidity: 58 %
Atmos. Press: 993 hPa

Model Name: MWLM-PR26H7

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (23.6 GHz – 24.0 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	23663.250	18.6	14.1	75.6	32.7	93.9	73.9	18.3	41.2	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 18.6 + 14.1 + 42.9 = 75.6
Average Result = Reading + C. Fac + PDF – DFC = 18.6 + 14.1 + 42.9 – 42.9 = 32.7

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	23663.250	18.6	14.1	-82.5	-70.0	12.5	Vert.

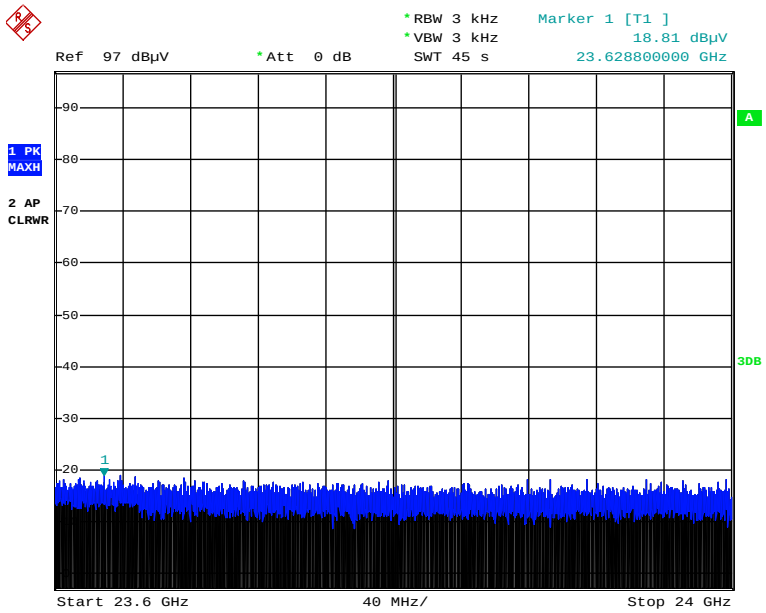
Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26H3

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (23.6 GHz – 24.0 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	23628.800	18.8	14.1	75.8	32.9	93.9	73.9	18.1	41.0	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 18.8 + 14.1 + 42.9 = 75.8
Average Result = Reading + C. Fac + PDF – DFC = 18.8 + 14.1 + 42.9 – 42.9 = 32.9

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	23628.800	18.8	14.1	-82.3	-70.0	12.3	Vert.

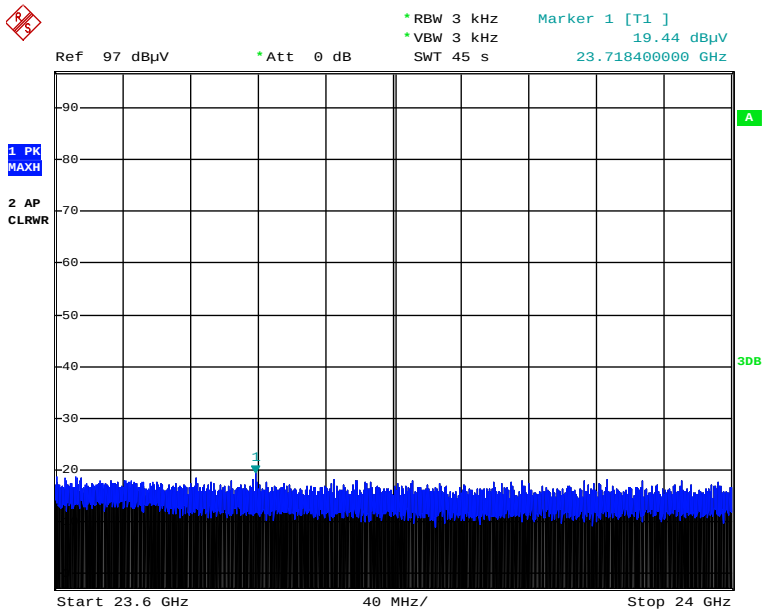
Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26H1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (23.6 GHz – 24.0 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	23718.400	19.4	14.1	76.4	33.5	93.9	73.9	17.5	40.4	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 19.4 + 14.1 + 42.9 = 76.4
Average Result = Reading + C. Fac + PDF – DFC = 19.4 + 14.1 + 42.9 – 42.9 = 33.5

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	23718.400	19.4	14.1	-81.7	-70.0	11.7	Vert.

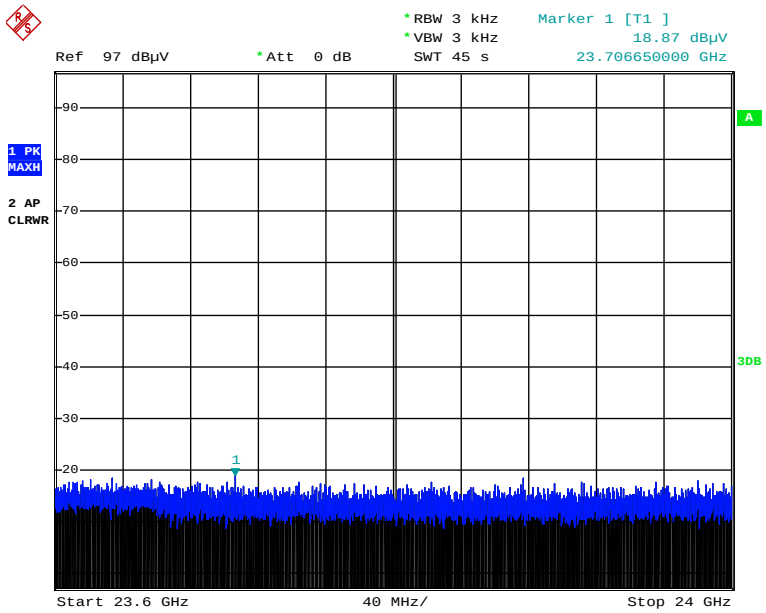
Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode
Measurement distance: 0.3 m
FCC Limit = 53.9 dBuV/m@ 3m, 73.9 dBuV/m @ 0.3m
Calculation method: 20 log (3 / 0.3) = 20 dB 53.9 + 20 = 73.9 dBuV/m @ 0.3 m
IC Limit (Restricted bands) = -70 dBm @ 3m
RBW = 3 kHz, VBW = 3 kHz

There were no spurious emissions greater than noise floor.

Graphical express of test result (23.6 GHz – 24.0 GHz)



FCC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[Pk] dBuV/m	Result[Av] dBuV/m	Limit[Pk] dBuV/m	Limit[Av] dBuV/m	Margin [Pk]dB	Margin [Av]dB	Antenna Polarization
1	23706.650	18.9	14.1	75.9	33.0	93.9	73.9	18.0	40.9	Vert.

Calculation method
Peak Result = Reading + C. Fac + PDF = 18.9 + 14.1 + 42.9 = 75.9
Average Result = Reading + C. Fac + PDF – DFC = 18.9 + 14.1 + 42.9 – 42.9 = 33.0

IC Result:

No	Frequency MHz	Reading [Pk]dBuV	C.Fac dB/m	Result[EIRP] dBm	Limit[EIRP] dBm	Margin dB	Antenna Polarization
1	23706.650	18.9	14.1	-82.2	-70.0	12.2	Vert.

Calculation method
EIRP = Reading (dBuV) + C.Fac (dB/m) + 20 log (0.3 m) -104.77

2.5.11 Transmitter output power (RSS-210 A11.2 (c))

Limit:
The transmitter output power shall not exceed 8 mill watts average power at the connector to the antenna.
8 mW = 9dBm

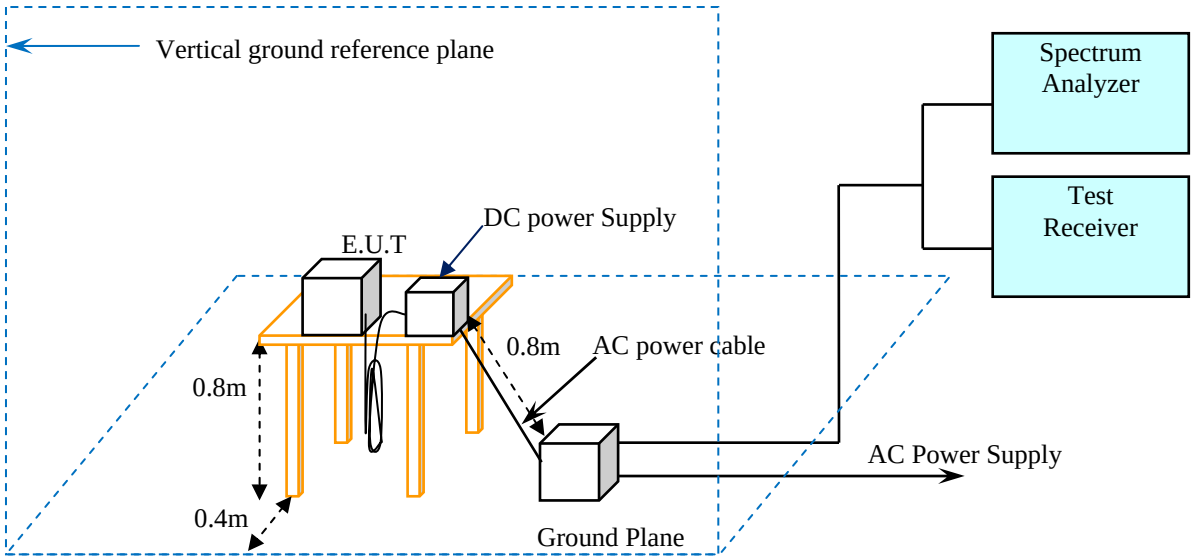
Calculation method:
$P_{av} = P_{peak} + 10 \log_{10} Tx_{on} / (Tx_{on} + Tx_{off})$

Result:
Peak power reading = -30.0dBm
PDF = - 42.9 dB
Peak power = -30.0 + 42.9 = 12.9 dBm
$P_{av} = P_{peak} + 10 \log_{10} Tx_{on} / (Tx_{on} + Tx_{off}) = 12.9 + 10\log_{10} (4ns / 559ns) = -8.5dBm$

Test results - Complied with requirement.

2.6 Transmitter AC power line conducted emissions

Test setup
Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 “General requirements for EUT equipment arrangements and operation” and Annex H.1 “AC power line conducted emission measurements setup”.



Test procedure
Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 7, clause 13.1.3 and Annex H.2 “AC power line conducted emission measurements”.
Exploratory measurements were used the spectrum analyzer to identify the frequency of the emission that has the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable positions, and with a typical system equipment configuration and arrangement.
Final ac power line conducted emission measurements were performed based on the exploratory tests.
The EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit are selected for the final measurement.
When the measurement value is greater than average limitation the average detection measurements were performed.

Applicable rule and limitation

§15.207 (a) AC power line conducted limits

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.
The lower limit applies at the band edges.

Test equipment used (refer to List of utilized test equipment)

TR09	LN05	CL18	LN06

Test results - Complied with requirement.

Test Data

Tested Date: April 9, 2013

Temperature: 18 ˚C
Humidity: 40 %
Atmos. Press: 1010 hPa

Model Name: MWLM-PR26H7

Operating mode: Normal Operating mode

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	14.401	36.4	27.7	10.2	46.6	37.9	60.0	50.0	13.4	12.1	Va
2	**15.465**	**37.1**	**29.3**	**10.3**	**47.4**	**39.6**	**60.0**	**50.0**	**12.6**	**10.4**	**Vb**
3	20.049	28.2	21.4	10.4	38.6	31.8	60.0	50.0	21.4	18.2	Va
4	21.101	29.8	22.7	10.4	40.2	33.1	60.0	50.0	19.8	16.9	Vb
5	24.000	30.7	27.9	10.5	41.2	38.4	60.0	50.0	18.8	11.6	Vb
6	24.000	30.7	27.9	10.5	41.2	38.4	60.0	50.0	18.8	11.6	Va

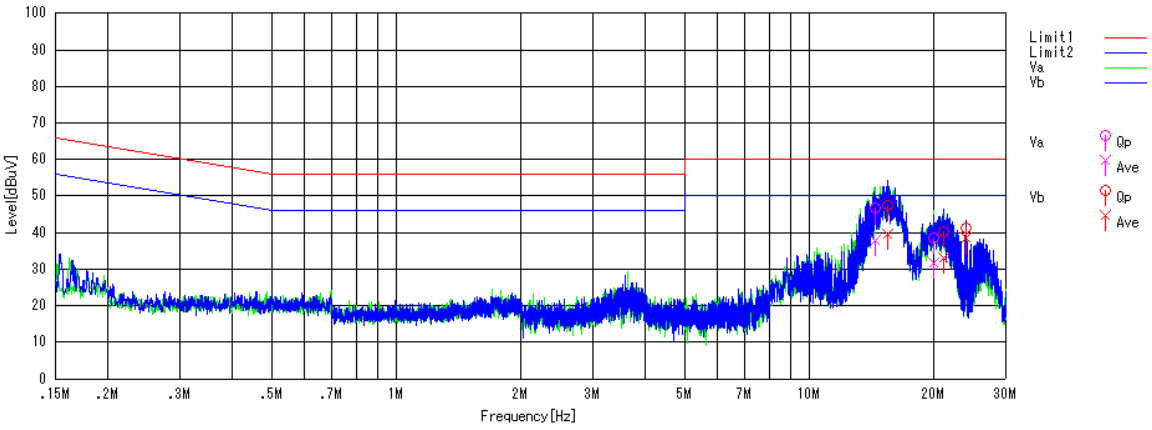
The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 15.465 MHz AV result as follow:

Result [dBuV] = Reading + C.F = 29.3 + 10.3 = 39.6 [dBuV]
Margin = Limit – Result = 50.0 – 39.6 = 10.4 [dB]

Graphical express of test result (0.15 MHz-30MHz)



Model Name: MWLM-PR26H3

Operating mode: Normal Operating mode

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	15.294	35.4	28.8	10.3	45.7	39.1	60.0	50.0	14.3	10.9	Va
2	**15.558**	**36.1**	**29.4**	**10.3**	**46.4**	**39.7**	**60.0**	**50.0**	**13.6**	**10.3**	**Vb**
3	20.005	28.7	20.5	10.4	39.1	30.9	60.0	50.0	20.9	19.1	Va
4	21.101	29.6	23.4	10.4	40.0	33.8	60.0	50.0	20.0	16.2	Vb
5	24.000	30.7	28.1	10.5	41.2	38.6	60.0	50.0	18.8	11.4	Vb
6	24.000	28.4	27.2	10.5	38.9	37.7	60.0	50.0	21.1	12.3	Va

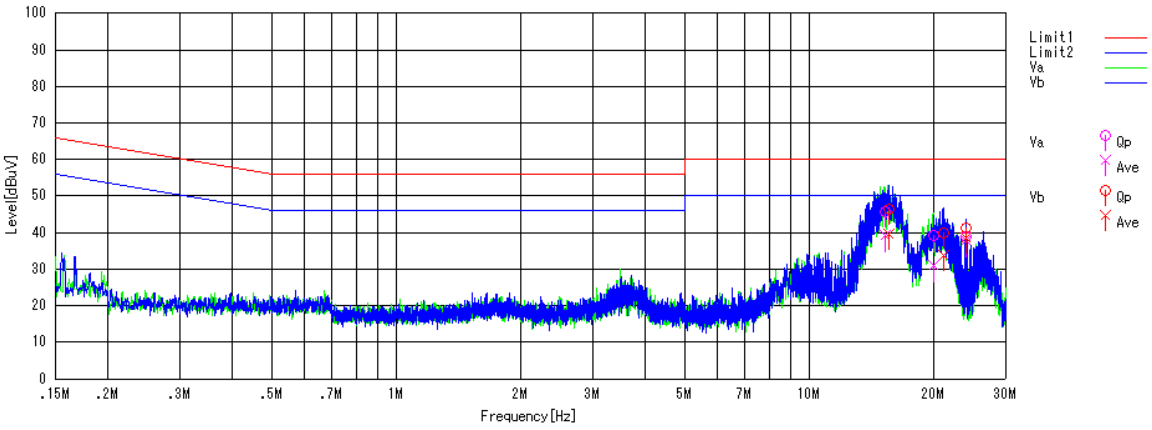
The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 15.558 MHz AV result as follow:

Result [dBuV] = Reading + C.F = 29.4 + 10.3 = 39.7 [dBuV]
Margin = Limit – Result = 50.0 – 39.7 = 10.3 [dB]

Graphical express of test result (0.15 MHz-30MHz)



Model Name: MWLM-PR26H1

Operating mode: Normal Operating mode

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	**15.197**	**35.4**	**28.6**	**10.3**	**45.7**	**38.9**	**60.0**	**50.0**	**14.3**	**11.1**	**Va**
2	15.267	34.9	27.8	10.3	45.2	38.1	60.0	50.0	14.8	11.9	Vb
3	20.713	28.6	22.3	10.4	39.0	32.7	60.0	50.0	21.0	17.3	Vb
4	21.215	29.5	22.3	10.4	39.9	32.7	60.0	50.0	20.1	17.3	Va
5	24.000	30.8	28.4	10.5	41.3	38.9	60.0	50.0	18.7	11.1	Vb
6	24.000	30.9	27.8	10.5	41.4	38.3	60.0	50.0	18.6	11.7	Va

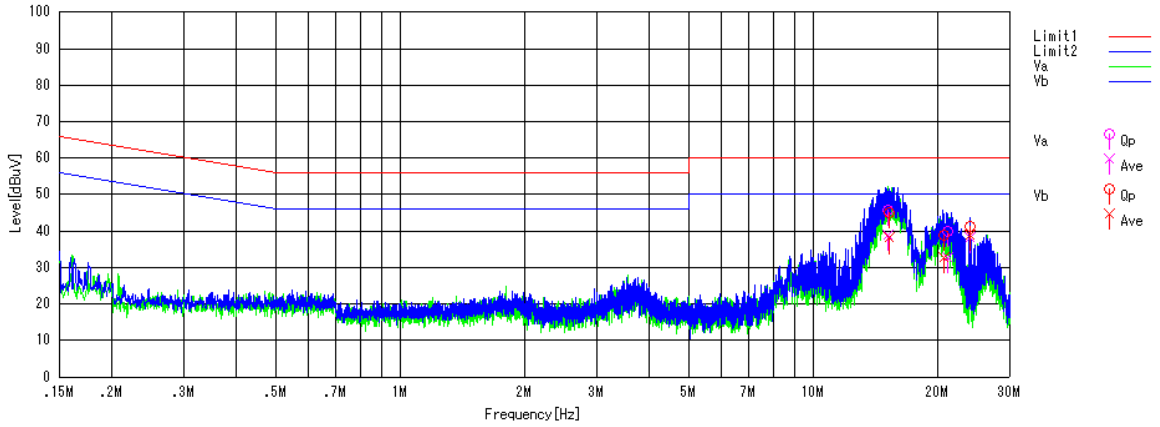
The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 15.197 MHz AV result as follow:

Result [dBuV] = Reading + C.F = 28.6 + 10.3 = 38.9 [dBuV]
Margin = Limit – Result = 50.0 – 38.9 = 11.1 [dB]

Graphical express of test result (0.15 MHz-30MHz)



Model Name: MWLM-PR26C1

Operating mode: Normal Operating mode

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
1	15.012	36.0	28.3	10.3	46.3	38.6	60.0	50.0	13.7	11.4	Va
2	**15.716**	**35.3**	**28.9**	**10.3**	**45.6**	**39.2**	**60.0**	**50.0**	**14.4**	**10.8**	**Vb**
3	21.083	30.0	22.9	10.4	40.4	33.3	60.0	50.0	19.6	16.7	Va
4	21.206	28.5	21.4	10.4	38.9	31.8	60.0	50.0	21.1	18.2	Vb
5	24.000	30.9	28.4	10.5	41.4	38.9	60.0	50.0	18.6	11.1	Vb
6	24.000	30.9	28.0	10.5	41.4	38.5	60.0	50.0	18.6	11.5	Va

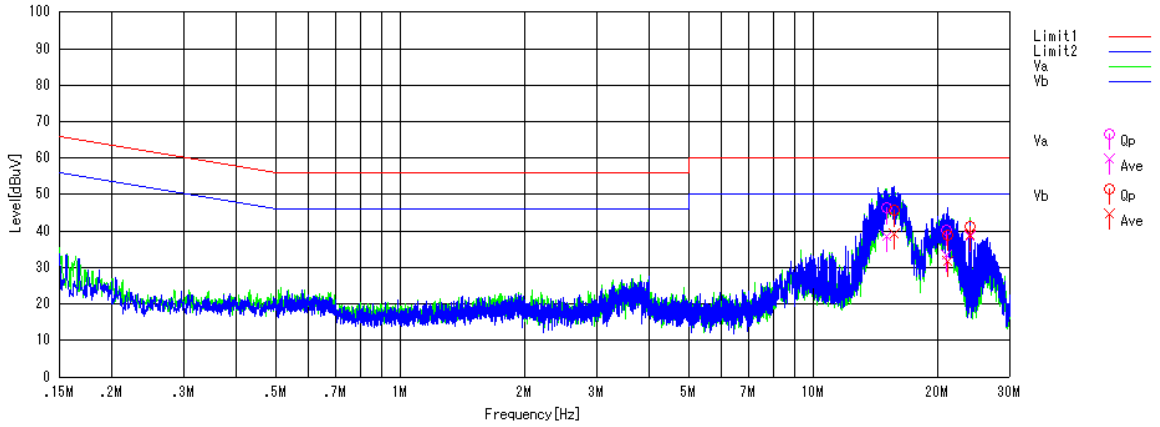
The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 15.716 MHz AV result as follow:

Result [dBuV] = Reading + C.F = 28.9 + 10.3 = 39.2 [dBuV]
Margin = Limit – Result = 50.0 – 39.2 = 10.8 [dB]

Graphical express of test result (0.15 MHz-30MHz)



2.7 RF Exposure Compliance

Per FCC 1.1310 Table 1B, the maximum permissible RF exposure for an uncontrolled environment is 1 mW/cm^2 for the frequencies used in this device. The worst-case power for each antenna at the center frequency of the band of operation is used for the calculation below. The power density at a 20 cm distance is shown for the antenna used. As shown, the calculated power density is well below the FCC's limit. The actual power density for the EUT is calculated as shown below.

$S = (P \times G) / (4 \times \pi \times d^2)$
Where:
S = power density
P = transmitter conducted power in (W)
G = antenna numeric gain
d = distance to radiation center (m)

The EUT power at the input of the antenna is 12.9 dBm – 21.4 dB = -8.5 dBm or 0.141 mW.
-21.4dB is derived from duty cycle = 10*log (PRF*Pulse width) = 10*log (4 ns/559 ns) = -21.4 dB
Where PRF = 1.7889 MHz, and Pulse width = 4 ns.

Frequency (GHz)	Antenna	Antenna Max Gain (dBi)	Numeric Gain	Power (mW)	Separation Distance (cm)	Power Density (mW/cm^2)
25.5	MWLM-PR26H7	25.7	371.5	0.141	20	0.010

Note: The MWLM-PR26H7 Antenna represents the highest antenna gain of all the antennas wrote clause 1.1 of this report. Demonstration of compliance to the FCC's RF Exposure limit using this antenna guarantees that all antennas wrote clause 1.1 meet the FCC's RF Exposure limit.

NOTICE:
Radiation Exposure Statement
This equipment shall only be installed and operated with the antennas listed in clause 1.1 of this report and shall be installed with a minimum of 20 cm of separation distance between the antenna and all persons during normal operation.

Please note that the installation of the EUT in closed tank applications in which tank diameters are always greater than 20 cm satisfy the 20 cm minimum RF exposure distance requirement.

4 List of utilized test equipment/ calibration

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
AC01(EM)	Anechoic Chamber (1st test room)	JSE	203397C	-	2013/4/17	2014/4/30
AC01(EG)	Anechoic Chamber (1st test room)	JSE	203397C	-	2012/11/17	2013/11/30
LP05	Loop Antenna	ETS-Lindgren	6502	00143302	2013/1/24	2014/1/31
BI05	Biconical Antenna	SCHWARZBECK	VHA9103 & BBA9106	91032894	2012/12/3	2013/12/31
LA07	Logperiodic Antenna	SCHWARZBECK	VUSLP9111B	102	2012/12/3	2013/12/31
CL11	Antenna Cable for RE	RFT	-	-	2012/10/1	2013/10/31
CL18	Antenna Cable for CE	RFT	-	-	2012/5/2	2013/5/31
CL24	RF Cable 5.0m	SUCOFLEX	SF104PE	48775/4PE	2012/6/8	2013/6/30
CL28	RF Cable 1.0m	SUHNER	SUCOFLEX104PE	75769	2012/8/24	2013/8/31
CL40	RF Cable 1.0m (40GHz)	SUHNER	SUCOFLEX102	35102	2012/6/14	2013/6/30
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2012/1/27	2014/1/31
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2012/5/10	2013/5/31
LN06	LISN	Kyoritsu	KNW-407F	8-1773-3	2012/5/22	2013/5/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2013/1/15	2014/1/31
PR15	Pre. Amplifier	Anritsu	MH648A	6201156141	2012/6/27	2013/6/30
PR20	Pre. Amplifier (20-40G)	RFT	SL40-B2510	0001	2012/6/15	2013/6/30
SA06	Spectrum Analyzer (F/W: 4.50 SP4)	Rohde & Schwarz	FSP40	100071	2012/11/6	2013/11/30
SA09R	Spectrum Analyzer	Agilent Technologies	E4448A	MY48250086	2013/1/18	2014/1/31
SH01	Standard Horn Antenna (18-26G)	A.H. Systems	SAS-572	208	2012/7/26	2014/7/31
SH03	Standard Horn Antenna (26-40G)	A.H. Systems	SAS-573	150	2013/2/8	2015/2/28
SH05	Standard Horn Antenna (40-60G)	CTEC	261U/383	001	2012/8/15	2013/8/31
SH07	Standard Horn Antenna (60-90G)	Custom Microwave	HO12R	001	2012/8/15	2013/8/31
MX01R	Harmonics mixer (40-60G)	Rohde & Schwarz	FS-Z60	100089	2012/8/15	2013/8/31
MX02R	Harmonics mixer (60-90G)	Rohde & Schwarz	FS-9Z0	100052	2012/8/15	2013/8/31
MX03R	Harmonics mixer (75-110G)	Rohde & Schwarz	FS-Z110	100021	2012/8/15	2013/8/31
SH09	Standard Horn Antenna (75-110G)	Wisewave	ARH-1020-02	995808-01	2012/8/15	2013/8/31
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2012/9/27	2013/9/30

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.