

TEST REPORT

For

RFID Reader

In conformity with

FCC CFR 47 Part15 Subpart C

Model: vPost-C001A001-USA

FCC ID: OOTVPOSTC001A001

Test Item: RFID Reader

Report No: RY1211Z15R1

Issue Date: 15 November, 2012

Prepared for

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Prepared by

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History

Report No.	Date	Revisions	Issued By
RY1211Z15R1	15 November, 2012	Initial Issue	K. Ohnishi

1 General information

1.1 Product description

Test item : RFID Reader
Manufacturer : CHUO ELECTRONICS CO., LTD. Yamanashi akeno factory
Address : 26-1, Azaoosakai, Sannokura, Akeno-cho, Hokuto city, Yamanashi Prefecture
408-0203, Japan
Model : vPost-C001A001-USA
FCC ID : OOTVPOSTC001A001
Serial numbers (Control unit) : 28A0001
Serial numbers (Antenna unit) : 28A0001, 28A0002, 28A0003, 28A0004, 28A0005, 28A0006, 28A0007
28A0008
Transmitting Frequency : 13.56 MHz
Type of Modulation : ASK 100% (Full power Double Sub Carrier)
ASK 100% (Half power Single Carrier)
Hardware version : C001A001
Software version (Control unit) : 1016e
Software version (Antenna unit) : 100B
Operating temperature range : 0 to +40 degree C (Manufacturer declaration)
Receipt date of EUT : 7 November, 2012
Nominal power source voltages : AC 120V, 60Hz

1.2 Co-located transmitter

Item : Wireless Embedded Device Server
FCC ID : R68WIPORTG
Transmitter information : 2400 - 2483.5MHz (802.11b/g)

1.3 Test(s) performed/ Summary of test result

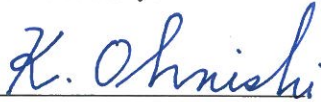
Test specification(s) : FCC CFR 47. Part 15 (October 1, 2010)
Test method(s) : ANSI C63.4: 2003
Test(s) started : 9 November, 2012
Test(s) completed : 14 November, 2012
Purpose of test(s) : Grant for Certification of FCC

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 : 
K. Ohnishi
EMC testing Department

Reviewer : 
T. Ikegami
Manager
EMC testing Department

1.4 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, per October 1, 2010. 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: 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

1.5 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: 2011 “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: ± 3.4 dB (10 kHz – 30 MHz)
Radiated emission (9 kHz - 30MHz): ± 2.9 dB
Radiated emission (30MHz - 200MHz): ± 5.0 dB
Radiated emission (200MHz - 1000MHz): ± 6.2 dB
Radiated emission (1GHz - 26GHz): ± 5.1 dB

1.6 Summary of test results

Requirement of;	Section in FCC15	Result	Section in this report
1.5.1 Occupied bandwidth	-	-	2.1
1.5.2 Transmitter radiated emissions between 9kHz to 30 MHz	15.225 (a),(b),(c), (d)	Complied	2.2.1
1.5.3 Transmitter radiated emissions between 30MHz to 1000 MHz	15.209	Complied	2.2.2
1.5.4 Transmitter radiated emissions above 1GHz	15.209	Complied	2.2.3
1.5.5 Carrier frequency stability	15.225 (e)	Complied	2.3
1.5.6 Transmitter AC power line conducted emissions	15.207	Complied	2.4

The field strength of spurious emission was measured in three orthogonal EUT positions (X-Plane, Y- Plane and Z-Plane).

1.7 Setup of equipment under test (EUT)

1.7.1 Test configuration of EUT

Equipment(s) under test:

	Item	Manufacturer	Model No.	Serial No.
A1	vPost Control Unit	CHUO ELECTRONICS CO., LTD	vPost-C001A0010-USA	28A0001
B1	vPost Antenna Unit 1			28A0001
B2	vPost Antenna Unit 2			28A0002
B3	vPost Antenna Unit 3			28A0003
B4	vPost Antenna Unit 4			28A0004
B5	vPost Antenna Unit 5			28A0005
B6	vPost Antenna Unit 6			28A0006
B7	vPost Antenna Unit 7			28A0007
B8	vPost Antenna Unit 8			28A0008
A2	vPost Control Unit			2XX0001 (for freq. stability)
B9	vPost Antenna Unit			2XX0014 (for freq. stability)
C	AC/DC adaptor	SINPRO	SPU46-108	SPU46-108-P01J002-S
D	Signal Tower	PATLITE	MES-A	-

Support Equipment(s):

	Item	Manufacturer	Model No.	Serial No.

Connected cable(s):

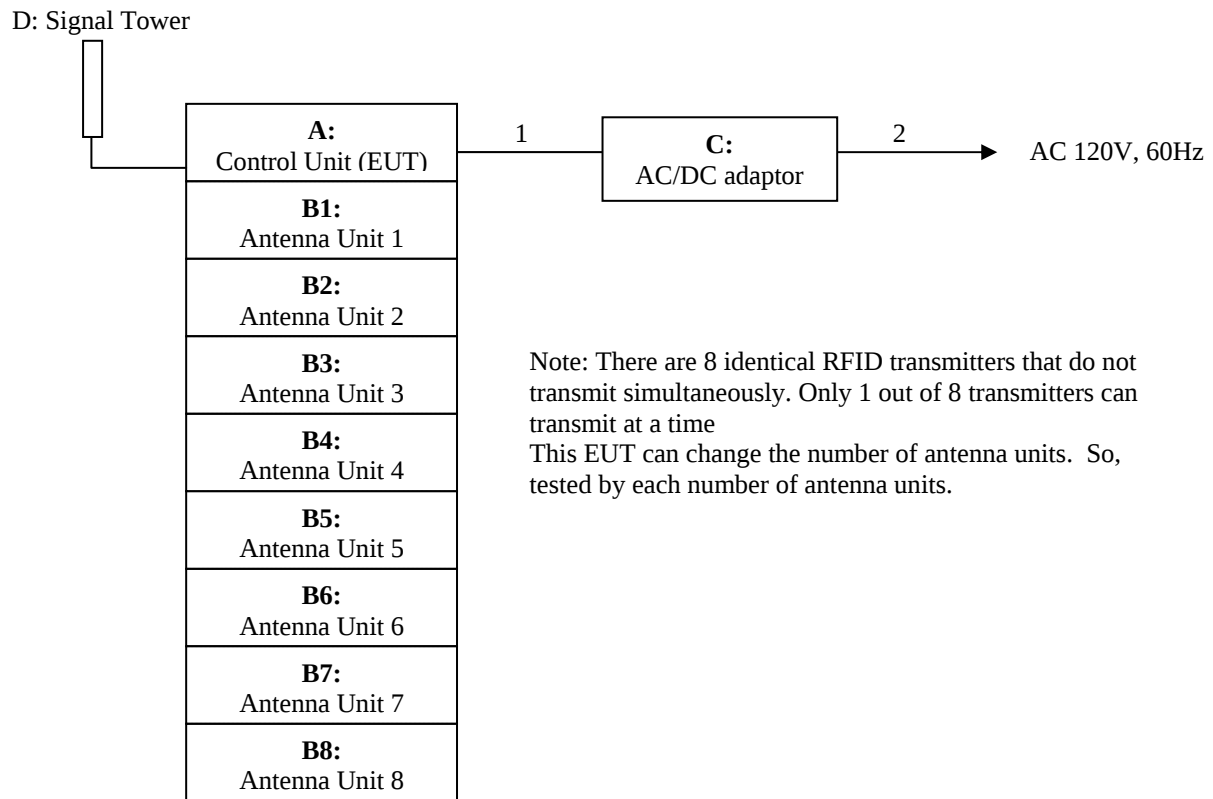
No.	Item	Identification (Manu.e.t.c)	Shielded YES / NO	Ferrite Core YES / NO	Connector Type Shielded YES / NO	Length (m)
1	DC power cable	SINPRO	No	No	No	1.3
2	AC power cable	SINPRO	No	No	No	2.0

1.7.2 Operating condition:

Operating mode:

- Continuous transmission under the test mode (without modulation)
- Continuous transmission under the test mode (ASK100% Full power Double Sub Carrier)
- Continuous transmission under the test mode (ASK100% Half power Single Carrier)
- Continuous transmission under the test mode (802.11 b/g)

1.7.3 Setup diagram of tested system:



1.8 Equipment modifications

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

1.9 Deviation from the standard

No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Occupied bandwidth

Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 13.1.7 “Occupied bandwidth measurements” and Annex H.6 “Occupied bandwidth measurements”.

Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003 13.1.7 “Occupied bandwidth measurements” and Annex H.6 “Occupied bandwidth measurements”.

The spectrum analyzer RBW was set as follows and VBW the video bandwidth shall be set to a value at least three times greater than the RBW.

Fundamental frequency being measured	Minimum instrument bandwidth
9 kHz to 30 MHz	1 kHz
30 MHz to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

Limitation

There are no limitations. The measurement value is used to calculate the emission designator.

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

AC01	LP01	CL11	TR06		
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Test results – Reporting purpose.

Frequency (MHz)	Occupied Bandwidth (kHz)	
	ASK 100%, Full power Double Sub Carrier	ASK 100%, Half power Single Carrier
13.56	2.28	2.28

Test Data

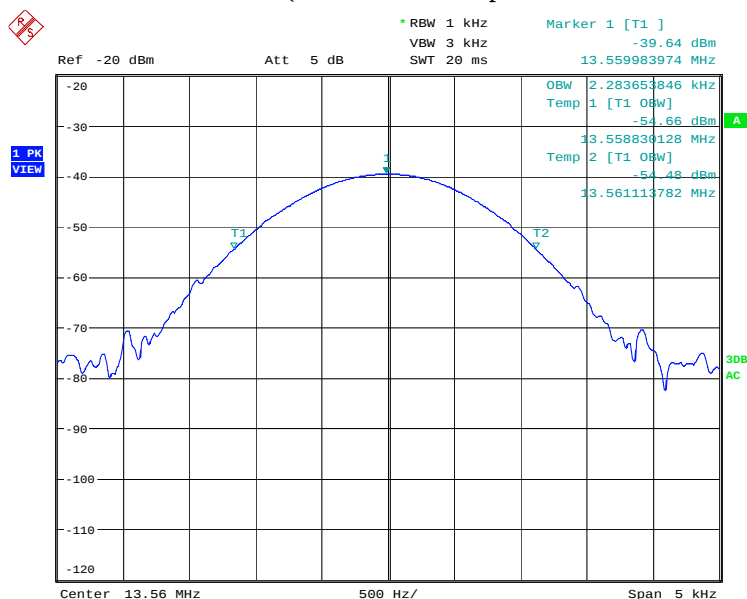
Tested Date: 9 November, 2012

Temperature: 22 degree C

Humidity: 43 %

Atmos. Press: 1015 hPa

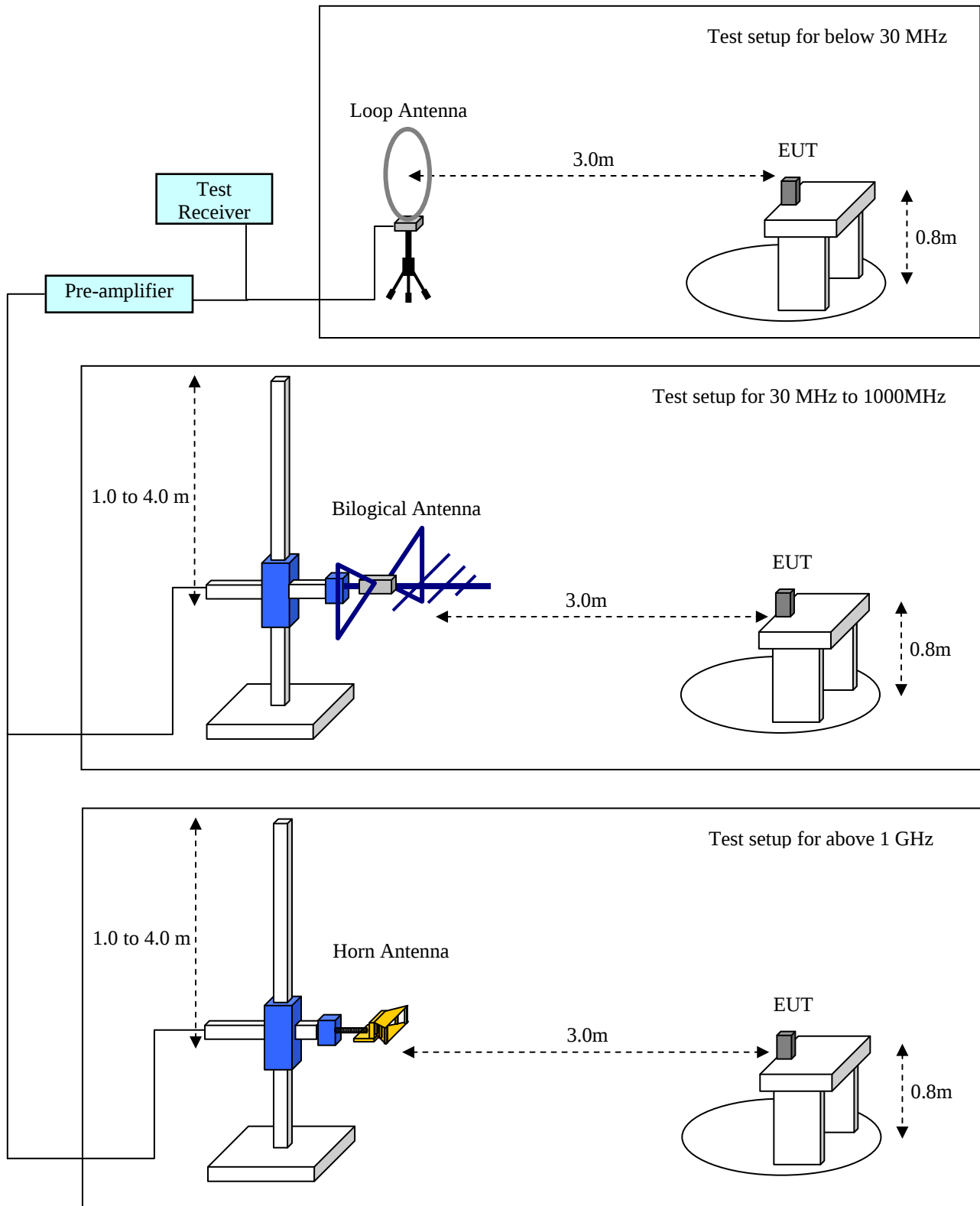
Operating mode: Continuous transmissions (ASK 100%, Full power Double Sub Carrier)



2.2 Transmitter Radiated spurious 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”, 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 clauses 8.2.

The EUT is placed 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.

EUT is placed at three different orientations (X, Y and Z axis) in order to find the worst orientation.

The spectrum analyzer and receiver are set to the followings;

Below 30 MHz:	RBW=10 kHz, VBW= 30 kHz Final measurement is carried out with a receiver RBW of 9 kHz (QP)
Between 30 - 1000 MHz:	RBW=100 kHz, VBW= 300 kHz Final measurement is carried out with a receiver RBW of 120 kHz (QP)
Above 1000 MHz:	Peak measurement- RBW=1 MHz, VBW= 1 MHz Average measurement – RBW=1 MHz, VBW=10 Hz

Applicable rule and limitation

§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.

15.209 (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.

§15.225 Operation within the band 13.110 – 14.010 MHz

Frequency (MHz)	Field strength @30m (uV/m)	Field strength @30m (dBuV/m)	Field strength @3m (dBuV/m)
13.110 - 13.410	106	40.5	80.5
13.410 - 13.553	334	50.5	90.5
13.553 - 13.567	15,848	84.0	124.0
13.567 - 13.710	334	50.5	90.5
13.710 - 14.010	106	40.5	80.5

$\text{dBuV/m} = 20 \times \log(\text{uV/m})$, Corrected distance factor = 40dB / decade (15.31(f))

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the above radiated emission limits in § 15.209.

Test results - Complied with requirement.

2.2.1 Below 30 MHz

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

AC01	LP01	CL11	TR06
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Test Data

Tested Date: 9 November, 2012

Temperature: 22 degree C
Humidity: 43%
Atmos. Press: 1015 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

§15.225(a)/ (b)/ (c) Fundamental emission (Worst condition)

Freq. (MHz)	Number of antenna unit	Transmitting antenna unit	Reading at 3m (dBuV)	Corr. Factor (dB)	Result (dBuV/m)	Limit at 3m (dBuV/m)	Margin (dB)
13.56	8	8	76.7	11.1	87.8	124.0	36.2
	7	7	76.6	11.1	87.7	124.0	36.3
	6	6	73.7	11.1	84.8	124.0	39.2
	5	5	73.7	11.1	84.8	124.0	39.2
	4	4	69.1	11.1	80.2	124.0	43.8
	3	3	67.7	11.1	78.8	124.0	45.2
	2	2	66.6	11.1	77.7	124.0	46.3
	1	1	62.7	11.1	73.8	124.0	50.2

Correction Factor [dB] = Antenna Factor [dB/m] + Cable Loss [dB]

§15.225(d) Harmonics and spurious emission between 9 kHz to 30MHz (refer 15.209 and 15.205)

There were no spurious emissions greater than noise floor or 20dB below the limit.

2.2.2 Between 30 – 1000 MHz

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

AC01	BI01	LA05	BA10	CL11	PR15	TR06
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Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

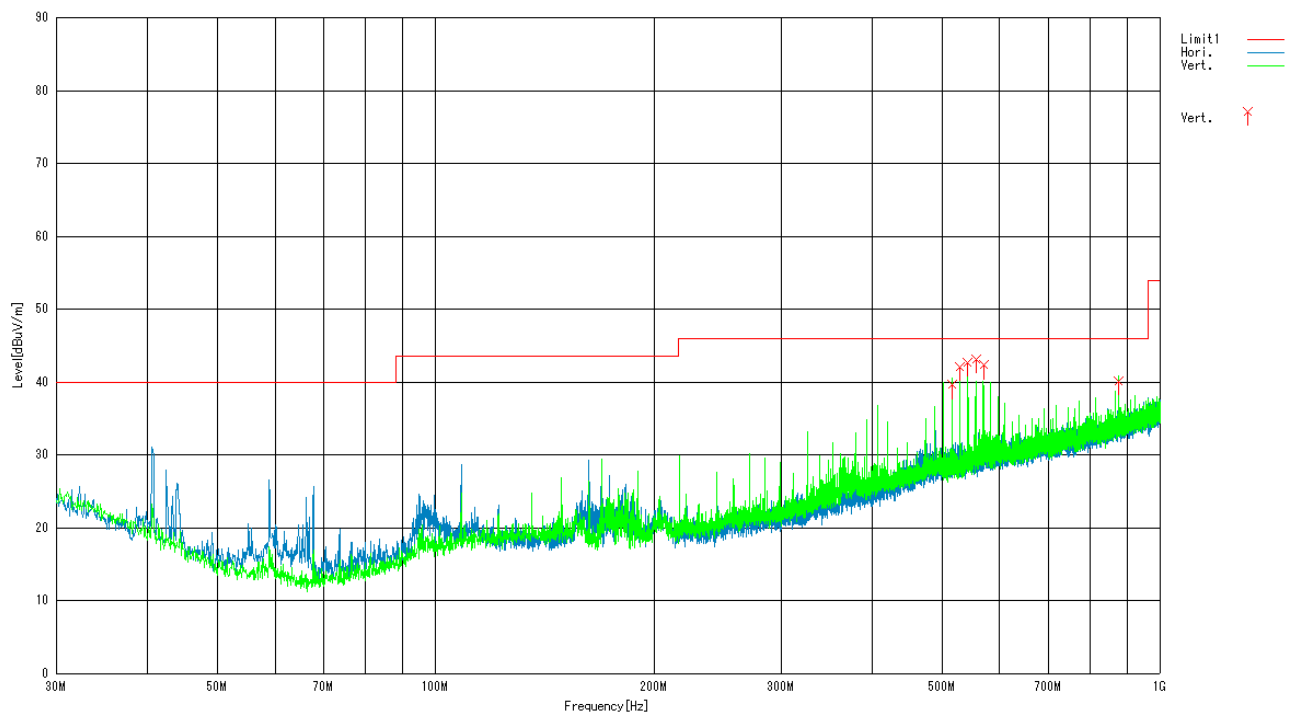
Number of antenna unit: 8 units

Transmitting antenna: Antenna Unit 7 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	515.279	40.0	17.8	11.4	29.6	39.6	46.0	6.4	Vert.
2	528.839	42.2	18.0	11.5	29.6	42.1	46.0	3.9	Vert.
3	542.399	42.6	18.2	11.5	29.6	42.7	46.0	3.3	Vert.
4	555.959	42.7	18.4	11.6	29.6	43.1	46.0	2.9	Vert.
5	569.519	41.6	18.6	11.7	29.6	42.3	46.0	3.7	Vert.
6	874.993	35.8	21.6	13.2	30.5	40.1	46.0	5.9	Vert.



Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

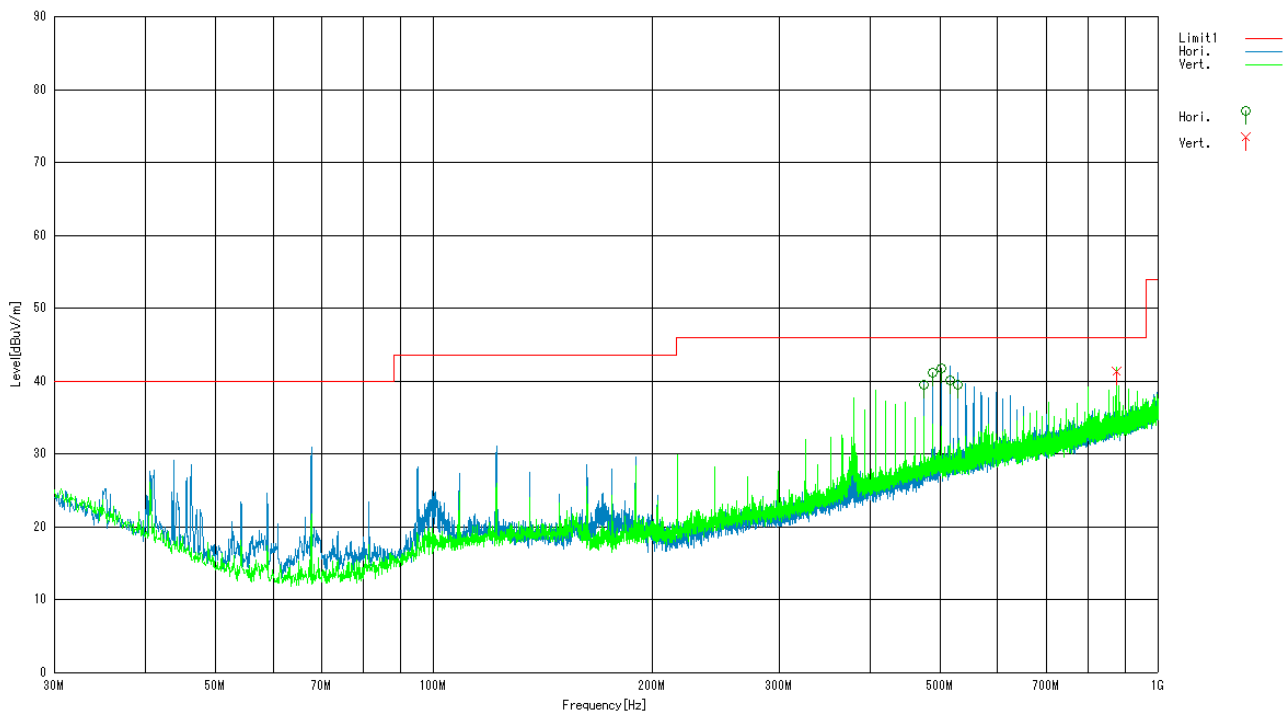
Number of antenna unit: 7 units

Transmitting antenna: Antenna Unit 7 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	474.599	40.9	17.1	11.2	29.7	39.5	46.0	6.5	Hori.
2	488.159	42.3	17.3	11.2	29.6	41.2	46.0	4.8	Hori.
3	501.719	42.5	17.5	11.3	29.6	41.7	46.0	4.3	Hori.
4	515.279	40.5	17.8	11.4	29.6	40.1	46.0	5.9	Hori.
5	528.839	39.6	18.0	11.5	29.6	39.5	46.0	6.5	Hori.
6	874.993	37.0	21.6	13.2	30.5	41.3	46.0	4.7	Vert.



Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

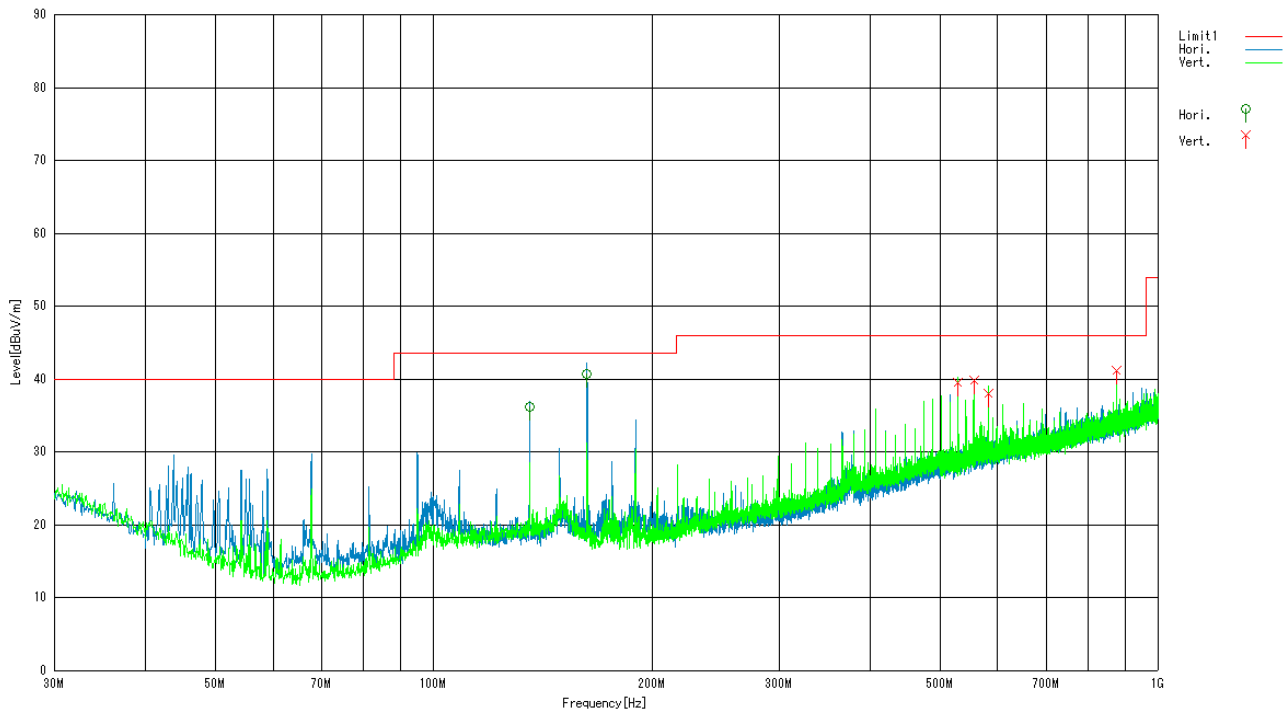
Number of antenna unit: 6 units

Transmitting antenna: Antenna Unit 2 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	135.599	43.9	14.0	8.4	30.1	36.2	43.5	7.3	Hori.
2	162.719	46.7	15.3	8.7	30.0	40.7	43.5	2.8	Hori.
3	528.839	39.6	18.0	11.5	29.6	39.5	46.0	6.5	Vert.
4	555.958	39.4	18.4	11.6	29.6	39.8	46.0	6.2	Vert.
5	583.078	37.1	18.8	11.7	29.6	38.0	46.0	8.0	Vert.
6	874.993	36.9	21.6	13.2	30.5	41.2	46.0	4.8	Vert.



Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

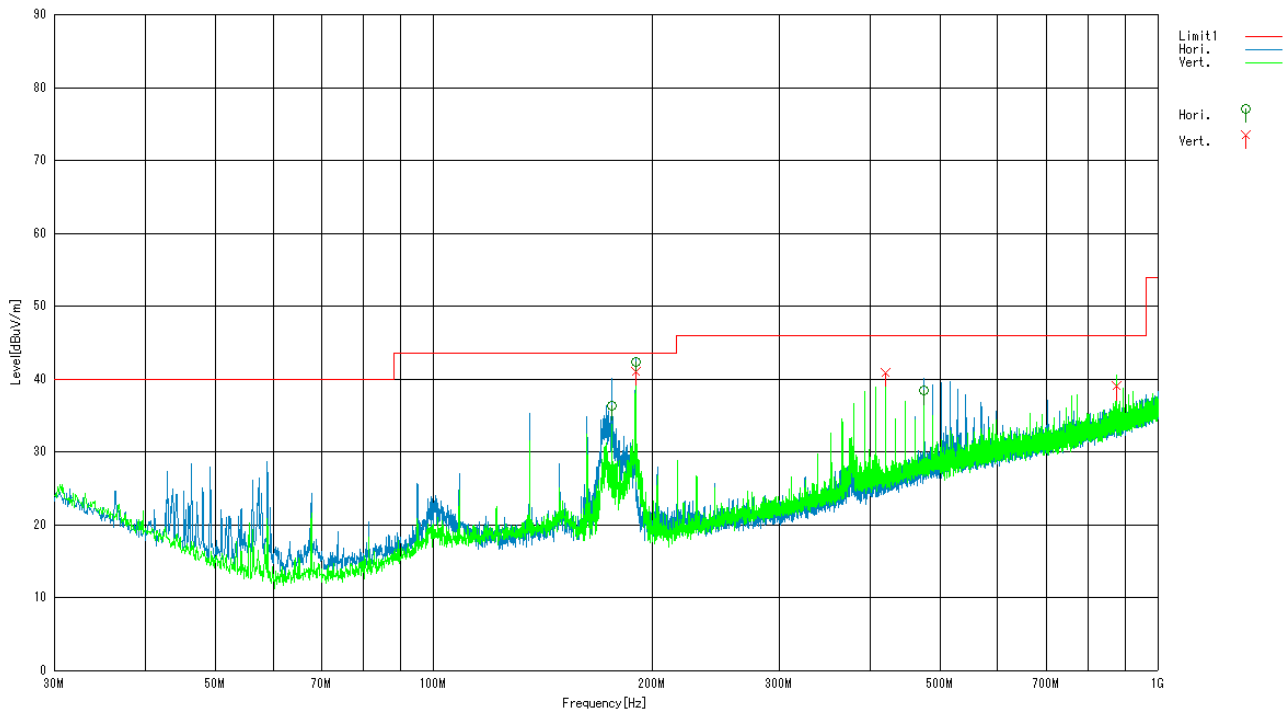
Number of antenna unit: 5 units

Transmitting antenna: Antenna Unit 4 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	176.279	41.5	16.0	8.8	30.0	36.3	43.5	7.2	Hori.
2	189.839	47.1	16.4	8.9	30.0	42.4	43.5	1.1	Hori.
3	189.839	45.7	16.4	8.9	30.0	41.0	43.5	2.5	Vert.
4	420.358	43.9	16.0	10.8	29.8	40.9	46.0	5.1	Vert.
5	474.597	39.8	17.1	11.2	29.7	38.4	46.0	7.6	Hori.
6	874.993	34.7	21.6	13.2	30.5	39.0	46.0	7.0	Vert.



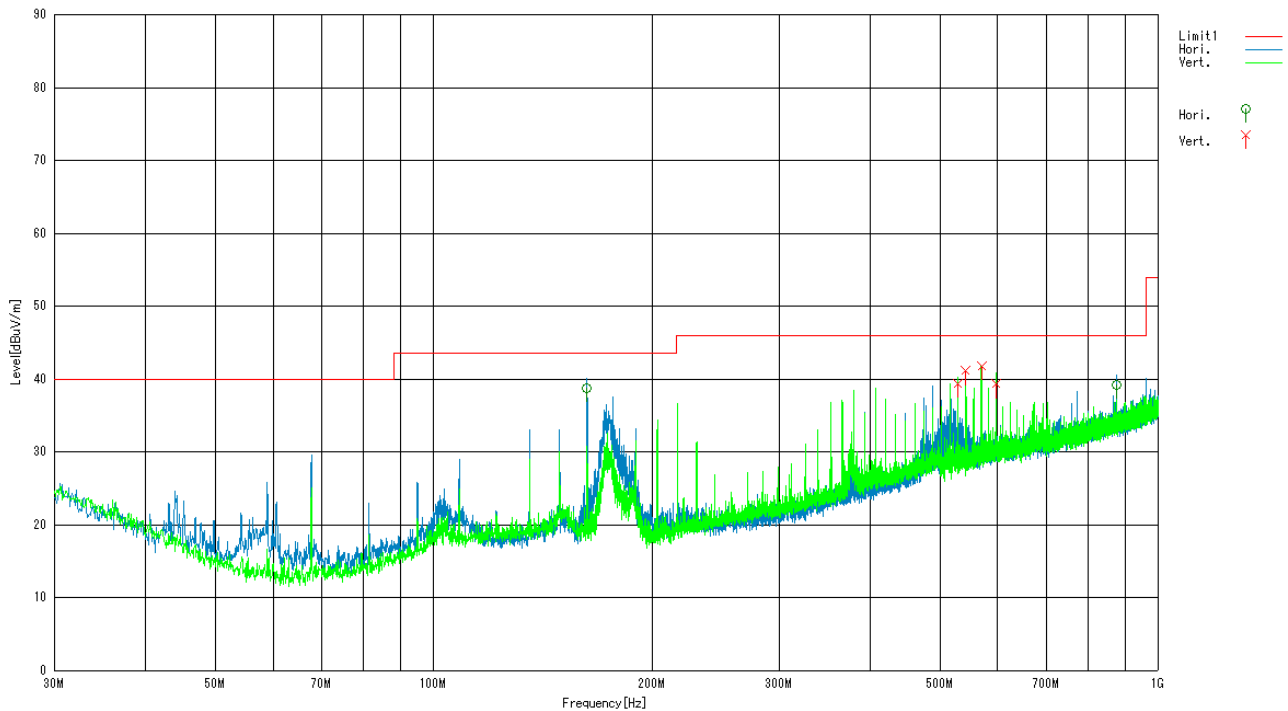
Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)
Number of antenna unit: 4 units
Transmitting antenna: Antenna Unit 1 (Worst condition)
EUT condition: Z-plane (Maximum condition)
Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	162.719	44.8	15.3	8.7	30.0	38.8	43.5	4.7	Hori.
2	528.838	39.5	18.0	11.5	29.6	39.4	46.0	6.6	Vert.
3	542.398	41.0	18.2	11.5	29.6	41.1	46.0	4.9	Vert.
4	569.517	41.1	18.6	11.7	29.6	41.8	46.0	4.2	Vert.
5	596.637	38.0	19.1	11.8	29.6	39.3	46.0	6.7	Vert.
6	874.994	34.9	21.6	13.2	30.5	39.2	46.0	6.8	Hori.



Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

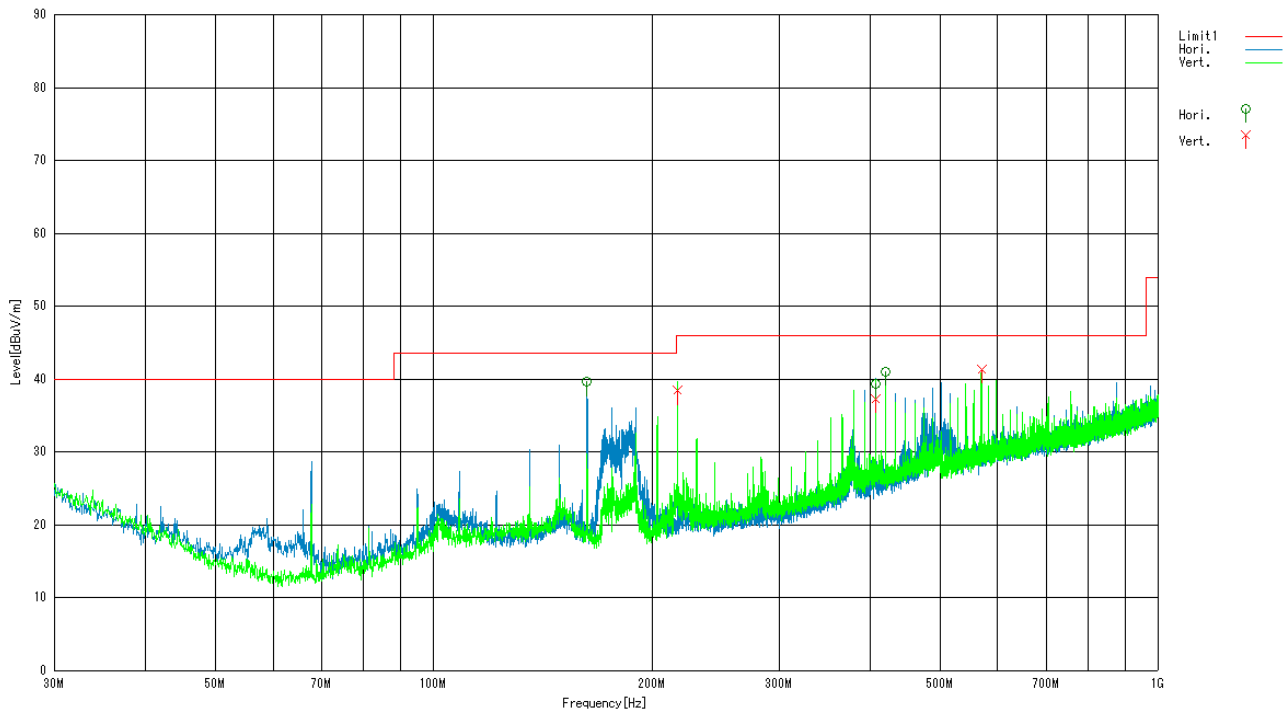
Number of antenna unit: 3 units

Transmitting antenna: Antenna Unit 1 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	162.719	45.6	15.3	8.7	30.0	39.6	43.5	3.9	Hori.
2	216.959	47.8	11.4	9.2	30.0	38.4	46.0	7.6	Vert.
3	406.798	40.8	15.7	10.7	29.9	37.3	46.0	8.7	Vert.
4	406.798	42.9	15.7	10.7	29.9	39.4	46.0	6.6	Hori.
5	420.358	44.0	16.0	10.8	29.8	41.0	46.0	5.0	Hori.
6	569.517	40.6	18.6	11.7	29.6	41.3	46.0	4.7	Vert.



Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)

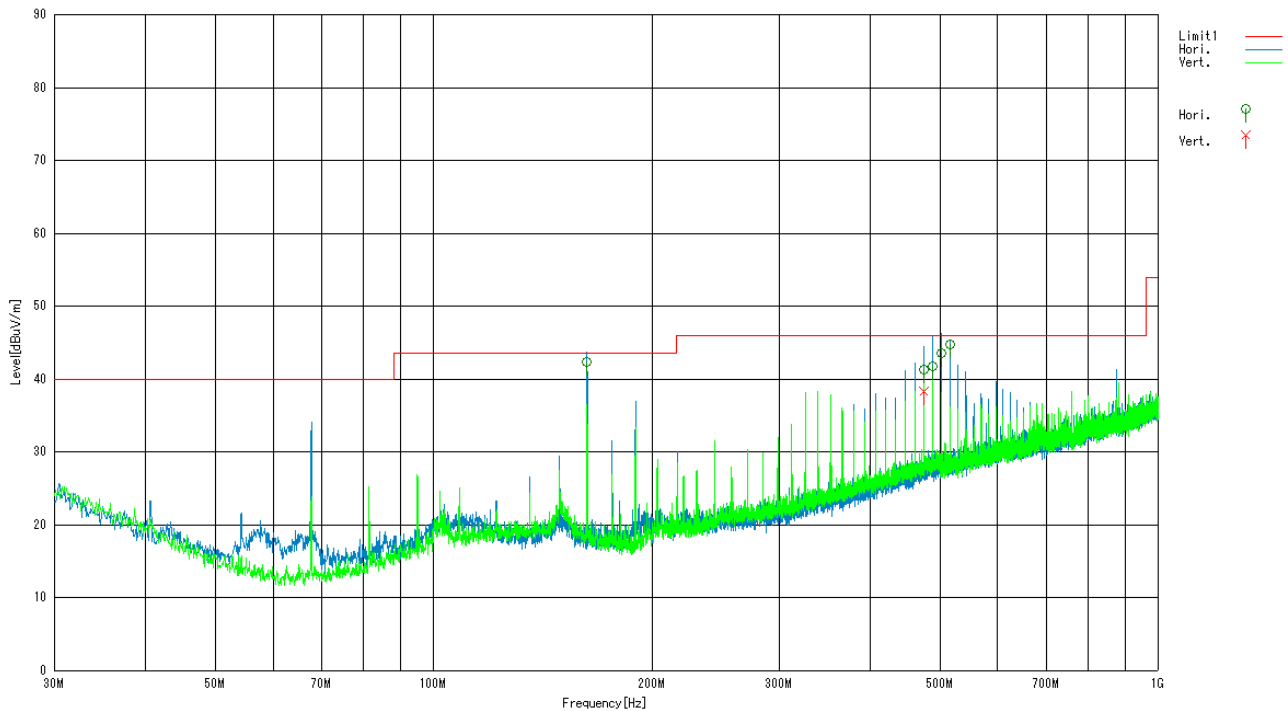
Number of antenna unit: 2 units

Transmitting antenna: Antenna Unit 2 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	162.719	48.4	15.3	8.7	30.0	42.4	43.5	1.1	Hori.
2	474.598	39.7	17.1	11.2	29.7	38.3	46.0	7.7	Vert.
3	474.598	42.7	17.1	11.2	29.7	41.3	46.0	4.7	Hori.
4	488.158	42.9	17.3	11.2	29.6	41.8	46.0	4.2	Hori.
5	501.718	44.4	17.5	11.3	29.6	43.6	46.0	2.4	Hori.
6	515.278	45.2	17.8	11.4	29.6	44.8	46.0	1.2	Hori.



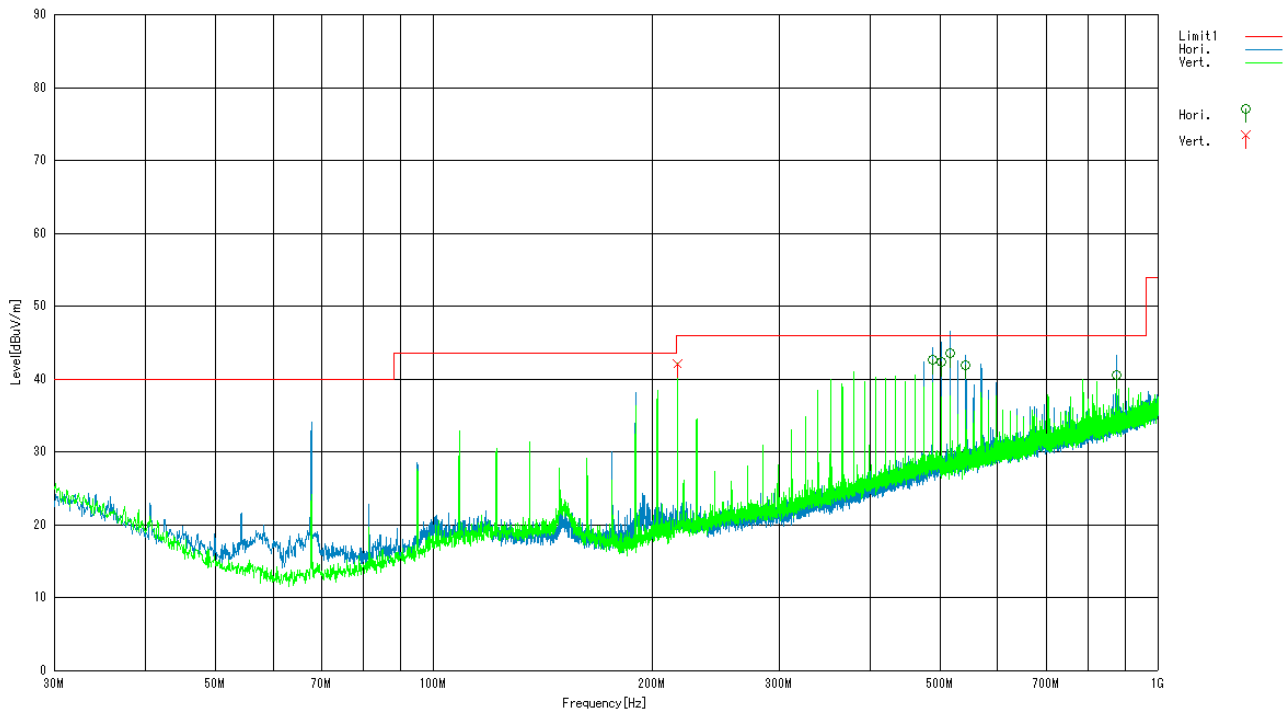
Test Data

Tested Date: 13 November, 2012

Temperature: 20 °C
Humidity: 50 %
Atmos. Press: 1008 hPa

Operating mode: Continuous Communication (Worst configuration: ASK 100% Full Power Double Sub Carrier)
Number of antenna unit: 1 unit
Transmitting antenna: Antenna Unit 1
EUT condition: Z-plane (Maximum condition)
Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	216.959	51.5	11.4	9.2	30.0	42.1	46.0	3.9	Vert.
2	488.158	43.7	17.3	11.2	29.6	42.6	46.0	3.4	Hori.
3	501.718	43.1	17.5	11.3	29.6	42.3	46.0	3.7	Hori.
4	515.278	43.9	17.8	11.4	29.6	43.5	46.0	2.5	Hori.
5	542.397	41.8	18.2	11.5	29.6	41.9	46.0	4.1	Hori.
6	874.993	36.3	21.6	13.2	30.5	40.6	46.0	5.4	Hori.



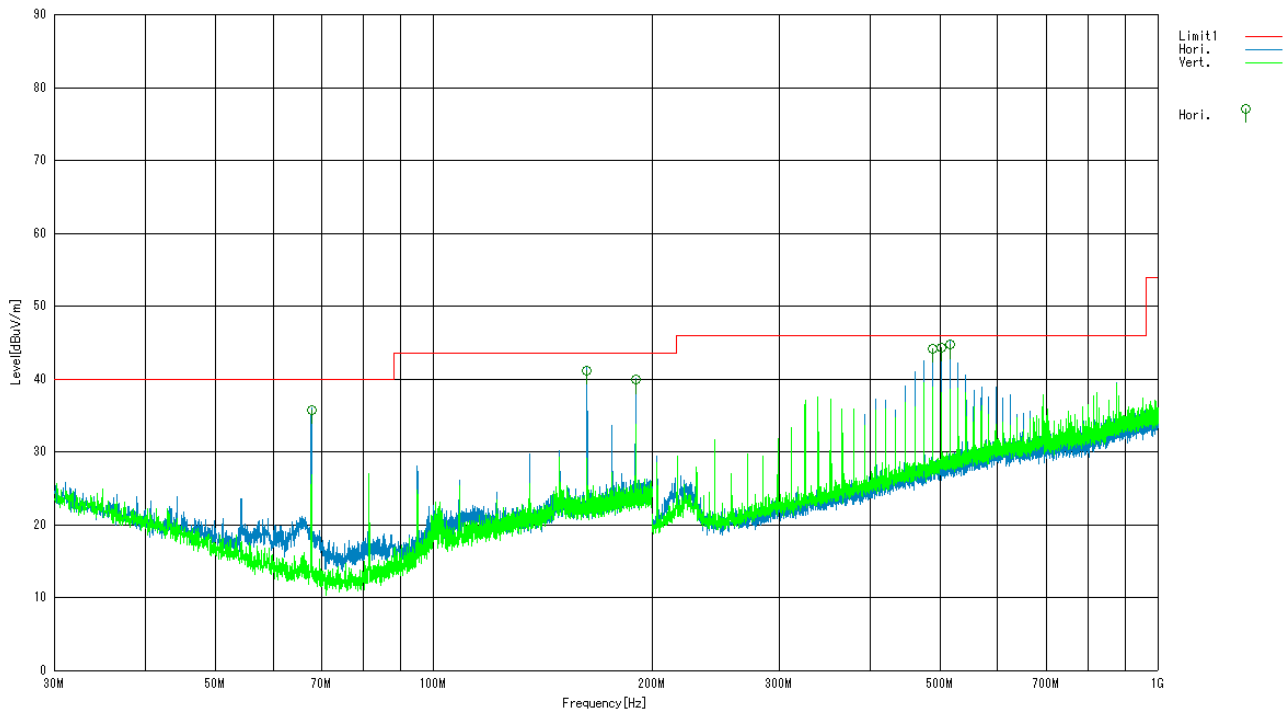
Test Data

Tested Date: 14 November, 2012

Temperature: 20 °C
Humidity: 40 %
Atmos. Press: 1012 hPa

Operating mode: Continuous Communication (ASK 100% Full Power Double Sub Carrier + 802.11b, 2337MHz)
Number of antenna unit: 2 units (Worst condition)
Transmitting antenna: Antenna Unit 2 (Worst condition)
EUT condition: Z-plane (Maximum condition)
Measurement distance: 3 m

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	67.799	51.8	6.7	7.5	30.2	35.8	40.0	4.2	Hori.
2	162.719	47.2	15.3	8.7	30.0	41.2	43.5	2.3	Hori.
3	189.839	44.6	16.4	8.9	30.0	39.9	43.5	3.6	Hori.
4	488.158	45.3	17.3	11.2	29.6	44.2	46.0	1.8	Hori.
5	501.718	45.1	17.5	11.3	29.6	44.3	46.0	1.7	Hori.
6	515.278	45.1	17.8	11.4	29.6	44.7	46.0	1.3	Hori.



2.2.3 Above 1000 MHz

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

AC01	BRF12	CL23	CL24	CL28	CH01	DH01	HPF1	PR12
SH01	TR06							

Test Data

Tested Date: 14 November, 2012

Temperature: 20 °C
 Humidity: 40 %
 Atmos. Press: 1012 hPa

Operating mode: Continuous Communication (ASK 100% Full Power Double Sub Carrier + 802.11b, 2337MHz)

Number of antenna unit: 2 units (Worst condition)

Transmitting antenna: Antenna Unit 2 (Worst condition)

EUT condition: Z-plane (Maximum condition)

Measurement distance: 3 m

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Margin		Polarization
		Peak [dBuV]	Ave [dBuV]		Peak [dBuV]	Ave [dBuV]	Peak [dBuV]	Ave [dBuV]	Peak [dB]	Ave [dB]	
1	2047.553	52.5	48.8	-4.2	48.3	44.6	73.9	53.9	25.6	9.3	Vert.
2	2047.553	53.5	50.4	-4.2	49.3	46.2	73.9	53.9	24.6	7.7	Hori.
3	2074.674	53.0	49.6	-4.1	48.9	45.5	73.9	53.9	25.0	8.4	Vert.
4	2074.674	53.1	49.7	-4.1	49.0	45.6	73.9	53.9	24.9	8.3	Hori.
5	2101.792	53.1	49.5	-4.0	49.1	45.5	73.9	53.9	24.8	8.4	Hori.
6	2101.792	52.5	48.8	-4.0	48.5	44.8	73.9	53.9	25.4	9.1	Vert.

2.3 Frequency stability

Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 clauses 13.1.6.1 "Frequency stability measurements", and Annex H.5 "Frequency measurements".

Test procedure

Measurement procedures were implemented according to the test method of ANSI C63.4: 2003 Annex H5.

Place the de-energized EUT in the temperature test chamber. Supply the EUT with nominal ac voltage, or install a new or fully charged battery in the EUT. An antenna was connected to the antenna output connector of the EUT if possible.

The frequency counter was connected to the measurement antenna with a suitable length of coaxial cable.

The environmental chamber set to the highest temperature specified in applicable regulation.

Allow sufficient time (approximately 30 minutes) for the temperature of the chamber to stabilize.

Turn the EUT on and measure the EUT operating frequency at startup, and two, five, and ten minutes after startup.

The measurements were performed that the temperature chamber set to reduce the lowest temperature specified in applicable regulation.

Applicable rule and limitation

§15.225(e): Frequency tolerance

Test items	Variation ranges		Limit
Temperature variations	-20 to +50 degrees C	120 +/-15% VAC	+/-0.01%

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

TR09	TC01		
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Test results - Complied with requirement.

Test Data

Tested Date: 13 November, 2012

Temperature: 20 degree C

Humidity: 50 %

Atmos. Press: 1008 hPa

Operating Mode: Continuous Transmission (without modulation)

Temp. (Degrees)	Voltages (V)	Measured Frequency (MHz)				Worst Deviation (%)	Limit (%)
		Start-up	2 min.	5 min.	10 min.		
50 *	120	13.559931	13.559931	13.559930	13.559930	0.0005	+/-0.01
40	120	13.559956	13.559954	13.559954	13.559954	0.0003	+/-0.01
30	120	13.559991	13.559987	13.559987	13.559987	0.0001	+/-0.01
20	102	13.560028	13.560024	13.560024	13.560024	-0.0002	+/-0.01
	138	13.560029	13.560025	13.560024	13.560024	-0.0002	+/-0.01
10	120	13.560058	13.560056	13.560056	13.560056	-0.0004	+/-0.01
0	120	13.560074	13.560073	13.560073	13.560073	-0.0005	+/-0.01
-10 *	120	13.560067	13.560069	13.560070	13.560069	-0.0005	+/-0.01
-20 *	120	13.560030	13.560035	13.560035	13.560035	-0.0003	+/-0.01

Note1: Operating temperature range of this product is 0 to 40 degrees C. (Please refer to user manual)

2.4 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
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Test results - Complied with requirement.

Test Data

Tested Date: 14 November, 2012

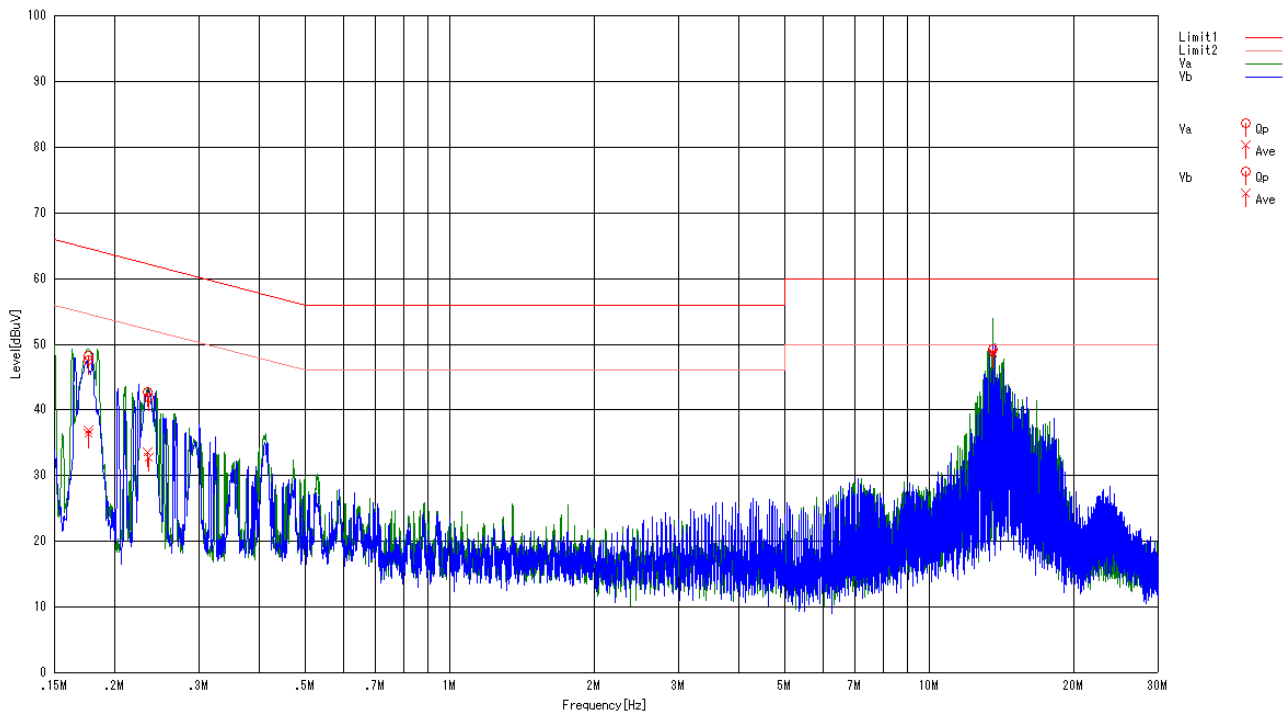
Temperature: 20 °C
Humidity: 40 %
Atmos. Press: 1012 hPa

Operating mode: Continuous Communication (ASK 100% Full Power Double Sub Carrier + 802.11b, 2337MHz)

Number of antenna unit: 8 units

Transmitting antenna: Antenna Unit 8 (with dummy load)

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	0.176	38.1	26.8	10.1	48.2	36.9	64.7	54.7	16.5	17.8	Va
2	0.176	37.4	26.2	10.1	47.5	36.3	64.7	54.7	17.2	18.4	Vb
3	0.234	32.6	23.4	10.1	42.7	33.5	62.3	52.3	19.6	18.8	Va
4	0.235	31.8	22.6	10.1	41.9	32.7	62.3	52.3	20.4	19.6	Vb
5	13.559	39.1	38.6	10.2	49.3	48.8	60.0	50.0	10.7	1.2	Va
6	13.560	39.0	38.3	10.2	49.2	48.5	60.0	50.0	10.8	1.5	Vb



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	Anechoic Chamber (1st test room)	JSE	203397C	-	2012/04/21	2013/04/30
BA10	Biological Antenna	TESEQ	CBL6111D	32342	2012/06/05	2013/06/30
BI01	Biconical Antenna	SCHWARZBECK	VHA9103 & BBA9106	2359	2012/03/12	2013/03/31
BRF12	Band Reject Filter (2400MHz)	M-City	BRF2440-01	RF0012-02	2012/03/22	2013/03/31
CH01	Conical Horn Antenna (12-18GHz)	ETS-Lindgren	3163-05	00126641	2012/07/13	2014/07/31
CL11	Antenna Cable for RE	RFT	-	-	2012/10/01	2013/10/31
CL18	Antenna Cable for CE	RFT	-	-	2012/05/02	2013/05/31
CL23	RF Cable 0.5m	SUHNER	SUCOFLEX104PE	48773	2012/06/08	2013/06/30
CL24	RF Cable 5.0m	SUHNER	SUCOFLEX104PE	48775	2012/06/08	2013/06/30
CL28	RF Cable 1.0m	SUHNER	SUCOFLEX104PE	75769	2012/08/24	2013/08/31
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2012/01/27	2014/01/31
HPF1	High Pass Filter (3500MHz)	TOKIMEC	TF323DCA	603	2012/06/08	2013/06/30
LA05	Logperiodic Antenna	SCHWARZBECK	VUSLP9111B	070	2012/03/12	2013/03/31
LP04	Loop Antenna	EMCO	6502	00058682	2012/09/24	2013/09/30
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2012/05/10	2013/05/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2012/01/24	2013/01/31
PR15	Pre. Amplifier	Anritsu	MH648A	6201156141	2012/06/27	2013/06/30
SH01	Standard Horn Antenna (18-26G)	A.H. Systems	SAS-572	208	2012/07/26	2014/07/31
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2012/09/27	2013/09/30
TR09	Test Receiver (F/W : 4.43 SP3)	Rohde & Schwarz	ESU8	100386	2012/01/10	2013/01/31
TC01	Temperature Chamber	ESPEC	SH-641	92000964	2011/11/18	2012/11/30

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.