TEST REPORT

For

RFID R/W

In conformity with

FCC CFR 47 Part15 Subpart C

Model : TR3-L4D01-24

FCC ID : MK4TR3-L4D01-24

Test Item : RFID R/W

Report No. : ERY1505J07R2

Issue Date : May 7, 2015

Prepared for

TAKAYA Corporation
661-1, Ibara-cho, Ibara-city, Okayama, 715-8503 Japan

Prepared by

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SGS RF Technologies Inc. is managed to ISO17025 and has the necessary knowledge and test facilities for testing according to the referenced standards. The test results in this report apply only to the sample tested.

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History

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ERY1503J09R1	March 9, 2015	Initial Issue	R.Kojima
ERY1503J26R4	March 26, 2015	1.6.1 Test configuration of EUT, EMC Countermeasure(s) 1.6.2 Setup diagram of tested system	R.Kojima
ERY1504J20R1	April 20, 2015	2.4 Frequency Stability (Revise of data)	R.Kojima
ERY1504J20R1	April 20, 2015	2.3 Transmitter radiated spurious emissions between 30MHz to 1000MHz Test data (Add detector)	R.Kojima
ERY1505J07R2	May 7, 2015	1.6.1 Test configuration of EUT EMC countermeasure(s) (Add ferrite core) 1.6.2 Setup diagram of tested system (Add ferrite core)	R.Kojima

1 General information

1.1 Product description

Test item	: RFID R/W
Manufacturer	: TAKAYA Corporation
Address	: 661-1, Ibara-cho, Ibara-city, Okayama, 715-8503 Japan
Model	: TR3-L4D01-24
FCC ID	: MK4TR3-L4D01-24
Serial numbers	: 14000001
Transmitting Frequency	: 13.56 MHz
Type of Modulation	: ASK
Operating temperature range	: 0 to +40 degree C
Receipt date of EUT	: December 15, 2015
Nominal power source voltages	: AC120V / 60Hz

1.2 Test(s) performed/ Summary of test result

Test specification(s)	: FCC CFR 47. Part 15 (October 1, 2013)
Test method(s)	: ANSI C63.4: 2003
Test(s) started	: December 17, 2014
Test(s) completed	: April 17, 2015
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 : R.Kojima
EMC testing Department

Reviewer : K.Onishi
Manager
EMC testing Department

1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at SGS RF Technologies Inc., 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, 2013.
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: 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 (150 kHz - 30 MHz): ± 3.4 dB
Radiated emission (9 kHz - 30 MHz): ± 3.3 dB
Radiated emission (30 MHz - 1000 MHz): ± 6.2 dB

1.5 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) and (d)	Complied	2.2
1.5.3 Transmitter radiated emissions between 30MHz to 1000 MHz	15.225 (d)	Complied	2.3
1.5.4 Carrier frequency stability	15.225 (e)	Complied	2.4
1.5.5 Transmitter AC Power Line Conducted Emissions	15.207	Complied	2.5

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

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test:

	Item	Manufacturer	Model No.	Serial No.
1	RFID R/W	TAKAYA Corporation	TR3-L4D01-24	14000001
2-A	Antenna	TAKAYA Corporation	TR3-CA033	13040028
2-B	Antenna	TAKAYA Corporation	TR3-CA034	13040039
2-C	Antenna	TAKAYA Corporation	TR3-CA044	14120005
2-D	Antenna	TAKAYA Corporation	TR3-CA045	14120026

Support Equipment(s):

	Item	Manufacturer	Model No.	Serial No.
3-25	Termination	TAKAYA	-	-
26	Dsub USB converter	-	-	-
27	AC adaptor	FUTABA ELECTRIC	RC60G-19D	000009F
28	PC	DELL	PP22L	73P7BBX
29	AC adaptor	DELL	LA90PS0-00	CN-0DF266-71615-78V-B442
30	HUB	BUFFALO	LSW3-TX-5EPL/B	16488414770718

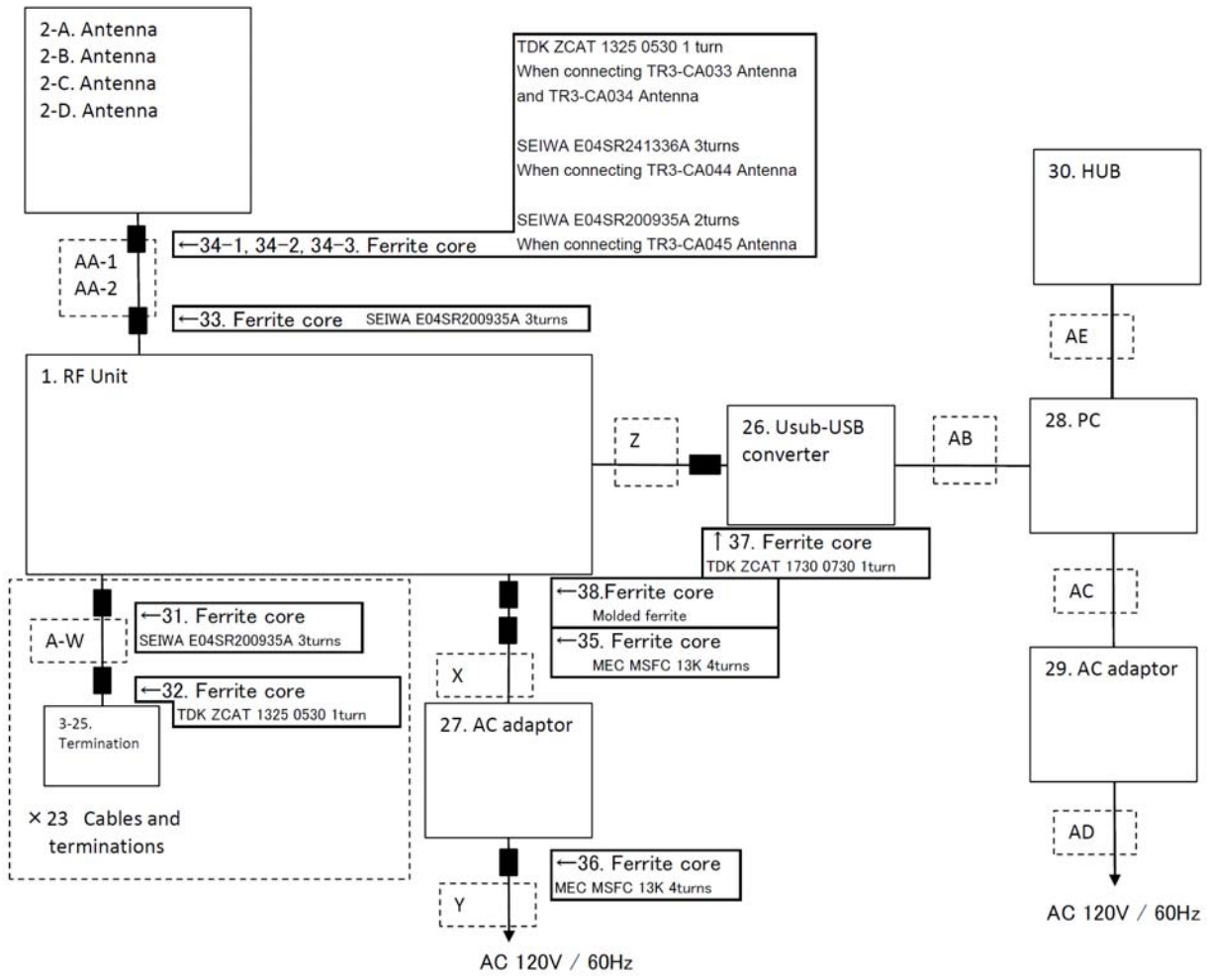
EMC Countermeasure(s):

	Item	Manufacturer	Model No.	Serial No.	Note
31	Ferrite core	SEIWA	E04SR200935A	-	3turns
32	Ferrite core	TDK	ZCAT 1325 0530	-	1 turn
33	Ferrite core	SEIWA	E04SR200935A	-	3turns
34-1	Ferrite core	TDK	ZCAT 1325 0530	-	1 turn When connecting TR3-CA033 Antenna and TR3-CA034 Antenna
34-2	Ferrite core	SEIWA	E04SR241336A	-	3turns When connecting TR3-CA044 Antenna
34-3	Ferrite core	SEIWA	E04SR200935A	-	2turns When connecting TR3-CA045 Antenna
35	Ferrite core	MEC	MSFC 13K	-	4turns
36	Ferrite core	MEC	MSFC 13K	-	4turns
37	Ferrite core	TDK	ZCAT 1730 0730	-	1 turn
38	Ferrite core	-	-	-	Molded ferrite

Connected cable(s):

No.	Item	Shielded YES / NO	Ferrite Core YES / NO	Connector Type Shielded YES / NO	Length (m)
A-W	RF cable	Yes	Yes	Yes	2.00
X	DC cable	No	Yes	No	1.00
Y	AC cable	No	Yes	No	2.00
Z	D-Sub9 cable	Yes	Yes	Yes	4.50
AA-1	RF cable (Connected Antenna TR3-CA033 and TR3-CA034)	Yes	Yes	Yes	2.43
AA-2	RF cable (Connected Antenna TR3-CA044 and TR3-CA045)	Yes	Yes	Yes	2.53
AB	USB cable	Yes	No	Yes	0.10
AC	DC cable	No	No	No	1.90
AD	AC cable	No	No	No	0.90
AE	LAN cable	No	No	No	3.00

1.6.2 Setup diagram of tested system:



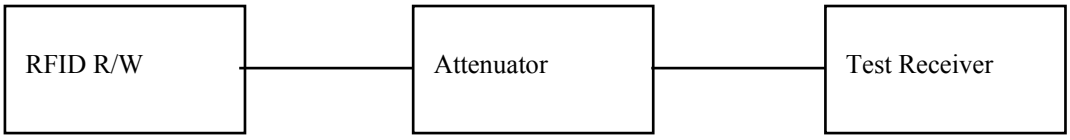
1.6.3 Operating condition:

Operating mode:

1-1 Continuous transmission mode (Antenna port No.1 with TR3-CA033 Antenna)
1-2 Continuous transmission mode (Antenna port No.1 with TR3-CA034 Antenna)
1-3 Continuous transmission mode (Antenna port No.1 with TR3-CA044 Antenna)
1-4 Continuous transmission mode (Antenna port No.1 with TR3-CA045 Antenna)

Note: The EUT has 24 antenna ports,
Antenna port of twenty four does not work with simultaneous transmission.
One of twenty four the port is operate.
Test applied to an antenna port, which has highest power. (Antenna port No.1)

Test setup



Test results

Antenna ports	Power [dBm]	Highest	Antenna ports	Power [dBm]	Highest
1	**34.840**	✓	13	34.740	
2	34.830		14	34.720	
3	34.800		15	34.700	
4	34.790		16	34.670	
5	34.770		17	34.810	
6	34.740		18	34.780	
7	34.720		19	34.760	
8	34.700		20	34.750	
9	34.830		21	34.720	
10	34.820		22	34.700	
11	34.790		23	34.670	
12	34.760		24	34.650	

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

TR06	AT38		

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

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	LP05	CL11	TR06		

Test results – Reporting purpose.

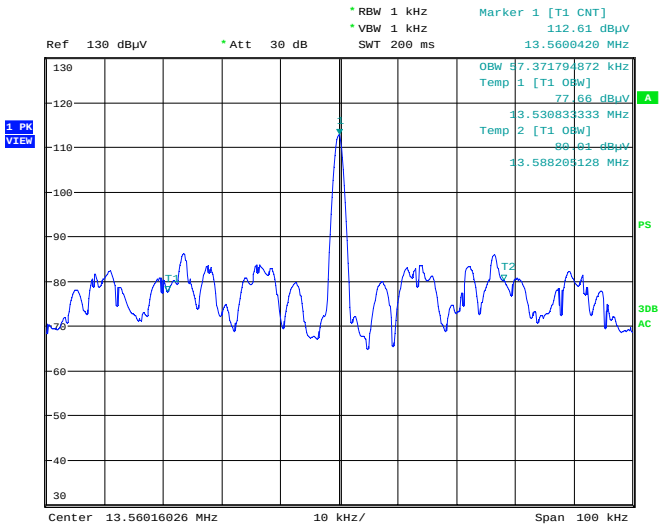
Frequency (MHz)	Occupied Bandwidth (kHz)
13.56	57.3718

Test Data

Tested Date: December 17, 2014

Temperature: 16 degree C
Humidity: 34 %
Atmos. Press: 999 hPa

Operating mode: Continuous transmission

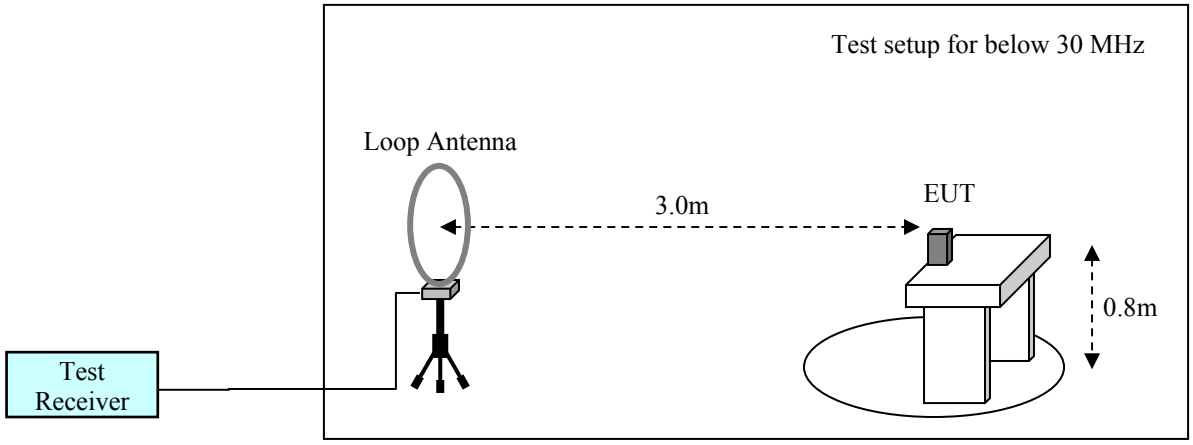


99% bandwidth

2.2 Transmitter radiated spurious emissions between 9 KHz to 30 MHz

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.
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)

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 general requirements
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

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

dBuV/m = 20 x log (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 equipment used (refer to List of utilized test equipment)

AC01	LP05	CL11	TR06	SW01

Test results - Complied with requirement.

Test Data

Tested Date: December 25, 2014

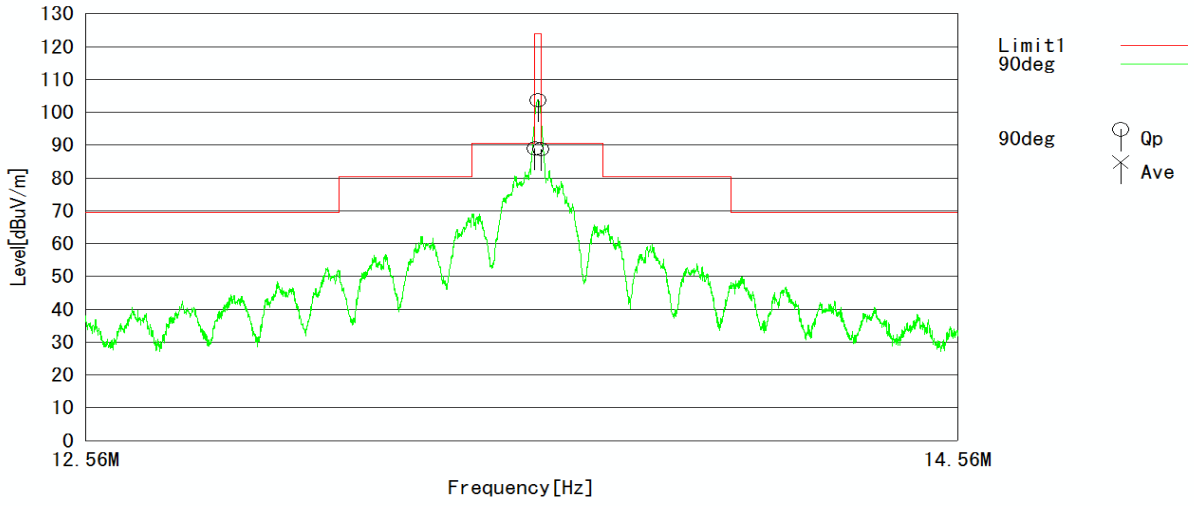
Temperature: 15 degree C
Humidity: 33 %
Atmos. Press: 1013 hPa

§15.225(a)/ (b)/ (c) Fundamental emission
Operating mode:
Worst configuration: Continuous transmission mode (Antenna port No.1 with TR3-CA045 Antenna)
EUT condition: Y-plane (Maximum condition)
Measurement distance: 3 m

Freq. (MHz)	Reading at 3m (dBuV)	Detector (QP/Ave)	Corr. Factor (dB)	Result (dBuV/m)	Limit at 3m (dBuV/m)	Margin (dB)
13.55300	78.3	QP	10.7	89.0	90.5	1.5
13.56000	93.1	QP	10.7	103.8	124.0	20.2
13.56700	78.1	QP	10.7	88.8	90.5	1.7

Correction Factor [dB] = Antenna Factor [dB/m] + Cable Loss [dB]
Sample calculation at 13.553 MHz result as follow:

Result [dBuV] = Reading + C.F = 78.3 + 10.7 = 89.0 [dBuV]
Margin = Limit – Result = 90.5 – 89.0 = 1.5 [dB]



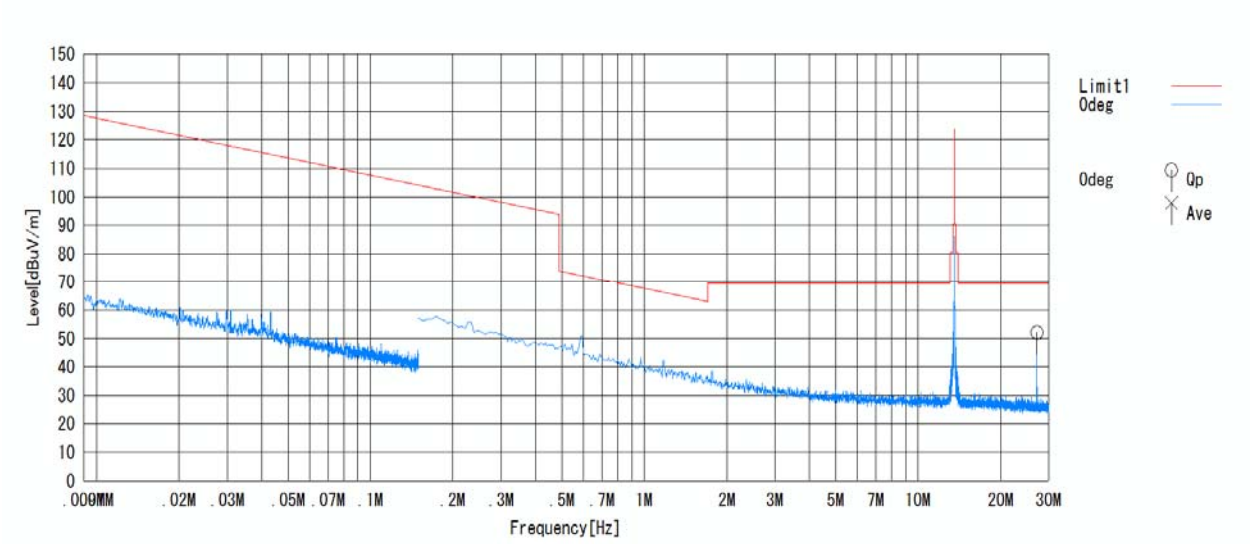
Graphical express of test result

§15.225(d) Harmonics and spurious emission between 9 kHz to 30MHz (refer 15.209 and 15.205)
Operating mode:
Worst configuration: Continuous transmission mode (Antenna port No.1 with TR3-CA045 Antenna)
EUT condition: X-plane (Maximum condition)
Measurement distance: 3 m

Freq. (MHz)	Reading at 3m (dBuV)	Detector (QP/Ave)	Corr. Factor (dB)	Result (dBuV/m)	Limit at 3m (dBuV/m)	Margin (dB)
27.12000	43.1	QP	9.0	52.1	69.5	17.4

Correction Factor [dB] = Antenna Factor [dB/m] + Cable Loss [dB]
Sample calculation at 27.12 MHz result as follow:

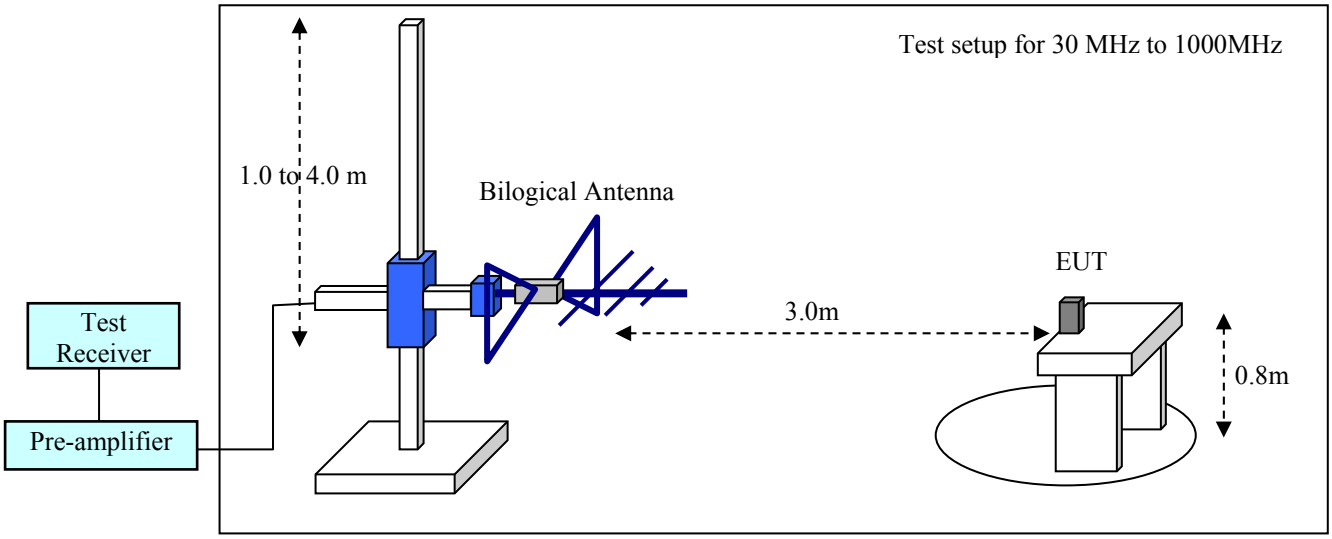
Result [dBuV] = Reading + C.F = 43.1 + 9.0 = 52.1 [dBuV]
Margin = Limit – Result = 69.5 – 52.1 = 17.4 [dB]



Graphical express of test result (9kHz – 30MHz)

2.3 Transmitter radiated spurious emissions between 30MHz to 1000MHz

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 8.2.3 and Annex H.4 “Radiated emission measurements setup”.



Test procedure
Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 8.2.3.
Exploratory radiated measurements were performed at the measurement distance of 3 meters using broadband antennas and a spectrum analyzer. The EUT was set up in its typical configuration and arrangement, and operated in its various modes.
For each mode of operation required to be tested, the frequency spectrum were monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) were explored to produce the emission that has the highest amplitude relative to the limit.
Based on the exploratory measurement results, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement
This investigation was performed with the EUT rotated 360° , 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 was placed at three different orientations (X, Y and Z axis) in order to find the worst orientation.

Applicable rule and limitation

§15.209 general requirements

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)	Measurement Distance (m)	Field Strength (uV/m)	Field Strength (dBuV/m)
30 – 88	3	100	40.0
88 –216	3	150	43.5
216 – 960	3	200	46.0
Above 960	3	500	53.9

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.

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

AC01	BA10	CL11	PR15	TR06	SW01

Test results - Complied with requirement.

Test Data

Tested Date: December 25, 2014

Temperature: 15 degree C
Humidity: 33 %
Atmos. Press: 1013 hPa

Operating mode:
Worst configuration: Continuous transmission mode (Antenna port No.1 with TR3-CA045 Antenna)
EUT condition: Z-plane (Maximum condition)
Measurement distance: 3 m
§15.225(d) Harmonics and spurious emission between 30MHz to 1000MHz (refer 15.209)

No.	Frequency [MHz]	Reading [dBuV]	Detector (QP/Ave)	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	**40.680**	**49.5**	**QP**	**13.3**	**7.0**	**30.2**	**39.6**	**40.0**	**0.4**	**Vert.**
2	67.800	49.9	QP	6.4	7.3	30.2	33.4	40.0	6.6	Vert.
3	108.480	47.7	QP	10.8	7.7	30.1	36.1	43.5	7.4	Vert.
4	149.160	53.1	QP	11.5	8.1	30.0	42.7	43.5	0.8	Hori.
5	149.160	49.1	QP	11.5	8.1	30.0	38.7	43.5	4.8	Vert.
6	216.960	48.5	QP	10.3	8.6	29.9	37.5	46.0	8.5	Hori.

Calculation method

The Correction Factors and RESULT are calculated as followings.

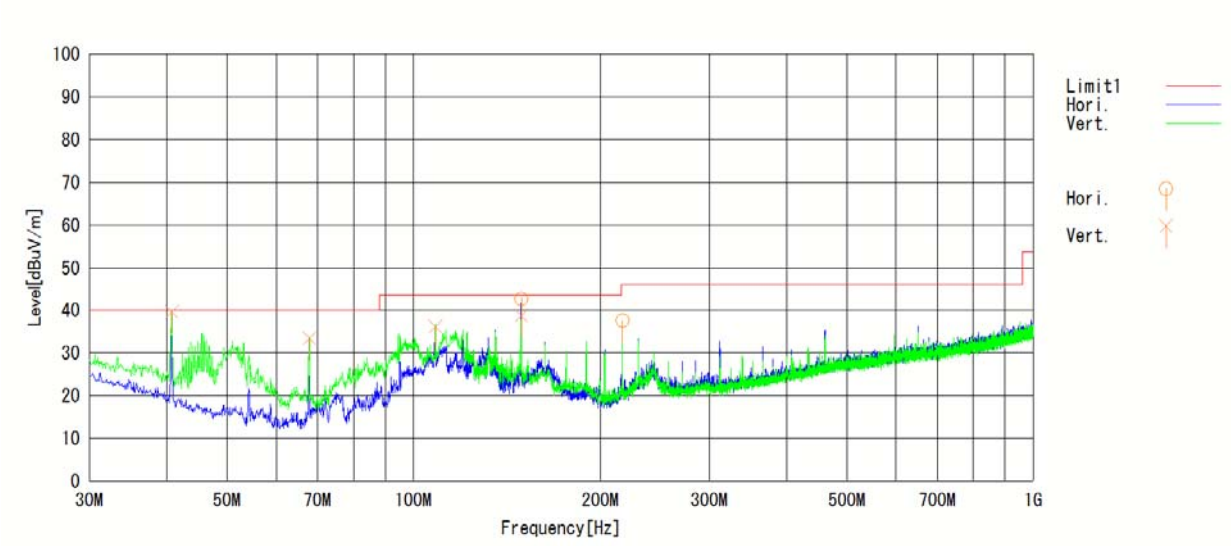
Correction Factor [dB/m] = FACTOR [dB/m] + CABLE LOSS [dB] – GAIN [dB]

RESULT [dBuV/m] = READING [dBuV] + Correction Factor [dB/m]

Sample calculation at 40.680 MHz Vertical result as follow:

Result [dBuV/m] = Reading + C.F = 49.5 + 13.3 + 7.0 – 30.2 = 39.6
Margin = Limit – Result = 40.0 – 39.6 = 0.4 [dB]

Graphical express of test result (30MHz-1000MHz)



2.4 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%

Note1: The above operating range is declared by manufacturer. (Please refer to user manual)

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

TR09	TC01		

Test results - Complied with requirement.

Test Data
Tested Date: December 19, 2014

Temperature: 21 degree C
Humidity: 30 %
Atmos. Press: 1029 hPa

Tested Date: April 17, 2015

Temperature: 23 degree C
Humidity: 47 %
Atmos. Press: 1011 hPa

Operating Mode: Continuous Transmission

Temp. (Degrees)	Voltages (V)	Measured Frequency (MHz)				Worst Deviation (%)	Limit (%)
		Start-up	2 min.	5 min.	10 min.		
-20	120	13.5601099	**13.5601100**	13.5601099	13.5601098	+0.000811	+/-0.01
-10	120	13.5601069	13.5601093	**13.5601178**	13.5601094	+0.000869	+/-0.01
0	120	**13.5600757**	13.5600669	13.5600608	13.5600556	+0.000558	+/-0.01
10	138	**13.5600634**	13.5600444	13.5600398	13.5600328	+0.000468	+/-0.01
20	120	**13.5600420**	13.5600239	13.5600114	13.5600038	+0.000310	+/-0.01
20	138	**13.5600090**	13.5600043	13.5600020	13.5600006	+0.000066	+/-0.01
20	102	**13.5600062**	13.5600028	13.5600012	13.5600004	+0.000046	+/-0.01
30	120	13.5600115	13.5599963	13.5599896	**13.5599861**	-0.000103	+/-0.01
40	120	13.5599902	13.5599832	**13.5599810**	13.5599818	-0.000140	+/-0.01
50	120	13.5600066	13.5600052	13.5600110	**13.5600334**	-0.000246	+/-0.01

2.5 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 grater 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	SW01

Test results - Complied with requirement.

Test Data

Tested Date: December 19, 2014

Temperature: 21 degree C
Humidity: 30%
Atmos. Press: 1029 hPa

Operating mode: Continuous Transmission

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	0.16702	33.4	25.0	10.3	43.7	35.3	65.1	55.1	21.4	19.8	Vb
2	0.19106	35.6	27.4	10.3	45.9	37.7	64.0	54.0	18.1	16.3	Va
3	0.25284	32.9	28.4	10.2	43.1	38.6	61.7	51.7	18.6	13.1	Va
4	0.25765	33.0	28.8	10.2	43.2	39.0	61.5	51.5	18.3	12.5	Vb
5	**0.29760**	**30.4**	**28.4**	**10.2**	**40.6**	**38.6**	**60.3**	**50.3**	**19.7**	**11.7**	**Va**
6	0.38787	26.2	13.1	10.2	36.4	23.3	58.1	48.1	21.7	24.8	Vb
7	0.83554	22.4	16.8	10.2	32.6	27.0	56.0	46.0	23.4	19.0	Va
8	0.84036	20.8	14.4	10.2	31.0	24.6	56.0	46.0	25.0	21.4	Vb
9	13.56000	14.8	11.9	10.3	25.1	22.2	60.0	50.0	34.9	27.8	Vb
10	13.56000	14.6	11.6	10.3	24.9	21.9	60.0	50.0	35.1	28.1	Va
11	27.12000	8.7	3.3	10.6	19.3	13.9	60.0	50.0	40.7	36.1	Vb
12	27.12000	9.0	3.7	10.5	19.5	14.2	60.0	50.0	40.5	35.8	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:

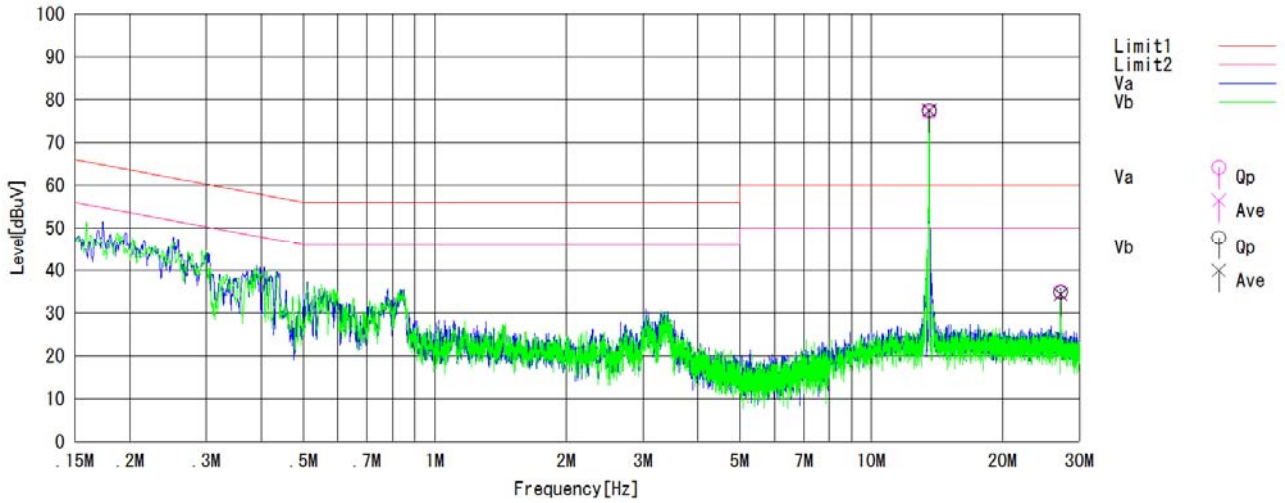
Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 0.29760 MHz AV result as follow:

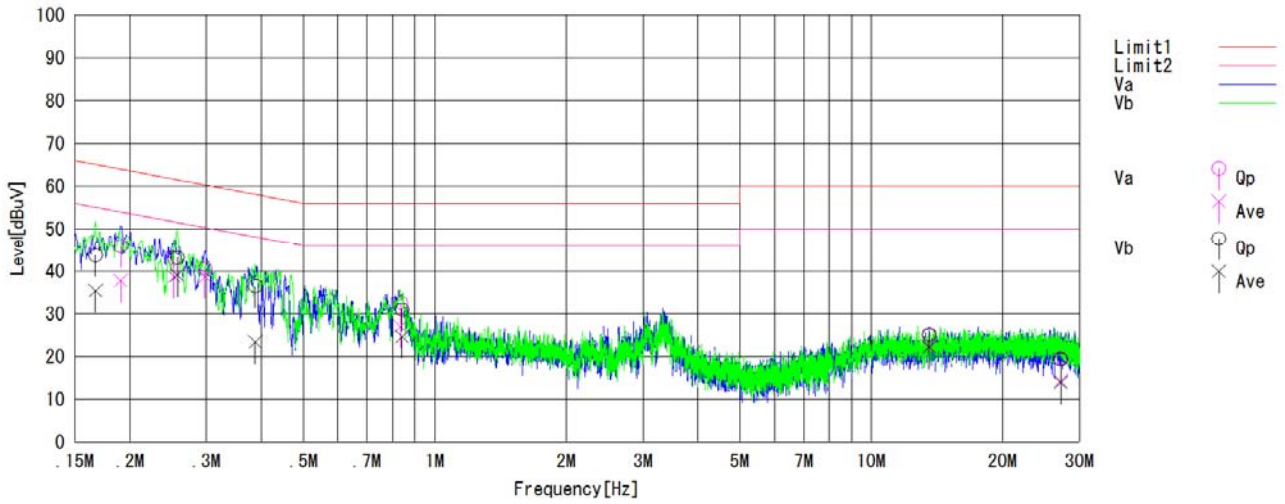
Result [dBuV] = Reading + C.F = 28.4 + 10.2 = 38.6 [dBuV]
Margin = Limit – Result = 50.3 – 38.6 = 11.7 [dB]

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

AC Power line conducted emission. (with Antenna)



AC Power line conducted emission. (with dummy load)



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	-	2014/4/26	2015/4/30
BA10	Bilogical Antenna	TESEQ	CBL6111D	32342	2014/6/9	2015/6/30
CL11	Antenna Cable for RE	RFT	-	-	2014/3/31	2015/3/31
CL18	Antenna Cable for CE	RFT	-	-	2014/4/18	2015/4/30
LP05	Loop Antenna	ETS-Lindgren	6502	00143302	2015/2/13	2016/2/29
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2014/5/22	2015/5/31
PR15	Pre. Amplifier	Anritsu	MH648A	6201156141	2014/6/10	2015/6/30
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2014/9/5	2015/9/30
TR09	Test Receiver (F/W : 4.43 SP3)	Rohde & Schwarz	ESU8	100386	2015/2/13	2016/2/29
TC01	Temperature Chamber	ESPEC	SH-641	92000964	2014/11/25	2015/11/30
AT38	Attenuator 30dB 75W 8.5GHz	Weinschel	WA29-30-34	8920	2014/7/14	2015/7/31
SW01	EMI Software	SGS RF Technologies	EMI Ver. 5.6	-	N/A	N/A

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.