TEST REPORT

For

RFID READER/WRITER

In conformity with

FCC CFR 47 Part15 Subpart C

Model: TR3XM-SD01 / TR3XM-SU01 / TR3XM-SN01

FCC ID: MK4TR3XM-SX01

Test Item: RFID READER/WRITER

Report No: RY1203Z12R1

Issue Date: 12 March, 2012

Prepared for

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

Prepared by

RF Technologies Ltd.
472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan
Telephone: +81+(0)45- 534-0645
FAX: +81+(0)45- 534-0646

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History

Report No.	Date	Revisions	Issued By
RY1203Z12R1	12 March, 2012	Initial Issue	K. Ohnishi

1 General information

1.1 Product description

Test item	: RFID READER/WRITER
Manufacturer	: TAKAYA Corporation
Address	: 661-1, Ibara-cho, Ibara-city, Okayama, 715-8503 Japan
Model	: TR3XM-SD01 / TR3XM-SU01 / TR3XM-SN01 * These products have the same radio circuits, the difference is the interface. SD-01: RS-232C / SU01: USB / SN-01: TCP/IP
FCC ID	: MK4TR3XM-SX01
Serial numbers	: 12000001 /12000001 / 12000001
Transmitting Frequency	: 13.56 MHz
Type of Modulation	: ASK
Operating temperature range	: 0 to +55 degree C (Manufacturer declaration)
Receipt date of EUT	: 23 February, 2012
Nominal power source voltages	: DC 5.0V

1.2 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	: 24 February, 2012
Test(s) completed	: 1 March, 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
K.Ohnishi
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, 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 is as follows;
Test site (Semi-Anechoic chamber 3m) R-2393, G-110
Test site (Shielded room) C-2617, T-1671

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: ± 1.9 dB (10 kHz – 30 MHz)
Radiated emission (9 kHz - 30MHz): ± 2.8 dB
Radiated emission (30MHz - 1000MHz): ± 5.9 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.
A1	RFID READER/WRITER	TAKAYA Corporation	TR3XM-SD01	12000001
A2	RFID READER/WRITER	TAKAYA Corporation	TR3XM-SU01	12000001
A3	RFID READER/WRITER	TAKAYA Corporation	TR3XM-SN01	12000001
B	AC adapter	UNIFIVE	US300520	B09-0396290

Support Equipment(s):

	Item	Manufacturer	Model No.	Serial No.
C	PC	DELL	VOSTRO 1500	JX189A00
D	AC adapter for PC	DELL	LA90PS0-00	DF266
E	HUB	corega	HUB-8PM	0053170010901922
F	AC adapter for HUB	corega	-	-

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 cable for EUT	UNIFIVE	No	No	No	1.9
2	USB - RS232C cable	-	Yes	Yes	Yes	2.0
3	DC cable for PC	DELL	No	No	No	1.8
4	AC cable for PC	DELL	No	No	No	0.9
5	USB cable	-	Yes	No	Yes	1.8
6	LAN cable	-	Yes	No	Yes	1.1
7	LAN cable	-	Yes	No	Yes	2.1

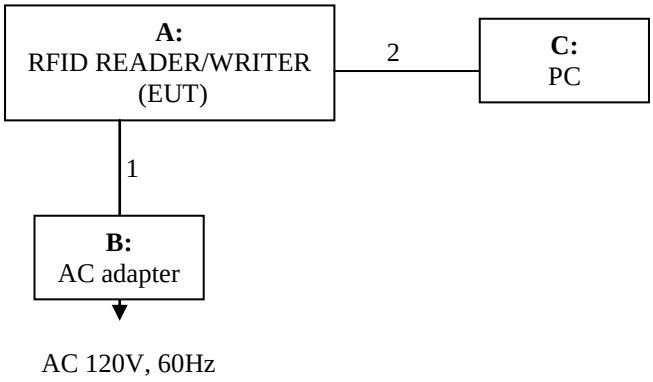
1.6.2 Operating condition:

Operating mode:

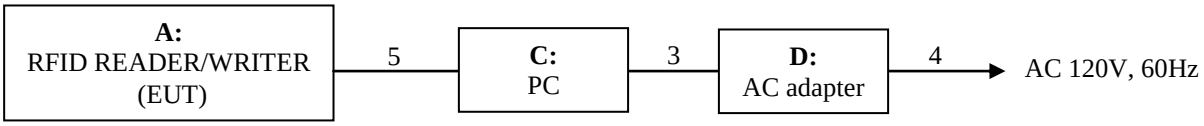
Continuous transmission under the test mode (without modulation)
Continuous transmission under the test mode (ISO/IEC 15693, 18000-3 (Mode 1) ASK10%)
Continuous transmission under the test mode (ISO/IEC 15693, 18000-3 (Mode 1) ASK100%)
Continuous transmission under the test mode (ISO/IEC 14443A)
Continuous transmission under the test mode (ISO/IEC 14443 B)
Continuous transmission under the test mode (ISO/IEC 18092 (Felica))
Continuous transmission under the test mode (ISO/IEC 18000-3 (Mode 3))

1.6.3 Setup diagram of tested system:

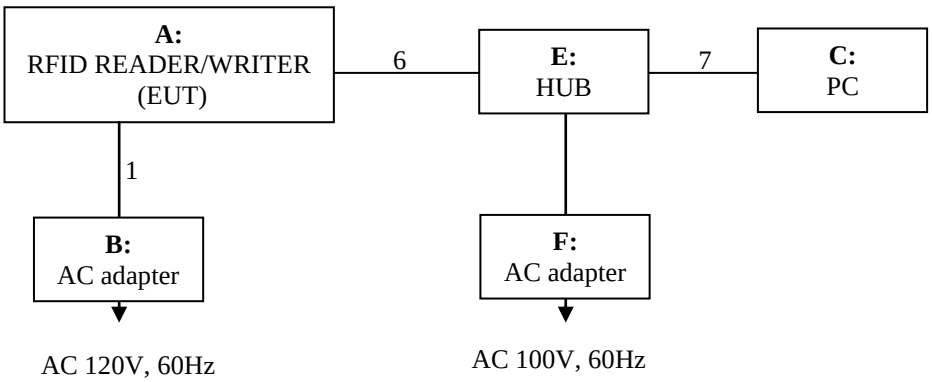
[TR3XM-SD01]



[TR3XM-SU01]



[TR3XM-SN01]



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	LP01	CL11	TR06		

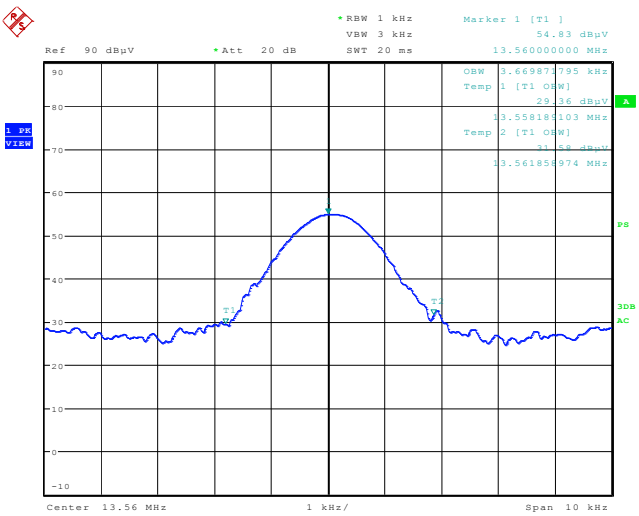
Test results – Reporting purpose.

Frequency (MHz)	Occupied Bandwidth (kHz)					
	ISO 15693 100%	ISO 15693 10%	ISO 14443 A	ISO 14443 B	ISO 18092 Felica	ISO 18000-3 Mode 3
13.56	3.66	2.96	3.46	3.49	3.09	2.99

Test Data
Tested Date: 27 February, 2012

Temperature: 16 degree C
Humidity: 28 %
Atmos. Press: 1017 hPa

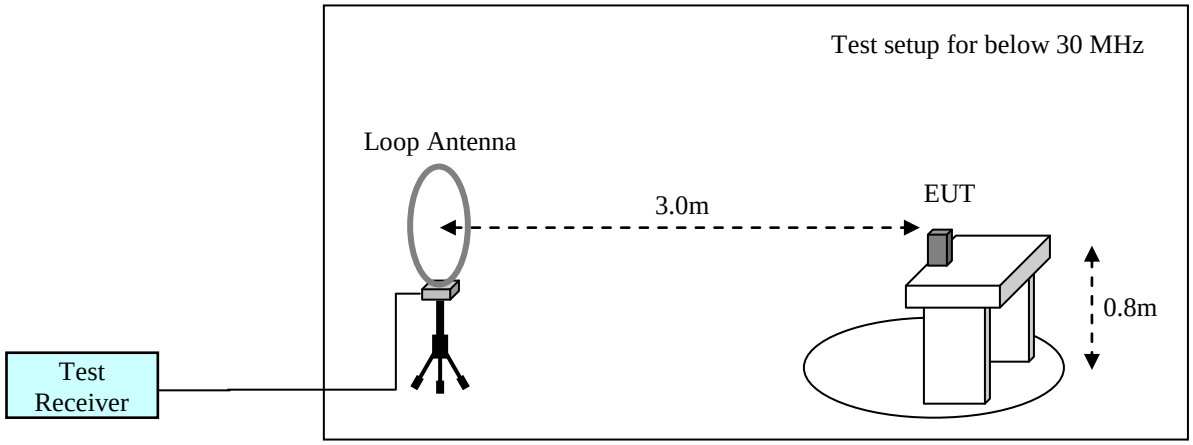
Operating mode: Continuous transmission (ISO 15693 100%)



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	LP01	CL11	TR06

Test results - Complied with requirement.

Test Data

Tested Date: 27 February, 2012

Temperature: 16 degree C
Humidity: 28%
Atmos. Press: 1017 hPa

Operating mode: Continuous Communication (Worst configuration: TR3XM-SN01, ISO/IEC 18000-3 (Mode 3))
EUT condition: Y-plane (Maximum condition)
Measurement distance: 3 m

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

Freq. (MHz)	Reading at 3m (dBuV)	Detector (QP/Ave)	Corr. Factor (dB)	Result (dBuV/m)	Limit at 3m (dBuV/m)	Margin (dB)
13.56	62.3	QP	11.0	73.3	124.0	50.7

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

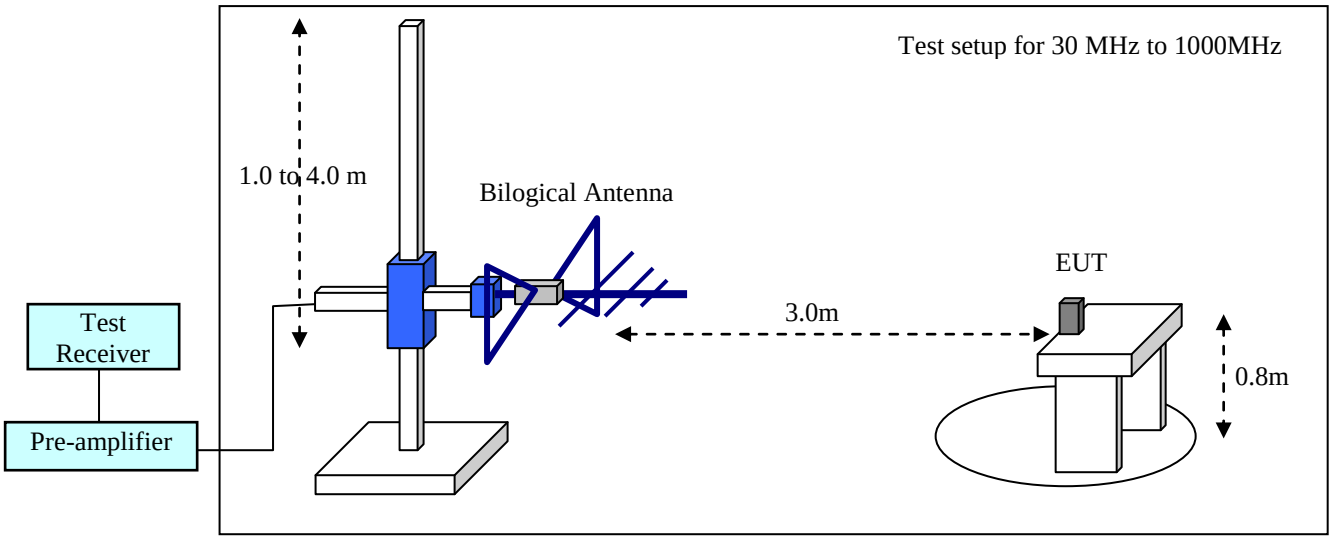
§15.225(d) Harmonics and spurious emission between 9 kHz to 30MHz (refer 15.209 and 15.205)

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

2.3 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	BA04	CL11	PR03	TR06

Test results - Complied with requirement.

Test Data

Tested Date: 28 February, 2012

Temperature: 17 degree C
Humidity: 25 %
Atmos. Press: 1027 hPa

Sample: TR3XM-SD01
Operating mode: Continuous Communication (Worst configuration: ISO/IEC 15693, 18000-3(Mode 1) ASK 100%)
EUT condition: Y-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]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	30.575	30.4	18.3	6.9	29.8	25.8	40.0	14.2	Vert.
2	40.680	42.4	12.7	7.1	29.7	32.5	40.0	7.5	Vert.
3	44.686	40.6	10.7	7.1	29.7	28.7	40.0	11.3	Vert.
4	**49.390**	**48.1**	**8.7**	**7.2**	**29.7**	**34.3**	**40.0**	**5.7**	**Vert.**
5	54.094	44.8	7.7	7.3	29.7	30.1	40.0	9.9	Vert.
6	87.330	43.3	8.6	7.7	29.7	29.9	40.0	10.1	Vert.
7	132.000	40.3	12.1	8.3	29.6	31.1	43.5	12.4	Vert.
8	420.360	37.1	16.0	10.6	29.8	33.9	46.0	12.1	Vert.
9	420.361	41.3	16.0	10.6	29.8	38.1	46.0	7.9	Hori.

Calculation method

The Correction Factors and RESULT are calculated as followings.

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

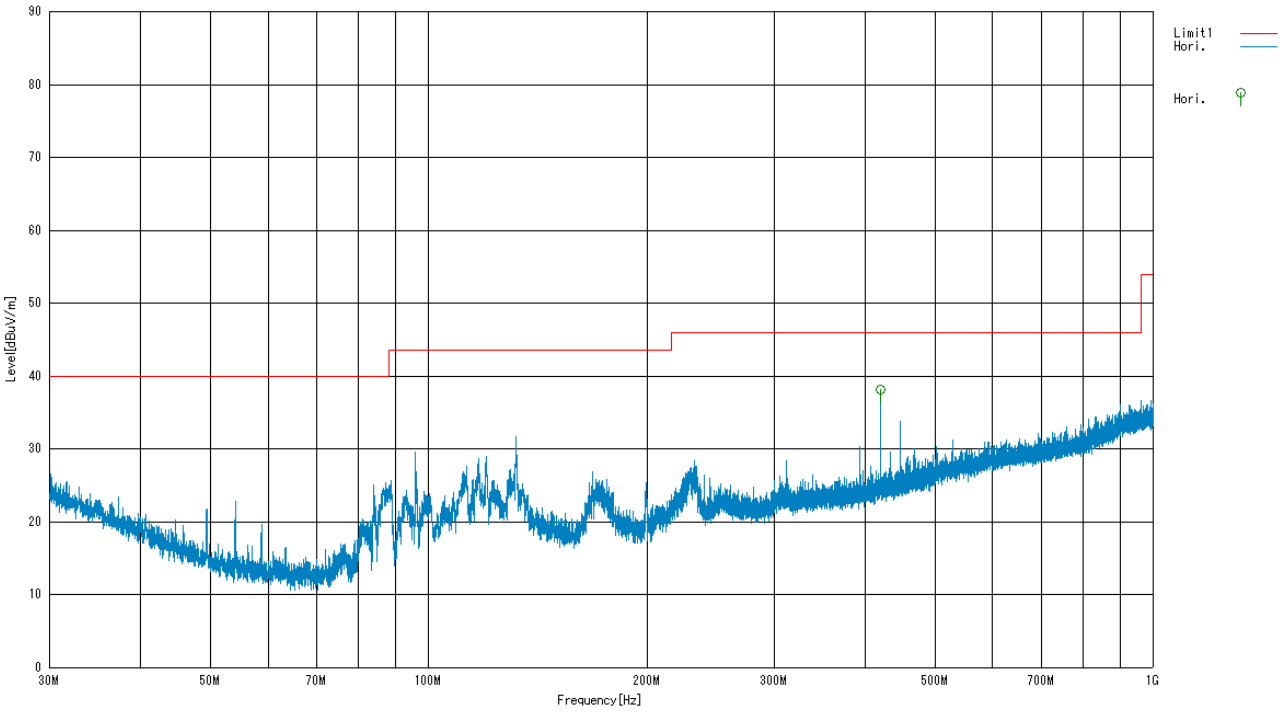
RESULT [dBuV/m] = READING [dBuV] + Correction Factor [dB/m]

Sample calculation at 49.390 MHz Vertical result as follow:

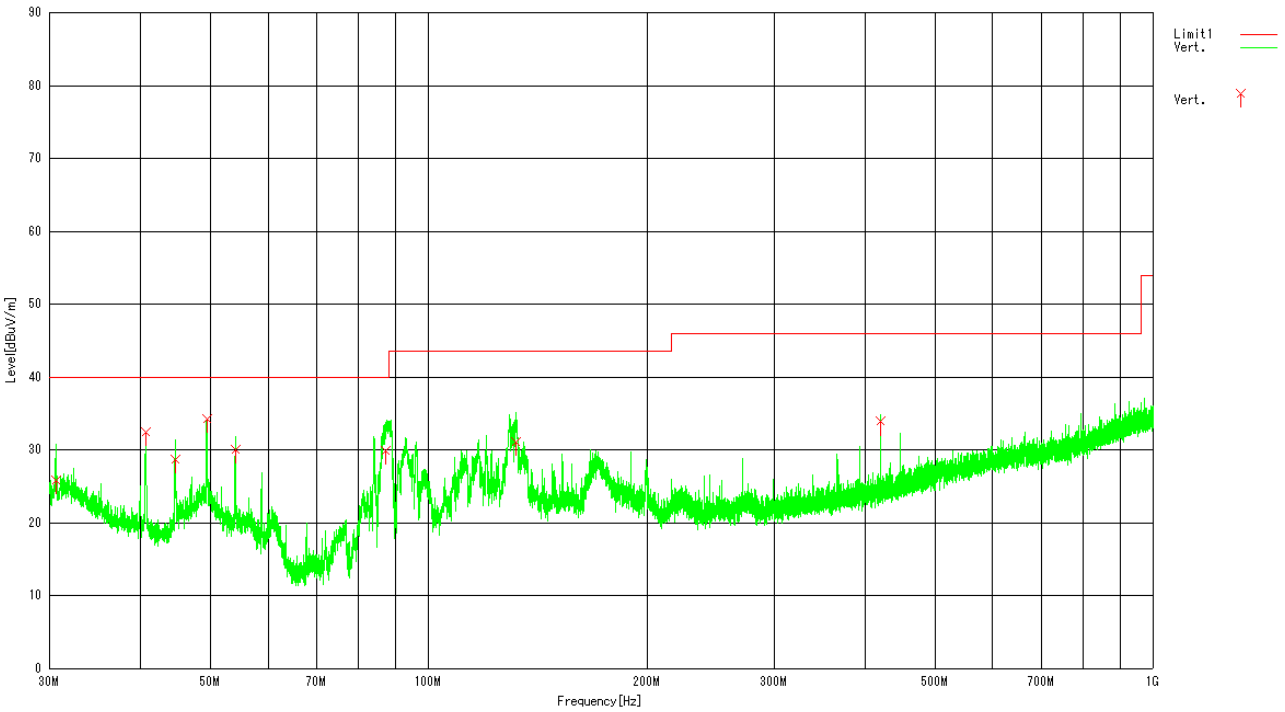
Result [dBuV/m] = Reading + C.F = 48.1 + 8.7 + 7.2 - 29.7 = 34.3
Margin = Limit – Result = 40.0 – 34.3 = 5.7 [dB]

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

Antenna polarization: Horizontal



Antenna polarization: Vertical



Tested Date: 28 February, 2012

Temperature: 17 degree C
Humidity: 25 %
Atmos. Press: 1027 hPa

Sample: TR3XM-SN01
Operating mode: Continuous Communication (Worst configuration: ISO/IEC 18092 (Felica))
EUT condition: Y-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]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	30.575	40.8	18.3	6.9	29.8	36.2	40.0	3.8	Vert.
2	149.994	46.2	11.1	8.5	29.6	36.2	43.5	7.3	Vert.
3	499.981	43.2	17.4	11.2	29.9	41.9	46.0	4.1	Vert.
4	**499.987**	**46.2**	**17.4**	**11.2**	**29.9**	**44.9**	**46.0**	**1.1**	**Hori.**
5	524.982	41.1	17.8	11.3	29.9	40.3	46.0	5.7	Vert.
6	549.985	39.9	18.1	11.5	29.9	39.6	46.0	6.4	Vert.
7	599.986	39.8	18.8	11.7	29.9	40.4	46.0	5.6	Vert.

Calculation method

The Correction Factors and RESULT are calculated as followings.

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

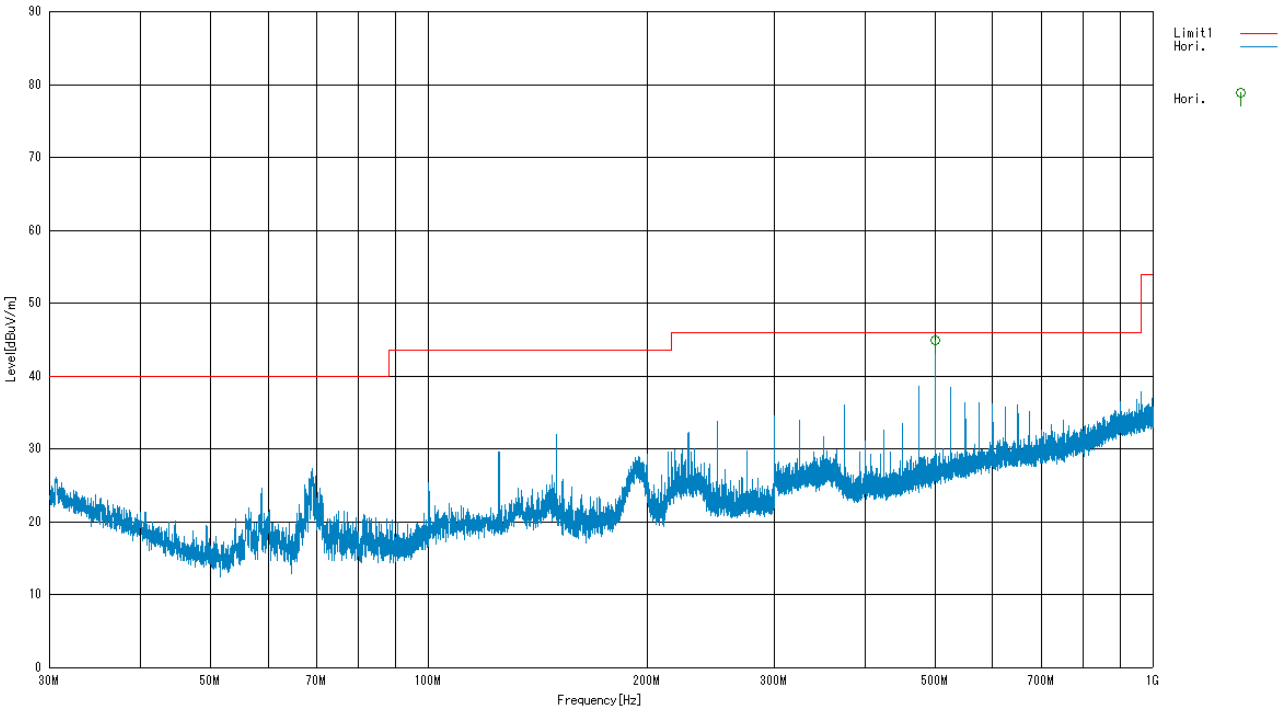
RESULT [dBuV/m] = READING [dBuV] + Correction Factor [dB/m]

Sample calculation at 499.987 MHz Horizontal result as follow:

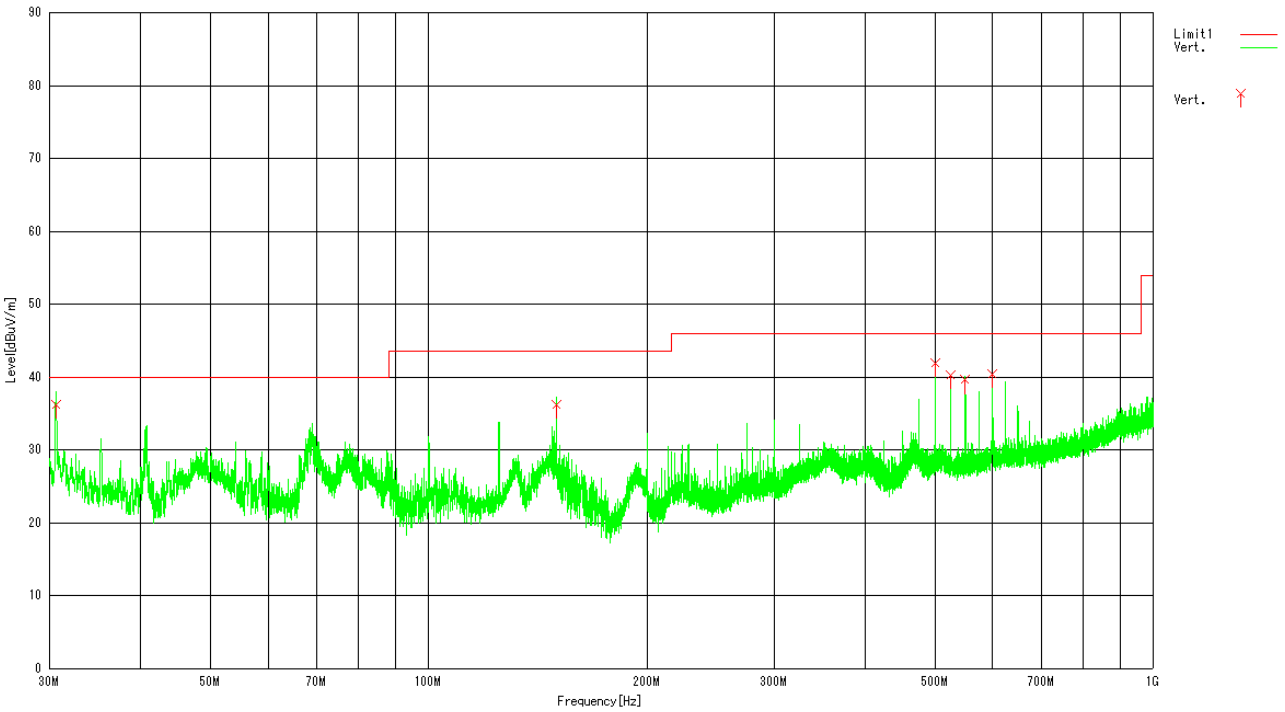
Result [dBuV/m] = Reading + C.F = 46.2 + 17.4 + 11.2 - 29.9 = 44.9
Margin = Limit – Result = 46.0 – 44.9 = 1.1 [dB]

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

Antenna polarization: Horizontal



Antenna polarization: Vertical



Tested Date: 1 March, 2012

Temperature: 17 degree C
Humidity: 36 %
Atmos. Press: 1026 hPa

Sample: TR3XM-SU01
Operating mode: Continuous Communication (Worst configuration: ISO/IEC 14443A)
EUT condition: Y-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]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization
1	30.575	32.4	18.3	6.9	29.8	27.8	40.0	12.2	Vert.
2	35.279	33.9	15.7	7.0	29.8	26.8	40.0	13.2	Vert.
3	40.680	44.9	12.7	7.1	29.7	35.0	40.0	5.0	Vert.
4	**44.686**	**48.4**	**10.7**	**7.1**	**29.7**	**36.5**	**40.0**	**3.5**	**Vert.**
5	49.390	43.3	8.7	7.2	29.7	29.5	40.0	10.5	Vert.
6	54.094	47.0	7.7	7.3	29.7	32.3	40.0	7.7	Vert.
7	120.634	41.6	12.7	8.2	29.6	32.9	43.5	10.6	Vert.

Calculation method

The Correction Factors and RESULT are calculated as followings.

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

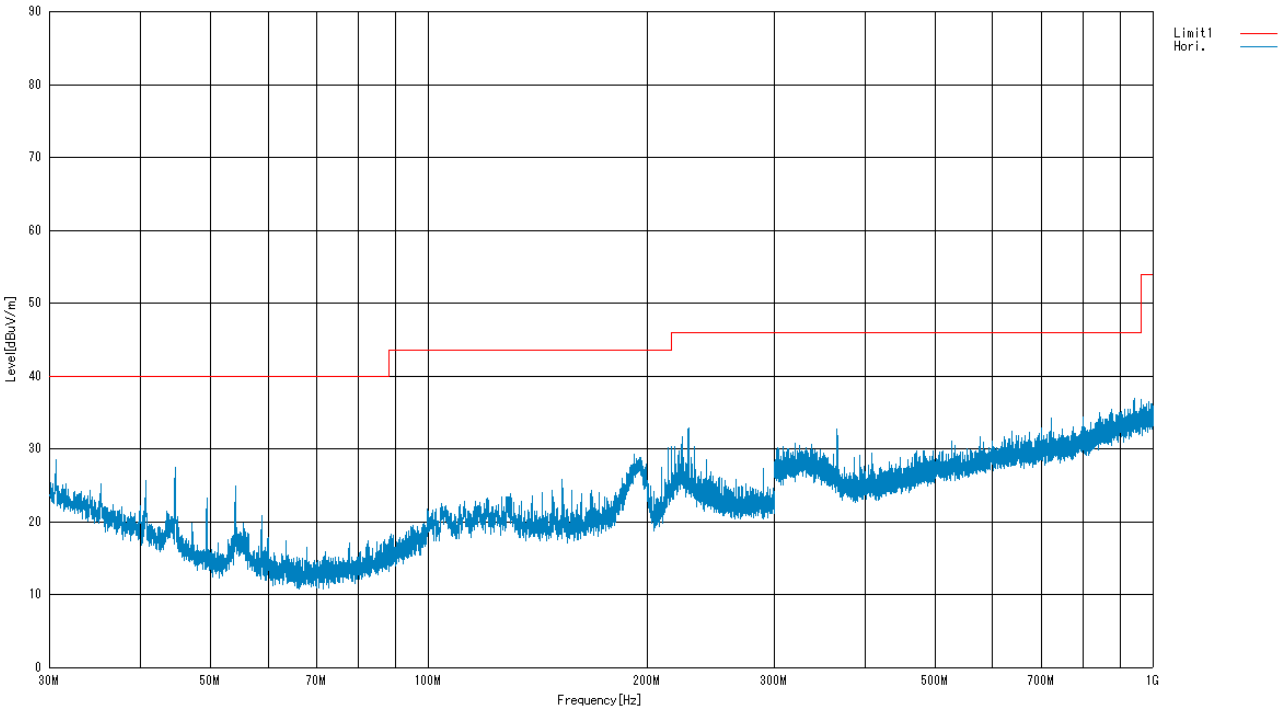
RESULT [dBuV/m] = READING [dBuV] + Correction Factor [dB/m]

Sample calculation at 44.686 MHz Vertical result as follow:

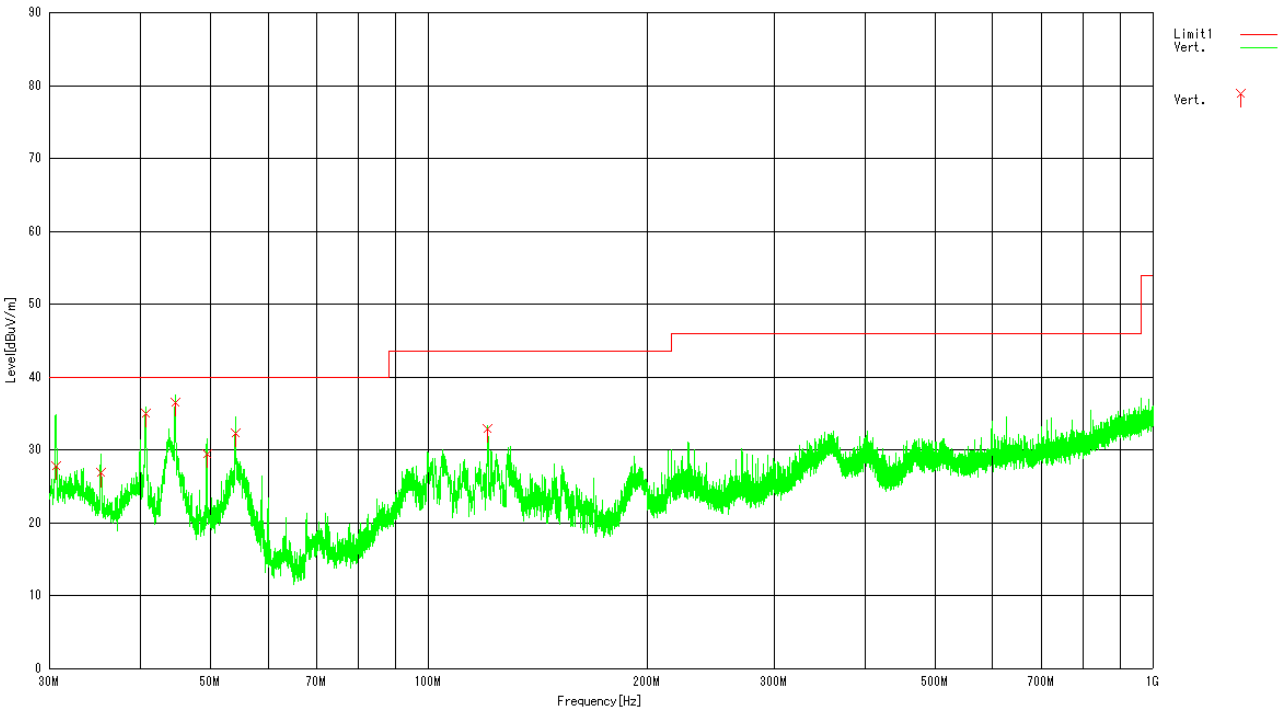
Result [dBuV/m] = Reading + C.F = 48.4 + 10.7 + 7.1 - 29.7 = 36.5
Margin = Limit – Result = 40.0 – 36.5 = 3.5 [dB]

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

Antenna polarization: Horizontal



Antenna polarization: Vertical



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	0 to +55 degrees C *	5.00 +/-10% VDC *	+/-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: 24 February, 2012

Temperature: 15 degree C
Humidity: 39 %
Atmos. Press: 1014 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.		
55	5.0	13.559941	13.559939	13.559938	**13.559937**	-0.0004	+/-0.01
20	5.5	**13.560066**	13.560055	13.560050	13.560045	+0.0004	+/-0.01
	4.5	**13.560054**	13.560046	13.560043	13.560041	+0.0003	+/-0.01
0	5.0	**13.560095**	**13.560095**	13.560094	13.560093	**+0.0007**	+/-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

Test results - Complied with requirement.

Test Data

Tested Date: 27 February, 2012

Temperature: 16 degree C
Humidity: 28%
Atmos. Press: 1017 hPa

Sample: TR3XM-SN01
Operating mode: Continuous Communication (Worst configuration: ISO/IEC 15693, 18000-3(Mode 1) ASK 100%)

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	**0.186**	**46.6**	27.8	**10.1**	**56.7**	37.9	**64.2**	54.2	**7.5**	16.3	**Vb**
2	**0.186**	**46.6**	28.9	**10.1**	**56.7**	39.0	**64.2**	54.2	**7.5**	15.2	**Va**
3	0.244	38.3	19.0	10.0	48.3	29.0	62.0	52.0	13.7	23.0	Va
4	0.246	38.4	18.3	10.0	48.4	28.3	61.9	51.9	13.5	23.6	Vb
5	0.312	33.2	14.2	10.0	43.2	24.2	59.9	49.9	16.7	25.7	Vb
6	0.313	33.2	14.9	10.0	43.2	24.9	59.9	49.9	16.7	25.0	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:

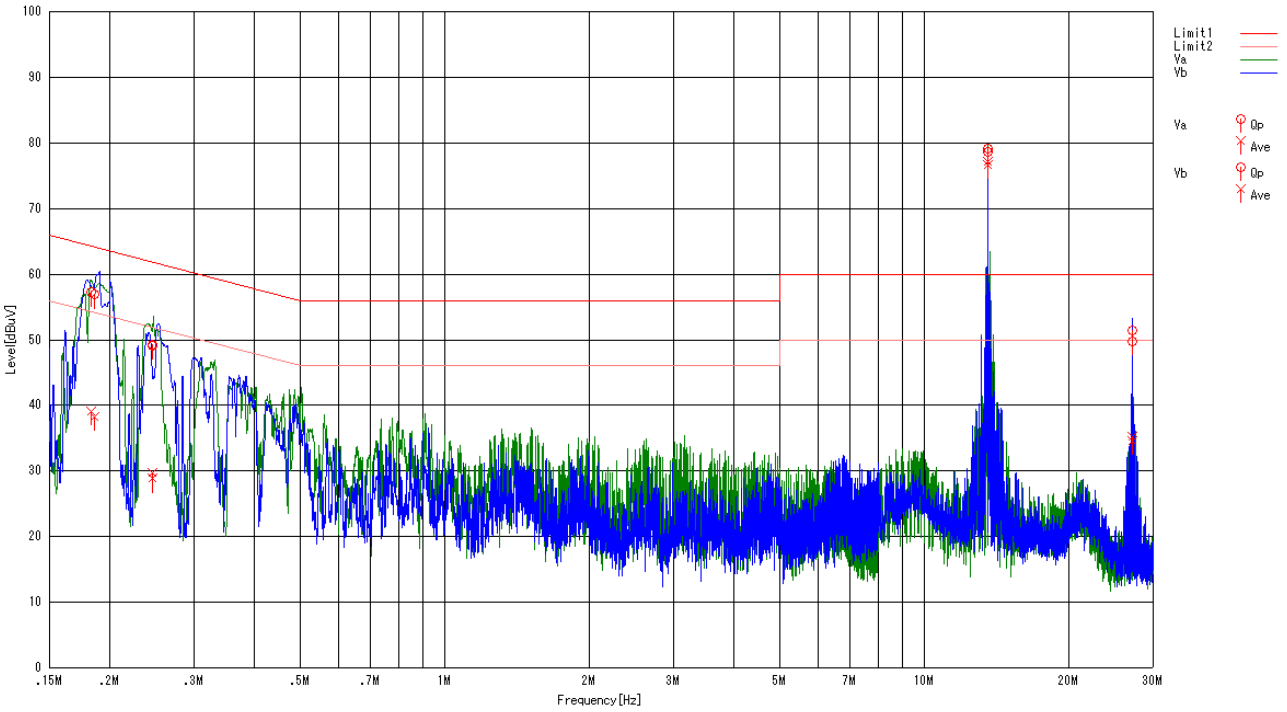
Result = Reading + C. F
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 0.186 MHz QP result as follow:

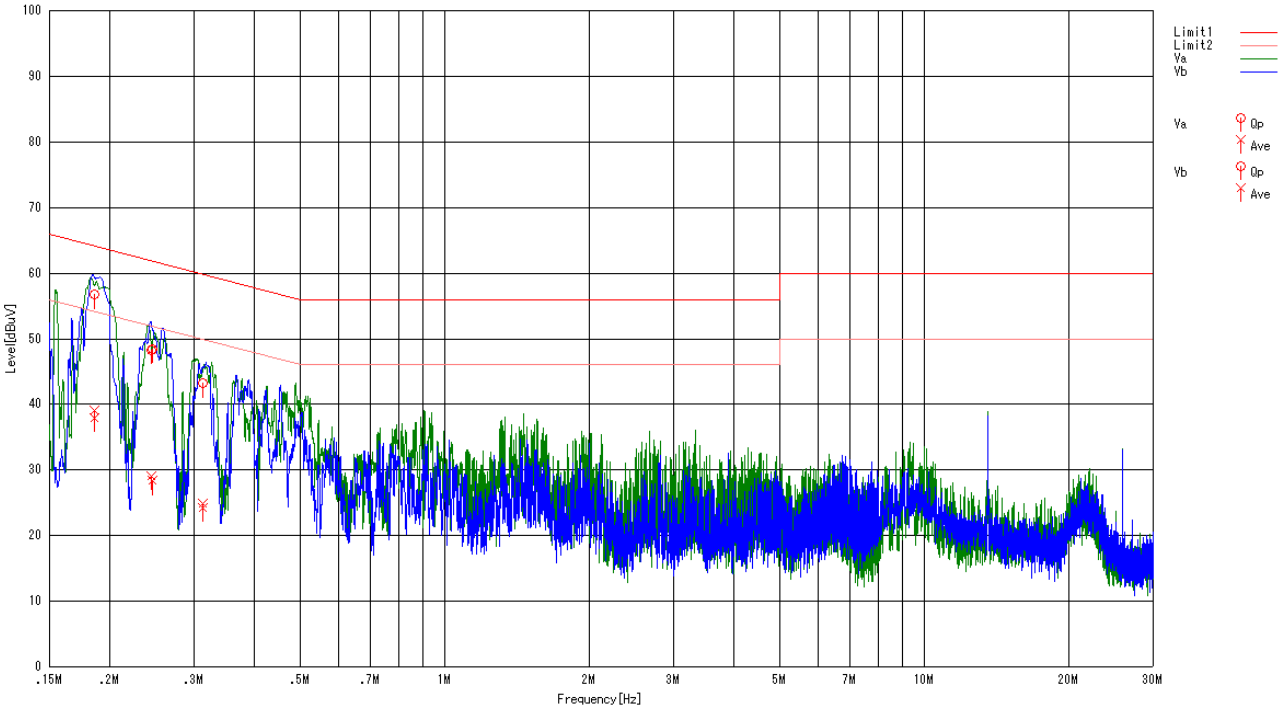
Result [dBuV] = Reading + C.F = 46.6 + 10.1 = 56.7 [dBuV]
Margin = Limit – Result = 64.2 – 56.7 = 7.5 [dB]

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	-	2011/04/23	2012/04/30
BA04	Bilogical Antenna	SCHAFFNER	CA2855	2903	2012/01/25	2013/01/31
CL11	Antenna Cable for RE	RFT	-	-	2011/10/27	2012/10/31
CL18	Antenna Cable for CE	RFT	-	-	2011/05/13	2012/05/31
LP01	Loop Antenna	EMCO	6502	3436	2011/10/22	2012/10/31
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2011/05/31	2012/05/31
PR03	Pre. Amplifier	Anritsu	MH648A	M41984	2011/05/12	2012/05/31
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2011/09/16	2012/09/30
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.