TEST REPORT

For

HF Transceiver

In conformity with

FCC CFR 47 Part15 Subpart B (ITE)

Model : FT-410

FCC ID : K6620621X50

Test Item : HF Transceiver

Report No. : ERY1505P21R1

Issue Date : 21 May. 2015

Prepared for

YAESU MUSEN CO., LTD.
Tennozu Parkside Building 2-5-8 Higashi-Shinagawa,
Shinagawa-ku, Tokyo 140-0002 JAPAN

Prepared by

SGS RF Technologies Inc.
3-5-23, Kiyatamata, Tsuzuki-ku, Yokohama, 224-0021, Japan
Telephone: +81+(0)45- 550-3520
FAX: +81+(0)45- 592-7506

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

Report No.	Date	Revisions	Issued By
ERY1505P08R1	08 May. 2015	Initial Issue	T.Kato
ERY1505P21R1	21 May. 2015	Revise the year of ANSI standard (Sec 1.2)	T.Kato

1 General information

1.1 Product description

Test item	: HF Transceiver
Manufacturer	: YAESU MUSEN CO., LTD.
Address	: 43 Utsuroda, Morijuku, Sukagawa-shi, Fukushima-ken 962-0001 JAPAN
Model	: FT-410
FCC ID	: K6620621X50
Serial number	: 5F000015
Hardware version	: SPP01.02
Software version	: SPP01
Highest internal operating Freq.	: 368.64 MHz
Receipt date of EUT	: 17 Apr. 2015
Nominal power source voltages	: DC 13.8 V (This is supplied AC/DC power supply)

1.2 Test(s) performed/ Summary of test result

Test specification(s)	: FCC CFR 47 Part 15 Subpart B (01 Oct. 2014)
Test method(s)	: ANSI C63.4: 2009
Test(s) started	: 01 May. 2015
Test(s) completed	: 07 May. 2015
Purpose of test(s)	: Certification as the peripheral of class B personal computer
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 : T. Kato
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, 2014.
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 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.

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: ± 3.4 dB (150 kHz - 30 MHz)
Radiated emission (9 kHz - 30 MHz): ± 3.3 dB
Radiated emission (30 MHz - 200 MHz): ± 5.0 dB
Radiated emission (200 MHz - 1000 MHz): ± 6.2 dB
Radiated emission (1 GHz - 6 GHz): ± 4.7 dB

1.5 Summary of test results

Requirement	Section in specification	Result	Section in this report
Radiated emissions (30 to 2000 MHz) (*)	15.109	Complied	2.1
AC power line conducted emissions	15.107	Complied	2.2

(*) The highest internal operating frequency is 368.64 MHz

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test

No.	Item	Manufacture	Model No.	Serial No.
A	HF Transceiver	YAESU MUSEN CO., LTD.	FT-410	5F000015
-	-	-	-	-

Support Equipment(s)

No.	Item	Manufacture	Model No.	Serial No.
B	DC Power Supply	YAESU MUSEN CO., LTD.	FP-1030A	1412167017
C	Hand Microphone	YAESU MUSEN CO., LTD.	MH-31B8J	5F000015
D	Headphone	YAESU MUSEN CO., LTD.	YH-77STA	YTS03
E	External Speaker	YAESU MUSEN CO., LTD.	MLS-100	064
F	USB Interface Unit	YAESU MUSEN CO., LTD.	SCU-17	17
G	PC	Panasonic	CF-W8GWYAJP	9GKSA91771
H	LAN Hub	NEC	PA-WR8700N-HP	87N1111286973B0
I	AC adaptor for Hub	NEC	AL1-002292-002	-

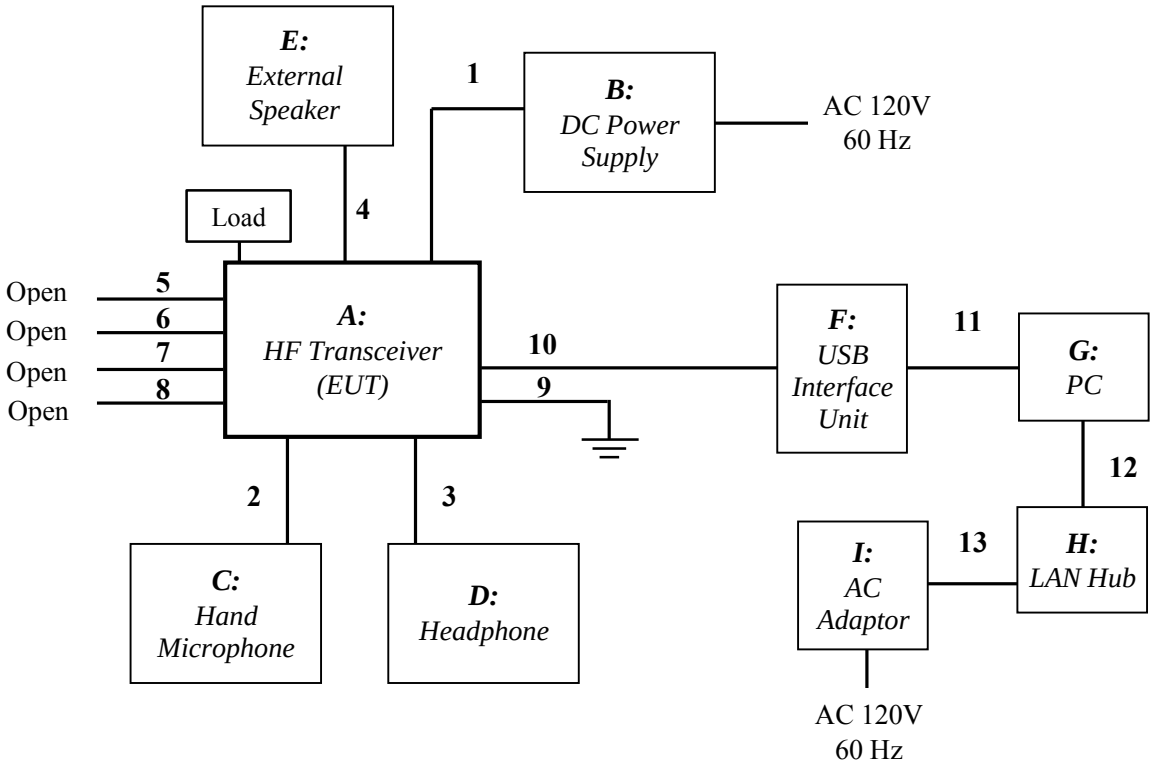
Connected cable(s)

No.	Item	Identification (Manu.etc.)	Cable Shielded	Ferrite Core	Length [m]
1	DC Power cable	YAESU MUSEN CO., LTD.	No	No	2.0
2	Mic. cable	YAESU MUSEN CO., LTD.	No	No	0.6
3	Headphones cable	YAESU MUSEN CO., LTD.	No	No	1.8
4	EXT SPKR cable	YAESU MUSEN CO., LTD.	No	No	1.8
5	TUNER cable	YAESU MUSEN CO., LTD.	No	No	1.1
6	LINER cable	YAESU MUSEN CO., LTD.	No	No	1.2
7	DATA cable	YAESU MUSEN CO., LTD.	No	No	1.6
8	KEY cable	YAESU MUSEN CO., LTD.	No	No	0.5
9	GND cable	YAESU MUSEN CO., LTD.	No	No	2.0
10	CAT cable	SANWA SUPPLY INC.	No	No	1.5
11	USB cable	YAESU MUSEN CO., LTD.	Yes	No	2.0
12	LAN Cable	-	No	No	2.0
13	DC cable for AC adaptor	NEC	No	No	1.3

1.6.2 Operating condition:

ITE mode: The EUT is connected to PC using CAT cable.

1.6.3 Setup diagram of tested system



Note: The signal cable 5 to 8 were connected to no AE by a request from the manufacturer.
50 ohm terminals were connected to the antenna terminals.

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

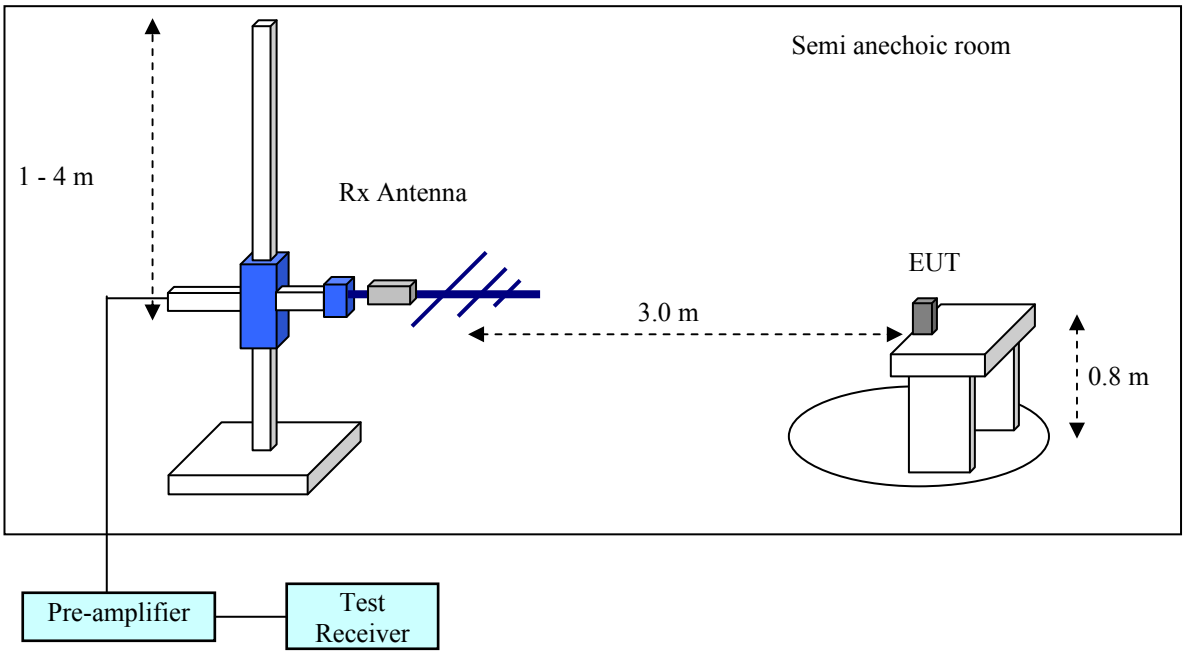
No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Radiated emissions

Test setup

Test setup was implemented according to the method of ANSI C63.4 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 clauses 8.2.
The EUT is place on a non-conducted table which is 0.8 m 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.
The antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.
The spectrum analyzer and receiver are set to the followings;

RBW=100 kHz (up to 1000 MHz) or 1 MHz (above 1000 MHz) ,
VBW= 300 kHz (up to 1000 MHz) or 3 MHz (above 1000 MHz)
Final measurement is carried out with a receiver RBW of 120 kHz (up to 1000 MHz), or 1 MHz (above 1000 MHz).

Applicable rule and limitation

FCC 15.109 Radiated emissions limits

Frequency [MHz]	Field Strength [μV/m]	Measurement Distance [m]	Field Strength [dBμV/m]
30 – 88	100	3	40.0
88 –216	150	3	43.5
216 – 960	200	3	46.0
Above 960	500	3	53.9

In the emission table above, the tighter limit applies at the band edges.
The emission limits shown in the above table are based on measurements employing a QP detector (up to 1000 MHz) or AVE/PEAK detector (above 1000 MHz).

Test results - *Complied with requirement*

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

AC01	TR06	CL11	PR15	BA10	CL29	CL30
PR12	DH01					

Test software used

EMI Ver. 5.6

Calculation method

The Correction Factor and Result are calculated as followings.

Correction Factor [dB/m] = Ant. Factor [dB/m] + Loss [dB] – Gain [dB]
Result [dBµV/m] = Reasding [dBµV] + Correction Factor [dB/m]

Test Data

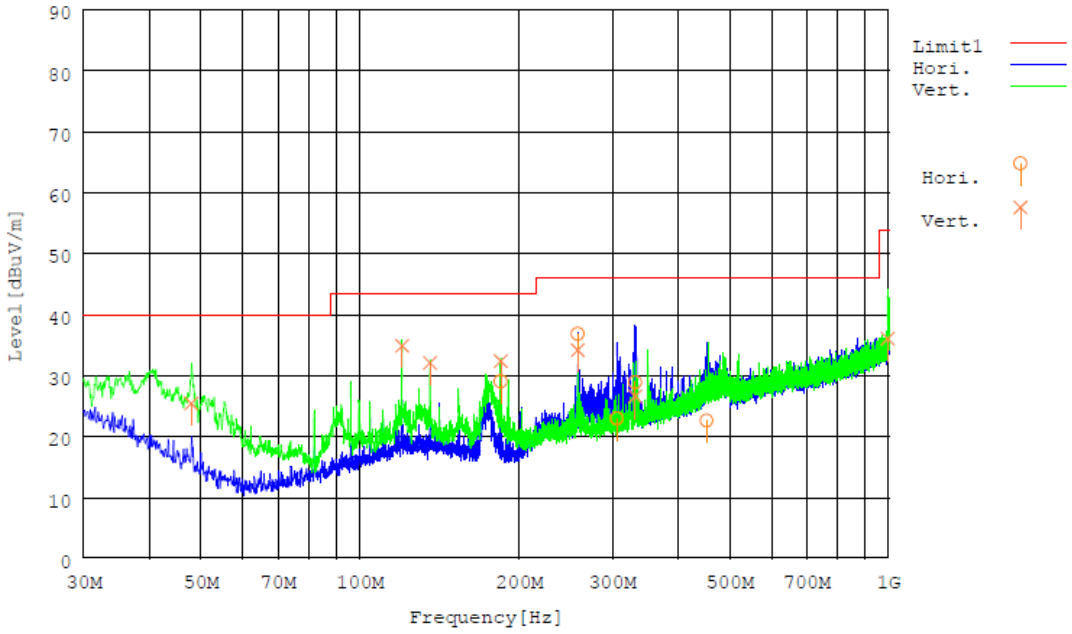
Range: 30 - 1000 MHz

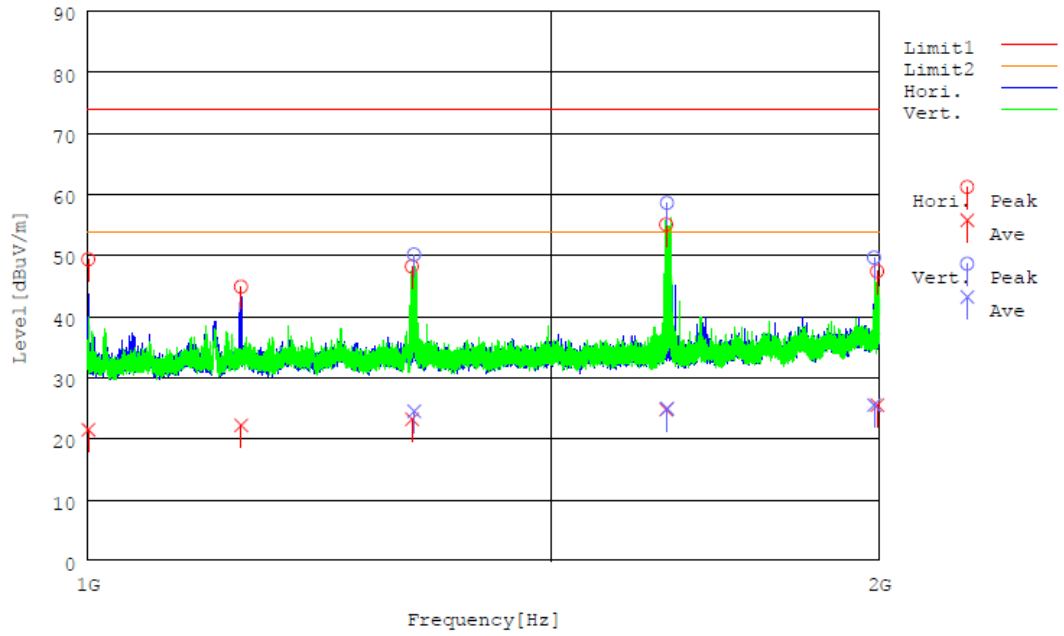
No.	Frequency [MHz]	Reading [dBµV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Ant.
1	184.318	41.6	9.0	8.4	30.0	29.0	43.5	14.5	Hori.
2	258.045	45.2	12.7	8.9	29.9	36.9	46.0	9.1	Hori.
3	306.352	30.1	13.6	9.2	29.9	23.0	46.0	23.0	Hori.
4	331.772	35.1	14.3	9.4	29.9	28.9	46.0	17.1	Hori.
5	452.446	25.0	17.2	10.1	29.7	22.6	46.0	23.4	Hori.
6	47.937	39.0	9.5	7.1	30.2	25.4	40.0	14.6	Vert.
7	120.045	45.5	11.6	7.9	30.1	34.9	43.5	8.6	Vert.
8	135.749	42.4	11.7	8.0	30.0	32.1	43.5	11.4	Vert.
9	184.318	45.0	9.0	8.4	30.0	32.4	43.5	11.1	Vert.
10	258.044	42.5	12.7	8.9	29.9	34.2	46.0	11.8	Vert.
11	331.772	32.8	14.3	9.4	29.9	26.6	46.0	19.4	Vert.
12	995.144	29.4	24.3	12.5	30.1	36.1	53.9	17.8	Vert.

Range: 1000 - 2000 MHz

No.	Frequency [MHz]	Reading PK [dBµV]	Reading AVE [dBµV]	C.Factor [dB/m]	Result PK [dBµV/m]	Result AVE [dBµV/m]	Limit PK [dBµV/m]	Limit AVE [dBµV/m]	Margin PK [dB]	Margin AVE [dB]	Ant.
1	1000.500	61.1	33.3	-11.8	49.3	21.5	73.9	53.9	24.6	32.4	Hori.
2	1143.493	55.6	32.9	-10.7	44.9	22.2	73.9	53.9	29.0	31.7	Hori.
3	1327.884	58.2	33.2	-10.0	48.2	23.2	73.9	53.9	25.7	30.7	Hori.
4	1659.267	63.7	33.4	-8.6	55.1	24.8	73.9	53.9	18.8	29.1	Hori.
5	1996.050	52.3	30.4	-4.9	47.4	25.5	73.9	53.9	26.5	28.4	Hori.
6	1330.583	60.0	34.4	-9.9	50.1	24.5	73.9	53.9	23.8	29.4	Vert.
7	1660.467	67.1	33.4	-8.5	58.6	24.9	73.9	53.9	15.3	29.0	Vert.
8	1990.950	54.6	30.5	-5.0	49.6	25.5	73.9	53.9	24.3	28.4	Vert.

[Chart]





[Test condition]

Tested Date:	01 May. 2015	Temperature:	21 degC
Humidity:	57 %	Atmos. Press:	1017 hPa

2.2 AC power line conducted emissions

Test setup

Test setup was implemented according to the method of ANSI C63.4 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 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

§15.107 (b) AC power line conducted limits

Frequency of Emission [MHz]	Conducted emissions Limit [dBµV]	
	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)

TR06	LN05	CL18

Test software used

EMI Ver. 5.6

Calculation method

The Correction Factor and Result are calculated as followings.

Correction Factor [dB] = ISN Factor [dB] + Loss [dB]
Result [dBµV] = Reading [dBµV] + Correction Factor [dB]

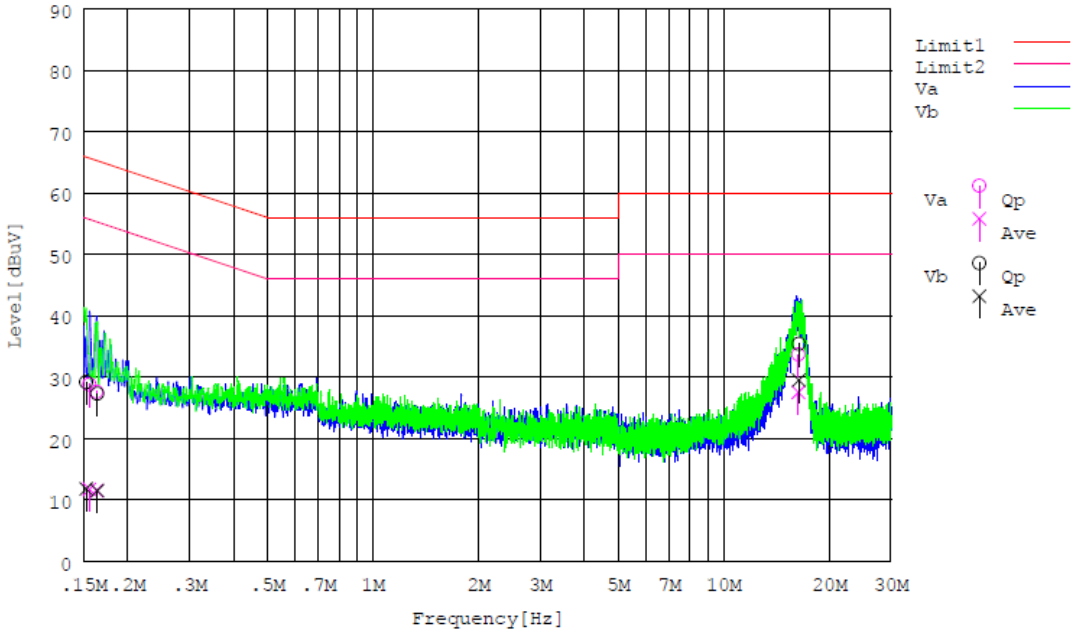
Test results - *Complied with requirement*

Test Data

[Emission level]

No.	Frequency [MHz]	Reading		C.F. [dB]	Result		Limit		Phase	Pass/Fail
		QP [dBµV]	AV [dBµV]		QP [dBµV]	AV [dBµV]	QP [dBµV]	AV [dBµV]		
1	0.15555	18.5	1.4	10.3	28.8	11.7	65.7	55.7	Va	Pass
2	0.16295	17.3	1.2	10.3	27.6	11.5	65.3	55.3	Va	Pass
3	16.30994	23.3	17.1	10.4	33.7	27.5	60.0	50.0	Va	Pass
4	0.15222	18.9	1.5	10.3	29.2	11.8	65.9	55.9	Vb	Pass
5	0.16369	17.0	1.2	10.3	27.3	11.5	65.3	55.3	Vb	Pass
6	16.36713	25.0	19.1	10.4	35.4	29.5	60.0	50.0	Vb	Pass

[Chart]



[Test condition]

Tested Date:	07 May. 2015	Temperature:	21 degC
Humidity:	52 %	Atmos. Press:	1013 hPa

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	-	2015/4/18	2016/4/30
AC01(EG)	Anechoic Chamber (1st test room)	JSE	203397C	-	2014/11/24	2015/11/30
BA10	Bilogical Antenna	TESEQ	CBL6111D	32342	2014/6/9	2015/6/30
CL11	RF Cable for RE	RFT	-	-	2015/3/13	2016/3/31
CL18	RF Cable for CE	RFT	-	-	2015/5/1	2016/5/31
CL29	RF Cable 2 m	SUHNER	SUCOFLEX104PE	94709	2015/1/26	2016/1/31
CL30	RF Cable 5 m	SUHNER	SUCOFLEX104PE	MY3599	2014/8/28	2015/8/31
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2014/1/21	2016/1/31
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2014/5/22	2015/5/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2015/1/26	2016/1/31
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

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.