TEST REPORT

For

RFID READER/WRITER MODULE

In conformity with

FCC CFR 47 Part15 Subpart C / IC RSS-Gen, RSS-210

Model : TM10-B/QQ

FCC ID : VQ7TM10-B-QQ

IC ID : 10795A-TM10BQQ

Test Item : RFID READER/WRITER MODULE

Report No. : RY1301Z28R1

Issue Date : 28 January, 2013

Prepared for

GL Sciences Inc.
4-16-3, Kuramae, Taito-ku, Tokyo, 111-0051, Japan

Prepared by

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History

Report No.	Date	Revisions	Issued By
RY1301Z28R1	28 January, 2013	Initial Issue	K.Ohnishi

1 General information

1.1 Product description

Test item	: RFID READER/WRITER MODULE
Manufacturer	: GL Sciences Inc.
Address	: 4-16-3, Kuramae, Taito-ku, Tokyo, 111-0051, Japan
Model	: TM10-B/QQ
FCC ID	: VQ7TM10-B-QQ
IC ID	: 10795A-TM10BQQ
Serial number	: 12CA00001, 12CA00002
Transmitting Frequency	: 13.56 MHz
Type of Modulation	: ASK
Operating temperature range	: 0 to +50 degC (Manufacturer declaration)
Receipt date of EUT	: 15 January, 2013
Nominal power source voltages	: 5.0 Vdc
Antenna Type	: Integral

1.2 Test(s) performed/ Summary of test result

Test specification(s)	: FCC CFR 47. Part 15 (01 October, 2010)
Test method(s)	: ANSI C63.4: 2003, RSS-Gen Issue 3, RSS-210 Issue 8
Test(s) started	: 15 January, 2013
Test(s) completed	: 28 January, 2013
Purpose of test(s)	: Grant for Certification of FCC/IC
Summary of test result	: Complied

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

Test engineer : 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
.
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.

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: ± 3.4 dB (10 kHz - 30 MHz)
Radiated emission (9 kHz - 30 MHz): ± 2.9 dB
Radiated emission (30 MHz - 200 MHz): ± 5.0 dB
Radiated emission (200 MHz - 1000 MHz): ± 6.2 dB

1.5 Summary of test results

Requirement	Section in FCC/IC	Sample	Result	Section in this report
1.5.1 Occupied bandwidth	-	A2	-	2.1
1.5.2 Transmitter radiated emissions (9 kHz to 30 MHz)	15.225 (a),(b),(c),(d) RSS-210 A2.6	A2	Complied	2.2.1
1.5.3 Transmitter radiated emissions (30 to 1000 MHz)	15.209 RSS-Gen 4.9	A2	Complied	2.2.2
1.5.4 Carrier frequency stability	15.225 (e) RSS-210 A2.6	A2	Complied	2.3
1.5.5 Transmitter AC power line conducted emissions	15.207 RSS-Gen 7.2.4	A2	Complied	2.4
1.5.6 Receiver radiated emissions (30 to 1000 MHz)	15.209 RSS-Gen 4.10	A1	Complied	2.5
1.5.7 Receiver AC power line conducted emissions	15.207 RSS-Gen 7.2.4	A1	Complied	2.6

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

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test

	Item	Manufacture	Model No.	Serial No.	Note
A1	RFID READER/WRITER MODULE	GL Sciences Inc.	TM10-B/QQ	12CA00001	For Rx test
A2	RFID READER/WRITER MODULE	GL Sciences Inc.	TM10-B/QQ	12CA00002	For Tx test

Support Equipment(s)

	Item	Manufacture	Model No.	Serial No.	Remark
B1	DC Power Supply	KIKUSUI	PMC18-3A	CD001794	-
B2	DC Power Supply	Agilent	E3632A	MY40003077	For AC Conducted test

Connected cable(s)

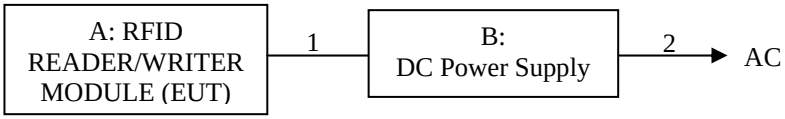
No.	Item	Identification (Manu.e.t.c)	Cable Shielded	Ferrite Core	Connector Shielded	Length [m]
1	DC cable	-	No	No	No	0.55
2	AC cable	-	No	No	No	2.00

1.6.2 Operating condition:

Operating mode: Continuous transmission (ISO 15693, ASK 100%)
Continuous transmission (no modulation)
Ready to reception (same as standby)

This transceiver could not achieved receiving mode only therefore the measurement was carried out under receiving ready condition of the EUT. This condition is same as standby.

1.6.3 Setup diagram of tested system



1.7 Equipment modifications

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

1.8 Deviation from the standard

No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Occupied bandwidth

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 is no limitation.

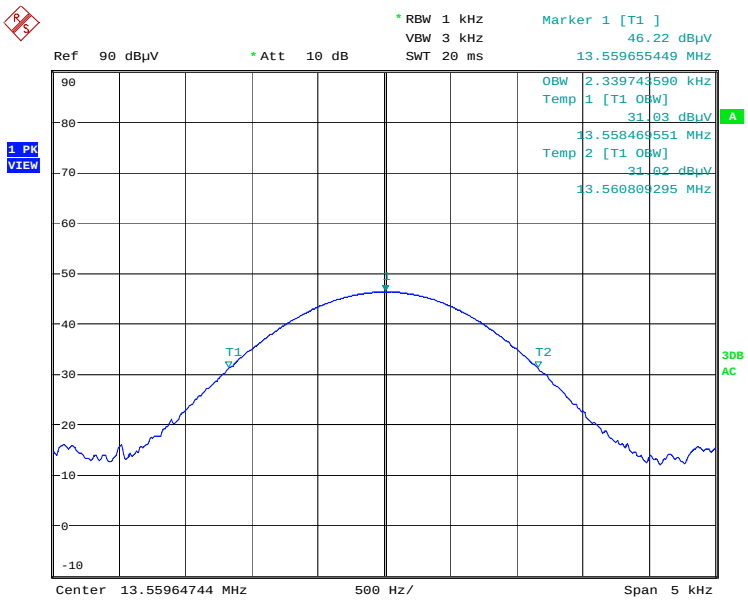
Test equipment used (refer to List of utilized test equipment)

TR06	LP04	CL11	

Test results – Reporting purpose.

Frequency [MHz]	Occupied Bandwidth [kHz]
13.559	2.34

Test Data

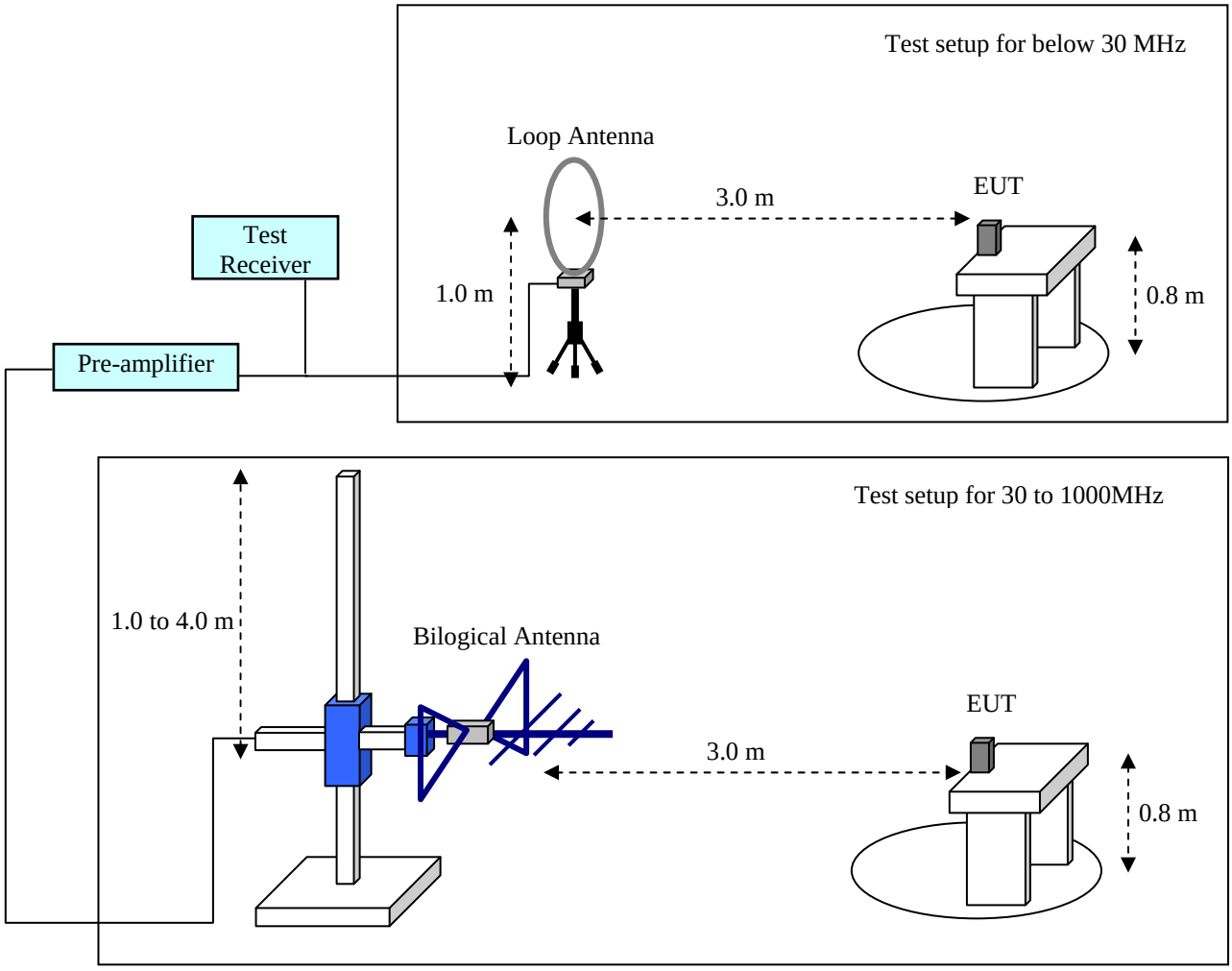


Tested Date:	16 January, 2013	Temperature:	17 degC
Humidity:	28 %	Atmos. Press:	1020 hPa

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

Applicable rule and limitation

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 [µV/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 [µV/m]	Field strength @30m [dBµV/m]	Field strength @3m [dBµV/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

dBµV/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 results - *Complied with requirement*.

2.2.1 Below 30 MHz

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

AC01	LP04	CL11	TR06

Test Data

Tested Date: 15 January, 2013 Temperature: 20 degC
Humidity: 26% Atmos. Press: 1016 hPa

Operating mode: Continuous transmission (ISO 15693, ASK 100%)
EUT condition: Y-plane (Maximum condition)
Measurement distance: 3 m

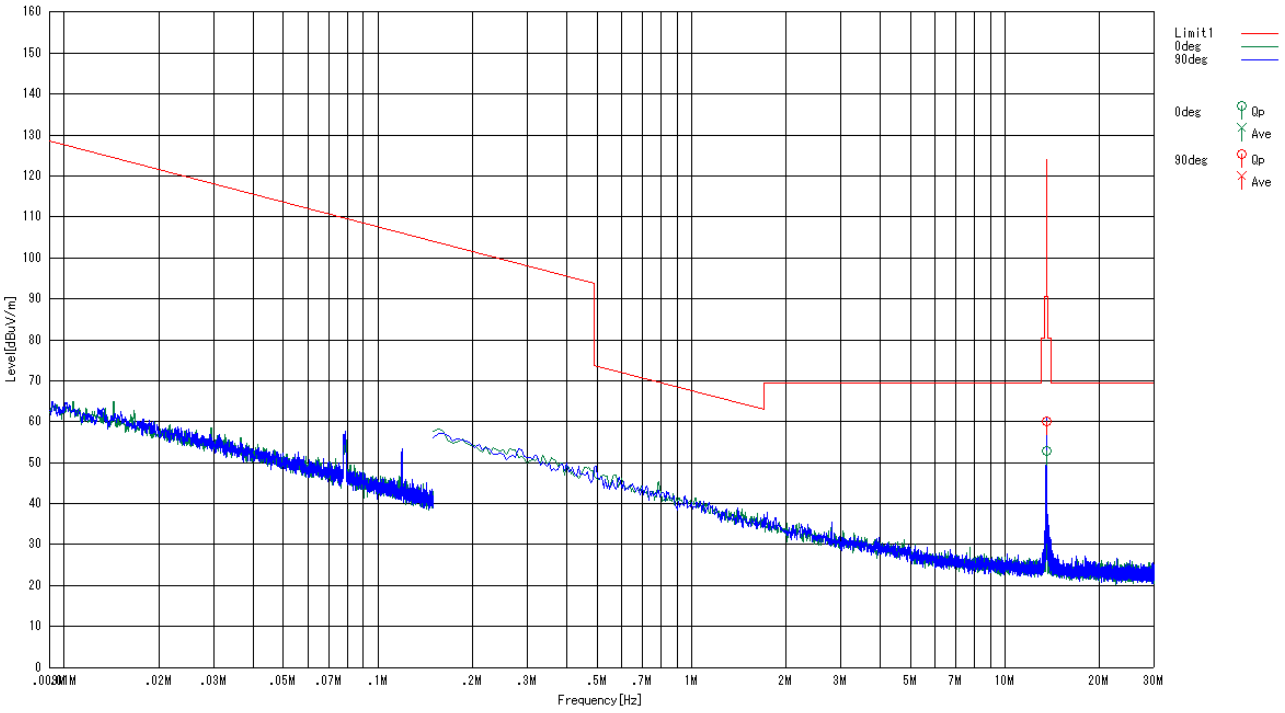
§15.225(a)/ (b)/ (c) Fundamental emission (Worst condition)

Freq. [MHz]	Reading @3m [dBµV]	Corr. Factor [dB]	Result [dBµV/m]	Limit @3m [dBµV/m]	Margin [dB]
13.559	49.1	11.1	60.2	124.0	63.8

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 was no spurious emission greater than noise floor or 20 dB below the limit.



Note: 13.56 MHz is a Tx carrier. This is not spurious emission from EUT.

2.2.2 Between 30 – 1000 MHz

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

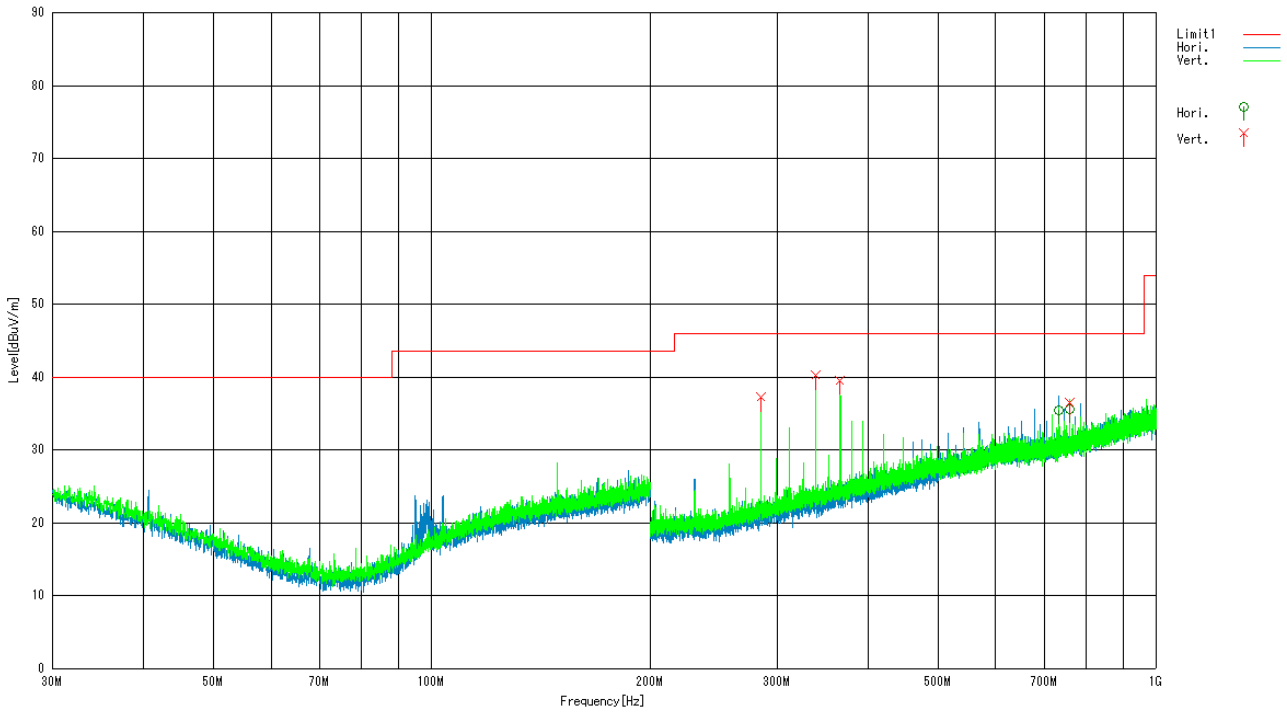
AC01	BI01	LA07	CL11	PR15	TR06	

Test Data

Tested Date: 16 January, 2013 Temperature: 17 degC
Humidity: 28% Atmos. Press: 1020 hPa

Operating mode: Continuous transmission (ISO 15693, ASK 100%)
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	284.753	44.4	13.0	9.7	29.9	37.2	46.0	8.8	Vert.
2	**338.991**	**45.4**	**14.5**	**10.2**	**29.9**	**40.2**	**46.0**	**5.8**	**Vert.**
3	366.110	43.9	15.1	10.4	29.9	39.5	46.0	6.5	Vert.
4	732.221	33.1	20.0	12.5	30.1	35.5	46.0	10.5	Hori.
5	759.340	33.0	20.3	12.6	30.3	35.6	46.0	10.4	Hori.
6	759.341	33.9	20.3	12.6	30.3	36.5	46.0	9.5	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 variation	-20 to +50 degC	± 0.01 %
Voltage variation	5.0 Vdc ± 10 % *	± 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)

TR06	TC01	LP51	

Test results - *Complied with requirement*.

Test Data

Tested Date: 24 January, 2013 Temperature: 22 degC
Humidity: 30 % Atmos. Press: 1016 hPa

Operating Mode: Continuous transmission (no modulation)

Temp. [degC]	Volt. [V]	Measured Frequency [MHz]				Worst Deviation [%]	Limit [%]
		Start-up	2 min.	5 min.	10 min.		
50	5.0	13.559639	13.559639	13.559637	**13.559635**	-0.0027	+/-0.01
40	5.0	13.559661	13.559656	13.559654	**13.559653**	-0.0026	+/-0.01
30	5.0	13.559701	13.559689	13.559686	**13.559685**	-0.0023	+/-0.01
20	4.5	13.559711	13.559713	13.559712	**13.559711**	-0.0021	+/-0.01
	5.5	13.559707	13.559702	13.559700	**13.559700**	-0.0022	+/-0.01
10	5.0	**13.559710**	13.559718	13.559717	13.559716	-0.0021	+/-0.01
0	5.0	**13.559695**	13.559722	13.559720	13.559721	-0.0022	+/-0.01
-10 *	5.0	**13.559676**	13.559706	13.559703	13.559707	-0.0024	+/-0.01
-20 *	5.0	**13.559640**	13.559658	13.559657	13.559658	-0.0027	+/-0.01

Note1: Operating temperature range of this product is 0 to 50 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 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 [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

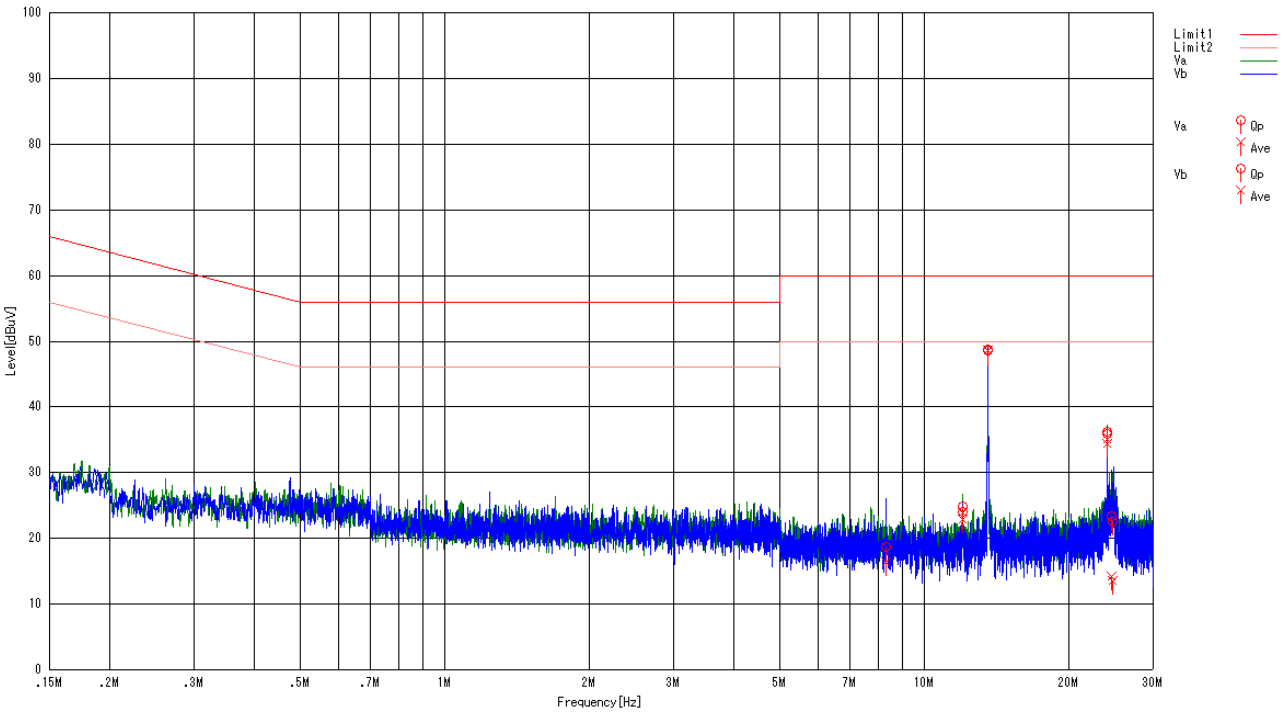
Test results - *Complied with requirement*.

Test Data

Tested Date: 28 January, 2013 Temperature: 16 degC
Humidity: 35 % Atmos. Press: 1014 hPa

Operating mode: Continuous transmission (ISO 15693, ASK 100%, 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	8.312	8.5	6.2	10.1	18.6	16.3	60.0	50.0	41.4	33.7	Vb
2	12.020	14.6	13.7	10.2	24.8	23.9	60.0	50.0	35.2	26.1	Vb
3	12.021	13.8	12.7	10.2	24.0	22.9	60.0	50.0	36.0	27.1	Va
4	**13.559**	38.5	**38.4**	**10.2**	48.7	**48.6**	60.0	**50.0**	11.3	**1.4**	**Va**
5	13.559	38.4	38.3	10.2	48.6	48.5	60.0	50.0	11.4	1.5	Vb
6	23.999	25.3	23.9	10.5	35.8	34.4	60.0	50.0	24.2	15.6	Va
7	23.999	25.7	24.5	10.5	36.2	35.0	60.0	50.0	23.8	15.0	Vb
8	24.504	12.8	3.7	10.5	23.3	14.2	60.0	50.0	36.7	35.8	Va
9	24.718	12.0	3.0	10.5	22.5	13.5	60.0	50.0	37.5	36.5	Vb



2.5 Receiver Radiated spurious emissions

Test setup - Same as clause 2.2

Test procedure - Same as clause 2.2

Applicable rule and limitation at 3m

RSS-Gen 6 Radiated Spurious Emission Limits

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

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

AC01	BI01	LA07	CL11	PR15	TR06	

Test results - *Complied with requirement.*

This transceiver could not achieved receiving mode only therefore the measurement was carried out under receiving ready condition of the EUT. This condition is same as standby.

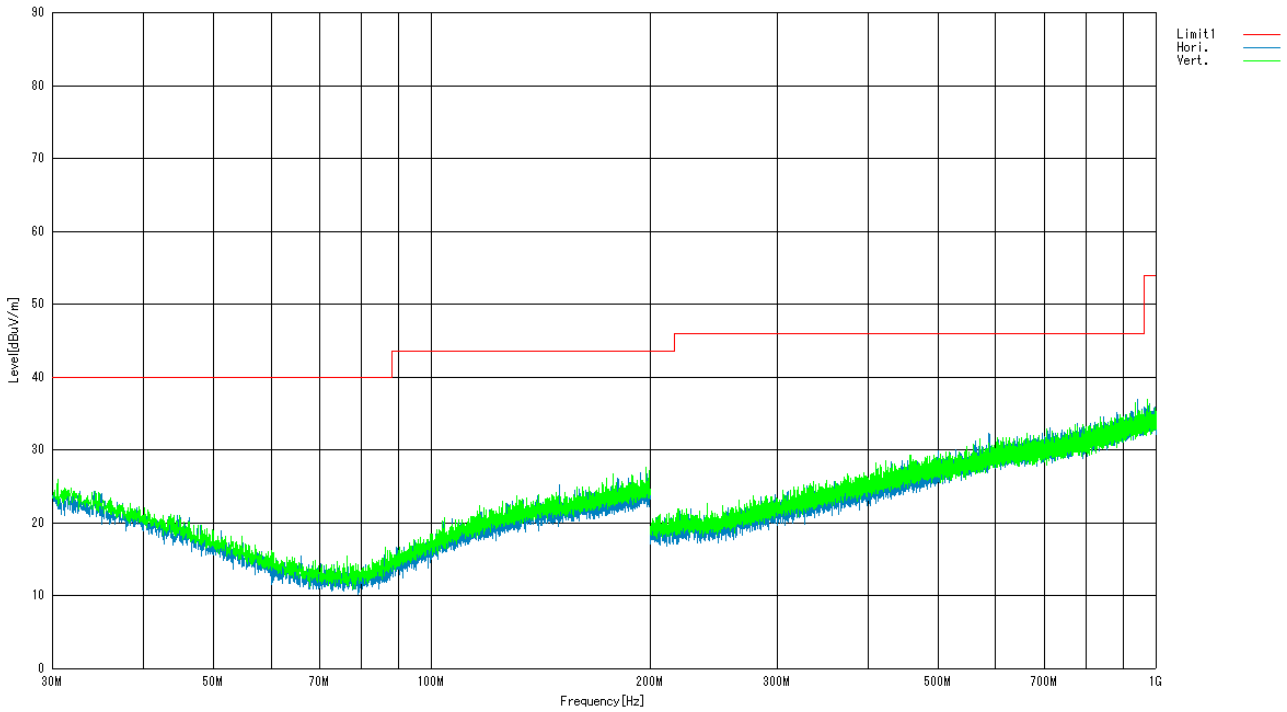
Test Data

Tested Date: 17 January, 2013 Temperature: 18 degC
Humidity: 28% Atmos. Press: 1014 hPa

Operating mode: Ready to reception (same as standby)
Measurement distance: 3 m

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

No.	Frequency [MHz]	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna Polarization



2.6 Receiver AC power line conducted emissions

Test setup - Same as clause 2.4

Test procedure - Same as clause 2.4

Applicable rule and limitation

RSS-Gen 7.2.4 AC Power Line Conducted Emissions Limits

Frequency of Emission [MHz]	Conducted 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 results - *Complied with requirement*.

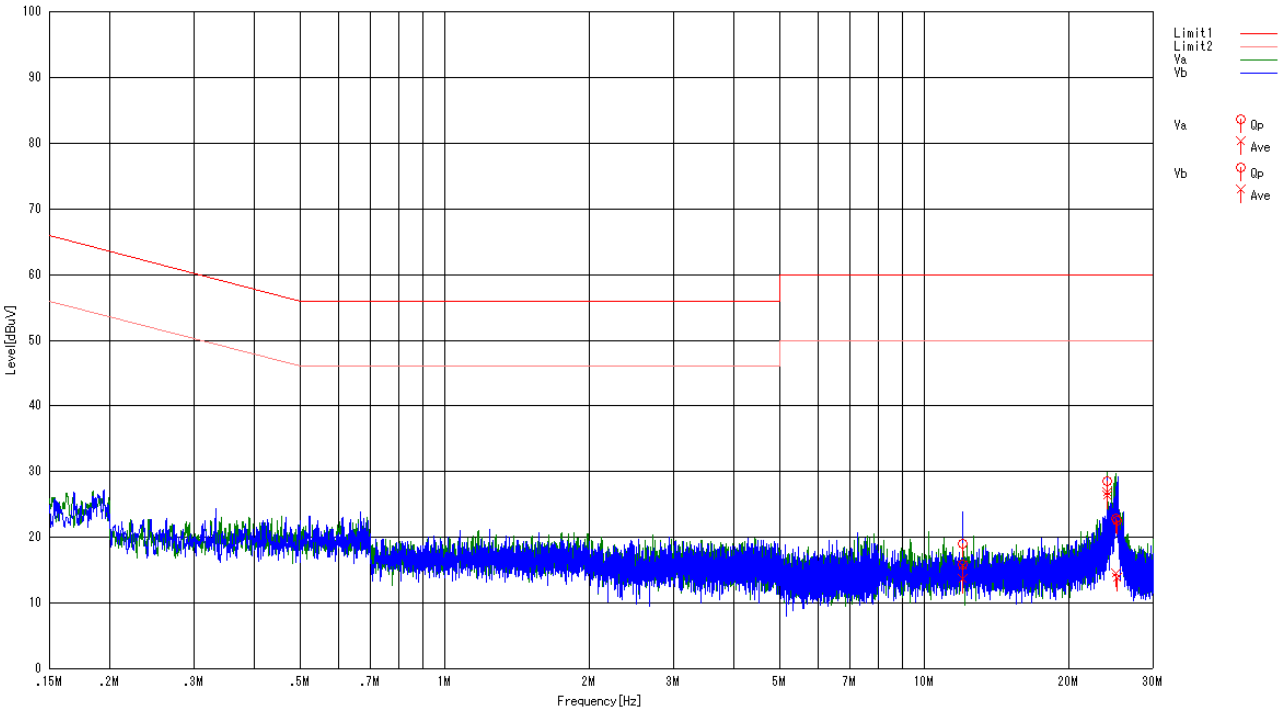
This transceiver could not achieved receiving mode only therefore the measurement was carried out under receiving ready condition of the EUT. This condition is same as standby.

Test Data

Tested Date: 18 January, 2013 Temperature: 18 degC
Humidity: 30 % Atmos. Press: 1018 hPa

Operating mode: Ready to reception (same as standby)

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	11.995	5.7	3.4	10.2	15.9	13.6	60.0	50.0	44.1	36.4	Vb
2	11.997	8.8	5.4	10.2	19.0	15.6	60.0	50.0	41.0	34.4	Va
3	23.999	18.0	15.9	10.5	28.5	26.4	60.0	50.0	31.5	23.6	Va
4	**24.000**	18.0	**16.3**	**10.5**	28.5	**26.8**	60.0	**50.0**	31.5	**23.2**	**Vb**
5	25.073	12.3	4.0	10.5	22.8	14.5	60.0	50.0	37.2	35.5	Va
6	25.146	12.0	3.3	10.5	22.5	13.8	60.0	50.0	37.5	36.2	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
BI01	Biconical Antenna	SCHWARZBECK	VHA9103 & BBA9106	2359	2012/03/12	2013/03/31
CL11	Antenna Cable for RE	RFT	-	-	2012/10/01	2013/10/31
CL18	Antenna Cable for CE	RFT	-	-	2012/05/02	2013/05/31
LA07	Logperiodic Antenna	SCHWARZBECK	VUSLP9111B	102	2012/12/03	2013/12/31
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
PR15	Pre. Amplifier	Anritsu	MH648A	6201156141	2012/06/27	2013/06/30
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	2012/11/19	2013/11/30

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.