RF TEST REPORT

Test item	:	Remote Switch
Model No.	:	RF-2B
Order No.	:	DTNC1408-03515
Date of receipt	:	2014-08-18
Test duration	:	2014-10-14 ~ 2014-12-10
Date of issue	:	2014-12-30
Use of report	:	FCC Original Grant

Applicant : Poskom Co., Ltd.
Room 405, Unitech Ville Bldg., 1141-2, Baeksuk-dong, Goyang, Korea

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15 Subpart C
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
HyunSu Son

Reviewed by:

Technical Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1412-1683	Dec. 30, 2014	Initial issue

CONTENTS

1. Equipment information 4
1.1 Equipment description 4
1.2 Ancillary equipment 4
2. Information about test items 5
2.1 Operating mode 5
2.2 Tested frequency 5
2.3 Auxiliary equipment 5
2.4 Tested environment 5
2.5 EMI Suppression Device(s)/Modifications 5
3. Test Report 6
3.1 Summary of tests 6
3.2 Transmitter requirements 7
3.2.1 20dB bandwidth 7
3.2.2 Field strength of fundamental and spurious emissions 10
3.2.3 Transmit Duration and Duration between Transmissions 12
3.2.4 AC power line conducted emission 13
3.2.5 Antenna requirement 16
APPENDIX I 17

1. Equipment information

1.1 Equipment description

FCC Equipment Class	Part 15 Remote Control/Security Device Transceiver
Equipment type	Remote Switch
Fundamental Frequency	433.700 MHz ~ 433.8875 MHz
Equipment model name	RF-2B
Modulation	FSK
Equipment serial no.	Identical prototype
Power	DC 5 V
Antenna type	External Antenna

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
AC Adapter	DA-30C03	379124308	Asian Power Devices Inc.	-
-	-	-	-	-

2. Information about test items

2.1 Operating mode

Operating Mode 1	This device was tested with continuous TX mode for field strength of fundamental and spurious emissions measurements.
Operating Mode 2	Normal operating mode was used for 20 dB BW and Transmit Duration and Duration between Transmissions

2.2 Tested frequency

	Frequency(MHz)
Lowest Channel	433.7000
Middle Channel	433.7875
Highest Channel	433.8875

2.3 Auxiliary equipment

Equipment	**Model No.**	**Serial No.**	**Manufacturer**	**Note**
-	-	-	-	-

2.4 Tested environment

Temperature	:	23 ~ 24 ^{o}C
Relative humidity content	:	31 ~ 34 % R.H.
Details of power supply	:	DC 5 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status Note 1
I. Test Items			
15.205	Restricted bands of operation	Radiated	**C**
15.209	Radiated emission limits, general requirements		**C**
15.231(e)	Transmit Duration and Duration between Transmissions		**C**
15.231(e)	Field strength of fundamental and spurious emissions		**C**
15.231(c)	20dB bandwidth		**C**
15.207	AC Power Line Conducted Emission	AC Line Conducted	**C**
15.203	Antenna Requirements	-	**C**

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

The sample was tested according to the following specification:
ANSI C-63.4-2009

3.2 Transmitter requirements

3.2.1 20dB bandwidth

- Procedure:
The Transmitter output is connected to the spectrum analyzer.

20dB Bandwidth: The RBW is set to 3 kHz. The VBW is set to 9.1 kHz. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

- Measurement Data: Comply
Note: See next pages for actual measured spectrum plots.

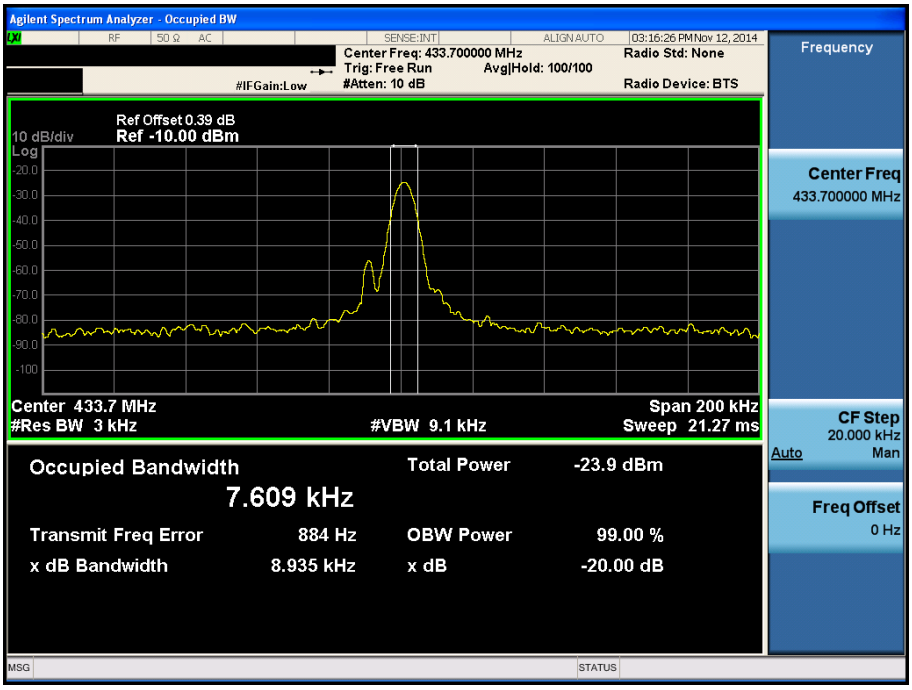
Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
433.7000	8.935	1084.25
433.7875	8.914	1084.47
433.8875	8.931	1084.72

- **Limit: § 15.209(c)**

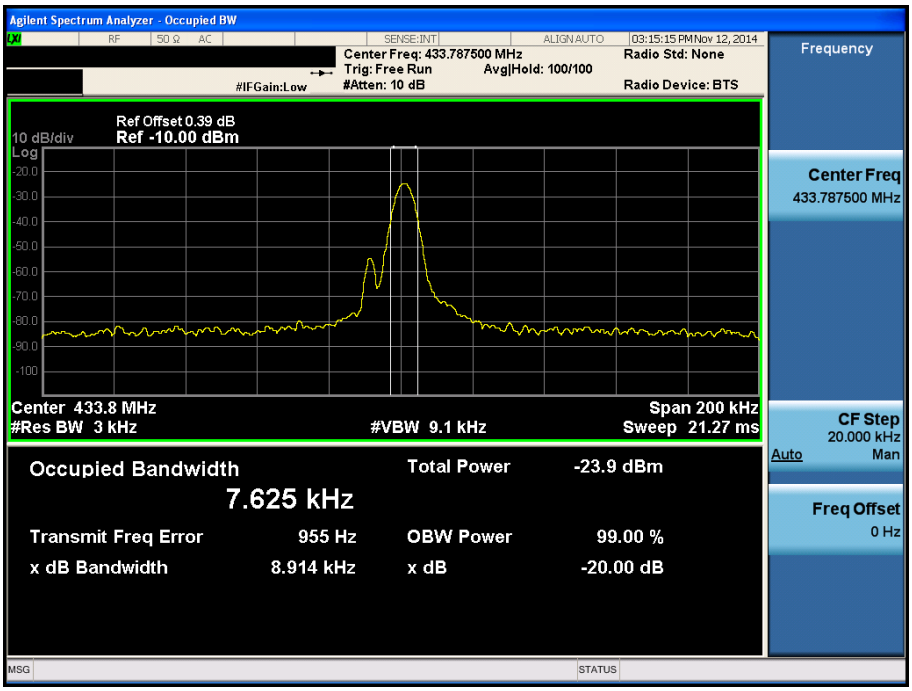
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

- Measurement Data:

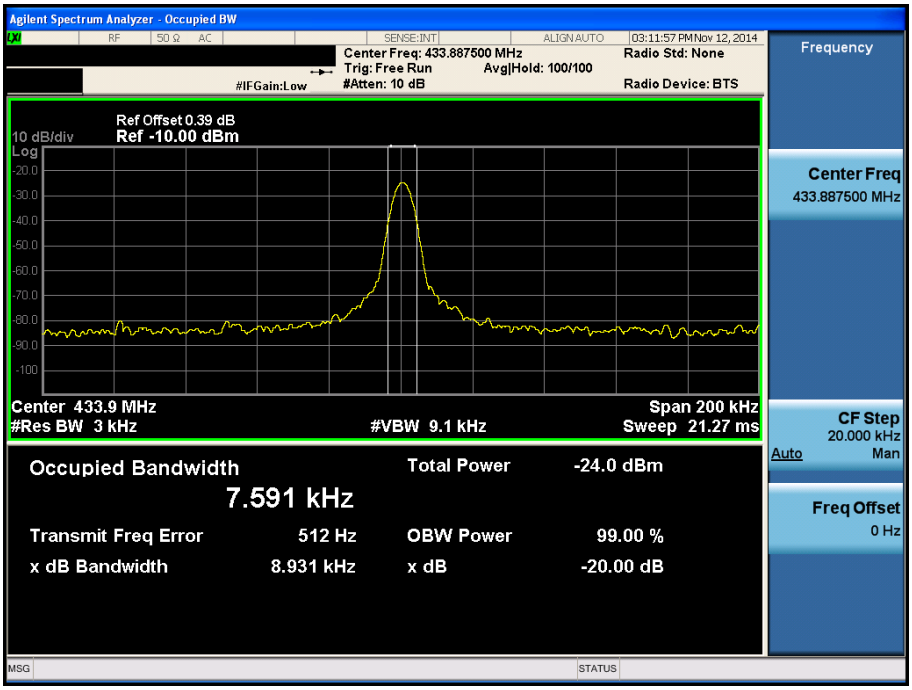
20dB bandwidth ***Lowest Frequency***



20dB bandwidth ***Middle Frequency***



20dB bandwidth ***Highest Frequency***



3.2.2 Field strength of fundamental and spurious emissions

- Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- Measurement Data: Refer to next page

- Limit:

§ 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

§ 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 of Fundamental Frequency [uV/m]	Measurement Distance [m]
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

§ 15.231(e), Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Field Strength of Spurious Emissions [uV/m]
40.66 ~ 40.70	1,000	100
70 ~ 130	500	50
130 ~ 174	500 to 1,500	50 to 150
174 ~ 260	1,500	150
260 ~ 470	1,500 to 5,000	150 to 500
Above 470	5,000	500

- Measurement Data: Comply

Field strength of fundamental

Measurement Distance : 3 m

Test Freq.	EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Averaging correction fator [dB]	Field Strength [dBuV/m]	Averaging Limit [dBuV/m]	Margin [dB]
Lowest Freq.	Y	433.7000	PK	Hor	78.10	-7.70	-	70.40	72.80	2.40
	Y	433.7000	PK	Ver	76.70	-7.70	-	69.00	72.80	3.80
Middle Freq.	Y	433.7875	PK	Hor	78.70	-7.70	-	71.00	72.80	1.80
	Y	433.7875	PK	Ver	76.20	-7.70	-	68.50	72.80	4.30
Highest Freq.	Y	433.8875	PK	Hor	78.60	-7.70	-	70.90	72.80	1.90
	Y	433.8875	PK	Ver	75.30	-7.70	-	67.60	72.80	5.20

Note 1 : EUT was in continuous transmission mode and peak field strength meets AV limit.
Therefore averaging correction factor using the duty cycle is not required.
Note 2 : The worst data was reported.
Note 3 : Sample calculation
T.F = AF + CL – AG / Field Strength = Reading + T.F + DF
Margin = Limit – Field Strength
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

Field strength of spurious emissions

Measurement Distance : 3 m

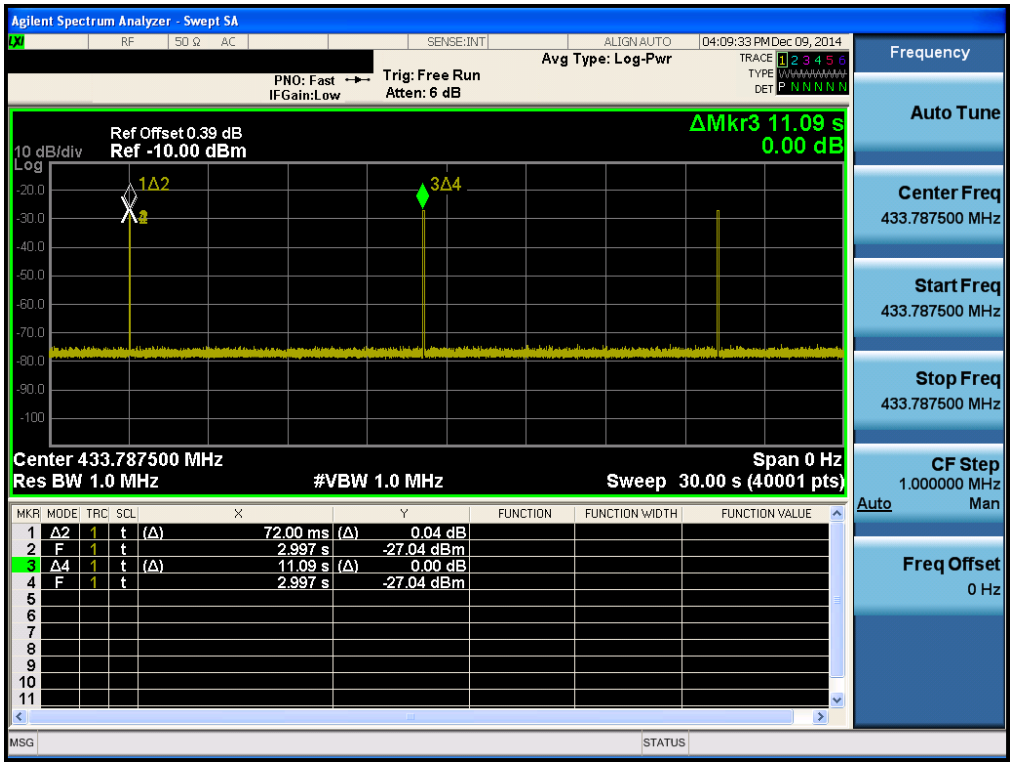
Test Freq.	EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Averaging correction fator [dB]	Field Strength [dBuV/m]	Averaging Limit [dBuV/m]	Margin [dB]
Lowest Freq.	Y	877.241	PK	Hor	29.80	-0.80	-	29.00	52.80	23.80
	Y	1301.038	PK	Hor	48.15	-1.38	-	46.77	52.80	6.03
Middle Freq.	Y	881.486	PK	Hor	27.00	-0.80	-	26.20	52.80	26.60
	Y	1301.236	PK	Hor	47.84	-1.38	-	46.46	52.80	6.34
Highest Freq.	Y	867.903	PK	Hor	26.90	-0.80	-	26.10	52.80	26.70
	Y	1301.325	PK	Hor	48.09	-1.38	-	46.71	52.80	6.09

Note 1 : EUT was in continuous transmission mode and peak field strength meets AV limit.
Note 2 : No other spurious and harmonic emissions were reported greater than listed emissions above table.
Note 3 : Sample calculation
T.F = AF + CL – AG / Field Strength = Reading + T.F + DF
Margin = Limit – Field Strength
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

3.2.3 Transmit Duration and Duration between Transmissions

- Measurement Data: Comply

	Measured Time (Sec)	Limit (Sec)	Margin (Sec)
Duration	0.072	1	0.928
Duration between Transmissions	11.09	10	1.09



- Limit: § 15.231(e)

The maximum duration is 1sec. Duration between transmissions more than 10Sec or 30 times the duration of the Transmission whichever is greater.

3.2.4 AC power line conducted emission

- Procedure:

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

- Measurement Data: Comply

Note: See next pages for actual measured spectrum plots.

- Limit:

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (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

AC Line Conducted Emissions (Graph)&Modulation: ***GFSK***

Results of Conducted Emission

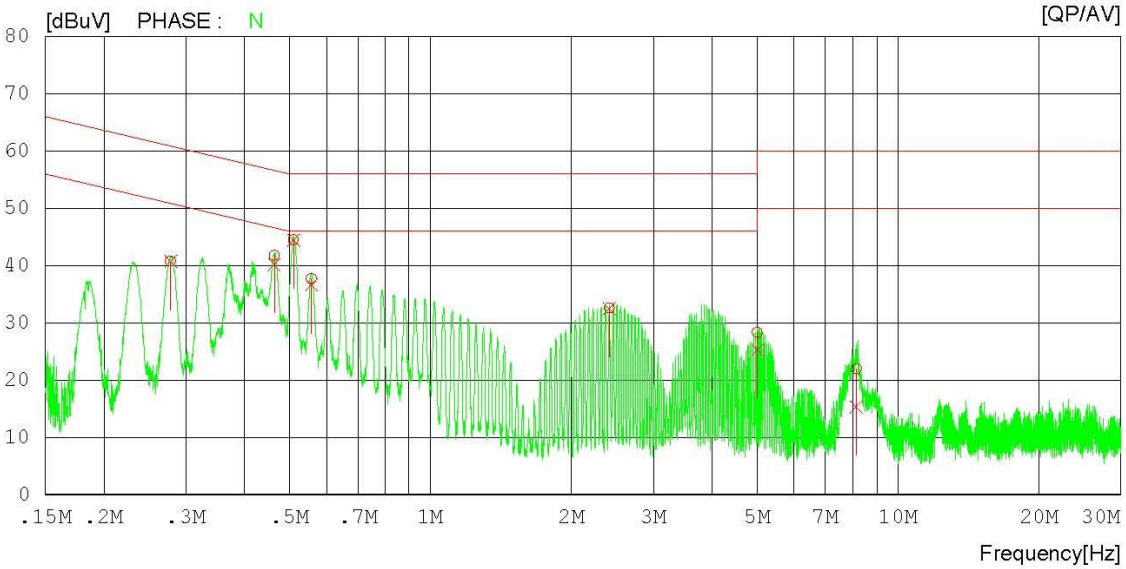
DT&C

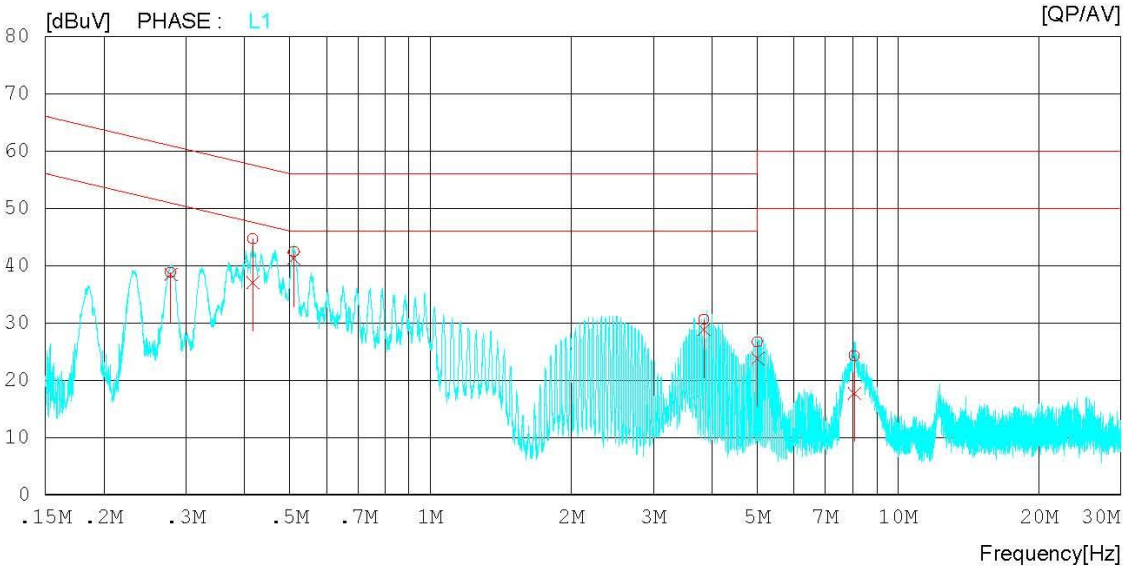
Date : 2014-11-13

Order No.	:		Referrence No.	:	
Model No.	:	RF-2B	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	23'C 31 % R.H
Test Condition	:		Operator	:	HyunSu Son

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (List)&Modulation: ***GFSK***

Results of Conducted Emission

DT&C

Date : 2014-11-13

Order No.	:	Referrence No.	:
Model No.	: RF-2B	Power Supply	: 120 V 60 Hz
Serial No.	:	Temp/Humi.	: 23'C 31 % R.H
Test Condition	:	Operator	: HyunSu Son

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.27823	40.6	40.6	0.1	40.7	40.7	60.9	50.9	20.2	10.2	N
2	0.46356	41.5	40.0	0.2	41.7	40.2	56.6	46.6	14.9	6.4	N
3	0.50987	44.3	44.2	0.2	44.5	44.4	56.0	46.0	11.5	1.6	N
4	0.55654	37.5	36.4	0.2	37.7	36.6	56.0	46.0	18.3	9.4	N
5	2.41160	32.4	32.4	0.1	32.5	32.5	56.0	46.0	23.5	13.5	N
6	5.00740	27.9	25.0	0.3	28.2	25.3	60.0	50.0	31.8	24.7	N
7	8.15040	21.4	14.8	0.5	21.9	15.3	60.0	50.0	38.1	34.7	N
8	0.27842	38.6	38.2	0.2	38.8	38.4	60.9	50.9	22.1	12.5	L1
9	0.41735	44.5	36.9	0.1	44.6	37.0	57.5	47.5	12.9	10.5	L1
10	0.51015	42.3	41.1	0.1	42.4	41.2	56.0	46.0	13.6	4.8	L1
11	3.84840	30.1	28.4	0.4	30.5	28.8	56.0	46.0	25.5	17.2	L1
12	5.00740	26.1	23.2	0.5	26.6	23.7	60.0	50.0	33.4	26.3	L1
13	8.07340	23.5	16.9	0.7	24.2	17.6	60.0	50.0	35.8	32.4	L1

3.2.5 Antenna requirement

- Procedure:
Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

- Measurement Data: Comply
The external antennas used a unique coupling to the intentional radiator.

- Limit: § 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

APPENDIX I

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	14/09/15	15/09/15	MY50200834
DC Power Supply	SM techno	SDP30-5D	14/02/10	15/02/10	305DLJ204
Vector Signal Generator	Rohde Schwarz	SMBV100A	14/01/07	15/01/07	255571
Signal Generator	Rohde Schwarz	SMF100A	14/07/01	15/07/01	102341
Multimeter	HP	34401A	14/02/27	15/02/27	3146A13475
PreAmplifier	Agilent	8449B	14/02/27	15/02/27	3008A00370
Amplifier (22dB)	H.P	8447E	14/01/08	15/01/08	2945A02865
High-Pass Filter	Wainwright Instruments	WHKX1.0	14/09/11	15/09/11	9
LOOP Antenna	SCHWARZBECK	FMZB1513	14/04/29	16/04/29	1513-128
TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB 9160	13/12/16	15/12/16	3358
Double-Ridged Guide Antenna	ETS-LINDGREN	3117	14/05/12	16/05/12	00140394
EMI TEST RECEIVER	R&S	ESU	14/01/08	15/01/08	100014
EMI TEST RECEIVER	Rohde Schwarz	ESCI7	14/02/27	15/02/27	100910
FREQUENCY CONVERTER	TaejIn Electronics	CVCF	14/09/11	15/09/11	ZU0033
ARTIFICIAL MAINS NETWORK	Rohde Schwarz	ESH2-Z5	14/09/11	15/09/11	828739/006
Thermohygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2