

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : E121R-022

AGR No. : A110A-066R

Applicant : Biospace Co., Ltd.

Address : 518-10 Dogok-dong, Gangnam-gu, Seoul, 135-854, Korea

Manufacturer : Biospace Co., Ltd.

Address : 272-1 Yongjeong-ri, Ipjang-myeon, Seobuk-gu, Cheonan-si, Chungcheongnam-do, 330-824, Korea

Type of Equipment : RFID Reader

FCC ID : F6O-BS-RFIDREADER

Model Name : BS-RFID Reader

Serial number : N/A

Total page of Report : 19 pages (including this page)

Date of Incoming : December 26, 2011

Date of Issuing : January 11, 2012

SUMMARY

The equipment complies with the requirements of *FCC CFR 47 PART 15 SUBPART C, SECTION 15.225*

This test report contains only the result of a single test of the sample supplied for the examination.

It is not a general valid assessment of the features of the respective products of the mass-production.

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ONETECH Corp.

CONTENTS

	Page
1. VERIFICATION OF COMPLIANCE	5
2. GENERAL INFORMATION	6
2.1 PRODUCT DESCRIPTION.....	6
2.2 MODEL DIFFERENCES:	6
2.3 RELATED SUBMITTAL(S) / GRANT(S)	6
2.4 PURPOSE OF THE TEST	6
2.5 TEST METHODOLOGY.....	6
2.6 TEST FACILITY	6
3. SYSTEM TEST CONFIGURATION	7
3.1 JUSTIFICATION	7
3.2 PERIPHERAL EQUIPMENT	7
3.3 MODE OF OPERATION DURING THE TEST	7
3.4 CABLE DESCRIPTION FOR THE EUT	7
3.5 EQUIPMENT MODIFICATIONS	7
3.6 CONFIGURATION OF TEST SYSTEM.....	8
3.7 ANTENNA REQUIREMENT	8
4. PRELIMINARY TEST	8
4.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....	8
4.2 RADIATED EMISSIONS TESTS.....	8
5. FINAL RESULT OF MEASUREMENT	9
5.1 CONDUCTED EMISSION TEST.....	9
5.2 FIELD STRENGTH OF THE OPERATING FREQUENCY BAND.....	11
5.2.1 OPERATION FREQUENCY BAND: (13.553 ~ 13.567) MHZ	11
5.2.2 OPERATION FREQUENCY BAND: BELOW 13.553 MHZ AND ABOVE 13.567 MHZ.....	12
5.3 SPURIOUS EMISSION TEST	13
6. 20 DB BANDWIDTH	14
6.1 OPERATING ENVIRONMENT	14
6.2 TEST SET-UP	14
6.3 TEST DATA FOR BANDWIDTH.....	14

7. FREQUENCY STABILITY WITH TEMPERATURE VARIATION.....	16
7.1 OPERATING ENVIRONMENT	16
7.2 TEST SET-UP	16
7.3 TEST DATA.....	16
8. FREQUENCY STABILITY WITH VOLTAGE VARIATION.....	17
8.1 OPERATING ENVIRONMENT	17
8.2 TEST SET-UP	17
8.3 TEST DATA.....	17
9. FIELD STRENGTH CALCULATION	18
10. LIST OF TEST EQUIPMENT	19

Revision History

Issue Report No.	Issued Date	Revisions	Effect Section
E121R-022	January 11, 2012	Initial Release	All

1. VERIFICATION OF COMPLIANCE

- . APPLICANT : Biospace Co., Ltd.
- . ADDRESS : 518-10 Dogok-dong, Gangnam-gu, Seoul, 135-854, Korea
- . CONTACT PERSON : Mr. Jae-Woo, Park / Assistant Manager
- . TELEPHONE NO : +82-2-3498-2824
- . FCC ID : F6O-BS-RFIDREADER
- . MODEL NO/NAME : BS-RFID Reader
- . BRAND NAME : **BIOSPACE**
- . SERIAL NUMBER : N/A
- . DATE : January 11, 2012

DEVICE TYPE	FCC: DXX - Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	RFID Reader - Intentional Radiator
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.4: 2009
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C, Section 15.225
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m open area test site

- . The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. GENERAL INFORMATION

2.1 Product Description

The Biospace Co., Ltd., Model BS-RFID Reader (referred to as the EUT in this report) is a RFID Reader. The port for computing peripheral device shall be subject to DoC procedure and issued by another test report. The product specification described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	Non-Metal
MODULATION	ASK
TRANSMITTING FREQUENCY	13.56 MHz
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1 MHz)	13.56 MHz and 16 MHz
ANTENNA TYPE	Inserted into the main board (Pattern Antenna)
RATED SUPPLY VOLTAGE	DC 5 V form a PC
NUMBER OF PCB LAYERS	2 Layers

2.2 Model Differences:

-. None

2.3 Related Submittal(s) / Grant(s)

-. Original

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 15.225.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2009. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The open area test site and conducted measurement facilities are located on at 307-51, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. The Onetech Corp. has been accredited as a Conformity Assessment Body (CAB) with designation number KR0013.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	N/A	FS-BS105 Ver. 2.0P	DoC

3.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	FCC ID	Description	Connected to
BS-RFID Reader	Biospace Co., Ltd.	F6O-BS-RFIDREADER	RFID Reader (EUT)	-
I-Code2	Firmsys	N/A	Card type Tag	EUT
PP04X	Dell Computer	DoC	Notebook PC	EUT
M-UV69a	Logitech electronics	DoC	Mouse	Notebook PC

3.3 Mode of operation during the test

-. To get a maximum radiated emission from the EUT, the EUT was continuously transmitted RF carrier and the passive card shall be used with the EUT and tested with together.

3.4 Cable Description for the EUT

Ports Name	Shielded	Ferrite Bead	Metal Shell	Length (m)	Connected to
USB	N	N	N	1.5	Notebook PC

3.5 Equipment Modifications

-. None

3.6 Configuration of Test System

Line Conducted Test: The EUT was connected to notebook PC and the power of notebook PC was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission tests were performed by using the procedure in ANSI C63.4: 2009 7.3.3 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.4: 2009 8.3.1.1 and 13.4.1 to determine the worse operating conditions. The radiated emissions measurements were performed on the 3 m open area test site. For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna. The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

3.7 Antenna Requirement

For intentional device, according to §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.

Antenna Construction:

The transmitter antenna of the EUT is a PCB pattern antenna in the EUT, so there is no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
Standby Mode	-
TX mode	X

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Standby Mode	-
TX mode	X

5. FINAL RESULT OF MEASUREMENT

5.1 Conducted Emission Test

Humidity Level : 40 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15 Section 15.207
 Result : PASSED BY -5.74 dB at 13.56 MHz under average mode

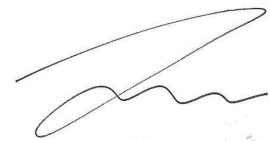
EUT : RFID Reader Date: December 27, 2011
 Operating Condition : Transmitting Mode
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Frequency (MHz)	Line	Peak (dBµV)		Margin (dB)
		Emission level	Q.P Limits	
0.16	H	55.39	65.21	-9.82
2.47	H	42.36	56.00	-13.64
3.21	N	46.53	56.00	-9.47
3.67	N	48.38	56.00	-7.62
13.56	N	47.16	60.00	-12.84
25.72	H	47.95	60.00	-12.05
Frequency (MHz)	Line	Average (dBµV)		Margin (dB)
		Emission level	Limits	
0.33	N	34.63	49.33	-14.70
0.57	H	32.93	46.00	-13.07
2.47	H	36.63	46.00	-9.37
13.56	N	44.26	50.00	-5.74

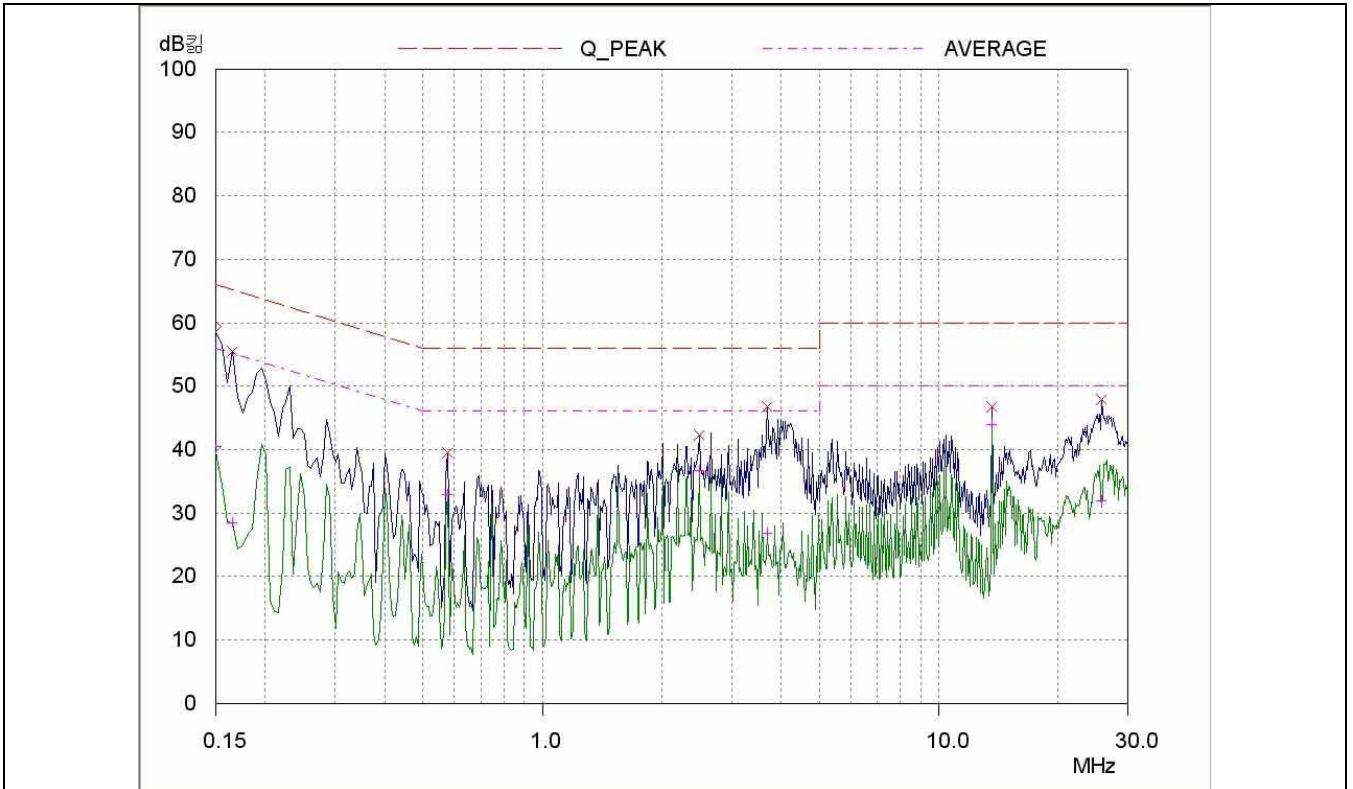
Line Conducted Emission Tabulated Data

Remark : "H": Hot Line, "N": Neutral Line.

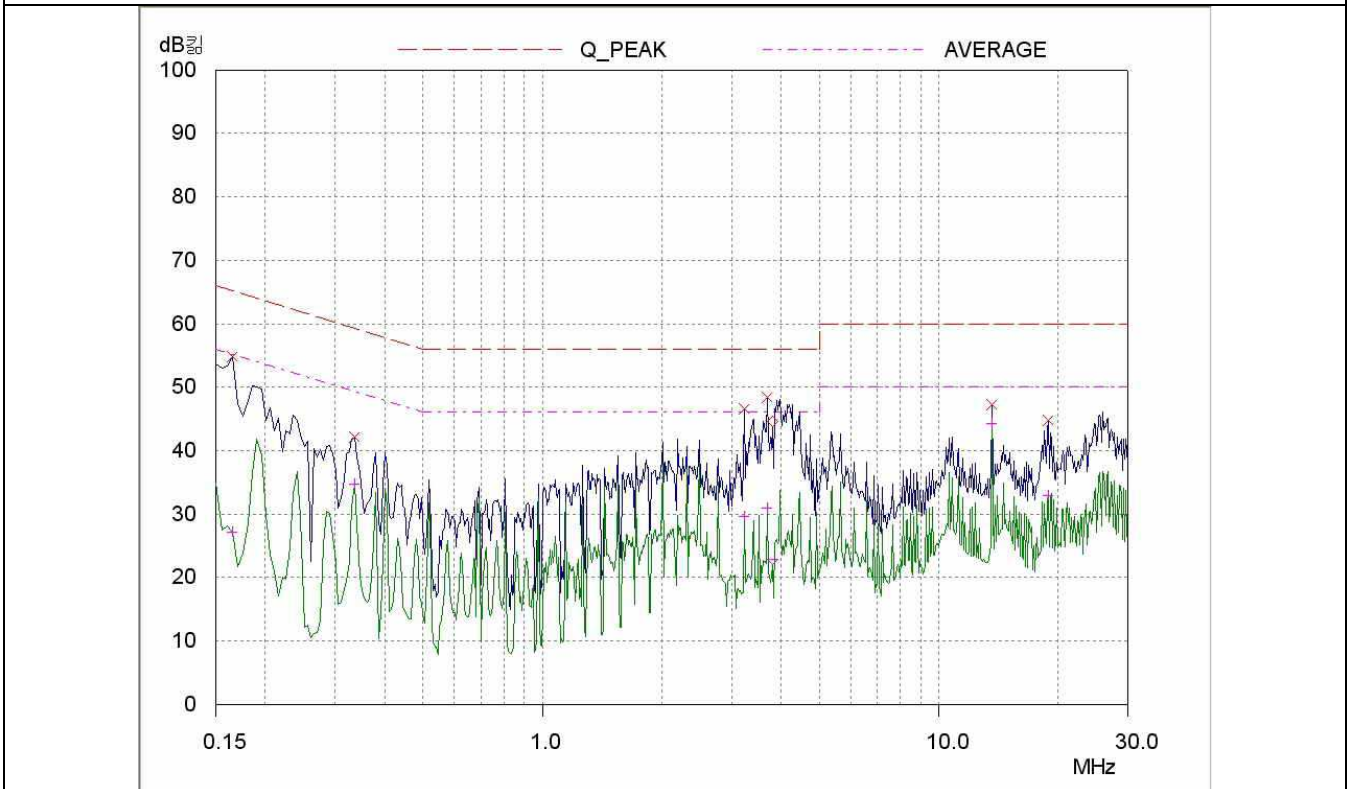
See next page for an overview sweep performed with peak and average detector.



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HOT LINE



NEUTRAL LINE

5.2 Field Strength of the Operating Frequency Band

5.2.1 Operation frequency band: (13.553 ~ 13.567) MHz

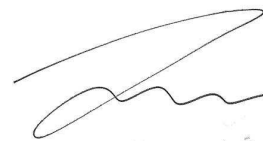
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 44 % R.H. Temperature: 22 °C
 Limits apply to : PART 15, SUBPART C, SECTION 15.225(a)
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED BY -72.00 dB at 13.56 MHz

EUT : RFID Reader Date: January 04, 2012
 Operating Condition : Transmitting Mode
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)
 Distance : 3 m

Radiated Emission		Ant	Correction Factors		Total	FCC/IC	
Freq. (MHz)	Amp. (dBμV)	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	32.40	V	18.40	0.30	51.10	124.00	-72.90
13.56	30.20	H	18.40	0.30	48.90	124.00	-75.10

Remark. The EUT was tested at 3 m, so conversation factor was included at above limit.



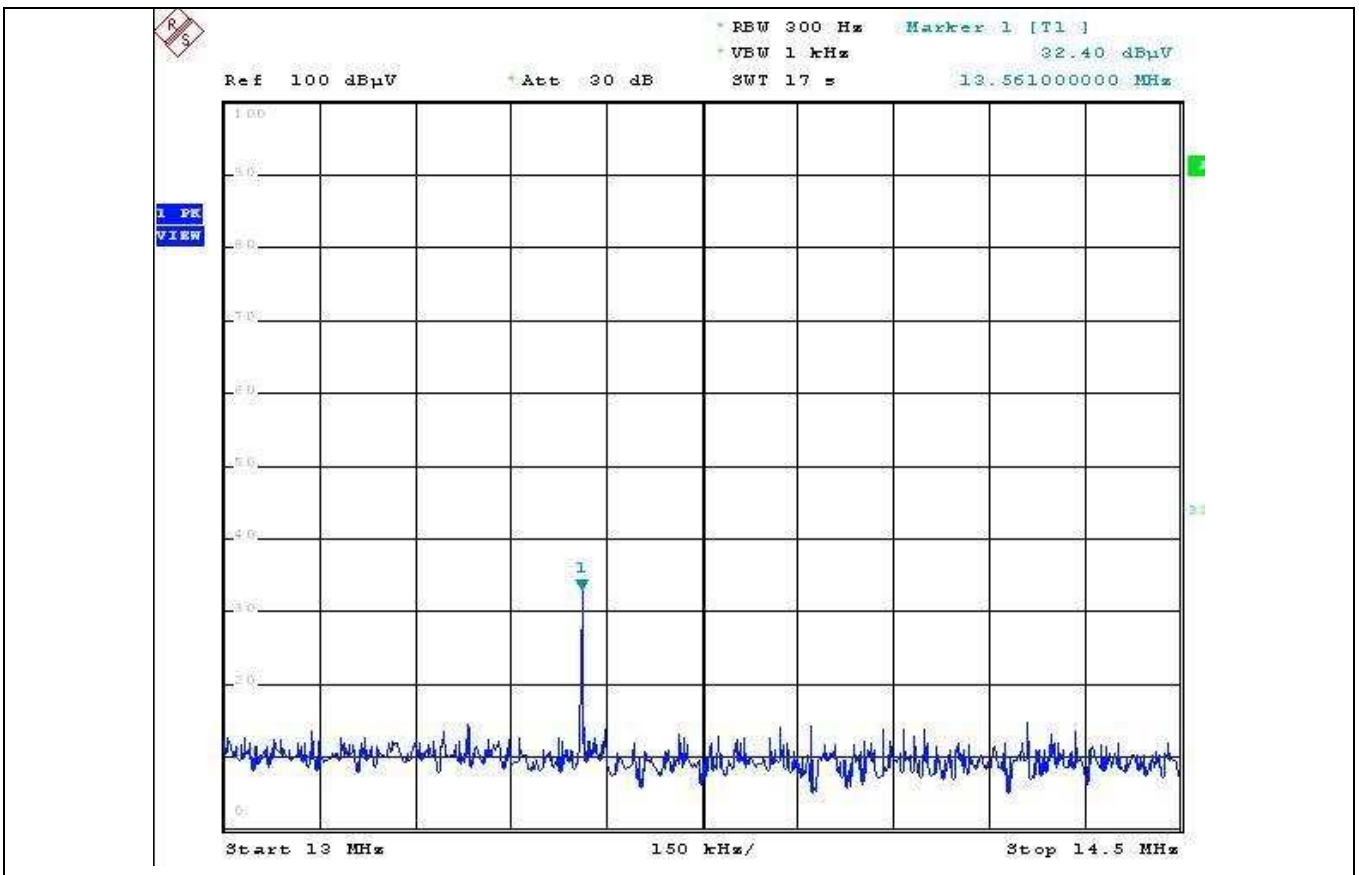
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5.2.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 44 % R.H. Temperature: 22 °C
 Limits apply to : PART 15, SUBPART C, SECTION 15.225(b)
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED

EUT : RFID Reader Date: January 04, 2012
 Operating Condition : Transmitting Mode



Acc. to above photo, the field strength level for the frequency subjected to 15.225 (b) met the requirement, because the maximum carrier level, 13. 56 MHz was 51.10 dBuV/m and the worst limit is 80.50 dBuV/m..

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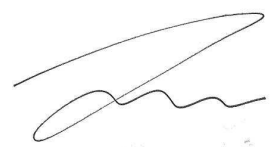
5.3 Spurious Emission Test

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 44 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225(d)
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED BY -9.62 dB at 798.92 MHz

EUT : RFID Reader Date: January 06, 2012
 Operating Condition : Transmitting Mode
 Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
33.05	5.50	V	100.00	300.00	17.13	1.06	23.69	40.00	-16.31
48.05	16.40	V	100.00	240.00	11.67	1.70	29.77	40.00	-10.23
51.86	12.90	V	120.00	330.00	10.65	1.63	25.18	40.00	-14.82
596.66	11.50	V	100.00	210.00	19.79	5.09	36.38	46.02	-9.64
798.73	5.20	H	110.00	150.00	22.22	6.38	33.80	46.02	-12.22
798.92	7.80	V	100.00	140.00	22.22	6.38	36.40	46.02	-9.62



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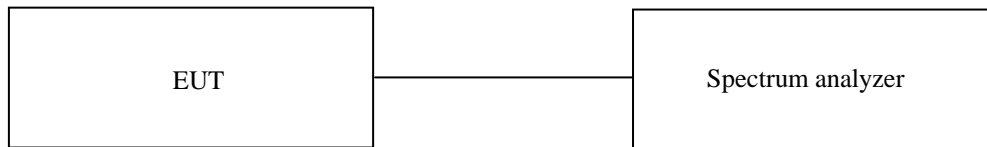
6. 20 dB BANDWIDTH

6.1 Operating environment

Temperature : 22 °C
 Relative humidity : 44 % R.H.

6.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 10 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.

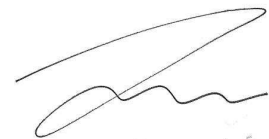


6.3 Test data for Bandwidth

- Test Date : January 04, 2012
- Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.215(c)

Operating Freq. (MHz)	Measured Value (Hz)		Assigned Operating Frequency Band (kHz)	Result
	20 dB Bandwidth	99 % Occupied Bandwidth		
13.56	498	604	900	PASS

Remark: See next page for 20 dB Bandwidth test data



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7. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

7.1 Operating environment

Temperature : 20 °C
 Relative humidity : 45 % R.H.

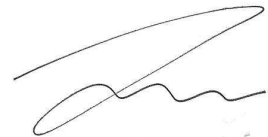
7.2 Test set-up

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -20 °C to +50°C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

7.3 Test data

-. Test Date : January 04 ~ 05, 2012
 -. Result : PASSED BY -834 Hz at 20 °C

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 560 000	13 560 390	966	± 1 356.00
-10		13 560 470	886	
0		13 560 497	859	
10		13 560 520	836	
20		13 560 522	834	
30		13 560 515	841	
40		13 560 502	854	
50		13 560 495	861	



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8. FREQUENCY STABILITY WITH VOLTAGE VARIATION

8.1 Operating environment

Temperature : 22 °C
 Relative humidity : 44 % R.H.

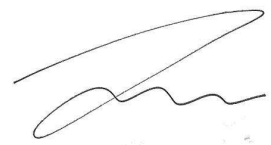
8.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.

8.3 Test data

-. Test Date : January 04, 2012
 -. Result : PASSED BY -839 Hz

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
5.75 (115 %)	13 560 000	13 560 517	839	± 1 356.00
5 (100 %)		13 560 517	839	
4.25 (85 %)		13 560 517	839	



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9. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses

+	Meter reading	(dB μ V)
+	Cable Loss	(dB)
+	Antenna Factor (Loss)	(dB/m)
=	Corrected Reading	(dB μ V/m)
-	Specification Limit	(dB μ V/m)
=	dB Relative to Spec	(\pm dB)

10. LIST OF TEST EQUIPMENT

No.	EQUIPMENTS	MFR.	MODEL	SER. NO.	LAST CAL	DUE CAL	USE
1.	Test receiver	R/S	ESiB26	100296	APR/11	12MONTH	-
2.	Test receiver	R/S	ESHS10	834467/007	JUN/11	12MONTH	■
3.	Spectrum analyzer	HP	8566B	3407A08547	JUN/11	12MONTH	-
	Spectrum analyzer	R/S	FSP	100017	MAR/11	12MONTH	■
4.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	VULB9163 202	MAY/10	24MONTH	■
5.	Biconical antenna	Schwarzbeck	VHA9103	91031852	MAR/10	24MONTH	-
6.	Log Periodic antenna	Schwarzbeck	9108-A(494)	62281001	MAR/10	24MONTH	-
7.	LISN	EMCO	3825/2	9109-1867	JUN/11	12MONTH	-
				9109-1869	JUN/11		-
		Schwarzbeck	NSLK 8126	8126-404	JUN/11		-
		Schwarzbeck	NSLK 8128	8128-216	JUN/11		■
8.	Position Controller	HD GmbH	HD100	N/A	N/A	N/A	■
9.	Turn Table	HD GmbH	DS420S	N/A	N/A	N/A	■
10.	Antenna Master	HD GmbH	MA240	N/A	N/A	N/A	■
11.	RF Amplifier	HP	8447D	2727A04987	JUN/11	12MONTH	■
12.	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D294	JUL/11	24MONTH	-
13.	Spectrum Analyzer	HP	8564E	3650A00756	JUN/11	12MONTH	■
14.	Frequency Converter	Digitek Power	VFS/DEFC	N/A	N/A	N/A	■
15.	Frequency Counter	HP	53152A	US39270295	NOV/11	12MONTH	■
16.	Slidacs (AC 0~300 V)	Dea Kwang	DH-60	N/A	SEP/11	12MONTH	-
17.	Chamber	Sam Kun	SSE-43CI-A	060712	JUN/11	12MONTH	■
18.	Loop Antenna	R/S	HFH 2-Z2	889 285 / 26	NOV/10	24 MONTH	■