

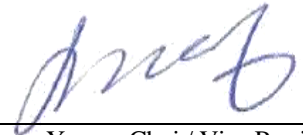
ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : W173R-D003
AGR No. : A16DA-118
Applicant : A1 Communications Korea Co., Ltd.
Address : #513, Hansin IT Tower, 272, Digital-ro, Guro-gu, Seoul, Korea
Manufacturer : FiRS Technologies Co., Ltd.
Address : 11th Floor, Building C1, Zhiyuan Xili Nanshan District, Shenzhen 518000 China
Type of Equipment : Facework
FCC ID : 2ALI4-FW-N10
Model Name : FW-N10
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 18 pages (including this page)
Date of Incoming : January 23, 2017
Date of Issuing : March 14, 2017

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.

Reviewed by: 
 Jae-Ho Lee / Chief Engineer
 ONETECH Corp.

Approved by: 
 Keun-Young, Choi / Vice President
 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 EQUIPMENT MODIFICATIONS.....	7
3.5 CONFIGURATION OF TEST SYSTEM.....	8
3.6 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 RADIATED EMISSION TEST.....	9
5.1.1 Operation frequency band: (13.553 ~ 13.567) MHz.....	9
5.1.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz.....	10
5.2 SPURIOUS EMISSION TEST.....	11
5.2.1 Spurious Radiated Emission Below 30 MHz	11
5.2.2 Spurious Radiated Emission below 1 GHz.....	12
5.3 20 dB BANDWIDTH	13
5.3.1 Operating environment.....	13
5.3.2 Test set-up	13
5.3.3 Test data	14
5.4 FREQUENCY STABILITY WITH TEMPERATURE VARIATION.....	15
5.4.1 Operating environment.....	15

5.4.2 Test set-up	15
5.4.3 Test data	15
5.5 FREQUENCY STABILITY WITH VOLTAGE VARIATION.....	16
5.5.1 Operating environment.....	16
5.5.2 Test set-up	16
5.5.3 Test data	16
6. FIELD STRENGTH CALCULATION	17
7. LIST OF TEST EQUIPMENT	18

REVISION HISTORY

Issued Report No.	Issued Date	Revisions	Effect Section
W173R-D003	March 14, 2017	Initial Issue	All

DOCUMENT HISTORY

Revision No.	Issued Date	Revisions	Effect Section
Original	March 14, 2017	Initial Issue	-

1. VERIFICATION OF COMPLIANCE

-. APPLICANT : A1 Communications Korea Co., Ltd.
-. ADDRESS : #513, Hansin IT Tower, 272, Digital-ro, Guro-gu, Seoul, Korea
-. CONTACT PERSON : Jong-Oh Kim / General Manager
-. TELEPHONE NO : +82-70-4044-7000
-. FCC ID : 2ALI4-FW-N10
-. MODEL NO/NAME : FW-N10
-. SERIAL NUMBER : N/A
-. DATE : March 14, 2017

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	Facework
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC CFR47 Part 15 Subpart C Section 15.225
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	10 m Semi Anechoic Chamber

-. 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 A1 Communications Korea Co., Ltd., Model FW-N10 (referred to as the EUT in this report) is a Facework, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Facework
TRANSMITTING FREQUENCY	13.56 MHz
MODULATION	ASK
ANTENNA TYPE	PCB Antenna
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1 MHz)	24 MHz

2.2 Model Differences:

-. None

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.225.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. 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	A05_MB_V230	N/A
LED BOARD	N/A	A05_LED_V210_20160602	N/A
Camera module	N/A	XB-0308-DUAL 36P-4	N/A
RFID Board	N/A	A1_Module_v2	N/A
Display Panel	N/A	N/A	N/A
Display Control Board 1	N/A	N/A	N/A
Display Control Board 2	N/A	N/A	N/A

3.2 Peripheral equipment

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

Model	Manufacturer	Description	Connected to
FW-N10	A1 Communications Korea Co., Ltd.	Facework (EUT)	-
SMS-00120350-S01	SHENZHEN SHANMUSEN POWER SOURCE CO.,LTD.	Adapter	EUT

3.3 Mode of operation during the test

-. The EUT was used for making continuous transmission mode during the test.

3.4 Equipment Modifications

-. None

3.5 Configuration of Test System

Radiated Emission Test : Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 3 m Semi Anechoic Chamber.

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.

3.6 Antenna Requirement

For intentional device, according to section 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 antenna 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)
It does not need to test this requirement, because the power of the EUT is supplied from a battery.	

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Tx Mode	X

5. FINAL RESULT OF MEASUREMENT

Preliminary test was done in normal operation mode. And the final measurement was selected for the maximized emission level.

5.1 RADIATED EMISSION TEST

5.1.1 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 : 46.2 % R.H. Temperature: 25.0 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225(a)
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED

EUT : Facework Date: February 02, 2017

Operating Condition : Transmitting Mode

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Distance : 3 m

Radiated Emission		Ant	Correction Factors		Total	FCC	
Freq. (MHz)	Amplitud (dBμV)	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	44.62	H	19.98	0.95	65.55	124	58.45
13.56	37.54	V	19.98	0.95	58.47	124	65.53

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



Tested by: Ha-Ram, Lee / Assistant Manager

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

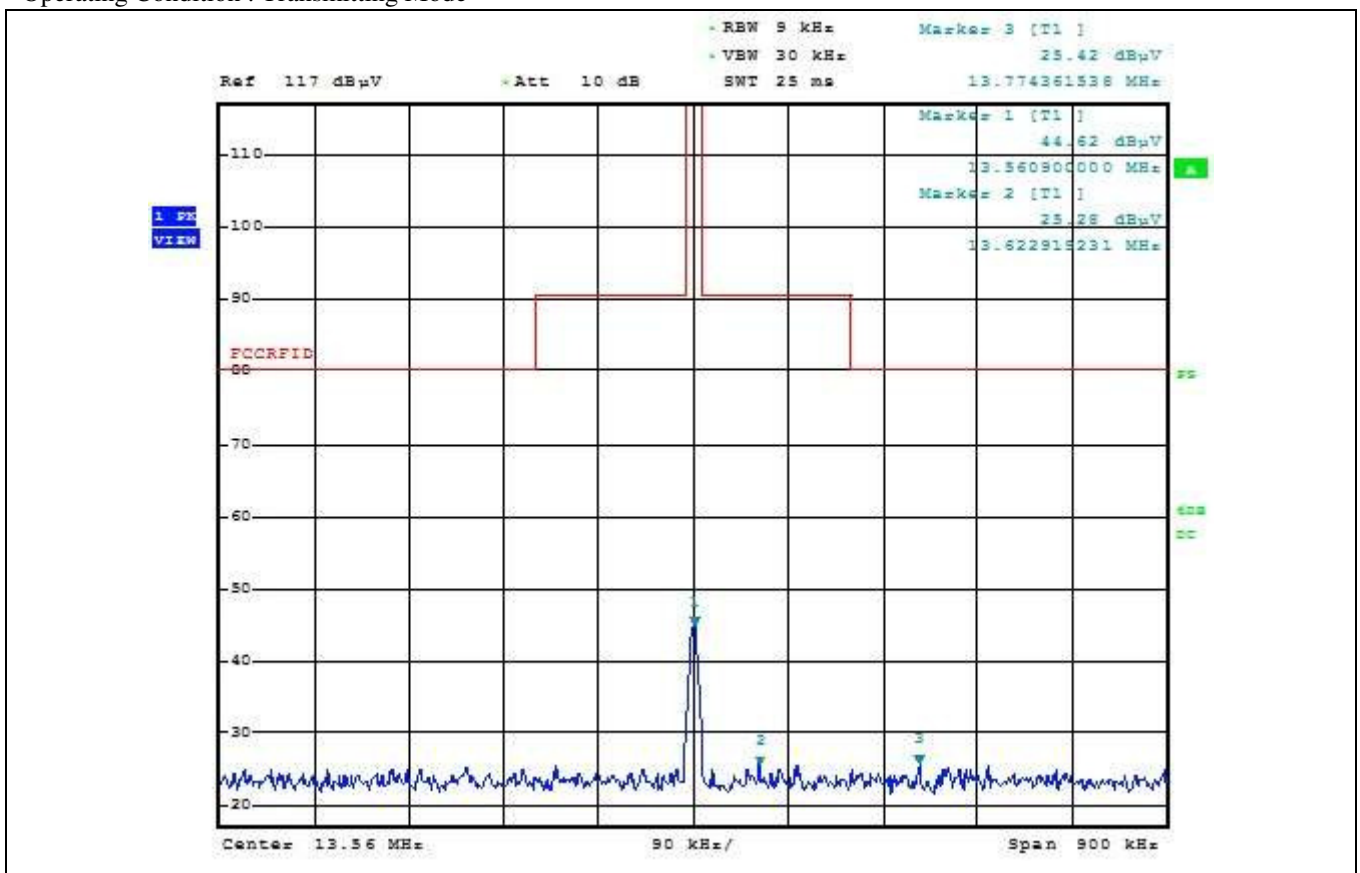
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level	: <u>49.4 % R.H.</u>	Temperature: <u>24.7 °C</u>
Limits apply to	: <u>FCC CFR 47, PART 15, SUBPART C, SECTION 15.225(b), (c)</u>	
Type of Test	: <u>Low Power Communication Device Transmitter</u>	
Result	: <u>PASSED</u>	

EUT : Facework

Date: August 11, 2016

Operating Condition : Transmitting Mode



Note. To the above test data, the field strength level of 13.56 MHz is 44.62 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 80.5 dBuV/m, so the EUT meets the requirement.



Tested by: Ha-Ram, Lee / Assistant Manager

5.2 SPURIOUS EMISSION TEST

5.2.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 50.6 % R.H.

Temperature: 23.9 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

Type of Test : Low Power Communication Device Transmitter

Frequency Range : 9 kHz ~ 30 MHz

Result : PASSED

EUT : Facework

Date: March 09, 2017

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)
Any emissions were not observed from the EUT.									



Tested by: Ha-Ram, Lee / Assistant Manager

5.2.2 Spurious Radiated Emission below 1 GHz

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

Humidity Level : 50.6 % R.H.

Temperature: 23.9 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

Type of Test : Low Power Communication Device Transmitter

Frequency range : 30 MHz ~ 1 000 MHz

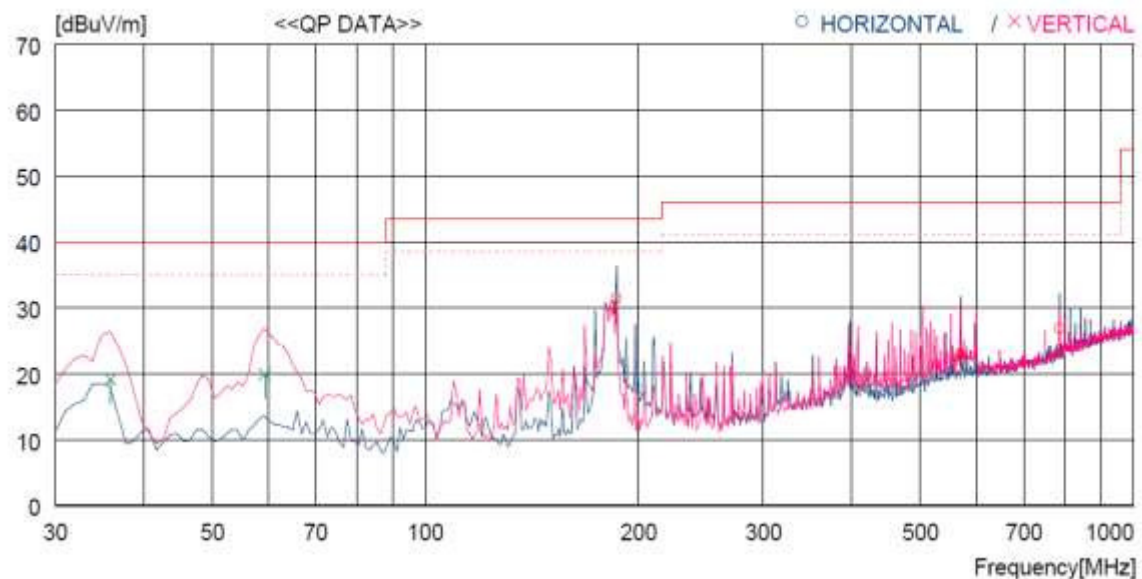
Result : PASSED

EUT : Facework

Date: March 09, 2017

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	186.020	51.1	9.7	3.6	33.0	31.4	43.5	12.1	226	130
2	569.547	31.3	18.4	6.7	33.4	23.0	46.0	23.0	101	218
3	786.507	31.9	20.3	7.9	33.3	26.8	46.0	19.2	335	308
----- Vertical -----										
4	35.903	37.9	12.5	1.8	33.0	19.2	40.0	20.8	100	133
5	59.236	37.5	13.3	2.1	33.0	19.9	40.0	20.1	112	204

Tested by: Ha-Ram, Lee / Assistant Manager

5.3 20 dB BANDWIDTH

5.3.1 Operating environment

Temperature : 25.0 °C
Relative humidity : 46.2 % R.H.

5.3.2 Test set-up

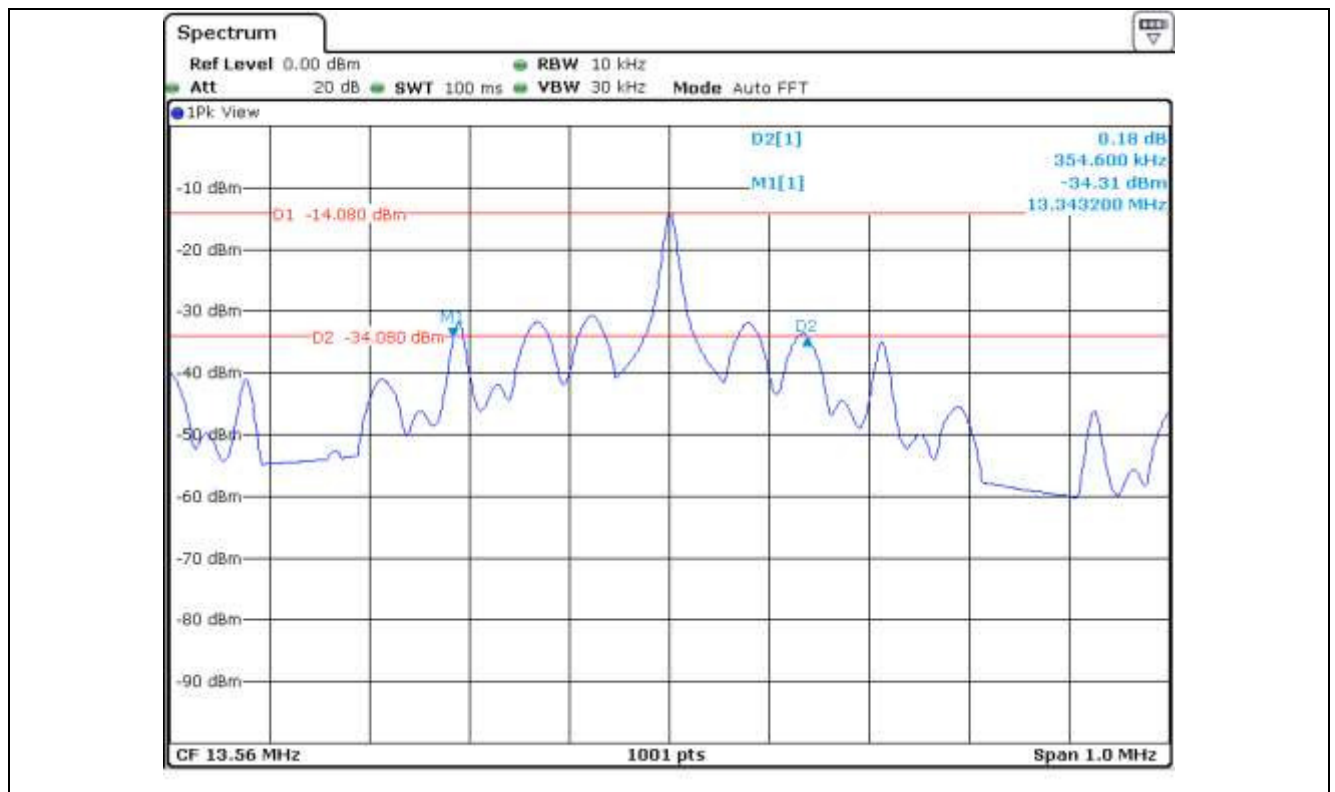
The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 10 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



5.3.3 Test data

- . Test Date : January 23, 2017
- . Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

Operating Freq. (MHz)	Measured Value (kHz)	Assigned Operating Frequency Band (kHz)	Result
13.56	354.6	900	PASS




Tested by: Ha-Ram, Lee / Assistant Manager

5.4 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

5.4.1 Operating environment

Temperature : 25.0 °C
Relative humidity : 46.2 % R.H.

5.4.2 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.

5.4.3 Test data

-. Test Date : January 23, 2017

-. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 560 000	13 560 578	778	± 1 356
-10		13 560 578	778	
0		13 560 578	778	
10		13 560 572	784	
20		13 560 552	804	
30		13 560 508	848	
40		13 560 492	864	
50		13 560 482	874	



Tested by: Ha-Ram, Lee / Assistant Manager

5.5 FREQUENCY STABILITY WITH VOLTAGE VARIATION

5.5.1 Operating environment

Temperature : 25.0 °C
Relative humidity : 46.2 % R.H.

5.5.2 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.

5.5.3 Test data

-. Test Date : January 23, 2017
-. Result : PASSED

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
6.29(85 %)	13 560 000	13 560 552	804	± 1 356
7.40(100 %)		13 560 552	804	
8.51(115%)		13 560 552	804	



Tested by: Ha-Ram, Lee / Assistant Manager

6. FIELD STRENGTH CALCULATION

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

+	Meter reading	(dB μ V)
-	Amplifier Gain	(dB)
+	Cable Loss	(dB)
-	Antenna Factor	(dB/m)
=	Corrected Result	(dB μ V/m)

Margin (dB)

	Specification Limit	(dB μ V/m)
-	Corrected Result	(dB μ V/m)
=	dB Relative to Spec	($\pm$ dB)

7. LIST OF TEST EQUIPMENT

No.	EQUIPMENTS	MFR.	MODEL	SER. NO.	LAST CAL	DUE CAL	USE
1.	Test receiver	R/S	ESCI	101013	Apr. 05, 2016	One Year	■
2.		R/S	ESU	100261	Apr. 06, 2016	One Year	■
3.		R/S	ESPI	101278	Nov. 01, 2016	One Year	□
4.	Spectrum analyzer	R/S	FSV30	101199	May. 04, 2016	One Year	■
5.	Amplifier	Sonoma Instrument	310N	312544	Apr. 05, 2016	One Year	□
6.	Amplifier	Sonoma Instrument	310N	312545	Apr. 05, 2016	One Year	□
7.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-255	May 20, 2016	Two Year	■
8.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-421	Apr. 15, 2016	Two Year	■
9.	Controller	Innco System	CO3000	CO3000/904/ 37211215/L	N/A	N/A	■
10.	LISN	EMCO	3825/2	9109-1867	Apr. 06, 2016	One Year	□
				9109-1869	Apr. 06, 2016	One Year	□
		Schwarzbeck	NSLK8126	8126-404	Apr. 05, 2016	One Year	□
		Schwarzbeck	NSLK8128	8128-216	Apr. 06, 2016	One Year	□
11.	Turn Table	Innco System	DT3000	930611	N/A	N/A	■
12.	Antenna Master	Innco System	MA4000-EP	MA4000/332/ 27030611/L	N/A	N/A	■
13.	Antenna Master	Innco System	MA-4000XPET	MA4000/509/ 37211215/L	N/A	N/A	■
14.	Loop Antenna	Schwarzbeck	FMZB 1513	1513-235	Jun. 10, 2016	Two Year	■
15.	Frequency Counter	HP	53152A	US39270295	Sep. 29, 2016	One Year	■
16.	Chamber	ESPEC	PSL-2KP	14009407	Feb. 02, 2017	One Year	■
17.	DC Power Supply	Digital Electronics	DRP-305DN	4030195	Sep. 02, 2016	One Year	□