

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : W17DR-D024
AGR No. : A17NA-358
Applicant : CHAHOO Limited
Address : B-4F, 25 Pangyo-ro 256beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do 13487
South Korea
Manufacturer : CHAHOO Limited
Address : B-4F, 25 Pangyo-ro 256beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do 13487
South Korea
Type of Equipment : Digital Door Lock
FCC ID : 2AM9GIG302
Model Name : IG302
Multiple Model Name : Entrava NEXT, 929SS-DMF1
Serial number : N/A
Total page of Report : 19 pages (including this page)
Date of Incoming : November 23, 2017
Date of Issuing : December 13, 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.

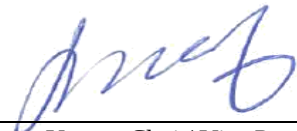
It is not a general valid assessment of the features of the respective products of the mass-production.

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.....	7
2.6 TEST FACILITY.....	7
3. SYSTEM TEST CONFIGURATION	8
3.1 JUSTIFICATION.....	8
3.2 PERIPHERAL EQUIPMENT	8
3.3 MODE OF OPERATION DURING THE TEST	8
3.4 EQUIPMENT MODIFICATIONS.....	8
3.5 CONFIGURATION OF TEST SYSTEM.....	9
3.6 ANTENNA REQUIREMENT	9
4. PRELIMINARY TEST	9
4.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....	9
4.2 RADIATED EMISSIONS TESTS.....	9
5. FINAL RESULT OF MEASUREMENT.....	10
5.1 RADIATED EMISSION TEST	10
5.1.1 Operation frequency band: (13.553 ~ 13.567) MHz.....	10
5.1.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz.....	11
5.2 SPURIOUS EMISSION TEST	12
5.2.1 Spurious Radiated Emission Below 30 MHz	12
5.2.2 Spurious Radiated Emission below 1 GHz.....	13
5.3 20 dB BANDWIDTH	14
5.3.1 Operating environment.....	14
5.3.2 Test set-up	14
5.3.3 Test data	15
5.4 FREQUENCY STABILITY WITH TEMPERATURE VARIATION.....	16

5.4.1 Operating environment.....	16
5.4.2 Test set-up	16
5.4.3 Test data	16
5.5 FREQUENCY STABILITY WITH VOLTAGE VARIATION.....	17
5.5.1 Operating environment.....	17
5.5.2 Test set-up	17
5.5.3 Test data	17
6. FIELD STRENGTH CALCULATION	18
7. LIST OF TEST EQUIPMENT	19

REVISION HISTORY

Issued Report No.	Issued Date	Revisions	Effect Section
W17DR-D024	December 13, 2017	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

-. APPLICANT : CHAHOO Limited
-. ADDRESS : B-4F, 25 Pangyo-ro 256beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do 13487 South Korea
-. CONTACT PERSON : YoungJae Im / HW Team Leader
-. TELEPHONE NO : +82-31-696-0499
-. FCC ID : 2AM9GIG302
-. MODEL NO/NAME : IG302
-. SERIAL NUMBER : N/A
-. DATE : December 13, 2017

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	Digital Door Lock
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 CHAHOO Limited, Model IG302 (referred to as the EUT in this report) is a Digital Door Lock, Product specification information described herein was obtained from product data sheet or user's manual.

Device Type	Digital Door Lock	
Operating Frequency	BLE	2 402 MHz ~ 2 480 MHz
	NFC	13.563 9 MHz
RF Output Power	BLE	-30.25 dBm
Number of Channel	BLE	40 Channels
	NFC	1 Channel
Modulation Type	BLE	GFSK
	NFC	ASK
Antenna Type	BLE	PCB Pattern antenna
	NFC	PCB Loop antenna
Antenna Gain	BLE	-1.28 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	16 MHz, 27.12 MHz	
Rated Supply Voltage	DC 6.0 V	

2.2 Model Differences:

-. The following lists consist of the added models and their differences.

Model Name	Differences	Tested
IG302	Basic Model.	☒
Entrava NEXT, 929SS-DMF1	The models are identical to basic model except for the OEM Brand.	☐

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacturer is responsible for the compliance of all variants.

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-14617/ 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	CHAHOO	IG3002 Rev 10	-
RFID Antenna Board	CHAHOO	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
N/A	N/A	N/A	N/A

3.3 Mode of operation during the test

-. The EUT has Bluetooth, program 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 10 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 is 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 : 47 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : Digital Door Lock Date: November 24, 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)	Amplitude (dBμV)	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.563 9	20.45	H	19.97	0.3	40.72	124	83.28
13.561 3	13.11	V	19.97	0.3	33.38	124	90.62

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

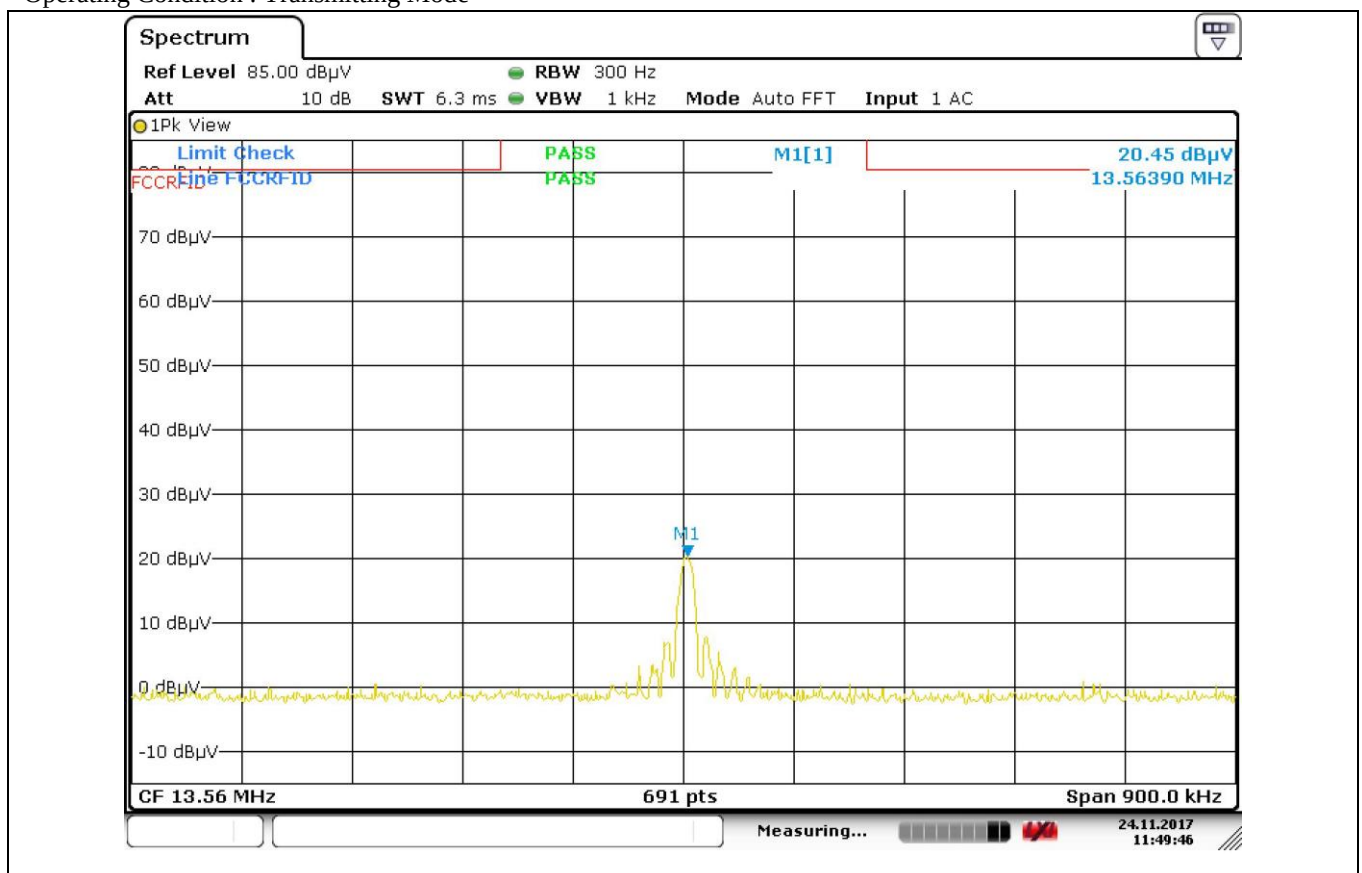
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 47 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : Digital Door Lock

Date: November 24, 2017

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.563 9 MHz is 20.45 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 : 47 % R.H.

Temperature: 24 °C

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

Type of Test : Low Power Transmitter below 1 705 kHz

Frequency Range : 9 kHz ~ 30 MHz

Result : PASSED

EUT : Digital Door Lock

Date: November 24, 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.

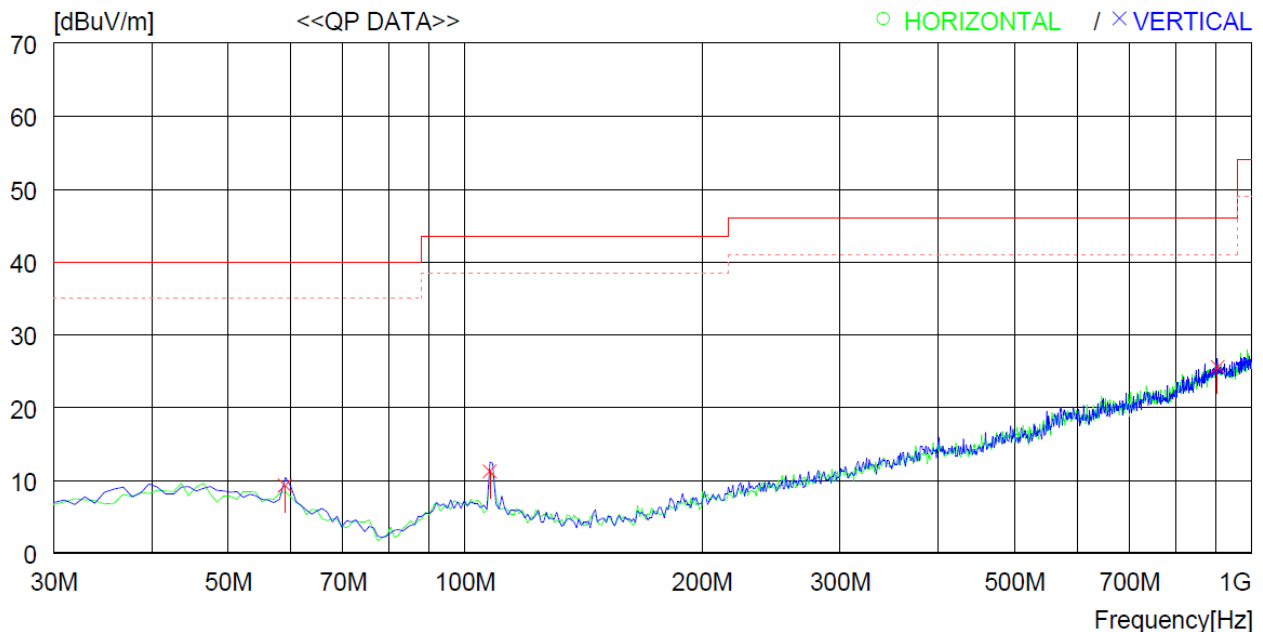
Humidity Level : 47 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Frequency range : 30 MHz ~ 1 000 MHz
 Result : PASSED

EUT : Digital Door Lock

Date: November 24, 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]
		[dBuV]	[dB]							
----- Vertical -----										
1	59.100	27.2	13.3	1.9	33.1	9.3	40.0	30.7	300	0
2	107.600	30.2	11.6	2.5	33.0	11.3	43.5	32.2	400	141
3	904.929	29.1	22.1	7.0	32.6	25.6	46.0	20.4	200	352

Tested by: Ha-Ram, Lee / Assistant Manager

5.3 20 dB BANDWIDTH

5.3.1 Operating environment

Temperature : 24 °C
Relative humidity : 47 % R.H.

5.3.2 Test set-up

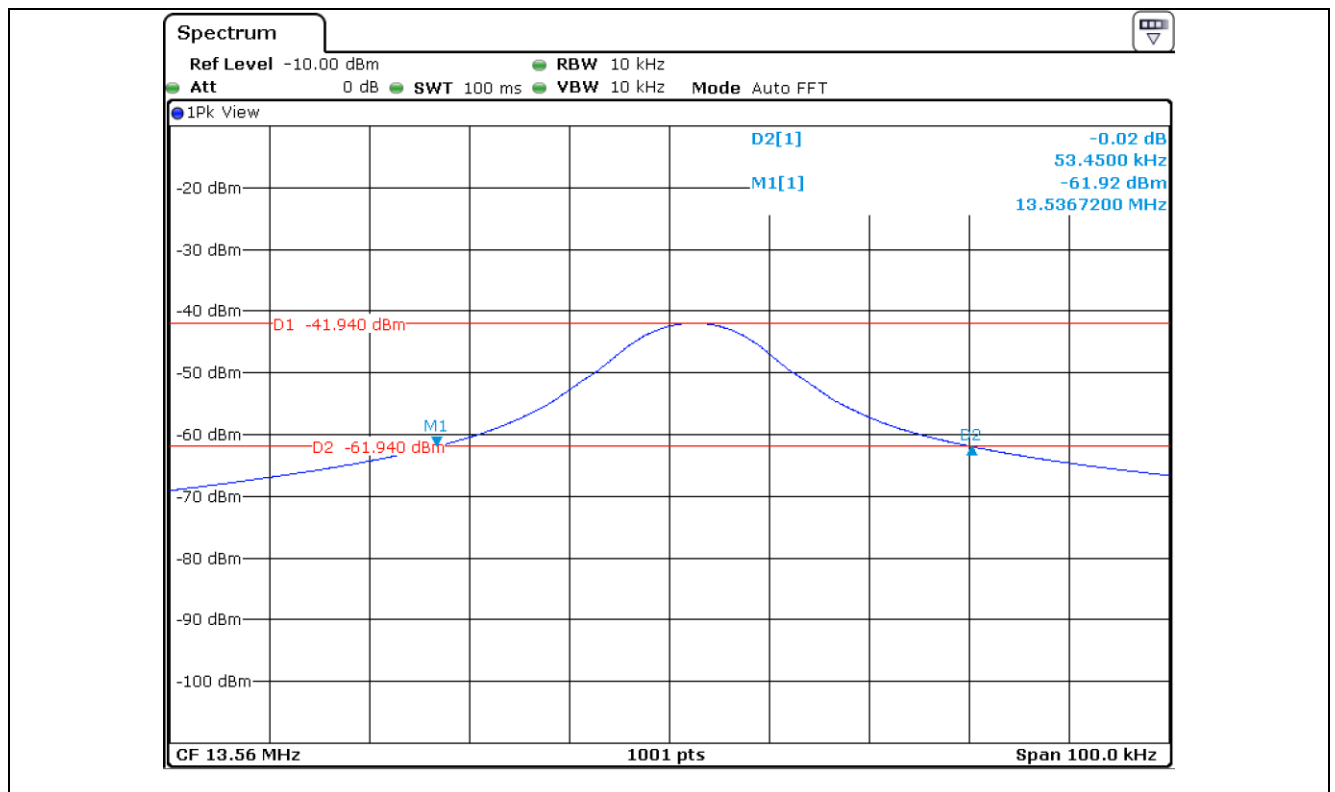
The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 10 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



5.3.3 Test data

- . Test Date : November 24, 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
13.563 9	53.45	900	PASS



Tested by: Ha-Ram, Lee / Assistant Manager

5.4 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

5.4.1 Operating environment

Temperature : -20 °C ~ 50 °C

Relative humidity : 47 % 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 : November 24, 2017

-. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 563 900	13 564 102	202	± 1 356.20
-10		13 564 086	186	
0		13 564 071	171	
10		13 564 062	162	
20		13 564 045	145	
30		13 564 013	113	
40		13 563 987	87	
50		13 563 972	72	



Tested by: Ha-Ram, Lee / Assistant Manager

5.5 FREQUENCY STABILITY WITH VOLTAGE VARIATION

5.5.1 Operating environment

Temperature : 24 °C
Relative humidity : 47 % 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 : November 24, 2017
-. Result : PASSED

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
6.9(115 %)	13 563 900	13 564 008	108	± 1 356.20
6.0(100 %)		13 563 987	87	
5.1(85 %)		13 564 043	143	



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. 04, 2017	One Year	☐
2.		R/S	ESPI	101278	Oct. 26, 2017	One Year	☐
3.		R/S	ESU	100261	Apr. 05, 2017	One Year	☒
4.	Spectrum analyzer	R/S	FSU26	200319	Apr. 04, 2017	One Year	☒
5.	Amplifier	Sonoma Instrument	310N	312544	Apr. 04, 2017	One Year	☒
6.	Amplifier	Sonoma Instrument	310N	312545	Apr. 04, 2017	One Year	☐
7.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-255	Jul. 17, 2017	Two Year	☐
8.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-419	Aug. 05, 2016	Two Year	☒
9.	Controller	Innco System	CO3000	CO3000/904/ 37211215/L	N/A	N/A	☒
10.	LISN	EMCO	3825/2	9109-1867	Apr. 07, 2017	One Year	☐
				9109-1869	Apr. 06, 2017	One Year	☐
		Schwarzbeck	NSLK8126	8126-404	Apr. 03, 2017	One Year	☐
		Schwarzbeck	NSLK8128	8128-216	Apr. 05, 2017	One Year	☐
11.	Turn Table	Innco System	DT3000	930611	N/A	N/A	☒
12.	Antenna Master	Innco System	MA-4000XPET	MA4000/509/ 37211215/L	N/A	N/A	☒
13.	Antenna Master	Innco System	MA4000-EP	MA4000/332/ 27030611/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. 05, 2017	One Year	☒
16.	Chamber	ESPEC	PSL-2KP	14009407	Feb. 02, 2017	One Year	☒
17.	DC Power Supply	Digital Electronics	DRP-305DN	4030195	Sep. 01, 2017	One Year	☐