

## TEST REPORT

**Report No.: 18040893HKG-001**

MGA Entertainment (HK) Ltd.

Application For Certification  
(Original Grant)

**FCC ID: LU9646720**

Transceiver

**Prepared and Checked by:**

**Approved by:**

Signed On File  
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Date: May 04, 2018

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## TEST REPORT

### GENERAL INFORMATION

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<b>Manufacturer:</b>	MGA Entertainment (HK) Ltd.
<b>Manufacturer Address:</b>	6th Floor, YHC Tower, 1 Sheung Yuet Road, Kowloon Bay, Kowloon, Hong Kong.
<b>Brand Name:</b>	646720 Shop 'n Learn Smart Cart
<b>Model:</b>	646720
<b>Additional Model:</b>	646720C, 646720E4C
<b>Type of EUT:</b>	Transceiver
<b>Description of EUT:</b>	Shop 'n Learn Smart Cart
<b>Serial Number:</b>	N/A
<b>FCC ID:</b>	LU9646720
<b>Date of Sample Submitted:</b>	April 17, 2018
<b>Date of Test:</b>	April 17, 2018 to April 30, 2018
<b>Report No.:</b>	18040893HKG-001
<b>Report Date:</b>	May 04, 2018
<b>Environmental Conditions:</b>	Temperature: +10 to 40°C Humidity: 10 to 90%

## TEST REPORT

### SUMMARY OF TEST RESULT

Test Specification	Reference	Results
Transmitter Field Strength Frequency Stability	15.225	Pass
Radiated Emission Radiated Emission on the Bandedge	15.209	Pass
Radiated Emission in Restricted Bands	15.205	Pass

The equipment under test is found to be complying with the following standards:  
FCC Part 15, October 1, 2016 Edition

- Note:
1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the provisions of this section.
  2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

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## TEST REPORT

### 1.0 GENERAL DESCRIPTION

#### 1.1 Product Description

The Equipment Under Test (EUT) is Shop 'n Learn Smart Cart, which contains a 13MHz RFID module. The RFID portion is for the tag function. After placing the tags on the EUT, the EUT will recognize the tags by sending out different sound effects. The EUT is powered by 3 X 1.5V AA batteries

The Model: 646720C and 646720E4C are the same as the Model: 646720 in hardware aspect. The difference in model number serves as marketing strategy. The models are different in packaging only.

Antenna Type: Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

#### 1.2 Related Submittal(s) Grants

This is a single application for certification of a RFID reader.

#### 1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). All radiated measurements were performed in an 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **“Justification Section”** of this Application.

#### 1.4 Test Facility

The 3m Chamber facility used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong. This test facility and site measurement data have been placed on file with the FCC.

## TEST REPORT

### 2.0 SYSTEM TEST CONFIGURATION

#### 2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The device was powered by new DC 4.5V (3 x 1.5V AA batteries).

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data report in Exhibit 3.0.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

#### 2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit is powered up, it transmits the RF signal continuously.

#### 2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

#### 2.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

#### 2.5 Support Equipment List and Description

N/A.

## TEST REPORT

### 3.0 EMISSION RESULTS

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

#### 3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG - AV$$

where FS = Field Strength in dB $\mu$ V/m

RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where FS = Field Strength in dB $\mu$ V/m

RR = RA - AG - AV in dB $\mu$ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V/m}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$AV = 5.0 \text{ dB}$$

$$FS = RR + LF$$

$$FS = 18 + 9 = 27 \text{ dB}\mu\text{V/m}$$

$$RR = 18.0 \text{ dB}\mu\text{V}$$

$$LF = 9.0 \text{ dB}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(27 \text{ dB}\mu\text{V/m})/20] = 22.4 \mu\text{V/m}$$

## TEST REPORT

### 3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 122.040 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

### 3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 9.1 dB



## TEST REPORT

### RADIATED EMISSIONS

Model: 646720

Date of Test: April 30, 2018

Worst-Case Operating Mode: Transmitting

Table 1  
Pursuant to FCC Part 15 Section 15.225 Requirement

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Distance Factor (-dB)	Calculated at 30m (dB $\mu$ V/m)	Limit at 30m (dB $\mu$ V/m)	Margin (dB)
V	13.560	52.1	0	10.8	62.9	40.0	22.9	84.0	-61.1
V	27.120	26.6	0	9.5	36.1	40.0	-3.9	29.5	-33.4

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Limit at 3m (dB $\mu$ V/m)	Margin (dB)
V	40.680	28.4	16	10.0	28.7	40.0	-11.3
V	54.240	30.2	16	11.0	25.0	40.0	-15.0
V	67.800	34.3	16	8.0	27.1	40.0	-12.9
H	81.360	29.1	16	7.0	22.9	40.0	-17.1
H	94.920	29.7	16	11.0	31.3	43.5	-12.2
<b>H</b>	<b>108.480</b>	<b>24.4</b>	<b>16</b>	<b>14.0</b>	<b>32.2</b>	<b>43.5</b>	<b>-11.3</b>
H	122.040	27.6	16	14.0	34.4	43.5	-9.1
<b>H</b>	<b>135.640</b>	<b>30.3</b>	<b>16</b>	<b>14.0</b>	<b>32.6</b>	<b>43.5</b>	<b>-10.9</b>
H	149.210	28.1	16	14.0	34.1	43.5	-17.4

- NOTES:
1. Peak Detector Data unless otherwise stated.
  2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative sign in the column shows value below limit.
  4. Loop antenna is used for the emissions below 30MHz.
  5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
  6. Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

## TEST REPORT

Model: 646720

Date of Test: April 30, 2018

Worst-Case Operating Mode: Transmitting

Table 2  
Pursuant to FCC Part 15 Section 15.209 Requirement

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Limit at 3m (dB $\mu$ V/m)	Margin (dB)
V	40.704	22.7	16	10.0	16.7	40.0	-23.3
V	71.591	20.3	16	7.0	11.3	40.0	-28.7
<b>V</b>	<b>119.122</b>	<b>19.6</b>	<b>16</b>	<b>14.0</b>	<b>17.6</b>	<b>43.5</b>	<b>-25.9</b>
<b>V</b>	<b>131.623</b>	<b>21.1</b>	<b>16</b>	<b>14.0</b>	<b>19.1</b>	<b>43.5</b>	<b>-24.4</b>
V	144.263	21.8	16	14.0	19.8	43.5	-23.7
V	150.288	24.1	16	14.0	22.1	43.5	-21.4
<b>V</b>	<b>162.788</b>	<b>19.3</b>	<b>16</b>	<b>16.0</b>	<b>19.3</b>	<b>43.5</b>	<b>-24.2</b>
V	219.930	14.9	16	17.0	15.9	46.0	-30.1
<b>V</b>	<b>325.439</b>	<b>10.4</b>	<b>16</b>	<b>24.0</b>	<b>18.4</b>	<b>46.0</b>	<b>-27.6</b>
V	488.160	17.2	16	26.0	27.2	46.0	-18.8
V	555.957	20.7	16	28.0	32.7	46.0	-13.3
V	583.083	20.8	16	28.0	32.8	46.0	-13.2
<b>V</b>	<b>610.209</b>	<b>19.4</b>	<b>16</b>	<b>29.0</b>	<b>32.4</b>	<b>46.0</b>	<b>-13.6</b>
V	637.335	19.2	16	29.0	32.2	46.0	-13.8
V	664.461	22.2	16	29.0	35.2	46.0	-10.8
V	691.552	18.8	16	30.0	32.8	46.0	-13.2
V	786.475	14.4	16	31.0	29.4	46.0	-16.6
V	867.853	14.2	16	31.0	29.2	46.0	-16.8

- NOTES:
1. Peak Detector Data unless otherwise stated.
  2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative sign in the column shows value below limit.
  4. Horn antenna is used for the emission over 1000MHz.
  5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
  6. Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

**TEST REPORT**

3.4 Frequency Stability

**FCC Part 15 Section 15.225**

**Data Table  
Frequency Deviation with Voltage Variation**

Operating frequency		13.559692MHz		
Test Voltage (V)	Temperature (°C)	Measured frequency (MHz)	Frequency error (%)	Limit (%)
4.5	+ 50	13.559636	-0.0004	±0.01
4.5	+ 40	13.559628	-0.0005	±0.01
4.5	+ 30	13.559651	-0.0003	±0.01
4.5	+ 20	13.559692	0	±0.01
4.5	+ 10	13.559729	+0.0003	±0.01
4.5	0	13.559714	+0.0002	±0.01
4.5	- 10	13.559783	+0.0007	±0.01
4.5	- 20	13.559800	+0.0008	±0.01

Nominal frequency Temperature (°C) Humidity (%)	Voltage	Frequency (MHz)	Frequency error (ppm)	Limit (ppm)	Result
20°C 50%	4.5	13.559692	0	100	Pass
20°C 50%	4.0	13.559685	-0.516	100	Pass
20°C 50%	3.8	13.559603	-6.564	100	Pass

The device is deemed to comply with requirement of FCC15.225(e).

## TEST REPORT

### 4.0 EQUIPMENT PHOTOGRAPHS

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

### 5.0 PRODUCT LABELLING

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

### 6.0 TECHNICAL SPECIFICATIONS

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

### 7.0 INSTRUCTION MANUAL

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

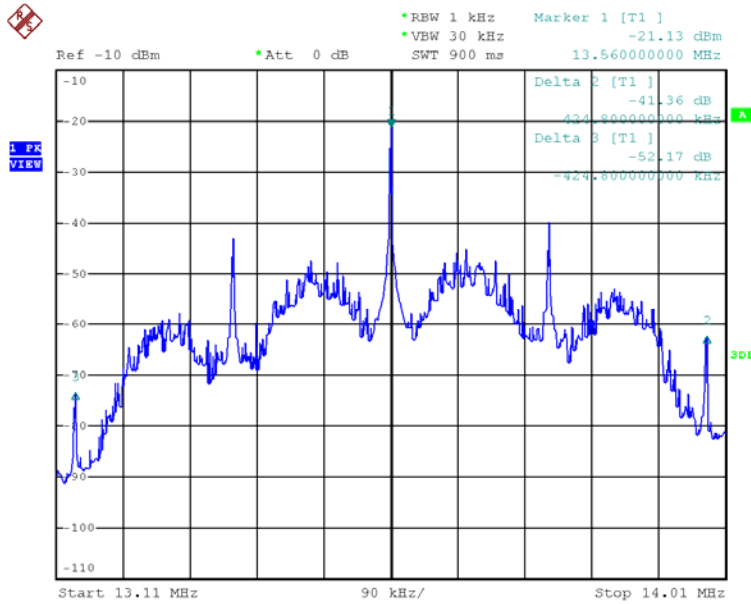
**TEST REPORT**

**8.0 MISCELLANEOUS INFORMATION**

The miscellaneous information includes details of the test procedure and measured bandwidth such as pulse desensitization and averaging factor (calculation and timing diagram).

**8.1 Measured Bandwidth**

The plot saved in bw.pdf which shows the fundamental emission is confined in the specified band. The emission of the fundamental is 22.9 dBμV/m and it is below the limit of 50.5 dBμV/m in the range of (13.410-13.553MHz) and (13.710-14.010MHz) and the limit of 40.5 dBμV/m in the frequency range of (13.110-14.410MHz) and (13.710-14.010MHz). In the frequency range from 13.110-14.010MHz, we can not find any emission higher than the fundamental emission. Therefore they meet the requirement of Section 15.225(a), (b), (c), & (d).



## TEST REPORT

### 8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. Since the transmitter transmits the RF signal continuously.

### 8.3 Calculation of Average Factor

The average factor is not applicable for this device as the transmitted signal is a continuously signal.

## TEST REPORT

### 8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

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### 8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.10 (2013).

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 3 MHz is used.

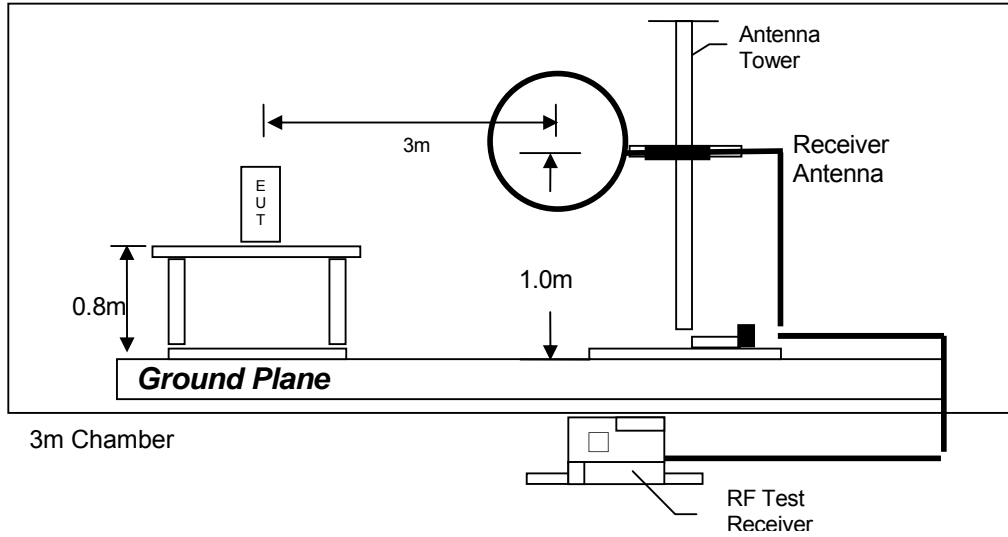
Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.



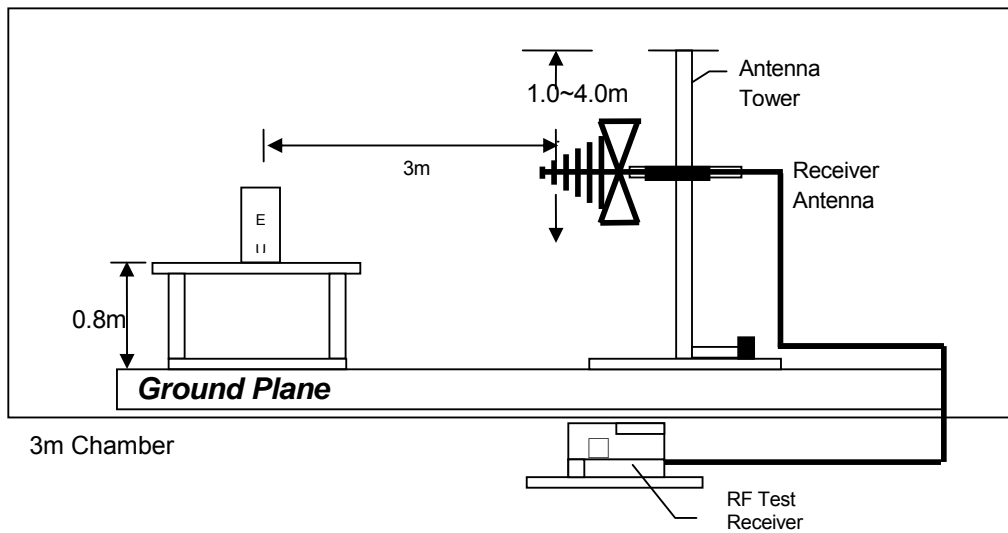
## TEST REPORT

### 8.4.1 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 30MHz



Test setup of radiated emissions above 1GHz

## TEST REPORT

### 9.0 EQUIPMENT LIST

#### 1) Radiated Emissions Test

EQUIPMENT	EMI TEST RECEIVER	SPECTRUM ANALYZER	Biconical Antenna
Registration No.	EW-2500	EW-3281	EW-2512
Manufacturer	R&S	ROHDESCHWARZ	EMCO
Model No.	ESCI	FSV40	3104C
Calibration Date	October 13, 2017	January 02, 2018	November 16, 2016
Calibration Due Date	October 13, 2018	January 02, 2019	May 16, 2018

EQUIPMENT	Log Periodic Antenna	14m Double Shield RF Cable
Registration No.	EW-1042	EW-2074
Manufacturer	EMCO	RADIALL
Model No.	3148	N(m)-RG142-BNC(m) L=14M
Calibration Date	June 19, 2017	January 20, 2017
Calibration Due Date	December 19, 2018	December 07, 2018

EQUIPMENT	RF Cable 14m	Active Loop H-field Antenna (9kHz to 30MHz)
Registration No.	EW-2781	EW-2313
Manufacturer	GREATBILLION	ELECTROMETRI
Model No.	SMA m/SHF5MPU /SMA m ra14m,26G	EM-6876
Calibration Date	September 25, 2017	March 08, 2018
Calibration Due Date	September 25, 2018	March 08, 2019

#### 2) Bandedge Measurement and Frequency Stability Measurement

Equipment	Spectrum Analyzer	Temperature & Humidity Chamber (2 chambers inside) (Top + Bottom)
Registration No.	EW-3016	EW-2395
Manufacturer	R&S	GIANT FORCE
Model No.	FSV40	GTH-210-40-SP-AR
Calibration Date	July 20, 2017	August 29, 2017
Calibration Due Date	July 20, 2018	September 04, 2018

**END OF TEST REPORT**