

TEST REPORT

Report No.: 18081437HKG-005

BBPOS International Limited

Application For Certification
(Original Grant)

This report contains the data of 13MHZ RFID portion only

FCC ID: 2AB7X-S1801

Transceiver

Prepared and Checked by:

Approved by:

Signed On File

Kung Wing Cheong, Steven
Senior Lead Engineer

Tang Kwan Mo, Jess
Lead Engineer

Date: September 20, 2018

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TEST REPORT

GENERAL INFORMATION

Grantee:	BBPOS International Limited
Grantee Address:	Suite 1903-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, N.T., Hong Kong.
Contact Person:	Adrian Kwan
Tel:	+852 31582585
Fax:	+852 31582586
e-mail:	adrian.kwan@bbpos.com
Manufacturer:	BBPOS International Limited
Manufacturer Address:	Suite 1903-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, N.T., Hong Kong.
Brand Name:	Shopify
Model:	S1801
Type of EUT:	Transceiver
Description of EUT:	Shopify Tap & Chip Reader
Serial Number:	N/A
FCC ID:	2AB7X-S1801
Date of Sample Submitted:	August 27, 2018
Date of Test:	August 27, 2018 to September 19, 2018
Report No.:	18081437HKG-005
Report Date:	September 20, 2018
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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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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1.0 GENERAL DESCRIPTION

1.1 Product Description

The Equipment Under Test (EUT) is an 13MHz RFID card reader which can support Bluetooth 2.1 and 4.2. For the RFID function, it uses to identify the tags. The EUT is powered by 3.7V internal battery.

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 transceiver.

1.3 Test Methodology

Both AC mains line-conducted and 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 and conducted measurement 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.

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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 fully charged 3.7V internal battery.

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 unit was operated standalone and placed in the center of the turntable.

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.

All relevant operation modes have been tested, and the worst case data was included in this report.

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

1. C3 EMV Test card (Supplied by Client)
2. Mobile phone (Brand: Samsung, Model: SM-G9287)(Supplied by Client)

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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 μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ 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 μ V/m

RR = RA - AG - AV in dB μ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ 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 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

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

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

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

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

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

$$FS = RR + LF$$

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

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

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

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

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 664.509 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 5.5 dB

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RADIATED EMISSIONS

Model: S1801

Date of Test: September 02, 2018

Worst-Case Operating Mode: Transmitting

Table 1
Pursuant to FCC Part 15 Section 15.225 Requirement

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Distance Factor (-dB)	Calculated at 30m (dB μ V/m)	Limit at 30m (dB μ V/m)	Margin (dB)
V	13.560	51.2	0	10.8	62.0	40.0	22.0	84.0	-62.0
V	27.120	14.9	0	9.5	24.4	40.0	-15.6	29.5	-45.1

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	40.680	37.5	16	10.0	31.5	40.0	-8.5
H	67.808	39.3	16	8.0	31.3	40.0	-8.7
H	94.926	35.0	16	11.0	30.0	43.5	-13.5
H	122.043	36.1	16	14.0	34.1	43.5	-9.4
V	149.160	30.0	16	14.0	28.0	43.5	-15.5
H	176.307	29.8	16	19.0	32.8	43.5	-10.7
H	203.425	31.0	16	16.0	31.0	43.5	-12.5
H	230.542	32.2	16	18.0	34.2	46.0	-11.8
H	257.659	29.5	16	21.0	34.5	46.0	-11.5
H	284.777	26.8	16	22.0	32.8	46.0	-13.2
H	664.509	27.5	16	29.0	40.5	46.0	-5.5

- 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 within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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3.4 Frequency Stability

FCC Part 15 Section 15.225

Data Table
Frequency Deviation with Voltage Variation

Operating frequency		13.560840MHz		
Test Voltage (V)	Temperature (°C)	Measured frequency (MHz)	Frequency error (%)	Limit (%)
3.7	+ 50	13.560760	-0.00059	±0.01
3.7	+ 40	13.560800	-0.00029	±0.01
3.7	+ 30	13.560780	-0.00044	±0.01
3.7	+ 20	13.560840	0	±0.01
3.7	+ 10	13.560880	0.00029	±0.01
3.7	0	13.560900	0.00044	±0.01
3.7	- 10	13.560900	0.00044	±0.01
3.7	- 20	13.560920	0.00059	±0.01

Nominal frequency Temperature (°C) Humidity (%)	Voltage	Frequency (MHz)	Frequency error (ppm)	Limite (ppm)	Result
20°C 50%	3.7	13.560840	0	100	Pass
20°C 50%	3.4	13.560850	0.737	100	Pass
20°C 50%	3.0	13.560860	1.475	100	Pass

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

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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.

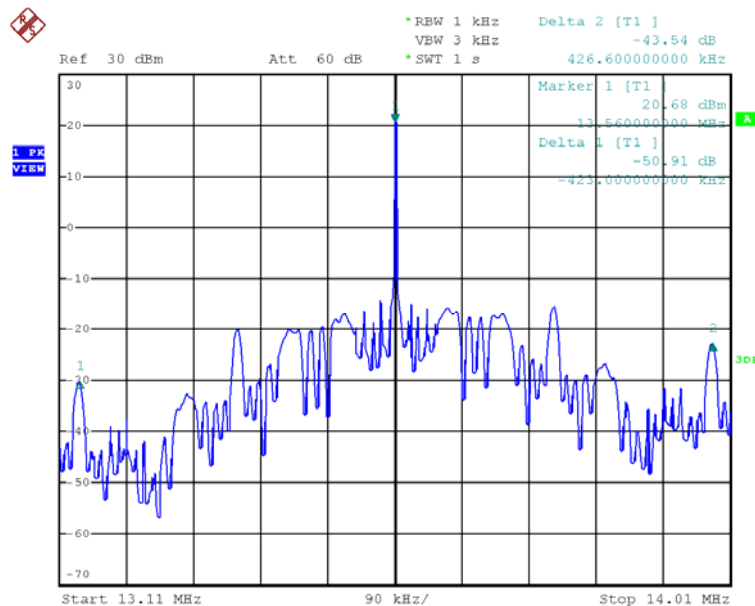
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8.0 MISCELLANEOUS INFORMATION

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 62.0 dB μ V/m and it is below the limit of 50.5 dB μ V/m in the range of (13.410-13.553MHz) and (13.567-13.710MHz) and the limit of 40.5 dB μ V/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).



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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.

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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. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.

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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).

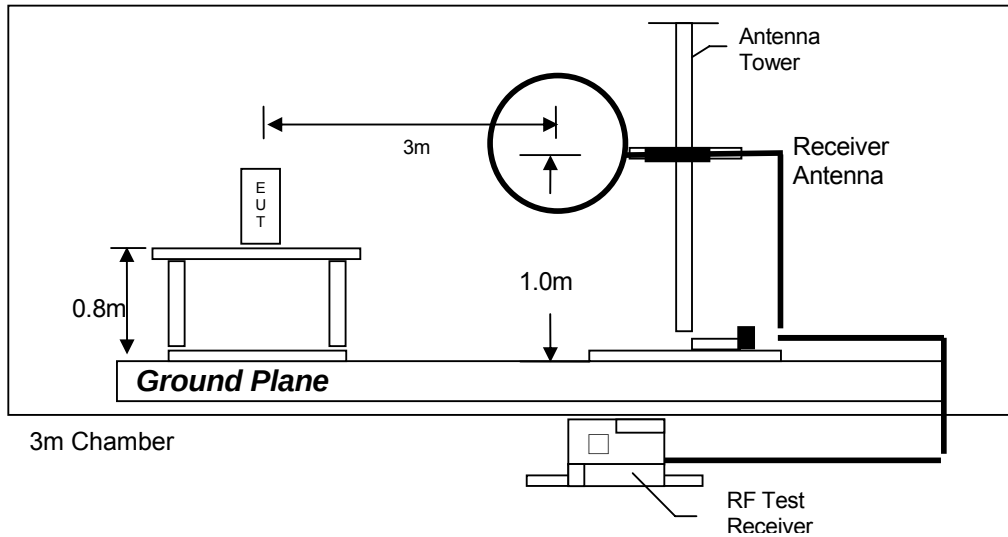
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion 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.

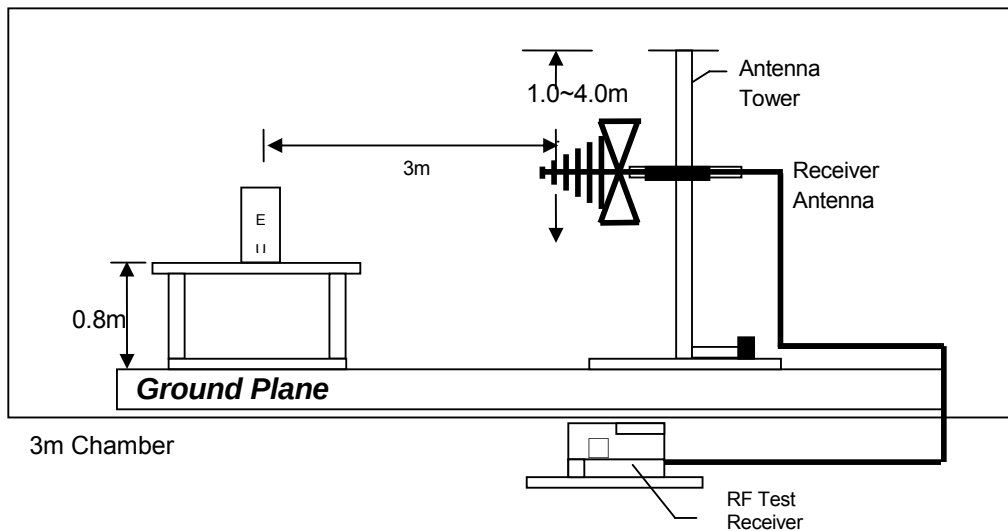
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8.4.1 Radiated Emission Test Setup

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

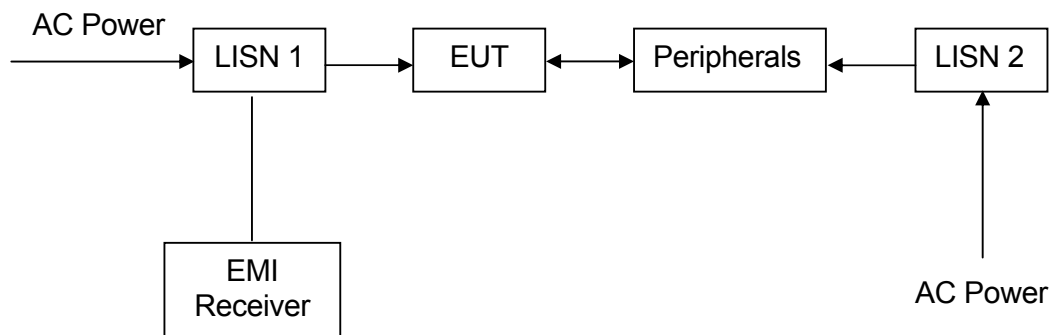
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8.4.2 Conducted Emission Test Procedures

For tabletop equipment, the EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table. For floor-standing equipment, the EUT and all cables were insulated, if required, from the ground plane by up to 12 mm of insulating material. The EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were moved to find the maximum emission.

8.4.3 Conducted Emission Test Setup



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9.0 CONFIDENTIALITY REQUEST

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

10.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Spectrum Analyzer	Biconical Antenna
Registration No.	EW-3156	EW-3281	EW-0571
Manufacturer	ROHDESCHWARZ	ROHDESCHWARZ	EMCO
Model No.	ESR26	FSV40	3104C
Calibration Date	November 10, 2017	January 02, 2018	February 27, 2018
Calibration Due Date	November 10, 2018	January 02, 2019	August 27, 2019

Equipment	Log Periodic Antenna	Double Ridged Guide Antenna	Log Periodic Antenna
Registration No.	EW-1042	EW-1133	EW-0447
Manufacturer	EMCO	EMCO	EMCO
Model No.	3148	3115	3146
Calibration Date	June 19, 2017	May 24, 2017	January 17, 2018
Calibration Due Date	December 19, 2018	November 24, 2018	July 17, 2019

Equipment	BiConiLog Antenna	Double Ridged Guide Antenna	Biconical Antenna
Registration No.	EW-3061	EW-0194	EW-2512
Manufacturer	EMCO	EMCO	EMCO
Model No.	3142E	3115	3104C
Calibration Date	November 02, 2017	March 14, 2018	August 06, 2018
Calibration Due Date	November 02, 2018	September 14, 2019	February 06, 2020

Equipment	Active Loop H-field Antenna (9kHz to 30MHz)	RF CABLE (9kHz to 1000 MHz)	RF Pre-amplifier (9kHz to 40GHz)
Registration No.	EW-2313	EW-3170	EW-3006
Manufacturer	ELETROMETRIC	UNBRANDED	SCHWARZBECK
Model No.	EM-6876	9kHz to 1000MHz	BBV 9718
Calibration Date	March 08, 2018	May 11, 2018	April 26, 2018
Calibration Due Date	September 08, 2019	May 11, 2019	April 26, 2019

2) Bandedge Measurement and Frequency Stability Measurement

Equipment	Spectrum Analyzer	Temperature & Humidity Chamber
Registration No.	EW-3281	EW-2134
Manufacturer	ROHDESCHWARZ	GIANT FORCE
Model No.	FSV40	GTH-750-40-CP-SD
Calibration Date	January 02, 2018	September 04, 2018
Calibration Due Date	January 02, 2019	September 04, 2019

END OF TEST REPORT