



**Nemko**

**Nemko USA, Inc.**

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## Certification Test Report

In Accordance With: FCC Part 15 Subpart C, 15.225

Applicant: IPS Group Inc  
5601 Oberlin Drive  
San Diego CA 92121

Equipment Under Test (EUT): Parking Meter  
Model: MK5 SSPM

FCC ID: SGWIPS2007SSPM

Tested By: Nemko USA Inc.  
2210 Faraday Avenue, Suite 150  
Carlsbad, CA 92008

Test Report Number: 2013 03231818 FCC2  
Date: March 6, 2013  
Project Number: 10239592  
NEX Number: 231818

Total Number of Pages: 21

## Applicant Affirmation

Gary Thomas representing IPS Group Inc hereby affirms:

- a) That he/she has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;
- b) That the devices in this test report will be representative of production units;
- c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.
- d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.



Gary Thomas  
Printed name of official

Signature of official

5601 Oberlin Drive  
Address

March 6, 2013  
Date

(858) 404-0607  
Telephone number

gary.thomas@ipsgroupinc.com  
Email address of official

*NOTE—This affirmation must be signed by the responsible party before it is submitted to a regulatory body for approval.*



## Section 1. Summary of Test Results

### 1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed: Parking Meter

Model: MK5 SSPM

Specification: FCC Part 15 Subpart C, 15.225

Date Received in Laboratory: February 25, 2013

Compliance Status: Complies

Exclusions: None

Non-compliances: None

## 1.2 Report Release History

REVISION	DATE	COMMENTS
-	January 13, 2010	Prepared By: <b>Mark Phillips</b>
-	January 13, 2010	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Mark Phillips, RF/EMC Test Engineer



EMC/RF Test Engineer



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## Section 2: Equipment Under Test

### 2.1 Theory of Operation

The MK5 SSPM is a Parking Meter. The operating frequencies are 410.610 MHz to 430.400 MHz and 13.56 MHz. The MK5 SSPM has firmware version 52.57.4.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

Highest frequency generated or used: 430.4 MHz

### 2.2 Technical Specifications of the EUT

Manufacturer:	IPS Group Inc
Operating Frequency:	13.56 MHz
Measured Field Strength:	32.7 dB $\mu$ V/m @ 10m
Modulation:	OOK
Antenna Data:	integral wire loop antenna
Antenna Connector:	NONE
Power Source:	3.6V Internal Rechargeable Batteries



## Section 3: Test Conditions

### 3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C,  
§ 15.225 Operation within the band 13.110-14.010 MHz.

### 3.2 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	14 – 22 °C
Humidity range	:	32—76 %
Pressure range	:	102.0 kPa
Power supply range	:	+/- 5% of rated voltages



### 3.3 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
911	Spectrum Analyzer	Agilent	E4440A	US41421266	10/15/2012	10/15/2013
110	Antenna, LPA	Electrometrics	LPA-25	1217	4/1/2011	4/1/2013
133	Antenna, Loop	Electrometrics	ALR-25M	678	7/18/2011	7/18/2013
128	Antenna, Bicon	EMCO	3104	2882	3/21/2011	3/21/2013
529	Antenna, DRWG	EMCO	3115	2505	10/31/2012	10/31/2014
901	Preamplifier	Sonoma	310 N	130607	10/15/2012	10/15/2013
E1013	Antenna	EMCO	3116	00119488	1/10/2012	1/10/2014
317	Preamplifier	HP	8449A	2749A00167	6/11/2012	6/11/2013
835	Spectrum Analyzer	R&S	FSEK	829058/005	9/6/2012	9/6/2013
E1041	Oscilloscope	LeCroy	WaveRunner	27167	6/12/2012	6/12/2013

Registrations of the 10m Semi-Anechoic Chamber are on file with the Federal Communications Commission and Industry Canada under Site Number 2040B-3.

## Section 4: Observations

### 4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

### 4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

### 4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

### 4.4 Tests Deleted

No Tests were deleted from this assessment.

### 4.5 Additional Observations

There were no additional observations made during this assessment.

### 4.6 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

## Section 5: Results Summary

This section contains the following:

### FCC Part 15 Subpart C: Test Results.

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N      No: not applicable / not relevant

Y      Yes: Mandatory i.e. the apparatus shall conform to these tests.

N/T     Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

#### 5.1 Test Results

Part 15.225	Test Description	Required	Result
15.225(a)	Field Strengths and Frequency Bands	Y	Pass
15.225(b) to (d)	Occupied Bandwidth	Y	Pass
15.225(e)	Frequency Stability	Y	Pass
15.207 (a)	Power line Conducted Emissions	N	NA*

\* Battery Powered

## Appendix A: Test Results

### Conducted Emissions

Client	IPS Group Inc	Temperature		°C
Nex #	231818	Relative Humidity		%
EUT Name	Parking Meter	Barometric Pressure		kPa
EUT Model	MK5 SSPM	Test Location		
Governing Doc	CFR 47, Part 15B	Test Engineer		
Basic Standard	Sec. 15.207 Transmit RSS-Gen 7.2.4	Date of test		
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line, Average Limit Green Line	Not applicable as EUT is battery powered. When Battery Charging, EUT does not Transmit.		

**Occupied Bandwidth**

15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

**Test Conditions:**

Client	IPS Group Inc	Temperature	19	°C
Nex #	231818	Relative Humidity	48	%
EUT Name	Parking Meter			
EUT Model	MK5 SSPM	Test Location	Enclosure 1	
Governing Doc	CFR 47, Part 15C	Test Engineer	Mark Phillips	
Basic Standard	Sec. 15.231 Transmit	Date of test	01-29-2013	

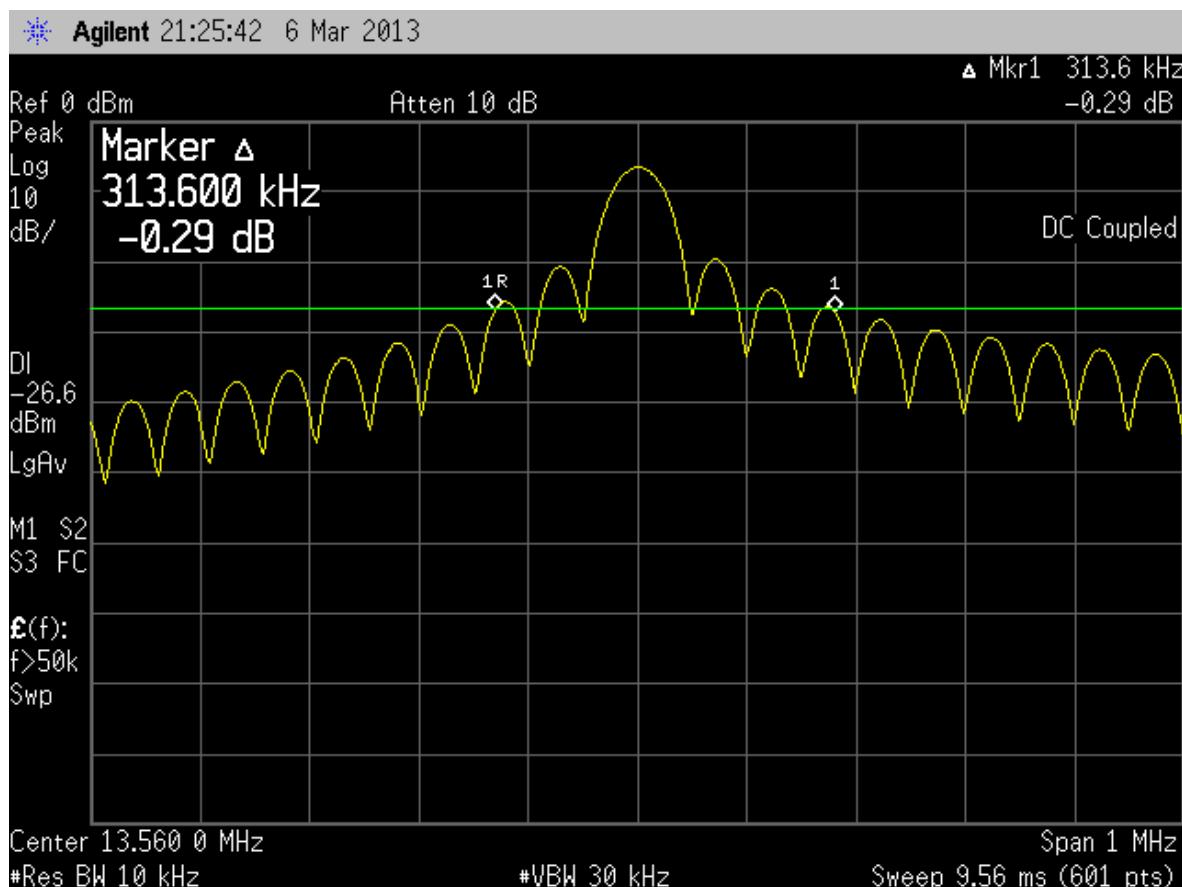
**Test Results:**

Measured Occupied Bandwidth:

Frequency	20 dB Bandwidth
13.56 MHz	313 kHz



Plots  
20 dB bandwidth



## Frequency Stability

15.225(e) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

15.231(d) For devices operating within the frequency band 40.66–40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be  $\pm 0.01\%$ . This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltages at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### Test Conditions:

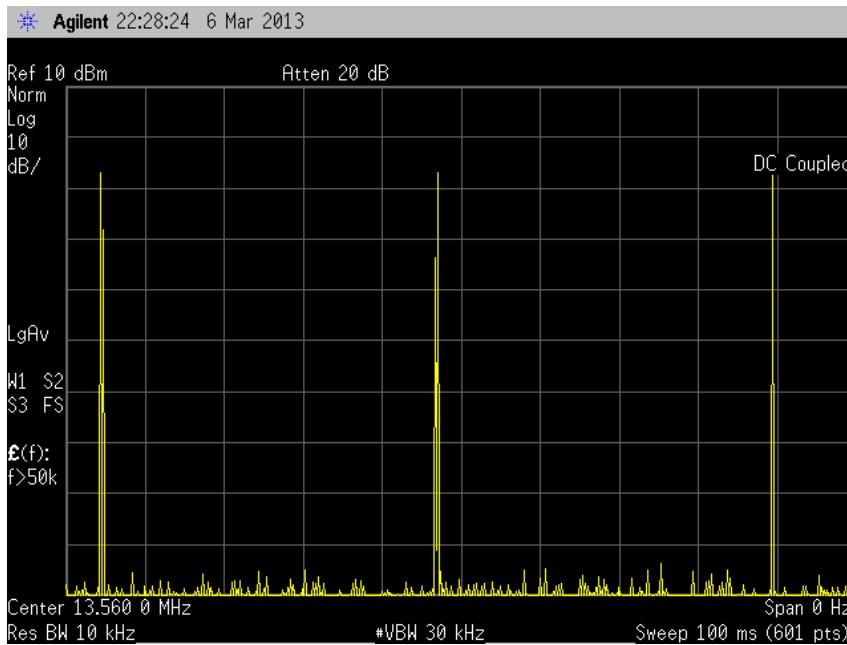
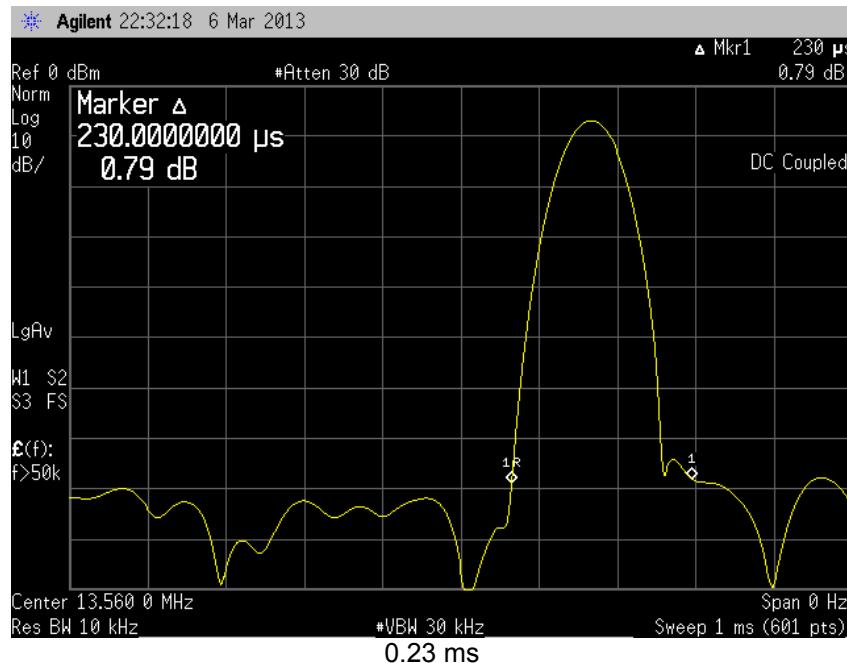
Client	IPS Group Inc	Temperature	25	°C
Nex #	231818	Relative Humidity	15	%
EUT Name	Parking Meter			
EUT Model	MK5 SSPM	Test Location	Environmental Chamber	
Governing Doc	CFR 47, Part 15C	Test Engineer	Mark Philips	
Basic Standard	15.225 Transmit	Date of test	3-1-2013	

For 15.225: EUT complies:

Installed freshly charged battery.

$\pm 0.01\%$  of the operating frequency = 1356 Hz

Temperature Degrees C	Frequency MHz	Frequency Drift		
		Hz	ppm	%
-30	13.560751	+751	+55.38	-0.005538
-20	13.560322	+322	+23.74	-0.002374
-10	13.560049	+49	+3.61	+0.000361
0	13.560100	+100	+7.37	+0.000737
10	13.560100	+100	+7.37	+0.000737
20	13.560105	+105	+7.74	+0.000774
30	13.560088	+88	+6.48	+0.000648
40	13.559949	-510	-37.61	-0.003761
50	13.560455	+455	+33.55	+0.003355

**Duty Cycle 15.225**

$$\begin{aligned} \text{Duty cycle factor} &= 20 \times \log((3 \times .230 \text{ ms})/100 \text{ ms}) \\ &= 20 \times \log(.690 \text{ ms}/100 \text{ ms}) \\ &= -43.2 \text{ dB} \end{aligned}$$

## Field Strength and Radiated Spurious Emissions

Sec. 15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter )	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

15.225 (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Client	IPS Group Inc	Temperature	19	°C
Nex #	231818	Relative Humidity		%
EUT Name	Parking Meter			
EUT Model	MK5 SSPM	Test Location	SOATS	
Governing Doc	CFR 47, Part 15C	Test Engineer	Mark Phillips	
Basic Standard	Sec. 15.231 Transmit	Date of test	January 24, 2013	

## Test Results:

See Table. EUT complies for fundamental power and spurious emissions.

## Additional Observations:

The Spectrum was searched from 2.6 MHz to the 1000 MHz

These results apply to emissions that may be found in the restricted bands defined in FCC Part 15 Subpart C, 15.205.

The EUT was investigated with a fresh battery. The emissions were measured with a test mode to repeat the emission so measurements could be maximized for the rotation of the sample and height and polarity of the measurement antenna.

All Measurements below 1GHz were performed at 3m employing a CISPR quasi-peak detector, except for the radio's fundamental. Peak measurements above 1GHz were done utilizing RBW of 1MHz and VBW of 3MHz.



Measurements made at the 3 meter distance of the 10m Semi-anechoic chamber, all measurements max hold after peaking for EUT rotation and antenna height from 1 to 4 meters.

All other emissions were found to be more than 20dB below the limit and have not been reported per FCC rule 15.31(o).

Emissions were measured on an 80cm (height) table

Since the EUT is defined as a vertical mounted device: emissions were measured in an upright configuration only.

*Note: Corrected Reading Computations*

Average = Peak Maximum Meter Reading + Antenna Factor + Path Loss

62.9 = 64.3 + 15.3 + 3.3 - 20

**15.225 Limit**

30 to 10 m extrapolation factor =  $40 \log(30/10) = 19.1$  dB

Limit  $15.848 \text{ mV/m} = 83.999 \text{ dBuV/m}$

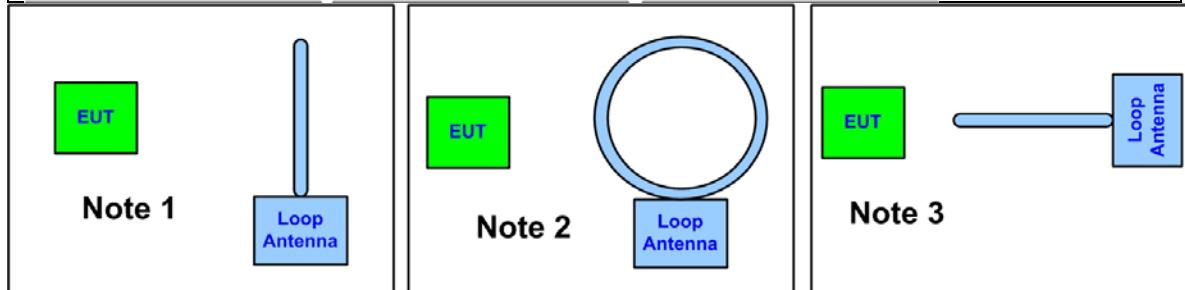
Limit  $84 + 19.1 = 103.1 \text{ dBuV/m}$

*Field Strength at 13.56 MHz = Maximum Meter Reading + Antenna Factor + Path Loss + PreAmp*

$32.7 \text{ dBuV/m} = 30.1 + 34.7 + 0.5 - 32.6$



Radiated Emissions Data															
Job #:	10239592		Date :	2/25/2013		Page	1	of	1						
NEX#:	231818		Time :	17:45											
Staff :	mp														
Client Name :	IPS				EUT Voltage :	3.6VDC									
EUT Name :	Parking Meter				EUT Frequency :										
EUT Model #:	MK 5 SSSPM				Phase:										
EUT Serial #:	None														
EUT Config. :	Transmitting with Modulation				Distance < 30 MHz:	10 m									
Specification :	FCC Part 15 Subpart C, 15.209				Distance < 1000 MHz:	3 m									
	FCC Part 15 Subpart C, 15.225				Distance > 1000 MHz:	3 m									
Loop Ant. #:	133														
Bicon Ant.#:	128_3m		Temp. (°C) :	21											
Log Ant.#:	110_3m		Humidity (%):	32											
DRG Ant. #	529		Spec Analyzer #:	911											
Cable LF#:	SAC_10m		Analyzer Display #:	911											
Cable HF#:	WCC		Quasi-Peak Detector #:	911											
Preamp LF#:	901		Duty Cycle (%):	100.00											
Preamp HF#:	1029														
Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.															
Measurements above 1 GHz are Average values, unless otherwise stated.															
Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dB $\mu$ V)	Corrected Reading (dB $\mu$ V/m)	Spec. limit (dB $\mu$ V/m)	CR/SL Diff. (dB)	Pass Fail	Comment				
13.560	30.1	NA	P	5.0	100.0	30.1	32.7	103.1	-70.4	Pass	NFC / RFID Output Power				
											Note 1 Position results				
											Note 2 position noise floor				
											Note 3 position noise floor				





## APPENDIX B

### B. Radiated Emissions Measurement Uncertainties

#### 1. Introduction

ISO/IEC 17025:2005 and ANSI/NCSL Z540.3: 2006 require that all measurements contained in a test report be "traceable". "Traceability" is defined in the *International Vocabulary of Basic and General Terms in Metrology* (ISO: 1993) as: "the property of the result of a measurement... whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, *all having stated uncertainties*".

The purposes of this Appendix are to "state the *Measurement Uncertainties*" of the conducted emissions and radiated emissions measurements contained in Section 5 of this Test Report, and to provide a practical explanation of the meaning of these measurement uncertainties.

#### 2. Statement of the Worst-Case Measurement Uncertainties for the Conducted and Radiated Emissions Measurements Contained in This Test Report

Table 1: Worst-Case Expanded Uncertainty "U" of Measurement for a k=2 Coverage Factor

Radiated Emissions Measurement Detection Systems	Applicable Frequency Range	"U" for a k=2 Coverage Factor
Spectrum Analyser with QPA & Preamplifier	30 MHz - 200 MHz	+3.9 dB, -4.0 dB
Spectrum Analyser with QPA & Preamplifier	200 MHz-1000 MHz	+/- 3.5 dB
Spectrum Analyser with Preamplifier	1 GHz - 18 GHz	+2.5 dB, -2.6 dB
Spectrum Analyser with Preamplifier	18 GHz - 40 GHz	+/- 3.4 dB

NOTES:

1. Applies to 3 and 10 meter measurement distances
2. Applies to all valid combinations of Transducers (i.e. LISNs, Line Voltage Probes, and Antennas, as appropriate)
3. Excludes the Repeatability of the EUT

### 3. Practical Explanation of the Meaning of Radiated Emissions Measurement Uncertainties

In general, a “Statement of Measurement Uncertainty” means that with a certain (specified) confidence level, the “true” value of a measurand will be between a (stated) upper bound and a (stated) lower bound.

In the specific case of EMC Measurements in this test report, the measurement uncertainties of the conducted emissions measurements and the radiated emissions measurements have been calculated in accordance with the method detailed in the following documents:

- ANSI Z540.2 (2002) *Guide to the Expression of Uncertainty in Measurement*
- NIS 81:1994, *The Treatment of Uncertainty in EMC Measurements* (NAMAS, 1994)
- NIST Technical Note 1297(1994), *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (NIST, 1994)

The calculation method used in these documents requires that the stated uncertainty of the measurements be expressed as an “expanded uncertainty”,  $U$ , with a  $k=2$  coverage factor. The practical interpretation of this method of expressing measurement uncertainty is shown in the following example:

EXAMPLE: Assume that at 39.51 MHz, the (measured) radiated emissions level was equal to +26.5 dBuV/m, and that the +/- 2 standard deviations (i.e. 95% confidence level) measurement uncertainty was +/- 3.4 dB.



## APPENDIX C

### C. Nemko USA, Inc. Test Equipment & Facilities Calibration Program

Nemko USA, Inc. operates a comprehensive Periodic Calibration Program in order to ensure the validity of all test data. Nemko USA's Periodic Calibration Program is fully compliant to the requirements of NVLAP Policy Guide PG-1-1988, ANSI/NCSL Z540.3: 2006, ISO 10012:2003, ISO/IEC 17025:2005, and ISO-9000: 2000. Nemko USA, Inc.'s calibrations program therefore meets or exceeds the US national commercial and military requirements [N.B. ANSI/NCSL Z540.1-1994 replaced MIL-STD-45662A].

Specifically, all of Nemko USA's *primary reference standard devices* (e.g. vector voltmeters, multimeters, attenuators and terminations, RF power meters and their detector heads, oscilloscope mainframes and plug-ins, spectrum analysers, RF preselectors, quasi-peak adapters, interference analysers, impulse generators, signal generators and pulse/function generators, field-strength meters and their detector heads, etc.) and certain *secondary standard devices* (e.g. RF Preamplifiers used in CISPR 11/22 and FCC Part 15/18 tests) are periodically recalibrated by:

- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratories by NIST; or,
- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratory by another accreditation body (such as A2LA) that is mutually recognized by NIST; or,
- A manufacturer of Measurement and Test Equipment (M&TE), if the manufacturer uses NIST-traceable standards and is ISO Guide 25-accredited as calibration laboratory either by NIST or by another accreditation body (such as A2LA) that is mutually recognized by NIST; or
- A manufacturer of M&TE (or by a Nemko USA-approved independent third party metrology laboratory) that is not ISO Guide 25-accredited. (In these cases, Nemko USA conducts an annual audit of the manufacturer or metrology laboratory for the purposes of proving traceability to NIST, ensuring that adequate and repeatable calibration procedures are being applied, and verifying conformity with the other requirements of ISO Guide 25).



In all cases, the entity performing the Calibration is required to furnish Nemko USA with a calibration test report and/or certificate of calibration, and a "calibration sticker" on each item of M&TE that is successfully calibrated.

Calibration intervals are normally one year, except when the manufacturer advises a shorter interval or if US Government directives or client requirements demand a shorter interval. Items of instrumentation/related equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit) are sidelined pending repair and recalibration. (Repairs are carried out either in-house [if minor] or by a Nemko USA-approved independent [third party] metrology laboratory, or by the manufacturer of the item of M&TE).

Each antenna used for CISPR 11 and CISPR 22 and FCC Part 15 and Part 18 radiated emissions testing (and for testing to the equivalent European Norms) is calibrated annually by either a NIST (or A2LA) ISO Standard 17025-Accredited third-party Antenna Calibration Laboratory or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory. The antenna calibrations are performed using the methods specified in Annex G.5 of CISPR 16-1(2003) or ANSI C63.5-2004, including the "Three-Antenna Method". Certain other kinds of antennas (e.g. magnetic-shielded loop antennas) are calibrated annually by either a NIST (or A2LA) ISO Standard 17025-accredited third-party antenna calibration laboratory, or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory using the procedures specified in the latest version of SAE ARP-958.

In accordance with FCC and other regulations, Nemko USA recalibrates its suite of antennas used for radiated emissions tests on an annual basis. These calibrations are performed as a precursor to the FCC-required annual revalidation of the Normalized Site Attenuation properties of Nemko USA's Open Area Test Site. Nemko USA, Inc. uses the procedures given in both Sub clause 16.6 and Annex G.2 of CISPR 16-1 (2003), and, ANSI C63.4-2003 when performing the normalized site attenuation measurements.

