

Global EMC Inc. Labs

EMC Test Report

As per

RSS-210 Issue 8: 2010

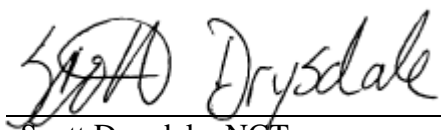
&

FCC Part 15 Subpart C:2012

FCC ID: ZPZ0213MGSOLO

on the

Mackay Guardian Solo



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Testing produced for



See Appendix A for full customer & EUT details.



Testing Laboratory
Certificate #2555.01



REG#382292

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

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Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Report Scope

This report addresses the EMC verification testing and test results of the , herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS Issue 8
FCC Part 15

Power line conducted and radiated emissions testing was evaluated on the EUT. Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Summary

The results contained in this report relate only to the item(s) tested.

Equipment under test	Mackay Guardian Solo
EUT Passed all tests performed.	Yes
Tests conducted by	Scott Drysdale
FCC ID	ZPZ0213MGSOLO (with addition modules as listed under justifications deviations section of this report)
IC certification #	9753A-MGSOLO (with addition modules as listed under justifications deviations section of this report)

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	QuasiPeak Average	Pass See Justification
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass See Justification
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.225 (see 15.209 results)	Radiated Emissions	QuasiPeak	Pass
Overall Result			PASS

All tests were performed by Scott Drysdale

If the product as tested complies with the specification, the EUT is deemed to comply with the standard and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' or 'FAIL' grade is independent of any measurement uncertainties.

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Justifications or Deviations

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), this device uses an internal antenna with no instructions for replacement.

For the Restricted Bands of operation, the EUT is designed to only operate at 127 kHz and 13.56 MHz.

For the power line conducted emissions requirements, the EUT is DC powered with no provisions for connection to the AC mains and this test does not apply.


Testing was performed to evaluate the device when the following previously certified module(s) are additionally incorporated:

GSM module(s)

GPRS Module with FCC ID: RI7GE910 (IC ID: 5131A-GE910)

CDMA Module with FCC ID: RI7CE910-DUAL (IC ID: 5131A-CE910DUAL)

No deviations are recorded.

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Applicable Standards, Specifications and Methods

ANSI C63.4:2009	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2012	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS 210:2010	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Sample calculation(s)

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)

Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)

Margin = 8.5 dB

Document Revision Status

Revision 1 -

First revision issued on August 12, 2013

Revision 2 –

Minor updates as per TCB request, on file. August 30, 2013

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxillary Equipment.

Class A device – A digital device that is marketed for use in a commercial, industrial or business environment. A ‘Class A’ device should not be marketed for use by the general public. A ‘Class A’ device should contain the following or similar warning in it’s user manual: “**Warning:** This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.”

Class B device – A digital device that is marketed for use in a residential environment and may also be used in a commercial, business or industrial environments. A ‘Class B’ device may also be defined as a device to which a broadcast radio or television receivers would be expected to be common within a distance of 10 m of the device concerned.

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity


EUT – Equipment Under Test

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line impedance stabilization network

NCR – No Calibration Required

RF – Radio Frequency

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
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Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Montréal, Québec, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, 382292), and Industry Canada (IC, 6844B-1). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at Global EMC. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at Global EMC. Global EMC Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratories current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

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Testing Environmental Conditions and Dates

Following were the environmental conditions in the facility during time of testing –

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
July 7, 2013	Radiated Emissions	SD	22	45	101.2

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Detailed Test Results Section

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limit(s) and Method

The method is as defined in ANSI C63.4

The limits are as defined in FCC Part 15, Section 15.209 and 15.225:

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m⁴
 0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m⁴
 1.705 MHz – 30 MHz, 30 uV/m at 30 m⁴
 30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m¹) at 3 m
 88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m¹) at 3 m
 216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m¹) at 3 m
 Above 960 MHz, 500 uV/m (54.0 dBuV/m¹) at 3 m
 Above 1000 MHz, 500 uV/m (54 dBuV/m²) at 3m
 Above 1000 MHz, 500 uV/m (74 dBuV/m³) at 3m

Additionally the requirements of 15.225 apply, which allow for the following:


13.553–13.567 MHz, 15,848 uV/m (84.0 dBuV/m) at 30 m⁴
 13.410–13.553 MHz and 13.567–13.710 MHz, 334 uV/m at 30 m⁴.
 13.110–13.410 MHz and 13.710–14.010 MHz 106 uV/m at 30 m⁴.

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¹Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.

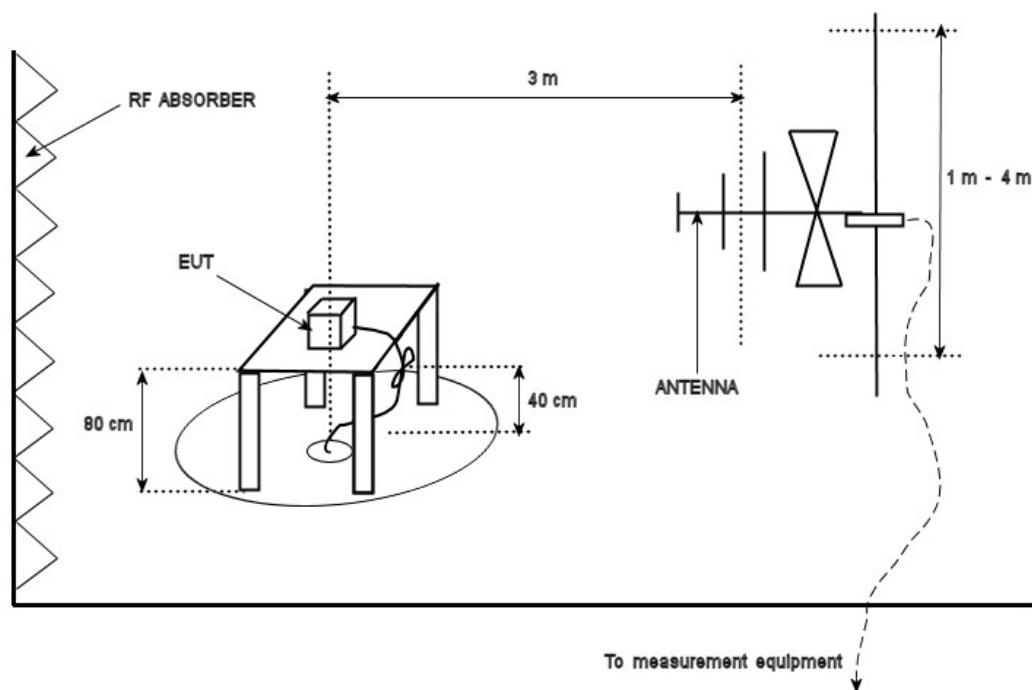
²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using an Average detector

⁴Limit is with using a Quasi-peak detector with a bandwidth as defined in CISPR 16-1-1

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Typical Radiated Emissions Setup



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Measurement Uncertainty


The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

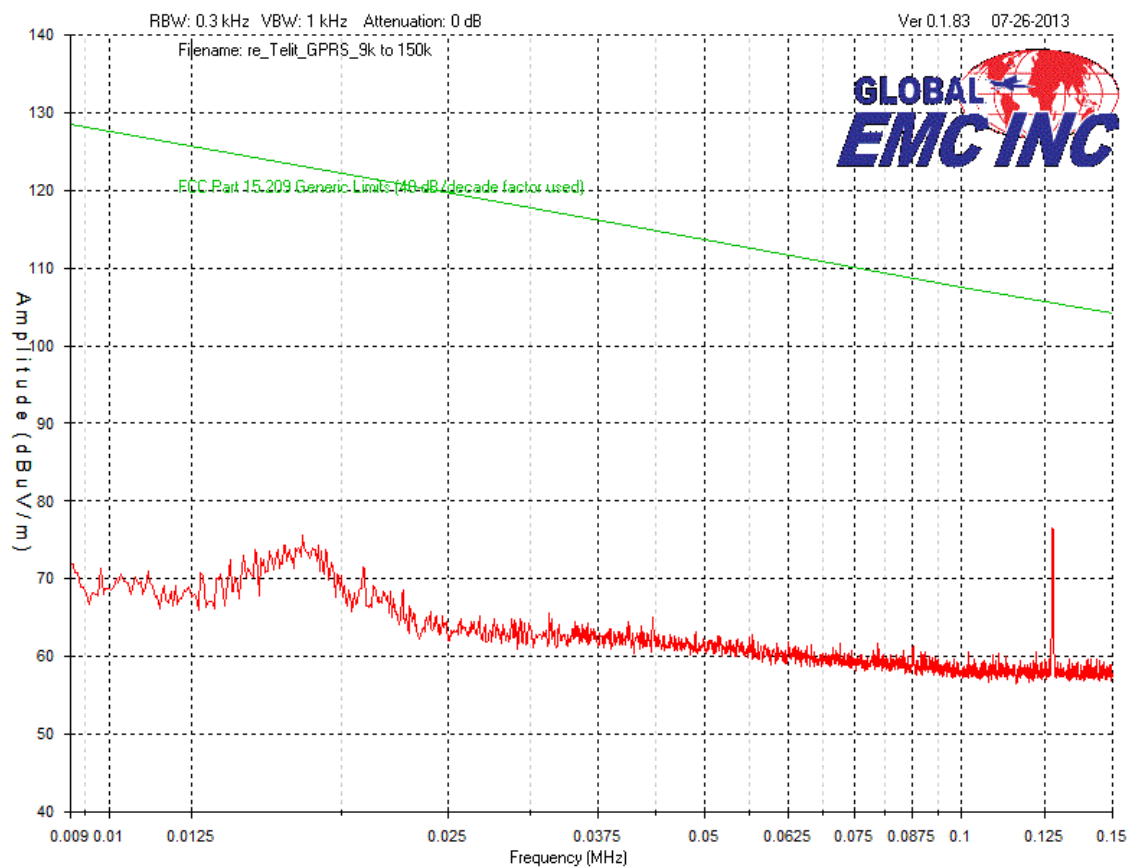
Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.


In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10th harmonic (a minimum of a 1 GHz).

Devices scanned above 1GHz may be scanned at a closer test distance, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz, and 40 dB/decade below 30 MHz.

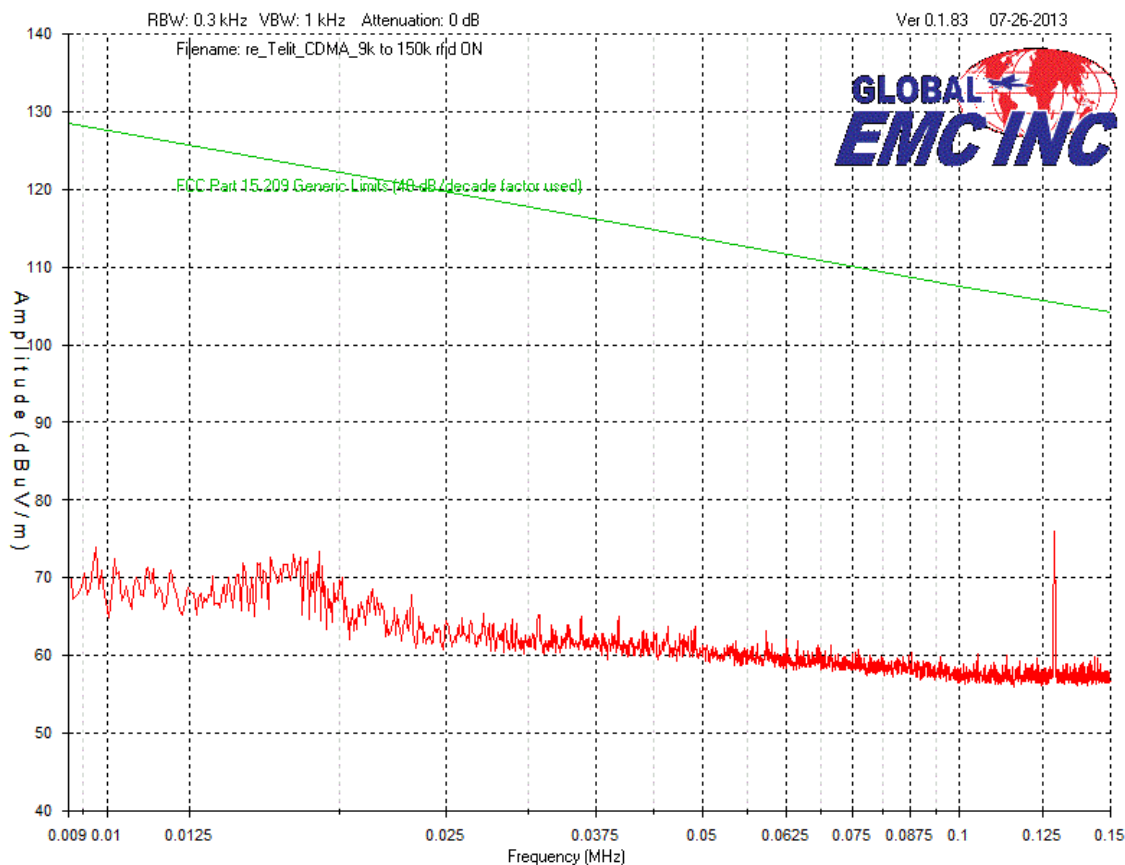
Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	


9 kHz to 150 kHz – with GPRS

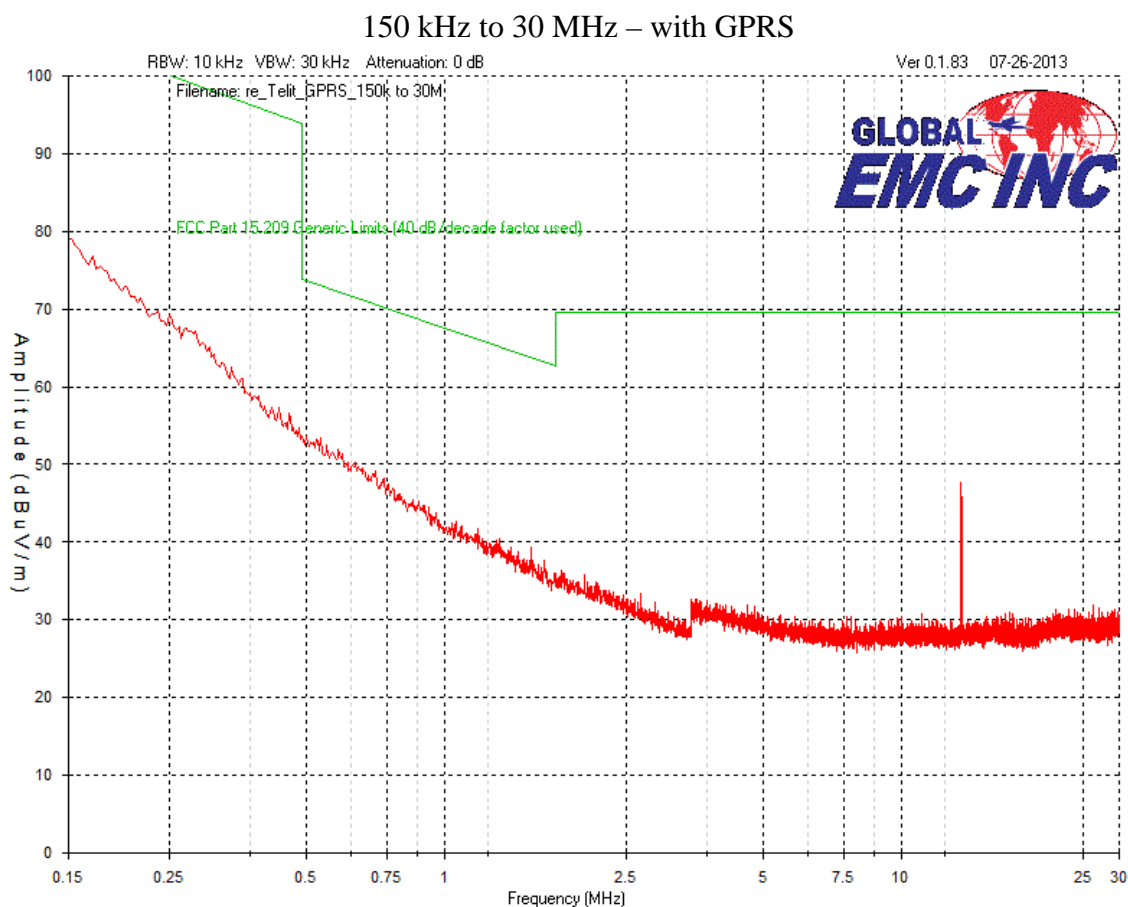



Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

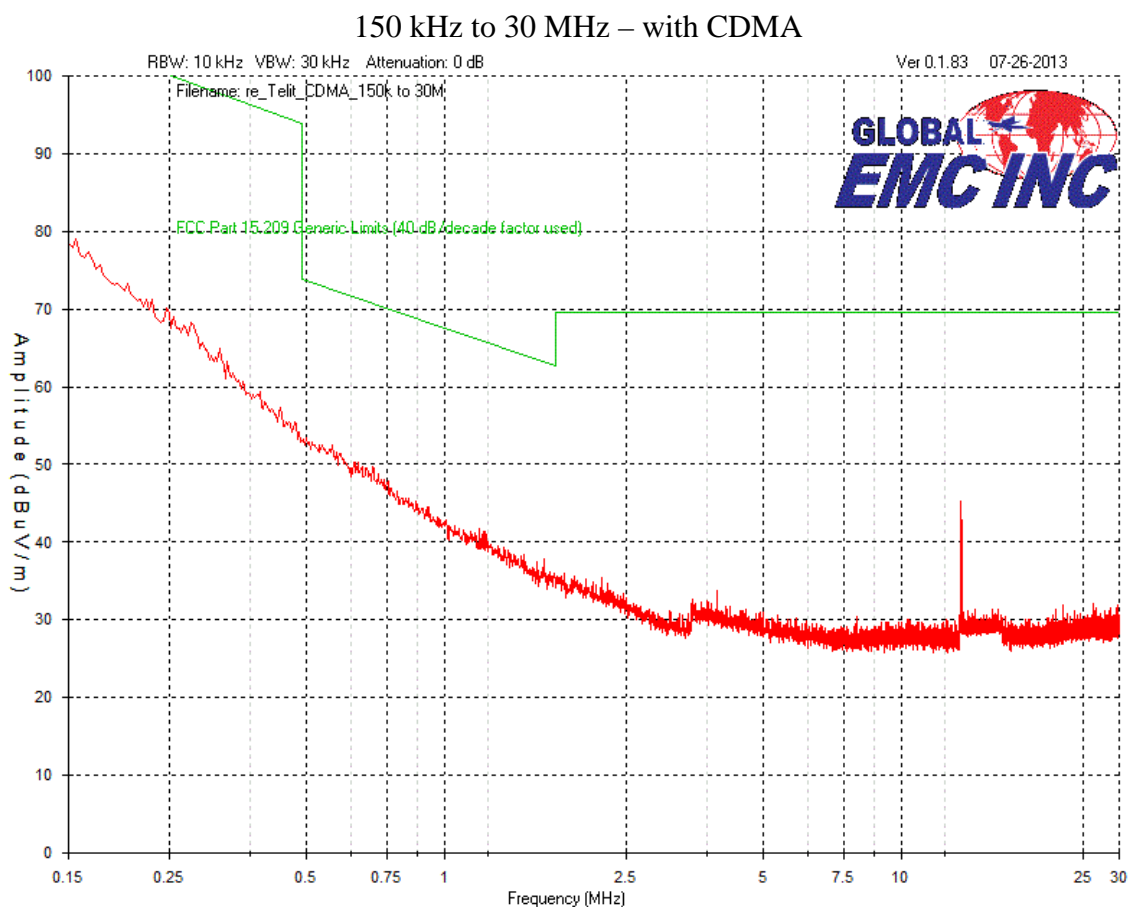
9 kHz to 150 kHz – with CDMA




Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

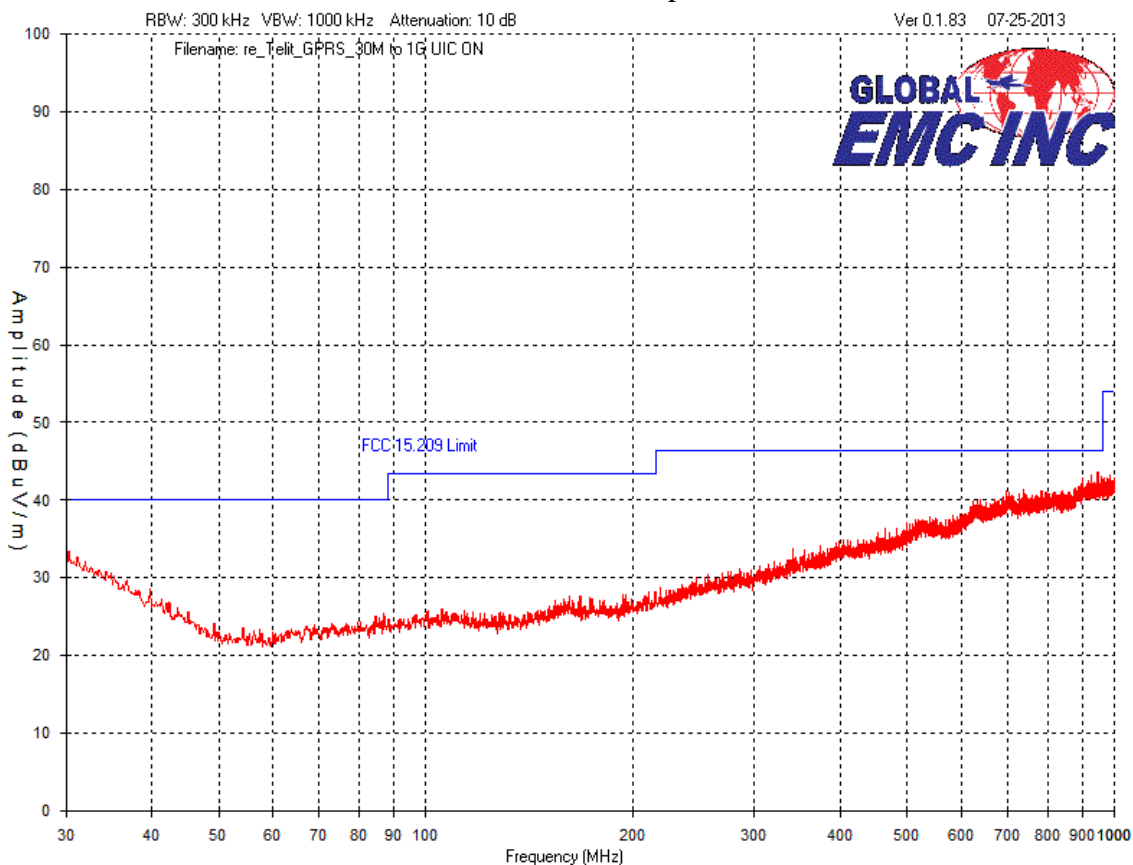



Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	



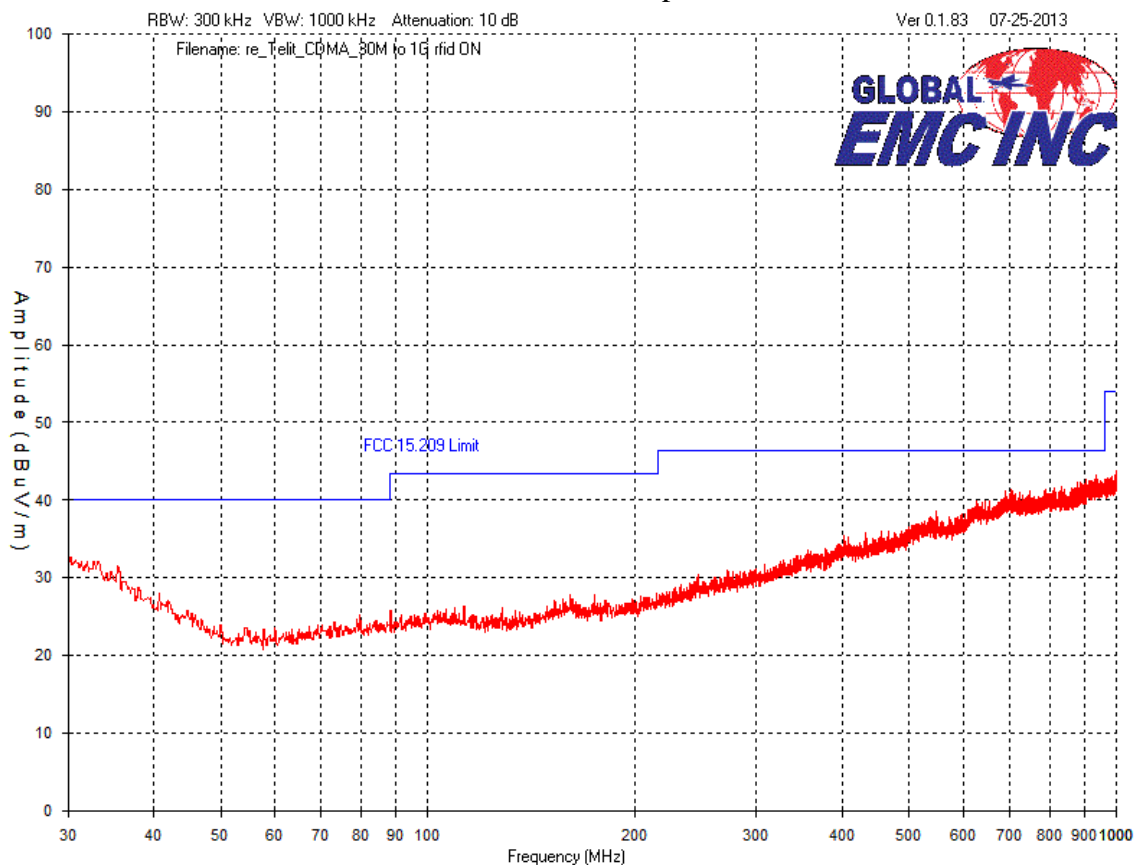
Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	


Vertical – Peak Emissions Graph – with GPRS



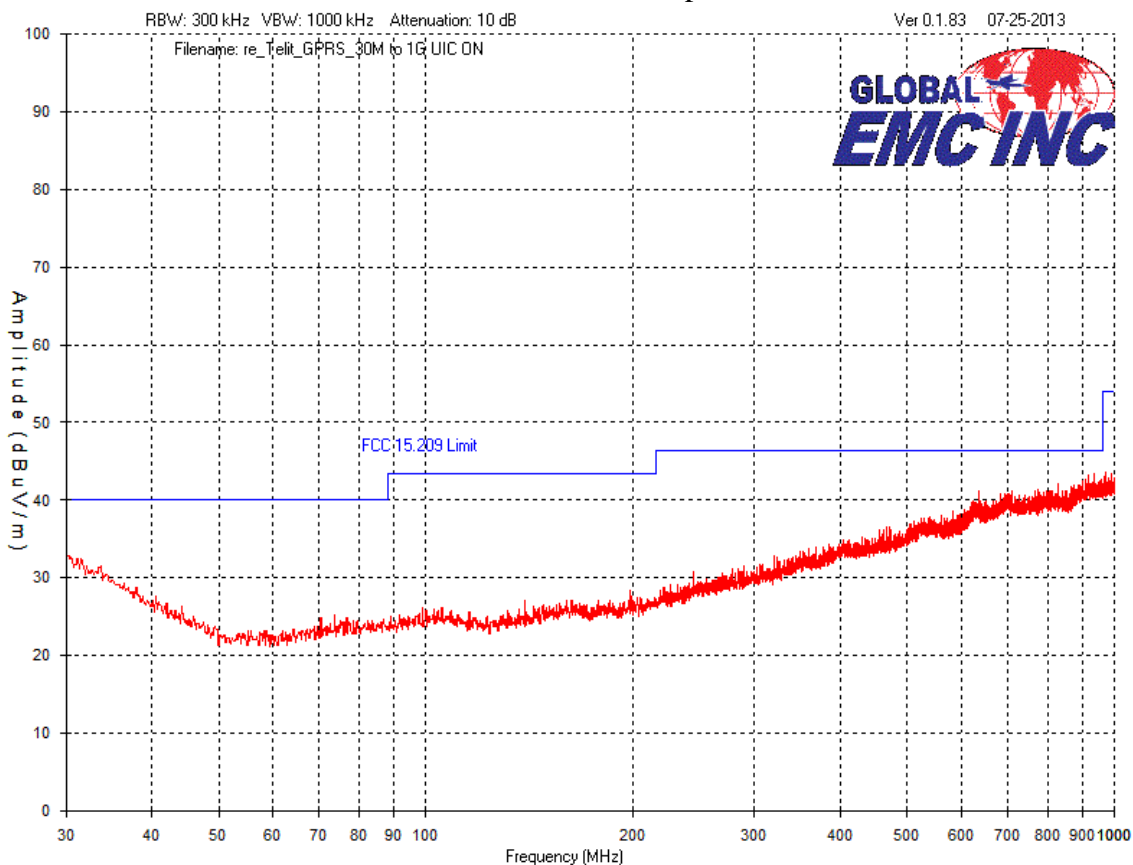
Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Vertical – Peak Emissions Graph – with CDMA



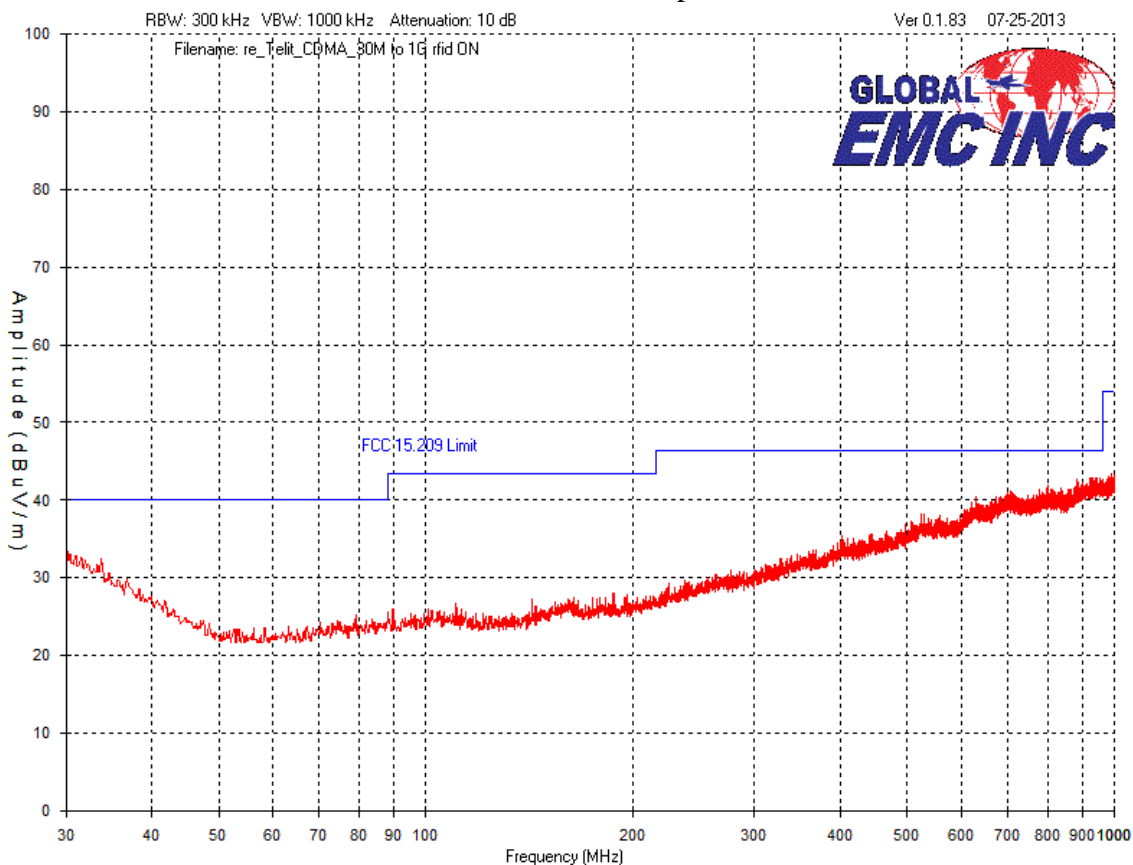
Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
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Horizontal – Peak Emissions Graph – with GPRS



Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	

Horizontal – Peak Emissions Graph – with CDMA



Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Final Measurements


The radiated emissions test results show no deviations beyond that which could be attributed to measurement uncertainty, as compared to original test report for FCC ID: ZPZ. For reference the original readings at 3 meters, not accounting for any extrapolation, for 127 kHz was 77.6 dBuV/m and 13.56 MHz was 49.4 dBuV/m.

CDMA

Frequency (MHz)	Detector	Raw Reading (dBuV)	Ant Loop 30 Hz - 1MHz Factor (dB/m)	Current to Voltage 51.5 Factor	Level (dBuV/m)	Limits (40 dB/decade factor used) Limit (dBuV/m)	Limits (40 dB/decade factor used) Margin (dB)
0.127	Peak	20.6	3.9	51.5	76	105.4	29.4

Frequency	Detector	Raw Reading	Ant Loop 100 kHz - 30 MHz Factor	Cable RE - 30M to 10G Factor	Current to Voltage 51.5 Factor	Preamplifier Factor	Level	FCC Part 15.209 Generic Limits (40 dB/decade factor used) Limit	FCC Part 15.209 Generic Limits (40 dB/decade factor used) Margin
13.56	Peak	28	-16	0.3	51.5	-18.5	45.3	69.5	24.2

Frequency	Detector	Raw Reading	Ant Loop 100 kHz - 30 MHz Factor	Cable RE - 30M to 10G Factor	Current to Voltage 51.5 Factor	Preamplifier Factor	Level	FCC Part 15.225 Limits (40 dB/decade factor used) Limit	FCC Part 15.225 Limits (40 dB/decade factor used) Margin
13.56	Peak	28	-16	0.3	51.5	-18.5	45.3	124.0	78.6


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GPRS

Frequency (MHz)	Detector	Raw Reading (dBuV)	Ant Loop 30 Hz - 1MHz Factor (dB/m)	Current to Voltage 51.5 Factor	Level (dBuV/m)	Limits (40 dB/decade factor used) Limit (dBuV/m)	Limits (40 dB/decade factor used) Margin (dB)
0.127	Peak	21.1	3.9	51.5	76.5	105.5	29

Frequency	Detector	Raw Reading	Ant Loop 100 kHz - 30 MHz Factor	Cable RE - 30M to 10G Factor	Current to Voltage 51.5 Factor	Preamplifier Factor	Level	FCC Part 15.209 Generic Limits (40 dB/decade factor used) Limit	FCC Part 15.209 Generic Limits (40 dB/decade factor used) Margin
13.56	Peak	30.3	-16	0.3	51.5	-18.5	47.6	69.5	21.9


Frequency	Detector	Raw Reading	Ant Loop 100 kHz - 30 MHz Factor	Cable RE - 30M to 10G Factor	Current to Voltage 51.5 Factor	Preamplifier Factor	Level	FCC Part 15.225 Limits (40 dB/decade factor used) Limit	FCC Part 15.225 Limits (40 dB/decade factor used) Margin
13.56	Peak	28	-16	0.3	51.5	-18.5	47.6	124.0	76.4

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	1/22/13	1/22/15	4169
Quasi Peak Adapter	85650A	HP	1/23/13	1/23/15	4170
Loop Antenna	EM 6871	Electro-Metrics	2013-02-05	2015-02-05	70
Loop Antenna	EM 6872	Electro-Metrics	2013-02-05	2015-02-05	71
BiLog Antenna	3142-C	ETS	4/25/13	4/25/15	4002
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/29/2012	8/29/2014	6403
Horn Antenna	ATH1G18G	AR	4/3/13	4/3/15	4003
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	8/27/2012	8/27/2014	6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	21-Dec-11	21-Dec-13	158
1GHz-26.5GHz preamp	HP 8449B	HP	4/25/13	4/25/15	4006
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	31


This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev3.doc"

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Appendix A – Customer Provided Details

General EUT Description

Manufacturer	J.J MacKay Canada Limited / MacKay Meters, Inc.
	1342 Abercrombie Road New Glasgow Nova Scotia Canada B2H 5E3
EUT Model Name / Number (as to be listed on title of report)	Mackay Guardian Solo
EUT Serial number	w RI7GE910 w RI7CE910-DUAL
Approximate Weight	25 lbs
Software/Firmware Version	See appendix B
Input Voltage and Frequency	Powered by DC (solar)
Rated Input Current	N/A
Intentional RF (If yes describe)	Yes FCC ID: ZPZ0213MGSOLO IC #: 9753A-MGSOLO
Table Top / Wall mount / Floor standing (choose table top if unsure)	Table Top (typically pole mounted)
I/O Connectors available on EUT	None
Peripherals required for test	None
Types and lengths of all I/O cables	N/A
Release type & Condition (New prototype/Production/Etc.)	Production

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Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see ‘Appendix B – EUT & Test Setup Photographs’.

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EUT Basic Functional Description

The EUT is a parking meter.

EUT Configuration

The EUT was configured in the following way during the tests:

The EUT was tested in standby condition and also the EUT was placed into a test mode to evaluate the 127 kHz and 13.56 MHz transmissions.

Operational Setup

These devices are required to be attached to the EUT for its normal operation.
(Ex Monitor to track progress)

None. The EUT was powered on.

Test Signals Required For Test

The following patterns or signals were generated during test by the peripherals as described above to exercise the EUT during testing.


None

Modifications Required for Compliance

No modifications were required.

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Appendix B – EUT and Test Setup Photographs

Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Standard(s)	RSS-210 Issue 8: 2010 FCC Part 15 Subpart C:2012	


EUT Photo 1



Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
Product	Mackay Guardian Solo	
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EUT Photo 2



Client	J.J MacKay Canada Limited / MacKay Meters, Inc.	
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Radiated Emissions 9 kHz to 30 MHz



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Radiated Emissions 30 MHz to 1 GHz

