EMC Technologies Pty Ltd
ABN 82 057 105 549
176 Harrick Road
Keilor Park Victoria Australia 3042

Ph: + 613 9365 1000
Fax: + 613 9331 7455
Email: sales@emctech.com.au

Global Product Certification
EMC-EMF Safety Approvals

TEST REPORT
VERIFICATION
to
FCC PART 15 RULES

Report Number: M160337-1

Test Sample: Hand Held Measurement Device
Model Number: C-Gap

Tested For: Mintap Services Pty Ltd

Date of Issue: 29 April 2016

TEST REPORT
VERIFICATION
to
FCC PART 15 RULES

EMC Technologies Report No. M160337-1
Issue Date: 29 April 2016

CONTENTS

TEST REPORT FOR VERIFICATION TO FCC PART 15 RULES

Test Sample:	Hand Held Measurement Device
Model Number:	C-Gap
Part Number:	MT_0001
Manufacturer:	Wild Messtechnik UG
Tested for:	Mintap Services Pty Ltd
Address:	PO Box 731, Scarborough, WA 6019 Australia
Contact:	Brant Tapley
Email:	brant@mintap.com.au
Equipment Type:	Unintentional Radiator, Class B Device
Test Standard/s:	**FCC Part 15 Subpart B** **ANSI C63.4-2009,** American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Result of Test:	The Test Sample complied with the applicable FCC Part 15 Subpart B requirements. Refer to Report M160337-1 for full details.
Test Date:	14th April 2016
Attestation:	*I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing*

Test Officer: **Hamse Mohamed**
EMC Engineer

Authorised Signatory: **Chris Zombolas**
Technical Director
EMC Technologies Pty Ltd

TEST REPORT FOR VERIFICATION
to
FCC PART 15 RULES & ICES-003

1.0 INTRODUCTION

This report details the results of EMI tests and measurements performed on the Hand Held Measurement Device, Model Number C-Gap. Testing was performed in accordance with:

- Federal Communications Commission (FCC) regulations as detailed in Title 47 CFR, Part 15 Subpart B for a Class B unintentional radiator.

The results and technical details of the test sample are detailed in this report. The test sample was found to comply with the Class B limits.

The test samples were provided by the Client. The results herein apply only to the test samples.

1.1 Summary of Test Results

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

FCC			
15.107	**Conducted Emissions:**	**0.15-30 MHz**	Not applicable, EUT is battery powered
15.109	**Radiated Emissions:**	**30-1000 MHz**	Complies Class B, margin of 9.8 dB
15.109	**Radiated Emissions:**	**> 1 GHz**	Not applicable, highest operating frequency is less than 108 MHz

The measurement procedure used was in accordance with ANSI C63.4-2009. The instrumentation conformed to the requirements of ANSI C63.2-2009.

1.2 EUT – Voltage Power Conditions

Radiated emissions testing was performed at 230V AC, 50 Hz.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

The Equipment Under Test (EUT) was identified as follows:

Test Sample:	Hand Held Measurement Device
Model Number:	C-Gap
Part Number:	MT_0001
Power Supply:	4 x AA batteries
Equipment Type:	Unintentional Radiator

2.1 Description supplied by Client

The test sample is a hand held measuring device that measures pressure from an incoming hose and then translates pressure to distance to measure the close side setting of a crusher.

2.2 Operating Conditions

Testing was performed with the test sample powered by battery and set to the measuring option. The EUT was re-started every 20 minutes during testing.

2.3 Modifications

No modifications were required to achieve compliance.

2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2009. Radiated emissions tests were performed at a distance of 10 metres (30-1000MHz) from the EUT and 3 metres from the EUT (above 1 GHz).

2.5 Test Facility

2.5.1 General

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR 2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 and 18 of the FCC Commission's rules – **Registration Number 494713 and Designation number AU0001.**

EMC Technologies' indoor open area test site (iOATS) has been accepted by Innovation, Science & Economic Development Canada (formerly Industry Canada) – ISED Canada, for the performance of radiated measurements in accordance with RSS-Gen, Issue 8 - **ISED Canada iOATS number - IC 3569B.**

2.5.2 NATA Accreditation

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the Mintap Services Pty Ltd and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system to ISO 17025. NATA is an ILAC member and has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A^2LA).

All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation.

The current full scope of accreditation can be found on the NATA website: www.nata.com.au
The scope also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

2.6 Units of Measurements

Conducted Emissions
Measurements are reported in units of dB relative to one microvolt (dBμV).

Radiated Emissions
Measurements are reported in units of dB relative to one microvolt per metre (dBμV/m).

2.6 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by a NATA accredited laboratory such as Keysight Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI). All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by Liberty Labs LLC and the working antennas (biconilog and horn) calibrated by Liberty Labs LLC and EMC Technologies respectively. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

3.0 TEST CONFIGURATION

Refer to Appendix B for photographs of the tested system.

4.0 CONDUCTED EMISSION MEASUREMENTS

Conducted emissions testing was not applicable as the EUT is battery powered.

5.0 RADIATED EMISSION MEASUREMENTS

5.1 Test Procedure

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated Biconilog antenna was used for measurements between 30 MHz and 1000 MHz.

Testing was performed at a distance of 10 metres for the frequency range 30 to 1000 MHz. The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz. The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. Each significant peak was then investigated and maximised with the Quasi-Peak detector. The measurement data for each frequency range was automatically corrected by the software for cable losses, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisations.

5.2 Plotting of Measurement Data for Radiated Emissions

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges. The accumulated EMI (EUT ON) was plotted as the Red trace.

The highest recorded EMI signals are shown on the Peaks List on the bottom right side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, quasi-peak field strength and the margin relative to the limit in dB. A negative margin is the deviation of the recorded value below the limit.

5.3 Calculation of Field Strength

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

E = V + AF - G + L

Where:

E = Radiated Field Strength in dBµV/m.
V = EMI Receiver Voltage in dBµV. (measured value)
AF = Antenna Factor in dB(m^{-1}). (stored as a data array of factor versus frequency)
G = Preamplifier Gain in dB. (stored as a data array of gain versus frequency)
L = Cable insertion loss in dB. (stored as a data array of insertion loss versus frequency)

- **Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dBµV is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20.0 dB. The resulting Field Strength is therefore as follows:

34.0 + 9.2 + 1.9 - 20.0 = 25.1 dBµV/m

5.4 Radiated EMI Results

5.4.1 30-1000 MHz

Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
947.50	Vertical	25.7	35.5	-9.8
953.03	Horizontal	25.7	35.5	-9.8
665.25	Vertical	21.9	35.5	-13.6
663.87	Horizontal	21.8	35.5	-13.7
354.10	Vertical	13.9	35.5	-21.6
160.54	Vertical	11.2	33.0	-21.8
95.30	Vertical	9.3	33.0	-23.7

The worst case radiated EMI occurred at 947.50 MHz and 953.03 MHz and complied with the Class B, quasi peak limit by a margin of 9.8 dB. Refer to Appendix C, Graphs 1 and 2.

5.4.2 Above 1 GHz

Radiated emissions testing above 1 GHz was not applicable as the highest operating frequency of the test sample was less than 108 MHz.

6.0 COMPLIANCE STATEMENT

The Hand Held Measurement Device, Model No. C-Gap, tested on behalf of Mintap Services Pty Ltd, complied with the applicable conducted and radiated EMI requirements of the FCC Part 15 Subpart B Rules for a Class B device.

The compliance margins were as follows:

FCC			
15.107	**Conducted Emissions:**	**0.15-30 MHz**	Not applicable, EUT is battery powered
15.109	**Radiated Emissions:**	**30-1000 MHz**	Complies Class B, margin of 9.8 dB
15.109	**Radiated Emissions:**	**> 1 GHz**	Not applicable, highest operating frequency is less than 108 MHz

The measurement procedure used was in accordance with ANSI C63.4-2009. The instrumentation conformed to the requirements of ANSI C63.2-2009.

7.0 MEASUREMENT UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

Conducted Emissions
Mains Port

9 kHz to 30 MHz	±3.2 dB

Radiated Emissions

9 kHz to 30 MHz	±4.1 dB
30 MHz to 300 MHz	±5.1 dB
300 MHz to 1000 MHz	±4.7 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Application of measurement uncertainty for this report:
The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement uncertainty. However, the measurement uncertainty shall appear in the test report.

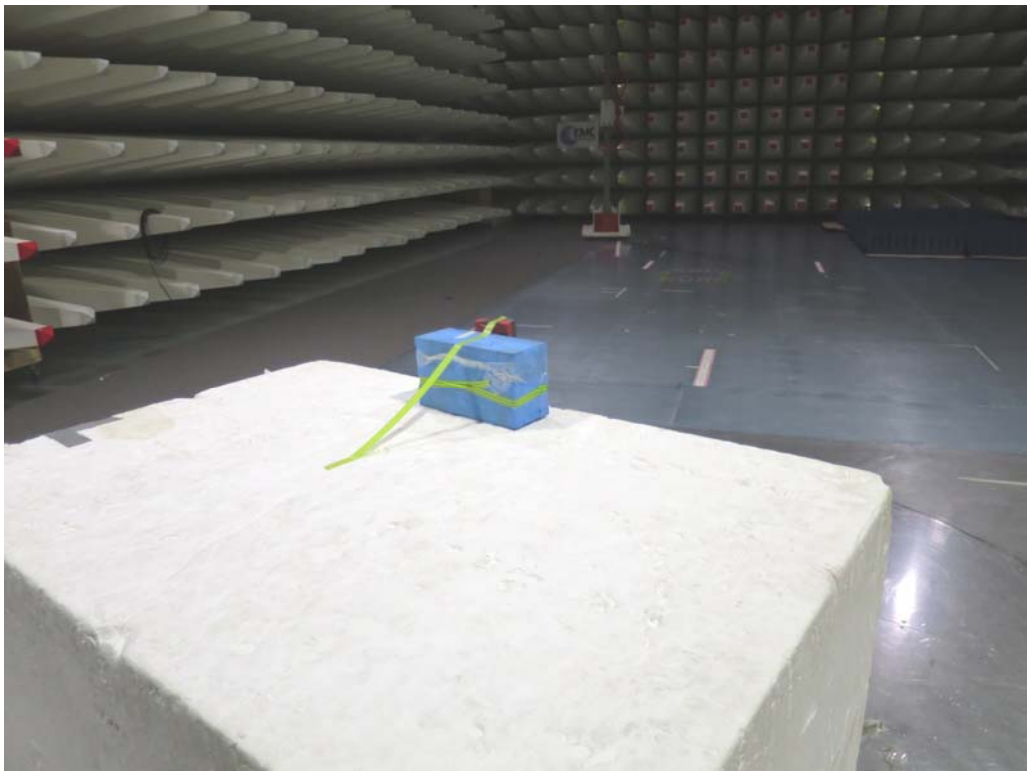
APPENDIX A
MEASUREMENT INSTRUMENTATION DETAILS

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	LAST CAL. DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
EMI RECEIVERS	R&S ESU40 Sn: 100182 (R-037)	18/02/16	18/02/17	1 YEAR *1
ANTENNAS	SUNOL JB6 BICONILOG (A-363) 30 - 6000 MHz Sn. A012312	16/05/14	16/05/16	2 YEAR *2

Note *1. NATA calibration by Rohde & Schwarz (Australia) Pty Ltd
Note *2. A2LA Accredited calibration by Liberty Labs, Inc.

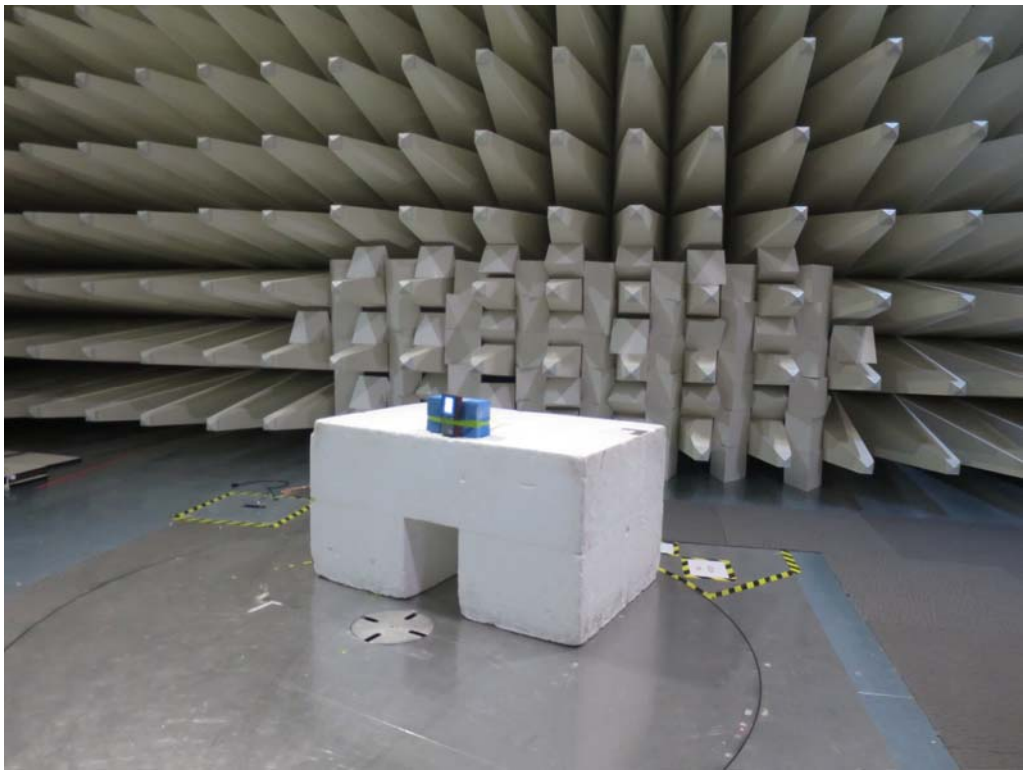
APPENDIX B1
TEST SETUP PHOTOGRAPHS

Radiated Emissions



APPENDIX B2
TEST SETUP PHOTOGRAPHS

Radiated Emissions



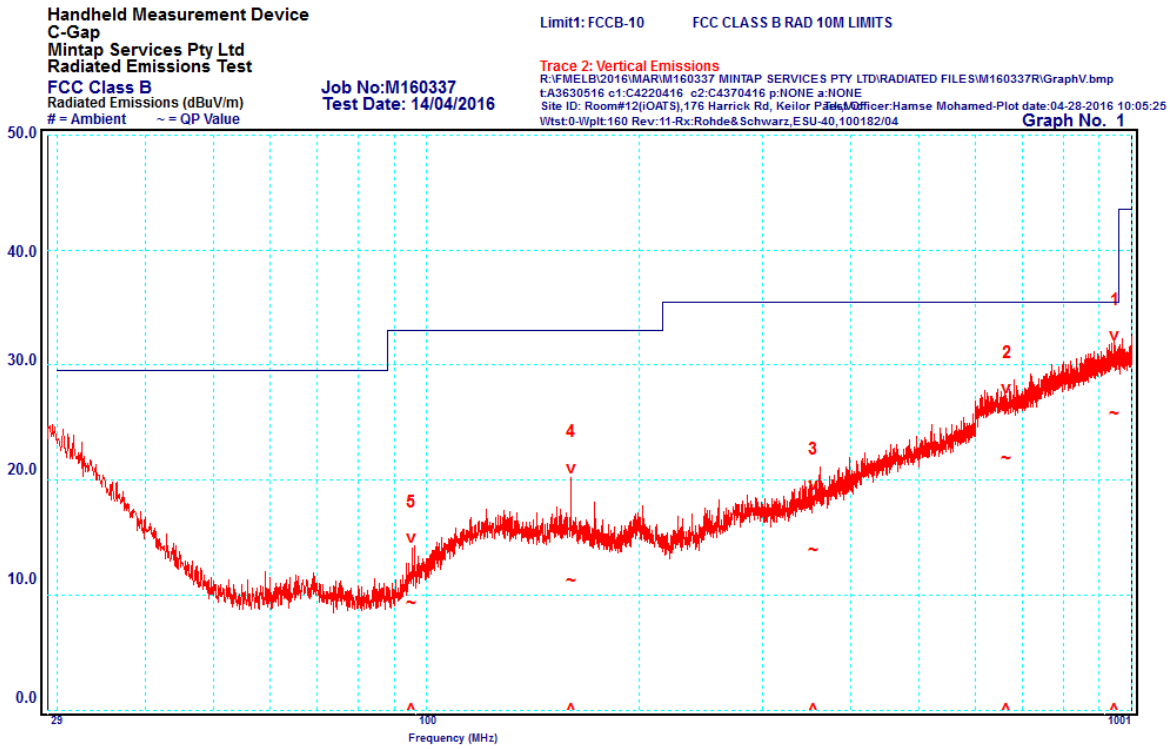
APPENDIX C
GRAPHS OF EMI MEASUREMENT

RADIATED EMI

Graph 1:	**Model AM888**	Vertical Polarity	30 - 1000 MHz
Graph 2:	**Model AM888**	Horizontal Polarity	30 - 1000 MHz

RADIATED EMI

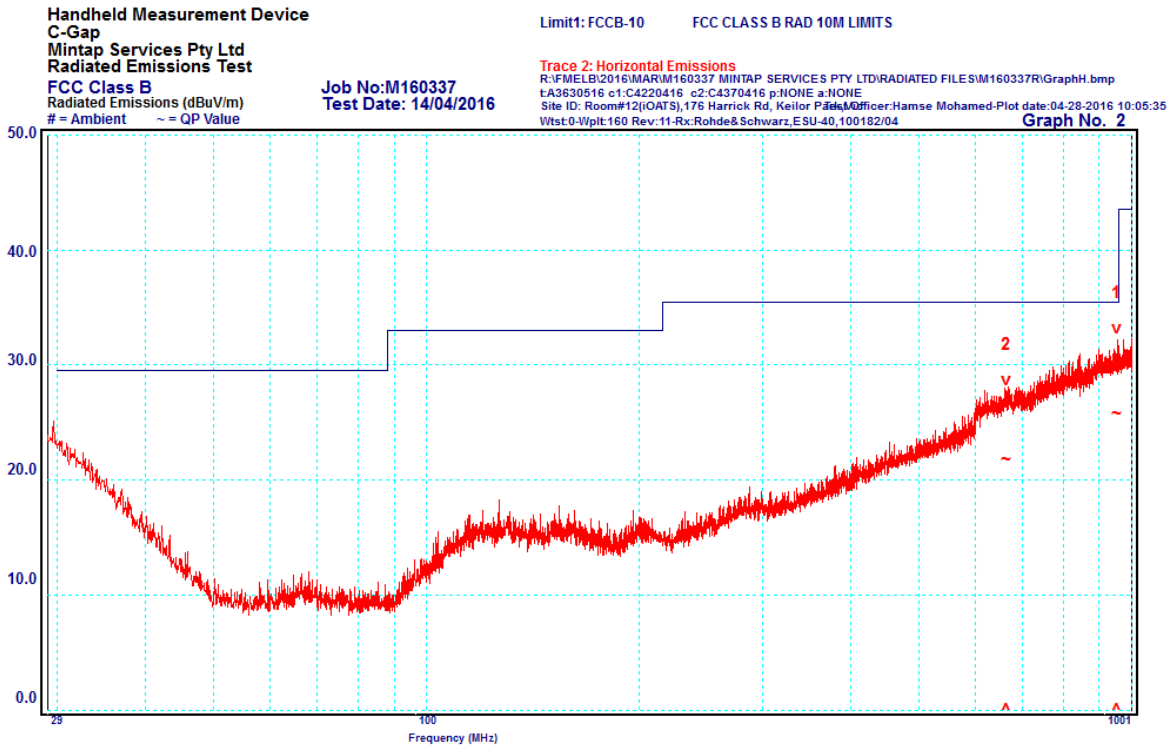
Graph 1: Vertical Polarity, 30 - 1000 MHz



Peak	Frequency MHz	Polarisation	QP Measured dBµV/m	QP Limit dBµV/m	ΔQP ± dB
1	947.50	Vertical	25.7	35.5	-9.8
2	665.25	Vertical	21.9	35.5	-13.6
3	354.10	Vertical	13.9	35.5	-21.6
4	160.54	Vertical	11.2	33.0	-21.8
5	95.30	Vertical	9.3	33.0	-23.7

RADIATED EMI

Graph 2: Horizontal Polarity, 30 - 1000 MHz



Peak	Frequency MHz	Polarisation	QP Measured dBµV/m	QP Limit dBµV/m	ΔQP ± dB
1	953.03	Horizontal	25.7	35.5	-9.8
2	663.87	Horizontal	21.8	35.5	-13.7

APPENDIX D
FEDERAL COMMUNICATIONS COMMISSION (FCC) REQUIREMENTS

1. FCC Report & Documentation Requirements

A copy of the measurement report showing compliance with FCC standards must be retained and, if requested, submitted to the commission.

The copy of the following documentation pertaining to the equipment tested must be kept with test report:

- Test Sample Block Diagram
- Test Sample Schematics
- Test Sample PCB Layouts
- Test Sample User Manual

It is important that testing and product information be readily available, as failure to produce this information within 14 days of a request by the FCC may result in them issuing of a substantial fine.

2. Labelling requirements (Reference FCC Rules - Section 15.19)

A device subject to Verification should be labelled as follows:

1. Receivers associated with operation of licensed radio service, e.g FM Broadcast under Part 73, In a mobile operation under Part 90, etc:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

2. Stand-alone cable input selector switch

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

3. All other devices

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

When the device is so small or for such use that it is not practicable to place the above applicable compliance information statement on the device it must be displayed in the user manual or product literature supplied to the user or alternatively, shall be placed on the container in which the device is marketed.

Please note that FCC regulations declare -

"The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase…."

"Permanently affixed means that the label is etched, engraved, stamped, silkscreened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable".

Example Label on device

Trade Name Model Number

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

Please note: If the device contains pre-approved modular transmitter the following label requirements apply:

If using a permanently affixed label, the modular transmitter must be labelled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: XYZMODEL1” or “Contains FCC ID: XYZMODEL1”. Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explains this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

Refer to FCC Part 15.212 vi(A)

4. Information to the user (Refer to Section 15.105)

Place the following text in the user (instruction) manual or product literature:

Class B Product:

NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encourage to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna*
- *Increase the separation between the equipment and receiver*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected*
- *Consult the dealer or an experienced radio/TV technician for help*

OR

Class A product:

NOTE:
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

5. Warning: (Refer to Section 15.21)
In addition the user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment (see example below).

Warning: Any changes or modifications not expressively approved by (company name) could void the user's authority to operate this equipment