COMPLIANCE TESTING REPORT
FCC TITLE 47 PART 15
SUBPARTS A & B (CLASS A)

Client:	Leica Geosystems
Address:	270 Gladstone Road, Dutton Park, QLD 4102
Report Number:	0226LEI_UHP_FCC15A&B
Date of Testing:	8th and 9th December 2014
File Number:	LEI 141020
Equipment Name:	UHP HP / UHP LP
Equipment Model Number:	828045 / 828043
Equipment Serial Number:	700001 / 900004
Equipment FCC ID:	-
Equipment Description:	Industrial Mining Computer
Result:	COMPLIES (refer to page 3)
Tested by:	Richard Turner
Approved by:	Steve Garnham Assessment Engineer
Date of Issue:	26th February 2015

AUSTEST (NSW) FCC REGISTRATION NUMBER 90455
DESIGNATION #AU0003 REGISTRATION 520620

Results appearing herein relate only to the sample(s) tested.

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02

Table of Contents:

1 TEST SUMMARY 3
2 MODIFICATIONS 3
3 REFERENCES 4
4 EQUIPMENT UNDER TEST (EUT) DESCRIPTION 4
5 EUT TEST SETUP & CONFIGURATION 6
5.1 Transmitter Test Channels – NOT APPLICABLE 8
6 TEST SPECIFICATIONS 9
6.1 Accreditations & Listings 9
6.2 Deviations from Standards and/or Accreditations 9
6.3 Test Facility 9
6.4 Test Equipment 10
6.5 Measurement Uncertainties 10
7 FCC Part 15B, Section 15.107 - CONDUCTED LIMITS 11
8 FCC Part 15B, Section 15.109 - RADIATED EMISSION LIMITS 11
8.1 EUT Test Operating Mode 11
8.2 Test Method 11
8.3 Sample Calculation Example 12
8.4 Test Results 12
APPENDIX A – PHOTOGRAPHIC RECORD OF EUT 16
APPENDIX B – FCC LABELLING REQUIREMENTS – CLASS A 19
APPENDIX C – EUT TEST SETUP PHOTOGRAPHS 20

Report Revision History:

Date	Report Number	Changes
26/02/2015	0226LEI_UHP_FCC15A&B	Initial issue

This document shall not be reproduced, except in full

1 TEST SUMMARY

Austest makes no claim regarding the consistency of production versions of the EUT.

The results in this report apply only to the tested EUT described in Section 3 of this report.

FCC Section	Test	Result	Notes
FCC Part 15, Subpart B – Unintentional Radiators			
15.107	Conducted Limits	NOT APPLICABLE	
15.109	Radiated Emission Limits	COMPLIES	

Notes (applicable only if referenced in "Notes" column of above summary table):
(i) EUT complies (the measurement results were below the applicable limits), but some emissions were within the range of measurement uncertainty of the limits.
(ii) EUT complies (when modified as described in Section 2 of this report).
(iii) There were deviations from the applied standard as described in Section 6.2 of this report.

2 MODIFICATIONS

The EUT required no modification to achieve compliance

This document shall not be reproduced, except in full

3 REFERENCES

FCC Title 47 Part 15 current as of December 2014
ANSI C63.4: 2009

4 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

EUT Name:	UHP HP / UHP LP
EUT Description:	Industrial mining computer
EUT Model:	828045 / 828043
EUT Serial Number:	700001 / 900004
EUT FCC ID:	Contains Wifi module SR71-A, FCC ID: SWX-SR71
Manufacturer:	Leica Geosystems
Power Supply & Rating:	9 to 36VDC
Highest Clock/Operating Frequency:	Highest clock, specified by the client - 600MHz Highest possible operating frequency, ~2462MHz (Wifi ch11)
Lowest Internal Frequency source	<500kHz (switching regulator)
Transmit Frequency Range:	As per SR71-A wireless module specifications
Transmit Power:	As per SR71-A wireless module specifications
Modulation Technique:	As per SR71-A wireless module specifications
Number of Channels:	As per SR71-A wireless module specifications
Antenna Specifications:	Supplied Mobile Mark OD6-2400MOD2-BLK-SP-335, gain 6dBi

This document shall not be reproduced, except in full

The equipment under test (EUT) is an industrial computer with GPS and WiFi functionality to be installed on mining vehicles.

Two models were supplied for testing. Both models contain the same processor (clock frequency 600MHz), interfaces and 2.4GHz WiFi module, but differ with number and model of GPS receivers installed.

UHP HP (High Precision)
Housed in a painted (red) metal case with two WiFi antenna ports and two GPS antenna ports. Contains Ubiquiti WiFi- module SR71-A (FCC ID: SWX-SR71) and two Novatel GPS modules OEM628RV-D2S-R0G-TT0.
Labelled:
P/N: 828045
S/N: 700001

UHP LP (Low Precision)
Housed in a painted (grey) metal case with two WiFi antenna ports and one GPS antenna port. Contains Ubiquiti WiFi- module SR71-A (FCC ID: SWX-SR71) and one Novatel GPS module OEMSTAR-10HZ-G.
Labelled:
P/N: 828043
S/N: 900004

Both models were supplied with the following:
- Leica Geosystems Planar Display Unit, model LX1250TI
- Mobile Mark OD6-2400MOD2-BLK-SP-335 WiFi antennas
- Antcom Corp Omnistar GPS antennas, p/n G5Ant-53AT1

Both models have a DC input voltage range of 9 to 36VDC

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

TEST LABORATORY
CERT #2765.02

5 EUT TEST SETUP & CONFIGURATION

The following cables and auxiliary equipment as supplied by the client were used:

UHP HP

Connection / Port	Connecting Cable	Source / Load
GPS ANT1	10m shielded 50Ω coaxial cable, bundled	Omnistar GPS antenna
GPS ANT2	10m shielded 50Ω coaxial cable, bundled	Omnistar GPS antenna
WIFI ANT1	10m shielded 50Ω coaxial cable, bundled	Mobile Mark antenna
WIFI ANT1	10m shielded 50Ω coaxial cable, bundled	Mobile Mark antenna
USB	-	-
DISPLAY	5m shielded multicore cable, bundled	Planar display unit.
P6	5m shielded multicore cable, bundled	Looped connection to port P7
P7	Refer port P6	
P3	6m shielded multicore cable, bundled	Looped connection to port P4
	5m unshielded CAT5 cable, bundled	-
	4.5m shielded USB cable, bundled	-
P4	Refer port P3	
ETHERNET	10m shielded 4 core CAT5 cable	Test router
POWER	4.8m shielded 4 core cable	12V/24V DC supply

This document shall not be reproduced, except in full

UHP LP

Connection / Port	Connecting Cable	Source / Load
GPS ANT1	10m shielded 50Ω coaxial cable, bundled	Omnistar GPS antenna
WIFI ANT1	10m shielded 50Ω coaxial cable, bundled	Mobile Mark antenna
WIFI ANT1	10m shielded 50Ω coaxial cable, bundled	Mobile Mark antenna
USB	-	-
DISPLAY	5m shielded multicore cable, bundled	Planar display unit.
P6	5m shielded multicore cable, bundled	Looped connection to port P7
P7	Refer port P6	
P3	6m shielded multicore cable, bundled	Looped connection to port P4
	5m unshielded RJ45 cable, bundled	-
	4.5m shielded USB cable, bundled	-
P4	Refer port P3	
ETHERNET	10m shielded 4 core CAT5 cable	Test router
POWER	4.8m shielded 4 core cable	9 to 36V DC supply

Each model was assessed separately and placed horizontally on the test table.

The GPS antennas were placed horizontally on the test table and the WiFi antennas mounted vertically on a plastic support. The display unit was placed vertically on a wooden support.

No cable was connected to the USB port as this is only used for maintenance/servicing.

Measurements were performed with an active Ethernet connection established between the EUT and a test router. The router was placed away from the test area.

Once powered, the EUT was configured with software that exercised every port. Refer to UHP EMC Setup document, dated 25/02/13, provided by the client.

DC supply voltage was varied from 9 to 36VDC to maximise emissions levels. DC power was provided by a GWINSTEK GPS-3030D power supply.

The EUT was tested within the allowed temperature and humidity range.

This document shall not be reproduced, except in full

EUT Operating Modes

Mode No.	Operating Mode Description
1	Powered by connection to 12VDC, intentional 2.4GHz transmission switched off
2	Powered by connection to 28VDC, intentional 2.4GHz transmission switched off

5.1 Transmitter Test Channels – NOT APPLICABLE

Note: Measurement of unintentional radiation was performed with the intentional 2.4GHz transmission switched off.

This document shall not be reproduced, except in full

6 TEST SPECIFICATIONS

6.1 Accreditations & Listings

Austest Laboratories has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules and Test Site Criteria (ANSI C63.4-2009) by the FCC Laboratory Division for Certification testing under Parts 15 or 18 of the FCC Rules.

Austest Laboratories (NSW)'s Yarramalong test facilities are listed with the FCC under Registration Number 90455.

Austest Laboratories (NSW)'s Yarramalong test facilities are accredited by A2LA. The tests reported herein have been performed in accordance with its terms of accreditation.

6.2 Deviations from Standards and/or Accreditations

None.

6.3 Test Facility

Testing was performed in New South Wales at Austest Laboratories (NSW)'s Yarramalong test facilities located at 46 Glenola Farm Lane in Yarramalong Valley, New South Wales, Australia.

Radiated emission testing is performed at an Open Area Test Site (OATS), where some ambient signals may exceed the continuous disturbance limit. The possibility of missing an emission during testing is removed by use of pre-scans, performed in a shielded enclosure, prior to the final OATS measurements.

This document shall not be reproduced, except in full

6.4 Test Equipment

Test Equipment	Brand & Model	Serial No./ID	Cal. Due Date
EMI Receiver	HP 8574B	2403A06592 2408A00178 3146A01323 3107A01557	Jan. 2015
EMI measurement software	HP85869PC	-	Verified
Spectrum Analyser	HP8593E	3911A03981	Jun.2015
Biconical Array Antenna	Emco 6912	297	Jun. 2015
Log-Periodic Array Antenna	Emco 6950	298	Jun. 2015
DRG Horn Antenna	AH Systems SAS-571	107	Jun. 2016
RF cables	Suhner	-	Jun. 2015
Pre-Amplifier (25MHz-1GHz)	HP 8447E	2434A01957	Jan. 2015
Pre-Amplifer (1GHz – 18GHz)	RE-218A	651	Jan. 2015
Pre-Amplifier (5Ghz – 18GHz)	RE-518A	650	Jan.2015

All test equipment was checked and performance verified prior to testing.

6.5 Measurement Uncertainties

The following uncertainties are for a 95% level of confidence, based on a coverage factor, k=2.

Test	Measurement Uncertainty
Radiated Emissions	±4.7dB

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02

7 FCC Part 15B, Section 15.107 - CONDUCTED LIMITS

NOT APPLICABLE
The EUT is powered by connection to a vehicle's battery supply.

8 FCC Part 15B, Section 15.109 - RADIATED EMISSION LIMITS

Test Date:	08/12/14 and 09/12/14	Temperature:	22° - 28°C
Test Officer:	Richard Turner	Humidity:	53% - 62%
Test Location:	Austest Laboratories (NSW)		

8.1 EUT Test Operating Mode

a. Mains power supply voltage – not applicable
b. Mode 2 – Powered by connection to 28VDC, intentional 2.4GHz transmission switched off (Mode 1 no significant difference).

8.2 Test Method

a. Measurements are performed in accordance with ANSI C63.4-2009.
b. Set the measuring receiver BW settings to:
   i. 120kHz (30MHz to 1GHz) EMI Receiver BW.
   ii. 1MHz (above 1GHz) RBW, 1MHz or more VBW, using a Spectrum Analyser for Peak measurements.
   iii. 1MHz (above 1GHz) RBW, 10Hz VBW, using a Spectrum Analyser for Average measurements.
c. Set up the EUT on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at the indicated test distance away from the measuring antenna.
d. To maximise emissions, rotate the EUT through 360° and adjust the measuring antenna height between 1m to 4m in the following antenna orientations:
   i. Biconical and Log-Periodic antennas (30MHz to 1GHz) - Both vertical and horizontal polarizations.
   ii. Horn antenna (above 1GHz) - Both vertical and horizontal polarizations.
e. Measure the maximised emission and repeat the above for all measurement frequencies.

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

TEST LABORATORY
CERT #2765.02

8.3 Sample Calculation Example

The final field strength levels were obtained from the measurement equipment software which automatically applied all the stored calibration factors. The calibration / correction factors were applied as follows:

$$E = V + AF + L_{cbl} - G_{pre}$$

Where:

E = Radiated Electric Field Strength in dBµV/m at the specified distance.
V = EMI Receiver measured signal input voltage in dBµV.
AF = Antenna Factor of the measuring antenna in dB/m.
L_{cbl} = Total cable insertion loss in dB.
G_{pre} = Preamplifier gain in dB.

Frequency (MHz)	Receiver Level, V (dBµV)	AF (dB/m)	Lcbl (dB)	Gpre (dB)	Corrected Level, E (dBµV/m)
100.0	40.0	12.0	2.9	22.5	32.4

8.4 Test Results

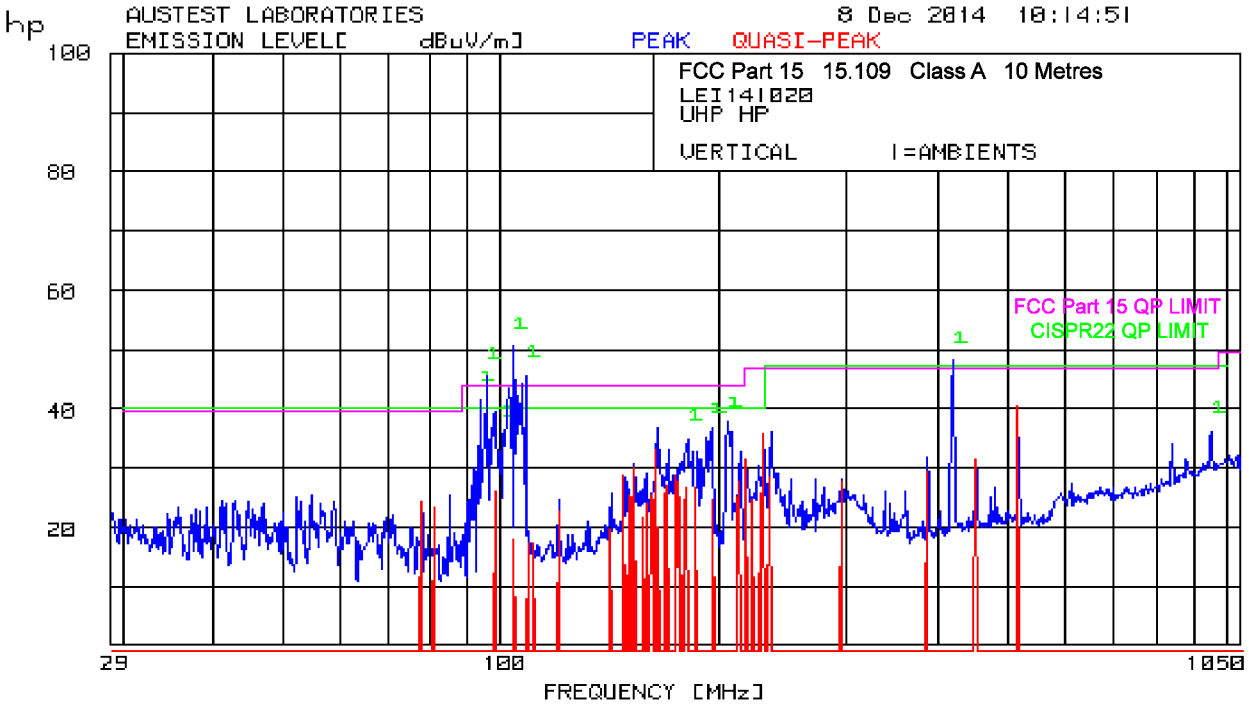
Disturbances 30MHz to 1GHz, 10m distance

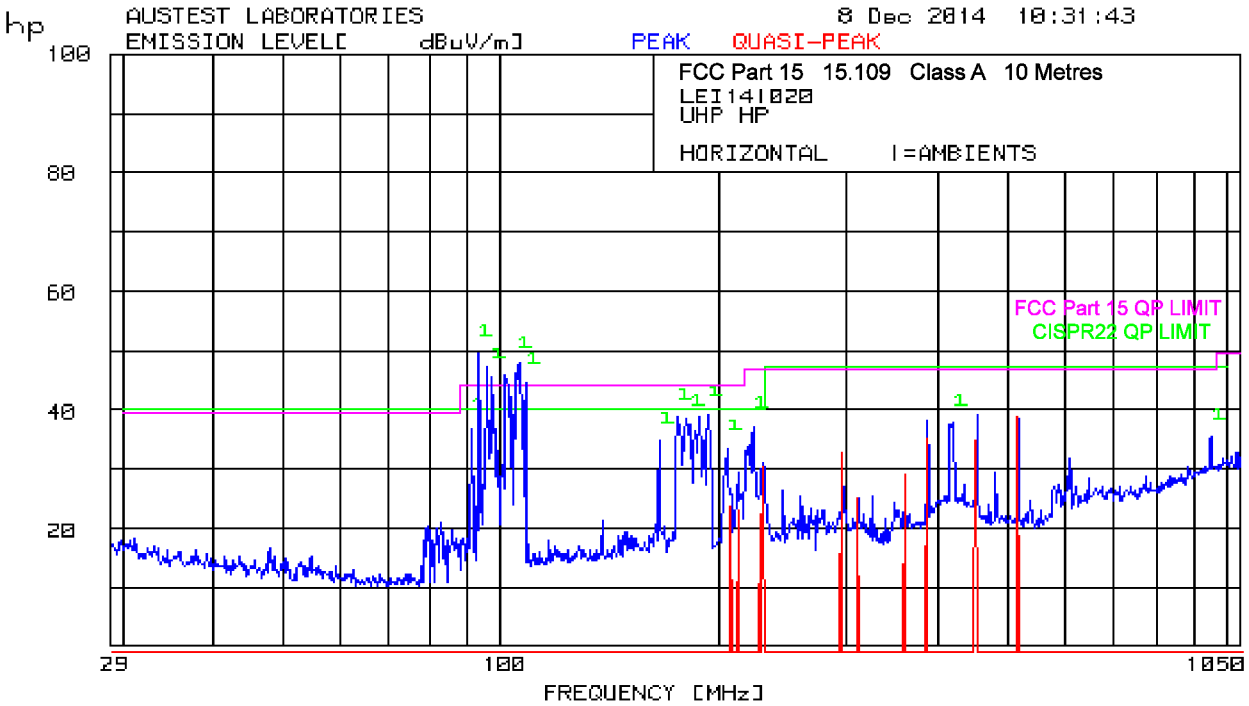
Preliminary measurements indicated that the HP unit had higher disturbance levels than the LP unit. No significant change in disturbance levels noted with change of DC supply voltage. Final measurement performed on the HP unit, powered from a 28VDC power supply.

The highest measured quasi-peak level was 6.1dB below the Class A quasi-peak limit at 514.5MHz.

Frequency MHz	Polarisation	Quasi-Peak µV/m	Quasi-Peak dBµV/m	Limit µV/m	Limit dBuV/m	Below Limit dB
514.5	Vertical	104	40.3	210	46.4	6.1
514.5	Horizontal	85	38.6	210	46.4	7.8
163.1	Vertical	45	33.0	150	43.5	10.5
228.4	Vertical	60	35.6	210	46.4	10.8
386.6	Horizontal	56	35.0	210	46.4	11.4
451.1	Horizontal	54	34.7	210	46.4	11.7

This document shall not be reproduced, except in full





Radiated Emissions 30MHz to 1000Mhz

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

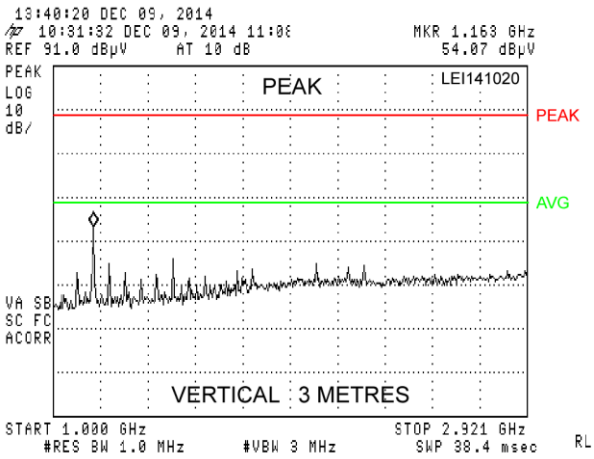
TEST LABORATORY
CERT #2765.02

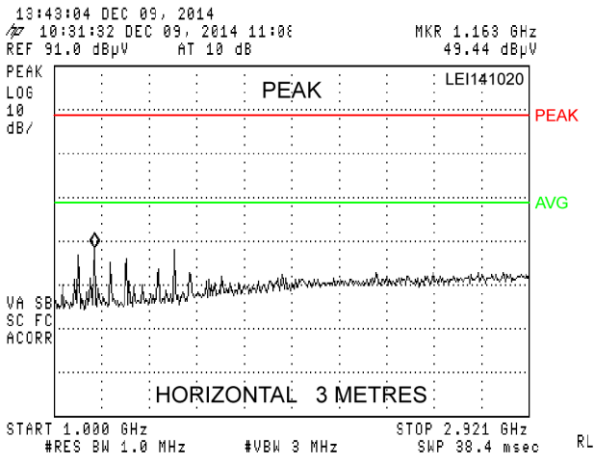
Disturbances above 1GHz

Both models assessed using both 12VDC and 28VDC supplies. No significant differences in emissions levels. Final measurement performed on the HP unit, powered from a 28VDC supply.

The client advised that the highest internal frequency source was the CPU operating at 600MHz.
The EUT contains a 2.4GHz WiFi transceiver.
In accordance with clause 6.2 of the standard measurement shall be made up to 12.5GHz.

The highest measured peak level was 55.8dBµV/m at 1159.9MHz, measured in vertical polarisation, which was 24.2dB below the Class A peak limit.
Measurement of average values was not undertaken as peak levels did not exceed the average limit.





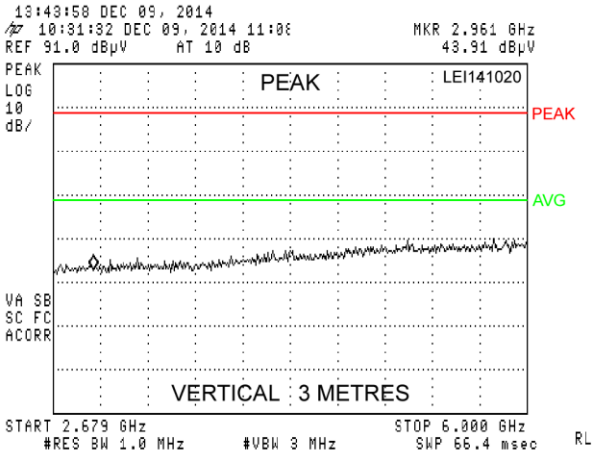
Radiated Emissions 1000MHz to 2900MHz

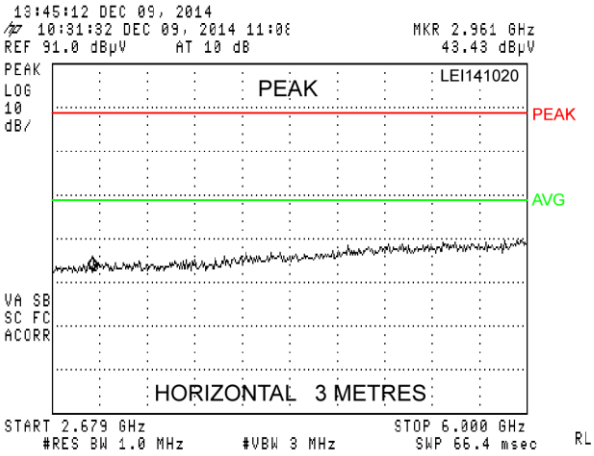
This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

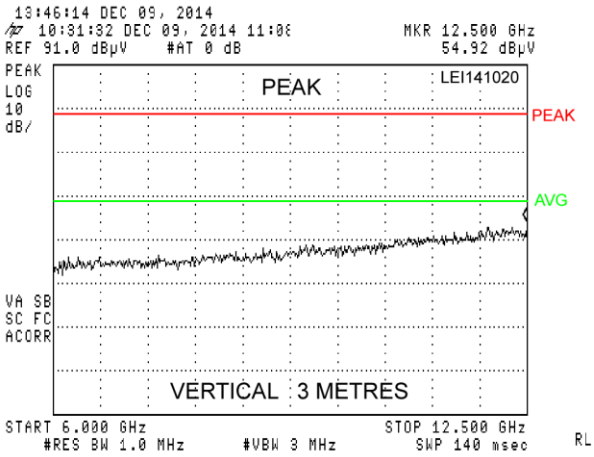
Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

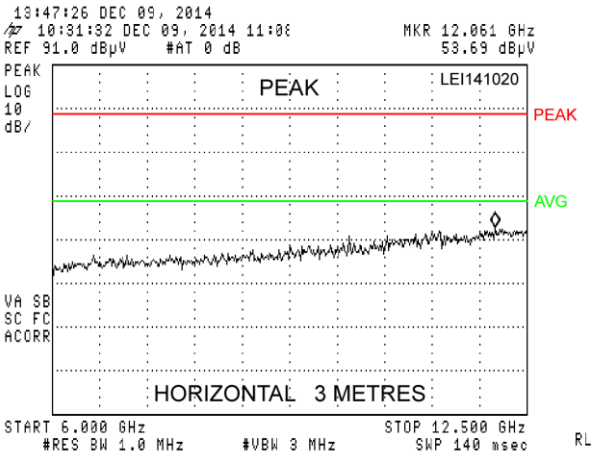
TEST LABORATORY
CERT #2765.02





Radiated Emissions 2600MHz to 6000MHz





Radiated Emissions 6000MHz to 12500MHz

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02

APPENDIX A – PHOTOGRAPHIC RECORD OF EUT

UHP HP and accesories

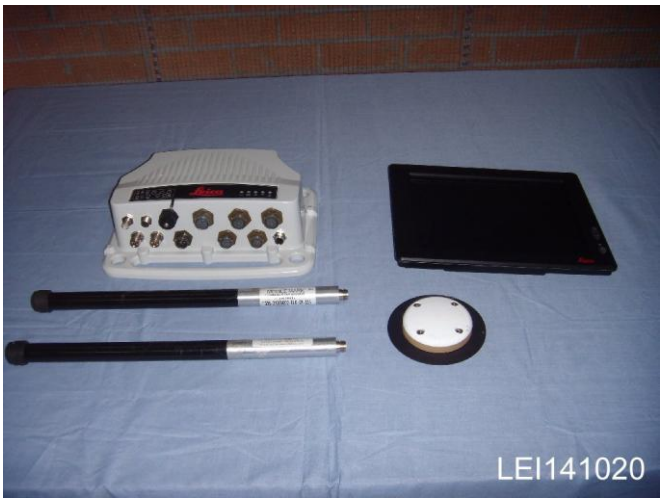
External – UHP HP

External – UHP HP

Internal – UHP HP

Label – UHP HP

APPENDIX A – PHOTOGRAPHIC RECORD OF EUT



UHP LP and accesories

External – UHP LP

External – UHP LP

Internal – UHP LP

Label – UHP LP

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02

APPENDIX A – PHOTOGRAPHIC RECORD OF EUT

Display

WiFi Antenna

GPS antenna

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02

APPENDIX B – FCC LABELLING REQUIREMENTS – CLASS A

1. In accordance with section 2.954 the EUT is to be labelled with a unique identifier.

2. In accordance with section 15.19 (a) (3) the EUT should bear the following statement in a conspicuous location

   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

3. In accordance with section 15.21

   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.

4. In accordance with section 15.105(a)

   For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

   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. In accordance with section 15.212 (a) (1) (vi) (A) if the FCC identification number of a modular transmitter is not visible when it 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"

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

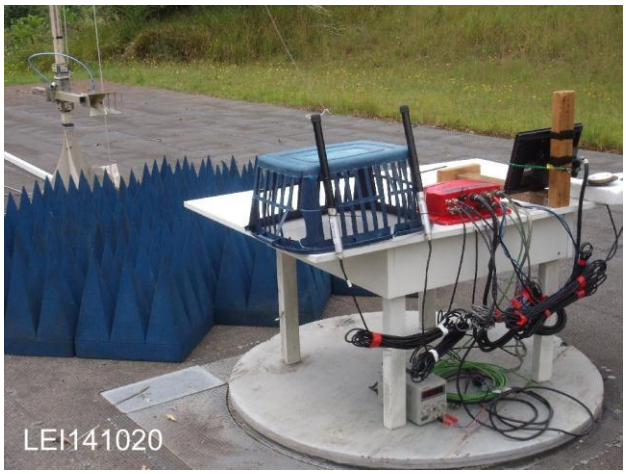
Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02

APPENDIX C – EUT TEST SETUP PHOTOGRAPHS

Radiated Emissions <1GHz

Radiated Emissions <1Ghz



Radiated Emissions >1GHz

Radiated Emissions >1Ghz

This document shall not be reproduced, except in full

This report is issued within the scope of A2LA accreditation #2765.02.

Accredited for compliance with ISO / IEC 17025.
Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
2/9 Packard Avenue, Castle Hill NSW 2154 Australia Ph: +612 9680 9990

ACCREDITED
TEST LABORATORY
CERT #2765.02