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RADIO REPORT FOR CERTIFICATION to FCC PART 15 Subpart C (Section 15.225)

FCC ID: 2AIKG-CP6100

Test Sample: Card Processor

Model: CP6100

Client: Vix Technology

Report Number: M160508-1

Issue Date: 20 September 2016

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RADIO REPORT FOR CERTIFICATION to FCC PART 15 Subpart C (Section 15.225)

Report Number: M160508-1

Issue Date: 20 September 2016

Sample: Card Processor
Model: CP6100
Serial Number: Not marked
Manufacturer: Vix Technology

FCC ID: 2AIKG-CP6100

Equipment Type: Intentional Radiator (13.56 MHz Transceiver)

Tested for: Vix Technology

Address: Level 4, 50 St Georges Tce

Perth 6060, Western Australia

Phone: +61 (0)8 6180 4613

Contact: Gino Bertino

Email: gino.bertino@vixtechnology.com

Standard: FCC Part 15 – Radio Frequency Devices

FCC Part 15 Subpart C - Intentional Radiators

Section 15.225 – Operation within the band 13.110-14.010 MHz

Test Dates: 30 July and 4 August 2016

Test Enginees:

Mahan Ghassempouri

M. Shassen Dei

Test Engineer

M.Sc. in Telecommunication

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.

Authorised Signatory:

Chris Zombolas
Technical Director

EMC TECHNOLOGIES PTY LTD

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RADIO REPORT FOR CERTIFICATION to FCC PART 15 SUBPART C (SECTION 15.225)

1.0 INTRODUCTION

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations that were deemed applicable for the CP6100:

47 CFR, Part 15, Subpart C: Rules for intentional radiators

Section 15.203: Antenna requirements

Section 15.205: Restricted bands of operation

Section 15.209: Radiated emission limits (General requirements)
Section 15.225: Operation within the band 13.110-14.010 MHz

The sample **complied** with the applicable requirements of 47 CFR, Part 15 Subpart C - Section 15.225.

The measurement procedure used was in accordance with ANSI C63.10: 2013. The instrumentation conformed to the requirements of ANSI C63.2: 2009.

1.1 Summary of Results

FCC Part 15 Subpart C	Test Performed	Results
	Antonia Deminerant	0 111
15.203	Antenna Requirement	Complied
15.205	Restricted bands of operation	Complied
15.207	Conducted Limits	Not applicable
15.209	Radiated Emissions Limits; General Requirements	Complied
15.225(a)	Fundamental Field Strength	Complied
15.225(b and c)	Transmission Mask 13.110-14.010 MHz	Complied
15.225(d)	Spurious Emissions	Complied
15.225(e)	Frequency Tolerance	Complied
2.1049	Occupied Bandwidth	170.5 Hz

1.2 Modifications by EMC Technologies

No modifications were performed.





2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 EUT (Transmitter) Details

Wireless Radio: 13.5615 MHz Antenna type: Integral, loop

2.2 EUT (Host) Details

Test Sample: Card Processor
Model Number: CP6100
Serial Number: Not marked
Manufacturer: Vix Technology

Supply Rating: 24 VDC Highest operating Frequency: 400 MHz

Radio Module: CLRC663 multi-protocol NFC frontend IC

2.3 Test Configuration

The EUT was transmitting continuously during the test.

2.4 Test Facility

2.4.1 General

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 47CFR2.948 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 & Designation number AU0001.

EMC Technologies indoor open are test site (iOATS) have been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS-Gen, Issue 8 - Industry Canada iOATS number - IC 3569B

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

2.4.2 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 company 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 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

EMC Technologies is accredited in Australia by the National Association of Testing Authorities (NATA). 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.asn.au





2.5 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI) or in-house. All equipment calibration is traceable to Australian national standards at the National Measurements Institute.

Equipment Type	Make/Model/Serial Number	Last Cal. dd/mm/yy	Due Date dd/mm/yy	Cal. Interval
Chamber	Frankonia SAC-10-2 (R-139)	8/01/2016	8/01/2017	1 Year, *1
EMI Receiver	R&S ESU40 20 Hz – 40 GHz Sn: 100392 (R-140)	19/11/2015	19/11/2016	1 Year, *2
	R&S ESU40 20 Hz – 40 GHz Sn: 100182 (R-037)	18/02/2016	18/02/2017	1 Year, *2
Antennas	EMCO 6502 Active Loop 9 kHz – 30 MHz Sn. 9311-2801 (A-231)	20/07/2015	20/07/2018	3 Year, *2
	SUNOL JB6 Biconilog 30 – 6000 MHz Sn. A012312 (A-363)	26/05/2016	26/05/2018	2 Year, *2
	EMCO 3115 Double Ridge Horn 1 – 18 GHz Sn: 8908-3282 (A-004)	15/07/2016	15/07/2019	3 Year, *1
Cables	Room 12 inbuilt cable Panel 1 to 10 m (C-422)	09/05/2016	09/05/2017	1 Year, *1
	Room 12 inbuilt cable Panel 1 to 3 m (C-421) Room 12 Antenna cable (C-437)	09/05/2016 09/05/2016	09/05/2017	1 Year, *1 1 Year, *1

Note *1. Internal NATA calibration.

Note *2. External NATA / A2LA calibration





3.0 TEST RESULTS

3.1 §15.203 Antenna Requirement

An internal, permanently attached antenna was incorporated within the CP6100 Reader ensuring that it could not be replaced.

3.2 §15.205 Restricted Bands of Operation

The limits of §15.209 were applied across the applicable spectrum and therefore complied with the restricted band requirements. The device was exempt from the resitricted band limits for the band 13.36-13.41 MHz.

3.3 §15.207 Conducted Limits

Not applicable as the EUT was DC powered from a vehicle supply and not connected directly or indirectly to an AC supply network.

3.4 §15.209 Radiated emission limits; general requirements

The general requirement limits were applied to the measurements of §15.225(d).





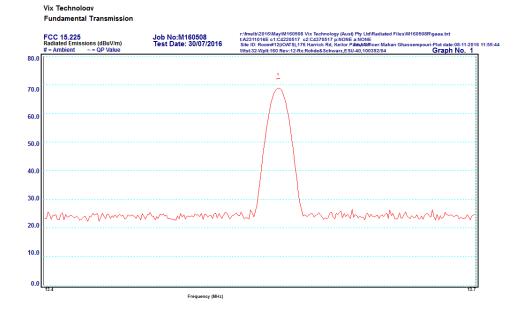
3.5 §15.225(a) Fundamental Field Strength

The field strength of the fundamental transmitted frequency was measured inside a compliant CISPR16-1-4 semi-anechoic chamber. The EUT was positioned on a test turn-table and rotated through 360° to determine the highest emissions. The measurement antenna was also varied between 1 and 4 metres height. The measurements were made with the loop antenna in three orthogonal orientations.

3.5.1 Result

All measurements were made at a distance of 10 metres. The fundamental emissions were measured using a peak detector and as the level did not exceed the limit further measurements were not made.

Loop Antenna Orientation	Frequency MHz	E- field dBμV/m	E-field μV/m	30 m Limit μV/m	10 m Limit μV/m	Result
Parallel	13.56	51.92	394	15,848	47,315	Complied
Perpendicular	13.56	72.13	4,041	15,848	47,315	Complied
Horizontal	13.56	70.48	3,342	15,848	47,315	Complied



3.5.2 Conclusion

The field strength of the fundamental transmitted signal complied with the limit of §15.225(a).





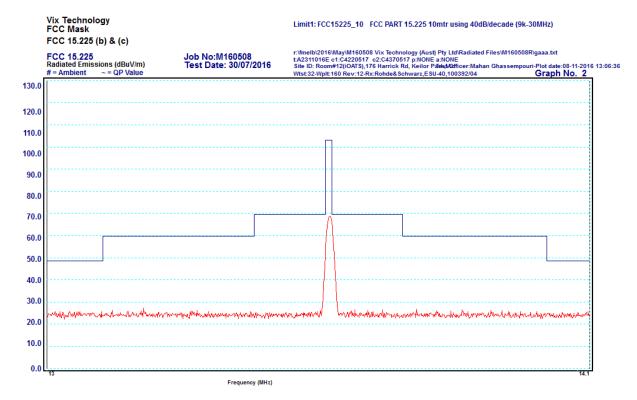
3.6 §15.225(b and c) Transmission Mask 13.110-14-010 MHz

Measurements were made at 10 metres using a 0.6 metre loop antenna. Initial investigations were made to find the EUT and measuring antenna orientations that produce the highest reading on the EMI receiver/spectrum analyser. These measurements were made at the transmit frequency, 13.56 MHz.

With the EUT and measuring antenna orientated in the position giving maximum emission measurements with a bandwidth of 9 kHz were made between 13.110 MHz and 14.010 MHz. The following limit mask applied:

Frequency band (MHz)	Field strength limit at 30 m (μV/m)	Equivalent field strength limit at 10 m (dBμV/m)
13.110 to 13.410	106	59.6
13.410 to 13.553	334	69.6
13.553 to 13.567	15,848	103.1
13.567 to 13.710	334	69.6
13.710 to 14.010	106	59.6

3.6.1 Result



No transmitted signal emissions were detected in the frequency bands 13.110 to 13.410 MHz, 13.410 to 13.553 MHz, 13.567 to 13.710 MHz and 13.710 to 14.010 MHz.

3.6.2 Conclusion

The transmitted signal complied with the limit mask of §15.225(b and c).





3.7 §15.225(d) Spurious Emissions

Radiated EMI tests were performed in a semi-anechoic chamber compliant with CISPR16-1-4. The chamber allows a 2m x 2m x 2m test volume up to 6 GHz, at a test distance of 3 metres and 10 metres.

The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks. Measurements in the range of 9 kHz-30 MHz were made at 10 metres distance using a 0.6 metre loop antenna. A calibrated Biconilog antenna (at 10 m distance) and horn antenna (at 3 m distance) were used for measurements in the frequency range of 30-1000 MHz and 1-2 GHz, respectively.

The EUT was slowly rotated with the spectrum analyser was set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable and by varying the antenna height. The procedure was repeated with the device orientated in three orthogonal axis to further maximise the emission.

Each significant peak was investigated with the Peak/Average Detectors. The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical antenna polarisations.

3.7.1 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 $dB\mu V/m$.

V = EMI Receiver Voltage in dBμV. (measured value)
 AF = Antenna Factor in dB. (stored as a data array)
 G = Preamplifier Gain in dB. (stored as a data array)

Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

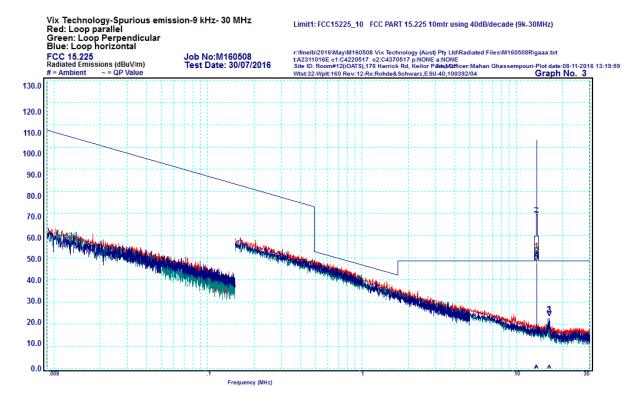




3.7.2 Frequency Band: 9 kHz - 30 MHz

Measurements were made at a distance of 10 metres. The measurement of emissions between 9 kHz - 150 kHz were made with a resolution bandwidth (RBW) of 200 Hz and the video bandwidth (VBW) of 3 kHz, 150 kHz - 30 MHz were measured with the resolution bandwidth (RBW) of 9 kHz and the video bandwidth (VBW) of 30 kHz.

3.7.2.1 Results



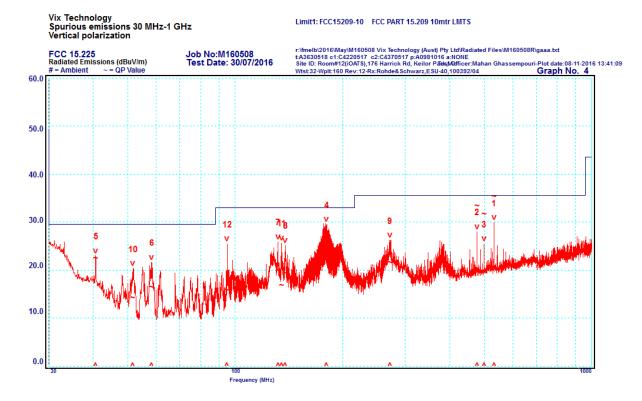
Point	Frequency (MHz)	Loop Orientation	Quasi-Peak (dBμV/m)	Limit (dBµV/m)	Margin (dB)
1	13.56	Parallel	51.90	103.10	-51.2
2	13.56	Perpendicular	72.10	103.10	-31.0
3	16.38	Perpendicular	16.30	48.60	-32.3
4	13.56	Horizontal	70.50	103.10	-32.6





3.7.3 Frequency Band: 30 - 1000 MHz

Measurements were made at a distance of 10 metres. The measurement of emissions between 30 - 1000 MHz were made with a resolution bandwidth (RBW) of 120 kHz and the video bandwidth (VBW) of 300 kHz. Measurements results are shown in the following graphs.



Point	Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	532.00	35.3	35.5	-0.2*
2	476.59	33.3	35.5	-2.2*
3	498.76	31.6	35.5	-3.9*
4	180.70	27.1	33.0	-5.9
5	40.69	22.5	29.5	-7.0
6	58.33	16.4	29.5	-13.1
7	131.86	19.8	33.0	-13.2
8	138.30	19.3	33.0	-13.7
9	271.68	21.6	35.5	-13.9
10	51.65	14.2	29.5	-15.3
11	135.05	16.7	33.0	-16.3
12	95.02	15.8	33.0	-17.2

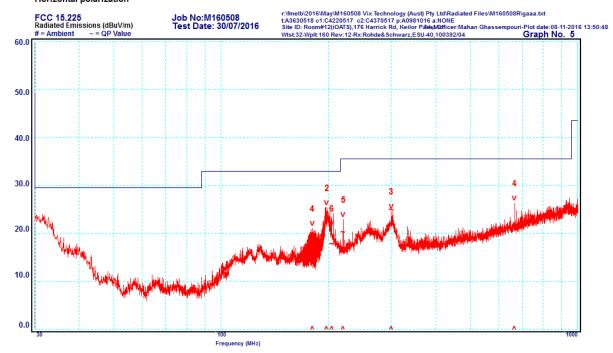
^{*} Within measurement uncertainty, results are below the limit therefore comply with §15.225(d) as the laboratory measurement uncertainty is below the ANSI requirement.





Vix Technology Spurious emissions 30 MHz-1 GHz Horizontal polarization

Limit1: FCC15209-10 FCC PART 15.209 10mtr LMTS



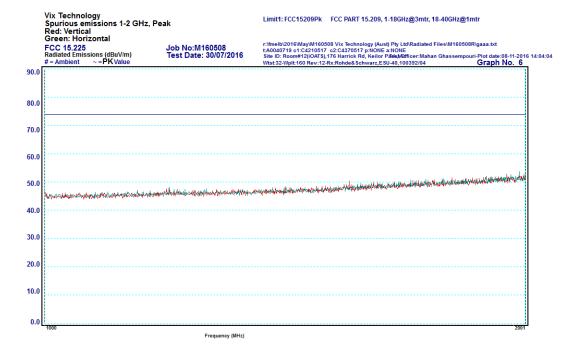
Point	Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBµV/m)	Margin (dB)
1	665.00	30.1	35.5	-5.4
2	197.66	22.5	33.0	-10.5
3	300.00	24.9	35.5	-10.6
4	180.03	19.7	33.0	-13.3
5	220.04	20.3	35.5	-15.2
6	204.12	17.7	33.0	-15.3

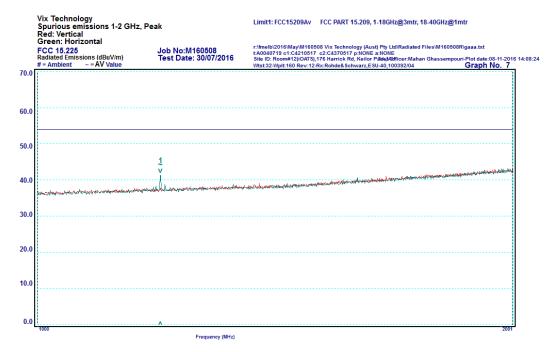




3.7.3 Frequency Band: 1000 - 2000 MHz

Measurements were made at a distance of 3 metres. The measurement of emissions between 1000 - 2000 MHz were made with a resolution bandwidth (RBW) of 1 MHz and the video bandwidth (VBW) of 3 MHz. Measurements were performed using Peak and average detectors for both polarizations. The EUT was placed 1.5 m above the floor. Measurement results are shown in the following graphs.





	Point	Polarization	Frequency (MHz)	Quasi-Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Ī	1	Horizontal	1197.20	44.1	54.0	-9.9

3.7.5 Conclusion

The spurious emissions complied with the general limits of §15.209 by a margin of 0.2 dB.





3.8 §15.225(e) Frequency Tolerance

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency (13.5615 MHz) over a temperature variation of -20 °C to +50 °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 °C. Measurements were performed according to ANSI C63.10, Clause 6.8.

Temperature	Voltage	Ме	asured fre	quency (N	lHz)	Limit (MHz)	Result
°C	V	start up	2 min	5 min	10 min		
50	24.0	13.561474	13.561461	13.561452	13.561445	13.56014385-13.56285615	Pass
40	24.0	13.561464	13.561454	13.561451	13.561450	13.56014385-13.56285615	Pass
30	24.0	13.561371	13.561495	13.561484	13.561479	13.56014385-13.56285615	Pass
	20.4	13.561551	13.561530	13.561524	13.561517	13.56014385-13.56285615	Pass
20	24.0	13.561543	13.561531	13.561524	13.5615 17*	13.56014385-13.56285615	Pass
	27.6	13.561546	13.561530	13.561524	13.561517	13.56014385-13.56285615	Pass
10	24.0	13.561593	13.561576	13.561565	13.561559	13.56014385-13.56285615	Pass
0	24.0	13.561635	13.561622	13.561611	13.561604	13.56014385-13.56285615	Pass
-10	24.0	13.561650	13.561643	13.561637	13.561634	13.56014385-13.56285615	Pass
-20	24.0	13.561671	13.561670	13.561668	13.561667	13.56014385-13.56285615	Pass

^{*} Reference value used as operating frequency.





3.9 §2.1049 Occupied Bandwidth

The occupied bandwidth was determined using the 99% transmit power function of a spectrum analyzer. The EUT was set to transmit continuously. Resolution bandwidth and video banwidth was set to 10 Hz and 30 Hz respectively.



Operating Frequency (MHz)	Occupied Bandwidth





4.0 COMPLIANCE STATEMENT

The Card Processor, Model CP6100, tested on behalf of Vix Technology **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.225 - Operation within the band 13.110-14.010 MHz.

Results were as follows:

FCC Part 15 Subpart C	Test Performed	Results
	Antonia Deminerant	O a manufic at
15.203	Antenna Requirement	Complied
15.205	Restricted bands of operation	Complied
15.207	Conducted Limits	Not applicable
15.209	Radiated Emissions Limits; General Requirements	Complied
15.225(a)	Fundamental Field Strength	Complied
15.225(b and c)	Transmission Mask 13.110-14.010 MHz	Complied
15.225(d)	Spurious Emissions	Complied
15.225(e)	Frequency Tolerance	Complied
2.1049	Occupied Bandwidth	170.5 Hz

5.0 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:	9 kHz to 30 MHz	±3.2 dB
Radiated Emissions:	9 kHz to 30 MHz 30 MHz to 300 MHz 300 MHz to 1000 MHz 1 GHz to 18 GHz	±4.1 dB ±5.1 dB ±4.7 dB ±4.6 dB
Peak Output Power:		+1.5 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%.



