FCC TITLE 47 PART 15 SUBPART C
TEST REPORT

Client:	PJM Systems Pty Ltd
Address:	Unit 10, 3 Northward Street, Upper Coomera, QLD 4209, Australia
Report No.:	0513WAL_MARS24AT_FCC15Ca
Test Date(s):	22nd November – 7th December 2023
Project No.:	WAL230922
Equipment Name:	MARS-24AT
Equipment Model No(s).:	MARS-24AT
Equipment FCC ID:	2BEI3-MARS24AT
Equipment Description	Multiple Antenna Reader Systems
Result:	**COMPLIED** (Refer to Test Summary page for clarifications)
Prepared by:	Steven Garnham Authoring Engineer
Approved by:	Richard Turner Assessment Engineer
Issue Date:	12th July 2024

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

This report is issued errors and omissions exempt and is subject to withdrawal at Austest Laboratories discretion.

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

Accredited for compliance with ISO / IEC 17025.
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ACCREDITED
TEST LABORATORY
CERT #2765.02

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1 REPORT REVISION HISTORY

Date	Report Number	Changes
13/05/2024	0513WAL_MARS24AT_FCC15C	Original Report.
12/07/2024	0513WAL_MARS24AT_FCC15Ca	Pages 18 and 24 revised to reflect extrapolated results.

2 REFERENCES

Document		Issue/ Amended
FCC Title 47	FCC Title 47 Part 15 – Radio Frequency Devices	Current as of November 2023
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
KDB 174176 D01	AC Power-Line Conducted Emissions FAQ	June 3, 2015
ANSI C63.4	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	2014
Client Test Plan	159-00-001-INS Ver 1	01/11/23

3 COMPLIANCE SUMMARY

DISCLAIMER: Austest Laboratories makes no claim regarding the consistency of production versions of the EUT. The results in this report apply only to the sample tested, as described in Section 5 of this report.

FCC Part 15, Subpart C – Intentional Radiators		Result	Notes
15.203	Antenna Requirement	Complied	(iii)
15.205	Restricted Bands of Operation	Complied	-
15.207	Conducted Limits	Complied	(i)
15.209	Radiated Emission Limits, General Requirements	Complied	-
15.215 (c)	Additional Provisions; 20dB BW; 99% BW	Complied	-
15.225 (a)	Operation Within the Band 13.553 -13.567 MHz:-Field Strength	Complied	(ii)
15.225 (b)	Operation Within the Band 13.410 -13.553 MHz; 13.567 – 13.710 MHz	Complied	-
15.225 (c)	Operation Within the Band 13.110 -14.010 MHz; 13.710 – 14.010 MHz	Complied	-
15.225 (d)	Operation outside of the 13.110-14.010 MHz band	Complied	(iv)
15.225 (e)	Frequency Tolerance	Complied	
15.225 (f)	Radio Frequency Powered Tags	Not Applicable	(v)

Notes

(i) Tested both with antennas connected and with a dummy load, as per KDB 174176 D01.
(ii) The EUT was assessed as a single fixed frequency RFID reader at 13.560MHz.
(iii) The EUT and unique antennas will be professionally installed and tested on site.
(iv) The EUT was found to be compliant with the radiated emission limits specified in section 15.209.
(v) The EUT is a RFID reader. No powered RFID tags were supplied with the EUT.

4 MODIFICATIONS

No modifications were made to the EUT.

5 EQUIPMENT UNDER TEST INFORMATION

5.1

Name:	MARS-24AT
Model No(s).:	MARS-24AT
Serial No(s).:	-
FCC ID:	2BEI3-MARS24AT
Power Supply Rating:	100V – 240V AC in, 12V DC @ 10A out
Highest Internal/Operating Frequency:	50MHz, as stated by manufacturer

5.2 EUT Description

The EUT was a multiple antenna RF ID reader system operating at 13.56MHz.

5.3 EUT Operating Mode(s)

Mode #	Description
1	Unit active with transmission on and scanning the 24 antenna ports with all antennas connected.
2	Unit active with test software setting maximum continuous output on a single channel into one antenna.
3	Unit active with test software setting maximum continuous output on a single channel into the supplied dummy load.

EUT was powered from 120 Vac, 60 Hz supply for all tests except for the frequency tolerance vs supply voltage variation.

6 TEST SETUP AND EUT CONFIGURATION

Test setup photographs are in Appendix B.

The EUT was setup as per the manufacturer's work instructions.
Depending on the test, all 24 antennas were connected to the MARS-24AT reader with the supplied RFID tags being placed on each antenna.
The supplied 13.56MHz dummy load was only connected for a specific mains-conducted test with the transmitter operating at maximum continuous output into a single antenna port.
Software on the supplied laptop enabled control of the EUT's operating functions for either all 24 antennas being scanned or for a single fixed antenna operation, depending on the test requirement.

6.1 Supporting Equipment

Equipment	Brand & Model
RFID Tags	Manufacturer supplied
Laptop with test software	ASUS VivoBook
USB-Ethernet adaptor	Comsol U3GBAD
13.56MHz Dummy Load	Manufacturer Supplied

6.2 Cables

EUT Port	Cable	Length (m)	Source/Load
24 BNC Antenna ports	RG58 coax with moulded section P/N: 098-22-124-ASY-3	1.6	Antennas
Antenna- 24 separate units P/N: 031-10-113-ASY VER A	(NA) - BNC connector on each antenna	-	Antenna ports on main unit's case via coax
Ethernet	UTP RJ45	1.5	USB/Ethernet adaptor
DC In	Attached to power adaptor	0.7	AC/DC adaptor
AC Mains into Power Adaptor	Unshielded 2 core / 2 pin plug	1.5	Mains supply
USB Type A	Not Used	-	No Connection
USB Type B	Not Used	-	N.C.
DB15	Not used	-	N.C.

7 TEST SPECIFICATIONS

7.1 7.1 Accreditations & Listings

Austest Laboratories are accredited by A2LA. The tests reported herein have been performed in accordance with its terms of accreditation.

7.2 Deviations from Standards and/or Accreditations

None.

7.3 Test Facility

7.3.1 46 Glenola Farm Lane, Yarramalong Valley, New South Wales 2259, Australia.

- A2LA accredited, Certificate Number 2765.02. The tests reported herein have been performed in accordance with its terms of accreditation.
- Radiated emissions testing was performed at an Open Area Test Site (OATS) compliant with ANSI C63.4:2014 and C63.4a:2017. Where some ambient signals may exceed the continuous disturbance limit, the possibility of missing an emission during testing was eliminated by performing pre-scans in a shielded enclosure prior to the final OATS measurements.

7.4 Test Equipment

All critical items are maintained on a scheduled calibration recall program, or verified with equipment maintained on a scheduled calibration program. Emission measurements are traceable to Australian National standards or international equivalents.

Test Equipment	Brand & Model	ID/Serial No.	Cal Due Date
EMI Receiver	HP8574B	ME72	30/11/2023
LISN	Com-Power LI-200	ME80	13/09/2024
Loop Antenna	EM6876	ME225	29/03/2024
Log Antenna	EM6950	ME298	25/07/2025
AC Source	Chroma 6512	ME322	Verified
RF Preamp	RE1200A	ME813	16/03/2024
Bicon Antenna	EM6912	ME828	28/07/2025
Spectrum Analyser	FSP40	ME1385	16/02/2025
Cables	Huber & Suhner	-	14/04/2024
Test Software	HP85869PC	-	Verified

7.5 Measurement Uncertainty

Measurement uncertainty U_{Lab} was calculated for a 95% level of confidence and based on a coverage factor of k=2.

Emissions Tests

Measurement	Uncertainty	
	U_{cispr}	U_{Lab}
RF Frequency	-	±5 part in 10^{10}
RF power conducted	-	±1.3dB
Conducted Emissions LISN (150kHz – 30 MHZ)	3.4 dB	±2.7 dB
Radiated Emissions – 30 MHz to 1000 MHz	6.3 dB	±4.7 dB

7.6 Test Criteria

EMISSIONS
Per CISPR 16-4-2, if U_{lab} is less than or equal to U_{cispr} then compliance is deemed to occur if no measured emission level exceeds the emission limit. Per CISPR 16-4-2, if U_{lab} is greater than U_{cispr} then compliance is deemed to occur if no measured emission level, increased by (U_{lab}-U_{cispr}), exceeds the emission limit.
The EUT was considered to have passed an emissions test if emissions were less than the relevant limit.

7.7 Test Witnesses

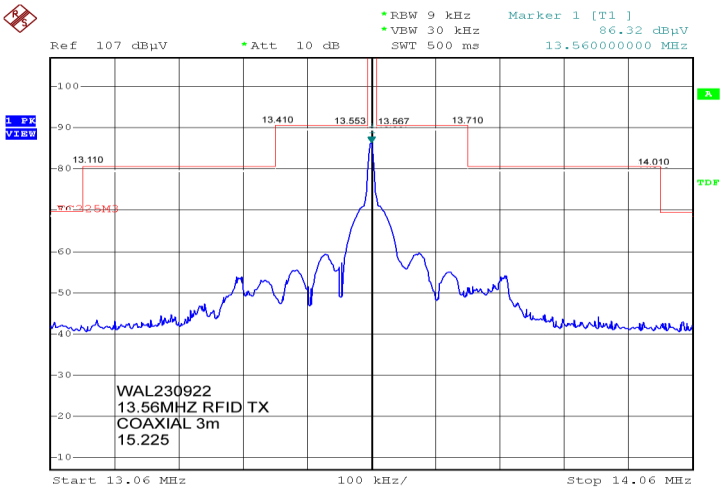
None.

8 ANTENNA REQUIREMENT, §15.203

The EUT complied with the requirement of this Section since the EUT will be professionally installed.

9 RESTRICTED BANDS OF OPERATION, §15.205

The EUT complied with the requirements of this Section since it did not operate within the listed Restricted Bands of Operation.



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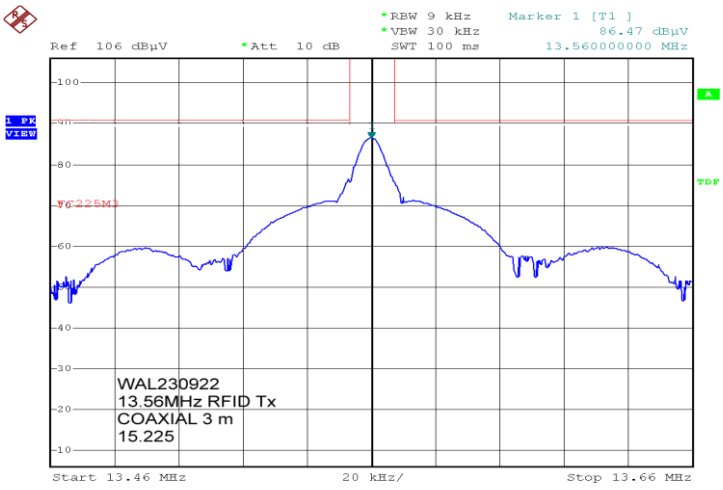
13.56MHz Mask at 3 Metres - Coaxial



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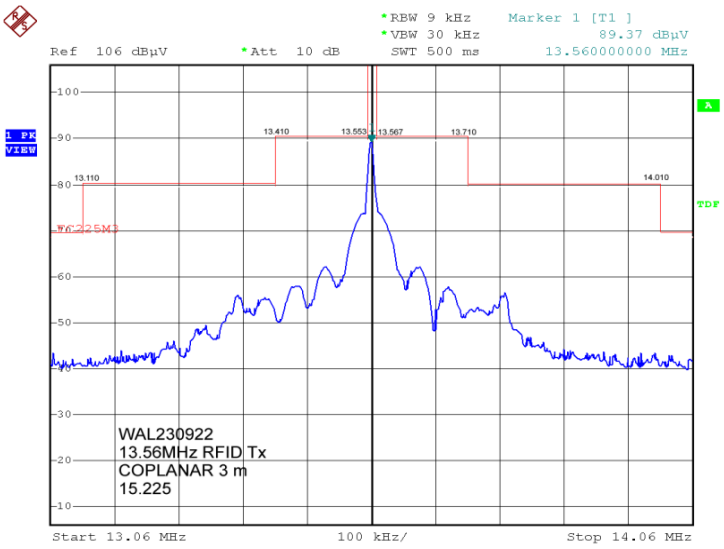

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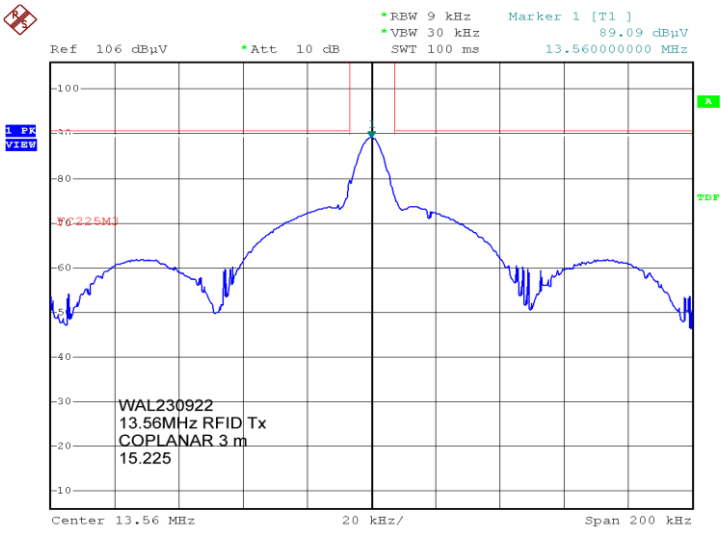

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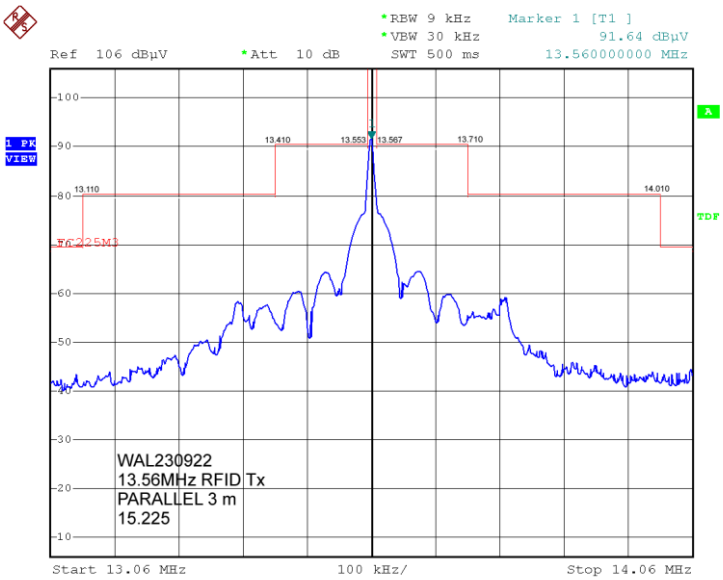

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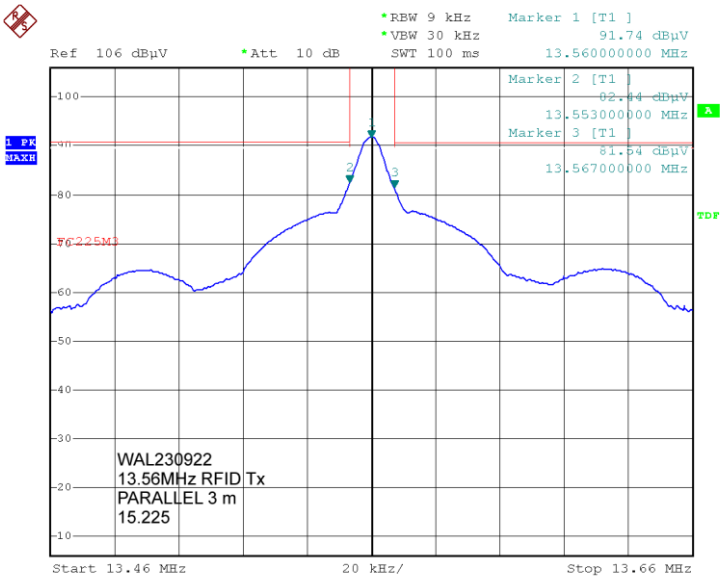
13.56MHz Mask at 3 Metres -Parallel



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13.56MHz Mask at 3 Metres -Parallel

10 CONDUCTED EMISSIONS (AC Power Lines): , §15.207.

Test Date:	22nd November 2023	Temperature:	27 °C
Test Engineer(s):	Steve Garnham	Humidity:	61 %
Test Location:	Austest Laboratories (Yarramalong)		

Test Standard: FCC Part 15C / ANSI C63.10:2013.

10.1 EUT Operating Mode

Refer to sections 5.3 and 6.

Tested in both modes with antennas connected and with a dummy load, as per KDB 174176 D01.

The EUT was tested once in normal operation while scanning all connected 24 antennas with tags and with the EUT configured for maximum transmission on a single antenna port which was connected to the supplied dummy load, replacing the normal antenna.

10.2 Test Method

- Performed in accordance with the standard ANSI C63.10:2013 and KDB 174176.D01.
- The EUT was set up on a non-conductive table, 0.8 m above a conductive ground plane.
- Rear of the EUT kept 0.4 m away from a conductive vertical reference plane (in electrical contact with the ground plane), and 0.8 m away from any other conductive surfaces.
- EUT power via 0.8 m ±10% cable length, was supplied from the EUT LISN (Line Impedance Stabilisation Network) which was grounded to the ground plane.
- When applicable, supporting equipment power supplied from a separate LISN grounded to the ground plane.
- Where possible, interconnecting cables draped over the table edge and kept 40 cm above the ground plane.
- Excess cable lengths folded back and forth to form a 30 cm to 40 cm bundle at the centre of and parallel to the cable.
- Conducted emission measurements made on both Active and Neutral ports of the EUT at the respective LISN measurement points.

10.3 Sample Calculations for Emissions

10.3.1 Conducted Emissions

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

Formula	Example Calculation
$V_c = V + L_{cbl} + L_{AMN} + L_{limiter}$	For V = 25 dBµV, L_{cbl} = 0.1 dB, L_{AMN} = 0.1 dB, $L_{limiter}$ = 15 dB
	V_c = 25 + 0.1 + 0.1 + 15 = 40.2 dBµV

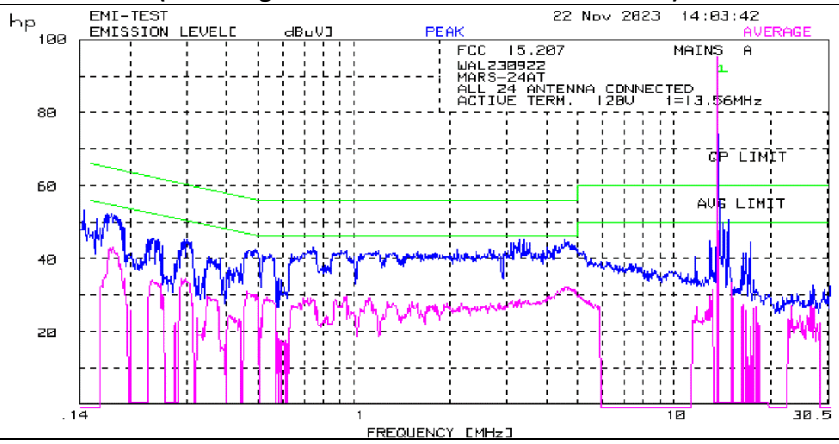
Where:
V_c = Corrected voltage level in dBµV for comparison against the limit.
V = EMI Receiver measured signal input voltage in dBµV.
L_{cbl} = Total cable insertion loss in dB.
L_{AMN} = Voltage division factor (insertion loss) of AMN in dB.
$L_{limiter}$ = Insertion loss of voltage limiter in dB.

10.4 Test Results

Tabulated worst-case results:

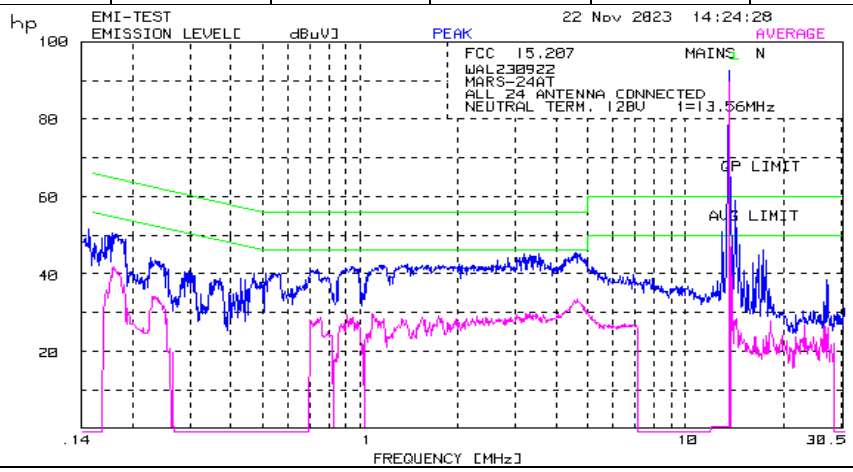
Normal operation with the antenna ports being connected to all 24 antennas with tags.

Frequency (MHz)	Port	Quasi-Peak (dBµV)			Average (dBµV)		
		Level	Limit	Margin	Level	Limit	Margin
All measured emission Peak/Quasi Peak and Average levels were greater than 10 dB below the respective limits. **(excluding the in-band 13.56MHz transmission)**							



Conducted Emissions (Power Ports) – Active Port – Normal operation into all 24 antennas.

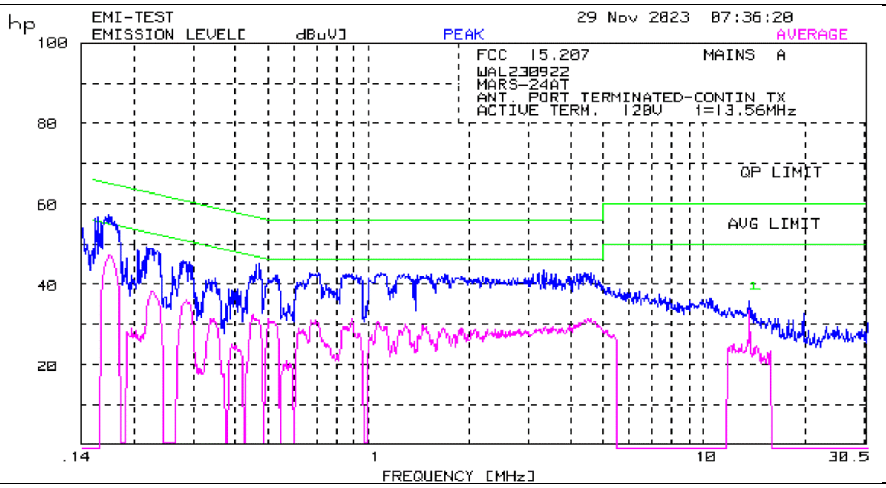
Frequency (MHz)	Port	Quasi-Peak (dBµV)			Average (dBµV)		
		Level	Limit	Margin	Level	Limit	Margin
All measured emission Peak/Quasi Peak and Average levels were greater than 10 dB below the respective limits. **(excluding the in-band 13.56MHz transmission)**							



Conducted Emissions (Power Ports) – Neutral Port, Normal operation into all 24 antennas.

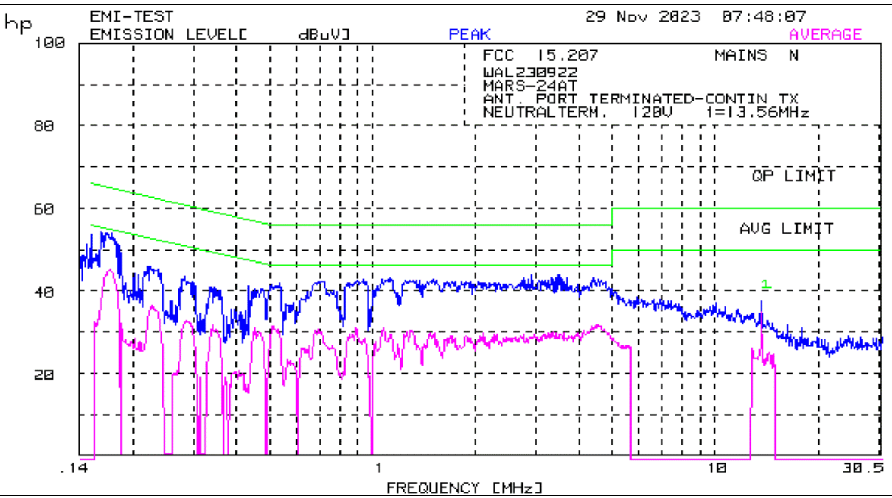
Operation with continuous transmission into one antenna port terminated with the dummy load.

Frequency (MHz)	Port	Quasi-Peak (dBµV)			Average (dBµV)		
		Level	Limit	Margin	Level	Limit	Margin
0.168	Active	-	65.0	>-10	47.3	55.0	-7.7
A negative margin indicates the margin was below the limit.							



Conducted Emissions (Power Ports) – Active Port

Frequency (MHz)	Port	Quasi-Peak (dBµV)			Average (dBµV)		
		Level	Limit	Margin	Level	Limit	Margin
0.172	Neutral	-	64.8	>-10	45.3	54.8	-9.5
A negative margin indicates the margin was below the limit.							



Conducted Emissions (Power Ports) – Neutral Port.

11 RADIATED EMISSIONS §15.209.

11.1 EUT Operating Mode

- Refer to Section 5.3 and 6 of this report.
- All 24 antenna were connected but the EUT was configured for constant transmission on one port.

11.2 Test Method

a. Measurements were performed in accordance with ANSI C63.10:2013. Peak measurements were performed using a Peak Detector; Average measurements were performed with an average detector; video averaging was not employed.
b. The measuring receiver BW settings were:

Frequency Range	Antenna	Measurement	Detector	RBW	VBW
0.15 to 30 MHz	60 cm Loop	Pre-scan	Peak	9 kHz	30 kHz
		Final Quasi-Peak	Quasi-Peak	9 kHz	-
30 to 1000 MHz	Hybrid (Bicon/log)	Pre-scan Peak	Peak	120 kHz	300 kHz
		Final Quasi-Peak	Quasi-Peak	120 kHz	-

c. The EUT was setup on a non-conductive turntable:- :-
   i. For measurements 30MHz to 1GHz at a height of 0.8m above the OATS conductive ground plane and at the indicated test distance away from the measuring antenna.
   ii. For measurements below 30MHz, at a height of 0.8m, initially above a metallic ground plane then final measurements over a non-metallic ground plane at the indicated test distance away from the measuring antenna.
d. To maximise emissions, the EUT was rotated through 360^{o} and the measuring antenna height adjusted between 1m to 4m (30MHz to 1GHz) in the following antenna orientations, except for the loop antenna below 30MHz :-
   i. Loop antenna (9kHz to 30MHz) over a non-metallic ground plane,– Coaxial, Coplanar and also horizontal (parallel to ground) orientations, at a fixed height above ground of 1m to the lowest height of the loop antenna (C63.10:2013 section 6.4.6).
   ii. Bilog antenna (30MHz to 1GHz) - Both vertical and horizontal polarizations.
e. The maximised emission level was measured and the above repeated for all measurement frequencies.
f. Average level measurements were not made where the peak level did not exceed the average limit.
g. Linearity of the measuring system was checked, reducing gain when required.
h. Test distances: Where the actual test distance used was different to that specified, then the test data results shown in any tables were extrapolated to the required distance using the formula specified within ANSI C63.10:2013. For simplicity, the test data plots have the limit lines adjusted to reflect any different test distance giving a visual indication of the relative margins.
i. **Ambient Emissions**: Measurements were performed at an Open Area Test Site (OATS), where some ambient signals may exceed the limit. The possibility of missing an emission during testing was removed by performing pre-scans in a shielded enclosure prior to the final OATS measurements. The ambient emissions are indicated as a '1' or 'A' on the scans, refer to the notes after the graphs.

11.3 Example Calculation

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:

Calculation	Example		
$\mathbf{E = V + AF + L_{cbl} - G_{pre}}$	V = 40.0 dBµV AF = 12.0 dB/m	L_{cbl} = 2.9 dB G_{pre} = 22.5 dB	E = 40 + 12 + 2.9 – 22.5 = 32.4 dBµV/m

Where E = Radiated Electric Field Strength in dBµV/m,
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 and
G_{pre} = Preamplifier gain in dB.

11.4 Test Results

11.4.1 Radiated Emissions: 9kHz to 150kHz at 10m distance.

Test Date:	6th December2023	Temperature:	26°C
Test Officer:	Steven Garnham	Humidity:	69%
Test Location:	Austest Laboratories (Yarramalong, NSW)		

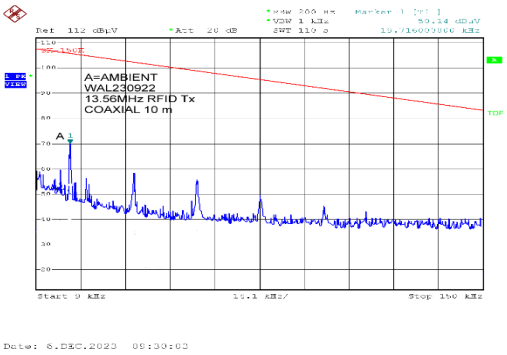
Measured data at the indicated distance was extrapolated to the distance defined by limits (300m for 9-490kHz and 30m for 490kHz – 30MHz).

9kHz – 150kHz extrapolation factor =40dB/ Decade, refer ANSI C63.10:2013 clause 6.4.4.1

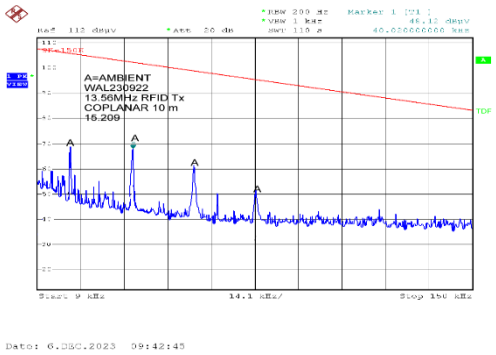
Note: Measurements were performed at 10 meters due to the noise floor to limit margin at 300 meters. There were no measured EUT emissions above the noise floor at 10 meters.

Measurements were performed both on an OATS ground plane and finally also over a non-conductive ground plane as specified in ANSI C63.10:2013, clause 5.2.

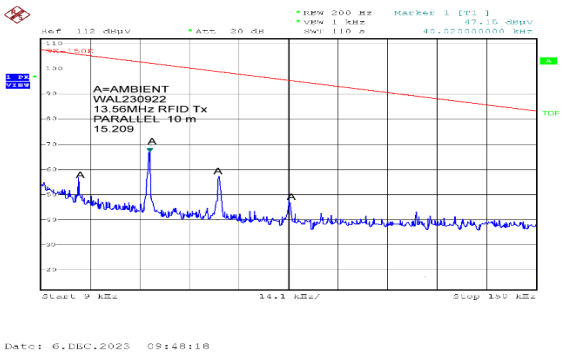
Frequency (MHz)	Antenna Polarity	Level Quasi-Peak / Linear Avg (dBµV/m)				
		Measured at 10m	Extrapolation Factor (10m - 300m)	Extrapolated Results	300m Limit	Margin
0.009	All	~60dBuV (noise floor) at 9kHz	-59.1dB	0.9dBuV (noise)	48.5dBuV	>-40dB
All measured out of band emissions were greater than 40 dB below the limits specified in 15.209.						



Radiated Emissions (Coaxial)



Radiated Emissions (Coplanar)



Radiated Emissions (Parallel)

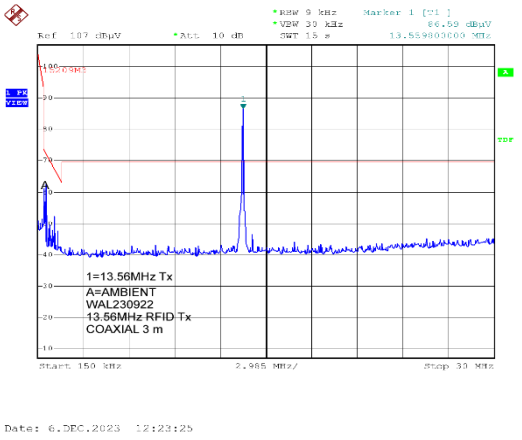
11.4.2 Radiated Emissions: 150kHz to 30MHz at 3m distance.

Test Date:	6th December 2023	Temperature:	28°C
Test Officer:	Steven Garnham	Humidity:	59%
Test Location:	Austest Laboratories (Yarramalong, NSW)		

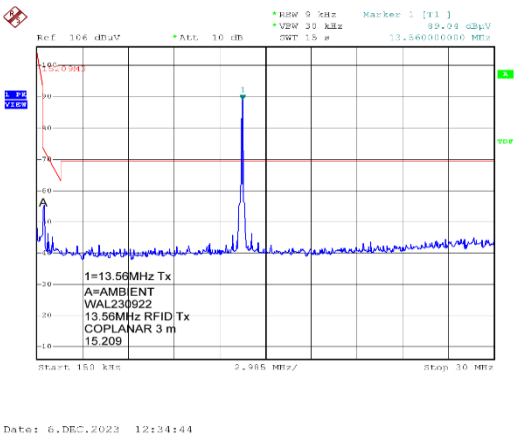
Measured data extrapolated to distance defined by limits (300m for 9-490kHz and 30m for 490kHz – 30MHz).

Measurements were performed both on an OATS ground plane and finally also over a non-conductive ground plane as specified in ANSI C63.10:2013, clause 5.2.

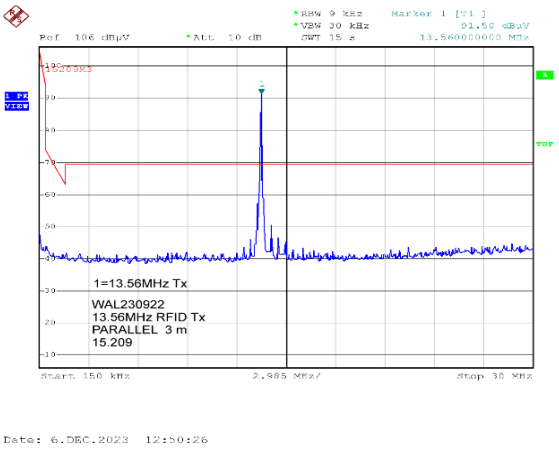
Frequency (MHz)	Channel	Antenna Polarity	Quasi-Peak / Linear Avg (dBµV/m)		
			Level	300m Limit	Margin
All measured out of band emissions were greater than 20 dB below the limits specified in 15.209.					



Radiated Emissions (Coaxial)



Radiated Emissions (Coplanar)



Radiated Emissions (Parallel)

11.4.3 Radiated Emissions: 30MHz to 1000MHz at 3m distance.

Test Date:	27th November 2023	Temperature:	29°C
Test Officer:	Steven Garnham	Humidity:	58%
Test Location:	Austest Laboratories (Yarramalong, NSW)		

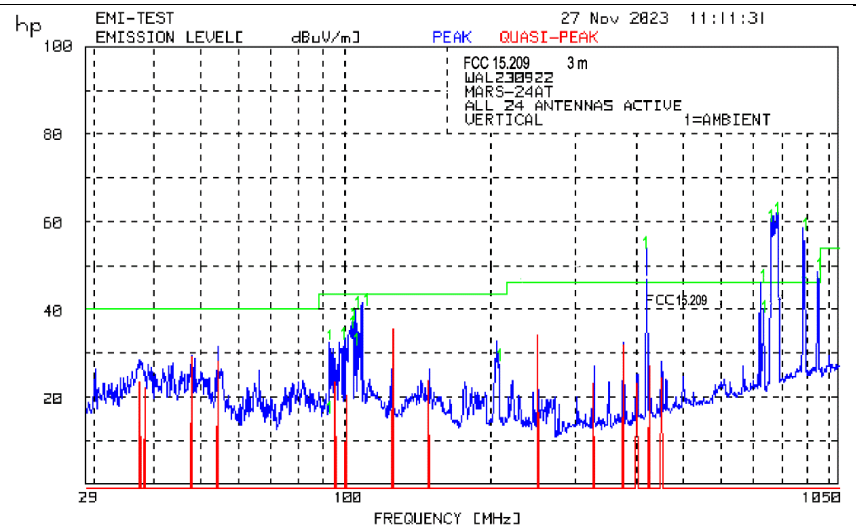
11.5 EUT Operating Mode

- Refer to Section 5.3 and 6 of this report.
- All 24 antenna were connected and active.

Tabulated worst-case results:

Test Distance:	3m			
Frequency (MHz)	**Antenna Pol.**	**Quasi-Peak (dBµV/m)**		
		Level	**Limit (3 m)**	**Margin**
125.0	Vertical	35.5	43.5	-8.0
47.9	Vertical	29.1	40.0	-10.9
250.0	Vertical	33.9	46.0	-12.1
375.0	Vertical	31.7	46.0	-14.3

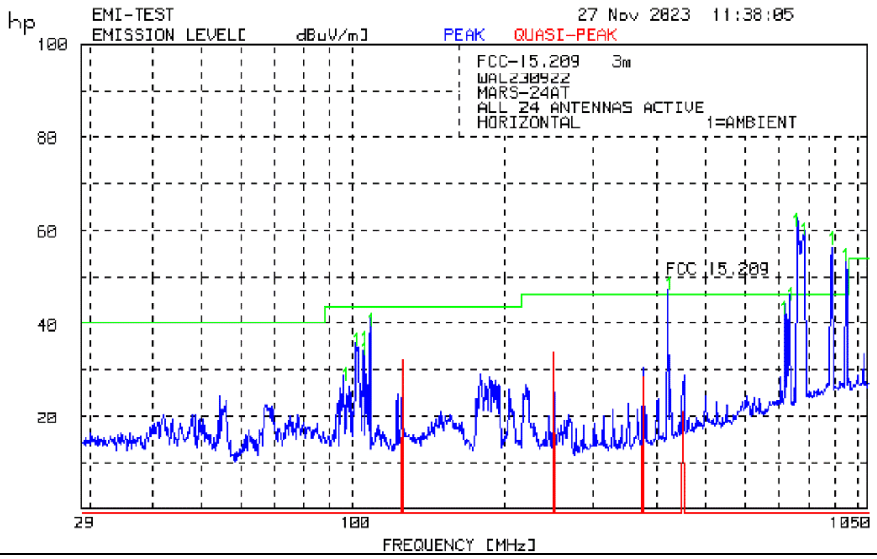
A negative margin indicates the margin was below the limit.
A "1" label on the plot indicates an Ambient and was not an emission from the EUT.



Radiated Emissions (30 MHz to 1 GHz) – Vertical Polarisation

Test Distance:	3m			
Frequency (MHz)	Antenna Pol.	Quasi-Peak (dBµV/m)		
		Level	Limit (3 m)	Margin
125.0	Horizontal	31.9	43.5	-11.6
250.0	Horizontal	33.6	46.0	-12.4

A negative margin indicates the margin was below the limit.
A "1" label on the plot indicates an Ambient and was not an emission from the EUT.



Radiated Emissions (30 MHz to 1 GHz) – Horizontal Polarisation

12 OBW - 20dB BANDWIDTH, §15.215(c)

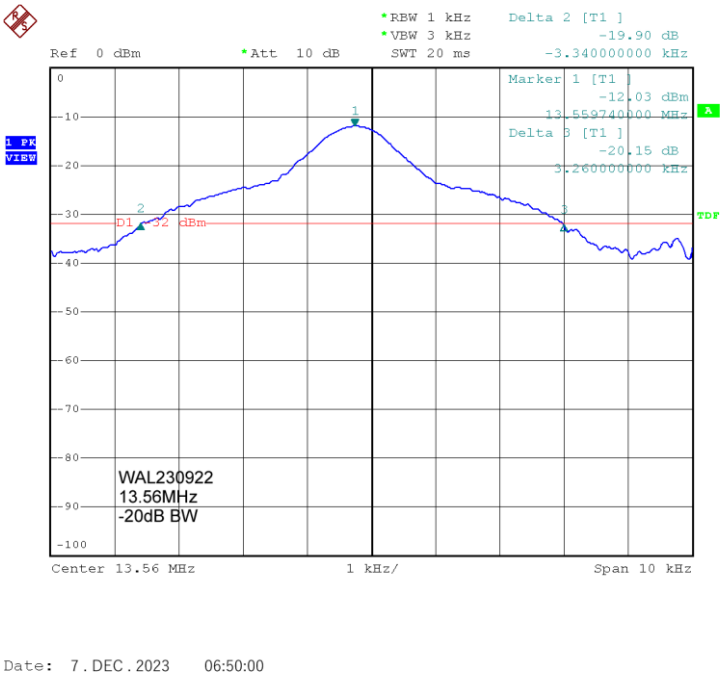
Test Date:	7th December 2023	Temperature:	20°C	Humidity:	71%
Test Officer:	Steven Garnham				
Test Location:	Austest Laboratories (Yarramalong)				

The EUT was configured and operated as per sect 5.3 and 6 of this report.

Measurements were performed by applying the procedure detailed in ANSI C63.10, Clause 6.9 Occupied Bandwidth tests.

The 20 dB bandwidth was calculated using the analyser ndB down marker function.

Frequency MHz	Lower Frequency MHz	Upper Frequency MHz	20 dB Bandwidth (kHz)
13.5600	13.556400	13.563000	6.60



20dB Bandwidth

13 OBW – 99% BANDWIDTH

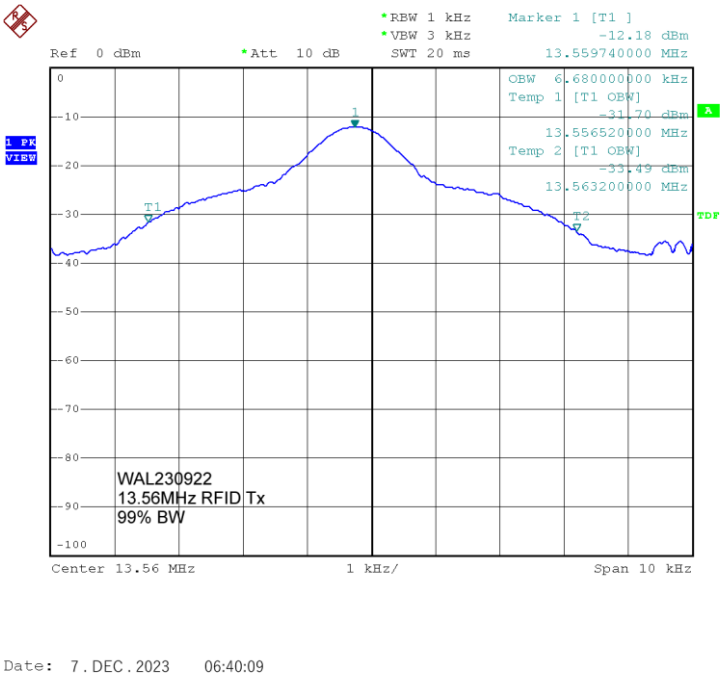
Test Date:	7th December 2023	Temperature:	20°C	Humidity:	71%
Test Officer:	Steven Garnham				
Test Location:	Austest Laboratories (Yarramalong)				

The EUT was configured and operated as per sect 5.3 and 6 of this report.

Measurements were performed by applying the procedure detailed in ANSI C63.10, Clause 6.9 Occupied Bandwidth tests.

The 99% bandwidth was measured using the analyser's power bandwidth function set to 99%.

Frequency MHz	Lower Frequency MHz	Upper Frequency MHz	99% Bandwidth (kHz)
13.559740	13.556520	13.563200	6.68



99% Bandwidth

14 RADIATED FIELD STRENGTH, §15.225(a), (b),(c)

Test Date:	7th December 2023	Temperature:	28°C	Humidity:	59%
Test Officer:	Steven Garnham				
Test Location:	Austest Laboratories (Yarramalong)				

The EUT was configured and operated as per sect 5.3 and 6 of this report.

All 24 antenna were connected but the EUT was configured for maximum constant transmission on one port.

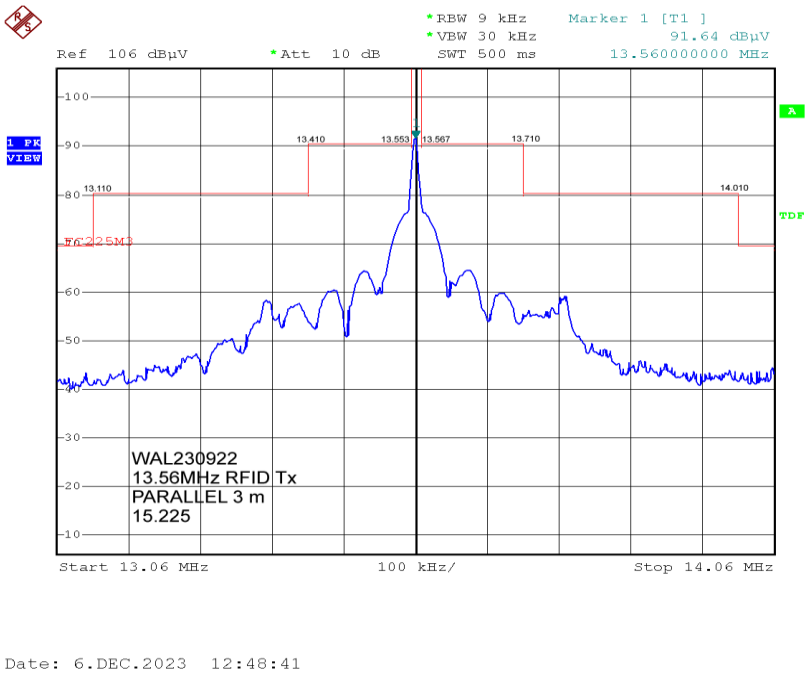
Measurements were performed by applying the procedure detailed in ANSI C63.10:2013, section 11.12.2.4.

Note: Measurements performed at a 3 meter distance due to the noise floor to limit margin at 30 meters.

Extrapolation factor was 40dB/Decade, refer ANSI C63.10:2013 clause 6.4.4.1

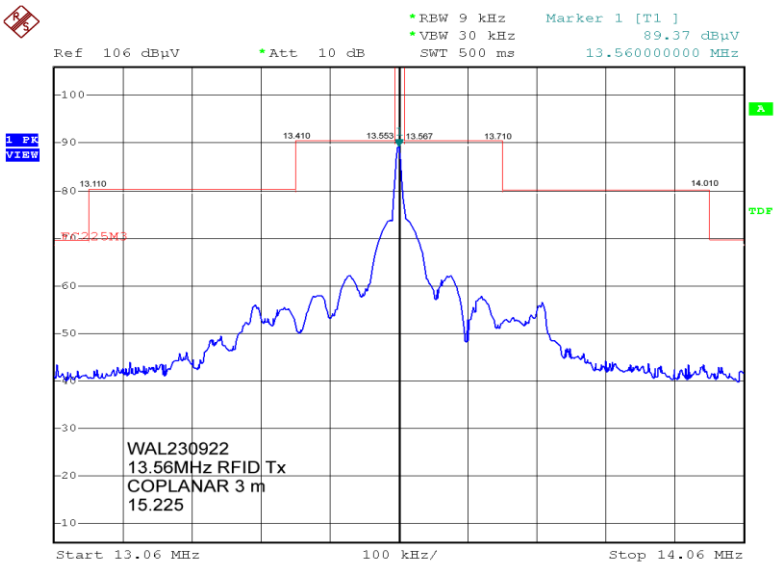
Test Results: 15.225 (a), (b), (c)

Frequency MHz	Antenna Orientation	Measured Level dBuV/m at 3 m	Extrapolation Factor 3m – 30m	Extrapolated Results to 30 m dBuV/m	Limit at 30 m dBuV/m	Margin dB
13.5600	Parallel	91.7	-40dB	51.7	84.0	-32.3
13.5600	Coplanar	89.1	-40dB	49.1	84.0	-34.9
13.5600	Coaxial	86.5	-40dB	46.5	84.0	-37.5
A negative margin indicates the margin was below the limit						



Date: 6.DEC.2023 12:48:41

Radiated Field Strength (Parallel)



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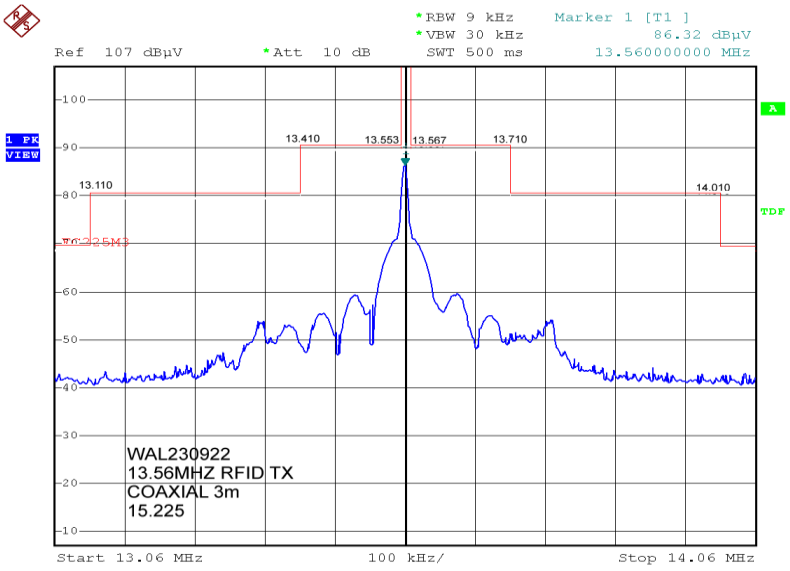
Radiated Field Strength (Coplanar)



Date: 6.DEC.2023 12:25:58

Radiated Field Strength (Coaxial)

15 FREQUENCY TOLERANCE, §15.225(e)

Test Date:	12th December 2023
Test Officer:	Steven Garnham
Test Location:	Austest Laboratories (Yarramalong)

15.1 EUT Operating Mode and configuration

- The EUT was placed inside the environmental chamber and configured for constant transmission on port 18, which was connected to the spectrum analyser via a 10dB attenuator and the supplied cable.

15.2 Test Method, Refer ANSI C63.10:2013, section 6.8.

Frequency Stability Under Temperature Variations, C63.10:2013, 6.8.1.

- Set analyser RBW and Span to obtain the required resolution, (RBW 1kHz, span 10kHz, resolution of 1Hz).
- With the EUT powered on for approximately 30 minutes, measure and record the EUT operating frequency at an initial 'Ambient' temperature of 20°C, with a mains supply at the nominal voltage (e.g. 120V).
- Turn the EUT off and raise the temperature to the maximum specified in the standard, e.g. 50°C. After the temperature has stabilised for approximately 30 minutes, record the frequency at initial switch on, at 2 minutes, 5 minutes and after 10 minutes operation.
- Decrease the temperature to the lowest specified (e.g. -20°C) in 10°C increments and after stabilisation at each temperature, record the frequency at this new temperature at initial switch on, at 2 minutes, 5 minutes and after 10 minutes operation.

Frequency Stability Under Supply Voltage Variations, C63.10:2013, 6.8.2.

- With the chamber and EUT temperature stabilised at 20°C, set the supply voltage to the normal rated operating voltage.
- Vary the supply voltage over the required range of ±15%and record the frequency.

Test Results: 15.225 (e)

Nominal Frequency: 13,560,000Hz

Frequency Stability verses Temperature							
Temperature	Measured Frequency, Hz				Maximum Deviation Hz	Limit Hz ±0.01% (±100 ppm)	Result / Margin
	Initial	2 Minutes	5 Minutes	10 Minutes			
-20°C	13,559,818	13,559,830	13,559,833	13,559,835	17	±1356 Hz	Pass
-10°C	13,559,830	13,559,837	13,559,841	13,559,846	16	±1356 Hz	Pass
0°C	13,559,848	13,559,854	13,559,849	13,559,843	11	±1356 Hz	Pass
10°C	13,559,848	13,559,832	13,559,819	13,559,811	37	±1356 Hz	Pass
20°C	13,559,812	13,559,790	13,559,779	13,559,770	42	±1356 Hz	'Ambient'
30°C	13,559,768	13,559,755	13,559,750	13,559,748	20	±1356 Hz	Pass
40°C	13,559,746	13,559,743	13,559,742	13,559,745	4	±1356 Hz	Pass
50°C	13,559,742	13,559,743	13,559,754	13,559,770	28	±1356 Hz	Pass

Supply Voltage (at 20°C Ref)	Measured Frequency (Hz)	Measured Change (Hz)	Limit Hz ±0.01% (±100 ppm)	Results / Margin
120V (Nominal) Reference (100%)	13,559,751	Ref.	±1356 Hz	Reference
102V (85%)	13,559,751	0	±1356 Hz	Pass
138 (115%)	13,559,751	0	±1356 Hz	Pass
230V (Nominal) Reference (100%)	13,559,751	Ref.	±1356 Hz	Reference
195.5V (85%)	13,559,751	0	±1356 Hz	Pass
264.5V (115%)	13,559,751	0	±1356 Hz	Pass

END OF REPORT BODY

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

Accredited for compliance with ISO / IEC 17025.
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