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RADIO REPORT FOR CERTIFICATION

47 CFR PART 15 SUBPART C

CLIENT: GALLAGHER GROUP LTD.
DEVICE UNDER TEST / PMN: WEIGH SCALE AND READER WITH SHEEP CRATE DRAFTER ANTENNA
MODEL NUMBER / HVIN: TWR5
FCC ID: **M5VG0260X**

REPORT NUMBER: M180325-1R1
(Replacement of report number M180325-1)
DATE OF ISSUE: 31 August 2018

Contents

RADIO REPORT
CERTIFICATE OF COMPLIANCE

Device under Test / PMN:	Weigh Scale and Reader with Sheep Crate Drafter Antenna
Model Number / HVIN:	TWR5
Part Number:	G02606 (TWR5 Weigh Scale and Reader) G05714 (Sheep Crate Drafter Antenna)
Manufacturer:	Gallagher Group Ltd.
FCC ID:	M5VG0260X
Tested for:	Gallagher Group Ltd.
Address:	181 Kahikatea Drive, Melville, Hamilton, 3026, New Zealand
Phone:	+64 7 838 9800
Contact:	Menardo Lazaro
Email:	menardo.lazaro@gallagher.com
Standards:	**47 CFR Part 15 –** Radio Frequency Devices **Subpart C –** Intentional Radiators
Test Dates:	21 February 2018 17 April to 4 July 2018
Issued by:	**EMC TECHNOLOGIES PTY. LTD.,** 176 Harrick Road, Keilor Park, VIC 3042, Australia. FCC Accredited: Designation AU0001 Phone: +61 3 9365 1000, Web: www.emctech.com.au
Issue Date:	31 August 2018
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: **William Alam**

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

RADIO REPORT FOR CERTIFICATION
to
47 CFR Part 15 Subpart C

1.0 INTRODUCTION

Radio tests were performed on the TWR5 Weigh Scale and Reader with Sheep Crate Drafter Antenna in accordance with the applicable requirements of 47 CFR, Part 15 Subpart C for a transmitter operating at 134.2 kHz.

1.1 Test Procedure

Radio measurements were performed in accordance with the appropriate procedures of ANSI C63.10: 2013.

The measurement instrumentation conformed to the requirements of ANSI C63.2: 2009.

1.2 Summary of 47 CFR Part 15 Subpart C Results

FCC	Test Performed	Results
1.1310	Maximum permissible exposure	**Complied**
15.203	Antenna requirement	**Complied**
15.205	Restricted bands of operation	**Complied**
15.207	Conducted limits	**Complied**
15.209	Radiated emissions limits; general requirements	**Complied**
15.215	Occupied Bandwidth	**Complied**

2.0 GENERAL INFORMATION
(Information supplied by the Client)

2.1 Equipment Under Test (EUT) - Transmitter Details

Radio:	RFID
Frequency Band:	134.2 kHz
Frequency Range:	134.2 kHz
Modulation:	AM
Emission Designator:	K1D
Antenna type and gain:	2 inductive loop antenna

2.2 EUT - Host Details

Device under Test / PMN:	Weigh Scale and Reader
Model Number / HVIN:	TWR5
Serial Number:	1745175111
Manufacturer:	Gallagher Group Ltd
Power Supply:	12 VDC via power supply
Highest Frequency:	600 MHz

2.3 Test Configuration

Testing was performed with the RFID set to continuously transmit a modulated signal.

2.4 Modifications by EMC Technologies

No modifications were performed to achieve compliance.

2.5 Test Facility

2.5.1 General

EMC Technologies Pty Ltd has 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) has also 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.

2.5.2 NATA Accreditation

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.

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to IEC/ISO17025. 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 documented test procedures, continued calibration of measurement equipment, traceable to the National Standard at the National Measurements Institute (NMI). NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A^2LA).

The current full scope of accreditation can be found on the NATA website: www.nata.com.au

2.6 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory 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/yyyy	Due Date dd/mm/yyyy	Cal. Interval
Chamber	Frankonia SAC-10-2 (R-139)	22/06/2018 22/03/2017	22/06/2019 22/03/2018	1 Year*1,3
	Frankonia SAC-3-2 (R-144)	17/06/2017	17/06/2018	1 Year*1
EMI Receiver	R&S ESW26, 2 Hz – 26.5 GHz Sn: 101306 (R-143)	31/03/2017 14/05/2018	31/03/2018 14/05/2019	1 Year*2,3
	R&S ESU40 Sn: 100392 (R-140)	19/03/2018	19/03/2019	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 JB1 Sn. A061917 (A-425)	21/07/2017	21/07/2019	2 Year*2
	EMCO 3115 Double Ridge Horn Sn: 9501-4398 (A-406)	15/07/2016	15/07/2019	3 Year*1
Cables	Room 12 inbuilt cable Panel 1 to 10 m (C-422)	31/05/2017	31/05/2018	1 Year*1,3
	Room 12 Antenna cable (C-437)	31/05/2017	31/05/2018	1 Year*1,3
	Huber & Suhner Sucoflex 104A Sn: 503055 (C-457)	02/01/2018	02/01/2019	1 Year*1
	Huber & Suhner Sucoflex 104A Sn: 503056 (C-167)	10/10/2017	10/10/2018	1 Year*1
	Huber & Suhner Sucoflex 104A Sn: 503061 (C-463)	03/01/2018	03/01/2019	1 Year*1
LISN	EMCO 3810/2NM LISN Sn: 9607-1505 (L-019)	05/01/2017	05/01/2019	2 Year*1
Limiter	Hewlett Packard 11947A Limiter Transient Sn: 3107A02888 (L-017)	18/07/2017	18/07/2018	1 Year*1

Note *1. Internal NATA calibration.
Note *2. External NATA / A2LA calibration
Note *3. Calibration date was valid during the time of testing.

3.0 TEST RESULTS

3.1 §15.203 Antenna Requirement

The connector for the antenna was a unique type ensuring that only the intended antennas could be used.

3.2 §15.207 Conducted Limits

3.2.1 Test Procedure

The arrangement specified in ANSI C63.10: 2013 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2: 2009 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

3.2.2 Peak Maximising Procedure

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

3.2.3 Calculation of Voltage Levels

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

$$V_{EMI} = V_{Rx} + L$$

Where: V_{EMI} = The Measured EMI voltage in dBµV to be compared to the limit.
V_{Rx} = The Voltage in dBµV read directly at the EMI receiver.
L = The insertion loss in dB of the LISN, cables and transient Limiter.

3.2.4 Plotting of Conducted Emission Measurement Data

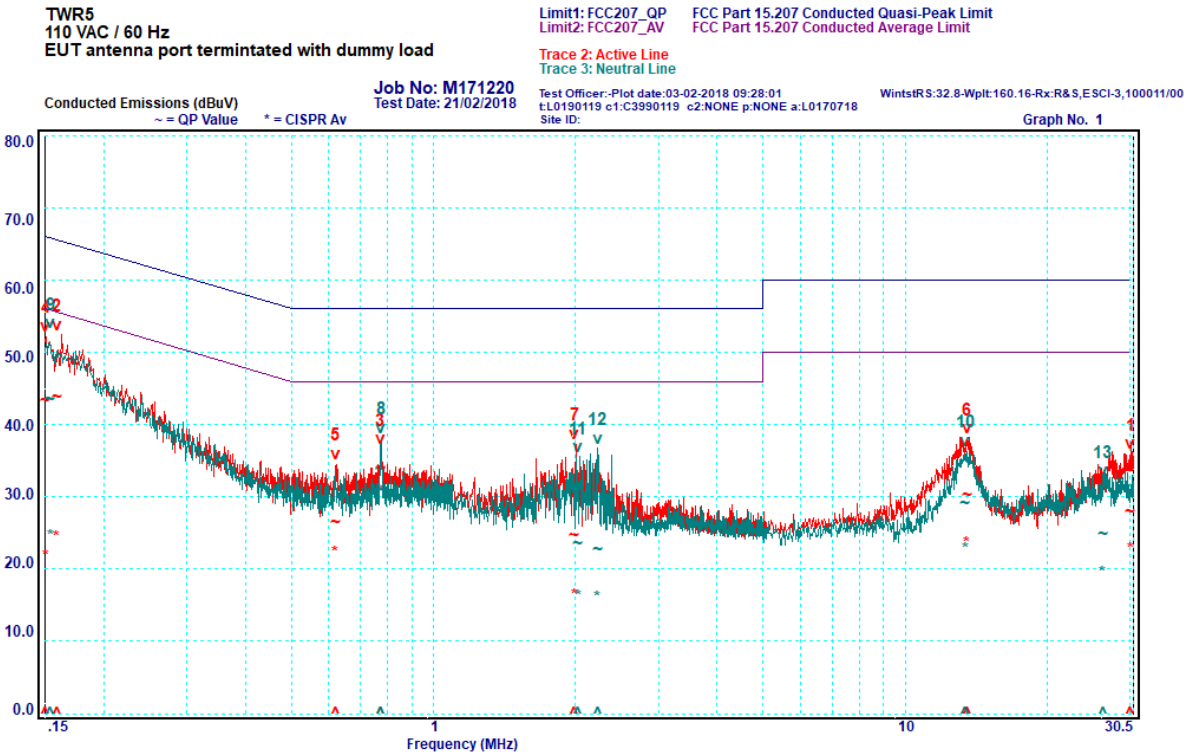
The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

3.2.5 Test Climatic Conditions

Shielded Room Temperature: 23°C
Relative Humidity: 52%

3.2.6 Conclusion

The sample complied with the applicable spurious emissions of §15.207. Refer to the following graphs for the results.



Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dBµV]	Limit [dBµV]	Margin [±dB]	Level [dBµV]	Limit [dBµV]	Margin [±dB]
1	0.160	Active	43.8	65.5	-21.7	24.3	55.5	-31.2
2	0.774	Active	34.0	56	-22.0	30.7	46	-15.3
3	0.151	Active	43.2	66	-22.8	21.7	56	-34.3
4	0.622	Active	26.4	56	-29.6	22.2	46	-23.8
5	13.56	Active	30.2	60	-29.8	23.5	50	-26.5
6	1.994	Active	24.7	56	-31.3	16.3	46	-29.7
7	0.775	Active	33.9	56	-22.1	30.4	46	-15.6
8	0.155	Neutral	43.5	65.7	-22.2	24.4	55.7	-31.3
9	13.45	Neutral	29.1	60	-30.9	22.7	50	-27.3
10	2.032	Neutral	23.4	56	-32.6	16.1	46	-29.9
11	2.231	Neutral	22.6	56	-33.4	15.9	46	-30.1
12	26.27	Neutral	24.9	60	-35.1	19.4	50	-30.6

3.4 §15.205 Restricted Bands of Operation

The restricted band limits were applied across the applicable spectrum and therefore complied with the restricted band requirements.

3.5 §15.209 Radiated emission limits; general requirements

3.5.1 Fundamental emission

Testing was performed in a semi anechoic chamber at a distance of 3 and 10 metres. Different configurations of EUT and antenna polarization were investigated to produce highest emission EIRP and the EUT was set to transmit in continuous transmission mode.

Results:

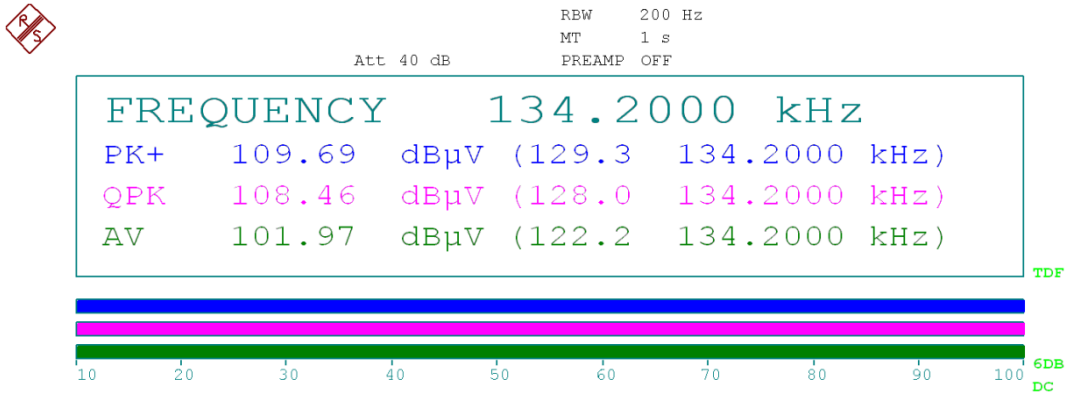
Freq. (kHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Distance (metres)
134.2	122.2	105.1	17.1	3
134.2	87.4	84.1	3.3	10
134.2	-10.9	25.0	**-35.9**	300

Freq. (kHz)	Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Distance (metres)
134.2	129.3	125.1	4.2	3
134.2	92.9	104.1	-11.2	10
134.2	-5.4	45.0	**-50.4**	300

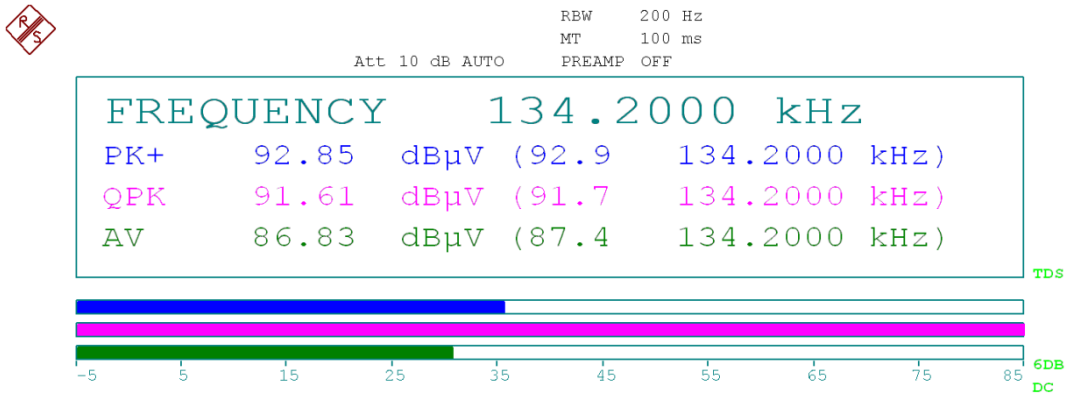
Calculation of extrapolation factor from measurement made at two distances:

3 m to 10 m rolloff = 34.8 dB
3 m to 10 m = 0.523 decade
10 m to 300 m = 1.477 decade
Extrapolation factor = 66.54 dB/decade
10m to 300m correction factor = 66.54 dB/decade x 1.477 decade = 98.28 dB

Subtract 98.28 dB to convert 10 m measurement value to 300 m measurement value.



3 metre measurement



10 metre measurement

3.5.2 Radiated Spurious Measurements

Radiated spurious emission measurements were performed in a semi-anechoic chamber compliant with ANSI C63.4: 2014.

The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of emissions.

Frequency range [MHz]	Measurement Bandwidth [kHz]	Measurement Distance [m]	Antenna
0.009 to 0.150	0.2	3	0.6 metre loop antenna
0.150 to 30	9	3	
30 to 1000	120	3	Biconilog hybrid
1000 to 18 000	1000	3	Standard gain or broad band horns
18 000 to 40 000	1000	1	

The sample was slowly rotated with the spectrum analyser set to Max-Hold. This was performed for at least 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. Devices design for a fixed position were tested in that position, portable devices were tested in three orthogonal orientations.

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.

Calculation of field strength

The field strength was calculated automatically by the software using 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/m.
AF = Antenna Factor in dB. (stored as a data array)
G = Preamplifier Gain in dB. (stored as a data array)
L = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

Field strength conversion over distance

To convert a limit given at a certain distance to a limit at the measurement distance or vice-versa the following equation was applied:

$$E_x = 20 \times \log\left(\frac{d_y \times 10^{E_y/20}}{d_x}\right)$$

Where: E_x = Electric field at x metres (dBµV/m)
E_y = Electric field at y metres (dBµV/m)
d_x = Measurement distance of x metres
d_y = Measurement distance of y metres

3.5.3 Spurious Emission Limit

The EUT emissions were subjected to 15.209 limits over the 9 kHz to 30 MHz range and 15.109 Class A limit over the 30 MHz to 6 GHz range pursuant to 15.31(k) as the device was considered a Class A unintentional radiator.

3.5.4 Radiated Spurious Emission Results

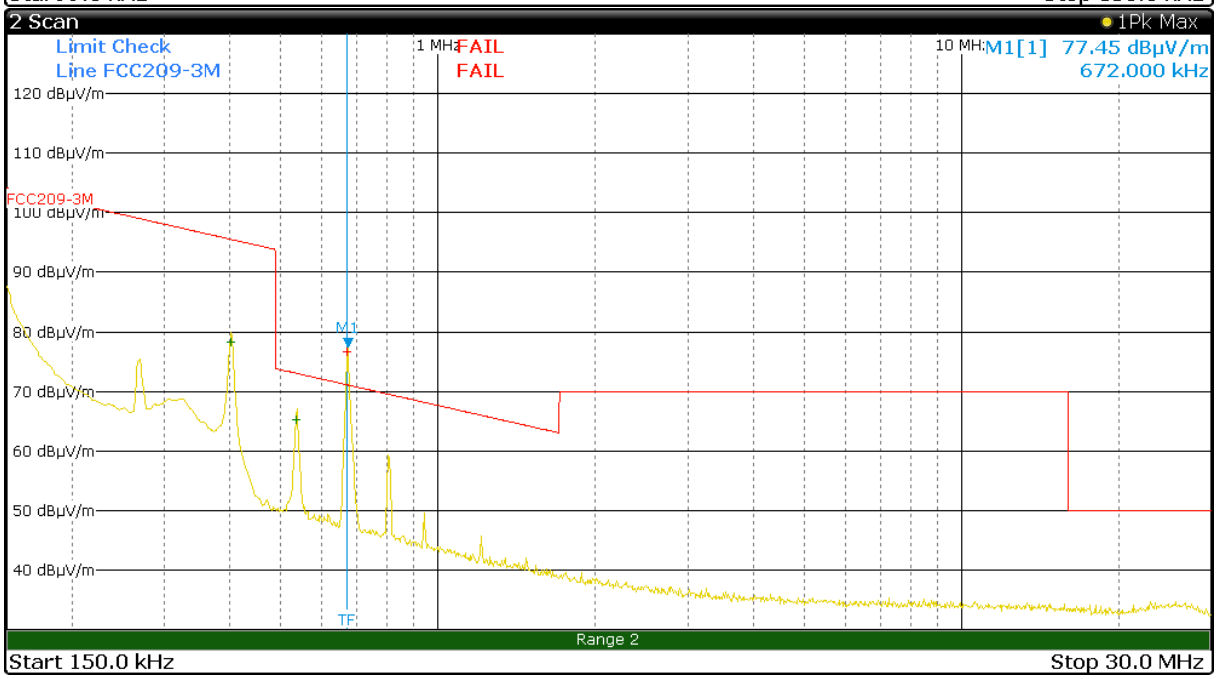
Frequency Band: 9 kHz - 30 MHz

Measurements were made at a distance of 3 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. Measurements were made with the loop antenna oriented perpendicular, parallel and ground-parallel with respect to the sample.

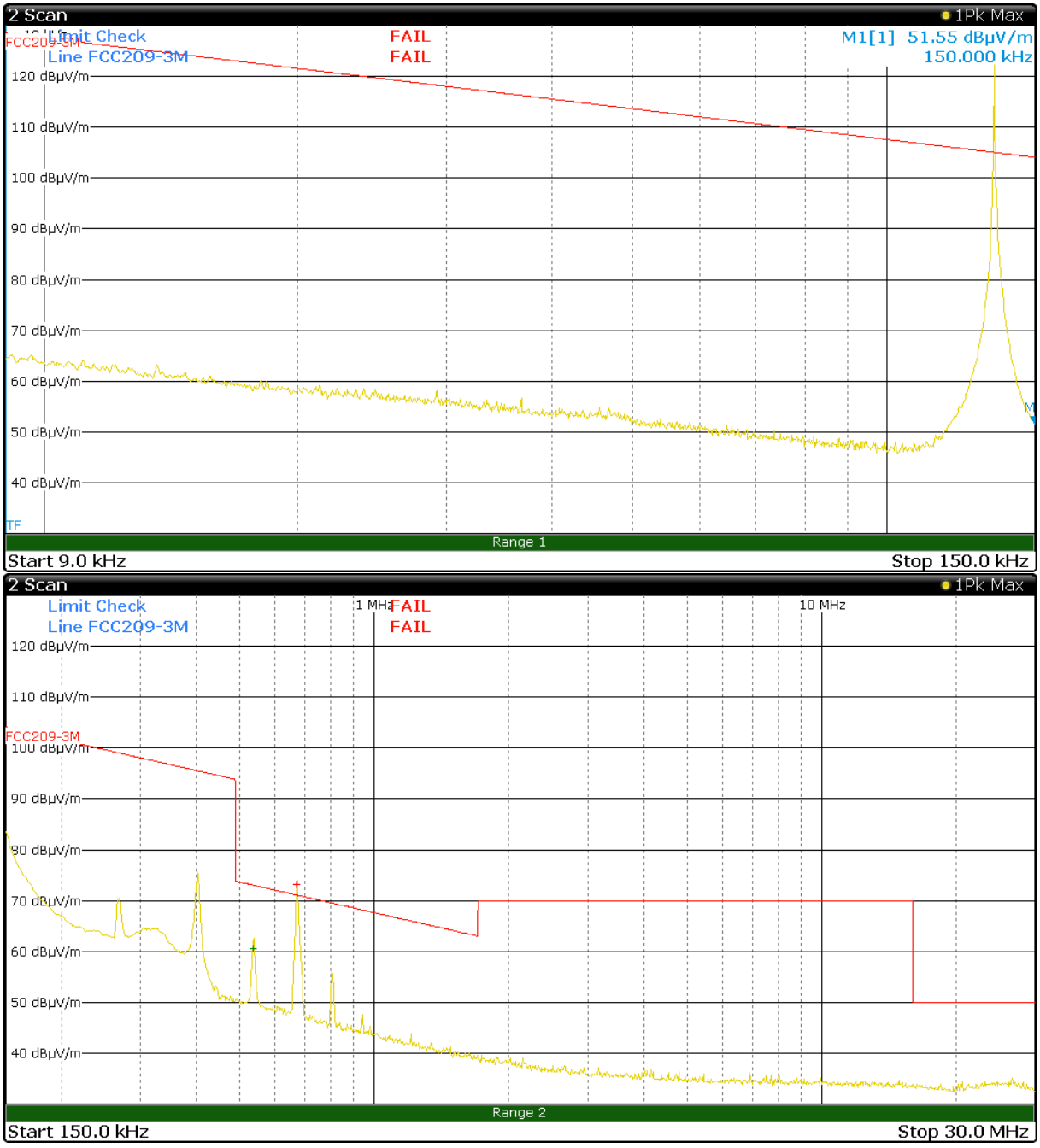
Limit 15.209 was applied over the full range, 9 kHz to 30 MHz.

Frequency MHz	Polarisation	Measured Level dBµV/m	Limit dBµV/m	Margin ±dB	Detector
0.402	Parallel	78.19	147.5	-69.31	AV
0.536	Parallel	65.18	99.0	-33.82	QP
0.671	Parallel	76.59	97.1	-20.51	QP
0.671	Ground - Parallel	68.00	97.1	-29.1	QP
0.537	Perpendicular	60.57	99.0	-38.43	QP
0.671	Perpendicular	73.11	97.1	-23.99	QP

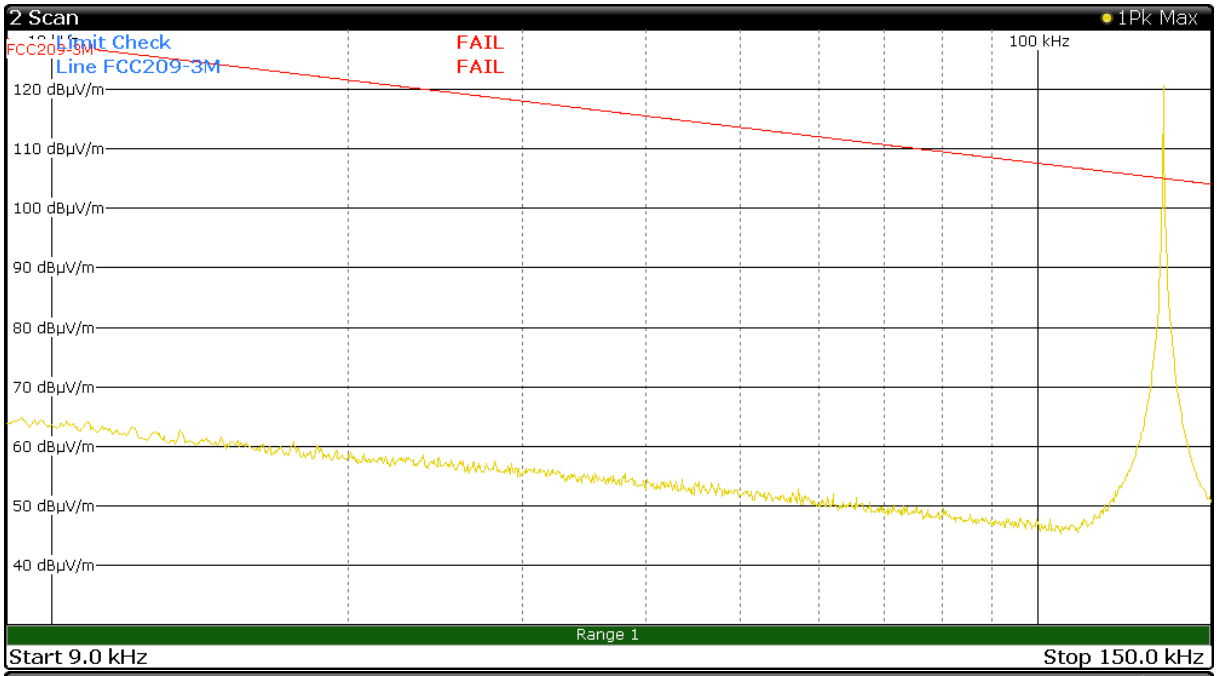
Note: The limit lines used in the following plots use a 40 dB/decade extrapolation factor and are for reference only. The actual limit is per the 66 dB/decade extrapolation factor derived in section 3.5.1 and used in the above table.

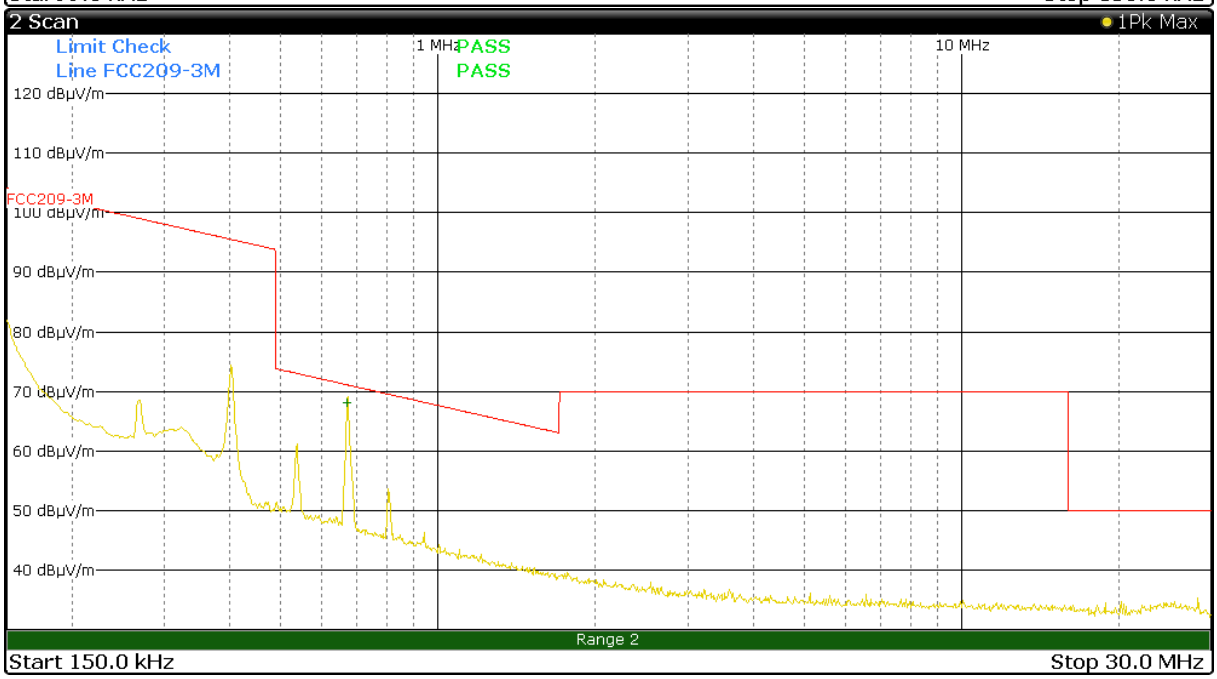


9 kHz to 30 MHz Parallel



9 kHz to 30 MHz Perpendicular





9 kHz to 30 MHz Ground-Parallel

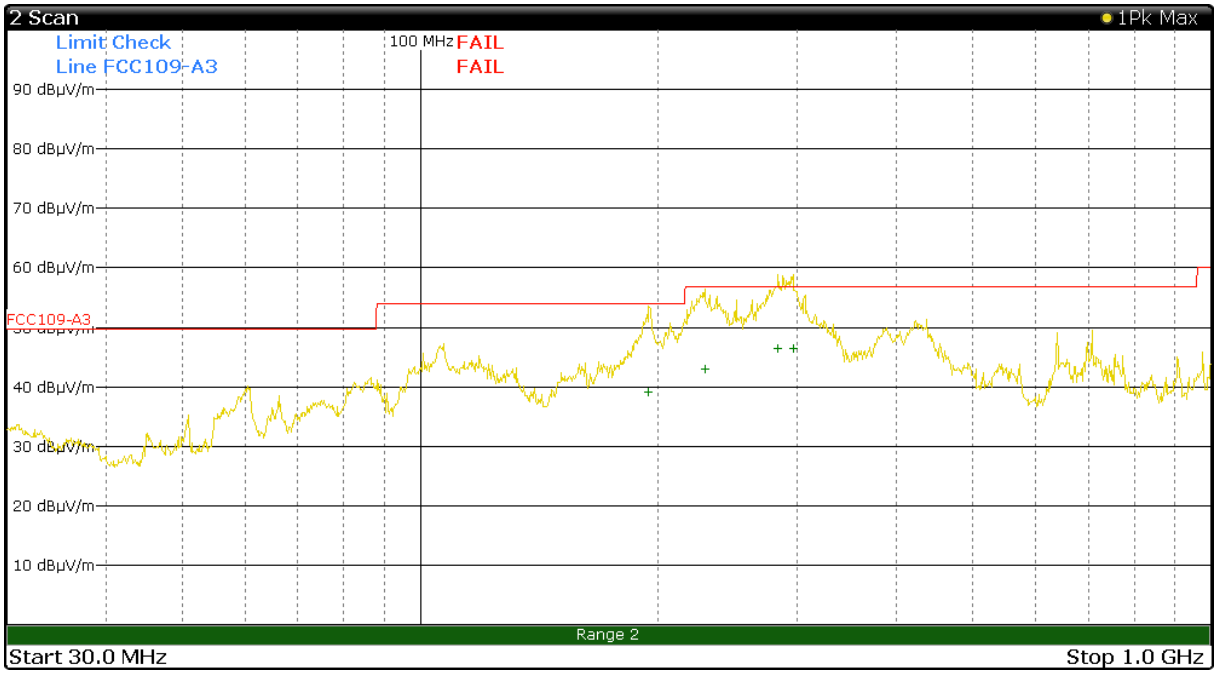
Frequency Band: 30 - 1000 MHz

Measurements were made at a distance of 3 metres. The measurements of emissions between 30 - 1000 MHz were made with a resolution bandwidth (RBW) of 120 kHz and the video bandwidth (VBW) of 300 kHz.

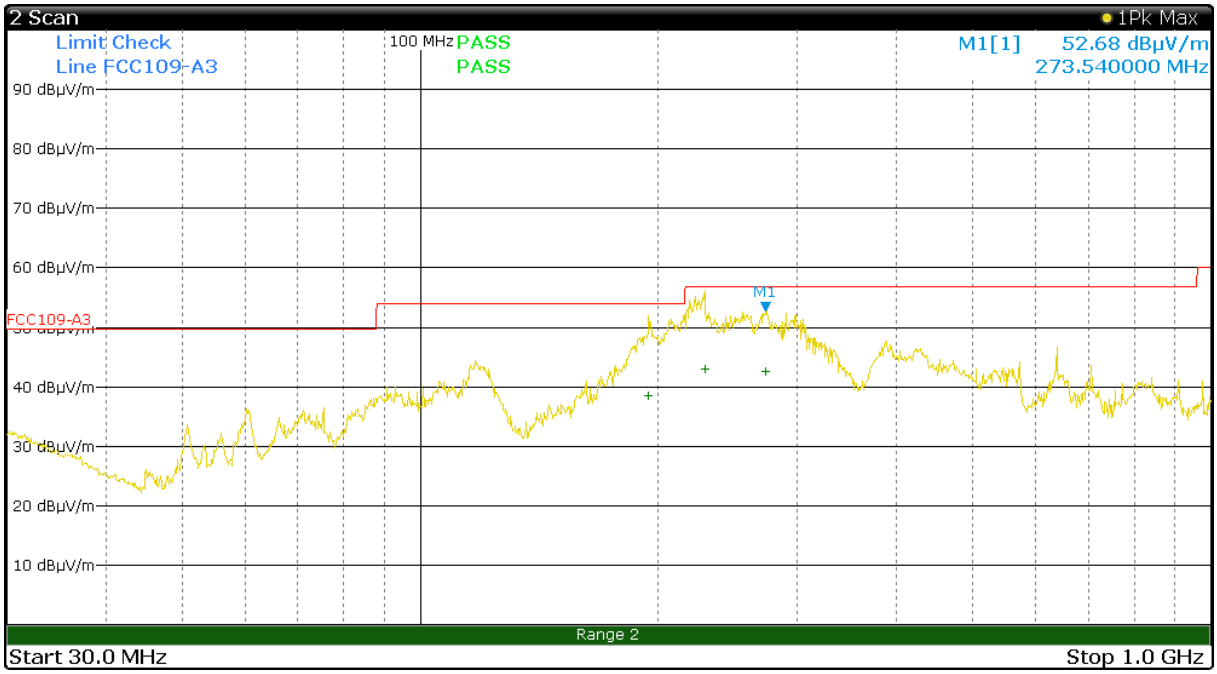
While digital emissions were evaluated according to 15.109 class A from 30-1000 MHz, transmitter related emissions were evaluated according to 15.209 up to 172 MHz .i.e. the 10th harmonic of the highest frequency 17.1776 MHz used in the transmitter circuits. There were no emissions measured in relation to the transmitter circuits.

The §15.109 Class A limits were applied for the digital emissions.

Frequency MHz	Polarisation	Measured Level dBµV/m	Limit dBµV/m	Margin ±dB
296.5	Vertical	46.49	56.9	-10.41
282.9	Vertical	46.37	56.9	-10.53
229.3	Horizontal	42.93	56.9	-13.97
229.2	Vertical	42.88	56.9	-14.02
273.5	Horizontal	42.66	56.9	-14.24
194.5	Vertical	39.06	54.0	-14.94
194.5	Horizontal	38.44	54.0	-15.56



30 MHz to 1000 MHz Vertical



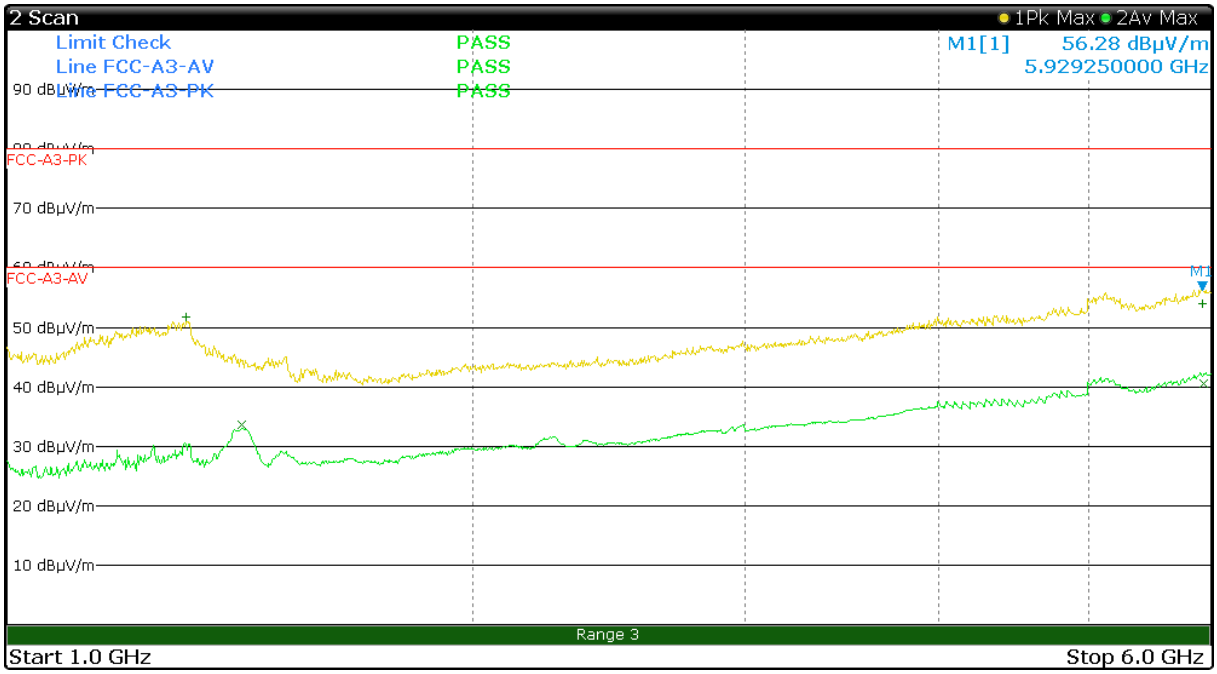
30 MHz to 1000 MHz Horizontal

Frequency Band: 1 000 – 6 000 MHz

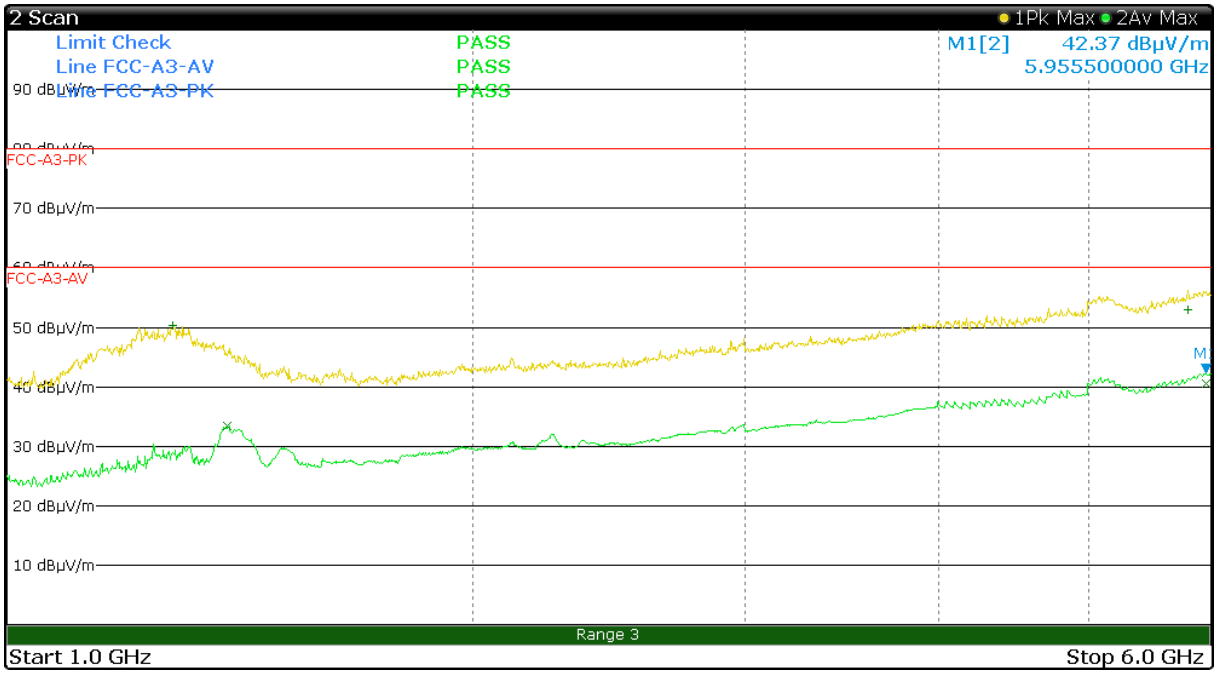
Measurements to 6 GHz were made at a distance of 3 metres. The measurements were made with a resolution bandwidth (RBW) of 1000 kHz and the video bandwidth (VBW) of 1000 kHz.

The §15.109 Class A limits were applied.

Detector	Frequency GHz	Polarisation	Measured Level dBµV/m	Limit dBµV/m	Margin ±dB
AV	5.931	Vertical	40.53	60	-19.47
AV	5.955	Horizontal	40.51	60	-19.49
PK	5.929	Vertical	53.98	80	-26.02
AV	1.419	Vertical	33.69	60	-26.31
AV	1.389	Horizontal	33.49	60	-26.51
PK	5.801	Horizontal	52.96	80	-27.04
PK	1.306	Vertical	51.65	80	-28.35
PK	1.280	Horizontal	50.24	80	-29.76



1 GHz to 6 GHz Vertical



1 GHz to 6 GHz Horizontal

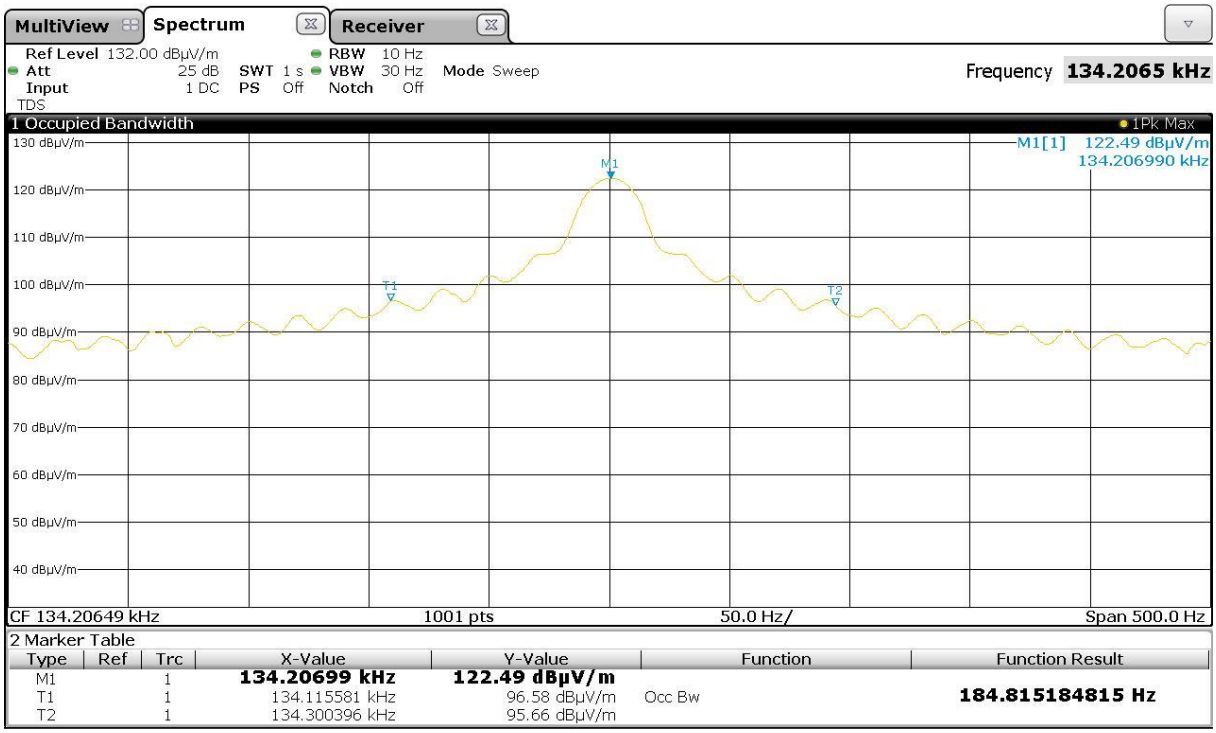
3.6 §1.1310 Maximum Permissible Exposure

The TWR5 complied with the applicable maximum permissible exposure levels. Refer to EMC Technologies report M180325-3.

3.7 §15.215 Occupied bandwidth – 99% power

The bandwidth containing 99% power of the transmitted signal was measured using the procedure from ANSI C63.10 section 6.9.

Channel [kHz]	99% Bandwidth [kHz]	Low Frequency [kHz]	High Frequency [kHz]
134.2	0.184	134.115	134.300



99% Occupied Bandwidth

4.0 COMPLIANCE STATEMENT

The TWR5 Weigh Scale and Reader with Sheep Crate Drafter Antenna tested on behalf of Gallagher Group Ltd **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators) for a transmitter operating at 134.2 kHz.

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	±4.1 dB
	30 MHz to 300 MHz	±5.1 dB
	300 MHz to 1000 MHz	±4.7 dB
	1 GHz to 18 GHz	±4.6 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%.