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RADIO REPORT FOR CERTIFICATION

REPORT NUMBER: M1908029-1

TEST STANDARD: FCC PART 15 SUBPART C

CLIENT: ALLFLEX USA, INC.

DEVICE: RFID TRANSCEIVER MODULE

MODEL: RM4

DATE OF ISSUE: 8 APRIL 2020

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Accreditation No.5292

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RADIO REPORT FOR CERTIFICATION TO FCC PART 15 SUBPART C SECTION 15.209

CERTIFICATE OF COMPLIANCE

Device: RFID Transceiver Module
Model Number: RM4
FCC ID: FCC ID: NQY-RM4

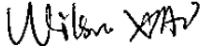
Tested for: Allflex USA, Inc.
Address: 2805 East 14th St. Dallas Texas, United States 75261-2266
Contact: Simon Alfaro
Telephone: (972) 456-3686

Standard: FCC Part 15 – Radio Frequency Devices
Subpart C – Intentional Radiators
Section 15.209 Radiated emission limits; general requirements


Result: The Test Sample complied with Clause §15.209 Radiated emission limits; general requirements of FCC 47 CFR Part 15. Refer to Report M1908029-1 for full details

Test Date(s): 30, 31 October and 2, 19 December, 2019

Issue Date: 8 April 2020

Test Engineer(s): 
Wilson Xiao

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: 
Shabbir Ahmed, PHD
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RADIO REPORT FOR CERTIFICATION TO FCC PART 15 SUBPART C

1 TEST SUMMARY

Section	Clause	Result(s)
6.1	§15.203 Antenna Requirement	Complied
6.2	§15.207 Conducted Limits	Complied
6.3	§15.215 Occupied Bandwidth	Complied
6.4	§15.209 (a) Radiated emission limits; general requirements	Complied

2 TEST FACILITY

2.1 General

EMC Technologies Pty Ltd is accredited by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies Pty Ltd has also been designated 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 Pty Ltd is also an ISED Canada recognized testing laboratory – **ISED company number: 9626A and CAB identifier number: AU0001.**

2.2 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 similar to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation to ISO 17025 for both testing and calibration and ISO 17020 for Inspection – **Accreditation Number 5292.**

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

3 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/yyyy	Due Date dd/mm/yyyy	Cal. Interval
EMI Receiver	Rhode & Schwarz ESR7 Sn: 101804 (R-142)	06/08/2019	06/08/2020	1 Year* ²
	Rohde & Schwarz ESCI Sn: 100011 (R-028)	02/07/2019	02/07/2020	1 Year* ²
Antennas	SUNOL JB1 Sn. A012312 (A-363)	05/06/2018	05/06/2020	2 Year* ²
	EMCO 6502 Active Loop Antenna Sn. 9311-2801 (A-231)	16/11/2018	16/11/2020	2 Year* ¹
Cables* ³	Huber & Suhner Sucoflex 104A Sn: 507095/4A (C-486)	29/01/2019	29/01/2020	1 Year* ¹
	Huber & Suhner Sucoflex 104A Sn: 503056 (C-458)	25/01/2019	25/01/2020	1 Year* ¹
	P1to10mSR N Sn: N/A (C-422)	25/01/2019	25/01/2020	1 Year* ¹

Note *1. Internal NATA calibration.

Note *2. External NATA / A2LA calibration.

Note *3. Cables are verified before measurements are taken.

4 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

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%.

5 DEVICE DETAILS

(Information supplied by the Client)

5.1 EUT (Transmitter) Details

Radio:	RFID Transceiver Module
Model:	RM4
Highest Intentional Frequency:	80 MHz
Operating Frequency:	134.2 kHz
Antenna:	Type 1: 1200x600 panel antenna Type 2: 600x400 panel antenna Type 3: 900x25 panel antenna Type 4: ferrite wand antenna

Note: Type 1, 2 and 3 are similar in construction and have similar radiation patterns. Therefore, Type 1 with the highest gain was tested as the worst-case representative of the three.

Antenna Gains:	Unknown
Antenna Connector:	Socket: GT272213-23048 Plug: GT2722A4-2304B

5.2 EUT (Host) Details

Device under Test:	RFID Transceiver Module
Model Number:	RM4
Power requirements:	12V DC via Plug pack
Plug pack details:	MEAN WELL Model: DR-4512 Input: 100-240V AC, 50/60 Hz, 1.5A Output: 12V DC, 3.5A

5.3 Test Configuration

Testing was performed with the EUT set to transmit continuously at 100% duty and Software setting "RFM Powering Setting: 7" was applied to the transmitter output power.

5.4 Modifications

No modifications were required to achieve compliance.

6 RESULTS

6.1 §15.203 Antenna Requirement

RFID antenna is placed with the RFID Transceiver Module. The below antennas will only be installed by professionals trained by the manufacturer. The said installation will preclude any unauthorised switching of antennas. Special socket and plug connection used.

The RFID Transceiver Module incorporates the following external antenna:

Antenna Type:	Type 1: 1200x600 panel antenna Type 2: 600x400 panel antenna Type 3: 900x25 panel antenna Type 4: ferrite wand antenna
Antenna gain:	Unknown
Antenna Connector:	Socket: GT272213-23048 Plug: GT2722A4-2304B

6.2 §15.207 Conducted Limits

The RFID Transceiver Module is powered by a plug pack as detailed below.

Plug pack:	MEAN WELL
Model:	DR-4512
Input supply:	100-240V AC, 50/60 Hz, 1.5A
Output supply:	12V DC, 3.5A

6.2.1 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 specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured. 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.

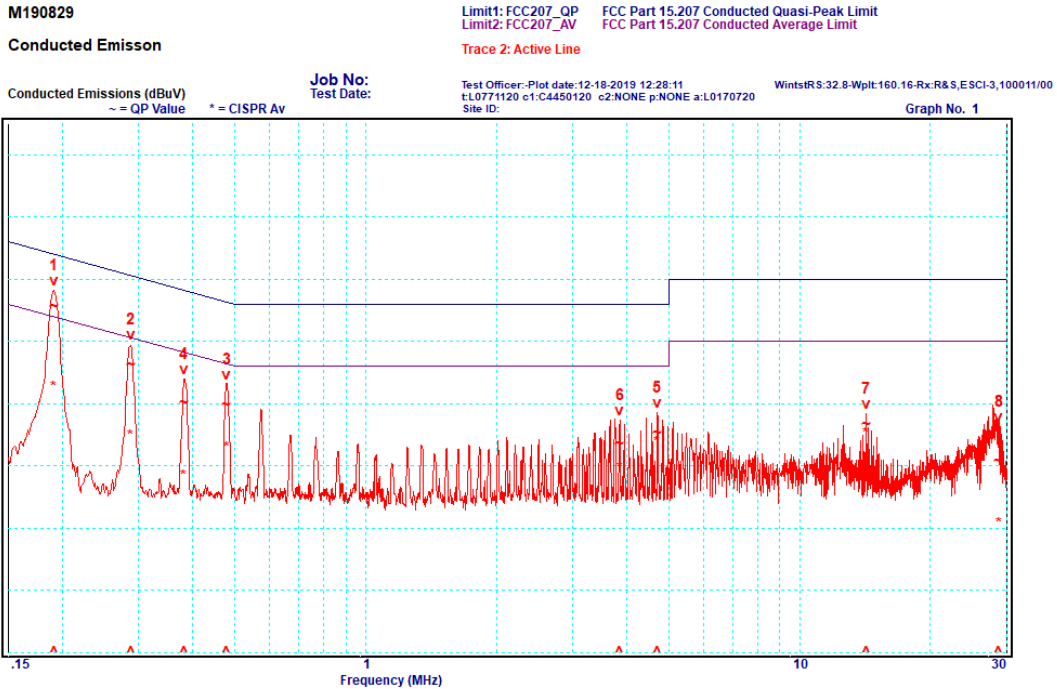
6.2.2 Limits

The limit applied was in accordance to the conducted limits defined in §15.207.

6.2.3 Results

The sample complied with the conducted emission limits of §15.207.

Testing was performed over the frequency range of 150 kHz to 30 MHz at a voltage of 110V AC, 60 Hz.



Graph 6-1: Active Line (0.15 MHz to 30 MHz)

Table 6-1: Active Line (0.15 MHz to 30 MHz)

Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dBμV]	Limit [dBμV]	Margin [dB]	Level [dBμV]	Limit [dBμV]	Margin [dB]
1	0.192	Active	55.6	64	-8.4	42.6	54	-11.4
2	0.288	Active	46.2	60.6	-14.4	34.7	50.6	-15.9
3	0.48	Active	39.7	56.3	-16.6	32.8	46.3	-13.5
4	0.382	Active	40.1	58.2	-18.1	28.2	48.2	-20
5	4.698	Active	35.3	56	-20.7	33.7	46	-12.3
6	3.854	Active	33.4	56	-22.6	29.5	46	-16.5
7	14.23	Active	36.6	60	-23.4	35	50	-15
8	28.75	Active	30.7	60	-29.3	20.6	50	-29.4



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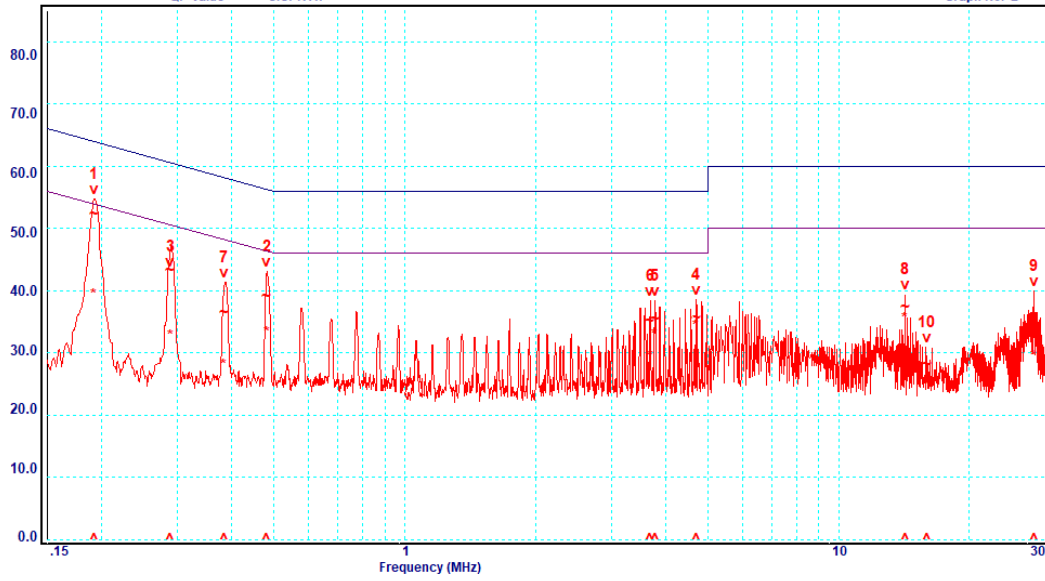
M190829

Conducted Emission

Limit1: FCC207_QP
 Limit2: FCC207_AV
 Trace 2: Neutral Line

FCC Part 15.207 Conducted Quasi-Peak Limit
 FCC Part 15.207 Conducted Average Limit

Conducted Emissions (dBuV) ~ = QP Value * = CISPR Av
 Job No: Test Date: Test Officer: Plot date: 12-18-2019 12:30:31 WinstRS:32.8-Wpit160.16-Rx:R&S_ESCI-3,100011/00
 t:L0771120 e1:G4450120 c2:NONE p:NONE a:L0170720 Site ID: Graph No. 2



Graph 6-2: Neutral Line (0.15 MHz to 30 MHz)

Table 6-2: Neutral Line (0.15 MHz to 30 MHz)

Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dBμV]	Limit [dBμV]	Margin [dB]	Level [dBμV]	Limit [dBμV]	Margin [dB]
1	0.193	Neutral	52.3	63.9	-11.6	39.3	53.9	-14.6
2	0.482	Neutral	39.1	56.3	-17.2	33.2	46.3	-13.1
3	0.289	Neutral	43.2	60.6	-17.4	32.7	50.6	-17.9
4	4.698	Neutral	35.6	56	-20.4	34.1	46	-11.9
5	3.773	Neutral	35.4	56	-20.6	32.8	46	-13.2
6	3.681	Neutral	35	56	-21	29.3	46	-16.7
7	0.384	Neutral	36.5	58.2	-21.7	28	48.2	-20.2
8	14.22	Neutral	37.4	60	-22.6	35.4	50	-14.6
9	28.18	Neutral	33.3	60	-26.7	29.3	50	-20.7
10	15.97	Neutral	28	60	-32	24.6	50	-25.4



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6.3 §15.215 Operating Frequency Range

6.3.1 Test procedure

A near-field passive probe was used to measure the operating frequency range. The RFID reader was allowed to sweep across its band of operation with the EMI receiver set at Max-Hold until the trace stabilised. The occupied bandwidth was recorded.

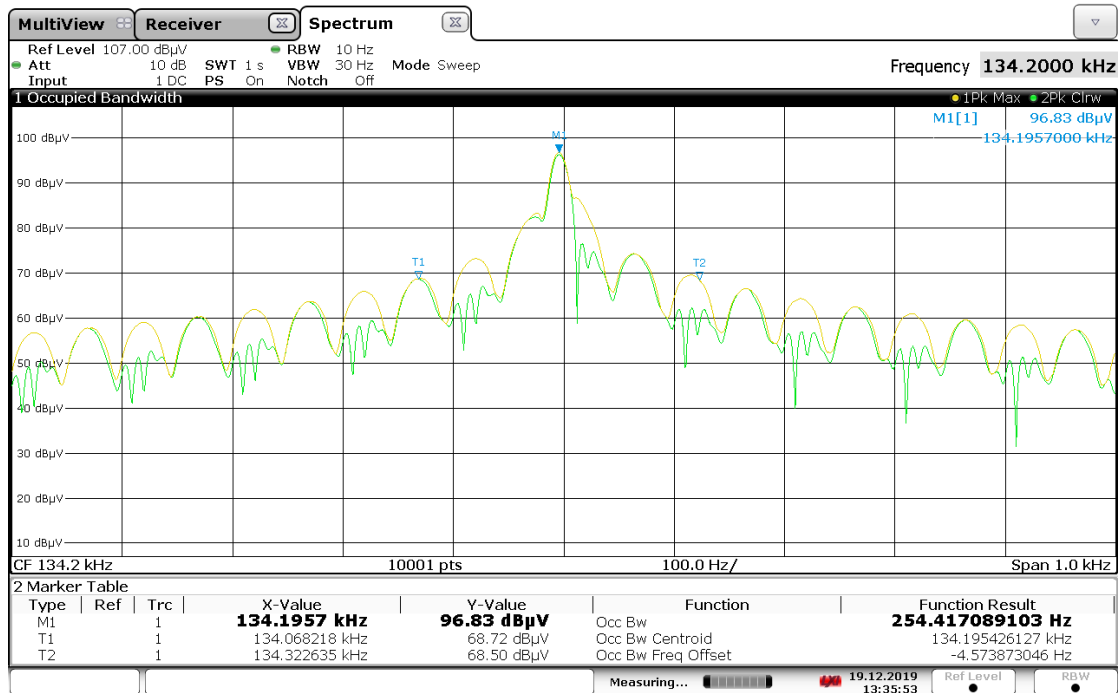
6.3.2 Limits

No set limits.

6.3.3 Results

Table 6-3: Operating Frequency Range

Centre Frequency [kHz]	Low Frequency [kHz]	High Frequency [kHz]	Occupied Bandwidth [kHz]
134.20	134.07	134.32	0.254



13:35:53 19.12.2019

Graph 6-3: Operating Frequency Range

6.4 §15.209 Radiated emission limits; general requirements

6.4.1 Test procedure

Radiated emissions 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 the defined resolution bandwidths 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	10	0.6 metre loop antenna
0.150 to 30	9	10	
30 to 1000	120	10	Biconilog hybrid
1000 to 18 000	1000	3	Standard gain or broadband horn
18 000 to 40 000	1000	1	

EUT was set at 0.8 m for measurements below 1000 MHz.

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. For below 1000 MHz the emissions were measured with a Quasi-Peak detector.

The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both polarisations of the measurement antenna.

The tests were performed at type 1: 1200x600 panel antenna and type 4: ferrite wand antenna.

6.4.2 Limits

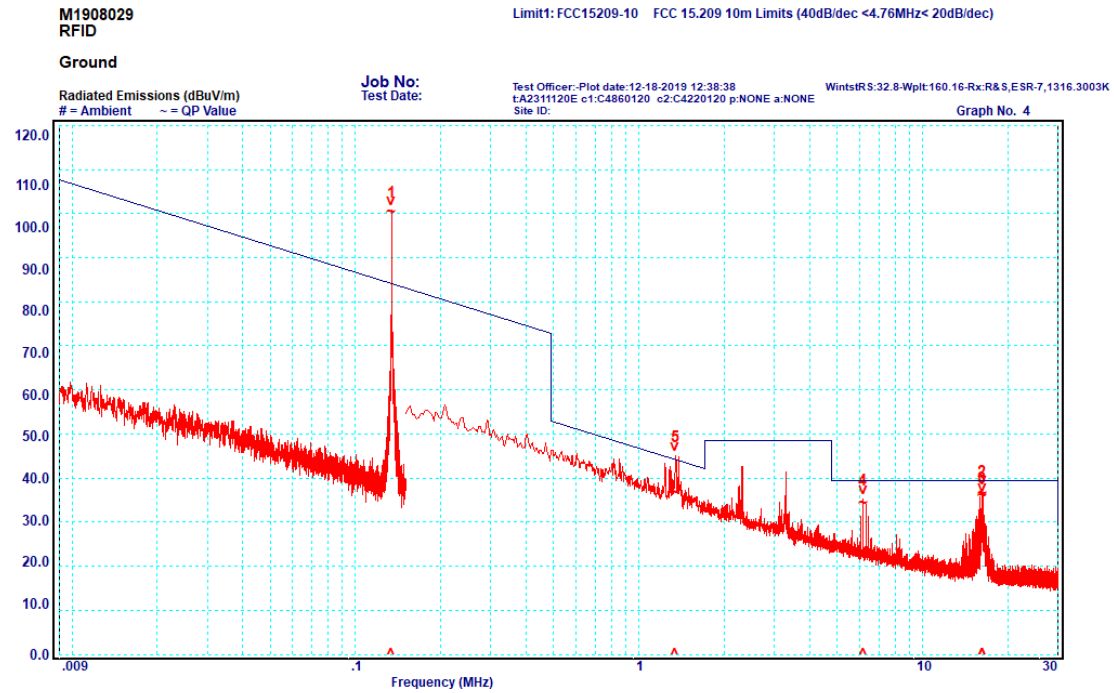
The limit applied is in accordance to the radiated emission limits defined in §15.209.

6.4.3 Results: Frequency Band: 9kHz - 30MHz

All spurious emissions measured in the frequency band 9 kHz – 30 MHz complied with the requirements of §15.209.

Note: Measurement level is extrapolated to limit distance according to Standard ANSI C63.10-2013 Clause 7.7.2 Inductive loop devices without phase-opposed characteristics.

Type 1: 1200x600 panel antenna



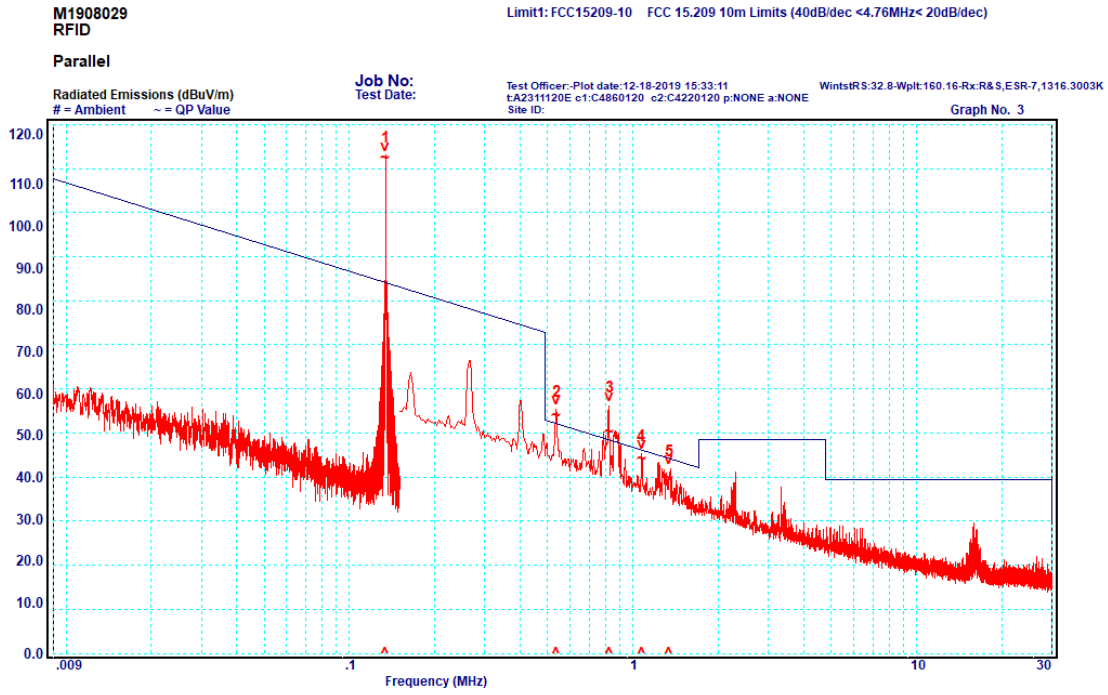
Graph 6-4: Spurious Emissions, 9kHz - 30MHz, Panel Antenna, Ground

Table 6-4: Spurious Emissions, 9kHz - 30MHz, Panel Antenna, Ground

Peak	Polarisation	Frequency (MHz)	Level at 10meters (dBµV/m)	Level Extrapolated to limit distance (dBµV/m)	Limit Distance (meters)	Limit (dBµV/m)	Delta Limit (dB)
1	Ground	0.134	101.28	12.65	300	25.06	-12.41
2	Ground	16.24	36.6	17.52	30	29.54	-12.02
3	Ground	16.24	36	16.92	30	29.54	-12.62
4	Ground	6.173	34.2	15.12	30	29.54	-14.42
5	Ground	1.341	36.8	8.17	30	25.06	-16.89



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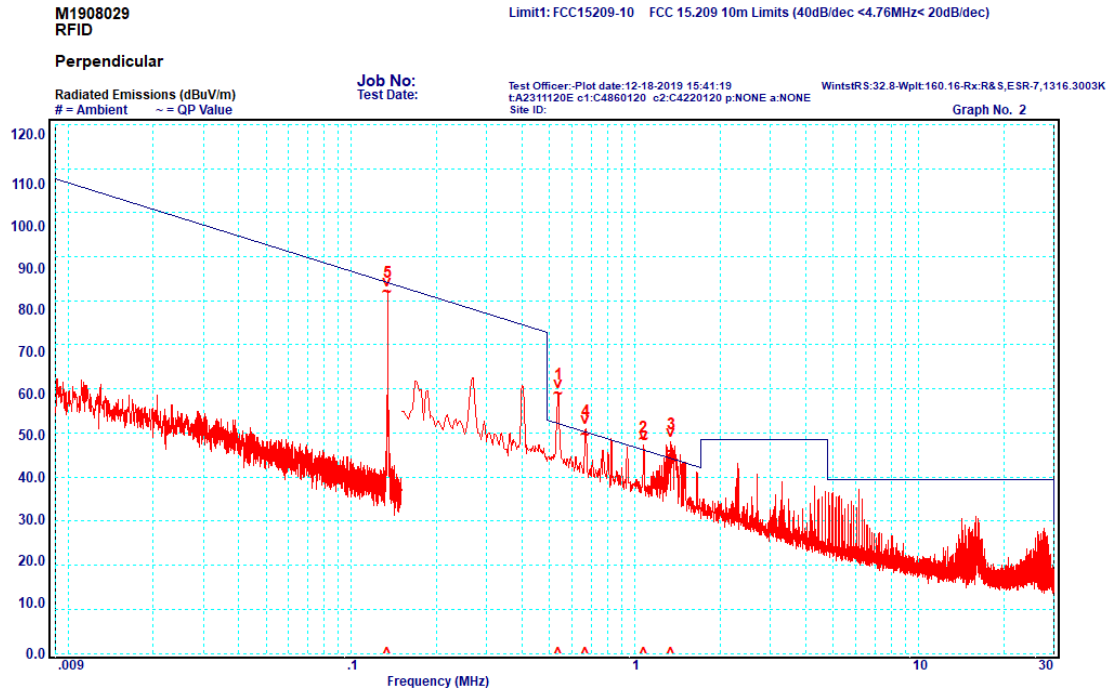


Graph 6-5: Spurious Emissions, 9kHz - 30MHz, Panel Antenna, Parallel

Table 6-5: Spurious Emissions, 9kHz - 30MHz, Panel Antenna, Parallel

Peak	Polarisation	Frequency (MHz)	Level at 10meters (dBµV/m)	Level Extrapolated to limit distance (dBµV/m)	Limit Distance (meters)	Limit (dBµV/m)	Delta Limit (dB)
1	Parallel	0.134	113.06	24.43	300	25.06	-0.63
2	Parallel	0.537	54.0	25.37	30	33.00	-7.63
3	Parallel	0.827	50.1	21.47	30	29.25	-7.78
4	Parallel	1.074	44.0	15.37	30	26.98	-11.61
5	Parallel	1.343	39.7	11.07	30	25.04	-13.97





Graph 6-6: Spurious Emissions, 9kHz - 30MHz, Panel Antenna, Perpendicular

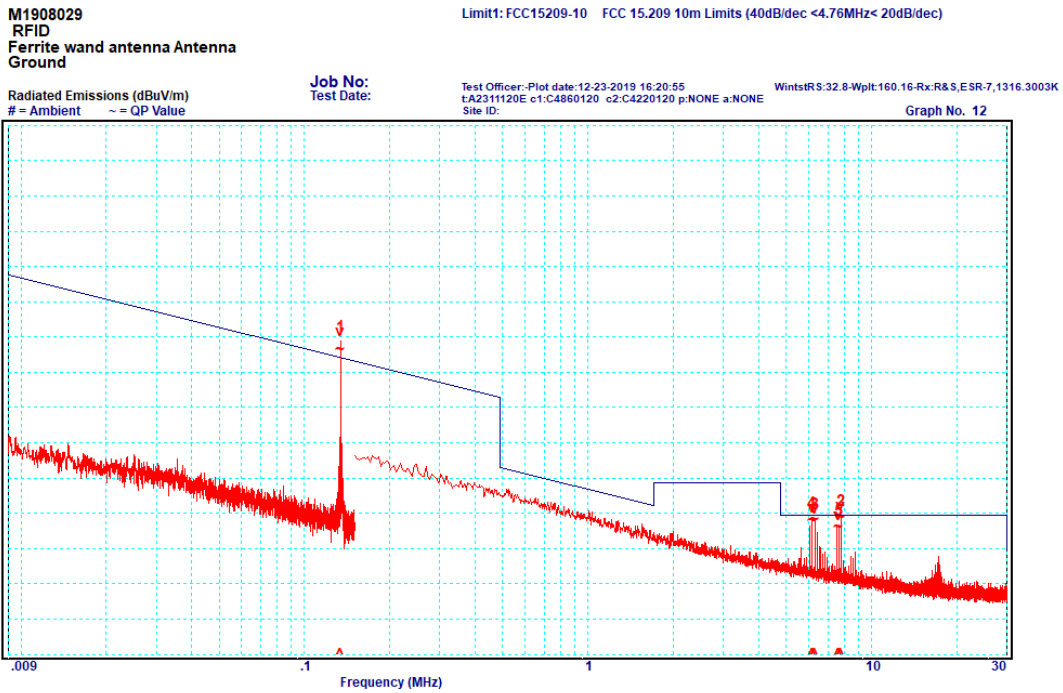
Table 6-6: Spurious Emissions, 9kHz - 30MHz, Panel Antenna, Perpendicular

Peak	Polarisation	Frequency (MHz)	Level at 10meters (dBuV/m)	Level Extrapolated to limit distance (dBuV/m)	Limit Distance (meters)	Limit (dBuV/m)	Delta Limit (dB)
1	Perpendicular	0.537	58.7	30.07	30	33.00	-2.93
2	Perpendicular	1.075	48.6	19.97	30	26.98	-7.01
3	Perpendicular	1.343	45.5	16.87	30	25.04	-8.17
4	Perpendicular	0.670	49.5	20.87	30	31.08	-10.21
5	Perpendicular	0.134	88.97	0.34	300	25.06	-24.72



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Type 4: ferrite wand antenna



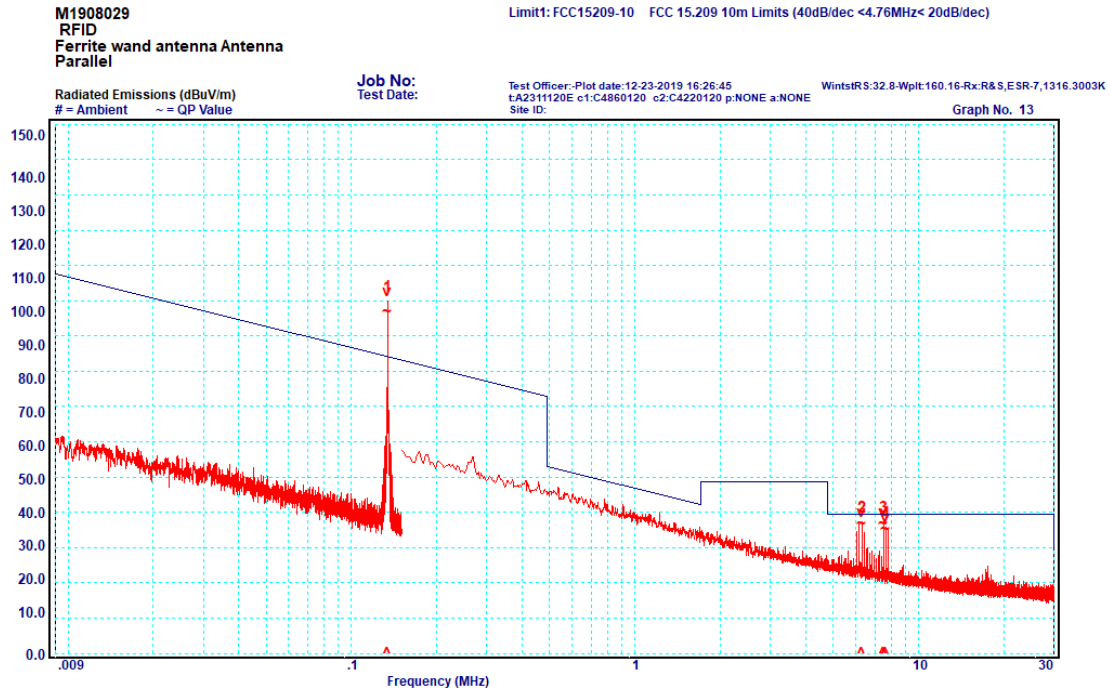
Graph 6-7: Spurious Emissions, 9kHz - 30MHz, Ferrite wand Antenna, Ground

Table 6-7: Spurious Emissions, 9kHz - 30MHz, Ferrite wand Antenna, Ground

Peak	Polarisation	Frequency (MHz)	Level at 10meters (dBµV/m)	Level Extrapolated to limit distance (dBµV/m)	Limit Distance (meters)	Limit (dBµV/m)	Delta Limit (dB)
1	Ground	0.134	86.3	-2.33	300	25.06	-27.39
2	Ground	7.784	38.7	19.62	30	29.54	-9.92
3	Ground	6.308	38.1	19.02	30	29.54	-10.52
4	Ground	6.173	38	18.92	30	29.54	-10.62
5	Ground	7.65	36.2	17.12	30	29.54	-12.42



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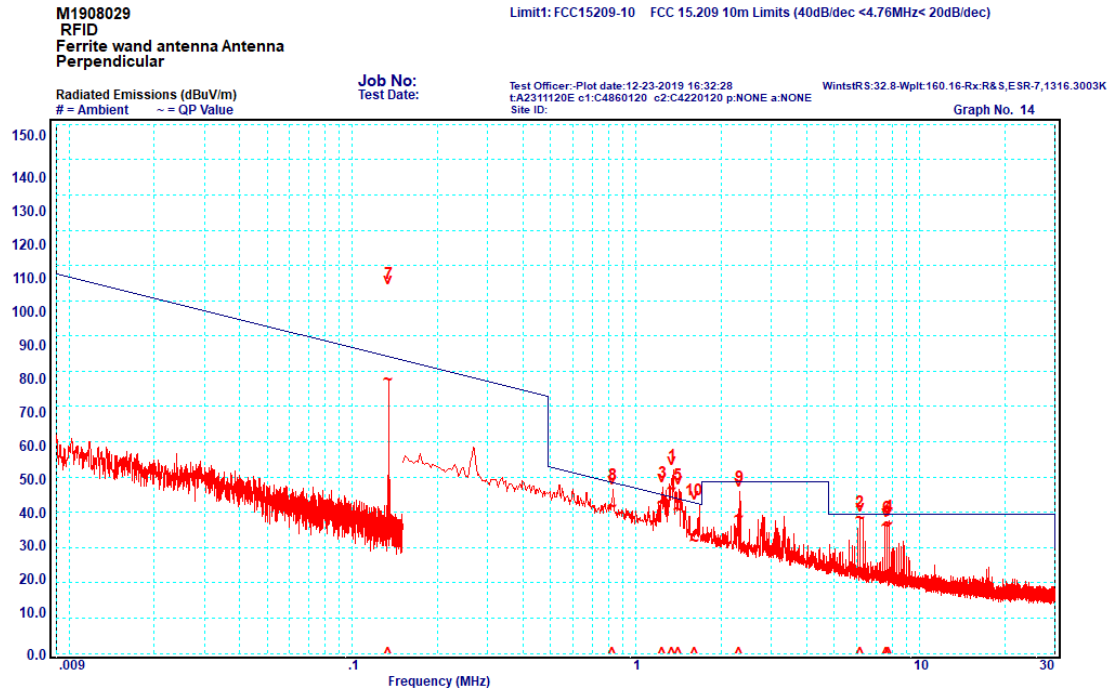
Graph 6-8: Spurious Emissions, 9kHz - 30MHz, Ferrite wand Antenna, Parallel

Table 6-8: Spurious Emissions, 9kHz - 30MHz, Ferrite wand Antenna, Parallel

Peak	Polarisation	Frequency (MHz)	Level at 10meters (dBµV/m)	Level Extrapolated to limit distance (dBµV/m)	Limit Distance (meters)	Limit (dBµV/m)	Delta Limit (dB)
1	Parallel	0.134	96.13	7.50	300	25.06	-17.56
2	Parallel	6.307	36.6	17.52	30	29.54	-12.02
3	Parallel	7.515	36.6	17.52	30	29.54	-12.02
4	Parallel	7.649	35.1	16.02	30	26.54	-13.52



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Graph 6-9: Spurious Emissions, 9kHz - 30MHz, Ferrite wand Antenna, Perpendicular

Table 6-9: Spurious Emissions, 9kHz - 30MHz, Ferrite wand Antenna, Perpendicular

Peak	Polarisation	Frequency (MHz)	Level at 10meters (dBµV/m)	Level Extrapolated to limit distance (dBµV/m)	Limit Distance (meters)	Limit (dBµV/m)	Delta Limit (dB)
1	Perpendicular	1.343	46.5	17.87	30	25.04	-7.17
2	Perpendicular	6.173	38.2	19.12	30	29.54	-10.42
3	Perpendicular	1.242	42.6	13.97	30	25.72	-11.75
4	Perpendicular	7.784	36.7	17.62	30	29.54	-11.92
5	Perpendicular	1.406	40.7	12.07	30	24.64	-12.57
6	Perpendicular	7.65	36.1	17.02	30	29.54	-12.52
7	Perpendicular	0.134	76.56	-12.07	300	25.06	-37.13
8	Perpendicular	0.826	41.6	12.97	30	29.26	-16.29
9	Perpendicular	2.315	38.6	13.23	30	29.54	-16.31
10	Perpendicular	1.608	31.8	3.26	30	23.48	-20.22

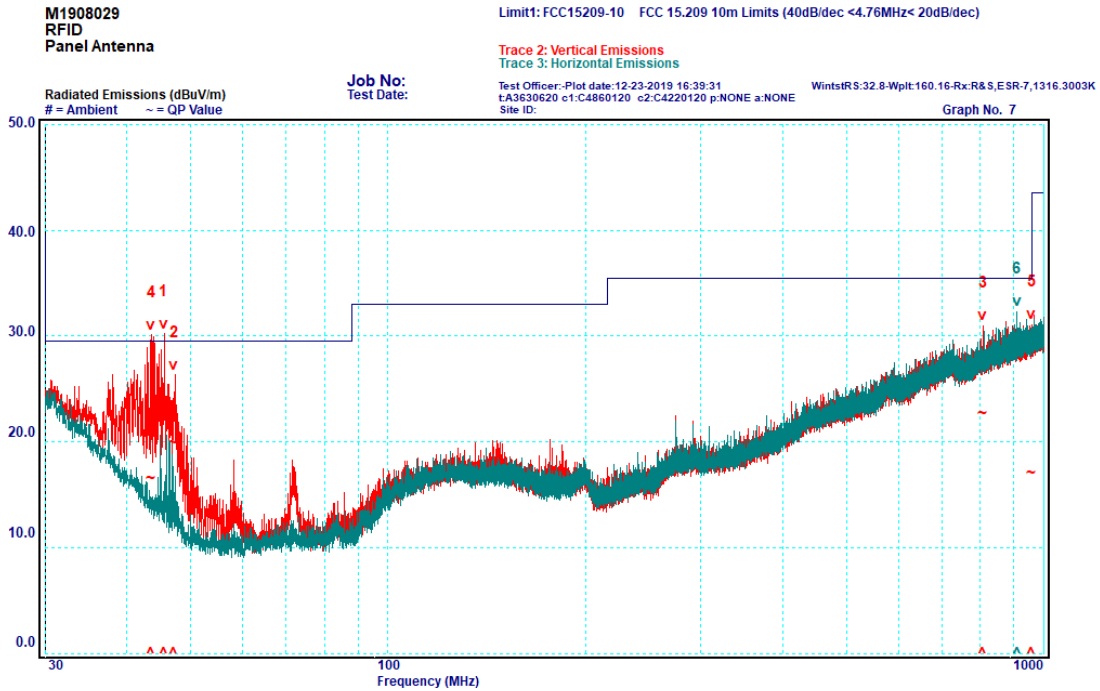


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6.4.4 Results: Frequency Band: 30 – 1000 MHz

All spurious emissions measured in the frequency band 30 MHz to 1000 MHz complied with the requirements of §15.209 (a).

Type 1: 1200x600 panel antenna



Graph 6-10: Spurious Emissions, 30 - 1000 MHz, Panel Antenna

Table 6-10: Spurious Emissions, 30 - 1000 MHz, Panel Antenna

Peak	Polarisation	Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1	45.51	Vertical	23.4	29.5	-6.1
2	47.19	Vertical	19.9	29.5	-9.6
3	807.33	Vertical	22.6	35.5	-12.9
4	43.6	Vertical	16.6	29.5	-12.9
5	958.25	Vertical	17.1	35.5	-18.4
6	910.4	Horizontal	28	35.5	-7.5



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Type 4: ferrite wand antenna

M1908029
RFUD
Ferrite wand Antenna

Limit1: FCC15209-10 FCC 15.209 10m Limits (40dB/dec <4.76MHz< 20dB/dec)

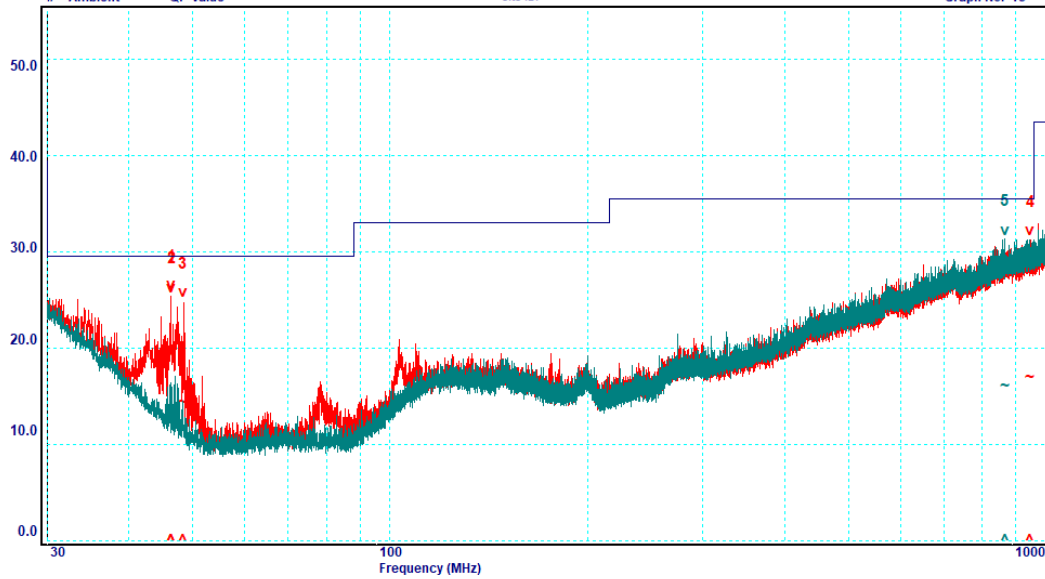
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No:
Test Date:

Test Officer: Plot date: 12-23-2019 16:43:21 WinstRS: 32.8-Wpit:160.16-Rx:R&S,ESR-7,1316.3003K
t:A3630620 c1:C4860120 c2:C4220120 p:NONE a:NONE
Site ID:

Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Graph No. 15



Graph 6-11: Spurious Emissions, 30 - 1000 MHz, Ferrite wand Antenna

Table 6-11: Spurious Emissions, 30 - 1000 MHz, Ferrite wand Antenna

Peak	Polarisation	Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Delta Limit (dB)
1	46.52	Vertical	19.5	29.5	-10
2	46.47	Vertical	19.3	29.5	-10.2
3	48.36	Vertical	14.4	29.5	-15.1
4	947.81	Vertical	16.9	35.5	-18.6
5	866.27	Horizontal	16	35.5	-19.5

END OF REPORT



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