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RADIO TEST REPORT

REPORT NUMBER: M2202042-1

TEST STANDARD: FCC PART 15 SUBPART C SECTION 15.247
ISED RSS-247 SECTION 5.0

CLIENT: FLEET SPACE TECHNOLOGIES

DEVICE: FLEET PORTAL

MODEL: FSPOR0201-2

FCC ID: 2AZ55-FSPOR0201

IC: 27397-FSPOR0201

DATE OF ISSUE: 27 JULY 2022

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.

REVISION TABLE

Version	Sec/Para Changed	Change Made	Date
1		Initial issue of document	27/07/2022

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RADIO TEST REPORT

CERTIFICATE OF COMPLIANCE

Device:	Fleet Portal
Model:	FSPOR0201-2
Serial Number:	POR-01202200008
FVIN:	4.0
Manufacturer:	Fleet Space Technologies
Radio Module:	Semtech SX1250 LoRa Transceiver
FCC ID:	2AZ55-FSPOR0201
IC ID:	27397-FSPOR0201
Tested for:	Fleet Space Technologies
Address:	8A, Myer Court, Beverly, SA 5009
Phone Number:	+61 418823218
Contact:	Flavia Tata Nardini
Email:	flavia@fleetspace.com
Standard:	FCC Part 15, Subpart C, Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz ISED RSS-247, Issue 2, Section 5 Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz
Result:	The Fleet Portal complied with the applicable requirements of the above standards. Refer to Report M2202042-1 for full details.
Test Dates:	12 – 13 May 2022
Issue Date:	27 July 2022
Test Engineer:	Ian Paul Ng
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:	Wilson Xiao Lead Engineer – Radio

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RADIO REPORT FOR CERTIFICATION

1 TEST SUMMARY

Section	Description	FCC	ISED	Result(s)
6.1	Conducted Limits	§15.207	RSS-Gen 8.8	Complied
6.2	Out-of-Band/Spurious Emissions	§15.247(d)	RSS-247 5.5	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: 3569B** and **CAB identifier number: AU0001.**

2.2 Test Laboratory/Accreditations

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 (A^2LA).

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 Keysight 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
Chamber	Frankonia SAC-3-2 (R-144)	10/08/2020	10/08/2023	3 Year*1
EMI Receiver	R&S ESW26 Sn: 101306 (R-143)	21/06/2021	21/06/2022	1 Year*2
Antennas	EMCO 6502 Active Loop Antenna Sn: 2021 (A-310)	31/08/2020	31/08/2022	2 Year*2
	SUNOL JB1 Sn. A052518 (A-434)	13/11/2020	13/11/2022	2 Year*2
	EMCO 3115 Horn Antenna Sn: 9501-4398 (A-406)	10/01/2022	10/01/2025	3 Year*1
Cables*3	Huber & Suhner Sucoflex 104A Sn: 503061/4A (C-463)	04/02/2022	04/02/2023	1 Year*1
	Huber & Suhner Sucoflex 104A Sn: 507100 /4A (C-478)	04/02/2022	04/02/2023	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:

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
	18 GHz to 40 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%.

Application of measurement uncertainty for this report:

The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement instrumentation uncertainty. However, the measurement uncertainty shall appear in the test report.

5 Device Details

(Information supplied by the Client)

The device is a network system that performs the collection and storage of data from the LoRa IoT deployment, as well as forwarding of this data to the satellite constellation.

5.1 EUT (Transmitter) Details

Radio:	Semtech SX1250 LoRa Transceiver
Number of Channels:	8
Frequency Band:	902 – 928 MHz
Operating Frequency:	Low Channel: 923.3 MHz Mid Channel: 925.7 MHz High Channel: 927.5 MHz
Modulation:	LoRa*
Nominal Bandwidth:	500 kHz (declared by client)
Antenna:	External - Blackhawk BH-OM-204 Omni Antenna
Antenna Peak Gain:	6 dBi

Note: LoRa is Semtech's proprietary spread-spectrum modulation technique derived from existing Chirp Spread Spectrum (CSS) technology.

5.2 EUT (Host) Details

Test Sample:	Fleet Portal
Model:	FSPOR0201-2
Serial Number:	POR-01202200008
FVIN:	4.0
Supply Plug:	Meanwell AC/DC Switching Adaptor Model No: GST60A12 (SN: EB8AF18284) Input: 100-240VAC, 50/60Hz Output: 12VDC, 5.0A, 60W Max

5.3 Test Configuration

Testing was performed with the transceiver set to transmit continuously at Low, Mid and High Channels with the following commands during the test.

Low channel – 923.3 MHz
cd /usr/bin/ap1 && ./reset_lgw.sh reset && /opt/libloragw-sx1302/gateway-utils/test_loragw_hal_tx -k 0 -c 0 -r 1250 -f 923.3 -m LORA -s 7 -b 500 -n 100000 -t 1000 -j -e /dev/spidev2.0 -p 23 --mix 5 --pa 1 --pwid 6

Mid channel – 925.7 MHz
cd /usr/bin/ap1 && ./reset_lgw.sh reset && /opt/libloragw-sx1302/gateway-utils/test_loragw_hal_tx -k 0 -c 0 -r 1250 -f 925.7 -m LORA -s 7 -b 500 -n 100000 -t 1000 -j -e /dev/spidev2.0 -p 23 --mix 5 --pa 1 --pwid 6

High channel – 927.5 MHz
cd /usr/bin/ap1 && ./reset_lgw.sh reset && /opt/libloragw-sx1302/gateway-utils/test_loragw_hal_tx -k 0 -c 0 -r 1250 -f 927.5 -m LORA -s 7 -b 500 -n 100000 -t 1000 -j -e /dev/spidev2.0 -p 23 --mix 5 --pa 1 --pwid 6

5.4 Modifications

No modifications were required to achieve compliance.

5.5 Deviations from the Standard

No deviations from the Standard.

6 RESULTS

6.1 §15.207 / RSS-Gen 8.8 Conducted Limits

6.1.1 Test Procedure

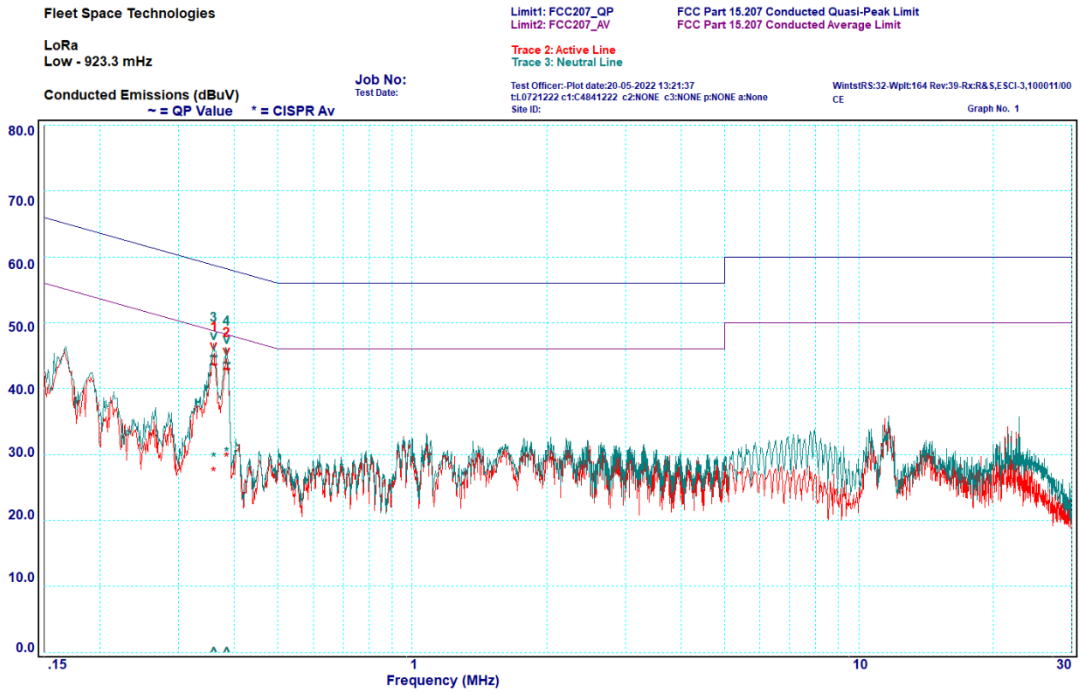
The arrangement specified in ANSI C63.10: 2013 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2: 2009 was used to perform the measurements.

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.

6.1.2 Limits

The limit applied was in accordance to the conducted limits defined in §15.207 / RSS-Gen 8.8.

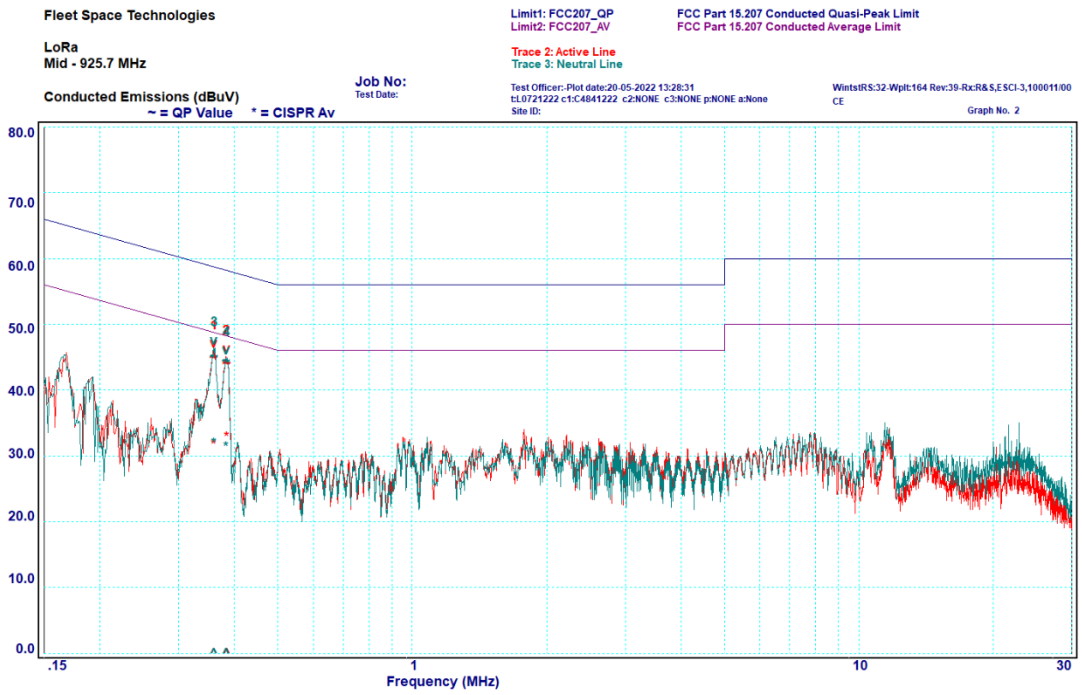
6.1.3 Results



Graph 6-1: AC Conducted Emission, Low channel, 923.3 MHz

Table 6-1: AC Conducted Emission, Low channel, 923.3 MHz

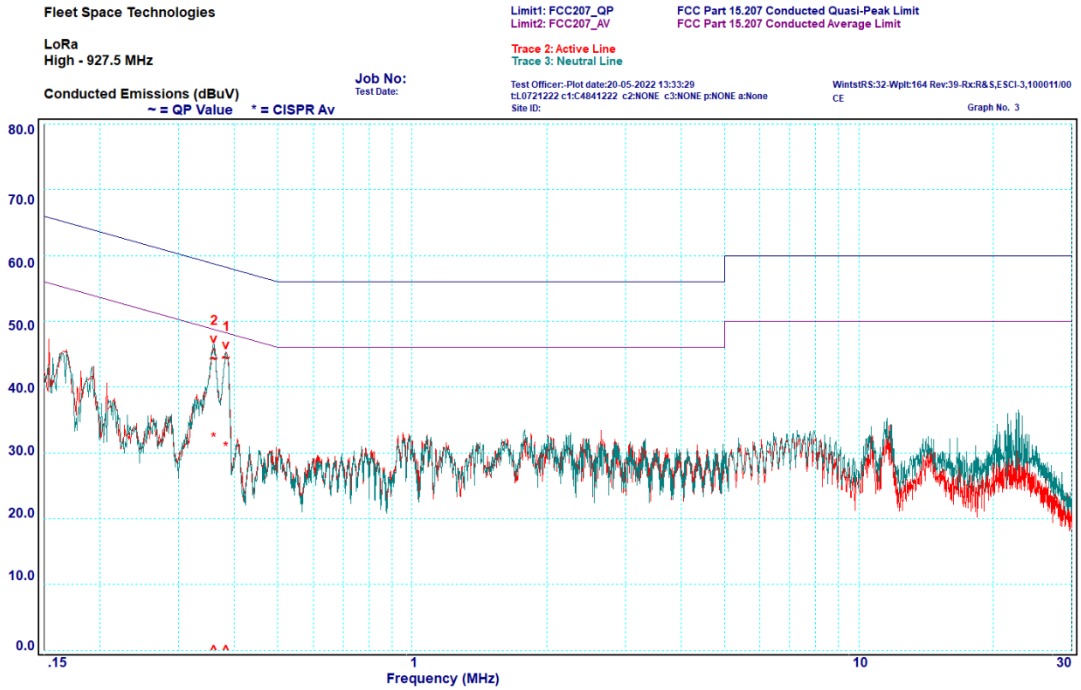
Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dBµV]	Limit [dBµV]	Margin [dB]	Level [dBµV]	Limit [dBµV]	Margin [dB]
1	0.360	Active	43.5	58.7	-15.2	27.3	48.7	-21.4
2	0.384	Active	42.9	58.2	-15.3	29.6	48.2	-18.6
3	0.359	Neutral	44.8	58.7	-13.9	29.5	48.7	-19.2
4	0.385	Neutral	43.8	58.2	-14.4	30.4	48.2	-17.8



Graph 6-2: AC Conducted Emission, Mid channel, 925.7 MHz

Table 6-2: AC Conducted Emission, Mid channel, 925.7 MHz

Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dBµV]	Limit [dBµV]	Margin [dB]	Level [dBµV]	Limit [dBµV]	Margin [dB]
1	0.360	Active	45.0	58.7	-13.7	31.8	48.7	-16.9
2	0.384	Active	44.1	58.2	-14.1	32.9	48.2	-15.3
3	0.360	Neutral	45.1	58.7	-13.6	32.0	48.7	-16.7
4	0.383	Neutral	44.4	58.2	-13.8	31.4	48.2	-16.8



Graph 6-3: AC Conducted Emission, High channel, 927.5 MHz

Table 6-3: AC Conducted Emission, High channel, 927.5 MHz

Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dBµV]	Limit [dBµV]	Margin [dB]	Level [dBµV]	Limit [dBµV]	Margin [dB]
1	0.383	Active	44.4	58.2	-13.8	30.9	48.2	-17.3
2	0.360	Active	44.3	58.7	-14.4	32.3	48.7	-16.4

6.2 §15.247(d) / RSS-247 5.5 Out-of-Band/Spurious Emissions

6.2.1 Test procedure

Radiated out-of-band/spurious 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	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 broadband horn
18 000 to 40 000	1000	1	

EUT was set at a height of 0.8 m for measurements below 1000 MHz and set at a height of 1.5 m for measurements above 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, and for above 1000 MHz the emissions were measured with Peak and 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 polarisations of the measurement antenna.

Measurements on the worst EUT orientation axis are presented below.

6.2.2 Limits

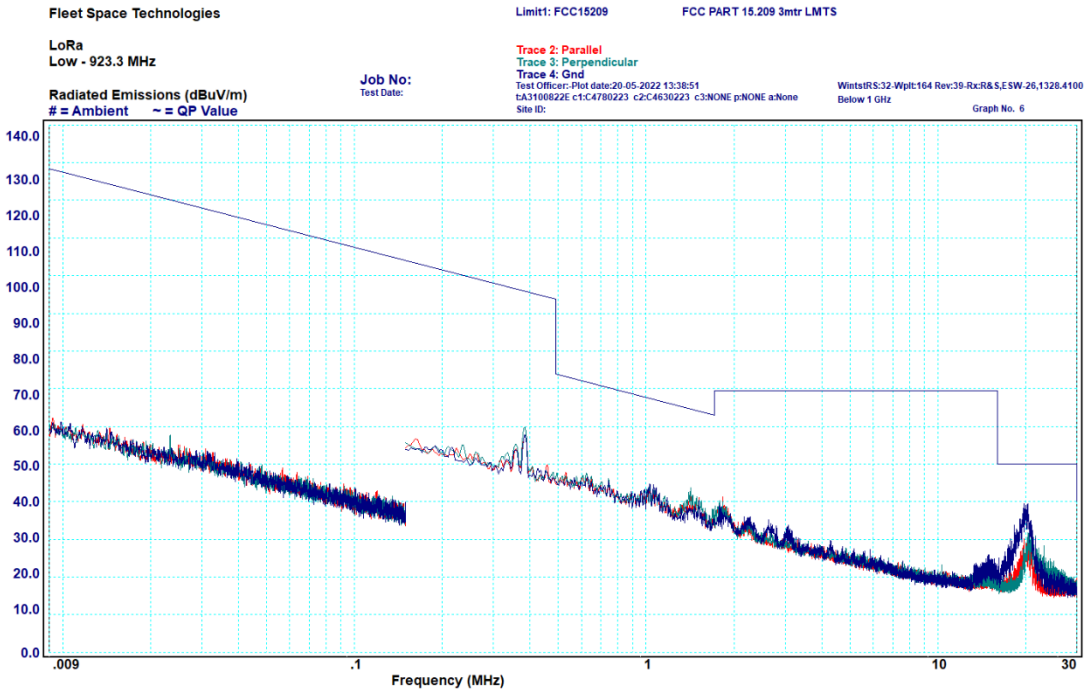
The limit applied is in accordance with the out-of-band/spurious emissions limit defined in §15.247(d).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

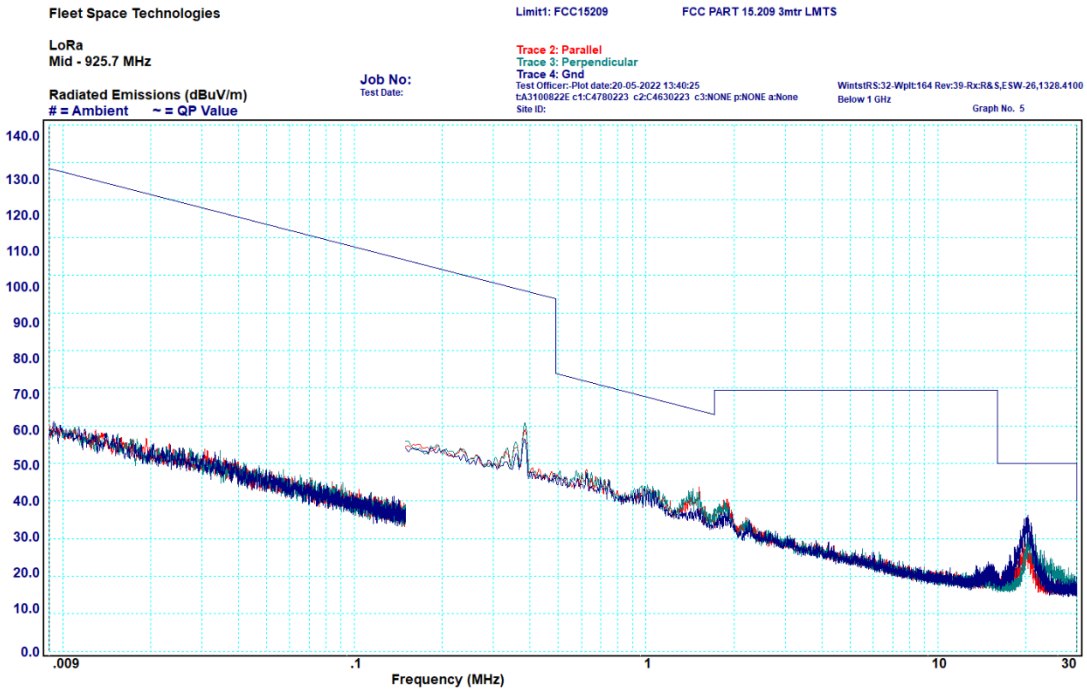
However, the general limits of §15.209 apply for the restricted bands of operation defined in §15.205.

6.2.3 Transmitter Spurious Emissions: 9 kHz to 30 MHz

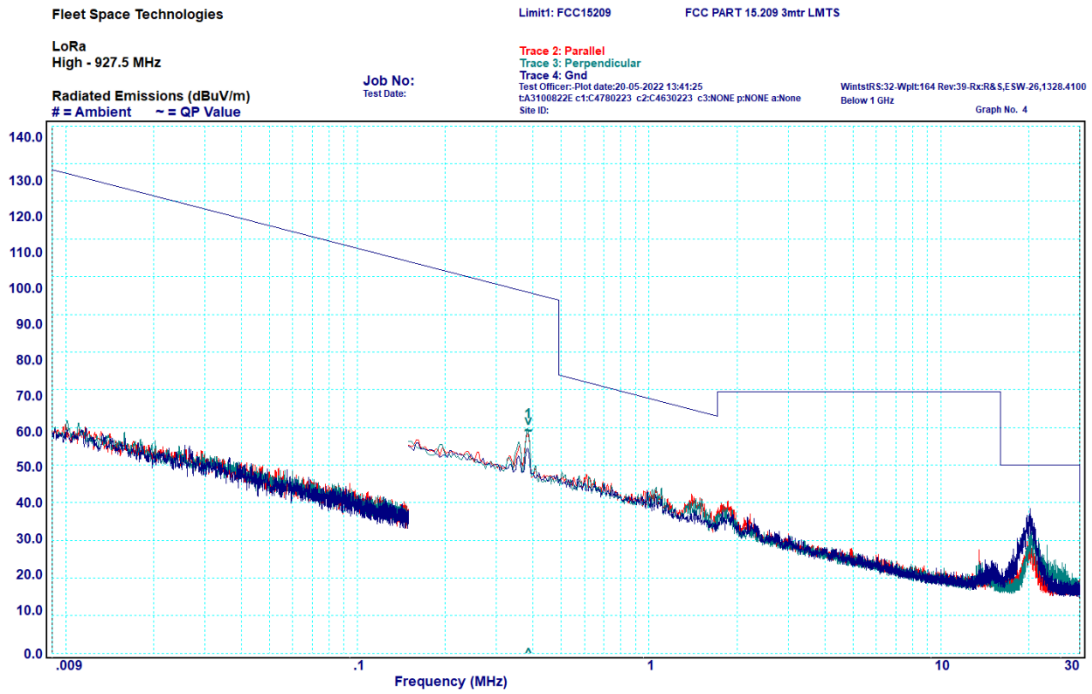
All emissions measured in the frequency band 9kHz - 30MHz complied with the requirements of the standard.



Graph 6-4: Transmitter Spurious Emissions, 9 kHz – 30 MHz, 923.3 MHz



Graph 6-5: Transmitter Spurious Emissions, 9 kHz – 30 MHz, 925.7 MHz



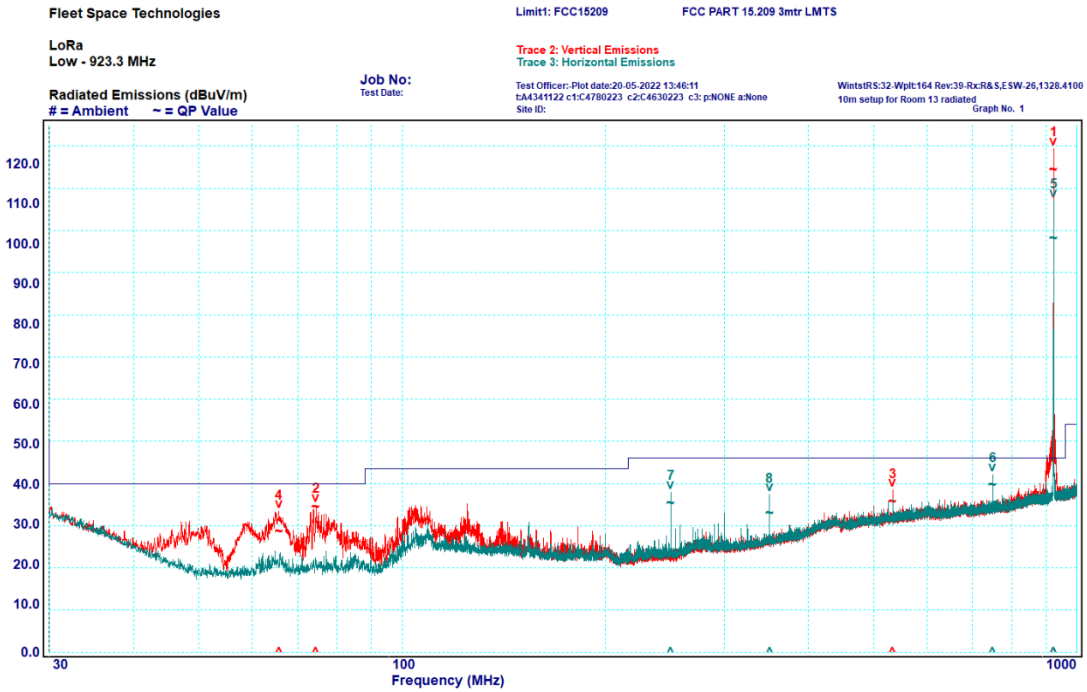
Graph 6-6: Transmitter Spurious Emissions, 9 kHz – 30 MHz, 927.5 MHz

Table 6-4: Transmitter Spurious Emissions, 9 kHz – 30 MHz, 927.5 MHz

Peak	Frequency [MHz]	Polarisation	Quasi peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	0.386	Perpendicular	59.0	95.9	-36.9

6.2.4 Transmitter Spurious Emissions: 30 - 1000 MHz

All emissions measured in the frequency band 30 – 1000 MHz complied with the requirements of the standard.

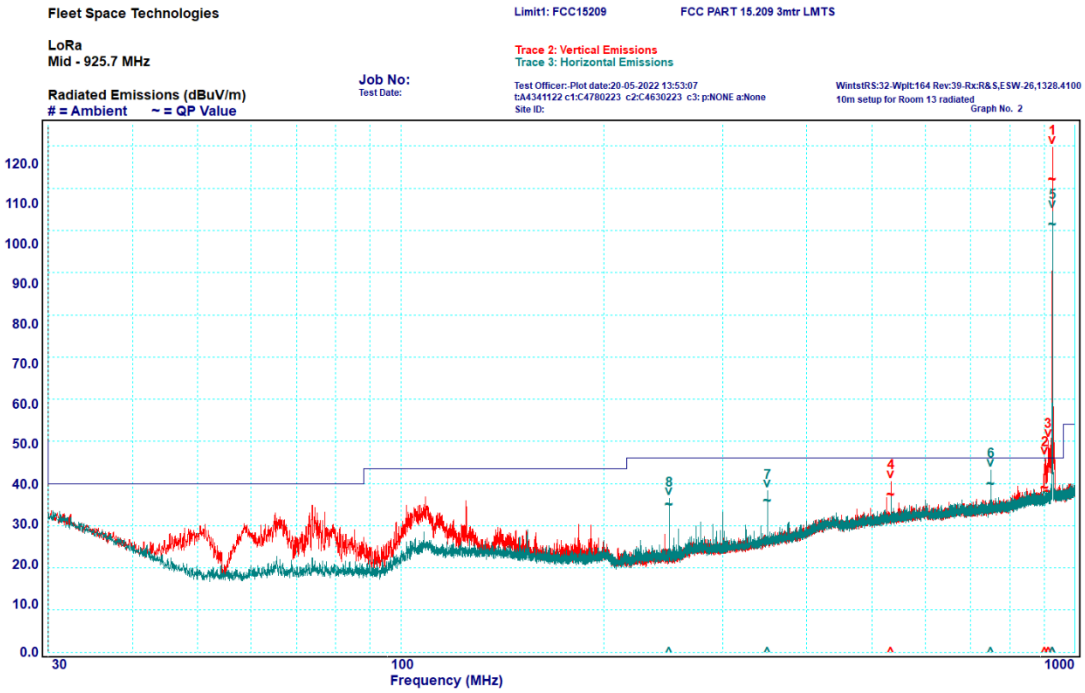


Graph 6-7: Transmitter Spurious Emissions, 30 – 1000 MHz, 923.3 MHz

Table 6-5: Transmitter Spurious Emissions, 30 – 1000 MHz, 923.3 MHz

Peak	Frequency [MHz]	Polarisation	Quasi peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1*	923.37	Vertical	N/A	N/A	N/A
2	74.56	Vertical	34.4	40.0	-5.6
3	533.09	Vertical	35.8	46.0	-10.2
4	65.68	Vertical	28.6	40.0	-11.4
5*	923.29	Horizontal	N/A	N/A	N/A
6	750.01	Horizontal	39.7	46.0	-6.3
7	250.02	Horizontal	35.3	46.0	-10.7
8	350.03	Horizontal	32.9	46.0	-13.1

Note: Peaks 1 and 5 are the fundamental transmission and not subject to the spurious emissions limit of the standard.

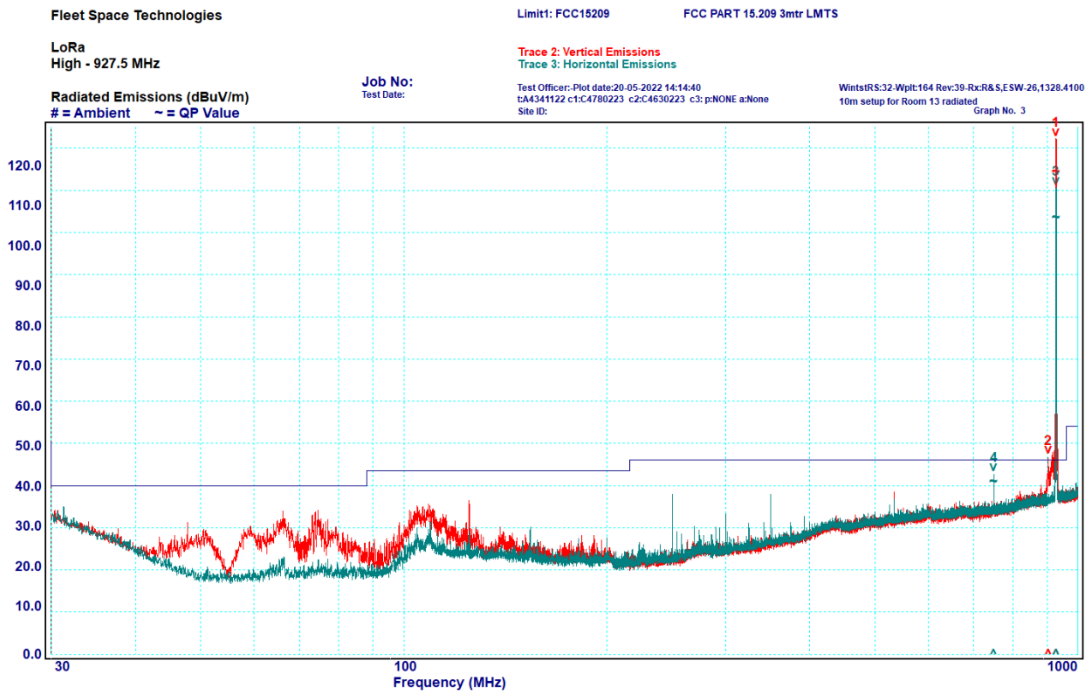


Graph 6-8: Transmitter Spurious Emissions, 30 – 1000 MHz, 925.7 MHz

Table 6-6: Transmitter Spurious Emissions, 30 – 1000 MHz, 925.7 MHz

Peak	Frequency [MHz]	Polarisation	Quasi peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1*	925.50	Vertical	N/A	N/A	N/A
2	902.0	Vertical	38.9	46.0	-7.1
3	913.22	Vertical	38.1	46.0	-7.9
4	533.05	Vertical	37.3	46.0	-8.7
5*	925.47	Horizontal	N/A	N/A	N/A
6	749.99	Horizontal	39.8	46.0	-6.2
7	349.99	Horizontal	35.8	46.0	-10.2
8	250.01	Horizontal	34.9	46.0	-11.1

Note: Peaks 1 and 5 are the fundamental transmission and not subject to the spurious emissions limit of the standard.



Graph 6-9: Transmitter Spurious Emissions, 30 – 1000 MHz, 927.5 MHz

Table 6-7: Transmitter Spurious Emissions, 30 – 1000 MHz, 927.5 MHz

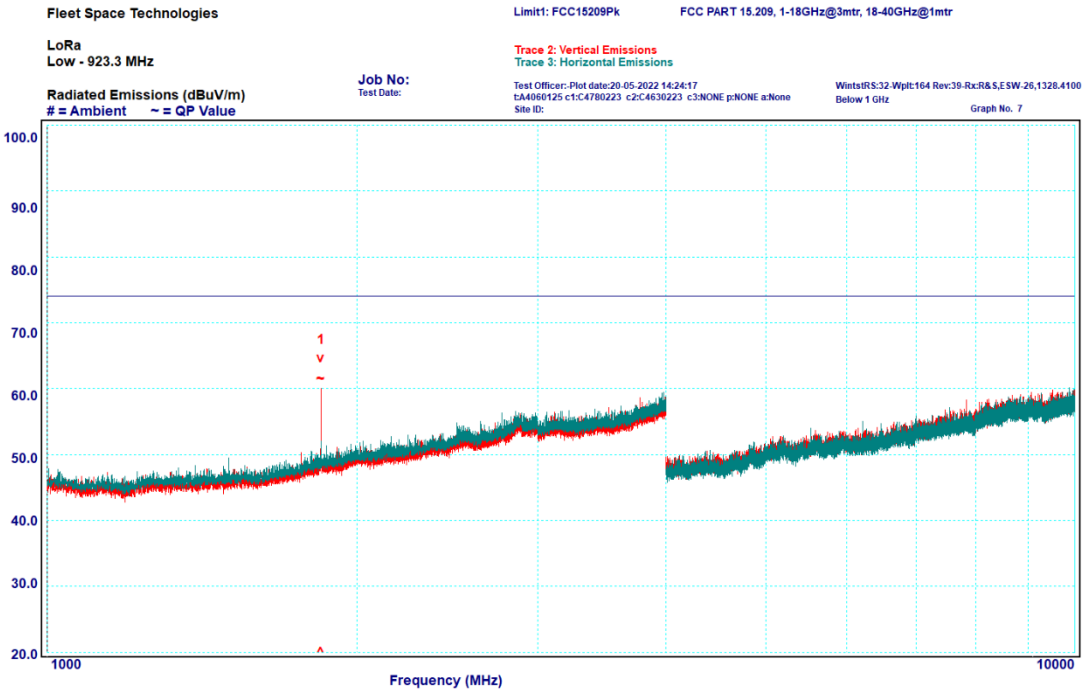
Peak	Frequency [MHz]	Polarisation	Quasi peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1*	927.50	Vertical	N/A	N/A	N/A
2	902.87	Vertical	36.2	46.0	-9.8
3*	927.60	Horizontal	N/A	N/A	N/A
4	750.00	Horizontal	40.9	46.0	-5.1

Note: Peaks 1 and 3 are the fundamental transmission and not subject to the spurious emissions limit of the standard.

6.2.5 Transmitter Spurious Emissions: 1 - 10 GHz

All emissions measured in the frequency band 1 – 10 GHz complied with the requirements of the standard.

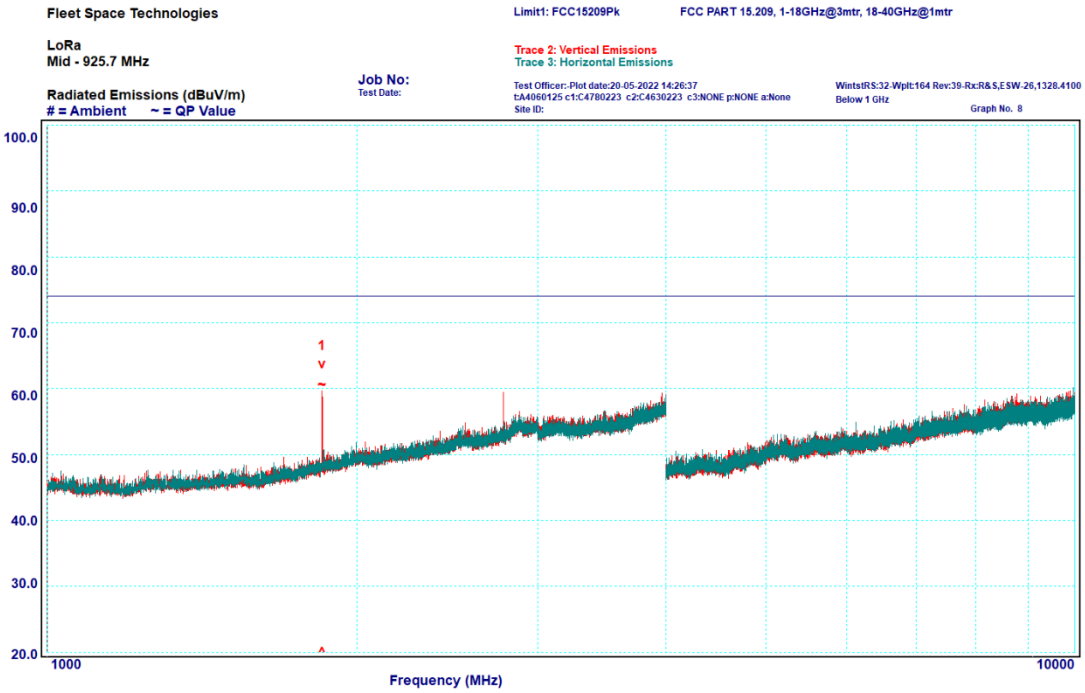
Peak Measurements:



Graph 6-10: Transmitter Spurious Emissions, 1 – 10 GHz, Peak, 923.3 MHz

Table 6-8: Transmitter Spurious Emissions, 1 – 10 GHz, Peak, 923.3 MHz

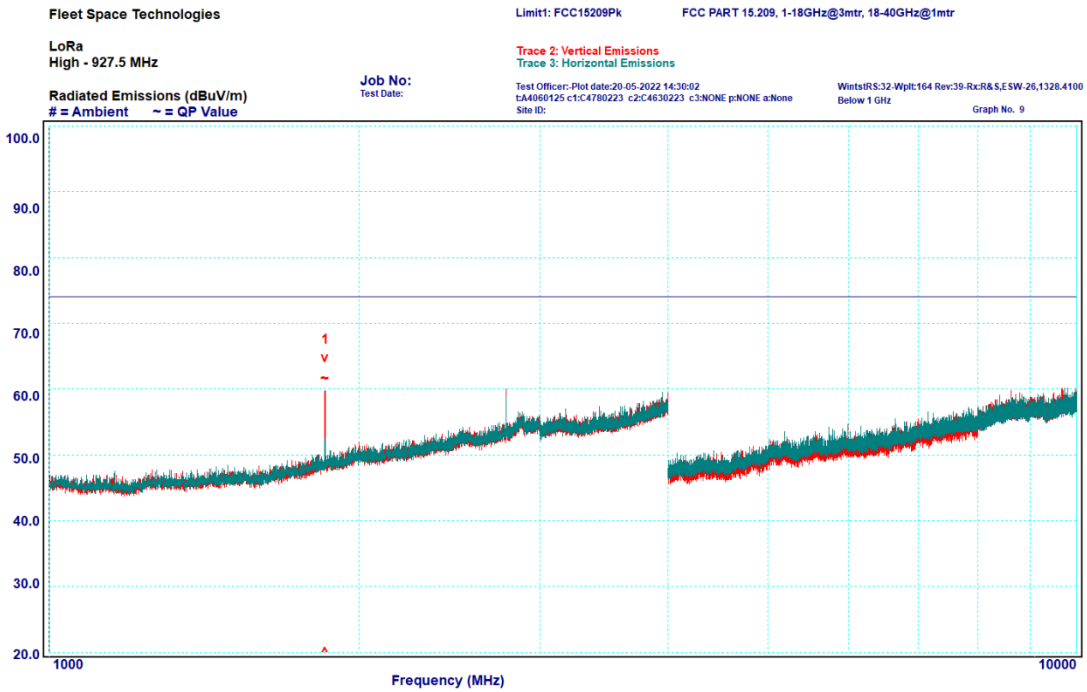
Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	1846.00	Vertical	61.5	74.0	-12.5



Graph 6-11: Transmitter Spurious Emissions, 1 – 10 GHz, Peak, 925.7 MHz

Table 6-9: Transmitter Spurious Emissions, 1 – 10 GHz, Peak, 925.7 MHz

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	1851.08	Vertical	60.6	74.0	-13.4

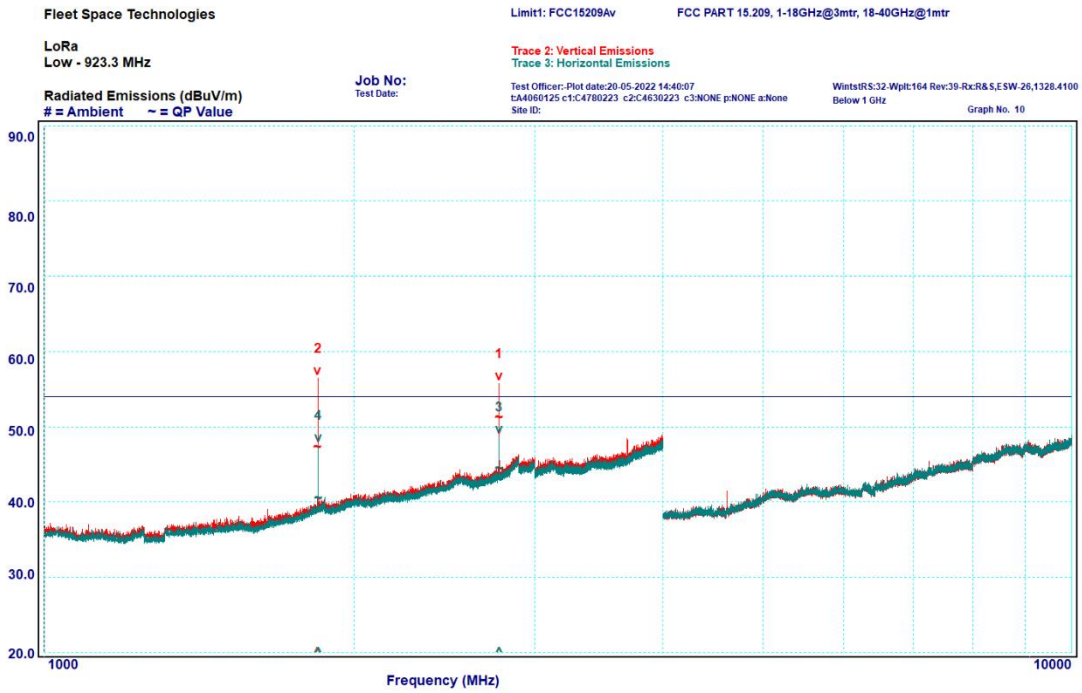


Graph 6-12: Transmitter Spurious Emissions, 1 – 10 GHz, Peak, 927.5 MHz

Table 6-10: Transmitter Spurious Emissions, 1 – 10 GHz, Peak, 927.5 MHz

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	1854.79	Vertical	61.6	74.0	-12.4

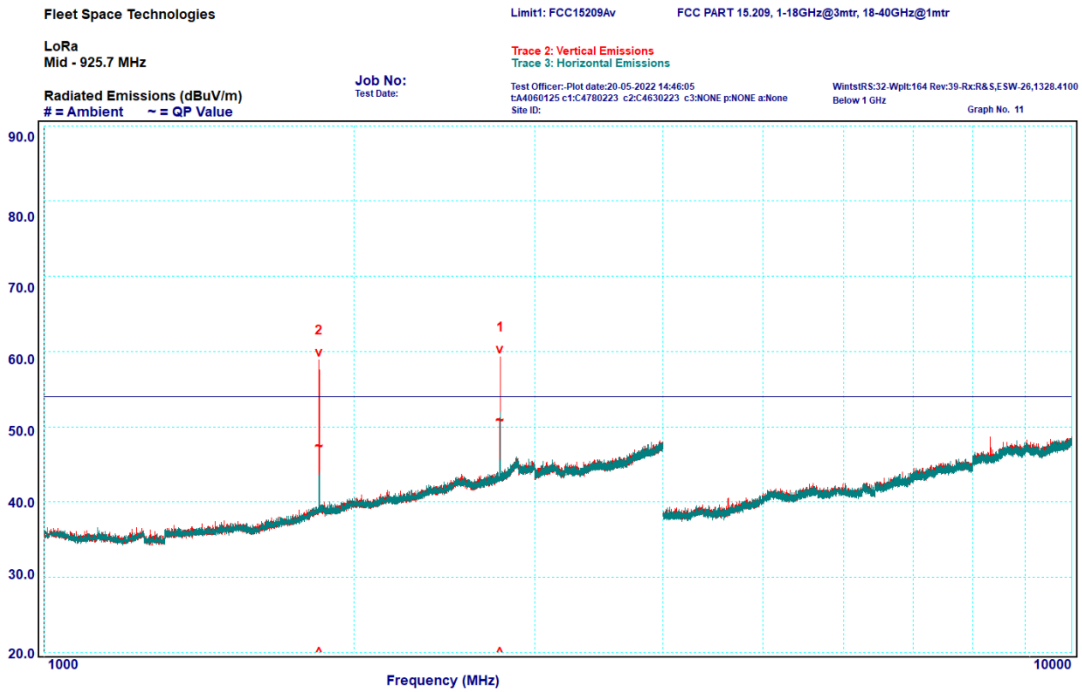
Average Measurements:



Graph 6-13: Transmitter Spurious Emissions, 1 – 10 GHz, Average, 923.3 MHz

Table 6-11: Transmitter Spurious Emissions, 1 – 10 GHz, Average, 923.3 MHz

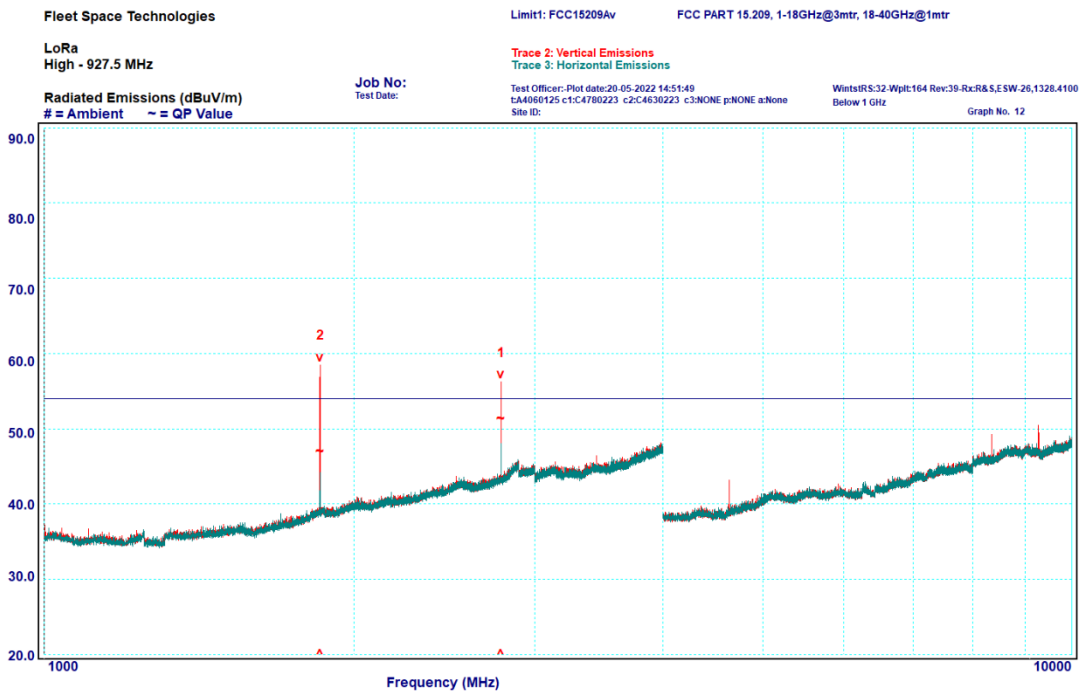
Peak	Frequency [MHz]	Polarisation	Avg		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	2770.11	Vertical	51.2	54.0	-2.8
2	1846.79	Vertical	47.3	54.0	-6.7
3	2770.42	Horizontal	44.5	54.0	-9.5
4	1847.13	Horizontal	40.5	54.0	-13.5



Graph 6-14: Transmitter Spurious Emissions, 1 – 10 GHz, Average, 925.7 MHz

Table 6-12: Transmitter Spurious Emissions, 1 – 10 GHz, Average, 925.7 MHz

Peak	Frequency [MHz]	Polarisation	Avg		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	2777.35	Vertical	50.8	54.0	-3.2
2	1851.11	Vertical	47.4	54.0	-6.6



Graph 6-15: Transmitter Spurious Emissions, 1 – 10 GHz, Average, 927.5 MHz

Table 6-13: Transmitter Spurious Emissions, 1 – 10 GHz, Average, 927.5 MHz

Peak	Frequency [MHz]	Polarisation	Avg		
			Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1	2783.09	Vertical	51.3	54.0	-2.7
2	1855.32	Vertical	46.9	54.0	-7.1

END OF REPORT