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RADIO TEST REPORT

Project ID

PRJ0044270

Report ID

REP018262

Type of assessment:

Complete Assessment

Applicant:

Barrett Communications Pty Ltd

Product name:

4075 Linear Amplifier - 500 W

Model:

BC407500

FCC ID:

OW4-407505

Specifications:

FCC 47 CFR Part 87

Aviation Services

Date of issue: **November 9, 2023**

Kevin Rose, EMC/RF Lab Manager

Andrey Adelberg, Senior EMC/RF Specialist

Reviewed by

Signature

Signature

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ANAB File Number: AT-3195 (Ottawa/Almonte); AT-3193 (Pointe-Claire); AT-3194 (Cambridge)



Lab and test locations

Company name	Nemko Canada Inc.			
Facilities	Ottawa site:	Montréal site:	Cambridge site:	Almonte site:
	303 River Road	292 Labrosse Avenue	1-130 Saltsman Drive	1500 Peter Robinson Road
	Ottawa, Ontario	Pointe-Claire, Québec	Cambridge, Ontario	West Carleton, Ontario
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	Tel: +1 613 737 9680	Tel: +1 514 694 2684	Tel: +1 519 650 4811	Tel: +1 613 256-9117
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Test site registration	Organization	Recognition numbers and location		
	FCC/ISED	CA2040 (Ottawa/Almonte); CA2041 (Montreal); CA0101 (Cambridge)		
Website	www.nemko.com			

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Barrett Communications Pty Ltd
Address	47 Discovery Drive, Bibra Lake
City	Perth
Province/State	Western Australia
Postal/Zip code	6163
Country	Australia

1.2 Test specifications

FCC 47 CFR Part 87	Aviation Services
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1.3 Test methods

ANSI C63.26:2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
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1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Table 1.6-1: Test report revision history

Revision #	Date of issue	Details of changes made to test report
REP018262	November 9, 2023	Original report issued



Section 2. Summary of test results

2.1 FCC Part 87 test results

Part	Test description	Verdict
§87.131	Power and emissions	Pass
2.1047	Modulation characteristics	Reported
87.139(c)	Emission limits, emission mask, bandwidth	Pass
87.141(d)	Modulation requirements	Pass
87.139(c)	Emission limits, conducted method	Pass
87.139(c)	Emission limits, radiated method	Pass
87.133(c)	Frequency stability	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	October 9, 2023
Nemko sample ID number	PRJ00442700003

3.2 EUT information

Product name	4075 Linear Amplifier (500 W)
Model	BC407500
Serial number	201000425

3.3 Technical information

Operating band	1.6–30 MHz
Test frequencies	2.182, 11.363, and 21.964 MHz
Modulation type	J3E and H3E
Occupied bandwidth (99 %)	2.7 kHz (J3E), 3 kHz (H3E)
Power requirements	120–240 V _{AC}
Emission designator	2K70J3E, 3K00H3E
Antenna information	Various types with standard PL-259 connector

3.4 Product description and theory of operation

The Barrett 4075 Linear Amplifier is a SDR based, 1000 channel HF SSB Transceiver with a frequency range of 1.6 to 30 MHz (250 kHz to 30 MHz in receive) with linear amplifier. The Barrett 4075 is designed using the latest technology including a high-resolution touch screen, IP connectivity, multi-language support, enhanced DSP noise reduction, secure digital voice, integrated GPS interface, ALE and advanced calling features.

3.5 EUT exercise details

The EUT was programmed for the low, mid, and high channels J3E used 400 and 1800 Hz input tone and H3E used 1500 Hz

3.6 EUT setup diagram

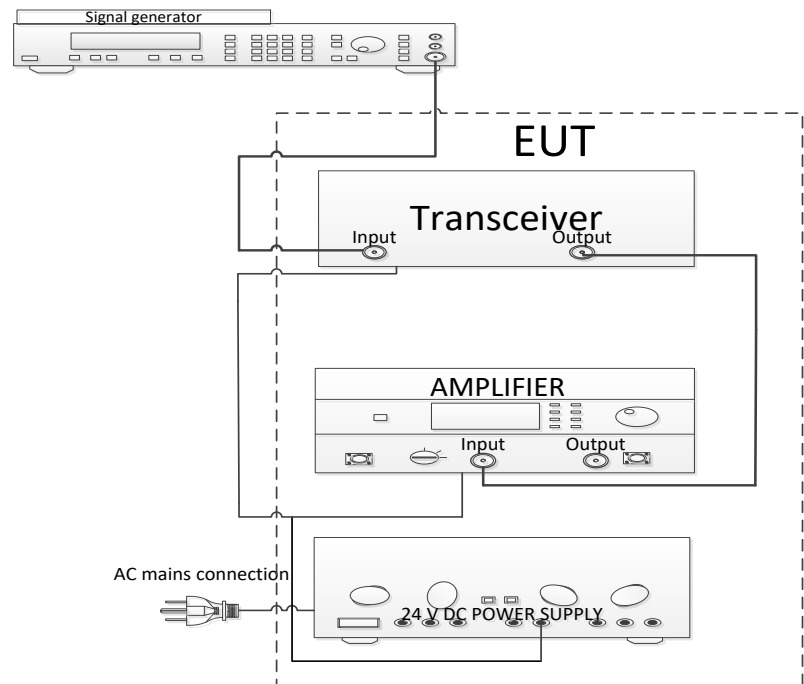


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Linear Amplifier	Barrett	4075	407510306
Break out box	Barrett	4050	407410238
24 V Power Supply/ 12.5 V 5 A charger	Barrett	4022	402411886
HF Transceiver	Barrett	4050	405013678

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

Tested as a system not as standalone amplifier

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.



Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	January 19, 2024
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
61505 AC source	Chroma	61509	FA003036	—	VOU
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	January 19, 2024
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	March 7, 2024
Active loop antenna (0.01–30 MHz)	Com-Power	AL-130	FA002722	1 year	April 3, 2024
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	January 24, 2024
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 28, 2023
Spectrum analyzer	Rohde & Schwarz	FSV 40	FA002731	1 year	March 9, 2024

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 87.131 Power and emissions

8.1.1 Definitions and limits

Class of station	Frequency band/frequency	Authorized emission(s) ²	Maximum power ¹
Aeronautical enroute and aeronautical fixed	HF	R3E, H3E, J3E, J7B, H2B, J2D	6 kW

¹The power is measured at the transmitter output terminals and the type of power is determined according to the emission designator as follows:

- (i) Mean power (pY) for amplitude modulated emissions and transmitting both sidebands using unmodulated full carrier.
- (ii) Peak envelope power (pX) for all emission designators other than those referred to in paragraph (i) of this note.

²Excludes automatic link establishment.

8.1.2 Test summary

Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1006 mbar
Verdict	Pass	Relative humidity	41 %

8.1.3 Observations, settings and special notes

J3E – two tones at frequencies of 400 Hz and 1800 Hz, H3E one tone at a frequency of 1500 Hz

Test receiver settings:

Detector mode	Peak
Resolution bandwidth	>OBW
Video bandwidth	>RBW
Trace mode	Max Hold
Measurement time	Auto

8.1.4
Test data

Table 8.1-1: Output power results for J3E

Modulation	Frequency, MHz	RF output power, dBm	Limit, dBm	Margin, dB
J3E	2.182	57.42	67.78	10.36
J3E	11.363	57.31	67.78	10.47
J3E	21.964	57.12	67.78	10.66

Table 8.1-2: Output power results for H3E

Modulation	Frequency, MHz	RF output power, dBm	Limit, dBm	Margin, dB
H3E	2.182	57.40	67.78	10.38
H3E	11.363	57.37	67.78	10.41
H3E	21.964	56.92	67.78	10.86

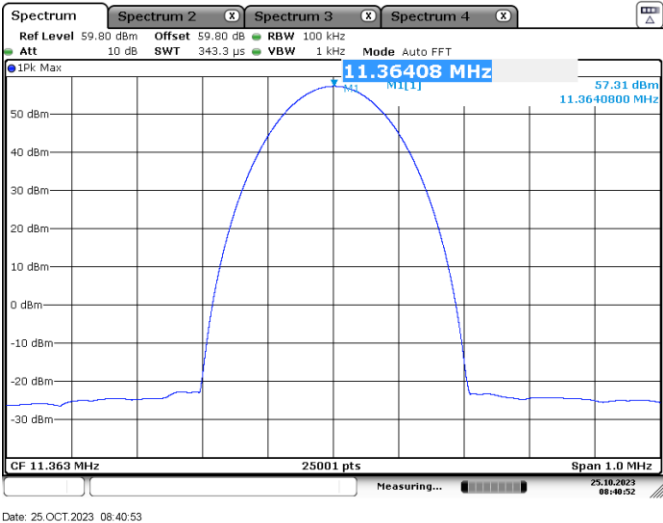


Figure 8.1-1: Power for J3E Example

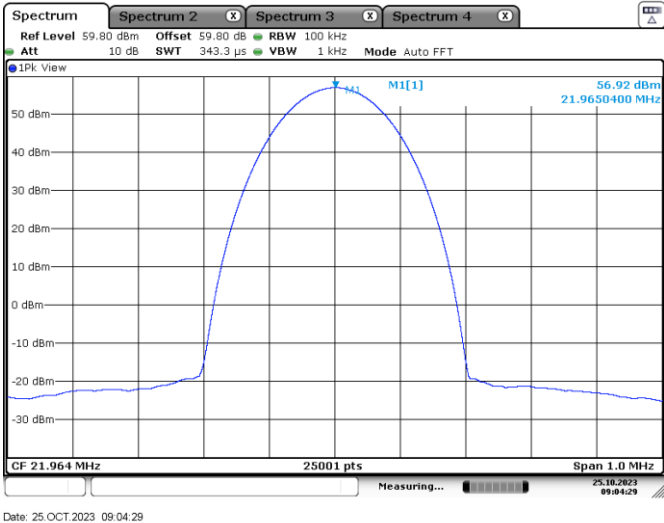


Figure 8.1-2: Power for H3E Example

8.2 FCC 2.1047 Modulation characteristics

8.2.1 Definitions and limits

(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.

8.2.2 Test summary

Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	42 %

8.2.3 Observations, settings and special notes

Settings and special notes

Detector mode	Peak
Resolution bandwidth	>OBW
Video bandwidth	>RBW

8.2.4 Test data

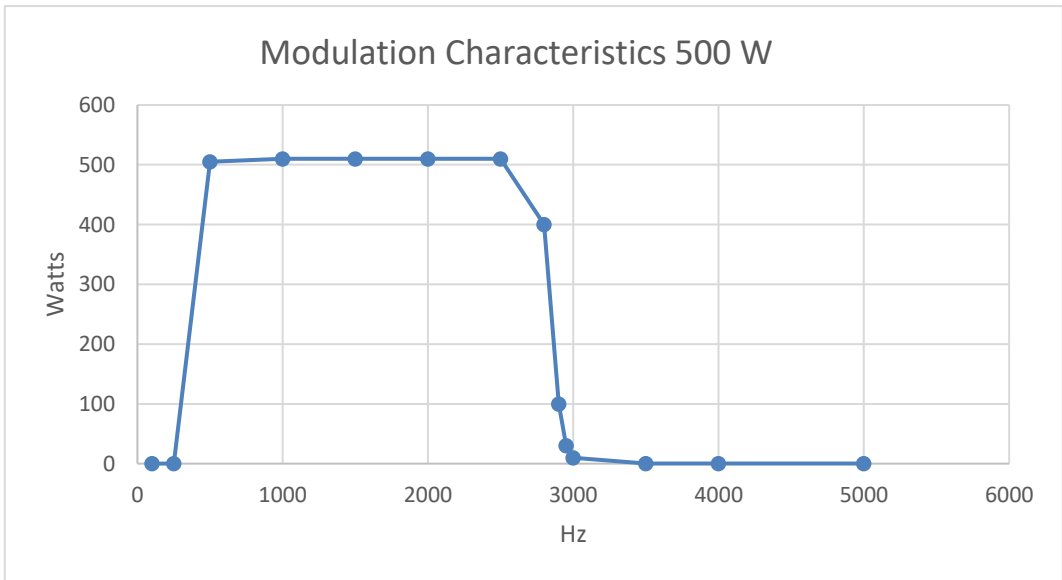


Figure 8.2-1: Modulation Characteristic

Table 8.2-1: Modulation Characteristic results

Hz	Watts
100	0.005
250	0.15
500	505
1000	510
1500	510
2000	510
2500	510
2800	400
2900	100
2950	30
3000	10
3500	0.006
4000	0.006
5000	0.006

Table 8.2-2: Modulation Limiting results

2.182 MHz		11.363 MHz		21.964 MHz	
Input Audio,V	Output power, Watts	Input Audio,V	Output power, Watts	Input Audio,V	Output power, Watts
0.03	1.5	0.03	0.26	0.07	2
0.04	2.6	0.04	0.5	0.1	4
0.05	4	0.05	0.9	0.15	9
0.1	17	0.1	4	0.2	20
0.15	34	0.15	9	0.25	30
0.2	78	0.2	20	0.3	56
0.25	126	0.25	36	0.35	70
0.3	200	0.3	64	0.36	80
0.35	280	0.35	100	0.37	85
0.37	300	0.37	120	0.38	100
0.4	390	0.4	140	0.39	110
0.41	400	0.41	150	0.4	120
0.45	480	0.45	190	0.41	124
0.5	500	0.5	250	0.42	130
		0.6	425	0.43	150
		0.72	510	0.5	200
				0.55	264
				0.66	300
				0.67	400
				0.75	450
				0.8	500

8.3 FCC 87.139(c) Emission limits, emission mask, bandwidth

8.3.1 Definitions and limits

(c) For aircraft station transmitters first installed after February 1, 1983, and for aeronautical station transmitters in use after February 1, 1983, and using H2B, H3E, J3E, J7B or J9W, the peak envelope power of any emissions must be attenuated below the peak envelope power of the transmitter (pX) as follows:

- 1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 30 dB.
- 2) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 38 dB.
- 3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least $43 + 10 \log_{10} pX$ dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

8.3.2 Test summary

Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	42 %

8.3.3 Observations, settings and special notes

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	300 Hz or 30 or 20 Hz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.3.1 Test data

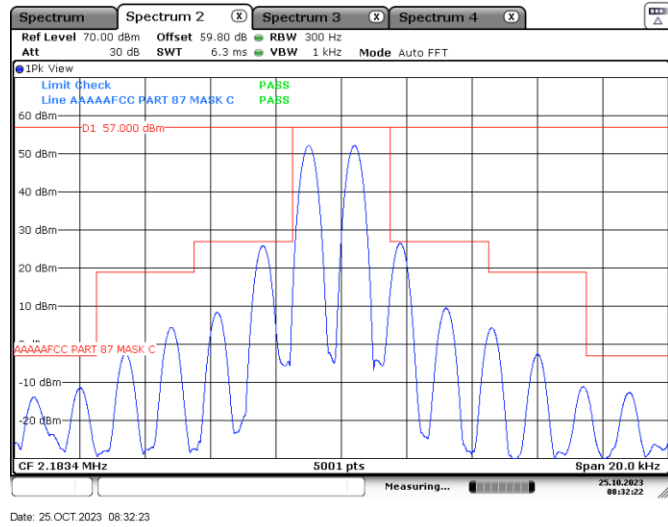


Figure 8.3-1: Low channel Mask J3E

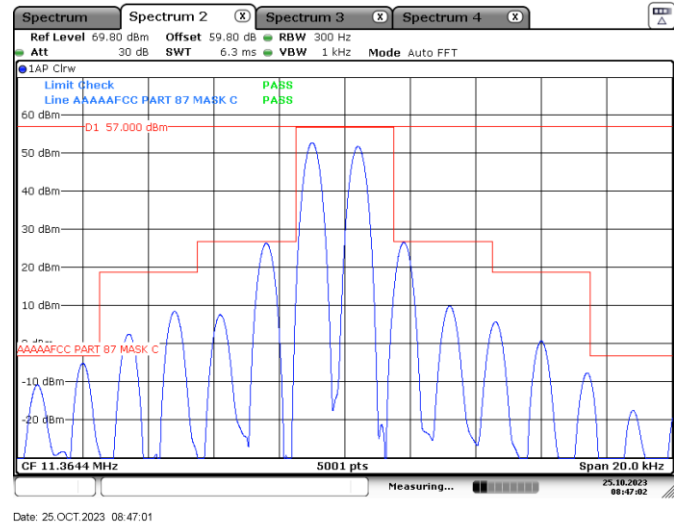


Figure 8.3-2: Mid channel Mask J3E

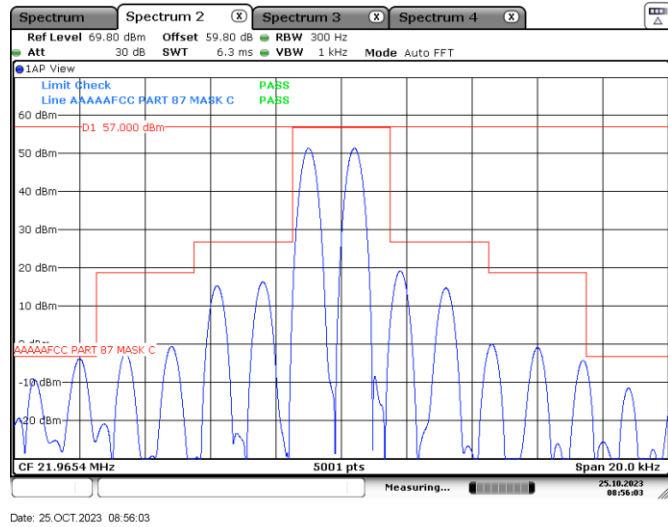


Figure 8.3-3: High channel Mask J3E

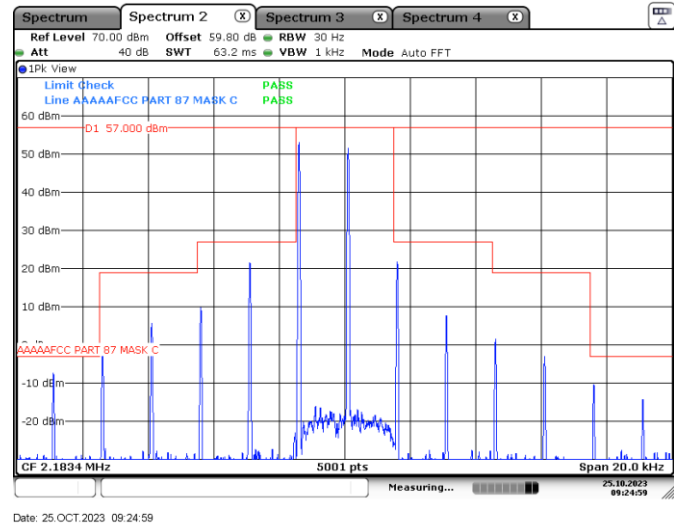


Figure 8.3-4: Low channel Mask H3E

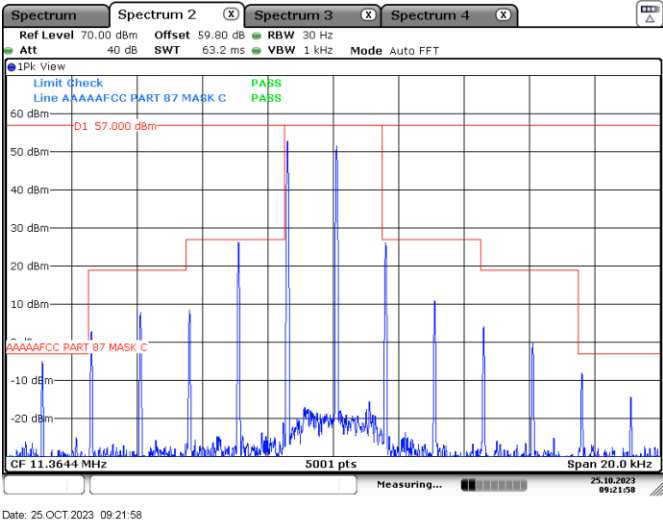


Figure 8.3-5: Mid channel Mask H3E

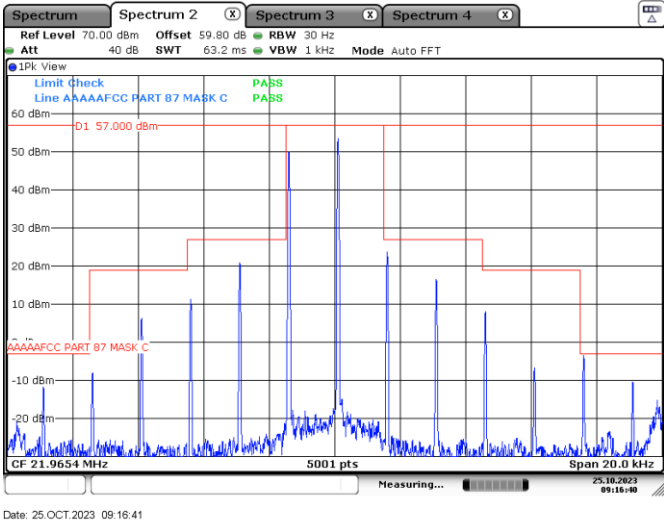


Figure 8.3-6: High channel Mask H3E

8.4 FCC 87.141(d) Modulation requirements

8.4.1 Definitions and limits

(d) Single sideband transmitters must be able to operate in the following modes:

Carrier mode	Level N(dB) of the carrier with respect to peak envelope power
Full carrier (H3E)	$0 > N > -6$
Suppressed carrier (J3E)	Aeronautical stations $N < -40$.

8.4.2 Test summary

Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	45 %

8.4.3 Observations, settings and special notes

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	30 Hz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.4.1 Test data

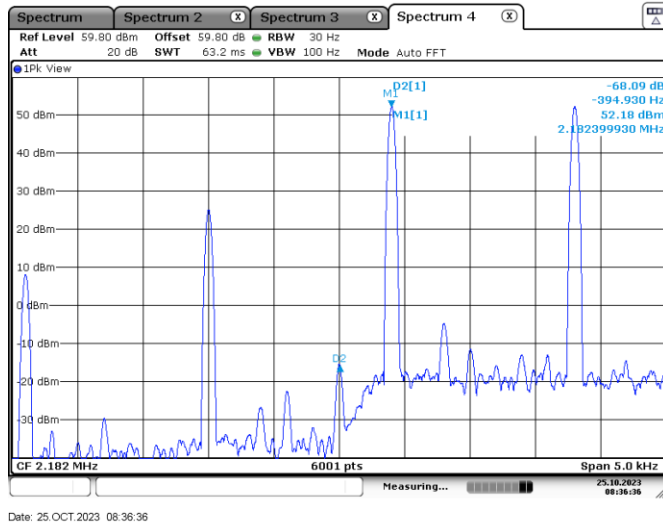


Figure 8.4-1: Low channel J3E 40 dB

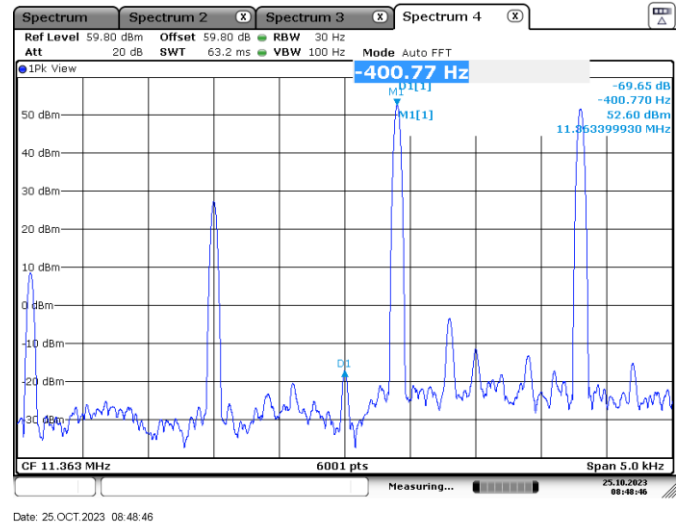


Figure 8.4-2: Mid channel J3E 40 dB

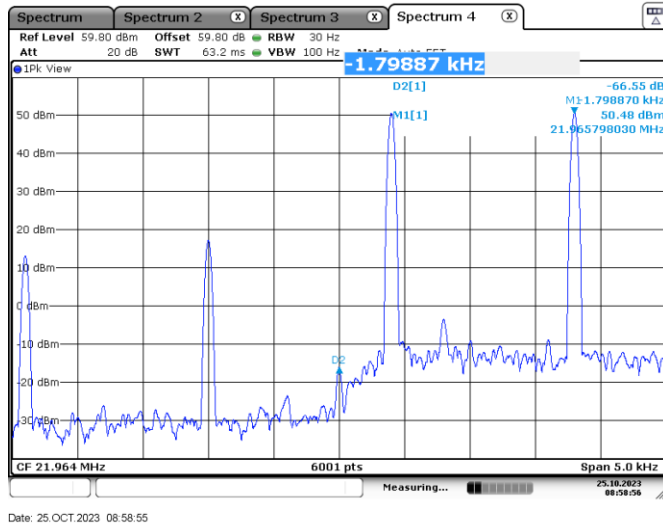


Figure 8.4-3: High channel J3E 40 dB

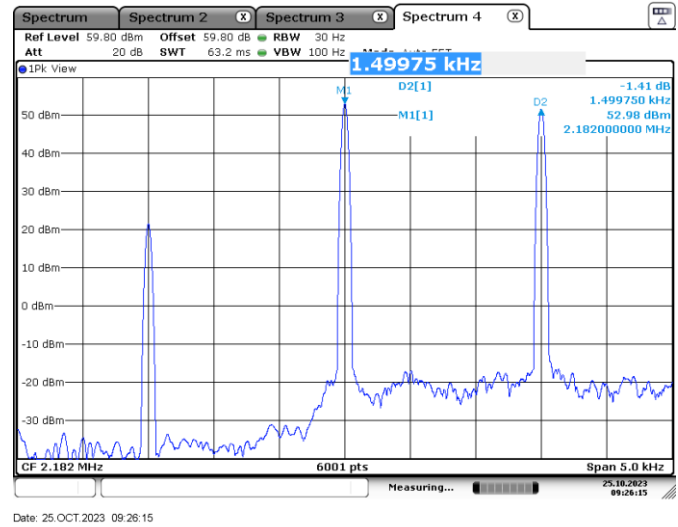


Figure 8.4-4: Low channel H3E 6 dB

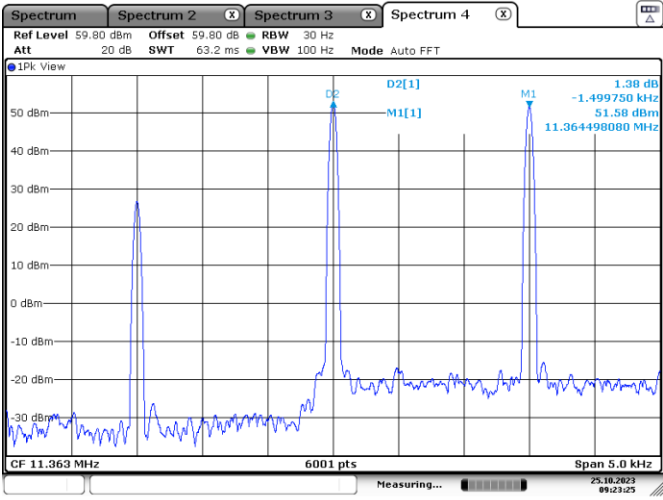


Figure 8.4-5: Mid channel H3E 6 dB

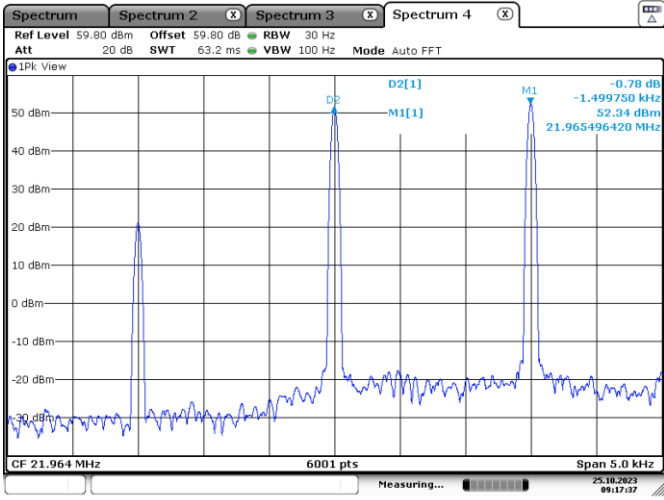


Figure 8.4-6: High channel H3E 6 dB

8.5 FCC 87.139(c) Emission limits, conducted method

8.5.1 Definitions and limits

(c) For aircraft station transmitters first installed after February 1, 1983, and for aeronautical station transmitters in use after February 1, 1983, and using H2B, H3E, J3E, J7B or J9W, the peak envelope power of any emissions must be attenuated below the peak envelope power of the transmitter (pX) as follows:

- 4) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 30 dB.
- 5) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 38 dB.
- 6) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least $43 + 10 \log_{10} \text{pX}$ dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

8.5.2 Test summary

Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	45 %

8.5.3 Observations, settings and special notes

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	10 kHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.5.1 Test data

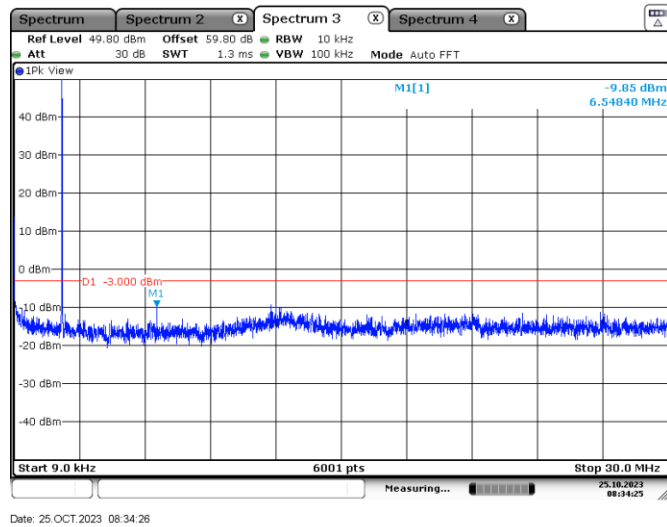


Figure 8.5-1: Low channel Conducted Spurious H3E

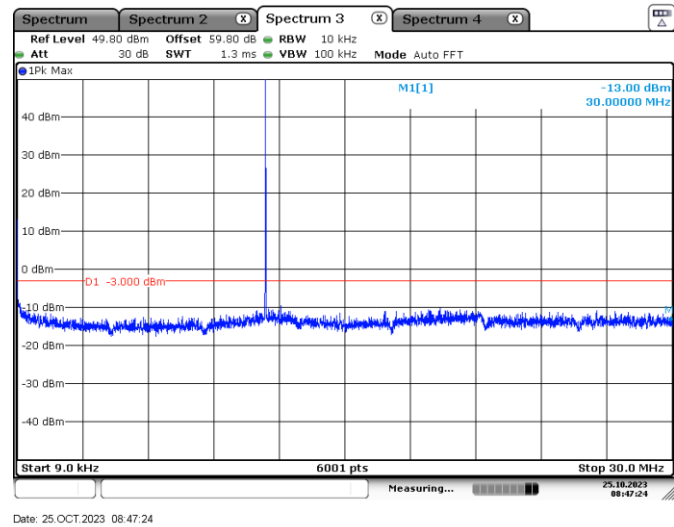


Figure 8.5-2: Mid channel Conducted Spurious H3E

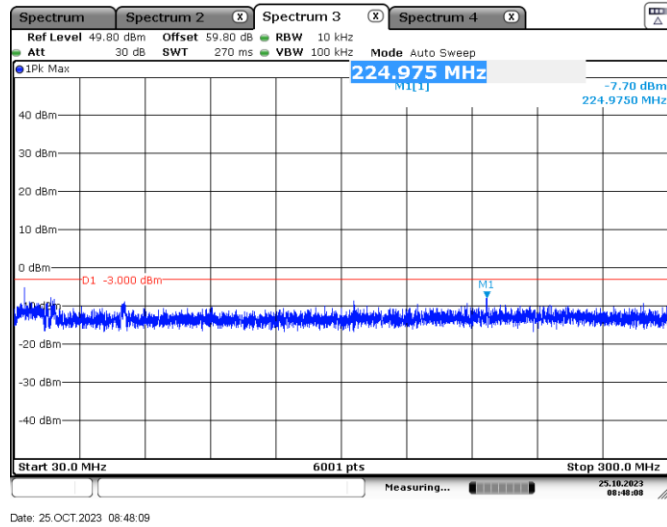


Figure 8.5-3: Mid channel Conducted Spurious H3E

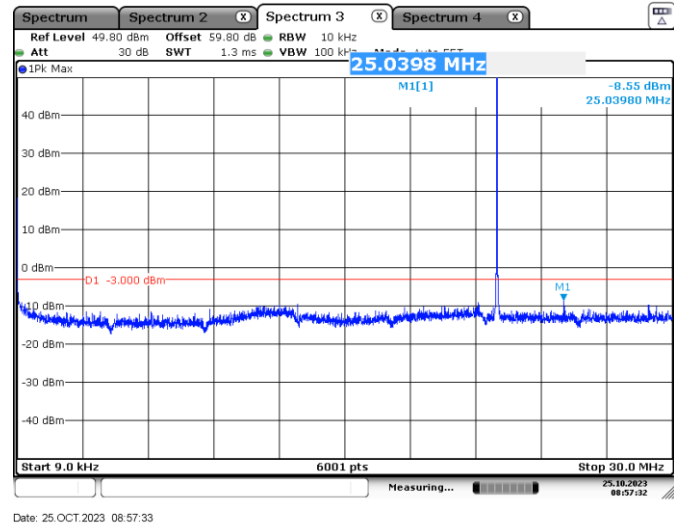


Figure 8.5-4: High channel Conducted Spurious H3E

8.5.1 Test data

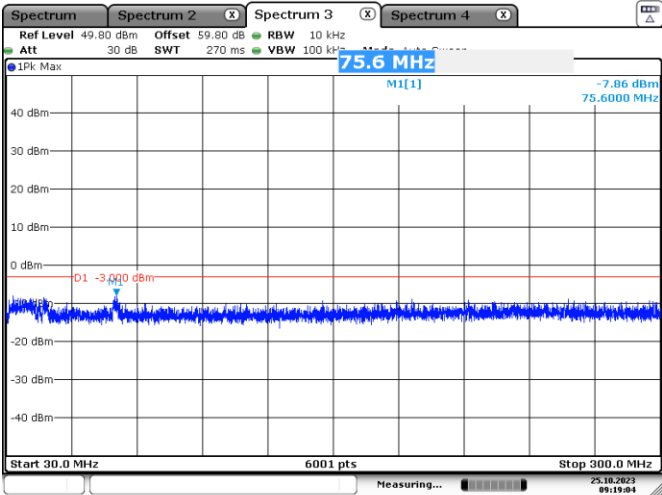


Figure 8.5-5: High channel Conducted Spurious H3E

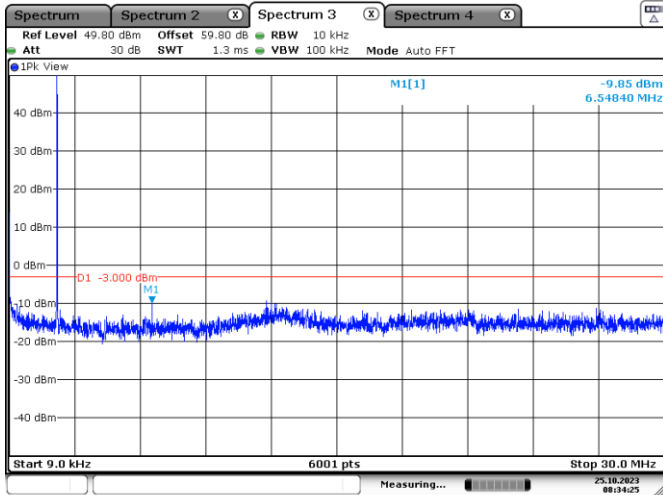


Figure 8.5-6: Low channel Conducted Spurious J3E

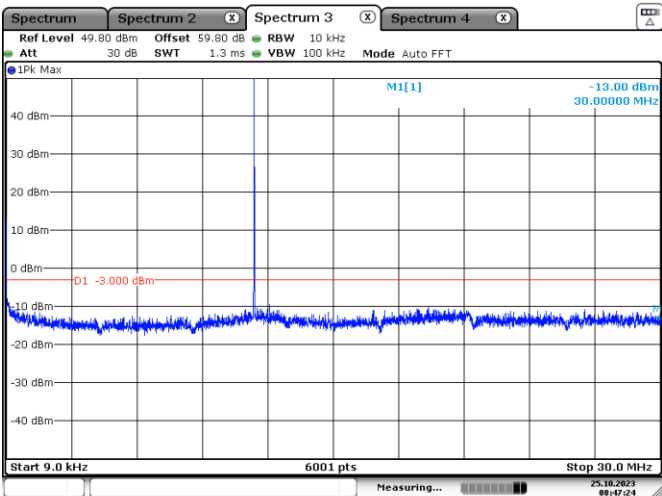


Figure 8.5-7: Mid channel Conducted Spurious J3E

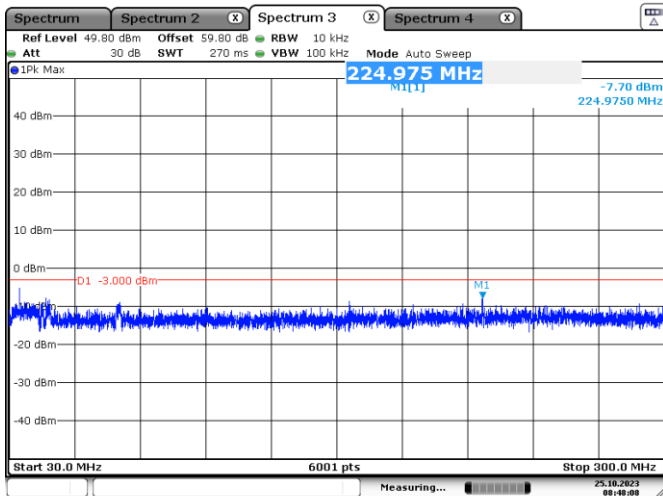


Figure 8.5-8: Mid channel Conducted Spurious J3E

8.5.1 Test data

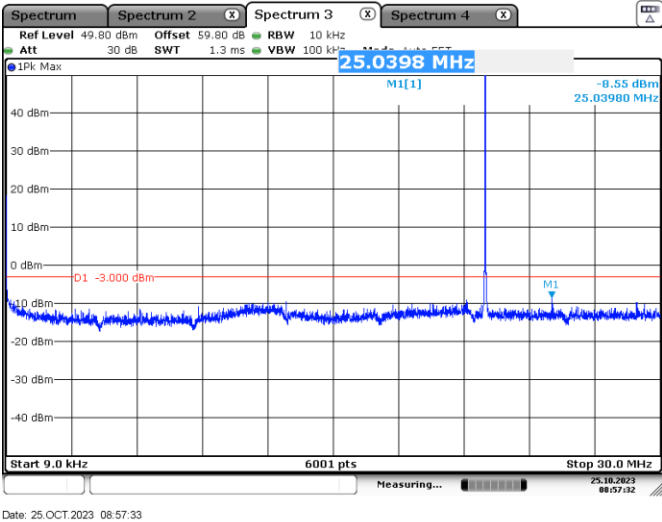


Figure 8.5-9: High channel Conducted Spurious J3E

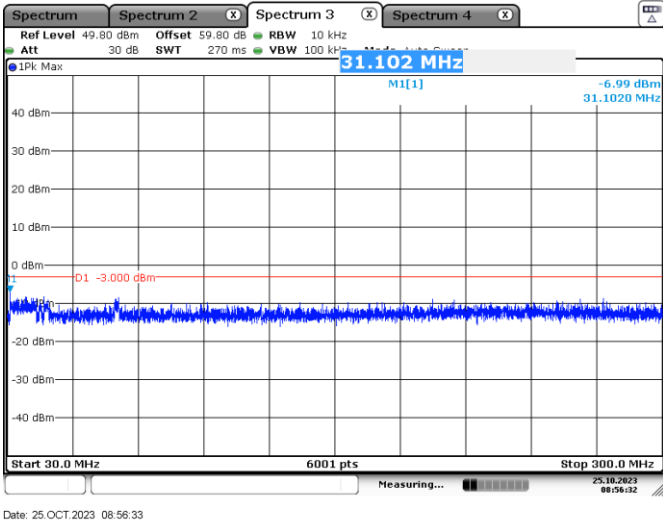


Figure 8.5-10: High channel Conducted Spurious J3E

8.6 FCC 87.139(c) Emission limits, radiated method

8.6.1 Definitions and limits

- (1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 30 dB.
- (2) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 38 dB.
- (c) For aircraft station transmitters first installed after February 1, 1983, and for aeronautical station transmitters in use after February 1, 1983, and using H2B, H3E, J3E, J7B or J9W, the peak envelope power of any emissions must be attenuated below the peak envelope power of the transmitter (pX) as follows:
- (3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least $43 + 10 \log_{10} pX$ dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

8.6.2 Test summary

Test date	October 19, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1010 mbar
Verdict	Pass	Relative humidity	45 %

8.6.3 Observations, settings and special notes

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	10 kHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

J3E 400 Hz and 1800 Hz tone was used during testing. Testing was performed up to 1 GHz, no spurious emissions above 300 MHz were observed.

8.6.1 Test data

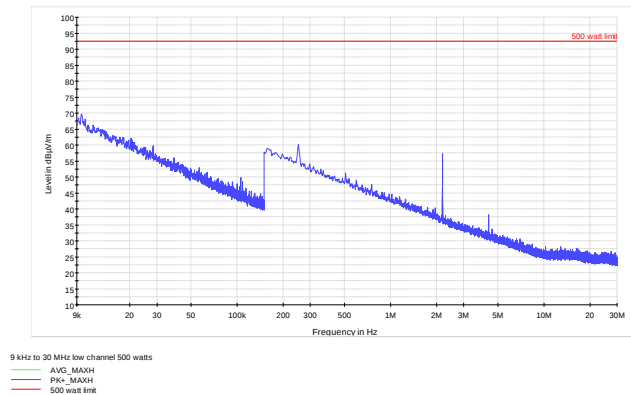


Figure 8.6-1: Low channel Radiated Spurious 9 kHz-30 MHz

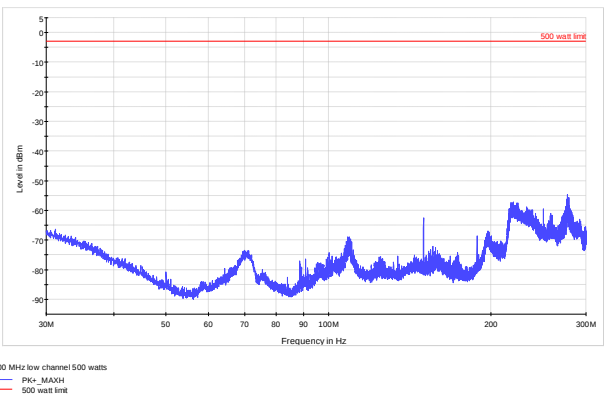


Figure 8.6-2: Low channel Radiated Spurious 30-300 MHz

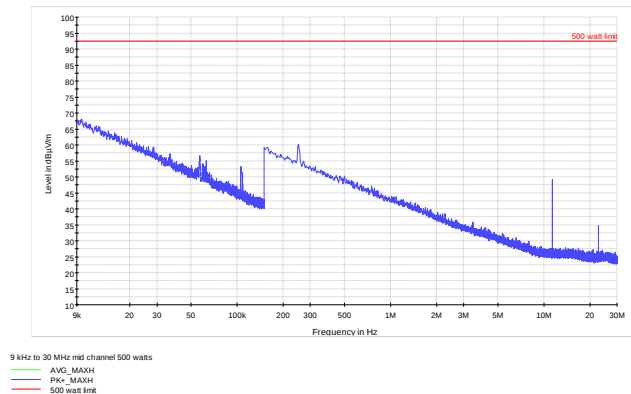


Figure 8.6-3: Mid channel Radiated Spurious 9 kHz-30 MHz

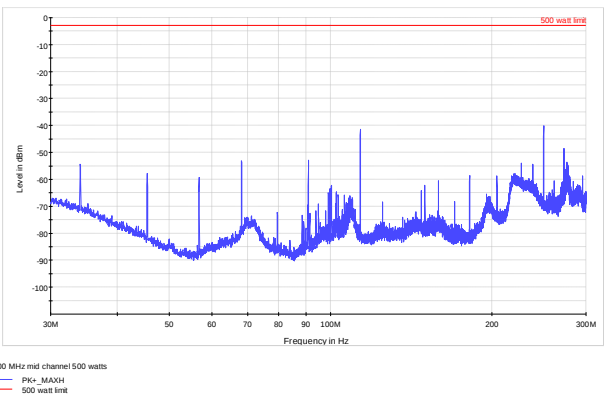


Figure 8.6-4: Mid channel Radiated Spurious 30-300 MHz

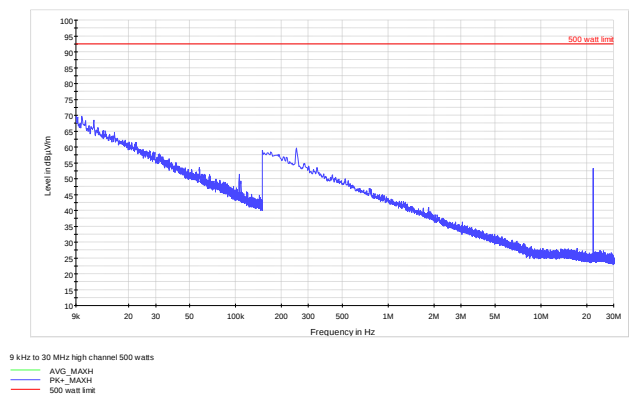


Figure 8.6-5: High channel Radiated Spurious 9 kHz-30 MHz

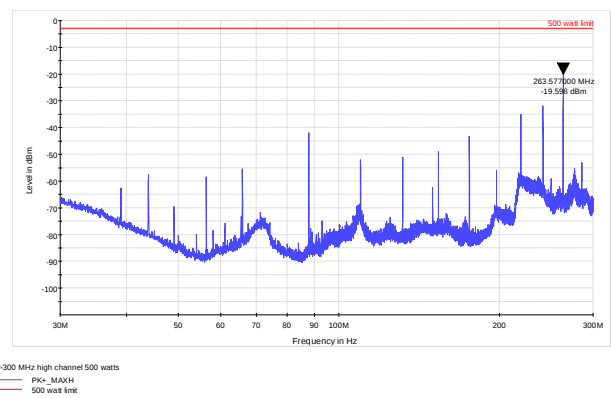


Figure 8.6-6: High channel Radiated Spurious 30-300 MHz

8.7 FCC 87.133 Frequency stability

8.7.1 Definitions and limits

(c) For single-sideband transmitters, the tolerance is:
(1) All aeronautical stations on land: 10 Hz.

8.7.2 Test summary

Test date	October 24, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	47 %

8.7.3 Observations, settings and special notes

1500 Hz tone was used during testing

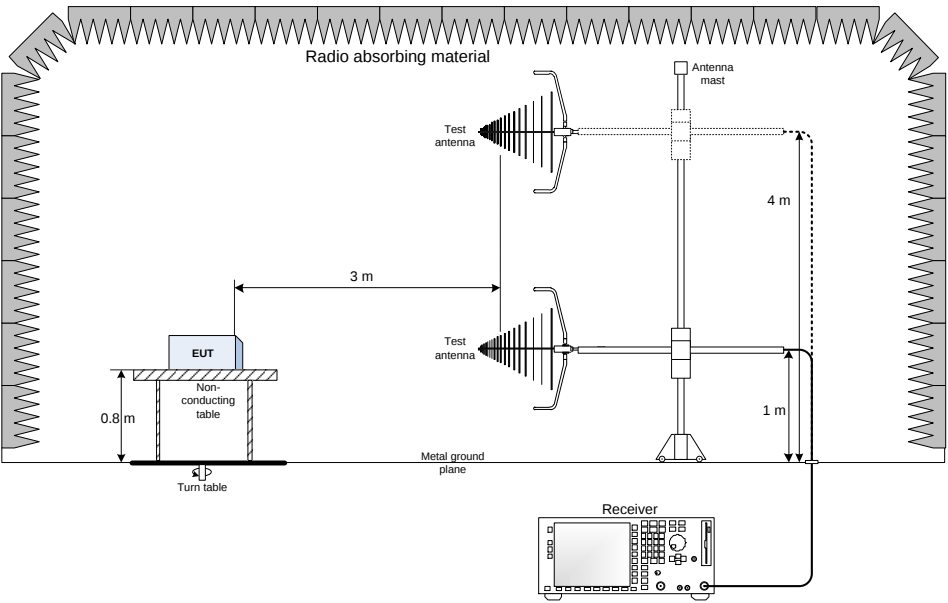
8.7.4 Test data

Table 8.7-1: Frequency drift measurement FCC Part 87 results 500 watts

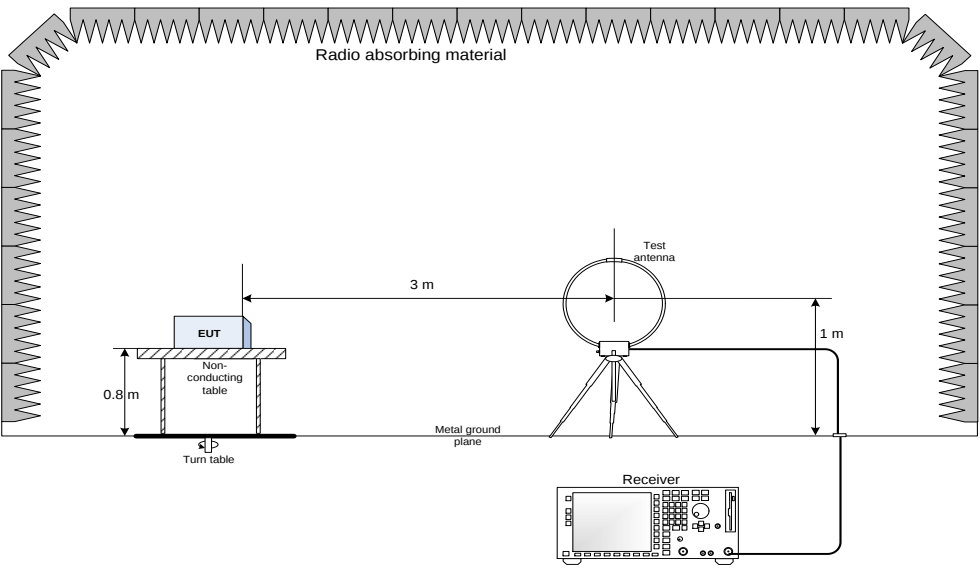
Test conditions	Frequency, Hz	Drift, Hz	Limit ±10 Hz
+50 °C, Nominal	11363395	7	±10 Hz
+40 °C, Nominal	11363398	4	±10 Hz
+30 °C, Nominal	11363400	2	±10 Hz
+20 °C, +15 %	11363402	0	±10 Hz
+20 °C, Nominal	11363402	0	Reference
+20 °C, -15 %	11363402	0	±10 Hz
+10 °C, Nominal	11363403	-1	±10 Hz
0 °C, Nominal	11363402	0	±10 Hz
-10 °C, Nominal	11363401	1	±10 Hz
-20 °C, Nominal	11363402	0	±10 Hz
-30 °C, Nominal	11363401	1	±10 Hz

Section 9. Block diagrams of test set-ups

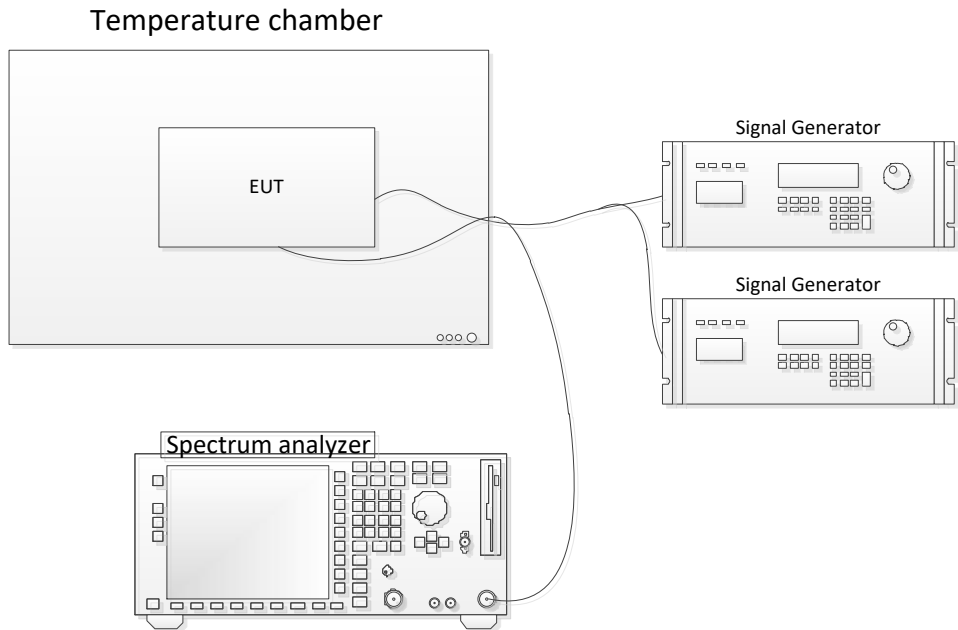
9.1 Radiated emissions set-up for frequencies 30 MHz- 1 GHz



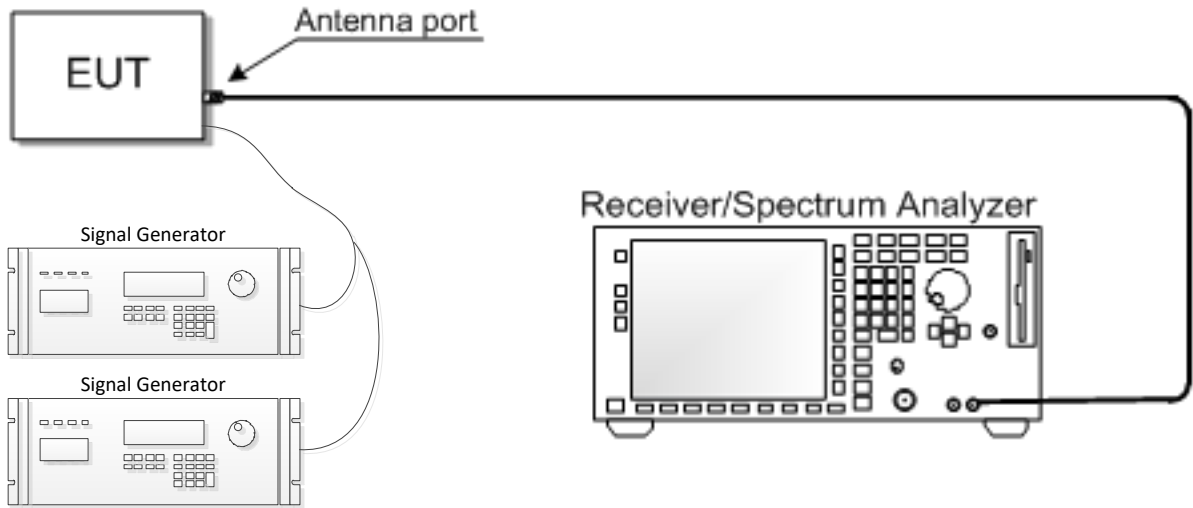
9.2 Radiated emissions set-up for frequencies below 30 MHz



9.3 Frequency stability



9.4 Power limits, Modulation Characteristics, Emission limits, emission mask, bandwidth, Emission limits, conducted method



-End of test report-