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RADIO TEST REPORT

Project ID
PRJ0044270

Report ID
REP018261

Type of assessment:
Complete Assessment

Applicant:
Barrett Communications Pty Ltd

Product:
4075 Linear Amplifier - 1000 W

Model:
BC407501

FCC ID:
OW4-407510

Specifications:
FCC 47 CFR Part 87
Aviation Services

Date of issue: November 11, 2023

Kevin Rose, EMC/RF Specialist

Tested by

Signature

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Reviewed by

Signature

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





Lab locations

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Test site registration	Organization FCC/ISED	Recognition numbers and location FCC: CA2040; IC: 2040A-4 (Ottawa); FCC: CA2041; IC: 2040G-5 (Montreal); CA0101 (Cambridge)	
Website	www.nemko.com		

Limits of responsibility

Note that this report's results 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 this report.

This test report has been completed following the requirements of ISO/IEC 17025. All results contained 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, Perth, Western Australia, Australia, 6163

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
REP018261	November 11, 2023	Original report issued

Section 2. Summary of test results

2.1 Test results

Table 2.1-1: Test summary

FCC Rule 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	PRJ00442700002

3.2 EUT information

Product name	4075 Linear Amplifier - 1000 W
Model	BC407501
Serial number	201000425

3.3 Technical information

Operating band	1.5–30 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
RF power Max (W), Conducted	1312.2 W (61.18 dBm)
Transmitter spurious, dBm @ 3 m	-16.724 dBm @ 263.577 MHz or 78.506 dBμV/m

3.4 Product description and theory of operation

The Barrett 4075 Transmitter is a SDR based, 1000 channel HF SSB Transceiver with a frequency range of 1.5 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

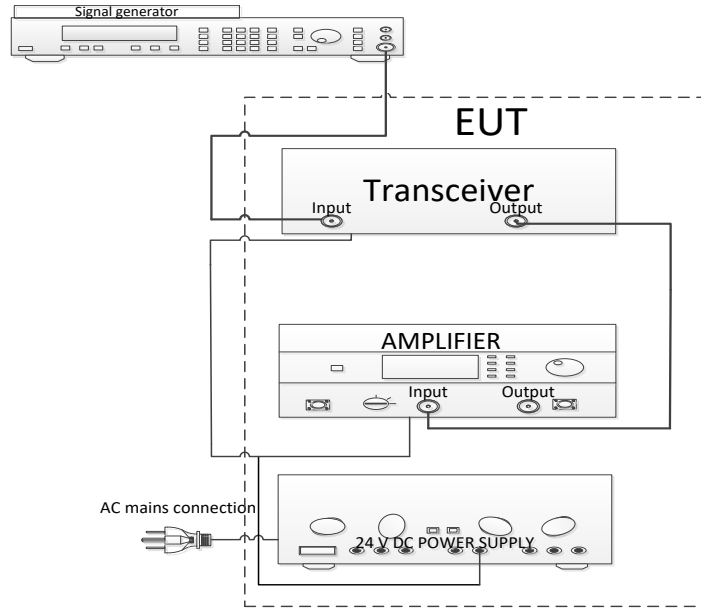


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Linear Amplifier	Barrett	4075	407510313
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

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

Table 8.1-1: 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

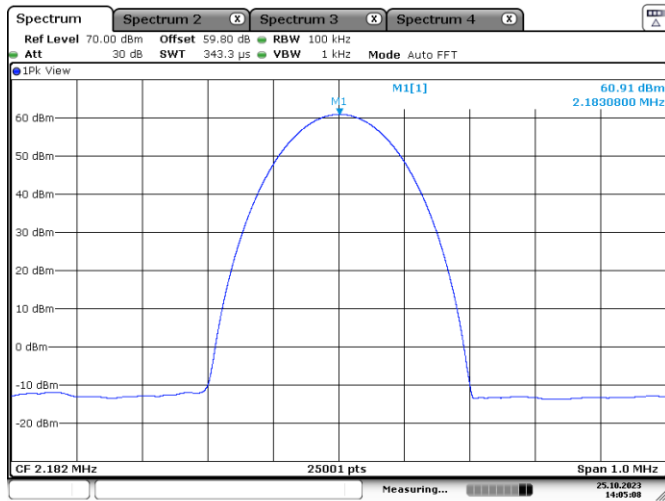
8.1.4 Test data

Table 8.1-2: Output power results for J3E

Modulation	Frequency, MHz	RF output power, dBm	Limit, dBm	Margin, dB
J3E	2.182	60.79	67.78	6.68
J3E	11.363	61.10	67.78	6.99
J3E	21.964	60.18	67.78	7.60

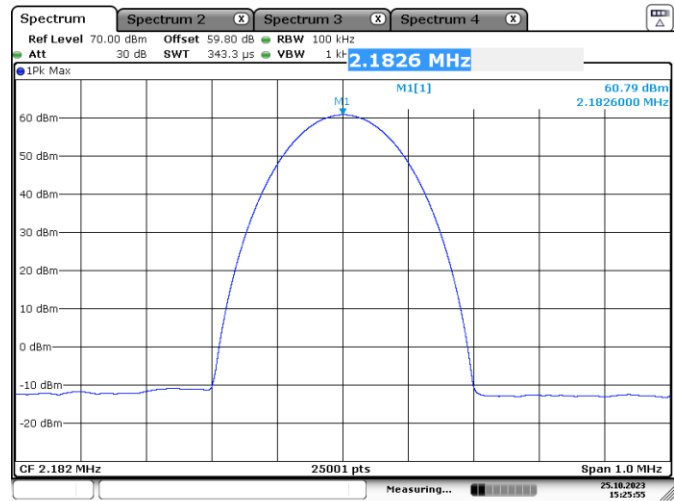
Table 8.1-3: Output power results for H3E

Modulation	Frequency, MHz	RF output power, dBm	Limit, dBm	Margin, dB
H3E	2.182	60.91	67.78	6.60
H3E	11.363	61.18	67.78	6.87
H3E	21.964	60.22	67.78	7.56



Date: 25.OCT.2023 14:05:08

Figure 8.1-1: Power H3E Example



Date: 25.OCT.2023 15:25:55

Figure 8.1-2: Power J3E 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

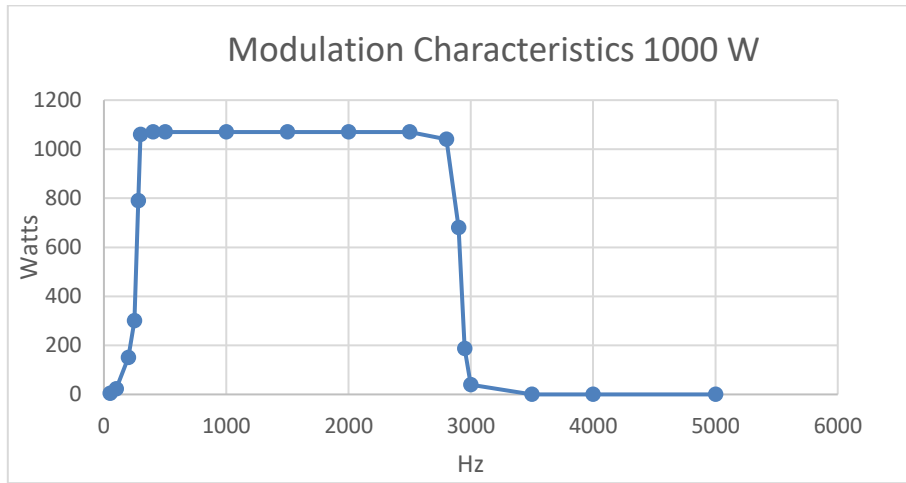


Figure 8.2-1: Modulation Characteristic plot

Table 8.2-1: Modulation Characteristic results

Hz	Watts
50	5
100	22
200	150
250	300
280	790
300	1060
400	1070
500	1070
1000	1070
1500	1070
2000	1070
2500	1070
2800	1040
2900	680
2950	187
3000	39
3500	0.028



Test data, conitued

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	0.03	0.3	0.07	1.1
0.04	2	0.04	0.7	0.1	2.3
0.05	3.7	0.05	1	0.15	5.3
0.1	16	0.1	4.5	0.2	11
0.15	36	0.15	11	0.25	20
0.2	75	0.2	25	0.3	36
0.25	125	0.25	45	0.35	57
0.3	200	0.3	80	0.39	77
0.35	300	0.35	120	0.4	82
0.4	400	0.37	140	0.5	150
0.45	530	0.4	170	0.6	260
0.5	680	0.41	190	0.7	425
0.6	1000	0.45	230	0.8	640
		0.5	320	0.9	840
		0.6	540	1	1000
		0.7	830		
		0.8	1000		

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 log₁₀ pX dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

8.3.2 Test summary

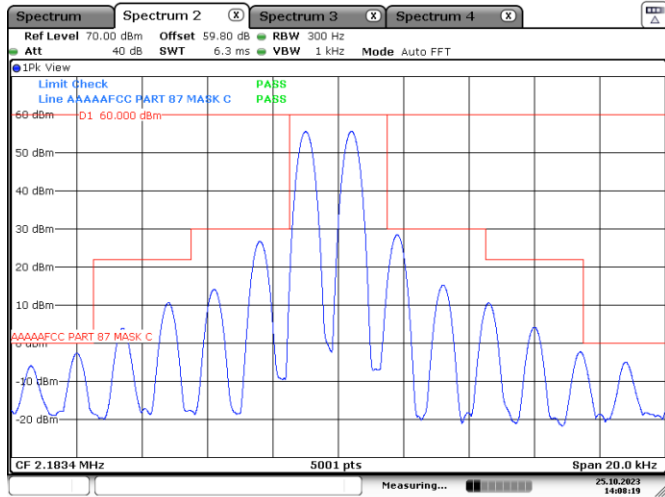
Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Verdict	Pass	Relative humidity	42 %

8.3.3 Observations, settings and special notes

Spectrum analyzer settings:

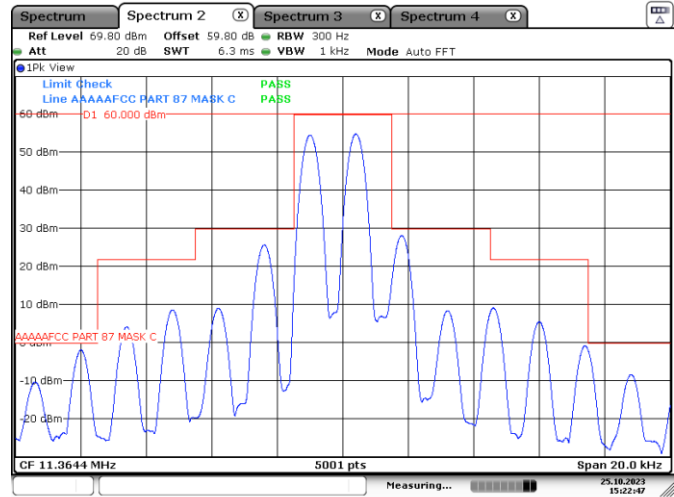
Detector mode	Peak
Resolution bandwidth	300 or 30 Hz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.3.4 Test data



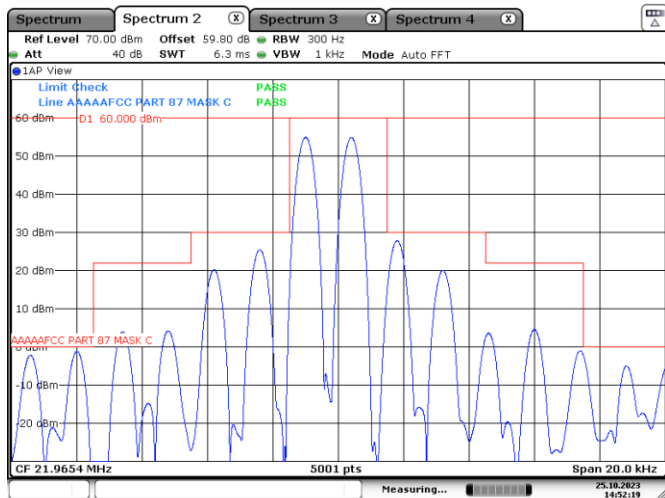
Date: 25.OCT.2023 14:08:19

Figure 8.3-1: Low channel Mask J3E



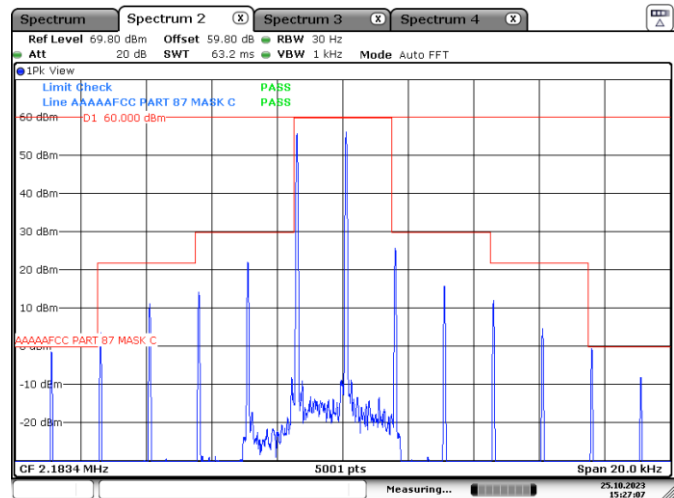
Date: 25.OCT.2023 15:22:47

Figure 8.3-2: Mid channel Mask J3E



Date: 25.OCT.2023 14:52:19

Figure 8.3-3: High channel Mask J3E



Date: 25.OCT.2023 15:27:07

Figure 8.3-4: Low channel Mask H3E

Test data, continued

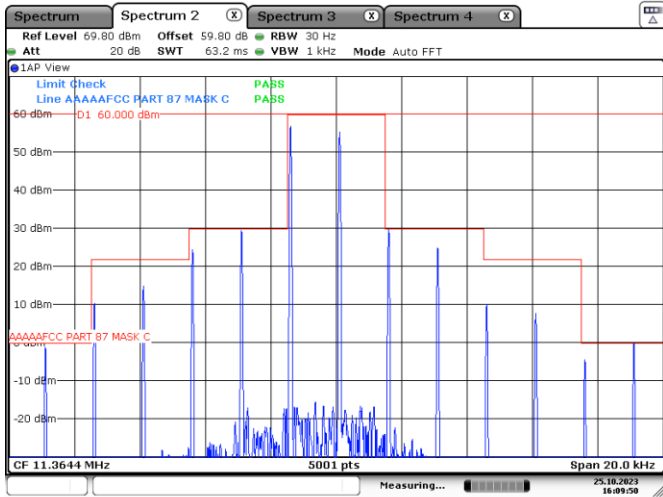


Figure 8.3-5: : Mid channel Mask H3E

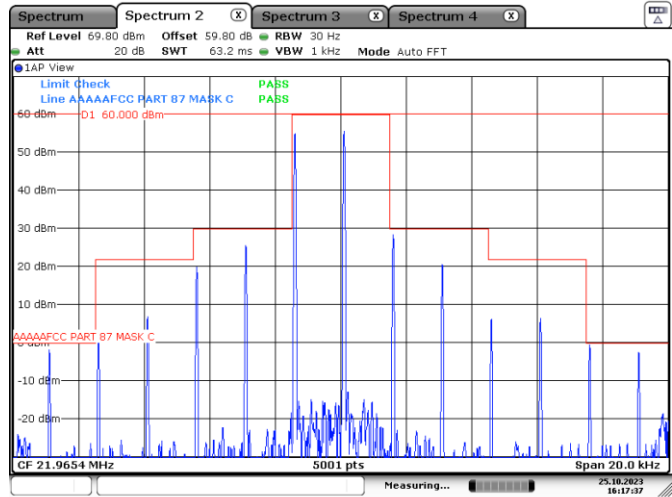


Figure 8.3-6: High channel Mask H3E

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:

Table 8.4-1: Limits

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

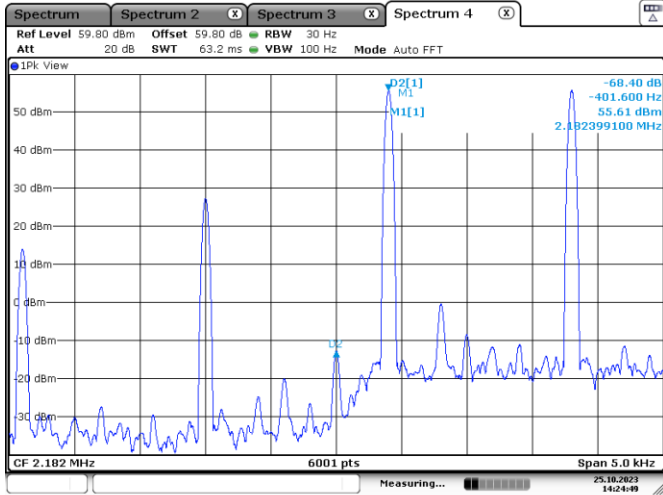
Test date	October 25, 2023	Temperature	21 °C
Test engineer	Kevin Rose	Air pressure	1009 mbar
Verdict	Pass	Relative humidity	45 %

8.4.3 Observations, settings and special notes

Spectrum analyzer settings:

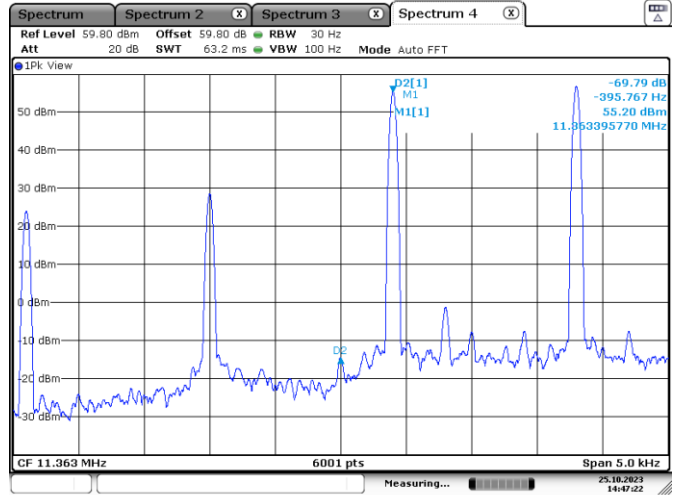
Detector mode	Peak
Resolution bandwidth	30 Hz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.4.4 Test data



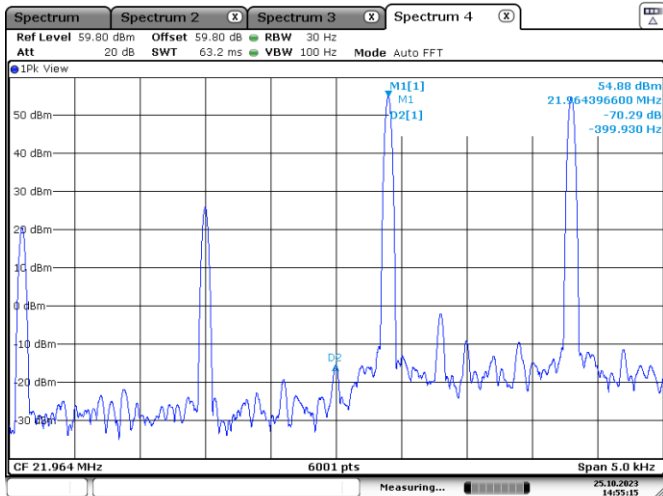
Date: 25.OCT.2023 14:24:49

Figure 8.4-1: Low channel J3E 40 dB



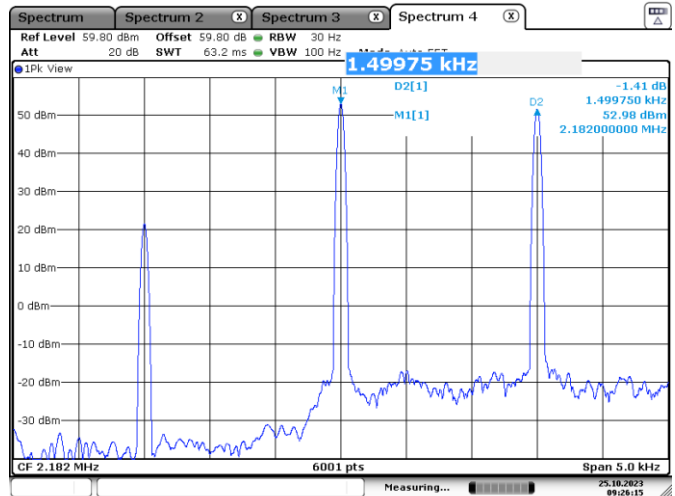
Date: 25.OCT.2023 14:47:23

Figure 8.4-2: Mid channel J3E 40 dB



Date: 25.OCT.2023 14:55:15

Figure 8.4-3: High channel J3E 40 dB



Date: 25.OCT.2023 09:26:15

Figure 8.4-4: Low channel H3E 6 dB

Test data, continued

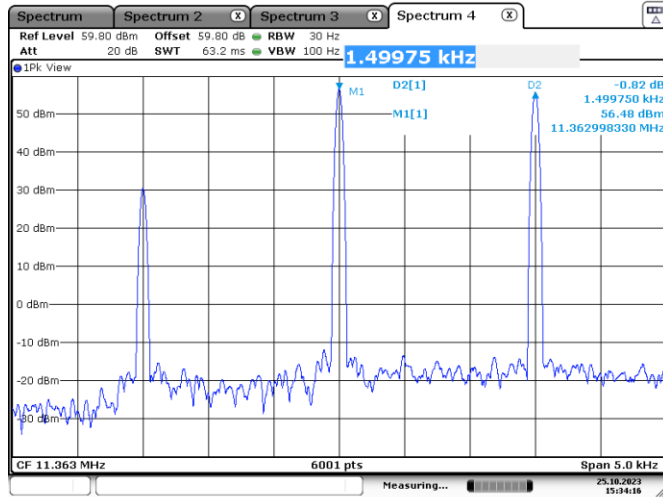


Figure 8.4-5: Mid channel H3E 6 dB

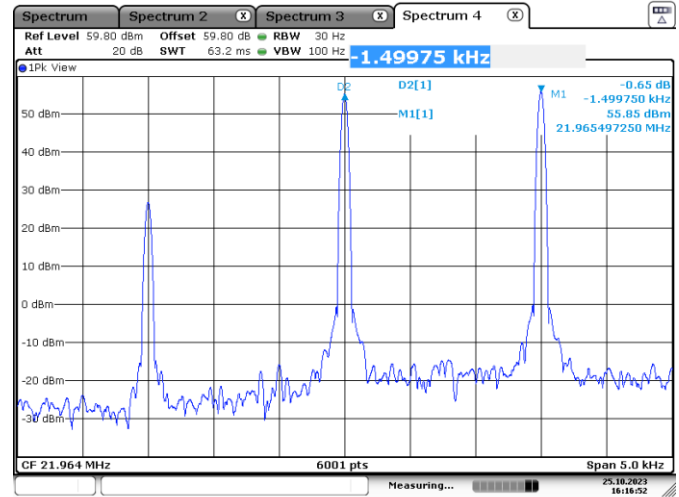


Figure 8.4-6: High channel H3E 6 dB

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 $43 + 10 \log_{10} pX$ 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 %

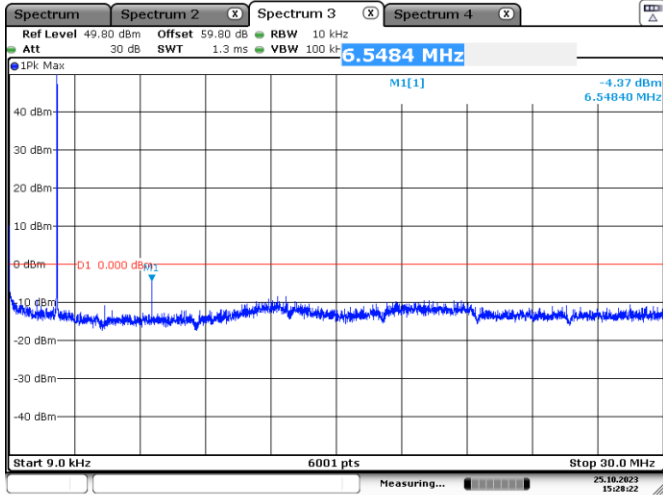
8.5.3 Observations, settings and special notes

Limit was determined by rated power of 1 kW = 60 dBm -60 dB = 0 dBm

Spectrum analyzer settings:

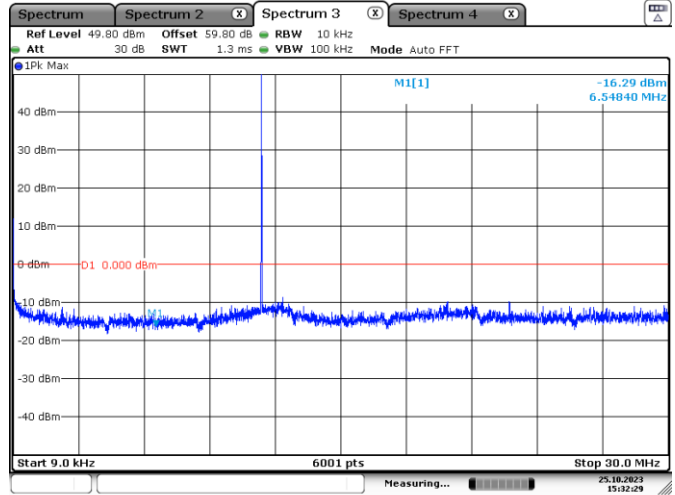
Detector mode	Peak
Resolution bandwidth	10 kHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.5.1 Test data



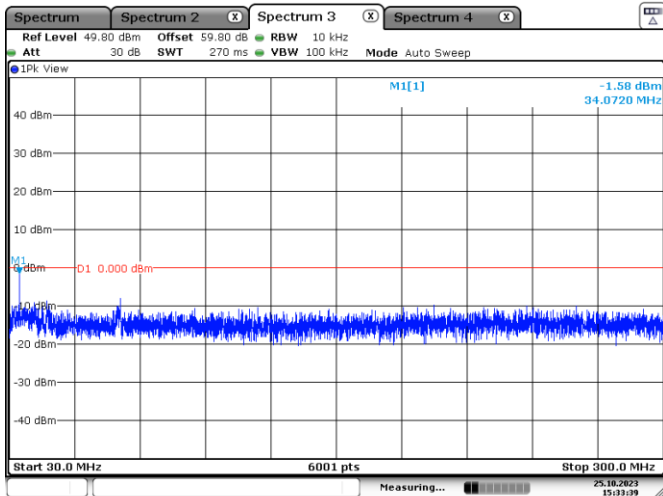
Date: 25.OCT.2023 15:28:23

Figure 8.5-1: Low channel Conducted Spurious H3E



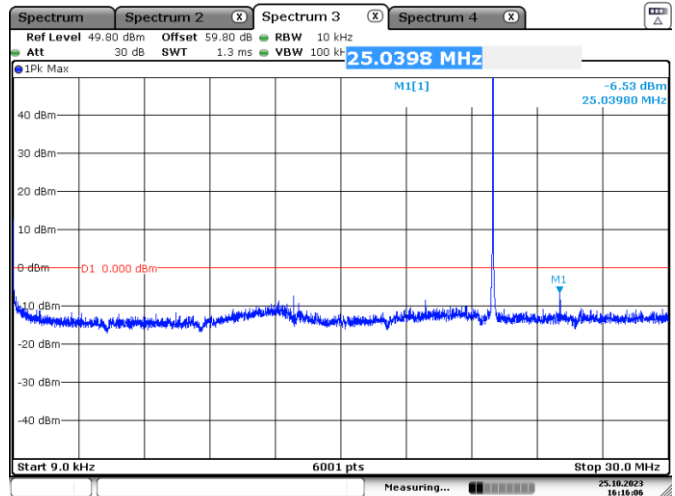
Date: 25.OCT.2023 15:32:29

Figure 8.5-2: Mid channel Conducted Spurious H3E



Date: 25.OCT.2023 15:33:39

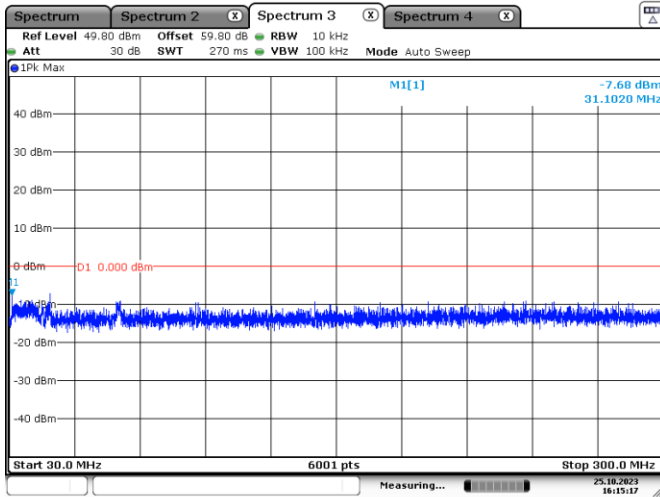
Figure 8.5-3: Mid channel Conducted Spurious H3E



Date: 25.OCT.2023 16:16:06

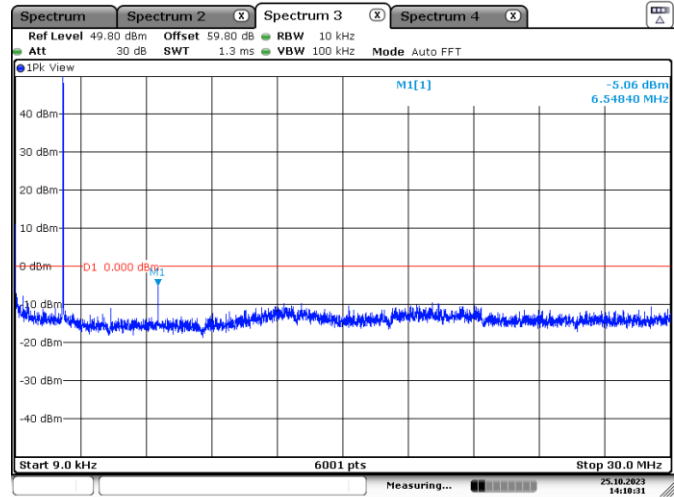
Figure 8.5-4: High channel Conducted Spurious H3E

Test data, conitued



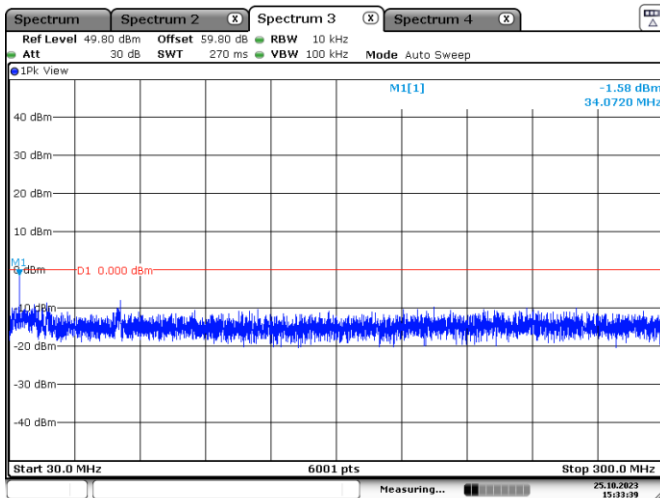
Date: 25.OCT.2023 16:15:18

Figure 8.5-5: High channel Conducted Spurious H3E



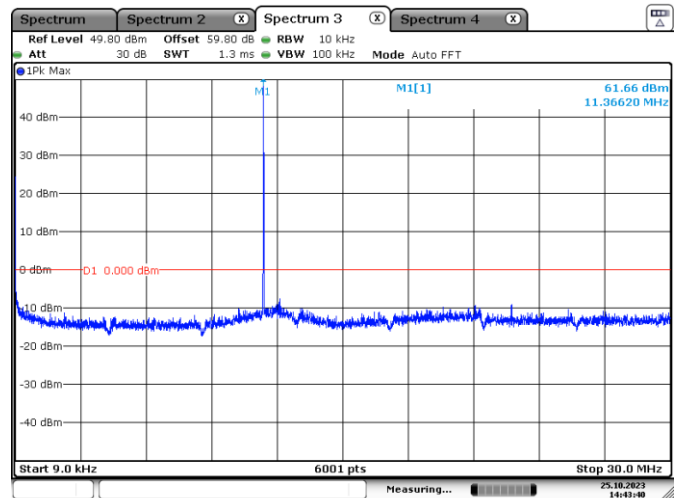
Date: 25.OCT.2023 14:10:31

Figure 8.5-6: Low channel Conducted Spurious J3E



Date: 25.OCT.2023 15:33:39

Figure 8.5-7: Mid channel Conducted Spurious J3E



Date: 25.OCT.2023 14:43:41

Figure 8.5-8: Mid channel Conducted Spurious J3E

Test data, continued

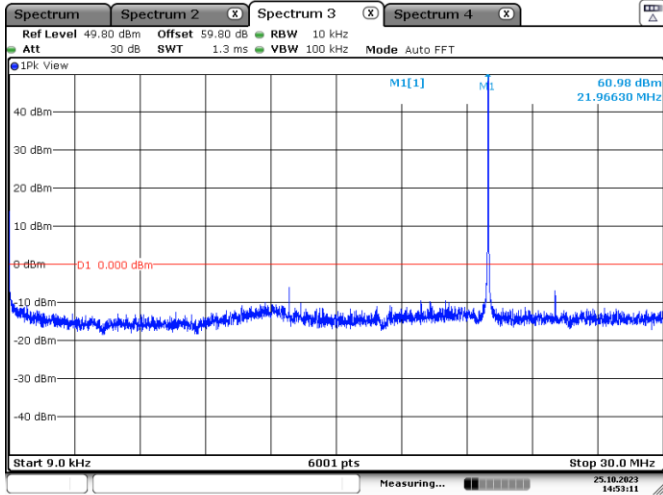


Figure 8.5-9: High channel Conducted Spurious J3E

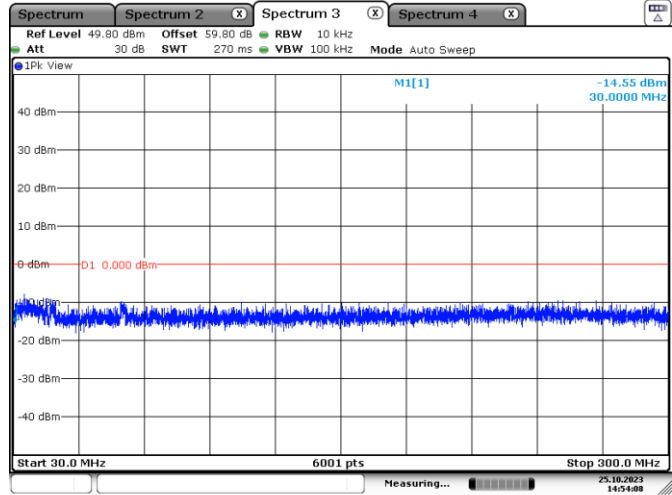


Figure 8.5-10: High channel Conducted Spurious J3E

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 log₁₀ 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 %

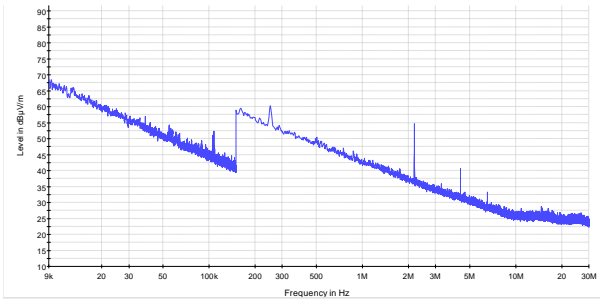
8.6.3 Observations, settings and special notes

- 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.
- Limit was determined by rated power of 1 kW = 60 dBm -60 dB = 0 dBm

Spectrum analyzer settings:

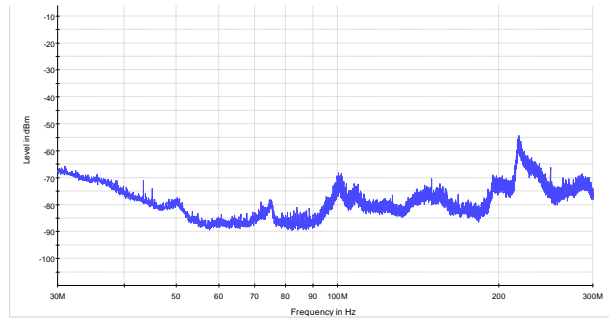
Detector mode	Peak
Resolution bandwidth	10 kHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.6.4 Test data



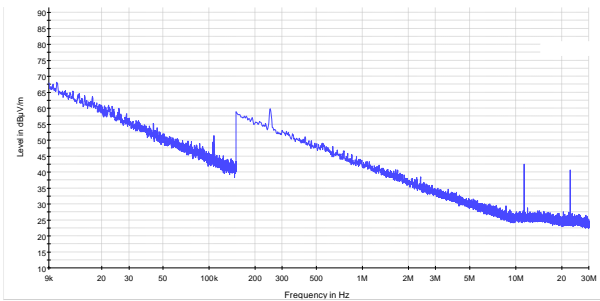
9 kHz to 30 MHz low channel 1000 watts
 PK+_MAXH

Figure 8.6-1: Low channel Radiated Spurious 9 kHz-30 MHz
 Notes Limit = 95.23 dBµV/m or 0 dBm



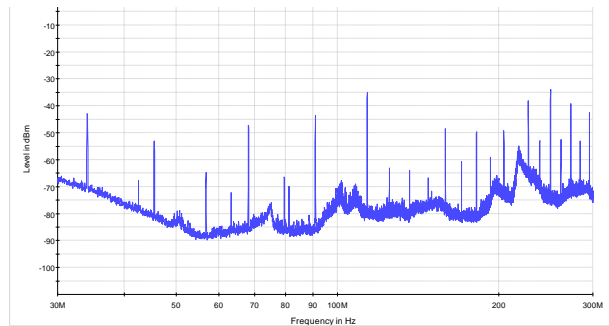
30-300 MHz low channel 1000 watts
 PK+_MAXH

Figure 8.6-2: Low channel Radiated Spurious 30-300 MHz
 Notes Limit = 95.23 dBµV/m or 0 dBm



9 kHz to 30 MHz mid channel 1000 watts
 PK+_MAXH

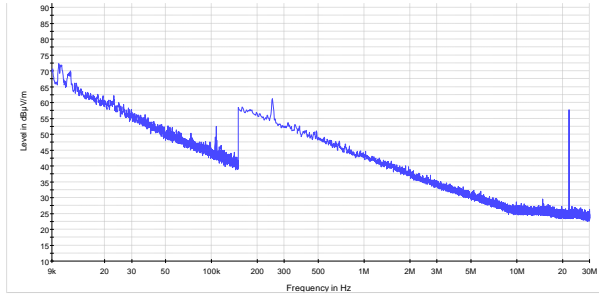
Figure 8.6-3: Mid channel Radiated Spurious 9 kHz-30 MHz
 Notes Limit = 95.23 dBµV/m or 0 dBm



30-300 MHz mid channel 1000 watts
 PK+_MAXH

Figure 8.6-4: Mid channel Radiated Spurious 30-300 MHz
 Notes Limit = 95.23 dBµV/m or 0 dBm

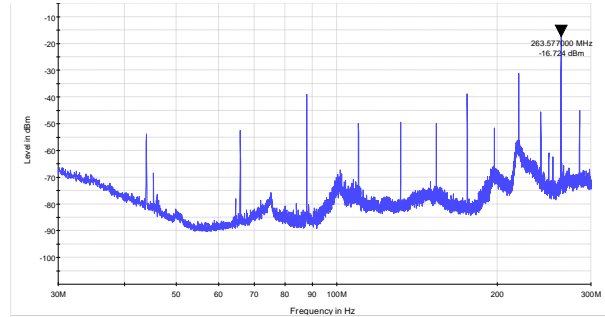
Test data, continued



9 kHz to 30 MHz high channel 1000 watts
PK+_MAXH

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

Notes Limit = 82.23 dBµV/m or -13 dBm



30-300 MHz high channel 1000 watts
PK+_MAXH

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

Notes Limit = 82.23 dBµV/m or -13 dBm

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

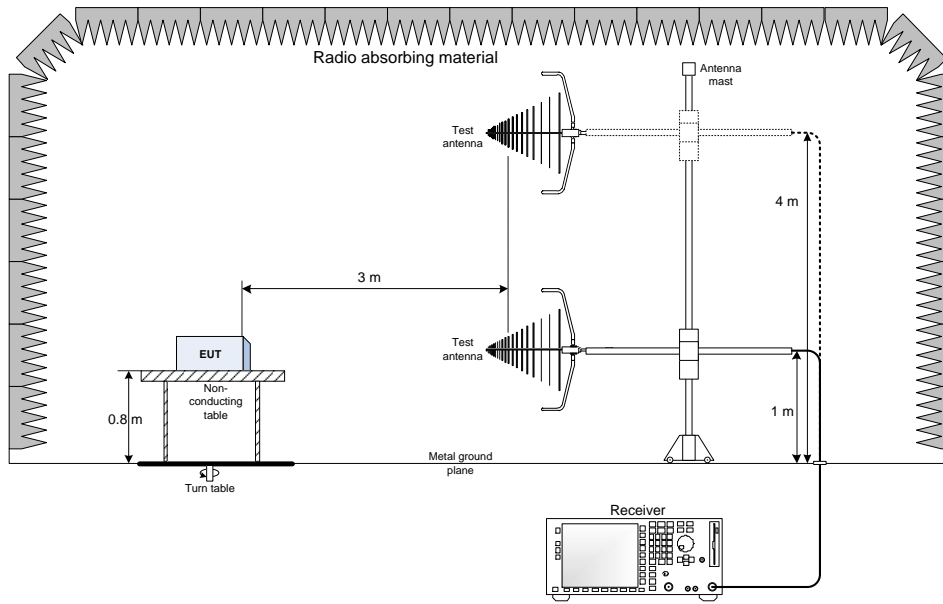
8.7.4 Test data

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

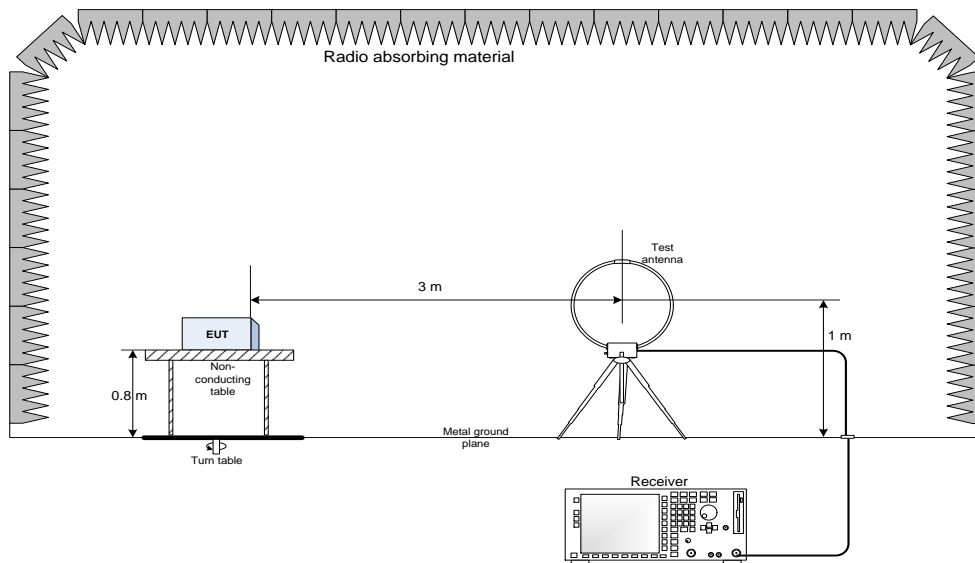
Test conditions	Frequency, Hz	Drift, Hz	Limit ±10 Hz
+50 °C, Nominal	11363395	7	±10 Hz
+40 °C, Nominal	11363396	6	±10 Hz
+30 °C, Nominal	11363399	3	±10 Hz
+20 °C, +15 %	11363402	0	±10 Hz
+20 °C, Nominal	11363402	0	Reference
+20 °C, -15 %	11363402	0	±10 Hz
+10 °C, Nominal	11363402	0	±10 Hz
0 °C, Nominal	11363402	0	±10 Hz
-10 °C, Nominal	11363402	0	±10 Hz
-20 °C, Nominal	11363403	-1	±10 Hz
-30 °C, Nominal	11363402	0	±10 Hz

Section 9. Block diagrams of test set-ups

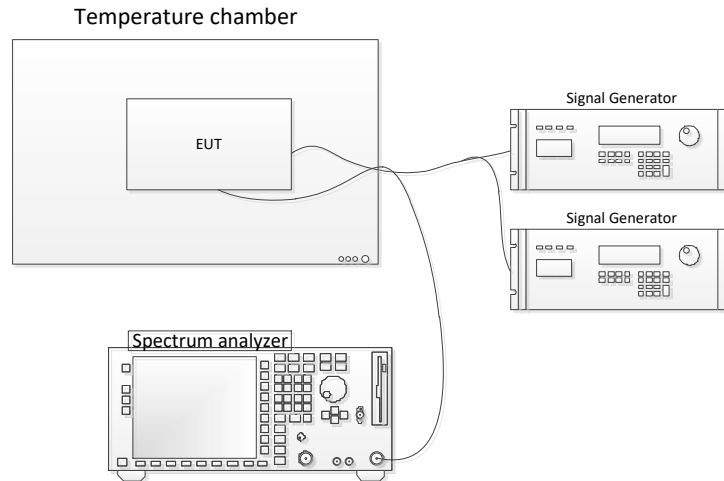
9.1 Radiated emissions set-up for frequencies 30 MHz- 1 GHz



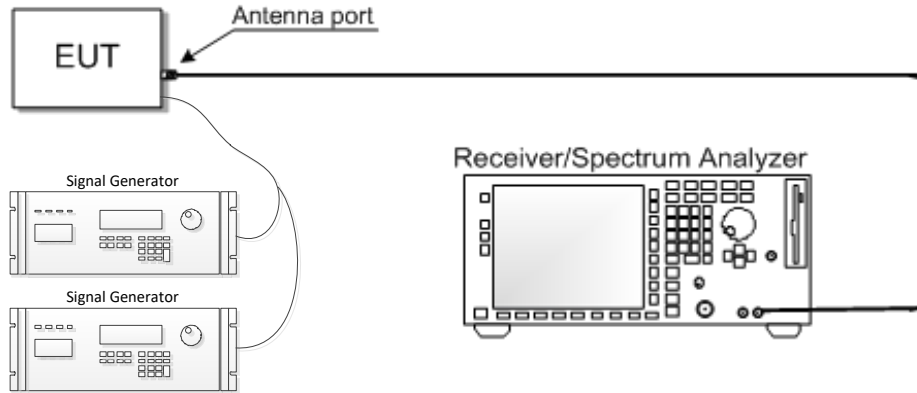
9.2 Radiated emissions set-up for frequencies below 30 MHz



9.3 Frequency stability



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



-End of test report-