



RADIO TEST REPORT – 451191-2TRFWL

Type of assessment:

Final product testing

Applicant:

Barrett Communications Pty Ltd

Product description:

Tactical HF SDR transceiver

Model (HVIN):

PRC-4090 HF SDR transceiver

Product name (PMN):

SDR Transceiver

FCC identifier:

FCC ID: OW4-PRC4090HF

ISED Certification number:

IC: 6468A-4090HF

Specifications:

FCC 47 CFR Part 87

Aviation Services

Date of issue: December 12, 2022

Kevin Rose, EMC/RF Lab Manager

Tested by

Signature

Andrey Adelberg, Senior EMC/RF Specialist

Reviewed by

Signature

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SCC File Number: 15064 (Ottawa/Almonte); 151100 (Montreal); 151097 (Cambridge)

Part 87 AVIATION SERVICES.docx; Date: Nov 2014





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	Test site registration	Organization FCC/ISED	Recognition numbers and location FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte); FCC: CA2041; IC: 2040G-5 (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 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
City	Bibra Lake
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

Revision #	Details of changes made to test report
TRF	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
87.141(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	May 18, 2022
Nemko sample ID number	1

3.2 EUT information

Product name	SDR Transceiver
Model (HVIN)	PRC-4090 HF SDR transceiver
Serial number	409000319

3.3 Technical information

Operating band	1.5–30 MHz
Test frequencies	1.722, 16.1, and 27.86 MHz
Modulation type	J3E and H3E
Occupied bandwidth (99 %)	2.7 kHz (J3E), 3 kHz (H3E)
Power requirements	13.8 Vdc for 30 Watt system
Emission designator	2K70J3E, 3K00H3E
Antenna information	Various types with standard PL-259 connector



3.4 Product description and theory of operation

The PRC-4090 HF SDR Transceiver is an SDR based HF SSB transceiver with a frequency range of 1.5 to 30 MHz in transmit and 250 kHz to 30 MHz in receive. The Barrett PRC-4090 is designed using the latest technology enabling a physically small package with a full feature complement.

Designed to operate in the most arduous environments, as encountered in portable, off-road vehicles, vessels and aircraft environments, the Barrett PRC-4090 will provide many years of efficient and trouble free service.

The Barrett PRC-4090 supports features such as digital voice, data transmission and remote diagnostics as well as established features such as Selective Call (Selcall), direct dial telephone connection to base stations fitted with telephone interconnect systems (Telcall), GPS location, 2G and 3G ALE (Automatic Link Establishment) and frequency hopping. These features make the Barrett PRC-4090 transceiver one of the most economical and versatile HF transceivers available today.

The Barrett PRC-4090 transceiver caters for increased use of HF data transmission for Internet email access and point-to-point data applications, by providing a comprehensive data modem interface port, high speed transmit-to-receive switching, a high stability frequency standard and an efficient cooling system option.

The Barrett PRC-4090 is operated by a smartphone-style touchscreen, full color Control Handset. The handset integrates seamlessly into manpack, vehicle and base station installations when used with the cradle and cradle docking station. The streamlined design and unobtrusive size can easily mount to a vehicle dashboard or vessel helm.

The Barrett PRC-4090 transceiver can be controlled from all major mobile and desktop platforms. Full remote control is available via the Barrett PRC-4090 Remote Control app, providing unprecedented access to all transceiver functionality across all major platforms.

Teamed with other matching Barrett products which include antennas, power supplies, vehicle tracking packages and HF modems, the Barrett PRC-4090 transceiver becomes a powerful tool, providing solutions to many long distance communication requirements.

Operated from either a battery or 12 volt (13.8 V) DC / 24 V DC supply, the transmitter is rated at 30 watt PEP (when connected to a battery) or 150 watt PEP (when connected to DC via the System Docking Station (SDS)) respectively in voice and data mode and is protected from over-voltage or reverse-voltage application.

Auxiliary features such as Selcall, Telcall, scanning, mute status, alarm system etc. can be individually enabled or disabled for every channel as required to suit your operation.

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

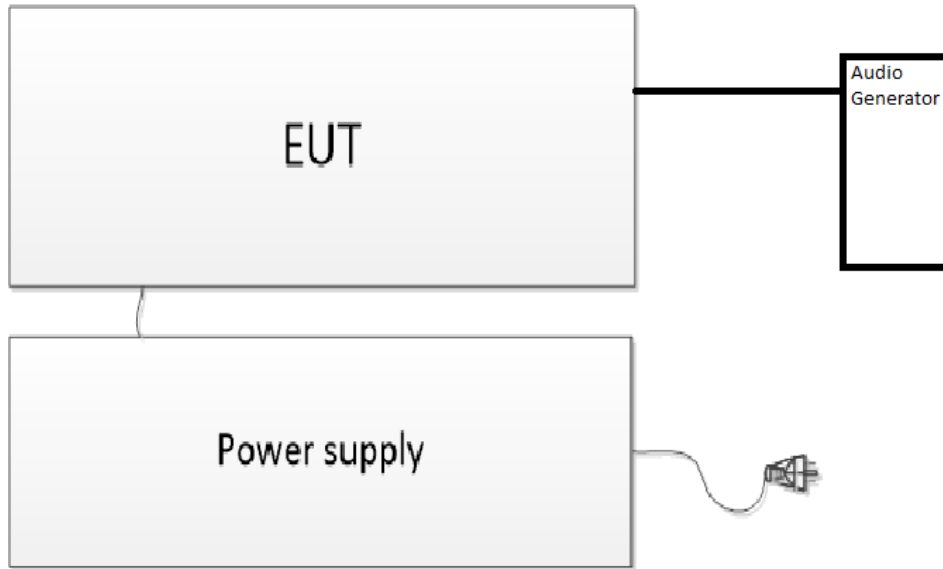


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Power supply 13.8 VDC	Barrett	2022	402410668
Agilent Audio generator	Audio generator	33500B	N/A

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

None

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./Ver. cycle	Next cal./ver.
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	January 20, 2023
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
AC Power source	Chroma		FA003020	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	November 25, 2022
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	February 14, 2023
Active loop antenna (0.01–30 MHz)	Com-Power	AL-130	FA002674	1 year	September 12, 2023
Spectrum analyzer	Rohde & Schwarz	FSW50	FA002971	1 year	November 29, 2022
Temperature chamber	Espec	EPX-4H	FA002735	1 year	January 16, 2023
Audio Generator	Agilent	33500 B series	None	N/A	NCR

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

Section 8. Test 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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.1.3 Observations, settings and special notes

Test conditions
 Test conditions

Audio input	1500 Hz
Modulation	H3E
Audio input	400 Hz and 1800 Hz
Modulation	J3E

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: results 30W system operation J3E modulation

Modulation	Frequency, MHz	RF output power, dBm	Limit, dBm	Margin, dB
J3E	1.722	44.61	67.78	23.17
J3E	16.1	45.01	67.78	22.77
J3E	27.86	44.76	67.78	23.02

Table 8.1-2: results 30W system operation H3E modulation

Modulation	Frequency, MHz	RF output power, dBm	Limit, dBm	Margin, dB
H3E	1.722	44.36	67.78	23.42
H3E	16.1	44.43	67.78	23.35
H3E	27.86	44.56	67.78	23.22

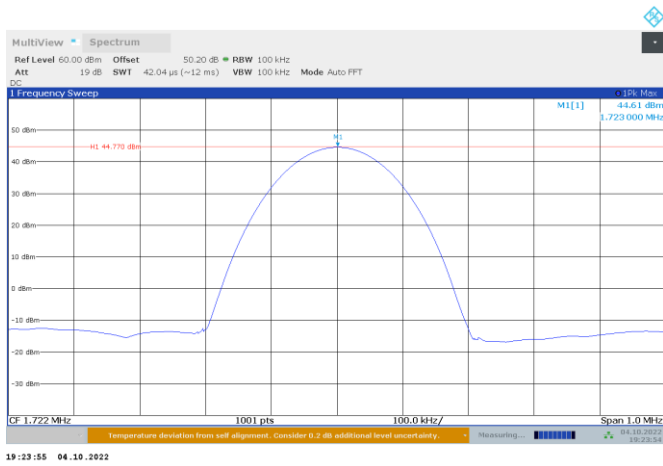


Figure 8.1-1: Low channel, 1.722 MHz, 30W, J3E modulation, output power

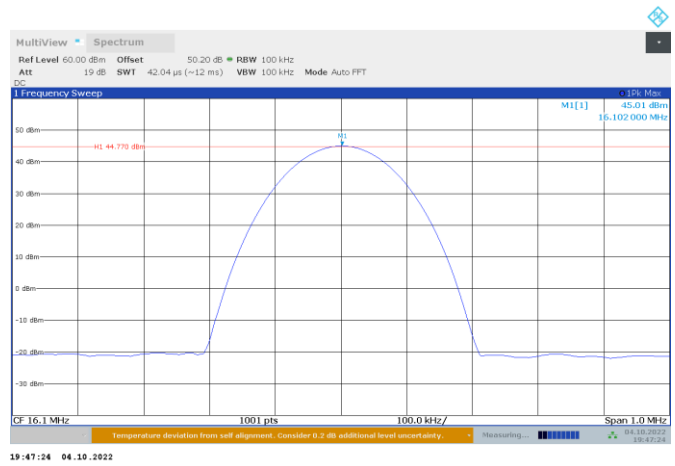


Figure 8.1-2: Mid channel, 16.1 MHz, 30W, J3E modulation, output power

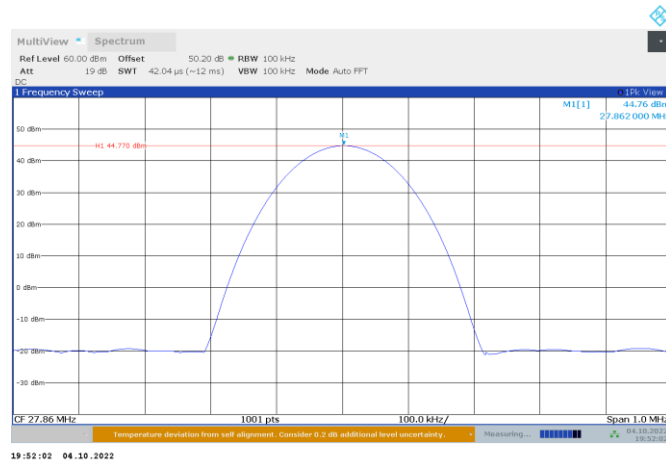


Figure 8.1-3: High channel, 27.86 MHz, 30W, J3E modulation, output power

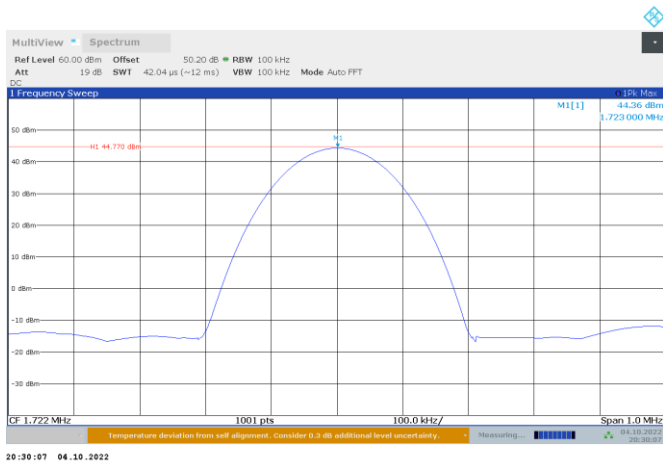


Figure 8.1-4: Low channel, 1.722 MHz, 30W, H3E modulation, output power

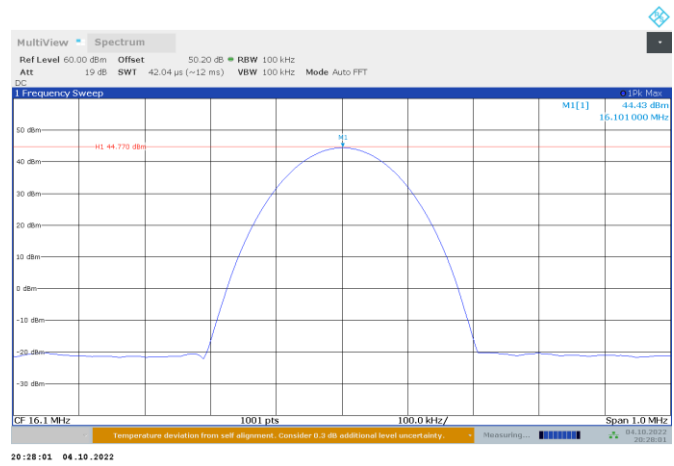


Figure 8.1-5: Mid channel, 16.1 MHz, 30W, H3E modulation, output power

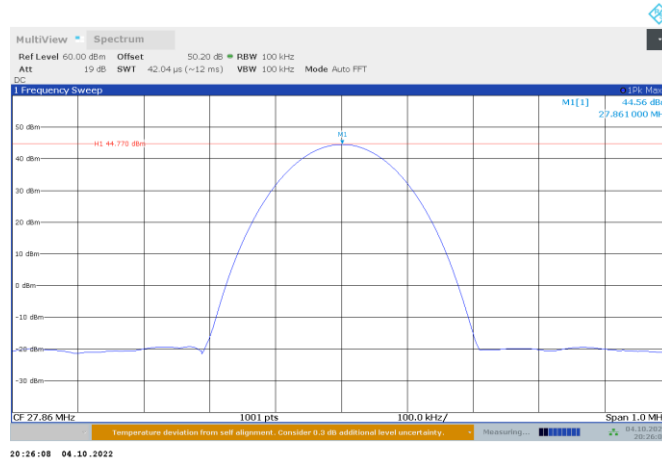


Figure 8.1-6: High channel, 26.86 MHz, 30W, H3E modulation, output power

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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.2.3 Observations, settings and special notes

None

8.2.4 Test data

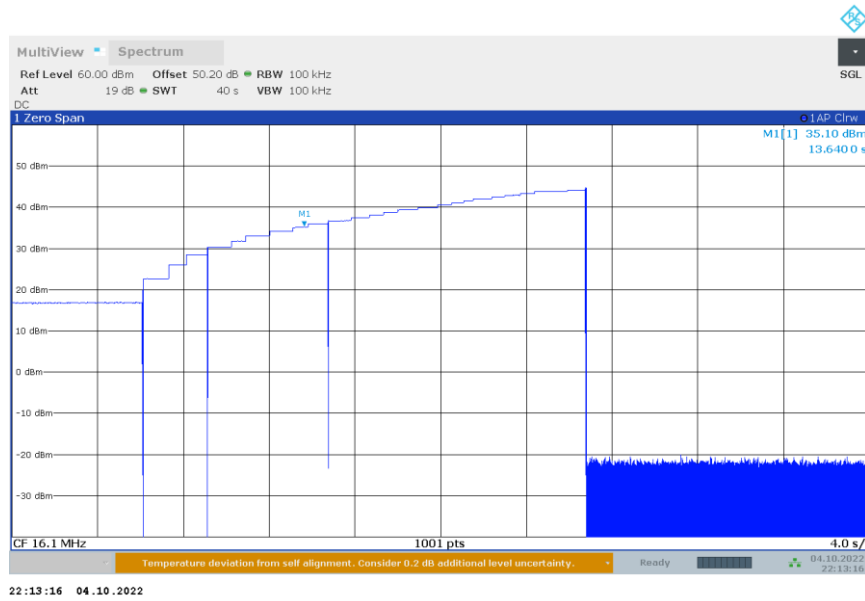


Figure 8.2-1: Modulation Characteristic Modulation limiting

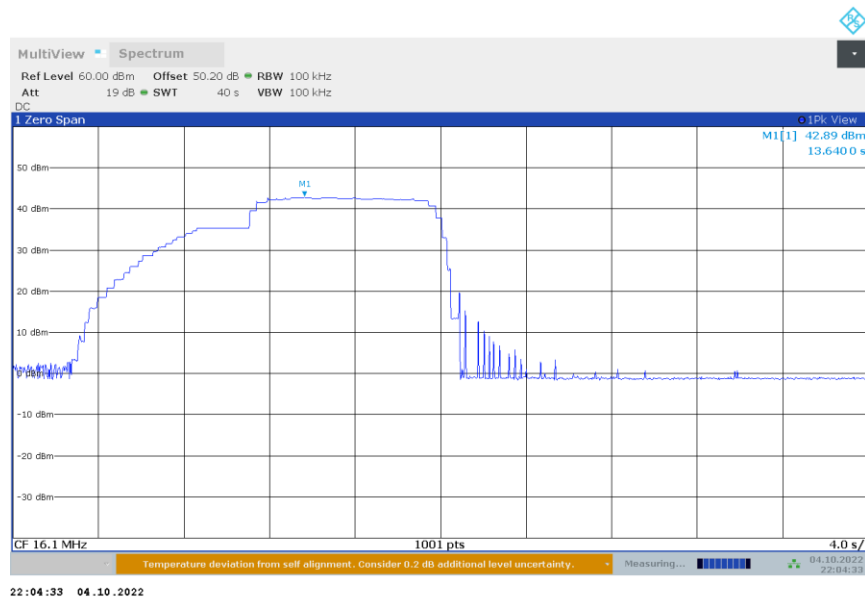


Figure 8.2-2: Modulation Characteristic Audio Frequency Response



Table 8.2-1: Modulation characteristics, frequency response results 30 Watts

Input Frequency, Hz	Output power, Watts
100	0.1
300	10
400	19.8
1000	19.8
2000	19.7
2500	19.6
2800	19.5
3000	10
5000	0.1

Note: the input level we reduced to see the true audio response. The EUT shuts down when it exceeds the limit.

Table 8.2-2: Modulation characteristics, modulation limiting results 30 Watts

1.722 MHz		16.1 MHz		27.86 MHz	
Input Audio, V p-p	Output power, Watts	Input Audio, V p-p	Output power, Watts	Input Audio, V p-p	Output power, Watts
0.01	0.05	0.01	0.1	0.01	0.1
0.02	0.3	0.02	0.7	0.02	0.7
0.04	0.5	0.04	1	0.04	0.8
0.05	1	0.05	1.9	0.05	1.9
0.07	2	0.07	2.6	0.07	2.6
0.1	4	0.1	6.2	0.1	6.8
0.15	26	0.15	10.1	0.18	10.8
0.2	28	0.2	27.3	0.25	27.8
0.26	29	0.26	29	0.34	29.1
0.27	0	0.27	0	0.35	0



8.3 FCC 87.139(c) Emission limits, emission mask

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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.3.3 Observations, settings and special notes

Test conditions

Audio input	1500 Hz
Modulation	H3E
Audio input	400 Hz and 1800 Hz
Modulation	J3E

Note: the EUT has an Audio low-pass filter.

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	50 Hz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.3.4 Test data

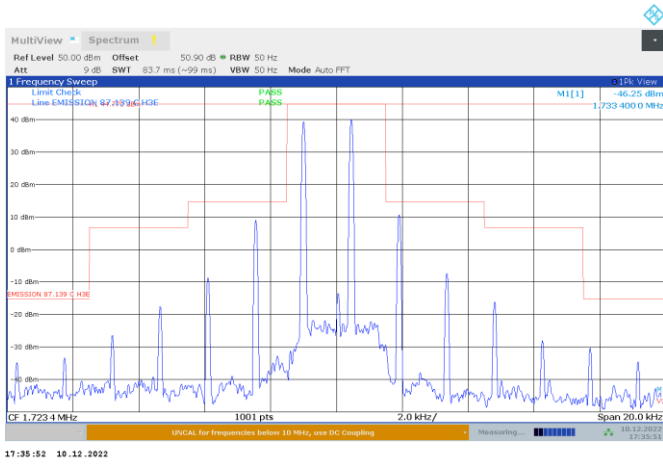


Figure 8.3-1: Low channel Mask 30W H3E

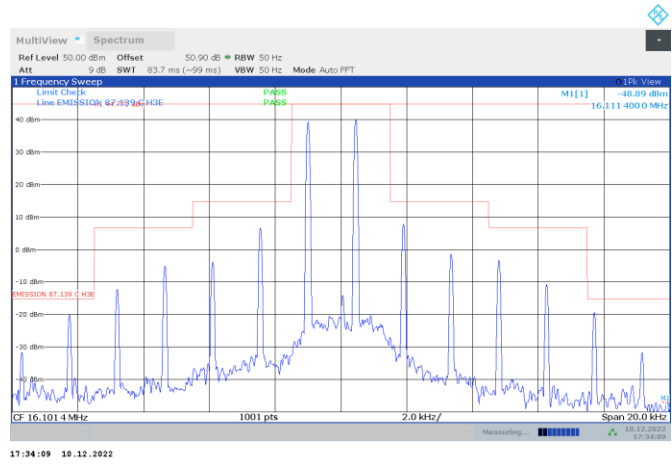


Figure 8.3-2: Mid channel Mask 30W H3E

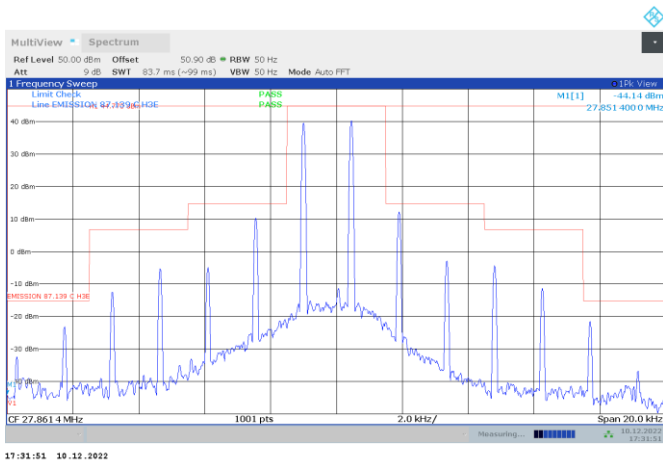


Figure 8.3-3: High channel Mask 30W H3E

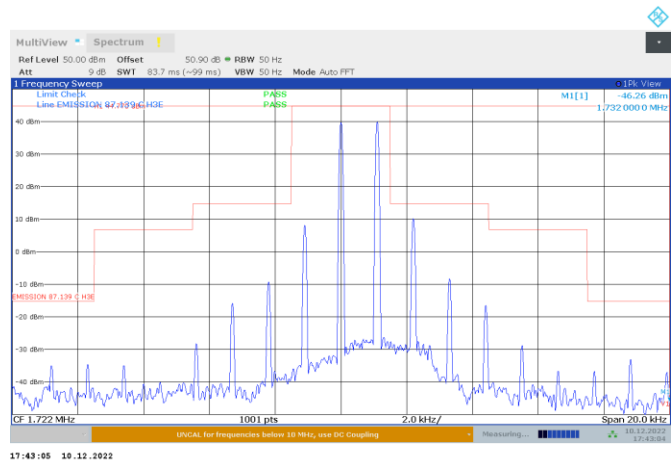


Figure 8.3-4: Low channel Mask 30W J3E

Section 8
Test name
Specification

Testing data
 FCC 87.139(c) Emission limits, emission mask
 FCC Part 87

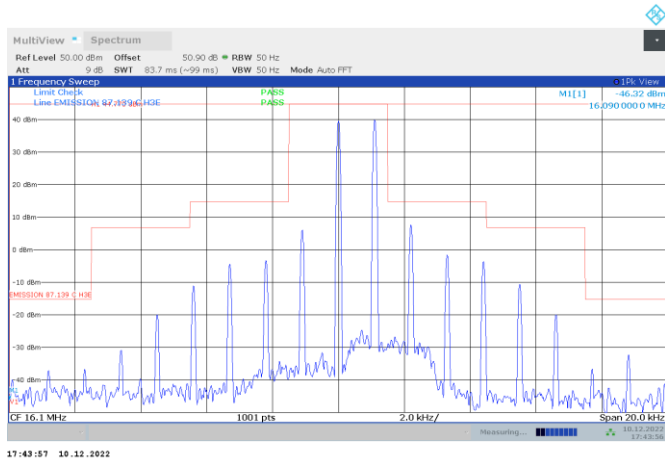


Figure 8.3-5: Mid channel Mask 30W J3E

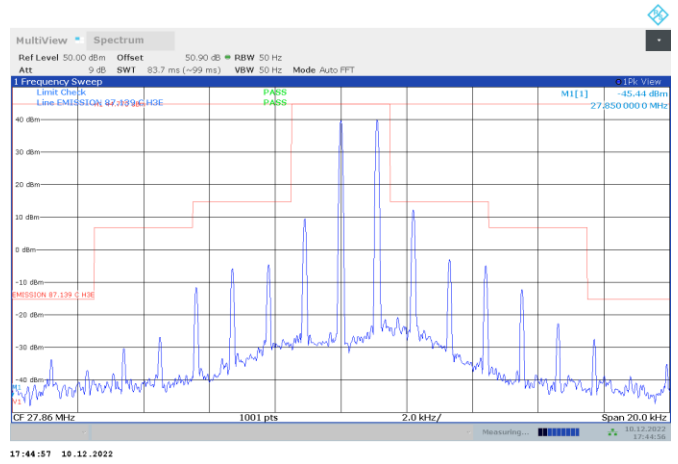


Figure 8.3-6: High channel Mask 30W J3E

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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.4.3 Observations, settings and special notes

Test conditions

Audio input	1500 Hz
Modulation	H3E

Audio input	400 Hz and 1800 Hz
Modulation	J3E

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	50 Hz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.4.4 Test data

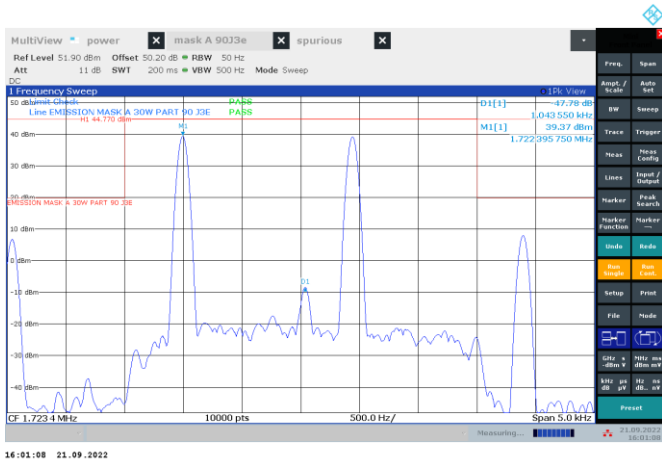


Figure 8.4-1: Low channel 30W 400 Hz and 1800 Hz
 40 dB Carrier suppression



Figure 8.4-2: Mid channel 30W 400 Hz and 1800 Hz
 40 dB Carrier suppression

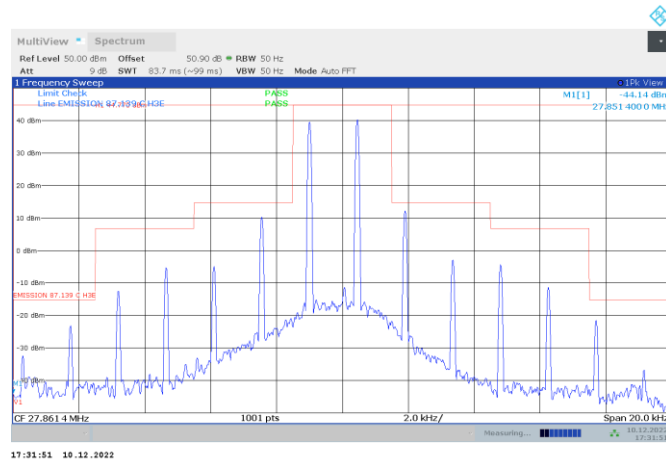


Figure 8.4-3: High channel 30W 400 Hz and 1800 Hz
 40 dB Carrier suppression

8.4.1 Test data

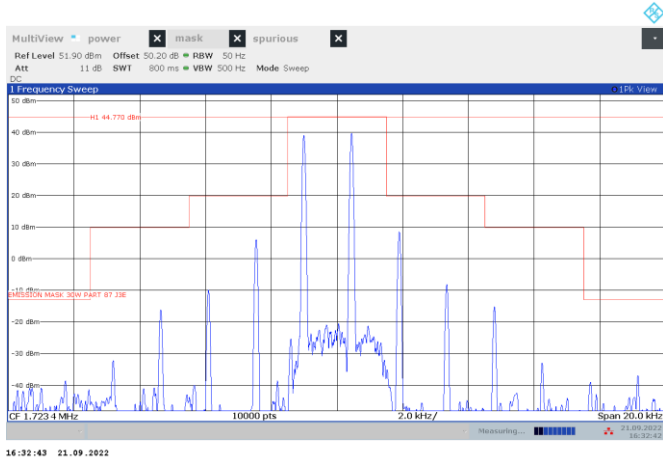


Figure 8.4-4: Low channel 30W 1500 Hz 6 dB

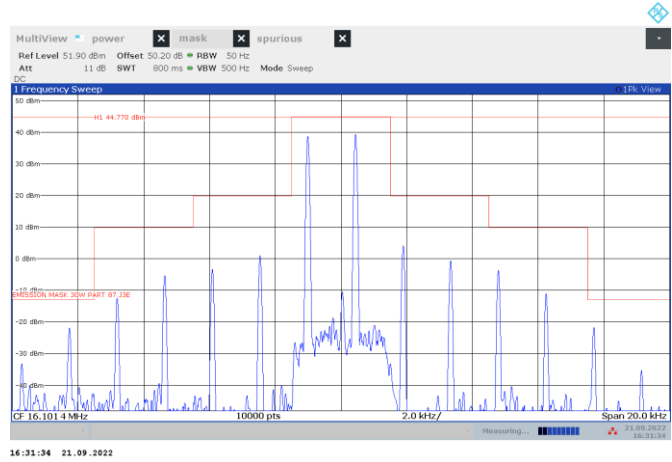


Figure 8.4-5: Mid channel 30W 1500 Hz 6 dB

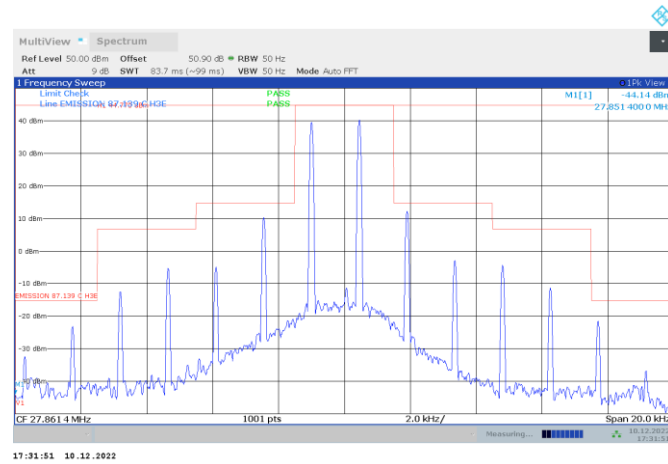


Figure 8.4-6: high channel 30W 1500 Hz 6 dB



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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.5.3 Observations, settings and special notes

Test conditions

Audio input	1500 Hz
Modulation	H3E

Spectrum analyzer settings below 30 MHz:

Detector mode	Peak
Resolution bandwidth	10 kHz
Video bandwidth	10 kHz
Trace mode	Max Hold

Spectrum analyzer settings above 30 MHz:

Detector mode	Peak
Resolution bandwidth	100 kHz
Video bandwidth	100 kHz
Trace mode	Max Hold

8.5.4 Test data

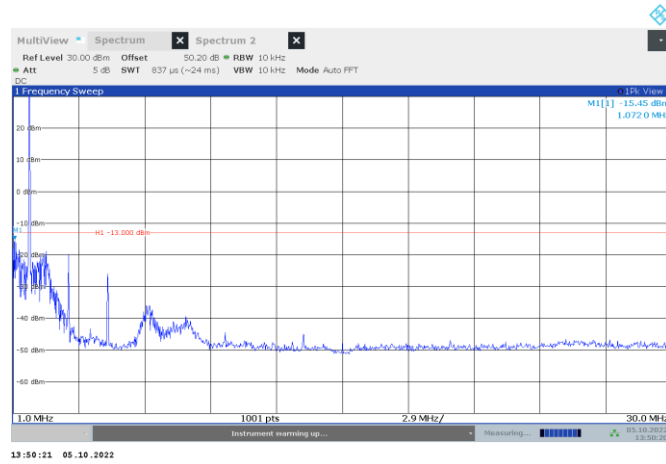


Figure 8.5-1: Low channel 1.722 MHz, H3E modulation, Conducted Spurious

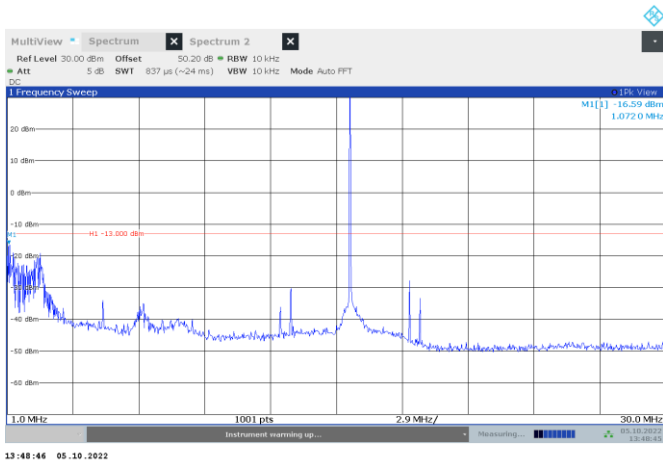


Figure 8.5-2: Mid channel 16.1 MHz, H3E modulation, Conducted Spurious

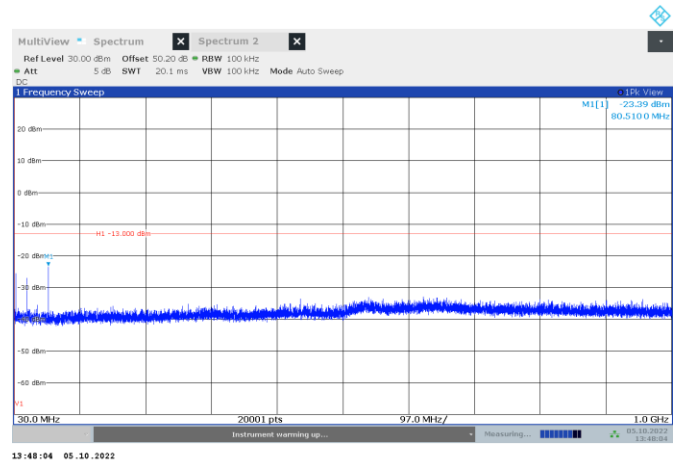


Figure 8.5-3: Mid channel 16.1 MHz, H3E modulation, Conducted Spurious

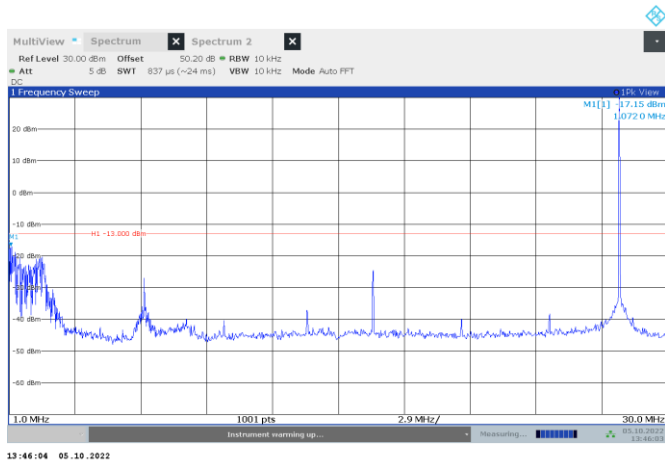


Figure 8.5-4: High channel 27.86 MHz, H₃E modulation, Conducted Spurious

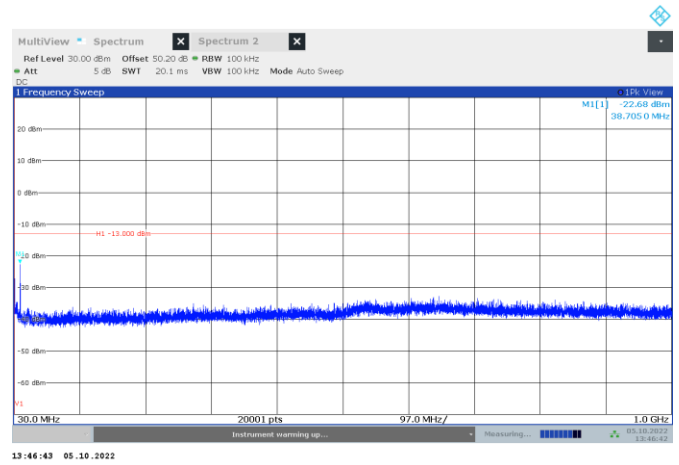


Figure 8.5-5: High channel 27.86 MHz, H₃E modulation, Conducted Spurious

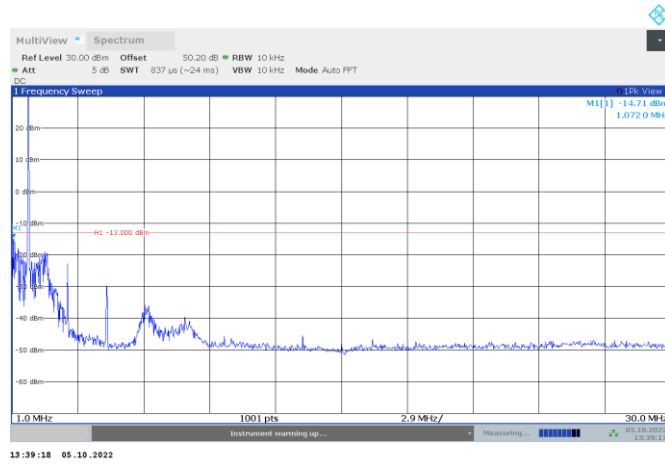


Figure 8.5-6: Low channel 1.722 MHz, J3E modulation, Conducted Spurious

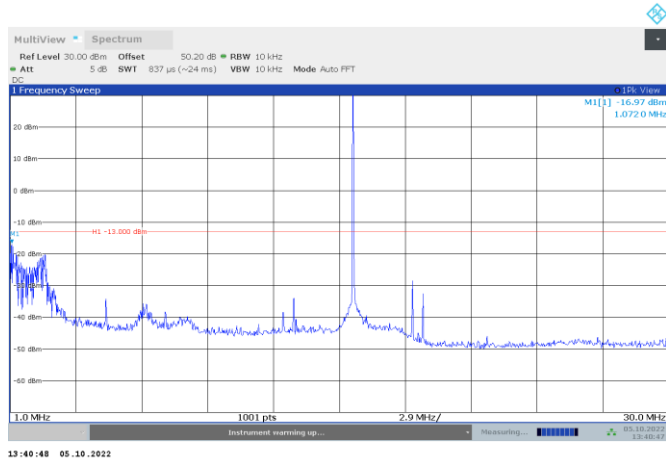


Figure 8.5-7: Mid channel 16.1 MHz, J3E modulation, Conducted Spurious

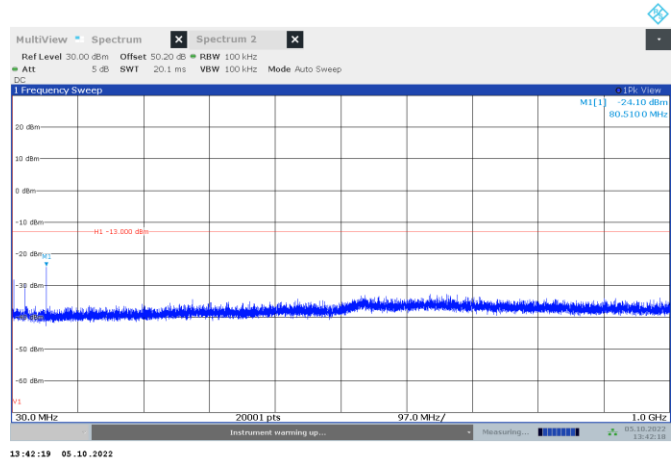


Figure 8.5-8: Mid channel 16.1 MHz, J3E modulation, Conducted Spurious

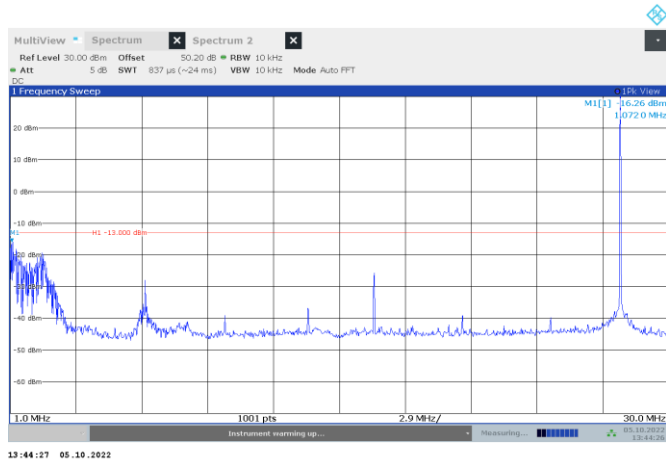


Figure 8.5-9: High channel 27.86 MHz, J3E modulation, Conducted Spurious

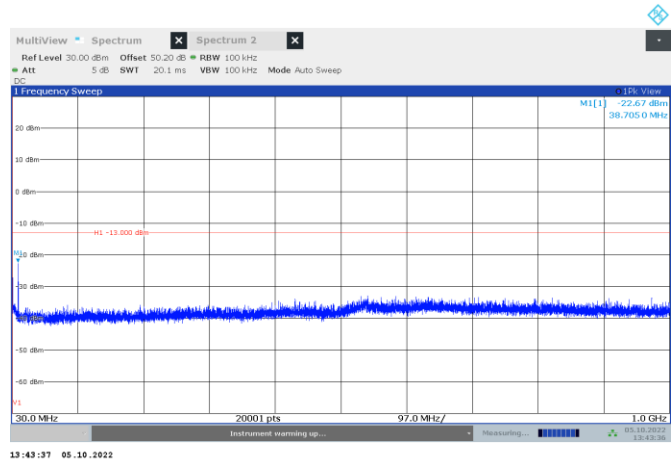


Figure 8.5-10: High channel 27.86 MHz, J3E modulation, Conducted Spurious



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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.6.3 Observations, settings and special notes

Test conditions

Audio input	1500 Hz
Modulation	H3E
Antenna termination	50 Ohm Load

Spectrum analyzer settings below 30 MHz:

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

Spectrum analyzer settings above 30 MHz:

Detector mode	Peak
Resolution bandwidth	100 kHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.6.4 Test data

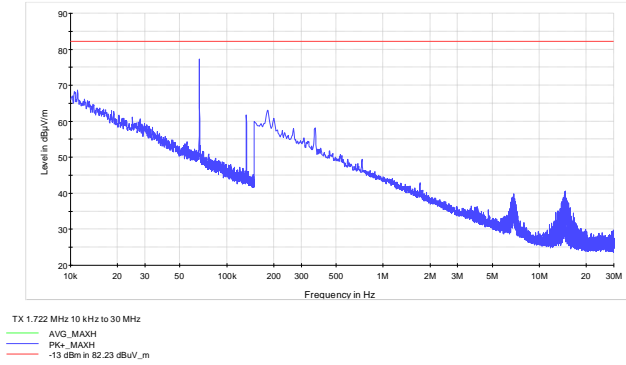


Figure 8.6-1: Low channel Radiated Spurious

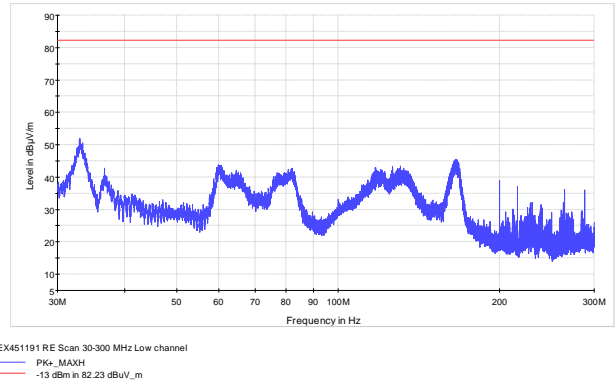


Figure 8.6-2: Low channel Radiated Spurious

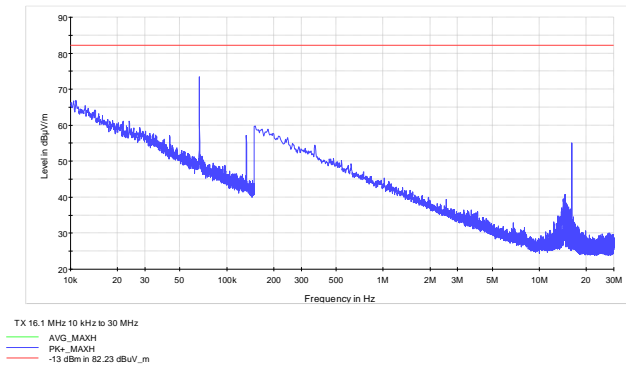


Figure 8.6-3: Mid channel Radiated Spurious

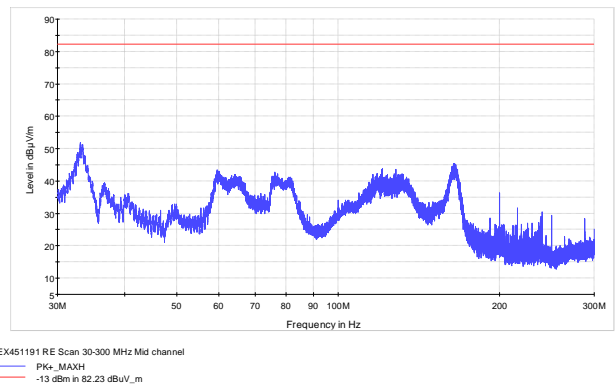
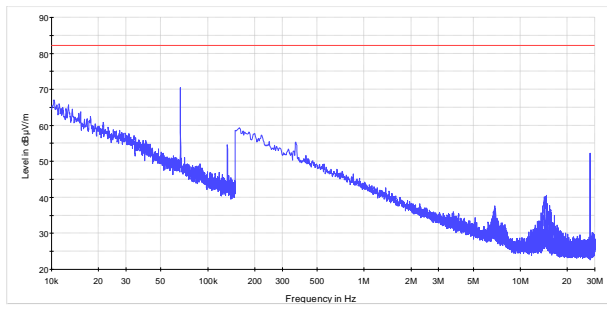
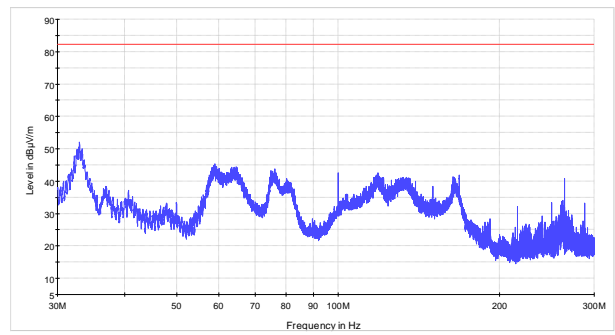


Figure 8.6-4: Mid channel Radiated Spurious



TX 27.86 MHz 10 kHz to 30 MHz
— AVG_MAXH
— Pk+_MAXH
— -13 dBm in 82.23 dBuV_m

Figure 8.6-5: High channel Radiated Spurious



NEX451191 RE Scan 30-300 MHz High channel
— Pk+_MAXH
— -13 dBm in 82.23 dBuV_m

Figure 8.6-6: High channel Radiated Spurious

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

Verdict	Pass		
Tested by	Kevin Rose	Test date	November 26, 2022

8.7.3 Observations, settings and special notes

1500 Hz tone was used during testing

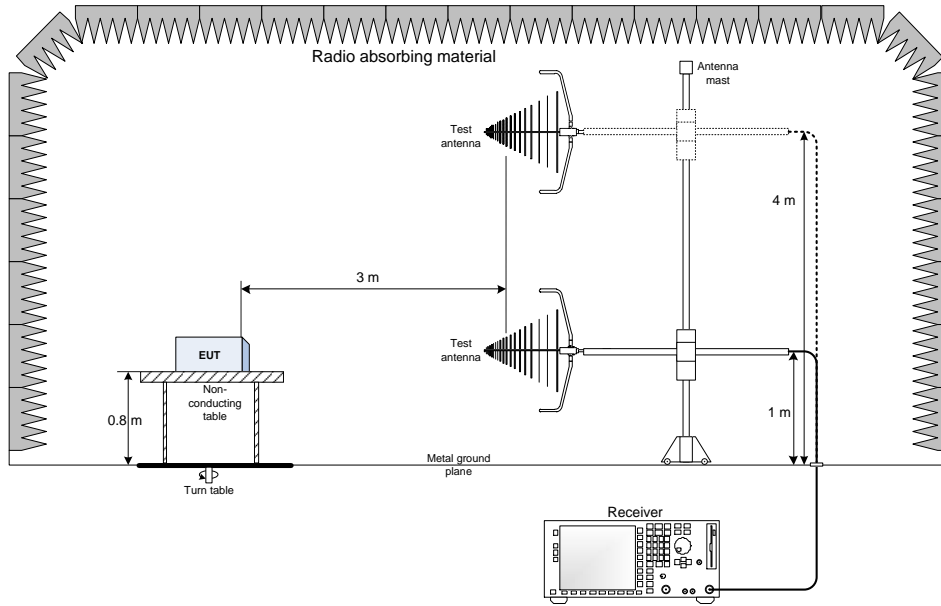
8.7.4 Test data

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

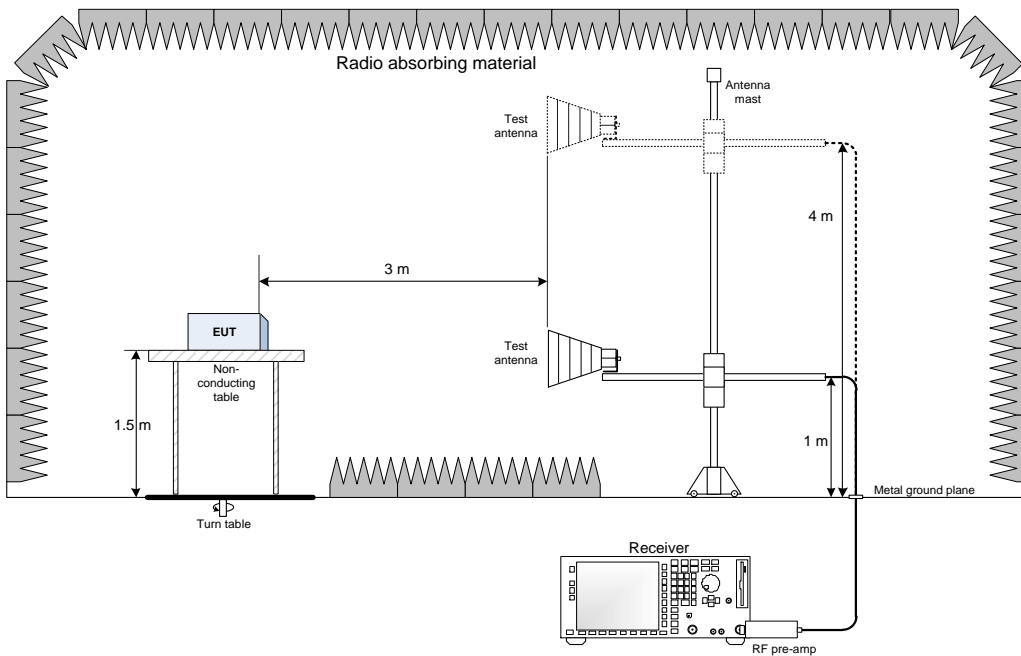
Test conditions	Frequency, MHz	Drift, Hz	Limit ±10 Hz
+50 °C, Nominal	11.362997	-4	±10 Hz
+40 °C, Nominal	11.362997	-4	±10 Hz
+30 °C, Nominal	11.362998	-3	±10 Hz
+20 °C, +15 %	11.363001	0	±10 Hz
+20 °C, Nominal	11.363001	Reference	
+20 °C, -15 %	11.363001	0	±10 Hz
+10 °C, Nominal	11.363001	0	±10 Hz
0 °C, Nominal	11.363001	0	±10 Hz
-10 °C, Nominal	11.362999	-2	±10 Hz
-20 °C, Nominal	11.363000	-1	±10 Hz
-30 °C, Nominal	11.363001	0	±10 Hz

Section 9. Block diagrams of test set-ups

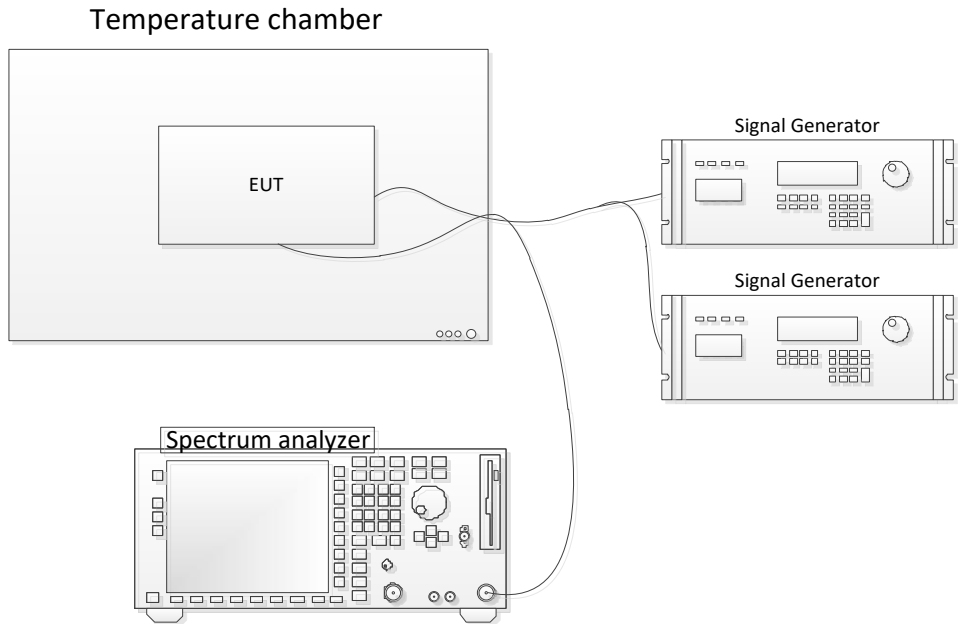
9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Frequency stability



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

