Test Report

Prepared for: Honeywell

Model: Aspire 350-3A

Description: Aircraft Earth Station

FCC ID: K6K-A350-3A
ISED ID: 1275B-A3503A

To

FCC Part 25
ISED RSS 170 Issue 4 (Sept 29, 2022)

Test Result: PASS

Date of Issue: May 20, 2024

On the behalf of the applicant:	**EMS Technologies Canada, LTD** **400 Maple Grove Road** **Ottawa, ON, Canada** **K2V 1B8**
Attention of:	**Yohannes Bisrat** **Ph: (613) 595-7979** **E-Mail:Yohannes.Bisrat@Honeywell.com**

Prepared By
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p2430005

Greg Corbin

Project Test Engineer

Test Result Summary

Specification		Test Name	Pass, Fail, N/A	Comments
FCC	ISED			
25.204(a) 2.1046	5.5	FCC - Power limits for earth stations ISED - Transmit output power for MESs	Pass	
25.202(f)(1)(2)(3) 2.1051	5.8(a)(b)	FCC - Emission limitations ISED – Unwanted Emission limits for MESs	Pass	
25.202(f)(4) 2.1051 2.1053	5.8(c)	FCC - Emission limitations ISED – Unwanted Emission limits for MESs	Pass	
25.209(a)(1)	N/A	Earth station antenna performance standards	Pass	
25.216(f)(g) 2.1051	5.9.1(a)(b)	Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service	Pass	
25.216(i) 2.1051	5.10	Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service _ carrier off state	Pass	
25.202(d) 2.1055	5.3	Frequency tolerance, Earth stations Frequency vs Voltage	Pass	
25.202(d) 2.1055	5.3	Frequency tolerance, Earth stations Frequency vs Voltage	Pass	

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	5/20/2024	Greg Corbin	Original Document
2.0	6/10/2024	Greg Corbin	Added Radiated Spurious emissions on pages15 - 16 and Annex F
3.0	6/12/2024	Greg Corbin	Revised HGA P/N and description in Table 1 on page 6
4.0	6/25/2024	Greg Corbin	Revised the FCC ID

Table of Contents

Table of Annexes

Acronyms and Abbreviations

Acronyms	Description
AES	Aircraft Earth Station
APSK	Amplitude and Phase-Shift Keying
BCX	Broadband Core Transceiver
GUI	Graphical User Interface
HCM	Honeywell Certus Modem
HGA	High Gain Antenna
LBT	L-Band Transceiver
SCM	SDU Configuration Module
SDU	Satellite Data Unit

ANAB

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Standard Test Conditions and Engineering Practices

Unless otherwise indicated, the procedures contained in FCC Part 25, ANSI C63.26-2015, RSS-170, and RSS-GEN were observed during testing.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst case measurement.

Unless otherwise indicated in the specific measurement results, the ambient temperature was maintained within the range of 10º to 40ºC (50º to 104ºF) and the relative humidity levels were in the range of 10% to 90%.

Environmental Conditions		
Temperature (°C)	**Humidity (%)**	**Pressure (mbar)**
23.7 - 28	27 - 36	961.7 - 978.1

EUT Description
Model: Aspire 350-3A
Description: Aeronautical Earth Station
Serial Number: 136
UPN:A3503A

Additional Information:

The Aspire 350-3A system is installed on aircraft to support aviation voice and datalink safety services communication as defined for existing Iridium Block 1 satellites as well as non-safety data services for cabin.
The Aspire 350-3A system contains 4 sub-system modules, SDU, SCM, LGA, HGA as listed in Table 1.

Table 1_Subsystem P/N and Descriptions

System Name	Honeywell Product Number	Description
Aspire 350-3A	90410181-001	Aspire 350-3A Aeronautical Earth Station
Subsystem Name	**Honeywell Part Number**	**Description**
SDU	90405928-001R	Satellite Data Unit
SCM	90405930-000	SDU Configuration Module
LGA	90406980	Low Gain Antenna
HGA	90412170	Non-Radiating High Gain Antenna

The Aspire 350-3A SDU contains 3 modems providing communication services to the aircraft.
2 modems LBT1 and LBT2 (LBT 9523N) are identical and support aviation voice and datalink safety services communication for the cockpit.
The 3rd modem, HCM (BCX 9810A) supplies non-safety data services to the cabin.

Table 2 - Transmit Frequency Range

Modem	TX Frequency Range (MHz
LBT1, LBT1 (cockpit service)	1616 - 1626 MHz
HCM (cabin service)	1618 - 1626 MHz

The following tables contain the emission designators, maximum conducted power levels at the provided test ports, antenna gain and maximum EIRP allowed.

Table 3 - Emission Designators for Aspire 350-3A Carriers

Carrier Type	Modulation	Symbol Rate (ksps)	Maximum Data Rate (kbps)	Nominated BW (kHz)	Emission Designation	Authorized BW (kHz)
B1	DE-QPSK	25	2.3	208	208KG7W	41.667
C1	QPSK	30	2.7	208	208KG7W	41.667
C2	QPSK	60	5.5	416	416KG7W	83.333
C8	QPSK	240	87.8	666	666KG7W	333.333
C8	16APSK	240	175.6	666	666KD7W	333.333
2C8	QPSK	480	175.6	1332	1M33G7W	666.667
2C8	16APSK	480	351.2	1332	1M33D7W	666.667

Table 4A - Transmit EIRP and Transmit RF Output Power Limits of the Safety Service with LBT 9523N modems

Carrier Type	Modulation	Nominal EIRP (dBW)	Nominal RF Output (dBm) at SDU Test Port (Antenna Gain = 3 dBic)	Maximum EIRP (Note 1) (dBW)
B1	DE-QPSK	6.4	33.4 +2.6/-3.4	9.0
Note 1: Maximum allowed output power is +36 dBm (9 dBW – 3 dBic, 0 dB cable loss)				

Table 4B - Transmit EIRP and Transmit RF Output Power Limits of the Cabin Service with HCM Modem – on HGA RF Test Port (Per DO-262F, Table F-11)

Carrier Type	Modulation	Nominal EIRP (dBW)	Nominal RF Output (dBm) at HGA Test Port (Note 1) (Antenna Gain = 8 dBic)	Maximum EIRP (Note 2) (dBW)
B1	DE-QPSK	5.0	21.0 ±1.0	10.5
C1	QPSK	4.0	20.0 ±1.0	9.5
C2	QPSK	3.0	19.0 ±1.0	8.5
C8	QPSK	9.0	25.0 ±1.0	14.5
2C8	QPSK	12.0	28.0 ±1.0	17.5
C8	16APSK	15.2	31.2 ±1.0	19.5
2C8	16APSK	18.2	34.2 ±1.0	22.5

Notes:
1) The HGA has 4 ports. The test port cable was attached to each port while measuring the HCM output power. The un-used ports were terminated into 50-ohm high power terminations. The output power for all 4 ports were summed together for the final output power.
2) EIRP Max is the maximum EIRP value allowed due to variation in antenna gain, temperature, and frequency per manufacturer internal specifications.

EUT Operation during Tests

The SDU was mounted in a test tray with several multi-conductor cables interfacing it to the HGA, SCM and the test rack provided by the manufacturer.
The LBT1 and LBT2 modem outputs were provided via RF cables that are part of the multi-conductor cables coming from the tray assembly. The cable insertion loss for the LBT1 and LBT2 RF cables was accounted for in the measurements.

The HCM modem output was provided via a test port on the HGA assembly.
The HGA assembly includes a bandpass filter. The manufacturer provided frequency vs insertion loss test data that included the gain / loss characteristics of the filter and radiating elements. This data was included in the output power and spurious emissions calculations.

The system is powered by 28 vdc provided by a separate DC power supply.

The frequency band is 10 MHz or less, so 2 test frequencies were selected for each carrier type, one frequency at the low end of the band and 1 frequency at the high end of the band. Throughout the test report the test frequency will be listed with the carrier type followed by the channel number.
The test frequencies are listed in Table 5.

Table 5 – Test Frequencies

Modem	Carrier Type	Modulation	Channel	Low Test Frequency (MHz)	Channel	High Test Frequency (MHz)
LBT1	B1	DE-QPSK	1	1616.020833	240	1625.979167
LBT2	B1	DE-QPSK	1	1616.020833	240	1625.979167
HCM	B1	DE-QPSK	49	1618.020833	240	1625.979167
HCM	C1	QPSK	49	1618.020833	240	1625.979167
HCM	C2	QPSK	49	1618.041667	240	1625.958334
HCM	C8	QPSK	49	1618.166667	240	1625.833334
HCM	C8	16APSK	49	1618.166667	240	1625.833334
HCM	2C8	QPSK	49 lower 49 upper	1618.166667 1618.500000	232 lower 232 upper	1625.500001 1625.833334
HCM	2C8	16APSK	49 lower 49 upper	1618.166667 1618.500000	232 lower 232 upper	1625.500001 1625.833334

Accessories:				
Qty	**Description**	**Manufacturer**	**Model**	**S/N**
1	Aspire 350 Qual ATE rack	Honeywell	PN: 90409840-406	2021-409

Cables:					
Qty	**Description**	**Length (M)**	**Shielding Y/N**	**Shielded Hood Y/N**	**Termination**
1	Multi-conductor cable bundle	8	Y	Y	EUT or test rack

Modifications:	
	None

Power limits for earth stations

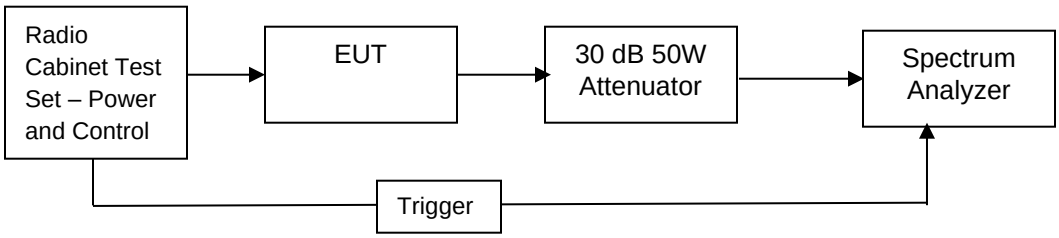
Engineer: Greg Corbin

Test Date: 5/10/2024

Test Procedure

EUT was connected as shown in the test set-up below.
A trigger from the test rack was used to trigger the spectrum analyzer so output power measurements were made only during the TX on time.
The Channel power tool on the spectrum analyzer was used to measure the modulated output power in a 4 kHz RBW.
For the LBT1 and LBT 2 modems there is only 1 output per modem. The output power for each port was recorded.

Output Power Test Setup



Output Power - LBT1 and LBT2 Modem

Modem	Carrier Type	Test Channel	Conducted Output Power	Antenna Gain	Final EIRP		Limit	Pass / Fail
			dBm	dB	dBm	dBW	dBW	
LBT1	B1	1	34.5	3	37.5	7.5	40	Pass
LBT1	B1	240	34.8	3	37.8	7.8	40	Pass
LBT2	B1	1	34.7	3	37.7	7.7	40	Pass
LBT2	B1	240	34.5	3	37.5	7.5	40	Pass

The final EIRP (dBm) = final conducted power (dBm) + antenna gain(dB).
Output Power (dBW) = Output Power (dBm) – 30.

Output Power – HCM Modem

The HGA has 4 outputs that get combined at the HGA antenna assembly. These outputs are correlated and need to be summed together before adding the antenna gain to produce the final EIRP.

All 4 channels were measured individually and summed together
The output power for each channel was measured in dBm, converted to watts.
The 4 channels were summed together, and the summed value was converted back to dBm.
The final dBm value was converted to dBW and compared to the limit.

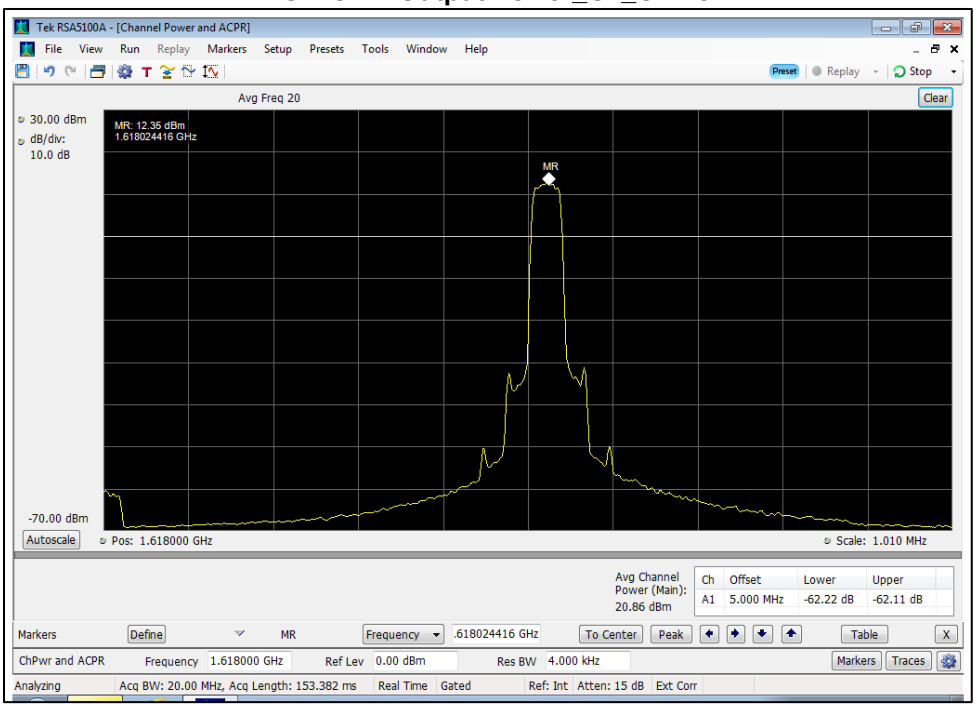
Convert dBm to watts = POWER(10,((dBm-30)/10))
Convert watts to dBm = (10*(LOG10(watts))+30)
Output Power (dBW) = Output Power (dBm) - 30
The final EIRP (dBm) = final conducted power (dBm) + antenna gain(dB).

Output power – HCM modem

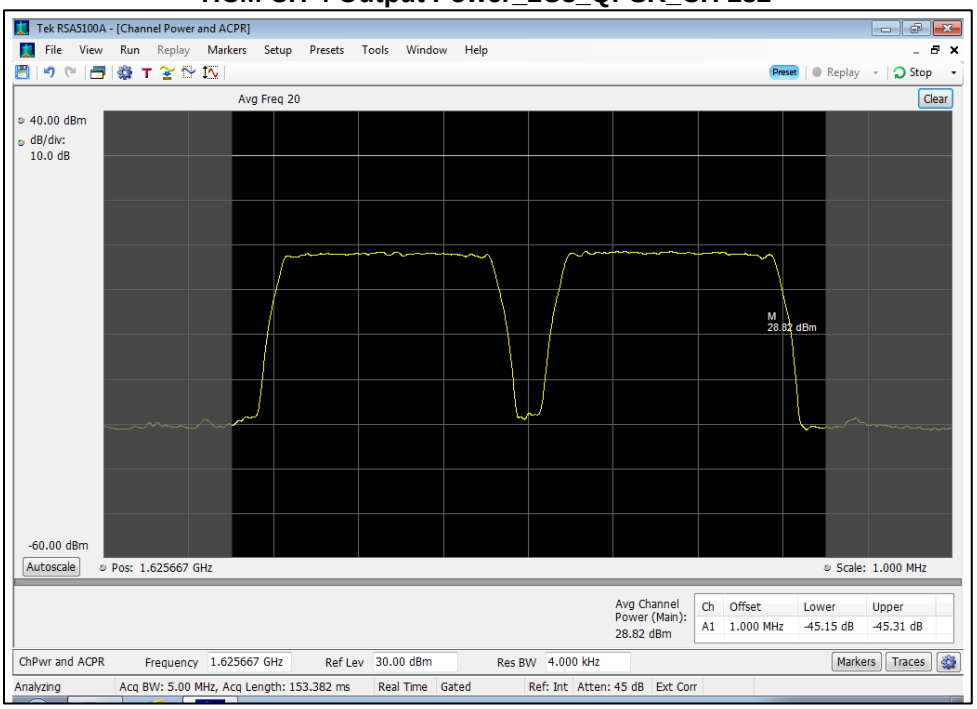
Carrier Type	Test Channel	Conducted Output Power - HGA output								CH1+2 +3+4	CH1+2 +3+4	Antenna Gain	Final EIRP		Limit	Pass /Fail
		CH 1		CH 2		CH 3		CH 4								
		dBm	watt	dBm	watt	dBm	watt	dBm	watt	watt	dBm	dB	dBm	dBW	dBW	
B1	49	20.8	0.120	20.700	0.117	21.700	0.148	18.900	0.078	0.463	26.658	8	34.658	4.658	40	Pass
B1	240	20	0.100	20.200	0.105	21.100	0.129	21.800	0.151	0.485	26.856	8	34.856	4.856	40	Pass
C1	49	19.8	0.095	19.900	0.098	20.500	0.112	20.900	0.123	0.428	26.319	8	34.319	4.319	40	Pass
C1	240	19.2	0.083	19.300	0.085	19.900	0.098	20.900	0.123	0.389	25.900	8	33.900	3.900	40	Pass
C2	49	18.5	0.071	18.500	0.071	19.500	0.089	19.700	0.093	0.324	25.106	8	33.106	3.106	40	Pass
C2	240	18.1	0.065	18.400	0.069	18.800	0.076	19.800	0.095	0.305	24.845	8	32.845	2.845	40	Pass
C8 (QPSK)	49	25.2	0.331	24.500	0.282	25.900	0.389	25.900	0.389	1.391	31.433	8	39.433	9.433	40	Pass
C8 (QPSK)	240	24.4	0.275	23.600	0.229	25.100	0.324	25.800	0.380	1.208	30.822	8	38.822	8.822	40	Pass
2C8 (QPSK)	49	27.3	0.537	26.800	0.479	28.300	0.676	28.900	0.776	2.468	33.923	8	41.923	11.923	40	Pass
2C8 (QPSK)	232	27.7	0.589	27.000	0.501	28.400	0.692	28.800	0.759	2.540	34.049	8	42.049	12.049	40	Pass
C8 (16APSK)	49	30.8	1.202	30.100	1.023	32.000	1.585	31.700	1.479	5.290	37.234	8	45.234	15.234	40	Pass
C8 (16APSK)	240	30.9	1.230	30.400	1.096	32.000	1.585	32.000	1.585	5.497	37.401	8	45.401	15.401	40	Pass
2C8 (16APSK)	49	34	2.512	33.500	2.239	35.000	3.162	35.000	3.162	11.075	40.444	8	48.444	18.444	40	Pass
2C8 (16APSK)	232	33.9	2.455	33.200	2.089	35.000	3.162	34.800	3.020	10.726	40.304	8	48.304	18.304	40	Pass

Sample output power plots

HCM CH 4 Output Power_C1_CH 49



HCM CH 4 Output Power_2C8_QPSK_CH 232



Emissions Limitations for Mobile Earth Stations_ Conducted

Engineer: Greg Corbin

Test Dates:4/9/2024 and 4/22/2024

Test Procedure

The EUT was connected directly to a spectrum analyzer and the conducted spurious emissions were measured to ensure that the EUT met the requirements specified. Only the worst-case emission at each frequency was reported. Notch and high pass filters were utilized to ensure that the fundamental power did not force the input of the spectrum analyzer into compression. These losses in addition to cable losses were input into the analyzer as a reference level offset to ensure that accurate measurements were obtained.
The emissions were investigated up to the 10th harmonic.
Due to the filters used, 3 frequency ranges were used to cover 30 MHz to 16.5 GHz.

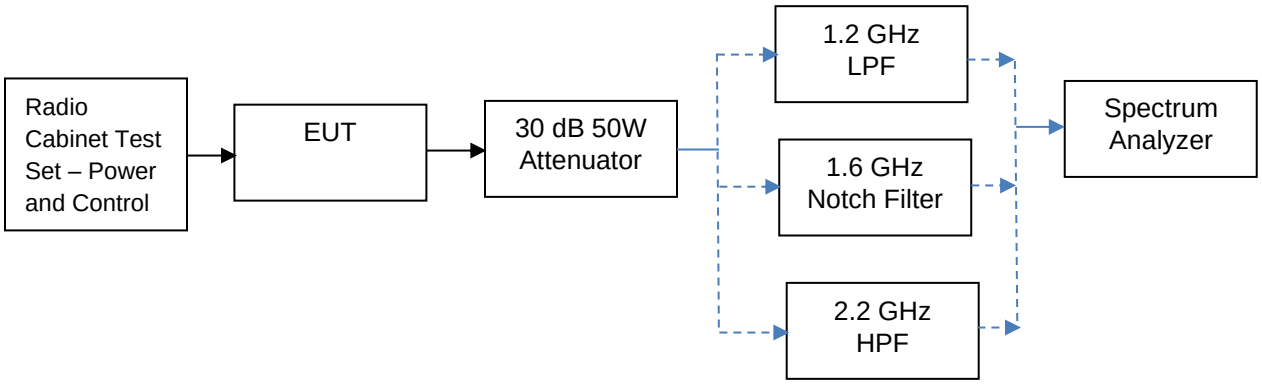
30 - 1000 MHz_ used 1.2 GHz LPF
1.6 GHz_ tunable Notch Filter
2.2 - 16.5 GHz_ used 2.2 GHz HPF

RBW = 100 kHz from 30 MHz to 1 GHz
RBW = 1 MHz from 1 – 16.5 GHz
VBW ≥ 3 x RBW

For the HCM output, there is a bandpass filter in the antenna assembly to further attenuate the spurious emissions.
The manufacturer provided a plot and a frequency vs insertion loss table that was used as part of the final spurious emissions calculation.
The filter attenuation was added to the HCM spurious levels to produce the final spurious emissions level.

For the initial testing, Peak detector set to max hold was used, any emissions within 7 dB of the limit was measured using an Avg detector for the final data.
When the Avg detector was used it is noted in the summary table.
Any emissions over the limit in the spectrum analyzer plots are fundamental emissions and are exempt from the spurious emission limit.

Conducted Spurious Emissions Test Setup



LBT1 and LBT2_ Conducted Emissions Limitations Summary Table

Channel and Modulation	Frequency Range	Freq	Power	Limit	Margin	Pass / Fail
		MHz	dBm	dBm	dB	
LBT1_B1_CH 1	30 - 1000 MHz	53.052	-55	-13	-42	P
LBT1_B1_CH 1	1 - 2.2 GHz	1632.8	-44.5	-13	-31.5	P
LBT1_B1_CH 1	2.2 - 16.5 GHz	15575.3	-26.8	-13	-13.8	P
LBT1_B1_CH 240	30 - 1000 MHz	77.833	-56.1	-13	-43.1	P
LBT1_B1_CH 240	1 - 2.2 GHz	1612.8	-41.5	-13	-28.5	P
LBT1_B1_CH 240	2.2 - 16.5 GHz	13923.2	-27.7	-13	-14.7	P
LBT2_B1_CH 1	30 - 1000 MHz	33.137	-56.8	-13	-43.8	P
LBT2_B1_CH 1	1 - 2.2 GHz	1632.8	-46.8	-13	-33.8	P
LBT2_B1_CH 1	2.2 - 16.5 GHz	15480.2	-28	-13	-15	P
LBT2_B1_CH 240	30 - 1000 MHz	33.319	-56.6	-13	-43.6	P
LBT2_B1_CH 240	1 - 2.2 GHz	1612.8	-41.6	-13	-28.6	P
LBT2_B1_CH 240	2.2 - 16.5 GHz	15520.7	-27.2	-13	-14.2	P

HCM_ Conducted Emissions Limitations Summary Table

Channel and Modulation	Frequency Range	Freq	Measured Emission Level	HPA Filter Rejection	sum 4 ports per KDB 662911	Final Emission Level	Limit	Margin	Pass / Fail
		MHz	dBm	dB	dB	dBm	dBm	dB	
HCM_B1_CH 49	30 - 1000 MHz	30.21	-57.1	-49.3	6	-100.4	-13	-87.4	P
HCM_B1_CH 49	1 - 2.2 GHz	1650	-53	-1.4	6	-48.4	-13	-35.4	P
HCM_B1_CH 49	2.2 - 16.5 GHz	9727.8	-20.8	-11	6	-25.8	-13	-12.8	P
HCM_B1_CH 240	30 - 1000 MHz	47.23	-55.6	-49.5	6	-99.1	-13	-86.1	P
HCM_B1_CH 240	1 - 2.2 GHz	1650	-54.8	-1.4	6	-50.2	-13	-37.2	P
HCM_B1_CH 240	2.2 - 16.5 GHz	3244.5	-21.4	-33.6	6	-49	-13	-36	P
HCM_C1_CH 49	30 - 1000 MHz	35	-56.6	-50	6	-100.6	-13	-87.6	P
HCM_C1_CH 49	1 - 2.2 GHz	1650	-53.6	-1.4	6	-49	-13	-36	P
HCM_C1_CH 49	2.2 - 16.5 GHz	3244.5	-23.1	-33.6	6	-50.7	-13	-37.7	P
HCM_C1_CH 240	30 - 1000 MHz	38.7	-56.8	-49.9	6	-100.7	-13	-87.7	P
HCM_C1_CH 240	1 - 2.2 GHz	1650	-54.6	-1.4	6	-50	-13	-37	P
HCM_C1_CH 240	2.2 - 16.5 GHz	3244.5	-23.4	-33.6	6	-51	-13	-38	P
HCM_C2_CH 49	30 - 1000 MHz	77.77	-56.6	-63.5	6	-114.1	-13	-101.1	P

HCM_C2_CH 49	1 - 2.2 GHz	1928.44	-53.2	-3.7	6	-50.9	-13	-37.9	P
HCM_C2_CH 49	2.2 - 16.5 GHz	9734.8	-25.3	-11.7	6	-31	-13	-18	P
HCM_C2_CH 240	30 - 1000 MHz	35	-57	-50	6	-101	-13	-88	P
HCM_C2_CH 240	1 - 2.2 GHz	1650	-54.7	-1.4	6	-50.1	-13	-37.1	P
HCM_C2_CH 240	2.2 - 16.5 GHz	3246.2	-26.3	-33.7	6	-54	-13	-41	P
HCM_C8_QPSK_CH 49	30 - 1000 MHz	38.5	-57.1	-49.9	6	-101	-13	-88	P
HCM_C8_QPSK_CH 49	1 - 2.2 GHz	1650	-51.5	-1.4	6	-46.9	-13	-33.9	P
HCM_C8_QPSK_CH 49	2.2 - 16.5 GHz	9708.4	-28.7	-11.5	6	-34.2	-13	-21.2	P
HCM_C8_QPSK_CH 240	30 - 1000 MHz	76.32	-56.9	-63	6	-113.9	-13	-100.9	P
HCM_C8_QPSK_CH 240	1 - 2.2 GHz	1650	-52.9	-1.4	6	-48.3	-13	-35.3	P
HCM_C8_QPSK_CH 240	2.2 - 16.5 GHz	3251.5	-30.6	-34.3	6	-58.9	-13	-45.9	P
HCM_C8_16APSK_CH 49	30 - 1000 MHz	47.22	-55.6	-49.5	6	-99.1	-13	-86.1	P
HCM_C8_16APSK_CH 49	1 - 2.2 GHz	1650	-51.6	-1.4	6	-47	-13	-34	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz	4854.3	-20.5	-12.9	6	-27.4	-13	-14.4	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz_ Avg det	3236.4	-33.8	-32.7	6	-60.5	-13	-47.5	P
HCM_C8_16APSK_CH 240	30 - 1000 MHz	30.05	-56.3	-49.3	6	-99.6	-13	-86.6	P
HCM_C8_16APSK_CH 240	1 - 2.2 GHz	1650	-51.9	-1.4	6	-47.3	-13	-34.3	P
HCM_C8_16APSK_CH 240	2.2 - 16.5 GHz	4877.4	-26.8	-12.8	6	-33.6	-13	-20.6	P
HCM_C8_16APSK_CH 240	2.2 - 16.5 GHz_ Avg det	3251.5	-39	-34.3	6	-67.3	-13	-54.3	P
2C8_QPSK_CH 49	30 - 1000 MHz	55	-57	-49.2	6	-100.2	-13	-87.2	P
2C8_QPSK_CH 49	1 - 2.2 GHz	1650	-50.1	-1.4	6	-45.5	-13	-32.5	P
2C8_QPSK_CH 49	2.2 - 16.5 GHz_ Avg det	3236.6	-41.2	-32.7	6	-67.9	-13	-54.9	P
2C8_QPSK_CH 232	30 - 1000 MHz	55.51	-56	-49.1	6	-99.1	-13	-86.1	P
2C8_QPSK_CH 232	1 - 2.2 GHz	1650	-51.2	-1.4	6	-46.6	-13	-33.6	P
2C8_QPSK_CH 232	2.2 - 16.5 GHz	3251.5	-20.7	-34.3	6	-49	-13	-36	P
2C8_16APSK_CH 49	30 - 1000 MHz	34.29	-56.7	-50.1	6	-100.8	-13	-87.8	P
2C8_16APSK_CH 49	1 - 2.2 GHz	1650	-51.3	-1.4	6	-46.7	-13	-33.7	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz_ Avg Det	3236.7	-37.1	-32.8	6	-63.9	-13	-50.9	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz_ Avg Det	4854.7	-44.2	-12.9	6	-51.1	-13	-38.1	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz_ Avg Det	6473.3	-43.5	-7.6	6	-45.1	-13	-32.1	P
2C8_16APSK_CH 232	30 - 1000 MHz	30.39	-57	-49.4	6	-100.4	-13	-87.4	P
2C8_16APSK_CH 232	1 - 2.2 GHz	1650	-53.1	-1.4	6	-48.5	-13	-35.5	P
2C8_16APSK_CH 232	2.2 - 16.5 GHz_ Avg det	3242.9	-28.9	-33.4	6	-56.3	-13	-43.3	P
2C8_16APSK_CH 232	2.2 - 16.5 GHz_ Avg det	4863.4	-35.9	-12.8	6	-42.7	-13	-29.7	P
2C8_16APSK_CH 232	2.2 - 16.5 GHz	6482.4	-37.2	-7.5	6	-38.7	-13	-25.7	P

Annex A – Conducted Emissions Limitations

Refer to Annex A for Conducted Emission Limitations plots.

Emissions Limitations for Mobile Earth Stations_ Radiated

Engineer: Greg Corbin

Test Dates:4/15/24

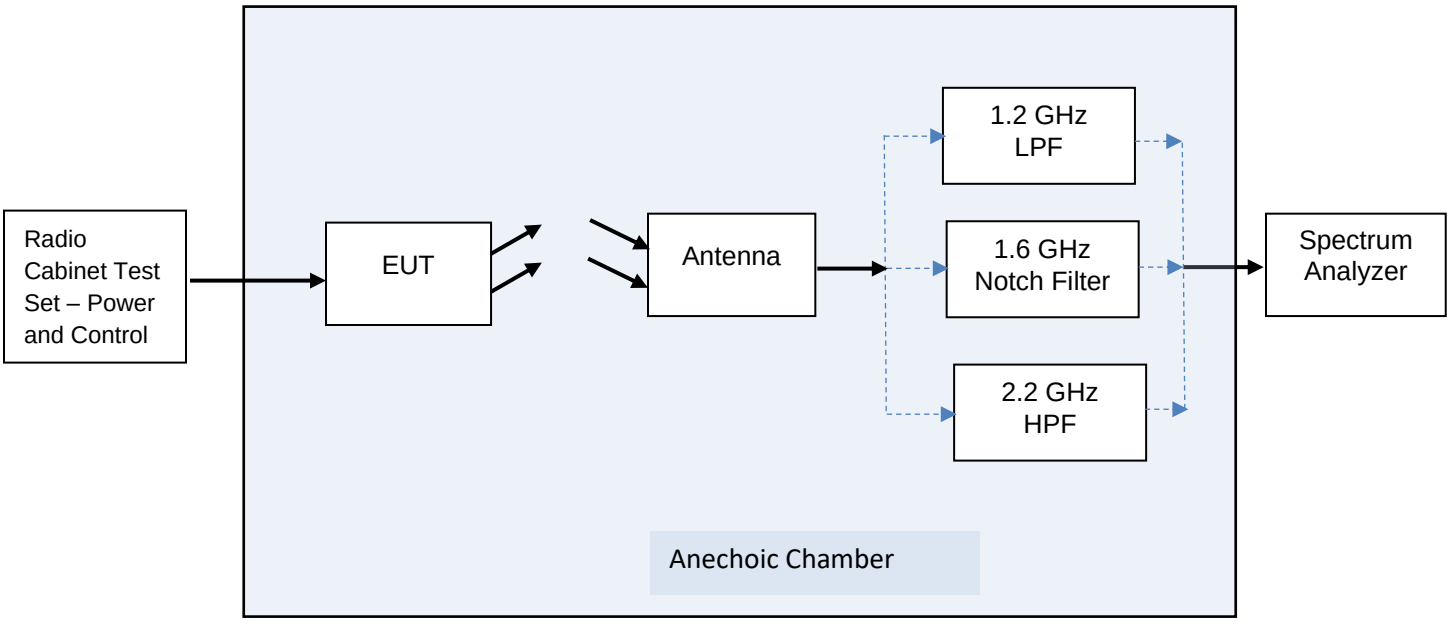
Test Procedure

The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm.

The frequency of investigation was from 30 MHz to the 10th Harmonic.
Due to the filters used, 3 frequency ranges were used to cover 30 MHz to 16.5 GHz.
30 - 1000 MHz_ used 1.2 GHz LPF
1.6 GHz_ tunable Notch Filter
2.2 - 16.5 GHz_ used 2.2 GHz HPF

Radiated Emissions measurements were performed on the channels with the highest conducted emissions.
The EUT was set to transmit at maximum power with the RF output terminated into 50-ohm 50w terminations.
The HGA filter insertion loss was not included in the cabinet radiated spurious emissions
The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.
The VBW was set to 3 times the RBW.
Pre-scans were performed with a peak detector set to max hold.
Additional measurements for any emissions near or over the limit were measured with an average detector in a 4 kHz RBW.

Radiated Spurious Emissions Test Setup



LBT1 and LBT2_ Radiated Emissions Limitations Summary Table

Channel and Modulation	Frequency Range	Detector	Freq	Power	Limit	Margin	Pass / Fail
		Peak / Avg	MHz	dBm	dBm	dB	
LBT1_B1_CH 1	30 - 1000 MHz	Peak	98.63	-45.7	-13	-32.7	P
LBT1_B1_CH 1	1 - 2.2 GHz	Avg	1925.9	-52.3	-13	-32.8	P
LBT1_B1_CH 1	2.2 - 16.5 GHz	Peak	8660.3	-33.7	-13	-20.7	P
LBT2_B1_CH 240	30 - 1000 MHz	Peak	98.63	-45.8	-13	-32.8	P
LBT2_B1_CH 240	1 - 2.2 GHz	Avg	1925.9	-50.8	-13	-37.8	P
LBT2_B1_CH 240	2.2 - 16.5 GHz	Peak	8660.3	-33.7	-13	-20.7	P

HCM Radiated Emissions Limitations Summary Table

Channel and Modulation	Frequency Range	Detector	Freq	Measured Emission Level	sum 4 ports per KDB 662911	Final Emission Level	Limit	Margin	Pass / Fail
		Peak / Avg	MHz	dBm	dB	dBm	dBm	dB	P
HCM_C8_16APSK_CH 49	30 - 1000 MHz	Peak	98.63	-47.1	6	-41.2	-13	-28.2	P
HCM_C8_16APSK_CH 49	1 - 2.2 GHz	Avg	1925.1	-52.4	6	-41.8	-13	-28.8	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	3236.3	-29.7	6	-25.1	-13	-12.1	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	4854.6	-35.2	6	-27.5	-13	-14.5	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	6472.7	-29.4	6	-26.8	-13	-13.8	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	8090.9	-30.8	6	-28.5	-13	-15.5	P
HCM_C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	9709	-29.7	6	-18.4	-13	-5.4	P
2C8_QPSK_CH 232	30 - 1000 MHz	Peak	98.63	-46.7	6	6	-13	19	P
2C8_QPSK_CH 232	1 - 2.2 GHz	Avg	1926.3	-53	6	6	-13	19	P
2C8_QPSK_CH 232	2.2 - 16.5 GHz	Avg	8128.6	-48.7	6	6	-13	19	P
2C8_QPSK_CH 232	2.2 - 16.5 GHz	Avg	9754	-35.8	6	6	-13	19	P
2C8_16APSK_CH 49	30 - 1000 MHz	Peak	98.63	-47.2	6	6	-13	19	P
2C8_16APSK_CH 49	1 - 2.2 GHz	Avg	1207.7	-47.8	6	6	-13	19	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	3236.7	-31.1	6	6	-13	19	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	4855.3	-33.5	6	6	-13	19	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	6473.3	-32.8	6	6	-13	19	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	8091.7	-34.5	6	6	-13	19	P
2C8_16APSK_CH 49	2.2 - 16.5 GHz	Avg	9710	-24.4	6	6	-13	19	P

Annex F – Radiated Emissions Limitations

Refer to Annex F for Radiated Emission Limitations plots.

Occupied Bandwidth

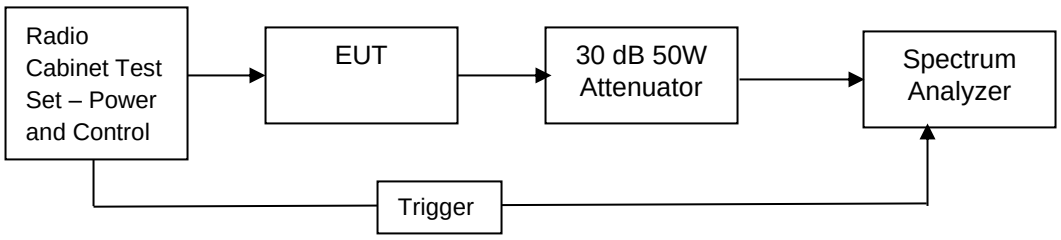
Engineer: Greg Corbin

Test Date:4/8/2024

Test Procedure

The EUT was connected directly to a spectrum analyzer. The 99% and -26 dB occupied bandwidth of the modulated output was measured and plotted.

Occupied Bandwidth Test Set-up



Occupied Bandwidth Test Results

Output	Modulation	CH	Measured Bandwidth (kHz)	
			99%	-26 dB
LBT1	B1	1	31.9	36.3
LBT1	B1	240	31.6	37.5
LBT2	B1	1	31.5	36.9
LBT2	B1	240	31.6	37.3
HCM	B1	49	32.1	39.1
HCM	B1	240	32.0	38.9
HCM	C1	49	32.9	36.9
HCM	C1	240	33.0	36.7
HCM	C2	49	64.6	72.4
HCM	C2	240	64.6	72.3
HCM	C8-QPSK	49	259	294
HCM	C8-QPSK	240	260	296
HCM	C8-16APSK	49	261	299
HCM	C8-16APSK	240	265	340
HCM	2C8-QPSK	49	587	630
HCM	2C8-QPSK	232	589	631
HCM	2C8-16APSK	49	587	634
HCM	2C8-16APSK	232	589	631

Annex B – Occupied Bandwidth

Refer to Annex B for Occupied Bandwidth plots.

Emission Masks

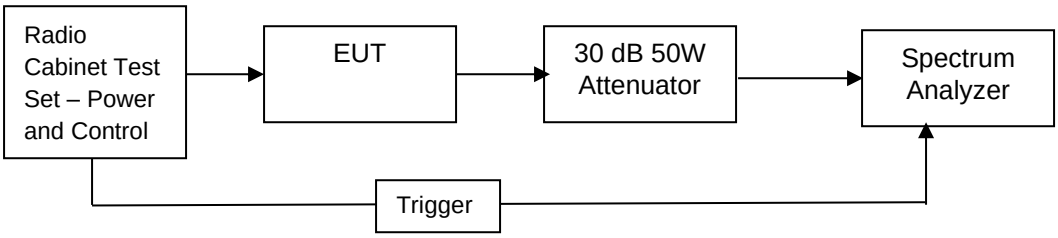
Engineer: Greg Corbin

Test Date: 4/8/2024

Test Procedure

The EUT was connected as shown to the spectrum analyzer to verify that the EUT met the requirements for emission masks.
The mask reference level was set to the same level as the output power.
The emission masks were recorded for each modulation at the low and high channels.
The RBW = 4 kHz

Emission Mask Test Setup



Annex C – Emission Mask

Refer to Annex C for Emission Mask plots.

Emissions Limits from mobile earth stations for protection of aeronautical radionavigation-satellite service

Engineer: Greg Corbin

Test Date: 4/10/24 and 5/15/24

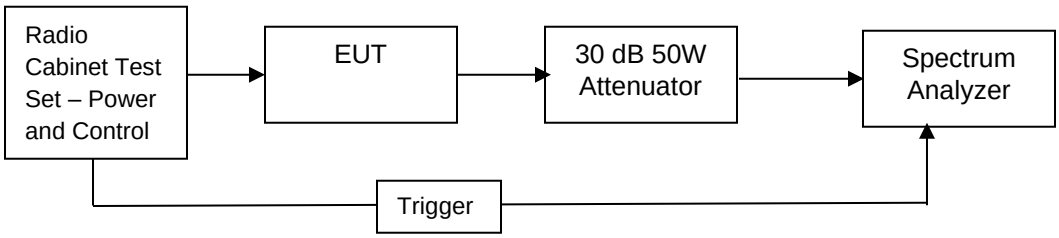
Test Procedure

The EUT was connected as shown and the spurious emissions were recorded per the following 2 FCC rules, 25.216(c) and 25.216(g).
The test was performed for the low and high channels for each modulation.

For the HCM outputs the HGA filter loss included the HGA antenna gain.

FCC KDB 662911 D01 Multiple Transmitter Outputs v02r01 was used for summing spurious emissions with multiple outputs. The 4 HCM outputs were summed together using KDB 662911 section 3(a)(iii), Measure and add 10*Log(NANT)dB, where NANT is the number of outputs.
The HCM has 4 outputs, 10*Log(4) = 6 dB.
1 output was measured, and 6 dB was added to the final spurious emission level for the HCM output.

Test Setup



25.216(c):
The e.i.r.p. density of emissions from mobile earth stations placed in service after July 21, 2002, with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed −70 dBW/MHz, averaged over any 2-millisecond active transmission interval, in the band 1559-1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed −80 dBW, averaged over any 2-millisecond active transmission interval, in the 1559-1605 MHz band.

For 1559 – 1605 MHz, emissions that require the RBW set to 700 Hz, the spectrum analyzer does not have a 700 Hz setting. The emissions were measured with the RBW set to 10 kHz and a RBW correction factor was applied in the results table.

BW correction Factor = 10Log B1/B2
BW correction Factor =10Log 700/10000 = - 11.5 dB

1559 – 1605 MHz Spurious Emissions test results for LBT1 and LBT2

Channel and Modulation	Emission Frequency	Measured Emission Level	Reference RBW	RBW used	RBW correction factor	Antenna Gain	Final Emission Level	Limit	Margin	Pass / Fail
	MHz	dBm			dB	dB	dBm	dBm	dB	
LBT1_B1_CH 1	1605	-53.5	1 MHz	1 MHz	0	3	-50.5	-40	-10.5	P
LBT1_B1_CH 1	1599.25	-74.4	700 Hz	10 kHz	-11.55	3	-82.95	-50	-32.95	P
LBT1_B1_CH 240	1561.91	-54.8	1 MHz	1 MHz	0	3	-51.8	-40	-11.8	P
LBT1_B1_CH 240	1593.19	-75.5	700 Hz	10 kHz	-11.55	3	-84.05	-50	-34.05	P
LBT2_B1_CH 1	1584.3	-54.8	1 MHz	1 MHz	0	3	-51.8	-40	-11.8	P
LBT2_B1_CH 1	1602.47	-75.2	700 Hz	10 kHz	-11.55	3	-83.75	-50	-33.75	P
LBT2_B1_CH 240	1575.79	-54.8	1 MHz	1 MHz	0	3	-51.8	-40	-11.8	P
LBT2_B1_CH 240	1581.46	-75.1	700 Hz	10 kHz	-11.55	3	-83.65	-50	-33.65	P

1559 – 1605 MHz Spurious Emissions test results for HCM Outputs

Channel and Modulation	Emission Frequency	Measured Emission Level	HPA Filter Rejection (includes HGA antenna gain)	Reference RBW	RBW used	RBW correction factor	sum 4 ports per KDB 662911	Final Emission Level	Limit	Margin	Pass / Fail
	MHz	dBm	dB			dB	dB	dBm	dBm	dB	P
HCM_B1_CH 49	1566.97	-53.4	-20.6	1 MHz	1 MHz	0	6	-68	-40	-28	P
HCM_B1_CH 49	1575.02	-73.3	-21.6	700 Hz	10 kHz	-11.55	6	-100.45	-50	-50.45	P
HCM_B1_CH 240	1602.78	-55.3	3.66	1 MHz	1 MHz	0	6	-45.64	-40	-5.64	P
HCM_B1_CH 240	1604	-74.8	4.2	700 Hz	10 kHz	-11.55	6	-76.15	-50	-26.15	P
HCM_C1_CH 49	1597.1	-55.4	-0.9	1 MHz	1 MHz	0	6	-50.3	-40	-10.3	P
HCM_C1_CH 49	1575.02	-75.1	-21.6	700 Hz	10 kHz	-11.55	6	-102.25	-50	-52.25	P
HCM_C1_CH 240	1601.01	-54.5	2.8	1 MHz	1 MHz	0	6	-45.7	-40	-5.7	P
HCM_C1_CH 240	1602.39	-75.1	3.5	700 Hz	10 kHz	-11.55	6	-77.15	-50	-27.15	P
HCM_C2_CH 49	1568.28	-54.6	-20.6	1 MHz	1 MHz	0	6	-69.2	-40	-29.2	P
HCM_C2_CH 49	1575.02	-74.4	-21.6	700 Hz	10 kHz	-11.55	6	-101.55	-50	-51.55	P
HCM_C2_CH 240	1577.17	-55	-22.6	1 MHz	1 MHz	0	6	-71.6	-40	-31.6	P
HCM_C2_CH 240	1575.02	-74.7	-21.6	700 Hz	10 kHz	-11.55	6	-101.85	-50	-51.85	P
HCM_C8_QPSK_CH 49	1604.92	-54.3	4.7	1 MHz	1 MHz	0	6	-43.6	-40	-3.6	P
HCM_C8_QPSK_CH 49	1575.02	-71.9	-21.6	700 Hz	10 kHz	-11.55	6	-99.05	-50	-49.05	P
HCM_C8_QPSK_CH 240	1604.92	-53.4	4.7	1 MHz	1 MHz	0	6	-42.7	-40	-2.7	P
HCM_C8_QPSK_CH 240	1575.02	-70.5	-21.6	700 Hz	10 kHz	-11.55	6	-97.65	-50	-47.65	P
HCM_C8_16APSK_CH 49	1603.54	-53.4	4	1 MHz	1 MHz	0	6	-43.4	-40	-3.4	P
HCM_C8_16APSK_CH 49	1604.54	-72.6	4.5	700 Hz	10 kHz	-11.55	6	-73.65	-50	-23.65	P
HCM_C8_16APSK_CH 240	1604.62	-54	4.5	1 MHz	1 MHz	0	6	-43.5	-40	-3.5	P
HCM_C8_16APSK_CH 240	1603.16	-72.9	3.8	700 Hz	10 kHz	-11.55	6	-74.65	-50	-24.65	P
2C8_QPSK_CH 49	1602.62	-53.5	3.6	1 MHz	1 MHz	0	6	-43.9	-40	-3.9	P
2C8_QPSK_CH 49	1575.02	-71.1	-21.6	700 Hz	10 kHz	-11.55	6	-98.25	-50	-48.25	P
2C8_QPSK_CH 232	1604.31	-53.3	4.4	1 MHz	1 MHz	0	6	-42.9	-40	-2.9	P
2C8_QPSK_CH 232	1603.62	-71.5	4.1	700 Hz	10 kHz	-11.55	6	-72.95	-50	-22.95	P
2C8_16APSK_CH 49	1605	-52.4	4.7	1 MHz	1 MHz	0	6	-41.7	-40	-1.7	P
2C8_16APSK_CH 49	1575.02	-72.5	-21.6	700 Hz	10 kHz	-11.55	6	-99.65	-50	-49.65	P
2C8_16APSK_CH 232	1604.77	-53.2	4.6	1 MHz	1 MHz	0	6	-42.6	-40	-2.6	P
2C8_16APSK_CH 232	1603.62	-71.5	4.1	700 Hz	10 kHz	-11.55	6	-72.95	-50	-22.95	P

Annex D – Spurious Emissions per FCC 25.216(c)

Refer to Annex D for Spurious Emissions plots per FCC 25.216(c)

25.216(g):
Mobile earth stations manufactured more than six months after Federal Register publication of the rule changes adopted in FCC 03-283 with assigned uplink frequencies in the 1610-1626.5 MHz band shall suppress the power density of emissions in the 1605-1610 MHz band-segment to an extent determined by linear interpolation from −70 dBW/MHz at 1605 MHz to −10 dBW/MHz at 1610 MHz averaged over any 2-millisecond active transmission interval. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from −80 dBW at 1605 MHz to −20 dBW at 1610 MHz, averaged over any 2-millisecond active transmission interval.

25.216(i):
The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after Federal Register publication of the rule changes adopted in FCC 03-283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed −80 dBW/MHz in the 1559-1610 MHz band averaged over any two millisecond interval.

For 1605 - 1610 MHz, emissions that require the RBW set to 700 Hz, the spectrum analyzer does not have a 700 Hz setting. The emissions were measured with the RBW set to 680 Hz and a RBW correction factor was applied in the results table.

BW correction Factor = 10Log B1/B2
BW correction Factor =10Log 700/680 = 0.13 dB

Channel and Modulation	Emission Frequency	Measured Emission Level	Reference RBW	RBW used	RBW correction factor	Antenna Gain	Final Emission Level	Limit	Margin	Pass / Fail
	MHz	dBm			dB	dB	dBm	dBm	dB	
LBT1_B1_CH 1	1605.4	-48.7	1 MHz	1 MHz	0	3	-45.7	-35.2	-13.5	P
LBT1_B1_CH 1	1606.79	-62.5	700 Hz	680 Hz	0.13	3	-59.37	-28.5	-34	P
LBT1_B1_CH 240	1609.1	-51.7	1 MHz	1 MHz	0	3	-48.7	9.2	-60.9	P
LBT1_B1_CH 240	1607.56	-63.3	700 Hz	680 Hz	0.13	3	-60.17	-19.3	-44	P
LBT2_B1_CH 1	1605.3	-46.5	1 MHz	1 MHz	0	3	-43.5	-36.4	-10.1	P
LBT2_B1_CH 1	1609.75	-62	700 Hz	680 Hz	0.13	3	-58.87	7	-69	P
LBT2_B1_CH 240	1609.13	-51.7	1 MHz	1 MHz	0	3	-48.7	9.6	-61.3	P
LBT2_B1_CH 240	1609.49	-60.5	700 Hz	680 Hz	0.13	3	-57.37	3.9	-64.4	P

Channel and Modulation	Emission Frequency	Measured Emission Level	HPA Filter Rejection (includes HGA antenna gain)	Reference RBW	RBW used	RBW correction factor	sum 4 ports per KDB 662911	Final Emission Level	Limit	Margin	Pass / Fail
	MHz	dBm	dB			dB	dB	dBm	dBm	dB	
HCM_B1_CH 49	1607.32	-57.8	5.5	1 MHz	1 MHz	0	6	-46.3	-12.1	-34.2	P
HCM_B1_CH 49	1608.95	-63	5.9	700 Hz	680 Hz	0.13	6	-50.97	7.4	-58.37	P
HCM_B1_CH 240	1608.98	-60.3	5.9	1 MHz	1 MHz	0	6	-48.4	7.8	-56.2	P
HCM_B1_CH 240	1605.34	-62.1	4.9	700 Hz	680 Hz	0.13	6	-51.07	-35.9	-15.17	P
HCM_C1_CH 49	1607.38	-57.8	5.5	1 MHz	1 MHz	0	6	-46.3	-11.4	-34.9	P
HCM_C1_CH 49	1607.59	-62.7	5.6	700 Hz	680 Hz	0.13	6	-50.97	-8.9	-42.07	P
HCM_C1_CH 240	1607.38	-57.8	5.5	1 MHz	1 MHz	0	6	-46.3	-11.4	-34.9	P
HCM_C1_CH 240	1608.03	-62.5	5.7	700 Hz	680 Hz	0.13	6	-50.67	-3.6	-47.07	P
HCM_C2_CH 49	1607.37	-59.4	5.5	1 MHz	1 MHz	0	6	-47.9	-11.6	-36.3	P
HCM_C2_CH 49	1606.90	-63.4	5.4	700 Hz	680 Hz	0.13	6	-51.87	-17.2	-34.67	P
HCM_C2_CH 240	1608.92	-60.5	5.9	1 MHz	1 MHz	0	6	-48.6	-7	-41.6	P
HCM_C2_CH 240	1607.39	-62.7	5.5	700 Hz	680 Hz	0.13	6	-51.07	-11.3	-39.77	P
HCM_C8_QPSK_CH 49	1607.54	-44.6	5.6	1 MHz	1 MHz	0	6	-33	-9.5	-23.5	P
HCM_C8_QPSK_CH 49	1609.79	-62.9	6.2	700 Hz	680 Hz	0.13	6	-50.57	17.5	-68.07	P
HCM_C8_QPSK_CH 240	1607.65	-56.8	5.6	1 MHz	1 MHz	0	6	-45.2	-8.2	-37	P
HCM_C8_QPSK_CH 240	1606.57	-62.4	5.3	700 Hz	680 Hz	0.13	6	-50.97	-21.2	-29.77	P
HCM_C8_16APSK_CH 49	1607.46	-41.6	5.6	1 MHz	1 MHz	0	6	-30	-10.5	-19.5	P
HCM_C8_16APSK_CH 49	1608.89	-62.5	5.9	700 Hz	680 Hz	0.13	6	-50.47	6.7	-57.17	P
HCM_C8_16APSK_CH 240	1609.58	-50.2	6.1	1 MHz	1 MHz	0	6	-38.1	15	-53.1	P
HCM_C8_16APSK_CH 240	1606.64	-62.7	5.3	700 Hz	680 Hz	0.13	6	-51.27	-20.3	-30.97	P
2C8_QPSK_CH 49	1607.67	-45.8	5.6	1 MHz	1 MHz	0	6	-34.2	-11.6	-22.6	P
2C8_QPSK_CH 49	1605.36	-62.3	4.9	700 Hz	680 Hz	0.13	6	-51.27	-35.7	-15.57	P
2C8_QPSK_CH 232	1609.23	-50.3	6	1 MHz	1 MHz	0	6	-38.3	10.8	-49.1	P
2C8_QPSK_CH 232	1609.22	-63.3	6	700 Hz	680 Hz	0.13	6	-51.17	10.6	-61.77	P
2C8_16APSK_CH 49	1607.65	-37.6	5.6	1 MHz	1 MHz	0	6	-26	-8.2	-17.8	P
2C8_16APSK_CH 49	1607.16	-63.2	5.5	700 Hz	680 Hz	0.13	6	-51.57	-14.7	-36.87	P
2C8_16APSK_CH 232	1609.73	-49.3	6.1	1 MHz	1 MHz	0	6	-37.2	16.8	-54	P
2C8_16APSK_CH 232	1605.69	-61.7	5.1	700 Hz	680 Hz	0.13	6	-50.47	-31.7	-18.77	P

Carrier offstate

Frequency Range	Emission Frequency	Measured Emission Level	RBW	Limit	Margin	Pass / Fail
1559 – 1610 MHz	1568.01	-60.8	1 MHz	-50 dBm	-10.8	P

Annex E – Spurious Emissions per FCC 25.216(g)

Refer to Annex E for Spurious Emissions plots per FCC 25.216(g)

Frequency Tolerance (Temperature Variation)

Test Engineer: Greg Corbin

Test Date: 4/10/2024

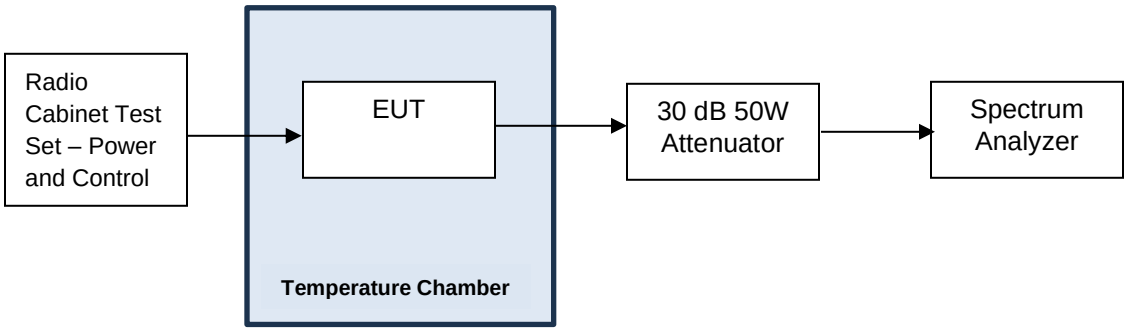
Test Procedure

The EUT was placed in an environmental test chamber and the temperature was raised from -30°C to 50°C in 10°C increments.
The EUT could not be placed in CW mode.
The frequency stability was recorded using a modulated signal, the 3 dB BW was measured and the center frequency was calculated from the 3 dB BW measurement.

Fc = F2 – F1/2+F1
Fc = EUT center frequency
F1= -3dB point (low side)
F2 = -3dB point (high side)

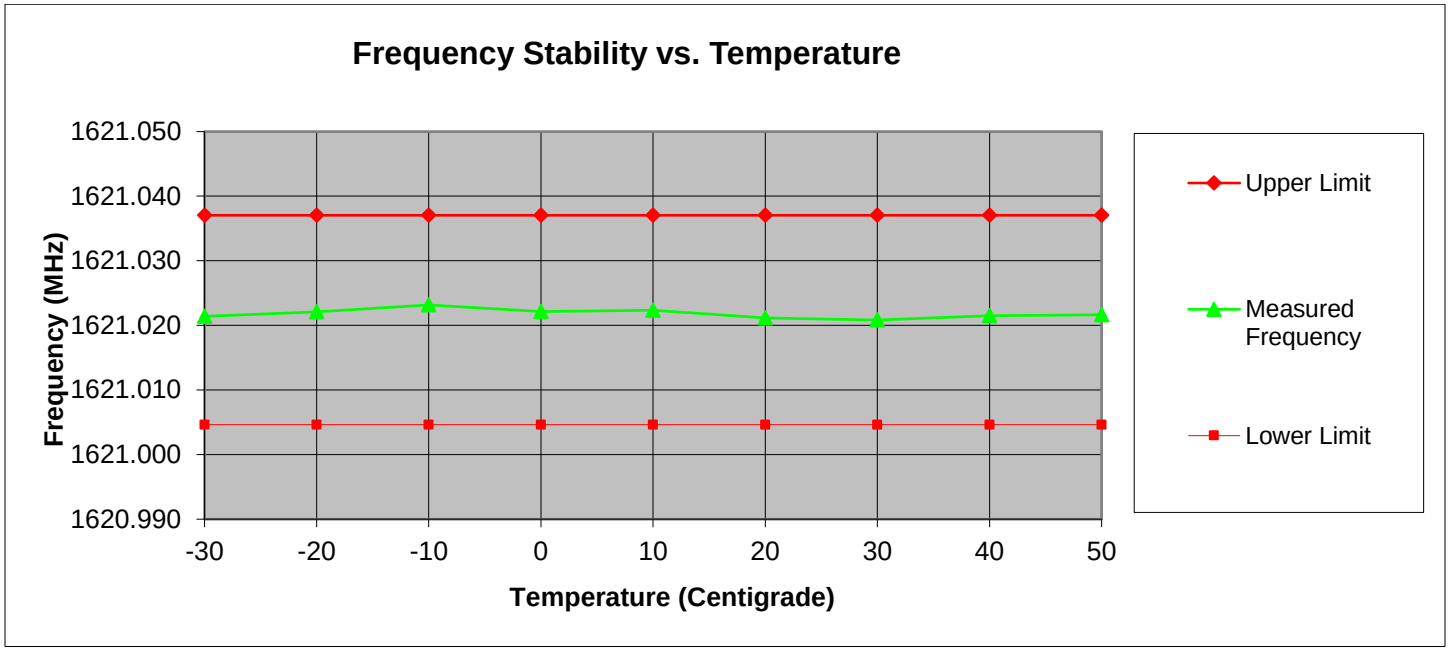
Limit:
FCC = 0.001%
ISED = ± 10 ppm

Frequency Stability Test Set-up



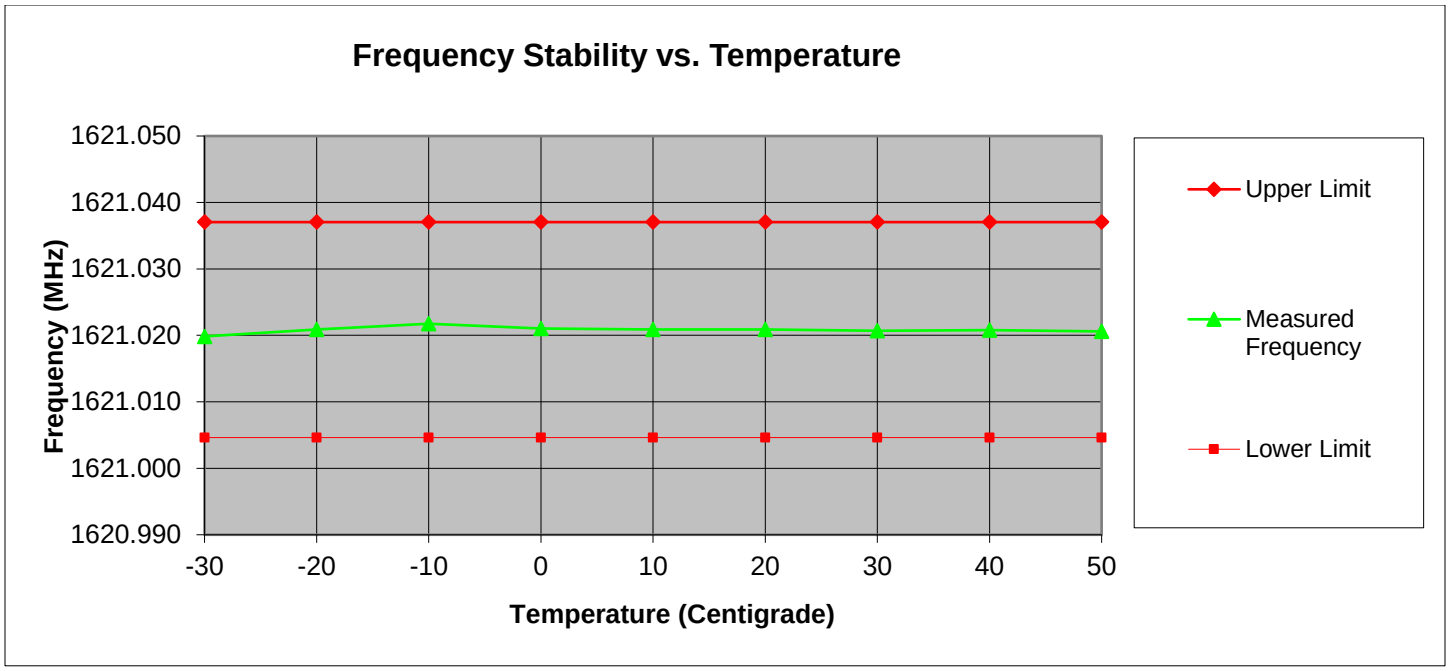
HCM Output - Frequency vs Temperature test results

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Temperature centigrade	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
1621.020834	0.0010	1621.0370439	1621.0046235	-30	1621.021382	0.0156624	0.0167580
1621.020834	0.0010	1621.0370439	1621.0046235	-20	1621.022113	0.0149309	0.0174895
1621.020834	0.0010	1621.0370439	1621.0046235	-10	1621.023166	0.0138779	0.0185425
1621.020834	0.0010	1621.0370439	1621.0046235	0	1621.022131	0.0149134	0.0175070
1621.020834	0.0010	1621.0370439	1621.0046235	10	1621.022356	0.0146884	0.0177320
1621.020834	0.0010	1621.0370439	1621.0046235	20	1621.021165	0.0158794	0.0165410
1621.020834	0.0010	1621.0370439	1621.0046235	30	1621.02083	0.0162144	0.0162060
1621.020834	0.0010	1621.0370439	1621.0046235	40	1621.021478	0.0155664	0.0168540
1621.020834	0.0010	1621.0370439	1621.0046235	50	1621.021622	0.0154219	0.0169985



LBT1 Output - Frequency vs Temperature test results

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Temperature centigrade	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
1621.020834	0.0010	1621.0370439	1621.0046235	-30	1621.019848	0.0171959	0.0152245
1621.020834	0.0010	1621.0370439	1621.0046235	-20	1621.020888	0.0161559	0.0162645
1621.020834	0.0010	1621.0370439	1621.0046235	-10	1621.021751	0.0152929	0.0171275
1621.020834	0.0010	1621.0370439	1621.0046235	0	1621.021016	0.0160279	0.0163925
1621.020834	0.0010	1621.0370439	1621.0046235	10	1621.020888	0.0161559	0.0162645
1621.020834	0.0010	1621.0370439	1621.0046235	20	1621.020865	0.0161789	0.0162415
1621.020834	0.0010	1621.0370439	1621.0046235	30	1621.02069	0.0163544	0.0160660
1621.020834	0.0010	1621.0370439	1621.0046235	40	1621.020785	0.0162589	0.0161615
1621.020834	0.0010	1621.0370439	1621.0046235	50	1621.020595	0.0164494	0.0159710



Frequency Tolerance (Voltage Variation)

Engineer: Greg Corbin

Test Date: 4/10/24

Test Procedure

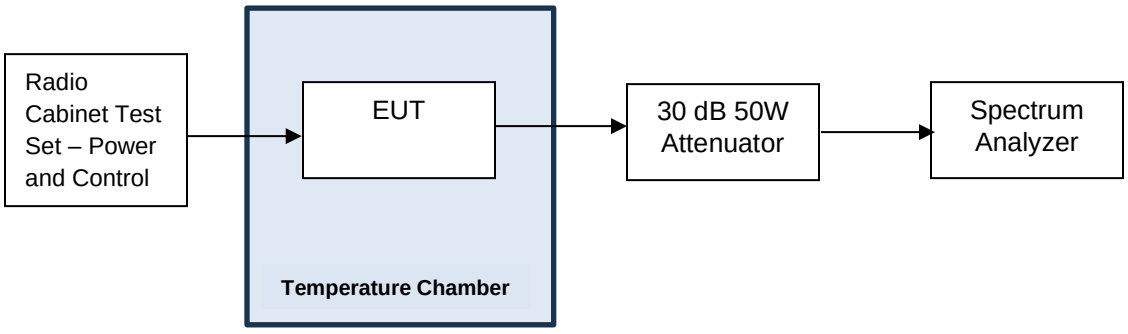
The EUT was placed in an environmental test chamber and the temperature was raised from -30°C to 50°C in 10°C increments.
The EUT output frequency was measured at the nominal voltage (28 vdc) and at the ± 15% voltage levels for the EUT.

The EUT could not be placed in CW mode.
The frequency stability was recorded using a modulated signal, the 3 dB BW was measured, and the center frequency was calculated from the 3 dB BW measurement.

Fc = F2 – F1/2+F1
Fc = EUT center frequency
F1= -3dB point (low side)
F2 = -3dB point (high side)

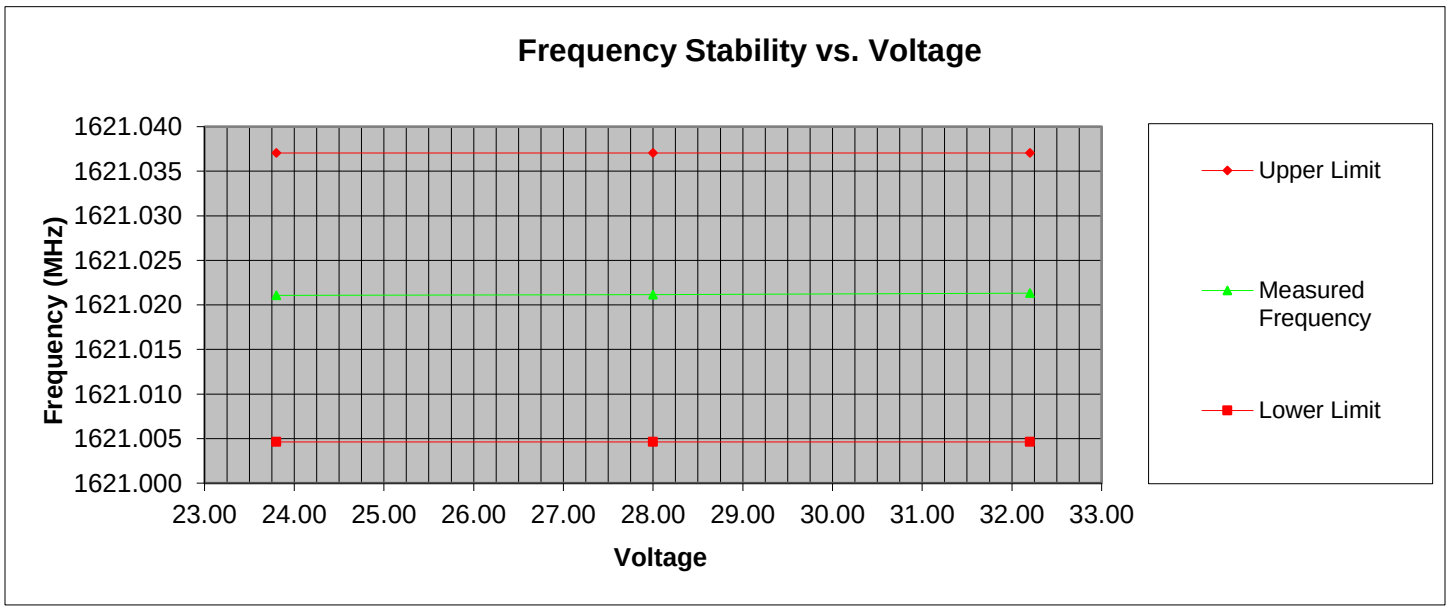
Limit:
FCC = 0.001%
ISED = ± 10 ppm

Frequency Stability Test Set-up



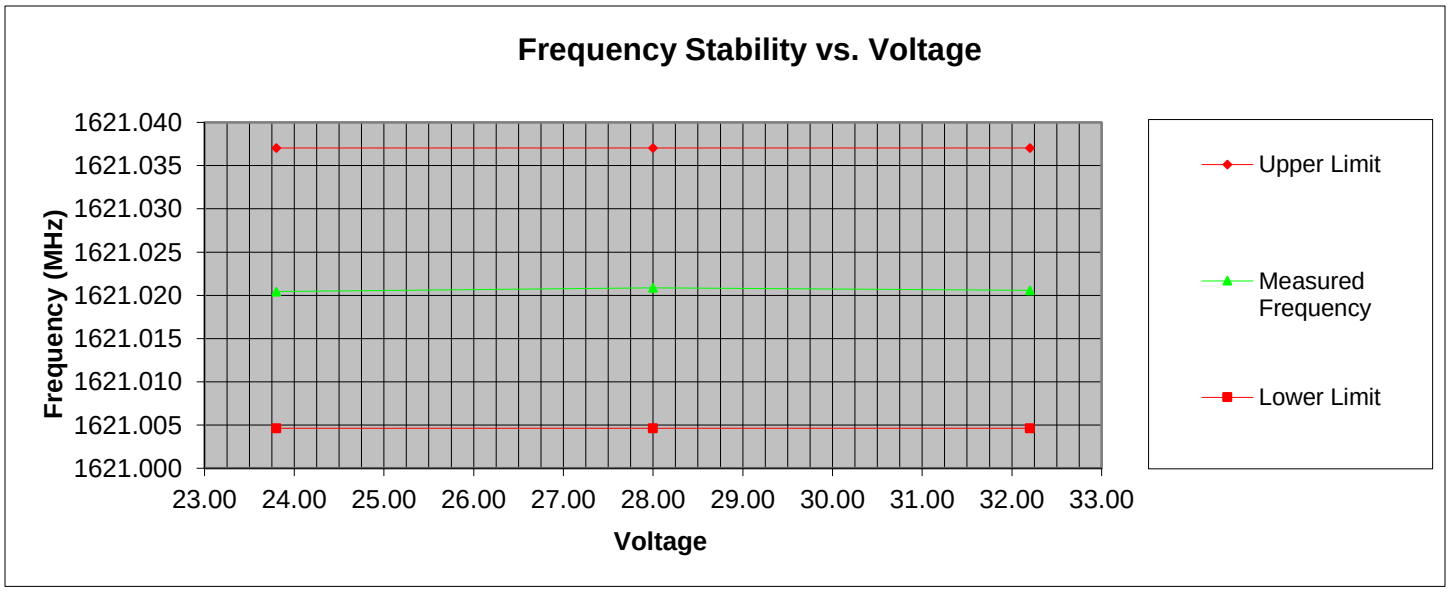
HCM Output - Voltage vs Temperature test results

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltage (vdc)	Voltage (vdc)	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
1621.02	0.0010	1621.0370442	1621.0046238	28.00	23.80	1621.0210680	-0.0159762	0.0164442
1621.02	0.0010	1621.0370442	1621.0046238		28.00	1621.0211645	-0.0159762	0.0164442
1621.02	0.0010	1621.0370442	1621.0046238		32.20	1621.0213155	-0.0159762	0.0164442



LBT1 Output - Voltage vs Temperature test results

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltage	Voltage	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
1621.020834	0.0010	1621.0370439	1621.0046235	28.00	23.80	1621.0204390	-0.0166049	0.0158155
1621.020834	0.0010	1621.0370439	1621.0046235	28.00	28.00	1621.0208650	-0.0166049	0.0158155
1621.020834	0.0010	1621.0370439	1621.0046235	28.00	32.20	1621.0205895	-0.0166049	0.0158155



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	8/11/22	8/11/24
Data Logger	Fluke	Hydra Data Bucket	i00343	6/28/23	6/28/24
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	2/7/23	2/7/25
Tunable Notch Filter	Trilithic	3VNF1500/25090-50-KK	i00410	Verified on: 4/9/24	
Spectrum Analyzer	Textronix	RSA5126A	i00424	6/21/23	6/21/24
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	6/27/23	6/27/24
Highpass Filter (1 GHz)	K&L	7IH40-980/T6000-O/O	i00432	Verified on: 4/9/24	
Attenuator, 30 dB, 50W	Mini-Circuits	BW- N30W50+	I00459	Verified on: 4/9/24	
PSA Spectrum Analyzer	Agilent	E4445A	i00471	1/5/24	1/5/25
Voltmeter	Fluke	179	i00488	6/19/23	6/19/24
MXE EMI receiver	Keysight	N9038A	i00552	3/1/24	3/1/25
Preamplifier	RF Lambda	RLNA00M45GA	i00555	Verified on: 2/19/24	
High Pass Filter (2.2 GHz)	Wainwright	WHKX2.2/12.75G-10SS	I00677	Verified on: 4/9/24	
Temp./humidity/pressure monitor	Omega Engineering	iBTHX-W-5	i00686	1/25/24	1/25/25
Lowpass Filter (1.2 GHz)	Reactel	TB5L-5-1200-M/M	i00700	Verified on: 4/9/24	
Preamplifier	Eravant	SBB-0115034019-2F2F-E3	i00722	Verified on: 2/7/24	

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

Measurement Uncertainty

Measurement Uncertainty (U_{lab}) for Compliance Testing is listed in the table below.

Measurement	U_{lab}
Radio Frequency	± 3.3 x 10^{-8}
RF Power, conducted	± 1.5 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 1.8 dB
Radiated Emissions	± 4.5 dB
Temperature	± 1.5 deg C
Humidity	± 4.3 %
DC voltage	± 0.20 VDC
AC Voltage	± 1.2 VAC

The reported expanded uncertainty +/- U_{lab}(dB) has been estimated at a 95% confidence level (k=2)

U_{lab} is less than or equal to U_{ETSI} therefore

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit

END OF TEST REPORT