



Test Report - FCC Part 80

Applicant: ICOM Incorporated

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature 04/7/2023

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1. Applicant Information

Applicant: ICOM Incorporated
Address: 1-1-32 Kamiminami
Hirano-ku, Osaka, 547-0003
Japan

1.1 Part 80 Test Result Summary

The following test procedure and guidance were used for measuring FCC PART 80 (Stations in the Maritime SERVICES), ANSI/TIA 603-D:2010. Full test results are available in this report.

Applicable Clauses		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
2.1033(c)(8)	Power at the Final Amplifier	Reported
2.1046(a), 80.215(e)(1)	RF Power Output	PASS
2.1033(c)(4), 80.205(a), 80.207	Modulation Characteristics	PASS
2.1047(a)(b)	Audio Frequency Response and Low Filter	PASS
2.1047(b), 80.213 (a)(2) & (b)	Audio Input Vs Modulation	PASS
2.1049(c), 80.211 (f)(1)(2)	Occupied Bandwidth	PASS
2.1051(a), 80.211(f)(3)	Spurious Emissions at Antenna Terminals (Conducted)	PASS
2.1053, 80.211(f)(3)	Field Strength of Spurious Emissions	PASS
2.1055, 80.209(a)	Frequency Stability	PASS

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.



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2. Location of Testing

2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA").

Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45, Newberry, Florida 32669

FCC test firm # 578780

FCC Designation # US1070

FCC site registration is under A2LA certificate # 0955.01

ISED Canada test site registration # 2056A

EU Notified Body # 1177

For all designations see A2LA scope # 0955.01

2.1 Testing was performed, reviewed by

Dates of Testing: 03-13-2023 – 03-24-2023

Signature:

Sr. EMC Engineer
EMC-003838-NE



Name & Title:

Tim Royer, EMC Engineer

Date of Signature

04/7/2023

Signature:

Name & Title:

Terri Allen, Project Specialist

Date of Signature

04/7/2023



3. Test Sample(s) (EUT/DUT)

The test sample was received: 03-13-2023

3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

Identification	
FCC ID:	AFJ436950
Brief Description	VHF Marine Transceiver - Mobile
Model(s) #	IC-M510BB, IC-M410BB
Firmware version	n/a
Software version	n/a
Serial Number	n/a

Technical Characteristics	
Frequency Range	156.025 – 157.425 MHz
RF O/P Power (Max.)	25W
Modulation	G3E, G2B, GWX
Bandwidth & Emission Class	14.8 kHz / 16K0G3E, 16K0G2B, 16K0GXW
Antenna Connector	UFL
Voltage Rating (AC or Batt.)	13.8vDC

Antenna Characteristics			
Antenna	Frequency Range	Mode / BW	Antenna Gain
1	157 MHz	n/a	0 dBi

- Note: Information such as antenna gain, firmware/software numbers are provided by manufacturer and cannot be validated by the test lab.



3.2 Configuration of EUT

Test Modes				
Mode (#)	Mode (Type)	Test Frequencies (MHz)	BW (nominal) (kHz)	Emission Designator
1	Voice	157	14.8	F3E

Operating conditions during Testing:

The device was operated without the provided antenna(s).

No other modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT) were made.

Peripherals used during Testing:

No peripherals used.

3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.



4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance:

Test procedures and guidance for measuring Licensed Part 80 Licensed device:

- 1) ANSI/TIA 603-D:2010

4.2 Applied Limits and Regulatory Limits:

- 1) FCC CFR 47 Part 80

5. Measurement Uncertainty

Parameter	Uncertainty (dB)
Conducted Emissions	± 3.14 dB
Radiated Emissions (9kHz – 30 MHz)	± 3.08 dB
Radiated Emissions (30 – 200 MHz)	± 2.16 dB
Radiated Emissions (200 – 1000 MHz)	± 2.15 dB
Radiated Emissions (1 GHz – 18 GHz)	± 2.14 dB
Radiated Emissions (18 GHz – 40 GHz)	± 2.31 dB
Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.	

6. Environmental Conditions

6.1 Temperature & Humidity

Measurements performed at the test site did not exceed the following:

Parameter	Measurement
Temperature	23 C +/- 5%
Humidity	55% +/- 5%
Barometric Pressure	30.05 in Hg
Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.	



7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

7.1 List of Test Equipment

Test Equipment						
Type	Device	Manufacturer	Model	SN#	Current Cal	Cal Due
Antenna	Biconical 1057	Eaton	94455-1	1057	10/16/20	10/16/2023
Antenna, NSA	Log-Periodic 1243	Eaton	96005	1243	05/04/21	05/3/2024
Antenna	Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	04/25/20	04/25/2023
CHAMBER	CHAMBER	Panashield	3M	N/A	03/12/19	12/21/2023
Pre-amp	Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	02/27/19	07/26/2025
Receiver	EMI Test Receiver R&S ESU 40	Rohde & Schwarz	ESU 40	100320	05/27/21	05/26/2024
Signal Generator	Signal Generator HP 8648C	HP	8648C	35537A01679	03/29/19	8/03/2025
Thermometer	Type K J Thermometer	Martel	303	080504494	01/18/20	1/17/2023

Software



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Software	Author	Version	Validation on
ESU Firmware	Rohde & Schwarz	4.43 SP3; BIOS v5.1-24-3	2018
RSCcommander	Rohde & Schwarz	1.6.4	2014
ScopeExplorer	LeCroy	v2.25.0.0	2009
Field Strength	Timco	v4.10.7.0	2016



8. Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

Unless noted otherwise in the referenced standard, the measurements of **ac power-line conducted emissions and conducted power output** will be reported in units of dB μ V. Unless noted otherwise in the referenced standard, the measurements of **radiated emissions** will be reported in units of decibels, referenced to one microvolt per meter (dB μ V/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dB μ V if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

Example:

Freq (MHz)	Meter Reading	+ ACF	+CL	= FS
33	20 dB μ V	+ 10.36 dB/m	+0.40 dB	=30.36 dB μ V/m @ 3m

$EIRP = P_{cond} \text{ (dBm)} + dBi$



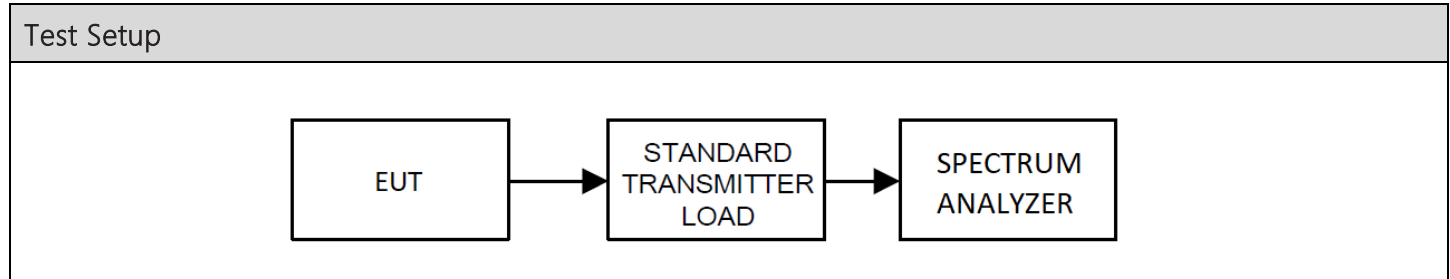
8.1 Power at the Final Amplifier

Limits from FCC Part 2.1033 (c)(8). No method of measurement is specified.

Test Results			
Power Setting (High, Low)	EUT Operating Voltage (V)	EUT Current (A)	Power at the Final Amplifier (W)
High	13.8	10	138

8.2 RF Output Power

Limits from FCC Parts 2.1046(a), and 80.215(e)(1); and test procedure from ANSI/TIA 603-D:2010.

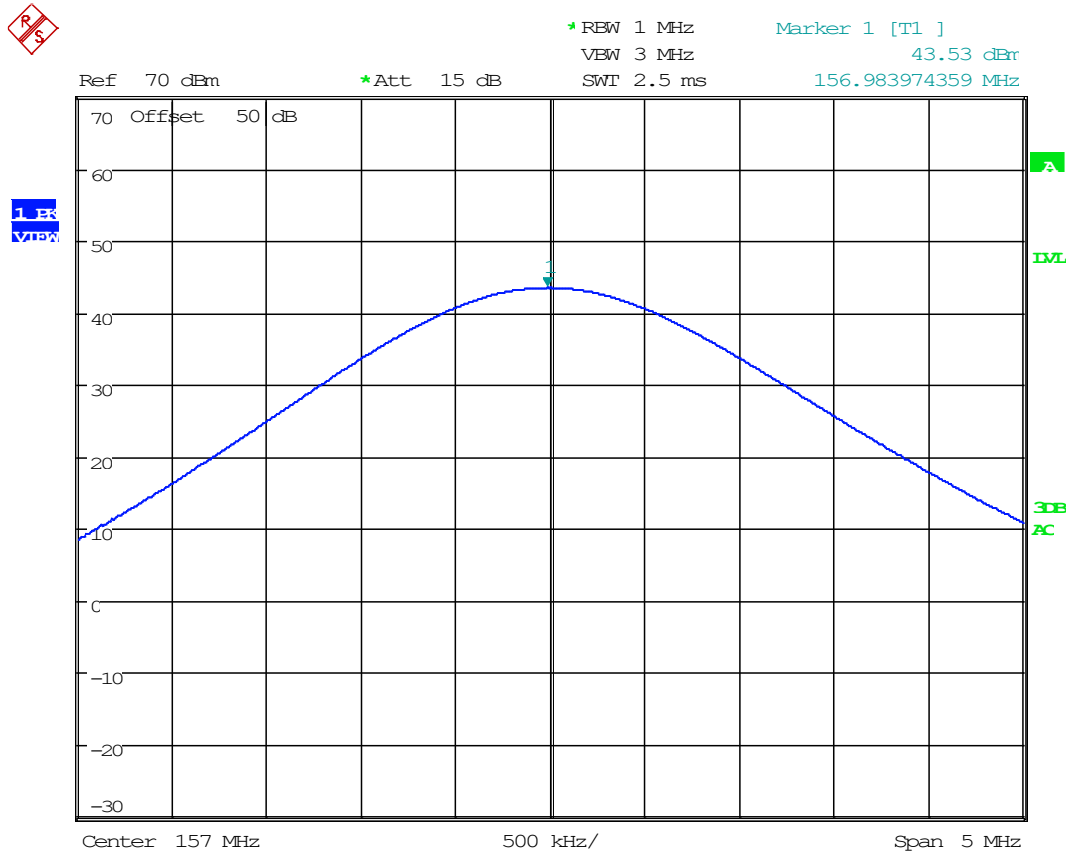


Test Results, Mode 1		
Tuned Frequency (MHz)	Power Output (dBm)	Power Output (W)
157	43.53	22.54



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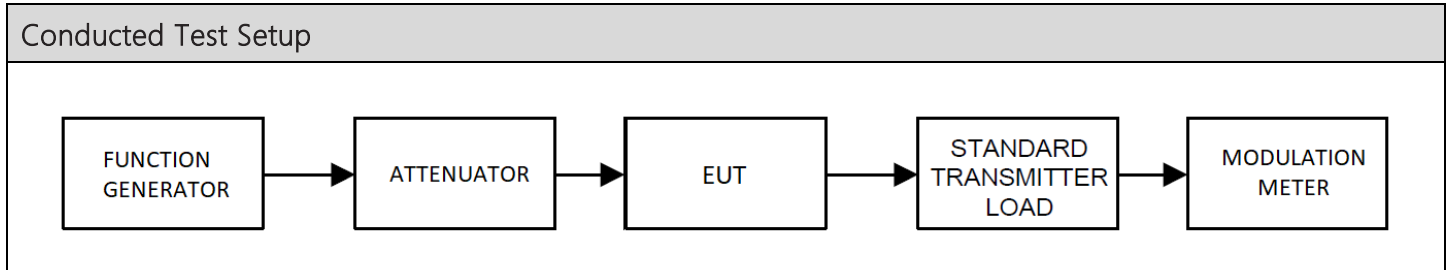
8.2.1 RF Power Output Plot, 157 MHz



Date: 24.MAR.2023 11:42:14

8.3 Modulation Characteristics

Limits from FCC Parts 2.1033(c)(4), 80.205(a), 80.207 and test procedure from ANSI/TIA 603-D:2010.



Test Data: 16K0G3E Bandwidth Calculation

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 4.6 \text{ kHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(3000) + 2(4.6K)(1) = 16.0K$$

80.205(a) ALLOWED AUTHORIZED BANDWIDTH – 20.00 kHz

The 99 % bandwidth for the DSC is 16 kHz. 16K0G3E, 16K0G2B, 16K0GXW



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8.4 Audio Frequency Response and Low Filter

Limits from FCC Parts 2.1047(a)(b); and test procedure from ANSI/TIA 603-D:2010.

Test Requirements: A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted.

Method of Measurement: ANSI/TIA-603

Test Data: See Attached Test Report IC-M510BB (01_Engineering_Report)



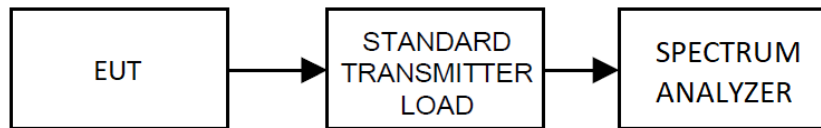
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8.5 Audio Input vs Modulation

Limits from FCC Parts 2.1047(b), and 80.213(a)(2)& (b); and test procedure from ANSI/TIA 603-D:2010.

Test Requirements: The peak modulation must be maintained between 75 and 100 percent. A Frequency deviation of ± 5 kHz is defined as 100 percent modulation. Radiotelephone transmitters using A3E, F3E and G3E emissions must have a modulation limiter to prevent any modulation over 100 percent.

Conducted Test Setup



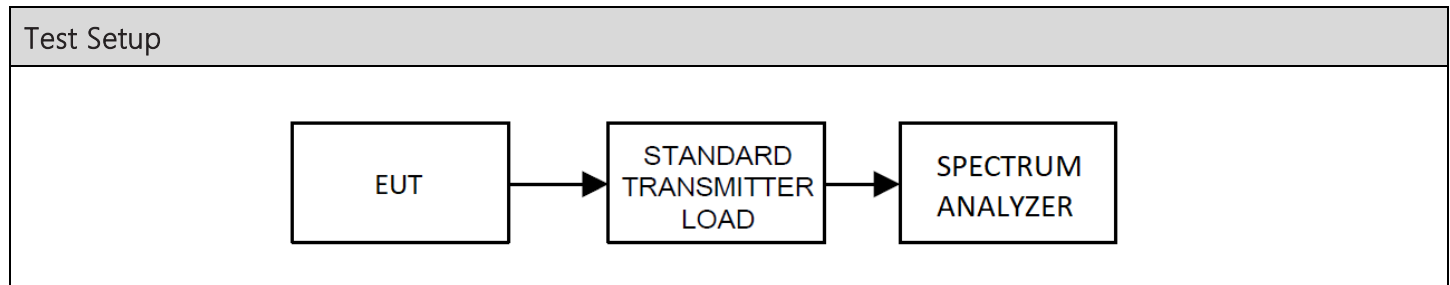
See Attached Test Report IC-M510BB (01_Engineering_Report)



Audio Input vs Modulation, Spectrum Plots

8.6 Occupied Bandwidth

Limits from FCC Parts 2.1049(c), and 80.205, and test procedure from ANSI/TIA 603-D:2010.



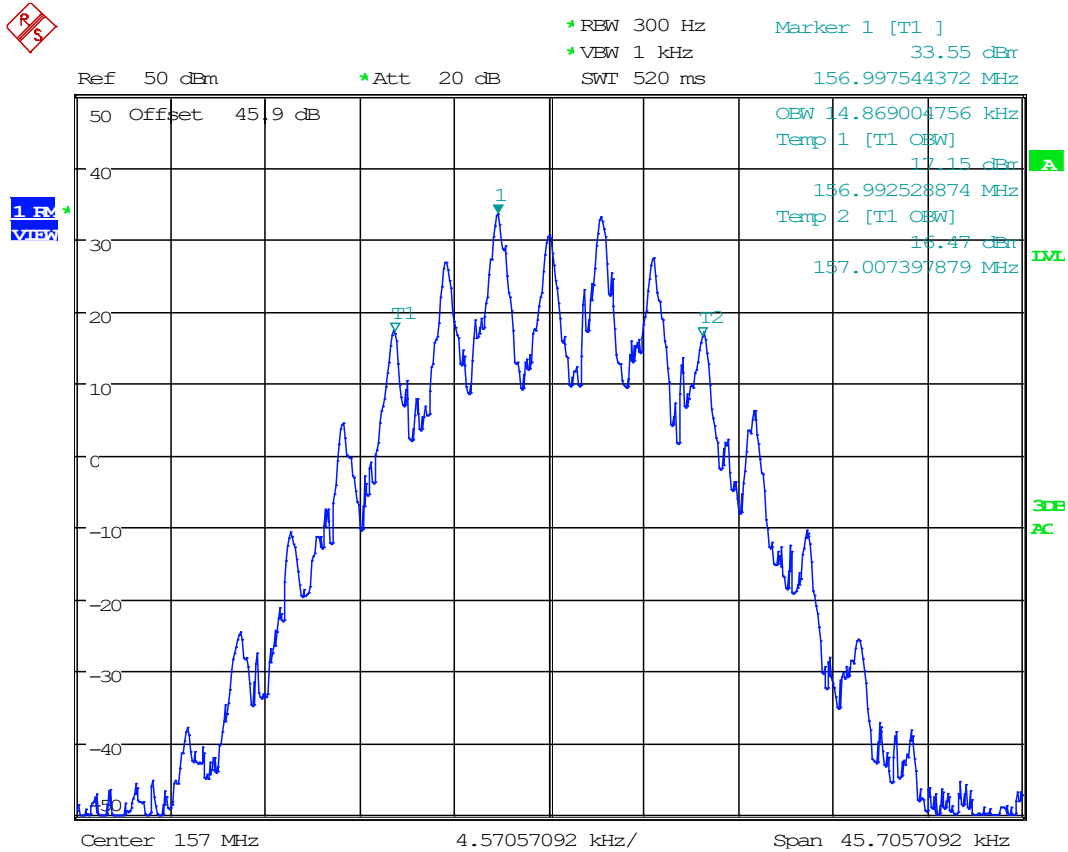
Test Results, Authorized Bandwidth		
Rule Part	Operating Range (MHz)	Authorized Bandwidth (kHz)
Part 80	157	20

Test Results, Occupied Bandwidth				
Tuned Frequency (MHz)	Mode	Emission Designator	Occupied Bandwidth (kHz)	Bandwidth Type
157	Voice	G3E	14.86	99%



Occupied Bandwidth, Spectrum Plots

8.6.1 99% Bandwidth Plot, Voice, 157 MHz

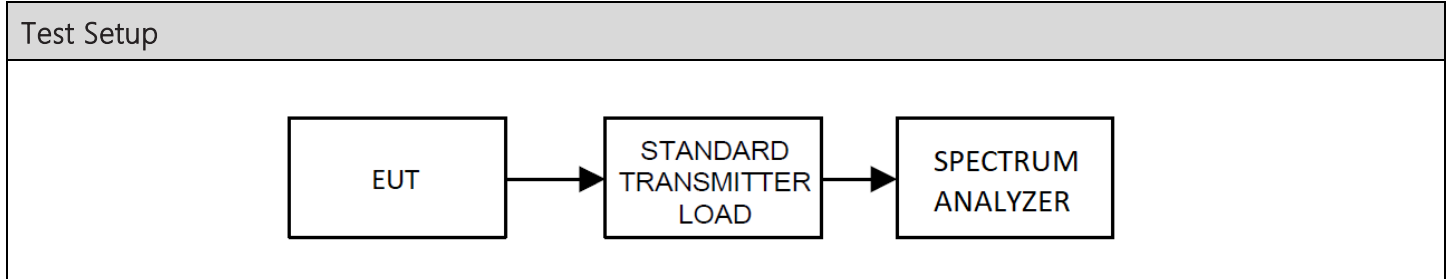


Date: 15.MAR.2023 13:34:52



8.7 Emission Mask

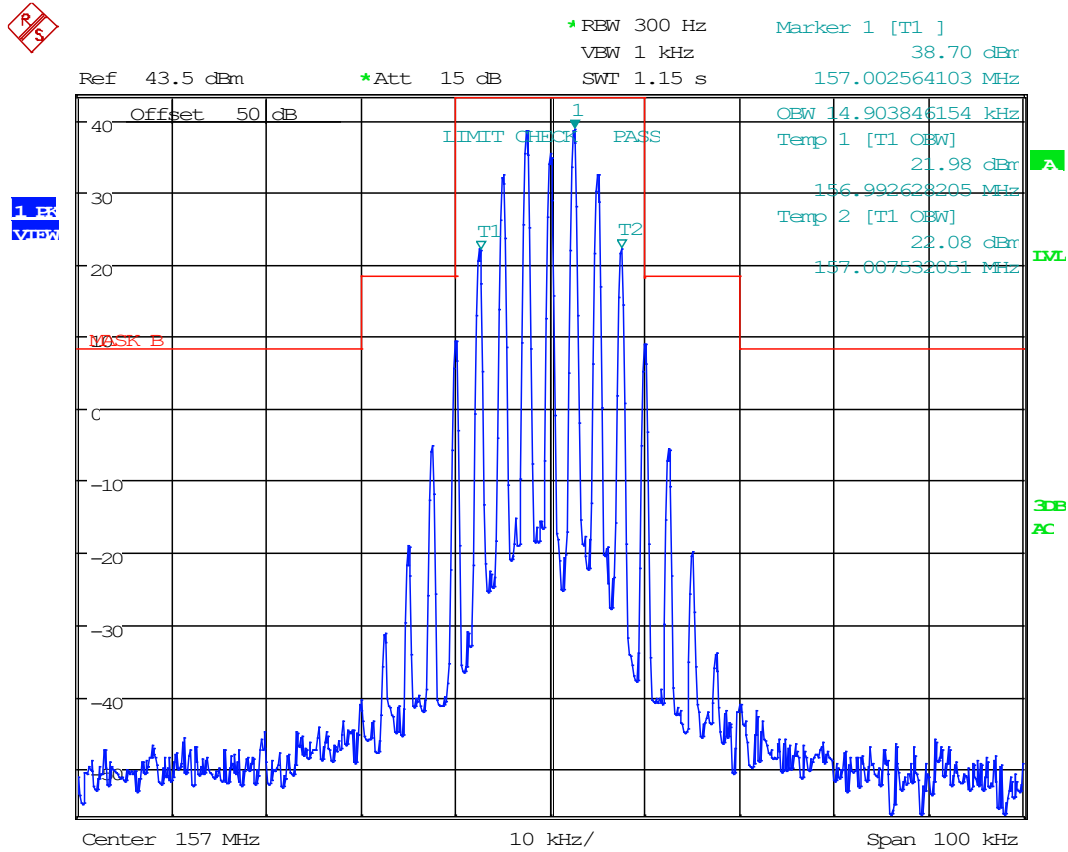
Limits from FCC Parts 2.1049(c), and 80.211(f)(1), and test procedure from ANSI/TIA 603-D:2010.





Emission Mask, Spectrum Plots

8.7.1 Emission Mask, 157 MHz



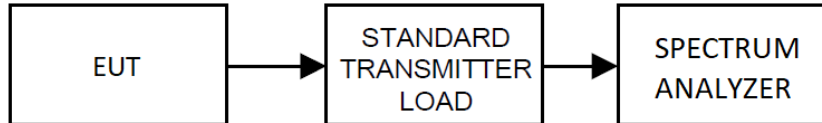
Date: 24.MAR.2023 11:44:33



8.8 Spurious Emissions At Antenna Terminals (Conducted)

Limits from FCC Parts 2.1051(a), and 80.211(f)(3); and test procedure from ANSI/TIA 603-D:2010.

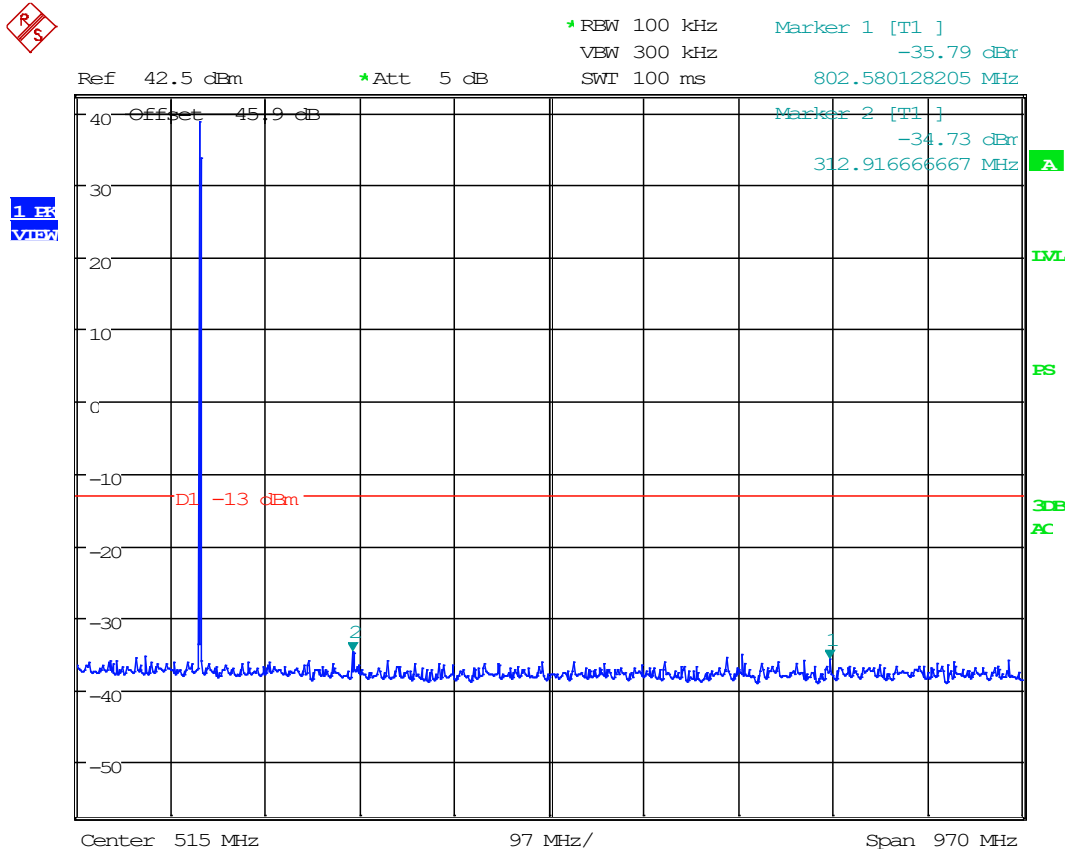
Conducted Test Setup





Spurious Emissions (Conducted) Spectrum Plots

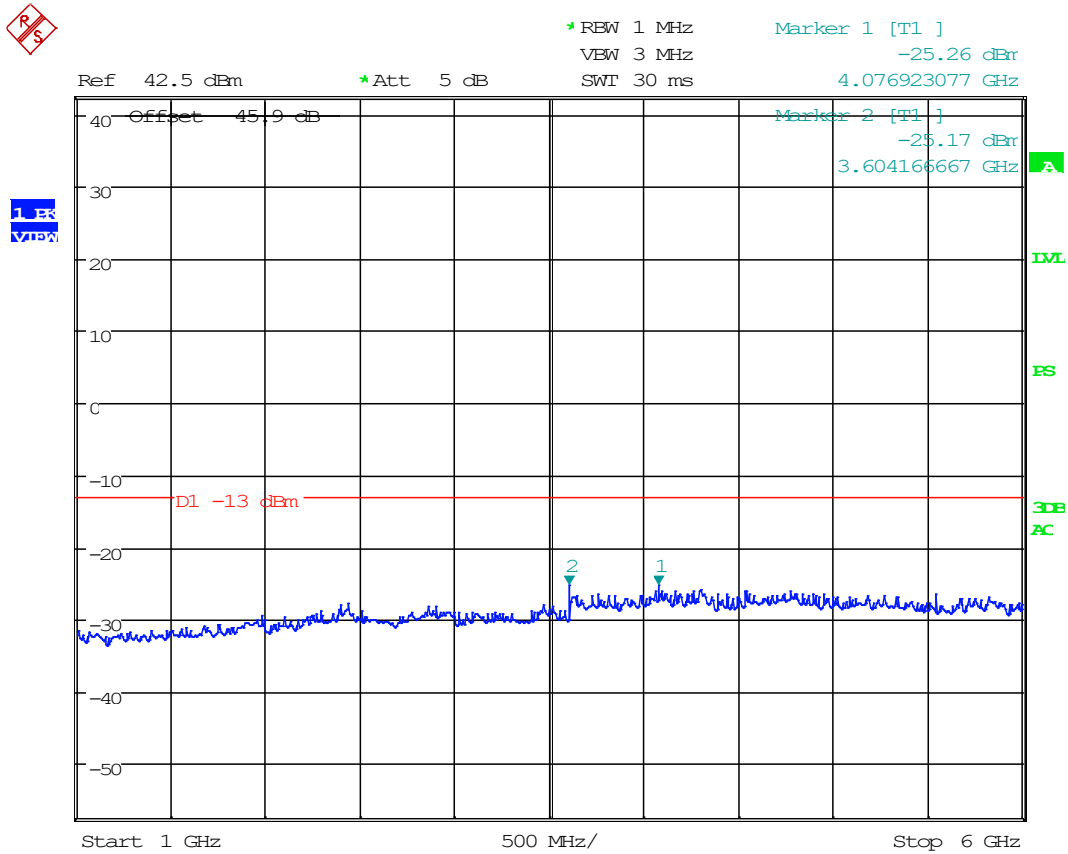
8.8.1 Conducted Emissions, Below 1GHz, 157 MHz



Date: 15.MAR.2023 14:36:18



8.8.2 Conducted Emissions Above 1GHz, 157 MHz

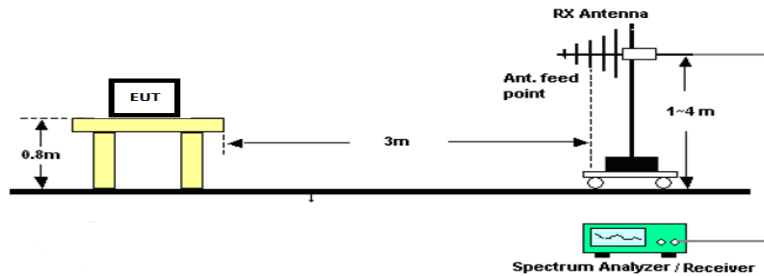


Date: 15.MAR.2023 14:38:46

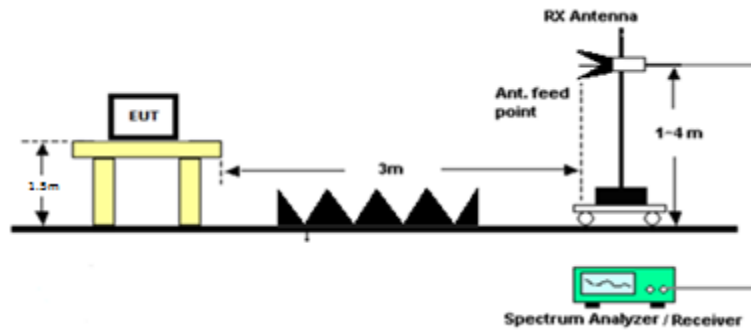
8.9 Field Strength of Spurious Emissions

Limits from FCC Parts 2.1053 and 80.211(f)(3); and test procedure from ANSI/TIA 603-D:2010.

Radiated Test Setup, 30 – 1000 MHz



Radiated Test Setup, Above 1000 MHz





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Radiated Emissions, Tabular Data

8.9.1 Radiated Emissions, 157 MHz

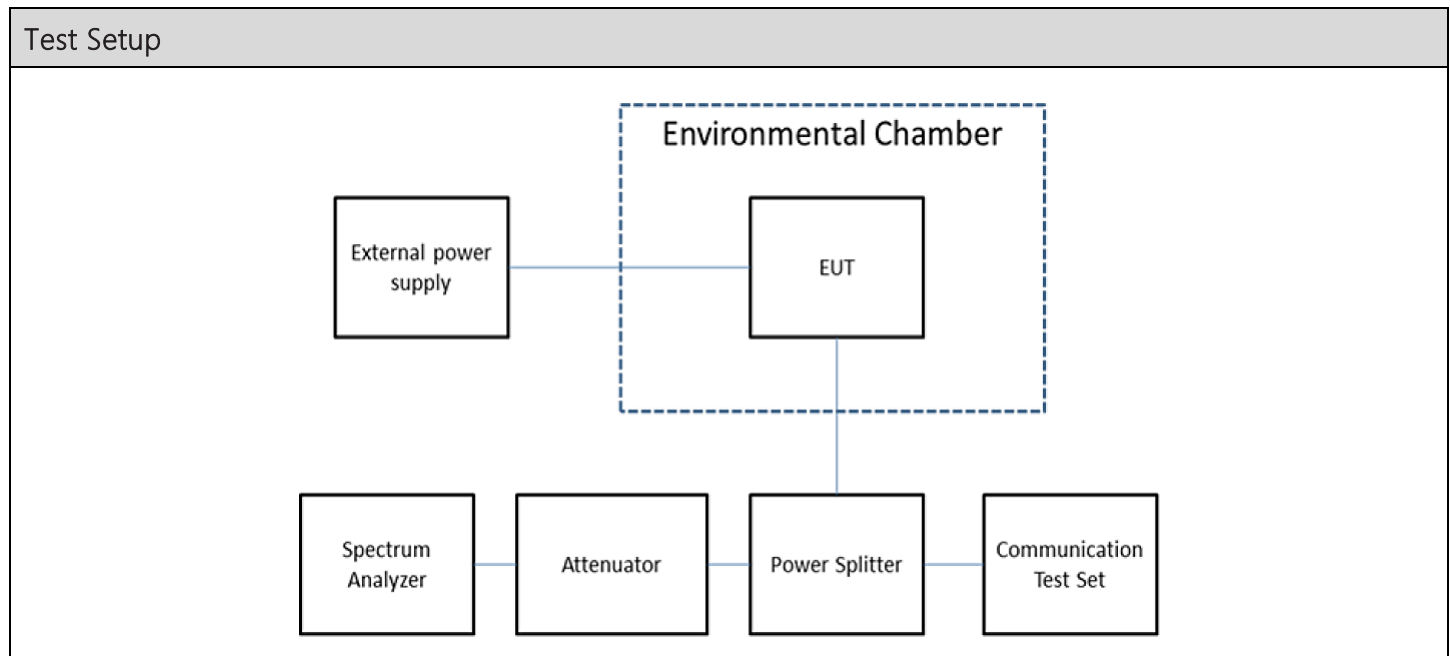
Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBuV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
157.00	314.00	PK	38.40	H	2.08	14.66	3.00	55.14	-42.23	-13.00	29.23
157.00	314.00	PK	31.90	V	2.08	14.66	3.00	48.64	-48.73	-13.00	35.73
157.00	471.00	PK	35.20	H	2.54	16.84	3.00	54.58	-42.80	-13.00	29.80
157.00	471.00	PK	40.90	V	2.54	16.84	3.00	60.28	-37.10	-13.00	24.10
157.00	628.00	PK	23.00	H	2.92	18.86	3.00	44.78	-52.60	-13.00	39.60
157.00	628.00	PK	29.20	V	2.92	18.86	3.00	50.98	-46.40	-13.00	33.40
157.00	785.00	PK	41.20	H	3.31	21.60	3.00	66.11	-31.27	-13.00	18.27
157.00	785.00	PK	37.50	V	3.31	21.60	3.00	62.41	-34.97	-13.00	21.97
157.00	942.00	PK	28.60	H	3.59	22.60	3.00	54.79	-42.58	-13.00	29.58
157.00	942.00	PK	34.10	V	3.59	22.60	3.00	60.29	-37.08	-13.00	24.08
157.00	1099.00	PK	13.60	H	3.85	27.16	3.00	44.61	-52.77	-13.00	39.77
157.00	1099.00	PK	22.10	V	3.85	27.16	3.00	53.11	-44.27	-13.00	31.27
157.00	1256.00	PK	13.50	H	4.08	28.45	3.00	46.03	-51.35	-13.00	38.35
157.00	1256.00	PK	19.80	V	4.08	28.45	3.00	52.33	-45.05	-13.00	32.05
157.00	1413.00	PK	12.10	H	4.31	28.37	3.00	44.78	-52.60	-13.00	39.60
157.00	1413.00	PK	16.20	V	4.31	28.37	3.00	48.88	-48.50	-13.00	35.50
157.00	1570.00	PK	12.00	H	4.60	27.88	3.00	44.48	-52.90	-13.00	39.90
157.00	1570.00	PK	11.70	V	4.60	27.88	3.00	44.18	-53.20	-13.00	40.20



8.10 Frequency Stability

Limits from FCC Parts 2.1055, and 80.209(a); and test procedure from ANSI/TIA 603-D:2010.

Requirements: The frequency must remain within the .0010%, 10.0 ppm, specification limit, for 20 kHz spacing (Temp range is -20 to +50)



Test Results, Mode 1		
Tuned Frequency (MHz)	Max Deviation (kHz)	Limit (ppm)
157	0.00000019	5

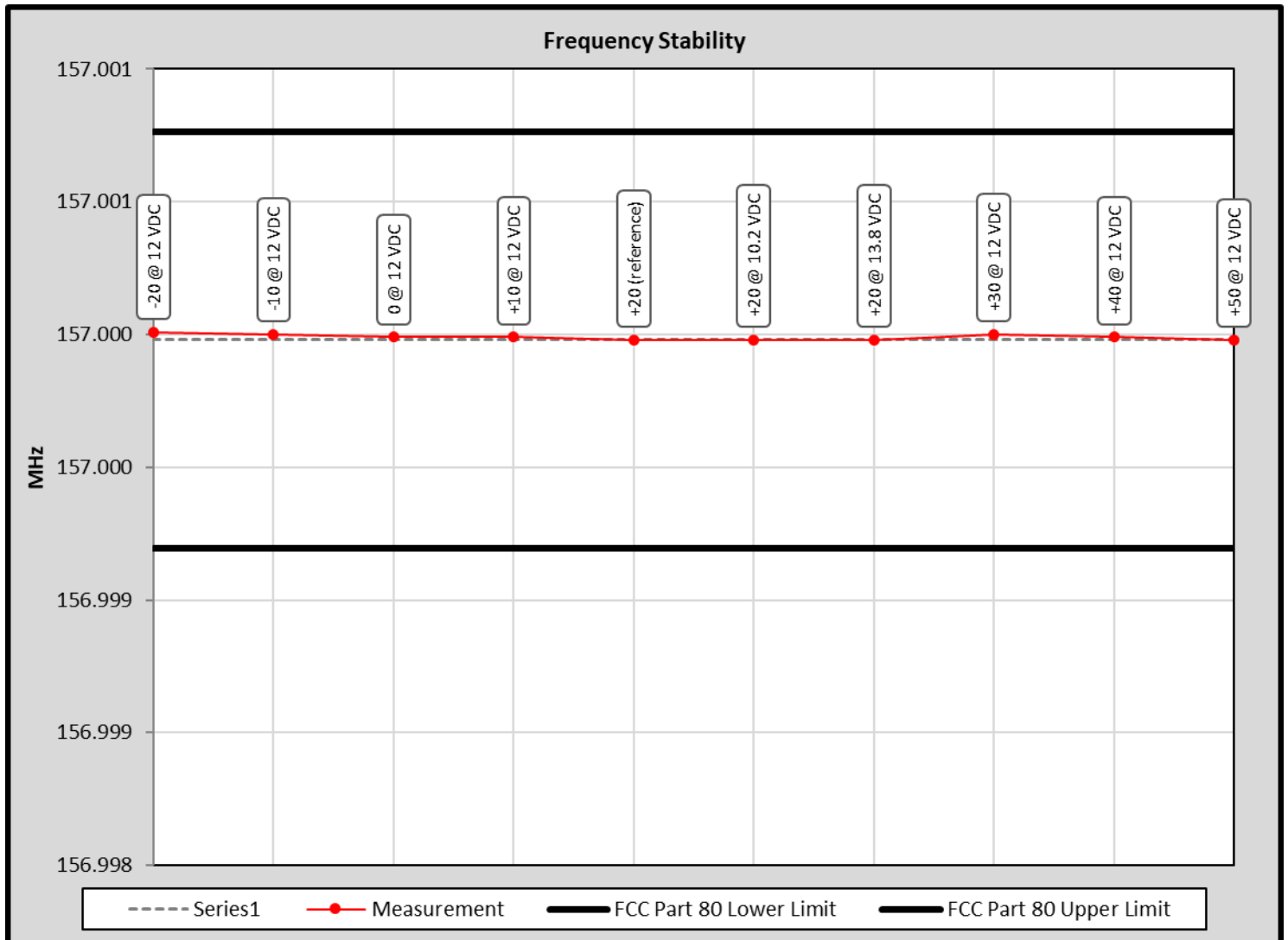


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8.10.1 Frequency Stability Data

FCC Part 80 Limit	5.0	ppm	
FCC Part 80 Limit	785.000	Hz	
FCC Part 80 Lower Limit	156.999195	MHz	
FCC Part 80 Upper Limit	157.000765	MHz	
Rated Supply Voltage	12.0	☐ AC ☒ DC	
Temperature / Voltage Variation			
Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
-20	12.0	157.00001	-0.030
-10	12.0	157	-0.020
0	12.0	156.99999	-0.010
+10	12.0	156.99999	-0.010
+20 (reference)	12.0	156.99998	0.000
+20	10.2	156.99998	0.000
+20	13.8	156.99998	0.000
+30	12.0	157.00000	-0.020
+40	12.0	156.99999	-0.010
+50	12.0	156.99998	0.000

8.10.2 Frequency Stability Plot





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9. ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT are in separate supplementary documents labelled EXTERNAL PHOTOS and INTERNAL PHOTOS.

10. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate supplementary ANNEX-B document.

11. History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_6983-22_FCC 80_	1	Initial release	03/27/2023



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END OF TEST REPORT
