



Test Report - FCC Part 90

Applicant: Aclara Technologies LLC

Signature:

A handwritten signature in black ink, appearing to read "Tim Royer".

Sr. EMC Engineer
EMC-003838-NE



Name & Title:

Tim Royer, EMC Engineer

Date of Signature

6/4/2024

Signature:

A handwritten signature in black ink, appearing to read "Kristoffer Costa".

Name & Title:

Kristoffer Costa, EMC Technician

Date of Signature

6/4/2024

This test report relates only to the items tested as identified and is not valid for any subsequent changes or modifications made to the equipment under test.

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1. Applicant Information

Applicant: Aclara Technologies LLC
Address: 77 Westport Plaza Drive
Suite 500
St. Louis, Missouri, 63146, United States

1.1 Part 90 Test Result Summary

The following test procedure and guidance were used for measuring FCC PART 90 (PRIVATE LAND MOBILE RADIO SERVICES) known as Licensed Land Mobile; ANSI C63.26-2015. Full test results are available in this report.

Applicable Clauses from Part 2		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
2.202	Bandwidth & Emission	Pass
2.1033 (c)(8)	Power at the Final Amplifier	Reported
2.1046 (a)	RF Output Power	Pass
2.1047	Modulation characteristics	N/A
2.1049	Occupied Bandwidth	Pass
2.1051	Spurious emissions at antenna terminals	Pass
2.1053	Field strength of spurious radiation	Pass
2.1055	Frequency stability	Pass

Applicable Clauses from Part 90		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
90.205 (r)	Transmitter Power	Pass
90.207 (n)	Emission designator	Reported
90.209 (b) (5) footnote 2	Bandwidth limitations	Pass
90.210 (n)	Emission masks, In-band	Pass
90.210 (n)	Emission masks, Out-of-band	Pass
90.213 (a) footnote 10	Frequency stability	Pass
90.214	Transient Frequency Behavior	N/A
90.221	Adjacent channel power limits	N/A

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.

2. Location of Testing

2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA"). Testing was performed at IIA's permanent laboratory located at 13146 NW 86th Drive, Suite 400, Alachua, Florida 32615.

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

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

The test sample was received: 5/21/2024

Dates of Testing: 5/23/2024 – 5/29/2024

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:	LLB2022002
Brief Description	Ultrasonic Gas Meter
Model(s) #	3511-066-LCW
Firmware version	N/A
Software version	N/A
Serial Number	N/A

Technical Characteristics	
Frequency Range	450 MHz- 470 MHz
RF O/P Power (Max.)	1W
Modulation	FM
Bandwidth & Emission Class	F1D
Number of Channels	N/A
Duty Cycle	50%
Antenna Connector	N/A
Voltage Rating (AC or Batt.)	3.4 VDC

Antenna Characteristics			
Antenna	Frequency Range	Mode / BW	Antenna Gain
1	n/a	n/a	5 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	Transmit	450.025 MHz 460 MHz 469.9875 MHz	12.5	F1D

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:

A laptop was used to program the EUT.

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 90 Licensed device:

- 1) ANSI C63.26-2015

4.2 Applied Limits and Regulatory Limits:

- 1) FCC CFR 47 Part 90 (2007)

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	11/19/21	11/18/2024
Antenna, NSA	Log-Periodic 1243	Eaton	96005	1243	5/4/21	11/18/2024
Antenna	Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	5/31/23	11/18/2024
CHAMBER	CHAMBER	Panashield	3M	N/A	12/29/23	12/18/2025
Pre-amp	Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	2/27/22	7/26/2025
Receiver	EMI Test Receiver R&S ESU 40	Rohde & Schwarz	ESU 40	100320	5/27/21	11/18/2024
Receiver	EMI Test Receiver R&S ESW44	Rohde & Schwarz	ESW44	103049	10/13/21	10/12/2024
Signal Generator	Signal Generator HP 8648C	HP	8648C	35537A01679	8/4/22	8/03/2025
Thermometer	Type K J Thermometer	Martel	303	080504494	1/16/23	1/15/2026

Software			
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

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

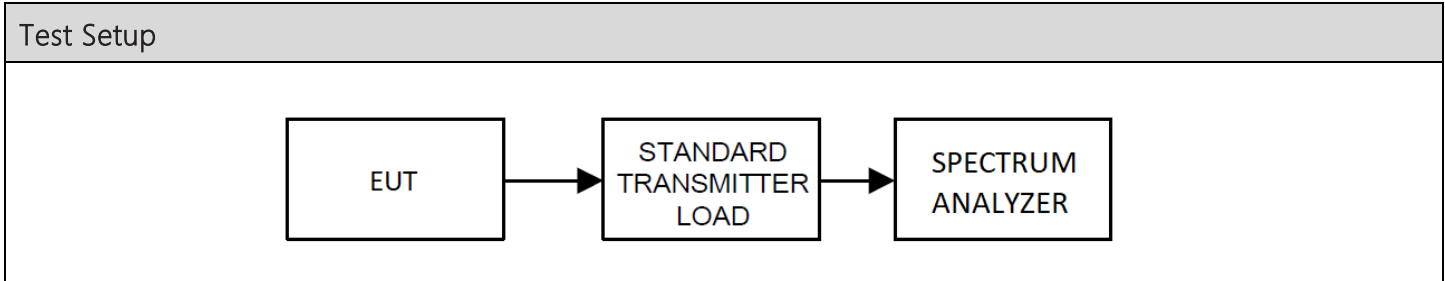
8.1 Power at the Final Amplifier

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

Test Results		
EUT Operating Voltage (V)	EUT Current (A)	Power at the Final Amplifier (W)
4	1	4

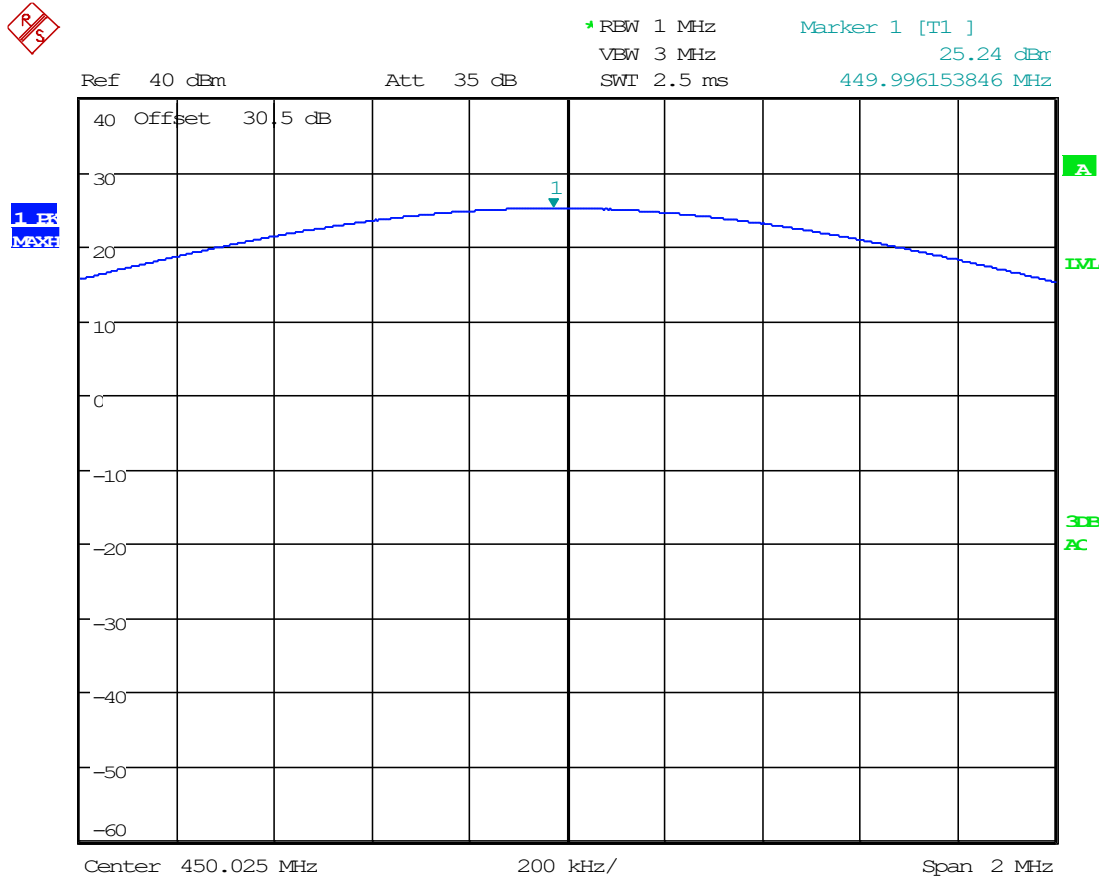
8.2 RF Output Power

Limits from FCC Parts 2.1046(a), and 90.205 (r); and test procedure from ANSI C63.26-2015.



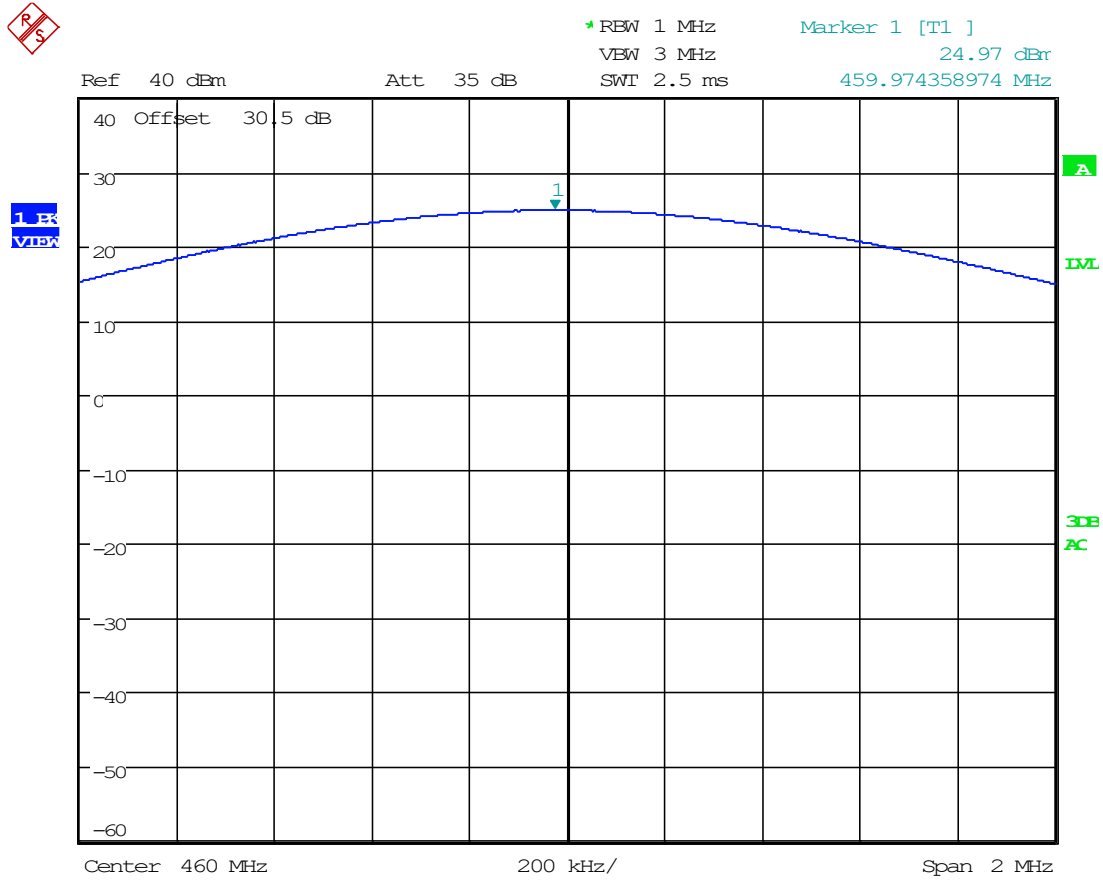
Test Results, Mode 1					
Tuned Frequency (MHz)	Standard Power Output (dBm)	Standard Power Output (W)		Extended Power Output (dBm)	Extended Power Output (W)
450.025	25.24	0.334		29.07	0.807
460	24.97	0.314		28.88	0.773
469.9875	25.20	0.331		28.86	0.769

8.2.1 RF Power Output Plot, Standard, 450.025 MHz



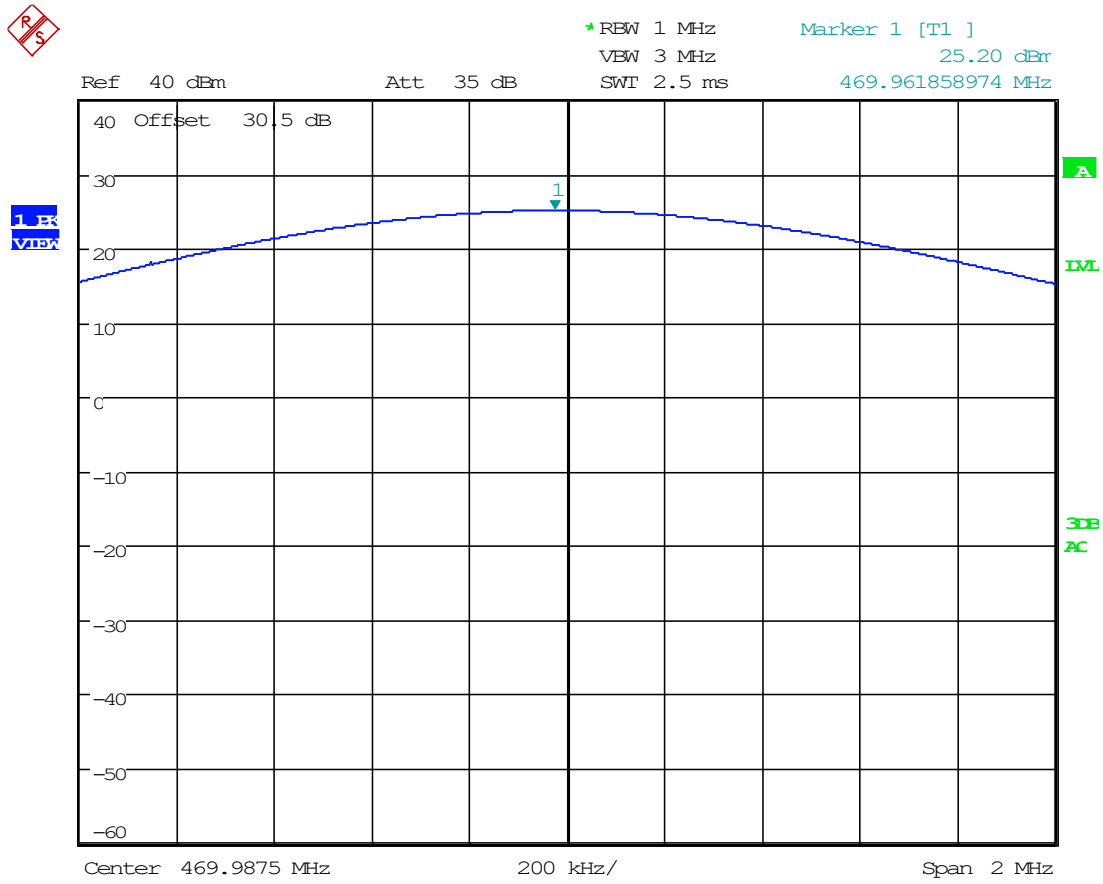
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8.2.2 RF Power Output Plot, Standard, 460 MHz



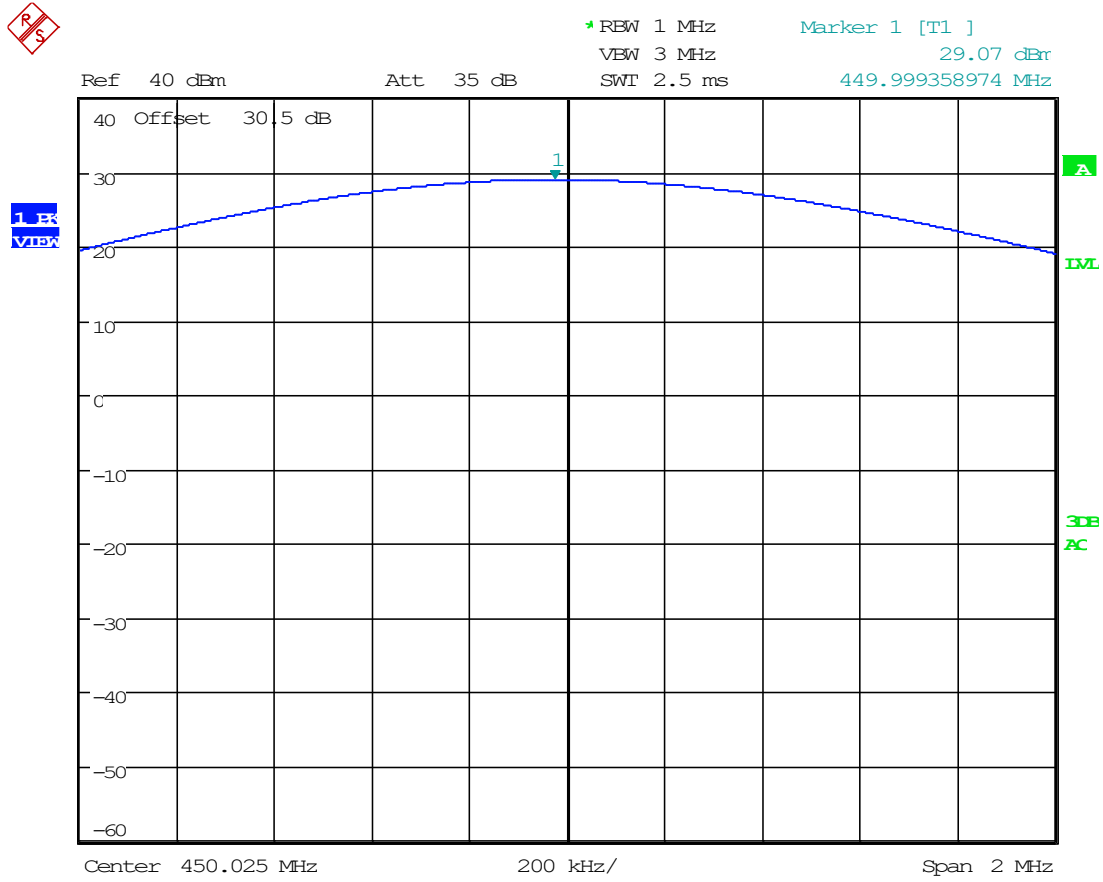
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8.2.3 RF Power Output Plot, Standard, 469.9875 MHz



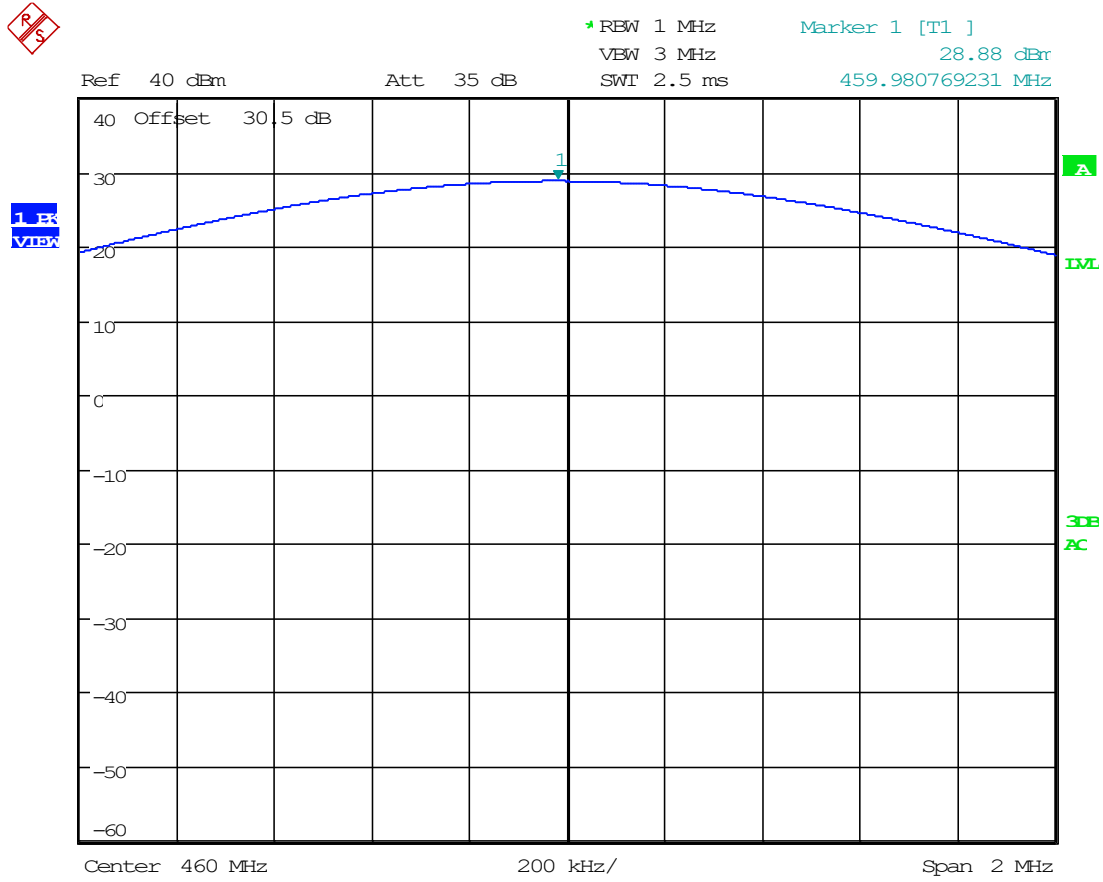
Date: 28.MAY.2024 11:16:55

8.2.4 RF Power Output Plot, Extended, 450.025 MHz



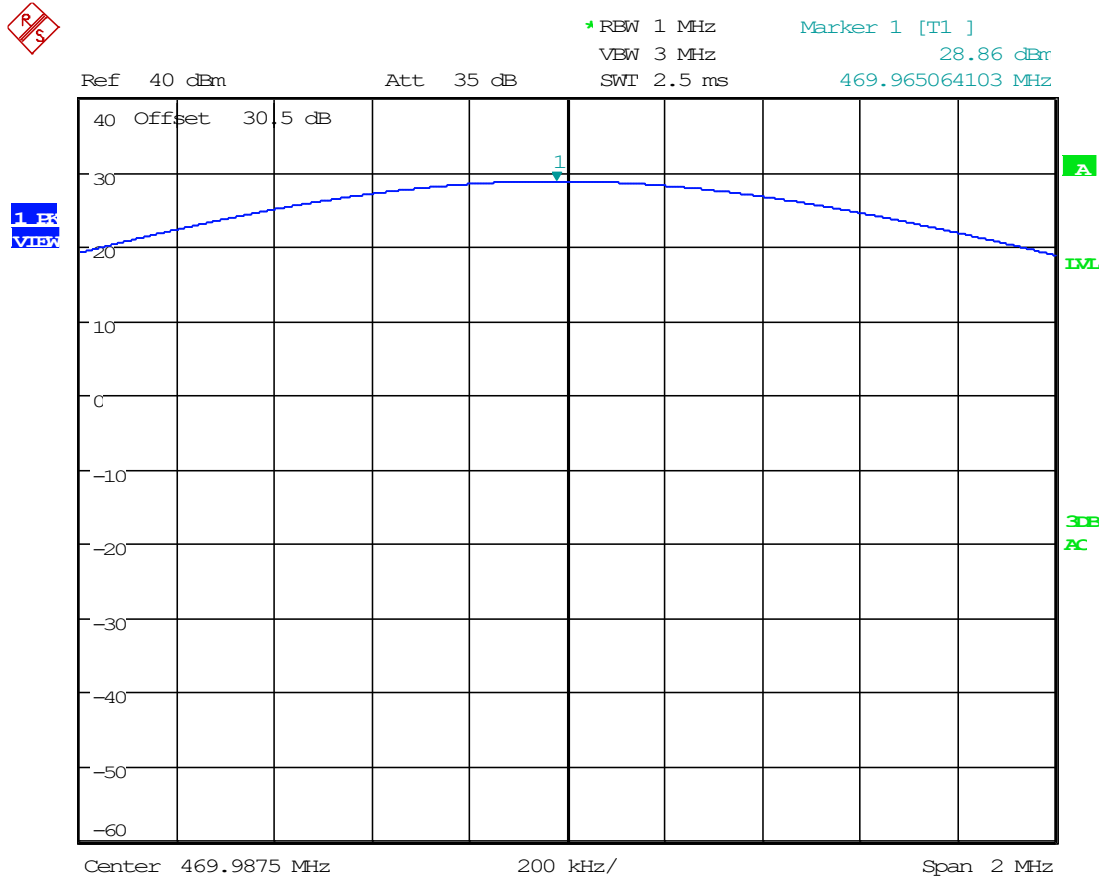
Date: 28.MAY.2024 10:25:24

8.2.5 RF Power Output Plot, Extended, 460 MHz



Date: 28.MAY.2024 10:59:20

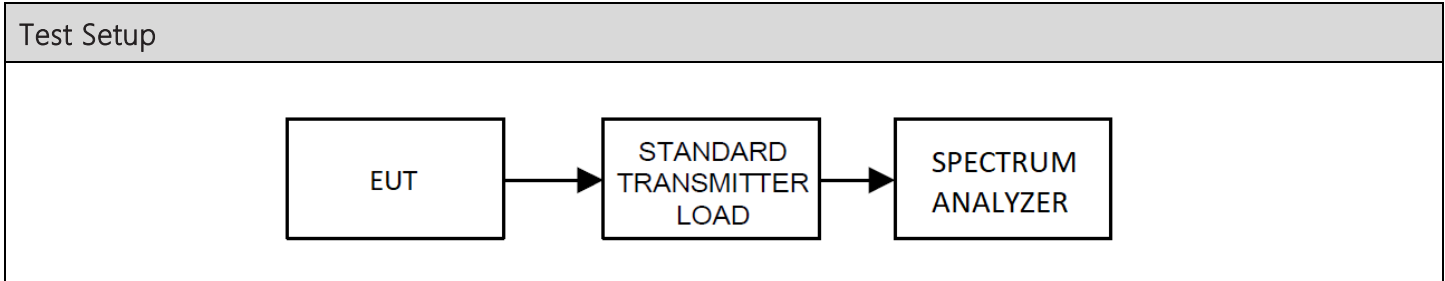
8.2.6 RF Power Output Plot, Extended, 469.9875 MHz



Date: 28.MAY.2024 11:19:01

8.3 Bandwidth & Emission

Limits from FCC Parts 2.1049, and 90.207 & 90.209, and test procedure from ANSI C63.26-2015.

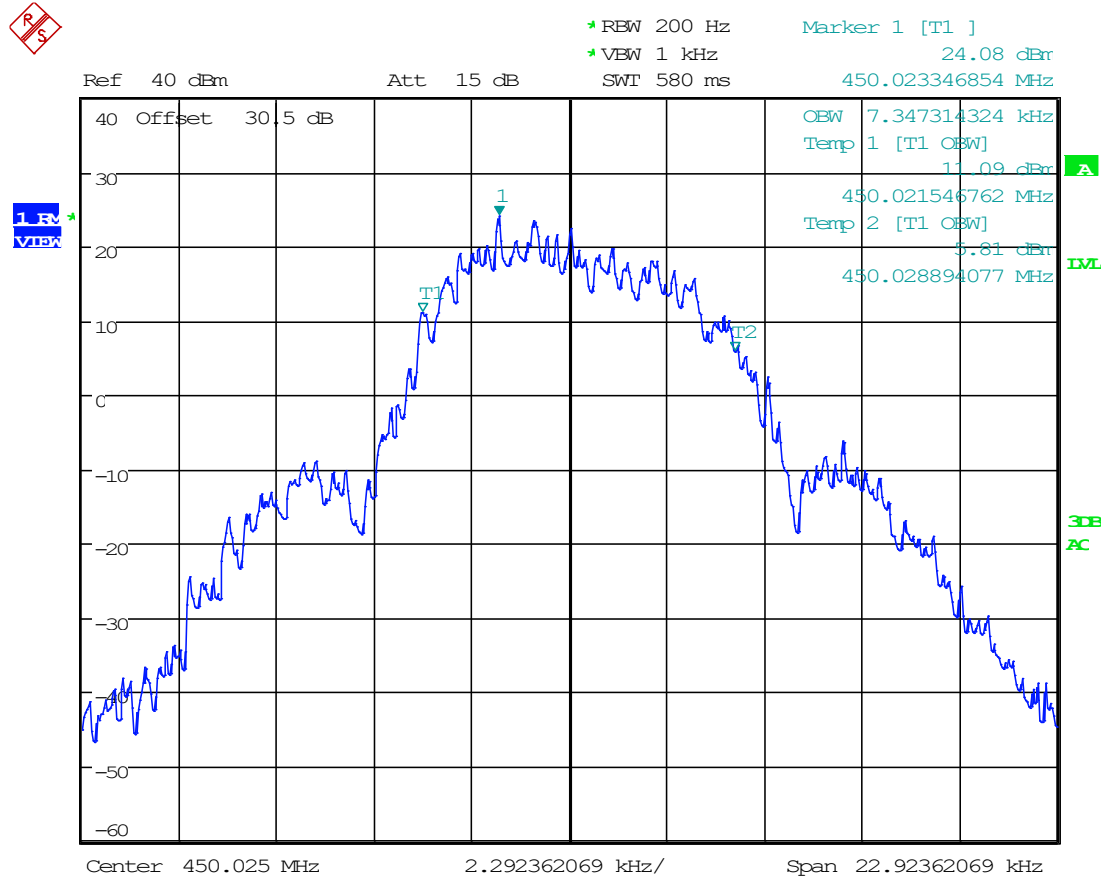


Test Results, Authorized Bandwidth		
Rule Part	Operating Range (MHz)	Authorized Bandwidth (kHz)
Part 90	450 MHz- 470 MHz	12.5

Test Results, Occupied Bandwidth				
Tuned Frequency (MHz)	Mode	Emission Designator	Occupied Bandwidth (kHz)	Bandwidth Type
450.025	1	F1D	7.34	99%
460	1	F1D	7.45	99%
469.9875	1	F1D	7.47	99%

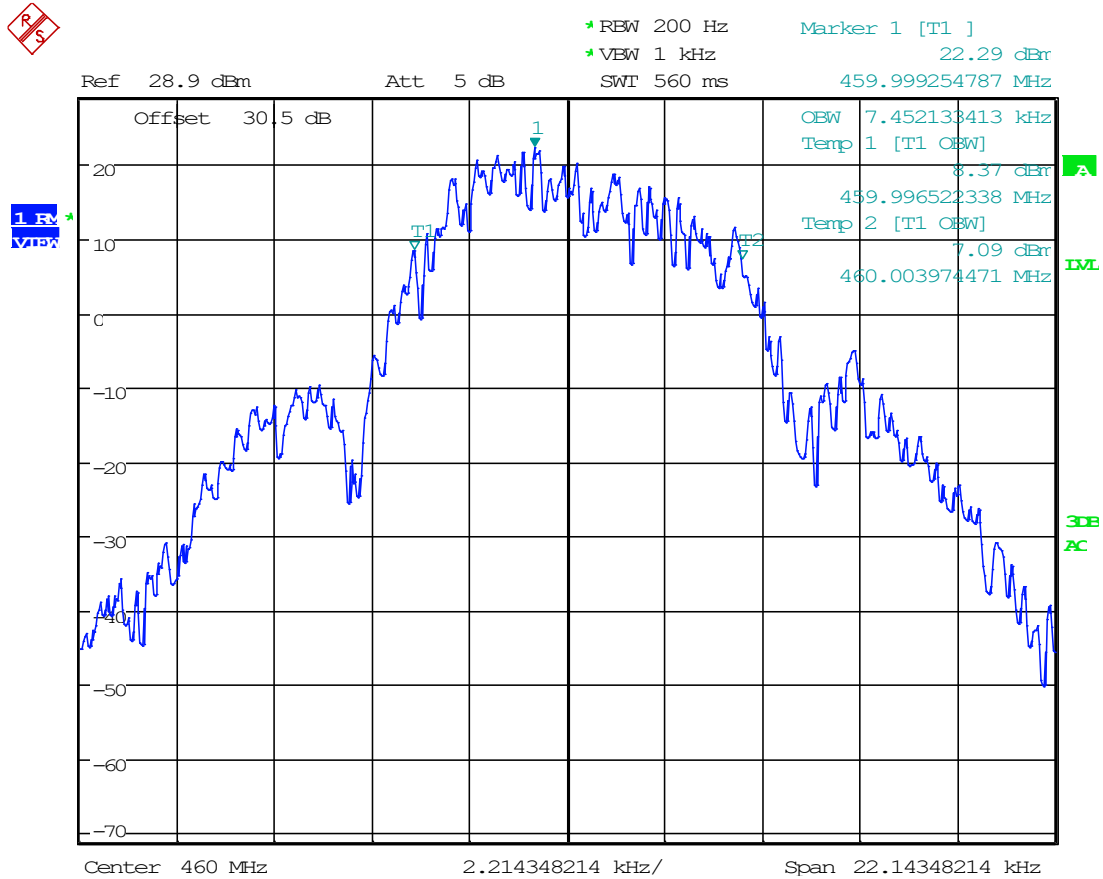
Occupied Bandwidth, Spectrum Plots

8.3.1 99% Bandwidth Plot, 450.025 MHz



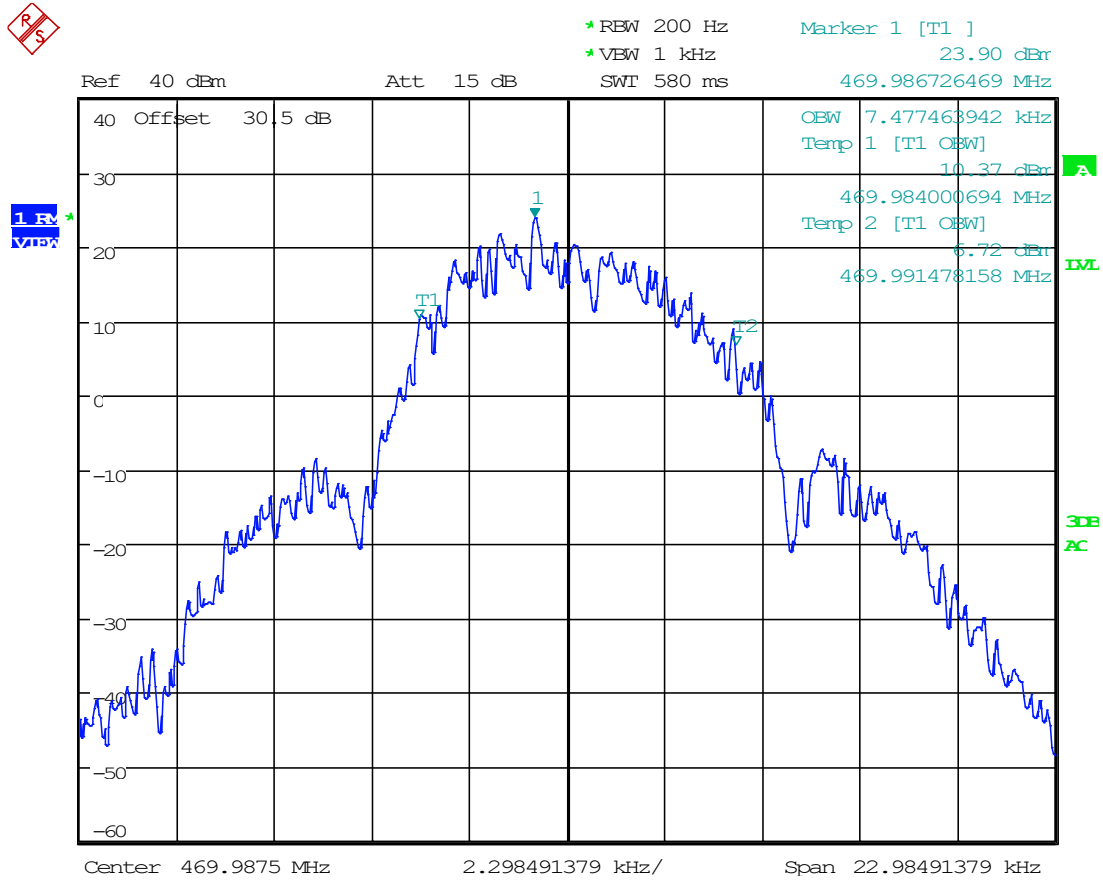
Date: 28.MAY.2024 11:25:12

8.3.2 99% Bandwidth Plot, 460 MHz



Date: 28.MAY.2024 11:37:13

8.3.3 99% Bandwidth Plot, 460.9875 MHz

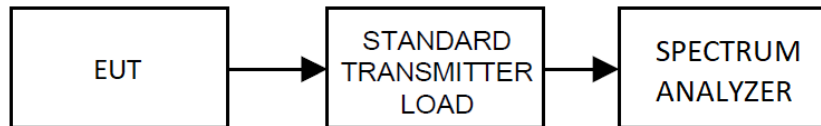


Date: 28.MAY.2024 11:27:11

8.4 Emission Limitations, In-Band

Limits from FCC Part 90.210; and test procedure from ANSI C63.26-2015.

Conducted Test Setup



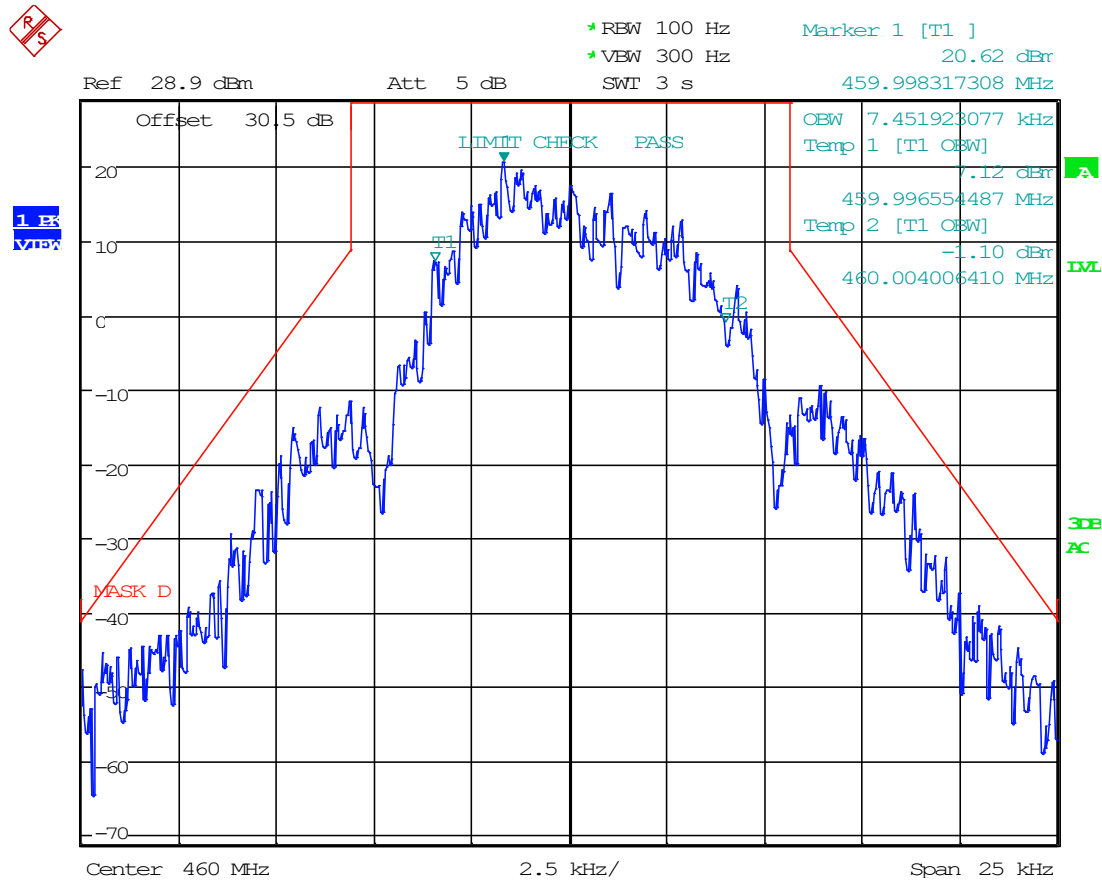
Conducted Emissions Mask, Spectrum Plots

8.4.1 Emission Mask D, 450.025 MHz



Date: 28.MAY.2024 10:37:06

8.4.2 Emission Mask D, 460 MHz



Date: 28.MAY.2024 11:31:54



A

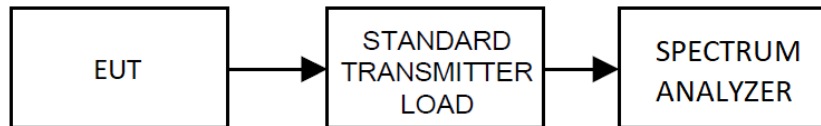
IML

3dB
AC

8.5 Emission Limitations, Out-of-Band

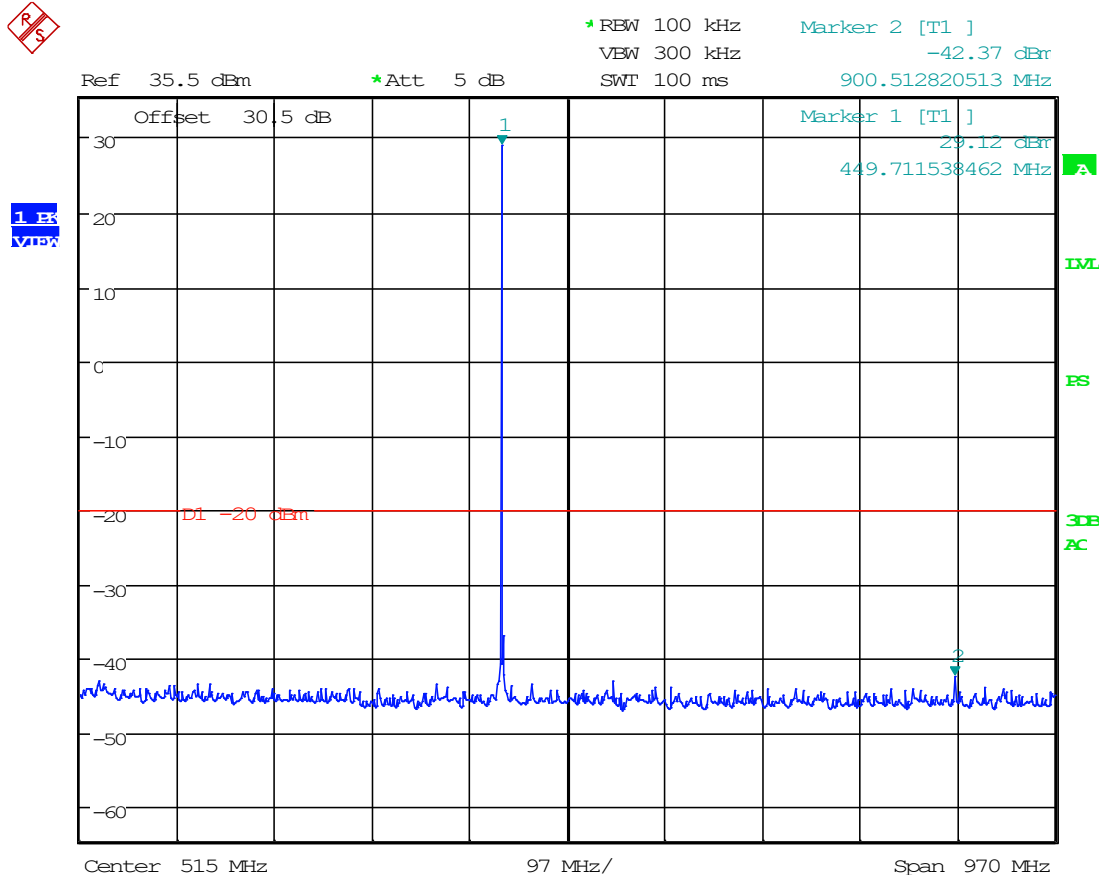
Limits from FCC Parts 2.1051, and 90.210; and test procedure from ANSI C63.26-2015.

Conducted Test Setup



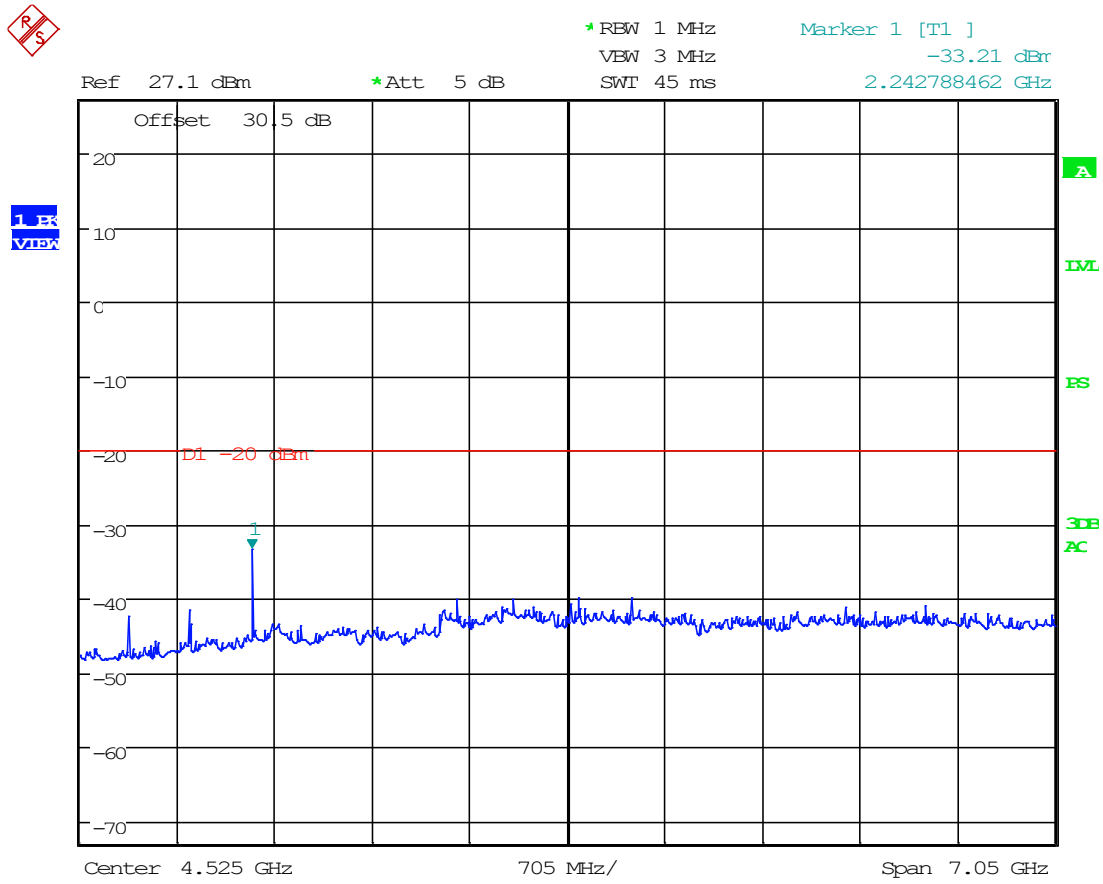
Conducted Emissions Spectrum Plots

8.5.1 Conducted Emissions, Below 1GHz, 450.025 MHz



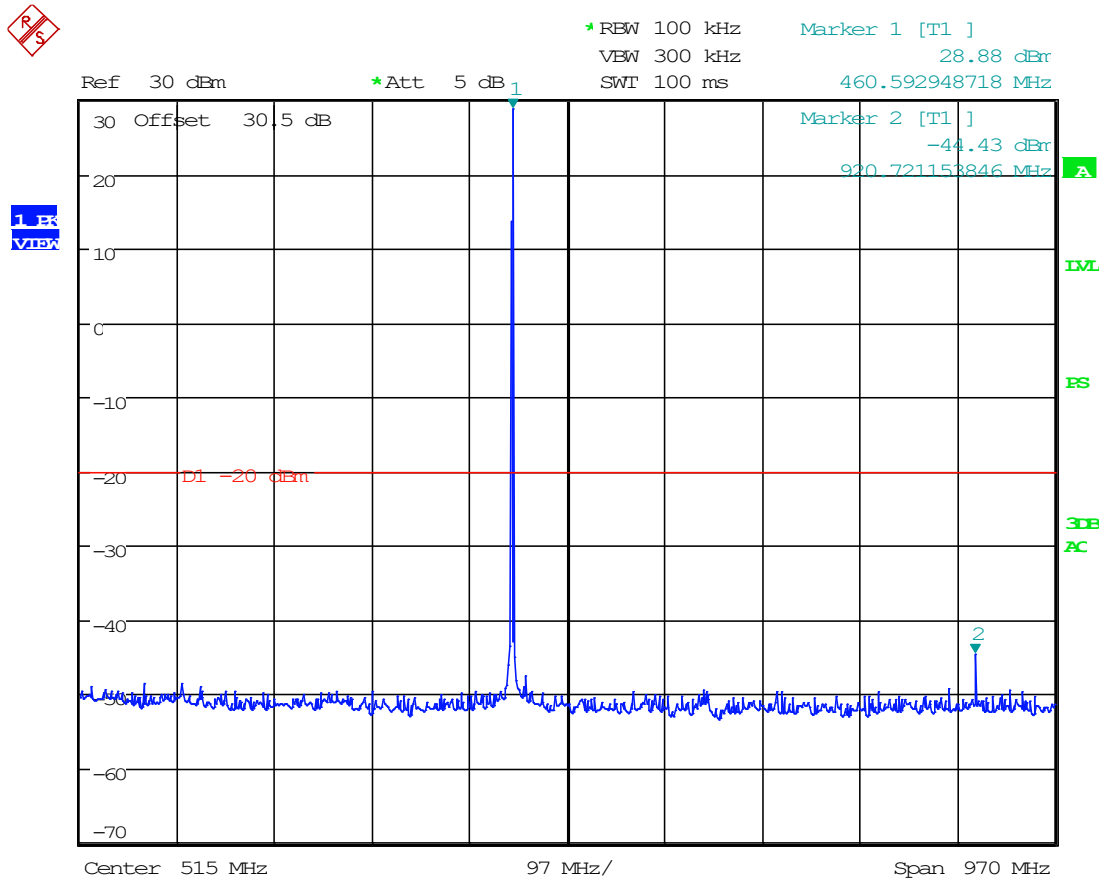
Date: 28.MAY.2024 10:44:32

8.5.2 Conducted Emissions Above 1GHz, 450.025 MHz



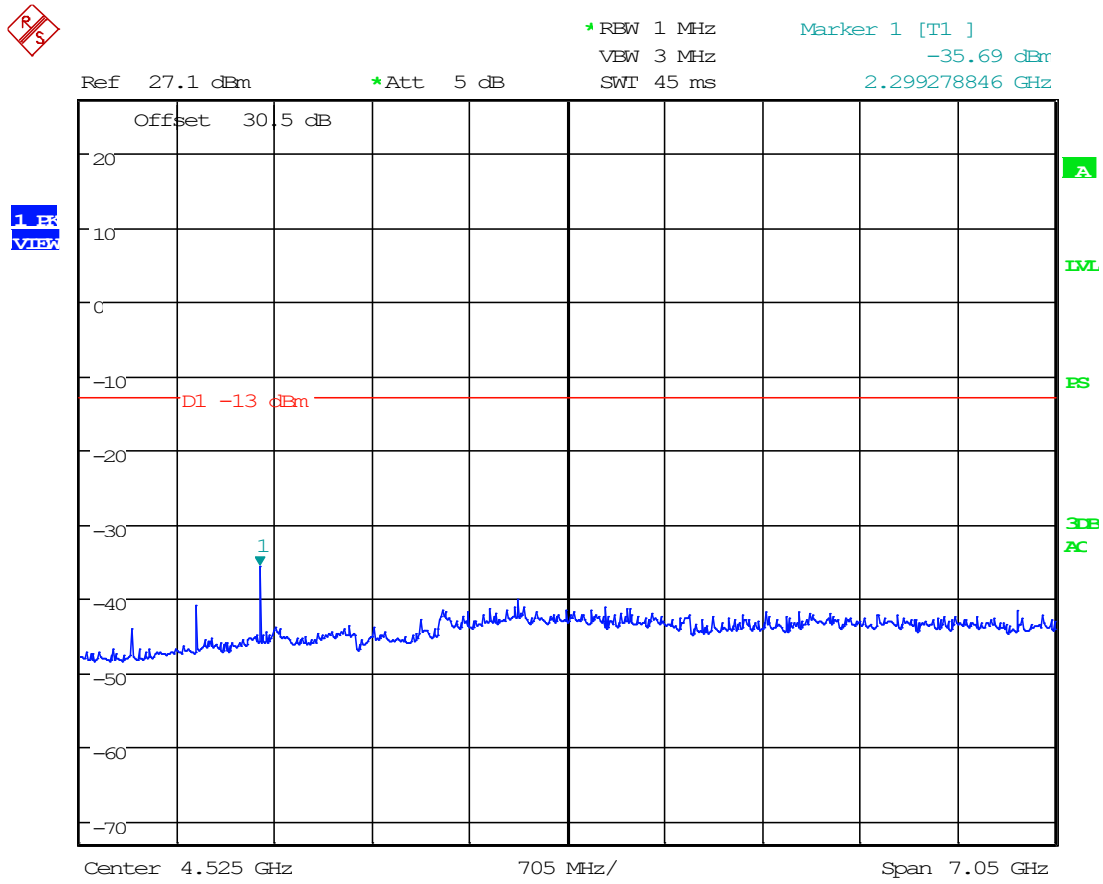
Date: 28.MAY.2024 10:46:35

8.5.3 Conducted Emissions Below 1GHz, 460 MHz



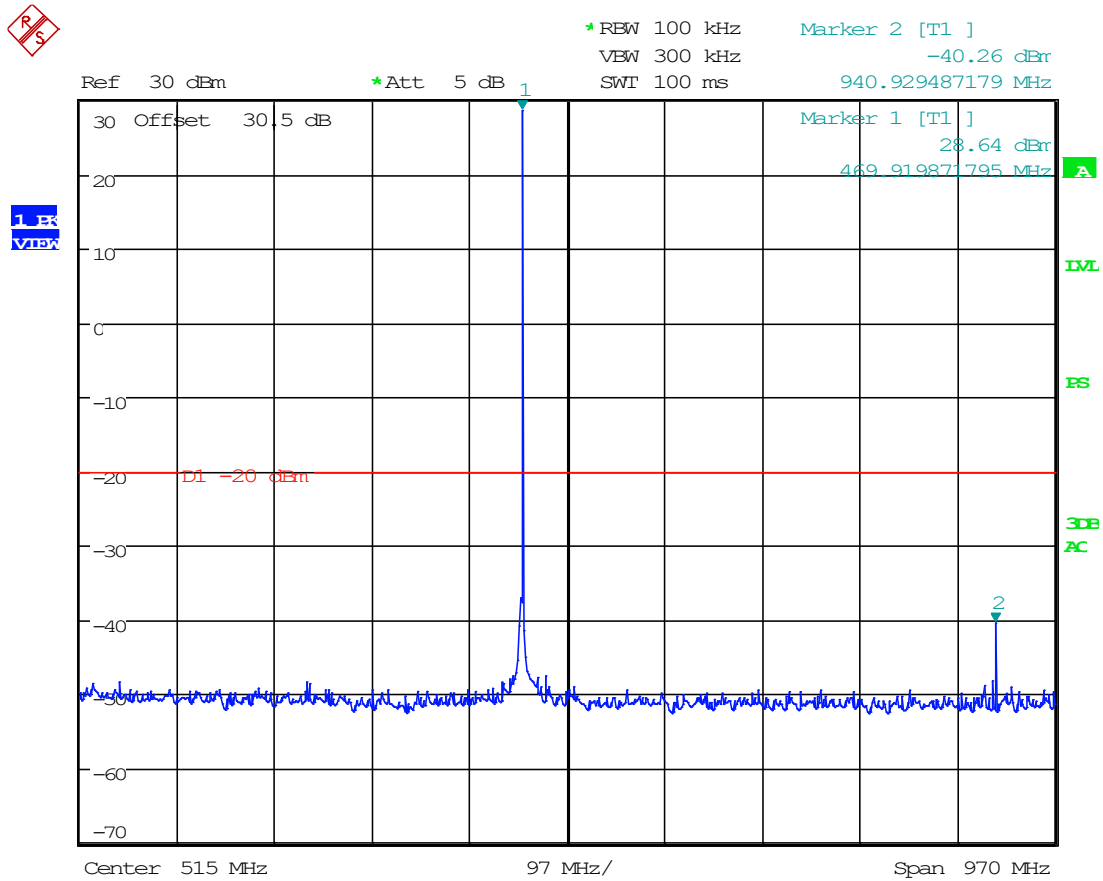
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8.5.4 Conducted Emissions Above 1GHz, 460 MHz



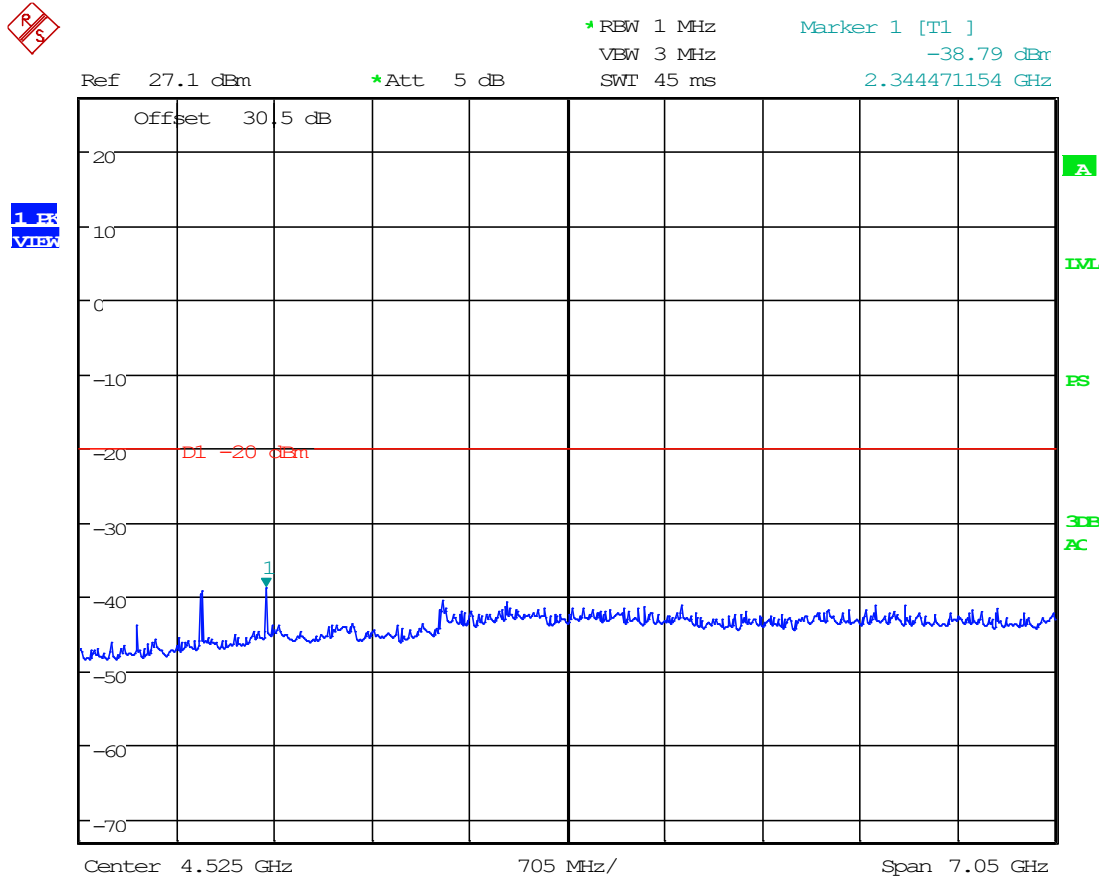
Date: 28.MAY.2024 11:44:51

8.5.5 Conducted Emissions Below 1GHz, 469.9875 MHz



Date: 28.MAY.2024 11:41:35

8.5.6 Conducted Emissions Above 1GHz, 469.9875 MHz

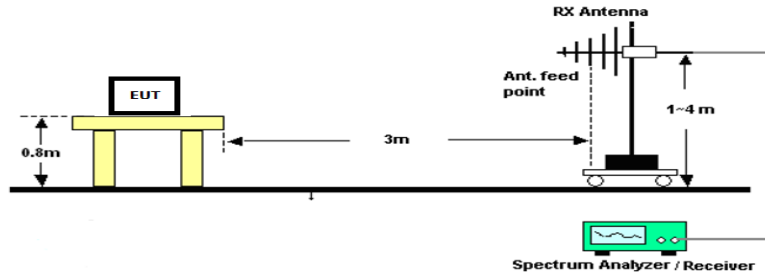


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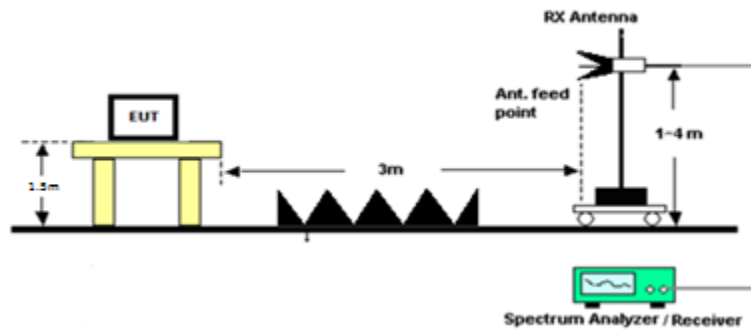
8.6 Radiated Emissions

Limits from FCC Parts 2.1053 and 90.210 (n); and test procedure from ANSI C63.26-2015.

Radiated Test Setup, 30 – 1000 MHz



Radiated Test Setup, Above 1000 MHz



Radiated Emissions, Tabular Data

8.6.1 Radiated Emissions, 450.025 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)
450.025	900.050	PK	28.70	H	-3.54	22.67	3.00	47.83	-49.55	-20.00	29.55
450.025	900.050	PK	29.60	V	-3.54	22.67	3.00	48.73	-48.65	-20.00	28.65
450.025	1350.075	PK	22.30	H	-4.32	28.76	3.00	46.74	-50.63	-20.00	30.63
450.025	1350.075	PK	22.40	V	-4.32	28.76	3.00	46.84	-50.53	-20.00	30.53
450.025	1800.100	PK	21.50	H	-5.11	30.45	3.00	46.84	-50.53	-20.00	30.53
450.025	1800.100	PK	20.70	V	-5.11	30.45	3.00	46.04	-51.33	-20.00	31.33
450.025	2250.125	PK	26.10	H	-5.69	31.88	3.00	52.29	-45.08	-20.00	25.08
450.025	2250.125	PK	22.30	V	-5.69	31.88	3.00	48.49	-48.88	-20.00	28.88
450.025	2700.150	PK	23.20	H	-6.19	32.47	3.00	49.48	-47.90	-20.00	27.90
450.025	2700.150	PK	23.90	V	-6.19	32.47	3.00	50.18	-47.20	-20.00	27.20
450.025	3150.175	PK	22.40	H	-6.72	32.85	3.00	48.54	-48.84	-20.00	28.84
450.025	3150.175	PK	22.30	V	-6.72	32.85	3.00	48.44	-48.94	-20.00	28.94
450.025	3600.200	PK	22.70	H	-7.14	33.08	3.00	48.64	-48.73	-20.00	28.73
450.025	3600.200	PK	22.50	V	-7.14	33.08	3.00	48.44	-48.93	-20.00	28.93
450.025	4050.225	PK	20.80	H	-7.61	33.38	3.00	46.57	-50.81	-20.00	30.81
450.025	4050.225	PK	20.80	V	-7.61	33.38	3.00	46.57	-50.81	-20.00	30.81
450.025	4500.250	PK	22.30	H	-8.05	33.87	3.00	48.12	-49.26	-20.00	29.26
450.025	4500.250	PK	21.70	V	-8.05	33.87	3.00	47.52	-49.86	-20.00	29.86

8.6.2 Radiated Emissions, 460 MHz

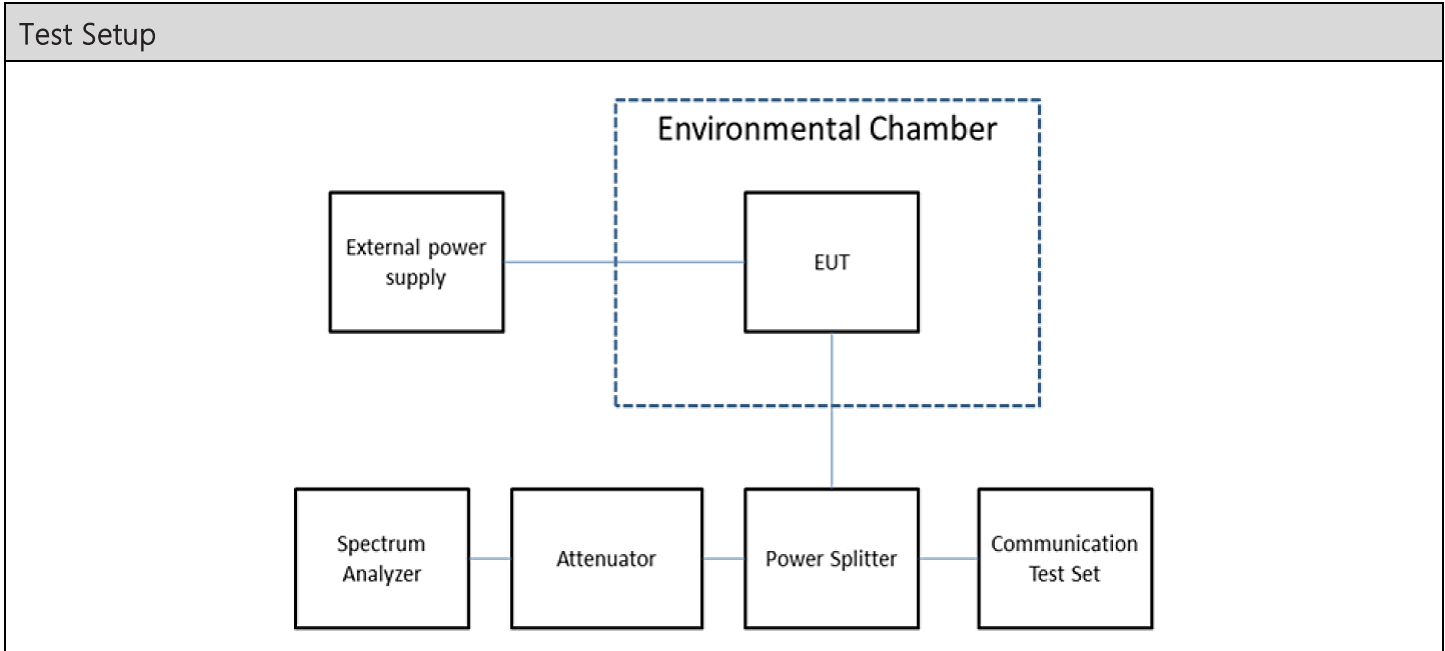
Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBuV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
460.00	920.00	PK	28.40	H	-3.58	22.82	3.00	47.64	-49.74	-20.00	29.74
460.00	920.00	PK	29.10	V	-3.58	22.82	3.00	48.34	-49.04	-20.00	29.04
460.00	1380.00	PK	26.30	H	-4.34	28.25	3.00	50.21	-47.17	-20.00	27.17
460.00	1380.00	PK	23.40	V	-4.34	28.25	3.00	47.31	-50.07	-20.00	30.07
460.00	1840.00	PK	22.70	H	-5.11	31.02	3.00	48.61	-48.77	-20.00	28.77
460.00	1840.00	PK	22.40	V	-5.11	31.02	3.00	48.31	-49.07	-20.00	29.07
460.00	2300.00	PK	21.50	H	-5.74	31.93	3.00	47.69	-49.69	-20.00	29.69
460.00	2300.00	PK	22.00	V	-5.74	31.93	3.00	48.19	-49.19	-20.00	29.19
460.00	2760.00	PK	24.40	H	-6.26	32.53	3.00	50.67	-46.71	-20.00	26.71
460.00	2760.00	PK	24.10	V	-6.26	32.53	3.00	50.37	-47.01	-20.00	27.01
460.00	3220.00	PK	21.20	H	-6.79	32.74	3.00	47.14	-50.23	-20.00	30.23
460.00	3220.00	PK	20.90	V	-6.79	32.74	3.00	46.84	-50.53	-20.00	30.53
460.00	3680.00	PK	22.90	H	-7.20	33.20	3.00	48.89	-48.48	-20.00	28.48
460.00	3680.00	PK	23.20	V	-7.20	33.20	3.00	49.19	-48.18	-20.00	28.18
460.00	4140.00	PK	20.90	H	-7.69	33.51	3.00	46.72	-50.65	-20.00	30.65
460.00	4140.00	PK	21.40	V	-7.69	33.51	3.00	47.22	-50.15	-20.00	30.15
460.00	4600.00	PK	20.80	H	-8.12	34.09	3.00	46.77	-50.61	-20.00	30.61
460.00	4600.00	PK	21.90	V	-8.12	34.09	3.00	47.87	-49.51	-20.00	29.51

8.6.3 Radiated Emissions, 469.9875 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)
469.9875	939.9750	PK	29.10	H	-3.59	23.04	3.00	48.55	-48.83	-20.00	28.83
469.9875	939.9750	PK	26.50	V	-3.59	23.04	3.00	45.95	-51.43	-20.00	31.43
469.9875	1409.9625	PK	26.30	H	-4.38	27.95	3.00	49.87	-47.51	-20.00	27.51
469.9875	1409.9625	PK	22.40	V	-4.38	27.95	3.00	45.97	-51.41	-20.00	31.41
469.9875	1879.9500	PK	21.20	H	-5.11	31.37	3.00	47.46	-49.92	-20.00	29.92
469.9875	1879.9500	PK	21.10	V	-5.11	31.37	3.00	47.36	-50.02	-20.00	30.02
469.9875	2349.9375	PK	21.80	H	-5.80	31.90	3.00	47.90	-49.48	-20.00	29.48
469.9875	2349.9375	PK	22.00	V	-5.80	31.90	3.00	48.10	-49.28	-20.00	29.28
469.9875	2819.9250	PK	24.10	H	-6.33	32.52	3.00	50.29	-47.09	-20.00	27.09
469.9875	2819.9250	PK	24.00	V	-6.33	32.52	3.00	50.19	-47.19	-20.00	27.19
469.9875	3289.9125	PK	21.70	H	-6.83	32.79	3.00	47.66	-49.72	-20.00	29.72
469.9875	3289.9125	PK	21.20	V	-6.83	32.79	3.00	47.16	-50.22	-20.00	30.22
469.9875	3759.9000	PK	22.40	H	-7.29	33.19	3.00	48.30	-49.08	-20.00	29.08
469.9875	3759.9000	PK	21.50	V	-7.29	33.19	3.00	47.40	-49.98	-20.00	29.98
469.9875	4229.8875	PK	21.20	H	-7.77	33.46	3.00	46.89	-50.49	-20.00	30.49
469.9875	4229.8875	PK	21.30	V	-7.77	33.46	3.00	46.99	-50.39	-20.00	30.39
469.9875	4699.8750	PK	22.20	H	-8.19	34.08	3.00	48.09	-49.29	-20.00	29.29
469.9875	4699.8750	PK	21.90	V	-8.19	34.08	3.00	47.79	-49.59	-20.00	29.59

8.7 Frequency Stability

Limits from FCC Parts 2.1055, and 90.213; and test procedure from ANSI C63.26-2015.

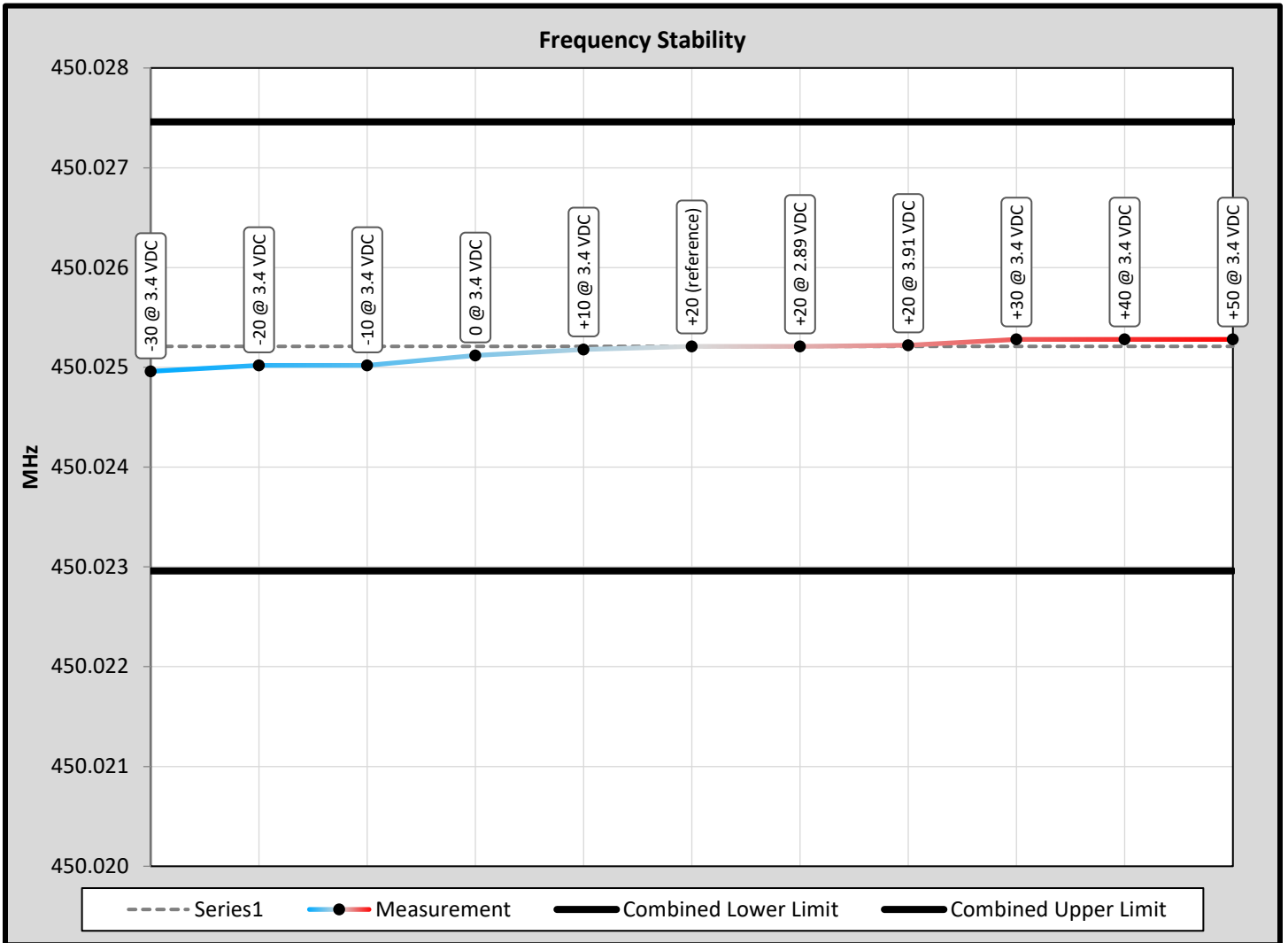


Test Results, Mode 1		
Tuned Frequency (MHz)	Max Deviation (kHz)	Limit (ppm)
450.025	0.250	5.0

8.7.1 Frequency Stability Data

FCC Part 90 Limit	5.0	ppm	
FCC Part 90 Limit, as ppb	5000	ppb (Parts per Billion)	
FCC Part 90 Limit, as %	0.00050	%	
Strictest Combined Limit, as Hz	2250.126	Hz	
Combined Lower Limit	450.022960	MHz	
Combined Upper Limit	450.027460	MHz	
Rated Supply Voltage	3.4	 AC  DC	
Temperature / Voltage Variation			
Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
-30	3.4	450.024960	0.250
-20	3.4	450.025020	0.190
-10	3.4	450.025020	0.190
0	3.4	450.025120	0.090
+10	3.4	450.025180	0.030
+20 (reference)	3.4	450.025210	0.000
+20	2.9	450.025210	0.000
+20	3.9	450.025220	-0.010
+30	3.4	450.025280	-0.070
+40	3.4	450.025280	-0.070
+50	3.4	450.025280	-0.070

8.7.2 Frequency Stability Plot



9. ANNEX-B – Test Setup Photographs

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

10. History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_13810-24_FCC 90_	1	Initial release	6/4/2024
	2	Updated pages 1, 3	10/4/2024

END OF TEST REPORT
