



Test Report - FCC PART 90 (TNB)

Prepared For: Qual-Tron, Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature
(YYYY-MM-DD): 2021-04-29

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1. Customer Information

Applicant: Qual-Tron, Inc.
Address: 9409 E. 55th Place South
Tulsa, OK 74145-8157

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.

The Following is for Test item FCC ID: OGE-QSM

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



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1.2 Part 90 Test Result Summary

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.



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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

2.2 Testing was performed, reviewed by

Dates of Testing: April 01 - 27, 2021

Signature:

Name & Title: Terri Allen, Technical Assistant

Date of Signature

(YYYY-MM-DD): 2021-04-29

Sr. EMC Engineer
EMC-003838-NE



Signature:

Name & Title: Tim Royer, EMC Engineer

Date of Signature

(YYYY-MM-DD): 2021-04-29



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

The test sample was received: April 01, 2021

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:	OGE-QSM
Brief Description	QSM Multi-Channel Data Modem
Type of Modular	Single Modular Transmitter
Model(s) #	QSM
Trade name	Qual-Tron, Inc.
Firmware version	51
Software version	.77
Serial Number	526 or 527

Technical Characteristics	
Technology	TNB
Frequency Range	138-158.2975
RF O/P Power (Max.)	29.24 dBm
Modulation	F1D
Bandwidth & Emission Class	7.34 kHz & F1D
Number of Channels	3100
Duty Cycle	100%
Antenna Connector	UFL
Voltage Rating (AC or Batt.)	9 V DC

Antenna Characteristics				
Antenna Name	Frequency Range	Antenna Type	Dimensions	Antenna Gain
n/a	n/a	n/a	n/a	n/a



3.2 Configuration of EUT

Test Modes			
Mode (#)	Test Frequencies	BW (nominal)	Modulation
1	150.8125MHz, 158.2975 MHz	11.25	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 provided by the manufacturer was used to control 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

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:

Temperature	23 C +/- 5%
Humidity	55% +/- 5%
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

Device	Manufacturer	Model	SN #	Current Cal	Cal Due
Audio Analyzer	HP	8903B	3011A13084	1/13/21	1/13/2024
Function Generator	Standford	DS340	25200	1/13/21	1/13/2024
Modulation Analyzer	HP	8901A	3050A05856	4/23/20	4/23/2023
Oscilloscope	LeCroy	LT364	00414	3/28/19	3/27/2022
Signal Generator HP 8648C	HP	8648C	3847A04696	3/31/21	3/30/2024
Sweep/Signal Generator	Anritsu	68369B	985112	1/19/21	1/19/2024
Digital Multimeter	Fluke	77	35053830	9/9/20	9/9/2023
Digital Multimeter	Fluke	77	43850817	7/20/19	7/19/2022
Digital Multimeter	Fluke	FLUKE-77-3	79510408	9/9/20	9/9/2023
Multimeter	HP	973A	JP37006959	9/9/20	9/9/2023
R&S 18 GHz USB Peak Power Sensor	Rohde & Schwarz	NRP-Z85	1411.7501.02-102085-W	2/4/19	2/3/2022
Active Loop	ETS-Lindgren	6502	00062529	10/20/20	10/20/2023
Biconical 1057	Eaton	94455-1	1057	10/16/20	10/16/2023
Log-Periodic 1243	Eaton	96005	1243	5/20/18	5/19/2021
Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	2/25/20	2/24/2023
Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	10/19/20	10/19/2023
CHAMBER	Panashield	3M	N/A	3/12/19	3/11/2022
Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	2/27/19	2/26/2022
EMI Test Receiver R&S ESIB 40	Rohde & Schwarz	ESIB 40	100274	7/22/19	7/21/2022
EMI Test Receiver R&S ESU 40	Rohde & Schwarz	ESU 40	100320	8/28/18	8/27/2021
Frequency Counter Small	HP	5385A	3242A07460	9/9/20	9/9/2023
Type K J Thermometer	Martel	303	080504494	1/18/20	1/17/2023

Software	Author	Version	Validation Or
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.



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8.1 Power at the Final Amplifier

Limits from FCC Part 2.1033 (c)(8).

No method of measurement is specified. The result has been calculated based on all available information.

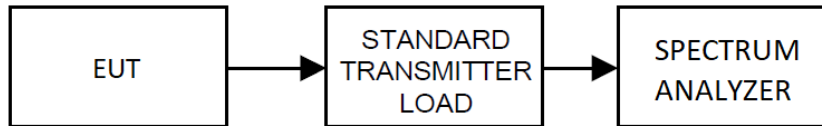
Test Results		
EUT Operating Voltage (V)	EUT Current (A)	Power at the Final Amplifier
9v	1A	9W



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 Setup

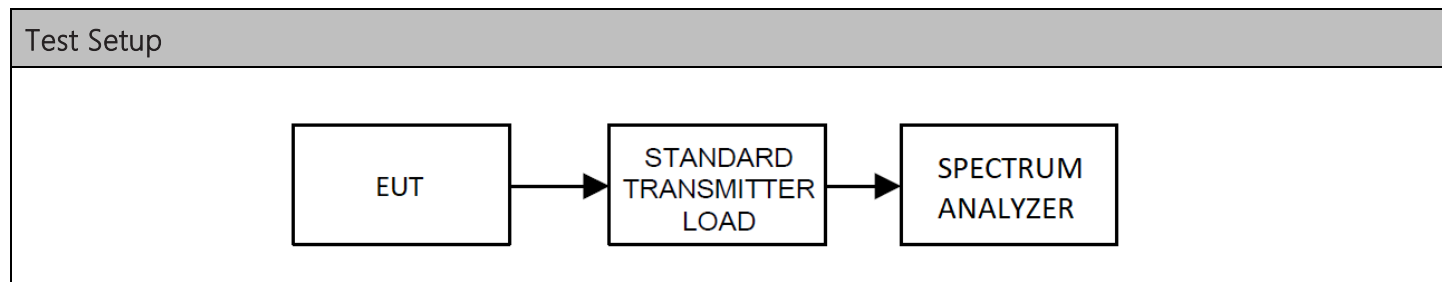


Tuned Frequency (MHz)	Power Output (dBm)	Power Output (W)
150.8	29.12	0.817
158.2975	30.29	1.069



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	Authorized Bandwidth
Part 90	150.8125– 174 MHz	11.25 kHz

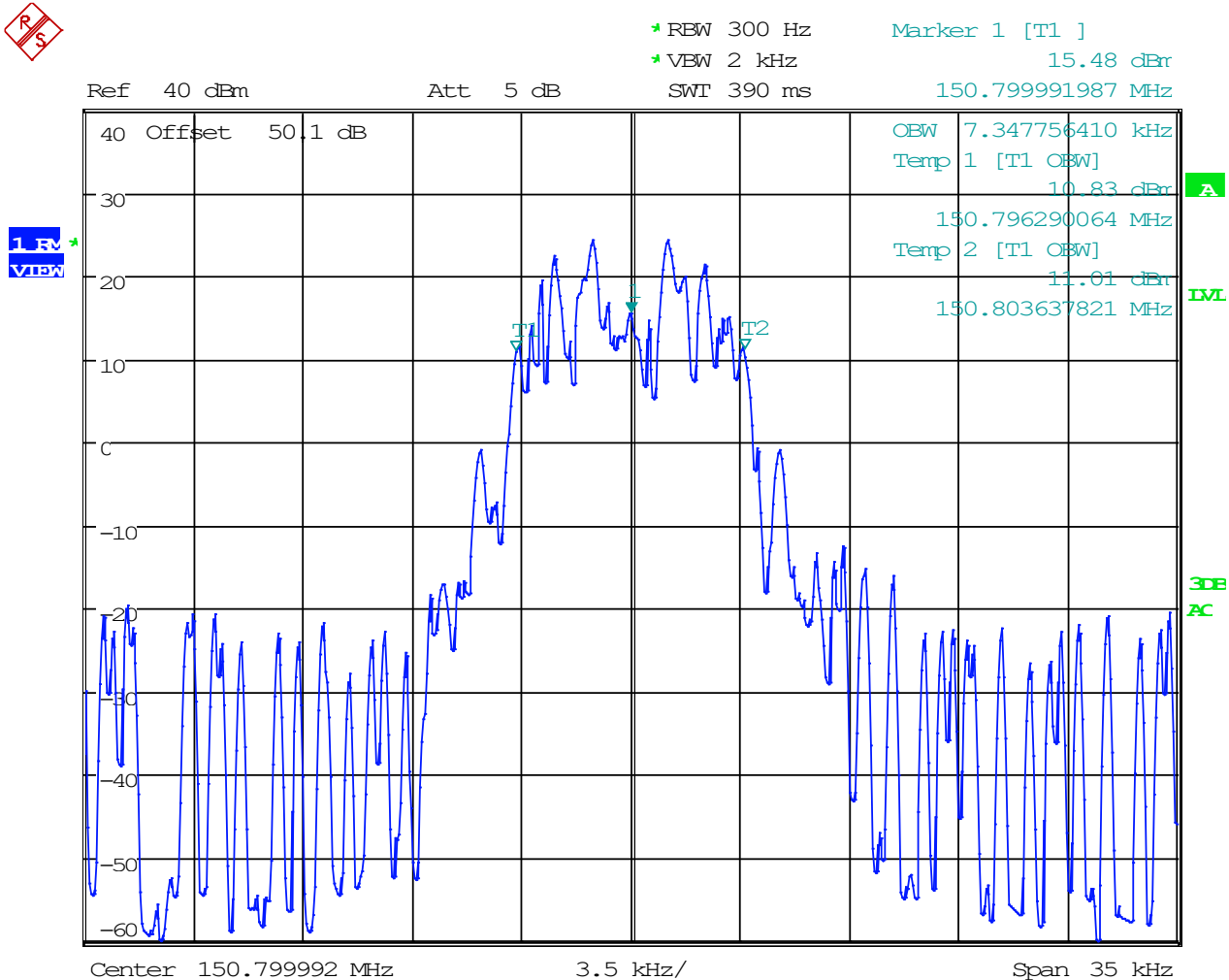
Test Results, Occupied Bandwidth		
Tuned Frequency (MHz)	Occupied Bandwidth (kHz)	Bandwidth Type
150.8125	7.34	F1D
158.2975	7.23	F1D

Test Results, Necessary Bandwidth			
Tuned Frequency (MHz)	Necessary Bandwidth (kHz)	Emission Designator	Bandwidth Type
150.8125	7.34	7k34	F1D



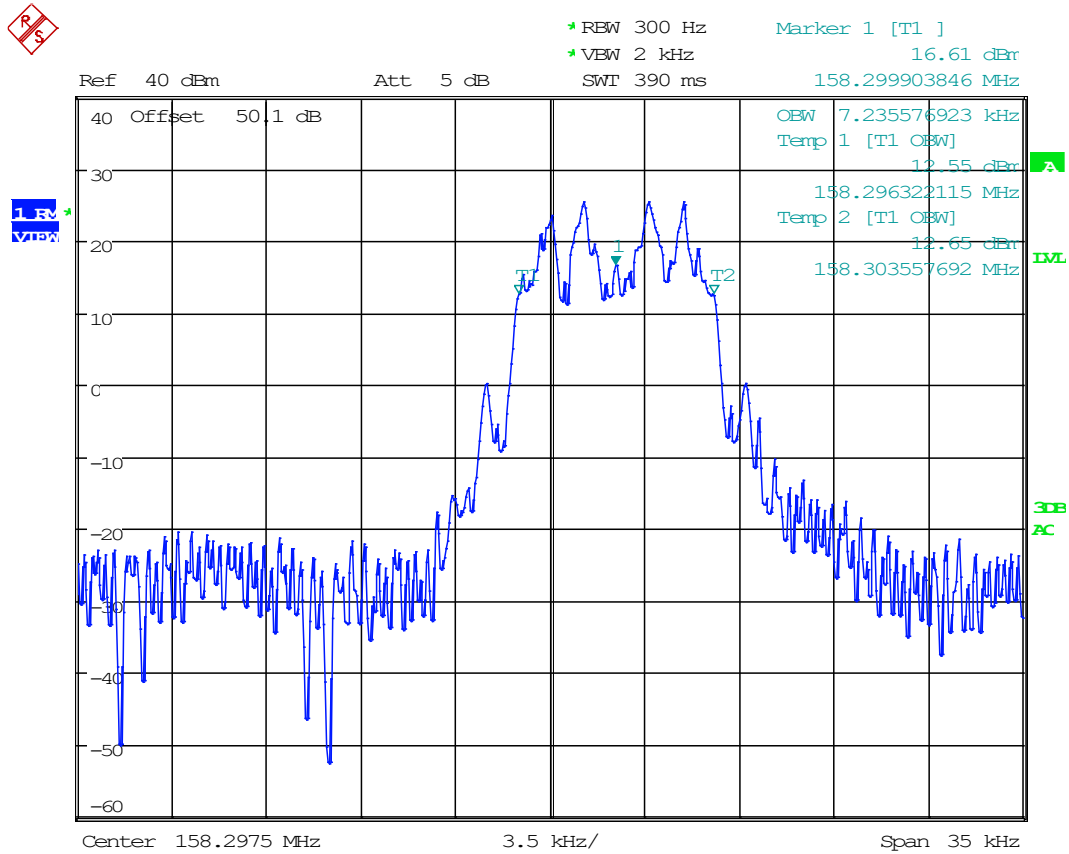
Occupied Bandwidth, Spectrum Plots

8.3.1 Bandwidth Plot, 99%, 150.8125MHz



Date: 22.APR.2021 13:24:47

8.3.1 Bandwidth Plot, 99%, 158.2975 MHz



Date: 22.APR.2021 13:17:55



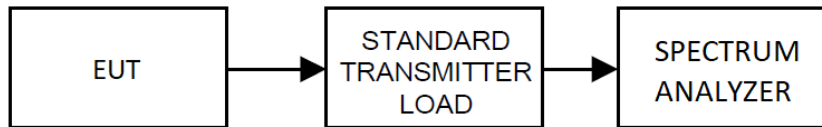
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Necessary Bandwidth, Spectrum Plots

8.4 Emission Limitations, In-Band

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

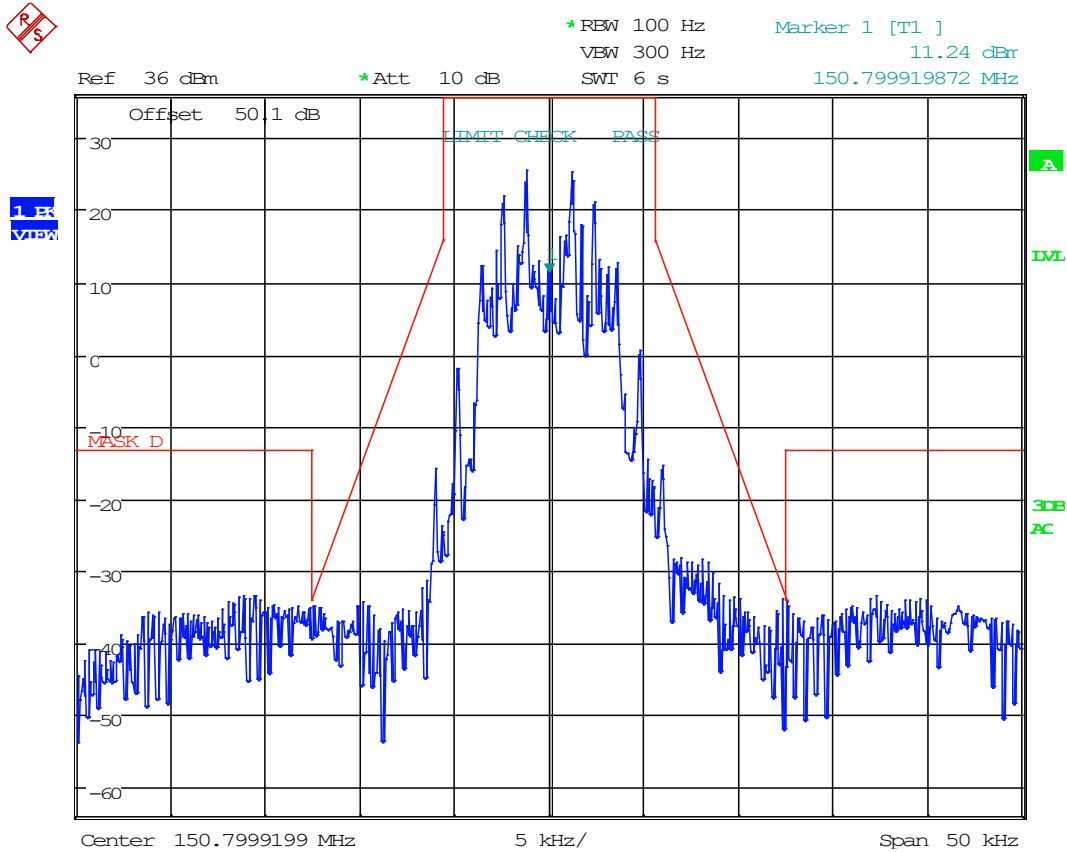
Conducted Test Setup





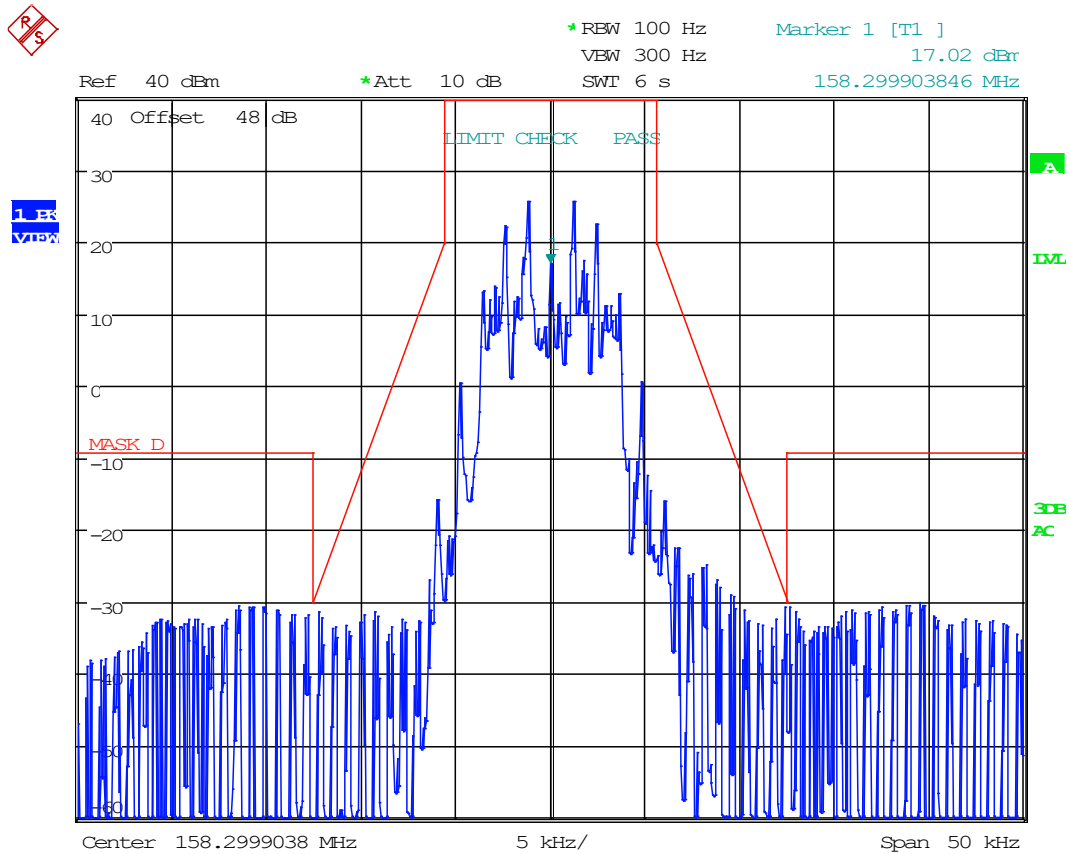
Conducted Emissions Mask, Spectrum Plots

8.4.1 Emission Mask, 150.8125MHz



Date: 27.APR.2021 11:32:01

8.4.1 Emission Mask, 158.2975 MHz



Date: 27.APR.2021 12:59:26

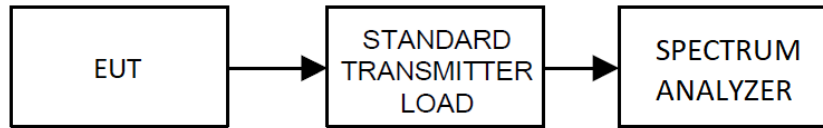


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8.5 Emission Limitations, Out-of-Band

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

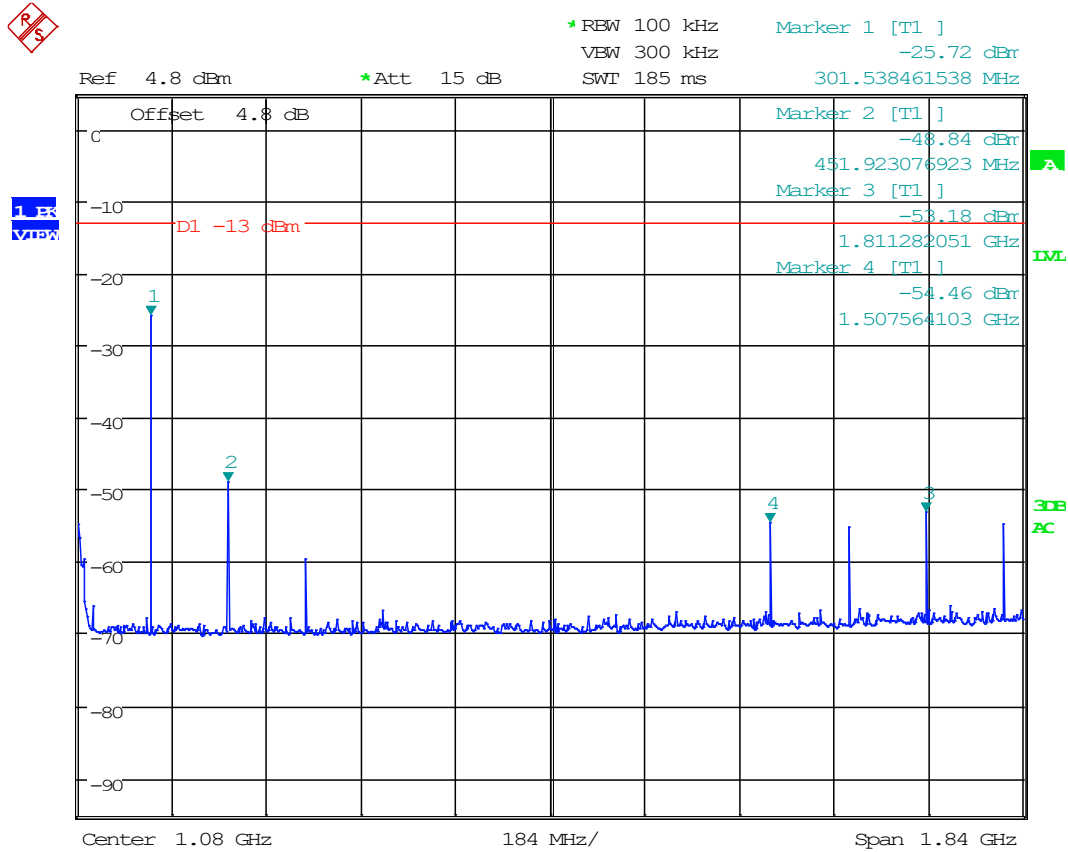
Conducted Test Setup





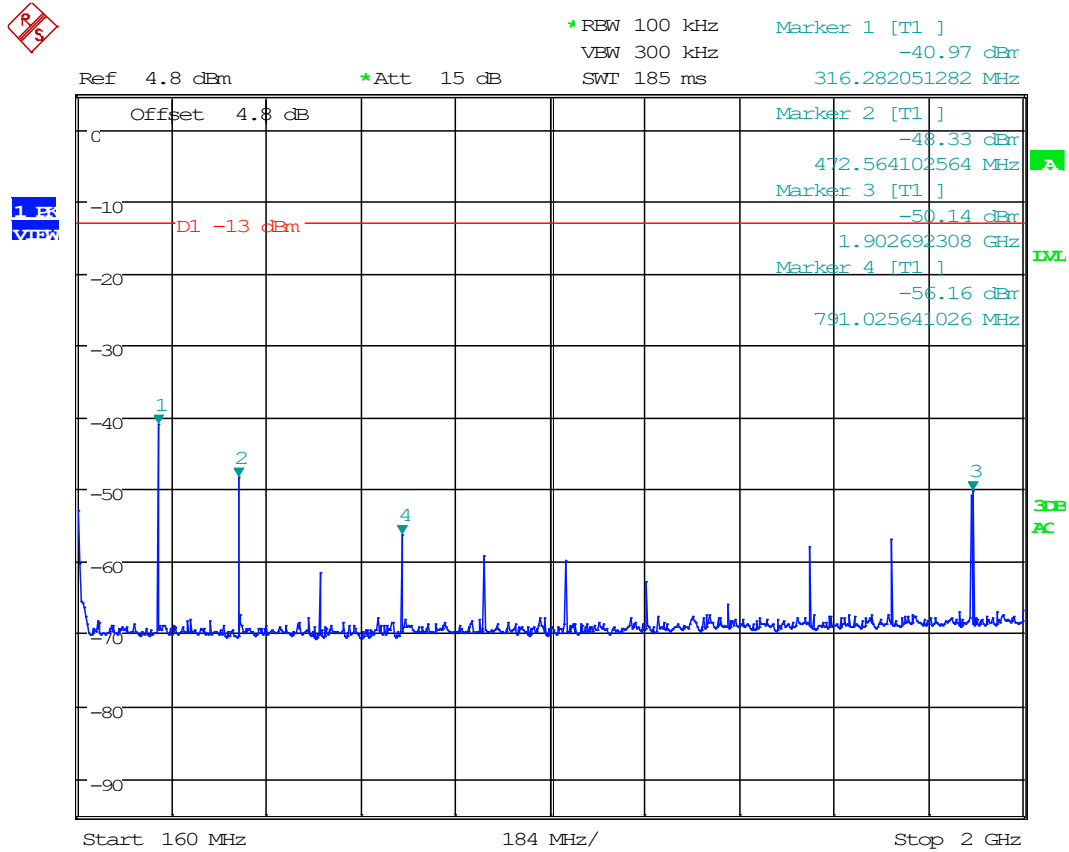
Conducted Emissions Spectrum Plots

8.5.1 Conducted Emissions 160 MHz to 10th Harmonic, 150.8125MHz



Date: 22.APR.2021 18:07:10

8.5.2 Conducted Emissions 160 MHz to 10th Harmonic, 158.2975 MHz

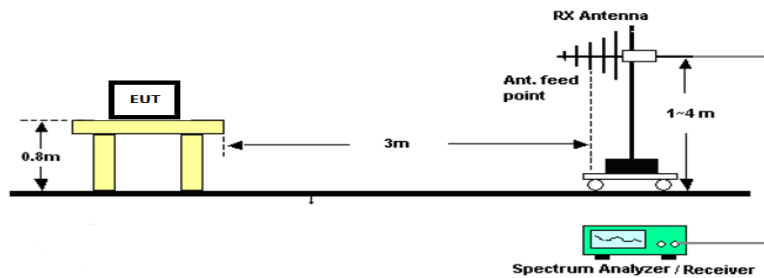


Date: 22.APR.2021 18:02:58

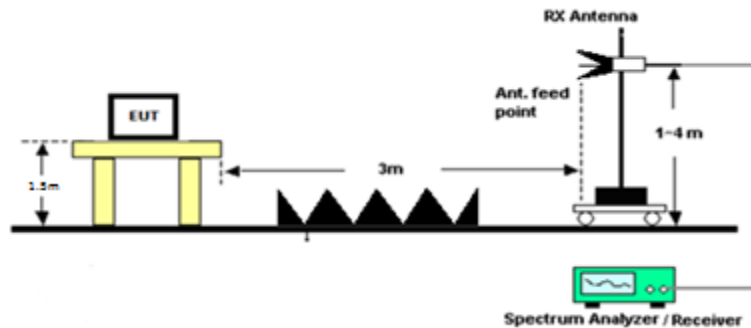
8.6 Radiated Emissions

Limits from FCC Parts 2.1053, 80.211 (f), 87.139 (a), and 90.210 (n); and test procedure from ANSI C63.26-2015.

Radiated Test Setup, 30 – 1000 MHz



Radiated Test Setup, Above 1000 MHz





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Radiated Emissions, Tabular Data

8.6.1 Radiated Emissions, 150.8125 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)
150.81	301.63	PK	35.56	H	2.08	13.73	3.00	51.37	-46.01	-13.00	33.01
150.81	301.63	PK	28.33	V	2.08	13.73	3.00	44.14	-53.24	-13.00	40.24
150.81	452.44	PK	14.56	H	2.47	15.85	3.00	32.88	-64.50	-13.00	51.50
150.81	452.44	PK	20.69	V	2.47	15.85	3.00	39.01	-58.37	-13.00	45.37
150.81	603.25	PK	16.04	H	2.87	18.47	3.00	37.37	-60.00	-13.00	47.00
150.81	603.25	PK	13.50	V	2.87	18.47	3.00	34.83	-62.54	-13.00	49.54
150.81	754.06	PK	15.19	H	3.22	20.98	3.00	39.40	-57.98	-13.00	44.98
150.81	754.06	PK	14.41	V	3.22	20.98	3.00	38.62	-58.76	-13.00	45.76
150.81	904.88	PK	14.71	H	3.54	22.19	3.00	40.44	-56.93	-13.00	43.93
150.81	904.88	PK	13.31	V	3.54	22.19	3.00	39.04	-58.33	-13.00	45.33
150.81	1055.69	PK	11.52	H	3.79	26.80	3.00	42.11	-55.27	-13.00	42.27
150.81	1055.69	PK	10.44	V	3.79	26.80	3.00	41.03	-56.35	-13.00	43.35
150.81	1206.50	PK	11.65	H	4.01	28.10	3.00	43.76	-53.62	-13.00	40.62
150.81	1206.50	PK	10.35	V	4.01	28.10	3.00	42.46	-54.92	-13.00	41.92
150.81	1357.31	PK	11.60	H	4.27	28.71	3.00	44.59	-52.79	-13.00	39.79
150.81	1357.31	PK	12.37	V	4.27	28.71	3.00	45.36	-52.02	-13.00	39.02
150.81	1508.13	PK	11.32	H	4.50	27.76	3.00	43.59	-53.79	-13.00	40.79
150.81	1508.13	PK	10.61	V	4.50	27.76	3.00	42.88	-54.50	-13.00	41.50



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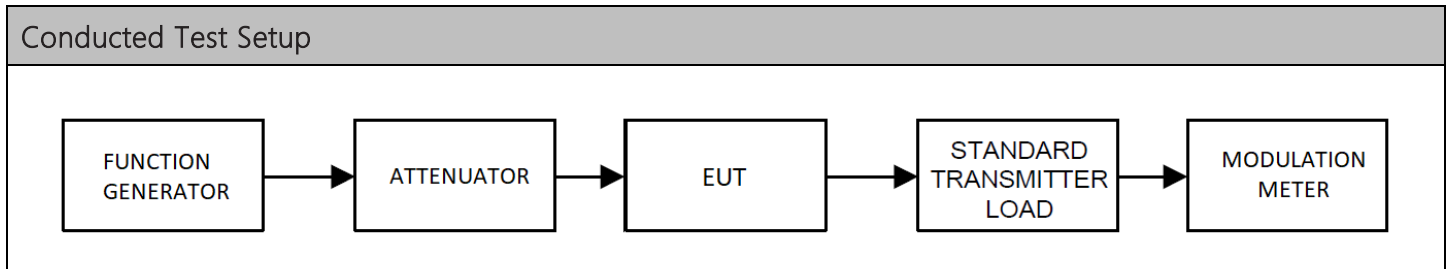
8.6.1 Radiated Emissions, 158.29750 MHz

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)
158.30	77.40	PK	23.68	H	1.06	7.72	3.00	32.46	-64.92	-13.00	51.92
158.30	56.40	PK	26.98	V	0.88	8.88	3.00	36.74	-60.64	-13.00	47.64
158.30	316.60	PK	33.60	H	2.09	14.38	3.00	50.06	-47.31	-13.00	34.31
158.30	316.60	PK	25.30	V	2.09	14.38	3.00	41.76	-55.61	-13.00	42.61
158.30	474.89	PK	15.90	H	2.56	17.00	3.00	35.46	-61.92	-13.00	48.92
158.30	474.89	PK	14.92	V	2.56	17.00	3.00	34.48	-62.90	-13.00	49.90
158.30	633.19	PK	14.82	H	2.93	19.09	3.00	36.84	-60.53	-13.00	47.53
158.30	633.19	PK	15.80	V	2.93	19.09	3.00	37.82	-59.55	-13.00	46.55
158.30	791.49	PK	16.93	H	3.31	20.71	3.00	40.96	-56.42	-13.00	43.42
158.30	791.49	PK	15.48	V	3.31	20.71	3.00	39.51	-57.87	-13.00	44.87
158.30	949.79	PK	15.28	H	3.61	22.79	3.00	41.68	-55.70	-13.00	42.70
158.30	949.79	PK	13.24	V	3.61	22.79	3.00	39.64	-57.74	-13.00	44.74
158.30	1108.08	PK	12.59	H	3.86	27.20	3.00	43.65	-53.73	-13.00	40.73
158.30	1108.08	PK	11.49	V	3.86	27.20	3.00	42.55	-54.83	-13.00	41.83
158.30	1266.38	PK	11.18	H	4.10	28.50	3.00	43.79	-53.59	-13.00	40.59
158.30	1266.38	PK	11.39	V	4.10	28.50	3.00	44.00	-53.38	-13.00	40.38
158.30	1424.68	PK	11.40	H	4.32	28.28	3.00	43.99	-53.38	-13.00	40.38
158.30	1424.68	PK	12.79	V	4.32	28.28	3.00	45.38	-51.99	-13.00	38.99
158.30	1582.98	PK	11.35	H	4.62	27.97	3.00	43.94	-53.44	-13.00	40.44
158.30	1582.98	PK	11.03	V	4.62	27.97	3.00	43.62	-53.76	-13.00	40.76



8.7 Modulation Characteristics

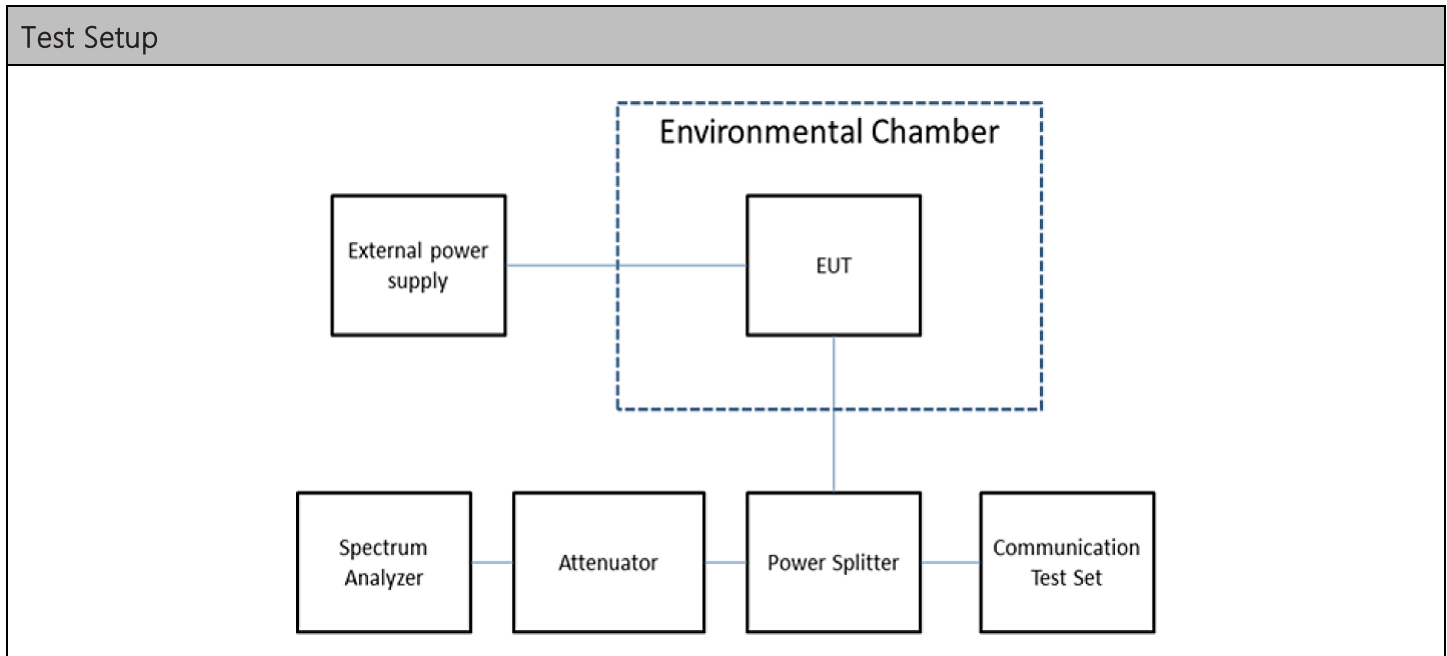
Limits from FCC Parts 2.1047, 80.213 (g), and 87.141; and test procedure from ANSI C63.26-2015



N/A

8.8 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 (ppm)	Limit (ppm)
158.2975	0.12	5

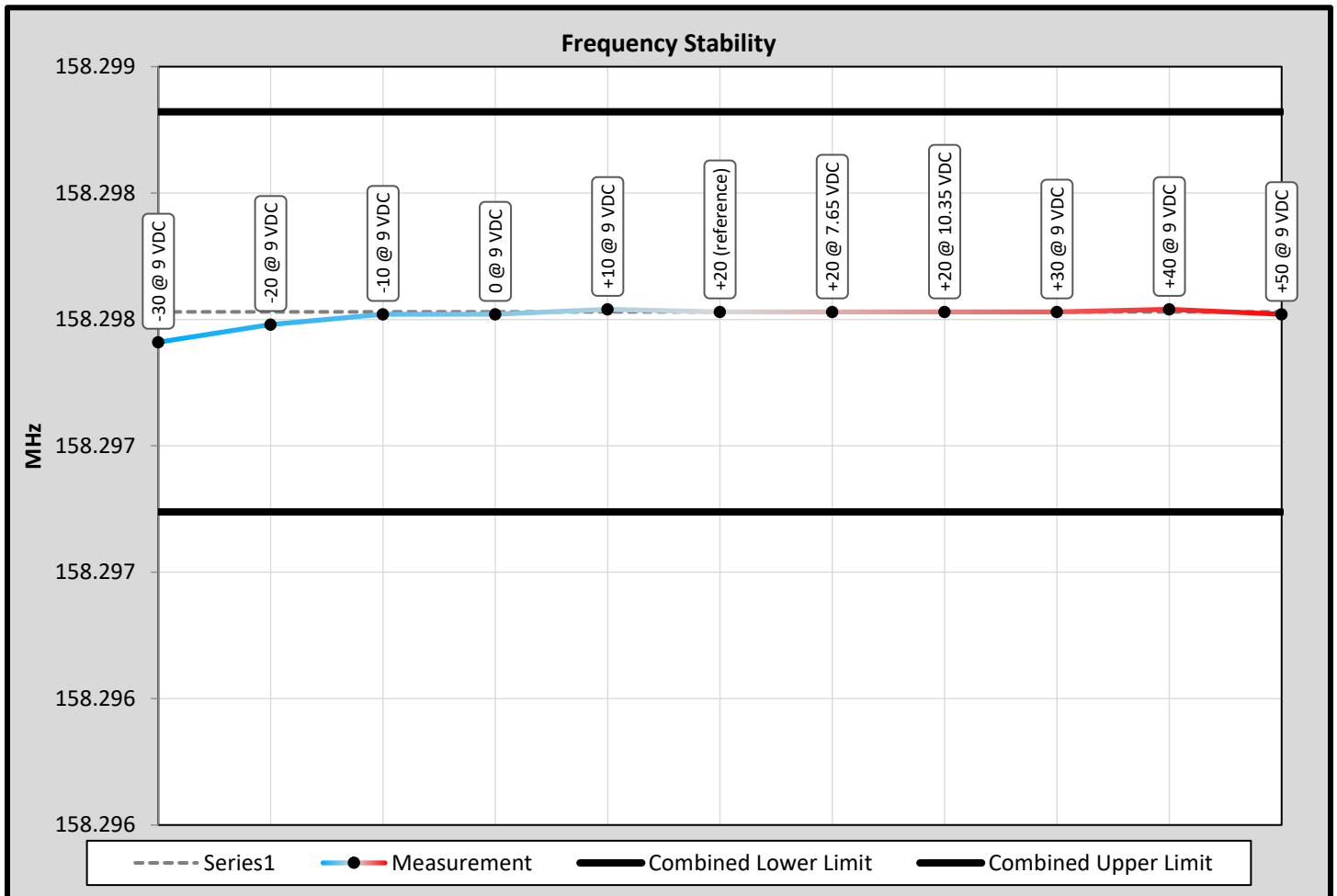


Frequency Stability, Tabular Data

8.8.1 Frequency Stability Data

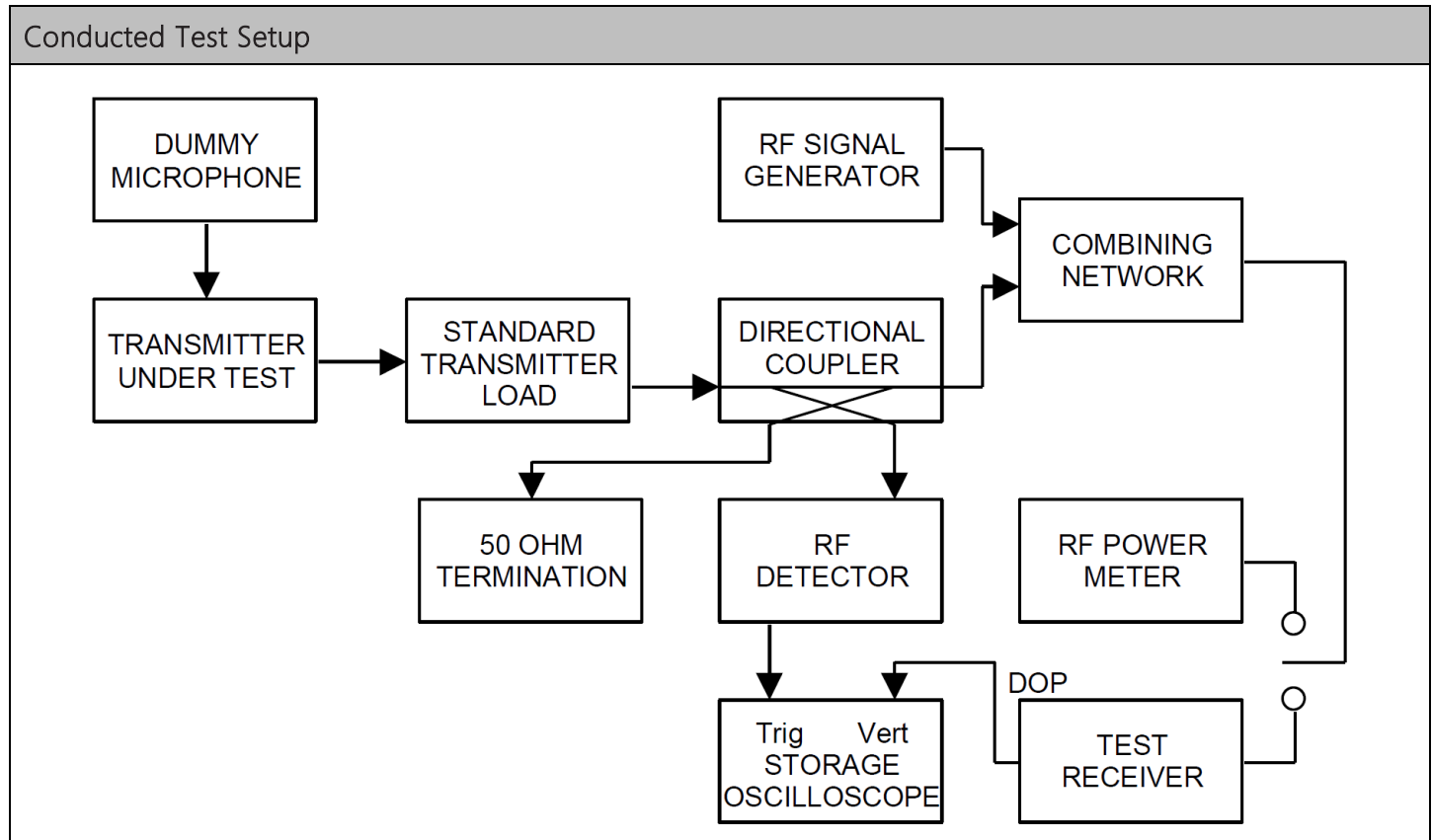
FCC Part 90 Limit	5.0	ppm	
FCC Part 90 Limit, as ppb	5000	ppb (Parts per Billion)	
FCC Part 90 Limit, as %	0.00050	%	
Strictest Combined Limit, as Hz	791.488	Hz	
Combined Lower Limit	158.296739	MHz	
Combined Upper Limit	158.298321	MHz	
Rated Supply Voltage	9.0	<input type="radio"/> AC <input checked="" type="radio"/> DC	
Temperature / Voltage Variation			
Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
-30	9.0	158.297410	0.120
-20	9.0	158.297480	0.050
-10	9.0	158.297520	0.010
0	9.0	158.297520	0.010
+10	9.0	158.297540	-0.010
+20 (reference)	9.0	158.297530	0.000
+20	7.7	158.297530	0.000
+20	10.4	158.297530	0.000
+30	9.0	158.297530	0.000
+40	9.0	158.297540	-0.010
+50	9.0	158.297520	0.010

8.8.2 Frequency Stability Plot



8.9 Transient Frequency Behavior

Limits from FCC Part 90.214; and test procedure from ANSI C63.26-2015.

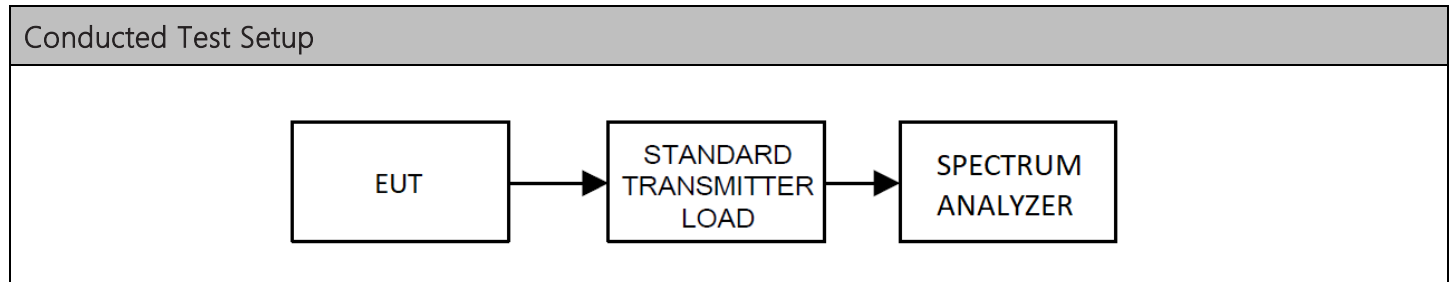


N/A



8.10 Adjacent channel power limits

Limits from FCC Part 90.221, and test procedure from ANSI C63.26-2015.



N/A



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Adjacent Channel Power, Output Spectrum Plots

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_1549-21_FCC_PT90_2	1	Initial release	April 29, 2021
	2	Corrected FCC ID On page 4	Sept. 16, 2022



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END OF TEST REPORT
