



Timco Engineering, Inc., an IIA Company
 849 NW State Road 45, Newberry, Florida 32669
 (352) 472-5500 / testing@timcoengr.com

Timco Test Report # TR_3417-21_FCC_PT73_2

Revision: 2



Test Report - FCC PART 73 / TBC
 Prepared For: BEI Electronics, LLC

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature 09/16/2021

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1 Customer Information

Applicant: BEI Electronics, LLC
Address: 4100 N 24TH STREET
 QUINCY IL 62305 United States

1.1 Test Result Summary

The following test procedure and guidance were used for measuring Licensed FM Broadcast Stations (TBC); FCC KDB 442401 and ANSI C63.26-2015. Full test results are available in this report.

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.

The Following is for Test item FCC ID: DDE-STXE

FCC Clauses	Description of the requirements	Result (Pass, Fail or N/A)
Applicable Clauses from Part 2		
2.1033 (c)(8)	The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.	For Info Only
2.202(g)(III)(3)	Necessary bandwidth (Sound Broadcasting)	Pass
2.1046 (a)	RF Power Output	Pass
2.1047 (a)	Modulation characteristics	Pass
2.1047 (b)	Modulation Limiting	Pass
2.1049 (e)(4)	FM broadcast transmitters for multiplex operation (SCA)	Pass
2.1049 (e)(5)	FM broadcast transmitter for stereophonic operation	Pass
2.202	Bandwidths	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 73		
73.267	Determining operating power.	Pass
73.317	FM transmission system requirements	Pass
73.840	Operating power and mode tolerances.	Pass



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2 Location of Testing

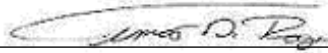

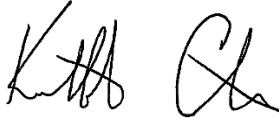
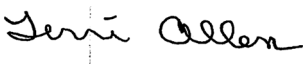
Test Laboratory

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: 8/3/2021 – 8/5/2021

Signature:		Sr. EMC Engineer EMC-003838-NE	
Name & Title:	Tim Royer, EMC Engineer		
Date of Signature	09/16/2021		
			
Name & Title:	Kristoffer Costa, EMC Technician		
Date of Signature	09/16/2021		
Signature:			
Name & Title:	Terri Allen, Technical Assistant		
Date of Signature	09/16/2021		



3 Test Sample(s) (EUT/DUT)

The test sample was received: 8/3/2021

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:	DDE-STXE
Brief Description	FM Broadcast Transmitter
Type of Modular	n/a
Model(s) #	STXe
Firmware version	n/a
Software version	n/a
Serial Number	44625

Technical Characteristics	
Technology	FM Broadcast Transmitter
Frequency Range	88-108 MHz
RF O/P Power (Max.)	3419.79 W
Modulation	FM
Bandwidth & Emission Class	F3E
Duty Cycle	100%
Antenna Connector	n/a
Voltage Rating (AC or Batt.)	AC

Antenna Characteristics			
Antenna	Frequency Range	Mode / BW	Antenna Gain
1	88 – 108 MHz	n/a	0 dBi
2			



3.2 Configuration of EUT

Test Modes

Band	Test Frequencies	Modulation	Number of Ant
88-108 MHz	88 MHz 98 MHz 108 MHz	FM	1

Operating conditions during Testing:

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

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

Test methods/Standards/Guidance:

Test procedures and guidance for measuring Licensed FM Broadcast Stations (TBC); FCC KDB 442401 and ANSI C63.26-2015.

- 1) ANSI C63.26-2015;
- 2) FCC KDB 442401

Limits and Regulatory Limits:

- 1) FCC CFR 47 Part 73

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
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

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.

List of Test Equipment

Antenna	Active Loop	ETS-Lindgren	6502	00062529	10/20/20	10/20/2023
Antenna	Biconical 1057	Eaton	94455-1	1057	10/16/20	10/16/2023
Antenna, NSA	Log-Periodic 1243	Eaton	96005	1243	5/4/21	5/3/2024
Antenna	Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	2/25/20	2/24/2023
Antenna	Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/14/20	10/14/2023
Antenna	Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	10/19/20	10/19/2023
CHAMBER	CHAMBER	Panashield	3M	N/A	3/12/19	3/11/2022
Pre-amp	Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	2/27/19	2/26/2022
Receiver	EMI Test Receiver R&S ESIB 40	Rohde & Schwarz	ESIB 40	100274	7/22/19	7/21/2022
Receiver	EMI Test Receiver R&S ESU 40	Rohde & Schwarz	ESU 40	100320	5/27/21	5/26/2024
Frequency Counter	Frequency Counter Small	HP	5385A	3242A07460	9/9/20	9/9/2023
Thermometer	Type K J Thermometer	Martel	303	080504494	1/18/20	1/17/2023
LISN	LISN (Primary)	Electro-Metrics	ANS-25/2	225363	9/16/20	9/16/2023

Type	Device	Manufacturer	Model	SN #
Attenuator	NM to NF 10dB 25W DC-8G	Weinschel Eng	33-10-34	AP4824



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).

Units of measurement

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. Necessary bandwidth (Sound Broadcasting)

Requirement from Test procedures and guidance for measuring Licensed FM Broadcast Stations (TBC); FCC KDB 442401 and ANSI C63.26-2015.

Type of Emission: 406KF3E

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 200 \text{ KHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(3K) + 2(200K) (1) = 406K$$

Where:

$$M = 10 \text{ (Modulation Frequency, kHz)}$$

$$D = 75 \text{ (Peak Deviation, kHz)}$$

$$K = 1 \text{ (constant value)}$$



8.2 RF Power Output

Requirement from FCC KDB 442401 and ANSI C63.26-2015.

Method of Measurement: RF power was measured by Indirect Method as described in the standard listed above.

Test Method:

$$\text{Transmitter output power} = E_p \times I_p \times F$$

Where:

E_p = DC input voltage of final radio stage.

I_p = Total DC input current of final radio stage.

F = Efficiency factor.

Test Data: RF Output Power

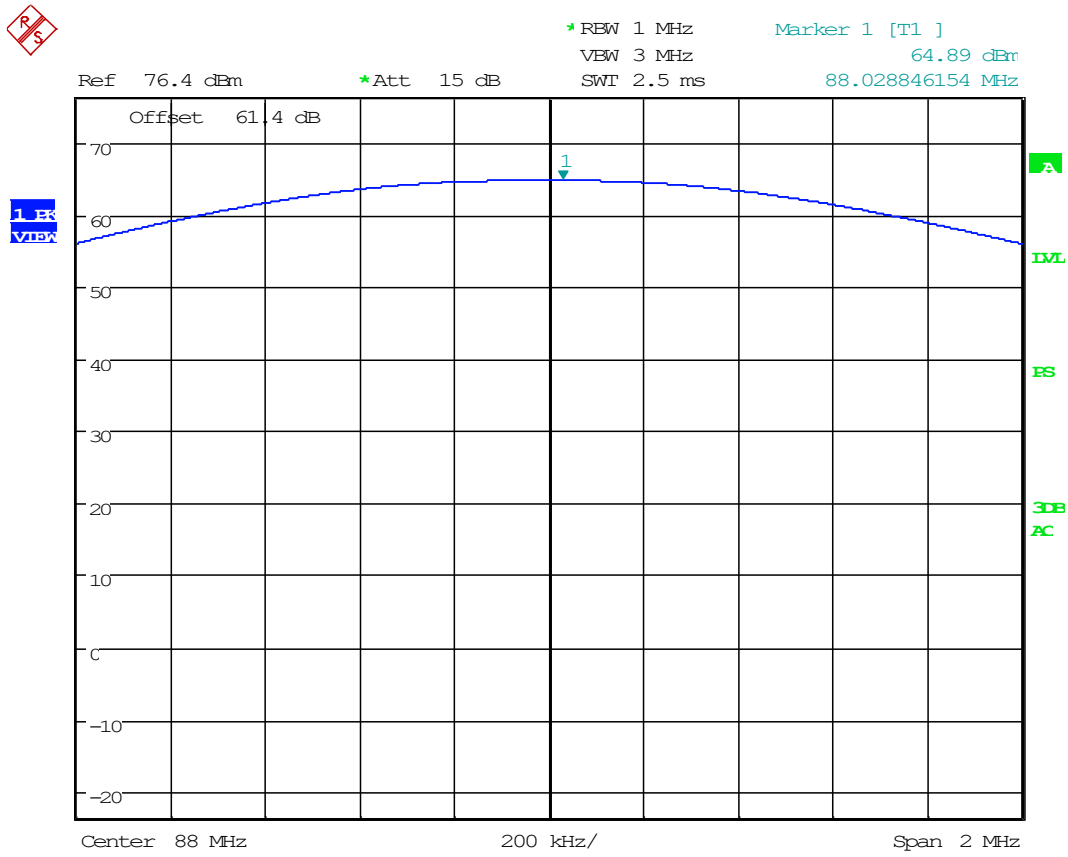
Test Results, Mode 1			
Mode	Tuned Frequency (MHz)	Power Output (dBm)	Power Output (W)
1	88	64.89	3083.19
1	98	64.77	2999.16
1	108	64.98	3147.74

OUTPUT POWER: 3147.74 Watts

Part 2.1033 (C) (8) DC Input into the final amplifier

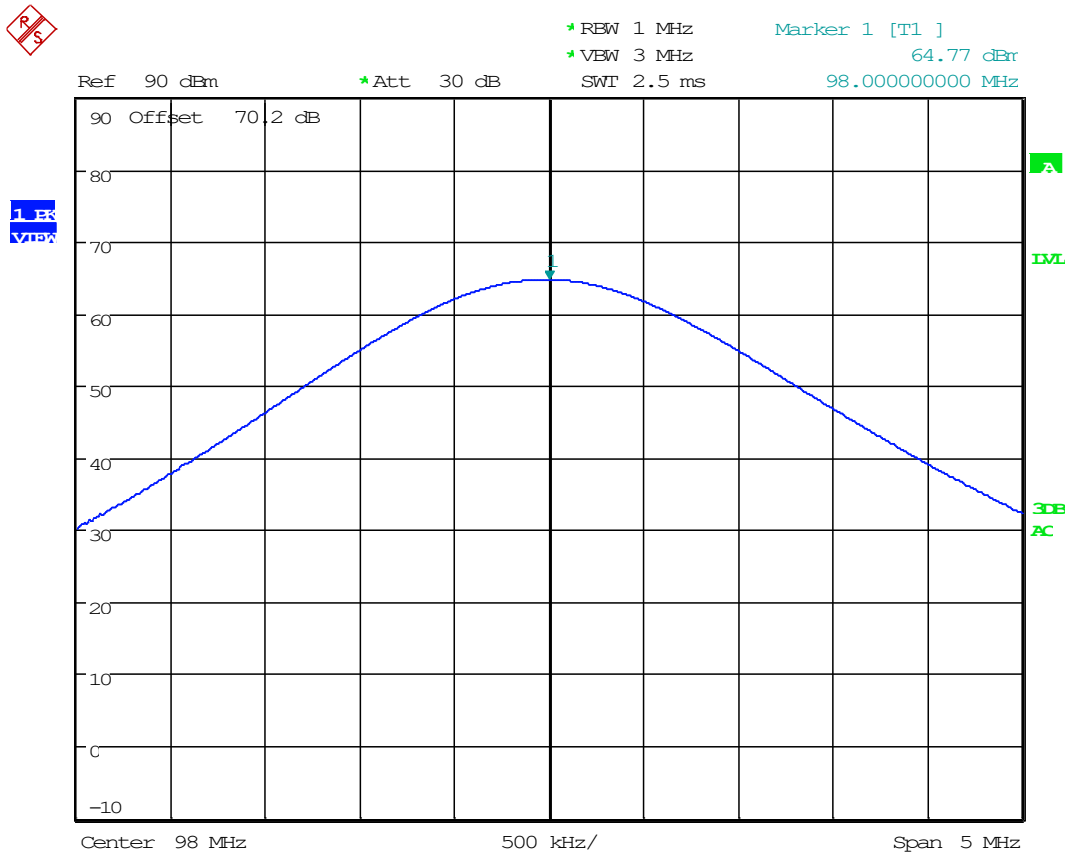
POWER SETTING INPUT POWER: (230.0V) (21.3) = 4899 Watts

8.2.1 Test Data: RF Output Power, Low End of Band



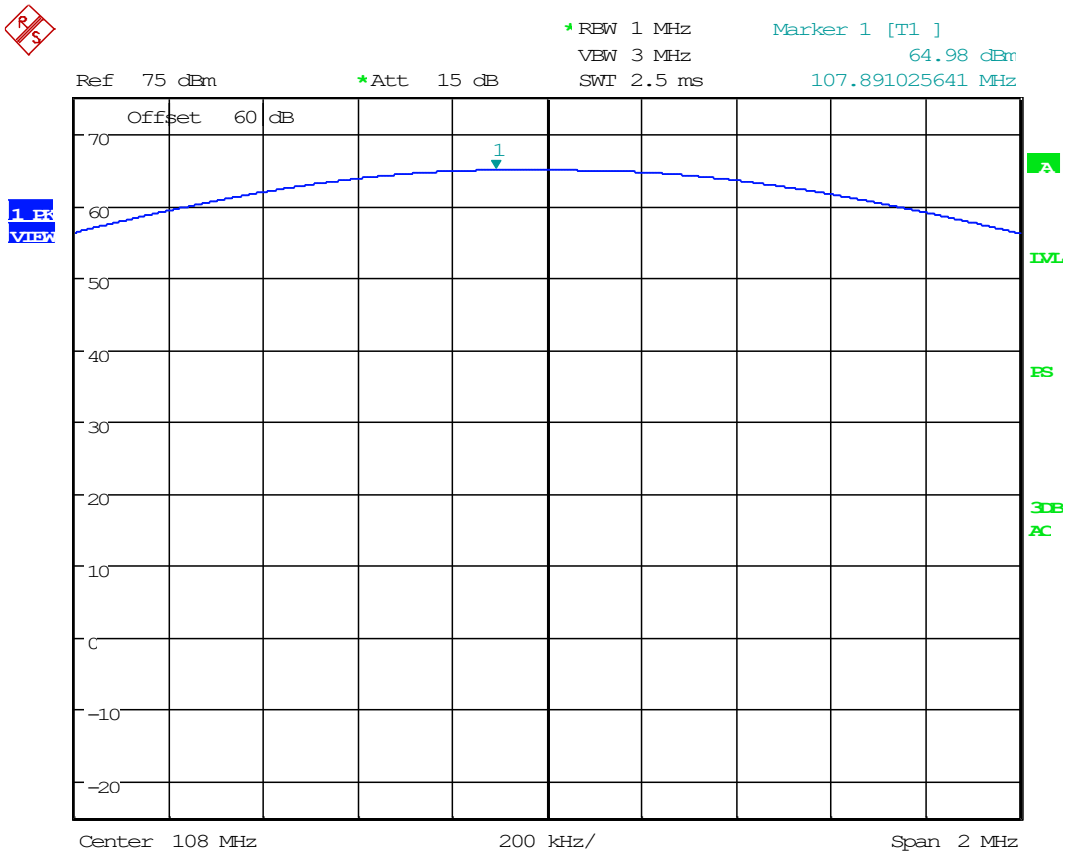
Date: 11.NOV.2021 14:48:38

8.2.2 Test Data: RF Output Power, Middle End of Band



Date: 5.AUG.2021 09:55:58

8.2.3 Test Data: RF Output Power, High End of Band



Date: 11.NOV.2021 14:34:14

8.3 Modulation characteristics

Limits from FCC Part 2.1047 (a) and test procedure from ANSI C63.26-2015

Setup

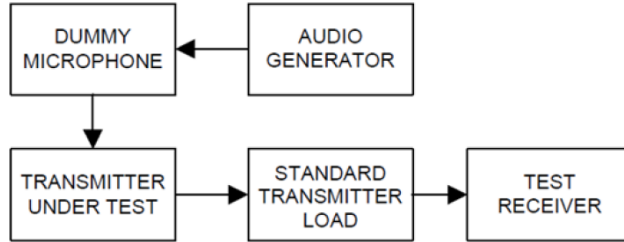
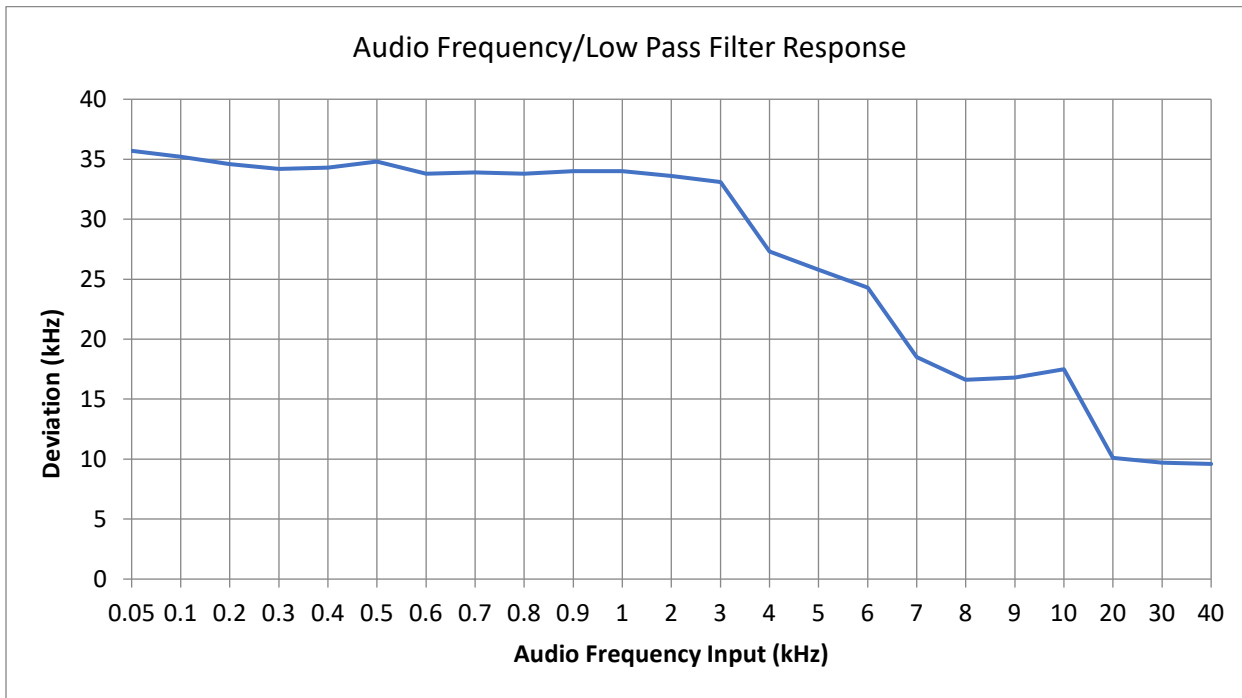


Figure 3—Equipment set-up audio frequency response (constant input)

8.3.1 Results



8.4 Modulation Limiting

Limits from FCC Part 2.1047 (b) and test procedure from ANSI C63.26-2015

Setup

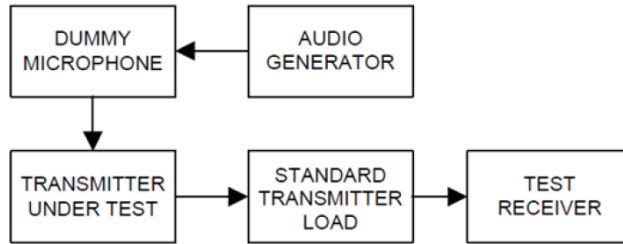
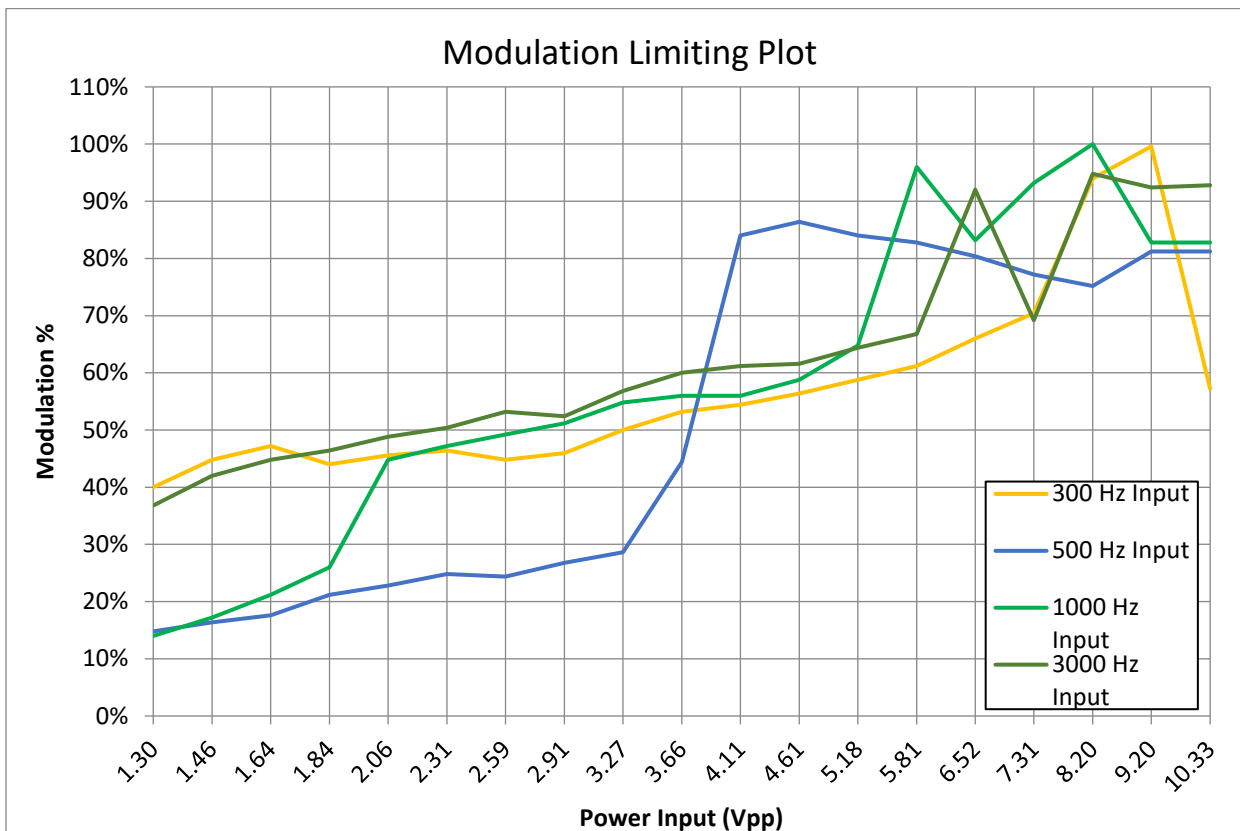


Figure 3—Equipment set-up audio frequency response (constant input)

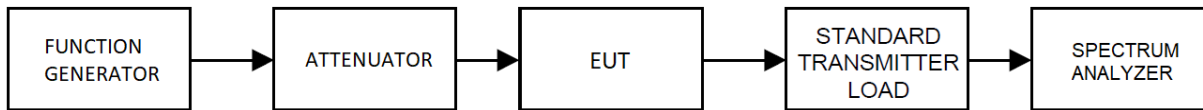
8.4.1 Test Data / Spectrum Plots



8.5 OCCUPIED BANDWIDTH & EMISSION MASK

Limits from FCC Part 2.1049 (e)(3) – (5), Part 73.317(b), (c) and test procedure from ANSI C63.26-2015

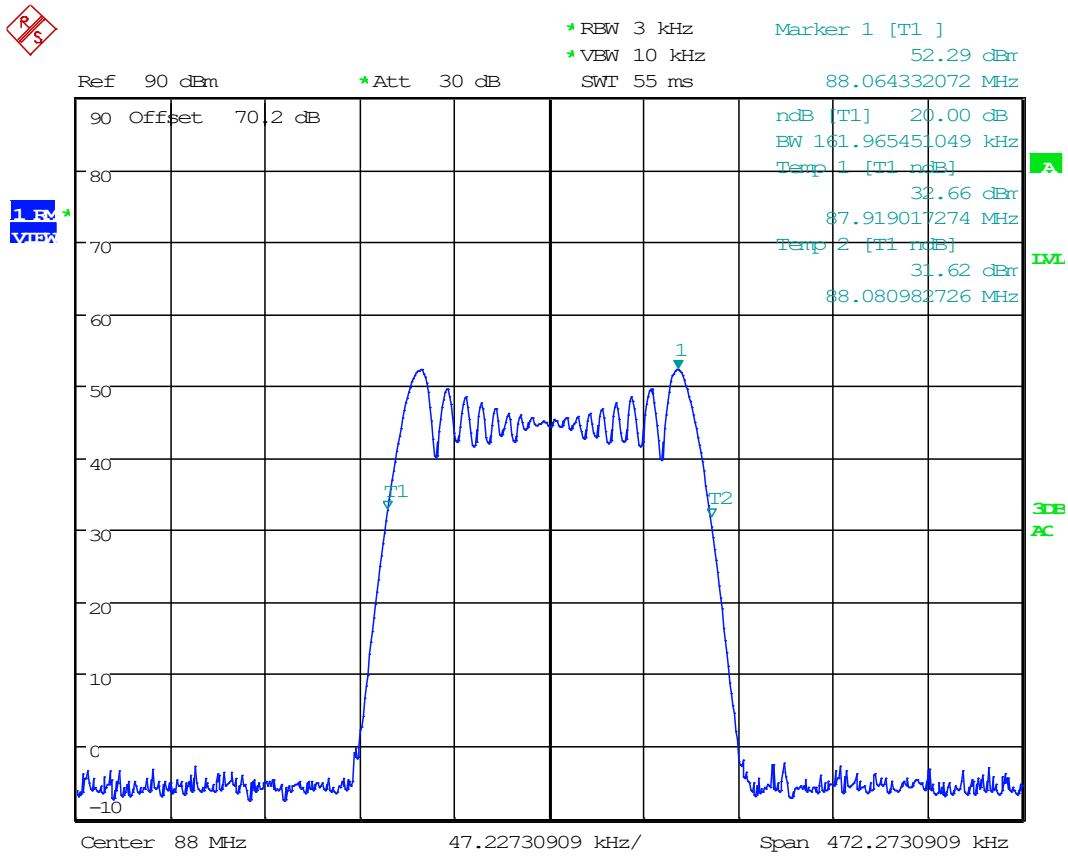
Setup



Test Data/ Spectrum Plots

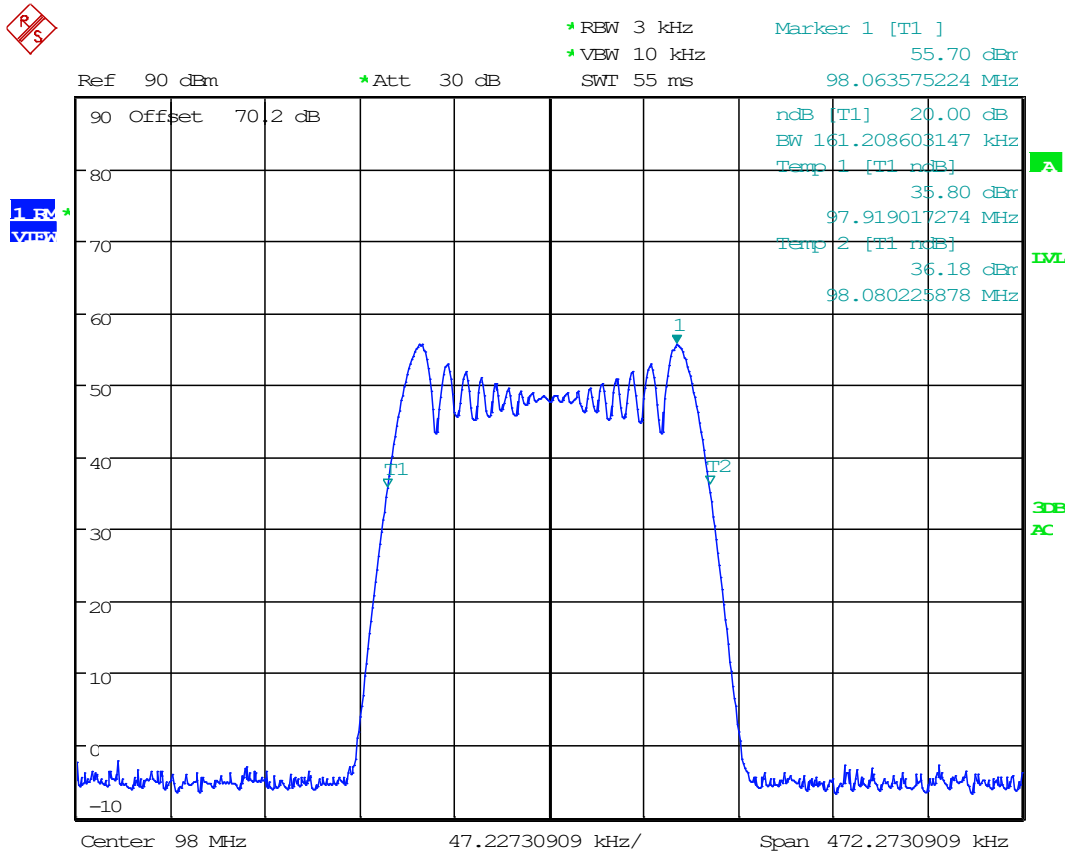
Frequency (MHz)	20dB OBW (kHz)
88	161.97
98	161.21
108	161.97

8.5.1 20dB OCCUPIED BANDWIDTH PLOT Low End of band



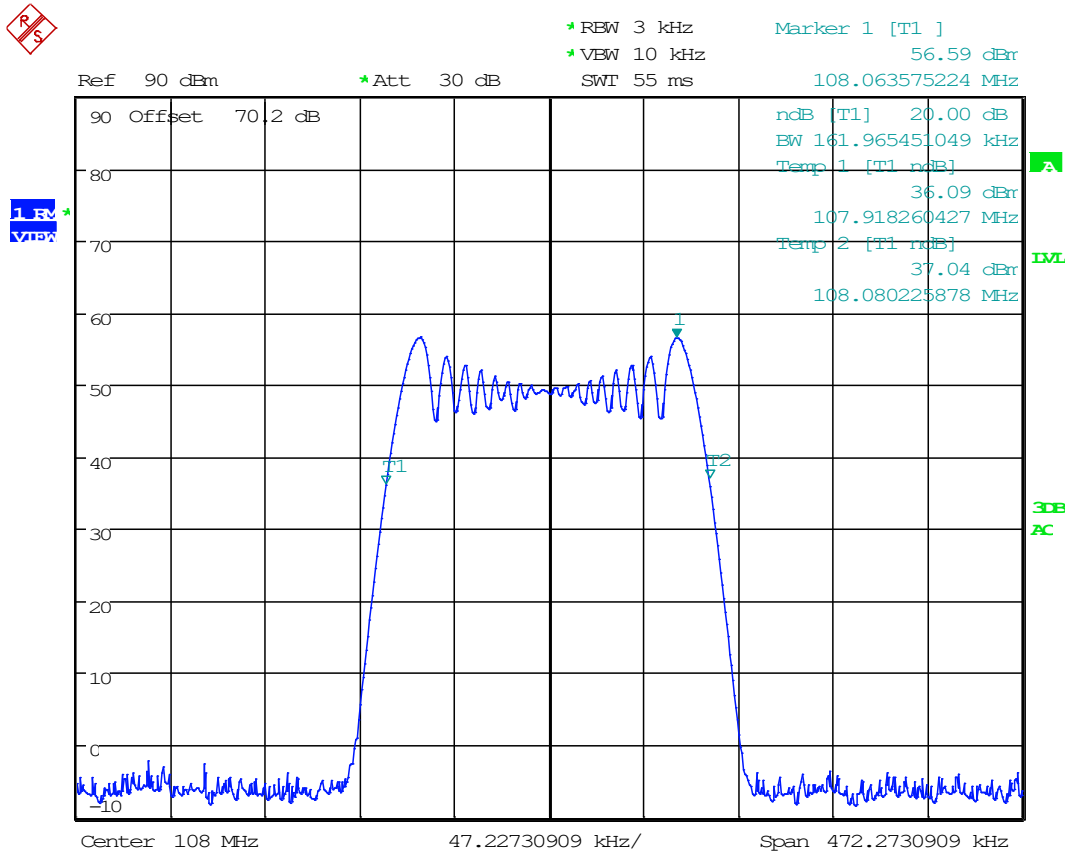
Date: 5.AUG.2021 10:29:55

8.5.2 20dB OCCUPIED BANDWIDTH PLOT Middle of band



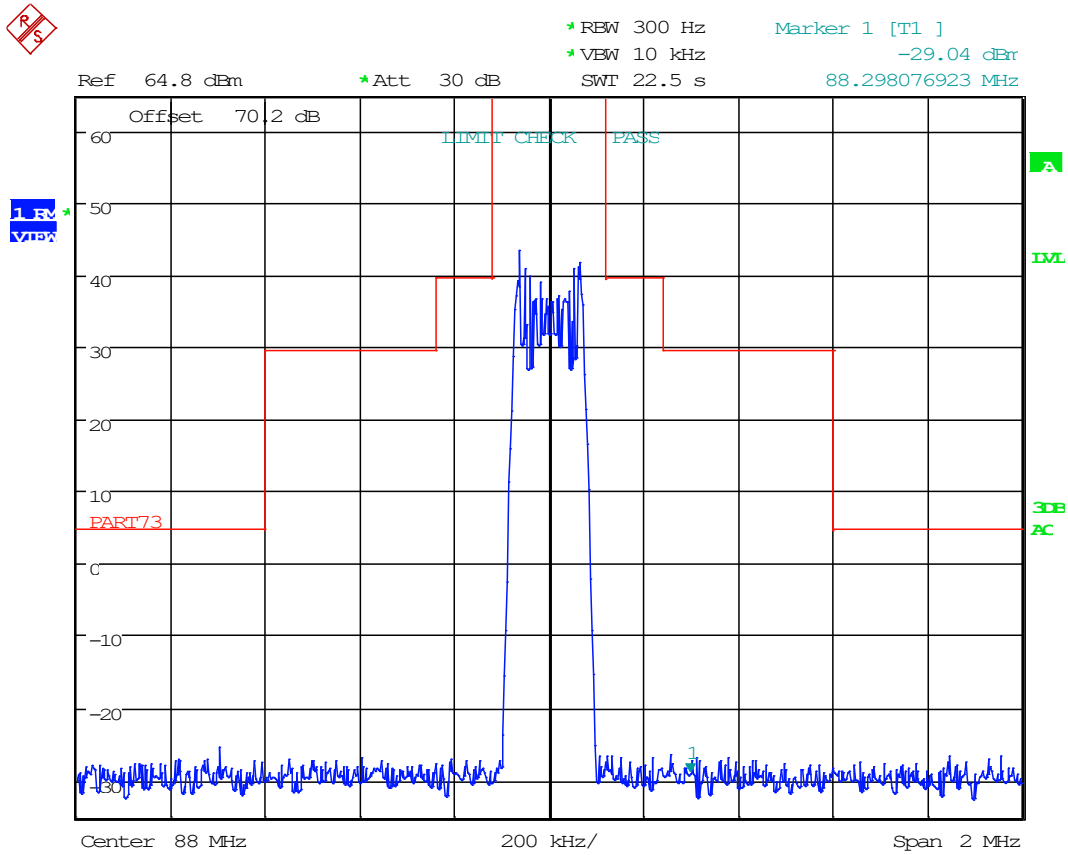
Date: 5.AUG.2021 10:29:13

8.5.3 20dB OCCUPIED BANDWIDTH PLOT High End of band



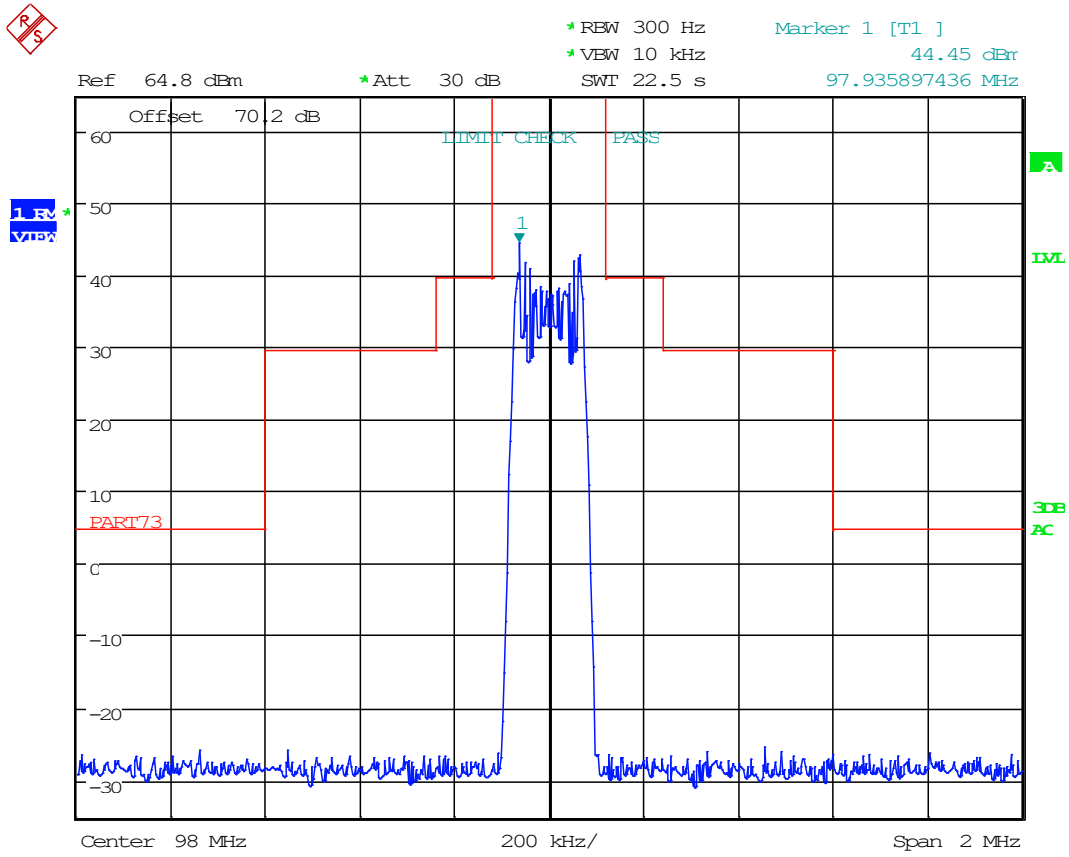
Date: 5.AUG.2021 10:28:16

8.5.4 EMISSION MASK PLOT Low End of band



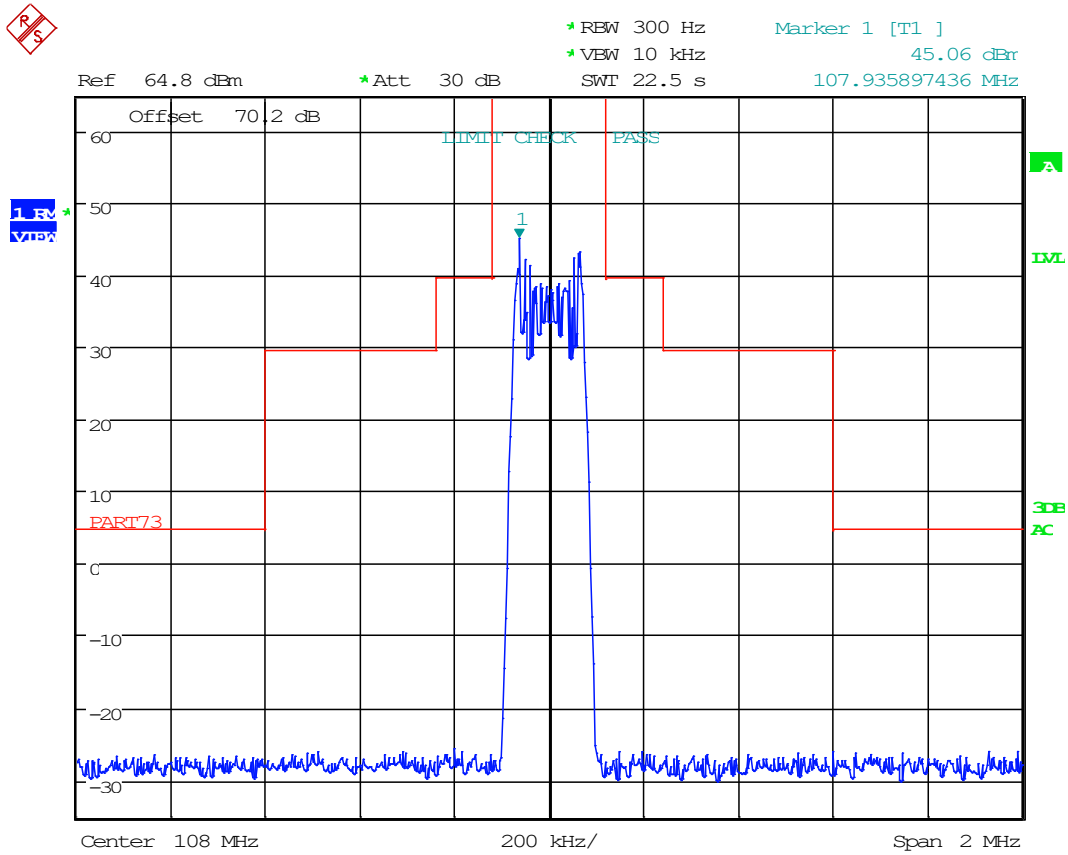
Date: 5.AUG.2021 10:32:24

8.5.5 EMISSION MASK PLOT Middle of band



Date: 5.AUG.2021 10:33:33

8.5.6 EMISSION MASK PLOT High End of band

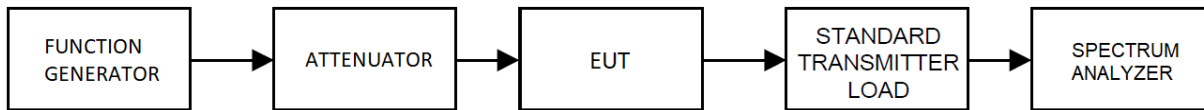


Date: 5.AUG.2021 10:35:08

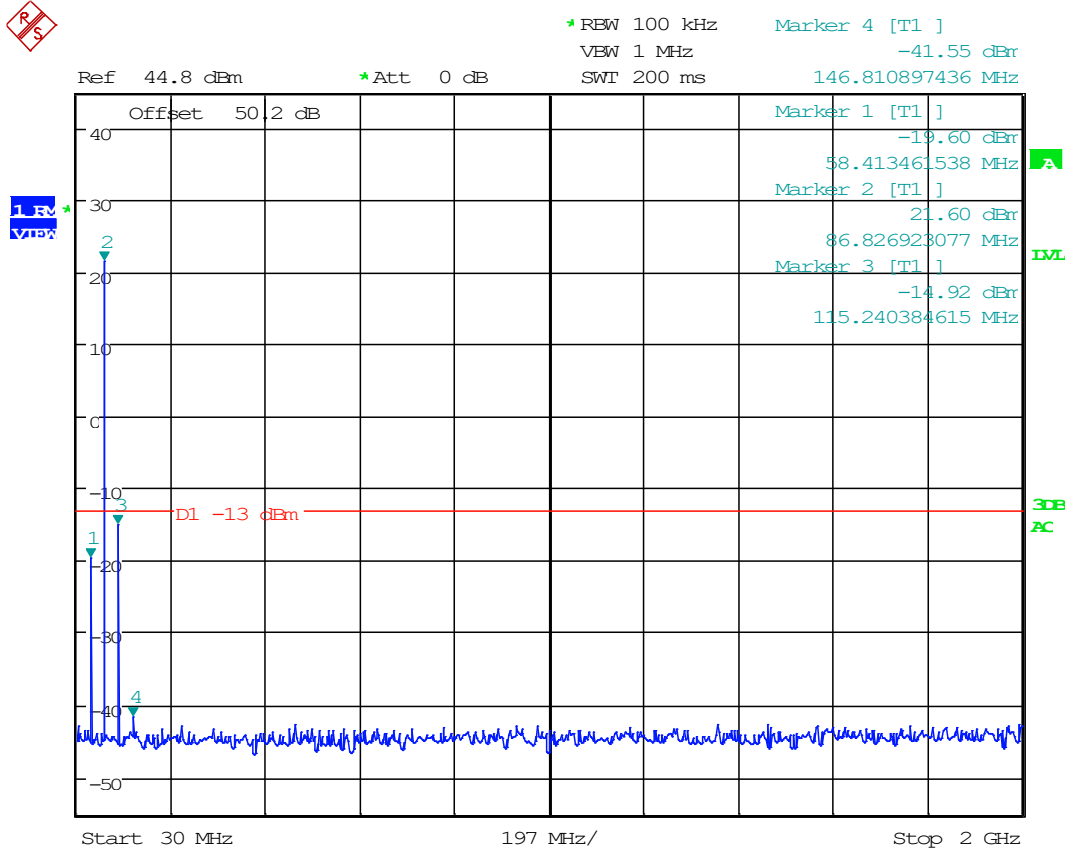
8.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Limits from FCC Part 2.1051 & 73.317(d) and test procedure from ANSI C63.26-2015

Setup

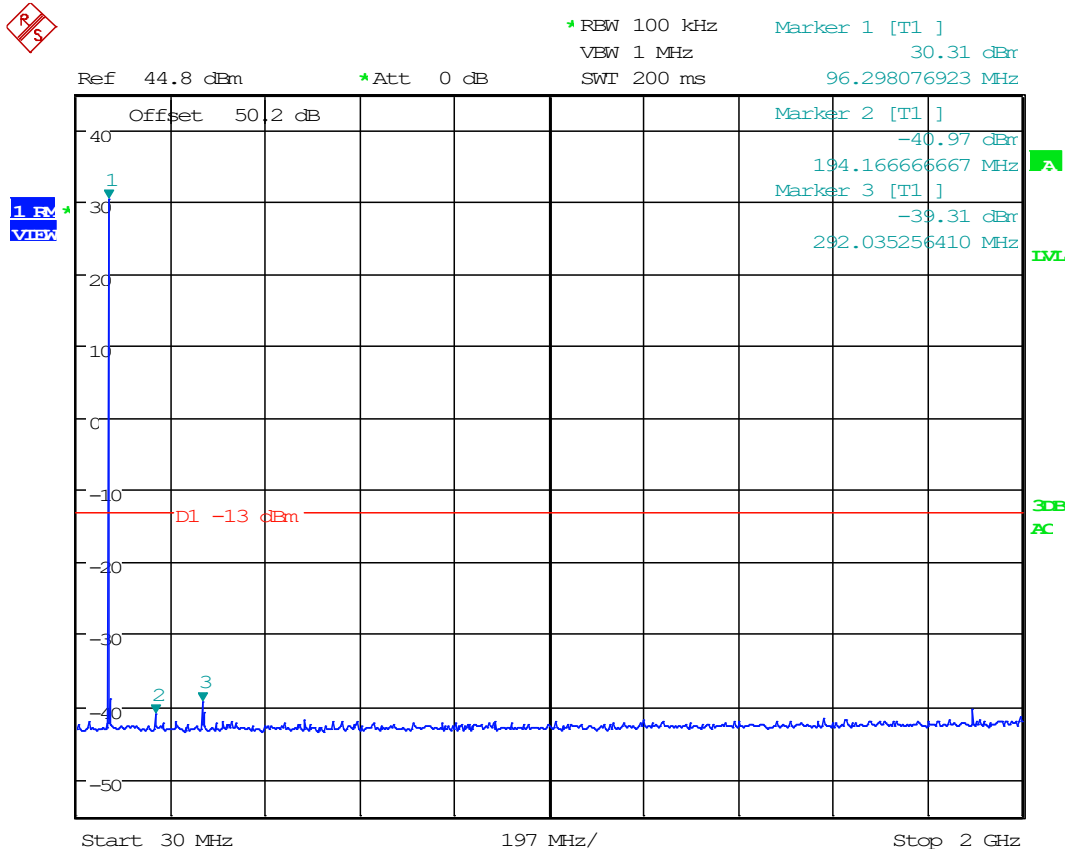


8.6.1 Test Data: Low Frequency



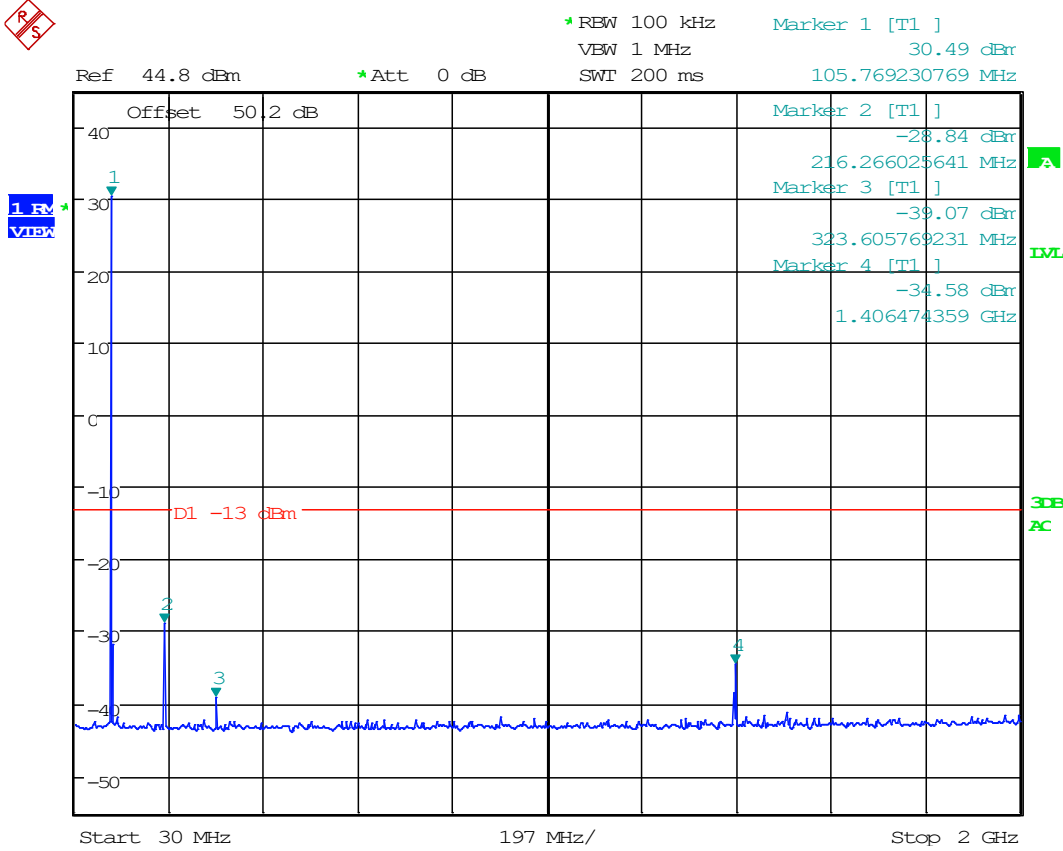
Date: 5.AUG.2021 14:27:49

8.6.2 Test Data: Middle Frequency



Date: 5.AUG.2021 14:26:26

8.6.3 Test Data: High Frequency



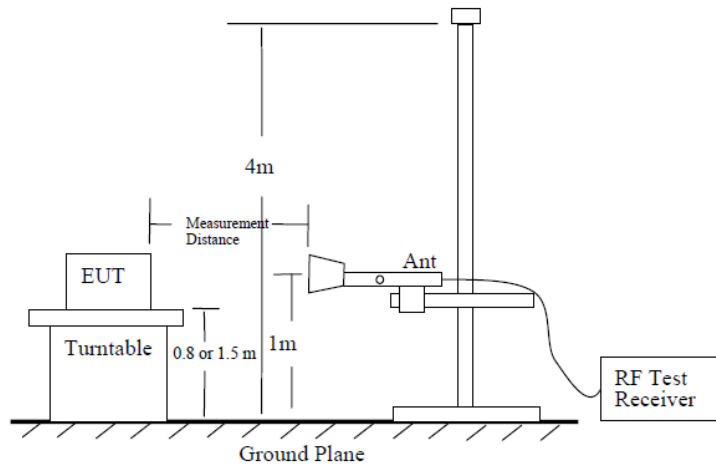
Date: 5.AUG.2021 14:25:11

8.7 FIELD STRENGTH OF SPURIOUS EMISSIONS

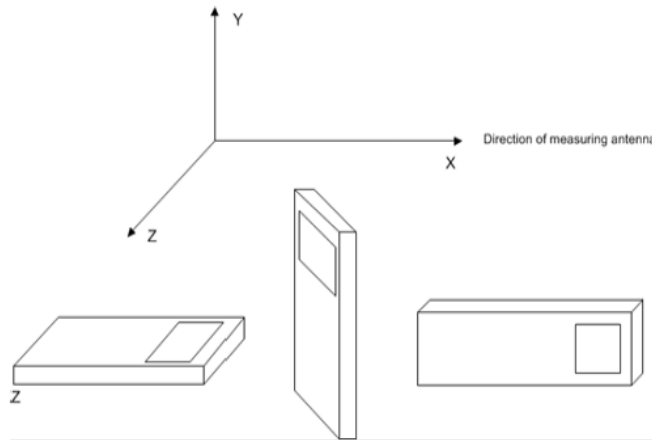
Limits from FCC Part 2.1051 & 73.317(d) and test procedure from ANSI C63.26-2015

Setup

Test Site Setup:



EUT Orientation(s):





FIELD STRENGTH OF SPURIOUS EMISSIONS

8.7.1 Test Data: Low Frequency

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)
88.00	176.00	PK	14.96	H	1.54	14.40	3.00	30.90	-66.47	-13.00	53.47
88.00	176.00	PK	35.14	V	1.54	14.40	3.00	51.08	-46.29	-13.00	33.29
88.00	264.00	PK	34.04	H	2.03	11.88	3.00	47.95	-49.42	-13.00	36.42
88.00	264.00	PK	42.38	V	2.03	11.88	3.00	56.29	-41.08	-13.00	28.08
88.00	352.00	PK	23.75	H	2.12	14.16	3.00	40.03	-57.35	-13.00	44.35
88.00	352.00	PK	32.28	V	2.12	14.16	3.00	48.56	-48.82	-13.00	35.82
88.00	440.00	PK	20.09	H	2.40	15.70	3.00	38.19	-59.19	-13.00	46.19
88.00	440.00	PK	33.66	V	2.40	15.70	3.00	51.76	-45.62	-13.00	32.62
88.00	528.00	PK	16.77	H	2.76	16.94	3.00	36.47	-60.91	-13.00	47.91
88.00	528.00	PK	23.75	V	2.76	16.94	3.00	43.45	-53.93	-13.00	40.93
88.00	616.00	PK	15.30	H	2.90	18.72	3.00	36.92	-60.46	-13.00	47.46
88.00	616.00	PK	16.75	V	2.90	18.72	3.00	38.37	-59.01	-13.00	46.01
88.00	704.00	PK	20.83	H	3.11	20.60	3.00	44.54	-52.84	-13.00	39.84
88.00	704.00	PK	20.47	V	3.11	20.60	3.00	44.18	-53.20	-13.00	40.20
88.00	792.00	PK	18.48	H	3.32	20.68	3.00	42.48	-54.90	-13.00	41.90
88.00	792.00	PK	24.55	V	3.32	20.68	3.00	48.55	-48.83	-13.00	35.83
88.00	880.00	PK	13.33	H	3.54	22.60	3.00	39.47	-57.91	-13.00	44.91
88.00	880.00	PK	16.63	V	3.54	22.60	3.00	42.77	-54.61	-13.00	41.61



8.7.2 Test Data: Middle Frequency

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
98.00	196.00	PK	35.87	H	1.61	15.40	3.00	52.88	-44.50	-13.00	31.50
98.00	196.00	PK	39.25	V	1.61	15.40	3.00	56.26	-41.12	-13.00	28.12
98.00	294.00	PK	30.76	H	2.08	13.12	3.00	45.96	-51.42	-13.00	38.42
98.00	294.00	PK	22.92	V	2.08	13.12	3.00	38.12	-59.26	-13.00	46.26
98.00	392.00	PK	35.14	H	2.27	14.60	3.00	52.01	-45.37	-13.00	32.37
98.00	392.00	PK	25.22	V	2.27	14.60	3.00	42.09	-55.29	-13.00	42.29
98.00	490.00	PK	23.60	H	2.62	16.80	3.00	43.02	-54.36	-13.00	41.36
98.00	490.00	PK	20.05	V	2.62	16.80	3.00	39.47	-57.91	-13.00	44.91
98.00	588.00	PK	16.39	H	2.87	18.48	3.00	37.74	-59.64	-13.00	46.64
98.00	588.00	PK	15.15	V	2.87	18.48	3.00	36.50	-60.88	-13.00	47.88
98.00	686.00	PK	29.17	H	3.06	20.64	3.00	52.87	-44.51	-13.00	31.51
98.00	686.00	PK	25.40	V	3.06	20.64	3.00	49.10	-48.28	-13.00	35.28
98.00	784.00	PK	14.85	H	3.30	21.68	3.00	39.83	-57.54	-13.00	44.54
98.00	784.00	PK	13.39	V	3.30	21.68	3.00	38.37	-59.00	-13.00	46.00
98.00	882.00	PK	13.54	H	3.54	22.44	3.00	39.52	-57.85	-13.00	44.85
98.00	882.00	PK	13.87	V	3.54	22.44	3.00	39.85	-57.52	-13.00	44.52
98.00	980.00	PK	17.21	H	3.69	22.50	3.00	43.40	-53.98	-13.00	40.98
98.00	980.00	PK	19.04	V	3.69	22.50	3.00	45.23	-52.15	-13.00	39.15



8.7.3 Test Data: High Frequency

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)
108.00	216.00	PK	54.71	H	1.67	10.38	3.00	66.76	-30.62	-13.00	17.62
108.00	216.00	PK	57.40	V	1.67	10.38	3.00	69.45	-27.93	-13.00	14.93
108.00	324.00	PK	21.14	H	2.09	13.74	3.00	36.97	-60.41	-13.00	47.41
108.00	324.00	PK	37.36	V	2.09	13.74	3.00	53.19	-44.19	-13.00	31.19
108.00	432.00	PK	26.60	H	2.38	15.88	3.00	44.86	-52.51	-13.00	39.51
108.00	432.00	PK	28.28	V	2.38	15.88	3.00	46.54	-50.83	-13.00	37.83
108.00	540.00	PK	23.18	H	2.78	17.40	3.00	43.36	-54.02	-13.00	41.02
108.00	540.00	PK	20.97	V	2.78	17.40	3.00	41.15	-56.23	-13.00	43.23
108.00	648.00	PK	14.92	H	2.96	19.72	3.00	37.60	-59.78	-13.00	46.78
108.00	648.00	PK	12.88	V	2.96	19.72	3.00	35.56	-61.82	-13.00	48.82
108.00	756.00	PK	21.54	H	3.23	20.98	3.00	45.75	-51.63	-13.00	38.63
108.00	756.00	PK	13.26	V	3.23	20.98	3.00	37.47	-59.91	-13.00	46.91
108.00	864.00	PK	14.25	H	3.50	22.36	3.00	40.11	-57.27	-13.00	44.27
108.00	864.00	PK	12.75	V	3.50	22.36	3.00	38.61	-58.77	-13.00	45.77
108.00	972.00	PK	28.63	H	3.66	22.72	3.00	55.01	-42.37	-13.00	29.37
108.00	972.00	PK	23.42	V	3.66	22.72	3.00	49.80	-47.58	-13.00	34.58
108.00	1080.00	PK	14.79	H	3.82	27.00	3.00	45.62	-51.76	-13.00	38.76
108.00	1080.00	PK	14.31	V	3.82	27.00	3.00	45.14	-52.24	-13.00	39.24



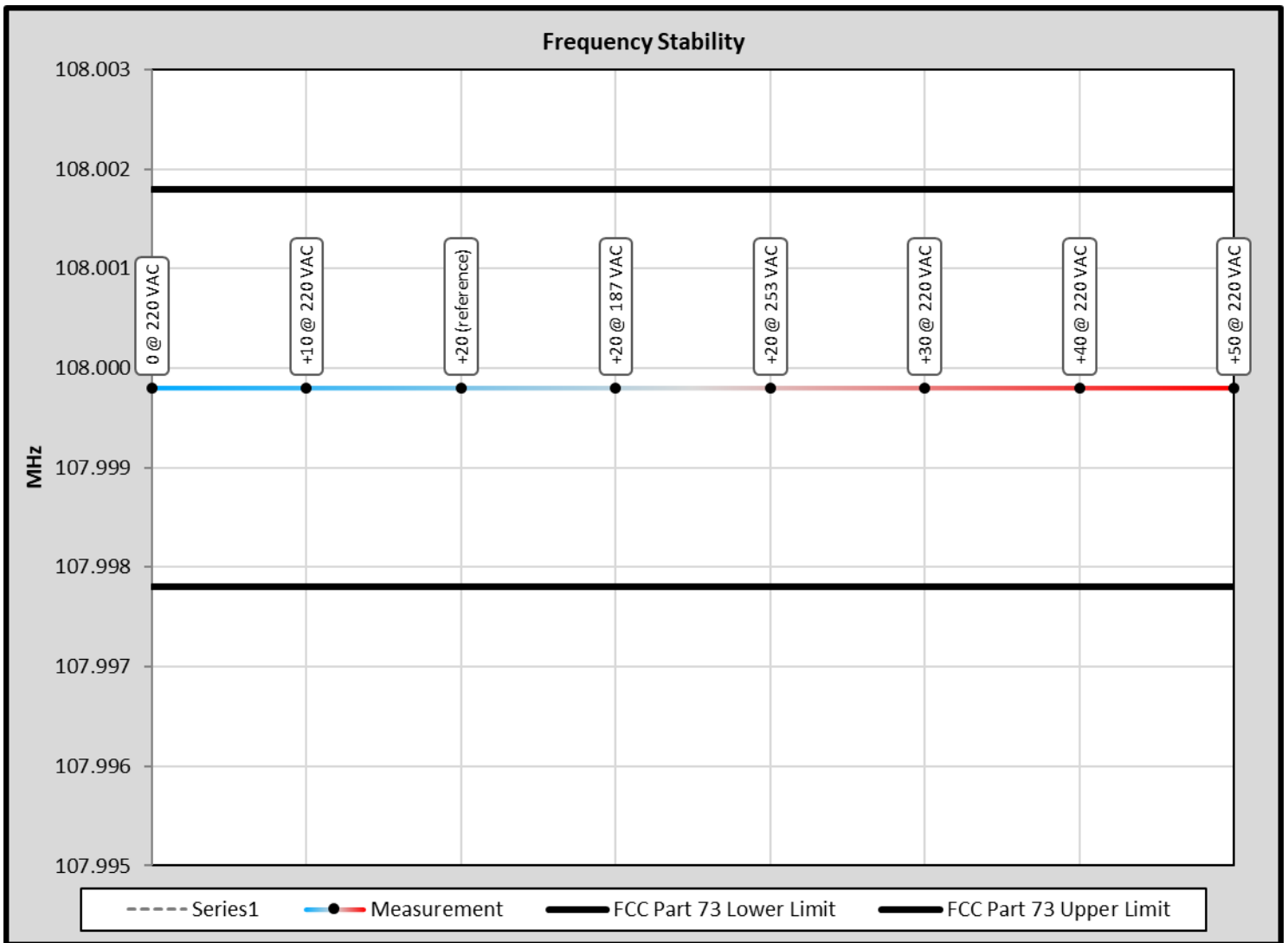
8.8 FREQUENCY STABILITY

Limits from FCC Part 2.1055(a)(3), Part 73.1545(b) and test procedure from ANSI C63.26-2015

8.8.1 Test Data: FCC Frequency Stability Table

FCC Part 73 Limit	2	+/- kHz	
FCC Part 73 Lower Limit	107.997800	MHz	
FCC Part 73 Upper Limit	108.001800	MHz	
Rated Supply Voltage	220.0	<input checked="" type="radio"/> AC <input type="radio"/> DC	
Temperature / Voltage Variation			
Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
0	220.0	107.999800	0.000
+10	220.0	107.999800	0.000
+20 (reference)	220.0	107.999800	0.000
+20	187.0	107.999800	0.000
+20	253.0	107.999800	0.000
+30	220.0	107.999800	0.000
+40	220.0	107.999800	0.000
+50	220.0	107.999800	0.000

8.8.2 Test Data: FCC Frequency Stability Plot





9 ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT
Are in a separate supplementary ANNEX-A document.

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_3417-21_FCC_PT73_1	1	Initial release	08/06/2021
TR_3417-21_FCC_PT73_2	2	Updated Pages 6, 9, 12 & 33 and Section 8.2	11/11/2021



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END of Test Report
