



Test Report - FCC PART 90 Signal Booster Class A (B9A)

Prepared For: TowerIQ Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature

(YYYY-MM-DD): 2020-10-29

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

1. Customer Information

Applicant: TowerIQ Inc.
Address: 13723 Riverport Drive
c/o Potter Electric Signal Company
Saint Louis MO 63043

Contact: Mr. Connor Crowley
Telephone: 347-200-8058
Email address: connorc@pottersignal.com

1.1 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 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters. 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: 2AXVJ4500402

Applicable Clauses from Part 2		
FCC Part 2 Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
2.202	Bandwidth & Emission	Pass
2.1033 (c)(8)	Power at the Final Amplifier	Pass
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 Subpart I		
FCC Part 90 Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
90.205	Transmitter Power	Pass
90.207	Types of Emissions	Pass
90.209	Bandwidth limitations	Pass
90.210	Emission masks, In-band	Pass
90.210	Emission masks, Out-of-band	Pass
90.213	Frequency stability	Pass
90.214	Transient Frequency Behavior	n/a
90.219 (d)(6)(i)	ERP of intermodulation products	n/a ¹
90.219 (d)(6)(ii)	ERP of noise within the passband	n/a ¹
90.219 (d)(6)(iii)	ERP of noise on spectrum < 1 MHz outside of the passband	n/a ¹
90.219 (d)(3)(i), (e)(1)	ERP of Radiated Power	n/a ¹
90.219 (e)(2)	Noise figure	Pass
90.219 (e)(3)	Spurious emissions	Pass
90.219 (e)(4)(i)(ii)(iii)	Retransmitted Signals	Pass
90.221	Adjacent channel power limits	n/a

Note 1: Requirements in Part 90.219 (d) apply at deployment of this EUT, therefore are not applicable at certification.

KDB 935210 D05 v01r04		
FCC KDB 935210 D05 Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
4.1	Test Signals for PLMRS (Input Signals)	Pass
4.2	AGC Threshold	Reported
4.3	Out-of-Band Rejection	Reported
4.4	Input-versus-Output Signal Comparison	Pass
4.5	Output Power	Pass
4.5	Amplifier/Booster Gain (optional)	Reported
4.6	Noise Figure	Pass
4.7.2	Out-of-band/Out-of-block Conducted Emissions (Intermodulation Products)	Pass
4.7.3	EUT Spurious Conducted Emissions	Pass
4.8	Frequency Stability	Pass
4.9	Spurious Radiated Emissions	Pass



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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: October 15, 2020

Signature:

Name & Title: Franklin Rose, EMC Specialist

Date of Signature

(YYYY-MM-DD): 2020-10-29

Signature:

Sr. EMC Engineer
EMC-003838-NE



Name & Title: Tim Royer, EMC Engineer

Date of Signature

(YYYY-MM-DD): 2020-10-29



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

The test sample was received: October 15, 2020

3.1 Definitions

Signal booster: A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A and Class B signal boosters as components.

Class A signal booster: A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.



3.2 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:	2AXVJ4500402
Brief Description	TowerlinQ Gateway
Type of Modular	n/a
Model(s) #	4500402
Trade name	n/a
Firmware version	ver. 1.0
Hardware version	TQ-03-1-MB-FCC
Software version	ver. 1.0 (web-configurator SW)
Serial Number	2e:0:35:0:11:51:36:34:34:34:33:34

Technical Characteristics	
Technology	Signal Booster
Frequency Range	470-512 MHz
RF O/P Power (Max.)	20 dBm (100 mW)
Modulation	FM
Bandwidth & Emission Class	16K0F3E
Number of Channels	2
Duty Cycle	100%
Antenna Connector	N
Voltage Rating (AC or Batt.)	24 V DC (Note 1)

Note 1: Manufacturer supplied 120 V AC to 28 V DC power supply for testing, representative of what is used in the installation environment.

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

Note: This EUT does not include antenna(s).



3.3 Configuration of EUT

Test Modes					
Band	Link Direction	Mode (Type)	Test Frequencies	BW (nominal)	Modulation
470 - 512	n/a	FM	470.025 MHz	16 kHz	FM
	n/a	FM	491.000 MHz	16 kHz	FM
	n/a	FM	511.975 MHz	16 kHz	FM

Note: The EUT RF path is unidirectional.

Operating conditions during Testing:

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 control the EUT.

3.4 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
- 2) FCC KDB 935210 D05 v01r04 Industrial Signal Boosters

4.2 Applied Limits and Regulatory Limits:

- 1) FCC CFR 47 Part 90 Subpart I, 90.219

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
Signal Generator R&S SMU-200A	Rohde & Schwarz	SMU200A	103195	4/23/18	4/22/2021
Sweep/Signal Generator	Anritsu	68369B	985112	11/8/17	11/7/2020
Digital Multimeter	Fluke	77	35053830	11/6/17	11/5/2020
R&S 18 GHz USB Peak Power Sensor	Rohde & Schwarz	NRP-Z85	1411.7501.02-102085-VV	2/4/19	2/3/2022
Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/10/2020
Biconical 1057	Eaton	94455-1	1057	12/13/17	12/12/2020
Log-Periodic 1243	Eaton	96005	1243	4/20/18	4/19/2021
Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	2/25/20	2/24/2023
CHAMBER	Panashield	3M	N/A	3/12/19	3/11/2021
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	11/6/17	11/5/2020

Device	Manufacturer	Model	SN #	Last Verified
N 20dB 20W DC-4G	Narda	766-20	0605	10/15/20
BMBM-0183-00 Silver	TEK		BMBM-0183-00	10/30/20
BMBM-0122-01 RG400	Pasternack	PE3582LF-48	BMBM-0122-01	10/15/20
Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 ; KMKM-0670-0	2/27/19
Splitter/Combiner 1-1000MHz	Mini-Circuits	ZFSC-4-1-BNC+	U115700826	10/15/20
Noise Source 10MHz - 18GHz	Agilent	346B	MY44421884	10/15/20
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	10/15/20
Terminator BNC 50OHM 1W	Amphenol		#122	10/15/20
Type R&S to NF			Test Equipment Adapter 04	10/15/20
Hygro-Thermometer	Extech	445703	0602	10/15/20

Software	Author	Version
ESU Firmware	Rohde & Schwarz	4.43 SP3; BIOS v5.1-24-3
RSCommander	Rohde & Schwarz	1.6.4
Field Strength	Timco	v4.10.7.0



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.



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.

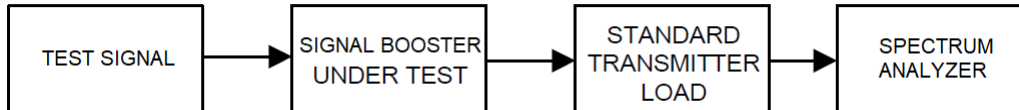
Test Results		
EUT Operating Voltage (V)	EUT Current (A)	Power at the Final Amplifier
24 V DC	0.56	13.5 W



8.2 RF Output Power & Gain

Limits from FCC Parts 2.1046(a), and 90.205 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.

Test Setup



Test Results, Power Output

Link Direction	Max Power Output (dBm)	Max Power Output (W)
Downlink	20.0	100 mW

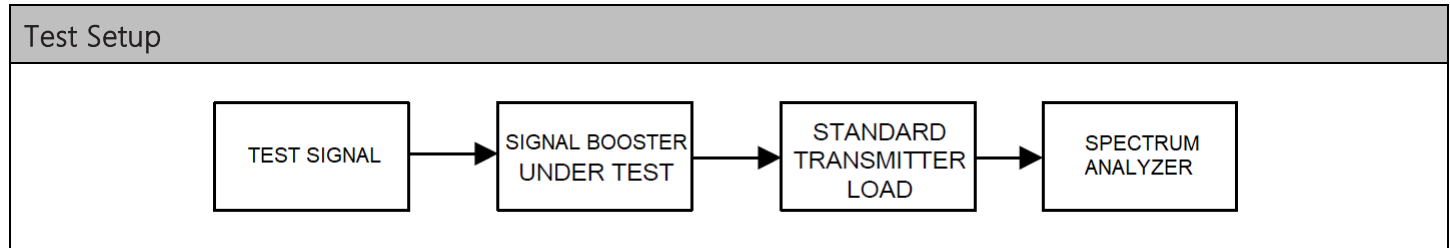


UHF Band Gain

Test Results, Gain					
Link Direction	Tuned Frequency (MHz)	Input Level	Power Input (dBm)	Power Output (dBm)	Gain (dB)
n/a	470.025	AGC	-87	19.43	106.43
		AGC+3	-84	19.44	103.44
		Maximum	-58	19.46	77.46
	491.000	AGC	-87	19.43	106.43
		AGC+3	-84	19.44	103.44
		Maximum	-58	19.46	77.46
	511.975	AGC	-87	19.43	106.43
		AGC+3	-84	19.44	103.44
		Maximum	-58	19.46	77.46

8.3 Out-of-band Rejection

Limits and test method from FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.



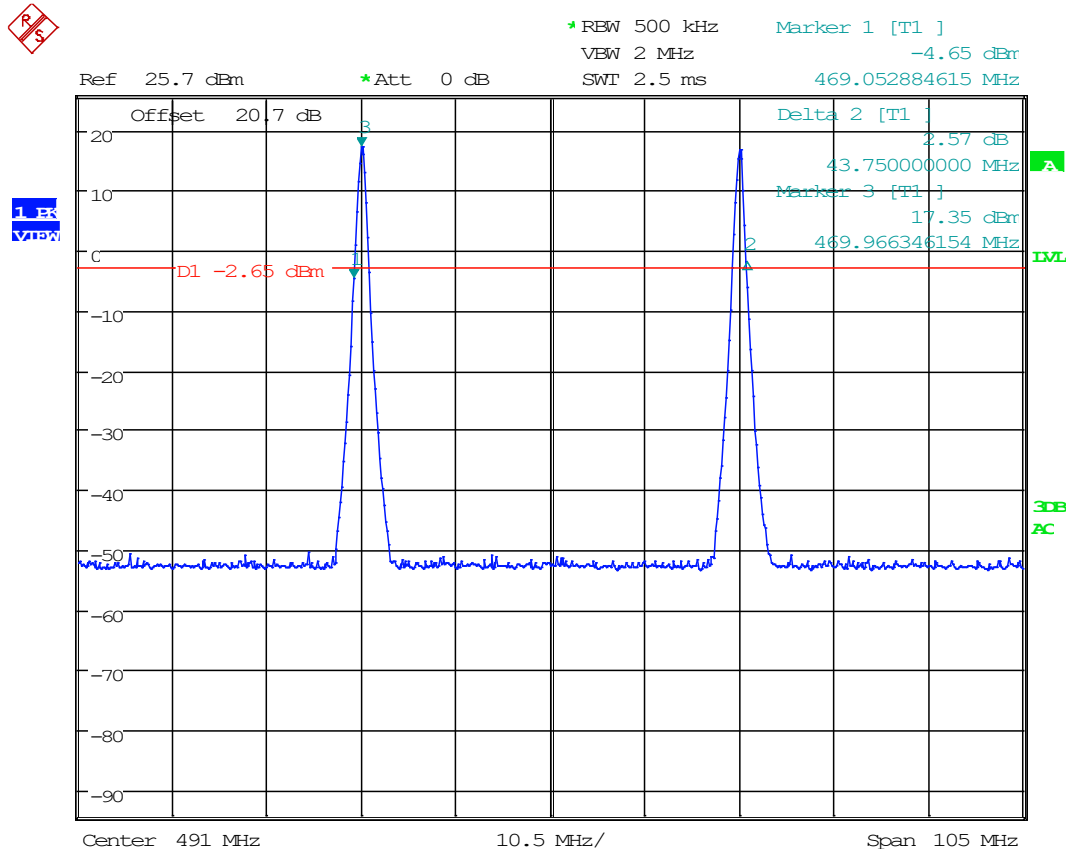
Test Results, Out-of-band Rejection and Class of Operation			
Operating Band	Link Direction	Passband (kHz)	Class of Operation
450 – 512 MHz	n/a	< 75 kHz (NOTE 1)	Class A

Note 1: The EUT is channelized as a Class A device, and does not utilize the entire operating band at once.



Out-of-band Rejection, Spectrum Plots

8.3.1 UHF Band



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8.4 Bandwidth & Emission

Limits from FCC Parts 90.209 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.

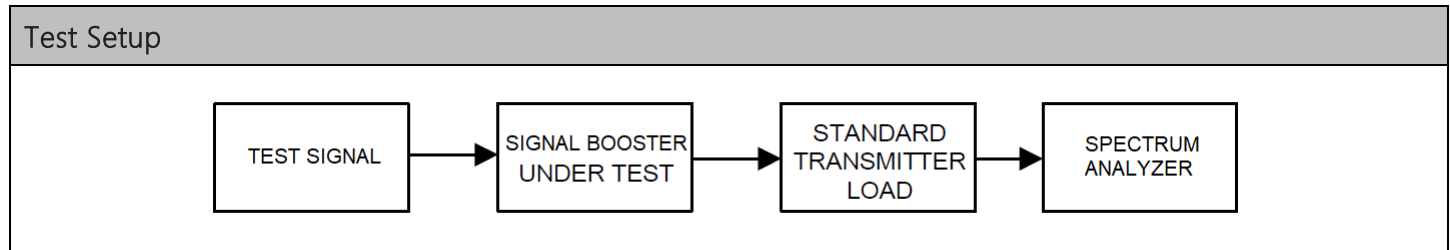
Authorized Bandwidth		
Rule Part	Operating Range	Authorized Bandwidth
Part 90	450 – 512 MHz	20 kHz, 11.25 kHz, 6 kHz

Applicable Input Signals		
Signal	Occupied Bandwidth (MHz)	Representative Emission Designator(s)
CW	n/a	n/a
25 kHz FM	16.0	16K0F3E



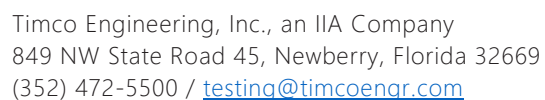
8.5 Input VS Output Signal Comparison

Limits from FCC Parts 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.



UHF Band Input VS Output Comparison

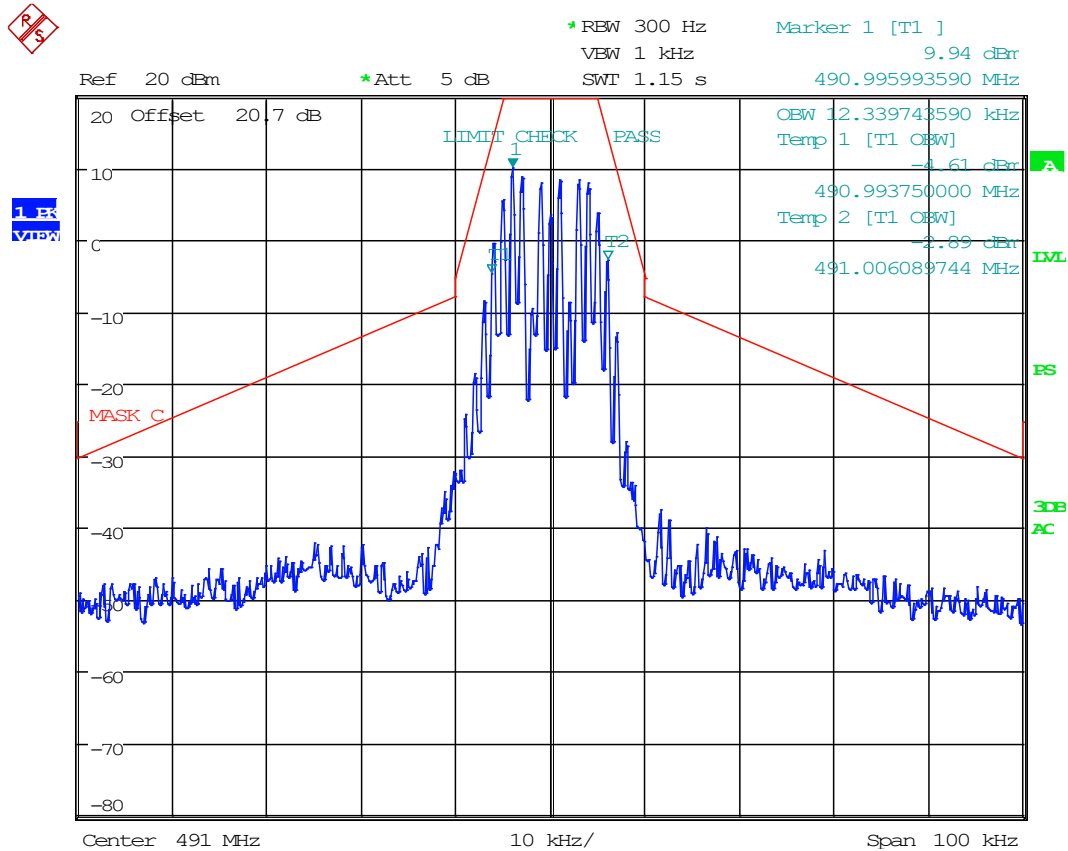
Test Results, Input VS Output Comparison						
Link Direction	Tuned Frequency (MHz)	AGC Level	Input Signal	99% OBW of Input (MHz)	99% OBW of Output (MHz)	Change (%)
n/a	491.000	@ AGC	25 kHz FM	12.34	12.34	0.00
		@ AGC+3 dB	25 kHz FM	12.34	12.34	0.00





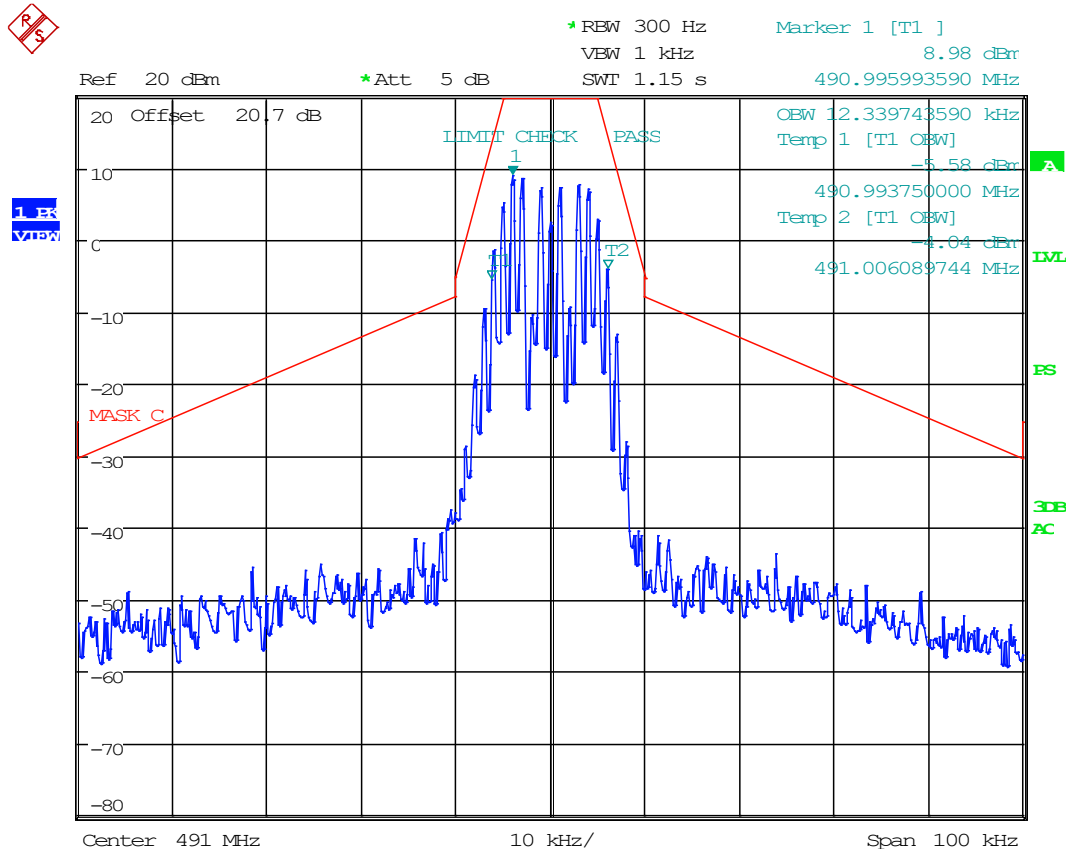
Input VS Output, Output Spectrum Plots, UHF Band

8.5.2 25 kHz FM, AGC, 491 MHz



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8.5.3 25 kHz FM, AGC +3dB, 491 MHz

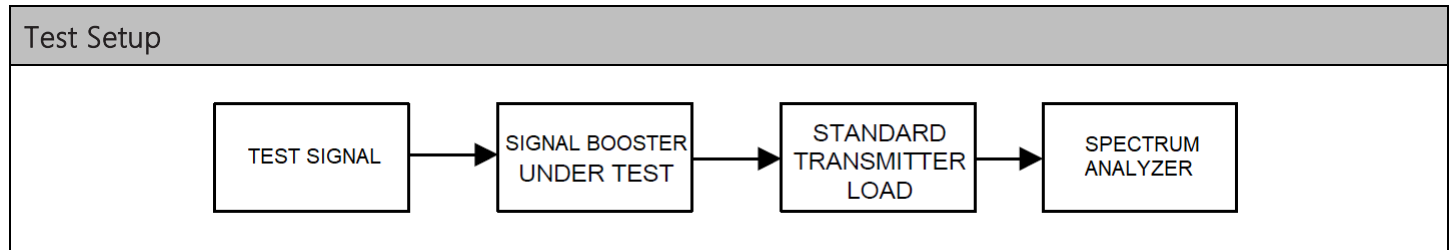


Date: 15.OCT.2020 12:09:55



8.6 Noise Figure

Limits from FCC KDB 935210 D05 v01r04 Industrial Signal Boosters. Test method from "Noise Figure Measurement Accuracy: The Y-Factor Method" by Keysight Technologies.

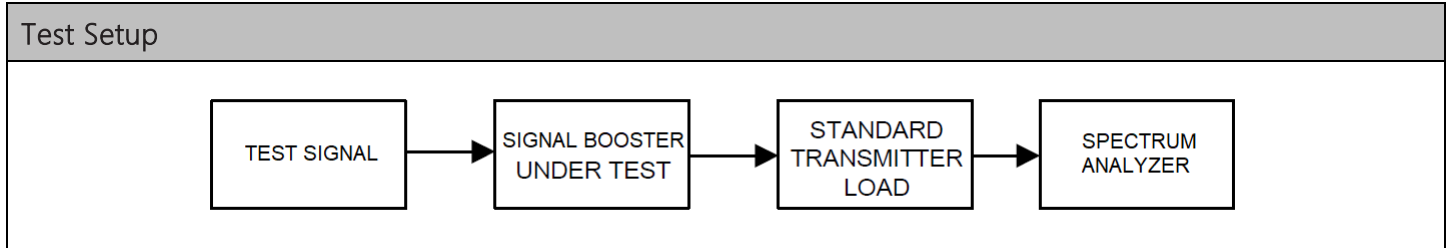


Test Results, Out-of-band Rejection and Class of Operation			
Operating Band	Link Direction	Noise Figure	Limit
450 – 512 MHz	n/a	6.48	< 9 dB



8.7 Out-of-Band/Out-of-Block Emissions (Intermodulation Products)

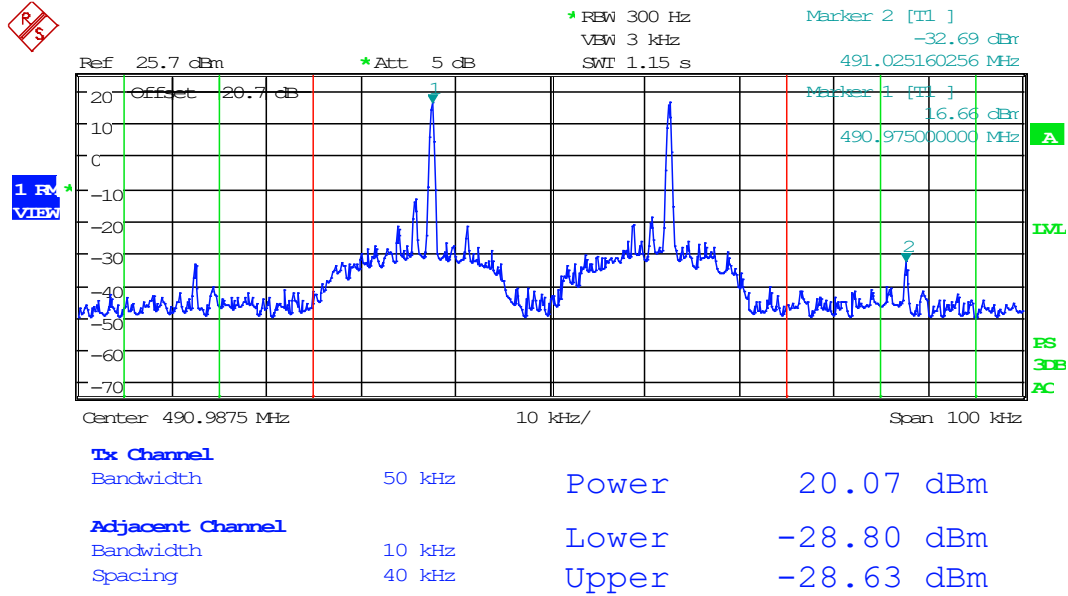
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





Intermodulation Products Spectrum Plots, UHF Band

8.7.1 25 kHz Signal, AGC



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Ref 25.7 dBm * Att 5 dB VEW 3 kHz SWI 1.15 s

Marker 1 [T1] -28.59 dBm 491.025160256 MHz

Marker 2 [T1] -26.64 dBm 490.975000000 MHz

Center 490.9875 MHz 10 kHz/ Span 100 kHz

Tx Channel Bandwidth 50 kHz Power 22.02 dBm

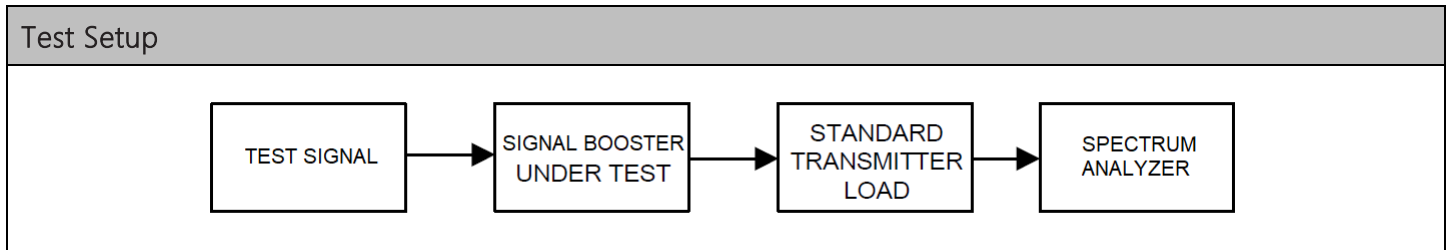
Adjacent Channel Bandwidth 10 kHz Lower -26.55 dBm Spacing 40 kHz Upper -26.27 dBm

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8.8 Emission Mask, Out-of-Band

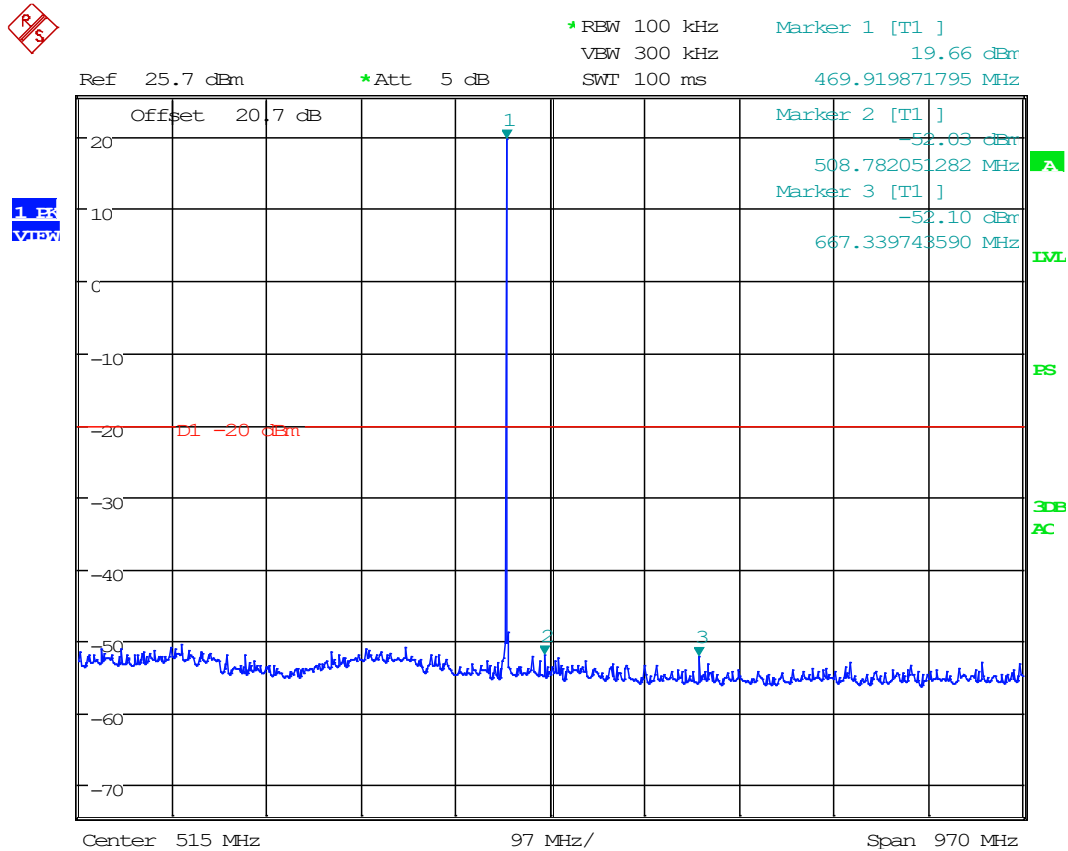
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





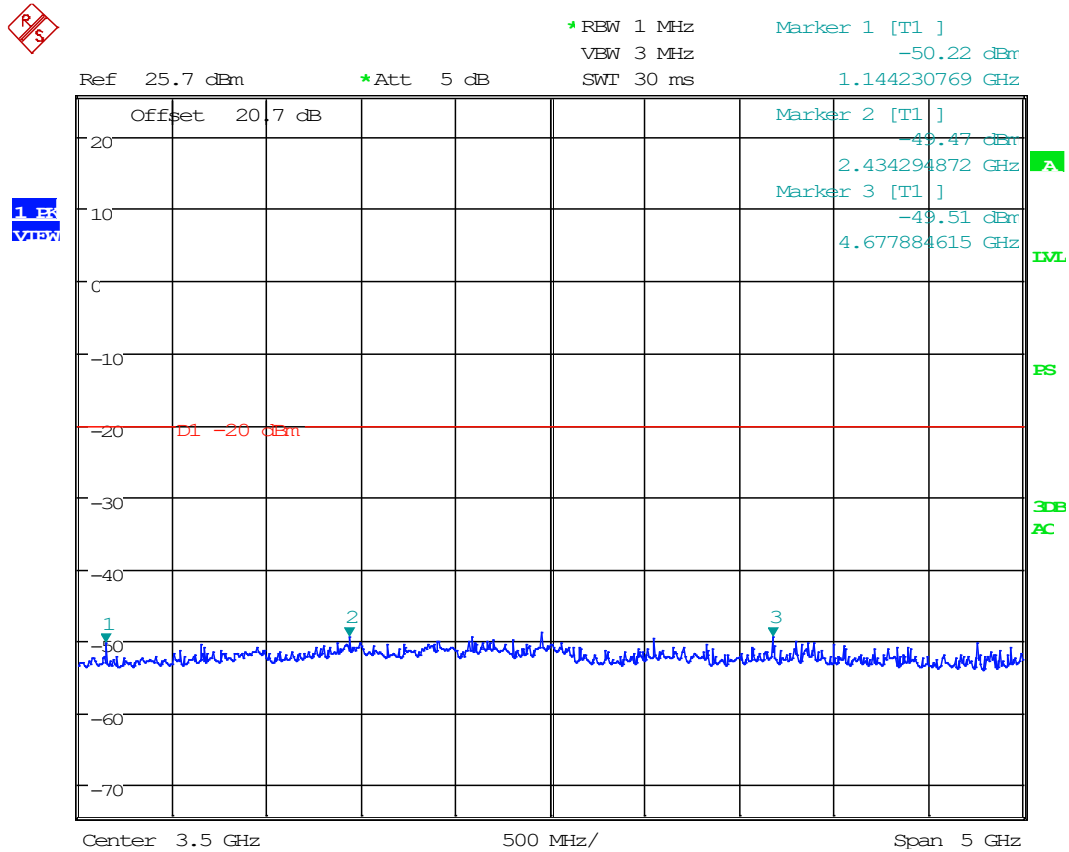
Conducted Emissions Spectrum Plots, UHF Band

8.8.1 30 MHz to 1 GHz, 470.025 MHz



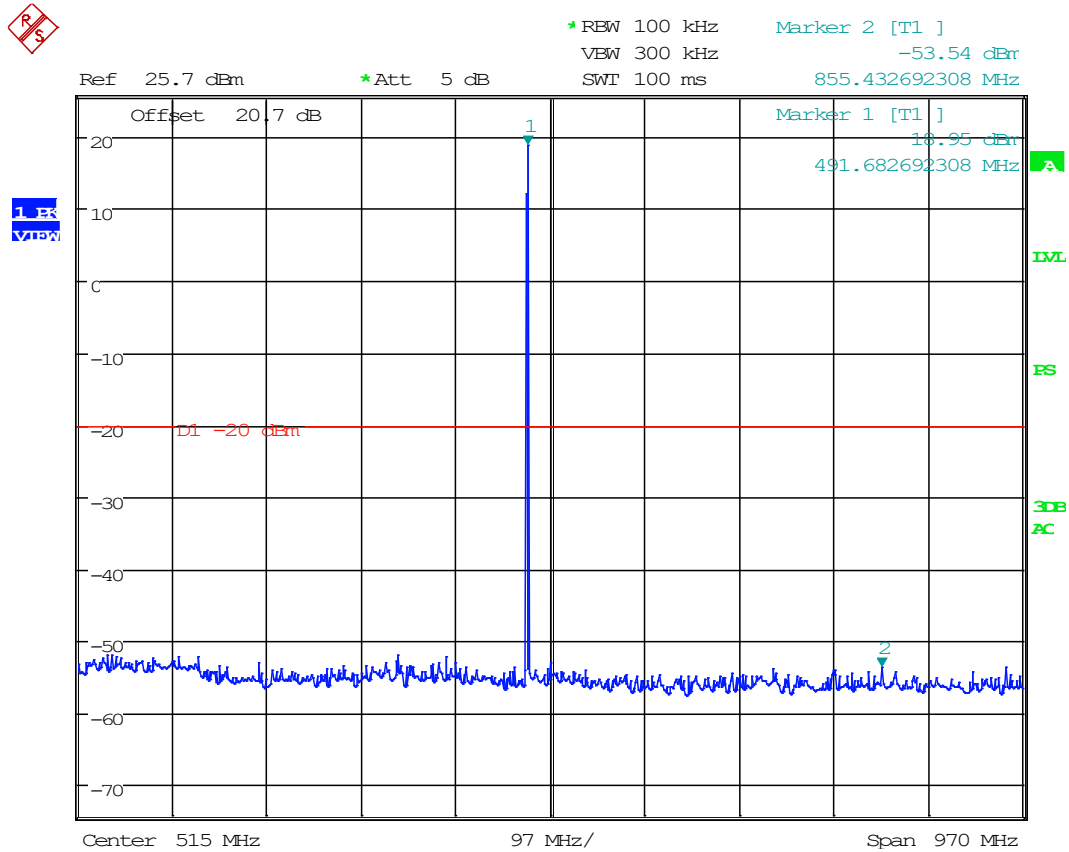
Date: 15.OCT.2020 12:01:52

8.8.2 1 GHz to 10th Harmonic, 470.025 MHz

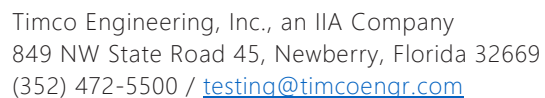


Date: 15.OCT.2020 12:03:41

8.8.1 30 MHz to 1 GHz, 491.000 MHz

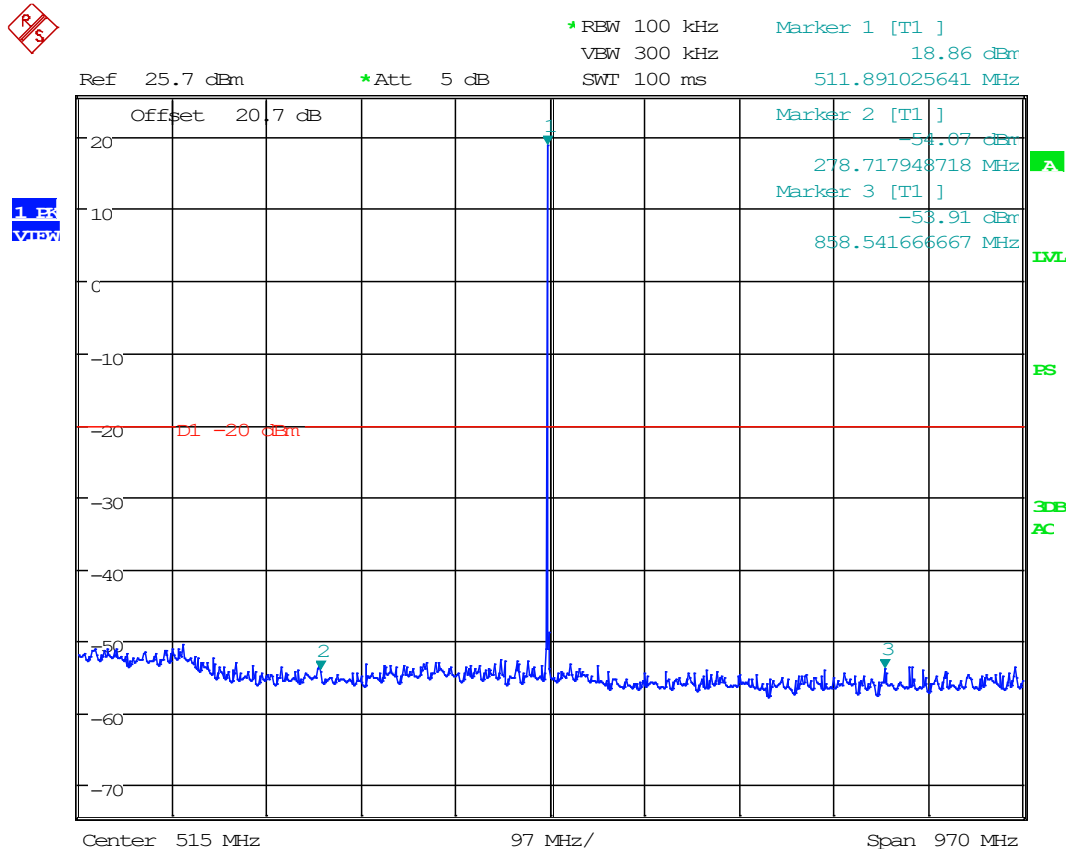


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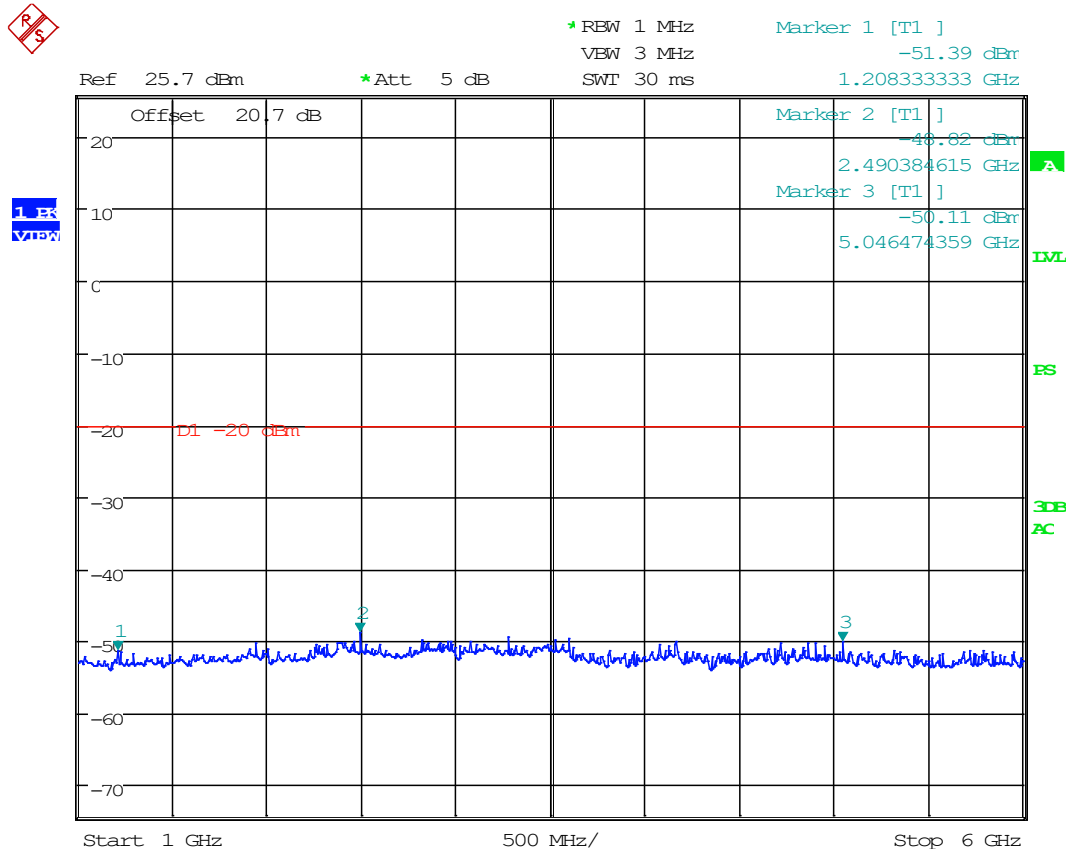
AC	3D	PS	IMT	A
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8.8.1 30 MHz to 1 GHz, 511.975 MHz



Date: 15.OCT.2020 12:02:39

8.8.2 1 GHz to 10th Harmonic, 511.975 MHz

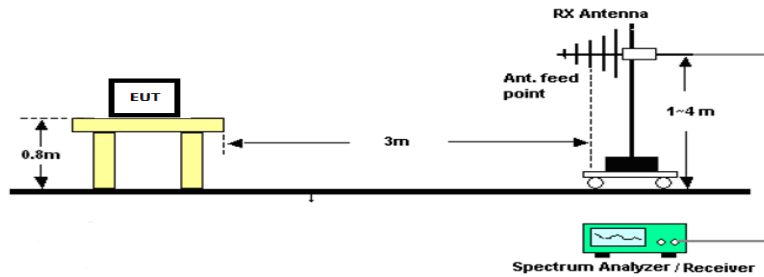


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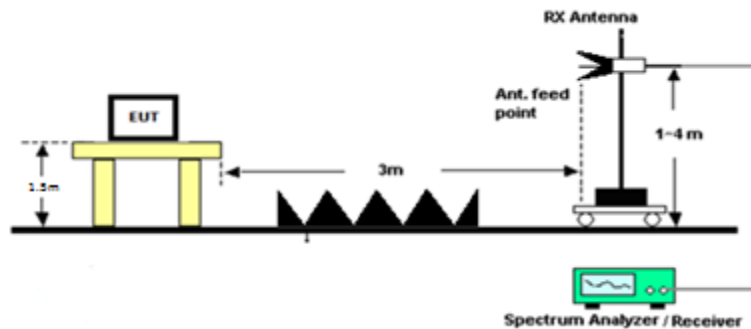
8.9 Spurious Radiated Emissions

Limits from FCC Parts 2.1053, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.

Radiated Test Setup, 30 – 1000 MHz



Radiated Test Setup, Above 1000 MHz





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

Radiated Emissions, Tabular Data, VHF Band

8.9.1 470.025 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
470.03	64.59	PK	34.54	H	0.95	6.28	3.00	41.77	-55.61	-13.00	42.61
470.03	55.88	PK	43.76	V	0.87	9.05	3.00	53.68	-43.70	-13.00	30.70
470.03	111.27	PK	29.34	H	1.21	10.10	3.00	40.65	-56.73	-13.00	43.73
470.03	112.54	PK	28.64	V	1.21	10.10	3.00	39.95	-57.42	-13.00	44.42
470.03	171.40	PK	34.64	H	1.53	15.06	3.00	51.23	-46.15	-13.00	33.15
470.03	176.80	PK	31.00	V	1.55	14.32	3.00	46.87	-50.51	-13.00	37.51
470.03	33.54	PK	36.20	H	0.65	13.25	3.00	50.11	-47.27	-13.00	34.27
470.03	203.84	PK	27.22	V	1.62	10.72	3.00	39.57	-57.81	-13.00	44.81
470.03	812.80	PK	26.43	V	3.39	20.46	3.00	50.27	-47.11	-13.00	34.11
470.03	835.90	PK	26.18	H	3.43	21.69	3.00	51.30	-46.08	-13.00	33.08
470.03	203.85	PK	27.08	H	1.62	10.72	3.00	39.43	-57.95	-13.00	44.95
470.03	940.05	PK	24.69	H	3.59	22.60	3.00	50.88	-46.50	-13.00	33.50
470.03	940.05	PK	23.30	V	3.59	22.60	3.00	49.49	-47.89	-13.00	34.89
470.03	1410.08	PK	11.54	H	4.31	28.39	3.00	44.24	-53.14	-13.00	40.14
470.03	1410.08	PK	11.59	V	4.31	28.39	3.00	44.29	-53.09	-13.00	40.09
470.03	1880.10	PK	12.01	H	5.03	30.94	3.00	47.98	-49.39	-13.00	36.39
470.03	1880.10	PK	13.57	V	5.03	30.94	3.00	49.54	-47.83	-13.00	34.83
470.03	2350.13	PK	12.72	H	5.58	31.93	3.00	50.22	-47.16	-13.00	34.16
470.03	2350.13	PK	12.57	V	5.58	31.93	3.00	50.07	-47.31	-13.00	34.31
470.03	2820.15	PK	10.92	H	6.21	32.43	3.00	49.56	-47.82	-13.00	34.82
470.03	2820.15	PK	13.03	V	6.21	32.43	3.00	51.67	-45.71	-13.00	32.71
470.03	3290.18	PK	12.03	H	6.70	32.63	3.00	51.36	-46.02	-13.00	33.02
470.03	3290.18	PK	13.66	V	6.70	32.63	3.00	52.99	-44.39	-13.00	31.39
470.03	3760.20	PK	10.59	H	6.45	33.13	3.00	50.16	-47.21	-13.00	34.21
470.03	3760.20	PK	10.79	V	6.45	33.13	3.00	50.36	-47.01	-13.00	34.01
470.03	4230.23	PK	10.46	H	7.10	33.33	3.00	50.89	-46.48	-13.00	33.48
470.03	4230.23	PK	11.53	V	7.10	33.33	3.00	51.96	-45.41	-13.00	32.41
470.03	4700.25	PK	10.23	H	7.20	33.88	3.00	51.31	-46.07	-13.00	33.07
470.03	4700.25	PK	11.14	V	7.20	33.88	3.00	52.22	-45.16	-13.00	32.16



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8.9.2 491.000 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
491.00	55.88	PK	40.50	H	0.87	9.05	3.00	50.42	-46.96	-13.00	33.96
491.00	56.15	PK	41.80	V	0.88	8.96	3.00	51.63	-45.75	-13.00	32.75
491.00	64.87	PK	40.02	H	0.95	6.23	3.00	47.19	-50.18	-13.00	37.18
491.00	33.54	PK	35.15	V	0.65	13.25	3.00	49.06	-48.32	-13.00	35.32
491.00	112.50	PK	30.89	H	1.21	10.10	3.00	42.20	-55.17	-13.00	42.17
491.00	170.30	PK	29.89	V	1.52	15.24	3.00	46.65	-50.73	-13.00	37.73
491.00	170.30	PK	31.95	H	1.52	15.24	3.00	48.71	-48.67	-13.00	35.67
491.00	274.40	PK	18.88	H	2.06	12.54	3.00	33.48	-63.90	-13.00	50.90
491.00	250.00	PK	23.46	H	1.89	11.20	3.00	36.55	-60.83	-13.00	47.83
491.00	641.00	PK	12.02	H	2.96	19.58	3.00	34.56	-62.82	-13.00	49.82
491.00	771.70	PK	11.25	V	3.28	21.57	3.00	36.10	-61.28	-13.00	48.28
491.00	201.30	PK	26.82	V	1.62	10.77	3.00	39.22	-58.16	-13.00	45.16
491.00	201.30	PK	25.18	H	1.62	10.77	3.00	37.58	-59.80	-13.00	46.80
491.00	982.00	PK	9.92	H	3.70	22.62	3.00	36.24	-61.14	-13.00	48.14
491.00	982.00	PK	9.56	V	3.70	22.62	3.00	35.88	-61.50	-13.00	48.50
491.00	1473.00	PK	10.68	H	4.42	27.94	3.00	43.04	-54.34	-13.00	41.34
491.00	1473.00	PK	11.72	V	4.42	27.94	3.00	44.08	-53.30	-13.00	40.30
491.00	1964.00	PK	11.97	H	5.14	31.31	3.00	48.42	-48.95	-13.00	35.95
491.00	1964.00	PK	12.25	V	5.14	31.31	3.00	48.70	-48.67	-13.00	35.67
491.00	2455.00	PK	11.87	H	5.61	31.88	3.00	49.36	-48.01	-13.00	35.01
491.00	2455.00	PK	12.73	V	5.61	31.88	3.00	50.22	-47.15	-13.00	34.15
491.00	2946.00	PK	11.93	H	6.29	32.32	3.00	50.54	-46.84	-13.00	33.84
491.00	2946.00	PK	12.08	V	6.29	32.32	3.00	50.69	-46.69	-13.00	33.69
491.00	3437.00	PK	12.65	H	6.87	32.61	3.00	52.13	-45.24	-13.00	32.24
491.00	3437.00	PK	13.00	V	6.87	32.61	3.00	52.48	-44.89	-13.00	31.89
491.00	3928.00	PK	10.11	H	7.19	33.31	3.00	50.60	-46.77	-13.00	33.77
491.00	3928.00	PK	10.22	V	7.19	33.31	3.00	50.71	-46.66	-13.00	33.66
491.00	4419.00	PK	10.05	H	7.29	33.71	3.00	51.05	-46.33	-13.00	33.33
491.00	4419.00	PK	10.32	V	7.29	33.71	3.00	51.32	-46.06	-13.00	33.06
491.00	4910.00	PK	10.97	H	7.57	33.92	3.00	52.46	-44.92	-13.00	31.92
491.00	4910.00	PK	11.10	V	7.57	33.92	3.00	52.59	-44.79	-13.00	31.79



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Radiated Emissions, Tabular Data, UHF Band

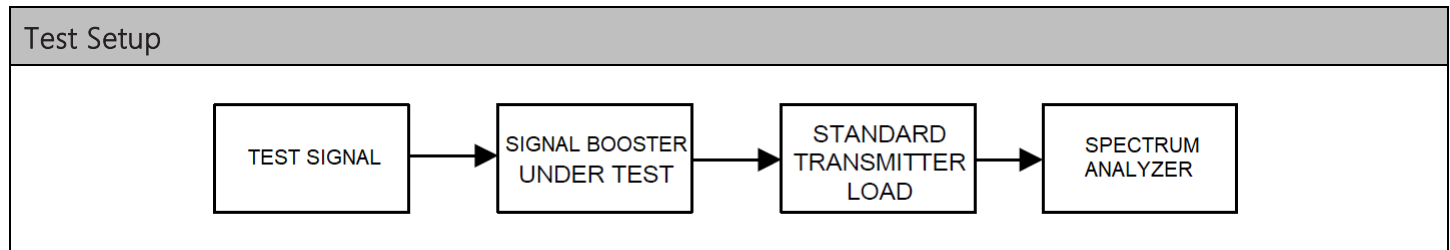
8.9.3 511.975 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
511.98	62.70	PK	34.30	H	0.93	6.69	3.00	41.92	-55.46	-20.00	35.46
511.98	112.30	PK	27.04	H	1.21	10.10	3.00	38.35	-59.03	-20.00	39.03
511.98	172.20	PK	31.57	H	1.53	14.96	3.00	48.06	-49.32	-20.00	29.32
511.98	172.20	PK	30.35	V	1.53	14.96	3.00	46.84	-50.54	-20.00	30.54
511.98	112.50	PK	24.66	V	1.21	10.10	3.00	35.97	-61.40	-20.00	41.40
511.98	63.78	PK	45.32	V	0.94	6.44	3.00	52.70	-44.67	-20.00	24.67
511.98	42.53	PK	39.42	V	0.73	12.99	3.00	53.14	-44.23	-20.00	24.23
511.98	202.50	PK	23.46	H	1.62	10.75	3.00	35.83	-61.54	-20.00	41.54
511.98	202.50	PK	24.62	V	1.62	10.75	3.00	36.99	-60.38	-20.00	40.38
511.98	265.30	PK	12.62	V	2.04	11.91	3.00	26.57	-70.80	-20.00	50.80
511.98	267.90	PK	19.05	H	2.06	12.02	3.00	33.12	-64.25	-20.00	44.25
511.98	899.90	PK	13.03	V	3.54	21.70	3.00	38.27	-59.11	-20.00	39.11
511.98	1023.95	PK	11.51	H	3.74	26.94	3.00	42.19	-55.19	-20.00	35.19
511.98	1023.95	PK	11.91	V	3.74	26.94	3.00	42.59	-54.79	-20.00	34.79
511.98	1535.93	PK	11.42	H	4.55	27.76	3.00	43.73	-53.65	-20.00	33.65
511.98	1535.93	PK	11.02	V	4.55	27.76	3.00	43.33	-54.05	-20.00	34.05
511.98	2047.90	PK	10.84	H	5.27	30.99	3.00	47.11	-50.27	-20.00	30.27
511.98	2047.90	PK	12.46	V	5.27	30.99	3.00	48.73	-48.65	-20.00	28.65
511.98	2559.88	PK	12.94	H	5.71	32.57	3.00	51.22	-46.16	-20.00	26.16
511.98	2559.88	PK	13.37	V	5.71	32.57	3.00	51.65	-45.73	-20.00	25.73
511.98	3071.85	PK	12.59	H	6.43	32.69	3.00	51.71	-45.67	-20.00	25.67
511.98	3071.85	PK	12.03	V	6.43	32.69	3.00	51.15	-46.23	-20.00	26.23
511.98	3583.83	PK	13.01	H	6.70	33.06	3.00	52.77	-44.61	-20.00	24.61
511.98	3583.83	PK	12.56	V	6.70	33.06	3.00	52.32	-45.06	-20.00	25.06
511.98	4095.80	PK	10.25	H	7.12	33.40	3.00	50.77	-46.61	-20.00	26.61
511.98	4095.80	PK	11.69	V	7.12	33.40	3.00	52.21	-45.17	-20.00	25.17
511.98	4607.78	PK	11.41	H	7.55	34.03	3.00	53.00	-44.38	-20.00	24.38
511.98	4607.78	PK	10.68	V	7.55	34.03	3.00	52.27	-45.11	-20.00	25.11
511.98	5119.75	PK	10.48	H	7.87	34.09	3.00	52.44	-44.94	-20.00	24.94
511.98	5119.75	PK	10.58	V	7.87	34.09	3.00	52.54	-44.84	-20.00	24.84



8.10 Modulation Characteristics

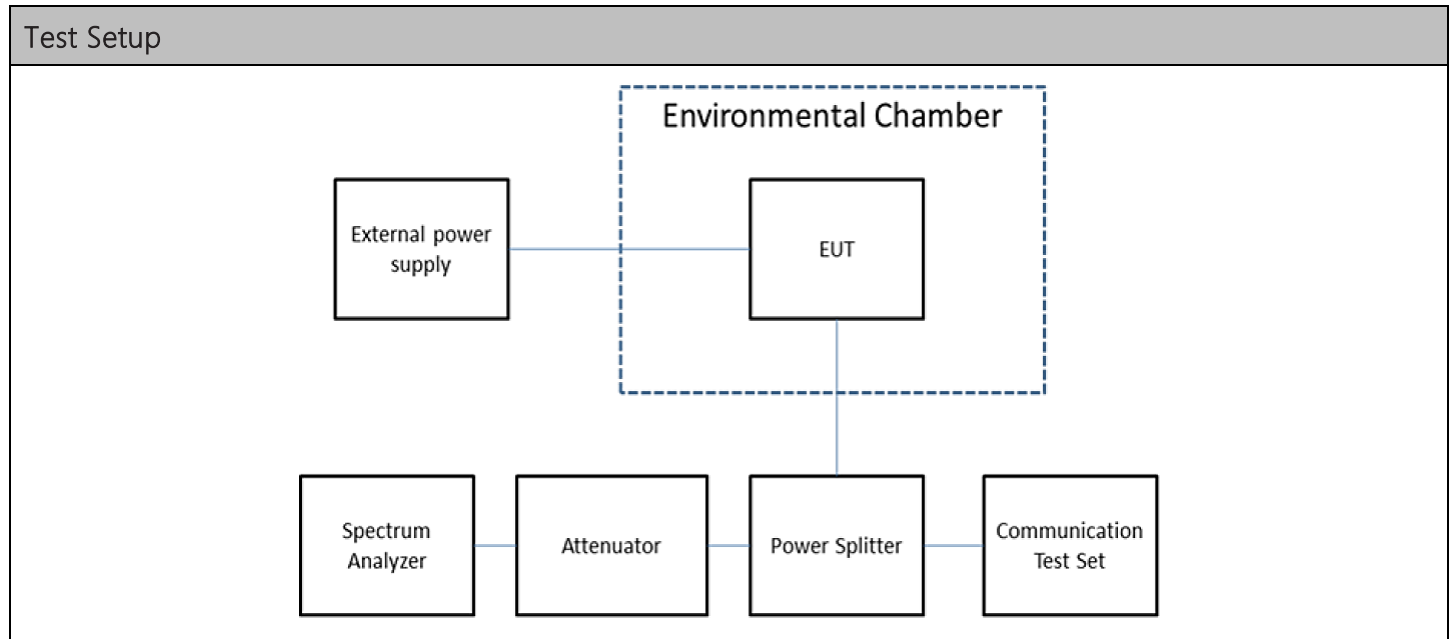
Limits from FCC Parts 2.1047, and test procedure from ANSI C63.26-2015.



N/A. The EUT does not alter the modulation of the incoming signal.

8.11 Frequency Stability

Limits from FCC Parts 2.1055, 90.213 (a); and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.



Test Results, Mode 1			
Tuned Frequency (MHz)	Max Deviation (Hz)	Max Deviation (ppm)	Limit (ppm)
470.025	15	0.03	2.5

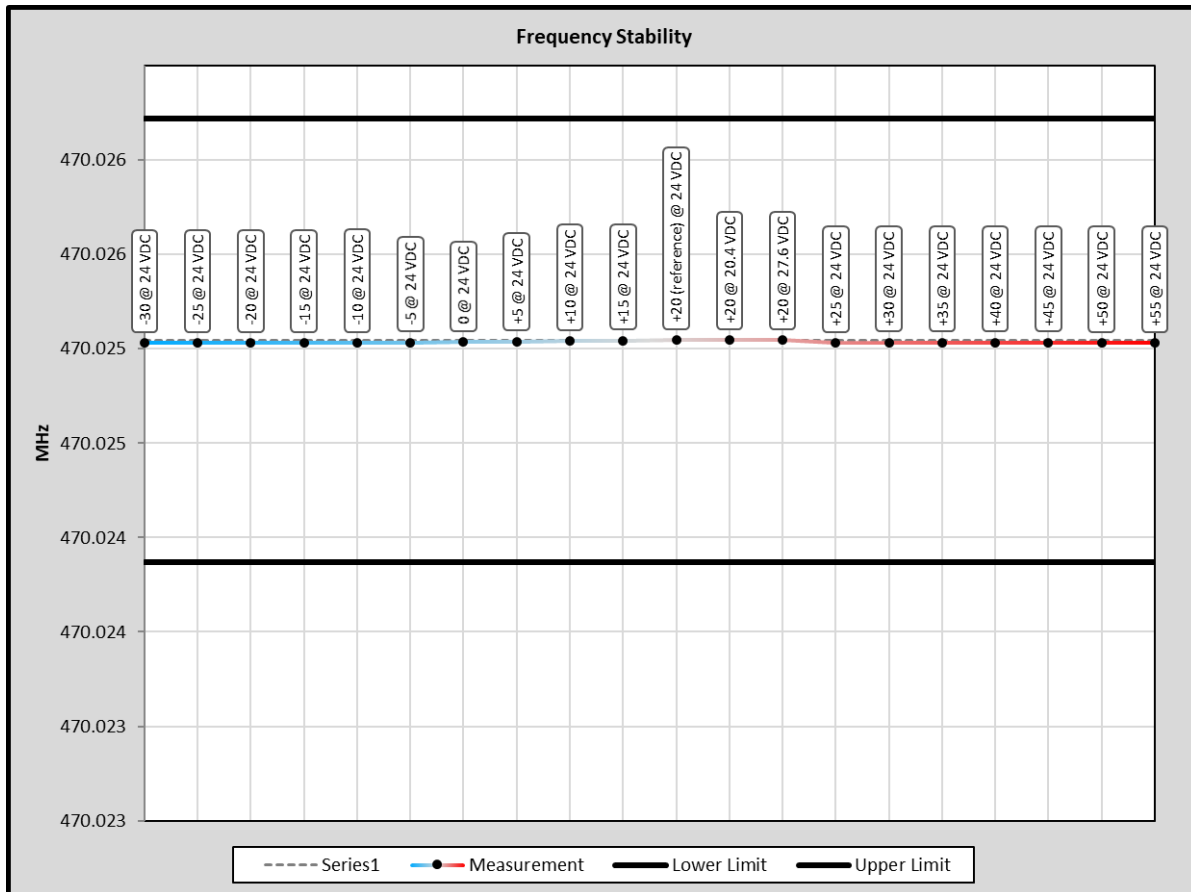


Frequency Stability

8.11.1 Frequency Stability Data

Limit	2.5	ppm	
Limit, as ppb	2500	ppb (Parts per Billion)	
Limit, as %	0.00025	%	
Limit, as Hz	1175.063	Hz	
Lower Limit	470.023870	MHz	
Upper Limit	470.026220	MHz	
Rated Supply Voltage	24.0	☐ AC ☒ DC	
Temperature / Voltage Variation			
Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (Hz)
-30	24.0	470.025030	15
-25	24.0	470.025030	15
-20	24.0	470.025030	15
-15	24.0	470.025030	15
-10	24.0	470.025032	13
-5	24.0	470.025034	11
0	24.0	470.025035	10
+5	24.0	470.025038	7
+10	24.0	470.025041	4
+15	24.0	470.025044	1
+20 (reference)	24.0	470.025045	0
+20	20.4	470.025045	0
+20	27.6	470.025045	0
+25	24.0	470.025032	13
+30	24.0	470.025033	12
+35	24.0	470.025033	12
+40	24.0	470.025033	12
+45	24.0	470.025033	12
+50	24.0	470.025032	13
+55	24.0	470.025032	13

8.11.2 Frequency Stability Plot





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8.12 Transient Frequency Behavior

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

N/A. The EUT does not "key-on" or "key off", and instead transmits indefinitely.



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8.13 Adjacent channel power limits

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

N/A. Device does not require ACP measurement.



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_3851-20_FCC_PT90_1	1	Initial release	October 29, 2020
TR_3851-20_FCC_PT90_2	2	Updated Address on Page 3, Updated equip. list	December 8, 2020



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END OF TEST REPORT
