Test Report # TR_2195-21_FCC_PT87-90_4
Revision: 4
Issue Date: 6/23/2021
Final Test Date: 6/15/2021

ACCREDITED
CERTIFICATE #0955.01

TIMCO ENGINEERING, Inc.
An IIA Company

Test Report - FCC PARTS 87 & 90
Prepared For: C SPEED, LLC

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager
Date of Signature
(YYYY-MM-DD): 6/17/2021

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA). 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.

Table of Contents

1. CUSTOMER INFORMATION 4
1.1 PART 87 TEST RESULT SUMMARY 5
1.2 PART 90 TEST RESULT SUMMARY 5
2. LOCATION OF TESTING 6
2.1 TEST LABORATORY 6
2.2 TESTING WAS PERFORMED, REVIEWED BY 6
3. TEST SAMPLE(S) (EUT/DUT) 7
3.1 DESCRIPTION OF THE EUT 7
3.2 CONFIGURATION OF EUT 8
3.3 TEST SETUP OF EUT 8
4. TEST METHODS & APPLICABLE REGULATORY LIMITS 9
4.1 TEST METHODS/STANDARDS/GUIDANCE: 9
4.2 APPLIED LIMITS AND REGULATORY LIMITS: 9
5. MEASUREMENT UNCERTAINTY 9
6. ENVIRONMENTAL CONDITIONS 9
6.1 TEMPERATURE & HUMIDITY 9
7. LIST OF TEST EQUIPMENT AND TEST FACILITY 10
7.1 LIST OF TEST EQUIPMENT 10
8. TEST RESULTS 11
8.1 POWER AT THE FINAL AMPLIFIER 12
8.2 RF OUTPUT POWER 13
8.3 BANDWIDTH & EMISSION 14
8.3.1 Bandwidth Plot, 99%, 2880 MHz 15
8.3.1 Bandwidth Plot, 99%, 2940 MHz 16
8.3.2 Bandwidth Plot, 40 dB BW, 2880 MHz 17
8.3.1 Bandwidth Plot, 40 dB BW, 2940 MHz 18
8.4 EMISSION LIMITATIONS, IN-BAND 19
8.4.1 Emission Mask, 2880 MHz 20
8.4.2 Emission Mask, 2940 MHz 21
8.5 EMISSION LIMITATIONS, OUT-OF-BAND 22
8.5.1 Conducted Emissions 30 MHz to 1 GHz, 2880 MHz 23
8.5.1 Conducted Emissions 1 GHz to Band Edge, 2880 MHz 24
8.5.1 Conducted Emissions Above fundamental to 26GHz, 2880 MHz 25
8.5.1 Conducted Emissions 26GHz to 40GHz, 2880 MHz 26
8.5.2 Conducted Emissions 30 MHz to 1 GHz, 2940 MHz 27
8.5.3 Conducted Emissions 1 GHz to Band Edge, 2940 MHz 28
8.5.4 Conducted Emissions Above fundamental to 26GHz, 2940 MHz 29

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.5.5 Conducted Emissions 26GHz to 40GHz, 2940 MHz *30*
8.6 RADIATED EMISSIONS 31
8.6.1 Radiated Emissions, 2880 MHz *32*
8.6.1 Radiated Emissions, 2940 MHz *32*
8.7 MODULATION CHARACTERISTICS 33
8.7.1 Audio Frequency Response *33*
8.7.2 Low Pass Filter Response *33*
8.7.3 Modulation Limiting *33*
8.8 FREQUENCY STABILITY 34
8.8.1 Frequency Stability Data, 2880 MHz *35*
8.8.2 Frequency Stability Plot, 2880 MHz *36*
8.8.1 Frequency Stability Data, 2940 MHz *37*
8.8.2 Frequency Stability Plot, 2940 MHz *38*
8.9 TRANSIENT FREQUENCY BEHAVIOR 39
8.10 ADJACENT CHANNEL POWER LIMITS 40
9. ANNEX-A - PHOTOGRAPHS OF THE EUT 41
10. ANNEX-B – TEST SETUP PHOTOGRAPHS 41
11. HISTORY OF TEST REPORT CHANGES 41

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

1. Customer Information

Applicant:	C SPEED, LLC
Address:	316 Commerce Blvd. Liverpool, New York, 13088

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

The Following is for Test item FCC ID: 2AXEILWRLP288010

1.1 Part 87 Test Result Summary

The following test procedure and guidance were used for measuring FCC PART 87 (AVIATION SERVICES) known as Licensed Aviation Radio; ANSI C63.26-2015. Full test results are available in this report.

Applicable Clauses from Part 87		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
87.131 footnote 4	Transmitter Power	Pass
87.133 (a) (8)	Frequency stability	Pass
87.135 (a) – (c)	Bandwidths (a) – (c)	Reported
87.137 (a) footnote 9	Emission designator	Reported
87.139 (a)	Emission Limitations, In-band	Pass
87.139 (a)	Emission Limitations, Out-of-band	Pass
87.141	Modulation Requirements	n/a

1.2 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 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.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

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: 5/7/2021

Signature: Sr. EMC Engineer
EMC-003838-NE

Name & Title: Tim Royer, EMC Engineer
Date of Signature
(YYYY-MM-DD): 6/17/2021

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

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

The test sample was received: 5/7/2021

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:	2AXEILWRLP288010
Brief Description	LightWave Radar
Type of Modular	n/a
Model(s) #	LWRLP
Trade name	n/a
Firmware version	XCV (34)
Software version	CTL (1.0.0.63)
Serial Number	001

Technical Characteristics	
Technology	FM Chirp Pulsed Radar
Frequency Range	2.7 – 3.1 GHz
RF O/P Power (Max.)	1000 w
Modulation	Pulse w/ no modulated information
Bandwidth & Emission Class	5M25Q3N, 26M0Q3N
Number of Channels	n/a
Duty Cycle	n/a
Antenna Connector	N connector
Voltage Rating (AC or Batt.)	AC 120 V

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

3.2 Configuration of EUT

Test Modes				
Band	Mode (#)	Test Frequencies	BW (nominal)	Modulation
2.880 – 2.9 GHz	Part 87	2880 MHz	13.79 MHz	Pulse
2.9 – 3.1 GHz	Part 90	2940 MHz	41.95 MHz	Pulse

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.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance:

Test procedures and guidance for measuring Licensed Part 87 & 90 Licensed device:

1) ANSI C63.26-2015
2) ITU-R M.1177-3 (per 80.273 (a) (6))

4.2 Applied Limits and Regulatory Limits:

1) FCC CFR 47 Part 87
2) 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.	

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

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	2/20/18	2/19/2021
Function Generator	Standford	DS340	25200	2/21/18	2/20/2021
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	9/11/20	9/11/2023
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
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-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
Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	12/8/17	12/7/2020
CHAMBER	Panashield	3M	N/A	3/12/19	3/11/2021
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	11/6/17	11/5/2020

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

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

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 dBµV. 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 (dBµV/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 dBµV 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.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

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
120 V AC	20 A	1440 W

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.2 RF Output Power

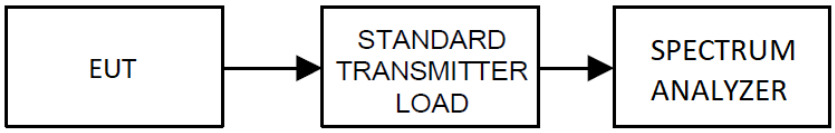
Limits from FCC Parts 2.1046(a), 80.215 (a) (3), (n) (3), 87.131 footnote 4, and 90.205 (r); and test procedure from ANSI C63.26-2015.

Maximum Power: **60 dBm = 1000 W**

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.3 Bandwidth & Emission

Limits from FCC Parts 2.1049, 80.205 (a), (d), 87.135 (a) – (c) & 87.137 (a) footnote 9, & 90.207 (n) & 90.209 (b) (5) footnote 2, and test procedure from ANSI C63.26-2015.

Test Setup


Test Results, Authorized Bandwidth		
Rule Part	Operating Range	Authorized Bandwidth
Part 87	2.7 – 2.9 GHz	550 MHz
Part 90	2.9 – 3.1 GHz	2050 MHz

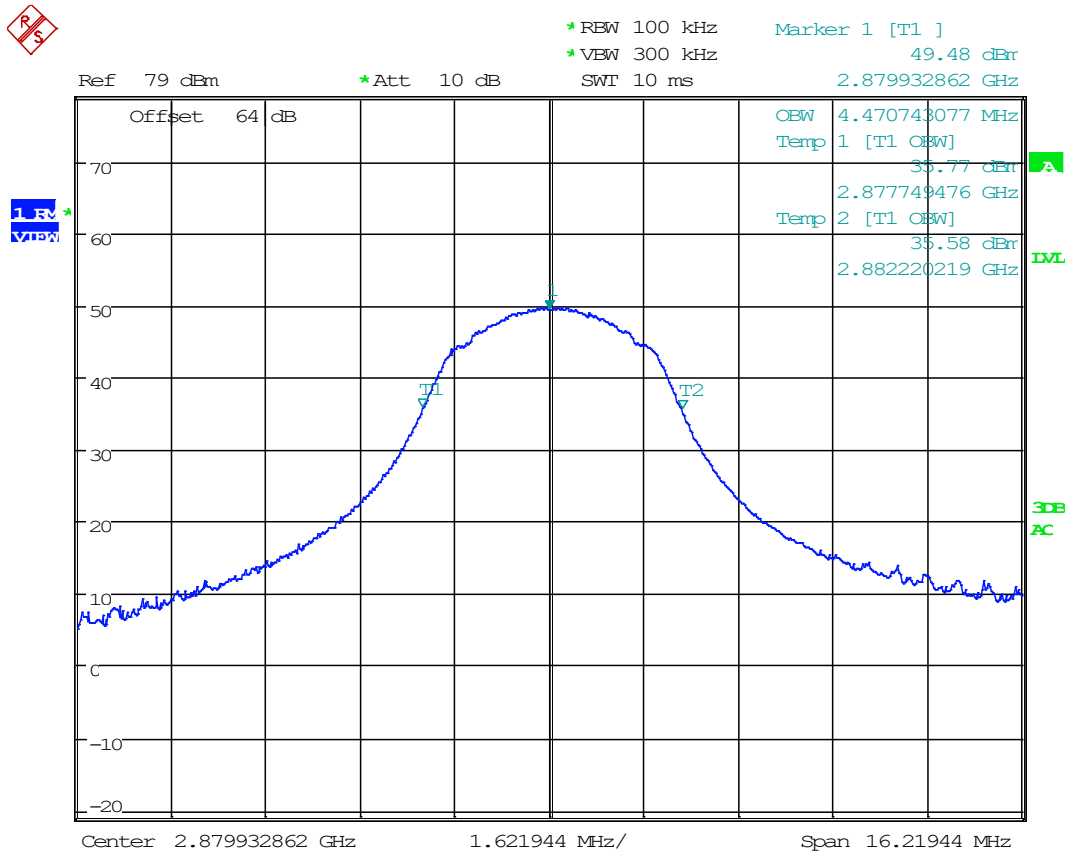
Test Results, Occupied Bandwidth		
Tuned Frequency (MHz)	Occupied Bandwidth (MHz)	Bandwidth Type
2880	4.47	99% Power
2940	22.19	99% Power
2880	13.79	40 dB
2940	41.95	40 dB

Test Results, Necessary Bandwidth			
Tuned Frequency (MHz)	Necessary Bandwidth (MHz)	Emission Designator	Bandwidth Type
2880	4.47	Q3N	99% Power
2940	22.19	Q3N	99% Power

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

Occupied Bandwidth, Spectrum Plots

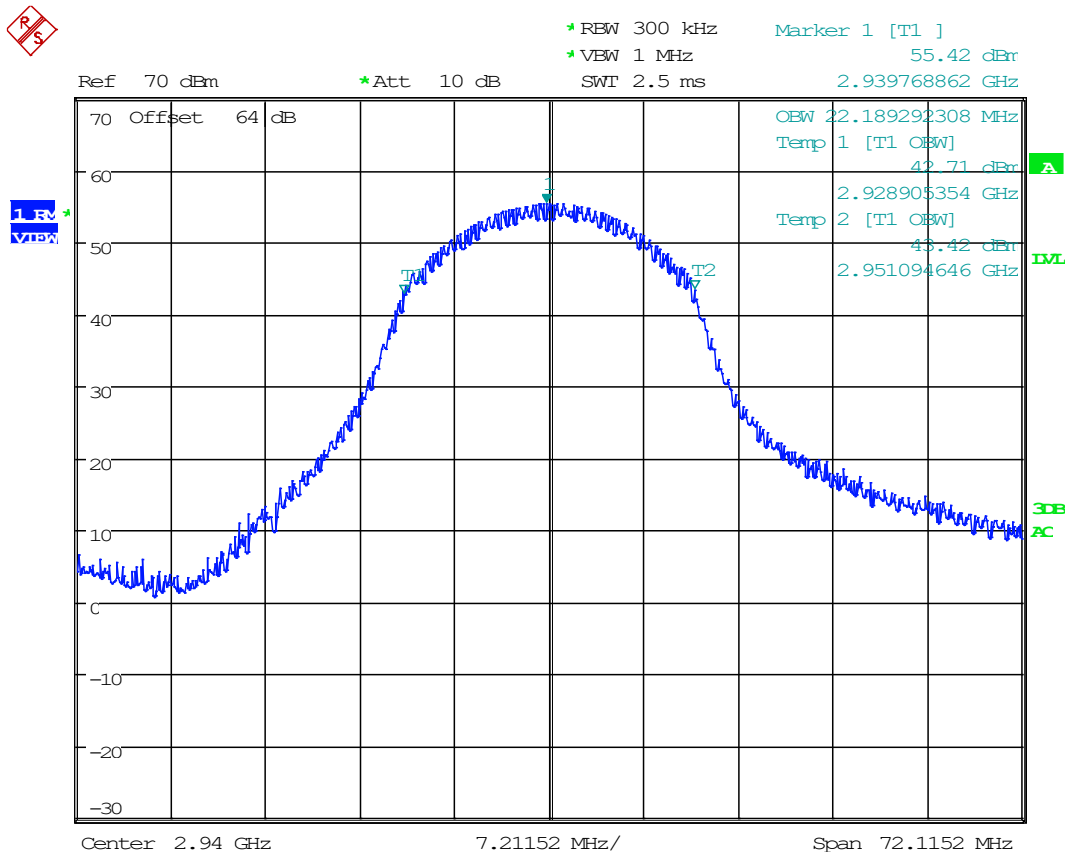
8.3.1 Bandwidth Plot, 99%, 2880 MHz



Date: 2.FEB.2003 03:47:31

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.3.1 Bandwidth Plot, 99%, 2940 MHz

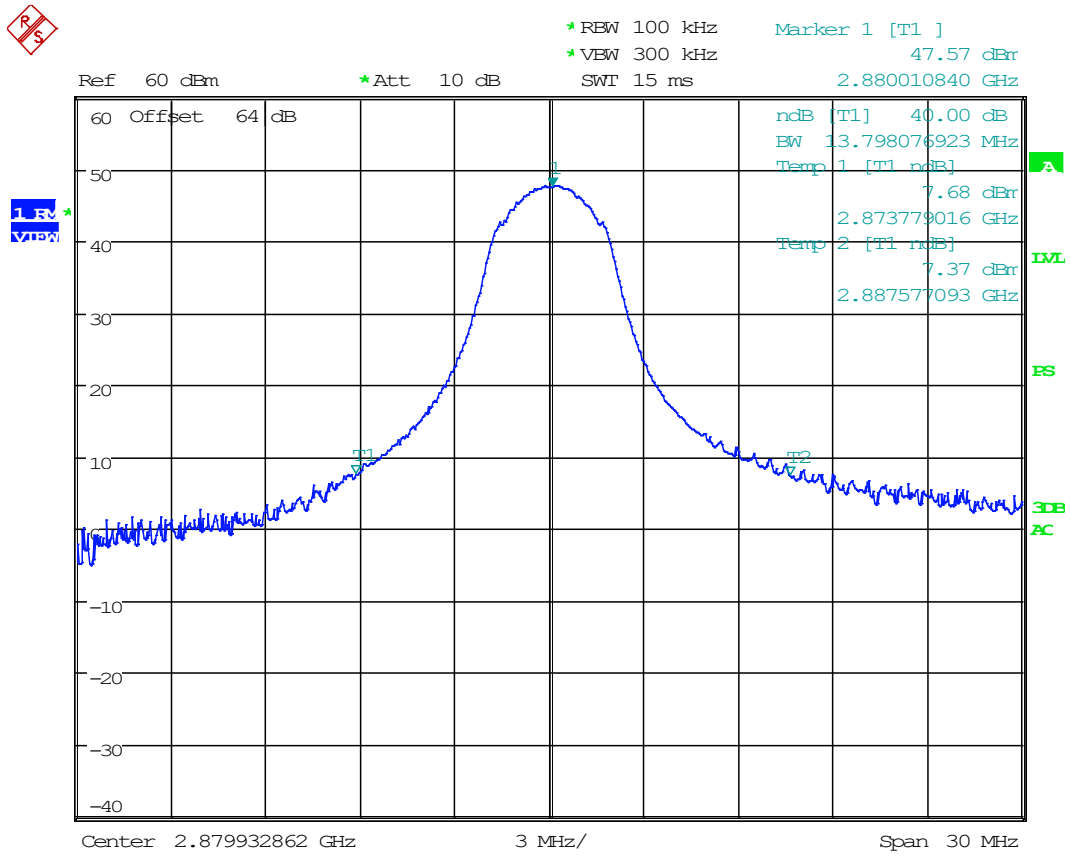


Date: 6.JAN.2003 07:23:12

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

Necessary Bandwidth, Spectrum Plots

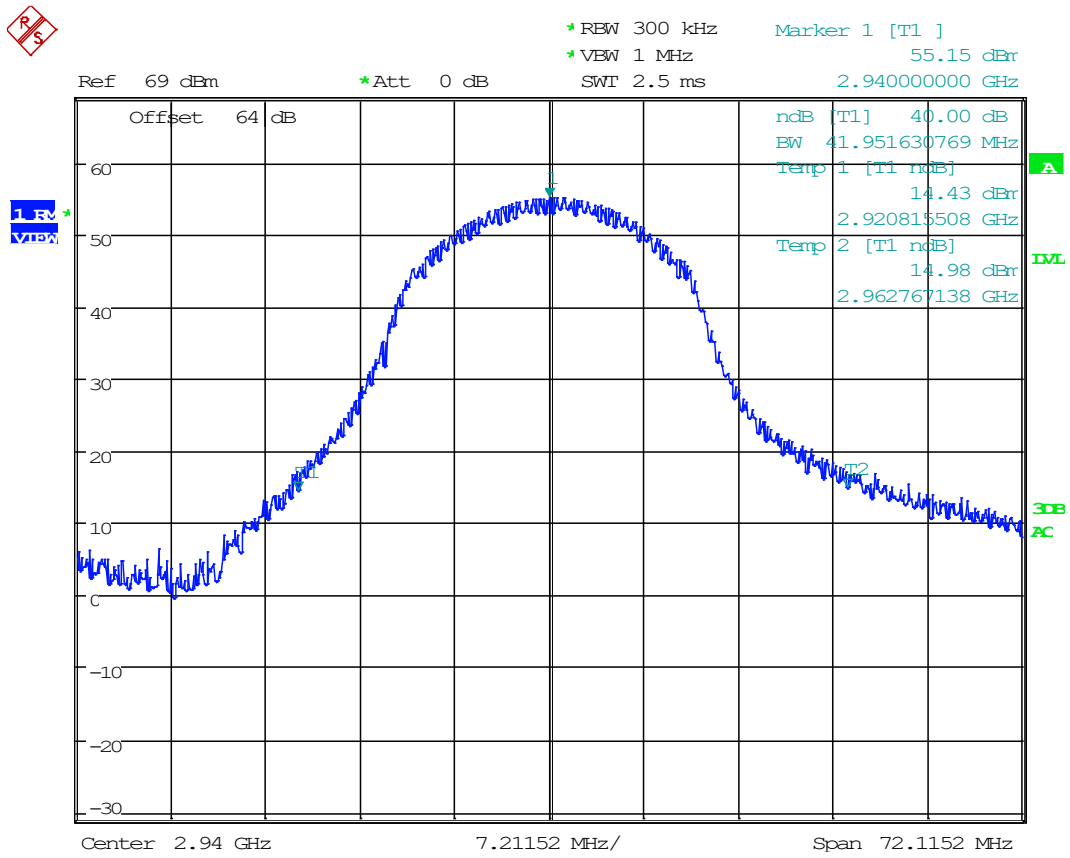
8.3.2 Bandwidth Plot, 40 dB BW, 2880 MHz



Date: 2.FEB.2003 03:50:55

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.3.1 Bandwidth Plot, 40 dB BW, 2940 MHz

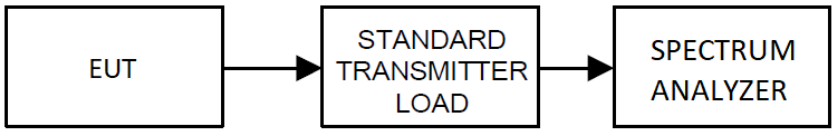


Date: 6.JAN.2003 07:24:46

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.4 Emission Limitations, In-Band

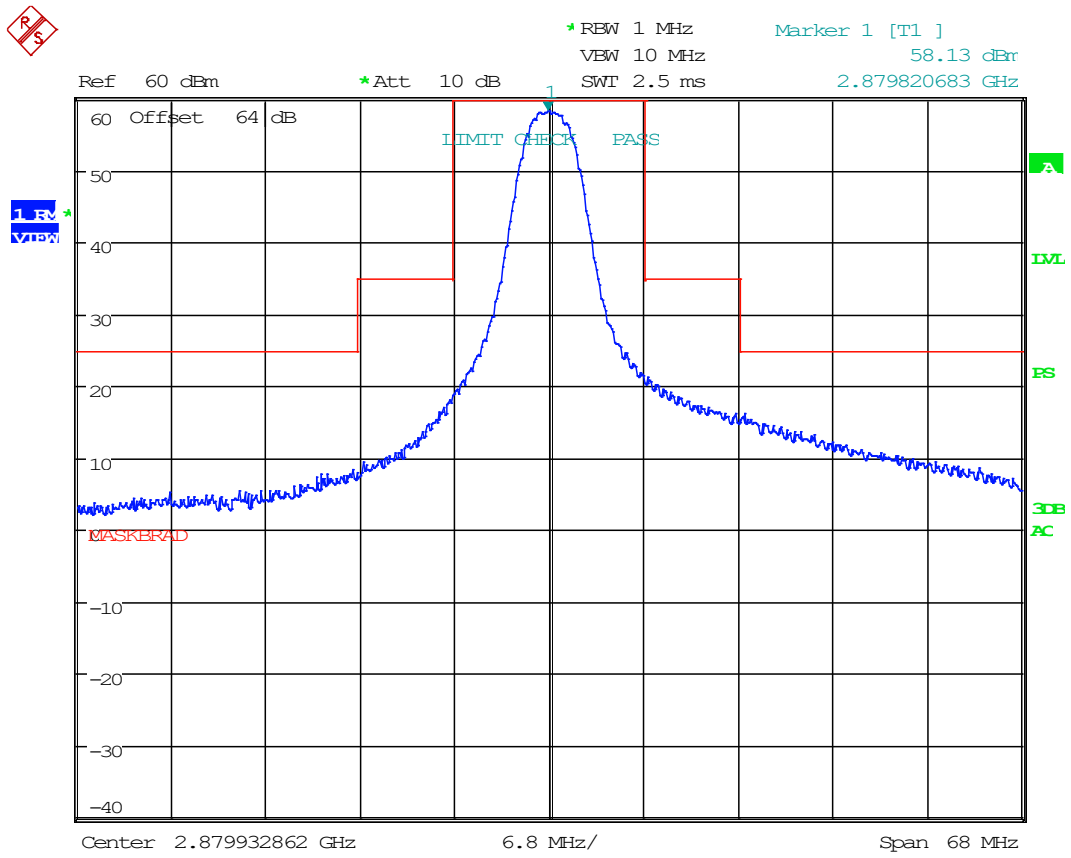
Limits from FCC Parts 80.211 (f), 87.139 (a), and 90.210 (n); and test procedure from ANSI C63.26-2015.

Conducted Test Setup


This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

Conducted Emissions Mask, Spectrum Plots

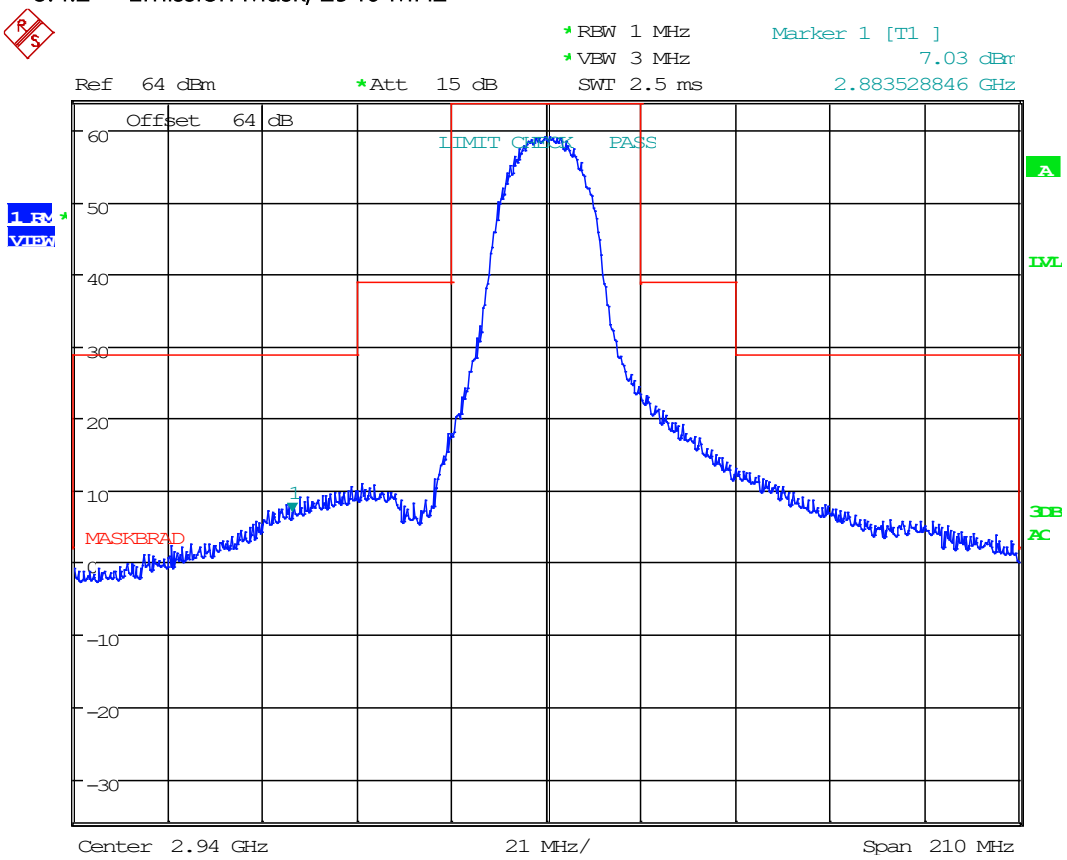
8.4.1 Emission Mask, 2880 MHz



Date: 2.FEB.2003 04:02:08

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.4.2 Emission Mask, 2940 MHz

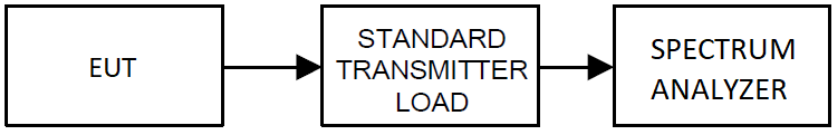


Date: 12.JAN.2003 03:06:35

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.5 Emission Limitations, Out-of-Band

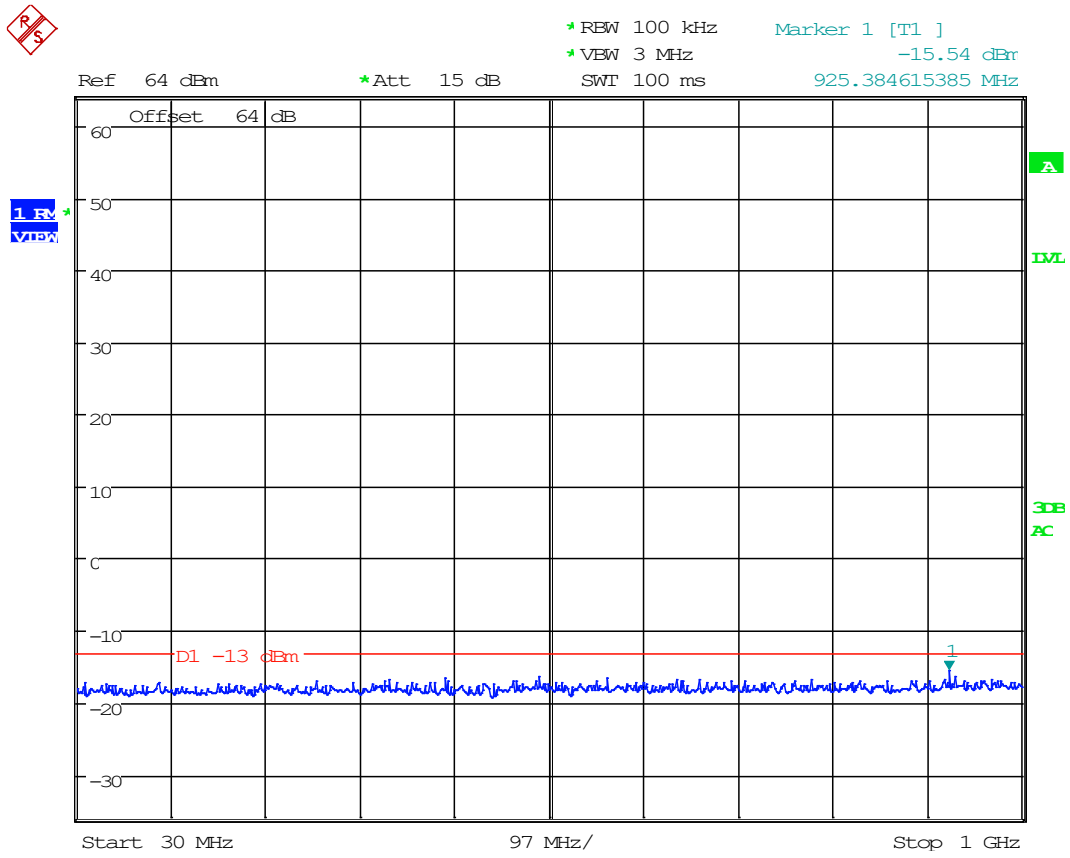
Limits from FCC Parts 2.1051, 80.211 (f), 87.139 (a), and 90.210 (n); and test procedure from ANSI C63.26-2015.

Conducted Test Setup


This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

Conducted Emissions Spectrum Plots

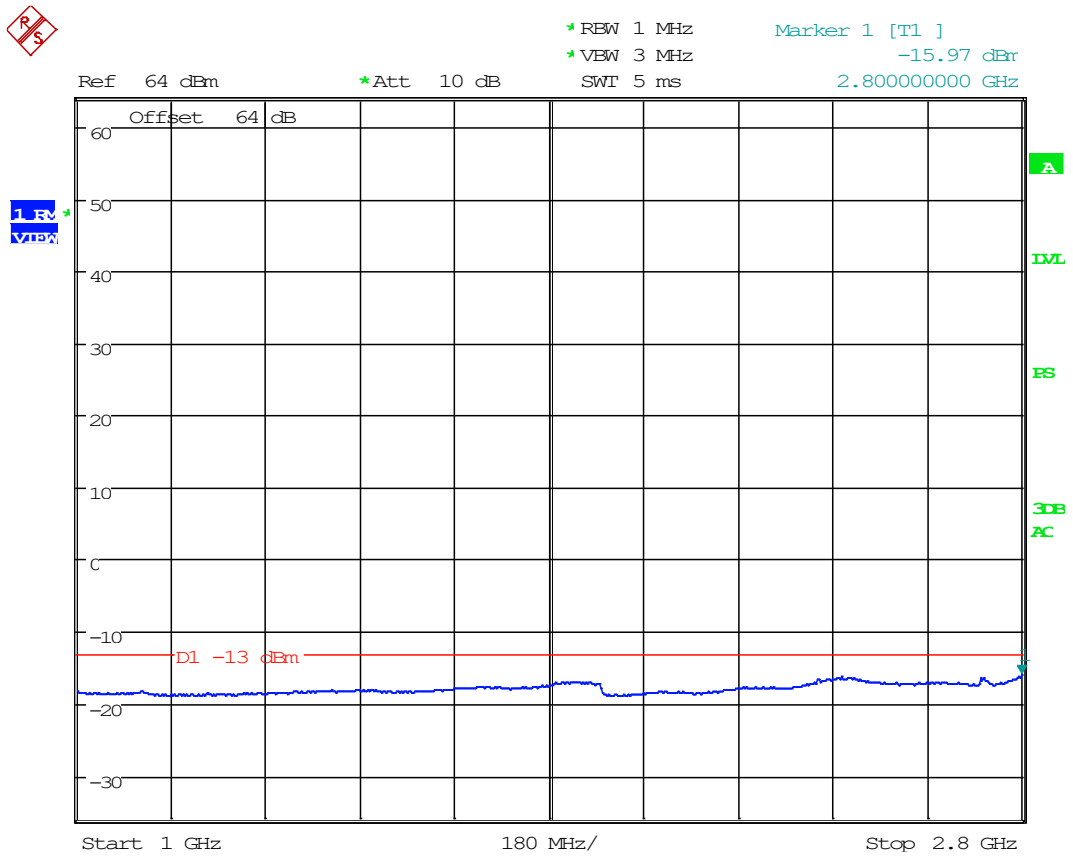
8.5.1 Conducted Emissions 30 MHz to 1 GHz, 2880 MHz



Date: 12.JAN.2003 03:34:56

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

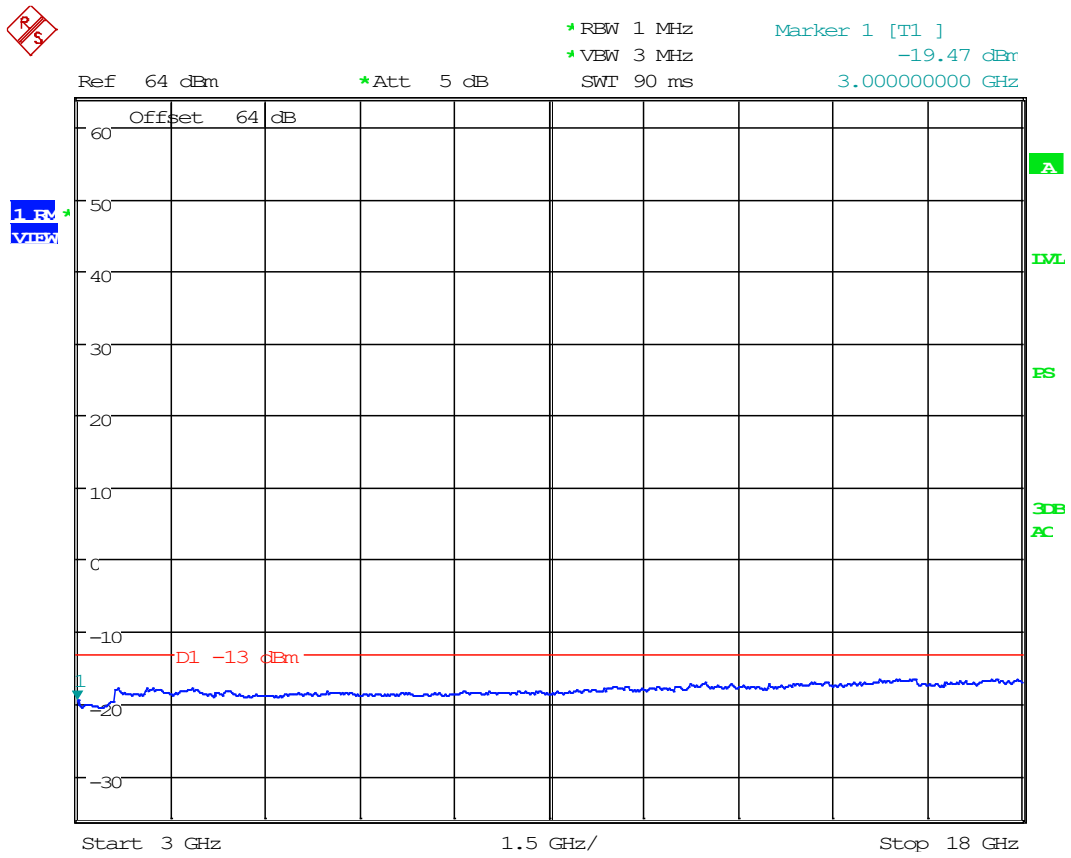
8.5.1 Conducted Emissions 1 GHz to Band Edge, 2880 MHz



Date: 12.JAN.2003 03:37:07

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

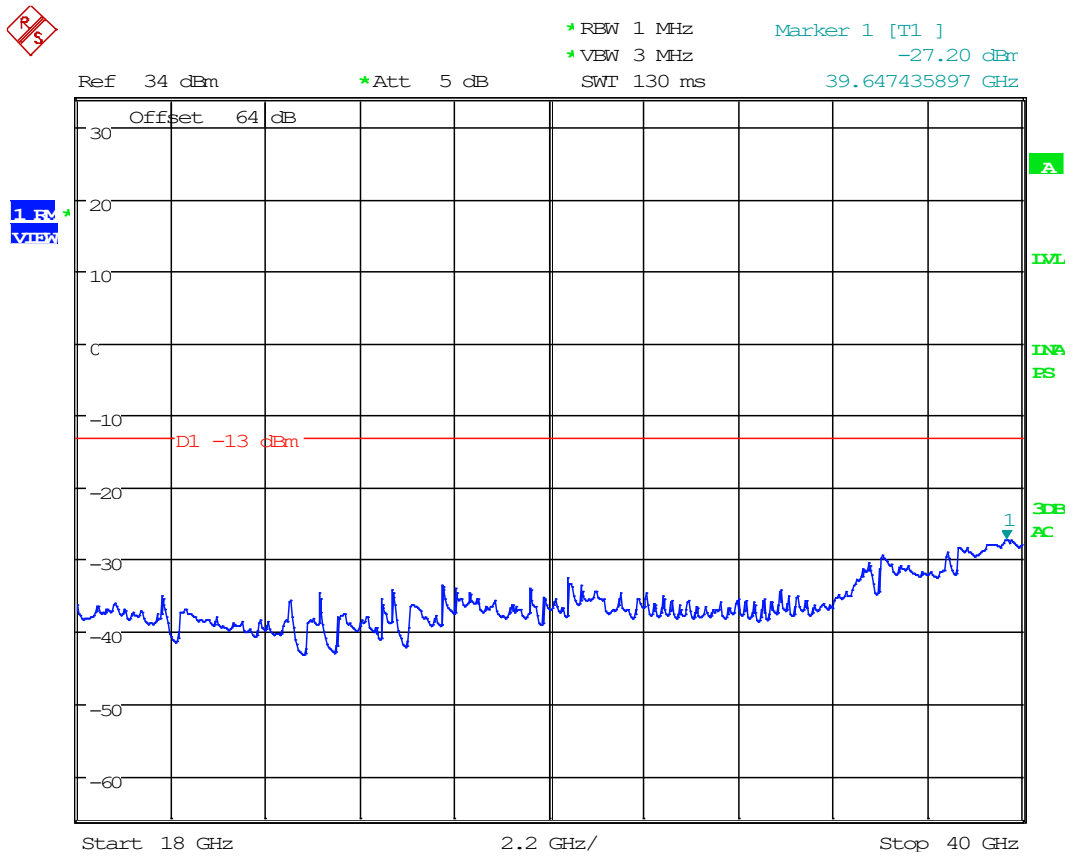
8.5.1 Conducted Emissions Above fundamental to 26GHz, 2880 MHz



Date: 12.JAN.2003 03:39:50

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

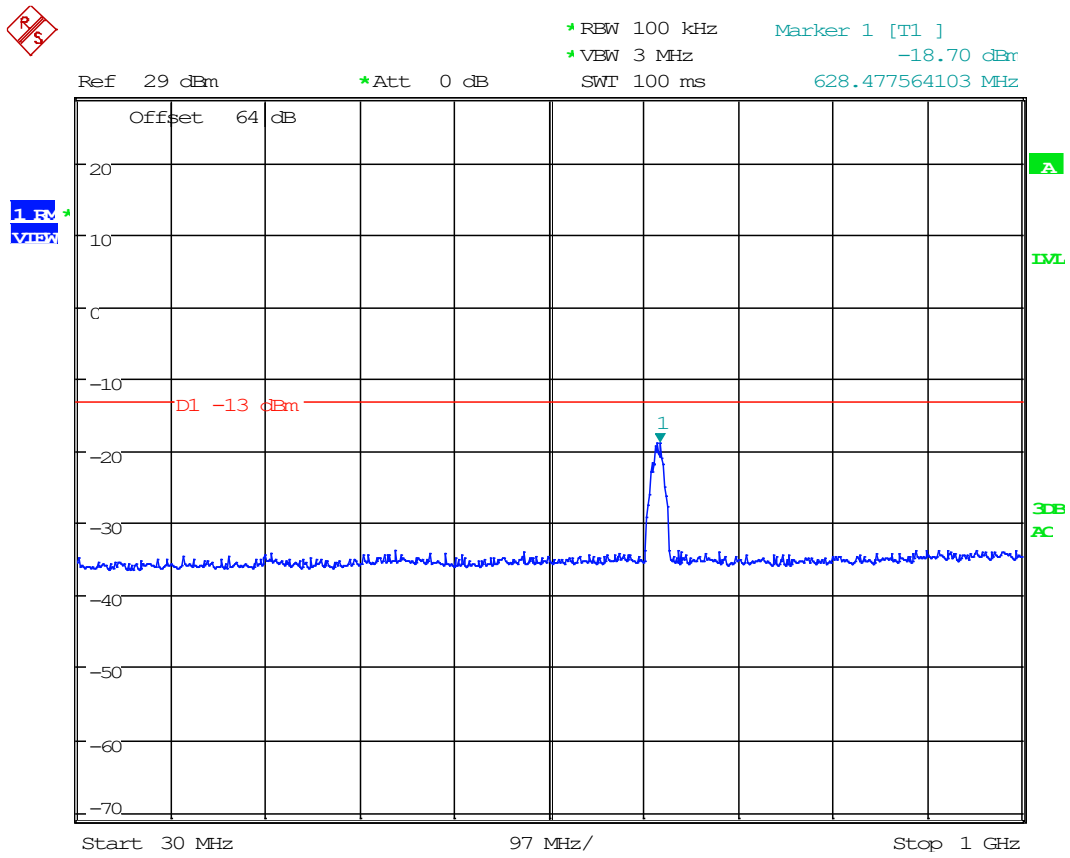
8.5.1 Conducted Emissions 26GHz to 40GHz, 2880 MHz



Date: 12.JAN.2003 03:41:29

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

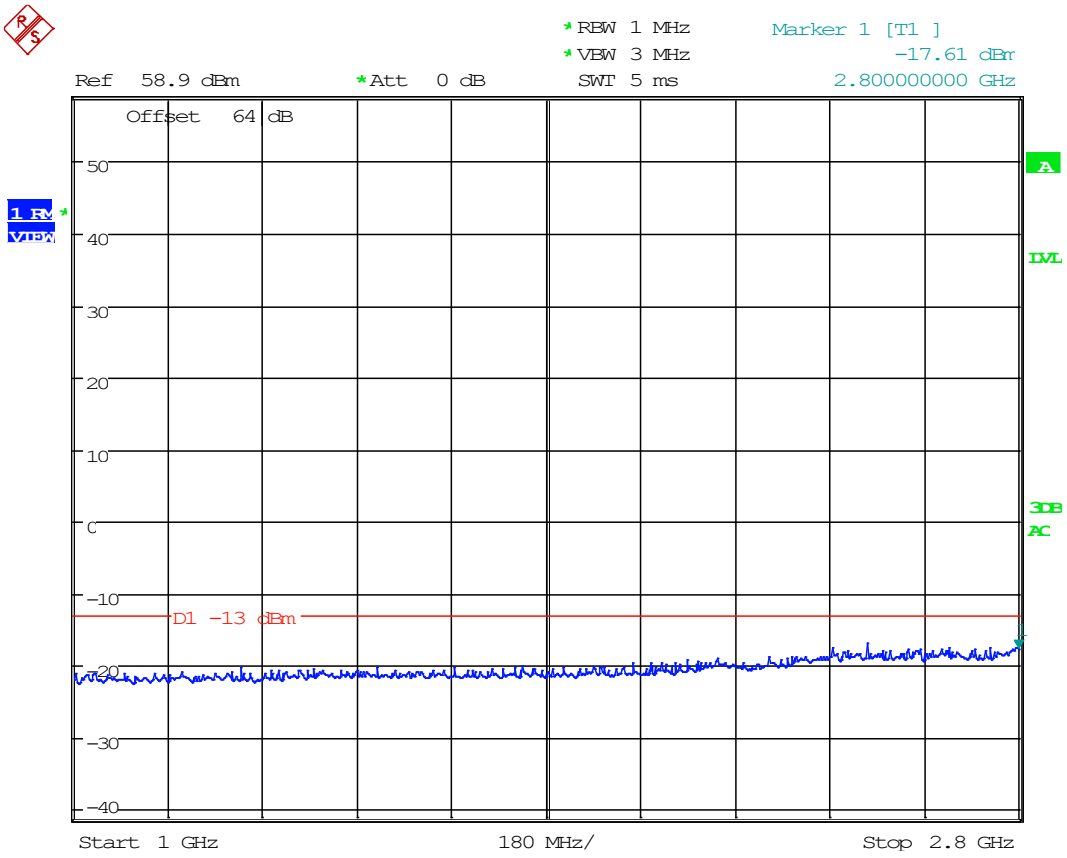
8.5.2 Conducted Emissions 30 MHz to 1 GHz, 2940 MHz



Date: 7.JAN.2003 00:26:42

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

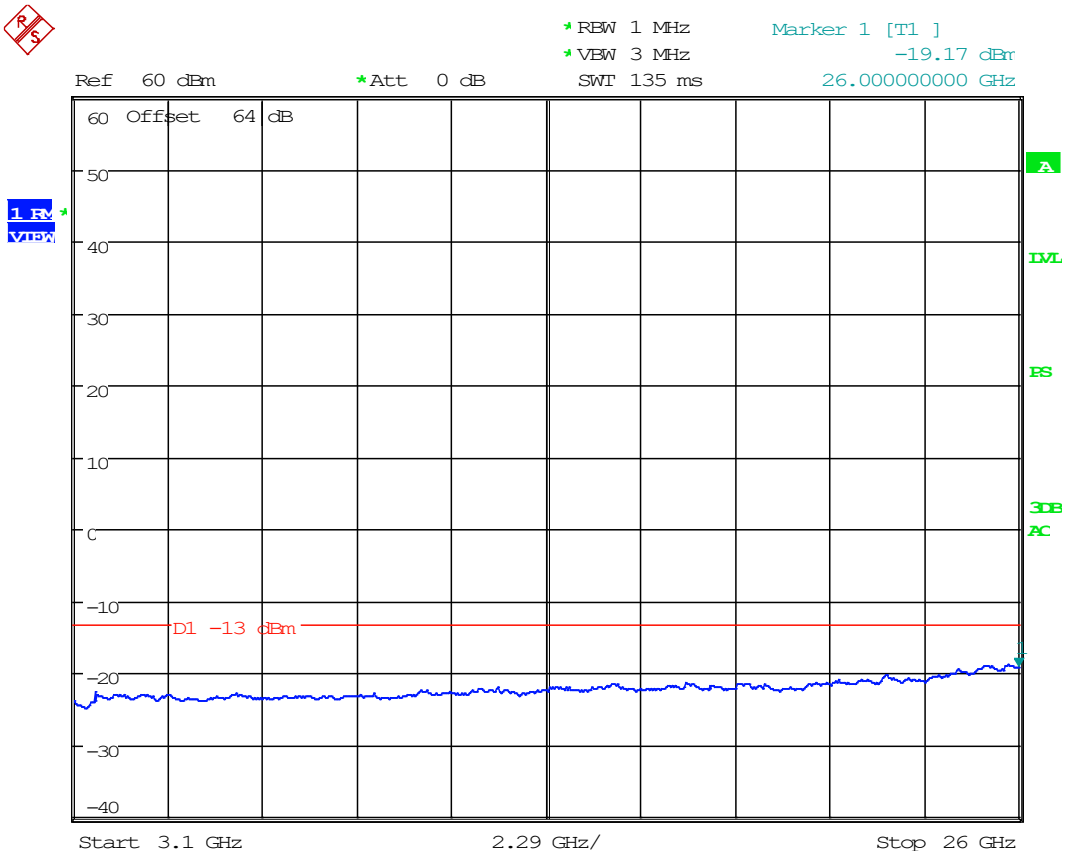
8.5.3 Conducted Emissions 1 GHz to Band Edge, 2940 MHz



Date: 6.JAN.2003 07:49:15

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

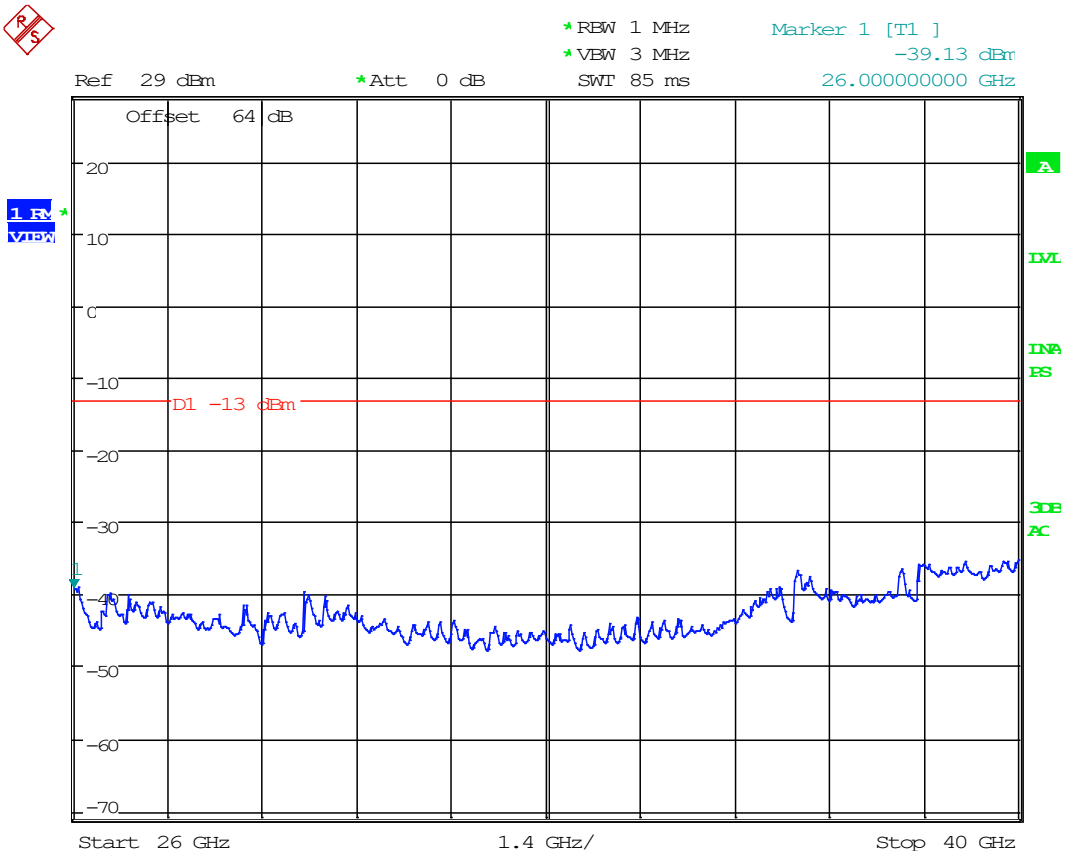
8.5.4 Conducted Emissions Above fundamental to 26GHz, 2940 MHz



Date: 6.JAN.2003 07:51:02

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.5.5 Conducted Emissions 26GHz to 40GHz, 2940 MHz

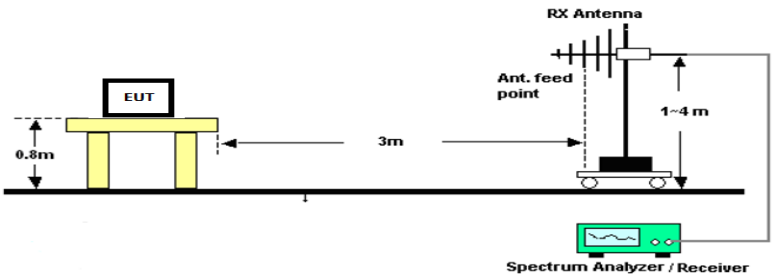


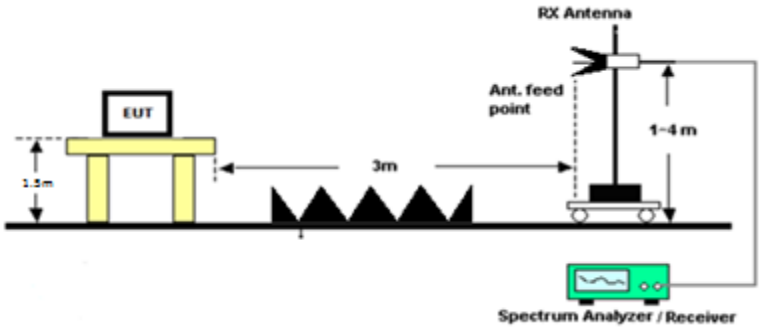
Date: 6.JAN.2003 07:53:06

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.6 Radiated Emissions

Limits from FCC Parts 2.1053, 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


This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

Radiated Emissions, Tabular Data

8.6.1 Radiated Emissions, 2880 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 (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
2883.00	5766.00	PK	9.71	H	8.22	35.00	3.00	52.93	-44.45	-13.00	
2883.00	5766.00	PK	11.10	V	8.22	35.00	3.00	54.32	-43.06	-13.00	30.06
2883.00	8649.00	PK	10.34	H	10.32	36.02	3.00	56.69	-40.69	-13.00	27.69
2883.00	8649.00	PK	9.34	V	10.32	36.02	3.00	55.69	-41.69	-13.00	28.69
2883.00	11532.00	PK	10.05	H	12.29	38.96	3.00	61.30	-36.08	-13.00	23.08
2883.00	11532.00	PK	11.37	V	12.29	38.96	3.00	62.62	-34.76	-13.00	21.76
2883.00	14415.00	PK	10.28	H	13.35	40.27	3.00	63.89	-33.48	-13.00	20.48
2883.00	14415.00	PK	10.93	V	13.35	40.27	3.00	64.54	-32.83	-13.00	19.83
2883.00	17298.00	PK	10.14	H	14.82	42.31	3.00	67.27	-30.11	-13.00	17.11
2883.00	17298.00	PK	10.20	V	14.82	42.31	3.00	67.33	-30.05	-13.00	17.05
2883.00	20181.00	PK	10.15	H	16.24	41.75	3.00	68.14	-29.23	-13.00	16.23
2883.00	20181.00	PK	11.62	V	16.24	41.75	3.00	69.62	-27.76	-13.00	14.76
2883.00	23064.00	PK	12.11	H	17.67	36.09	3.00	65.87	-31.50	-13.00	18.50
2883.00	23064.00	PK	12.42	V	17.67	36.09	3.00	66.18	-31.19	-13.00	18.19
2883.00	25947.00	PK	12.05	H	18.20	28.28	3.00	58.53	-38.85	-13.00	25.85
2883.00	25947.00	PK	12.60	V	18.20	28.28	3.00	59.08	-38.30	-13.00	25.30
2883.00	28830.00	PK	5.18	H	19.63	57.36	3.00	82.17	-15.21	-13.00	2.21
2883.00	28830.00	PK	3.86	V	19.63	57.36	3.00	80.85	-16.53	-13.00	3.53

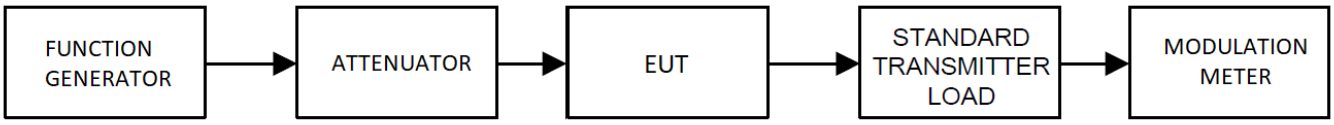
8.6.1 Radiated Emissions, 2940 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
2940.00	5880.00	PK	40.47	H	8.43	35.00	3.00	83.89	-13.48	-13.00	
2940.00	5880.00	PK	37.46	V	8.43	35.00	3.00	80.88	-16.49	-13.00	3.49
2940.00	8820.00	PK	37.45	H	10.74	36.02	3.00	84.22	-13.16	-13.00	0.16
2940.00	8820.00	PK	33.64	V	10.74	36.02	3.00	80.41	-16.97	-13.00	3.97
2940.00	11760.00	PK	33.15	H	12.11	38.96	3.00	84.22	-13.15	-13.00	0.15
2940.00	11760.00	PK	33.27	V	12.11	38.96	3.00	84.34	-13.03	-13.00	0.03
2940.00	14700.00	PK	22.23	H	13.40	40.27	3.00	75.89	-21.48	-13.00	8.48
2940.00	14700.00	PK	28.52	V	13.40	40.27	3.00	82.18	-15.19	-13.00	2.19
2940.00	17640.00	PK	10.77	H	14.61	42.31	3.00	67.69	-29.68	-13.00	16.68
2940.00	17640.00	PK	10.80	V	14.61	42.31	4.00	67.72	-27.15	-13.00	14.15
2940.00	20580.00	PK	12.00	H	16.31	41.75	5.00	70.06	-22.88	-13.00	9.88
2940.00	20580.00	PK	10.57	V	16.31	41.75	6.00	68.63	-22.72	-13.00	9.72
2940.00	23520.00	PK	11.33	H	17.14	36.09	7.00	64.56	-25.46	-13.00	12.46
2940.00	23520.00	PK	12.48	V	17.14	36.09	8.00	65.71	-23.15	-13.00	10.15
2940.00	26460.00	PK	13.70	H	18.31	28.28	9.00	60.29	-27.55	-13.00	14.55
2940.00	26460.00	PK	13.84	V	18.31	28.28	10.00	60.43	-26.49	-13.00	13.49
2940.00	29400.00	PK	4.32	H	19.22	57.36	3.00	80.90	-16.48	-13.00	3.48
2940.00	29400.00	PK	4.61	V	19.22	57.36	4.00	81.19	-13.69	-13.00	0.69

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.7 Modulation Characteristics

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

Conducted Test Setup


FCC 80.213(g) – Device is allowed any modulation type.

FCC 87.141 – n/a. Part 87 does not provide guidance concerning the modulation of this EUT.

8.7.1 Audio Frequency Response

N/A. Device does not carry Audio.

8.7.2 Low Pass Filter Response

N/A. Device does not carry Audio.

8.7.3 Modulation Limiting

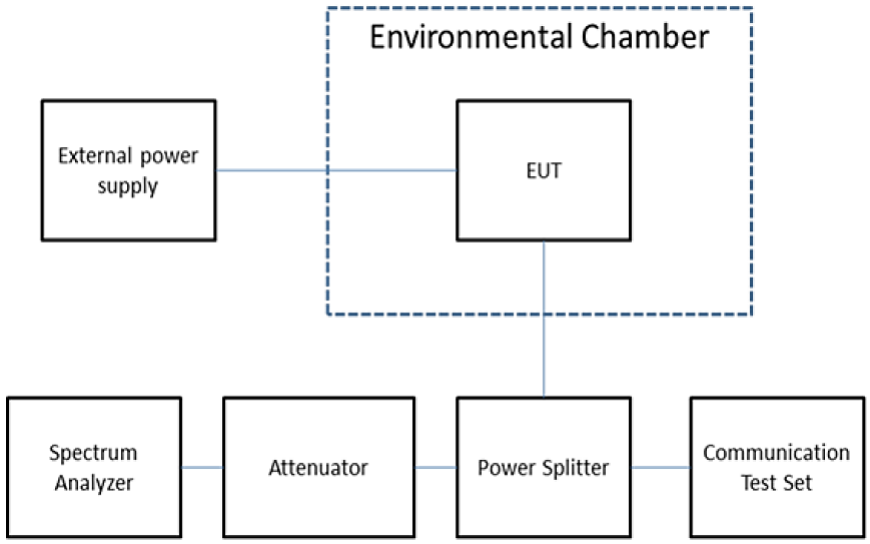
N/A. Device does not need to limit modulation.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.8 Frequency Stability

Limits from FCC Parts 2.1055, 80.209 (c), 87.133 (a) (8), and 90.213 (a) footnote 10; and test procedure from ANSI C63.26-2015.

Test Setup



Test Results, Mode 1

Tuned Frequency (MHz)	Max Deviation (ppm)	Limit (ppm)
2880	0	1250
2940	0	1250

Note: This EUT is designed to operate within FCC Parts 80, 87, 90, and in accordance with ISED RSS-238. Therefore, in lieu of FCC Part 90 unspecified stability limit, the EUT shall meet Frequency Stability limits from the appropriate standards (1250 ppm).

Note: The frequency determining element is the same component for both low and high ranges. The Frequency Stability testing was not repeated for both bands.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

Frequency Stability, Tabular Data

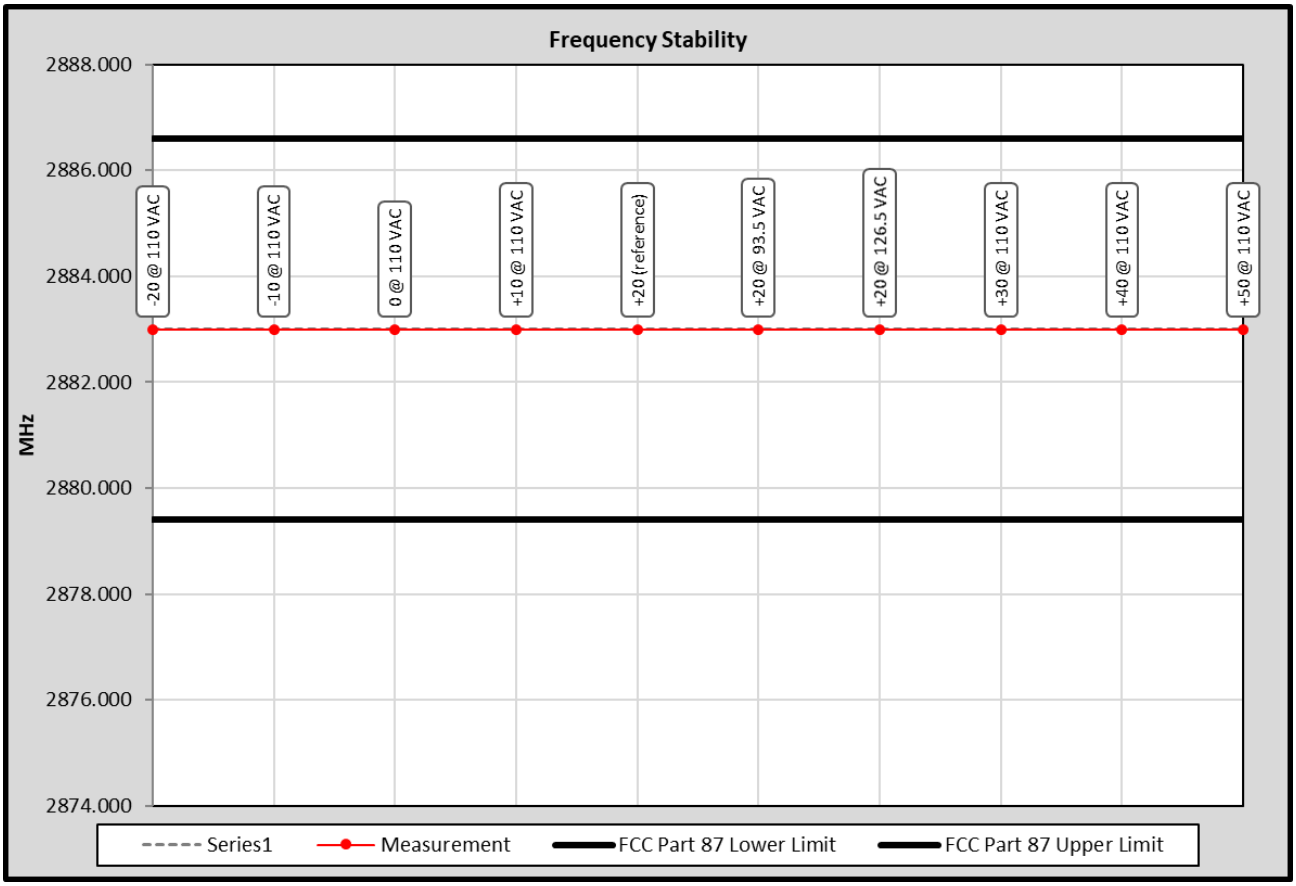
8.8.1 Frequency Stability Data, 2880 MHz

FCC Part 87 Limit		1250.0	ppm
FCC Part 87 Limit		3603750.000	Hz
FCC Part 87 Lower Limit		2879.396250	MHz
FCC Part 87 Upper Limit		2886.603750	MHz
Rated Supply Voltage		110.0	◉ AC ○ DC
Temperature / Voltage Variation			
Temperature (°C)	**Supplied Voltage (V)**	**Frequency (MHz)**	**Deviation (kHz)**
-20	110.0	2883.0000004	0.000
-10	110.0	2883.0000000	0.000
0	110.0	2883.0000000	0.000
+10	110.0	2883.0000000	0.000
+20 (reference)	110.0	2883.0000000	0.000
+20	93.5	2883.0000000	0.000
+20	126.5	2883.0000000	0.000
+30	110.0	2883.0000000	0.000
+40	110.0	2883.0000000	0.000
+50	110.0	2883.0000000	0.000

Note: The EUT's built-in power supply is designed to run stable and eliminated voltage differences from AC Mains. Input voltage variation was found to have no effect on the result.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.8.2 Frequency Stability Plot, 2880 MHz



This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

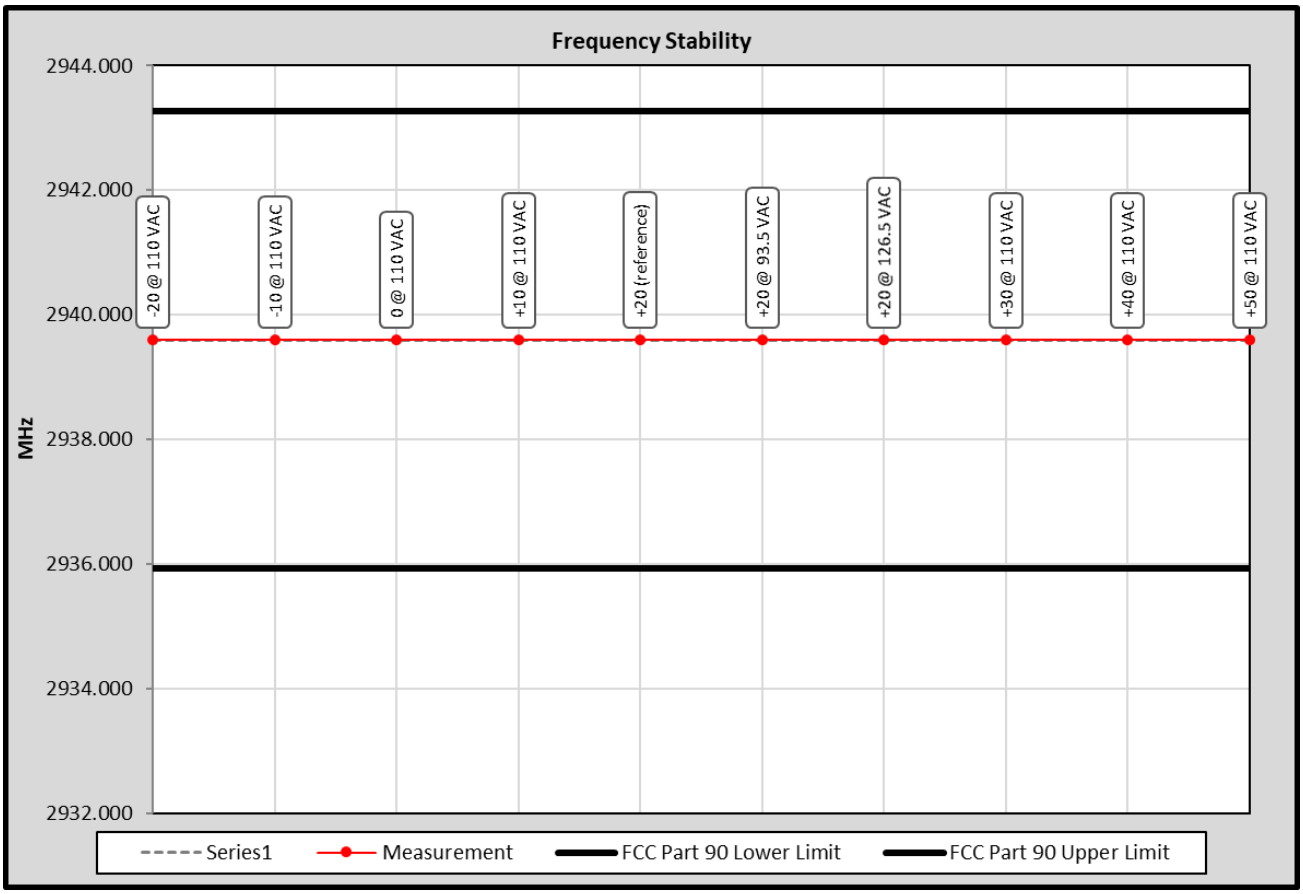
8.8.1 Frequency Stability Data, 2940 MHz

FCC Part 90 Limit	1250.0	ppm	
FCC Part 90 Limit	3674495.192	Hz	
FCC Part 90 Lower Limit	2935.921658	MHz	
FCC Part 90 Upper Limit	2943.270649	MHz	
Rated Supply Voltage	110.0	◉ AC ○ DC	
Temperature / Voltage Variation			
Temperature (°C)	**Supplied Voltage (V)**	**Frequency (MHz)**	**Deviation (kHz)**
-20	110.0	2939.5961538	0.000
-10	110.0	2939.5961534	0.000
0	110.0	2939.5961534	0.000
+10	110.0	2939.5961534	0.000
+20 (reference)	110.0	2939.5961534	0.000
+20	93.5	2939.5961534	0.000
+20	126.5	2939.5961534	0.000
+30	110.0	2939.5961534	0.000
+40	110.0	2939.5961534	0.000
+50	110.0	2939.5961534	0.000

Note: The EUT's built-in power supply is designed to run stable and eliminated voltage differences from AC Mains. Input voltage variation was found to have no effect on the result.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.8.2 Frequency Stability Plot, 2940 MHz

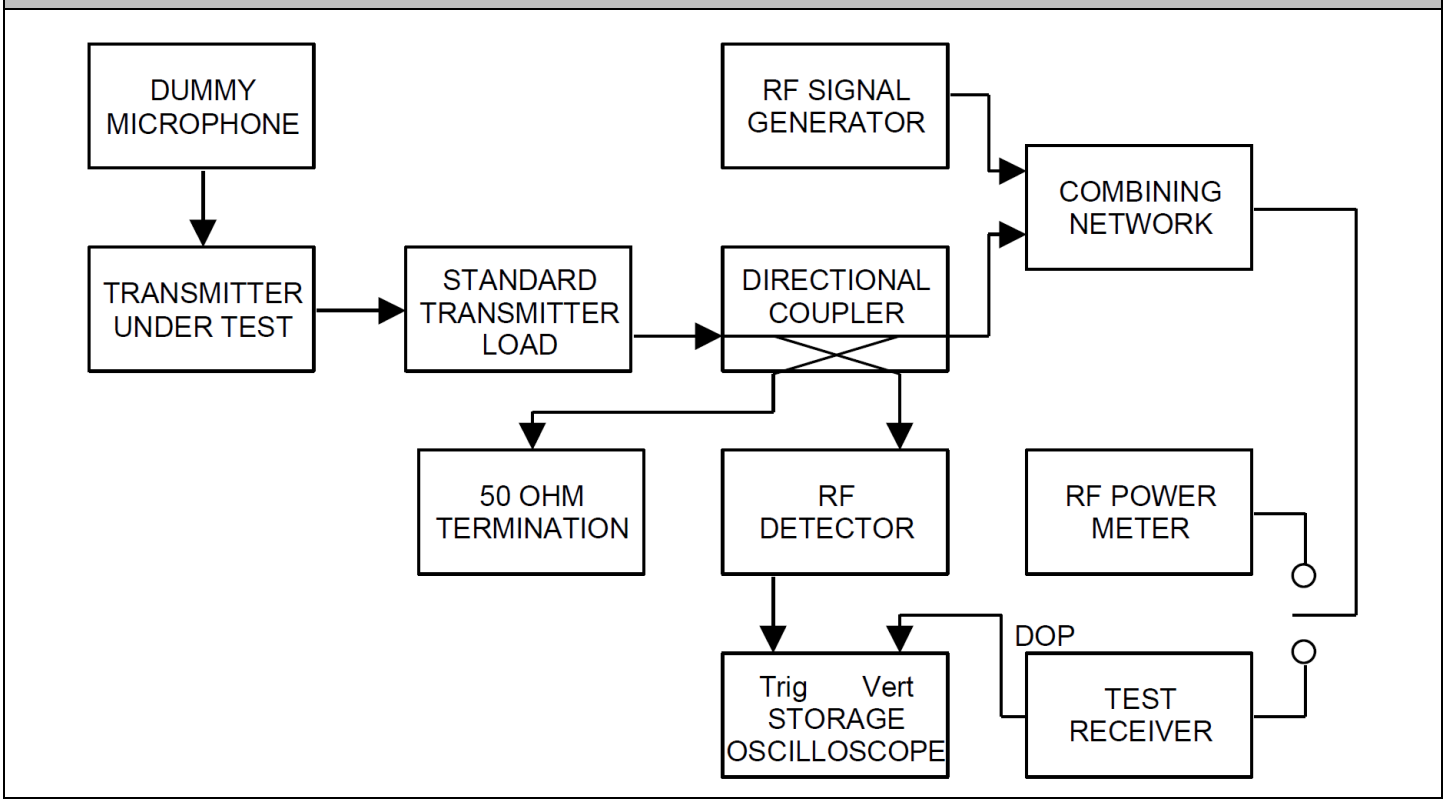


This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.9 Transient Frequency Behavior

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

Conducted Test Setup

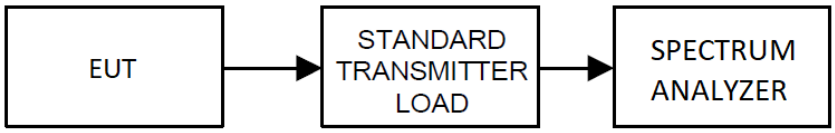


N/A. Device does not operate in a band requiring TFR measurement.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

8.10 Adjacent channel power limits

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

Conducted Test Setup


N/A. Device does not operate in a band requiring ACP measurement.

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

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_2195-21_FCC_PT87-90_1	1	Initial release	6/16/2021
	2	Clerical update	6/23/2021
	3	Clerical update	6/25/2021
	4	Emission Designator updates	6/25/2021

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).

END OF TEST REPORT

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA).