



FCC CFR 47 Part 22 E Test Report

APPLICANT	STANDARD COMMUNICATIONS PTY.LTD.
ADDRESS	17 GIBBON ROAD WINSTON HILLS NSW 2153 AUSTRALIA
FCC ID	TXJCM60V25
MODEL NUMBER	CM60-V25B, CM60-V25D, CM60-V25L, CM60-V25P, CM60-V25R, CM60-V25S
PRODUCT DESCRIPTION	VHF TRANSCEIVER
DATE SAMPLE RECEIVED	4/9/2018
FINAL TEST DATE	4/16/2018
TESTED BY	Franklin Rose
APPROVED BY	Tim Royer
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

Report Number	Report Version	Description	Issue Date
477CUT18 PT22_TestReport_	Rev1	Initial Issue	04/16/2018
477CUT18 PT22_TestReport_	Rev2	Clerical Updates	05/30/2018
477CUT18 PT22_TestReport_	Rev3	Updated Model Numbers and Emission Designator	11/06/2018
477CUT18 PT22_TestReport_	Rev4	Updated Address	12/28/2018

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.

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GENERAL REMARKS

Summary

The device under test does:

- ☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.
- ☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669
Designation #: US1070

Tested by:



Name and Title	Franklin Rose, Project Manager / EMC Testing Technician
Date	04/26/2018

Reviewed and Approved by:



Name and Title	Tim Royer, Project Manager / EMC Testing Engineer
Date	04/26/2018

GENERAL INFORMATION

EUT Specification

EUT Description	VHF TRANSCEIVER
FCC ID	TXJCM60V25
Model Number	CM60-V25B, CM60-V25D, CM60-V25L, CM60-V25P, CM60-V25R, CM60-V25S
Operating Frequency	Band 1: 150.8 – 152.855 Band 2: 157.45 – 161.775 MHz
Test Frequencies	Band 1: 150.8075, 152.8475 MHz Band 2: 157.4575, 161.7675 MHz
Type of Emission	11K2F3E (Narrowband Analog FM Voice), 8K10F1E (P25 Phase I C4FM Voice), 8K10F1D (P25 Phase I C4FM Data)
Modulation	FM
EUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz
	<input checked="" type="checkbox"/> DC Power (13.8 V)
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Antenna Connector	BNC
Test Conditions	The temperature was 26°C Relative humidity of 50%.
Modification to the EUT	No Modification to EUT.
Test Exercise	The EUT was placed in continuous transmit and was operated in “Test Mode” for digital emissions tests.
Applicable Standards	ANSI/TIA 603-E:2016, ANSI C63.26, FCC CFR 47 Part 2, Part 22, using FCC CFR 47 Part 90 for reference
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070

RESULTS SUMMARY

Rule Part No.	Test Item	Results
2.1046(a), 22.535(a),(b), 22.565(f), 22.593	RF Power Output	PASS
Part 2.1033(c)(4)	Modulation Characteristics	PASS
2.1047(a)	Audio Frequency Response and Low Filter	PASS
2.1047(b)	Modulation Limiting	PASS
2.1049 (c)	Occupied Bandwidth	PASS
2.1051(a), 22.359(a)	Spurious Emissions at Antenna Terminals	PASS
2.1053(a), 22.359(a)	Field Strength of Spurious Emissions	PASS
2.1055(a)(2), 22.355	Frequency Stability < 5 ppm	PASS

RF POWER OUTPUT

FCC Rule Parts: FCC Part 2.1046(a), 22.535(a),(b), 22.565(f), 22.593

The effective radiated power (ERP) of transmitters operating on the channels listed in §22.531 must not exceed the limits in this section.

(a) *Maximum ERP.* The ERP must not exceed the applicable limits in this paragraph under any circumstances.

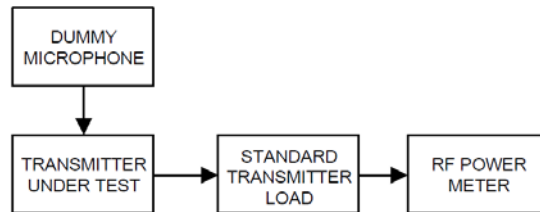
Frequency range (MHz)	Maximum ERP (Watts)
152-159	1400

(b) *Basic power limit.* Except as provided in paragraph (d) of this section, the ERP of transmitters on the VHF channels must not exceed 500 Watts.

The effective radiated power of fixed stations operating on the channels listed in §22.591 must not exceed 150 Watts. The equivalent isotropically radiated power of existing fixed microwave stations (2110-2130 and 2160-2180 MHz) licensed under this part (pursuant to former rules) must not exceed the applicable limits set forth in §101.113 of this chapter.

(f) *Mobile transmitters.* The transmitter output power of mobile transmitters must not exceed 60 watts.

Method of Measurement: TIA-603-E, 2.2.1



Test Data: Power Measurement Table

Peak Power Output						
Tx Power Level	dBm	Watts	Max Rated Antenna Gain (dBi)	EIRP (dBm)	ERP (dBm)	ERP (W)
High	43.81	24.04	5.15	48.96	46.81	47.97
Med	39.84	9.64	5.15	44.99	42.84	19.23
Low	30.02	1.00	5.15	35.17	33.02	2.00

Part 2.1033 (c)(8) DC Input into Final Amplifier

INPUT POWER: (13.8 V) (6.0 A) = **82.8 Watts**

Result: Meets Requirements

MODULATION CHARACTERISTICS

FCC Rule Parts: Part 2.1033(c)(4)

11K2F3E (Narrowband Analog FM Voice) Bandwidth

$$\begin{aligned} B_n &= 2M + 2Dk \\ B_n &= (2 \times 3) + (2 \times 2.5) = 11.0 \text{ kHz} \end{aligned}$$

Where:

$$\begin{aligned} f_m &= \text{modulating frequency, kHz} \\ f_d &= \text{deviation, kHz} \\ k &= \text{constant} (= 1) \end{aligned}$$

Necessary Bandwidth for 11K2F3E = **11.0 kHz**

90. 209(b)(5) Authorized Bandwidth for 11K2F3E = **11.25 kHz**

8K10F1E/F1D (C4FM Voice/Data) Bandwidth

$$\begin{aligned} B_n &= (R/\log_2 S) + 2DK \\ B_n &= (9600/\log_2(4)) + 2(1800)(0.916) \\ B_n &= 4800 + 3298 \\ B_n &= 8.10 \text{ kHz} \end{aligned}$$

Where:

$$\begin{aligned} R &(\text{data rate}) = 9600 \text{ bps} \\ D &(\text{peak deviation}) = 1800 \text{ Hz} \\ S &(\text{symbols}) = 4 \\ K &(\text{constant}) = 0.916 \end{aligned}$$

Necessary Bandwidth for 8K10F1E/F1D = **8.10 kHz**

90. 209(b)(5) Authorized Bandwidth for 8K10F1E/F1D = **11.25 kHz**

Note: This device is intended for operation also under FCC CFR 47 Part 90. Part 22 E "One-way or Two-way Mobile Operation" does not provide a bandwidth limitation, so Part 90 bandwidth limitations have been shown in this test report.

Result: Meets Requirements

AUDIO FREQUENCY RESPONSE & LOW PASS FILTER

Rule Part No.: 2.1047(a)

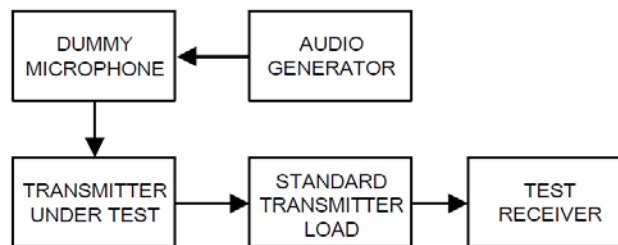
Requirements:

(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

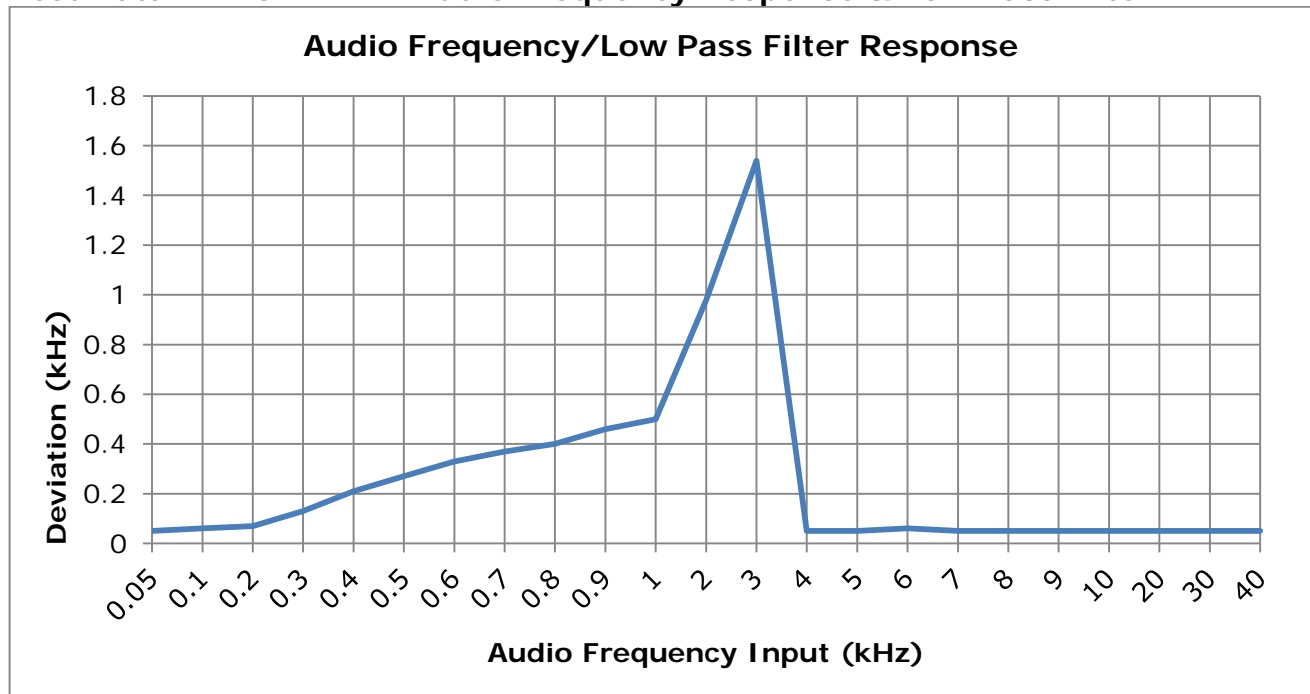
Test Procedure: TIA 603-E, 2.2.6.2.2, 2.2.15 (Using the Test Setup from section 2.2.6)

Note: The Low Pass Filter is digital, and has no "input" or "output" as found in the method of measurement, above. Testing has been altered accordingly to show the operation of the filter.

Note: Testing deviates from TIA 603-E 2.2.6.2.2 and 2.2.15. The Audio Frequency Response and Low Pass Filter Response plot data has been taken simultaneously using the Modulation Meter reading of Deviation (kHz), satisfying the requirements above.



Test Data: 12.5 kHz FM Audio Frequency Response & Low Pass Filter



MODULATION LIMITING

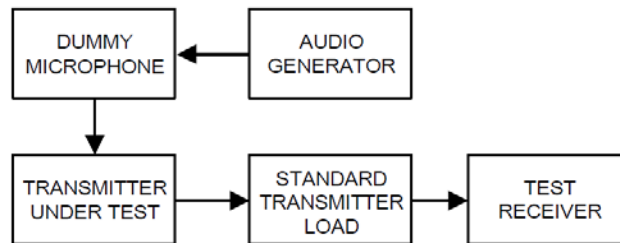
Rule Part No.: 2.1047(b)

Requirements:

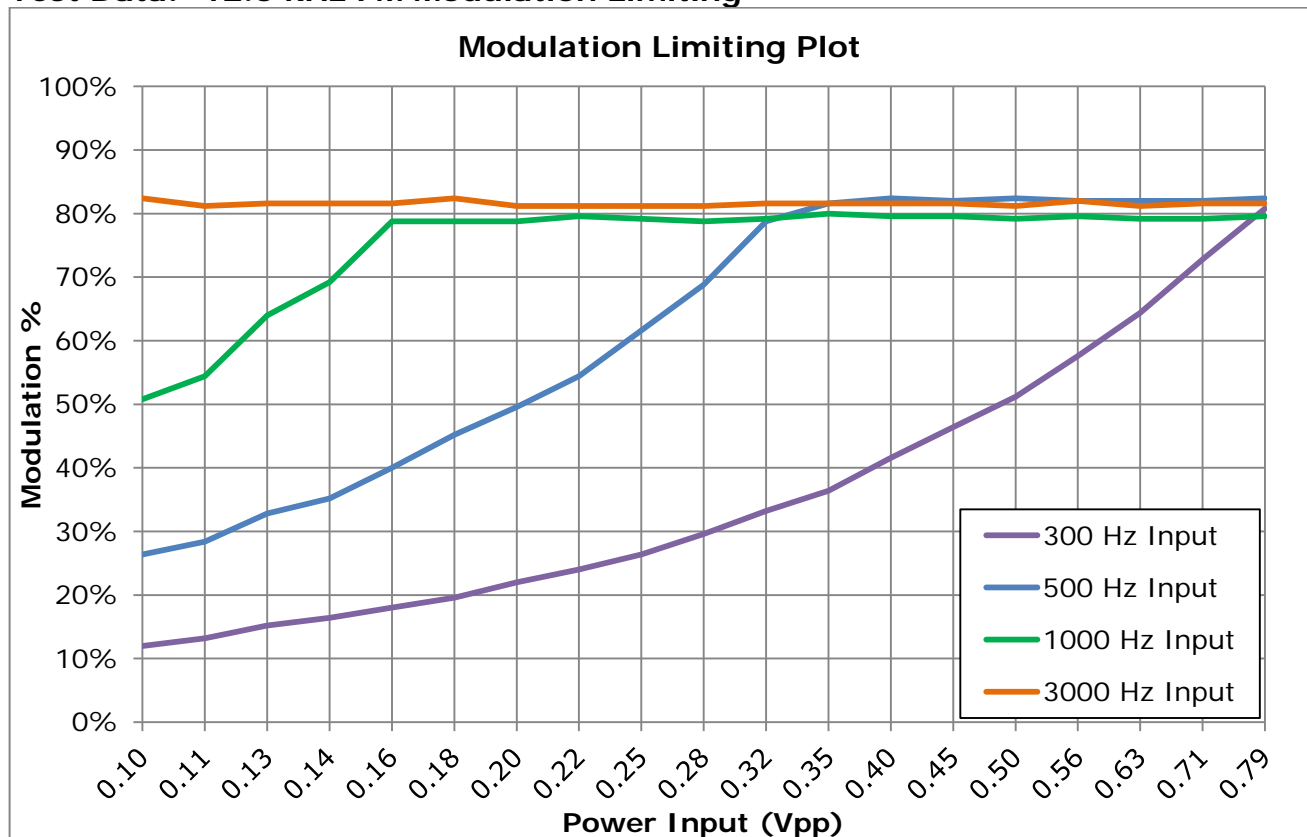
(b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Test Procedure: TIA 603-E, 2.2.3

Note: The test method alone is not sufficient to meet the standard of FCC Pt. 2.1047(b). Deviation (kHz), as recorded from test equipment, has been converted into percentage as required above.



Test Data: 12.5 kHz FM Modulation Limiting



OCCUPIED BANDWIDTH

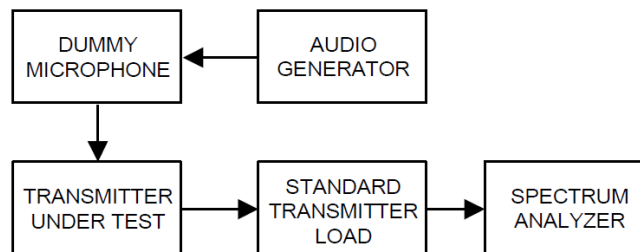
FCC Rule Parts: 2.1049 (c)

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

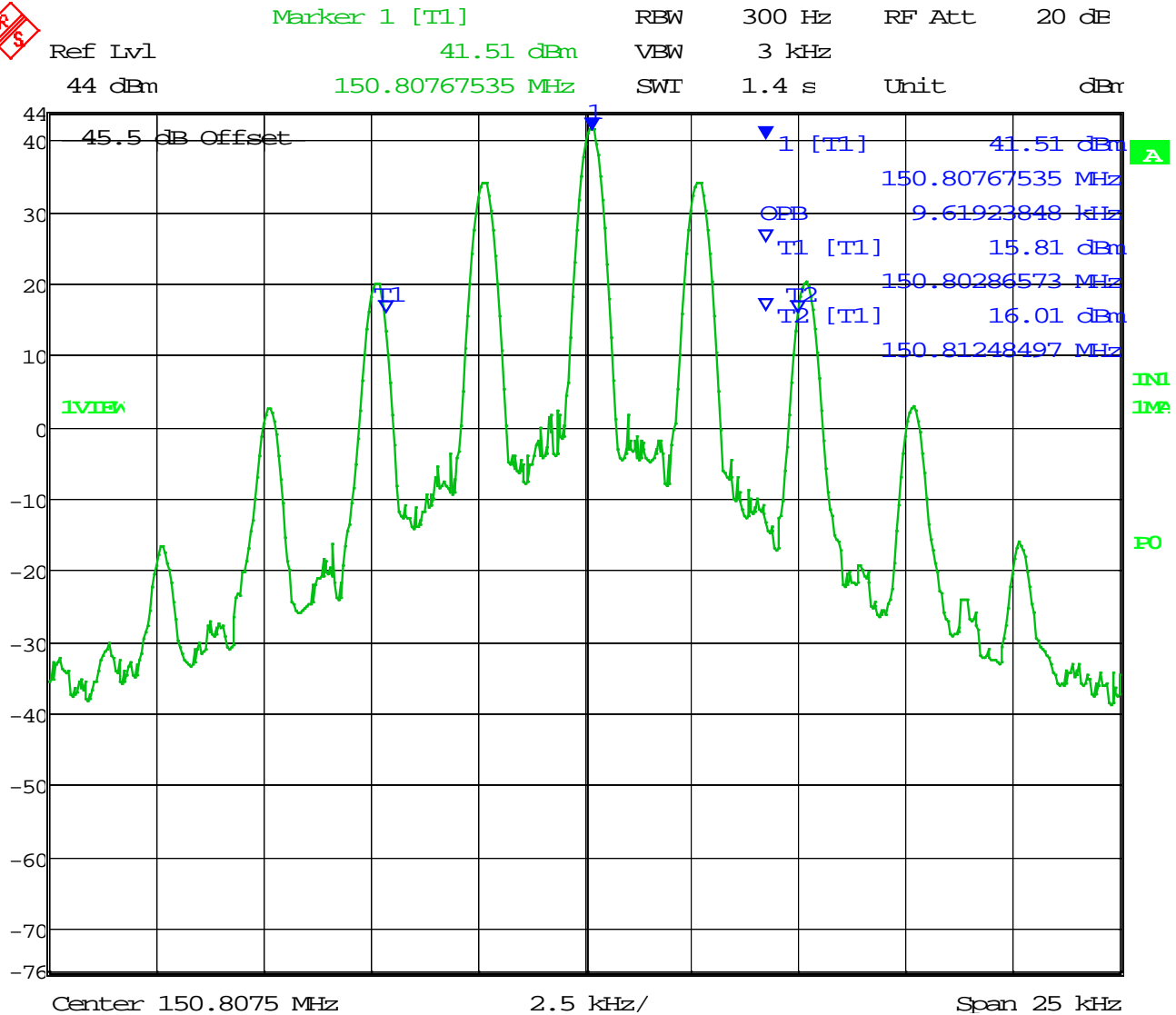
Method of Measurement: ANSI C63.26, 5.4.4 (using Test Setup from TIA 603-E 2.2.11, below)

Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to ANSI C63.26, 5.4.4, Step e).



OCCUPIED BANDWIDTH 99%

Test Data: 11K2F3E (Narrowband Analog FM Voice)

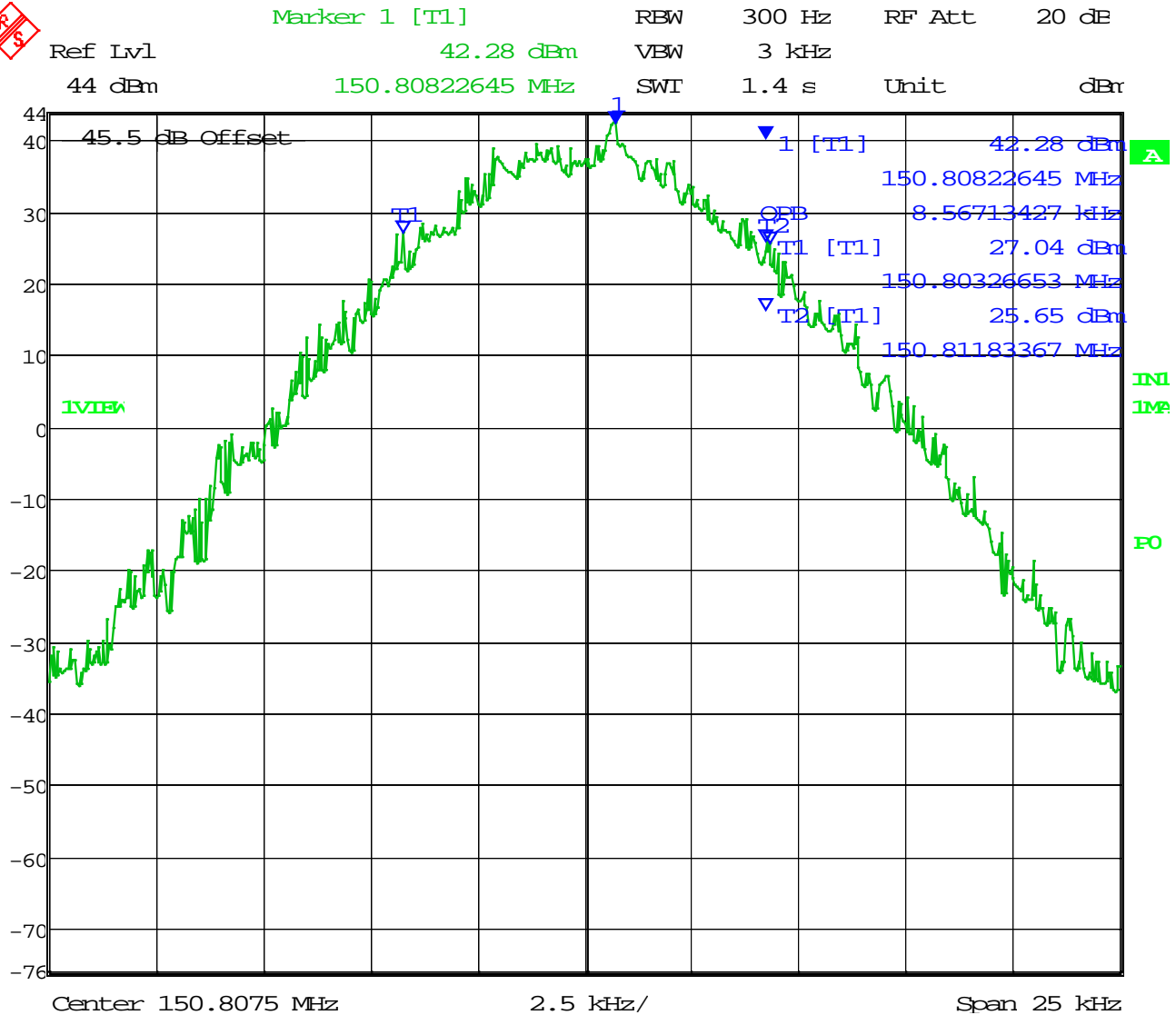


Date: 1.JAN.1997 05:13:13

99% OBW = 9.62 kHz

OCCUPIED BANDWIDTH 99%

Test Data: 8K10F1E/F1D (C4FM Voice/Data)



Date: 1.JAN.1997 05:16:20

99% OBW = 8.57 kHz

Result: Meets Requirements

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

FCC Rule Parts: 2.1051(a), 22.359(a)

Requirements:

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

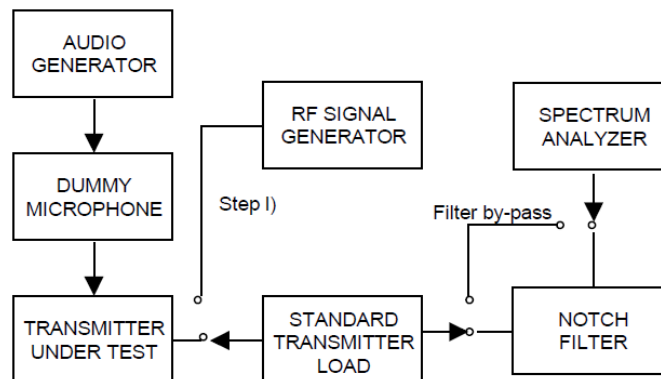
The limit below conforms to FCC CFR 47 Part 90.210(d)(3) and in all cases is more strict than that set forth in this rulepart. Please refer below:

FCC Rule Parts: 90.210(d)(3)

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

Method of Measurement: ANSI/TIA-603-E

Test Procedure: TIA 603-E, 2.2.13



SPURIOUS EMISSIONS - NARROWBAND FM (12.5 kHz)

Test Data: 150.8075 MHz

Spurious Conducted Emissions, Narrowband FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	150.8075	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	301.6150	-40.53	20.53	-39.19	19.19	-43.36	23.36
3rd Harmonic	452.4225	-37.84	17.84	-43.06	23.06	-50.10	30.10
4th Harmonic	603.2300	-31.41	11.41	-36.63	16.63	-47.49	27.49
5th Harmonic	754.0375	-45.32	25.32	-44.78	24.78	-48.48	28.48
6th Harmonic	904.8450	-32.21	12.21	-42.93	22.93	-49.72	29.72
7th Harmonic	1055.6525	-58.96	38.96	-58.54	38.54	-55.03	35.03
8th Harmonic	1206.4600	-53.35	33.35	-55.31	35.31	-54.41	34.41
9th Harmonic	1357.2675	-57.88	37.88	-57.09	37.09	-56.64	36.64
10th Harmonic	* 1508.0750	-60.21	40.21	-59.64	39.64	-60.00	40.00

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 152.8475 MHz

Spurious Conducted Emissions, Narrowband FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	152.8475	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	305.6950	-42.20	22.20	-38.66	18.66	-43.66	23.66
3rd Harmonic	458.5425	-39.84	19.84	-40.94	20.94	-49.82	29.82
4th Harmonic	611.3900	-29.30	9.30	-36.29	16.29	-46.81	26.81
5th Harmonic	764.2375	-41.56	21.56	-45.66	25.66	-51.48	31.48
6th Harmonic	917.0850	-31.95	11.95	-40.35	20.35	-51.26	31.26
7th Harmonic	* 1069.9325	-59.77	39.77	-58.18	38.18	-55.12	35.12
8th Harmonic	1222.7800	-53.45	33.45	-56.12	36.12	-55.12	35.12
9th Harmonic	1375.6275	-58.34	38.34	-58.60	38.60	-58.73	38.73
10th Harmonic	* 1528.4750	-60.09	40.09	-59.88	39.88	-60.45	40.45

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 157.4575 MHz

Spurious Conducted Emissions, Narrowband FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	157.4575	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	314.9150	-43.72	23.72	-39.44	19.44	-45.41	25.41
3rd Harmonic	472.3725	-39.72	19.72	-38.80	18.80	-48.03	28.03
4th Harmonic	629.8300	-31.34	11.34	-32.66	12.66	-43.59	23.59
5th Harmonic	787.2875	-35.66	15.66	-44.23	24.23	-42.28	22.28
6th Harmonic	944.7450	-28.52	8.52	-35.56	15.56	-52.85	32.85
7th Harmonic	1102.2025	-53.33	33.33	-56.73	36.73	-55.99	35.99
8th Harmonic	1259.6600	-55.10	35.10	-57.43	37.43	-55.58	35.58
9th Harmonic	1417.1175	-57.49	37.49	-60.48	40.48	-60.54	40.54
10th Harmonic	* 1574.5750	-59.05	39.05	-58.61	38.61	-59.74	39.74

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 161.7675 MHz

Spurious Conducted Emissions, Narrowband FM (12.5 kHz), Mask D Limit (≥250% Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	161.7675	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	323.5350	-42.88	22.88	-42.40	22.40	-48.49	28.49
3rd Harmonic	485.3025	-37.12	17.12	-45.16	25.16	-45.05	25.05
4th Harmonic	647.0700	-44.27	24.27	-32.69	12.69	-41.25	21.25
5th Harmonic	808.8375	-34.34	14.34	-48.83	28.83	-59.62	39.62
6th Harmonic	970.6050	-38.21	18.21	-37.34	17.34	-60.38	40.38
7th Harmonic	1132.3725	-50.47	30.47	-55.38	35.38	-56.91	36.91
8th Harmonic	1294.1400	-59.61	39.61	-59.30	39.30	-59.02	39.02
9th Harmonic	1455.9075	-56.68	36.68	-59.03	39.03	-58.75	38.75
10th Harmonic	* 1617.6750	-59.75	39.75	-58.69	38.69	-58.41	38.41

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

SPURIOUS EMISSIONS – P25 Phase I C4FM (12.5 kHz)

Test Data: 150.8075 MHz

Spurious Conducted Emissions, C4FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	150.8075	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	301.6150	-40.54	20.54	-39.48	19.48	-43.82	23.82
3rd Harmonic	452.4225	-36.70	16.70	-43.92	23.92	-52.32	32.32
4th Harmonic	603.2300	-30.73	10.73	-36.10	16.10	-47.09	27.09
5th Harmonic	754.0375	-44.30	24.30	-45.26	25.26	-50.86	30.86
6th Harmonic	904.8450	-32.05	12.05	-43.23	23.23	-49.28	29.28
7th Harmonic	1055.6525	-59.35	39.35	-58.23	38.23	-54.06	34.06
8th Harmonic	1206.4600	-52.31	32.31	-54.48	34.48	-54.34	34.34
9th Harmonic	1357.2675	-57.84	37.84	-57.29	37.29	-57.29	37.29
10th Harmonic	* 1508.0750	-59.50	39.50	-59.70	39.70	-58.88	38.88

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 152.8475 MHz

Spurious Conducted Emissions, C4FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	152.8475	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	305.6950	-41.65	21.65	-38.67	18.67	-43.98	23.98
3rd Harmonic	458.5425	-37.09	17.09	-41.28	21.28	-50.68	30.68
4th Harmonic	611.3900	-30.13	10.13	-36.42	16.42	-46.96	26.96
5th Harmonic	764.2375	-41.16	21.16	-46.50	26.50	-51.24	31.24
6th Harmonic	917.0850	-31.90	11.90	-39.84	19.84	-51.63	31.63
7th Harmonic	1069.9325	-58.88	38.88	-57.62	37.62	-55.12	35.12
8th Harmonic	1222.7800	-54.85	34.85	-56.20	36.20	-54.56	34.56
9th Harmonic	1375.6275	-58.74	38.74	-56.65	36.65	-56.21	36.21
10th Harmonic	* 1528.4750	-59.46	39.46	-58.88	38.88	-59.46	39.46

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 157.4575 MHz

Spurious Conducted Emissions, C4FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	157.4575	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	314.9150	-43.17	23.17	-39.67	19.67	-45.99	25.99
3rd Harmonic	472.3725	-35.94	15.94	-42.03	22.03	-49.17	29.17
4th Harmonic	629.8300	-31.92	11.92	-33.99	13.99	-43.69	23.69
5th Harmonic	787.2875	-35.66	15.66	-54.79	34.79	-54.62	34.62
6th Harmonic	944.7450	-28.44	8.44	-35.55	15.55	-52.01	32.01
7th Harmonic	1102.2025	-52.80	32.80	-55.12	35.12	-56.99	36.99
8th Harmonic	1259.6600	-54.60	34.60	-56.53	36.53	-56.13	36.13
9th Harmonic	1417.1175	-57.39	37.39	-60.48	40.48	-59.83	39.83
10th Harmonic	* 1574.5750	-59.51	39.51	-60.14	40.14	-59.49	39.49

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 161.7675 MHz

Spurious Conducted Emissions, C4FM (12.5 kHz), Mask D Limit ($\geq 250\%$ Authorized BW)		High Power		Med Power		Low Power	
		dBm	43.81	dBm	39.84	dBm	30.02
		Watts	24.04	Watts	9.64	Watts	1.00
		Limit (dBm)	-20	Limit (dBm)	-20	Limit (dBm)	-20
Frequency (MHz)		Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
Fundamental	161.7675	43.81	0.00	39.84	0.00	30.02	0.00
2nd Harmonic	323.5350	-41.89	21.89	-41.46	21.46	-47.93	27.93
3rd Harmonic	485.3025	-33.46	13.46	-41.41	21.41	-43.21	23.21
4th Harmonic	647.0700	-45.66	25.66	-33.19	13.19	-40.84	20.84
5th Harmonic	808.8375	-35.22	15.22	-49.59	29.59	-59.39	39.39
6th Harmonic	970.6050	-38.94	18.94	-37.20	17.20	-59.57	39.57
7th Harmonic	1132.3725	-50.41	30.41	-56.93	36.93	-58.13	38.13
8th Harmonic *	1294.1400	-59.91	39.91	-59.21	39.21	-59.72	39.72
9th Harmonic	1455.9075	-56.07	36.07	-58.94	38.94	-59.45	39.45
10th Harmonic *	1617.6750	-59.30	39.30	-58.60	38.60	-59.11	39.11

* Indicates Noise Floor of Measurement

FIELD STRENGTH OF SPURIOUS EMISSIONS

FCC Rule Parts: FCC Part 2.1053(a), 22.359(a)

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

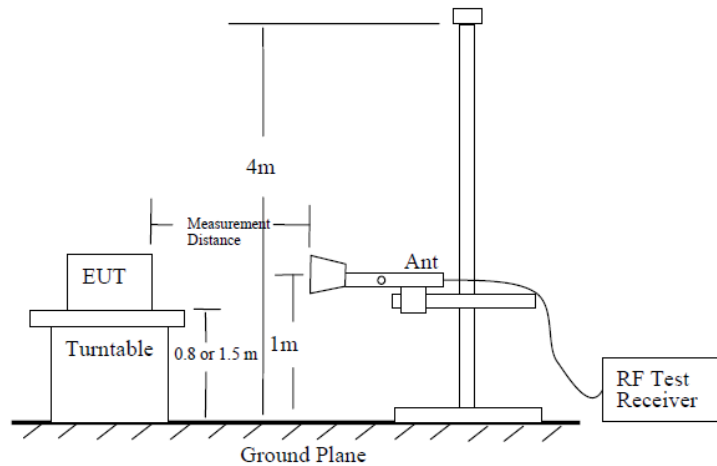
The limit below conforms to FCC CFR 47 Part 90.210(d)(3) and in all cases is more strict than that set forth in this rulepart. Please refer below:

FCC Rule Parts: 90.210(d)(3)

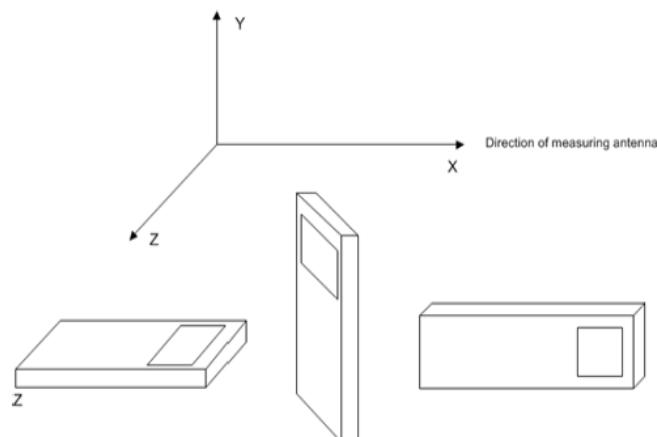
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

Method of Measurement: ANSI C63.26, 5.5.4

Test Site Setup:



EUT Orientation(s):



Note: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from the lowest frequency generated internally to at least the tenth harmonic of the fundamental. This test was conducted in accordance with the standard listed above using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669. The measurements below represent the worst case of all the frequencies tested.

Note: The six (6) highest emissions or more of each worst-case operational modes of the EUT are represented below. Emissions 20 dB below the limit are not required to be reported.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 150.8075 MHz

Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
30.02	1.00	50.02	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
150.81	603.23	V	-44.188	24.19
150.81	603.23	H	-43.218	23.22

Medium Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
39.84	9.64	59.84	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
150.81	603.23	H	-33.278	13.28
150.81	603.23	V	-32.348	12.35
150.81	904.84	V	-36.972	16.97
150.81	904.84	H	-35.912	15.91

High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
43.81	24.04	63.81	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
150.81	904.84	H	-27.452	7.45
150.81	904.84	V	-28.232	8.23
150.81	754.04	H	-40.273	20.27
150.81	603.23	H	-27.948	7.95
150.81	603.23	V	-26.928	6.93

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 152.8475 MHz

Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
30.02	1.00	50.02	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
152.85	611.39	H	-39.016	19.02
152.85	611.39	V	-35.866	15.87
152.85	917.09	H	-40.306	20.31
152.85	917.09	V	-37.096	17.10

Medium Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
39.84	9.64	59.84	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
152.85	611.39	H	-27.346	7.35
152.85	611.39	V	-24.036	4.04
152.85	917.09	H	-30.336	10.34
152.85	917.09	V	-27.016	7.02

High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
43.81	24.04	63.81	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
150.81	904.84	H	-27.452	7.45
150.81	904.84	V	-28.232	8.23
150.81	754.04	H	-40.273	20.27
150.81	603.23	H	-27.948	7.95
150.81	603.23	V	-26.928	6.93

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 157.4575 MHz

Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
30.02	1.00	50.02	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
157.45	629.77	H	-41.808	21.81
157.45	629.77	V	-40.428	20.43

Medium Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
39.84	9.64	59.84	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
157.45	629.83	V	-21.918	1.92
157.45	629.83	H	-26.928	6.93
157.45	944.74	V	-21.278	1.28
157.45	944.74	H	-23.988	3.99

High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
43.81	24.04	63.81	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
157.46	629.83	V	-22.718	2.72
157.46	629.83	H	-24.308	4.31
157.46	787.29	V	-30.860	10.86
157.46	787.29	H	-26.920	6.92
157.46	944.74	V	-21.298	1.30
157.46	944.74	H	-21.848	1.85

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 161.7675 MHz

Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
30.02	1.00	50.02	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
161.77	647.07	H	-39.387	19.39
161.77	647.07	V	-41.267	21.27

Medium Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
39.84	9.64	59.84	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
161.77	647.07	H	-29.767	9.77
161.77	647.07	V	-29.907	9.91
161.77	970.60	V	-26.745	6.74
161.77	970.60	H	-26.945	6.94

High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
43.81	24.04	63.81	-20.00	
Tuned Freq MHz	Emission Frequency MHz	Antenna Polarity	ERP (dBm)	Margin (dB)
161.77	970.60	V	-24.205	4.20
161.77	970.60	H	-24.405	4.40
161.77	808.84	H	-31.712	11.71
161.77	808.84	V	-31.942	11.94
161.77	647.07	V	-39.227	19.23
161.77	647.07	H	-35.827	15.83

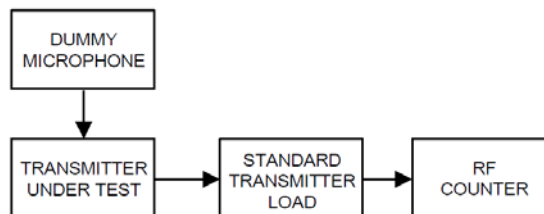
FREQUENCY STABILITY

FCC Rule Parts: FCC Part 2.1055(a)(2), 22.355

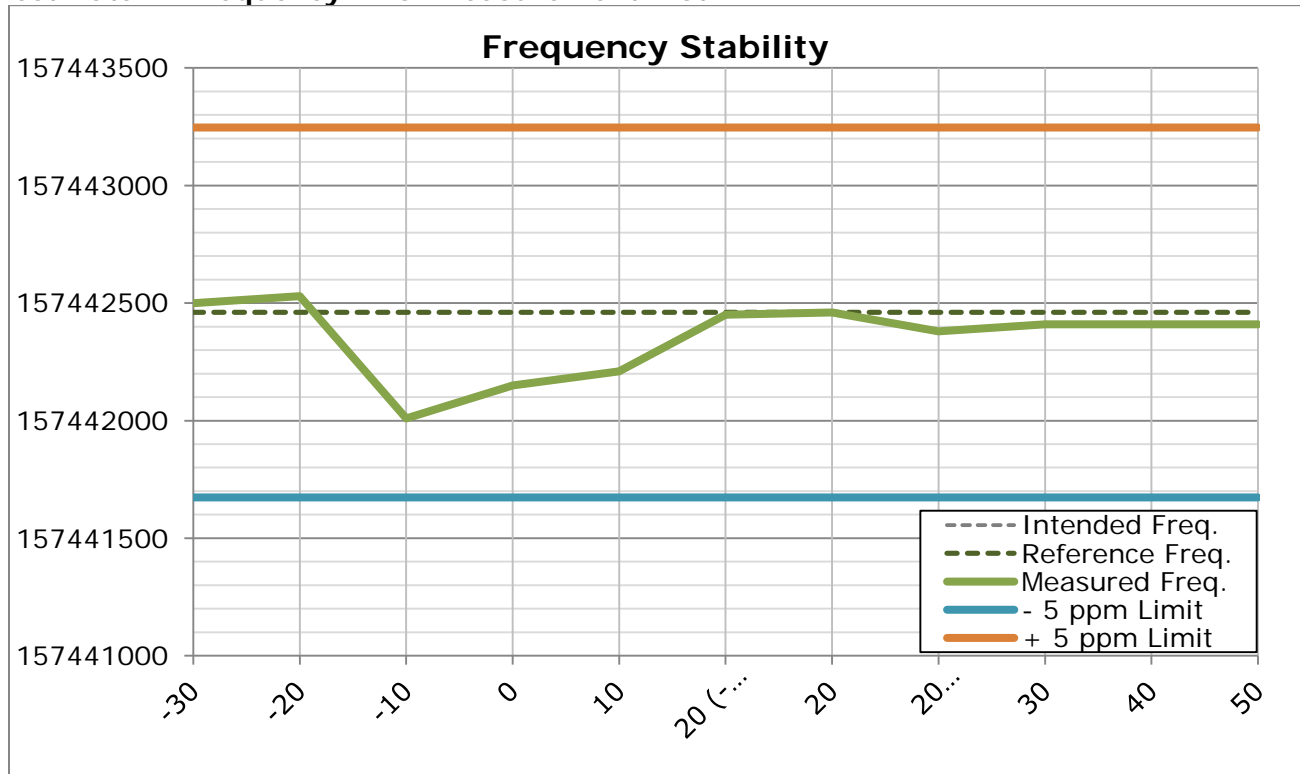
TABLE C-1—FREQUENCY TOLERANCE FOR TRANSMITTERS IN THE PUBLIC MOBILE SERVICES

Frequency range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
50 to 450	5.0	5.0	50.0

Method of Measurements: TIA 603-E, 2.2.2



Test Data: Frequency Error Measurement Plot



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table

Limit:		5 ppm		
Temperature (°C)	Supplied Voltage (VDC)	Intended Frequency (Hz)	Measured Reference Frequency (Hz)	Deviation (Hz)
20°C (reference)	13.8	157440000	157442460	-2460

@ 20°C (reference)				
Supplied Voltage (%)	Supplied Voltage (VDC)	Frequency (Hz)	Deviation (Hz)	PPM
-15%	11.73	157442450	10	0.064
15%	15.87	157442380	80	0.508

Temperature (°C)	Supplied Voltage (VDC)	Frequency (Hz)	Deviation (Hz)	PPM
50	13.8	157442410	50	0.318
40	13.8	157442410	50	0.318
30	13.8	157442410	50	0.318
20	13.8	157442460	0	0.000
10	13.8	157442210	250	1.588
0	13.8	157442150	310	1.969
-10	13.8	157442010	450	2.858
-20	13.8	157442530	70	-0.445
-30	13.8	157442500	40	-0.254

RESULT: Meets Requirements

STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16-4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: “Uncertainty in EMC Measurements” and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	± 0.93 dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	± 1.86 dB	
Occupied Bandwidth	$\pm 2.65\%$	
Audio Frequency Response	± 1.86 dB	
Modulation limiting	$\pm 1.88\%$	
Radiated RF Power	± 1.4 dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq.	$\pm 1.88\%$	
Within 6kHz and 25kHz of audio Freq.	$\pm 2.04\%$	
Rad Emissions Sub Meth up to 26.5GHz	± 2.14 dB	
Adjacent channel power	± 1.47 dB	(1)
Transient Frequency Response	$\pm 1.88\%$	
Temperature	$\pm 1.0^{\circ}\text{C}$	(1)
Humidity	$\pm 5.0\%$	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Coaxial Cable - BMBM-0065-01 Black DC-2G	Belden		BMBM-0065-01	07/18/16	07/18/18
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	09/01/16	09/01/18
Frequency Counter Small Chamber	HP	5385A	3242A07460	08/22/17	08/22/19
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 KMKM-0670-01 KFKF-0197-00	N/A	N/A
CHAMBER	Panashield	3M	N/A	04/25/16	5/31/18
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Passive Loop	EMCO	6512	9706-1211	07/26/17	07/26/19
Type K J Thermometer	Martel	303	080504494	11/02/17	11/02/19
EMI Test Receiver R & S ESIB 40	Rohde & Schwarz	ESIB 40	100274	08/18/16	08/18/18
EMI Test Receiver R & S ESU 40	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/19
Attenuator N 20dB 20W DC-12G	Narda	768-20-SP	155	07/10/17	07/10/19
Attenuator N 20dB 20W DC-12G	Narda	768-20-SP	344	07/10/17	07/10/19
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/17	05/24/19
Attenuator BNC 10dB DC-2G	MiniCircuits	HAT-10+	#54	07/14/17	07/14/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Tunable Notch Filter 250-850 MHz	Eagle	TNF-200	250-850 MHz (#19)	11/19/17	11/19/19
Terminator N 20W DC-18G	Narda	8205	#14	04/06/17	04/06/19
Attenuator BNC 6dB 50Ohm DC-2G	Mini-Circuits	HAT-6+	#53	07/14/17	07/14/19
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/17	05/23/19
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Modulation Analyzer	HP	8901A	3050A05856	04/13/17	04/13/19
Function Generator	Standford	DS340	25200	02/21/18	02/21/20
Terminator N 20W DC-18G	Narda	8205	#14	04/06/17	04/06/19

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT

Document Name	Description of Change	Revision Date	Approved By
PT 80 Rpt	Initial Issue		SS Sanders
	Added Document History to Template		G Greene
	Added Uc Table	170508	Cory Leverett