

KTL Test Report: 8R00924

Applicant: TAD Radio of Canada Inc.
3101 – 29 Avenue
Vernon, BC V1T 1Z2

Equipment Under Test: M10 Mobile Radio with 10W & 30W Power Output
(E.U.T.)

FCC ID: H7CM-10A

In Accordance With: **FCC Part 90, Subpart I**
Private Land Mobile Transmitter

Tested By: KTL Ottawa Inc.
3325 River Road, R.R. 5
Ottawa, Ontario K1V 1H2

Authorized By: _____
W. Waterhouse, RF Engineering Lab Manager

Date: _____

Total Number of Pages: 40

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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 1. Summary of Test Results

Manufacturer: TAD Radio of Canada Inc.

Model No.: M10

Serial No.: 81497

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Subpart I.

New Submission Production Unit

Class II Permissive Change Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See "Summary of Test Data".



NVLAP LAB CODE: 100351-0

TESTED BY: _____ DATE: _____
Kevin Carr, Technologist

TECHNICAL REVIEW: _____ DATE: _____
Tom Tidwell, Wireless Group Manager

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This report applies only to the items tested.

*EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A*

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.205	\pm dB	30W	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	Plot	Complies
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A	Plot	Complies
Occupied Bandwidth	90.210	Mask D	Plot	Complies
Spurious Emissions at Antenna Terminals	90.210	-20 dBm	Plot	Complies
Field Strength of Spurious Emissions	90.210	75.3 dB μ V/m	Chart	Complies
Frequency Stability	90.213	N/A	N/A	N/A
Transient Frequency Behavior	90.214	5ppm	Graph	Complies

Footnotes For N/A's: Since there were no modifications to the frequency determining circuitry, Frequency Stability was not tested.

Test Conditions: Temperature: 21 °C
Humidity: 32 %

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input:	13.6 Vdc				
Frequency Range:	138 – 174 MHz				
Tunable Bands:	1				
Necessary Bandwidth:	11.25 kHz				
Type(s) of Modulation:	F3E (Voice) <input checked="" type="checkbox"/>	F1D <input type="checkbox"/>	F2D <input type="checkbox"/>	D7W (QAM) <input type="checkbox"/>	Other <input type="checkbox"/>
Data Rate(s)	Not Applicable				
Internal/External Data Source:	N/A				
Emission Designator:	11K25F3EJN				
Output Impedance:	50 ohm				
RF Power Output (rated):	Single 1W (low) or 30W (high)				
Duty Cycle:	N/A				
Channel Spacing(s):	12.5 kHz				
Operator Selection of Operating Frequency:	Software Controlled Push-Button Selection				
Power Output Adjustment Capability:	Preset by Software				

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Receiver

Frequency Range:	138-174 MHz
Tunable Bands:	1
Local Oscillator:	Not Applicable
1st IF:	21.6 MHz
2nd IF:	11.25 kHz
Operator Selection of Operating Frequency:	Software Controlled Push Button Selection

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output

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Description of Modifications For Class II Permissive Change

Component change from M57741 to M67741H. As well, changes to analog and power circuitry. Specific changes noted on schematics included in this package.

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Modifications Made During Testing

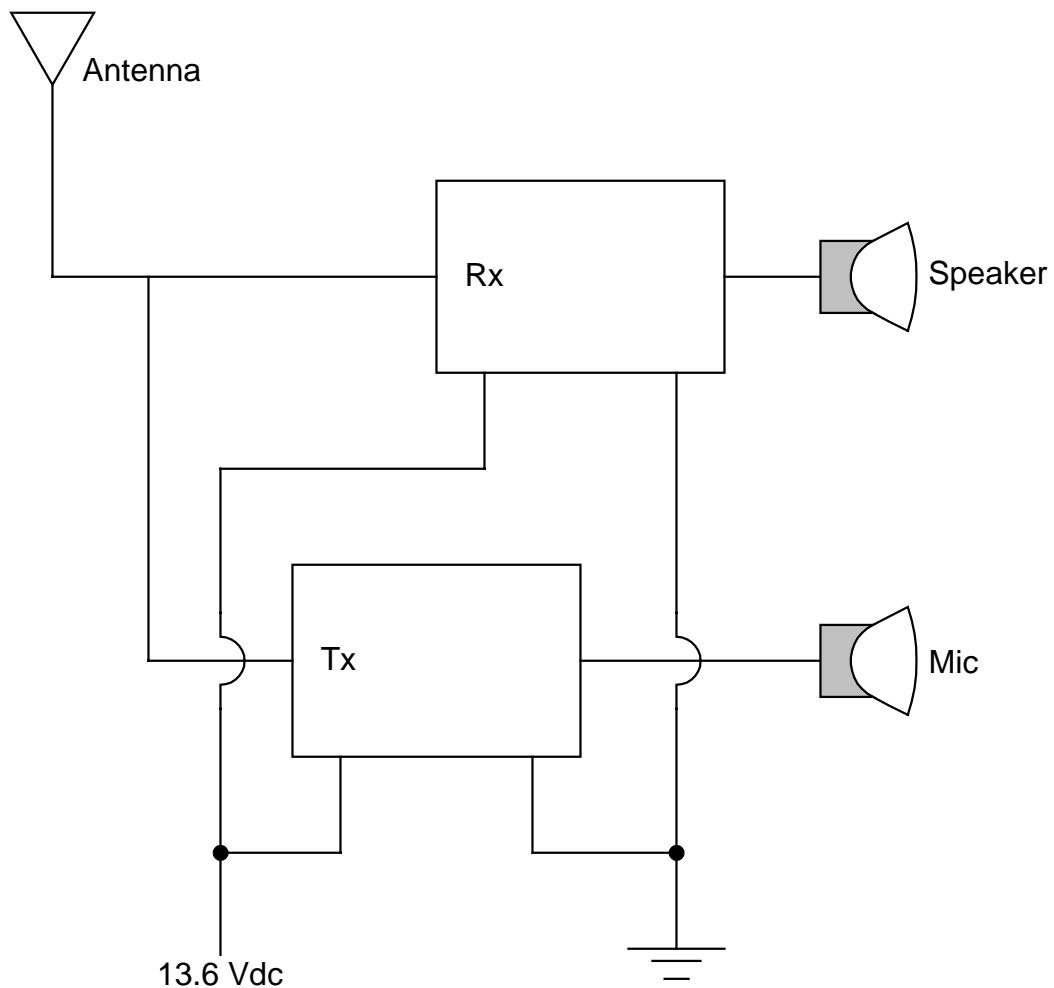
Incorporated changes as per Page 5 of Document 7TA200-1C. In addition to these modifications, ferrite block, P/N: 28A2029-0A0 was clamped around the orange and red wires (DC power cable).

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
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Theory of Operation

The E.U.T. is a mobile vehicle mount FM radio that operates in the 138 to 174 MHz band. It has high and low power settings.

System Diagram



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Section 3. RF Power Output

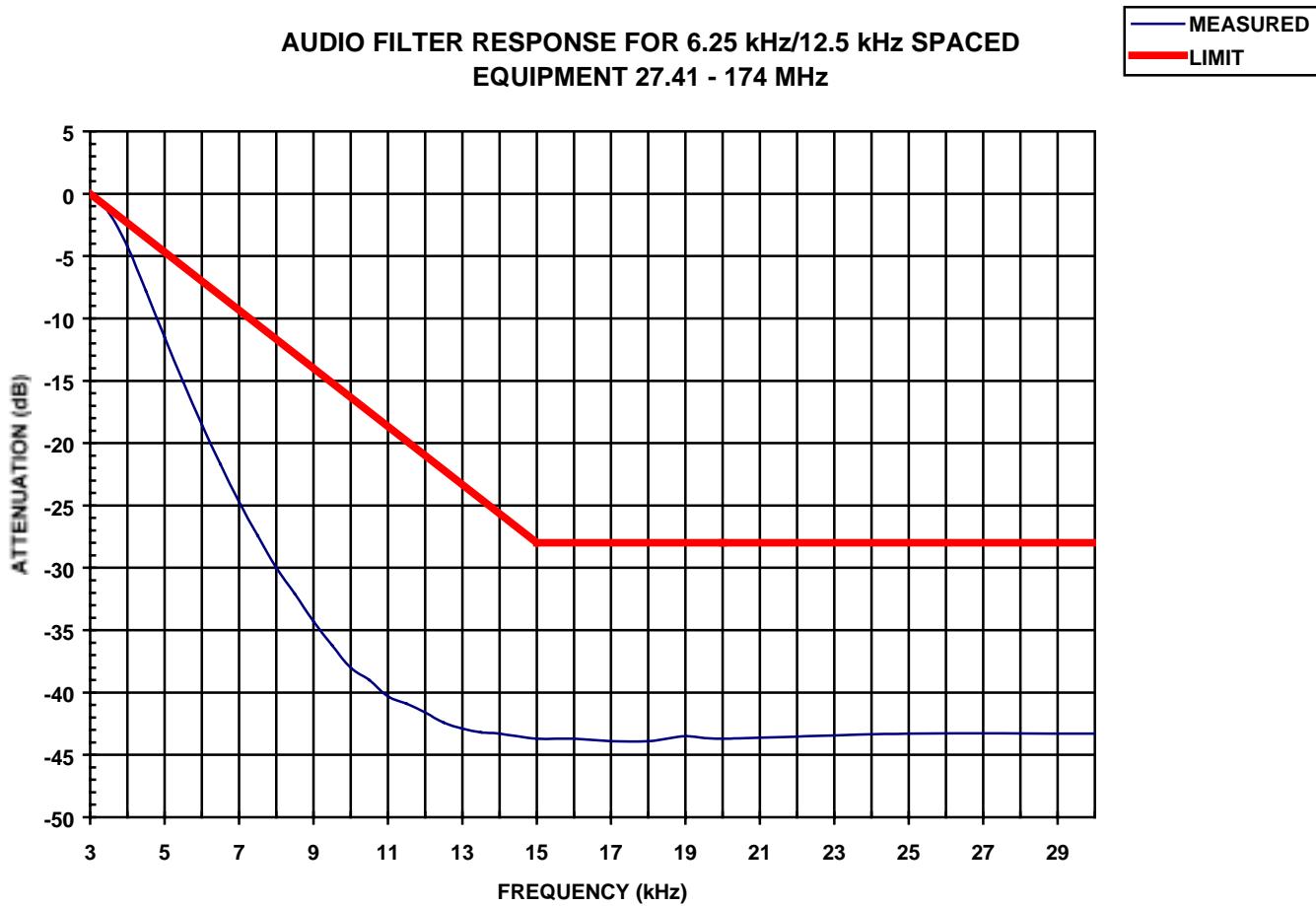
NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Kevin Carr	DATE: September 28, 1998

Test Results: Complies.

Measurement Data:

	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
Hi	156 MHz	44.9	44.8	0.1
Low	156 MHz	30.0	30	0.0

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

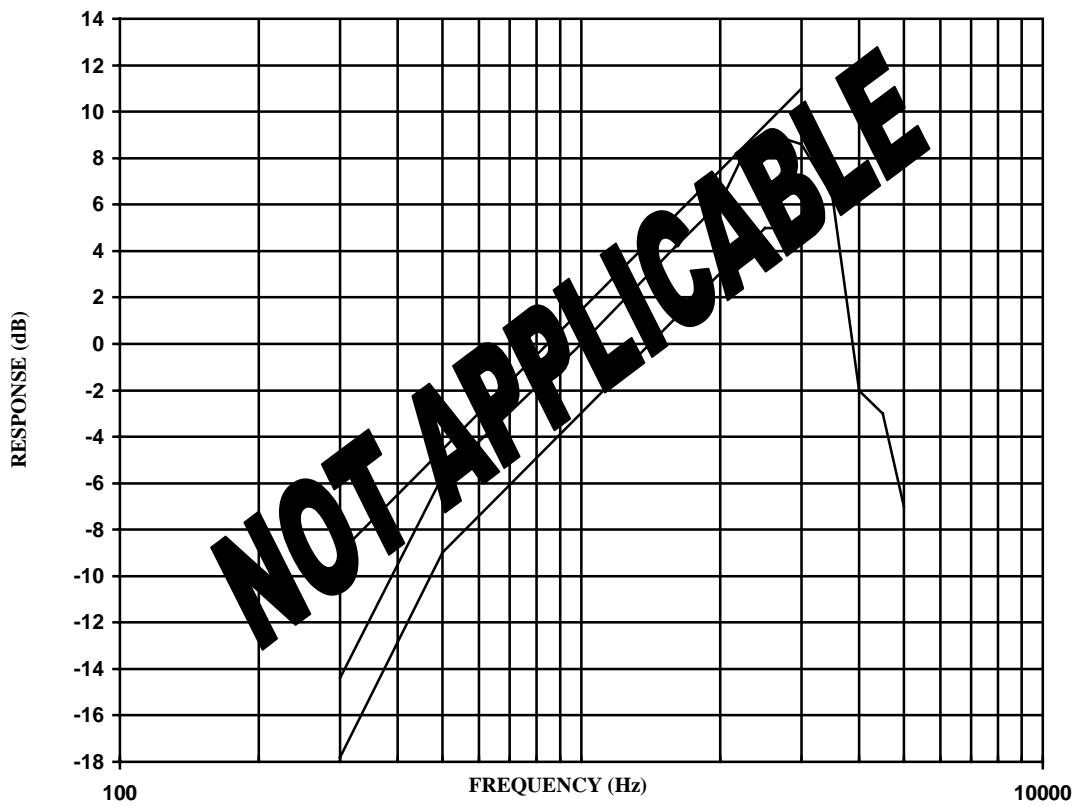
Section 4. Audio Frequency Response

NAME OF TEST: Audio Frequency Response

PARA. NO.: 2.987(a)

TESTED BY:

DATE:



Audio Frequency Response

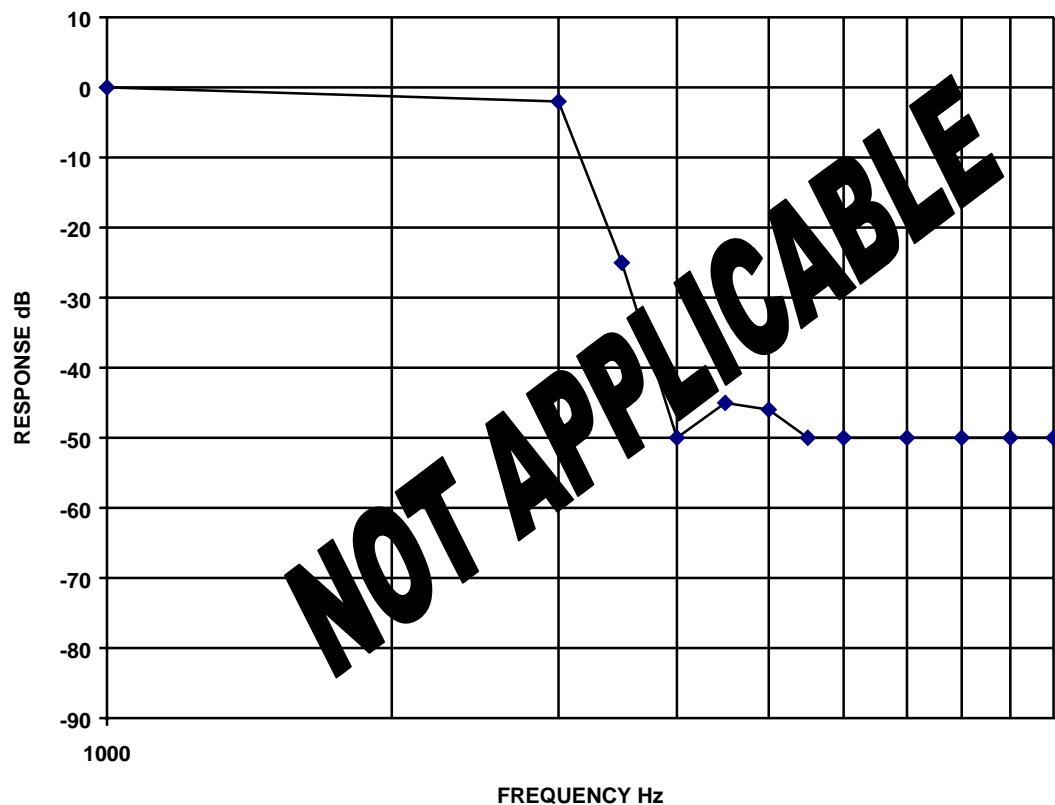
Frequency	300	600	900	1.2 k	1.5 k	1.8 k	2.1k	2.3 k	2.6 k	3.0 k	3.5 k	4 k

Frequency	4.5 k	5 k	5.5 k	6 k	6.5 k	7 k	7.5 k	8 k	8.5 k	9 k	9.5 k	10 k

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 5. Audio Low-Pass Filter Response

NAME OF TEST: Audio Low-Pass Filter Response	PARA. NO.: 2.987(a)
TESTED BY:	DATE:

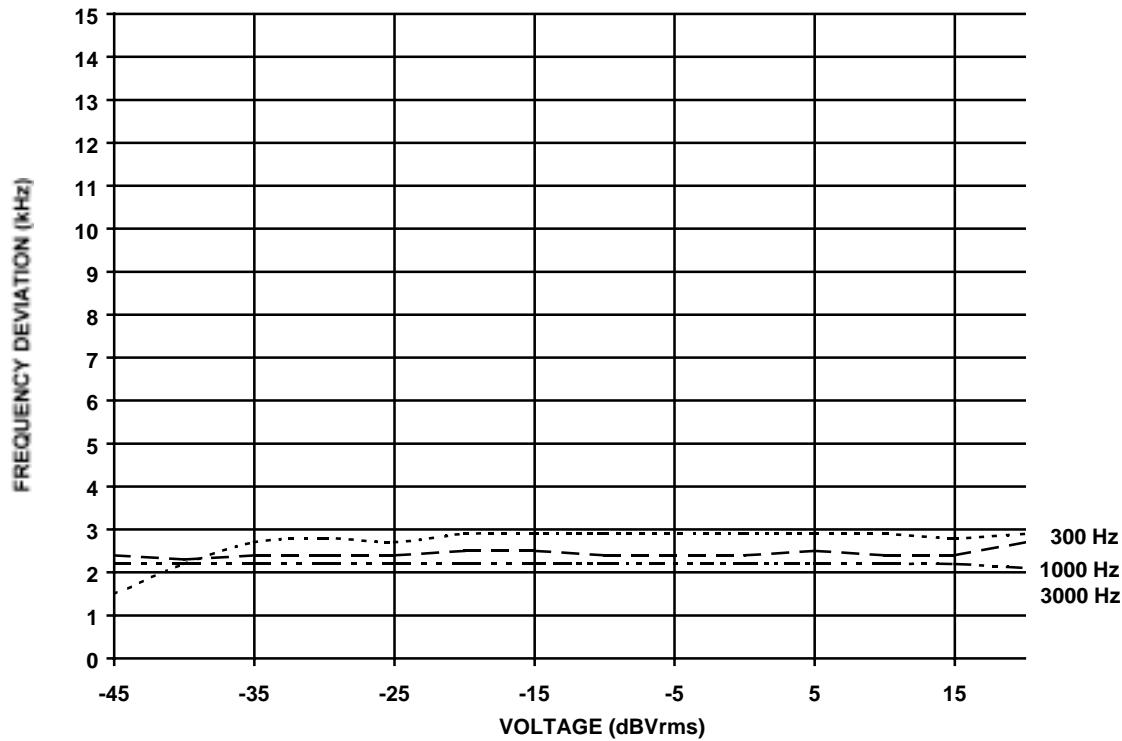


Audio Low-Pass Filter Response

Frequency	1k	3 k	3.5 k	4 k	4.5 k	5 k	5.5 k	6 k	7 k	8 k	9 k	10 k

*EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output**FCC ID: H7CM-10A***Section 6. Modulation Limiting**

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(b)
TESTED BY: Kevin Carr	DATE: September 28, 1998



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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 7. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Kevin Carr	DATE: September 28, 1998

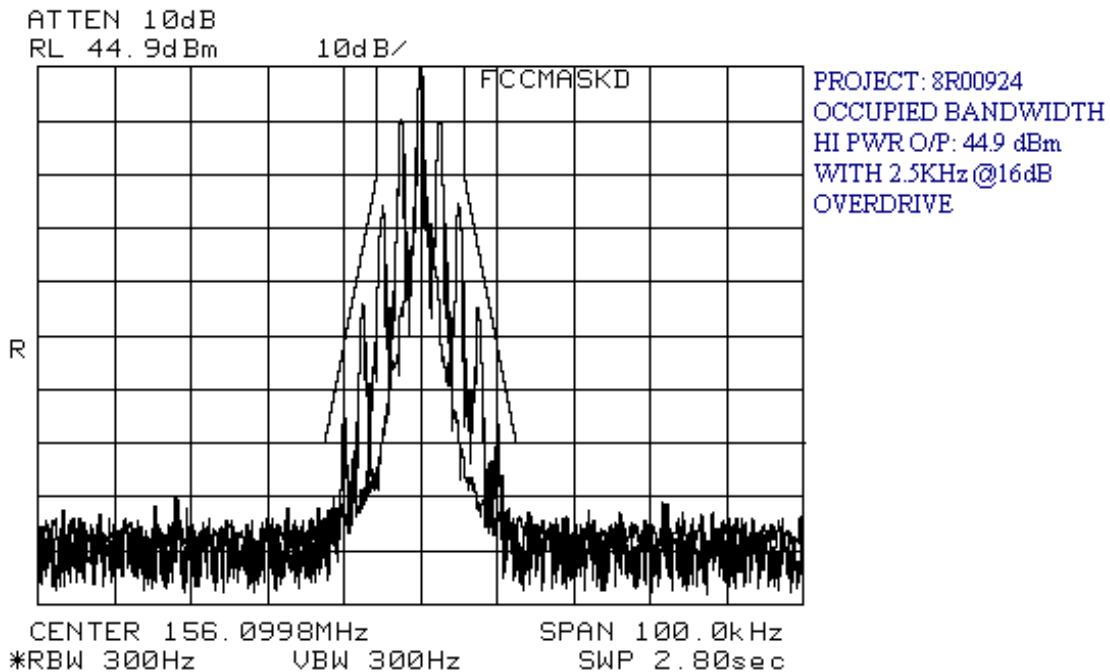
Test Results: Complies.

Test Data: See attached graph(s).

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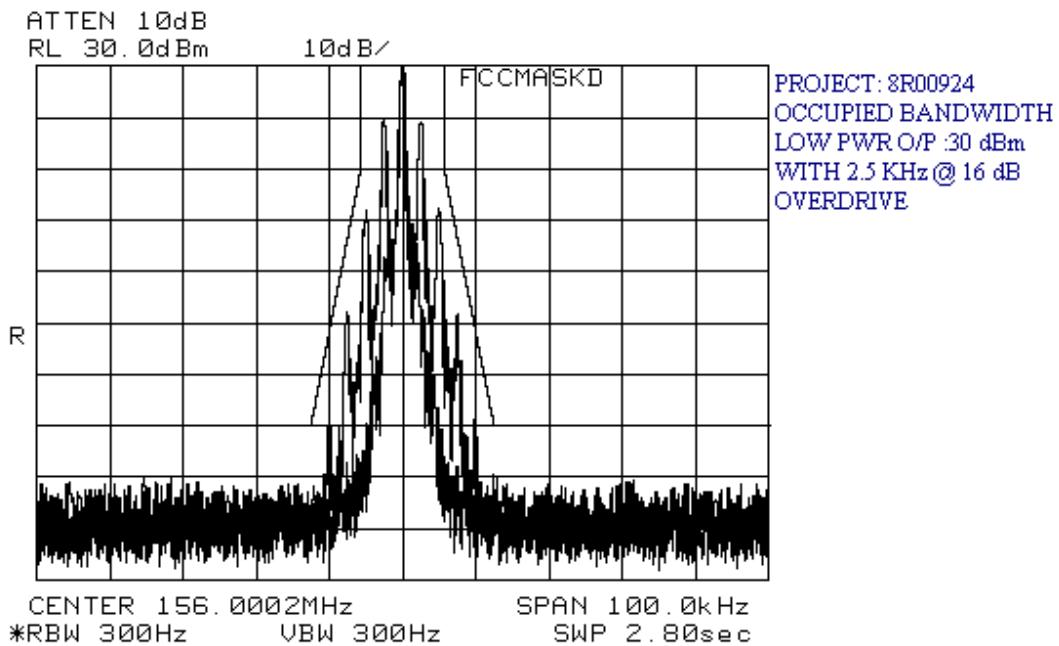
EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A



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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output

FCC ID: H7CM-10A

Section 8. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
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TESTED BY: Kevin Carr	DATE: September 28, 1998
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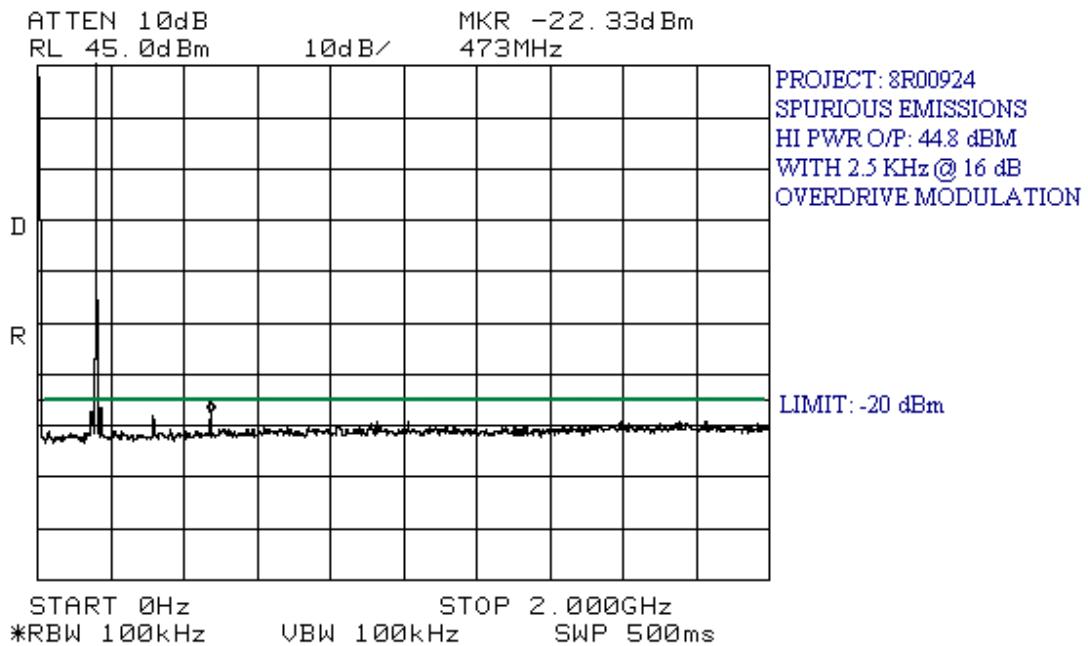
Test Results: Complies.

Test Data: See attached graph(s).

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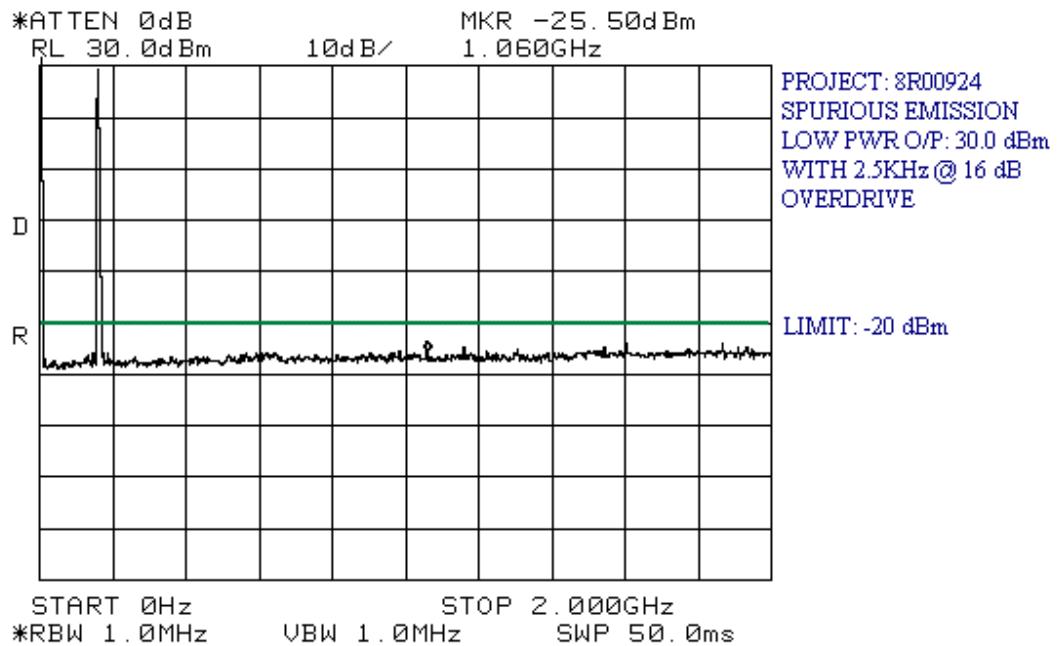
EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A



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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A



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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 9. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Kevin Carr	DATE: October 6, 1998

Test Results: Complies.

Test Data: See attached table.

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Test Data - Radiated Emissions

Distance: 3m		A tower		Receiver: 014		Detector: (1) 120 kHz		Q-Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dB μ V/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
312.0	L/P	V			50.6	19.0			69.6	77.4	7.8
312.0	L/P	H			60.6	19.0			79.6	77.4	(2.2)*
468.0	L/P	V			50.1	22.1			72.2	77.4	5.2*
468.0	L/P	H			48.9	22.1			71.0	77.4	6.4
624.0	L/P	V			43.2	25.2			68.4	77.4	9.0
624.0	L/P	H			42.7	25.2			67.9	77.4	9.5
780.0	L/P	V			38.1	28.2			66.3	77.4	11.1
780.0	L/P	H			41.6	28.2			69.8	77.4	7.6
936.0	L/P	V			29.9	30.8			60.7	77.4	16.7
936.0	L/P	H			30.3	30.8			61.1	77.4	16.3
1096.0	Hrn2	V			31.3	28.4			59.7	75.3	15.6
1096.0	Hrn2	H			41.0	28.4			69.4	75.3	5.9
1248.0	Hrn2	V			30.0	28.9			58.9	75.3	16.4
1248.0	Hrn2	H			34.5	28.9			63.4	75.3	11.9
1404.0	Hrn2	V			31.0	29.5			60.5	75.3	14.8
1404.0	Hrn2	H			35.4	29.5			64.9	75.3	10.4
1560.0	Hrn2	V			31.2	29.3			60.5	75.3	14.8
1560.0	Hrn2	H			36.0	29.3			65.3	75.3	10.0
468.0	E/D4	V			45.2	26.3			71.5	77.4	5.9
468.0	E/D4	H			44.3	26.3			70.6	77.4	6.8
312.0	E/D3	H			50.5	22.2			72.7	77.4	4.7
312.0	E/D3	V			44.0	22.2			66.2	77.4	11.2

Notes:

The spectrum was search up to the 10th harmonic of the fundamental frequency.

B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole

* Includes cable loss when amplifier is not used.

** Includes cable loss.

() Denotes failing emission level.

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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output

FCC ID: H7CM-10A

Photographs of Test Setup

FRONT VIEW

REAR VIEW

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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output

FCC ID: H7CM-10A

Section 10. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY:	DATE

Test Results: Complies/Does Not Comply.

Measurement Data: See attached tables.

NOT APPLICABLE

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EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 11. Transient Frequency Behaviour

NAME OF TEST: Transient Frequency Behaviour	PARA. NO.: 90.214
TESTED BY: Kevin Carr	DATE: October 7, 1998

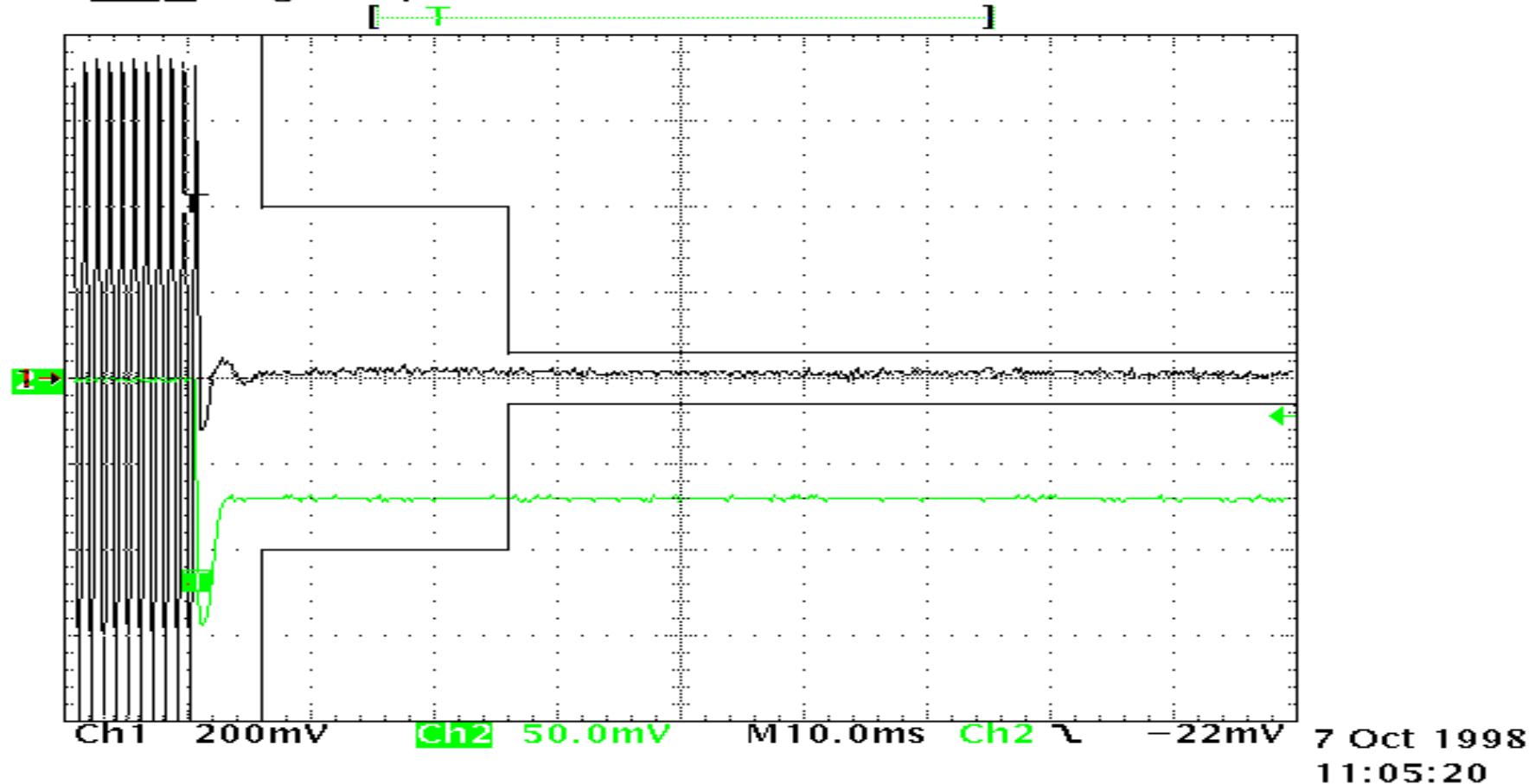
Test Results: Complies.

Measurement Data: See attached graphs.

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Switch On

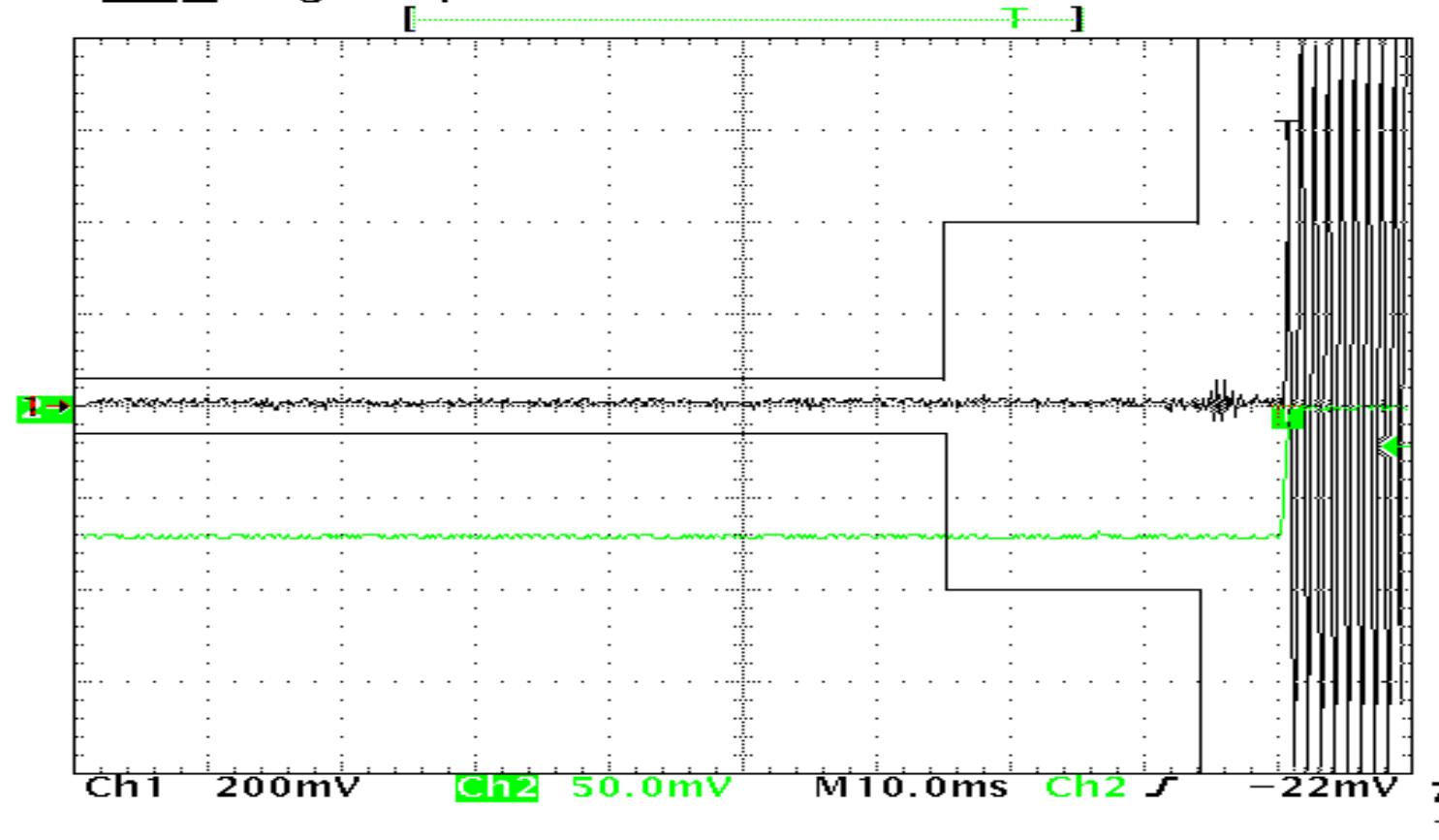
Tek Stop: Single Seq 5.00ks/s



EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Switch Off

Tek Stop: Single Seq 5.00ks/s



7 Oct 1998
11:08:19

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

Section 12. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 20/98	May 20/99	
1 Year	Spectrum Analyzer-2	Hewlett Packard	8566B	1950A00400	July 22/98	July 22/99	
1 Year	Spectrum Analyzer Display-2	Hewlett Packard	85662A	1950A01177	July 22/98	July 22/99	
1 Year	Quasi Peak Adaptor-2	Hewlett Packard	85650A	2251A00620	July 22/98	July 22/99	
1 Year	Radio Test Set	Rohde & Schwarz	CMS 52	840.0009.52	July 23/98	July 23/99	
	Power Supply	Astron	VS-50M	8405071	NCR	NCR	
1 Year	Attenuator	Narda	765-20	9510	July 24/98	July 24/99	
1 Year	Attenuator	Narda	768-10	9709	July 24/98	July 24/99	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/98	July 23/99	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/98	July 23/99	
1 Year	Receiver	Rohde & Schwarz	ESVP	892661/014	Mar. 31/98	Mar. 31/99	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	Log Periodic Antenna	EMCO	LPA-25	1141	July 27/98	July 27/99	
1 Year	Dipole Antenna Set	EMCO	3121C	1029	Oct. 28/97	Oct. 28/98	
	50 Ω Termination	Wiltron	26N50	605248	N/A	N/A	
1 Year	Directional Coupler	Hewlett Packard	765D	228	July 21/98	July 21/99	
	Detector	Sierra	164B	395	N/A	N/A	
	50 ohm Combiner Pad	Mini Circuits	ZA3PD-4	9740	Dec. 12/97	Dec. 12/98	
1 Year	Digital Storage Oscilloscope	Tektronix	TDS544A	B012005	July 23/98	July 23/99	
1 Year	RF Generator	Rohde & Schwartz	SIMIQ03	DE24154	Oct. 17/98	Oct. 17/99	

NA: Not Applicable

NCR: No Cal Required

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FCC PART 90, SUBPART I
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ANNEX A

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
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ANNEX A

TEST METHODOLOGIES

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
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Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
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NAME OF TEST: Audio Frequency Response	PARA. NO.: 2.987(a)
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Test Method: TIA/EIA-603

Minimum Standard: TIA/EIA-603, Para. 3.2.6 from 300 Hz to 3000 Hz. The transmitter audio frequency response shall have a nominal 6 dB per octave pre-emphasis characteristic.

NAME OF TEST: Audio Low-Pass Filter Frequency Response	PARA. NO.: 2.987(a)
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Test Method: TIA/EIA-603

Minimum Standard: TIA/EIA-603

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(a)
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Test Method: TIA/EIA-603

Minimum Standard: TIA/EIA-603

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
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Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

Test Method:

RBW: 1% of emission bandwidth in 0 - 1 GHz range. 1 MHz at frequencies above 1 GHz.

VBW: RBW

The spectrum is search up to 10 times the fundamental frequency.

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.993
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Minimum Standard: Para. No. 90.210, see table 1 for applicable mask.

Calculation of Field Strength Limit

An example of attenuation requirement of $50 + 10 \log P$ is equivalent to -20 dBm (1×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions $\leq 1 \text{ GHz}$:

$G = 1.64$ (Dipole Gain)

$P = 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V/m} = 77.4 \text{ dB}\mu\text{V/m}$$

For emissions $> 1 \text{ GHz}$:

$G = 1$ (Isotropic Gain)

$P = 1 \times 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = 77.4 - 20 \log \sqrt{1.64} = 75.2 \text{ dB}\mu\text{V/m} @ 3\text{m}$$

MASK	Spurious Limit	FS Limit Below 1 GHz	FS Limit Above 1 GHz
A,B,C,G,H,I	-13dBm	84.4 dB μ V/m@3m	82.2 dB μ V/m@3m
D,J	-20dBm	77.4 dB μ V/m@3m	75.2 dB μ V/m@3m
E,F,K	-25dBm	72.4 dB μ V/m@3m	70.2 dB μ V/m@3m

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
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Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

NAME OF TEST: Transient Frequency Behaviour	PARA. NO.: 2.214
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Minimum Standard:

Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels

	Maximum	Frequency ranges (MHz) All equipment					
		Base station and portable radios			Mobile Radios		
Time intervals ^{1,2}	Frequency difference ³ (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1^4	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t_2	± 12	20.0	25.0	50.0	20.0	25.0	20.0
t_3^4	± 25	5.0	10.0	10.0	5.0	10.0	5.0

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

	Maximum	Frequency ranges (MHz) All equipment		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
Time intervals ^{1,2}	Frequency difference ³ (kHz)			
t_1^4	$\pm 12.5 / \pm 6.25$	5.0	10.0	20.0
t_2	$\pm 6.25 / \pm 3.125$	20.0	25.0	50.0
t_3^4	$\pm 12.5 / \pm 6.25$	5.0	10.0	10.0

KTL Ottawa

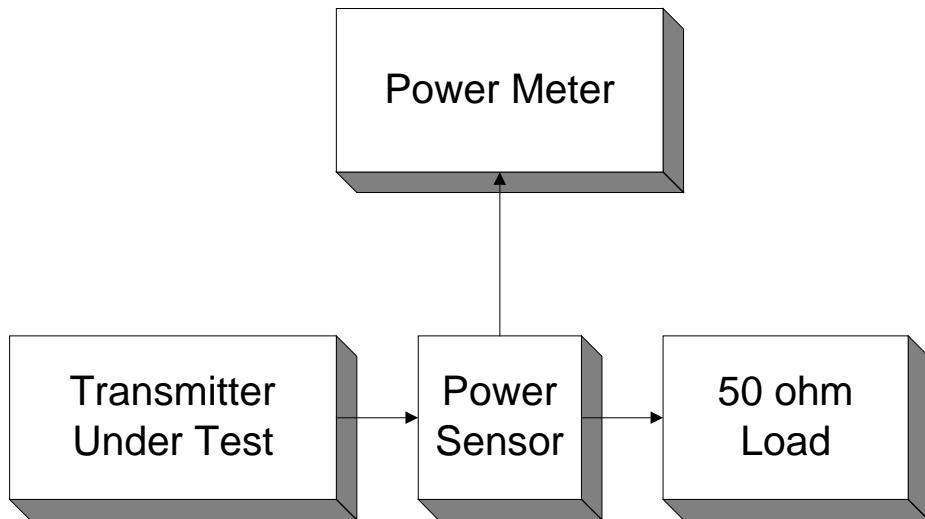
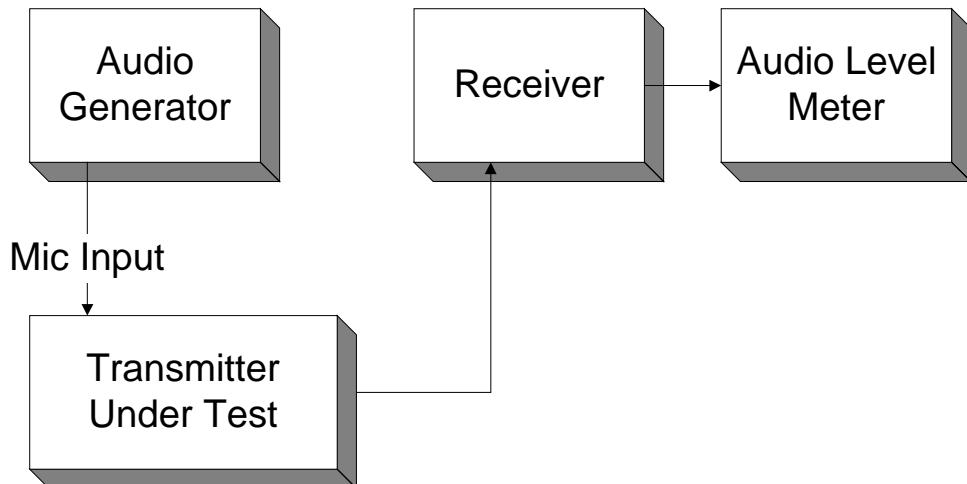
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE TRANSMITTER
PROJECT NO.: 8R00924
ANNEX B

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

ANNEX B

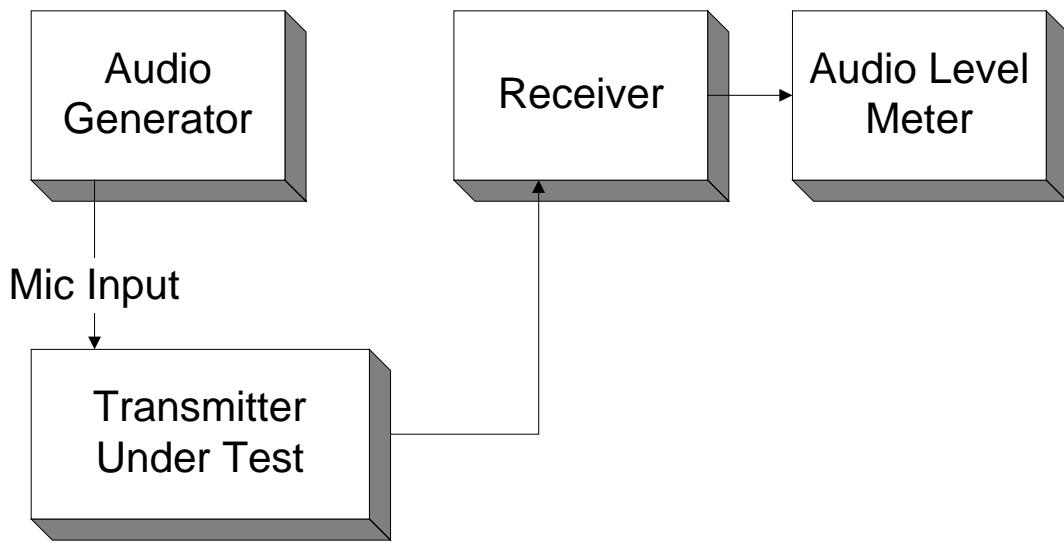
TEST DIAGRAMS

*EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A*

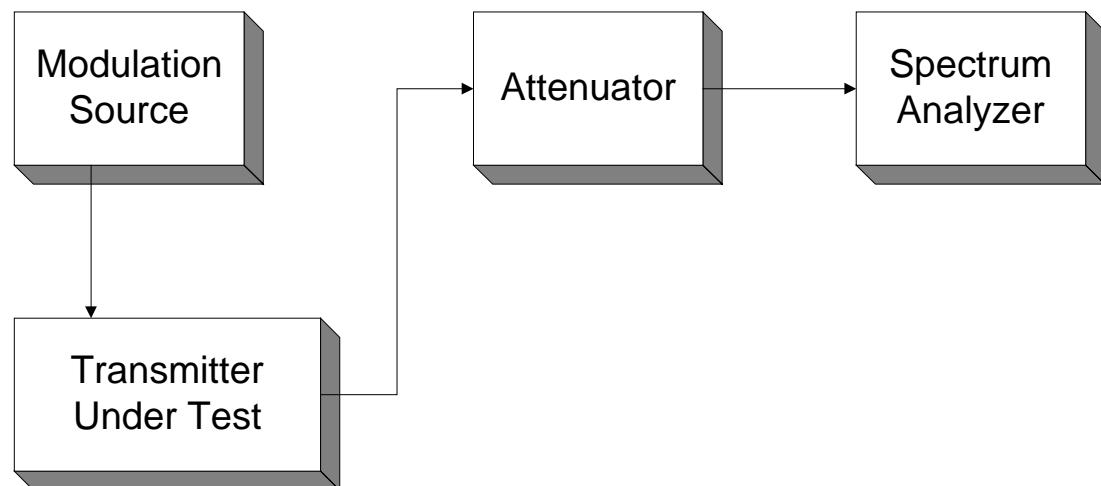
Para. No. 2.985 - R.F. Power Output**Para. No. 2.987(a) - Audio Frequency Response**

EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A

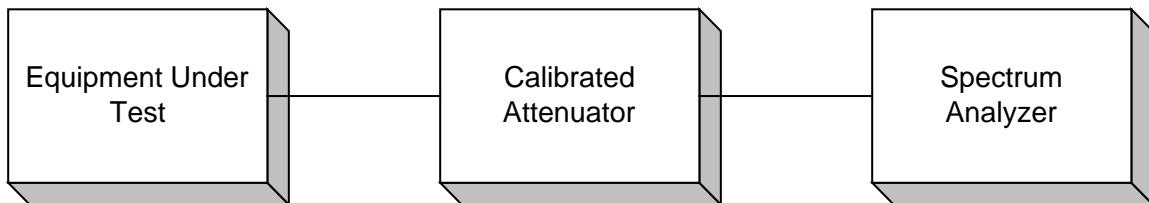
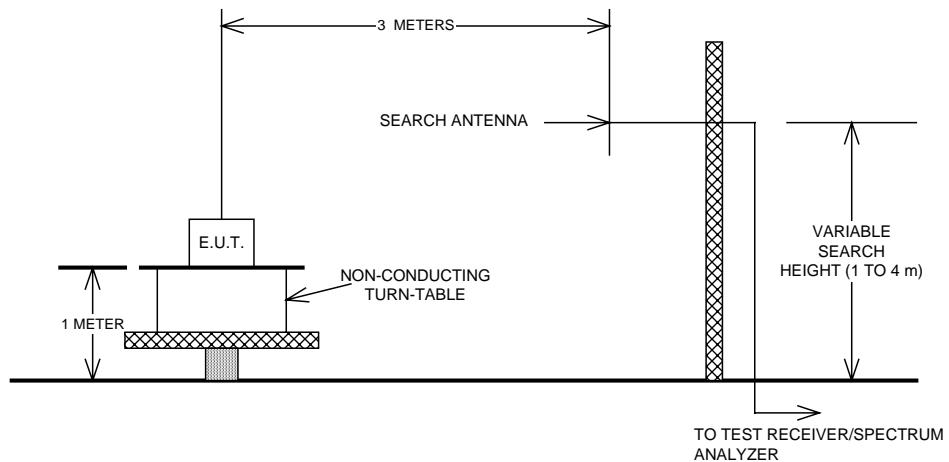
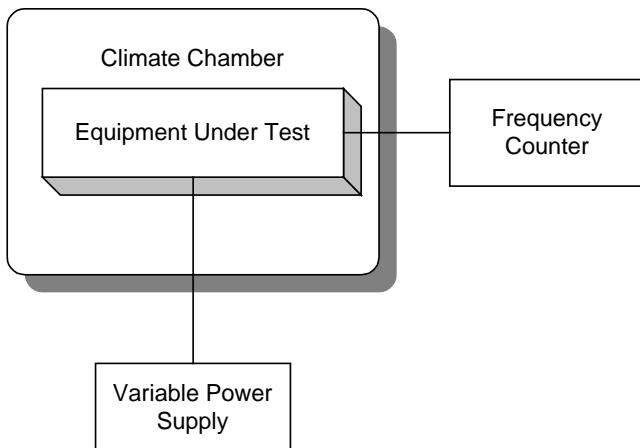
Para. No. 2.987(b) - Modulation Limiting



Para. No. 2.989 - Occupied Bandwidth

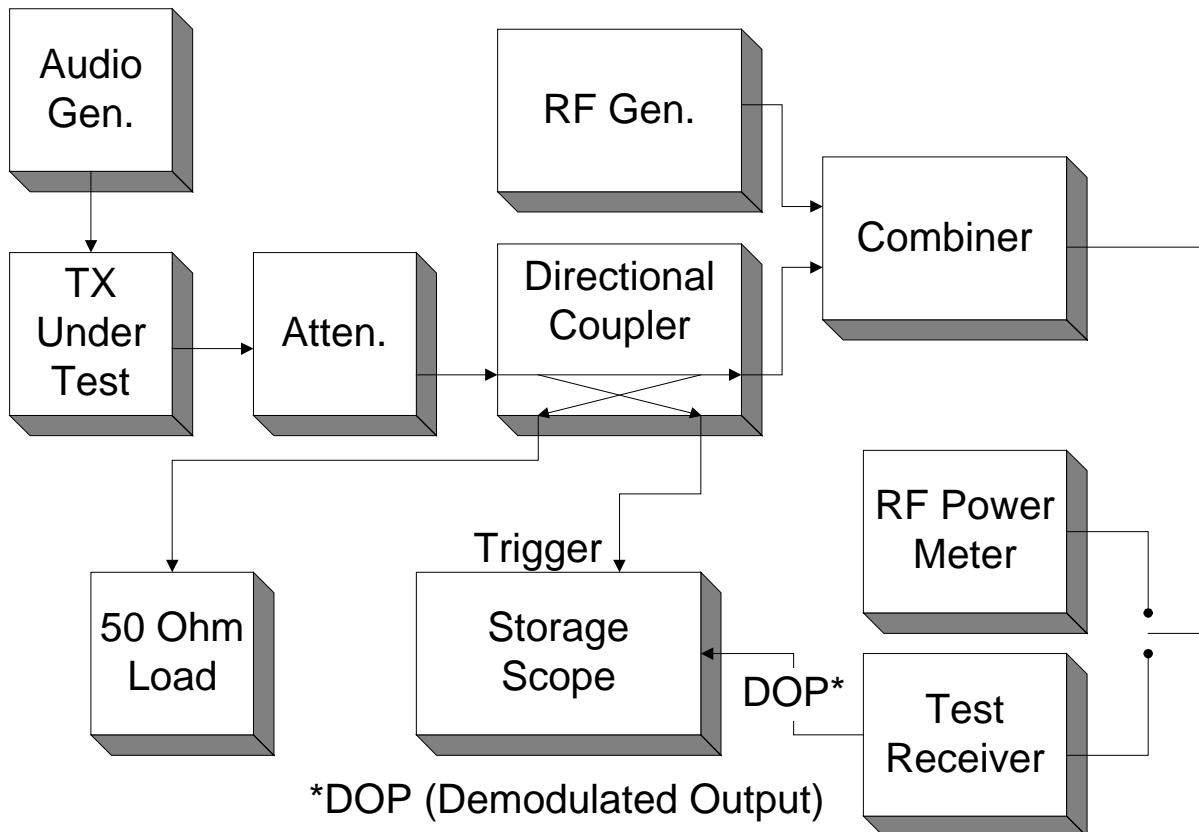


*EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
FCC ID: H7CM-10A*

Para. No. 2.991 - Spurious Emissions at Antenna Terminals**Para. No. 2.993 - Field Strength of Spurious Radiation****Para. No. 2.995 - Frequency Stability**

*EQUIPMENT: M10 Mobile Radio With 10W & 30W Power Output
 FCC ID: H7CM-10A*

Para. No. 90.214 - Transient Frequency Behaviour



Voice

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

Data

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).