



Nemko

Test Report: 5W51196, Issue 2.


Applicant: Mark IV Industries
6020 Ambler Drive
Mississauga, Ontario
L4W 2P1

Apparatus: RFM-S Transmitter

FCC ID: JQU 801531

In Accordance With: **FCC Part 90, Subpart M**
902-928MHz, LMS Systems

Tested By: Nemko Canada Inc.
303 River Road
Ottawa, Ontario
K1V 1H2

Authorized By: 

Sim Jagpal, General Manager

Date: 28 September 2005

Total Number of Pages: 21

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Sub part M. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	RFM-S Transmitter
Specification:	FCC Part 90, Subpart M 902-928MHz, LMS Systems
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

Author: Xu Jin, Wireless Specialist

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

TABLE OF CONTENTS

Report Summary	2
Section 1: Equipment Under Test	4
1.1 Product Identification	4
1.2 Samples Submitted for Assessment.....	4
1.3 Technical Specifications of the EUT	5
Section 2: Test Conditions	6
2.1 Specifications	6
2.2 Deviations From Laboratory Test Procedures	6
2.3 Test Environment	6
2.4 Test Equipment.....	6
Section 3: Observations	7
3.1 Modifications Performed During Assessment	7
3.2 Record Of Technical Judgements	7
3.3 EUT Parameters Affecting Compliance	7
3.4 Test Deleted.....	7
Section 4: Results Summary	8
4.1 FCC Part 90: Test Results	9
Appendix A: Test Results	10
Section 1. RF Output Power	10
Section 2. Transmitter Emissions IN Band	11
Section 3. Spurious Emissions at Antenna Terminals.....	13
Section 4. Radiated Spurious Emissions	15
Section 6: Frequency Stability	17
Appendix B : Setup Photographs	19
Appendix C : Block Diagram of Test Set-ups	20

Section 1: Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:
RFM-S Transmitter

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
1	MARK I.V.H.S. ROAD CHECK RF MODULE #5	N.A.
2	MARK I.V.H.S. ROAD CHECK READER	0601048

The first samples were received on: Sep.1, 2005

1.3 Technical Specifications of the EUT

Manufacturer:	Mark IV Industries
Operating Frequency:	915.75MHz
Emission Designator:	K1D
Rated Conducted Power:	4W
Modulation:	On-off Keying
Antenna Information	15dB
Power Source:	120VAC

Section 2: Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 90, Subpart M

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 °C
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSP	FA001920	March 22/05	March 22/06
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 18/05	May 18/06
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 18/05	May 18/06
Horn Antenna #1	EMCO	3115	FA000649	Dec. 22/04	Dec. 22/05
Biconical (1) Antenna	EMCO	3109	FA000805	April 22/05	April 22/06
0.1 – 1300 MHz Amplifier	Hewlett Packard	8447D	FA001909	Jan. 13/05	Jan. 13/06
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	July 14/05	July 14/06
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	July 14/05	July 14/06
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	July 14/05	July 14/06
5.0 – 18.0 GHz Amplifier	NARDA	DWT-186N23U40	FA001409	COU	COU
Receiver	Rohde & Schwarz	ESVS-30	FA001437	July 27/05	July 27/06
Climate Chamber	Thermotron	SM-16C	15649-S	COU	COU

COU – Cal. On Use

NCR – No Cal. Required

Section 3: Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

Section 4: Results Summary

This section contains the following:

FCC Part 90: Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No: not applicable / not relevant.
- Y Yes: Mandatory i.e. the apparatus shall conform to these tests.
- N/T Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 90: Test Results

Section	Clause FCC Part 90	Test Method	Test Description	Required	Result
1	90.205	2.1046	RF Power Output	Y	Complied
2	90.210	2.1049	Transmitter Emissions in Band	Y	Complied
3	90.210	2.1051	Spurious Emissions at Antenna Terminals	Y	Complied
4	90.210	2.1053	Field Strength of Spurious Emissions	Y	Complied
5	90.213	2.1055	Frequency Stability	Y	Complied

Appendix A: Test Results

Section 1. RF Output Power

Criteria: Clause 90.205(K)

LMS systems operating pursuant to Subpart M of this part in the 902-927.25 MHz band will be authorized a maximum of 30 watts ERP

Test Conditions:

Sample Number:	1 &2	Temperature:	23
Date:	Sep 6, 2005	Humidity:	51
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Wireless Lab

Test Limit: 30W(44.77dBm) ERP

Test Results: Complied

Test Data: See attached tables

Note: The test has been conducted at normal voltage condition and extreme voltage conditions. The Maximum RF output power is within ±1dB of the manufacturer’s rating.

The test was conducted with spectrum analyser with peak detector with RBW 3MHz, VBW 3MHz settings.

Frequency (MHz)	Rated Power (dBm)	Measured Power at 120VA (dBm)	Measured Power at 102VAC (dBm) (-15%)	Measured Power at 138VAC(dBm) (+15%)
915.75	36	35.27	35.67	35.49

Antenna Gain=15dB

*RF Path Loss= 15dB

Maximum ERP power=35.67dBm+15dB-15dB=35.67dBm

Note:

*Manufacture declared the RF path loss between the antenna input port and the RFM-S transmitter shall be greater than or equal to the antenna gain.

Section 2. Transmitter Emissions IN Band

Criteria: Clause 90. 210

For all other transmitters authorized under Subpart M that operate in the 902-928 MHz band, the peak power of any emission shall be attenuated below the power of the highest emission contained within the licensee's sub-band in accordance with the following schedule:

- (i) On any frequency within the authorized bandwidth: Zero dB.
- (ii) On any frequency outside the licensee's sub-band edges: $55 + 10 \log(P)$ dB, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

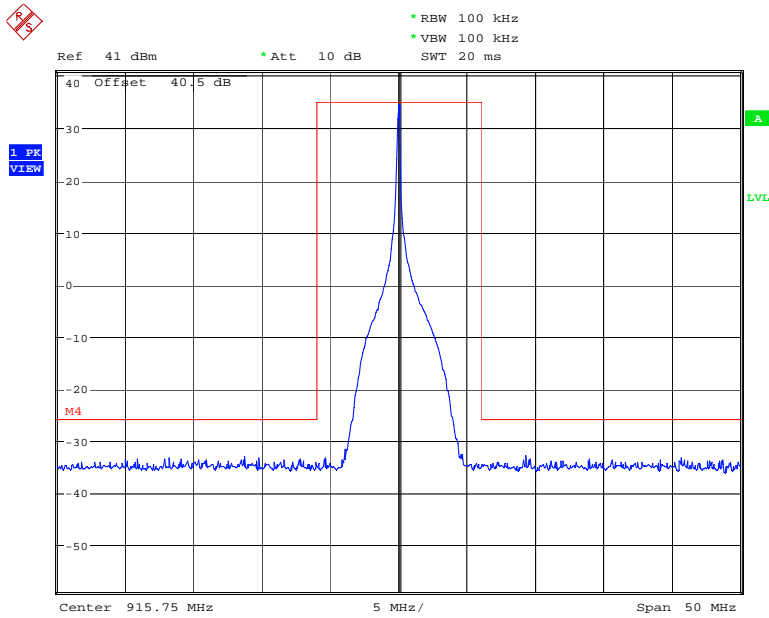
Test Conditions:

Sample Number:	1 &2	Temperature:	23
Date:	Sep 6, 2005	Humidity:	51
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Wireless Lab

Test Results: Complies

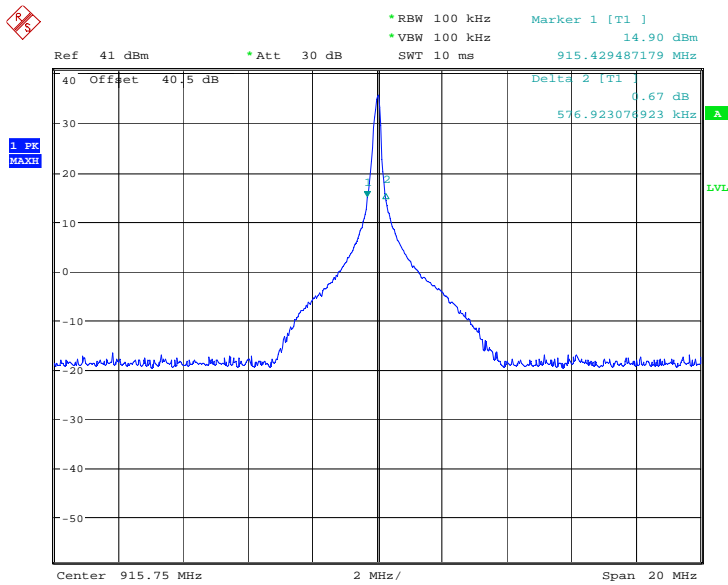
Test Data: See Attached Plots.

Note: The EUT was operated at 909.75MHz to 921.75MHz band for LMS operation.



Date: 6.SEP.2005 12:12:44

20dB Occupied Bandwidth=376.9KHz



Date: 12.SEP.2005 15:14:37

Section 3. Spurious Emissions at Antenna Terminals

Criteria: Clause 90.210

On any frequency outside the licensee's sub-band edges: $55 + 10 \log(P)$ dB, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

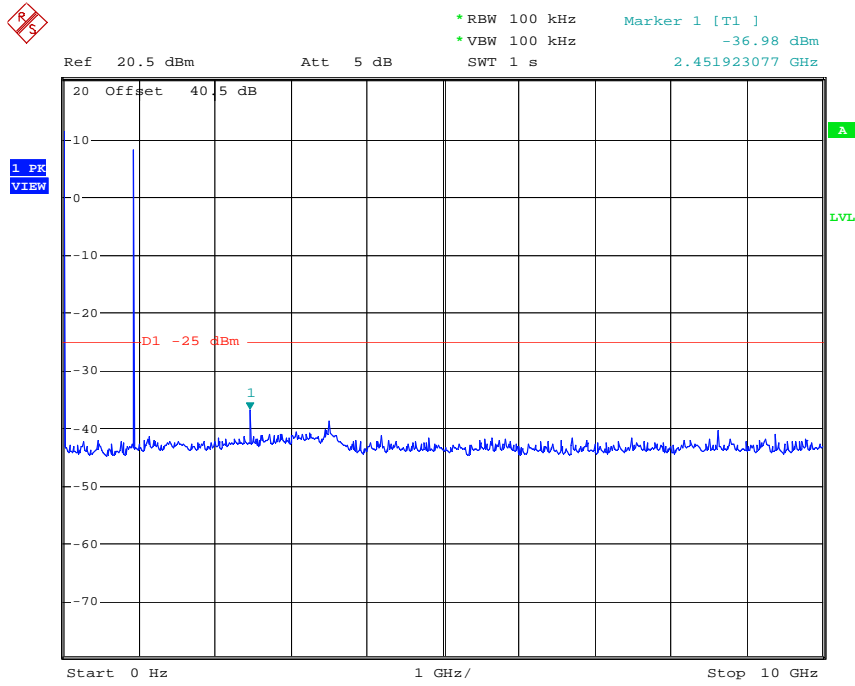
Test Conditions:

Sample Number:	1 &2	Temperature:	23
Date:	Sep 6, 2005	Humidity:	51
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Wireless Lab

Test Limit: -25dBm

Test Results: Complies

Test Data: See Attached Plots.



Date: 2.SEP.2005 16:19:00

Section 4. Radiated Spurious Emissions

Criteria: Clause 90.210

On any frequency outside the licensee's sub-band edges: $55 + 10 \log(P)$ dB, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band

Test Conditions:

Sample Number:	1 &2	Temperature:	23
Date:	Sep 7, 2005	Humidity:	51
Modification State:	0	Tester:	Xu Jin
		Laboratory:	OATS

Test Result: Complies

Test Results: See Attached Table for Results.

All measurements were performed using a Peak Detector with 100kHz RBW below 1GHz and a 1MHz RBW above 1GHz at a distance of 3 meters.

The EUT was searched from 30MHz to 10GHz.

Only worst case has been presented.

Radiated Spurious Emissions Test Data

Test Distance: 3 meters.

Frequency (MHz)	Antenna	Polarity	RCVD Signal (dBµV)	Sig. Sub. Factor (dB)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Detector
73.7500	BC1	H	43.3	-91.3	-48	-25	23	Peak
73.7500	BC1	V	41.1	-89.0	-47.9	-25	22.9	Peak
1831.3000	Horn1	H	73.7	-116.4	-42.7	-25	17.7	Peak
1831.3000	Horn1	V	72.5	-116.4	-43.9	-25	18.9	Peak

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole

Note 2: Detector Legend: Q-Peak = 120 kHz RBW, Average = 1.0 MHz RBW

Below 1GHz, Peak detector with 100 kHz RBW, 100KHz VBW

Above 1GHz, Peak detector with 1.0MHz RBW, 1.0MHz VBW

Section 5: Frequency Stability

Criteria: Clause 2.1055

(a) The frequency stability shall be measured 1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a)(2) and (3) of this section.

Test Conditions:

Sample Number:	1 &2	Temperature:	23
Date:	Sep.7, 2005	Humidity:	50
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Environment Chamber

Test Results: Complies

Test Conditions Ambient Temperature: 23°C
Extreme Temperature: -30°C to +50°C
Extreme Voltage Conditions: +/-15% of AC Mains

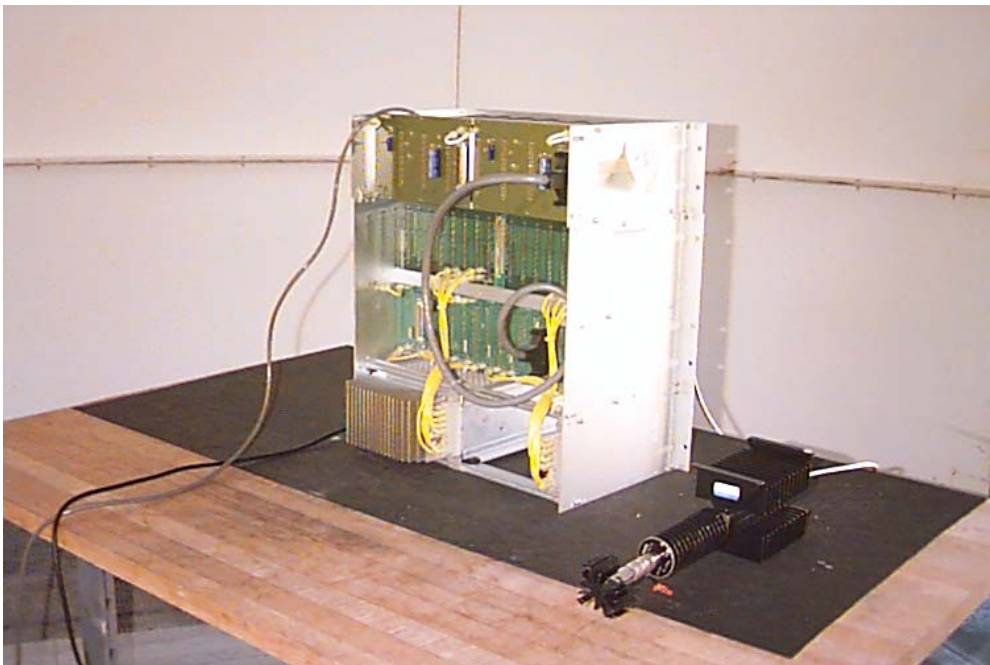
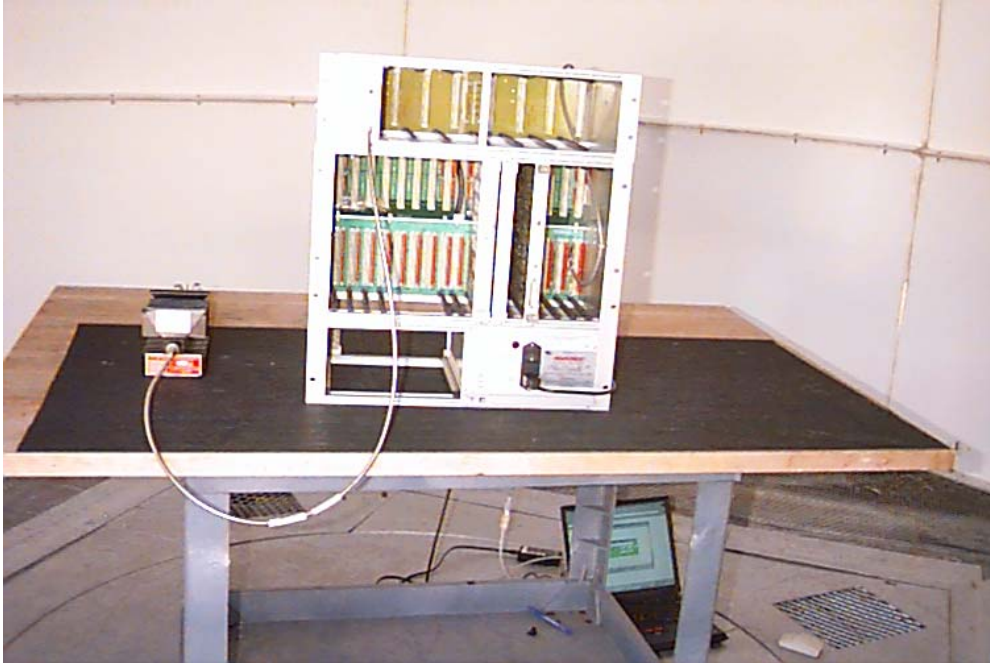
Test Data: See Attached tables

Frequency Tolerance Test

Test Condition	Measured Frequency (MHz)	Frequency Drift (ppm)
+23°C, 120 VAC	915.7558348	----
+23°C, 102 VAC	915.7550981	-0.8ppm
+23°C, 138 VAC	915.7553824	-0.5ppm
+50°C, 120 VAC	915.7567617	1.01ppm
+50°C, 102 VAC	915.7564652	0.7ppm
+50°C, 138 VAC	915.7537977	-2.22ppm
-30°C, 120 VAC	915.7539826	-2.02ppm
-30°C, 102 VAC	915.7538762	-2.14ppm
-30°C, 138 VAC	915.7542185	-1.76ppm

Appendix B : Setup Photographs

Radiated Spurious Emissions Setup:

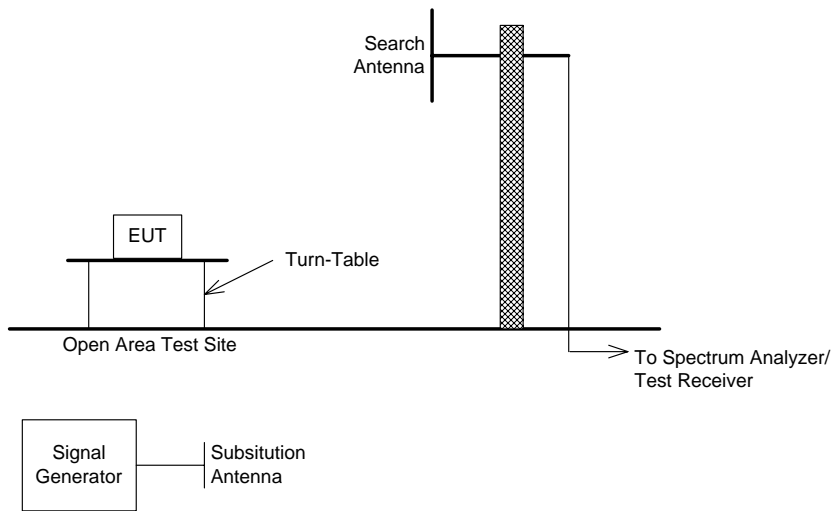


Appendix C : Block Diagram of Test Set-ups

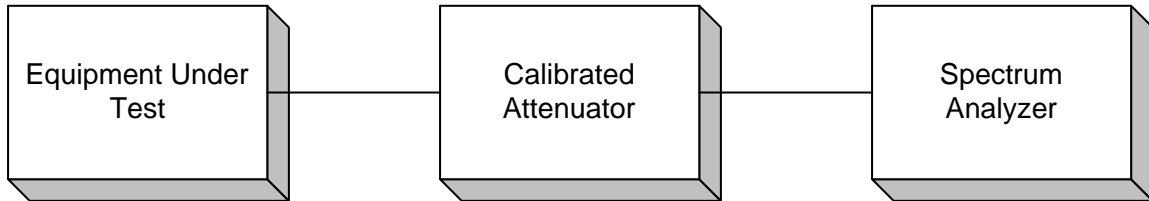
Test Site for Radiated Emissions

Para No.2.1053-Field Strength of Spurious Radiation

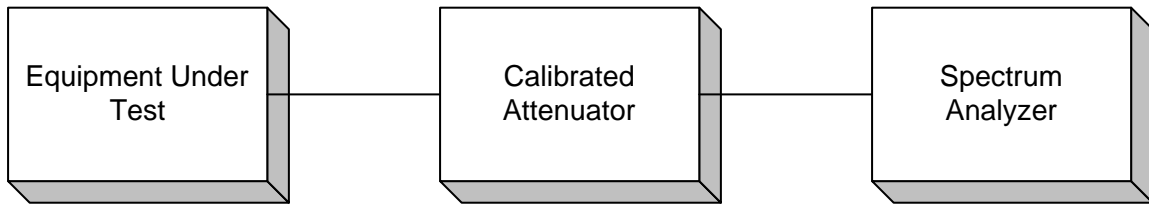
TIA/EIA 603
Effective Radiated Power
Spurious Emissions



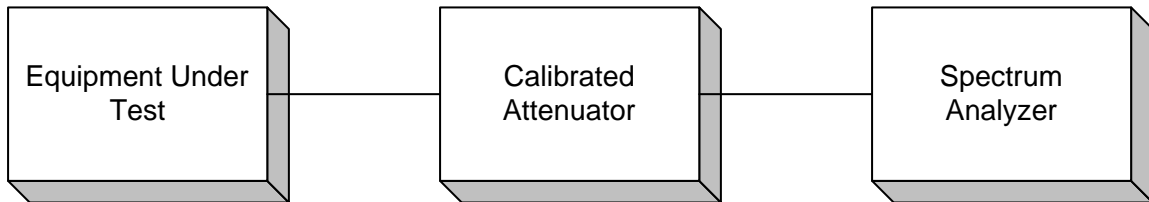
Para No.2.1046 – RF Output Power



Para No.2.1049 – Occupied Bandwidth



Para. No. 2.1051-Spurious Emissions at Antenna Terminals



Para. No. 2.1055 – Frequency Stability

