Nemko Test Report:	3L0023RUS1Rev2
Applicant:	Nokia Mobile Phones, Inc. 6021 Connection Drive

Irving, Texas 75039

Equipment Under Test: (E.U.T.)

Model 2220 (Mexican Build)

In Accordance With:

FCC Parts 2 and 22 800 MHz Cellular Subscriber Units

Tested By:

Nemko Dallas Inc. 802 N. Kealy Lewisville, TX 75057-3136

Jo- Till

Authorized By:

Tom Tidwell, Frontline Manager

Date:

5/5/03

Total Number of Pages: 32

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Section 1. Summary of Test Results

Manufacturer: Nokia

Model No.: Model 2220

Serial No.: ESN: 07201962409 ESN: 07201962410

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 22, Subpart H.

\boxtimes	New Submission		Production Unit
	Class II Permissive Change	\square	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".

TESTED BY: David Light

DATE: <u>March 19 2003</u>

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	2.1046	7W ERP	Complies
Spurious Emissions at Antenna Terminals	2.1051	-13 dBm	Complies
Field Strength of Spurious Emissions	2.1053	82.3 dBµV/m	Complies
Frequency Stability	2.1055	2.5 ppm	Complies

Footnotes:

Section 2. General Equipment Specification

Frequency Range, MHz:	824.04 to 848.97
Tunable Bands:	824.04 to 848.97
Necessary Bandwidth:	Not selectable by user 30 kHz
Type of Modulation and Designator:	40K0F1D, 40K0F8W, and 30K0DXW
Output Impedance:	50 ohms
RF Power Output (rated):	528.4 mW (TDMA) 290.4 mW (AMPS)
Duty Cycle:	Continuous
Channel Spacing:	30 kHz
Operator Selection of Frequency:	Software Controlled
Power Output Adjustment Capability:	Software Controlled

Operational Description

This device is a wireless dual mode phone that operates in the cellular band.

System Diagram

Refer to separate EXHIBITS

Section 3. RF Power Output

NAME OF TEST: RF Power Output	
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PARA. NO.: 22.913

TESTED BY: Tom Tidwell

DATE: 4/11/03

Test Results: Complies.

Measurement Data:

Conducted Data -

Frequency (MHz)	Mode	Conducted Power (dBm)	Conducted Power (mW)
824.04	AMPS	24.63	290.4
836.52	AMPS	24.63	290.4
848.97	AMPS	24.29	268.5
824.04	TDMA	27.23	528.4
836.52	TDMA	27.13	516.4
848.97	TDMA	26.74	472.1

Agilent power meter E4418B s/n GB40206972 Cal'd 9/19/02 Due 9/19/03 Agilent power sensor 8482H s/n 3318A05855 Cal'd 12/19/02 Due 12/19/03

FCC PARTS 2 and 22 800 MHz CELLULAR SUBSCRIBER UNITS Report No.: 3L0023RUS1Rev1

Dallas Headquarters:

Test Data - ERP

Ner	nko Dallas		ko		802 N. Kealy Lewisville, TX 75057 Tel: (972) 436-9600 Fax: (972) 436-2667					
Nei		, me.		ERP	Substitutio	n Method				
Page 1 o	of 1							Complete	Х	
ob No.:	3L0023R			Date:	3/19/03			Preliminary	Х	-
pecification:	Parts 2 & 22		Ten	nperature(°C):						-
ested By:	David Light			Humidity(%)						
.U.T.:		ellular phone								
onfiguration:	Upright	Figure 1								
ample No:	2									
ocation:	A-OATS			-	RBW:	100 kHz		Measurement		
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re-Amp:				5	Cable #1	1983				
ilter:						1705				
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ttenuator #1	1050									
ttenuator #2:										
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feasurement U Frequency (MHz) 824.04 824.04 836.52 836.52 836.52 848.97	Meter Reading (dBm) -11.5 -22.9 -10.9 -21.7 -11.2	+/-1.7 dB Correction Factor (dB) 38.4 39.1 37.6 38.2 37.6	Substitution Input [dBm] 26.9 16.2 26.7 16.5 26.4	Gain (dB) 0 0 0 0 0 0 0	Antenna Gain		(dBm) 26.9 16.2 26.7 16.5 26.4	(mW) 493.1738 41.9759 466.6594 445.656 - 431.5191	V H H V V	TDMA TDMA TDMA TDMA TDMA TDMA
feasurement U Frequency (MHz) 824.04 824.04 836.52 836.52 836.52 848.97 848.97	Meter Reading (dBm) -11.5 -22.9 -10.9 -21.7 -11.2 -20.3	+/-1.7 dB Correction Factor (dB) 38.4 39.1 37.6 38.2 37.6 40.3	Substitution Input [dBm] 26.9 16.2 26.7 16.5 26.4 20.0	Gain (dB) 0 0 0 0 0 0 0 0 0 0	Antenna Gain		(dBm) 26.9 16.2 26.7 16.5 26.4 20.0	(mW) 493.1738 41.9759 466.6594 44.5656 431.5191 98.8553	V H H V H	TDMA TDMA TDMA TDMA TDMA TDMA TDMA
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Test Setup Photo



Section 4. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions At Antenna Terminals PARA. NO.: 2.1051

TESTED BY: Eldon Berry

DATE: 1/30/2003

Test Results: Complies.

Measurement Data:

Test Plots – Spurious Emissions at Antenna Terminals

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Test Plots – Spurious Emissions at Antenna Terminals



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Data Plot		Spur	ious Emi	ssions at	Antenna 🛛	Ferminal	s			
Page <u>2</u> of 6										
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Test Plots – Spurious Emissions at Antenna Terminals

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bb No: <u>31.0023R</u> Data <u>31.082003</u> preditation: <u>Ps 2 & 22</u> Temperature(°C): <u>22</u> stead By: <u>Dual mode cellular phone (Mexican Build)</u> UT: <u>Dual mode cellular phone (Mexican Build)</u> 29.5 dBm <u>SHT</u> 115 s Unit CHECK : <u>Ph SSED</u> 19.9 dB Offset <u>Lilit CHECK : Ph SSED</u> 19.9 dB Offset <u>Lilit CHECK : Ph SSED</u> 10 10 10 10 10 10 10 10 10 10		Spurious Emissions at A	Antenna T	<u>[erminals</u>							
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Test Plots – Spurious Emissions at Antenna Terminals



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-70.5											the work						
	Cente	∋r	824	MHz				200	KH2	Z/				Sp	an 2	MHz	
Date:		1	18.M	AR.2	003	15:5	3:36										
Note	s. 1	0.10	FRP	ND FI	DGE - TDN	14											
Note	_			4 MHz	/GE - IDA	171											
	-	(4	, 52														
	-																

Test Plots – Spurious Emissions at Antenna Terminals



Nemko Dallas, Inc.		A 4	T • 1		
Test Plot:	<u>Spurious Emissions at</u>	Antenna	Terminals		
Page <u>5</u> of <u>6</u>					
Job No.: <u>3L0023R</u>	Date: 3/18/2003	-			
Specification: Pts 2 & 22	Temperature(°C): 22	-			
Tested By: David Light	Relative Humidity(%) 45	-			
E.U.T.: Dual mode cellular ph	ione (Mexican Build)				
Configuration: Tx full power					
	Marker 2 [11]	кви	3UU KHZ	RF Att	20 dB
Ref Lvl	-33.17 dBm	VBW	300 kHz	Mixer	-10 dBm
29.5 dBm	2.47472946 GHz	SWT	250 ms	Unit	dBm
29.5					
19.9 dB Offs	et l				A
20					
20					
10					
0	<u> </u>	-			
1VIEW					1MA
-10					
-10 					
					EXT
-20					
-30					
	▼				
-40			manner	when the marke	mome
10 Admin lancolo	for the man the man the second second	mun			
-50					
1					
-60					
		MU	I		
Start 30 MHz	897	MHz/		Ste	op 9 GHz
ate: 18.MAR.2003 15:55:59					
Notes: SPURIOUS EMIS	SIONS AT ANTENNA TERMINAL - T	TDMA			
	CATES CARRIER - MARKER 2 INDI		EST EMISSION		
	CTRUM TO 10TH HARMONIC OF CA		251 201001011		

Test Plots – Spurious Emissions at Antenna Terminals



Test Plot	•	Snur	ious Emis	sions at A	ntenna T	erminal	s			
Page 6 c		<u>Spur</u>		510115 at 1	Mittina 1	CI IIIIIai	5			
Job No.:	3L0023R		Date: 3/1	8/2003						
Specification:	Pts 2 & 22	Tem	perature(°C): 22							
Tested By: David Light Relative Humidity(%) 45										
E.U.T.:	Dual mode cellular pl	none (Mexican B	uild)							
Configuration:	Tx full power									
	Lvl	Marker	2 [11]	99 dBm	КВМ КВМ	300 H 300 H		- Att ixer	20 dB -10 dBm	
· ·	.5 dBm	F	-38. 3.950741		SML	250 r		nit	dBm	
29 5				10 0112		200	по оп т	1		
19	∃.9 <mark>1</mark> dB Offs ▼	et								A
20										
10										
10										
0										
1 V I	EW									1MA
-10	-13 dBm									
-01	-18 GBM									ЕХТ
-20										
-30										
00										
10							2			
-40						mone	Mandura	man	when	
helene	wellphingh	form	mann	man	man .					
-50										
-60										
-70.5										
Sta	Start 30 MHz 897 MHz/ Stop 9 GHz									
Date:	ate: 18.MAR.2003 16:01:46									
Notes:	SPURIOUS EMIS	SIONS AT AN	TENNA TED	MINAL - AN	IPS					
110165.	MARKER 1 INDI					ST EMISSI	ON			
	SEARCHED SPE									

Section 5. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: David Light	DATE: 3/20/03

Test Results:

Complies.

Measurement Data: See attached table.

FCC PARTS 2 and 22 800 MHz CELLULAR SUBSCRIBER UNITS Report No.: 3L0023RUS1Rev1

Test Data - Radiated Emissions

Nemko Dallas, Inc.								Lew Tel:	as Headqua 802 N. Kealy <i>i</i> sville, TX 79 (972) 436-5 (972) 436-2	7 5057 9600
				F	RP Substit	ution Met	thod			
Page 1 of	f 1							Complete	x	
Job No.:	3L0023R			Date ⁻	3/20/03			Preliminary	X	-
Specification:	Part 22		Temr	perature(°C):				,		-
Tested By:	David Light			Humidity(%)						
E.U.T.:		(Mexican build)		, , , , , , , , , , , , , , , , , , ,						
Configuration:	Upright (Wo						-			
Sample No:	2						-			
Location:	AC 1				RBW:	100 kHz		Measurement		
Detector Type:	Peak				VBW:	100 kHz	_	Distance:	3	m
Test Fauinm	ont Ucod									
Test Equipm				D	inantianal Caumlan					
Antenna:	1304			L	virectional Coupler:		-			
Pre-Amp:	1481				Cable #1:	1485 1484	-			
Filter:					Cable #2:	1484	-			
Receiver: Attenuator #1	1036				Cable #3:		-			
							-			
Attenuator #2: Additional equip	mont used:	1060			Mixer:		-			
Measurement Un		+/-1.7 dB					-			
Measurement On	icertainty.	±/-1.7 dB								
Frequency	Meter Reading	Correction Factor		Pre-Amp Gain	Substitution Antenna Gain	Limit	ERP	ERP	Polarity	Comments
(MHz)	(dBm)	(dB)		(dB)	(dBd)	(dBm)	(dBm)	(mW)		
1673.04	-84.3	31.0		0	7.3	-13	-46.1	0.0000	V	Noise floor
2509.56	-80.8	35.5		0	8.0	-13	-37.4	0.0002	V	
3346.08	-85.0	39.8		0	8.0	-13	-37.2	0.0002	V	Noise floor
4182.60	-86.2	45.3		0	8.2	-13	-32.7	0.0005	V	Noise floor
5019.12	-85.8	41.3		0	8.2	-13	-36.3	0.0002	V	Noise floor
5855.64	-85.5	39.8		0	9.3	-13	-36.4	0.0002	V	Noise floor
6692.16	-83.3	41.3		0	9.4	-13	-32.6	0.0005	V	Noise floor
7528.68	-84.8	41.8		0	9.2	-13	-33.8	0.0004	V	Noise floor
8365.20	-86.3	42.8		0	9.1	-13	-34.4	0.0004	V	Noise floor
1673.04	-84.3	33.0		0	7.3	-13	-44.1	0.0000	Н	Noise floor
2509.56	-80.7	35.5		0	8.0	-13	-37.3	0.0002	Н	
3346.08	-85.0	36.3		0	8.0	-13	-40.7	0.0001	Н	Noise floor
4182.60	-86.2	34.8		0	8.2	-13	-43.2	0.0000	Н	Noise floor
5019.12	-85.8	38.3		0	8.2	-13	-39.3	0.0001	Н	Noise floor
5855.64	-85.5	37.8		0	9.3	-13	-38.4	0.0001	Н	Noise floor
6692.16	-83.3	39.2		0	9.4	-13	-34.8	0.0003	Н	Noise floor
7528.68	-84.8	41.5		0	9.2	-13	-34.2	0.0004	Н	Noise floor
8365.20	-86.3	42.5		0	9.1	-13	-34.7	0.0003	Н	Noise floor
Notes		spectrum to the			rrier Jpright orientatio	n was detern	nined to be wo	rst case		-
1	THE GEVICE	, was tested of	i o oiuiayu	ວາາຕາ ຕໍ່ A ເວັ້. ໂ	Prignt Unentatio	m was uetelli	med to be wo			

Photographs of Test Setup



Section 6. Frequency Stability

NAME OF TEST: Fre	quency Stability	PARA. NO.: 2.1055
TESTED BY: David L	ight	DATE: 3/20/03
Test Results:	Complies.	
Measurement Data:	See attached tables.	
Equipment Used:	Wavetek Cellular Test System Mc Cal'd 11/25/02 Due 11/25/03 283-619	del 3600D s/n 9228038
Temperature:	22 °C	
Relative Humidity:	30 %	

Test Data – Frequency Stability

Mode of Operation:	AMPS
Channel	384
Standard Test Frequency:	836.52 MHz
Standard Test Voltage:	3.8 Vdc

Temperature	Voltage	Frequency	Change	Change
(^O C)	(Vdc)	(MHz)	(Hz)	(ppm)
50	3.8	836.520247	247	0.295
40	3.8	836.520320	320	0.383
30	3.8	836.520296	296	0.354
20	3.8	836.520268	268	0.320
10	3.8	836.520336	336	0.402
0	3.8	836.520330	330	0.394
-10	3.8	836.520303	303	0.362
-20	3.8	836.520328	328	0.392
-30	3.8	836.520325	325	0.389
20	4.4	836.520240	240	0.287
20	3.1*	836.520241	241	0.288

Mode of Operation	TDMA
Channel	384
Standard Test Frequency:	836.52 MHz
Standard Test Voltage:	3.8 Vdc

Temperature	Voltage	Frequency	Change	Change
(O ^O)	(Vdc)	(MHz)	(Hz)	(ppm)
50	3.8	836.519999	-1	-0.001
40	3.8	836.519991	-9	-0.011
30	3.8	836.519994	-6	-0.007
20	3.8	836.519995	-5	-0.006
10	3.8	836.520001	1	0.001
0	3.8	836.520004	4	0.005
-10	3.8	836.519996	-4	-0.005
-20	3.8	836.519996	-4	-0.005
-30	3.8	836.520000	0	0.000
20	4.4	836.519994	-6	-0.007
20	3.1*	836.519995	-5	-0.006

*Note – Unit cutoff point.

Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	01/10/02	01/10/03
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01	07/31/03
1404	Dipole set	EMCO 3121C	9701-1256	06/10/02	06/10/03
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	12/19/03
1983	CABLE	KTL Site A OATS	N/A	08/05/02	08/05/03
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	08/13/02	08/13/03
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/15/02	07/15/03
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/15/02	07/15/03
1628	CABLE, 6 ft	MEGAPHASE TM26 S1S5 72	N/A	03/05/03	03/04/04
1478	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W6	NONE	CBU	N/A
1481	Microwave Highpass Filter	K & L 3DH1-2000/T8000-0/0	4	Cal B4 Use	N/A
1060	TUNABLE NOTCH FILTER	K&L 3TNF-500/1000-N/N	162	CBU	N/A
619	THERMOMETER	FLUKE 51	4520028	02/25/03	02/25/04

Wavetek Cellular Test System Model 3600D s/n 9228038 Cal'd 11/25/02 Due 11/25/03 Agilent power meter E4418B s/n GB40206972 Cal'd 9/19/02 Due 9/19/03 Agilent power sensor 8482H s/n 3318A05855 Cal'd 12/19/02 Due 12/19/03

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output PARA. NO.: 2.1046

Minimum Standard: Para. No. 22.913(a). The E.R.P. of mobile transmitter and auxiliary test transmitter must not exceed 7 watts.

EIA is 19B Para. No. 3.2.1.3. The transmitter shall be compiled of 8 distinct power levels.

The output power shown above shall be maintained within the range of +2 dB, -4 dB of nominal dBW value

PL	I	II	III
0	+6	+2	-2
1	+2	+2	-2
2	-2	-2	-2
3	-6	-6	-6
4	-10	-10	-10
5	-14	-14	-14
6	-18	-18	-18
7	-22	-22	-22

Method Of Measurement:

Detachable Antenna:

The power at antenna terminals is measured using an in-line power meter.

Integral Antenna:

Test Method: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

NAME OF TEST: Occupied Bandwidth PARA. NO.: 2.1049

(i) **Minimum Standard:** No in-band emission requirements.

Para. No. 22.917(a). 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 $43 + 10 \log(P) dB$.

Method Of Measurement:

Spectrum Analyzer Settings on band edges (up to 1 MHz from band edge):

RBW: 1% of 26 dBc bandwidth VBW: ≥ RBW Span: 2 MHz Sweep: Auto

Spectrum Analyzer Settings out-of-band(> 1MHz from band edge):

RBW: 100 kHz or greater VBW: ≥ RBW Sweep: Auto

Input Signal Characteristics (F3E/F3D):

AF1 frequency: 2.5 kHz AF1 level: 16 dB above the level sufficient to produce \pm 6 kHz deviation with a 1 kHz tone. SAT: 6000 Hz SAT SAT level: sufficient to produce \pm 2 kHz deviation.

Input Signal Characteristics: RF level: Maximum recommended by manufacturer 10 kbps WBD + DAT ST

NAME OF TEST: Spurious Emission at AntennaPARA. NO.: 2.1053Terminals

Minimum Standard: Para. No. 22.917(a). 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 $43 + 10 \log(P) dB$.

Method Of Measurement:

<u>Spectrum Analyzer Settings:</u> RBW: 100 kHz or greater. VBW: ≥ RBW Start Frequency: 0 MHz Stop Frequency: 10 GHz Sweep: Auto

NAME OF TEST: Field Strength of Spurious Radiation PARA. NO.: 2.1053

Minimum Standard: Para. No. 22.917(a). 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.

Test Method: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

The spectrum is searched to 10 GHz.

NAME OF TEST: Frequency Stability

PARA. NO.: 2.1055

Minimum Standard: shall remain

Para. No. 22.355. The transmitter carrier frequency

within the tolerances given in Table C-1.

Freq. Range (MHz)	Mobile > 3 W	Mobile ≤ 3 W			
821 to 896	2.5	2.5			
Table C-1					

Method Of Measurement:

Frequency Stability With Voltage Variation:

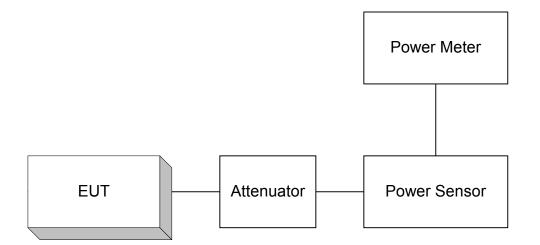
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation:

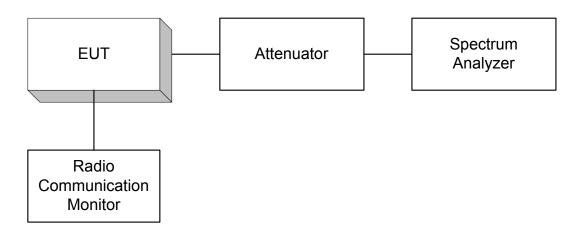
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

Para. No. 2.1046 - R.F. Power Output

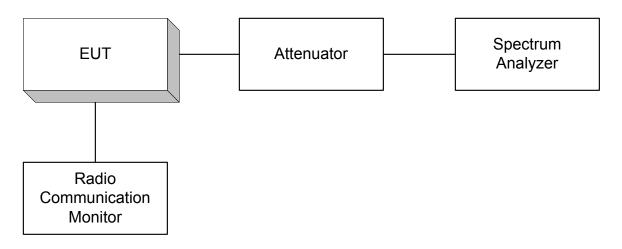


Para. No. 2.1049 - Occupied Bandwidth



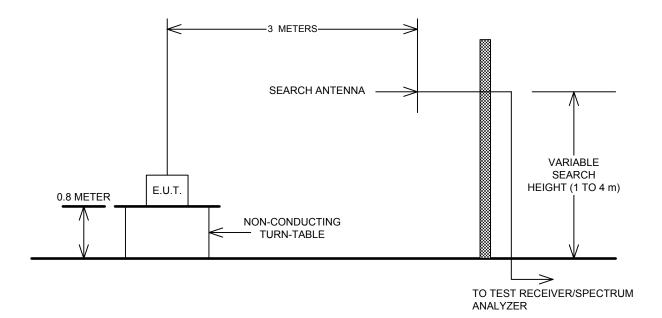
The Radio Communication Monitor is used only to provide modulation input for external modulation.

Para. No. 2.1053 Spurious Emissions at Antenna Terminals



The Radio Communication Monitor is used only to provide modulation input for external modulation.

Para. No. 2.1053 - Field Strength of Spurious Radiation



Para. No. 2.1055 - Frequency Stability

