

Nemko Test Report: 3L0216RUS1

Applicant: Electronic Systems Technology
415 N. Quay St. Suit 4
Kennewick, WA 99336

Equipment Under Test: 192CHP
(E.U.T.) Narrow Band Packet Burst Wireless Modem

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

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, TX 75057-3136

Authorized By:

A handwritten signature in blue ink, appearing to read "Tom Tidwell", is written over a horizontal line.

Tom Tidwell, Frontline Manager

Date: 9/3/03

Total Number of Pages: 43

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EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

Section 1. Summary of Test Results

Manufacturer: Electronic Systems Technology

Model No.: 192CHP

Serial No.: CHP 12040

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".

TESTED BY: Eldon Berry DATE: August 28, 2003

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.205		10W/30W	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
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	2.5kHz/ 3.5 kHz	Complies
Occupied Bandwidth	90.210	Mask C or D	Plots	Complies
Spurious Emissions at Antenna Terminals	90.210	Mask C or D	Plots	Complies
Field Strength of Spurious Emissions	90.210	Mask C or D	Table	Complies
Frequency Stability	90.213	5 ppm	1.74 ppm	Complies
Transient Frequency Behavior	90.214	Plot	Plots	Complies

Footnotes:

The EUT does not provide for voice modulation.

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input:	13 Vdc nominal				
Frequency Range:	450-470 MHz				
Tunable Bands:	One				
Necessary Bandwidth:	16.6 kHz or 9.8 kHz				
Type(s) of Modulation:	F3E (Voice)	F1D	F2D	D7W (QAM)	Other
	☐	☐	☒	☐	☐
Data Rate(s)	9,600 bps or 19,000 bps				
Internal/External Data Source:	External				
Emission Designator:	9K8F2D (9,600 bps) or 16K6F2D (19,200 bps)				
Output Impedance:	50 ohm				
RF Power Output (rated):	10, 20, 30 W				
Channel Spacing(s):	12.5 or 25 kHz				
Operator Selection of Operating Frequency:	U.S.A.	Selectable by user.			
	Canada	Set at factory			
Power Output Adjustment Capability:	Pre-programmed.				

Theory of Operation

The EUT is a wireless data transceiver that operates in the 450 – 470 MHz band. Modulation level is 4 level FSK. The radio can generate a data rate of 9,600 bps in a 12.5 kHz channel or 19,200 bps in a 25 kHz channel.

Modulation Description and Necessary Bandwidth

9K8F2D

Necessary Bandwidth:

$$\begin{aligned} B_n &= 2M + 2d \\ M &= 2,400 \text{ Hz} \\ D &= 2,500 \text{ Hz} \\ B_n &= 9.8 \text{ kHz} \end{aligned}$$

16K6F2D

Necessary Bandwidth:

$$\begin{aligned} B_n &= M + 2d \\ M &= 4,800 \text{ Hz} \\ D &= 3,500 \text{ Hz} \\ B_n &= 16.6 \text{ kHz} \end{aligned}$$

EQUIPMENT: **190CHP**PROJECT NO.: **3L0216R****Section 3. RF Power Output**

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Eldon Berry	DATE: 25Aug03

Measurement Results: Complies.**Measurement Data:****RF Power Output (Conducted)**

Job No.: **3L0216R** Date: **8/25/2003**
 Specification: **FCC part 90** Temperature(°C): **22**
 Tested By: Eldon Berry Humidity(%) **50**
 E.U.T.: **192CHP**
 Configuration: **Test software control**
 Detector: Peak

Test Equipment Used:

Power Meter: _____ Directional Coupler: **1054**
 Power Sensor: _____ Cable #1: **1629**
 Load: _____ Cable #2: _____
 Spectrum Analyzer: **1036** Cable #3: _____
 Attenuator #1 **1064** Cable #4: _____
 Attenuator #2: _____ Cable #5: _____
 Attenuator #3: _____ Cable #6: _____
 Attenuator #4: _____ Power Splitter: _____

Measurement Uncertainty: **+/- 1.6 dB**

Frequency MHz	Power Watts	Modulation Type	Output Power (dBm)	Output Power (mW)	Rated Power (dBm)
460	10	9K8F1D	39.9	9772.37	40.00
460	10	16K6F1D	39.9	9772.37	40.00
460	30	9K8F1D	44.8	30199.52	44.78
460	30	16K6F1D	44.8	30199.52	44.78

Section 4. Modulation Characteristics

The equipment does not provide for voice modulation.

Maximum Frequency Deviation with Data:

Channel Width (kHz)	Data Rate (bps)	Deviation (kHz)
12.5	9,600	2.5
25	19,200	3.5

EQUIPMENT: **190CHP**

PROJECT NO.: **3L0216R**

Section 5. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Eldon Berry	DATE: 25Aug03

Measurement Results: Complies.

Measurement Data: See attached data

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

Occupied Bandwidth Plot



Dallas Headquarters:

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Fax: (972) 436-2667

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Data Plot		Occupied Bandwidth	
Page 1 of 4		Complete <u>X</u>	
Job No.:	3L0216R	Date:	8/25/2003
Specification:	FCC Part 90.210	Temperature(°C):	21
Tested By:	Eldon Berry	Relative Humidity(%)	50
E.U.T.:	192CHP		
Configuration:	Controlled by test software.		
Sample Number:	S01		
Location:	Lab 4	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots
		Measurement	Distance: <u> </u> m
Test Equipment Used			
Antenna:		Directional Coupler:	1054
Pre-Amp:		Cable #1:	1629
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	0
Attenuator #1:	1064	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-1.7 dB		
Ref Lvl 40 dBm RBW 200 Hz RF Att 30 dB VBW 200 Hz SWT 12.5 s Unit dBm 39.8 dB Offset 1VIEW FRQ 1MA LIMIT CHECK PASSED 802100 Center 460 MHz 10 kHz Span 100 kHz			

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

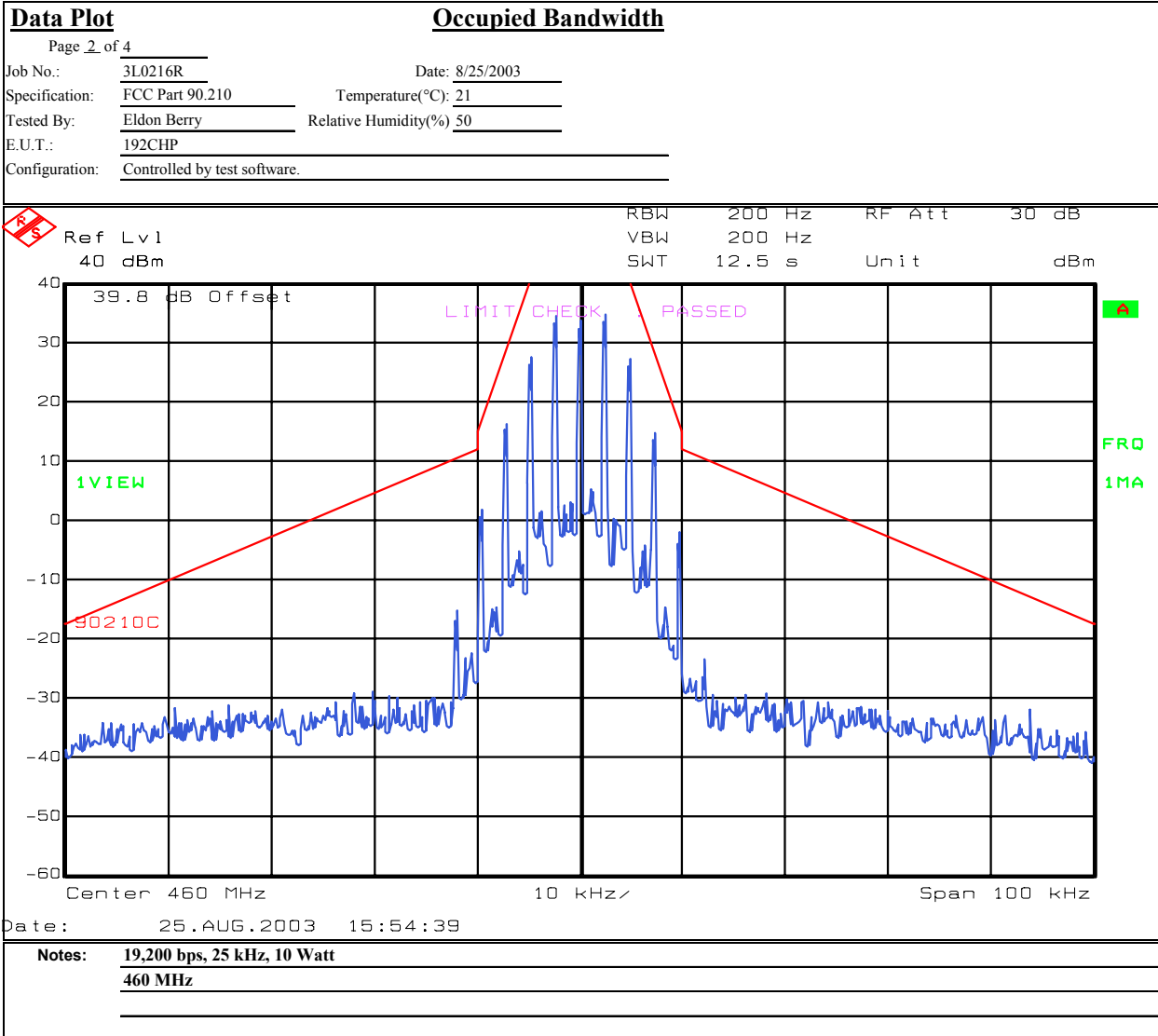
Occupied Bandwidth Plot – cont.



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EQUIPMENT: 190CHP

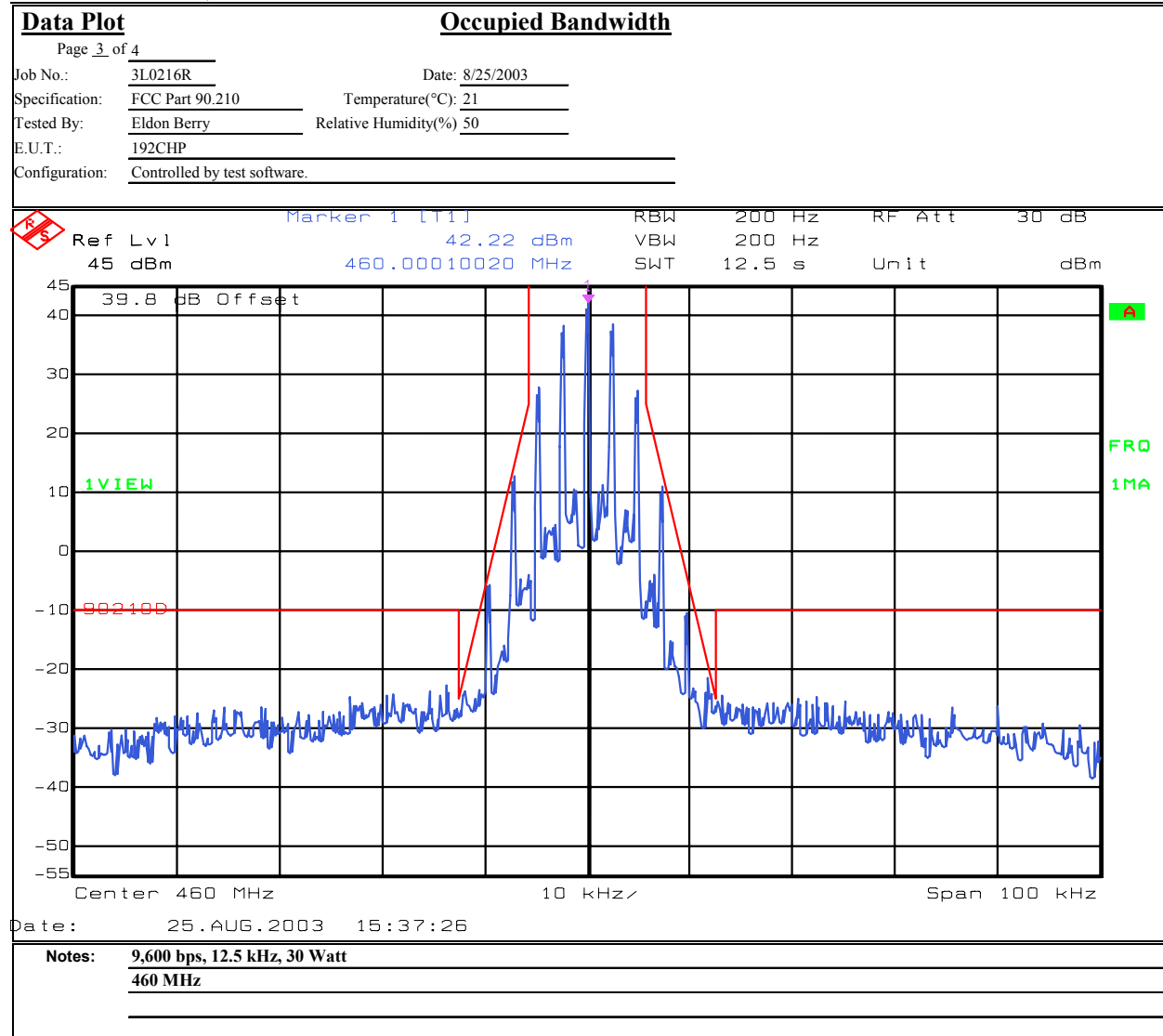
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Occupied Bandwidth Plot – cont.



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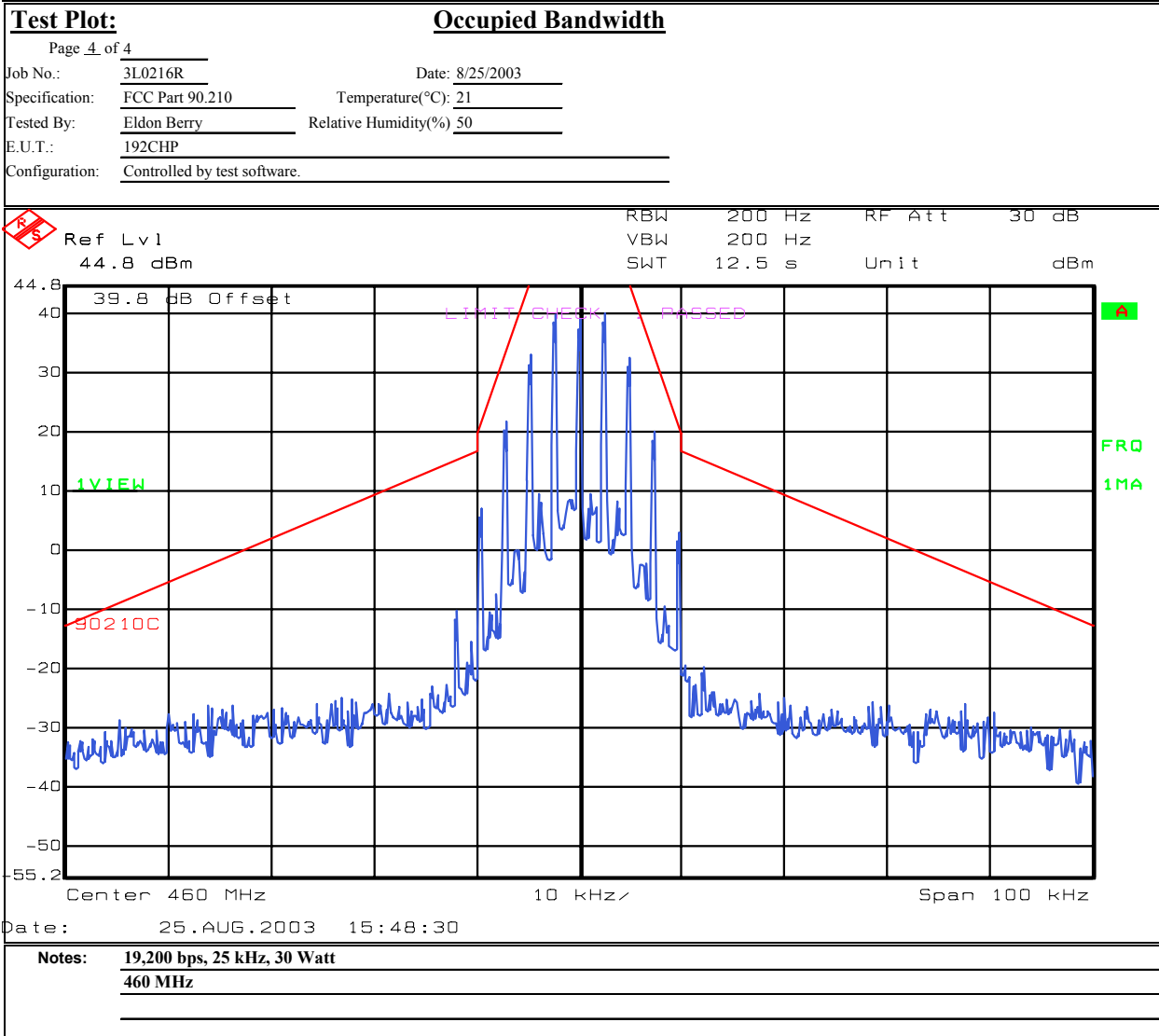
Occupied Bandwidth Plot – cont.



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EQUIPMENT: **190CHP**

PROJECT NO.: **3L0216R**

Section 6. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Eldon Berry	DATE: 26Aug03

Measurement Results: Complies.

Measurement Data: See attached data

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

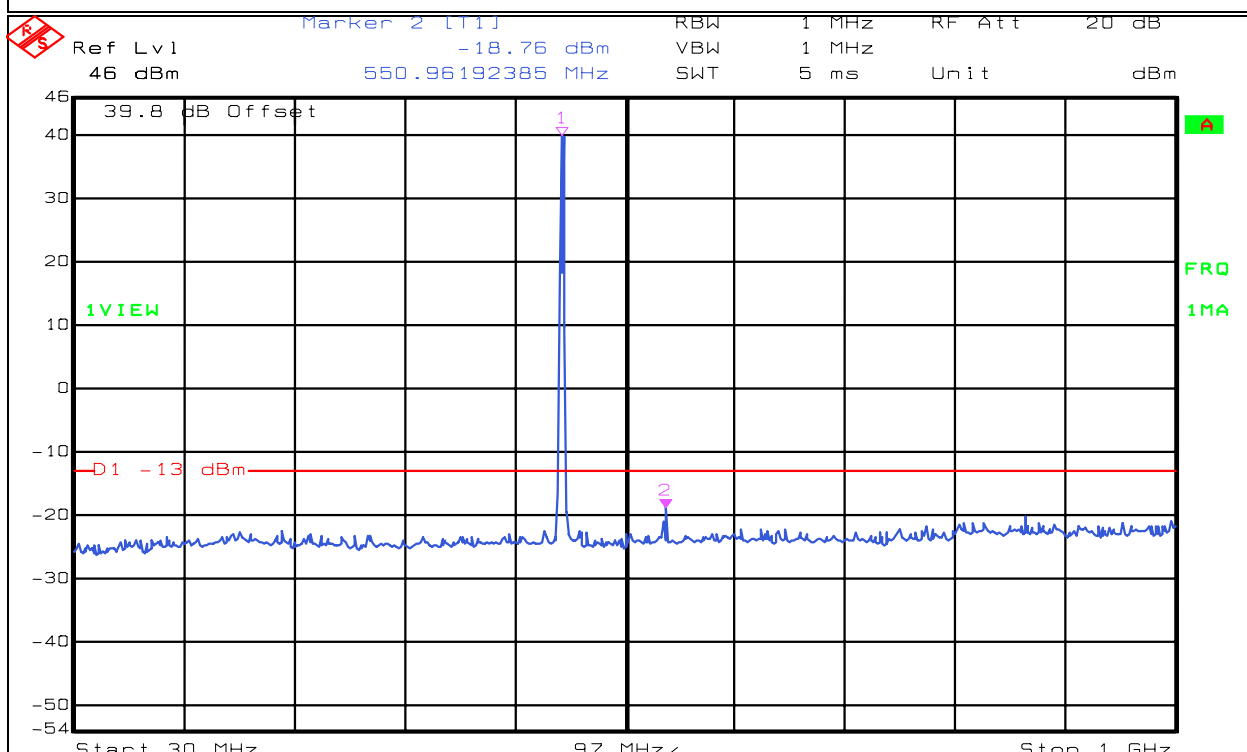
Spurious Emissions at Antenna Terminals



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Data Plot		Spurious Emissions at Antenna Terminals	
Page 1 of 8		Complete	X
Job No.: 3L0216R	Date: 8/26/2003	Preliminary:	
Specification: FCC Part 90	Temperature(°C): 21		
Tested By: Eldon Berry	Relative Humidity(%): 46		
E.U.T.: 192CHP			
Configuration: Controlled by test software.			
Sample Number: S01			
Location: Lab 4	RBW: Refer to plots	Measurement	
Detector Type: Peak	VBW: Refer to plots	Distance:	m
Test Equipment Used			
Antenna:	Directional Coupler: 1054		
Pre-Amp:	Cable #1: 1629		
Filter:	Cable #2:		
Receiver: 1036	Cable #3: 0		
Attenuator #1: 1064	Cable #4:		
Attenuator #2:	Mixer:		
Additional equipment used:			
Measurement Uncertainty: +/-1.7 dB			
			
Date: 26.AUG.2003 10:13:51			
Notes: 10 watt, 9600 bps 460 MHz Marker 1 = carrier, marker 2 = highest emission.			

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

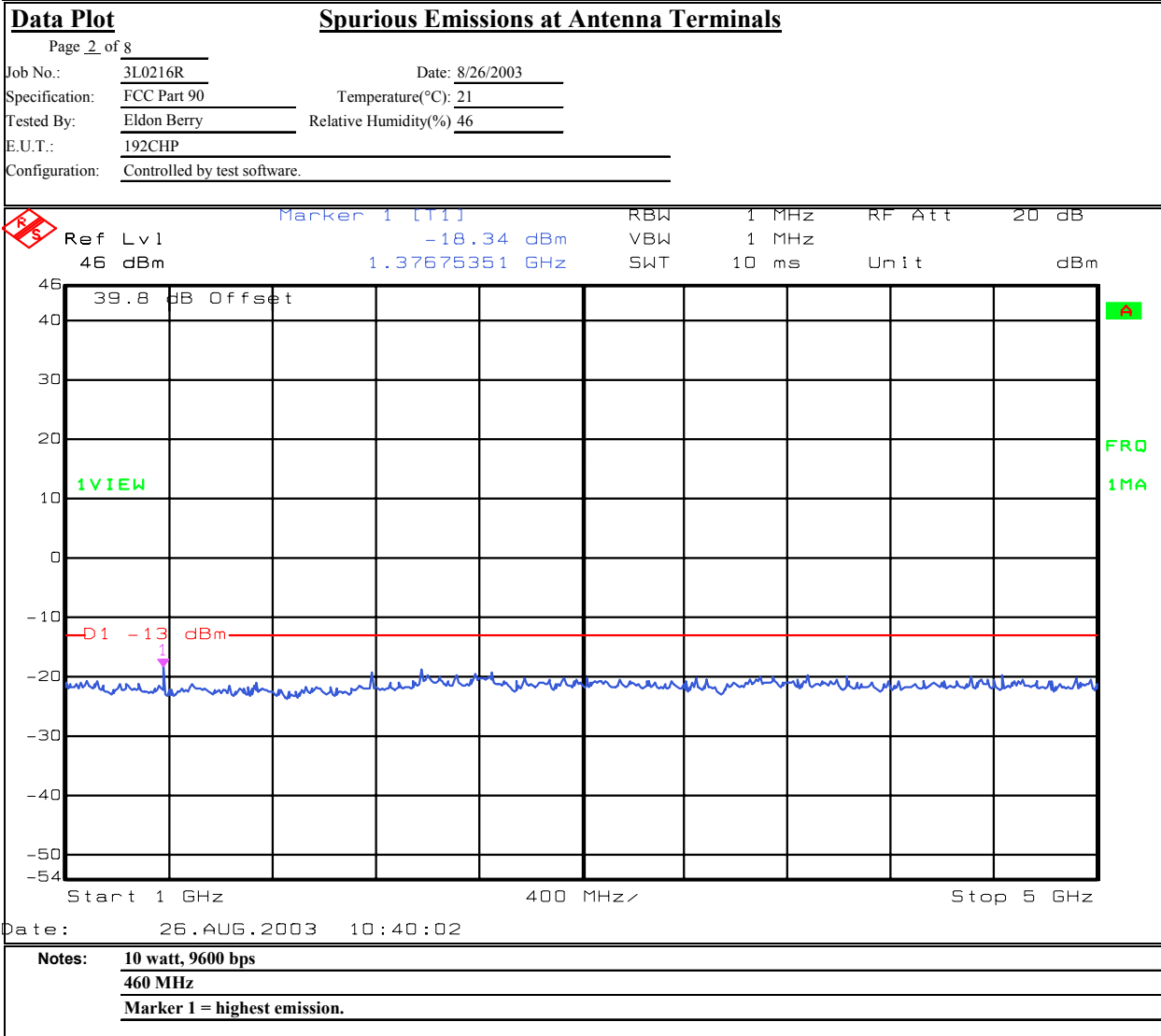
Spurious Emissions at Antenna Terminals – cont.



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EQUIPMENT: 190CHP

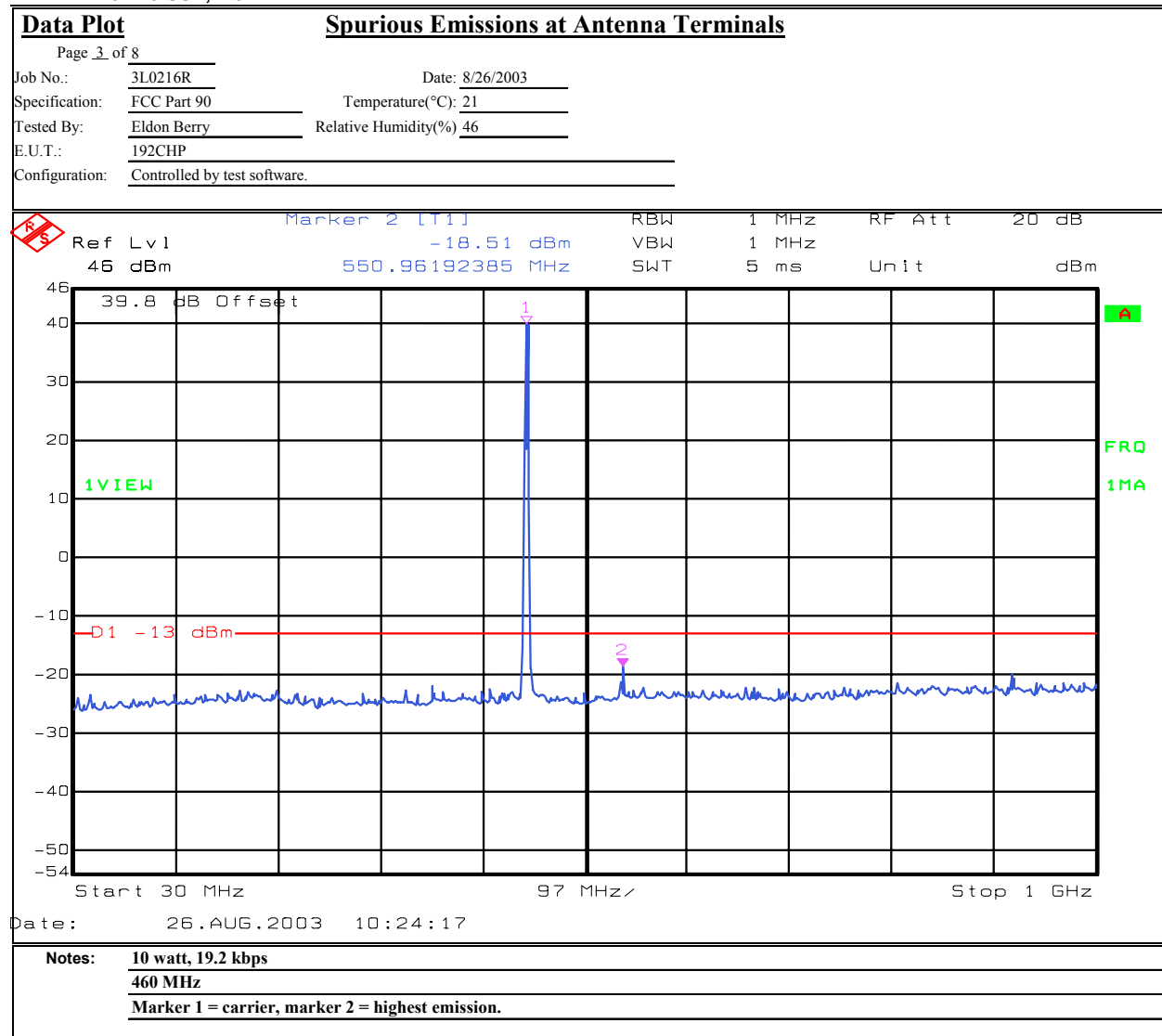
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Spurious Emissions at Antenna Terminals – cont.



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EQUIPMENT: 190CHP

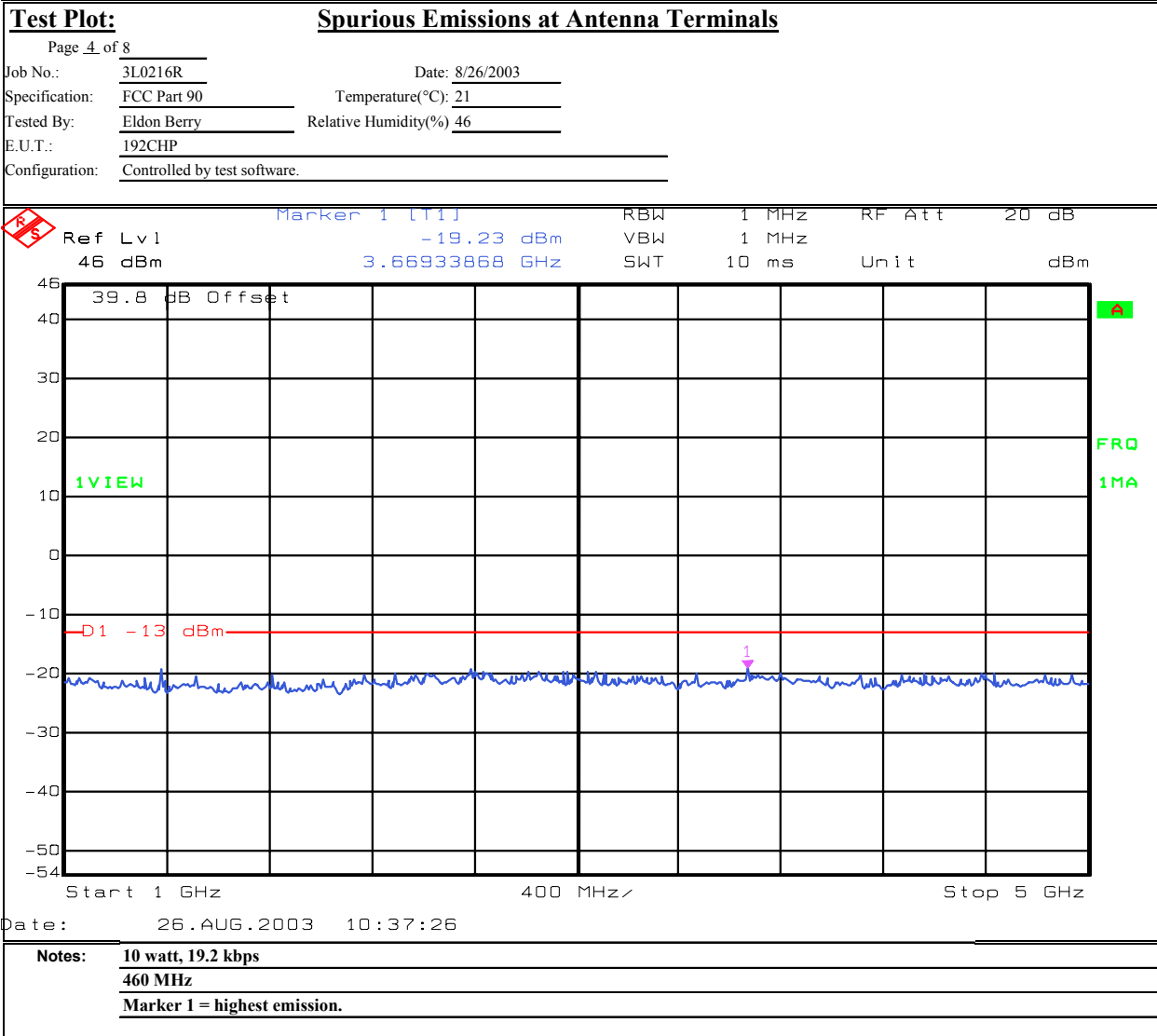
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Spurious Emissions at Antenna Terminals – cont.



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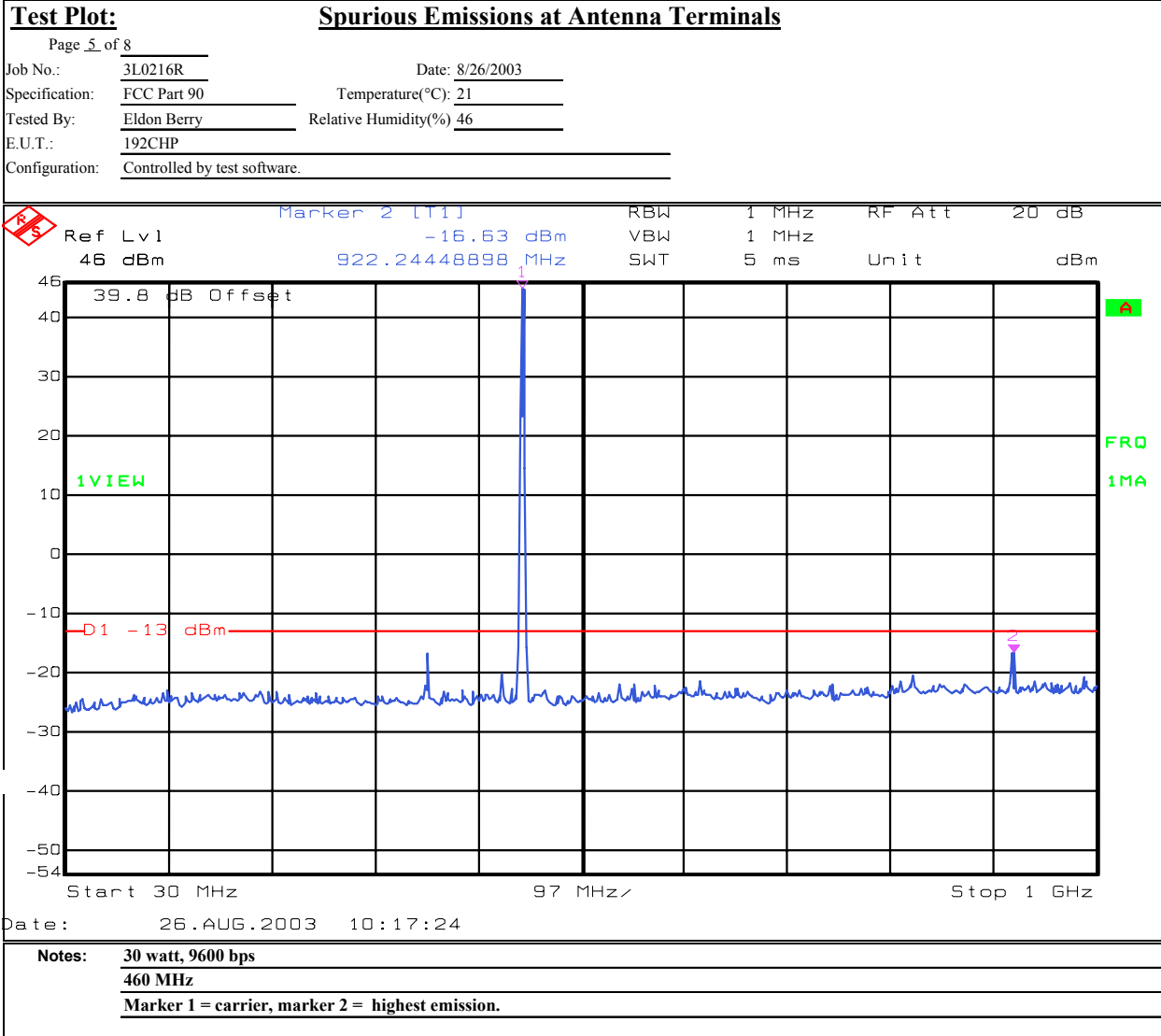
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PROJECT NO.: 3L0216R

Spurious Emissions at Antenna Terminals – cont.



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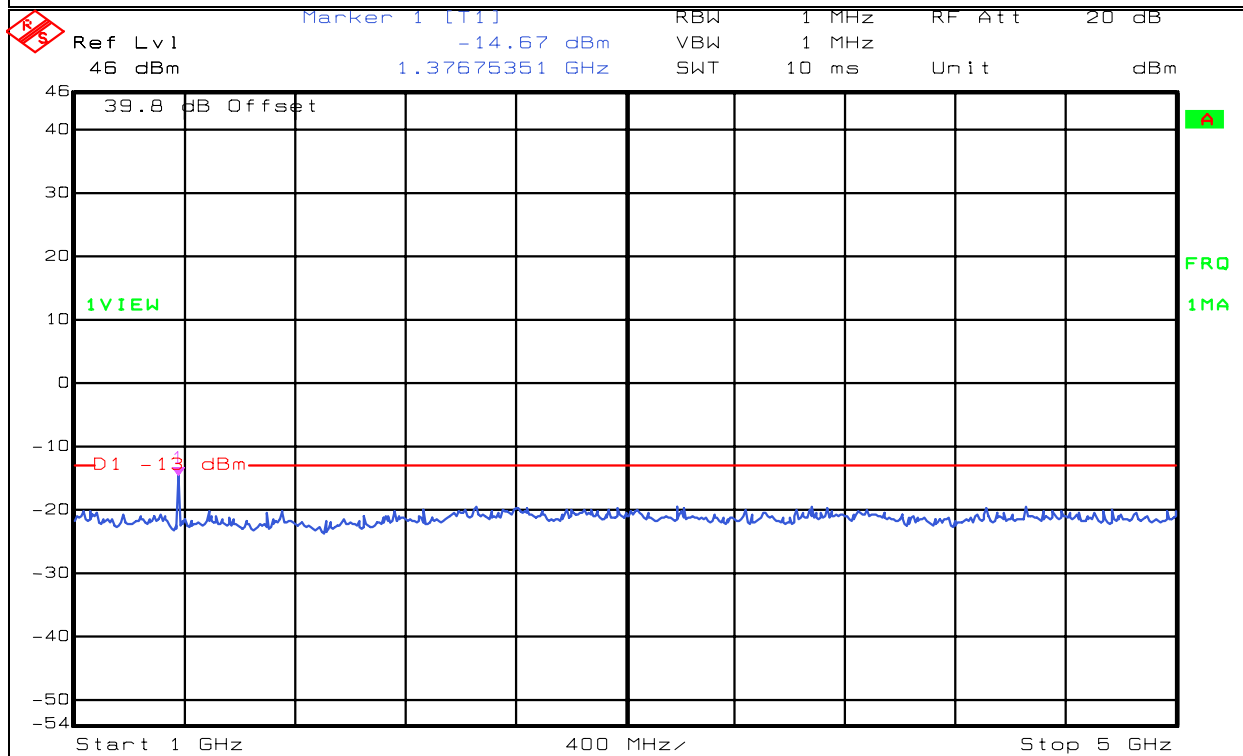
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Test Plot:

Spurious Emissions at Antenna Terminals

Page 6 of 8

Job No.: 3L0216R Date: 8/26/2003
Specification: FCC Part 90 Temperature(°C): 21
Tested By: Eldon Berry Relative Humidity(%) 46
E.U.T.: 192CHP
Configuration: Controlled by test software.



Date: 26.AUG.2003 10:41:12

Notes: 30 watt, 9600 bps
460 MHz
Marker 1 = highest emission.

EQUIPMENT: 190CHP

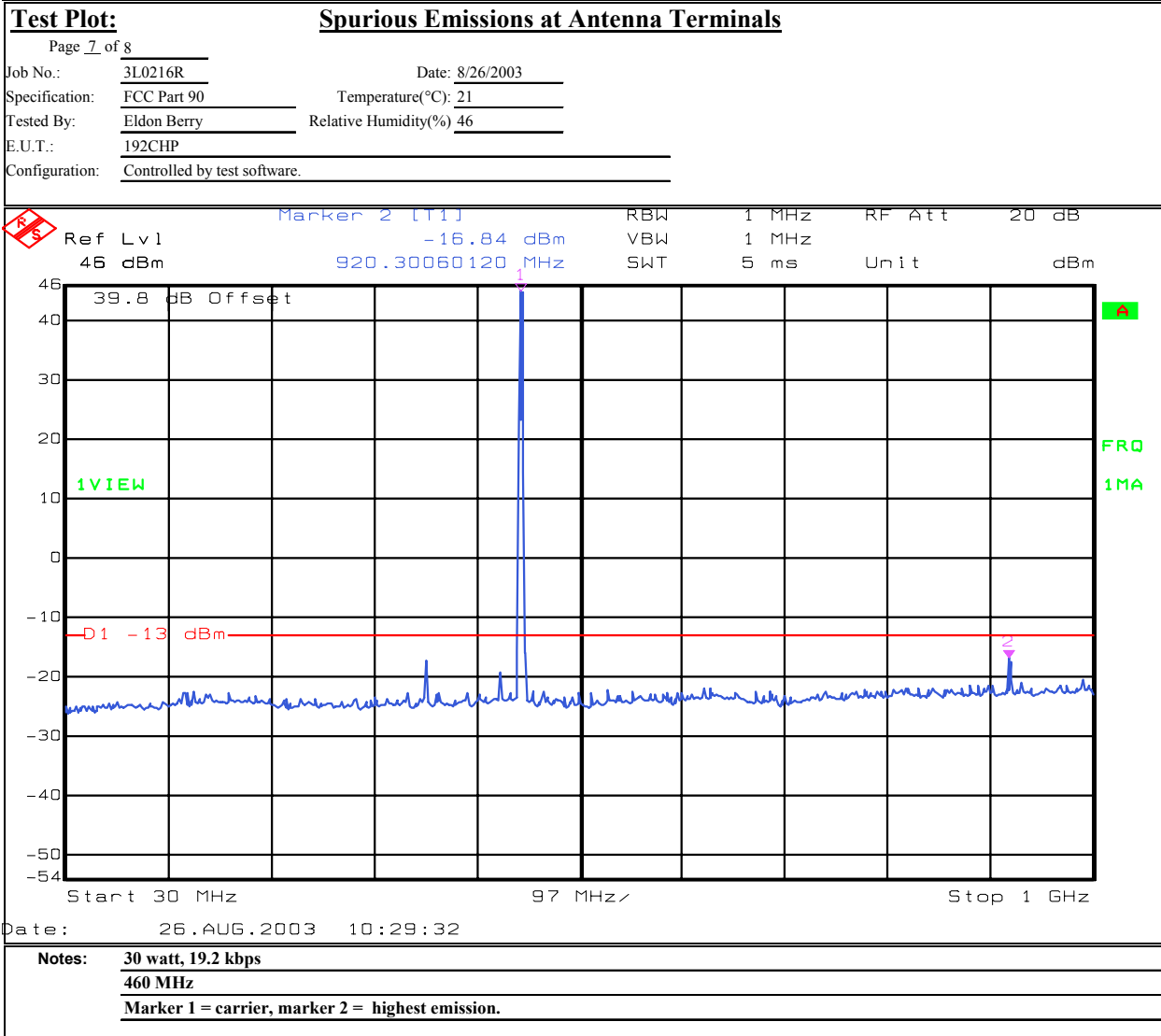
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Spurious Emissions at Antenna Terminals – cont.



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EQUIPMENT: 190CHP

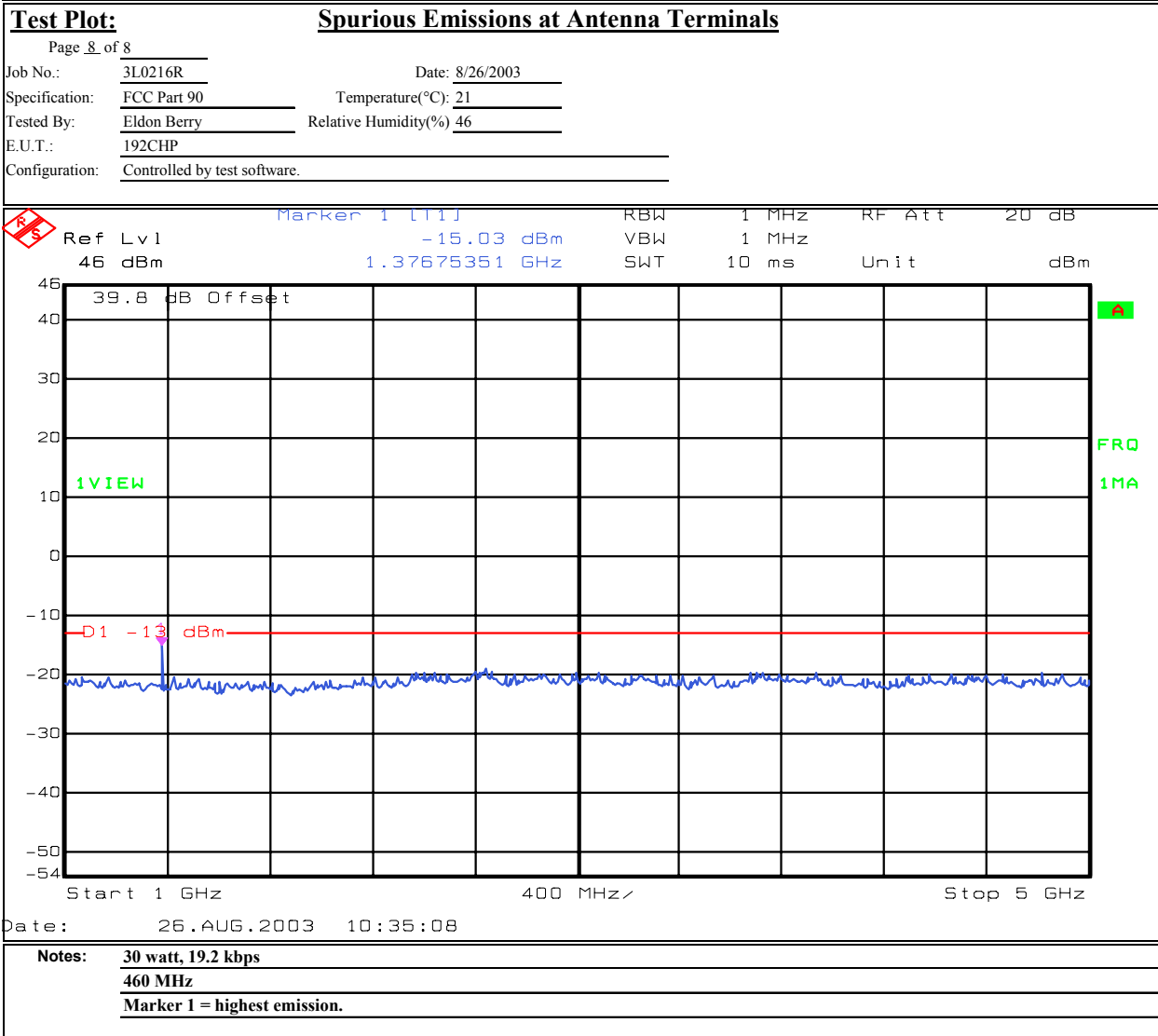
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Spurious Emissions at Antenna Terminals – cont.



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EQUIPMENT: **190CHP**

PROJECT NO.: **3L0216R**

Section 7. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Eldon Berry	DATE: 27Aug03

Measurement Results: Complies.

Measurement Data: See attached data

EQUIPMENT: **190CHP**PROJECT NO.: **3L0216R****Test Data - Radiated Emissions**

ERP Substitution Method										
Page <u>1</u> of <u>1</u>									Complete <u>X</u>	
Job No.: 3L0216R		Date: 8/27/03							Preliminary _____	
Specification: Part 90		Temperature(°C): <u>22</u>								
Tested By: Eldon Berry		Relative Humidity(%) <u>48</u>								
E.U.T.: 192CHP										
Configuration: 12.5 kHz BW. EUT controlled by test software										
Sample No: 1										
Location: AC 3		RBW: 1 MHz		Measurement						
Detector Type: Peak		VBW: 1 MHz		Distance: <u>3</u> m						
Test Equipment Used										
Antenna: 1304		Directional Coupler: _____								
Pre-Amp: 1016		Cable #1: 1485								
Filter: _____		Cable #2: 1484								
Receiver: 1464		Cable #3: _____								
Attenuator #1: _____		Cable #4: _____								
Attenuator #2: _____		Mixer: _____								
Additional equipment used: 791										
Measurement Uncertainty: +/-1.7 dB										
Frequency (MHz)	Meter Reading (dBm)	Substitution Level (dBm)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarity	Comments
										9600 bps
920	-31.2	-26.0		24.1	5.0	-26.0	-13.0	-12.9667	V	
1380	-34.0	-34.5		32	4.9	-34.5	-13.0	-21.5000	V	
1840	-38.5	-40.5		33	7.3	-40.5	-13.0	-27.5000	V	
2300	-38.6	-37.3		32.9	6.8	-37.3	-13.0	-24.3333	V	
2760	-47.0	-44.6		33.1	8.0	-44.6	-13.0	-31.6000	V	
3220	-56.0	-48.9		32.7	8.0	-48.9	-13.0	-35.8667	V	
3680	-59.8	-49.5		33	8.6	-49.5	-13.0	-36.4667	V	
4140	-53.8	-41.8		33.3	8.2	-41.8	-13.0	-28.7667	V	
4600	-58.8	-48.0		33.2	8.7	-48.0	-13.0	-35.0000	V	
920	-25.6	-18.7		24.1	5.0	-18.7	-13.0	-5.7000	H	
1380	-36.3	-37.6		32	4.9	-37.6	-13.0	-24.6333	H	
1840	-39.0	-39.0		33	7.3	-39.0	-13.0	-26.0000	H	
2300	-46.8	-42.7		32.9	6.8	-42.7	-13.0	-29.7000	H	
2760	-47.0	-44.6		33.1	8.0	-44.6	-13.0	-31.6000	H	
3220	-58.2	-54.6		32.7	8.0	-54.6	-13.0	-41.5667	H	
3680	-60.0	-57.5		33	8.6	-57.5	-13.0	-44.5000	H	
4140	-54.5	-53.0		33.3	8.2	-53.0	-13.0	-39.9667	H	
4600	-57.6	-55.3		33.2	8.7	-55.3	-13.0	-42.3000	H	
Notes: SEARCHED SPECTRUM TO THE 10TH HARMONIC OF CARRIER										

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

Test Data - Radiated Emissions – cont.

ERP Substitution Method										
Page 1 of 1									Complete <u>X</u>	
Job No.: 3L0216R		Date: 8/27/03							Preliminary _____	
Specification: Part 90		Temperature(°C): 22								
Tested By: Eldon Berry		Relative Humidity(%) 48								
E.U.T.: 192CHP										
Configuration: 30 watt 25 kHz BW. EUT controlled by test software										
Sample No: 1										
Location: AC 3		RBW: 1 MHz							Measurement	
Detector Type: Peak		VBW: 1 MHz							Distance: 3 m	
Test Equipment Used										
Antenna: 1304		Directional Coupler: _____								
Pre-Amp: 1016		Cable #1: 1485								
Filter: _____		Cable #2: 1484								
Receiver: 1464		Cable #3: _____								
Attenuator #1: _____		Cable #4: _____								
Attenuator #2: _____		Mixer: _____								
Additional equipment used: 791										
Measurement Uncertainty: +/-1.7 dB										
Frequency (MHz)	Meter Reading (dBm)	Substitution Level (dBm)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarity	Comments
										19.2 kbps
920	-29.6	-24.4		24.1	5.0	-24.4	-13.0	-11.3667	V	
1380	-35.8	-36.3		32	4.9	-36.3	-13.0	-23.3000	V	
1840	-40.3	-42.3		33	7.3	-42.3	-13.0	-29.3000	V	
2300	-39.2	-37.9		32.9	6.8	-37.9	-13.0	-24.9333	V	
2760	-46.2	-43.8		33.1	8.0	-43.8	-13.0	-30.8000	V	
3220	-57.5	-50.4		32.7	8.0	-50.4	-13.0	-37.3667	V	
3680	-64.0	-53.7		33	8.6	-53.7	-13.0	-40.6667	V	
4140	-61.0	-49.0		33.3	8.2	-49.0	-13.0	-35.9667	V	
4600	-60.3	-49.5		33.2	8.7	-49.5	-13.0	-36.5000	V	
920	-26.0	-19.1		24.1	5.0	-19.1	-13.0	-6.1000	H	
1380	-38.3	-39.6		32	4.9	-39.6	-13.0	-26.6333	H	
1840	-39.6	-39.6		33	7.3	-39.6	-13.0	-26.6000	H	
2300	-47.0	-42.9		32.9	6.8	-42.9	-13.0	-29.9000	H	
2760	-57.0	-54.6		33.1	8.0	-54.6	-13.0	-41.6000	H	
3220	-57.0	-53.4		32.7	8.0	-53.4	-13.0	-40.3667	H	
3680	-59.5	-57.0		33	8.6	-57.0	-13.0	-44.0000	H	
4140	-54.5	-53.0		33.3	8.2	-53.0	-13.0	-39.9667	H	
4600	-56.8	-54.5		33.2	8.7	-54.5	-13.0	-41.5000	H	
Notes: SEARCHED SPECTRUM TO THE 10TH HARMONIC OF CARRIER										

Photographs of Test Setup



EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

Section 8. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: Eldon Berry	DATE: 28Aug03

Measurement Results: Complies.**Measurement Data:**

Measurement Conditions: Temperature: 23 °C
Humidity: 62 %

Measurement Uncertainty: +/- 10⁻⁷ ppm

Test Equipment: #283, #425, #1990, #1048, #1064, #1054, #1019

Mode 12.5 kHz BW 9600 bps
Standard Test Frequency: 460 MHz

Temperature	Voltage (Vdc)	Frequency (MHz)	Change* (Hz)	Change (PPM)
50	13	459.999632	-475	1.03
40	13	459.999856	-251	0.55
30	13	460.000340	233	0.51
20	13	460.000107	0	0.00
10	13	460.000726	619	1.35
0	13	460.000750	643	1.40
-10	13	460.000755	648	1.41
-20	13	460.000813	706	1.53
-30	13	460.000887	780	1.70
20	11.05	460.000107	0	0.00
20	14.95	460.000090	-17	0.04

* Change compared to frequency at 20 degree C.

Mode 25 kHz BW 19,200 bps

EQUIPMENT: 190CHP**PROJECT NO.:** 3L0216R

Standard Test Frequency: 460 MHz

Test Equipment: #283, #425, #1990, #1048, #1064, #1054, #1019

Temperature	Voltage (Vdc)	Frequency (MHz)	Change* (Hz)	Change (PPM)
50	13	459.999636	-452	0.98
40	13	459.999856	-232	0.50
30	13	460.000340	252	0.55
20	13	460.000088	0	0.00
10	13	460.000735	647	1.41
0	13	460.000734	646	1.40
-10	13	460.000741	653	1.42
-20	13	460.000806	718	1.56
-30	13	460.000888	800	1.74
20	11.05	460.000088	0	0.00
20	14.95	460.000073	-15	0.03

* Change compared to frequency at 20 degree C.

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

Section 9. Transient Frequency Behavior

NAME OF TEST: Transient Frequency Behaviour	PARA. NO.: 90.214
TESTED BY: Eldon Berry	DATE: 26Aug03

Measurement Results: Complies.

Measurement Data: See attached plots

Measurement Conditions: Temperature: 23 °C
Humidity: 60 %

Test Equipment: #892, #1036, #1064, #1629, #1054, #1048, #1990, #425, #1051,
#1341

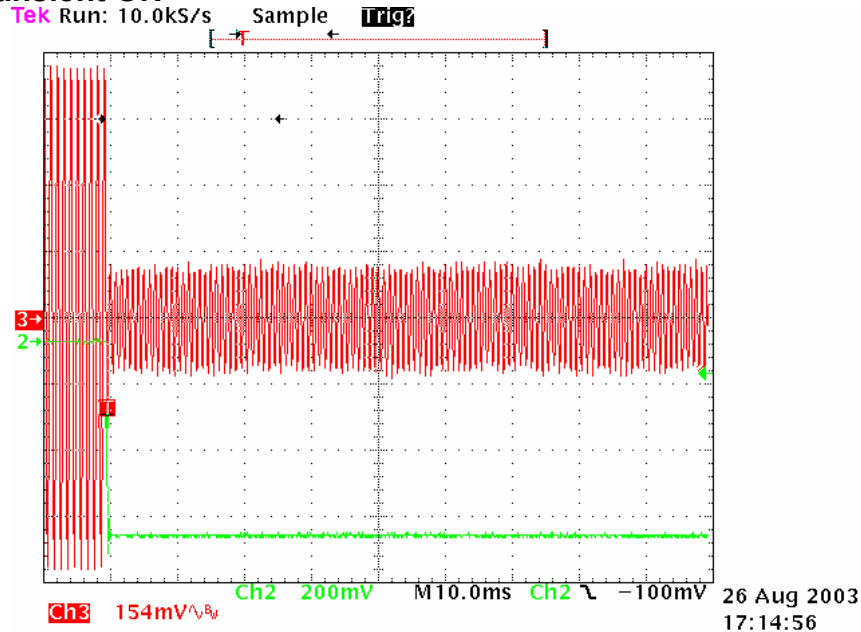
EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

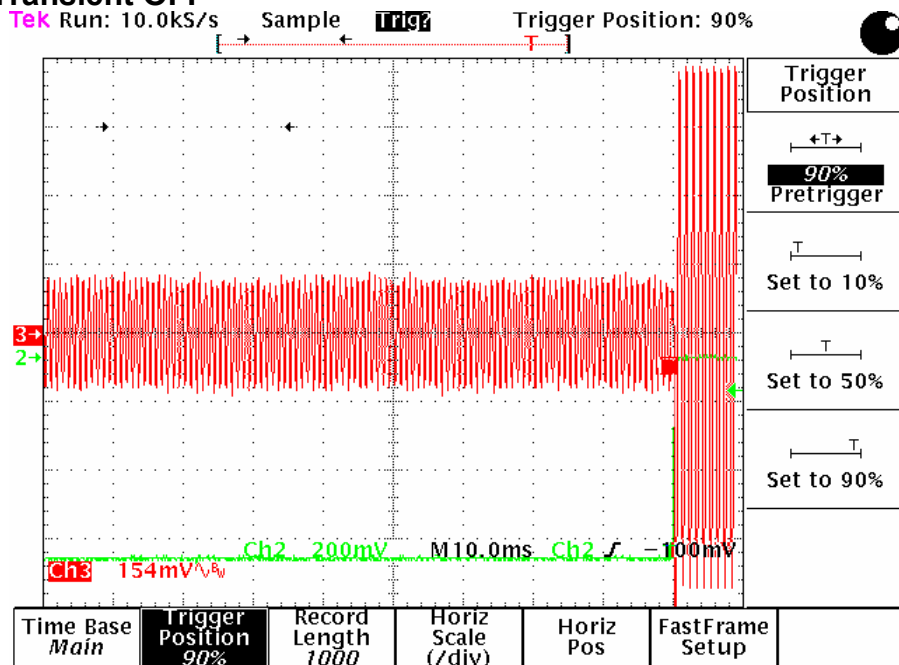
Transient Plots - 12.5 kHz Bandwidth

Vertical scale = 3.125 kHz/div, Horizontal scale = 10 ms/div

9600 bps Transient ON



9600 bps Transient OFF



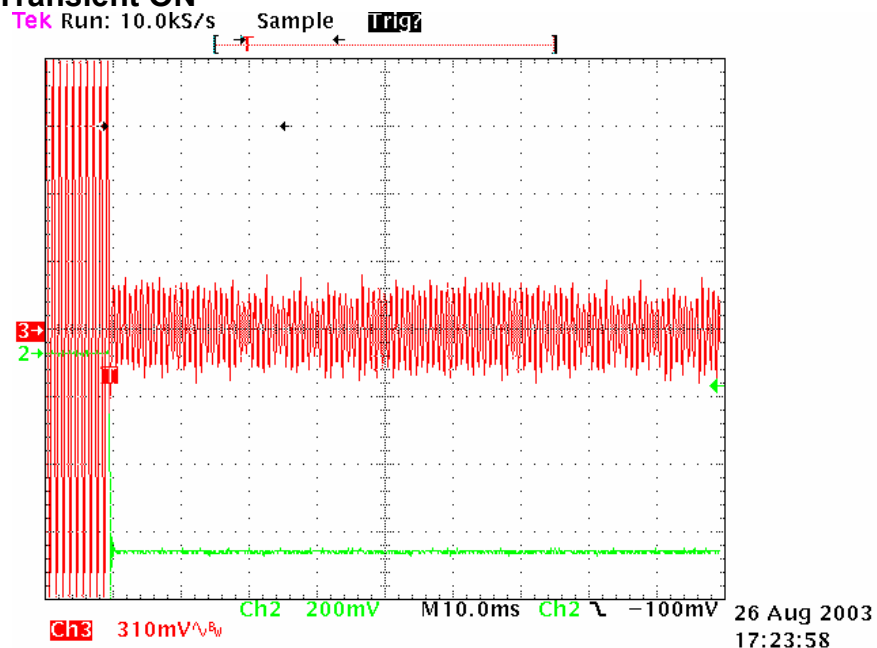
EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

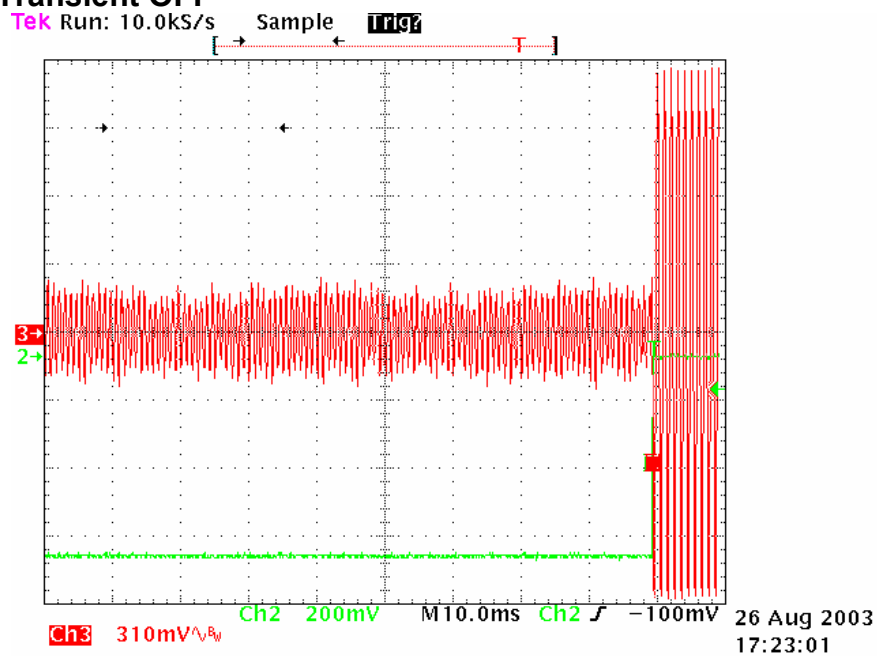
Transient Plots - 25 kHz Bandwidth

Vertical scale = 6.25 kHz/div, Horizontal scale = 10 ms/div

19,200 bps Transient ON



19,200 bps Transient OFF



EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

Section 10. 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	04/22/03	04/21/04
425	DIGITAL MULTIMETER	FLUKE 45-01	5930073	10/03/02	10/03/03
718	HP SPECTRUM ANALYZER	HEWLETT PACKARD 8591EM	3639A00980	01/06/03	01/06/04
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	08/28/03	08/28/04
1019	CABLE, 9.5m	KTL RG223	N/A	01/02/03	01/02/04
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	12/19/03
1048	50 OHM LOAD	NARDA 27470	254	Cal B4 Use	N/A
1051	Radio Communication Analyzer	Rhode & Schwarz CMTA-54	835875/002	CNR	N/A
1054	DUAL DIRECTIONAL COUPLER	NARDA 3020A	34366	Cal Not Req	N/A
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1341	RADIO COMMUNICATION SERVICE MONITOR	ROHDE & SCHWARZ CMS53	883832/018	CNR	N/A
1463	Color 4 Ch Digitizing Oscilloscope	Tektronix TDS684A	B010460	08/07/03	08/06/04
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1983	CABLE	KTL Site A OATS	N/A	03/28/03	03/27/04
1990	CABLE, 4.8m	KTL RG214	N/A	04/09/03	04/08/04

ANNEX A - TEST METHODOLOGIES

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

NAME OF TEST: RF Power Output**PARA. NO.: 2.985**

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: **190CHP**PROJECT NO.: **3L0216R**

NAME OF TEST: Audio Frequency Response**PARA. NO.: 2.987(a)****Test Method:** TIA/EIA-603**Minimum Standard:** TIA/EIA-603, Para. 3.2.6 from 300 Hz to 3000 Hz.
Thetransmitter 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)****Test Method:** TIA/EIA-603**Minimum Standard:** TIA/EIA-603**NAME OF TEST: Modulation Limiting****PARA. NO.: 2.987(a)****Test Method:** TIA/EIA-603**Minimum Standard:** TIA/EIA-603

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.989****Minimum Standard:**
mask.

Para. No. 90.210, see table 1 below for applicable

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: $\Rightarrow$ RBW

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

EQUIPMENT: 190CHP

PROJECT NO.: 3L0216R

NAME OF TEST: Field Strength of Spurious**PARA. NO.: 2.993****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 ≤ 1 GHz:

G = 1.64 (Dipole Gain)

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

R = 3m (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 GHz:

G = 1 (Isotropic Gain)

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

R = 3m (Measurement Distance)

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

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: 190CHP

PROJECT NO.: 3L0216R

NAME OF TEST: Frequency Stability**PARA. NO.: 2.995**

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****Minimum Standard:****Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels**

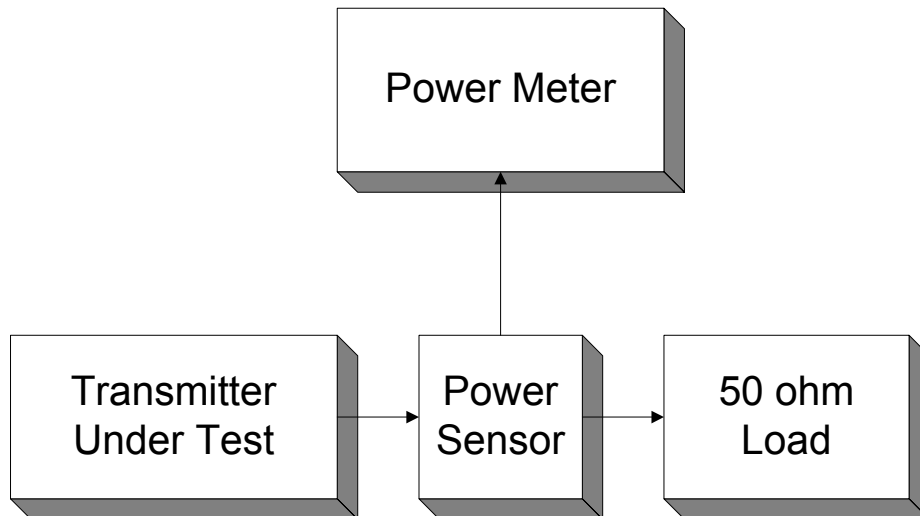
	Maximum	Frequency ranges (MHz) All equipment					
		Base station and portable radios			Mobile Radios		
Time intervals ^{1,2}	Frequency difference ³ (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₁ ⁴	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t ₂	± 12	20.0	25.0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

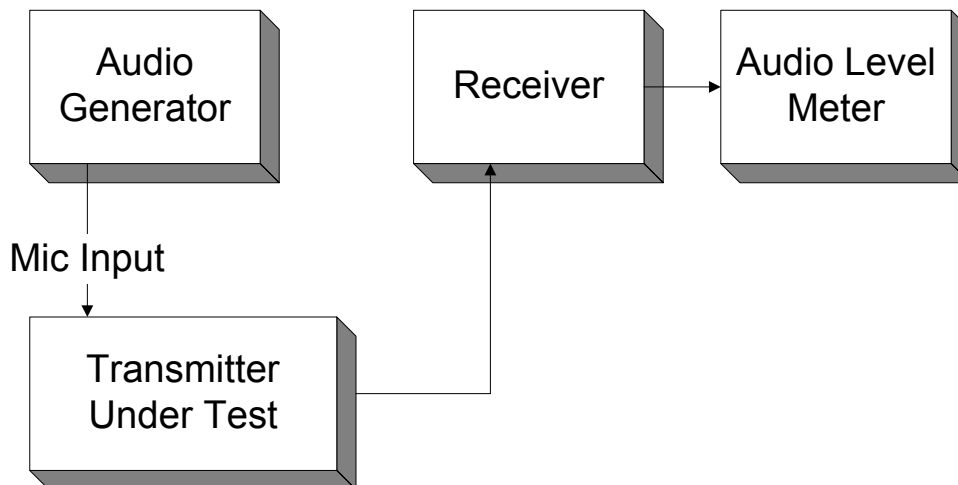
	Maximum	Frequency ranges (MHz) All equipment		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
Time intervals ^{1,2}	Frequency difference ³ (kHz)			
t ₁ ⁴	± 12.5 / ± 6.25	5.0	10.0	20.0
t ₂	± 6.25 / ± 3.125	20.0	25.0	50.0
t ₃ ⁴	± 12.5 / ± 6.25	5.0	10.0	10.0

ANNEX B - TEST DIAGRAMS

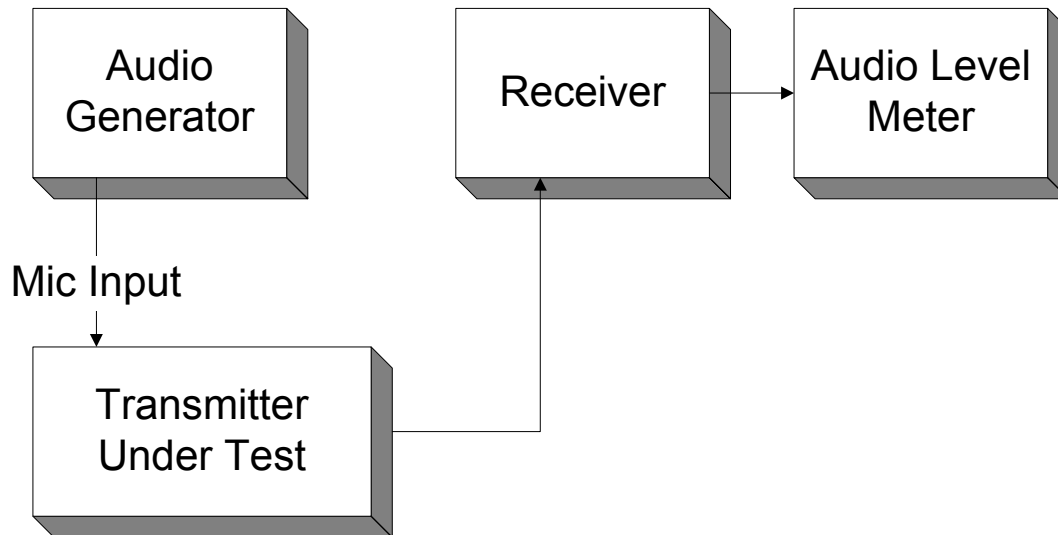
Para. No. 2.985 - R.F. Power Output



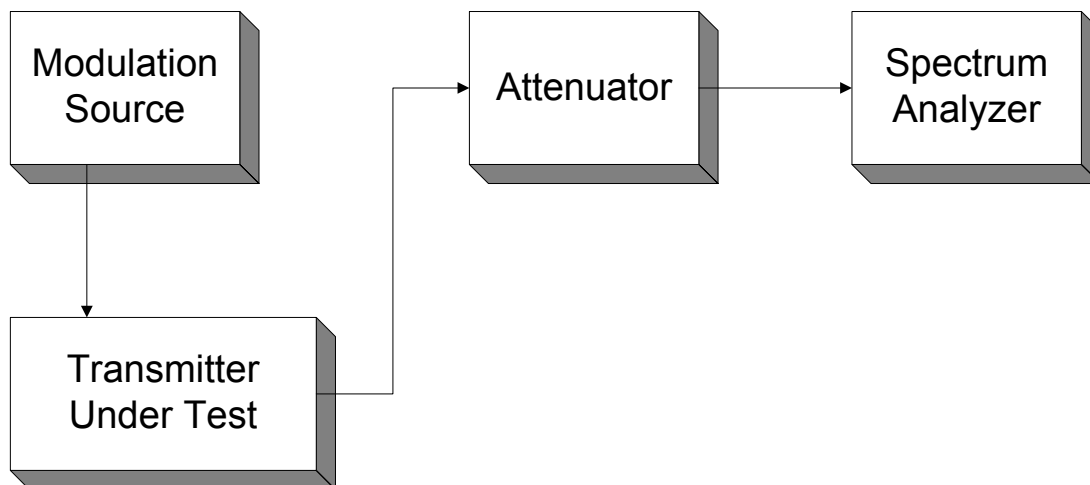
Para. No. 2.987(a) - Audio Frequency Response



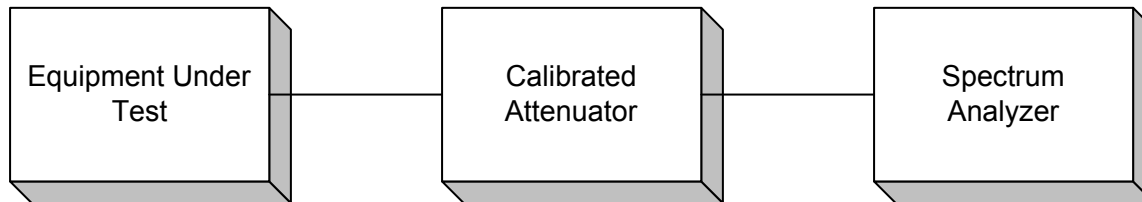
Para. No. 2.987(b) - Modulation Limiting



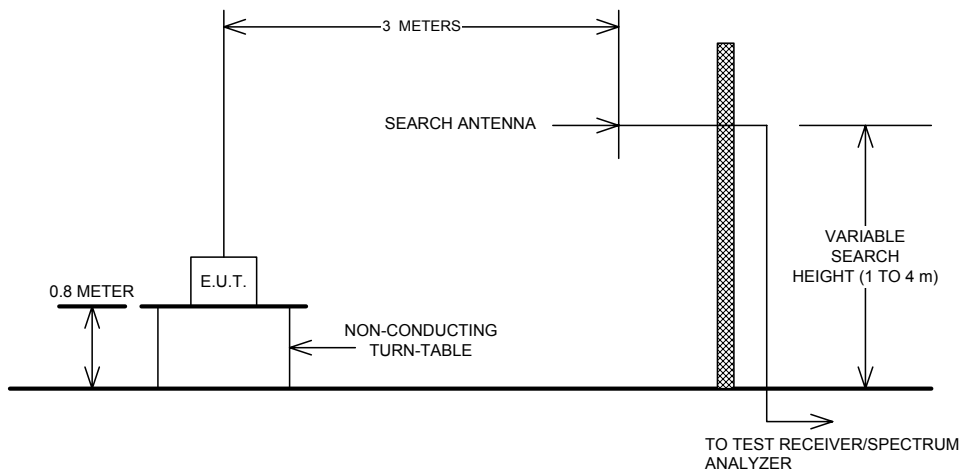
Para. No. 2.989 - Occupied Bandwidth



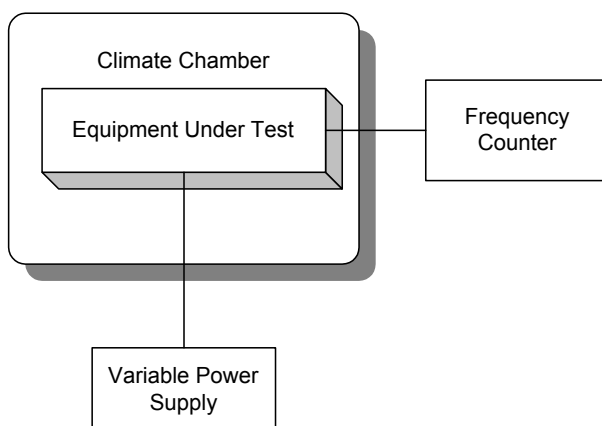
Para. No. 2.991 - Spurious Emissions at Antenna Terminals

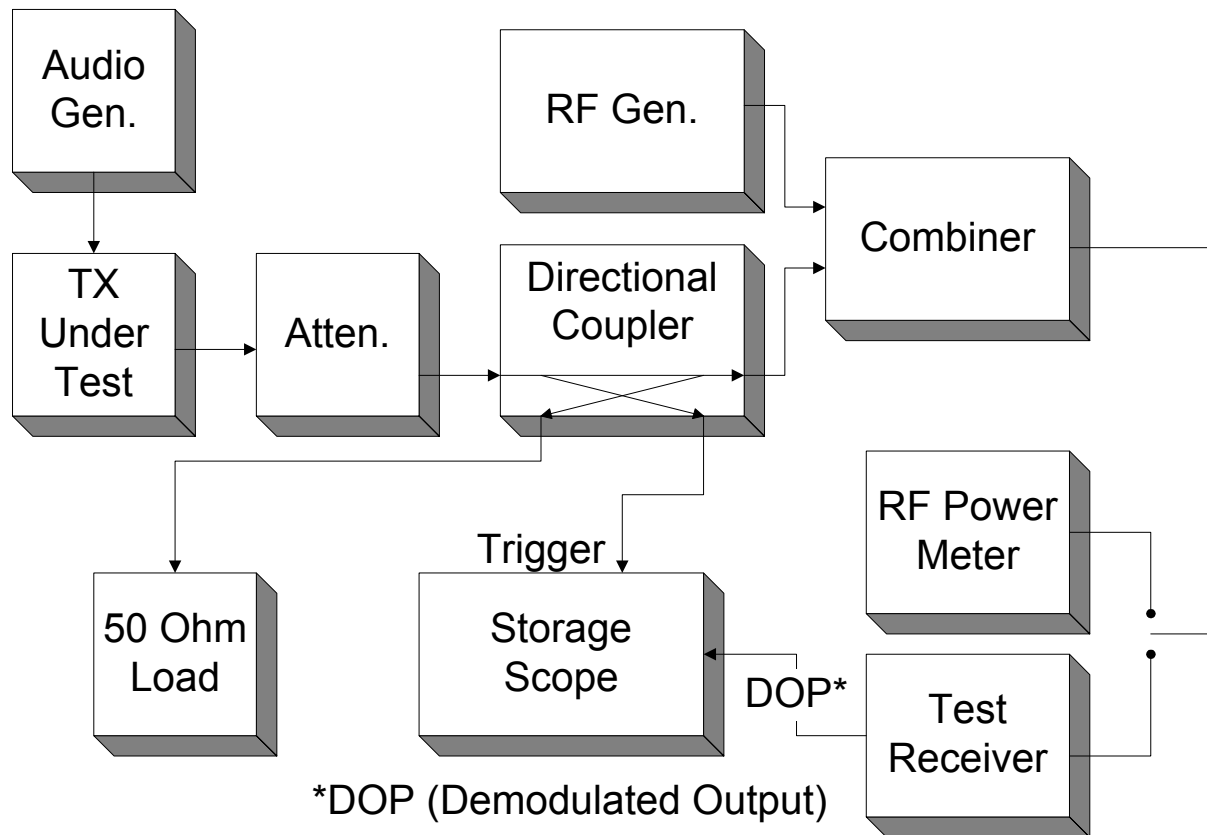


Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability



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).