

EMC EMISSION - TEST REPORT

UNITED STATES STANDARD 47 CFR, PART 15, SUBPART C

Test Report File No. : **SC106727-03F** Date of Issue: 05 March 2002

Model / Serial No. : **40400-XX¹ / ENGR UNIT #1**

Product Type : **Spread Spectrum Radio FCC ID: HZB-US58-B60²**

Applicant : **WESTERN MULTIPLEX CORPORATION**

Manufacturer : **WESTERN MULTIPLEX CORPORATION**

License holder : **WESTERN MULTIPLEX CORPORATION**

Address : **1196 Borregas Avenue**
: **Sunnyvale, CA 94089**

Test Result : ☒ **Positive³** ☐ **Negative**

Test Project Number
Reference(s) : **SC106727-03F**

Total pages - Test Report : **82**

NOTES: (1) 40400-25 (20 megabytes) and 40400-65 (20 to 60 megabytes)
(2) References to UNII and HZB-U58-B60 in the report should be Spread Spectrum and HZB-US58-B60.
(3) See General Remarks.

NOTE: All test equipment used by TÜV Product Service during testing is calibrated and traceable to NIST.

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(*) Data supplied by Western Multiplex.

EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to the following regulations:

- | | | |
|---|--|--|
| ☐ - EN 50081-1 / 1991 | | |
| ☐ - EN 55011 / 1998 | ☐ - Group 1
☐ - Class A | ☐ - Group 2
☐ - Class B |
| ☐ - EN 55014 / 1993 | ☐ - Household appliances and similar
☐ - Portable tools
☐ - Semiconductor devices | |
| ☐ - EN 55022 / 1987 | ☐ - Class A | ☐ - Class B |
| ☐ - EN 55022 / 1998 | ☐ - Class A | ☐ - Class B |
| ☐ - VCCI | ☐ - Class A ITE | ☐ - Class B ITE |
|
☒ - 47 CFR Part 15, Subpart C | | |
| ☒ - 15.247(c)
☒ - 15.207
☒ - 15.247(b)
☒ - 15.209(a)
☒ - 15.109(a)
☒ - 15.205
☒ - 15.247(d)*
☒ - 15.247(a)(2)*
☒ - 15.247(e)* | | |
| ☐ - AS/NZS 3548: 1995 | ☐ - Class A | ☐ - Class B |
| ☐ - CISPR 11 (1997) | ☐ - Group 1
☐ - Class A | ☐ - Group 2
☐ - Class B |
| ☐ - CISPR 22 (1997) | ☐ - Class A | ☐ - Class B |

(*) Data supplied by Western Multiplex. See Appendix D.

Environmental Conditions In The Laboratory:

	<u>Actual</u>
Temperature:	: 23 °C
Relative Humidity:	: 50 %
Atmospheric Pressure:	: 100.0 kPa

Power Supply Utilized:

Power supply system : 115 V / 60 Hz / 1 ϕ

Symbol Definitions:

- - Applicable
- - Not Applicable

SUMMARY

SPECIFICATION	RESULT
15.247(c), Conducted Spurious	Pass
15.247(b) Output Power	Pass
15.207 Conducted Emissions	Pass
15.209 Radiated Spurious	Pass
15.109 Radiated Emissions	Pass
15.205 Restricted Band Emissions	Pass
15.247(d) Power Density	Pass*
15.247(a)(2) 6 dB Bandwidth	Pass*
15.247(e) Processing Gain	Pass*

(*) Data supplied by Western Multiplex. See Appendix D for data and test results verification.

Emissions Test Conditions: Output Power, FCC Part 15, Paragraph 15.247(b)

The *EMISSIONS* measurements were performed at the following test location:

☐ - Test not applicable

■ - SR-3, Shielded Room, 12' x 20' x 8', Metal Chamber

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Due Date
HP8900D	802	Peak Power Meter	Hewlett Packard	3607U00653	04/02

Result :

■ - Pass

☐ - Fail

Remarks: _____

Emissions Test Conditions: Conducted Emission, FCC Part 15, Paragraph 15.207

The *EMISSIONS* measurements were performed at the following test location:

☐ - Test not applicable

■ - SR-3, Shielded Room, 12' x 20' x 8', Metal Chamber

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Due Date
9252-50-R-24-BNC	458	LISN, 50 μ H /250 μ H/50 Ω / 0.25 μ F	Solar Electronics Co.	941719	04/02
ESHS 30	459	EMI Test Receiver	Rohde & Schwarz	832354/004	11/01
CAT-20	602	20 dB Attenuator	Mini-Circuits	--	09/02

Result :

■ - Pass

☐ - Fail

Remarks: _____

Emissions Test Conditions: Radiated Spurious, Restricted Band, FCC Part 15, Paragraphs 15.209(a); 15.109(a); 15.205

The <i>EMISSIONS</i> measurements were performed at the following test location:
--

☐ - Test not applicable
--

- - Roof (Small Open Area Test Site) (Calibration Due Date: 16 July 2002)
- - Canyon #2 (3- and 10-Meter Open Area Test Site), Carroll Canyon, San Diego (Calibration Due Date: 12 July 2002)

Testing was performed at a test distance of :

- - 3 meters

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Due Date
LPB 2520/A	739	Antenna Bilog	Antenna Research	1170	04/02
ESVS 30	427	EMI Test Receiver	Rohde & Schwarz	830350/006	11/01
8566B	823	Spectrum Analyzer	Hewlett Packard	2332A02751	07/02
HP8445B	809	Automatic Preselector	Hewlett Packard	1442A01127	11/01
AFD3-0208-40-ST	367	PreAmp, 2GHz-8 GHz	Miteq Inc	155382	--
3115	251	Antenna, Horn	Electro Mechanics Co	2595	10/02
3146	244	Antenna	Electro Mechanics Co	1063	02/02
3115	453	Double Ridge Antenna 1GHz-18 GHz	EMCO	9412-4364	10/02
AMF-5D-010180-35-10P	719	PreAmp, 2GHz-20GHz	TUV PS	549460	04/02
HP8586B	407	Spectrum Analyzer	Hewlett Packard	2311A02209	02/02
HP11970K	652	Mixer	Hewlett Packard	3003A05400	--
12A18115300	6377	Antenna, Horn 18GHz-26 GHz	MI Technologies	21554MB	--

Result :

- - Pass
- ☐ - Fail

Remarks: Restricted Bands: No signals were measurable at 3 meters. EUT moved to 1 meter distance. Special limit adjusted for 1 meter.

Equipment Under Test (EUT) Test Operation Mode - Emissions Tests :

The equipment under test was operated under the following conditions during emissions testing:

- ☐ - Standby
- ☐ - Test Program (H - Pattern)
- ☐ - Test Program (Color Bar)
- ☐ - Test Program (Customer Specified)
- ☐ - Practice Operation
- ☒ - Normal Operating Mode
- ☐ - _____

Configuration of the equipment under test:

- ☐ - See Constructional Data Form in Appendix B - Page B2
- ☒ - See Product Information Form(s) in Appendix B - Page B2

The following peripheral devices and interface cables were connected during the testing:

- | | |
|---|----------------|
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - unshielded power cable | |
| ☐ - unshielded cables | |
| ☐ - shielded cables | MPS.No.: _____ |
| ☐ - customer specific cables | |
| ☐ - _____ | |

GENERAL REMARKS:

NOTES: 1) All photographs in this report are representative of setup for maximum emissions.
2) Radiated Emission in Restricted Bands - no signals were measurable at 3 meters. EUT moved to 1 meter distance. Special limit adjusted for 1 meter
3) Data for FCC Part 15, Paragraphs 15.247(d), Power Density; 15.247(a)(2), 6 dB Bandwidth; and 15.247(e) Processing Gain; and 15.247(c), Out of Band Antenna Conducted Emissions were supplied by the Western Multiplex. See Appendix D for data and test results verification.

SUMMARY:

All tests according to the regulations cited on page 3 were

■ - Performed^{2,3}

□ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements cited on page 3.^{2,3}

□ - **Does not** fulfill the general approval requirements cited on page 3.

Statement of Measurement Uncertainty

The data and results referenced in this document are true and accurate. The measurement uncertainty is calculated to be ± 2 dB for conducted emissions and ± 4 dB for radiated emissions.

Equipment Received Date: 24 September 2001

Testing Start Date: 24 September 2001

Testing End Date: 04 October 2001

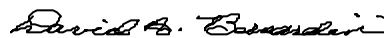
- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:



Jim Owen
(EMC Chief Engineer)

Responsible Engineer:



Dave Bernardin
(EMC Engineer)

Technical Documentation

Test Data Sheets
and
Test Setup Drawing(s)

Output Power

QPSK 3/4 Modulation				
Frequency MHz	Output Power mW	Output Power dBm	EIRP Limit dBm	Max Gain dBi
Ch 5 5908.56	49.7	17.0	36	19.0
Ch 2 5768.06	49.3	16.9	36	19.1
Ch 0 5740.40	48.8	16.9	36	19.1

Conducted Emissions

**TUV Product Service
Powerline Conducted Emissions**

EUT: Tsunami Multipoint Base Station
 Manuf: Western multiplex
 Op Cond: 110 Vac to -48Vdc
 Operator: Dave Bernardin *DB*
 Test Spec: FCC Part 15 B
 Comment: 110V ac 60 Hz Line 1Channel 6a QPSK-3/4
 SC106727
 Date: 24. Sep 01 10:14

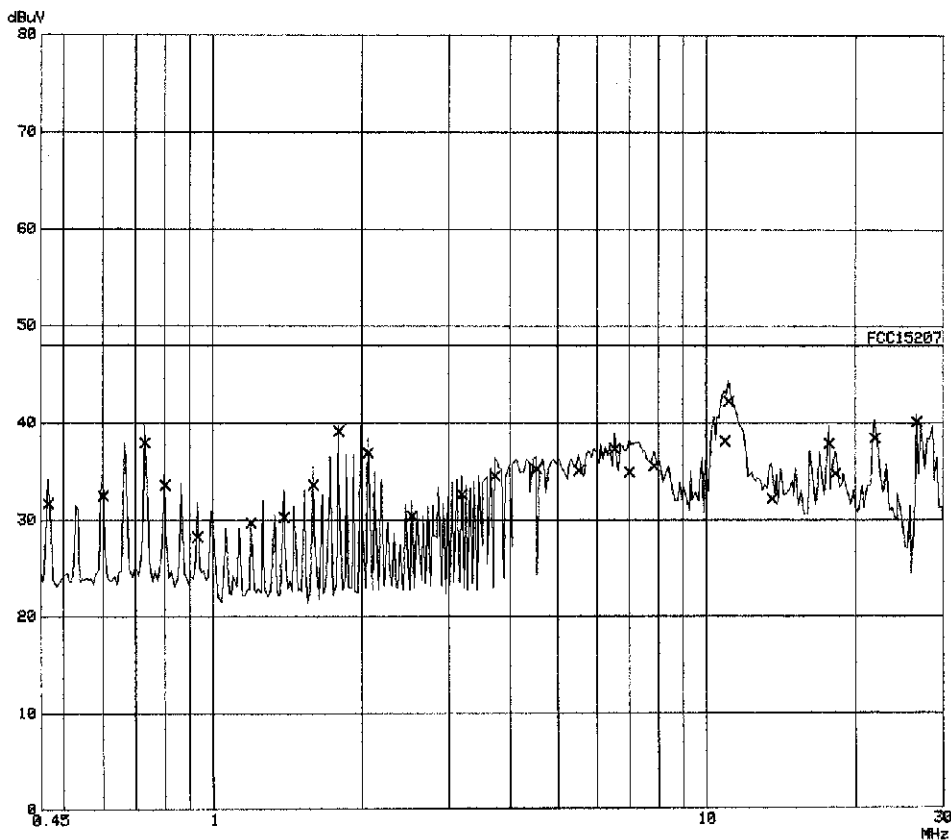
Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	100ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	2ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	9k	30M	20dBLISN

Final Measurement: x QP

Meas Time: 1 s
 Subranges: 25
 Acc Margin: 35dB



**TUV Product Service
Powerline Conducted Emissions**

EUT: Tsunami Multipoint Base Station
 Manuf: Western multiplex
 Op Cond: 110 Vac to -48Vdc
 Operator: Dave Bernardin *DB*
 Test Spec: FCC Part 15 B
 Comment: 110V ac 60 Hz Line 1Channel 6a QPSK-3/4
 SC106727
 Date: 24. Sep 01 10:14

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.46500	31.7	48.0
0.60000	32.5	48.0
0.73000	38.0	48.0
0.80000	33.6	48.0
0.93000	28.2	48.0
1.19500	29.7	48.0
1.39500	30.3	48.0
1.59500	33.6	48.0
1.79500	39.2	48.0
2.06000	36.9	48.0
2.53000	30.4	48.0
3.19500	32.6	48.0
3.72500	34.5	48.0
4.52500	35.3	48.0
5.52000	35.1	48.0
6.52000	37.3	48.0
6.99000	35.0	48.0
7.85000	35.6	48.0
10.90500	38.2	48.0
11.11000	42.2	48.0
13.57000	32.1	48.0
17.69500	37.9	48.0
18.24500	34.8	48.0
21.91000	38.5	48.0
26.61000	40.1	48.0

* limit exceeded

TUV Product Service
Powerline Conducted Emissions

EUT: Tsunami Multipoint Base Station
 Manuf: Western multiplex
 Op Cond: 110 Vac to -48Vdc
 Operator: Dave Bernardin *DB*
 Test Spec: FCC Part 15 B
 Comment: 110V ac 60 Hz Line 2Channel 6a QPSK-3/4
 SC106727
 Date: 24. Sep 01 10:21

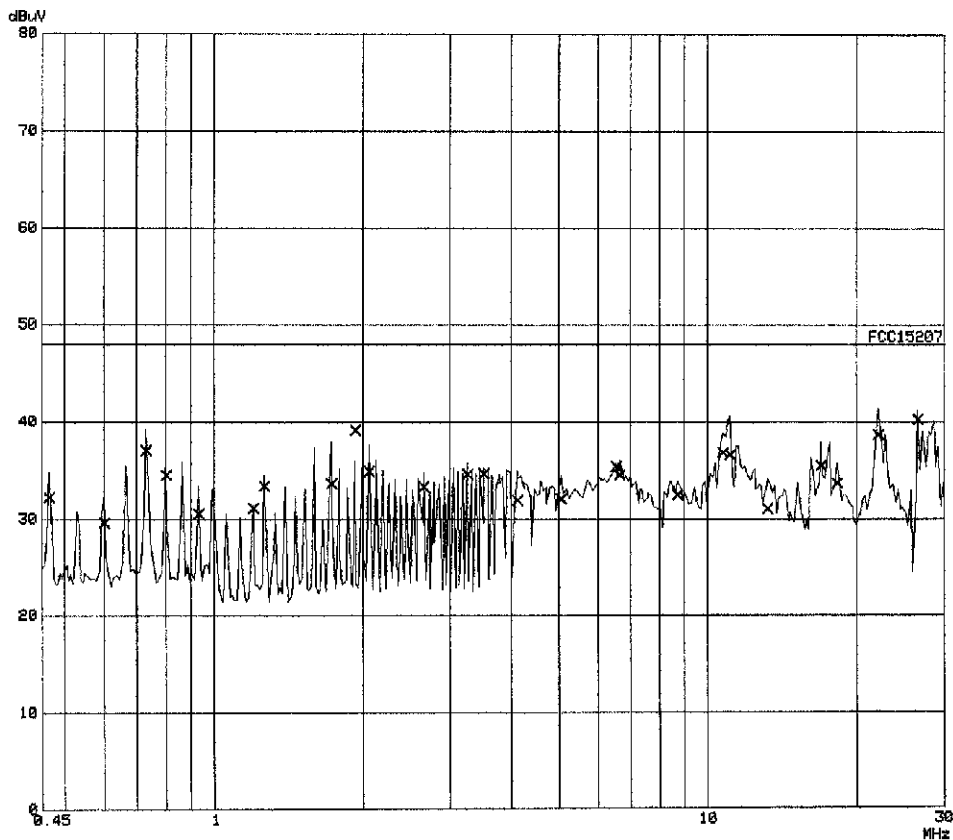
Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	100ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	2ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	9k	30M	20dBLISN

Final Measurement: x QP

Meas Time: 1 s
 Subranges: 25
 Acc Margin: 35dB



**TUV Product Service
Powerline Conducted Emissions**

EUT: Tsunami Multipoint Base Station
 Manuf: Western multiplex
 Op Cond: 110 Vac to -48Vdc
 Operator: Dave Bernardin *DB*
 Test Spec: FCC Part 15 B
 Comment: 110V ac 60 Hz Line 2Channel 6a QPSK-3/4
 SC106727
 Date: 24. Sep 01 10:21

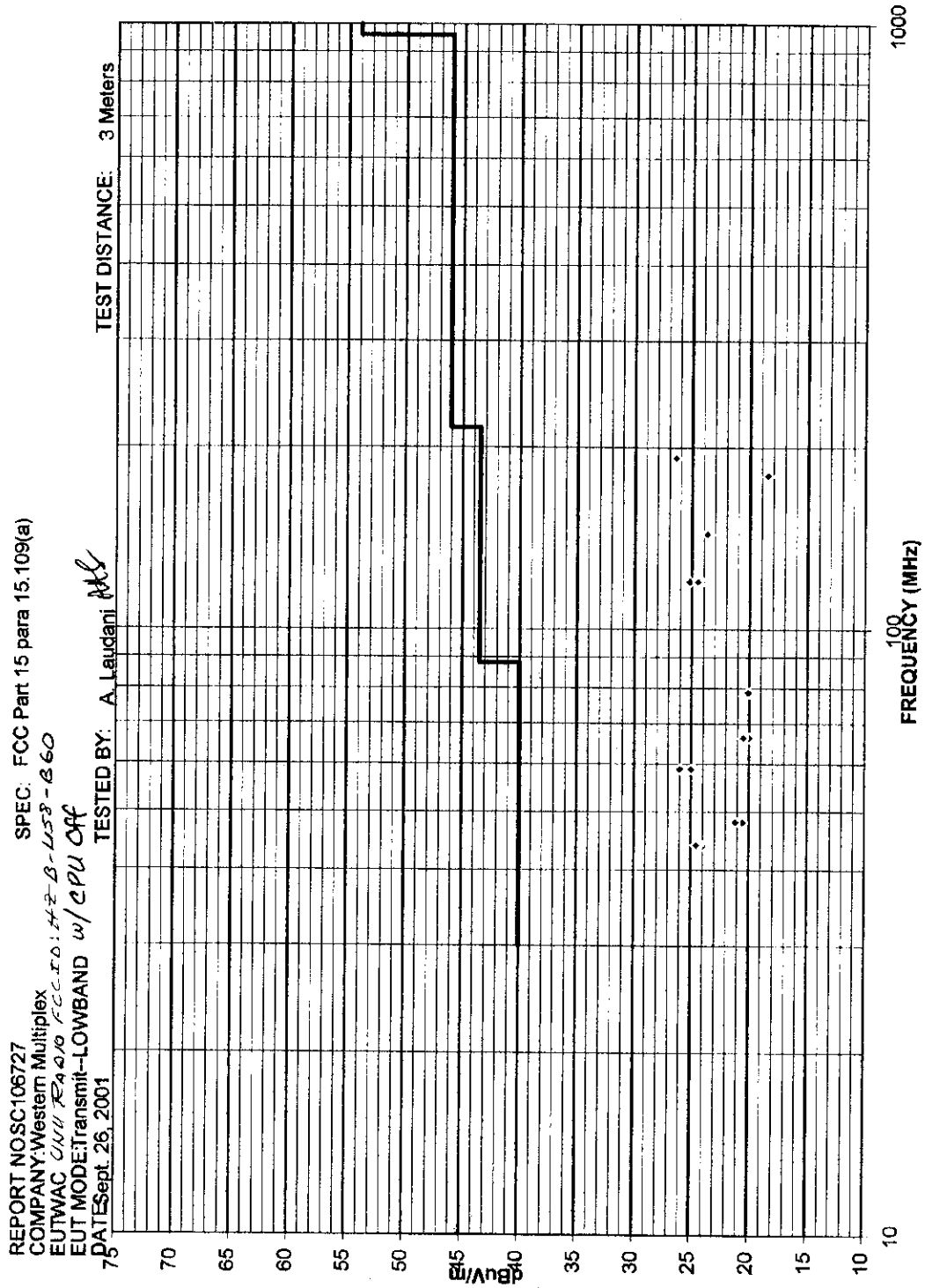
Final Measurement Results:

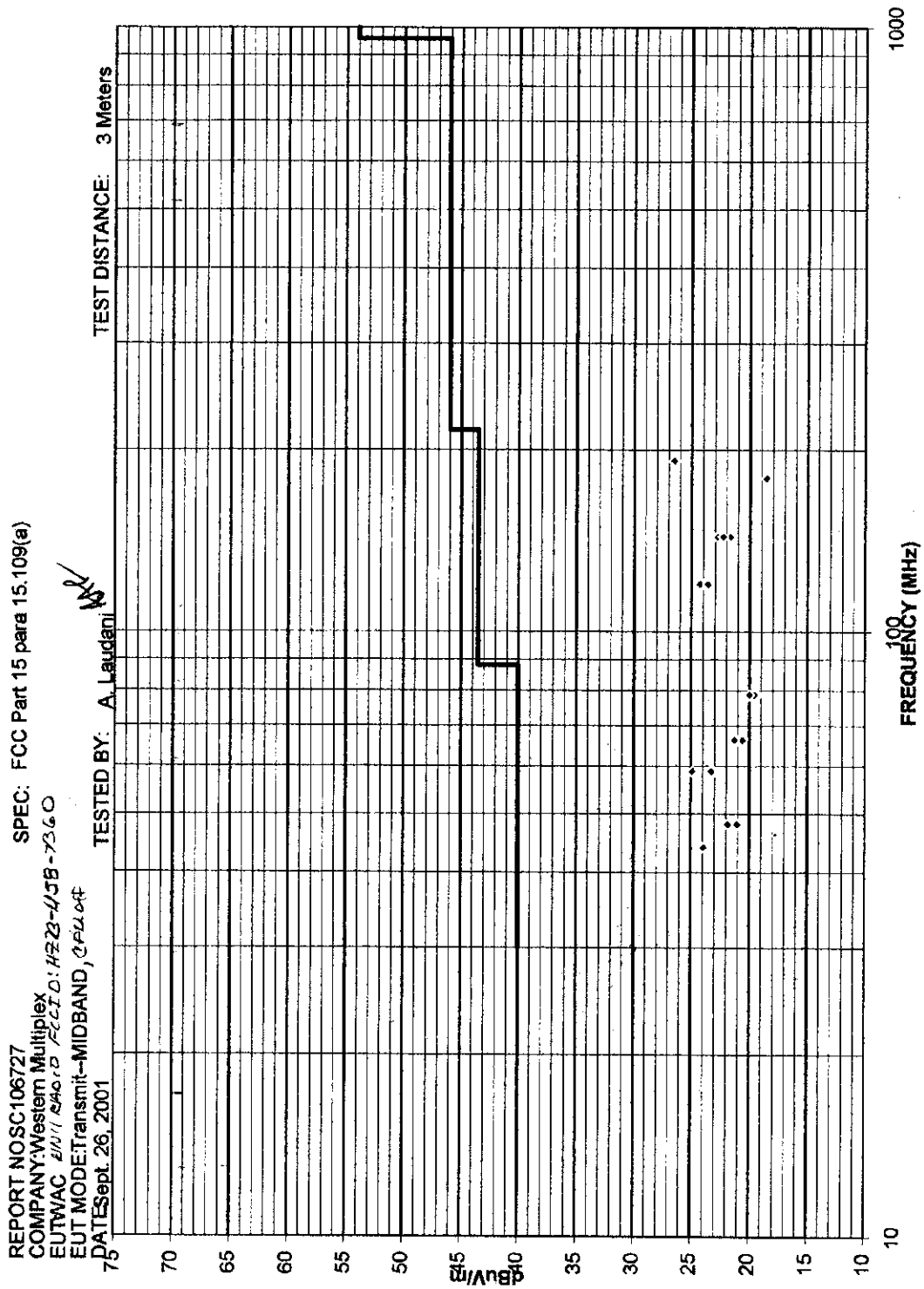
Frequency MHz	QP Level dBuV	QP Limit dBuV
0.46500	32.2	48.0
0.60000	29.6	48.0
0.73000	37.1	48.0
0.80000	34.6	48.0
0.93000	30.5	48.0
1.20000	31.2	48.0
1.26500	33.5	48.0
1.72500	33.7	48.0
1.93000	39.2	48.0
2.06000	34.9	48.0
2.66000	33.3	48.0
3.26000	34.6	48.0
3.52500	34.7	48.0
4.12000	31.9	48.0
5.05500	32.1	48.0
6.52000	35.4	48.0
6.65000	34.6	48.0
8.71500	32.5	48.0
10.77500	36.9	48.0
11.10500	36.6	48.0
13.24000	31.0	48.0
16.96000	35.5	48.0
18.30500	33.7	48.0
22.15000	38.7	48.0
26.61000	40.3 <i>AS</i>	48.0

* limit exceeded

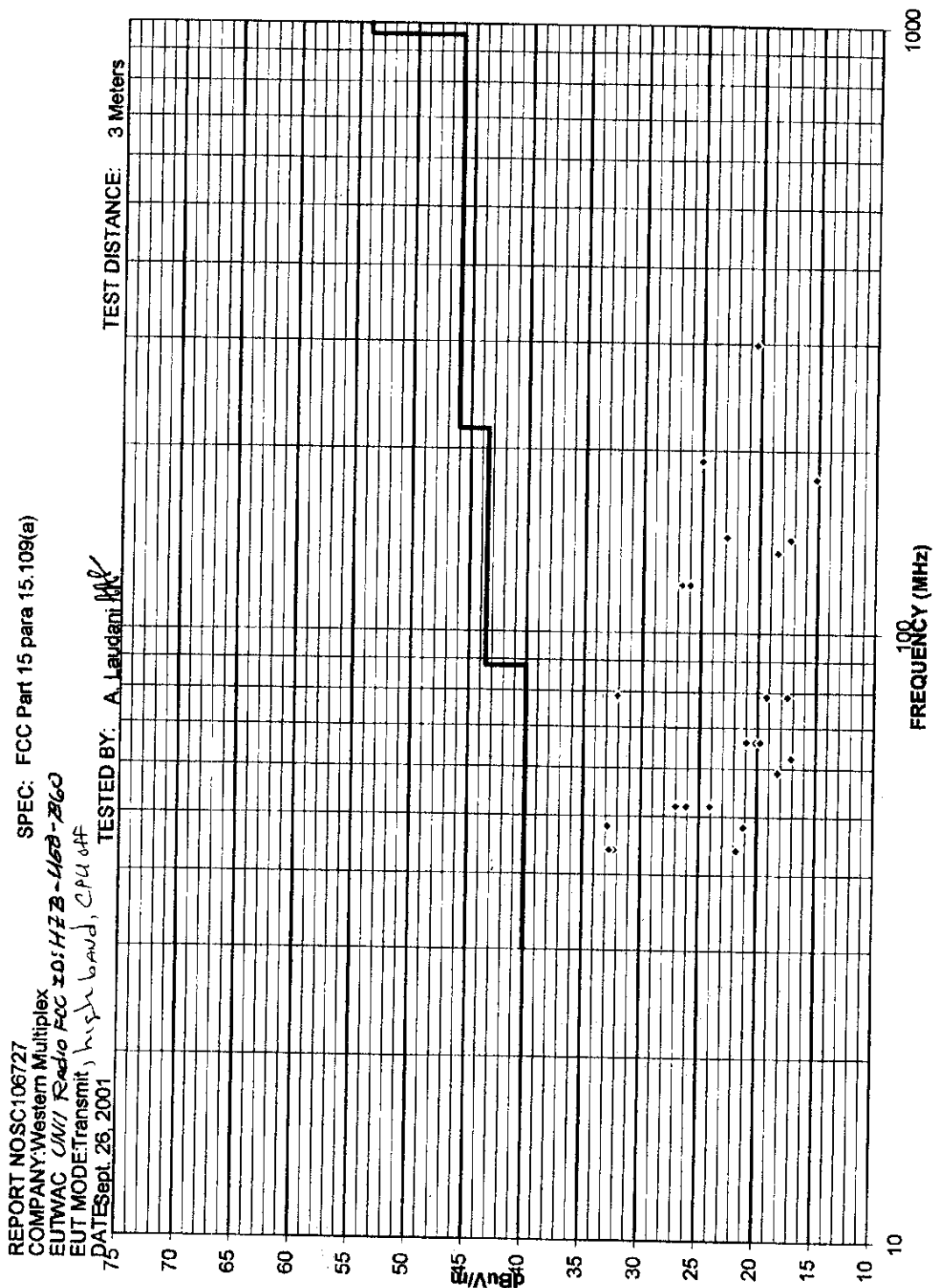
Radiated Spurious and Restricted Bands

- NOTE: 1) Reference to UNII should be Spread Spectrum and reference to HZB-U58-B60 should be HZB-US58-B60.
- 2) The modulation type for this filling from the following data records is QPSK $\frac{3}{4}$





[illegible]



REPORT No: SC106727
 CUSTOMER: Western Multiplex
 SPEC: FCC Part 15 para 15.109(a)
 TEST DIST: 3 Meters
 EUT: WAC UNII Radio FCC ID: HZB-US58-B60
 TEST SITE: 2
 EUT MODE: Transmitting high band, CPD60FF
 BICONICAL: 739
 DATE: Sept 26, 200
 TESTED BY: A. Laudani
 LOG PERIODIC: 739
 NOTES: Quasi-Peak with 120 KHz measurement bandwidth. RCVR: 427

EUT MARGIN		Temperature		Relative Humidity		44		ver 1.8	
FREQUENCY (MHz)	VERTICAL measured (dBuV)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)	NOTE
43.90	14	5	18.3	32.3	40	-7.7	0	1	16QAM -6F
48.00	15.4	4.9	17.5	32.9	40	-7.1	0	1	16QAM -6F
52.00	10.5	0.3	16.5	27.0	40	-13.0	0	1	16QAM -6F
59.10	4.5	-0.1	13.8	18.3	40	-21.7	90	1	16QAM -6F
62.40	5	2	12.1	17.1	40	-22.9	90	1	16QAM -6F
66.21	8	10.5	10.5	21.0	40	-19.0	60	1	16QAM -6F
78.71	22.3	23	9.1	32.1	40	-7.9	60	1	16QAM -6F
120.00	11	3.3	14.8	25.8	43.5	-17.7	60	1	16QAM -6F
136.00	5.6	-0.1	12.9	18.5	43.5	-25.0	180	1	16QAM -6F
143.00	5.4	-1	12.0	17.4	43.5	-26.1	110	1	16QAM -6F
144.00	11	-1	11.9	22.9	43.5	-20.6	280	1	16QAM -6F
180.00	3	2	12.2	15.2	43.5	-28.3	190	1	16QAM -6F
192.00	12	10.8	13.0	25.0	43.5	-18.5	270	1	16QAM -6F
239.00	3.1	-0.2	17.4	20.5	46	-25.5	130	1	16QAM -6F
43.90	14.4	5	18.3	32.7	40	-7.3	0	1	8QAM -6F
48.00	3.7	3	17.5	21.2	40	-18.8	0	1	8QAM -6F
78.71	8.4	5	9.1	17.5	40	-22.5	60	1	8QAM -6F
52.00	7.6	0	16.5	24.1	40	-15.9	60	1	8QAM -6F
120.00	11.9	3	14.8	26.7	43.5	-16.8	60	1	8QAM -6F
66.21	9.7	2	10.5	20.2	40	-19.8	60	1	8QAM -6F
43.90	3.5	-2	18.3	21.8	40	-18.2	0	1	QPSK3/4 -6F
48.00	3.7	1.4	17.5	21.2	40	-18.8	0	1	QPSK3/4 -6F
52.00	9.6	1.1	16.5	26.1	40	-13.9	80	1	QPSK3/4 -6F
66.21	9.3	2	10.5	19.8	40	-20.2	60	1	QPSK3/4 -6F
78.71	10.2	3.6	9.1	19.3	40	-20.7	60	1	QPSK3/4 -6F
120.00	11.2	3	14.8	26.0	43.5	-17.5	60	1	QPSK3/4 -6F

844

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v.beta1a

[illegible]

Date: 4-Oct-01

Test Area: SR5

Test Report #: SC106727

Test Method FCC15.205(b) Restricted bands of operation

Temperature: 23 °C
Air Pressure: 100.1 kPa
Relative Humidity: 48 %

EUT Model #: UNII Radio
EUT POWER: 115 Vac/60 Hz

EUT Description FCC ID: HZB-US58-B60

NOTES: Mode: Receive/Transmit Normal Mode
No signals were measurable at 3 meters. The EUT was moved to one meter distance.
SPEC LIMIT was adjusted for one meter.

FREQ (MHz)	VERTICAL (dBuV) pk av	HORIZONTAL (dBuV) pk av	CORRECTION FACTOR (dB/m)	MAX LEVEL (dBuV/m) pk av	SPEC LIMIT (dBuV/m) pk av	MARGIN (dB) pk av	EUT Rotatio	Antenna Height	Notes
22961	31.5 19.8	31.5 19.8	32.92	64.42 52.72	84 64	-19.58 -11.28	0	1	8QAM CH 0, 6A
22961	32.4 19.9	32.4 19.9	32.92	65.32 52.82	84 64	-18.68 -11.18	0	1	16QAM CH 0, 6A
22961	31.5 19.8	31.5 19.8	32.92	64.42 52.72	84 64	-19.58 -11.28	0	1	QPSK 3/4 CH 0, 6A
23072	29.6 19.4	29.6 19.4	32.92	62.52 52.32	84 64	-21.48 -11.68	0	1	8QAM CH 2, 6C
23072	29.7 19.4	29.7 19.4	32.92	62.62 52.32	84 64	-21.38 -11.68	0	1	16QAM CH 2, 6C
23072	30.5 19.5	30.5 19.5	32.92	63.42 52.42	84 64	-20.58 -11.58	0	1	QPSK 3/4 CH 2, 6C
23244	29.6 19.4	29.6 19.4	32.96	62.56 52.36	84 64	-21.44 -11.64	0	1	8QAM CH 5, 6F
23244	29.4 19.4	29.4 19.4	32.96	62.36 52.36	84 64	-21.64 -11.64	0	1	16QAM CH 5, 6F
23255	29.8 19.5	29.8 19.5	32.96	62.76 52.46	84 64	-21.24 -11.54	0	1	QPSK 3/4 CH 5, 6F

Test Equipment Used:	Model Number	Prop. #	Description	Manufacturer	Serial No.	Cal. Date
hp8586B	407		Spectrum Analyzer	Hewlett Packard	2311A02209	2/15/02
hp11975A	719		Amplifier	Hewlett Packard	2517A00639	not req'd.
hp11970K	652		Mixer	Hewlett Packard	3003A05400	not req'd.
12A18 115300	0006377		Horn Antenna 18-26 GHz	MI Technologies	21554MB	not req'd.

Tested Dave Bernardin

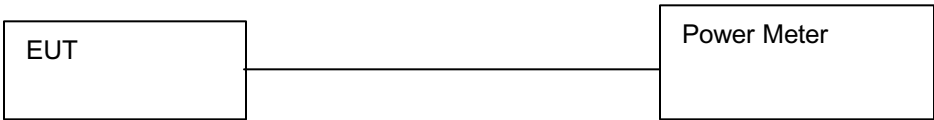
Reviewed by: Alan Laudani

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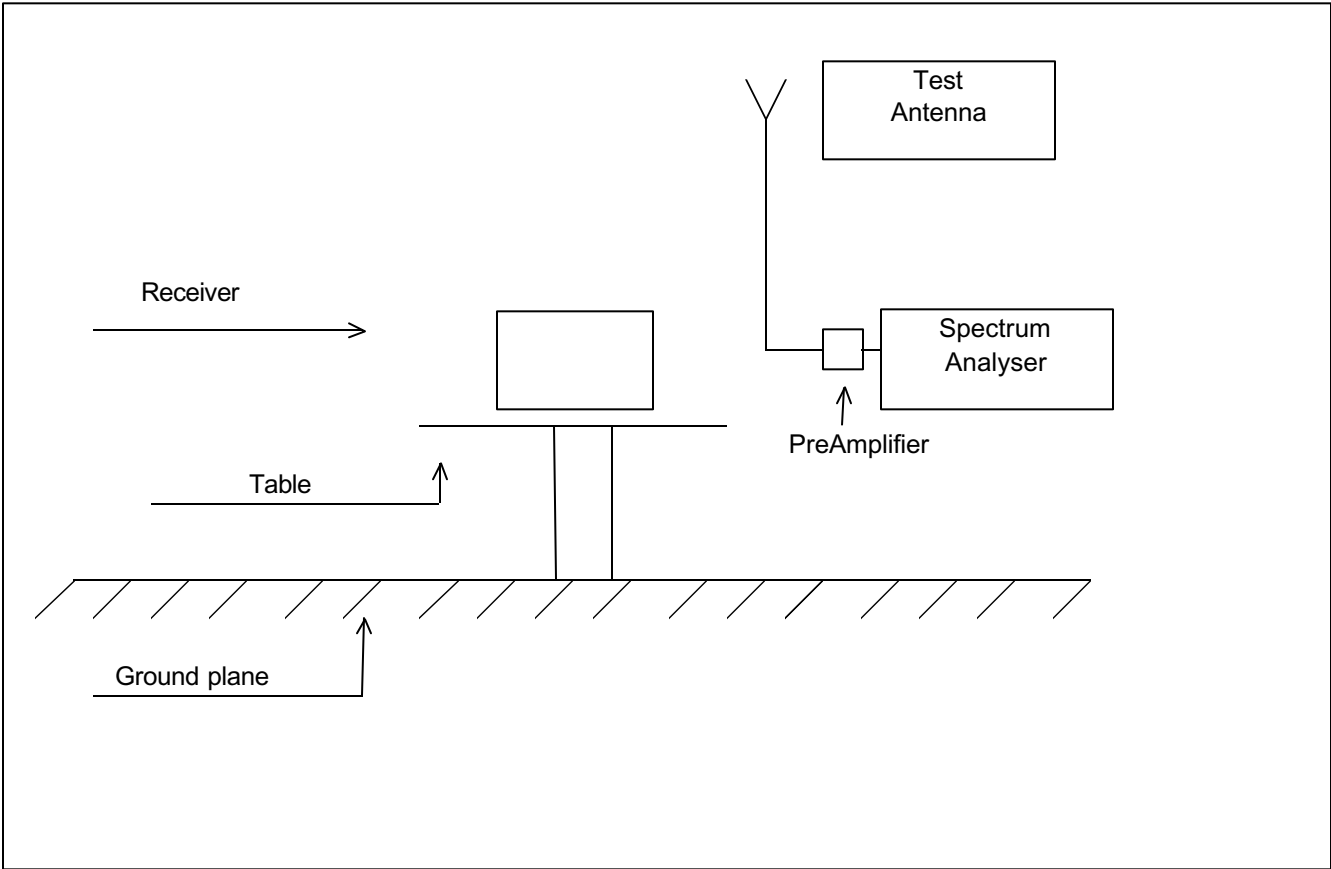
Conducted Spurious Test Setup



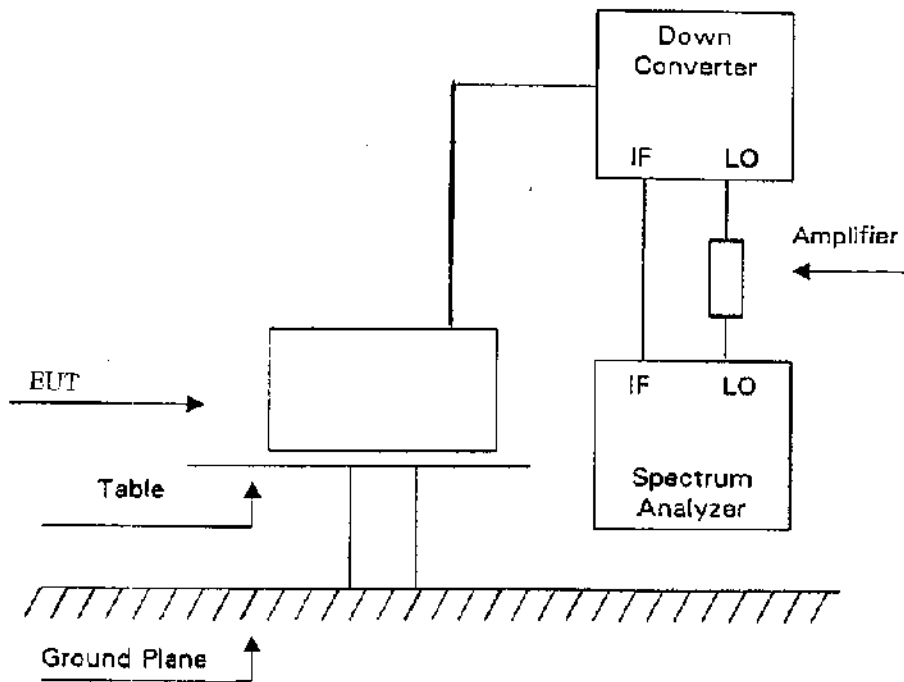
Output Power Test Setup



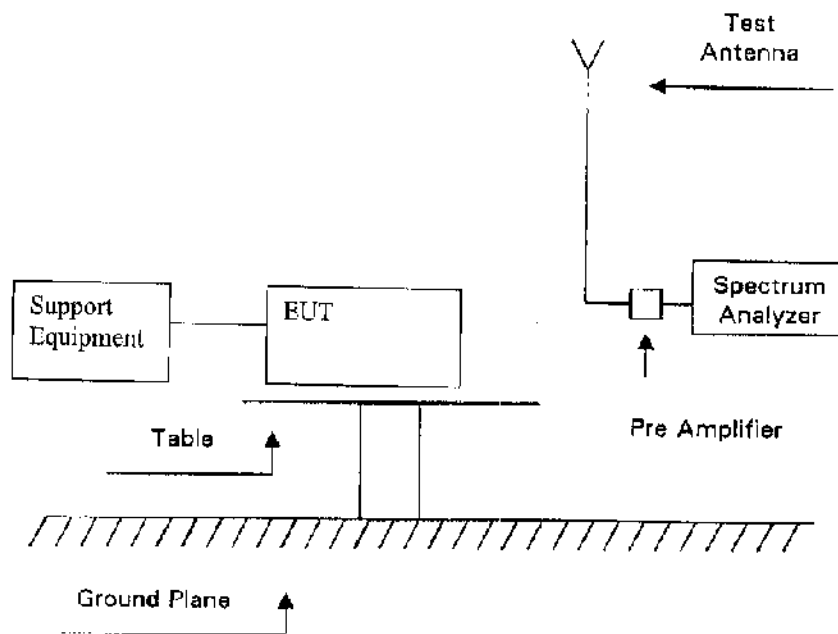
Radiated Spurious Emissions



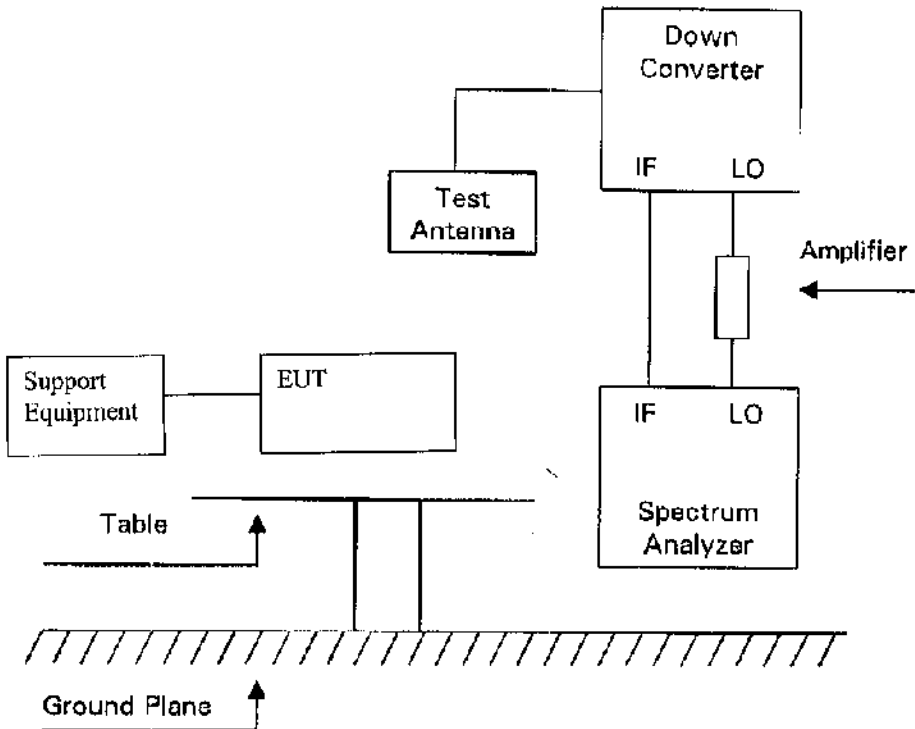
Test Setup for Out of Band Antenna Conducted Emission



Test Setup for Radiated Emission in Restricted Bands and Radiated Emission from Receiver L.O.

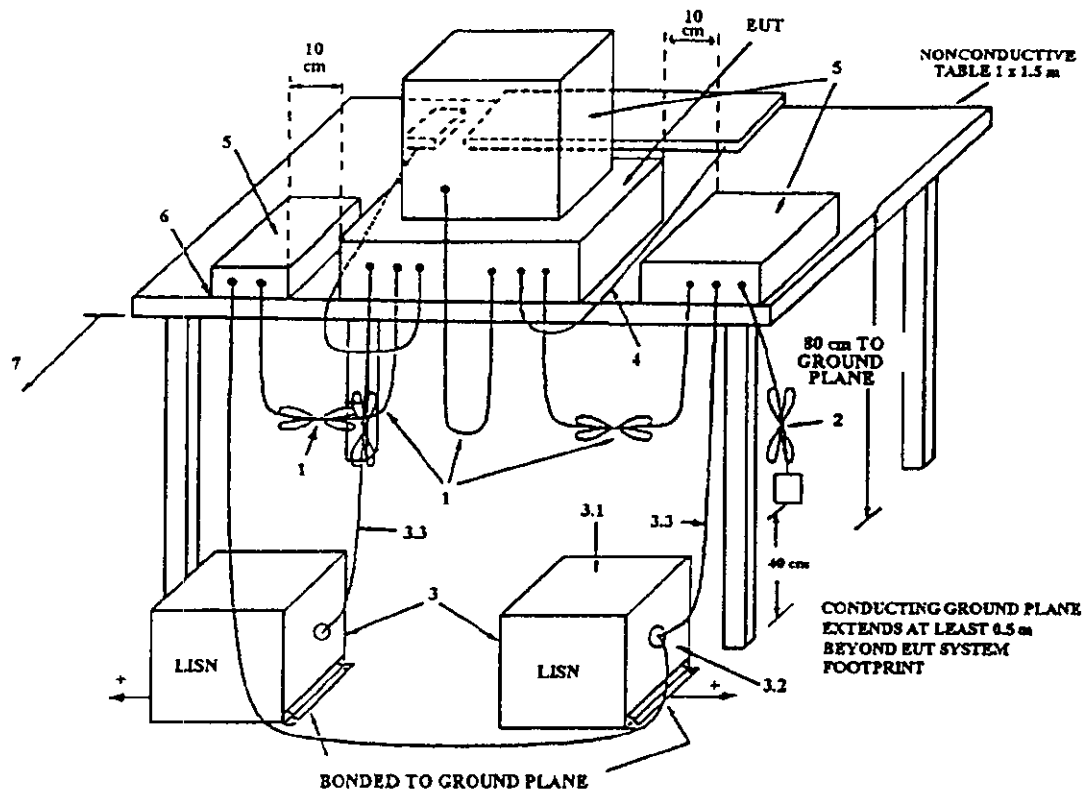


Test Setup for Radiated Emission in Restricted Bands



Conducted Emissions Test Setup, 0.15 to 30 MHz

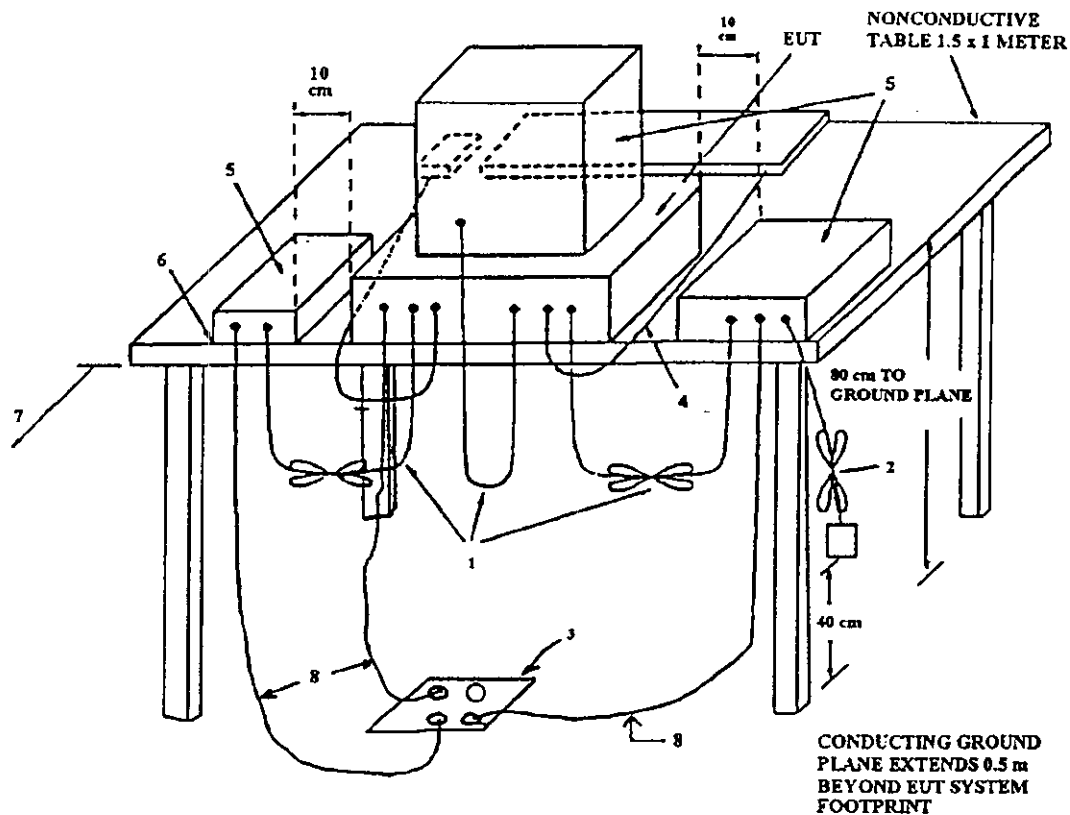
ELECTRICAL AND ELECTRONIC EQUIPMENT IN THE RANGE OF 9 kHz to 40 GHz



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN connectors shall be terminated in 50 Ω . LISN can be placed on top of, or immediately beneath, ground plane.
 - 3.1 All other equipment powered from second LISN.
 - 3.2 Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
 - 3.3 LISN at least 80 cm from nearest part of EUT chassis.
4. Cables of hand-operated devices, such as keyboards, mice, etc., have to be placed as close as possible to the controller.
5. Non-EUT components being tested.
6. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.
7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the floor ground plane.

Radiated Emissions Test Setup, 30 to 1000 MHz



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mice, etc., have to be placed as close as possible to the controller.
5. Non-EUT components of EUT system being tested.
6. The rear of all components of the system under test shall be located flush with the rear of the table.
7. No vertical conducting wall used.
8. Power cords drape to the floor and are routed over to receptacle.