ENGINEERING TEST REPORT

Portable DVD/CD Player
MODEL NO.: DVD-LX95

FCC ID: ACJDVDLX95

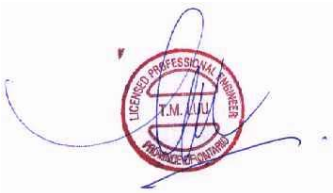
Applicant:

Matsushita Electric Industrial Co., Ltd.
1006 Oaza Kadoma
Kadoma, Osaka 571, Japan

Tested in Accordance With

FCC Part 15, Subpart C, Section 15.239
Low Power Transmitters
Operation in the Frequency Band 88-108 MHz

UltraTech's File No.: PAN-058F15C239

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: February 7, 2005	
Report Prepared by: Dan Huynh Issued Date: February 7, 2005	Tested by: Hung Trinh, RF Technician Test Dates: February 4-6, 2005

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	Test report	OK
1	Test Setup Photos	Test Setup Photos	OK
2	External Photos of EUT	External EUT Photos	OK
3	Internal Photos of EUT	Internal EUT Photos	OK
4	Cover Letters	▪ Letter from Ultratech for Certification Request ▪ Letter from the Applicant to appoint Ultratech to act as an agent ▪ Letter from the Applicant to request for Confidentiality Filing	OK
5	Attestation Statements	--	--
6	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
7	Block Diagrams	Block Diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	Parts List	OK
10	Operational Description	Detailed Operational Description	OK
11	RF Exposure Info	N/A	N/A
12	Users Manual	Portable DVD/CD Player Operating Instructions	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.239
Title:	Code of Federal Regulations (CFR), Title 47 - Telecommunication, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Low Power Licensed-Exempt Transmitters operating in the Frequency Band 88-108 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	▪ Residential ▪ Commercial, industrial or business environment.

2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2004	Code of Federal Regulations, Title 47 – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	2003 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1	2003	Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Matsushita Electric Industrial Co., Ltd.
Address:	1006 Oaza Kadoma Kadoma, Osaka 571-8501, Japan
Contact Person:	Richard Mullen Phone #: 201-348-7758 Fax #: 201-392-4564 Email Address: mullenr@us.panasonic.com

MANUFACTURER	
Name:	Matsushita Electric Industrial Co., Ltd. Network Business Group
Address:	1 -15 Matsuo-cho Kadoma, Osaka Japan, 571-8504
Contact Person:	Mr. Nobuyuki Nishihara Phone #: +81-6-6906-2739 Fax #: +81-6-6906-8405 Email Address: nishihara.nobuyuki@jp.panasonic.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name;	Panasonic
Product Name:	Portable DVD/CD Player
Model Name or Number:	DVD-LX95
Serial Number:	Pre-production
Type of Equipment:	Low Power Communication Device Transmitter
Input Power Supply Type:	DC 12 V (DC IN terminal) / DC 7.2 V (Battery)
Primary User Functions of EUT:	DVD Play Function

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	▪ Residential ▪ Commercial, light industry & heavy industry
Power Supply Requirement:	DC 5V
RF Output Power Rating:	44.53 dBμV/m (Peak at 3 Metres) 38.68 dBμV/m (Average at 3 Metres)
Operating Frequency Range:	88.3 – 107.7 MHz
Channel Spacing:	0.1 MHz
RF Output Impedance:	75 Ohms
Modulation Type:	FM
Oscillator Frequencies:	7.6 MHz
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Matsushita Electric Industrial Co., Ltd Type: Monopole Antenna Model: DVD-LX95PP-K Frequency Range: 88.3MHz - 107.7MHz Gain: -22.85 dBi

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	DC IN	1	DC Plug-in Jack	Non-shielded
2	VIDEO	1	1/8" Mini Phone Jack	Shielded
3	AUDIO/OPT OUT	1	1/8" Mini Phone Jack	Shielded
4	Headphone Jack	2	1/8" Mini Phone Jack	Shielded

3.5. ANCILLARY EQUIPMENT

None.

3.6. GENERAL TEST SETUP

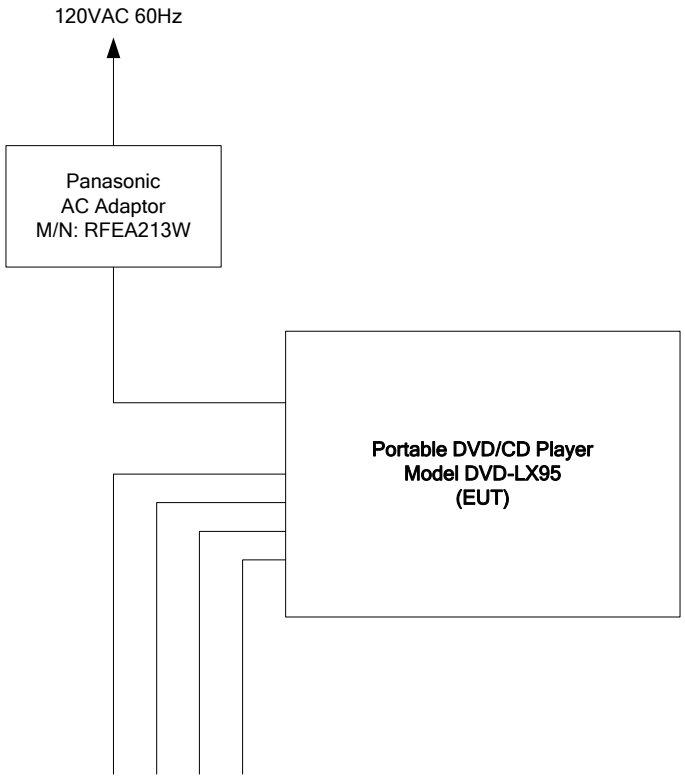


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	DC 12 V (DC IN terminal) / DC 7.2 V (Battery)

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Each of the channel frequencies transmits continuously for emissions measurements.
Special Test Software:	None.
Special Hardware Used:	None.
Transmitter Test Antenna:	Integral antenna.

Transmitter Test Signals	
Frequency Band(s):	88.3 – 107.7 MHz
Frequency(ies) Tested:	88.3 MHz, 98 MHz and 107.7 MHz
RF Power Output (measured maximum output power):	44.53 dBμV/m (Peak at 3 Metres) 38.68 dBμV/m (Average at 3 Metres)
Normal Test Modulation:	FM
Modulating Signal Source:	Internal

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

  The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: February 17, 2004.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.107(a) & 15.207	AC Power Conducted Emissions	Yes
15.239(a)	Occupied Bandwidth	Yes
15.239(b) & (c)	Field Strength of Emissions Inside and Outside the permitted band 88 - 108 MHz	Yes

The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices. The engineering test report can be provided upon requests.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report.

6.2. MEASUREMENT UNCERTAINITES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4, FCC 15.239 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

The essential function of the EUT is to correctly communicate data to radios over RF link.

6.5. AC POWER LINE CONDUCTED EMISSIONS [§ 15.207]

6.5.1. Limits

The equipment shall meet the limits of the following table:

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

6.5.2. Method of Measurements

Refer to Section 8.2 of this test report & ANSI C63.4 for details.

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 85462A	3325A00141	9 kHz – 6.5 GHz
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 μH
24'x16'x8' RF Shielded Chamber	RF Shielding	…	..	…

6.5.4. Test Data

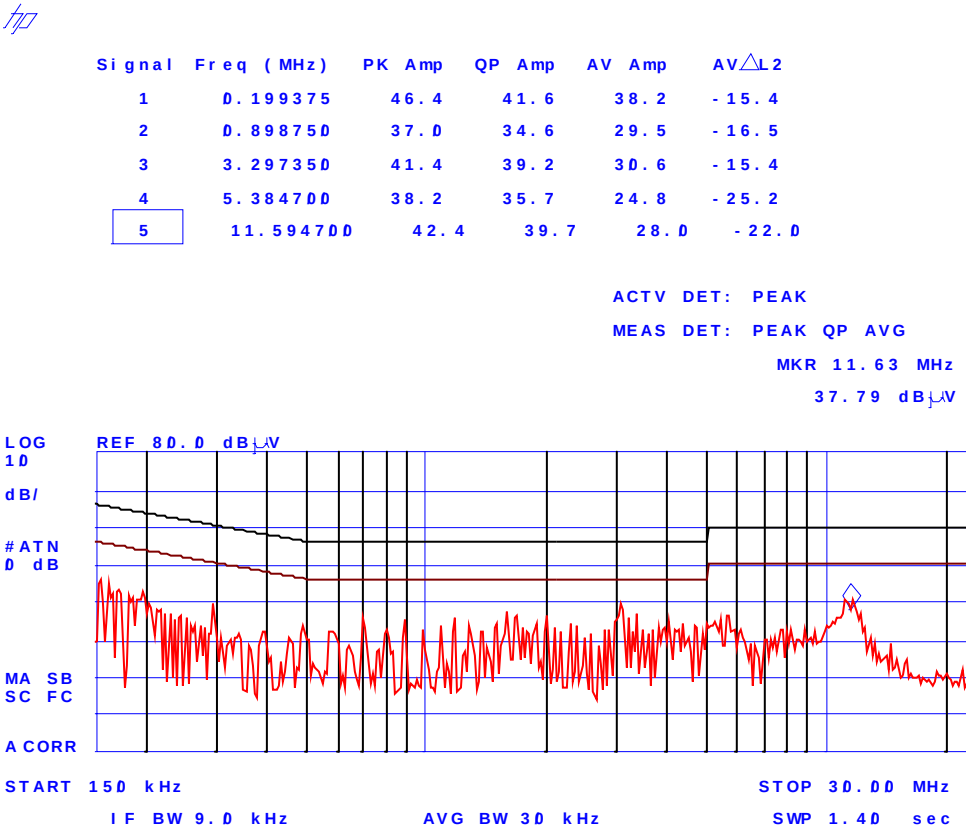
Frequency (MHz)	RF Level (dBuV)	Receiver Detector (QP/AVG)	QP Limit (dBuV)	AVG Limit (dBuV)	Margin (dB)	Pass/ Fail	Line Tested (L1/L2)
FM Transmitter ON (Stereo Mode)							
0.199375	41.6	QP	63.6	53.6	-22.0	Pass	L1
0.199375	38.2	AVG	63.6	53.6	-15.4	Pass	L1
0.898750	34.6	QP	56.0	46.0	-21.4	Pass	L1
0.898750	29.5	AVG	56.0	46.0	-16.5	Pass	L1
3.297350	39.2	QP	56.0	46.0	-16.8	Pass	L1
3.297350	30.6	AVG	56.0	46.0	-15.4	Pass	L1
5.384700	35.7	QP	60.0	50.0	-24.3	Pass	L1
5.384700	24.8	AVG	60.0	50.0	-25.2	Pass	L1
11.594700	39.7	QP	60.0	50.0	-20.3	Pass	L1
11.594700	28.0	AVG	60.0	50.0	-22.0	Pass	L1
0.197925	41.6	QP	63.7	53.7	-22.1	Pass	L2
0.197925	38.8	AVG	63.7	53.7	-14.9	Pass	L2
0.895300	35.1	QP	56.0	46.0	-20.9	Pass	L2
0.895300	30.2	AVG	56.0	46.0	-15.8	Pass	L2
3.385825	40.3	QP	56.0	46.0	-15.7	Pass	L2
3.385825	33.0	AVG	56.0	46.0	-13.0	Pass	L2
5.580225	39.1	QP	60.0	50.0	-20.9	Pass	L2
5.580225	30.8	AVG	60.0	50.0	-19.2	Pass	L2
11.465000	41.0	QP	60.0	50.0	-19.0	Pass	L2
11.465000	30.9	AVG	60.0	50.0	-19.1	Pass	L2

Frequency (MHz)	RF Level (dBuV)	Receiver Detector (QP/AVG)	QP Limit (dBuV)	AVG Limit (dBuV)	Margin (dB)	Pass/ Fail	Line Tested (L1/L2)
FM Transmitter OFF							
0.193350	41.5	QP	63.9	53.9	-22.4	Pass	L1
0.193350	37.2	AVG	63.9	53.9	-16.7	Pass	L1
0.584800	37.0	QP	56.0	46.0	-19.0	Pass	L1
0.584800	32.8	AVG	56.0	46.0	-13.2	Pass	L1
3.330350	39.4	QP	56.0	46.0	-16.6	Pass	L1
3.330350	32.4	AVG	56.0	46.0	-13.6	Pass	L1
5.786275	35.1	QP	60.0	50.0	-24.9	Pass	L1
5.786275	26.3	AVG	60.0	50.0	-23.7	Pass	L1
11.484825	40.2	QP	60.0	50.0	-19.8	Pass	L1
11.484825	28.5	AVG	60.0	50.0	-21.5	Pass	L1
0.198350	42.0	QP	63.7	53.7	-21.7	Pass	L2
0.198350	38.9	AVG	63.7	53.7	-14.8	Pass	L2
0.891575	35.1	QP	56.0	46.0	-20.9	Pass	L2
0.891575	29.7	AVG	56.0	46.0	-16.3	Pass	L2
3.370025	40.6	QP	56.0	46.0	-15.4	Pass	L2
3.370025	33.3	AVG	56.0	46.0	-12.7	Pass	L2
5.849825	38.2	QP	60.0	50.0	-21.8	Pass	L2
5.849825	29.1	AVG	60.0	50.0	-20.9	Pass	L2
11.310400	41.2	QP	60.0	50.0	-18.8	Pass	L2
11.310400	30.9	AVG	60.0	50.0	-19.1	Pass	L2

See the following plots (1 to 4) for detailed measurements.

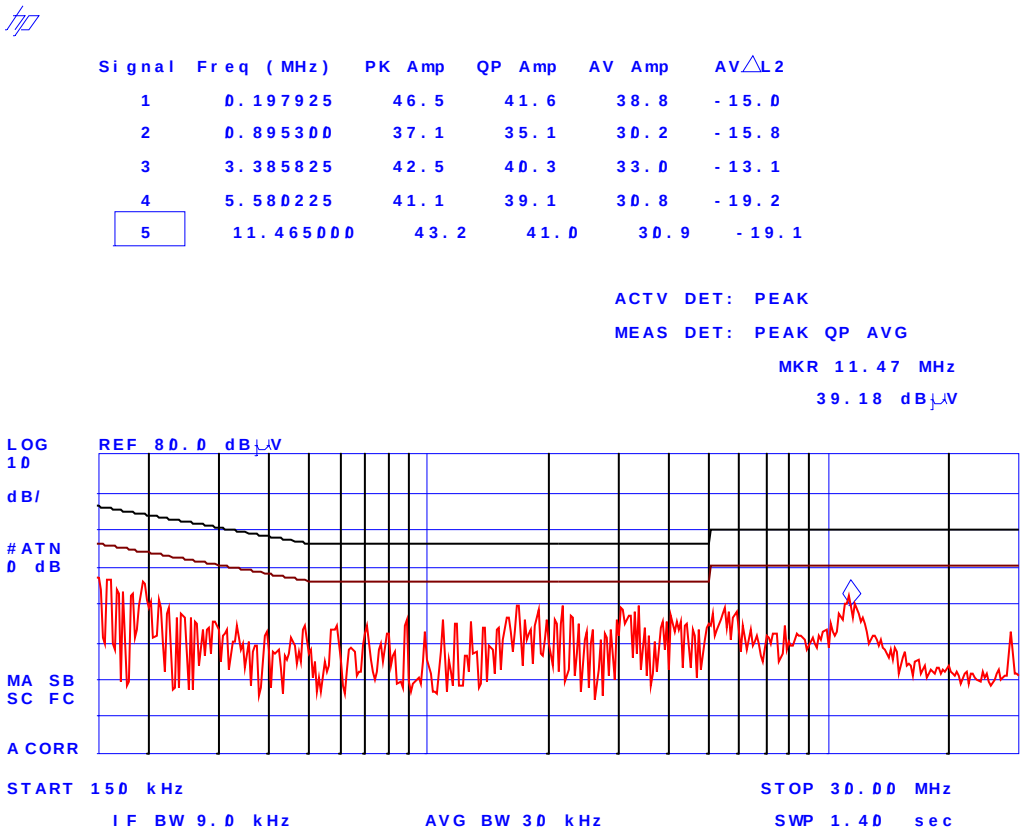
Plot 1:
AC Power Line Conducted Emissions (FM Transmitter ON, Stereo Mode)
Line Voltage: 120VAC 60Hz
Line Tested: Line 1

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	AV△L2
1	0.199375	46.4	41.6	38.2	-15.4
2	0.898750	37.0	34.6	29.5	-16.5
3	3.297350	41.4	39.2	30.6	-15.4
4	5.384700	38.2	35.7	24.8	-25.2
5	11.594700	42.4	39.7	28.0	-22.0



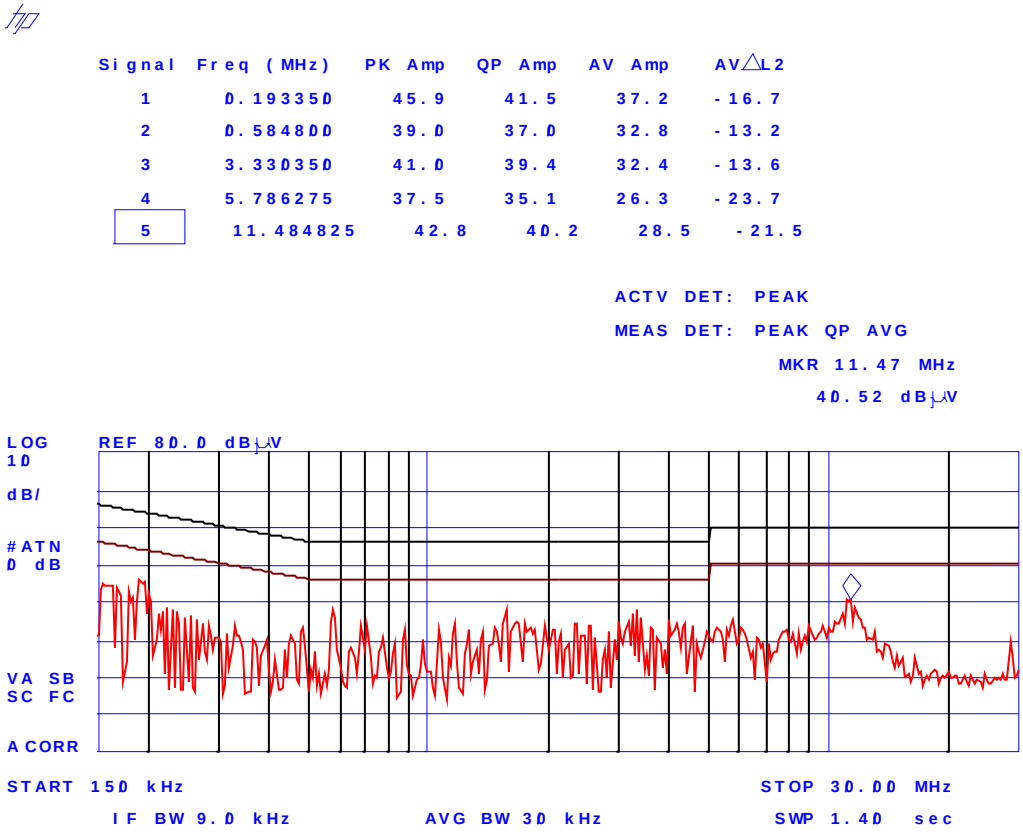
Plot 2:
AC Power Line Conducted Emissions (FM Transmitter ON, Stereo Mode)
Line Voltage: 120VAC 60Hz
Line Tested: Line 2

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	AV△L2
1	0.197925	46.5	41.6	38.8	-15.0
2	0.895300	37.1	35.1	30.2	-15.8
3	3.385825	42.5	40.3	33.0	-13.1
4	5.580225	41.1	39.1	30.8	-19.2
5	11.465000	43.2	41.0	30.9	-19.1

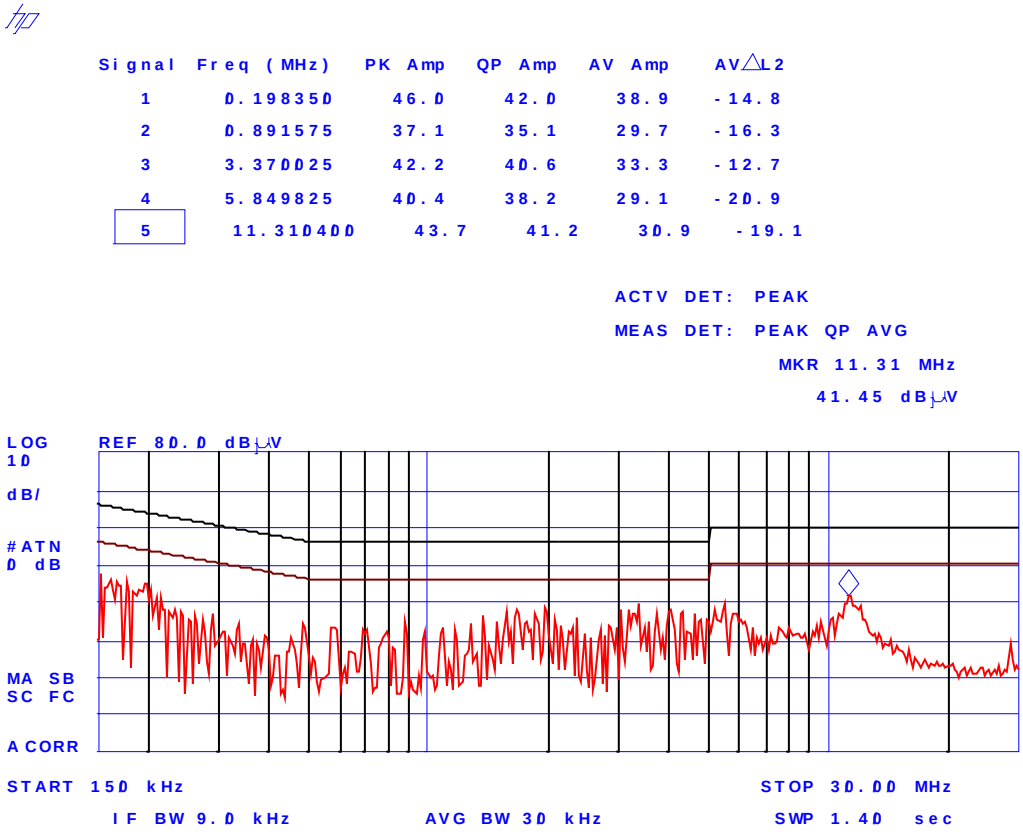


Plot 3:
AC Power Line Conducted Emissions (FM Transmitter OFF)
Line Voltage: 120VAC 60Hz
Line Tested: Line 1

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	AV△L2
1	0.193350	45.9	41.5	37.2	-16.7
2	0.584800	39.0	37.0	32.8	-13.2
3	3.330350	41.0	39.4	32.4	-13.6
4	5.786275	37.5	35.1	26.3	-23.7
5	11.484825	42.8	40.2	28.5	-21.5



Plot 4:
AC Power Line Conducted Emissions (FM Transmitter OFF)
Line Voltage: 120VAC 60Hz
Line Tested: Line 2



6.6. OCCUPIED BANDWIDTH [§ 15.239(a)]

6.6.1. Limits

Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88–108 MHz.

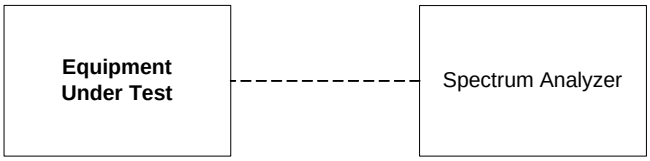
6.6.2. Method of Measurements

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63.4

6.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Dipole Antenna	EMCO	3121C-DB2	440	30 MHz – 1 GHz

6.6.4. Test Arrangement

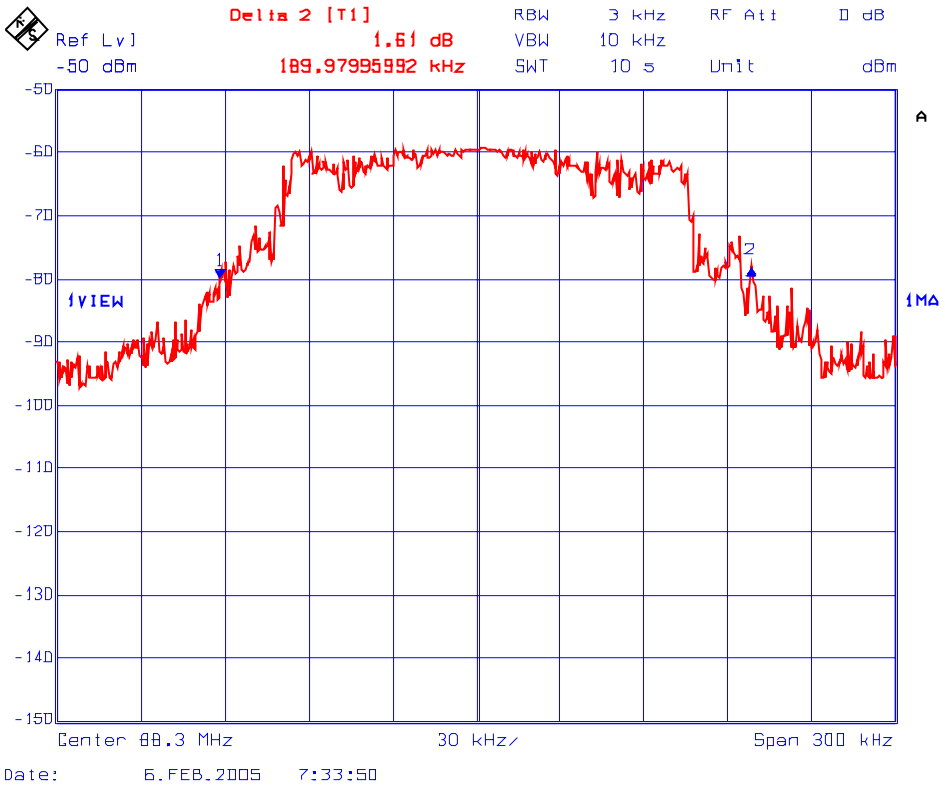


6.6.5. Test Data

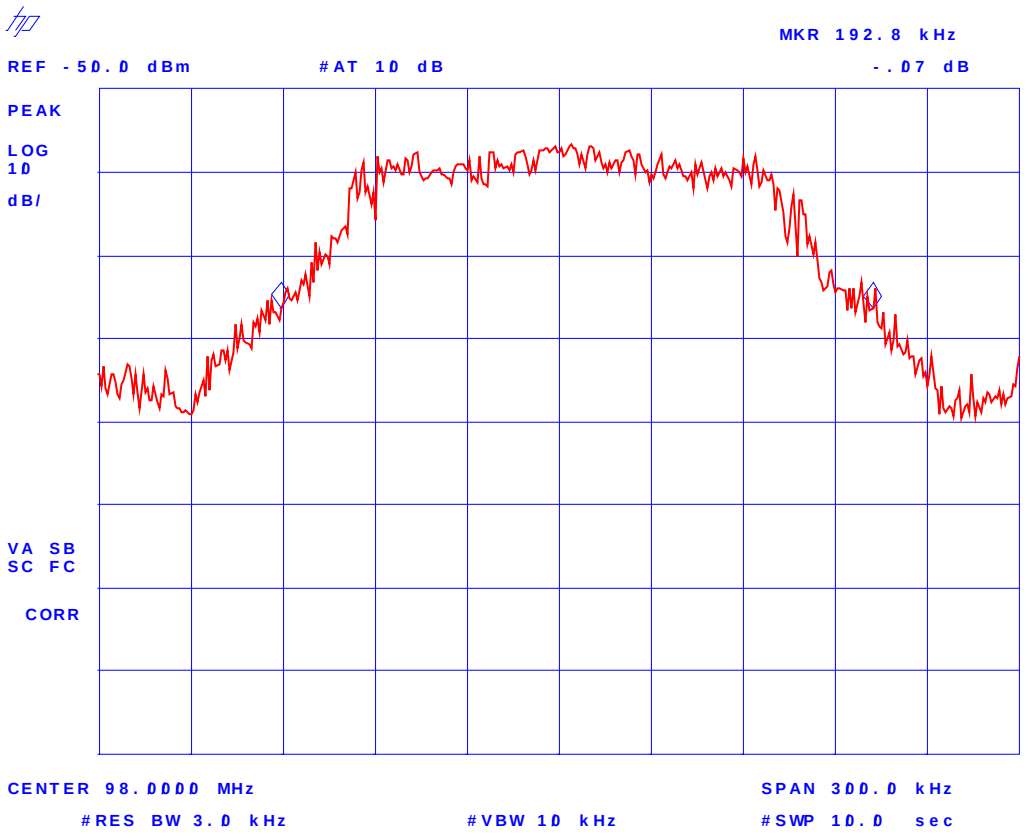
Channel Frequency (MHz)	20 dB Bandwidth (kHz)
Stereo Mode	
88.3	190.0
98.0	192.8
107.7	188.8
Mono Mode	
88.3	160.5
98.0	171.0
107.7	121.4

See the following plots (5 – 10) for detailed measurements.

Plot 5:
20 dB Bandwidth
Test Frequency: 88.3 MHz (Stereo Mode)

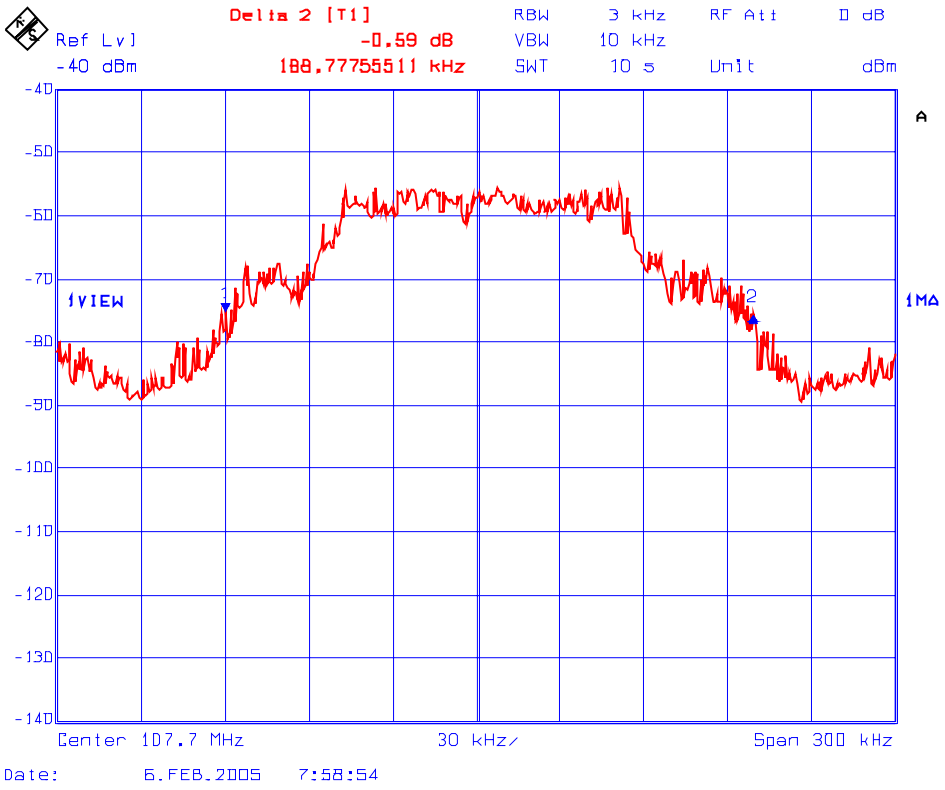


Plot 6:
20 dB Bandwidth
Test Frequency: 98.0 MHz (Stereo Mode)



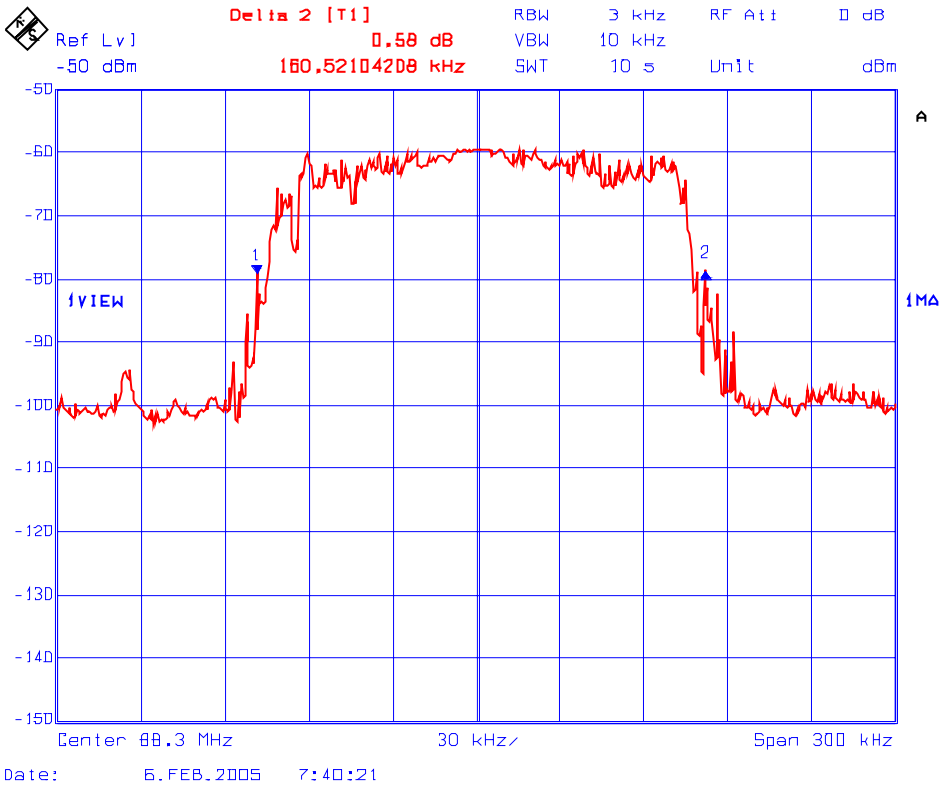
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 7:
20 dB Bandwidth
Test Frequency: 107.7 MHz (Stereo Mode)

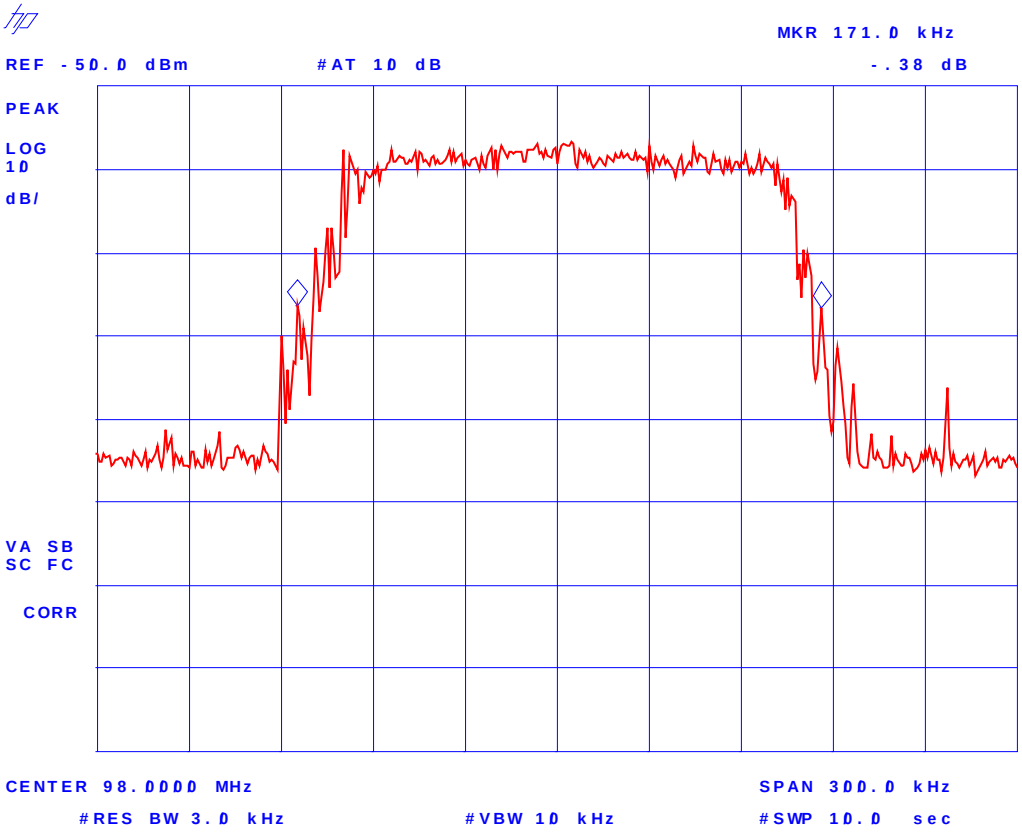


All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

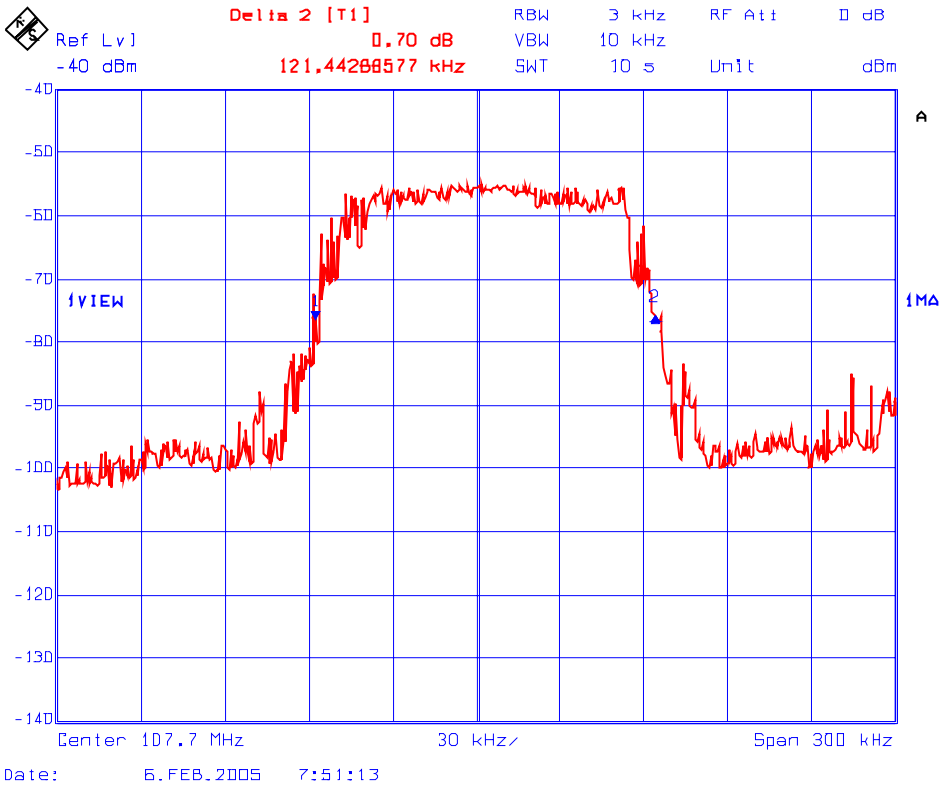
Plot 8:
20 dB Bandwidth
Test Frequency: 88.3 MHz (Mono Mode)



Plot 9:
20 dB Bandwidth
Test Frequency: 98.0 MHz (Mono Mode)



Plot 10:
20 dB Bandwidth
Test Frequency: 107.7 MHz (Mono Mode)



All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.7. FIELD STRENGTH OF EMISSIONS INSIDE & OUTSIDE THE PERMITTED BAND 88-108 MHz [§ 15.239(b)&(c)]

6.7.1. Limits

§15.239:

(b) The field strength of any emissions within the permitted 200 kHz band shall not exceed 250 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in § 15.35 for limiting peak emissions apply.

(c) The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in § 15.209.

47 CFR 15.209(a) General Radiated Emission Limits

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76– 88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.		

6.7.2. Method of Measurements

Refer to Section 8.3 of this test report and ANSI 63.4 for detailed radiated emissions measurement procedures.

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For 9 kHz $\leq$ frequencies $\leq$ 150 kHz: RBW = 1 KHz, VBW $\geq$ 1 KHz, SWEEP=AUTO.
- For 150 MHz $\leq$ frequencies $\leq$ 30 MHz: RBW = 10 KHz, VBW $\geq$ 10 KHz, SWEEP=AUTO.
- For 30 MHz $\leq$ frequencies $\leq$ 1 GHz: RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.
- For frequencies $\geq$ 1 GHz: RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.
- If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Peak Power Meter & Peak Power Sensor	Hewlett Packard	8900 8481A	2131A00124 2551A01965	0.1-18 GHz 50 Ohms Input
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Log Periodic / Bow-Tie Antenna	EMCO	3143	1029	20 - 1000 MHz

6.7.4. Test Data

6.7.4.1. Field Strength Within the Permitted Band [Stereo Mode]

Frequency (MHz)	RF Level @ 3m (dBμV/m)	Detector Used (Peak/AVG)	Antenna Plane (H/V)	Limits (dBμV/m)	Margin (dB)	Pass/ Fail
Carrier Frequency at 88.3 MHz						
88.3	44.53	Peak	V	48.0	-3.5	Pass
88.3	33.83	Peak	H	48.0	-14.2	Pass
Carrier Frequency at 98.0 MHz						
98.0	40.36	Peak	V	48.0	-7.6	Pass
98.0	35.34	Peak	H	48.0	-12.7	Pass
98.0	37.92	AVG	V	48.0	-10.1	Pass
98.0	34.54	AVG	H	48.0	-13.5	Pass
Carrier Frequency at 107.7 MHz						
107.7	40.74	Peak	V	48.0	-7.3	Pass
107.7	36.60	Peak	H	48.0	-11.4	Pass
107.7	38.68	AVG	V	48.0	-9.3	Pass
107.7	35.75	AVG	H	48.0	-12.3	Pass

6.7.4.2. Field Strength Outside the Permitted Band (as well as outside the band 88 –108MHz)[Stereo Mode]

Frequency (MHz)	RF Level @ 3m (dBμV/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limits (dBμV/m)	Margin (dB)	Pass/ Fail
Carrier Frequency at 88.3 MHz						
176.6	28.69	Peak	V	43.5	-14.8	Pass
176.6	21.77	Peak	H	43.5	-21.7	Pass
Carrier Frequency at 98.0 MHz						
196	28.07	Peak	V	43.5	-15.4	Pass
196	23.57	Peak	H	43.5	-19.9	Pass
Carrier Frequency at 107.7 MHz						
215.4	21.54	Peak	V	43.5	-22.0	Pass
215.4	22.24	Peak	H	43.5	-21.3	Pass

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	$\pm$1.5	$\pm$1.5
LISN coupling specification	Rectangular	$\pm$1.5	$\pm$1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	$\pm$0.3	$\pm$0.5
Mismatch: Receiver VRC Γ_1 = 0.03 LISN VRC Γ_R = 0.8(9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1$\pm\Gamma_1\Gamma_R$)	U-Shaped	$\pm$0.2	$\pm$0.3
System repeatability	Std. deviation	$\pm$0.2	$\pm$0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	$\pm$1.25	$\pm$1.30
Expanded uncertainty U	Normal (k = 2)	$\pm$2.50	$\pm$2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30$ dB

$U = 2u_c(y) = \pm 2.6$ dB

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k = 2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8. GENERAL TEST PROCEDURES

8.1. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

8.1.1. Normal Temperature and Humidity

Normal temperature: +15°C to +35°C
Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

8.1.2. Normal power source

8.1.2.1. Mains Voltage

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

8.1.2.2. Battery Power Source

For operation from battery power sources, the nominal test voltage shall be as declared by the equipment manufacturer. This shall be recorded in the test report.

8.1.3. Operating Condition of Equipment Under Test

- All tests shall be performed with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle.
1 to 10 MHz	2	1 near top and 1 near bottom.
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom.

- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers.

8.2. METHOD OF MEASUREMENTS - AC MAINS CONDUCTED EMISSIONS

- AC Mains conducted emissions measurements were performed in accordance with the standard against appropriate limits for each detector function.
- The test was performed in the shielded room, 24'(L) x 16'(W) x 8'(H).
- The test was performed were made over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio noise voltage which was conducted from the EUT power-input terminals that were directly connected to a public power network.
- The EUT normally received power from another device that connects to the public utility ac power lines, measurements would be made on that device with the EUT in operation to ensure that the device continues to comply with the appropriate limits while providing the EUT with power.
- If the EUT operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, AC Mains conducted measurements are not required.
- Table-top devices were placed on a platform of nominal size 1 m by 1.5m raised 80 cm above the conducting ground plane.
- The EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the power source. All unused 50-Ohm connectors of the LISN was terminated in 50-ohm when not connected to the measuring instruments.
- The line cord of the EUT connected to one LISN which was connected to the measuring instrument. Those power cords for the units of devices not under measurement were connected to a separate multiple ac outlet. Drawings and photographs of typically conducted emission test setups were shown in the Test Report. Each current-carrying conductor of the EUT shall be individually tested.
- The EUT was normally operated with a ground (safety) connection, the EUT was connected to the ground at the LISN through a conductor provided in the lead from the ac power mains to the LISN.
- The excess length of the power cord was folded back and forth in an 8-shape on a wooden strip with a vertical prong located on the top of the LISN case.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (9 KHz RBW, VBW > RBW), frequency span 150 kHz to 30 MHz.

- The maximum conducted emission for a given mode of operation was found by using the following step-by-step procedure:

  Step 1: Monitor the frequency range of interest at a fixed EUT azimuth.
  Step 2: Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
  Step 3: The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.
  Step 4: After completing step 1 through 3, record EUT and peripheral device configuration, mode of operation, cable configuration, signal levels and frequencies for final test.

- Each highest signal level at the maximized test configuration was zoomed in a small frequency span on the spectrum analyzer's display (the manipulation of cables and peripheral devices and EUT operation modes might have to be repeated to obtain the highest signal level with the spectrum analyzer set to PEAK detector mode 10 KHz RBW and VBW > RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz VBW) and AVERAGE detector mode (10 kHz RBW, 1 Hz VBW). The final highest RF signal levels and frequencies were record.

8.3. SPURIOUS EMISSIONS (CONDUCTED & RADIATED)

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10th harmonic of the highest frequency generated by the EUT.

8.3.1. Spurious Emissions (Conducted)

- The radio was connected to the measuring equipment via a suitable attenuator.
- The spectrum analyzer were used and set as follows:

- Resolution BW: 100 kHz
- Video BW: same or greater
- Detector Mode: Positive Peak
- Averaging: Off
- Span: 100 MHz
- Amplitude: Adjust for middle of the instrument's range
- Sweep Time: Auto

8.3.2. Spurious Emissions (Radiated)

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.
- Radiated emissions measurements were made using the following test instruments:

Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
Calibrated Advantest spectrum analyzer and pre-selector were used. The spectrum analyzer would be used as follows:

For frequencies below 1 GHz:
- Resolution BW: 100 kHz
- Video BW: same or greater
- Detector Mode: Positive Peak
- Averaging: Off
- Span: 100 MHz
- Amplitude: Adjust for middle of the instrument's range
- Sweep Time: Auto

For frequencies above 1 GHz:
- Resolution BW: 1 MHz
- Video BW: same or greater
- Detector Mode: Positive Peak
- Averaging: Off
- Span: 500 MHz
- Amplitude: Adjust for middle of the instrument's range
- Sweep Time: Auto

- The frequencies of emissions were first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.
- The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:
  - Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
  - Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
  - Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

- Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength
RA = Receiver/Analyzer Reading
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Example: If a receiver reading of 60.0 dBμV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:

Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBμV/m.
Field Level = $10^{(38/20)}$ = 79.43 μV/m.