ENGINEERING TEST REPORT

VHF Transceiver
Model No.: IC-F14, IC-F14S, BC100V AND IC-F3011

Applicant:

ICOM Incorporated
1-1-32, Kaminami
Hirano-ku, Osaka
Japan, 547-0003

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Part 15, Subpart B
Class B Unintentional Radiators

UltraTech's File No.: ICOM-205F15B

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: April 22, 2009	
Report Prepared by: JaeWook Choi Issued Date: April 22, 2009	Tested by: Wayne Wu, RFI/EMI Technician Test Dates: March 31, 2009

- *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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ANSI	FC	VCCI	Industry Canada	NVLAP	BSMI	Korea MIC-RRL
0685	31040/SIT	C-1376	46390-2049	200093-0	SL2-IN-E-1119R	2005-82 & 83

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart B, Sections 15.107, 15.109 & 15.111
Title:	Telecommunication - 47 Code of Federal Regulations (CFR), Part 15
Purpose of Test:	FCC Verification Authorization for Class B Unintentional Radiators and Radio Receivers operating in 136-174 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.

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2008	Code of Federal Regulations – 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

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami, Hirano-ku, Osaka Japan, 547-0003
Contact Person:	Mr. Takayuki Watanabe Phone #: +81-66-793-5302 Fax #: +81-66-793-0013 Email Address: export@icom.co.jp

MANUFACTURER	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami, Hirano-ku, Osaka Japan, 547-0003
Contact Person:	Mr. Takayuki Watanabe Phone #: +81-66-793-5302 Fax #: +81-66-793-0013 Email Address: export@icom.co.jp

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

Brand Name:	ICOM Incorporated
Product Name:	VHF Transceiver
Model Name or Number:	IC-F3011
Serial Number:	000001
External Power Supply:	7.2 VDC nominal
Transmitting/Receiving Antenna Type:	Non-integral
Type of Equipment:	Non-broadcast Radio Communication Equipment
Primary User Functions of EUT:	VHF Transceiver for voice communication in occupational environment.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Receiver	
Power Supply Requirement:	7.2 VDC nominal
Operating Frequency Range:	136-174 MHz
RF Input Impedance:	50 Ohms
Channel Spacing:	25.0 kHz, 12.5 kHz
IF Frequencies	46.35 MHz (1st IF), 450 kHz (2nd IF)
Audio Output Power	0.35 W (8 Ω load)

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Shielded/Non-shielded
1	Antenna Connector	1	J Type	N/A

2.5. PHOTOGRAPH OF TEST STEUP

< Radiated emissions from Receiver >

< Radiated emissions from digital receiver >

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The EUT was set to the RF receiving mode
Special Test Software:	None
Special Hardware Used:	Test jig was provided by the manufacturer.
Receiver Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Receiver Signals	
Frequency Band(s):	136-174 MHz
Test Frequency(ies): (Near lowest & near highest frequencies in the frequency range of operation.)	138.1 MHz, 151.0 MHz, 160.9 MHz, 173.3 MHz

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. 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.

Power Line Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site 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 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049A-3). Last Date of Site Calibration: May 17, 2007.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Part 15, Subpart B	Test Requirements	Compliance (Yes/No)
15.107(a), Class B	Power Line Conducted Emissions Measurements	N/A
15.111(a)	Receiver Antenna Power Conducted Emissions for Non-Integral Antenna Port	Yes
15.109(a)	Radiated Emissions from Radio Receivers	Yes
15.109(a), Class B	Radiated Emissions from Unintentional Radiators (Digital Devices)	Yes

4.3. MODIFICATIONS REQUIRED FOR COMPLIANCE

None.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

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

5.2. MEASUREMENT UNCERTAINTIES

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.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

The Radio Receiver was operated as its normal intended mode during testing.

5.5. RECEIVER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§ 15.111(a)]

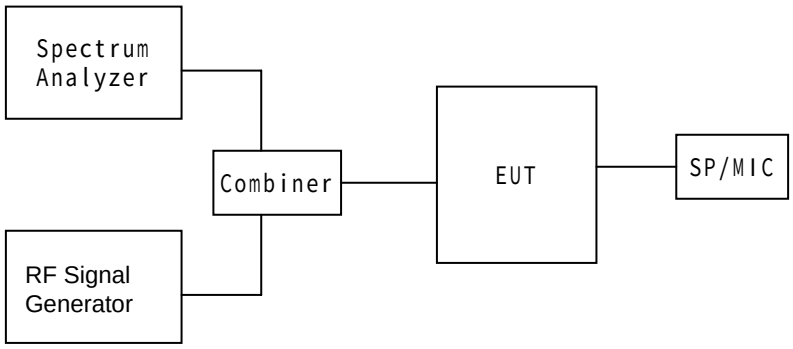
5.5.1. Limits

Receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provides terminals for the connection of an external antenna may be tested to demonstrate compliance with the provisions of § 15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna, provided these receivers also comply with the following: ***With the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at frequency within the range from 30 Mhz to 5th harmonic of the highest frequency shall not exceed 2.0 nanowatts (or -57 dBm @ 50 Ohm).***

5.5.2. Method of Measurements

Refer to ANSI C63.4

5.5.3. Test Arrangement

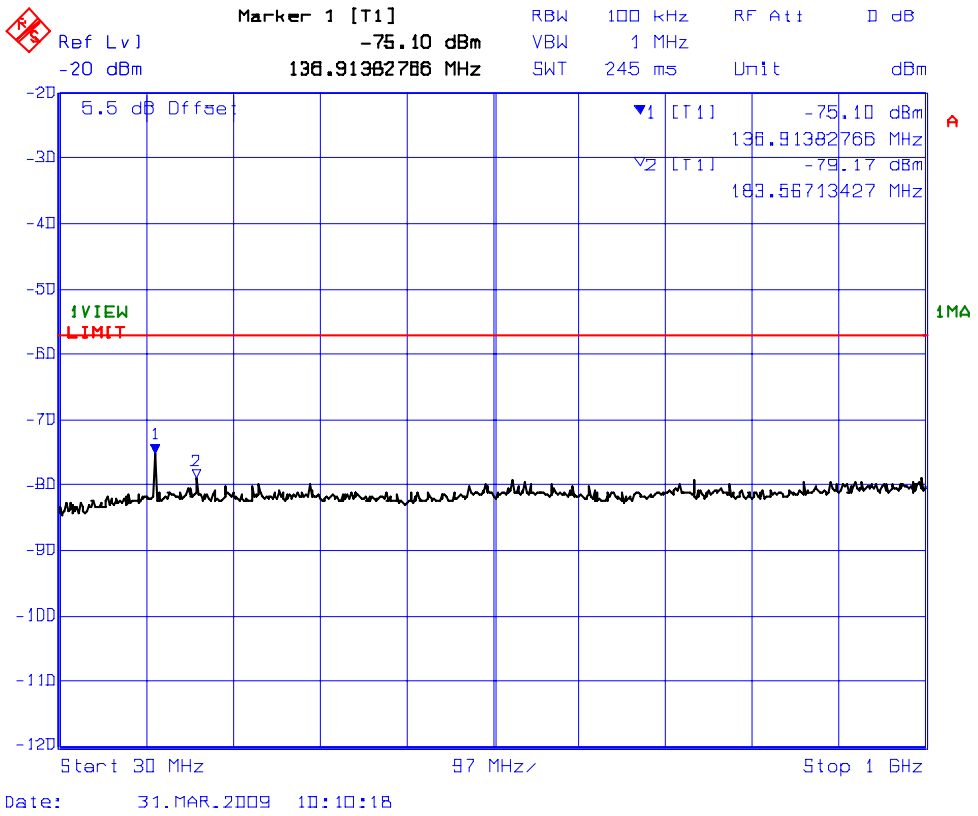


5.5.4. Test Data

Receive Mode (MHz): 138.1

Frequency (MHz)	EMI Detector (Peak/QP)	RF Level (dBm)	Limit (dBm)	Margin (dB)
163.57	Peak	-79.17	-57	-22.17

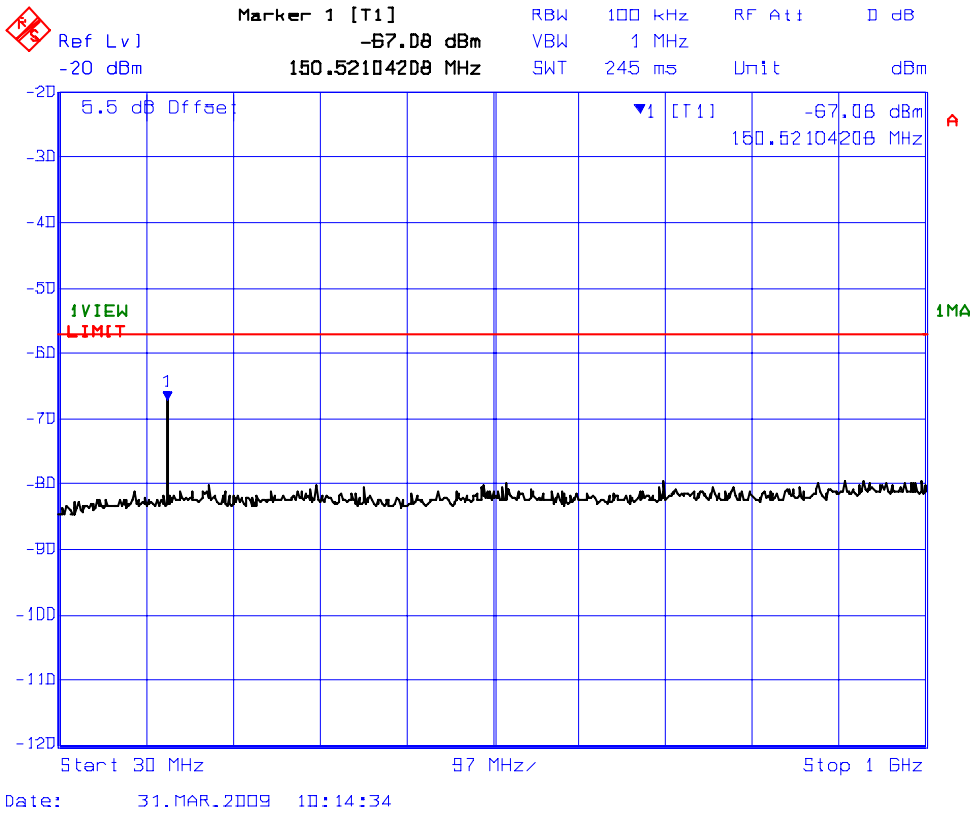
Plot 5.5.4.1. Receiver Spurious Emissions (Conducted)
Receive Mode: Input signal of 60 dBuV at 138.1 MHz



Receive Mode (MHz): 151.0

Frequency (MHz)	EMI Detector (Peak/QP)	RF Level (dBm)	Limit (dBm)	Margin (dB)
No signal found within 20 dB below the limit				

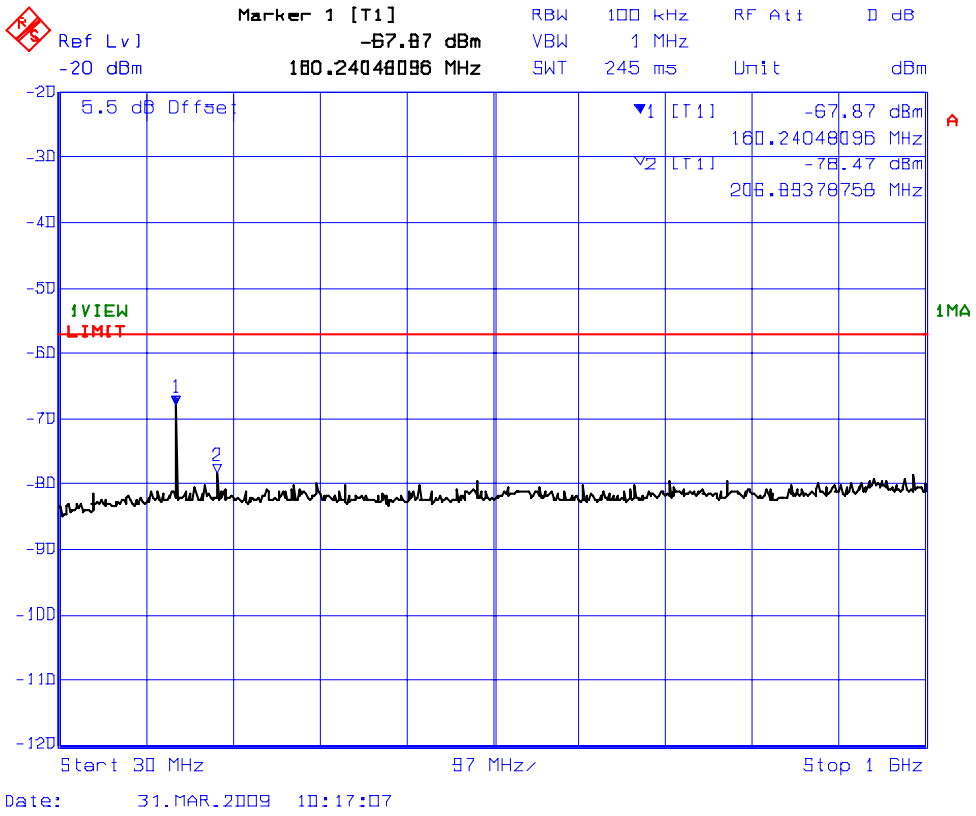
Plot 5.5.4.2. Receiver Spurious Emissions (Conducted)
Receive Mode: Input signal of 60 dBuV at 151.0 MHz



Receive Mode (MHz): 160.9

Frequency (MHz)	EMI Detector (Peak/QP)	RF Level (dBm)	Limit (dBm)	Margin (dB)
206.89	Peak	-78.47	-57	-21.47

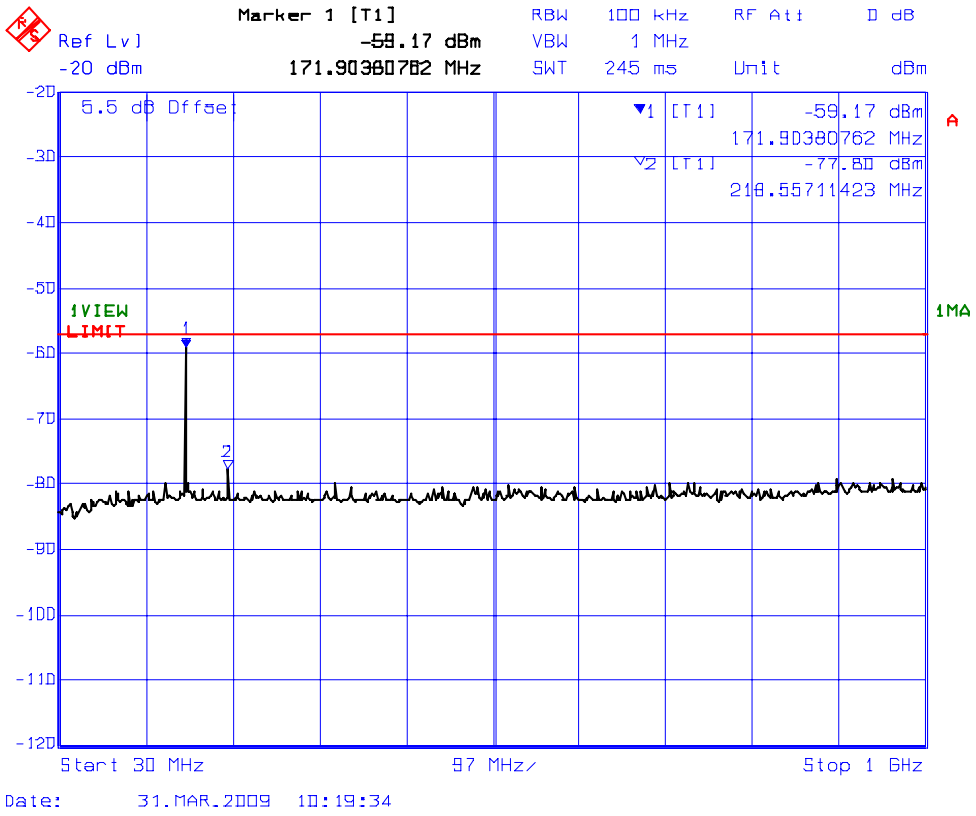
Plot 5.5.4.3. Receiver Spurious Emissions (Conducted)
Receive Mode: Input signal of 60 dBuV at 160.9 MHz



Receive Mode (MHz): 173.3

Frequency (MHz)	EMI Detector (Peak/QP)	RF Level (dBm)	Limit (dBm)	Margin (dB)
218.56	Peak	-77.80	-57	-20.80

Plot 5.5.4.4. Receiver Spurious Emissions (Conducted)
Receive Mode: Input signal of 60 dBuV at 173.3 MHz



5.6. RECEIVER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 15.109(a)]

5.6.1. Limits

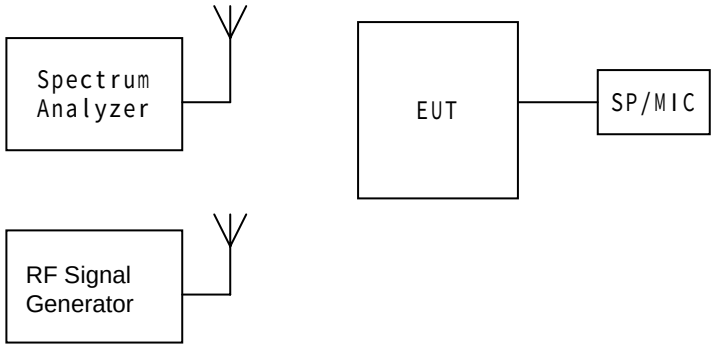
The equipment shall meet the limits of the following table:

Test Frequency Range (MHz)	Limits @ 3 m (dBµV/m)	EMI Detector Used	Measuring Bandwidth (kHz)
30 – 88	40.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
88 – 216	43.5	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
216 – 960	46.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
Above 960	54.0	Quasi-Peak (below 1 GHz) / Average (above 1 GHz)	RBW = 120 kHz, VBW ≥ 120 kHz / RBW = 1 MHz, VBW ≥ 1 Hz

5.6.2. Method of Measurements

Refer to EXHIBIT 8. of this test report and ANSI C63.4 for radiated emissions test method. Input signal of 60 dBuV was fed at each receiver frequencies to stimulate the receiver.

5.6.3. Test Arrangement



5.6.4. Test data

5.6.4.1. Near Lowest Frequency (138.1 MHz)

The emissions were scanned from 30 MHz to 6 GHz at 3 Meters distance and All emissions within 20 dB of the specified limits have been reported unless otherwise specified.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP/AVG)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
184.45	30.78	PEAK	V	43.5	-12.72	PASS
184.45	37.48	PEAK	H	43.5	-6.02	PASS
184.45	35.85	QP	H	43.5	-7.65	PASS
368.90	32.64	PEAK	H	46.0	-13.36	PASS
553.35	26.39	PEAK	V	46.0	-19.61	PASS
553.35	27.84	PEAK	H	46.0	-18.16	PASS
922.25	29.62	PEAK	V	46.0	-16.38	PASS
922.25	31.98	PEAK	H	46.0	-14.02	PASS

5.6.4.2. Near Highest Frequency (151.0 MHz)

The emissions were scanned from 30 MHz to 6 GHz at 3 Meters distance and All emissions within 20 dB of the specified limits have been reported unless otherwise specified.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP/AVG)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
197.35	29.62	PEAK	V	43.5	-13.88	PASS
197.35	19.42	PEAK	H	43.5	-24.08	PASS

5.6.4.3. Near Highest Frequency (160.9 MHz)

The emissions were scanned from 30 MHz to 6 GHz at 3 Meters distance and All emissions within 20 dB of the specified limits have been reported unless otherwise specified.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP/AVG)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
207.25	20.57	PEAK	V	43.5	-22.93	PASS
207.25	21.83	PEAK	H	43.5	-21.67	PASS
414.50	24.50	PEAK	V	46.0	-21.50	PASS
414.50	22.91	PEAK	H	46.0	-23.09	PASS
621.75	25.62	PEAK	H	46.0	-20.38	PASS
829.00	27.64	PEAK	V	46.0	-18.36	PASS
829.00	29.71	PEAK	H	46.0	-16.29	PASS

5.6.4.4. Near Highest Frequency (173.3 MHz)

The emissions were scanned from 30 MHz to 6 GHz at 3 Meters distance and All emissions within 20 dB of the specified limits have been reported unless otherwise specified.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP/AVG)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
219.65	19.81	PEAK	V	46.0	-26.19	PASS
439.30	24.50	PEAK	V	46.0	-21.50	PASS
658.95	24.53	PEAK	V	46.0	-21.47	PASS
658.95	27.39	PEAK	H	46.0	-18.61	PASS

5.7. RADIATED EMISSIONS FROM CLASS B UNINTENTIONAL RADIATORS (DIGITAL DEVICES) [§ 15.109(a)]

5.7.1. Limits

The equipment shall meet the limits of the following table:

Test Frequency Range (MHz)	Class B Limits @ 3m (dBμV/m)	EMI Detector Used	Measuring Bandwidth (kHz)
30 – 88	40.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
88 – 216	43.5	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
216 – 960	46.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
Above 960	54.0	Quasi-Peak (below 1 GHz) / Average (above 1 GHz)	RBW = 120 kHz, VBW ≥ 120 kHz / RBW = 1 MHz, VBW ≥ 1 Hz

5.7.2. Method of Measurements

The EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator frequency in the digital devices or 1 GHz whichever is higher. Please refer to the EXHIBIT 8. of this test report and ANSI C63.4 for radiated emissions test method.

5.7.3. Test Arrangement

5.7.4. Test Data

The emissions were scanned from 30 MHz to 6 GHz at 3 Meters distance and all emissions within 20 dB of the specified limits have been reported unless otherwise specified.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP/AVG)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
57.50	24.39	PEAK	V	40.0	-15.61	PASS
76.80	32.80	PEAK	V	40.0	-7.20	PASS
76.80	16.80	PEAK	H	40.0	-23.20	PASS
110.50	28.83	PEAK	V	43.5	-14.67	PASS
112.50	28.46	PEAK	V	43.5	-15.04	PASS
115.80	26.77	PEAK	V	43.5	-16.73	PASS
118.50	29.12	PEAK	V	43.5	-14.38	PASS
121.30	33.94	PEAK	V	43.5	-9.56	PASS
121.30	20.94	PEAK	H	43.5	-22.56	PASS
123.00	35.84	PEAK	V	43.5	-7.66	PASS
123.00	21.86	PEAK	H	43.5	-21.64	PASS
126.50	29.16	PEAK	V	43.5	-14.34	PASS
126.50	19.01	PEAK	H	43.5	-24.49	PASS
139.05	20.08	PEAK	V	43.5	-23.42	PASS
1660.00	51.80	PEAK	V	54.0	-2.20	PASS
1660.00	50.00	PEAK	H	54.0	-4.00	PASS
1660.00	50.46	AVG	V	54.0	-0.54	PASS

EXHIBIT 6. Test Equipments List

Test Instruments	Manufacturer	Model No.	Serial No.	Operating Range
Attenuator	Weinschel	46-20-34	BM1347	DC – 18 GHz
Attenuator	Weinschel	46-30-34	BM5354	DC – 18 GHz
BiConiLog Antenna	Emco	3142	10005	0.03 – 2 GHz
BiConiLog Antenna	ETS-Lindgren	3142B	1575	26 MHz – 2 GHz
Communication test set	Hewlett Packard	8920B	US39064699	AF SG DC – 20 kHz
EMC Analyzer	Hewlett Packard	8593EM	…	9kHz – 22 GHz
FFT (audio) EMI Receiver	Advantest	R9211E	82020336	10 mHz – 100 kHz, 1 MHz Input Impedance
High Pass Filter	Mini-Circuits	SHP-300	10427	Cut of 230 MHz
Horn Antenna	Emco	3155	9701-5061	1 – 18 GHz
Horn Antenna	Emco	3155	9911-5955	1 – 18 GHz
Infinium Oscilloscope	Hewlett Packard	54810A	US38380192	500 MHz, 1 GSa/s
Microwave Frequency Counter	EIP	545A	2683	10 Hz – 18 GHz
Modulation Analyzer	Hewlett Packard	8910B	3226A04606	150 kHz – 1300 MHz
Power Divider	Mini-Circuits	15542	105	1 MHz – 1 GHz
Power Meter	Hewlett Packard	437B	3.13E+09	10 kHz – 50 GHz
Power Sensor	Hewlett Packard	8481A	1150A15143	9 kHz – 26.5 GHz
RF Amplifier	Com-Power	PA-103		1 MHz – 1 GHz
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz
Signal Generator	Hewlett Packard	83752B	3610A00457	0.01- 20 GHz
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz
Spectrum Analyzer	Advantest	R3271	15050203	100 Hz – 26.5 GHz
Spectrum Analyzer / EMI Receiver	Hewlett Packard	8546A	3650A00371	9 kHz – 6.5 GHz Built-in amplifier 30dB
Temperature & Humidity Chamber	Tenney	T5	9723B	-40 ºC – +80 ºC range

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	±1.5	±1.5
LISN coupling specification	Rectangular	±1.5	±1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	±0.3	±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±$\Gamma_1\Gamma_R$)	U-Shaped	±0.2	±0.3
System repeatability `	Std. deviation	±0.2	±0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	±1.25	±1.30
Expanded uncertainty U	Normal (k=2)	±2.50	±2.60

Sample Calculation for Measurement Accuracy in 150 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. MEASUREMENT METHODS

8.1. GENERAL TEST CONDITIONS

8.1.1. Test Conditions

- The measurement shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications.
- An attempt shall be made to maximize the detected radiated emissions, for example moving cables of the equipment, rotating the equipment by 360^{o} and moving the measuring receiving antenna up and down within 1 to 4 meters high.
- Where appropriate, a single tone or a bit stream shall be used to modulate the receiver. The manufacturer shall define the modulation with the highest emission in transmit mode.

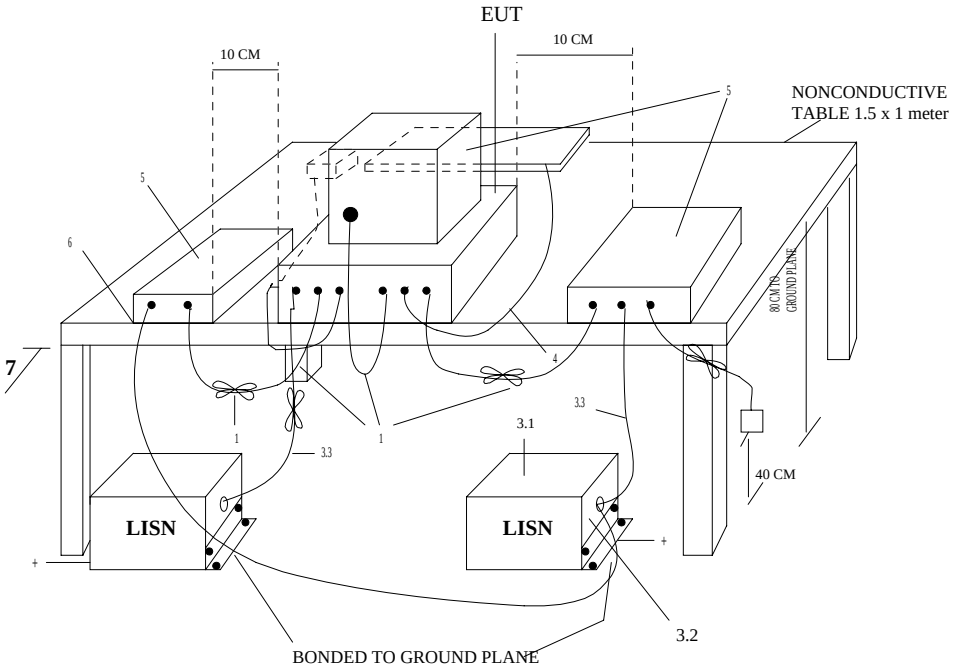
8.1.2. Method of Measurements - AC Mains Conducted Emissions

- 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, 16'(L) by 16'(W) by 12'(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 outlFCC. 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 this 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 150KHz - 30MHz.

- 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 9 KHz RBW and VBW > RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (10 KHz RBW, 1 MHz VBW) and AVERAGE detector mode (9 kHz RBW, 1 Hz VBW). The final highest RF signal levels and frequencies were record.



+LISNs may have to be moved to the side to meet 3.3 below

LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back at 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 1m.

3. EUT connected to one LISN. Unused LISN connectors shall be terminated in 50 Ohm. 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-EUTequipment.
3.3 LISN at least 80 cm from nearest part of EUT chassis.

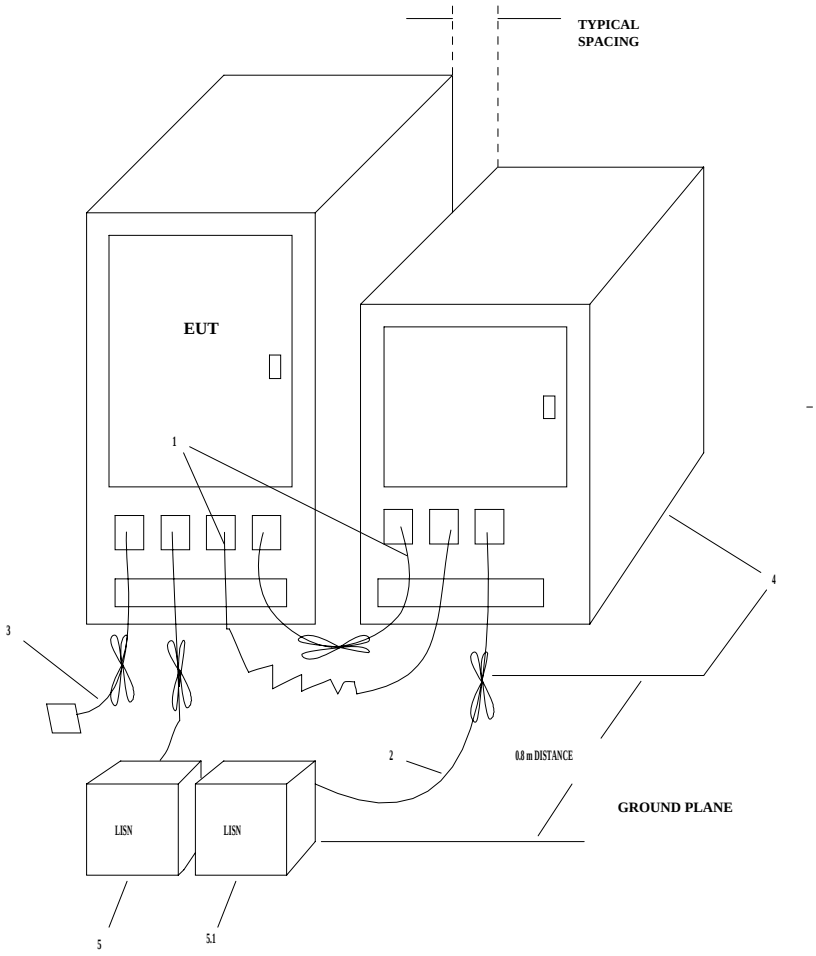
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the host.

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 (see 5.2)

Tabletop Equipment Conducted Emissions



LEGENEND:

1. Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bunding shall not exceed 40 cm in length.

2. Excess power cords shall be bundled in the center or shortened to appropriated length.

3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.

4. EUT and all cables shall be insulated from ground plane by 3 to 12 mm of insulating material.

5. EUT connected to one LISN. LISN can be placed on top of, or immediately beneath, ground plane.
5.1 All other equipment powered from second LISN.

Floor-Standing Equipment Conducted Emissions

8.1.3. Method of Measurements - Electric Field Radiated Disturbance

- 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:

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

        – The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (120 KHz VBW and VBW $\geq$ RBW).

        – If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and VBW $\geq$ RBW) was then set to measure the signal level.

        – If the signal being measured was narrowband and the ambient field was broadband, the bandwidth of the spectrum analyzer was reduced.

- The EUT was set-up in its typical configuration and operated in its various modes as described in this test report.
- The frequencies of emissions was 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:

  Step 1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

  Step 2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step 3: 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.

  Step 4: Move the antenna over its full allowed 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.

Step 5: 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.

Step 6: 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.

Step 7: 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:

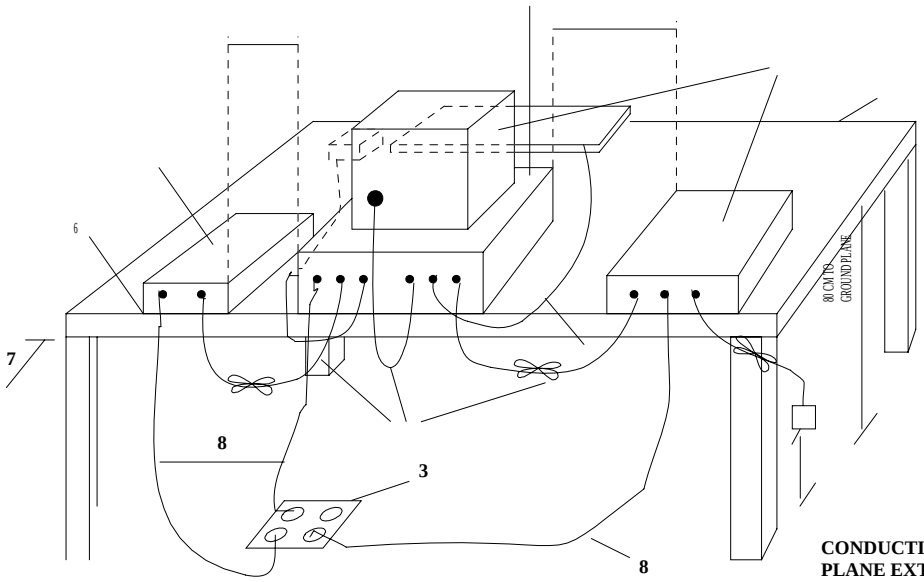
$$FS = RA + AF + CF - AG$$

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.



CONDUCTING GROUND PLANE EXTENDS 0.5 m BEYOND EUT SYSTEM FOOTPRINT

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 1m.

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 receptable flush with the ground plane.

4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.

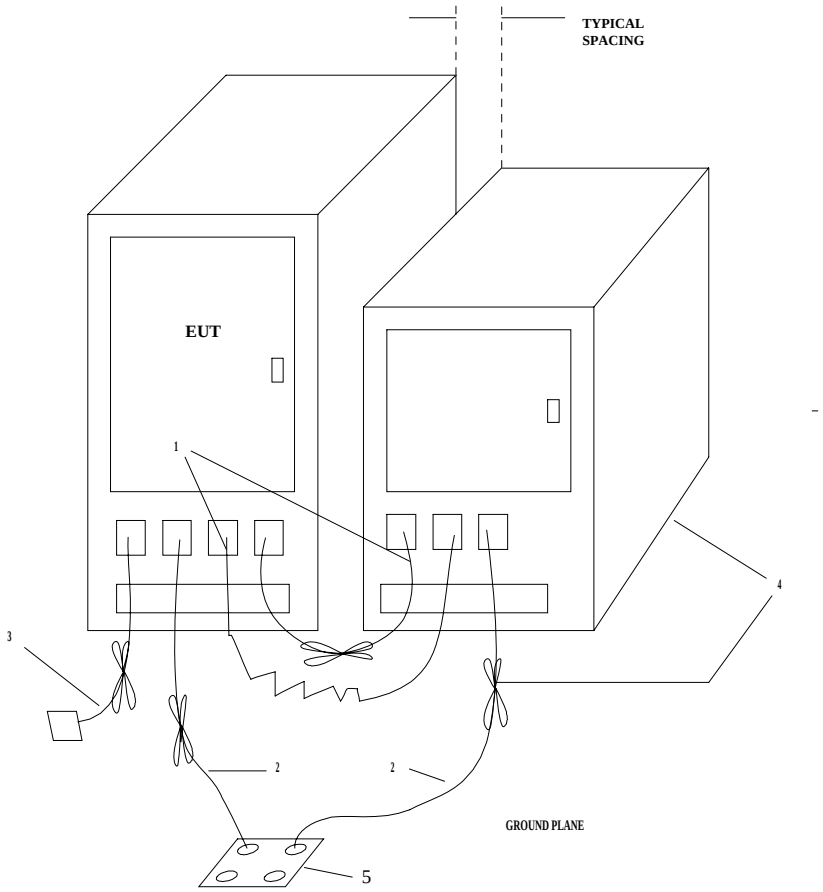
5. Non-EUT components of EUT system being tested.

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.

Tabletop Equipment Radiated Emissions



LEGEND:

1. Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion.

2. Excess power cords shall be bundled in the center or shortened to appropriated length.

3. I/O cables that are not connected to aperipheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.

4. EUT and all cables shall be inslulated from ground plane by 3 to 12 mm of insulating material.

5. 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.

Floor-Standing Equipment Radiated Emissions

EXHIBIT 9. LABELLING & VERIFICATION REQUIREMENTS

9.1. SECTION 15.19 – LABELLING REQUIREMENTS

A device subject to verification shall be labelled as follows:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

9.2. SECTIONS 15.21 & 15.105 – INFORMATION TO USER

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

(a) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

NOTE: ***This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provided reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.***

Warning: Changes or modifications not expressly approved by <manufacturer> could void the user's authority to operate the equipment.

9.3. SECTION 2.902 - VERIFICATION

(a) Verification is a procedure where the manufacturer makes measurements or takes the necessary steps to insure that the equipment complies with the appropriate technical standards. Submittal of a sample unit or representative data to the Commission demonstrating compliance is not required unless specifically requested by the Commission pursuant to § 2.957, of this part.

(b) Verification attaches to all items subsequently marketed by the manufacturer or importer which are identical as defined in § 2.908 to the sample tested and found acceptable by the manufacturer.

9.4. SECTION 2.909 – RESPONSIBLE PARTY

The following parties are responsible for the compliance of radio frequency equipment with the applicable standards:

(a) In the case of equipment which requires the issuance by the Commission of a grant of equipment authorization, the party to whom that grant of authorization is issued (the grantee) If the radio frequency equipment is modified by any party other than the grantee and that party is not working under the authorization of the grantee pursuant to §2.929(b), the party performing the modification is responsible for compliance of the product with the applicable administrative and technical provisions in this chapter.

(b) In the case of equipment subject to authorization under the verification procedure, the manufacturer or, in the case of imported equipment, the importer. If subsequent to manufacture and importation, the radio frequency equipment is modified by any party not working under the authority of the responsible party, the party performing the modification becomes the new responsible party.

(c) In the case of equipment subject to authorization under the Declaration of Conformity procedure:

(1) The manufacturer or, if the equipment is assembled from individual component parts and the resulting system is subject to authorization under a Declaration of Conformity, the assembler.

(2) If the equipment, by itself, is subject to a Declaration of Conformity and that equipment is imported, the importer.

(3) Retailers or original equipment manufacturers may enter into an agreement with the responsible party designated in paragraph (c)(1) or (c)(2) of this section to assume the responsibilities to ensure compliance of equipment and become the new responsible party.

(4) If the radio frequency equipment is modified by any party not working under the authority of the responsible party, the party performing the modifications, if located within the U.S., or the importer, if the equipment is imported subsequent to the modifications, becomes the new responsible party.

(d) If, because of modifications performed subsequent to authorization, a new party becomes responsible for ensuring that a product complies with the technical standards and the new party does not obtain a new equipment authorization, the equipment shall be labelled, following the specifications in § 2.925(d), with the following: ‘‘This product has been modified by [insert name, address and telephone number of the party performing the modifications].’’

9.5. SECTION 2.945 – SAMPLING TEST OF EQUIPMENT COMPLIANCE

The Commission will, from time to time, request the responsible party to submit equipment subject to this chapter to determine the extent to which subsequent production of such equipment continues to comply with the data filed by the applicant (or on file with the responsible party for equipment subject to notification or a Verification). Shipping costs to the Commission’s laboratory and return shall be borne by the responsible party.

9.6. SECTION 2.946 – PENALTY FOR FAILURE TO PROVIDE TEST SAMPLES AND DATA

(a) Any responsible party, as defined in § 2.909, or any party who markets equipment subject to the provisions of this chapter, shall provide test sample(s) or data upon request by the Commission. Failure to comply with such a request within 14 days may be cause for forfeiture, pursuant to § 1.80 of this chapter, or other administrative sanctions such as suspending action on any applications for equipment authorization submitted by such party while the matter is being resolved.

(b) The Commission may consider extensions of time upon submission of a showing of good cause.

9.7. SECTION 2.952 - LIMITATION ON VERIFICATION

(a) Verification signifies that the manufacturer or importer has determined that the equipment has been shown to be capable of compliance with the applicable technical standards if no unauthorized change is made in the equipment and if the equipment is properly maintained and operated. Compliance with these standards shall not be construed to be a finding by the manufacturer or importer with respect to matters not encompassed by the Commission's rules.

(b) Verification of the equipment by the manufacturer or importer is effective until a termination date is otherwise established by the Commission.

(c) No person shall, in any advertising matter, brochure, etc., use or make reference to a verification in a deceptive or misleading manner or convey the impression that such verification reflects more than a determination by the manufacturer or importer that the device or product has been shown to be capable of compliance with the applicable technical standards of the Commission's Rules.

9.8. SECTION 2.953 - RESPONSIBILITY FOR COMPLIANCE

(a) In verifying compliance, the responsible party, as defined in § 2.909 warrants that each unit of equipment marketed under the verification procedure will be identical to the unit tested and found acceptable with the standards and that the records maintained by the responsible party continue to reflect the equipment being produced under such verification within the variation that can be expected due to quantity production and testing on a statistical basis.

(b) The importer of equipment subject to verification may upon receiving a written statement from the manufacturer that the equipment complies with the appropriate technical standards rely on the manufacturer or independent testing agency to verify compliance. The test records required by § 2.955 however should be in the English language and made available to the Commission upon a reasonable request, in accordance with § 2.956.

(c) In the case of transfer of control of equipment, as in the case of sale or merger of the grantee, the new manufacturer or importer shall bear the responsibility of continued compliance of the equipment.

(d) Verified equipment shall be reverified if any modification or change adversely affects the emanation characteristics of the modified equipment. The party designated in § 2.909 bears responsibility for continued compliance of subsequently produced equipment.

9.9. SECTION 2.954 - IDENTIFICATION

Devices subject only to verification shall be uniquely identified by the person responsible for marketing or importing the equipment within the United States. However, the identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified or type accepted equipment. The importer or manufacturer shall maintain adequate identification records to facilitate positive identification for each verified device.

9.10. SECTION 2.955 - RETENTION OF RECORDS

(a) For each equipment subject to verification, the responsible party, as shown in §2.909 shall maintain the records listed as follows:

(1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the requirements of § 2.953.

(2) A record of the procedures used for production inspection and testing (if tests were performed) to insure the conformance required by § 2.953. (Statistical production line emission testing is not required.)

(3) A record of the measurements made on an appropriate test site that demonstrates compliance with the applicable regulations in this chapter.
The record shall:

(i) Indicate the actual date all testing was performed;

(ii) State the name of the test laboratory, company, or individual performing the verification testing. The Commission may request additional information regarding the test site, the test equipment or the qualifications of the company or individual performing the verification tests;

(iii) Contain a description of how the device was actually tested, identifying the measurement procedure and test equipment that was used;

(iv) Contain a description of the equipment under test (EUT) and support equipment connected to, or installed within, the EUT;

(v) Identify the EUT and support equipment by trade name and model number and, if appropriate, by FCC Identifier and serial number;

(vi) Indicate the types and lengths of connecting cables used and how they were arranged or moved during testing;

(vii) Contain at least two drawings or photographs showing the test set-up for the highest line conducted emission and showing the test set-up for the highest radiated emission. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used;

(viii) List all modifications, if any, made to the EUT by the testing company or individual to achieve compliance with the regulations in this chapter;

(ix) Include all of the data required to show compliance with the appropriate regulations in this chapter; and

(x) Contain, on the test report, the signature of the individual responsible for testing the product along with the name and signature of an official of the responsible party, as designated in § 2.909.

(4) For equipment subject to the provisions in part 15 of this chapter, the records shall indicate if the equipment was verified pursuant to the transition provisions contained in § 15.37 of this chapter.

(b) The records listed in paragraph (a) of this section shall be retained for two years after the manufacture of said equipment item has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the manufacturer or importer is officially notified that an investigation or any other administrative proceeding involving his equipment has been instituted.

9.11. SECTION 2.956 - FCC INSPECTION & SUBMISSION OF EQUIPMENT FOR TESTING

(a) Each responsible party shall upon receipt of reasonable request:

(1) Submit to the Commission the records required by § 2.955.

(2) Submit one or more sample units for measurements at the Commission's Laboratory.

(i) Shipping costs to the Commission's Laboratory and return shall be borne by the responsible party.

(ii) In the event the responsible party believes that shipment of the sample to the Commission's Laboratory is impractical because of the size or weight of the equipment, or the power requirement, or for any other reason, the responsible party may submit a written explanation why such shipment is impractical and should not be required.

(b) Requests for the submission of the records in § 2.955 or for the submission of sample units are covered under the provisions of § 2.946.