ENGINEERING TEST REPORT

2.4 GHz FHSS OEM Transceiver
Model No.: PKLR2400

FCC ID: KQL-PKLR2400

Applicant: **AEROCOMM INC.**
13256 West, 98th Street
Lenexa, Kansas
USA, 66215

Tested in Accordance With

FCC Part 15, Subpart C, Para. 15.247
Frequency Hopping Spread Spectrum Transmitters
Operating in Frequency Band from 2402 – 2478 MHz

UltraTech's File No.: AER20-FTX

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs …… Date: ……	
Report Prepared by: Dan Huynh ……	Tested by: Hien Luu, RFI Technician ……
Issued Date: August 23, 1999	Test Dates: July 20-28, 1999

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

UltraTech

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Section 15.247: 1998
Title	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Frequency Hopping Spread Spectrum Transmitters operating in the Frequency Band 2400 - 2483.5 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:	• Light-industry, Commercial • Industry

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

None

1.3. NORMATIVE REFERENCES

Note*: When the international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.*

Publication	YEAR	Title
FCC CFR Parts 0-19	1998	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	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	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT:	
Name:	AEROCOMM INC.
Address:	13256 West, 98th Street Lenexa, Kansas USA, 66215
Contact Person:	Mr. Daniel A. Miller Phone #: (800)492-2320 or (913)492-2320 Fax #: (913)492-1243 Email Address: N/A

MANUFACTURER:	
Name:	AEROCOMM INC.
Address:	13256 West, 98th Street Lenexa, Kansas USA, 66215
Contact Person:	Mr. Daniel A. Miller Phone #: (913)492-2320 Fax #: (913)492-1243 Email Address: N/A

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	AEROCOMM INC.
Product Name	2.4 GHz FHSS OEM Transceiver
Model Name or Number	PKLR2400
Serial Number	Pre-production
Type of Equipment	Frequency Hopping Spread Spectrum Transmitters
External Power Supply	N/A
Transmitting/Receiving Antenna Type	Non-integral
Primary User Functions of EUT:	2.4 GHz FHSS Radio operate in transparent and packet modes.

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable, mobile and fixed stations
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	5VDC
RF Output Power Rating:	10 mW peak
Operating Frequency Range:	2402 - 2478 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	1 MHz
Duty Cycle:	Continuous
20 dB Bandwidth:	1 MHz
Emission Designation:	Frequency Hopping Spread Spectrum
Oscillator Frequencies:	2402-2478 MHz
Antenna Connector Type:	MMCX

Antenna Description
The following items are alternative antennas, which will be provided with EUT.

Manufacturer	Type	Model	Frequency Range (GHz)	In/Out Impedance (Ω)	Gain (dBi)
CENTURION	Omni	WXE2400	2.4-2.5	50	2
MAXRAD	Omni	MFB24008	2.4-2.4835	50	8
MAXRAD	Omni-Mobile	BMMG24000MMCX6'	2.4	50	unity
MAXRAD	Omni-Mobile	BMMG24000RPSMA12'	2.4	50	5
AeroComm	Omni	NZH2400	2.4	50	unity
MAXRAD	Panel	MP24013FC	2.4-2.4835	50	13
MAXRAD	Omni-Mobile	MUF24005	2.4	50	5

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Antenna	1	MMCX	Shielded
2	COM	1	DB9	Shielded
3	DC Connector	1	DC Jack	Non-shielded

NOTE:

- ***Ports of the EUT which in normal operation*** *were connected to ancillary equipment through interconnecting cables via a representative interconnecting cable to simulate the input/output characteristics. RF input/output was correctly terminated to the associated antenna.*
- ***Ports which are not connected to cables during normal intended operation****: None*

2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	OMNIBOOK Laptop
Brand name:	Hewlett Packard
Model Name or Number:	DN-2100
Serial Number:	TW63403246
Connected to EUT's Port:	Serial Port

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	101 kPa
Power input source:	5VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in normal frequency hopping mode for occupancy duration, and frequency separation.
Special Test Software:	▪ Special software is provided by the Applicant to select and operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	A class 2 transformer was used to provide 5Vdc to the radio for modular radio test purposes. In normal application, the radio will use 5Vdc power from the system in which it will be installed.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as a non-integral antenna equipment.

Transmitter Test Signals:	
Frequencies: ▪ 2402 - 2478 MHz band:	Center of each of frequency bands that the transmitter covers: ▪ 2402 MHz, 2443 MHz and 2478 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 10 mW Peak Direct or 39 mW EIRP max. ▪ Each channel is FSK modulated with data @ 441 Kbps ▪ Internal

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.

- AC Powerline 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 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: Sep. 20, 1998.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
15.107(a)	AC Power Line Conducted Emissions Measurements (Transmit & Receive)	Not applicable for DC supplied device.
15.247(a)(1) & 15.247(a)(1)(ii)	Hopping Channel Frequency Characteristics	Yes
15.247(b)(2) & 1.1310	Peak Output Power and RF Exposure Limit	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

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 7 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 6 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 C64-3:1992, FCC 15.247 and CISPR 16-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER:

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

5.5. AC POWERLINE CONDUCTED EMISSIONS @ FCC PART 15, SUBPART B, PARA.15.107(A)

Not applicable for DC supplied device.

5.6. HOPPING CHANNEL CARRIER FREQUENCY CHARACTERISTICS @ FCC CFR 47, PARA 15.247(A)(1) & (A)(1)(II)

5.6.1. Limits

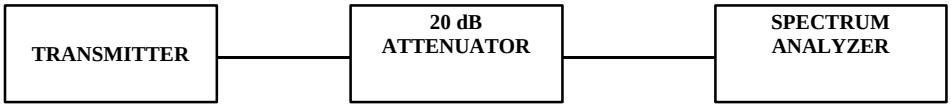
- **FCC CFR 47, Para 15.247(a)(1)**:- Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

- **FCC CFR 47, Para 15.247(a)(1)(ii)**:- Frequency hopping systems operating in the 2400 - 2483.5 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

5.6.2. Method of Measurements

Refer to FCC 15.247(a)(1) & ANSI C63-4:1992

5.6.3. Test Arrangement



5.6.4. 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
Microwave Amplifier	Hewlett Packard	83017A	..	1 GHz – 26.5 GHz 34-38 dB gain
Horm Antenna	EMCO	3115	9701-5061	1 – 18 GHz

5.6.5. Test data

Test Description	FCC Specification	Measured Values	Comments
Channel Hopping Frequency Separation	minimum of 25 KHz or 20dB BW whichever is greater.	1 MHz	Pass
Channel frequency hopping method	See Note (1)	Refer to the manufacturer's description of the frequency hopping method in Exhibit 8 of this report.	Nil.
Number hopping frequencies	75 minimum	77 channels starting from 2402 MHz to 2478 MHz	Pass
20 dB BW of the hopping channel	1 MHz maximum	1 MHz	Pass
Average Time of Occupancy	0.4 seconds max. within 30 seconds period	0.388 seconds within 30 seconds period	Pass

Note (1):- The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals

5.6.6. Plots

Please refer to EXHIBIT 15A.

5.6.7. Photographs of Test Setup

None

5.7. MAXIMUM PEAK OUTPUT POWER @ FCC 15.247(B) AND RF EXPOSURE LIMIT FCC 1.1310

5.7.1. Limits

- **FCC 15.247(b)(1):** Maximum peak output power of the transmitter shall not exceed 1 Watt.
- **FCC 15.247(b)(3):** If the antenna of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- **FCC 15.247(b)(3)(i):** Systems operating in the 2400 - 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduce by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi..
- **FCC 1.1310:**- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

5.7.2. Method of Measurements

Refer to FCC 15.247(b)(1)&(3), ANSI C63-4:1992, FCC @ 1.1310 & OST Bulletin No. 65-October 1985

$S = PG/4\Pi r^2 = EIRP/4\Pi r^2$

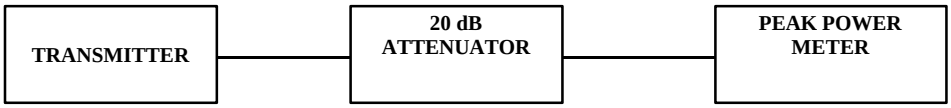
Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{PG/4\Pi S}$$

FCC radio frequency exposure limits may not be exceeded at distances closer than r cm from the antenna of this device

5.7.3. Test Arrangement



5.7.4. 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
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

5.7.5. Test data

5.7.5.1. DIRECT PEAK POWER MEASUREMENTS AT THE ANTENNA TERMINAL

TRANSMITTER CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	DATA RATE/ MODULATION	MEASURED PEAK TOTAL POWER @ ANTENNA TERMINAL (mW)	PEAK POWER LIMIT (mW)
Lowest	2402	FSK @ 441Kbps	10	1000
Middle	2443	FSK @ 441Kbps	8.5	1000
Highest	2478	FSK @ 441Kbps	8.1	1000

5.7.5.2. EFFECTIVE ISOTROPIC RADIATED POWER (EIRP) MEASURED AT 3 METER DISTANCE

(Substitution Method)

Test Configuration # 1: 2.4GHz FHSS OEM Transceiver with Centurion WXE2400 External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	2	105.38	0.007	0.72
2443	FSK @ 441Kbps	2	107.78	0.011	0.95
2478	FSK @ 441Kbps	2	106.22	0.008	0.80

Test Configuration # 2: 2.4GHz FHSS OEM Transceiver with Maxrad MFB24008 External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	8	117.56	0.027	1.47
2443	FSK @ 441Kbps	8	118.75	0.036	1.68
2478	FSK @ 441Kbps	8	117.22	0.025	1.41

Test Configuration # 3: 2.4GHz FHSS OEM Transceiver with Maxrad BMMG24000MMCX6' External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	unity	108.63	0.022	1.32
2443	FSK @ 441Kbps	unity	111.09	0.039	1.75
2478	FSK @ 441Kbps	unity	109.19	0.025	1.41

Test Configuration # 4: 2.4GHz FHSS OEM Transceiver with Maxrad BMMG24000RPSMA12' External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	5	107.03	0.005	0.62
2443	FSK @ 441Kbps	5	109.94	0.009	0.86
2478	FSK @ 441Kbps	5	111.56	0.014	1.04

Test Configuration # 5: 2.4GHz FHSS OEM Transceiver with AEROCOMM NZH2400 External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	unity	107.97	0.019	1.22
2443	FSK @ 441Kbps	unity	108.97	0.024	1.37
2478	FSK @ 441Kbps	unity	108.97	0.024	1.37

Test Configuration # 6: 2.4GHz FHSS OEM Transceiver with Maxrad MP24013FC External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	13	109.09	0.001	0.31
2443	FSK @ 441Kbps	13	111.44	0.002	0.41
2478	FSK @ 441Kbps	13	109.59	0.001	0.33

Test Configuration # 7: 2.4GHz FHSS OEM Transceiver with Maxrad MUF24005 External Antenna

CHANNEL FREQUENCY (MHz)	DATA RATE / MODULATION	Tx Antenna Gain (dBi)	Max. Field Strength Level @ 1 MHz BW At 3 m (dBuV/m)	EIRP Power (Watts)	(Note 1) Min. Allowable Distance ® from Skin (Centi-Meter)
2402	FSK @ 441Kbps	5	113.06	0.019	1.24
2443	FSK @ 441Kbps	5	107.72	0.006	0.67
2478	FSK @ 441Kbps	5	108.44	0.007	0.73

Note (1):

RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\Pi S)^{1/2} = (EIRP/4\Pi S)^{1/2}$

Since the power density of 1 mW/cm^2 is at a very short distance from the radiating antenna and due to very low operating RF power required, the RF exposure limit warning or SAR tests are not necessary.

5.7.6. Photographs of Test Setup

None

5.7.7. Plots

None

5.8. TRANSMITTER ANTENNA CONDUCTED EMISSIONS, FCC CFR 47, PARA. 15.247

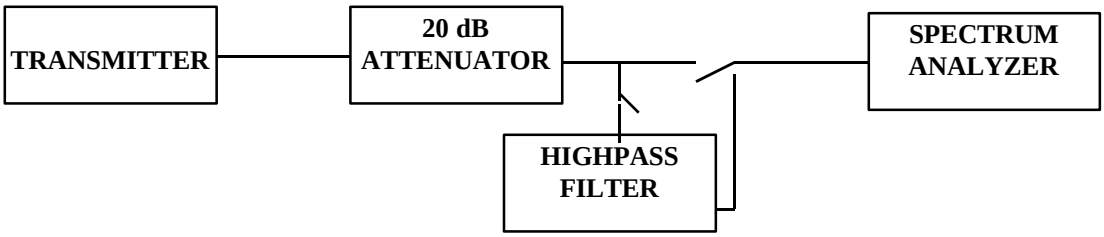
5.8.1. Limits

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power.

5.8.2. Method of Measurements

Refer to FCC 15.247(c) & ANSI C63-4:1992

5.8.3. Test Arrangement



5.8.4. 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

5.8.5. Test Data

5.8.5.1. Lowest Frequency (2402 MHz)

There were no significant signal found from the frequency range of 10MHz to 25GHz.

5.8.5.2. Middle Frequency (2441MHz)

There were no significant signal found from the frequency range of 10MHz to 25GHz.

5.8.5.3. Highest Frequency (2478 MHz)

There were no significant signal found from the frequency range of 10MHz to 25GHz.

5.8.6. Plots

Please refer to EXHIBIT 15B

5.8.7. Photographs of Test Setup

None

5.9. TRANSMITTER RADIATED EMISSIONS @ 3 METERS, FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205

5.9.1. Limits

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in @ 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in @ 15.205(a) shall not exceed the general radiated emission limits specified in @ 15.209(a)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- @ **FCC CFR 47, Para. 15.237(c)** - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in **@15.35** for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 – 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 – 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 – 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 – 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 – 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 – 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 – 156.9	2200 - 2300	9000 - 9200	

FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / 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

5.9.2. Method of Measurements

Refer to **ANSI 63.4-1992, Para. 8** for detailed radiated emissions measurement procedures.

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 measurement below 1 GHz, set RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.

For measurement above 1 GHz, set 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).

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

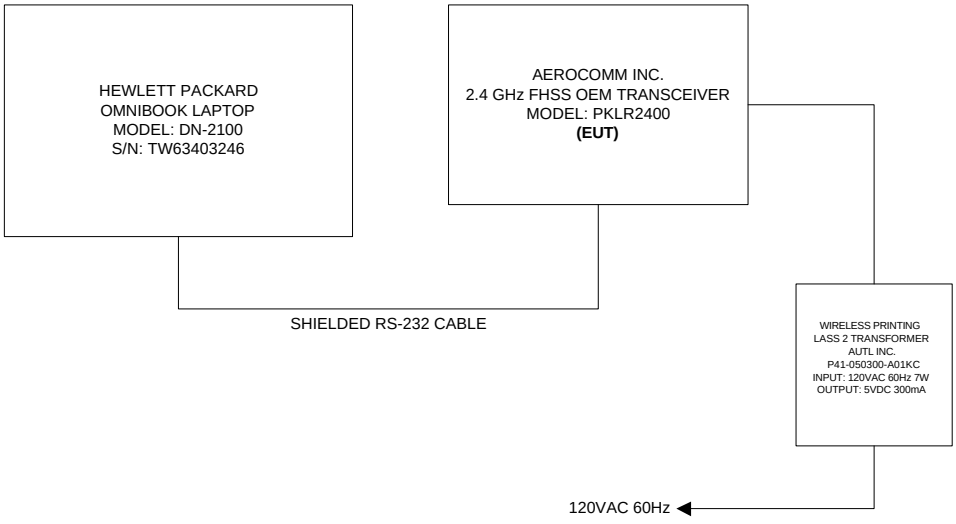
FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

(a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below he mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the commission.

5.9.3. Test Arrangement



5.9.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3160-09	..	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	..	26.5 GHz – 40 GHz
Mixer	Tektronix	118-0098-00	..	18 GHz – 26.5 GHz
Mixer	Tektronix	119-0098-00	..	26.5 GHz – 40 GHz

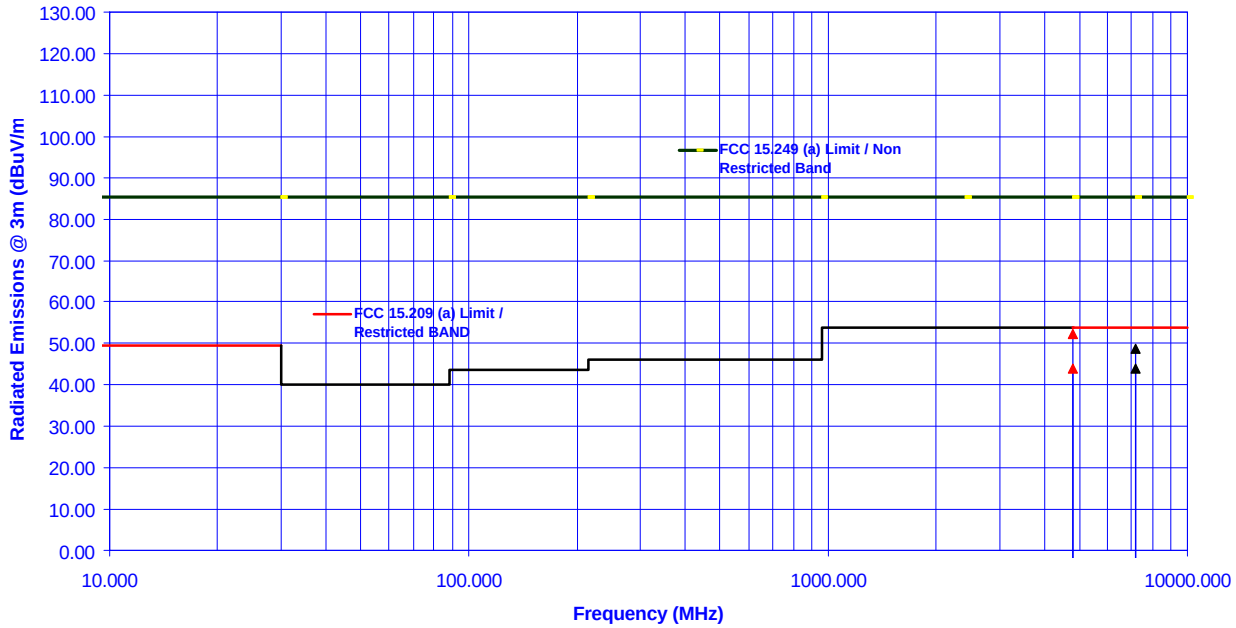
5.9.5. Test data

REMARK: ** Indicate that the frequency are the restricted band

5.9.5.1. Test Configuration # 1: 2.4GHz FHSS OEM Transceiver with Centurion WXE2400 External Antenna

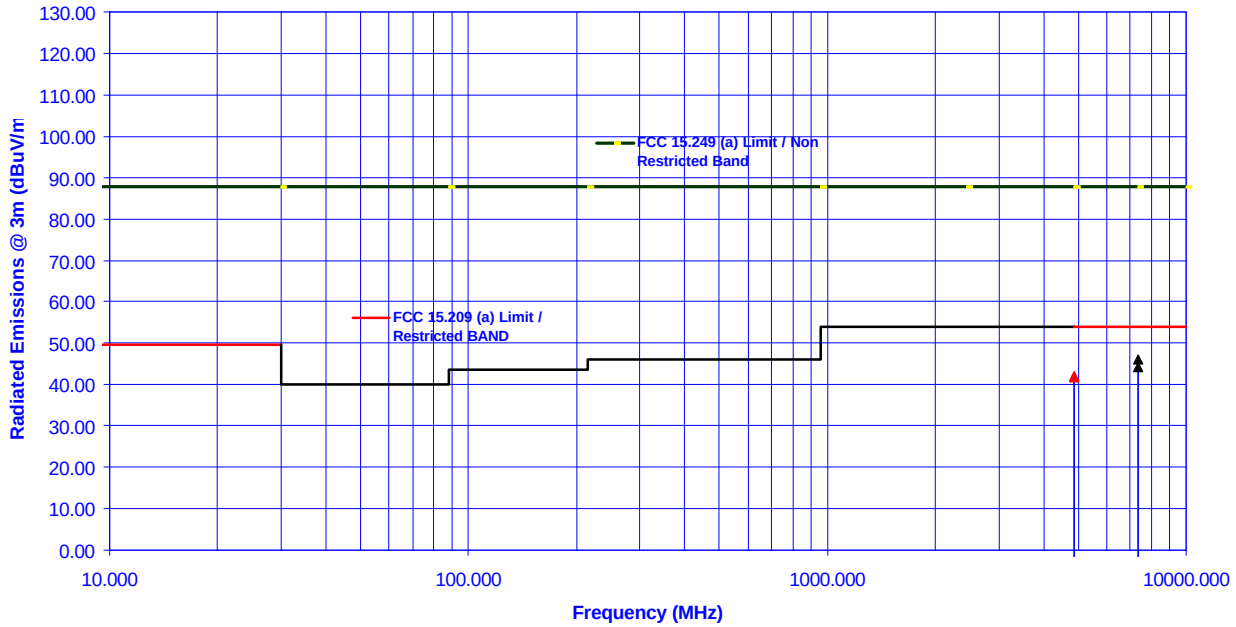
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	105.38	--	V	54.0	85.4	--	--
2402.0	102.47	--	H	54.0	85.4	--	--
4804.0	59.41	52.38	V	54.0	85.4	-1.6	**PASS
4804.0	53.72	43.94	H	54.0	85.4	-10.1	**PASS
7206.0	58.42	48.85	V	54.0	85.4	-36.6	PASS
7206.0	54.13	43.84	H	54.0	85.4	-41.6	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



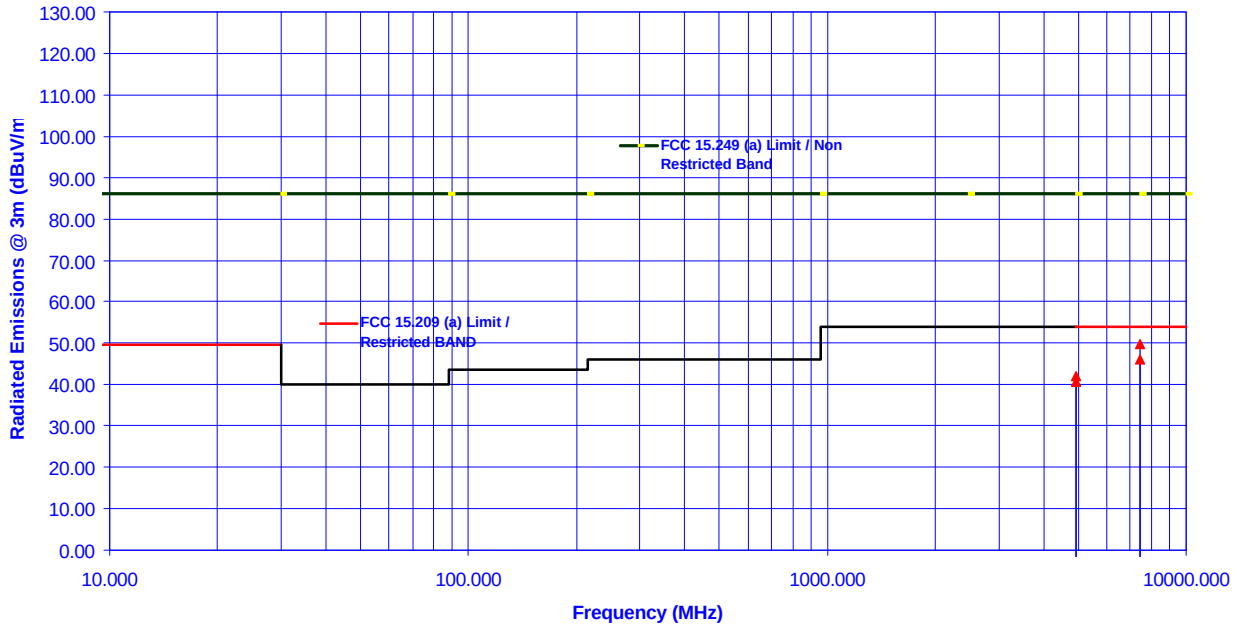
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	107.78	--	V	54.0	--	--	--
2443.0	104.47	--	H	54.0	--	--	--
4886.0	51.72	41.59	V	54.0	87.8	-12.4	**PASS
4886.0	52.41	42.09	H	54.0	87.8	-11.9	**PASS
7329.0	55.72	45.94	V	54.0	87.8	-41.9	PASS
7329.0	54.94	44.13	H	54.0	87.8	-43.7	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	106.22	--	V	54.0	--	--	--
2478.0	102.69	--	H	54.0	--	--	--
4956.0	51.98	42.00	V	54.0	86.2	-12.0	**PASS
4956.0	52.03	40.56	H	54.0	86.2	-13.4	**PASS
7434.0	60.53	49.81	V	54.0	86.2	-4.2	**PASS
7434.0	55.63	46.00	H	54.0	86.2	-8.0	**PASS
The emissions were scanned from 100 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

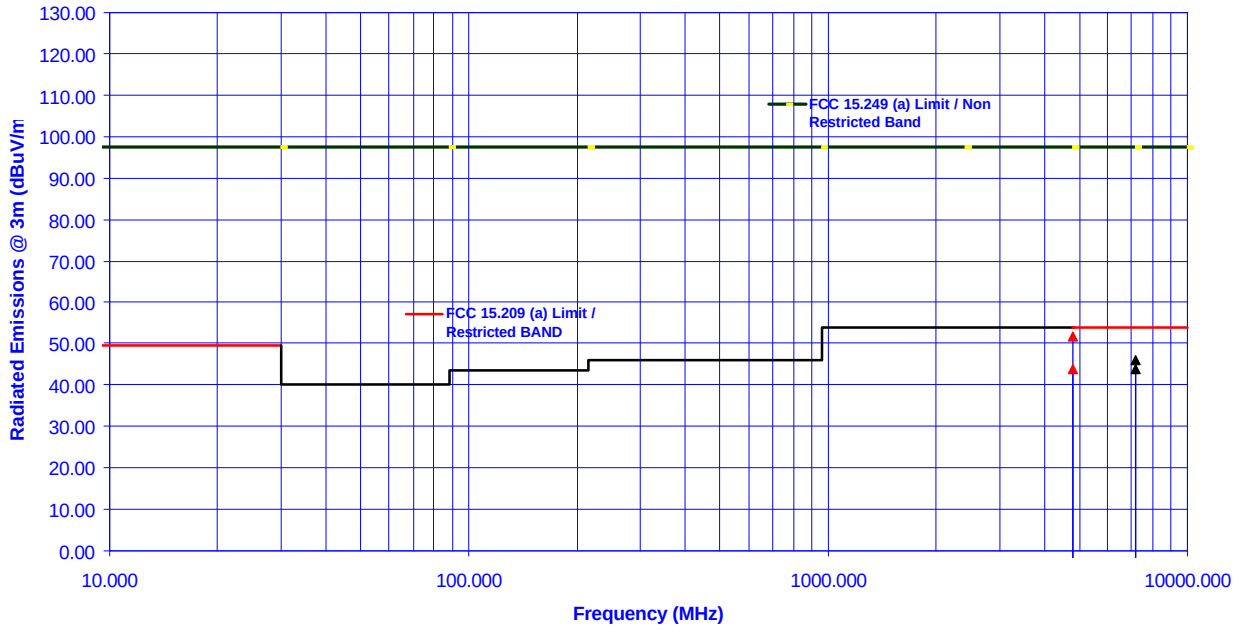
Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz



5.9.5.2. Test Configuration # 2: 2.4GHz FHSS OEM Transceiver with Maxrad – MFB24008 External Antenna

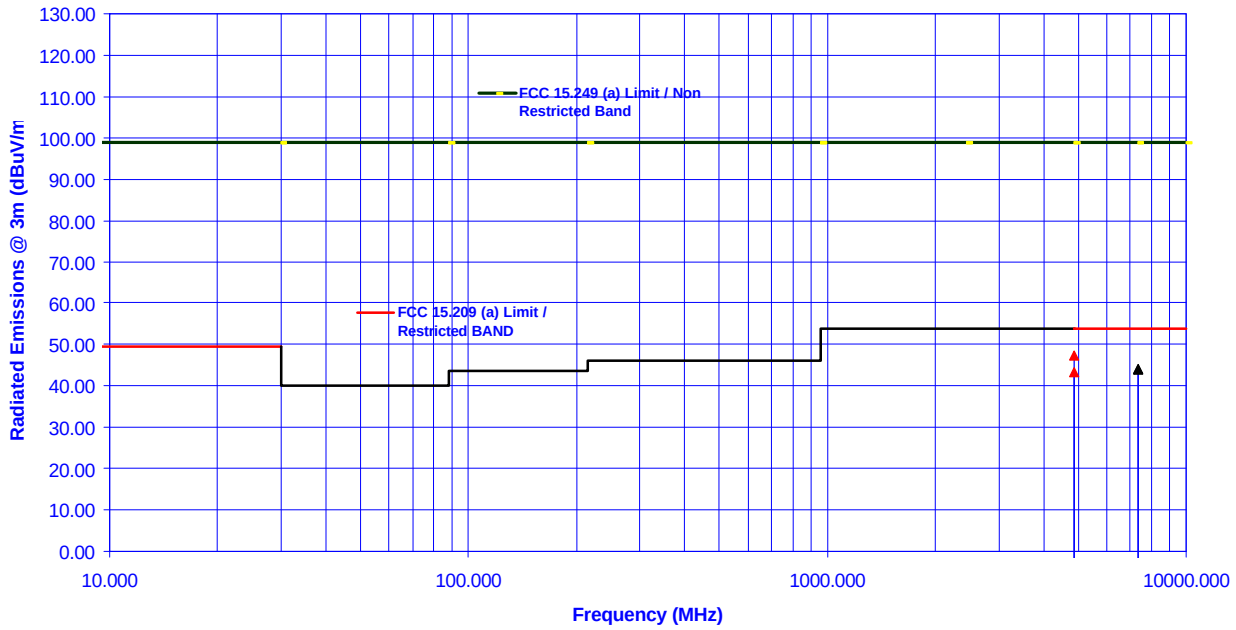
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	117.56	--	V	54.0	--	--	--
2402.0	99.47	--	H	54.0	--	--	--
4804.0	58.81	51.78	V	54.0	97.6	-2.2	**PASS
4804.0	53.00	44.00	H	54.0	97.6	-10.0	**PASS
7206.0	56.19	46.13	V	54.0	97.6	-51.4	PASS
7206.0	53.56	43.88	H	54.0	97.6	-53.7	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 50 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



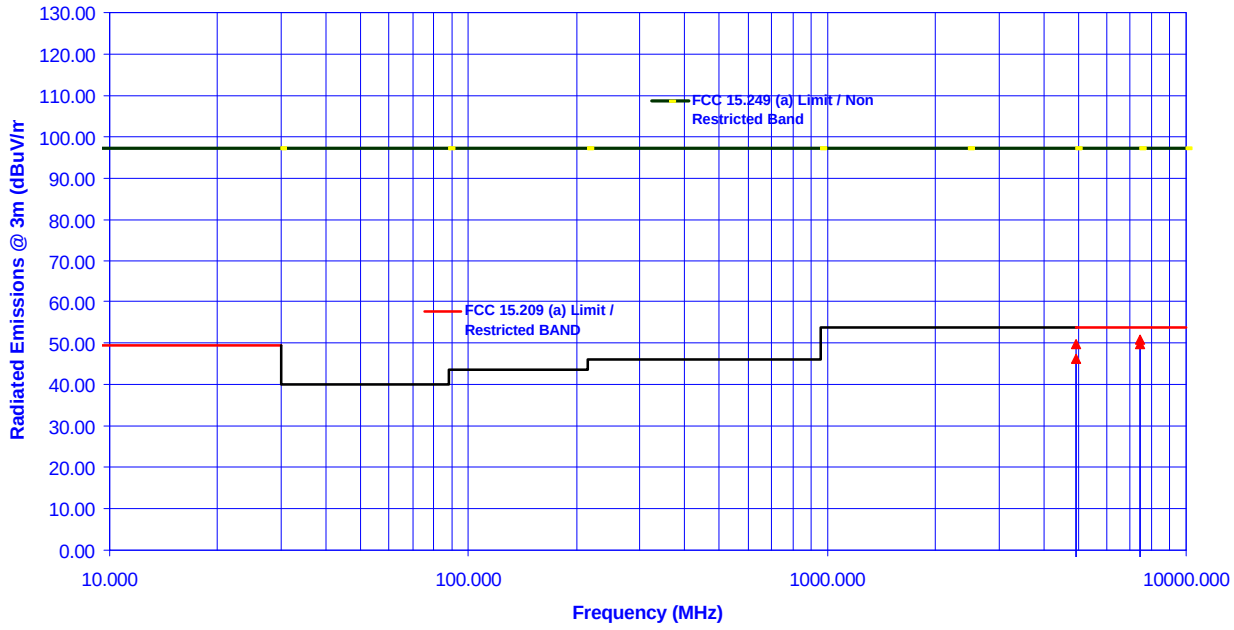
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	118.75	--	V	54.0	--	--	--
2443.0	100.41	--	H	54.0	--	--	--
4886.0	55.91	47.50	V	54.0	98.8	-6.5	**PASS
4886.0	53.44	43.34	H	54.0	98.8	-10.7	**PASS
7329.0	54.81	44.09	V	54.0	98.8	-54.7	PASS
7329.0	54.53	43.88	H	54.0	98.8	-54.9	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 50 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	117.22	--	V	54.0	--	--	--
2478.0	100.94	--	H	54.0	--	--	--
4956.0	56.95	49.88	V	54.0	97.2	-4.1	**PASS
4956.0	55.09	46.19	H	54.0	97.2	-7.8	**PASS
7434.0	60.88	50.81	V	54.0	97.2	-3.2	**PASS
7434.0	60.34	49.94	H	54.0	97.2	-4.1	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz

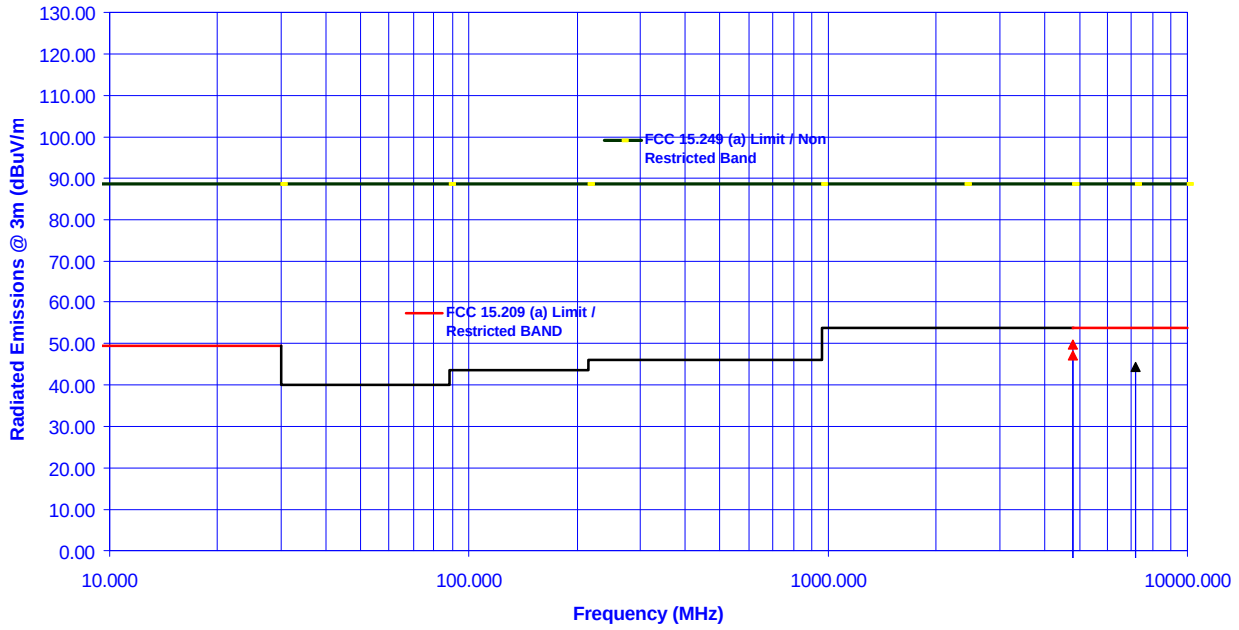


5.9.5.3. Test Configuration # 3: 2.4GHz FHSS OEM Transceiver with Maxrad – BMMG24000MMCX6'

External Antenna

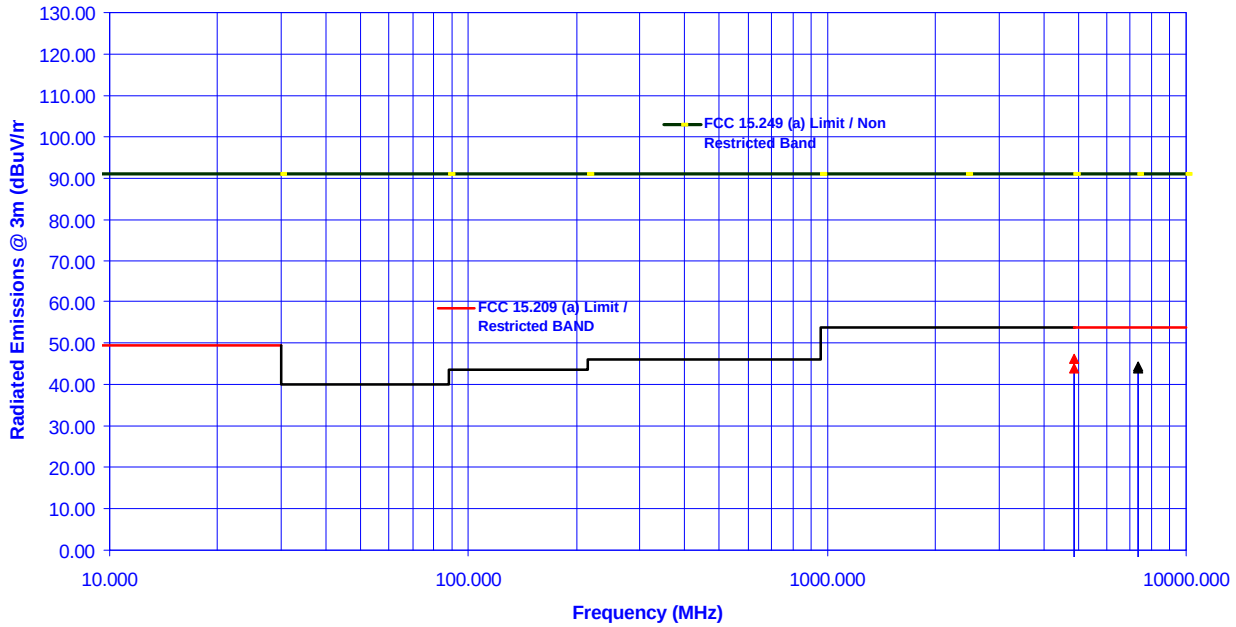
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	108.63	--	V	54.0	--	--	--
2402.0	102.28	--	H	54.0	--	--	--
4804.0	57.66	49.88	V	54.0	88.6	-4.1	**PASS
4804.0	55.94	47.06	H	54.0	88.6	-6.9	**PASS
7206.0	54.13	44.44	V	54.0	88.6	-44.2	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



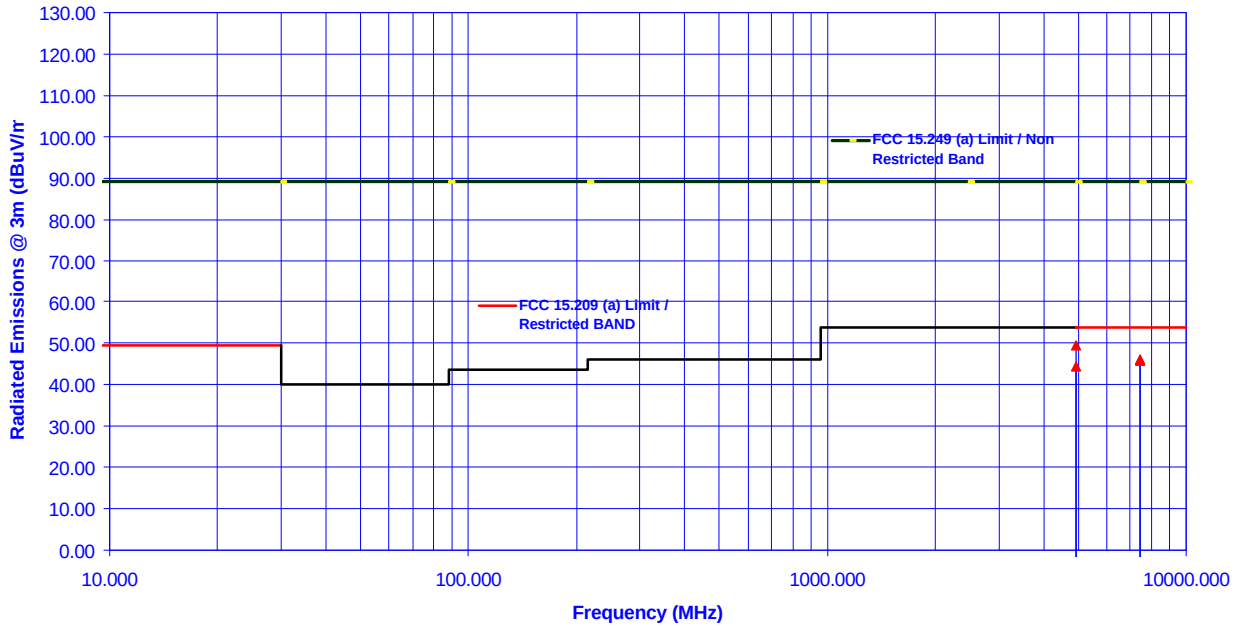
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	111.09	--	V	54.0	--	--	--
2443.0	103.88	--	H	54.0	--	--	--
4886.0	54.69	46.28	V	54.0	91.1	-7.7	**PASS
4886.0	53.16	43.78	H	54.0	91.1	-10.2	**PASS
7329.0	54.38	44.34	V	54.0	91.1	-46.8	PASS
7329.0	53.72	43.81	H	54.0	91.1	-47.3	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	109.19	--	V	54.0	--	--	--
2478.0	102.91	--	H	54.0	--	--	--
4956.0	56.28	49.69	V	54.0	89.2	-4.3	**PASS
4956.0	53.63	44.31	H	54.0	89.2	-9.7	**PASS
7434.0	55.69	45.84	V	54.0	89.2	-8.2	**PASS
7434.0	56.25	46.16	H	54.0	89.2	-7.8	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

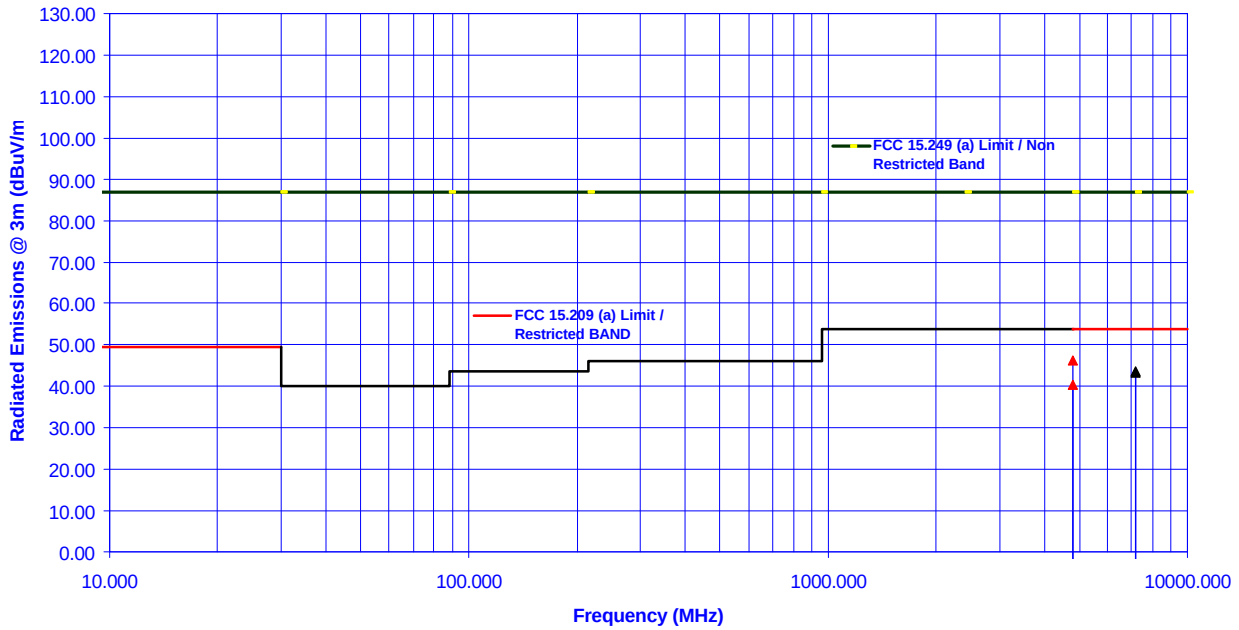
Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz



5.9.5.4. Test Configuration # 4: 2.4GHz FHSS OEM Transceiver with Maxrad – BMMG24000RPSMA12' External Antenna

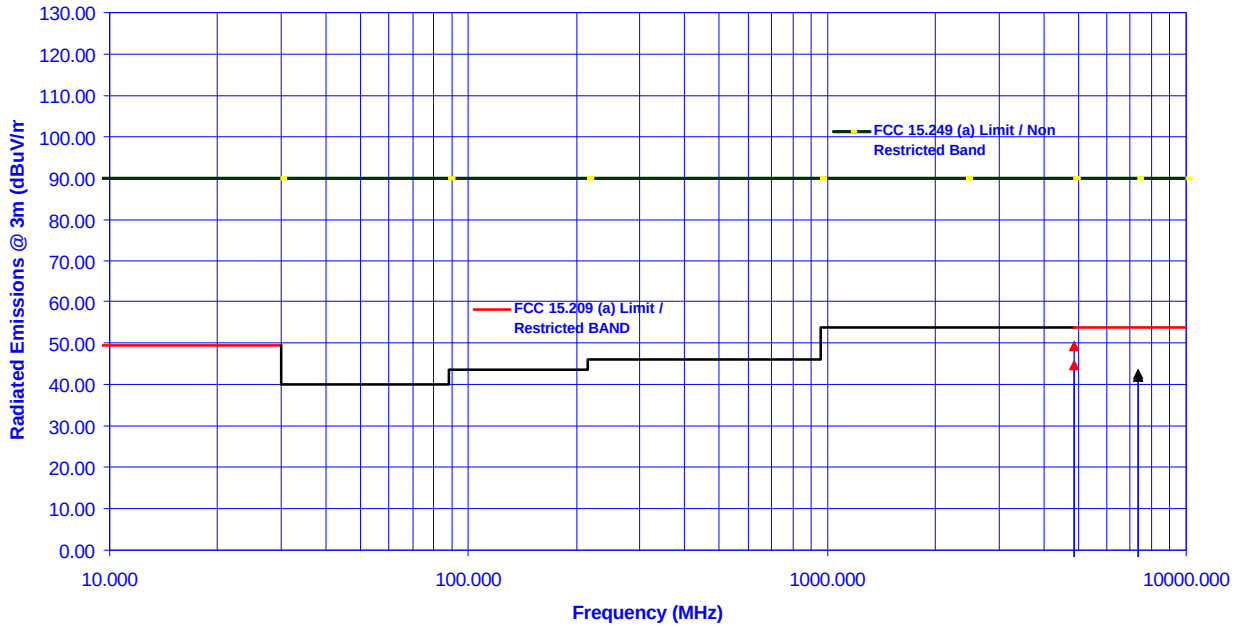
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	107.03	--	V	54.0	--	--	--
2402.0	99.66	--	H	54.0	--	--	--
4804.0	54.69	46.41	V	54.0	87.0	-7.6	**PASS
4804.0	51.84	40.39	H	54.0	87.0	-13.6	**PASS
7206.0	54.59	43.72	V	54.0	87.0	-43.3	PASS
7206.0	54.53	43.31	H	54.0	87.0	-43.7	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



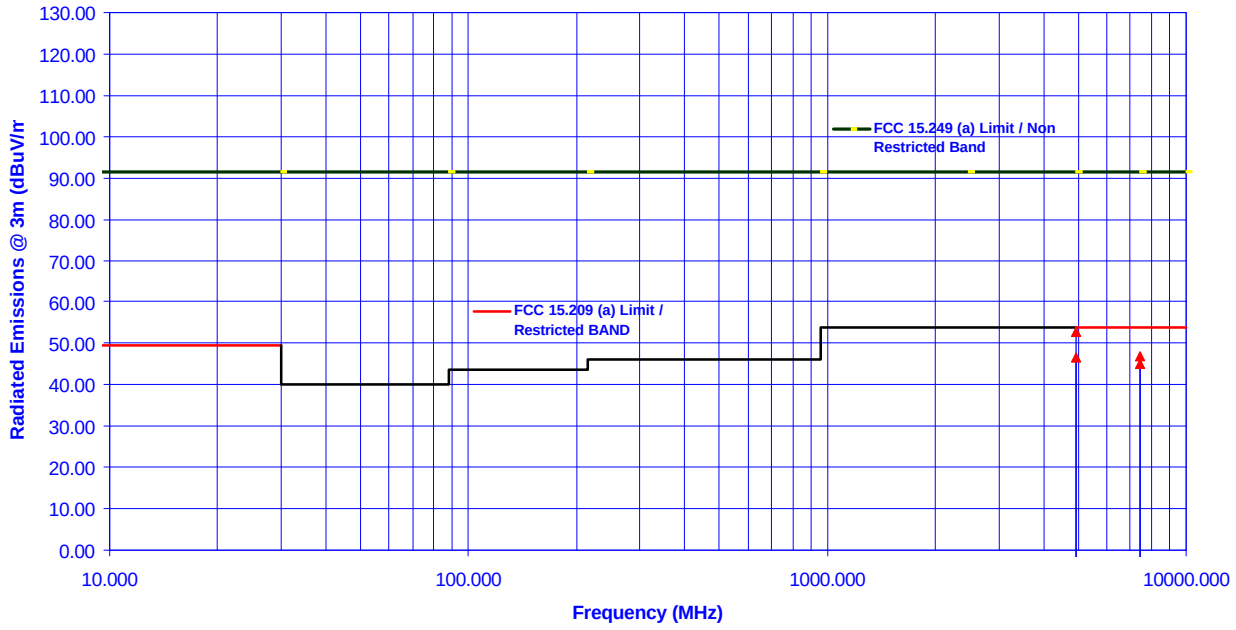
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	109.94	--	V	54.0	--	--	--
2443.0	99.69	--	H	54.0	--	--	--
4886.0	58.06	49.25	V	54.0	89.9	-4.8	**PASS
4886.0	54.44	44.72	H	54.0	89.9	-9.3	**PASS
7329.0	53.63	42.59	V	54.0	89.9	-47.4	PASS
7329.0	53.53	42.00	H	54.0	89.9	-47.9	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	111.56	--	V	54.0	--	--	--
2478.0	102.22	--	H	54.0	--	--	--
4956.0	57.56	52.72	V	54.0	91.6	-1.3	**PASS
4956.0	54.66	46.53	H	54.0	91.6	-7.5	**PASS
7434.0	56.25	45.03	V	54.0	91.6	-9.0	**PASS
7434.0	57.84	46.97	H	54.0	91.6	-7.0	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

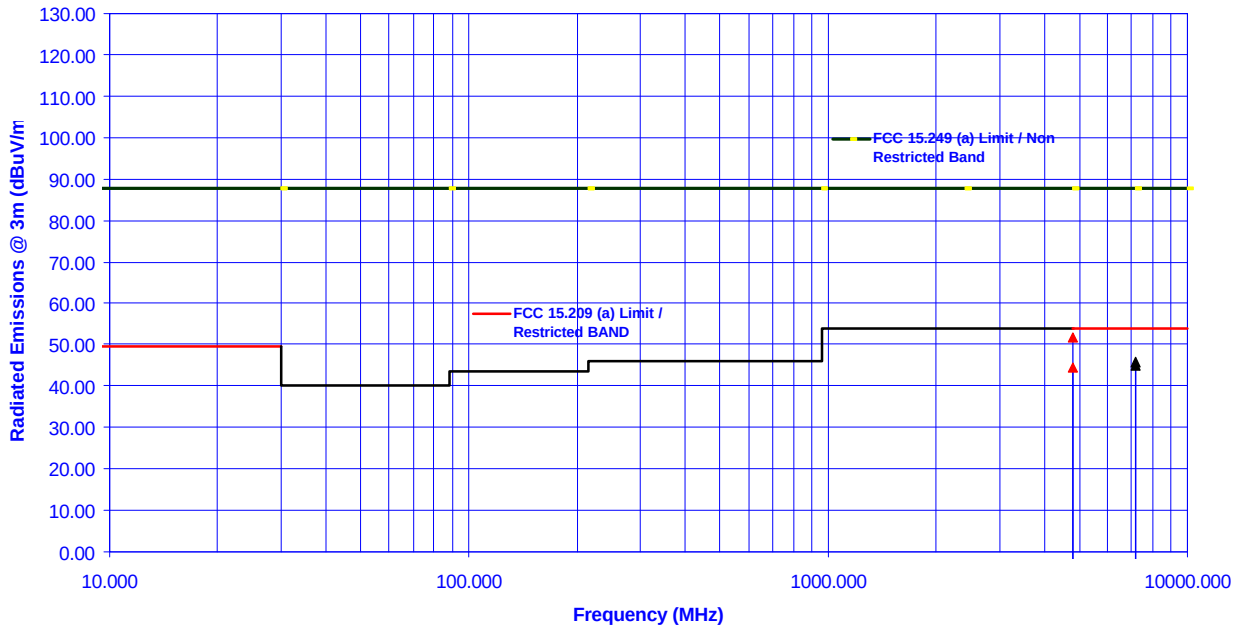
Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz



5.9.5.5. Test Configuration # 5: 2.4GHz FHSS OEM Transceiver with AEROCOMM – NZH2400 External Antenna

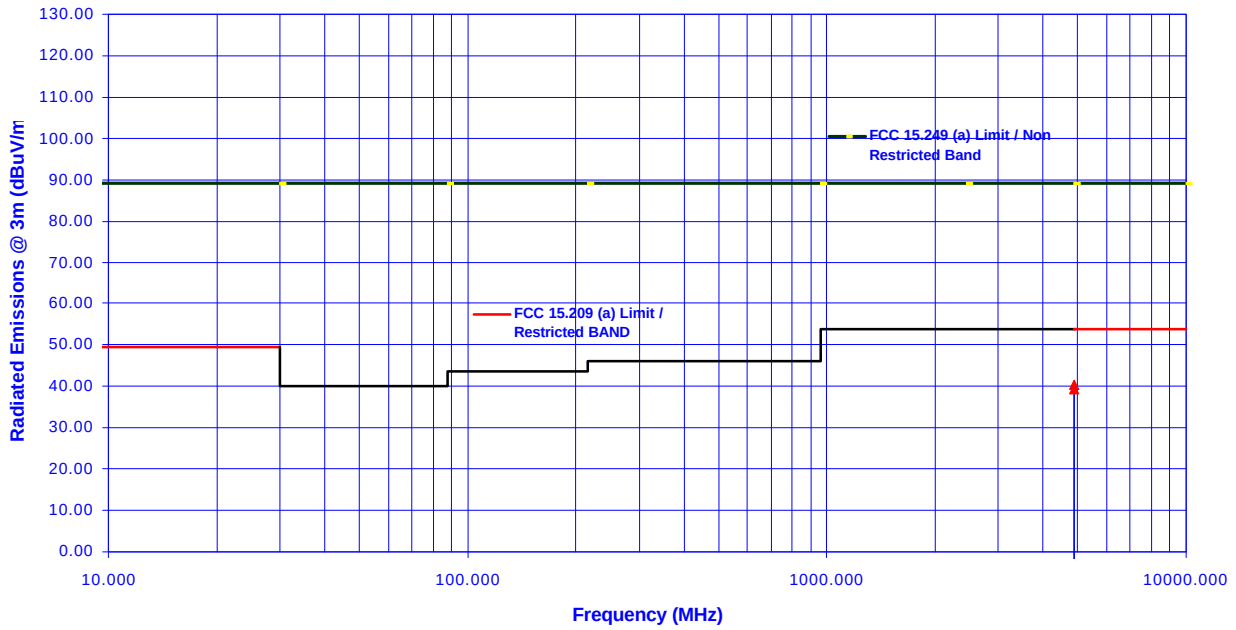
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	107.78	--	V	54.0	--	--	--
2402.0	105.38	--	H	54.0	--	--	--
4804.0	58.97	51.75	V	54.0	87.8	-2.3	**PASS
4804.0	54.25	44.45	H	54.0	87.8	-9.6	**PASS
7206.0	56.06	45.69	V	54.0	87.8	-42.1	PASS
7206.0	55.09	45.00	H	54.0	87.8	-42.8	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



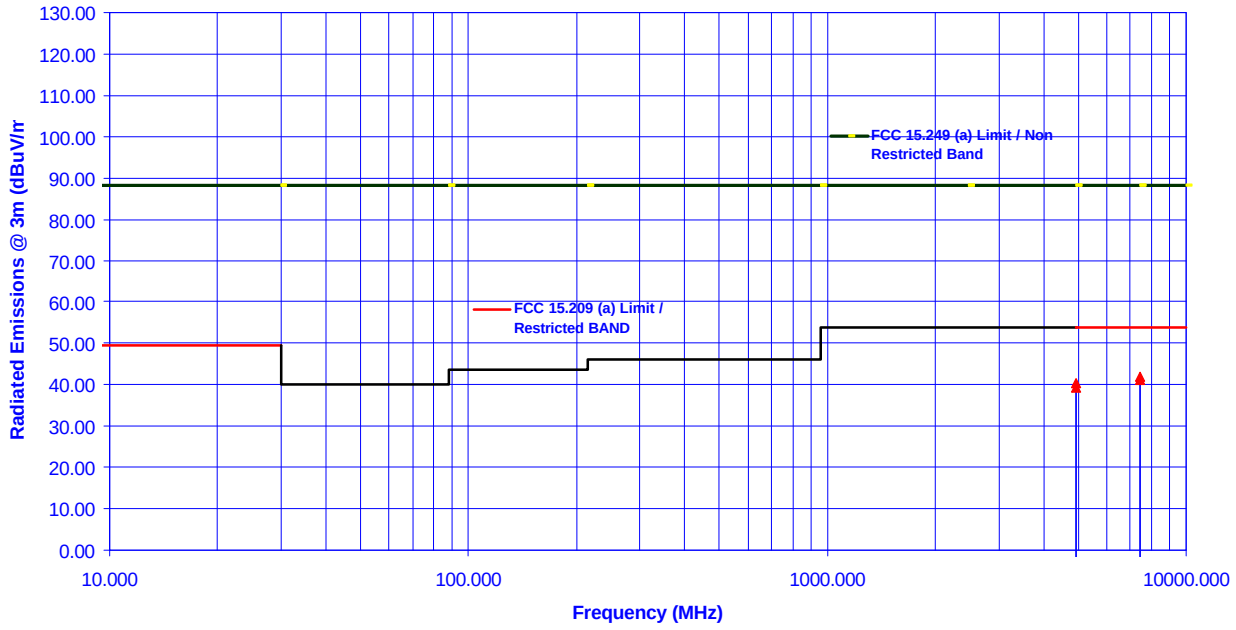
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	105.31	--	V	54.0	--	--	--
2443.0	108.97	--	H	54.0	--	--	--
4886.0	50.72	40.45	V	54.0	89.0	-13.6	**PASS
4886.0	49.56	39.25	H	54.0	89.0	-14.8	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	106.38	--	V	54.0	--	--	--
2478.0	108.41	--	H	54.0	--	--	--
4956.0	50.75	40.34	V	54.0	88.4	-13.7	**PASS
4956.0	50.50	39.22	H	54.0	88.4	-14.8	**PASS
7434.0	52.90	42.00	V	54.0	88.4	-12.0	**PASS
7434.0	52.19	41.13	H	54.0	88.4	-12.9	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

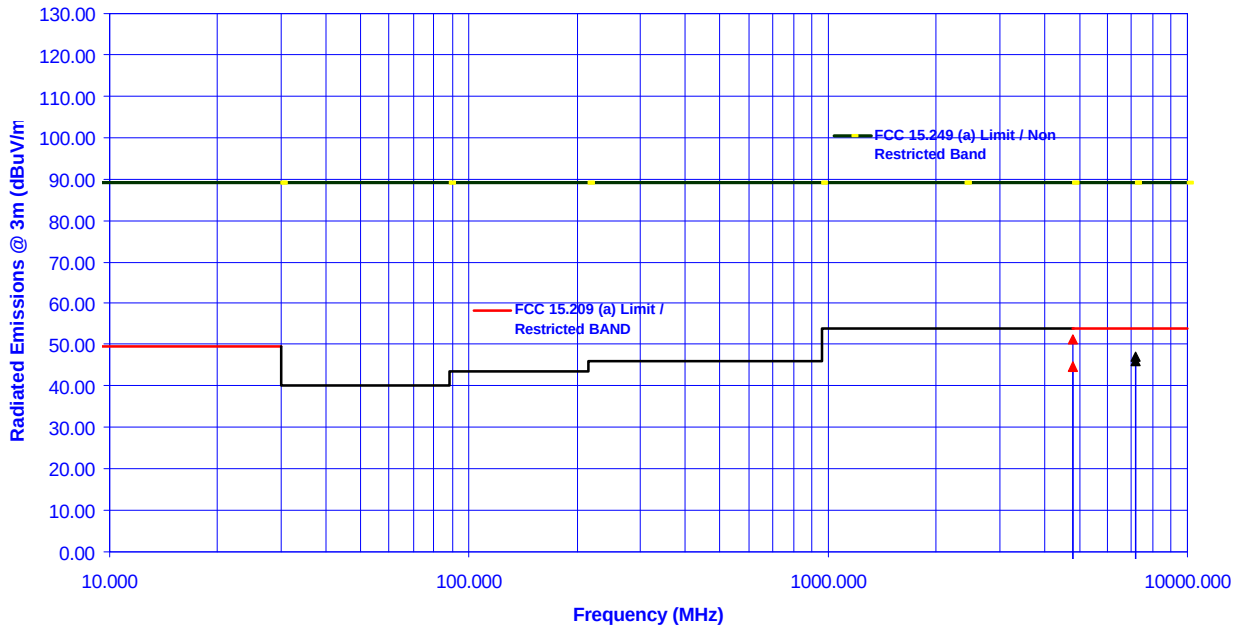
Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz



5.9.5.6. Test Configuration # 6: 2.4GHz FHSS OEM Transceiver with Maxrad – MP24013FC External Antenna

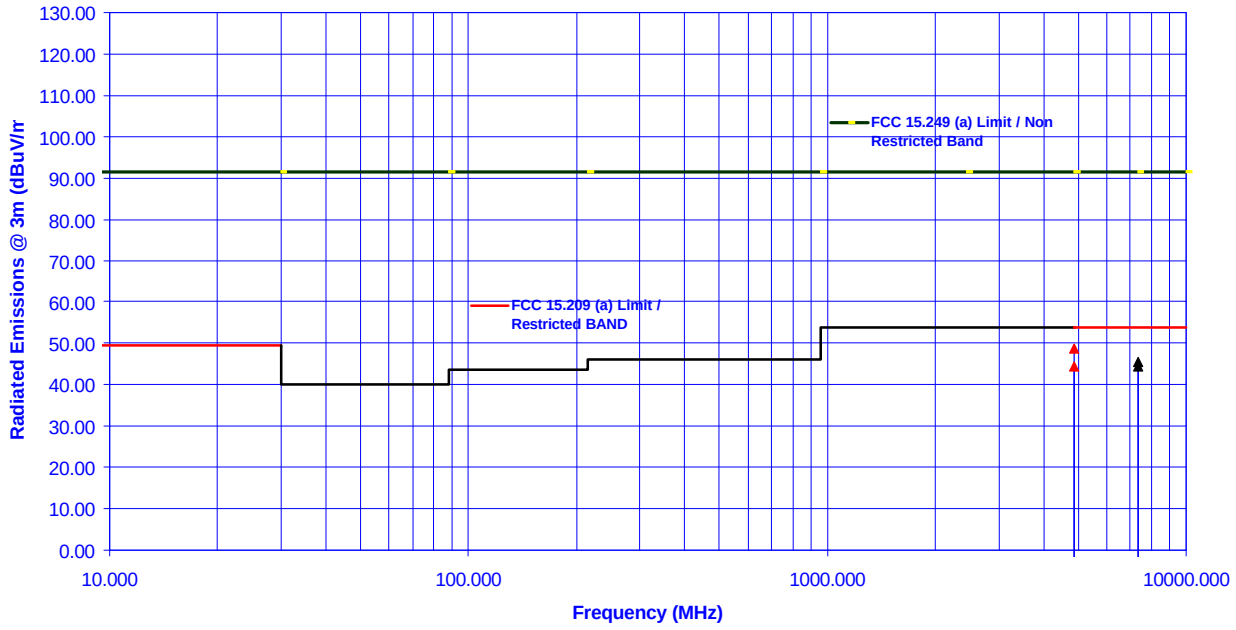
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	102.19	--	V	54.0	--	--	--
2402.0	109.09	--	H	54.0	--	--	--
4804.0	58.03	51.28	V	54.0	89.1	-2.7	**PASS
4804.0	53.81	44.69	H	54.0	89.1	-9.3	**PASS
7206.0	57.09	47.19	V	54.0	89.1	-41.9	PASS
7206.0	56.97	46.09	H	54.0	89.1	-43.0	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



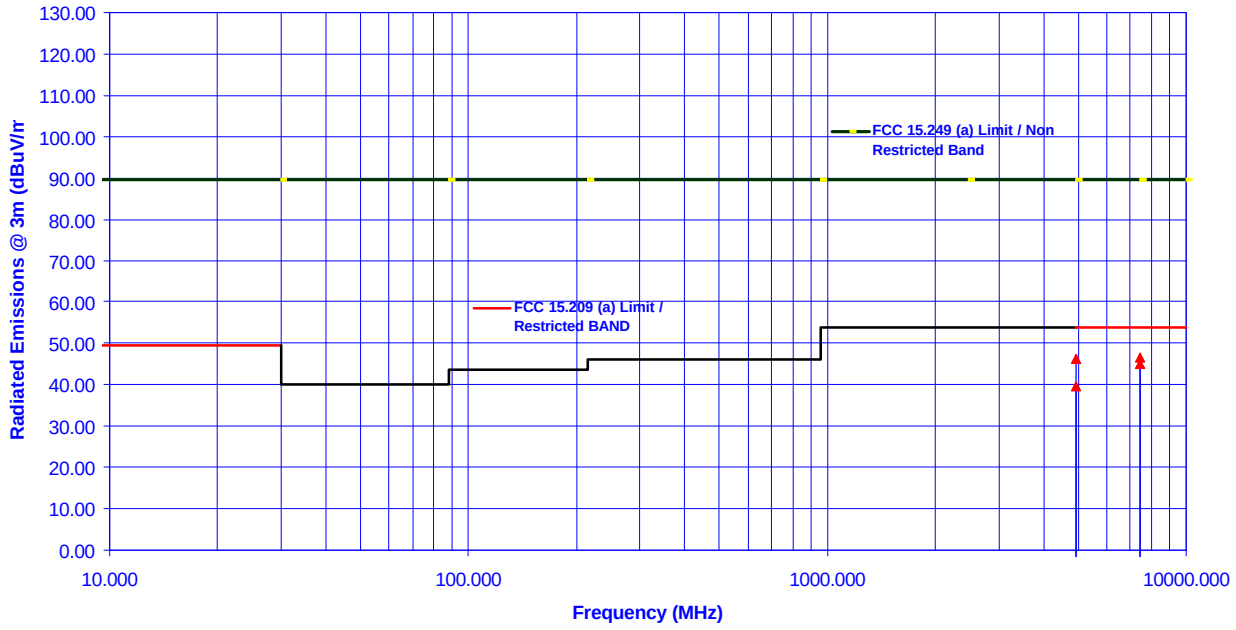
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	103.72	--	V	54.0	--	--	--
2443.0	111.44	--	H	54.0	--	--	--
4886.0	56.47	48.66	V	54.0	91.4	-5.3	**PASS
4886.0	53.84	44.47	H	54.0	91.4	-9.5	**PASS
7329.0	55.97	45.53	V	54.0	91.4	-45.9	PASS
7329.0	54.47	44.53	H	54.0	91.4	-46.9	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	102.19	--	V	54.0	--	--	--
2478.0	109.59	--	H	54.0	--	--	--
4956.0	54.72	46.34	V	54.0	89.6	-7.7	**PASS
4956.0	51.78	39.56	H	54.0	89.6	-14.4	**PASS
7434.0	55.31	44.88	V	54.0	89.6	-9.1	**PASS
7434.0	56.50	46.63	H	54.0	89.6	-7.4	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

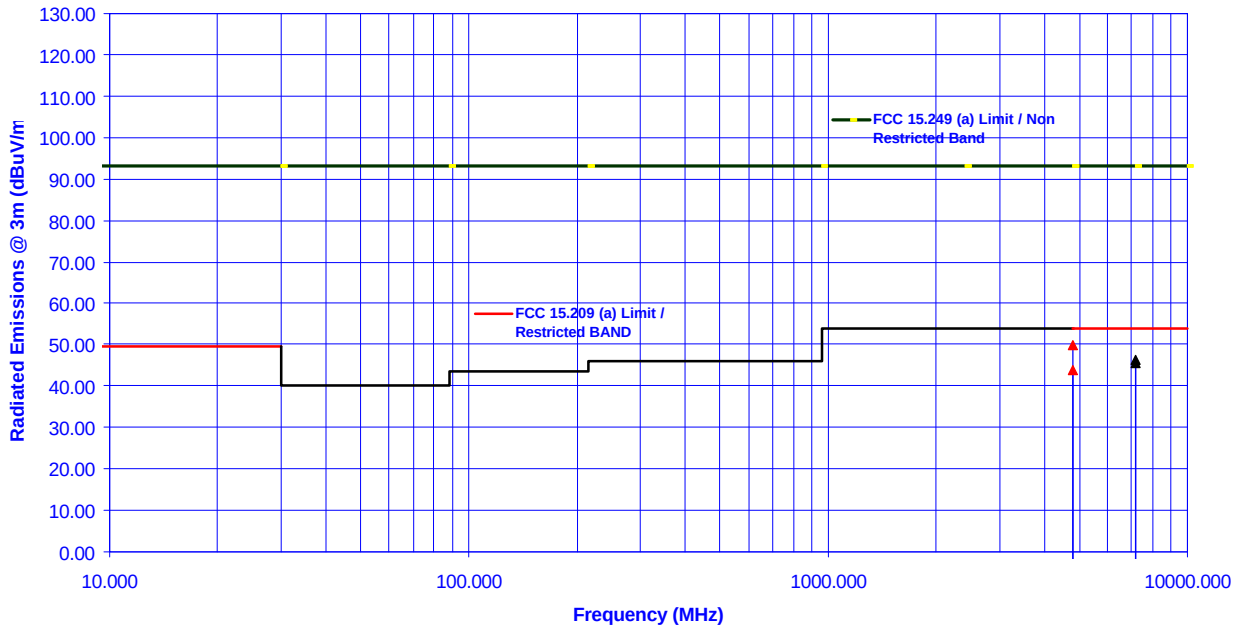
Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz



5.9.5.7. Test Configuration # 7: 2.4GHz FHSS OEM Transceiver with Maxrad – MUF24005 External Antenna

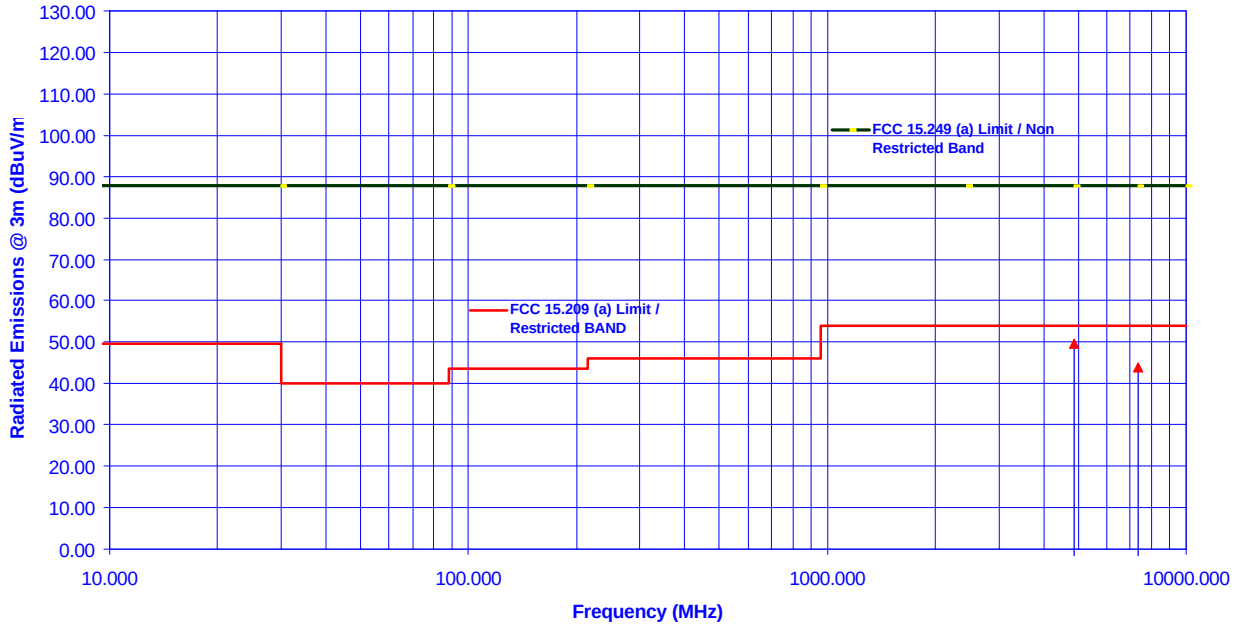
Lowest Frequency (2402 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.0	113.06	--	V	54.0	--	--	--
2402.0	103.66	--	H	54.0	--	--	--
4804.0	55.78	49.84	V	54.0	93.1	-4.2	**PASS
4804.0	53.34	43.81	H	54.0	93.1	-10.2	**PASS
7206.0	54.87	45.53	V	54.0	93.1	-47.5	PASS
7206.0	57.38	46.25	H	54.0	93.1	-46.8	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2402 MHz



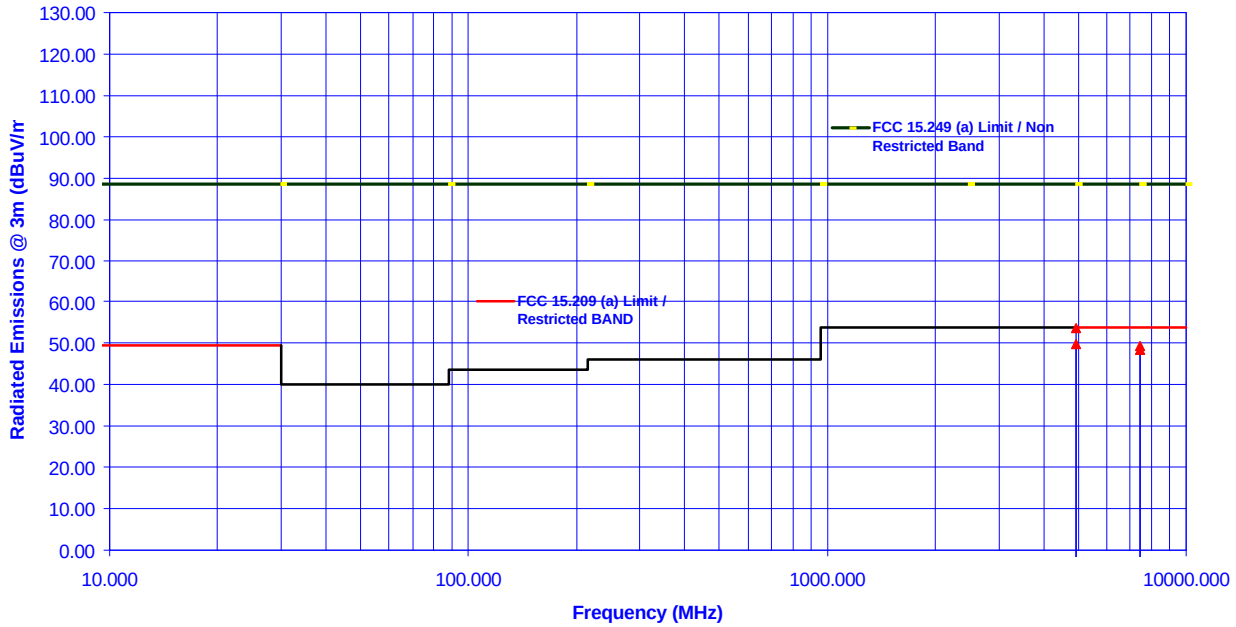
Middle Frequency (2443 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2443.0	107.72	--	V	54.0	--	--	--
2443.0	101.00	--	H	54.0	--	--	--
4886.0	56.69	49.66	V	54.0	87.7	-4.3	**PASS
7329.0	53.41	43.84	V	54.0	87.7	-43.9	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2443 MHz



Highest Frequency (2478 MHz)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2478.0	108.44	--	V	54.0	--	--	--
2478.0	98.53	--	H	54.0	--	--	--
4956.0	59.94	53.72	V	54.0	88.4	-0.3	**PASS
4956.0	56.72	49.78	H	54.0	88.4	-4.2	**PASS
7434.0	58.56	48.59	V	54.0	88.4	-5.4	**PASS
7434.0	59.16	49.22	H	54.0	88.4	-4.8	**PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions not more than 40 dB below the permissible value were recorded.							

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
AeroComm Inc.
2.4 GHz HFSS OEM Transceiver
Model PKLR2400
TRANSMIT Freq.: 2478 MHz



5.9.6. Plots

Please refer to EXHIBIT 15C for Transmitter Radiated Emissions plots.

5.9.7. Photographs of Test Setup

Please refer to EXHIBIT 11.

EXHIBIT 6. MEASUREMENT UNCERTAINTY

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

6.1. 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

6.2. 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 7. MEASUREMENT METHODS

7.1. GENERAL TEST CONDITIONS

7.1.1. 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.

7.1.2. 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 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 150KHz-30MHz.

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

  Step1. Monitor the frequency range of interest at a fixed EUT azimuth.

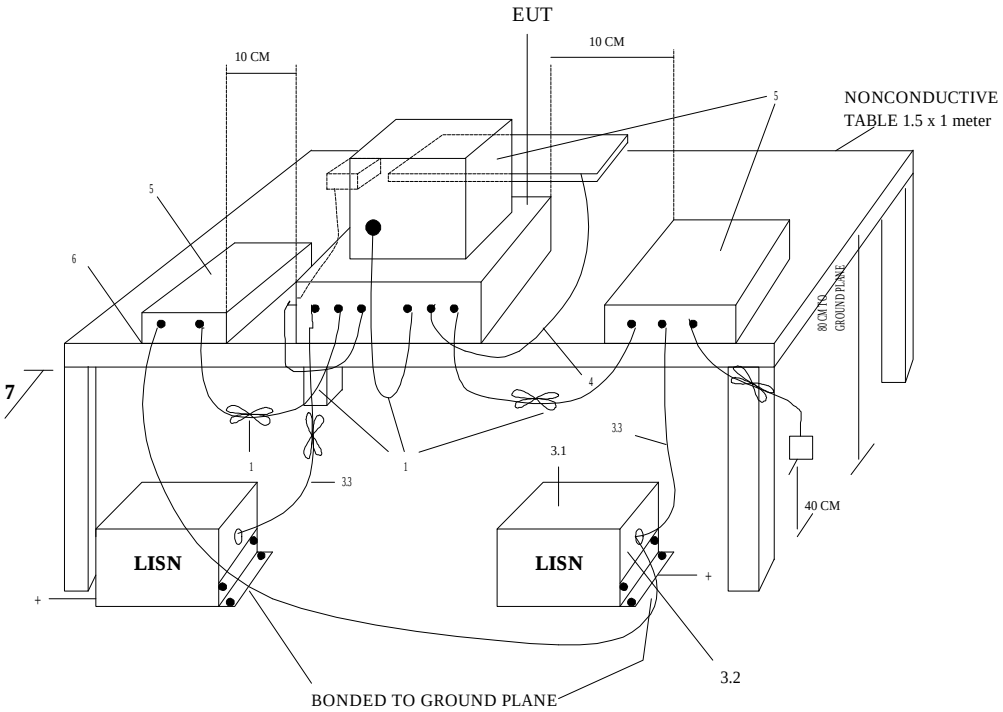
  Step2. Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step3. The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.

  Step4. 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 (9 KHz RBW, 1 MHz VBW) and AVERAGE detector mode (9 kHz RBW, 1 MHz VBW). The final highest RF signal levels and frequencies were record.

- ***Broad-band ac Powerline conducted emissions***:- If the EUT exhibits ac Powerline conducted emissions that exceed the limit with the instrument set to the quasi-peak mode, then measurements should be made in the average mode. If the amplitude measured in the quasi-peak mode is at least 6 dB higher than the amplitude measured in the average mode, the level measured in quasi peak mode may be reduced by 13 dB before comparing it to the limit.



+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.

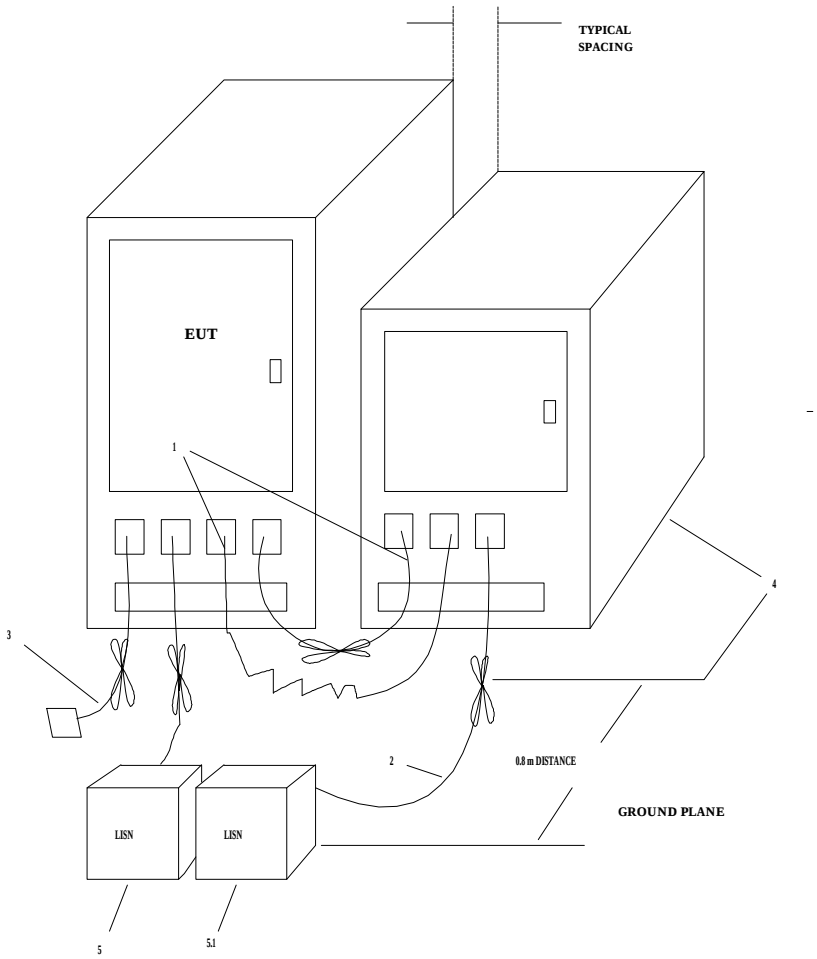
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the host.

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

7.1.3. Method of Measurements - Electric Field Radiated Disturbance

- The radiated emission measurements were performed at the UltraTech's 10 or 30 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. 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 3.2 of the 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:

  Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

  Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step3: 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.

  Step4: 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.

Step5: 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.

Step6: 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.

Step7: 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:

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

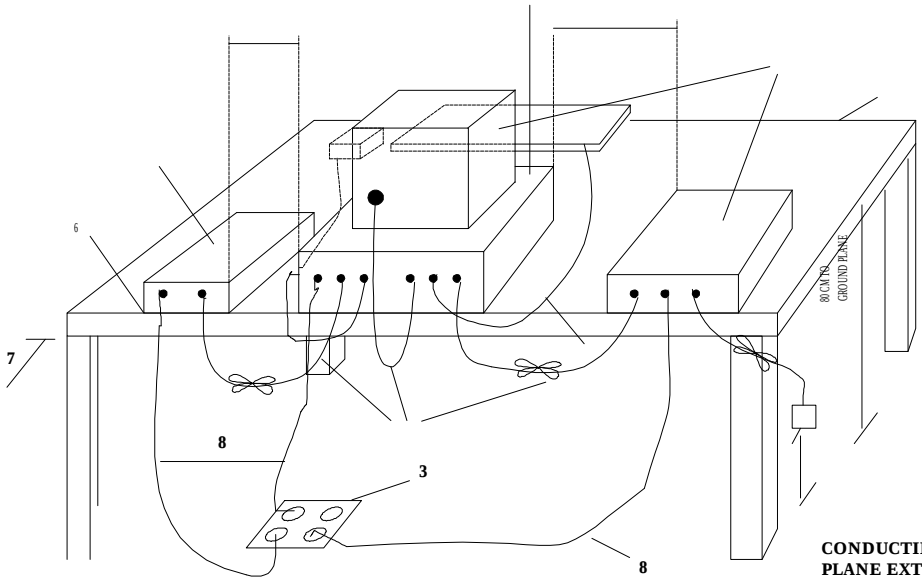
Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV 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 dBuV/m.

Field Level = $10^{(38/20)}$ = 79.43 uV/m.

NOTE: The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 20 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.



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.

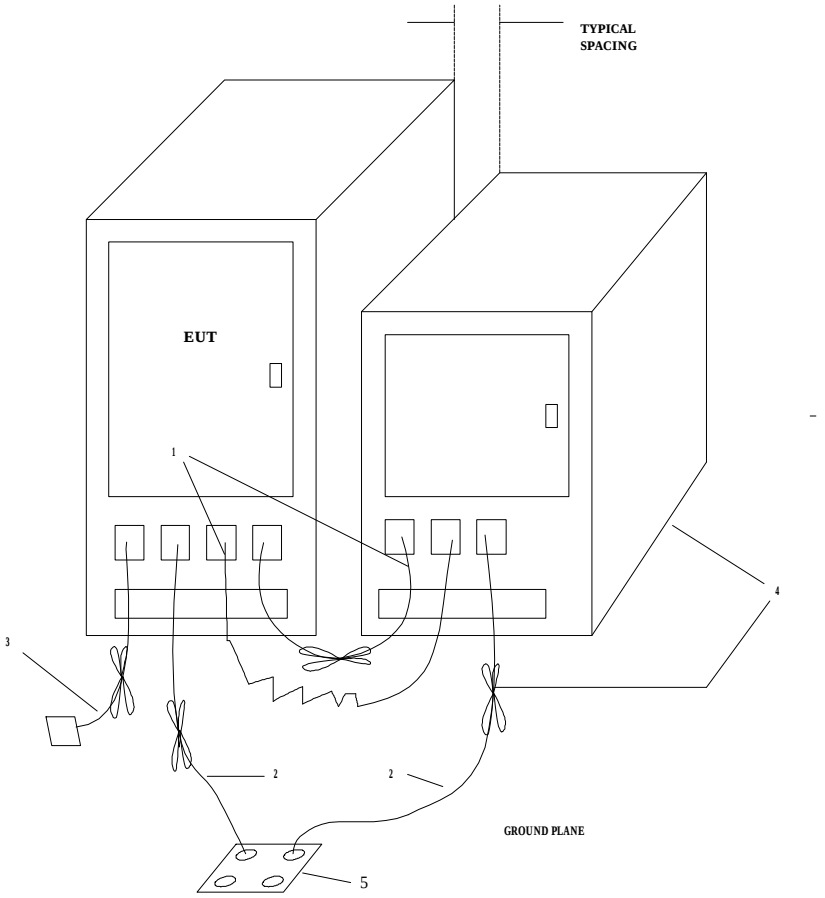
5. Non-EUT components of EUT system being tested.

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 8. FCC FORM 731, APPLICANT'S LETTERS & STATEMENT

8.1. FCC FORM 731

8.2. APPLICANT'S AUTHORIZATION TO APPOINT ULTRATECH ENGINEERING LABS INC. TO ACT AS AN AGENT

8.3. LETTER REQUEST FOR FCC CONFIDENTIALITY FILING

8.4. DESCRIPTION OF THE FREQUENCY HOPPING METHOD

8.5. OEM RADIO BOM

8.6. BLOCK DIAGRAM OF PROPRIETARY MMCX ANTENNA CONNECTOR

EXHIBIT 9. FCC ID LABEL & SKETCH OF LABEL LOCATION

EXHIBIT 10. "FCC INFORMATION TO USER"

Please refer to AeroComm PKLR2400 Radio user's manual.

EXHIBIT 11. PHOTOGRAPHS OF TEST SETUP

EXHIBIT 12. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

EXHIBIT 13. SYSTEM BLOCK DIAGRAM(S) & SCHEMATIC DIAGRAMS

EXHIBIT 14. USER'S MANUAL

EXHIBIT 15. TEST RESULTS PLOTS

EXHIBIT 15A. 20 dB BANDWITH AND AVERAGE TIME OF OCCUPANCY

EXHIBIT 15B. TRANSMITTER CONDUCTED EMISSIONS

EXHIBIT 15C. TRANSMITTER RADIATED EMISSIONS