UltraTech
Group of Labs

31040/SIT

C-1376

46390-2049

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00-034

SL2-IN-E-1119R

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Website: www.ultratech-labs.com
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Oct. 23, 2003

TIMCO ENGINEERING INC.
849 NW State Road 45
Newberry, Florida 32669
USA

Subject: **Type Acceptance Application under FCC 47 CFR, Parts 2 and 90 (Subpart I) - Licensed Non-Broadcast Radio Transmitter Operating in the 2450-2483.52 MHz Band**

Applicant: **Vostek Electronics**
Product: **Audio/Video Transmitter**
Model: **MX3000**
FCC ID: **OGR-MX3000**

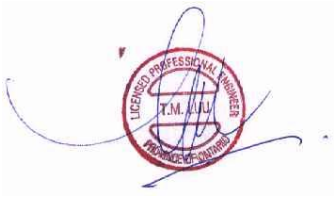
Dear Sir/Madam,

As appointed agent for **Vostek Electronics**, we would like to submit the application to Federal Communications Commission for certification of the above product. Please review all files uploaded to TIMCO website.

If you have any queries, please do not hesitate to contact us by our TOLL FREE number:

OUR TELEPHONE NO.: 1-877-747-6381

Yours truly,



Tri Minh Luu, P. Eng.,
V.P., Engineering

TML/DH

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Oct. 23, 2003

Vostek Electronics
P.O. BOx 60043
1032 Pape Ave.
Toronto, Ontario
Canada M4K 3Z3

Attn.: **Vasco Bjelica**

Subject: **Certification Testing in accordance with FCC 47 CFR, Parts 2 and 90 (Subpart I) - Licensed Non-Broadcast Radio Transmitter Operating in the 2450-2483.52 MHz Band**

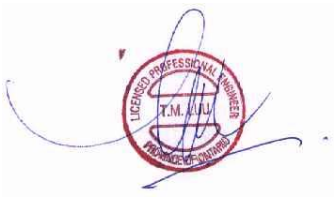
Product: **Audio/Video Transmitter**
Model: **1000**

Dear Mr. Bjelica,

The product sample has been tested in accordance with **FCC 47 CFR, Parts 2 and 90 (Subpart I) - Licensed Non-Broadcast Radio Transmitter Operating in the 2450-2483.52 MHz Band** , and the results and observation were recorded in the engineering report, Our File No.: VOS-09FCC90

Enclosed you will find copy of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,



Tri Minh Luu, P.Eng
Vice President - Engineering

Encl.

ENGINEERING TEST REPORT

Audio/Video Transmitter
Model No.: MX3000
FCC ID: OGR-MX3000

Applicant:

Vostek Electronics
P.O BOX 60043
1032 Pape Ave.
Toronto, Ontario
M4K 3Z3

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, PARTS 2 and 90 (Subpart I)

UltraTech's File No.: VOS-09FCC90

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: Oct. 23, 2003	
Report Prepared by: Tri Luu Issued Date: Oct. 23, 2003	Tested by: Hung Trinh, EMI/RFI Technician Test Dates: Oct. 20 - 22, 2003

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

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EXHIBIT 1. SUBMITTAL CHECK LIST

Annex Number	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	▪ Exhibit 1: Submittal check lists ▪ Exhibit 2: Introduction ▪ Exhibit 3: Performance Assessment ▪ Exhibit 4: EUT Operation and Configuration during Tests ▪ Exhibit 5: Summary of test Results ▪ Exhibit 6: Measurement Data ▪ Exhibit 7: Measurement Uncertainty ▪ Exhibit 8: Measurement Methods	OK
1	Test Setup Photos	Radiated Emissions Test Setup Photos	OK
2	External EUT Photos	External EUT Photos	OK
3	Internal EUT Photos	Internal EUT Photos	OK
4	Cover Letters	▪ Letter from Ultratech for Certification Request ▪ Letter from the Applicant to appoint Ultratech to act as an agent ▪ Letter from the Applicant to request for Confidentiality Filing	OK
5	Attestation Statements	--	--
6	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
7	Block Diagrams	CamLite Block Diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	▪ FM Transmitter Module BOM ▪ Audio Modulator - Revision B ▪ Camlite Power Amplifier Rev CO4	OK
10	Operational Description	Technical Description	OK
11	RF Exposure Info	See SAR Test Report	OK
12	Users Manual	CamLite Video/Audio System Operating Instructions	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Telecommunication – 47 Code of Federal Regulations (CFR) Parts 2 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 2450-2483.52 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.

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

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2002	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	1999	Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Vostek Electronics
Address:	P.O BOX 60043 1032 Pape Ave. Toronto, Ontario M4K 3Z3
Contact Person:	Mr. Vasco Bjelica Phone: 416-423-0882 Fax.: 416-423-0882 Email Address: vostek@globility.com

MANUFACTURER	
Name:	Vostek Electronics
Address:	P.O BOX 60043 1032 Pape Ave. Toronto, Ontario M4K 3Z3
Contact Person:	Mr. Vasco Bjelica Phone: 416-423-0882 Fax.: 416-423-0882 Email Address: vostek@globility.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

Brand Name:	Vostek Electronics
Product Name:	Audio/Video Transmitter
Model Name or Number:	MX3000
Serial Number:	Test Sample
Type of Equipment:	Licensed Non-Broadcast Radio Communication Equipment
External Power Supply:	N/A
Transmitting Antenna Type:	Integral
Primary User Functions of EUT:	Transmit audio and video information

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile & Base
Intended Operating Environment:	Residential, Commercial & Industrial
Power Supply Requirement:	9 Volts battery
RF Output Power Rating:	0.0398 Watts
Operating Frequency Range:	2452 – 2481 MHz
Number of Channel:	2 channels (2452 MHz and 2481 MHz)
RF Output Impedance:	50 Ohm
*** Occupied Bandwidth (99%):** *** 26 dB Bandwidth:**	2.45 MHz 12.6 MHz
Frequency Deviation:	Video: 6 MHz maximum Audio: 25 kHz
Emission Designation:	20M5FXW
Antenna Connector Type:	Antenna Gain Limit: 14 dBi

M= 4.25 MHz, D = 6 MHz maximum, K=1
Necessary Bandwidth (NB): NB = 2M + 2DK = 2x4.25 + 2x6 MHz = 20.5 MHz

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21^{o}C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	9 Volts battery

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with FM, NTSC video with 6 MHz aural sub-carrier.
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the integral printed dipole antenna.

Transmitter Test Signals	
Frequency Band(s): ▪ 2452 – 2481 MHz	Near lowest & near highest frequencies in each frequency band(s) that the transmitter covers: ▪ 2452 & 2481 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): 0.0398 W, ERP ▪ Normal Test Modulation: FM, NTSC video with 6MHz aural sub-carrier ▪ Modulating Signal Source: Internal	

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

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

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 site 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: August 10, 2002.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC 47 CFR Section(s)	Test Requirements	Applicability (Yes/No)
90.205 & 2.1046	RF Power Output	Yes
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Not applicable
90.210 & 2.1047(b)	Modulation Limiting	Not applicable
90.210 & 2.1049	Emission Limitation & Band-Edge Emissions	Yes
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Not applicable
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
90.213 & 2.1055	Frequency Stability	Yes
1.1307, 1.1310, 2.1091 & 2.1093	Radiofrequency Radiation Exposure Evaluation	Yes

Audio/Video Transmitter, Model No.: **MX3000,** by **Vostek Electronics** has also been tested and found to comply with FCC Part 15, Subpart B - Class B Digital Devices. The engineering test report has been documented and kept in file and it is available upon FCC request.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

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

6.1. TEST PROCEDURES

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

6.2. MEASUREMENT 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.

6.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4:1992 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

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

6.5. RF POWER OUTPUT [§§ 2.1046 & 90.205(l)]

6.5.1. Limits @ FCC 90.205(l)

Refer to FCC 47 CFR, Part 90, Subpart I, Section 90.205(l) for specification details. The maximum transmitter power is 5 Watts.

6.5.2. Test Arrangement and Method of Measurements

Refer to section 8.2 of this test report for test arrangement and measurement method.

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz – 40 GHz
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz
Synthesize Sweeper	Hewlett Packard	83752B	3610A00457	0.01 – 20 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz

6.5.4. Test Data

Frequency (MHz)	RF Conducted Power (dBm)	Maximum Antenna Gain (dBi)	ERP (dBm)
2452	16.1	14.0	28.0
2481	15.9	14.0	27.8

6.6. RF EXPOSURE REQUIRMENTS @ 1.1310 & 2.1091

6.6.1. Limits

- 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				
1500-100,000	**...**	**...**	**5**	**6**
(B) Limits for General Population/Uncontrolled Exposure				
1500-100,000	**...**	**...**	**1.0**	**30**

F = Frequency in MHz

6.6.2. Method of Measurements

Refer to FCC @ 1.1310, 2.1091 and Public Notice DA 00-705 (March 30, 2000)

- Spread spectrum transmitters operating under section 15.247 are categorically from routine environmental evaluation to demonstrating RF exposure compliance with respect to MPE and/or SAR limits. These devices are not exempted from compliance (As indicated in Section 15.247(b)(4), these transmitters are required to operate in a manner that ensures that exposure to public users and nearby persons) does not exceed the Commission's RF exposure guidelines (see Section 1.1307 and 2.1093). Unless a device operates at substantially low power levels, with a low gain antenna(s), supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its antenna(s) in order to determine compliance with the RF exposure guidelines.

- In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
(4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

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

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

- For portable transmitters (see Section 2.1093), or devices designed to operate next to a person's body, compliance is determined with respect to the SAR limit (define in the body tissues) for near-field exposure conditions. If the maximum average output power, operating condition configurations and exposure conditions are comparable to those of existing cellular and PCS phones., an SAR evaluation may be required in order to determine if such a device complies with SAR limit. When SAR evaluation data is not available, and the additional supporting information cannot assure compliance, the Commission may request that a SAR evaluation be performed, as provided for in Section 1.1307(d)

6.6.3. Test Data

Antenna Gain Limit specified by Manufacturer: 14 dBi

Frequency (MHz)	Measured RF Conducted (dBm)	Calculated EIRP (dBm)	Calculated Antenna Separation Distance (cm)
2452	16.1	30.1	9.0

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

$S = 1.0\ mW/cm^2$

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: 9 cm	Manufacturer' instruction for separation distance between antenna and persons required: 20 cm. Please refer to the Users/ Manual and FCC RF Exposure folder
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Please refer to the Users/ Manual and FCC RF Exposure folder

6.7. BAND-EDGE EMISSION [§ 2.1049, 90.209 & 90.210]

6.7.1. Limits @ FCC 90.209 & 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	FCC Applicable Mask
2450-2483.52	No prescribed mask for this frequency band. The attenuation of 43 + 10log(P) dB outside the permitted 2450-2483.52 MHz band will be used for compliance evaluation.

* P is the power in watts

6.7.2. Test Arrangement and Method of Measurements

ANSI C63-4:1992 for radiated emissions measurements and section 8.2.1 of this test report for details of measurement method.

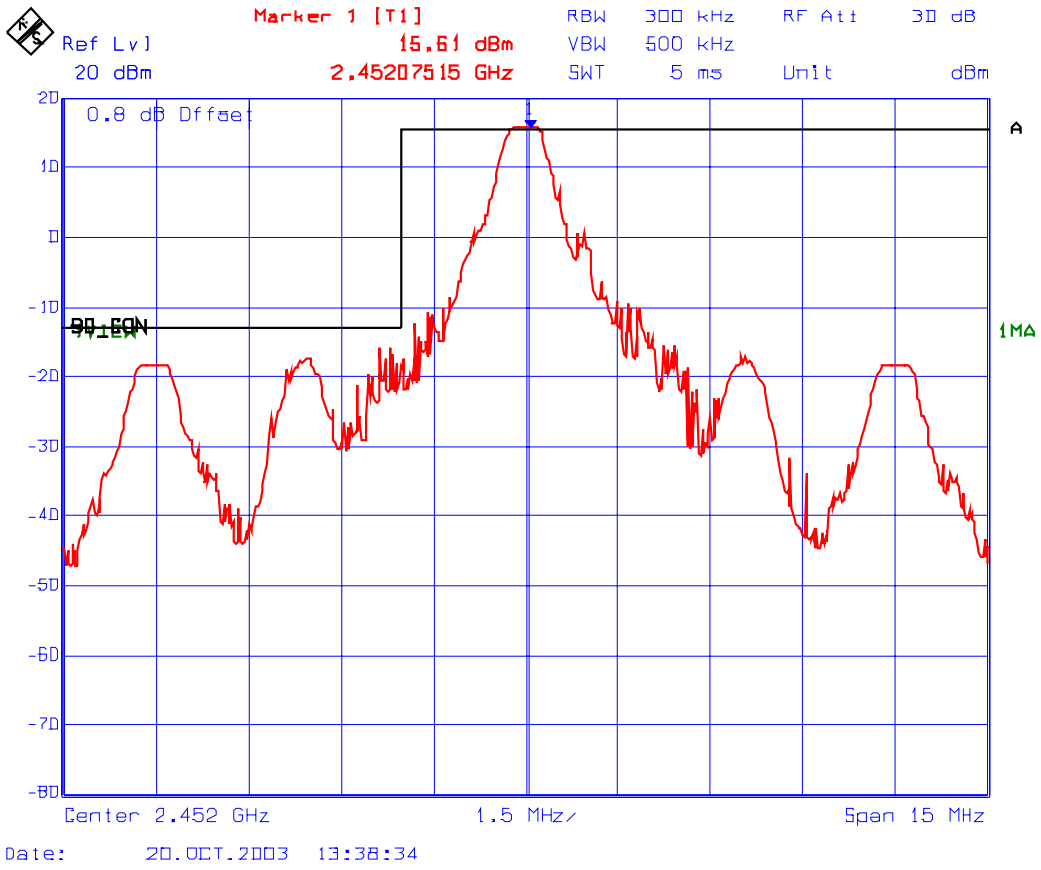
6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz – 40 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz, 30 dB nominal
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

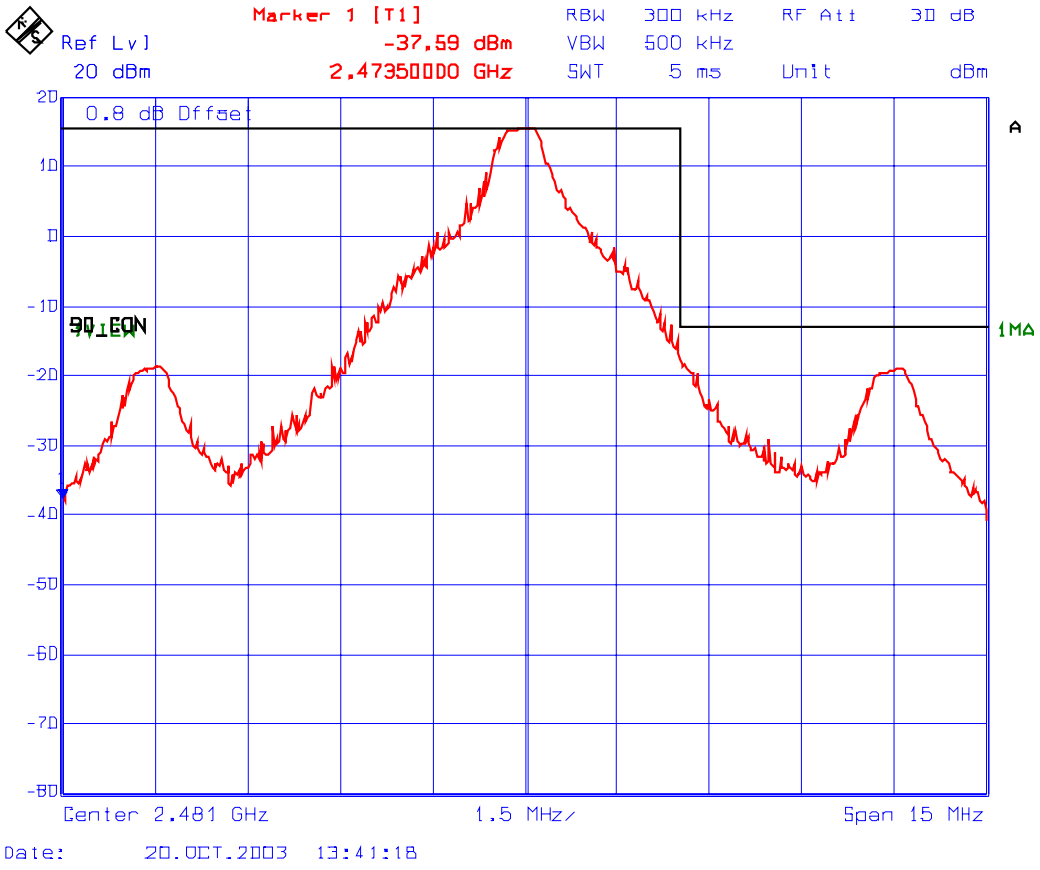
6.7.4. Test Data

Conform. See Plots below for measurement details.

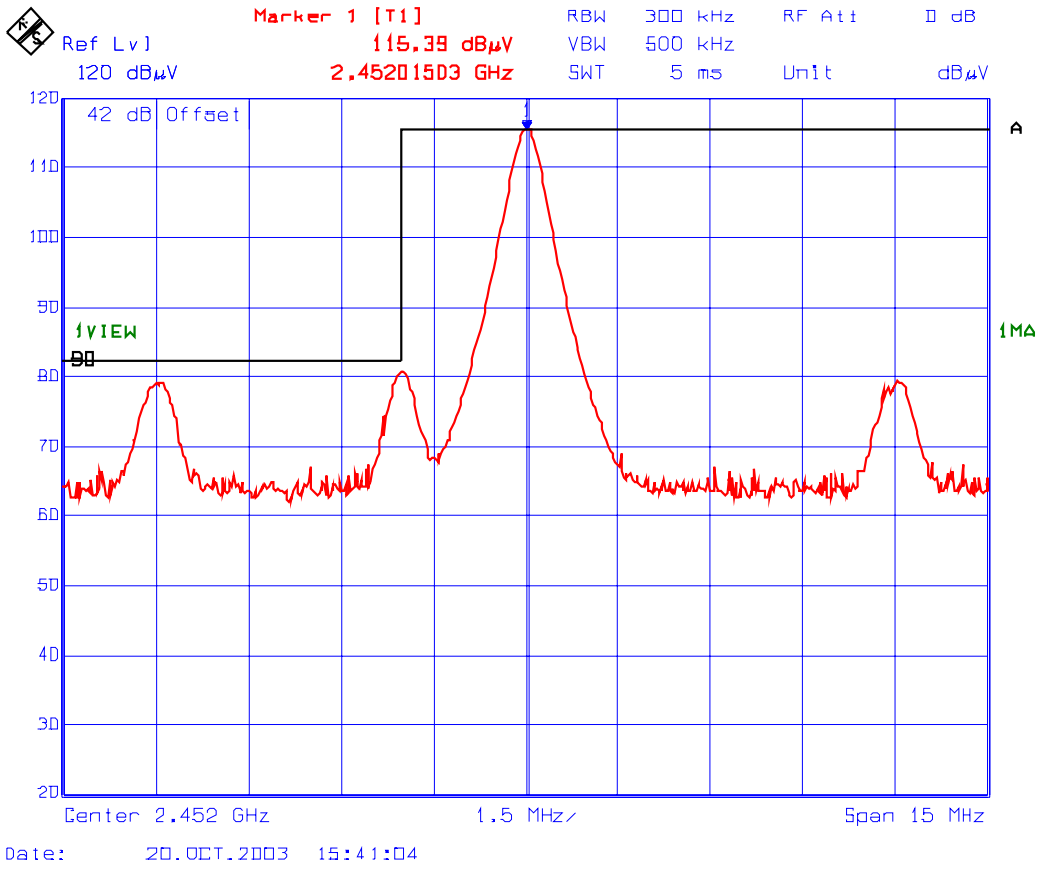
Plot #1: Lower Band-Edge Conducted Emissions
Frequency: 2452 MHz



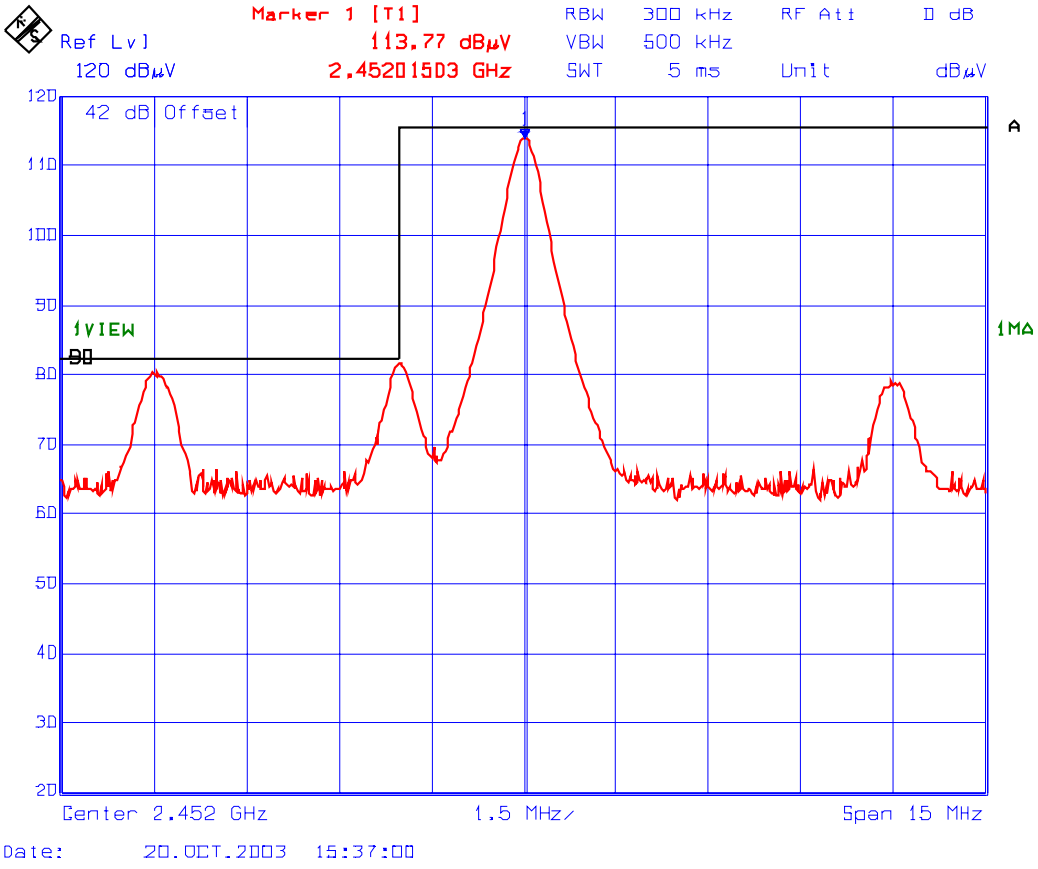
Plot # 2: Upper Band-Edge Conducted Emissions
Frequency: 2481 MHz



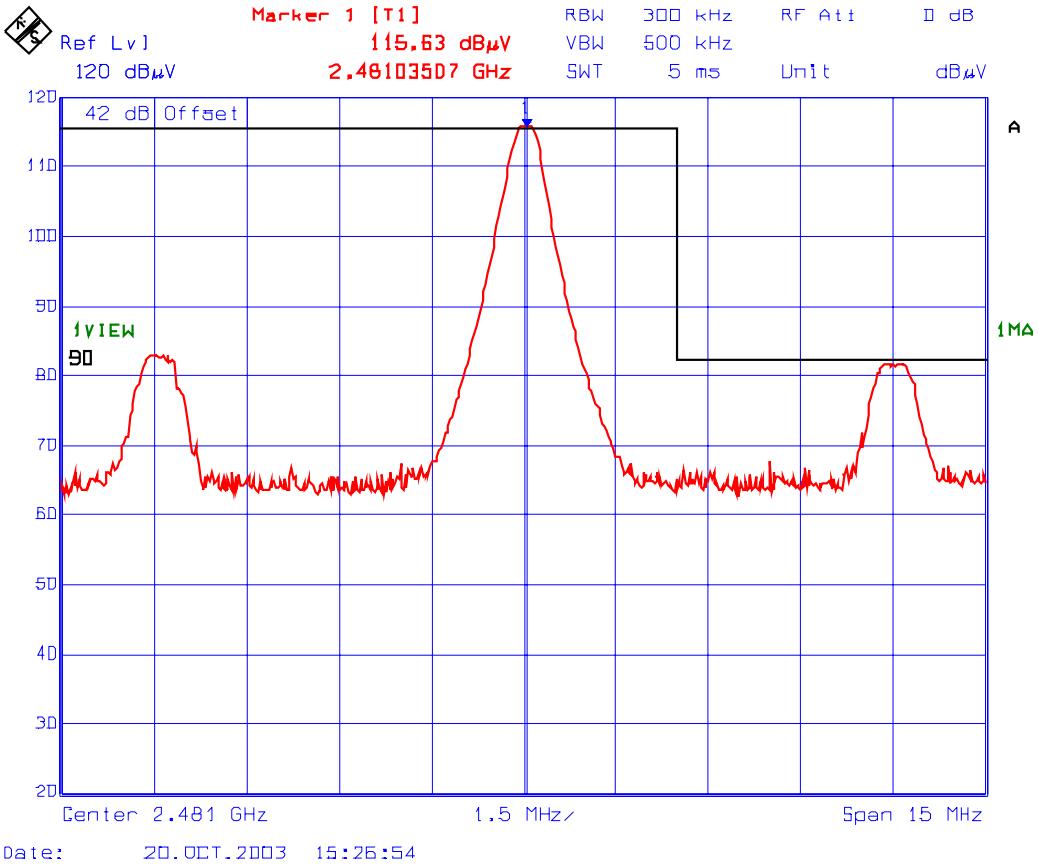
Plot #3: Lower Band-Edge Radiated Emissions @ 3 meters, Vertical Polarization Frequency: 2452 MHz



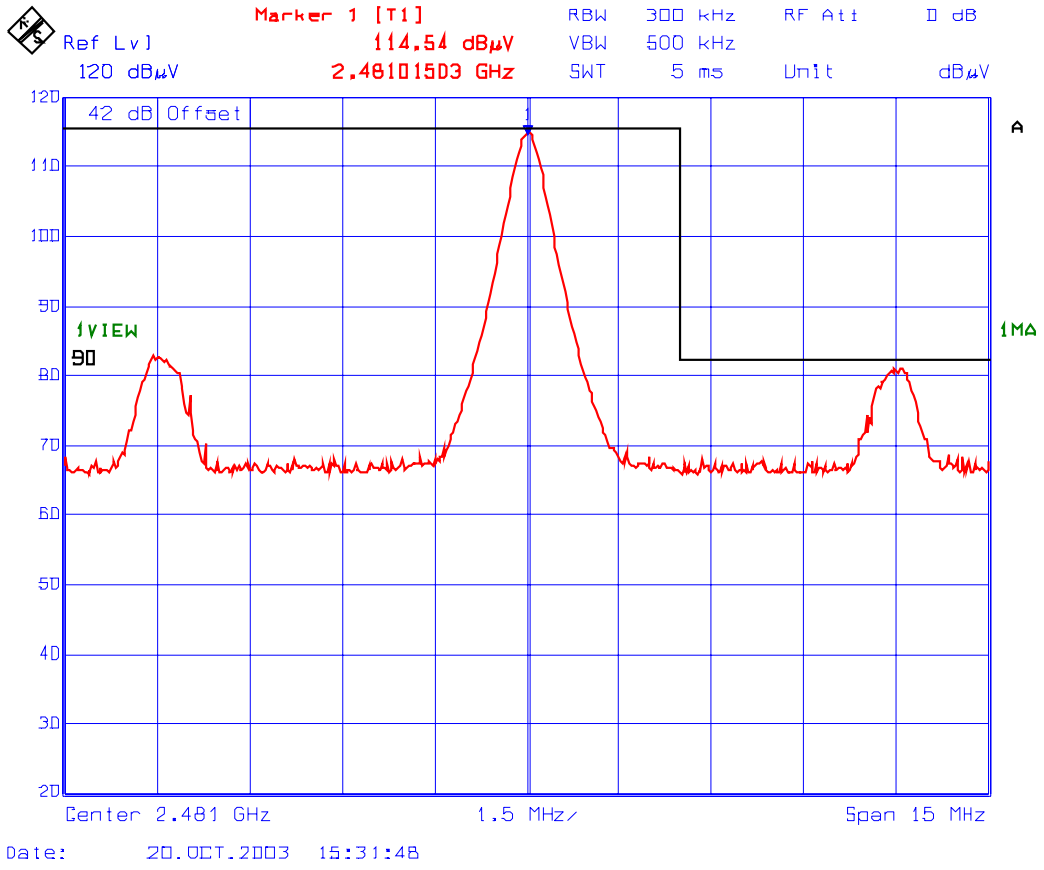
Plot #4: Lower Band-Edge Radiated Emissions @ 3 meters, Horizontal Polarization Frequency: 2452 MHz



Plot #5: Upper Band-Edge Radiated Emissions @ 3 meters, Vertical Polarization Frequency: 2481 MHz



Plot #6: Upper Band-Edge Radiated Emissions @ 3 meters, Horizontal Polarization Frequency: 2481 MHz



6.8. HARMONIC/SPURIOUS CONDUCTED & RADIATED EMISISONS [§§ 2.1053 & 90.210]

6.8.1. Limits @ FCC 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Frequency Range	Attenuation Limit (dBc)
90.210	10 MHz or Lowest frequency of the radio to 10^{th} harmonic of the highest frequency of the radio	43+10*log(P in Watts)

6.8.2. Method of Measurements

The spurious/harmonic ERP measurements, using substitution method specified in Exhibit 8, section 8.2 of this report and its value in dBc is calculated as follows:

If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.

If the transmitter's antenna is non-integral and diverse, the lowest ERP of the carrier with 0 dBi antenna gain is used for calculation of the spurious/harmonic emissions in dBc:

Lowest ERP of the carrier = EIRP – 2.15 dB = Pc + G - 2.15 dB = xxx dBm (conducted) + 0 dBi – 2.15 dB
Spurious /harmonic emissions levels expressed in dBc (dB below carrier) are as follows:

ERP of spurious/harmonic (dBc) = ERP of carrier (dBm) – ERP of spurious/harmonic emission (dBm)

6.8.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz – 40 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz, 30 dB nominal
Biconilog Antenna	EMCO	3142	10005	30 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz

6.8.4. Test Data

6.8.4.1. Harmonic/Spurious Conducted Emissions

- **Channel #1 (2452 MHz)**

Fundamental Frequency: 2452 MHz
RF Output Power: 16.1 dBm (Conducted)
Limit: -29.1 dBc
Modulation: FM, NTSC video with 6MHz aural sub-carrier

FREQUENCY (MHz)	TRANSMITTER ANTENNA CONDUCTED EMISSIONS (dBm)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
4904.00	-36.1	-52.2	-29.1	-23.1	PASS
7356.00	-34.9	-51.0	-29.1	-21.9	PASS
9808.00	-39.3	-55.4	-29.1	-26.3	PASS
12260.00	-54.3	-70.4	-29.1	-41.3	PASS

- The emissions were scanned from 10 MHz to 25 GHz and all emissions within 50 dB below the limits were recorded.
- Refer to Plots 7 & 8 for measurement details

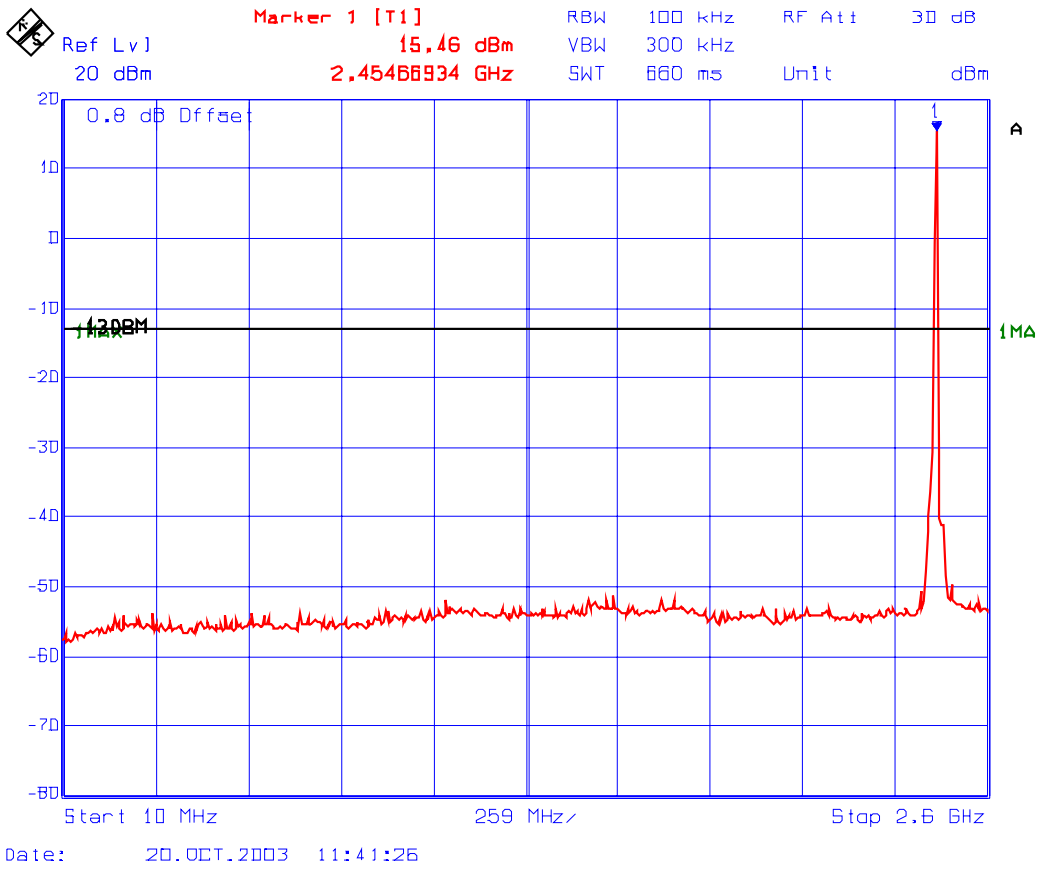
- **Channel # 2 (2481 MHz)**

Fundamental Frequency: 2481 MHz
RF Output Power: 15.9 dBm (Conducted) (ERP)
Limit: -28.9 dBc
Modulation: FM, NTSC video with 6MHz aural sub-carrier

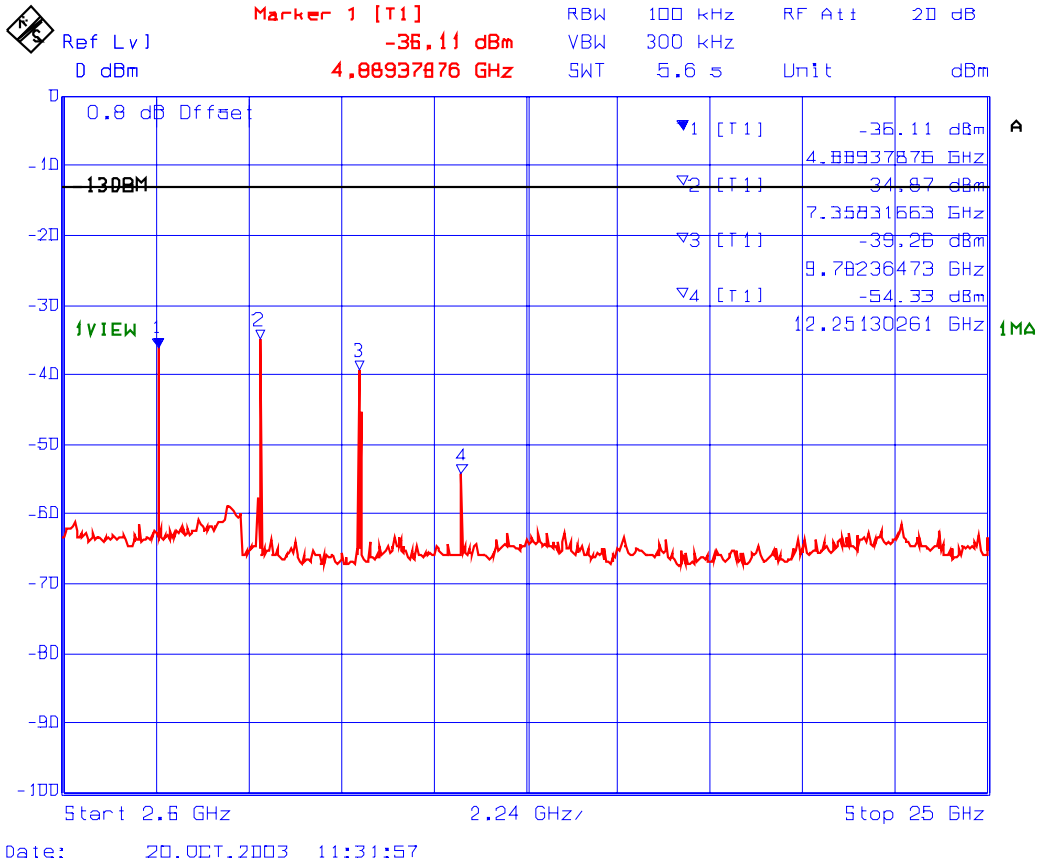
FREQUENCY (MHz)	TRANSMITTER ANTENNA CONDUCTED EMISSIONS (dBm)	(dBc)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
4962.00	-52.7	-68.6	-28.9	-39.7	PASS
7443.00	-38.8	-54.7	-28.9	-25.8	PASS
9924.00	-46.9	-62.8	-28.9	-33.9	PASS
12405.00	-61.0	-76.9	-28.9	-48.0	PASS

- The emissions were scanned from 10 MHz to 25 GHz and all emissions within 50 dB below the limits were recorded.
- Refer to Plots 9 & 10 for measurement details

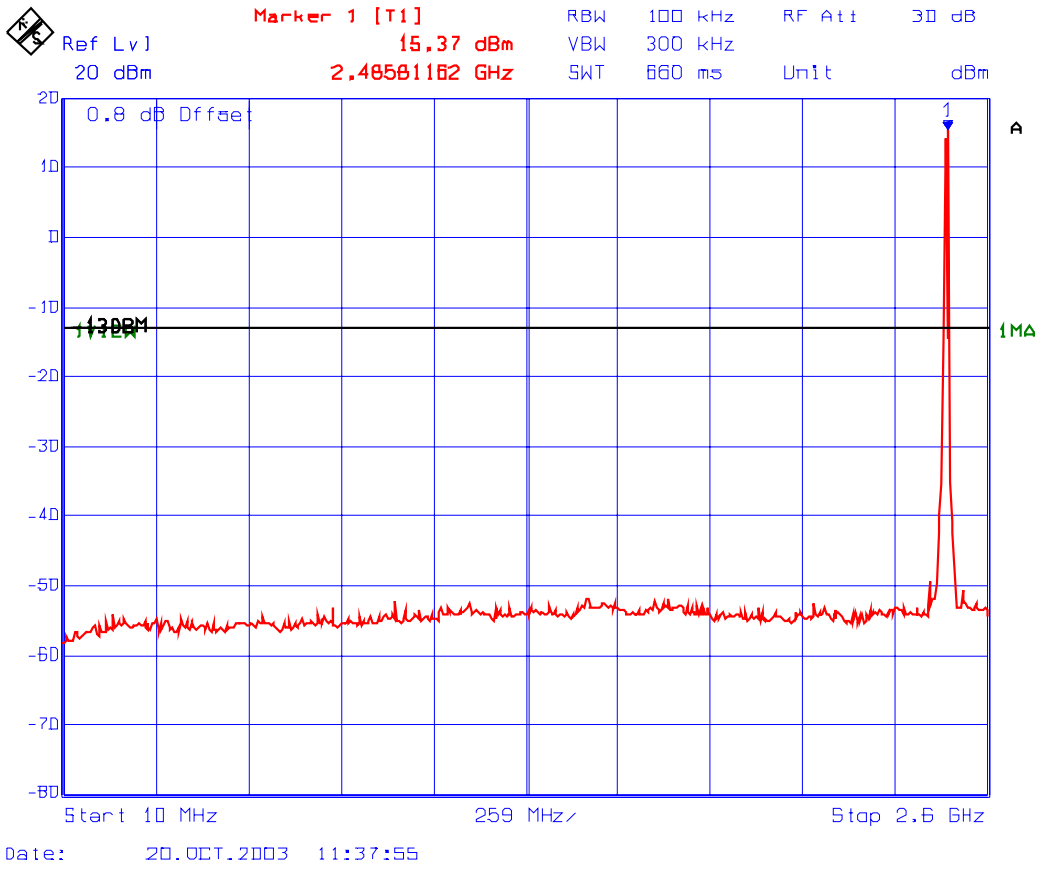
Plot #7: Transmitter Spurious Emissions Conducted at Antenna terminal Frequency: 2452 MHz



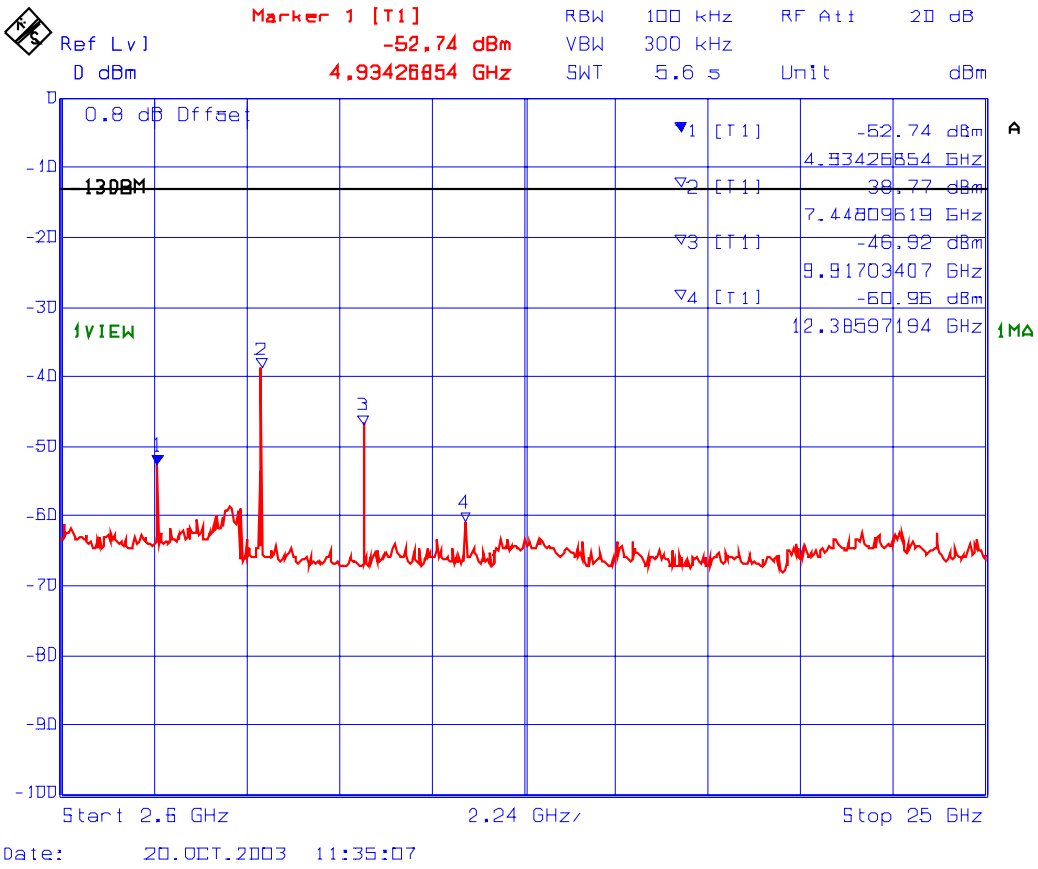
Plot #8: Transmitter Spurious Emissions Conducted at Antenna terminal Frequency: 2452 MHz



Plot #9: Transmitter Spurious Emissions Conducted at Antenna terminal Frequency: 2481 MHz



Plot #10: Transmitter Spurious Emissions Conducted at Antenna terminal Frequency: 2481 MHz



6.8.4.2. Harmonic/Spurious Radiated Emissions

- **Channel #1 (2452 MHz)**

Fundamental Frequency: 2452 MHz
RF Output Power: 16.1 dBm (Conducted)
Limit: -29.1 dBc
Modulation: FM, NTSC video with 6MHz aural sub-carrier

Frequency (MHz)	E-Field @3m (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method (dBm)	(dBc)	Limit (dBc)	Margin (dB)	Pass / Fail
4904.00	70.30	Peak	V	-32.78	-48.88	-29.1	-19.78	Pass
4904.00	71.42	Peak	H	-31.51	-47.61	-29.1	-18.51	Pass
7356.00	70.49	Peak	V	-32.65	-48.75	-29.1	-19.65	Pass
7356.00	70.68	Peak	H	-31.64	-47.74	-29.1	-18.64	Pass
9808.00	65.48	Peak	V	-38.75	-54.85	-29.1	-25.75	Pass
9808.00	65.72	Peak	H	-37.38	-53.48	-29.1	-24.38	Pass
12260.00	64.09	Peak	V	-39.04	-55.14	-29.1	-26.04	Pass
12260.00	64.57	Peak	H	-38.18	-54.28	-29.1	-25.18	Pass
14712.00	60.99	Peak	V	-45.3	-61.4	-29.1	-32.30	Pass
14712.00	63.57	Peak	H	-39.46	-55.56	-29.1	-26.46	Pass

The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the limits were recorded.

- **Channel # 2 (2481 MHz)**

Fundamental Frequency: 2481 MHz
RF Output Power: 15.9 dBm (Conducted) (ERP)
Limit: -28.9 dBc
Modulation: FM, NTSC video with 6MHz aural sub-carrier

Frequency (MHz)	E-Field @3m (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method (dBm)	(dBc)	Limit (dBc)	Margin (dB)	Pass / Fail
4962.0	71.8	Peak	V	-30.9	-46.8	-28.9	-17.9	Pass
4962.0	72.9	Peak	H	-29.7	-45.6	-28.9	-16.7	Pass
7443.0	71.4	Peak	V	-32.6	-48.5	-28.9	-19.6	Pass
7443.0	70.0	Peak	H	-31.7	-47.6	-28.9	-18.7	Pass
9924.0	64.9	Peak	V	-38.1	-54.0	-28.9	-25.1	Pass
9924.0	64.8	Peak	H	-37.8	-53.7	-28.9	-24.8	Pass
12405.0	68.3	Peak	V	-36.1	-52.0	-28.9	-23.1	Pass
12405.0	62.2	Peak	H	-40.8	-56.7	-28.9	-27.8	Pass

The emissions were scanned from 10 MHz to 25 GHz and all emissions within 40 dB below the limits were recorded.

6.9. FREQUENCY STABILITY [§§ 2.1055 & 90.213]

6.9.1. Limits @ FCC 90.213

The frequency stability will be specified in the station authorization.

6.9.2. Method of Measurements

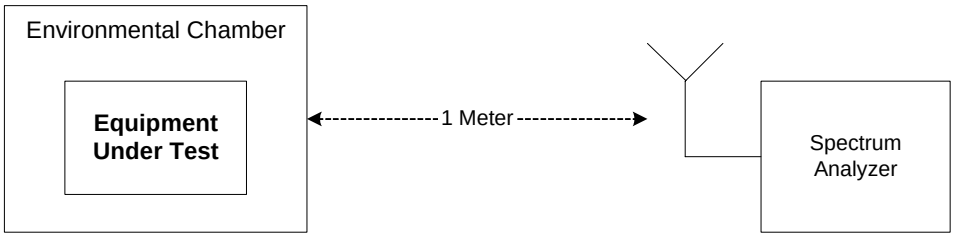
Refer to Exhibit 8, § 8.3 of this report for measurement details

The frequency stability will be specified in the station authorization. For the purpose of compliance, the carrier frequency stability will be checked for out-of-band emissions at room temperature (20^{o}C) and extreme temperatures (-30^{o}C and +50^{o}C).

6.9.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3182	110401382	9 kHz – 40 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40^{o} to +60^{o} C range

6.9.4. Test Arrangement



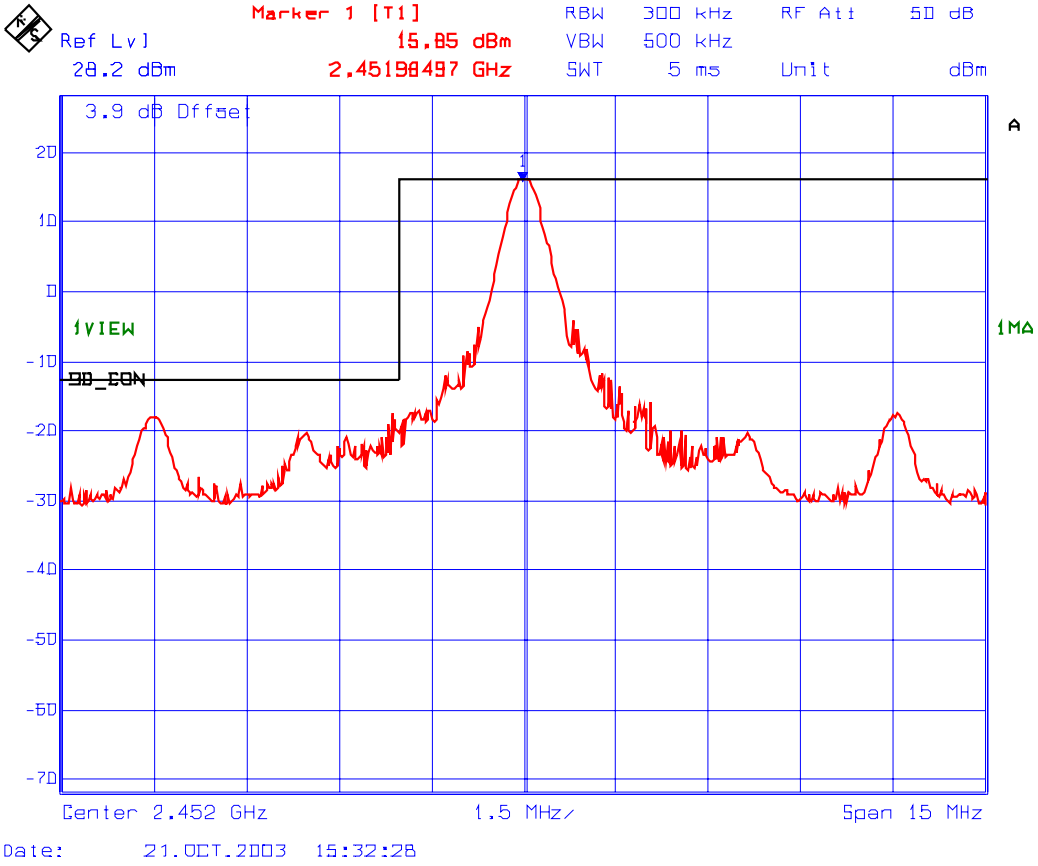
6.9.5. Test Data

Conforms. At room temperature (20°C) and extreme temperature (-30°C and +50°C) conditions, the carrier frequencies were found to remain within the FCC permitted 2450-2483.52 MHz band. See test data plots (# 11 to 16) for measurement details.

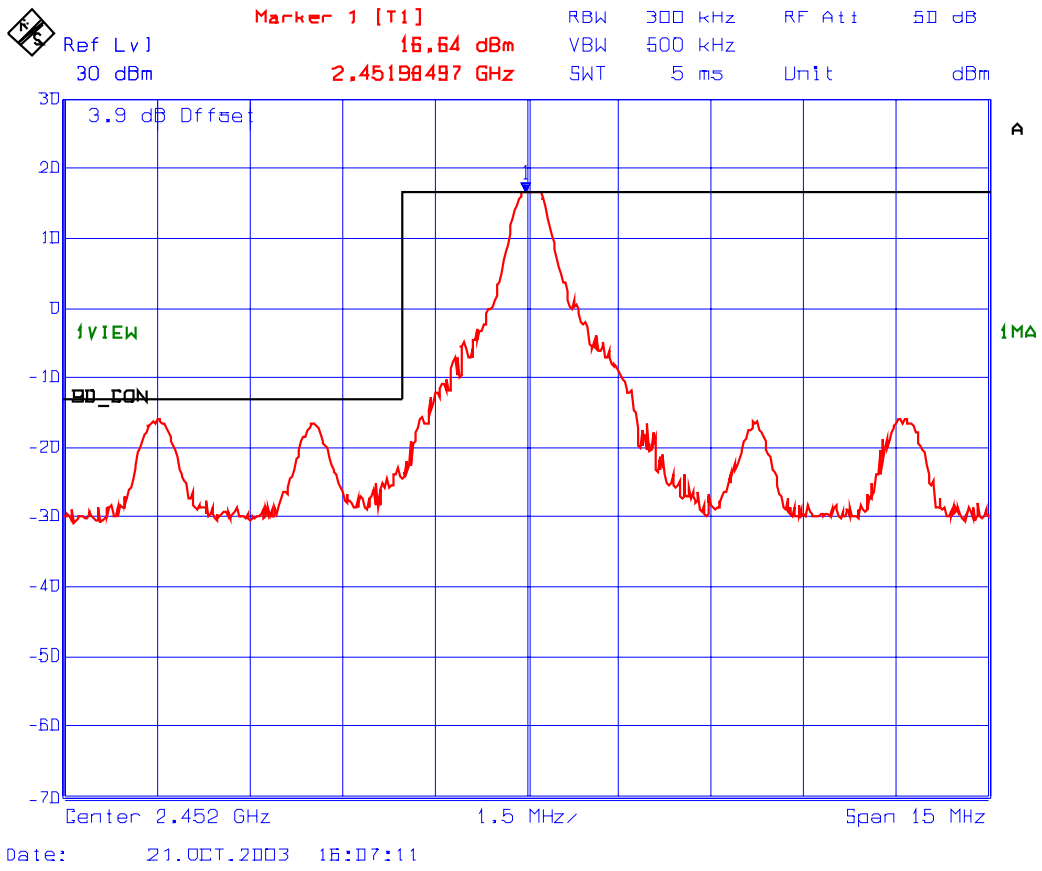
Lowest Frequency:	2452 MHz
Full Power Level:	16.1 dBm
Frequency Tolerance Limit:	The frequency stability will be specified in the station authorization
Max. Frequency Tolerance Measured:	+43 kHz or +17.5 ppm
Input Voltage Rating:	9 nominal (12 Vdc maximum)

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature	Supply Voltage (Nominal) 9 Volts	Supply Voltage (Level where the rf transmission start to cease) 5.5 Volts	Supply Voltage (maximum specified by manufacturer 12 Vdc) Volts
(°C)	Hz	Hz	Hz
-30	43,000	N/A	N/A
+20	500	-3,000	10,000
+50	11,000	N/A	N/A

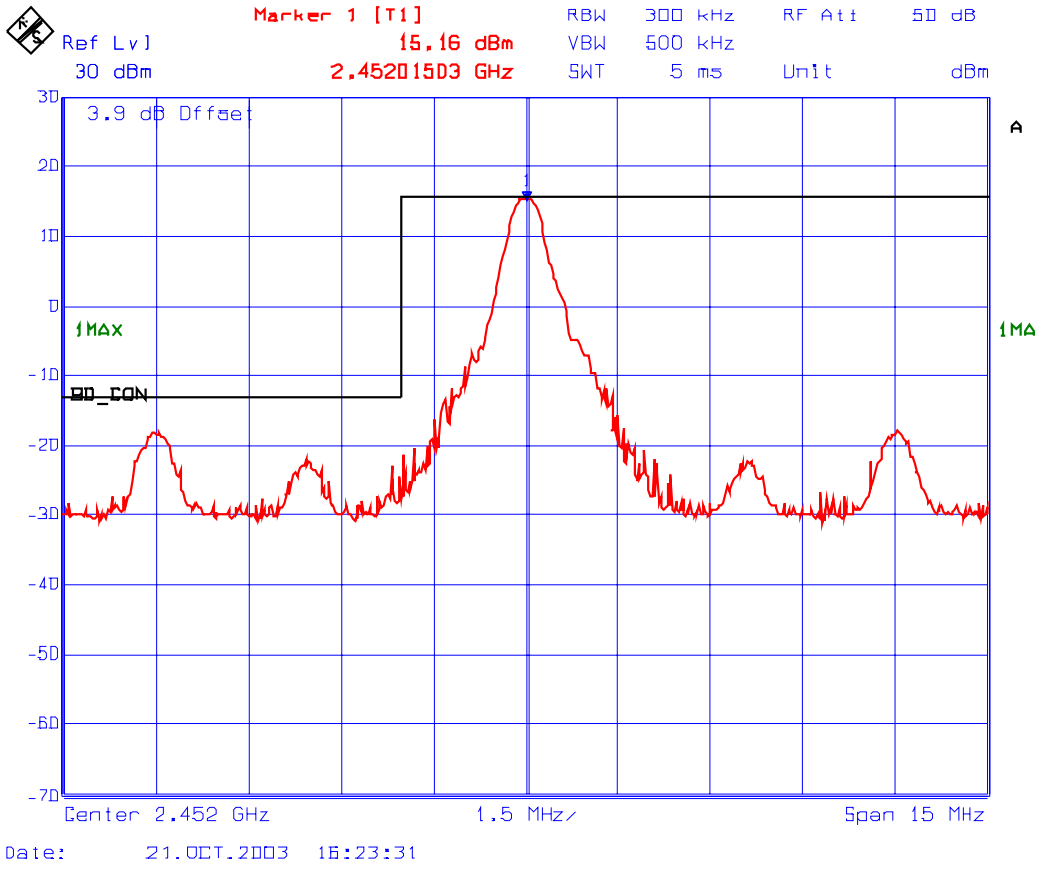
Plot # 11: Lower Band-Edge @ 20°C
Frequency: 2452 MHz



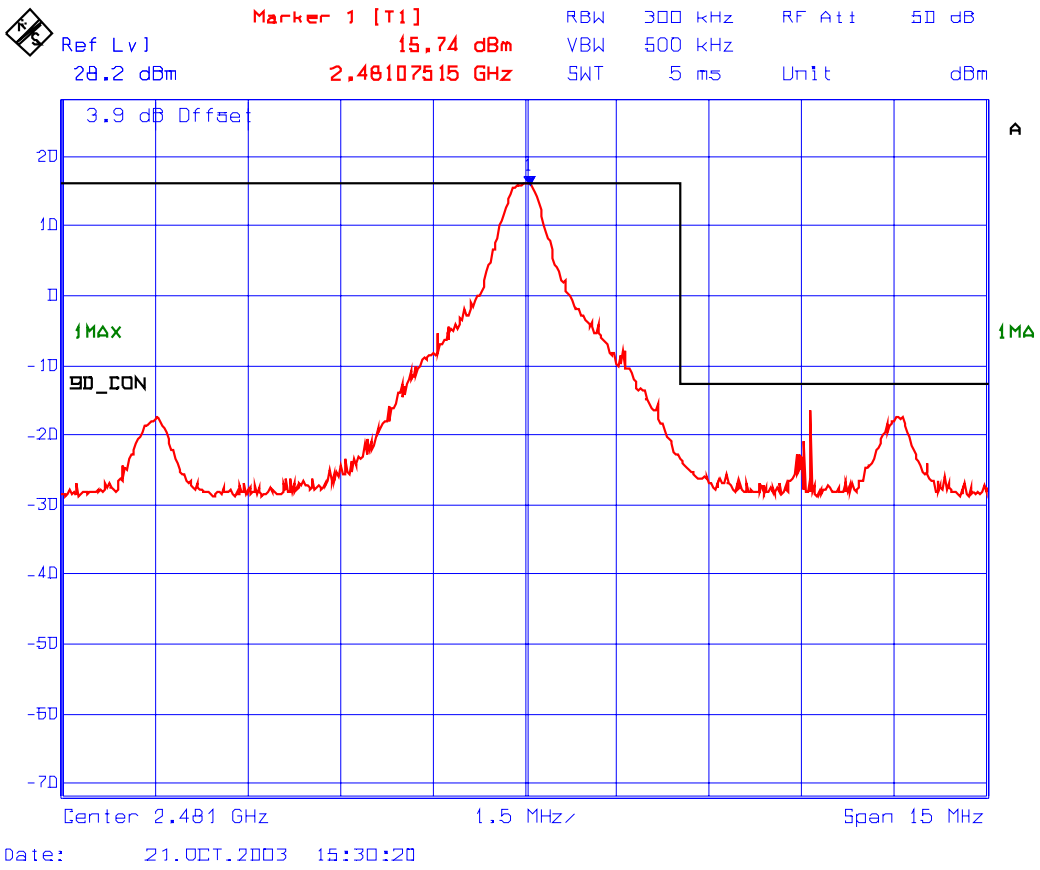
Plot # 12: Lower Band-Edge @ -30°C
Frequency: 2452 MHz



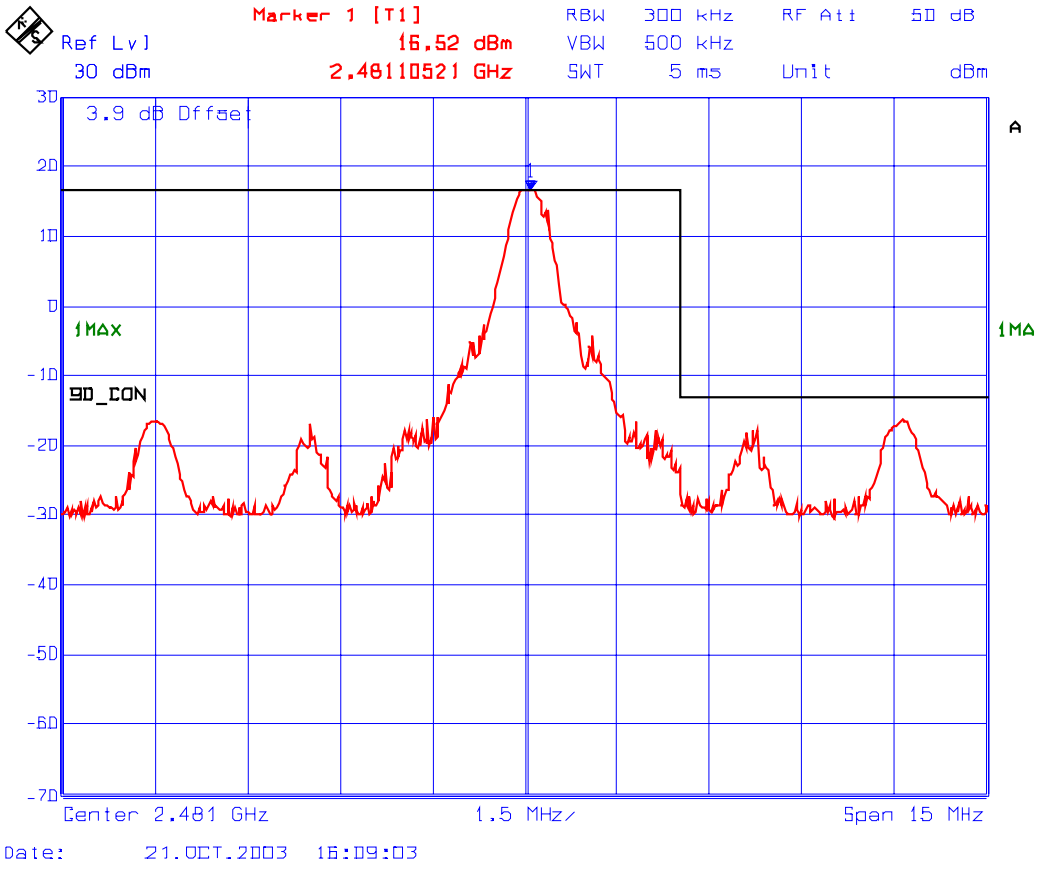
Plot # 13: Lower Band-Edge @ 50°C
Frequency: 2452 MHz



Plot #14: Upper Band-Edge @ 20°C
Frequency: 2481MHz



Plot # 15: Upper Band-Edge @ -30°C
Frequency: 2481MHz



Plot # 16: Upper Band-Edge @ 50°C
Frequency: 2481MHz

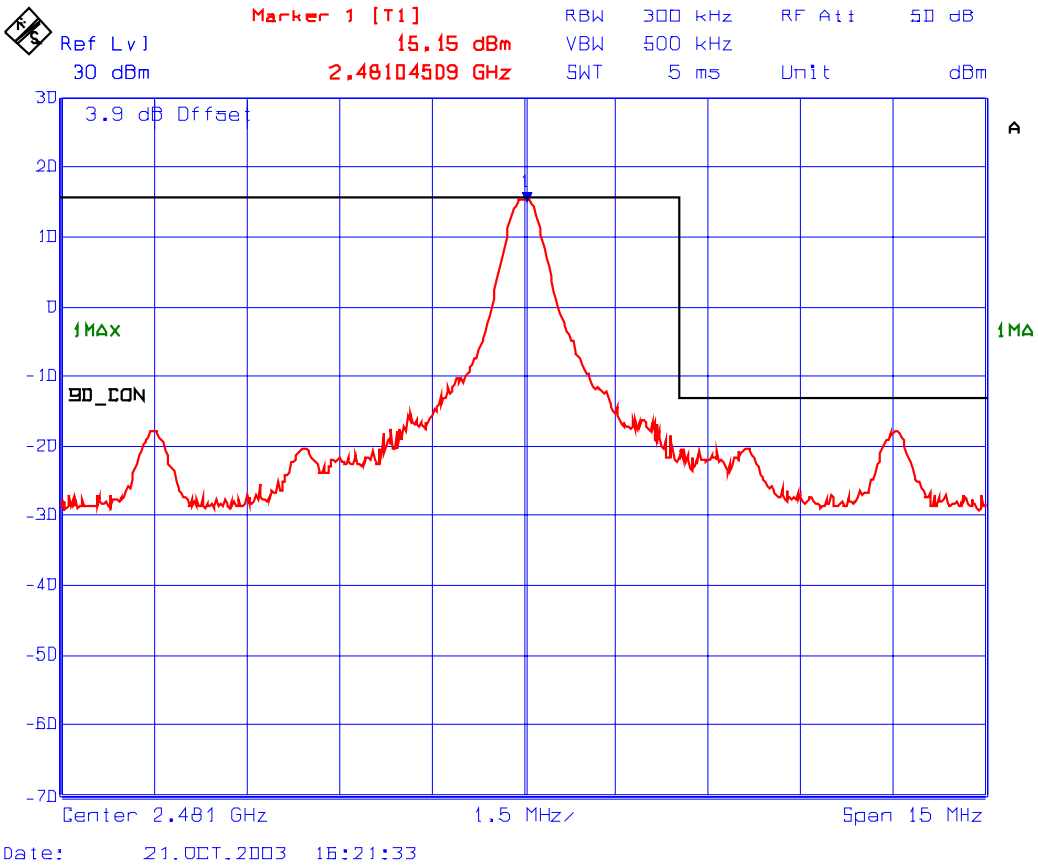


EXHIBIT 7. MEASUREMENT UNCERTAINTY

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

7.1. 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. CONDUCTED POWER MEASUREMENTS

The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
The following method of measurement shall apply to both conducted and radiated measurements.
The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal.

The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

Step 2: Calculation of Average EIRP (See Figure 1)

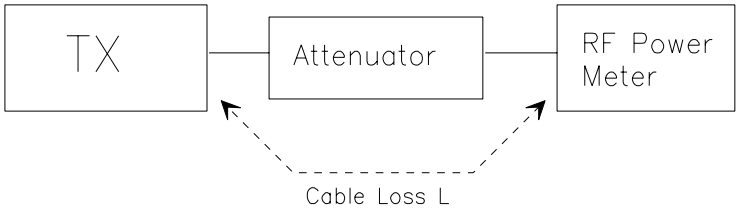
The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);

The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{X = 1 for continuous transmission => 10log(1/x) = 0 dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. Maximizing RF Emission Level (E-Field)

(a) The measurements were performed with full rf output power and modulation.
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
- Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
- E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver #1 and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver #1(for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	10 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
- Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
- E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculates the ERP/EIRP as follows:

$P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1$
$EIRP = P + G1 = P3 + L2 - L1 + A + G1$
$ERP = EIRP – 2.15\ dB$

Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where: P: Actual RF Power fed into the substitution antenna port after corrected.
P1: Power output from the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2.

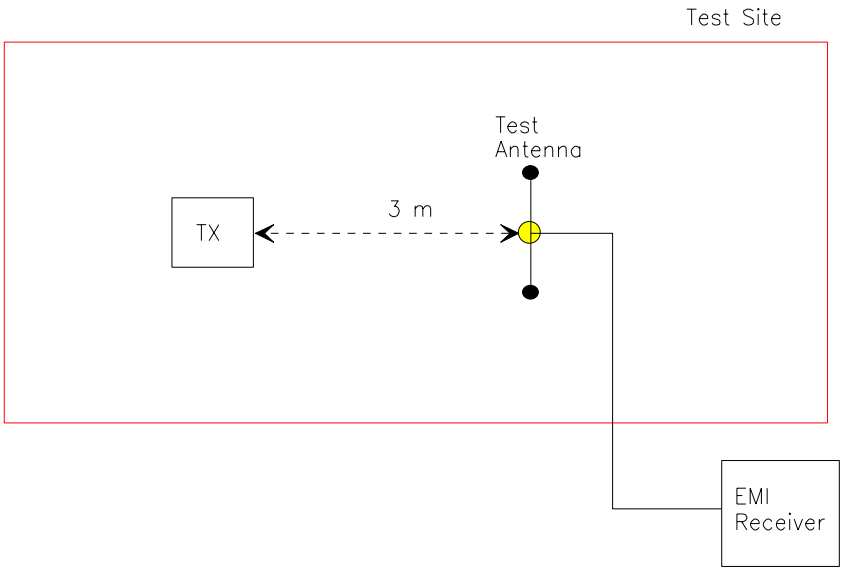
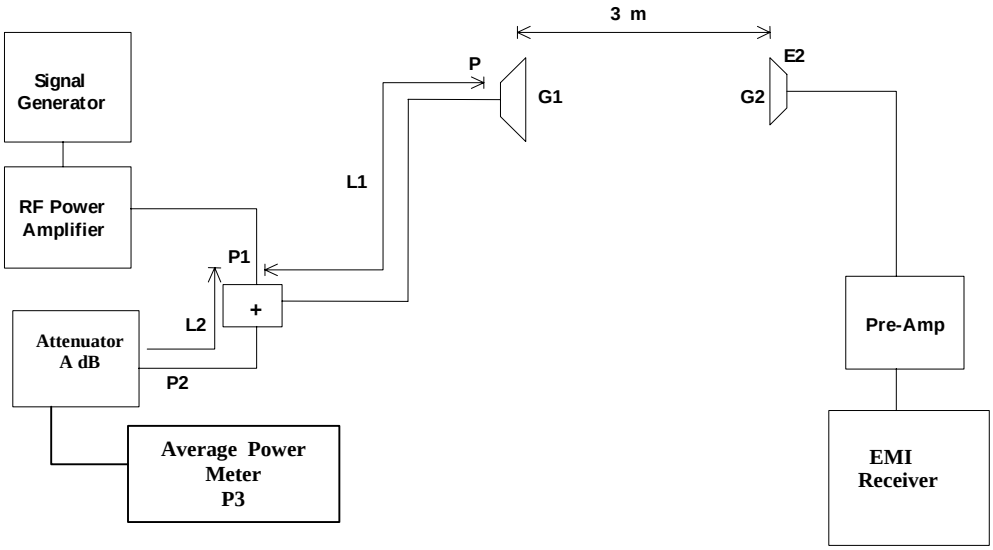


Figure 3.



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

8.3. FREQUENCY STABILITY

Refer to FCC @ 2.1055.

(a) The frequency stability shall be measured with variation of ambient temperature as follows: From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.

(b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.

(d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).