UltraTech
Group of Labs

FCC TCB & IC CB

Ultratech's Accreditations:

0685

FCC
91038

1309

Industry Canada
Industrie Canada
Approved Test Facility
46390-2049

NvLap Lab Code 200093-0

SL2-IN-E-1119R

Korea KCC-RRL
CA2049

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Oakville, Ontario,
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Email: vic@ultratech-labs.com

February 9, 2011

Icom Incorporated
2380 116 Avenue North East
Bellevue, Washington
USA, 98004

Attn.: **Mr. Masaaki Takahashi**

Subject: **Technical Acceptance Certificate (TAC) Application under INDUSTRY CANADA, RSS-182, Issue 4 - Maritime Radio Transmitters and Receivers, In 156.0-162.5 MHz Band**

Applicant: **Icom Incorporated**
Product: **Class B AIS Transponder**
Model: **MA-500TR**
IC: **202D-322800 B**
Equipment Designator: B

Dear Mr. Takahashi,

The product sample, as provided by you, has been tested and found to comply with **Industry Canada, RSS-182, Issue 4- Maritime Radio Transmitters and Receivers, in 156-162.5 MHz Band**

We, UltraTech Engineering Labs Inc., as appointed agent for **Icom Incorporated**, will prepare the application to Industry Canada (IC) for authorization of this equipment under Certification requirements of IC Rules.

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, B.A.Sc
Vice President - Engineering

Encl.

ENGINEERING TEST REPORT

Class B AIS Transponder
Model No.: MA-500TR
Equipment Designator: B

IC: 202D-322800 B

Applicant:

ICOM Canada Inc.
Glenwood Centre-150-6165 Hwy. 17
Delta, BC
Canada V4K 5B8

Tested in Accordance With

Industry Canada RSS-182, Issue 4
Maritime Radio Transmitters and Receivers in the Band 156-162.5 MHz

UltraTech's File No.: ICOM-235_RSS182

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: February 9, 2011	
Report Prepared by: Dharmajit Solanki Issued Date: February 9, 2011	Tested by: Wayne Wu, RF Technician Test Dates: May 31, 2010 – Feb 8, 2011

- *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.*

UltraTech

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FCC	VCCI	Industry Canada / Industrie Canada Approved Test Facility	NVLAP	BSMI	Korea KCC-RRL
91038	1309	46390-2049	NVLAP Lab Code 200093-0	SL2-IN-E-1119R	CA2049

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	Industry Canada RSS-182, Issue 4
Title:	Maritime Radio Transmitters and Receivers in the Band 156-162.5 MHz.
Purpose of Test:	To obtain Industry Canada Type Acceptance Authorization for Class B AIS Transponder, Model No.: MA-500TR, manufactured by Icom Incorporated, operating in 156.025–162.025 MHz
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA-603 (01-Nov-2002) – Land Mobile FM or PM Communications Equipment Measurement and performance Standards.

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

None

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2009	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 16-1	2003	Specification for Radio Disturbance and Immunity measuring apparatus and methods
RSS-182, Issue 4	2003	Maritime Radio Transmitters and Receivers in the Band 156-162.5 MHz
ITU-R M.493-12	2007	Digital selective-calling system for use in the maritime mobile service
TIA-603-B	2002	Land Mobile FM or Pm Communications Equipment, Measurement and Performance Standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Icom Canada Inc.
Address:	Glenwood Centre-150-6165 Hwy. 17 Delta, BC Canada V4K 5B8
Contact Person:	Mr. Bob Brunkow Phone #: 604-952-4266 Fax #: 604-952-0090 Email Address: bbrunkow@icomcanada.com

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

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

Brand Name:	ICOM Incorporated
Product Name:	Class B AIS Transponder
Model Name or Number:	MA-500TR
Serial Number:	00000056
Type of Equipment:	AIS Transponder
External Power Supply Requirement:	9.6 to 15.6 V DC
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	An AIS transponder is a short range data radio unit, used primarily for collision-risk management and navigation safety

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	Marine
RF Output Power Rating:	2 Watts
Operating Frequency Range:	156.025–162.025 MHz (Marine), 161.975 &162.025 MHz (default)
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz
Modulation Employed	GMSK
Occupied Bandwidth (99%):	9.68 kHz
Emission Designation*:	16K0GXW
Antenna Type:	Omni-directional antenna (9.0 dBi)

For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:

Channel Spacing = 25 KHz, D = 5 KHz max, K = 1, M = 3 KHz
B_n = 2M + 2DK = 2(3) + 2(5)(1) = **16 KHz**
Emission designation: 16K0GXW

RECEIVER	
Operating Frequency Range:	156.025–162.025 MHz (Marine)
RF Input Impedance:	50 Ohms
IF Frequencies **AIS1:** **AIS2:**	 1st: 21.700 MHz, 2nd: 450 kHz 1st: 30.875 MHz, 2nd: 450 kHz

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	PL-259/SO-239	N/A
2	DC Jack	1	Plug-in Jack	N/A
3	GPS Antenna	1	Plug-in Jack	N/A
4	NMEA I/O	1	D-Sub 15 pins	N/A

2.5. ANCILLARY EQUIPMENT

None.

EXHIBIT 3. EUT OPERATION CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	55%
Pressure:	102 kPa
Power input source:	13.8 V DC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band(s):	▪ 156.025–162.025 MHz
Test Frequency(ies): (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	▪ 156.025 MHz, 161.975 MHz, 162.025 MHz
Transmitter Wanted Output Test Signals:	
• Transmitter Power (measured maximum output power):	2 Watts
• Normal Test Modulation:	GMSK
• Modulating signal source:	Internal

Receiver Signals	
Frequency Band(s):	156.025-162.025 MHz
Test Frequency(ies): (Near lowest & near highest frequencies in the frequency range of operation.)	156.025 MHz, 161.975 MHz, 162.025 MHz

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

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

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2011-05-01.

4.2. SUMMARY OF TEST RESULTS

Industry Canada	Test Requirements	Compliance (Yes/No)
RSS-182 § 3.8	Transport Canada Requirements	Yes
RSS-182 § 4.2 & 6.1	Frequency Stability	Yes
RSS-182 § 6.2	Output Power Test	Yes
RSS-182 § 6.3	Unwanted Emissions (Conducted)	Yes
RSS-182 § 6.3	Unwanted Emissions (Radiated)	Yes
RSS-182 § 6.3.1 - 6.3.3	Emission Mask and Authorized Bandwidth	Yes
RSS-182 § 6.4	FM Modulation Limiting and Audio Low Pass Filter	N/A
RSS-182 § 6.5	Transmitters Not Exceeding 120 milliwatts	N/A
RSS-182 § 6.6	Data Modem Tests	N/A
RSS-182 § 6.7	Receiver Spurious Emissions (Conducted)	Yes
RSS-182 § 6.7	Receiver Spurious Emissions (Radiated)	Yes
RSS-182 § 5.5 (RSS-102)	Exposure of Human to RF Fields	Yes
ICES-003	Digital Portion – Radiated Emissions	Yes
ICES-003	Power Line Conducted Emissions	N/A

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. FREQUENCY STABILITY

5.1.1. Limits

With the exception of DSC emissions, the RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at 20 °C and rated supply voltage) in excess of:

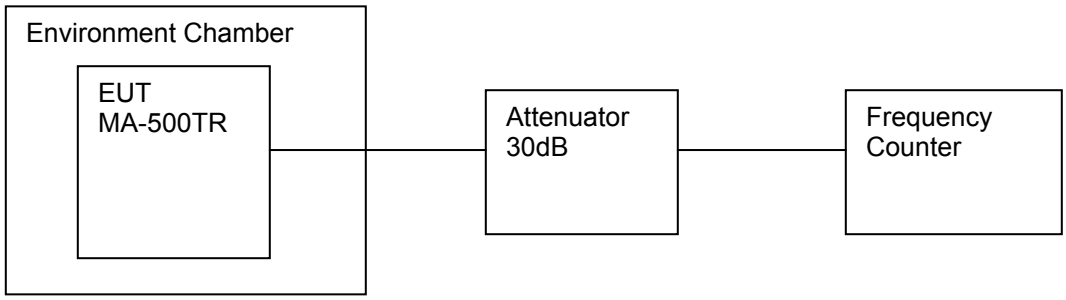
Ships stations	±10 ppm

For DSC emissions, the frequency tolerance of the 1300Hz and 2100Hz tones: ±10 Hz

5.1.2. Method of Measurements

Refer to Industry Canada RSS-182, Issue 4, section 4.2, ITU-R M.493-12 section 1.3.2; Section 7.4 of this test report for details.

5.1.3. Test Arrangement



5.1.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Frequency Counter	EIP	545A	02683	10 Hz – 18 GHz	Jan 11, 2011
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	In-house calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	In-house calibrated at tests
DC Power Supply	Tenma Laboratory	72-7295	490300297	0-18V, 10A	N/A
Temperature & Humidity Chamber	Tenney	T5	72-6202	-40 ºC – +80 ºC range	July 30, 2010

5.1.5. Test Data

5.1.5.1. Frequency Tolerance versus Ambient Temperature

Product Name: **Model No.:**	**Class B AIS Transponder** **MA-500TR**
Center Frequency:	156.025 MHz
Full Power Level:	33.0 dBm
Frequency Tolerance Limit (Worst Case):	±10 ppm or 1560.25 Hz
Max. Frequency Tolerance Measured:	-86 Hz or 0.55 ppm
Input Voltage Rating:	13.8 V DC

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature (°C)	**Supply Voltage (Nominal) 13.8 Volts**	**Supply Voltage (Minimum before switch-off)) 10.8 Volts**	**Supply Voltage (115% of Nominal) 15.6 Volts**
	Hz	**Hz**	**Hz**
-20	-80	N/A	N/A
-10	-61	N/A	N/A
0	-16	N/A	N/A
+10	15	N/A	N/A
+20	-10	4	12
+30	-32	N/A	N/A
+40	-58	N/A	N/A
+50	-84	N/A	N/A
+60	-86	N/A	N/A

5.2. OUTPUT POWER

5.2.1. Limits

The output power shall be within ± 1.0 dB of the manufacturer's rated power.

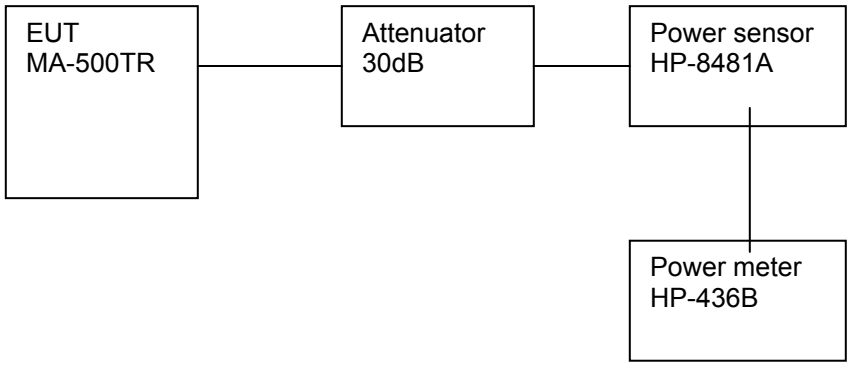
5.2.2. Method of Measurements

Refer to Industry Canada RSS-182, Issue 4, Section 6.2; for details.

- The resolution RBW of the spectrum analyzer shall be greater than the OBW of the device
- If the signal is pulses, i.e. non-continuous, the spectrum analyzer should be appropriately gated to measure the signal power, averaged over any duration of the duration of the burst.
- The output power or field strength is to be measured at the rated supply voltage and ambient temperature.

5.2.3. Test Arrangement

Power at RF Power Output Terminals



5.2.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Power Meter	Hewlett Packard	436B	2347A17246	10 kHz – 50 GHz, sensor dependent	May 20, 2011
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz	July 21, 2011
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	In-house calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	In-house calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	In-house calibrated at tests
DC Power Supply	Tenma Laboratory	72-7295	490300297	0-18V, 10A	N/A

5.2.5. Test Data

Transmitter Channel	Fundamental Frequency (MHz)	Measured (Average) Conducted Power (dBm)	Power Rating (dBm)
Power Setting: 2W			
CH 60	156.025	32.74	33.0
CH 87B	161.975	32.52	33.0
CH 88B	162.025	32.52	33.0

5.3. EMISSION MASKS AND AUTHORIZED BANDWIDTH

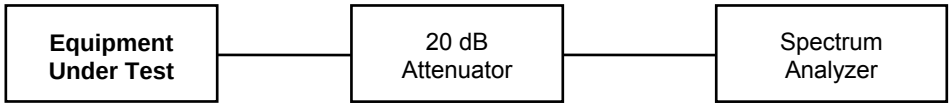
5.3.1. Limits

Refer to RSS-182, Sections 6.3.1 – 6.3.3 for emission masks B

5.3.2. Method of Measurements

Refer to RSS-182, Section 6.3 and Section 7.2 of this report for measurement details.

5.3.3. Test Arrangement



5.3.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK 30	100077	20 Hz – 40 GHz	Aug 14, 2011
RF Communication Test Set	Hewlett Packard	8920B	US39064699	30 MHz – 1 GHz	Oct 27, 2011
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	In-house calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	In-house calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	In-house calibrated at tests
DC Power Supply	Tenma Laboratory	72-7295	490300297	0-18V, 10A	N/A

5.3.5. Test Data

5.3.5.1. 99% Occupied Bandwidth

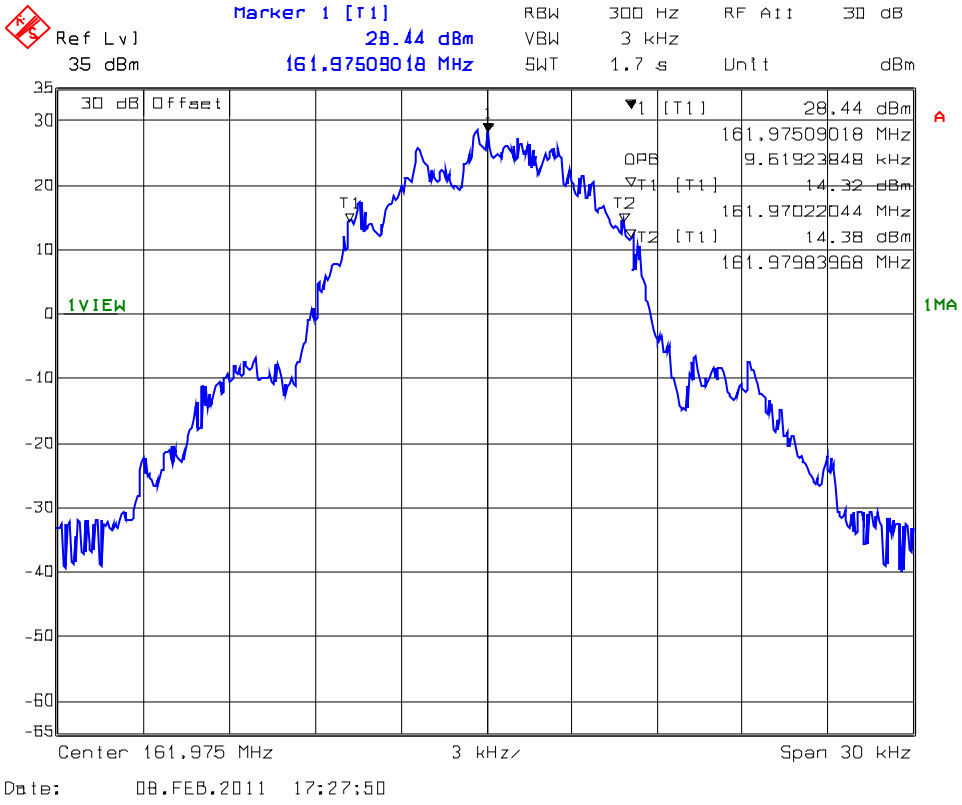
Frequency (MHz)	Channel Spacing (kHz)	Measured 99% OBW (kHz)	Authorized Bandwidth (kHz)
156.025	25.0	9.68	16
161.975	25.0	9.62	16
162.025	25.0	9.68	16

Remark: 99% Occupied Bandwidth measurements were done using the built-in auto function of the analyzer.

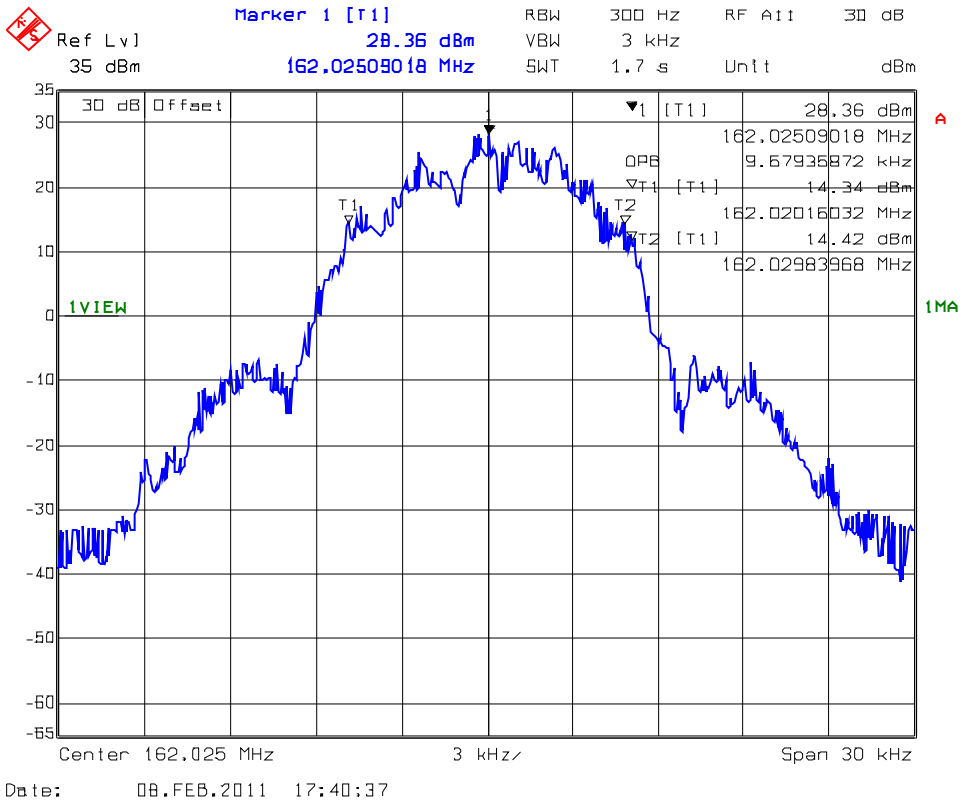
See the following plots (1 to 3) for details of measurements.

Plot # 1.:
Occupied Bandwidth
Carrier Frequency: 156.025 MHz
Channel Spacing: 25.0 kHz
Power: 2 W
Modulation: GXW, 2.5 kHz sine wave

Plot # 2.:
Occupied Bandwidth
Carrier Frequency: 161.975 MHz
Channel Spacing: 25.0 kHz
Power: 2 W
Modulation: GXW, 2.5 kHz sine wave



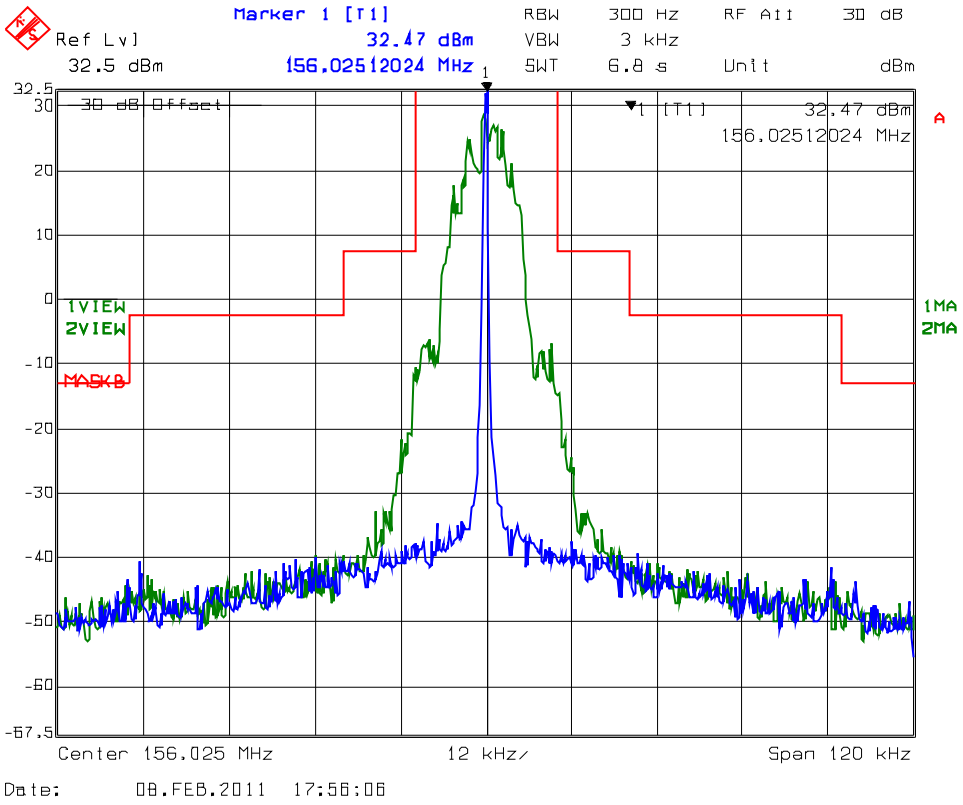
Plot # 3.:
Occupied Bandwidth
Carrier Frequency: 162.025 MHz
Channel Spacing: 25.0 kHz
Power: 2 W
Modulation: GXW, 2.5 kHz sine wave



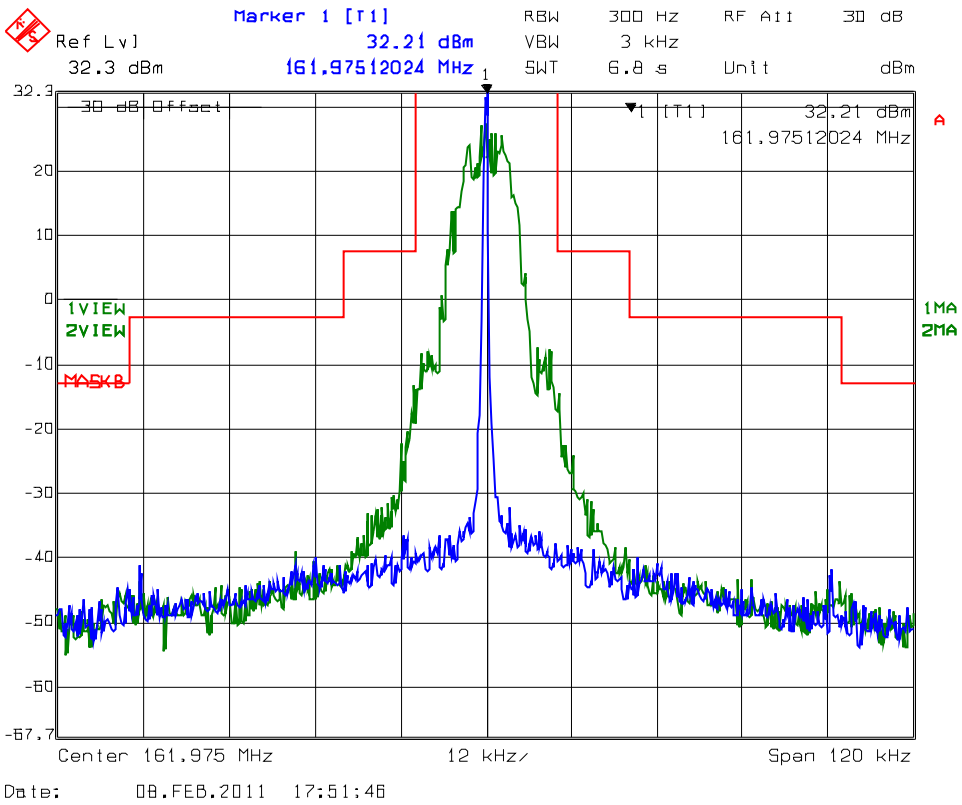
5.3.5.2. Emission Masks

Conform. See the following test data plots (4 to 6) for details.

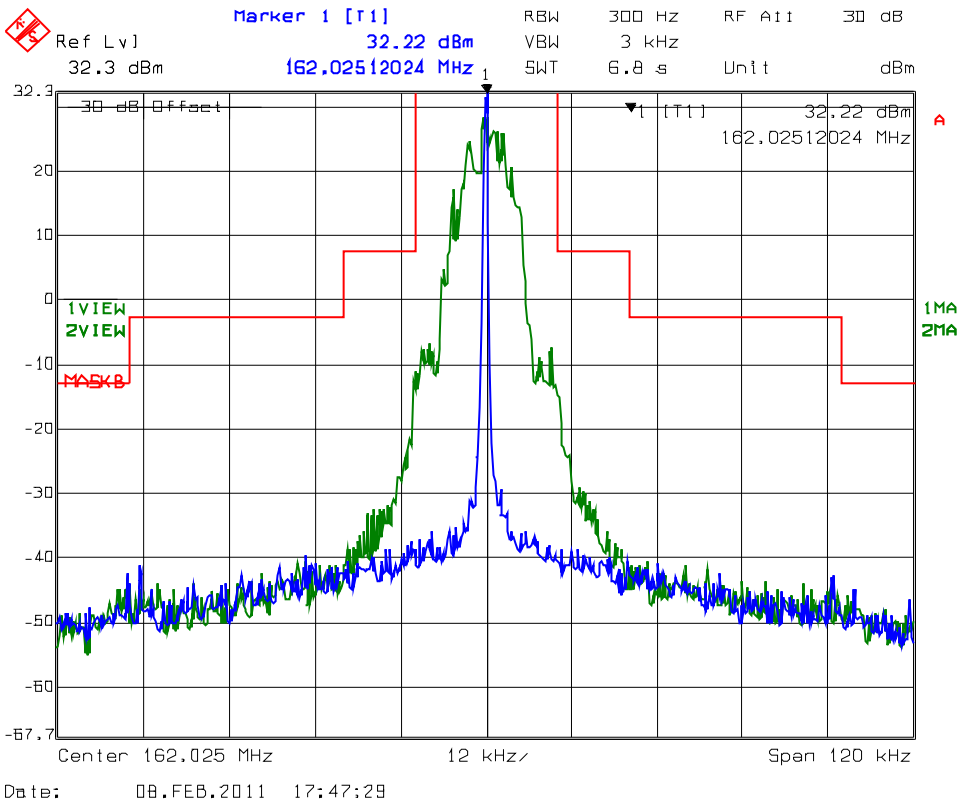
Plot # 4.:
Emission Mask B
Carrier Frequency: 156.025 MHz
Channel Spacing: 25 kHz
Power: 2 W
Modulation: GXW, 2.5 kHz sine wave



Plot # 5.:
Emission Mask B
Carrier Frequency: 161.975 MHz
Channel Spacing: 25 kHz
Power: 2 W
Modulation: GXW, 2.5 kHz sine wave



Plot # 6.:
Emission Mask B
Carrier Frequency: 162.025 MHz
Channel Spacing: 25 kHz
Power: 2 W
Modulation: GXW, 2.5 kHz sine wave



5.4. TRANSMITTER UNWANTED EMISSIONS (CONDUCTED)

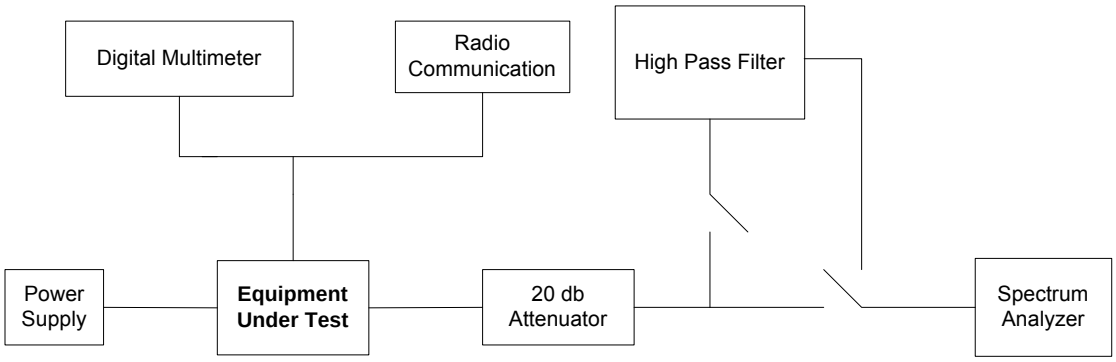
5.4.1. Limits

The spectrum plots shall comply with the masks specified in IC RSS-182, Issue 4, Section 6.3.

5.4.2. Method of Measurements

Refer to Industry Canada RSS-182 (Section 6.3, Issue 4) and Section 7.3 of this test report.

5.4.3. Test Arrangement



5.4.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK 30	100077	20 Hz – 40 GHz	Aug 14, 2011
RF Communication Test Set	Hewlett Packard	8920B	US39064699	30 MHz – 1 GHz	Oct 27, 2011
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
High Pass Filter	Mini Circuit	SHP 250	-	Cut off 230 MHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-7295	490300297	0-18V, 10A	N/A

5.4.5. Test Data

5.4.5.1. Lowest Frequency

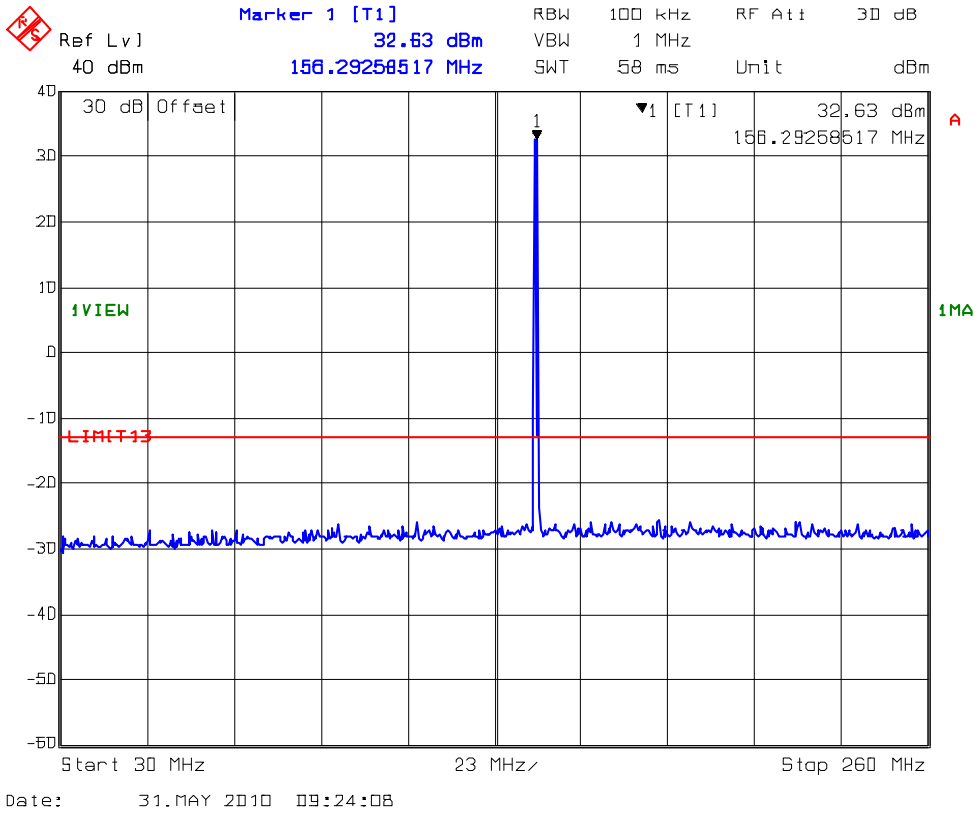
Carrier Frequency (MHz): 156.025

Power (dBm): 32.74

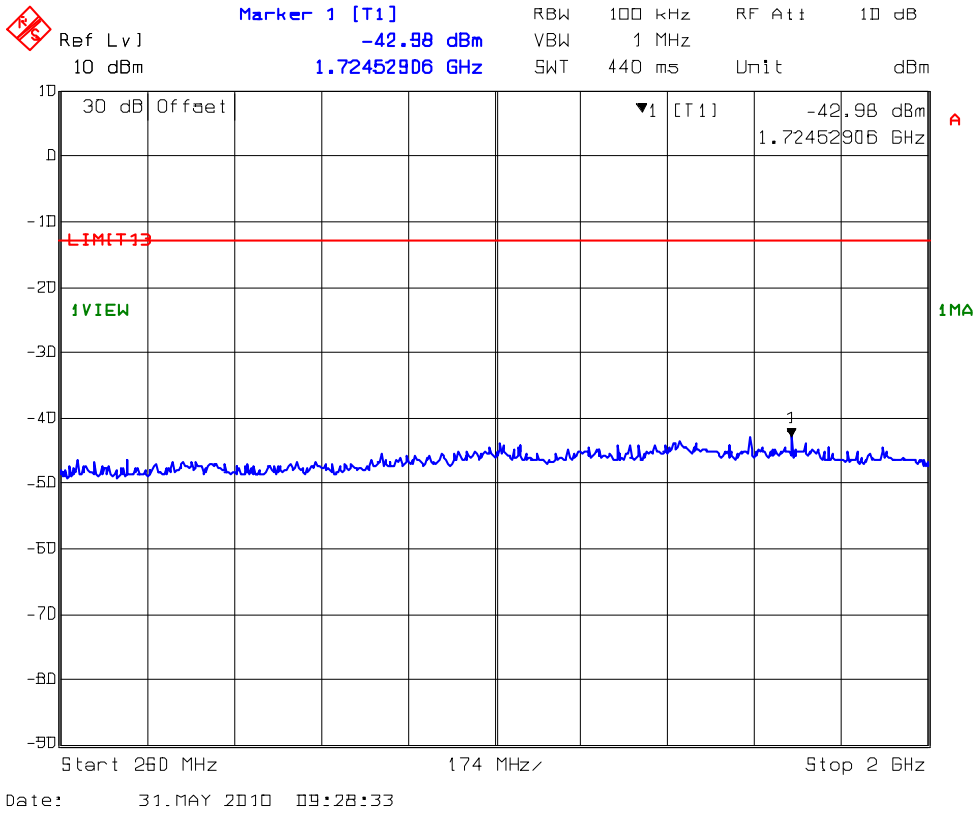
Limit (dBm): -13

All emissions found were more than 20 dB below the permissible limits.

Plot # 7.:
Spurious Emissions at Antenna Terminals
Carrier Frequency: 156.025 MHz
Channel Spacing: 25 kHz
Power: 2 W, Modulation: GXW



Plot # 8.:
Spurious Emissions at Antenna Terminals
Carrier Frequency: 156.025 MHz
Channel Spacing: 25 kHz
Power: 2 W, Modulation: GXW

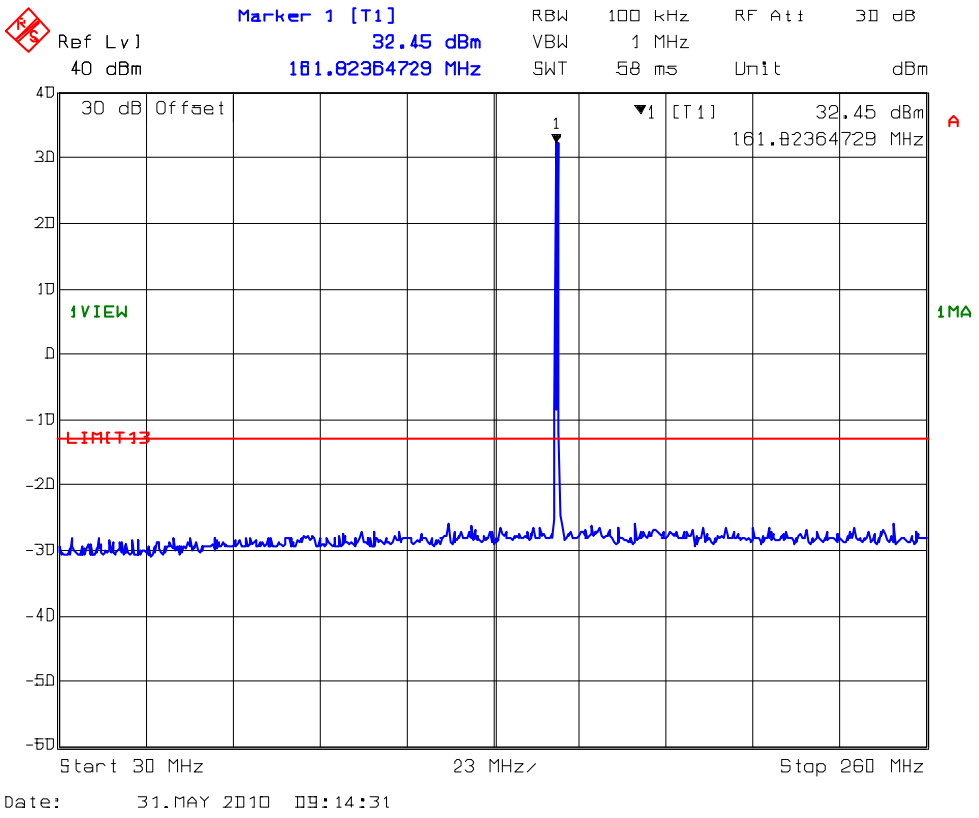


5.4.5.2. Near Centre Frequency

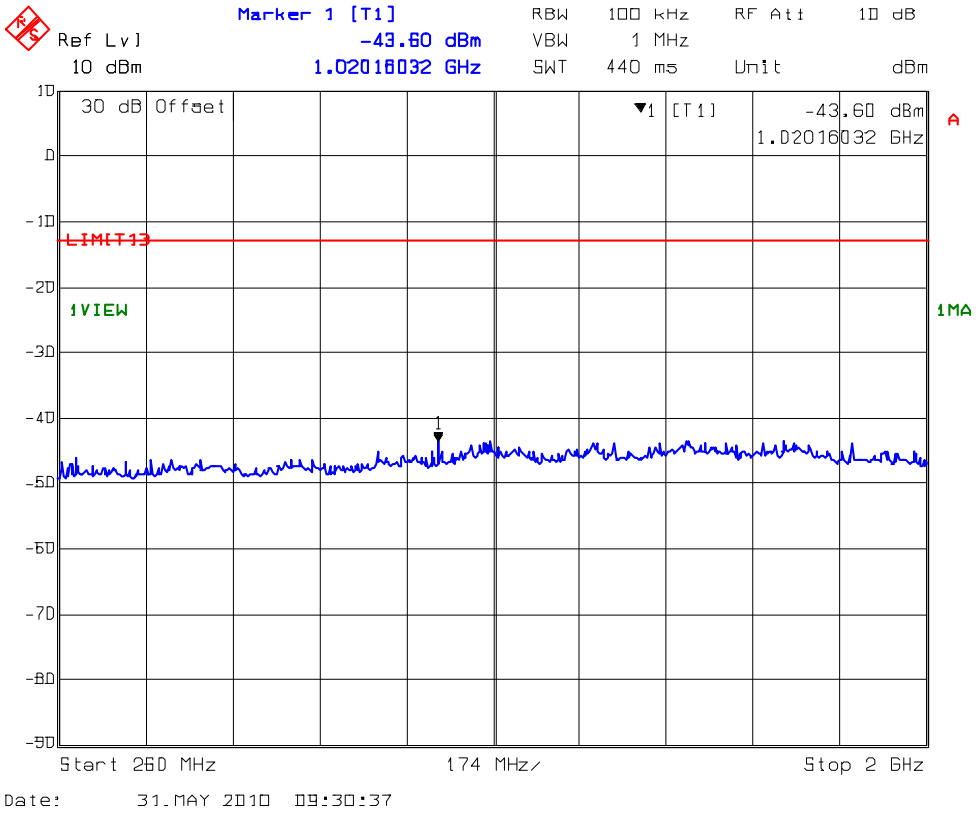
Carrier Frequency (MHz):	161.975
Power (dBm):	32.52
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 9.:
Spurious Emissions at Antenna Terminals
Carrier Frequency: 161.975 MHz
Channel Spacing: 25 kHz
Power: 2 W, Modulation: GXW



Plot # 10.:
Spurious Emissions at Antenna Terminals
Carrier Frequency: 161.975 MHz
Channel Spacing: 25 kHz
Power: 2 W, Modulation: GXW



5.4.5.3.

5.4.5.4. Highest Frequency

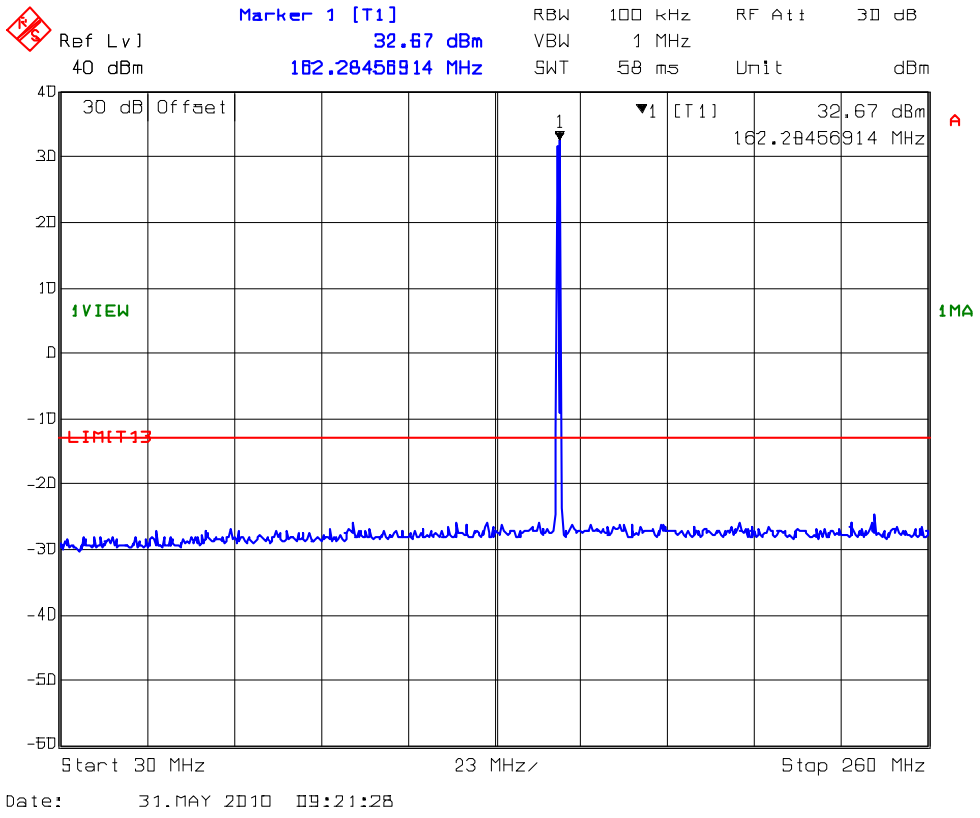
Carrier Frequency (MHz): 162.025

Power (dBm): 32.52

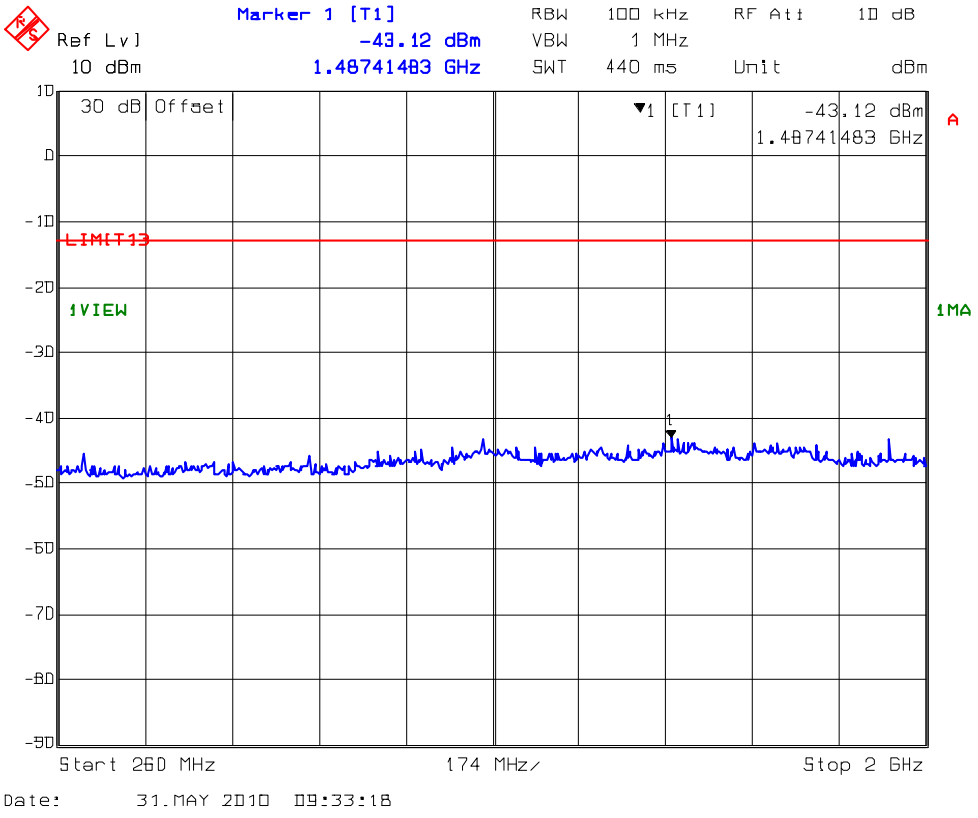
Limit (dBm): -13

All emissions found were more than 20 dB below the permissible limits.

Plot # 11.:
Spurious Emissions at Antenna Terminals
Carrier Frequency: 162.025 MHz
Channel Spacing: 25 kHz
Power: 2 W, Modulation: GXW



Plot # 12.:
Spurious Emissions at Antenna Terminals
Carrier Frequency: 162.025 MHz
Channel Spacing: 25 kHz
Power: 2 W, Modulation: GXW



5.5. UNWANTED EMISSIONS (RADIATED AT 3 METRES)

5.5.1. Limits

The unwanted emissions shall comply with the emission masks specified in IC RSS-182, Issue 4, Section 6.3.

5.5.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in 7.1 of this report and its value in dBc is calculated as follows:

(1) If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.
(2) 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 = Pc dBm (conducted) + 0 dBi – 2.15 dB

5.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	March 09, 2011
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	Jan 18, 2011
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	April 18, 2011
Biconi-Log Antenna	Emco	3142C	00026873	26 – 3000 MHz	April 18, 2011
Horn Antenna	Emco	3117	119425	1 – 18 GHz	Jan 18, 2011
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	In-house calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	In-house calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.5.4. Test Data

Remarks: The radiated emissions are performed with high power setting (2 Watts) at 3 meters distance to represents the worst-case test configuration.

5.5.4.1. Near Lowest Frequency (156.025 MHz)

Carrier Frequency (MHz):	156.025
Power (dBm):	32.74
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

5.5.4.2. Middle Frequency (161.975 MHz)

Carrier Frequency (MHz):	161.975
Power (dBm):	32.52
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

5.5.4.3. Near Highest Frequency (162.025 MHz)

Carrier Frequency (MHz):	162.025
Power (dBm):	32.52
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

5.6. RECEIVER SPURIOUS EMISSIONS (CONDUCTED)

5.6.1. Limits

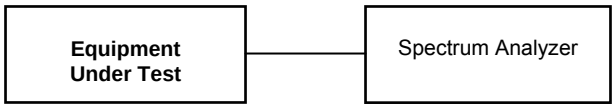
RSS-182, Section 6.7: The emission power in any 4 kHz shall not exceed 2 nanowatts (316 microvolts or -57.0 dBm across 50 ohms).

Note: The most stringent limit will be applied for compliance.

5.6.2. Method of Measurements

Refer to Industry Canada RSS-182, Issue 4 and ANSI C63.4

5.6.3. Test Arrangement



5.6.4. Test Equipment List

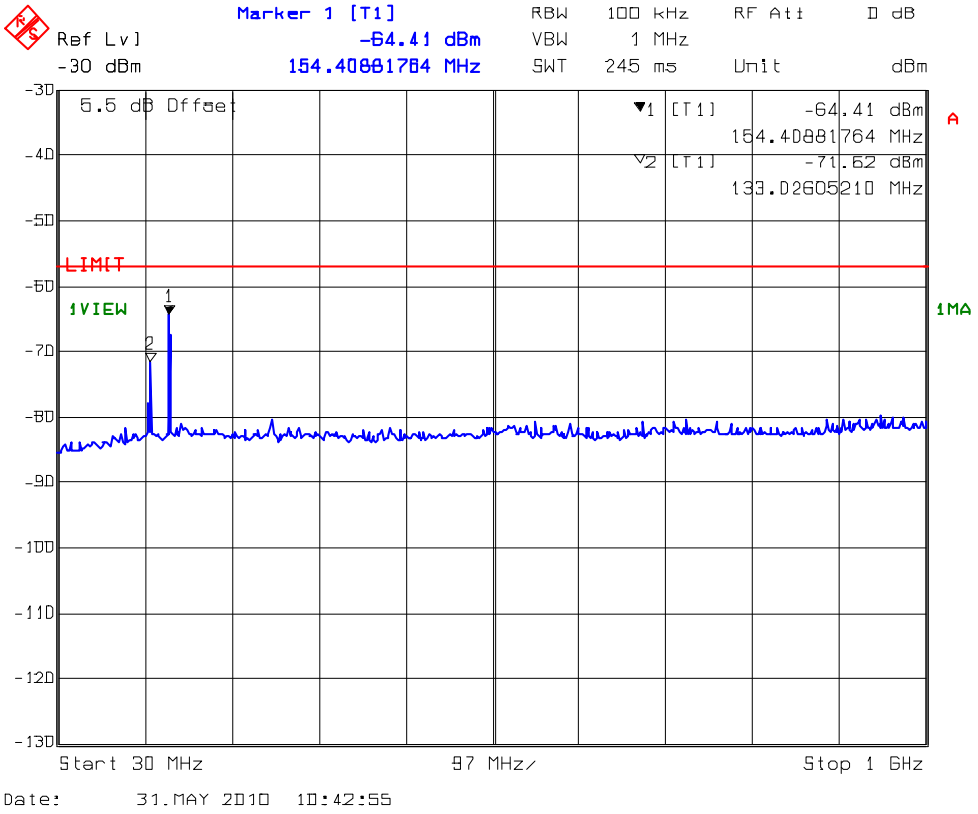
Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK 30	100077	20 Hz – 40 GHz	Aug 14, 2011
Signal Generator	Hewlett Packard	83752B	3610A00457	0.01 – 20 GHz	Oct 19, 2011
Power Divider	Mini-Circuits	15542	0235	DC – 18 GHz	Inhouse calibrated at tests
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.6.5. Test Data

Receive Mode (MHz): 156.025

Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)
133.02	-71.62	- 57.0	- 14.62
154.41	-64.41	- 57.0	- 7.41

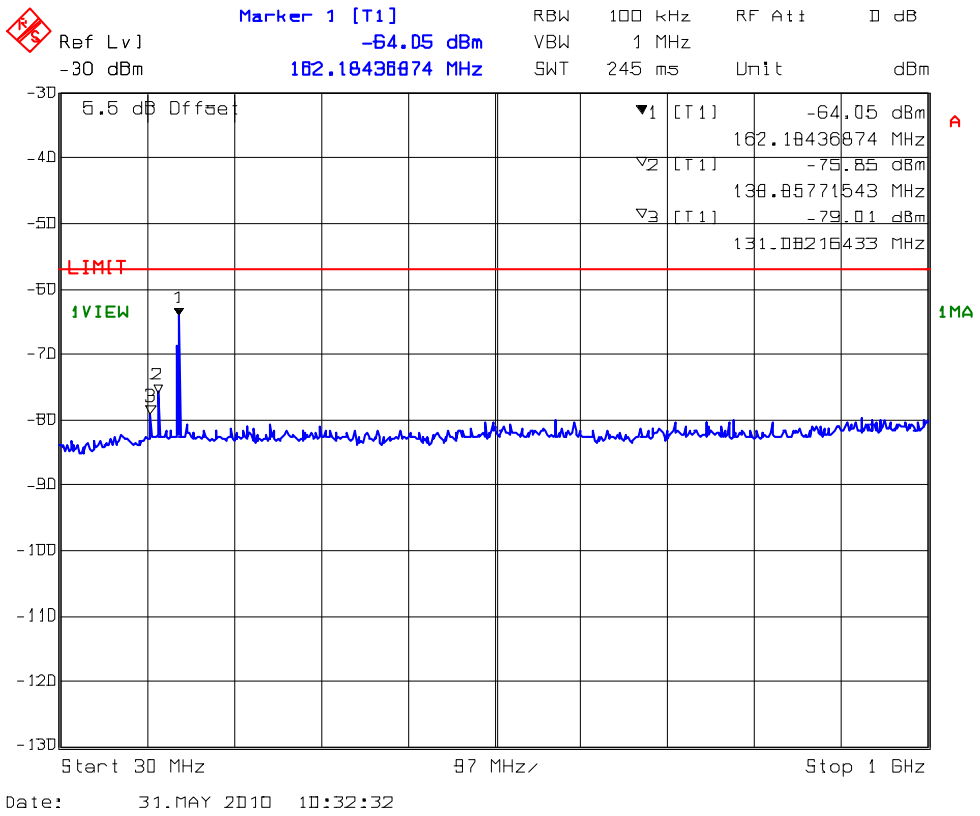
Plot # 13.: Receiver Spurious Emissions (Conducted)
Receive Mode: CH 60, 156.025 MHz



Receive Mode (MHz): 161.975

Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)
138.85	-75.87	- 57.0	- 18.87
162.18	-64.05	- 57.0	- 7.05

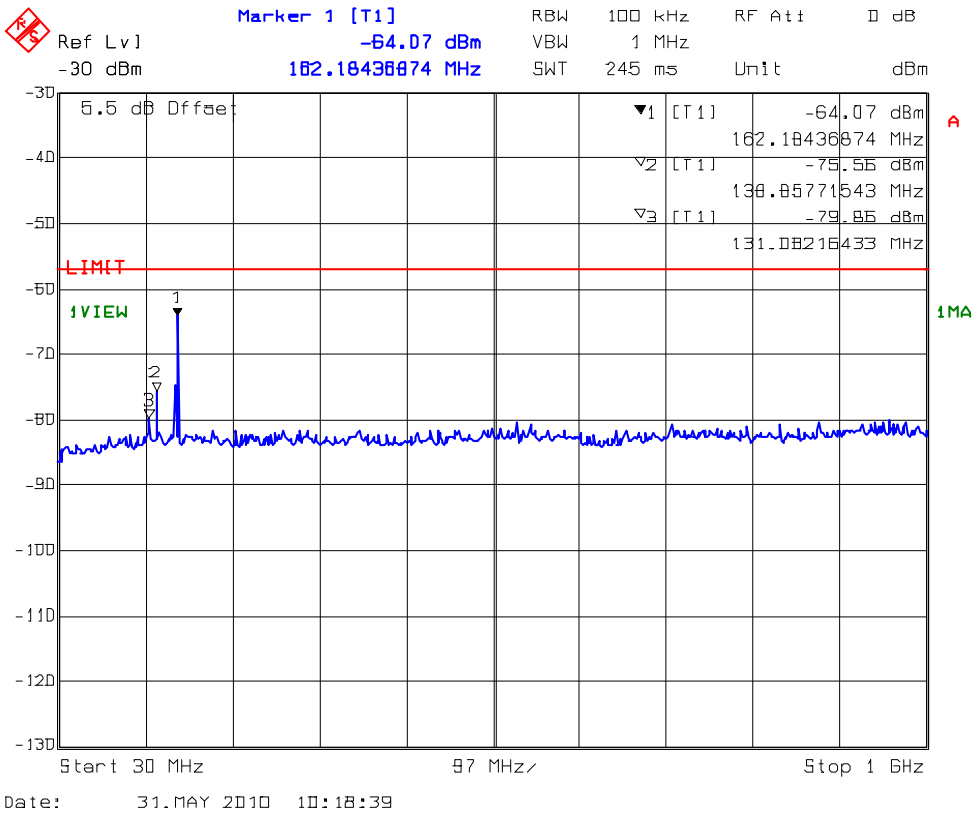
Plot # 14.: Receiver Spurious Emissions (Conducted)
Receive Mode: CH 87B, 161.975 MHz



Receive Mode (MHz): 162.025

Frequency (MHz)	RF Level (dBm)	Limit (dBm)	Margin (dB)
138.85	-75.56	- 57.0	- 18.56
162.18	-64.07	- 57.0	- 7.07

Plot # 15.: Receiver Spurious Emissions (Conducted)
Receive Mode: CH 88B, 162.025 MHz



5.7. RF EXPOSURE REQUIREMENTS [RSS-102]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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

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

5.7.1. Test Data

Antenna Gain Limit specified by Manufacturer: 9 dBi

(1) Lowest Frequency (MHz)	Measured Peak RF Conducted Power (dBm)	Calculated EIRP (dBm)	Exposure Condition	Calculated Minimum RF Safety Distance r (cm)*
156.025	32.74	41.74	General Population	78

* The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\Pi S)^{1/2} = (EIRP/4\Pi S)^{1/2}$
Power Density for General Population Use = S = 0.2 mW/cm^2

$r = (EIRP/4\Pi S)^{1/2} = (14928/(4\Pi(0.2))^{½} = 77.09$ cm

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: 78 cm	Manufacturer' instruction for separation distance between antenna and persons required: 300 cm
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 User's Manual for details.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Please refer to Page iii of User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None

5.8. RECEIVER SPURIOUS EMISSIONS (RADIATED)

5.8.1. Limits

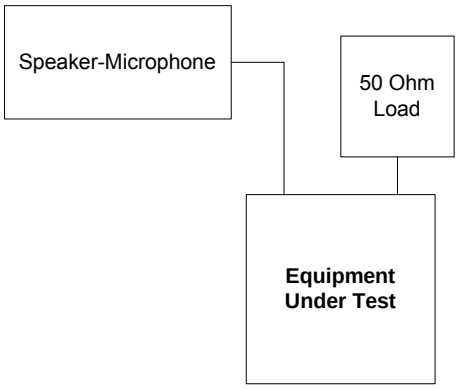
The equipment shall meet the limits of the following table:

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

5.8.2. Method of Measurements

Refer to Industry Canada RSS-182, Issue 4 and ANSI C63.4 for radiated emissions test method.

5.8.3. Test Arrangement



5.8.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	March 09, 2011
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	Jan 18, 2011
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	April 18, 2011
Biconi-Log Antenna	Emco	3142C	00026873	26 – 3000 MHz	April 18, 2011
Horn Antenna	Emco	3117	119425	1 – 18 GHz	Jan 18, 2011
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.8.5. Test data

5.8.5.1. Near Lowest Frequency (156.050 MHz)

The emissions were scanned from 30 MHz to 2.5 GHz at 3 Meters distance and all emissions less than 20 dB below the limits were recorded.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
134.325	30.7	Peak	V	43.5	- 12.8	Pass
134.325	24.5	Peak	H	43.5	- 19.0	Pass
402.975	31.2	Peak	V	46.0	- 14.8	Pass
402.975	27.7	Peak	H	46.0	- 18.3	Pass
537.300	29.4	Peak	V	46.0	- 16.6	Pass
537.300	26.6	Peak	H	46.0	- 19.4	Pass
671.625	26.6	Peak	H	46.0	- 19.4	Pass

All other measurements were more than 20 dB below the limits.

5.8.5.2. Near Lowest Frequency (161.975 MHz)

The emissions were scanned from 30 MHz to 2.5 GHz at 3 Meters distance and all emissions less than 20 dB below the limits were recorded.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
140.275	33.8	Peak	V	43.5	- 9.8	Pass
140.275	27.4	Peak	H	43.5	- 16.1	Pass

All other measurements were more than 20 dB below the limits.

5.8.5.3. Near Highest Frequency (162.025 MHz)

The emissions were scanned from 30 MHz to 2.5 GHz at 3 Meters distance and all emissions less than 20 dB below the limits were recorded.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
131.15	33.5	Peak	V	43.5	- 10.0	Pass
131.15	25.4	Peak	H	43.5	- 18.1	Pass
262.30	25.9	Peak	V	46.0	- 20.1	Pass
262.30	27.7	Peak	H	46.0	- 18.3	Pass
393.45	31.0	Peak	V	46.0	- 15.0	Pass
393.45	34.6	Peak	V	46.0	- 11.4	Pass

All other measurements were more than 20 dB below the limits.

5.9. RADIATED EMISSIONS FROM CLASS B DIGITAL APPARATUS (DIGITAL DEVICES) @ INDUSTRY CANADA ICES-003, ISSUE 4, TABLE III & CISPR 22:2008 / EN 55022:2006 [6, TABLE 6]

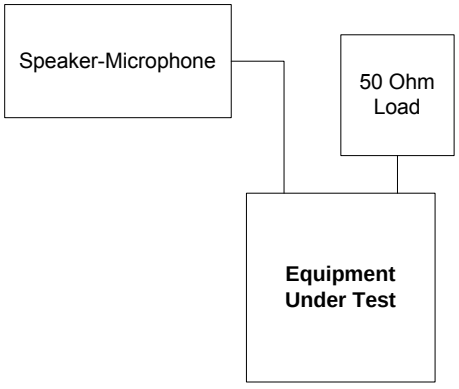
5.9.1. Limits

Test Frequency Range (MHz)	Class B Limits @ 3m (dBμV/m)	EMI Detector Used	Measuring Bandwidth (kHz)	Measurement Distance (meters)
30 – 230	40.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz	3
230 – 1000	47.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz	3
1000 – 3000	70.0 50.0	Peak Average	RBW = 1 MHz, VBW ≥ 1 MHz	3
3000 – 6000	74.0 54.0	Peak Average	RBW = 1 MHz, VBW ≥ 1 MHz	3

5.9.2. Method of Measurements

The EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator frequency in the digital devices or 1 GHz whichever is higher. Please refer to the Exhibit 7 of this test report and ANSI C63.4 for radiated emissions test method.

5.9.3. Test Arrangement



5.9.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	March 09, 2011
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	Jan 18, 2011
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	April 18, 2011
Biconi-Log Antenna	Emco	3142C	00026873	26 – 3000 MHz	April 18, 2011
Horn Antenna	Emco	3117	119425	1 – 18 GHz	Jan 18, 2011
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.9.5. Test Data

Remarks:
- The measuring receiver shall be tuned over the frequency range 30 MHz to 6 GHz.
- All spurious emissions that are in excess of 20dB below the specified limit shall be recorded.

Frequency (MHz)	RF Level (dBµV/m)	Detector Used (Peak/QP/Avg)	Antenna Plane (H/V)	Limit at 3 m (dBµV/m)	Margin (dB)
46.3	30.5	Peak	V	40.0	-9.5
59.8	31.0	Peak	V	40.0	-9.0
59.8	26.5	Peak	H	40.0	-13.5
77.0	35.2	Peak	V	40.0	-4.8
81.5	32.5	QP	V	40.0	-7.5
86.0	33.8	QP	V	40.0	-6.2
86.0	23.2	Peak	H	40.0	-16.8
96.0	34.2	Peak	V	40.0	-5.8
127.4	35.2	Peak	V	40.0	-4.8
127.4	29.5	Peak	H	40.0	-10.5
131.0	30.6	Peak	V	40.0	-9.4
131.0	28.0	Peak	H	40.0	-12.0
133.4	30.9	Peak	V	40.0	-9.1
133.4	23.7	Peak	H	40.0	-16.3
140.8	32.0	Peak	V	40.0	-8.0
140.8	24.7	Peak	H	40.0	-15.3
145.7	31.7	Peak	V	40.0	-8.3

145.7	27.2	Peak	H	40.0	-12.8
149.9	32.1	Peak	V	40.0	-7.9
149.9	34.5	Peak	H	40.0	-5.5
168.6	33.1	Peak	H	40.0	-6.9
191.2	35.3	Peak	V	40.0	-4.7
194.0	33.3	Peak	V	40.0	-6.7
196.7	37.9	Peak	V	40.0	-2.1
196.7	35.6	Peak	H	40.0	-4.4
218.2	31.6	Peak	H	40.0	-8.4
295.0	33.2	Peak	H	47.0	-13.8
323.8	30.9	Peak	V	47.0	-16.1
323.8	33.1	Peak	H	47.0	-13.9
344.1	35.6	Peak	V	47.0	-11.4
344.1	38.9	Peak	H	47.0	-8.1
365.5	31.8	Peak	V	47.0	-15.2
365.5	32.6	Peak	H	47.0	-14.4
379.5	39.6	Peak	V	47.0	-7.4
407.9	39.2	Peak	H	47.0	-7.8
414.8	32.8	Peak	V	47.0	-14.2
442.7	35.7	Peak	V	47.0	-11.3
442.7	34.6	Peak	H	47.0	-12.4
513.1	35.2	Peak	H	47.0	-11.8
541.5	34.9	Peak	V	47.0	-12.1
541.5	32.0	Peak	H	47.0	-15.0
611.7	33.8	Peak	V	47.0	-13.2
611.7	34.7	Peak	H	47.0	-12.3
639.7	38.8	Peak	V	47.0	-8.2
639.7	38.9	Peak	H	47.0	-8.1
696.5	34.1	Peak	V	47.0	-12.9
737.9	35.5	Peak	V	47.0	-11.5
737.9	36.8	Peak	H	47.0	-10.2
767.3	33.2	Peak	V	47.0	-13.8
836.2	37.4	Peak	V	47.0	-9.6
836.2	36.8	Peak	H	47.0	-10.2
934.3	33.4	Peak	V	47.0	-13.6
934.3	31.3	Peak	H	47.0	-15.7
1124.0	39.5	Peak	V	50.0	-10.5
1404.0	43.0	Peak	V	50.0	-7.0
1404.0	43.7	Peak	H	50.0	-6.3

EXHIBIT 6. TEST INSTRUMENTS & MEASUREMENT UNCERTAINTY (K=2, 95% CONFIDENCE LEVEL)

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

6.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.15**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.30**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.87**	Under consideration
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	Under consideration

EXHIBIT 7. MEASUREMENT METHODS

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

7.1.1. 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 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

7.1.2. Measuring the EIRP of Spurious/Harmonic Emissions Using Substitution Method

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

Center Frequency:	equal to the signal source
Resolution BW:	100 kHz
Video BW:	VBW > RBW
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 calculate 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

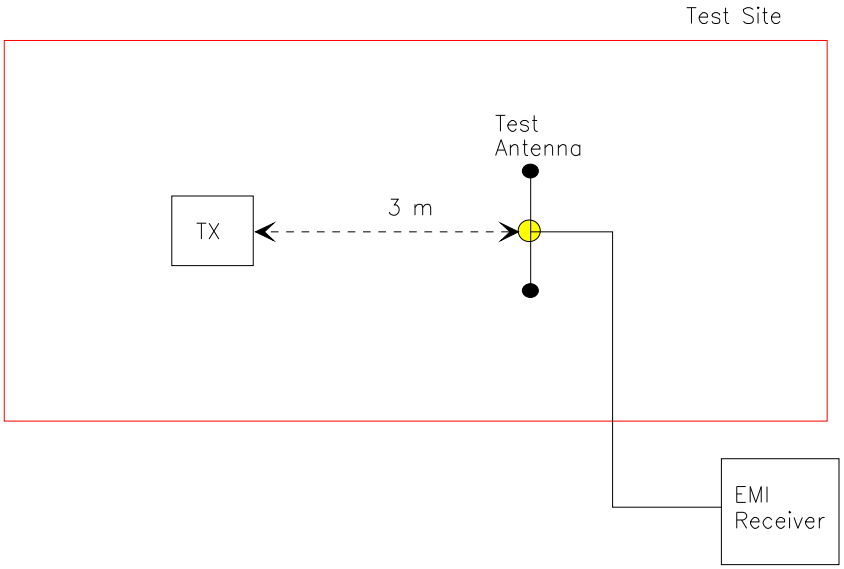
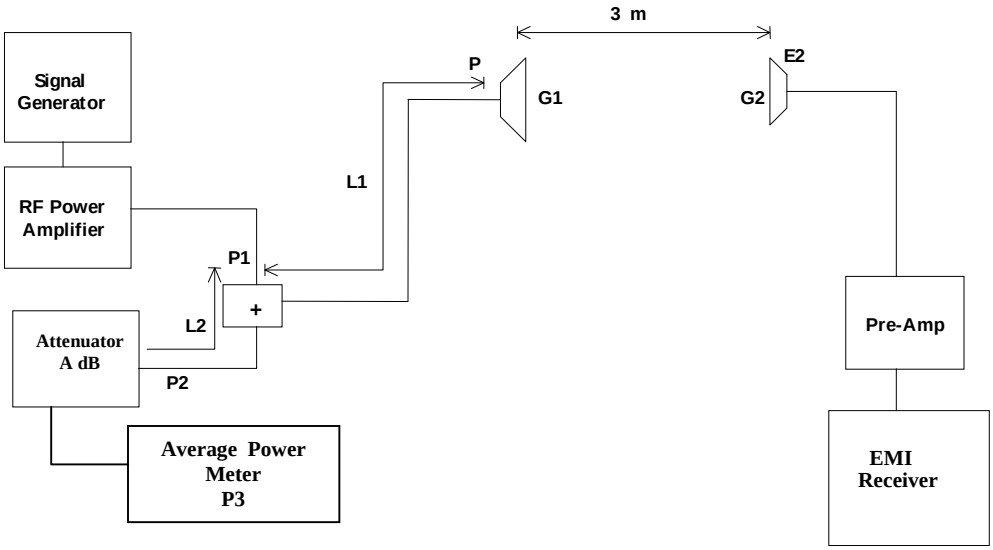


Figure 3



7.2. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(1):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: ±2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.1049(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

The following EMI Receiver bandwidth shall be used for measurement of Emission Mask/Out-of-Band Emission Measurements:

(1) For 25 kHz Channel Spacing: RBW = 300 Hz
(2) For 12.5 kHz or 6.25 kHz Channel Spacings: RBW = 100 Hz

The all cases the Video Bandwidth shall be equal or greater than the measuring bandwidth.

7.3. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the EMI Receiver controls set as RBW = 30 kHz minimum, VBW ≥ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

47 CFR § 2.1057 - 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.

47 CFR § 2.1051 - Spurious emissions at antenna terminal: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

7.4. FREQUENCY STABILITY

Refer to 47 CFR 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).