



FCC PART 80

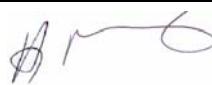
MEASUREMENT AND TEST REPORT

For

SAMYUNG ENC Co., Ltd.

1123-17, Dongsam-3-Dong
Youngdo-Gu, Busan, South Korea

FCC ID: RN6SRG-3150DN

Report Type:	Product Type:
<input checked="" type="checkbox"/> Original Report	Maritime MF/HF Transceiver
Test Engineer:	Boni Baniqued 
Report Number:	R0803116
Testing Date(s):	2008-03-26 to 2008-03-31
Report Date:	2008-04-02
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Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

This Bay Area Compliance Laboratories Corp. test report has been prepared on behalf of *SamYung ENC Co., LTD* and their product, model: *SRG-3150DN*, FCC ID: *RN6 SRG-3150DN* or the EUT (Equipment Under Test) as referred to in the rest of this report. The EUT is a MF/HF-DSC ship station Transceiver.

This radio equipment SRG-3150DN is MF/HF radio capable of transmitting and receiving DSC, NBDP and radiotelephony.

General Specification:

Frequency Range:	TX: 1.6 MHz - 27.5MHz RX: 500 kHz - 29.99999 MHz
Type of Emission:	2K80J3E (SSB), 300HF1B (DSC)
Power Supply:	DC 24V
Dimensions:	324 (W) X 162 (H) X 347 (D) mm
Weight:	7.2 Kg

** The test data gathered are from typical production sample, model: SRG-3150DN serial number: B1745 assigned by the BACL.*

EUT Photo



Additional photos in Exhibit C

Objective

This type approval report is prepared on behalf of *SamYung ENC Co., LTD* in accordance with Part 2, Subpart J and Part 80 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for RF output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, field strength of spurious radiation, frequency stability, and conducted and radiated margin.

This report is provided on behalf of *SamYung ENC Co., LTD* for confirmation of regulatory compliance. The manufacturer declares that the model: SRG-3150DN serial number: B1745 provided for testing is identical in construction and electrical operation with the post production product. Retesting is recommended for any changes to the model that might affect compliance including those with respect to software, circuitries, PCB layout, RF module, features and functionality.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 80 – Stations in the Maritime Services

Applicable Standards: TIA-603-C, ANSI C63.4-2003.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from ± 2.0 for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. to collect radiated and conducted emission measurement data is located at their facility in Sunnyvale, California 94089, USA.

The test site at Bay Area Compliance Laboratories Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of

the FCC Rules and Article 8 of the VCCI regulations. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference have the reports on file and are listed under FCC file 31040/SIT 1300F2, IC registration number: 3062A, and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA-603-C.

The final qualification test was performed with test software provided by the manufacturer.

Block Diagram

Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Sorensen	DC Power Supply	DCR 60-45B2	9540285
SamYung	DC Power Supply	SP-1250ADC	8304114
Weinschel Corporation	Attenuator 6dB	58-6-33	ML011
Weinschel Corporation	Attenuator 6dB	58-6-33	ML012
Weinschel Corporation	Attenuator 6dB	58-6-33	ML013
Mini Circuits	Attenuator 20dB	BW-N20W5+	/

Interface Ports and Cabling

Cable Description	Length (m)	From	To
Audio cable	0.5	Microphone	EUT

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§2.1046, §80.211, 80.215	Output Power, Emission Limitations, Transmitter Power	Compliant
§2.1047, §80.207, §80.213	Modulation Characteristics, Classes of Emission, Modulation Requirements	Compliant
§2.1049, §80.205	Occupied Bandwidth, Bandwidths (Authorized Bandwidth)	Compliant
§2.1051; §80.217 (b)	Spurious Emission at Antenna Terminals, Suppression of Interference	Compliant
§2.1053, §80.217 (b)	Field Strength of Spurious Emission, Suppression of Interference	Compliant
§2.1055, §80.209	Frequency Stability, Transmitter Frequency Tolerance	Compliant
§2.1091, §80.227	Radiofrequency radiation exposure evaluation: mobile devices, Special requirements for protection from RF radiation	Compliant
§80.221	Special requirements for automatically generating the radiotelephone alarm signal	Compliant
§80.225	Requirements for selective calling equipment	Compliant
§80.229	Special requirements for automatic link establishment (ALE)	N/A

§2.1046, §80.211, 80.215 – OUTPUT POWER, EMISSION LIMITATIONS, TRANSMITTER POWER

Applicable Standard**§2.1046 (b)**

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§80.211 (a)

(a) The mean power when using emissions H3E, J3E and R3E:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth:

at least 25 dB for transmitters installed before February 1, 1992,

at least 28 dB for transmitters installed on or after February 1, 1992;

(2) On any frequency removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}(\text{mean power in watts})$ dB.

§80.215 (d)

(d) *Ship station frequencies below 27500 kHz.* The maximum power must not exceed the values listed below:

(2) Radiotelephony:

(i) All ships—Great Lakes and Inland Waters—150W

Test Procedure

The Transmitter (EUT) was connected to a resistive load coaxial attenuator of normal load impedance and modulated output power was measured by means of on Spectrum Analyzer.

Test Equipment List and Details

Equipment Description	Model Number	Manufacturer	Serial Numbers	Last Calibration
Spectrum Analyzer	E4446A	Agilent	US44300386	2007-04-26
RF Communication test set	8920A	HP	3438A05338	2008-03-20
Function Generator	33220A	Agilent	MY43004878	2007-06-04

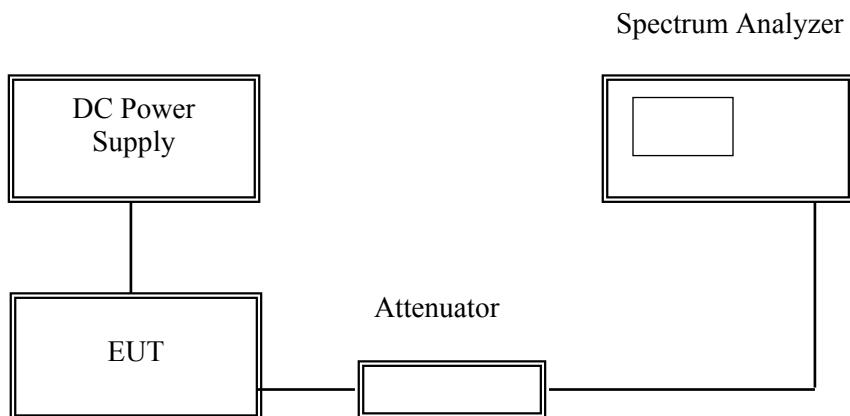
* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	59 %
ATM Pressure:	102.0 kPa

* The testing was performed by Boni Baniqued on 2008-03-26

Test Setup



Test Results

Frequency (kHz)	Power Level	Final Voltage (Vdc)	Final Current (A)	Transmit Output Power	
				(dBm)	(Watts)
1655.00	High	24.0	14.5	51.41	138.4
	Middle	24.0	12.5	49.69	93.1
	Low	24.0	9.3	46.65	46.23
2187.50	High	24.0	12.1	49.56	90.1
	Middle	24.0	11.9	49.51	89.5
	Low	24.0	10.5	48.12	65.0
12230.00	High	24.0	15.1	51.27	133.96
	Middle	24.0	13.5	49.83	96.16
	Low	24.0	9.9	46.76	47.42
25070.00	High	24.0	14.9	51.58	143.9
	Middle	24.0	13.4	49.95	98.9
	Low	24.0	10.1	46.85	48.4

§2.1047, §80.207, §80.213 - MODULATION CHARACTERISTICS, CLASSES OF EMISSION, MODULATION REQUIREMENTS

Applicable Standard

CFR47 § 2.1047(a) (c)

(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(c) *Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.* A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.

§80.207 (d)

§80.213 (a) (3)

(a) Transmitters must meet the following modulation requirements:

(3) In single sideband operation the upper sideband must be transmitted. Single sideband transmitters must automatically limit the peak envelope power to their authorized operating power and meet the requirements in §80.207(c).

Test Procedure

Audio Frequency Response:

The audio frequency of the test signal was varied from 100Hz to 5000Hz with the level of the audio frequency held at constant. Record the deviation level is recorded.

Peak Envelope Power vs Modulation Input voltage:

The transmitter is modulated in J3E mode with 400Hz and 1800 Hz. The output power relative to the rated Peak Envelope Power was measured using spectrum analyzer.

Test Equipment List and Details

Equipment Description	Model Number	Manufacturer	Serial Numbers	Last Calibration
Spectrum Analyzer	E4446A	Agilent	US44300386	2007-04-26
RF Communication test set	8920A	HP	3438A05338	2008-03-20
Function Generator	33220A	Agilent	MY43004878	2007-06-04

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	59 %
ATM Pressure:	102.0 kPa

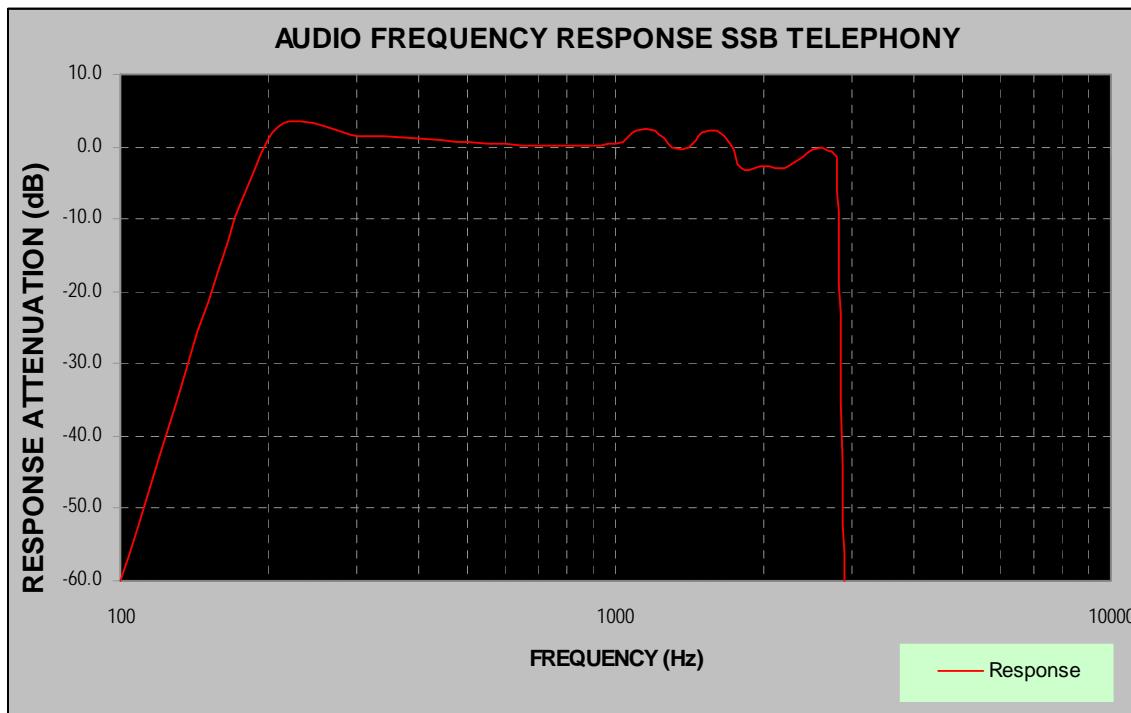
* The testing was performed by Boni Baniqued on 2008-03-28

Test Results

Please refer to the following plots.

Audio Frequency Response (Single Sideband Telephony)

Test Frequency: Middle Channel @ 12.230 MHz

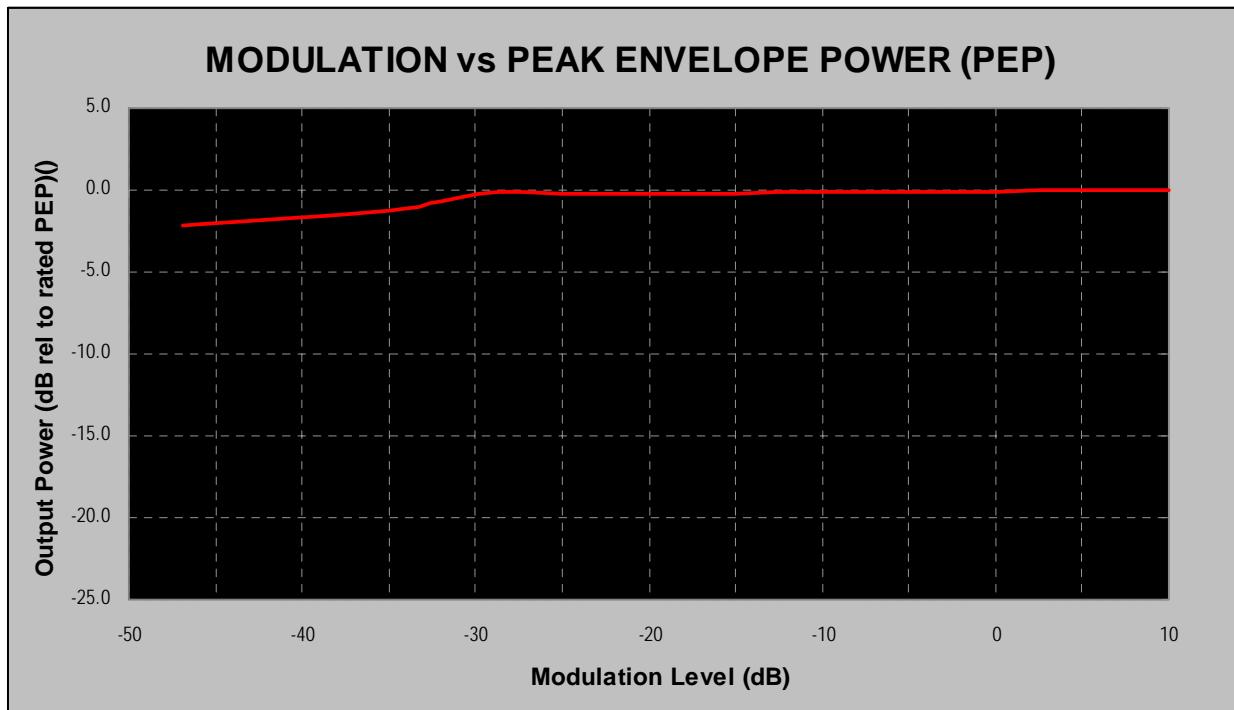


Classes of Emission:

- a. Radiotelephony: J3E
- b. DSC: F1B

Modulation vs Peak Envelope Power (PEP)

Test Frequency: Middle Channel @ 12.230 MHz



§2.1049, §80.205 - OCCUPIED BANDWIDTH, BANDWIDTHS (AUTHORIZED BANDWIDTH)

Applicable Standards

CFR 47 § 2.1049 (c) (4).

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(2) Single sideband transmitters in A3A or A3J emission modes—when modulated by two tones at frequencies of 400 Hz and 1800 Hz (for 3.0 kHz authorized bandwidth), or 500 Hz and 2100 Hz (for 3.5 kHz authorized bandwidth), or 500 Hz and 2400 Hz (for 4.0 kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(3) Single sideband transmitters in the A3H emission mode—when modulated by one tone at a frequency of 1500 Hz (for 3.0 kHz authorized bandwidth), or 1700 Hz (for 3.5 kHz authorized bandwidth), or 1900 Hz (for 4.0 kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(4) As an alternative to paragraphs (c) (2) and (3) of this section, other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However, any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the -25 dB step of the emission bandwidth limitation curve, the seventh and ninth order products must fall within the -35 dB step of the referenced curve and the eleventh and all higher order products must fall beyond the -35 dB step of the referenced curve.

§ 80.205

Bandwidths:

Class of Emission	Emission Designator	Authorized Bandwidth (kHz)
J3E	2K80J3E	3.0
F1B	300HF1B	0.5

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation. The EUT is modulated in J3E mode with 400Hz and 1800 Hz tones with a level 10dB greater than that of necessary to produce rated peak envelope power.

Test Equipment List and Details

Equipment Description	Model Number	Manufacturer	Serial Numbers	Last Calibration
Spectrum Analyzer	E4446A	Agilent	US44300386	2007-04-26
RF Communication test set	8920A	HP	3438A05338	2008-03-20
Function Generator	33220A	Agilent	MY43004878	2007-06-04

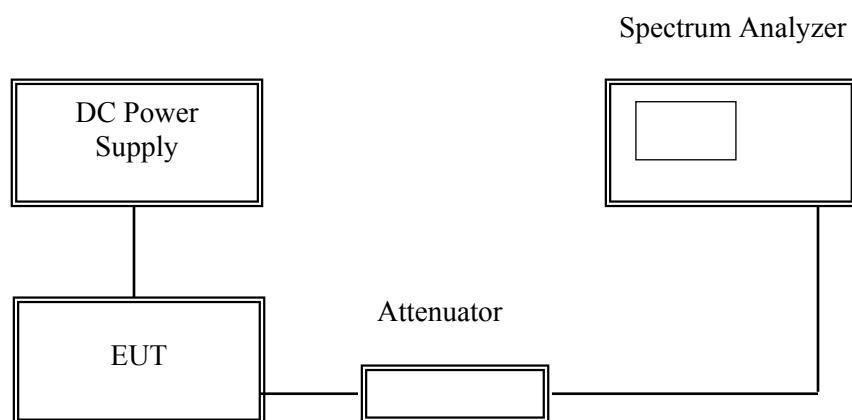
Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	59 %
ATM Pressure:	102.0 kPa

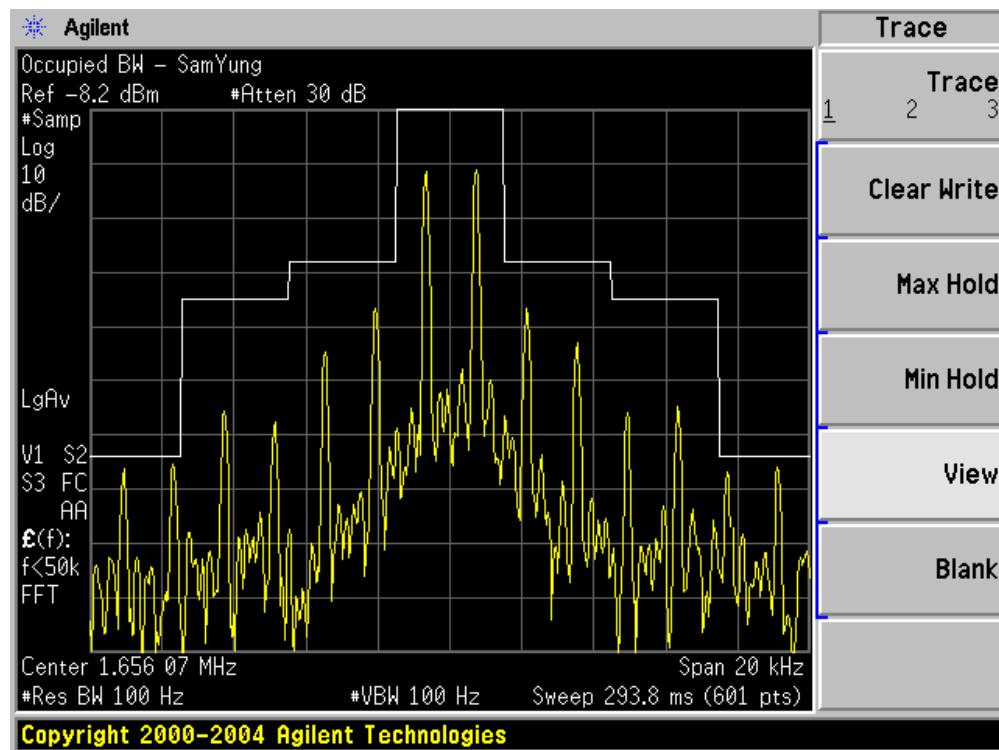
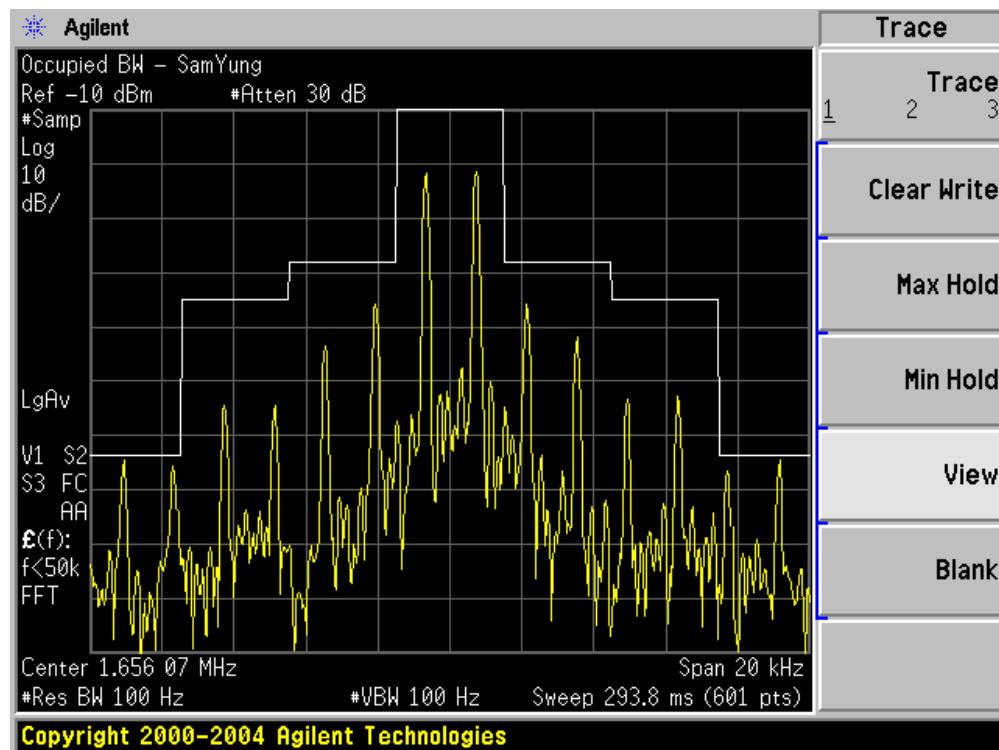
* The testing was performed by Boni Baniqued on 2008-03-31

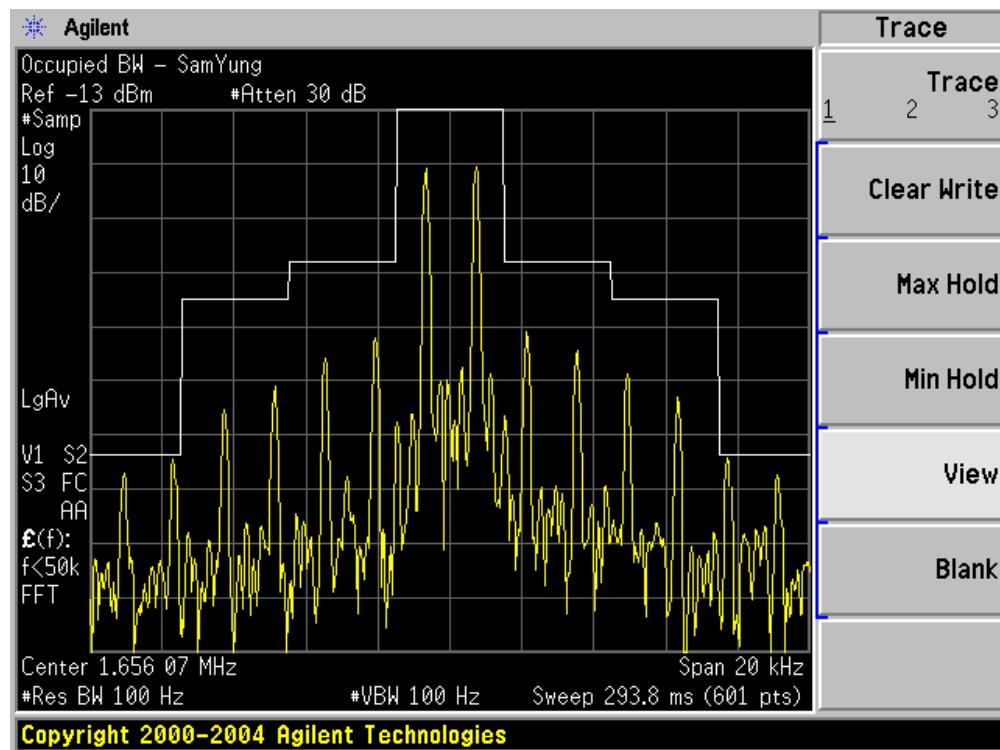
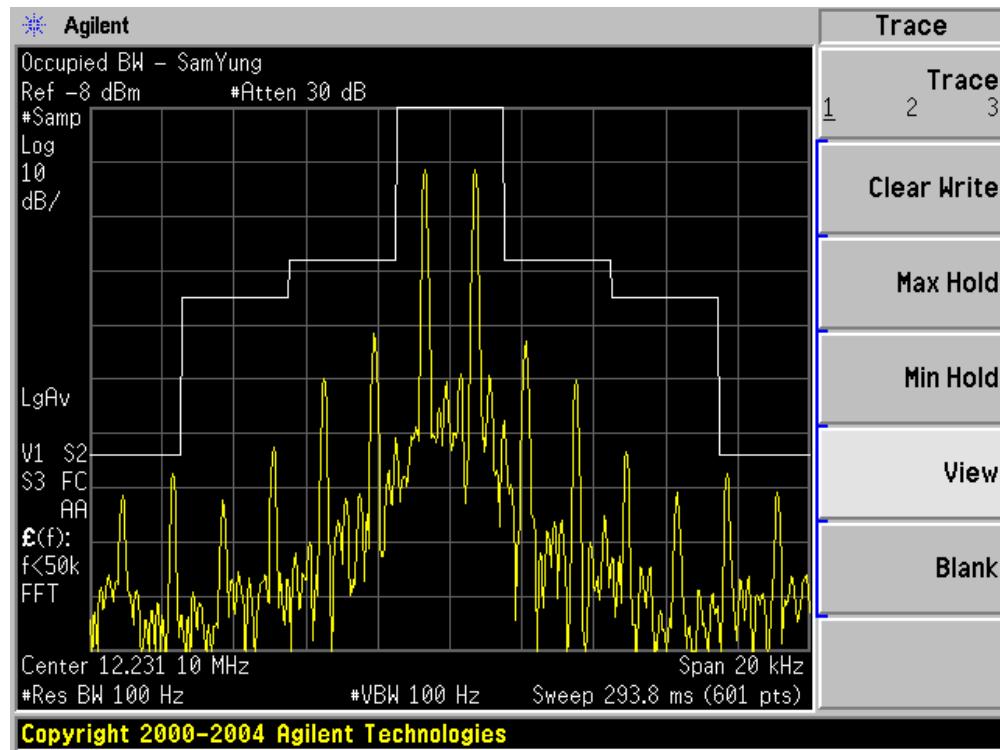
Test Setup

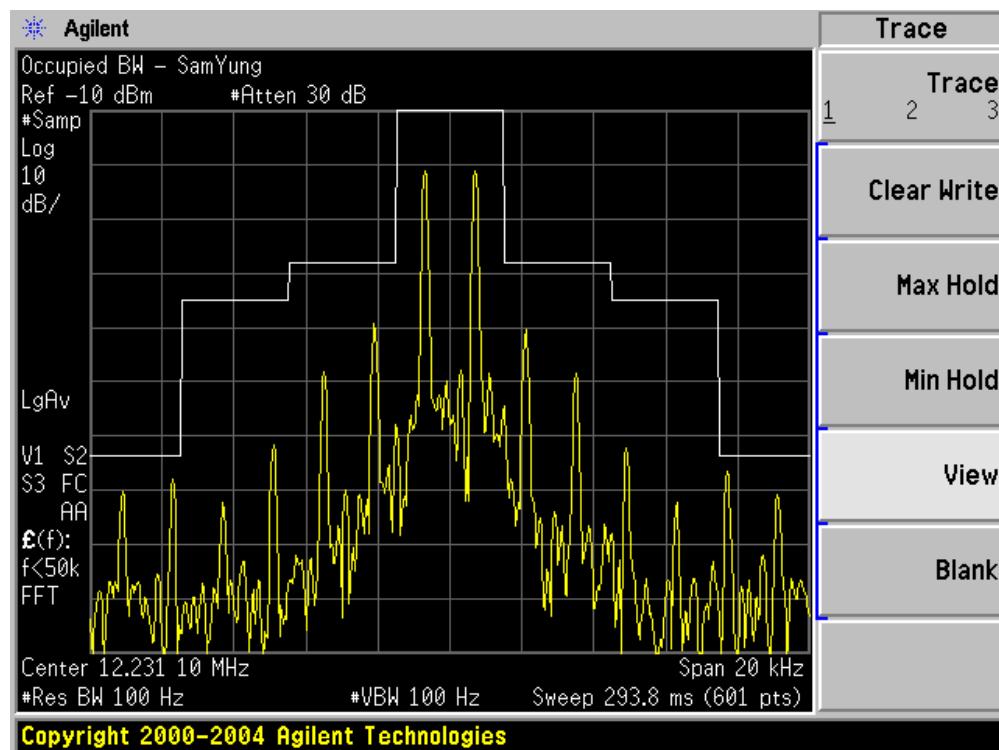
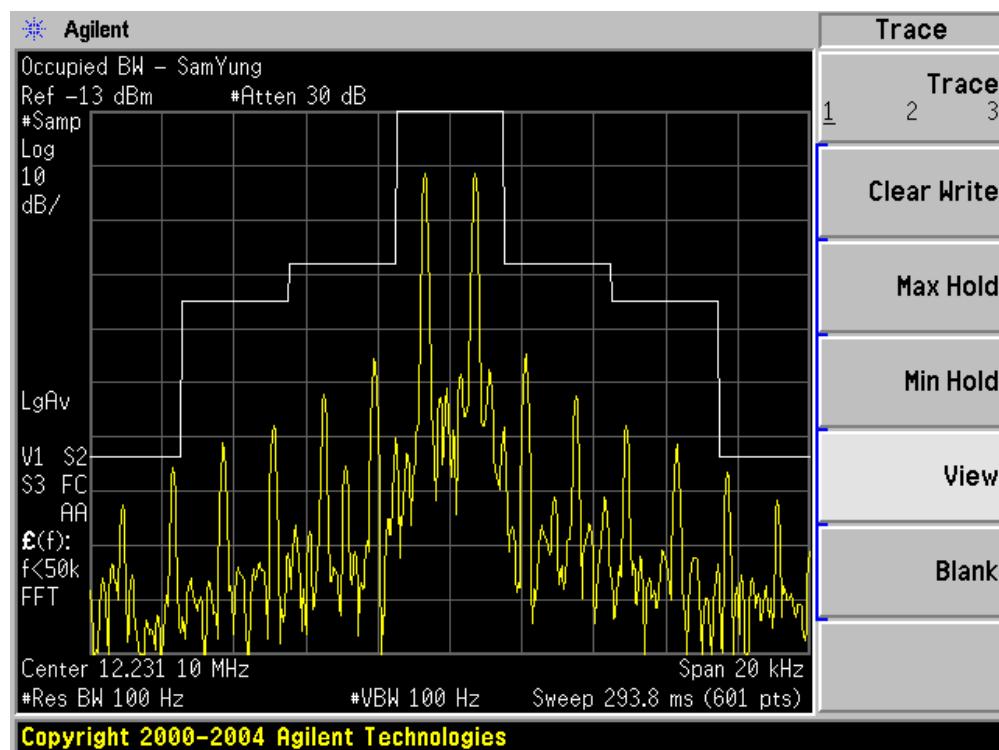


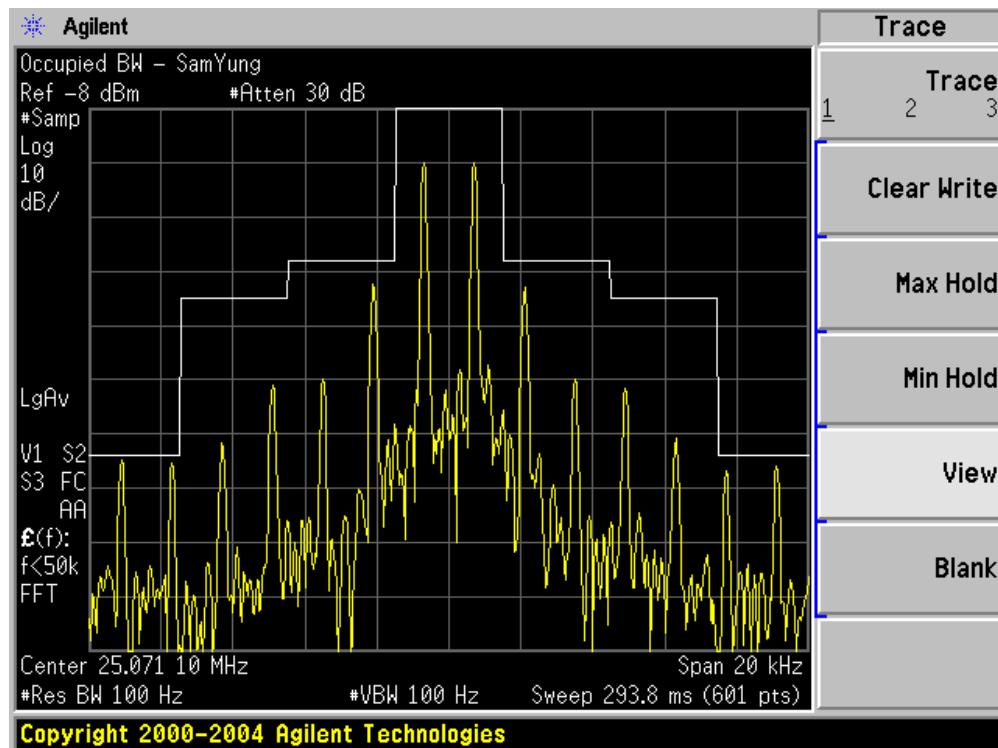
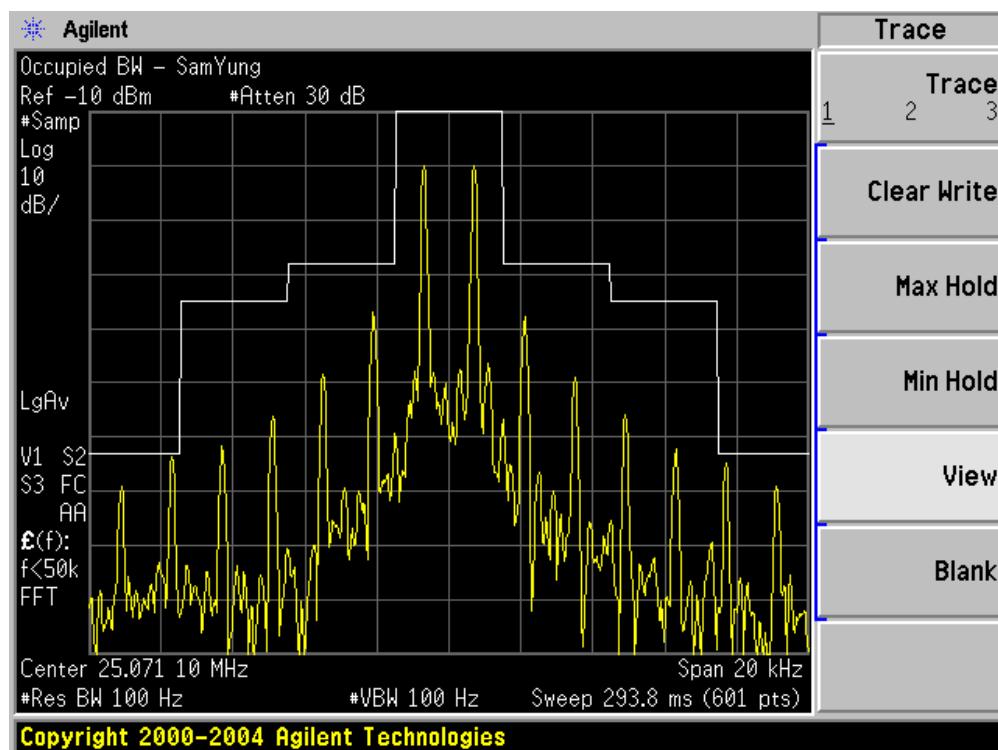
Test Results

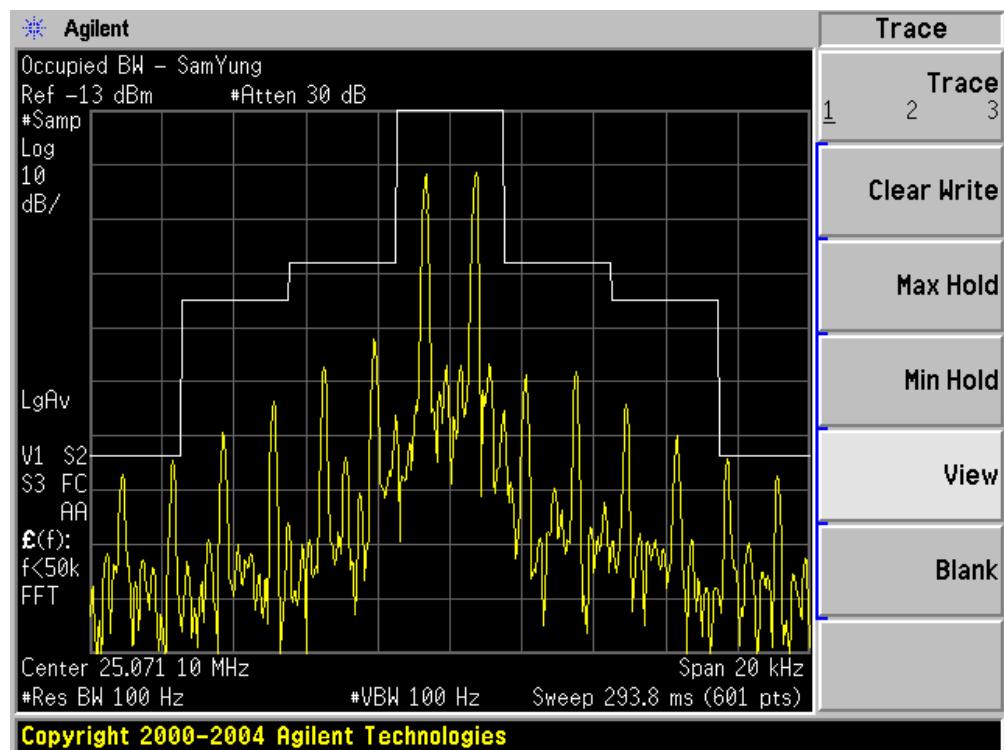
Please refer to the following plots.

Plot 1: Low Channel @ 1.6550 MHz (High Power)**Plot 2: Low Channel @ 1.6550 MHz (Middle Power)**

Plot 3: Low Channel @ 1.6550 MHz (Low Power)**Plot 4: Middle Channel @ 12.2300 MHz (High Power)**

Plot 5: Middle Channel @ 12.2300 MHz (Middle Power)**Plot 6: Middle Channel @ 12.2300 MHz (Low Power)**

Plot 7: High Channel @ 25.070 MHz (High Power)**Plot 8: High Channel @ 25.070 MHz (Middle Power)**

Plot 9: High Channel @ 25.070 MHz (Low Power)

§2.1051; §80.217 (b) – SPURIOUS EMISSION AT ANTENNA TERMINALS, SUPPRESSION OF INTERFERENCE

Applicable Standards

§ 2.1051

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 each 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.

§80.217 (b)

(b) The electromagnetic field from receivers required by statute or treaty must not exceed the following value at a distance over sea water of one nautical mile from the receiver:

Frequency of interfering emissions	Field intensity in microvolts per meter
Below 30 MHz	0.1
30 to 100 MHz	.3
100 to 300 MHz	1.0
Over 300 MHz	3.0

or

Deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

Frequency of interfering emissions	Power to artificial antenna in microwatts
Below 30 MHz	400
30 to 100 MHz	4,000
100 to 300 MHz	40,000
Over 300 MHz	400,000

Test Procedure

Conducted:

TIA 603-C Clause 2.2.13

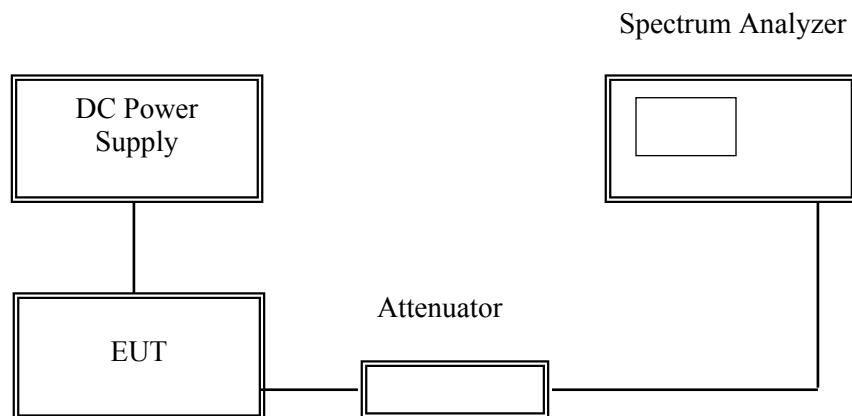
The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation.

Test Equipment List and Details

Equipment Description	Model Number	Manufacturer	Serial Numbers	Last Calibration
Spectrum Analyzer	E4446A	Agilent	US44300386	2007-04-26
RF Communication test set	8920A	HP	3438A05338	2008-03-20
Function Generator	33220A	Agilent	MY43004878	2007-06-04

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup



Environmental Conditions

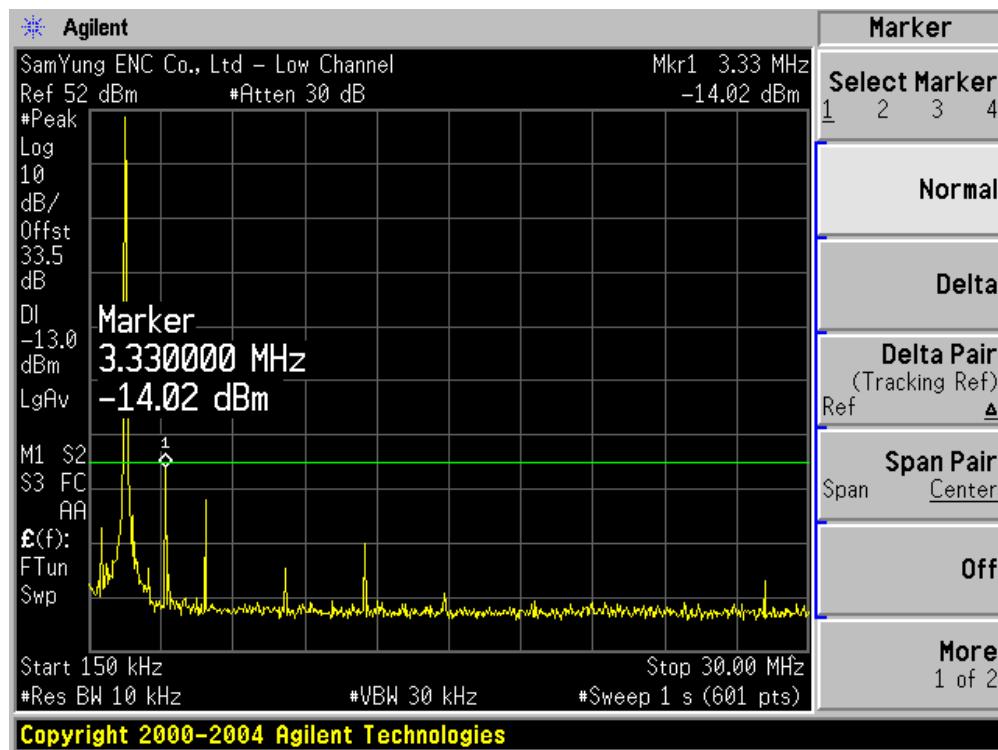
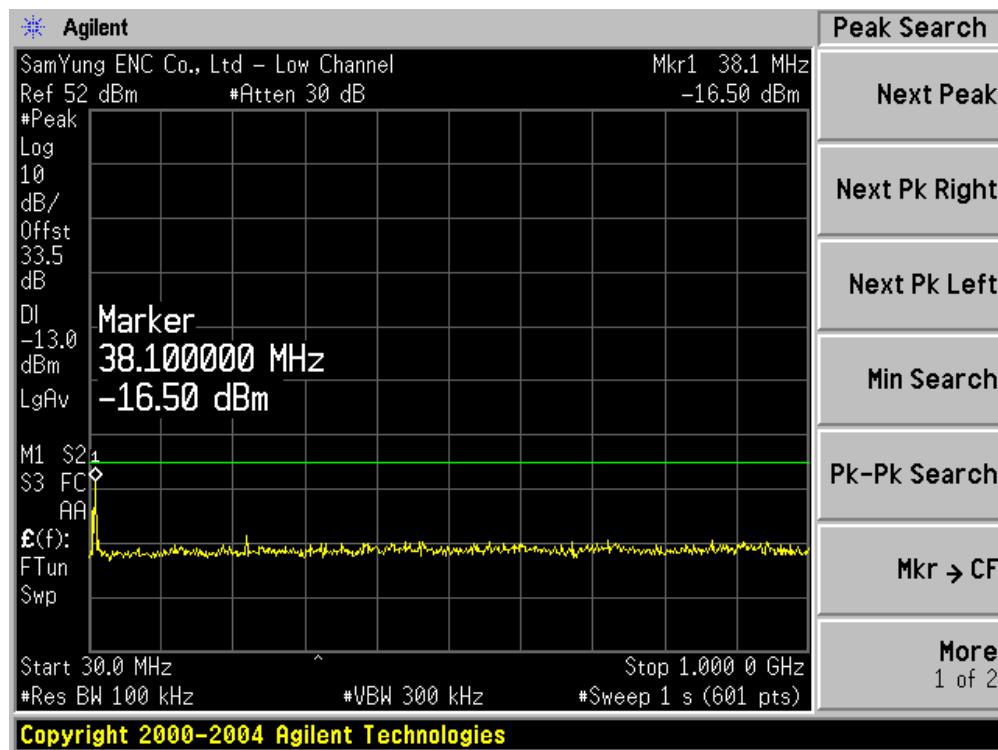
Temperature:	20 °C
Relative Humidity:	59 %
ATM Pressure:	102.0 kPa

* The testing was performed by Boni Baniqued on 2008-03-26

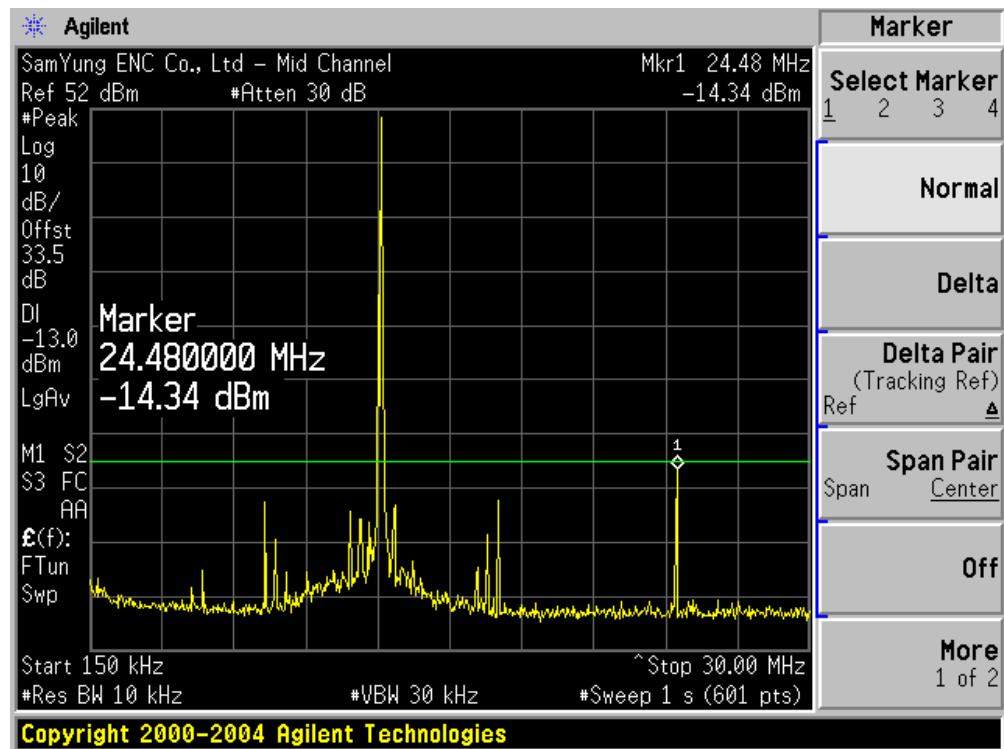
Test Results

Please refer to the following plots.

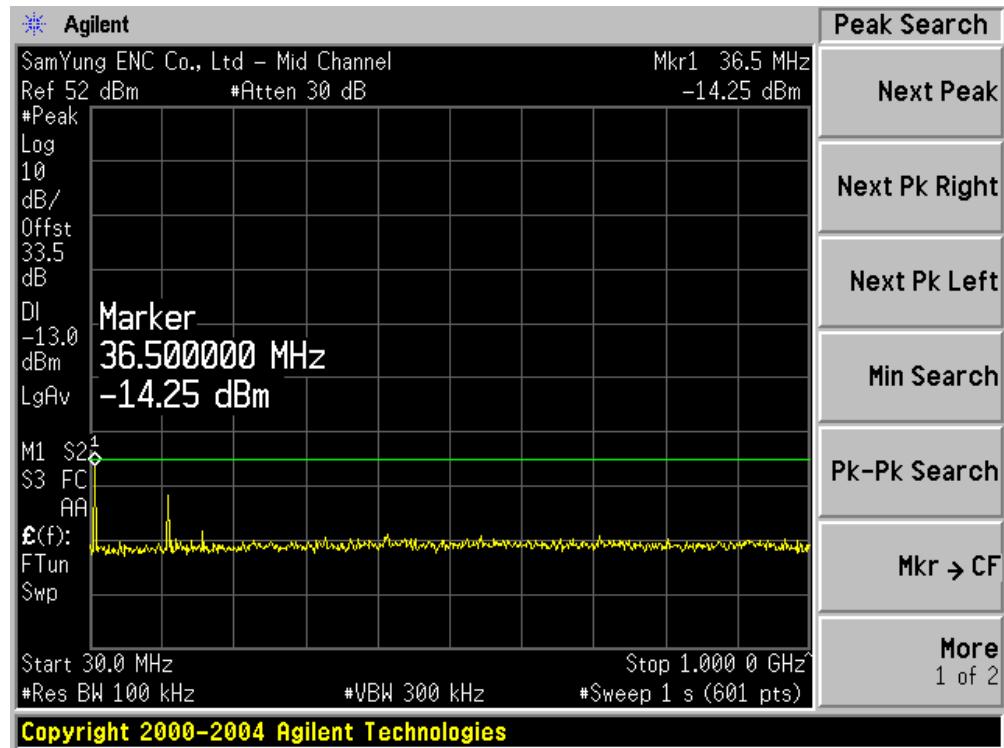
Note: Attenuation Limit = 65 dB (-13dBm)

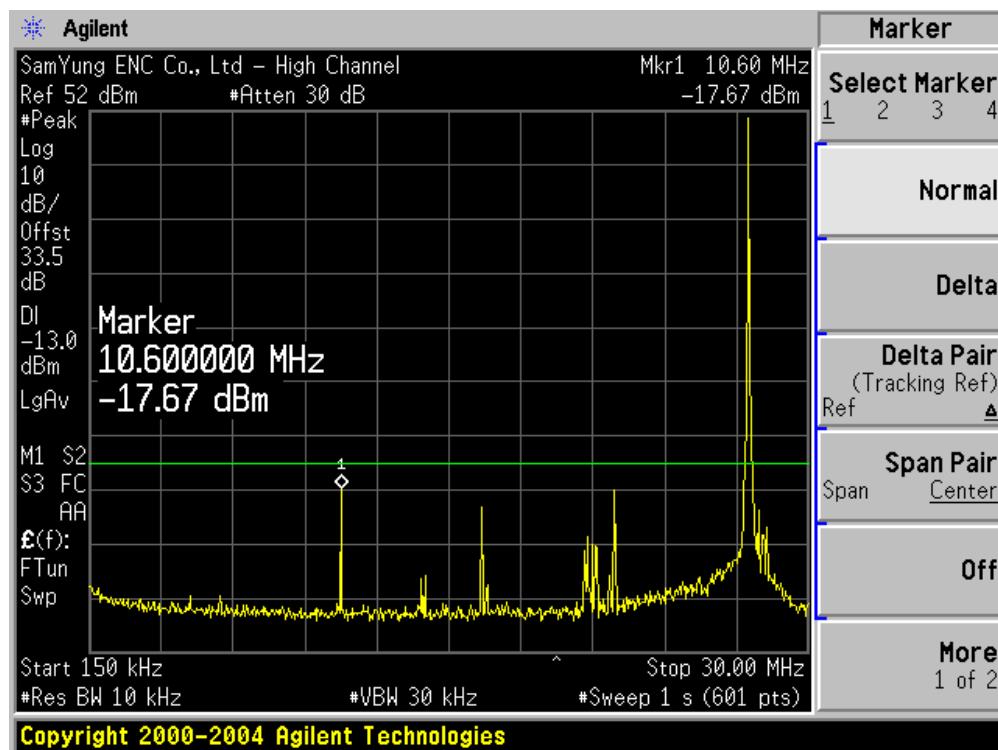
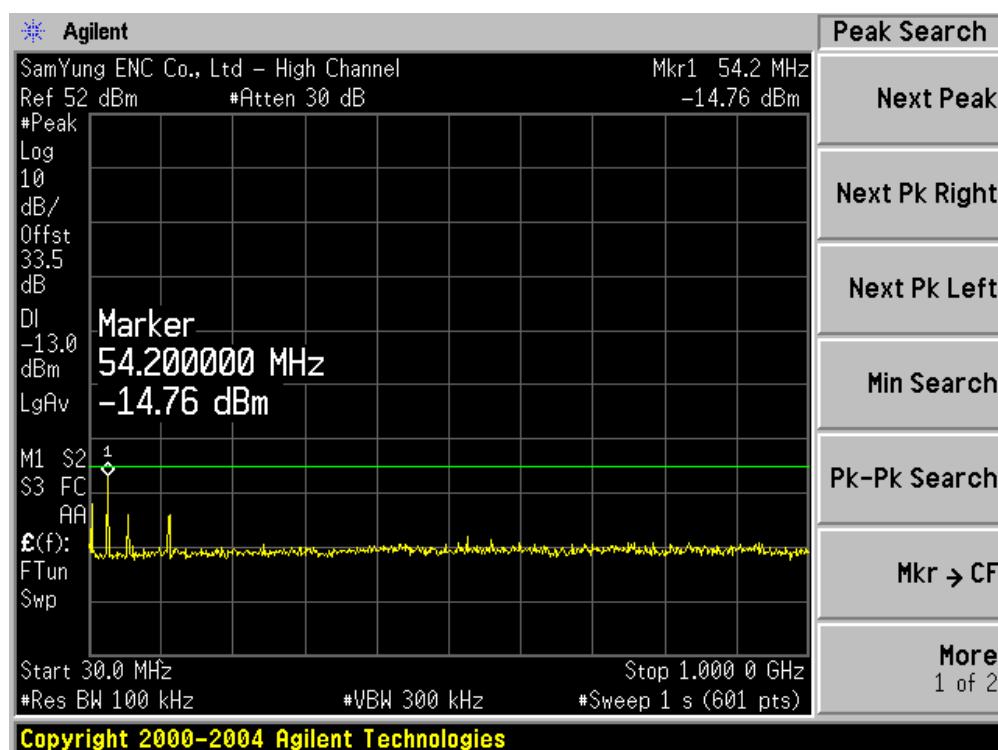
Plot 1: Low Channel (150 kHz ~ 300 MHz)**Plot 2: Low Channel (> 300 MHz)**

Plot 3: Middle Channel (150 ~ 30 MHz)



Plot 4: Middle Channel (> 30 MHz)



Plot 5: High Channel (150 kHz ~ 30 MHz)**Plot 6: High Channel (> 30 MHz)**

Receiver Spurious Emission (Conducted)

Tuned Frequency (MHz)	Emission Frequency (Mhz)	Emission Level (dBm)	Emission Level (nW)	Limit
1.6550	-	-	-	
12.230	-	-	-	
25.070	-	-	-	

Note: All other emissions in the required measurement range were more than 20 dB below the required Limit.

**§2.1053, §80.217 (b) - FIELD STRENGTH OF SPURIOUS EMISSION,
SUPPRESSION OF INTERFERENCE****Applicable Standards****§2.1053**

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be 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 (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements 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 reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

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

- (1) Those in which the spurious emissions are required to be 60 dB or more below the 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.

§80.217 (b)

(b) The electromagnetic field from receivers required by statute or treaty must not exceed the following value at a distance over sea water of one nautical mile from the receiver:

Frequency of interfering emissions	Field intensity in microvolts per meter
Below 30 MHz	0.1
30 to 100 MHz	.3
100 to 300 MHz	1.0
Over 300 MHz	3.0

or

Deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

Frequency of interfering emissions	Power to artificial antenna in microwatts
Below 30 MHz	400
30 to 100 MHz	4,000
100 to 300 MHz	40,000
Over 300 MHz	400,000

Test Procedure

TIA/EIA 603-C Clause 2.2.12

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The EUT Removed and replaced with a substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \log (\text{TX Power in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{Power out in Watts})$

$$= 43 + 10 \log_{10} (150) = 65 \text{ dB}$$

Test Equipment List and Details

Equipment Description	Model Number	Manufacturer	Serial Numbers	Last Calibration
Spectrum Analyzer	E4446A	Agilent	US44300386	2007-04-26
Modulation Analyzer	8901A	HP	2026A00847	2007-04-27
Generator	33220A	Agilent	MY43004878	2007-06-04
Antenna, Bi-log	JB1	Sunol	A020106-1 / S010293	2007-05-21
Pre-amplifier	317	Sonoma Instrument	260407	2007-04-26
Antenna, Dipole	AD-100	Com-Power	2219	2007-05-10

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	59 %
ATM Pressure:	102.0 kPa

* The testing was performed by Boni Baniqued on 2008-03-31.

Test Results

Transmitter:

Tuned Frequency (MHz)	Emission Frequency (MHz)	Antenna Polarity (V/H)	Emission Level (dBm)	Spurious Attenuation (dBc)
25.070	60.89	H	-46.57	98.04
	81.41	H	-59.06	110.53
	52.31	H	-62.87	114.34
	111.48	H	-60.17	111.64
	50.37	H	-64.66	116.13
	156.1	H	-60.78	112.25
	170.65	V	-69.62	121.09
	95.96	V	-57.06	108.53
	200.72	V	-61.58	113.05
	186.17	V	-62.54	114.01
	82.38	V	-67.19	118.66
	51.34	V	-67.28	118.75

Receiver:

Tuned Frequency (MHz)	Emission Frequency (MHz)	Antenna Polarity (V/H)	Emission Level (dBuV/m)	Emission Level (dBuV/m)	Limit (uV/m)
25.070	-	-	-	-	-
	-	-	-	-	-

Note: All other emissions in the required measurement range were more than 20 dB below the required Limit.

§2.1055, §80.209 – FREQUENCY STABILITY, TRANSMITTER FREQUENCY TOLERANCE

Applicable Standard

CFR47 §2.1055, §80.209 (a)

(a) The frequency tolerance requirements applicable to transmitters in the maritime services are shown in the following.

Band 1600-4000 kHz

Ship Stations:

For transmitters with digital selective calling emissions: 10 Hz

Band 4000-27500 kHz

Ship Stations:

For transmitters with digital selective calling emissions: 10 Hz

Test Procedure

Frequency Stability vs. Temperature:

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed through attenuators. EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the frequency counter.

Frequency Stability vs. Voltage:

An external variable DC power supply was connected to the EUT. The voltage was set to 115%, 100%, and 85% of the nominal operating input voltage, and the frequency output was recorded from the frequency counter.

Test Equipment List and Details

Equipment Description	Model Number	Manufacturer	Serial Number	Calibration Date
Microwave Frequency Counter	5342A	HP	2232A06383	2007-07-26
DC Power supply	DCR 60-45B2	Sorensen	9540285	N/A
Temp/ Humidity chamber	ESL-4CA	ESPEC	18010	2007-12-12

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	20 ~ 21 °C
Relative Humidity:	55 ~ 59 %
ATM Pressure:	101.5 ~ 102.0 kPa

* The testing was performed by Boni Baniqued on 2008-03-2

Test Results

Frequency Stability with Temperature

Supply Voltage (Vdc)	Temperature (°C)	Channel Frequency (khz)	Measured Frequency (kHz)	Frequency Error (Hz)	Limit (Hz)
24.00	-20	1655.00	1656.60	1.60	± 10
		25070.00	25071.95	1.95	± 10
	-10	1655.00	1656.60	1.60	± 10
		25070.00	25071.95	1.95	± 10
	0	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10
	10	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10
	20	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10
	30	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10
	40	1655.00	1656.60	1.60	± 10
		25070.00	25071.95	1.95	± 10
	50	1655.00	1656.60	1.60	± 10
		25070.00	25072.00	2.00	± 10

Frequency Stability with Supply Voltage

Voltage Variation (%)	Supply Voltage (V)	Channel Frequency (kHz)	Frequency (kHz)	Frequency Error (Hz)	Limit (Hz)
-15.0	20.4	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10
0.0	24.0	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10
15.0	27.6	1655.00	1656.40	1.40	± 10
		25070.00	25071.41	1.41	± 10

§2.1091, §80.227 - RADIOFREQUENCY RADIATION EXPOSURE EVALUATION: MOBILE DEVICES, SPECIAL REQUIREMENTS FOR PROTECTION FROM RF RADIATION

Applicable Standards

§ 2.1091

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

§ 80.227

As part of the information provided with transmitters for ship earth stations, manufacturers of each such unit must include installation and operating instructions to help prevent human exposure to radiofrequency (RF) radiation in excess of the RF exposure guidelines specified in §1.1307(b) of the Commission's Rules.

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	6
1.34-30	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	/	/	5.0	6

f = frequency in MHz

* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

At Low Frequency (1.655 MHz)

MPE limit for uncontrolled exposure at prediction frequency: 328.58 (mW/cm²)

At Higher Frequency (25.070 MHz)

Maximum peak output power at antenna input terminal:	51.76(dBm)
Maximum peak output power at antenna input terminal:	<u>150000 (mW)</u>
Prediction distance:	183 (cm)
Prediction frequency:	25.070 (MHz)
Antenna Gain (typical):	3.0 (dBi)
antenna gain:	2.0 (numeric)
Power density at predication frequency at 20 cm:	<u>0.71(mW/cm²)</u>

MPE limit for uncontrolled exposure at prediction frequency: 1.43 (mW/cm²)

The Power density at prediction distance of 183cm (6 feet) does not exceed the limit (900/f²). Therefore, the exposure condition is compliant with FCC Rules.

§80.221 - SPECIAL REQUIREMENTS FOR AUTOMATICALLY GENERATING THE RADIOTELEPHONE ALARM SIGNAL

Applicable Standards

(a) Each device for automatically generating the radiotelephone alarm signal must be capable of being disabled to permit the immediate transmission of a distress call and message.

(b) The device must comply with the following requirements:

- (1) The frequency tolerance of each tone must be ± 1.5 percent;
- (2) The duration tolerance of each tone must be ± 50 milliseconds;
- (3) The interval between successive tones must not exceed 50 milliseconds; and
- (4) The amplitude ratio of the tones must be flat within 1.6 dB.

(c) Devices installed on or after January 1, 1983, must comply with the following requirements:

- (1) The frequency tolerance of each tone must be ± 1.5 percent;
- (2) The duration tolerance of each tone must be ± 10 milliseconds;
- (3) The interval between successive tones must not exceed 4 milliseconds;
- (4) The amplitude ratio of the tones must be flat within 1.6 dB;
- (5) The output of the device must be sufficient to modulate the associated transmitter for H2B emission to at least 70 percent, and for J2B emission to within 3 dB of the rated peak envelope power;
- (6) Light from the device must not interfere with the safe navigation of the ship;
- (7) After activation the device must automatically generate the radiotelephone alarm signal for not less than 30 seconds and not more than 60 seconds unless manually interrupted;
- (8) After generating the radiotelephone alarm signal or after manual interruption the device must be immediately ready to repeat the signal;
- (9) The transmitter must be automatically switched from the stand-by condition to the transmit condition at the start and return to the stand-by condition at the conclusion of the radiotelephone alarm signal.

(d) Any device used by a station to automatically generate the radiotelephone alarm signal must be certificated by the Commission.

Compliant

N/A

§80.225 - REQUIREMENTS FOR SELECTIVE CALLING

Applicable Standards

(a) The requirements for DSC equipment voluntarily installed in coast or ships stations are as follows:

(1) Prior to March 25, 2009, DSC equipment must meet the requirements of the following standards in order to be approved for use:

(i) RTCM Paper 56-95/SC101-STD, RTCM Recommended Minimum Standards for Digital Selective Calling (DSC) Equipment Providing Minimum Distress and Safety Capability," Version 1.0, August 10, 1995, and ITU-R Recommendation M.493-10, "Digital Selective-calling System for Use in the Maritime Mobile Service," with Annexes 1 and 2, 2000 (including only equipment classes A, B, D, and E); or

(ii) ITU-R Recommendation M.493-11, "Digital Selective-calling System for Use in the Maritime Mobile Service," with Annexes 1 and 2, 2004, and, in the case of Class D DSC equipment only, IEC 62238, First edition, "Maritime navigation and radiocommunication equipment and systems—VHF radiotelephone equipment incorporating Class 'D' Digital Selective Calling (DSC)—Methods of testing and required test results," March 2003.

Compliant

N/A

§80.229 – SPECIAL REQUIREMENTS FOR AUTOMATIC LINK ESTABLISHMENT (ALE)

Applicable Standards

Brief signalling for the purposes of measuring the quality of a radio channel and thereafter establishing communication shall be permitted within the 2 MHz–30 MHz band. Public coast stations providing high seas service are authorized by rule to use such signalling under the following conditions:

- (a) The transmitter power shall not exceed 100 W ERP;
- (b) Transmissions must sweep linearly in frequency at a rate of at least 60 kHz per second, occupying any 3 kHz bandwidth for less than 50 milliseconds;
- (c) The transmitter shall scan the band no more than four times per hour;
- (d) Transmissions within 6 kHz of the following protected frequencies and frequency bands must not exceed 10 μ W peak ERP:

(1) Protected frequencies (kHz)

2091.0	4188.0	6312.0	12290.0	16420.0
2174.5	4207.5	8257.0	12392.0	16522.0
2182.0	5000.0	8291.0	12520.0	16695.0
2187.5	5167.5	8357.5	12563.0	16750.0
2500.0	5680.0	8364.0	12577.0	16804.5
3023.0	6215.0	8375.0	15000.0	20000.0
4000.0	6268.0	8414.5	16000.0	25000.0
4177.5	6282.0	10000.0		

(2) Protected bands (kHz)

4125.0–4128.0

8376.25–8386.75

13360.0–13410.0

25500.0–25670.0

- (e) The instantaneous signal, which refers to the peak power that would be measured with the frequency sweep stopped, along with spurious emissions generated from the sweeping signal, must be attenuated below the peak carrier power (in watts) as follows:

- (1) On any frequency more than 5 Hz from the instantaneous carrier frequency, at least 3 dB;
- (2) On any frequency more than 250 Hz from the instantaneous carrier frequency, at least 40 dB; and
- (3) On any frequency more than 7.5 kHz from the instantaneous carrier frequency, at least $43 + 10\log_{10}(\text{peak power in watts})$ db.

Compliant

N/A