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CERTIFICATION TEST REPORT
PART 15.247C

For The Land Mobile Terminal
Model: 9450

FCC ID: K3YHNS9450

PREPARED FOR:

Hughes Network Systems
9605 Scranton Road Suite 500
San Diego, CA 92121

Prepared on: July 20, 2010

Report Number: 2010 06149531 FCC

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DOCUMENT HISTORY

REVISION	DATE	COMMENTS
-	June 20, 2010	Prepared By: Alan Laudani
-	June 20, 2010	Initial Release: Alan Laudani

NOTE: Nemko USA, Inc. hereby makes the following statements so as to conform to Chapter 10 (Test Reports) Requirements of ANSI C63.4 (2003) "Methods and Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz":

- The unit described in this report was received at Nemko USA, Inc.'s facilities on June 7, 2010.
- Testing was performed on the unit described in this report on June 8, 2010 to July 20, 2009
- The Test Results reported herein apply only to the Unit actually tested, and to substantially identical Units.
- This report does not imply the endorsement of the Federal Communications Commission (FCC), Industry Canada, NVLAP or any other government agency.

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CERTIFICATION

Nemko USA, Inc., an independent Electromagnetic Compatibility (EMC) Test Laboratory, produced this Test Report and performed the Radio Frequency Interference (RFI) testing and data evaluation contained herein.

Nemko USA, Inc.'s measurement facility is currently registered with the United States Federal Communications Commission (FCC) in accordance with the provisions of 47 United States Code (CFR) Part 2, Subpart I, Section 2.948(a). A current description of Nemko USA, Inc.'s measurement facility is on file with the FCC. Nemko USA Inc. has additionally satisfied the FCC that it complies with the requirements set forth in 47 CFR Part 2, Subpart I, Section 2.948(d) regarding the accreditation of EMC laboratories.

The RFI testing, test data collection and test data evaluation were accomplished in accordance with the ANSI C63.4–2003 Standard, and in accordance with the applicable sections of the FCC rules (47 CFR Parts 2 and 15). The testing was also accomplished in accordance with Industry Canada's ICES-003 standard for unintentional radiating device per EMCAB-3, Issue 3 (May 1998). The administrative summary of this test report provides a description of the test sample.

I hereby certify that the test data, test data evaluation, and equipment configurations used to compile this test report are a true and accurate representation of the test sample's radio frequency interference characteristics as of the test date(s), and, for the design of the test sample.

Chip Fleury
Resource Manager

1. ADMINISTRATIVE DATA AND TEST SUMMARY

1.1. Administrative Data

CLIENT:	Hughes Network Systems 9605 Scranton Road Suite 500 San Diego, CA 92121
CONTACT: E-Mail:	Dave Couchman Dave.couchman@hughes.com
DATE (S) OF TEST:	June 8, 2010 to July 20, 2009
EQUIPMENT UNDER TEST (EUT):	Land Mobile Terminal
MODEL:	9450
SERIAL NUMBER:	000013
CONDITION UPON RECEIPT:	Suitable for Test
TEST SPECIFICATION:	FCC CFR 47:Part 15.247C. Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

2. Test Summary

This section contains the following:

FCC Part 15 Subpart C:

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant
Y Yes: Mandatory i.e. the apparatus shall conform to these tests.
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

Part 15C	Test Description	Required	Result
15.207 (a)	Conducted Emission Limit	NA	
15.215(c)	20 dB Bandwidth	Y	Pass
15.247(a)(2)	Minimum 6dB RF Bandwidth	Y	Pass
15.247(b)(3)	Peak Output Power	Y	Pass
15.247(d)	Band-edge Compliance of RF Conducted Emissions	Y	Pass
15.247 (d)	Spurious RF Conducted Emissions	Y	Pass
15.247 (d)	Spurious Radiated Emissions	Y	Pass
15.247(e)	Power Spectral Density for Digitally Modulated Devices	Y	Pass
	Receiver Spurious Emissions	Y	Pass

3. SYSTEM CONFIGURATION

3.1. Description and Method of Exercising the EUT

The 9450 is a Land Mobile Terminal. The 9450 comprises a FCC Part 25 Transmitter in the frequency range 1626.5 MHz to 1660.5 MHz and a FCC Part 15.247 in the frequency range of 2412 to 2462 MHz. An Ethernet connection allows for frequency changes during RF testing. The radios continue to transmit without the Ethernet connection and to be used for network connection in normal operation.

The Land Mobile Terminal model 9450 supports both the Class 10 and Class 11 satellite tracking antenna.
When supplied with a Class 10 antenna, it is designated model 9450-10.
When supplied with a Class 11 antenna, it is designated model 9450-11.

FCC ID: K3YHNS9450

The Hughes 9450 Land Mobile Terminal is a vehicular mobile unit with either an external Class 10 (for the 9450-10) or Class 11 (for the 9450-11) satellite tracking antenna which is secured to the roof of the vehicle by either bolts or magnetic mounts and connected to the terminal by an RF cable. Power for the terminal is provided by the vehicle; power for the antenna is provided by the terminal via the connecting RF cable.
User connectivity is provided by Ethernet and WLAN interfaces for connection to a computer, and ISDN and RJ-11 interfaces for ISDN and POTS handsets. A Web MMI, accessed via a browser on a connected computer, allows setup and monitoring actions to be performed on the terminal. An integrated SIM carrier enables a user to insert a SIM card to gain access to authorized Inmarsat services. A GPS receiver in the external antenna provides location information to the terminal.
To establish a connection with the Inmarsat BGAN network the terminal will use its tracking antenna to search and locate the appropriate satellite based on its GPS location and thereafter maintain track whether the vehicle is on the move or stationary

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

3.2. System Components and Power Cables

DEVICE	MANUFACTURER MODEL # SERIAL #	POWER CABLE
EUT - Land Mobile Terminal	Hughes Network Systems Model: 9450 Serial #: 000013	3 wire, shielded 20 AWG
Support Laptop computer	Toshiba Model: Satellite Pro 4600 Serial #:	1.5m, unshielded, 12 VDC coaxial
Laptop – AC Adapter	Toshiba Model: Serial #:	1.5m, unshielded, 18 AWG, 2-wire, IEC connector
DC power supply	Kikusui Model: Regulated Power Supply NEMKO #: N97	1.5m, unshielded, 18 AWG, 3-wire, IEC connector
I/Q Modulation Generator	Rohde & Schwarz Model: AMIQ SN: 833750/020 Calibration Due 10/21/2012	1.5m, unshielded, 18 AWG, 3-wire, IEC connector
Signal Generator	Rohde & Schwarz Model: SMIQ 03B SN: DE 33948 Calibration Due 10/21/2010	1.5m, unshielded, 18 AWG, 3-wire, IEC connector
Power Splitter	Mini Circuits Model: ZN2PD-1900W SN: 476100731	NA
Power Splitter	Mini Circuits Model: ZAPD-21 SN: 15542	NA
20 dB Attenuator	Weinshel Corp Model: 33-20-34 SN: SX4210	NA
Analog Telephone	AT&T Model: “THE PHONE” SN: NA	NA
ISDN Telephone	Swisscon Model: A27 SN: NA	NA

3.3. Device Interconnection and I/O Cables

Connection	I/O Cable
EUT Ethernet to Laptop	3m, CAT5, 5m, unshielded cable
Support Equipment to EUT	Coax, 50 ohm—see test configuration diagram

3.4. Design Modifications for Compliance

The following design modifications were made to the EUT during testing.

num	change	schematic sheet#	Reason
1	Replace T5 with Pulse P0502NL (9506160-0002)	4	Improve EMC
2	Add in parallel with VR2, three capacitors: 4.7uF/100V (9509097-0029), 2 x 1uF/100V (9501048-0038)	4	Improve EMC
3	Add between pin 1 and pin 3 of J11 (DC_IN connector), two capacitors: 4.7uF/100V (9509097-0029)	4	Improve EMC
4	Add in parallel with C36, capacitor: 4.7uF/100V (9509097-0029)	4	Improve EMC
5	Replace C38, C39, C40, and C25 with 470uF/63V (9501066-0008)	6	Improve EMC
6	Replace C304 and C288 with 0.1uF/1kV (9509098-0036)	4	Improve EMC
7	Add capacitor 0.1uF/1kV (9509098-0036) between hot and cold GND, place it between Q1 and Q2.	7	Improve EMC
8	Replace C88 and C93 with 0.1uF/1kV (9509098-0036)	8	Improve EMC
9	Rotate C113 and C114 90 deg to shorten the GND connection with plating for post, next to the CR15. Route +42V trace from CR15-CR16, on the left side (face plate side) of the C113, C114.	8	Improve EMC
10	Add plating to the heat sink holes, add three capacitors 0.1uF/1kV (9509098-0036) from each hole plating to the hot GND. Place them close to the heat sink holes.	6	Improve EMC
11	Add plating to the front post (next to the fuse holder) hole, add capacitor 0.1uF/1kV (9509098-0036) from hole plating to the hot GND.	4	Improve EMC
12	Add 68V zener (9502844-0021) between drain and source of Q3	6	Improve EMC
13	Add snubber components between drain and source of Q3 (diode MURS120T3 (9500053-0001), 2 cap 0.1uF / 100V in series (9500314-0067), and resistor 4.7k (9500747-0090)). Place the new components close to Q3.	6	Improve EMC
14	Add snubber components between drain and source of Q1 (diode MURS120T3 (9500053-0001), 2 cap 0.1uF / 100V in series (9500314-0067), and 2 resistor 4.7k in series (9500747-0090)). Place the new components close to Q1.	7	Improve EMC
15	Add snubber components between drain and source of Q2 (diode MURS120T3 (9500053-0001), 2 cap 0.1uF / 100V in series (9500314-0067), and 2 resistor 4.7k in series (9500747-0090)). Place the new components close to Q2.	7	Improve EMC
16	DNI R443, and install R445, 4.75k; 0402 (9500410-0354), (move R443 in the R445 position)	15	Change PoE management IC mode from auto to semi-auto
17	Replace R20, R21, R28, R30 (0.5 ohm; 2010; 9501372-0187), with 0.25 ohm 2010 (9501372-0186)	15	Required for PoE operating in semi-auto mode
19	Add 0 ohm; 0402 resistor (9500059-0002), between 12-24VSENSE signal and pin# 93 of J5 connector, add DNI 0 ohm; 0402 resistor (9500059-0002), between 12-24VSENSE signal and pin# 91 of J5 connector	20	provide option for SW

3.5. Technical Specifications of the EUT

Manufacturer:	Hughes Network Systems
Operating Frequency:	2412 MHz to 2462 MHz in the 2400-2483.5 MHz Band
Rated Power:	0.020 W
Modulation:	Digital
Number of Operating Frequencies:	11
Antenna Type:	HG2403RD-RSF, 3 dBi
Antenna Connector:	Reverse SMA
Power Source:	12 and/or 24 VDC

4. DESCRIPTION OF TEST SITE AND ENVIRONMENT

4.1. Description of Test Site

The test site is located at 11696 Sorrento Valley Road, Suite F, San Diego, CA 92121. The site is physically located 18 miles Northwest of downtown San Diego. The general area is a valley 1.5 miles east of the Pacific Ocean. This particular part of the valley tends to minimize ambient levels, i.e. radio and TV broadcast stations and land mobile communications. The three and ten-meter Open Area Test Site (OATS) is located behind the office/lab building. It conforms to the normalized site attenuation limits and construction specifications as set in the EN 55022 (1987), CISPR 16 and 22 (1985) and ANSI C63.4-2001 documents. The OATS normalized site attenuation characteristics are verified for compliance every year, and registered with the Federal Communications Commission under Registration Number 90579 and Industry Canada under 2040B-1 and 2040B-2.

4.2. Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedures.

4.3. Modifications Performed During Assessment

Modification: Grounding of the WLAN connector was achieved by adding copper foil to the backside of the enclosure plate to connect the ground from the antenna port to the ground of the WLAN connector. Additionally, a grounding spring was added to the interface board and the spring was connected to the copper foil. This reduced digital spurious emissions under 500 MHz.

4.4. Record Of Technical Judgements

No technical judgements were made during the assessment.

4.5. EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.6. Test Deleted

No Tests were deleted from this assessment.

4.7. Additional Observations

There were no additional observations made during this assessment.

4.8. Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	17 – 22 ^{o}C
Humidity range	:	29 - 50%
Pressure range	:	87 - 105 kPa
Power supply range	:	120VAC 60Hz (±15%)

5. DESCRIPTION OF TESTING METHODS

5.1. Introduction

As required in 47 CFR, Parts 2 and 15, the methods employed to test the radiated and conducted emissions (as applicable) of the EUT are those contained within the American National Standards Institute (ANSI) document ANSI C63.4–2003, titled "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." All applicable FCC Rule Sections that provide further guidance for performance of such testing are also observed.

For General Test Configuration please refer to Figure 1 on the following page.

Digital devices sold in Canada are required to comply with the Interference Causing Equipment Standard for Digital Apparatus, ICES-003. These test methods and limits are specified in the Canadian Standards Association's (CSA) Standard C108.8-M1983 (1-1-94 version) and are "essentially equivalent" with FCC, Part 15 and CISPR 22 (EN55022) rules for unintentional radiators per EMCAB-3, Issue 3 (May 1998). No further testing is required for compliance to ICES-003.

5.2. Configuration and Methods of Measurements for Conducted Emissions

Section 7 of ANSI C63.4 determines the general configuration of the EUT and associated equipment, as well as the test platform for conducted emissions testing. Tabletop devices are placed on a non-conducting surface 80 centimeters above the ground plane floor and 40 centimeters from the ground plane wall. The EUT and associated system are configured to operate continuously, representing a "normally operating" mode. The EUT is powered via a Line Impedance Stabilization Network (LISN). The emissions are recorded using the required bandwidth of 9 kHz in the quasi-peak mode. The average amplitude is also observed employing a 10 kHz bandwidth to determine the presence of broadband RFI. When such interference is caused by broadband sources (as defined by the FCC and ANSI Rules), the deviation guidelines contained in Section 11.3.1 of ANSI C63.4 are employed, which allows a correction factor of 13 dB to be subtracted from the quasi-peak reading. The emission levels are then compared to the applicable FCC limits to determine compliance.

5.3. Configuration and Methods of Measurements for Frequency Identification

When performing all testing of equipment, the actual emissions of the EUT are segregated from ambient signals present within the laboratory or the open-field test range. Preliminary testing is performed to ensure that ambient signals are sufficiently low to allow for proper observation of the emissions from the EUT. Incoming power lines are filtered using a 120 dB, 30-ampere; 115/208-volt filter to assist in reducing ambient signals for tests of levels of conducted emissions. Ambients within the laboratory are compared to those noted at the nearby open-field site to discriminate between signals produced from the EUT and ambient signals. In the event that a significant emission is produced by the EUT at a frequency which is also demonstrating significant ambient signals, the spectrum analyzer is placed in the peak mode, the bandwidth is narrowed, the EUT's signal is centered on the analyzer, the scan width is expanded to 50 kHz while monitoring the audio to ensure that only the EUT signal is present, the analyzer is switched to quasi-peak mode, and the level of the EUT signal is recorded.

5.4. Configuration and Methods of Measurements for Radiated Emissions

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified inside a shielded chamber by positioning a broadband receive antenna one meter from the EUT. Next, the EUT and associated system are placed on a turntable on a ten-meter open area test site (OATS) with known attenuation characteristics and all significant radiated emissions are recorded. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. The numerical results are included herein to demonstrate compliance. The numerical results of the test are included herein to demonstrate compliance.

The numerical results that are applied to the emissions limits are arrived as demonstrated by the example below:

A	B	C	D	E	F	G	H	I	J	K
Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail
47.2	44.5	44.6	Q	-	1.0	44.6	24.2	30.0	-5.8	Pass

A. Frequency Measured in MHz.
B. Meter Reading: Emission Amplitude as measured with the antenna in Vertical polarity in dBµV, this is from the EMI receiver or Spectrum Analyzer.
C. Meter Reading: Emission Amplitude as measured with the antenna in Horizontal polarity in dBµV, this is from the EMI receiver or Spectrum Analyzer.
D. Detector used: Q for Quasi-Peak, A for average, P for peak.
E. EUT Side F/L/R/B: Side of EUT facing the receiving antenna. Front, Left, Right, Back. If not noted, emission did not peak in a significant manner to discriminate which side of the EUT emitted the emission.
F. Ant. Height m: Antenna height in meters of strongest emission when the antenna was raised from 1 to 4 meters, vertical or horizontal.
G. Max Reading: Max meter reading of B vertical and C horizontal in dBµV.
H. Corrected Reading: Corrected Reading in dBµV/m; Max Reading corrected for cable loss (dB), antenna factor (dBV/m) and preamplifier gain (dB).
I. Spec limit: Specification Limit at the measured frequency in dBµV/m.
J. CR/SL Diff.: Difference in dB of Corrected Reading and Specification Limit, negative result is pass margin.
K. Pass Fail: Result; EUT does or does not comply at this frequency.

Example:
44.6 dBµV (Meter reading—Max.)
+0.8 dB (cable loss @ frequency)
45.4 dBµV
+11.5 dB/m (antenna factor @ frequency)
56.9 dBµV/m
-32.7 dB (preamplifier gain @ frequency)
24.2 dBµV/m --Final Corrected Reading
30.0 dBµV/m Specification Limit @ frequency
-5.8 dB CR/SL Difference.
Pass as difference is negative (below limit).

6. Test Results

6.1. Conducted Emissions

Part 15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

7.2.2 The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network. Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries. The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Conducted Emissions Test Data – Transceiver mode
Test is not applicable as device is powered and used in a vehicle.

6.2. Receiver Spurious Emission

Emissions relating to digital clocks reported below,
Mode is Transceiver as device has no separate receive mode.
Limits meet FCC 15.209 limits.
Emissions were searched over a range of 30 MHz to 10000 MHz

Radiated Emissions Data

Job # :	42995-1	Date :	7-7-2010	Page	1 of 1
NEX #:	149531	Time :	1414		
		Staff :	AAL		
Client Name :	Hughes Network Systems			EUT Voltage :	24
EUT Name :	Land Mobile Terminal			EUT Frequency :	DC
EUT Model # :	9450 with C10			Phase:	
EUT Serial # :	00109			NOATS	
EUT Config. :	SEE BELOW			SOATS	X
				Distance < 1000 MHz:	10m
				Distance > 1000 MHz:	3 m
Specification :	FCC 15.107/15.207				
Loop Ant. #:	NA				
Bicon Ant.#:	115	Temp. (°C) :	18		
Log Ant.#:	110_10M	Humidity (%) :	70		
DRG Ant. #	877	Spec An.#:	898		
Cable LF#:	SOATS	Spec An. Display #:	898		
Cable HF#:	SOATS	QP #:	898		
Preamp LF#:	NA	PreSelect#:	899		
Preamp HF#	na				

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average	RBW: 1 MHz
	Video Bandwidth 10 Hz

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
38	9.8	8.8	Q	-	1.0	9.8	21.9	30.0	-8.1	Pass	STANDBY/PING
55	12.7	11.4	Q	-	1.0	12.7	26.7	30.0	-3.3	Pass	4 POE
75	19.6	12.1	Q	-	1.0	19.6	28.8	30.0	-1.2	Pass	
130.9	11.7	10.1	Q	-	1.0	11.7	27.0	30.0	-3.0	Pass	
307.5	8.7	14.8	Q	-	1.0	14.8	31.1	37.0	-5.9	Pass	
337.9002	13.0	11.1	Q	-	1.0	13	29.8	37.0	-7.2	Pass	
360.9503	6.0	9.9	Q	-	1.0	9.9	27.6	37.0	-9.4	Pass	
376.0004	3.3	3.9	Q	-	1.0	3.9	21.4	37.0	-15.6	Pass	
38	11.2	9.3	Q	-	1.0	11.2	23.3	30.0	-6.7	Pass	TX/ PING
55	11.6	11.4	Q	-	1.0	11.6	25.6	30.0	-4.4	Pass	4 POE
75	19.0	13.4	Q	-	1.0	19	28.2	30.0	-1.8	Pass	
130	11.8	9.5	Q	-	1.0	11.8	27.1	30.0	-2.9	Pass	
307.5	16.9	2.7	Q	-	1.0	16.9	33.2	37.0	-3.8	Pass	
337.9002	13.3	10.3	Q	-	1.0	13.3	30.1	37.0	-6.9	Pass	
360.9503	4.1	11.5	Q	-	1.0	11.5	29.2	37.0	-7.8	Pass	
376.0004	10.9	12.1	Q	-	1.0	12.1	29.6	37.0	-7.4	Pass	
											3 METER SITE
1007.9	20.2	32.1	P	-	1.0	32.1	60.8	74.0	-13.2	Pass	TX/ PING
1105.0	21.3	28.4	P	-	1.0	28.4	57.7	74.0	-16.3	Pass	4 POE
1138.0	26.4	23.9	P	-	1.0	26.4	57.9	74.0	-16.1	Pass	
1007.9	5.1	13.1	A	-	1.0	13.1	41.8	54.0	-12.2	Pass	
1105.0	6.1	3.3	A	-	1.0	6.1	35.4	54.0	-18.6	Pass	
1138.0	12.4	10.2	A	-	1.0	12.4	43.9	54.0	-10.1	Pass	
1138.0	19.4	13.1	P	-	1.2	19.4	50.9	74.0	-23.1	Pass	STANDBY
1138.0	12.2	8.1	A	-	1.2	12.2	43.7	54.0	-10.3	Pass	4 POE

Radiated Emissions Data

Job # :	42995-1	Date :	7-7-2010	Page	1 of 1
NEX #:	149531	Time :	1230		
		Staff :	AAL		
Client Name :	Hughes Network Systems			EUT Voltage :	24
EUT Name :	Land Mobile Terminal			EUT Frequency :	dc
EUT Model # :	9450 with C11			Phase:	-
EUT Serial # :	00109			NOATS	
EUT Config. :	SEE BELOW			SOATS	X
				Distance < 1000 MHz:	10 m
				Distance > 1000 MHz:	3 m
Specification :	FCC 15.107/15.207				
Loop Ant. #:	NA				
Bicon Ant.#:	115	Temp. (°C) :	16		
Log Ant.#:	110_10m	Humidity (%) :	86		
DRG Ant. #	877	Spec Analyzer #:	898		
Cable LF#:	SOATS	Analyzer Display #:	898		
Cable HF#:	SOATS	Quasi-Peak Detector #:	898		
Preamp LF#:	NA	Preselector #:	899		
Preamp HF#	NA				

Quasi-Peak	RBW:	120 kHz
	Video Bandwidth	300 kHz
Peak	RBW:	1 MHz
	Video Bandwidth	3 MHz
Average	RBW:	1 MHz
	Video Bandwidth	10 Hz

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
32.0	9.9	0.7	Q	-	1.0	9.9	21.9	30.0	-8.1	Pass	STANDBY/PING
108.9	11.4	13.5	Q	-	1.0	13.5	28.3	30.0	-1.7	Pass	POE (30
168.8	5.3	2.7	Q	-	1.0	5.3	23.0	30.0	-7.0	Pass	
200.4	8.4	6.0	Q	-	1.0	8.4	21.8	30.0	-8.2	Pass	
261.4	4.6	4.7	Q	-	1.0	4.7	19.2	37.0	-17.8	Pass	
287.5	8.6	12.0	Q	-	1.0	12.0	28.0	37.0	-9.0	Pass	
350.0	6.1	9.7	Q	-	1.0	9.7	27.1	37.0	-9.9	Pass	
376.0	7.5	6.0	Q	-	1.0	7.5	25.0	37.0	-12.0	Pass	
											TX/PING
32.0	9.6	2.3	Q	-	1.0	9.6	21.6	30.0	-8.4	Pass	POE (3)
108.9	10.1	12.4	Q	-	1.0	12.4	27.2	30.0	-2.8	Pass	
168.8	4.0	2.2	Q	-	1.0	4.0	21.7	30.0	-8.3	Pass	
200.4	10.4	6.8	Q	-	1.0	10.4	23.8	30.0	-6.2	Pass	
261.4	6.0	4.9	Q	-	1.0	6.0	20.5	37.0	-16.5	Pass	
287.5	12.3	8.7	Q	-	1.0	12.3	28.3	37.0	-8.7	Pass	
350.0	15.8	12.5	Q	-	1.0	15.8	33.2	37.0	-3.8	Pass	
376.0	6.4	9.2	Q	-	1.0	9.2	26.7	37.0	-10.3	Pass	
											3 meters
1138.0	27.0	22.7	P	-	1.2	27	56.3	74.0	-17.7	Pass	STANDBY
1172.9	28.0	25.0	P	-	1.2	28	57.3	74.0	-16.7	Pass	4 POE
1105.0	21.1	18.7	P	-	1.0	21.1	50.4	74.0	-23.6	Pass	
1203.0	24.9	21.5	P	-	1.0	24.9	55.1	74.0	-18.9	Pass	
1138.0	12.2	7.9	A	-	1.2	12.2	41.5	54.0	-12.5	Pass	
1172.9	13.2	10.2	A	-	1.2	13.2	42.5	54.0	-11.5	Pass	
1105.0	6.3	3.9	A	-	1.0	6.3	35.6	54.0	-18.4	Pass	
1203.0	10.1	6.7	A	-	1.0	10.1	40.3	54.0	-13.7	Pass	
											TX/ PING
1138.0	27.4	24.0	P	-	1.2	27.4	56.7	74.0	-17.3	Pass	4 POE
1105.0	21.7	19.5	P	-	1.2	21.7	51.0	74.0	-23.0	Pass	
1203.0	24.9	21.1	P	-	1.2	24.9	55.1	74.0	-18.9	Pass	
1138.0	12.6	9.2	A	-	1.2	12.6	41.9	54.0	-12.1	Pass	
1105.0	6.9	4.7	A	-	1.0	6.9	36.2	54.0	-17.8	Pass	
1203.0	10.1	6.3	A	-	1.0	10.1	40.3	54.0	-13.7	Pass	

6.3. 20 dB Bandwidth

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Sample Number:	9450	Temperature:	24°C
Date:	6-10-2010	Humidity:	55%
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	Room 2

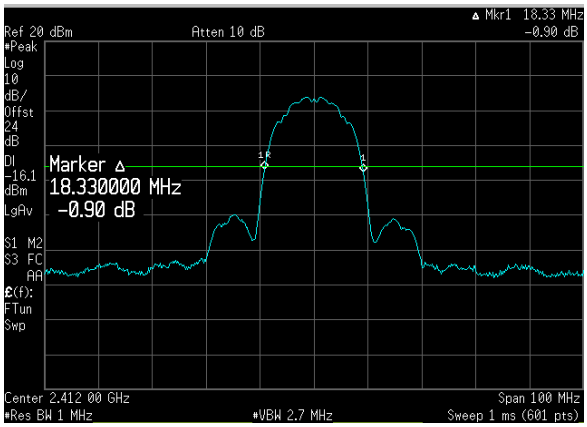
15.247(a)(1)

- Measurements were made conductively.
- Each channel investigated was maximized in the OATS before any reading was made. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier.
- A PEAK output reading was taken, a DISPLAY line was drawn 20 dB lower than PEAK level.
- Span is wide enough to capture the channel transmission
- RBW is 1% of the span
- VBW is 3X RBW
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- The bandwidth was determined from where the channel output spectrum intersected the display line.

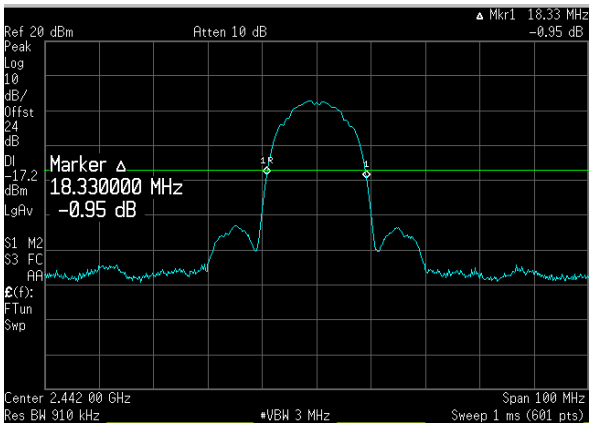
Test Results:

Low Channel 2412 MHz	Mid Channel 2437 MHz	High Channel 2462 MHz
18.33 MHz	18.33 MHz	18.50 MHz

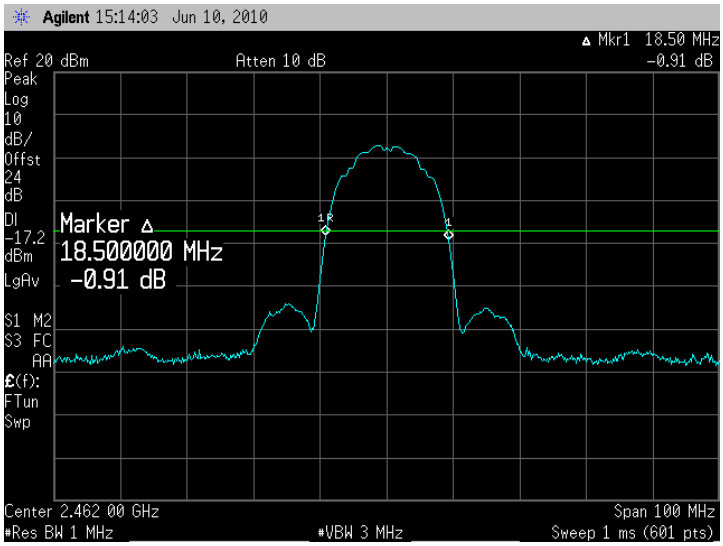
2412 MHz – 20dB BW/2 = 2402.835 MHz (within the frequency band)
2462 MHz + 20dB BW/2 = 2471.250 MHz (within the frequency band)



Low Channel



Mid Channel



High Channel

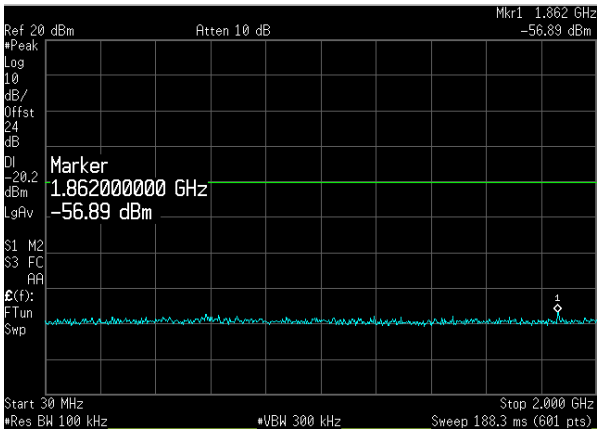
6.4. Out-of-band Emissions – Conducted

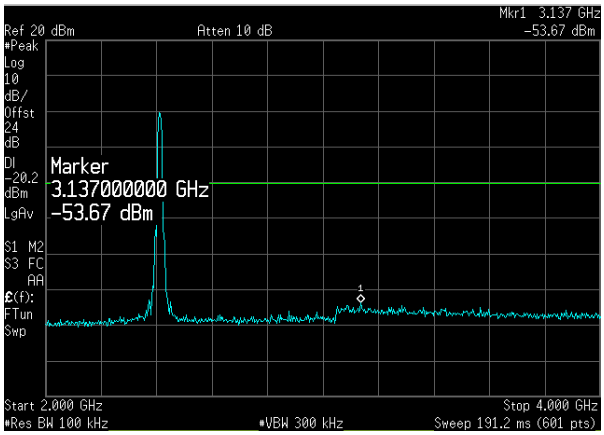
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

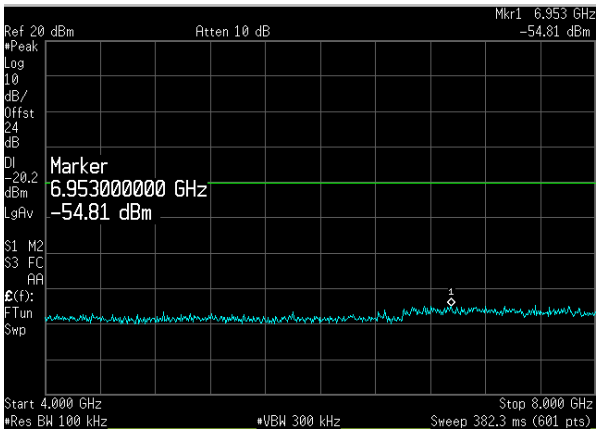
Sample Number:	9450	Temperature:	24°C
Date:	6-10-2010	Humidity:	55%
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	Room 2

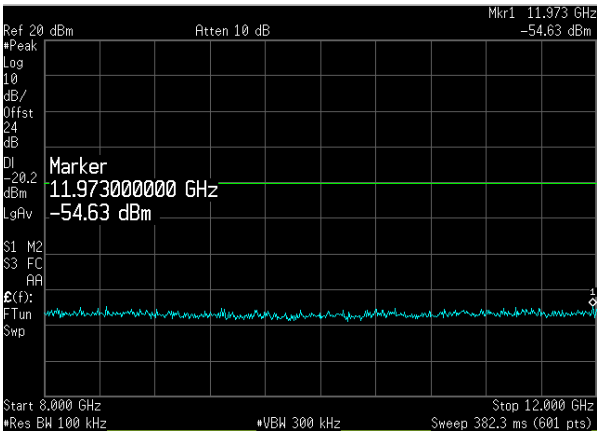
- This is a conducted test. The 24.0dB offset is from the attenuator and cable assembly used.
- Span is wide enough to capture the peak level of the emission. Each start of a measurement, a preliminary scan using a span capturing the 20dB bandwidth is performed to verify that the peak emissions is captured on the final span used during the actual measurement.
- Emissions are investigated from 30 MHz to 25,000 MHz.
- RBW is 100kHz
- VBW is > RBW
- Detector is Peak
- Trace is Max Hold
- Display line is –20dBc

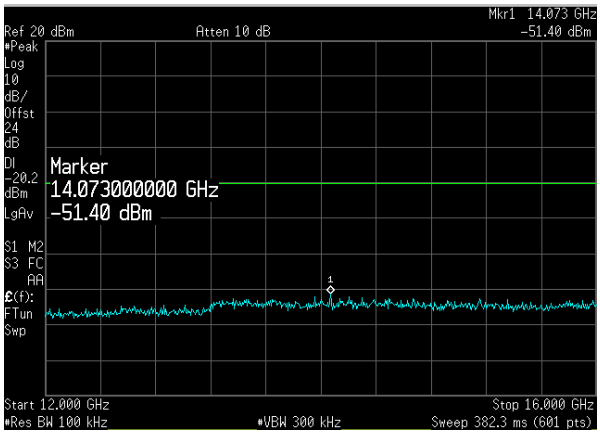
Low Channel:

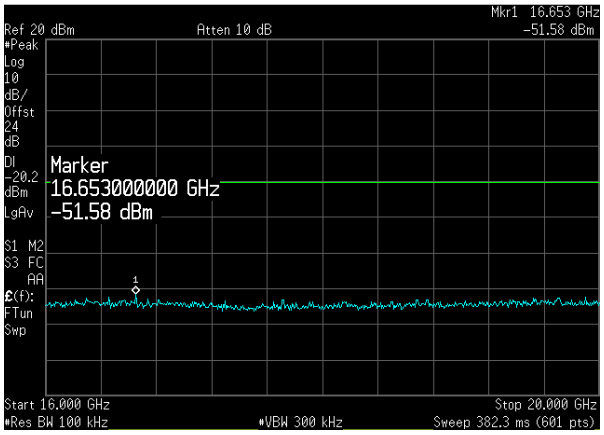

Mkr1 1.862 GHz
Ref 20 dBm
Atten 10 dB
-56.89 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
1.862000000 GHz
-56.89 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.000 GHz
Sweep 188.3 ms (601 pts)

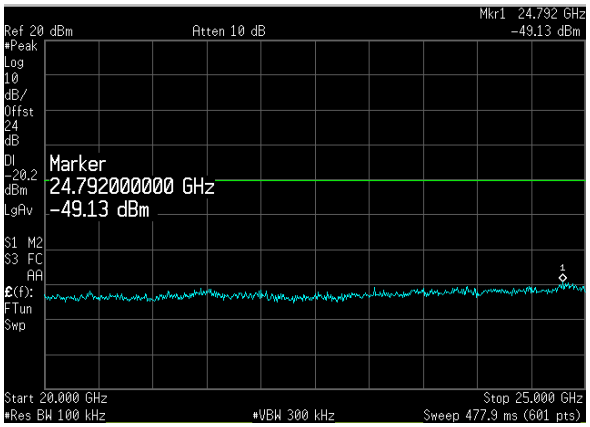

Mkr1 3.137 GHz
Ref 20 dBm
Atten 10 dB
-53.67 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
3.137000000 GHz
-53.67 dBm
Start 2.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 4.000 GHz
Sweep 191.2 ms (601 pts)


Mkr1 6.953 GHz
Ref 20 dBm
Atten 10 dB
-54.81 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
6.953000000 GHz
-54.81 dBm
Start 4.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 8.000 GHz
Sweep 382.3 ms (601 pts)

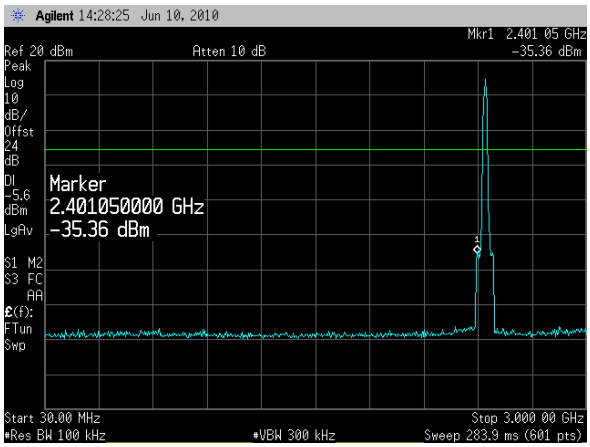

Mkr1 11.973 GHz
Ref 20 dBm
Atten 10 dB
-54.63 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
11.973000000 GHz
-54.63 dBm
Start 8.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 12.000 GHz
Sweep 382.3 ms (601 pts)

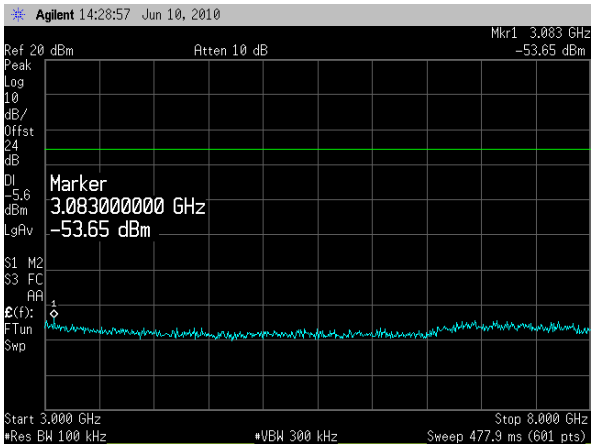

Mkr1 14.073 GHz
Ref 20 dBm
Atten 10 dB
-51.40 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
14.073000000 GHz
-51.40 dBm
Start 12.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 16.000 GHz
Sweep 382.3 ms (601 pts)

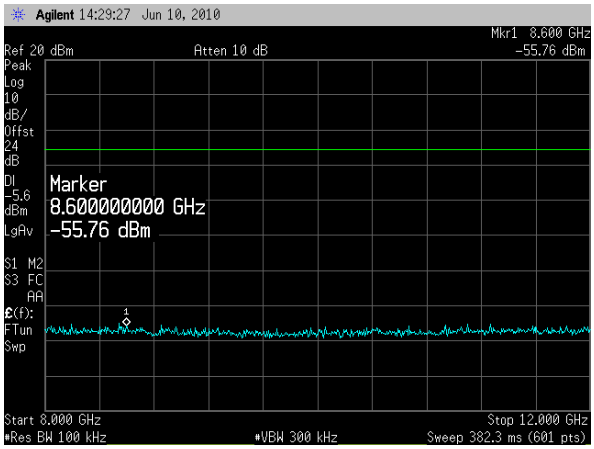

Mkr1 16.653 GHz
Ref 20 dBm
Atten 10 dB
-51.58 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
16.653000000 GHz
-51.58 dBm
Start 16.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 20.000 GHz
Sweep 382.3 ms (601 pts)


Mkr1 24.792 GHz
Ref 20 dBm
Atten 10 dB
-49.13 dBm
#Peak
Log
10
dB/
Offst
24
dB
Marker
24.792000000 GHz
-49.13 dBm
Start 20.000 GHz
Stop 25.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 477.9 ms (601 pts)

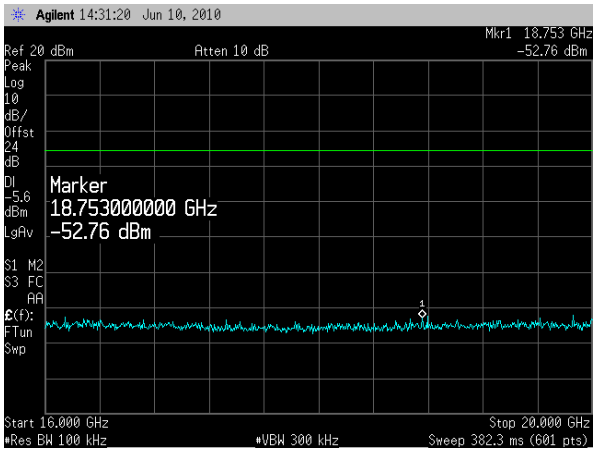
Mid Channel:

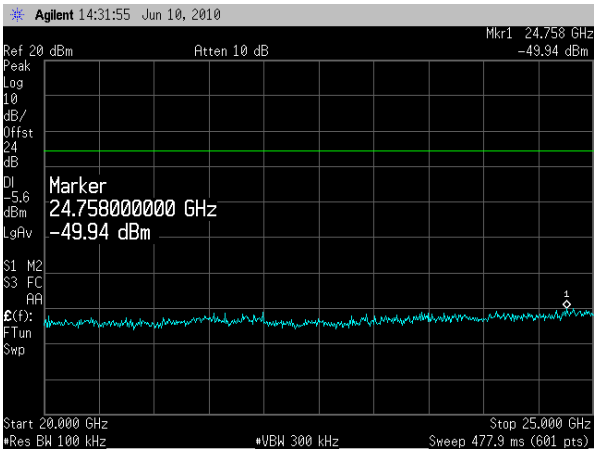

Agilent 14:28:25 Jun 10, 2010
Mkr1 2.401 05 GHz
Ref 20 dBm
Atten 10 dB
-35.36 dBm
Peak
Log
10
dB/
Offst
24
dB
Marker
2.401050000 GHz
-35.36 dBm
Start 30.00 MHz
Stop 3.000 00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 283.9 ms (601 pts)


Agilent 14:28:57 Jun 10, 2010
Mkr1 3.083 GHz
Ref 20 dBm
Atten 10 dB
-53.65 dBm
Peak
Log
10
dB/
Offst
24
dB
Marker
3.083000000 GHz
-53.65 dBm
Start 3.000 GHz
Stop 8.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 477.9 ms (601 pts)

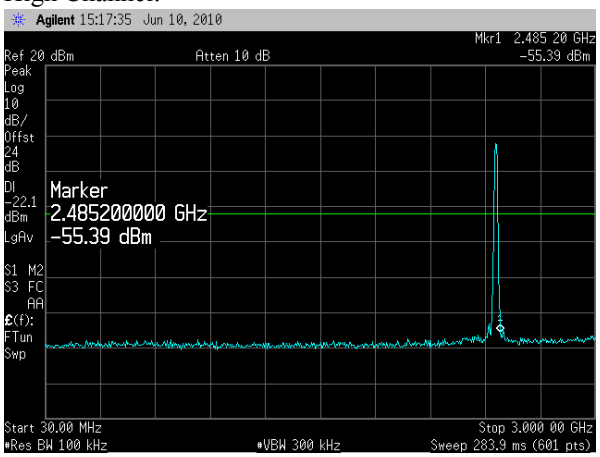

Agilent 14:29:27 Jun 10, 2010
Mkr1 8.600 GHz
Ref 20 dBm
Atten 10 dB
-55.76 dBm
Peak
Log
10
dB/
Offst
24
dB
Marker
8.600000000 GHz
-55.76 dBm
Start 8.000 GHz
Stop 12.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 382.3 ms (601 pts)

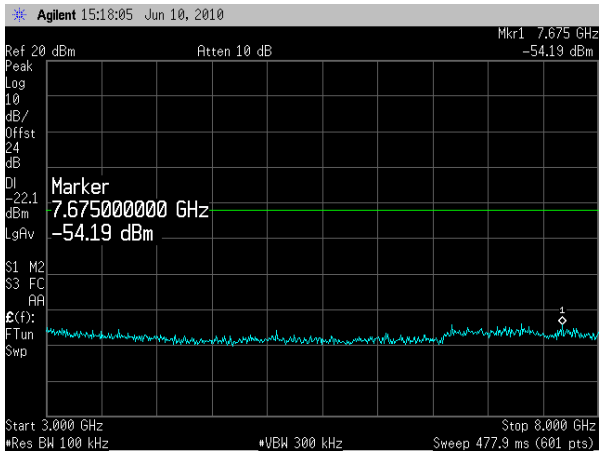

Agilent 14:30:35 Jun 10, 2010
Mkr1 13.940 GHz
Ref 20 dBm
Atten 10 dB
-52.74 dBm
Peak
Log
10
dB/
Offst
24
dB
Marker
13.940000000 GHz
-52.74 dBm
Start 12.000 GHz
Stop 16.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 382.3 ms (601 pts)

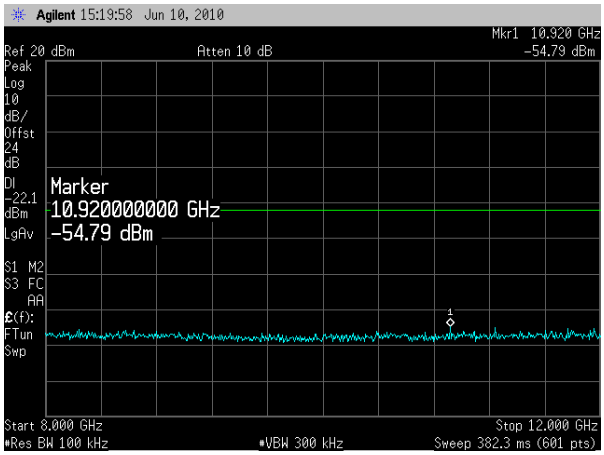


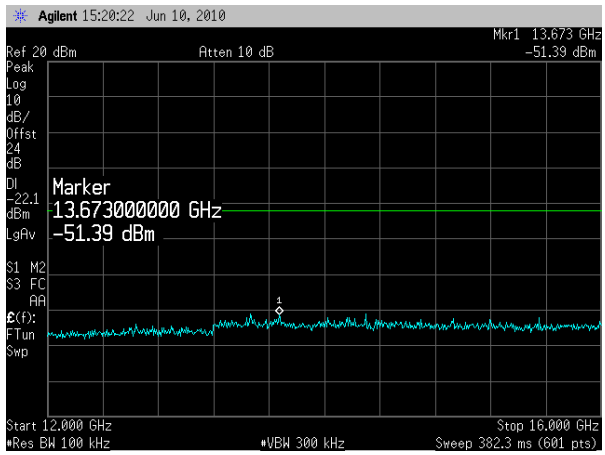


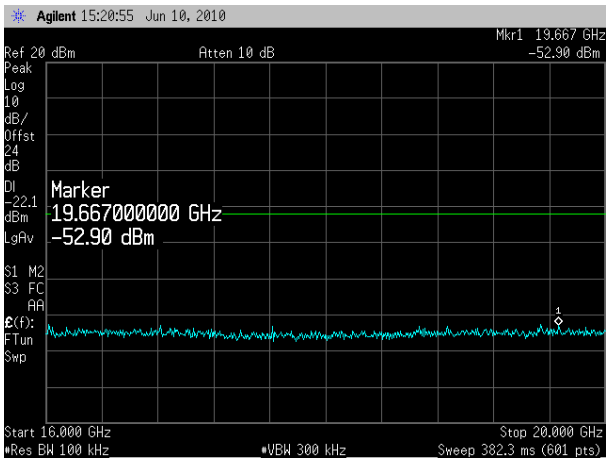
High Channel:










Agilent 15:20:55 Jun 10, 2010
Mkr1 19.667 GHz
Ref 20 dBm
Atten 10 dB
-52.90 dBm
Peak
Log
10
dB/
Offst
24
dB
Marker
19.667000000 GHz
-52.90 dBm
Start 16.000 GHz
Stop 20.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 382.3 ms (601 pts)

6.5. Out-of-band Emissions / Radiated Emissions within Restricted Bands

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Sample Number:	9450	Temperature:	See table
Date:		Humidity:	
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	SOATS

Test Results

- The Spectrum was searched from 30MHz to the 10th Harmonic, 25000 MHz.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Radiated Measurements below 1GHz were performed at 3m with a Quasi-Peak detector (RBW 120kHz/VBW 300kHz) while Radiated Peak (RBW 1MHz/VBW 3MHz) and Average (RBW 1MHz/VBW 10Hz) measurements conducted above 1GHz.
- No emissions observed other than the fundamental.

Radiated Emissions Data

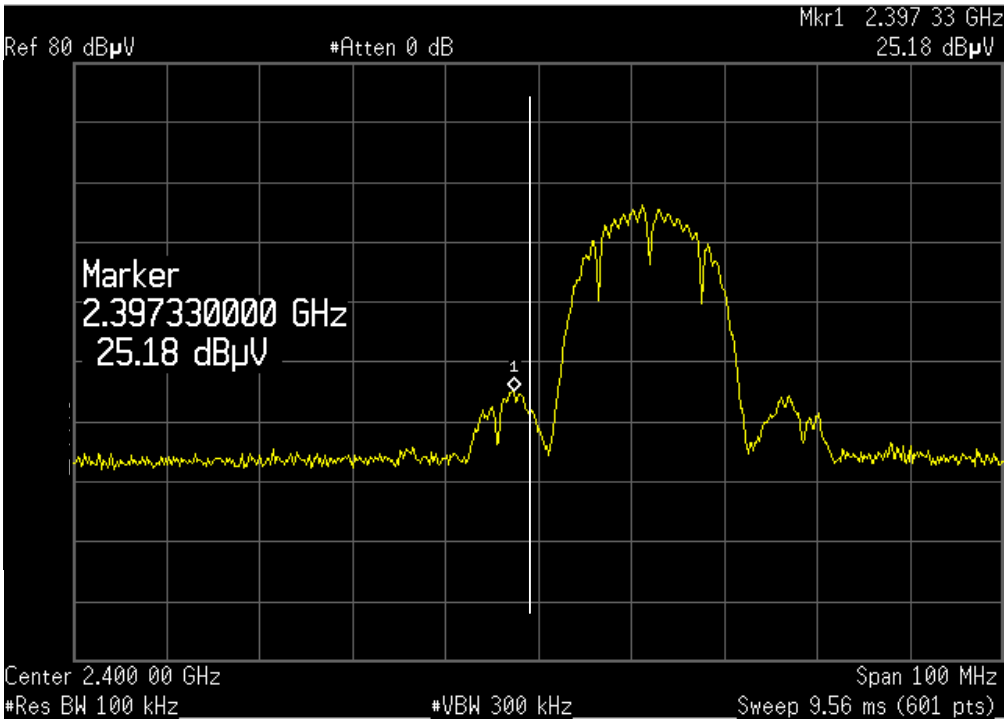
Job # :	149531	Date :	6-14-2010	Page 1 of 1	
NEX #:	42995-1	Time :	1051		
		Staff :	aal		
Client Name :	Hughes Network Systems			EUT Voltage :	24Vdc
EUT Name :	Land Mobile Terminal			EUT Frequency :	-
EUT Model # :	9450			Phase:	-
EUT Serial # :	000013			NOATS	
EUT Config. :	Test Program continuous transmit			SOATS	X
	100 % duty cycle			Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	CFR47 Part 15, Subpart C, 15.247(d)				
Loop Ant. #:	NA				
Bicon Ant.#:	NA	Temp. (°C) :	18		
Log Ant.#:	NA	Humidity (%) :	55		
DRG Ant. #	877	Spec Analyzer #:	911		
Cable LF#:	NA	Analyzer Display #:	911		
Cable HF#:	60FT_blue	Quasi-Peak Detector #:	911		
Preamp LF#:	NA	Preselector #:	NA		
Preamp HF#	317				

Quasi-Peak	RBW:	120 kHz
	Video Bandwidth	300 kHz
Peak	RBW:	1 MHz
	Video Bandwidth	3 MHz
Average	RBW:	1 MHz
	Video Bandwidth	10 Hz

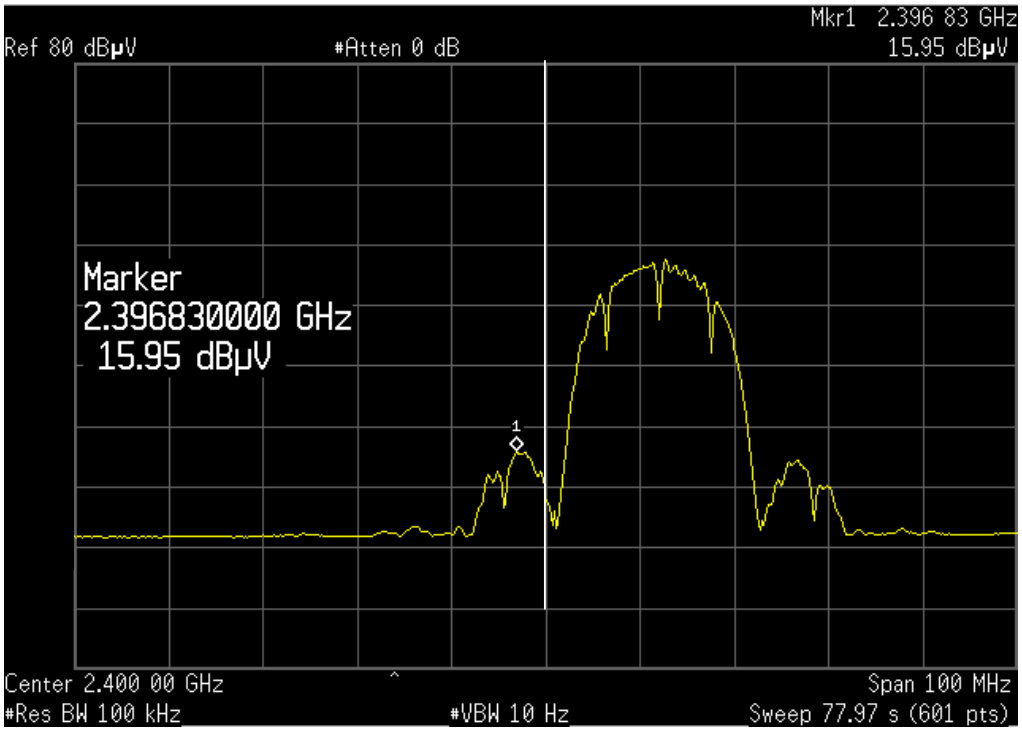
Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
2400.0	25.2	19.2	P	-	1.2	25.2	64.7	76.1	-11.4	Pass	bandedge
2400.0	15.9	8.2	A	-	1.2	15.9	55.4	56.1	-0.7	Pass	NOT A RESTRICTED BAND
											100 kHz RBW
2412.0	56.6	53.6	P	-	1.2	56.6	96.1	123.0	-26.9	Pass	RELATIVE FIELD STRENGTH
											100 kHz RBW
2390.0	25.4	23.8	P	-	1.0	25.4	64.6	74.0	-9.4	Pass	NEARBY RESTRICTED BAND
2390.0	13.3	12.2	A	-	1.0	13.3	52.5	54.0	-1.5	Pass	1 MHz
2483.5	26.3	23.0	P	-	1.2	26.3	65.8	74.0	-8.2	Pass	bandedge
2483.5	12.8	12.8	A	-	1.2	12.8	52.3	54.0	-1.7	Pass	RESTRICTED BAND
											1 MHz
2462.0	61.1	49.8	P	-	1.2	61.1	100.6	123.0	-22.4	Pass	RELATIVE FIELD STRENGTH
											1 MHz
2442.0	60.2	48.5	P	-	1.2	60.2	66.5	123.0	-56.5	Pass	RELATIVE FIELD STRENGTH
											1 MHz

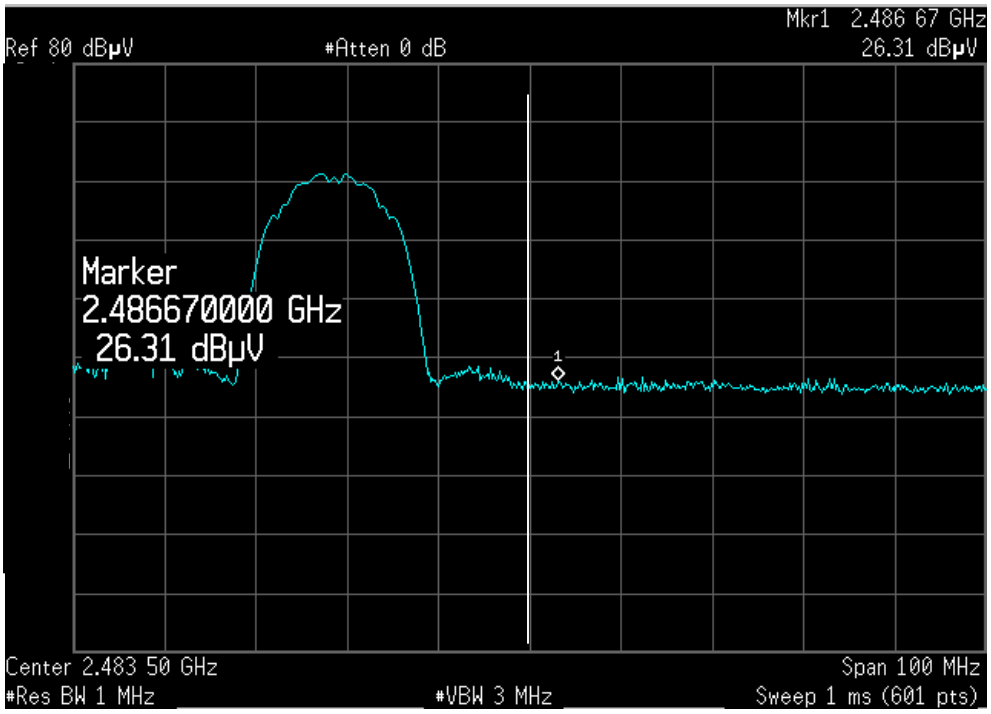
Band Edge Plots



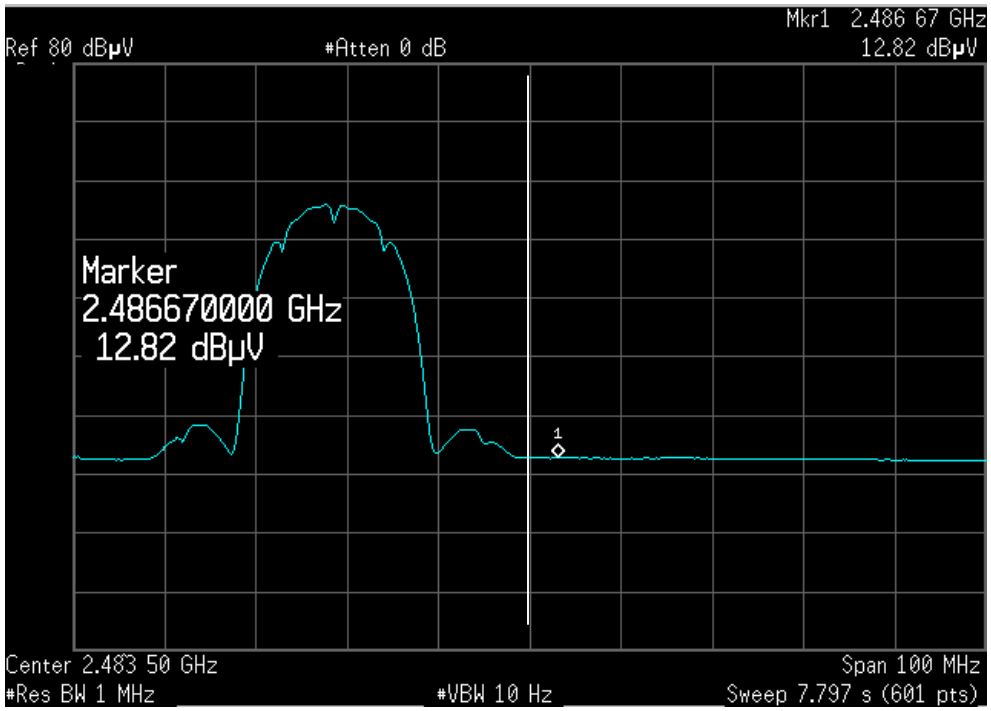
Low Channel 2412 MHz (Peak Measurement)
See table above.



Low Channel 2412 MHz (Average Measurement)
See table above.



High Channel 2462 MHz (Peak Measurement)
See table above.



High Channel 2462 MHz (Average Measurement)
See table above.

6.6. Minimum 6dB RF Bandwidth

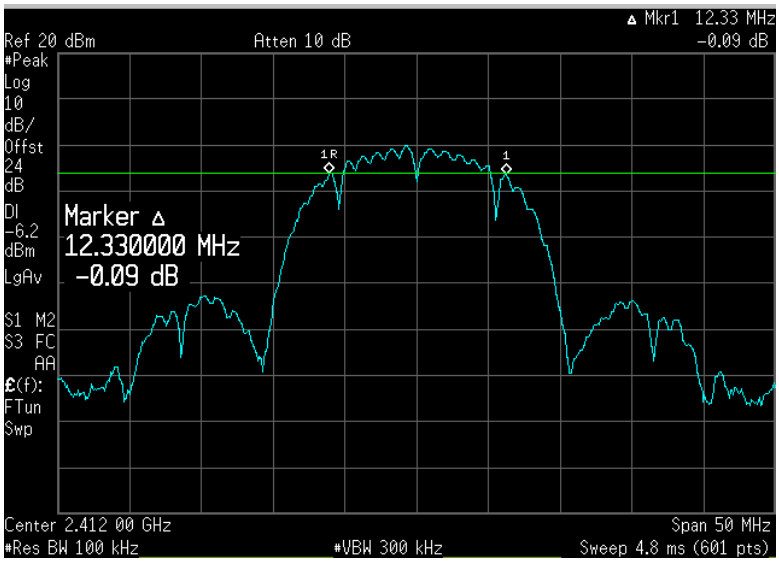
(a)(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Sample Number:	9450	Temperature:	24°C
Date:	6-10-2010	Humidity:	55%
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	Room 2

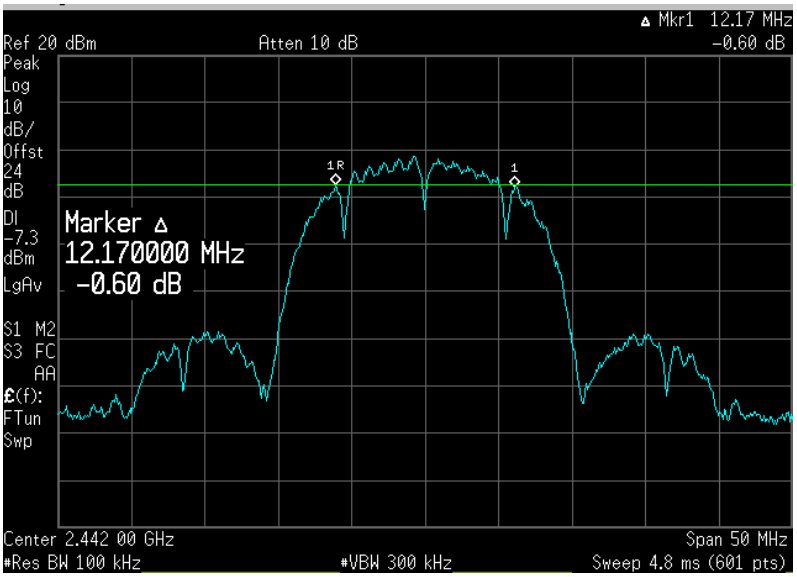
Test Results:

- This is a conducted test
- RBW is set to 100kHz
- VBW is 3X RBW
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was plotted; a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

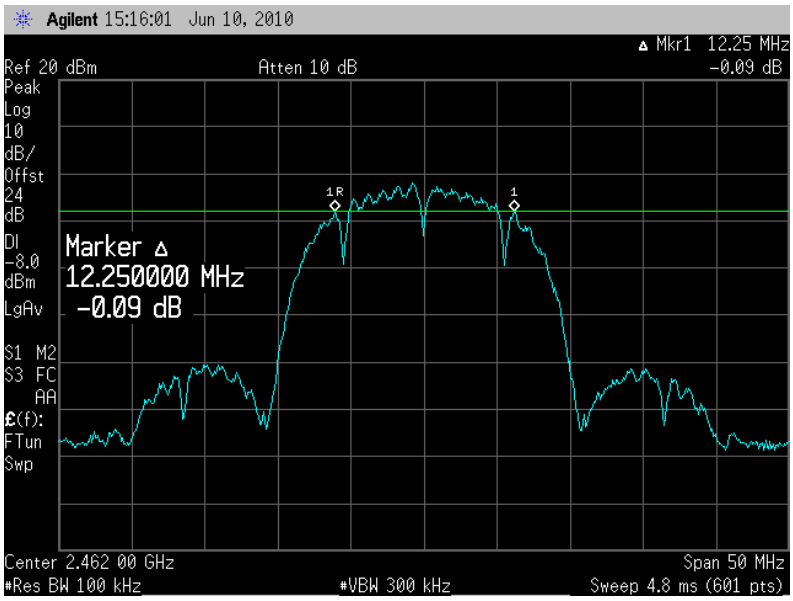
Channel Range	6 dB Bandwidth
Low (2412 MHz)	12.23 MHz
Mid (2442 MHz)	12.17 MHz
High (2462 MHz)	12.25 MHz



LOW Channel



MID Channel



HIGH Channel

6.7. Maximum peak output power

(b) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Sample Number:	9450	Temperature:	24°C
Date:	6-10-2010	Humidity:	55%
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	Room 2

Additional Observations:

- This is a conducted test using a peak power meter. A correction factor of 24.0 was added to compensate for power attenuator and cable loss.
- Measurements were made at 10.2 VDC, 12 VDC, 13.8 VDC and 20.4 VDC, 24.0 VDC, 27.6 VDC; however no significant differences were observed.

Test Results:

Voltage Input	Peak Output Power Low channel dBm	Peak Output Power Mid channel dBm	Peak Output Power High channel dBm
10.8VDC	12.94	11.05	11.27
13.2VDC	12.94	11.06	11.24
15.6VDC	12.94	11.08	11.23
21.6VDC	**13.08**	11.11	11.19
26.4VDC	12.99	11.07	11.27
31.2VDC	13.00	11.14	11.19

6.8. Power Spectral Density

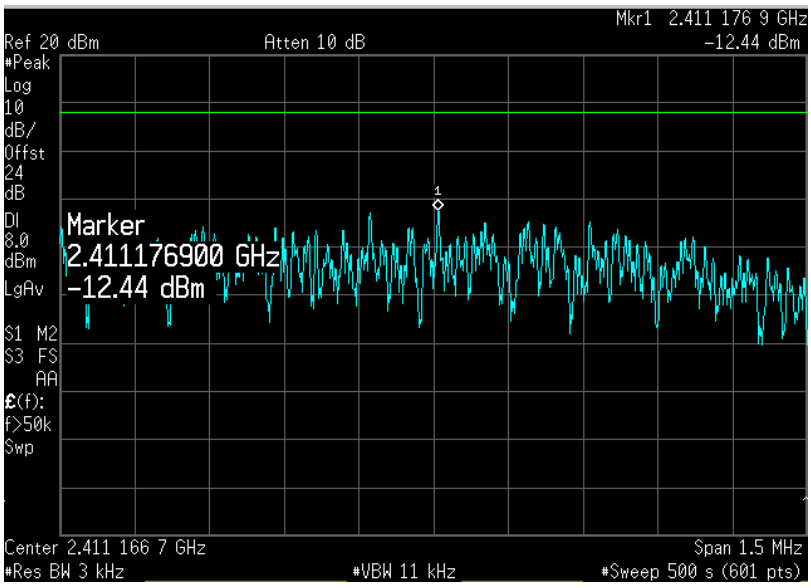
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Sample Number:	9450	Temperature:	24°C
Date:	6-10-2010	Humidity:	55%
Modification State:	Lo/Mid/High Channels	Tester:	Alan Laudani
		Laboratory:	Room 2

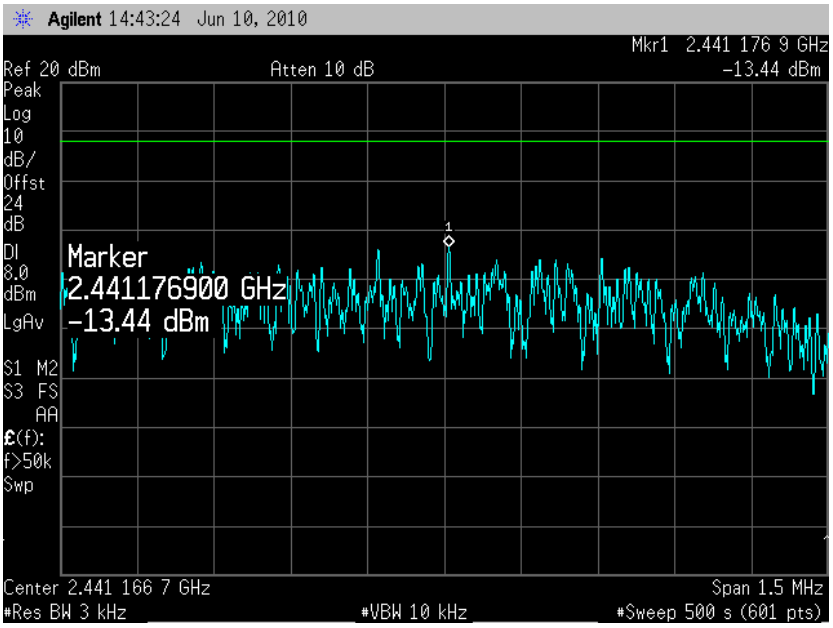
- This is a conducted test. The 24.0dB offset is from the attenuator and cable assembly used.
- Span is wide enough to capture the peak level of the emission. Each start of a measurement, a preliminary scan using a span capturing the 20dB bandwidth is performed to verify that the peak emissions is captured on the final span used during the actual measurement.
- 1.5 MHz was verified the absolute minimum span that would contain the peak emissions.
- RBW is 3kHz
- VBW is > RBW
- Sweep is Span/RBW (1.5MHz/3kHz = 500 seconds).
- Detector is Peak
- Trace is Max Hold

Test Results:

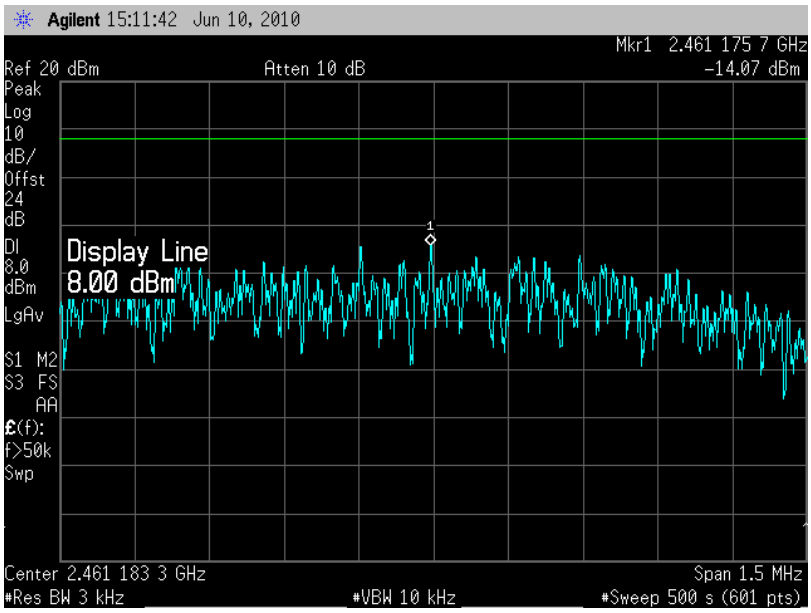
Channel Frequency (MHz)	RF Power Level in 3KHz BW (dBm)	Maximum Limit (dBm)	PASS/FAIL
2412	-12.44	8	Pass
2442	-13.44	8	Pass
2462	-14.07	8	Pass



Low Channel



Mid Channel



High Channel

6.9. Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
E1009	Multimeter	Fluke	287	11610042	12/18/2009	12/18/2010
911	Spectrum Analyzer	Agilent	E4440A	US41421266	12/17/2009	12/17/2010
E1019	Two Line V-Network	Rohde & Schwarz	ENV216	101045	3/12/2010	3/12/2011
E1018	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	835363/0003	1/22/2010	1/22/2011
946	Peak Power Sensor	Hewlett Packard	84815A 0.05-18GHz (-40 to 20dBm)	3318A01726	9/16/2009	9/16/2010
947	Peak Power Analyzer	Hewlett Packard	8991A	3621A00906	9/16/2009	9/16/2010
114	Antenna, Bicon	EMCO	3104	2997	3/5/2010	3/5/2012
110	Antenna, LPA	Electrometrics	LPA-25	1217	1/10/2009	2/10/2011
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	7/28/2008	7/28/2010
317	Preamplifier	HP	8449A	2749A00167	5/7/2010	5/7/2011
898	EMI Receiver & filter set	HP	8546A	3625A00348	6/22/2010	6/22/2011
899	Filter Section	HP	85460A	3448A00288	6/22/2010	6/22/2011

Registration of the OATS are on file with the Federal Communications Commission, under Registration Number 90579.