

FCC PART 25 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

Wireless Matrix USA, Inc.

12369-B Sunrise Valley Drive
Reston, VA 20191

FCC ID: P5ISDT5

This Report Concerns: ☒ Original Report	Equipment Type: Satellite Earth Station equipment
Test Engineer: Snell Leong 	
Report No.: R0511175	
Report Date: 2005-12-9	
Reviewed By: Richard Lee 	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Wireless Matrix USA, Inc.* 's product, FCC ID: *P5ISDT5*, model number: SDT5000 or the "EUT" as referred to in this report is a Satellite Earth Station equipment. The EUT operates at 1626.50 – 1660.5 MHz with maximum output power 46.07 dBm (EIRP).

** The test data gathered are from production sample, serial number: #001, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Wireless Matrix USA, Inc.* in accordance with Part 2, Subpart J, and Part 25, Subparts C of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for Radiated Emission, Frequency Tolerance, Emission Limitation (out of band), Power Density, Emission Limitation (in band), and Power Limit.

Related Submittal(s)/Grant(s)

No Related Submittals.

Test Methodology

All measurements contained in this report were conducted with TIA 603-C.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp.

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA with registration number: 90464.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC), Industry Canada (IC), and Voluntary Control Council for Interference (VCCI).

The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is 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 host system was configured for testing according to TIA 603-C.

The EUT was tested in the Continuous transmit operating mode to represent *worst-case* results during the final qualification test.

EUT Exercise Software

The EUT was configured through HyperTerminal, The following setting was used for testing.

The EUT operates in max data rate = 6750 bit/sec, or sample rate = 3375.

Transmitting mode = on

Signal modulation = random

TX I & Q Level = 100%

TX Power Setting = 1950

Channel number = 0 , 34000, 68000 (low, mid, high)

(firmware info: SDT-S (NP) – Wireless Matrix Corporation © 2005)

Special Accessories

As shown in following test setup block diagram, all interface cables used for compliance testing are shielded.

Schematics / Block Diagram

Please refer to Appendix A.

Equipment Modifications

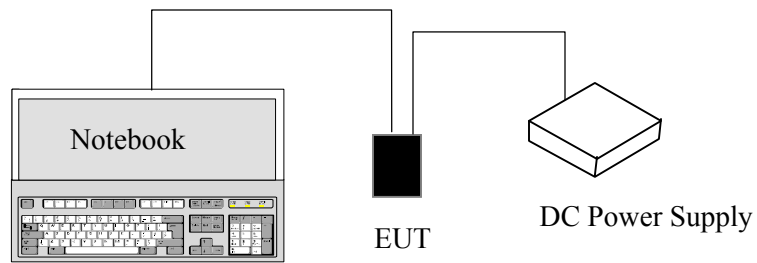
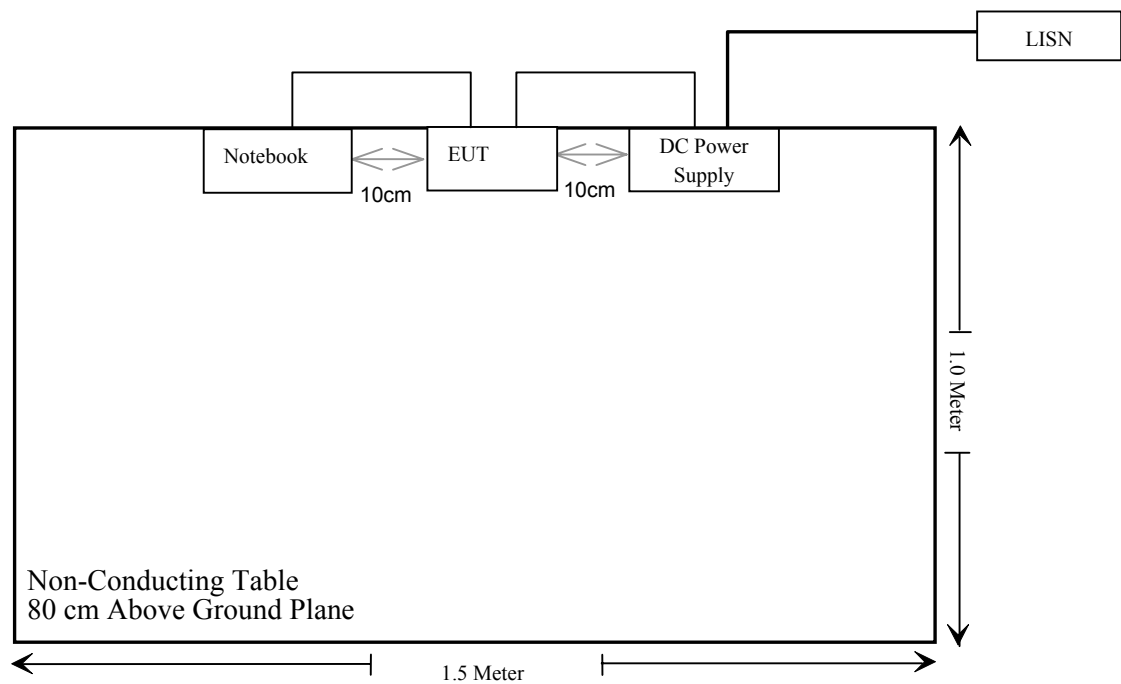
No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Compaq	Laptop	Presario 2100	CNF43403FB	DOC
BK Precision	DC Power Supply	1621A	D1855052265	DOC

External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Serial Cable	1	Laptop	EUT

Configuration of Test System**Test Setup Block Diagram**

SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§1.1307(b)(1) & §2.1091	RF Exposure	Compliant
§2.1047	Modulation Characteristic	Compliant
§2.1051	Spurious Emission at Antenna Terminals	Compliant
§15.107	AC Line Conducted Emission	Compliant
§2.1055 & §25.202(d)	Frequency Stability	Compliant
§2.1053 & §25.202(f)	Field Strength of Spurious Radiation	Compliant
§25.202	Emission Mask	Compliant
§25.216 (b) & (g)	Emission from Mobile Earth Station for Protection of Aeronautical Radio navigation-Satellite Service	Compliant
§2.1046 & §25.204	Power Output	Compliant

§2.1047 – MODULATION CHARACTERISTICS

The EUT uses digital modulation techniques only which were employed during the tests for occupied bandwidth.

For other modulation test information, please refer to Appendix F

§2.1051 – SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Standard Applicable

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment by more than 250% of the authorized bandwidth (1.23MHz), at least

$43 + 10 \log (P_{\text{watts}})$ attenuation below the mean power of the transmitter.

For Lowest Channel = $43 + 10 \log (2.723\text{W}) = 47.35 \text{ dBc}$

For Highest Channel = $43 + 10 \log (2.735\text{W}) = 47.37 \text{ dBc}$

Measurement Procedure

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable & 20dB attenuator to the antenna output terminals of EUT as specified by the manufacturer.

Note: The RBW was set to 10KHz instead of 4KHz, If the test result complied with 10KHz resolution bandwidth, it deem to comply for 4KHz .

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2005-11-10

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

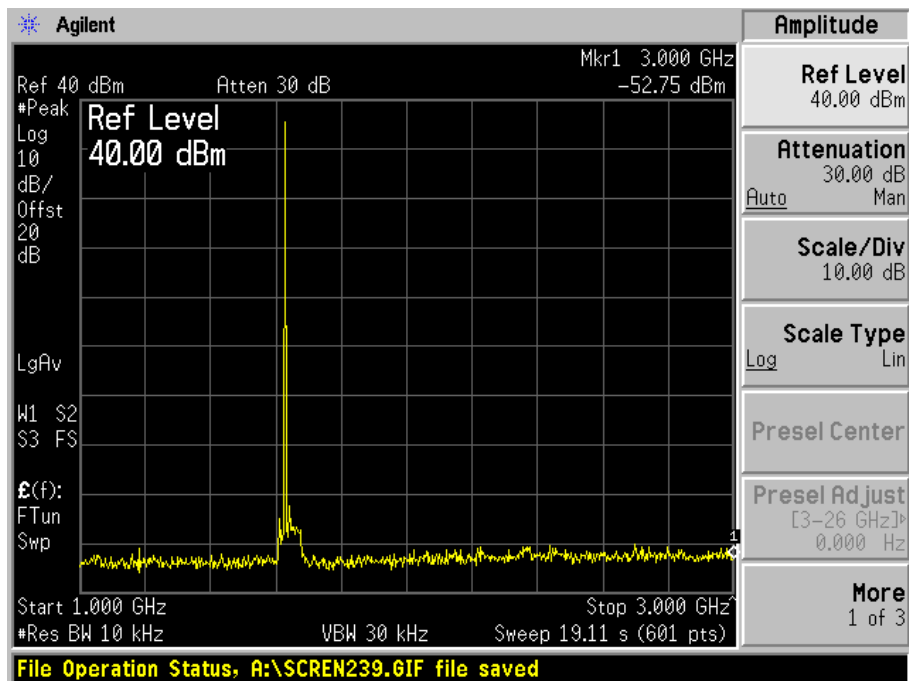
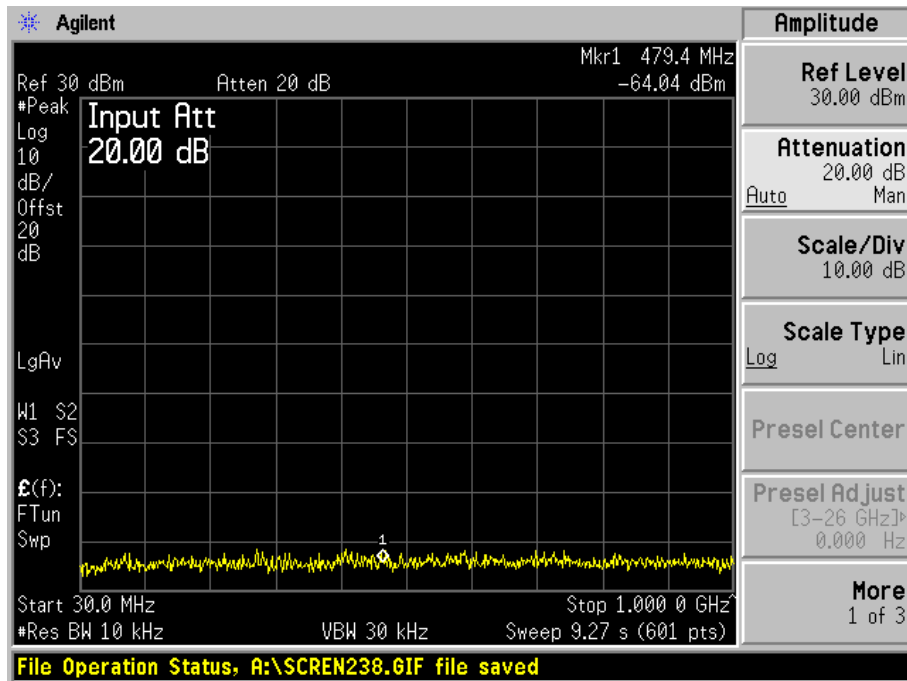
Measurement Result

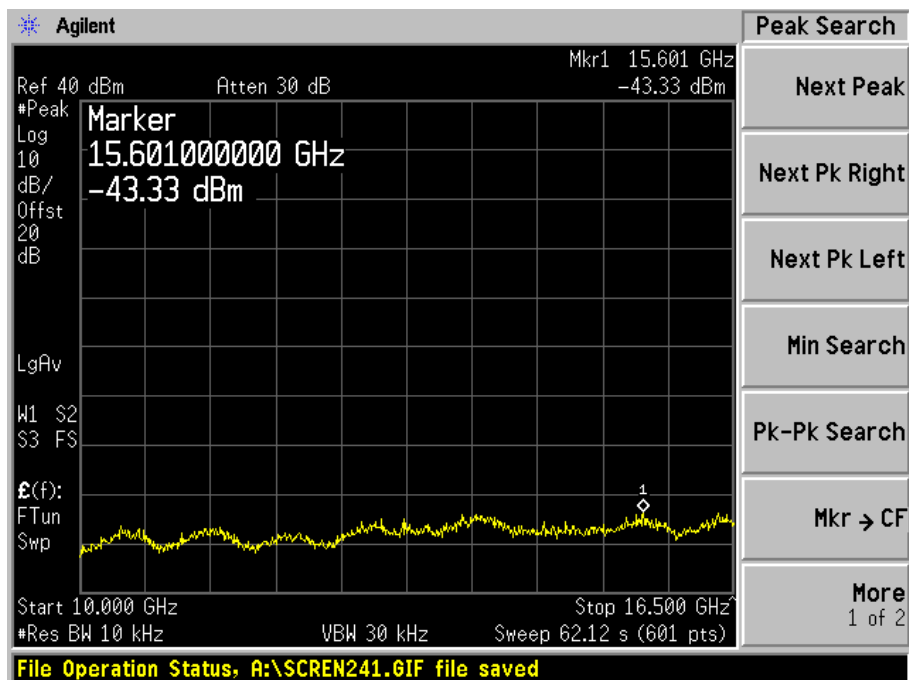
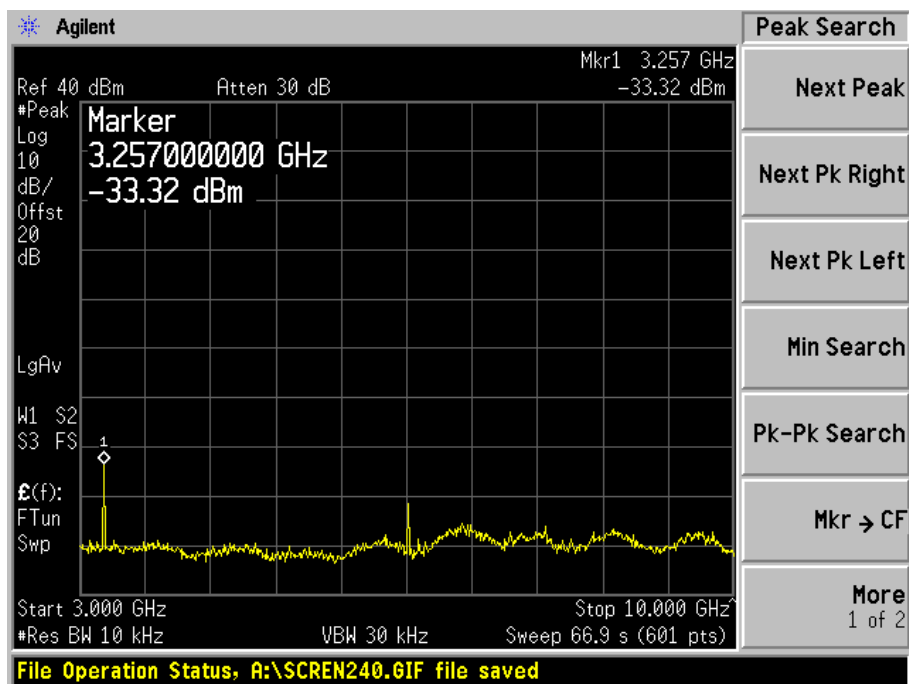
Environmental Conditions

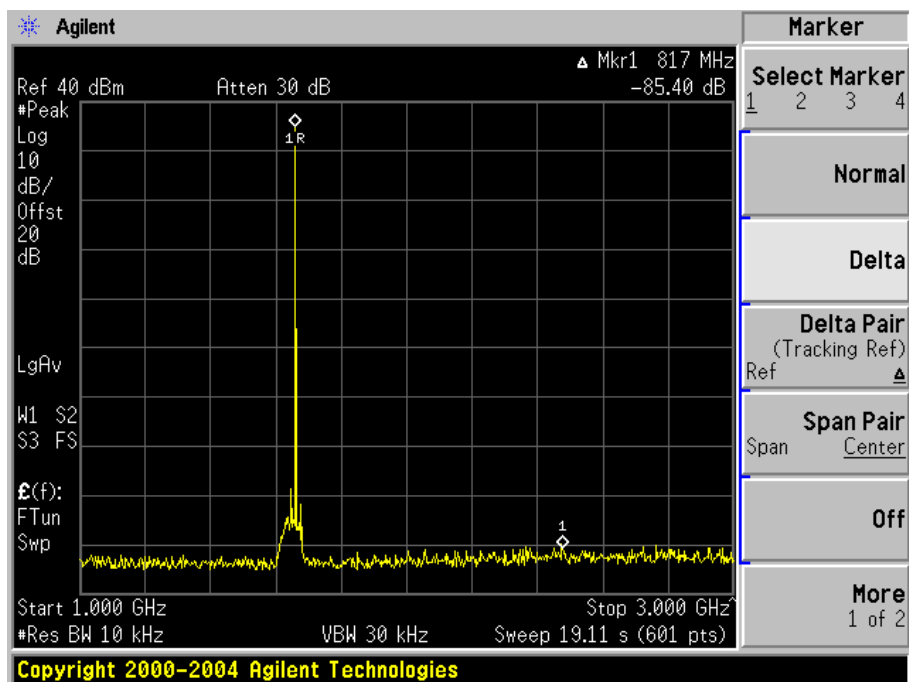
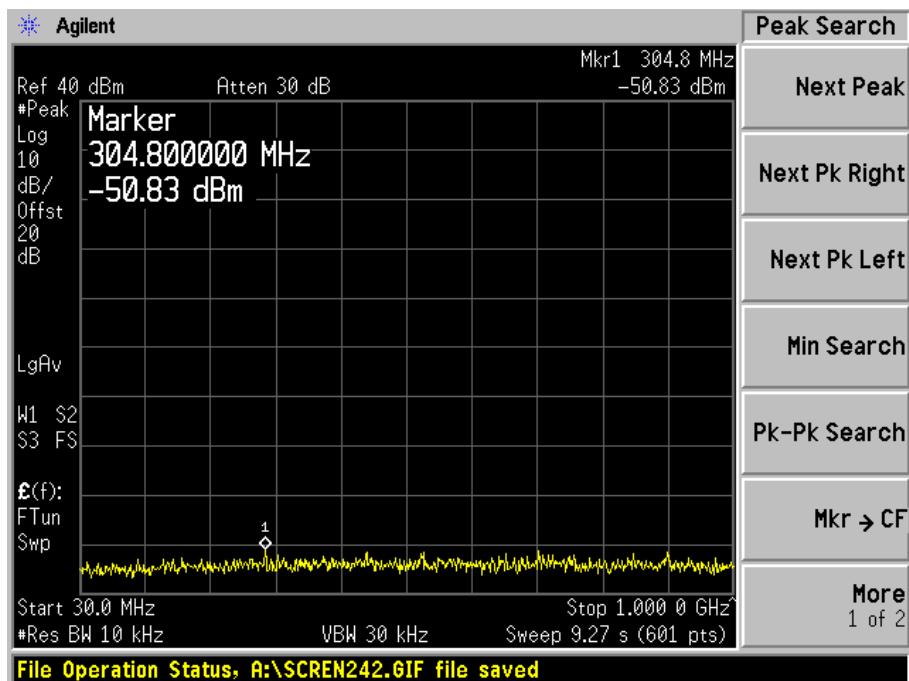
Temperature:	20° C
Relative Humidity:	58%
ATM Pressure:	1010 mbar

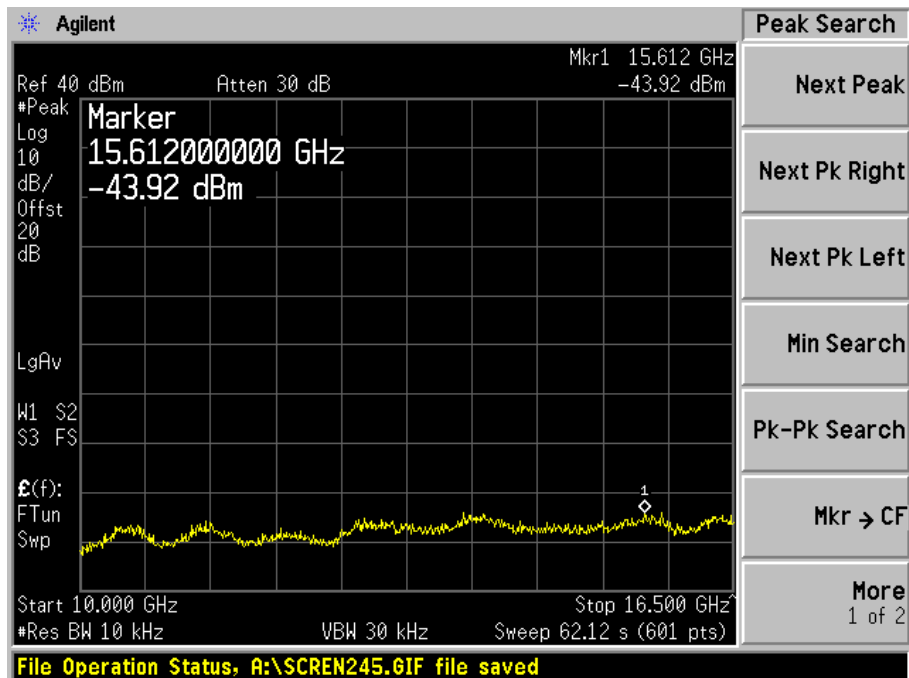
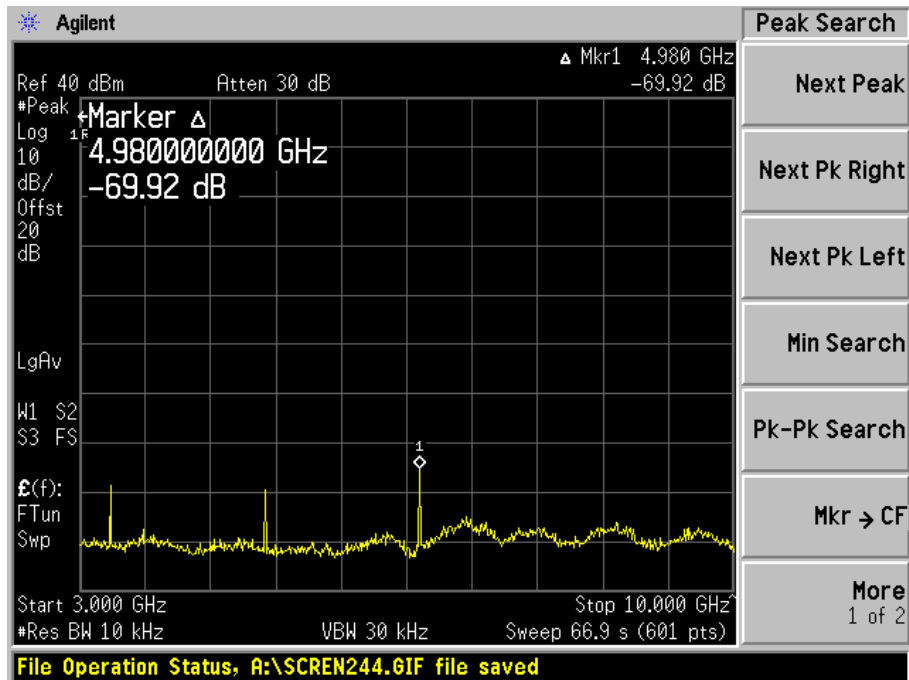
The testing was performed by Snell Leong on 2005-11-17.

The following plots show that all emissions ere at least 48.5 dB below the fundamental.

Low Channel



High Channel



§15.107 - CONDUCTED EMISSIONS

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are receiver, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ± 2.4 dB.

EUT Setup

The measurement was performed in the shielded room, using the same setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC 15 Class B limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to 120VAC/60Hz power source.

Receiver Setup

The receiver was set to investigate the frequency from 150 kHz to 30MHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schewarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-08-16
Rohde & Schewarz	EMI Test Receiver	ESCS30	100176	2005-09-15
Fluke	Calibrated Voltmeter	189	18485-38	2005-09-15

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

Test Procedure

During the conducted emission test, the power cord of the EUT was connected to the mains outlet of the LISN-1, the power cord of the monitor and modem were connected to the LISN-2.

Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the quasi-peak and average detection mode. Quasi-Peak readings are distinguished with an "QP". Average readings are distinguished with an "Ave".

Test Results Summary

According to the recorded data, the EUT complies with the FCC Conducted limits for a Class B device, with the worst margin reading of:

-16.6 dB at 0.990 MHz at Line mode at 150 kHz to 30 MHz

Conducted Emissions Test Data

Environmental Conditions

Temperature:	22 °C
Relative Humidity:	53%
ATM Pressure:	1021mbar

**Testing was performed by Snell Leong on 2005-11-28.*

LINE CONDUCTED EMISSIONS				FCC15 CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Mode Line/Neutral	Limit dBμV	Margin dB
0.990	29.4	Ave	Line	46.00	-16.6
0.990	36.4	QP	Line	56.00	-19.6
0.995	25.3	Ave	Neutral	46.00	-20.7
0.360	37.2	QP	Neutral	58.73	-21.5
0.995	32.8	QP	Neutral	56.00	-23.2
0.150	36.7	QP	Line	66.00	-29.3
13.800	20.7	Ave	Neutral	50.00	-29.3
13.800	19.1	Ave	Line	50.00	-30.9
13.800	25.2	QP	Neutral	60.00	-34.8
13.800	25.1	QP	Line	60.00	-34.9
0.360	10.6	Ave	Neutral	48.73	-38.1
0.150	10.8	Ave	Line	56.00	-45.2

Plots of Conducted Emission

The plots of conducted emission are presented hereinafter as reference.

Bay Area Compliance Laboratory Corp
Class B

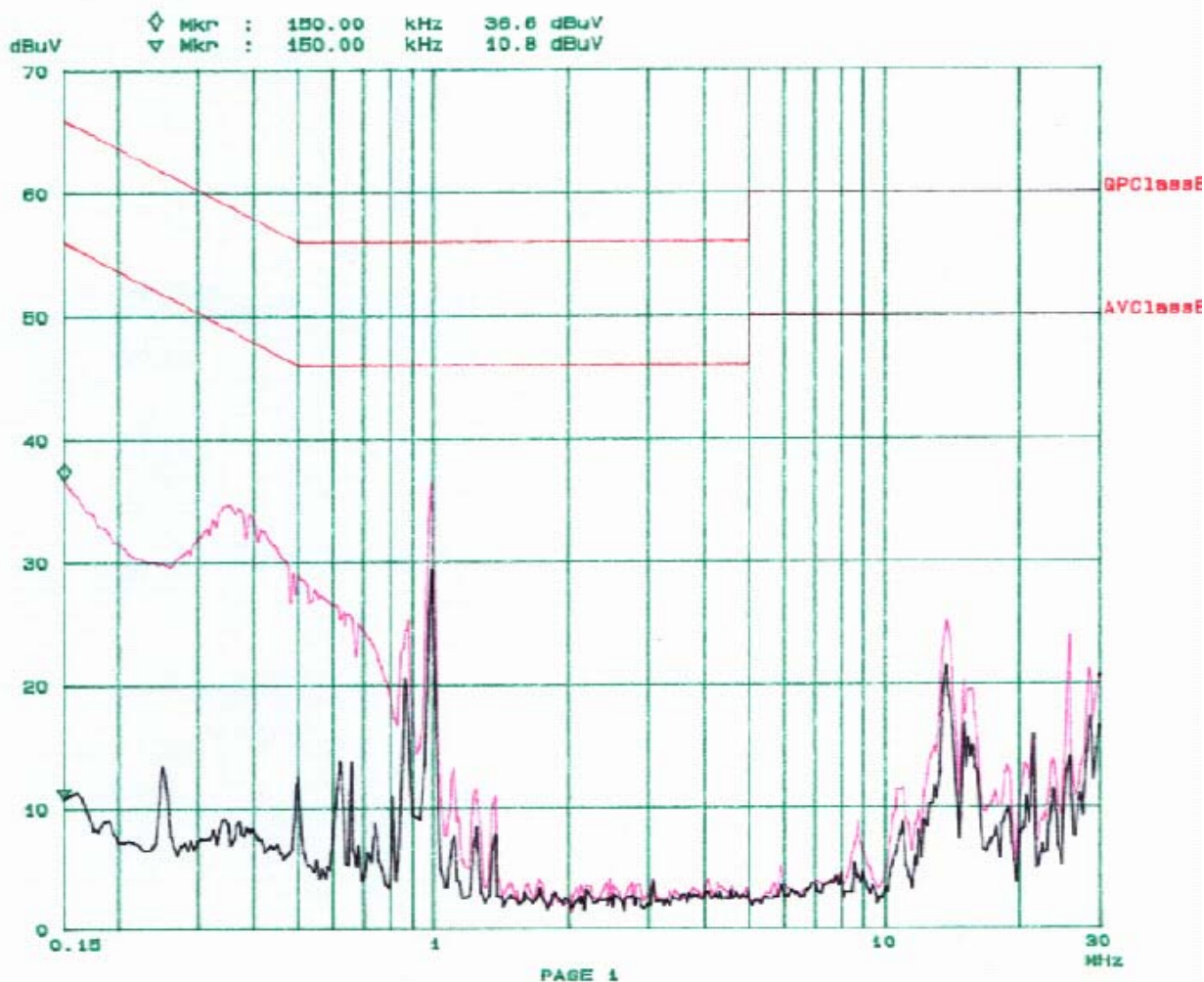
28. Nov 05 18:18

Nov 28/05
Shu

EUT: MES
Manuf: Wireless matrix
Op Cond: Normal
Operator: Shu
Comment: 1
120 VAC

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	GP+AV	20ms	15dB LN	OFF
1M	5M	10k	9k	GP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	GP+AV	1ms	15dB LN	OFF



Bay Area Compliance Laboratory Corp
Class B

28. Nov 05 14:56

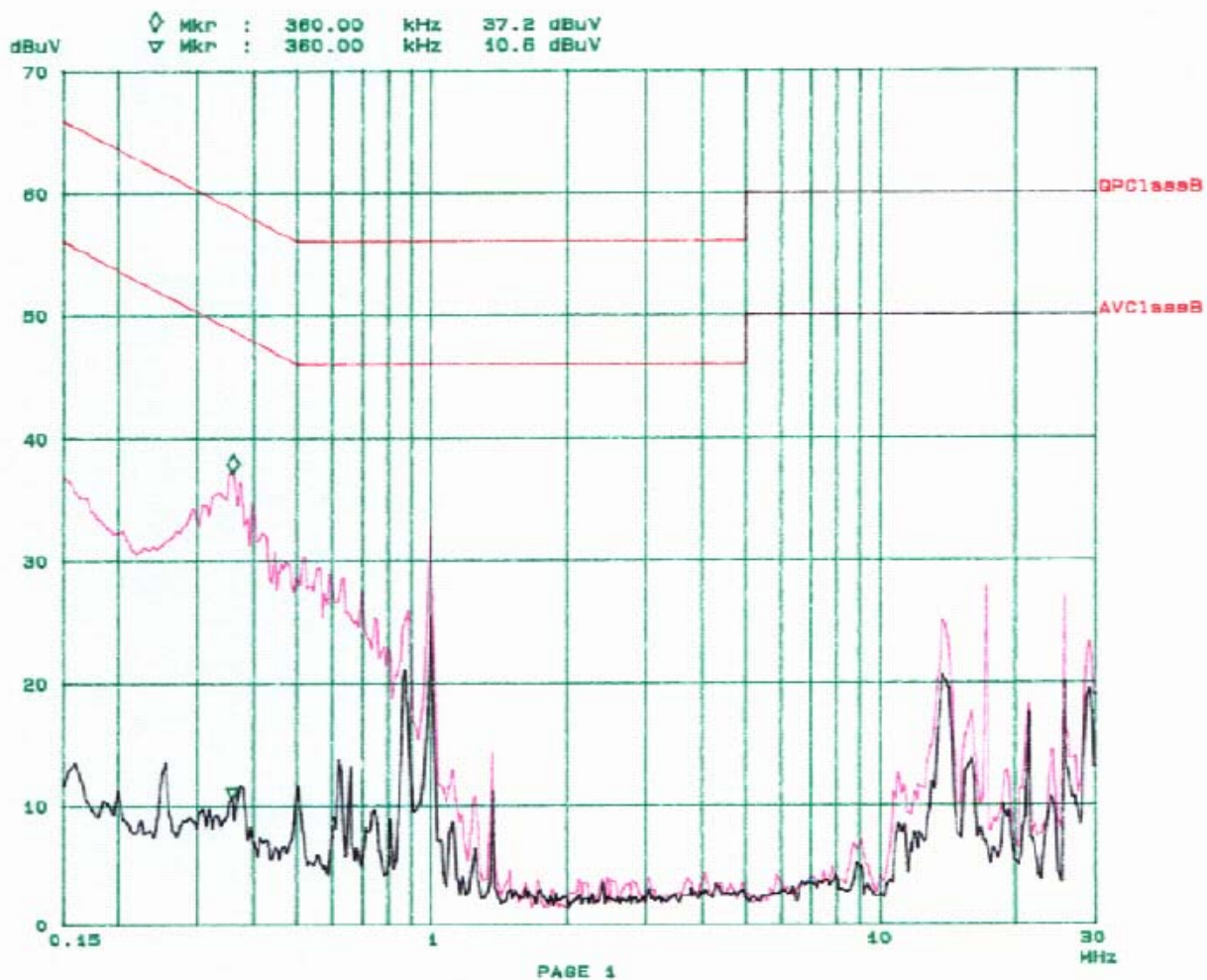
Nov 28 / 05

Shell

EUT: MES
Manuf: Wireless matrix
Op Cond: Normal
Operator: Shell
Comment: N
120 VAC

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	15dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF



§ 2.1053 & §25.202 (f) – FIELD STRENGTH OF SPURIOUS RADIATION

Standard Applicable

Requirements: CFR 47, § 25.202(f). The mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

Measurement Procedure

The testing procedure was set according to TIA 603-C.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2005-11-10
HP	Pre Amp	8449B	314A00400	2005-05-10
A.H.System	Horn Antenna	SAS-200/571	261	2005-04-20
HP	Signal Generator	83650B	3614A00276	2005-05-10

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

Measurement Result

Environmental Conditions

Temperature:	23° C
Relative Humidity:	65%
ATM Pressure:	1025 mbar

The testing was performed by Snell Leong on 2005-10-07.

-17.5 dB at 8132.5 MHz, Low Channel

-20.5 dB at 8302.5 MHz, High Channel

Final Scan 1GHz – 16.6GHz (Lowest Channel: 1626.5 MHz), Antenna gain= 11.7 dB,
 $P=34.35 \text{ dBm}$
 $43 + 10 * \log(P) = 47.35 \text{ dBc}$,

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute		Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Gain	Loss	Leval			
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	Correction	dB	dBm	nW	dBm	dB
8132.5	15.75*	0	1.4	h	8132.5	-35.0	9.8	5.27	-30.5	897.429	-13	-17.5
1641.5	39.40	0	1.4	h	1641.5	-38.4	8.8	1.57	-31.2	763.836	-13	-18.2
8132.5	15.35*	0	1.4	v	8132.5	-36.1	9.8	5.27	-31.6	696.627	-13	-18.6
1641.5	39.25	0	1.4	v	1641.5	-39.0	8.8	1.57	-31.8	665.273	-13	-18.8
2255.5	28.95	0	1.4	h	2255.5	-46.0	8.3	1.76	-39.5	113.240	-13	-26.5
4879.5	13.75*	0	1.4	v	4879.5	-47.0	11.8	5.07	-40.3	93.972	-13	-27.3
4879.5	12.40*	0	1.4	h	4879.5	-48.6	11.8	5.07	-41.9	65.013	-13	-28.9
2255.5	24.40	0	1.2	v	2255.5	-51.2	8.3	1.76	-44.7	34.198	-13	-31.7
3253.0	13.60*	0	1.4	h	3253.0	-55.2	9.6	2.4	-48.0	15.849	-13	-35.0
3253.0	11.85*	0	1.4	v	3253.0	-68.5	9.6	2.4	-61.3	0.741	-13	-48.3

* Measurement were taken without pre amp

Final Scan 1GHz – 16.6GHz (Highest Channel: 1660.5 MHz), Antenna gain= 11.7 dB,
 $P=34.37 \text{ dBm}$
 $43 + 10 * \log(P) = 47.37 \text{ dBc}$,

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute		Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Gain	Loss	Leval			
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	Correction	dB	dBm	nW	dBm	dB
8302.5	36.9	0	1.4	h	8302.5	-39	9.8	4.27	-33.5	449.780	-13	-20.5
8302	35.5	180	1.4	v	8302	-41.5	9.8	4.27	-36.0	252.930	-13	-23.0
6642	35	90	1.2	v	6642	-45	10.9	4.73	-38.8	130.918	-13	-25.8
6642	35.9	0	1.4	h	6642	-46	10.9	4.73	-39.8	103.992	-13	-26.8
3321	49.9	330	1.2	h	3321	-51	9.6	2.4	-43.8	41.687	-13	-30.8
4981.5	33.7	180	1.4	v	4981.5	-54	11.8	5.07	-47.3	18.750	-13	-34.3
1645.5	40.8	0	1.4	h	1645.5	-55.3	8.8	1.57	-48.1	15.596	-13	-35.1
4981.5	34.3	0	1.4	h	4981.5	-56	11.8	5.07	-49.3	11.830	-13	-36.3
1645.5	39.1	180	1.4	v	1645.5	-56.7	8.8	1.57	-49.5	11.298	-13	-36.5
3321	43.1	90	1.2	v	3321	-58	9.6	2.4	-50.8	8.318	-13	-37.8

§25.202 – EMISSION MASK

Standard Applicable

According to CFR 47, § 25.202. The mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and include 250 percent of the authorized bandwidth: 35 dB;

Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through 20dB attenuation. The resolution bandwidth of the spectrum analyzer was set at 4 kHz. Sufficient scans were taken to show any out of band emissions up to 250% authorized bandwidth.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2005-11-10

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

Measurement Result

Environmental Conditions

Temperature:	20° C
Relative Humidity:	58%
ATM Pressure:	1010 mbar

The testing was performed by Snell Leong on 2005-11-28.

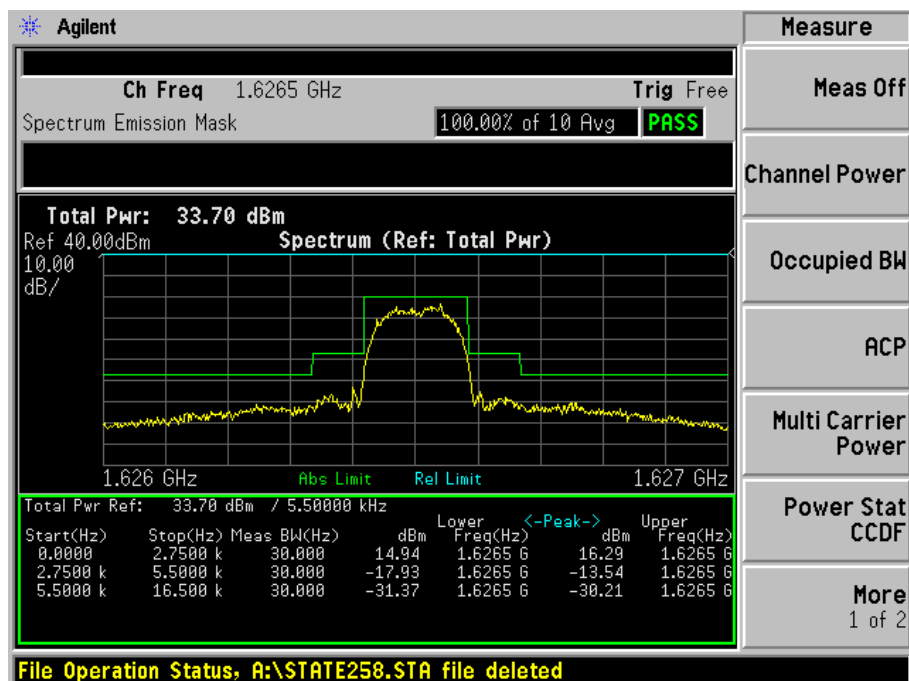
Occupied Bandwidth = 5.5KHz

50% - 100% => 2.75KHz – 5.5KHz

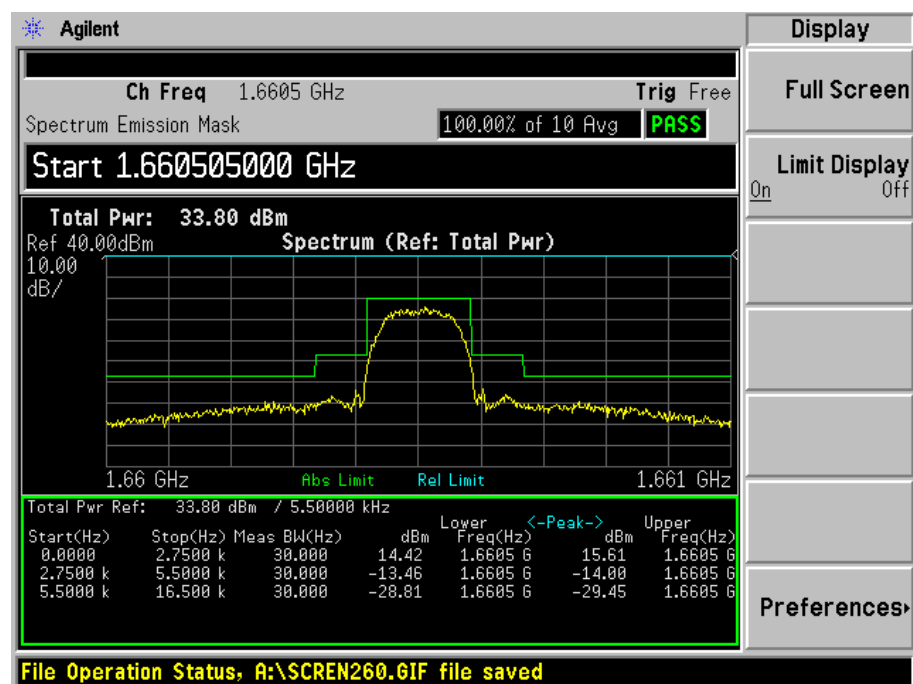
100% - 250% => 5.5KHz – 16.5KHz

Please plots for emission mask:

Low Channel



High Channel



§2.1046 & §25.204 – POWER OUTPUT (EIRP)

Standard Applicable

According to §25.204 (a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

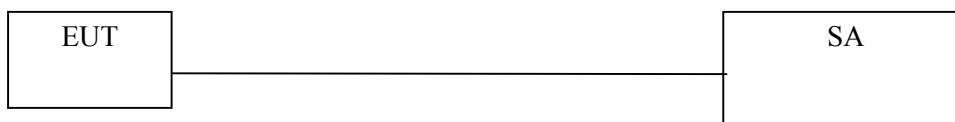
+40 dBW in any 4 kHz band for $\Theta \leq 0^\circ$

+40 + 3 Θ dBW in any 4 kHz band for $0^\circ < \Theta \leq 5^\circ$

where Θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable & 20 dB Attenuator from the antenna port to a Spectrum Analyzer.



Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2005-11-10

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

Measurement Result

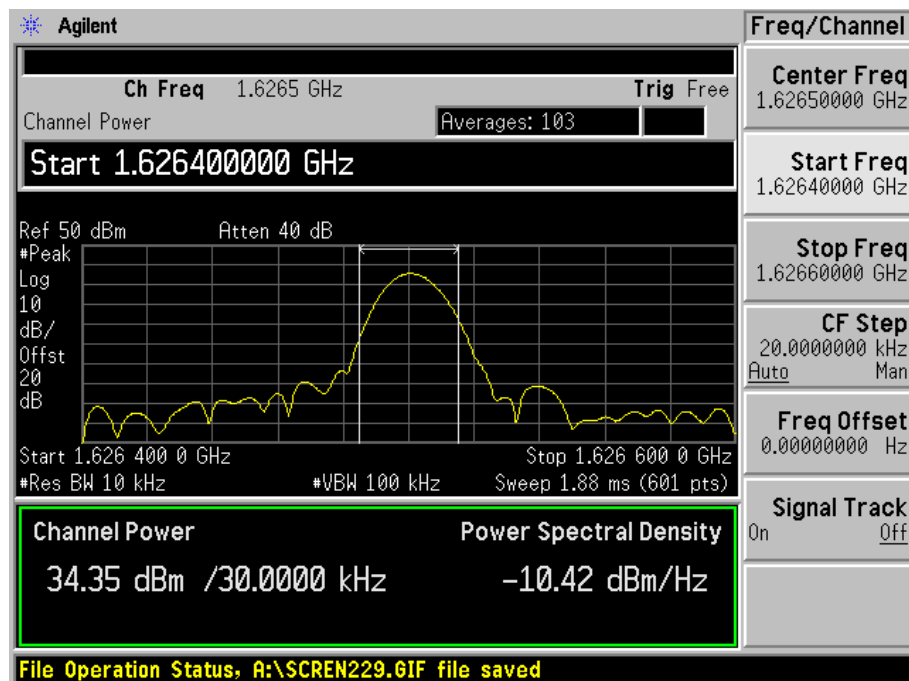
Environmental Conditions

Temperature:	23° C
Relative Humidity:	65%
ATM Pressure:	1025 mbar

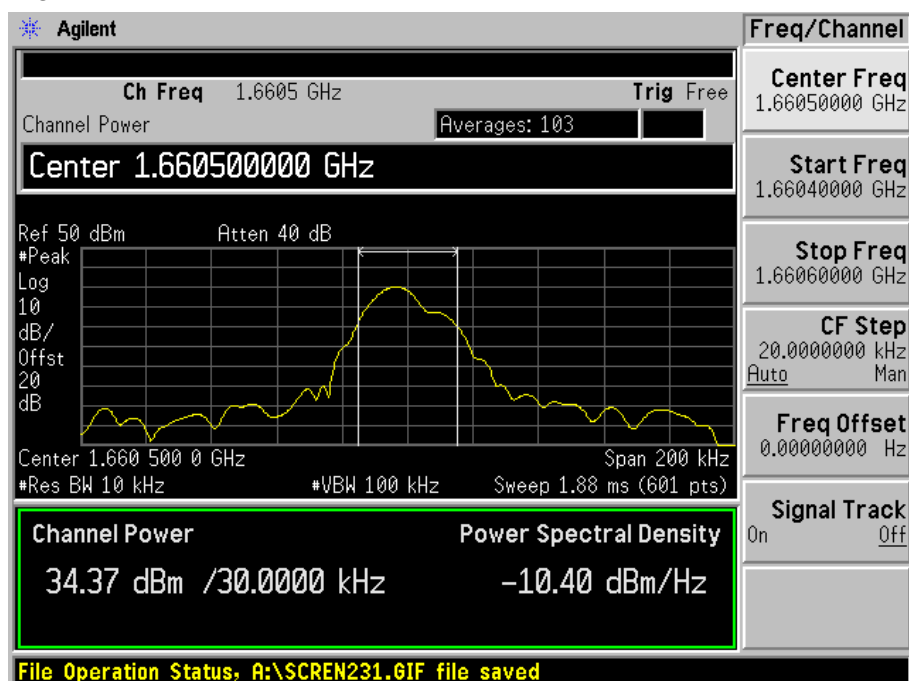
The testing was performed by Snell Leong on 2005-10-07.

Channel	Frequency MHz	Max conducted power		Corrected Factors			Limit (dBW)	Result
		(dBm)	dBW	Antenna Gain dB	Cable Loss dB	EIRP dBW		
Low	1626.5	34.35	4.35	11.7	0	16.05	40	Pass
High	1660.5	34.37	4.37	11.7	0	16.07	40	Pass

Low Channel



High Channel



**§25.216(b) & §25.216(g) – EMISSIONS FROM MOBILE EARTH STATIONS
FOR PROTECTION OF AERONAUTICAL RADIONAVIGATION-
SATELLITE SERVICE**

Standard Applicable

According to §215.216(b), the e.i.r.p. density of emissions from mobile earth stations placed in service on or before July 21, 2002 with assigned uplink frequencies between 1610 MHz and 1626.5 MHz shall not exceed -64 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1587.42–1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth generated by such stations shall not exceed -74 dBW, averaged over any 2 millisecond active transmission interval, in the 1587.42–1605 MHz band.

According to §215.216(g), mobile earth stations manufactured more than six months after Federal Register publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1610–1626.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz averaged over any 2 millisecond active transmission interval. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -20 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

Measurement Procedure

Please refer to Appendix D

Equipment Lists

Please refer to Appendix D

Measurement Result

Please refer to Appendix D

§2.1055 & §25.202(d) – FREQUENCY STABILITY

Standard Applicable

According to §25.202(d) *Frequency tolerance, Earth stations*. The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

Test Equipment List and Details

Please refer to Appendix E

Measurement Result

Please refer to Appendix E