# FCC PART 22 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

## **Telular Corporation**

580 Old Willets Path, Hauppauge, NY 11788

FCC ID: MTFSX6P360C112005

This Report Co	ncerns:	Equipment Type:
⊠ Original Report		CDMA 800MHz Wireless
		Deskphone
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Report No.:	R0511171	
Report Date:	2005-12-13	
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#### **GENERAL INFORMATION**

#### **Product Description for Equipment Under Test (EUT)**

The *Telular Corporation* 's product, *FCC ID: MTFSX6P360C112005* or the "EUT" as referred to in this report is a CDMA 800MHz Wireless Deskphone, which measures approximately 217.0mm L x 180.5mm W x 71.3mm H. The antenna gain is 1.5dBi.

\* The test data gathered are from typical production sample, serial number: E6819182 provided by the manufacturer.

#### **Objective**

This type approval report is prepared on behalf of *Telular Corporation* in accordance with Part 2, Subpart J, and Part 22 Subpart H of the Federal Communication Commissions rules.

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

#### 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 22 Subpart H - Public Mobile Services

Applicable Standards: TIA EIA 98-E, TIA603-C, and ANSI 63.4-2003.

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

#### **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 <a href="http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm">http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm</a>

## **SYSTEM TEST CONFIGURATION**

#### **Justification**

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

The final qualification test was performed with the EUT operating at Continuous transmitting mode.

#### **Block Diagram**

Please refer to Exhibit D.

## **Equipment Modifications**

No modifications were made to the EUT.

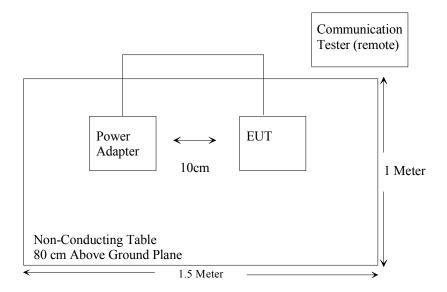
#### **Local Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number	FCC ID
Telular	Power adapter	WNA-0512MDC- US	Part no: 74009001	DOC

#### **Remote Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number	FCC ID	
HP	Communication Tester	8960	N/A	None	

#### **Configuration of Test System**



## SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1047	Modulation Characteristics	Compliant
§ 2.1053 , 22.917	Field Strength of Spurious Radiation	Compliant
§2.1091	RF Exposure	Compliant
§ 2.1046, § 22.913	RF Output Power	Compliant
§ 2.1049 § 22.917 § 22.905	Out of Band Emission, Occupied Bandwidth	Compliant
§15.109	Receiver Spurious Emission	Compliant
§ 2.1051, § 22.917	Spurious Emissions at Antenna Terminals	Compliant
§ 2.1055 (a) § 2.1055 (d) § 22.355	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 22.917	Band Edge	Compliant

## §2.1047 - MODULATION CHARACTERISTIC

## **Applicable Standard**

Requirement: FCC § 2.1047. As this is using Digital Modulation, Therefore no test is required!

Test Results: N/A

#### §2.1053, 22.917 - SPURIOUS RADIATED EMISSIONS

#### **Applicable Standard**

Requirements: CFR 47, § 2.1053.

#### **Test Procedure**

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 test was performed by placing the EUT on 3-orthogonal axis.

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

Remove the EUT and replace it with 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  $dB = 10 \log (TXpwr in Watts/0.001)$  – the absolute level

Spurious attenuation limit in  $dB = 43 + 10 \text{ Log}_{10}$  (power out in Watts)

#### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
	Analyzer,			
Agilent	Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005
Sunol Science	Antenna, Log-Periodic	JB1	A03105-3	02/11/2005
HP	Amplifier, Pre	8447D	2944A10198	8/17/2005
HP	Amplifier, Pre, Microwave	8449B	3147A00400	8/10/2005
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	4/20/2005
HP	Generator, Signal	83650B	3614A00276	5/10/2005
A.R.A.	Antenna, Horn	DRG-118/A	1132	8/17/2005

<sup>\*</sup> **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

## **Environmental Conditions**

Temperature:	22° C
Relative Humidity:	45%
ATM Pressure:	1016 mbar

The testing was performed by Snell Leong on 2005-12-05.

#### **Test Result**

The worse case reading is

#### -30.8 dB at 1673.04 MHz in Vertical Polarization

Indica	ated	Table	Test An	tenna	Substitu	ted	Antenna	Cable	Absolute	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Gain	Loss	Level	Lillit	Margin
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	Correction	dB	dBm	dBm	dB
1673.04	40.5	90	1.2	v	1673.04	-47.8	8.8	4.76	-43.8	-13	-30.8
1673.04	38.6	0	1.4	h	1673.04	-49.7	8.8	4.76	-45.7	-13	-32.7
2509.56	37.6	0	1.4	v	2509.56	-51.3	9.9	6.26	-47.7	-13	-34.7
2509.56	35.6	0	1.4	h	2509.56	-53.7	9.9	6.26	-50.1	-13	-37.1
3346.08	30.1	0	1.4	v	3346.08	-58.7	9.6	8.26	-57.4	-13	-44.4
3346.08	29.8	0	1.4	h	3346.08	-59.6	9.6	8.26	-58.3	-13	-45.3

## §1.1307(b)(1) & §2.1091 - RF EXPOSURE

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

Limits for General Population/Uncontrolled Exposure

Frequency	Electric Field	Magnetic Field	Power Density	Averaging Time
Range (MHz)	Strength (V/m)	Strength (A/m)	$(mW/cm^2)$	(minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	$*(180/f^2)$	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

#### **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

Maximum peak output power at antenna input terminal: 23.15 (dBm) Maximum peak output power at antenna input terminal: 206.54 (mW)

Prediction distance: 20 (cm)

Predication frequency: 835 (MHz)

Antenna Gain (typical): 1.5 (dBi) antenna gain: 1.4 (numeric)

Power density at predication frequency at 20 cm: 0.058 (mW/cm<sup>2</sup>)

MPE limit for uncontrolled exposure at prediction frequency: 0.56 (mW/cm<sup>2</sup>)

#### **Test Result**

The EUT is a mobile device. The power density level at 20 cm is 0.058 mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 0.56 mW/cm<sup>2</sup> at 835 MHz.

<sup>\* =</sup> Plane-wave equivalent power density

## §2.1046, §22.913(a) – CONDUCTED OUTPUT POWER & ERP

#### **Applicable Standard**

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

#### **Test Procedure**

- (1) The EUT, Simulator, and analyzer are connected via 3 ways splitter.
- (2) The path loss from EUT RF port to analyzer is measured at 8 dB.
- (3) Connection is established between simulator and EUT with maximum transmit power.
- (4) Record output power measurement on analyzer.

#### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date	
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005	
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005	

<sup>\*</sup> **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

#### **Environmental Conditions**

Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Snell Leong on 2005-12-05.

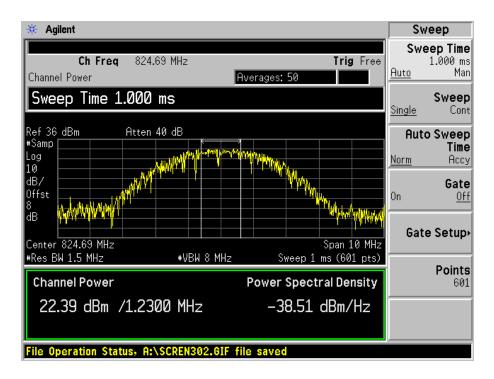
#### **Test Results**

Antenna gain = 2dBi

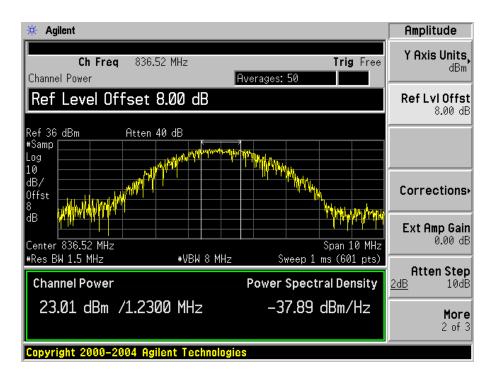
Channel	Frequency (MHz)	Output Power in dBm	ERP (dBm)	Limit in W
LOW	824.69	22.39	24.39	7
MIDDLE	836.52	23.01	25.01	7
HIGH	848.32	23.15	25.15	7

Peak ERP = 23.15 + 2 = 25.15 dBm

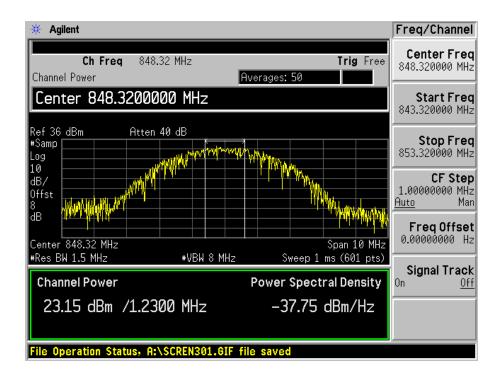
#### Low Channel



#### Middle Channel



#### High Channel



## §2.1049, §22.917(d) - OCCUPIED BANDWIDTH

#### **Applicable Standard**

Requirements: CFR 47, Section 2.1049 and 22.917(d).

#### **Test Procedure**

- (1) The EUT, Simulator, and analyzer are connected via 3 ways splitter.
- (2) The path loss from EUT RF port to analyzer is measured at 8 dB.
- (3) Connection is established between simulator and EUT with maximum transmit power.
- (4) The resolution bandwidth of the spectrum analyzer was set at 30 kHz and the 99% bandwidth was recorded.

## **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

<sup>\*</sup> **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

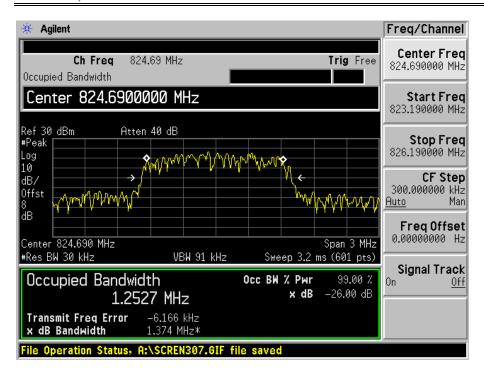
#### **Environmental Conditions**

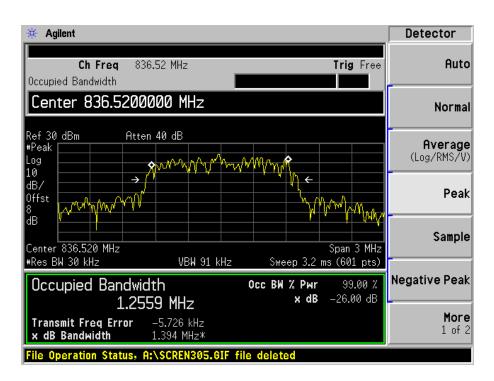
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

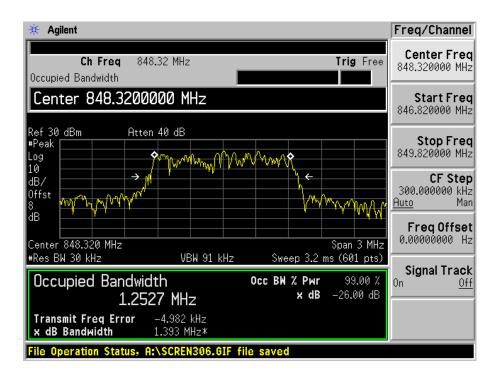
The testing was performed by Snell Leong on 2005-12-05.

#### **Test Results**

Please refer to the following plots.







#### §15.109 - RECEIVER SPURIOUS EMISSION

#### **Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in the 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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

#### **EUT Setup**

The radiated emission tests were performed in the open area 10-meter test site, using the setup in accordance with ANSI C63.4-2003. The specification used in this report was the FCC 15 Class B limits.

#### **Spectrum Analyzer Setup**

The system was tested to 1000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	RBW	Video B/W
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

#### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal Date
HP	Amplifier, Pre	8447D	2944A10198	2005-08-20
Sunol Science	30MHz-2Ghz	JB1	A03105-3	2005-02-11
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10

<sup>\*</sup> Statement of Traceability: BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

#### **Test Procedure**

For Radiated Emissions test, maximizing procedure was performed on the six (6) highest emissions in the described configurations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**Qp**" in the data table.

#### **Corrected Amplitude & Margin Calculation**

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Class B Limit

#### **Summary of Test Results**

According to the data in following tables, the EUT complied with the FCC Conducted limits for a Class B device, with the worst margin reading of:

-9.0 dB at 37.56 MHz in the Horizontal polarization

#### Radiated Emissions Test Data, 3 meters

#### **Environmental Conditions**

Temperature:	18 ° C
Relative Humidity:	56%
ATM Pressure:	1016mbar

The testing was performed by Snell Leong on 2005-12-05.

## Radiated Emissions Test Data, 3 meters

INDICA	ATED	TABLE	Ante	ENNA	Сог	RRECTION FA	ACTOR	CORRECTED  AMPLITUDE	FCC 15	CLASS B
Freq.	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB
37.56	39.9	270	3.2	Н	18.4	1.4	28.7	31.0	40	-9.0
37.56	37.7	75	1.8	V	18.4	1.4	28.7	28.8	40	-11.2
74.38	46.9	280	2.8	Н	8.5	1.8	28.4	28.8	40	-11.2
74.38	43.4	250	1.0	V	8.5	1.8	28.4	25.3	40	-14.7
364.25	39.4	280	2.8	Н	15.6	4.1	27.8	31.3	46	-14.7
325.90	38.7	240	3.1	Η	14.5	3.8	27.5	29.5	46	-16.5
364.25	37.4	250	1.0	V	15.6	4.1	27.8	29.3	46	-16.7
325.90	37.2	270	1.0	V	14.5	3.8	27.5	28.0	46	-18.0
176.45	35.5	240	3.1	Н	11.7	2.7	27.9	22.0	43.5	-21.5
176.45	33.7	330	3.0	V	11.7	2.7	27.9	20.2	43.5	-23.3

## §2.1051, §22.917 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

#### **Applicable Standard**

Requirements: CFR 47, § 2.1051, § 22.917.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

#### **Test Procedure**

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to  $10^{\text{th}}$  harmonic.

#### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

<sup>\*</sup> Statement of Traceability: BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

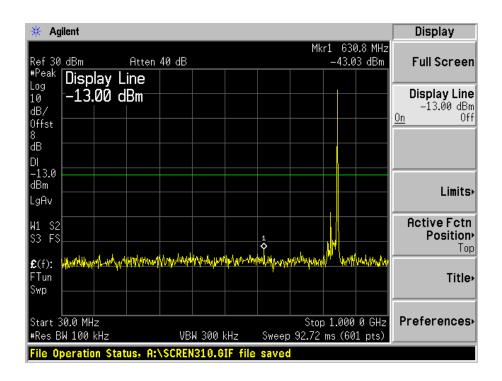
#### **Environmental Conditions**

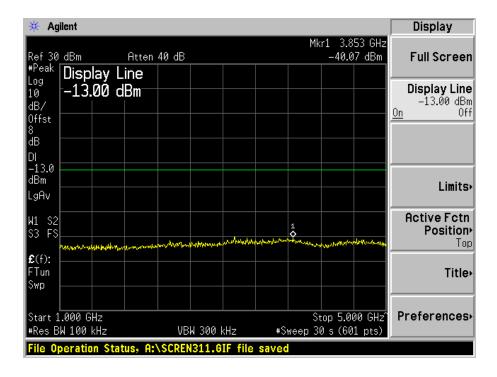
Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

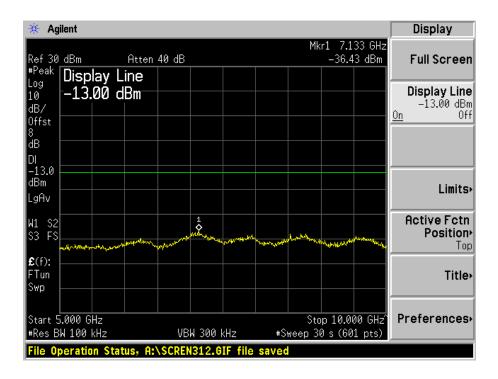
The testing was performed by Snell Leong on 2005-12-05.

#### **Test Results**

Please refer to the hereinafter plots.







## §2.1055 (a), §2.1055 (d), §22.355 - FREQUENCY STABILITY

#### **Applicable Standard**

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1\_Frequency Tolerance for Transmitters in the Public Mobile Services

Base, Frequency range (MHz)	(p	SU][le][/	J]3 watts	[le]3 watts
25 to 50	20.0	20.0	50.0	
50 to 450	5.0	5.0	50.0	
450 to 512	2.5	5.0	5.0	
821 to 896	1.5	2.5	2.5	
928 to 929	5.0	n/a	n/a	
929 to 960	1.5	n/a	n/a	
2110 to 2220	10.0	n/a	n/a	

#### **Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to AC power supply and the RF output was connected to a communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC 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 communication test set.

Frequency Stability vs. Voltage: The voltage was set to 115% of the nominal value and was then decreased to 95% of the nominal value. The output frequency was recorded for each voltage level.

#### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005
Tenney	Oven, Temperature	VersaTenn	12.222-193	6/4/2005

<sup>\*</sup> **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

## **Environmental Conditions**

Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Snell Leong on 2005-12-05.

#### **Test Results**

Frequency Stability Versus Temperature

Reference Frequency: 836.52 MHz, Limit: 2.5ppm						
Environment Temperature (°C)	Power Supplied (VAc)	Frequency Measure with Time Elapsed				
		Frequency error (HZ)	PPM Error			
-30	120	836.52003	0.04			
0	120	836.520021	0.03			
20	120	836.520033	0.04			
30	120	836.520015	0.02			
50	120	836.519986	0.02			
-20	120	836.52009	0.11			
50	120	836.519972	0.03			
-20	120	836.520025	0.03			
50	120	836.519977	0.03			

Frequency Stability Versus Voltage

Reference Frequency: 836.52 MHz, Limit: 2.5ppm					
Power Supplied	Environment Temperature (°C)	Frequency error (HZ)	PPM Error		
(VAc)	( C)				
126.5	-20	836.52009	0.11		
126.5	50	836.519972	0.03		
93.5	-20	836.520025	0.03		
93.5	50	836.519977	0.03		

#### **§22.917 – BAND EDGE**

#### **Applicable Standard**

According to § 22.917, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P) dB$ .

#### **Test Procedure**

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency, RBW set to 30kHz.

#### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	8/8/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

<sup>\*</sup> **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

#### **Environmental Conditions**

Temperature:	23° C
Relative Humidity:	41%
ATM Pressure:	1016 mbar

The testing was performed by Snell Leong on 2005-12-05.

#### **Test Results**

Please refer to the following plots.

