

FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

VTech Telecommunications Ltd.

23/F Tai Ping Industrial Centre, Block 1, 57 Ting Kok Road, Tai Po, N.T., Hong Kong

FCC ID: EW780-5744-01

This Report Concerns: ☒ Original Report	Equipment Type: Cordless Telephone Remote Transceiver
	
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Report No.:	<u>R0505251b(H)</u>
Report Date:	<u>2005-06-08</u>
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The VTech Telecommunications Ltd.'s product, FCC ID: EW7-80-5744-01, or the "EUT" as referred to in this report is the handset part of a Cordless Telephone, which measures approximately 200mmL x 55mm W x 30mm H. The EUT operates at the frequency range of 922 – 927MHz, with the maximum conducted output power of 3.31dBm (2.14mW).

** The test data gathered are from a production sample, S/N:E2116001 , provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of VTech Telecommunications Ltd .in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003& TIA/EIA-603.

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.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports 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 and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC 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 ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the system components.

Once loaded, set the Tx channel to low, mid and high for testing.

Special Accessories

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

Schematics / Block Diagram

Please refer to Appendix A.

Equipment Modifications

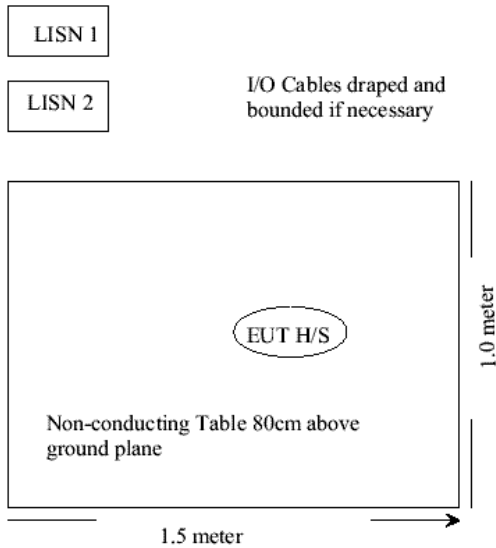
No modifications were made to the EUT.

Configuration of Test System



Handset

Test Setup Block Diagram



§15.203 - ANTENNA REQUIREMENT

Standard Applicable

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to § 15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The gain of antenna used for transmitting is 1 dBi by default, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

§15.207(a) - CONDUCTED EMISSIONS

No conducted emission test due to battery operation.

§2.1051 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Standard Applicable

Requirements: CFR 47, § 2.1051.

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

Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer 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 10th harmonic.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Analyzer, Spectrum	8565EC	3946A00131	8/6/2004

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

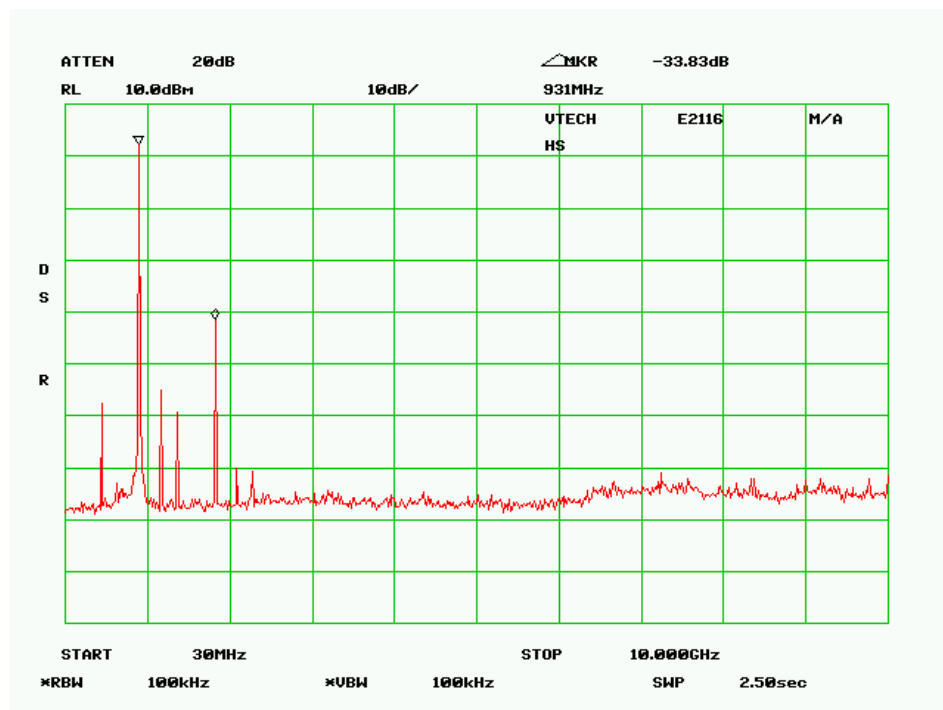
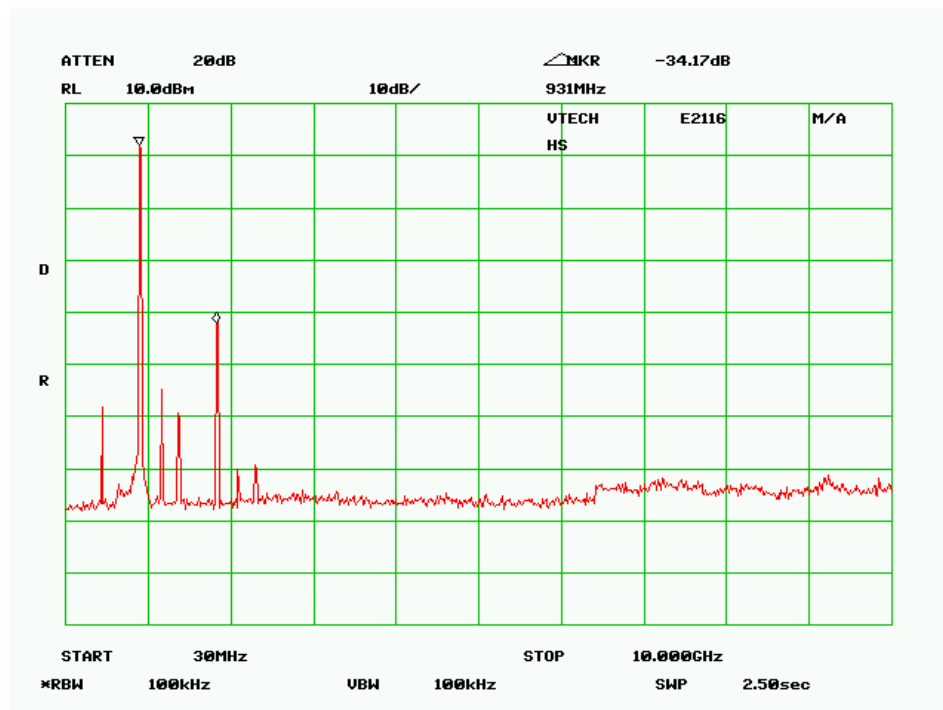
Measurement Result

Please refer to following pages for plots of spurious emission.

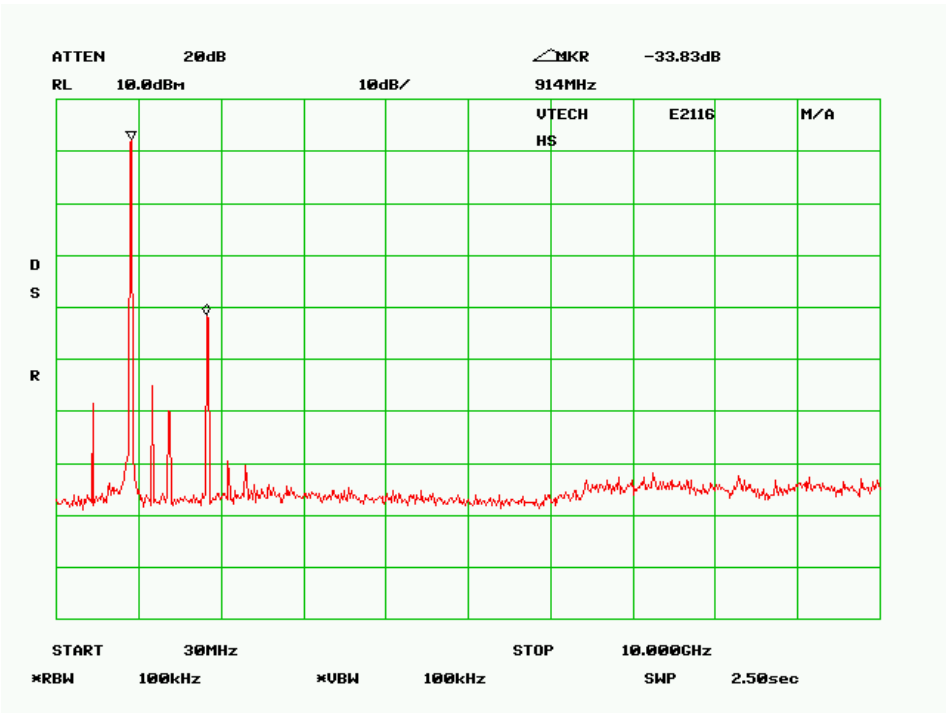
Environmental Conditions

Temperature:	24° C
Relative Humidity:	69%
ATM Pressure:	1020 mbar

**The testing was performed by Snell Leong on 2005-05-27.*

Low Channel*Mid Channel*

High Channel



§15.205 & §15.209 - SPURIOUS RADIATED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties. 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.

According to §15.205, except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
¹ 0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2655 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.57725	240 – 285	3345.8 – 3358	36.43 – 36.5
13.36 – 13.41	322 – 335.4	3600 – 4400	(²)

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz

² Above 38.6

Except as provided in paragraph (d) and (e), the filed strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

According to §15.209, the device shall meet radiated emission general requirements.

Except for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength	
	(Microvolts/meter)	(dB μ V/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 30 to 10000 MHz.

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

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

For Average measurement: RBW = 1MHz, VBW = 10Hz (above 1000MHz)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Pre, microwave	8447D	2944A10198	2004-08-20
HP	Amplifier, Pre,	8449B	3147A00400	2004-06-14
Agilent	Analyzer, Spectrum	E4446A	US44300386	2004-11-10
ETS	Antenna, Biconical	3110B	9603-2315	2004-12-14
A. H. Systems	Antenna, Horn, Std	ARH-2823-02	10555-02	2004-12-13
EMCO	Antenna, logperiodic	3148	4-1155	2004-12-14

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

Environmental Conditions

Temperature:	24° C
Relative Humidity:	69%
ATM Pressure:	1020 mbar

**The testing was performed by Snell Leong on 2005-05-27.*

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.247, and had the worst margin of:

- 9.5 dB at 1844 MHz in the **Vertical** polarization, Low Channel, 3 meters
- 3.6 dB at 1849.6 MHz in the **Vertical** polarization, Middle Channel, 3 meters
- 3.6 dB at 1854 MHz in the **Vertical** polarization, High Channel, 3 meters
- 3.7 dB at 450.92 MHz in the **Horizontal** polarization, Unintentional Emission, 3 meters

Radiated Emission Test Data @ 3 Meters

Indicated			Antenna	Antenna		Correction Factor			FCC 15.247		
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable	Amp.	Corr.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	Loss	dB	Ampl.	dBμV/m	dB	
Low Channel											
922.0000	101.2	90	1.0	v	23.4	4.0	28.3	100.3			Fund/Peak
922.0000	94.8	0	1.2	h	23.4	4.0	28.3	93.9			Fund/Peak
922.0000	100.3	180	1.2	v	23.4	4.0	28.3	99.4			Ave
922.0000	94.1	0	1.2	h	23.4	4.0	28.3	93.3			Ave
1844.0000	54.2	270	2.4	v	24.8	1.9	36.3	44.5	54	-9.5	Ave
1844.0000	53.8	180	2.3	h	24.8	1.9	36.3	44.1	54	-9.9	Ave
2766.0000	37.2	180	2.0	v	28.9	2.4	35.5	33.0	54	-21.0	Ave
1596.7700	42.7	180	2.0	v	24.8	1.9	36.3	33.0	54	-21.0	Ave
2766.0000	35.2	90	2.0	h	28.9	2.4	35.5	31.1	54	-23.0	Ave
1596.7700	37.9	90	2.0	h	24.8	1.9	36.3	28.2	54	-25.8	Ave
1844.0000	57.3	270	2.4	v	24.8	1.9	36.3	47.7	74	-26.4	Peak
1844.0000	56.5	180	2.3	h	24.8	1.9	36.3	46.9	74	-27.2	Peak
2766.0000	47.8	90	2.0	v	28.9	2.4	35.5	43.6	74	-30.4	Peak
2766.0000	46.5	180	2.0	h	28.9	2.4	35.5	42.3	74	-31.7	Peak
1596.7700	49.5	90	2.0	v	24.8	1.9	36.3	39.8	74	-34.2	Peak
1596.7700	47.7	180	2.0	h	24.8	1.9	36.3	38.1	74	-36.0	Peak
Middle Channel											
924.8000	101.1	90	1.0	v	23.4	4.0	28.3	100.2			Fund/Peak
924.8000	96.6	0	1.5	h	23.4	4.0	28.3	95.7			Fund/Peak
924.8000	99.7	180	1.2	v	23.4	4.0	28.3	98.8			Ave
924.8000	95.6	0	1.5	h	23.4	4.0	28.3	94.7			Ave
1849.6000	60.1	270	2.4	v	24.8	1.9	36.3	50.4	54	-3.6	Ave
1849.6000	56.0	180	2.2	h	24.8	1.9	36.3	46.3	54	-7.7	Ave
1599.8500	47.0	180	2.1	h	24.8	1.9	36.3	37.3	54	-16.7	Ave
1599.8500	45.2	270	2.4	v	24.8	1.9	36.3	35.5	54	-18.5	Ave
1196.7700	46.0	270	2.4	v	23.3	1.3	36.8	33.8	54	-20.2	Ave
1849.6000	63.4	270	2.4	v	24.8	1.9	36.3	53.7	74	-20.3	Peak
1849.6000	60.4	180	2.2	h	24.8	1.9	36.3	50.7	74	-23.3	Peak
2774.4000	34.3	270	2.4	v	28.9	2.4	35.5	30.1	54	-23.9	Ave
1196.7700	42.1	180	2.1	h	23.3	1.3	36.8	29.8	54	-24.2	Ave
2774.4000	32.9	180	2.1	h	28.9	2.4	35.5	28.8	54	-25.3	Ave
1599.8500	55.3	180	2.3	h	24.8	1.9	36.3	45.7	74	-28.4	Peak
1599.8500	51.8	270	2.4	v	24.8	1.9	36.3	42.1	74	-31.9	Peak
1196.7700	54.3	270	2.4	v	23.3	1.3	36.8	42.1	74	-31.9	Peak
2774.4000	45.4	270	2.4	v	28.9	2.4	35.5	41.3	74	-32.8	Peak
2774.4000	44.8	180	2.3	h	28.9	2.4	35.5	40.6	74	-33.4	Peak
1196.7700	48.6	180	2.3	h	23.3	1.3	36.8	36.4	74	-37.6	Peak

High Channel											
927.0000	100.3	0	1.8	v	23.4	4.0	28.3	99.5			Fund/Peak
927.0000	95.3	90	1.8	h	23.4	4.0	28.3	94.4			Fund/Peak
927.0000	99.8	90	1.6	v	23.4	4.0	28.3	98.9			Ave
927.0000	94.6	0	1.6	h	23.4	4.0	28.3	93.7			Ave
1854.0000	60.1	270	2.4	v	24.8	1.9	36.3	50.4	54	-3.6	Ave
1854.0000	57.3	90	2.1	h	24.8	1.9	36.3	47.6	54	-6.4	Ave
1854.0000	62.7	270	2.4	v	24.8	1.9	36.3	53.0	74	-21.0	Peak
2781.0000	35.3	270	2.4	v	28.9	2.4	35.5	31.1	54	-22.9	Ave
1854.0000	60.5	90	2.1	h	24.8	1.9	36.3	50.8	74	-23.2	Peak
2781.0000	33.6	90	2.1	h	28.9	2.4	35.5	29.4	54	-24.6	Ave
1179.0800	34.8	270	2.4	v	23.3	1.3	36.8	22.5	54	-31.5	Ave
1179.0800	34.8	180	2.1	h	23.3	1.3	36.8	22.5	54	-31.5	Ave
2781.0000	46.0	90	2.1	h	28.9	2.4	35.5	41.9	74	-32.2	Peak
2781.0000	45.7	270	2.4	v	28.9	2.4	35.5	41.6	74	-32.5	Peak
1179.0800	47.2	270	2.4	v	23.3	1.3	36.8	34.9	74	-39.1	Peak
1179.0800	46.6	180	2.3	h	23.3	1.3	36.8	34.3	74	-39.7	Peak

FUND: Fundamental

AVG: Average

Unintentional Emission

Frequency MHz	Indicated		Antenna Height Meter	Antenna		Correction Factor			FCC 15B	
	Ampl. dBμV/m	Direction Degree		Polar H/V	Antenna dB	Cable Loss dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
450.9200	49.2	240	3.1	H	16.9	4.6	28.4	42.3	46	-3.7
318.9730	51.3	280	2.8	V	13.8	3.8	27.5	41.4	46	-4.6
722.9200	42.0	330	3.0	H	20.4	6.0	28.2	40.2	46	-5.8
220.6270	51.3	280	2.8	V	10.7	3.1	27.6	37.5	46	-8.5
450.9200	43.6	250	1.0	V	16.9	4.6	28.4	36.7	46	-9.3
318.9730	44.4	270	1.0	H	13.8	3.8	27.5	34.5	46	-11.5
722.9200	35.2	240	3.1	V	20.4	6.0	28.2	33.4	46	-12.6
246.9730	43.9	250	1.0	V	11.8	3.4	27.5	31.6	46	-14.4
220.6270	44.5	270	1.0	H	10.7	3.1	27.6	30.7	46	-15.3
246.9730	42.9	240	3.1	H	11.8	3.4	27.5	30.6	46	-15.4

§15.247(a)(2) – 6 dB BANDWIDTH

Standard Applicable

According to §15.247(a)(2), for digital modulation techniques, the minimum 6dB bandwidth shall be at least 500 kHz.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

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

Measurement Result

Environmental Conditions

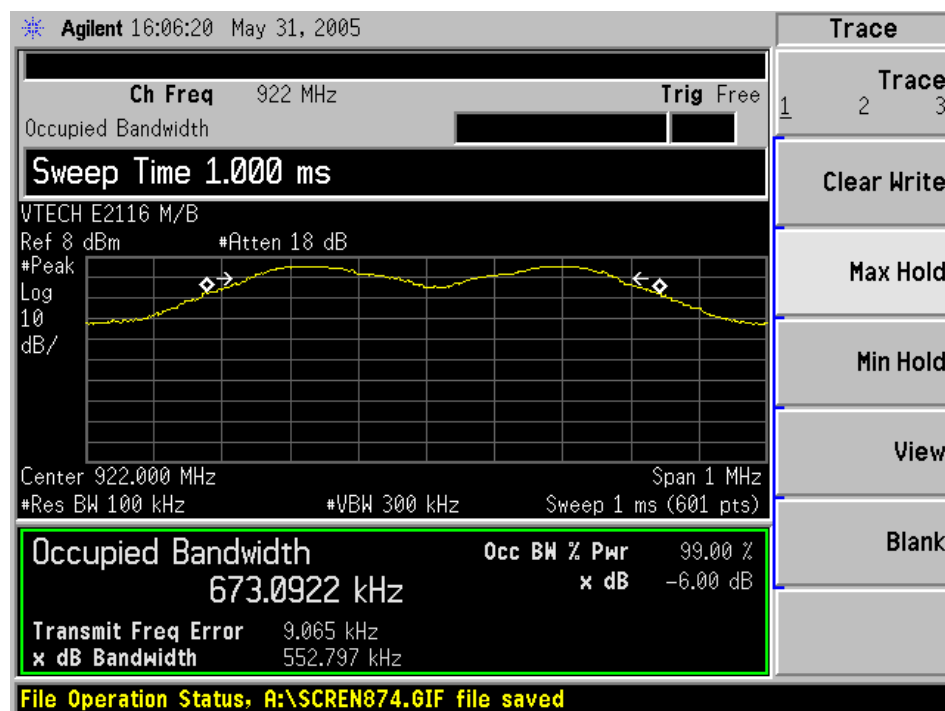
Temperature:	26° C
Relative Humidity:	59%
ATM Pressure:	1014 mbar

*The testing was performed by Snell Leong on 2005-05-31.

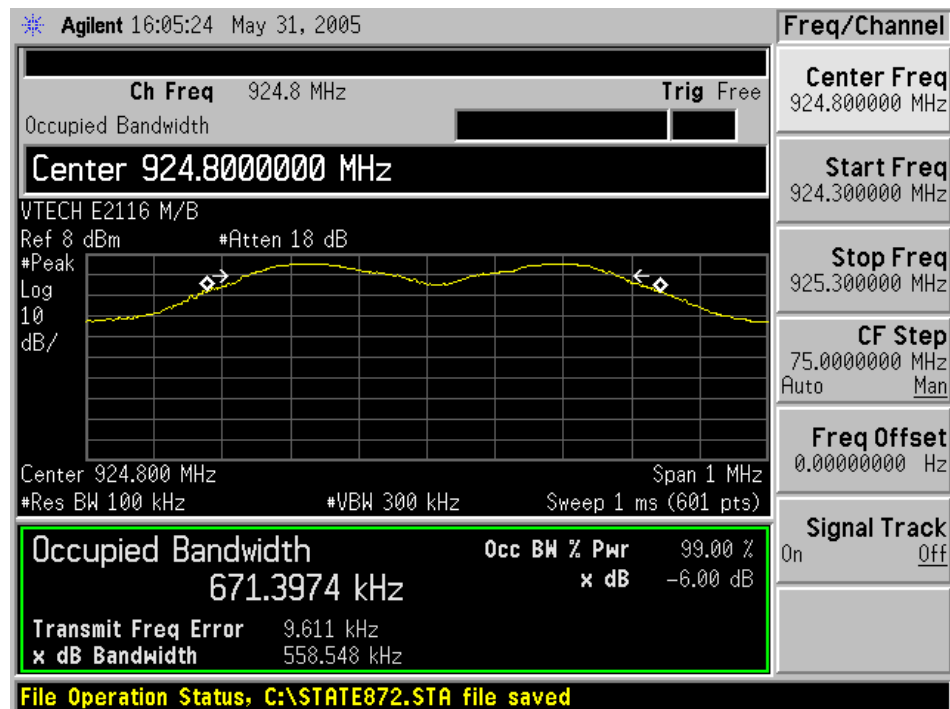
Test Result

Channel	Frequency (MHz)	Measured (KHz)	Standard (kHz)	Result
Low	922	552.8	≥ 500	Pass
Mid	924.8	558.55	≥ 500	Pass
High	927	555.83	≥ 500	Pass

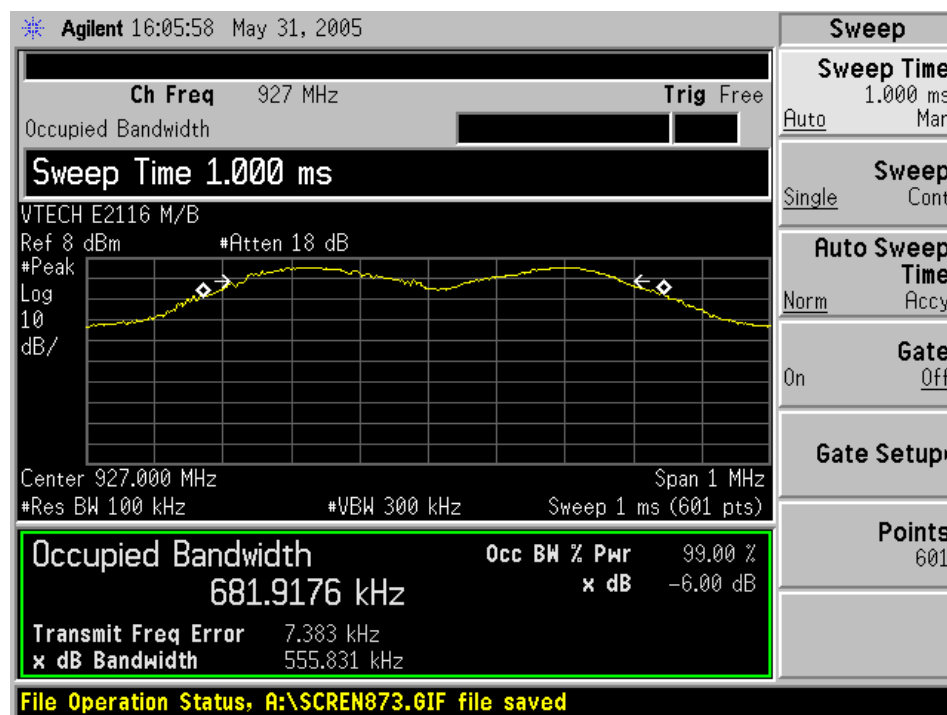
Low Channel



Middle Channel



High Channel



§15.247(b)(3) - PEAK OUTPUT POWER MEASUREMENT

Standard Applicable

According to §15.247(b) (3), for systems using digital modulation in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: 1 Watt

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 from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

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

Measurement Result

Environmental Conditions

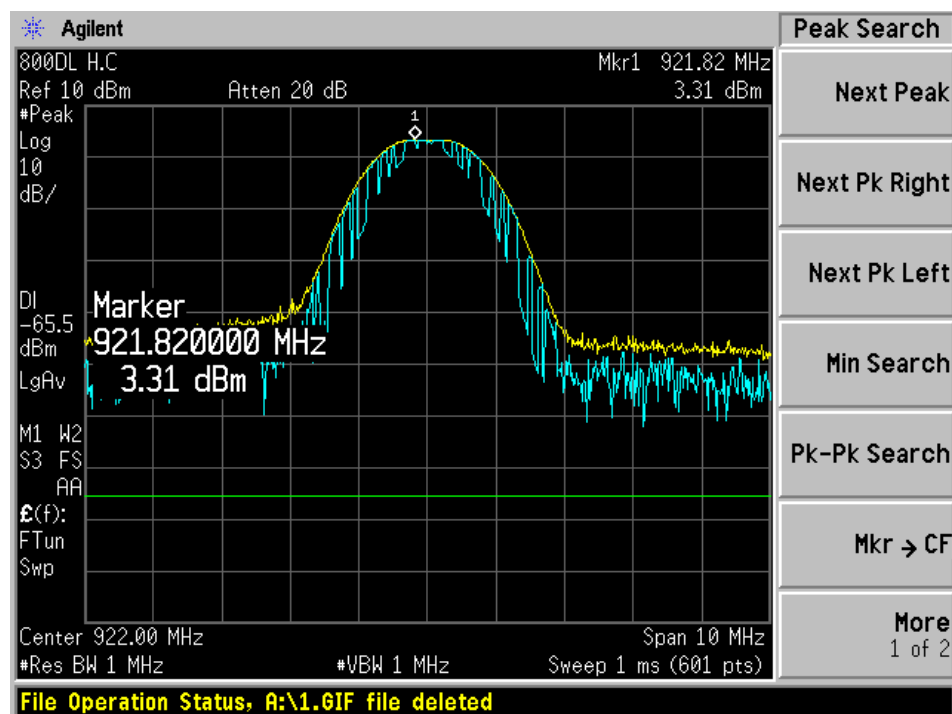
Temperature:	20° C
Relative Humidity:	50%
ATM Pressure:	1012 mbar

*The testing was performed by Snell Leong on 2005-06-07.

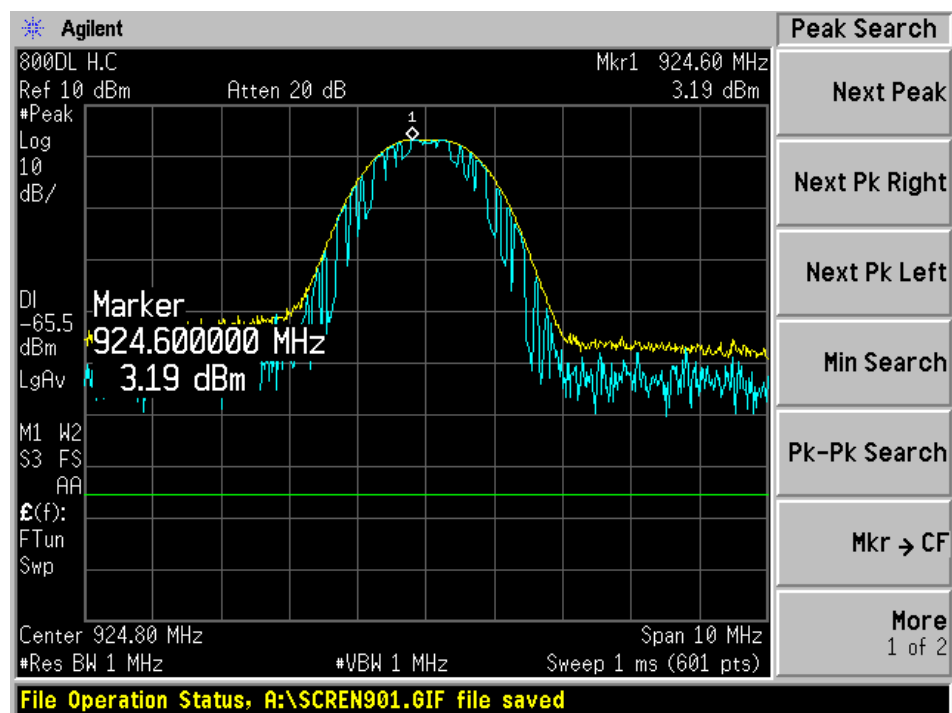
Output Power

Channel	Frequency MHz	Max Peak Output Power		Limit (mW)	Result
		(dBm)	(mW)		
Low	922	3.31	2.14	1000	pass
Mid	924.8	3.19	2.08	1000	pass
High	927	3.15	2.07	1000	pass

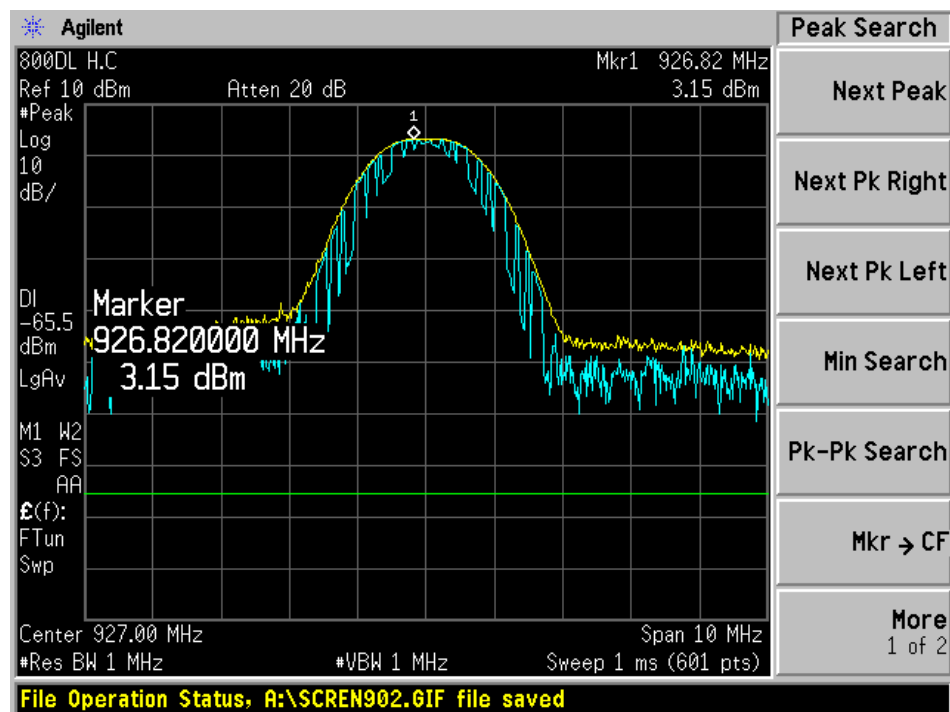
Low Channel



Middle Channel



High Channel



§15.247(d) - 100 KHZ BANDWIDTH OF BAND EDGES

Standard Applicable

According to §15.247(d), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) see §15.205(c)).

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Analyzer, Spectrum	8565EC	3946A00131	8/6/2004

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

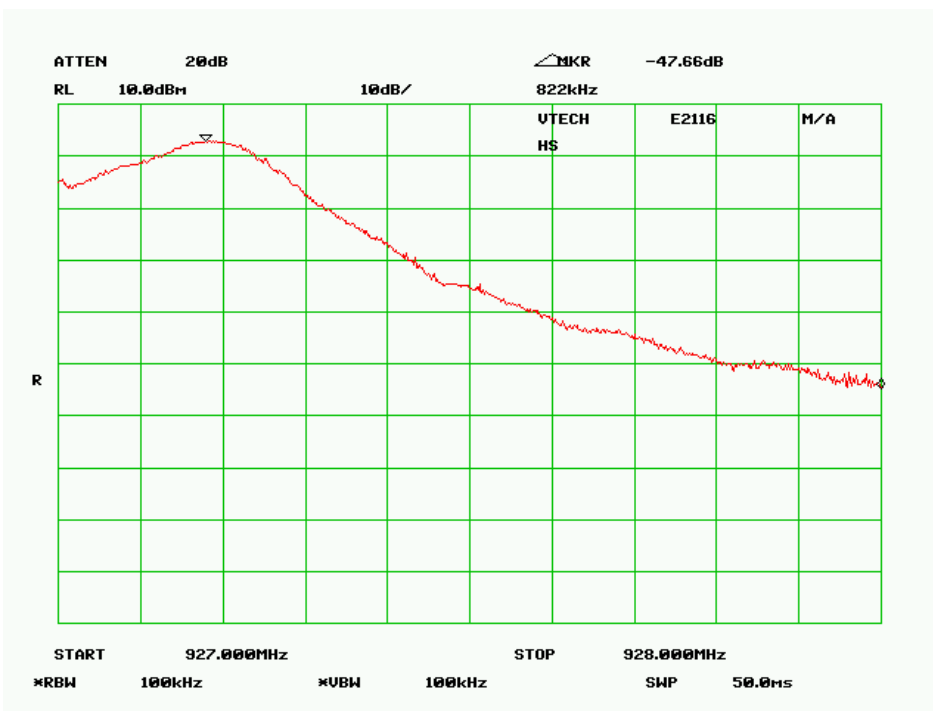
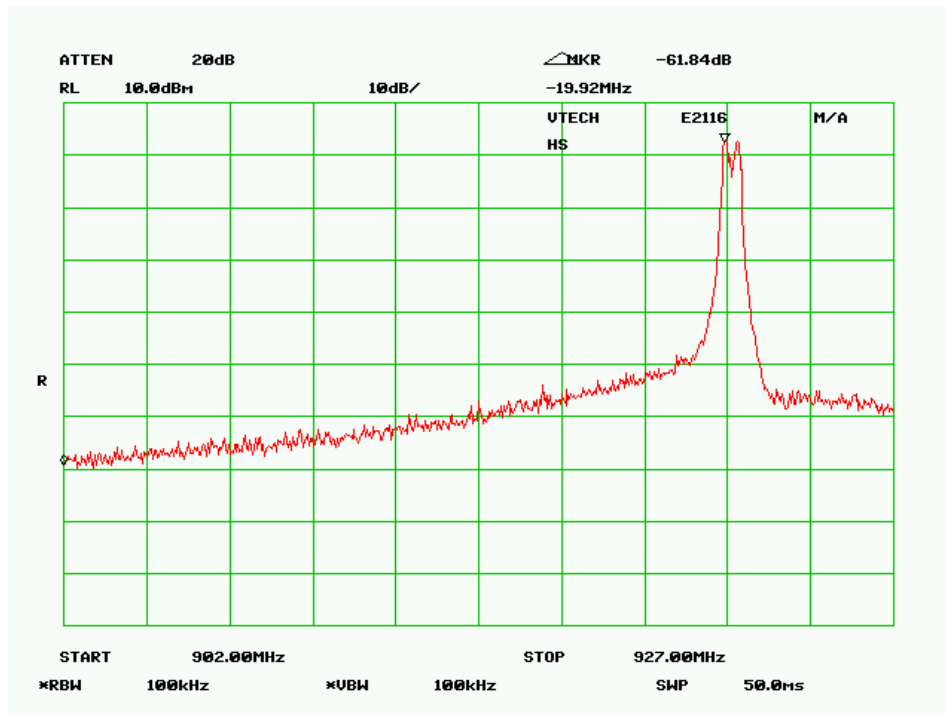
Measurement Result

Environmental Conditions

Temperature:	26° C
Relative Humidity:	59%
ATM Pressure:	1014 mbar

**The testing was performed by Snell Leong on 2005-05-31.*

Please refer to following pages for plots of band edge.



§15.247(e) - PEAK POWER SPECTRAL DENSITY

Standard Applicable

According to §15.247 (e), for direct sequence systems, the peak 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.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

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

Measurement Result

Environmental Conditions

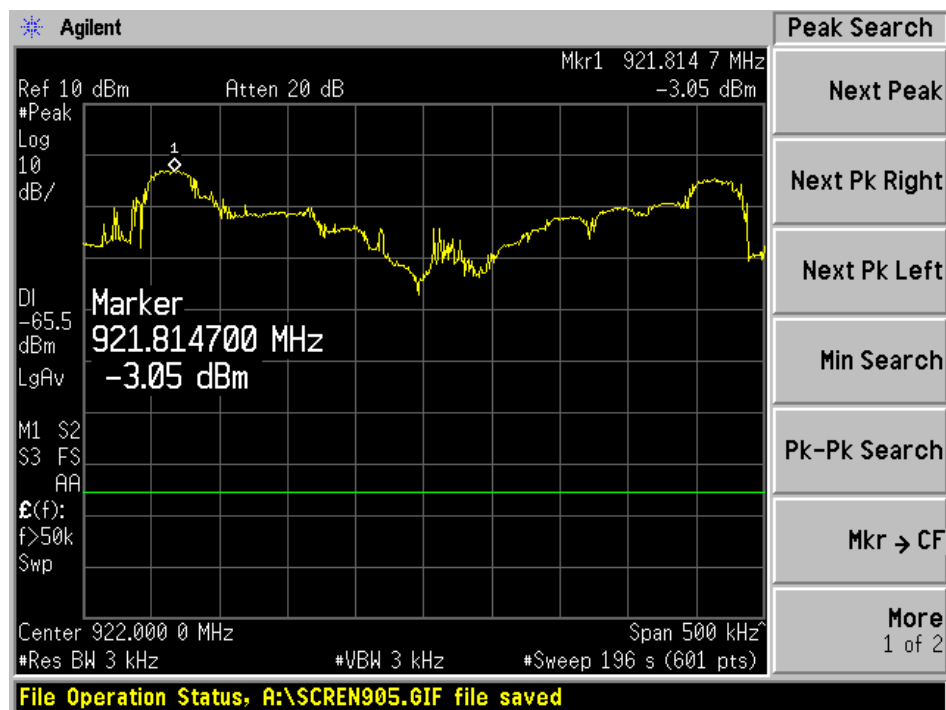
Temperature:	20° C
Relative Humidity:	50%
ATM Pressure:	1012 mbar

*The testing was performed by Snell Leong on 2005-06-07.

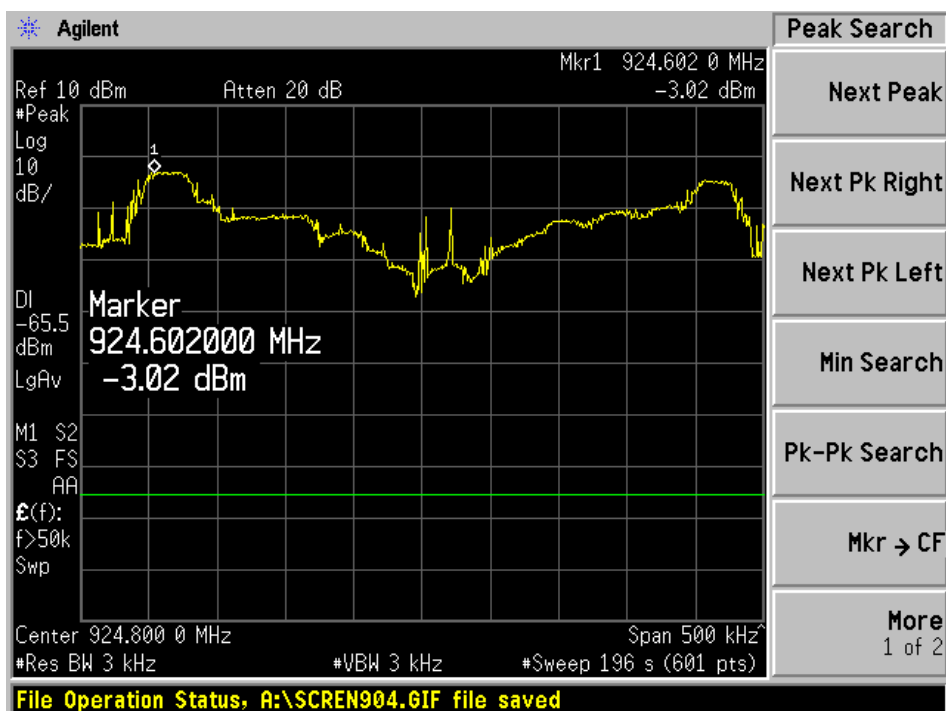
Test Result

Channel	Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
Low	922	-3.05	≤ 8	Pass
Mid	924.8	-3.02	≤ 8	Pass
High	927	-2.86	≤ 8	Pass

Low Channel



Middle Channel



High Channel

