Lab Code: 200167-0

FCC PART 15.247

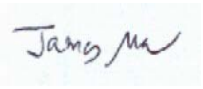
EMI MEASUREMENT AND TEST REPORT

For

ZEBRA TECHNOLOGIES CORPORATION

333 Corporate Woods Parkway
Vernon Hills, IL 60061

FCC ID: I28MD-BTC2TY6

This Report Concerns: ☒ Original Report	**Product Type:** Bluetooth modular
Test Engineer:	Oscar Au  Choon Sian Ooi 
Report No.:	R0608281
Report Date:	2006-09-06
Reviewed By:	Test Engineer: James Ma 
Prepared By:	Bay Area Compliance Laboratory Corporation 1274 Anvilwood Ave. Sunnyvale, CA 94089 Tel: (408) 732-9162 Fax: (408) 732-9164

Note: This test report is for the customer shown above and their specific product only. It may not be duplicated without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP or any agency of the U.S. Government.

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

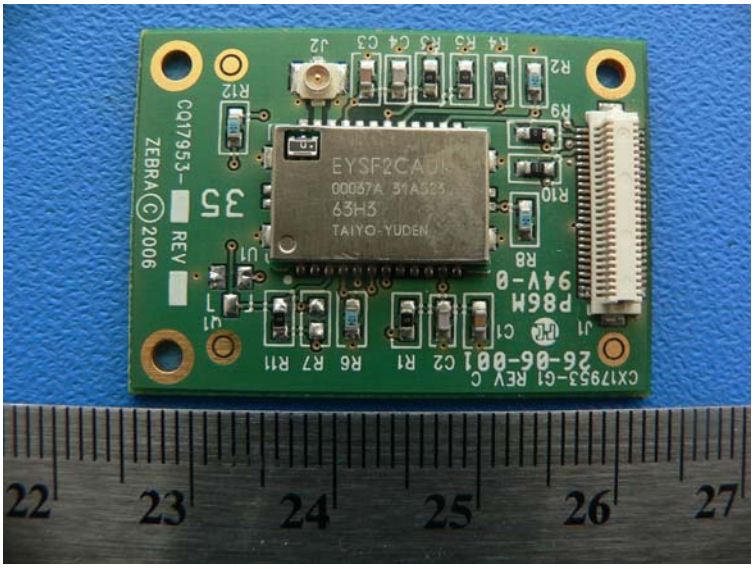
The *Zebra Technologies Corporation*'s product, *FCC ID: I28MD-BTC2TY6* or the "EUT" as referred to in this report is a 2.4GHz Bluetooth modular. It is designed for mobile printing applications. Its compact size and rugged construction is ideally suited to print receipts and for many other situations where on-site printing is required.

Mechanical Description

The EUT measures approximately 38mmL x 27mm W x 3mm H.

** The test data gathered are from a production sample, Serial Number: 001, provided by the manufacturer.*

EUT Photo



Objective

This type approval report is prepared on behalf of *Zebra Technologies Corporation* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

Measurement Uncertainty

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

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

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

Test Facility

The Test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports 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 test methods and procedures set forth in ANSI C63.4-2003& TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 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 is attached hereinafter and can also be found at
http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was built in the host (printer model name:MZ320) tested in the engineering test operating mode to represent *worst*-case results during the final qualification test.

Special Accessories

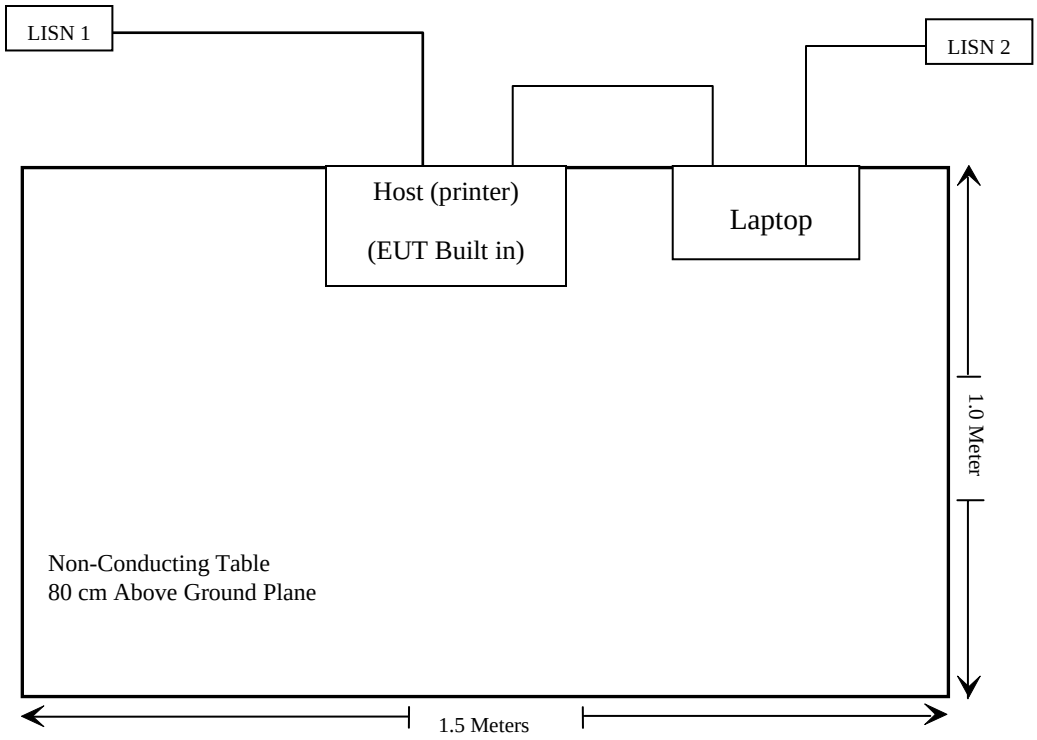
As shown in following test block diagram.

Equipment Modifications

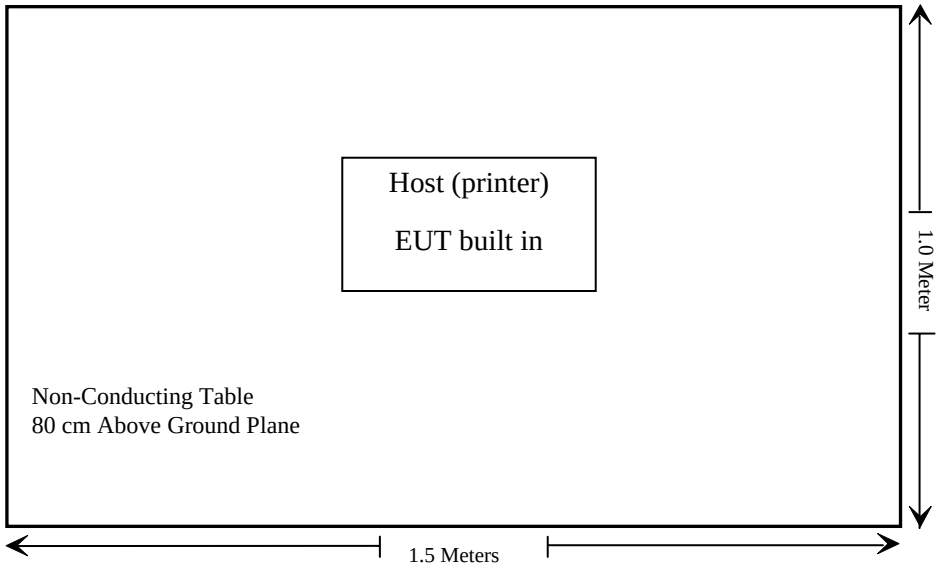
No modifications were made to the EUT.

Test Setup Block Diagram

Conducted Emissions



Radiated Emissions



SUMMARY OF TEST RESULTS FOR FCC PART 15 C

Fcc Rules	Description Of Test	Result
§15.247(e)(i) §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§2.1051 & §15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209 & §15.247(c)	Radiated Emissions	Compliant
§15.247 (a) (1)	Hopping Channel Separation	Compliant
§15.247 (a) (1)	Channel Bandwidth	Compliant
§15.247 (a) (1) (iii)	Number of Hopping Frequencies Used	Compliant
§15.247 (a) (1) (iii)	Dwell Time of Each Frequency	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant

§ 15.247 (e)(i) - RF EXPOSURE

According to §15.247(e)(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to TCB Exclusions list, no SAR required if power is lower than the flowing threshold:

Frequency Range		Center frequency (MHz)	60/f SAR Limitation (mw)
Low Frequency (MHz)	High Frequency (MHz)		
2402	2480	2441	24.58

Maximum measured transmitter power:

Conducted Power (mw)	Max Antenna Gain (dBi)	EIRP (mw)
0.65	2.64	1.19

Threshold at which no SAR required is 24.58 mw.

Maximum Tx power is 1.19 mw EIRP.

Conclusion: No SAR is required.

§ 15.203 ANTENNA REQUIREMENTS

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 antenna for the EUT is an integrated antenna with 2.64 dBi gain.

§15.207 (a) – AC Line Conducted Emissions

Test Setup

The measurement was performed at shield room, using the same setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

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

The EUT was connected with LISN-1.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
FCC	LISN	FCC LISN 50-50-2-M-H	06013	2006-03-31
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2006-03-13

*** 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 emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

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

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

Environmental Conditions

Temperature:	23° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

**The testing was performed by Choon Sian Ooi on 2006-09-01.*

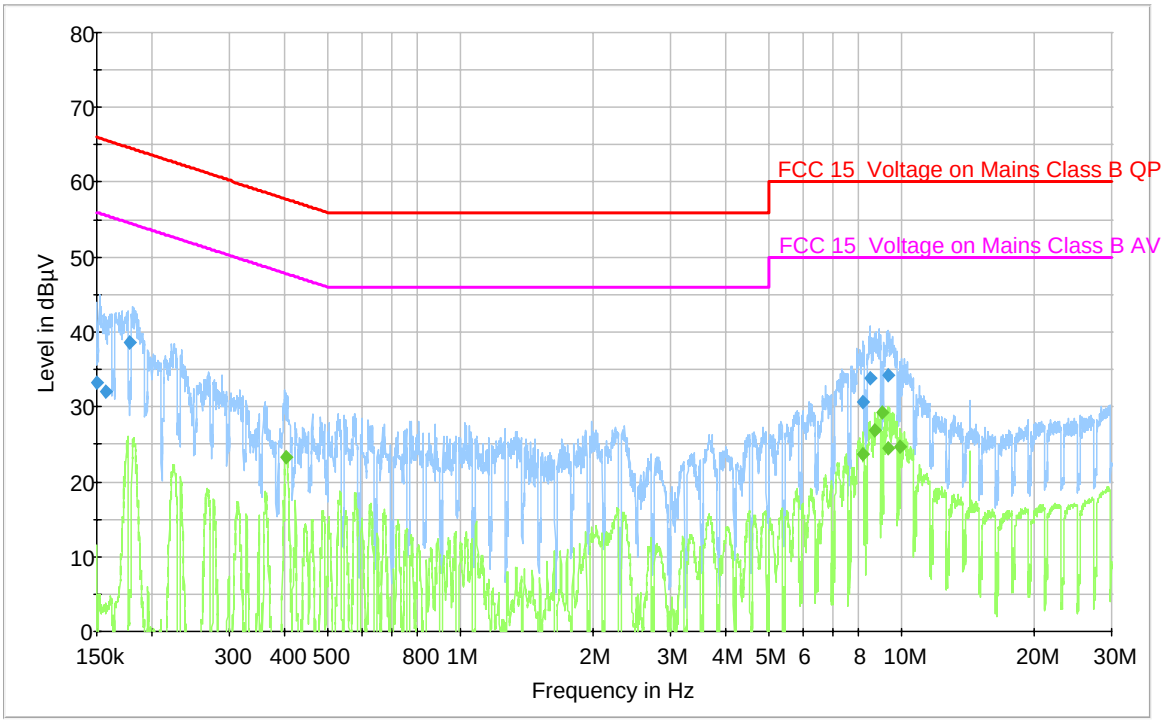
Summary of Test Results

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

-20.8 dB at **9.078027 MHz** in the **Line** conductor

Conducted Emissions Test Data

120V/60Hz - Line



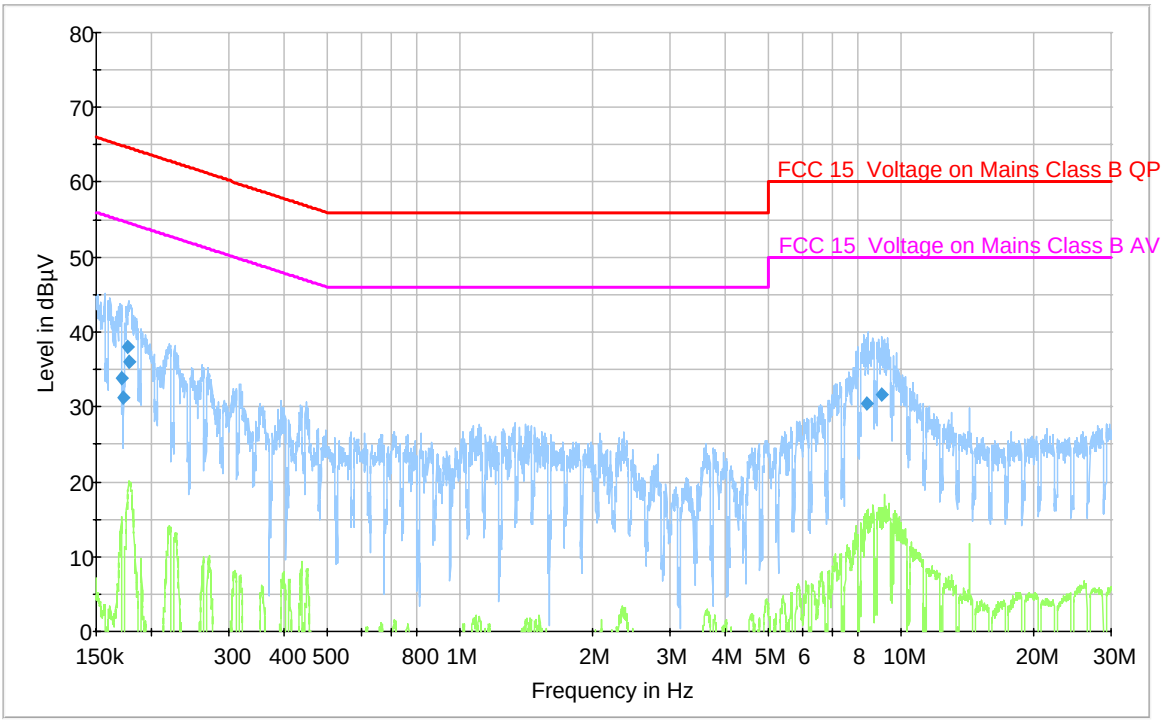
QP measurement

Frequency (MHz)	Quasi-Peak (dBµV)	Line	Limit (dBµV)	Margin (dB)
9.308912	34.3	L1	60.0	-25.7
0.178315	38.6	L1	64.6	-26.0
8.495615	33.8	L1	60.0	-26.2
8.210202	30.6	L1	60.0	-29.4
0.150150	33.2	L1	66.0	-32.8
0.156587	32.1	L1	65.6	-33.6

Average measurement

Frequency (MHz)	Average (dBµV)	Line	Limit (dBµV)	Margin (dB)
9.078027	29.2	L1	50.0	-20.8
8.729241	26.8	L1	50.0	-23.2
0.403008	23.2	L1	47.8	-24.6
9.956728	24.7	L1	50.0	-25.3
9.374542	24.5	L1	50.0	-25.5
8.185621	23.7	L1	50.0	-26.3

120V/60Hz - Neutral



QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Line	Limit (dBµV)	Margin (dB)
0.176365	38.1	N	64.7	-26.6
9.078073	31.6	N	60.0	-28.4
0.178315	36.1	N	64.6	-28.5
8.402407	30.4	N	60.0	-29.6
0.171669	33.9	N	64.9	-31.0
0.172874	31.3	N	64.8	-33.5

§2.1051 & 15.247 (d) Spurious Emissions at Antenna Port

Applicable Standard

According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emissions limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emissions being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Position the EUT on a bench 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 the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.

4. Set the SA on View mode and then plot the result on SA screen.

5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
R &S	Spectrum Analyzer	FSEM	DE23840	2005-12-21

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

Environmental Conditions

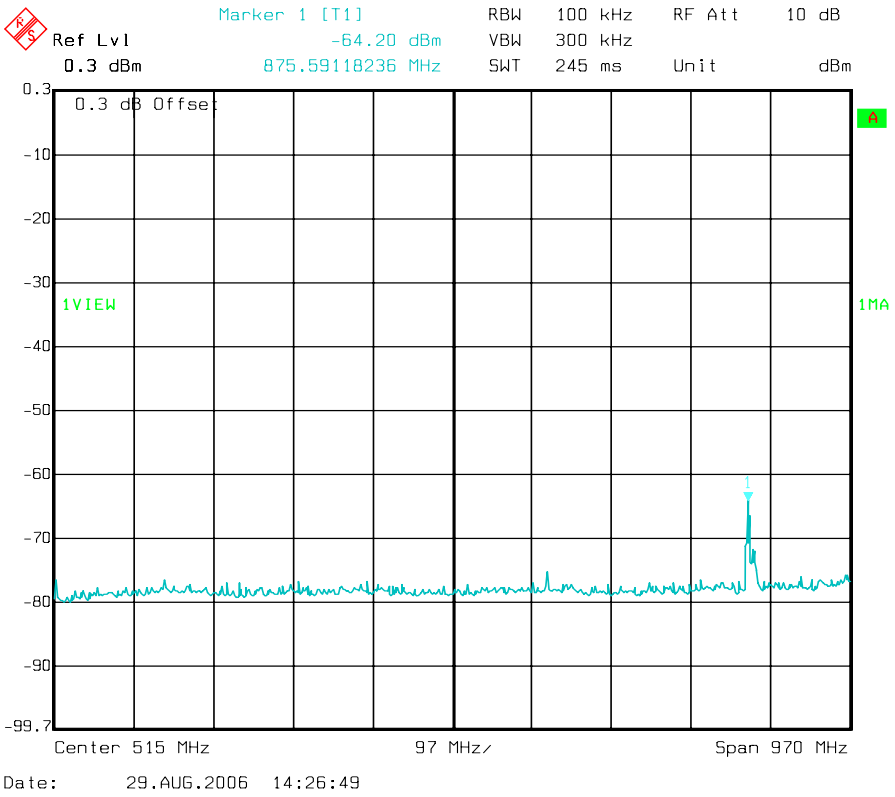
Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1021mbar

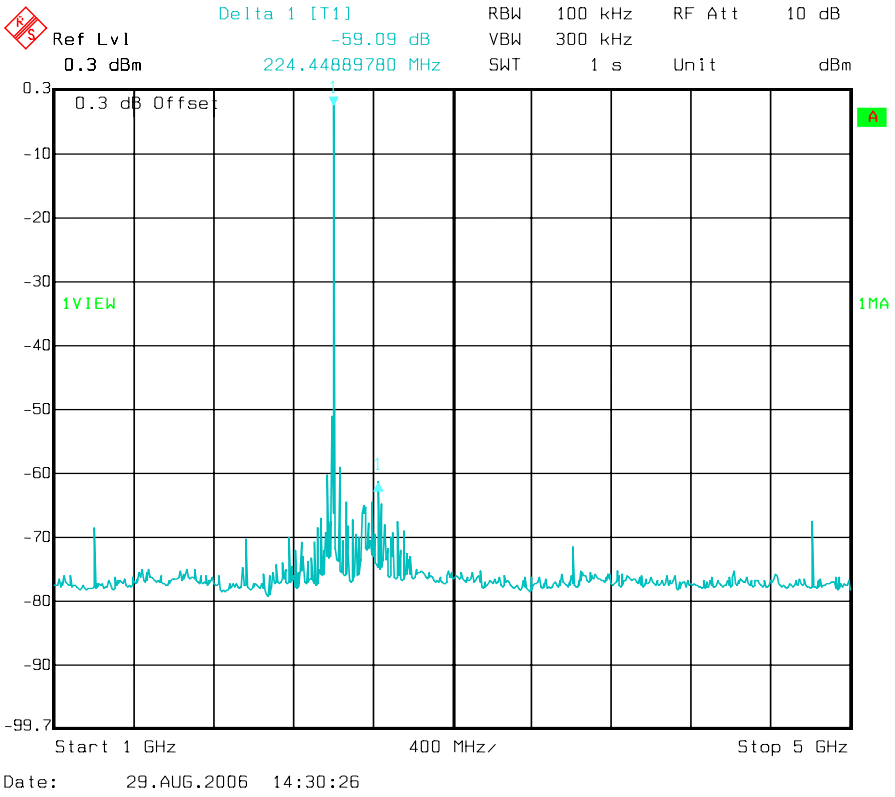
**The testing was performed by Oscar Au on 2006-09-01.*

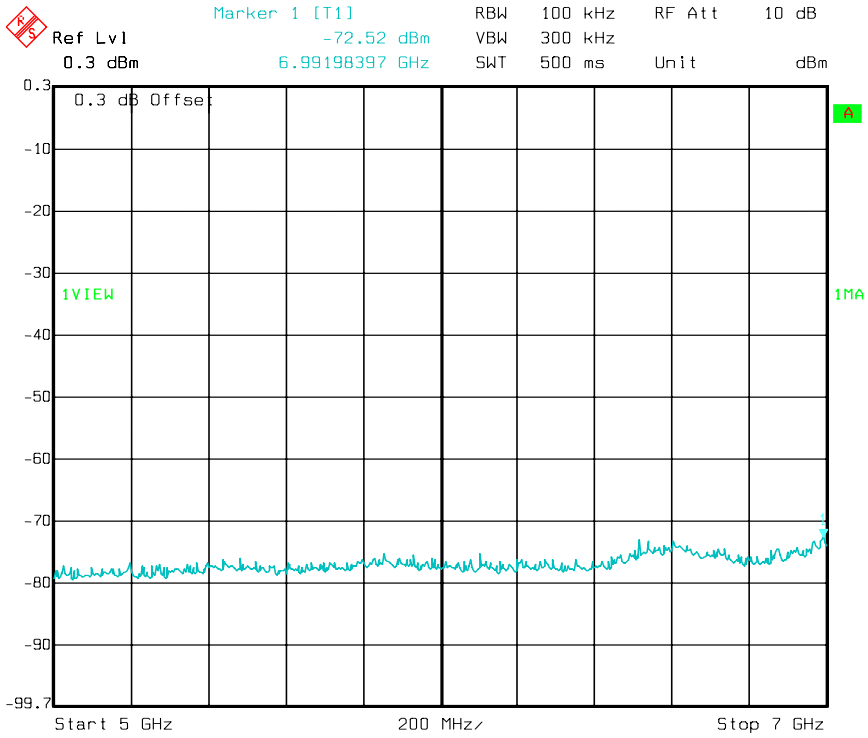
Measurement Results

Please refer to the following plots.

Low Channel (EUT)



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Ref Lvl
0.3 dBm
-72.52 dBm
6.99198397 GHz
RBW 100 kHz
VBW 300 kHz
SWT 500 ms
RF Att 10 dB
Unit dBm
0.3 dB Offset
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 5 GHz
200 MHz/
Stop 7 GHz
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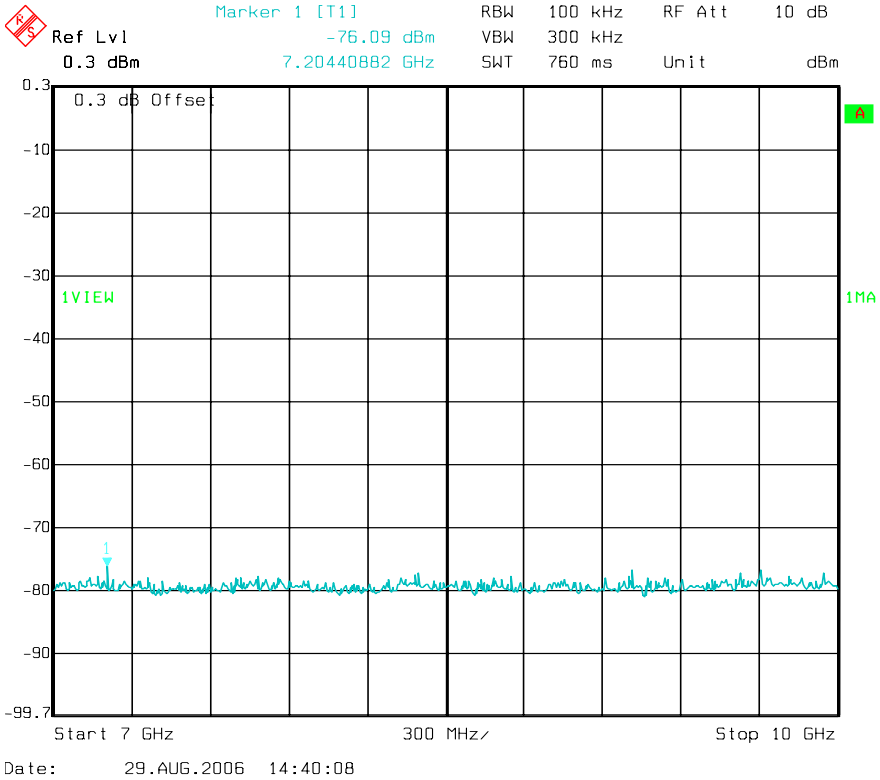
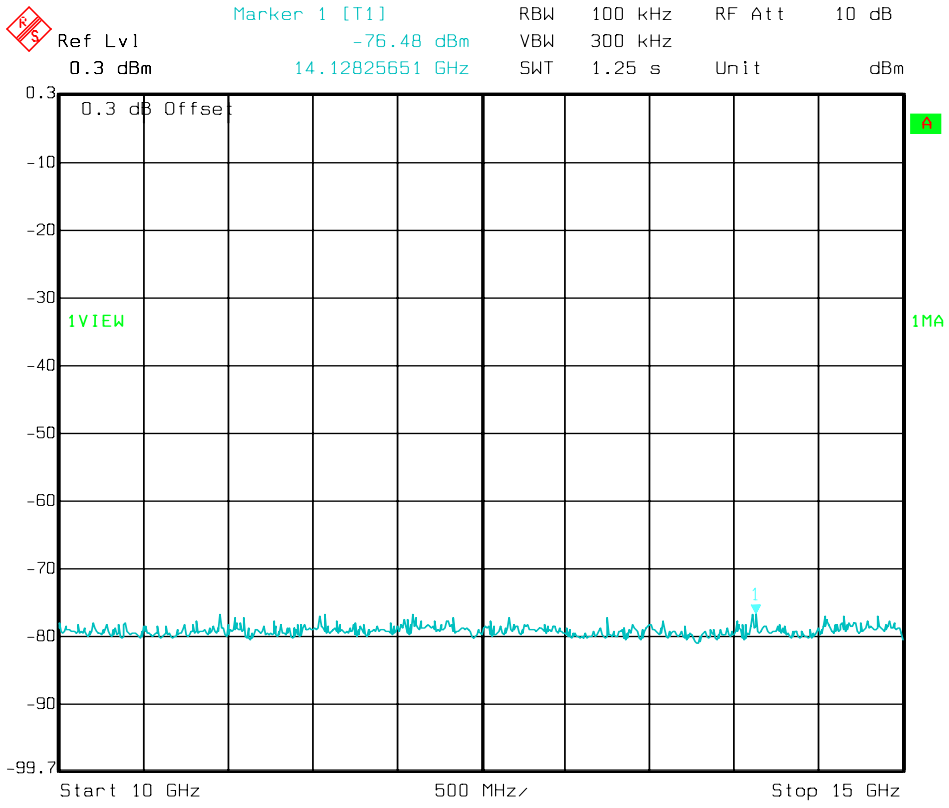

Marker 1 [T1]
Ref Lvl
0.3 dBm
-76.09 dBm
7.20440882 GHz
RBW 100 kHz
VBW 300 kHz
SWT 760 ms
RF Att 10 dB
Unit dBm
0.3 dB Offset
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 7 GHz
300 MHz/
Stop 10 GHz
Date: 29.AUG.2006 14:40:08



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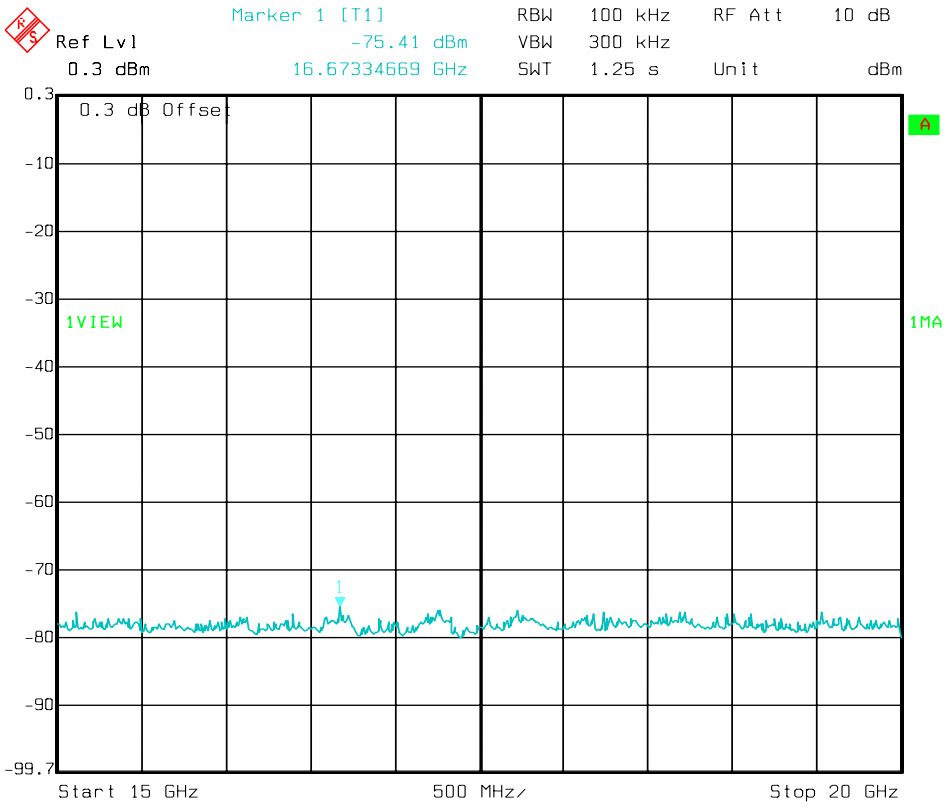

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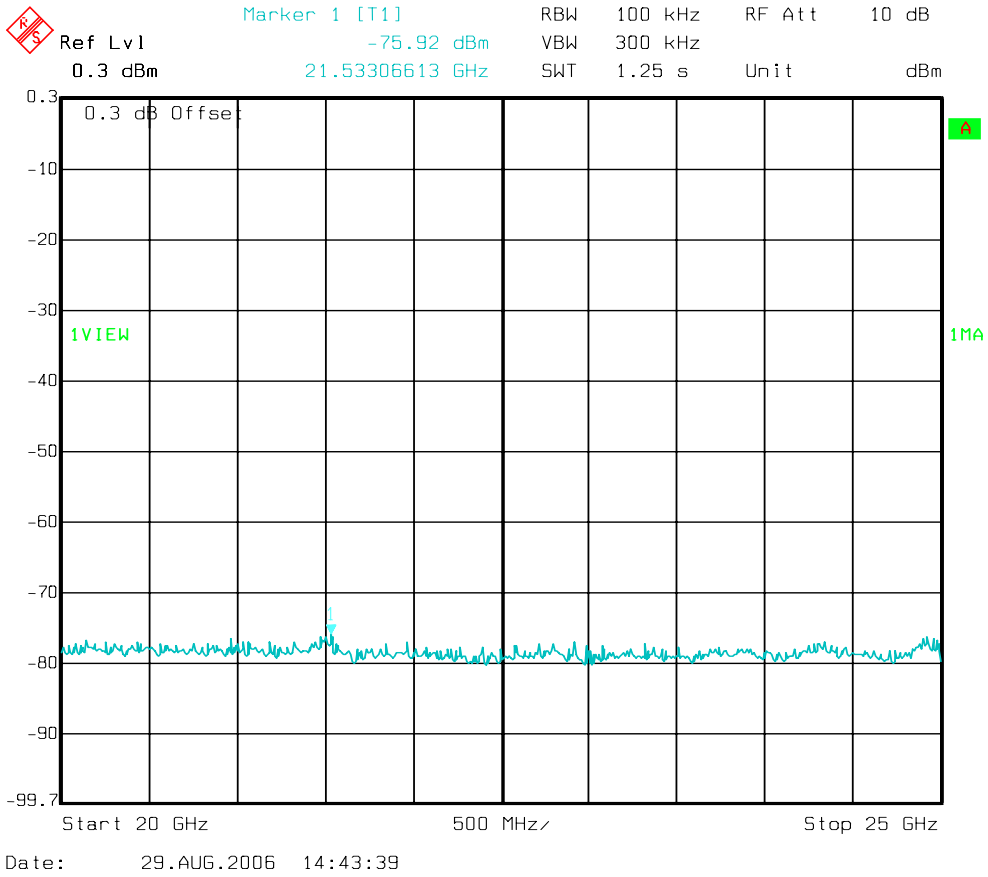
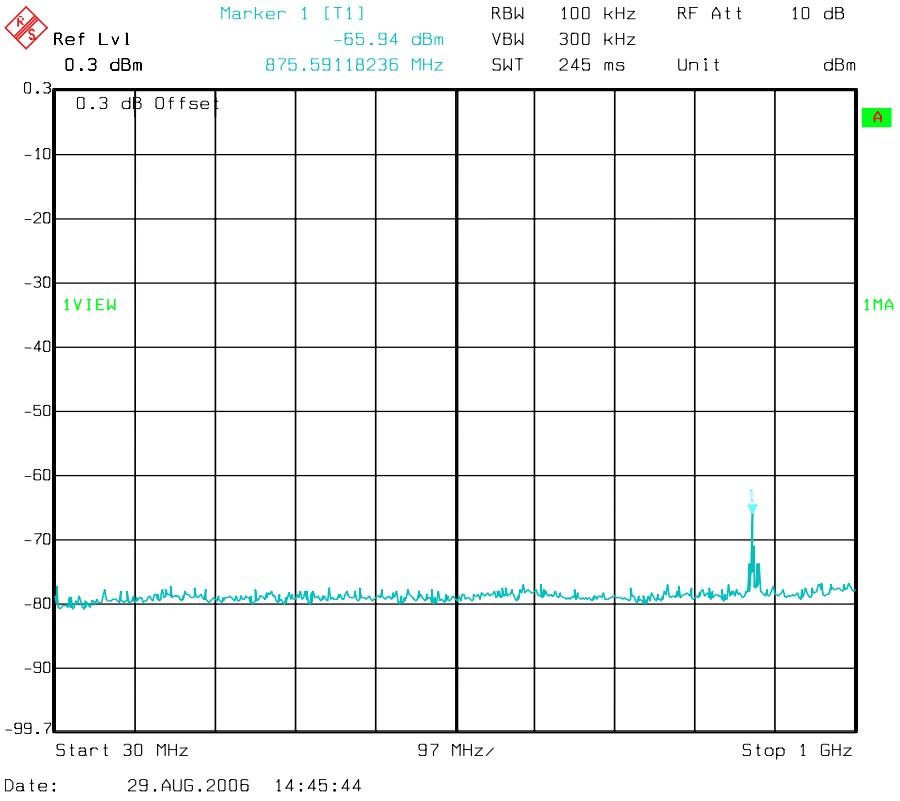

Marker 1 [T1]
Ref Lvl
0.3 dBm
-75.92 dBm
21.53306613 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 10 dB
Unit dBm
0.3 dB Offset
A
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 20 GHz
500 MHz/
Stop 25 GHz
Date: 29.AUG.2006 14:43:39

Mid Channel


Marker 1 [T1]
-65.94 dBm
875.59118236 MHz
RBW 100 kHz
VBW 300 kHz
SWT 245 ms
RF Att 10 dB
Unit dBm
Ref Lvl
0.3 dBm
0.3 dB Offset
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 30 MHz
97 MHz/
Stop 1 GHz
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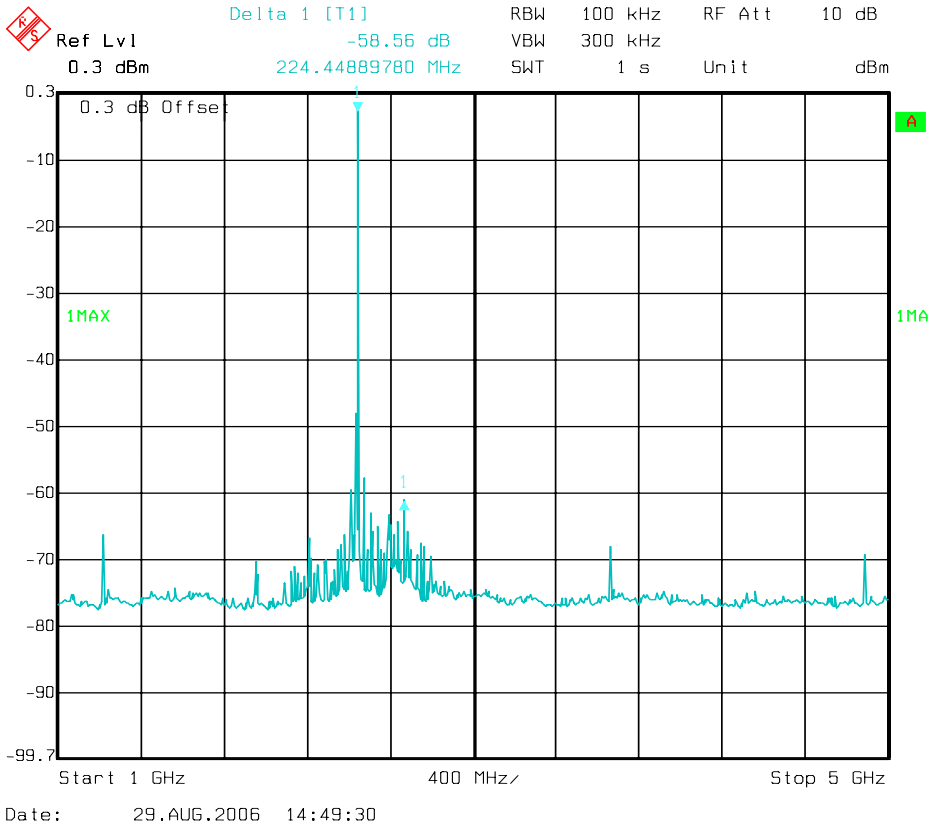
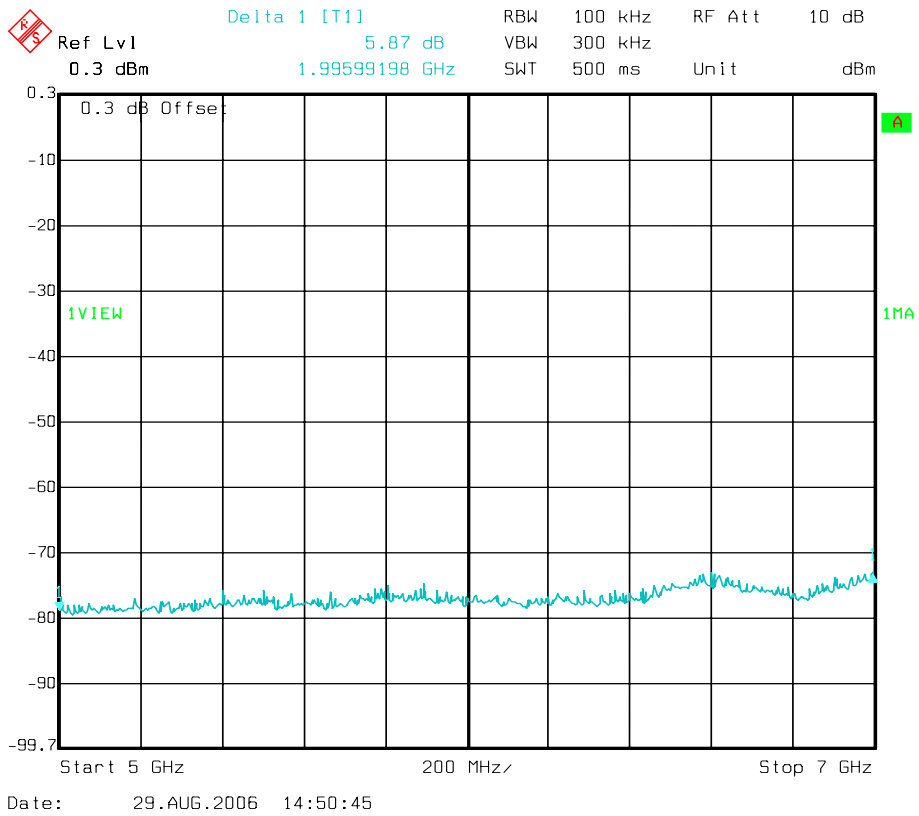
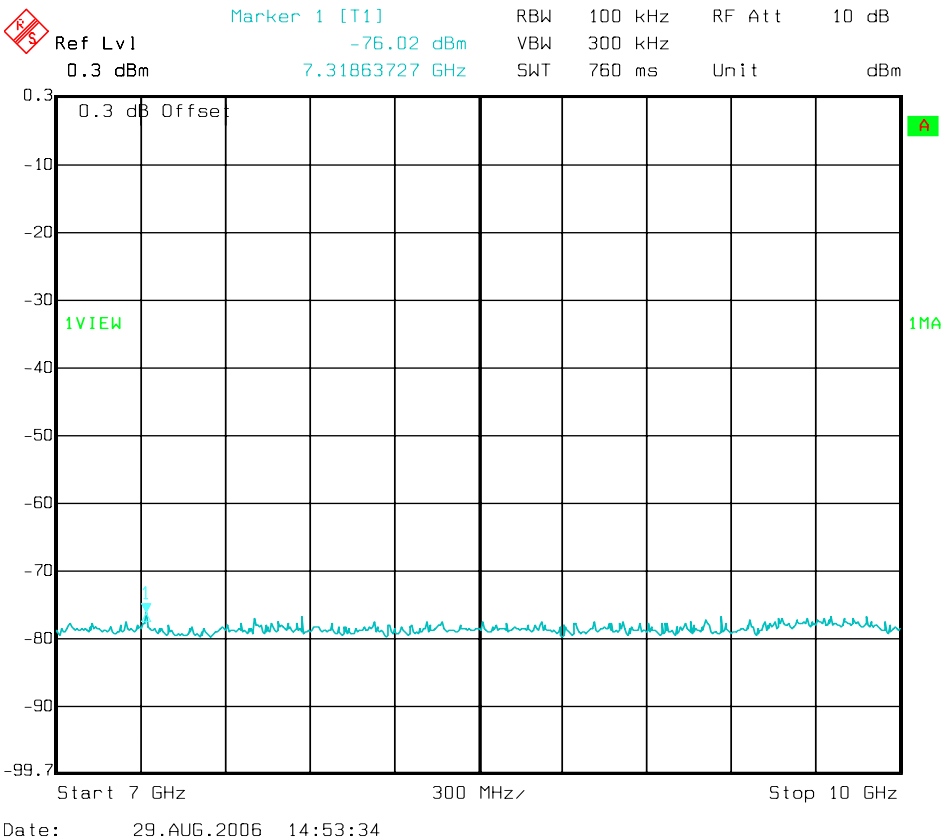

Delta 1 [T1]
-58.56 dB
224.44889780 MHz
RBW 100 kHz
VBW 300 kHz
SWT 1 s
RF Att 10 dB
Unit dBm
Ref Lvl
0.3 dBm
0.3 dB Offset
1MAX
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 1 GHz
400 MHz/
Stop 5 GHz
Date: 29.AUG.2006 14:49:30


Delta 1 [T1]
5.87 dB
1.99599198 GHz
RBW 100 kHz
VBW 300 kHz
SWT 500 ms
RF Att 10 dB
Unit dBm
Ref Lvl
0.3 dBm
0.3 dB Offset
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
1VIEW
1MA
A
Start 5 GHz
200 MHz/
Stop 7 GHz
Date: 29.AUG.2006 14:50:45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-76.02 dBm
7.31863727 GHz
RBW 100 kHz
VBW 300 kHz
SWT 760 ms
RF Att 10 dB
Unit dBm
Ref Lvl
0.3 dBm
0.3 dB Offset
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
1VIEW
1MA
A
Start 7 GHz
300 MHz/
Stop 10 GHz
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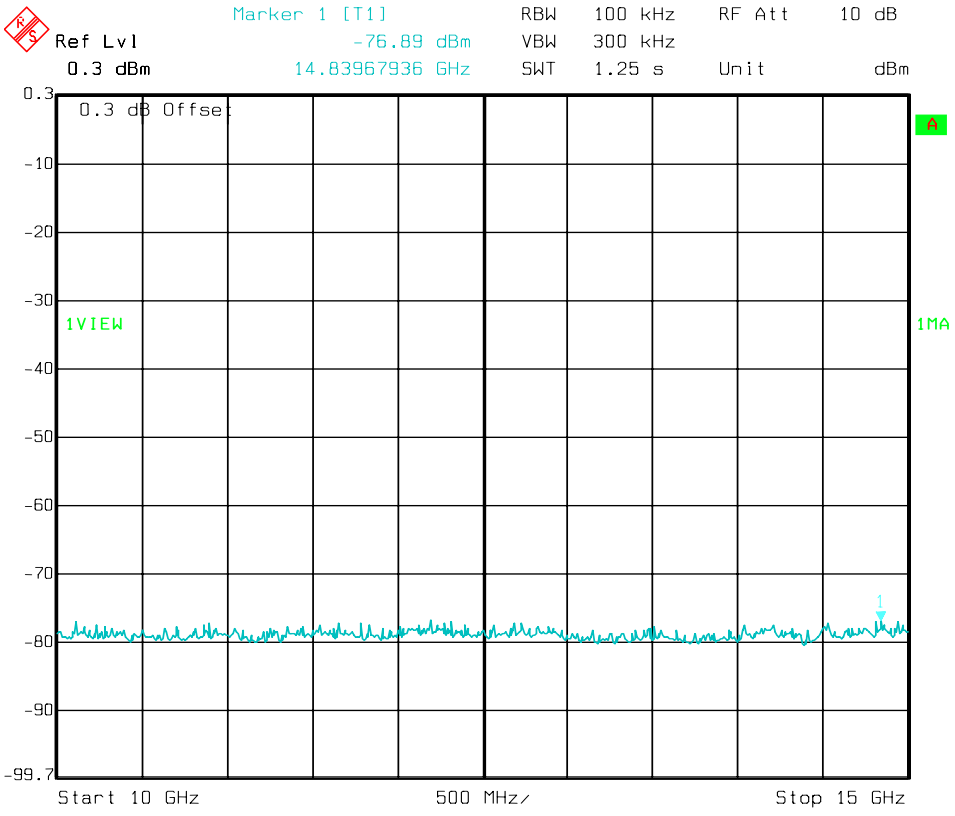
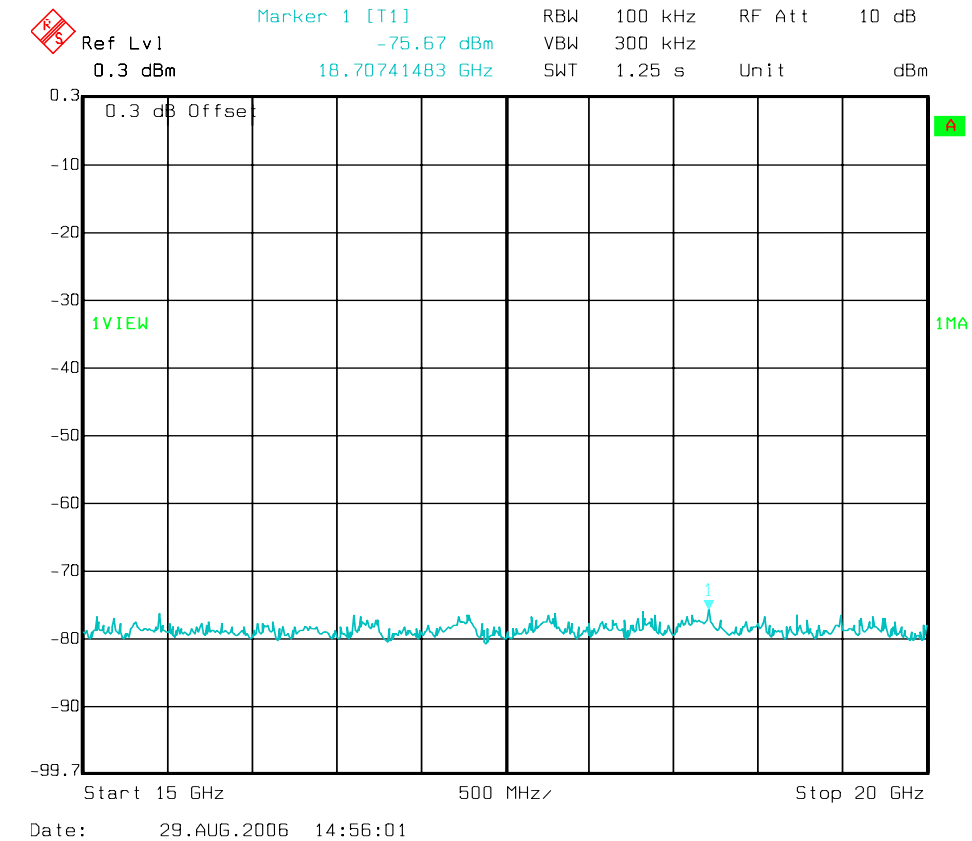
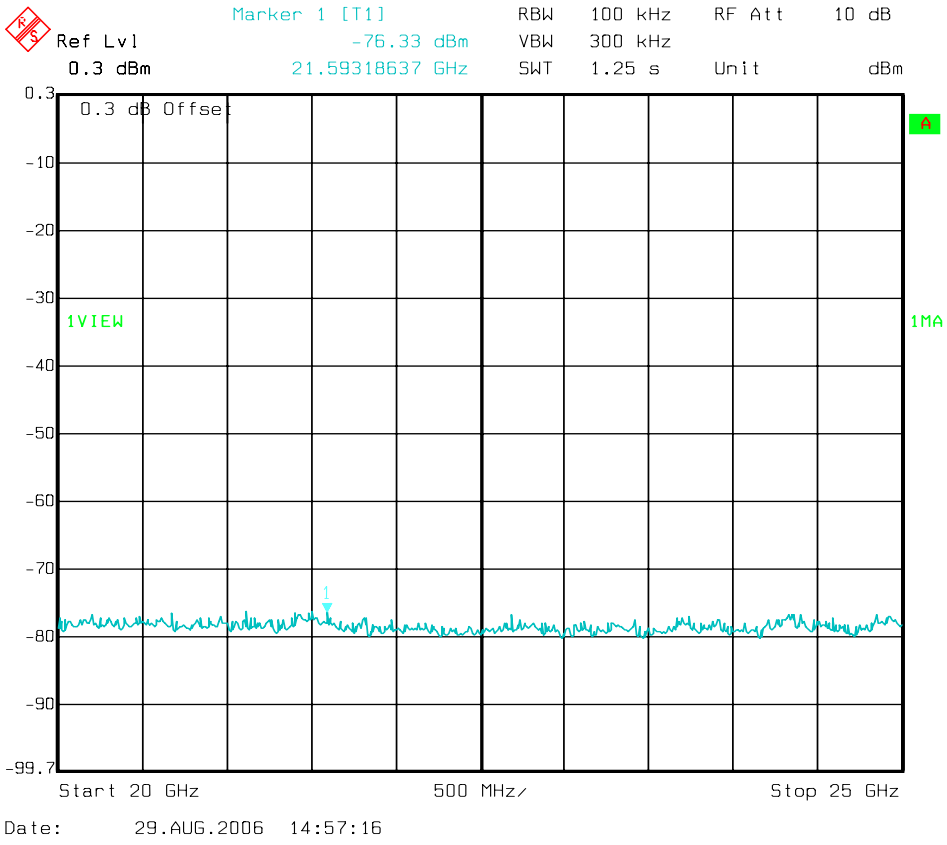
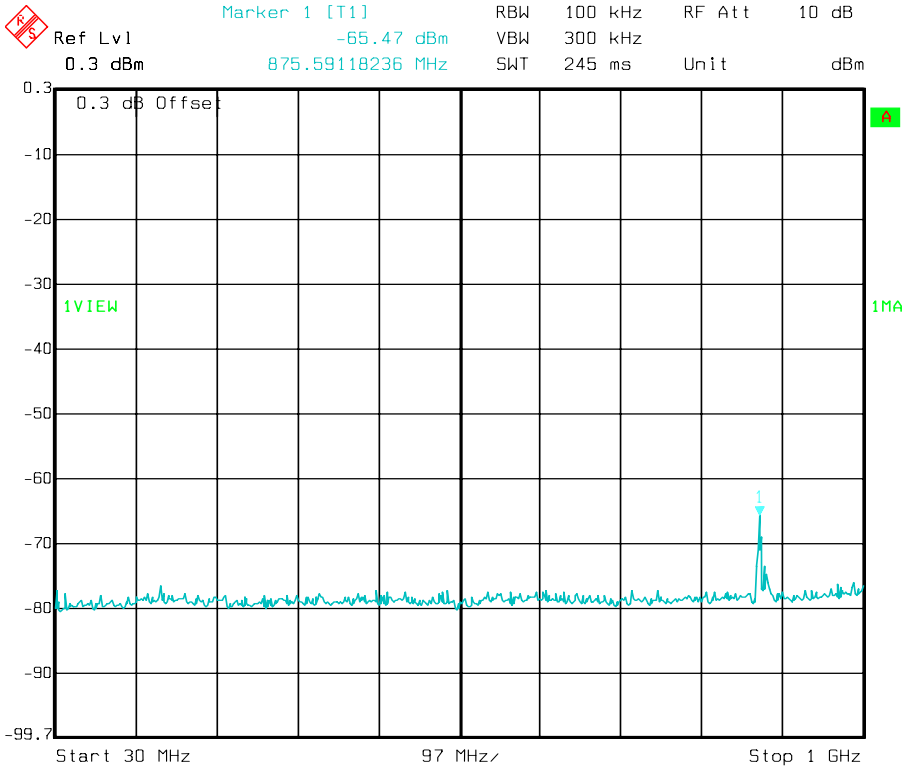
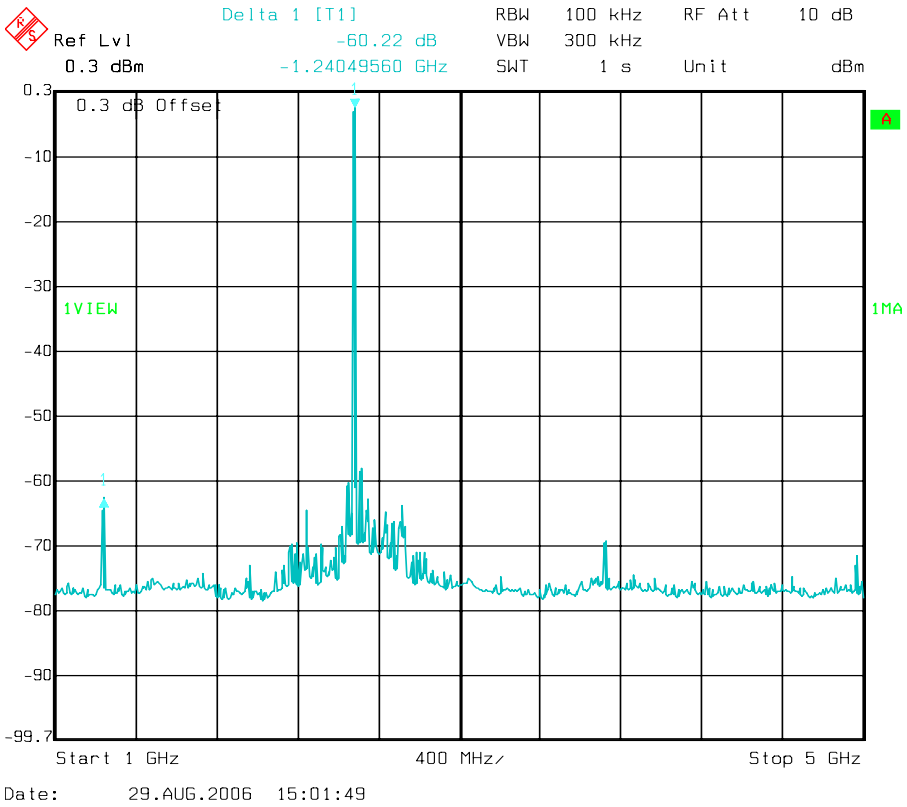

Marker 1 [T1]
Ref Lvl
-76.89 dBm
0.3 dBm
14.83967936 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 10 dB
Unit dBm
0.3 dB Offset
A
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 10 GHz
500 MHz/
Stop 15 GHz
Date: 29.AUG.2006 14:55:07

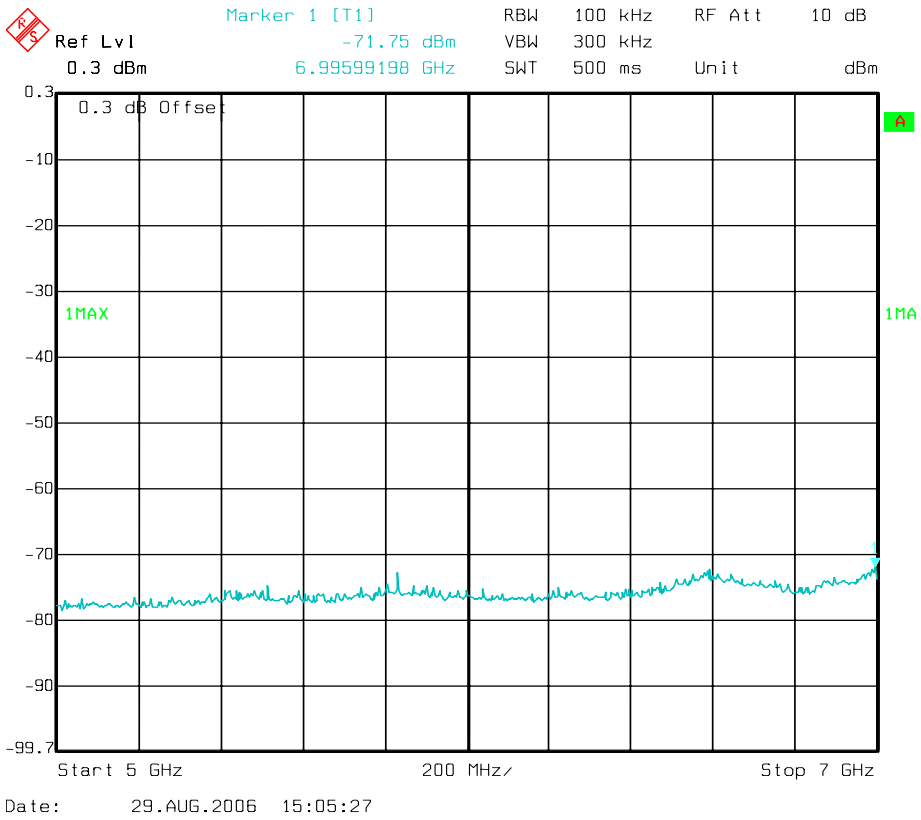

Marker 1 [T1]
Ref Lvl
-75.67 dBm
0.3 dBm
18.70741483 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 10 dB
Unit dBm
0.3 dB Offset
A
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 15 GHz
500 MHz/
Stop 20 GHz
Date: 29.AUG.2006 14:56:01


Marker 1 [T1]
Ref Lvl
0.3 dBm
-76.33 dBm
21.59318637 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 10 dB
Unit dBm
0.3 dB Offset
1VIEW
1MA
A
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 20 GHz
500 MHz/
Stop 25 GHz
Date: 29.AUG.2006 14:57:16

High Channel:



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RBW 100 kHz
RF Att 10 dB
Ref Lvl
-71.75 dBm
VBW 300 kHz
0.3 dBm
6.99599198 GHz
SWT 500 ms
Unit dBm
0.3 dB Offset
A
1MAX
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 5 GHz
200 MHz/
Stop 7 GHz
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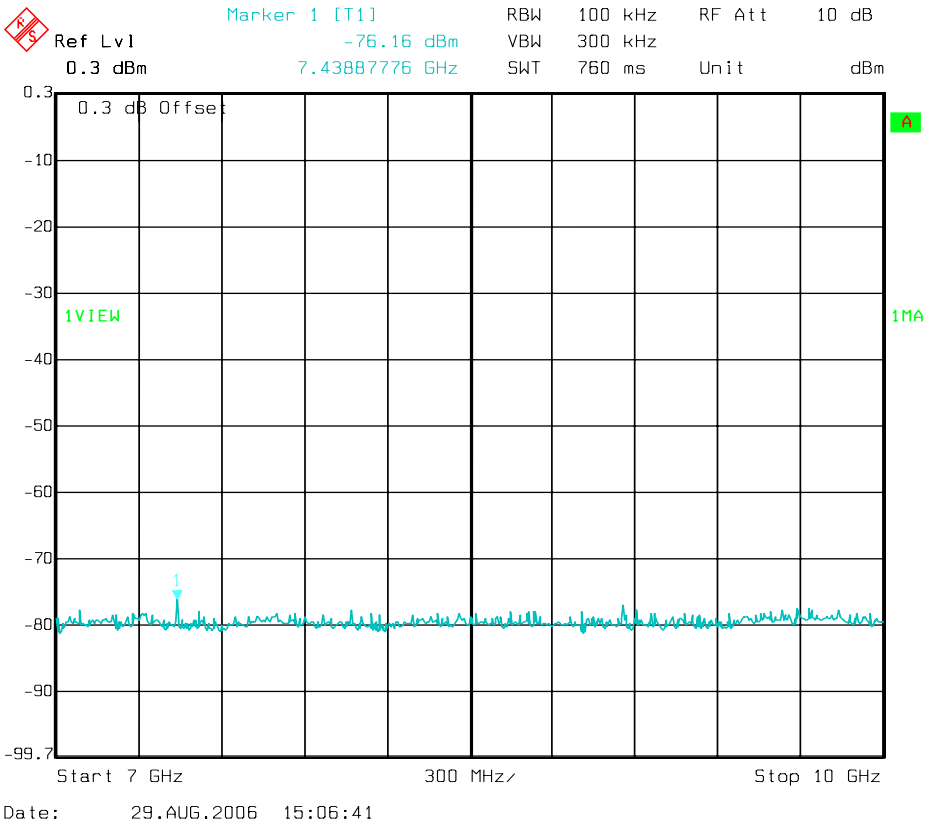
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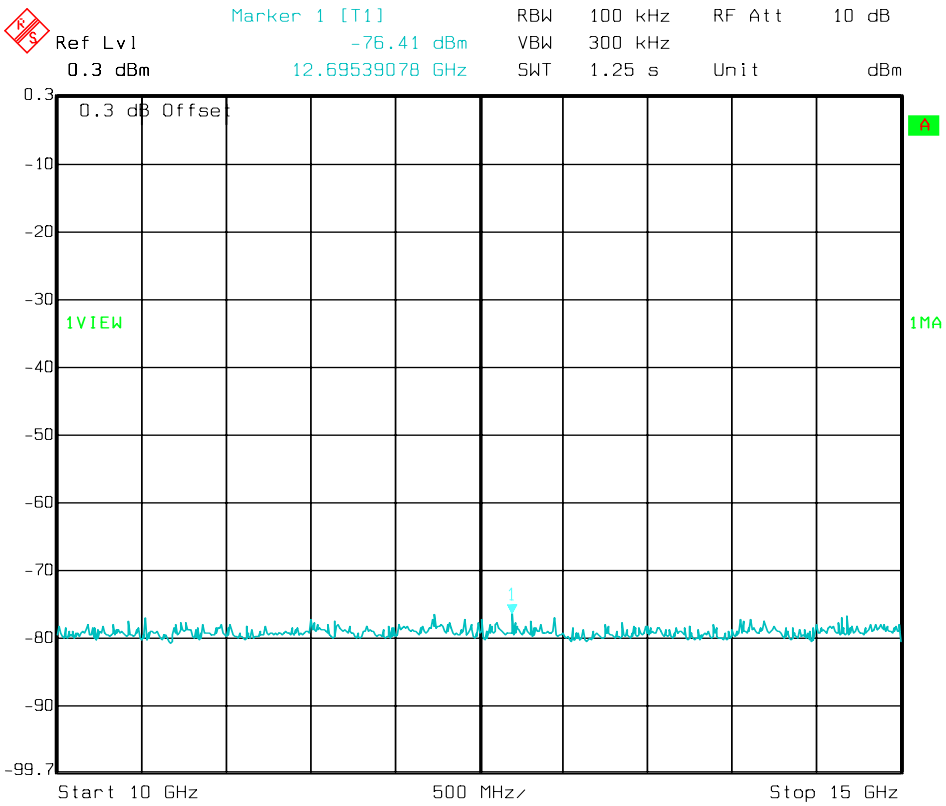
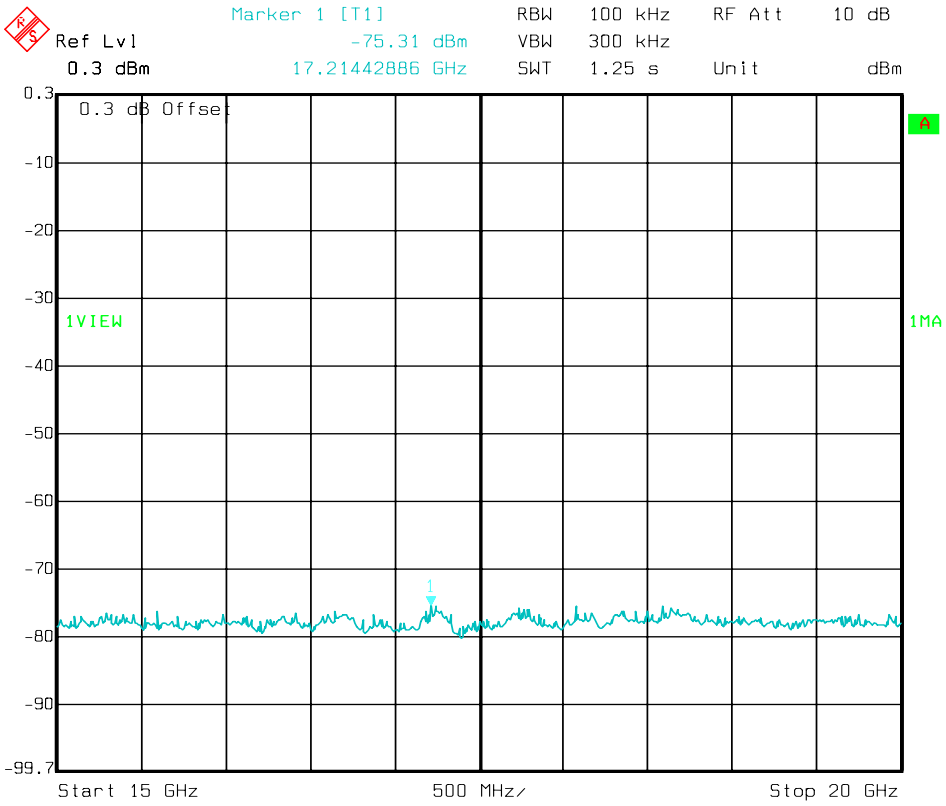
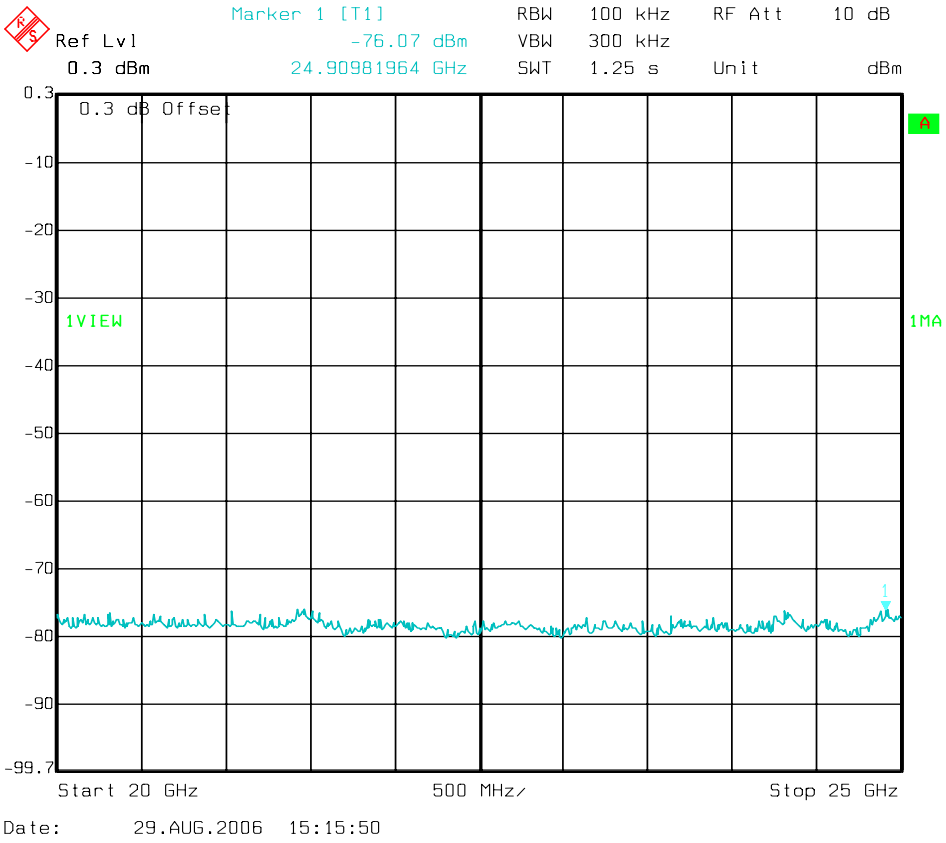
RF Att 10 dB
Ref Lvl
-76.16 dBm
VBW 300 kHz
0.3 dBm
7.43887776 GHz
SWT 760 ms
Unit dBm
0.3 dB Offset
A
1VIEW
1MA
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 7 GHz
300 MHz/
Stop 10 GHz
Date: 29.AUG.2006 15:06:41



Date: 29.AUG.2006 15:07:46



Date: 29.AUG.2006 15:14:47


Marker 1 [T1]
Ref Lvl
0.3 dBm
-76.07 dBm
24.90981964 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 10 dB
Unit dBm
0.3 dB Offset
1VIEW
1MA
A
0.3
-10
-20
-30
-40
-50
-60
-70
-80
-90
-99.7
Start 20 GHz
500 MHz/
Stop 25 GHz
Date: 29.AUG.2006 15:15:50

§15.205, §15.209 & §15.247(c) - RADIATED EMISSIONS

Test Setup

The radiated emissions tests were performed in the shield room, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Sonoma Instruments	Pre amplifier	317	260406	2006-02-03
Agilent	Pre amplifier	8449B	3008A01978	2006-08-21
Sunol Science	Combination Antenna	JB3 Antenna	A013105	2006-02-11
DRG	Horn Antenna	SAS-200/571	261	2006-04-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2005-12-14
Sunol Science	System Controller	SC99V	122303-1	N/R
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-11-14
Agilent	Spectrum analyzer	E4446A	US44300386	2006-03-06

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

Environmental Conditions

Temperature:	20-22° C
Relative Humidity:	40-50%
ATM Pressure:	1012-1014 mbar

**The testing was performed by Oscar Au and Choon Sian Ooi on 2006-09-01.*

Test Procedure

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

All data were 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:

Corrected Amplitude = 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 emissions are 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Class B Limit

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

For 30-1000MHZ (RX Spurious Emissions)

-4.2dB at **46.890000 MHz** in the **Vertical** polarization

Radiated spurious emissions above 1GHz

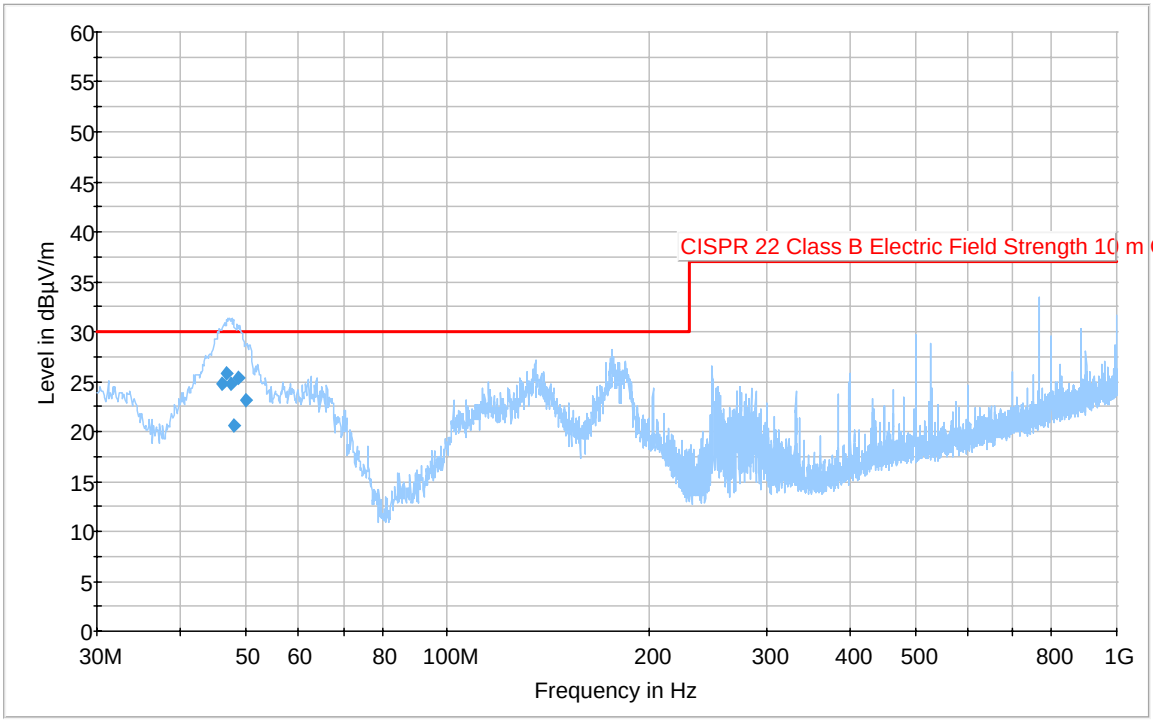
-15.6 dB at **4804.0000MHz** in the **Horizontal** polarization, 1GHz – 25GHz**, Low Channel**

-12.7 dB at **4882.0000MHz** in the **Horizontal** polarization, 1GHz – 25GHz**, Middle Channel**

-11.1 dB at **4960.0000MHz** in the **Horizontal** polarization, 1GHz – 25GHz**, High Channel**

Radiated Emissions Test Data @ 10 meter

30-1000MHZ (RX Spurious Emissions)



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Limit (dBµV/m)	Margin (dB)
46.890000	25.8	118.0	V	214.0	30.0	-4.2
48.717500	25.4	99.0	V	204.0	30.0	-4.6
47.496250	24.8	100.0	V	214.0	30.0	-5.2
46.040000	24.7	298.0	V	0.0	30.0	-5.3
50.048750	23.1	280.0	V	0.0	30.0	-6.9
48.025000	20.6	204.0	V	215.0	30.0	-9.4

Radiated spurious emissions above 1GHZ

1GHz – 25GHz

Low Channel: 2402 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth Degrees	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBuV/m)	FCC15.247 Limit (dBuV/m)	FCC15.247 Margin (dB)	Comments
2402.0000	90.8	267	1.3	v	28.7	1.5	35.8	85.2	-	-	Fund/Peak
2402.0000	94.8	350	1.2	h	28.7	1.5	35.8	89.2	-	-	Fund/Peak
2402.0000	90.7	267	1.3	v	28.7	1.5	35.8	85.1	-	-	Ave
2402.0000	94.8	350	1.2	h	28.7	1.5	35.8	89.2	-	-	Ave
4804.0000	38.8	331	1.3	h	32.5	1.9	34.8	38.4	54	-15.6	Ave
4804.0000	28.7	165	1.1	v	32.5	1.9	34.8	28.3	54	-25.7	Ave
4804.0000	42.2	331	1.3	h	32.5	1.9	34.8	41.8	74	-32.2	Peak
4804.0000	37.3	165	1.1	v	32.5	1.9	34.8	36.9	74	-37.1	Peak

Middle Channel: 2441 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth Degrees	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBuV/m)	FCC15.247 Limit (dBuV/m)	FCC15.247 Margin (dB)	Comments
2441.0000	91.5	210	1.3	v	28.7	1.5	35.8	85.9	-	-	Fund/Peak
2441.0000	97.8	340	1.9	h	28.7	1.5	35.8	92.2	-	-	Fund/Peak
2441.0000	91.5	210	1.3	v	28.7	1.5	35.8	85.9	-	-	Ave
2441.0000	97.7	340	1.9	h	28.7	1.5	35.8	92.1	-	-	Ave
4882.0000	41.7	335	1.3	h	32.5	1.9	34.8	41.3	54	-12.7	Ave
4882.0000	27.8	235	1.2	v	32.5	1.9	34.8	27.4	54	-26.6	Ave
4882.0000	44.1	335	1.3	h	32.5	1.9	34.8	43.7	74	-30.3	Peak
4882.0000	36.5	235	1.2	v	32.5	1.9	34.8	36.1	74	-37.9	Peak

High Channel: 2480 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth Degrees	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBuV/m)	FCC15.247 Limit (dBuV/m)	FCC15.247 Margin (dB)	Comments
2480.0000	90.9	280	1.8	v	28.7	1.5	35.8	85.2	-	-	Fund/Peak
2480.0000	98.5	338	1.8	h	28.7	1.5	35.8	92.8	-	-	Fund/Peak
2480.0000	90.9	180	1.3	v	28.7	1.5	35.8	85.2	-	-	Ave
2480.0000	98.5	280	1.8	h	28.7	1.5	35.8	92.8	-	-	Ave
4960.0000	43.3	332	1.3	h	32.5	1.9	34.8	42.9	54	-11.1	Ave
4960.0000	30.9	314	1.1	v	32.5	1.9	34.8	30.5	54	-23.5	Ave
4960.0000	45.1	332	1.3	h	32.5	1.9	34.8	44.7	74	-29.3	Peak
4960.0000	37.3	314	1.1	v	32.5	1.9	34.8	36.9	74	-37.1	Peak

§15.247 (a) (1) – Hopping Channel Separation

Applicable Standard

According to §15.247(a)(1), frequency hopping system shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench 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.
3. By using the Max-Hold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

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

Environmental Conditions

Temperature:	21° C
Relative Humidity:	46%
ATM Pressure:	1011 mbar

**The testing was performed by Oscar Au on 2006-09-01.*

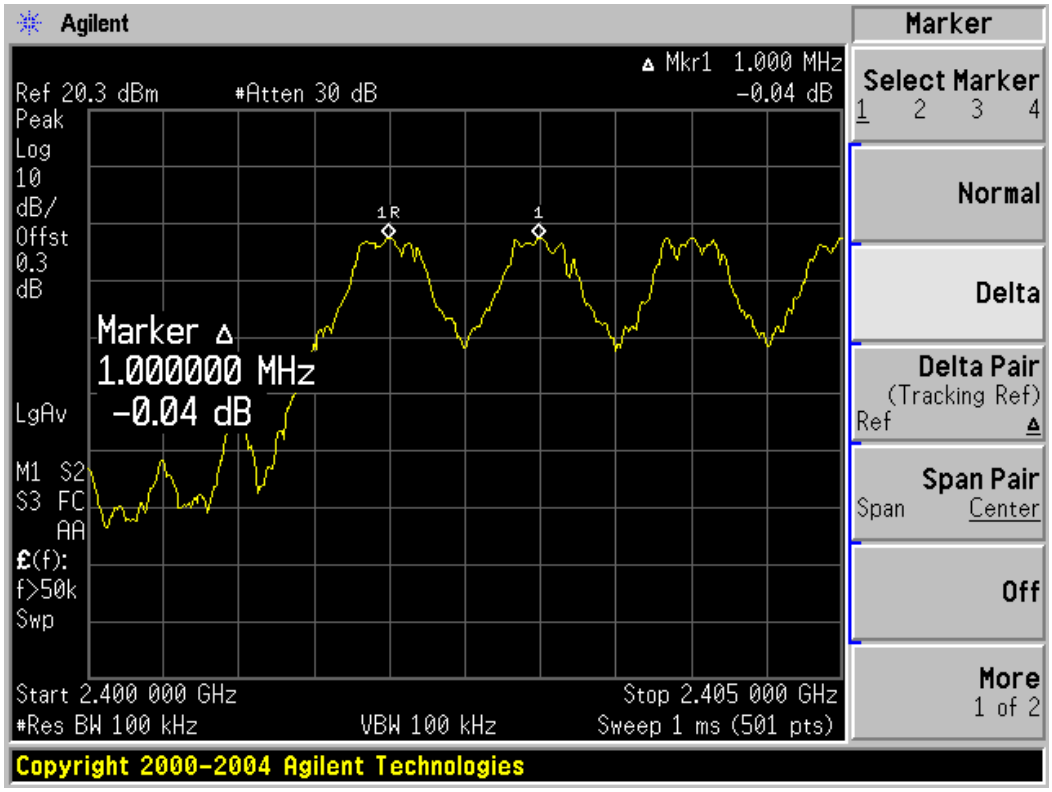
Measurement Results

Handset

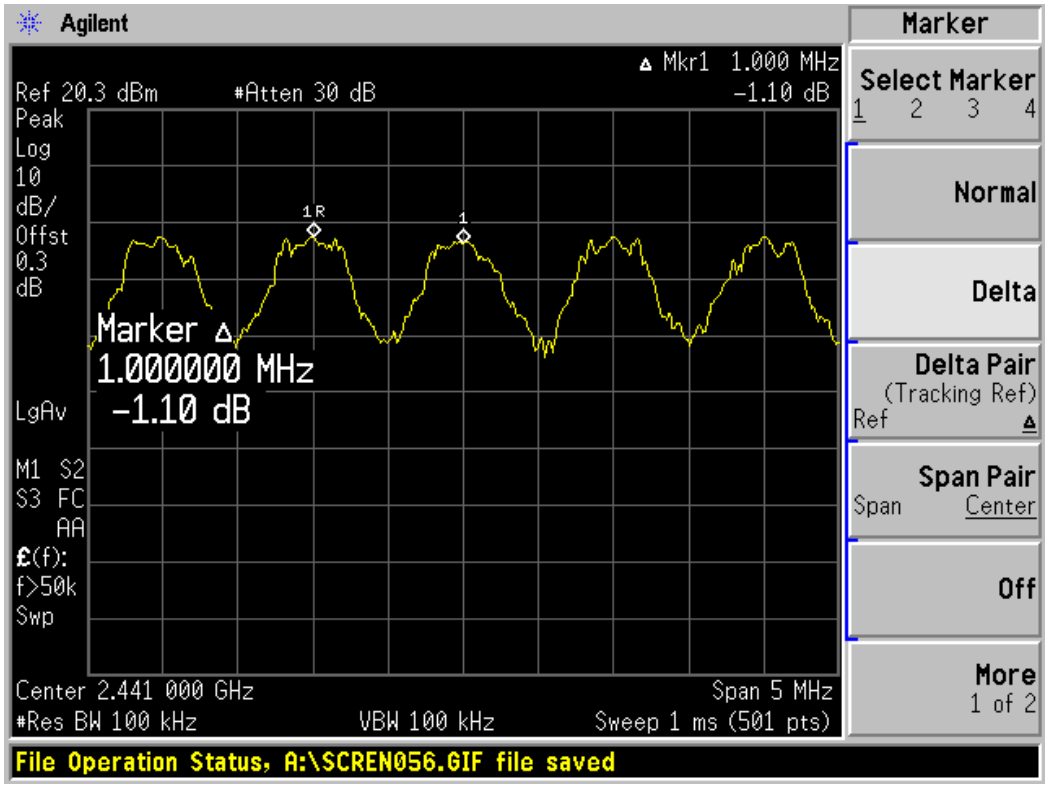
Channel	Frequency (MHz)	Channel Separation (KHz)
Low	2402	1000
Mid	2441	1000
High	2480	1000

Please refer to the following plots.

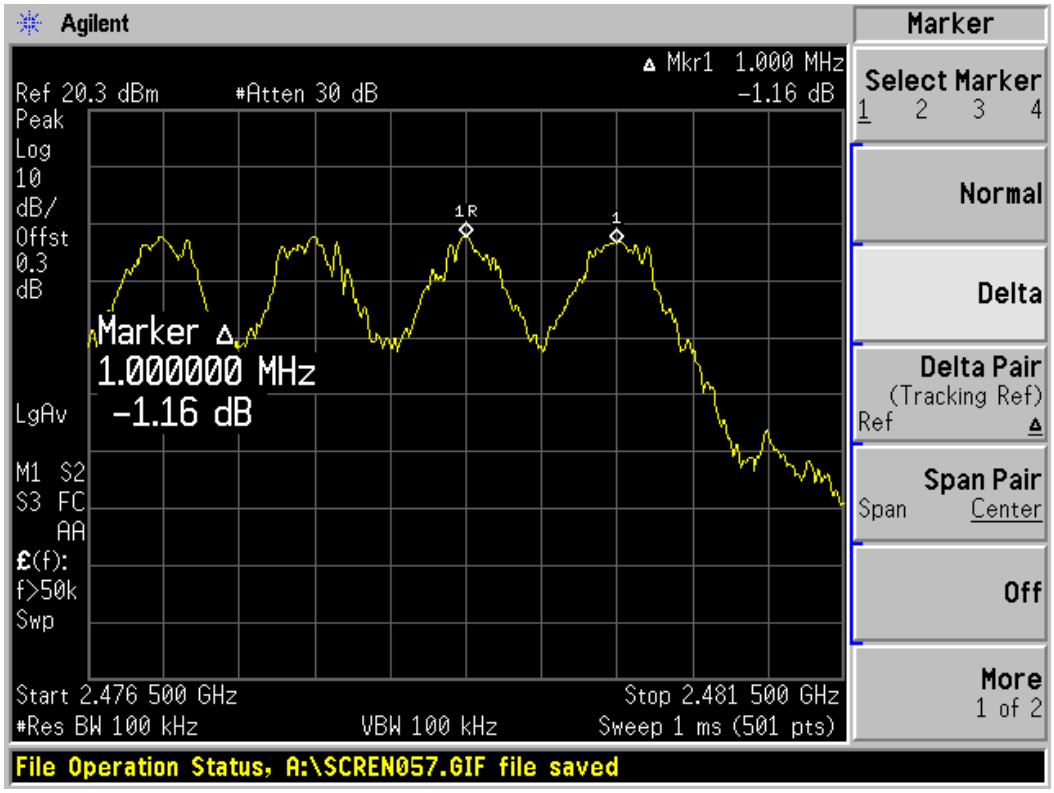
Low Channel



Middle Channel



High Channel



§15.247 (a) (1) - Channel Bandwidth

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 20 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

*** 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:	45%
ATM Pressure:	1021 mbar

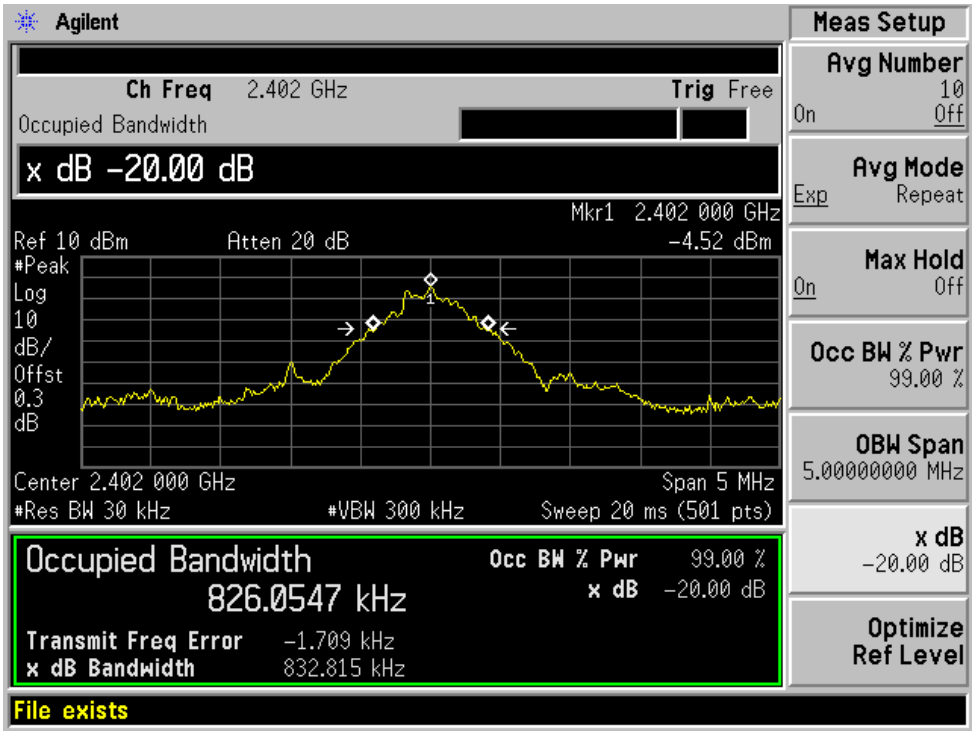
**The testing was performed by Oscar Au on 2006-09-01.*

Measurement Result

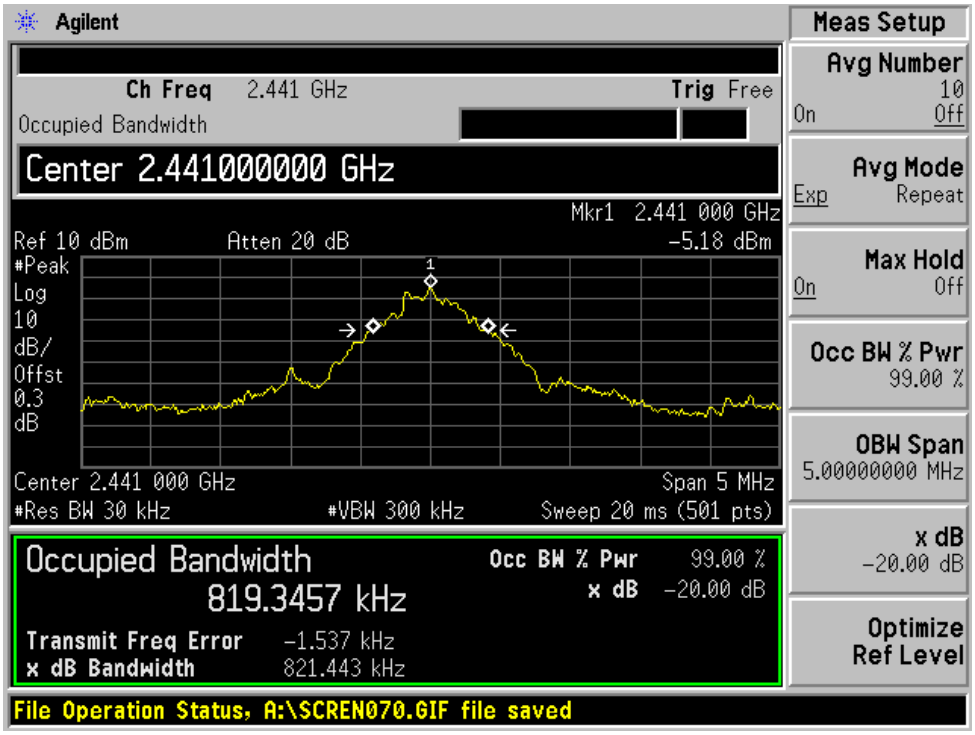
Please see the following plots

Channel	Frequency MHz	Channel Bandwidth (KHz)
Low	2402	832.8
Mid	2441	821.4
High	2480	821.9

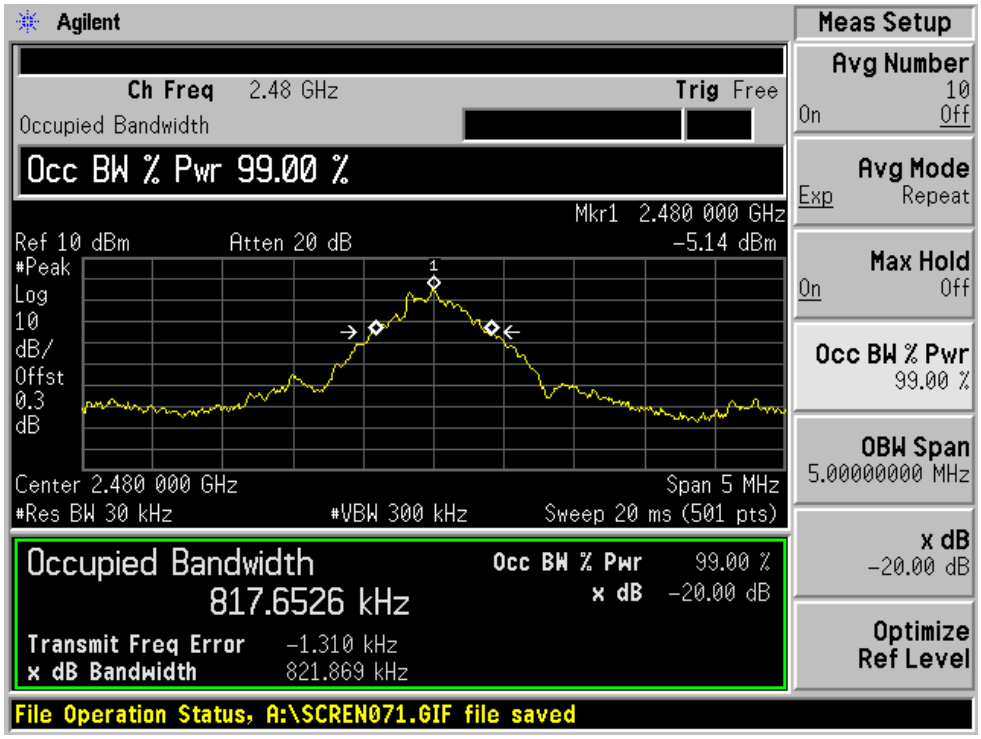
Low Channel



Middle Channel



High Channel



§15.247 (a) (1) (iii) - Number of Hopping Frequencies Used

Applicable Standard

According to §15.247(a)(1)(iii), for Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench 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 the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

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

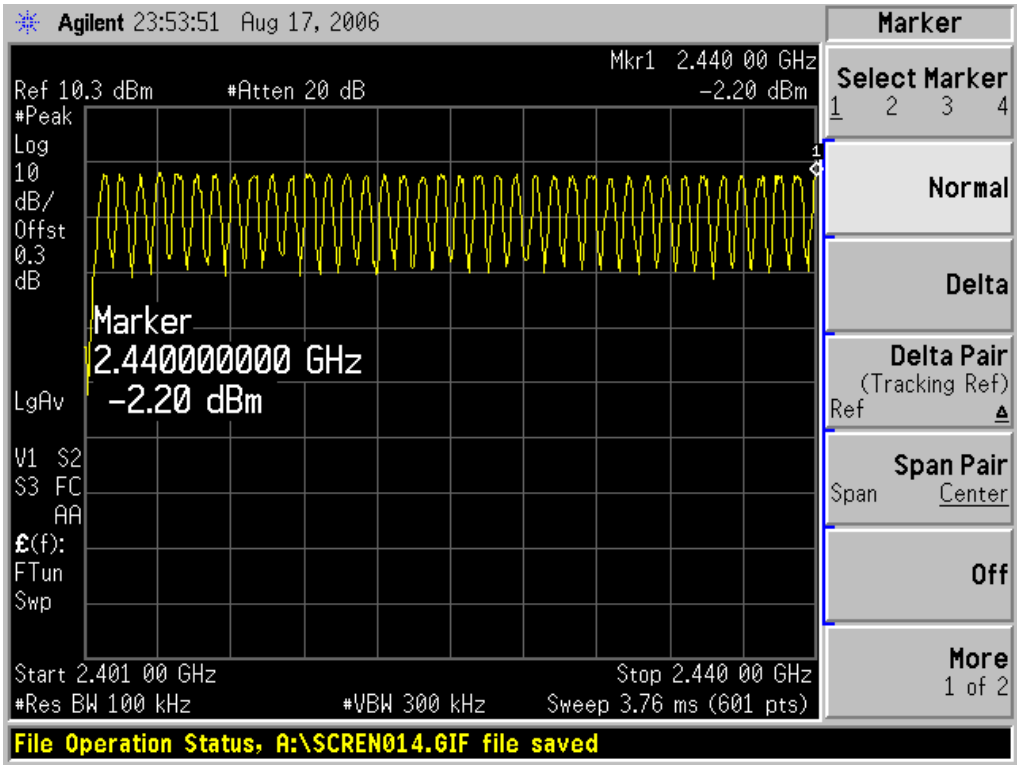
Environmental Conditions

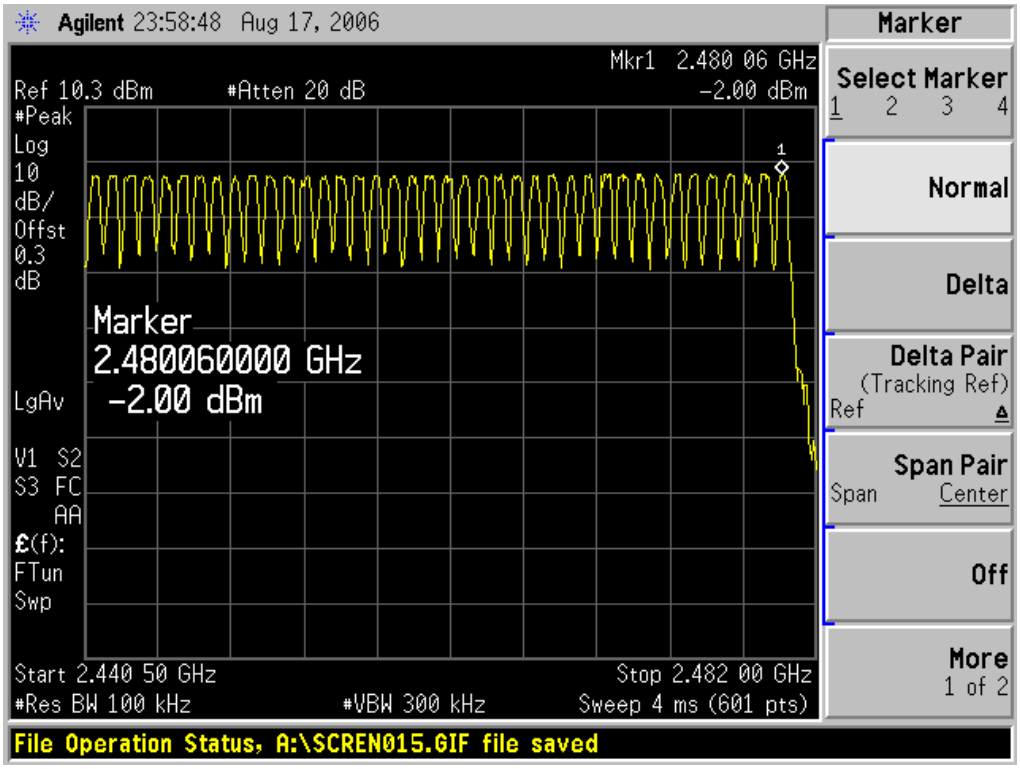
Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1021 mbar

**The testing was performed by Oscar Au on 2006-09-01.*

Measurement Results: 79 Channels

Please refer to the attached plots.





§15.247(a)(1)(iii)– Dwell Time

Applicable Standard

According to §15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

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 zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
R & S	Spectrum Analyzer	ESCI 3	100044	2006-02-07

*** 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:	45%
ATM Pressure:	1021mbar

**The testing was performed by Oscar Au on 2006-09-01.*

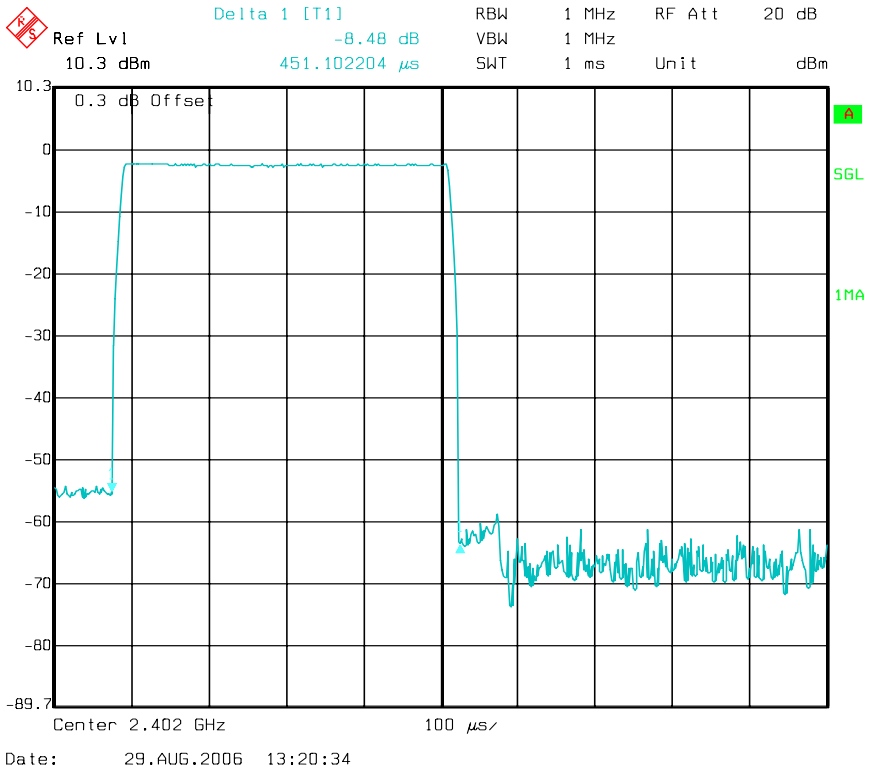
Measurement Results:

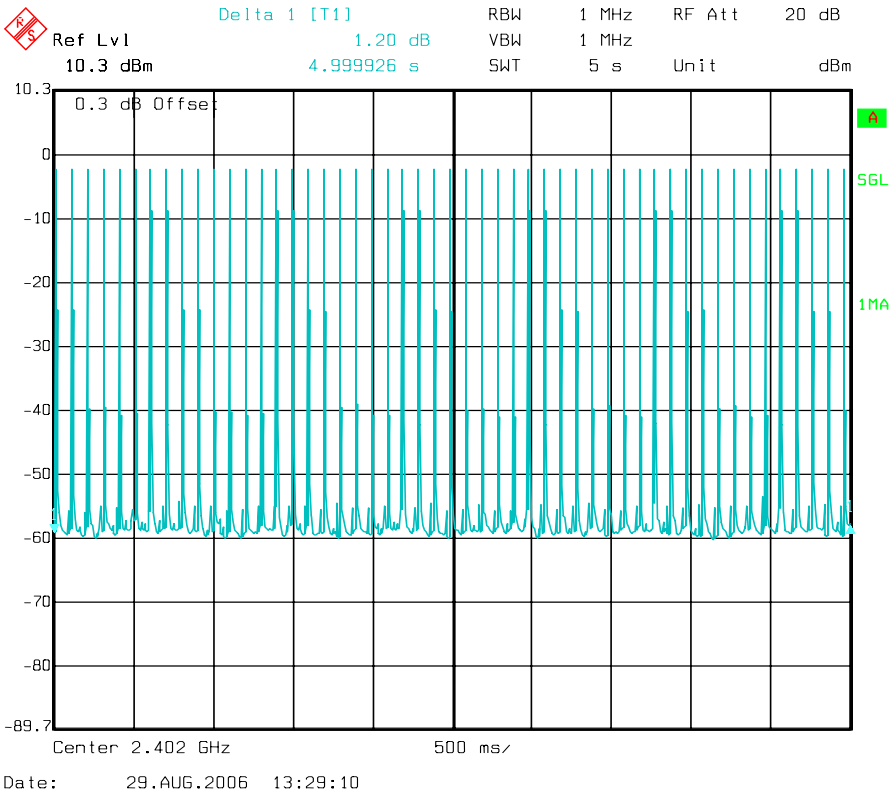
Channel	Frequency MHz	Pulse Wide ms	Occupied time	Dwell Time Sec	Limit Sec
Low	2402	451.1	306	0.138	0.4
Mid	2441	460.9	336	0.155	0.4
High	2480	460.9	300	0.138	0.4

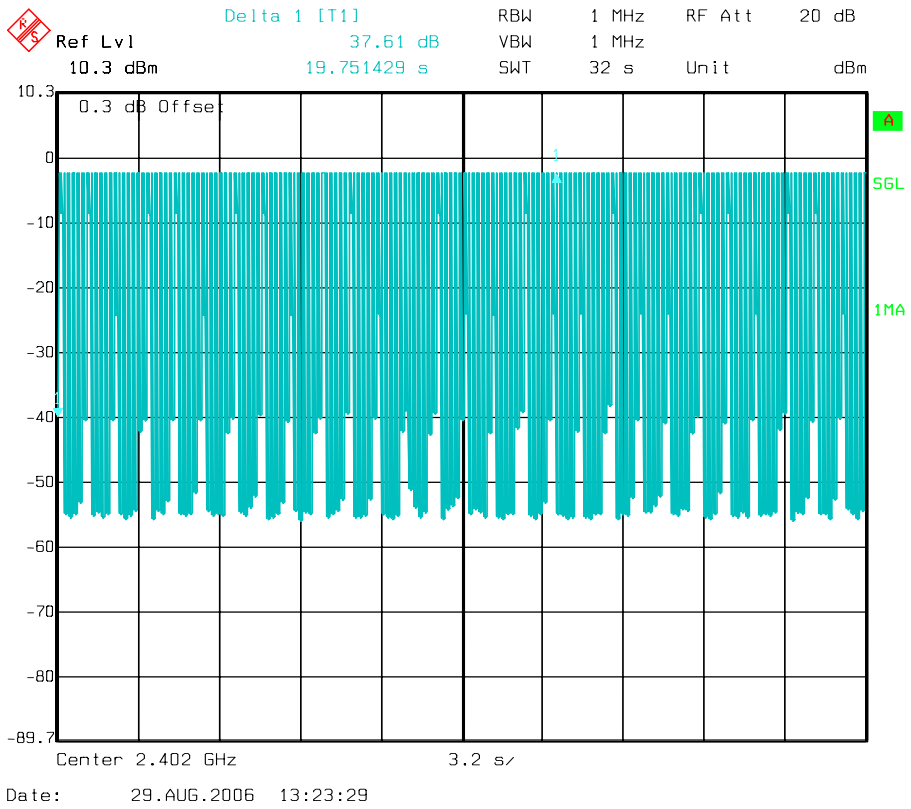
Result: *Pass*

Please refer the following plots.

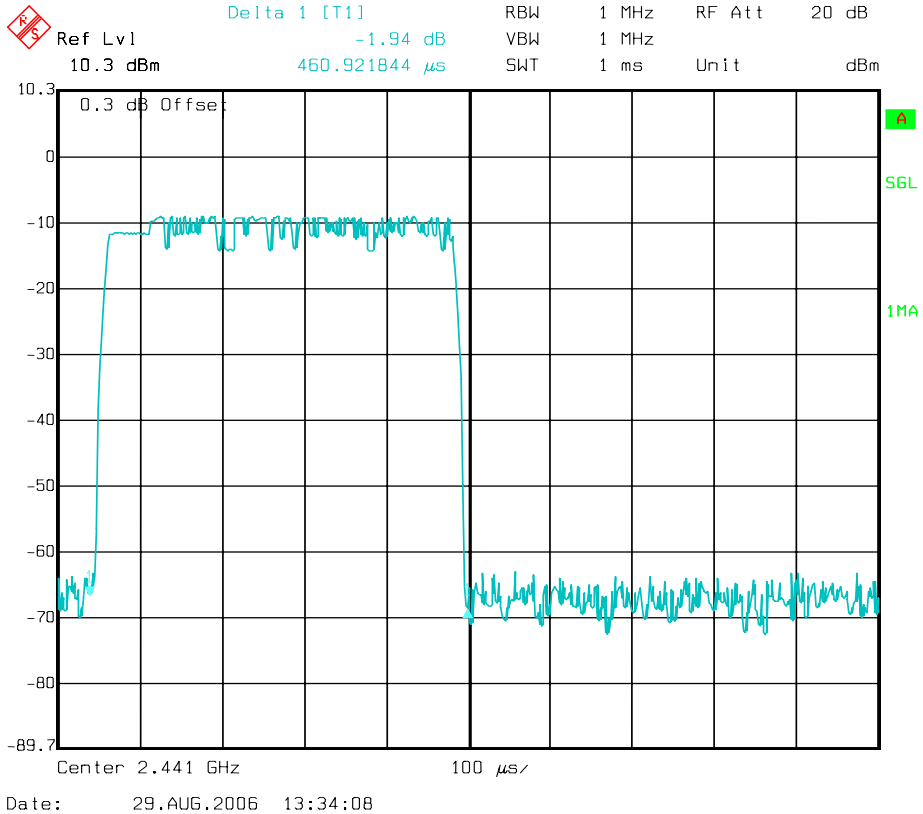
Low Channel:

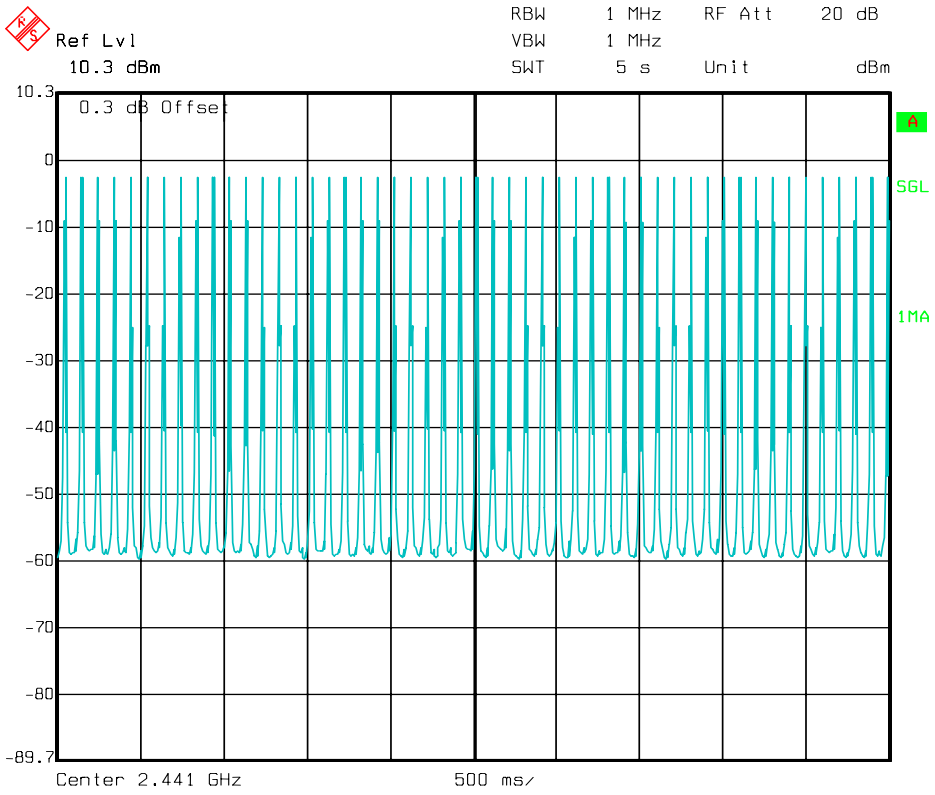


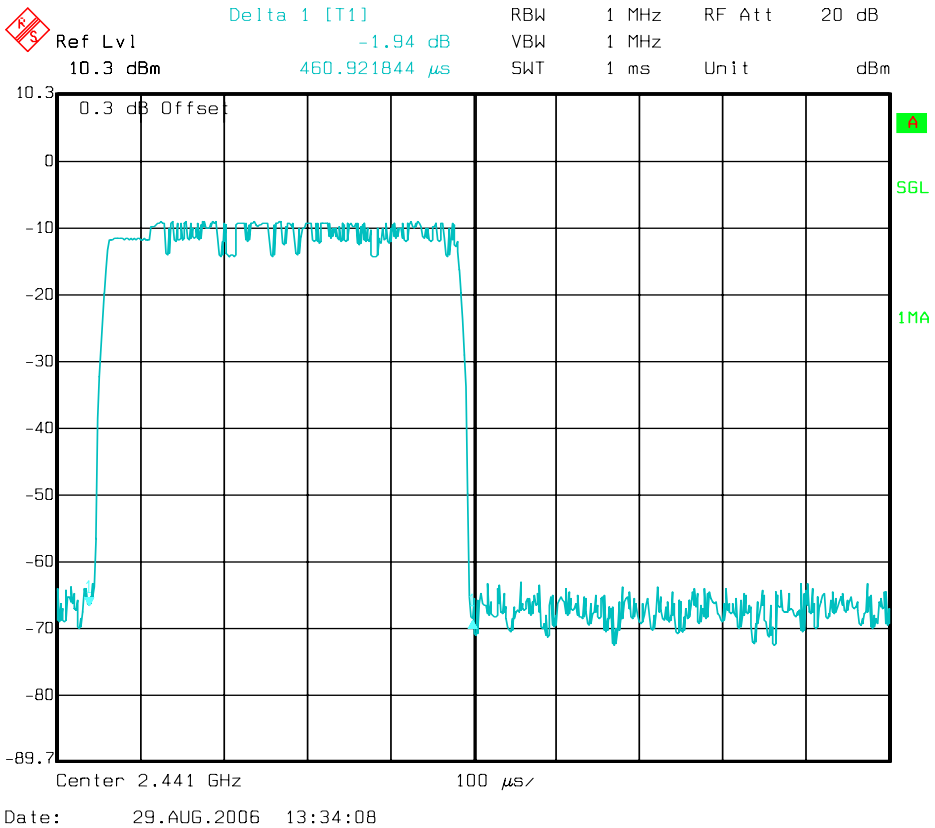




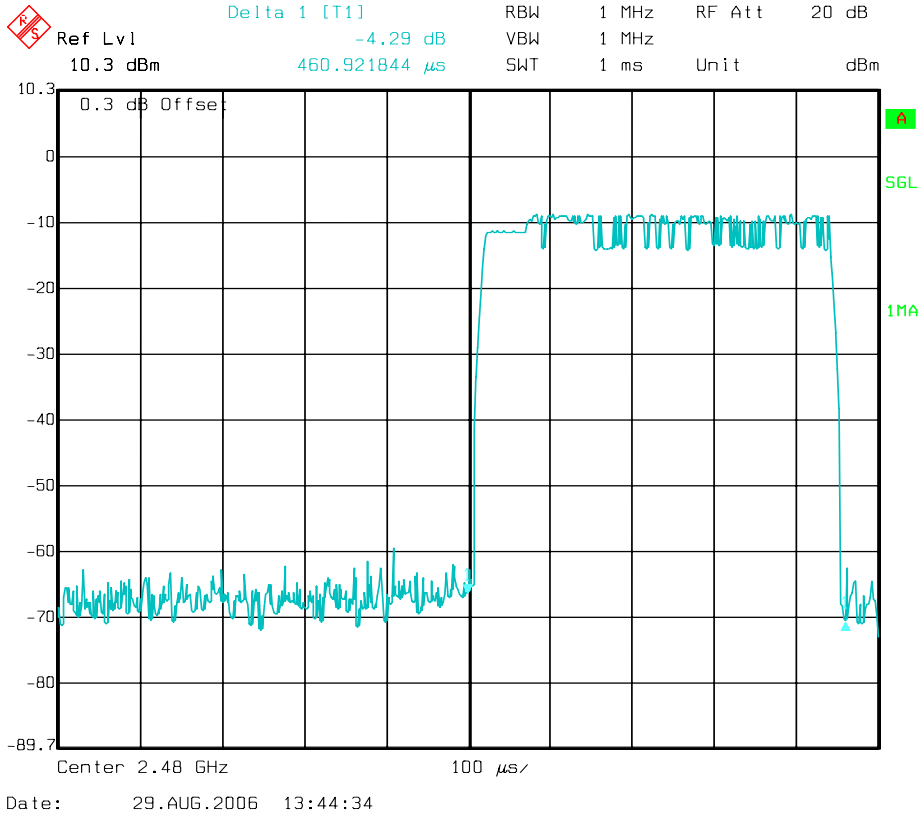
Middle Channel:

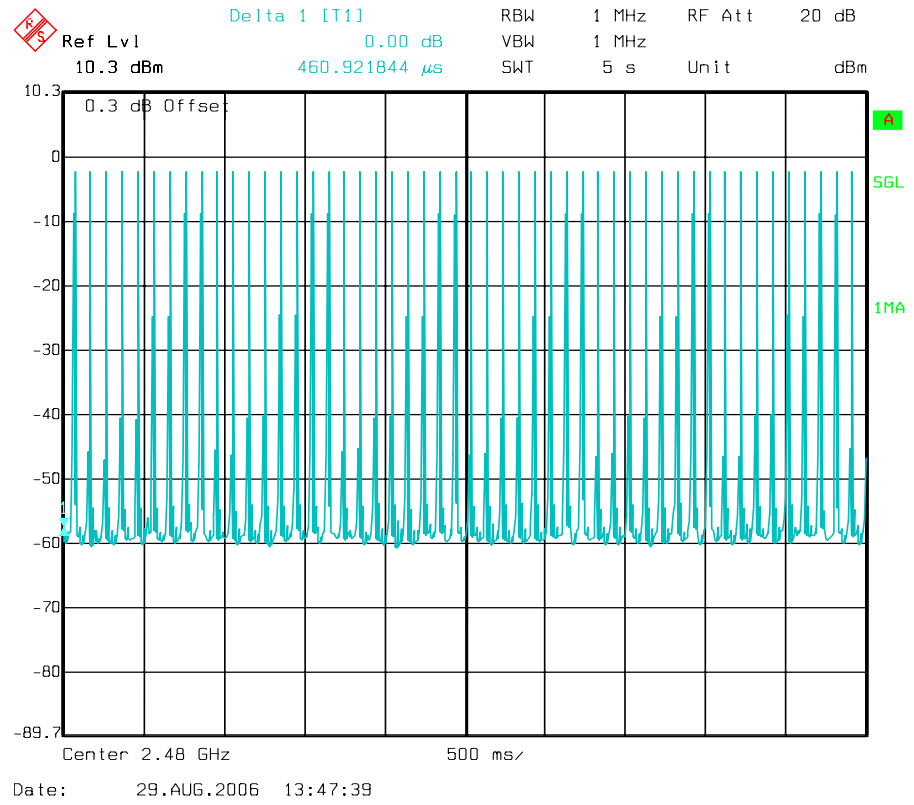


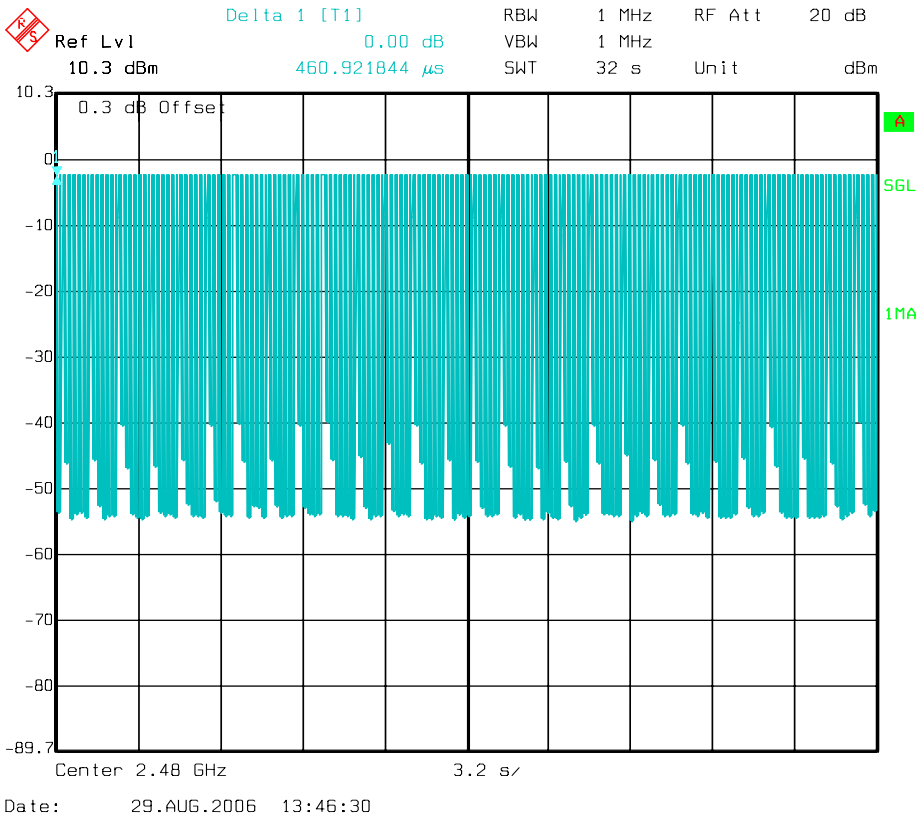

Ref Lvl
10.3 dBm
RBW 1 MHz
VBW 1 MHz
SWT 5 s
RF Att 20 dB
Unit dBm
0.3 dB Offset
10.3
0
-10
-20
-30
-40
-50
-60
-70
-80
-89.7
A
SGL
1MA
Center 2.441 GHz
500 ms/
Date: 29.AUG.2006 13:40:08


Delta 1 [T1]
-1.94 dB
460.921844 µs
Ref Lvl
10.3 dBm
RBW 1 MHz
VBW 1 MHz
SWT 1 ms
RF Att 20 dB
Unit dBm
0.3 dB Offset
10.3
0
-10
-20
-30
-40
-50
-60
-70
-80
-89.7
A
SGL
1MA
Center 2.441 GHz
100 µs/
Date: 29.AUG.2006 13:34:08

High Channel:






Delta 1 [T1]
RBW 1 MHz
RF Att 20 dB
Ref Lvl
0.00 dB
VBW 1 MHz
10.3 dBm
460.921844 µs
SWT 32 s
Unit dBm
10.3
0.3 dB Offset
0
-10
-20
-30
-40
-50
-60
-70
-80
-89.7
A
SGL
1MA
Center 2.48 GHz
3.2 s/
Date: 29.AUG.2006 13:46:30

§15.247(b)(3) - Maximum Peak Output Power

Applicable Standard

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Measurement Procedure

1. Place the EUT on the turntable 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 the spectrum analyzer.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

*** 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:	45%
ATM Pressure:	1021 mbar

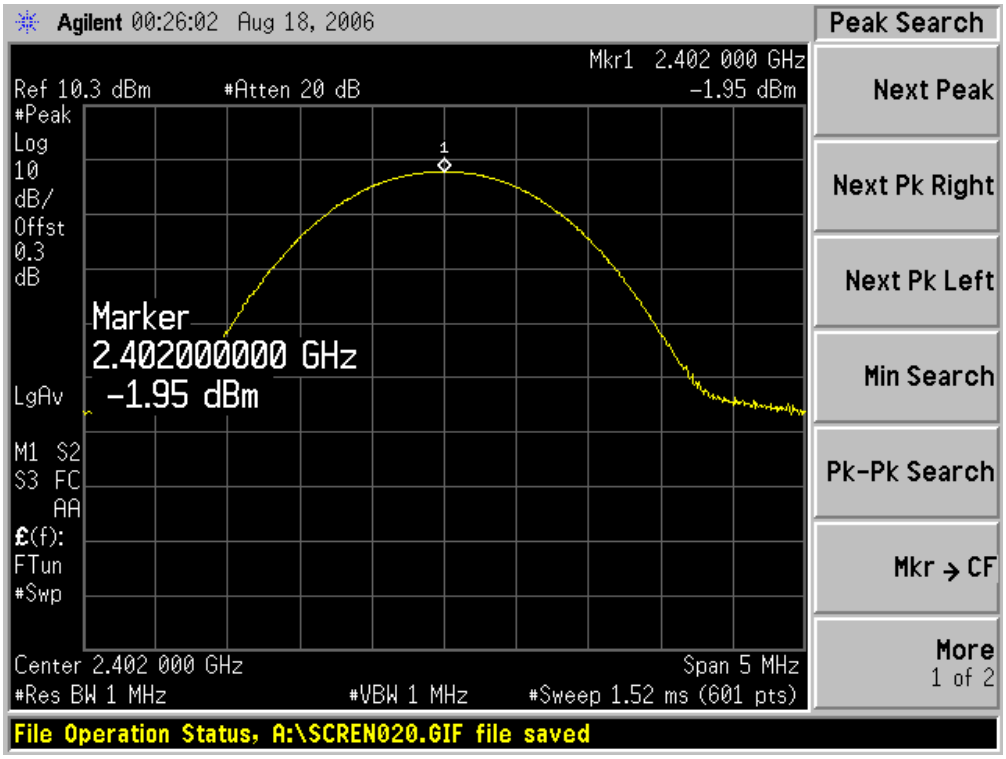
**The testing was performed by Oscar Au on 2006-09-01.*

Measurement Result

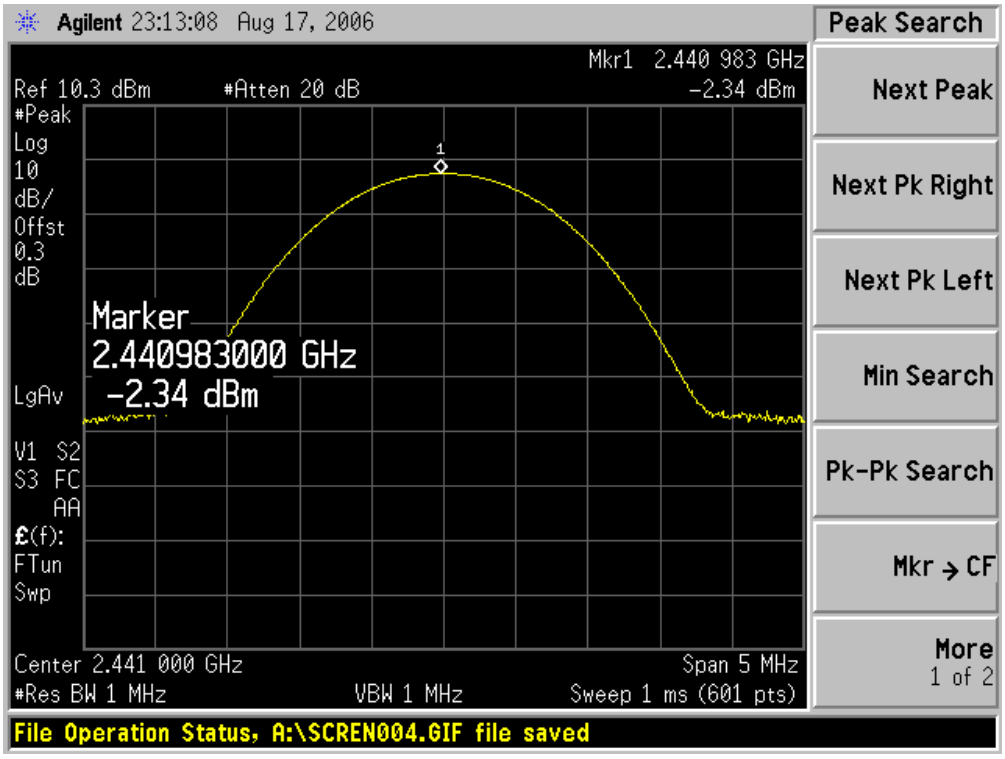
Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	-1.95	0.638	1000	pass
Mid	2441	-2.34	0.583	1000	pass
High	2480	-1.87	0.650	1000	pass

Please see the following plots

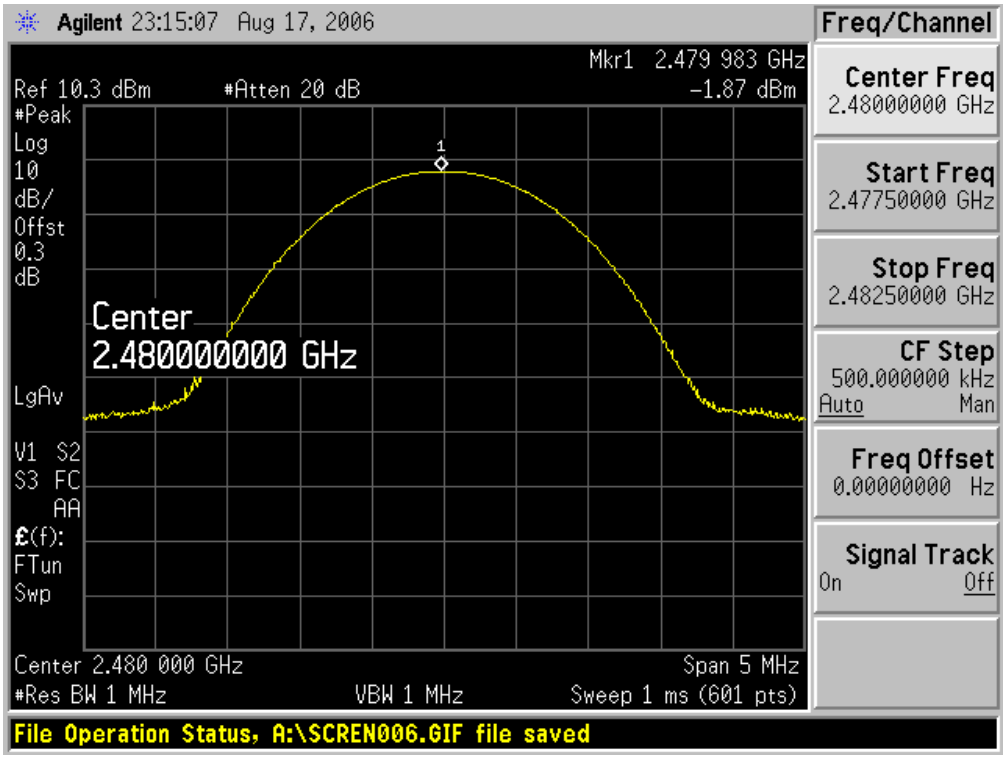
Low Channel



Middle Channel



High Channel



§15.247 (d) - 100 KHz Bandwidth of Band Edges

Applicable Standard

According to §15.247(d) in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

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.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

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

Environmental Conditions

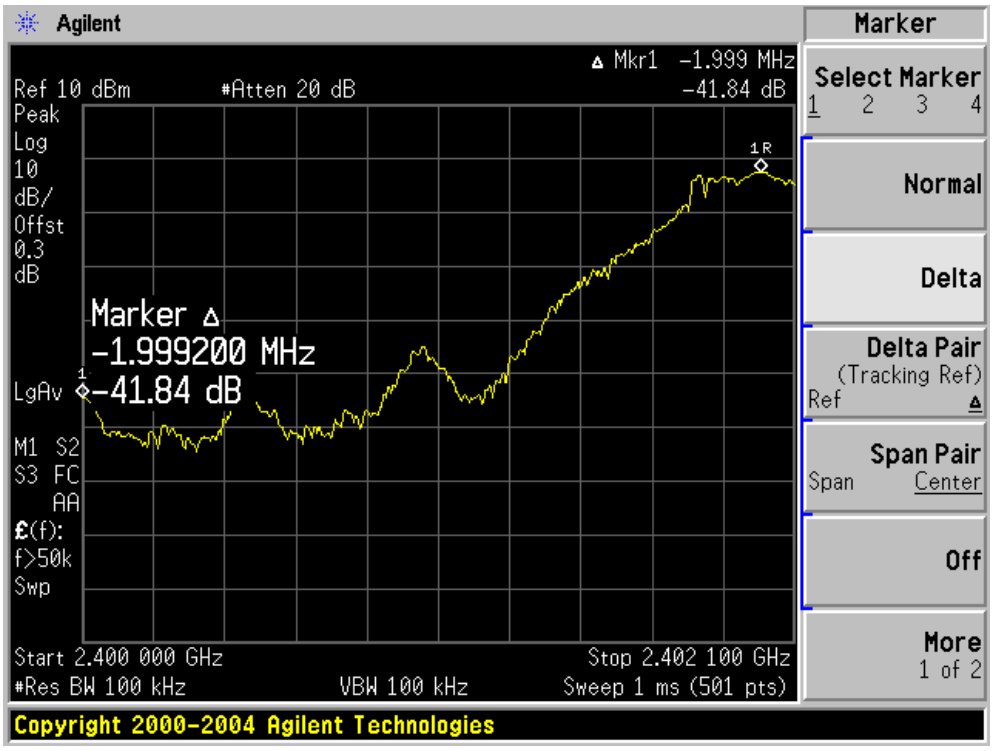
Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1021 mbar

**The testing was performed by Oscar Au on 2006-09-01.*

Plots of 100KHz Bandwidth of Band Edge

Please refer the following plots.

Low Channel



High Channel