

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: Razer Naga Epic Laser Gaming Mouse

Brand Name: Razer

Model Name: RC30-005101

Model Different: N/A

FCC ID: WX9RC30005101

Report No.: ER/2010/90014

Issue Date: Oct. 15, 2010

FCC Rule Part: §15.247, Cat: DTS

Prepared for: Razer (Asia-Pacific) Pte Ltd

**514 Chai Chee Lane, #07-01~06, Singapore
469029**

Prepared by: SGS Taiwan Ltd.

Electronics & Communication Laboratory

**No. 134, Wu Kung Rd., Wuku Industrial Zone,
Taipei County, Taiwan.**



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VERIFICATION OF COMPLIANCE

Applicant: Razer (Asia-Pacific) Pte Ltd

514 Chai Chee Lane, #07-01~06, Singapore 469029

Product Name: Razer Naga Epic Laser Gaming Mouse

Brand Name: Razer

FCC ID: WX9RC30005101

Model No.: RC30-005101

Model Difference: N/A

File Number: ER/2010/90014

Date of test: Sep. 20, 2010 ~ Oct. 15, 2010

Date of EUT Received: Sep. 20, 2010

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

Test By:

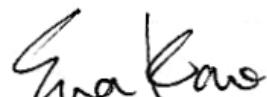


Date:

Oct. 15, 2010

Jason Wu / Asst. Supervisor

Prepared By:

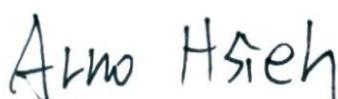


Date:

Oct. 15, 2010

Eva Kao / Asst. Supervisor

Approved By:



Date:

Oct. 15, 2010

Arno Hsieh /Asst. Supervisor

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Version

Version No.	Date	Description
00	Oct. 15, 2010	Initial creation of document

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name	Razer Naga Epic Laser Gaming Mouse
Brand Name	Razer
Model Name	RC30-005101
Model Difference	N/A
Data Cable (USB)	I provide
Power Supply	Battery (3.0V-4.3VDC) or PC (5VDC)
Frequency Range:	2402MHz – 2480MHz
Channel number:	79 channels
Channel spacing	1MHz
Max. Output Power:	1.35 dBm
Modulation type / Technology:	DSSS / GFSK
Transition Rate:	250kbps (DSSS)
Antenna Designation:	PCB Trace On Board / Peak Gain: 1.36dBi

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1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: WX9RC30005101** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a DoC procedure.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2003). Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with Oct 2002 KDB558074 for compliance to FCC 47 CFR 15.247 requirements

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. FCC Registration Number are: 990257 and 236194, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7 and 13 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. According to the requirements in Section 8 and 13 of ANSI C63.4-2003 and KDB558074.

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2.4 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

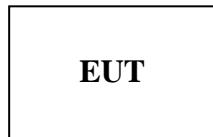


Fig. 2-1 AC Power line Conducted Emission Configuration

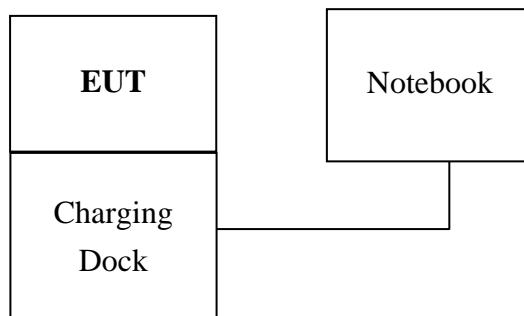


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	Charging Dock	Razer	RC30-005102	N/A	shielding	N/A
2.	Notebook	IBM	T60	L3DK794	shielding	Un-shielding

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(a)(2)(b)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(c)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c)	Spurious Emission	Compliant
§15.247	Peak Power Density	Compliant
§15.203	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode is programmed.

Channel Low: 2402MHz; Channel Mid: 2441MHz; Channel High: 2480MHz are chosen for full testing.

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5 CONDUCTED EMISSION TEST

5.1. Standard Applicable:

According to §15.207, frequency range within 150KHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

5.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCS30	828985/004	09/15/2010	09/14/2011
LISN	Rolf-Heine	NNB-2/16Z	99012	02/02/2010	02/01/2011
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	02/02/2010	02/01/2011
Coaxial Cables	N/A	WK CE Cable	N/A	11/28/2009	11/27/2010

5.3. EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2003.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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5.4. Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.5. Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

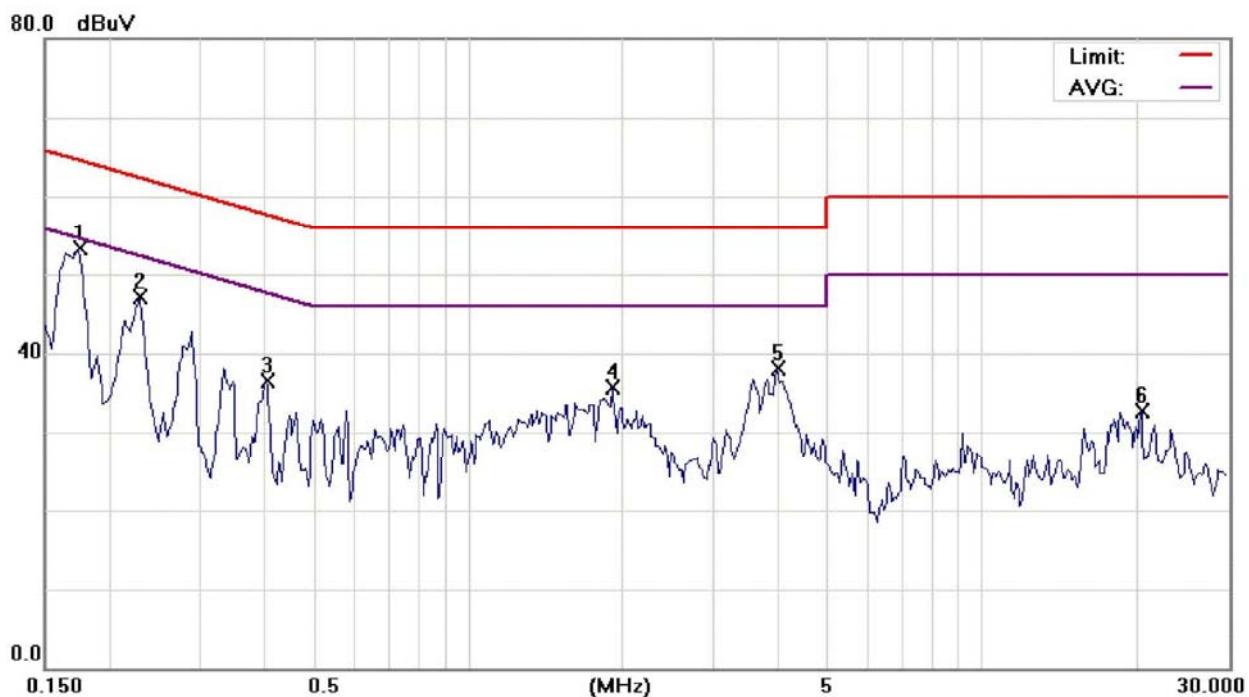
Note: Refer to next page for measurement data and plots.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Charging Operation			Test Date:	Oct. 06, 2010
Temperature:	24 °C	Humidity:		Test By:	Jason
uncertainty values: 2.59 dB					

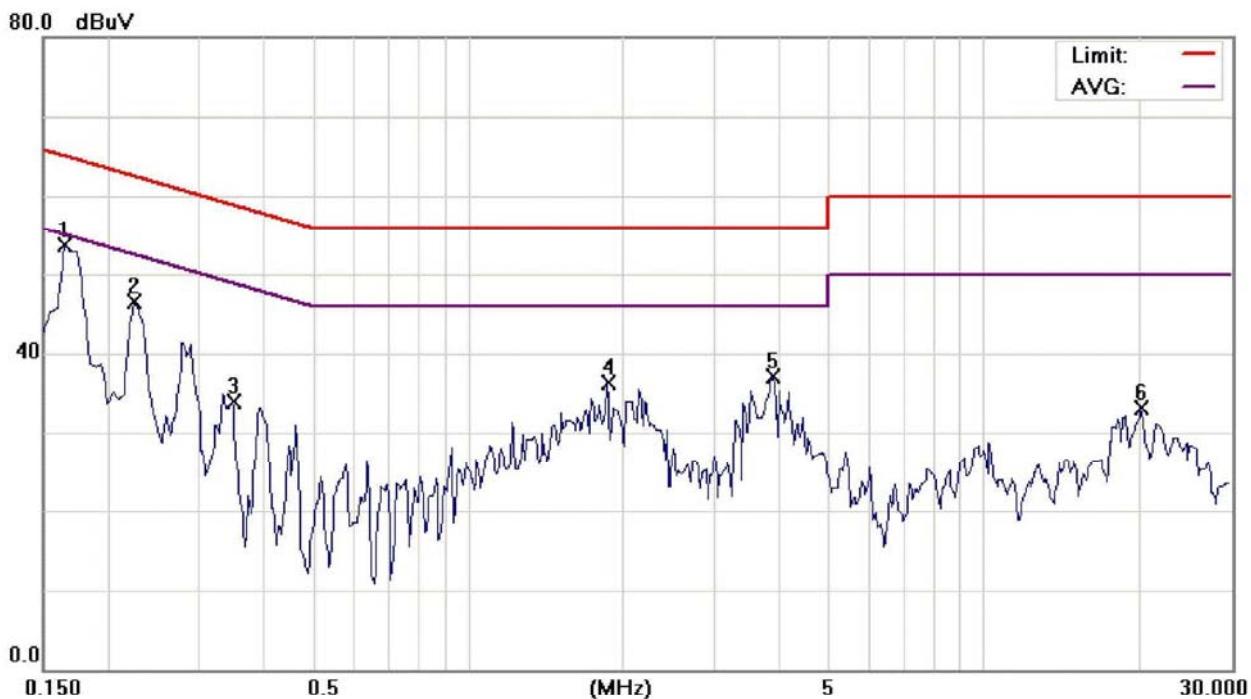


Site SGS CONDUCTED #1	Phase: L1	Temperature: 24 °C
Limit: CISPR22/11/EN55022 Class B	Power: AC 120V/60Hz	Humidity: 55 %
EUT: Razer Naga Epic Elite MMO Gaming M	Distance:	Air Pressure: hpa
M/N: RC30-005101		
Note: Charging Operation		

No.	Mk.	Freq.	Reading Level	Factor	Measure- ment	Limit	Over						
							MHz	dBuV	dB	dBuV	dB	Detector	Comment
1	*	0.1750	53.20	0.13	53.33	64.72	-11.39	peak					
2		0.2300	47.01	0.12	47.13	62.45	-15.32	peak					
3		0.4050	36.30	0.12	36.42	57.75	-21.33	peak					
4		1.9100	35.64	0.16	35.80	56.00	-20.20	peak					
5		3.9900	37.82	0.20	38.02	56.00	-17.98	peak					
6		20.4800	32.18	0.52	32.70	60.00	-27.30	peak					

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Site SGS CONDUCTED #1

Phase: **N**

Temperature: 24 °C

Limit: CISPR22/11/EN55022 Class B

Power: AC 120V/60Hz

Humidity: 55 %

EUT: Razer Naga Epic Elite MMO Gaming M

Distance:

Air Pressure: hpa

M/N: RC30-005101

Note: Charging Operation

No.	Mk.	Freq.	Reading Level	Factor	Measure- ment	Limit	Over		Comment
							MHz	dBuV	dB
1	*	0.1650	53.64	0.14	53.78	65.21	-11.43		peak
2		0.2250	46.44	0.13	46.57	62.63	-16.06		peak
3		0.3500	33.73	0.12	33.85	58.96	-25.11		peak
4		1.8600	36.11	0.16	36.27	56.00	-19.73		peak
5		3.8900	36.87	0.20	37.07	56.00	-18.93		peak
6		20.2200	32.63	0.41	33.04	60.00	-26.96		peak

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6 PEAK OUTPUT POWER MEASUREMENT

6.1 Standard Applicable:

According to §15.247(a)(2), (b)

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

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

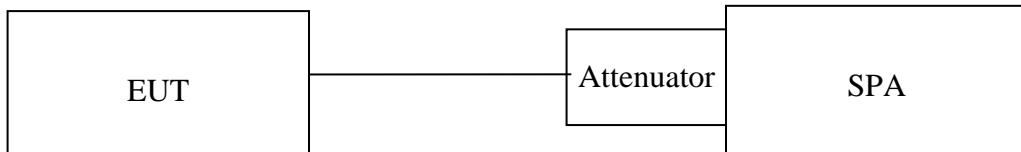
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6.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Sensor	Anritsu	MA2411B	917032	01/21/2010	01/20/2012
Power Meter	Anritsu	ML2495A	1005007	02/17/2010	02/16/2012
Spectrum Analyzer	Agilent	E4446A	MY43360126	04/19/2010	04/18/2012
Spectrum Analyzer	Agilent	E4440A	MY45304525	01/25/2010	01/24/2011
DC Block	Agilent	BLK-18	155452	07/05/2010	07/04/2011
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2010	01/04/2011
Attenuator	Mini-Circuit	BW-S6W5	001	07/05/2010	07/04/2011
Attenuator	Mini-Circuit	BW-S10W5	001	07/05/2010	07/04/2011
Attenuator	Mini-Circuit	BW-S20W5	001	07/05/2010	07/04/2011
Splitter	Agilent	11636B	N/A	07/05/2010	07/04/2011

6.3 .Test Set-up:



6.4 Measurement Procedure:

1. Place the EUT on the table 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 power meter or spectrum. (max peak function, RBW, VBW = 3MHz, Span = 10MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

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6.5 Measurement Result:

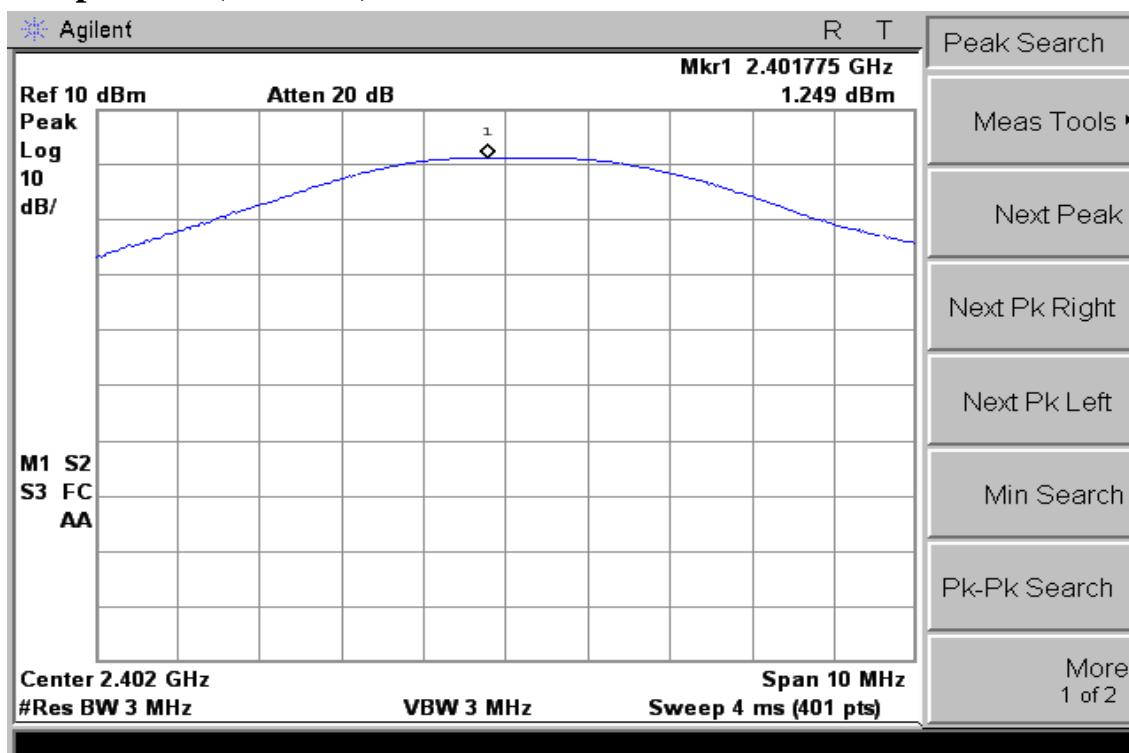
Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	1.25	0.10	1.35	0.00136	1
2441.00	0.83	0.10	0.93	0.00124	1
2480.00	0.37	0.10	0.47	0.00111	1

Uncertainty values: 1.3 dB

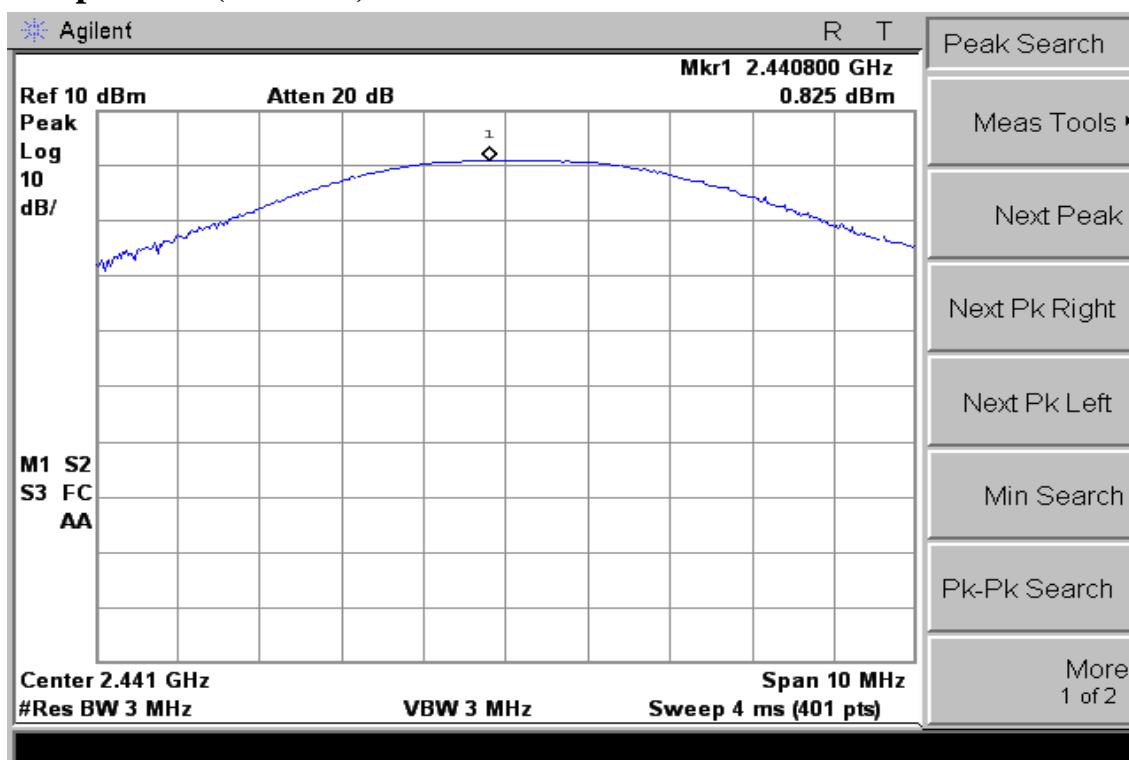
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Power Output Plot (CH Low)

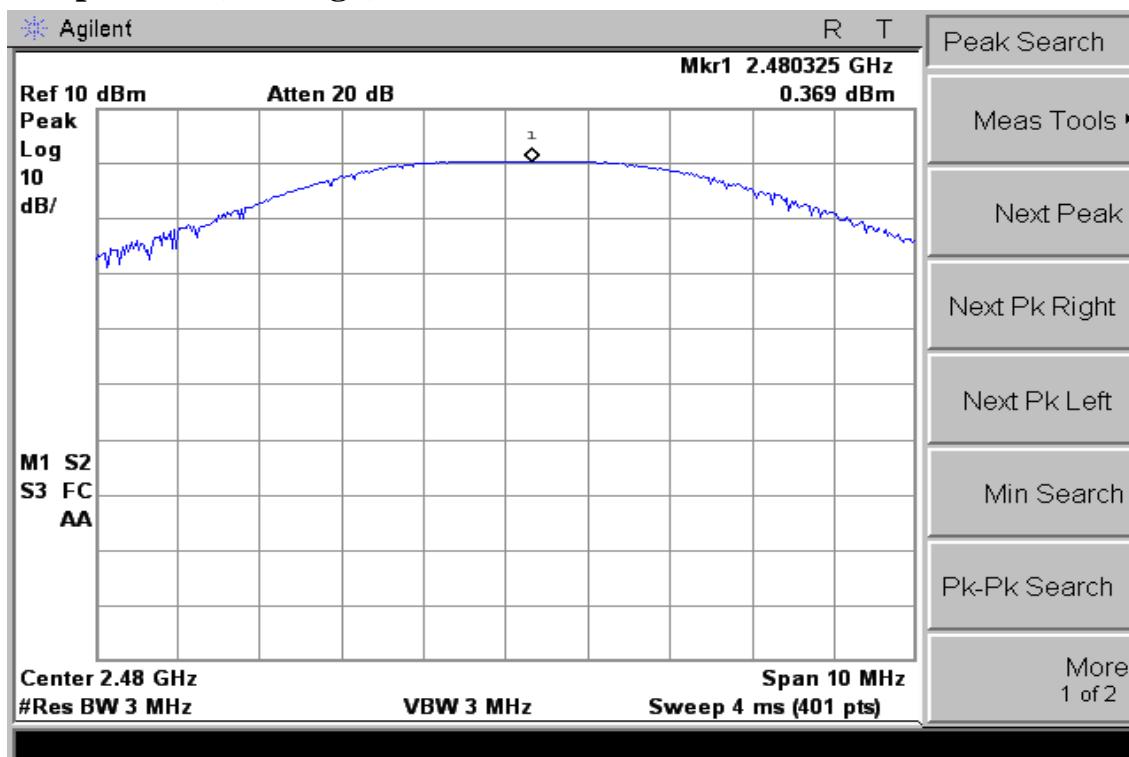


Power Output Plot (CH Mid)



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Power Output Plot (CH High)

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7 6dB Bandwidth

7.1 Standard Applicable:

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500kHz.

7.2 Measurement Equipment Used:

Refer to section 6.2 for details.

7.3 Test Set-up:

Refer to section 6.3 for details.

7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the 3.antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as $RBW \geq 1\%$ of emission Bandwidth, $VBW = 3*RBW$, Span= 5MHz, Sweep=auto
4. Mark the peak frequency and -6 dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

7.5 Measurement Result:

6dB Bandwidth

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2402	0.9432	> 500	PASS
2441	0.9315	> 500	PASS
2480	0.9431	> 500	PASS

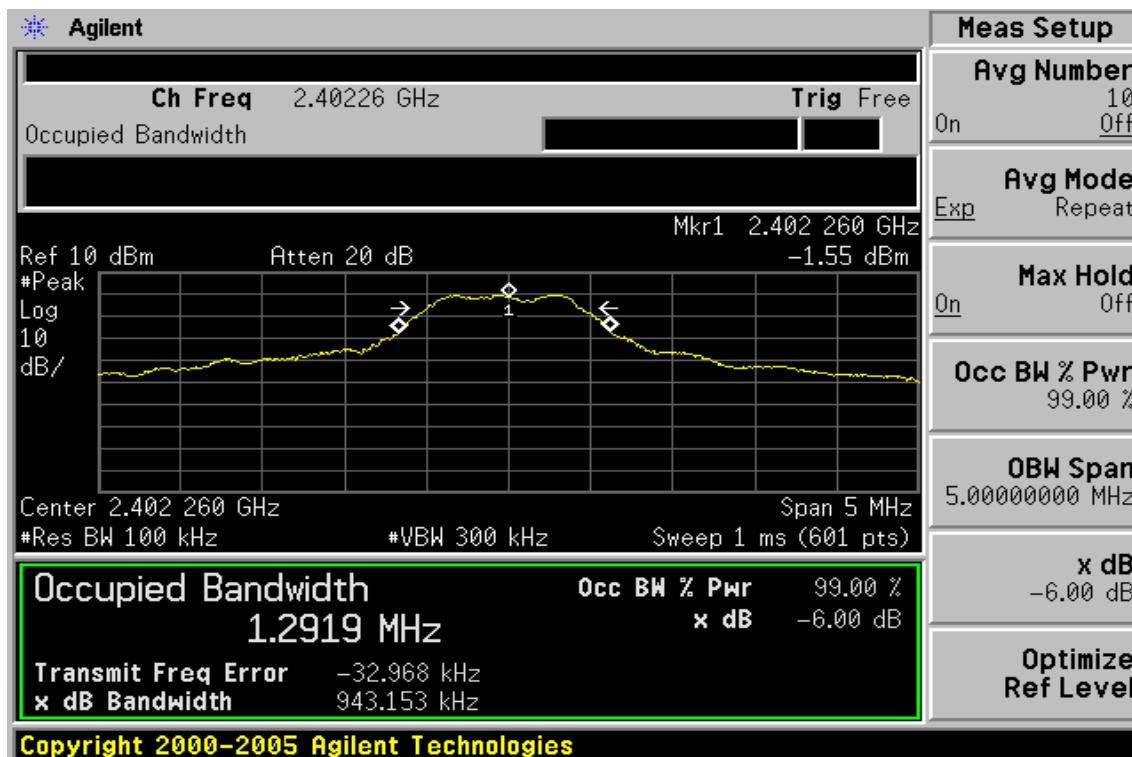
Uncertainty values: 290Hz

Note: Refer to next page for plots.

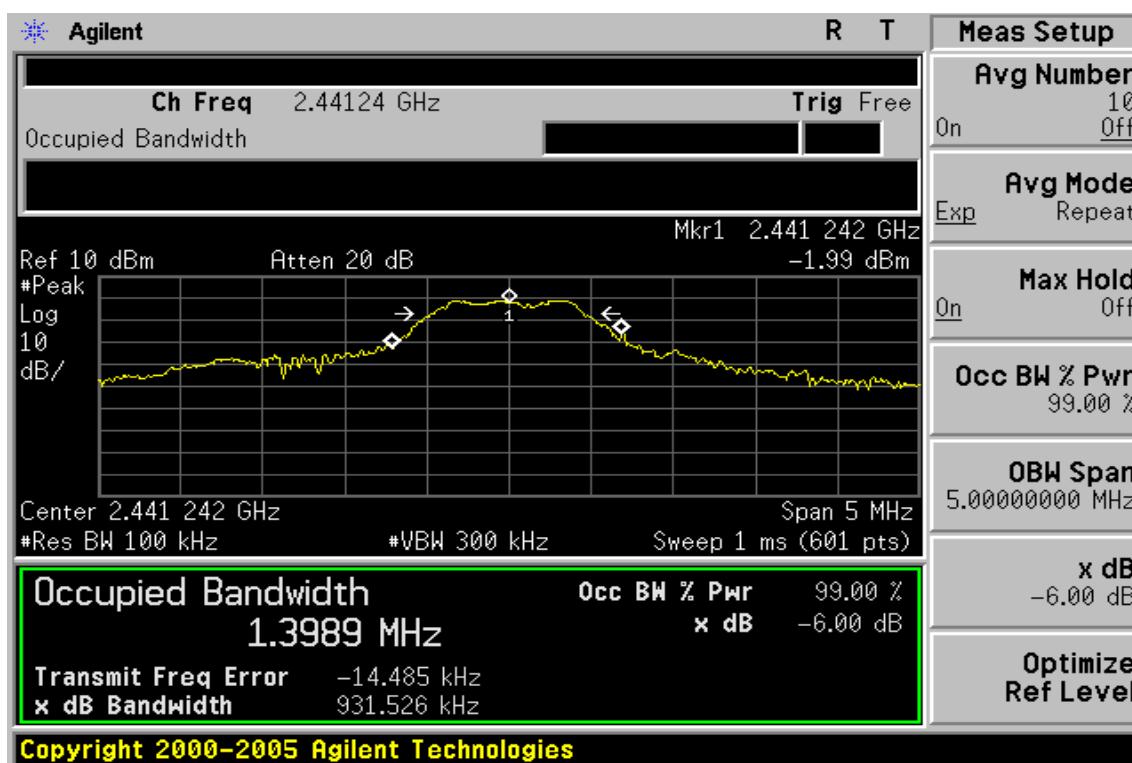
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6dB Bandwidth & 99% Bandwidth Test Data CH-Low



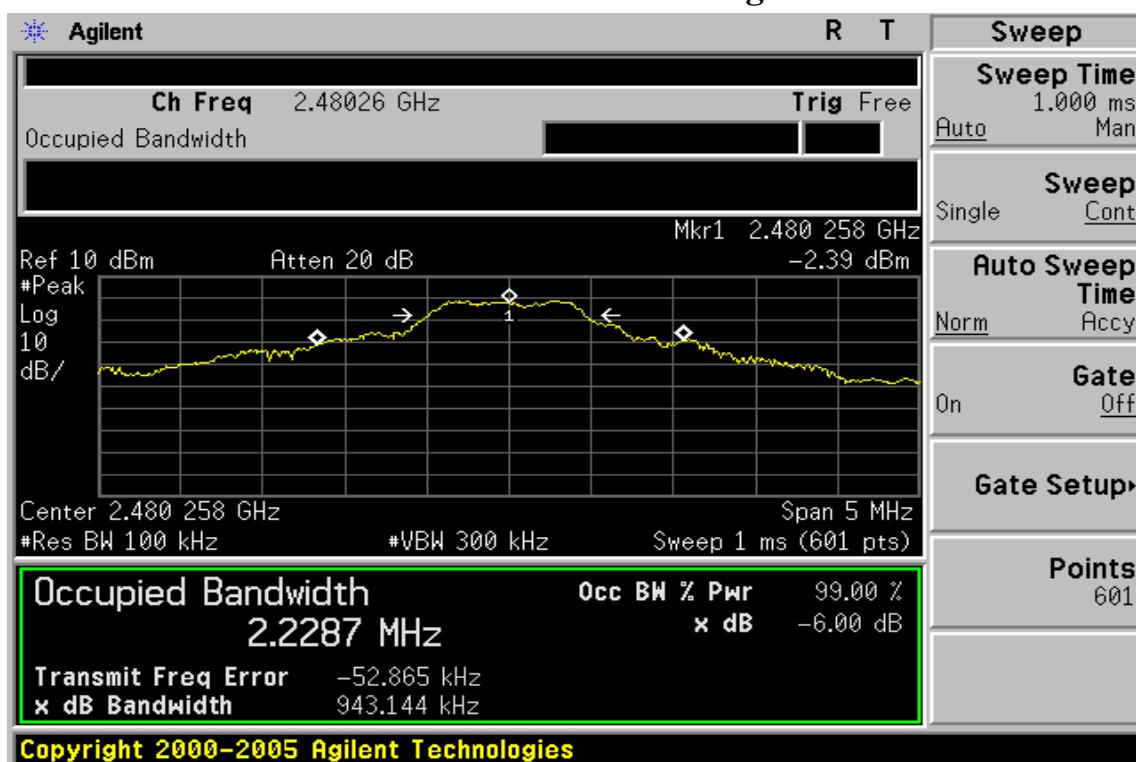
6dB Bandwidth & 99% Bandwidth Test Data CH-Mid



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6dB Bandwidth & 99% Bandwidth Test Data CH-High



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8 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 Standard Applicable:

According to §15.247©, 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 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power. 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).

8.2 Measurement Equipment Used:

8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

8.2.2. Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	02/12/2010	02/11/2011
Bilog Antenna	SCHWAZBECK	VULB9160	3136	11/19/2009	11/18/2010
Horn antenna	SCHWAZBECK	BBHA 9120D	309/320	03/09/2009	03/08/2011
Pre-Amplifier	Agilent	8447D	1937A02834	11/28/2009	11/28/2010
Pre-Amplifier	Agilent	8449B	3008A01973	01/05/2010	01/04/2011
Radio Communication Analyzer	R & S	CMU200	111787	10/31/2008	10/30/2010
DC Block	Agilent	BLK-18	155452	07/05/2010	07/04/2011
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	01/05/2010	01/04/2011
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	01/05/2010	01/04/2011
3m Site	SGS	966 chamber	N/A	11/08/2009	11/09/2010

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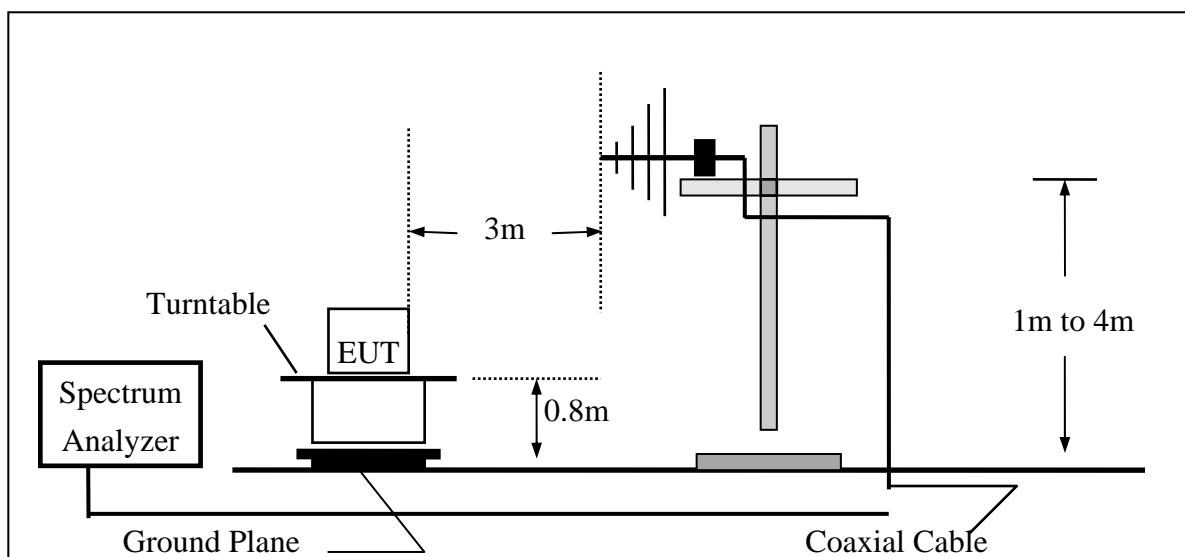
8.3 Test SET-UP:

8.3.1 Conducted Emission at antenna port:

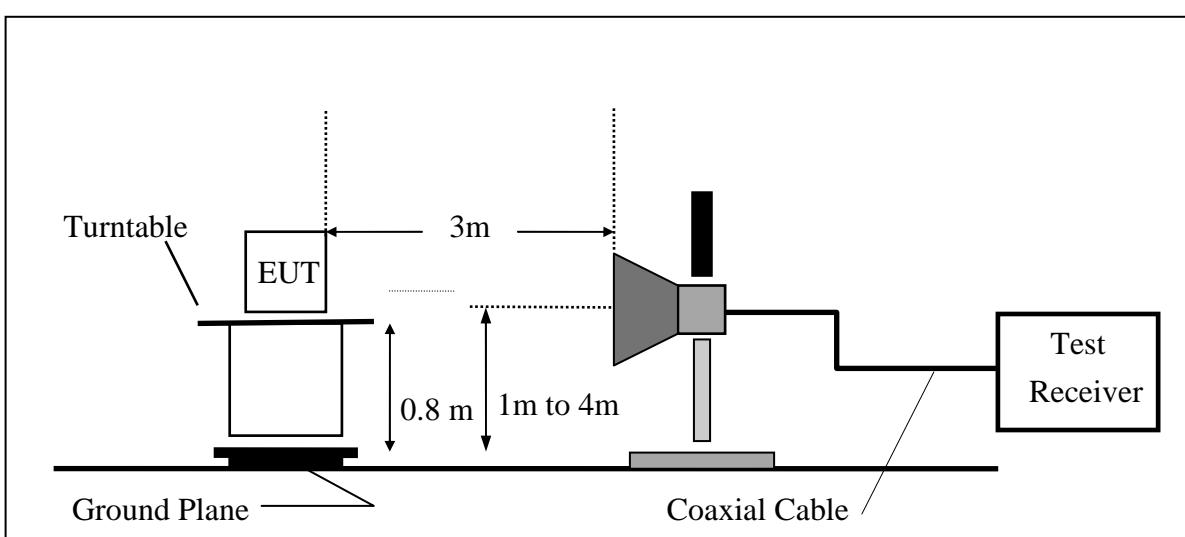
Refer to section 6.3 for details.

8.3.2 Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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8.4 Measurement Procedure:

1. Place the EUT on the table 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.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=50MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

8.5 Field Strength Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

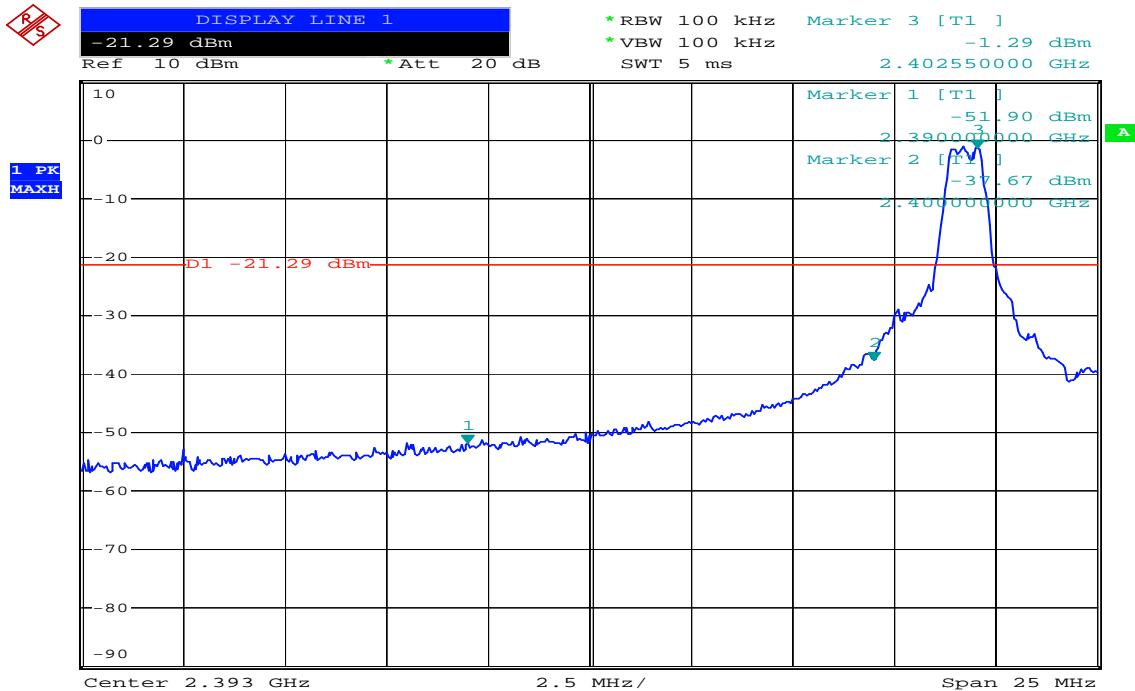
8.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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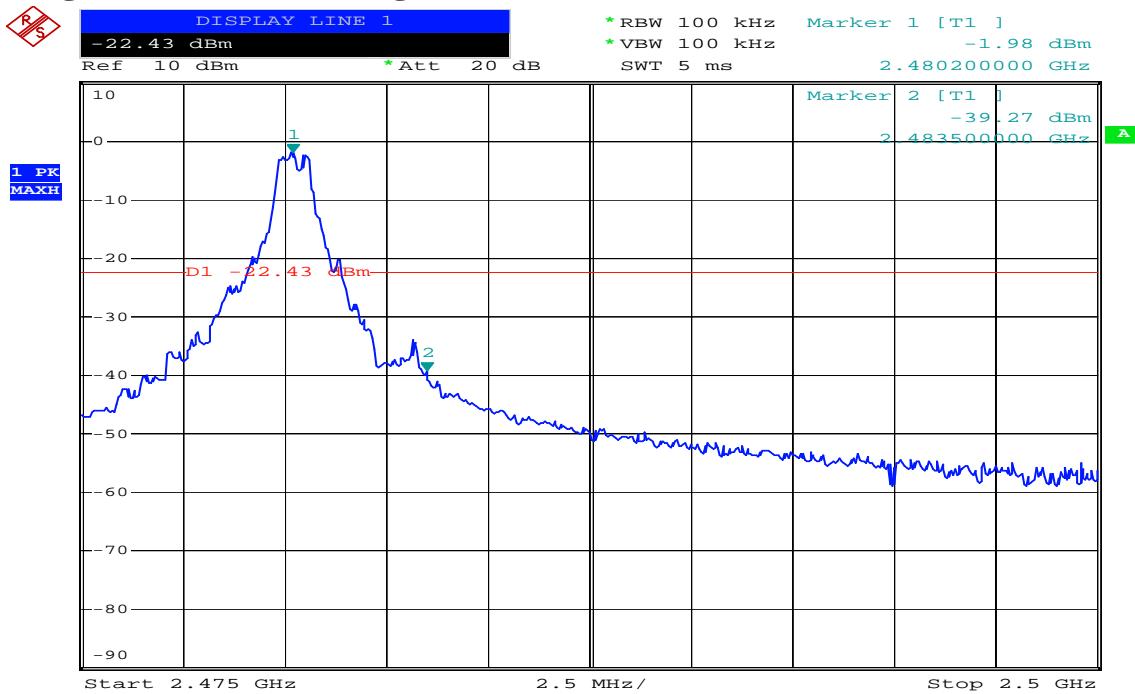
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Band Edges Test Data CH-Low



Date: 4.OCT.2010 16:24:29

Band Edges Test Data CH-High



Date: 4.OCT.2010 16:25:50

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Radiated Emission:

Operation Mode	TX CH Low	Test Date	Sep. 29, 2010
Fundamental Frequency	2402 MHz	Test By	Jason
Temperature	25 °C	Pol	Ver.
Humidity	65 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)			
2390.00	44.61	---	-1.39	43.22	---	74.00	54.00	-10.78 Peak

Operation Mode	TX CH Low	Test Date	Sep. 29, 2010
Fundamental Frequency	2402 MHz	Test By	Jason
Temperature	25 °C	Pol	Hor.
Humidity	65 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)			
2390.00	53.98	---	-1.39	52.59	---	74.00	54.00	-1.41 Peak

Remark:

- (1) Data of measurement within this frequency range shown “ – ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- (5) uncertainty values:
Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB,
1-40GHz: 4.04 dB
Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz:
3.39 dB, 1-40GHz: 4.08 dB

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Radiated Emission:

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 25 °C
Humidity 65 %

Test Date Sep. 29, 2010
Test By Jason
Pol Ver.

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)			
2483.56	61.56	43.55	-0.92	60.64	42.63	74.00	54.00	-11.37 AV

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 25 °C
Humidity 65 %

Test Date Sep. 29, 2010
Test By Jason
Pol Hor.

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)			
2483.56	67.68	46.55	-0.92	66.76	45.63	74.00	54.00	-8.37 AV

Remark:

- (1) Data of measurement within this frequency range shown “ – ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- (5) uncertainty values:
Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB,
1-40GHz: 4.04 dB
Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz:
3.39 dB, 1-40GHz: 4.08 dB

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9 SPURIOUS RADIATED EMISSION TEST

9.1 Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

9.2 Measurement Equipment Used:

9.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

9.2.2. Radiated emission:

Refer to section 7.2 for details.

9.3 Test SET-UP:

9.3.1. Conducted Emission at antenna port:

Refer to section 6.3 for details.

9.3.2. Radiated emission:

Refer to section 7.3 for details.

9.4 Measurement Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

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9.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

9.6 Measurement Result:

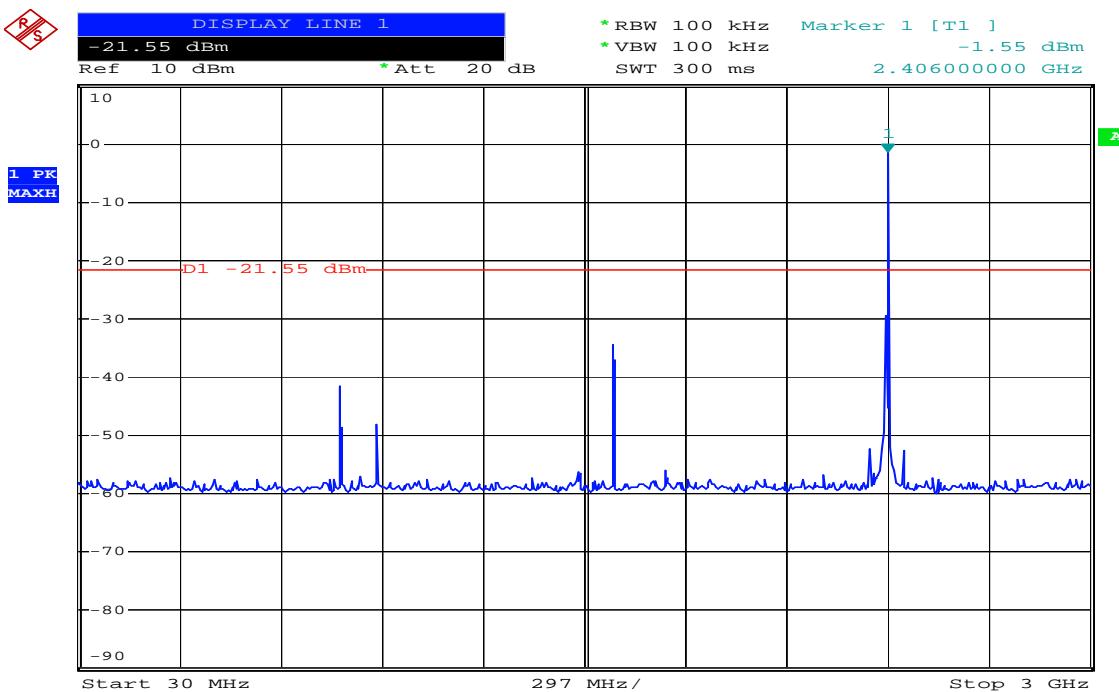
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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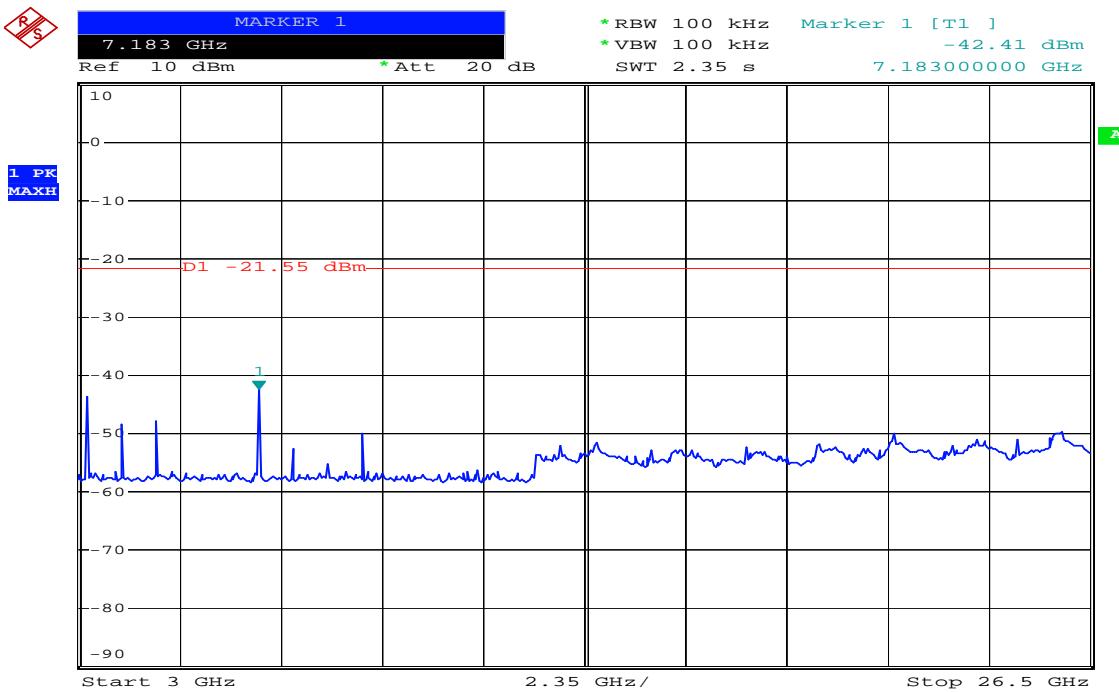
Conducted Spurious Emission Measurement Result

Ch Low 30MHz – 3GHz



Date: 4.OCT.2010 16:36:34

Ch Low 3GHz – 26.5GHz

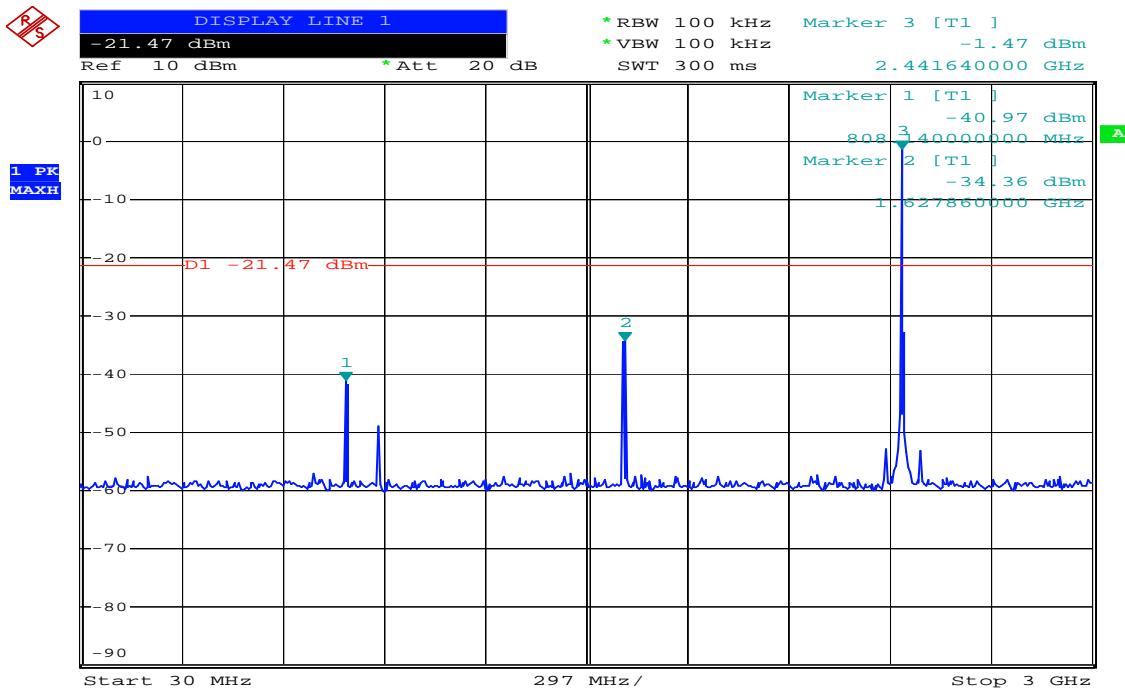


Date: 4.OCT.2010 16:44:50

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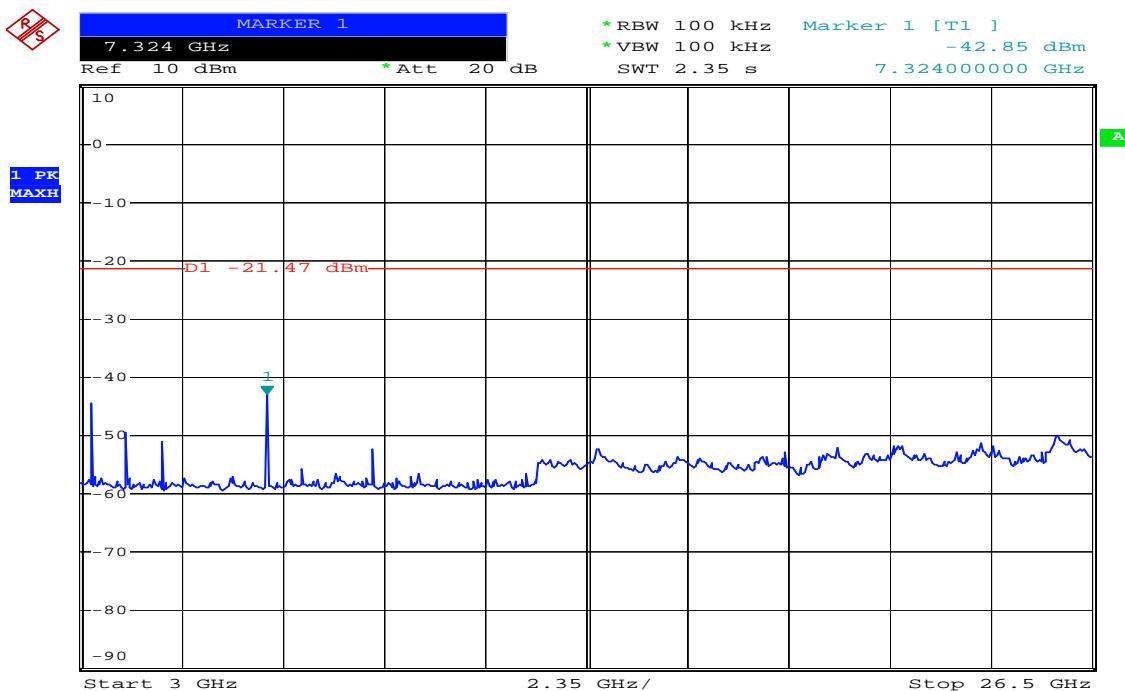
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Ch Mid 30MHz – 3GHz



Date: 4.OCT.2010 16:33:11

Ch Mid 3GHz – 26.5GHz

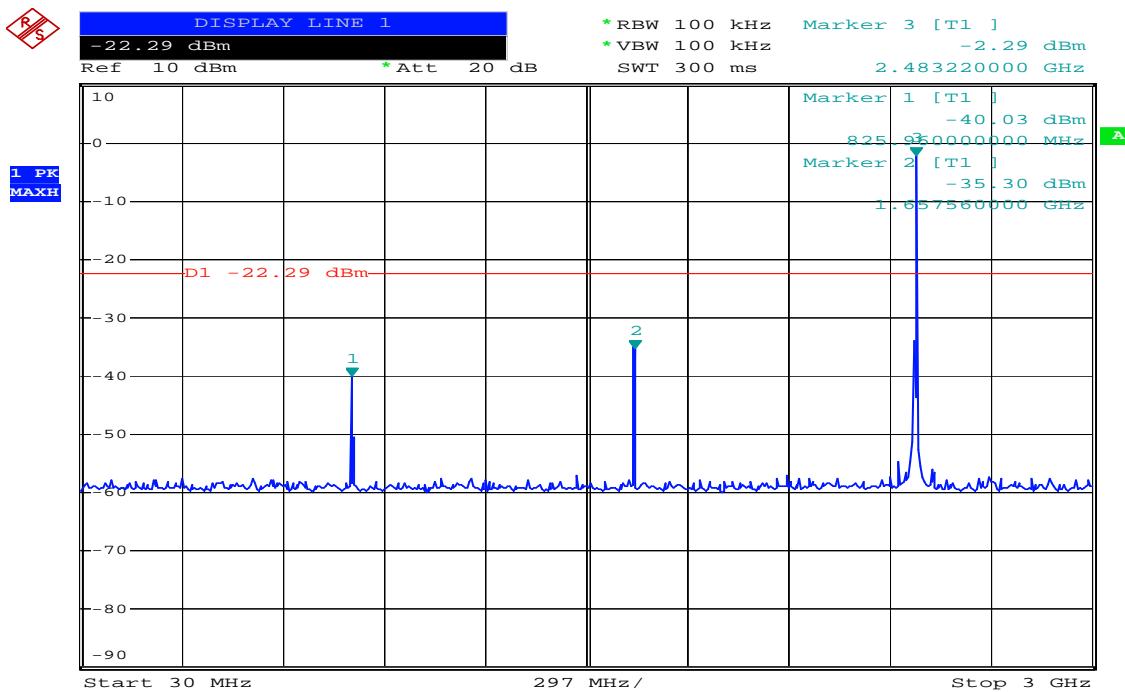


Date: 4.OCT.2010 16:34:39

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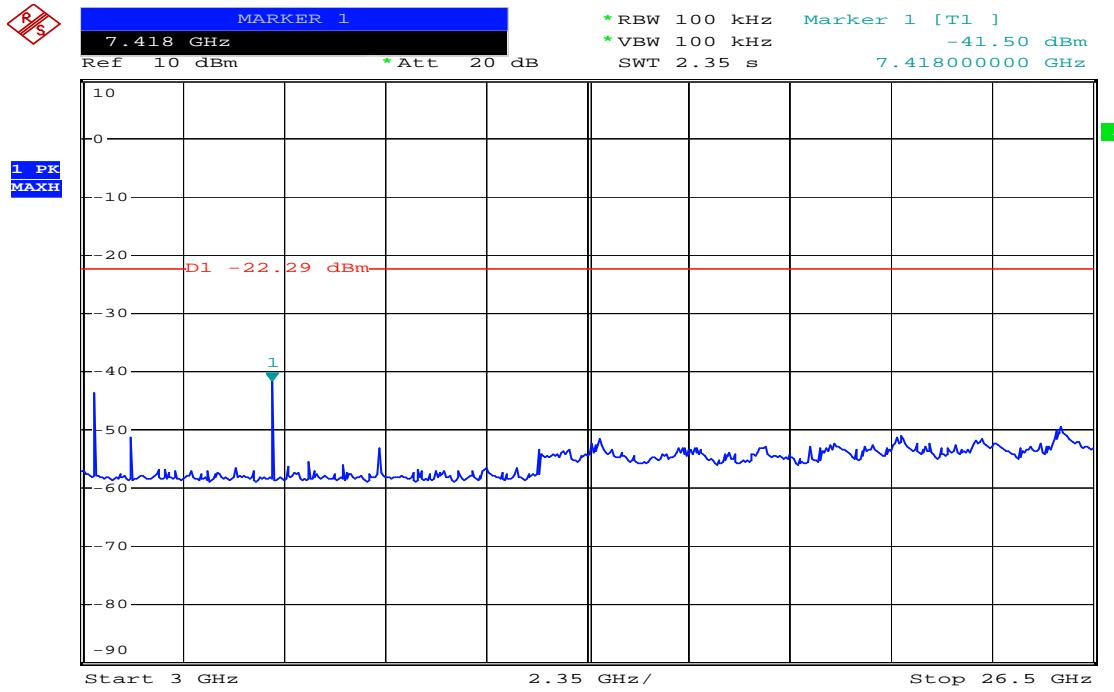
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Ch High 30MHz – 3GHz



Date: 4.OCT.2010 16:27:41

Ch High 3GHz – 26.5GHz



Date: 4.OCT.2010 16:31:17

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH Low	Test Date	Sep. 29, 2010
Fundamental Frequency	2402MHz	Test By	Jason
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
31.94	V	Peak	45.11	-14.82	30.29	40.00	-9.71
58.13	V	Peak	40.21	-14.66	25.55	40.00	-14.45
92.08	V	Peak	48.38	-17.38	31.00	43.50	-12.50
858.38	V	Peak	33.19	-1.86	31.33	46.00	-14.67
31.94	H	Peak	42.41	-14.82	27.59	40.00	-12.41
92.08	H	Peak	44.69	-17.38	27.31	43.50	-16.19
465.53	H	Peak	39.92	-8.55	31.37	46.00	-14.63

Remark:

- 1 Measuring frequencies from 30 MHz to the 1GHz.
- 2 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- 3 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.
- 5 uncertainty values:
Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB,
1-40GHz: 4.04 dB
Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz:
3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH Mid	Test Date	Sep. 29, 2010
Fundamental Frequency	2441MHz	Test By	Jason
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
30.00	V	Peak	45.05	-14.97	30.08	40.00	-9.92
58.13	V	Peak	39.61	-14.66	24.95	40.00	-15.05
92.08	V	Peak	48.57	-17.38	31.19	43.50	-12.31
36.79	H	Peak	41.08	-14.36	26.72	40.00	-13.28
92.08	H	Peak	45.00	-17.38	27.62	43.50	-15.88
465.53	H	Peak	40.36	-8.50	31.86	46.00	-14.14

Remark:

- 1 Measuring frequencies from 30 MHz to the 1GHz.
- 2 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- 3 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.
- 5 uncertainty values:
Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB,
1-40GHz: 4.04 dB
Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz:
3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH High	Test Date	Sep. 29, 2010
Fundamental Frequency	2480MHz	Test By	Jason
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
30.00	V	Peak	46.05	-14.97	31.08	40.00	-8.92
58.13	V	Peak	39.88	-14.66	25.22	40.00	-14.78
92.08	V	Peak	48.82	-17.38	31.44	43.50	-12.06
30.00	H	Peak	40.93	-14.97	25.96	40.00	-14.04
92.08	H	Peak	44.94	-17.38	27.56	43.50	-15.94
465.53	H	Peak	37.99	-8.55	29.44	46.00	-16.56

Remark:

- 1 Measuring frequencies from 30 MHz to the 1GHz.
- 2 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- 3 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.
- 5 uncertainty values:
Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB,
1-40GHz: 4.04 dB
Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz:
3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	Sep. 29, 2010
Fundamental Frequency	2402MHz	Test By	Jason
Temperature	23 °C	Pol	Ver.
Humidity	54 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1598.0	41.79	---	-5.48	36.31	---	74.00	54.00	-17.69 Peak
4003.0	39.70	---	3.70	43.40	---	74.00	54.00	-10.60 Peak
4804.0	45.80	---	5.99	51.79	---	74.00	54.00	-2.21 Peak
7206.0	----					74.00	54.00	
9608.0	----					74.00	54.00	
12010.0	----					74.00	54.00	
14412.0	----					74.00	54.00	
16814.0	----					74.00	54.00	
19216.0	----					74.00	54.00	
21618.0	----					74.00	54.00	
24020.0	----					74.00	54.00	

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- 5 Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- 6 uncertainty values:
 - Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB, 1-40GHz: 4.04 dB
 - Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz: 3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	Sep. 29, 2010
Fundamental Frequency	2402MHz	Test By	Jason
Temperature	23 °C	Pol	Hor
Humidity	54 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1598.0	45.13	---	-5.48	39.65	---	74.00	54.00	-14.35 Peak
3203.5	39.56	---	1.07	40.63	---	74.00	54.00	-13.37 Peak
4003.0	37.89	---	3.70	41.59	---	74.00	54.00	-12.41 Peak
4804.0	45.91	---	5.99	51.90	---	74.00	54.00	-2.10 Peak
7206.0	----					74.00	54.00	
9608.0	----					74.00	54.00	
12010.0	----					74.00	54.00	
14412.0	----					74.00	54.00	
16814.0	----					74.00	54.00	
19216.0	----					74.00	54.00	
21618.0	----					74.00	54.00	
24020.0	----					74.00	54.00	

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- 5 Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- 6 uncertainty values:
 - Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB, 1-40GHz: 4.04 dB
 - Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz: 3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	Sep. 29, 2010
Fundamental Frequency	2441MHz	Test By	Jason
Temperature	23 °C	Pol	Ver
Humidity	54 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1630.5	44.60	---	-5.26	39.34	---	74.00	54.00	-14.66 Peak
3138.5	36.68	---	0.88	37.56	---	74.00	54.00	-16.44 Peak
4068.0	40.13	---	3.89	44.02	---	74.00	54.00	-9.98 Peak
4882.0	43.62	---	6.17	49.79	---	74.00	54.00	-4.21 Peak
7323.0	----					74.00	54.00	
9764.0	----					74.00	54.00	
12205.0	----					74.00	54.00	
14646.0	----					74.00	54.00	
17087.0	----					74.00	54.00	
19528.0	----					74.00	54.00	
21969.0	----					74.00	54.00	
24410.0	----					74.00	54.00	

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- 5 Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- 6 uncertainty values:
 - Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB, 1-40GHz: 4.04 dB
 - Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz: 3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	Sep. 29, 2010
Fundamental Frequency	2441MHz	Test By	Jason
Temperature	23 °C	Pol	Hor
Humidity	54 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1630.5	46.88	---	-5.26	41.62	---	74.00	54.00	-12.38 Peak
4068.0	37.82	---	3.89	41.71	---	74.00	54.00	-12.29 Peak
4882.0	41.19	---	6.17	47.36	---	74.00	54.00	-6.64 Peak
7323.0	----					74.00	54.00	
9764.0	----					74.00	54.00	
12205.0	----					74.00	54.00	
14646.0	----					74.00	54.00	
17087.0	----					74.00	54.00	
19528.0	----					74.00	54.00	
21969.0	----					74.00	54.00	
24410.0	----					74.00	54.00	

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- 5 Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- 6 uncertainty values:
 - Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB, 1-40GHz: 4.04 dB
 - Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz: 3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH High	Test Date	Sep. 29, 2010
Fundamental Frequency	2480MHz	Test By	Jason
Temperature	23 °C	Pol	Ver
Humidity	54 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1643.5	44.52	---	-5.22	39.30	---	74.00	54.00	-14.70 Peak
3158.0	37.04	---	0.93	37.97	---	74.00	54.00	-16.03 Peak
4133.0	36.22	---	4.11	40.33	---	74.00	54.00	-13.67 Peak
4960.0	37.26	---	6.36	43.62	---	74.00	54.00	-10.38 Peak
7440.0	----					74.00	54.00	
9920.0	----					74.00	54.00	
12400.0	----					74.00	54.00	
14880.0	----					74.00	54.00	
17360.0	----					74.00	54.00	
19840.0	----					74.00	54.00	
22320.0	----					74.00	54.00	
24800.0	----					74.00	54.00	

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- 5 Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- 6 uncertainty values:
Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB, 1-40GHz: 4.04 dB
Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz: 3.39 dB, 1-40GHz: 4.08 dB

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH High	Test Date	Sep. 29, 2010
Fundamental Frequency	2480MHz	Test By	Jason
Temperature	23 °C	Pol	Hor
Humidity	54 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	Remark	
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)			
1643.5	49.82	---	-5.22	44.60	---	74.00	54.00	-9.40	Peak
4133.0	37.99	---	4.11	42.10	---	74.00	54.00	-11.90	Peak
4960.0	38.55	---	6.36	44.91	---	74.00	54.00	-9.09	Peak
7440.0	----					74.00	54.00		
9920.0	----					74.00	54.00		
12400.0	----					74.00	54.00		
14880.0	----					74.00	54.00		
17360.0	----					74.00	54.00		
19840.0	----					74.00	54.00		
22320.0	----					74.00	54.00		
24800.0	----					74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- 5 Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.
- 6 uncertainty values:
 - Ant. position at Horizontal --- 30-167 MHz: 3.37 dB, 167MHz-1GHz: 3.19 dB, 1-40GHz: 4.04 dB
 - Ant. position at Vertical --- 30-180 MHz: 4.22 dB, 180-417 MHz: 3.44 dB, 0.417-1GHz: 3.39 dB, 1-40GHz: 4.08 dB

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10 Peak Power Spectral Density

10.1 Standard Applicable:

According to §15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

10.2 Measurement Equipment Used:

Refer to section 6.2 for details.

10.3 Test Set-up:

Refer to section 6.3 for details.

10.4 Measurement Procedure:

1. Place the EUT on the table 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.
3. Set the spectrum analyzer as RBW = 3KHz, VBW = 10KHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat above procedures until all frequency measured were complete.

10.5 Measurement Result:

Frequency MHz	RF Power Density Reading (dBm)	Cable loss (dB)	RF Power Density Level (dBm)	Maximum Limit (dBm)
2402	-8.49	0.10	-8.39	8
2441	-8.60	0.10	-8.50	8
2480	-9.31	0.10	-9.21	8

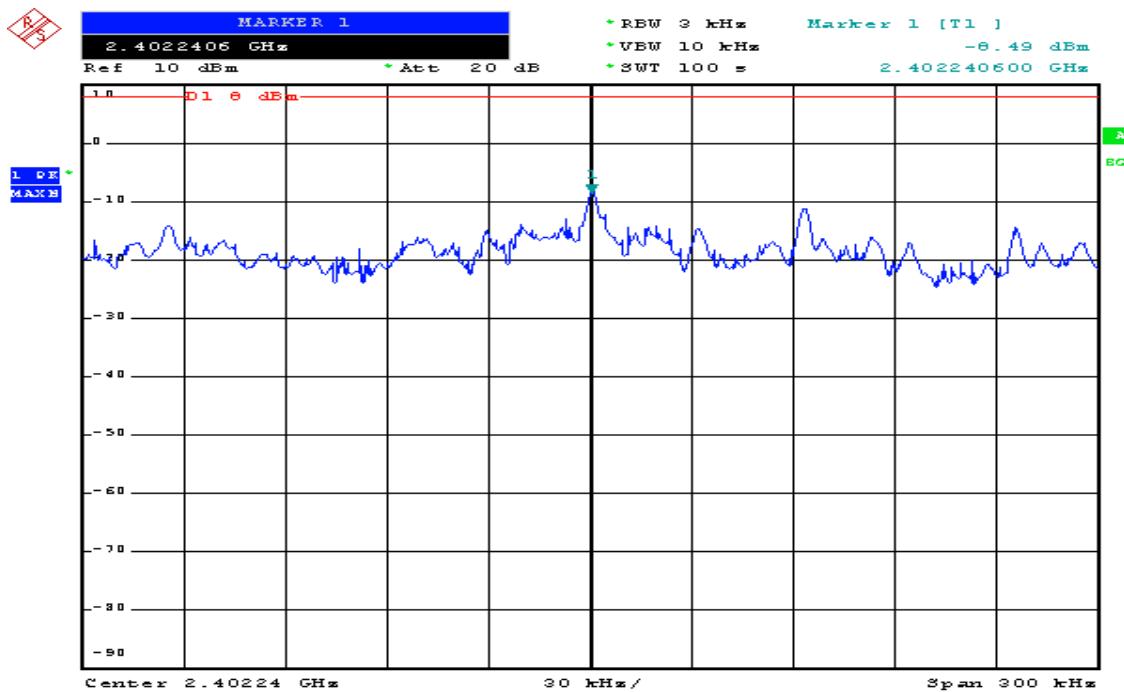
Uncertainty values: 1.3 dB

Note: Refer to next page for plots.

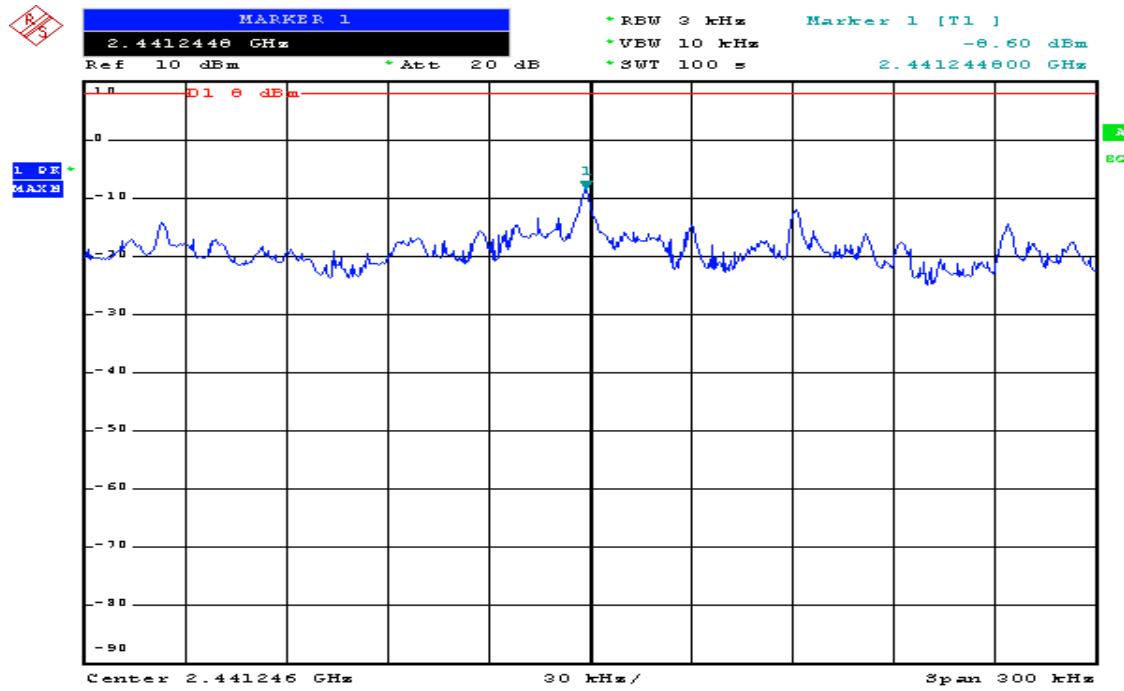
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Power Spectral Density Test Plot (CH-Low)

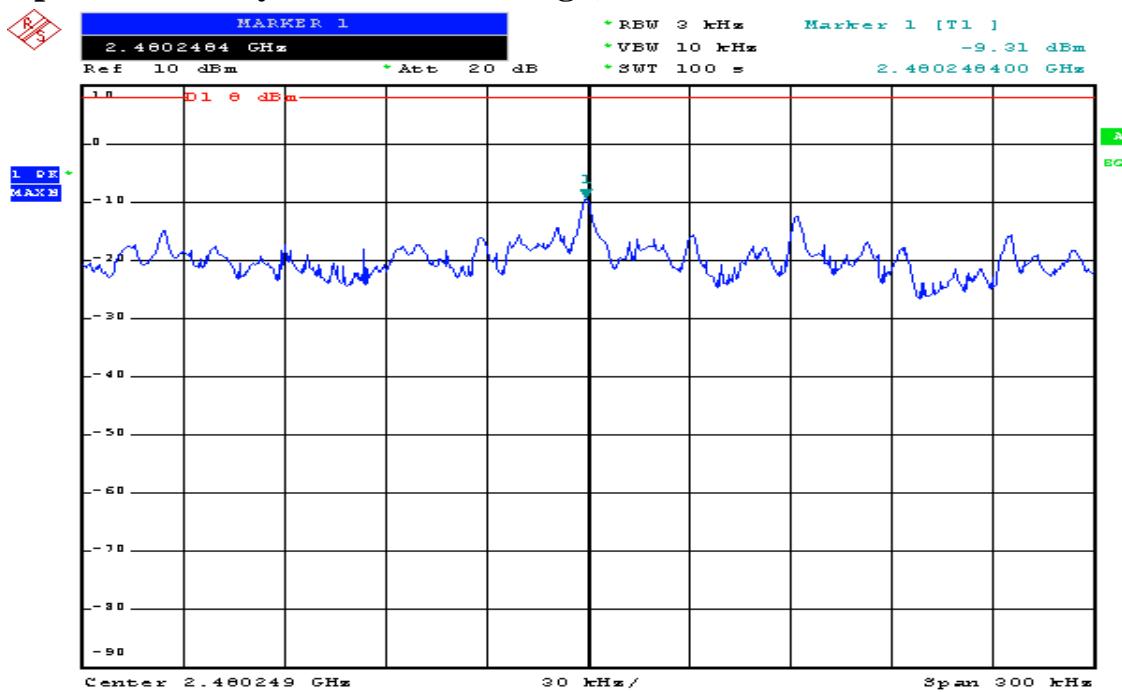


Power Spectral Density Test Plot (CH-Mid)



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Power Spectral Density Test Plot (CH-High)

Date: 4.OCT.2010 16:09:35

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11 ANTENNA REQUIREMENT

11.1. Standard Applicable:

According to §15.203, Antenna requirement.

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

11.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is 1.36 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

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