



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Portable Navigator

Model: Mio C720; Mio C320; Mio C520

Trade Name: Mio DigiWalker

Prepared for

Mitac International Corporation

6th Fl., No. 187, Tiding Blvd., Sec. 2, Nei-Hu, Taipei, Taiwan, R.O.C.

Issued by

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Lab. Code: 200581-0

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1. TEST RESULT CERTIFICATION

Applicant: Mitac International Corporation
6th Fl., No. 187, Tiding Blvd., Sec. 2, Nei-Hu, Taipei, Taiwan,
R.O.C.

Equipment Under Test: Portable Navigator

Trade Name: Mio DigiWalker

Model: Mio C720; Mio C320; Mio C520

Date of Test: From December 20, 2006 to January 5, 2007

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We here by certify that:

The above equipment was tested by Compliance Certification Services Inc. 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 the requirements of FCC Rules Part 15.207, 15.209, 15.247.

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

Approved by:

Miro Chuen
Section Manger
Compliance Certification Service Inc.

Reviewed by:

Lin Zhang
EMC Supervisor
Compliance Certification Service Inc.



2. COMPLIANCE CERTIFICATION SERVICES INC. EUT DESCRIPTION

Product	Portable Navigator
Trade Name	Mio DigiWalker
Model Number	Mio C720; Mio C320; Mio C520
Model Discrepancy	All the above models are identical except the model designation.
Bluetooth module Model Number	BC41B143A
Bluetooth module Brand name	CSR
Power Supply	For AC adapter: Trade name: PHIHONG Model number: PSAA05R-050 Input: AC 100-240V, 50~60Hz, 0.3A Output: DC 5V, 1A; For DC adapter: Trade name: Atech Model number: PCC609050100 Input: DC 10-30V, 3A Output: DC 5V, 1A;
Frequency Range	2402 ~ 2480 MHz
Transmit Power	0.33 dBm
Modulation Technique	FHSS
Transmit Data Rate	1Mbps
Number of Channels	79 Channels
Antenna Specification	Chip Antenna / Gain: -3.50 dBi

Remark: This submittal(s) (test report) is intended for FCC ID: P4Q-MIOC720 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

EUT CONFIGURATION

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

EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

MODIFICATION

N/A



FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

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

² Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field 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 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, 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.

DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

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

The field strength of spurious radiation emission was measured in the following position:

Mode 1: Charging Mode laid in Horizontal

Mode 2: PC Link Mode laid in Horizontal

Mode 3: Charging Mode laid in Vertical

Mode 4: PC Link Mode laid in Vertical

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

Mode 1 Channel Low (2402MHz) 、 Mid (2441MHz) and High (2480MHz) were chosen for full testing.



4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



5. FACILITIES AND ACCREDITATIONS

FACILITIES

All measurement facilities used to collect the measurement data are located at CCS China Kunshan Lab at 10#Weiye Rd, Innovation Park Eco. & Tec. Development Zone Kunshan city JiangSu, (215300), CHINA.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.




All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200581-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (Registration no: 93105 and 90471).



TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP	EN 55022, EN 61000-3-2, EN 61000-3-3, EN550024, EN 61000-4-2, EN 61000-4-3, EN61000-4-4, EN 61000-4-5, EN 61000-4-6, IEC 61000-4-8, EN 61000-4-11 ANSI C63.4, CISPR16-1, IEC61000-3-2, IEC61000-3-3, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11	 Lab. Code: 200581-0
USA	FCC	3/10 meter Sites to perform FCC Part 15/18 measurements	 93105, 90471
Japan	VCCI	3/10 meter Sites and conducted test sites to perform radiated/conducted measurements	 R-1600 C-1707

** No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.*



6. SETUP OF EQUIPMENT UNDER TEST

SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

SUPPORT EQUIPMENT

No	Equipment	Model	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	SD card	128MB	N/A	DoC	Kingston	N/A	N/A

Remark:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*



7. FCC PART 15.247 REQUIREMENTS

PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

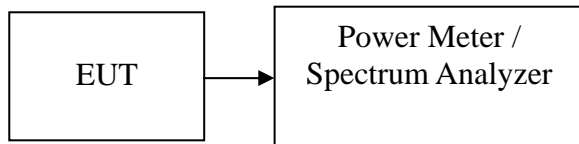
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007
Peak and Avg Power Sensor	Agilent	E9327A	US40441788	07/29/2007
EPM-P Series Power Meter	Agilent	E4416A	QB41292714	07/29/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter.

TEST RESULTS

No non-compliance noted

Test Data

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-1.17	1.50	0.33	0.00108	1	PASS
Mid	2441	-1.24	1.50	0.26	0.00106		PASS
High	2480	-1.93	1.50	-0.43	0.00091		PASS

BAND EDGES MEASUREMENT

LIMIT

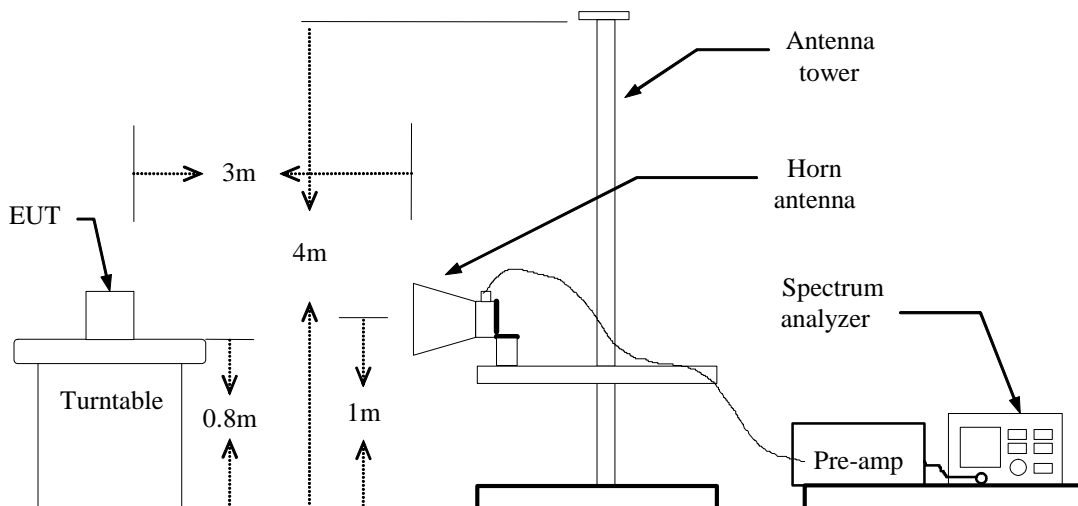
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains 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).

MEASUREMENT EQUIPMENT USED

977 Chamber (3m)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007
Pre-Amplifier	Miteq	NSP4000-NF	870731	01/21/2007
Horn Antenna	Austriah	BBHA9120D	D267	02/03/2007
Turn Table	CT	CT123	4162	N.C.R
Antenna Tower	CT	CTERG23	3253	N.C.R
Controller	CT	CT100	95635	N.C.R
Coax Switch	Anitsu	MP 598	M 80094	N/A
Site NSA	CCS Lab.	N/A	N/A	02/15/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out



- the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
 5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

CH LOW

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Peak Margin (dB)	AV Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)				
2390.00	V	39.58	27.83	4.80	44.38	32.63	74	54	-29.62	-21.37
	V									
2390.00	H	39.91	27.7	4.80	44.71	32.5	74	54	-29.29	-21.5
	H									

CH HIGH

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Peak Margin (dB)	AV Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)				
2483.50	V	47.11	31.04	4.80	51.91	35.84	74	54	-22.09	-18.16
	V									
2483.50	H	48.07	32.09	4.80	52.87	36.89	74	54	-21.13	-17.11
	H									

Refer to attach spectrum analyzer data chart.

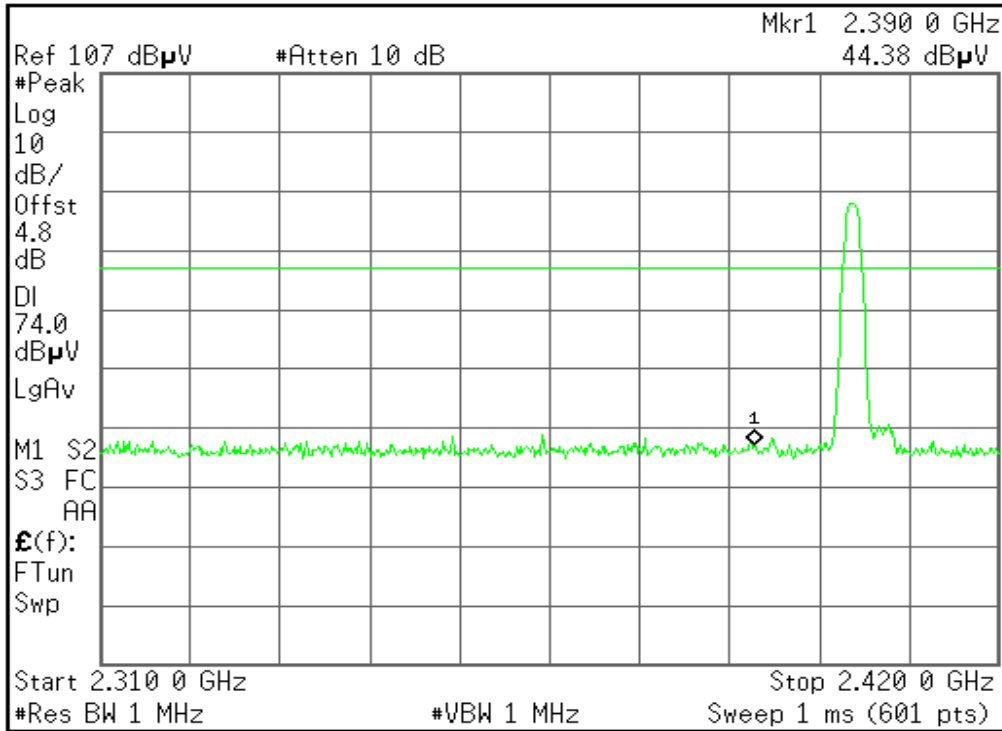


Band Edges (CH Low)

Detector mode: Peak

Polarity: Vertical

Agilent 15:47:20 Jan 3, 2007



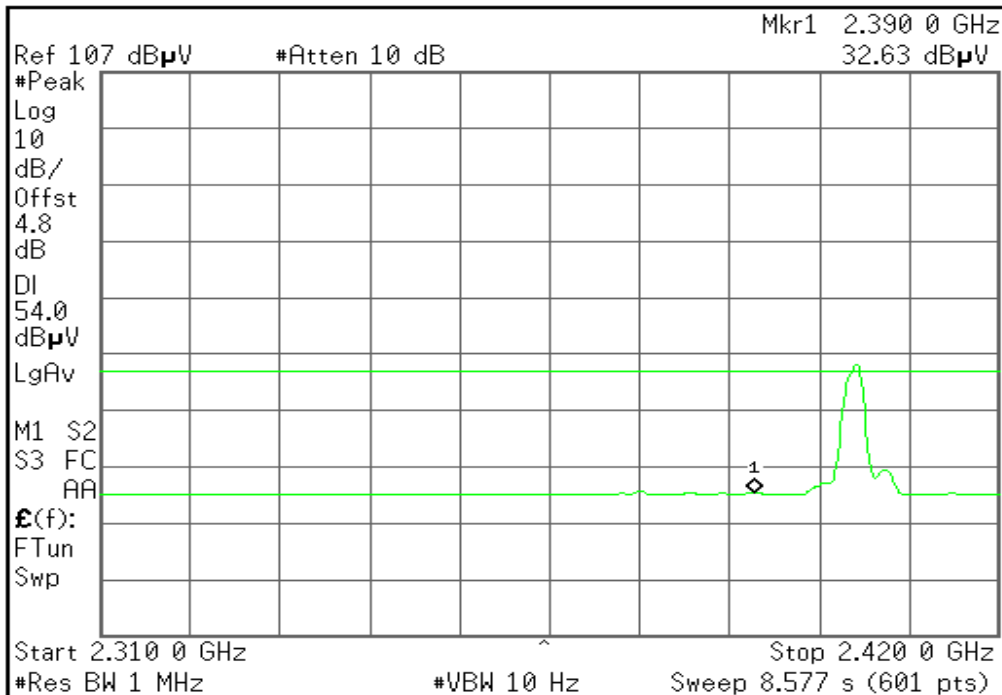
Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)	Ref			
Span Pair	Span	Center		
Off				
More	1 of 2			

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Detector mode: Average

Polarity: Vertical

Agilent 15:51:26 Jan 3, 2007



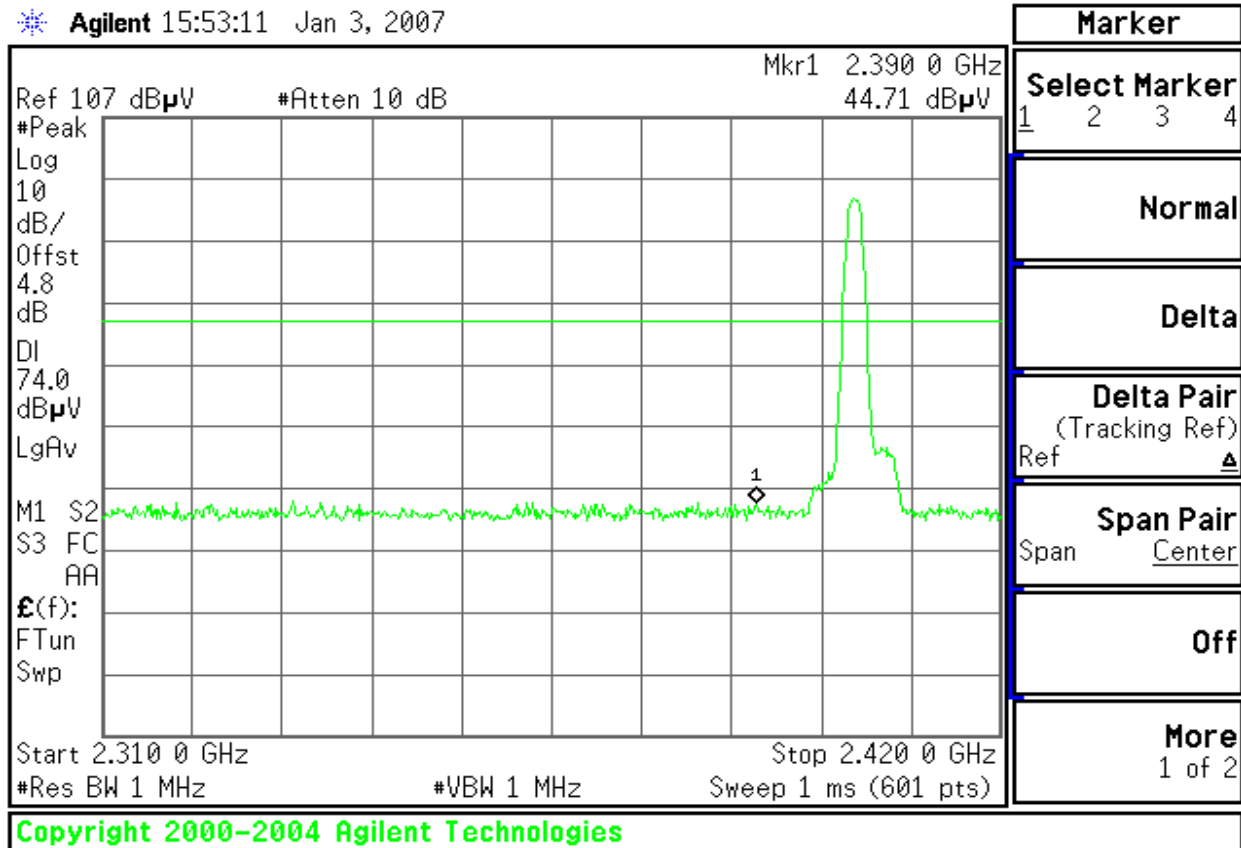
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Select Marker	1	2	3	4
Normal				
Delta				
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Span Pair	Span	Center		
Off				
More	1 of 2			

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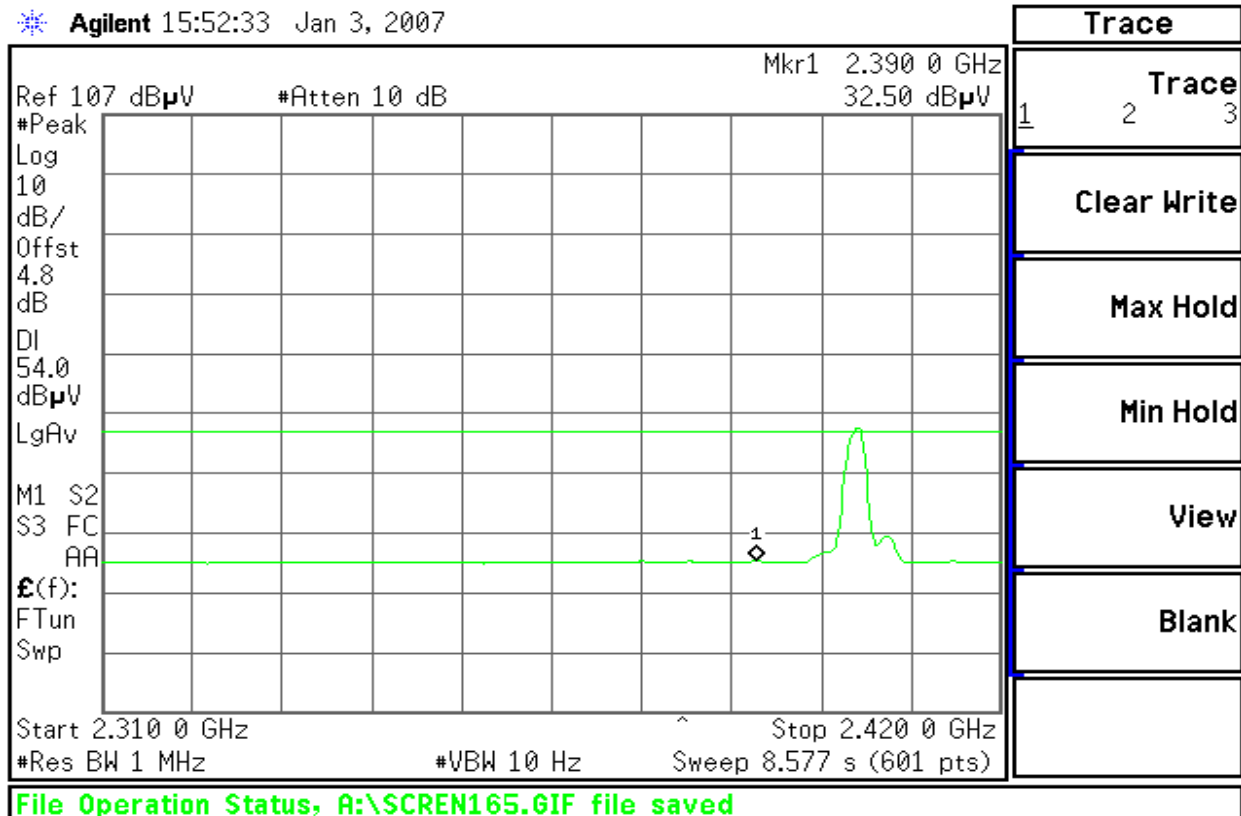
Detector mode: Peak Polarity: Horizontal

Agilent 15:53:11 Jan 3, 2007



Detector mode: Average Polarity: Horizontal

Agilent 15:52:33 Jan 3, 2007



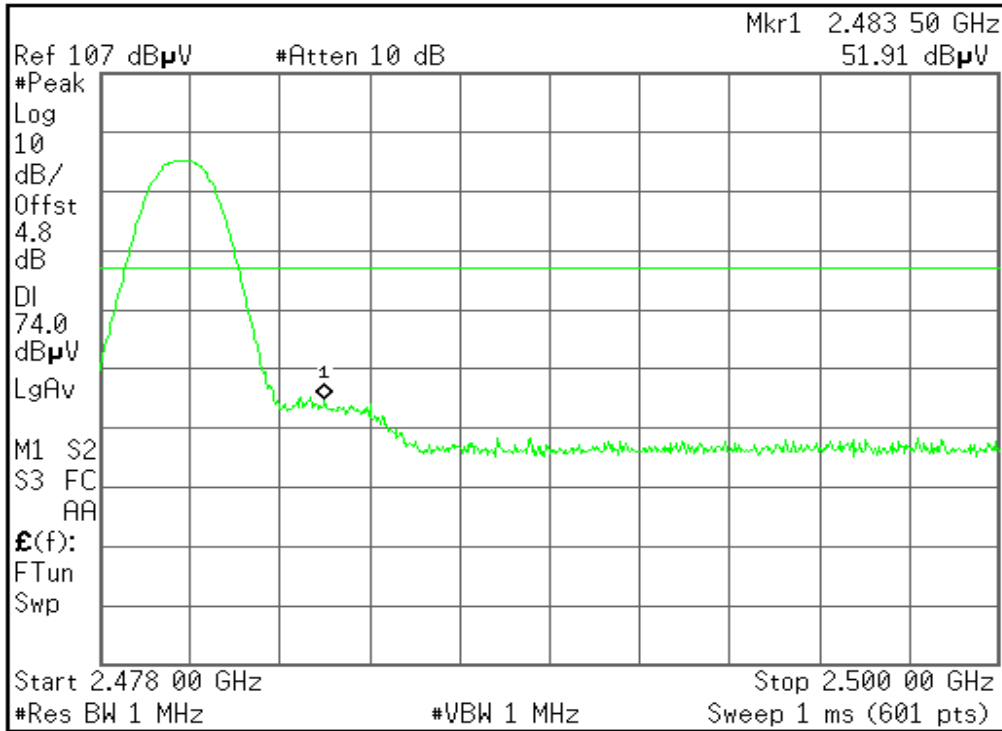


Band Edges (CH High)

Detector mode: Peak

Polarity: Vertical

Agilent 15:59:09 Jan 3, 2007



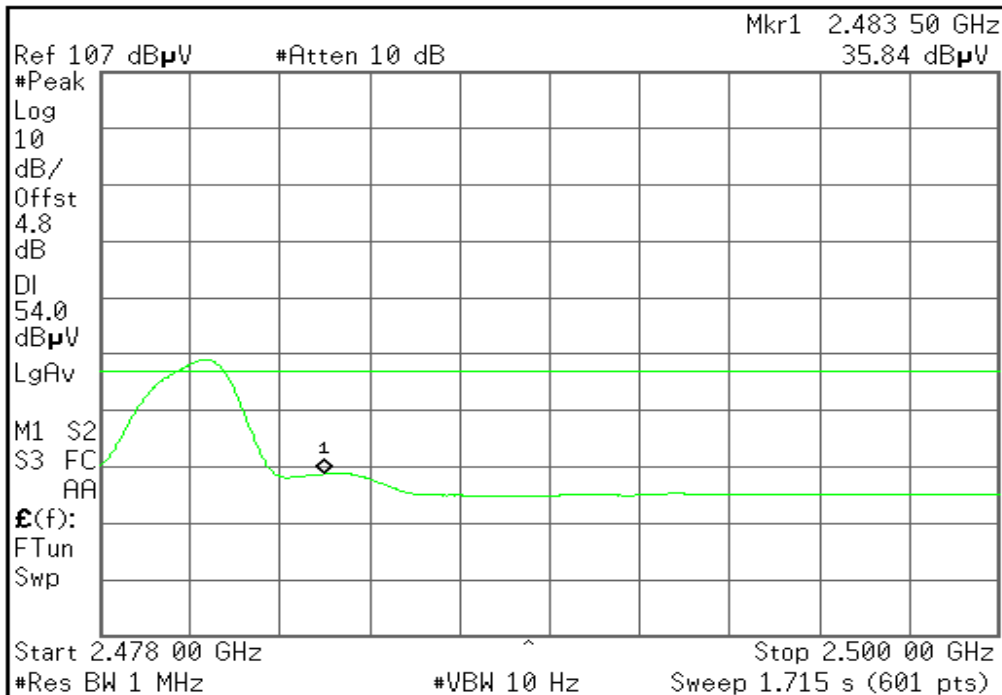
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Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)	Ref			
Span Pair	Span	Center		
Off				
More	1 of 2			

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Detector mode: Average

Polarity: Vertical

Agilent 15:58:26 Jan 3, 2007



Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)	Ref			
Span Pair	Span	Center		
Off				
More	1 of 2			

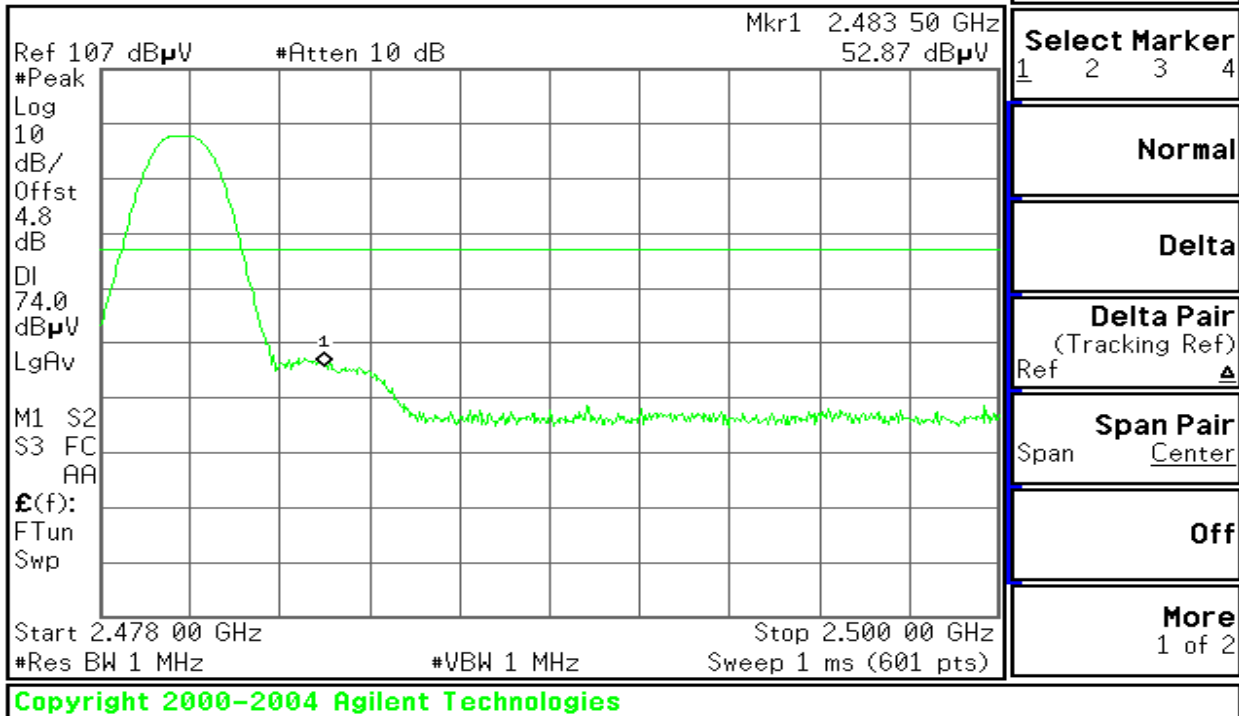
Copyright 2000-2004 Agilent Technologies



Detector mode: Peak

Polarity: Horizontal

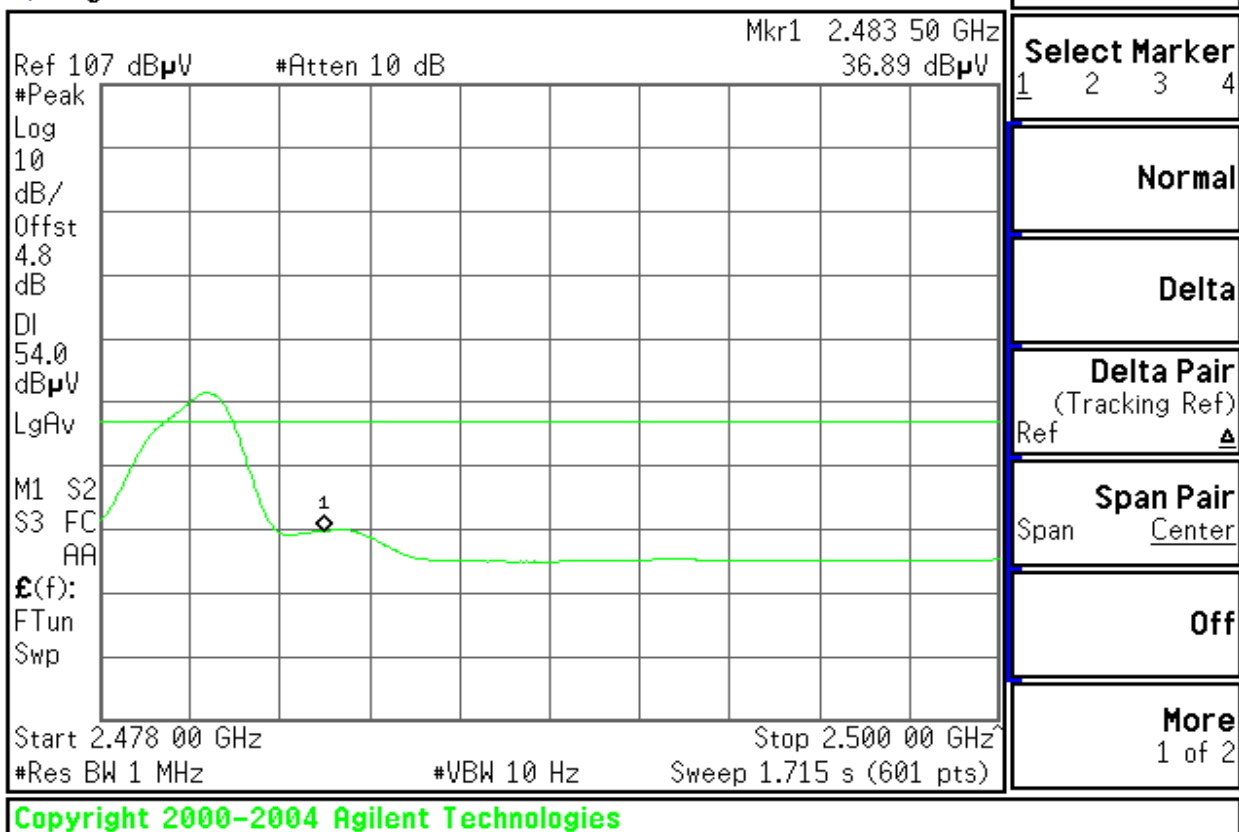
Agilent 15:57:03 Jan 3, 2007



Detector mode: Average

Polarity: Horizontal

Agilent 15:57:34 Jan 3, 2007





PEAK POWER SPECTRAL DENSITY

LIMIT

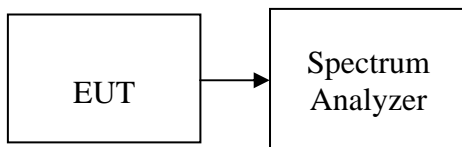
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST 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 the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

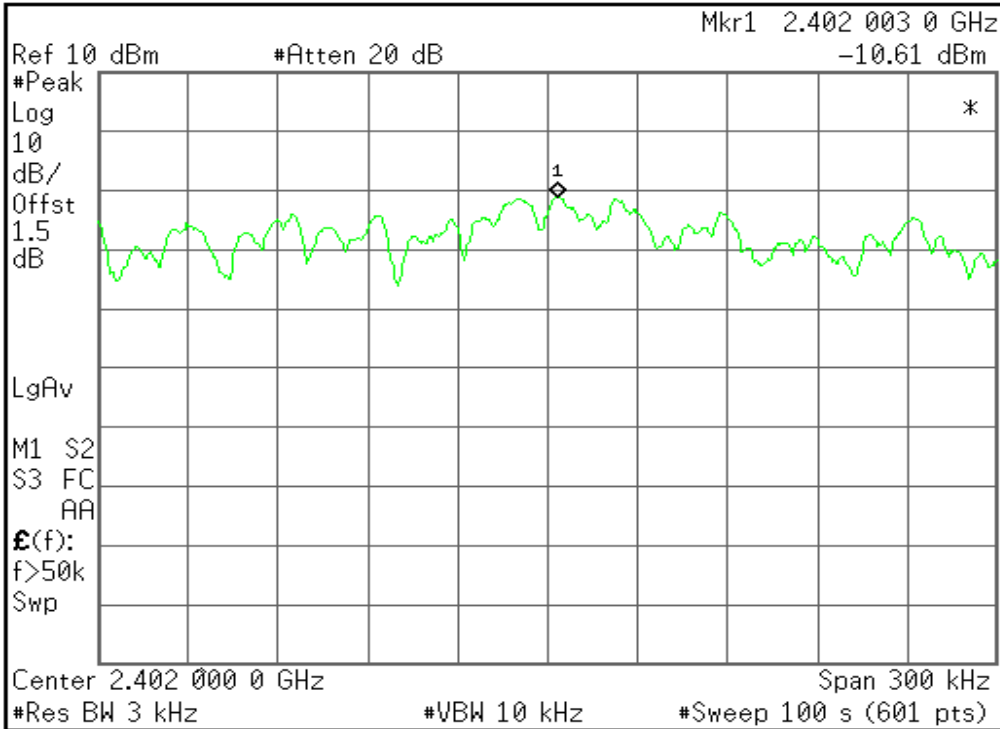
Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-12.11	1.50	-10.61	8.00	PASS
Mid	2441	-12.60	1.50	-11.10		PASS
High	2480	-12.72	1.50	-11.22		PASS



Test Plot

PPSD (CH Low)

Agilent 14:55:24 Jan 3, 2007

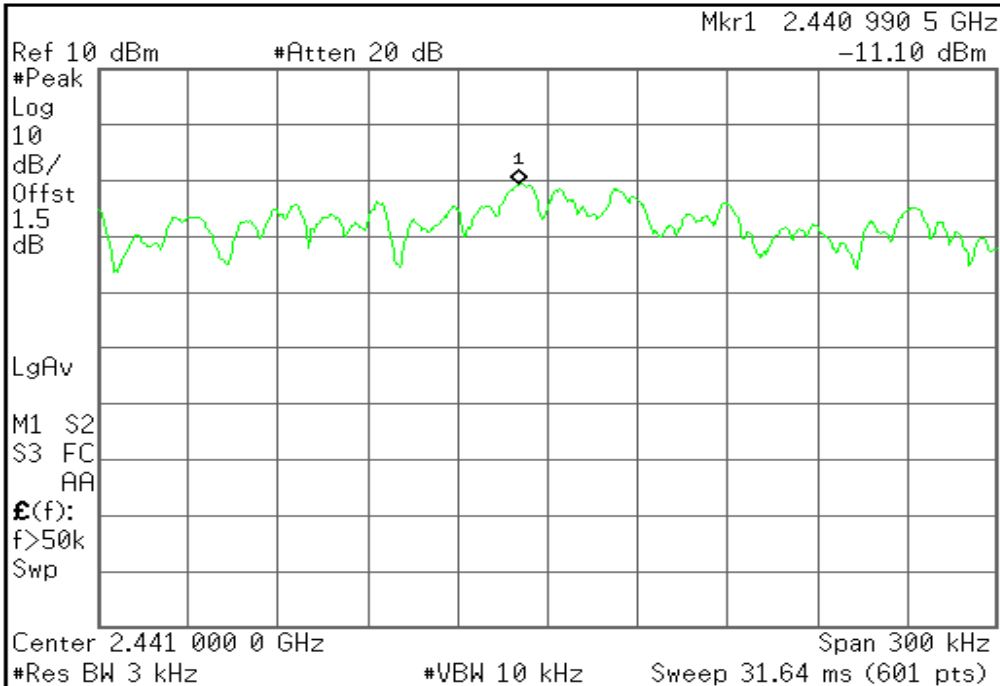


Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)				
Ref				▲
Span Pair				
Span				Center
Off				
More 1 of 2				

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PPSD (CH Mid)

Agilent 14:30:10 Jan 3, 2007



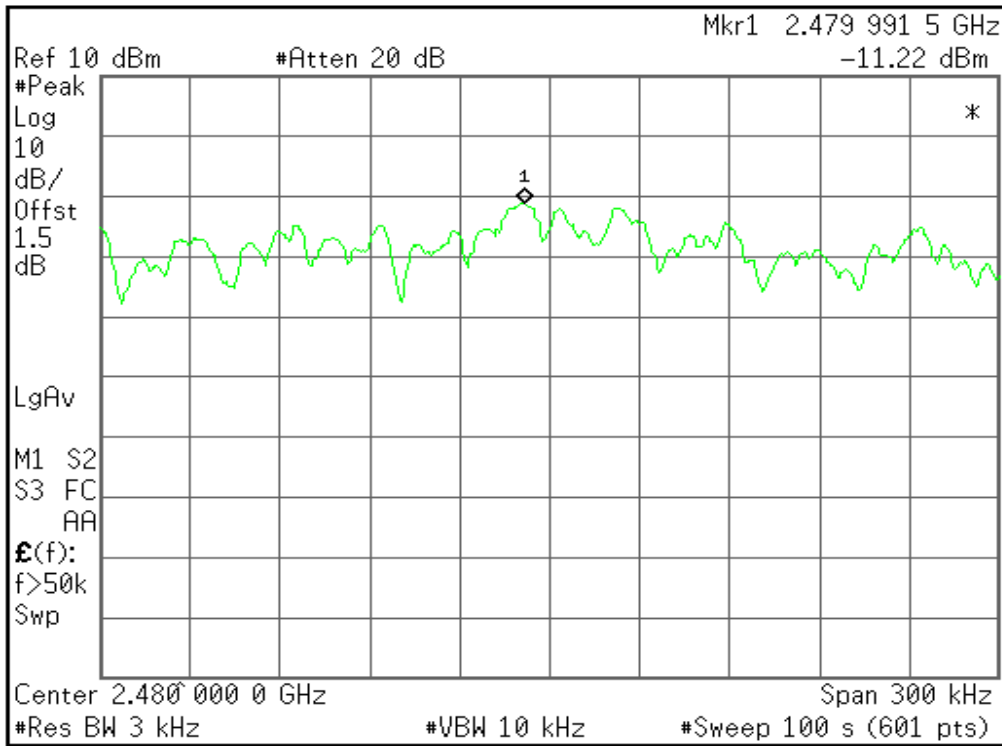
Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)				
Ref				▲
Span Pair				
Span				Center
Off				
More 1 of 2				

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PPSD (CH High)

Agilent 14:26:14 Jan 3, 2007



Marker			
Select Marker			
1	2	3	4
Normal			
Delta			
Delta Pair (Tracking Ref)			
Ref	▲		
Span Pair			
Span	Center		
Off			
More 1 of 2			

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FREQUENCY SEPARATION

LIMIT

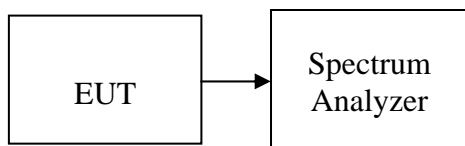
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST 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 = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

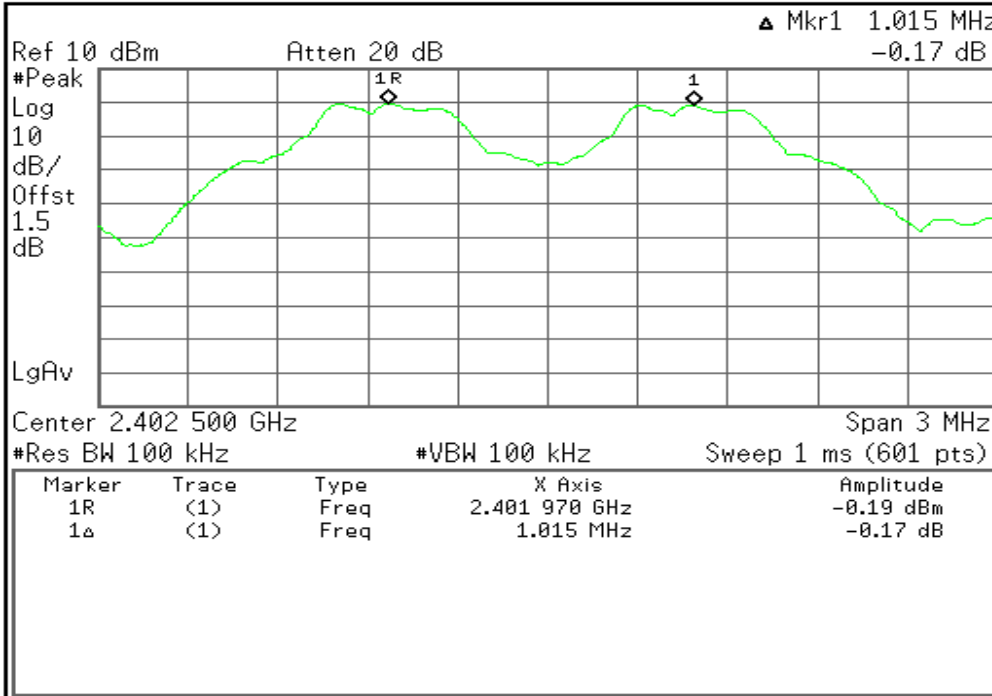
Channel Separation (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
1.015	1115	>25	Pass



Test Plot

Measurement of Channel Separation

Agilent 12:33:04 Jan 3, 2007

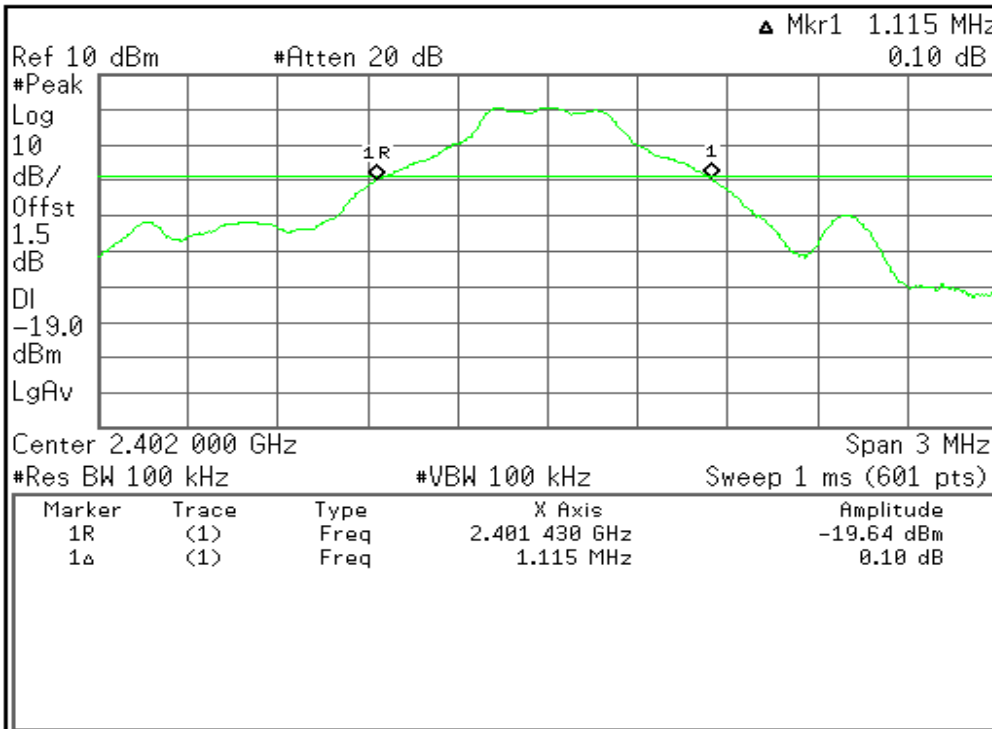


Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)				
Ref				▲
Span Pair				
Span				Center
Off				
More				1 of 2

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Measurement of 20dB Bandwidth

Agilent 14:54:04 Jan 3, 2007



Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref)				
Ref				▲
Span Pair				
Span				Center
Off				
More				1 of 2

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NUMBER OF HOPPING FREQUENCY

LIMIT

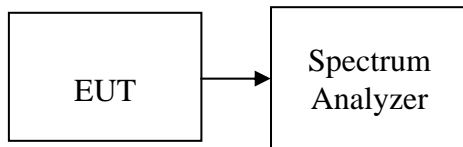
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST 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 spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = auto and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=100kHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

Test Data

Result (No. of CH)	Limit (No. of CH)	Result
79	>75	PASS

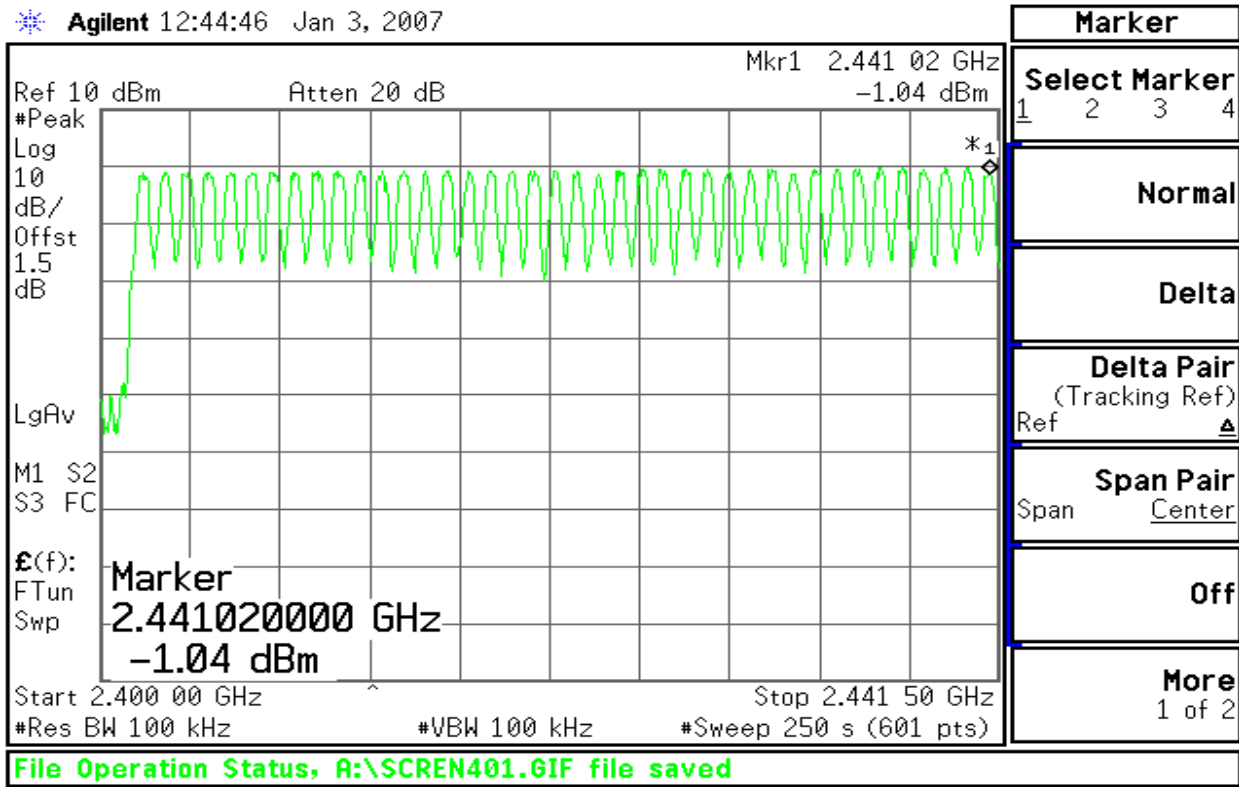


Test Plot

Channel Number

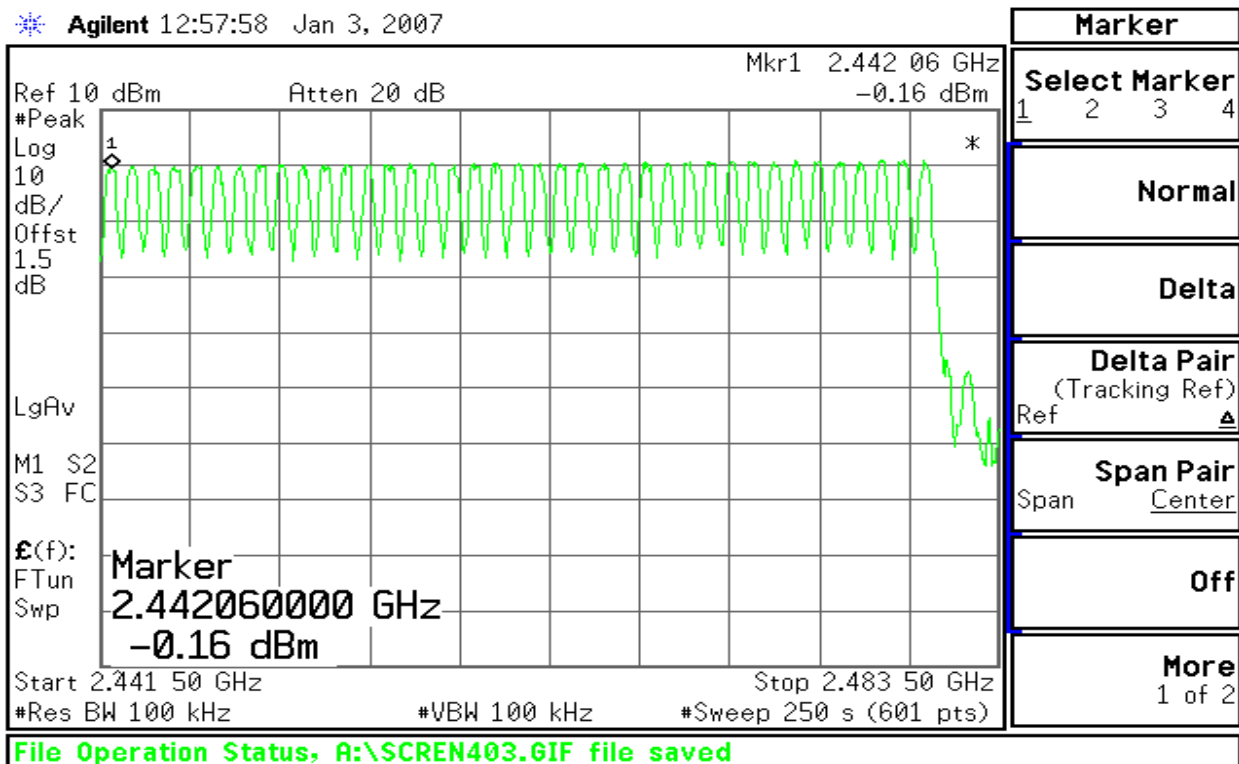
2.4 GHz – 2.4415 GHz

Agilent 12:44:46 Jan 3, 2007



2.4415 GHz – 2.4835 GHz

Agilent 12:57:58 Jan 3, 2007





TIME OF OCCUPANCY (DWELL TIME)

LIMIT

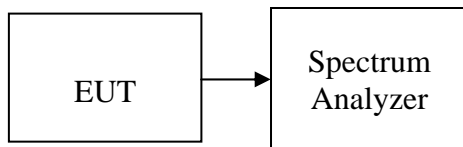
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST 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=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.



TEST RESULTS

No non-compliance noted

Test Data

DH 1

$$0.433 * (1600/2)/79 * 31.6 = 138.56 \text{ (ms)}$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
0.433	138.56	31.60	400.00	PASS

DH 3

$$1.70 * (1600/4)/79 * 31.6 = 272.00 \text{ (ms)}$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
1.70	272.00	31.60	400.00	PASS

DH 5

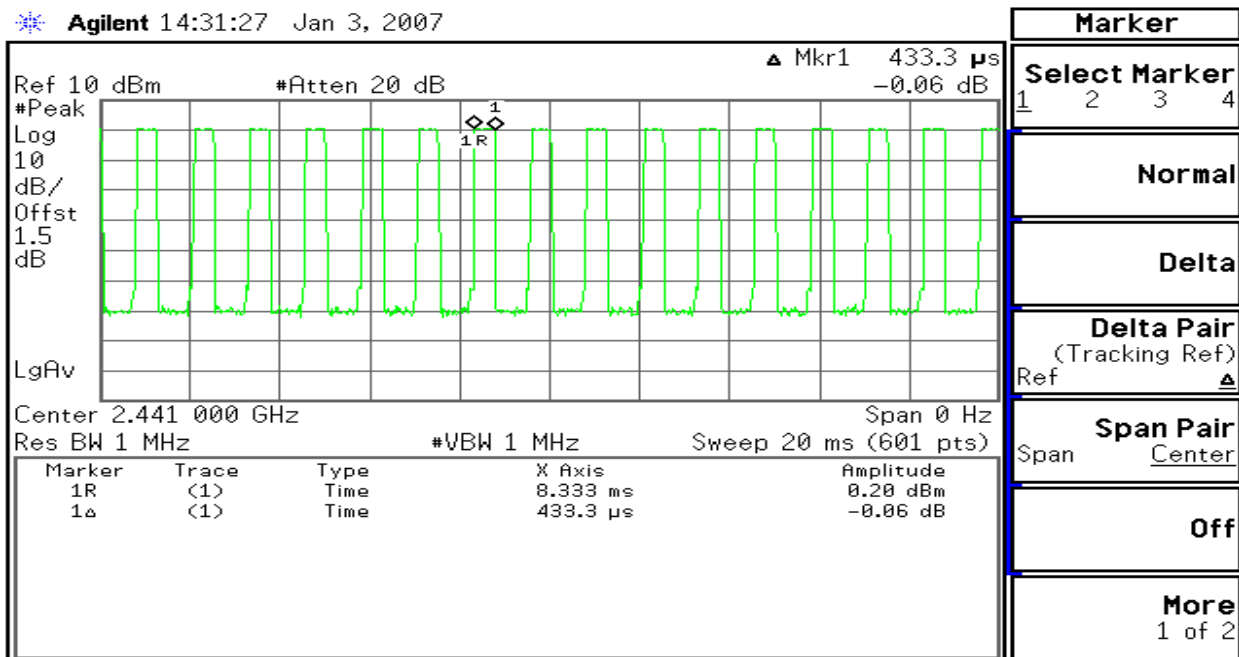
$$2.933 * (1600/6)/79 * 31.6 = 312.85 \text{ (ms)}$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2.933	312.85	31.60	400.00	PASS

Test Plot

DH 1

Agilent 14:31:27 Jan 3, 2007

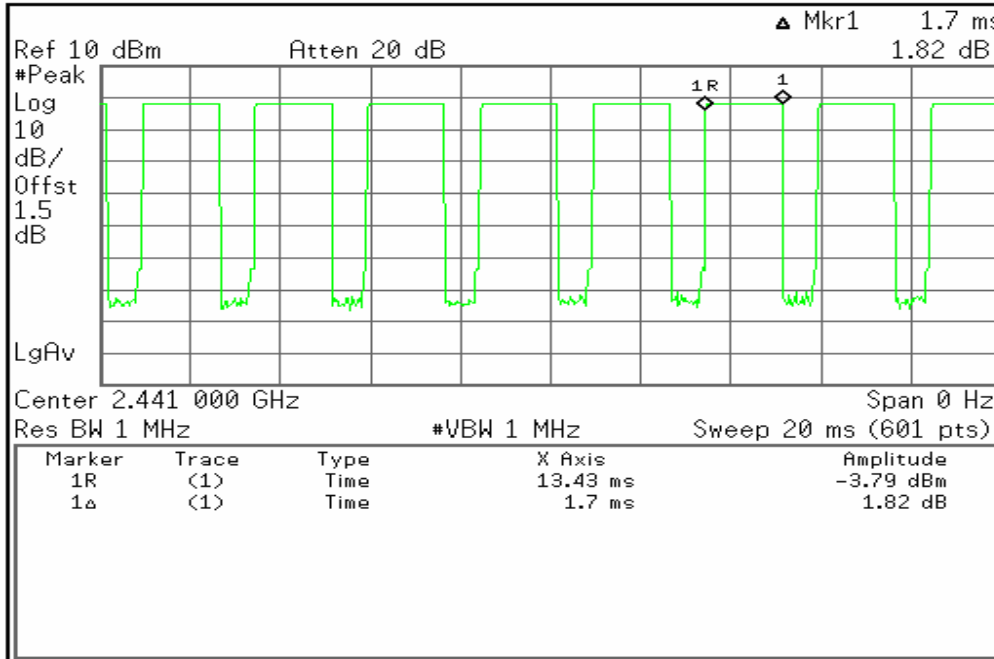


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DH 3

Agilent 16:12:06 Jan 3, 2007

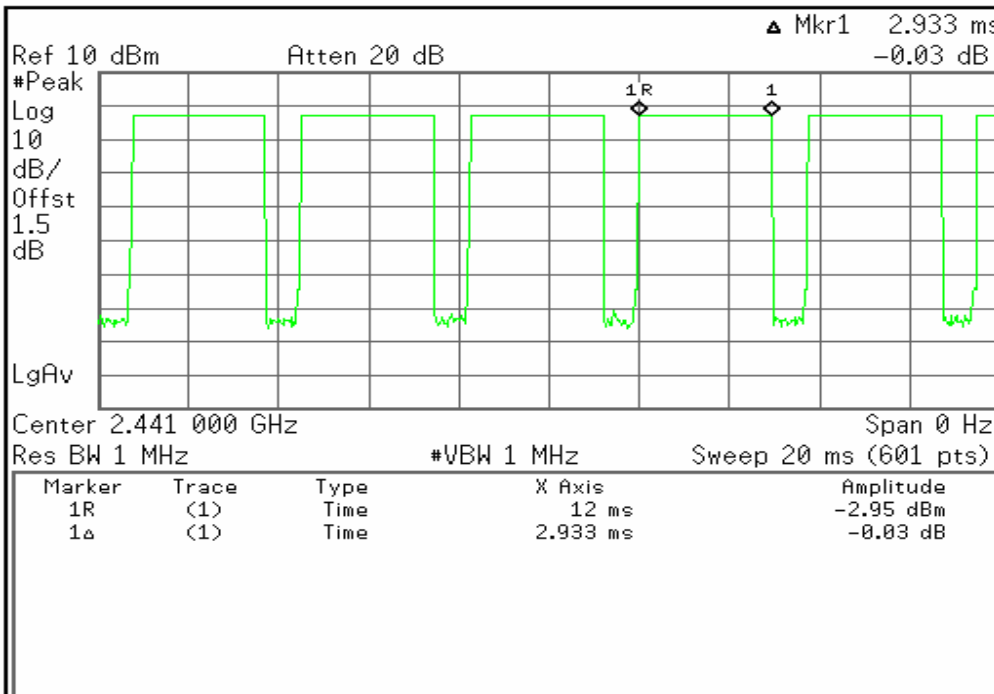


Marker			
Select Marker			
1	2	3	4
Normal			
Delta			
Delta Pair (Tracking Ref)			
Ref			▲
Span Pair			
Span	Center		
Off			
More 1 of 2			

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DH 5

Agilent 16:17:08 Jan 3, 2007



Marker			
Select Marker			
1	2	3	4
Normal			
Delta			
Delta Pair (Tracking Ref)			
Ref			▲
Span Pair			
Span	Center		
Off			
More 1 of 2			

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RADIO FREQUENCY EXPOSURE

LIMIT

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 levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	GPS Tracking System
Frequency band (Operating)	<input type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input checked="" type="checkbox"/> Others: <u>Bluetooth: 2.402GHz ~ 2.480GHz</u>
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure ($S = 5mW/cm^2$) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ($S=1mW/cm^2$)
Antenna diversity	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
Max. output power	0.33dBm (1.079mW)
Antenna gain (Max)	-3.50 dBi (Numeric gain: 0.447mW)
Evaluation applied	<input type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation <input checked="" type="checkbox"/> N/A

Remark:

1. The maximum output power is 0.33dBm (1.079mW) at 2402MHz (with 0.447 numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.

TEST RESULTS

Non-compliance.



SPURIOUS EMISSIONS

Conducted Measurement

LIMIT

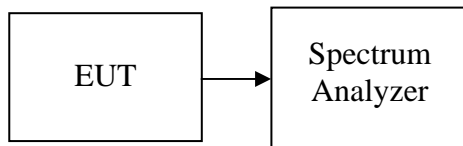
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 100 KHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

No non-compliance noted

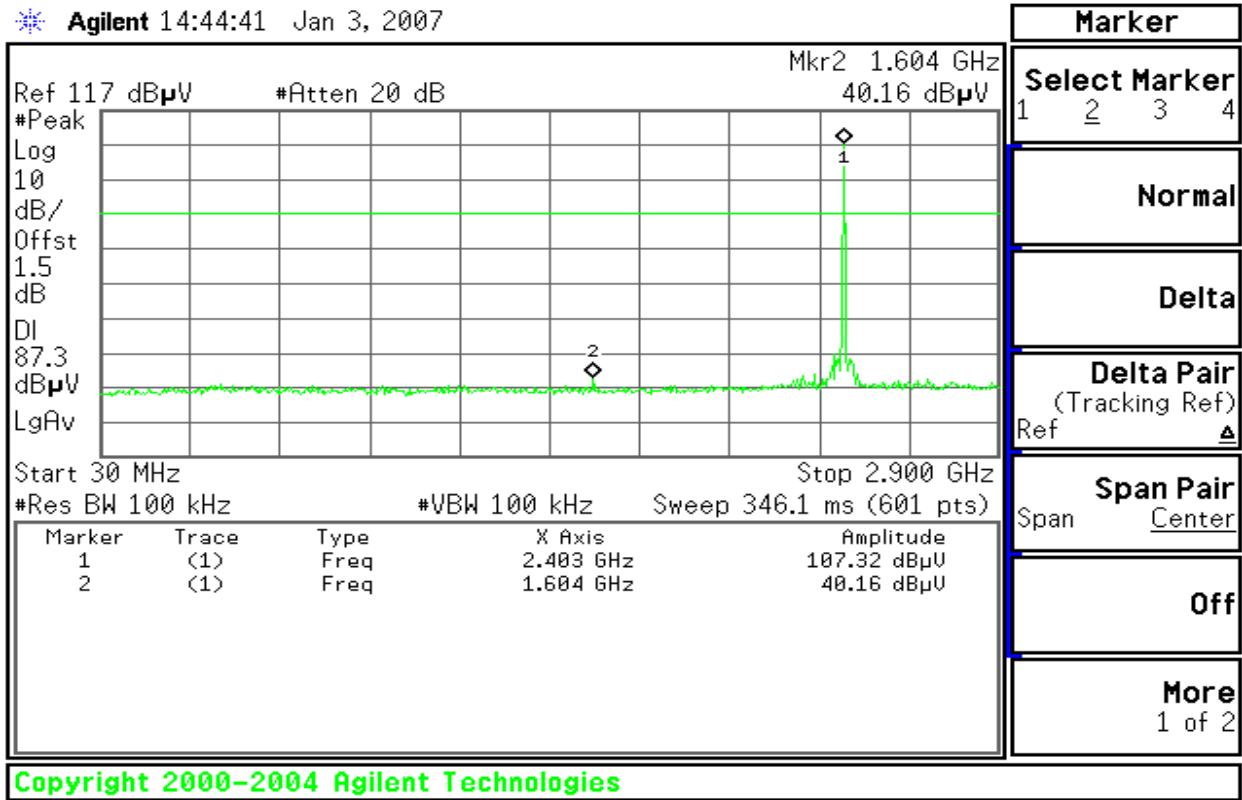


Test Plot

CH Low

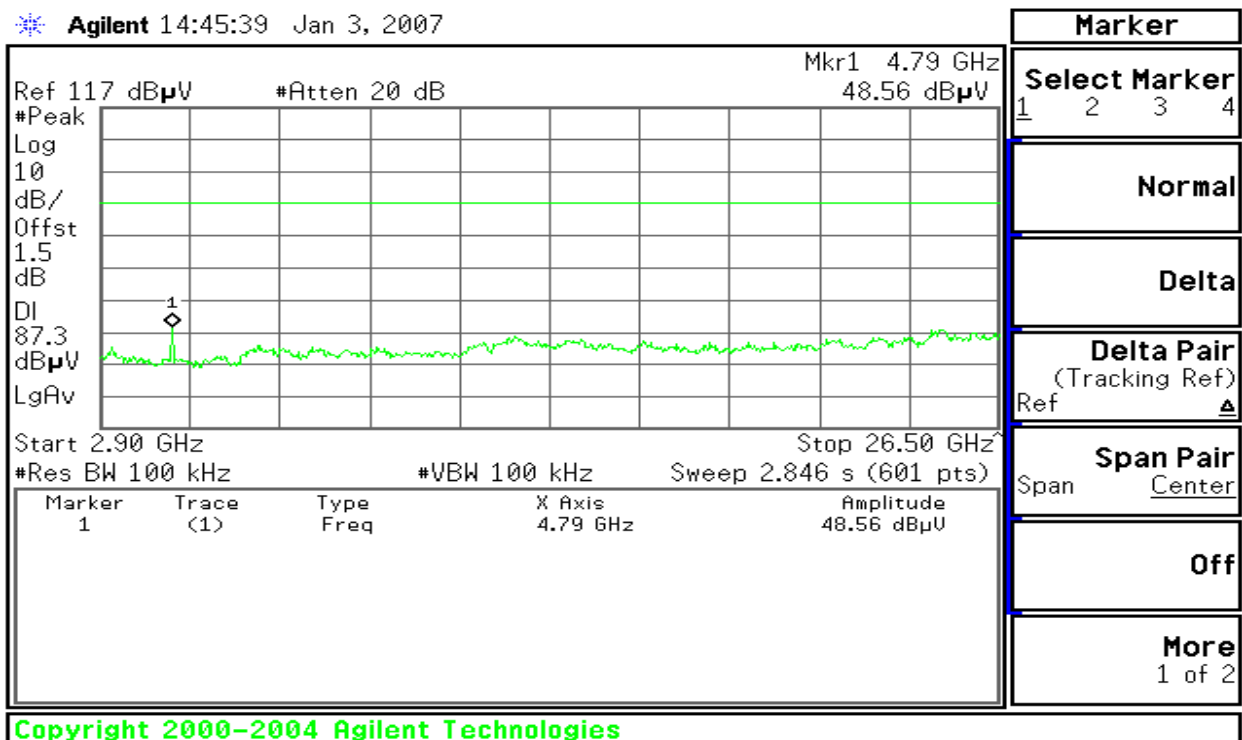
30MHz ~ 2.9GHz

Agilent 14:44:41 Jan 3, 2007



2.9GHz ~ 26.5GHz

Agilent 14:45:39 Jan 3, 2007

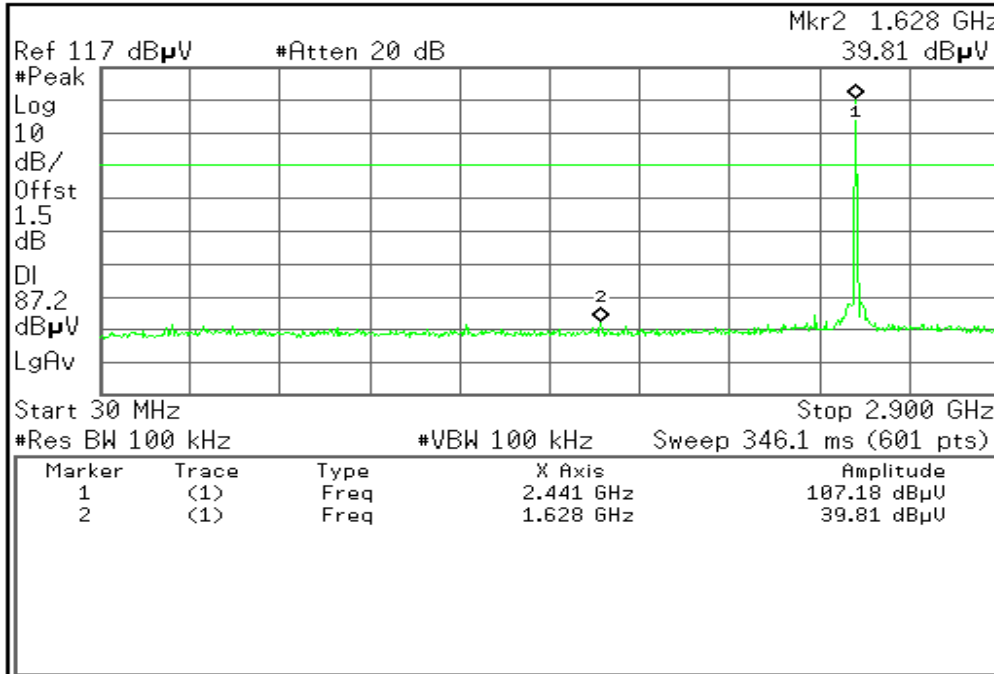




CH Mid

30MHz ~ 2.9GHz

Agilent 14:34:07 Jan 3, 2007



Marker

Select Marker 1 2 3 4

Normal

Delta

Delta Pair (Tracking Ref) Ref ▲

Span Pair Center

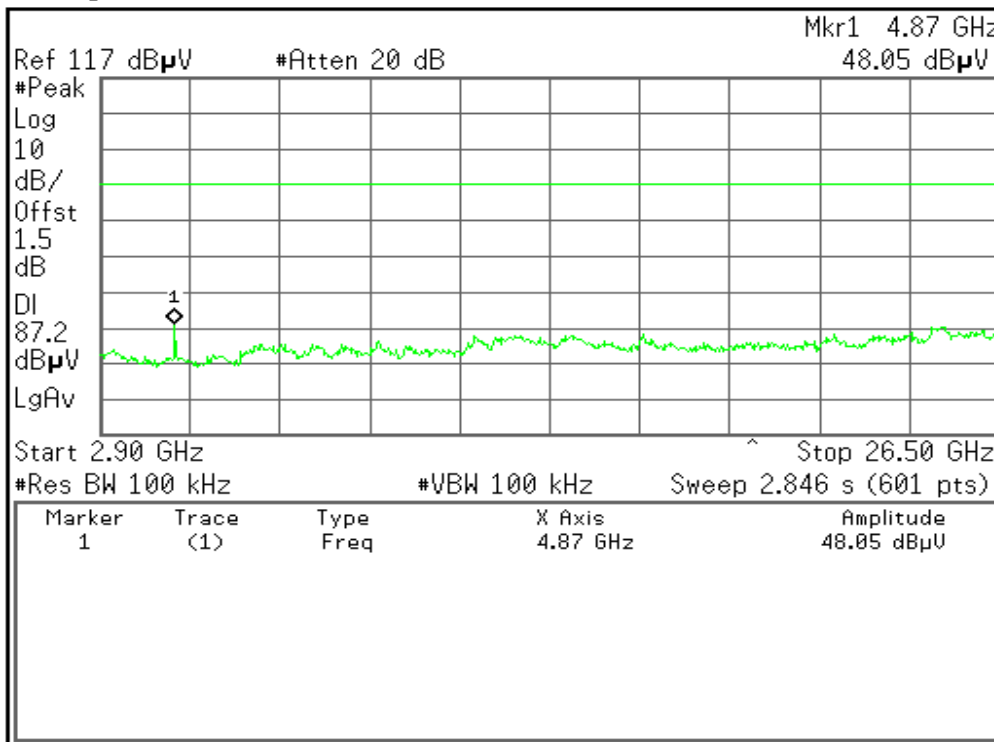
Off

More 1 of 2

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2.9GHz ~ 26.5GHz

Agilent 14:35:33 Jan 3, 2007



Marker

Select Marker 1 2 3 4

Normal

Delta

Delta Pair (Tracking Ref) Ref ▲

Span Pair Center

Off

More 1 of 2

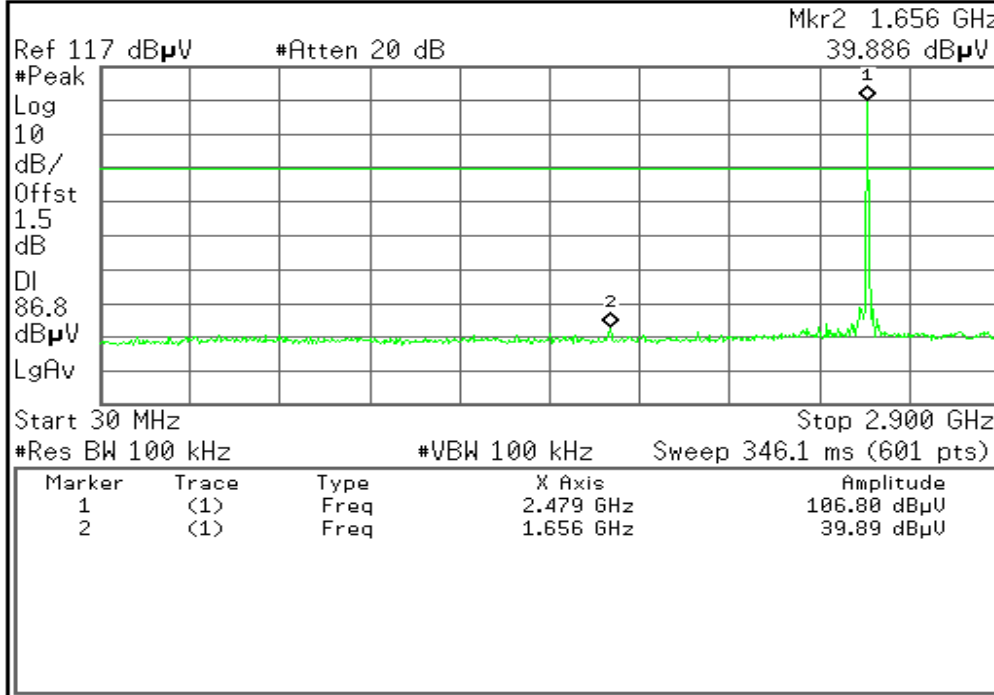
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CH High

30MHz ~ 2.9GHz

Agilent 14:18:44 Jan 3, 2007

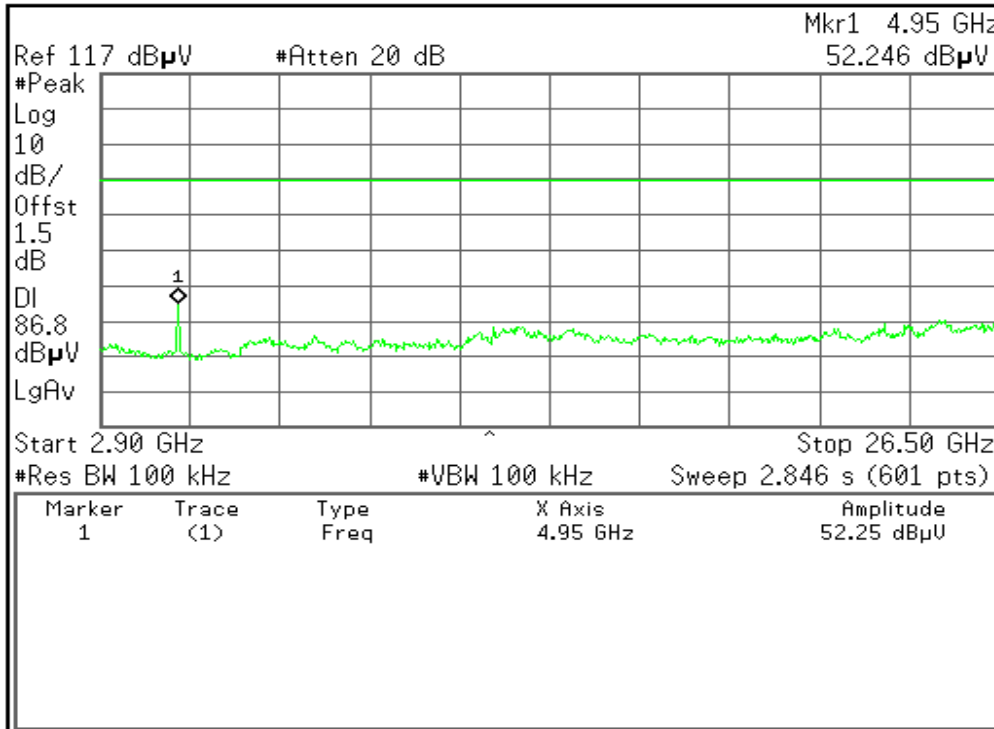


Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref) Ref ▲				
Span Pair Center				
Off				
More 1 of 2				

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2.9GHz ~ 26.5GHz

Agilent 14:19:42 Jan 3, 2007



Marker				
Select Marker	1	2	3	4
Normal				
Delta				
Delta Pair (Tracking Ref) Ref ▲				
Span Pair Center				
Off				
More 1 of 2				

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Radiated Emissions

LIMIT

1. Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (μ V/m at 3-meter)	Field Strength (dB μ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

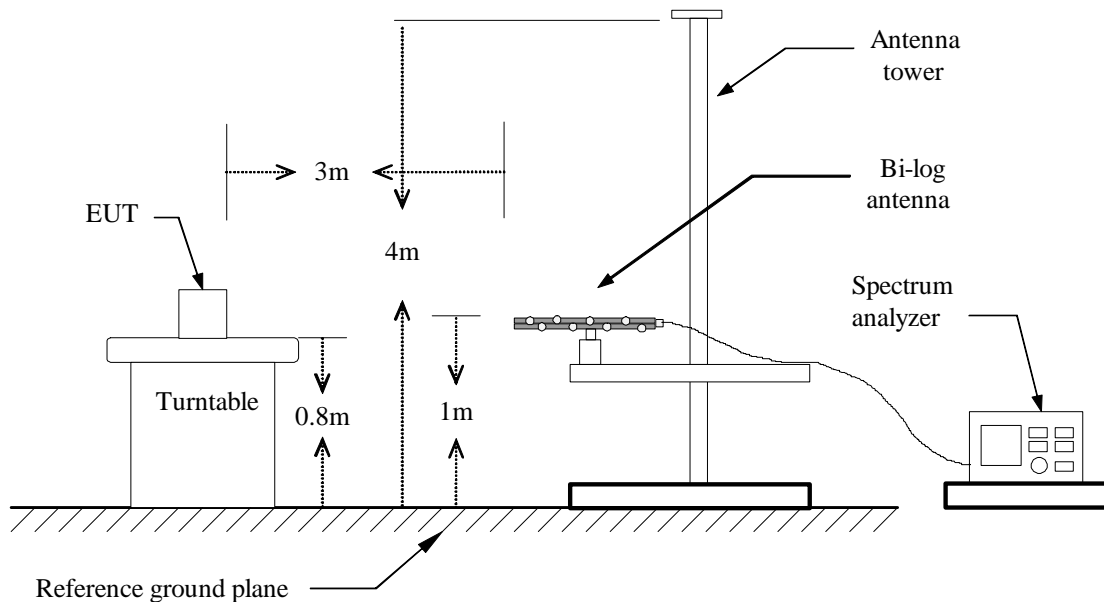
MEASUREMENT EQUIPMENT USED

977 Chamber (3m)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	11/16/2007
ESPI3 EMI RECEIVER	R&S	ESPI3	101026	11/10/2007
Pre-Amplifier	MINI	ZFL-1000VH2	d041703	12/12/2007
Pre-Amplifier	Miteq	NSP4000-NF	870731	01/21/2007
Bi-log Antenna	Sunol Sciences	JB1	A110204-2	11/09/2007
Horn Antenna	Austriah	BBHA9120D	D267	09/20/2007
Turn Table	CT	CT123	4162	N.C.R
Antenna Tower	CT	CTERG23	3253	N.C.R
Controller	CT	CT100	95635	N.C.R
Coax Switch	Anitsu	MP 598	M 80094	N/A
Site NSA	CCS Lab.	N/A	N/A	02/15/2007

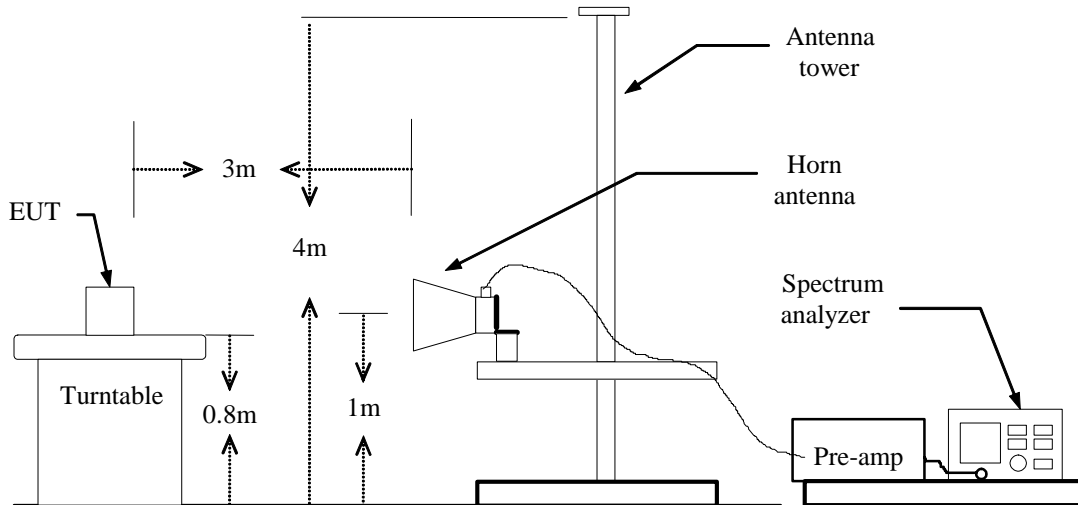
Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Below 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.



TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link

Test Date: January 8, 2007

Temperature: 23°C

Tested by: jeff

Humidity: 47 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
66.79	V	Peak	41.13	-14.4	26.73	40.0	-13.27
200.44	V	Peak	42.72	-9.2	33.52	43.5	-9.98
213.43	V	Peak	44.84	-10.5	34.34	43.5	-9.16
733.47	V	Peak	35.67	1.44	37.11	46.0	-8.89
823.25	V	Peak	29.05	2.86	31.91	46.0	-14.09
868.14	V	Peak	28.96	3.29	32.25	46.0	-13.75
109.54	H	Peak	35.33	-9.91	25.42	43.5	-18.08
200.44	H	Peak	38.07	-9.20	28.87	43.5	-14.63
422.04	H	Peak	39.26	-4.06	35.2	46.0	-10.8
733.47	H	Peak	36.76	1.44	38.2	46.0	-7.8
778.36	H	Peak	34.46	2.25	36.71	46.0	-9.29
823.25	H	Peak	32.73	2.86	35.59	46.0	-10.41

Notes:

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 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.



Above 1 GHz

Operation Mode: TX/ CH Low

Test Date: January 8, 2007

Temperature: 25°C

Tested by: jeff

Humidity: 48 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4800.00	V	40.04	33.41	10.98	51.02	44.39	74	54	-9.61	Avg
7416.67	V	38.13	26.1	17.97	56.1	44.07	74	54	-9.93	Avg
4800.00	H	41.13	32.74	10.98	52.11	43.72	74	54	-10.28	Avg
7416.67	H	37.06	26.22	17.97	55.03	44.19	74	54	-9.81	Avg

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
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 setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



Operation Mode: TX/ CH Mid

Test Date: January 8, 2007

Temperature: 25°C

Tested by: jeff

Humidity: 48 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4883.67	V	38.79	30.99	10.56	49.35	41.55	74	54	-12.45	Avg
7325.00	V	39.3	27.43	15.84	55.14	43.27	74	54	-10.73	Avg
4883.33	H	37.62	30.41	10.56	48.18	40.97	74	54	-13.03	Avg
7324.96	H	38.33	27.05	15.84	54.17	42.89	74	54	-11.11	Avg

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
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 setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



Operation Mode: TX/ CH High

Test Date: January 8, 2007

Temperature: 25°C

Tested by: jeff

Humidity: 48 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4958.33	V	38.48	31.91	11.19	49.67	43.1	74	54	-10.9	Avg
7433.33	V	40.18	29.1	18.23	58.41	47.33	74	54	-6.67	Avg
4958.33	H	40.28	32.52	11.19	51.47	43.71	74	54	-10.29	Avg
7433.33	H	40.83	29.91	18.23	59.06	48.14	74	54	-5.86	Avg

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
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 setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBµV)	
	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

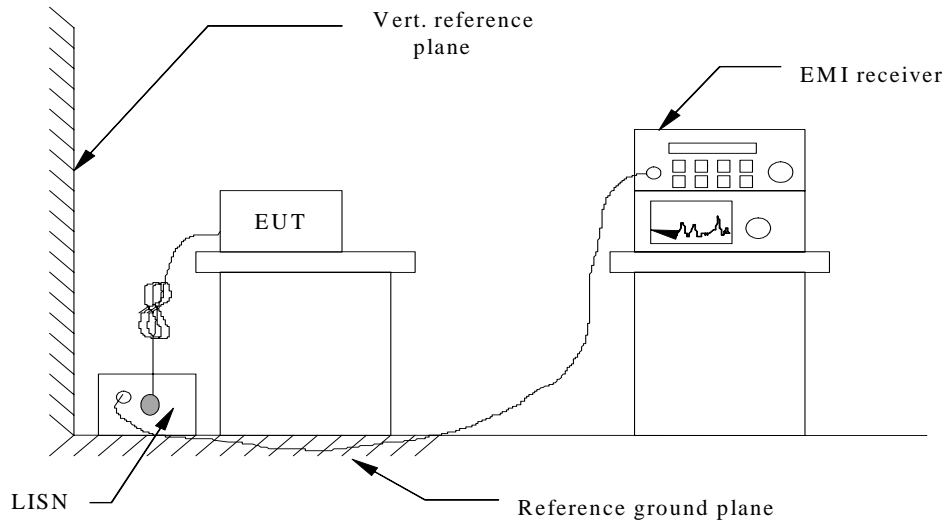
Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

MEASUREMENT EQUIPMENT USED

Conducted Emission Test Site A (10m chamber)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESI26	100068	02/11/2007
EMC Analyzer	Agilent	E7402A	US41160329	02/11/2007
LISN	FCC	FCC-LISN-50-50-2-M	01067	02/11/2007
LISN (EUT)	FCC	FCC-LISN-50-50-2-M	01068	02/11/2007
TRANSIENT LIMITER	SCHAFFNER	CFL9206	1710	03/15/2007
EMI Monitor control box	FCC	0-SVDC	N/A	N/A

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST 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.

**TEST RESULTS**

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.

Test Data**Model:** Mio C720**Test Mode:** Normal Link**Temperature:** 25°C**Humidity:** 48% RH**Tested by:** jeff**Test Results:** Pass

Freq. (MHz)	Q.P. Raw reading (dBuV)	AVG Raw reading (dBuV)	Correction factor(dB)	Q.P. Amptd. (dBuV)	AVG Amptd. (dBuV)	Q.P. Limit (dBuV)	AVG Limit (dBuV)	Q.P. Margin (dB)	AVG Margin (dB)	Line/Neutral
0.407	22.03	21.79	10.41	32.44	32.20	58.64	48.64	-26.20	-16.44	Line
0.533	20.56	18.33	10.40	30.96	28.73	56.00	46.00	-25.04	-17.27	Line
0.718	17.67	17.81	10.41	28.08	28.22	56.00	46.00	-27.92	-17.78	Line
0.878	20.93	19.44	10.42	31.35	29.86	56.00	46.00	-24.65	-16.14	Line
1.149	13.74	14.85	10.44	24.18	25.29	56.00	46.00	-31.82	-20.71	Line
2.166	13.37	12.94	10.52	23.89	23.46	56.00	46.00	-32.11	-22.54	Line
0.411	32.85	32.84	10.40	43.25	43.24	58.55	48.55	-15.30	-5.31	Neutral
0.541	16.89	16.29	10.39	27.28	26.68	56.00	46.00	-28.72	-19.32	Neutral
0.743	28.31	28.66	10.40	38.71	39.06	56.00	46.00	-17.29	-6.94	Neutral
0.877	30.11	29.83	10.41	40.52	40.24	56.00	46.00	-15.48	-5.76	Neutral
1.116	30.50	30.95	10.43	40.93	41.38	56.00	46.00	-15.07	-4.62	Neutral
1.812	18.60	18.46	10.48	29.08	28.94	56.00	46.00	-26.92	-17.06	Neutral

Remark:

1. The measuring frequencies range between 0.15 MHz and 30 MHz.
2. The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
3. “---” denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
4. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.

Note:

Freq. = Emission frequency in KHz

Factor (dB) = cable loss + Insertion loss of LISN+ Insertion loss of TRANSIENT LIMITER (The TRANSIENT LIMITER included 10 dB ATTENUATION)



$Amptd\ dBuV = Uncorrected\ Analyzer/Receiver\ reading + cable\ loss + Insertion\ loss\ of\ LISN +$
 $Insertion\ loss\ of\ TRANSIENT\ LIMITER,$
 $if\ it > 0.5\ dB$

$Limit\ dBuV = Limit\ stated\ in\ standard$

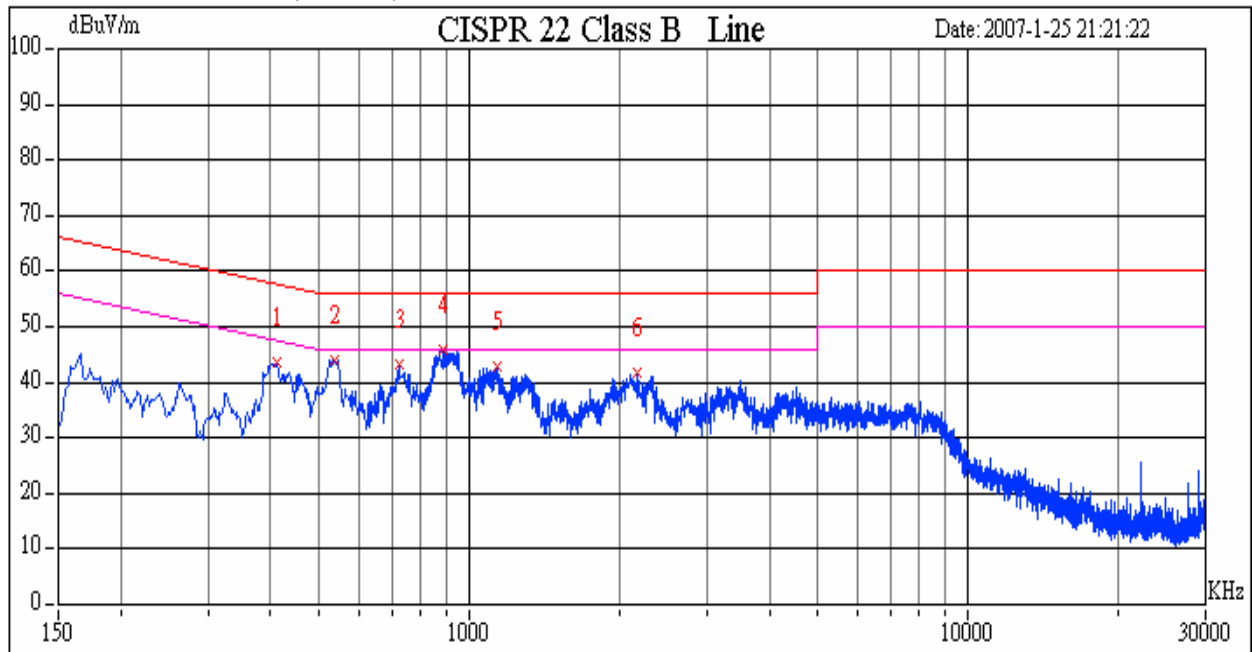
$Margin\ dB = Reading\ in\ reference\ to\ limit$

Calculation Formula

$Margin\ (dB) = Amptd\ (dBuV) - Limit\ (dBuV)$

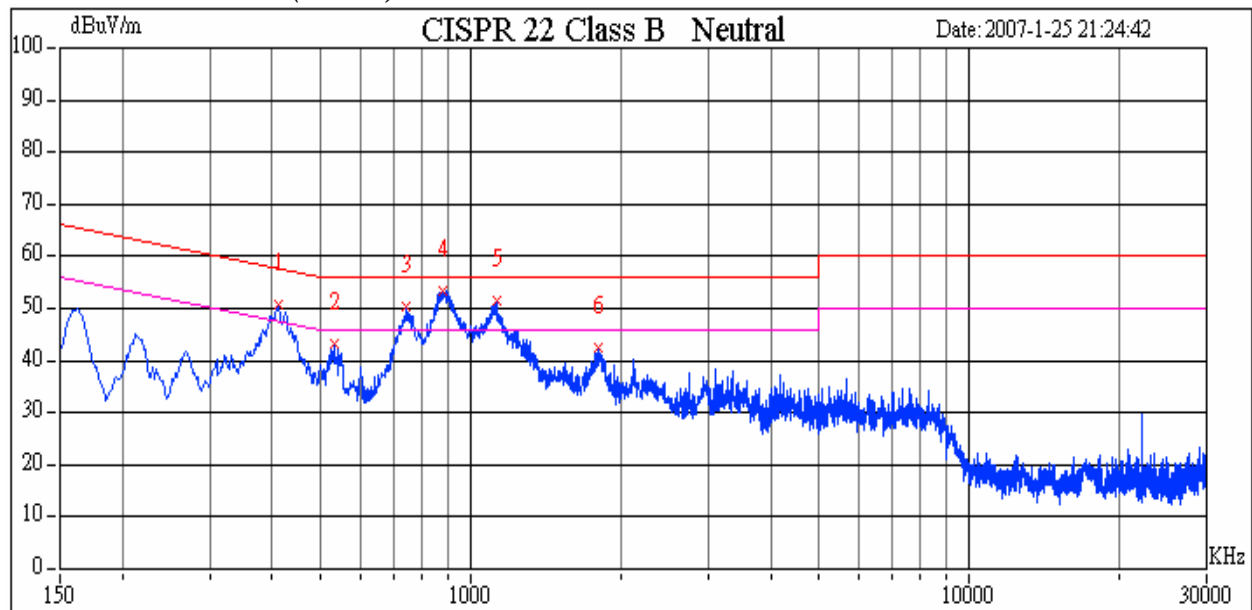
Test Plot

Conducted emissions (Line 1)



Test Plot

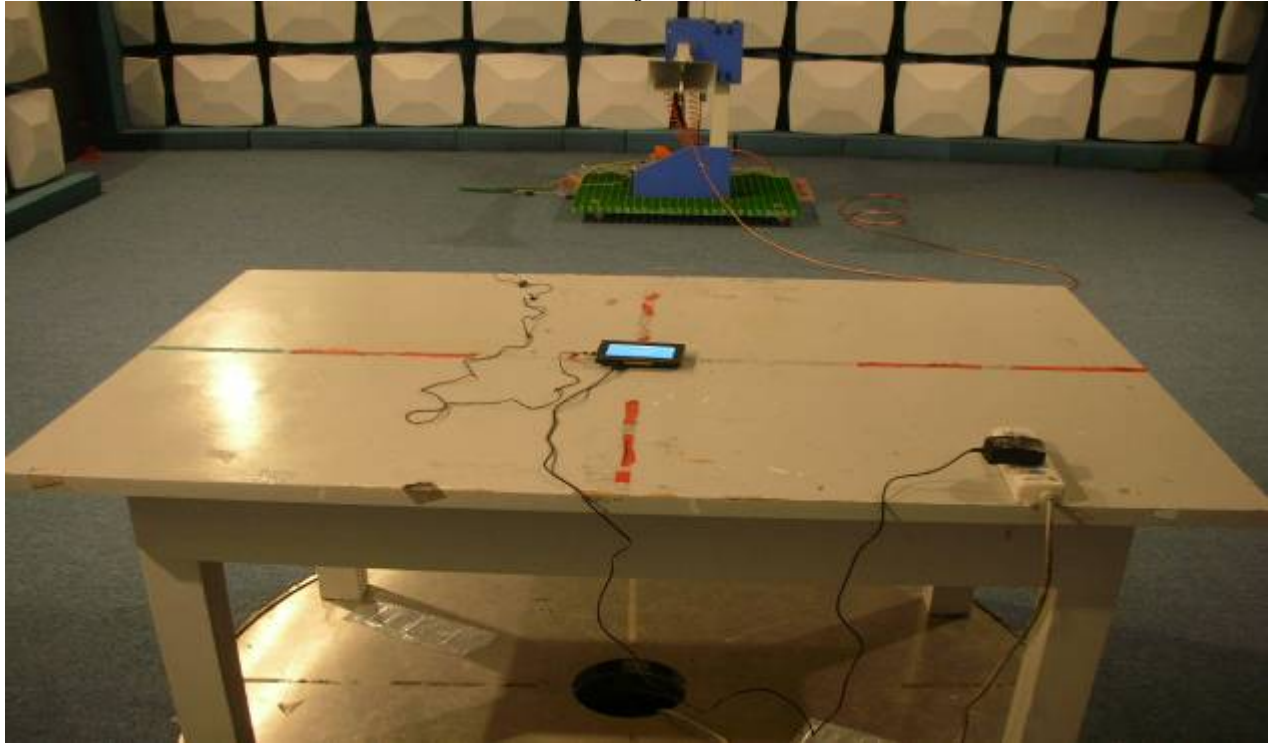
Conducted emissions (Line 2)



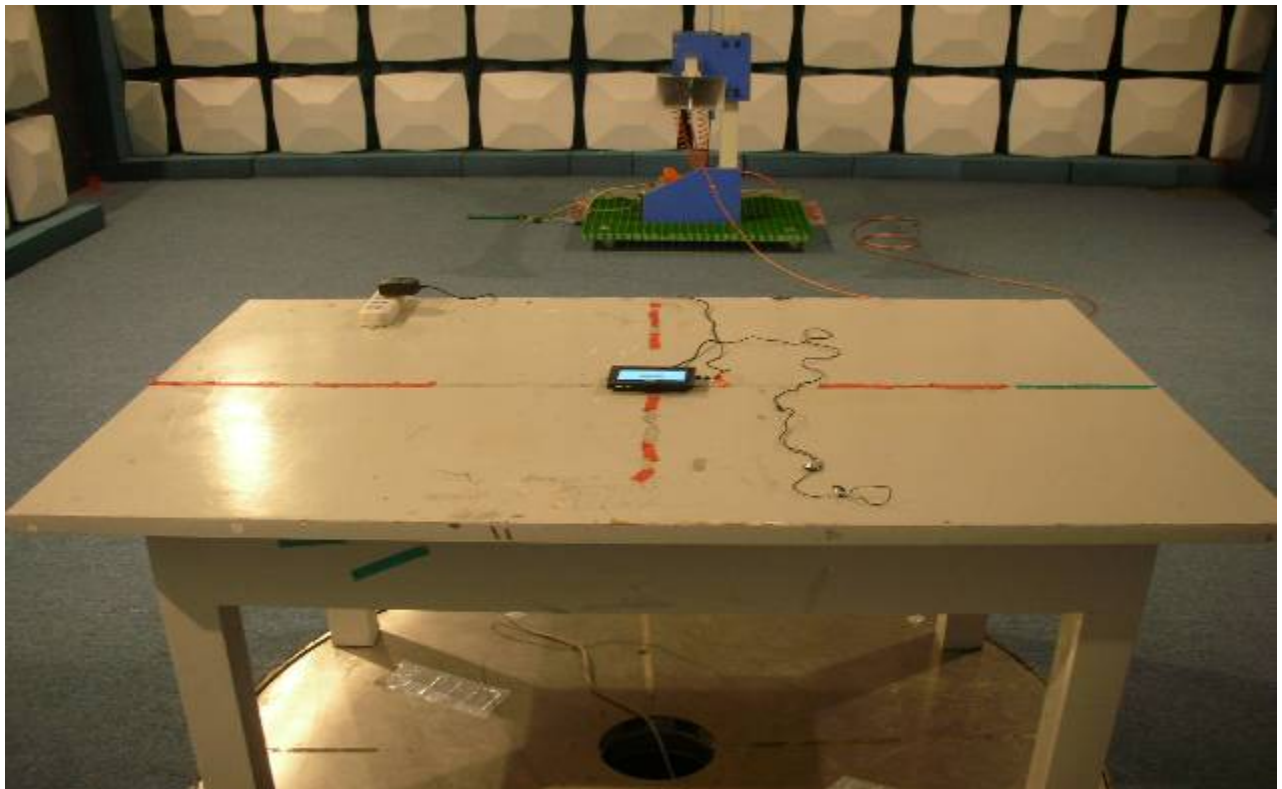
APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

Radiated Emission Set up Photos

Front of view



Back of view



Conducted Emission Set Up Photos

