

TEST REPORT For FCC

Test Report No. : 2008070033
Date of Issue : July 16, 2008
FCC ID : WHAPD-111R
Model/Type No. : PD-111R
Kind of Product : Digital Wireless Transmitter/Receiver
Applicant : PENTAONE CO., LTD.
Applicant Address : HyoChang Bldg, 3F 1013-6, Inkye-dong, Paldal-Gu, Suwon City
Gyeonggi-Do, Korea
Manufacturer : PENTAONE CO., LTD.
Manufacturer Address : HyoChang Bldg, 3F 1013-6, Inkye-dong, Paldal-Gu, Suwon City
Gyeonggi-Do, Korea
Contact Person : Park, Jae Chan / Managing Director (CTO)
Telephone : +82-31-233-4465
Received Date : July 4, 2008
Test period : Start : July 4, 2008 End : July 16, 2008
Test Results : ☒ In Compliance ☐ Not in Compliance

The test results presented in this report relate only to the object tested.

Tested by



Eun-Won, Lee
Test Engineer
Date: May 19, 2008

Reviewed by



Young-Joon, Park
Technical Manager
Date: May 19, 2008



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REPORT REVISION HISTORY

Date	Revision	Page No
July 16, 2008	Issued (2008070033)	All

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1.0 General Product Description

Equipment model name : PD-111R
Serial number : Prototype
EUT condition : Pre-production, not damaged
Antenna type : Dipole Antenna (Gain : 4.5 dBi)
Frequency Range : 2417MHz – 2467MHz
RF output power : 23.97 dBm Peak Conducted
Number of channels : 11
Type of Modulation : QPSK
Transfer Rate : 11Mbps
Power Source : DC 12V

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz) For 802.11b	2417	2442	2467

1.2 Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC
Dual-Tracking DC Power Supply	Topward Electric Instruments Co., Ltd.	6303D	711196	-



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1.5 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.6 Test Facility

The measurement facility is located at 386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.7 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	 93250
JAPAN	VCCI	10 meter Open Area Test Site and one conducted site.	 R-948, C-986
KOREA	MIC	EMI (10 meter Open Area Test Site and two conducted sites) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 No. 51, KR0025
International	KOLAS	EMC	
Europe	GLAS	EMC EN 55011, EN 55022, EN 61000-6-3, EN 61000-6-4, EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 50130-4, EN 55024, EN 61204-3, EN 60601-1-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11	 No.13000796-02



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2.0 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500kHz	Conducted	C
15.247(b)	Transmitter Output Power	< 1Watt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.247(d)	Transmitter Power Spectral Density	< 8dBm @ 3kHz		C
				C
15.209	Field Strength of Harmonics	< 54 dBuV (at 3m)	Radiated	C
15.207	AC Conducted Emissions	15.207	Line Conducted	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:
- FCC Part 15.247, ANSI C63.4-2003

2.1 Technical Characteristic Test

2.1.1 6dB Bandwidth

Procedure:

The bandwidth at 6dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 40 MHz

VBW = 100 kHz (VBW ≥ RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Frequency (MHz)	Channel No.	Test Results	
		Measured Bandwidth (MHz)	Result
2417	1	15.04	Complies
2442	6	15.04	Complies
2467	11	15.04	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

6 dB Bandwidth > 500kHz

See next pages for actual measured spectrum plots.



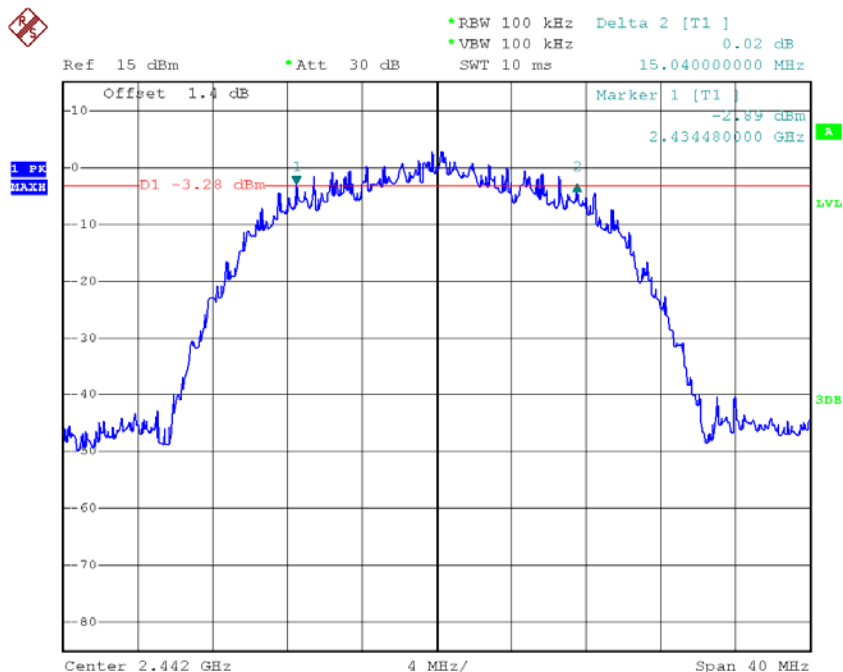
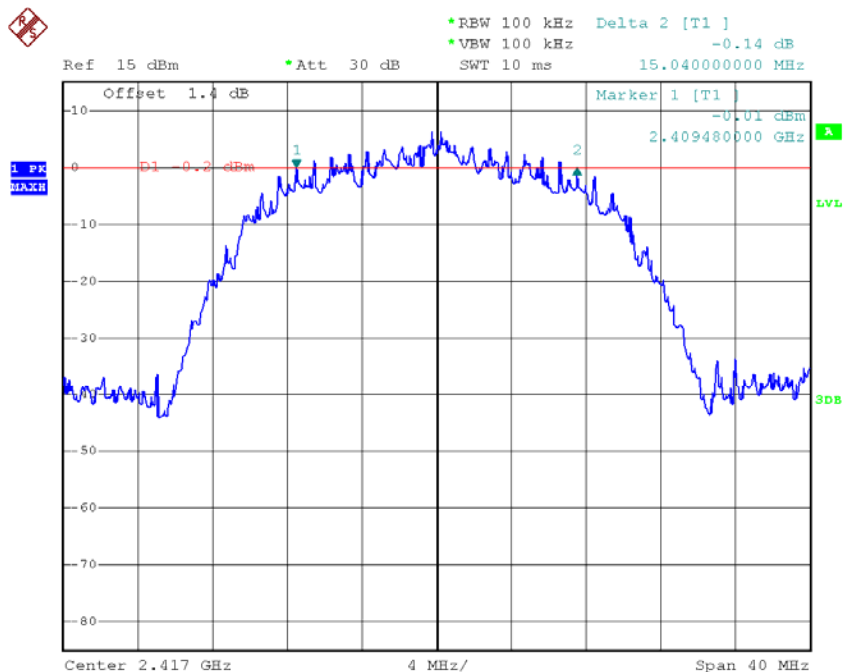
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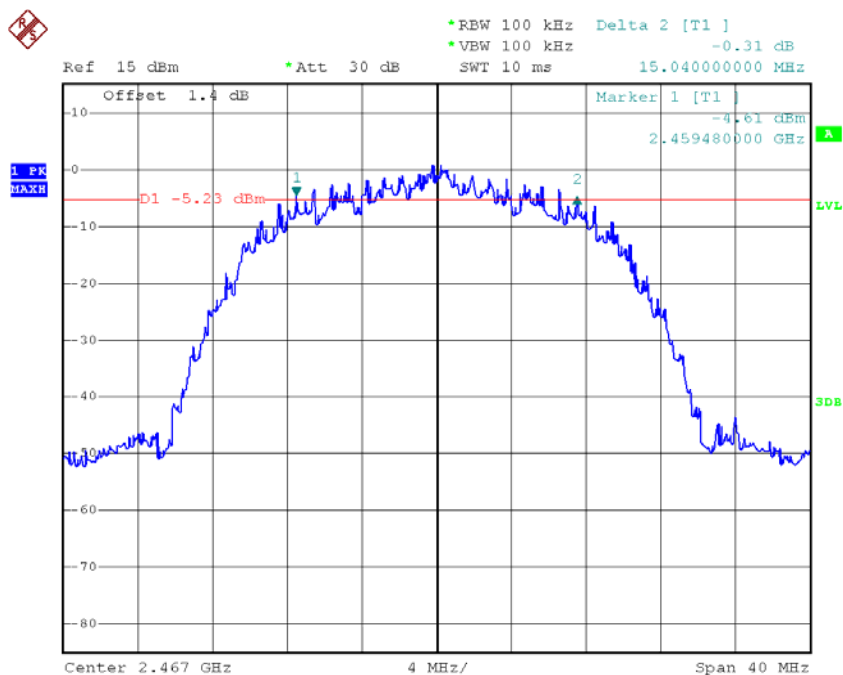
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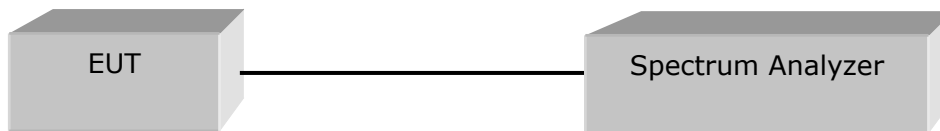
2.1.2 Maximum peak Conducted Output Power

Test Location

RF Test Room

Test Procedures

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Limit

< 1 W

Test Results

Frequency (MHz)	Channel No.	Peak output power(dBm)	Limit	Result
2417	Low	23.97	30dBm	Complies
2442	Middle	21.25	30dBm	Complies
2467	High	19.52	30dBm	Complies

See next pages for actual measured spectrum plots.

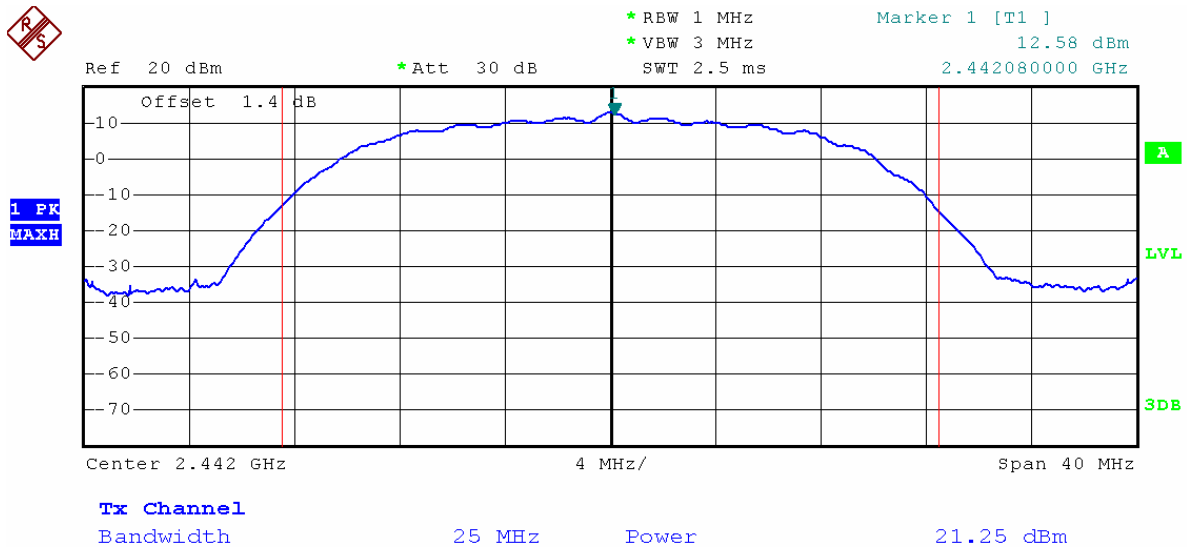
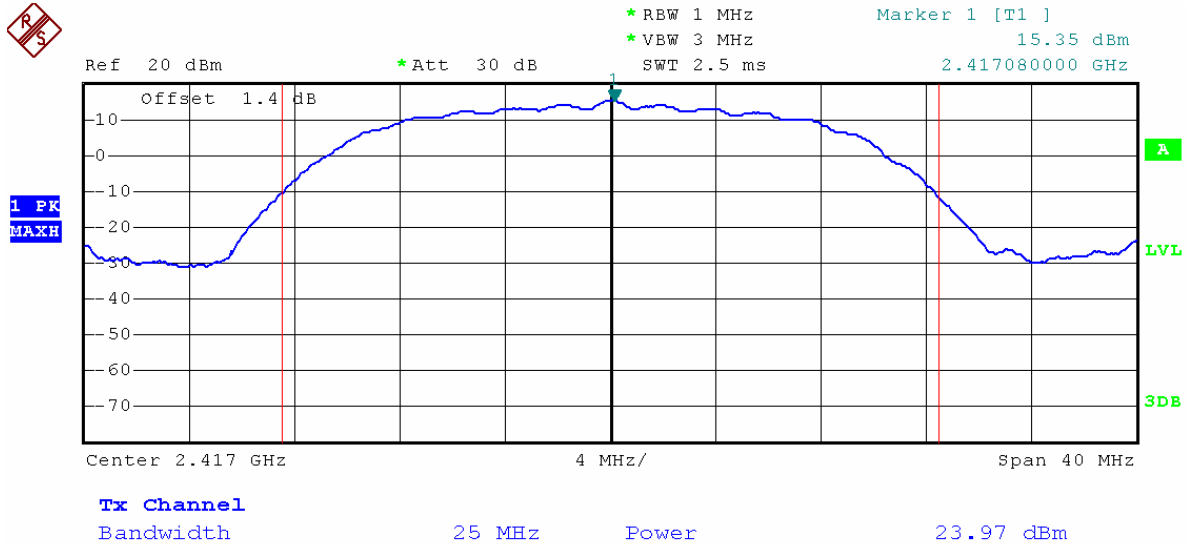


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Peak Conducted Output Power





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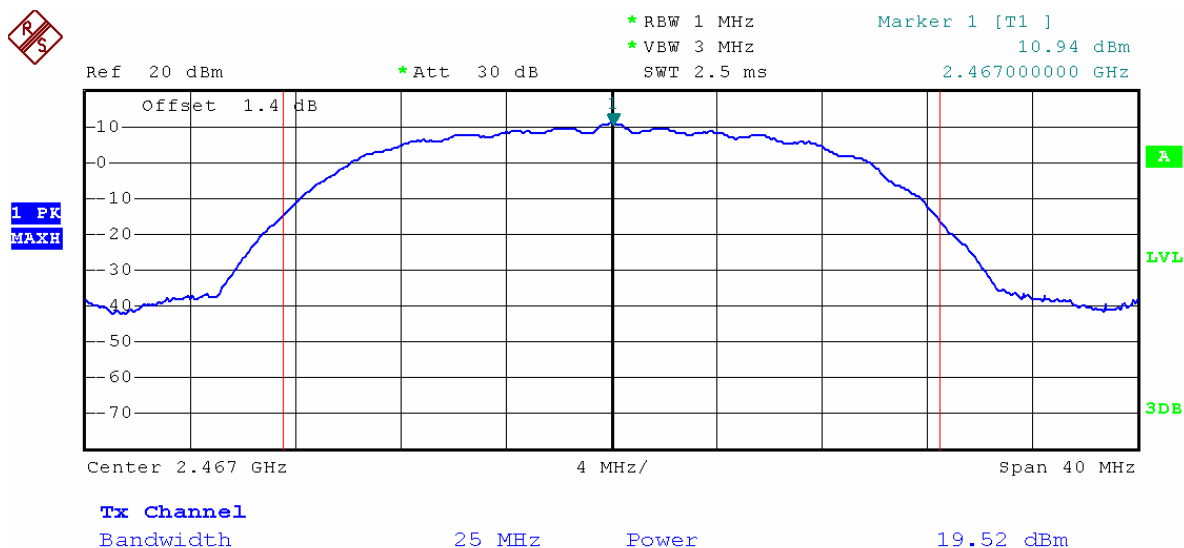
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Peak Conducted Output Power



2.1.3 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The spectrum analyzer is set to:

RBW = 3 kHz

VBW = (VBW \geq RBW)

Sweep = 100KHz(Span/3KHz)

Span = 300 KHz

Detector function = peak

Trace = max hold

Measurement Data:

Frequency (MHz)	Ch.	Test Results	
		dBm	Result
2417	1	-13.01	Complies
2442	6	-15.23	Complies
2467	11	-18.09	Complies

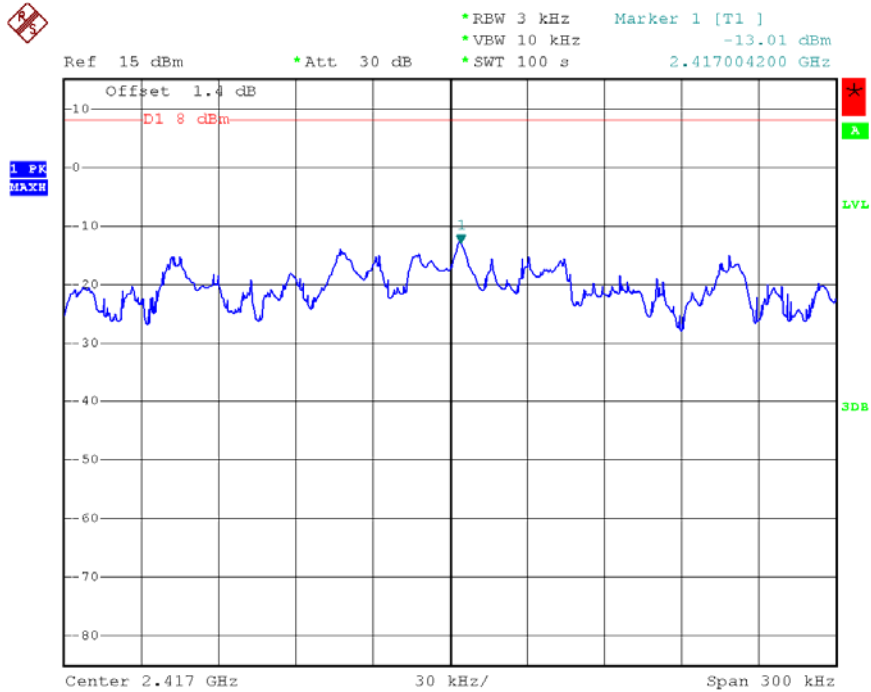
- See next pages for actual measured spectrum plots.

Minimum Standard:

Power Spectral Density	< 8dBm @ 3kHz BW
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See next pages for actual measured spectrum plots.

Power Density Measurement





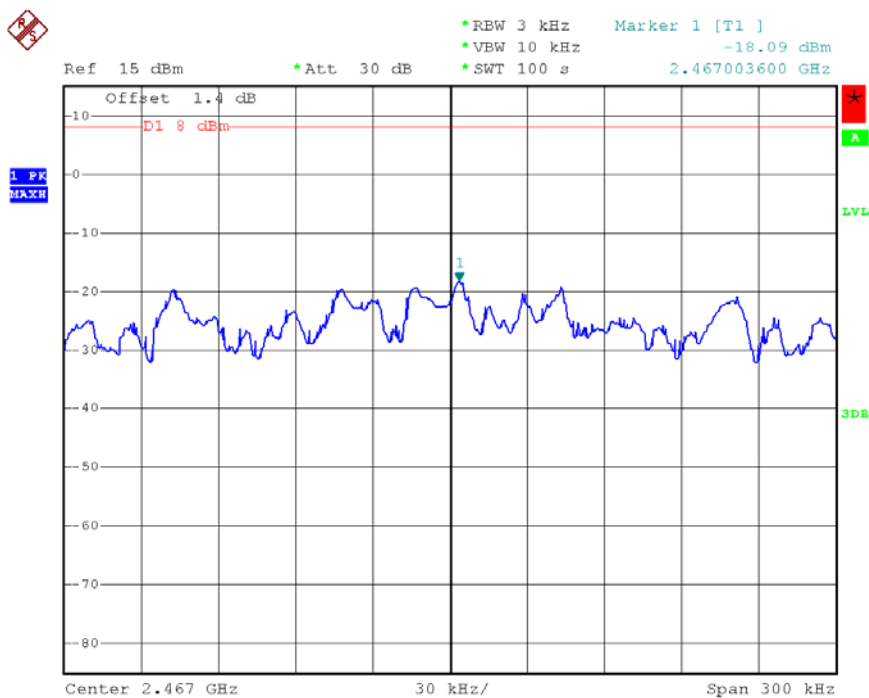
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2.1.4 Band - edge

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz

Span = 40 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

Minimum Standard:	> 20 dBc
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See next pages for actual measured spectrum plots.



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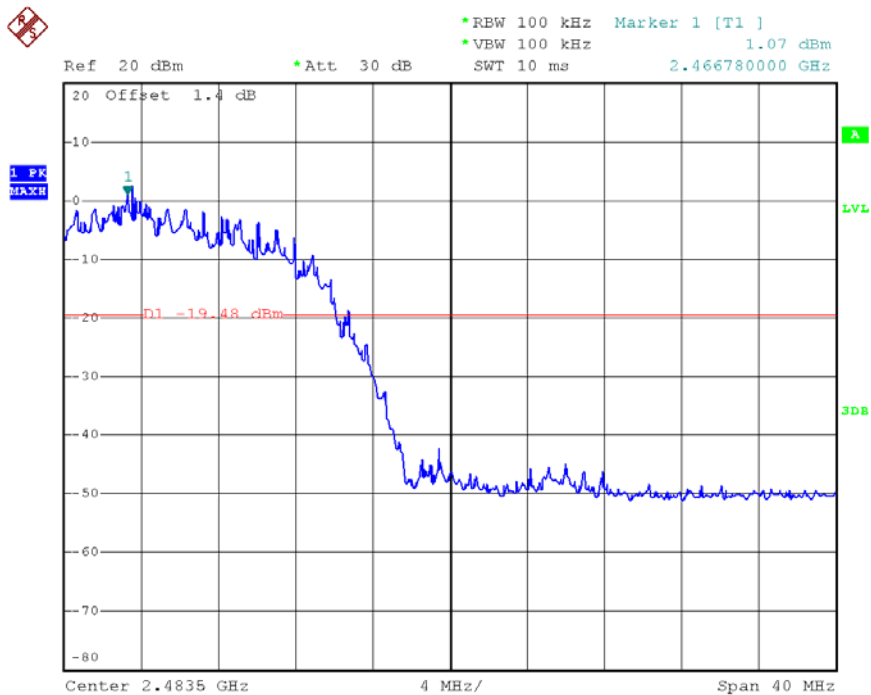
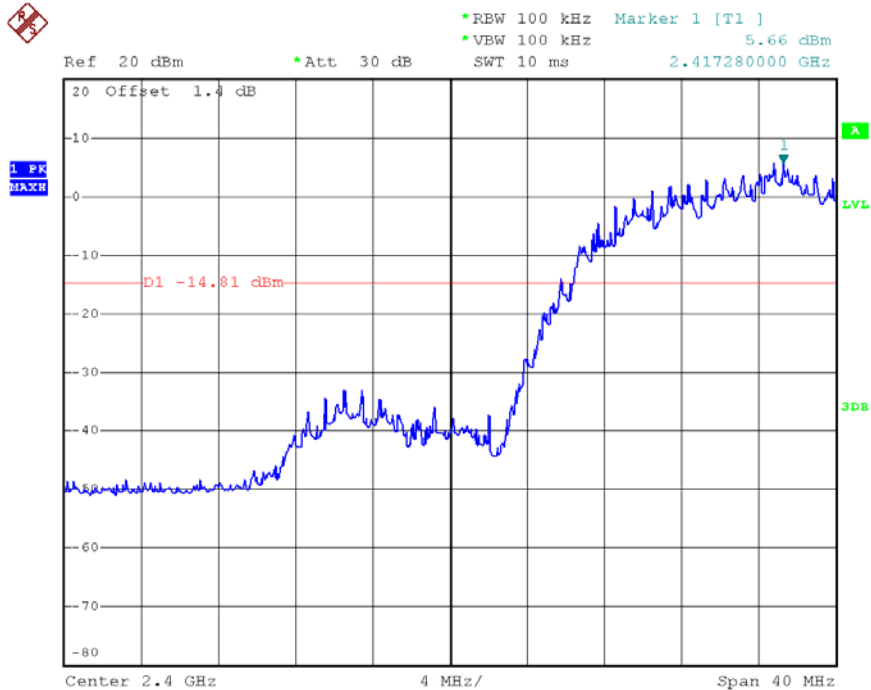
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Band-edge Measurements





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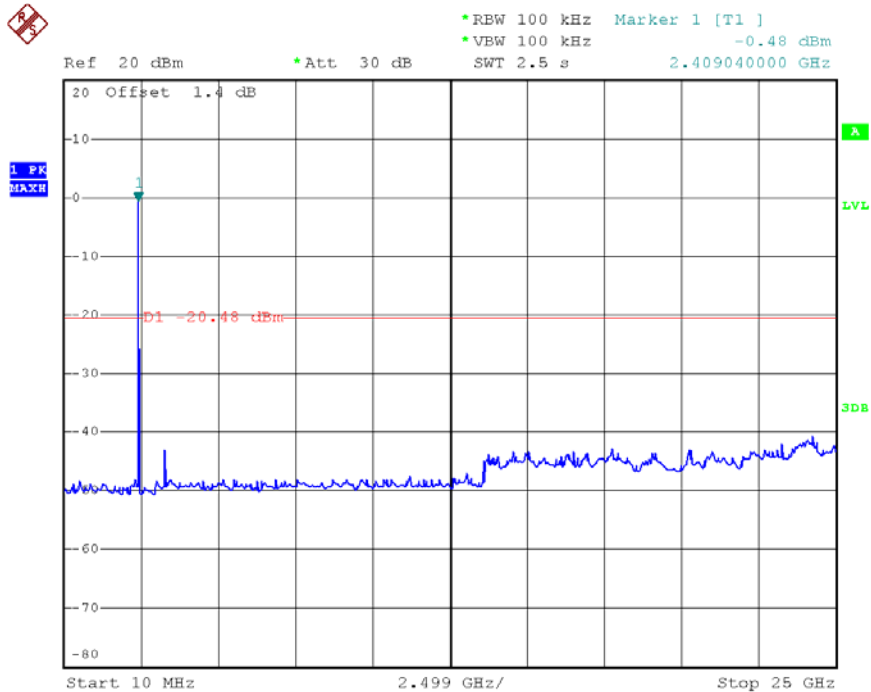


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Band – edge (at 20 dB blow) – Mid channel
Frequency Range = 30 MHz ~ 10th harmonic



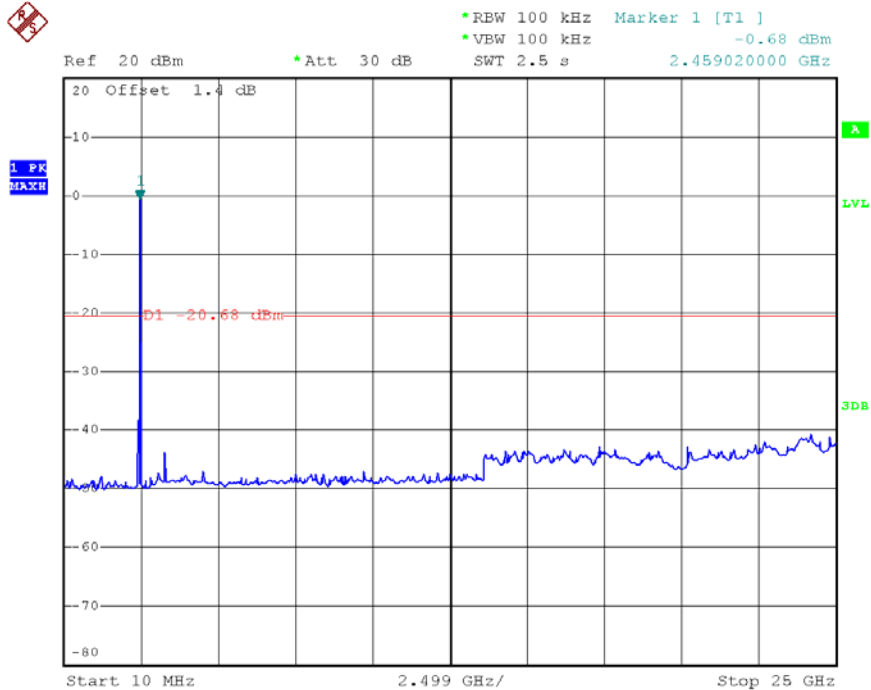


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Band – edge (at 20 dB blow) – High channel Frequency Range = 30 MHz ~ 10th harmonic



2.1.5 Field Strength of Emissions

Test Location

☒ Testing was performed at a test distance of 3 meter Open Area Test Site

Test Procedures

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 30 MHz ~ 10th harmonic

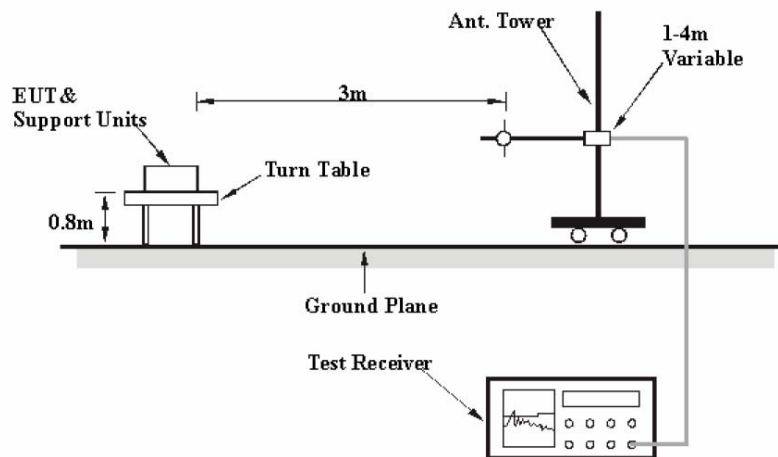
RBW = 120 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Detector function = Quasi-peak

Trace = max hold



Limit

- 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m
30-88	100**	40
88-216	150**	43.5
216-960	200**	46
Above 960	500	54

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Test Results

EUT	Digital Wireless Transmitter/Receiver	Measurement Detail	
Model	PD-111R	Frequency Range	Below 1000MHz
Channel	-	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
265.26	42.7	3.3	Quasi-Peak

Test Data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor		Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Cable			
144.06	30.2	V	1.0	8.2	1.3	43.5	39.7	3.8
265.26	30.5	H	3.8	10.1	2.1	46.0	42.7	3.3
396.29	23.6	H	3.0	13.4	2.8	46.0	39.8	6.2
432.64	24.4	H	2.8	14.2	3.0	46.0	41.6	4.5
439.82	24.2	H	2.0	14.4	3.1	46.0	41.7	4.3
468.92	22.0	V	1.6	15.0	3.3	46.0	40.3	5.7

H : Horizontal, V : Vertical



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Test Results

EUT	Digital Wireless Transmitter/Receiver	Measurement Detail	
Model	PD-111R	Frequency Range	1-25GHz
Channel	Channel 1	Detector function	Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	-

Test Data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Amp. Gain	Cable			
No emission were detected at a level greater than 20dB below limit									

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Amp. Gain	Cable			
No emissions were detected at a level greater than 20dB below limit.									



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Test Results

EUT	Digital Wireless Transmitter/Receiver	Measurement Detail	
Model	PD-111R	Frequency Range	1-25GHz
Channel	Channel 6	Detector function	Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	-

Test Data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Amp. Gain	Cable			
No emission were detected at a level greater than 20dB below limit									



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Test Results

EUT	Digital Wireless Transmitter/Receiver	Measurement Detail	
Model	PD-111R	Frequency Range	1-25GHz
Channel	Channel 11	Detector function	Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	-

Test Data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Amp. Gain	Cable			
No emission were detected at a level greater than 20dB below limit									

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Amp. Gain	Cable			
No emissions were detected at a level greater than 20dB below limit.									



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2.1.6 AC Conducted Emissions

Test Location

Shielded Room

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

- 15.207(a)

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

Test Results

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.16	43.3	22.1	Quasi-peak



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Test Data

Frequency [MHz]	Correction Factor		Line	Quasi-peak				Average			
				Limit	Reading	Result	Margin	Limit	Reading	Result	Margin
	LISN	Cable		[dBuV]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dB]
0.16	0.3	0.1	H	65.5	42.9	43.3	22.1	55.5	27.3	27.7	27.7
0.18	0.3	0.1	H	64.7	41.4	41.8	22.9	54.7	17.2	17.6	37.1
0.19	0.3	0.1	H	64.0	38.4	38.8	25.3	54.0	23.9	24.3	29.7
0.20	0.3	0.1	H	63.6	37.5	37.9	25.7	53.6	16.4	16.8	36.8
0.21	0.3	0.1	H	63.2	37.1	37.5	25.7	53.2	21.5	21.9	31.3
0.22	0.3	0.1	H	62.8	34.8	35.2	27.7	52.8	21.5	21.9	30.9

H : HOT, N : NEUTRAL



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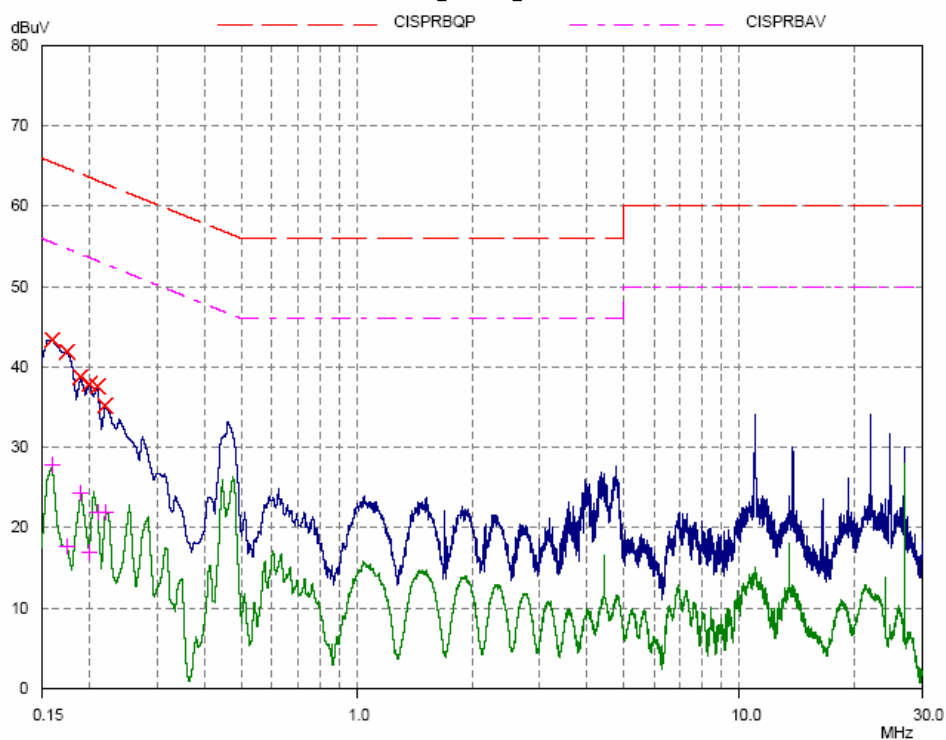
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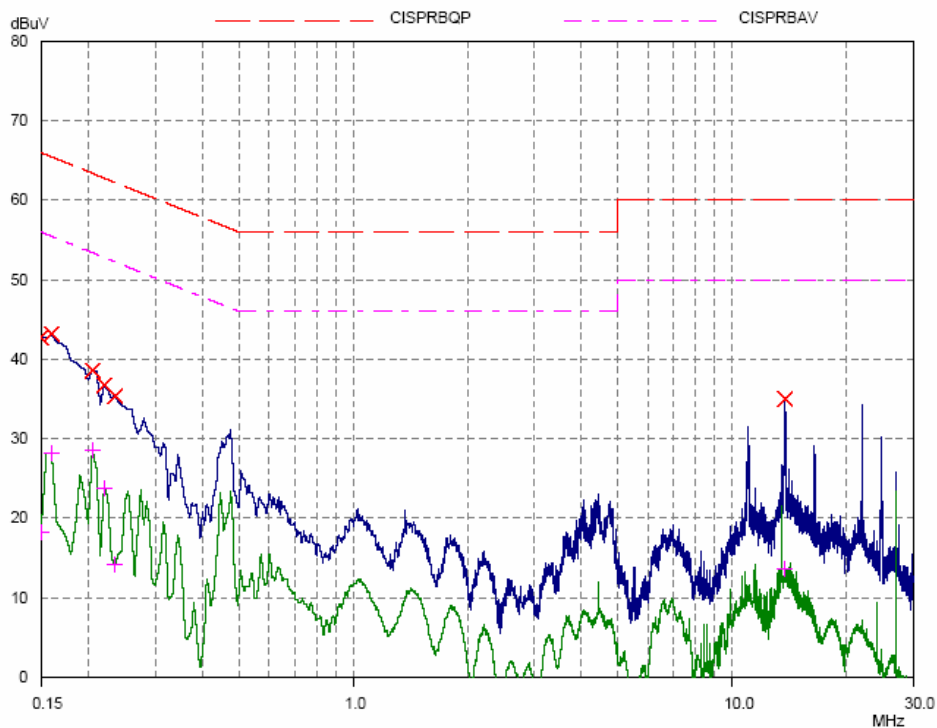
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APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
1	Spectrum Analyzer	Agilent	8564E	3551A0041	2008-11-01
2	Spectrum Analyzer	HP	E4403B	US39440619	2008-09-03
3	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2008-11-19
4	EMI Test Receiver	Rohde & Schwarz	ESVS30	826638/008	2009-03-07
5	ULTRA Broadband Antenna	Rohde & Schwarz	HL562	361324/014	2009-06-20
6	LOOP ANTENNA	EMCO	6502	9107-2652	2008-10-17
7	LOOP ANTENNA	EMCO	6502	9607-3020	2009-03-06
8	System Power Supply	HP	6032A	3440A-10521	2009-07-07
9	EPM Series Power Meter	HP	E4418A	GB38272734	2008-11-03
10	Power Sensor	HP	8481A	331BA92056	2008-11-03
11	Power Sensor	HP	8482B	331BA05406	2008-11-03
12	Audio Analyzer	HP	8903B	2747A03432	2008-11-01
13	ESG-D Series Signal Generator	Agilent	E4432B	US40054094	2008-11-01
14	SYNTHESIZED SWEEPER	HP	8341B	2819A01563	2008-11-22
15	Modulation Analyzer	HP	8901B	3438A05228	2008-11-08
16	Attenuator	HP	8494A	3308A33351	2008-11-06
17	Attenuator	HP	8496A	3308A15142	2008-11-06
18	Temp&Humi Chamber	Kunpoong	KP-1000	2002KP050041	2009-01-21
19	Temp&Humi Chamber	Kunpoong	KP-RC2000	2002KP650042	2009-01-21
20	EMC Analyzer	Agilent	E7405A	MY45110859	2009-01-21
21	Horn Antenna	ETS-Lindgren	3115	00078894	2008-11-29
22	Horn Antenna	ETS-Lindgren	3115	00078895	2008-11-29
23	Horn Antenna	ETS-Lindgren	3116	00062504	2008-11-27
24	Horn Antenna	ETS-Lindgren	3116	00062916	2008-11-27
25	Dipole Antenna	SCHWARZBECK	VHA 9103	VHA91032557	2009-11-27
26	Dipole Antenna	SCHWARZBECK	UHA 9105	UHA91052417	2009-11-27
27	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2009-03-13
28	PREAMPLIFIER	Agilent	8449B	3008A02307	2008-11-05
29	Radio Communication Tester	Rohde & Schwarz	CMU200	106765	2009-02-09
30	Band Reject Filter	Wainwright Instruments	WRCG824	-	2009-04-16
31	Band Reject Filter	Wainwright Instruments	WRCG1750	-	2009-04-13