

Test Report No. S08EEC02725/05

dated 01 Dec 2008

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH FCC Parts 15B & C : 2008 OF A RF TRANSCEIVER CARD [Model : SH-TR70A] [FCC ID : ACJT09002]

TEST FACILITY

TÜV SÜD PSB Pte Ltd,
Electrical & Electronics Centre (EEC), Product Services,
1 Science Park Drive, Singapore 118221

FCC REG. NO.

90937 (3m & 10m OATS)
99142 (10m Semi-Anechoic Chamber)
871638 (3m Semi-Anechoic Chamber)
325572 (10m Semi-Anechoic Chamber)

IND. CANADA REG. NO.

IC 4257 (3m and 10m Semi-Anechoic Chambers)

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QUOTATION NUMBER

Q08EEC3061

JOB NUMBER

S08EEC02725

TEST PERIOD

03 Nov 2008 – 01 Dec 2008

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TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

Test Standard	Description	Pass / Fail
FCC Part 15: 2008		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(2)	Spectrum Bandwidth (6dB Bandwidth Measurement)	Pass
15.247(b)(3)	Maximum Peak Power	Pass
15.247(d)	RF Conducted Spurious Emissions	Pass
15.247(d)	Band Edge Compliance (Conducted)	Pass
15.247(d)	Band Edge Compliance (Radiated)	Pass
15.247(e)	Peak Power Spectral Density	Pass
1.1310	Maximum Permissible Exposure	See page 46 for details
15.35(c)	Duty Cycle Factor Computation	See Note 5



TEST SUMMARY

Notes

1. Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

<u>Transmit Channel</u>	<u>Frequency (GHz)</u>
Channel 0	2.412
Channel 1	2.438
Channel 2	2.462
2. All the measurements in section 15.247 were done based on conducted measurements except Band Edge Compliance (Radiated).
3. The EUT is a Class B device when in non-transmitting state and meets the FCC Part15B Class B requirements.
4. All test measurement procedures are according to ANSI C63.4: 2003.
5. The Equipment Under Test (EUT) was set to continuous RF transmission, ie, 0dB duty cycle.
6. The Equipment Under Test (EUT) contains two identical antennas with same RF power. As such, only one antenna was evaluated. The EUT will only able to activate one antenna at a time in actual application.

Modifications

No modifications were made.



PRODUCT DESCRIPTION

Description : The Equipment Under Test (EUT) is a **RF TRANSCEIVER CARD**.

Manufacturer : Panasonic AVC Networks (S) Pte Ltd
202, Bedok South Avenue 1,
Singapore 469332

Model Number : SH-TR70A

FCC ID : ACJT09002

Serial Number : Nil

Microprocessor : Integrated

Operating / Transmitting Frequency : 2.412GHz to 2.462GHz
3 channels in total

Clock / Oscillator Frequency : 16MHz

Modulation : Direct Sequence Spread Spectrum (DSSS)

Antenna Gain : -3 dBi

Port / Connectors : Refer to manufacturer's user manual / operating manual.

Rated Input Power : 5Vdc via AC/DC power adaptor

Accessories : Refer to manufacturer's user manual / operating manual.



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SUPPORTING EQUIPMENT DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Unbranded AC/DC Adapter (for EUT)	M/N: PLR-050060 US S/N: Nil FCC ID: Nil	0.70 m unshielded DC power cable
Panasonic AC Adapter (for test jig)	M/N: DE-922A S/N: H400540DC FCC ID: Nil	1.30m unshielded AC power cable 1.80m unshielded DC power cable



EUT OPERATING CONDITIONS

FCC Part 15

- 1. Conducted Emissions**
- 2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)**
- 3. Spectrum Bandwidth (6dB Bandwidth Measurement)**
- 4. Maximum Peak Power**
- 5. RF Conducted Spurious Emissions**
- 6. Band Edge Compliance (Conducted)**
- 7. Band Edge Compliance (Radiated)**
- 8. Peak Power Spectral Density**
- 9. Maximum Permissible Exposure**

The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at lower, middle and upper channels respectively at one time.



CONDUCTED EMISSION TEST

FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

Frequency Range (MHz)	Limit Values (dB μ V)	
	Quasi-peak (QP)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreasing linearly with the logarithm of the frequency

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver – ESI3	ESIB7	100015	02 Jun 2009
Schaffner LISN – LISN7 (for EUT)	NNB42	00008	27 Jul 2009



CONDUCTED EMISSION TEST

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a $50\Omega/50\mu\text{H}$ EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz

Q-P limit (Class B) = $1000 \mu\text{V} = 60.0 \text{ dB}\mu\text{V}$

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = $40.0 \text{ dB}\mu\text{V}$
(Calibrated for system losses)

Therefore, Q-P margin = $40.0 - 60.0 = -20.0$

i.e. **20.0 dB below Q-P limit**



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CONDUCTED EMISSION TEST



Conducted Emissions Test Setup (Front View)



Conducted Emissions Test Setup (Rear View)



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CONDUCTED EMISSION TEST

FCC Parts 15.107(a) and 15.207 Conducted Emission Results

Test Input Power	110V 60Hz	Temperature	24°C
Line Under Test	AC Mains	Relative Humidity	57%
Model	SH-TR70A	Atmospheric Pressure	1030mbar
		Tested By	Lucas Beh

Frequency (MHz)	Q-P Value (dB μ V)	Q-P Margin (dB)	AV Value (dB μ V)	AV Margin (dB)	Line	Channel
0.2318	48.3	-14.1	23.6	-28.8	Neutral	0
0.3254	32.4	-27.2	14.4	-35.2	Neutral	0
0.6686	20.3	-35.7	8.8	-37.2	Neutral	0
1.0887	24.5	-31.5	9.9	-36.1	Neutral	0
1.2099	24.3	-31.7	11.9	-34.1	Neutral	0
6.6878	28.1	-31.9	7.1	-42.9	Neutral	0

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
9kHz - 30MHz
RBW: 10kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz is $\pm 3.0\text{dB}$.



RADIATED EMISSION TEST

FCC Part 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6
13.36 - 13.41			

FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBμV/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*

* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz–26.5GHz) – ESMI2	ESMI	829214/006 829550/001	12 May 2009
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	11 Jan 2009
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	26 Jan 2009
Schaffner Bilog Antenna – BL	CBL6112D	22020	19 May 2009
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2009
Mirco-Tronics 2.4GHz Bandstop Filter	BRM50701	042	13 Aug 2009



RADIATED EMISSION TEST

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 10th harmonics of the EUT fundamental frequency, using the Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz

Q-P limit (Class B) = 200 μ V/m = 46.0 dB μ V/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dB μ V/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40.0 - 46.0 = -6.0

i.e. 6 dB below Q-P limit



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RADIATED EMISSION TEST



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)



RADIATED EMISSION TEST

FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Test Input Power	110V 60Hz	Temperature	24°C
Test Distance	3m	Relative Humidity	59%
Model	SH-TR70A	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB μ V/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
262.1000	32.7	-13.3	104	236	V	0
268.9470	9.9	-36.1	262	187	V	0
292.5730	32.7	-13.3	273	194	V	0
316.9610	29.3	-16.7	258	201	V	0
341.4150	24.6	-21.4	213	124	V	0
908.7240	20.5	-25.5	209	263	H	0

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dB μ V/m)	Average Value (dB μ V/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
4.8311	52.4	42.9	-11.1	237	100	V	0
4.8311	53.5	43.7	-10.3	237	100	V	2
4.8755	52.5	43.1	-10.9	204	100	V	1
8.1266	54.1	41.4	-12.6	204	100	V	1
8.8777	53.7	41.8	-12.2	74	100	V	2
9.6500	57.2	46.0	-8.0	319	100	V	0

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
3. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
 30MHz - 1GHz
 RBW: 120kHz VBW: 1MHz
 >1GHz
 RBW: 1MHz VBW: 1MHz



RADIATED EMISSION TEST

Notes (continued)

5. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
6. The channel in the table refers to the transmit channel of the EUT.
7. Radiated Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is $\pm 4.6\text{dB}$.



SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Limits

The EUT shows compliance to the requirements of this section, which states that the minimum bandwidth of the EUT employing digital modulation techniques shall be at least 500kHz.

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	26 Sep 2009

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 0 (2.412GHz).
2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 6dB bandwidth of the transmitting frequency.
3. The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.
4. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. The frequencies below the 6dB peak frequency at lower (f_L) and upper (f_H) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser.
5. The 6dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies, $|f_H - f_L|$.
6. The steps 2 to 5 were repeated with the transmitting frequency was set to Channel 1 (2.438GHz) and Channel 2 (2.462GHz) respectively.



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SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST



S08EEC02725
Spectrum Bandwidth (6dB Bandwidth Measurement) Test Setup



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SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Results

Test Input Power	110V 60Hz	Temperature	24°C
Attached Plots	1 - 3	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	

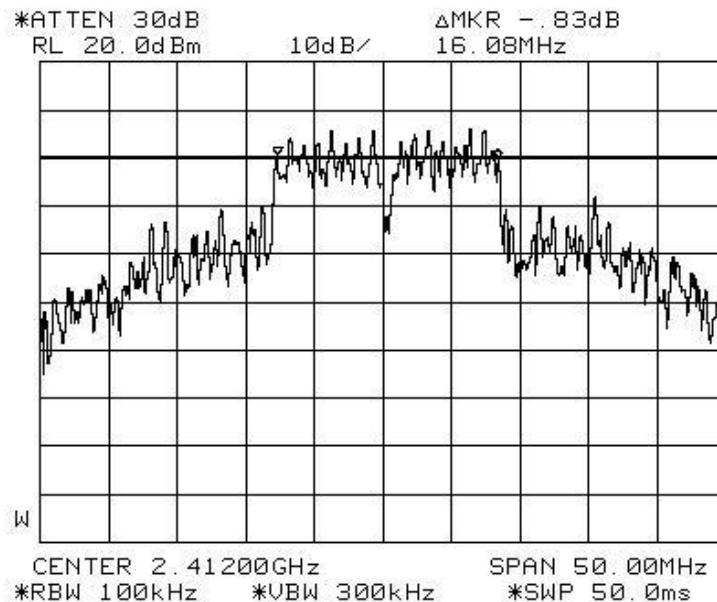
Channel	Channel Frequency (GHz)	6dB Bandwidth (MHz)
0	2.412	16.080
1	2.438	15.420
2	2.462	15.750



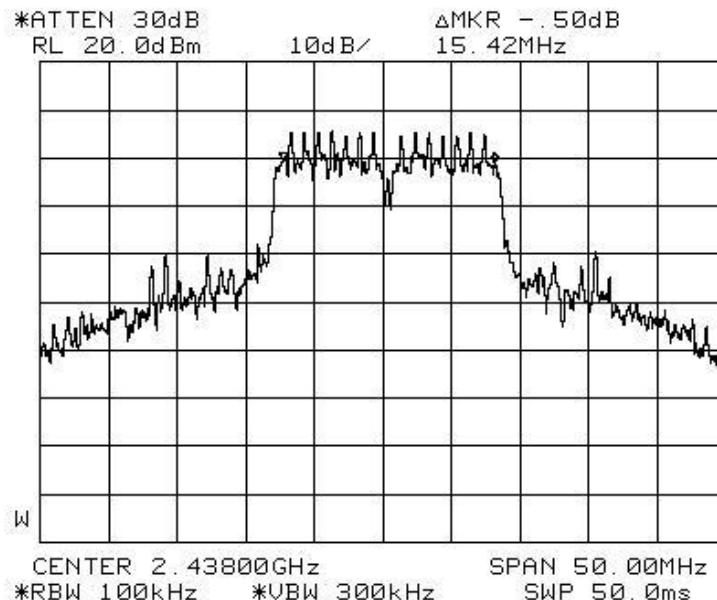
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SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots



Plot 1 - Channel 0



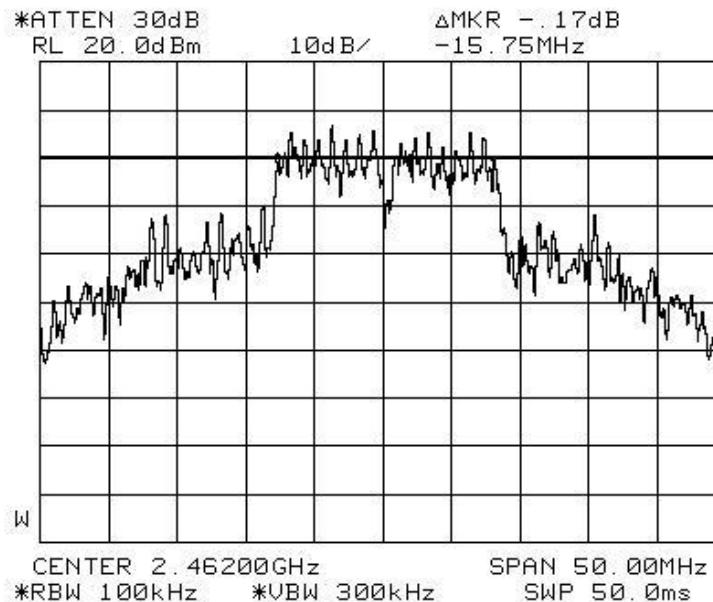
Plot 2 - Channel 1



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SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots



Plot 3 - Channel 2



MAXIMUM PEAK POWER TEST

FCC Part 15.247(b)(3) Maximum Peak Power Limits

The EUT shows compliance to the requirements of this section, which states the maximum peak power of the EUT employing digital modulation shall not exceed 1W (30dBm).

FCC Part 15.247(b)(3) Maximum Peak Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Universal Radio Communication Tester	CMU 200	837587/068	24 Jul 2009

FCC Part 15.247(b)(3) Maximum Peak Power Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the Universal Radio Communication Tester, which set into power analyser mode via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another filtered mains.

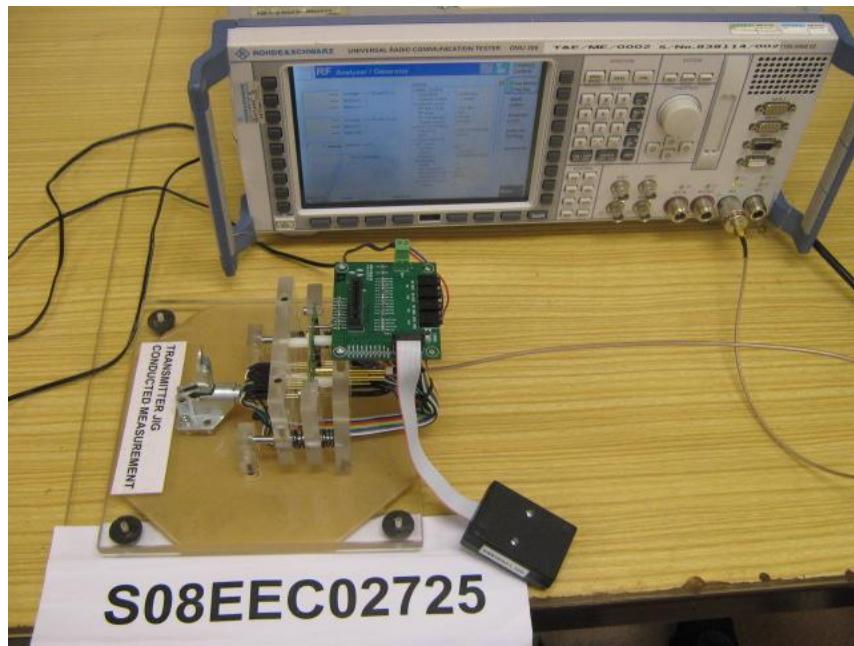
FCC Part 15.247(b)(3) Maximum Peak Power Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 0 (2.412GHz).
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. The Equivalent Isotropic Radiated Power (EIRP) of the EUT was computed by adding its antenna gain to the measured maximum peak power.
4. The steps 2 to 3 were repeated with the transmitting frequency was set to Channel 1 (2.438GHz) and Channel 2 (2.462GHz) respectively.



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MAXIMUM PEAK POWER TEST



Maximum Peak Power Test Setup



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MAXIMUM PEAK POWER TEST

FCC Part 15.247(b)(3) Maximum Peak Power Results

Test Input Power	110V 60Hz	Temperature	24°C
Antenna Gain	-3.0 dBi	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Maximum EIRP (W)	Limit (W)
0	2.412	0.0645	0.0323	1.0
1	2.438	0.0933	0.0467	1.0
2	2.462	0.0977	0.0489	1.0

Notes

1. Power analyser of Universal Radio Communication Tester was used for power measurement with peak detection as mode of measurement. The power analyser mode supports a wideband power measurement ranging from 100kHz to 2700MHz.



RF CONDUCTED SPURIOUS EMISSIONS TEST

FCC Part 15.247(d) RF Conducted Spurious Emissions Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) RF Conducted Spurious Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	26 Sep 2009

FCC Part 15.247(d) RF Conducted Spurious Emissions Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) RF Conducted Spurious Emissions Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.412GHz).
2. The start and stop frequencies of the spectrum analyser were set to 30MHz and 10GHz.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with frequency span was set from 10GHz to 25GHz.
5. The steps 2 to 4 were repeated with the transmitting frequency was set to Channel 1 (2.438GHz) and Channel 2 (2.462GHz) respectively.



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RF CONDUCTED SPURIOUS EMISSIONS TEST



RF Conducted Spurious Emissions Test Setup



RF CONDUCTED SPURIOUS EMISSIONS TEST

FCC Part 15.247(d) RF Conducted Spurious Emissions Results

Test Input Power	110V 60Hz	Temperature	23°C
Attached Plots	4 - 9	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

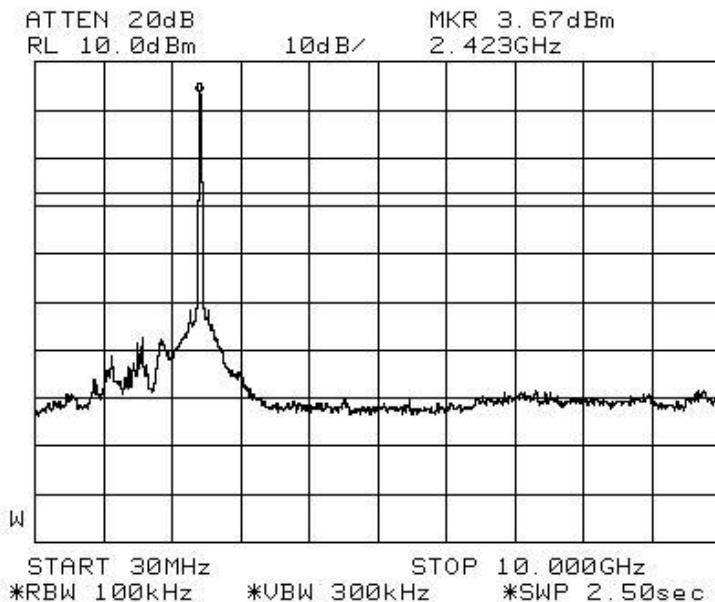
All spurious signals found were below the specified limit. Please refer to the attached plots.



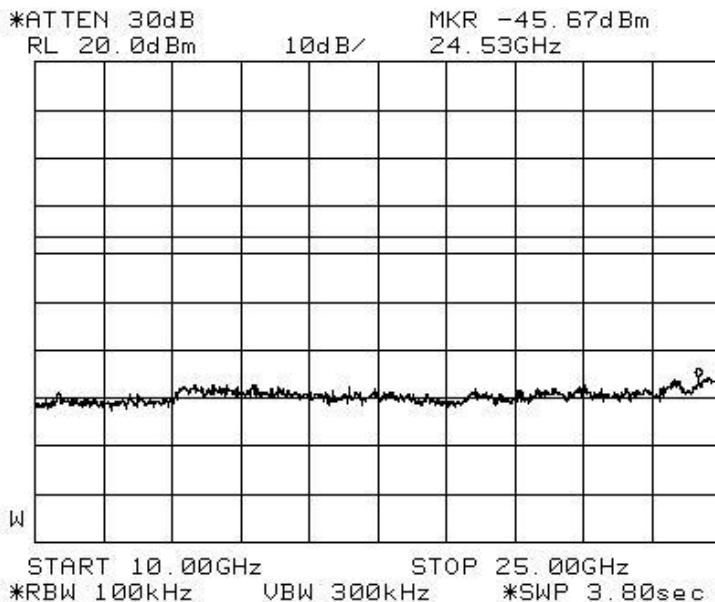
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RF CONDUCTED SPURIOUS EMISSIONS TEST

RF Conducted Spurious Emissions Plots



Plot 4 – Channel 0

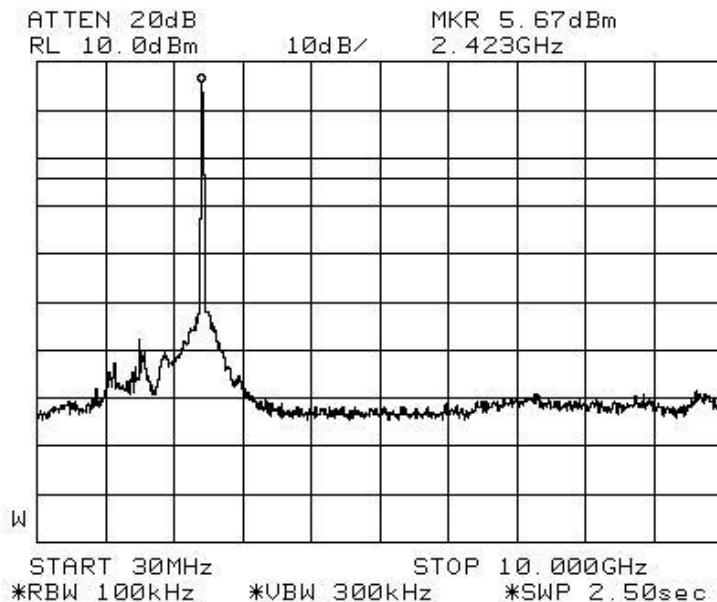


Plot 5 – Channel 0

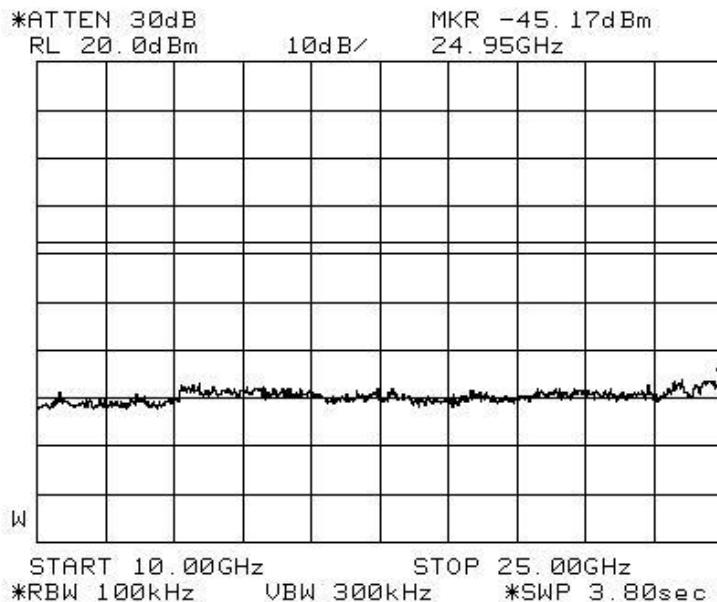


RF CONDUCTED SPURIOUS EMISSIONS TEST

RF Conducted Spurious Emissions Plots



Plot 6 – Channel 1



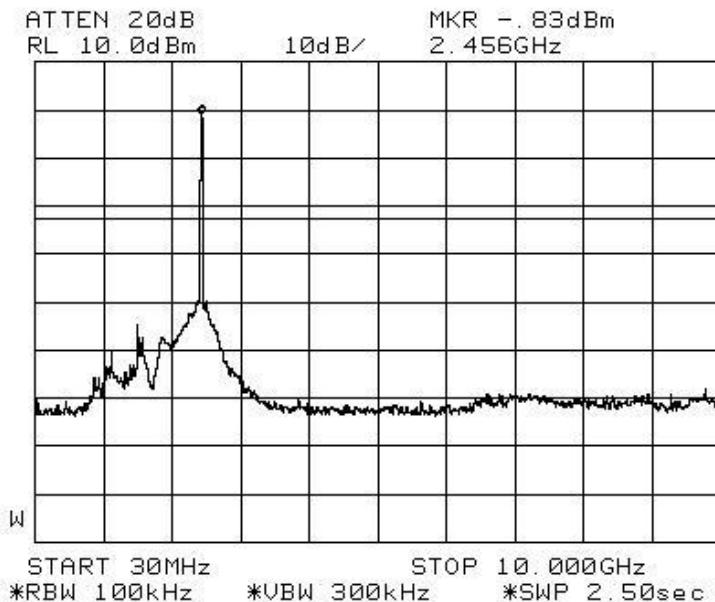
Plot 7 – Channel 1



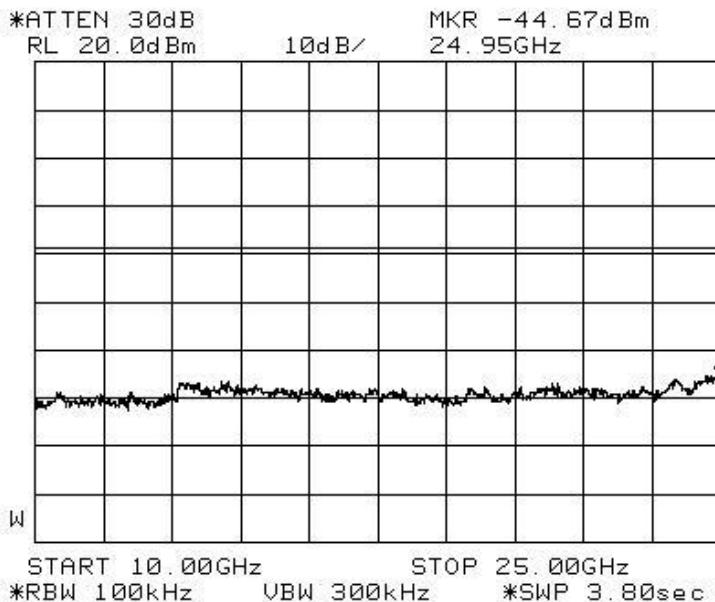
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RF CONDUCTED SPURIOUS EMISSIONS TEST

RF Conducted Spurious Emissions Plots



Plot 8 – Channel 2



Plot 9 – Channel 2



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BAND EDGE COMPLIANCE (CONDUCTED) TEST

FCC Part 15.247(d) Band Edge Compliance (Conducted) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz)	E7405A	US40240195	17 Jan 2009

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

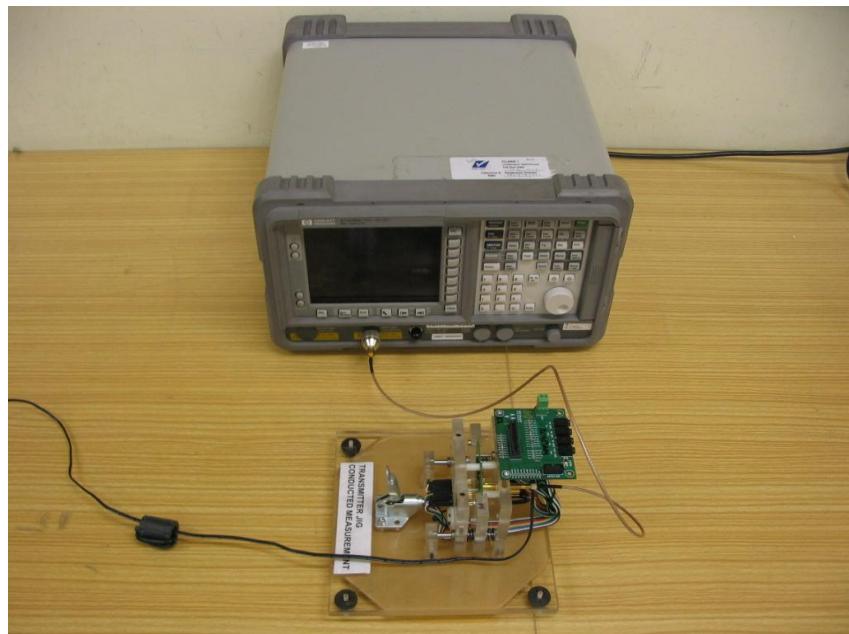
FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.



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BAND EDGE COMPLIANCE (CONDUCTED) TEST



Band Edge Compliance (Conducted) Test Setup



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BAND EDGE COMPLIANCE (CONDUCTED) TEST

FCC Part 15.247(d) Band Edge Compliance (Conducted) Results

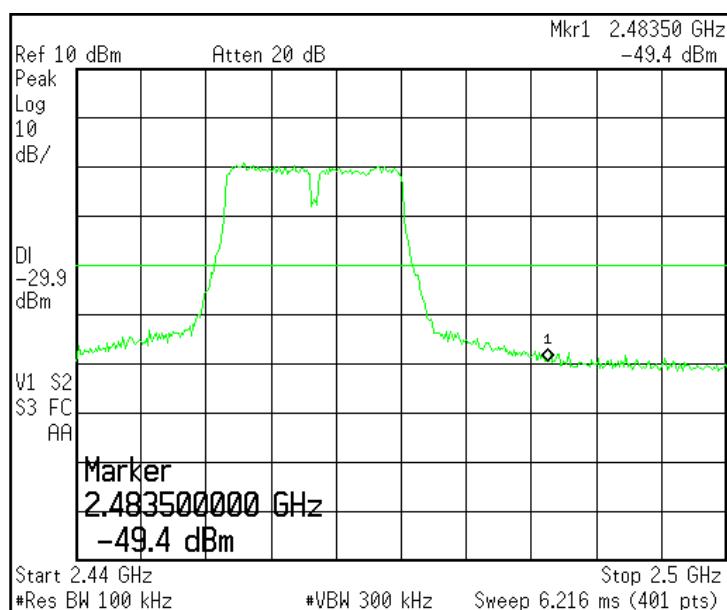
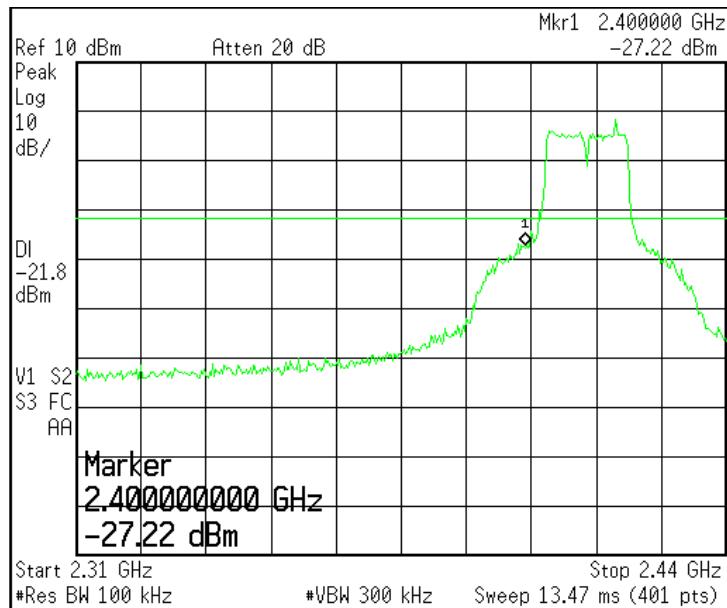
Test Input Power	110V 60Hz	Temperature	23°C
Attached Plots	10 - 11	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

No significant signal was found and they were below the specified limit.



BAND EDGE COMPLIANCE (CONDUCTED) TEST

Band Edge Compliance (Conducted) Plots





BAND EDGE COMPLIANCE (RADIATED) TEST

FCC Part 15.247(d) Band Edge Compliance (Radiated) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power. In addition, radiated emissions which fall in the restricted bands shall comply to the radiated emission limits specified in 15.209.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz–26.5GHz) – ESMI2	ESMI	829214/006 829550/001	12 May 2009
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	11 Jan 2009
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	26 Jan 2009
Schaffner Bilog Antenna –BL	CBL6112D	22020	19 May 2009
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2009
Mirco-Tronics 2.4GHz Bandstop Filter	BRM50701	042	13 Aug 2009

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz to show compliance of spurious at band edges are at least 20dB below the carriers. For restricted band spurious at band edges, peak and average measurement plots were taken using the following setting:
 - a. Peak Plot:
RBW = VBW = 1MHz
 - b. Average Plot
RBW = 1MHz, VBW = 10Hz
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.



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BAND EDGE COMPLIANCE (RADIATED) TEST



Band Edge Compliance (Radiated) Test Setup



BAND EDGE COMPLIANCE (RADIATED) TEST

FCC Part 15.247(d) Band Edge Compliance (Radiated) Results

Test Input Power	110V 60Hz	Temperature	23°C
Attached Plots	12 - 17	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

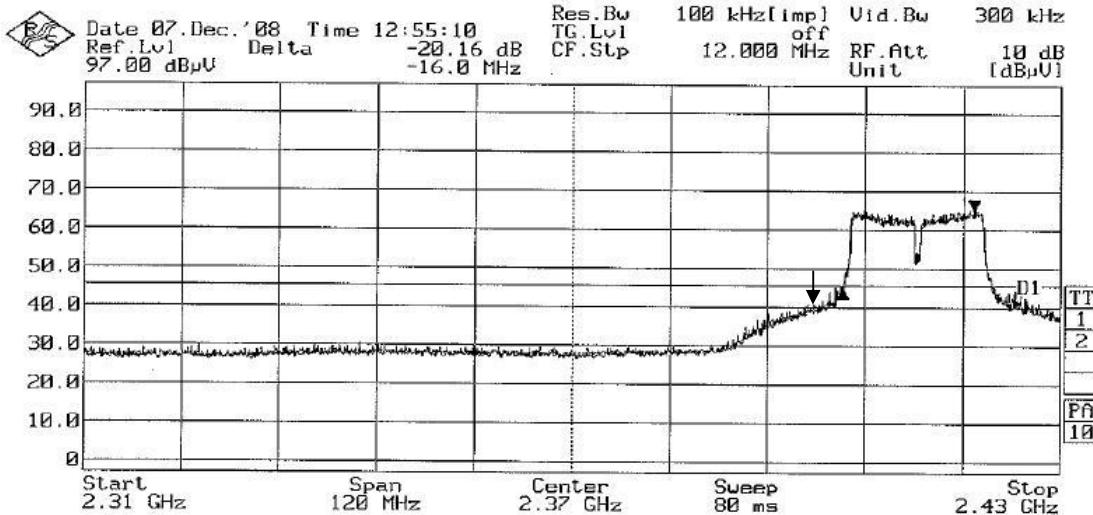
No significant signal was found and they were below the specified limit.



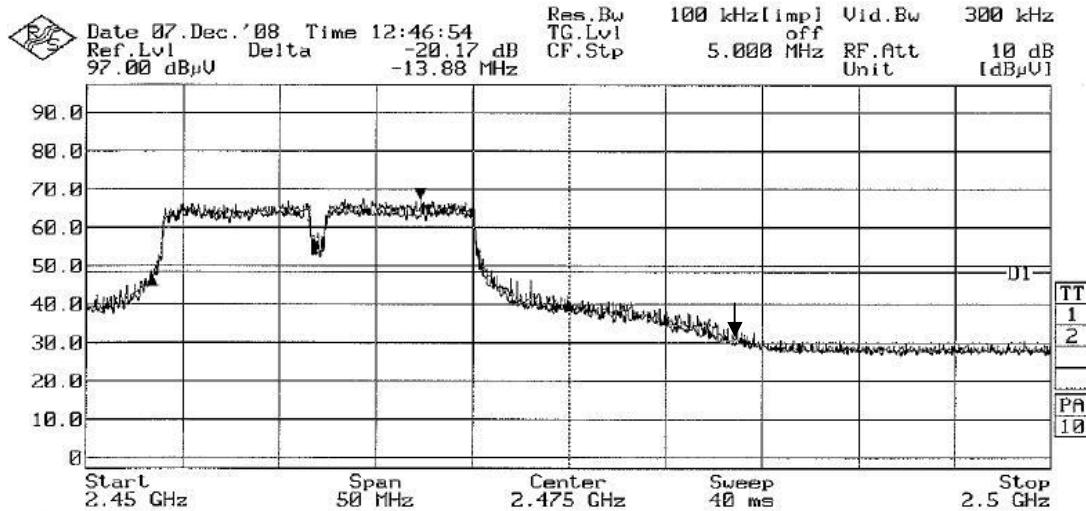
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BAND EDGE COMPLIANCE (RADIATED) TEST

Band Edge Compliance (Radiated) Plots (20dB Delta from Carrier at Band Edge)



Plot 12 – Lower Band Edge at 2.4000GHz



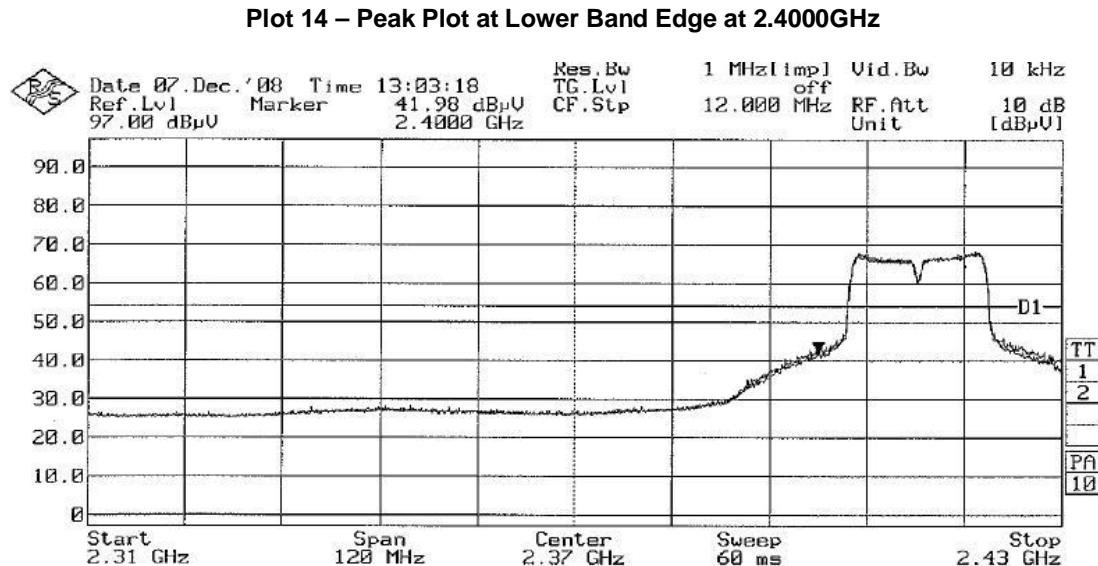
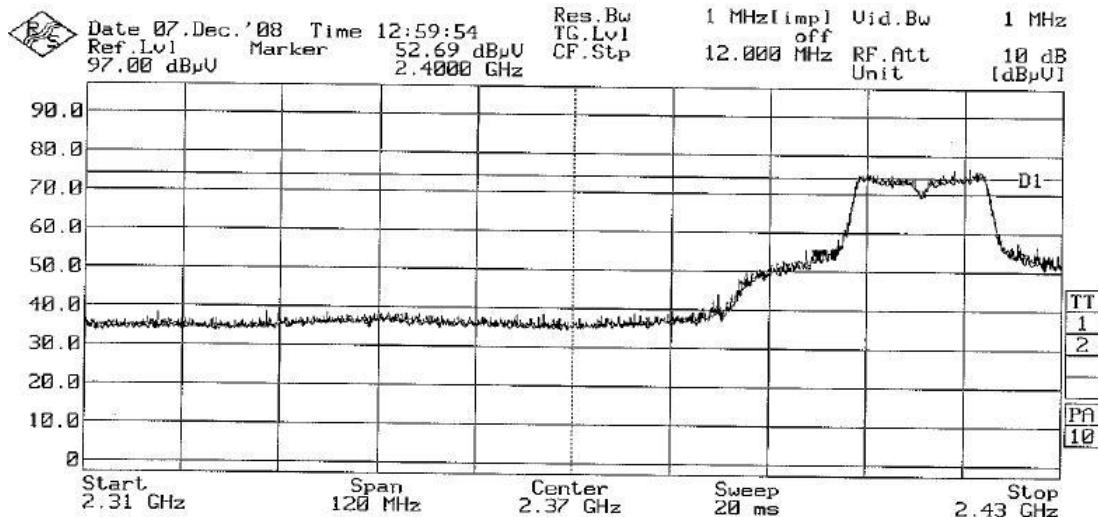
Plot 13 – Upper Band Edge at 2.4835GHz



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BAND EDGE COMPLIANCE (RADIATED) TEST

Band Edge Compliance (Radiated) Plots (Restricted Band)

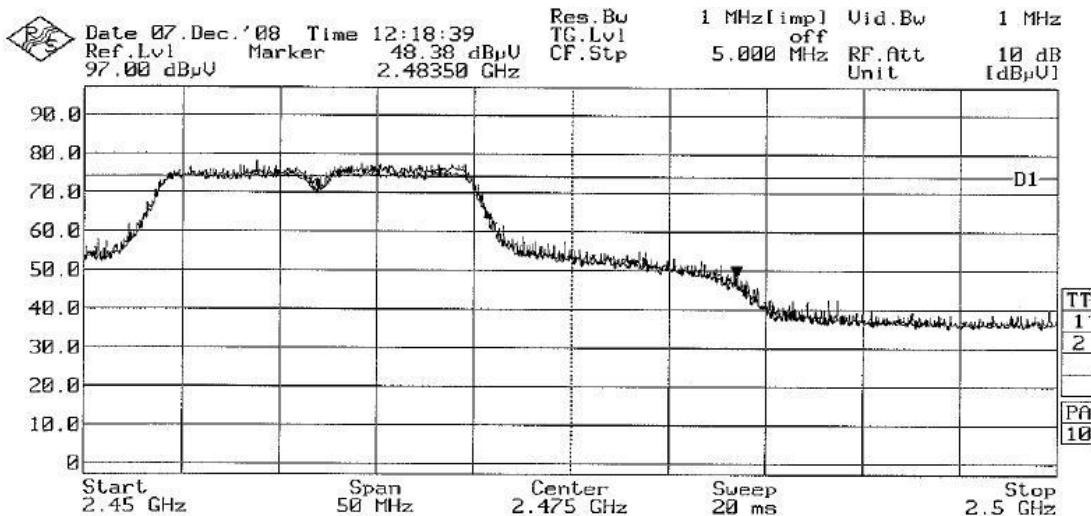




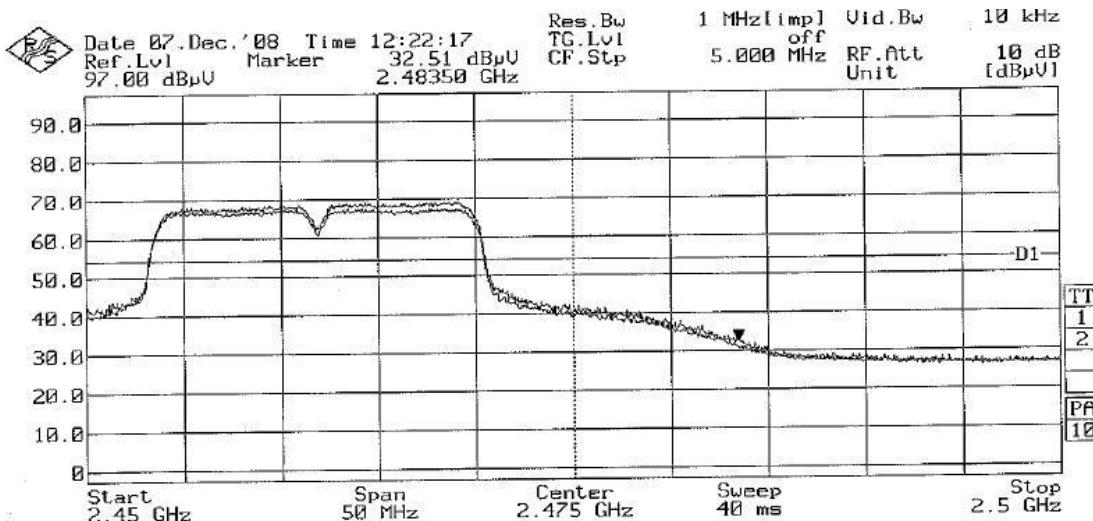
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BAND EDGE COMPLIANCE (RADIATED) TEST

Band Edge Compliance (Radiated) Plots (Restricted Band)



Plot 16 – Peak Plot at Upper Band Edge at 2.4835GHz



Plot 17 – Average Plot at Upper Band Edge at 2.4835GHz



PEAK POWER SPECTRAL DENSITY TEST

FCC Part 15.247(e) Peak Power Spectral Density Limits

The EUT shows compliance to the requirements of this section, which states the peak power spectral density conducted from the intentional radiator (EUT) to the antenna shall not be greater than 8dBm (6.3mW) in any 3kHz band during any time interval of continuous transmission.

FCC Part 15.247(e) Peak Power Spectral Density Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz)	E7405A	US40240195	17 Jan 2009

FCC Part 15.247(e) Peak Power Spectral Density Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 3kHz and 10kHz.
5. All other supporting equipment were powered separately from another filtered mains.

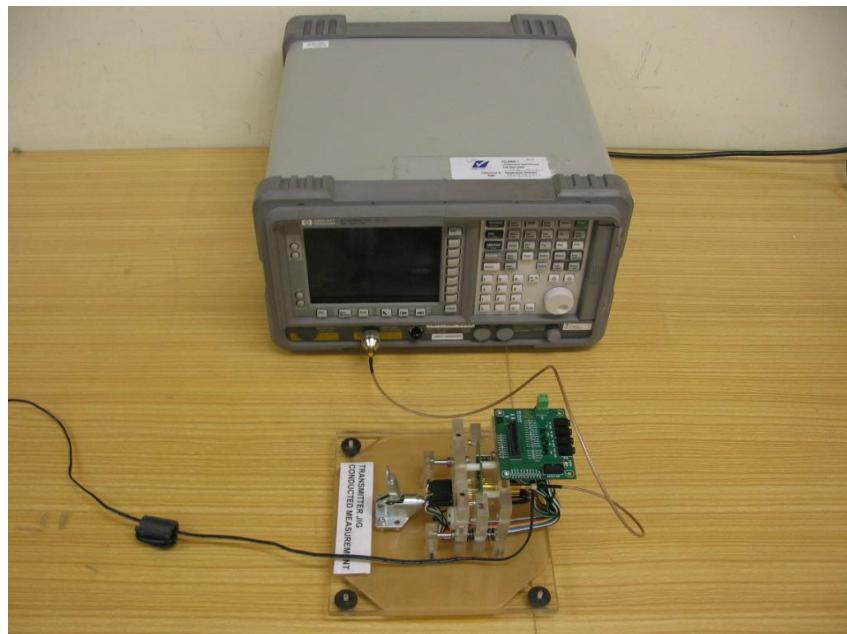
FCC Part 15.247(e) Peak Power Spectral Density Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 0 (2.412GHz).
2. The sweep time of the spectrum analyser was set to the value of the ratio of the frequency span divided by the RBW.
3. The peak power density of the transmitting frequency was detected and recorded.
4. The step 3 was repeated with the transmitting frequency was set to Channel 1 (2.438GHz) and Channel 2 (2.462GHz) respectively.



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PEAK POWER SPECTRAL DENSITY TEST



Peak Power Spectral Density Test Setup



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PEAK POWER SPECTRAL DENSITY TEST

FCC Part 15.247(e) Peak Power Spectral Density Results

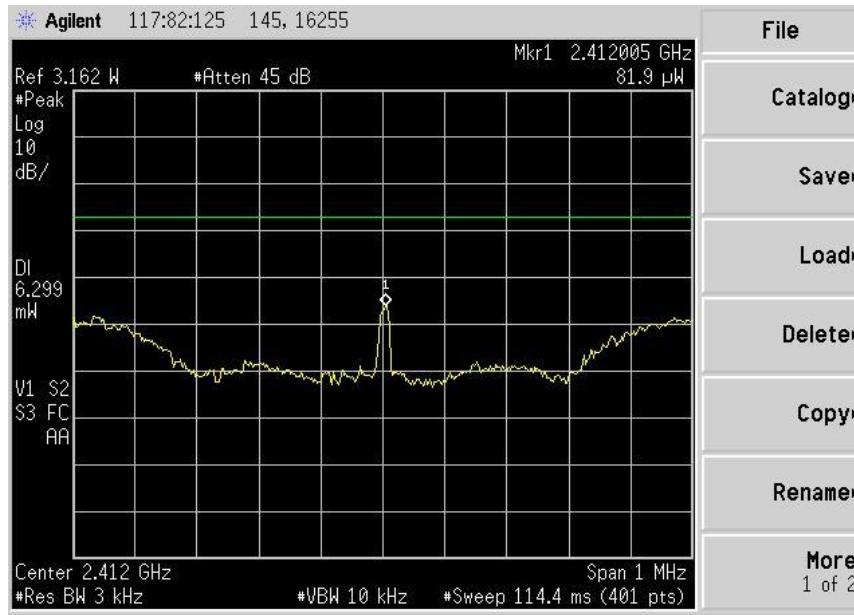
Test Input Power	110V 60Hz	Temperature	23°C
Attached Plots	18 - 20	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0	2.412	0.081	6.3
1	2.438	0.019	6.3
2	2.462	0.043	6.3

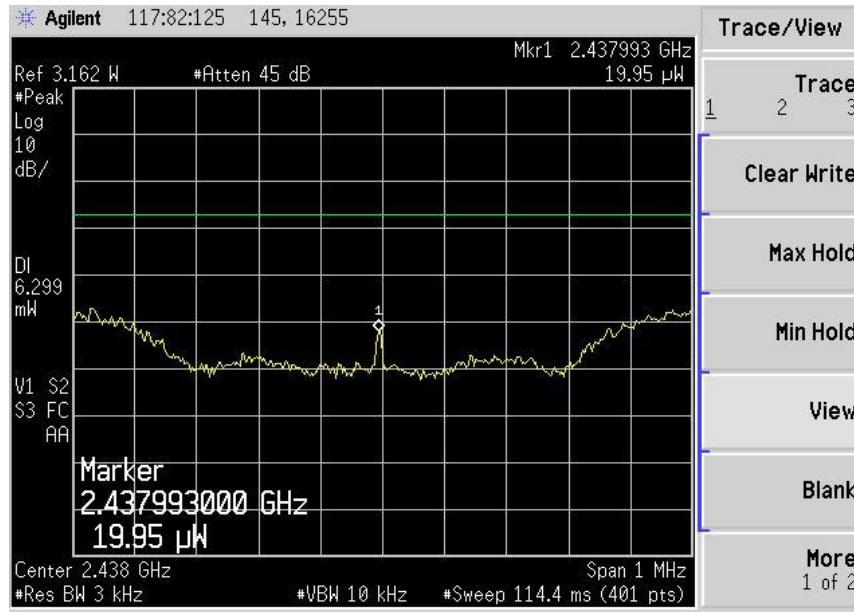


PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots



Plot 18 – Channel 0

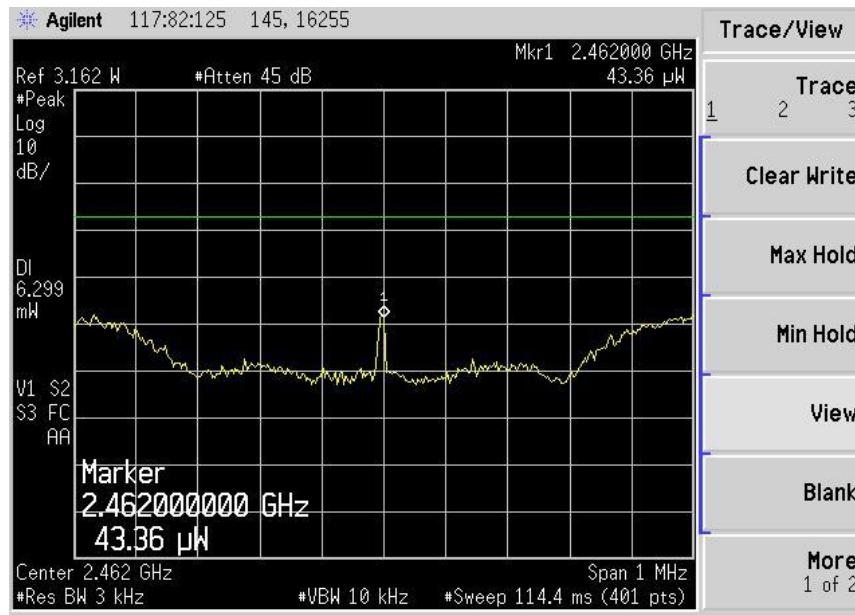


Plot 19 – Channel 1



PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots





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MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Limits

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (min)
0.3 - 1.34	614	1.63	100 ^{Note 2}	30
1.34 - 30	824 / f	2.19 / f	180 / f ² ^{Note 2}	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f / 1500	30
1500 - 100000	-	-	1.0	30
Notes				
1. f = frequency in MHz				
2. Plane wave equivalent power density				

FCC Part 1.1310 Maximum Permissible Exposure Computation

The minimum safe distance between the EUT and field probe was computed from the following formula:

$$\begin{aligned}
 d &= \sqrt{[(30GP) / 377S]} \\
 \text{where } S &= \text{Power density, } 10\text{W/m}^2 \\
 P &= 0.0489\text{W} \\
 d &= \text{Minimum safety distance, m} \\
 G &= \text{Numerical isotropic gain, } 0.5 \text{ (-3.0dB)}
 \end{aligned}$$

Substituting the relevant parameters into the formula:

$$\begin{aligned}
 d &= \sqrt{[(30GP) / 377S]} \\
 &= 0.0140\text{m} \\
 &= 1.40\text{cm}
 \end{aligned}$$

∴ The distance between users and the EUT shall be maintained at a minimum distance of 1.4cm during normal operation in order to ensure RF exposure to the users is within the allowable safety margin.



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January 2008



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EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

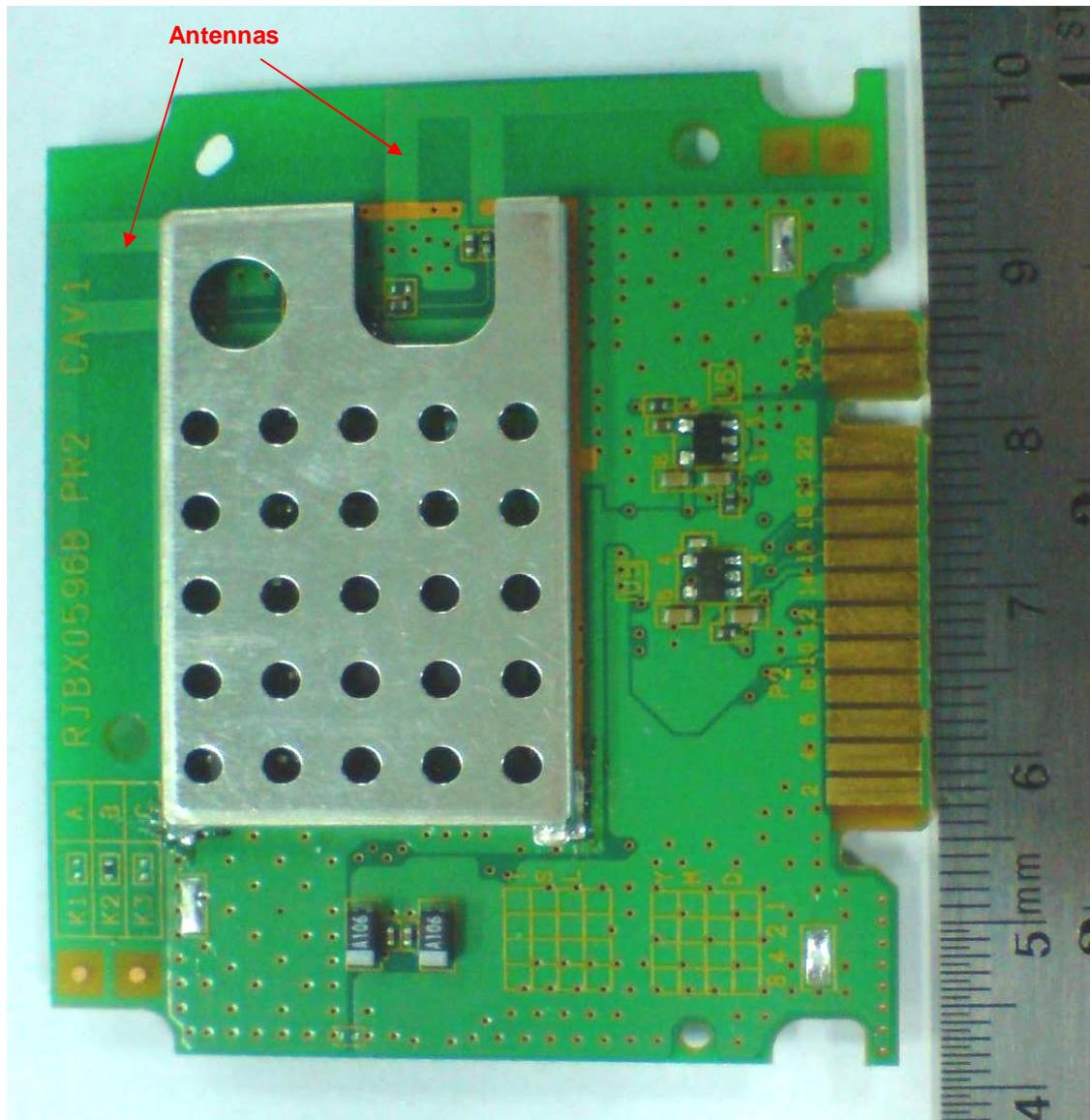
ANNEX A

EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS



Front View

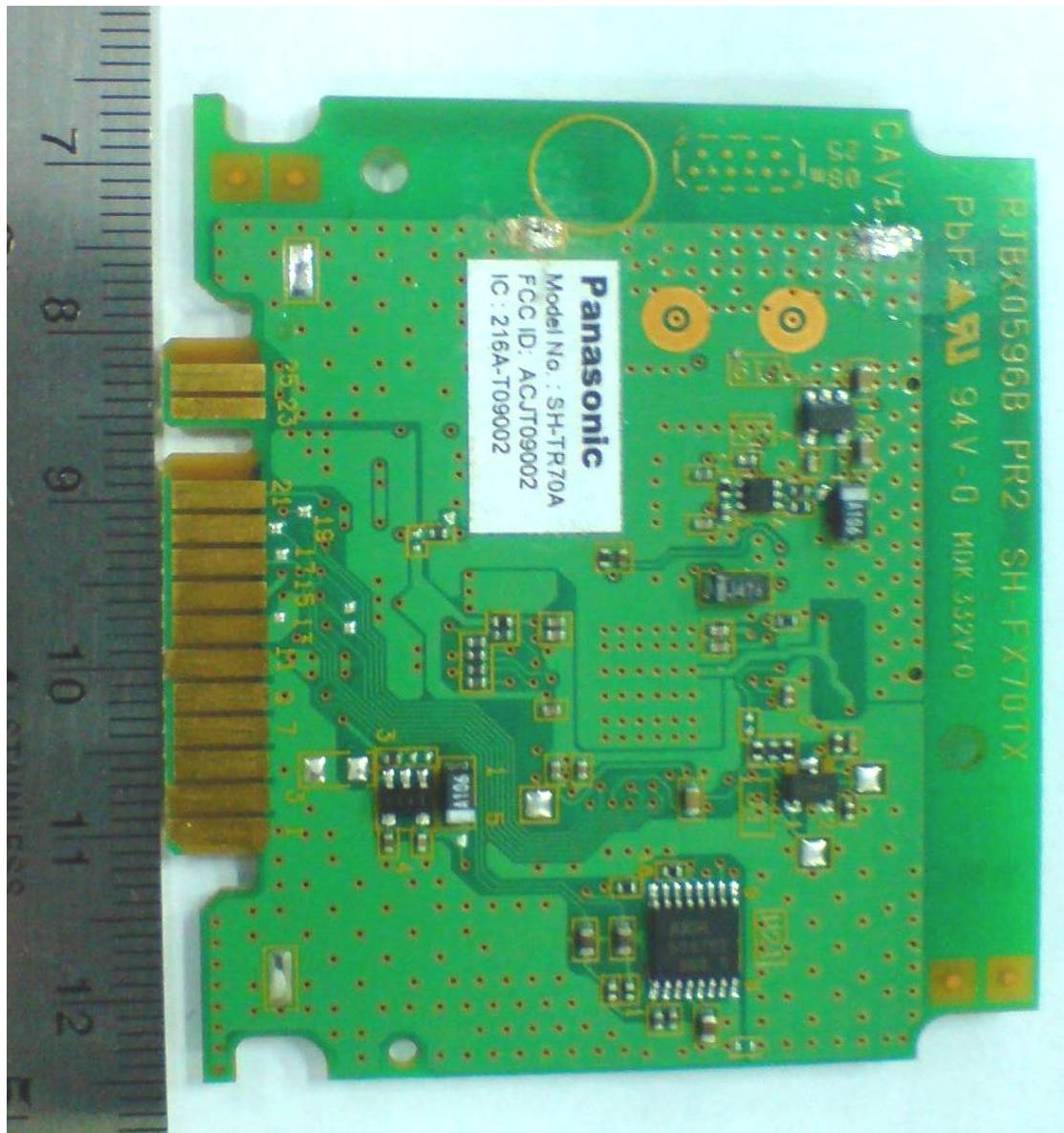


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EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS



Rear View

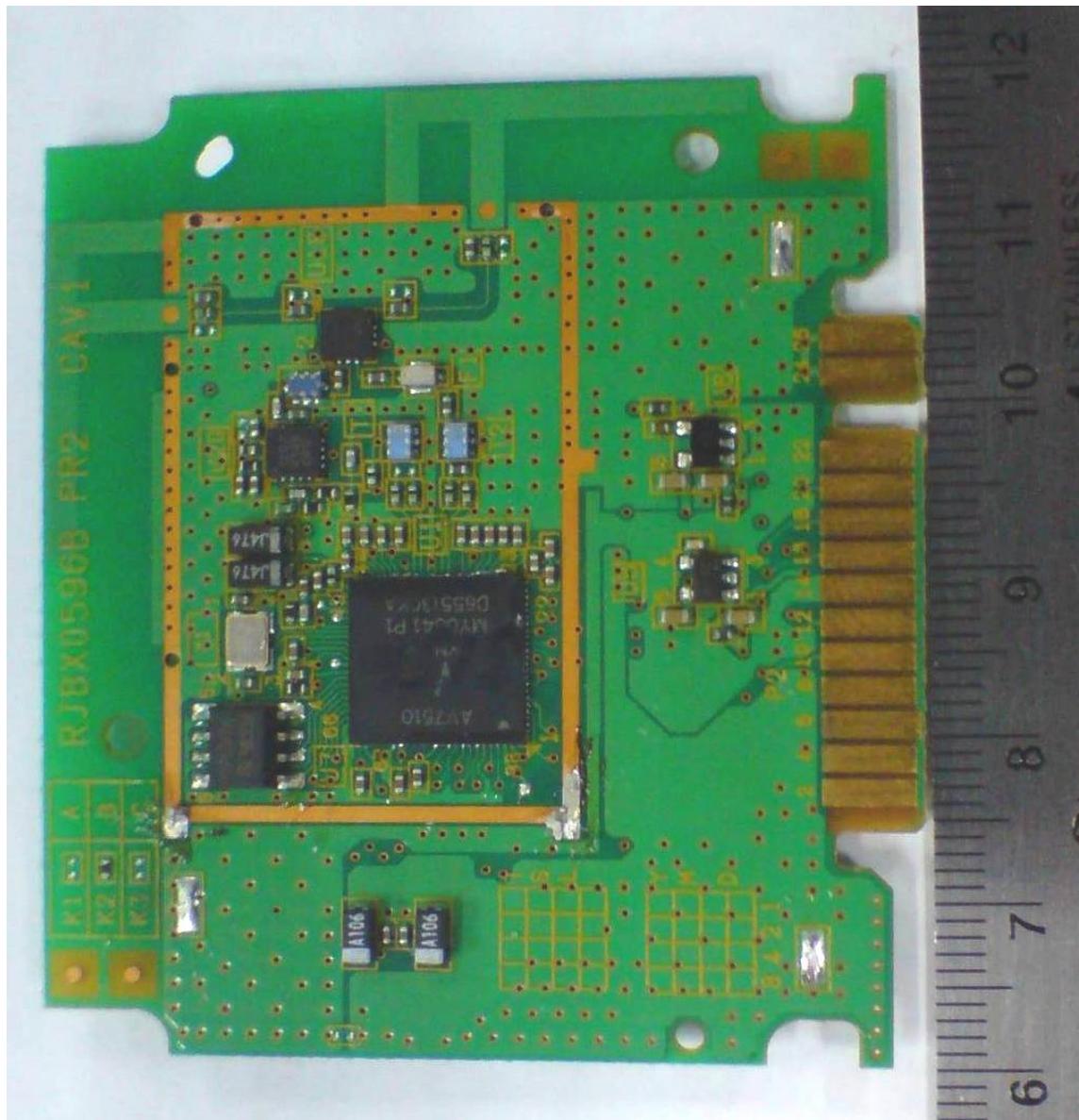


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EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS



Shield Removed View



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FCC LABEL & POSITION

ANNEX B

ANNEX B

FCC LABEL & POSITION



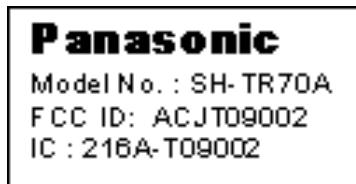
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FCC LABEL & POSITION

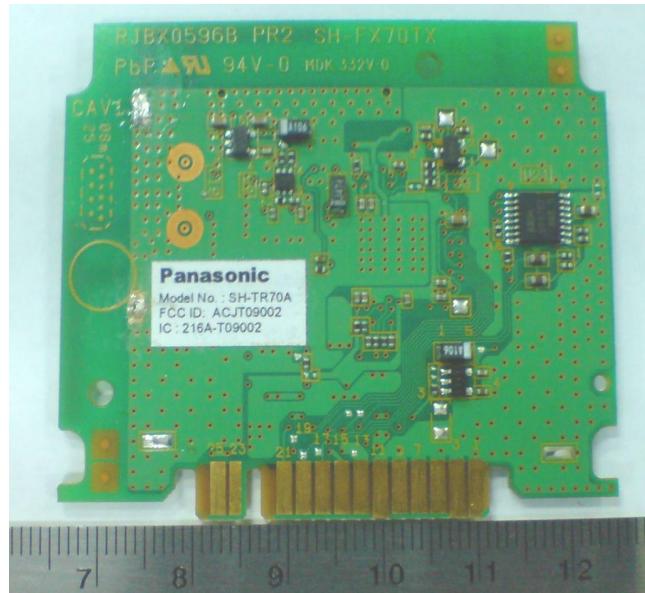
ANNEX B

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.



SH-TR70A Sample Label



Physical Location of FCC Label on EUT



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**USER MANUAL TECHINICAL DESCRIPTION BLOCK
& CIRCUIT DIAGRAMS**

ANNEX C

ANNEX C

**USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS**

(Please refer to manufacturer for details)