

Test Report No. S09ICM00159/EMC/05
dated 10 Feb 2009



PSB Singapore

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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]

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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. 2932I-1 (3m and 10m Semi-Anechoic Chambers)

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QUOTATION NUMBER Q09ICM00169

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LA-2007-0385-E
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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	Not Tested *see Note 6
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)	Not Tested *see Note 6
15.247(b)(3)	Maximum Peak Power	Not Tested *see Note 6
15.247(d)	RF Conducted Spurious Emissions	Not Tested *see Note 6
15.247(d)	Band Edge Compliance (Conducted)	Not Tested *see Note 6
15.247(d)	Band Edge Compliance (Radiated)	Not Tested *see Note 6
15.247(e)	Peak Power Spectral Density	Not Tested *see Note 6
1.1310	Maximum Permissible Exposure	Not Tested *see Note 6
15.35(c)	Duty Cycle Factor Computation	See Note 4



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. The EUT is a Class B device when in non-transmitting state and meets the FCC Part15B Class B requirements.
3. All test measurement procedures are according to ANSI C63.4: 2003.
4. The Equipment Under Test (EUT) was set to continuous RF transmission, ie, 0dB duty cycle.
5. 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.
6. As the changes listed below do not change the RF power, RF parameters and input power of the Equipment Under Test (EUT), the impact to EMC and RF performance of the EUT is minimal. As such, this test is required and the test results reflected in TÜV SÜD PSB issued test report S08EEC02725/05 remains valid.
 - a. Change of C99 from 1.5pF to 3.0pF to improve antenna matching.
 - b. Change of C165 from 470pF to 27pF to improve RF PA feedback control response.

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.



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. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)
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.

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)	CPA9231A	3422	18 Feb 2009
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	26 Jan 2010
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

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	22°C
Test Distance	3m	Relative Humidity	58%
Model	SH-TR70A	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian Anthony Toh

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
48.4120	1.1	-38.9	95	177	H	1
316.9510	38.1	-8.0	229	99	H	1
329.1420	36.9	-9.1	223	107	H	1
335.2380	36.2	-9.8	228	100	H	1
341.3340	43.4	-2.6	223	100	H	1
347.4000	27.6	-18.4	173	100	V	1

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBµV/m)	Average Value (dBµV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

RADIATED EMISSION TEST

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. "--" indicates no emissions were found and shows compliance to the limits.
3. 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.
4. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
5. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
30MHz - 1GHz
RBW: 120kHz VBW: 1MHz
>1GHz
RBW: 1MHz VBW: 1MHz
6. 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.
7. The channel in the table refers to the transmit channel of the EUT.
8. 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 $\pm 4.6\text{dB}$.

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PSB Singapore

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January 2008



EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

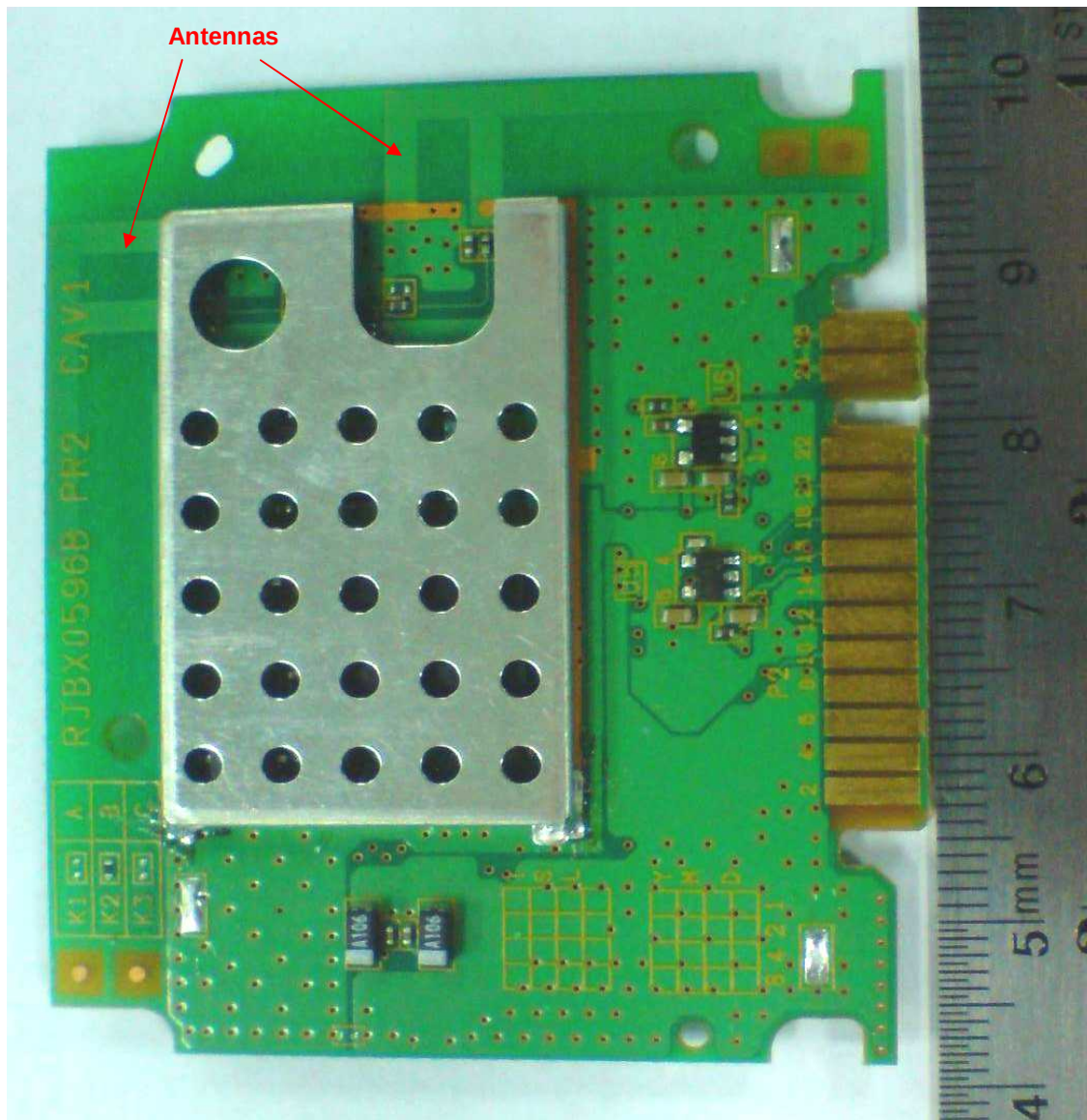
ANNEX A

EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS

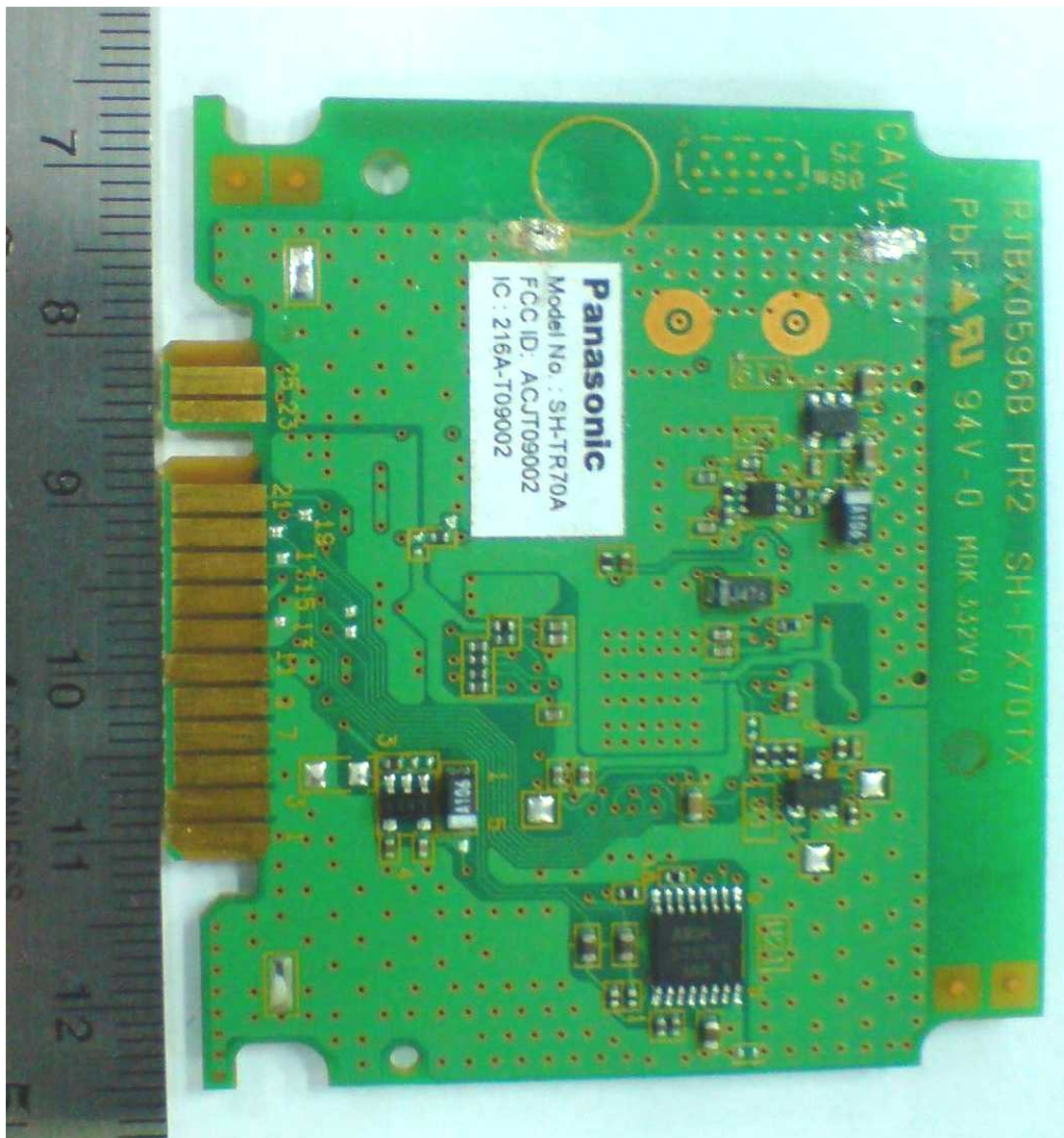


Front View

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS

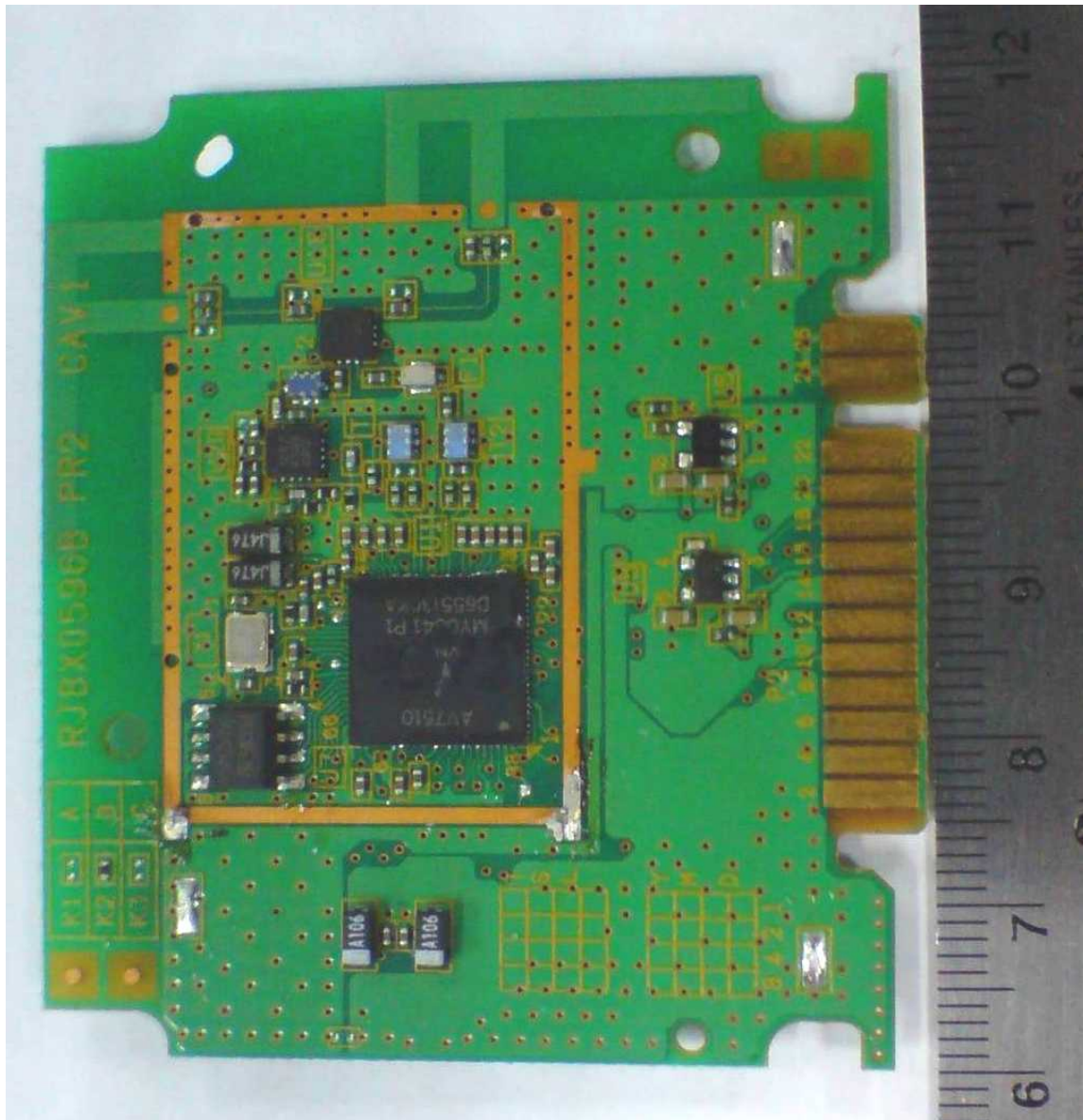


Rear View

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS



Shield Removed View



FCC LABEL & POSITION

ANNEX B

ANNEX B

FCC LABEL & POSITION

FCC LABEL & POSITION

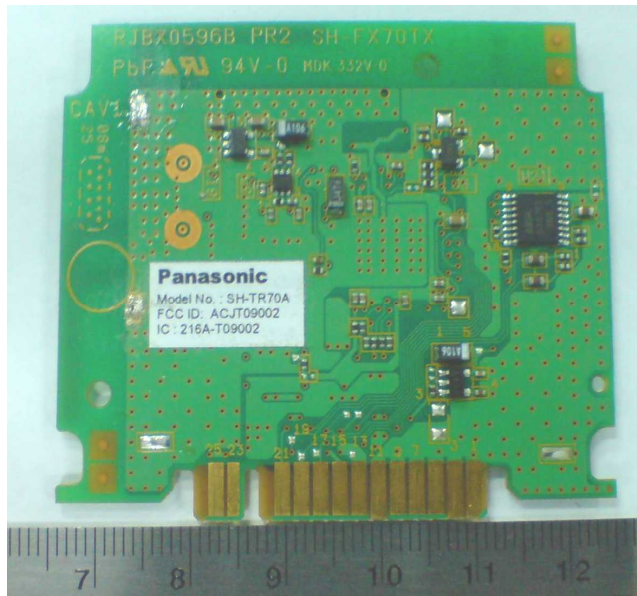
ANNEX B

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



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

ANNEX C

ANNEX C

**USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS**
(Please refer to manufacturer for details)