

**Test Report No. 53S071029/EMC/01**  
**dated 20 May 2007**



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**FORMAL REPORT ON TESTING IN ACCORDANCE WITH**  
**FCC Parts 15B & C : 2006**  
**OF A**  
**WIRELESS TRANSCEIVER MODULE**  
**[ Model : SB0940 ]**  
**[ FCC ID : IBAAV-SB0940T01 ]**

**TEST FACILITY** TÜV SÜD PSB Pte Ltd,  
Telecoms & EMC, Testing Group,  
1 Science Park Drive, Singapore 118221

**FCC REG. NO.** 90937 (3m & 10m OATS)  
99142 (10m Anechoic Chamber)  
871638 (5m Anechoic Chamber)  
325572 (10m Anechoic Chamber)

**IND. CANADA REG. NO.** IC 4257 (3m and 10m Anechoic Chambers)

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**QUOTATION NUMBER** 53Q0700316

**JOB NUMBER** 53S071029

**TEST PERIOD** 20 Apr 2007 – 02 May 2007

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LA-2007-0380-A  
LA-2007-0380-A-1  
LA-2007-0381-F  
LA-2007-0382-B  
LA-2007-0383-G  
LA-2007-0384-G  
LA-2007-0385-E  
LA-2007-0386-C

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.



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**TABLE OF CONTENTS**

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TEST SUMMARY

PRODUCT DESCRIPTION

SUPPORTING EQUIPMENT DESCRIPTION

EUT OPERATING CONDITIONS

CONDUCTED EMISSION TEST

RADIATED EMISSION TEST

SPECTRUM BANDWIDTH (6dB BANDWIDTH  
MEASUREMENT) TEST

MAXIMUM PEAK POWER TEST

RF CONDUCTED SPURIOUS EMISSIONS TEST

BAND EDGE COMPLIANCE (CONDUCTED) TEST

BAND EDGE COMPLIANCE (RADIATED) TEST

PEAK POWER SPECTRAL DENSITY TEST

MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

ANNEX A	- EUT PHOTOGRAPHS / DIAGRAMS
ANNEX B	- FCC LABEL & POSITION
ANNEX C	- USER MANUAL, TECHNICAL DESCRIPTION, BLOCK & CIRCUIT DIAGRAMS

**Test Report No. 53S071029/EMC/01**  
dated 20 May 2007



**TEST SUMMARY**

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

**Test Results Summary**

Test Standard	Description	Pass / Fail
FCC Part 15: 2006		
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	Pass

## 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 1	2.412
Channel 2	2.438
Channel 3	2.464

2. All the measurements in section 15.247 were done based on conducted measurements.
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.

### Modifications

1. No modifications were made.



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**PRODUCT DESCRIPTION**

Description	: The Equipment Under Test (EUT) is a <b>WIRELESS TRANSCEIVER MODULE.</b>
Manufacturer	: Creative Technology Ltd
Model Number	: SB0940
FCC ID	: IBAAV-SB0940T01
Serial Number	: Nil
Microprocessor	: Radio MAX2381, DARR79
Operating / Transmitting Frequency	: 2.412GHz to 2.464GHz
Clock / Oscillator Frequency	: 12.288MHz
Modulation	: BPSK
Port / Connectors	: Refer to manufacturer's user manual / operating manual.
Rated Input Power	: 5Vdc
Accessories	: AC adaptor (model : SW0510 or TESA9G-0502400)



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**SUPPORTING EQUIPMENT DESCRIPTION**

The EUT was tested as a stand-alone unit without any supporting equipment.



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**EUT OPERATING CONDITIONS**

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<b>FCC Part 15</b>
<ol style="list-style-type: none"><li>1. Conducted Emissions</li><li>2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)</li><li>3. Spectrum Bandwidth (6dB Bandwidth Measurement)</li><li>4. Maximum Peak Power</li><li>5. RF Conducted Spurious Emissions</li><li>6. Band Edge Compliance (Conducted)</li><li>7. Band Edge Compliance (Radiated)</li><li>8. Peak Power Spectral Density</li><li>9. Maximum Permissible Exposure</li></ol>
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 (dBμV)	
	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 – ESI1	ESI40	100010	04 Aug 2007
R&S Pulse Limiter – PL2	ESH3-Z2	100347	13 Apr 2008
Schaffner LISN – LISN7 (for EUT)	NNB42	00008	15 May 2007



## 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 $\mu$ 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 $\mu$ V = 60.0 dB $\mu$ 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 dB $\mu$ V (Calibrated for system losses)	
Therefore, Q-P margin = 40.0 - 60.0 = -20.0	i.e. <b>20.0 dB below Q-P limit</b>

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**CONDUCTED EMISSION TEST**



**Conducted Emissions Test Setup (Front View)**



**Conducted Emissions Test Setup (Rear View)**

**Test Report No. 53S071029/EMC/01**  
dated 20 May 2007



**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	58%
Test Mode	Transmit	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.2175	47.2	-15.7	41.0	-11.9	Neutral	3
0.2694	43.8	-17.3	38.5	-12.6	Live	3
0.7806	41.8	-14.2	32.0	-14.0	Neutral	3
1.3522	41.6	-14.4	29.5	-16.5	Neutral	3
6.1433	47.7	-12.3	43.2	-6.8	Neutral	3
18.4303	47.0	-13.0	41.9	-8.1	Neutral	3

Test Input Power	110V 60Hz	Temperature	24°C
Line Under Test	AC Mains	Relative Humidity	58%
Test Mode	Receive / Standby	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.2185	58.6	-4.3	52.6	-0.3	Neutral	3
0.3268	38.3	-21.2	32.2	-17.3	Live	3
0.7715	42.8	-13.2	32.7	-13.3	Neutral	3
1.2925	43.1	-12.9	36.4	-9.6	Neutral	3
6.1433	47.2	-12.8	43.1	-6.9	Neutral	3
18.4303	46.8	-13.2	41.9	-8.1	Neutral	3

**Notes**

- 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.
- A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:  
9kHz - 30MHz  
RBW: 10kHz VBW: 30kHz
- 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 (Average & Quasi-peak) is ±3.0dB.

**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) – ESMI1 (Ref)	ESMI	849182/003 848926/007	19 Apr 2008
Schaffner Bilog Antenna – BL3 (Ref)	CBL6112B	2549	08 Nov 2007
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2007
TESEQ Preamplifier (1GHz-18GHz) – PA17	LNA6018	70215	09 Jan 2008
Mirco-Tronics 2.4GHz Bandstop Filter	BRM50701	042	13 Aug 2007

## **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**

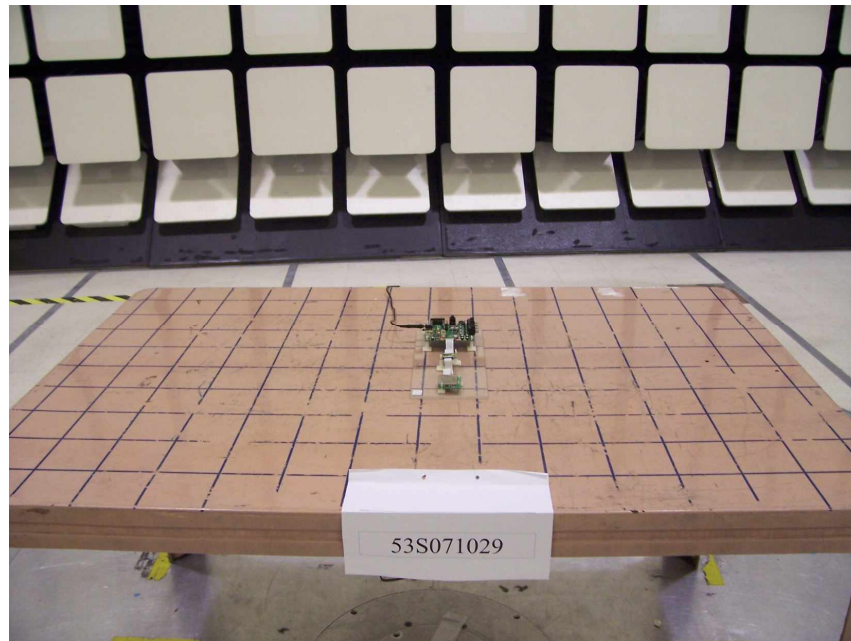
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which attitude 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 10<sup>th</sup> harmonics of the EUT fundamental frequency, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

### **Sample Calculation Example**

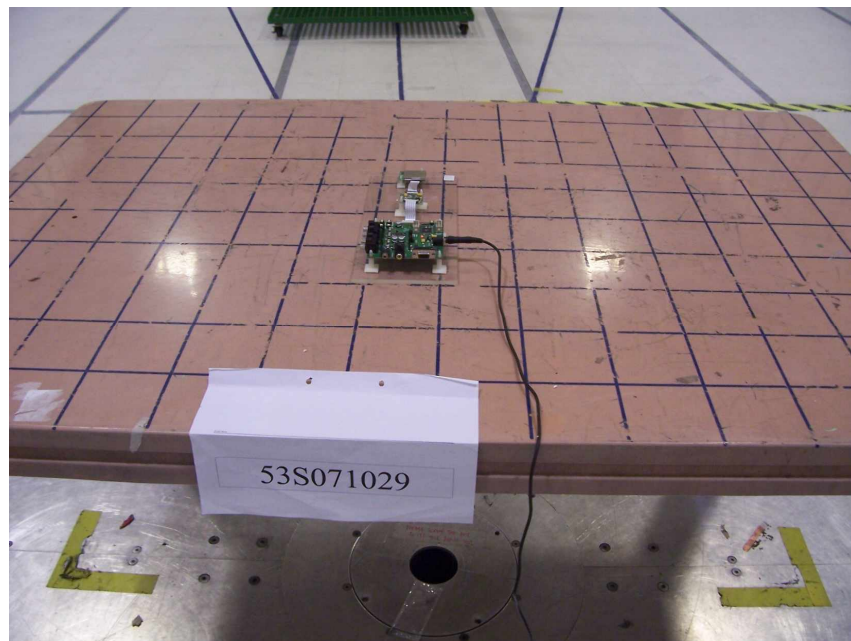
At 300 MHz	Q-P limit (Class B) = 200 $\mu$ V/m = 46.0 dB $\mu$ V/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 40.0 dB $\mu$ V/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 40.0 - 46.0 = -6.0	i.e. <b>6 dB below Q-P limit</b>

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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	23°C
Test Distance	3m	Relative Humidity	57%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler / Dylan Lin / Zechs Ng Chee Siong

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB $\mu$ V/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
35.7500	31.8	-8.2	25	105	V	3
119.7500	37.5	-6.0	197	100	V	3
121.7500	38.3	-5.2	165	100	V	3
615.5200	39.5	-5.5	177	180	H	3
640.0000	38.4	-7.6	54	100	V	3
928.0000	38.8	-7.2	61	100	H	3

Spurious Emissions above 1GHz

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

**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.



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**RADIATED EMISSION TEST**

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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 (QP only @ 3m & 10m) is  $\pm 4.6\text{dB}$  (for EUTs < 0.5m X 0.5m X 0.5m).



### **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 – SA2	8593E	3325Z00702	23 Feb 2008

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

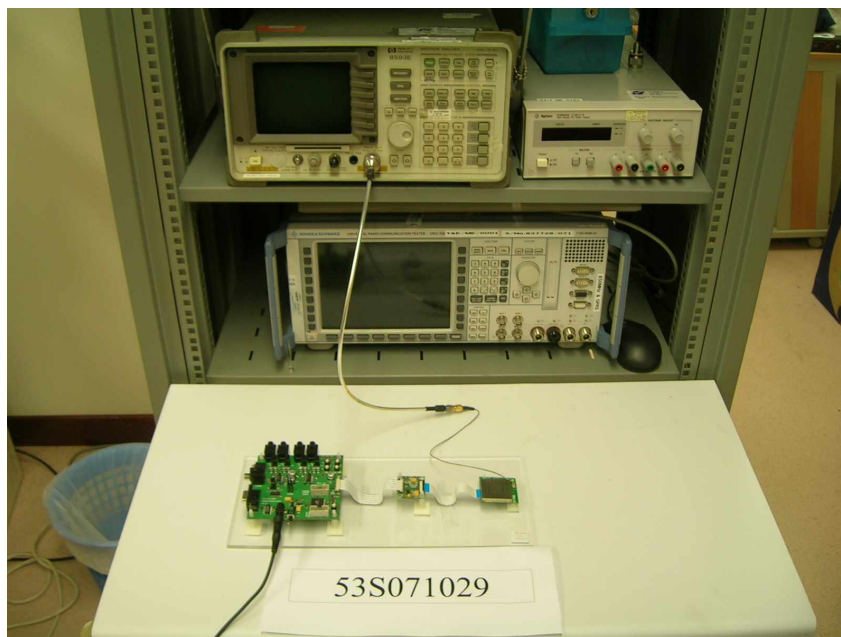
1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 3MHz.
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 1 (2.412GHz) with specified modulation and data rate.
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. Repeat steps 1 to 5 with all possible modulations and data rates.
7. The steps 2 to 6 were repeated with the transmitting frequency was set to Channel 2 (2.438GHz) and Channel 3 (2.464GHz) respectively.

**SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST**

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**Spectrum Bandwidth (6dB Bandwidth Measurement) Test Setup**

**Test Report No. 53S071029/EMC/01**  
dated 20 May 2007



**SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST**

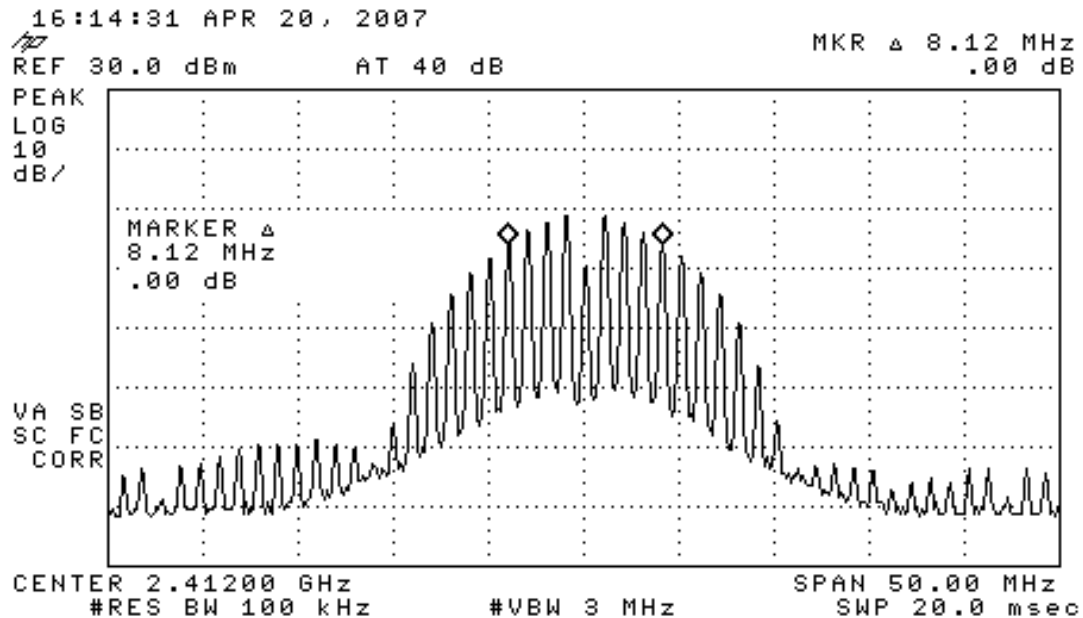
**FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Results**

Test Input Power	110V 60Hz	Temperature	22°C
Attached Plots	1 - 3	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

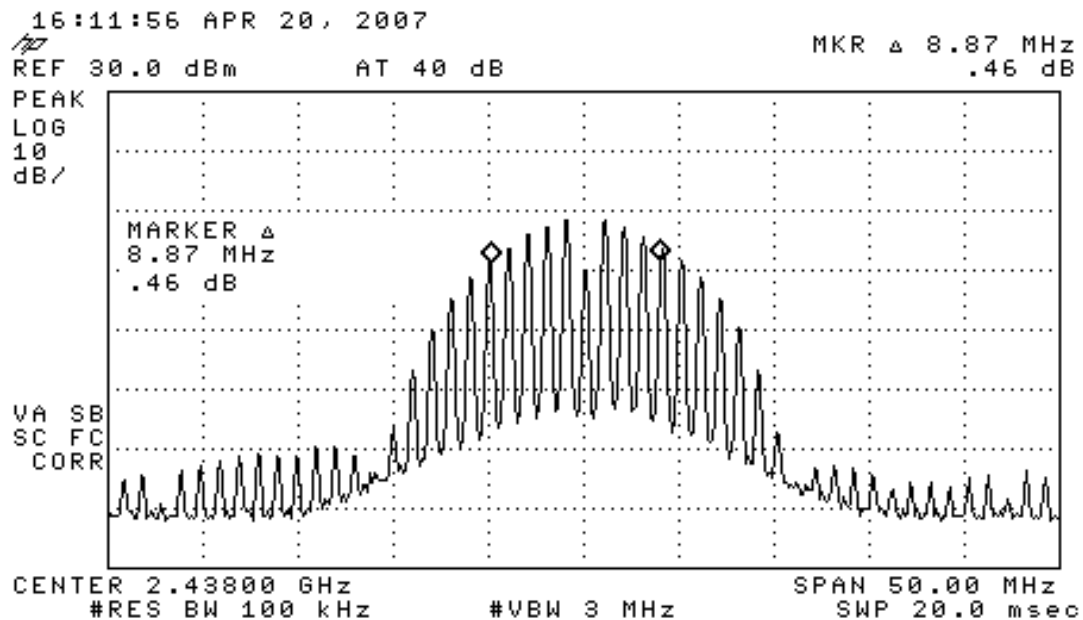
Channel	Channel Frequency (GHz)	6dB Bandwidth (MHz)
1	2.412	8.120
2	2.438	8.870
3	2.464	10.000

**SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST**

**Spectrum Bandwidth (6dB Bandwidth Measurement) Plots**



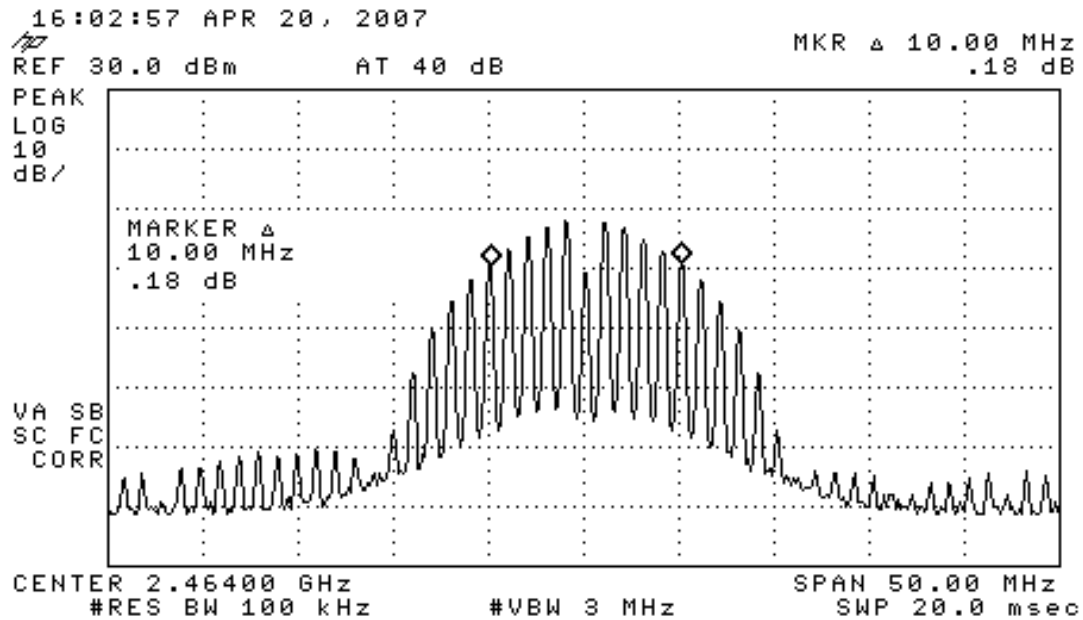
**Plot 1 - Channel 1**



**Plot 2 - Channel 2**

**SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST**

**Spectrum Bandwidth (6dB Bandwidth Measurement) Plots**



**Plot 3 - Channel 3**



## 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	06 Mar 2008

### 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 1 (2.412GHz) with specified modulation and data rate.
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. Repeat steps 1 to 2 with all possible modulations and data rates.
4. The steps 2 to 3 were repeated with the transmitting frequency was set to Channel 2 (2.438GHz) and Channel 3 (2.464GHz) respectively.

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**MAXIMUM PEAK POWER TEST**



**Maximum Peak Power Test Setup**



**MAXIMUM PEAK POWER TEST**

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

Test Input Power	110V 60Hz	Temperature	22°C
		Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)
1	2.412	0.0479	1.0
2	2.438	0.0468	1.0
3	2.464	0.0437	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 Analyzer	E7405	US40240195	18 Jan 2008

### **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 1 (2.412GHz) with specified modulation and data rate.
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. Repeat steps 1 to 4 with all possible modulations and data rates.
6. The steps 2 to 5 were repeated with the transmitting frequency was set to Channel 2 (2.438GHz) and Channel 3 (2.464GHz) respectively.

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**RF CONDUCTED SPURIOUS EMISSIONS TEST**

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**RF Conducted Spurious Emissions Test Setup**



**RF CONDUCTED SPURIOUS EMISSIONS TEST**

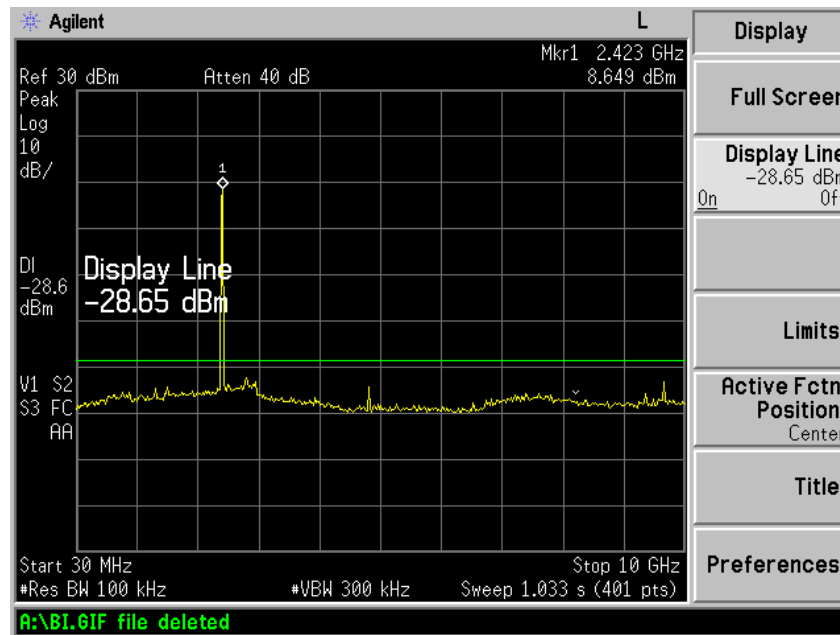
**FCC Part 15.247(d) RF Conducted Spurious Emissions Results**

Test Input Power	110V 60Hz	Temperature	22°C
Attached Plots	4 - 9	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

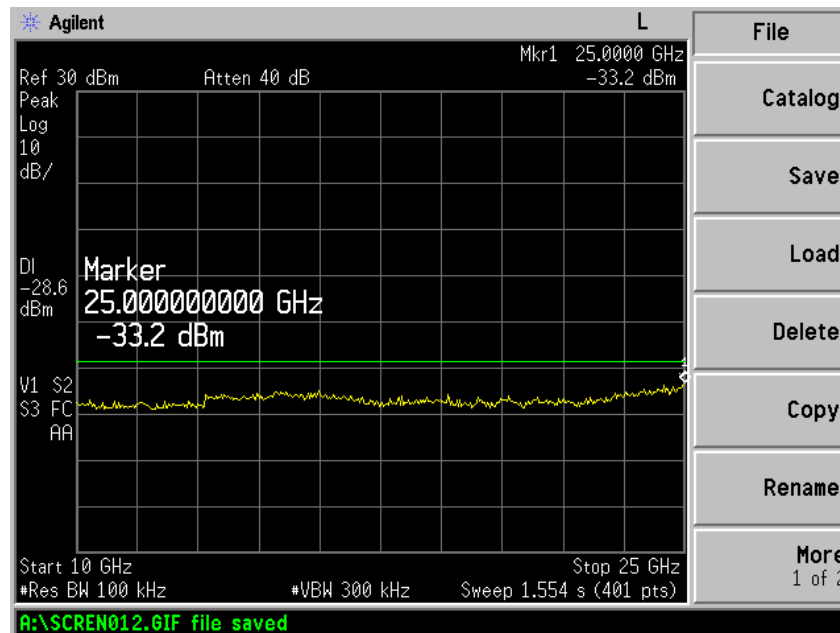
All spurious signals found were below the specified limit. Please refer to the attached plots.

## RF CONDUCTED SPURIOUS EMISSIONS TEST

### RF Conducted Spurious Emissions Plots



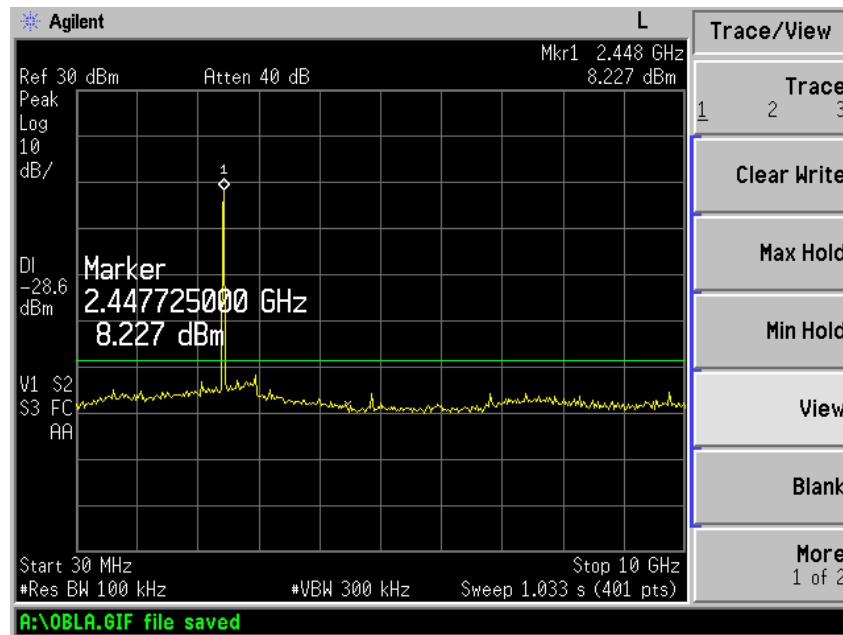
Plot 4 – Channel 1



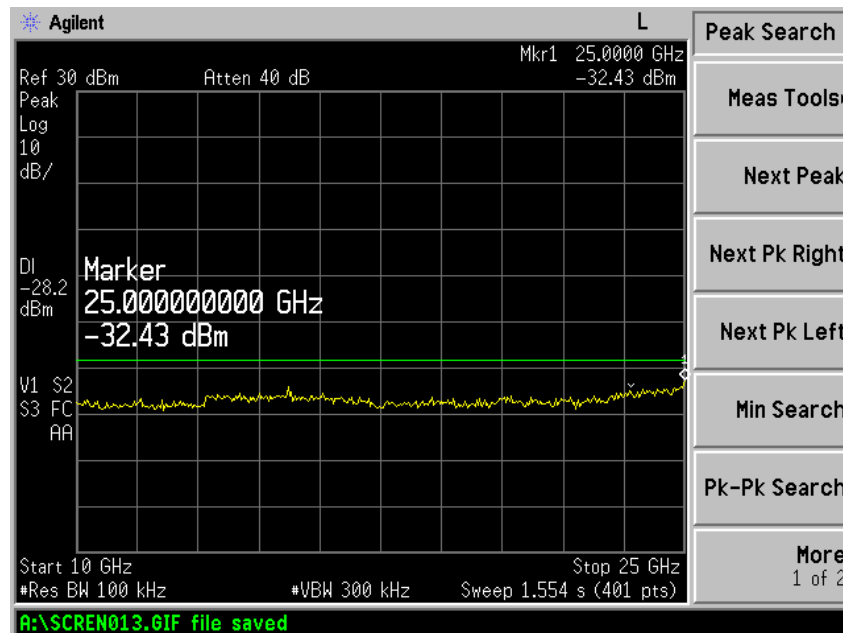
Plot 5 – Channel 1

## RF CONDUCTED SPURIOUS EMISSIONS TEST

### RF Conducted Spurious Emissions Plots



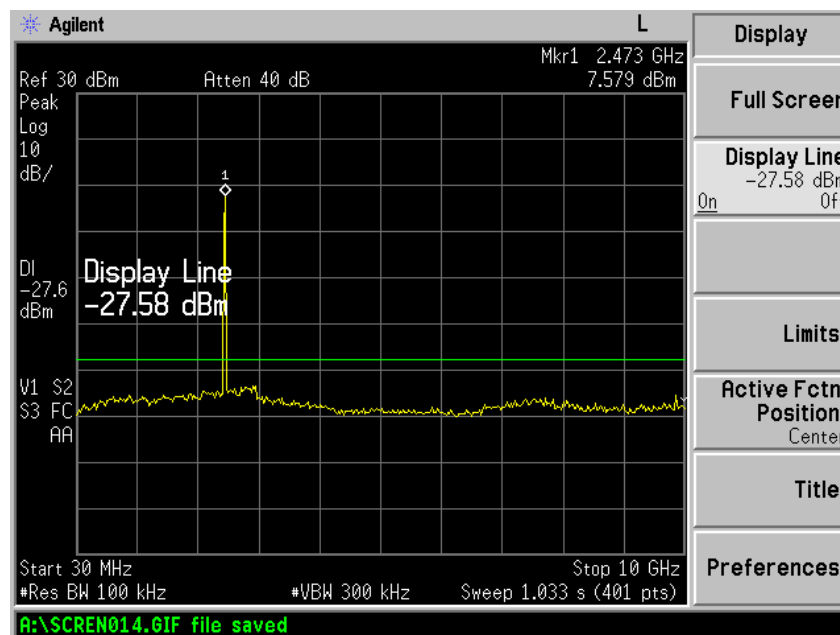
Plot 6– Channel 2



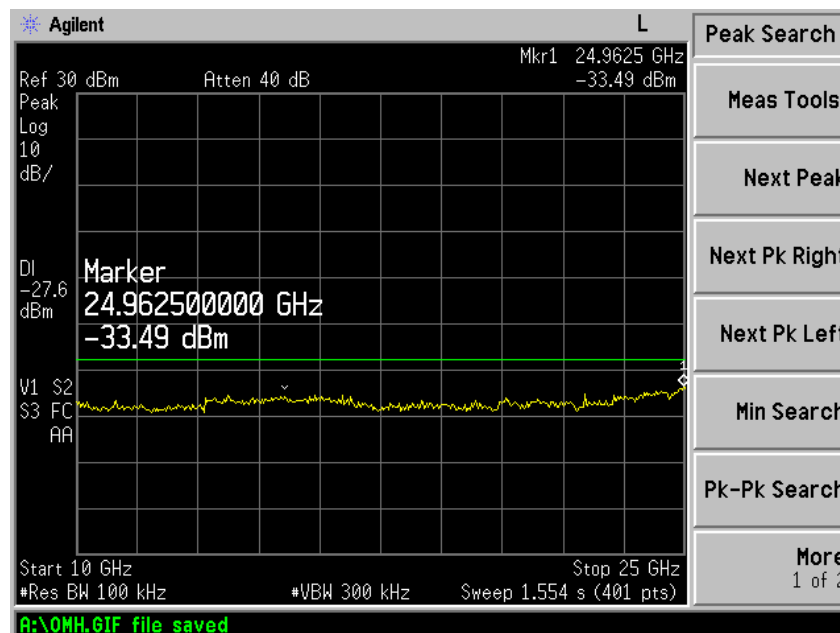
Plot 7– Channel 2

## RF CONDUCTED SPURIOUS EMISSIONS TEST

### RF Conducted Spurious Emissions Plots



Plot 8 – Channel 3



Plot 9 – Channel 3



## **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
HP Spectrum Analyzer	E7405	US40240195	18 Jan 2008

### **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 with specified modulation and data rate.
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. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 2 to 4 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**

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**Band Edge Compliance (Conducted) Test Setup**





**BAND EDGE COMPLIANCE (CONDUCTED) TEST**

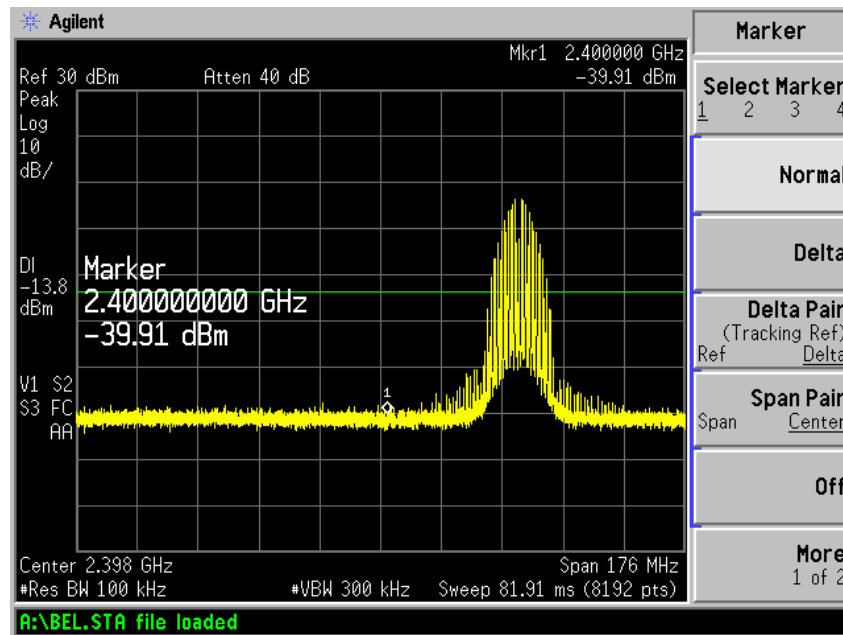
**FCC Part 15.247(d) Band Edge Compliance (Conducted) Results**

Test Input Power	110V 60Hz	Temperature	22°C
Attached Plots	10 - 11	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

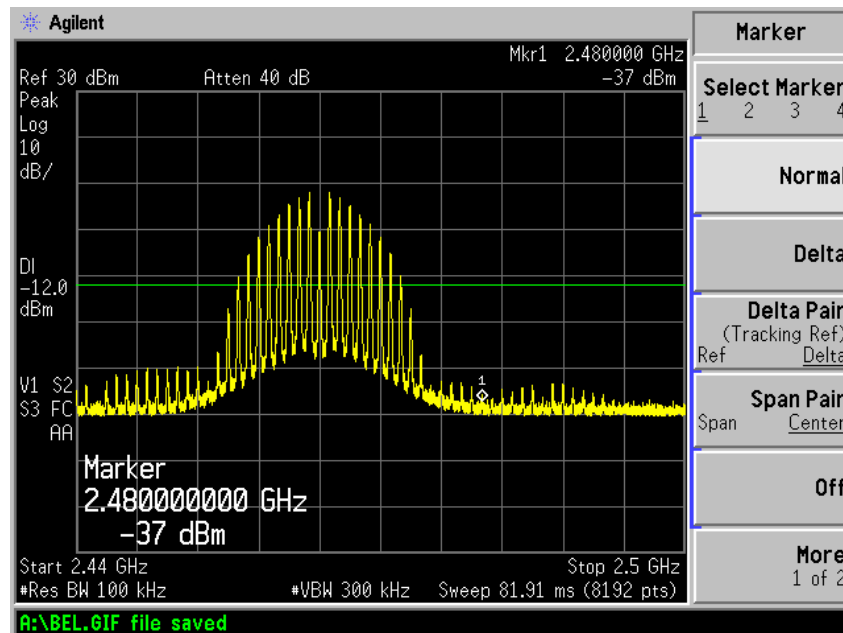
No significant signal was found and they were below the specified limit.

## BAND EDGE COMPLIANCE (CONDUCTED) TEST

### Band Edge Compliance (Conducted) Plots



Plot 10 – Lower Band Edge at 2.4000GHz



Plot 11 – Upper Band Edge at 2.4835GHz



**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) – ESMI3	ESMI	829214/005 829550/004	24 Nov 2007
TESEQ Preamplifier (1GHz-18GHz) – PA16	LNA6018	70214	09 Jan 2008
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	12 Jan 2008
Schaffner Bilog Antenna – BL3 (Ref)	CBL6112B	2549	08 Nov 2007
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2007
Bandstop Filter (2.4-2.5 GHz)	BRM50701	017	13 Aug 2007



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**BAND EDGE COMPLIANCE (RADIATED) TEST**

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**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 with specified modulation and data rate.
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. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 2 to 4 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**

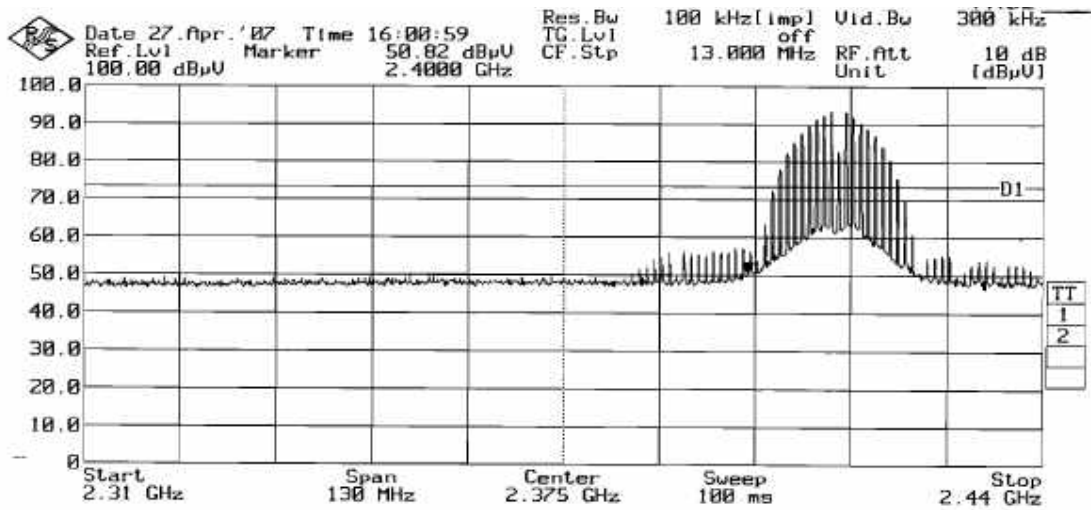
**FCC Part 15.247(d) Band Edge Compliance (Radiated) Results**

Test Input Power	110V 60Hz	Temperature	22°C
Attached Plots	12 - 17	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

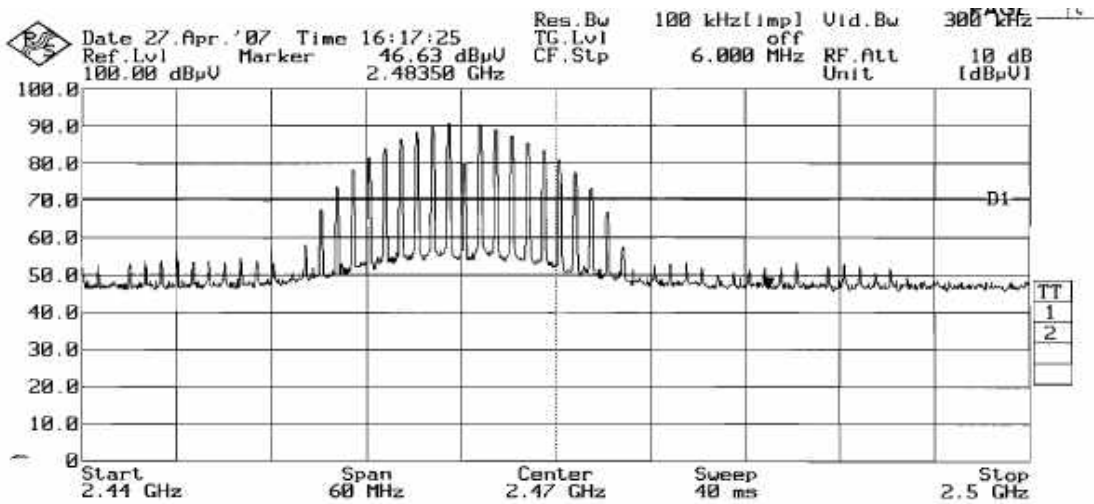
No significant signal was found and they were below the specified limit.

**BAND EDGE COMPLIANCE (RADIATED) TEST**

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



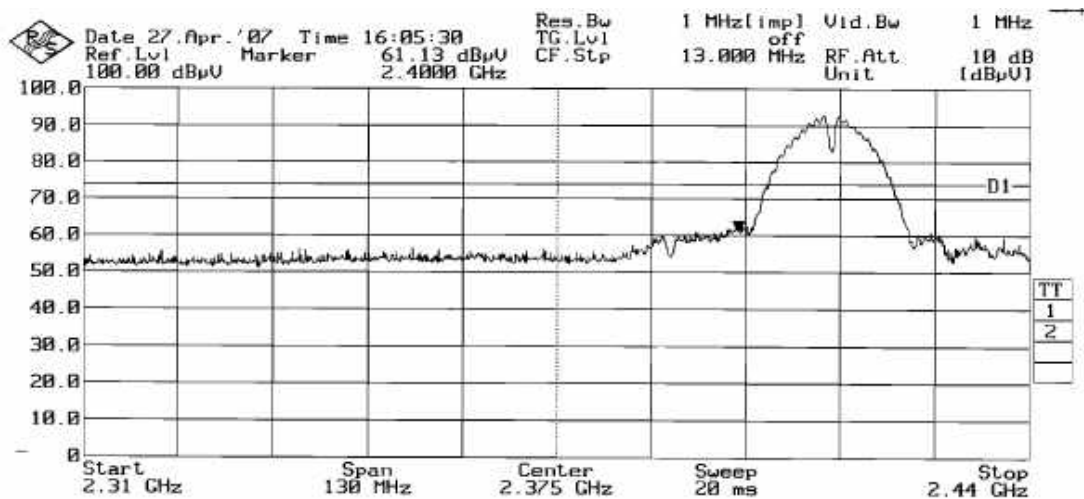
**Plot 12 – Lower Band Edge**



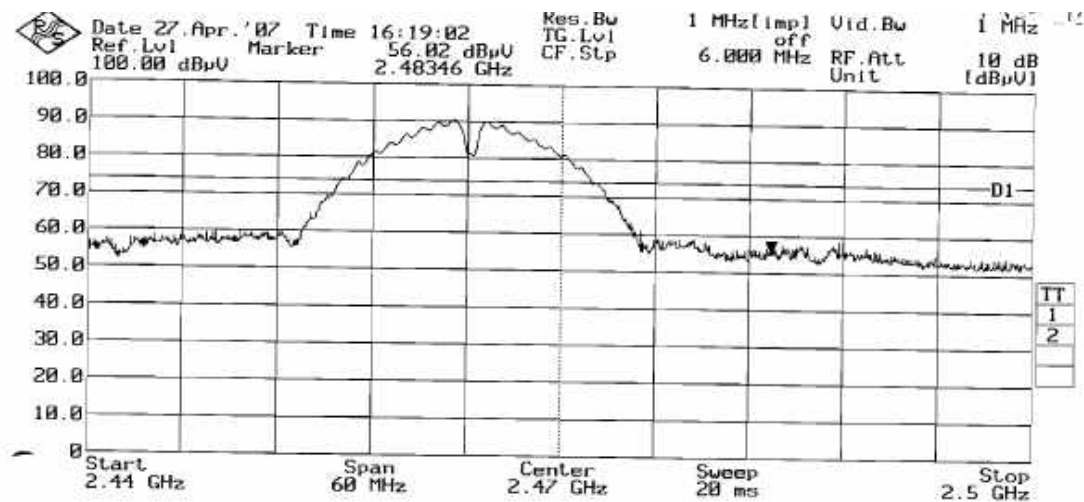
**Plot 13 – Upper Band Edge**

## BAND EDGE COMPLIANCE (RADIATED) TEST

### Band Edge Compliance (Radiated) Plots (Restricted Band)



Plot 14 – Peak Plot at Lower Band Edge

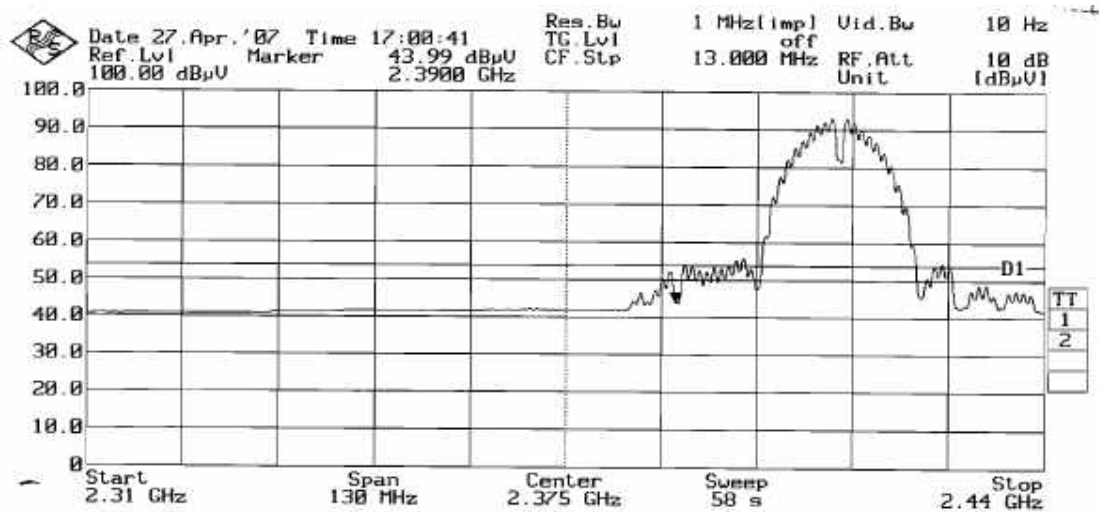


Plot 15 – Peak Plot at Upper Band Edge

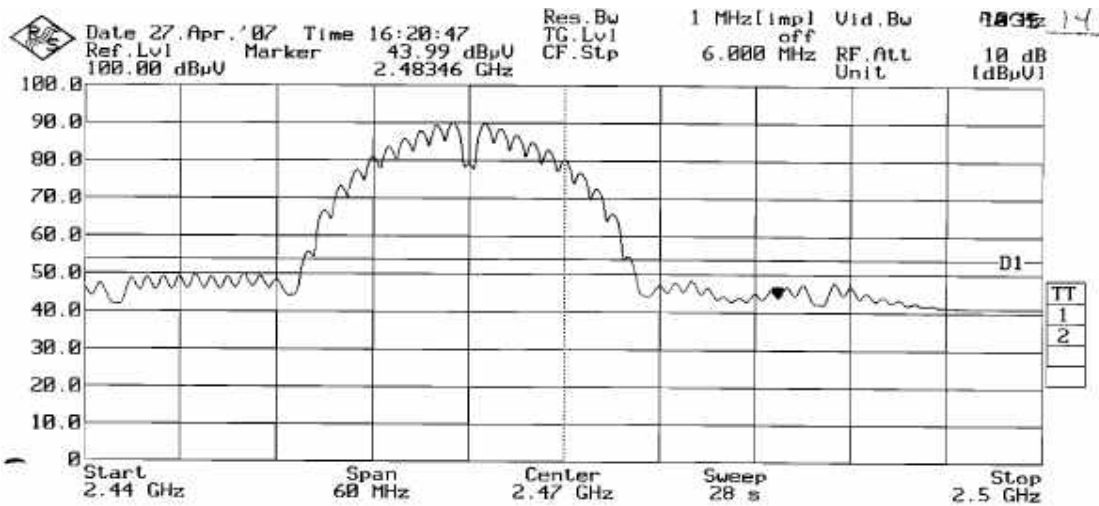


## BAND EDGE COMPLIANCE (RADIATED) TEST

### Band Edge Compliance (Radiated) Plots (Restricted Band)



Plot 16 – Average Plot at Lower Band Edge



Plot 17 – Average Plot at Upper Band Edge

## 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
HP Spectrum Analyzer	E7405	US40240195	18 Jan 2008

### 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 1 (2.412GHz) with specified modulation and data rate.
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. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 3 to 4 were repeated with the transmitting frequency was set to Channel 2 (2.438GHz) and Channel 3 (2.464GHz) respectively.

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**PEAK POWER SPECTRAL DENSITY TEST**



**Peak Power Spectral Density Test Setup**



**PEAK POWER SPECTRAL DENSITY TEST**

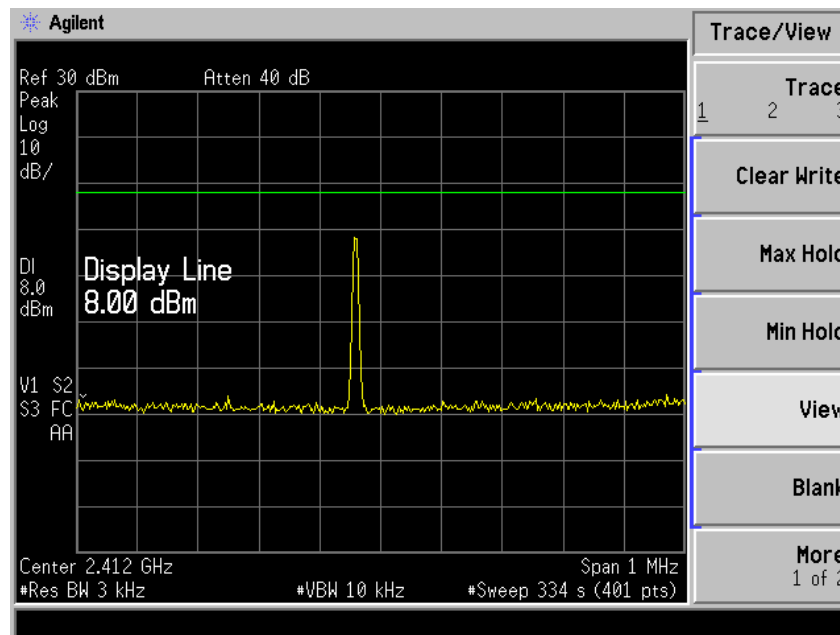
**FCC Part 15.247(e) Peak Power Spectral Density Results**

Test Input Power	110V 60Hz	Temperature	22°C
Attached Plots	18 - 20	Relative Humidity	58%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

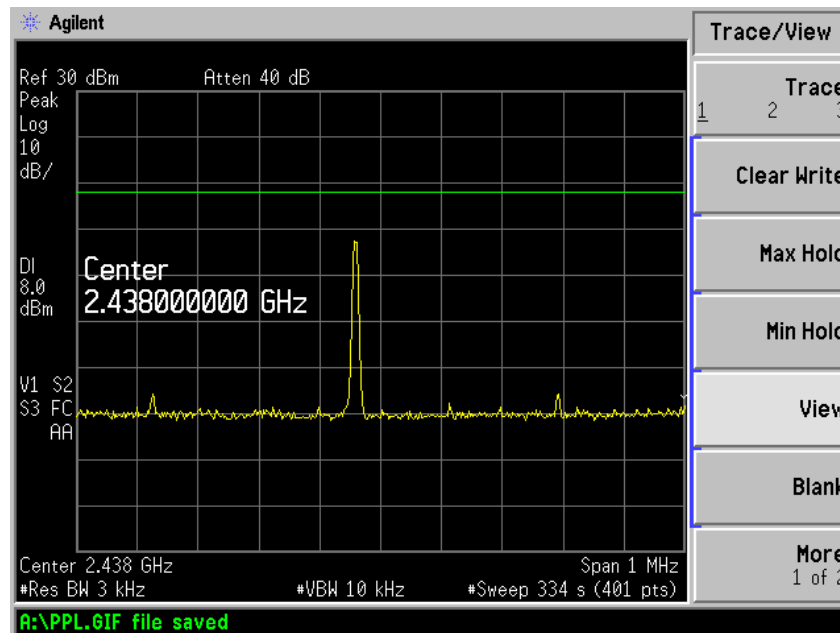
Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
1	2.412	0.6026	6.3
2	2.438	0.5998	6.3
3	2.438	0.5998	6.3

## PEAK POWER SPECTRAL DENSITY TEST

### Peak Power Spectral Density Plots



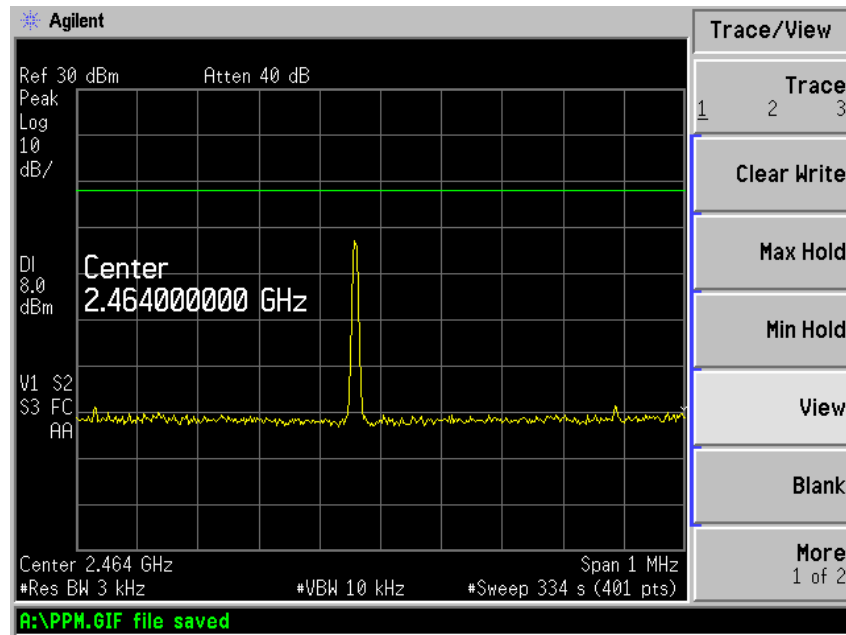
Plot 18– Channel 1



Plot 19 – Channel 2

**PEAK POWER SPECTRAL DENSITY TEST**

**Peak Power Spectral Density Plots**



**Plot 20 – Channel 3**

## 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 <sup>2</sup> )	Average Time (min)
0.3 - 1.34	614	1.63	100 <sup>Note 2</sup>	30
1.34 - 30	824 / f	2.19 / f	180 / f <sup>2</sup> <sup>Note 2</sup>	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 (MPE) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
PMM 8053 Portable Field Meter	8053	0220J10308	16 Apr 2008

### FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Setup

- The EUT and supporting equipment were set up as shown on the setup photo.
- The relevant field probe was positioned at least 20cm away from the EUT and supporting equipment boundary.

### FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Method

- The EUT was switched on and allowed to warm up to its normal operating condition.
- The test was first carried out at one of the positions / sides of the EUT.
- Power density measurement (mW/cm<sup>2</sup>) was made using the field meter set to the required averaging time.
- Steps 2 and 3 were repeated for the next position and its associate EUT operating mode, until all possible positions and modes were measured.

### Sample Calculation Example

At 2400 MHz, limit = 1.0 mW/cm<sup>2</sup>

Power density reading obtained directly from field meter = 0.3 mW/cm<sup>2</sup> averaged over the required 30 minutes.

Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm<sup>2</sup>

i.e. **0.7 mW/cm<sup>2</sup> below limit**

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**MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST**



**Maximum Permissible Exposure (MPE) Test Setup**



**MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST**

**FCC Part 1.1310 Maximum Permissible Exposure (MPE) Results**

Test Input Power	110V 60Hz	Temperature	24°C
Test Distance	20cm	Relative Humidity	57%
		Atmospheric Pressure	1030mbar
		Tested By	Lucas Beh

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm <sup>2</sup> )	Margin (mW/cm <sup>2</sup> )	Averaging Time (min)	Limit (mW/cm <sup>2</sup> )
1	2.412	0.0024	-0.9976	30	1.0
2	2.438	0.0022	-0.9978	30	1.0
3	2.464	0.0021	-0.9979	30	1.0

**Notes**

1. All possible modes of operation were investigated. Only the worst case highest radiation levels were measured. Measurements were taken at the required averaging time. All other radiation levels 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. 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 0.1MHz – 3GHz is ±15%.

**Test Report No. 53S071029/EMC/01**  
**dated 20 May 2007**



This Report is issued under the following conditions:

1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.
2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.
3. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment.
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May 2007



**EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A**

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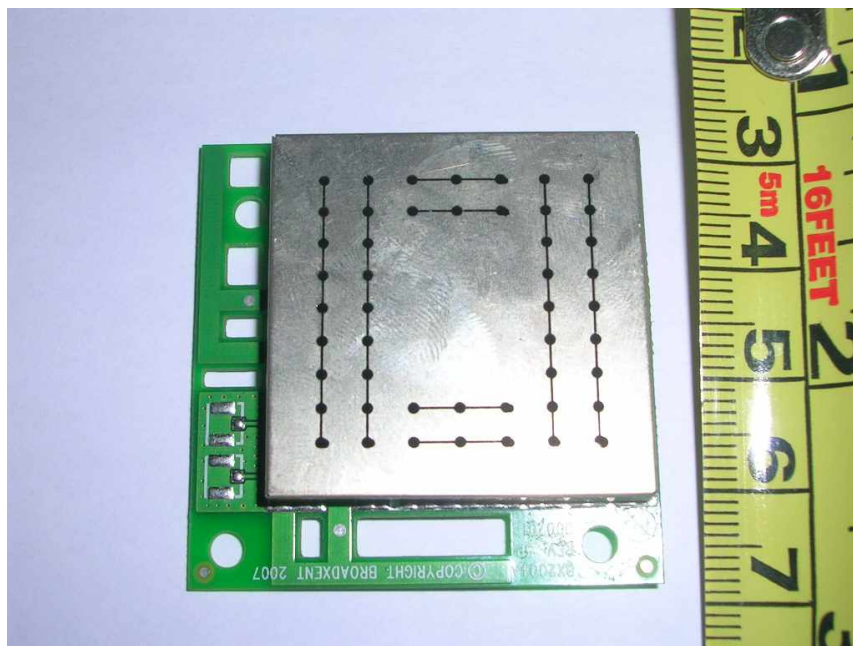
## **ANNEX A**

### **EUT PHOTOGRAPHS / DIAGRAMS**

**EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A**

**EUT PHOTOGRAPHS**



**Front View**

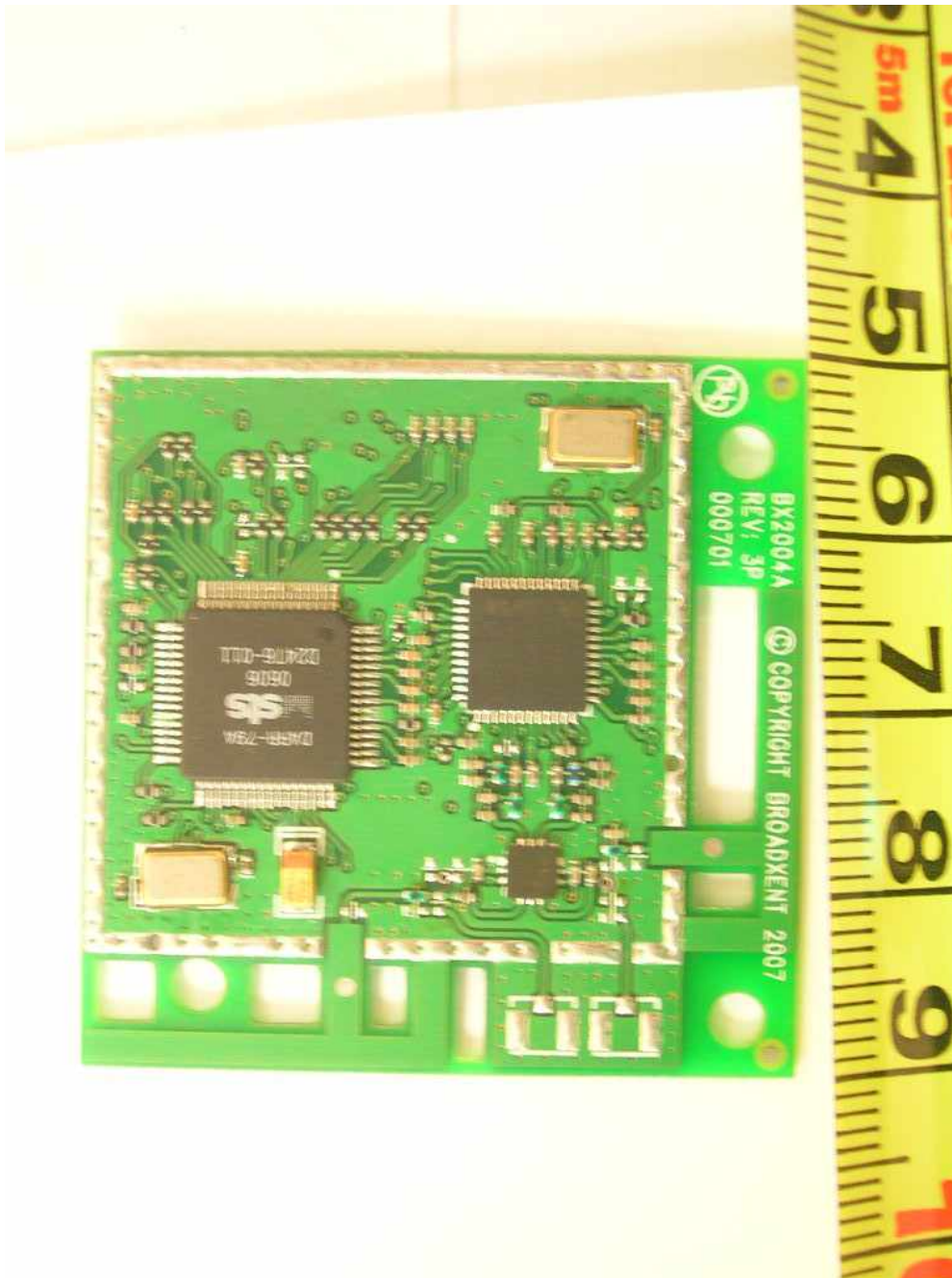


**Rear View**

**EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A**

**EUT PHOTOGRAPHS**



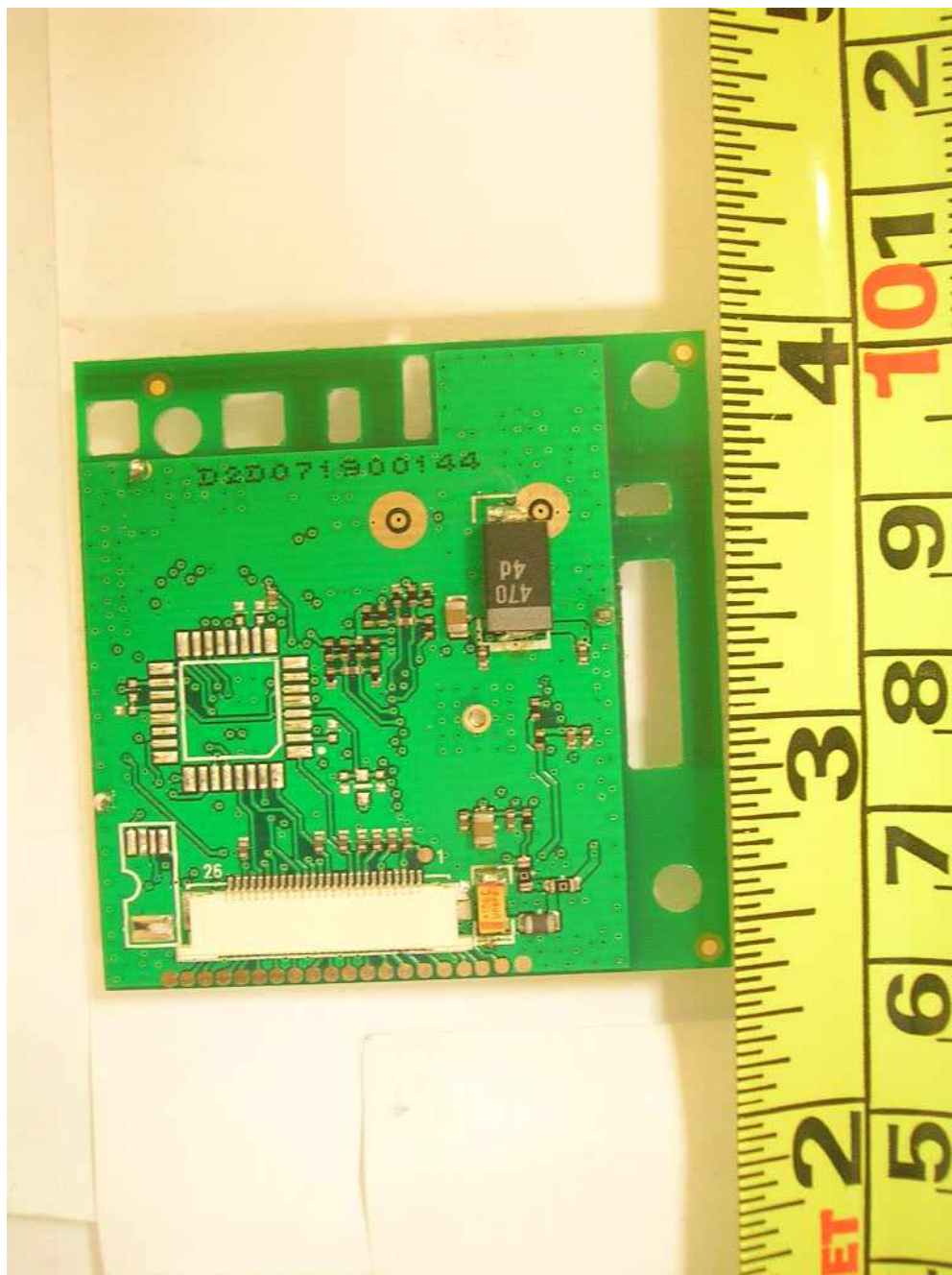
**Main-Board - Component Side**



**EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A**

**EUT PHOTOGRAPHS**

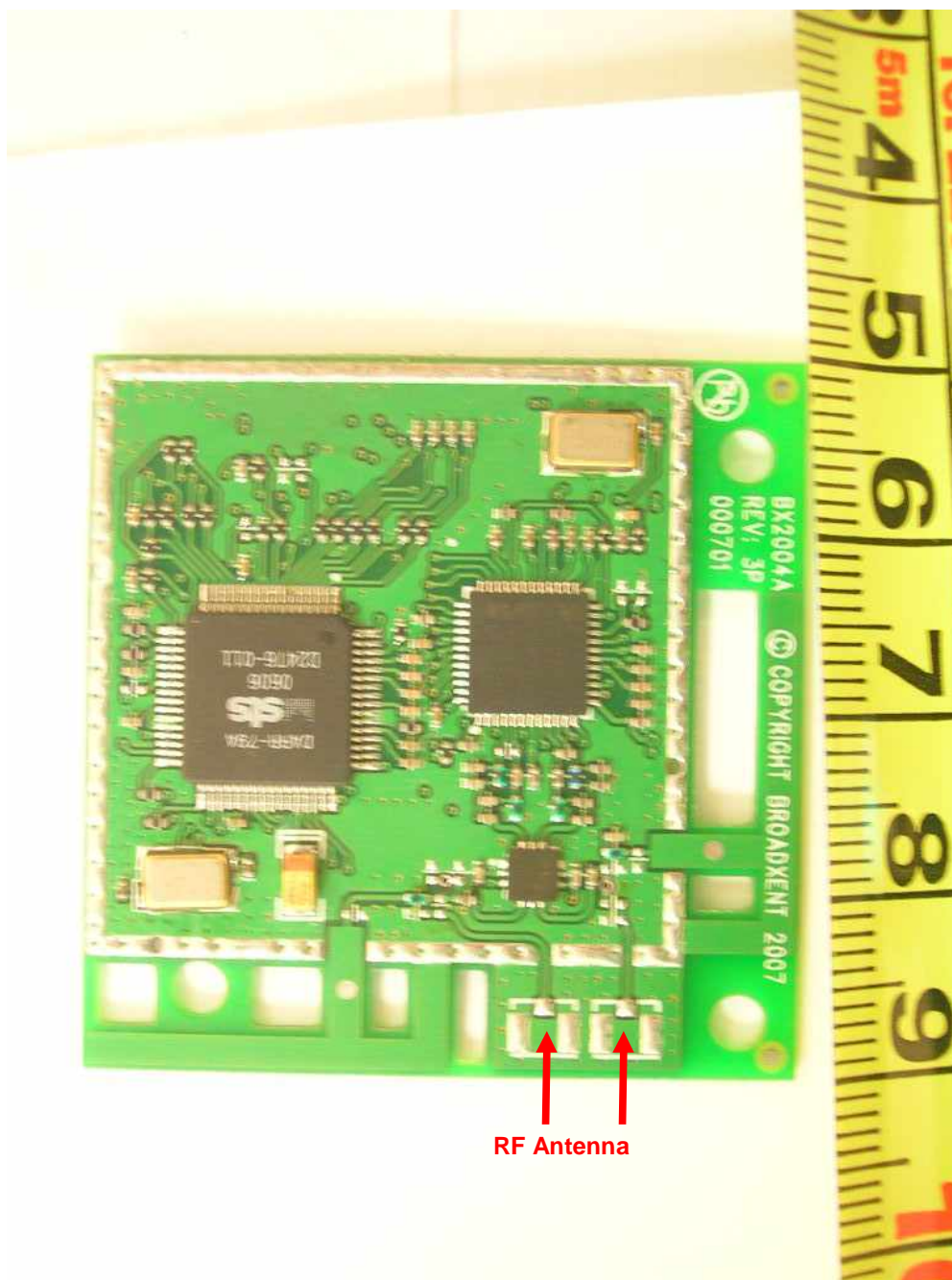


**Main-Board - PCB Trace Side**

**EUT PHOTOGRAPHS / DIAGRAMS**

**ANNEX A**

**EUT PHOTOGRAPHS**



**RF Module Circuit with RF Shield Removed**



**FCC LABEL & POSITION**

**ANNEX B**

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**ANNEX B**

**FCC LABEL & POSITION**

(Refer to manufacturer for details)





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

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**ANNEX C**

**ANNEX C**

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

(Please refer to manufacturer for details)