Test Report No. 56S061113/03A
dated 08 Jan 2007

Note: This report is issued subject to TÜV SÜD PSB Corporation's "Terms and Conditions Governing Technical Services". The terms and conditions governing the issue of this report are set out as attached within this report.

FORMAL REPORT ON TESTING IN ACCORDANCE WITH
FCC Parts 15C : 2006
OF A
NOKIA BLUETOOTH DISPLAY CAR KIT
[Model : CK-15W]
[FCC ID : OW3HF-15]

TEST FACILITY	TÜV SÜD PSB Corporation 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)
PREPARED FOR	Detlev Aust Nokia Corporation Rensingstrasse 15; Bochum, Gemany Zip Code 44807 Tel : +49 (0) 234 984 4577 Fax : +49 (0) 234 984 3801
QUOTATION NUMBER	56Q0601047
JOB NUMBER	56S061113
TEST PERIOD	14 Dec 2006 – 29 Dec 2006

PREPARED BY

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LA-2001-0212-A LA-2001-0213-F LA-2001-0214-E LA-2001-0215-B LA-2001-0216-G LA-2001-0217-G LA-2006-0355-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

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	Not Applicable *See Note 5
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(1)	Carrier Frequency Separation	Pass
	Spectrum Bandwidth (20dB Bandwidth Measurement)	Pass
15.247(a)(1)(iii)	Number of Hopping Frequencies	Pass
	Average Frequency Dwell Time	Pass
15.247(b)(1)	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
15.35(c)	Duty Cycle Factor Computation	Refer to page 50 for details

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.

Transmit Channel	Frequency (GHz)
Channel 0	2.402
Channel 39	2.441
Channel 78	2.480

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

3. All test measurement procedures are according to ANSI C63.4: 2003.

4. The Equipment Under Test (EUT) is a battery operated device and contains no provision for public utility connections.

Modifications

1. No modifications were made.

PRODUCT DESCRIPTION

Description	:	The Equipment Under Test (EUT) is a **NOKIA BLUETOOTH DISPLAY CAR KIT.** The EUT consists of: 1 x hands free unit (Nokia HF-15) 1 x LCD display (Nokia SU-29) 1 x input device (Nokia CU-8) 1 x microphone (Nokia MP-2) 1 x loudspeaker (Nokia SP-3)
Manufacturer	:	Nokia Corporation Rensingstrasse 15; Bochum, Gemany Zip Code 44807
FCC ID	:	OW3HF-15
Model Number	:	CK-15W
Software Version	:	D01.09/HF-15_1.480
Hardware Version	:	R4
FRN	:	0008260473
Serial Number(s)	:	Nil
Microprocessor(s)	:	Refer to manufacturer's specification & user manual
Operating Frequency	:	2.402GHz – 2.480GHz
Clock / Oscillator Frequency	:	Refer to manufacturer's specification & user manual
Modulation	:	Gaussian Frequency Shift Keying (GFSK)
Port / Connectors	:	1 x microphone port 1 x speaker port 1 x RJ11 port (for control unit, CU-8) 1 x RJ45 port (for LCD Display, SU-29) 1 x DC input port
Rated Input Voltage	:	10.5VDC - 16.5VDC
Accessories	:	Refer to manufacturer's specification & user manual

SUPPORTING EQUIPMENT DESCRIPTION

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

EUT OPERATING CONDITIONS

FCC Part 15
1. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement) **2. Spectrum Bandwidth (20dB Bandwidth Measurement)** **3. Maximum Peak Power** **4. RF Conducted Spurious Emissions** **5. Peak Power Spectral Density** **6. Maximum Permissible Exposure** **7. Duty Cycle Factor Computation**
The EUT was exercised by operating in maximum continuous transmission with frequency hopping off, i.e transmitting at lower, middle and upper channels respectively at one time.
FCC Part 15
1. Carrier Frequency Separation **2. Number of Hopping Frequencies** **3. Average Frequency Dwell Time** **4. Band Edge Compliance (Conducted)** **5. Band Edge Compliance (Radiated)**
The EUT was exercised by operating in maximum continuous transmission with frequency hopping on.

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	ESMI	849182/003 848926/007	04 Jul 2007
Schaffner Pre-Amplifier	CPA9231A	3422	01 Apr 2007
Schaffner Bilog Antenna –BL4	CBL6112B	2593	12 May 2007
EMCO Horn Antenna – H14	3115	0003-6087	19 May 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

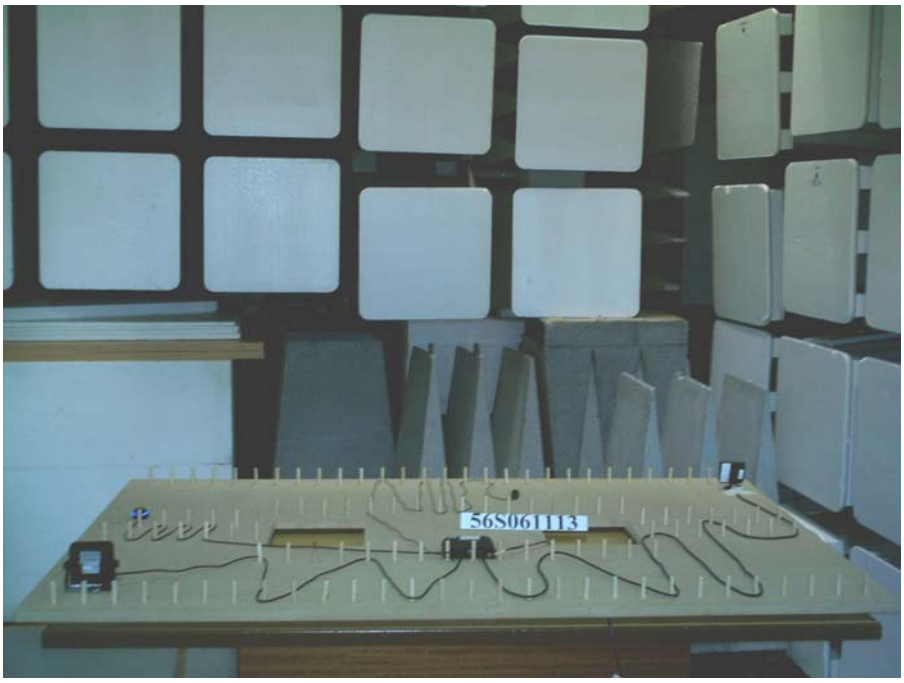
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which attitude 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 10th 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 μV/m = 46.0 dBμV/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/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	12VDC	Temperature	23°C
Test Distance	3m	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

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
149.1610	28.6	-14.9	253	198	H	78
165.9221	28.7	-14.8	74	100	H	78
202.3001	29.9	-13.6	277	100	H	78
222.5871	35.8	-10.2	301	101	H	78
243.2840	23.6	-22.4	305	100	H	78
305.4610	21.2	-24.8	245	101	H	78

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
1601.3101	46.2	36.7	-17.3	107	126	H	0
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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 (QP only @ 3m & 10m) is ±4.3dB (for EUTs < 0.5m X 0.5m X 0.5m).

CARRIER FREQUENCY SEPARATION TEST

FCC Part 15.247(a)(1) Carrier Frequency Separation Limits

The EUT shows compliance to the requirements of this section, which states the adjacent carrier frequencies must be separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, the EUT may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW (21dBm).

FCC Part 15.247(a)(1) Carrier Frequency Separation Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

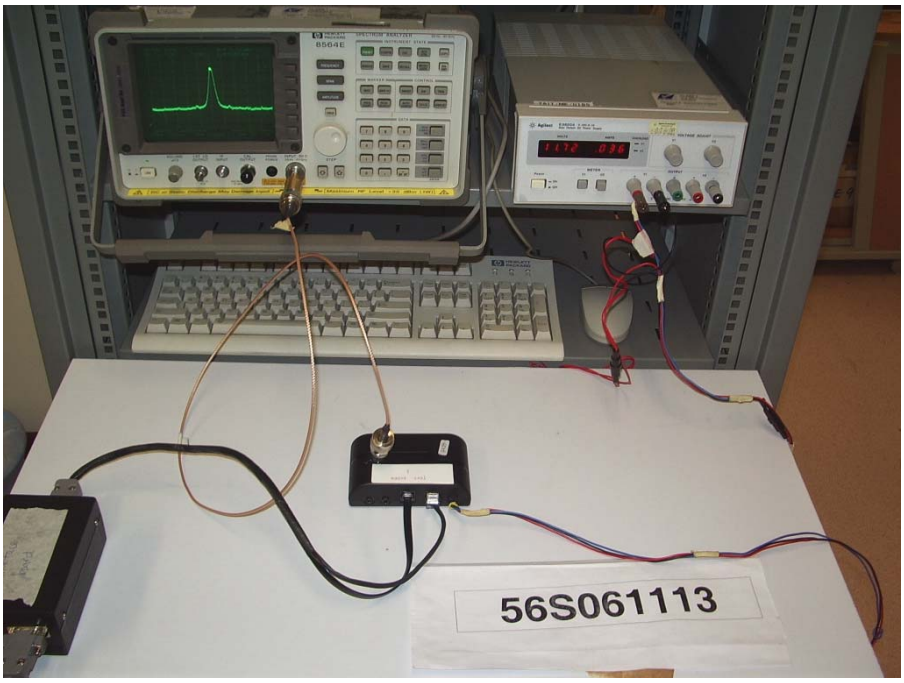
FCC Part 15.247(a)(1) Carrier Frequency Separation Test Setup

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 100kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1) Carrier Frequency Separation 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 frequency hopping sequence on.
2. The start and stop frequencies of the spectrum analyser were set to 2.401GHz and 2.404GHz.
3. The spectrum analyser was set to max hold to capture the two adjacent transmitting frequencies within the span. The signal capturing was continuous until no further signals were detected.
4. The carrier frequency separation of the two adjacent transmitting / operating frequency was measured by finding the carrier frequency difference between the two adjacent channels.
5. The steps 2 to 4 were repeated with the following start and stop frequencies settings:
   a. 2.439GHz to 2.442GHz
   b. 2.478GHz to 2.481GHz

CARRIER FREQUENCY SEPARATION TEST



Carrier Frequency Separation Test Setup

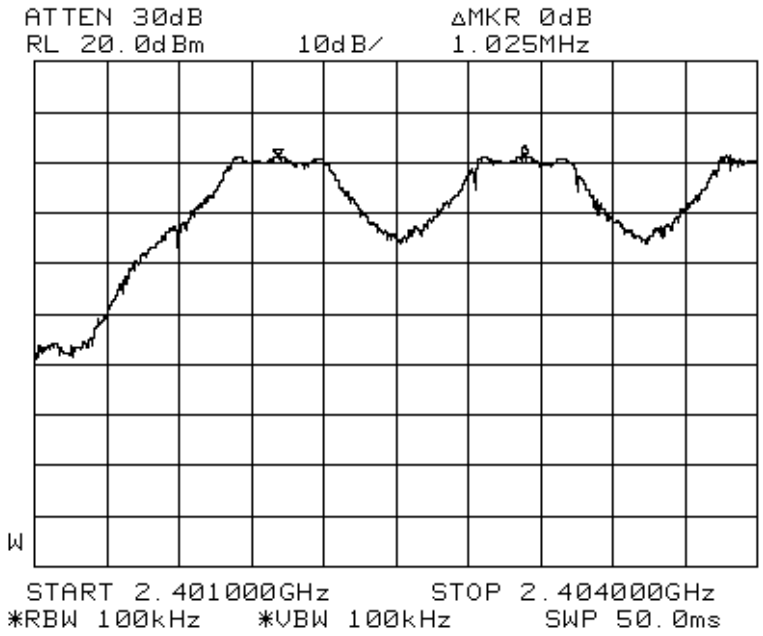
FCC Part 15.247(a)(1) Carrier Frequency Separation Results

Test Input Power	12VDC	Temperature	24°C
Attached Plots	1 - 3	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

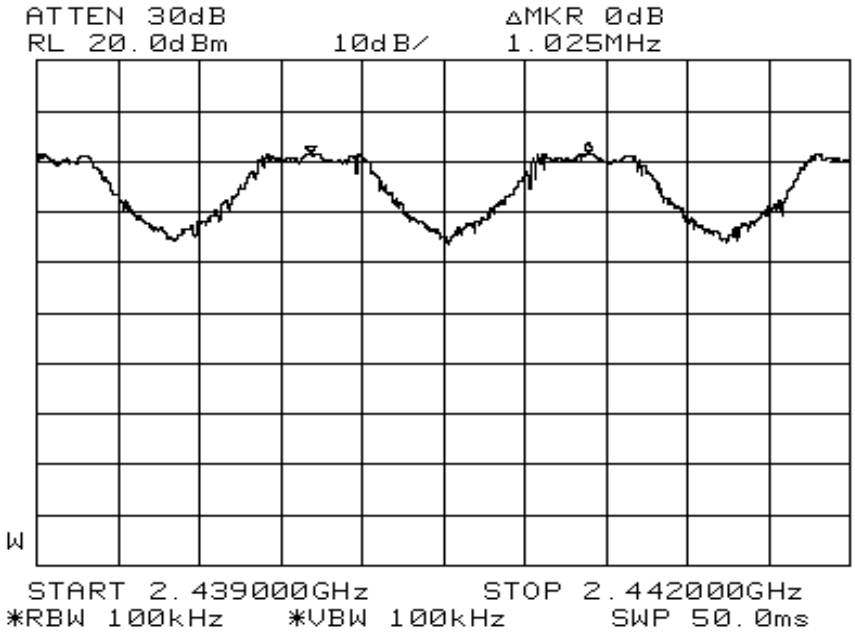
Adjacent Channels	Channel Separation (MHz)
0 and 1	1.025
38 and 39	1.025
77 and 78	1.020

CARRIER FREQUENCY SEPARATION TEST

Carrier Frequency Separation Plots



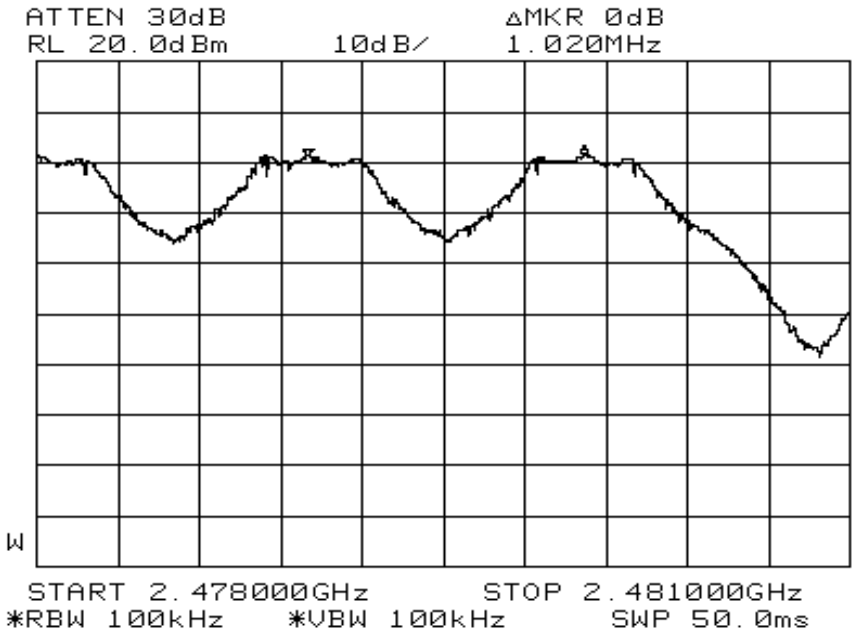
Plot 1 - Channels 0 and 1 Separation



Plot 2 – Channels 38 and 39 Separation

CARRIER FREQUENCY SEPARATION TEST

Carrier Frequency Separation Plots



Plot 3 - Channels 77 and 78 Separation

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Limits

The EUT shows compliance to the requirements of this section, which states that the 20dB bandwidth of the hopping channel shall be the channel frequency separation by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

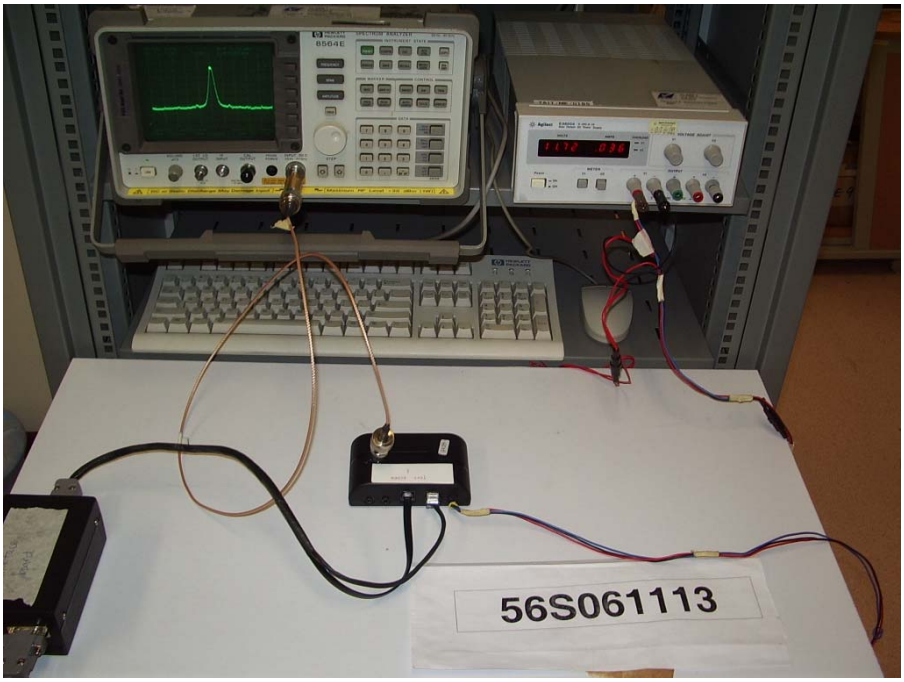
FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Test Setup

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 10kHz and 30kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB 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, non-hopping with transmitting frequency at Channel 0 (2.402GHz).
2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 20dB 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 20dB 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 20dB 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 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST



Spectrum Bandwidth (20dB Bandwidth Measurement) Test Setup

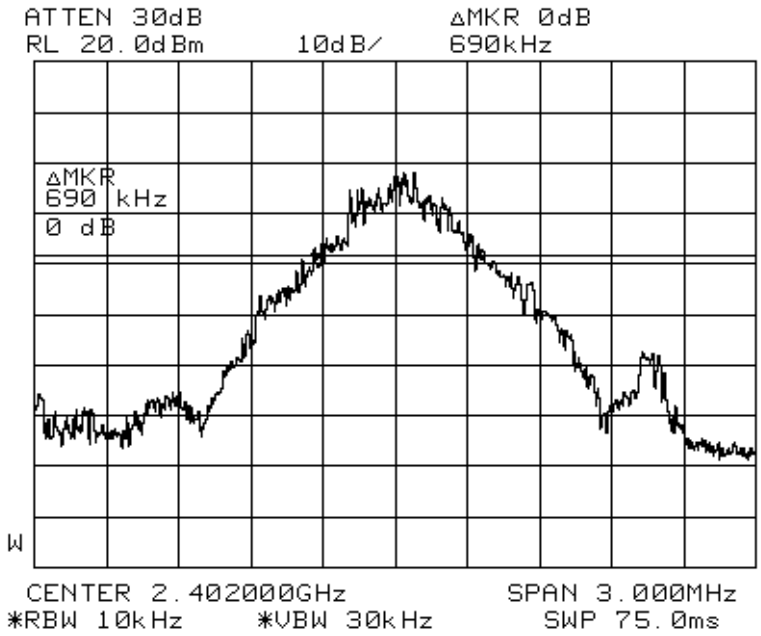
FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Results

Test Input Power	12VDC	Temperature	24°C
Attached Plots	4 - 6	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

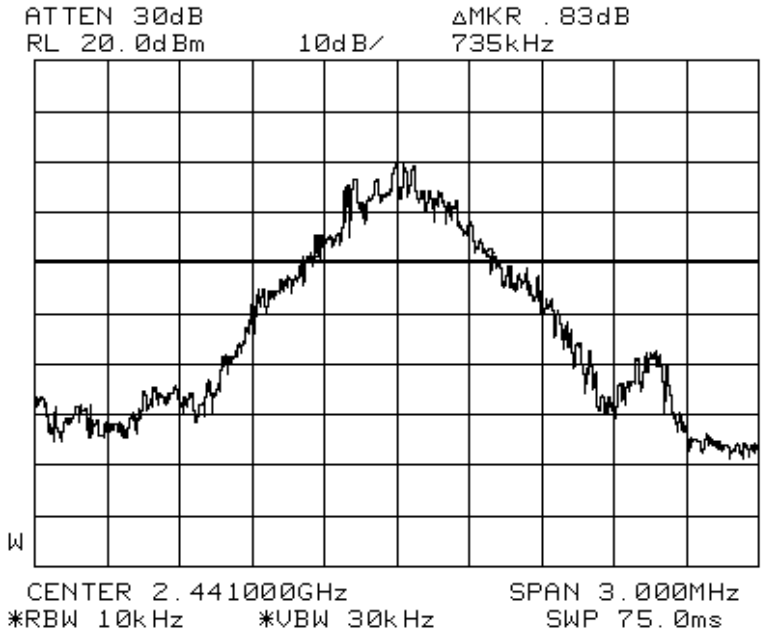
Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)
0	2.402	0.690
39	2.441	0.735
78	2.480	0.745

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (20dB Bandwidth Measurement) Plots



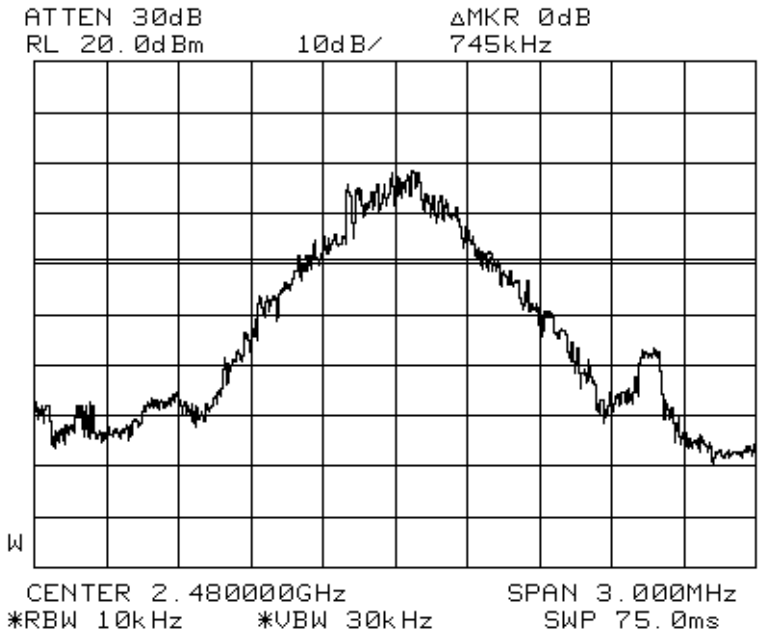
Plot 4 – Channel 0



Plot 5 – Channel 39

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (20dB Bandwidth Measurement) Plots



Plot 6 – Channel 78

NUMBER OF HOPPING FREQUENCIES TEST

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Limits

The EUT shows compliance to the requirements of this section, which states the EUT shall use at least 15 channels.

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Test Instrumentation

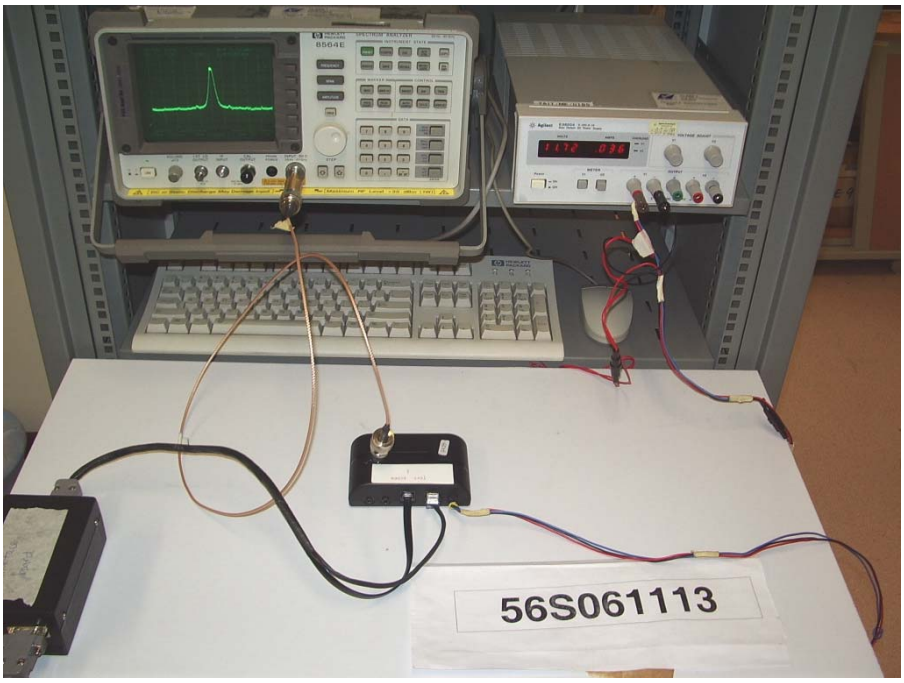
Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies 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 300kHzand 1000kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies 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 frequency hopping sequence on.
2. The start and stop frequencies of the spectrum analyser were set to 2.40GHz and 2.421GHz.
3. The spectrum analyser was set to max hold to capture all the transmitting frequencies within the span. The signal capturing was continuous until all the transmitting frequencies were captured and no further signals were detected.
4. The numbers of transmitting frequencies were counted and recorded.
5. The steps 2 to 4 were repeated with the following start and stop frequencies settings:
   a. 2.420GHz to 2.441GHz
   b. 2.440GHz to 2.461GHz
   c. 2.460GHz to 2.4835GHz
6. The total number of hopping frequencies is the sum of the number of the hopping frequencies found for each span.



Number of Hopping Frequencies Test Setup

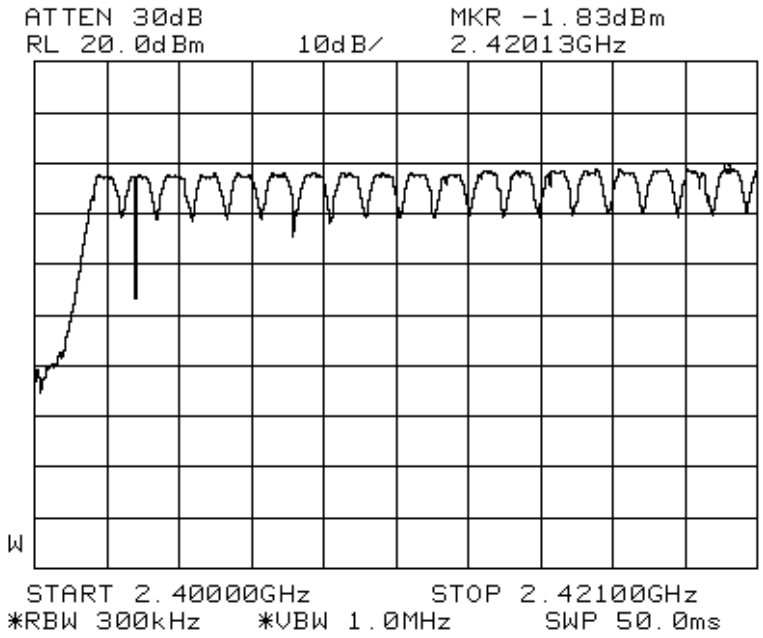
FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Results

Test Input Power	12VDC	Temperature	24°C
Attached Plots	7 - 10	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

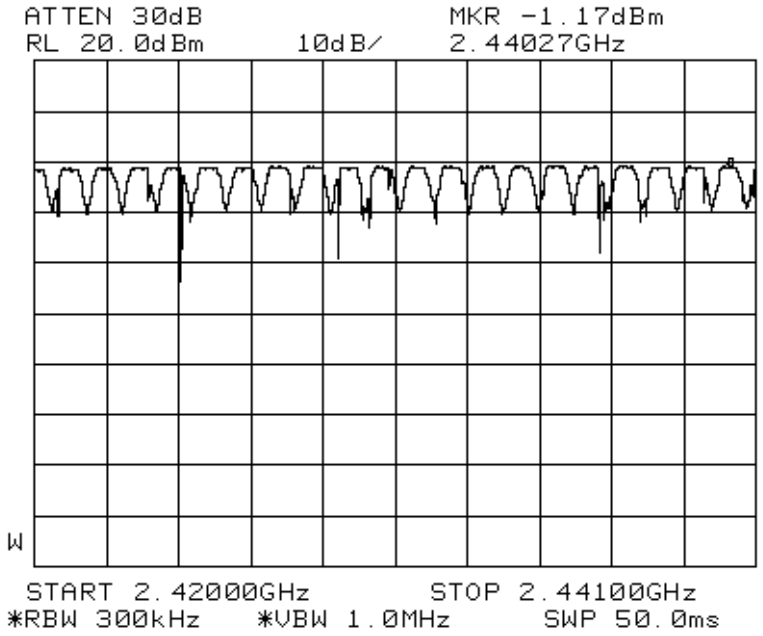
The EUT was found to have 79 hopping frequencies. Please refer to the attached plots.

NUMBER OF HOPPING FREQUENCIES TEST

Number Of Hopping Frequencies Plots

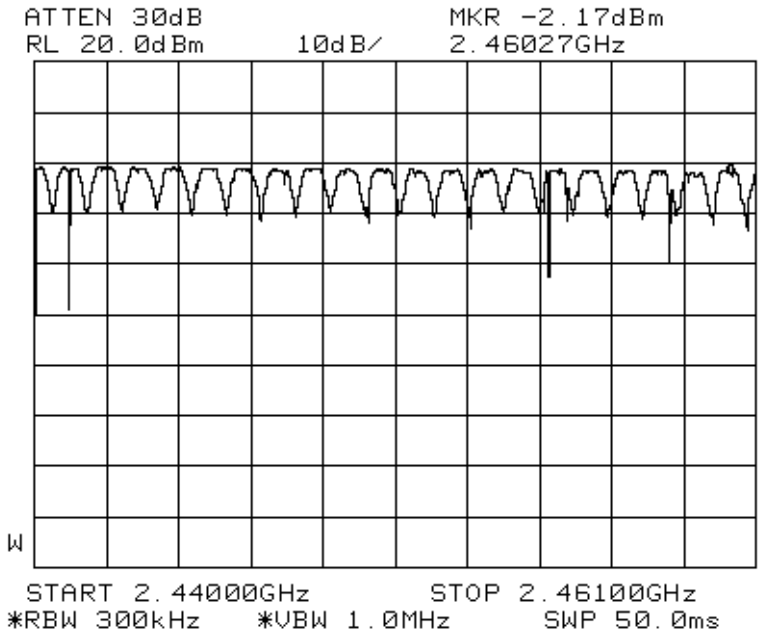


Plot 7 - Channels 0 to 18

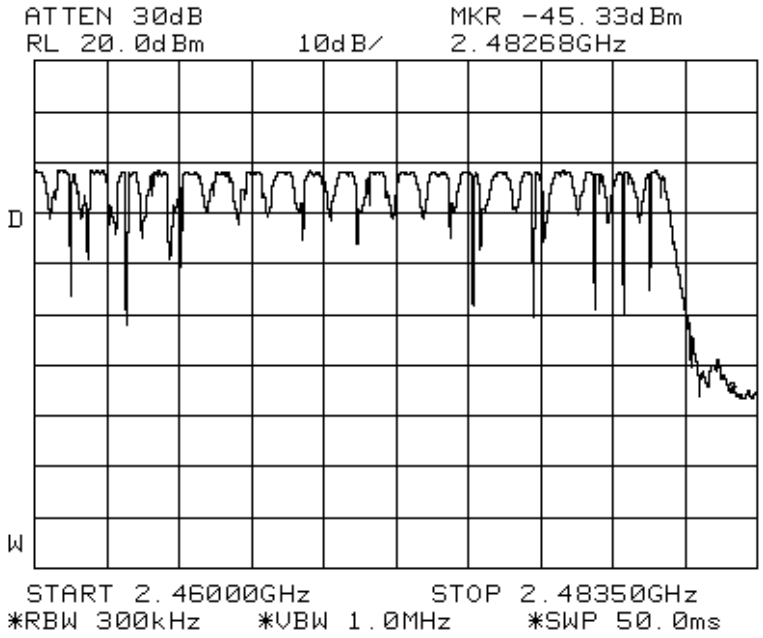


Plot 8 - Channels 19 to 38

Number Of Hopping Frequencies Plots



Plot 9 - Channels 39 to 58



Plot 10 - Channels 59 to 78

AVERAGE FREQUENCY DWELL TIME TEST

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Time Limits

The EUT shows compliance to the requirements of this section, which states the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Time Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Test Setup

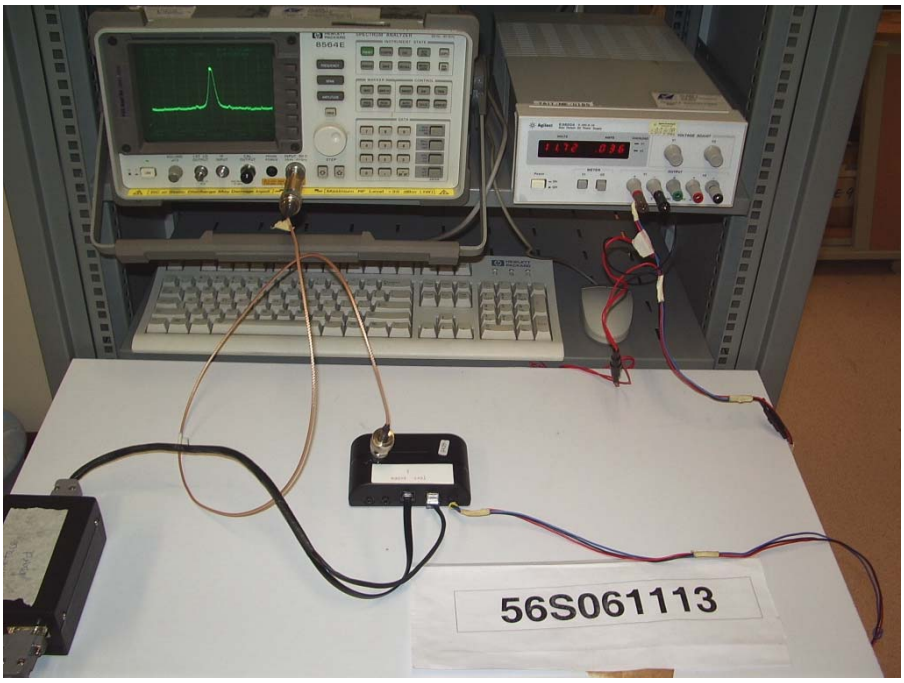
1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW)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

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell 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 frequency hopping sequence on.
2. The center frequency of the spectrum analyser was set to 2.402GHz with zero frequency span (spectrum analyser acts as an oscilloscope).
3. The sweep time of the spectrum analyser was adjusted until a stable signal can be seen on the spectrum analyser.
4. The duration (dwell time) of a packet was measured using the marker-delta function of the spectrum analyser. The average dwell time of the transmitting frequency was computed based on general expression as shown below:

   Average Frequency Dwell Time = [measured time slot length x hopping rate / number of hopping channels] x [0.4 x number of hopping channels]
5. The steps 2 to 4 were repeated with the center frequency of the spectrum analyser were set to 2.441GHz and 2.480GHz respectively.

AVERAGE FREQUENCY DWELL TIME TEST



Average Frequency Dwell Time Test Setup

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Time Results

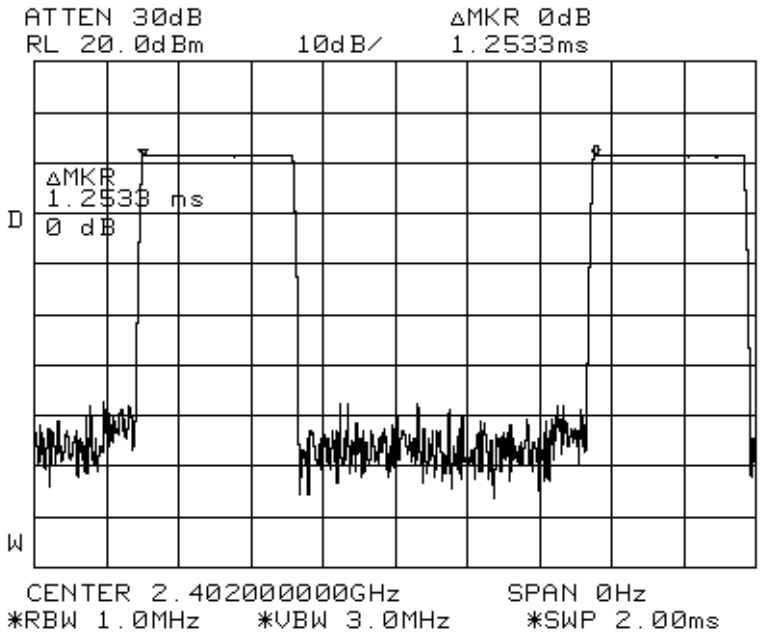
Test Input Power	12VDC	Temperature	26°C
Attached Plots	11 - 13	Relative Humidity	60%
Hopping Rate	1600 hops / s	Atmospheric Pressure	1030mbar
Number of Hopping Channels	79 channels	Tested By	Johnsen Tia

Channel	Channel Frequency (GHz)	Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0	2.402	0.2005	0.4
39	2.441	0.2005	0.4
78	2.480	0.1995	0.4

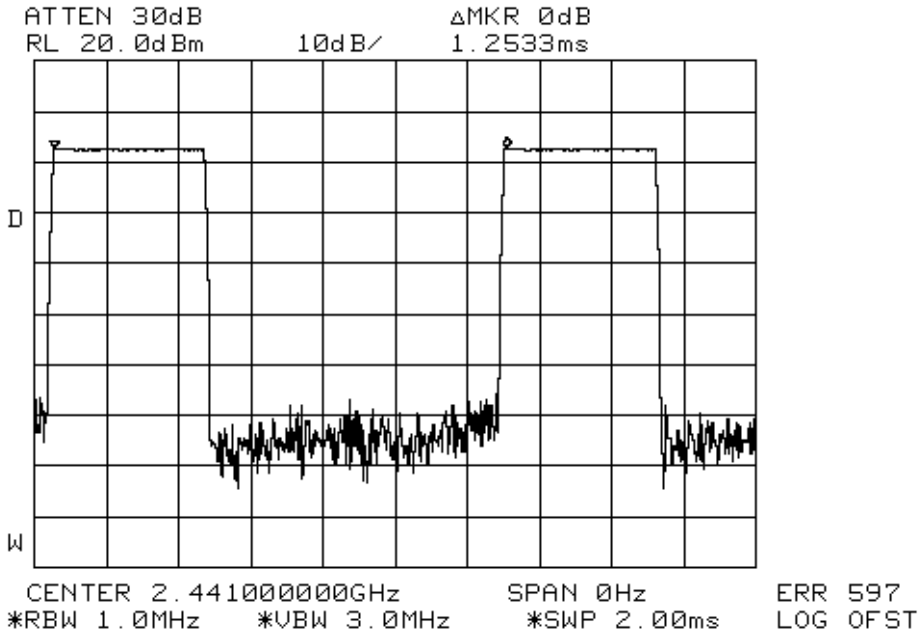
Notes

1. The EUT operates based on 1-slot transmission and 1-slot reception basis. As such, there are [1600 / (1 + 1)] transmissions per second and the time occupancy per channel is [measured time slot length / 2].
2. Average Frequency Dwell Time = [measured time slot length / 2 x hopping rate / 2 / number of hopping channels] x [0.4 x number of hopping channels]

Average Frequency Dwell Time Plots

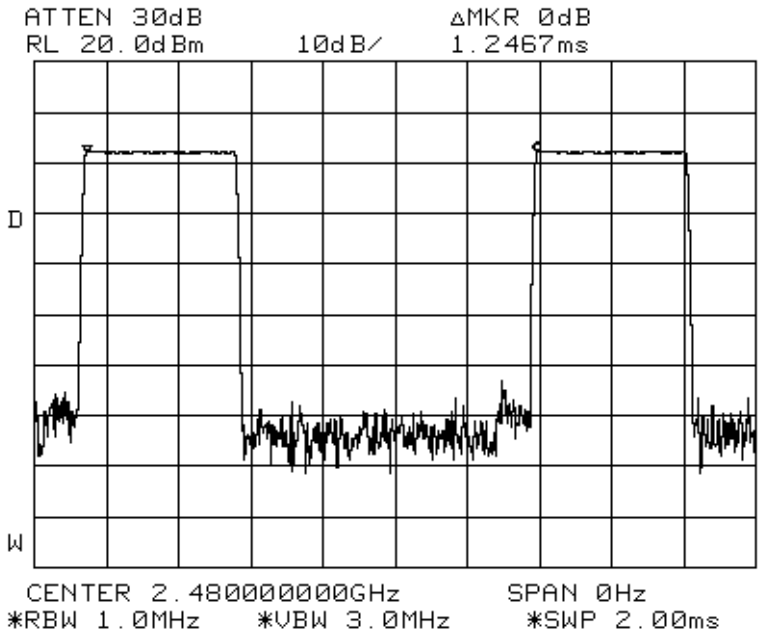


Plot 11 – Channel 0



Plot 12 – Channel 39

Average Frequency Dwell Time Plots



Plot 13 – Channel 78

MAXIMUM PEAK POWER TEST

FCC Part 15.247(b)(1) Maximum Peak Power Limits

The EUT shows compliance to the requirements of this section, which states the EUT employing at least 75 non-overlapping hopping channels shall not exceed 1W (30dBm). For the EUT employs other frequency hopping systems, the peak power shall not greater than 0.125W (21dBm).

FCC Part 15.247(b)(1) Maximum Peak Power Test Instrumentation

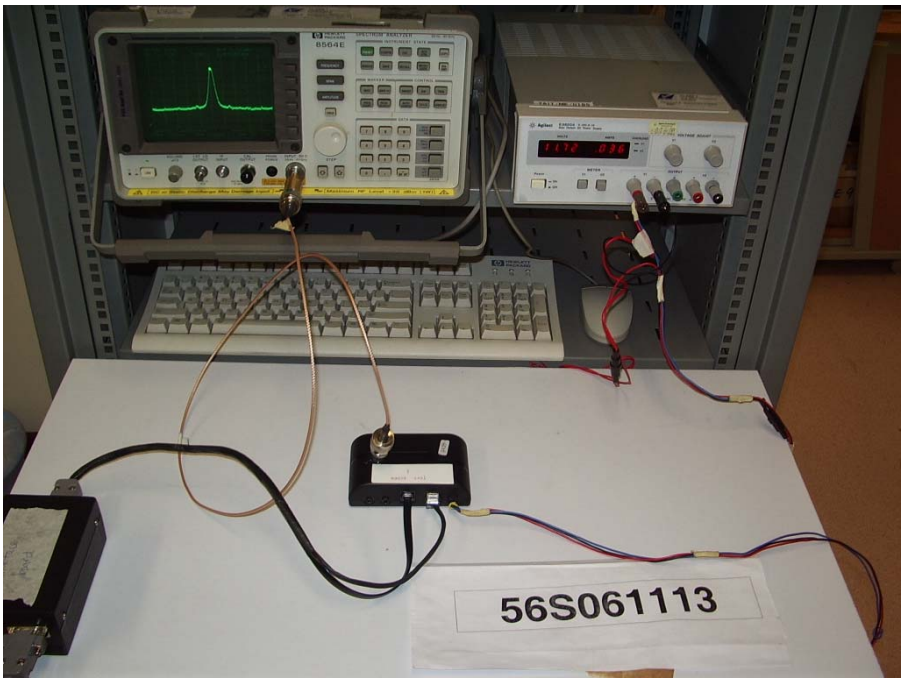
Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser – SA11	8563E	3846A09953	14 Sep 2008
R&S Universal Radio Communication Tester	CMU 200	837587/068	13 Jul 2007
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

FCC Part 15.247(b)(1) 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)(1) 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, non-hopping with transmitting frequency at Channel 0 (2.402GHz).
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. The step 2 was repeated with the transmitting frequency was set to Channel 39 (2.441GHz*)* and Channel 78 (2.480GHz) respectively.



Maximum Peak Power Test Setup

FCC Part 15.247(b)(1) Maximum Peak Power Results

Test Input Power	12VDC	Temperature	24°C
		Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)
0	2.402	0.0015	1.0
39	2.441	0.0020	1.0
78	2.480	0.0015	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	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

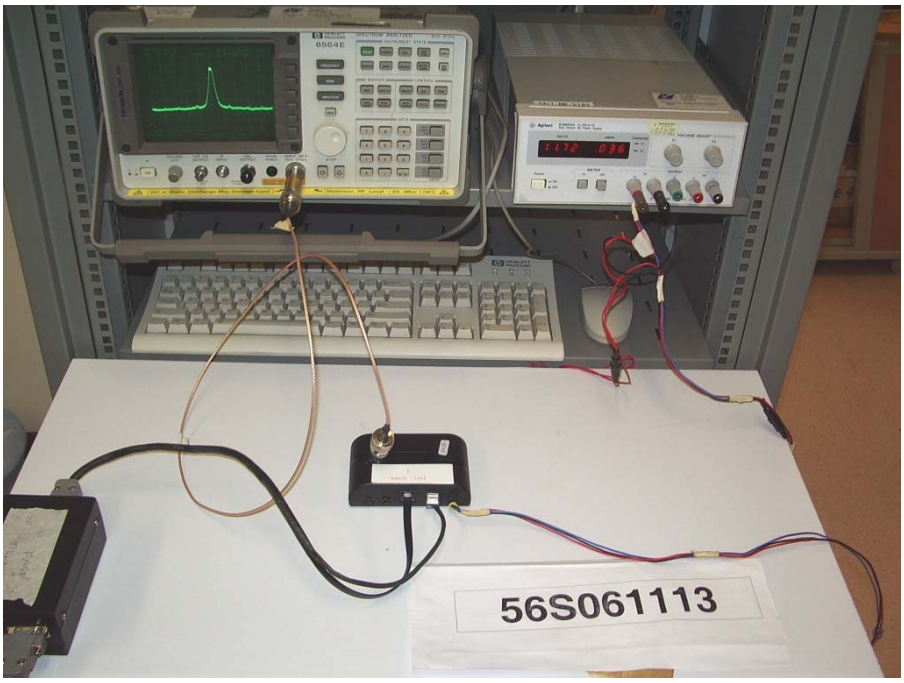
FCC Part 15.247(d) RF Conducted Spurious Emissions Test Setup

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 (2.402GHz).
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 39 (2.441GHz*)* and Channel 78 (2.480GHz) respectively.

RF CONDUCTED SPURIOUS EMISSIONS TEST



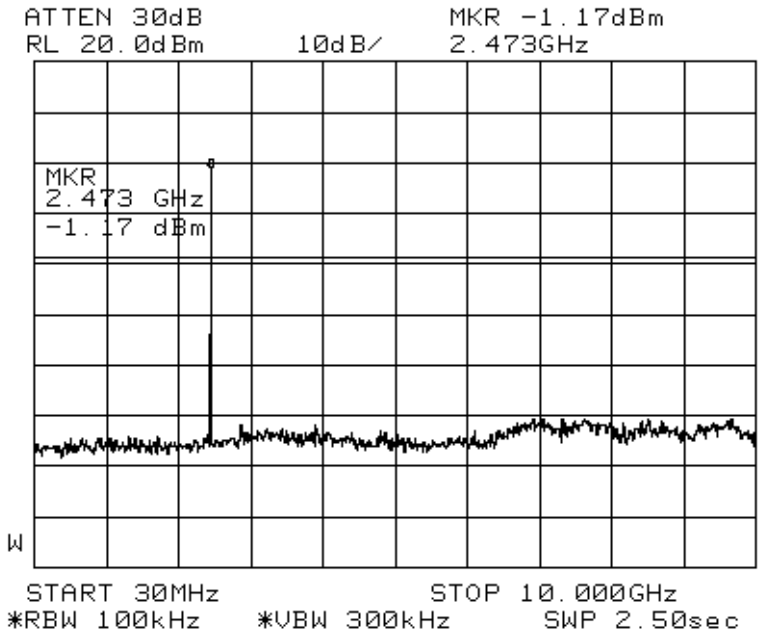
RF Conducted Spurious Emissions Test Setup

FCC Part 15.247(d) RF Conducted Spurious Emissions Results

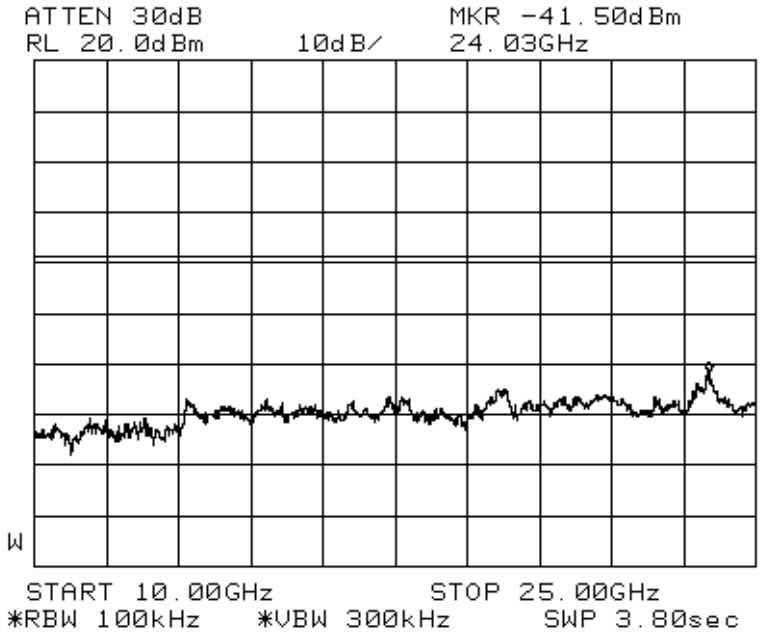
Test Input Power	12Vdc	Temperature	24°C
Attached Plots	14 - 19	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

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

RF Conducted Spurious Emissions Plots

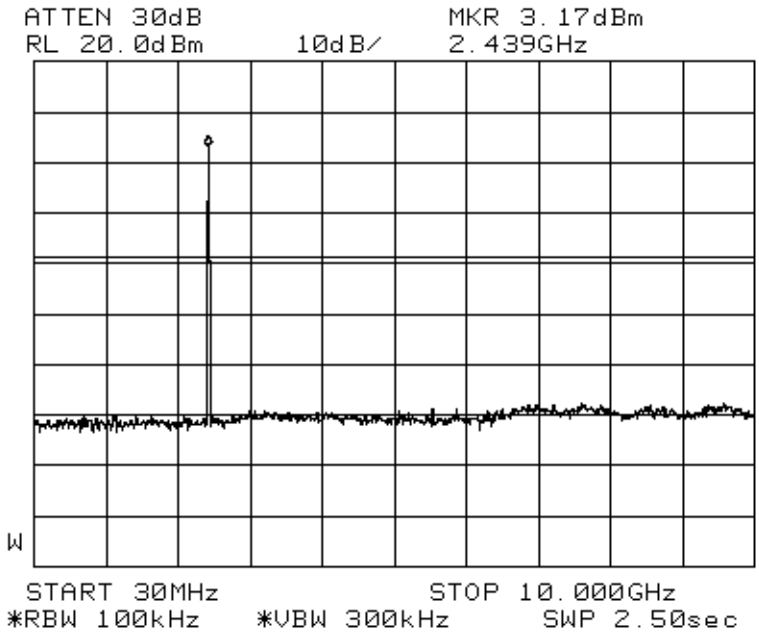


Plot 14 – Channel 0

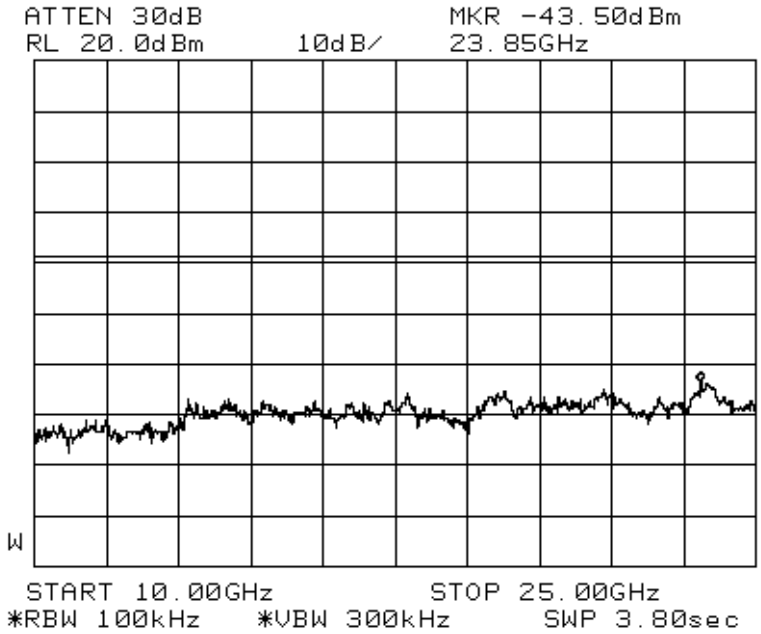


Plot 15 – Channel 0

RF Conducted Spurious Emissions Plots

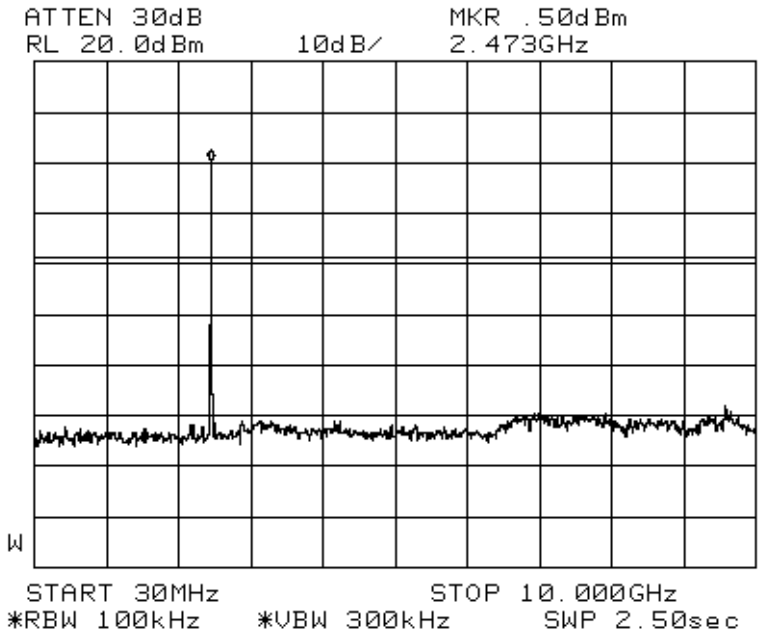


Plot 16 – Channel 39

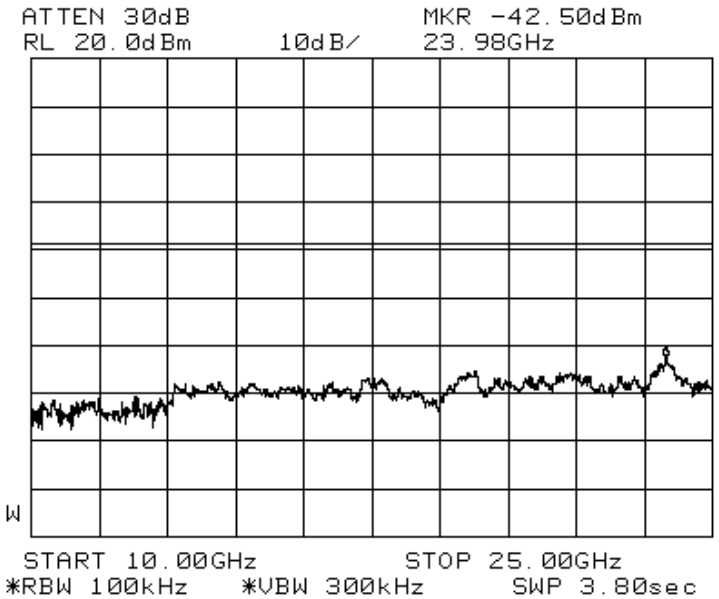


Plot 17 – Channel 39

RF Conducted Spurious Emissions Plots



Plot 18 – Channel 78



Plot 19 – Channel 78

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 Analyser – SA11	8563E	3846A09953	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

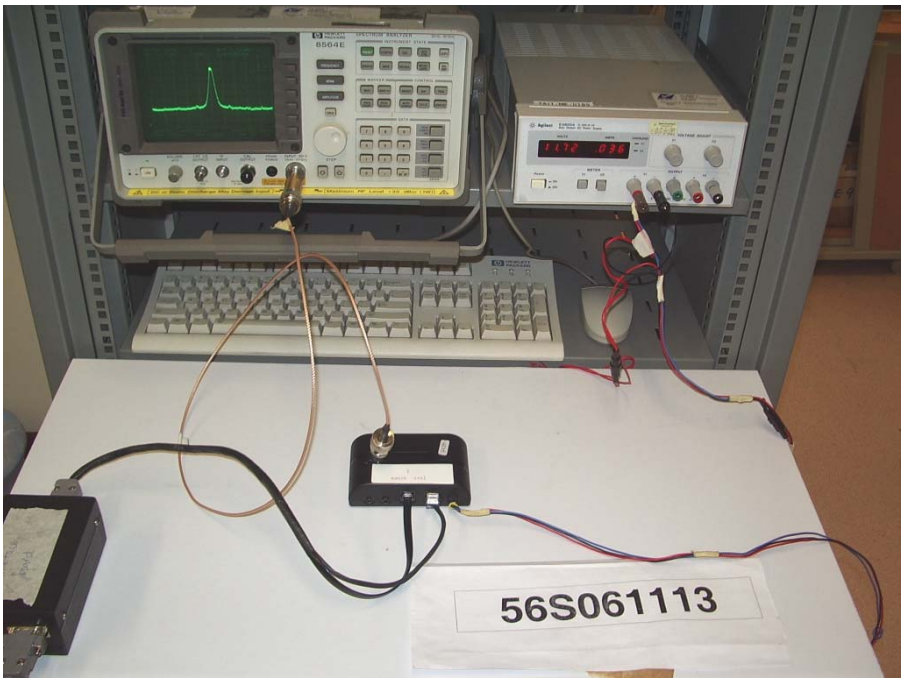
FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Setup

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 frequency hopping sequence on.
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.

BAND EDGE COMPLIANCE (CONDUCTED) TEST



Band Edge Compliance (Conducted) Test Setup

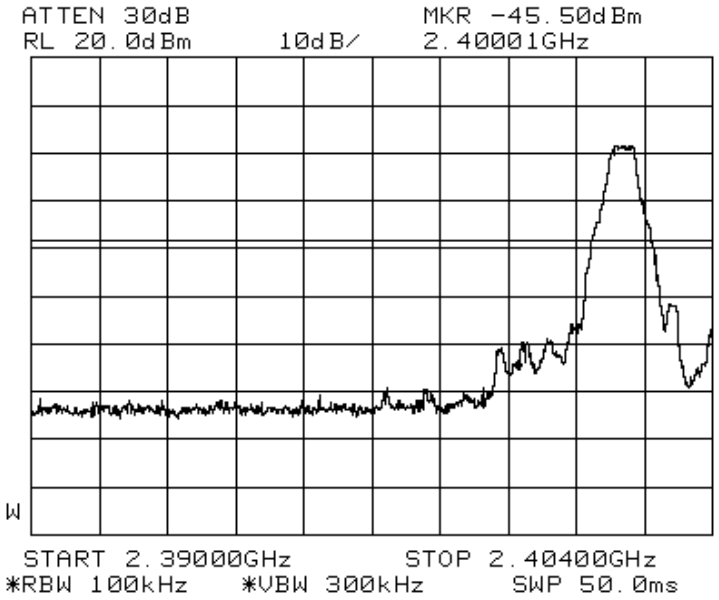
FCC Part 15.247(d) Band Edge Compliance (Conducted) Results

Test Input Power	12VDC	Temperature	24°C
Attached Plots	20 - 21	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

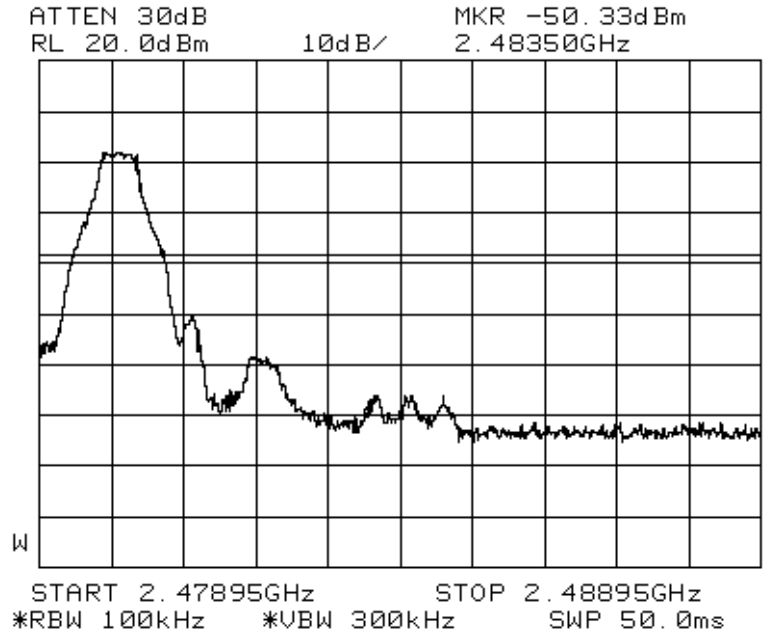
No significant signal was found and they were below the specified limit.

BAND EDGE COMPLIANCE (CONDUCTED) TEST

Band Edge Compliance (Conducted) Plots



Plot 20 – Lower Band Edge at 2.4000GHz



Plot 21 – 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) – ESMI1	ESMI	849182/003 848926/007	04 Jul 2007
Schaffner Pre-Amplifier	CPA9231A	3422	01 Apr 2007
Schaffner Bilog Antenna –BL4	CBL6112B	2593	12 May 2007
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2007

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 frequency hopping sequence on.
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.

BAND EDGE COMPLIANCE (RADIATED) TEST

Band Edge Compliance (Radiated) Test Setup

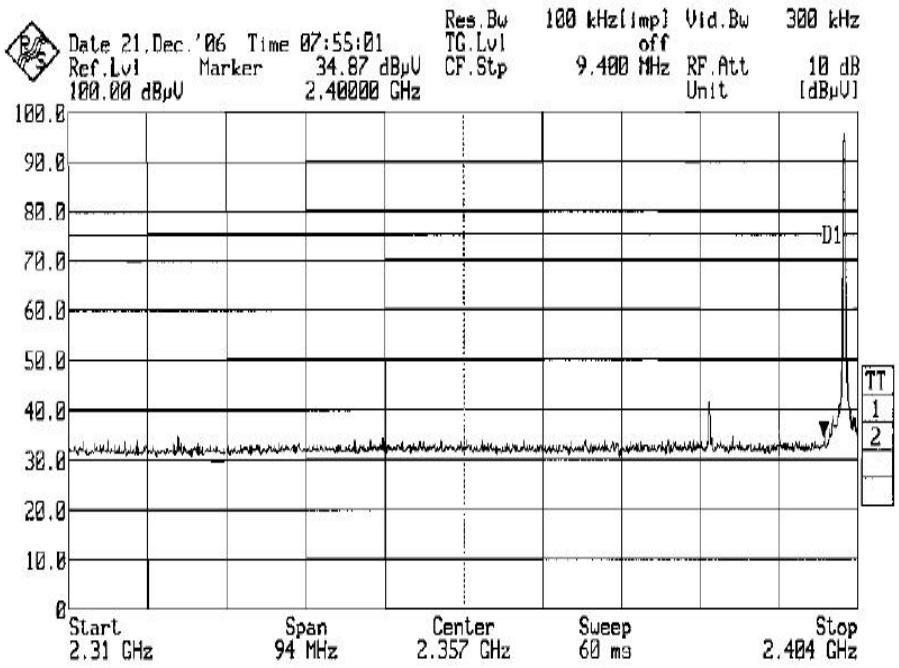
FCC Part 15.247(d) Band Edge Compliance (Radiated) Results

Test Input Power	12VDC	Temperature	23°C
Attached Plots	22 - 27	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

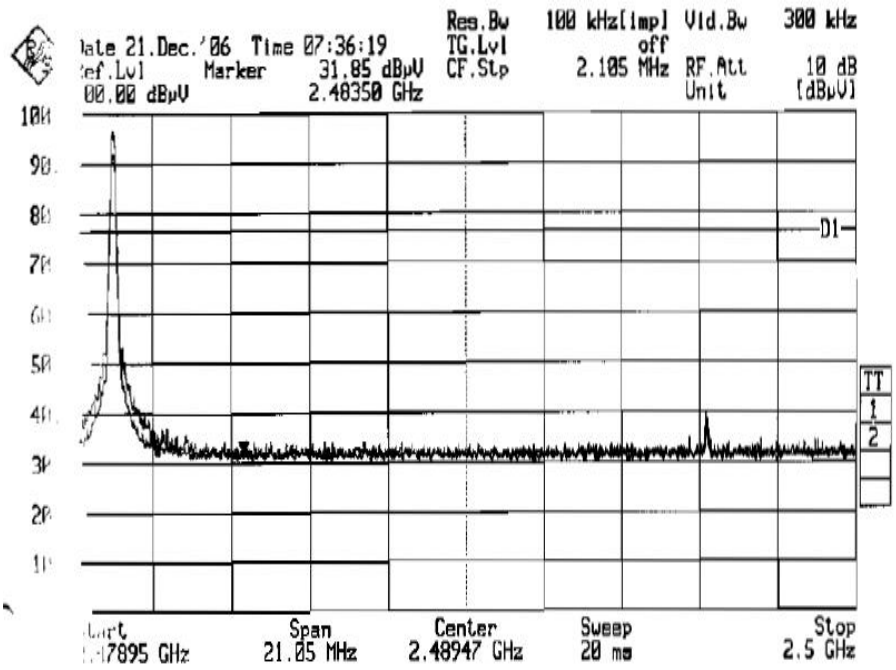
No significant signal was found and they were below the specified limit.

BAND EDGE COMPLIANCE (RADIATED) TEST

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

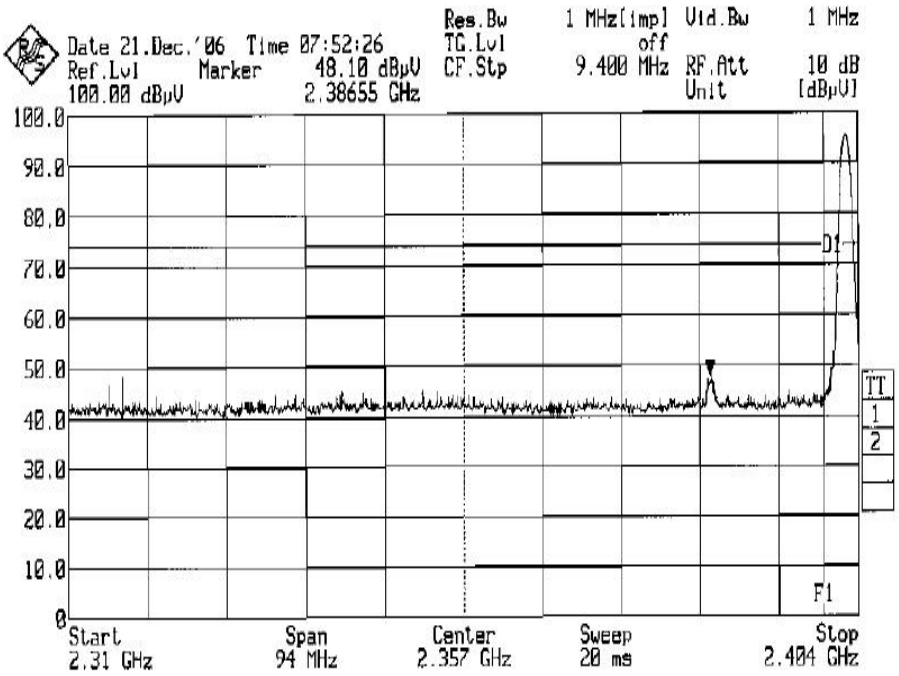


Plot 22 – Lower Band Edge at 2.4000GHz

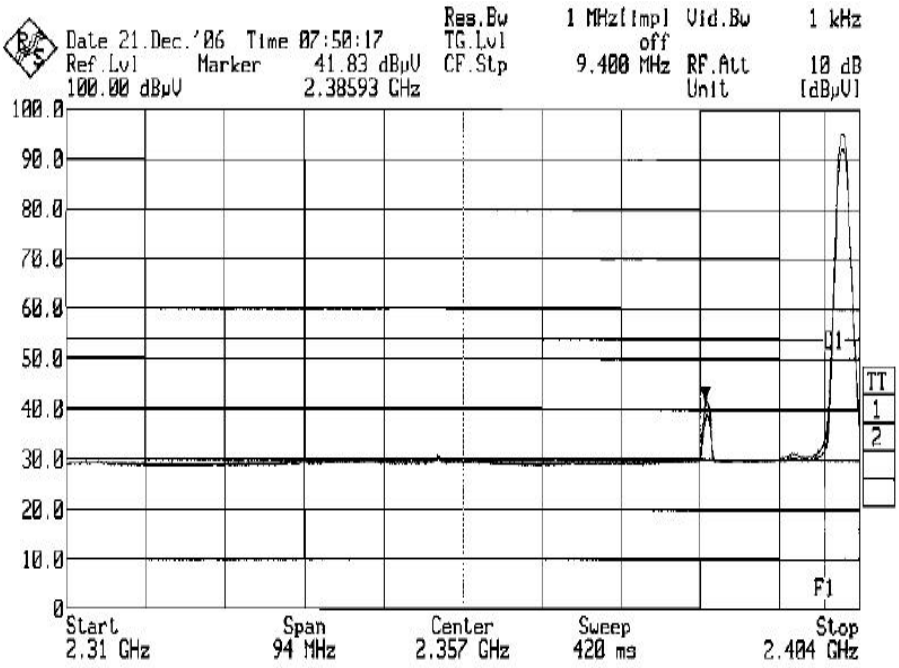


Plot 23 – Upper Band Edge at 2.4835GHz

Band Edge Compliance (Radiated) Plots (Restricted Band)

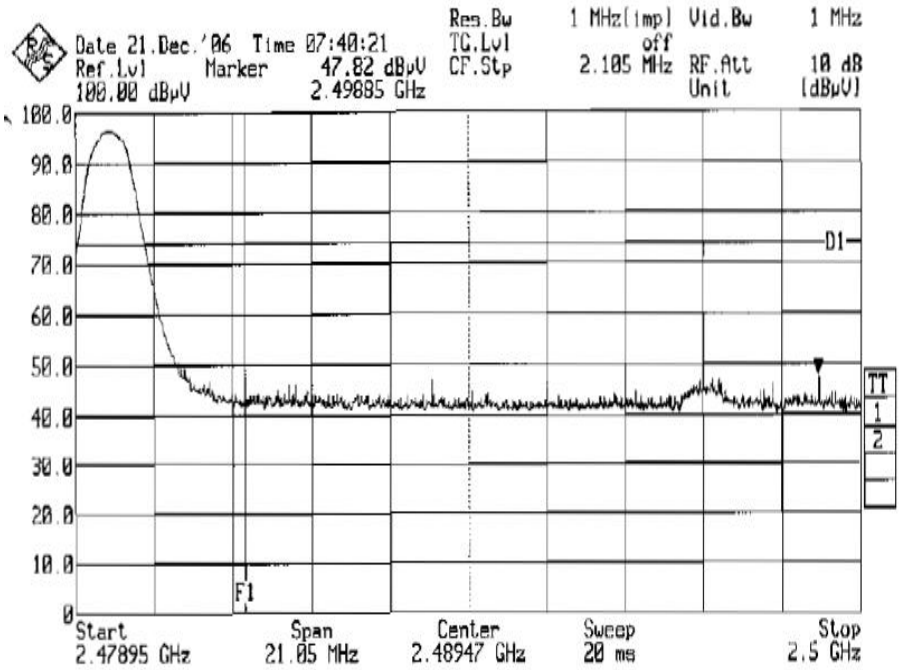


Plot 24 – Peak Plot at Lower Band Edge at 2.4000GHz

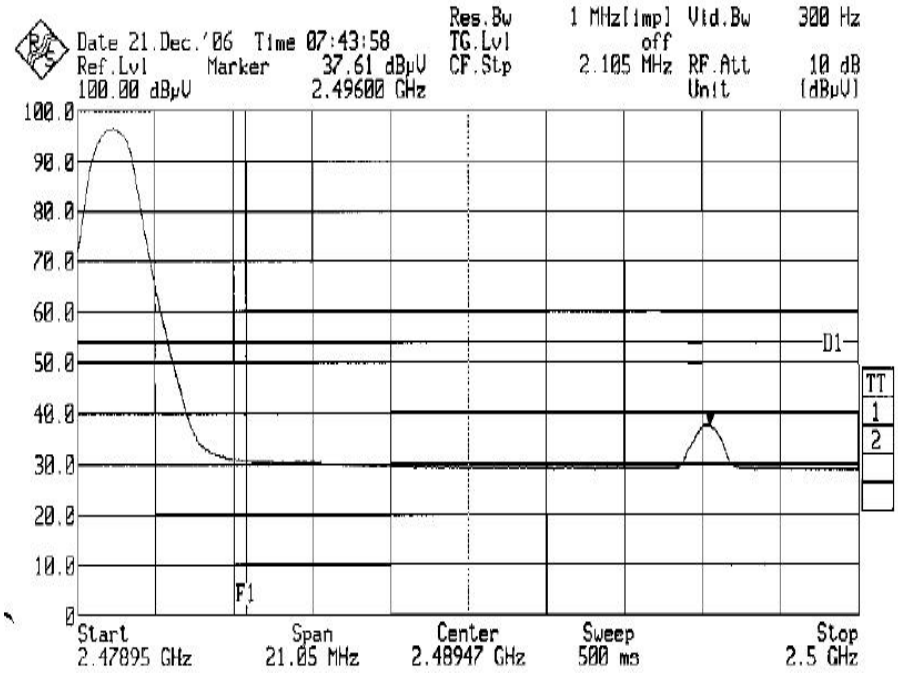


Plot 25 – Average Plot at Lower Band Edge at 2.4000GHz

Band Edge Compliance (Radiated) Plots (Restricted Band)



Plot 26 – Peak Plot at Upper Band Edge at 2.4835GHz



Plot 27 – 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
HP Spectrum Analyser – SA11	8563E	3846A09953	14 Sep 2008
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

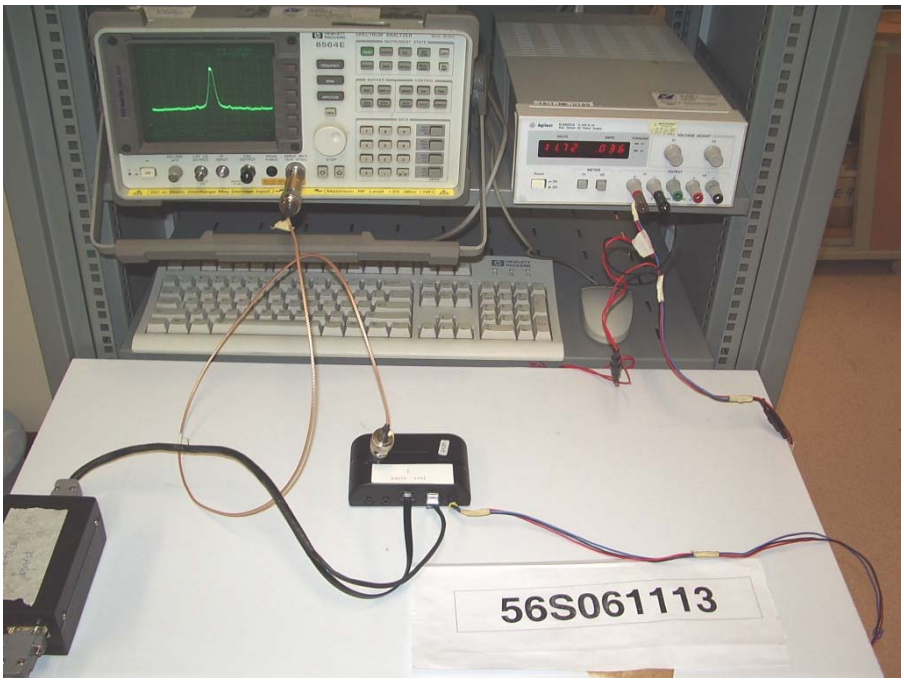
FCC Part 15.247(e) Peak Power Spectral Density Test Setup

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, non-hopping with transmitting frequency at Channel 0 (2.402GHz).
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 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

PEAK POWER SPECTRAL DENSITY TEST



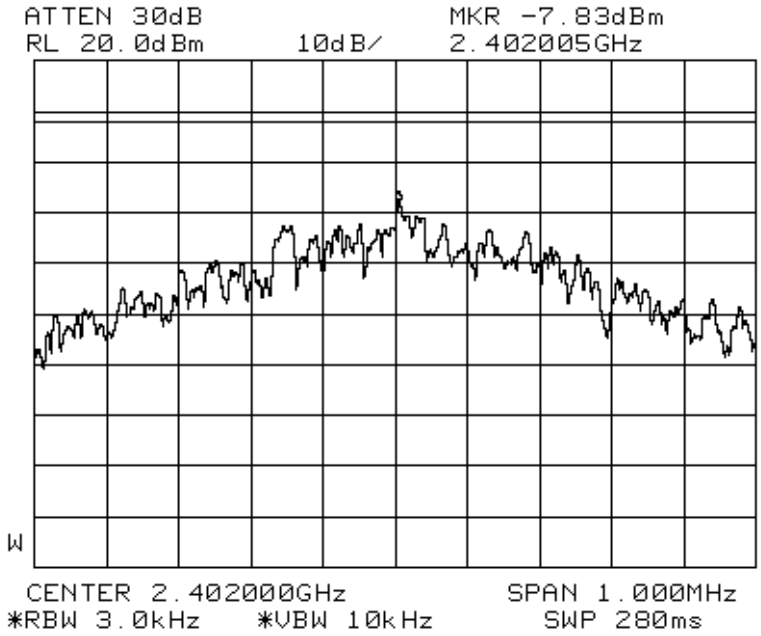
Peak Power Spectral Density Test Setup

FCC Part 15.247(e) Peak Power Spectral Density Results

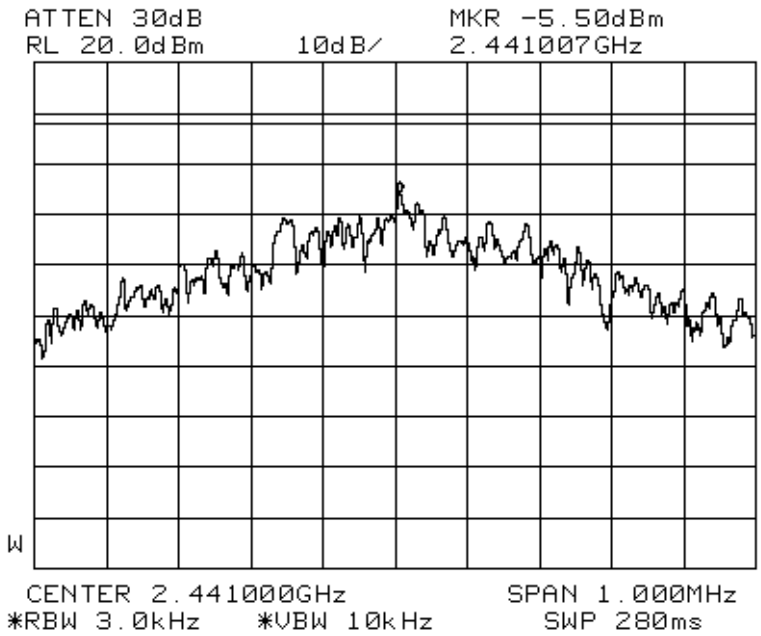
Test Input Power	12VDC	Temperature	24°C
Attached Plots	28 - 30	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0	2.402	0.1648	6.3
39	2.441	0.2818	6.3
78	2.480	0.1358	6.3

Peak Power Spectral Density Plots

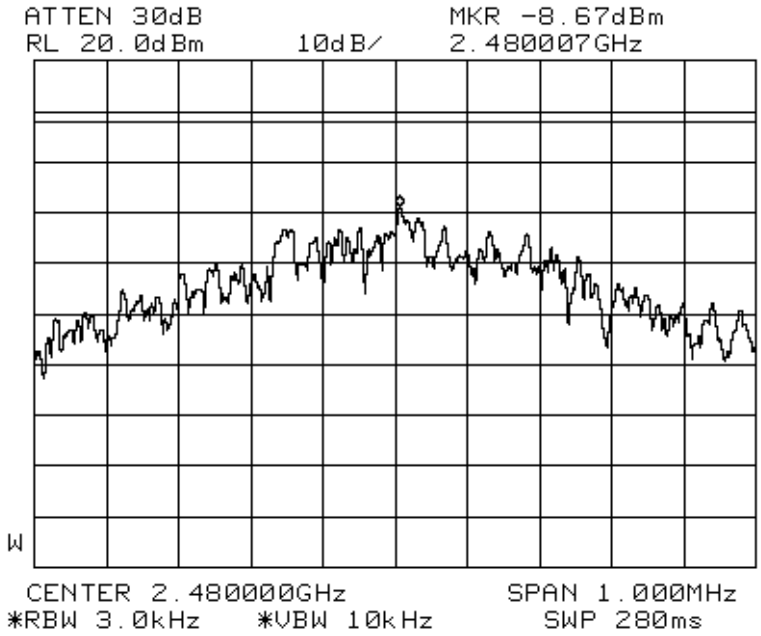


Plot 28 – Channel 0



Plot 29 – Channel 39

Peak Power Spectral Density Plots



Plot 30 – Channel 78

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 (MPE) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
PMM 8053 Portable Field Meter	8053	0220J10308	16 Apr 2007
Agilent DC Power Supply	E3620A	MY40000336	08 Nov 2007

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Setup

1. The EUT and supporting equipment were set up as shown on the setup photo.
2. 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

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was first carried out at one of the positions / sides of the EUT.
3. Power density measurement (mW/cm^2) was made using the field meter set to the required averaging time.
4. 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^2

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

Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm^2 i.e. **0.7 mW/cm^2 below limit**

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	12Vdc	Temperature	22°C
Test Distance	20cm	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

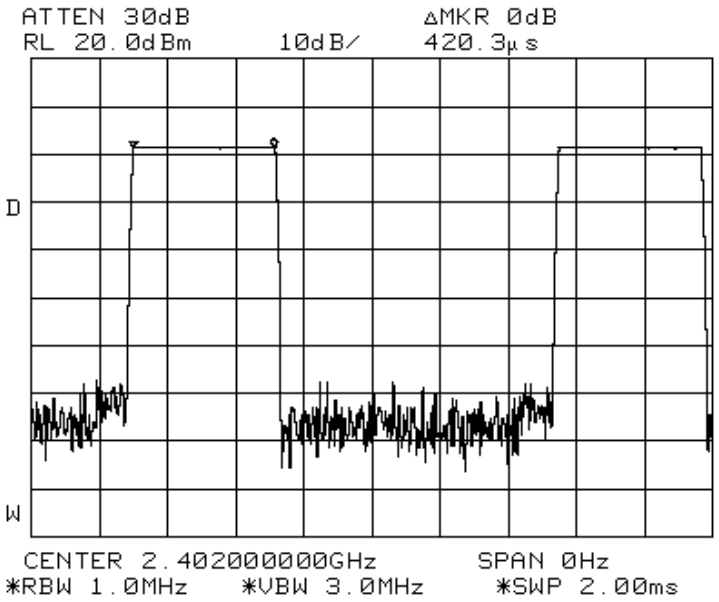
Channel	Channel Frequency (GHz)	Power Density Value (mW/cm^2)	Margin (mW/cm^2)	Averaging Time (min)	Limit (mW/cm^2)
0	2.402	0.0005	-0.9995	30	1.0
39	2.441	0.0003	-0.9997	30	1.0
78	2.480	0.0001	-0.9999	30	1.0

Notes

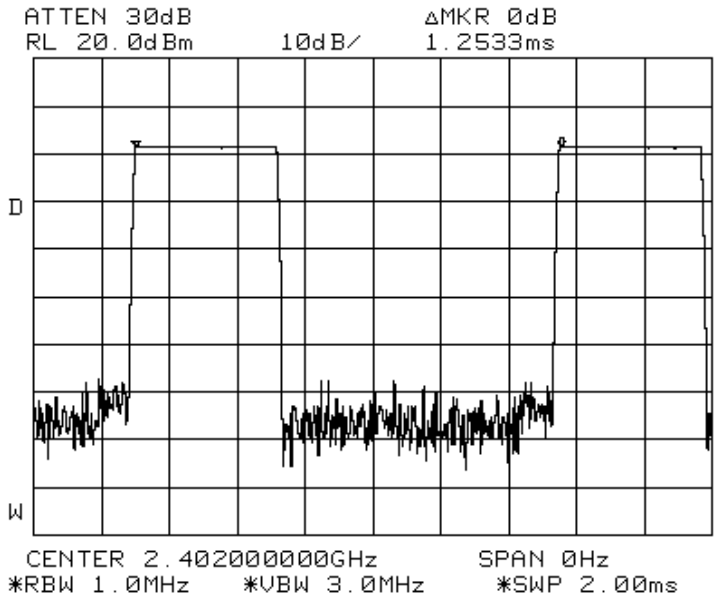
1. All possible modes of operation were investigated. Only the worst case highest radiation levels were measured. Measurements were taken at the required averaging time. All other radiation levels were relatively insignificant.
2 A "-ve" margin indicates a PASS as it refers to the margin present below 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%.

DUTY CYCLE FACTOR COMPUTATION

FCC Part 15.35(c) Duty Cycle Correction Factor



On Time



Period

Duty Cycle Factor (worst- case) = 20 log [Total On time / Period]
= 20 log [(0.4203 / 1.2533)]
= **-9.5dB**

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 Corporation approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB Corporation in any way "guarantees" the later performance of the product/equipment.

4. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB Corporation therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.

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10. Unless otherwise stated, the tests are carried out in TÜV SÜD PSB Corporation Pte Ltd, No.1 Science Park Drive Singapore 118221.

October 2006

ANNEX A

EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

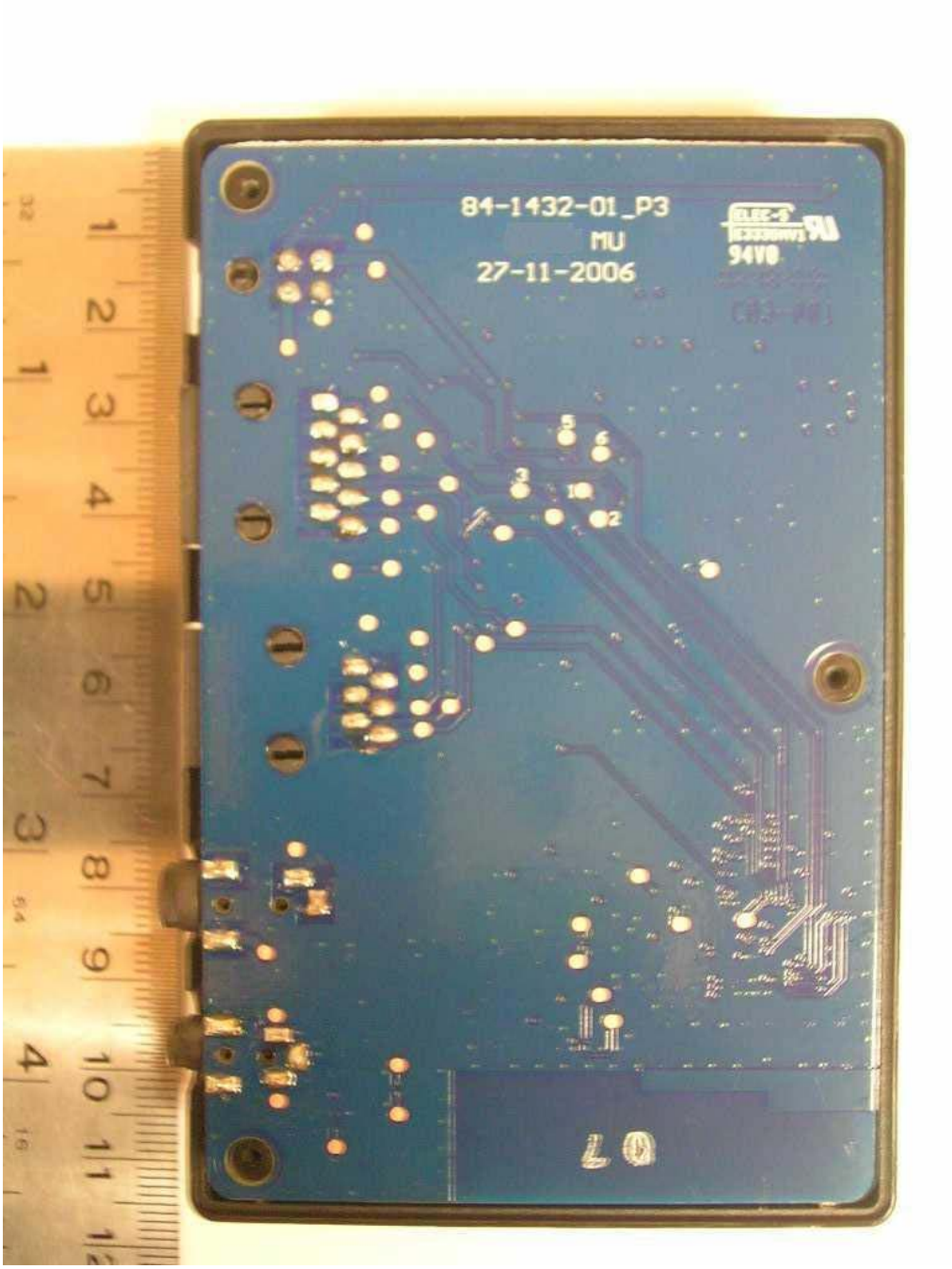
EUT PHOTOGRAPHS – MAIN UNIT

Front View

Rear View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

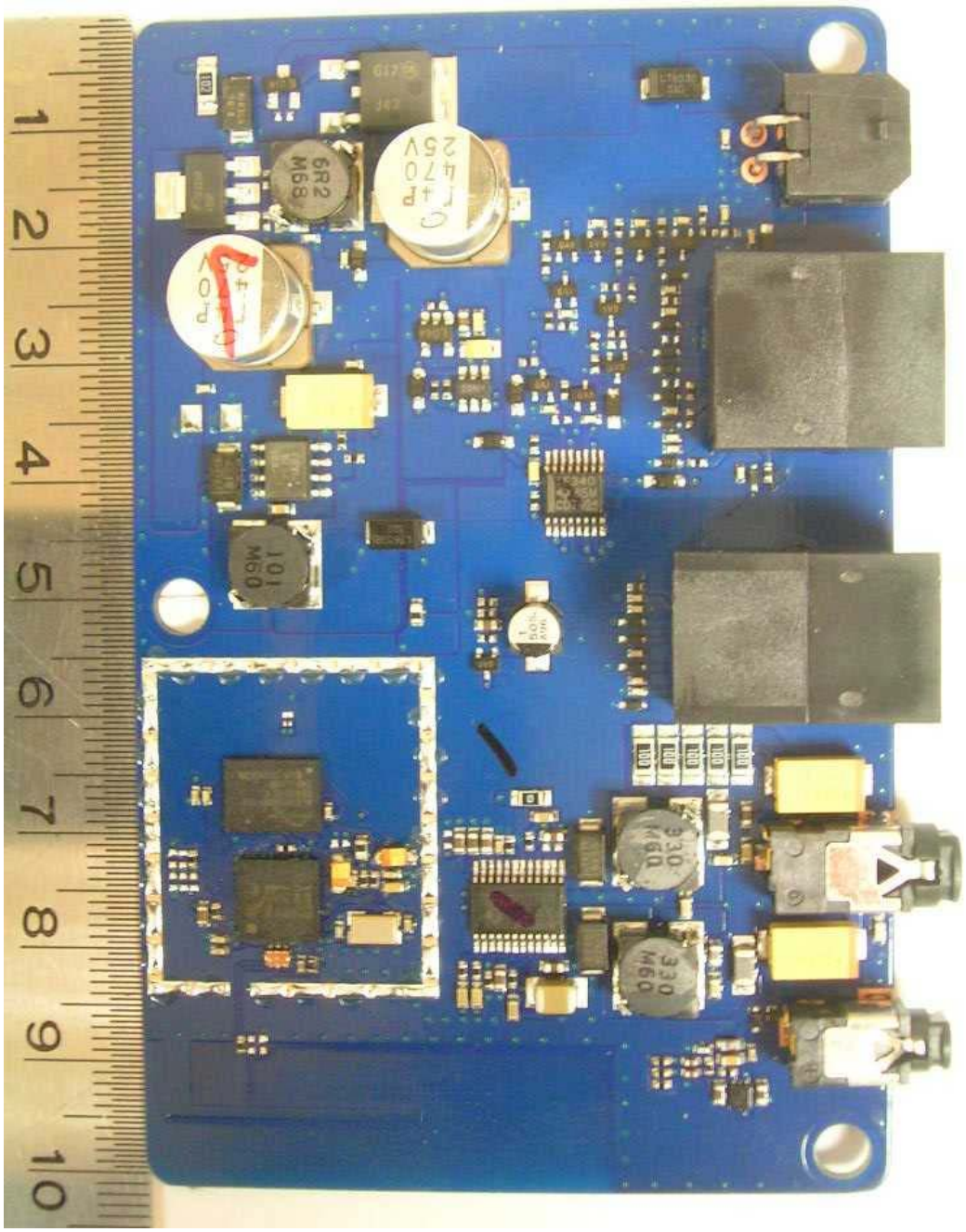
EUT PHOTOGRAPHS – MAIN UNIT



Main Unit - Internal View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

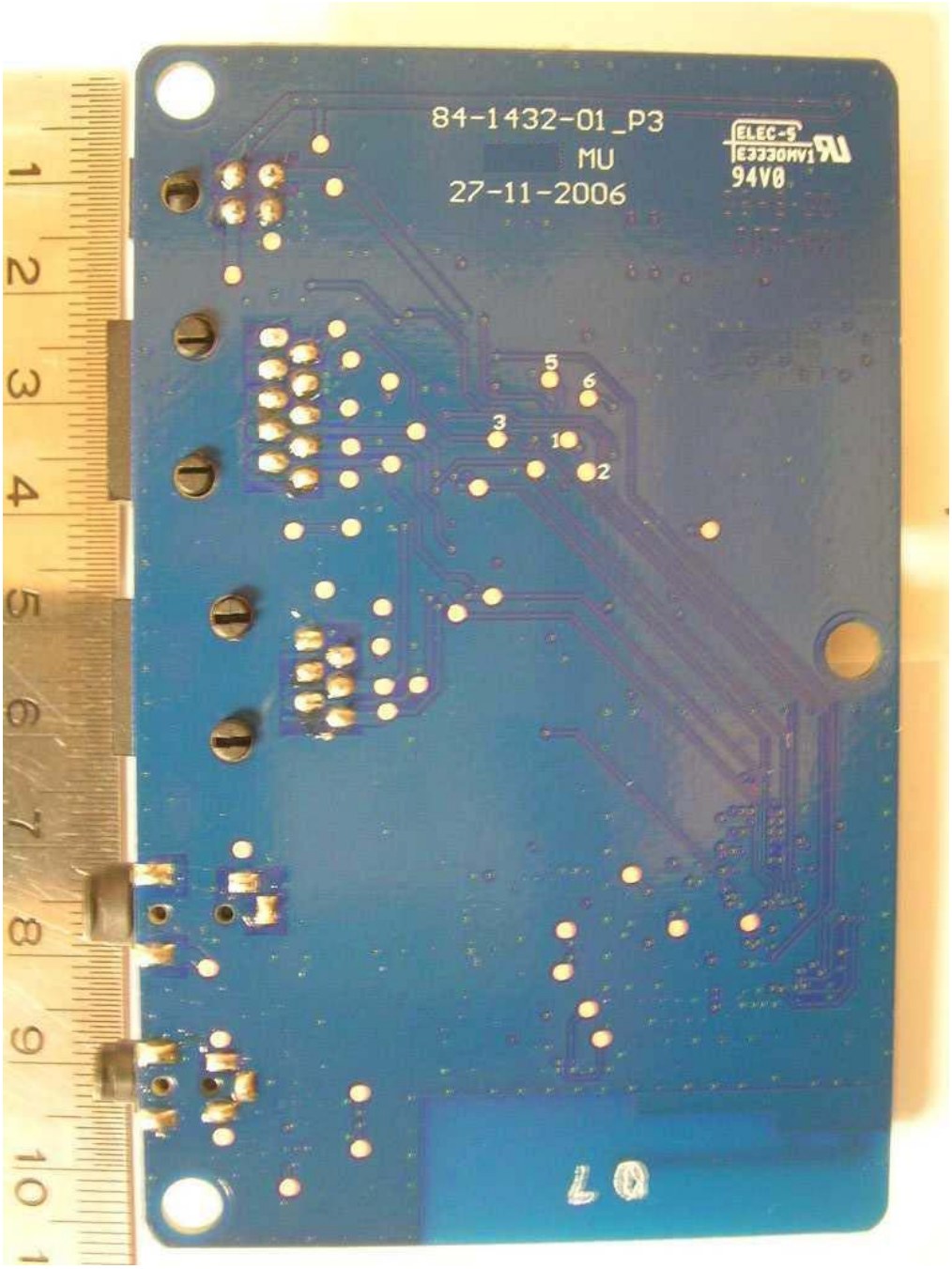
EUT PHOTOGRAPHS – MAIN UNIT



Main Unit Board - Component Side

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

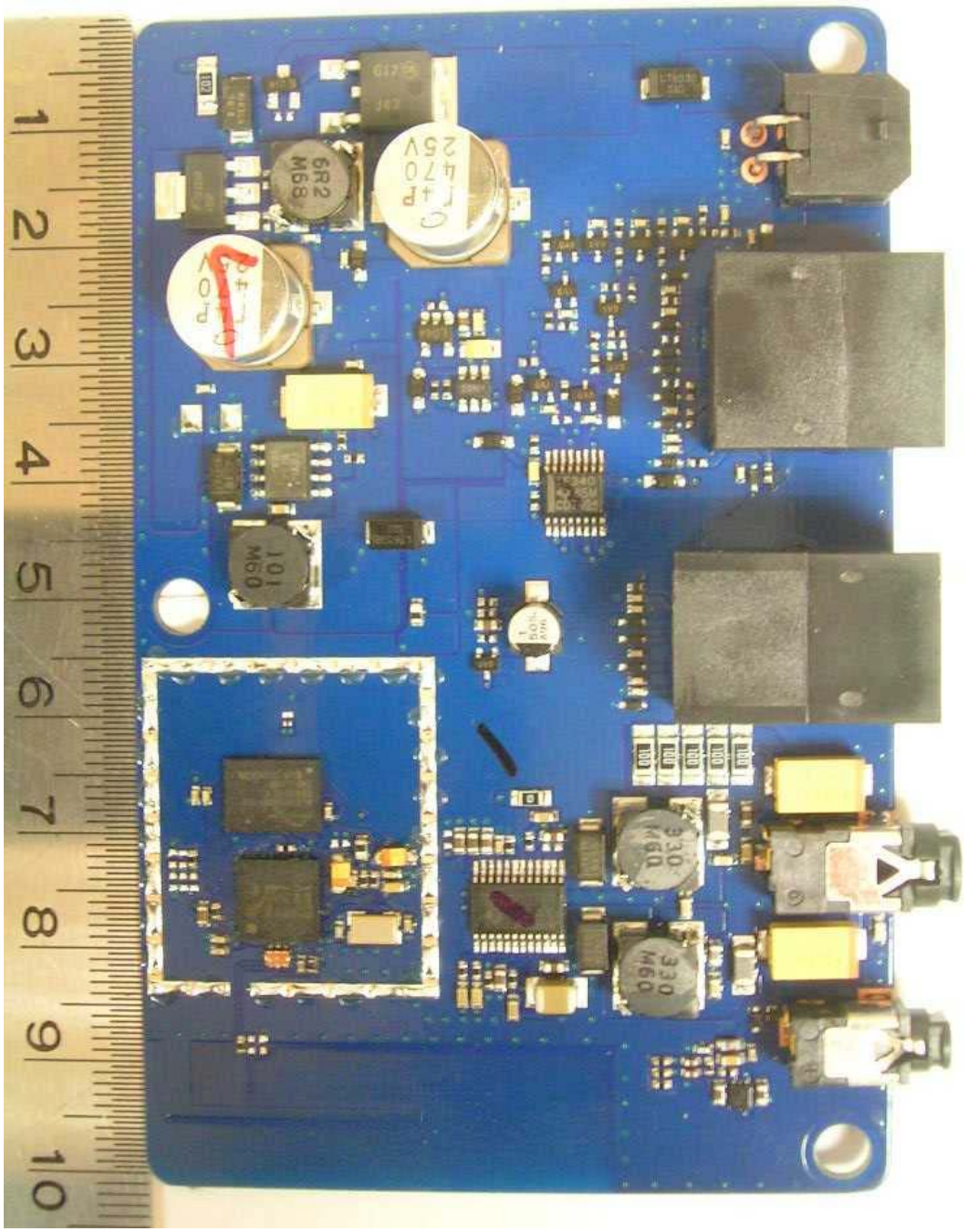
EUT PHOTOGRAPHS – MAIN UNIT



Main Unit Board - PCB Trace Side

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – MAIN UNIT



RF Module Circuit with RF Shield Removed

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – SPEAKER UNIT

Front View

Rear View

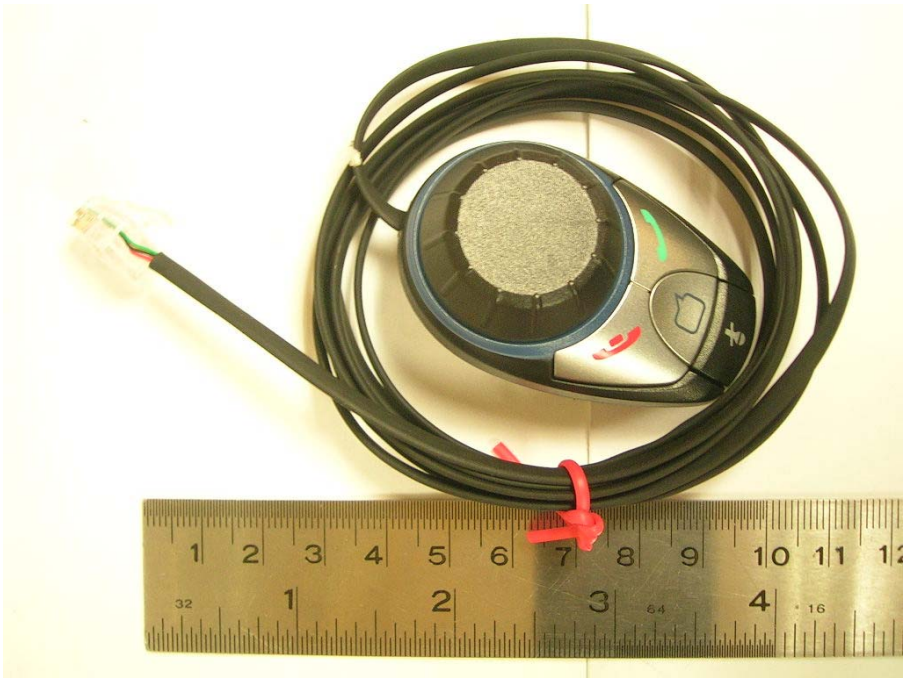
EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – SPEAKER UNIT

Speaker Unit - Internal View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – INPUT DEVICE UNIT



Front View

Rear View

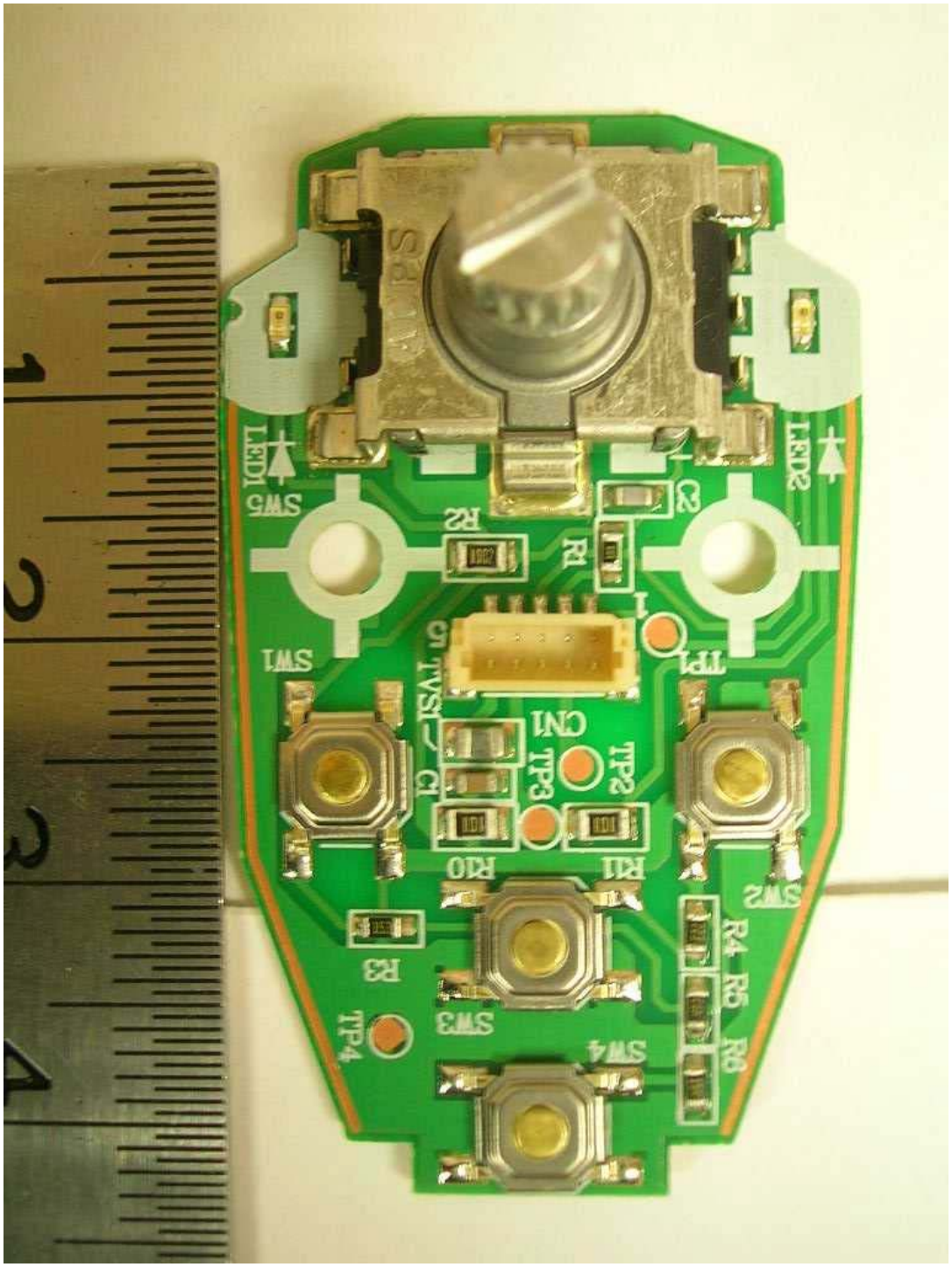
EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – INPUT DEVICE UNIT

Control unit - Internal View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – INPUT DEVICE UNIT



Control Unit Board - Component Side

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – INPUT DEVICE UNIT

Control Unit Board - PCB Trace Side

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

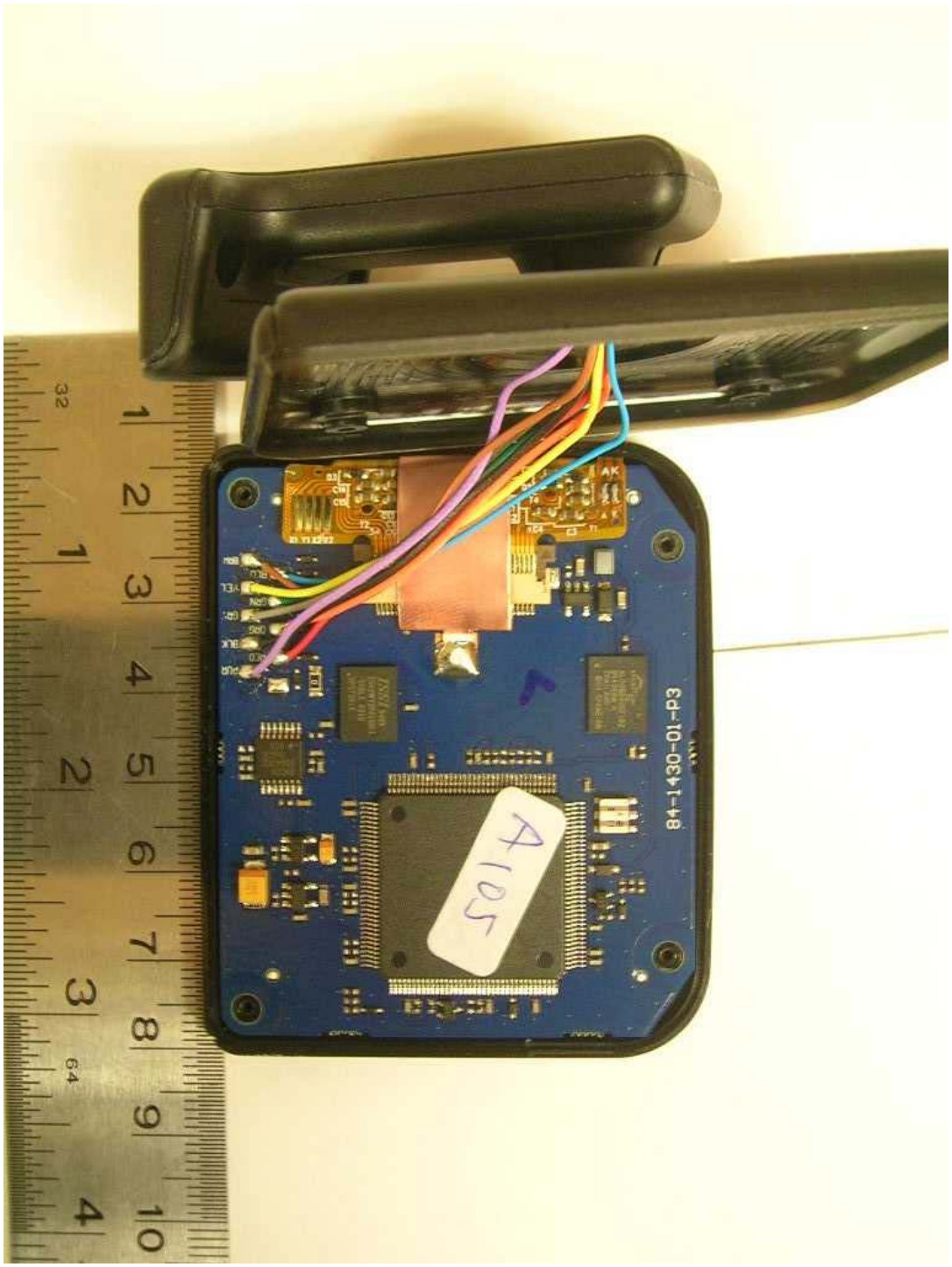
EUT PHOTOGRAPHS – LCD UNIT

Front View

Rear View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

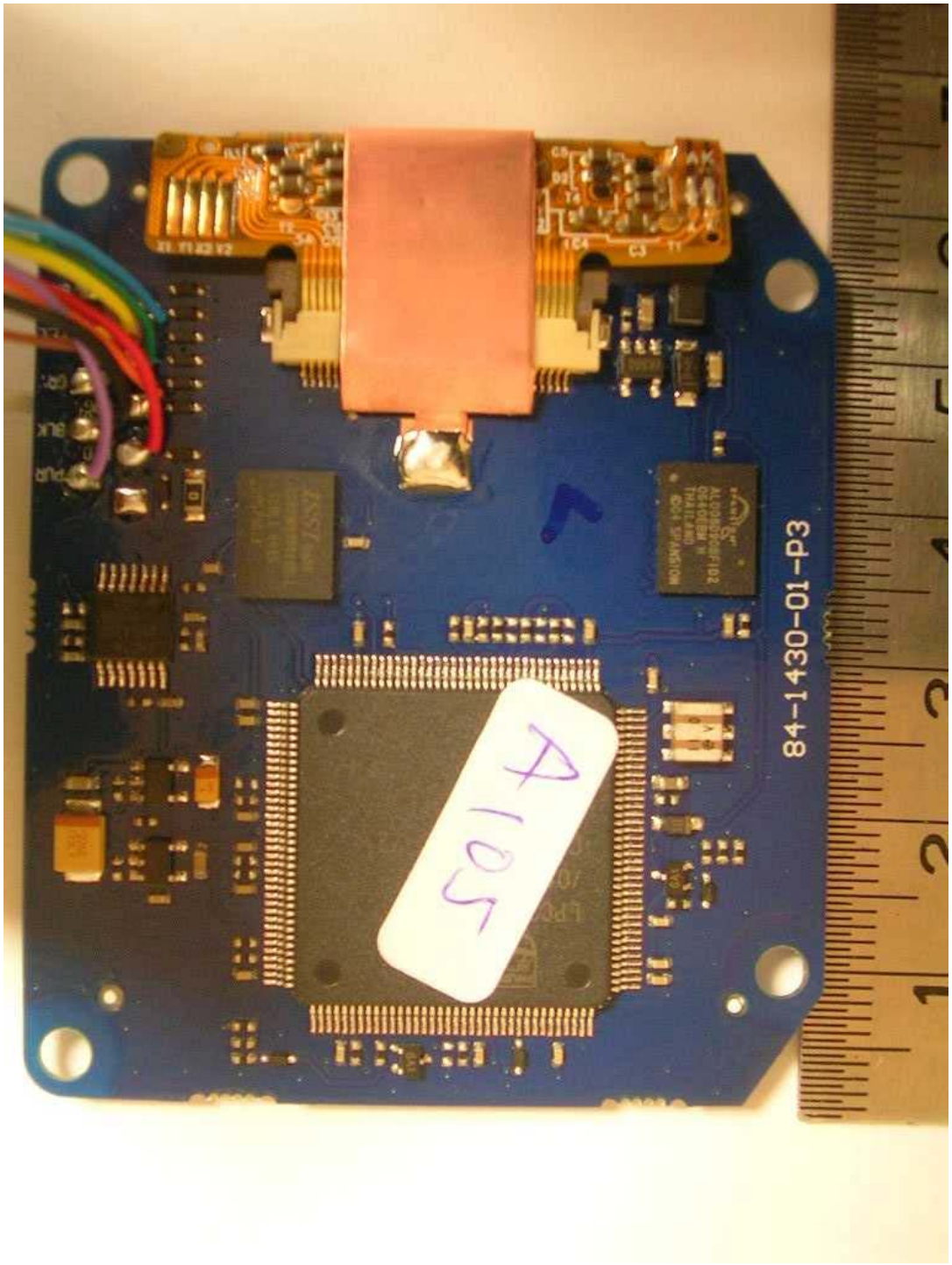
EUT PHOTOGRAPHS – LCD UNIT



LCD Board – Internal View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

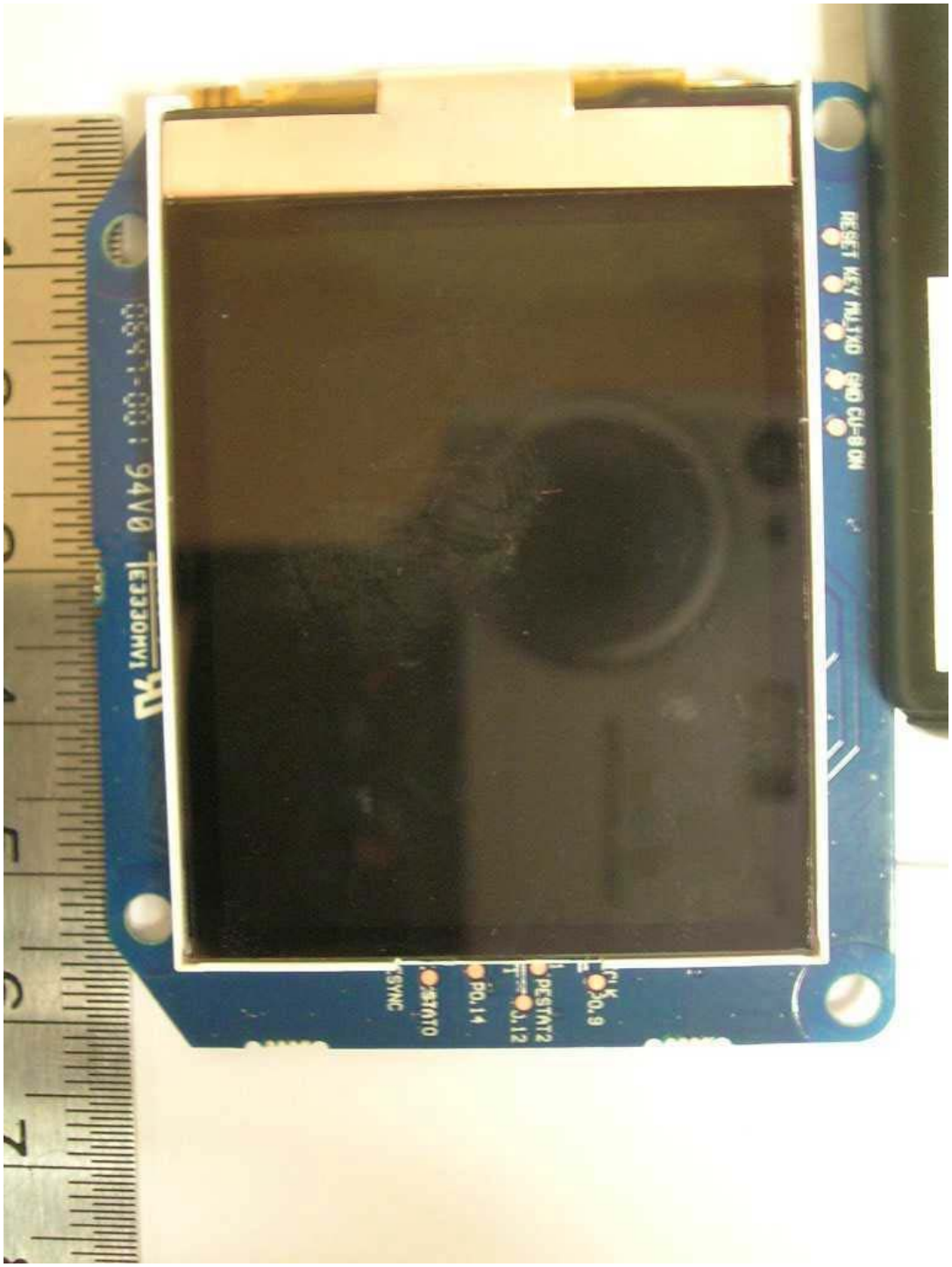
EUT PHOTOGRAPHS – LCD UNIT



LCD Board - Component Side

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – LCD UNIT



LCD Board - PCB Trace Side

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – MICROPHONE UNIT

Front View

Rear View

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS – MICROPHONE UNIT

Internal View

Internal View

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.

NOKIA® NOKIA CORPORATION

Type/Tipo: HF-15

MADE IN Malaysia
FABRIQUÉ EN MALAISIE
ORIGEM: MALÁSIA MODELO: CK-15W

FCC ID: OW3HF-15
IC : 661AA-HF15

CE 1177

This device complies with part 15 of the FCC rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

ME 96 NOM NYCE

Sample Label

Physical Location of FCC Label on EUT

ANNEX C

USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)