TEST REPORT

Your Ref:

Date: 21 Jul 2005

Our Ref: 56S050567/01

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NOTE: This report is issued subject to 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 15B & C : 2004
OF A
2.4GHz WIRELESS HEADPHONE SYSTEM
[MODELs : NTJD-800 and NTED-800]
[FCC IDs : LLP-NTJD800 and LLP-NTED800]

TEST FACILITY	Telecoms & EMC, Testing Group, PSB Corporation Pte Ltd 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 (10m Anechoic Chamber)
PREPARED FOR	Nasaco Electronics Pte Ltd 4/F. Nasaco Tech Centre 49 Changi South Ave 2, Singapore 485056 Tel : 65 6214 0676 Fax : 65 6214 1146
JOB NUMBER	56S050567
TEST PERIOD	30 Jun 2005 – 19 Jul 2005

PREPARED BY	**APPROVED BY**
Lucas Beh Associate Engineer	Lim Cher Hwee Product Manager

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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

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 marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

TABLE OF CONTENTS

TEST SUMMARY

PRODUCT DESCRIPTION

SUPPORTING EQUIPMENT LIST

EUT OPERATING CONDITION

TEST RESULTS

ANNEX A - TEST INSTRUMENTATION & GENERAL PROCEDURES

ANNEX B - EUT PHOTOGRAPHS / DIAGRAMS

ANNEX C - USER MANUAL, TECHNICAL DESCRIPTION, BLOCK & CIRCUIT DIAGRAMS

ANNEX D - FCC LABEL & POSITION

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

Test Results Summary

Test Standard	Description	Pass / Fail
FCC Part 15: 2004		
15.107, 15.207	Conducted Emissions	Pass
15.109, 205, 15.209	Radiated Emissions	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 & Band Edge Compliance at the Transmitter Antenna Terminal	Pass
15.247 (e)	Peak Power Spectral Density	Pass
15.35(c)	Duty Cycle Correction Factor	Refer to pages 50 and 51 for details

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	2.40333
Channel 7	2.44224
Channel 14	2.47910

   The EUT contains total 15 channels.

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.

Modifications

No modifications were done.

Description	:	The Equipment Under Test (EUT) is a **2.4GHz Wireless Headphone System**. The EUT consists of following: - one wireless transmitter, NTJD-800 (a RF transceiver) - one wireless headphone, NTED-800 (RF transceiver) The wireless transmitter will transmit the inputted audio source wirelessly to the wireless headphone. Upon receipt the audio signal from the wireless transmitter, the headphone will send an acknowledged signal back to the transmitter.
Factory Address	:	Nasaco Electronics (Shenzhen) Ltd. 7/F, Phase 1, Hing Yick Industrial Estate, Fu Yong, Shenzhen City, Guangdong, China.
Manufacturer	:	Nasaco Electronics (HK) Ltd RM 1106, Eastren Centre 1065 King's Road Tel – 852 2563 0592 Fax – 852 2565 9613
Model Number	:	NTJD-800 (Wireless transmitter) NTED-800 (Wireless headphone)
FCC IDs	:	LLP-NTJD800 (Wireless transmitter) LLP-NTED800 (Wireless headphone)
Serial Number	:	Nil
Microprocessor	:	TYJ-1101 Baseband module (Wireless transmitter) TYM-1101 Baseband module (Wireless headphone)
Operating / Transmitting Frequency	:	2.40333GHz to 2.47910GHz
Modulation	:	Frequency Shift Keying (FSK)
Port / Connectors	:	1 x DC In jack 2 x Audio In (L & R) 1 x Line In 1 x Charger jack
Rated Input Power	:	6V DC via 110VAC 60Hz AC/D adapter (Wireless transmitter) 3 X AAA batteries (Wireless headphone)

SUPPORTING EQUIPMENT DESCRIPTION

The Equipment Under Test (EUT), a 2.4GHz Wireless Headphone System was tested as a stand-alone device without any supporting equipment.

EUT OPERATING CONDITIONS

The 2.4GHz Wireless Headphone System was powered from 110V, 60Hz mains supply.

Tests	Description Of Operation
1. Conducted Emissions 2. Radiated Emissions 3. Carrier Frequency Separation 4. Spectrum Bandwidth (20dB Bandwidth Measurement) 5. Number Of Hopping Frequencies 6. Average Frequency Dwell Time 7. Maximum Peak Power 8. RF Conducted Spurious Emissions at the Transmitter Antenna Terminal 9. Band Edge Compliance at the Transmitter Antenna Terminal 10. Peak Power Spectral Density 11. Duty Cycle Correction Factor	The EUT was exercised by operating in the test mode with maximum transmitting power and following configuration during the tests: <u>Carrier Frequency Separation, Number of Hopping Frequency, Average Frequency Dwell Time and Band Edge at the Transmitting Antenna</u> Frequency hopping and modulation are on. <u>Conducted Emissions, Radiated Emissions, Spectrum Bandwidth (20dB Bandwidth Measurement), Maximum Peak Power, RF Conducted Spurious Emissions at the Transmitter Antenna Terminal, Peak Power Spectral Density, Duty Cycle Correction Factor</u> Frequency hopping is off and the modulation is on.

FCC Part 15B (15.107 & 15.207) Class B Conducted Emission Results

Unit Under Test: Wireless Transmitter

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.5450	12.2	-43.8	7.7	-38.3	Neutral	0
0.6790	11.9	-44.1	7.4	-38.6	Neutral	0
1.2722	11.6	-44.4	7.3	-38.7	Live	0
2.1358	11.8	-44.2	7.4	-38.6	Neutral	0
4.1297	12.0	-44.0	7.4	-38.6	Neutral	0
4.9858	11.6	-44.4	7.4	-38.6	Live	0

Unit Under Test: Wireless Headphone (Wireless headphone in charging mode which it was connected to wireless transmitter)

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line
0.2160	34.2	-28.8	29.6	-23.4	Live
1.2556	15.7	-40.4	4.5	-41.5	Live
1.7442	2.7	-53.3	-0.5	-46.5	Neutral
2.4202	4.2	-51.9	1.3	-44.7	Neutral
4.7067	31.5	-24.5	-8.2	-54.2	Neutral
22.1223	20.1	-39.9	15.6	-34.4	Live

Tested by: Kenneth Ler

Notes:

1. Environmental Conditions — Temperature: 22°C; Relative Humidity: 58%; Atmospheric Pressure: 1030mbar
2. All possible modes of operation were investigated from 150kHz to 30MHz. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
3. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   9kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
5. 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 ±2.4dB.

Conducted Emissions Setup (Front View)

Conducted Emissions Setup (Rear View)

FCC Part 15 (15.109, 15.205 & 15.209) Class B Radiated Emission (Spurious Emissions) Results

Test Distance : 3m

Unit Under Test: Wireless Transmitter

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Channel	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
114.4115	33.3	-10.2	14	241	100	V
294.9008	37.1	-9.0	14	276	100	H
344.0430	38.4	-7.6	14	36	100	H
393.2100	41.6	-4.4	14	118	100	H
442.3480	45.8	-0.2	14	65	100	H
466.9291	41.8	-4.3	14	100	101	H

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Average Margin (dB)	Channel	Azimuth (Degrees)	Height (cm)	Pol (H/V)
4.8088	73.9	52.9	-1.1	0	165	100	H
4.8877	73.6	52.6	-1.4	7	145	100	H
4.9633	73.0	52.0	-2.0	14	178	100	H
7.2111	61.3	40.3	-13.7	0	167	100	H
7.3288	65.3	44.3	-9.7	7	141	100	H
7.4366	62.0	41.0	-13.0	14	177	100	H

Tested by: Thor Wen Lei / Anthony Toh

Notes:

1. Environmental Conditions — Temperature: 24°C; Relative Humidity: 58%; Atmospheric Pressure: 1030mbar
2. 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.
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 peak emissions above 1GHz show compliance to the requirement stated in Section 15.35 (b).
7. The upper frequency of radiated emission investigations were according to requirements stated in Section 15.33 (a) for intentional radiators & Section 15.33 (b) for unintentional radiators.
8. The channel in the table refers to the transmit channel of the EUT.
9. 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).

FCC Part 15 (15.109, 15.205 & 15.209) Class B Radiated Emission (Spurious Emissions) Results

Test Distance : 3m

Unit Under Test: Wireless Headphone

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Channel	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
541.9000	31.5	-14.5	14	268	105	V
640.0000	32.2	-13.8	14	157	100	V
738.0000	32.7	-13.3	14	59	102	V
836.1000	32.5	-13.5	14	141	100	V
885.7000	32.4	-13.6	14	311	103	V
934.2000	33.2	-12.8	14	196	105	V

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Average Margin (dB) See Note 3	Channel	Azimuth (Degrees)	Height (cm)	Pol (H/V)
1500	36.8	See Note 2	-17.2	14	141	106	H
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--	--	--	--	--	--	--	--

Tested by: Anthony Toh / Dylan Lin

Notes:

1. Environmental Conditions — Temperature: 24°C; Relative Humidity: 58%; Atmospheric Pressure: 1030mbar
2. As the measured peak shows compliance to the average limit, as such no average measurement was required.
3. The average margin indicates the margin of the measured peak value below the average limit.
4. "--" indicates no emissions were found and shows compliance to the limits.
5. 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.
6. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
7. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   30MHz - 1GHz
   RBW: 120kHz VBW: 1MHz
   >1GHz
   RBW: 1MHz VBW: 1MHz

8. The peak emissions above 1GHz show compliance to the requirement stated in Section 15.35 (b).
9. The upper frequency of radiated emission investigations were according to requirements stated in Section 15.33 (a) for intentional radiators & Section 15.33 (b) for unintentional radiators.
10. The channel in the table refers to the transmit channel of the EUT.
11. 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).

Radiated Emissions Setup (Front View)

Radiated Emissions Setup (Rear View)

FCC Part 15C (15.247(a)(1)) Carrier Frequency Separation Results

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.

Unit Under Test	Channel Separation (MHz)
Wireless Transmitter	2.060
Wireless Headphone	2.090

Please refer to the attached Plots 1 - 2 for details.

Tested by: Thor Wen Lei

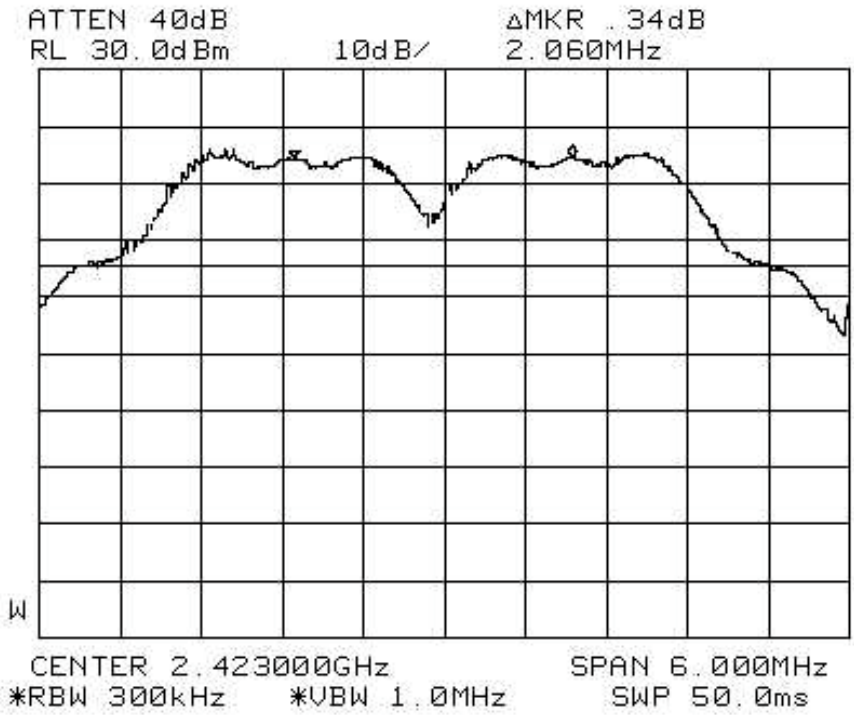
Notes:

1. Environmental Conditions

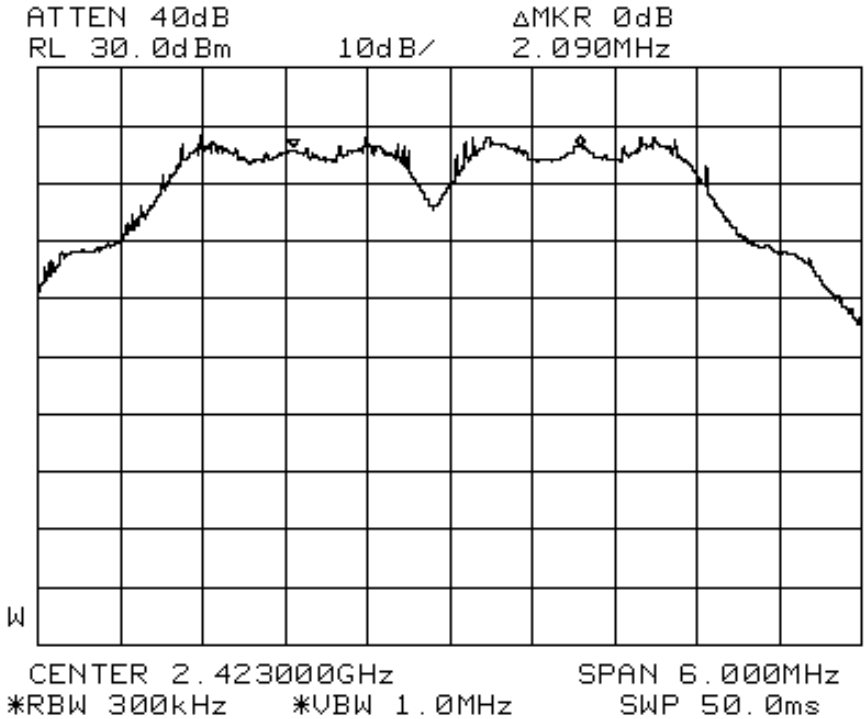
Temperature	24°C
Relative Humidity	60%
Atmospheric Pressure	1030mbar

Carrier Frequency Separation Measurement Test Setup

CARRIER FREQUENCY SEPARATION PLOTS



Plot 1- Carrier Frequency Separation - Wireless Transmitter



Plot 2 – Carrier Frequency Separation - Wireless Headphone

FCC Part 15C (15.247(a)(1)) Spectrum Bandwidth (20dB Bandwidth Measurement) Results

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.

Unit Under Test: Wireless Transmitter

Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)
0	2.40333	1.970
7	2.44224	1.940
14	2.47910	1.920

Please refer to attached Plots 3 - 5 for details.

Unit Under Test: Wireless Headphone

Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)
0	2.40333	1.960
7	2.44224	1.980
14	2.47910	1.950

Please refer to attached Plots 6 - 8 for details.

Tested by: Johnsen Tia

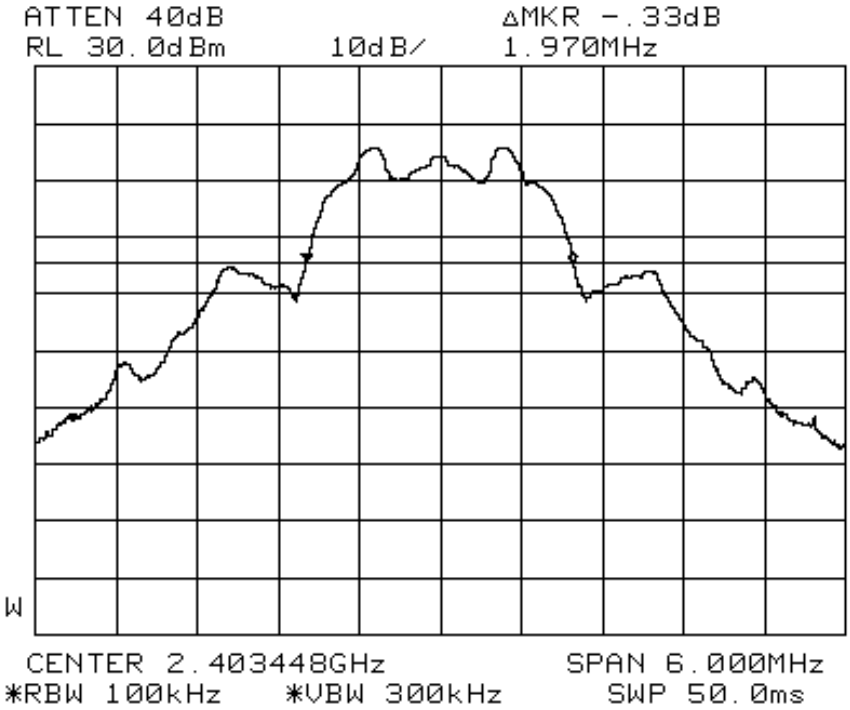
Notes:

1. Environmental Conditions

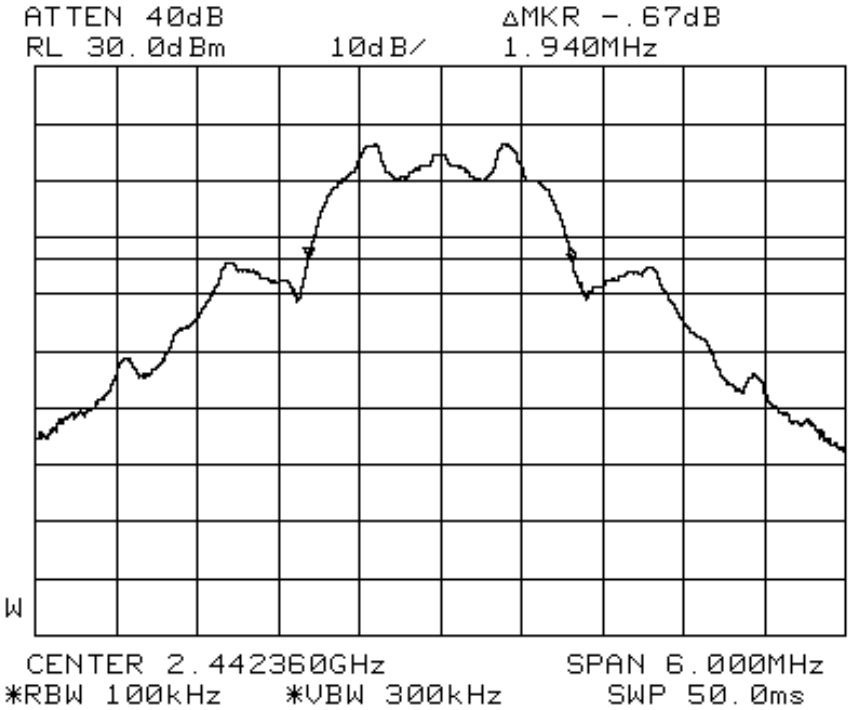
Temperature	24°C
Relative Humidity	60%
Atmospheric Pressure	1030mbar

Spectrum Bandwidth Measurement Test Setup

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) PLOTS - WIRELESS TRANSMITTER

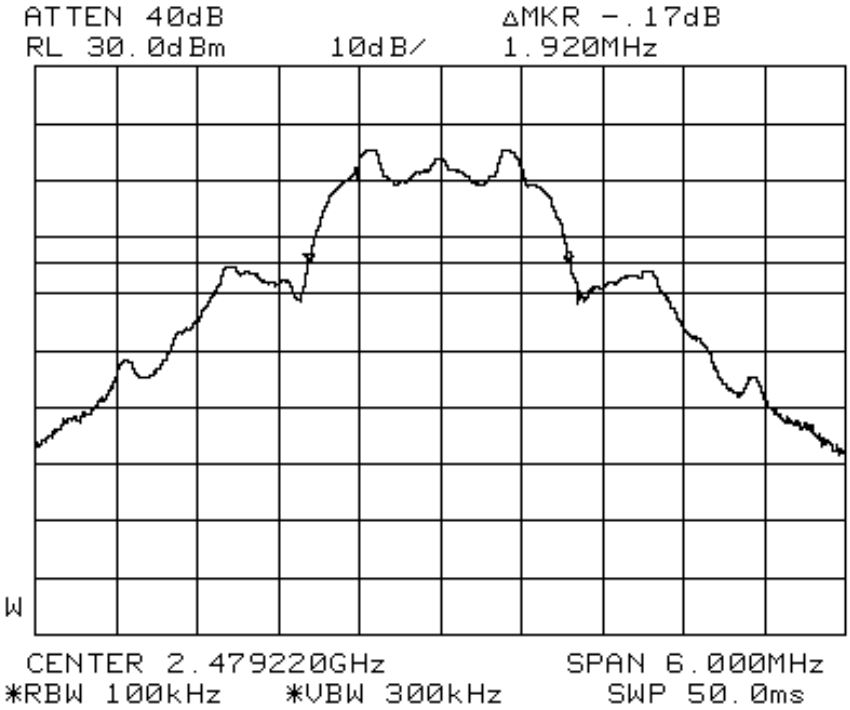


Plot 3 – Channel 0



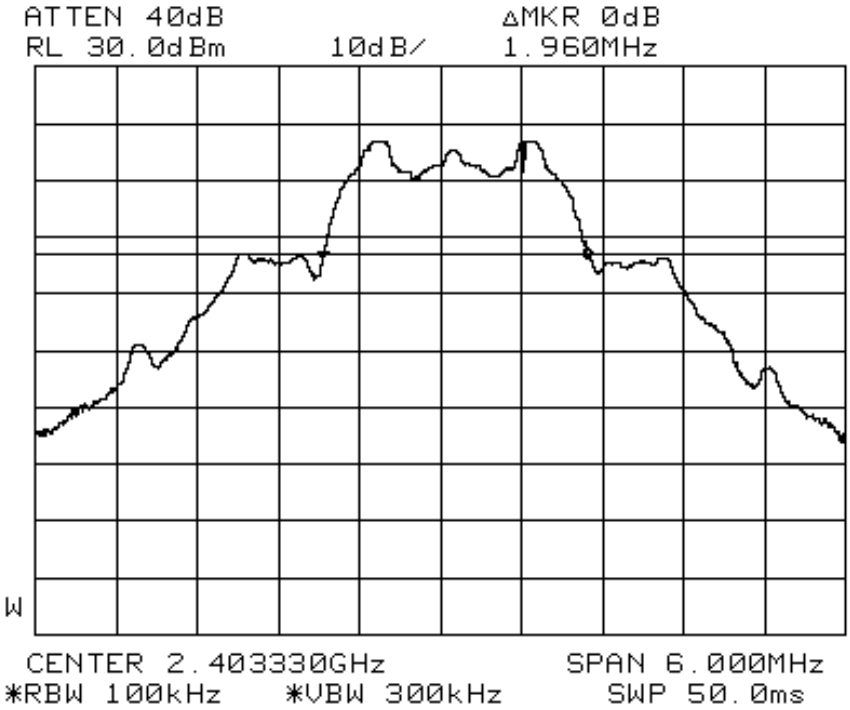
Plot 4 – Channel 7

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) PLOTS - WIRELESS TRANSMITTER

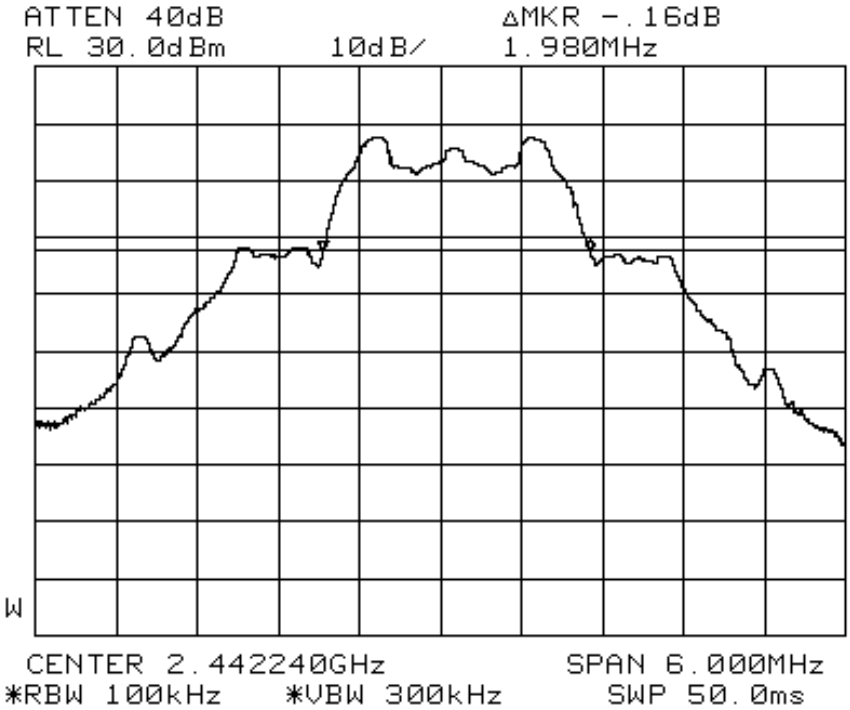


Plot 5 – Channel 14

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) PLOTS - WIRELESS HEADPHONE

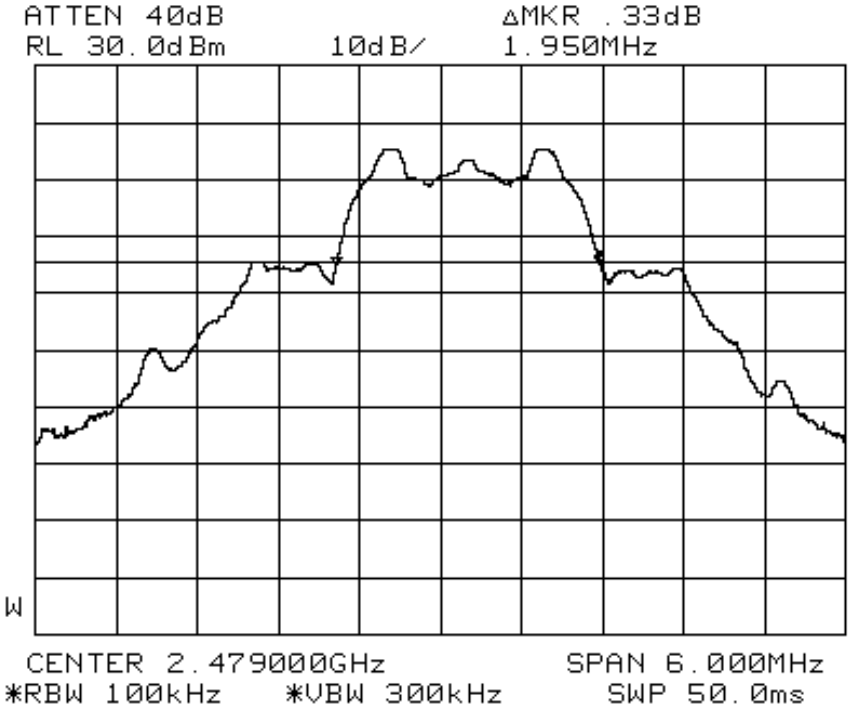


Plot 6 – Channel 0



Plot 7 – Channel 7

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) PLOTS- WIRELESS HEADPHONE



Plot 8 – Channel 14

FCC Part 15C (15.247(a)(1)(iii)) Number of Hopping Frequencies Results

The EUT shows compliance to the requirements of this section, which states the number of hopping frequencies shall be at least 15.

The EUT was found to have 15 hopping frequencies.

Please refer to the attached Plots 9 - 12 for wireless transmitter details.

Please refer to the attached Plots 13 - 16 for wireless headphone details.

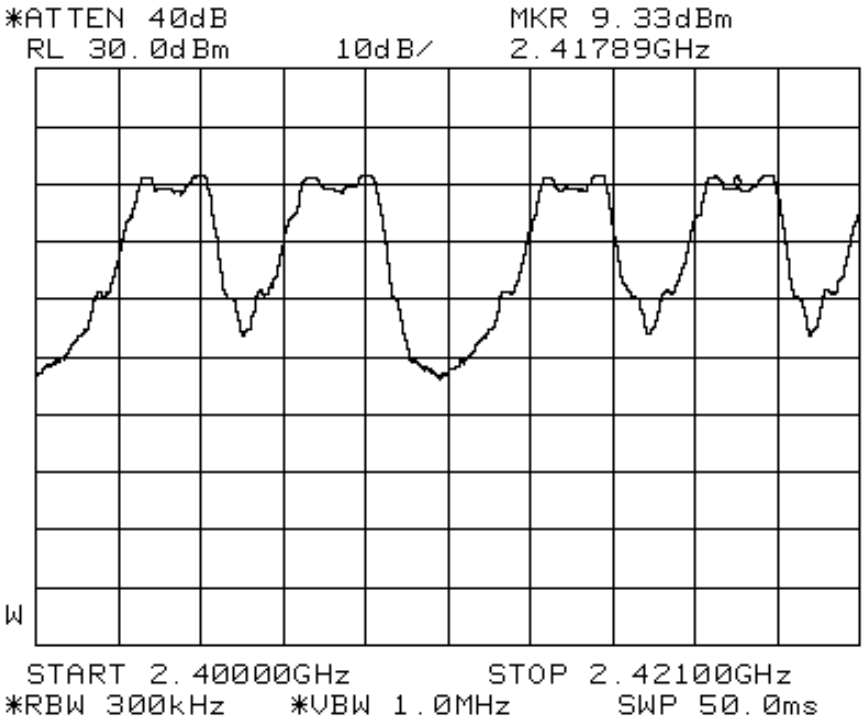
Tested by: Johnsen Tia

Notes:

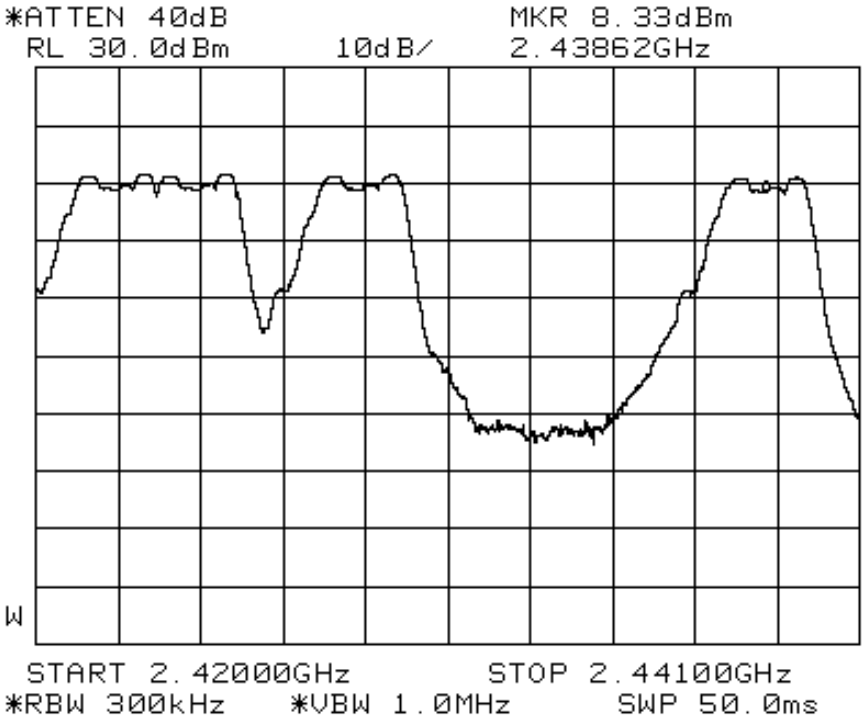
1.	Environmental Conditions	Temperature	24°C
		Relative Humidity	60%
		Atmospheric Pressure	1030mbar

Number of Hopping Frequencies Measurement Test Setup

NUMBER OF HOPPING FREQUENCIES PLOTS - WIRELESS TRANSMITTER

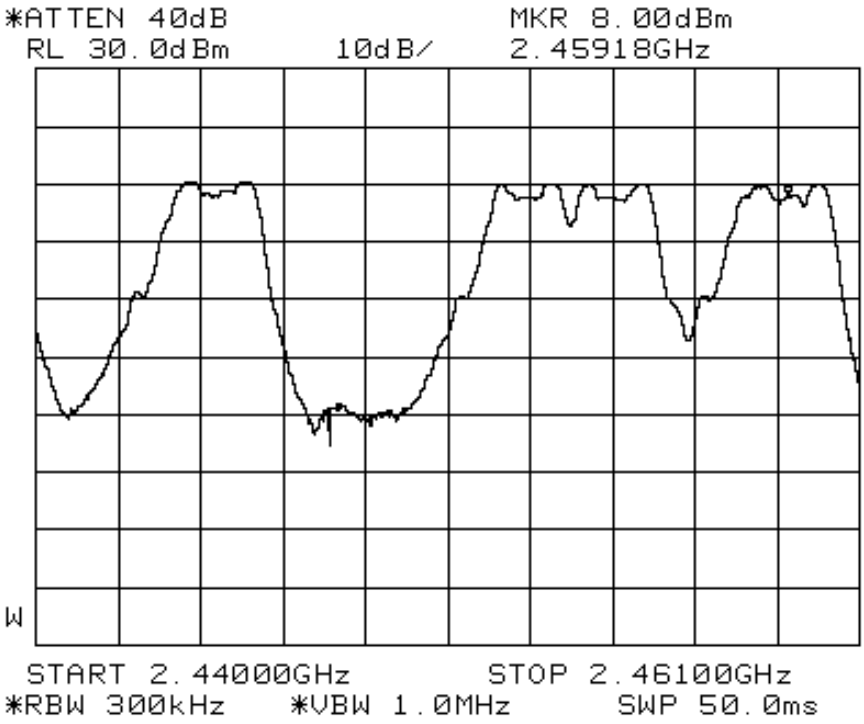


Plot 9 - Channels 0 to 3

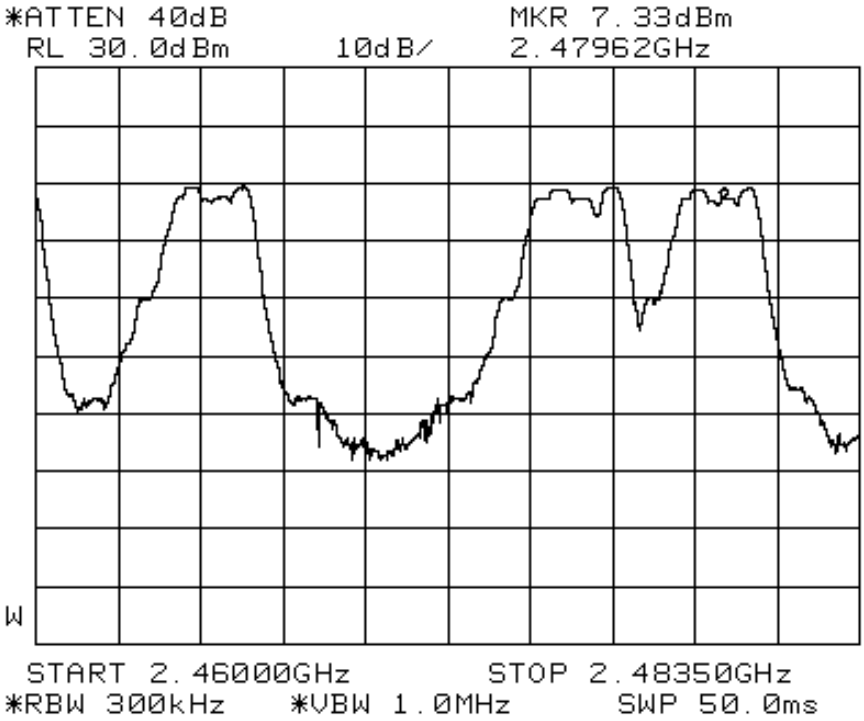


Plot 10 - Channels 4 to 7

NUMBER OF HOPPING FREQUENCIES PLOTS - WIRELESS TRANSMITTER

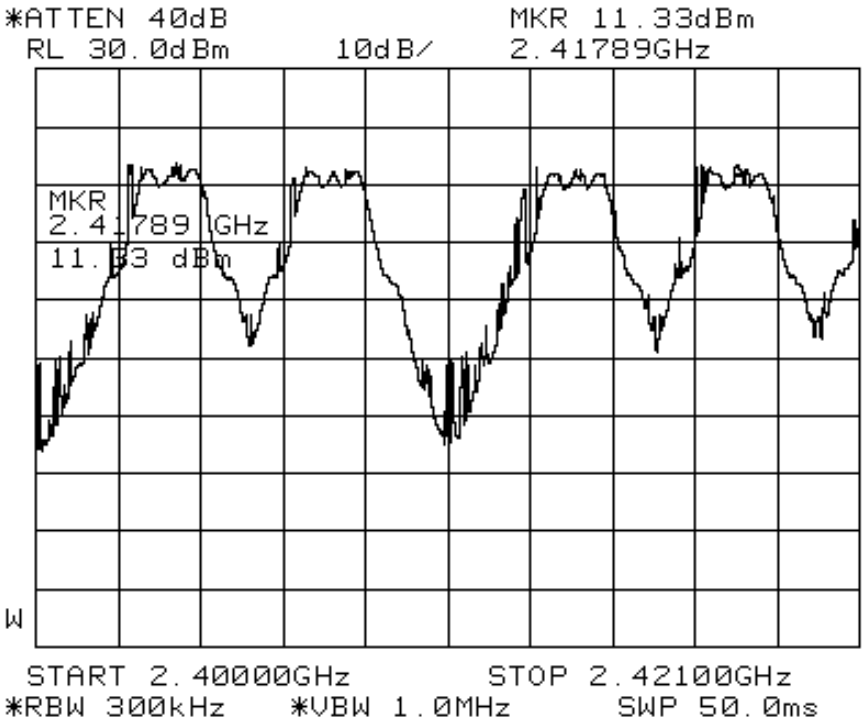


Plot 11 - Channels 8 to 11

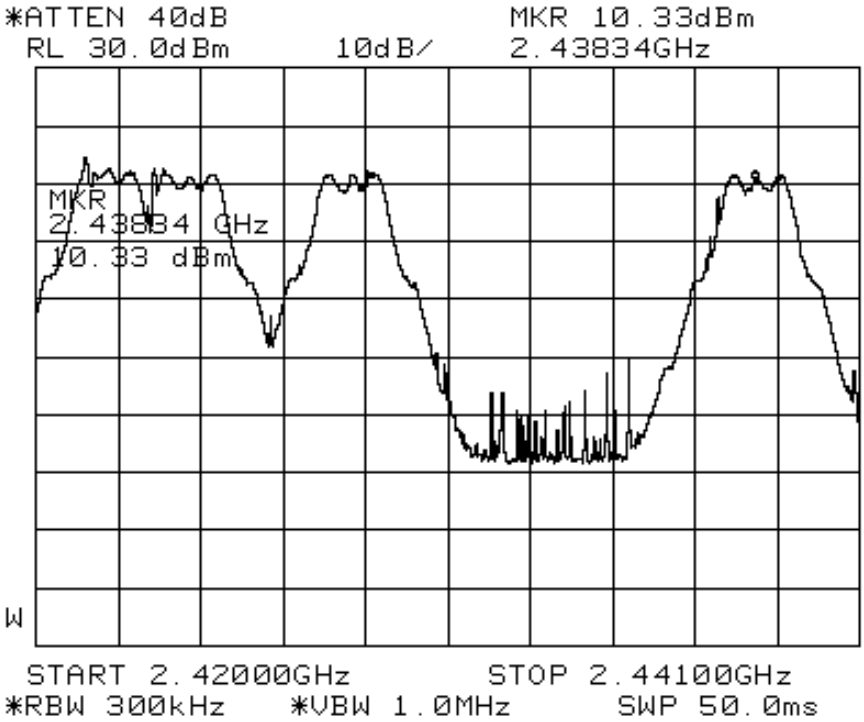


Plot 12 - Channels 12 to 14

NUMBER OF HOPPING FREQUENCIES PLOTS - WIRELESS HEADPHONE

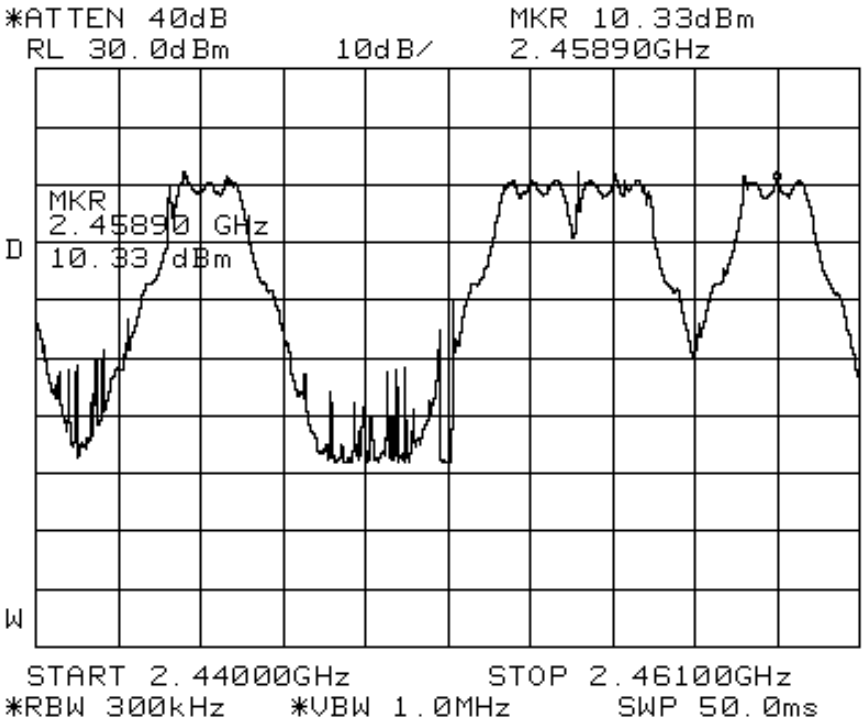


Plot 13 - Channels 0 to 3

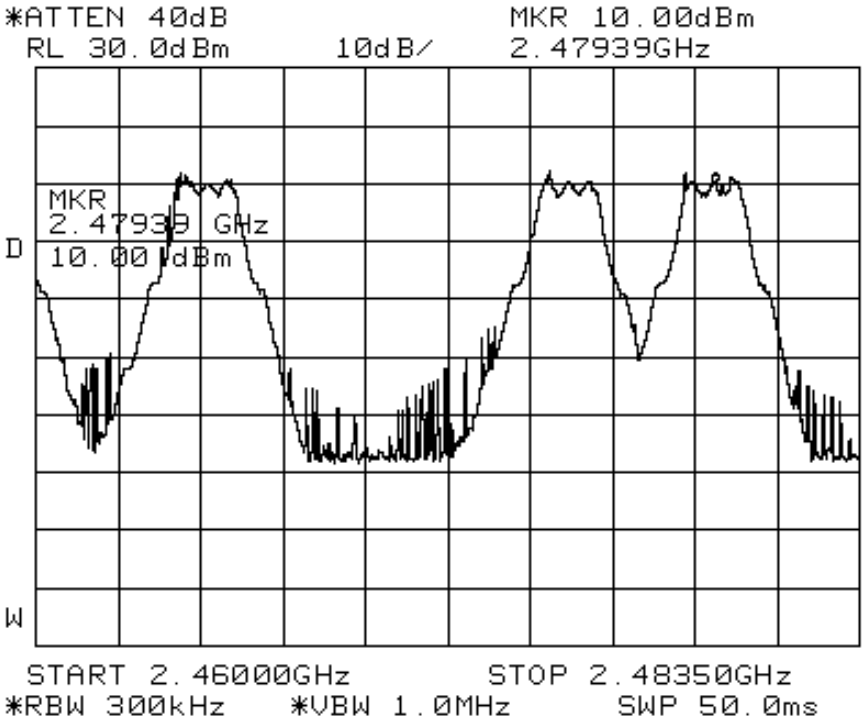


Plot 14 - Channels 4 to 7

NUMBER OF HOPPING FREQUENCIES PLOTS - WIRELESS HEADPHONE



Plot 15 - Channels 8 to 11



Plot 16 - Channels 12 to 14

FCC Part 15C (15.247(a)(1)(iii)) Average Frequency Dwell Time Results

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 second within a period of 0.4 second multiplied by the number of hopping channels employed.

Unit Under Test: Wireless Transmitter

EUT hopping rate = 187.5 hops/s
Number of EUT hopping frequencies = 15 hops

Average Frequency Dwell Time = measured time slot length (l) x hopping rate (h) / number of hopping frequencies

Channel	Channel Frequency (GHz)	Measured Time Slot Length (ms)	Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0	2.40333	4.6700	0.0584	0.4
7	2.44224	4.6700	0.0584	0.4
14	2.47910	4.6700	0.0584	0.4

Please refer to the attached Plots 17 – 19 for details.

Unit Under Test: Wireless Headphone

EUT hopping rate = 187.5 hops/s
Number of EUT hopping frequencies = 15 hops

Average Frequency Dwell Time = measured time slot length (l) x hopping rate (h) / number of hopping frequencies

Channel	Channel Frequency (GHz)	Measured Time Slot Length (ms)	Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0	2.402	4.33	0.0541	0.4
7	2.441	4.67	0.0584	0.4
14	2.480	4.67	0.0584	0.4

Please refer to the attached Plots 20 – 22 for details.

Tested by: Johnsen Tia

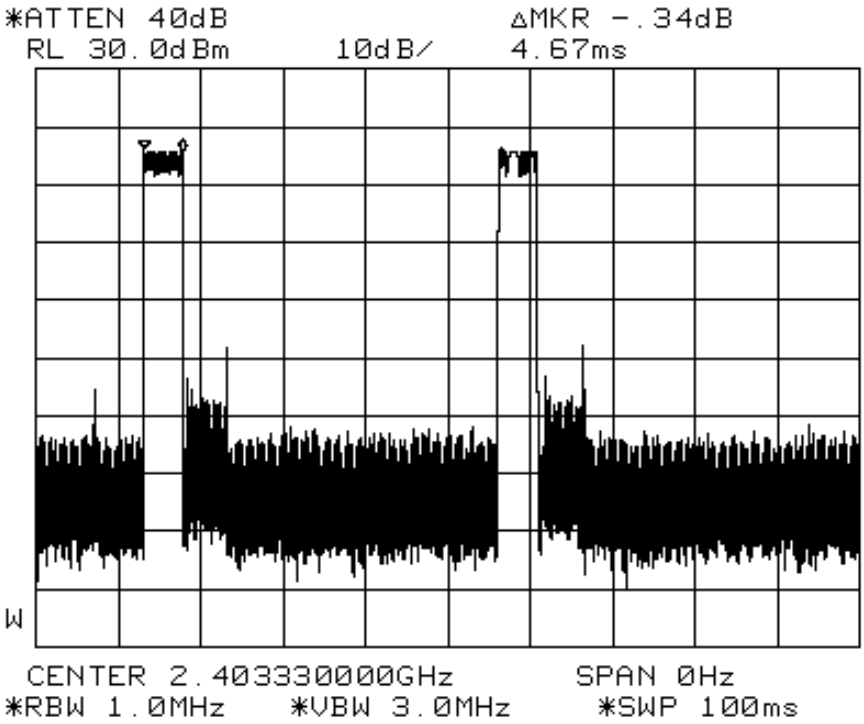
Notes:

1. Environmental Conditions

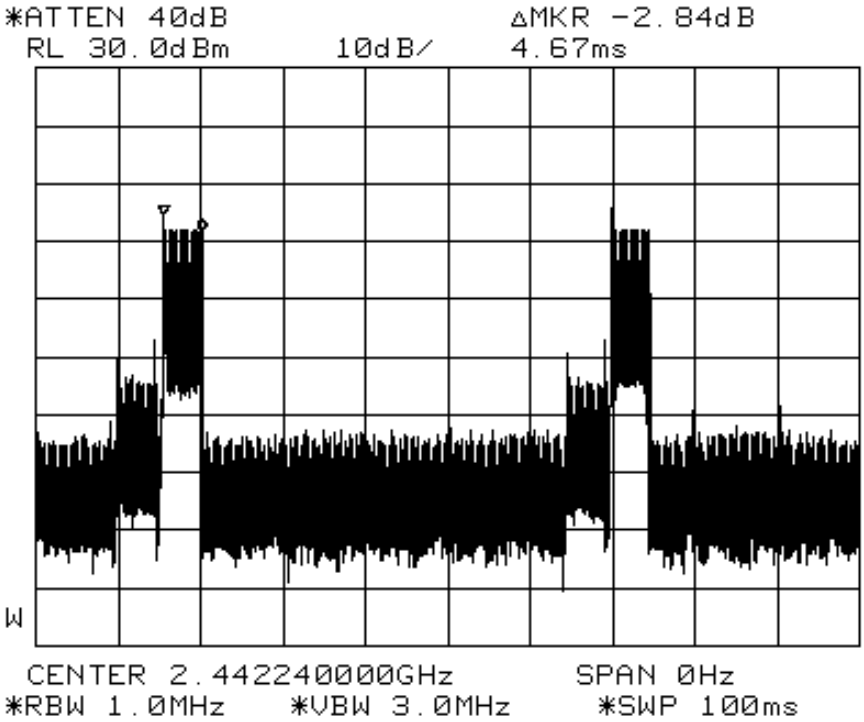
Temperature	24°C
Relative Humidity	60%
Atmospheric Pressure	1030mbar

Average Frequency Dwell Time Measurement Test Setup

AVERAGE FREQUENCY DWELL TIME PLOTS - WIRELESS TRANSMITTER

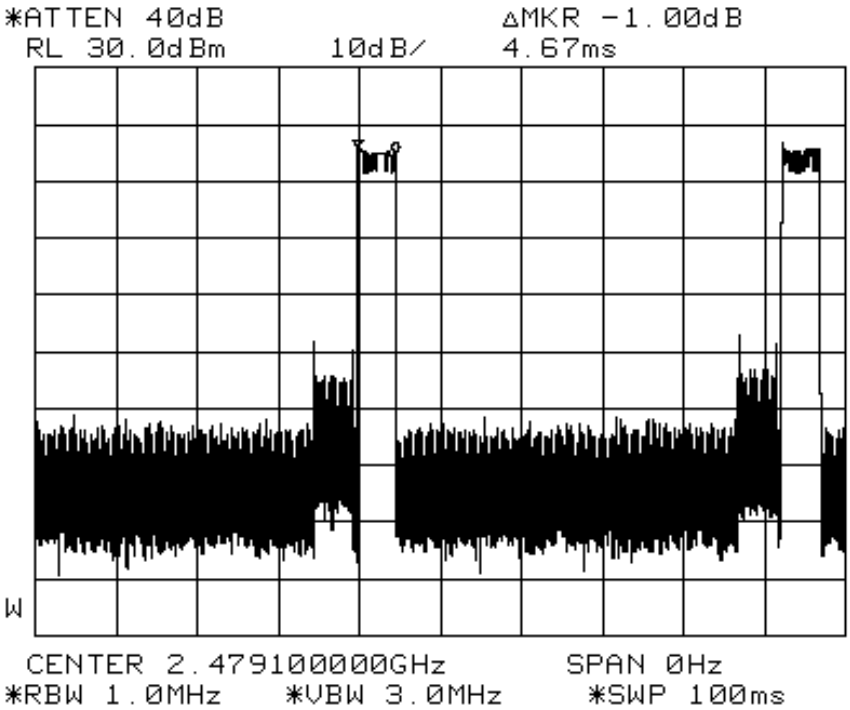


Plot 17 – Channel 0



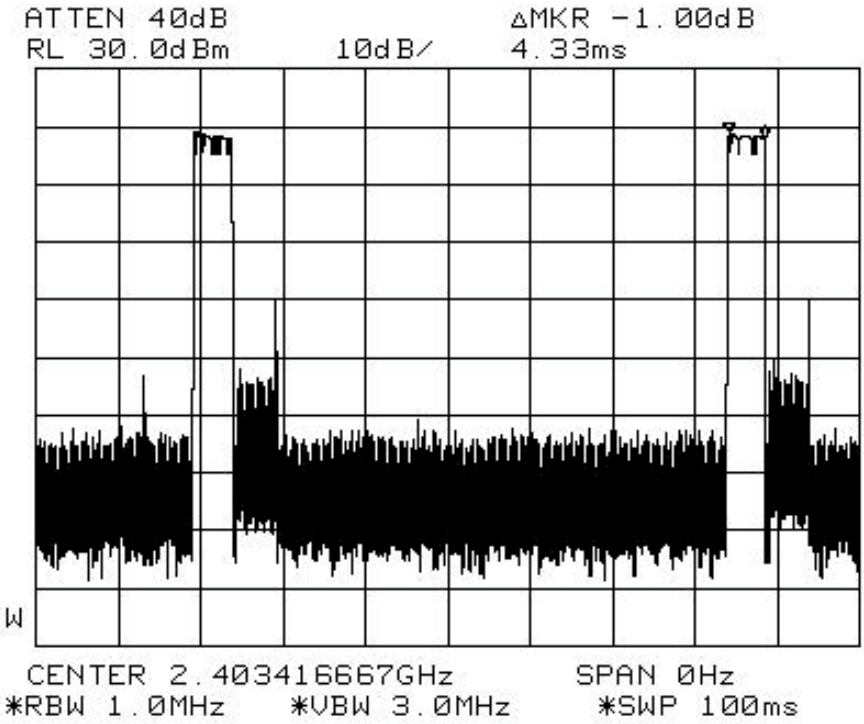
Plot 18 – Channel 7

AVERAGE FREQUENCY DWELL TIME PLOTS - WIRELESS TRANSMITTER

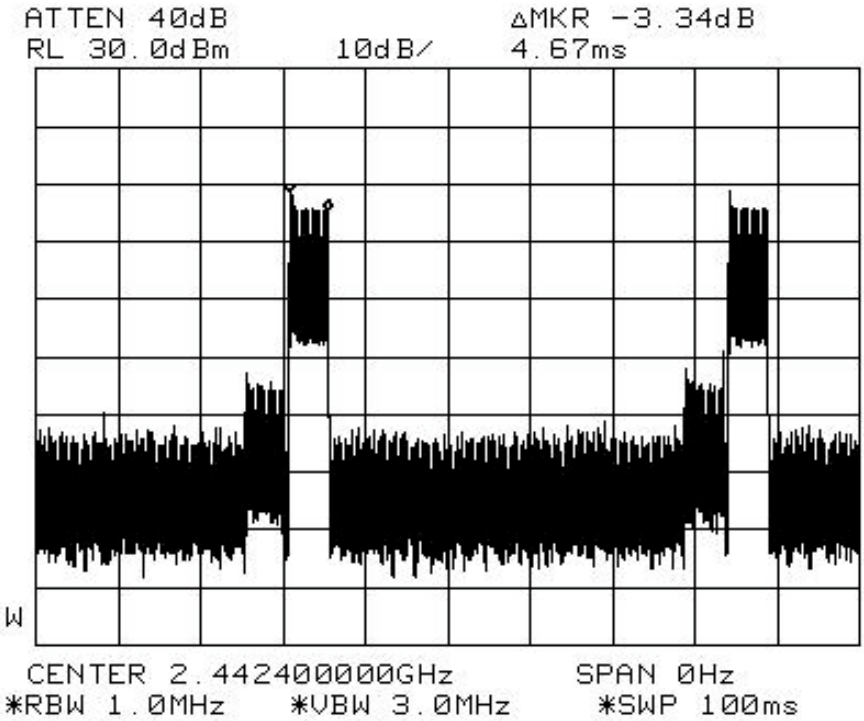


Plot 19 – Channel 14

AVERAGE FREQUENCY DWELL TIME PLOTS - WIRELESS HEADPHONE

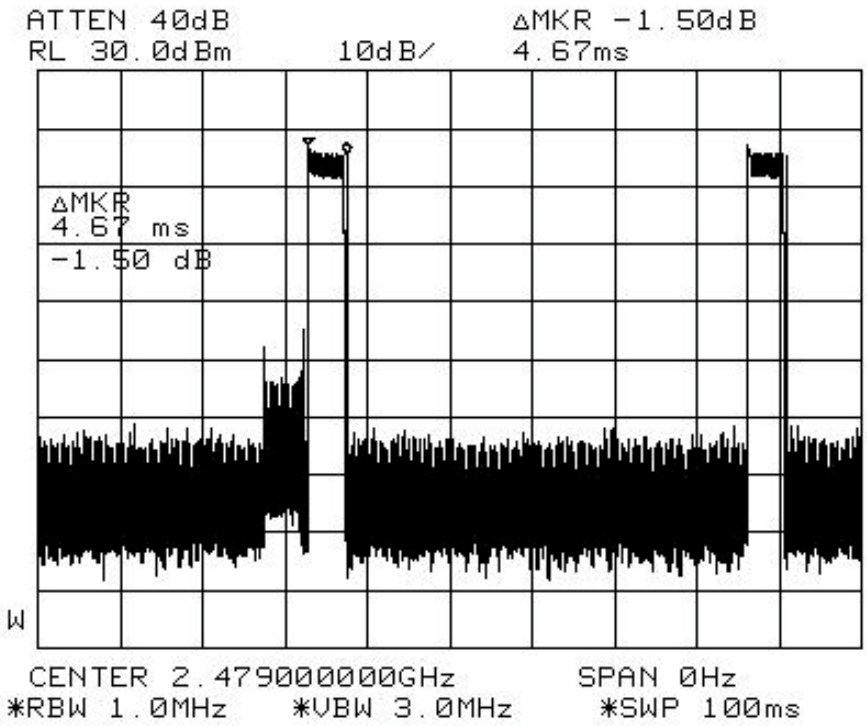


Plot 20 – Channel 0



Plot 21 – Channel 7

AVERAGE FREQUENCY DWELL TIME PLOTS - WIRELESS HEADPHONE



Plot 22 – Channel 14

FCC Part 15C (15.247(b)(1)) Maximum Peak Power Results

The EUT shows compliance to the requirements of this section, which states the peak power of an intentional radiator (EUT) for frequency hopping systems (other than frequency hopping systems employing at 75non-overlapping channels) shall not exceed 21dBm (125mW).

The maximum peak power for Channels 0, 7 and 14 at 2.40333GHz, 2.44224GHz and 2.47910GHz of both wireless transmitter and wireless headphone were investigated and found below 21dBm (125mW).

Unit Under Test: Wireless Transmitter

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)
0	2.40333	0.062	0.125
7	2.44224	0.059	0.125
14	2.47910	0.058	0.125

Unit Under Test: Wireless Headphone

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)
0	2.40333	0.093	0.125
7	2.44224	0.091	0.125
14	2.47910	0.055	0.125

Tested by: Johnsen Tia

Notes:

1. Environmental Conditions — Temperature: 24°C; Relative Humidity: 60%; Atmospheric Pressure: 1030mbar

2. 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.

Maximum Peak Power Measurement Test Setup

FCC Part 15C (15.247(c)) RF Conducted Spurious Emissions & Band Edge Compliance at the Transmitter Antenna Results

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 RF power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

The RF conducted spurious emissions were scanned from 30MHz to 25GHz for Channels 0, 7, and 14 with channel frequency at 2.40333GHz, 2.44224GHz and 2.47910GHz respectively. No significant signal was found and they were below the specified limit. Please refer to the following attached plot for details:

- Plots 23 - 28 (wireless transmitter)
- Plots 29 - 34 (wireless headphone)

The conducted spurious at lower and upper band-edges (2.4000GHz and 2.4835GHz) were scanned. The spurious emissions at band-edges were found below the specified limit. Please refer to the following plots for details:

- Plots 35 - 36 (wireless transmitter)
- Plots 37 - 38 (wireless headphone)

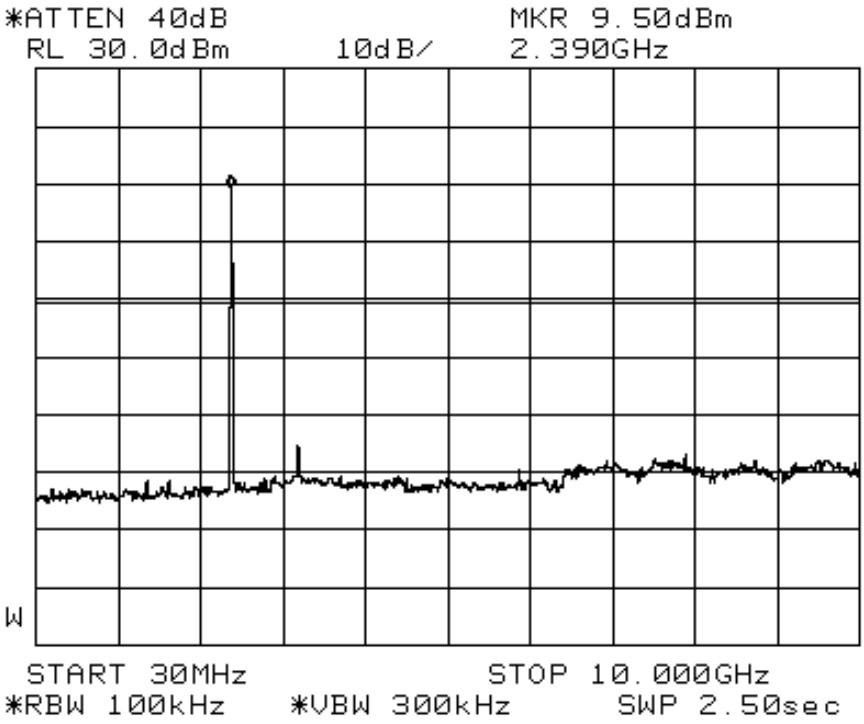
Tested by: Johnsen Tia

Notes:

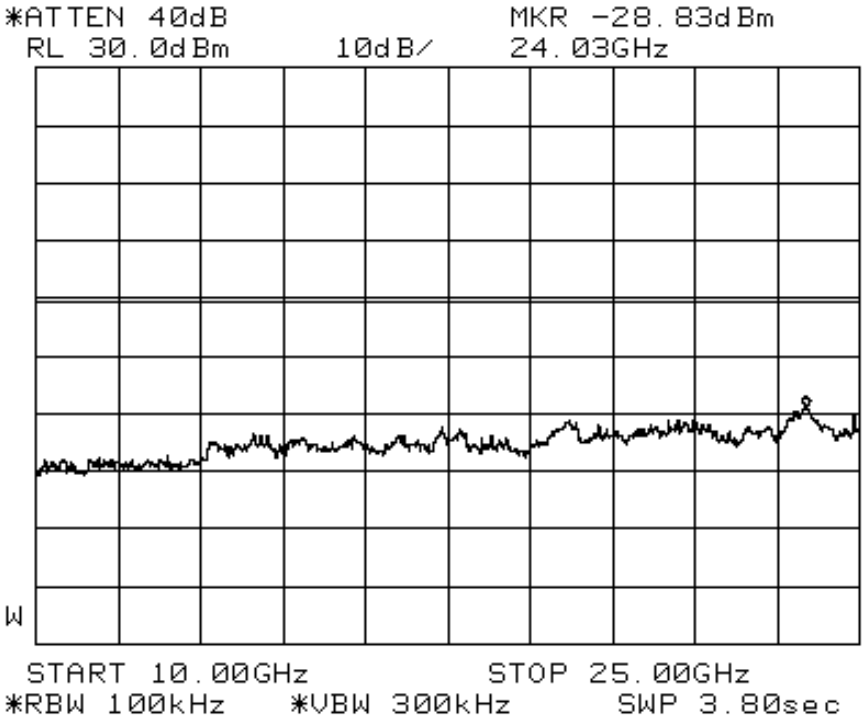
1.	Environmental Conditions	Temperature	24°C
		Relative Humidity	60%
		Atmospheric Pressure	1030mbar

RF Conducted Spurious & Band Edge Measurement Test Setup

RF CONDUCTED SPURIOUS EMISSIONS PLOTS - WIRELESS TRANSMITTER

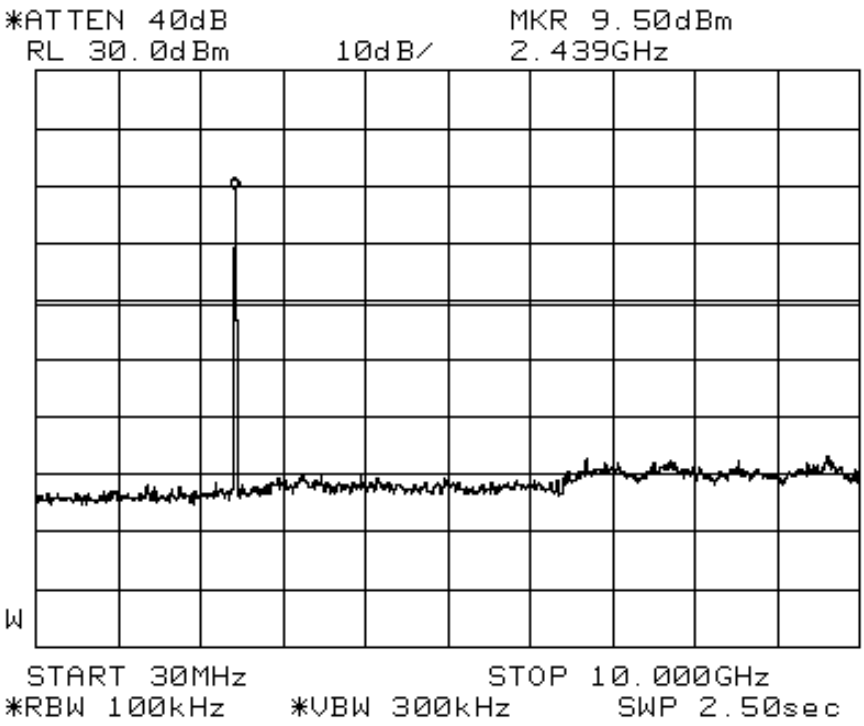


Plot 23 – Channel 0

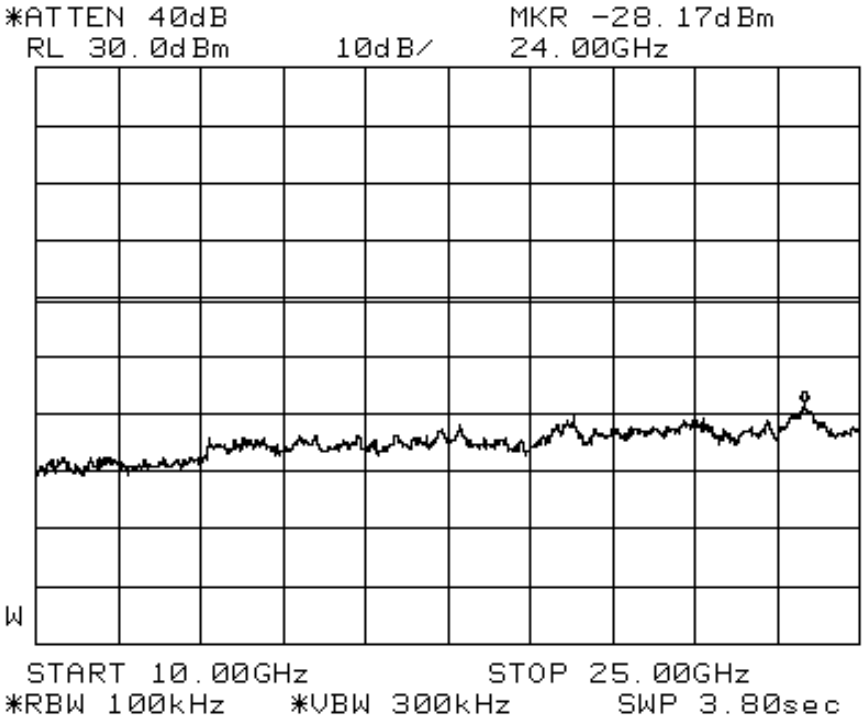


Plot 24 – Channel 0

RF CONDUCTED SPURIOUS EMISSIONS PLOTS - WIRELESS TRANSMITTER

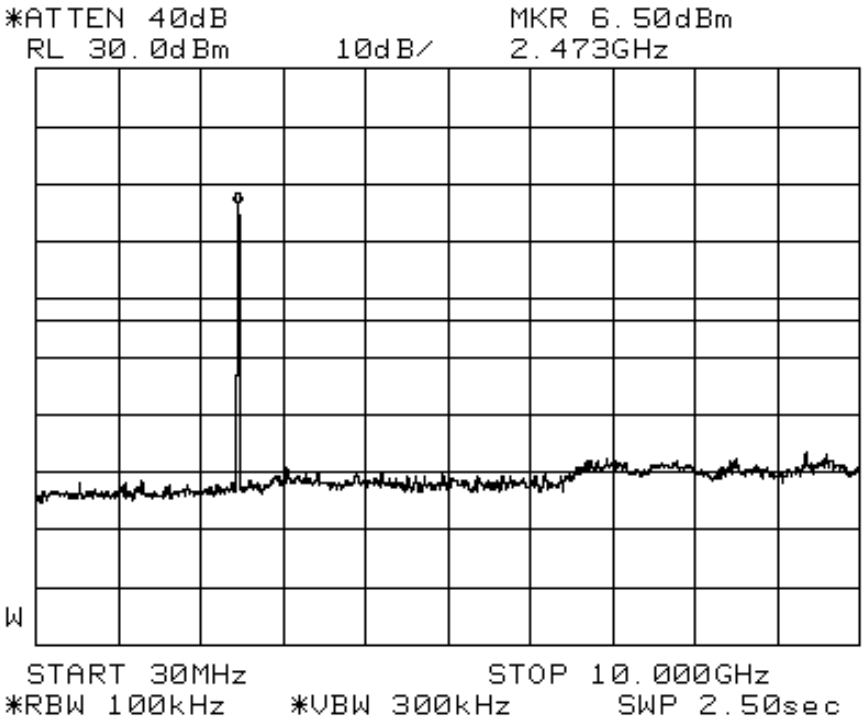


Plot 25 – Channel 7

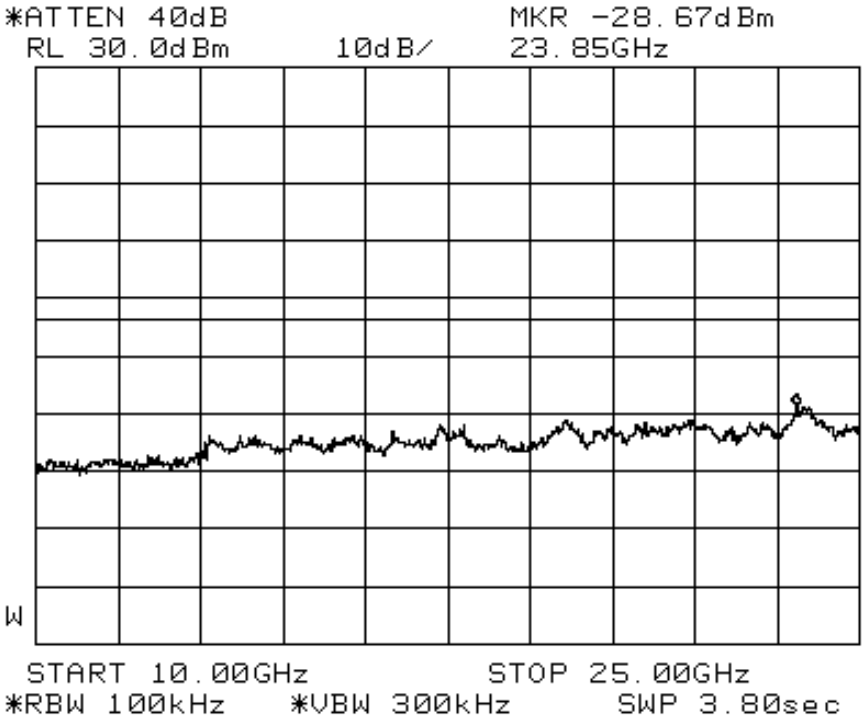


Plot 26 – Channel 7

RF CONDUCTED SPURIOUS EMISSIONS PLOTS - WIRELESS TRANSMITTER

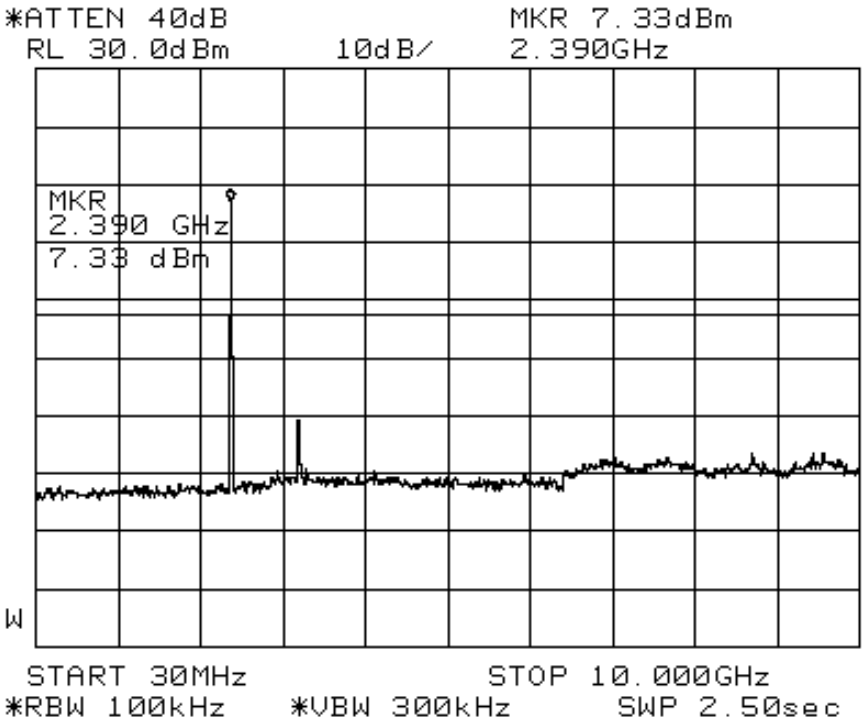


Plot 27 – Channel 14

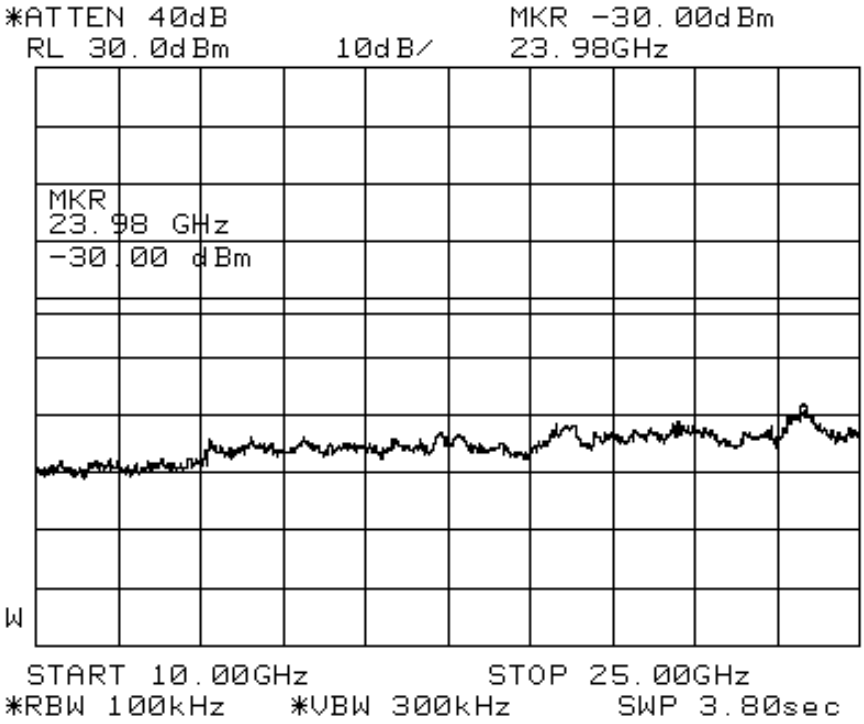


Plot 28 – Channel 14

RF CONDUCTED SPURIOUS EMISSIONS PLOTS - WIRELESS HEADPHONE

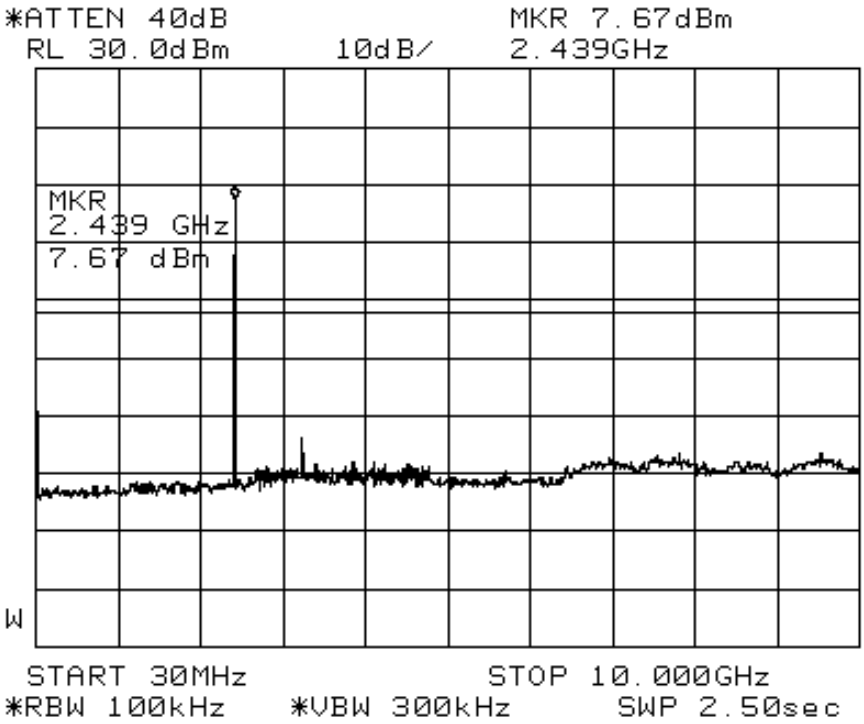


Plot 29 – Channel 0

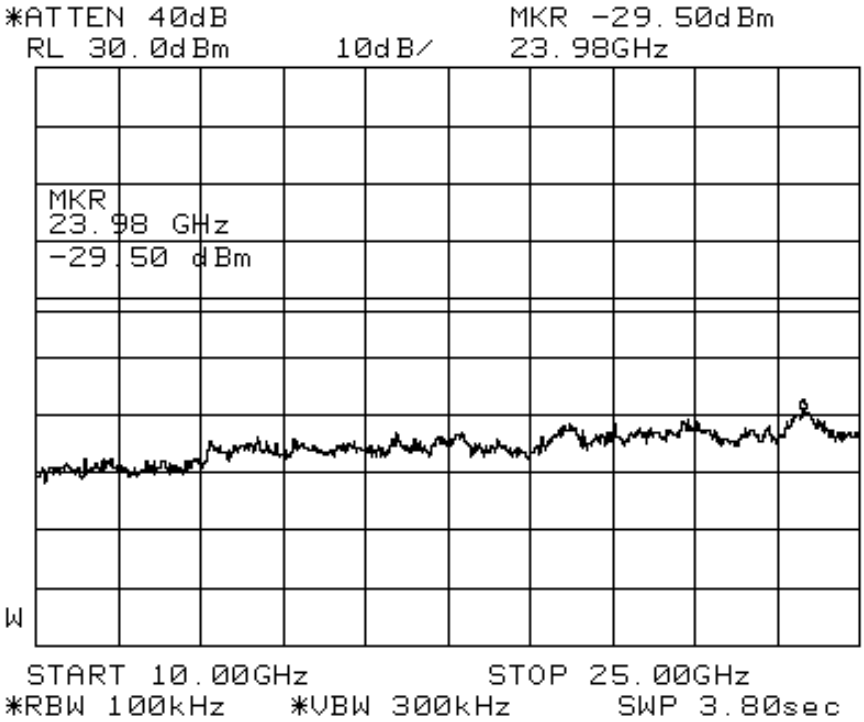


Plot 30 – Channel 0

RF CONDUCTED SPURIOUS EMISSIONS PLOTS - WIRELESS HEADPHONE

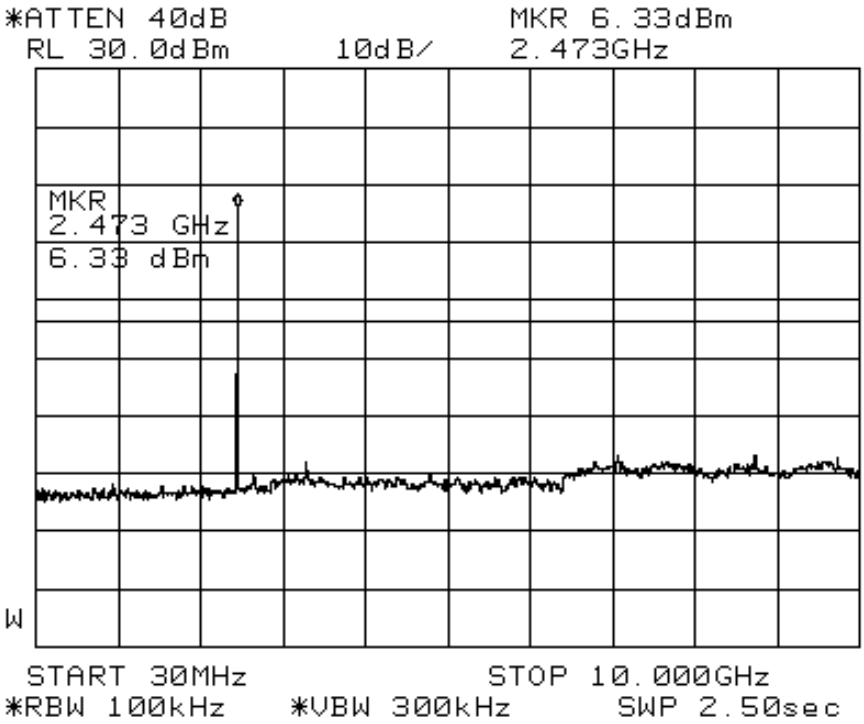


Plot 31 – Channel 7

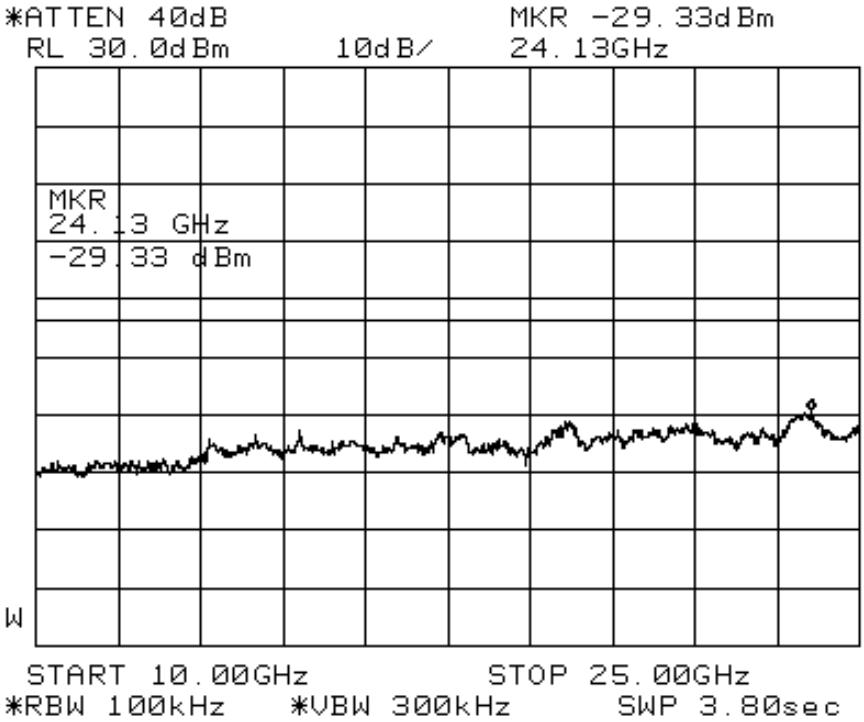


Plot 32 – Channel 7

RF CONDUCTED SPURIOUS EMISSIONS PLOTS - WIRELESS HEADPHONE

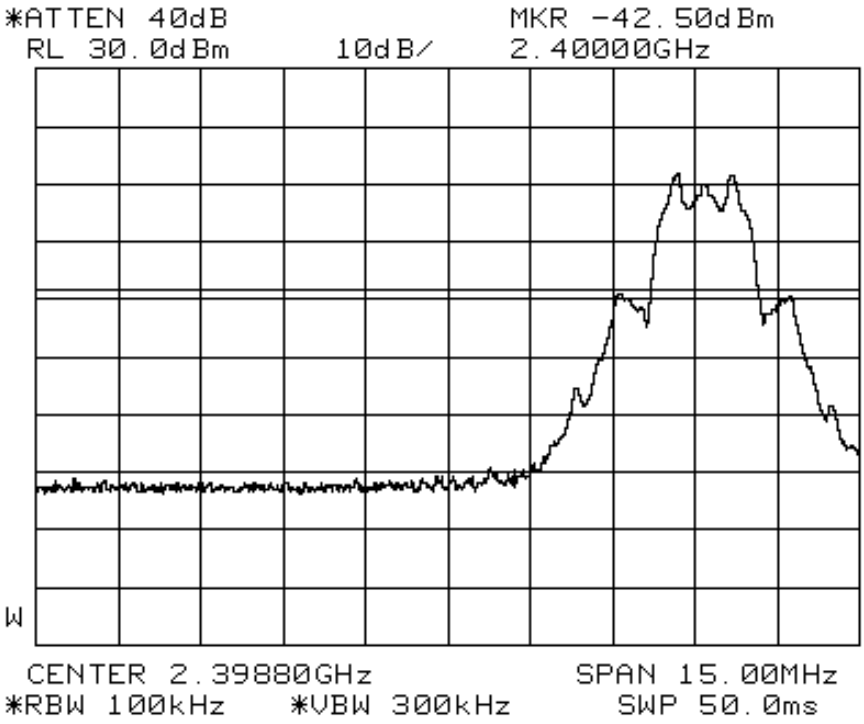


Plot 33 – Channel 14

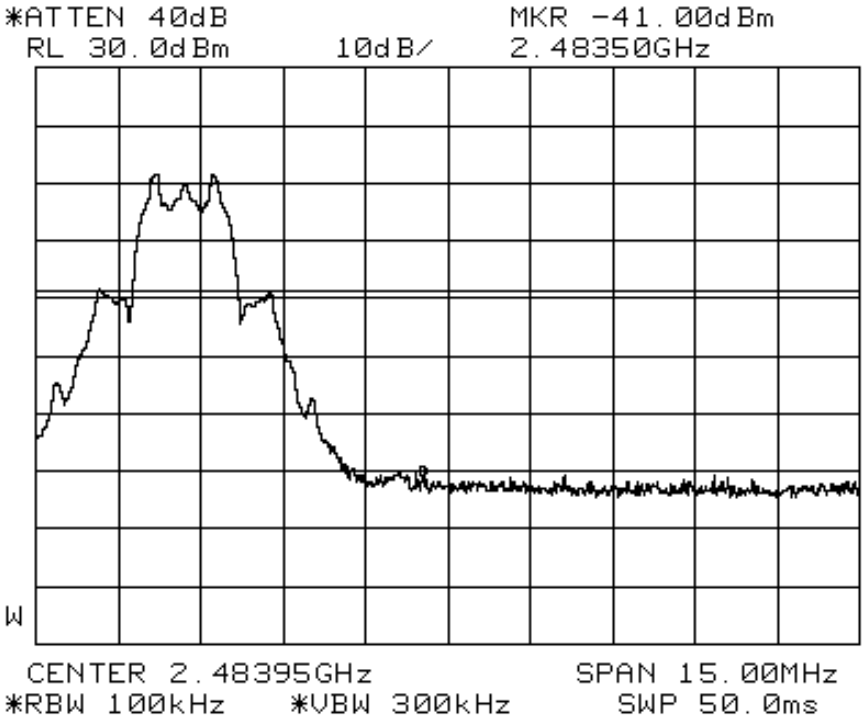


Plot 34 – Channel 14

BAND EDGE COMPLIANCE PLOTS - WIRELESS TRANSMITTER

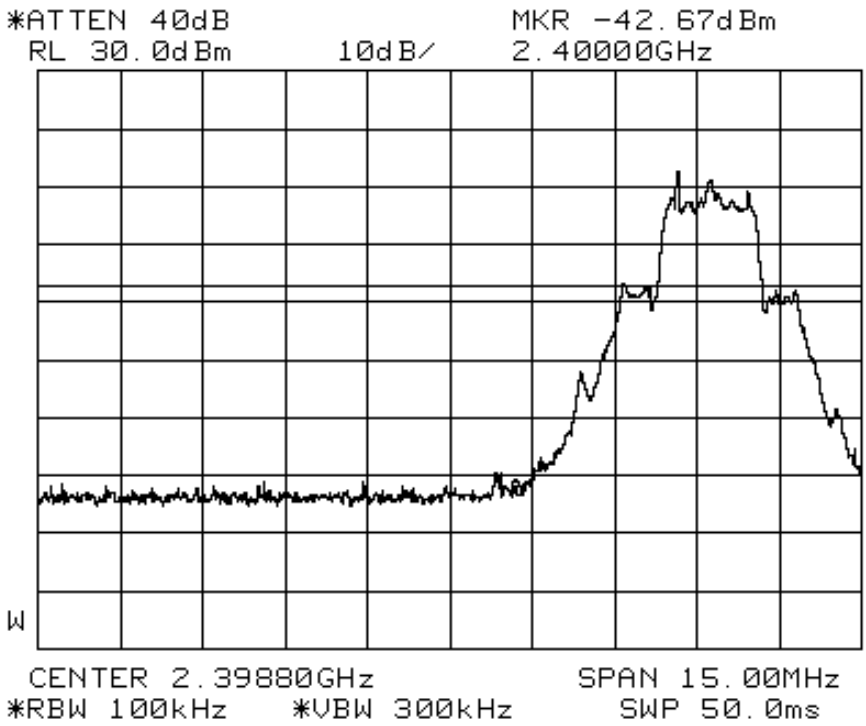


Plot 35 – Lower Band Edge at 2.40GHz

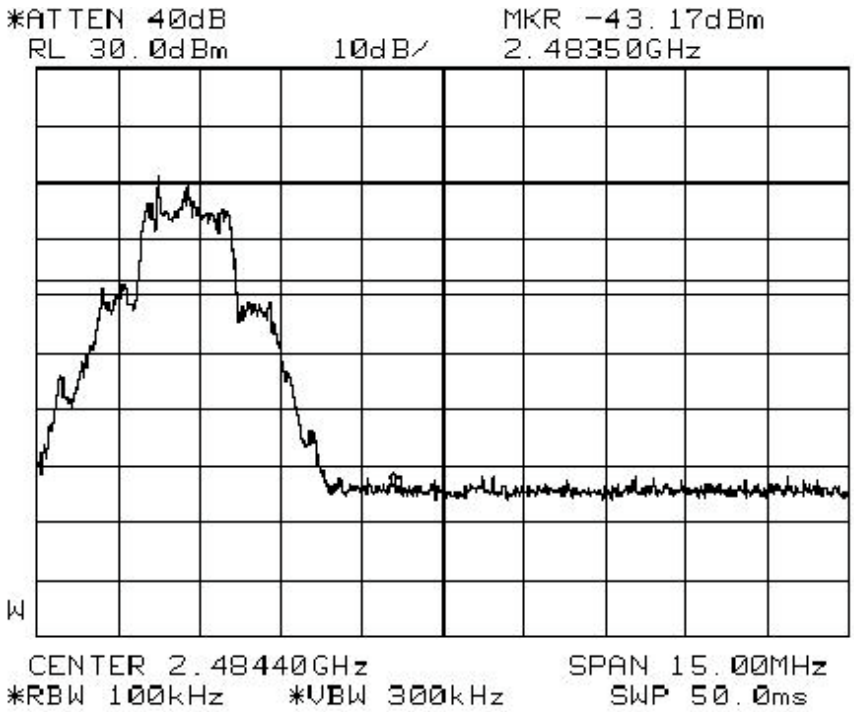


Plot 36 – Upper Band Edge at 2.4835GHz

BAND EDGE COMPLIANCE PLOTS - WIRELESS HEADPHONE



Plot 37 – Lower Band Edge at 2.40GHz



Plot 38 – Upper Band Edge at 2.4835GHz

FCC Part 15C (15.247(d)) Peak Power Spectral Density Results

The EUT shows compliance to the requirements of this section, which states the peak power spectral density of an 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.

Unit Under Test: Wireless Transmitter

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0	2.40333	1.0400	6.3
7	2.44224	0.8913	6.3
14	2.47910	0.9617	6.3

Please refer to the attached Plots 39 – 41 for details.

Unit Under Test: Wireless Headphone

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0	2.40333	3.0409	6.3
7	2.44224	3.5481	6.3
14	2.47910	2.0749	6.3

Please refer to the attached Plots 42 – 44 for details.

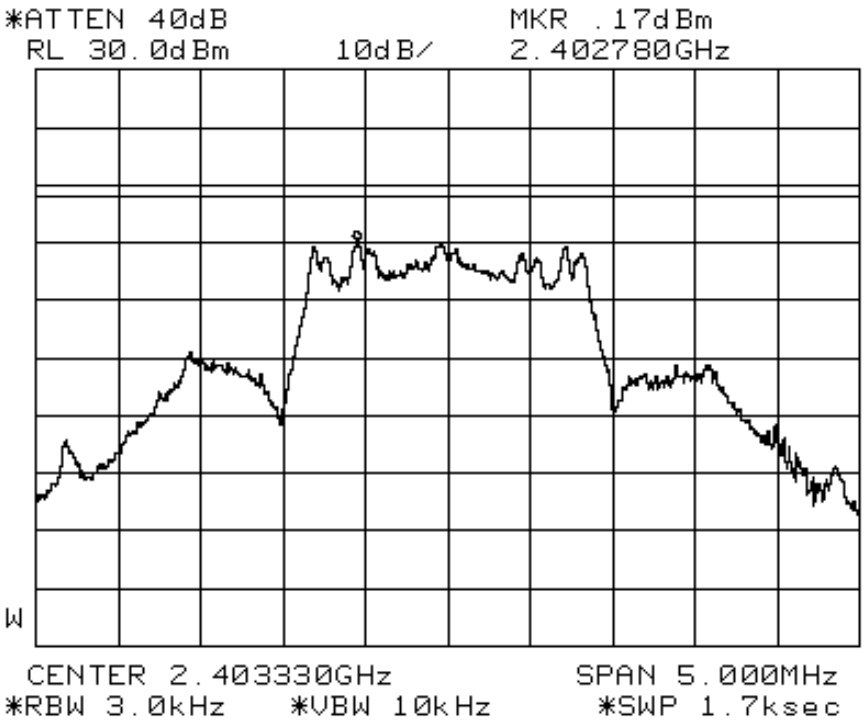
Tested by: Johnsen Tia

Notes:

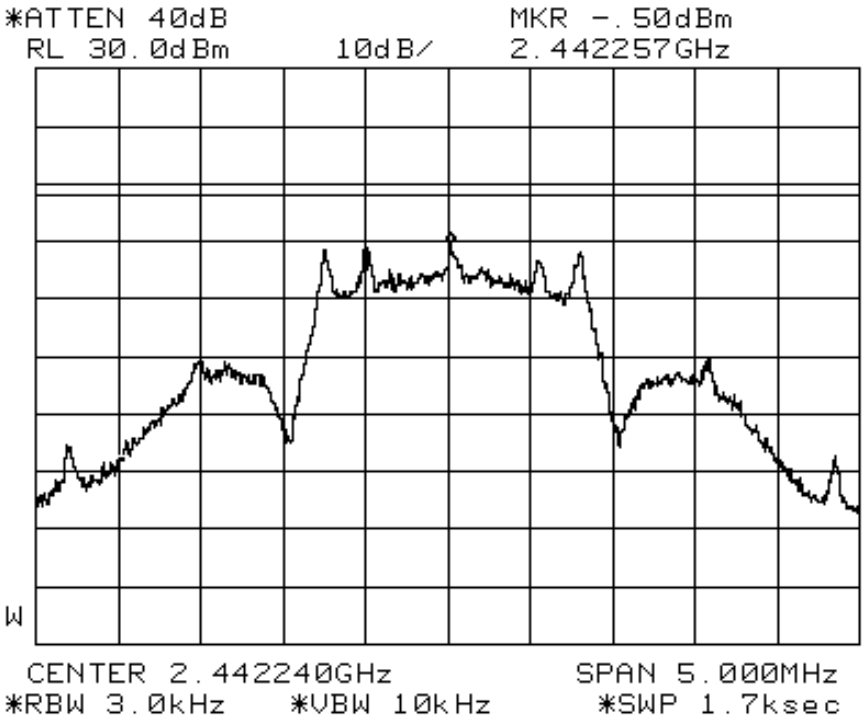
1. Environmental Conditions — Temperature: 24°C; Relative Humidity: 60%; Atmospheric Pressure: 1030mbar

Peak Power Spectral Density Measurement Test Setup

PEAK POWER SPECTRAL DENSITY PLOTS - WIRELESS TRANSMITTER

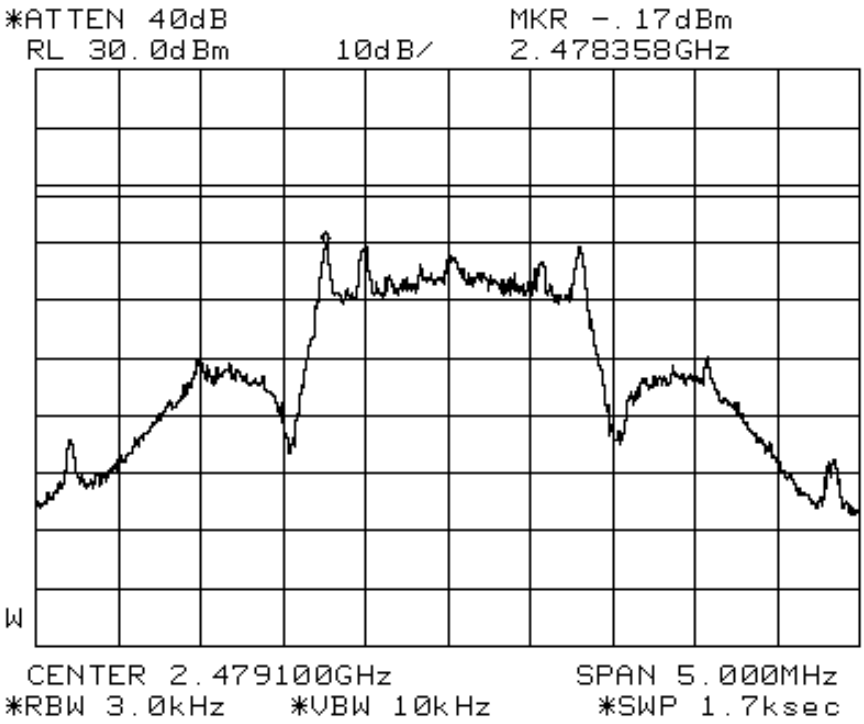


Plot 39 - Channel 0



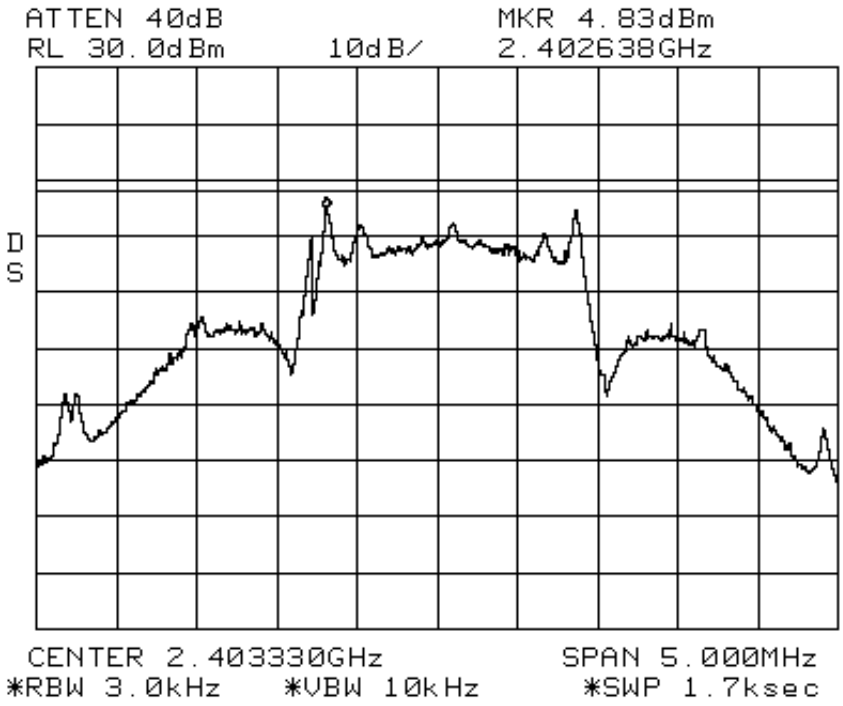
Plot 40 - Channel 7

PEAK POWER SPECTRAL DENSITY PLOTS - WIRELESS TRANSMITTER

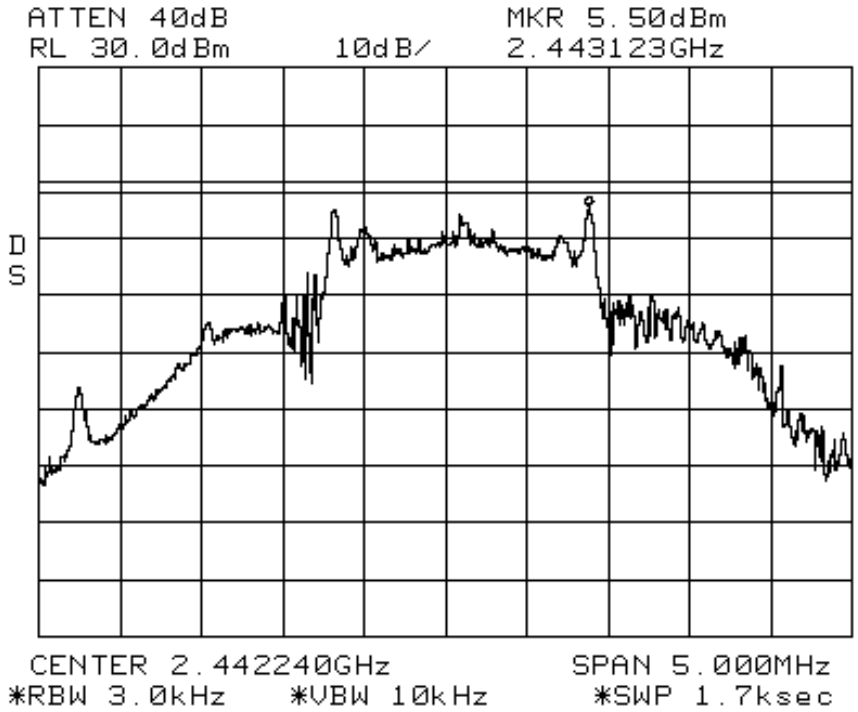


Plot 41 - Channel 14

PEAK POWER SPECTRAL DENSITY PLOTS - WIRELESS HEADPHONE

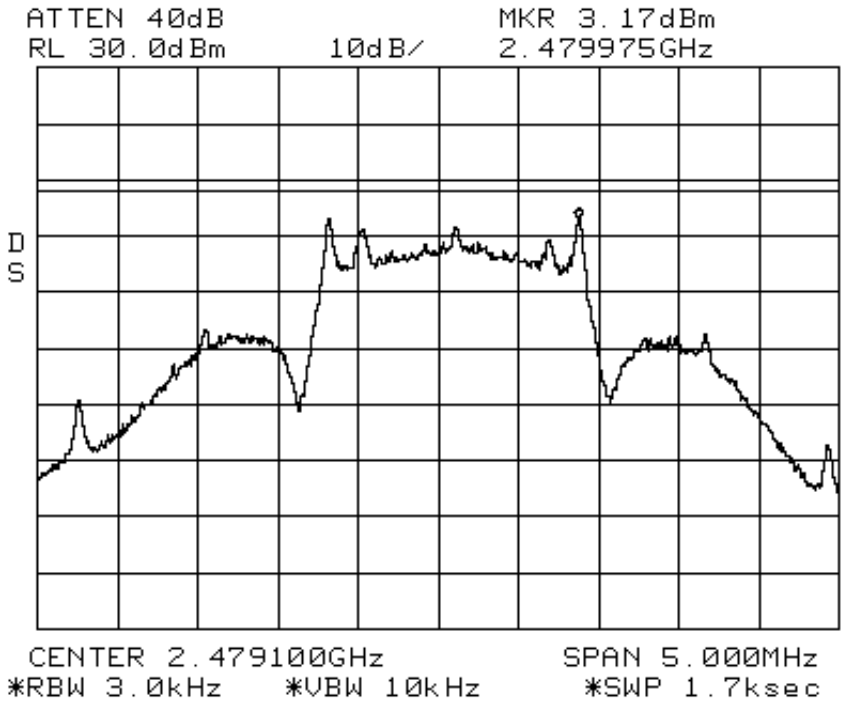


Plot 42 - Channel 0



Plot 43 - Channel 7

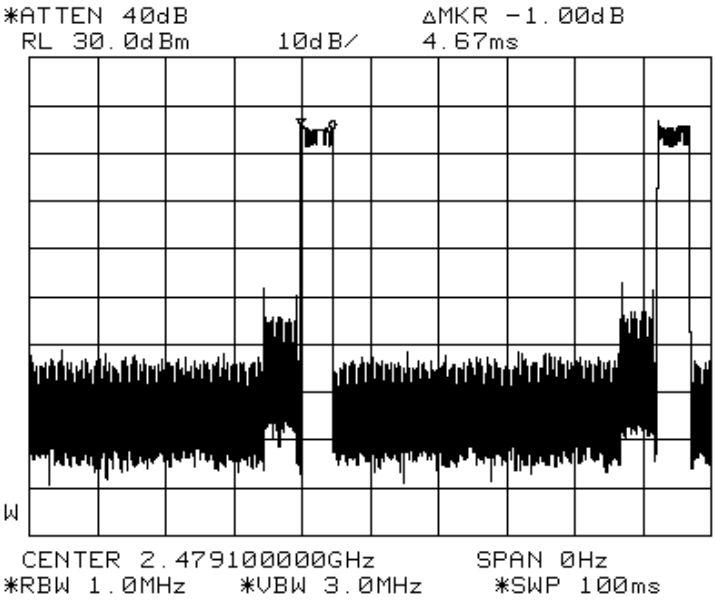
PEAK POWER SPECTRAL DENSITY PLOTS - WIRELESS HEADPHONE



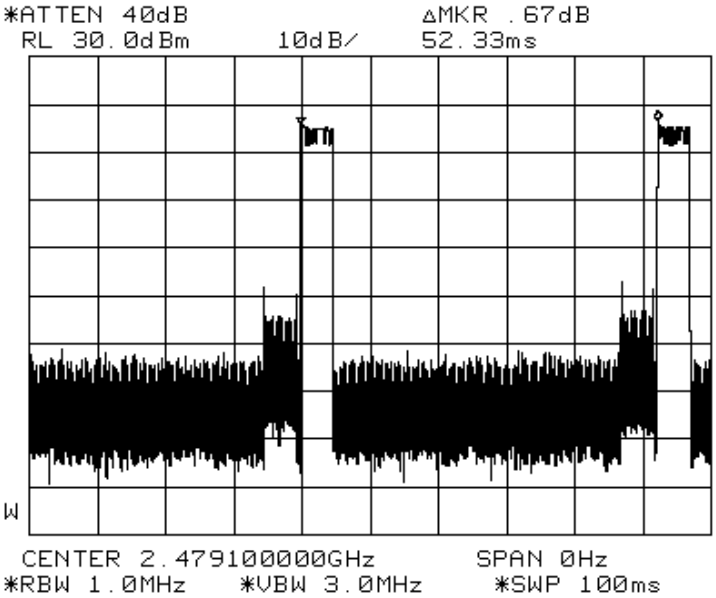
Plot 44 - Channel 14

FCC Part 15 (15.35(c)) Duty Cycle Correction Factor

Unit Under Test: Wireless Transmitter



On Time

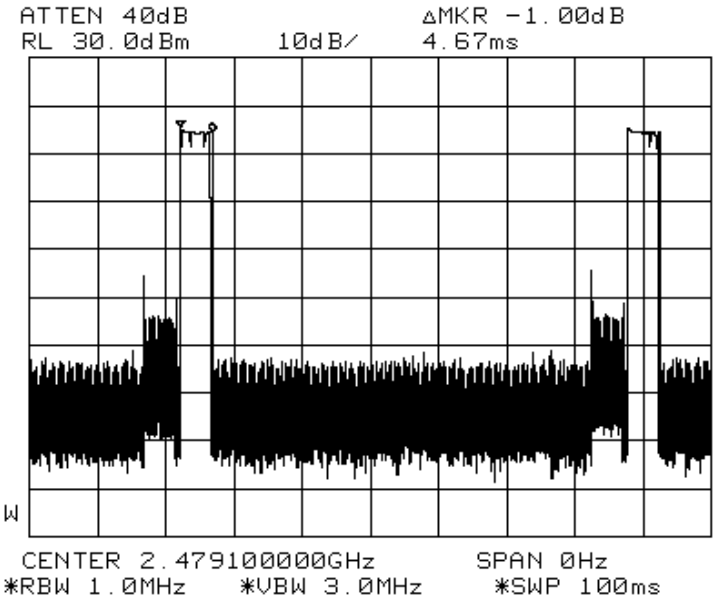


Period

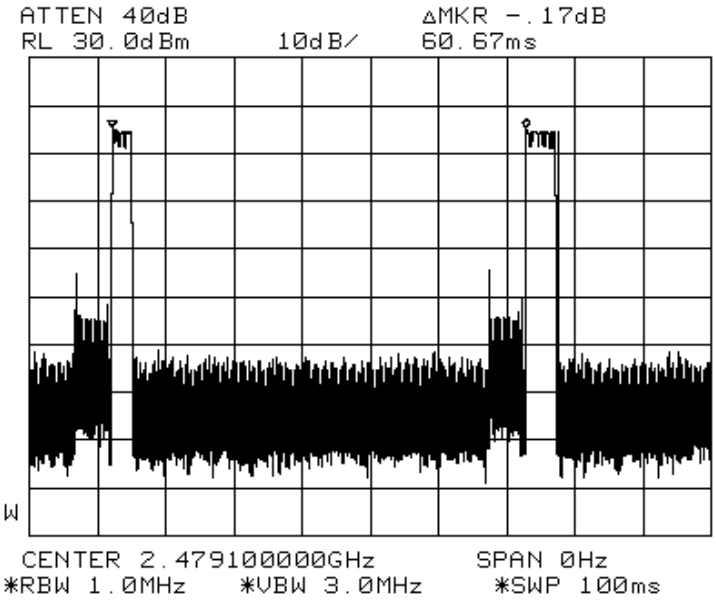
Duty Cycle Factor (worst- case)	=	20 log [Total On time / Period]
	=	20 log [(4.67 / 52.33)]
	=	**-21.0dB**

FCC Part 15 (15.35(c)) Duty Cycle Correction Factor

Unit Under Test: Wireless Headphone



On Time



Period

Duty Cycle Factor (worst- case)	=	20 log [Total On time / Period]
	=	20 log [(4.67 / 60.67)]
	=	**-22.3dB**

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

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May 2005

ANNEX A

TEST INSTRUMENTATION & GENERAL PROCEDURES

3m OATS Test Instrumentation
(Conducted Emissions)

Instrument	Model	S/No	Cal Due Date	
R&S Test Receiver (9kHz-30MHz)	ESH3	862301/005	24 Jun 2005	x
R&S Pulse Limiter – PL1	ESH3-Z2	357.8810.52	15 Apr 2006	x
Schaffner Pulse Limiter – PL5	CFL 9206	1720	15 Apr 2006	x
EMCO LISN (for EUT) – LISN3	3850/2	9903-1075	24 Feb 2006	x
EMCO LISN (for EUT) – LISN9	3825/2	9309-2128	24 Jan 2006	x

3m Anechoic Chamber Test Instrumentation
(Radiated Emissions)

Instrument	Model	S/No	Cal Due Date	
R&S Test Receiver (20Hz–26.5GHz) – ESMI2	ESMI	829214/006 829550/001	22 Apr 2006	x
HP Preamplifier (0.01-3GHz) – PA5	87405A	3950M00352	01 Apr 2006	x
HP Preamplifier (for ESMI3, 0.01-3GHz) – PA6	87405A	3950M00353	01 Apr 2006	x
MITEQ Preamplifier (0.1-26.5GHz) – PA11	NSP2650-N	728231	01 Apr 2006	x
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	01 Apr 2006	x
Schaffner Bilog Antenna – BL5	CBL6143	5041	13 May 2006	x
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2006	x
EMCO Horn Antenna – H2	3115	9403-4250	19 May 2006	x
Micro-tronics Band-Stop Filter	BRM50701	017	1 Apr 2006	x

Lab 7 Test Instrumentation
(Carrier Frequency Separation, Number Of Hopping Frequencies, Spectrum Bandwidth (20dB Bandwidth Measurement), Average Frequency Dwell Time, Maximum Peak Power, RF Conducted Spurious Emissions at the Transmitter Antenna Terminal, Band Edge Compliance at the Transmitter Antenna Terminal, Duty Cycle Correction Factor, Peak Power Density)

Instrument	Model	S/No	Cal Due Date	
HP Spectrum Analyzer	8564E	3846A09953	16 Dec 2006	×
R&S Universal Radio Communication Tester	CMU 200	837587/068	22 Apr 2006	×

CONDUCTED EMISSIONS TEST DESCRIPTION

Test Set-up

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 50Ω/50μH 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.

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 limit = 250 μV = 47.96 dBμV

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

Q-P reading obtained directly from EMI Receiver = 40 dBμV
(Calibrated for system losses)

Therefore, Q-P margin = 40 - 47.96 = -7.96 i.e. **7.96 dB below limit**

RADIATED EMISSIONS TEST DESCRIPTION

Test Set-up

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.

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 frequencies**.**

3. The test was carried out at the selected frequency points obtained from the prescan. 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 25GHz, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

Sample Calculation Example

At 300 MHz limit = 200 μV/m = 46 dBμV/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.511 dB

Q-P reading obtained directly from EMI Receiver = 40 dBμV/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40 - 46 = -6 i.e. **6 dB below limit**

CARRIER FREQUENCY SEPARATION TEST DESCRIPTION

Test Set-up

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 300kHz and 1MHz.

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

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 hopping sequence on.

2. 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.

3. The carrier frequency separation of the two adjacent transmitting / operating frequency was measured by finding the carrier frequency difference between the two adjacent channels.

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST DESCRIPTION

Test Set-up

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.

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 (2.40333GHz).

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.

6. The 20dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies, $| f_H – f_L |$.

7. The steps 2 to 5 were repeated with the transmitting frequency was set to Channel 7 (2.44224GHz) and Channel 14 (2.47910GHz) respectively.

NUMBER OF HOPPING FREQUENCIES TEST DESCRIPTION

Test Set-up

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.

4. 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 300kHz and 1MHz.

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

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 hopping sequence on.

2. The start and stop frequencies of the spectrum analyser were set to 2.40GHz and 2.421GHz with frequency sweeping set to 50ms.

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 5 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.

AVERAGE FREQUENCY DWELL TIME TEST DESCRIPTION

Test Set-up

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.

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, hopping sequence on.

2. The center frequency of the spectrum analyser was set to 2.40333GHz 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 as below:

Average Frequency Dwell Time	=	measured time slot length (l) x hopping rate (h) / number of hopping frequencies
where EUT hopping rate	=	187.5 hops/s
Number of EUT hopping frequencies	=	15 hops

5. The steps 2 to 4 were repeated with the center frequency of the spectrum analyser were set to 2.44224GHz and 2.47910GHz respectively.

MAXIMUM PEAK POWER TEST DESCRIPTION

Test Set-up

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.

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 (2.40333GHz).

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 7 (2.44224GHz) and Channel 14 (2.47910GHz) respectively.

RF CONDUCTED SPURIOUS EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL TEST DESCRIPTION

Test Set-up

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.

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 (2.40333GHz).

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 7 (2.44224GHz) and Channel 14 (2.47910GHz) respectively.

BAND EDGE COMPLIANCE AT THE TRANSMITTER ANTENNA TERMINAL TEST DESCRIPTION

Test Set-up

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.

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, hopping sequence on.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the band, 2.40GHz 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 band, 2.4835GHz and the any spurious emissions at the band-edge.

PEAK POWER SPECTRAL DENSITY TEST DESCRIPTION

Test Set-up

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.

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 (2.40333GHz).
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 7 (2.44224GHz) and Channel 14 (2.47910GHz) respectively.

DUTY CYCLE CORRECTION FACTOR DESCRIPTION

Test Set-up

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 1MHz and 3MHz.
5. All other supporting equipment were powered separately from another filtered mains.

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 (2.40333GHz).
2. The on time and period of the transmission pulse were measured.
3. The steps 2 and 3 were repeated with the transmitting frequency was set to Channel 7 (2.44224GHz) and Channel 14 (2.47910GHz) respectively.
4. Compute the worst-case (longest on time) duty cycle correction factor as shown below.

   Duty Cycle Factor = 20 log [Total On time / Period]

ANNEX B

TEST PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER

Top View

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER

Bottom View

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER

Front View

Rear View

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER

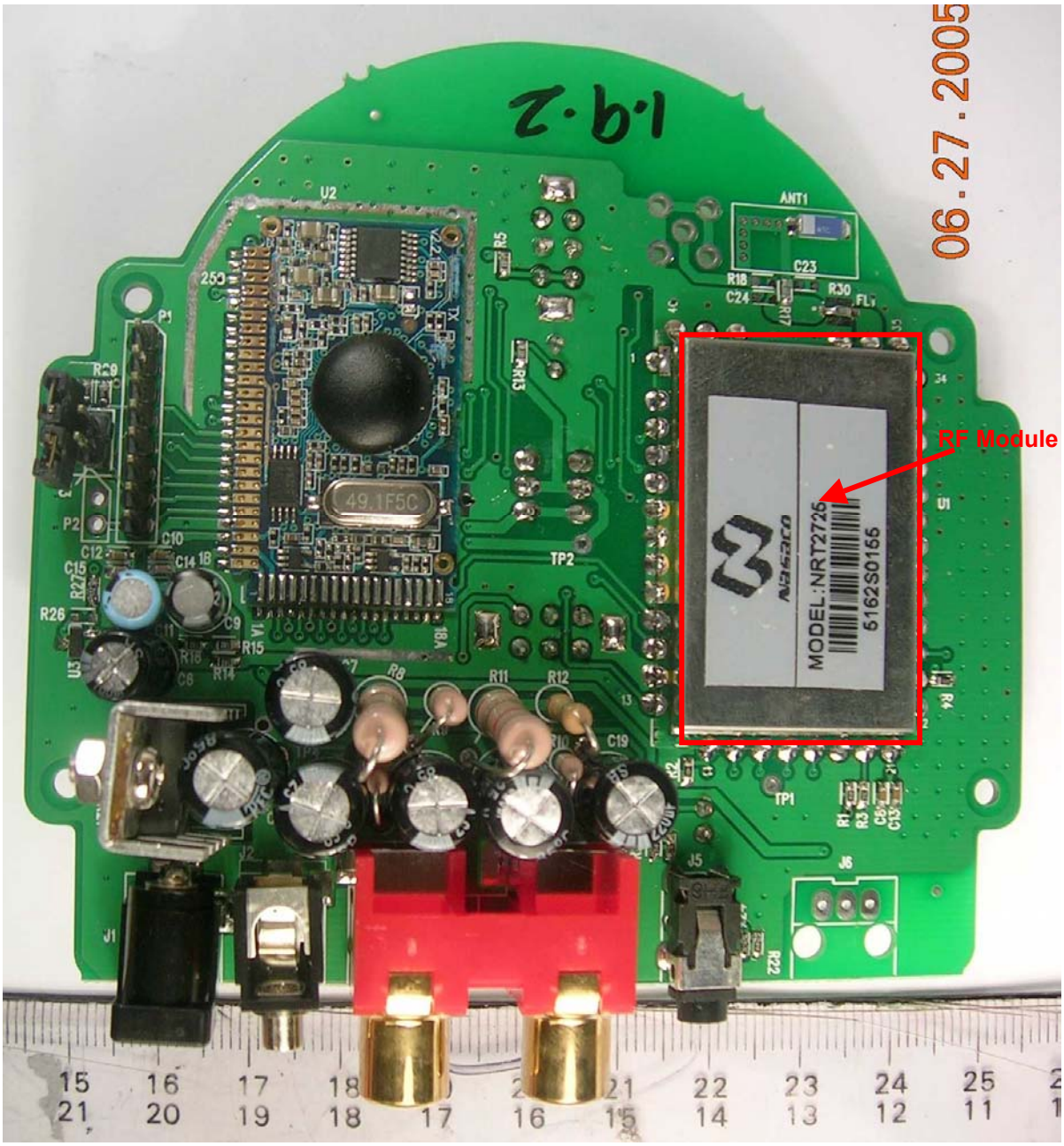
Top View

Bottom View

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER

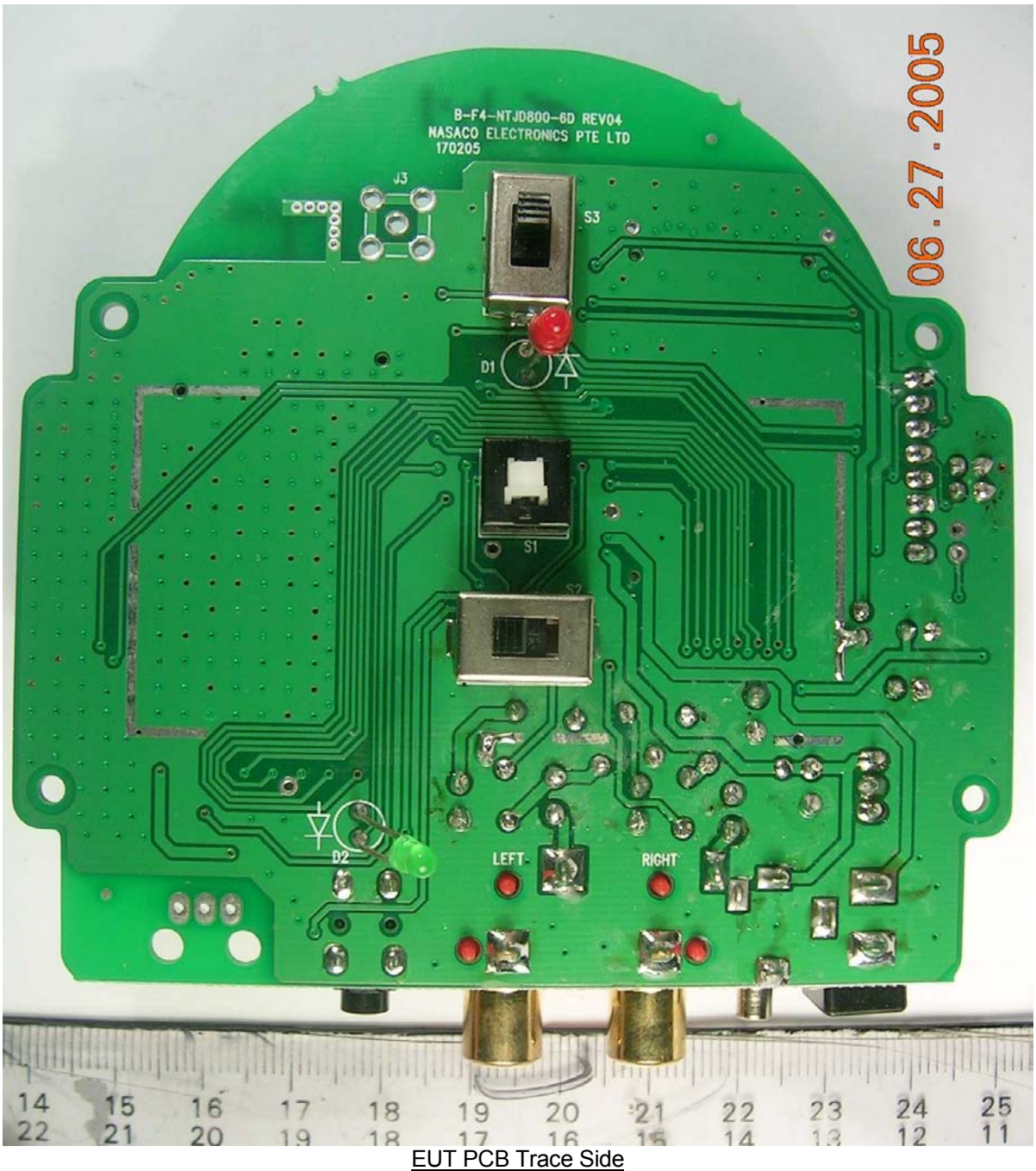
Internal View

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER



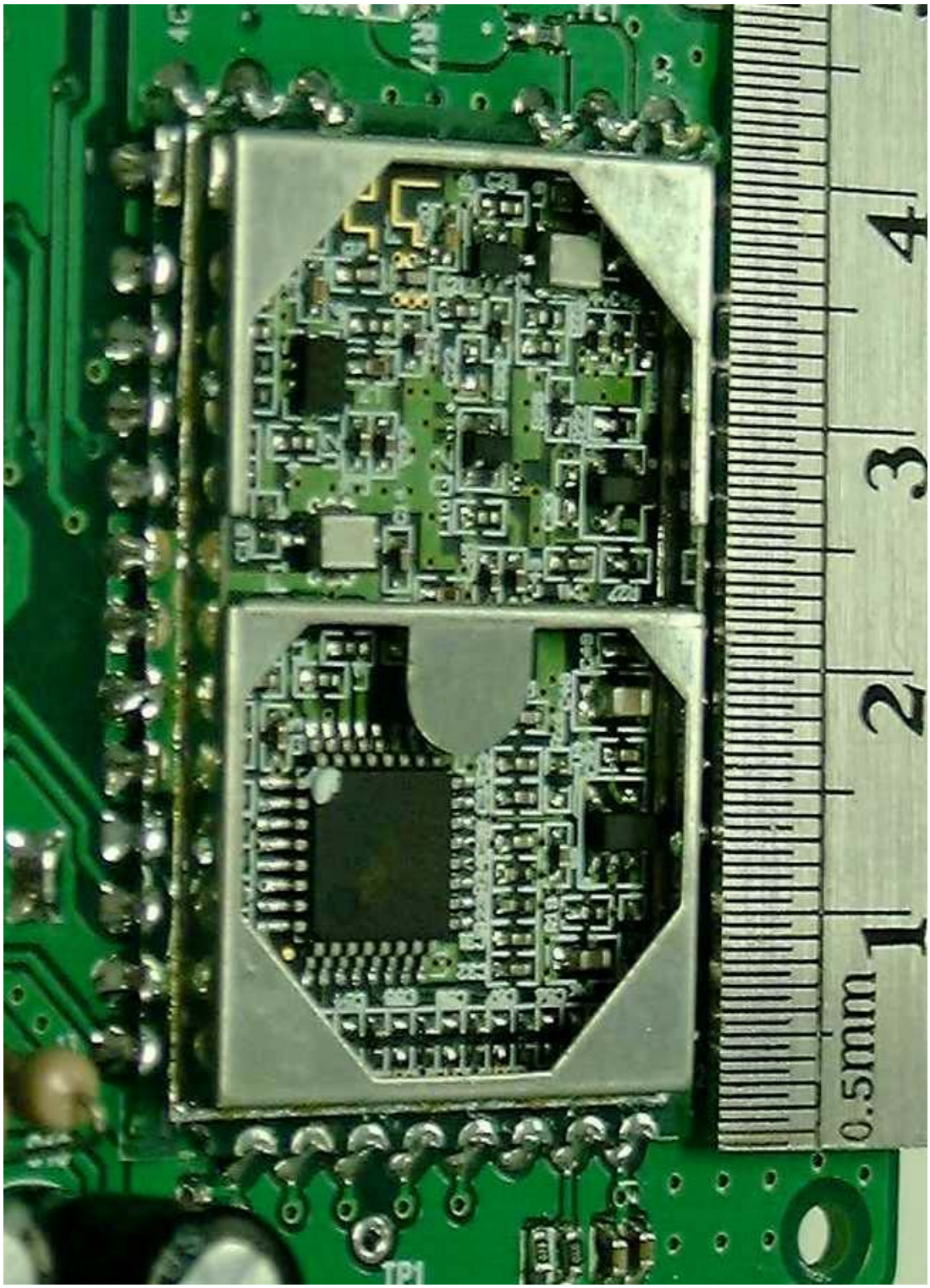
EUT PCB Component Side

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER



EUT PCB Trace Side

EUT PHOTOGRAPHS - WIRELESS TRANSMITTER



RF Module Circuit with RF Shield Removed

EUT PHOTOGRAPHS - WIRELESS HEADPHONE

Front View

EUT PHOTOGRAPHS - WIRELESS HEADPHONE

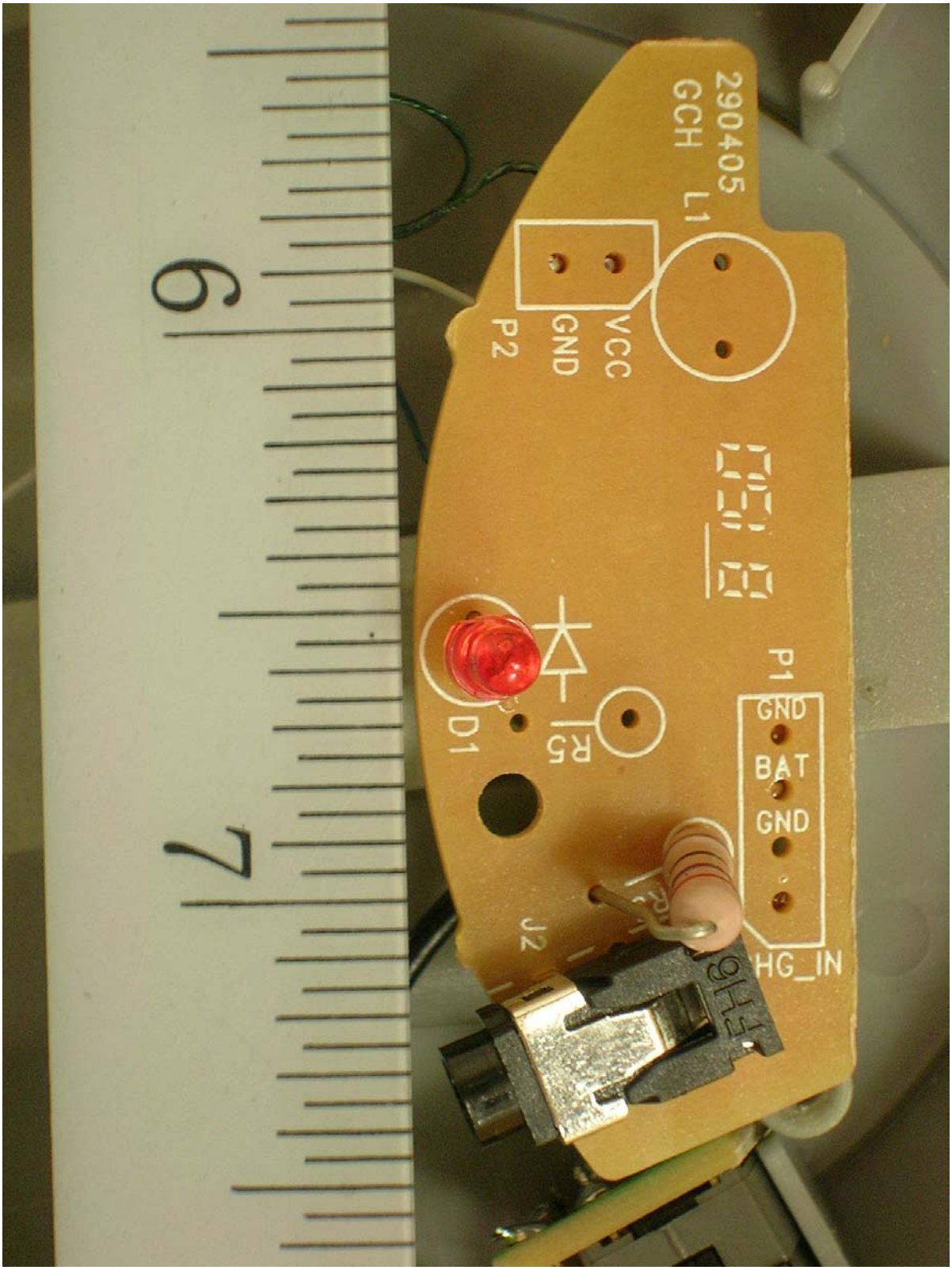
Rear View

EUT PHOTOGRAPHS - WIRELESS HEADPHONE

Top View

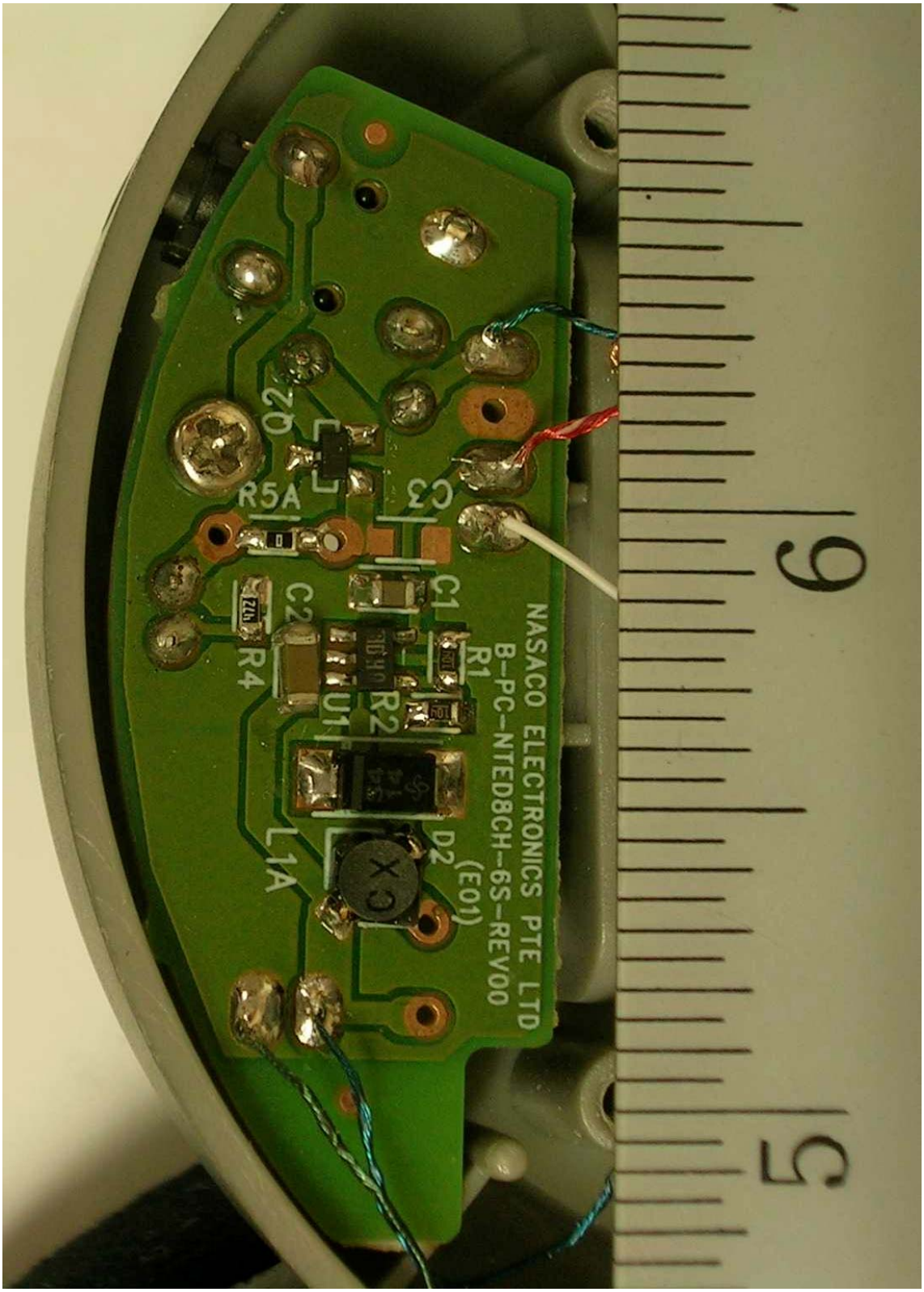
Bottom View

EUT PHOTOGRAPHS - WIRELESS HEADPHONE



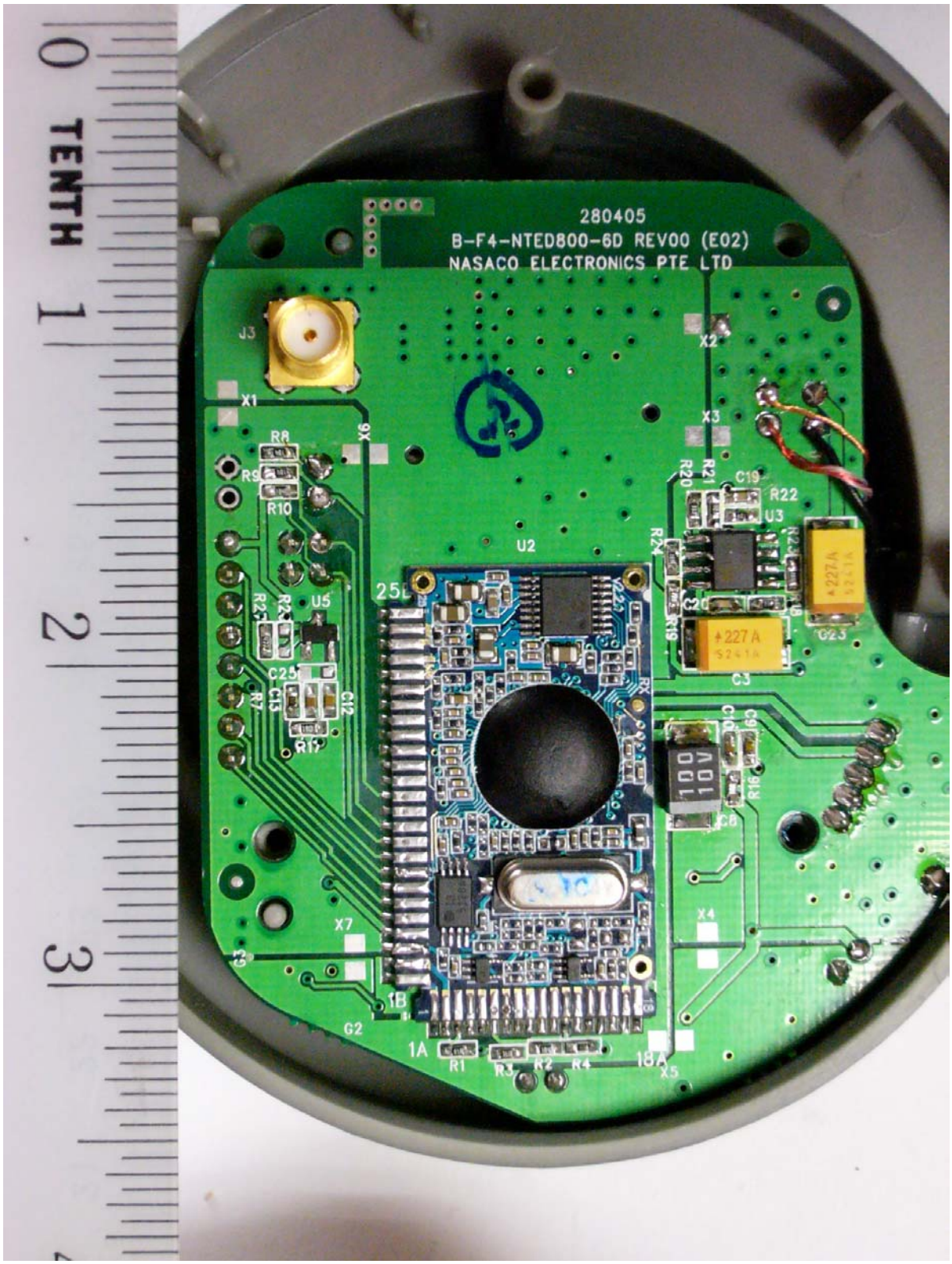
EUT Charger Circuit - Component Side

EUT PHOTOGRAPHS - WIRELESS HEADPHONE



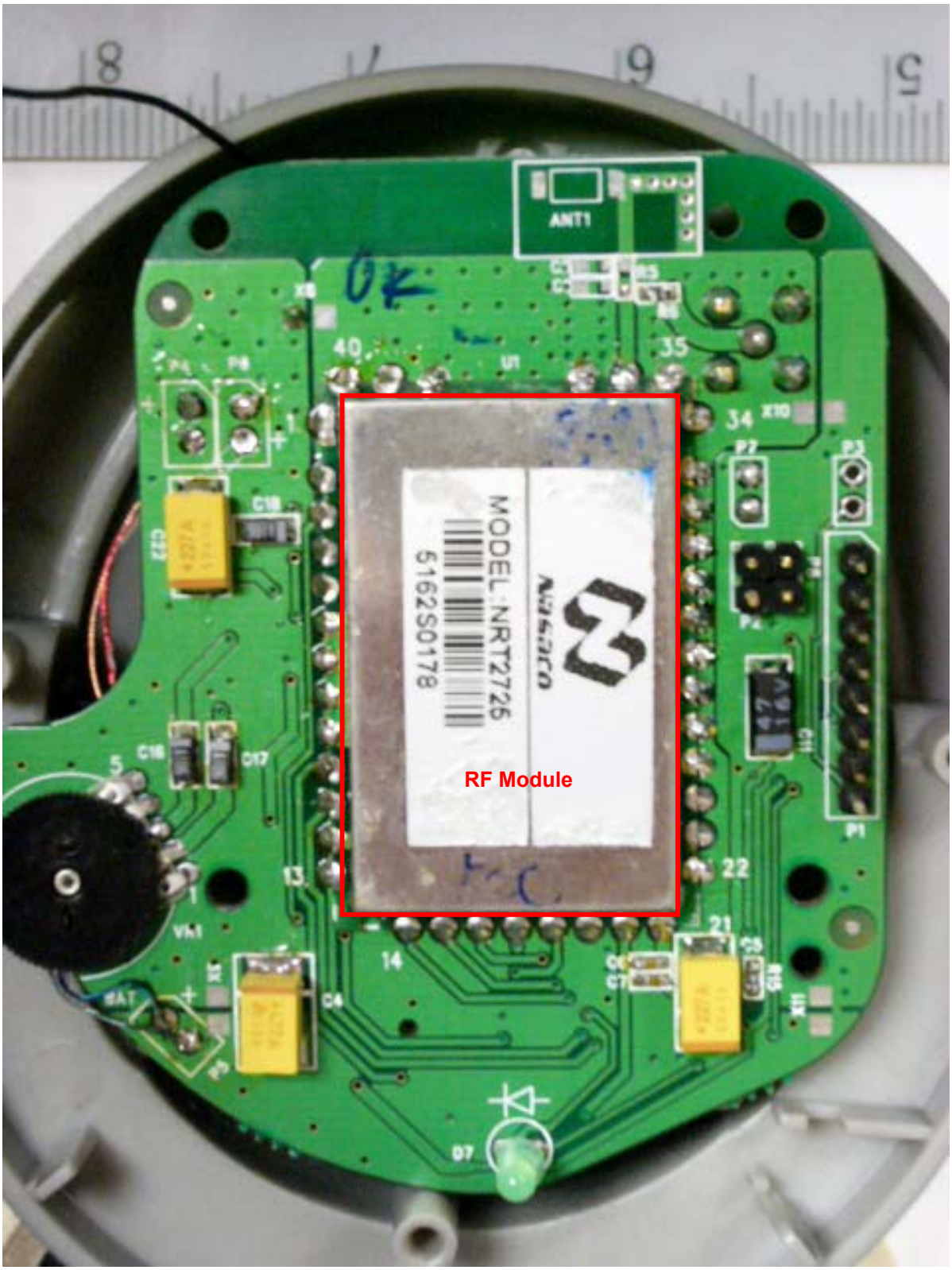
EUT Charger Circuit - Trace Side

EUT PHOTOGRAPHS - WIRELESS HEADPHONE



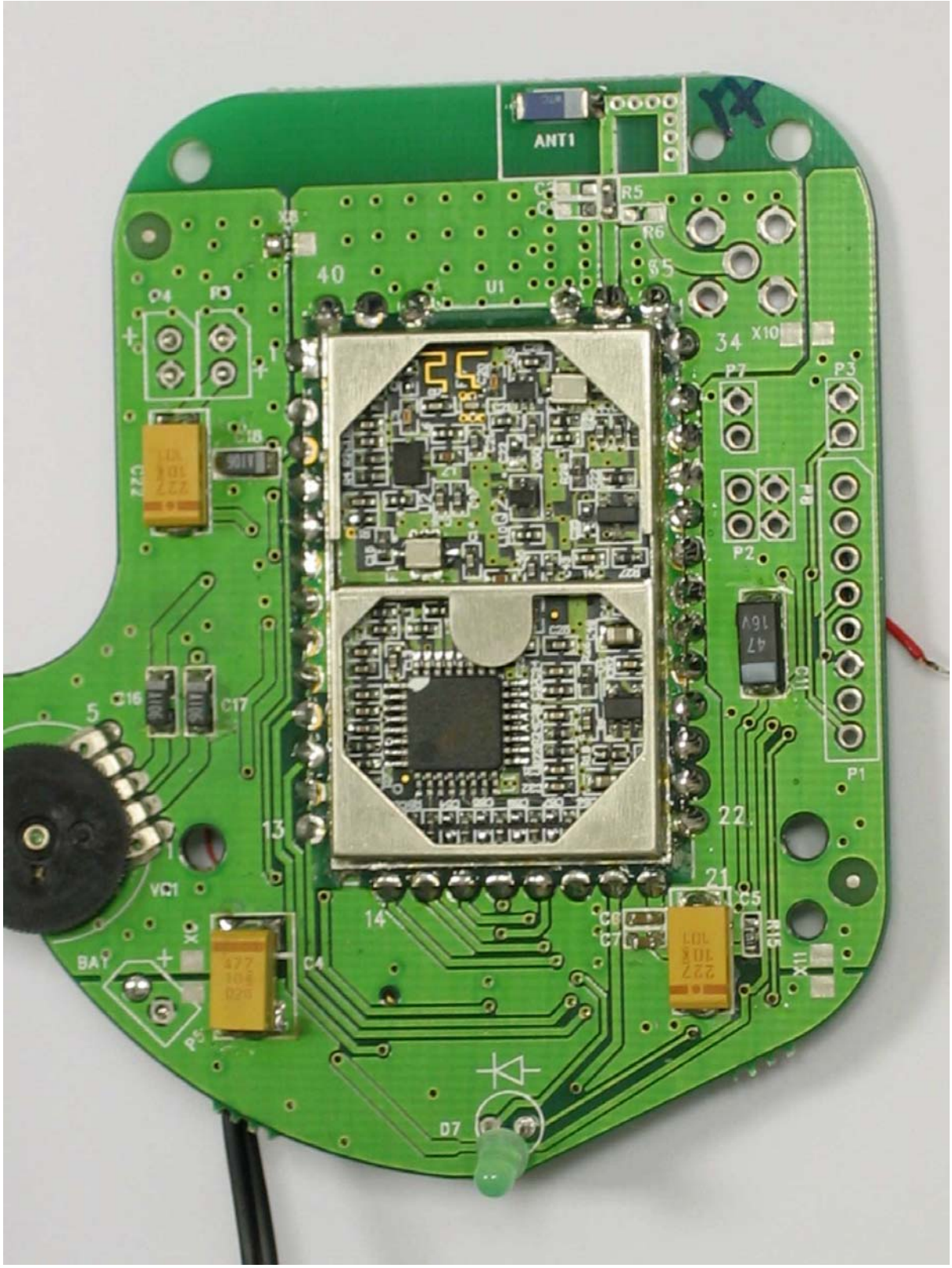
EUT Main Board - Top View

EUT PHOTOGRAPHS - WIRELESS HEADPHONE



EUT Main Board - Bottom View

EUT PHOTOGRAPHS - WIRELESS HEADPHONE



RF Module Circuit with RF Shield Removed

ANNEX C

USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS

(Please refer to attached copy)

ANNEX D

FCC LABEL & POSITION

FCC LABEL & POSITION ANNEX D

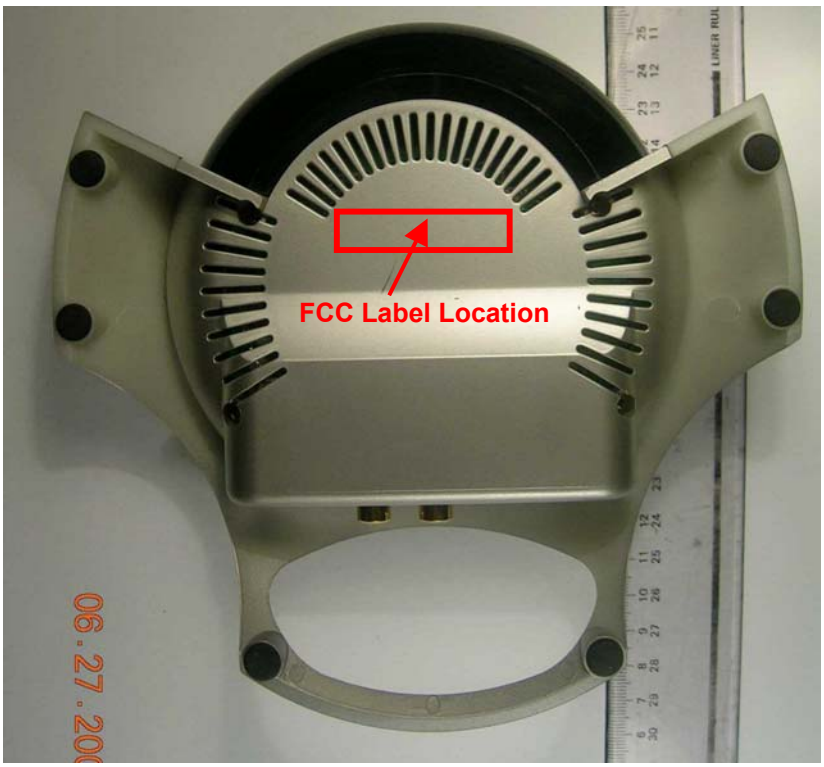
Labelling requirements per Section 2.925 & 15.19

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.

FCC ID: LLP-NTJD800
S/N: XXXXXXXXX
MADE IN CHINA

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.

Sample Label



Physical Location of FCC Label on EUT

FCC LABEL & POSITION ANNEX D

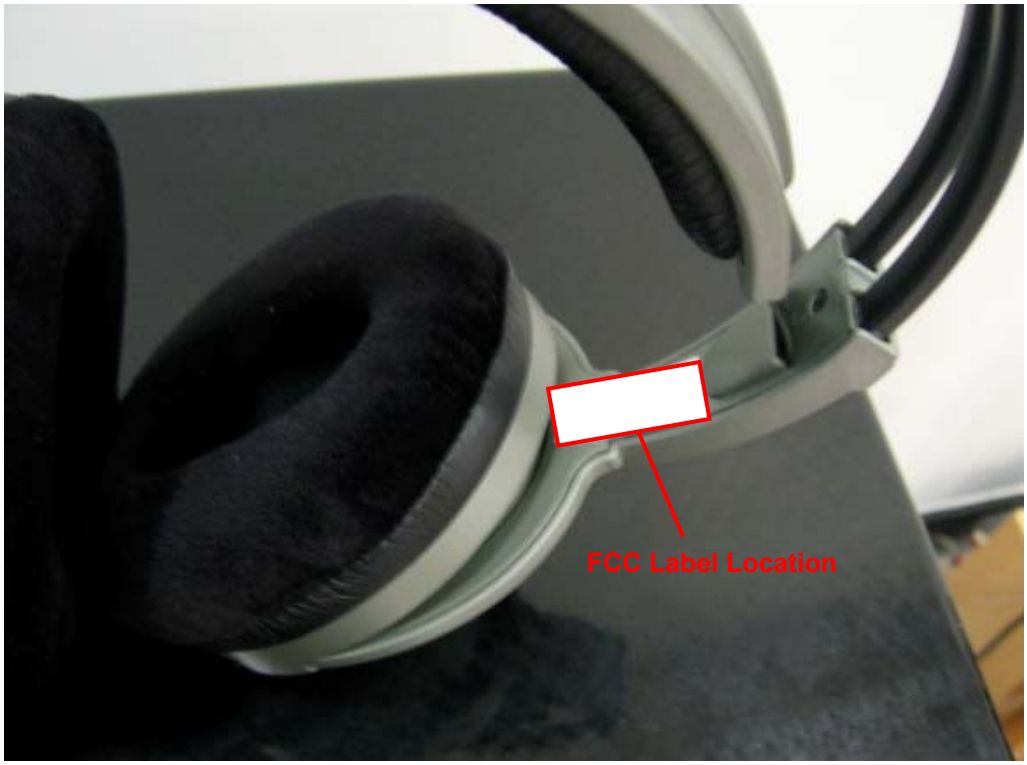
Labelling requirements per Section 2.925 & 15.19

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.

FCC ID: LLP-NTED800
S/N: XXXXXXXXX
MADE IN CHINA

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.

Sample Label



Physical Location of FCC Label on EUT