



DATE: 15 January 2014

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Cardo Peripheral Systems

Equipment under test:

Bluetooth Headset

Scala Rider G9x

Written by:

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This report relates only to items tested.



Measurement/Technical Report for Cardo Peripheral Systems

Bluetooth Headset

Scala Rider G9x

FCC ID: Q95ER14

IC ID: 4668-ER14

This report concerns:	Original Grant:	
	Class I Change:	
	Class II Change:	X

Equipment type:	Spread Spectrum Transmitter
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Limits used:	47CFR15 Section 15.247
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Measurement procedure used is Public Notice: DA 00-705 Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems and ANSI C63.4-2003.

Application for Certification
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1. General Information

1.1 Administrative Information

Manufacturer:	Cardo Peripheral Systems
Manufacturer's Address:	13 Hamifal St., Or Yehuda, 60221, Israel Tel: +973-3-735-3111 Fax: +973-3-562-3360
Manufacturer's Representative:	Avi Moato
Equipment Under Test (E.U.T):	Bluetooth Headset
Equipment Model No.:	Scala Rider G9x
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	10.12.13
Start of Test:	10.12.13
End of Test:	16.12.13
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 9978000
Test Specifications:	See Section 2



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.



1.3 Product Description

The EUT is a Bluetooth headset, technology compliant with Bluetooth Ver 3.0 class1, Bluetooth intercom for motorbikes and FM Radio receiver.

It also has additional transceiver at frequency 2401 MHz. The EUT is powered from a 4.2V battery.

1.4 Test Methodology

Radiated testing was performed according to the procedures in Public Notice: DA 00-705 Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems and ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing November 21, 2012).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

Note: See ITL Procedure No. PM 198.



2. System Test Configuration

2.1 Justification

The product was originally authorized for FCC certification under FCC ID: Q95ER14.

The device contains both a 2402.0-2480.0 MHz Bluetooth radio and a 2401 MHz radio.

No changes have been made to the 2401 MHz radio.

The C2PC concerns the Bluetooth radio only.

The Class II Permissive Changes to the original product are as follows:

1. Change the layout of the Bluetooth RF area on the board.
2. Replace the Bluetooth 2.4GHz amplifier from:
Manufacturer: CEL, Model: uPG2253T6s to
Manufacturer: RF AXIS, Model: RFX2401C.
3. Add an OR gate for preventing an involuntary SW update.

2.2 Special Accessories

No special accessories were needed to achieve compliance.

2.3 Equipment Modifications

No modifications were needed to achieve compliance.

2.4 Configuration of Tested System



Figure 1. Configuration of Tested System

3. Test Setup Photos



Figure 2 Radiated Emission 9 kHz -30 MHz

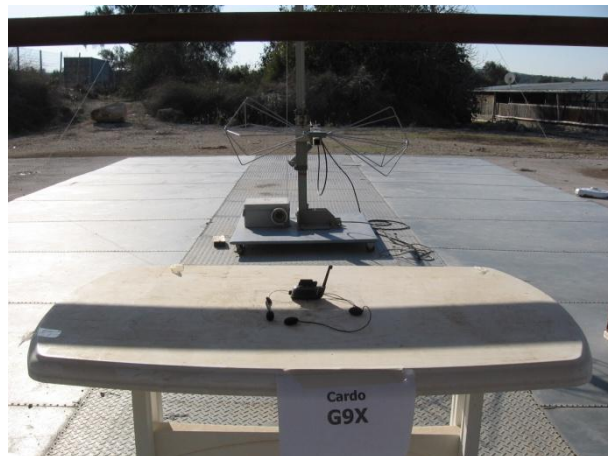


Figure 3 Radiated Emission 30 -300 MHz



Figure 4 Radiated Emission 300 -1000 MHz

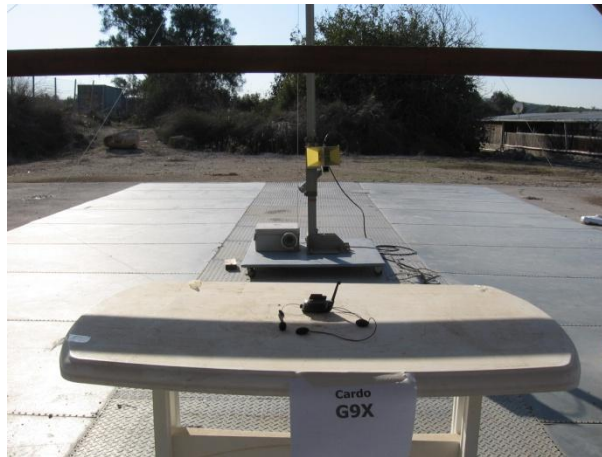


Figure 5 Radiated Emission above 1 GHz

4. Maximum Transmitted Peak Power Output

4.1 Test Specification

FCC Part 15 Section 15.247(b)

4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested in three operating channels and frequencies (1 (2.402 GHz); 8 (2.441 GHz); 14 (2.480 GHz)).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

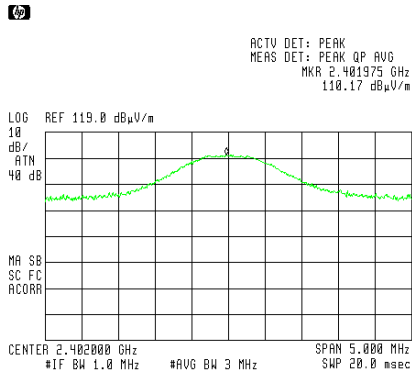


Figure 6 Low Channel – Vertical, Standard

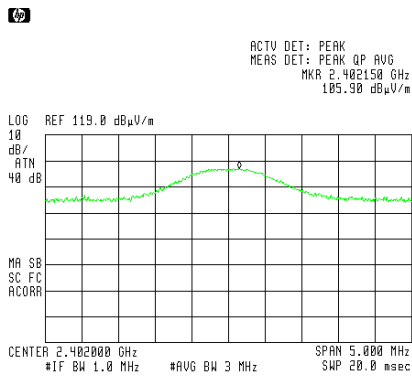


Figure 7 Low Channel – Horizontal, Standard

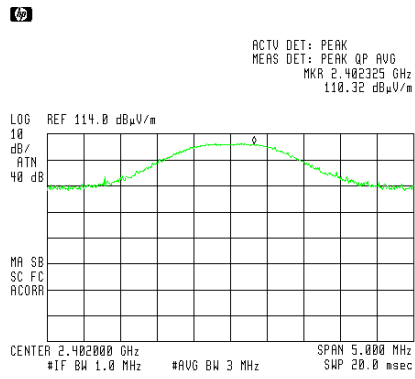


Figure 8 Low Channel – Vertical, EDR

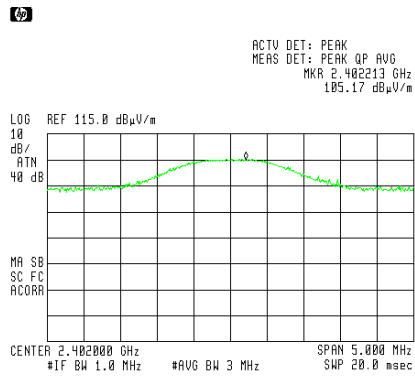


Figure 9 Low Channel – Horizontal, EDR

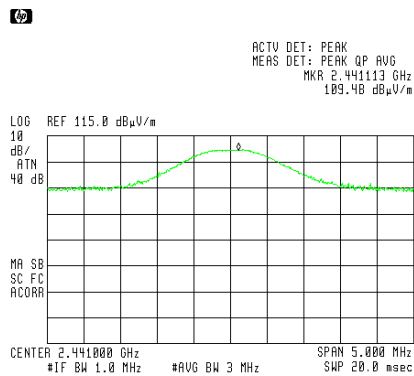


Figure 10 Mid Channel – Vertical, Standard

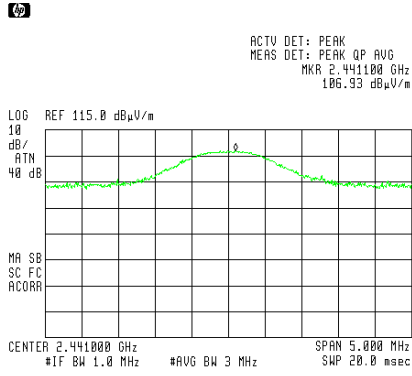


Figure 11 Mid Channel – Horizontal, Standard

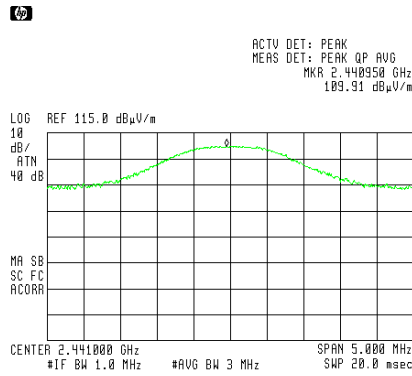


Figure 12 Mid Channel – Vertical, EDR

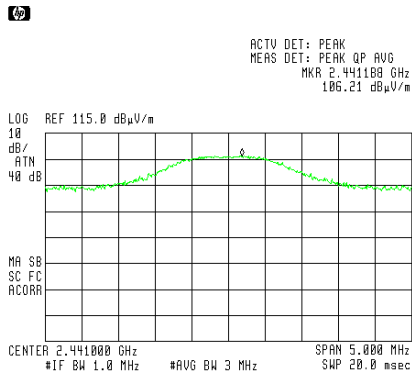


Figure 13 Mid Channel – Horizontal, EDR

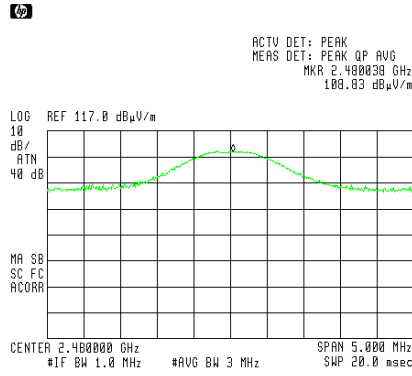


Figure 14 High Channel – Vertical, Standard

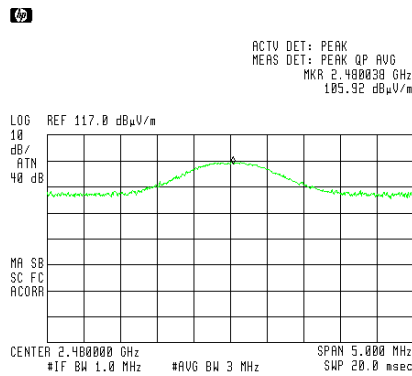


Figure 15 High Channel – Horizontal, Standard

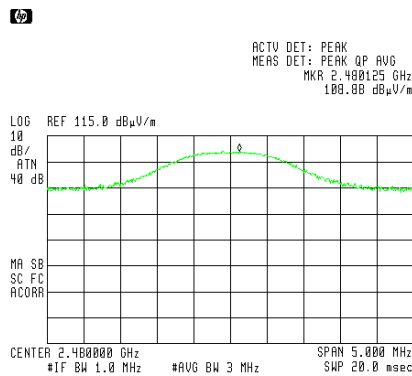


Figure 16 High Channel – Vertical, EDR

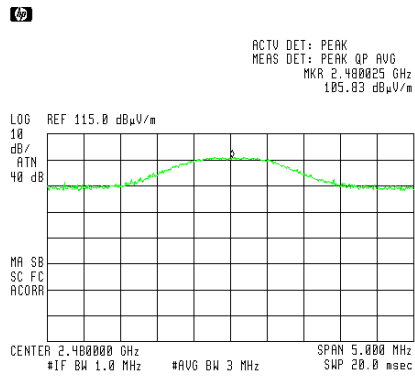


Figure 17 High Channel – Horizontal, EDR



Operation Frequency (MHz)	Modulation	Polarization	Field Strength (dBuV/m)	Power (W)	Power (mW)	Specification (mW)	Margin (dB)
Low	Standard	V	110.17	0.0155	15.5	1000	-984.5
Low	Standard	H	105.90	0.0058	5.8	1000	-994.2
Low	EDR	V	110.32	0.0161	16.1	1000	-983.9
Low	EDR	H	105.17	0.0049	4.9	1000	-995.1
Mid	Standard	V	109.48	0.0133	13.3	1000	-986.7
Mid	Standard	H	106.93	0.0073	7.3	1000	-992.7
Mid	EDR	V	109.91	0.0146	14.6	1000	-985.4
Mid	EDR	H	106.21	0.0062	6.2	1000	-993.8
High	Standard	V	108.83	0.0114	11.4	1000	-988.6
High	Standard	H	105.92	0.0058	5.8	1000	-994.2
High	EDR	V	108.88	0.0115	11.5	1000	-998.5
High	EDR	H	105.83	0.0057	5.7	1000	-994.3

Figure 18 Maximum Peak Power Output

JUDGEMENT: Passed by 983.9mW

TEST PERSONNEL:

Tester Signature: 

Date: 20.01.14

Typed/Printed Name: A. Sharabi



4.1 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 19 Test Equipment Used

5. Band Edge Spectrum

5.1 Test Specification

FCC Part 15 Subpart C Section 15.247(c)

5.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2402 MHz, and 2480 MHz correspondingly.

5.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
Standard	2402	2400.0	80.15	90.0	-10.15
EDR	2402	2400.0	67.98	90.0	-37.98
Standard	2480	2483.5	66.76	88.0	-21.24
EDR	2480	2483.5	65.79	88.0	-22.21

Figure 20 Band Edge Spectrum

See additional details in *Figure 21* to *Figure 24*.

JUDGEMENT: Passed by 10.15dB

TEST PERSONNEL:

Tester Signature: 

Date: 20.01.14

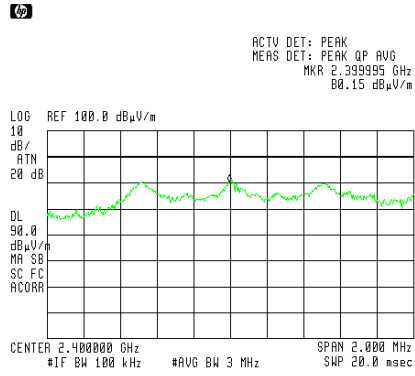


Figure 21 —Low Channel – Vertical, Standard

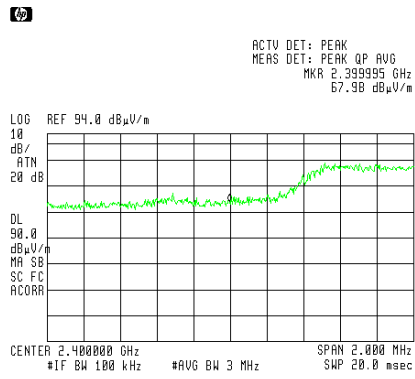


Figure 22 —Low Channel – Vertical, EDR

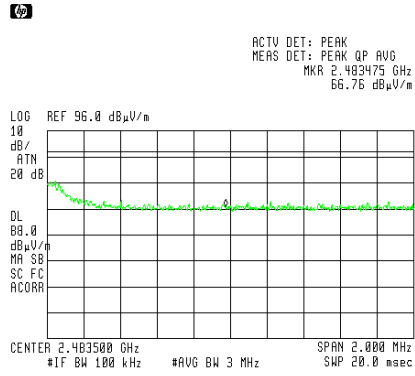


Figure 23 —High Channel – Vertical, Standard

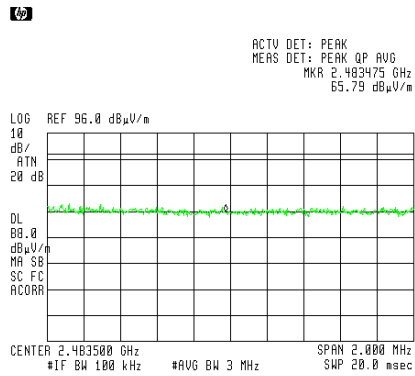


Figure 24 —High Channel – Vertical , EDR



5.4 Band Edge Spectrum Test Equipment Used.

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 25 Band Edge Spectrum Test Equipment Used

6. 26dB Bandwidth

6.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

6.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested in three frequencies: Low, Mid and High

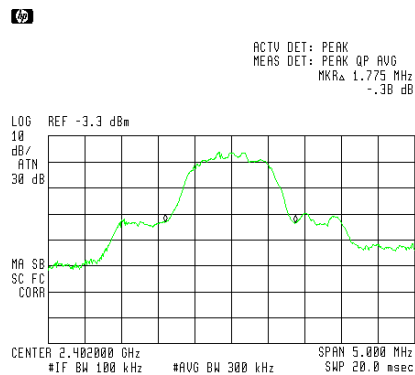


Figure 26. Low Channel, EDR Modulation

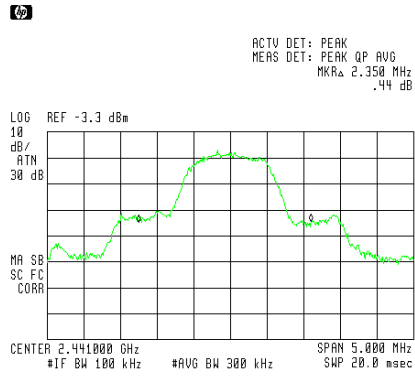


Figure 27. Mid Channel, EDR Modulation

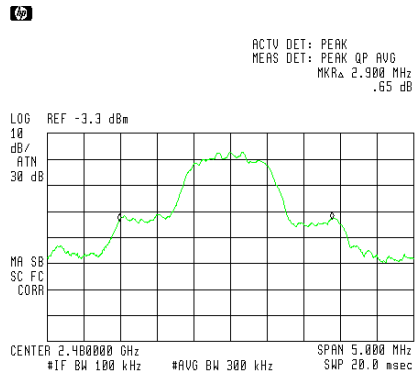


Figure 28. High Channel, EDR Modulation



6.3 Test Results

E.U.T Description: Bluetooth Headset

Model: Scala Rider G9x


Serial Number: Not Designated

Operation Frequency (MHz)	Modulation	Bandwidth Reading (MHz)
Low	EDR	1.775
Mid	EDR	2.350
High	EDR	2.900

Figure 29 26 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ 

Date: 20.01.14

Typed/Printed Name: A. Sharabi



6.4 Test Equipment Used, 26 dB Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 30 Test Equipment Used

7. 20dB Bandwidth

7.1 Test Specification

Specification: FCC Part 15, Subpart C (15.247-a2)

7.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 30 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested in three frequencies: Low, Middle and High.

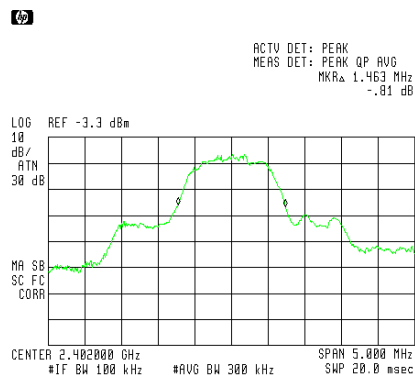


Figure 31. Low Channel, EDR Modulation

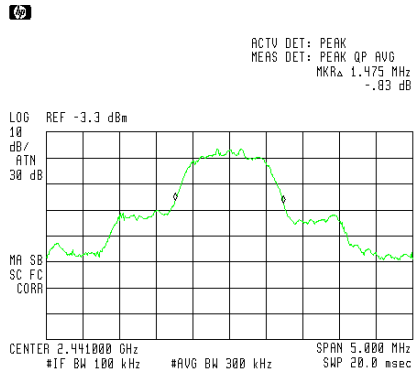


Figure 32. Mid Channel, EDR Modulation

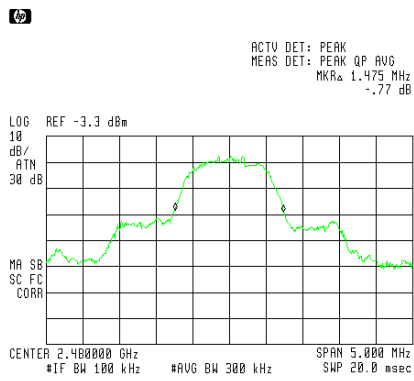


Figure 33. High Channel, EDR Modulation



7.3 Test Results

E.U.T Description: Bluetooth Headset


Model: Scala Rider G9x

Serial Number: Not Designated

Operation Frequency (MHz)	Modulation	Bandwidth Reading (MHz)
Low	EDR	1.463
Mid	EDR	1.475
High	EDR	1.475

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 20.01.14

Typed/Printed Name: A. Sharabi



7.4 Test Equipment Used.

20dB Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 34 Test Equipment Used



8. Number of Hopping Frequencies Section 15.247(a)(1)(iii)

8.1 *Test Specification*

F.C.C., Part 15, Subpart C

8.2 *Test Procedure*

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: Every 40 MHz Frequency

Band of Operation: 2402-2481 MHz

RBW: 30kHz

VBW: 300kHz

Detector Function: Peak

Trace: Maximum Hold

The number of hopping frequencies is 79 (See plots).

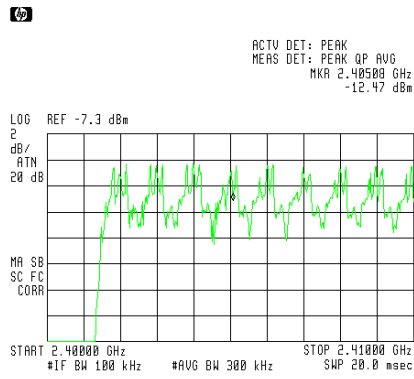


Figure 35. Frequency Hopping, EDR modulation

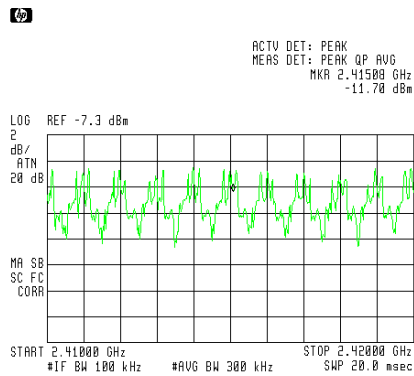


Figure 36. Frequency Hopping, EDR modulation

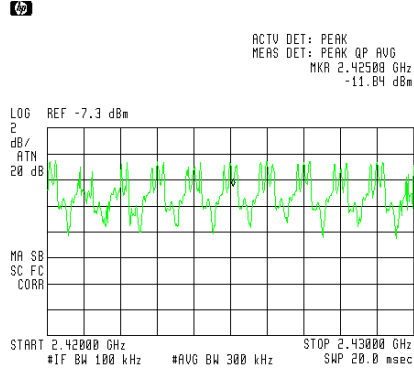


Figure 37. Frequency Hopping, EDR modulation

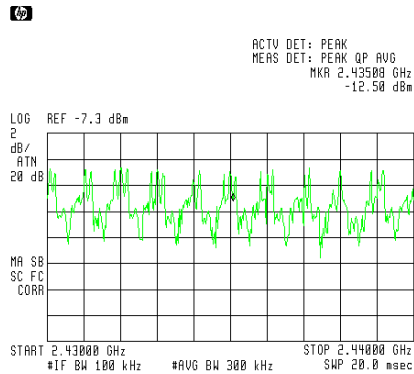


Figure 38. Frequency Hopping, EDR modulation

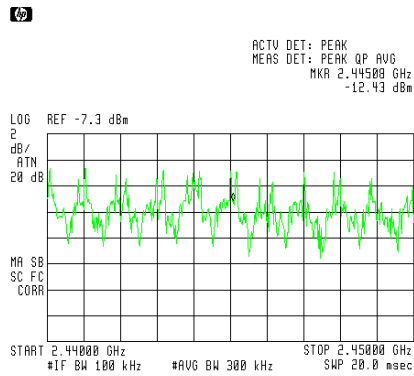


Figure 39. Frequency Hopping, EDR modulation

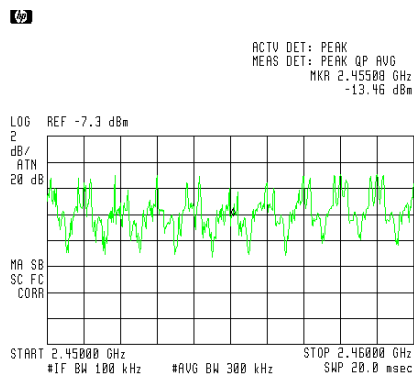


Figure 40. Frequency Hopping, EDR modulation

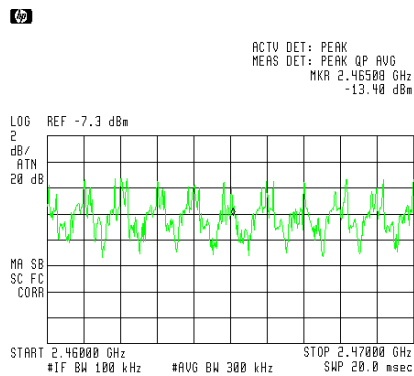


Figure 41. Frequency Hopping, EDR modulation

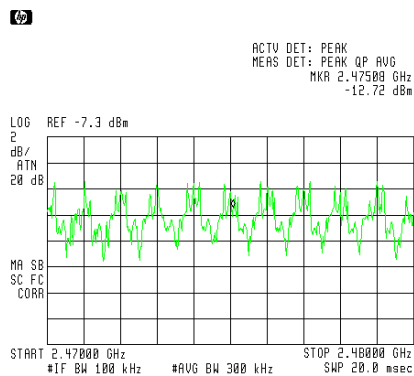


Figure 42. Frequency Hopping, EDR modulation



8.3 Results table

E.U.T. Description: Bluetooth Headset

Model No.: Scala Rider G9x

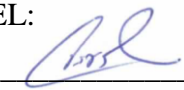
Serial Number: Not Designated

Specification: FCC Part 15, Subpart C, 15.247(a)(1)(iii)

Modulation	Number of Hopping Frequencies	Specification
EDR	79	>75

Figure 43 Number of Hopping Frequencies

TEST PERSONNEL:

Tester Signature:  Date: 20.01.14
Typed/Printed Name: A. Sharabi



8.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	December 10, 2013	1 year

9. Channel Frequency Separation

9.1 Test Specification

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

9.2 Test procedure

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: 2 MHz

RBW: 10kHz

VBW: 10kHz

Detector Function: Peak

Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

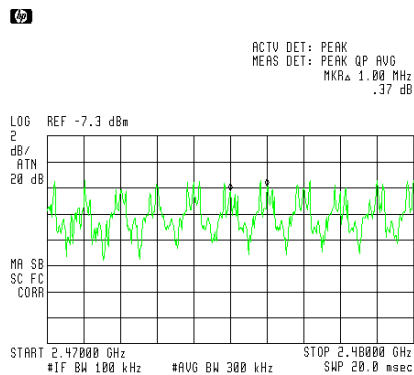


Figure 44. EDR



9.3 Results table

E.U.T. Description: Bluetooth Headset

Model No.: Scala Rider G9x

Serial Number: Not Designated


Specification: FCC Part 15, Subpart C, 15.247(a) (1)

Modulation	Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
EDR	1000.0	983.0	-17.0

Figure 45 Channel Frequency Separation

JUDGEMENT: Passed by 17.0 kHz

TEST PERSONNEL:

Tester Signature: 

Date: 20.01.14

Typed/Printed Name: A. Sharabi



9.4 *Test Instrumentation Used*

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	December 10, 2013	1 year

10. Dwell Time on Each Channel

10.1 Test Specification

FCC Part 15, Section 15.247(a)(1)(iii)

10.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitutional antenna. The spectrum analyzer was set to 30 kHz RBW and 300 kHz VBW.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

10.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(iii).

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____

Date: 20.01.14

Typed/Printed Name: A. Sharabi

Additional information of the results is given in *Figure 46* to *Figure 47*.

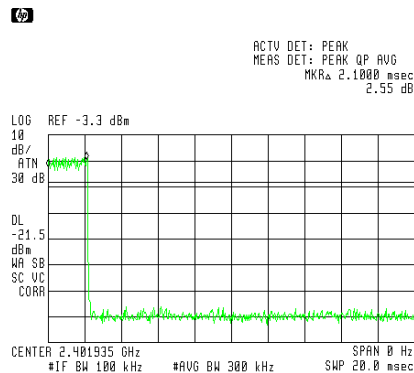


Figure 46 — Ton=2.1msec , EDR Modulation

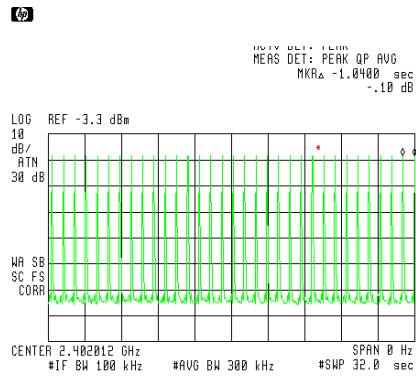


Figure 47 — Dwell time at 2.402GHz , EDR Modulation
[32 X 2.1msec = 67.2msec < limit 400msec]



10.4 Test Equipment Used, Dwell Time.

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year

Figure 48 Test Equipment Used



11. Radiated Emission, 9 kHz – 30 MHz

11.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

11.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was tested at the operating frequencies of 2402, 2441, and 2480 MHz.

11.3 Measured Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all three operating frequencies were the same.

The signals in the band 9 kHz – 30 MHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature: 

Date: 20.01.14

Typed/Printed Name: A. Sharabi



11.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	April 11, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

11.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

- FS: Field Strength [dB μ v/m]
- RA: Receiver Amplitude [dB μ v]
- AF: Receiving Antenna Correction Factor [dB/m]
- CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

12. Spurious Radiated Emission 30 – 1000 MHz

12.1 Test Specification

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

12.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 1*.

The frequency range 30 MHz-1000 MHz was scanned and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

- Turning the E.U.T on and off.

- Using a frequency span less than 10 MHz.

- Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The E.U.T. was tested at the operating frequencies of 2402, 2441, and 2480 MHz.



12.3 **Test Data**

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.
The results for all three operating frequencies were the same.

The signals in the band 30 MHz – 1.0 GHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature:  _____ Date: 20.01.14

Typed/Printed Name: A. Sharabi



12.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

12.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{v/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

- FS: Field Strength [dB μ v/m]
- RA: Receiver Amplitude [dB μ v]
- AF: Receiving Antenna Correction Factor [dB/m]
- CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

13. Spurious Radiated Emission Above 1 GHz

13.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested at the operating frequencies of 2402, 2441, and 2480 MHz.



13.2

Test Data

JUDGEMENT: Passed by 4.6 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is 5.7dB in the worst case at the frequency of 9608.00 MHz, vertical polarization.

For the operation frequency of 2441 MHz, the margin between the emission level and the specification limit is 4.9dB in the worst case at the frequency of 9764.00 MHz, vertical polarization.


For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is 4.6dB in the worst case at the frequency of 9920.00 MHz, vertical polarization.

The results for all modulations were the same.

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

The details of the highest emissions are given in *Figure 49* to *Figure 54*.

TEST PERSONNEL:

Tester Signature: 

Date: 20.01.14

Typed/Printed Name: A. Sharabi



Radiated Emission Above 1 GHz

E.U.T Description Bluetooth Headset
Type Scala Rider G9x
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak
Operation Frequency: 2402 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
2390.00	H	58.3	74.0	-15.7
2390.00	V	58.5	74.0	-15.5
4804.00	H	62.5	74.0	-11.5
4804.00	V	64.4	74.0	-9.6
9608.00	H	67.9	74.0	-6.1
9608.00	V	68.3	74.0	-5.7

Figure 49. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter



Radiated Emission Above 1 GHz

E.U.T Description Bluetooth Headset
Type Scala Rider G9x
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: 2402 MHz

Freq.	Polarity	Average Amp	Average Specification	Average. Margin
(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
2390.00	H	25.3	54.0	-28.7
2390.00	V	25.5	54.0	-28.5
4804.00	H	29.5	54.0	-24.5
4804.00	V	31.4	54.0	-22.6
9608.00	H	34.9	54.0	-19.1
9608.00	V	35.3	54.0	-18.7

Figure 50. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter



Radiated Emission Above 1 GHz

E.U.T Description Bluetooth Headset
Type Scala Rider G9x
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak
Operation Frequency: 2441 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
4882.00	H	63.0	74.0	-11.0
4882.00	V	63.4	74.0	-10.6
9764.00	H	67.5	74.0	-6.5
9764.00	V	69.1	74.0	-4.9

Figure 51. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter



Radiated Emission Above 1 GHz

E.U.T Description Bluetooth Headset
Type Scala Rider G9x
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: 2441 MHz

Freq.	Polarity	Average Amp	Average Specification	Average. Margin
(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
4882.00	H	30.0	54.0	-24.0
4882.00	V	30.4	54.0	-23.6
9764.00	H	34.5	54.0	-19.5
9764.00	V	36.1	54.0	-17.9

Figure 52. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description Bluetooth Headset
 Type Scala Rider G9x
 Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
 Test Distance: 3 meters Detector: Peak
 Operation Frequency: 2480 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
2483.50	H	59.0	74.0	-15.0
2483.50	V	59.7	74.0	-14.3
4960.00	H	63.0	74.0	-11.0
4960.00	V	61.6	74.0	-12.4
9920.00	H	68.4	74.0	-5.6
9920.00	V	69.4	74.0	-4.6

Figure 53. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter



Radiated Emission Above 1 GHz

E.U.T Description Bluetooth Headset
Type Scala Rider G9x
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: 2480MHz

Freq.	Polarity	Average Amp	Average Specification	Average. Margin
(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
2483.50	H	26.0	54.0	-28.0
2483.50	V	26.7	54.0	-27.3
4960.00	H	30.0	54.0	-24.0
4960.00	V	28.6	54.0	-25.4
9920.00	H	35.4	54.0	-18.6
9920.00	V	36.4	54.0	-17.6

Figure 54. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

- * “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain
- ** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter
- * Avg. Factor calculation:



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 2.1750 msec
1.00 dB

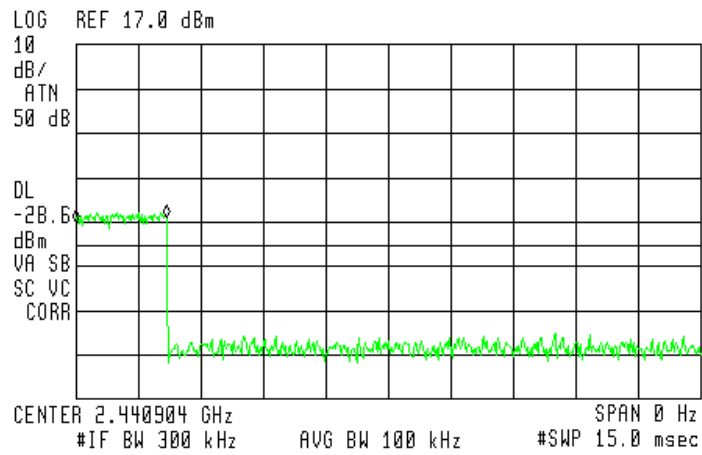


Figure 55. Avg. Factor – burst duration 2.175



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 1.0000 sec
.31 dB

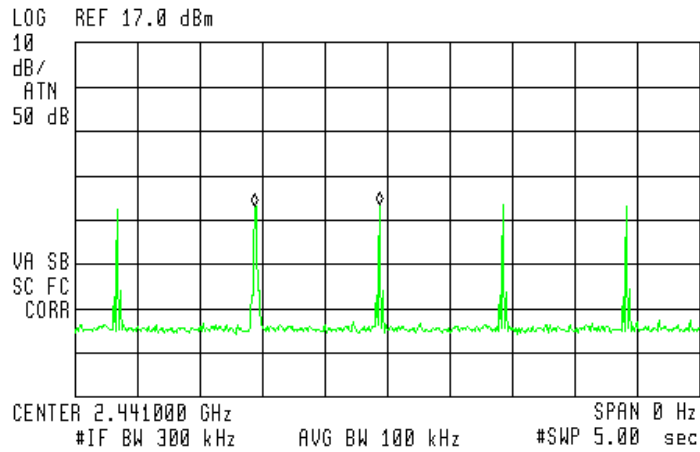


Figure 56. Avg. Factor – transmission = $20\log(2.175/100) = -33.0\text{dB}$



13.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1008	January 26, 2011	3 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A



14. Antenna Gain/Information

Integral, 2 dBi.

15. R.F Exposure/Safety

Typical use of the E.U.T. is as a Bluetooth headset. The typical placement of the E.U.T. is on a motorcycle helmet. The distance between the E.U.T. and the user is 3cm. See photo on next page.

Per information from the customer:

As written in the Bluetooth standard – CORE 3.0+HS- the maximum SCO channels that could be activated on a single Bluetooth product is 3.

In the G9x, only one SCO channel is used when communicating between headsets. Every SCO channel is 1/3 of time, and on each channel, every unit transmits half of the time, because every channel consists of two participants (voice transfer), every unit is on Tx the 1/6 part of the time, which is 16.66%. So the theoretical maximum duty cycle is 16.66%, effectively, is less, due to Tx and Rx and Rx to Tx transfer time.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 2402 MHz is: $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t - Transmitted Power = 110.32 dBuV/m (Peak) = 16.1mW

G_t - Antenna Gain = 2dBi= 1.58 numeric

R- Distance from Transmitter = 3 cm

(c) The average power density is:

$$S_{avg} = \frac{16.1 \times 0.16 \times 1.58}{4\pi(3)^2} = 0.036 \frac{mW}{cm^2}$$

(d) This is below the FCC limit.



EUT

16. APPENDIX A - CORRECTION FACTORS

16.1 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

16.2 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.
2. The overall length of the cable is 10 meters.

16.3 Correction factors for CABLE

**from spectrum analyzer
to test antenna above 2.9 GHz**

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

- 1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.*
- 2. The cable is used for measurements above 2.9 GHz.*
- 3. The overall length of the cable is 10 meters.*



**16.4 Correction factors for LOG PERIODIC ANTENNA
Type LPD 2010/A
at 3 and 10 meter ranges.**

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range,
and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission
Test EMI Receiver".



**16.5 Correction factors for Antenna Biconical
Type 3104
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
30	14.8
40	13.4
50	11.8
60	11.0
70	9.1
80	8.1
90	12.4
100	13.9
120	13.7
140	12.5
160	15.1
180	16.5
200	16.4
250	18.6
300	20.6

NOTE:

Antenna serial number is 2606.



16.6 Correction factors for Double-Ridged Waveguide Horn

**Model: 3115, S/N 29845
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			



16.7 Correction factors for

**Horn Antenna
Model: SWH-28
at 1 meter range.**

FREQUENCY (GHz)	APE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4



**16.8 Correction factors for ACTIVE LOOP ANTENNA
Model 6502
S/N 9506-2950**

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2



17. Comparison Industry Canada Requirements With FCC

Cardo Peripheral Systems Bluetooth Headset

M/N: Scala Rider G9x

IC: Q95ER14 FCC ID: 4668A-ER14

Test	FCC	IC
<input type="checkbox"/> Radiated Emission	15.209	RSS 210 Issue 8 Clause 2.5
<input type="checkbox"/> Max power / Peak power	15.247(b)(3)	RSS 210 Issue 8 A8.4(4)
<input type="checkbox"/> 6dB BW	15.247(a)2	RSS 210 Issue 8 A8.2a
<input type="checkbox"/> Power density	15.247(e)	RSS 210 Issue 8 A8.2b
<input type="checkbox"/> Spurious radiated emission in the restricted band	15.205(c)	RSS 210 Issue 8 2.5 RSS Gen 7.2.2 (Table 1)
<input type="checkbox"/> Band edge spectrum	15.247(d)	RSS 210 Issue 8 A8.5
<input type="checkbox"/> RF Exposure Limits	1.1310	RSS 102 4.4