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Wireless Product Development
ACCREDITED
TESTING CERT #1255.01
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TEST REPORT # 313174 A
LSR Job #: C-1754

Compliance Testing of:

Inspire Limited Edition Wireless

Test Date(s):
8/15/13, 8/30/13, 9/3/13, 9/4/13 and 9/5/13

Prepared For:
Seth Burgett
Verto Medical Solutions, LLC d/b/a Yurbuds,
900 Spruce Street Suite 550,
Saint Louis, MO 63102.

This Test Report is issued under the Authority of:
Khairul Aidi Zainal, Senior EMC Engineer.

Signature:  Date: 9/13/13

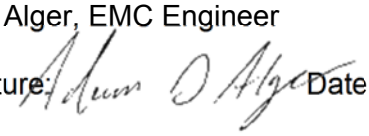
Test Report Reviewed by:	Project Engineer:
Adam Alger, EMC Engineer	Khairul Aidi Zainal, Senior EMC Engineer.
Signature:  Date: 9/12/13	Signature:  Date: 9/9/13

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EXHIBIT 1. INTRODUCTION

1.1 - Scope

References:	FCC Part 15, Subpart C, Section 15.247 RSS GEN issue 3 and RSS 210 issue 8 Annex 8
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	Radiated Measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	Residential

1.2 – Normative References

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2013	Code of Federal Regulations - Telecommunications
RSS 210 Issue 8 Annex 8	2010-12	Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI 63.10	2009	American National Standard For Testing Unlicensed Wireless devices.
FCC DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

1.3 - LS Research, LLC Test Facility

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) as conforming to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted. Accreditation status can be verified at A2LA's web site: www.a2la.net.

1.4 – Location of Testing

All testing was performed at the following location utilizing the facilities listed below, unless otherwise noted.

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA,

List of Facilities Located at LS Research, LLC:

Compact Chamber
Semi-Anechoic Chamber
Open Area Test Site (OATS)

1.5 – Test Equipment Utilized

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated by a calibration laboratory accredited to the requirements of ISO/IEC 17025, and traceable to the SI standard.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 – Client Information

Manufacturer Name:	Verto Medical Solutions, LLC d/b/a Yurbuds
Address:	900 Spruce Street, Suite 550 Saint Louis, MO 63102.
Contact Name:	Seth Burgett

2.2 - Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Inspire Limited edition Wireless
Model Number:	30003
Serial Number:	Engineering prototype

2.3 - Associated Antenna Description

The antenna used is a bent 'L monopole' antenna.

2.4 - EUT'S Technical Specifications

EUT Frequency Range (in MHz)	2402 MHz to 2480MHz
RF Power in Watts	☒ Conducted Measurement ☐ EIRP
Minimum(Watts):	GFSK =0.00398 EDR 2 =0.00294 EDR 3 =0.00308
Maximum(Watts):	GFSK =0.00665 EDR 2 =0.00561 EDR 3 =0.00586
Occupied Bandwidth (99% and 20dB)	20dB (kHz): GFSK=948.4 EDR2=1271.0 EDR3=1286.0 99%(kHz): GFSK=858.4 EDR2=1195.0 EDR3=1195.0
Type of Modulation	GFSK, QPSK
Emission Designator	1M19FXD
Transmitter Spurious (worst case radiated) at 3 meters	49.7dBµV/m at 2483.5MHz (Band-edge)
Stepped (Y/N)	N
Step Value:	N/A
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	Bent L monopole antenna.
Gain	1dBi peak (Customer declaration)
EUT will be operated under FCC Rule Part(s)	Title 47 part 15.247
EUT will be operated under RSS Rule Part(s)	RSS 210
Modular Filing	☐ Yes ☒ No
Portable or Mobile?	Portable

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	X	RF Evaluation

The EUT was evaluated against the SAR test exclusion threshold listed in KDB 447498 D01 General RF Exposure Guidance v05r01. The EUT was found to be compliant with the SAR exclusion threshold for 100MHz to 6GHz at a minimum separation distance of ≤ 50mm.

Frequency = 2.480 GHz
Antenna gain =1.0 dBi
EIRP (dBm) = 8.2dBm + 1.0dBi = 9.2 dBm
EIRP (mW)= 8.32 milliwatt
Minimum separation distance = less than 5 mm

[8.32mw/5mm]*[√2.48GHz] = 1.33*1.57 = **2.62 ≤ 3**

2.5 - Product Description

The Inspire Limited edition Wireless headphones are designed for a customer to stream music and take phone calls through a wireless connection. They are designed for active users such as runners, bikers, etc. The unique molding of the ear piece prevents the ear bud from falling out. The ear buds are designed to work with smartphones such as the Windows phone, iPhone, and Android systems.

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 - Climate Test Conditions

Temperature:	70-71° F
Humidity:	34-38%
Pressure:	729-742mmHg

3.2 - Applicability & Summary Of EMC Emission Test Results

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	N/A
FCC : 15.247 (a)(1) IC : RSS 210 A8.1 (a)	20 dB Bandwidth	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.247(d) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC:15.247 (a)(1)(iii) IC: RSS 210 (b)	Carrier Frequency Separation	Yes
FCC:15.247 (a)(1)(i),(ii),(iii) IC: RSS 210 (c),(d),(e)	Number of hopping channels	Yes
FCC:15.247 (a)(1)(i),(ii),(iii) IC: RSS 210 (c),(d),(e)	Time of occupancy (Dwell Time)	Yes
FCC : 15.247(b) IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions in the restricted bands	Yes

3.3 - Modifications Incorporated In The EUT For Compliance Purposes

☒ None ☐ Yes (explain below)

3.4 - Deviations & Exclusions From Test Specifications

☒ None ☐ Yes (explain below)

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 8 (2010), Annex 8 (section 8.1).

Note: If some emissions are seen to be within 3 dB of their respective limits; as these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 - Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber.

The EUT was operated in continuous transmit modulated mode for final testing. The EUT is powered via a rechargeable 3.6 VDC battery. During final testing, the EUT was powered via a charging cable due to the short battery life. This mode is a forced mode using the 'BlueTest3' test tool/software. Under normal operation, the EUT does not transmit/receive during charging.

Using the 'Blue Test3', the test sample was operated on one of three (3) standard channels: low (2402MHz), middle (2440MHz) and high (2480MHz) to comply with FCC Part 15.31(m).

5.2 - Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 26000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 200 MHz, and a Log Periodic Antenna was used to measure emissions from 200 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz while a standard gain horn antenna was used in the 18 GHz to 25 GHz range. The maximum radiated RF emissions between 30MHz to 4 GHz were found by raising and lowering the sense antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. Between 4GHz to 26GHz, the sense antenna was raised and lowered between 1 and 1.8 meters in height.

The EUT was positioned in 3 orthogonal orientations.

5.3 - Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a calibration laboratory accredited to ISO 17025, and are traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. **As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading.** The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz).

5.4 - Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 and Canada RSS-210, Issue 8 (2010), Annex 8 for an FHSS transmitter. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 - Calculation of Radiated Emissions Limits and reported data

Reported data:

For both fundamental and spurious emissions measurement, the data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBμV/m) + Antenna correction Factor + Cable factor (dB) + Miscellaneous factors when applicable (dB) – amplification factor when applicable (dB).

Generic example of reported data at 200 MHz:

Reported Measurement data = 18.2 (raw receiver measurement) + 15.8 (antenna factor) + 1.45 (cable factor) = 35.45 (dBμV/m).

As specified in 15.247 (d) and RSS 210 A8.5, radiated emissions that fall within the restricted band described in 15.205(c) for FCC and section 2.2 of RSS 210 for IC, must comply with the general emissions limit.

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands. The mentioned limits correspond to those limits listed in RSS GEN.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Sample conversion of field strength (μV/m to dBμV/m):
To convert 100 μV/m to dBμV/m,

dBμV/m = 20 $\log_{10}$ (100)= 40 dBμV/m (from 30-88 MHz)

5.6 - Radiated Emissions Test Data Chart

Manufacturer:	Verto Medical Solutions, LLC d/b/a Yurbuds					
Date(s) of Test:	8/30/13, 9/3/13,9/4/13					
Project Engineer(s):	Khairul Aidi Zainal					
Test Engineer(s):	Michael Hintzke and Khairul Aidi Zainal					
Voltage:	3.6 VDC					
Operation Mode:	continuous transmit, modulated					
Environmental Conditions in the Lab:	Temperature: 70-71° F Relative Humidity: 34-38%					
EUT Power:		Single Phase 120VAC		3 Phase ___VAC		
	X	Battery		Other: Bench DC supply		
EUT Placement:	**X**	80cm non-conductive pedestal		10cm Spacers		
EUT Test Location:	**X**	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	**X**	Final
Detectors Used:	**X**	Peak	**X**	Quasi-Peak	**X**	Average

Table of emissions other than harmonics of the transmitter.

Frequency (MHz)	Height (meter)	Azimuth (°)	Antenna (H/V)	EUT	Peak Detector (dBµV/m)	Q.Peak Detector (dBµV/m)	Average Detector (dBµV/m)	Peak limit (dBµV/m)	Q.Peak limit (dBµV/m)	Average limit (dBµV/m)	Peak Margin (dB)	Q.Peak Margin (dB)	Average Margin (dB)	Notes
72.07	1.00	0	H	V	22.4	17.5	12.1	N/A	40.0	N/A	N/A	22.5	N/A	1
123.40	1.00	0	H	V	23.4	17.8	11.2	N/A	43.0	N/A	N/A	25.2	N/A	1
144.00	1.00	186	V	V	29.6	25.6	22.2	N/A	43.0	N/A	N/A	17.4	N/A	
43.98	1.00	0	V	V	25.8	20.7	15.1	N/A	40.0	N/A	N/A	19.3	N/A	1
191.40	1.00	0	V	V	27.4	21.6	15.0	N/A	43.0	N/A	N/A	21.4	N/A	1
758.00	1.00	0	H	V	32.8	27.6	20.9	N/A	46.0	N/A	N/A	18.4	N/A	1
982.60	1.00	0	H	V	36.6	30.6	24.0	N/A	54.0	N/A	N/A	23.4	N/A	1
272.00	1.00	43	V	V	29.6	25.1	21.0	N/A	46.0	N/A	N/A	20.9	N/A	
984.20	1.00	0	V	V	35.2	29.7	23.1	N/A	54.0	N/A	N/A	24.3	N/A	1
2138.00	1.00	0	H	F	51.0	41.3	37.9	74.0	N/A	54.0	23.0	N/A	16.1	1

Notes:

1. Measurement of system noise floor.

RADIATED EMISSIONS DATA CHART (continued)

The following table depicts the level of significant radiated **harmonic** emissions of channel 2402 MHz:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Duty Cycle (D.C) correction factor (dB)	D.C. Corrected Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4804	1.03	106	74.8	20.5	54.3	63.5	9.2	Horizontal	Side
12010	1.00	59	52.2	20.5	31.7	63.5	31.9	Vertical	Side
19220	1.00	323.6	51.7	20.5	31.2	63.5	32.3	Horizontal	Vertical

The following table depicts the level of significant radiated **harmonic** emissions of channel 2440 MHz:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Duty Cycle (D.C) correction	D.C. Corrected Reading	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4880	1.00	337	76.7	20.5	56.2	63.5	7.3	Horizontal	Side
7320	1.00	251	63.1	20.5	42.6	63.5	20.9	Horizontal	Vertical
12200	1.00	61	59.0	20.5	38.5	63.5	25.0	Vertical	Side
19516	1.00	324.2	51.9	20.5	31.4	63.5	32.1	Horizontal	Vertical

The following table depicts the level of significant radiated **harmonic** emissions of channel 2480 MHz in the restricted band:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Duty Cycle (D.C) correction factor (dB)	D.C. Corrected Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4960	1.04	323	77.6	20.5	57.1	63.5	6.4	Horizontal	Vertical
7440	1.09	217	65.4	20.5	44.9	63.5	18.6	Vertical	Flat
12400	1.00	56	59.7	20.5	39.2	63.5	24.3	Vertical	Side
19836	1.00	323.1	54.1	20.5	33.6	63.5	29.9	Horizontal	Vertical

Notes:

1. Measurements above 4 GHz were made at 1 meter separation distance from the EUT.
2. Refer to exhibit 5.5 on explanation of how data is reported.
3. Duty cycle correction was applied to peak reading and compared to the average limit. Example calculation:

   At 4960MHz,

   Peak reading (dBµV/m) – D.C. correction factor (dB) = Corrected reading (dBµV/m)

   77.6dBµV/m – 20.5dB = 57.16dBµV/m

   Margin:

63.5dBµV/m – 57.16dBµV/m = 6.4 dB

4. Duty cycle correction justification is in the next section (Section 5.7)

5.7 – Duty Cycle Correction Justification

(Provided by customer)

The time a Bluetooth system dwells on one of 79 channels depends on the type of packet being set. The system returns to that channel only after hopping through the rest of the other channels. The hopping epoch is the dwell time multiplied by the number of channels. In the Bluetooth Frequency adaptive Hopping mode, the Bluetooth system eliminates channels in the channel set to avoid interference. The channel set can be reduced to as little as 20 channels.

In calculating the worst case dwell time, the worst case packet, per the Bluetooth Core Specification, was determined to be the **3-DH5** packet which occupies up to 5 time slots. In the Bluetooth system, one time slot is 0.625ms, therefore a **3-DH5** packet will occupy

3 x 5 x 0.625ms = 9.4ms.

The hopping epoch, i.e. a particular channel in the hop sequence is repeated, is

20 channels x 9.4ms = 188ms.

Since the pulse train is greater than 100ms, the duty cycle is calculated based on a 100ms window:

Duty Cycle = 9.4ms/100ms = 0.094

The **duty cycle correction** is therefore

$-20\log_{10}(0.094)$ = **20.5dB**

The tables below, which were taken from the Bluetooth Core Specification, show the different types of packets in the Bluetooth system.

Type	Payload (bytes)	FEC	CRC	Symmetric Max. Rate	Asymmetric Max. Rate
ID	na	na	na	na	na
NULL	na	na	na	na	na
POLL	na	na	na	na	na
FHS	18	2/3	yes	na	na

Link Control packets.

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Symmetric Max. Rate (kb/s)	Asymmetric Max. Rate (kb/s)	
						Forward	Reverse
DM1	1	0-17	2/3	yes	108.8	108.8	108.8
DH1	1	0-27	no	yes	172.8	172.8	172.8
DM3	2	0-121	2/3	yes	258.1	387.2	54.4
DH3	2	0-183	no	yes	390.4	585.6	86.4
DM5	2	0-224	2/3	yes	286.7	477.8	36.3
DH5	2	0-339	no	yes	433.9	723.2	57.6
AUX1	1	0-29	no	no	185.6	185.6	185.6
2-DH1	2	0-54	no	yes	345.6	345.6	345.6
2-DH3	2	0-367	no	yes	782.9	1174.4	172.8
2-DH5	2	0-679	no	yes	869.1	1448.5	115.2
3-DH1	2	0-83	no	yes	531.2	531.2	531.2
3-DH3	2	0-552	no	yes	1177.6	1766.4	235.6
3-DH5	2	0-1021	no	yes	1306.9	2178.1	177.1

ACL (Asynchronous Connection-oriented Logical) packets.

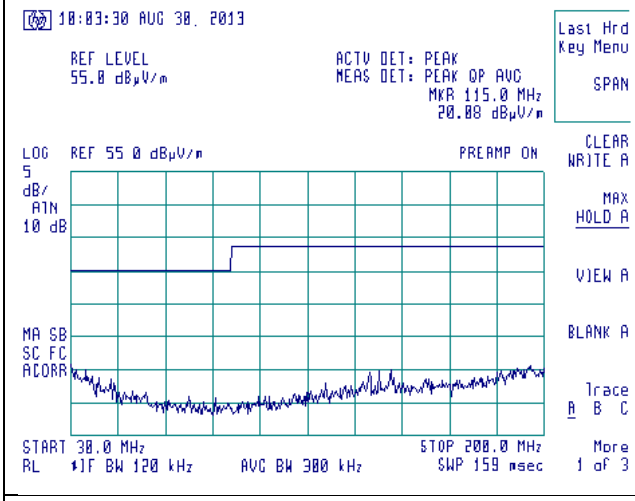
Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Symmetric Max. Rate (kb/s)
HV1	na	10	1/3	no	64.0
HV2	na	20	2/3	no	64.0
HV3	na	30	no	no	64.0
DV[1]	1 D	10+(0-9) D	2/3 D	yes D	64.0+57.6 D
EV3	na	1-30	No	Yes	96
EV4	na	1-120	2/3	Yes	192
EV5	na	1-180	No	Yes	288
2-EV3	na	1-60	No	Yes	192
2-EV5	na	1-360	No	Yes	576
3-EV3	na	1-90	No	Yes	288
3-EV5	na	1-540	No	Yes	864

Synchronous packets.

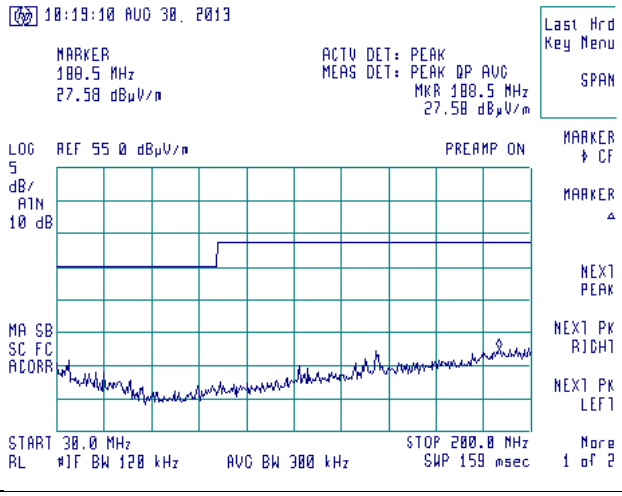
5.8 – Screen Captures of Radiated emissions.

The screen captures represent worst case emissions.

30MHz to 200MHz, 3m distance

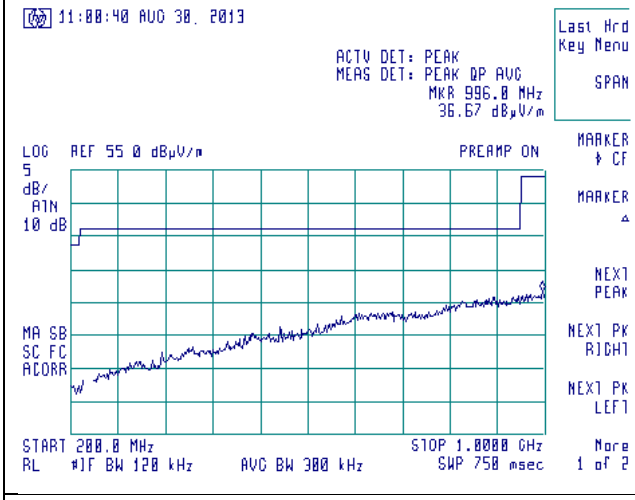


Horizontal Polarization

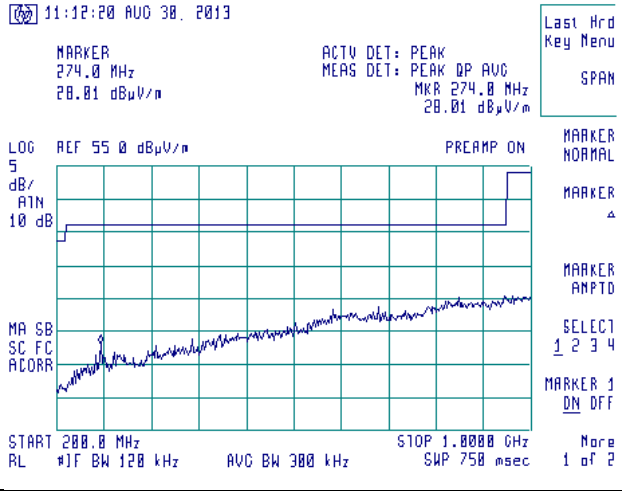


Vertical Polarization

200MHz to 1000MHz, 3m distance

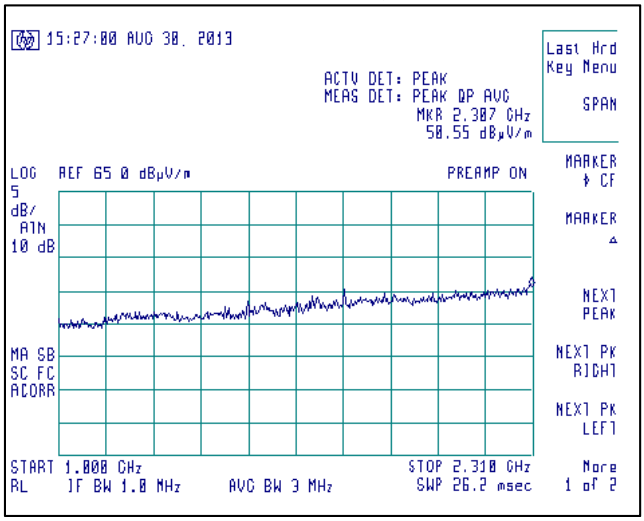


Horizontal Polarization

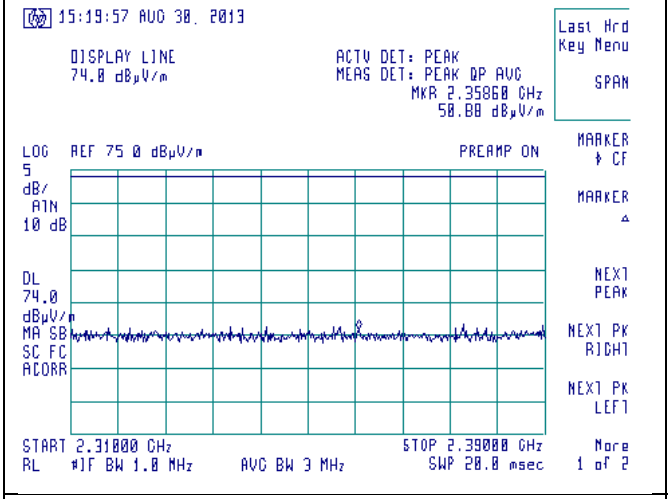


Vertical Polarization

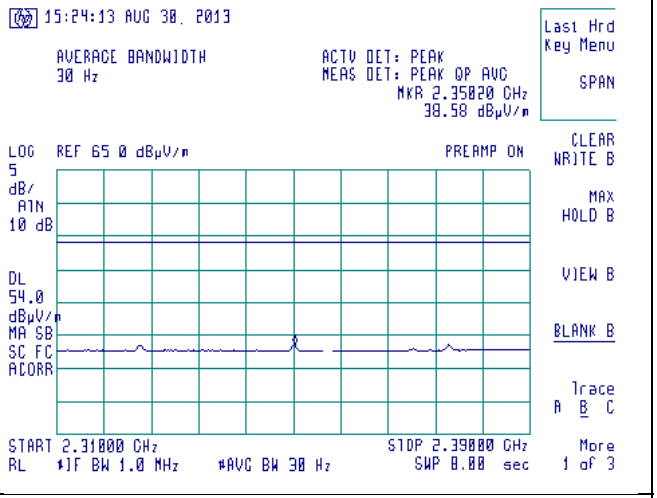
1000MHz to 2390MHz, 3m distance



2310MHz to 2390MHz, 3m distance

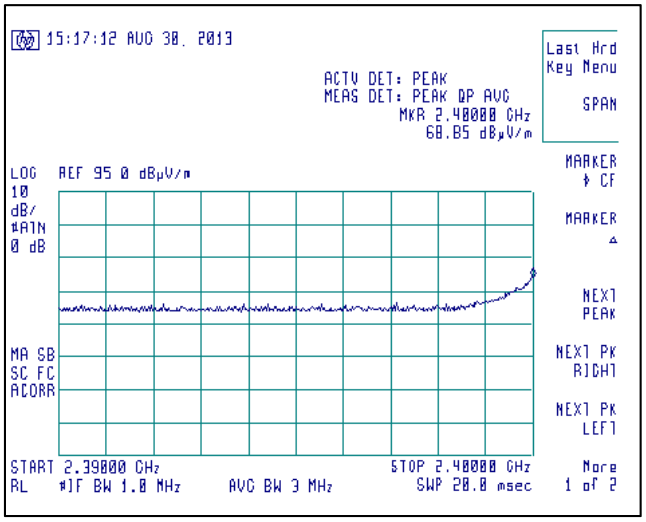


Peak

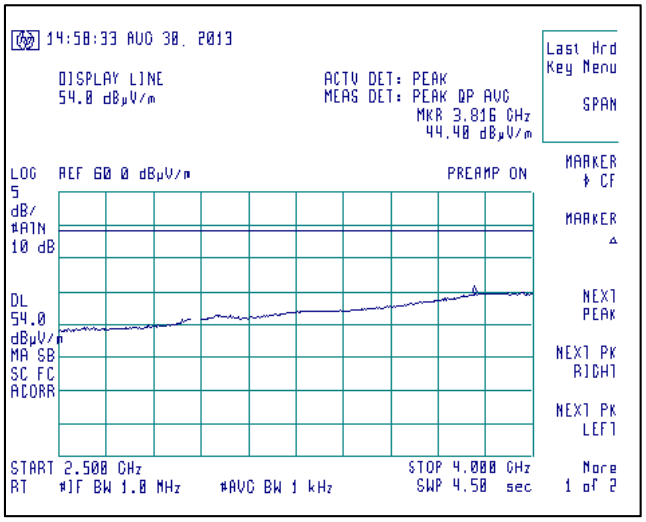


Average

2390 to 2400 MHz, 3m distance



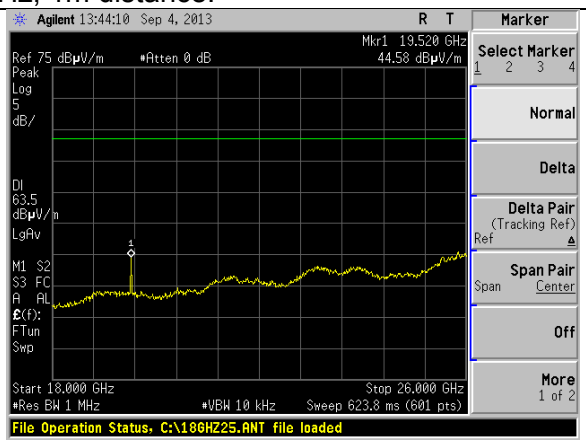
2500 to 4000 MHz, 3m distance



(Reduced video Bandwidth)

Note: The range 2483.5 to 2500 MHz is in section 8 of this report (band-Edges)

4000 MHz to 25000 MHz, 1m distance.

	
4000 MHz to 18000 MHz	18000 MHz to 26000 MHz

(Reduced video Bandwidth)

EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

6.1 Test Setup

THIS TEST WAS NOT REQUIRED; THE EUT IS BATTERY POWERED AND DOES NOT TRANSMIT/RECEIVE DURING CHARGING.

EXHIBIT 7. OCCUPIED BANDWIDTH

7.1 - Limits

For an FHSS system operating in the 2400 to 2483.5 MHz band, there are no limits for 20dB bandwidth.

7.2 - Method of Measurements

Industry Canada (IC RSS GEN 4.6.1) requires the measurement of the 99% bandwidth while CFR 47 part 15.247 requires the measurement of the 20dB bandwidth. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. A bandwidth measurement function that is built into the spectrum analyzer was used to measure the bandwidths.

7.3 - Test Data

A. GFSK

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2402.0	948.4	858.4
2440.0	944.8	850.5
2480.0	945.8	852.9

B. EDR2

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2402.0	1271.0	1177.4
2440.0	1240.0	1187.1
2480.0	1243.0	1195.0

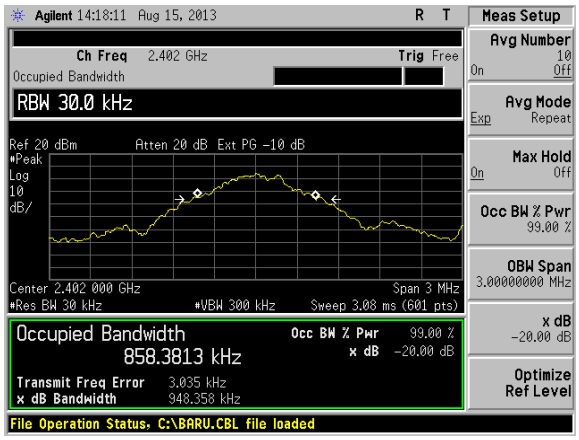
C. EDR3

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2402.0	1286.0	1168.9
2440.0	1276.0	1187.6
2480.0	1278.0	1195.0

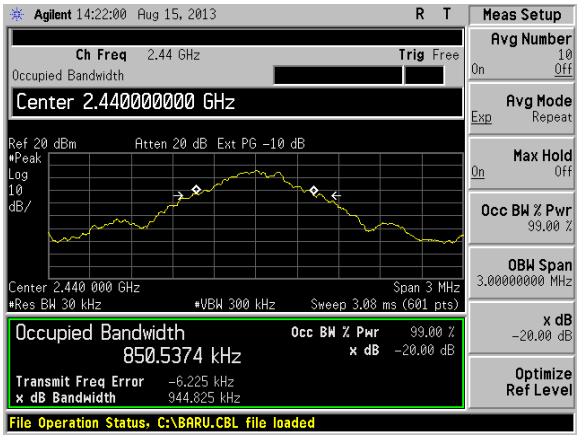
7.4 – Screen Captures

A. GFSK

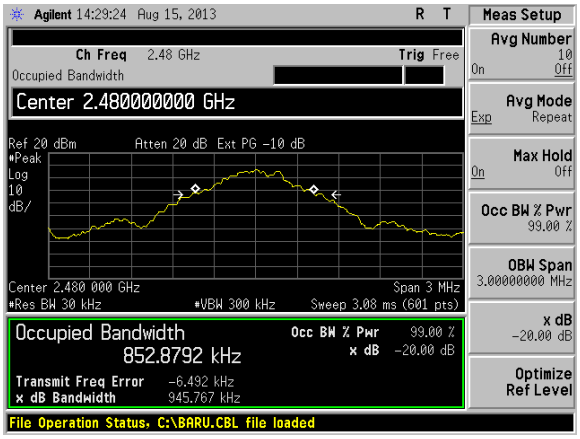
Channel 2402MHz



Channel 2440MHz

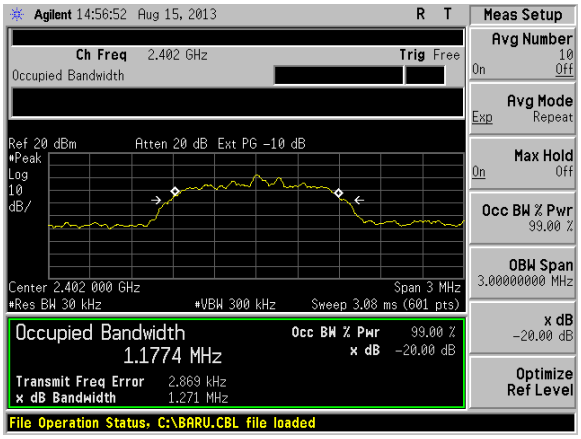


Channel 2480MHz

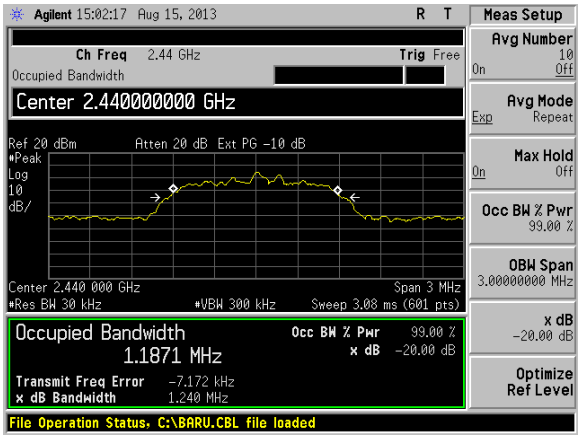


B. EDR2

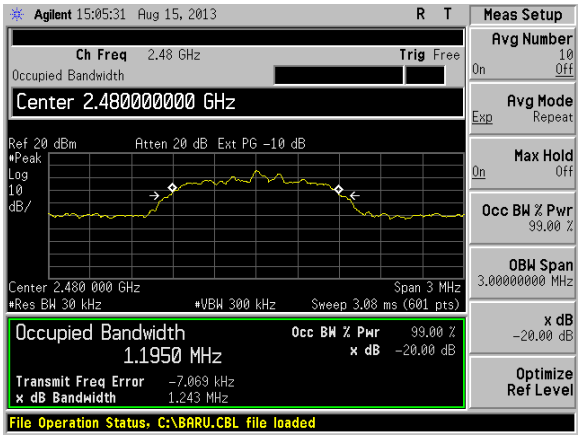
Channel 2402MHz



Channel 2440MHz

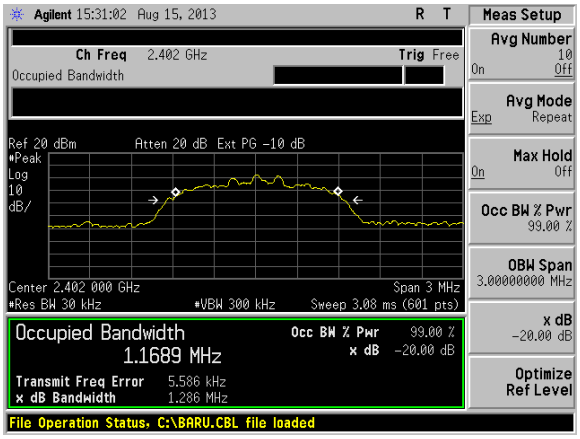


Channel 2480MHz

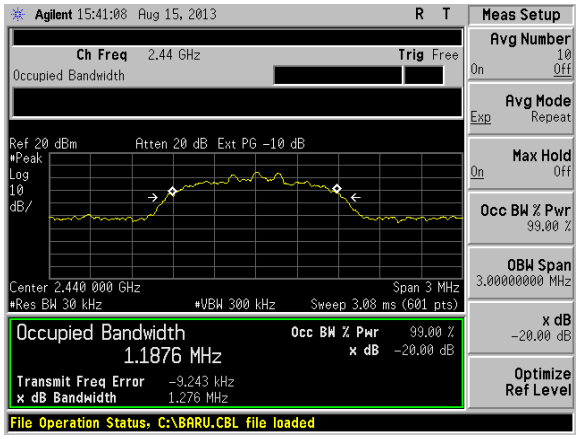


C. EDR3

Channel 2402MHz



Channel 2440MHz



Channel 2480MHz

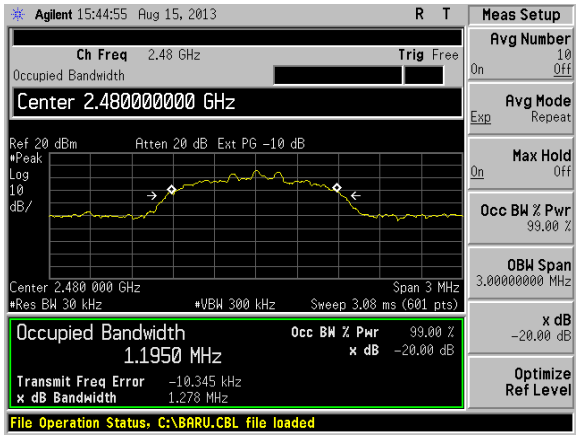


EXHIBIT 8. BAND EDGE MEASUREMENTS

8.1 - Method of Measurements

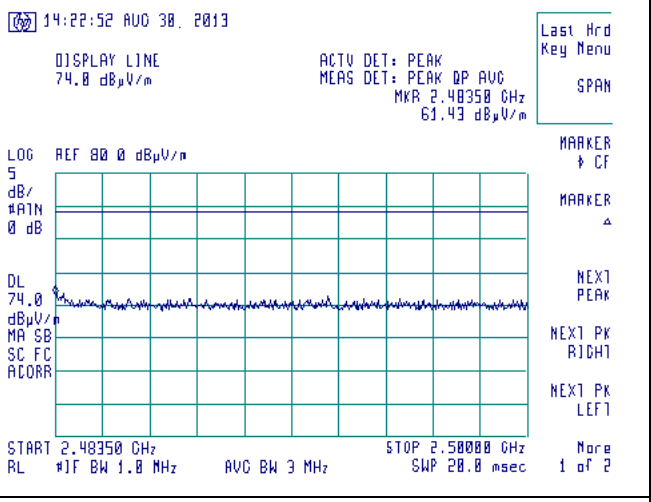
FCC 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in RSS GEN and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the 2400 – 2483.5 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

The Band-edge measurements were performed radiated and conducted. The conducted measurement of band-edge was performed to satisfy FCC 15.247(d). The radiated measurements were performed to satisfy the conditions of 15.205 restricted bands.

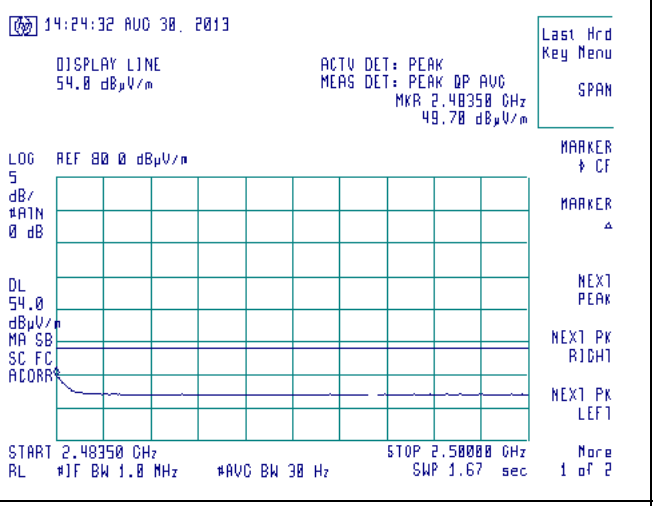
Conducted measurements of the spurious emission were performed with a measurement bandwidth of 100kHz while radiated measurements were performed with a measurement bandwidth of 1MHz.

8.2. Band-Edge captures.

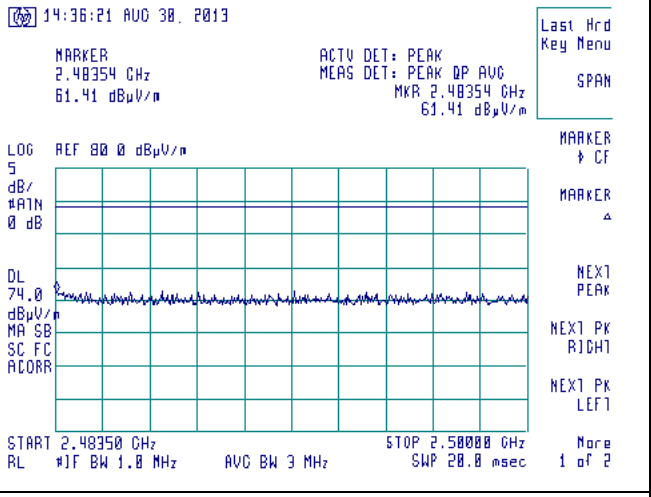
Radiated Band-edge restricted band (2483.5 to 2500 MHz):



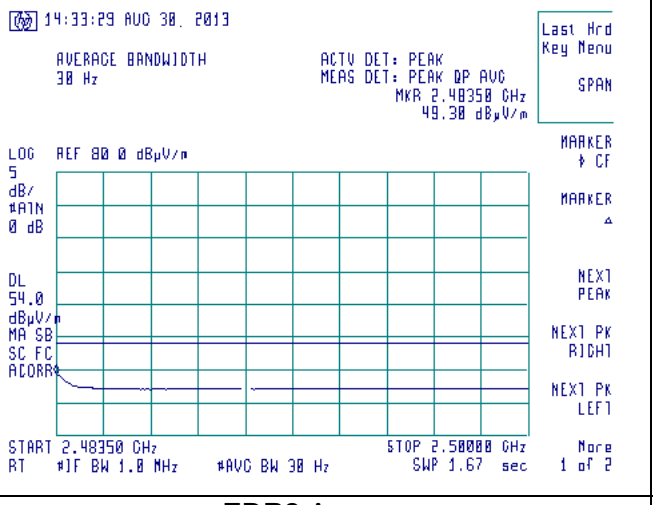
GFSK Peak



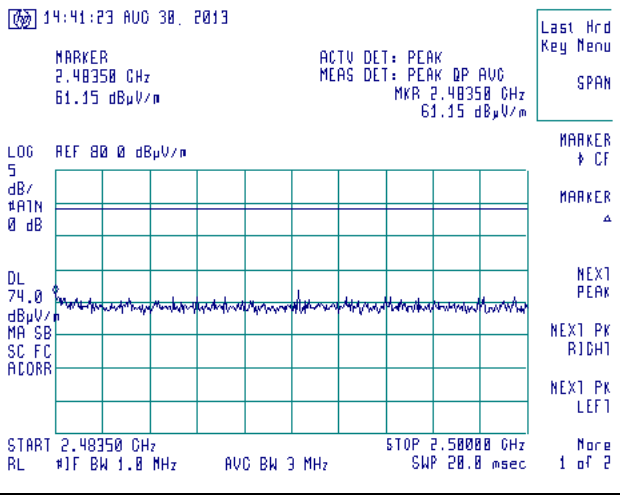
GFSK Average



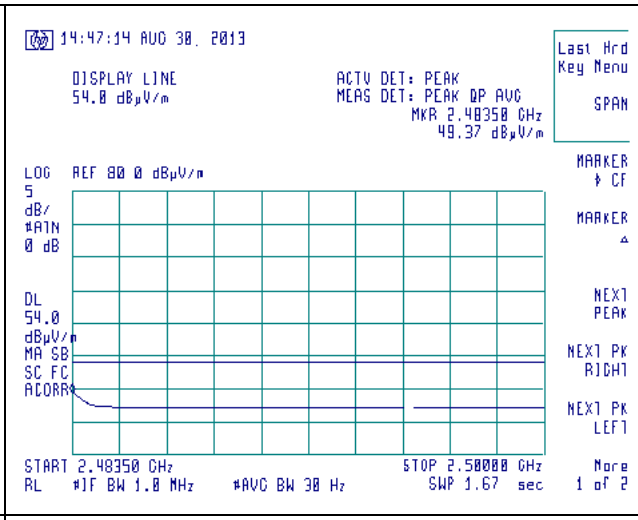
EDR2 Peak



EDR2 Average



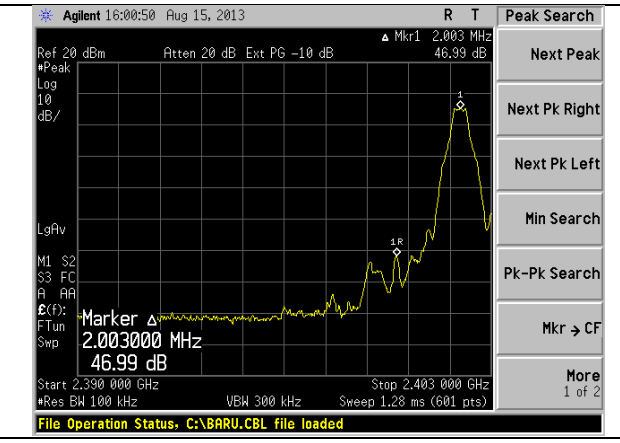
EDR3 Peak



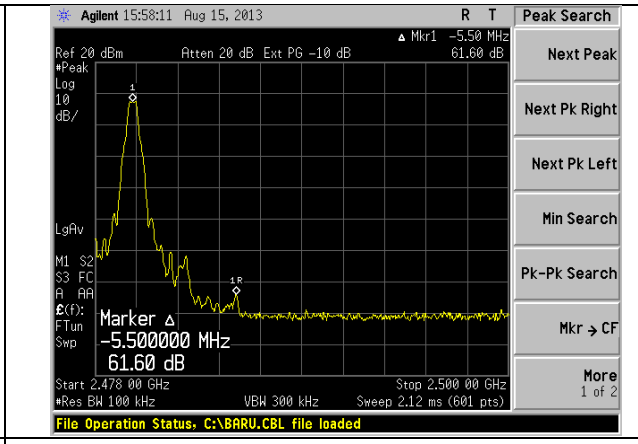
EDR3 Average

Conducted Band-edge:

A. GFSK

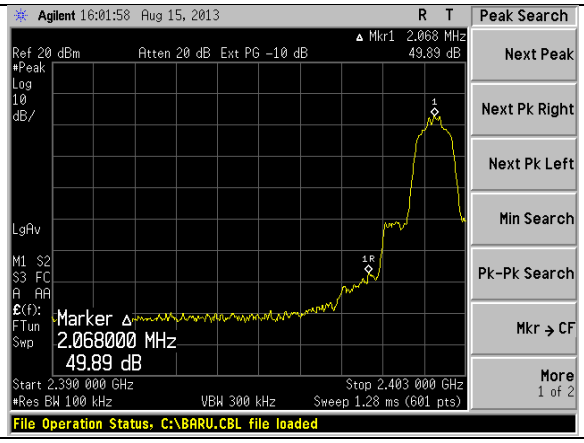


Lower band edge

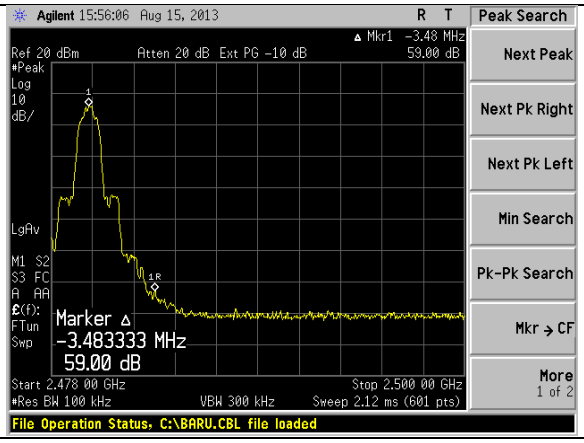


Upper band edge

B. EDR2

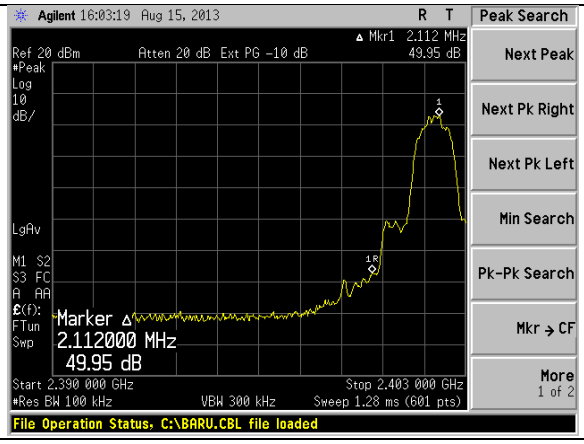


Lower band edge

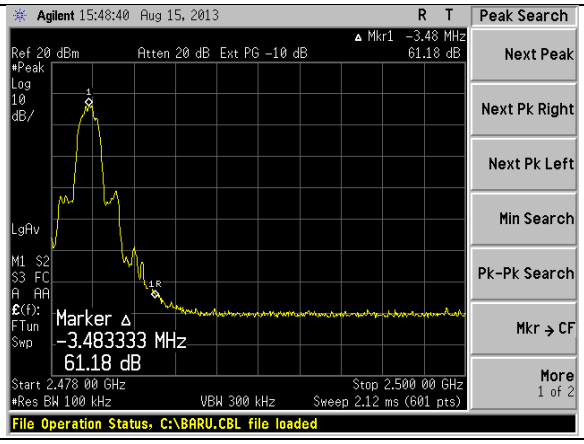


Upper band edge

C. EDR3

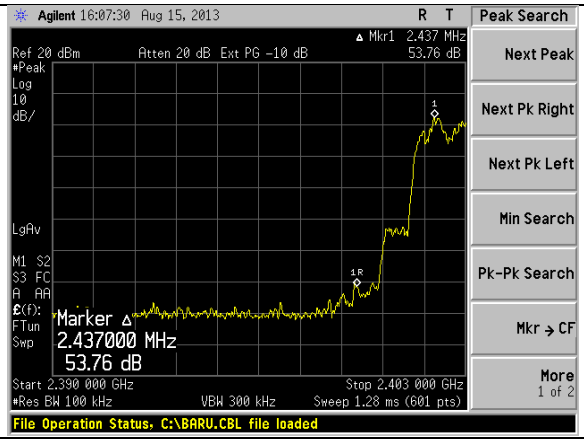


Lower band edge

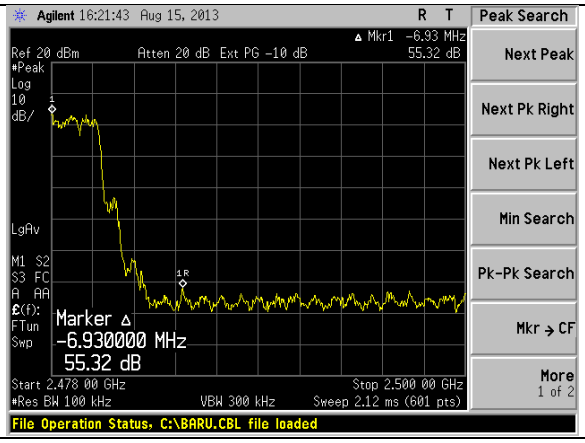


Upper band edge

D. Hopping mode.



Lower band edge



Upper band edge

Note:
The screen captures above are those of the EUT in EDR2 mode, being used to represent all the other Bluetooth modulation as worst case.

EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 - Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with the appropriate resolution bandwidth, with measurements from a peak detector presented in the chart below.

9.2 - Test Data

A. GFSK

Frequency (MHz)	SA reading (dBm)	Short Cable correction (dB)	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Margin (dB)
2402.0	5.3	0.7	6.0	3.98	30.0	24.0
2440.0	6.9	0.7	7.6	5.69	30.0	22.5
2480.0	7.5	0.7	8.2	6.65	30.0	21.8

B. EDR2

Frequency (MHz)	SA reading (dBm)	Short Cable correction (dB)	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Margin (dB)
2402.0	4.0	0.7	4.7	2.94	30.0	25.3
2440.0	6.0	0.7	6.7	4.68	30.0	23.3
2480.0	6.8	0.7	7.5	5.61	30.0	22.5

C. EDR3

Frequency (MHz)	SA reading (dBm)	Short Cable correction (dB)	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Margin (dB)
2402.0	4.2	0.7	4.9	3.08	30.0	25.1
2440.0	6.2	0.7	6.9	4.94	30.0	23.1
2480.0	7.0	0.7	7.7	5.86	30.0	22.3

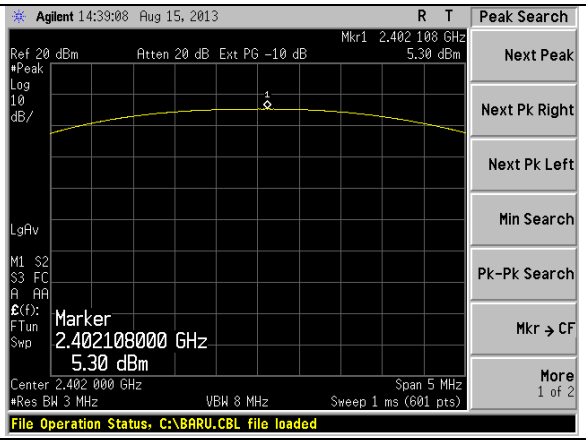
Note:

1. Reported data sample calculation (2402 MHz, EDR3):

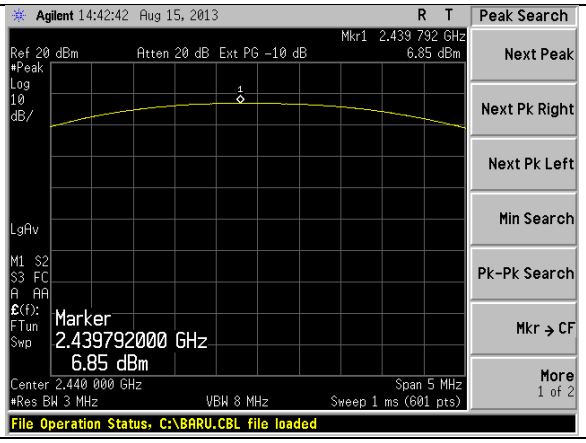
   Peak Output Power (dBm) = 4.2dBm + 0.7dB = **4.9dBm**

9.3 – Screen Captures

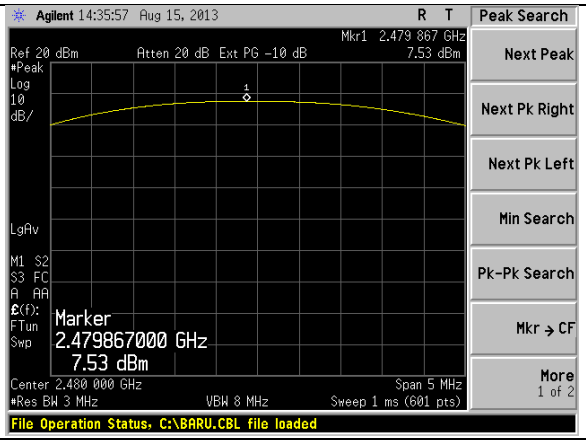
A. GFSK



Low Channel

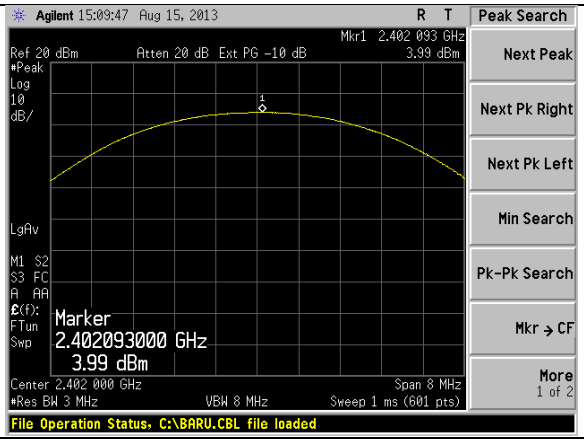


Middle Channel

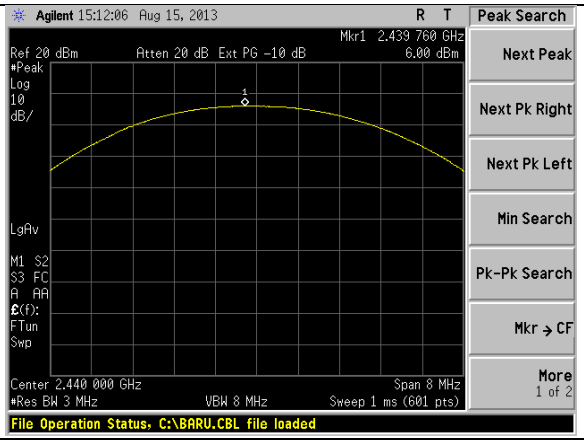


High Channel

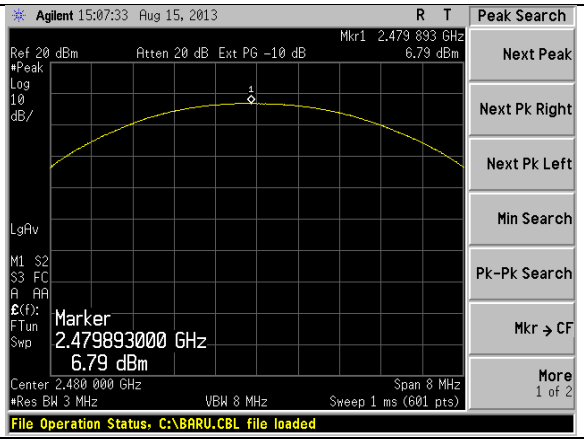
B. EDR2



Low Channel

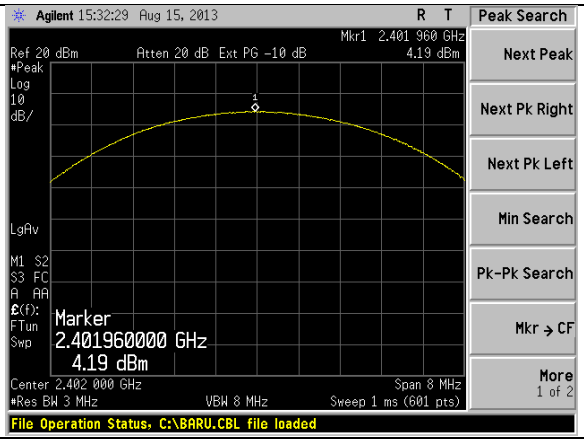


Middle Channel

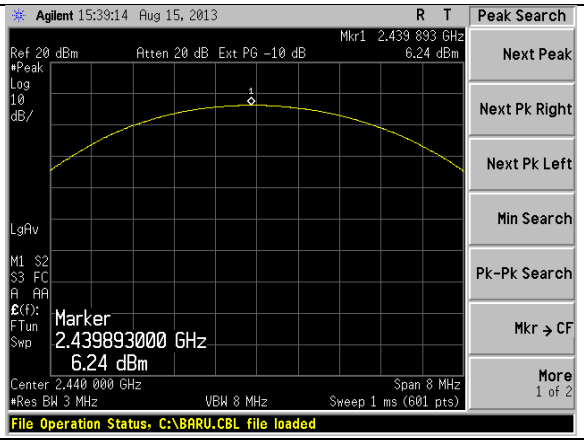


High Channel

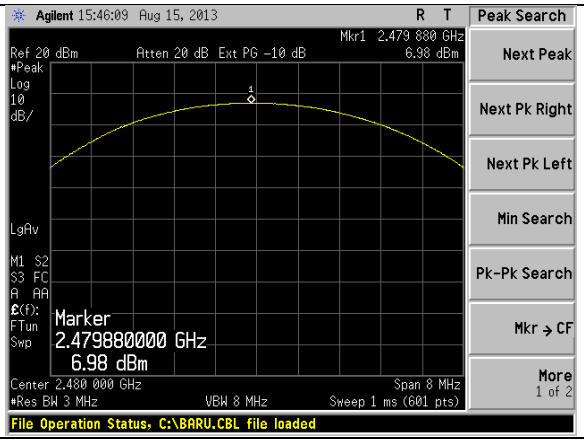
C. EDR3



Low Channel



Middle Channel



High Channel

EXHIBIT 10. CONDUCTED SPURIOUS EMISSIONS: 15.247(d)

10.1 - Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

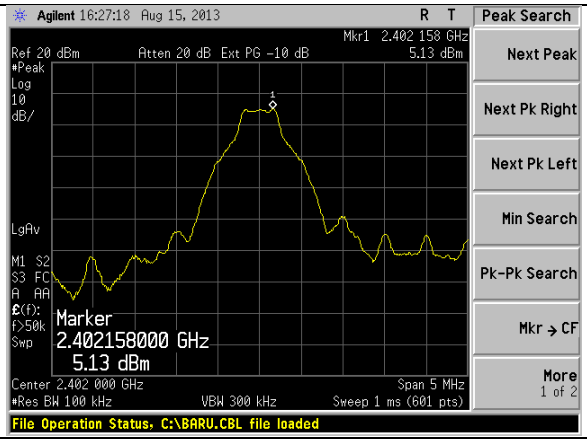
10.2 – Conducted Harmonic And Spurious RF Measurements

FCC Part 15.247(d) and IC RSS 210 A8.5 both require a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct readings of the measurements made without the need for any further corrections. A spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

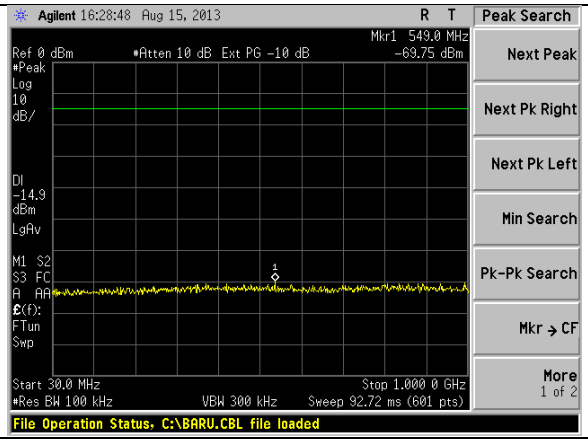
10.3 - Test Data

(Data shown is that of GFSK mode being worst case.

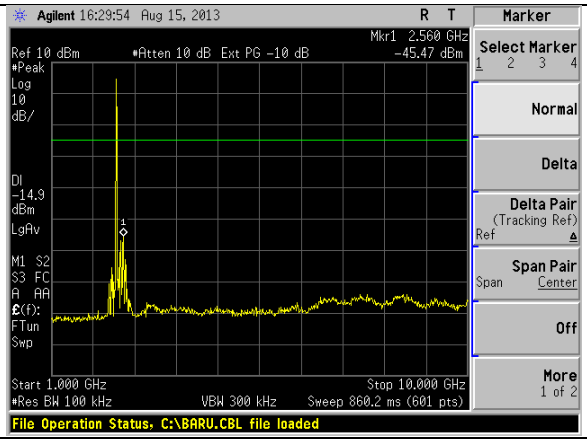
A. Low Channel



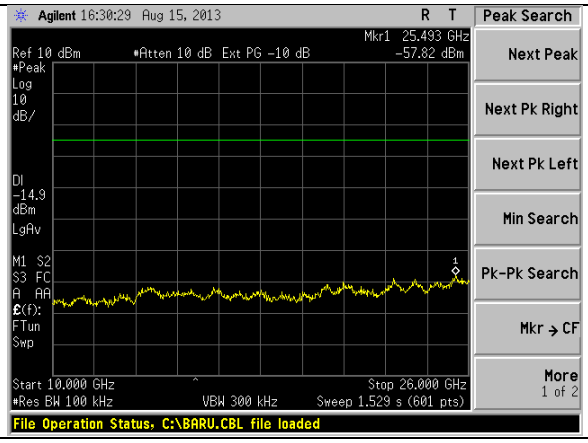
Fundamental in 100kHz



30 to 1000MHz

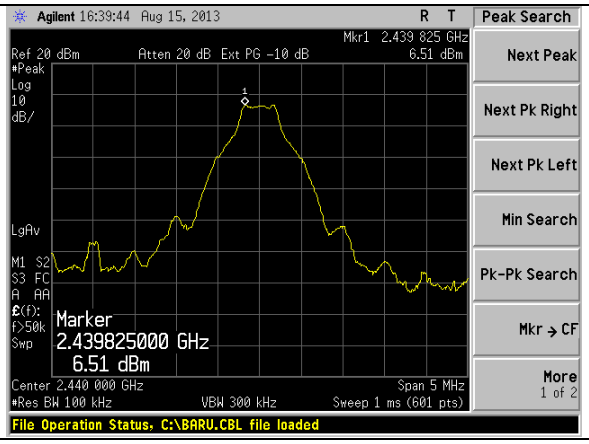


1000 to 10000 MHz

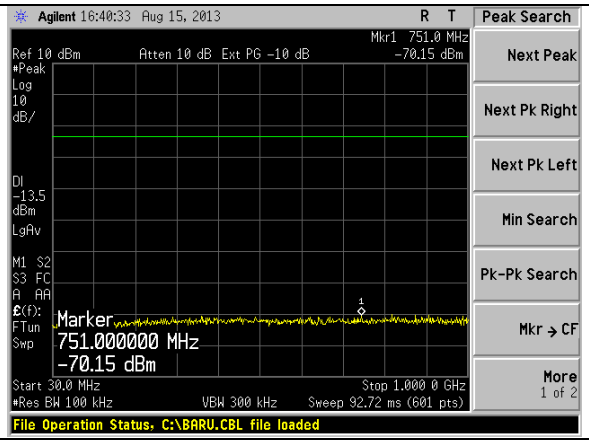


10000 to 26000

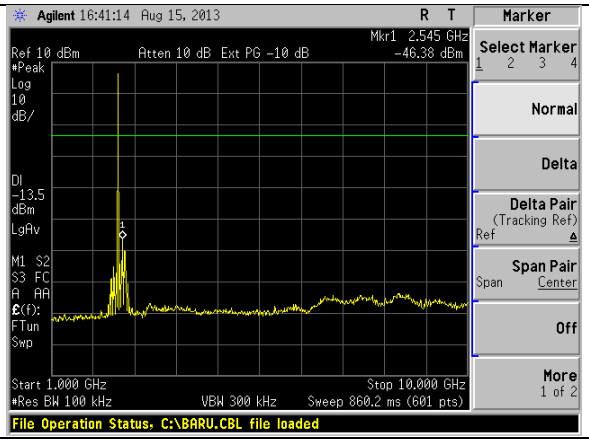
B. Middle Channel



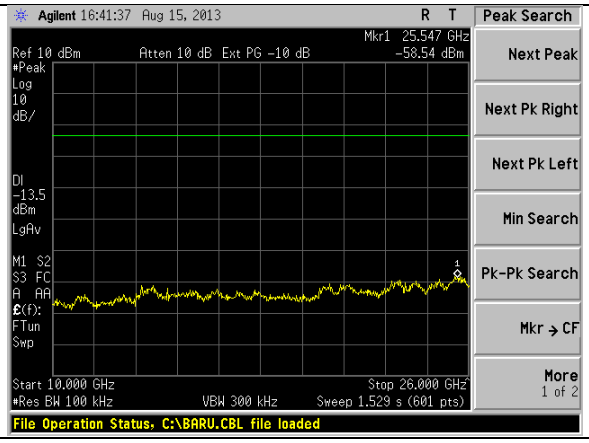
Fundamental in 100kHz



30 to 1000MHz

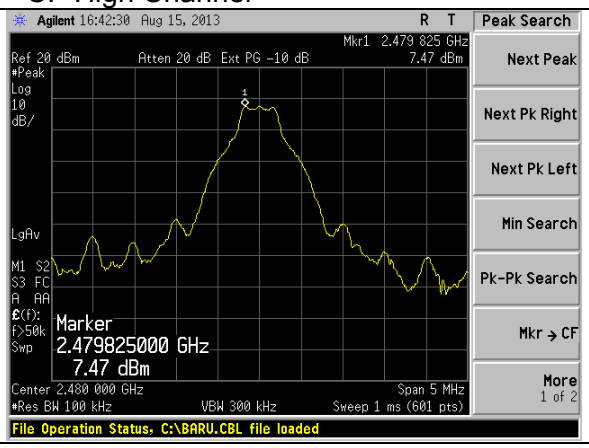


1000 to 10000 MHz

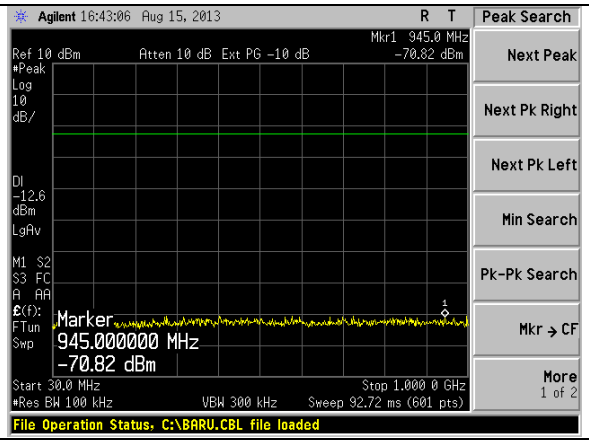


10000 to 26000

C. High Channel



Fundamental in 100kHz



30 to 1000MHz

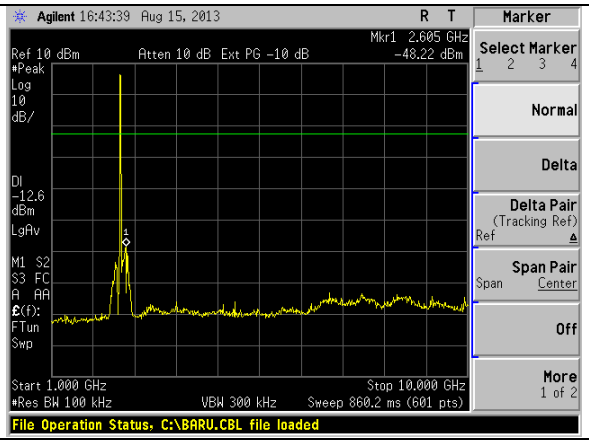
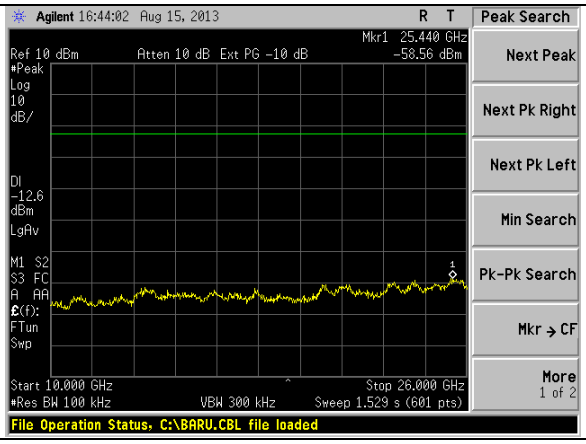
	
1000 to 10000 MHz	10000 to 26000

EXHIBIT 11. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

The power and frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied -15% from the nominal since it is a battery powered device.

	Supply Voltage					
	3.1		3.6		4.1	
	Frequency (HZ)	Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)	Power (dBm)
Low Chan	2401997930	5.3	2401998563	5.3	Note 1	Note 1
Mid Chan	2439997094	7.1	2439997207	7.1	Note 1	Note 1
High Chan	2479998084	7.6	2479997691	7.6	Note 1	Note 1

Note:

1. EUT is battery powered. It was not designed for supply voltage greater than its nominal/maximum voltage rating.

The maximum frequency deviation is:

633 Hz. (Better than 100 ppm)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.

EXHIBIT 12. CHANNEL PLAN AND SEPARATION

A spectrum analyzer was used with a resolution bandwidth of 1% of the span to measure the channel separation of the EUT.

The channel separation measured for this device **1008.7 kHz** which is greater than 2/3 of the 20dB bandwidth. The maximum 20dB bandwidth of the device, as reported in the previous section is 1286 kHz, therefore 2/3 of the 20dB bandwidth = 857.3 kHz. The following plots describe this spacing, and also establish the channel separation and plan.

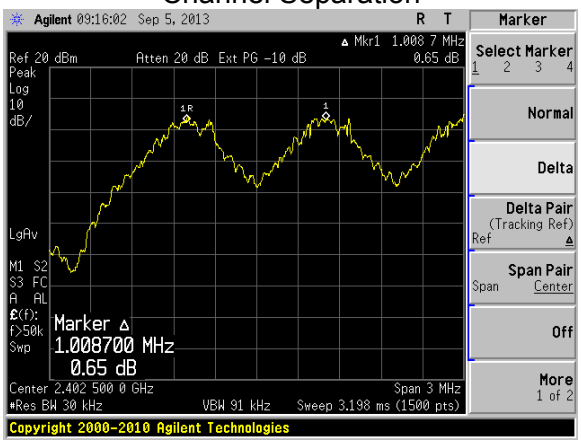
This EUT also satisfies the minimum number of hopping channels which is 15.

Span	Number of channels
2400 to 2420 MHz	18.5
2420 to 2440 MHz	20.0
2440 to 2460 MHz	20.0
2460 to 2483.5 MHz	20.5

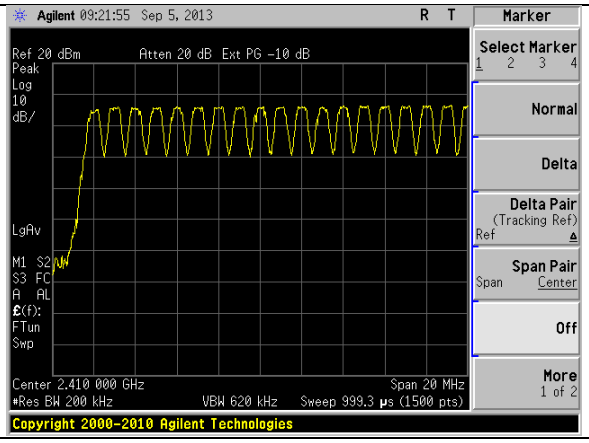
Total Number of channels	79.0

12.1 - Screen Captures

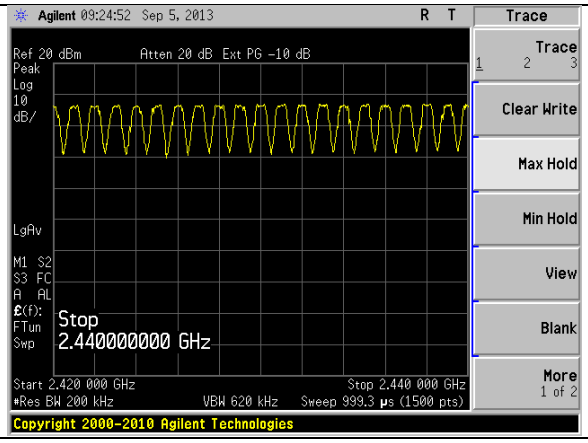
Channel Separation



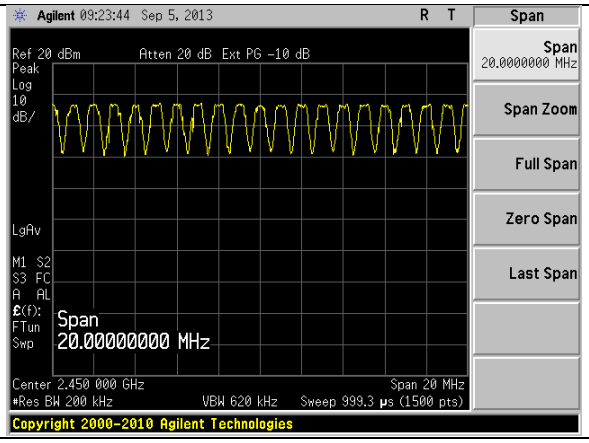
Number of channels



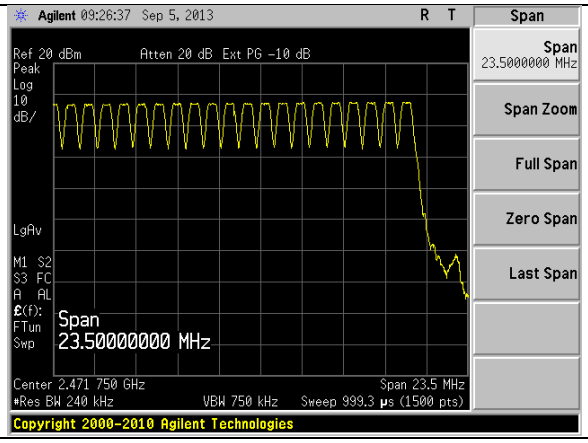
2400 – 2420 MHz



2420 – 2440 MHz



2440 – 2460 MHz



2460 – 2483.5 MHz

EXHIBIT 13. CHANNEL OCCUPANCY.

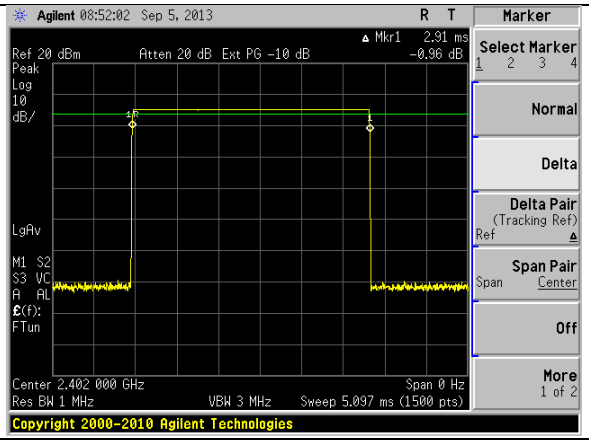
Part 15.247(a)(1)(i) requires an average channel occupancy, for this device, of no more than 400 milliseconds in a 31.6 second window .The channel occupancy for this EUT was measured using a spectrum analyzer, set to zero-span at the frequency of interest. With the analyzer in peak-hold mode, the transmission lengths can be measured by adjusting the sweep rate of the analyzer. A suitable sweep rate was used to measure the channel occupancy at the low, mid and high channels. The longest time a single transmission will occur on a single channel is **2.92 ms**. The number of occurrences in a **5 seconds** window is **20**(twenty). In a 31.6 seconds window, there will be 126.4 occurrences. Therefore the total time occupancy in a 31.6 seconds window is

126.4 x 2.92ms = **369.1ms**

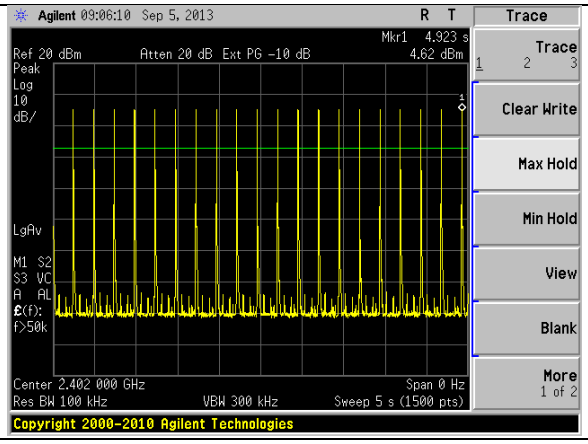
Channel (MHz)	Occupancy (ms)	Meas window (ms)	Occurances in 5s	Occupancy in 31.6s	Limit (ms)
2402.0	2.91	5.0	20.0	367.8	400.0
2440.0	2.92	5.0	20.0	369.1	400.0
2480.0	2.92	5.0	20.0	369.1	400.0

13.1 Time occupancy captures.

Channel 2402MHz

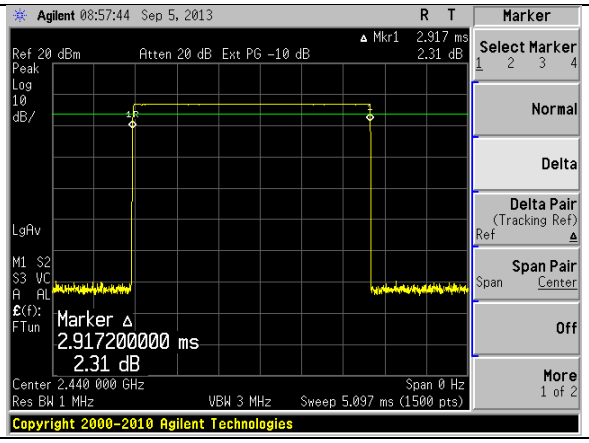


Single transmission

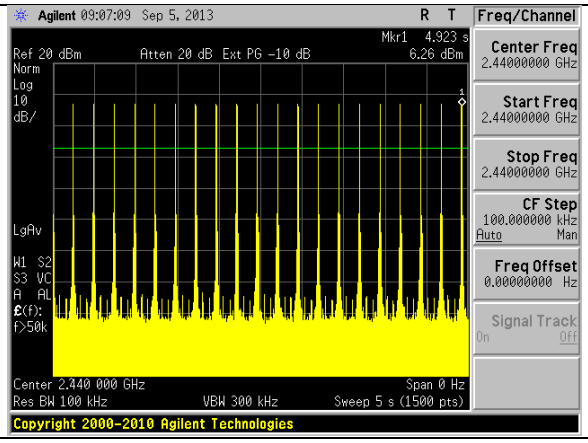


Maximum Occupancy in 5s

Channel 2440 MHz

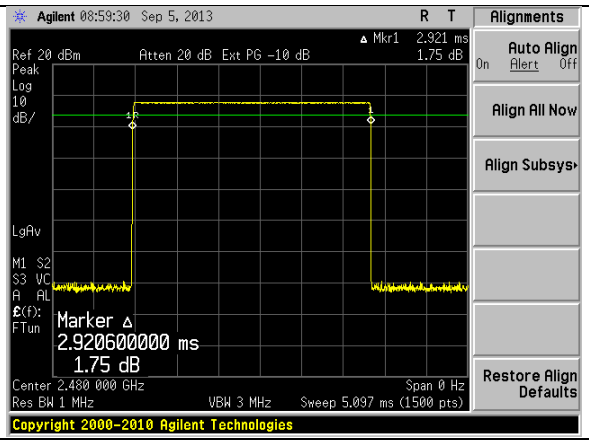


Single transmission

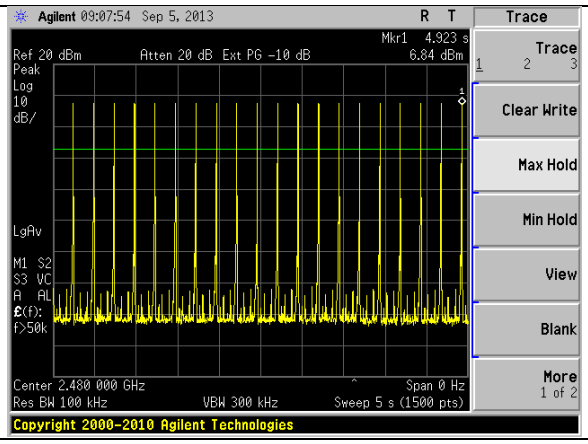


Maximum Occupancy in 5s

Channel 2480 MHz



Single transmission



Maximum Occupancy in 5s

EXHIBIT 14. EQUAL CHANNEL USAGE

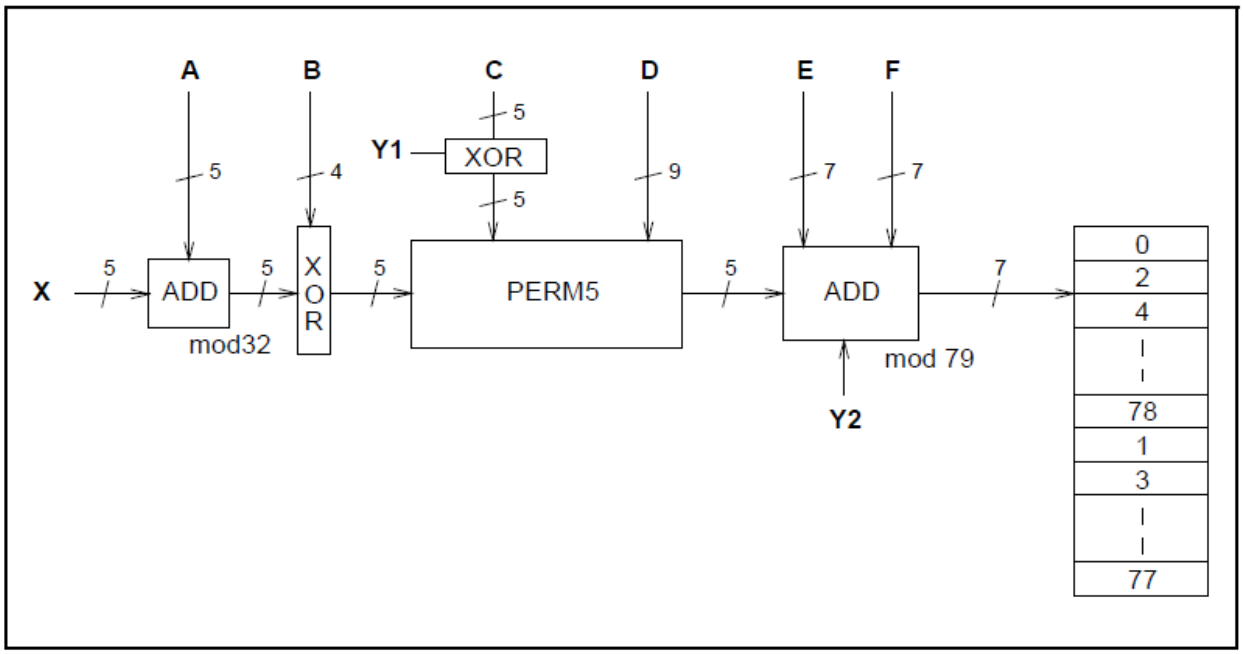
(Supplied by Customer)

The transceiver implemented in the EUT is a Bluetooth core specification V2.1 + EDR hence satisfies this requirement.

EXHIBIT 15. PSEUDORANDOM HOPPING SEQUENCE.

(Supplied by Customer; referencing Bluetooth Core specifications.)

Bluetooth devices use a hopping kernel to generate a hopping map. The figure below represents the basic hop selection kernel for the hop system. The output of the adder addresses a bank of 79 registers. The registers are loaded with the synthesizer code words corresponding to the hop frequencies 0 to 78. Note that the upper half of the bank contains the even hop frequencies, whereas the lower half of the bank contains the odd hop frequencies.



The X input determines the phase in the 32-hop segment, whereas Y1 and Y2 selects between master-to-slave and slave-to-master. The inputs A to D determine the ordering within the segment, the inputs E
and F determine the mapping onto the hop frequencies. The kernel addresses a register containing the RF channel indices. This list is ordered so that first all even RF channel indices are listed and then all odd hop frequencies. In this way, a 32-hop segment spans about 64 MHz and visits these hops in a pseudo-random order. Next, a different 32-hop segment is chosen, etc. When the basic channel hopping sequence is selected, the output constitutes a pseudo-random sequence that slides through the 79 hops. The principle is depicted below:

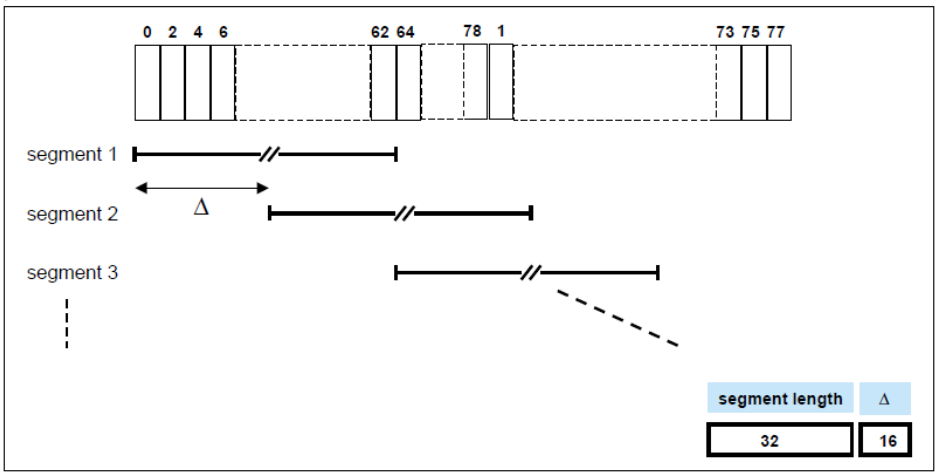


EXHIBIT 16. RECEIVER SYNCHRONIZATION AND INPUT BANDWIDTH.

(Supplied by Customer; referencing Bluetooth Core specifications.)

During the pairing process, the Master sets the data rate with the slave device. This will then determine the bandwidth of the receiver input. If a request is made for a change in data rate after pairing, the receiver bandwidth changes accordingly. This is set in the Bluetooth protocol.

During typical operation a physical radio channel is shared by a group of devices that are synchronized to a common clock and frequency hopping pattern. One device provides the synchronization reference and is known as the master. All other devices synchronized to a master's clock and frequency hopping pattern are known as slaves. A group of devices synchronized in this fashion form a piconet. This is the fundamental form of communication in the Bluetooth BR/EDR wireless technology.

Devices in a piconet use a specific frequency hopping pattern, which is algorithmically determined by certain fields in the Bluetooth address and clock of the master. The basic hopping pattern is a pseudo-random ordering of the 79 frequencies, separated by 1 MHz, in the ISM band. The hopping pattern can be adapted to exclude a portion of the frequencies that are used by interfering devices.

Each packet starts with an access code. If a packet header follows, the access code is 72 bits long, otherwise the access code is 68 bits long. This access code is used for synchronization, DC offset compensation and identification. The access code identifies all packets exchanged on the channel of the piconet: all packets sent in the same piconet are preceded by the same channel access code. In the receiver of the Bluetooth unit, a sliding correlator correlates against the access code and triggers when a threshold is exceeded. This trigger signal is used to determine the receive timing.

Slaves maintain an estimate of the master's native clock by adding a timing offset to the slave's native clock. This offset shall be updated each time a packet is received from the master. By comparing the
exact RX timing of the received packet with the estimated RX timing, slaves shall correct the offset for any timing misalignments. Since only the channel access code is required to synchronize the slave, slave RX timing can be corrected with any packet sent in the master-to-slave transmission slot.

APPENDIX A – Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 16-Jul-2013 Type Test : Radiated Measurements Job # : C-1754

Prepared By: Aidi Customer : Yurbuds Quote #: 313174

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	2/11/2013	2/11/2014	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	2/11/2013	2/11/2014	Active Calibration
3	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	12/12/2012	12/12/2013	Active Calibration
4	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
6	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	8/7/2013	8/7/2014	Active Calibration
7	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration
8	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	System	System	System
9	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/29/2013	1/29/2014	Active Calibration
10	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	2/1/2013	2/1/2014	Active Calibration
11	AA 960154	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-02	7/19/2013	7/19/2014	Active Calibration
12	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	WLA622-4 / 3160-09	123001	9/26/2012	9/26/2013	Active Calibration

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 16-Jul-2013 Type Test : Conducted Measurements Job # : C-1754

Prepared By: Aidi Customer : Yurbuds Quote #: 313174

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	System	System	System
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration

Project Engineer: Quality Assurance:

APPENDIX B – Test Standards: CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
ANSI C63.10	2009		
FCC 47 CFR, Parts 0-15	2013		
FCC Public Notice DA 00-705	2000		
RSS GEN	2010		
RSS 210	2010		

Updated on 11-22-11 P=Project FD= Final Draft

APPENDIX C - Uncertainty Statement

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	*3 – Meter chamber, Biconical Antenna*	*4.82 dB*
Radiated Emissions	*3-Meter Chamber, Log Periodic Antenna*	*4.88 dB*
Radiated Emissions	*3-Meter Chamber, Horn Antenna*	*4.85 dB*
Radiated Emissions	*10-Meter OATS, Biconical Antenna*	*4.32 dB*
Radiated Emissions	*10-Meter OATS, Log Periodic Antenna*	*3.63 dB*
Absolute Conducted Emissions	*Agilent PSA/ESA Series*	*1.38 dB*
AC Line Conducted Emissions	*Shielded Room/EMCO LISN*	*3.20 dB*
Radiated Immunity	*3 Volts/Meter in 3-Meter Chamber*	*2.05 Volts/Meter*
Conducted Immunity	*3 Volts level*	*2.33 V*
EFT Burst, Surge, VDI	*230 VAC*	*54.4 V*
ESD Immunity	*Discharge at 15kV*	*3200 V*
Temperature/Humidity	*Thermo-hygrometer*	*0.64° / 2.88 %RH*