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TEST REPORT

SCOPE OF WORK
FCC TESTING–1830

REPORT NUMBER
180516024SZN-001

ISSUE DATE **[REVISED DATE]**

23 August 2018 [----------]

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TEST REPORT

Intertek Report No.: 180516024SZN-001

Microsoft Corporation

Application
For
Certification

FCC ID: C3K1830

Bluetooth Accessory

Model: 1830

2.4GHz Transceiver

Report No.: 180516024SZN-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-17]

Prepared and Checked by:

Rui Zhou
Project Engineer

Approved by:

Kidd Yang
Technical Supervisor
Date: 23 August 2018

Revision History

Report No.	Version	Description	Issued Date
180516024SZN-001	Rev.01	Initial issue of report	02 August 2018
180516024SZN-001	Rev.02	Second issue of report	17 August 2018
180516024SZN-001	Rev.03	Third issue of report	23 August 2018

LIST OF EXHIBITS

MEASUREMENT/TECHNICAL REPORT

Bluetooth Accessory

Model: 1830

FCC ID: C3K1830

This report concerns (check one) Original Grant ___X___ Class II Change ____

Equipment Type: DSS - Part 15 Spread Spectrum Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No ___X___

If yes, defer until : _____
date

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No ___X___

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-01-17] Edition] provision.

Report prepared by:

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Table of Contents

EXHIBIT 1

SUMMARY OF TEST RESULTS

1.0 Summary of Test results

Applicant: Microsoft Corporation

Address: One Microsoft Way Redmond, WA 98052 USA

Bluetooth Accessory

Model: 1830

FCC ID: C3K1830

TEST ITEM	REFERENCE	RESULTS
Max. Output power	15.247(b)(3)	Pass
20 dB Bandwidth	15.247(a)(1)	Pass
Number of Hopping Frequencies	15.247(a)(1)	Pass
Carrier Frequency Separation	15.247(a)(1)	Pass
Dwell Time	15.247(a)(1)	Pass
Out of Band Antenna Conducted Emission	15.247(d)	Pass
Radiated Emission in Restricted Bands	15.247(d)	Pass
AC Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass (See Notes)

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

EXHIBIT 2

GENERAL DESCRIPTION

2.0 General Description

2.1 Product Description

The Equipment Under Test (EUT) is a Bluetooth Accessory with Bluetooth function operating at 2402-2480MHz. For more detailed features description, please refer to the user's manual.

Bluetooth Version: 4.1 (dual-mode)
Antenna Type: Integral antenna
Antenna Gain: 2 dBi
Modulation Type: GFSK, π/4-DQPSK and 8-DPSK

For electronic filing, the brief circuit description is saved with filename: Model 1830 Operational Description.pdf.

2.2 Related Submittal(s) Grants

This is an application for certification of transceiver for the Bluetooth Accessory which has Bluetooth function (classic Bluetooth mode), and for the BLE mode was tested and demonstrated in report 180516024SZN-002.

2.3 Test Methodology

All measurements were performed according to the procedures in ANSI C63.10: 2013 and KDB 558074 D01 v04. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. All other measurements were made in accordance with the procedures in part 15 of CFR 47.

2.4 Test Facility

The Semi-anechoic chamber and shielding room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 1F/2F, Building B, QiaoAn Scientific Technology Park, Shangkeng Community, Guanhu Subdistrict, Longhua District, Shenzhen, P.R. China. This test facility and site measurement data have been fully placed on file with File Number: CN1188.

EXHIBIT 3

SYSTEM TEST CONFIGURATION

3.0 System Test Configuration

3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables were manipulated to produce worst case emissions. Only the worst case data was reported.

All packets DH1, DH3 & DH5 mode in modulation type GFSK, π/4-DQPSK and 8-DPSK were tested and only the worst data was reported in this report.

For maximizing emissions, the EUT was rotated through 360°, the EUT was placed on the styrene turntable with 0.8m up to 1GHz and 1.5 m above 1GHz. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

The unit was placed at the center of turntable and the rear of unit was flushed with the rear of the styrene table.

Radiated emission measurement were performed the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the styrene table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

3.2 EUT Exercising Software

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

The parameters of test software setting:
During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

Test Tool:

Description	Manufacturer	Name	Version
EMI Test Software	R&S	EMC32-ME+	V1.0

3.3 Special Accessories

N/A.

3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Measurement Uncertainty	Uncertainty
Occupied Channel Bandwidth	±5%
RF Output Power	±1.5dB
Conducted Unwanted Emission	±3.0dB
Spurious emission (Above 1GHz)	±6.0dB
Radiated emission (Up to 1GHz)	±4.8dB
AC Conducted emission	±3.6 dB
Temperature	±1°C
Humidity	±5%

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

3.5 Equipment Modification

Any modifications installed previous to testing by Microsoft Corporation will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

3.6 Support Equipment List and Description

This product was tested in the following configuration:

Refer List:

Description	Manufacturer	Model No.
USB A-C Cabel (Provided by Applicant)	N/A	Shielded, 135cm
PC (Provided by Intertek)	HP	430
AC Adaptor (Provided by Intertek)	HMD Global Oy	FC0200

EXHIBIT 4

MEASUREMENT RESULTS

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830

4.0 Measurement Results

4.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

4.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB

FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dBµV/m

Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830

4.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: 1830 Test Setup Photos. pdf.

4.1.3 Radiated Emissions- FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

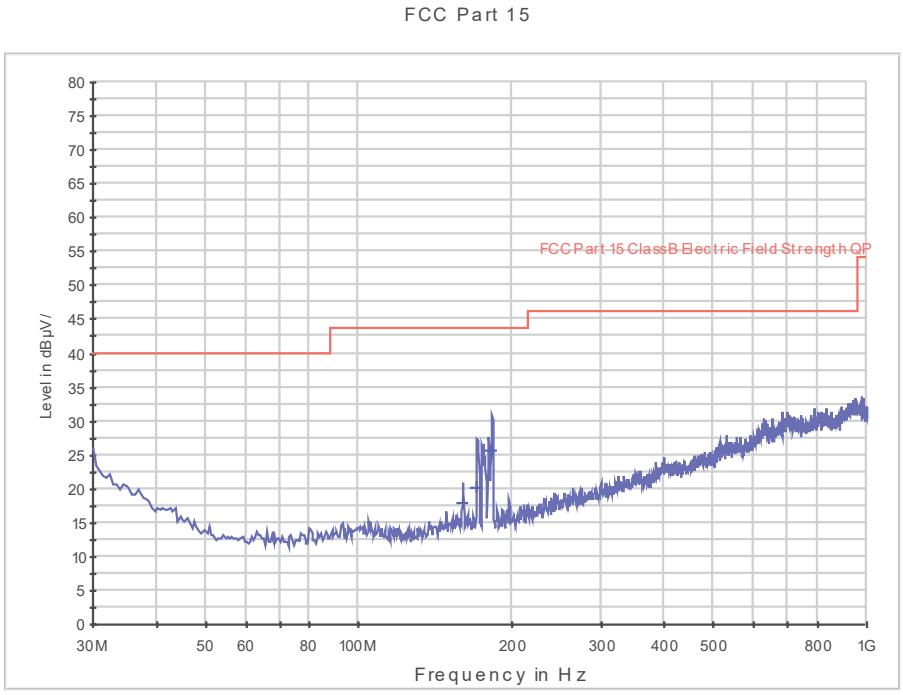
Worst Case Radiated Emission

at 905.910 MHz

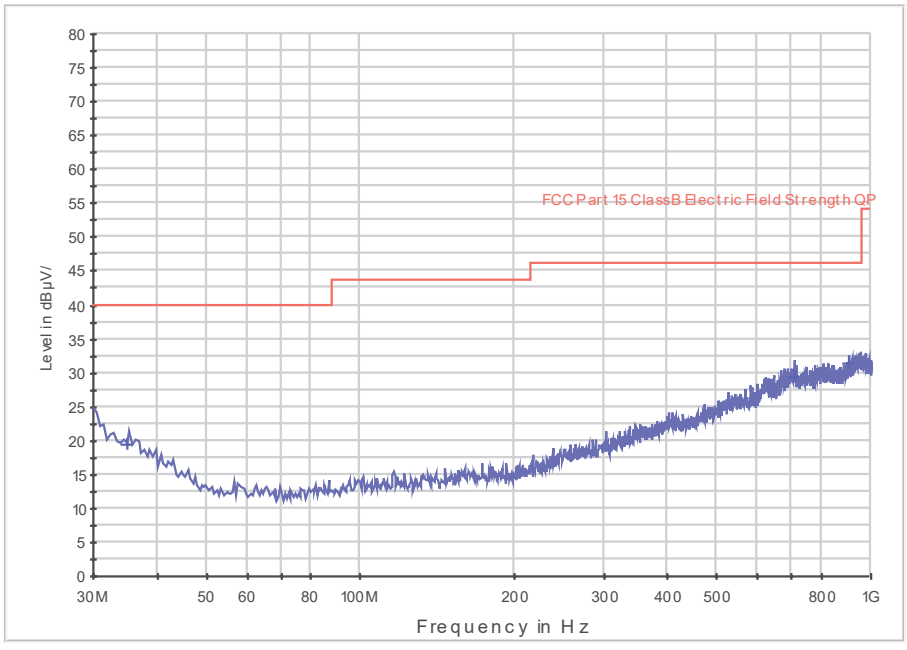
Judgement: Passed by 14.6 dB

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting(2402MHz)

ANT Polarity: Horizontal



ANT Polarity: Vertical



Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting(2402MHz)

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	160.465	26.6	20.0	11.3	17.9	43.5	-25.6
Horizontal	171.135	29.4	20.0	10.9	20.3	43.5	-23.2
Horizontal	183.000	34.3	20.0	11.4	25.7	43.5	-17.8
Vertical	35.000	24.0	20.0	15.3	19.3	40.0	-20.7
Vertical	707.545	24.0	20.0	25.3	29.3	46.0	-16.7
Vertical	905.910	24.8	20.0	26.6	31.4	46.0	-14.6

NOTES:
1. Quasi-Peak detector is used for frequency below 1GHz.
2. All measurements were made at 3 meters.
3. Negative value in the margin column shows emission below limit.
4. All emissions are below the QP limit.
5. The spurious emissions were very low against the limit in the frequency range 9KHz to 30MHz. The amplitude of spurious emissions that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting(2402MHz)

4.1.4 Transmitter Spurious Emissions (Radiated) - FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

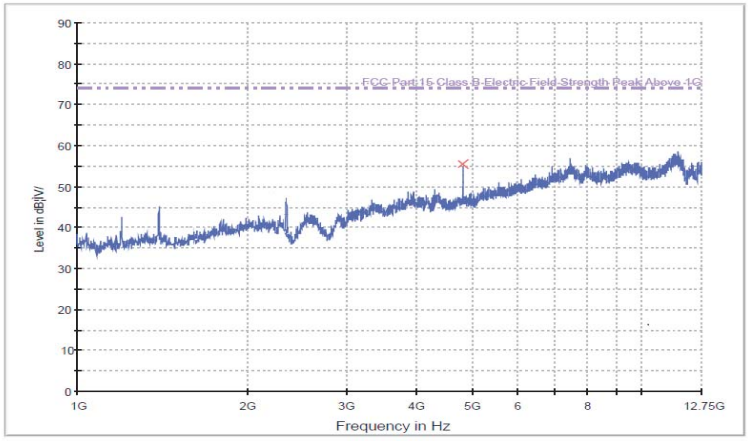
Worst Case Radiated Emission

at 4960.000 MHz

Judgement: Passed by 16.8 dB

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting (2402MHz)

Radiated Emissions



Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2402.000	109.2	36.7	28.1	100.6	/	/
Horizontal	*4804.000	58.7	36.8	33.5	55.4	74.0	-18.6

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2402.000	109.2	36.7	28.1	22.5	78.1	/	/
Horizontal	*4804.000	58.7	36.8	33.5	22.5	32.9	54.0	-21.1

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters.

3. Negative value in the margin column shows emission below limit.

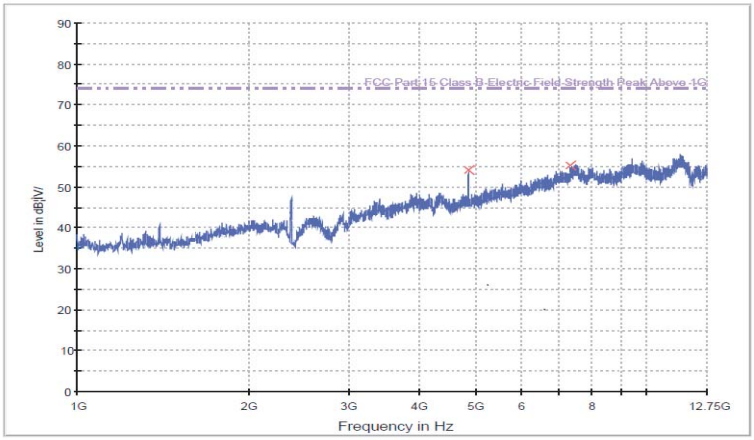
4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205 and RSS Gen (issue 4) - 8.10. The corresponding limit as per 15.209 and RSS Gen (issue 4) - 8.9 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting (2440MHz)

Radiated Emissions



Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*4882.000	57.4	36.7	33.4	54.1	74.0	-19.9
Horizontal	*7323.000	55.0	36.6	36.8	55.2	74.0	-18.8

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*4882.000	57.4	36.7	33.4	22.5	31.6	54.0	-22.4
Horizontal	*7323.000	55.0	36.6	36.8	22.5	32.7	54.0	-21.3

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters.

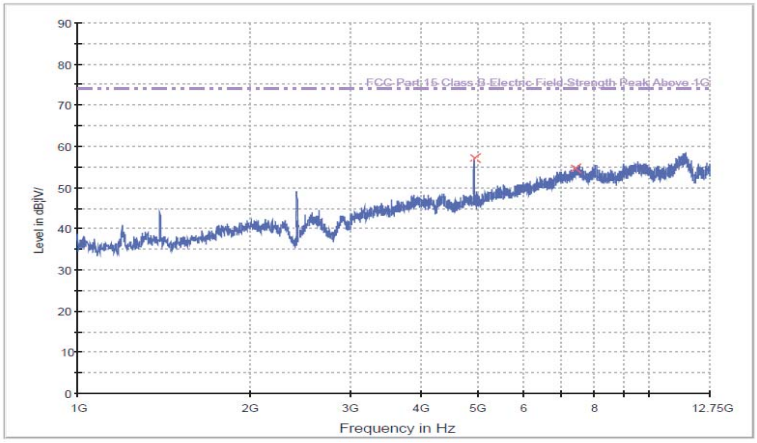
3. Negative value in the margin column shows emission below limit.

3. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205 and RSS Gen (issue 4) - 8.10. The corresponding limit as per 15.209 and RSS Gen (issue 4) - 8.9 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting (2480MHz)

Radiated Emissions



Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2480.000	109.7	36.7	28.1	101.1	/	/
Horizontal	*4960.000	60.7	36.8	33.3	57.2	74.0	-16.8
Horizontal	*7440.000	54.4	36.5	36.7	54.6	74.0	-19.4

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2480.000	109.7	36.7	28.1	22.5	78.6	/	/
Horizontal	*4960.000	60.7	36.8	33.3	22.5	34.7	54.0	-19.3
Horizontal	*7440.000	54.4	36.5	36.7	22.5	32.1	54.0	-21.9

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205 and RSS Gen (issue 4) - 8.10. The corresponding limit as per 15.209 and RSS Gen (issue 4) - 8.9 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

4.1.5 Restricted-Band Band-Edge Emissions (Radiated) - FCC section 15.209

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in15.209.

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission

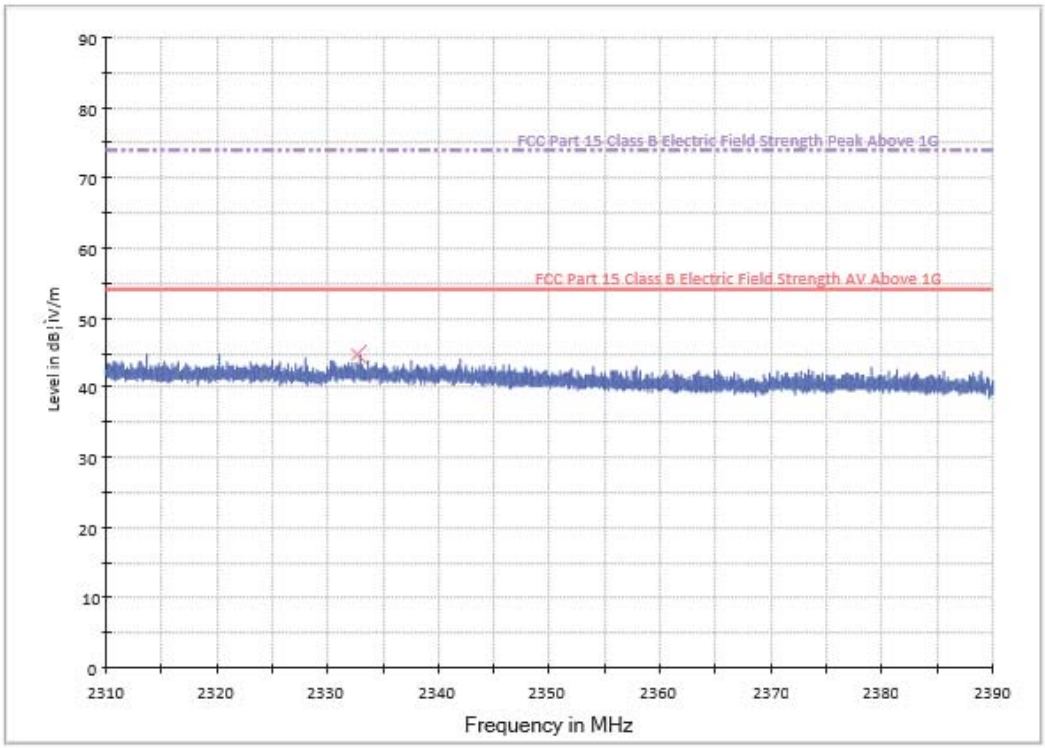
at 2483.506 MHz

Judgement: Passed by 27.1 dB

Restricted-Band Band-Edge Emissions (2310-2390MHz)

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting (2402MHz)

Radiated Emissions



Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2333.610	53.6	36.7	28.1	45.0	74.0	-29.0

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters.

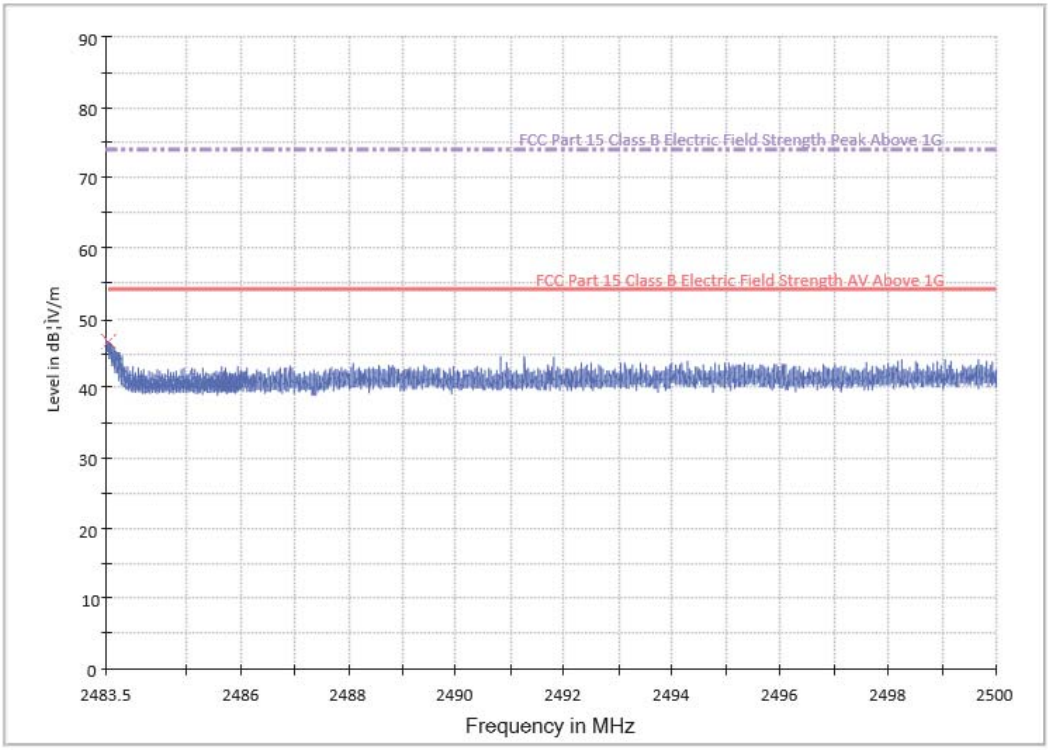
3. Negative value in the margin column shows emission below limit.

4. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

Restricted-Band Band-Edge Emissions (2483.5-2500MHz)

Applicant: Microsoft Corporation
Date of Test: May 24, 2018 Model: 1830
Worst Case Operating Mode: Transmitting (2480MHz)

Radiated Emissions



Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2483.506	55.5	36.7	28.1	46.9	74.0	-27.1

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters.

3. Negative value in the margin column shows emission below limit.

4. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

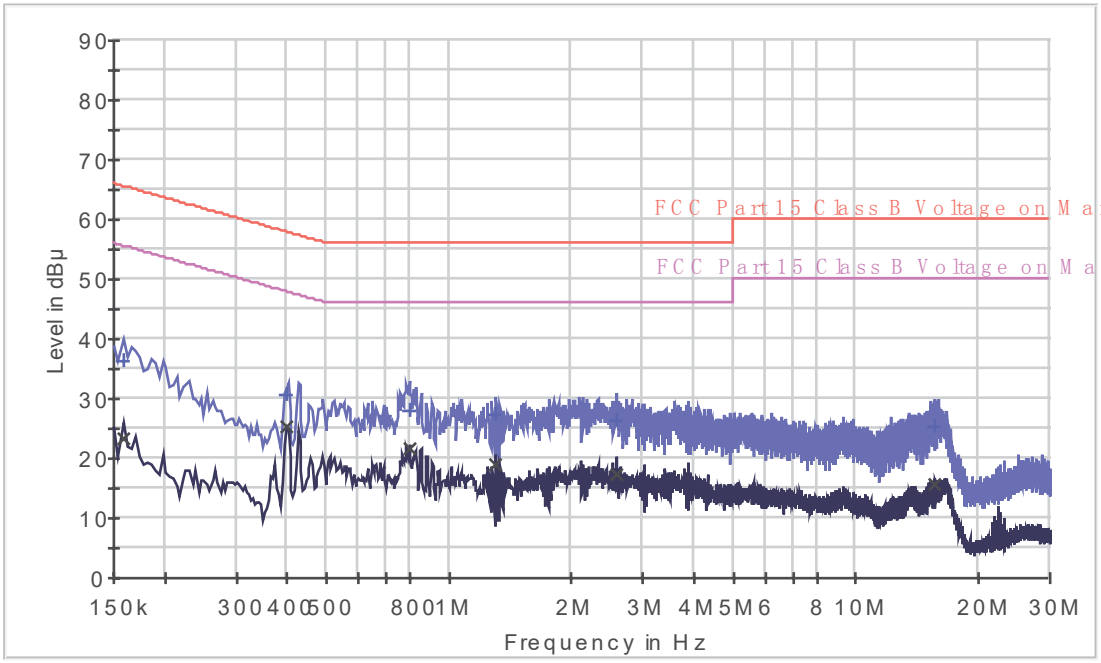
4.2 Conducted Emission

Worst Case Conducted emission at 0.422 MHz is Passed by 22.0 dB margin

For electronic filing, the worst case conducted emission configuration photograph is saved with filename: 1830 Test Setup Photos.pdf.

Applicant: Microsoft Corporation
Date of Test: May 25, 2018
Model: 1830
Worst Case Operating Mode: BT Link
Modulation type: GFSK
Phase: Live

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB¦ÌV)	Line	Corr. (dB)	Margin (dB)	Limit (dB¦ÌV)
0.158000	36.2	L1	9.6	29.4	65.6
0.398000	30.6	L1	9.7	27.3	57.9
0.802000	28.0	L1	9.7	28.0	56.0
1.306000	27.4	L1	9.7	28.6	56.0
2.582000	26.3	L1	9.7	29.7	56.0
15.658000	25.2	L1	10.1	34.8	60.0

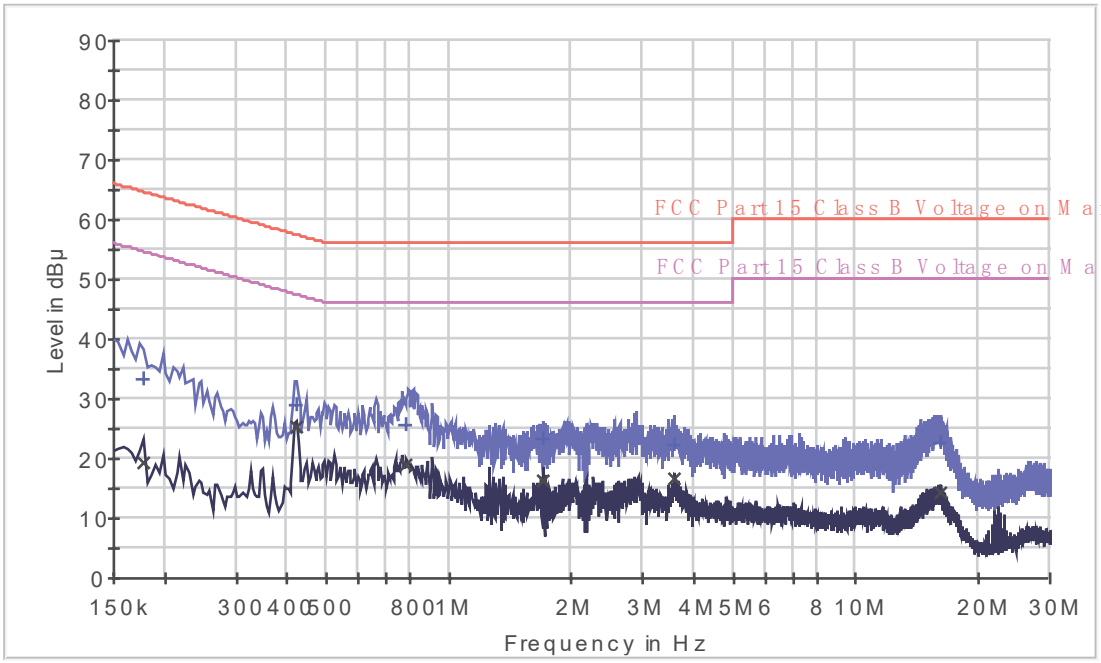
Result Table AV

Frequency (MHz)	Average (dB¦ÌV)	Line	Corr. (dB)	Margin (dB)	Limit (dB¦ÌV)
0.158000	23.4	L1	9.6	32.2	55.6
0.398000	25.5	L1	9.7	22.4	47.9
0.802000	21.8	L1	9.7	24.2	46.0
1.306000	19.1	L1	9.7	26.9	46.0
2.582000	17.3	L1	9.7	28.7	46.0
15.658000	15.7	L1	10.1	34.3	50.0

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Limit (dBuV) – Level (dBuV)

Applicant: Microsoft Corporation
Date of Test: May 25, 2018
Model: 1830
Worst Case Operating Mode: BT Link
Modulation type: GFSK
Phase: Neutral

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB¦ÌV)	Line	Corr. (dB)	Margin (dB)	Limit (dB¦ÌV)
0.178000	33.2	N	9.7	31.4	64.6
0.422000	29.0	N	9.7	28.4	57.4
0.786000	25.8	N	9.7	30.2	56.0
1.702000	23.5	N	9.7	32.5	56.0
3.570000	22.4	N	9.8	33.6	56.0
16.114000	22.7	N	10.1	37.3	60.0

Result Table AV

Frequency (MHz)	Average (dB¦ÌV)	Line	Corr. (dB)	Margin (dB)	Limit (dB¦ÌV)
0.178000	19.5	N	9.7	35.1	54.6
0.422000	25.4	N	9.7	22.0	47.4
0.786000	19.0	N	9.7	27.0	46.0
1.702000	16.4	N	9.7	29.6	46.0
3.570000	16.7	N	9.8	29.3	46.0
16.114000	14.5	N	10.1	35.5	50.0

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Limit (dBuV) – Level (dBuV)

Applicant: Microsoft Corporation
Date of Test: July 20, 2018 Model: 1830

4.3 Peak Power

Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(1).
The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for RBW > 20dB bandwidth and power was read directly in dBm.

Worst case result:

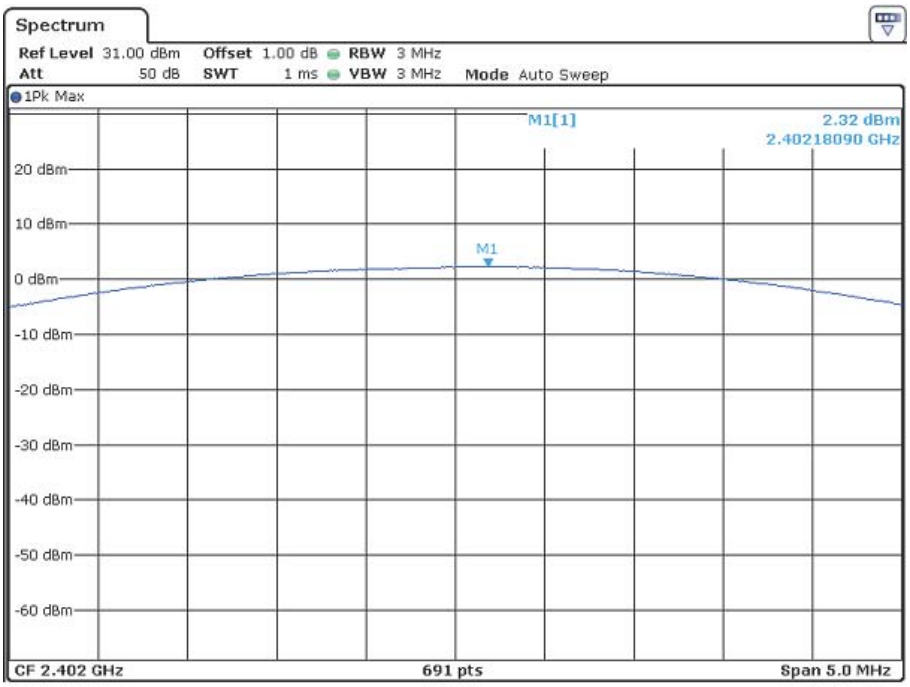
Antenna Gain = 2dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	2.32	1.706
	2441	3.70	2.344
	2480	3.80	2.399

For antenna with gains of 6dBi or less, and frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, the systems operate with an output power no greater than 125 mW.

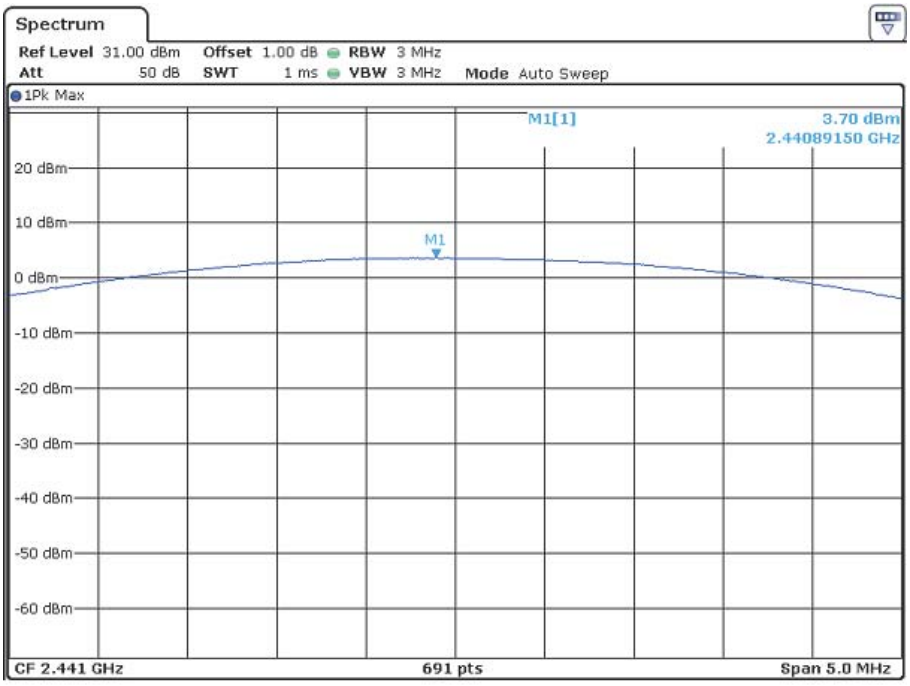
Cable loss, external attenuation has been included in OFFSET(1.0dB) function.

Modulation Type: GFSK

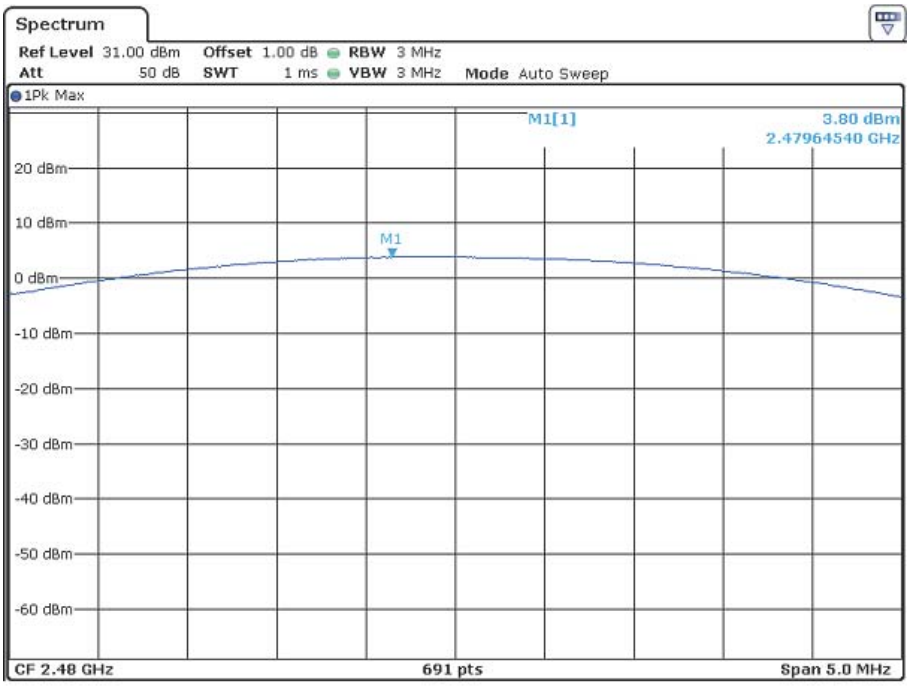
CH00



CH39



CH78


Spectrum
Ref Level 31.00 dBm Offset 1.00 dB RBW 3 MHz
Att 50 dB SWT 1 ms VBW 3 MHz Mode Auto Sweep
1Pk Max
M1[1] 3.80 dBm
2.47964540 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
CF 2.48 GHz
691 pts
Span 5.0 MHz

Applicant: Microsoft Corporation
Date of Test: July 20, 2018 Model: 1830

4.4 20dB Bandwidth

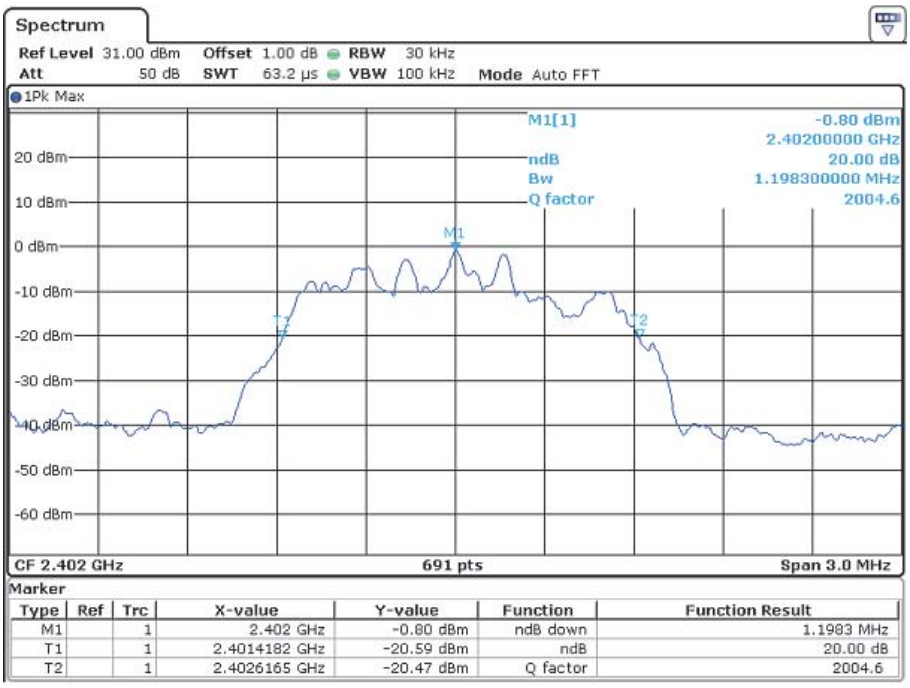
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

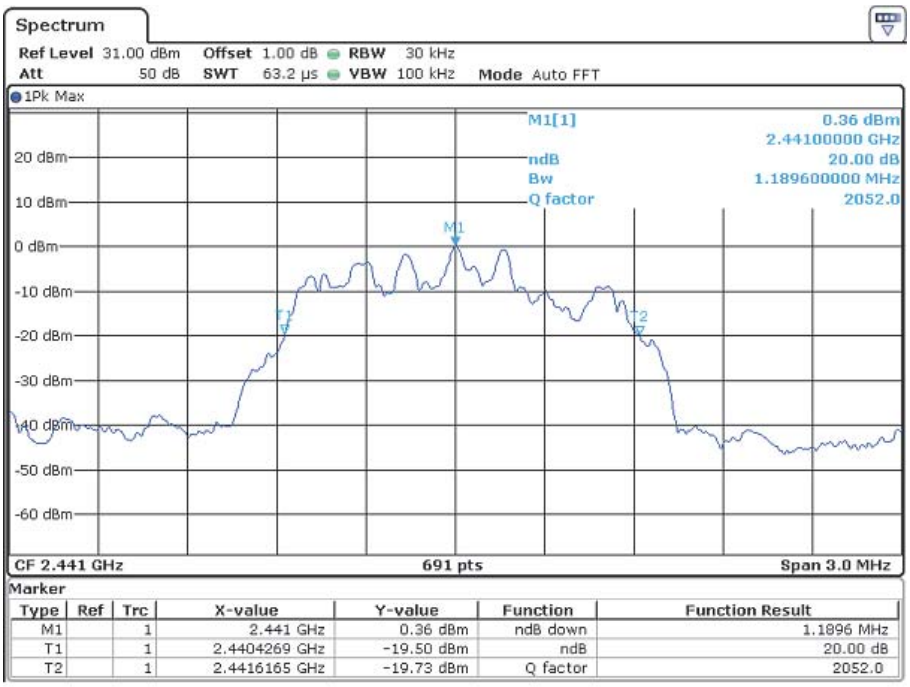
Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.1983
2441	1.1896
2480	1.1852

Worst Case Modulation Type: 8DPSK

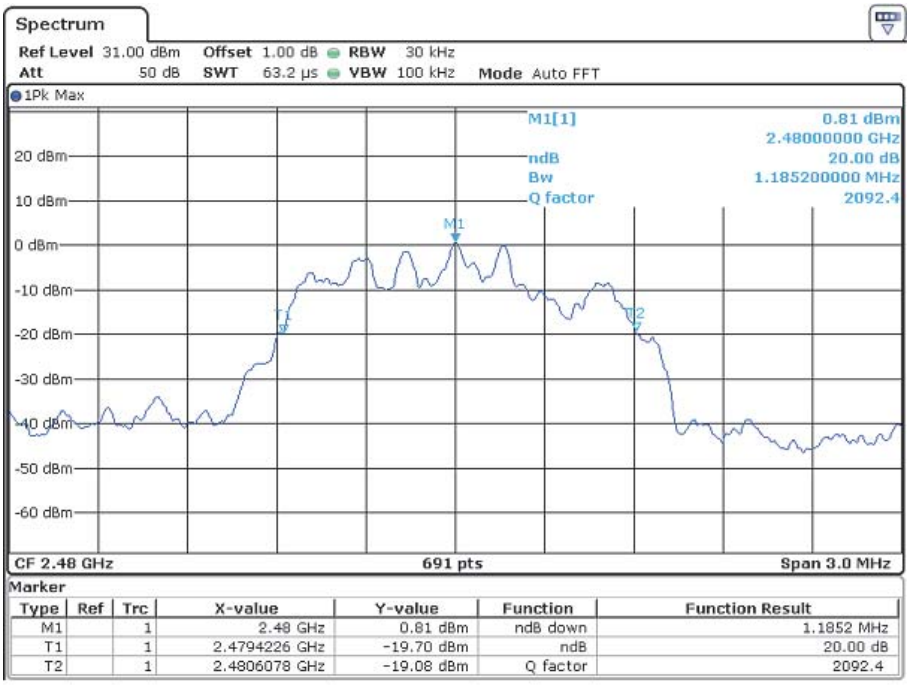
CH00



CH39


Spectrum
Ref Level 31.00 dBm Offset 1.00 dB RBW 30 kHz
Att 50 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
1Pk Max
M1[1] 0.36 dBm
2.44100000 GHz
ndB 20.00 dB
Bw 1.189600000 MHz
Q factor 2052.0
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.441 GHz
691 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441 GHz 0.36 dBm ndB down 1.1896 MHz
T1 1 2.4404269 GHz -19.50 dBm ndB 20.00 dB
T2 1 2.4416165 GHz -19.73 dBm Q factor 2052.0

CH78


Spectrum
Ref Level 31.00 dBm Offset 1.00 dB RBW 30 kHz
Att 50 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
1Pk Max
M1[1] 0.81 dBm
2.48000000 GHz
ndB 20.00 dB
Bw 1.185200000 MHz
Q factor 2092.4
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.48 GHz
691 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.48 GHz 0.81 dBm ndB down 1.1852 MHz
T1 1 2.4794226 GHz -19.70 dBm ndB 20.00 dB
T2 1 2.4806078 GHz -19.08 dBm Q factor 2092.4

Applicant: Microsoft Corporation
Date of Test: July 20, 2018 Model: 1830

4.5 Channel Number (Number of Hopping Frequencies)

Minimum Number of Hopping Frequencies, FCC Rule 15.247(a) (1) (iii):

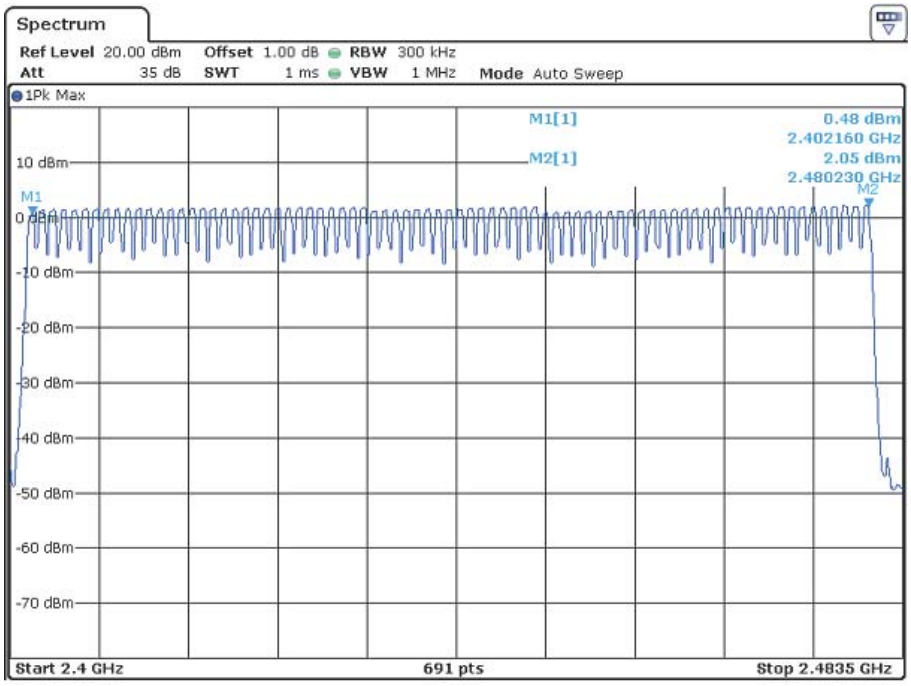
The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Number of hopping channels =	79

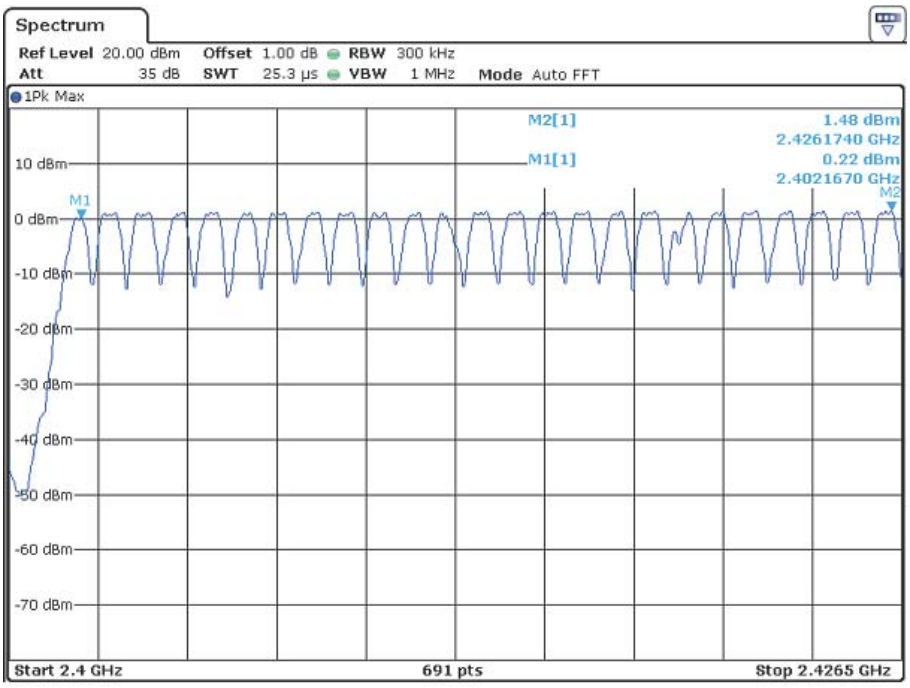
Note: In AFH mode, this device operates using 20 channels and it's satisfied the requirement of limit of minimum of 15 hopping channels.

Worst Case Modulation Type: GFSK

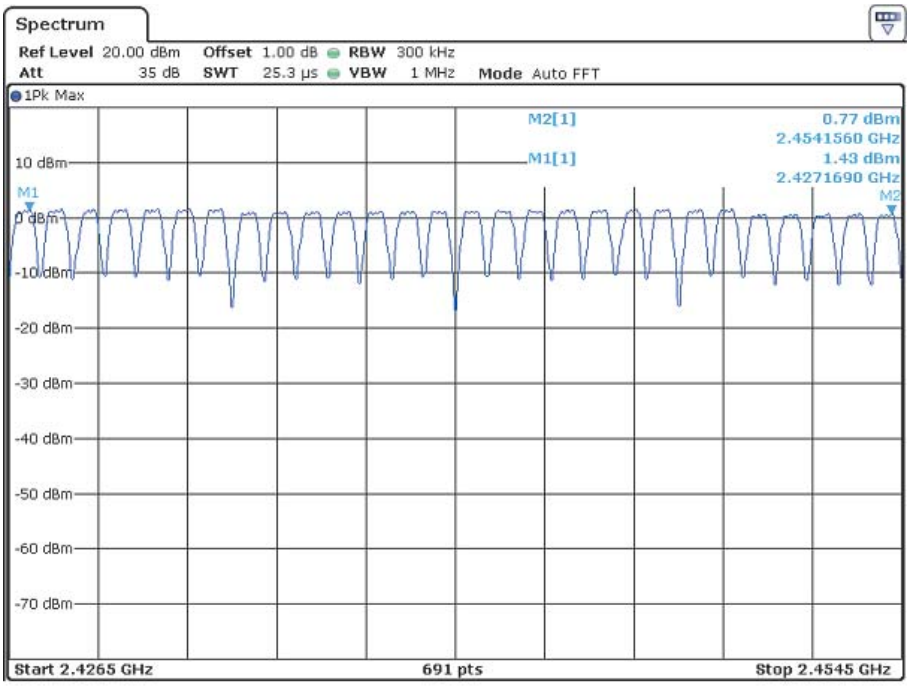
CH00-CH78



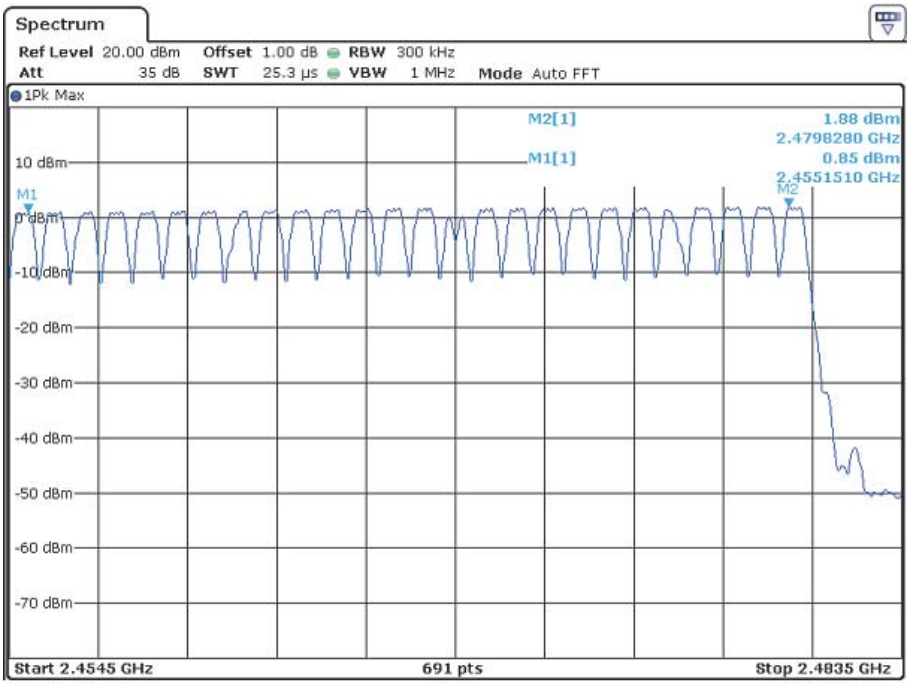
CH00-CH24



CH25-CH52



CH53-CH78


Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 300 kHz
Att 35 dB SWT 25.3 µs VBW 1 MHz Mode Auto FFT
1Pk Max
M2[1] 1.88 dBm
2.4798280 GHz
M1[1] 0.85 dBm
2.4551510 GHz
10 dBm
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M2
Start 2.4545 GHz
691 pts
Stop 2.4835 GHz

Applicant: Microsoft Corporation
Date of Test: July 20, 2018 Model: 1830

4.6 Channel Separation (Carrier Frequency Separation)

Minimum Hopping Channel Carrier Frequency Separation, FCC Ref: 15.247(a)(1):

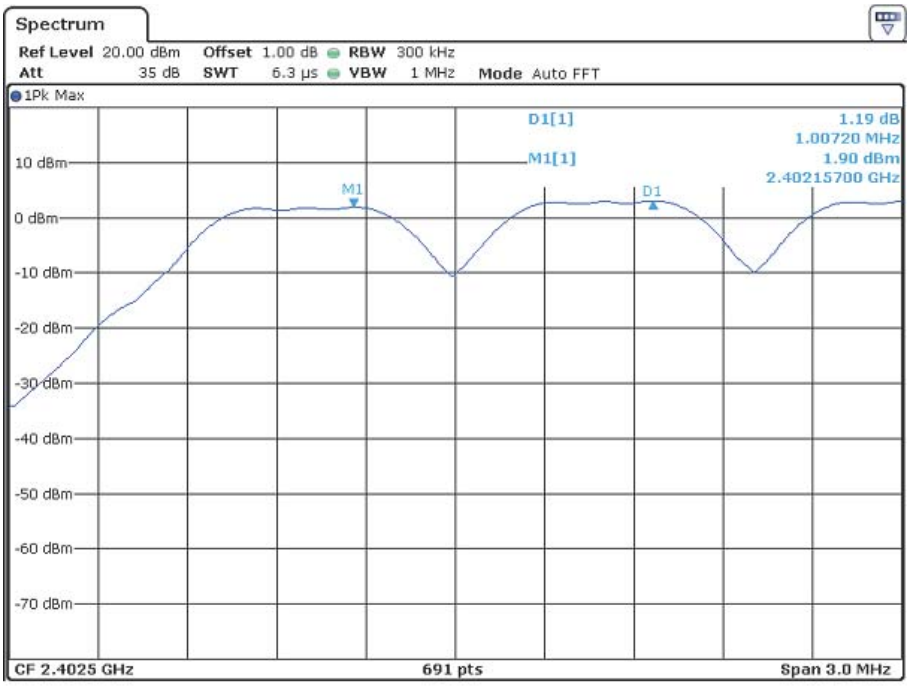
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel: 1.1983 x 2/3 = 0.799MHz

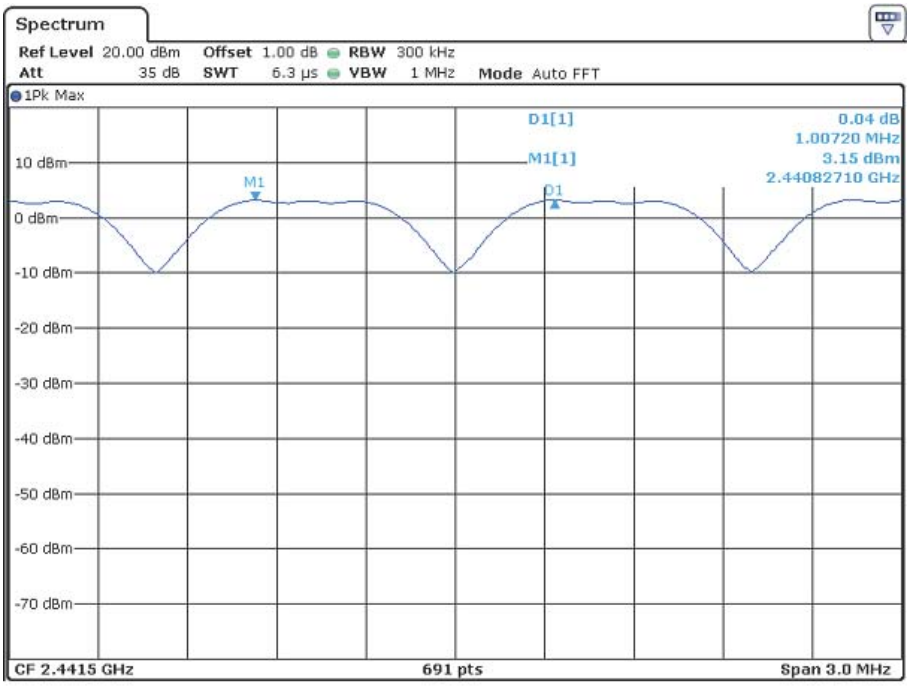
Minimum Channel Separation	1.0072 MHz

Worst Case Modulation Type: 8DPSK

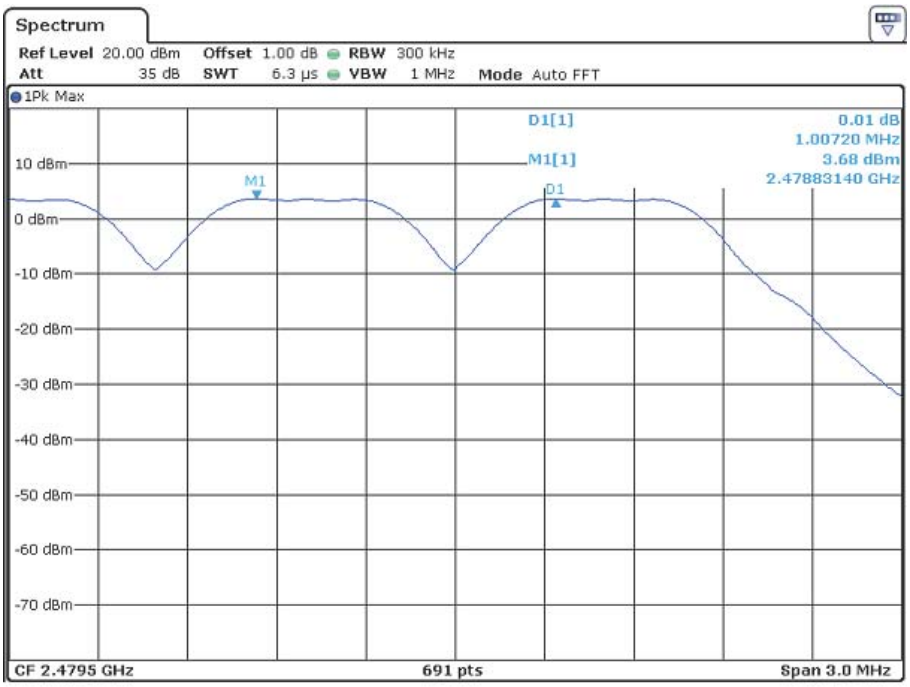
Low Channel



Middle Channel



High Channel



Applicant: Microsoft Corporation
Date of Test: May 30, 2018 Model: 1830

4.7 Dwell Time (Time of Occupancy)

Average Channel Occupancy Time, FCC Ref: 15.247(a) (1)(iii):

The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 10ms, the SPAN was set to ZERO SPAN, and the TRIGGER was set to VIDEO. The time duration of the transmissions so captured was measured with the MARKER DELTA function.

The maximum number of hopping channels in 31.6s for DH1
=1600 / 2 / 79 *31.6=320

The maximum number of hopping channels in 31.6s for DH3
=1600 / 4 / 79 *31.6=160

The maximum number of hopping channels in 31.6s for DH5
=1600 / 6 / 79 *31.6=107

Modulation Type	Packet	Max Dwell Time				Limit (s)	Result
8DPSK	3DH1	0.416	ms * 320=	133.12	ms	0.4	Pass
	3DH3	1.667	ms * 160=	266.72	ms	0.4	Pass
	3DH5	2.922	ms * 107=	302.14	ms	0.4	Pass

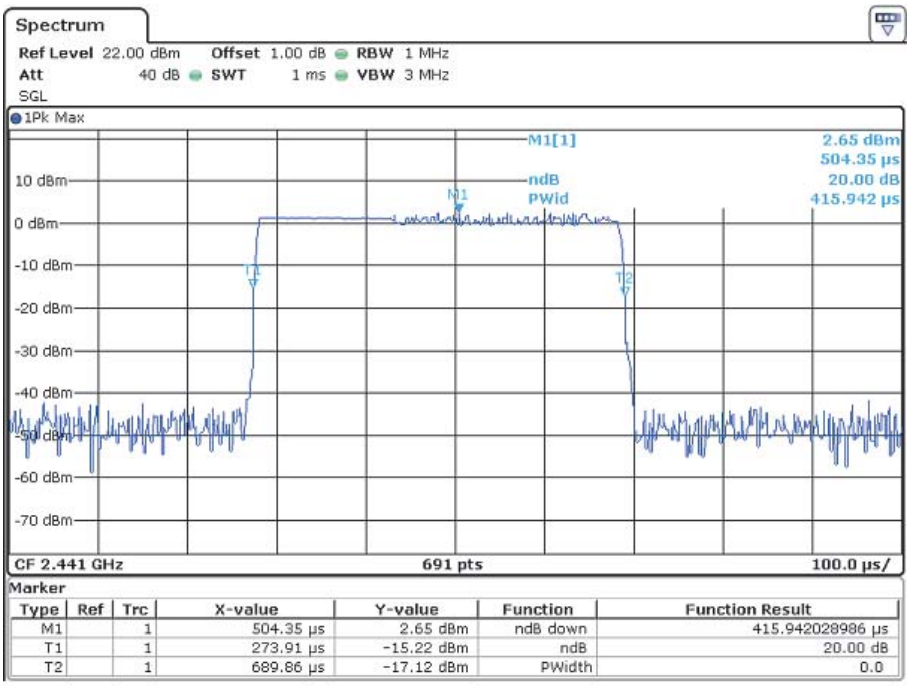
AFH mode:
The maximum number of hopping channels in 8s for DH1
=800 / 2 / 20 *8=160

The maximum number of hopping channels in 8s for DH3
=800 / 4 / 20 *8=80

The maximum number of hopping channels in 8s for DH5
=800 / 6 / 20 *8=53.33

Modulation Type	Packet	Max Dwell Time				Limit (s)	Result
8DPSK	3DH1	0.416	ms * 160=	66.56	ms	0.4	Pass
	3DH3	1.667	ms * 80=	133.36	ms	0.4	Pass
	3DH5	2.922	ms * 53.33=	155.83	ms	0.4	Pass

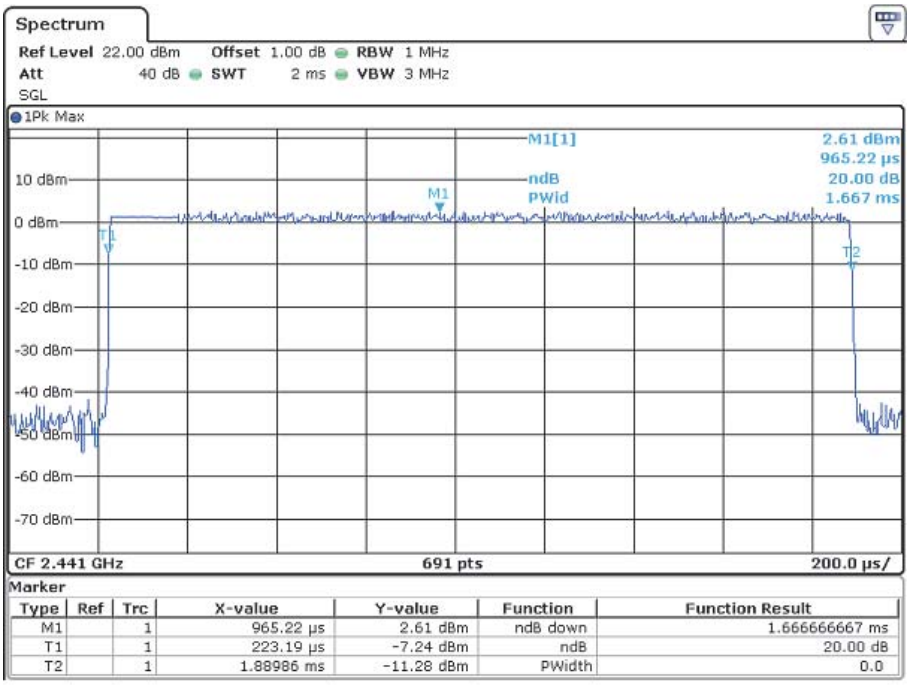
Worst Case Modulation Type: 8DPSK
Packet: 3DH1



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	504.35 µs	2.65 dBm	ndB down	415.942028986 µs
T1		1	273.91 µs	-15.22 dBm	ndB	20.00 dB
T2		1	689.86 µs	-17.12 dBm	PWidth	0.0

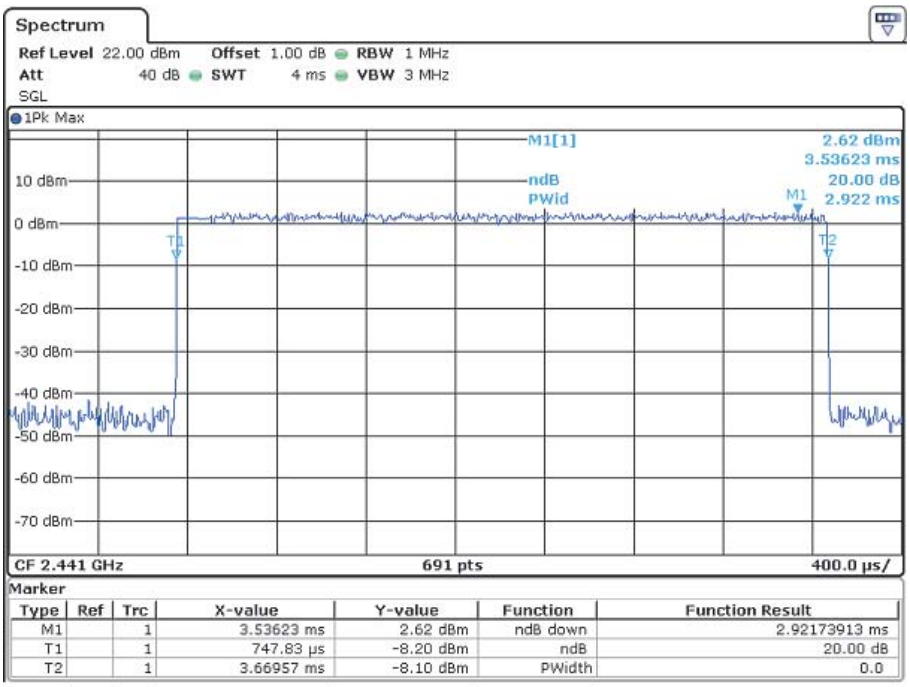
Packet: 3DH3



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	965.22 µs	2.61 dBm	ndB down	1.666666667 ms
T1		1	223.19 µs	-7.24 dBm	ndB	20.00 dB
T2		1	1.88986 ms	-11.28 dBm	PWidth	0.0

Packet: 3DH5



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	3.53623 ms	2.62 dBm	ndB down	2.92173913 ms
T1		1	747.83 µs	-8.20 dBm	ndB	20.00 dB
T2		1	3.66957 ms	-8.10 dBm	PWidth	0.0

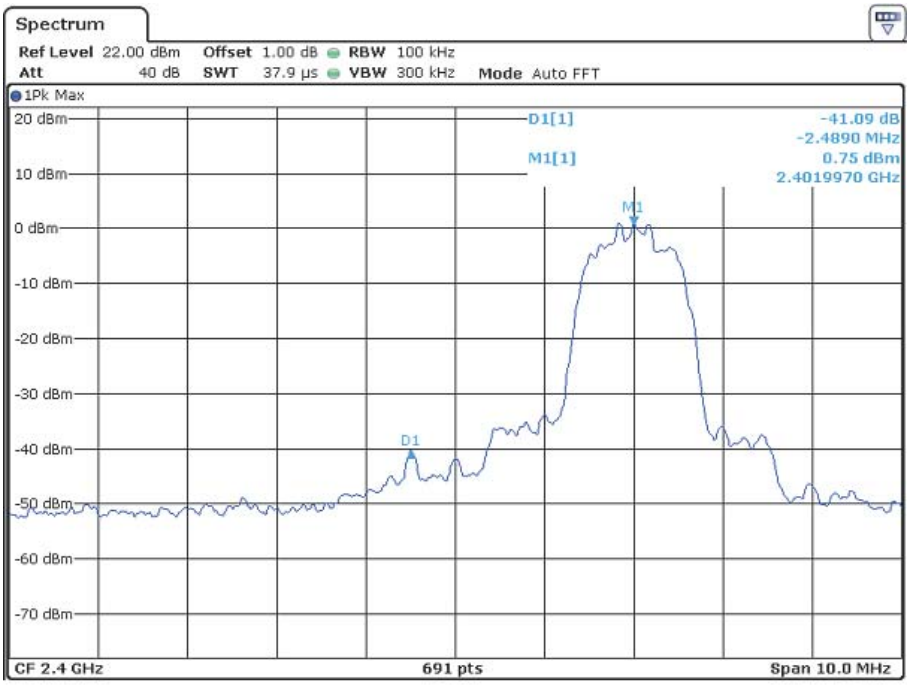
Applicant: Microsoft Corporation
Date of Test: May 30, 2018 & July 20, 2018 Model: 1830

4.8 Band Edge

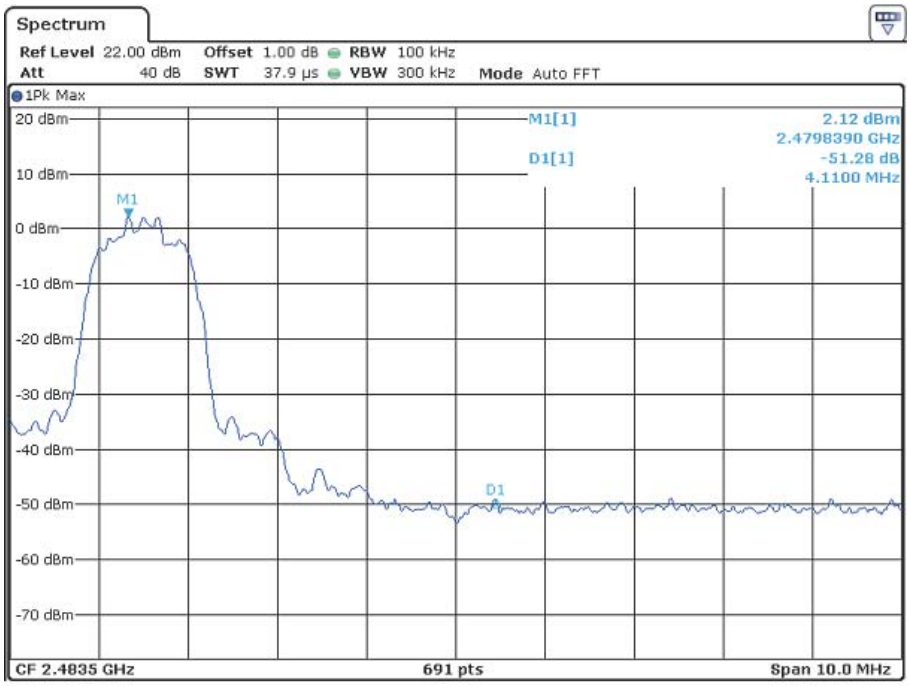
Out of Band Conducted Emissions, FCC Rule 15.247(d)

In any 100 KHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

Worst Modulation Type: 8DPSK

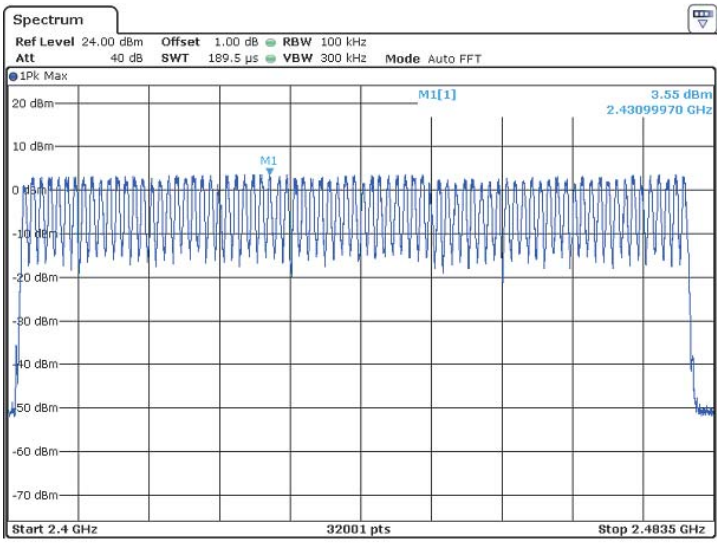


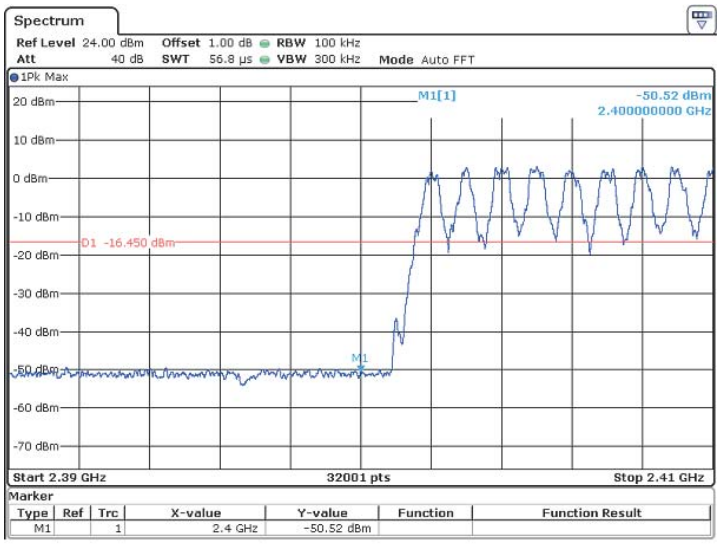
Maximum Out of Band Conducted Emissions was 41.09 dB below the maximum in-band 100 kHz emission.

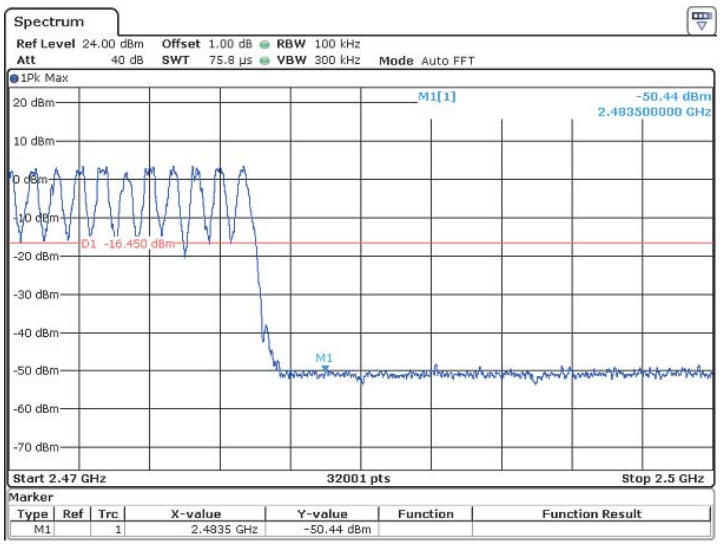


Maximum Out of Band Conducted Emissions was 51.28 dB below the maximum in-band 100 kHz emission.

Hopping Mode：
Reference Level: 3.55dBm







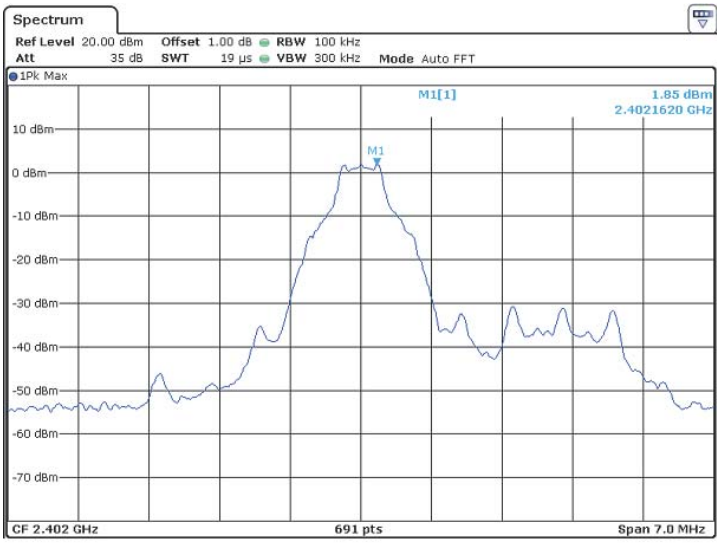
4.9 Transmitter Spurious Emissions (Conducted)

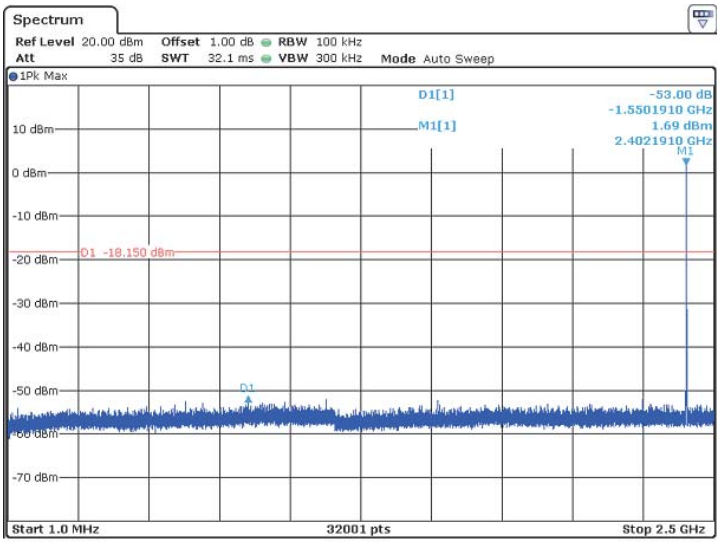
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

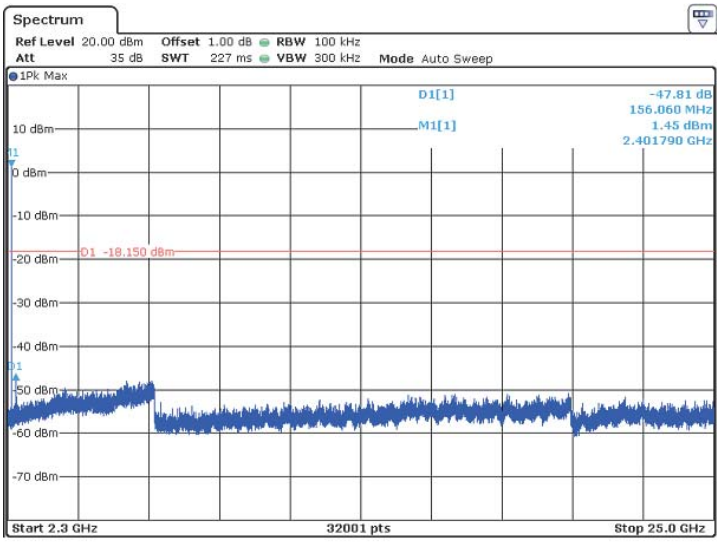
All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

Worst Case Modulation Type: GFSK

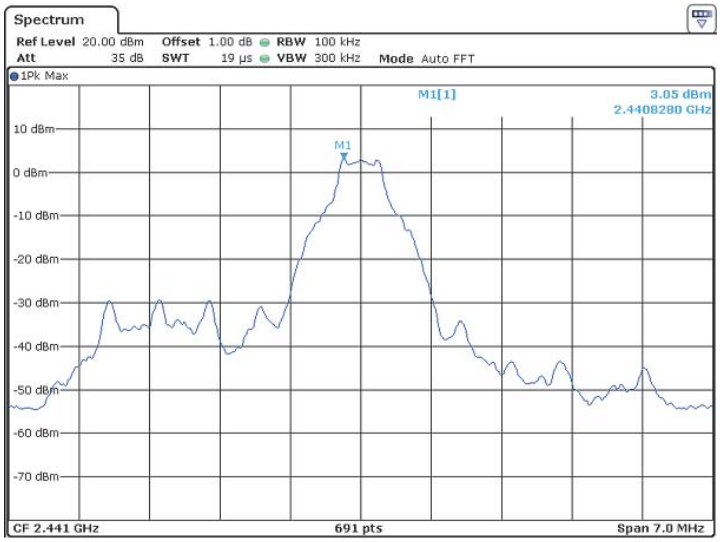
CH00 Reference Level: 1.85dBm

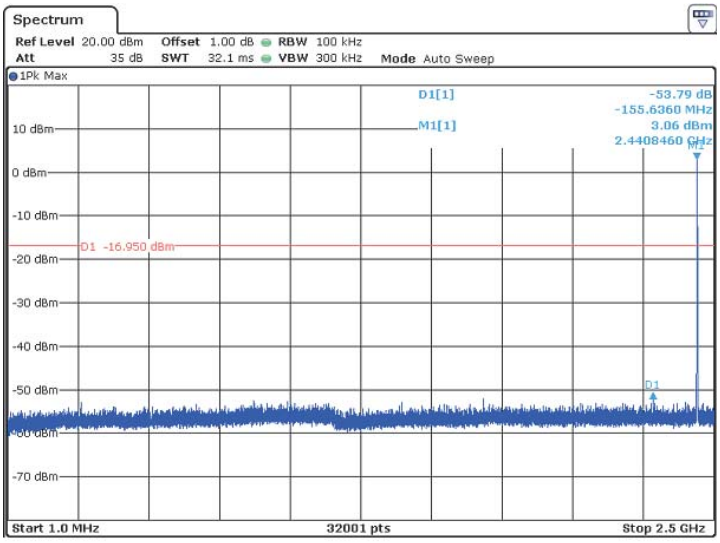


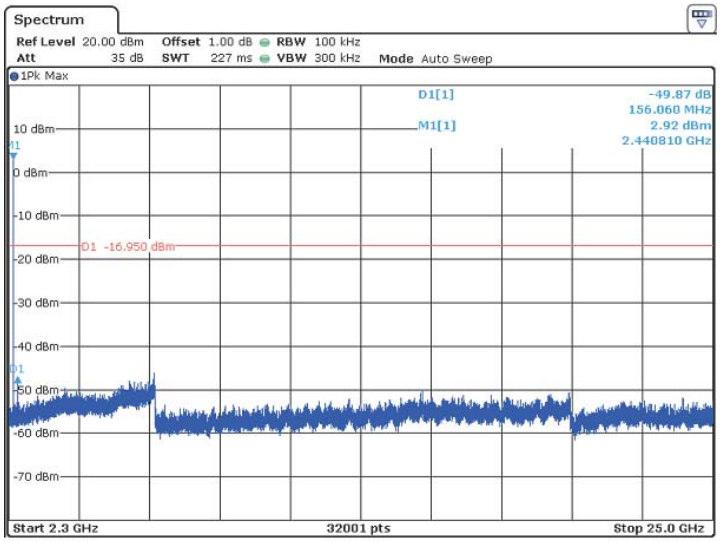




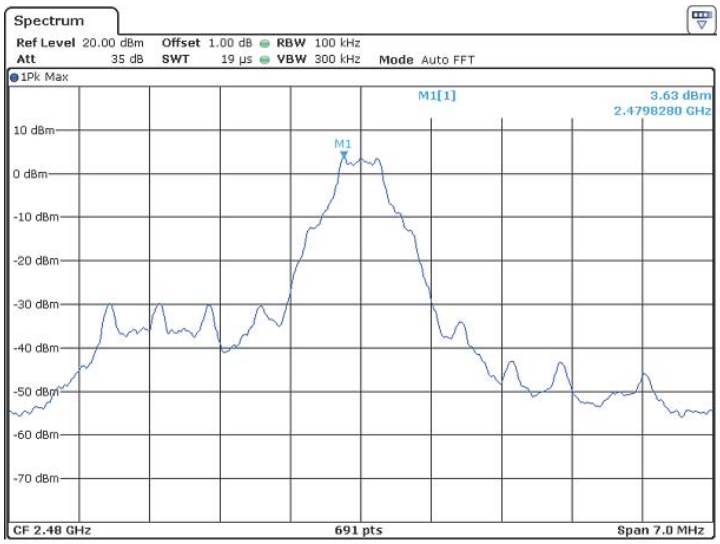
CH39 Reference Level: 3.05dBm

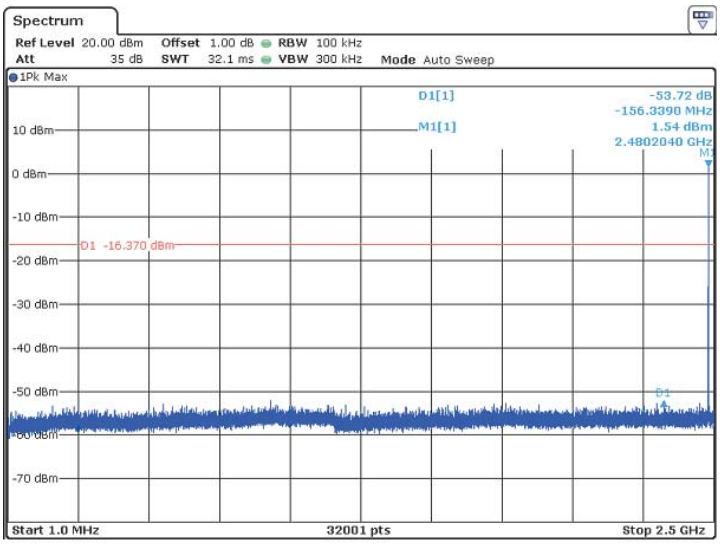






CH78 Reference Level: 3.63dBm





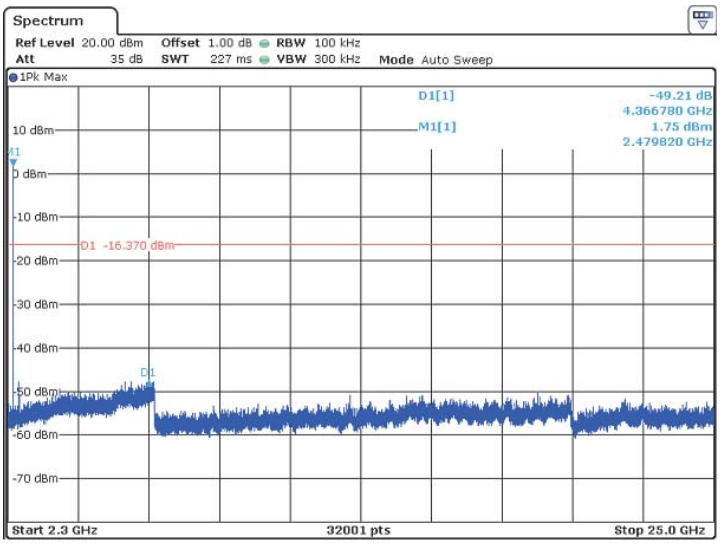


EXHIBIT 5

MISCELLANEOUS INFORMATION

5.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, the test procedure and calculation of factor such as pulse desensitization.

5.1 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 625μs for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

5.2 Transmitter Duty Cycle Calculation, FCC Rule 15.35(b, c)

Based on the Bluetooth Specification, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length (single-slot and multi-slot). The maximum transmitter ON time for the Bluetooth is 625μs.

Each TX and RX time slot is 625μs in length. A TDD scheme is used where master and slave alternately transmit. For one period for a pseudo-random hopping through all 79 RF channels, for DH5:

Normal Mode:
Channel hop rate=1600 hops/second
Time of 1 hopset (5 TX slots + 1 RX slot) = 0.625 ms x 6 = 3.75 ms
Time of 1 cycle =3.75 ms x 79 = 296.25 ms
Average factor = 20 log (3.125 / 100) = -30.1 dB

AFH Mode:
Channel hop rate = 800 hops/second (AFH Mode)
Adjusted channel hop rate for DH5 mode = 133.33 hops/second
Time per channel hop = 1 / 133.33 hops/second = 7.5 ms
Time to cycle through all channels = 7.5 x 20 channels = 150 ms
Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)
Worst case dwell time = 7.5 ms
Duty cycle connection factor = 20log10(7.5ms / 100ms) = -22.5 dB

5.3 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10: 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter, up to 1GHz 0.8m and above 1GHz 1.5m in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz with RBW 9KHz used.

5.3.1 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.10: 2013.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used (RBW 3MHz used for fundamental emission).

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

EXHIBIT 7

TEST EQUIPMENT LIST

6.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-12	BiConiLog Antenna	ETS	3142E	00166158	20-Sep-2017	20-Sep-2018
SZ185-01	EMI Receiver	R&S	ESCI	100547	24-Jan-2018	24-Jan-2019
SZ061-08	Horn Antenna	ETS	3115	00092346	20-Sep-2017	20-Sep-2018
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	17-Mar-2018	17-Mar-2019
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	11-May-2018	11-May-2019
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	01-Jun-2017	01-Jun-2018
					05-Jun-2018	05-Jun-2019
SZ056-06	Signal Analyzer	R&S	FSV 40	101101	07-Jul-2017	07-Jul-2018
					05-Jun-2018	05-Jun-2019
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	24-Jan-2018	24-Jan-2019
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	16-Jan-2017	16-Jan-2019
SZ062-02	RF Cable	RADIALL	RG 213U	--	16-Jun-2017	16-Jun-2018
					02-Jun-2018	02-Jun-2019
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	16-Jun-2017	16-Jun-2018
					02-Jun-2018	02-Jun-2019
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	16-Jun-2017	16-Jun-2018
					02-Jun-2018	02-Jun-2019
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	14-Jun-2017	14-Jun-2018
					05-Jun-2018	05-Jun-2019
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	30-Oct-2017	30-Oct-2018
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	30-Oct-2017	30-Oct-2018
SZ188-03	Shielding Room	ETS	RFD-100	4100	16-Jan-2017	16-Jan-2019

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