VOXX Accessories Corp.

Application
For
Certification

FCC ID: VIXHPA205

Bluetooth earbud

Model: HPA205

Brand name: 808

2.4GHz Transceiver

Report No.: 160126003SZN-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 [10-1-14]

Prepared and Checked by:	Approved by:
Sign on file	 Digitally signed by Andy Yan Location: Intertek Testing Services
Vincent Chen Engineer	Andy Yan Technical Supervisor Date: February 17, 2016

TRF No.: FCC 15C_TX_c

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MEASUREMENT/TECHNICAL REPORT

Dongguan Koppo Electronics Co., Ltd.

Model: HPA205

FCC ID: VIXHPA205

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 [10-1-14 Edition] provision.

Report prepared by:

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List of attached file

Exhibit type	File Description	filename
Test Report	Test Report	report.pdf
Operational Description	Technical Description	descri.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted photos.pdf
External Photos	External Photo	external photos.pdf
Internal Photos	Internal Photo	internal photos.pdf
ID Label/Location Info	Label Artwork and Location	label.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
Users Manual	User Manual	manual.pdf
Cover Letter	Letter of Agency	agency.pdf
Cover Letter	Confidentiality Letter	request.pdf

EXHIBIT 1

GENERAL DESCRIPTION

1.0 General Description

1.1 Product Description

The equipment under test (EUT) is a Bluetooth earbud, with Bluetooth FHSS technology operating in 2402-2480MHz. The EUT is powered by DC 3.7V lithium battery and charged by DC 5V USB port. For more detail information pls. refer to the user manual.

Bluetooth Version: 4.1 single mode
Antenna Type: Ceramic antenna
Antenna Gain: 2dBi
Modulation Type: GFSK, π/4-DQPSK and 8-DPSK

HPA205 (or EUT) comes in color variations but are electrically and mechanically the same. The only difference is the color.

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is an application for certification of transceiver for the Bluetooth earbud which has Bluetooth function, and there is no corresponding unit for certification.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10: 2013 and DA 00-705. 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.

1.4 Test Facility

The Semi-anechoic chamber and shield room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 242492).

EXHIBIT 2

SYSTEM TEST CONFIGURATION

2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10: 2013.

The EUT was powered by DC 3.7V lithium battery and charged by DC 5V USB port through PC and AC/DC adapter respectively (PC and AC/DC Adapter with AC120V/60Hz input) during the test, and 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 antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The rear of unit was flushed with the rear of the table when it was powered by adapter up to 1GHz and placed in the centre of turntable above 1GHz.

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

2.2 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.

2.3 Special Accessories

No special accessory attached.

2.4 Equipment Modification
Any modifications installed previous to testing by VOXX Accessories Corp. will be incorporated in each production model sold / leased in the United States.

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

2.5 Measurement Uncertainty

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

2.6 Support Equipment List and Description

Description	Manufacturer	Model No.
iPod	Apple	A1367
USB Cable	N/A	Unshielded, Length 100cm
PC	HP	DU567AV
AC Adapter	TP-LINK	T050100-2A3

EXHIBIT 3

TEST RESULTS

3.0 Test Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

3.1 Radiated Test Results

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

3.1.1 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

3.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

3.1.3 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 30.485 MHz

Judgement: Passed by 14.1 dB

TEST PERSONNEL:

Sign on file

Vincent Chen, Engineer
Typed/Printed Name

February 14, 2016
Date

Applicant: VOXX Accessories Corp. Date of Test: February 14, 2016
Model: HPA205
Sample: 1/1
Worst-case operating Mode: Transmitting (2402MHz) and charged by adapter
Modulation type: GFSK

Table 1

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	304.025	35.4	20.0	10.9	26.3	46.0	-19.7
Horizontal	448.070	36.4	20.0	14.6	31.0	46.0	-15.0
Horizontal	560.105	29.9	20.0	19.9	29.8	46.0	-16.2
Vertical	30.485	38.6	20.0	7.3	25.9	40.0	-14.1
Vertical	53.280	21.5	20.0	19.2	20.7	40.0	-19.3
Vertical	446.130	36.0	20.0	13.0	29.0	46.0	-17.0

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

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

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

4. All emissions are below the QP limit.

3.1.4 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 7323.000 MHz

Judgement: Passed by 11.1 dB

TEST PERSONNEL:

Sign on file

Vincent Chen Engineer
Typed/Printed Name

February 14, 2016
Date

Applicant: VOXX Accessories Corp. Date of Test: February 14, 2016
Model: HPA205
Sample: 1/1
Worst-case operating Mode: Transmitting (2402 MHz) and charged by adapter
Modulation type: GFSK

Table 2

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	106.6	36.7	28.1	98.0	--	--
Horizontal	*4804.000	59.7	36.1	35.5	59.1	74.0	-14.9

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	*4804.000	59.7	36.1	35.5	22.5	36.6	54.0	-17.4

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

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

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. The corresponding limit as per 15.209 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: VOXX Accessories Corp. Date of Test: February 14, 2016
Model: HPA205
Sample: 1/1
Worst-case operating Mode: Transmitting (2441 MHz) and charged by adapter
Modulation type: GFSK

Table 3

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	63.3	36.1	35.5	62.7	74.0	-11.3
Horizontal	*7323.000	61.2	36.2	37.9	62.9	74.0	-11.1

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	63.3	36.1	35.5	22.5	40.2	54.0	-13.8
Horizontal	*7323.000	61.2	36.2	37.9	22.5	40.4	54.0	-13.6

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

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

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. The corresponding limit as per 15.209 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: VOXX Accessories Corp. Date of Test: February 14, 2016
Model: HPA205
Sample: 1/1
Worst-case operating Mode: Transmitting (2480 MHz) and charged by adapter
Modulation type: GFSK

Table 4

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	109.3	36.7	28.1	100.7	--	--
Horizontal	*4960.000	61.6	36.1	35.5	61.0	74.0	-13.0
Horizontal	*7440.000	60.7	36.2	38.2	62.7	74.0	-11.3

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	*4960.000	61.6	36.1	35.5	22.5	38.5	54.0	-15.5
Horizontal	*7440.000	60.7	36.2	38.2	22.5	40.2	54.0	-13.8

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

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

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. The corresponding limit as per 15.209 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.

3.2 Conducted Emission at Mains Terminal

3.2.1 Conducted Emissions Configuration Photograph

For electronic filing, the worst case conducted emission configuration photograph is saved with filename: conducted photos.pdf.

3.2.2 Conducted Emissions

Worst Case Conducted Configuration

at 0.182 MHz

Judgement: Passed by 12.3 dB margin

TEST PERSONNEL:

Sign on file

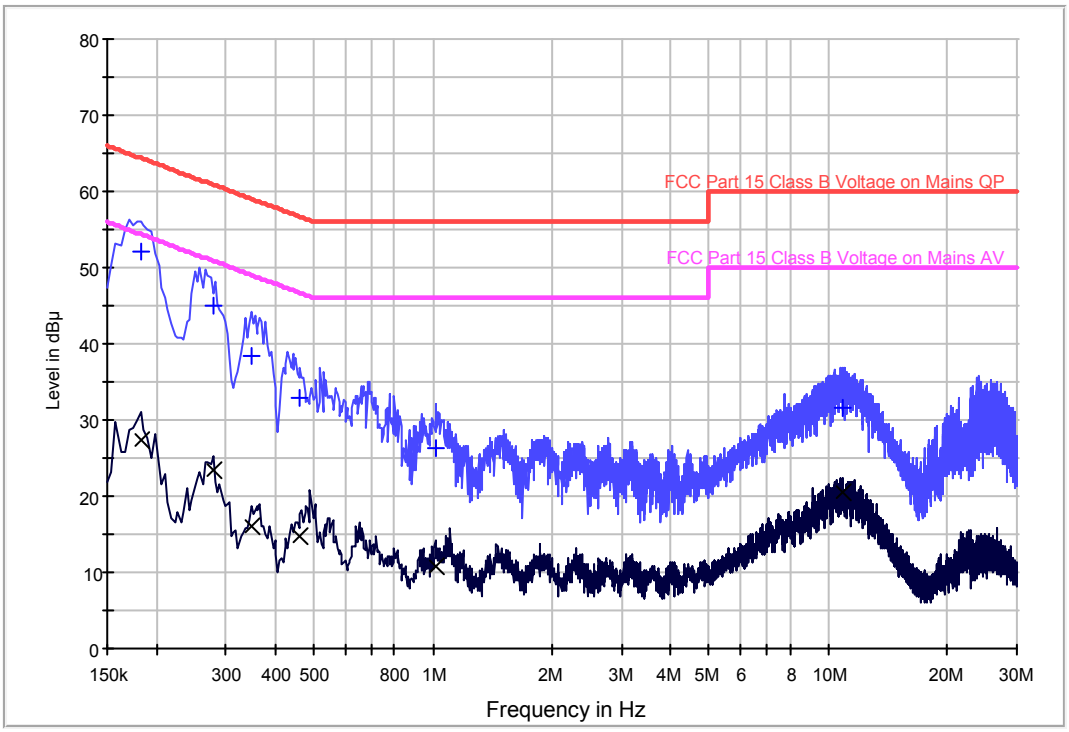
Vincent Chen, Engineer
Typed/Printed Name

February 14, 2016
Date

Applicant: VOXX Accessories Corp.
Model: HPA205
Sample: 1/1
Worst-case operating Mode: BT Link and charged by adapter

Date of Test: February 14, 2016

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.182	52.1	L	9.8	12.3	64.4
0.278	45.0	L	9.9	15.9	60.9
0.346	38.5	L	9.9	20.6	59.1
0.460	33.0	L	9.9	23.7	56.7
1.020	26.4	L	9.9	29.6	56.0
10.826	31.7	L	10.1	28.3	60.0

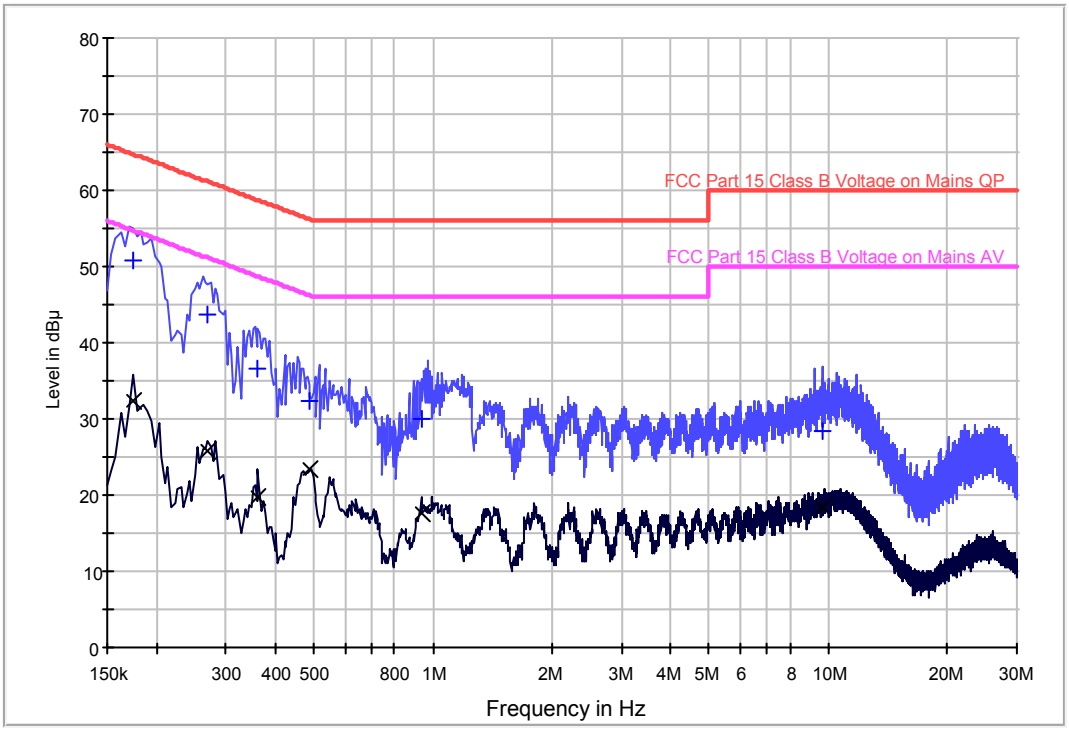
Result Table AV

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.182	27.4	L	9.8	27.0	54.4
0.278	23.5	L	9.9	27.4	50.9
0.346	16.0	L	9.9	33.1	49.1
0.460	14.7	L	9.9	32.0	46.7
1.020	10.9	L	9.9	35.1	46.0
10.826	20.5	L	10.1	29.5	50.0

Applicant: VOXX Accessories Corp.
Model: HPA205
Sample: 1/1
Worst-case operating Mode: BT Link and charged by adapter

Date of Test: February 14, 2016

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174	50.9	N	10.2	13.9	64.8
0.270	43.7	N	10.2	17.4	61.1
0.362	36.6	N	10.2	22.1	58.7
0.486	32.3	N	10.2	23.9	56.2
0.934	30.0	N	10.3	26.0	56.0
9.630	28.3	N	10.4	31.7	60.0

Result Table AV

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174	32.3	N	10.2	22.5	54.8
0.270	25.9	N	10.2	25.2	51.1
0.362	19.7	N	10.2	29.0	48.7
0.486	23.4	N	10.2	22.8	46.2
0.934	17.6	N	10.3	28.4	46.0
9.630	18.4	N	10.4	31.6	50.0

3.3 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 peak responding power meter. The power was read directly in dBm.

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.

Worst Case Mode (GFSK)

Antenna Gain = 2dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	-4.41	0.36
	2441	-2.91	0.51
	2480	-3.81	0.42

Cable loss: 1.0 dB External Attenuation: 0 dB

3.4 20dB Bandwidth

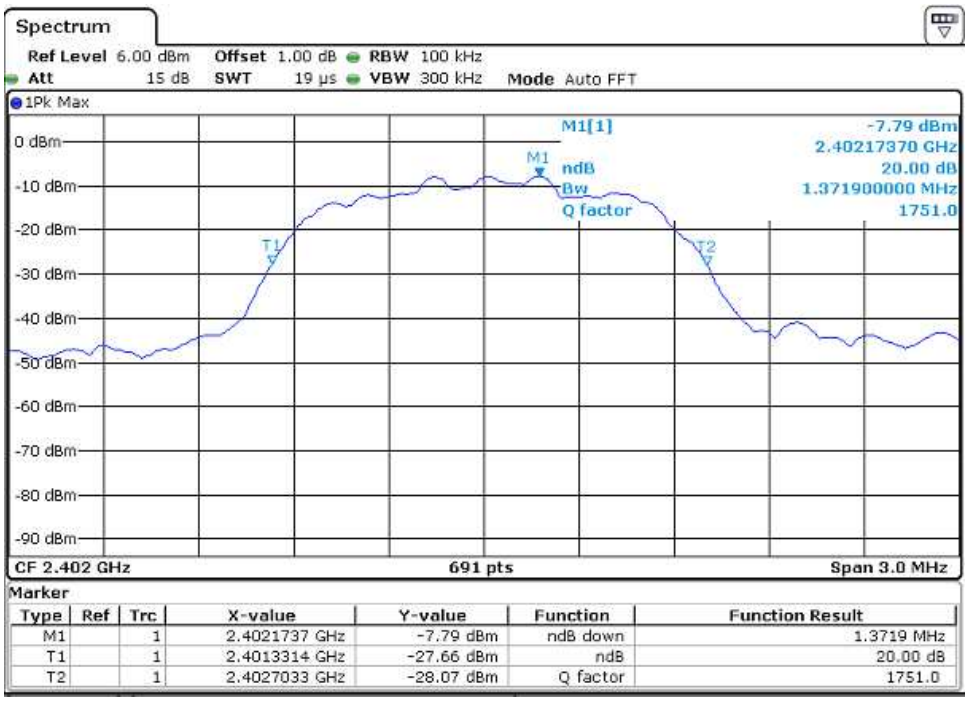
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

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.

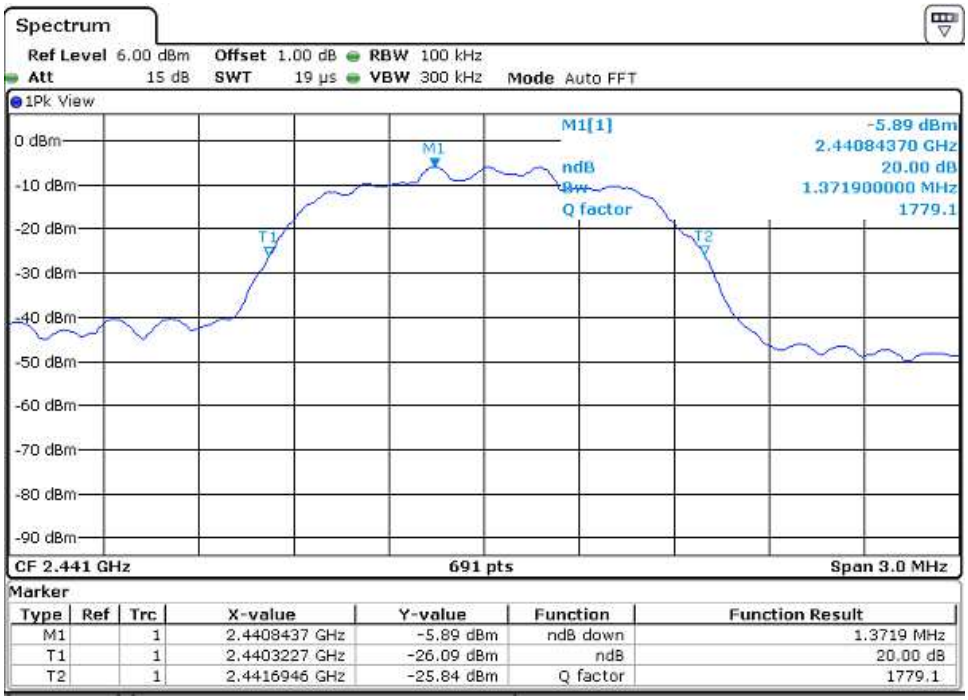
Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.372
2441	1.372
2480	1.368

Modulation Type: 8-DPSK

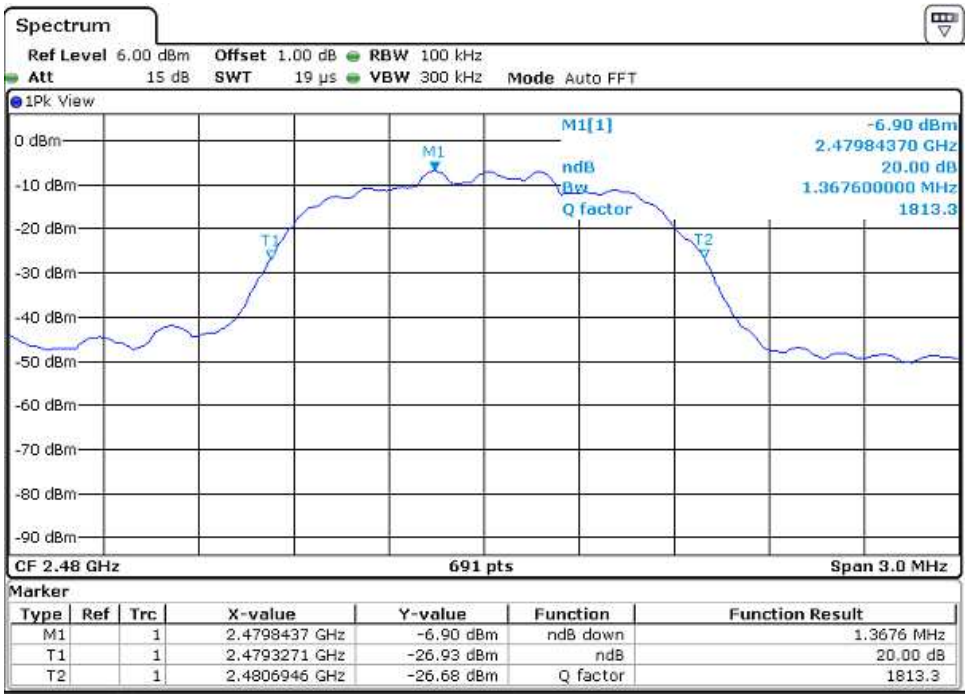
CH00



CH39


Spectrum
Ref Level 6.00 dBm Offset 1.00 dB RBW 100 kHz
Att 15 dB SWT 19 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -5.89 dBm
2.44084370 GHz
ndB 20.00 dB
Bw 1.371900000 MHz
Q factor 1779.1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
M1
T1
T2
CF 2.441 GHz
691 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4408437 GHz -5.89 dBm ndB down 1.3719 MHz
T1 1 2.4403227 GHz -26.09 dBm ndB 20.00 dB
T2 1 2.4416946 GHz -25.84 dBm Q factor 1779.1

CH78


Spectrum
Ref Level 6.00 dBm Offset 1.00 dB RBW 100 kHz
Att 15 dB SWT 19 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -6.90 dBm
2.47984370 GHz
ndB 20.00 dB
Bw 1.367600000 MHz
Q factor 1813.3
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
M1
T1
T2
CF 2.48 GHz
691 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4798437 GHz -6.90 dBm ndB down 1.3676 MHz
T1 1 2.4793271 GHz -26.93 dBm ndB 20.00 dB
T2 1 2.4806946 GHz -26.68 dBm Q factor 1813.3

3.5 Channel Number (Number of Hopping Frequencies)

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

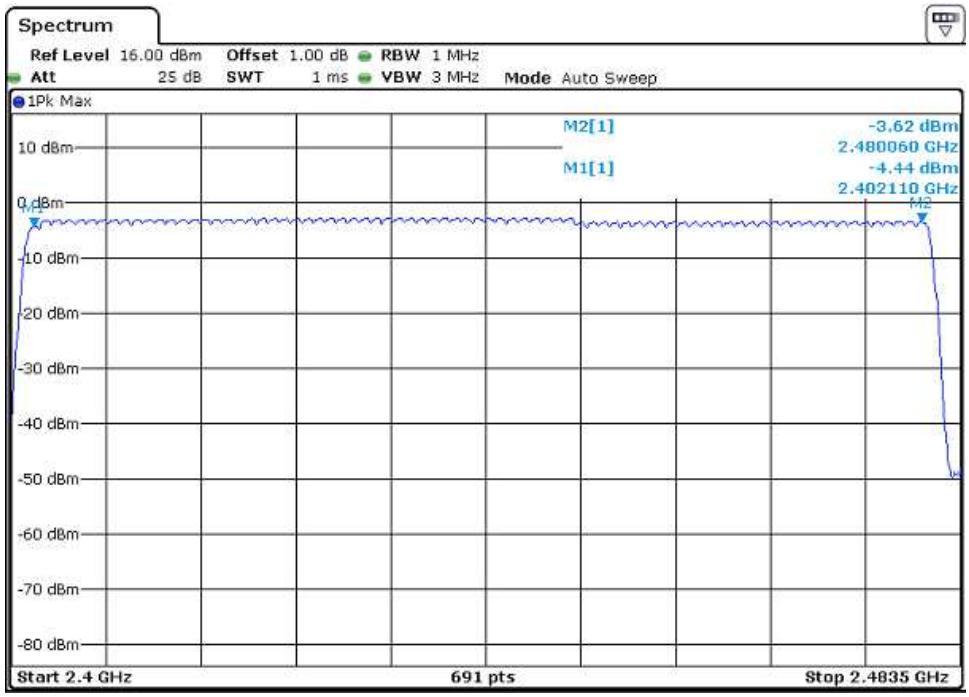
The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Number of hopping channels =	79

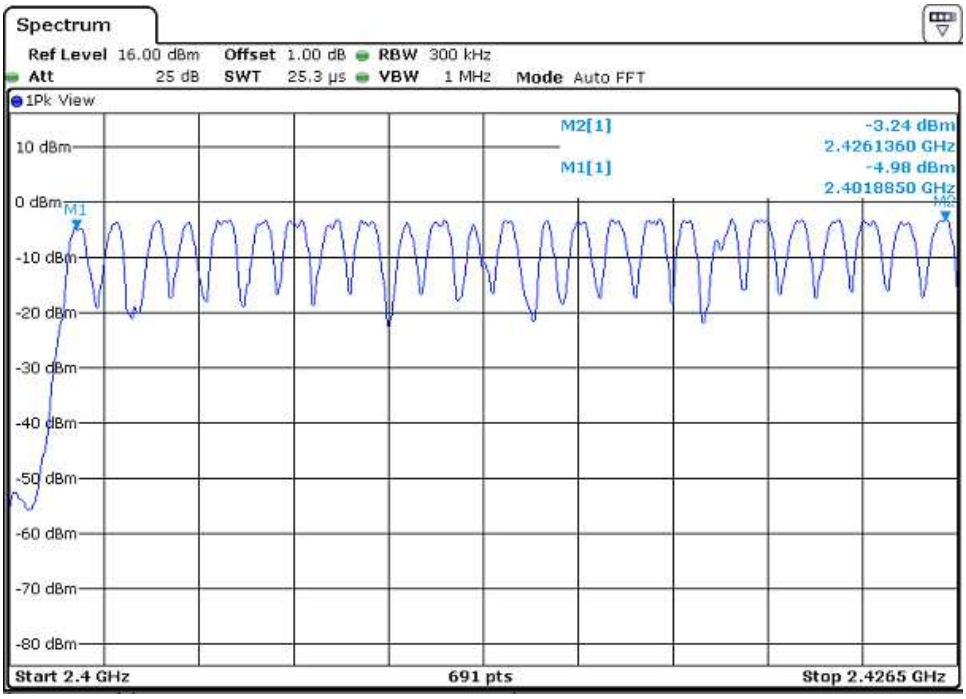
Note: In AFH mode, this device operates using 20 channels and it's satisfied the requirement of limit of minimum of 15 hopping channels.

Modulation Type: GFSK

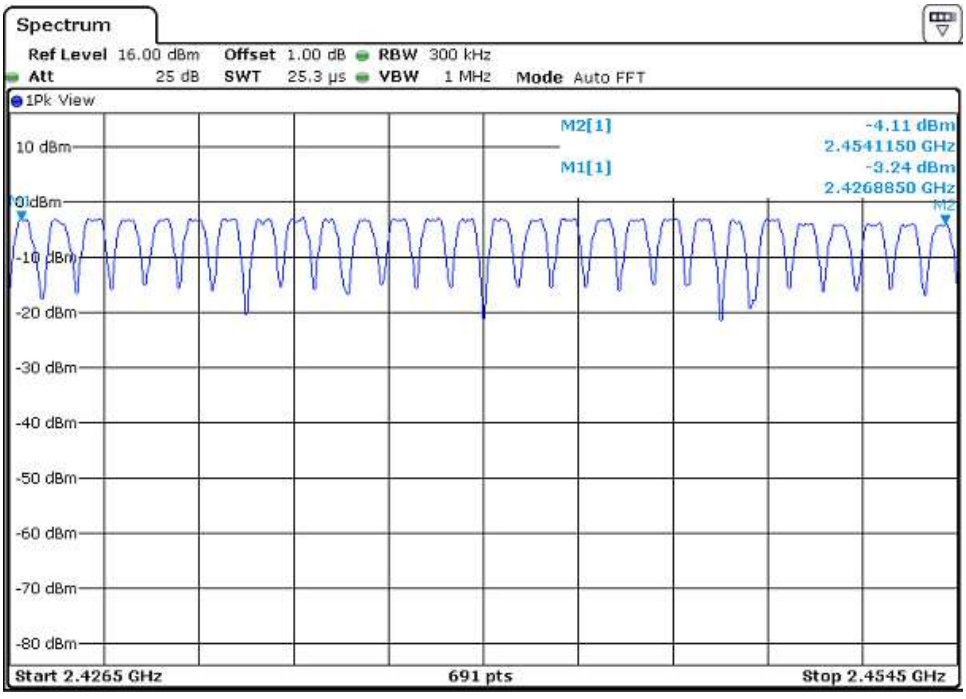
CH00-CH78



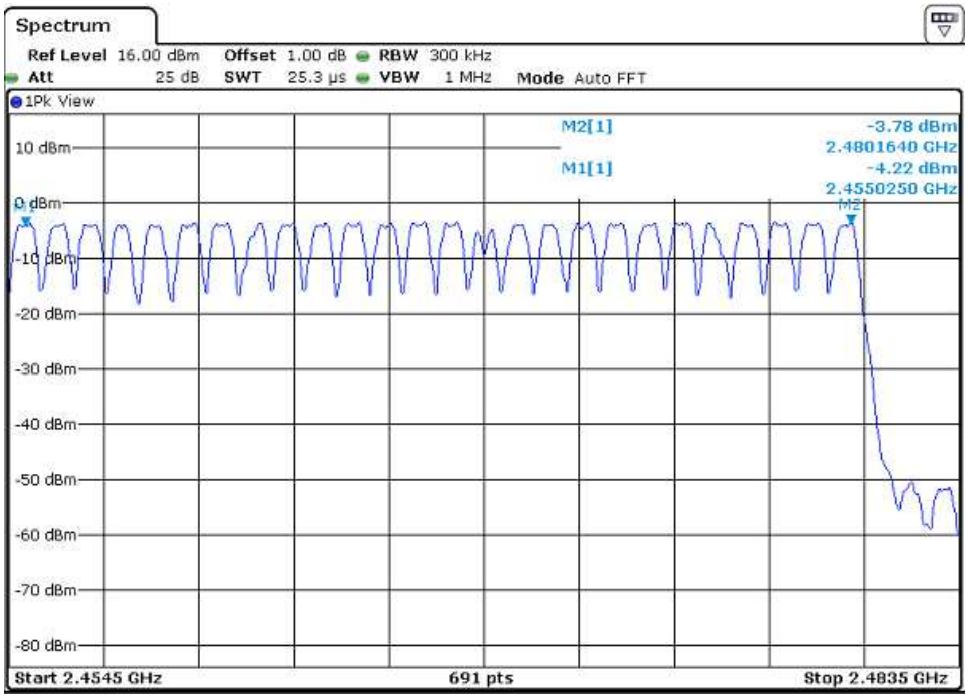
CH00-CH24



CH25-CH52



CH53-CH78


Spectrum
Ref Level 16.00 dBm Offset 1.00 dB RBW 300 kHz
Att 25 dB SWT 25.3 µs VBW 1 MHz Mode Auto FFT
1Pk View
M2[1] -3.78 dBm
2.4801640 GHz
M1[1] -4.22 dBm
2.4550250 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 2.4545 GHz
691 pts
Stop 2.4835 GHz

3.6 Channel Separation (Carrier Frequency Separation)

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

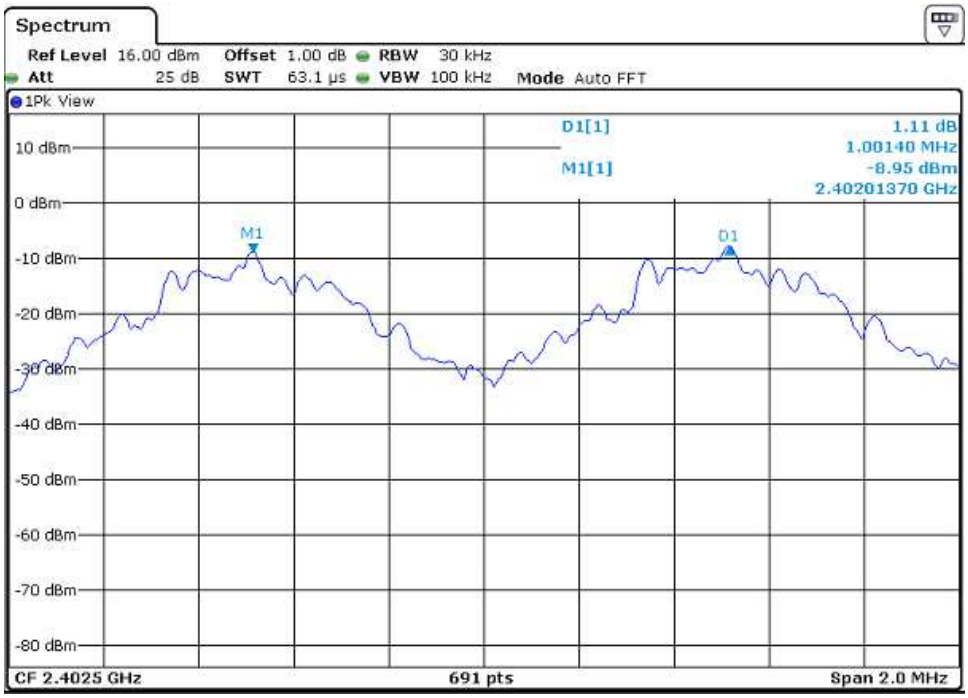
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel: 1.372 x 2/3 = 0.915MHz

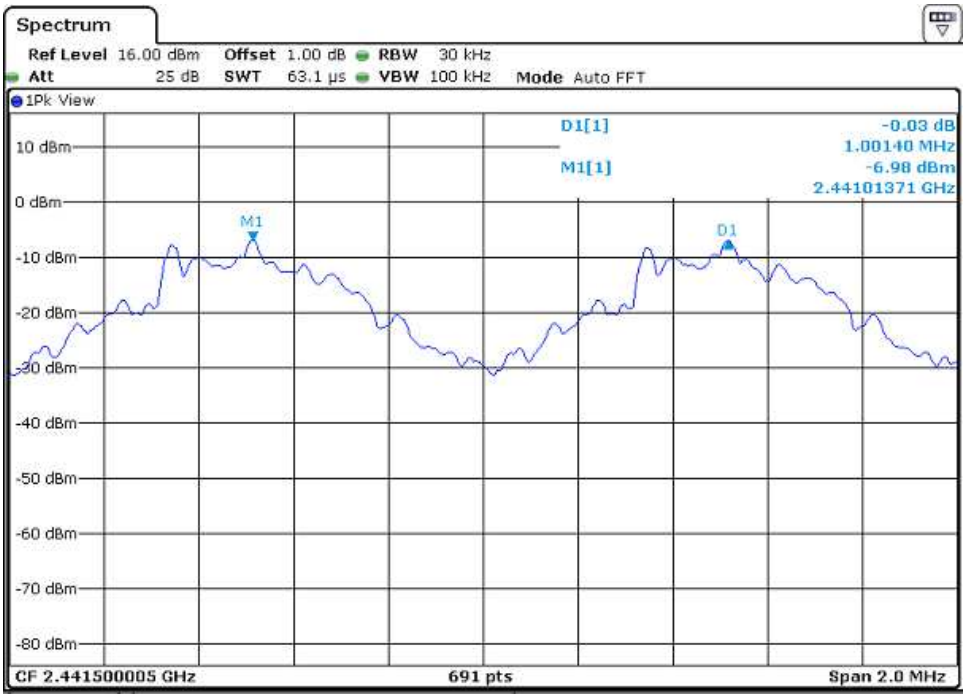
Minimum Channel Separation	1.001 MHz

Modulation Type: 8DPSK

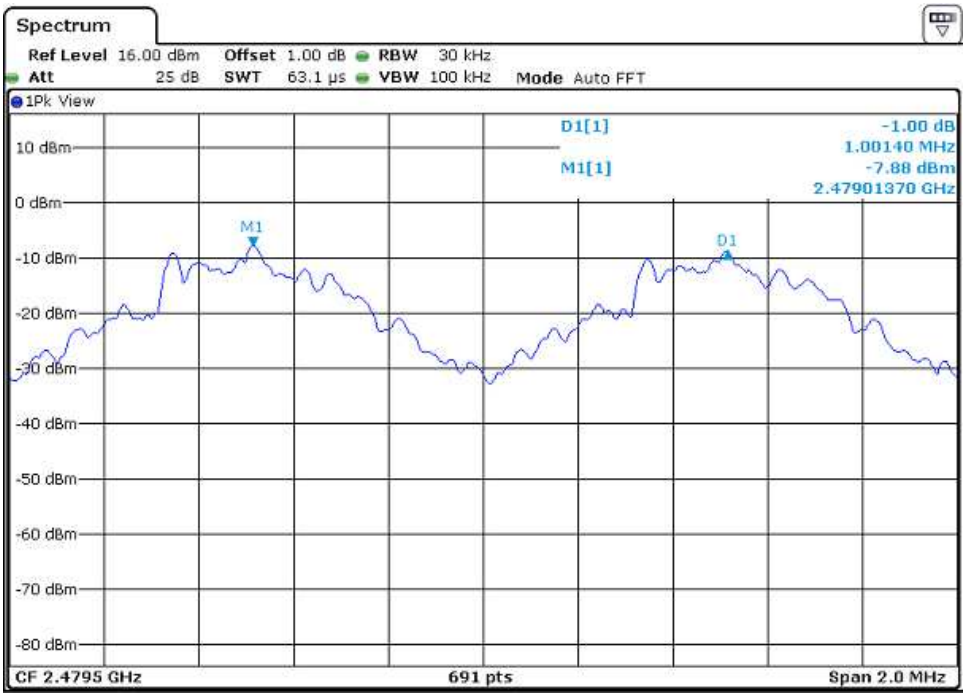
Low Channel



Middle Channel



High Channel



3.7 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

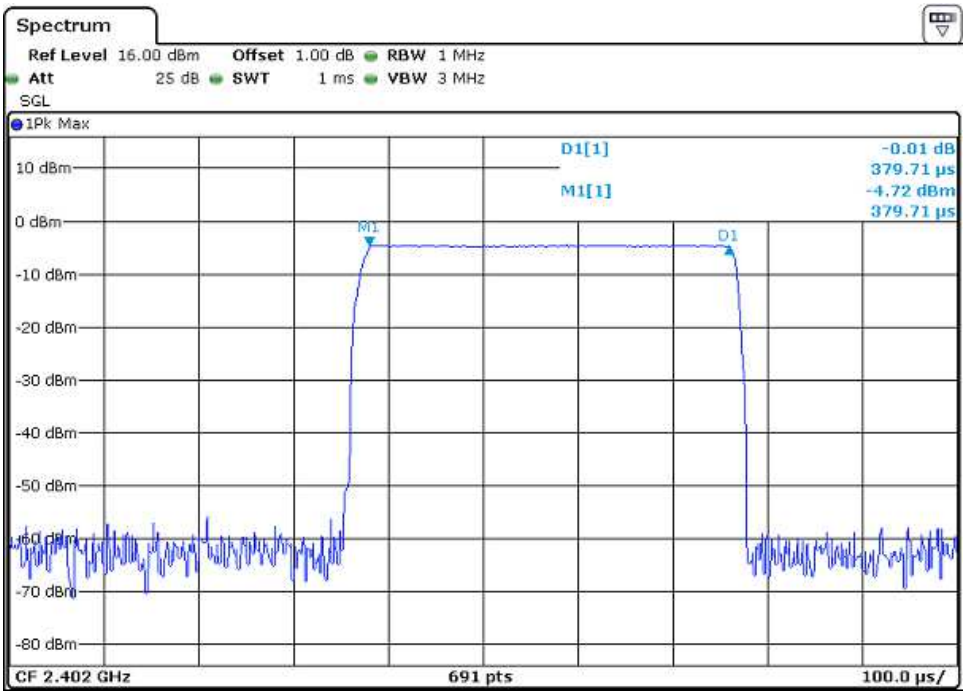
The maximum number of hopping channels in 31.6s for DH3
=1600 / 4 / 79 *31.6=160

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

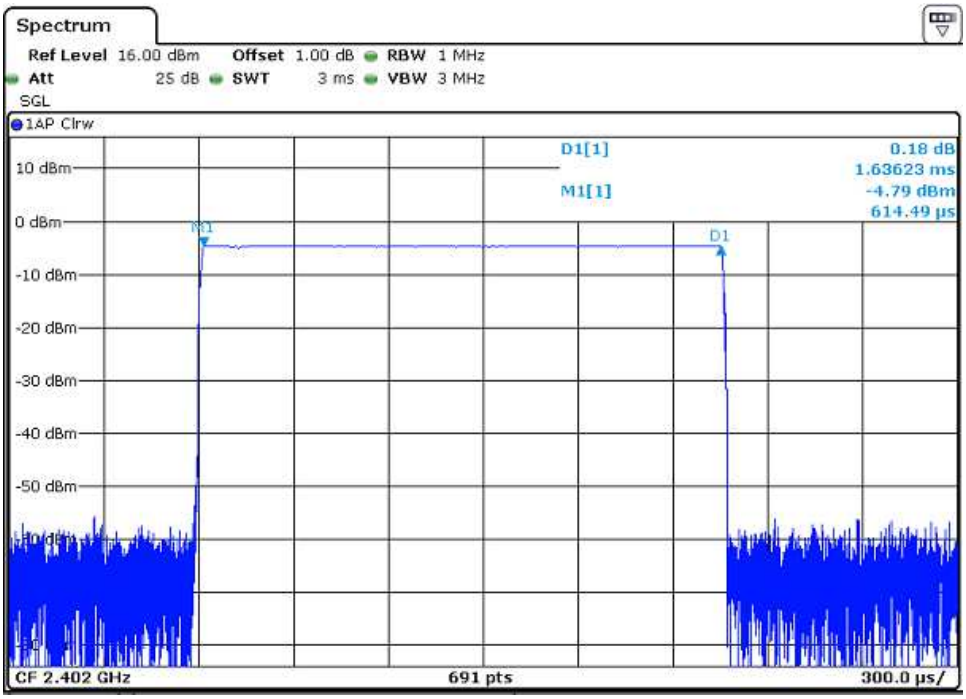
Worst Case Mode:

Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
GFSK	DH1	0.379 ms * 320= 121.28 ms	0.4	Pass
	DH3	1.636 ms * 160= 261.76 ms	0.4	Pass
	DH5	2.888 ms * 107= 309.02 ms	0.4	Pass

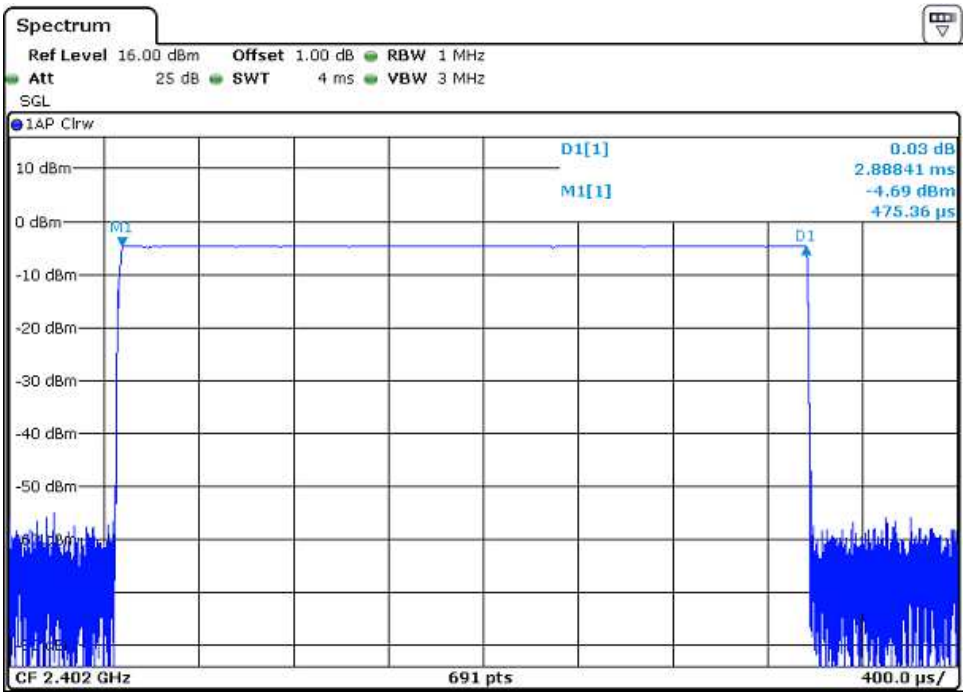
Modulation Type: GFSK
Packet: DH1



Packet: DH3



Packet: DH5


Spectrum
Ref Level 16.00 dBm Offset 1.00 dB RBW 1 MHz
Att 25 dB SWT 4 ms VBW 3 MHz
SGL
1AP Clrw
D1[1] 0.03 dB
2.88841 ms
M1[1] -4.69 dBm
475.36 µs
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
M1
D1
CF 2.402 GHz
691 pts
400.0 µs/

3.8 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.

Furthermore, delta measurement technique for measuring bandage emissions was shown as below:

(i) Lower channel 2402MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot
= 98.0dBμv/m-50.1dB
= 47.9dBμv/m

(ii) Upper channel 2480MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot
= 100.7dBμv/m-50.1dB
= 50.6dBμv/m

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74 dBμv/m (Peak Limit) and 54dBμv/m (Average Limit).

Modulation Type: GFSK

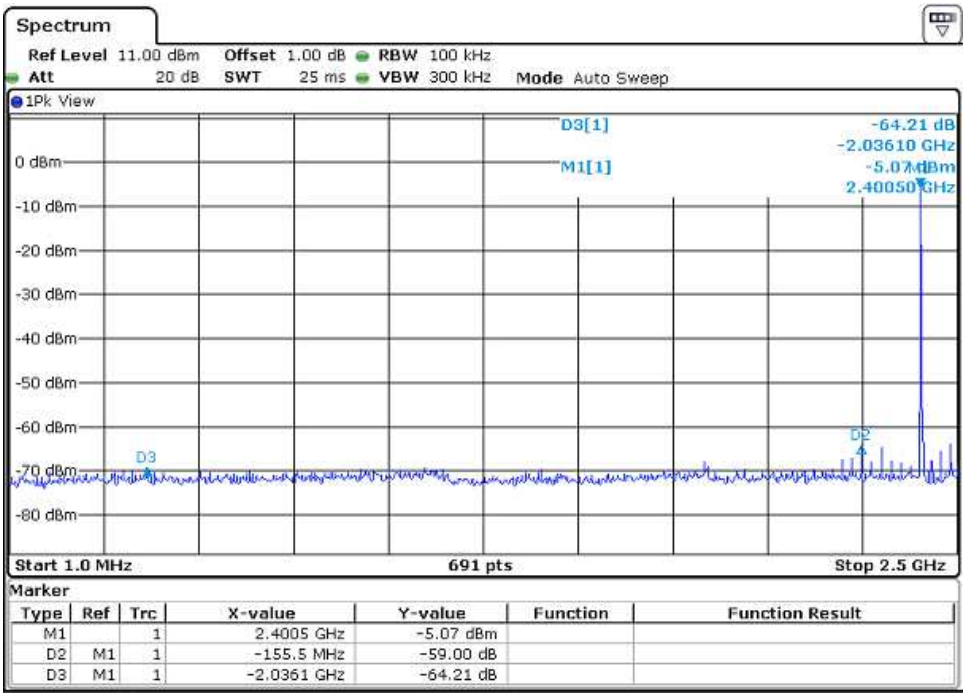
3.9 Transmitter Spurious Emissions (Conducted)

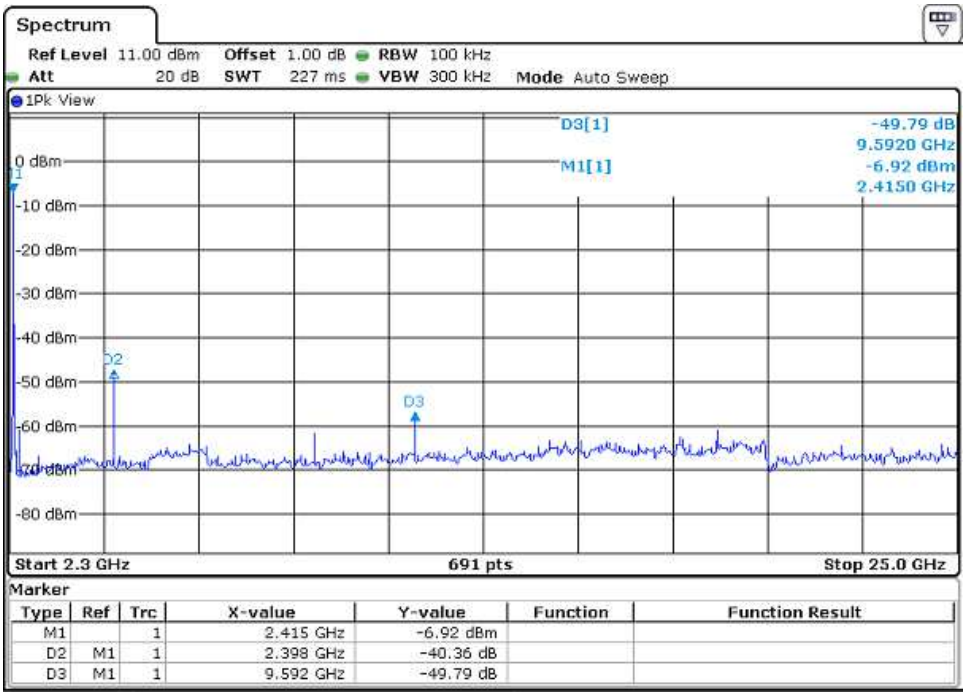
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

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.

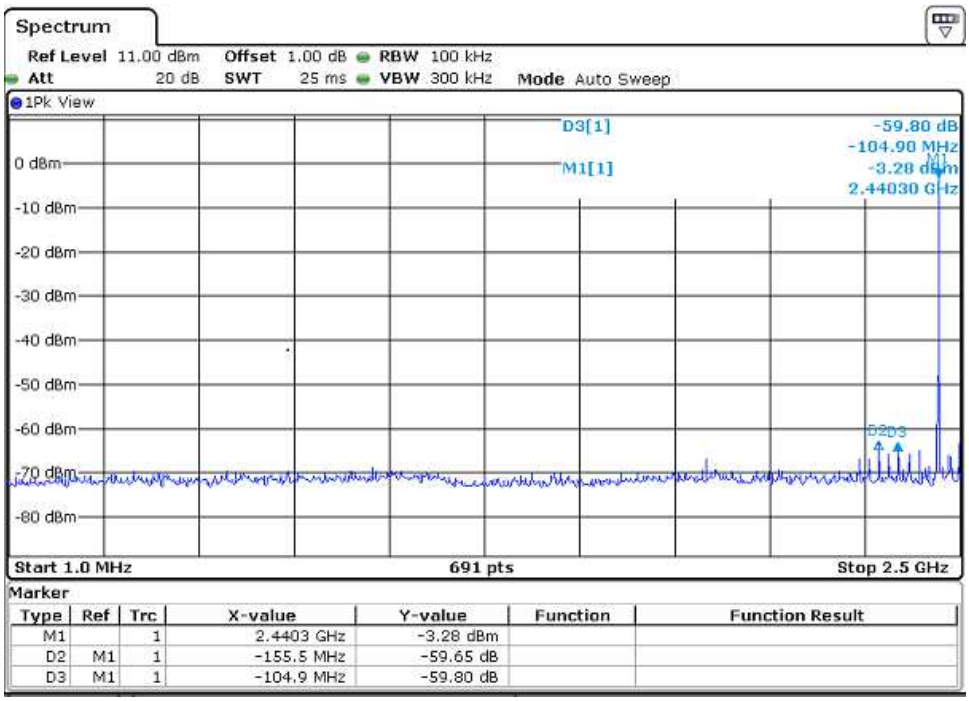
Modulation Type: GFSK

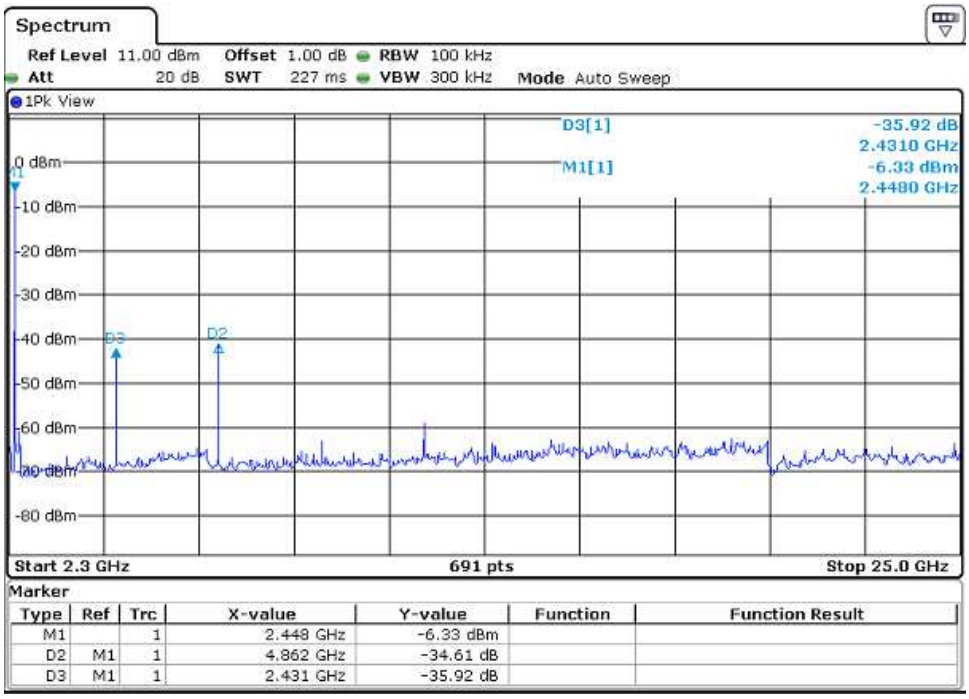
CH00



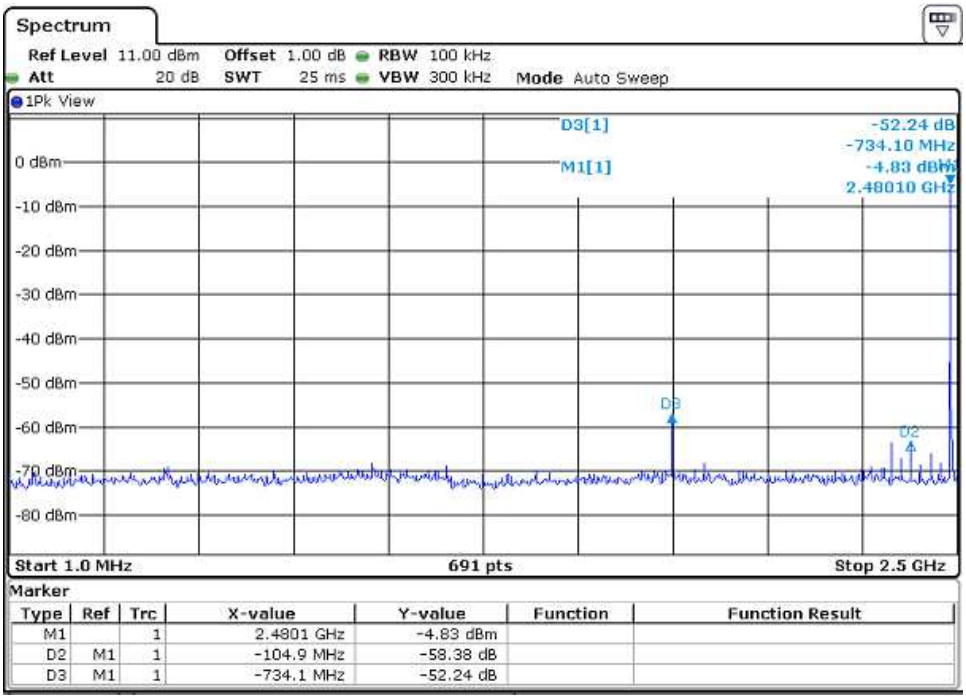


CH39


Spectrum
Ref Level 11.00 dBm Offset 1.00 dB RBW 100 kHz
Att 20 dB SWT 25 ms VBW 300 kHz Mode Auto Sweep
1Pk View
D3[1] -59.80 dB
-104.90 MHz
M1[1] -3.28 dBm
2.44030 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 1.0 MHz 691 pts Stop 2.5 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4403 GHz -3.28 dBm
D2 M1 1 -155.5 MHz -59.65 dB
D3 M1 1 -104.9 MHz -59.80 dB


Spectrum
Ref Level 11.00 dBm Offset 1.00 dB RBW 100 kHz
Att 20 dB SWT 227 ms VBW 300 kHz Mode Auto Sweep
1Pk View
D3[1] -35.92 dB
2.4310 GHz
M1[1] -6.33 dBm
2.4480 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
D3
D2
Start 2.3 GHz 691 pts Stop 25.0 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.448 GHz -6.33 dBm
D2 M1 1 4.862 GHz -34.61 dB
D3 M1 1 2.431 GHz -35.92 dB

CH78


Spectrum
Ref Level 11.00 dBm Offset 1.00 dB RBW 100 kHz
Att 20 dB SWT 25 ms VBW 300 kHz Mode Auto Sweep
1Pk View
D3[1] -52.24 dB
-734.10 MHz
M1[1] -4.83 dBm
2.48010 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D3
D2
Start 1.0 MHz
691 pts
Stop 2.5 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4801 GHz -4.83 dBm
D2 M1 1 -104.9 MHz -58.38 dB
D3 M1 1 -734.1 MHz -52.24 dB

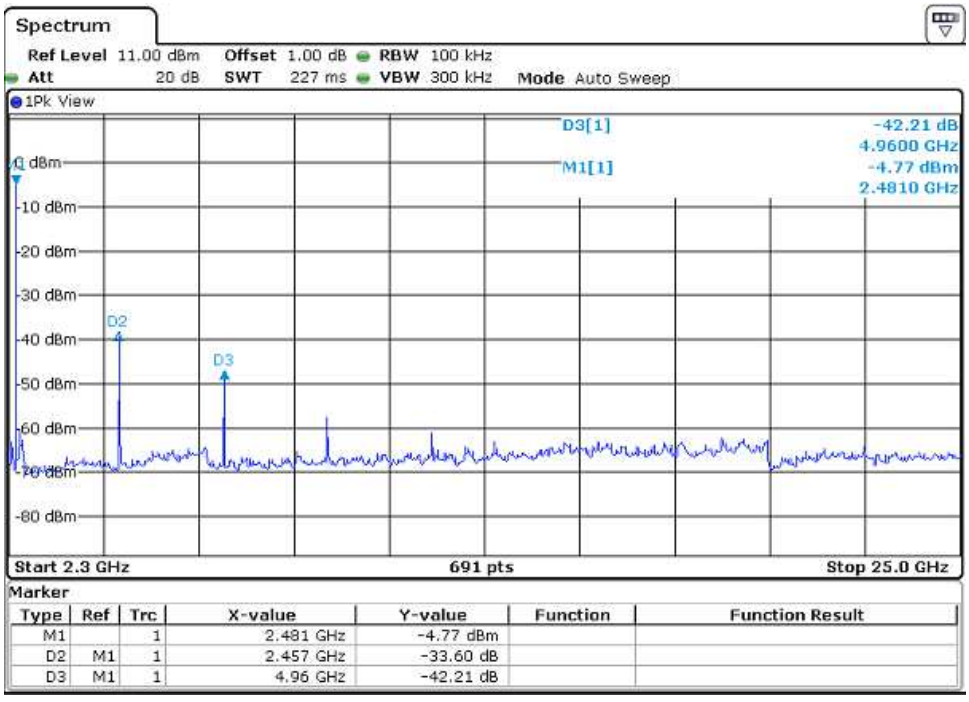

Spectrum
Ref Level 11.00 dBm Offset 1.00 dB RBW 100 kHz
Att 20 dB SWT 227 ms VBW 300 kHz Mode Auto Sweep
1Pk View
D3[1] -42.21 dB
4.9600 GHz
M1[1] -4.77 dBm
2.4810 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D2
D3
Start 2.3 GHz
691 pts
Stop 25.0 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.481 GHz -4.77 dBm
D2 M1 1 2.457 GHz -33.60 dB
D3 M1 1 4.96 GHz -42.21 dB

EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

4.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

EXHIBIT 5

PRODUCT LABELLING

5.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

EXHIBIT 6

TECHNICAL SPECIFICATIONS

6.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

EXHIBIT 7

INSTRUCTION MANUAL

7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

EXHIBIT 8

MISCELLANEOUS INFORMATION

8.0 Miscellaneous Information

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

8.1 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.

8.2 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

8.3 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.

8.3 Emissions Test Procedures (cont'd)

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

AC power to the unit 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.

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 9
CONFIDENTIALITY REQUEST

9.0 Confidentiality Request

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

EXHIBIT 10

TEST EQUIPMENT LIST

10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	20-May-2015	20-May-2016
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	20-May-2015	20-May-2016
SZ061-03	BiConiLog Antenna	ETS	3142C	00066460	14-Jun-2015	14-Jun-2016
SZ185-01	EMI Receiver	R&S	ESCI	100547	23-Jan-2016	23-Jan-2017
SZ061-08	Horn Antenna	ETS	3115	00092346	17-Oct-2015	17-Oct-2016
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	29-Apr-2015	29-Apr-2016
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	8-Jun-2015	8-Jun-2016
EM031-03	Spectrum Analyzer	R&S	FSV 40	101506	6-Jun-2015	6-Jun-2016
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	23-Jan-2016	23-Jan-2017
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	19-Apr-2014	19-Apr-2016
SZ062-02	RF Cable	RADIALL	RG 213U	--	27-Dec-2015	27-Jun-2016
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	8-Oct-2015	8-Apr-2016
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	8-Oct-2015	8-Apr-2016
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	20-May-2015	20-May-2016
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	3-Nov-2015	3-Nov-2016
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	24-Jun-2015	24-Jun-2016
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	24-Jun-2015	24-Jun-2016
SZ188-03	Shielding Room	ETS	RFD-100	4100	23-Aug-2014	23-Aug-2016