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TEST REPORT

SCOPE OF WORK
FCC TESTING–X22C

REPORT NUMBER
190124006SZN-001

ISSUE DATE	**[REVISED DATE]**
13 March 2019	[----------]

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TEST REPORT

Intertek Report No.: 190124006SZN-001

Huawei Technologies Co., Ltd.

Application
For
Certification

FCC ID: QIS-X22C

Huawei STB/Huawei BOX

Model: X22C

2.4GHz Transceiver

Report No.: 190124006SZN-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: 13 March 2019

LIST OF EXHIBITS

MEASUREMENT/TECHNICAL REPORT

Huawei Technologies Co., Ltd.

Model: X22C

FCC ID: QIS-X22C

This report concerns (check one:) Original Grant ___X___ Class I 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 [10-1-17 Edition] provision.

Report prepared by:

Rui Zhou
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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
User 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 Huawei STB/Huawei BOX with Bluetooth FHSS technology operating in 2402-2480MHz. The EUT is powered by DC 12V/1A from adapter.

For more detail information pls. refer to the user manual.

Bluetooth Version: 4.2
Antenna Type: Integral antenna
Antenna Gain: 0 dBi Max
Modulation Type: GFSK, π/4-DQPSK and 8-DPSK
For electronic filing, the brief circuit description is saved with filename: descri.pdf.

The Huawei STB/Huawei BOX, Model: X22C has six designing schemes. It would be placed on the market with six different adapters, Partly tests are required to both designing schemes, and shown the worst case in report.

Adapter	Model	Manufacture	Electrical parameters
Adapter 1	HW-120100U0W	Shenzhen TOPOW Electronics Co.,Ltd.	Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 12V 1A
Adapter 2	HW-120100U0W	Shenzhen Huntkey Electronic Co.,Ltd.	Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 12V 1A
Adapter 3	HW-120100U0W	Dongguan Phitek Electronics Co.,Ltd.	Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 12V 1A
Adapter 4	HW-120100U2W	Shenzhen TOPOW Electronics Co.,Ltd.	Input: AC 100-150V, 60Hz, 500mA Output: DC 12V 1A
Adapter 5	HW-120100U2W	Dongguan Shilong Fuhua Electronic Co.,Ltd.	Input: AC 100-150V, 60Hz, 500mA Output: DC 12V 1A
Adapter 6	HW-120100U2W	Dongguan Phitek Electronics Co.,Ltd.	Input: AC 100-150V, 60Hz, 500mA Output: DC 12V 1A

1.2 Related Submittal(s) Grants

This is an application for certification of transceiver for the Huawei STB/Huawei BOX which has classic Bluetooth function.
For the BT BLE function was tested and demonstrated in report 190124006SZN-002.
For the 2.4GHz WiFi function was tested and demonstrated in report 190124006SZN-003.
For the 5GHz WiFi function was tested and demonstrated in report 190124006SZN-004.
For other functions were reported in the SDOC report: 190124005SZN-001.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). 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 shielding room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, Shenzhen. This test facility and site measurement data have been fully placed on file with File Number: CN1188.

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 12V/1A through adapter and the adapter was powered by AC 120V, 60Hz during the test.

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 below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. 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.

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 Huawei Technologies Co., Ltd. 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.

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.
Laptop (Provided by Intertek)	Lenovo	T420
Test TV (Provided by Intertek)	SONY	KDL-24EX520
Mini Bluetooth Speak (Provided by Intertek)	/	M20
USB Memory (Provided by Intertek)	SanDisk	SDCZ36-002G-P36
Optical cable (Provided by Intertek)	/	unshielded, 130cm
Dummy Load (Provided by Intertek)	/	/
HDMI Cable (Provided by Applicant)	/	unshielded, 150cm
AV out Cable (Provided by Applicant)	/	unshielded, 150cm
RJ45 Cable (Provided by Applicant)	/	unshielded, 150cm
Remote control	/	/

EXHIBIT 3

TEST RESULTS

3.0 Test Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels). Simultaneous transmission was considered during the test.

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.

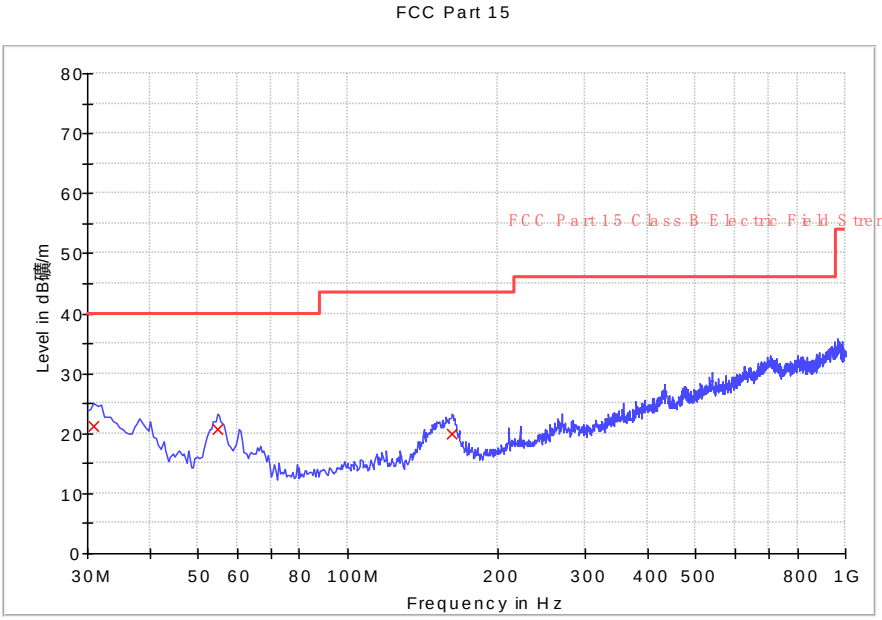
Worst Case Radiated Emission

at 45.013 MHz

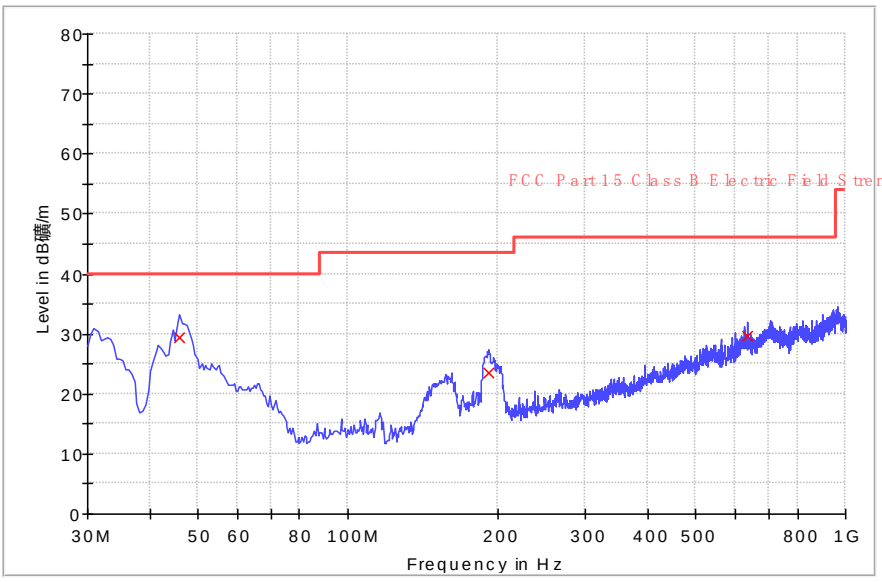
Judgement: Passed by 10.8 dB

Applicant: Huawei Technologies Co., Ltd.
Date of Test: January 31, 2019 Model: X22C
Worst Case Operating Mode: Transmitting(2402MHz)
Worst Case Adapter: Adapter1

ANT Polarity: Horizontal



ANT Polarity: Vertical



Applicant: Huawei Technologies Co., Ltd.
Date of Test: January 31, 2019 Model: X22C
Worst Case Operating Mode: Transmitting(2402MHz)
Worst Case Adapter: Adapter1

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	30.970	23.9	20.0	17.3	21.2	40.0	-18.8
Horizontal	54.735	32.3	20.0	8.4	20.7	40.0	-19.3
Horizontal	162.405	28.8	20.0	11.2	20.0	43.5	-23.5
Vertical	45.013	38.9	20.0	10.3	29.2	40.0	-10.8
Vertical	189.270	32.0	20.0	11.3	23.3	43.5	-20.2
Vertical	632.510	27.3	20.0	23.9	31.2	46.0	-14.8

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 4882.000 MHz

Judgement: Passed by 7.1 dB

Applicant: Huawei Technologies Co., Ltd.
Date of Test: January 31, 2019 Model: X22C
Worst Case Operating Mode: Transmitting(2402MHz)

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	106.2	36.7	28.5	98.0	--	--
Horizontal	*4804.000	55.2	36.7	33.2	51.7	74.0	-22.3
Horizontal	*2387.700	52.5	36.7	28.4	44.2	74.0	-29.8

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m	Margin (dB)
Horizontal	**2402.000	95.8	36.7	28.5	87.6	--	--
Horizontal	*4804.000	47.7	36.7	33.2	44.2	54.0	-9.8
Horizontal	*2387.700	41.4	36.7	28.4	33.1	54.0	-20.9

NOTES: 1. RBW=1MHz/VBW=3MHz was used for peak measurements and average measurements were made with measurement instrumentation employing an average detector function using a minimum resolution bandwidth of 1 MHz.

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: Huawei Technologies Co., Ltd.
Date of Test: January 31, 2019 Model: X22C
Worst Case Operating Mode: Transmitting(2441MHz)

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	**2441.000	106.5	36.7	28.6	98.4	--	--
Horizontal	*4882.000	55.7	36.7	33.3	52.3	74.0	-21.7
Horizontal	*7323.000	51.5	36.1	38.1	53.5	74.0	-20.5

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m	Margin (dB)
Horizontal	**2441.000	94.4	36.7	28.5	86.2	--	--
Horizontal	*4882.000	50.3	36.7	33.3	46.9	54.0	-7.1
Horizontal	*7323.000	41.2	36.1	38.1	43.2	54.0	-10.8

NOTES:
1. RBW=1MHz/VBW=3MHz was used for peak measurements and average measurements were made with measurement instrumentation employing an average detector function using a minimum resolution bandwidth of 1 MHz.
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: Huawei Technologies Co., Ltd.
Date of Test: January 31, 2019 Model: X22C
Worst Case Operating Mode: Transmitting(2480MHz)

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	105.3	36.7	28.6	97.2	--	--
Horizontal	*4960.000	54.4	36.7	33.5	51.2	74.0	-22.8
Horizontal	*7440.000	52.0	36.1	38.5	54.4	74.0	-19.6

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m	Margin (dB)
Horizontal	**2480.000	93.2	36.7	28.6	85.1	--	--
Horizontal	*4960.000	47.5	36.7	33.5	44.3	54.0	-9.7
Horizontal	*7440.000	41.8	36.1	38.5	44.2	54.0	-9.8

NOTES:
1. RBW=1MHz/VBW=3MHz was used for peak measurements and average measurements were made with measurement instrumentation employing an average detector function using a minimum resolution bandwidth of 1 MHz.
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.

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

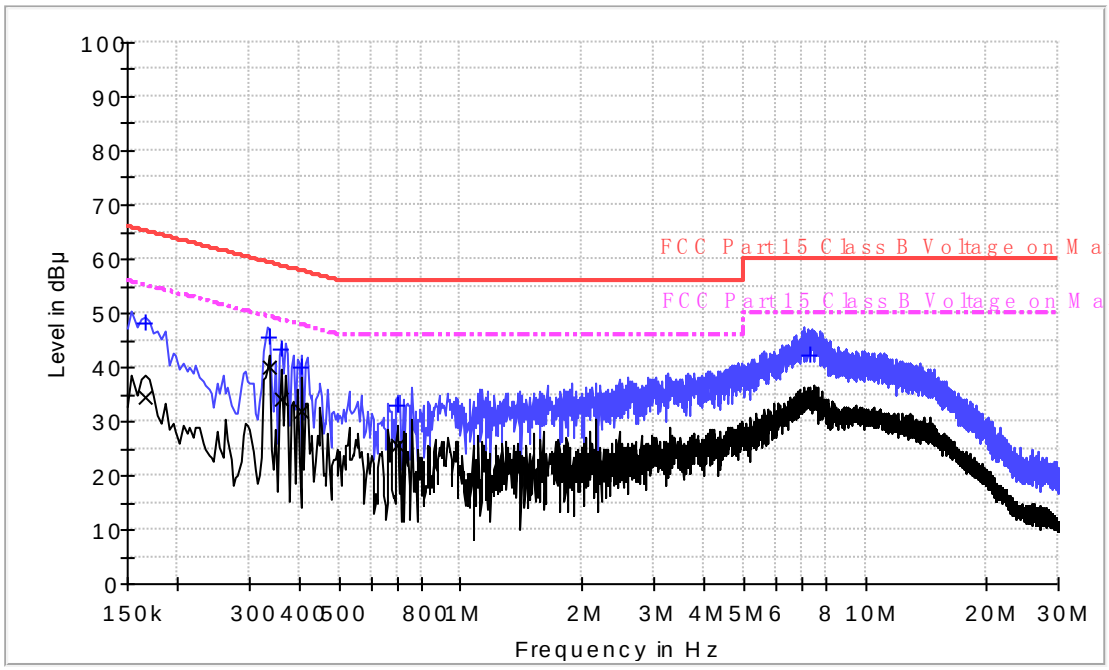
Worst Case Conducted Configuration

at 0.338 MHz

Judgement: Passed by 9.2 dB margin

Applicant: Huawei Technologies Co., Ltd.
Date of Test: February 18, 2019 Model: X22C
Worst Case Operating Mode: BT Link
Phase: Live
Worst Case Adapter: Adapter 5

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB¦ÌV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB¦ÌV)
0.166000	48.1	9.000	L	9.6	17.1	65.2
0.338000	45.4	9.000	L	9.6	13.9	59.3
0.362000	43.5	9.000	L	9.6	15.2	58.7
0.406000	39.9	9.000	L	9.6	17.8	57.7
0.702000	32.8	9.000	L	9.7	23.2	56.0
7.274000	42.1	9.000	L	9.8	17.9	60.0

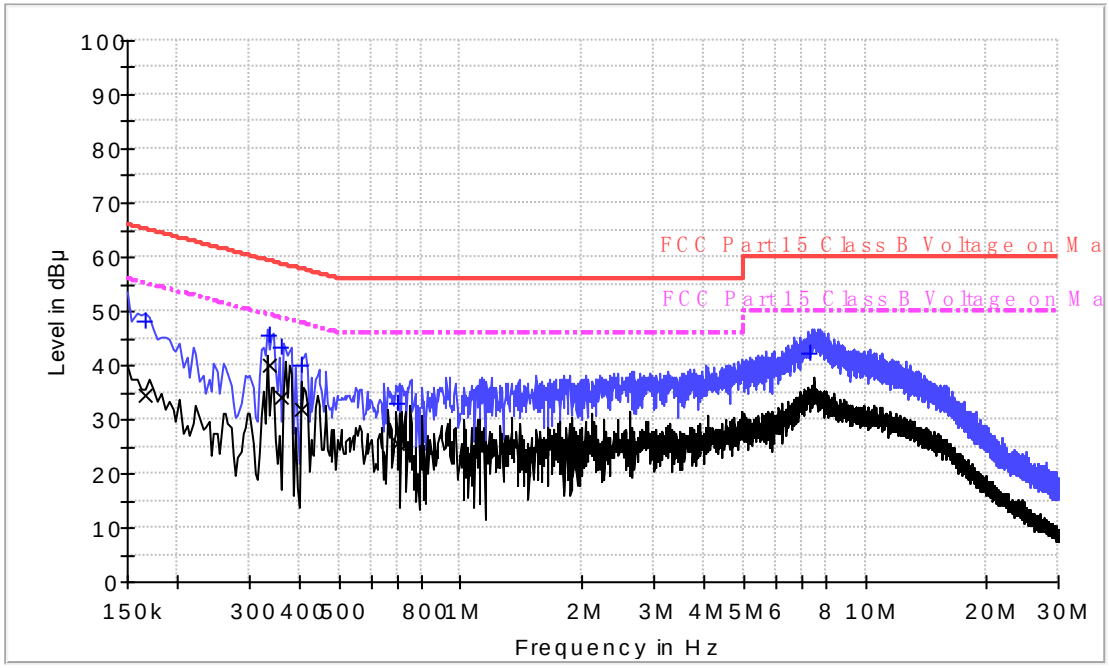
Result Table AV

Frequency (MHz)	Average (dB¦ÌV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB¦ÌV)
0.166000	34.3	9.000	L	9.6	20.9	55.2
0.338000	40.1	9.000	L	9.6	9.2	49.3
0.362000	33.9	9.000	L	9.6	14.8	48.7
0.406000	31.7	9.000	L	9.6	16.0	47.7
0.702000	25.4	9.000	L	9.7	20.6	46.0
7.274000	34.6	9.000	L	9.8	15.4	50.0

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

Applicant: Huawei Technologies Co., Ltd.
Date of Test: February 18, 2019 Model: X22C
Worst Case Operating Mode: BT Link
Phase: Neutral
Worst Case Adapter: Adapter 5

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	48.1	9.000	N	9.6	17.1	65.2
0.339000	45.3	9.000	N	9.6	14.0	59.3
0.361000	43.5	9.000	N	9.6	15.2	58.7
0.406000	39.9	9.000	N	9.6	17.8	57.7
0.702000	32.8	9.000	N	9.7	23.2	56.0
7.274000	42.1	9.000	N	9.8	17.9	60.0

Result Table AV

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	34.3	9.000	N	9.6	20.9	55.2
0.339000	40.0	9.000	N	9.6	9.3	49.3
0.361000	33.9	9.000	N	9.6	14.8	48.7
0.406000	31.7	9.000	N	9.6	16.0	47.7
0.702000	25.4	9.000	N	9.7	20.6	46.0
7.274000	34.6	9.000	N	9.8	15.4	50.0

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

Applicant: Huawei Technologies Co., Ltd.
Date of Test: March 11, 2019 Model: X22C

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 spectrum analyzer. The analyzer was set for RBW > 20dB bandwidth and power was read directly in dBm.

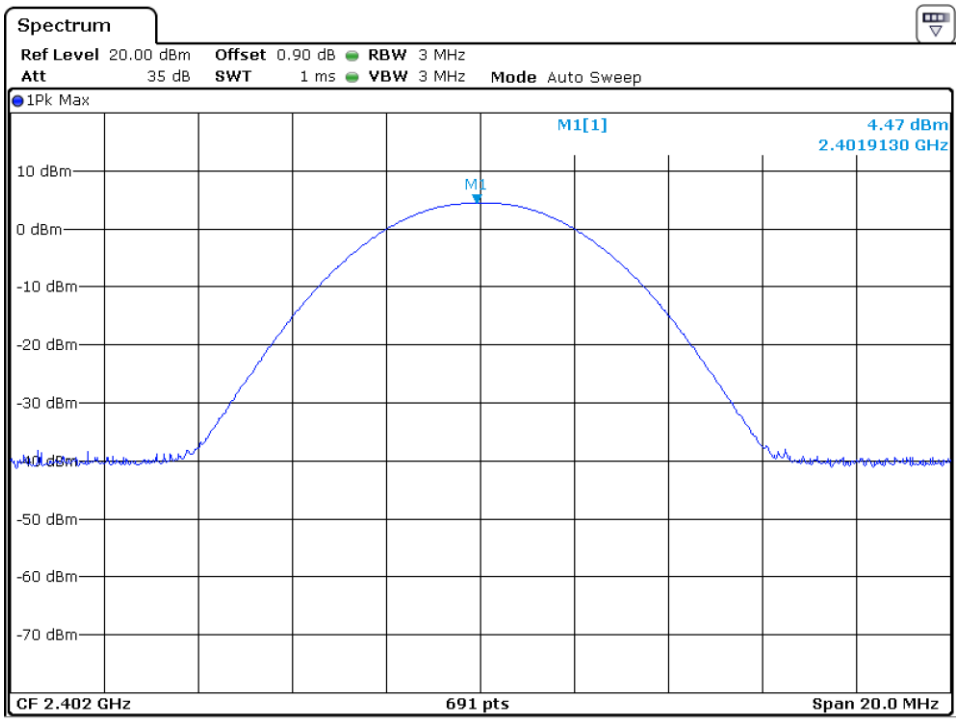
For antenna with gains of 6dBi or less, and frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, the systems operate with an output power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

Antenna Gain = 0dBi			
Modulation Type	Frequency (MHz)	Output Power (Peak Reading) (dBm)	Output Power (mW)
GFSK	2402	4.47	2.799
	2441	4.39	2.748
	2480	3.59	2.286

Cable loss: 0.9 dB External Attenuation: 0 dB
Cable loss, external attenuation has been included in OFFSET function

Modulation Type: GFSK

CH00



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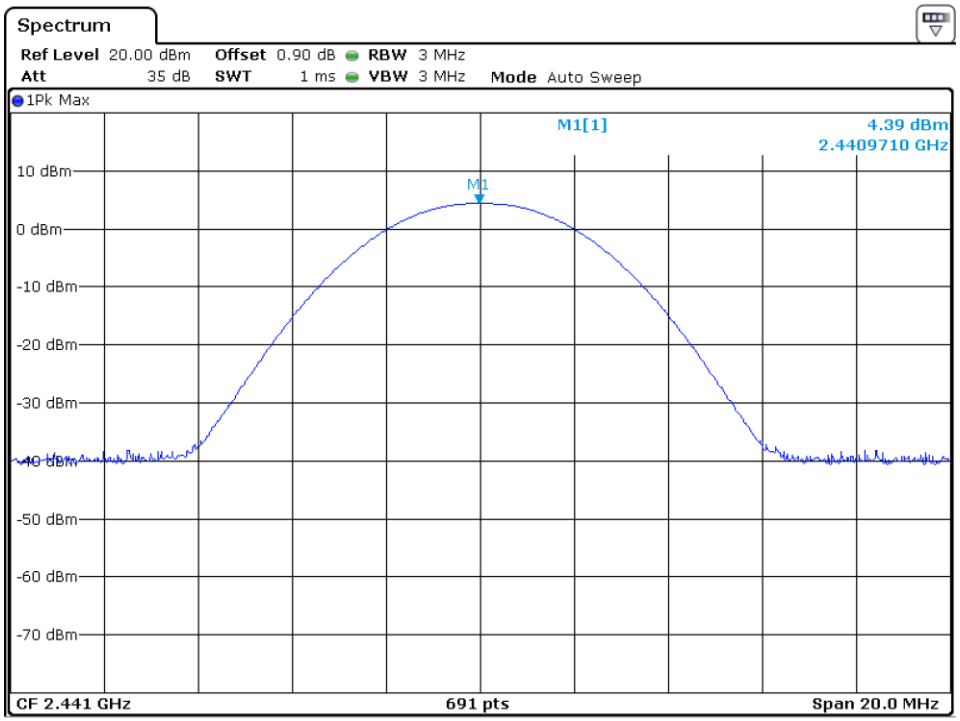
CH39



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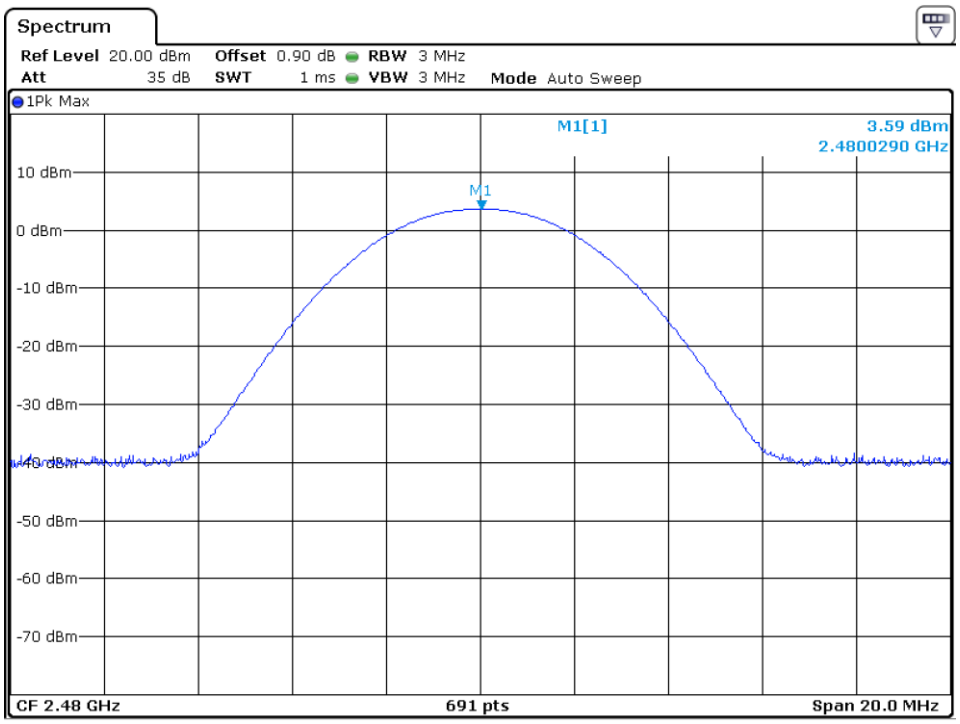
CH78



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Applicant: Huawei Technologies Co., Ltd.
Date of Test: March 11, 2019 Model: X22C

3.4 20dB Bandwidth

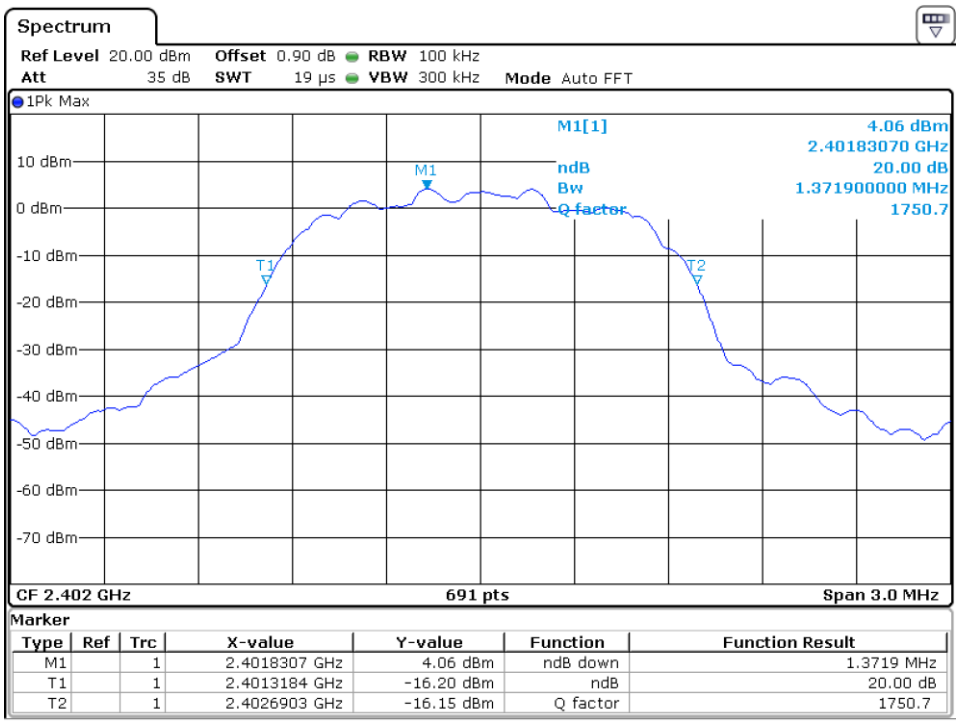
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

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	1.3719
2441	1.3676
2480	1.3719

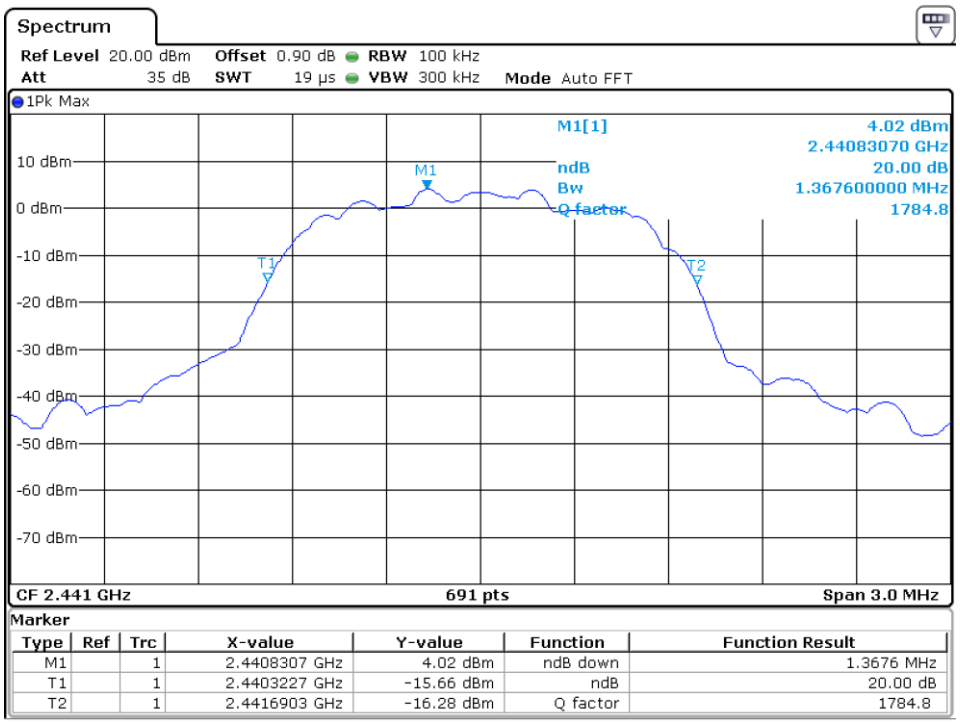
Modulation Type: 8DPSK

CH00



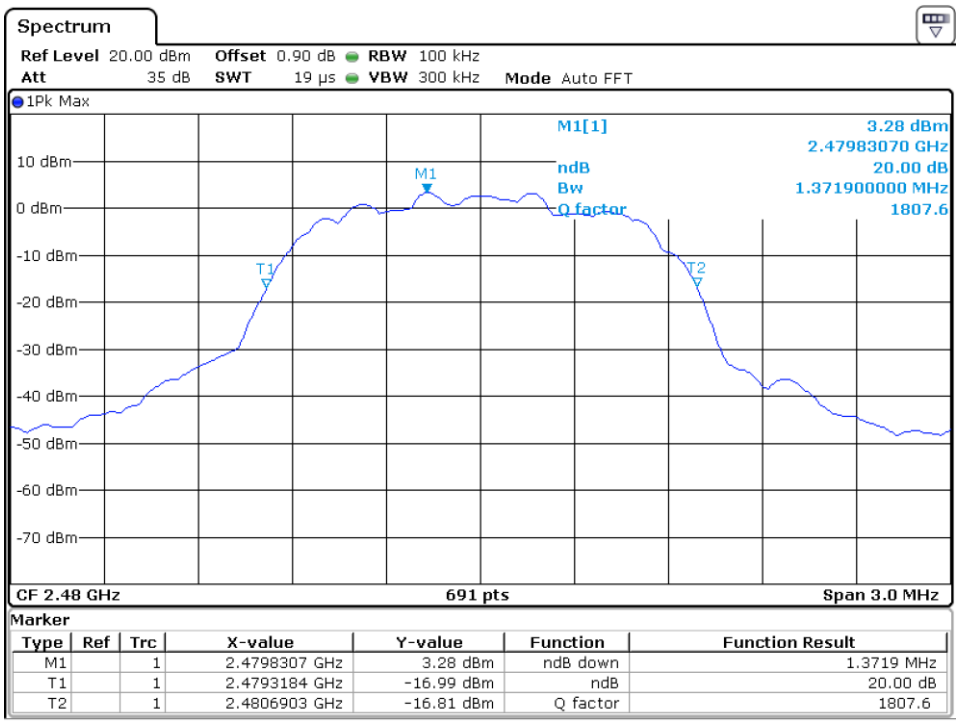
Date: 11.MAR.2019 15:19:56

CH39



Date: 11.MAR.2019 15:18:52

CH78



Date: 11.MAR.2019 15:18:13

Applicant: Huawei Technologies Co., Ltd.
Date of Test: March 11, 2019 Model: X22C

3.5 Channel Number (Number of Hopping Frequencies)

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

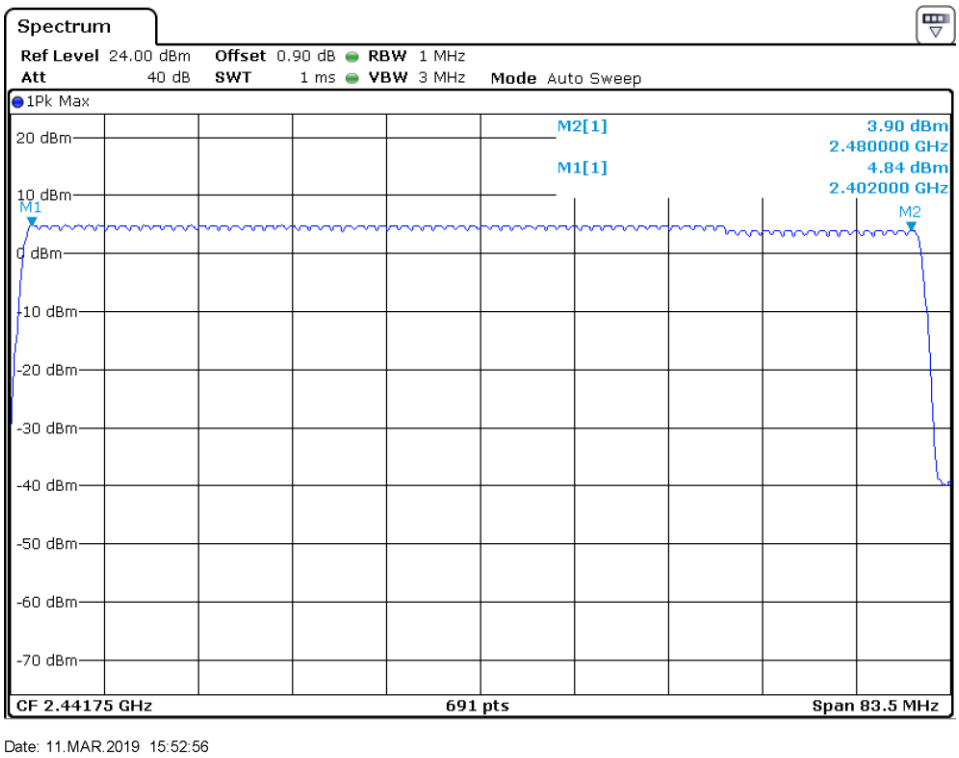
The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Number of hopping channels =	79

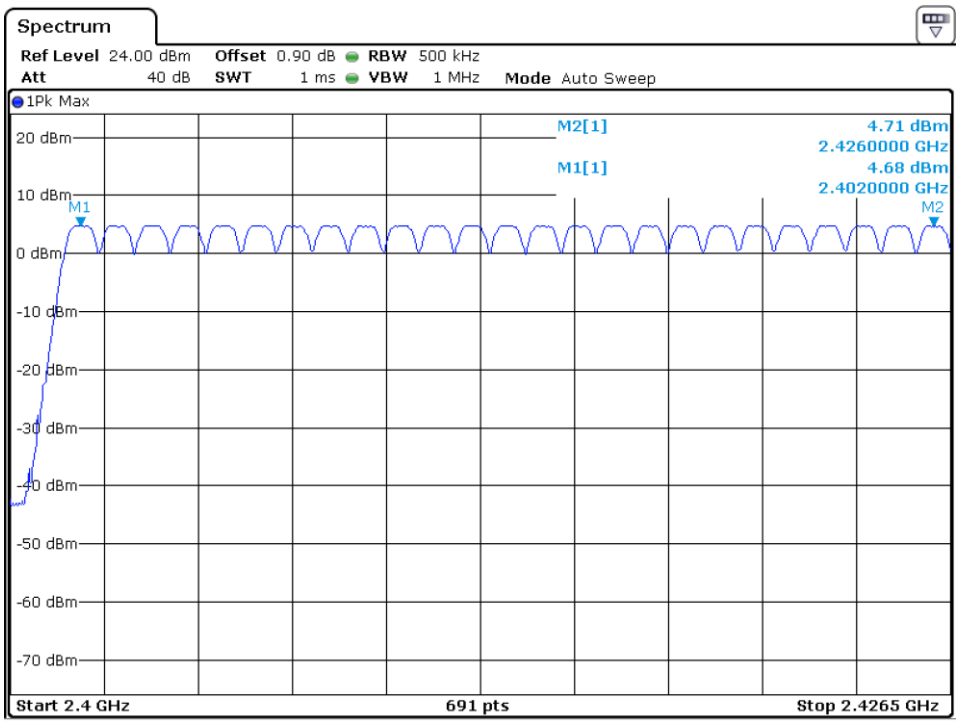
Note: In AFH mode, this device operates using 20 channels and it's satisfied the requirement of limit of minimum of 15 hopping channels.

Modulation Type: GFSK

CH00-CH78

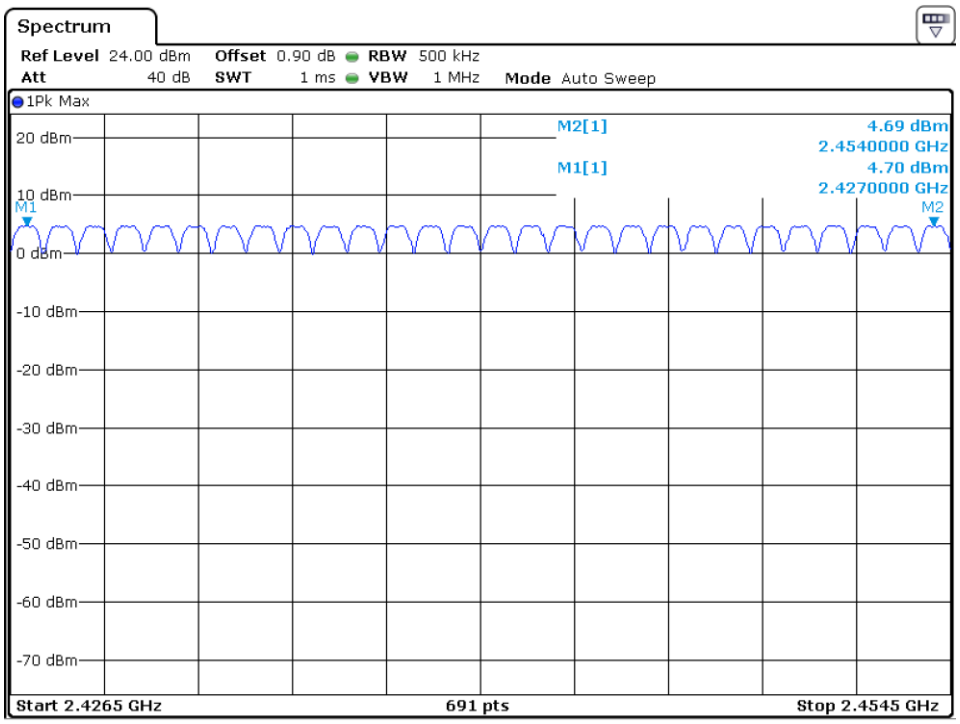


CH00-CH24



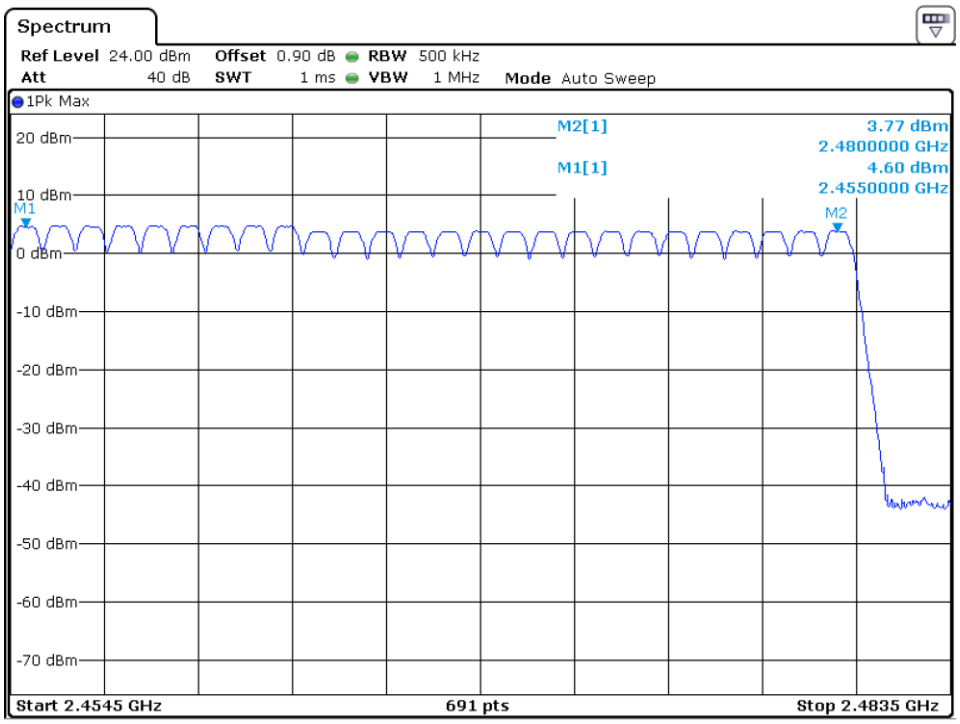
Date: 11.MAR.2019 15:54:09

CH25-CH52



Date: 11.MAR.2019 15:55:38

CH53-CH78



Date: 11.MAR.2019 15:56:08

Applicant: Huawei Technologies Co., Ltd.
Date of Test: March 11, 2019 Model: X22C

3.6 Channel Separation (Carrier Frequency Separation)

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

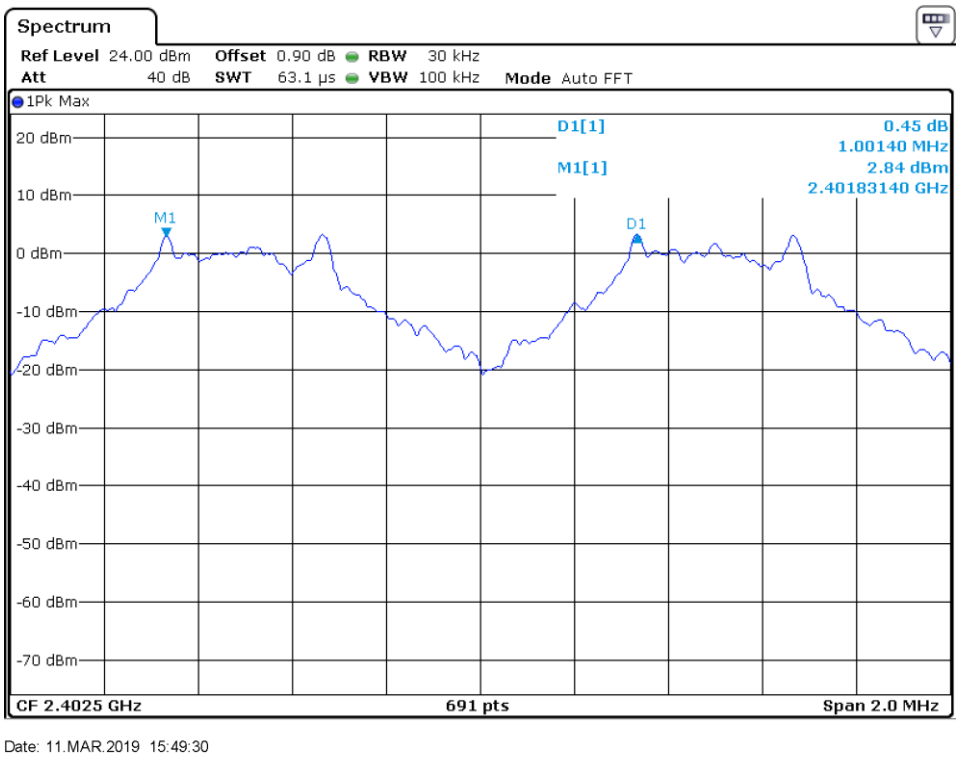
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel: 1.3719 x 2/3 = 0.9146MHz

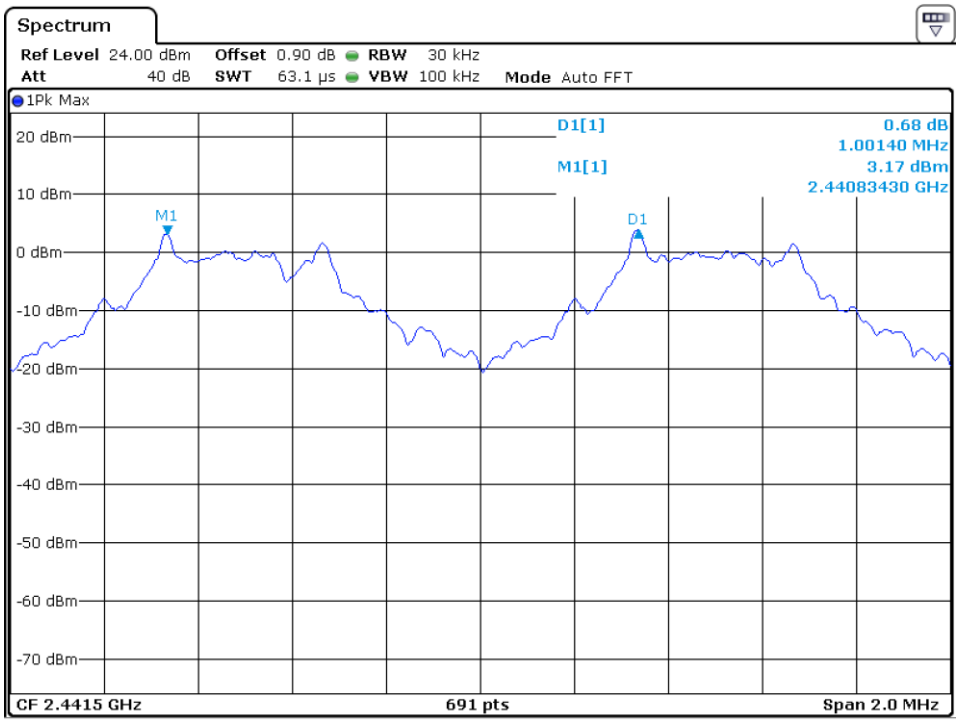
Minimum Channel Separation	1.0014 MHz

Modulation Type: GFSK

Low Channel

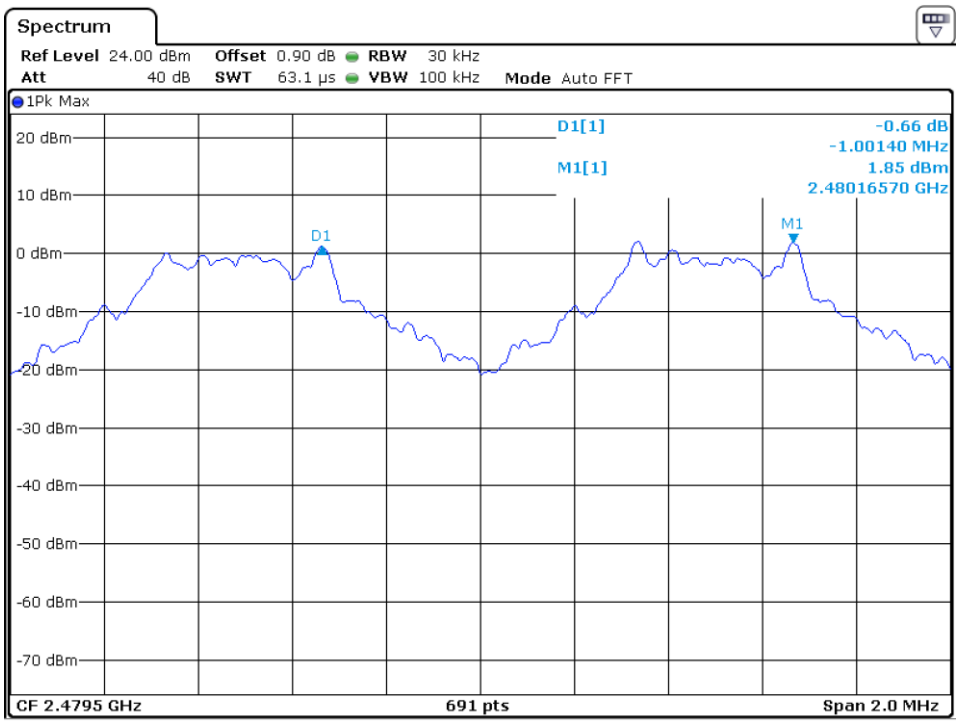


Middle Channel



Date: 11.MAR.2019 15:50:26

High Channel



Date: 11.MAR.2019 15:52:03

Applicant: Huawei Technologies Co., Ltd.
Date of Test: March 11, 2019 Model: X22C

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 with a longer sweep time to show two successive hops on a channel; the SPAN was set to ZERO SPAN, and the TRIGGER was set to VIDEO. RBW shall be ≤channel spacing and where possible RBW should be set >>1/T, where T is the expected dwell time per channel. The time duration of the transmissions so captured was measured with the MARKER DELTA function.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Different modes of operation were performed and only the worst case data was reported.

Worst Test Result:

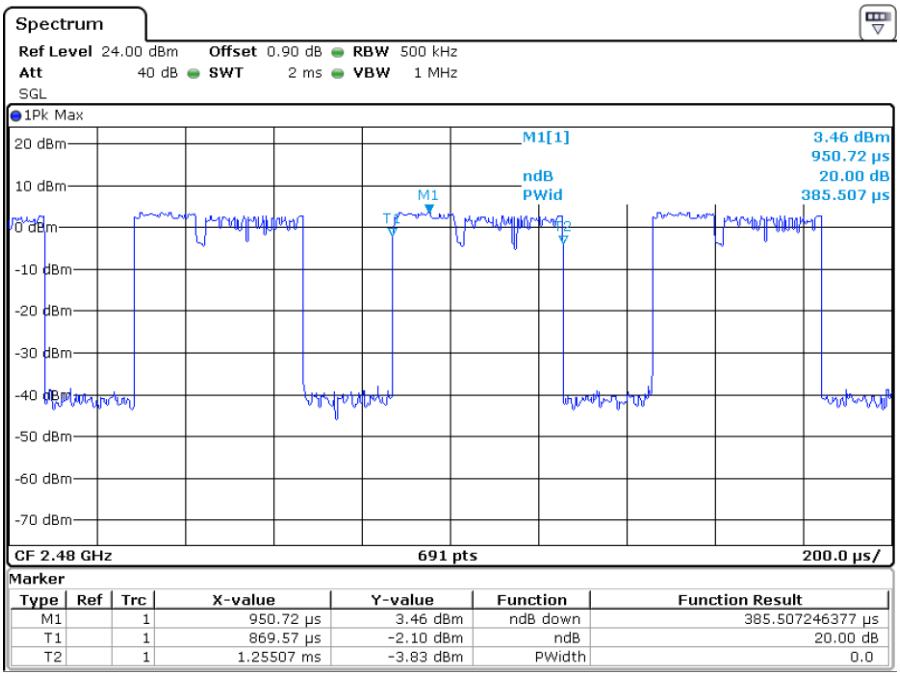
Normal hopping mode:

Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
8DPSK	3DH1	0.386ms * 852= 328.87ms	0.4	Pass
	3DH3	1.641ms * 223= 365.94ms	0.4	Pass
	3DH5	2.887ms * 130 = 375.31ms	0.4	Pass

AFH mode:

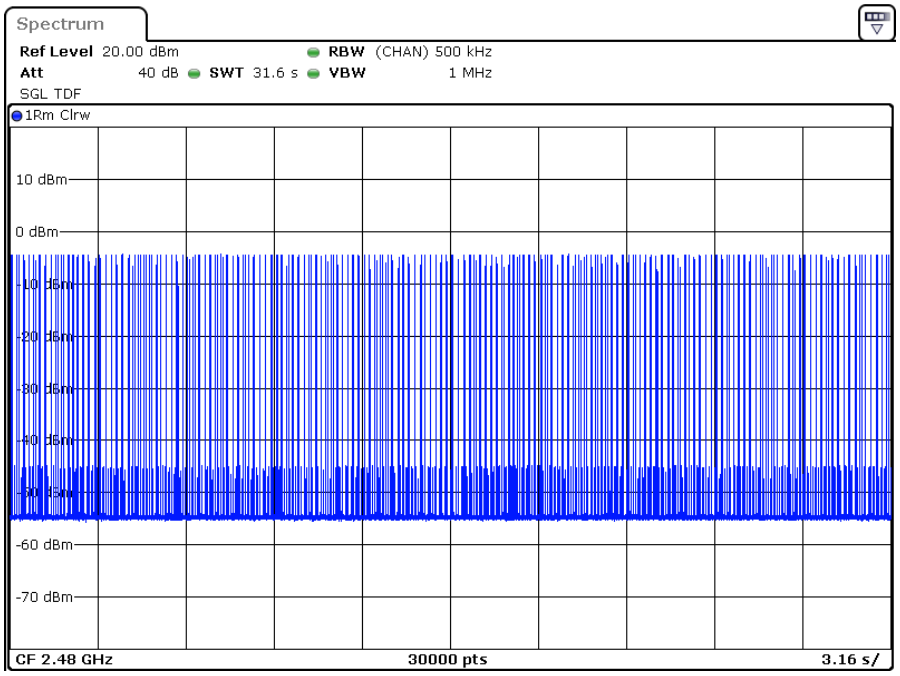
Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
8DPSK	3DH1	0.386ms *82 = 31.65ms	0.4	Pass
	3DH3	1.641ms *59 = 96.82ms	0.4	Pass
	3DH5	2.887ms *51 = 147.24ms	0.4	Pass

Modulation Type: 8DPSK
Packet: 3DH1



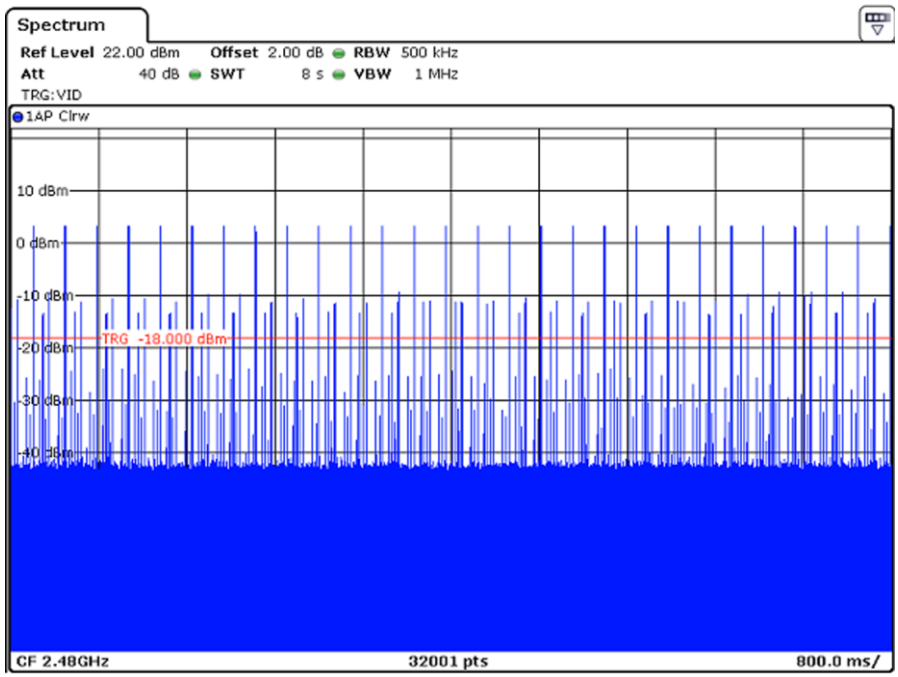
Date: 11.MAR.2019 15:28:34

Number of hops (Normal hopping mode)



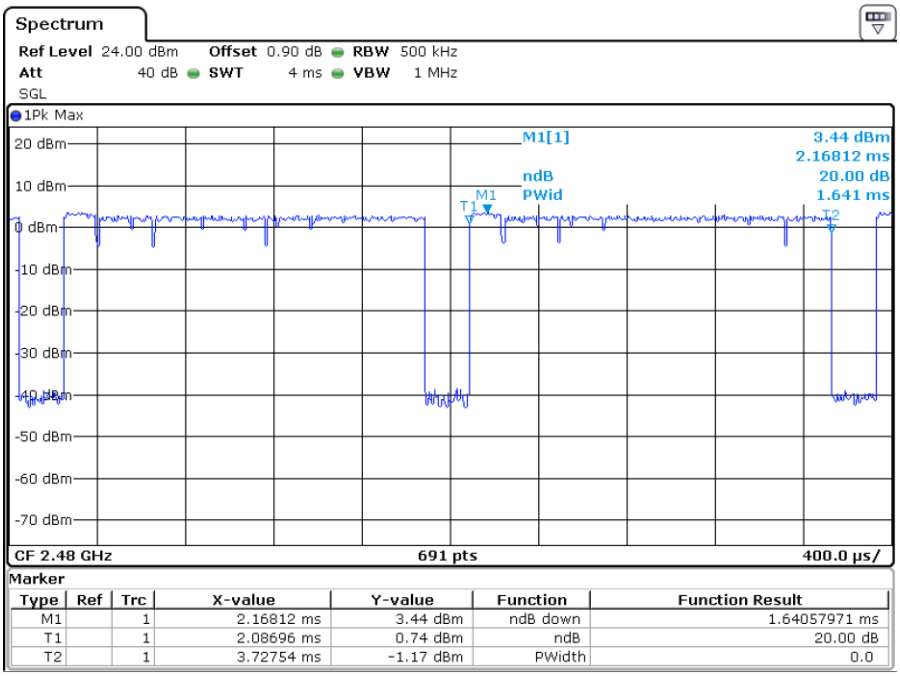
Date: 11.MAR.2019 17:26:32

Number of hops (AFH mode)



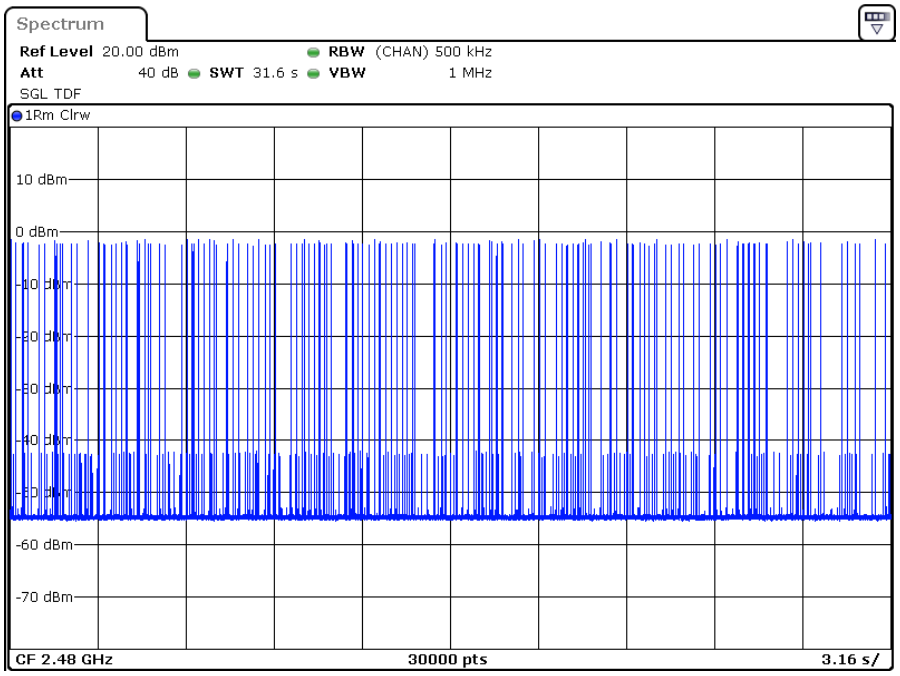
Date: 11.MAR.2019 15:40:02

Packet: 3DH3

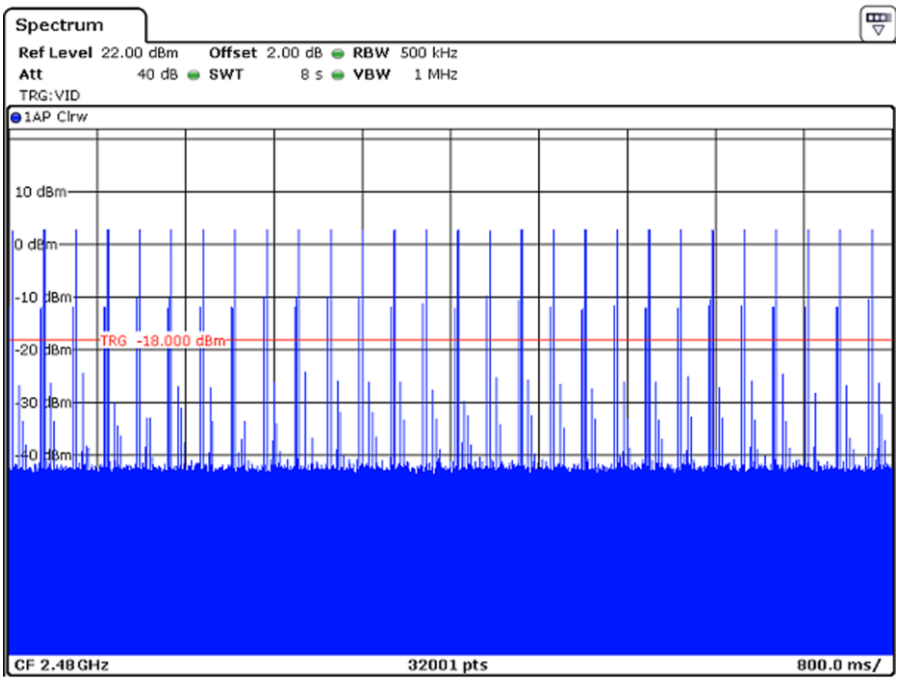


Date: 11.MAR.2019 15:27:00

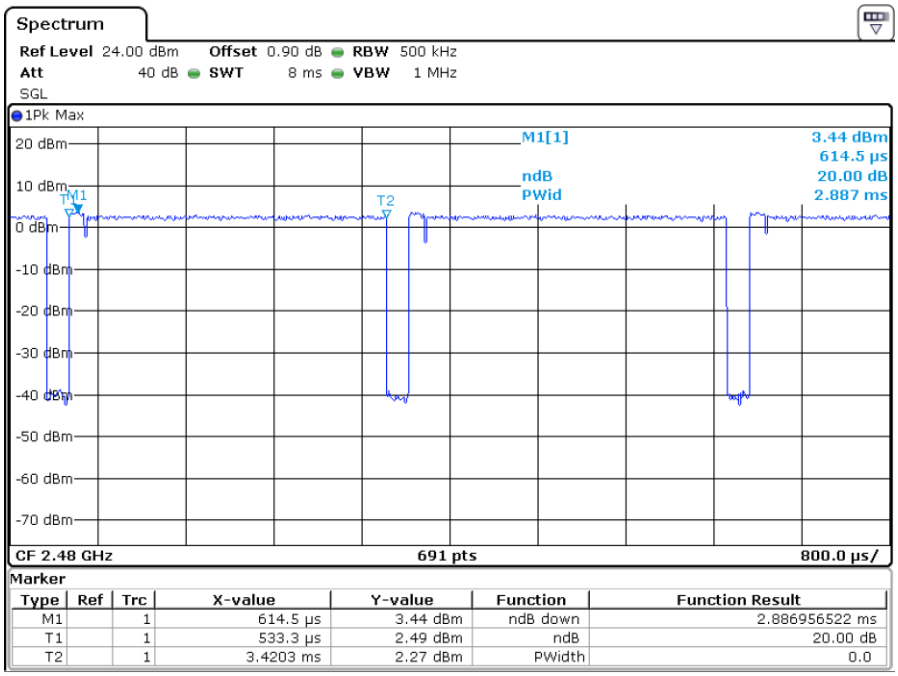
Number of hops (Normal hopping mode)



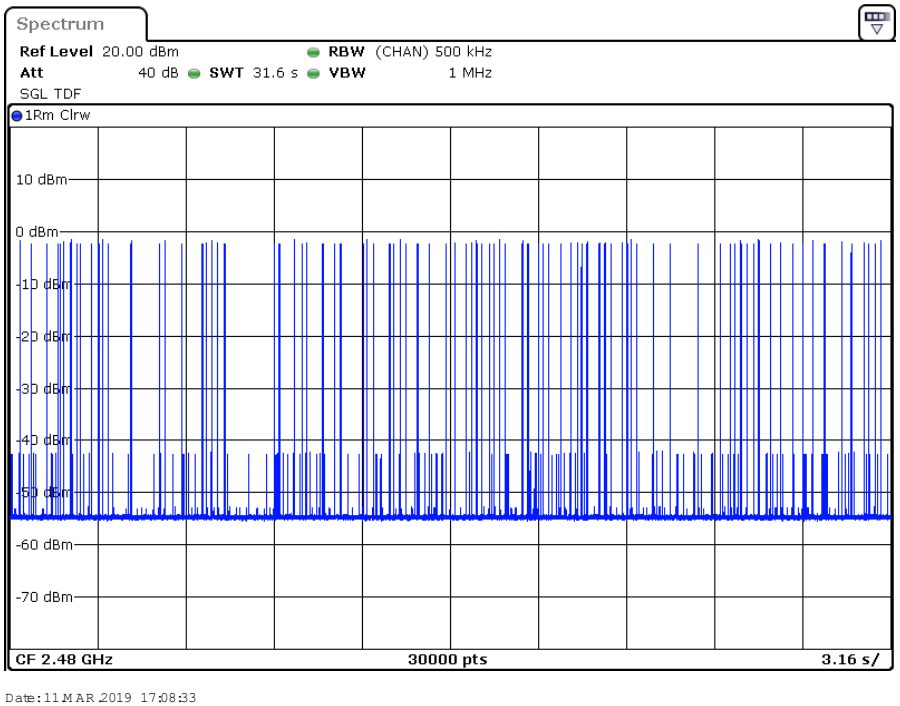
Number of hops (AFH mode)



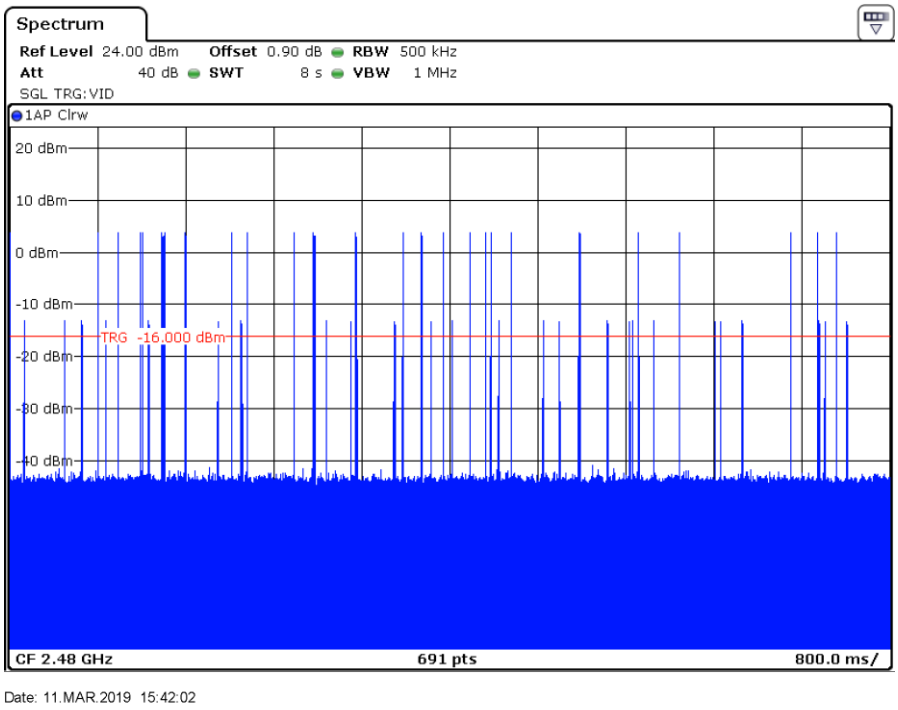
Packet: 3DH5



Number of hops (Normal hopping mode)



Number of hops (AFH mode)



Applicant: Huawei Technologies Co., Ltd.
Date of Test: March 11, 2019 Model: X22C

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-51.17dB
= 46.83dBμv/m

Average Resultant field strength = Fundamental emissions (Average value) – delta from the bandedge plot
= 87.6dBμv/m-51.17dB
= 36.43dBμv/m

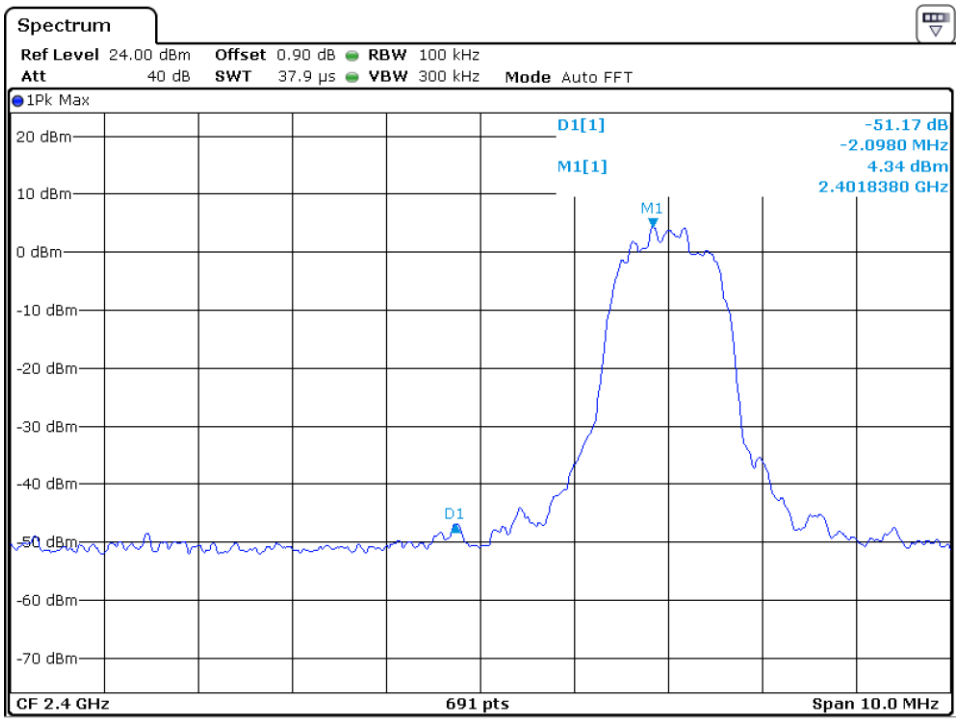
(ii) Upper channel 2480MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot
= 97.2dBμv/m-52.85dB
= 44.35dBμv/m

Average Resultant field strength = Fundamental emissions (Average value) – delta from the bandedge plot
= 85.1dBμv/m-52.85dB
= 32.25dBμv/m

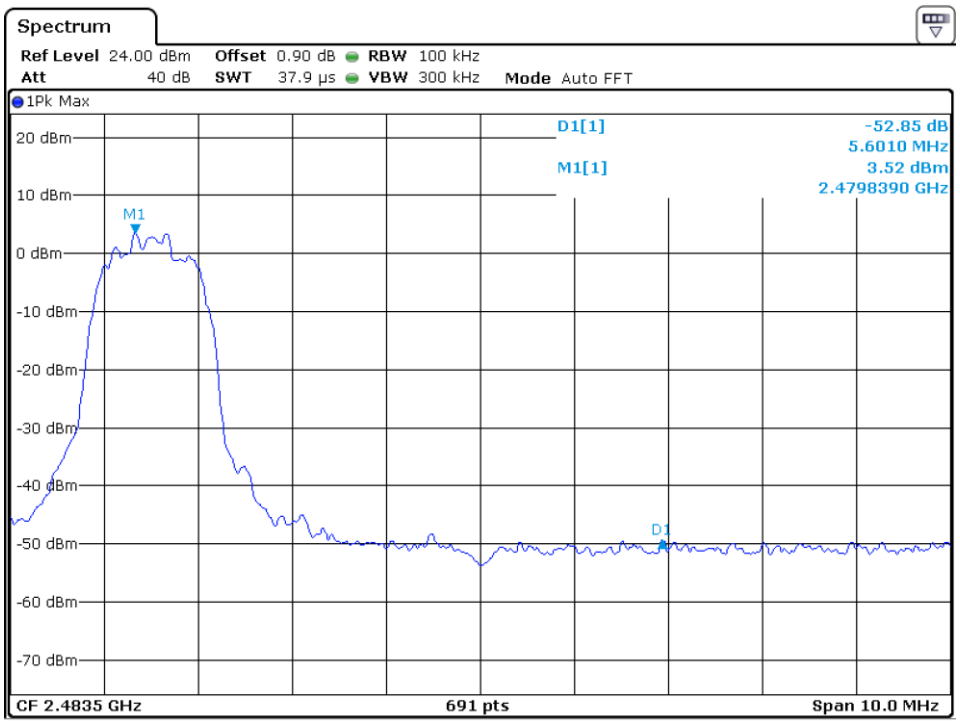
The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dBμv/m (Peak Limit) and 54dBμv/m (Average Limit).

Modulation Type: GFSK
Single Channel



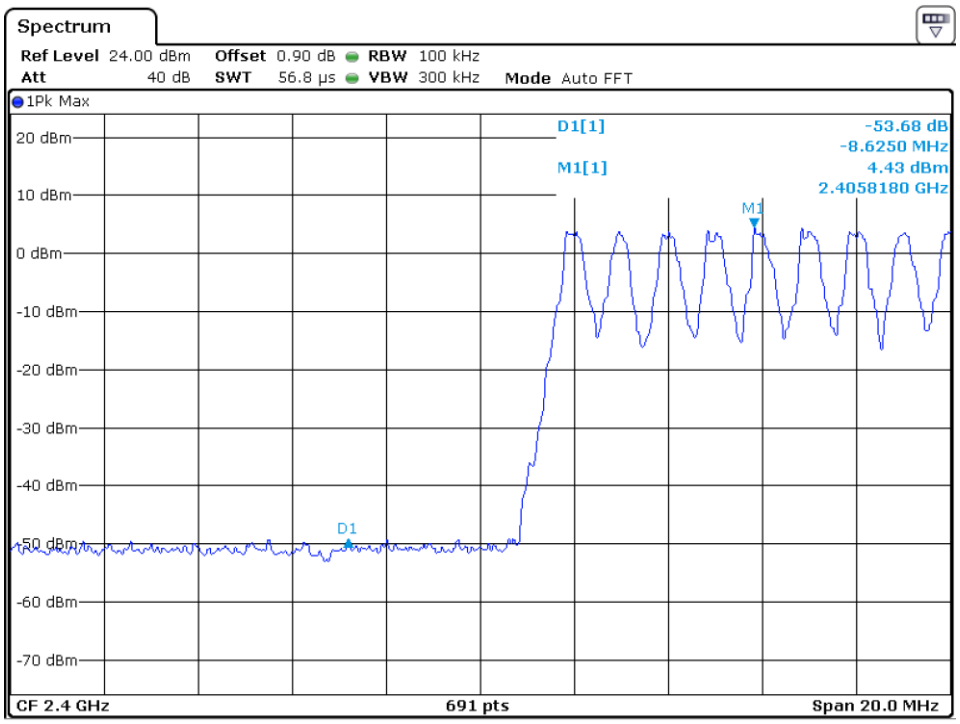
Date: 11.MAR.2019 16:00:01

Single Channel



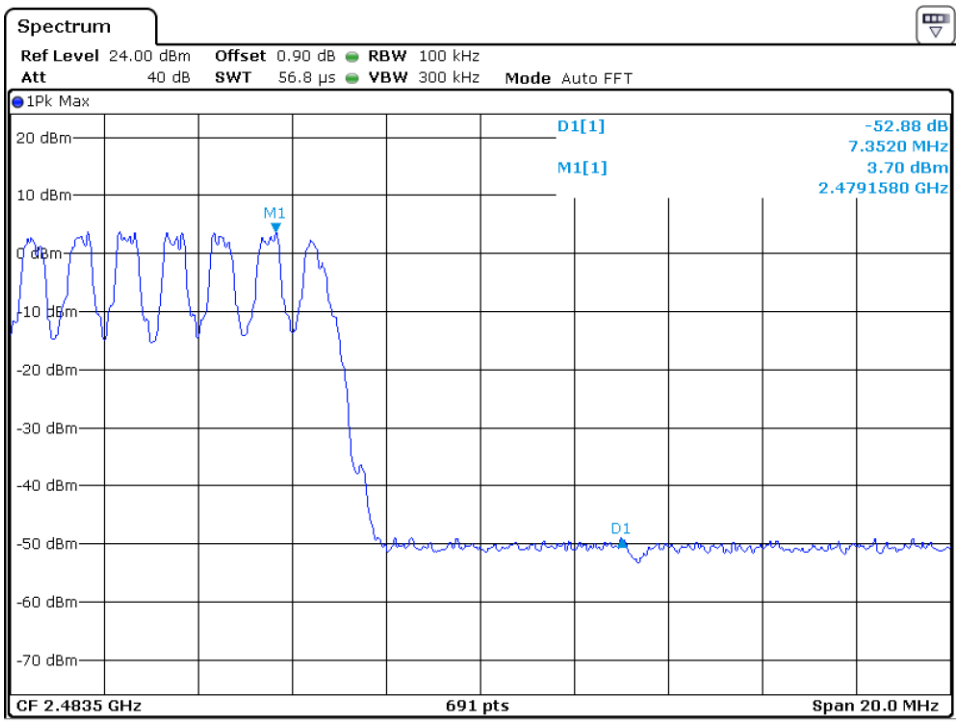
Date: 11.MAR.2019 15:58:27

Hopping



Date: 11.MAR.2019 15:46:09

Hopping



Date: 11.MAR.2019 15:47:26

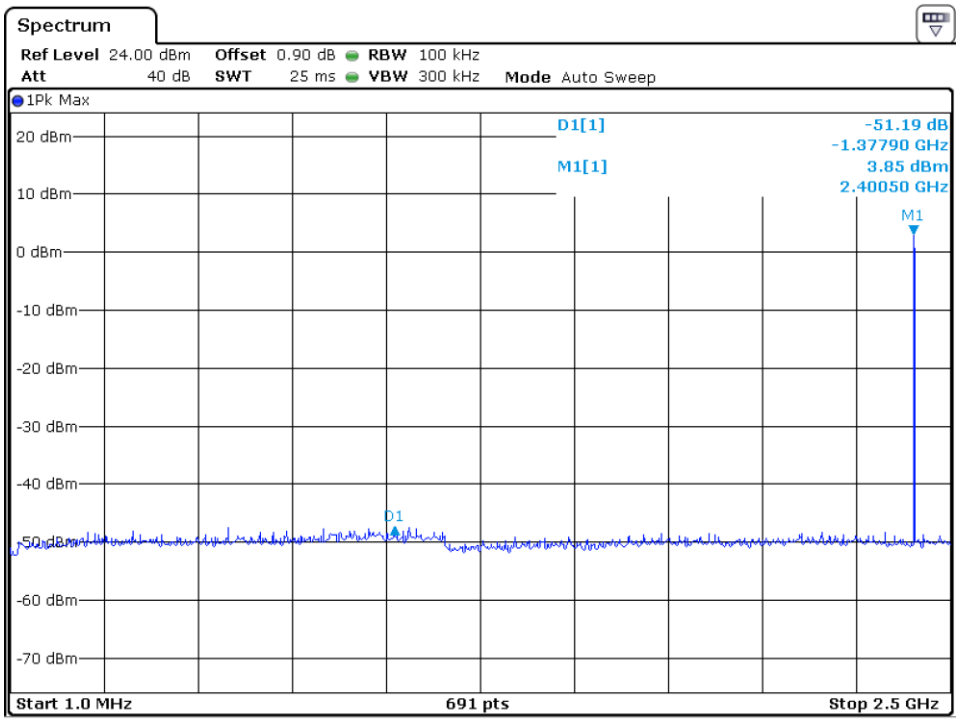
3.9 Transmitter Spurious Emissions (Conducted)

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

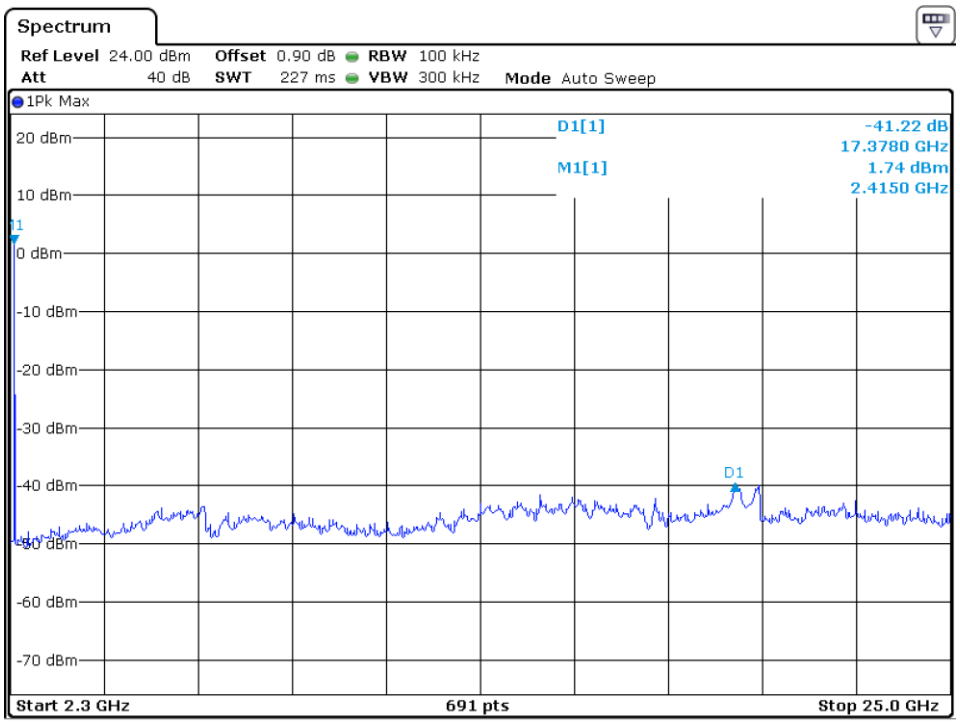
All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

Modulation Type: GFSK

CH00

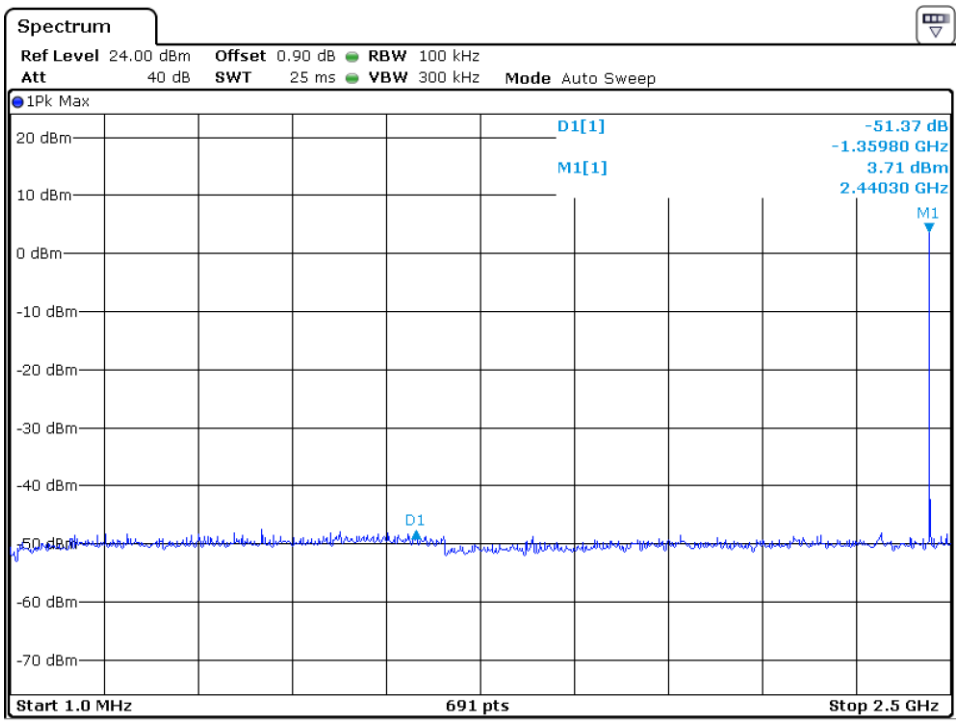


Date: 11.MAR.2019 16:03:38

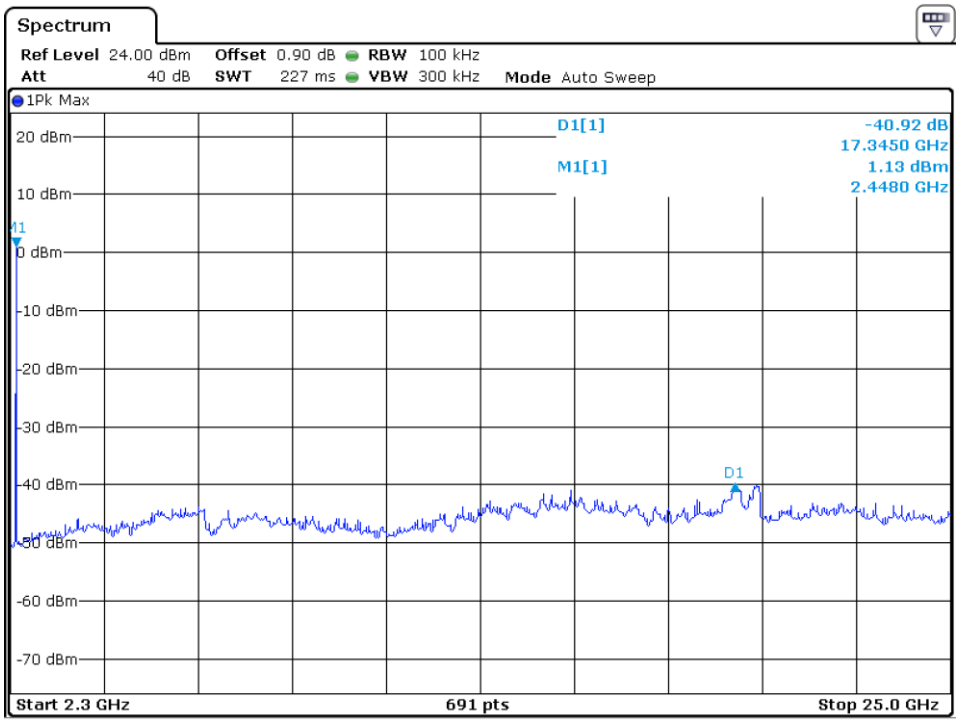


Date: 11.MAR.2019 16:04:39

CH39

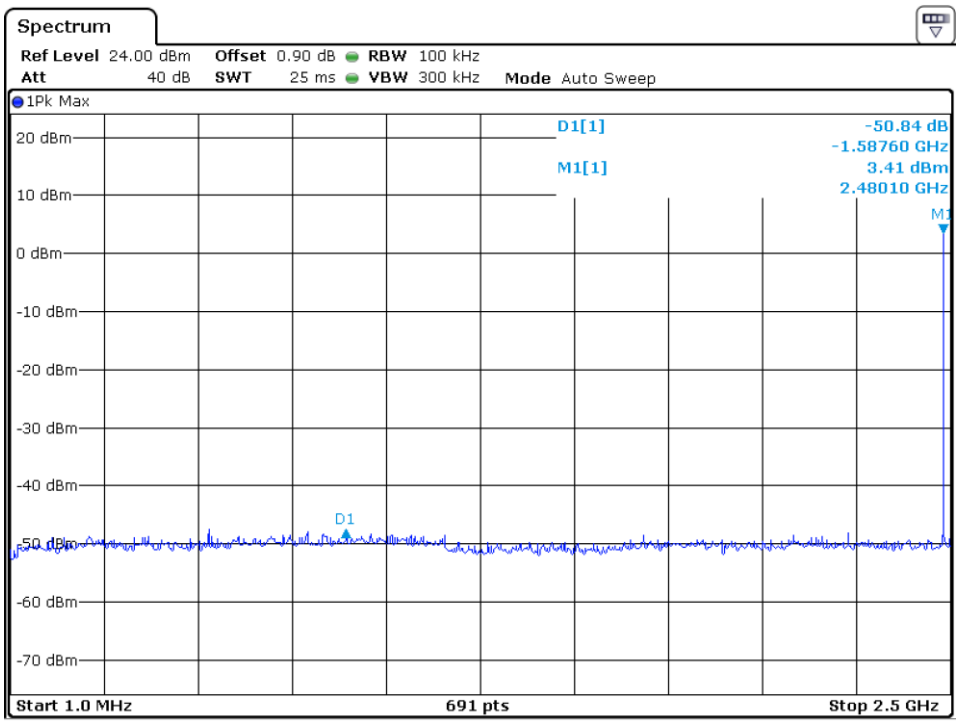


Date: 11.MAR.2019 16:06:34

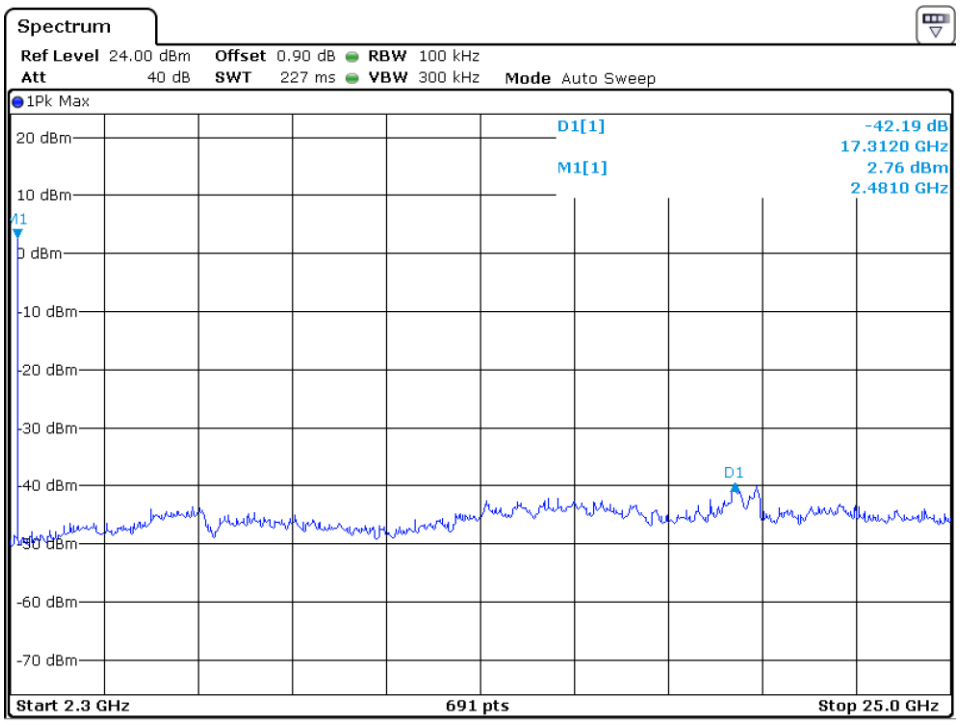


Date: 11.MAR.2019 16:05:51

CH78



Date: 11.MAR.2019 16:07:17



Date: 11.MAR.2019 16:08:09

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 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 measurements were made with measurement instrumentation employing an average detector function using a minimum resolution bandwidth of 1 MHz.

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 (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 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 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-12	BiConiLog Antenna	ETS	3142E	00166158	14-Sep-2018	14-Sep-2019
SZ185-01	EMI Receiver	R&S	ESCI	100547	4-Jan-2019	4-Jan-2020
SZ061-08	Horn Antenna	ETS	3115	00092346	14-Sep-2018	14-Sep-2019
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	21-May-2018	21-May-2019
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	05-Jun-2018	05-Jun-2019
SZ056-06	Signal Analyzer	R&S	FSV 40	101101	05-Jun-2018	05-Jun-2019
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	15-Jan-2019	15-Jan-2020
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	15-Dec-2018	15-Dec-2020
SZ062-02	RF Cable	RADIALL	RG 213U	--	10-Jun-2018	10-Jun-2019
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	10-Jun-2018	10-Jun-2019
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	10-Jun-2018	10-Jun-2019
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	05-Jun-2018	05-Jun-2019
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	26-Oct-2018	26-Oct-2019
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	26-Oct-2018	26-Oct-2019
SZ188-03	Shielding Room	ETS	RFD-100	4100	16-Jan-2017	16-Jan-2020

********** End of Report**********