

Huawei Technologies Co., Ltd

Application
For
Certification
FCC ID: QISY221-U03

WCDMA Digital Mobile Phone

Model: HUAWEI Y221-U03

Report No.: 140611034SZN-002

2.4GHz Transceiver

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 [10-1-13]

Prepared and Checked by:

Approved by:

Sign on file

Jenner Liu
Assitant Engineer

Andy Yan
Project Engineer
Date: July 15, 2014

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
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- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF No.: FCC 15C_TX_b

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MEASUREMENT/TECHNICAL REPORT

Huawei Technologies Co.,Ltd
Model: WCDMA Digital Mobile Phone

FCC ID: QISY221-U03

This report concerns (check one:) Original Grant ☒ Class II Change ☐

Equipment Type: DSS - Part 15 Spread Spectrum Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes ☐ No ☒

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 ☒

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-13 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/safety info.pdf
Cover Letter	Letter of Agency	agency.pdf
Cover Letter	Confidentiality Letter	request.pdf

EXHIBIT 1

GENERAL DESCRIPTION

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1.0 **General Description**

1.1 Product Description

The equipment under test (EUT) is a WCDMA Digital Mobile Phone, Model: HUAWEI Y221-U03 with Bluetooth FHSS technology. The EUT was powered by AC/DC Adapter (input: 100-240Vac, 50/60Hz, Output: 5Vdc, 550mA).

Antenna Type: Integral antenna

Antenna Gain: -3.2 dBi

Modulation Type: GFSK, $\pi/4$ -DQPSK and 8-DPSK

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:
DSS- Part 15 Spread Spectrum Transmitter (Bluetooth FHSS portion)

Remaining portions are subject to the following procedures:

1. WiFi Transceiver (2.4G band): 140611034SZN-003.
2. WCDMA Digital Mobile Phone (2G&3G): 140611034SZN -001.
3. PC download (Class B personal computer and peripherals): 140611034SZN-004.
4. Other function: 140611034SZN-005.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4: 2009 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.

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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 C63.4: 2009.

The EUT was powered by AC/DC Adapter (Input: 120Vac, 60Hz, Output: 5Vdc, 550mA), and only the worst case data was recorded in this report.

The simultaneous transmission spurious was tested, only the worst case data was recorded in this report.

All packets mode in modulation type GFSK, $\pi/4$ -DQPSK and 8-DPSK with different accessories listed in next page 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 shall be 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

One shielded USB cable attached.

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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. 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.
Earphone	Goertek	HA1-3
	Quancheng	1293#+3283#3.5MM-150
	Lianchuang	MEMD1532B528000
USB Cable	/	Shielded 100 cm
Battery	BYD	HB5N1
	COSLIGHT	
	SCUD	HB5N1H
	SDDG	
AC/DC Adapter (Huawei)	BYD / HuntKey	HW-050055U1W Input: 100-240Vac, 50/60Hz, 0.2A; Output: 5Vdc, 550mA
	BYD / HuntKey	HW-050055E1W Input: 100-240Vac, 50/60Hz, 0.2A; Output: 5Vdc, 550mA
	BYD / HuntKey	HW-050055B1W Input: 100-240Vac, 50/60Hz, 0.2A; Output: 5Vdc, 550mA
	BYD /UE	HW-050055A1W Input: 100-240Vac, 50/60Hz, 0.2A; Output: 5Vdc, 550mA
	BYD /UE	HW-050055R1W Input: 100-240Vac, 50/60Hz, 0.2A; Output: 5Vdc, 550mA

Note 1: The Model: HUAWEI Y221-U03 have five different AC/DC Adapter power suppliers, which have already arranged the test accordingly, and the worst case data was recorded in this report.

EXHIBIT 3
TEST RESULTS

3.0 **Test Results**

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

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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 dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- 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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 62.0 dB μ V
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB

AV = -10 dB

$$FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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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
49.860 MHz

Judgement: Passed by 4.2 dB

TEST PERSONNEL:

Sign on file

Jenner Liu Assitant Engineer
Typed/Printed Name

July 13, 2014
Date

INTERTEK TESTING SERVICES

Applicant: Huawei Technologies Co.,Ltd

Date of Test: July 13, 2014

Model: HUAWEI Y221-U03

Sample: 1/1

Worst-case operating Mode: BT Link

Modulation type: GFSK

AC/DC Adapter: HuntKey (HW-050055U1W)

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	50.400	34.0	20.0	9.1	23.1	40.0	-16.9
Horizontal	414.600	37.4	20.0	8.3	25.7	46.0	-20.3
Horizontal	933.540	36.7	20.0	12.7	29.4	46.0	-16.6
Vertical	36.780	37.4	20.0	8.4	25.8	40.0	-14.2
Vertical	49.860	46.8	20.0	9.0	35.8	40.0	-4.2
Vertical	83.340	37.9	20.0	8.3	26.2	40.0	-13.8

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.

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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
4804 MHz

Judgement: Passed by 23.8 dB

TEST PERSONNEL:

Sign on file

Jenner Liu Assitant Engineer
Typed/Printed Name

July 15, 2014
Date

INTERTEK TESTING SERVICES

Applicant: Huawei Technologies Co.,Ltd

Date of Test: July 15, 2014

Model: HUAWEI Y221-U03

Sample: 1/1

Worst-case operating Mode: Transmit-CH00 (2402MHz)

Modulation type: GFSK

Table 2

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2402.000	112.6	36.7	28.1	104.0	--	--
Horizontal	*4804.000	50.8	36.1	35.5	50.2	74.0	-23.8

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4804.000	50.8	36.1	35.5	22.5	27.7	54.0	-26.3

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.

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INTERTEK TESTING SERVICES

Applicant: Huawei Technologies Co.,Ltd

Date of Test: July 15, 2014

Model: HUAWEI Y221-U03

Sample: 1/1

Worst-case operating Mode: Transmit-CH39 (2441MHz)

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	2441.000	113.2	36.7	28.1	104.6	--	--
Horizontal	*4882.000	50.5	36.1	35.5	49.9	74.0	-24.1

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	50.5	36.1	35.5	22.5	27.4	54.0	-26.6

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.

TRF No.: FCC 15C_TX_b

FCC ID: QISY221-U03

Report No.: 140611034SZN-002

INTERTEK TESTING SERVICES

Applicant: Huawei Technologies Co.,Ltd

Date of Test: July 15, 2014

Model: HUAWEI Y221-U03

Sample: 1/1

Worst-case operating Mode: Transmit-CH78 (2480MHz)

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	112.3	36.7	28.1	103.7	--	--
Horizontal	*4960.000	50.7	36.1	35.5	50.1	74.0	-23.9

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	*4960.000	50.7	36.1	35.5	22.5	27.6	54.0	-26.4

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.

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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
1.949 MHz

Judgement: Passed by 3.9 dB margin

TEST PERSONNEL:

Sign on file

Jenner Liu Assitant Engineer
Typed/Printed Name

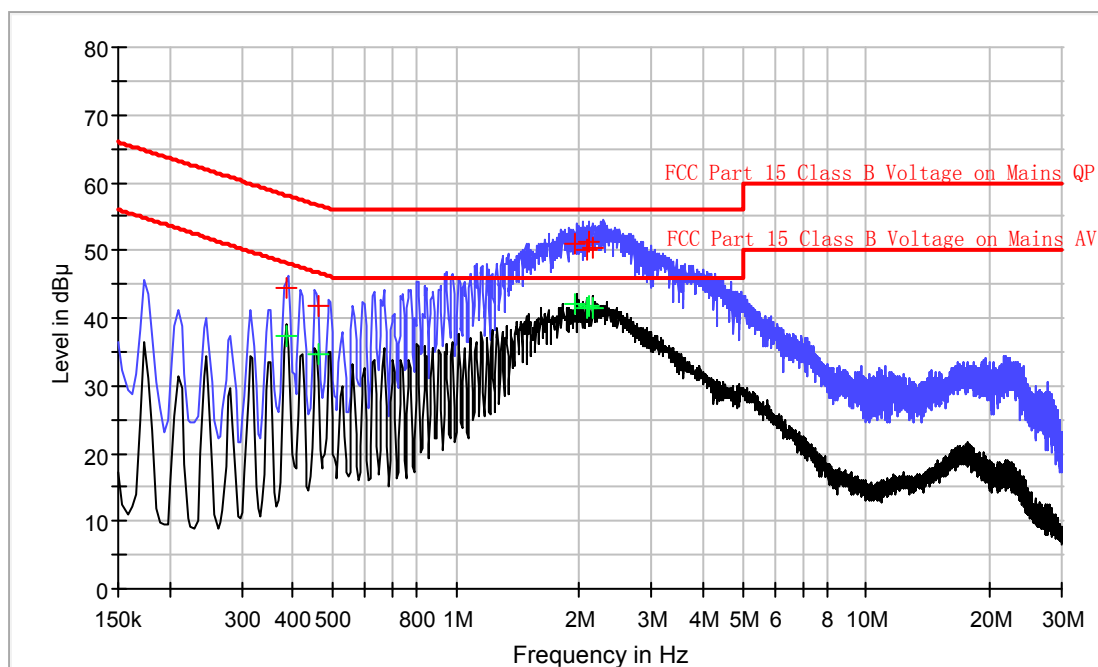
July 13, 2014
Date

INTERTEK TESTING SERVICES

Applicant: Huawei Technologies Co.,Ltd
Model: HUAWEI Y221-U03
Sample: 1/1
Worst-case operating Mode: BT Link
Modulation type: GFSK
Adapter: HuntKey (HW-050055U1W)

Date of Test: July 13, 2014

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB μV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ)
0.386000	44.3	9.000	L1	9.7	13.8	58.1
0.461000	41.9	9.000	L1	9.7	14.8	56.7
1.949000	51.0	9.000	L1	9.8	5.0	56.0
2.078000	50.0	9.000	L1	9.8	6.0	56.0
2.121000	51.2	9.000	L1	9.8	4.8	56.0
2.150000	50.4	9.000	L1	9.8	5.6	56.0

Result Table AV

Frequency (MHz)	Average (dB μV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ)
0.386000	37.4	9.000	L1	9.7	10.7	48.1
0.461000	34.6	9.000	L1	9.7	12.1	46.7
1.949000	42.1	9.000	L1	9.8	3.9	46.0
2.078000	41.5	9.000	L1	9.8	4.5	46.0
2.121000	41.9	9.000	L1	9.8	4.1	46.0
2.150000	41.4	9.000	L1	9.8	4.6	46.0

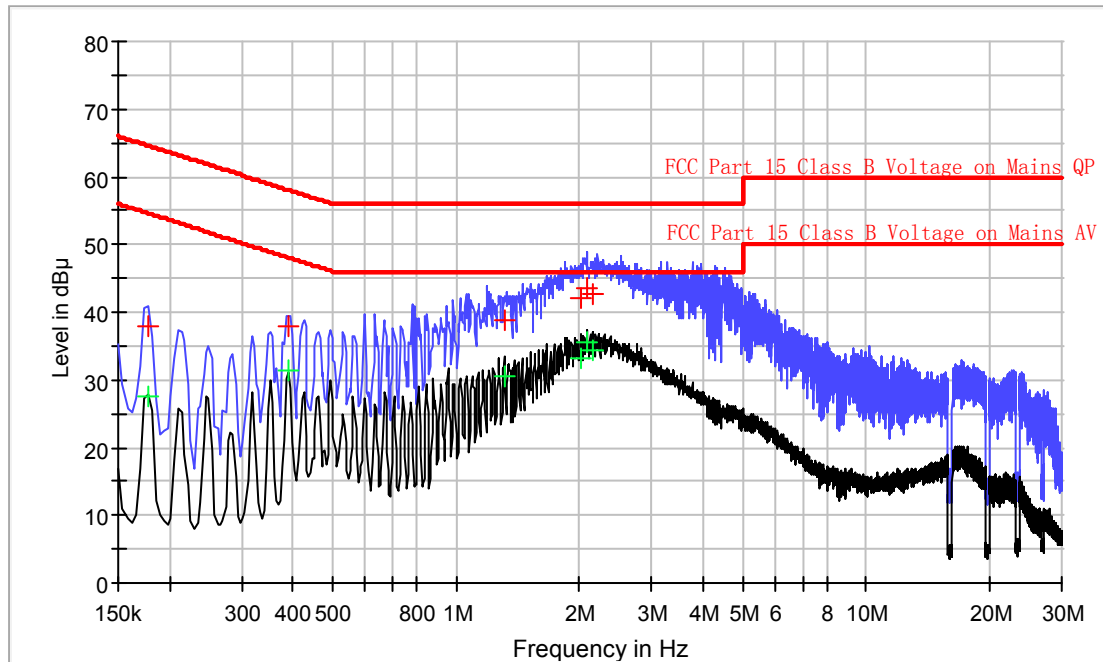
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INTERTEK TESTING SERVICES

Applicant: Huawei Technologies Co.,Ltd
Model: HUAWEI Y221-U03
Sample: 1/1
Worst-case operating Mode: BT Link
Modulation type: GFSK
Adapter: HuntKey (HW-050055U1W)

Date of Test: July 13, 2014

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ)
0.178000	37.9	9.000	N	9.9	26.7	64.6
0.390000	37.9	9.000	N	9.6	20.2	58.1
1.310000	38.9	9.000	N	9.8	17.1	56.0
2.014000	42.0	9.000	N	9.9	14.0	56.0
2.086000	43.5	9.000	N	9.9	12.5	56.0
2.158000	42.5	9.000	N	9.9	13.5	56.0

Result Table AV

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ)
0.178000	27.6	9.000	N	9.9	27.0	54.6
0.390000	31.5	9.000	N	9.6	16.6	48.1
1.310000	30.7	9.000	N	9.8	15.3	46.0
2.014000	33.3	9.000	N	9.9	12.7	46.0
2.086000	35.4	9.000	N	9.9	10.6	46.0
2.158000	34.5	9.000	N	9.9	11.5	46.0

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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.

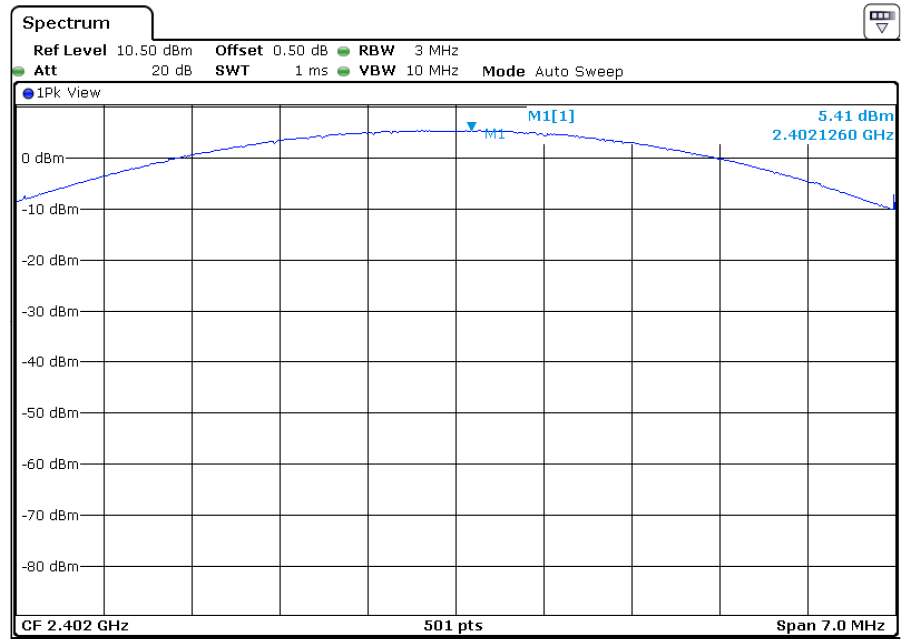
For antenna with gains of 6dBi or less, and frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, the systems operate with an output power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

Antenna Gain = -3.2dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	5.41	3.48
	2441	5.57	3.61
	2480	5.51	3.56

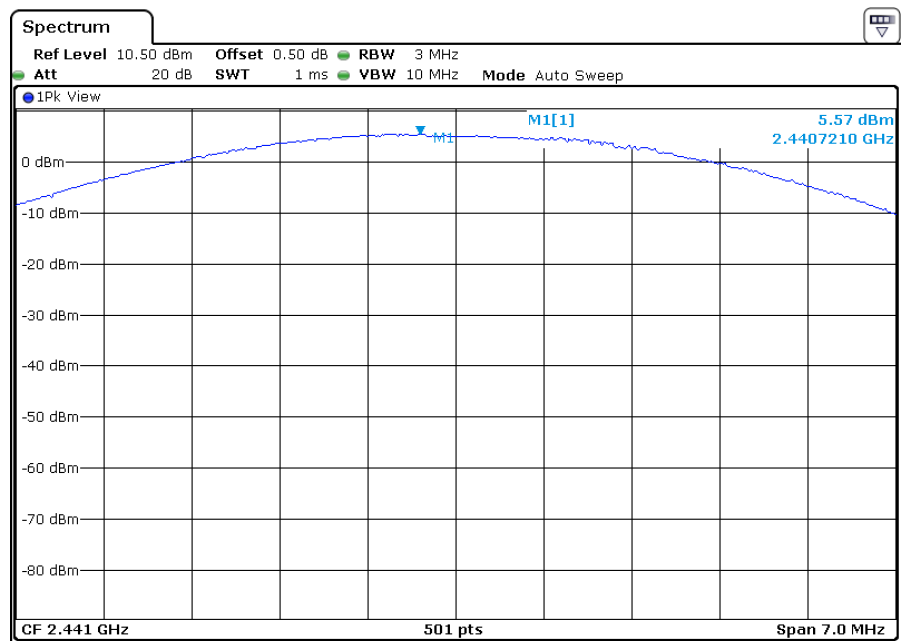
Cable loss: 0.5 dB External Attenuation: 0 dB

INTERTEK TESTING SERVICES

Modulation Type: GFSK
CH00

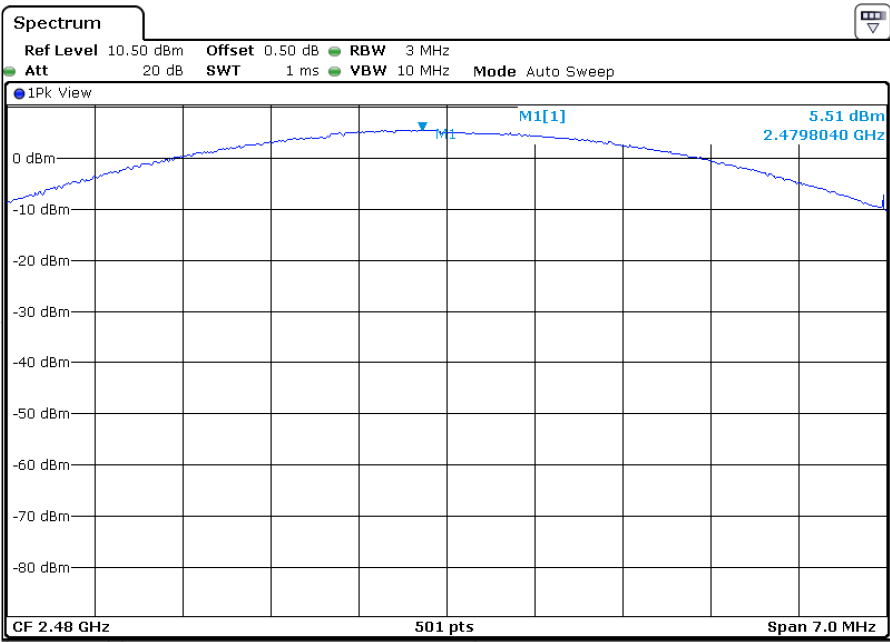


CH39



TRF No.: FCC 15C_TX_b
FCC ID: QISY221-U03
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INTERTEK TESTING SERVICES

3.4 20dB Bandwidth

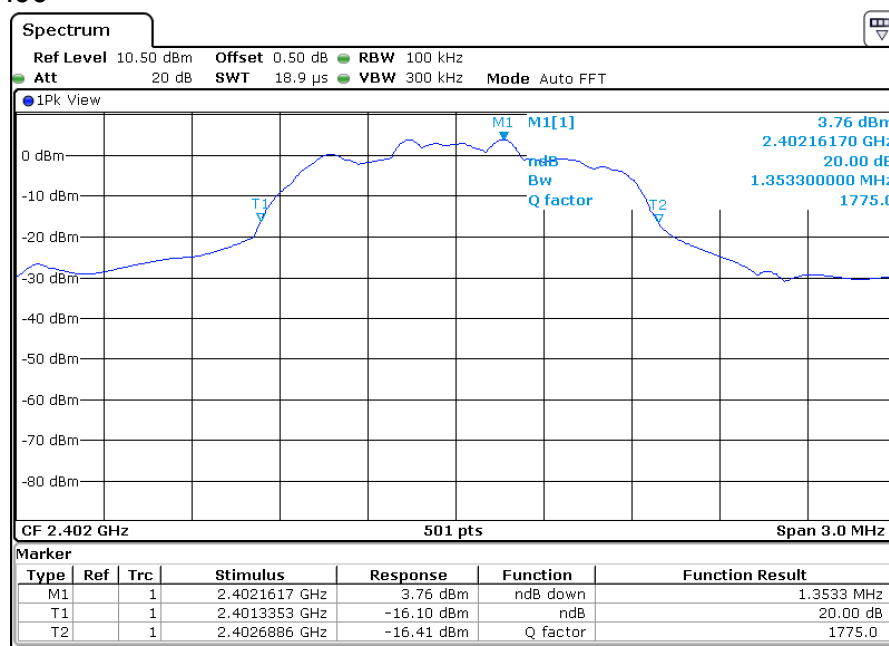
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

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	1.35
2441	1.37
2480	1.34

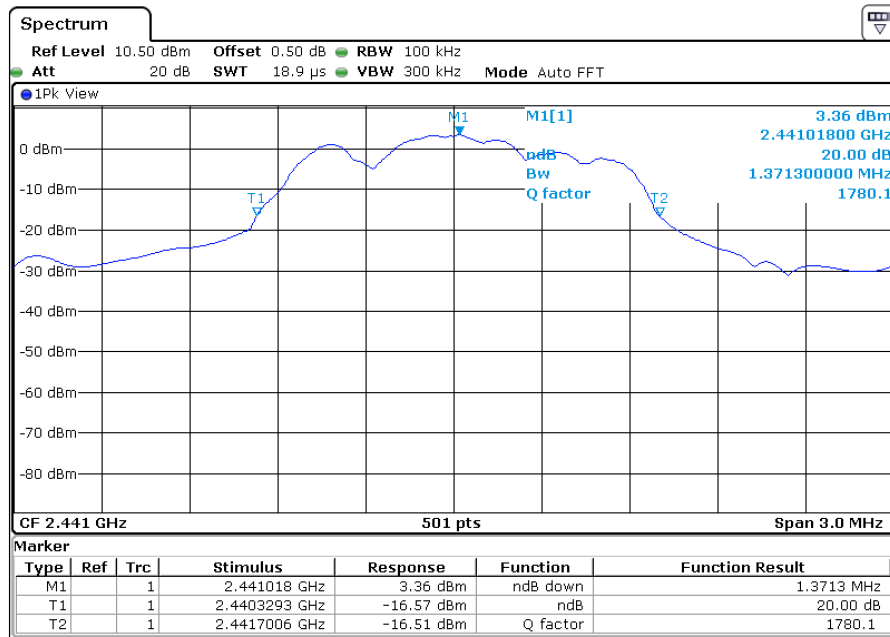
Modulation Type: 8DPSK

CH00

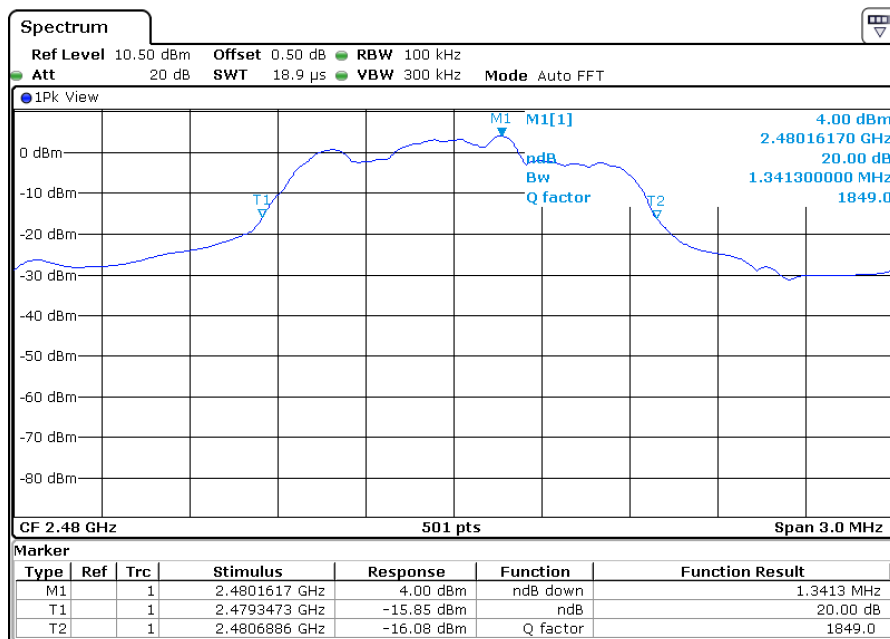


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3.5 Channel Number (Number of Hopping Frequencies)

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

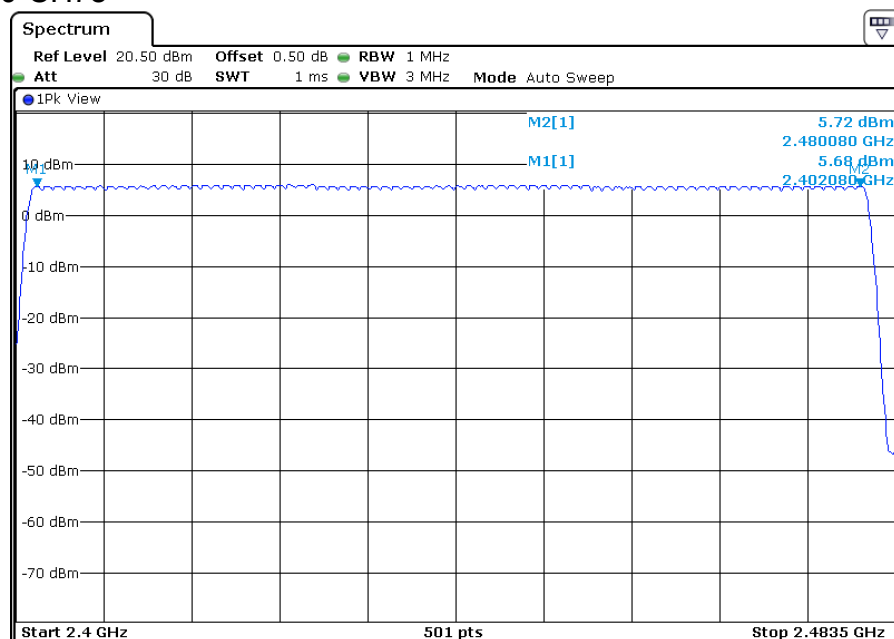
The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Number of hopping channels =	79
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Note: In AFH mode, this device operates using 20 channels and it's satisfied the requirement of limit of minimum of 15 hopping channels.

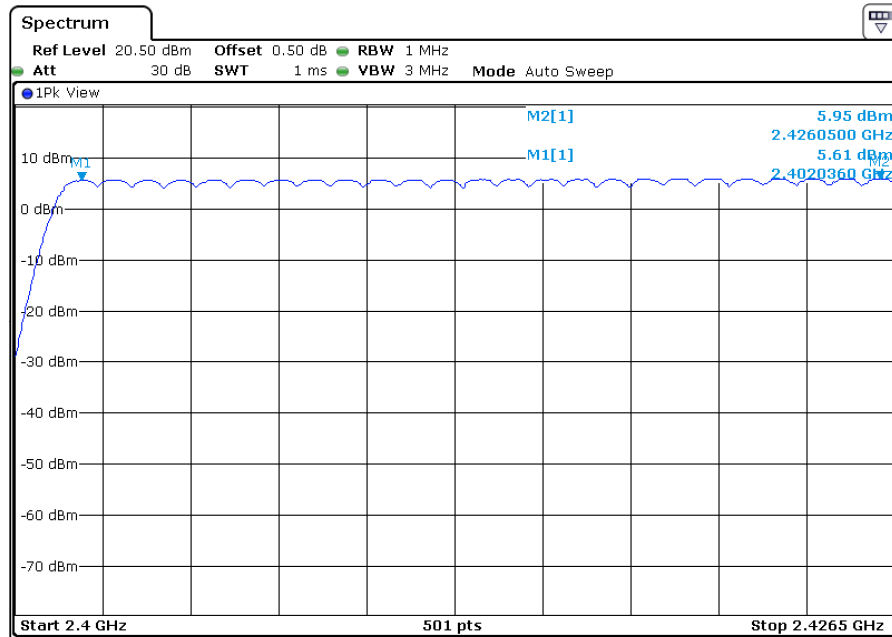
Modulation Type: GFSK

CH00-CH78

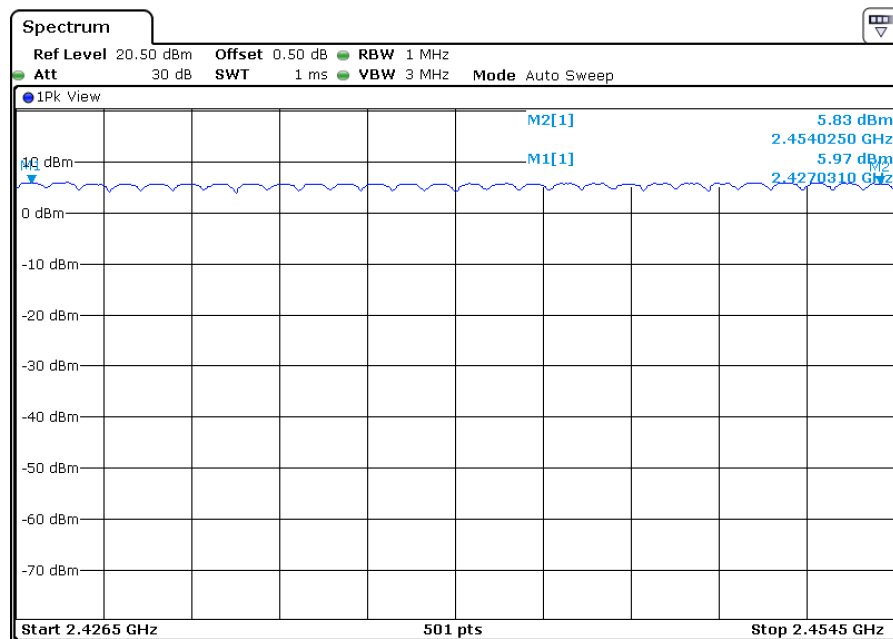


INTERTEK TESTING SERVICES

CH00-CH25

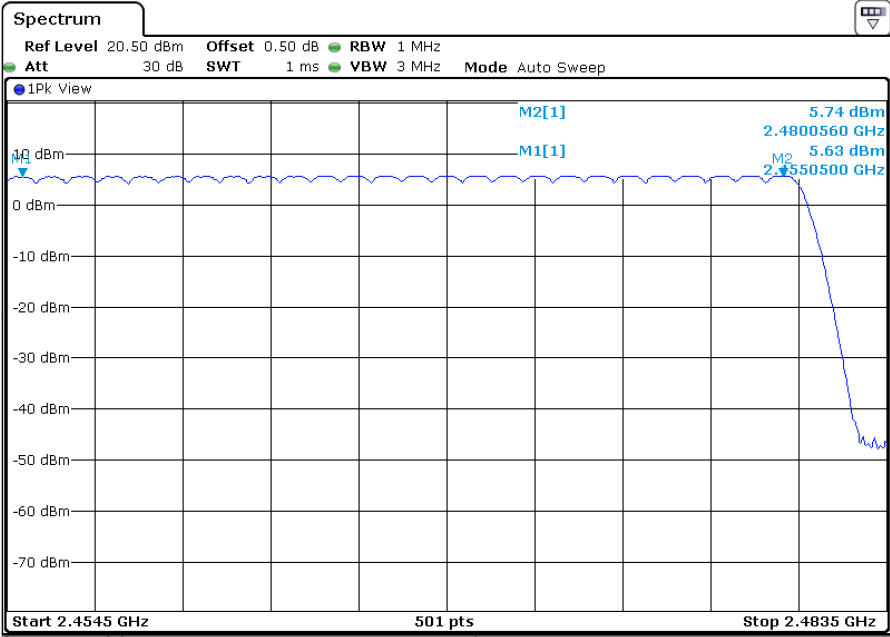


CH26-CH53



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CH54-CH78



INTERTEK TESTING SERVICES

3.6 Channel Separation (Carrier Frequency Separation)

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

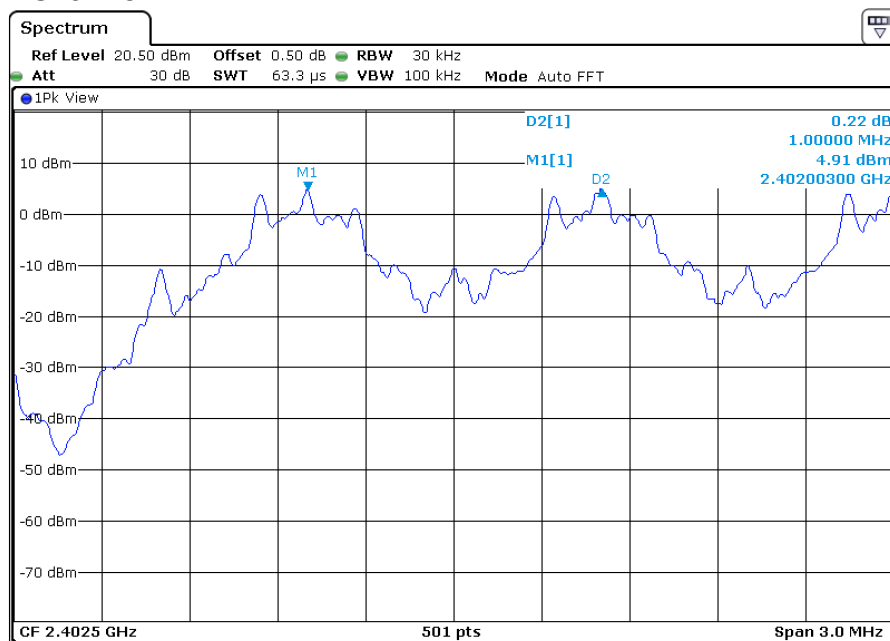
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel: $1.37 \times 2/3 = 0.913$ MHz

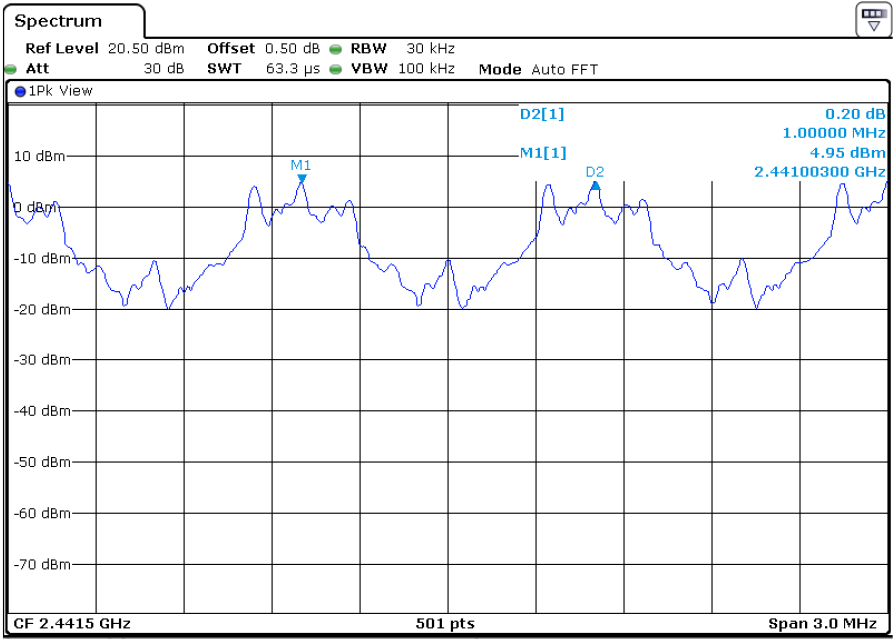
Channel Separation	1.000 MHz
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Modulation Type: GFSK

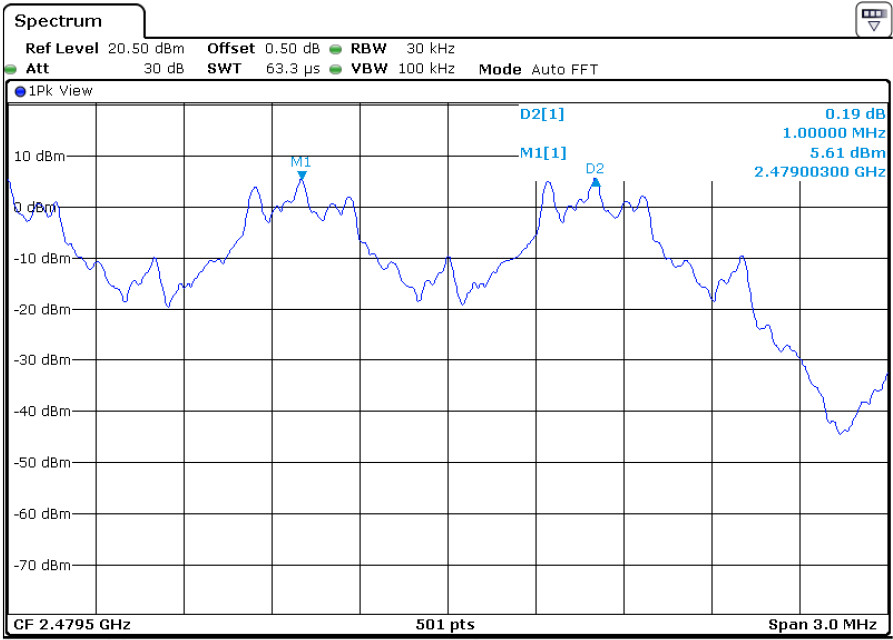
Low Channel



Middle Channel



High Channel



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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
 $=1600 / 6 / 79 * 31.6 = 107$

Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
GFSK	DH1	0.372 ms * 320 = 119.04 ms	0.4	Pass
	DH3	1.630 ms * 160 = 260.80 ms	0.4	Pass
	DH5	2.877 ms * 107 = 307.84 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
 $=800 / 4 / 20 * 8 = 80$

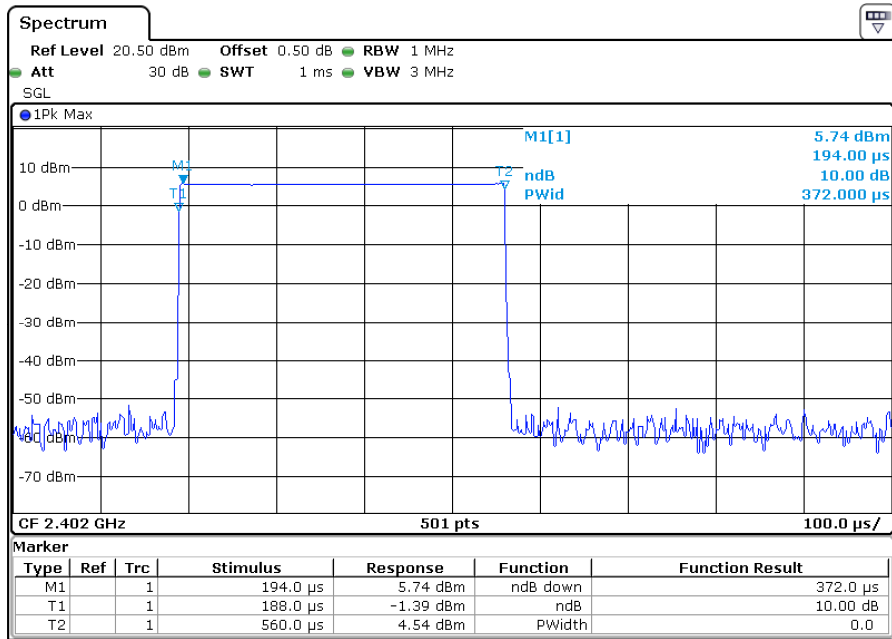
The maximum number of hopping channels in 8s for DH5
 $=800 / 6 / 20 * 8 = 53.33$

Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
GFSK	DH1	0.372 ms * 160 = 59.52 ms	0.4	Pass
	DH3	1.630 ms * 80 = 130.40 ms	0.4	Pass
	DH5	2.877 ms * 53.33 = 153.43 ms	0.4	Pass

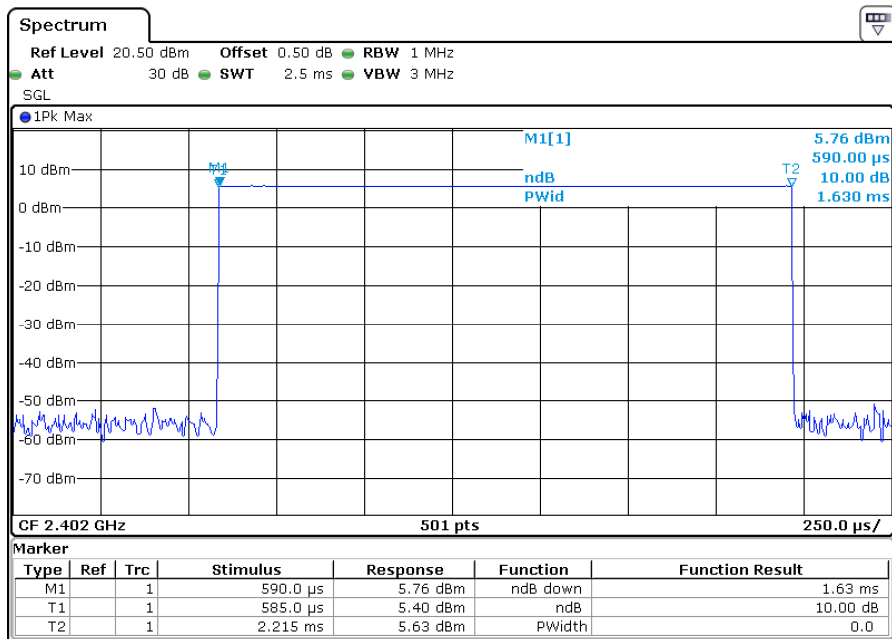
INTERTEK TESTING SERVICES

Modulation Type: GFSK

Packet: DH1



Packet: DH3

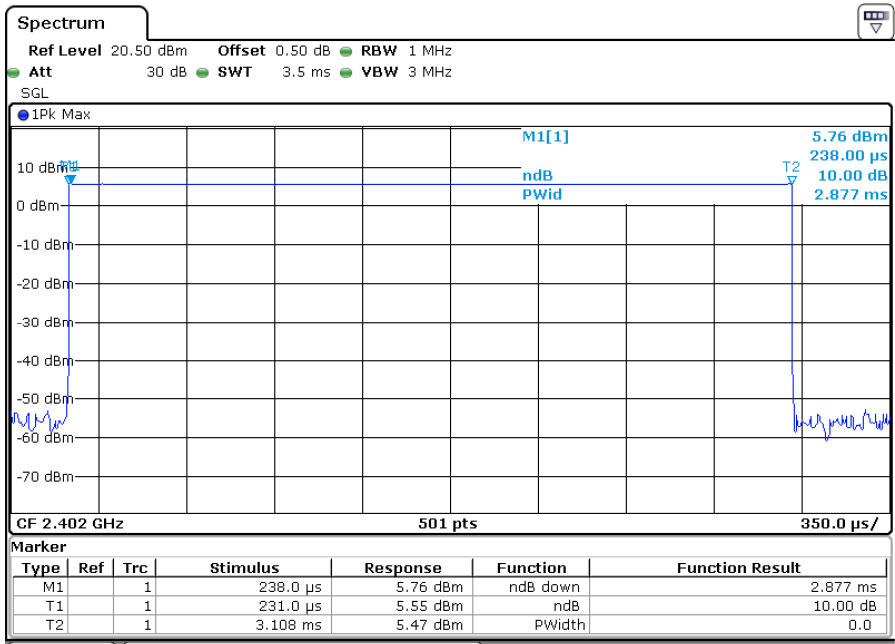


TRF No.: FCC 15C_TX_b

FCC ID: QISY221-U03

Report No.: 140611034SZN-002

Packet: DH5



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
= 104.0dB μ v/m-54.4dB
= 49.6dB μ v/m

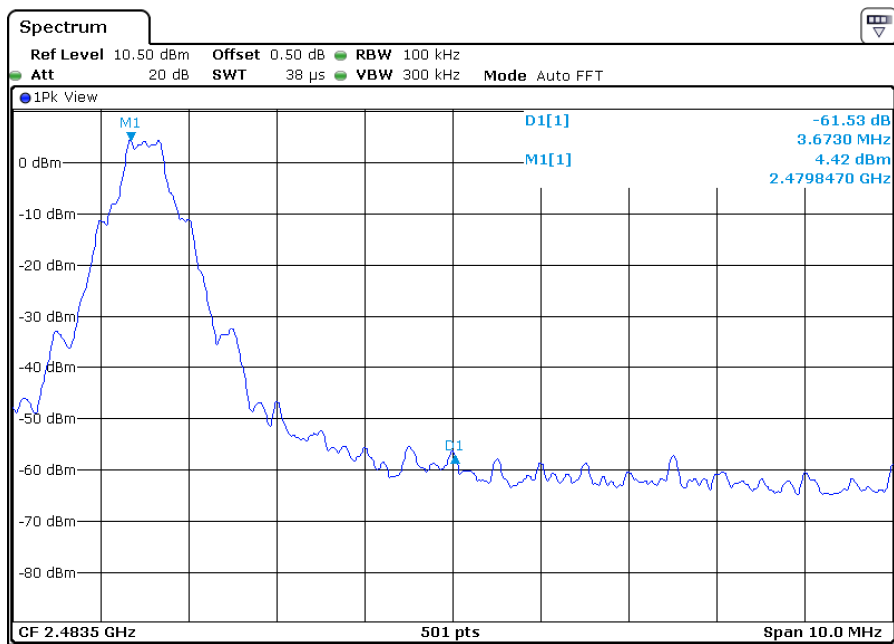
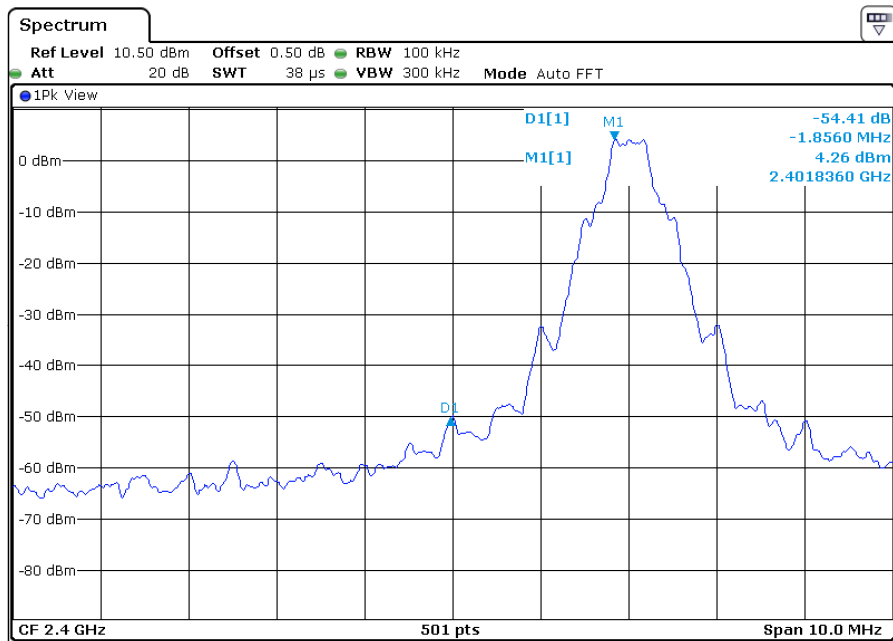
(ii) Upper channel 2480MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot
= 103.7dB μ v/m-61.5B
= 42.2dB μ v/m

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

INTERTEK TESTING SERVICES

Modulation Type: GFSK



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3.9 Transmitter Spurious Emissions (Conducted)

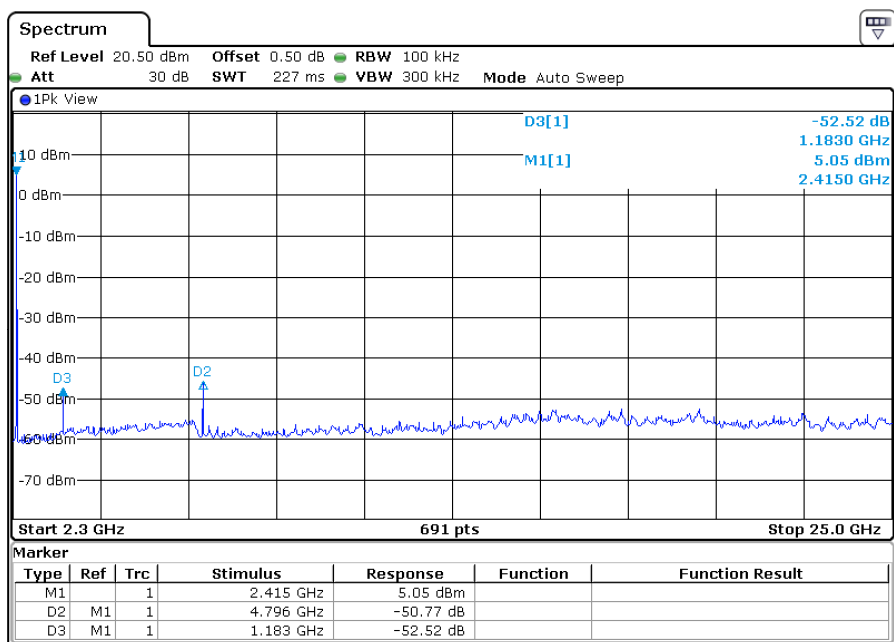
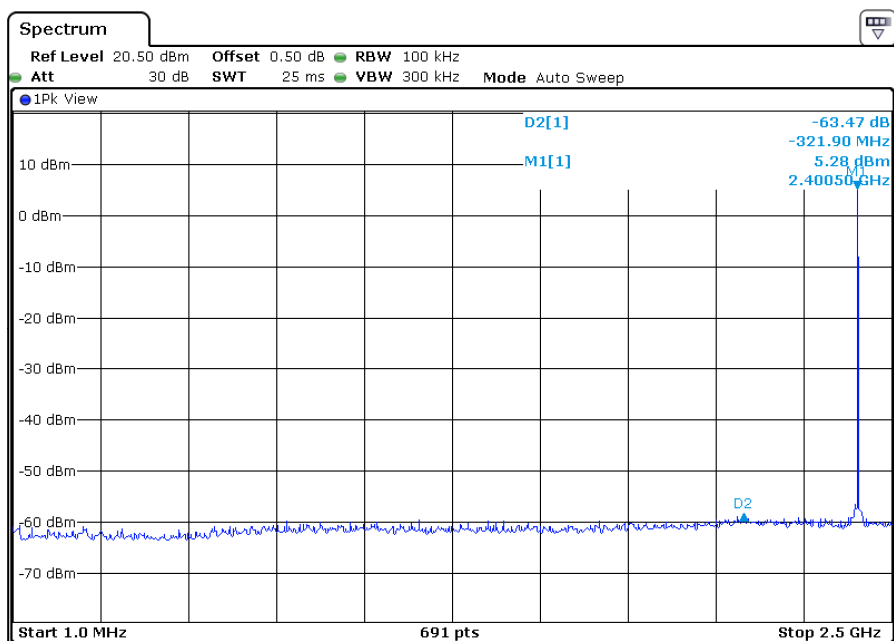
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

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.

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Modulation Type: GFSK

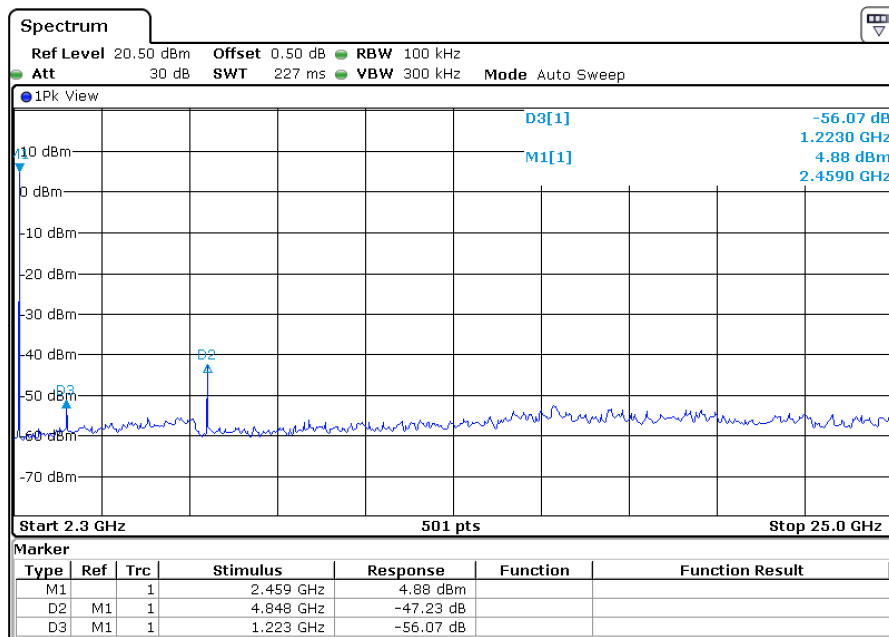
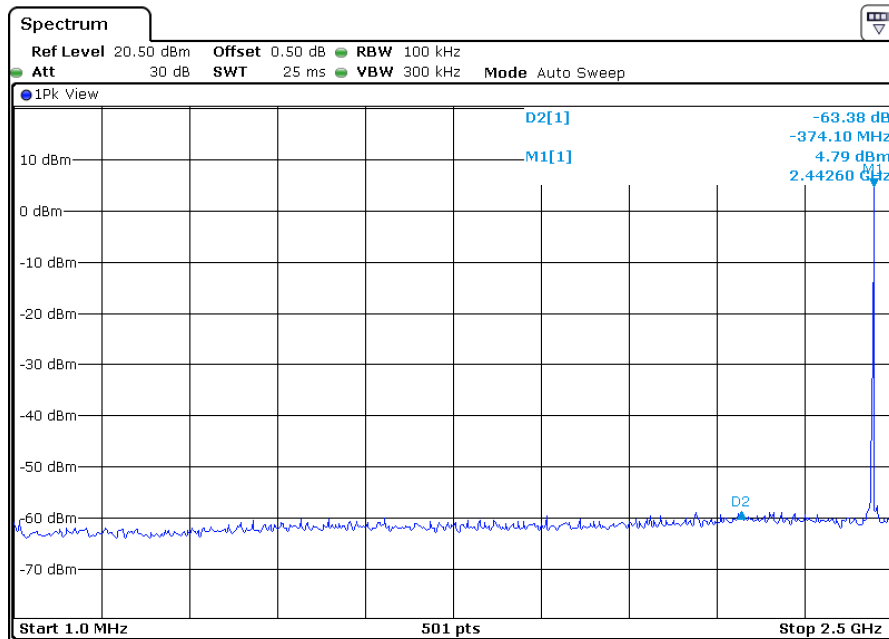
CH00



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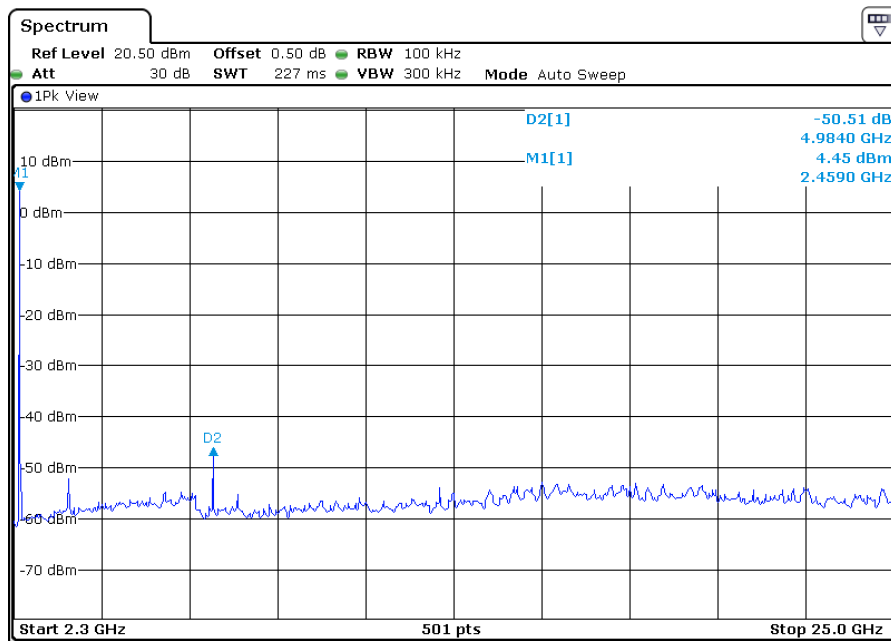
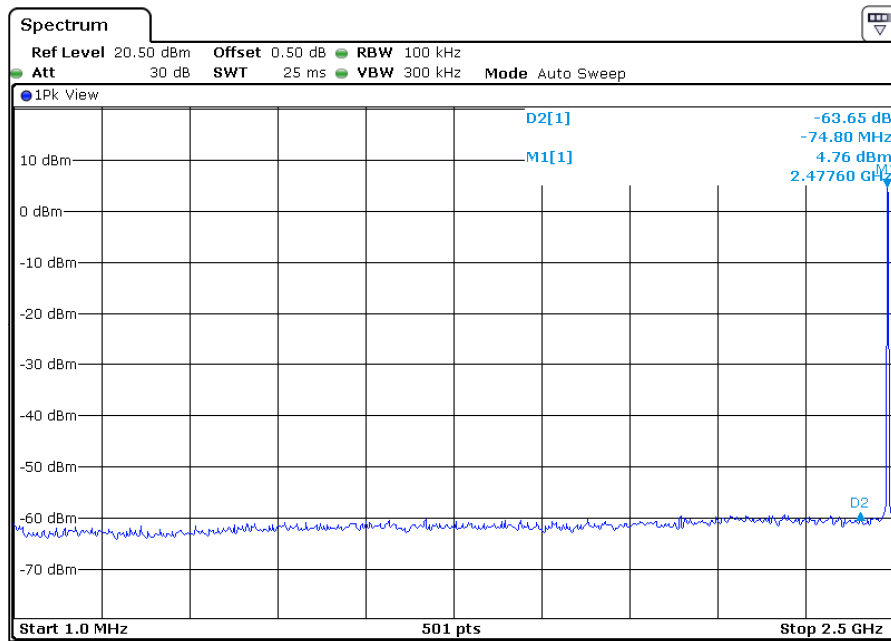
CH39



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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

INTERTEK TESTING SERVICES

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

INTERTEK TESTING SERVICES

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

INTERTEK TESTING SERVICES

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.

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EXHIBIT 8

MISCELLANEOUS INFORMATION

TRF No.: FCC 15C_TX_b
FCC ID: QISY221-U03
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8.0 Miscellaneous Information

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

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8.1 Discussion of Pulse Desensitization

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

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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 = $20 \log (3.125 / 100) = -30.1 \text{ dB}$

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 = $1 / 133.33 \text{ hops/second} = 7.5 \text{ ms}$

Time to cycle through all channels = $7.5 \times 20 \text{ channels} = 150 \text{ ms}$

Number of times transmitter hits on one channel = $100 \text{ ms} / 150 \text{ ms} = 1 \text{ time(s)}$

Worst case dwell time = 7.5 ms

Duty cycle connection factor = $20 \log_{10}(7.5 \text{ ms} / 100 \text{ ms}) = -22.5 \text{ dB}$

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 C63.4: 2009.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter 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 adjusted 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.

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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 C63.4: 2009.

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

INTERTEK TESTING SERVICES

9.0 Confidentiality Request

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

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EXHIBIT 10

TEST EQUIPMENT LIST

TRF No.: FCC 15C_TX_b
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INTERTEK TESTING SERVICES

10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-03	BiConiLog Antenna	ETS	3142C	00066460	28-Jun-2014	28-Jun-2015
SZ185-01	EMI Receiver	R&S	ESCI	100547	10-Mar-2014	10-Mar-2015
SZ061-09	Horn Antenna	ETS	3115	00092346	16-Nov-2013	16-Nov-2014
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	27-Aug-2013	27-Aug-2014
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	29-Apr-2014	29-Apr-2015
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	10-Mar-2014	10-Mar-2015
SZ181-04	Preamplifier	Agilent	8449B	3008A0247 4	10-Mar-2014	10-Mar-2015
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	10-Mar-2014	10-Mar-2015
SZ062-02	RF Cable	RADIAL	RG 213U	--	14-Jan-2014	14-Jul-2014
SZ062-06	RF Cable	RADIAL	0.04-26.5GHz	--	14-Jan-2014	14-Jul-2014
SZ062-12	RF Cable	RADIAL	0.04-26.5GHz	--	17-Apr-2014	17-Oct-2014
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02	--	21-May-2014	21-May-2015
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	9-Nov-2013	9-Nov-2014
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	9-Nov-2013	9-Nov-2014
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	9-Nov-2013	9-Nov-2014
SZ188-03	Shielding Room	ETS	RFD-100	4100	23-Aug-2013	23-Aug-2014

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