

## Huawei Technologies Co., Ltd

## Application For Certification FCC ID: QISY520-U33

## WCDMA Digital Mobile Phone

## Model: HUAWEI Y520-U33

## **Class 2 permissive change**

## Report No.: 141125019SZN-001

## 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

Vincent Chen Engineer Andy Yan Senior Project Engineer Date: 05 December 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: QISY520-U33

This report concerns (check one:) Orig	ginal Grant	Class II Change <u>X</u>
Equipment Type: <u>DSS - Part 15 Spread S</u>	Spectrum Transmitter	
Deferred grant requested per 47 CFR 0.4		
	lf yes, defer until	date
Company Name agrees to notify the Com		date
of the intended date of announcement of date.	the product so that the	grant can be issued on that
Transition Rules Request per 15.37?	Yes	s No <u></u>
If no, assumed Part 15, Subpart C for Edition] provision.	intentional radiator - 1	the new 47 CFR [10-1-13
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 WCDMA Digital Mobile Phone, Model: HUAWEI Y520-U33 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: 0.5 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. Bluetooth LE 4.0(2.4G band): 141125019SZN-002
- 2. WiFi Transceiver (2.4G band): 141125019SZN-003
- 3. WCDMA Digital Mobile Phone (2G&3G): 141125019SZN-004
- 4. PC download (Class B personal computer and peripherals): 141125019SZN-005
- 5. Other function: 141125019SZN-006

#### 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.

## 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.

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.				
	Goertek	HA1-3				
Earphone (Black)	Quancheng	1293#+3283# 3.5MM-150				
	Lianchuang	MEMD1532B528000				
Earphone (White)	Merry	EMC323-011-01				
	Goertek	HG-04A				
USB Cable	/	Data Cable USB A Male to Micro USB, shielded, 100cm				
	BYD	HB5V1 (1730mAh)				
Battery	LISHEN					
Dattery	SUNWODA	HB5V1HV (1950mAh)				
	SCUD					
		HW-050055U1W				
	BYD / HuntKey	Input: 100-240Vac, 50/60Hz, 0.2A;				
		Output: 5Vdc, 550mA				
		HW-050055E1W				
	BYD / HuntKey	Input: 100-240Vac, 50/60Hz, 0.2A;				
		Output: 5Vdc, 550mA				
AC/DC Adapter		HW-050055B1W				
(Huawei)	BYD / HuntKey	Input: 100-240Vac, 50/60Hz, 0.2A;				
		Output: 5Vdc, 550mA				
		HW-050055A1W				
	BYD /UE	Input: 100-240Vac, 50/60Hz, 0.2A;				
		Output: 5Vdc, 550mA				
		HW-050055R1W				
	BYD /UE	Input: 100-240Vac, 50/60Hz, 0.2A;				
		Output: 5Vdc, 550mA				

Note: The Model: HUAWEI Y520-U33 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.

TRF No.: FCC 15C\_TX\_b FCC ID: QISY520-U33 Report No.: 141125019SZN-001 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  $FS = Field Strength in dB\mu V/m$   $RA = Receiver Amplitude (including preamplifier) in dB\mu V$  CF = Cable Attenuation Factor in dB AF = Antenna Factor in dB AG = Amplifier Gain in dB PD = Pulse Desensitization in dBAV = 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 $\mu$ 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 $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 62.0 dB $\mu$ 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 dB $\mu$ V/m Level in  $\mu$ V/m = Common Antilogarithm [(32 dB $\mu$ V/m)/20] = 39.8  $\mu$ V/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 57.660 MHz

Judgement: Passed by 12.4 dB

## **TEST PERSONNEL:**

Sign on file

Jenner Liu Assistant Engineer Typed/Printed Name

25 July 2014 Date

Applicant: Huawei Technologies Co.,Ltd Model: HUAWEI Y520-U33 Sample: 1/1 Worst-case operating Mode: BT Link Modulation type: GFSK AC/DC Adapter: HuntKey (HW-050055U1W) Date of Test: 25 July 2014

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	202.200	34.8	20.0	10.6	25.4	43.5	-18.1
Horizontal	243.900	38.3	20.0	12.0	30.3	46.0	-15.7
Horizontal	310.800	32.5	20.0	14.7	27.2	46.0	-18.8
Vertical	30.480	27.8	20.0	18.9	26.7	40.0	-13.3
Vertical	51.360	37.7	20.0	9.2	26.9	40.0	-13.1
Vertical	57.660	39.8	20.0	7.8	27.6	40.0	-12.4

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 4960 MHz

Judgement: Passed by 22.8 dB

## TEST PERSONNEL:

Sign on file

Jenner Liu Assistant Engineer Typed/Printed Name

25 July 2014 Date

Applicant: Huawei Technologies Co.,Ltd [ Model: HUAWEI Y520-U33 Sample: 1/1 Worst-case operating Mode: Transmit-CH00 (2402MHz) Modulation type: GFSK

Date of Test: 25 July 2014

## 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	114.1	36.7	28.1	105.5		
Horizontal	*4804.000	50.9	36.1	35.5	50.3	74.0	-23.7

Polarization	Frequency	Reading	Pre-	Antenna	Average	Net	Average Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	Factor	at 3m	at 3m	(dB)
			Gain	(dB)	(-dB)	(dBµV/m)	(dBµV/m)	
			(dB)					
Horizontal	*4804.000	50.9	36.1	35.5	22.5	27.8	54.0	-26.2

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: Huawei Technologies Co.,Ltd [ Model: HUAWEI Y520-U33 Sample: 1/1 Worst-case operating Mode: Transmit-CH39 (2441MHz) Modulation type: GFSK

Date of Test: 25 July 2014

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	113.5	36.7	28.1	104.9		
Horizontal	*4882.000	51.4	36.1	35.5	50.8	74.0	-23.2

Polarization	Frequency	Reading	Pre-	Antenna	Average	Net	Average Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	Factor	at 3m	at 3m	(dB)
		、 . ,	Gain	(dB)	(-dB)	(dBµV/m)	(dBµV/m)	. ,
			(dB)			· · /		
Horizontal	*4882.000	51.4	36.1	35.5	22.5	28.3	54.0	-25.7

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: Huawei Technologies Co.,Ltd [ Model: HUAWEI Y520-U33 Sample: 1/1 Worst-case operating Mode: Transmit-CH78 (2480MHz) Modulation type: GFSK

Date of Test: 25 July 2014

#### 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	113.5	36.7	28.1	104.9		
Horizontal	*4960.000	51.8	36.1	35.5	51.2	74.0	-22.8

Pola	arization	Frequency	Reading	Pre-	Antenna	Average	Net	Average Limit	Margin
		(MHz)	(dBµV)	Amp	Factor	Factor	at 3m	at 3m	(dB)
				Gain	(dB)	(-dB)	(dBµV/m)	(dBµV/m)	
				(dB)					
Ho	orizontal	*4960.000	51.8	36.1	35.5	22.5	28.7	54.0	-25.3

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.

## 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 2.634 MHz

Judgement: Passed by 10.1 dB margin

## TEST PERSONNEL:

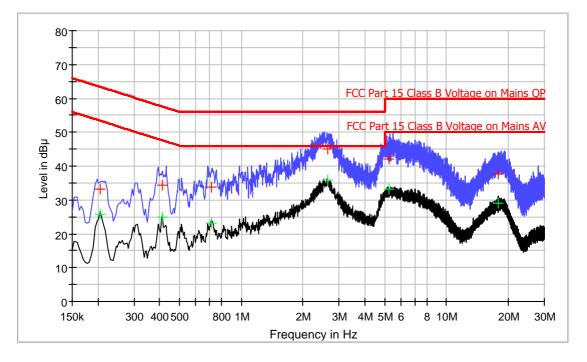
Sign on file

Jenner Liu Assistant Engineer Typed/Printed Name

25 July 2014 Date

Applicant: Huawei Technologies Co.,Ltd Model: HUAWEI Y520-U33 Sample: 1/1 Worst-case operating Mode: BT Link Modulation type: GFSK AC/DC Adapter: HuntKey (HW-050055U1W) Date of Test: 25 July 2014

## **Conducted Emission Test - FCC**



## **Result Table QP**

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.206	25.9	L	9.8	30.1	63.4
0.414	24.8	L	9.8	23.1	57.6
0.714	23.3	L	10.0	22.3	56.0
2.634	35.9	L	10.0	10.9	56.0
5.238	33.2	L	10.0	17.9	60.0
17.946	29.1	Ĺ	10.4	22.2	60.0

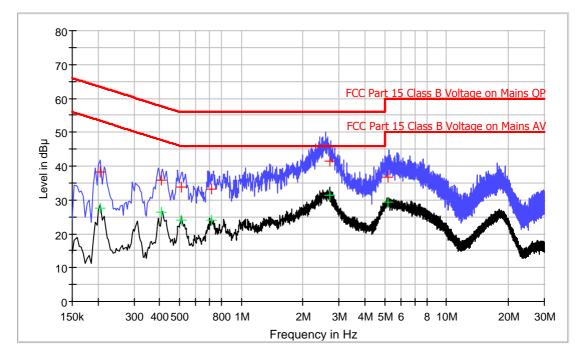
## **Result Table AV**

Frequency	QuasiPeak	Line	Corr.	Margin	Limit
(MHz)	(dB µ V)	LINE	(dB)	(dB)	(dB µ V)
0.206	33.3	L	9.8	27.5	53.4
0.414	34.5	L	9.8	22.8	47.6
0.714	33.7	L	10.0	22.7	46.0
2.634	45.1	L	10.0	10.1	46.0
5.238	42.1	L	10.0	16.8	50.0
17.946	37.8	L	10.4	20.9	50.0

TRF No.: FCC 15C\_TX\_b FCC ID: QISY520-U33 Report No.: 141125019SZN-001

Applicant: Huawei Technologies Co.,Ltd Model: HUAWEI Y520-U33 Sample: 1/1 Worst-case operating Mode: BT Link Modulation type: GFSK AC/DC Adapter: HuntKey (HW-050055U1W) Date of Test: 25 July 2014

## **Conducted Emission Test - FCC**



## **Result Table QP**

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.206	38.3	N	10.1	25.1	63.4
0.410	36.0	N	10.1	21.6	57.6
0.510	33.9	N	10.2	22.1	56.0
0.714	33.2	N	10.2	22.8	56.0
2.690	41.4	Ν	10.3	14.6	56.0
5.202	36.7	Ν	10.4	23.3	60.0

## **Result Table AV**

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.206	27.6	N	10.1	25.8	53.4
0.410	26.5	N	10.1	21.1	47.6
0.510	23.9	N	10.2	22.1	46.0
0.714	23.9	N	10.2	22.1	46.0
2.690	31.4	N	10.3	14.6	46.0
5.202	29.3	Ν	10.4	20.7	50.0

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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 = 0.5dBi								
Modulation Type Frequency Output Power Output Power									
	(MHz)	(dBm)	(mW)						
GFSK	2402	8.08	6.43						
	2441	8.49	7.06						
	2480	8.56	7.18						

Cable loss: 0.8 dB External Attenuation: 0 dB

# Modulation Type: GFSK CH00

Spectrum Ref Level	20.80 dBm	Offset	).80 dB 👄 F	BW 3 MHz				∣⊽
Att	30 dB	SWT		BW 10 MHz	Mode Au	ito Sweep		
1Pk View								
					M1	[1]	2.40	8.08 dBn 117770 GH
10 dBm				M1				
) dBm								
-10 dBm								
-20 dBm								
20 dbiii								
-30 dBm								
SO GDIII								
40 dBm								
-40 ubiii								
-50 dBm								
-50 aBm								
-60 dBm								
-70 dBm								

## CH39

Spectrum									₽
Ref Level :	20.80 dBm	Offset	0.80 dB 👄 R	BW 3 MHz					(`)
Att 🗧	30 dB	SWT	1 ms 👄 🖌	<b>'BW</b> 10 MHz	Mode A	uto Sweep			
⊖1Pk View									
					М	1[1]			8.49 dBm
				M1		1	1	2.44	07570 GHz
10 dBm									
0 dBm									
-10 dBm									
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.441 GH	z			691	pts			Spa	n 7.0 MHz



	20.80 dBm		0.80 dB 😑 I					
Att	30 dB	SWT	1 ms 👄 '	VBW 10 MHz	Mode Au	ito Sweep		
1Pk Max								
					M1	[1]	2.4	8.56 dBr 797570 GH
10 dBm				M1				
D dBm								
-10 dBm								
-20 dBm								
-30 dBm								
-40 dBm								
HO UBIII								
-50 dBm								
-60 dBm							 	
-70 dBm							 	

## 3.4 20dB Bandwidth

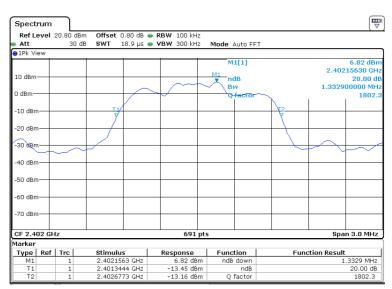
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

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.

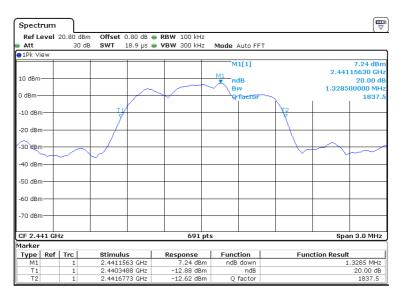
Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.33
2441	1.33
2480	1.33

#### Modulation Type: 8DPSK





## CH39



## CH78

Spectr									
	evel 2	0.80 dBm			RBW 100 kHz				
Att 🛛		30 dB	SWT 18	.9 µs 😑	VBW 300 kHz	Mode Auto	FFT		
∋1Pk Vie	9W								
						M1[1]			7.33 dBn
10 - 10						M1		2.480	15630 GH:
10 dBm-						ndB			20.00 di
0 dBm—				$\sim$		BW		1.32850	00000 MH;
u ubiii—			1			'Q fact	tor		1866.9
-10 dBm			Т1/				12		
-10 ubiii			7				Y		
-20 dBm									
-20 ubiii									
-30 dBm									
-50 0011	$\rightarrow$	$\sim$					×	$\rightarrow$ $\checkmark$	$\sim$
-40 dBm									
10 0011									
-50 dBm									
-60 dBm	_								
-70 dBm	_								
CF 2.48	GHz				691 p	ts		Spar	1 3.0 MHz
Marker									
	Ref	Trc	Stimulus	1	Response	Function	Fur	ction Result	
M1		1	2.4801563	GHz	7.33 dBm				3285 MHz
Τ1		1	2.4793488	GHz	-12.75 dBm	no	1B		20.00 dB
T2		1	2.4806773	GHz	-13.01 dBm	Q fact	or		1866.9

## 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	

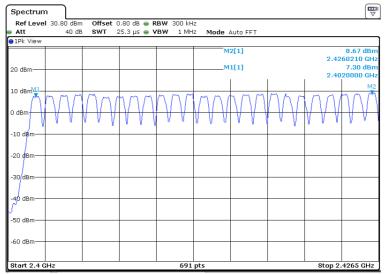
Note: In AFH mode, this device operates using 20 channels and it's satisfied the requirement of limit of minimum of 15 hopping channels.

## Modulation Type: GFSK

## CH00-CH78

Spectrum								
RefLevel 30.80 Att 4	dBm Offset D dB SWT	0.80 dB 👄 RBV 1 ms 👄 VBV		Mode Au	to Sweep			
1Pk View								
				M	2[1]			7.53 dBr 80060 GH
				M	1[1]		2.4	7.00 dBr
20 dBm							2.4	02110 GH
101dBm								M2
Ymmerow	wwww	······	$\cdots$	~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m
dBm								$ \rightarrow $
								}
10 dBm								$ \rightarrow $
-20 dBm								
30 dBm								
40 dBm								
50 dBm								
60 dBm								
Start 2.4 GHz			691	pts			Stop 2.	4835 GHz

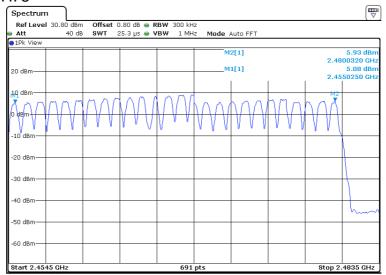
## CH00-CH25



## CH26-CH53

Spectrum							
Ref Level 30.80 dBm Att 40 dB	Offset 0.80 dB ● RBW 300 kH SWT 25.3 µs ● VBW 1 MH						
Phy View							
20 dBm		M2[1] M1[1]	8.62 dBm 2.4540340 GHz 7.71 dBm 2.4270070 GHz				
₩ dBm	0		2.+270070 GH2 M2				
			ſ₩₩₩₩₩				
-10 dBm							
-20 dBm							
-30 dBm							
-40 dBm							
-50 dBm							
-60 dBm							
Start 2.4265 GHz	691	pts	Stop 2.4545 GHz				

#### CH54-CH78



## 3.6 Channel Separation (Carrier Frequency Separation)

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

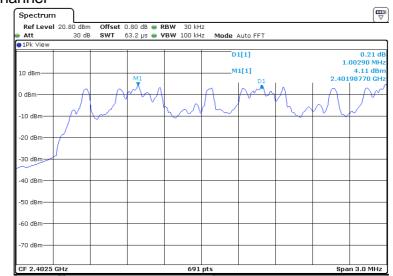
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel:  $1.33 \times 2/3 = 0.887$  MHz

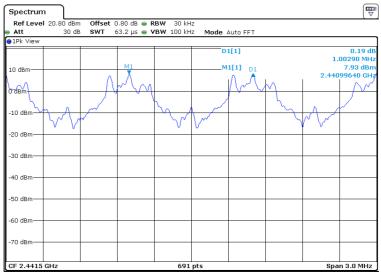
Channel Separation	1.003 MHz

Modulation Type: GFSK

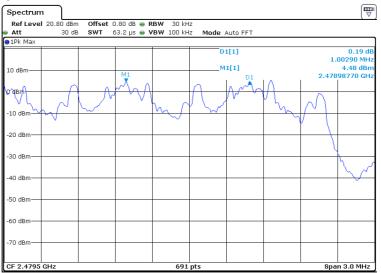
Low Channel



#### 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

Modulation	Packet	Max D	well Time	Limit	Result		
Туре						(S)	
	DH1	0.372	ms * 320=	119.04	ms	0.4	Pass
GFSK	DH3	1.627	ms * 160=	260.32	ms	0.4	Pass
	DH5	2.881	ms * 107=	308.27	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	Packet	Max Dwell Time					Result
Туре						(S)	
	DH1	0.372 ms*	160=	59.52	ms	0.4	Pass
GFSK	DH3	1.627 ms *	80=	130.16	ms	0.4	Pass
	DH5	2.881 ms *	53.33=	153.64	ms	0.4	Pass

# Modulation Type: GFSK

Packet	t: D	H1				
Spectrum						
Ref Level	20.80	dBm Offset 0.80 d	B 🖷 RBW 1 MHz			( '
Att	з	DdB 👄 SWT 1 m	s 👄 VBW 3 MHz			
SGL						
●1Pk Max						
				M1[1]		7.76 dBm
10 dBm			M1			450.72 µs
TO GBM				ndB		10.00 dB
0 dBm			Ĭ	PWid		372.464 µs
o abiii					т2	
-10 dBm						
-20 dBm						
-30 dBm						
-40 dBm						
-40 uBm					4	
-50 dBm						
	1 Julie	4. March March Mar Market	h		سيحط الأ	in Marandara.
rtanhankhank	an an	2000 CONTRACTOR OF THE OWNER	MW -		https://	╘╢╲╢╺╲╝┍╢║╱╸╎╩╘
Ŭ,						
-70 dBm						
CF 2.402 G	lz		691 p	ts		100.0 µs/
Marker						
Type Ref		Stimulus	Response	Function	Function Re:	
M1	1	450.72 µs	7.76 dBm		372.	463768116 µs
T1	1	405.8 µs				10.00 dB
T2	1	778.26 µs	-9.38 dBm	PWidth		0.0

#### Packet: DH3

Spectru	m								
	el 20.80 d		-	RBW 1 MHz					
🖷 Att	30	dB 👄 SWT	2.5 ms 👄	VBW 3 MHz					
SGL 91Pk Max									
DIPK Max					M	1[1]			7.64 dBm
		N11				-[-]		Т2	514.49 µs
10 dBm—	τF				n			-7	10.00 dB
0 dBm	T				P	Wid			1.627 ms
-10 dBm—									<u> </u>
00.10									
-20 dBm—									
-30 dBm—									
-40 dBm—				-					
-50 dBm—									
	لريق بالما							م المعالم ال	L. HAMPHI MILLAN
-60 dBm-	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~							<u>wy</u> anyy	Pha o hdharadha
-70 dBm—									
CF 2.402	GHz			691 j	ots				250.0 µs/
Marker	- 1 - 1				1				
Type R M1	ef Trc	Stimulus	49 µs	Response 7.64 dBr	Func	tion down	Func	tion Result	t 811594 ms
T1	1		49 µs 29 µs	0.89 dBr		ndB		1.020	10.00 dB
T2	1		71 ms	7.57 dBr		PWidth			0.0

## Packet: DH5

Spectrum						
Ref Level			3 🖷 RBW 1 MHz			(·,
Att 🛛	3	0 dB 🖷 SWT 4 m	5 👄 VBW 3 MHz			
SGL						
●1Pk Max						
				M1[1]		7.62 dBm
10 dBM				ndB	T2	266.67 μs 10.00 dB
The state of the s				PWid	ľ	2.881 ms
0 dBm				FWIG		2.001 ms
-10 dBm						
-20 dBm						
-30 dBm						
-30 0011						
-40 dBm						
-50 dBm						
crowly					եղի	new www. My My My My My
-60 dBm						
70 10-2						
-70 dBm						
CF 2.402 G	Hz		691 pts	i		400.0 μs/
Marker						1
	Trc	Stimulus	Response	Function	Fun	ction Result
M1	1	266.67 µs	7.62 dBm	ndB down		2.88115942 ms
T1 T2	1	220.29 µs 3.10145 ms	1.21 dBm 7.32 dBm	ndB PWidth		10.00 dB 0.0
12	1 1	3.10145 MS	7.32 UBM	Pwiuth		0.0

#### 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

= 105.5dBµv/m-55.70dB

= 49.8dBµv/m

#### (ii) Upper channel 2480MHz:

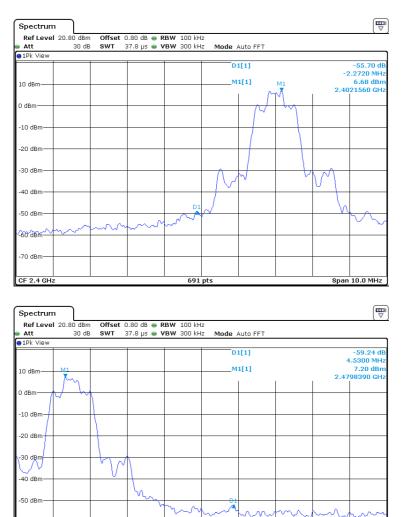
Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 104.9dB $\mu$ v/m-59.24dB

= 45.7dBµv/m

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

### Modulation Type: GFSK



691 pts

Span 10.0 MHz

-60 dBm -70 dBm CF 2.4835 GHz

#### 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

RefLevel 20.80 dBm Offse Att 30 dB SWT	t 0.80 dB 👄 RBW 100 k 25 ms 👄 VBW 300 k		
1Pk View			
		D1[1]	-65.92 dE -133.80 MH
10 dBm		M1[1]	7.12∖dBn 2.40050\GH
			2.400301017
) dBm			
-10 dBm			
10 0000			
-20 dBm			
-30 dBm			
40 dBm			
-50 dBm			
60 d8m			P1
and the terre all the strange with dates	wale for the second of the		
-70 dBm			
Start 1.0 MHz	69	1 pts	Stop 2.5 GHz

10 dBm	opecu	um										
IPk View         D3[1]         -59.16 dl 13.8300 CH 13.8300 CH 6.96 dBr 2.4150 CH           0 dBm         0             -10 dBm              -20 dBm              -20 dBm              -20 dBm              -20 dBm              -40 dBm              -40 dBm              -40 dBm              -70 dBm              -70 dBm              70 dBm              70 dBm              70 dBm              70 dBm              70 dBm              1         2             Marker </th <th></th> <th>evel</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Auto Sv</th> <th>veep</th> <th></th> <th></th> <th></th>		evel						Auto Sv	veep			
10 dBm       Image: state of the state of t	●1Pk Vi	₽₩							· F			
10 dBm							D	3[1]				-59.16 dB
0 dBm     2.415 0 GH       -10 dBm     -10 dBm       -20 dBm     -10 dBm       -20 dBm     -10 dBm       -20 dBm     -10 dBm       -30 dBm     -10 dBm	10 dBm-										13	
0 dBm							IM	1[1]			2	
-20 dBm	0 dBm—	-										
-30 dBm -40 dBm -50 dBm -50 dBm -50 dBm -50 dBm -50 dBm -70	-10 dBm											
-40 dBm     -40 dBm     D2     D2     D2       -50 dBm     -50 dBm     -50 dBm     D2     D2       -70 dBm     -60 dBm     -60 dBm     -60 dBm       -70 dBm     -70 dBm     -70 dBm     -70 dBm       -70 dBm     -70 dBm <td>-20 dBm</td> <td>-</td> <td></td>	-20 dBm	-										
50 dBm         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02         02 <t< td=""><td>-30 dBm</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	-30 dBm	-										
S0 dbm         S0 dbm<	-40 dBrr	+			D2							
Start 2.3 GHz         691 pts         Stop 25.0 GHz           Marker         Type         Ref         Trc         Stimulus         Response         Function         Function Result           M1         1         2.415 GHz         6.96 dBm         Function         Function Result           D2         M1         1         7.194 GHz         -5.346 dB         Function	-50 dBm							D3				
Type         Ref         Trc         Stimulus         Response         Function         Function Result           M1         1         2.415 GHz         6.96 dBm         6.96 dBm         6.96 dBm	-en der	med	mentille	Umohum	mound	howwww	menoration	Augur	mm	allowing	m	wanter
Start 2.3 GHz         691 pts         Stop 25.0 GHz           Marker         Type         Ref         Trc         Stimulus         Response         Function         Function Result           M1         1         2.415 GHz         6.96 dBm         Function Result         Function Result           D2         M1         1         7.194 GHz         -53.46 dB         Function         Function Result												
Marker         Type         Ref         Trc         Stimulus         Response         Function         Function Result           M1         1         2.415 GHz         6.96 dBm             D2         M1         1         7.194 GHz         -5.34 d db	-70 dBm											
Type         Ref         Trc         Stimulus         Response         Function         Function Result           M1         1         2.415 GHz         6.96 dBm              D2         M1         1         7.194 GHz         -53.46 dB	Start 2	.3 GH	z			691	pts				Stop	25.0 GHz
M1         1         2.415 GHz         6.96 dBm           D2         M1         1         7.194 GHz         -53.46 dB	Marker											
D2 M1 1 7.194 GHz -53.46 dB		Ref						tion		Function	n Result	
		M1										
	D3	M1	1									

### CH39

Ref Level         20.80 dBm         Offset         0.80 dB         RBW         100 kHz           0 Att         30 dB         SWT         25 ms         VBW         300 kHz         10 kHz           10 dBm         0 dBm         0 dBm         0 dBm         0 dBm         0 dBm         0 dBm	Mode Auto Sweep D1[1] M1[1]	-65.81 d -629.30 MH 7.44 dBr
0 d8m		-629.30 MH 7.44 dBt
rdBm		-629.30 MH 7.44 dBt
rdBm	M1[1]	7.44 dBt
rdBm		0.44000.0
		2.44030 GH
10 dBm		
20 dBm		
30 dBm		
40 dBm		
50 dBm		
	D1	1 1 1
50 dBm	and a second with the work of the	Maller and the second
had and have a house of the form and the second and the		
70 dBm		
tart 1.0 MHz 691 pts		Stop 2.5 GHz
Ref Level         20.80 dBm         Offset         0.80 dB         ● RBW         100 kHz           Att         30 dB         SWT         227 ms         ● YBW         300 kHz         r		
Att 30 dB SWT 227 ms  VBW 300 kHz r 1Pk View	Mode Auto Sweep	
	D2[1]	-54.28 d
		7.3260 GF
.0 dBm	M1[1]	7.41 dBi 2.4480 GH
dBm		
10 dBm		
20 dBm		
		<u>+ + +</u>
30 dBm		
30 dBm		
40 dBm	anthon when have	hardwood
40 dBm	whater	hardward
40 dBm D2 50 dBm D2 50 dBm Uwhywhat www. Lathan Mark	and the second and the second se	handwork
40 dBm	who have get a second second	had when have

### CH78

Ref Li Att	evel :	20.80 30	dBm ) dB	Offse SWT				100 k⊢ 300 k⊢		1ode /	Auto Sv	veep					
1Pk Vi	ew																
			ſ							D	1[1]	_					66.39
																	5.30 M
.0 dBm	-									IVI	1[1]						7.79 di 3010 G
											1	1				2.10	
) dBm—	_						_							-		_	
10 dBm																	
20 000	·																
20 dBrr																	
30 dBrr	-+-		-														
									1								
40 dBm	η <del></del>		_				_										
50 dBrr																	
SU UBII	'		T														
																D	1
60 dBm	whene	مسلمه	AL AND	metherloy	do ha	when	mo	where	huga	ntrented	month	here	whitey	w for	where the	wheel and	Junited
	- 00000	Q	· • •						1								
70 dBrr	∩		-+											-		-+	
								691	pts							atop	2.5 GF
Spect Ref L	rum	20.80				-		100 kH	łz							atup	2.3 GF
Spect Ref Li Att	rum evel	20.80	dBm ) dB	Offse SWT		-			łz	4ode ∤	Auto Sv	weep				atup	
Spect Ref L Att	rum evel	20.80				-		100 kH	łz			weep					(
Spect Ref L Att	rum evel	20.80				-		100 kH	łz		Auto Sv 3[1]	veep					59.29
Spect Ref L Att	rum evel	20.80				-		100 kH	łz	D	3[1]	veep					59.29 3300 G
Spect Ref L Att	rum evel	20.80				-		100 kH	łz	D		weep				13.6	59.29 3300 G 7.69 dl
Spect Ref Li Att 1Pk Vi	rum evel	20.80				-		100 kH	łz	D	3[1]	veep				13.6	59.29 3300 G
Spect Ref L Att 1Pk Vi 0 dBm	rum evel	20.80				-		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref L Att 1Pk Vi 0 dBm	rum evel	20.80				-		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref Li 1Pk Vi 10 dBm ) dBm-	rum evel	20.80				-		100 kH	łz	D	3[1]	veep				13.6	59.29 3300 G 7.69 dl
Spect Ref Li 1Pk Vi 0 dBm 0 dBm– 10 dBm	rum evel	20.80				-		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref Li 1Pk Vi 0 dBm- 0 dBm- 10 dBm 20 dBn	rum evel	20.80				-		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref Li 1Pk Vi 0 dBm- 0 dBm- 10 dBm 20 dBn	rum evel	20.80				-		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref L 1Pk Vi 1Pk Vi 0 dBm- 10 dBm- 10 dBm 20 dBn 30 dBn	rum evel	20.80			227	' ms 🖷		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref L 1Pk Vi 1Pk Vi 0 dBm- 10 dBm- 10 dBm 20 dBn 30 dBn	rum evel	20.80			227	7 ms •		100 kH	łz	D	3[1]	weep				13.6	59.29 3300 G 7.69 dl
Spect Ref L Att PIPk Vi O dBm O dBm O dBm 20 dBm 30 dBn 40 dBn		20.80			227	' ms 🖷		100 kH	łz	D	3[1] 1[1]					13.6	59.29 3300 G 7.69 dl
Spect Ref L Att DIPk Vi dBm- 10 dBm- 10 dBm- 10 dBm- 30 dBm- 40 dBm 30 dBm 30 dBm		20.80		SWT	227	7 ms •		100 kH		D	3[1] 1[1]	weep				2.4	59.29 3300 G 7.69 dl
<b>Spect</b> <b>Ref L</b> <b>Att</b> (1Pk Vi 0 dBm- 10 dBm- 10 dBm- 20 dBm- 30 dBm- 40 dBm- 50 dBm		20.80			227	7 ms •		100 kH 300 kH		D:	3[1] 1[1]		angreed			2.4	(1 59.29 3300 C 7.69 dl #810 C
<b>Spect</b> <b>Ref L</b> <b>Att</b> 11Pk Vi 10 dBm- 10 dBm- 10 dBm- 10 dBm- 30 dBm- 30 dBm 30 dBm 40 dBm 50 dBm		20.80		SWT	227	7 ms •		100 kH 300 kH		D:	3[1] 1[1]				~~~***********************************	2.4	(1 59.29 3300 C 7.69 dl #810 C
Spect Ref L Att 11Pk Vi 0 dBm- 10 dBm- 10 dBm 20 dBm 30 dBm 30 dBm 40 dBm 50 dBm		20.80		SWT	227	7 ms •		100 kH 300 kH		D:	3[1] 1[1]		nnonmen			2.4	(1 59.29 3300 C 7.69 dl #810 C
Spect Ref L Att 11Pk Vi 0 dBm- 10 dBm- 10 dBm 20 dBm 30 dBm 30 dBm 40 dBm 50 dBm		20.80		SWT	227	7 ms •		100 kH 300 kH		D:	3[1] 1[1]		nongolum			2.4	(1 59.29 3300 C 7.69 dl #810 C
<b>Spect</b> <b>Ref L</b> <b>Att</b> 1Pk Vi 1Pk Vi 0 dBm- 10 dBm- 10 dBm 20 dBm 40 dBm 50 dBm 50 dBm 50 dBm 70 dBm		20.80		SWT	227	7 ms •		100 kH		D:	3[1] 1[1]		nongolaut				(1 59.29 3300 C 7.69 dl #810 C
Spect Ref L Att (1Pk Vi 0 dBm- 10 dBm- 10 dBm- 10 dBm- 20 dBm 30 dBm- 30 dBm 30 dBm 30 dBm 70 dBm 70 dBm 70 dBm 70 dBm		20.80 31		SWT		7 ms •	VBW	100 kH		D: M	a[1] 1[1]				£		59.29 3300 C 7.69 dl #810 C
Spect Ref L1 11Pk Vi 0 dBm 10 dBm 20 dBm 20 dBm 20 dBm 30 dBm 40 dBm 50 dBm 50 dBm 50 dBm 50 dBm 50 dBm 50 dBm 50 dBm 10 dBm 70 dBm 50 dBm 10 dBm 770 dBm 10		20,80 31		SWT	222	D2 A	VBW	100 kH	IZ N Villa pts	D:	a[1] 1[1]						59.29 3300 C 7.69 dl #810 C
		20.80 31		SWT		D2 A GHz	VBW	100 kH	IZ N	D: M	a[1] 1[1]				£		59.29 3300 C 7.69 dl #810 C

**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 msTime of 1 cycle =3.75 ms x 79 = 296.25 msAverage 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 hops/second = 7.5 ms Time to cycle through all channels =  $7.5 \times 20$  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 =  $20\log_{10}(7.5\text{ms} / 100\text{ms}) = -22.5$  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 C63.4: 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 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.

#### 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** 

#### 9.0 **Confidentiality Request**

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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	21-May-2014	21-May-2015
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	21-May-2014	21-May-2015
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
EM031-03	EXA Spectrum Analyzer	R&S	FSV40	101506	09-Jun-2014	09-Jun-2015
SZ181-04	Preamplifier	Agilent	8449B	3008A0247 4	10-Mar-2014	10-Mar-2015
SZ188-01	Anechoic Chamber	ETS	RFD-F/A- 100	4102	19-Apr-2014	19-Apr-2015
SZ062-02	RF Cable	RADIALL	RG 213U		19-Apr-2014	19-Oct-2014
SZ062-05	RF Cable	RADIALL	0.04- 26.5GHz		19-Apr-2014	19-Oct-2014
SZ062-12	RF Cable	RADIALL	0.04- 26.5GHz		19-Apr-2014	19-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