

## **FCC - TEST REPORT**

Report Number	:	68.950.14.119.01	1	Date of Issue:	June 17, 2014
Model	<u>:</u>	BT-310			
Product Type	:	Bluetooth Head	set		
Applicant	<u>:</u>	Fujikon Industri	al Co., Li	td.	
Address	<u>:</u>	16/F., Tower 1,	Grand C	entral Plaza, 1	38 Shatin Rural
		Committee Roa	ıd, Shatir	n, N.T, HONG I	KONG
Production Facility	<u>:</u>	Fujikon Industri	al Co., Lt	td.	
Address	<u>:</u>	16/F., Tower 1,	Grand C	entral Plaza, 1	38 Shatin Rural
		Committee Roa	ıd, Shatir	n, N.T, HONG I	KONG
Test Result	:	■ Positive [	⊐ Negativ	ve	
Total pages including Appendices	:	44			

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Report Number: 68.950.14.119.01



# **Table of Contents**

1	T	Γable of Contents	2
2	D	Details about the Test Laboratory	3
3	D	Description of the Equipment Under Test	4
4	S	Summary of Test Standards	5
5	S	Summary of Test Results	6
6	G	General Remarks	7
7	T	Test Setups	8
8	S	Systems test configuration	9
9	T	Fechnical Requirement	10
ç	9.1	Conducted Emission.	10
9	9.2	Conducted peak output power	13
9	9.3	20 dB bandwidth and 99% Occupied Bandwidth	15
9	9.4	Carrier Frequency Separation	20
9	9.5	Number of hopping frequencies	22
9	9.6	Dwell Time	24
9	9.7	Spurious RF conducted emissions.	29
9	8.6	Band edge testing	35
ç	9.9	Spurious radiated emissions for transmitter	40
10	T	Test Equipment List	43
11	S	System Measurement Uncertainty	44



# 2 Details about the Test Laboratory

# **Details about the Test Laboratory**

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

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Test Site 2

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Guangdong,

China

Telephone: 86 755 2663 9496 Fax: 86 755 2663 2877

Report Number: 68.950.14.119.01 Page 3 of 44



# 3 Description of the Equipment Under Test

Product: Bluetooth Headset

Model no.: BT-310

FCC ID: TTC-BT-310

Brand Name: Fujikon

Options and accessories: NIL

Rating: DC3.7V (Supplied by Li-ion rechargeable battery)

DC5.0V (Charged by USB Port)

**RF Transmission** 

Frequency:

2402-2480MHz

No. of Operated Channel: 79

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

Duty Cycle: 35.10%

Antenna Type: PIFA

Antenna Gain: 0dBi

Description of the EUT: The Equipment Under Test (EUT) is a Bluetooth headset operated at

2.4GHz



# 4 Summary of Test Standards

	Test Standards
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES
10-1-2013 Edition	Subpart C - Intentional Radiators

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and C63.10 (2009).

Report Number: 68.950.14.119.01 Page 5 of 44



# **Summary of Test Results**

	Technical Requirements			
FCC Part 15 Sub	part C			
Test Condition		Pages	Test Site	Test Result
§15.207	Conducted emission AC power port	10	Site 2	Pass
§15.247(b)(1)	Conducted peak output power	13	Site 2	Pass
§15.247(a)(2)	6dB bandwidth			N/A
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	15	Site 2	Pass
§15.247(a)(1)	Carrier frequency separation	20	Site 2	Pass
§15.247(a)(1)(iii)	Number of hopping frequencies	22	Site 2	Pass
§15.247(a)(1)(iii)	Dwell Time	24	Site 2	Pass
§15.247(e)	Power spectral density*			N/A
§15.247(d)	Spurious RF conducted emissions	29	Site 2	Pass
§15.247(d)	Band edge	35	Site 2	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	40	Site 2	Pass
§15.203	Antenna requirement	See	note 2	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a permanently PIFA antenna, which gain is 0dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



## 6 General Remarks

#### Remarks

This submittal(s) (test report) is intended for FCC ID: TTC-BT-310, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules

#### **SUMMARY:**

All tests according to the regulations cited on page 5 were

- Performed
- ☐ Not Performed

The Equipment Under Test

- - Fulfills the general approval requirements.
- ☐ **Does not** fulfill the general approval requirements.

Sample Received Date: May 12, 2014

Testing Start Date: March 14, 2014

Testing End Date: June 13, 2014

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by:

Prepared by:

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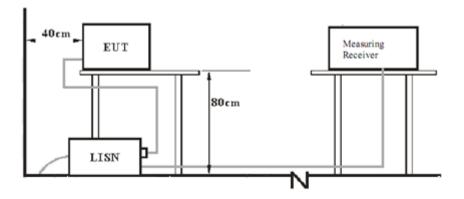
Felis-L

Leo Li EMC Test Engineer

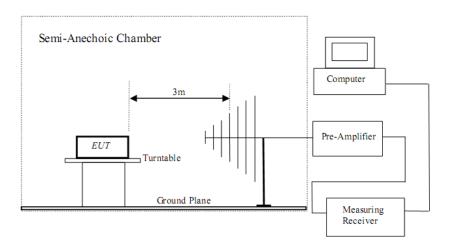


# **Test Setups**

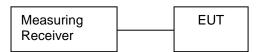
## 7.1 AC Power Line Conducted Emission test setups



# 7.2 Radiated test setups



# 7.3 Conducted RF test setups





# 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
NoteBook	Lenovo	X220	

Test software: Bluetest 3.0, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

Report Number: 68.950.14.119.01 Page 9 of 44



# 9 Technical Requirement

## 9.1 Conducted Emission

#### **Test Method**

- 1. The EUT was placed on a table, which is 0.8m above ground plane
- 2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
- 3. Maximum procedure was performed to ensure EUT compliance
- 4. A EMI test receiver is used to test the emissions from both sides of AC line

#### Limit

According to §15.207, conducted emissions limit as below:

Frequency	QP Limit	AV Limit	
 MHz	dΒμV	dΒμV	
0.150-0.500	66-56*	56-46*	_
0.500-5	56	46	
5-30	60	50	

Decreasing linearly with logarithm of the frequency



#### **Conducted Emission**

Product Type : Bluetooth Headset

M/N : BT-310 Operating Condition : Transmitting

Test Specification : Line

Comment : AC 120V/60Hz



Trace: (Discrete)

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
-	0 10000	0.10		26.40	26 50	F4 10	17 60	
Τ.	0.18800	0.13	9.88	26.49	36.50	54.12	17.62	Average
2	0.18800	0.13	9.88	40.49	50.50	64.12	13.62	QP
3	3.839	0.24	9.93	18.60	28.77	46.00	17.23	Average
4	3.839	0.24	9.93	28.70	38.87	56.00	17.13	QP

Frequency (MHz)

Remarks: 1.Emission Level=LISN Factor+Cable Loss(Include 10dB pulse limit) +Reading.

2.If the average limit is met when useing a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

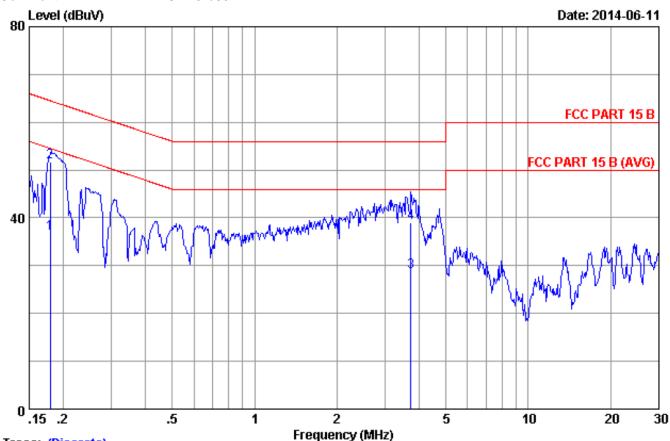
Report Number: 68.950.14.119.01



#### **Conducted Emission**

Product Type : Bluetooth Headset

M/N : BT-310
Operating Condition : Transmitting
Test Specification : Neutral
Comment : AC 120V/60Hz



Trace: (Di	iscre	te)
------------	-------	-----

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.17866	0.13	9.88	26.70	36.71	54.55	17.84	Average
2	0.17866	0.13	9.88	41.60	51.61	64.55	12.94	QP
3	3.719	0.26	9.93	18.50	28.69	46.00	17.31	Average
4	3.719	0.26	9.93	28.90	39.09	56.00	16.91	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss(Include 10dB pulse limit) +Reading.

2. If the average limit is met when useing a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.



# 9.2 Conducted peak output power

#### **Test Method**

- Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
- 2. Add a correction factor to the display.
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

#### Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

Frequency Range	Limit	Limit
MHz	W	dBm
2400-2483.5	≤1	≤30

Report Number: 68.950.14.119.01 Page 13 of 44



# Conducted peak output power

# Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	5.522	Pass
Middle channel 2441MHz	6.888	Pass
High channel 2480MHz	6.872	Pass

# Bluetooth Mode $\pi/4$ -DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	5.620	Pass
Middle channel 2441MHz	5.437	Pass
High channel 2480MHz	4.875	Pass

# Bluetooth Mode 8DPSK modulation Test Result

Frequency MHz	Output Power dBm	Result		
Low channel 2402MHz	5.257	Pass		
Middle channel 2441MHz	5.360	Pass		
High channel 2480MHz	3.773	Pass		

Page 14 of 44



#### **Test Method**

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

	Limit [kHz]	
·	N/A	

Report Number: 68.950.14.119.01 Page 15 of 44

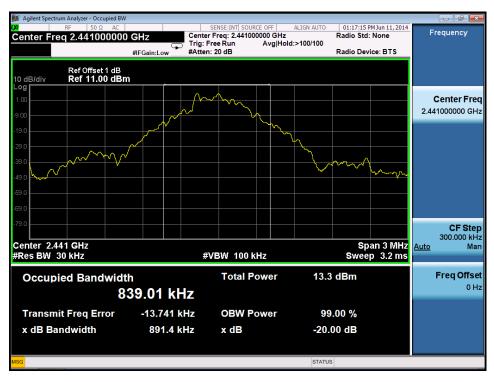


## Bluetooth Mode GFSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result	
MHz	kHz	kHz	kHz		
2402	912.4	838.1		Pass	•
2441	891.4	839.0		Pass	
2480	890.6	839.4		Pass	











## Bluetooth Mode 8DPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result	
MHz	kHz	kHz	kHz		
2402	1.211	1.1422		Pass	
2441	1.210	1.1413		Pass	
2480	1.207	1.1479		Pass	











# 9.4 Carrier Frequency Separation

#### **Test Method**

- Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. By using the Max-Hold function record the separation of two adjacent channels.
- 3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
- 4. Repeat above procedures until all frequencies measured were complete.

#### Limit

Limit
kHz
≥25KHz or 2/3 of the 20 dB bandwidth which is greater

#### **GFSK Modulation Limit**

Frequency	2/3 of 20 dB Bandwidth
MHz	kHz
2402	608.27
2441	594.27
2480	593.73

Report Number: 68.950.14.119.01 Page 20 of 44



## **Carrier Frequency Separation**

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

## **GFSK Modulation test result**

Frequency	Carrier Frequency Separation	Result
MHz	kHz	
2402	1000	Pass
2441	1000	Pass
2480	1000	Pass





# 9.5 Number of hopping frequencies

#### **Test Method**

- Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
- 3. Record all the signals from each channel until each one has been recorded.
- 4. Repeat above procedures until all frequencies measured were complete.

#### Limit

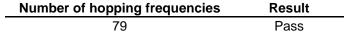
Limit
number
≥ 15

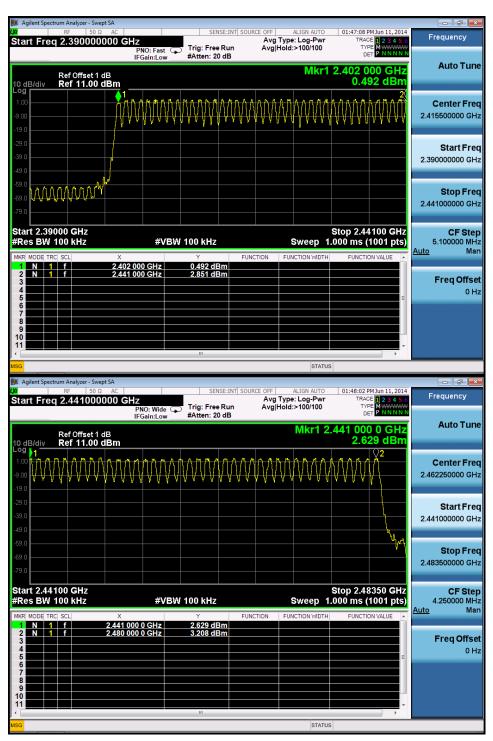
Report Number: 68.950.14.119.01 Page 22 of 44



#### Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.







## 9.6 Dwell Time

#### **Test Method**

- Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
   Equipment mode: Spectrum analyzer
- 2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
- 3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
- 4. Measure the Dwell Time by spectrum analyzer Marker function.
- 5. Repeat above procedures until all frequencies measured were complete.

## Limit

According to §15.247(a)(1)(iii), The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Report Number: 68.950.14.119.01 Page 24 of 44



## **Dwell Time**

#### **Dwell time**

The maximum dwell time shall be 0,4 s.

The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 79 [ch] = 31.6 [s\*ch];

The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5=1600 / 6 / 79 \*31.6=106.67

**Test Result** 

Modulation	Mode	Reading (µs)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	DH1	452	320	144.64	< 400	Pass
GFSK	DH3	1719	160	275.04	< 400	Pass
GFSK	DH5	2990	106.67	318.94	< 400	Pass
8-DPSK	3DH1	483	320	154.56	< 400	Pass
8-DPSK	3DH3	1743	160	278.88	< 400	Pass
8-DPSK	3DH5	2960	106.67	315.74	< 400	Pass

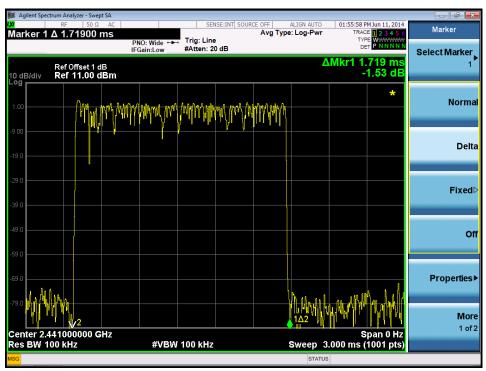
#### **GFSK Modulation**



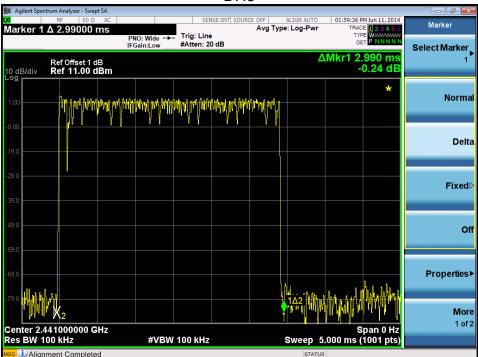
DH1



**Product Service** 



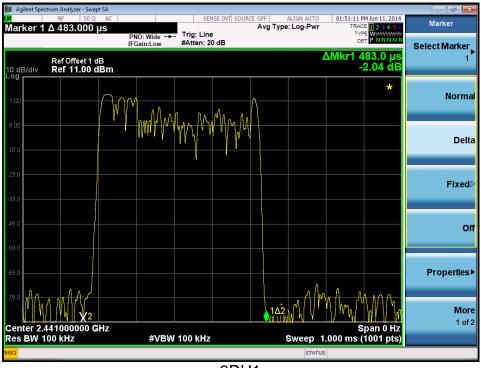




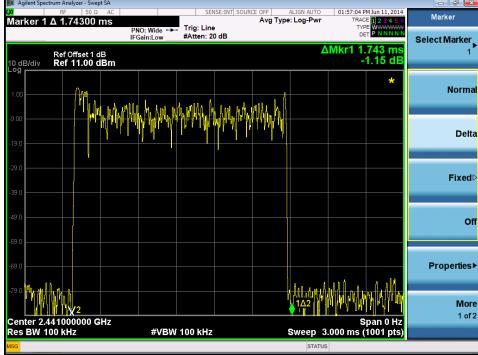
DH5



#### 8-DPSK Modulation



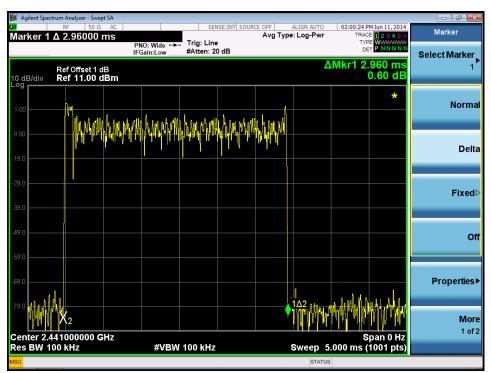
# 3DH1



3DH3



#### **Product Service**



3DH5



#### **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 3. The level displayed must comply with the limit specified in this Section. Submit these plots.
- 4. Repeat above procedures until all frequencies measured were complete.

#### Limit

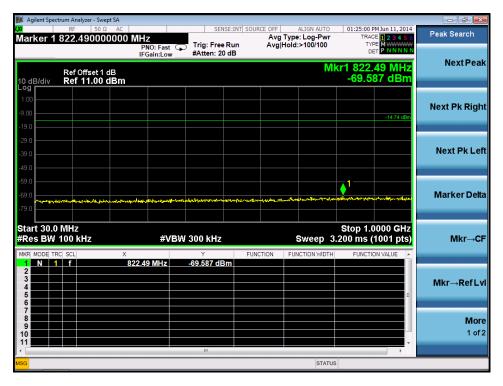
Frequency Range MHz	Limit (dBc)
30-25000	-20

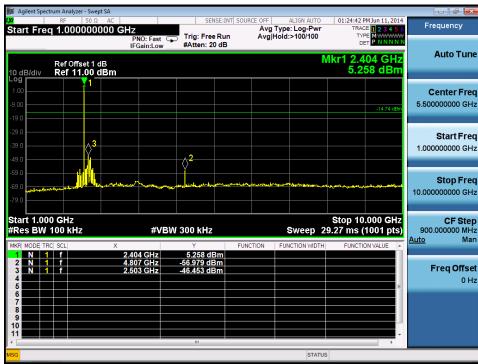
Report Number: 68.950.14.119.01 Page 29 of 44



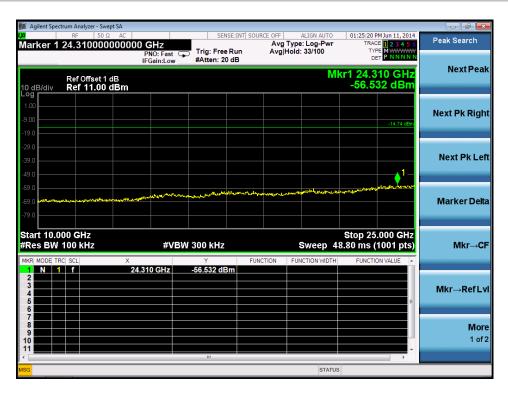
Only the worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

## 2402MHz

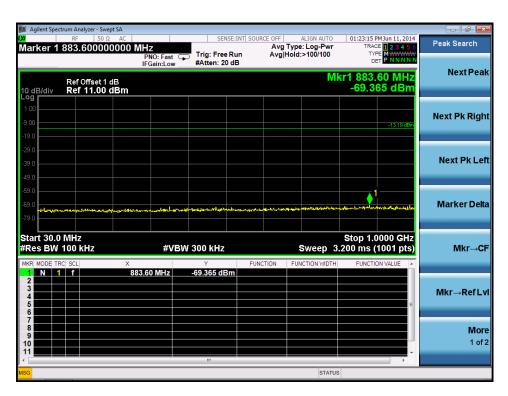




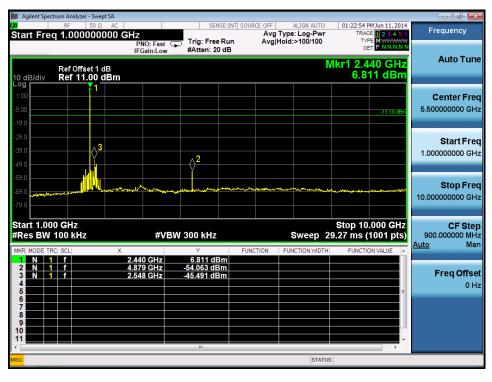




#### 2441MHz





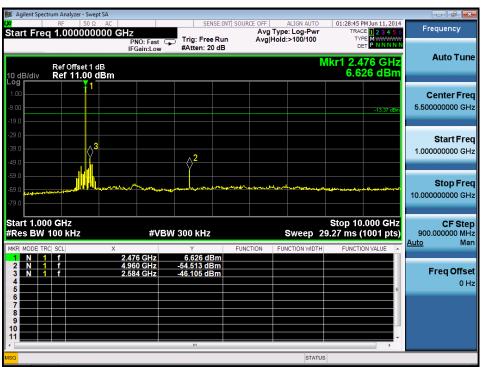




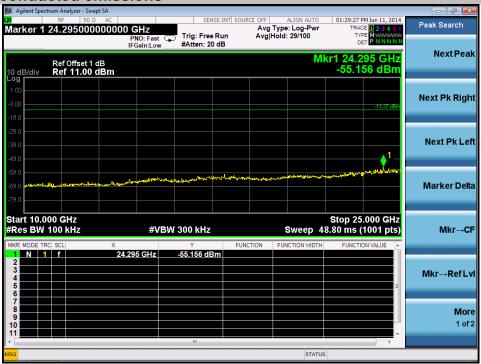


#### 2480MHz











#### **Test Method**

- 1 Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

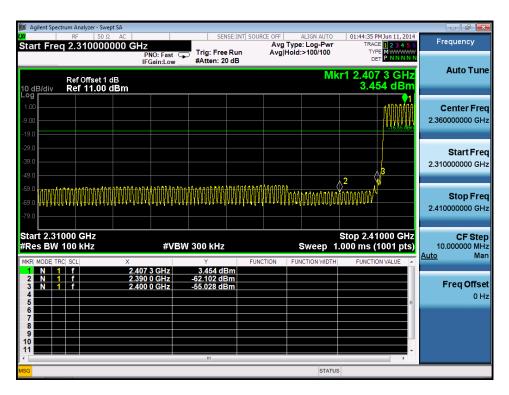
#### Limit:

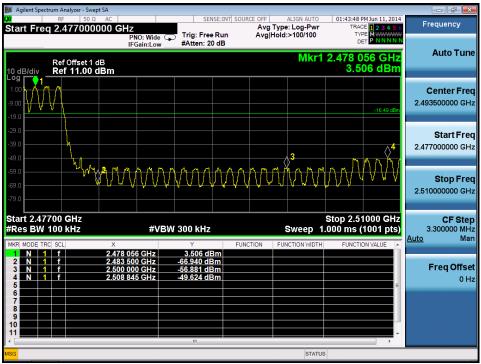
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Report Number: 68.950.14.119.01 Page 35 of 44



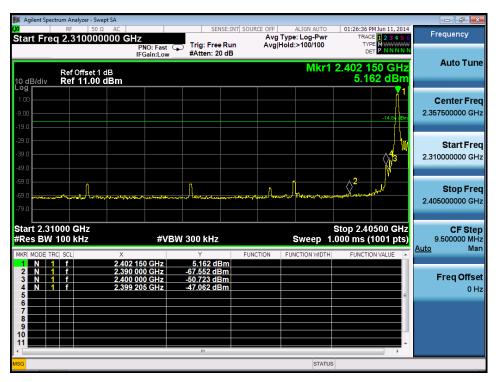
GFSK Modulation Test Result: Hopping on mode:







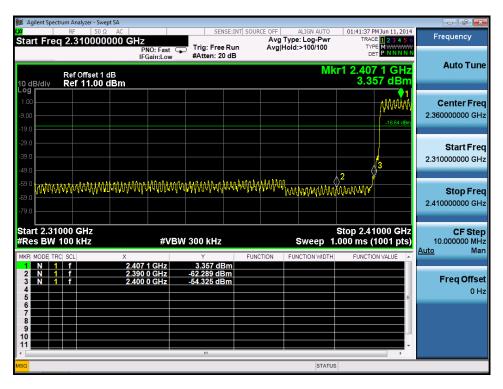
# Hopping off mode:

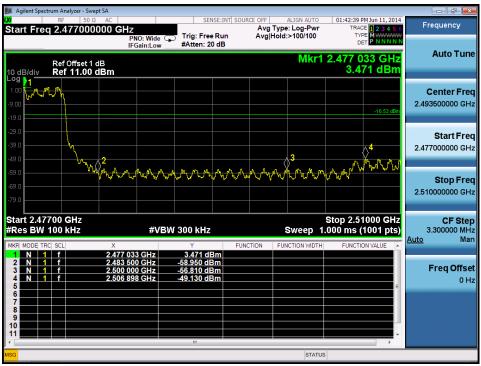






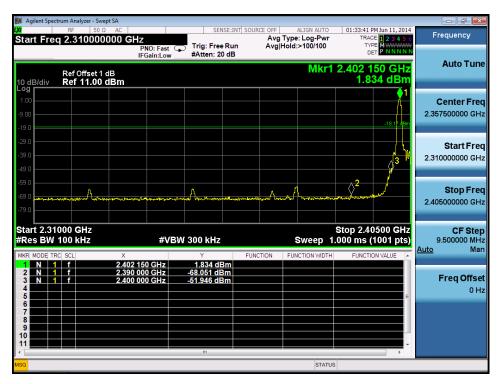
8DPSK Modulation Test Result: Hopping on mode:







# Hopping off mode:







# 9.9 Spurious radiated emissions for transmitter

#### **Test Method**

- 1. The EUT is placed on a turntable, which is 0.8m above ground plane.
- 2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 3. Use the following spectrum analyzer settings:

  Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥

  1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak,

  Trace = max hold
- 4. Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

#### Limit

According to part 15.247(d), the radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency	Field Strength	Field Strength	Detector
MHz	uV/m	dBμV/m	
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Report Number: 68.950.14.119.01 Page 40 of 44



## **Spurious radiated emissions for transmitter**

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

## Transmitting spurious emission test result as below:

Bluetooth Mode GFSK Modulation 2402MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
						Horizontal	40	QP	Pass
						Horizontal	43.5	QP	Pass
*4804	32.85	8.56	35.70	43.51	49.22	Horizontal	74	PK	Pass
*4804	32.85	8.56	35.70			Horizontal	54	AV	Pass
*4804	32.85	8.56	35.70	42.19	47.90	Vertical	74	PK	Pass
*4804	32.85	8.56	35.70			Vertical	54	AV	Pass

#### Bluetooth Mode GFSK Modulation 2441MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
*4882	32.99	8.64	35.70	42.94	48.87	Horizontal	74	PK	Pass
*4882	32.99	8.64	35.70	-		Horizontal	54	AV	Pass
*4882	32.99	8.64	35.70	39.53	45.46	Vertical	74	PK	Pass
*4882	32.99	8.64	35.70			Vertical	74	AV	Pass

#### Bluetooth Mode GFSK Modulation 2480MHz Test Result

Frequency	Antenna Factor	Cable Loss	Amp. Factor	Reading	Emission Level	Polarization	Limit	Detector	Result
MHz	dB/m	dB	dB	dBuV	dBuV/m		dBµV/m		
*4960	33.13	8.72	35.70	44.20	50.35	Horizontal	74	PK	Pass
*4960	33.13	8.72	35.70			Horizontal	54	AV	Pass
*4960	33.13	8.72	35.70	40.37	46.52	Vertical	74	PK	Pass
*4960	33.13	8.72	35.70			Vertical	54	AV	Pass

#### Remark:

- (1) QP Emission Level= Antenna Factor +Cable Loss + Reading PK Emission Level= Antenna Factor +Cable Loss Amp. factor + Reading AV Emission Level= PK Emission Level+20log(dutycycle)
- (2) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (3) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

Report Number: 68.950.14.119.01 Page 41 of 44



#### Remark:

- (1) QP Emission Level= Antenna Factor +Cable Loss + Reading PK Emission Level= Antenna Factor +Cable Loss Amp. factor + Reading AV Emission Level= PK Emission Level+20log (dutycycle)
- (2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (3) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section RSS-Gen.



# 10 Test Equipment List

## **List of Test Instruments**

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE	
CE _	Test Receiver	Rohde & Schwarz	ESHS10	838693/001	Nov.04, 14	$\boxtimes$
	L.I.S.N.#1	Rohde & Schwarz	ESH2-Z5	834066/011	Nov.04, 14	
	L.I.S.N.#3	Kyoritsu	KNW-242C	8-1920-1	May.07, 14	
	RF Cable	3D-2W	Fujikura	LISN Cable 1#	May.07, 14	$\boxtimes$
	Coaxial Switch	MP59B	Anritsu M55367		May.07, 14	
	Passive Probe	ESH2-Z3	Rohde & Schwarz	299.7810.52	May.07, 14	
	Pulse Limiter	ESH3-Z2	Rohde & Schwarz	100341	May.07, 14	
С	Spectrum	Agilent	E4446A	US44300459	May.08, 14	$\boxtimes$
RE < 1	Test Receiver <1GHz	Rohde & Schwarz	ESVS10	834468/011	May.07, 14	$\boxtimes$
GHz	Amplifier < 1 GHz	HP	8447D	2648A04738	May.07, 14	
	HF Cable	Hubersuhne	Sucoflex104	Room 2	May.08, 14	
	Bilog Antenna	Schaffner	CBL6111C	2598	Oct.25, 14	$\boxtimes$
RE > 1 GHz	Spectrum > 1GHz	Agilent	E4446A	US44300459	May.08, 14	
	Horn Antenna	EMCO	3115	9607-4877	Jun. 24, 14	
	Amp > 1 Ghz	HP	8449B	3008A08495	May.08, 14	$\boxtimes$
	HF Cable	Hubersuhne	Sucoflex104	Room1	May.08, 14	$\boxtimes$

#### C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Power spectral density\*
- Spurious RF conducted emissions
- Band edge



# 11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items	Extended Uncertainty		
Radiated spurious emission	4.32dB (30MHz-1GHz)		
Radiated spurious emission	2.27dB (1GHz -25GHz)		
Conducted spurious emission	2.10dB(30MHz-25GHz)		
Bandwidth test	1*10 <sup>-9</sup>		
Conducted emission	2.4dB		