

### **FCC/IC - TEST REPORT**

Report Number	: 68.950.18.014	8.01	Date of Issue:	May 28, 2018		
Model	: BF2100S					
Product Type	: Bluetooth Hea	dset				
Applicant	: Plantronics, In	С.				
Address	: 345 Encinal S	treet, Santa	Cruz, CA, 95060,	USA		
Manufacturer	: Plantronics, Inc.					
Address	: 345 Encinal Street, Santa Cruz, CA, 95060, USA					
Test Result	: n Positive	o Negati	ve			
Total pages including Appendices	: 46	_				

TÜV SÜD CERTIFICATION AND TESTING (CHINA) CO., LTD. SHENZHEN BRANCH is a subcontractor to TÜV SÜD Product Service GmbH according to the principles outlined in ISO 17025. TÜV SÜD CERTIFICATION AND TESTING (CHINA) CO., LTD. SHENZHEN BRANCH reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations TÜV SÜD CERTIFICATION AND TESTING (CHINA) CO., LTD. SHENZHEN BRANCH shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD CERTIFICATION AND TESTING (CHINA) CO., LTD. SHENZHEN BRANCH issued reports. This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.



## 1 Table of Contents

1	Tal	ble of Contents				
2	De	tails about the Test Laboratory				
3	De	scription of the Equipment Under Test4				
4	Su	mmary of Test Standards				
5	Su	mmary of Test Results				
6	Ge	neral Remarks				
7	Tes	st Setups				
8	Sys	stems test configuration				
9	Teo	chnical Requirement				
ç	9.1	Conducted peak output power				
ç	9.2	20 dB bandwidth and 99% Occupied Bandwidth17				
ç	9.3	Carrier Frequency Separation				
ç	9.4	Number of hopping frequencies				
ç	9.5	Dwell Time				
ç	9.6 Spurious RF conducted emissions					
ç	9.7	Band edge testing				
ç	9.8	Spurious radiated emissions for transmitter				
10	Tes	st Equipment List				
11	Sys	stem Measurement Uncertainty				



## 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 Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052 P.R. China
Telephone: Fax:	86 755 8828 6998 86 755 828 5299
FCC Registration	514049
IC Registration No.:	10320A -1



## 3 Description of the Equipment Under Test

Product:	Bluetooth Headset
Model no.:	BF2100S
FCC ID:	AL8-BF2100S
IC:	457A-BF2100S
Options and accessories:	USB Cable
Rating:	3.7VDC, 120mAh (Supplied by Built Li-ion Polymer battery) 5VDC (Charged by USB port)
RF Transmission	2402MHz-2480MHz
Frequency: No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type:	Integrated antenna
Antenna Gain:	2.0dBi
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					
10-1-2017 Edition Subpart C - Intentional Radiators						
RSS-Gen Issue 5 April 2018	General Requirements for the Certification of Radio Apparatus					
RSS-247lssue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices					

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 ANSI C63.10-2013.



## 5 Summary of Test Results

	Т	echnical Requirements			
FCC Part 15 Sub	part C/RSS-247 Is	sue 2/RSS-Gen Issue 5			
Test Condition			Pages	Test Result	Test Site
§15.207 RSS-GEN 8.8 Conducted emission AC power port				N/A	
§15.247(b)(1)	RSS-247 Clause 5.4(d)	Conducted peak output power	10	Pass	Site 1
§15.247(e)	RSS-247 Clause 5.2(b)	Power spectral density*		N/A	
§15.247(a)(2)	RSS-247 Clause 5.2(a)	6dB bandwidth		N/A	
§15.247(a)(1)	RSS-247 Clause 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	17	Pass	Site 1
§15.247(a)(1)	RSS-247 Clause 5.1(b)	Carrier frequency separation	24	Pass	Site 1
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Number of hopping frequencies	27	Pass	Site 1
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Dwell Time	29	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	32	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Band edge	36	Pass	Site 1
§15.247(d) & §15.209 &	RSS-247 Clause 5.5 & RSS-GEN 6.13	Spurious radiated emissions for transmitter and receiver	41	Pass	Site 1
§15.203	RSS-GEN 6.8	Antenna requirement	See note 1	Pass	

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a Integrated antenna, which gain is 2.0dBi. 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: AL8-BF2100S, IC: 457A-BF2100S complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C, RSS-247 issue 2 and RSS-Gen issue 5 rules.

BF2100S is a Bluetooth Headset with Bluetooth 5.0. The TX and RX range is 2402MHz-2480MHz.

Note: The report is for BDR+EDR only.

#### SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

O - Not Performed

The Equipment Under Test

n - Fulfills the general approval requirements.

• - **Does not** fulfill the general approval requirements.

Sample Received Date:	April 16, 2018
Testing Start Date:	April 16, 2018
Testing End Date:	May 7, 2018

Reviewed by:

non

Phoebe Hu EMC Section Manager

Prepared by:

Tested by:

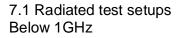
Mark chen

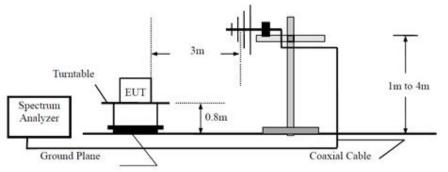
Mark Chen EMC Project Engineer

Tree them

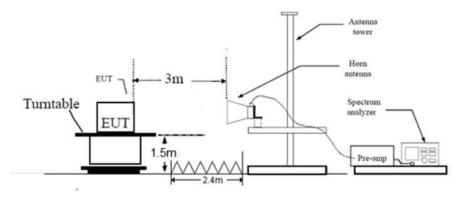
Tree Zhan EMC Test Engineer

### 7 Test Setups

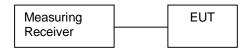




### Above 1GHz



### 7.2 Conducted RF test setups







## 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Notebook	Lenovo	X220	

Test software: CRS test tool, 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.



## 9 Technical Requirement

### 9.1 Conducted peak output power

### **Test Method**

- Use the following spectrum analyzer settings: Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel RBW > the 20dB 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

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



### Conducted peak output power

Bluetooth Mode GFSK modulation Test Result							
Conducted Peak							
Frequency	Output Power	Result					
MHz	dBm						
Low channel 2402MHz	1.02	Pass					
Middle channel 2441MHz	2.27	Pass					
High channel 2480MHz	2.84	Pass					

Spectrum						
Ref Level 27.00 dBm	Offset 1.00 dB 👄	RBW 1 MHz				
Att 45 dB		VBW 3 MHz	Mode Auto Sw	еер		
1Pk Max						
20 dBm			M1[1]		2.402	1.02 dBm 213020 GHz
10 dBm						
0 dBm		_	M1	-		
-10 dBm						
-20 dBm						-
30 dBm						
-40 dBm						
-50 dBm						
-60 dBm						
-70 dBm						
CF 2.402 GHz		691	pts		Spa	n 3.0 MHz
1arker						
Type Ref Trc M1 1	2.4021302 GHz	<u>Y-value</u> 1.02 dB	Function	F	unction Resul	t
	2.4021302 GHZ	1.02 08	<b>`</b>			
			Measurin	g 🚺 🚺	4,40	26.04.2018 17:24:08

#### Low channel 2402MHz

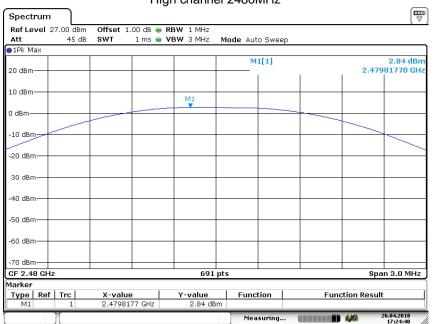
Date: 26.APR.2018 17:24:08



Middle channel 2441MHz

Ref Level Att	27.00 dBm 45 dB			RBW 1 MHz VBW 3 MHz	Mode Auto	Gwoon			
1Pk Max	15 00	011	1 1115	TON STAILS	MOUE AUL	- 2weeh			
20 dBm					M1	[1]		2.440	2.27 dBn 182200 GH
10 dBm									
				M1					
0 dBm	_							-	
-10 dBm									
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.441 G	Hz			691	pts			Spa	n 3.0 MHz
Marker									
Type Ref M1	Trc 1	2,44082		<u>Y-value</u> 2.27 dB	Functi	ion	Fun	ction Result	:
	)(	2		2.2. 40		uring		120	26.04.2018 17:24:25

Date: 26.APR.2018 17:24:25



High channel 2480MHz

Date: 26.APR.2018 17:24:41

-



### Bluetooth Mode π/4-DQPSK modulation Test Result Conducted Peak

Frequency	Output Power	Result
MHz	dBm	
Low channel 2402MHz	-1.23	Pass
Middle channel 2441MHz	0.20	Pass
High channel 2480MHz	0.73	Pass

	Lo	w channe	el 2402MHz		
Spectrum					
Ref Level 27.00 dBm	Offset 1.00 dB 👄	RBW 1 MHz			
Att 45 dB		VBW 3 MHz	Mode Auto Sweep		
∎1Pk Max					
20 dBm			M1[1]	1 1	-1.23 dBm 2.40190450 GHz
10 dBm					
0 dBm		M1			
-10 dBm					
-20 dBm					
-40 dBm					
-50 dBm					
-60 dBm					
-70 dBm					
CF 2.402 GHz		691	pts		Span 3.0 MHz
Marker					
Type Ref Trc M1 1	2.4019045 GHz	<u>Y-value</u> -1.23 dBr	Function	Function	Result
		1.20 00	Measuring		26.04.2018 17:23:38

Date: 26.APR.2018 17:23:38

#### Report Number: 68.950.18.0148.01



Middle	channel	2441MHz
--------	---------	---------

Ref Level         27.00 dBm         Offset         1.1           Att         45 dB         SWT	00 dB 👄 RBW 1 MHz 1 ms 👄 VBW 3 MHz 🛛 MI	ode Auto Sweep	
1Pk Max			
20 dBm		M1[1]	0.20 dBn 2.44083500 GH:
10 dBm			
0 dBm	M1		
-10 dBm-			
-20 dBm			
30 dBm			
-40 dBm			
-50 dBm			
-60 dBm			
-70 dBm			
CF 2.441 GHz	691 pts	· · ·	Span 3.0 MHz
Marker Type   Ref   Trc   X-value	l Vuelue I	Function	Function Result
Type         Ref         Trc         X-value           M1         1         2.44083	5 GHz 0.20 dBm	Function	Function Result

Date: 26.APR.2018 17:23:21

High channel 2480MHz Spectrum Ref Level 27.00 dBm Att 45 dB 
 Offset
 1.00 dB ●
 RBW
 1 MHz

 SWT
 1 ms ●
 VBW
 3 MHz
 Mode Auto Sweep ●1Pk Max 0.73 dBm 2.47989580 GHz M1[1] 20 dBm-10 dBm M1 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 2.48 GHz 691 pts Span 3.0 MHz Marker **Y-value** 0.73 dBm Type Ref Trc X-value 2.4798958 GHz Function **Function Result** M1 1 26.04.2018 17:22:58 Measuring... ••••• 

Date: 26.APR.2018 17:22:58

-



Bluetooth Mode 8D	PSK modulation Tes	t Result
	Conducted Peak	
Frequency	Output Power	Result

MHz	dBm	
Low channel 2402MHz	-1.00	Pass
Middle channel 2441MHz	0.53	Pass
High channel 2480MHz	0.99	Pass

		Low channel	2402MHz		
Spectrum					
Ref Level 27.00 d	IBm Offset 1.00 dB	RBW 1 MHz			
<b>Att</b> 45	dB SWT 1 ms	🔵 VBW 3 MHz 🛛 M	Iode Auto Sweep		
●1Pk Max					
20 dBm			M1[1]	2.40	-1.00 dBm 203470 GHz
10 dBm					
0 dBm		11 			
-10 dBm					
-20 dBm					
-30 dBm					
-40 dBm					
-50 dBm					
-60 dBm					
-70 dBm					
CF 2.402 GHz		691 pt	s	Sp	an 3.0 MHz
Marker					]
Type Ref Trc M1 1	2.4020347 GHz	Y-value -1.00 dBm	Function	Function Resu	t
			Measuring		26.04.2018 17:25:44

Date: 26.APR.2018 17:25:45

EMC\_SZ\_FR\_21.00FCC Release 2014-03-20



Middle channel 2441MHz

Ref Level 27.00 dBr Att 45 d					
Att 45 d	B SWI IMS 🖷	VBW 3 MHz M	lode Auto Swee	p	
20 dBm			M1[1]	1 1	0.53 dBn 2.44093920 GH:
10 dBm					
0 dBm		M1			
-10 dBm					
-20 dBm					
-30 dBm					
-40 dBm					
-50 dBm					
-60 dBm					
-70 dBm					
CF 2.441 GHz		691 pt	s		Span 3.0 MHz
Marker Type   Ref   Trc	X-value	Y-value	Function	Functi	on Result
M1 1	2.4409392 GHz	0.53 dBm			

Date: 26.APR.2018 17:25:23

Spectrum Att 27.00 dBm 
 Offset
 1.00 dB ●
 RBW
 1 MHz

 SWT
 1 ms ●
 VBW
 3 MHz
 Mode Auto Sweep ●1Pk Max M1[1] 0.99 dBm 2.48001300 GHz 20 dBm-10 dBm-**M**11 0 dBm -10 dBm -20 dBm 30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 2.48 GHz 691 pts Span 3.0 MHz Marker **Y-value** 0.99 dBm TypeRefTrcM11 X-value 2.480013 GHz Function Result Function 26.04.2018 17:25:02 Measuring... ••••••••

High channel 2480MHz

Date: 26.APR.2018 17:25:03



### 9.2 20 dB bandwidth and 99% Occupied Bandwidth

#### **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

Limit [kHz]

N/A



### 20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

20 dB Bandwidth Frequency 99% Bandwidth Limit

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	942.1	868.31		Pass
2441	950.8	863.97		Pass
2480	946.5	863.97		Pass

			Low	channe	el 24	402MI	Ηz				
Spectrum	ı )										
Ref Level	20.00 dE	m Offset 1.00	dB 🔵 RB	W 30 kHz							
Att	35 (	dB <b>SWT</b> 63.2	µs 👄 VB	₩ 100 kHz	Mo	ode Auto	FFT				
⊖1Pk Max											
						D2[1	1				0.76 dB
10 dBm-											942.10 kHz
10 dbiii						Occ					801736 kHz
0 dBm	D2	-0.670 dBm				M1[1	1]				-20.85 dBm
	0.000	Second and the Contraction		~~~	S	$\Delta =$		1		2.40	153550 GHz
-10 dBm-						5					
			MII	04		T					
-20 dBm	D1 -20.6	70 dBm					-03	10			
-30 dBm-								~h			
-30 ubiii		~						1			
-40 dBm									han	$\sim$	
	1	m/1								1 m	In a start
-50 dBm 🕂	1	~						_			
m											
-60 dBm-											
-70 dBm											
CF 2.402 G	Hz			691	pts					Spa	an 3.0 MHz
Marker											
Type Ret		X-value		Y-value		Functio	<u>n</u>		Fund	ction Resul	t
M1 T1	1	2.4015355 (		-20.85 dBi -19.50 dBi		Occ	D			060,006	801736 kHz
T2	1	2.40157019 (		-19.50 dB		000	DW			000.300	OUI/30 KHZ
D2 M	_	942.1		0.76 d							
	1				1	Measu	nina			1.92	26.04.2018
						rieasu	ring			1.0	17:36:30

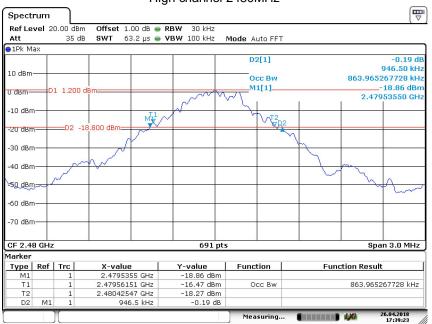
Date: 26.APR.2018 17:36:30



	_		IVIIC			-		_
Spectrum								2
Ref Level 2	0.00 dBm	Offset	1.00 dB 👄	RBW 30 kHz				
Att	35 dB	SWT	63.2 µs 👄	VBW 100 kHz	Mode Auto FFT			
∎1Pk Max								
					D2[1]			0.35 d
10 dBm								950.80 kH
10 0.0111					Occ Bw		863.9652	
0 dBm D	1 0.500 d	Bm	_	-	M1[1]			20.09 dBr
					w)	1	2.440	53110 GH
-10 dBm			T1	-N-	<u> </u>			
			MX	$\sim$	M <sup>2</sup> R	2		
-20 dBm	-D2 -19	9.500 dBm=				~		
00.10			N			The second secon		
-30 dBm		$\wedge$	/			1		
-40 dBm		AN						
-+o ubiii	5						12	
50 dBm	~		_				h	A
-60 dBm			-					
-70 dBm			-					
CF 2.441 GH	z			691 pt	ts		Spa	n 3.0 MHz
larker								
Type Ref	Trc	X-val		Y-value	Function	Fun	ction Result	
M1	1		5311 GHz	-20.09 dBm				
T1	1		151 GHz	-17.22 dBm			863.9652	67728 kHz
T2 D2 M1	1		2547 GHz 50.8 kHz	-18.98 dBm 0.35 dB				
02 101	1	9	30.0 KHZ	0.35 UB				

Middle channel 2441MHz

Date: 26.APR.2018 17:38:16



High channel 2480MHz

Date: 26.APR.2018 17:39:24

EMC\_SZ\_FR\_21.00FCC Release 2014-03-20 Page 19 of 46



### 20 dB bandwidth and 99% Occupied Bandwidth

Blueto	Bluetooth Mode $\pi/4$ -DQPSK Modulation test result									
	Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result					
	MHz	kHz	kHz	kHz						
	2402	1241.7	1167.9		Pass					
	2441	1246.0	1167.9		Pass					
	2480	1241.7	1167.9		Pass					

			Low channe			
Spectrum						
Ref Level 2	0.00 dBr	n Offset 1.00 dE	) 👄 RBW 🛛 30 kHz			· · · ·
Att	35 d	B <b>SWT</b> 63.2 µs	: 👄 VBW 100 kHz	Mode Auto FFT	-	
●1Pk Max						
				D2[1]		0.24 dB
10 dBm						1.24170 MHz
10 ubiii				Occ Bw		1.167872648 MHz
				M1[1]		-23.73 dBm
	1 -3.330	) dBm		- I	1	2.40137050 GHz
-10 dBm			$- \Lambda \mathcal{A}$	Not lo		
		11,~~	www.	a much	NT2	
-20 dBm		MJZ/			12	
	D2 -:	23.330 dBm 🕇 👘				
-30 dBm						
-40 dBm	100				10	
-50 dBm	~ ~ ~				VY	h
-50 UBIII						
-60 dBm						
-oo abiii						
-70 dBm						
CF 2.402 GH	17		691 p	nts		Span 3.0 MHz
Marker			031	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		opunoio mite
Type   Ref	Trc	X-value	Y-value	Function	Euno	ction Result
M1	1	2.4013705 GH			- Tun	ston Rosult
T1	1	2.40140955 GH				1.167872648 MHz
T2	1	2.40257742 GH		1		
D2 M1	1	1.2417 MH	lz 0.24 dB	3		
				Measuring		26.04.2018

#### Low channel 2402MHz

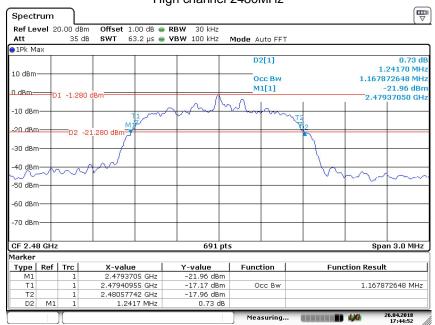
Date: 26.APR.2018 17:43:18



						Ē
Spectrum						( <del>•</del>
Ref Level 3	20.00 dBm	Offset 1.00 dB	RBW 30 kHz			
Att	35 dB	<b>SWT</b> 63.2 μs	🔵 <b>VBW</b> 100 kHz	Mode Auto FFT	-	
∋1Pk Max						
				D2[1]		0.03 dE
10 dBm						1.24600 MH
TO UBIN				Occ Bw		1.167872648 MH
				M1[1]		-22.38 dBn
	01 -1.860	dBm		Δ .		2.44037050 GH
-10 dBm			- A - A - H	What	20.000	
		1	v pro		TE	
-20 dBm		1.860 dBm			Vg2	
	D2 -2					
-30 dBm						
-40 dBm	nn					00 0
-50 dBm-	0					
-50 0.0111						
-60 dBm						
-70 dBm						
CF 2.441 G	Iz		691 pt	ts		Span 3.0 MHz
larker						•
Type   Ref	Trc	X-value	Y-value	Function	Fund	tion Result
M1	1	2.4403705 GHz	-22.38 dBm			
Τ1	1	2.44040955 GHz				1.167872648 MHz
T2	1	2.44157742 GHz				
D2 M1	. 1	1.246 MHz	0.03 dB			
				Measuring.		26.04.2018 17:44:02

Middle channel 2441MHz

Date: 26.APR.2018 17:44:02



High channel 2480MHz

Date: 26.APR.2018 17:44:53



### 20 dB bandwidth and 99% Occupied Bandwidth

#### Bluetooth Mode 8DPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1263.4	1159.2		Pass
2441	1263.4	1163.5		Pass
2480	1259.0	1159.2		Pass

Low channel 2402MHz

D2[1]         -0.24 dB           10 dBm         0cc Bw         1.26340 MHz           0 dBm         D1 -3.360 dBm         -23.36 Bm           -10 dBm         2.40135750 GHz           -10 dBm         -23.360 dBm         -24.40135750 GHz           -30 dBm         -02 -23.360 dBm         -24.40135750 GHz           -50 dBm         -60 dBm         -60 dBm         -60 dBm           -70 dBm         -70 dBm         -70 dBm         -70 dBm					anner	270210	11 12			
Att         35 dB         SWT         63.2 µs         VBW         100 kHz         Mode         Auto FFT           1Pk Max         02[1]         -0.24 dB         1.2634 dM Hz         1.2634 dM Hz           10 dBm         0         0         0Cc Bw         1.159189580 MHz         -23.53 dBm           0 dBm         01         -3.360 dBm         -24.0135750 GHz         -24.0135750 GHz         -24.0135750 GHz           -10 dBm         02         -23.360 dBm         -24.0135750 GHz         -24.0135750 GHz         -24.0135750 GHz           -20 dBm         02         -23.360 dBm         -24.0135750 GHz         -24.0135750 GHz         -24.0135750 GHz           -30 dBm         -02         -23.360 dBm         -24.0135750 GHz         -24.013575 GHz         -24.013575 GHz           -50 dBm         -02         -23.360 dBm         -24.013575 GHz         -24.013575 GHz         -24.01400 GHz           -60 dBm         -00         -00         -00         -00         -00         -00           -60 dBm         -00         -00         -00         -00         -00         -00         -00           -70 dBm         -70 dBm         -70         -72.53 dBm         -72.53 dBm         -72.53 dBm         -72.53 dBm         -72.	Spectrum									
IPk Max         D2[1]         -0.24 dB           10 dBm         0 dBm         0.26 dB MHz           0 dBm         01 -3.360 dBm         -23.53 dBm           -10 dBm         02 -23.360 dBm         -2.40135750 GHz           -20 dBm         02 -23.360 dBm         -2.40135750 GHz           -30 dBm         02 -23.360 dBm         -2.40135750 GHz           -30 dBm         -2.4013575 GHz         -2.4013575 GHz           -30 dBm         -2.4013575 GHz         -2.4013575 GHz           -70 dBm         -70 dBm         -70 dBm         -70 dBm           -70 dBm         -70 dBm         -72.3.53 dBm         -72.3.53 dBm           -71 1         1         2.4013575 GHz         -23.53 dBm           -71 1         1         2.4013575 GHz         -23.53 dBm           -72 0 dBm         -72.3.53 dBm         -72.3.53 dBm           -72 1         2.4013575 GHz         -23.53 dBm           -72 1         2.4013575 GHz         -23.53 dBm           -72 1         2.4013575 GHz         -20.30 dBm         0cc Bw           11         1.2634 MHz         -0.24 dB         -0.24 dB	Ref Level	20.00 di	Bm Offset 1.00 di	B 🖷 RBW	30 kHz					
D2[1]         -0.24 dB           10 dBm         0 cc Bw           0 dBm         01 -3.360 dBm           01 -3.360 dBm         -23.53 dBm           -20 dBm         D2 -23.360 dBm           -30 dBm         -22 -23.360 dBm           -30 dBm         -20 dBm           -20 dBm         -22 -23.360 dBm           -30 dBm         -22 -23.360 dBm           -20 dBm         -22 -23.360 dBm           -30 dBm         -20 -23.360 dBm           -50 dBm         -20 -23.360 dBm           -60 dBm         -20 -23.360 dBm           -70 dBm         -20 -23.360 dBm           -70 dBm         -20 -23.360 dBm           -70 dBm         -20 -23.360 dBm           -71 1         1 2.4013575 GHz         -23.53 dBm           T1         1 2.4013575 GHz         -23.53 dBm           T2         1 2.40125730 GHz         -19.30 dBm           T2         1 2.40257308 GHz         -19.				-	100 kHz	Mode Au	to FFT			
10 dBm     1.26340 MHz       0 dBm     0 cc Bw       0 dBm     01 -3.360 dBm       -20 dBm     2.40135750 GHz       -20 dBm     -23.360 dBm       -20 dBm     -240135750 GHz       -30 dBm     -20 dBm       -30 dBm     -20 dBm       -70 dBm     -20 dBm       -70 dBm     -20 dBm       -70 dBm     -21 dPts       Span 3.0 MHz       Mit     1.4.4013575 GHz       -20.30 dBm     -23.53 dBm       M1     1.2.4013575 GHz       -23.53 dBm     -21 dPts       Span 3.0 MHz       Marker       T1     1.4.40141389 GHz       -20.30 dBm     -22.33 dBm       T2     1.2.40125730 GHz       -19.30 dBm     -11.15918958 MHz       T2     1.2.40257308 GHz       -19.30 dBm     -22.40 dB	●1Pk Max									
10 dBm 0 cc Bw 1.159189580 MHz -223.53 dBm 2.40135750 GHz -220.53 dBm 2.40135750 GHz -20 dBm 0 2.4013575 GHz -20 dBm 0 2.4014389 GHz -20 dBm 0 2.4013575 GHz -20 dBm 0 2.4014389 GHz -20 dBm 0 2.4013575 GHz -20 dBm 0 2.4014389 GHz -20 dBm 0 2.4						D2	[1]			-0.24 dB
Occ Bw         1.159189580 MHz           0 dBm         01 -3.360 dBm         -23.53 dBm           -10 dBm         -2.40135750 GHz           -20 dBm         -D2 -23.360 dBm         -2.40135750 GHz           -20 dBm         -D2 -23.360 dBm         -2.40135750 GHz           -30 dBm         -02 -23.360 dBm         -2.40135750 GHz           -30 dBm         -2.4013575 GHz         -2.4013575 GHz           -50 dBm         -60 dBm         -60 dBm           -60 dBm         -60 dBm         -70 dBm           -70 dBm         -70 dBm         -70 dBm           -70 dBm         -70 dBm         -2.4013575 GHz           -21 1         2.4013575 GHz         -23.53 dBm           M1         1         2.4013575 GHz           -21 1         2.40141389 GHz         -20.30 dBm           D2         M1         1.2634 MHz           -20.30 dBm         -0.24 dB         -26.942018	10 d0m								1.	26340 MHz
0 dbm       01 -3.360 dbm       2.40135750 GHz         -10 dbm       -20 dbm       01 -3.360 dbm       -2.40135750 GHz         -20 dbm       -02 -23.360 dbm       -2.40135750 GHz       -2.40135750 GHz         -30 dbm       -02 -23.360 dbm       -2.4013575 GHz       -2.4013575 GHz         -30 dbm       -0.40 dbm       -0.40 dbm       -0.24 db       -0.24 db         -40 dbm       -0.24 db       -0.24 db       -2.4013575 GHz       -2.4013575 GHz         -70 dbm       -10.30 dbm       -23.53 dbm       -11.15918958 MHz       -11.15918958 MHz         -72 H1       1       2.40125730 GHz       -19.30 dbm       Occ Bw       1.15918958 MHz         -72 H1       1       2.40257308 GHz       -19.30 dbm       Occ Bw       1.15918958 MHz	TO UBIII					Oc	c Bw		1.1591	89580 MHz
01     -3.360 dBm     2.40135750 GHz       -10 dBm     -20 dBm     -23.360 dBm       -20 dBm     -22.3360 dBm     -23.360 dBm       -30 dBm     -20 dBm     -23.360 dBm       -40 dBm     -40 dBm     -40 dBm       -60 dBm     -60 dBm     -60 dBm       -70 dBm     -70 dBm     -70 dBm       -71     1     2.4013675 GHz       -72     1     2.4013875 GHz       -11     1     2.4013875 GHz       -23.53 dBm     -20.30 dBm       02     M1     1       1     2.4013875 GHz       -20.30 dBm     -20.30 dBm       02     M1     1       1     2.40257308 GHz       -19.30 dBm     -0.24 dB	0 dBm					M1	[1]			
20 dBm         D2 -23 360 dBm         Tig           -30 dBm         -20 dBm         -20 dBm         -20 dBm           -30 dBm         -30 dBm         -30 dBm         -30 dBm           -40 dBm         -50 dBm         -50 dBm         -50 dBm           -50 dBm         -60 dBm         -60 dBm         -60 dBm           -60 dBm         -70 dBm         -70 dBm         -70 dBm           -70 dBm         -70 dBm         -70 dBm         -70 dBm           T1         1         2.40141389 GHz         -23.53 dBm         -70 dBm           T2         1         2.40257308 GHz         -19.30 dBm         -70.24 dB         -70.24 dB           D2         M1         1         26.942018         -70.24 dB         -70.24 dB         -70.24 dB         -70.24 dB		D1 -3.36	50 dBm		0	0 1		1	2.401	35750 GHz
D2         -23.360 dBm           -30 dBm         -30 dBm           -40 dBm         -40 dBm           -50 dBm         -50 dBm           -60 dBm         -60 dBm           -70 dBm         -60 dBm           -70 dBm         -70 dBm           -71 dBm         -23.53 dBm           -71 1         1           2.4013575 GHz         -23.53 dBm           T1         1           1         2.4013575 GHz           -20.30 dBm         Occ Bw           T1         1           1         2.40127308 GHz           -19.30 dBm         -11.15918958 MHz           D2         M1           1         1.2634 MHz           -0.24 dB         -20.424 dB	-10 dBm				And		~~			
D2         -23.360 dBm           -30 dBm         -30 dBm           -40 dBm         -40 dBm           -50 dBm         -50 dBm           -60 dBm         -60 dBm           -70 dBm         -60 dBm           -70 dBm         -70 dBm           -71 dBm         -23.53 dBm           -71 1         1           2.4013575 GHz         -23.53 dBm           T1         1           1         2.4013575 GHz           -20.30 dBm         Occ Bw           T1         1           1         2.40127308 GHz           -19.30 dBm         -11.15918958 MHz           D2         M1           1         1.2634 MHz           -0.24 dB         -20.424 dB			11	m	0.0860.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	"hay	T2		
-30 dBm     -40 dBm       -40 dBm     -40 dBm       -50 dBm     -50 dBm       -60 dBm     -60 dBm       -70 dBm     -61 dPm       -70 dBm     -70 dBm       -70 dBm     -70 dBm       -71 dBm     -70 dBm       -72 dBm     -72 dBm       -71 dPm     -72 dPm       -72 dBm     -72 dBm       -71 dPm     -72 dPm       -72 dPm     -72 dPm       -73 dPm     -72 dPm       -74 dPm     -72 dPm       -75 dPm     -72 dPm	-20 dBm		MI					12 2		
40 dBm     -40 dBm       -50 dBm     -50 dBm       -60 dBm     -60 dBm       -70 dBm     -60 dBm       -70 dBm     -60 dBm       -70 dBm     -60 dBm       -71 dBm     -70 dBm       -72 dBm     -70 dBm       -71 dBm     -70 dBm       -72 dBm     -70 dBm       -71 dBm     -70 dBm       -71 dBm     -70 dBm       -71 1     2.4013575 GHz       -72 - 20.30 dBm     -70.30 dBm       -71 1     2.40141389 GHz       -72 1     2.40257308 GHz       -19.30 dBm     -0.24 dB       D2 M1     1       1     2.6042208		D2	-23.360 dBm							
S0 dBm         -50 dBm         -60 dBm         -60 dBm           -60 dBm         -60 dBm         -70 dBm         -70 dBm         -70 dBm           -70 dBm <td>-30 dBm</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	-30 dBm									
S0 dBm         -50 dBm         -60 dBm         -60 dBm           -60 dBm         -60 dBm         -70 dBm         -70 dBm         -70 dBm           -70 dBm <td>10 10-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	10 10-									
-60 dBm -70	-40 dBm	m	2000 C							
-60 dBm -70	-50 dBm							8	m	m
CF 2.402 GHz         691 pts         Span 3.0 MHz           Arker           Type         Ref         Trc         Y-value         Function         Function Result           M1         1         2.4013575 GHz         -23.53 dBm         -20.30 dBm         -21.33 dBm           T1         1         2.40141389 GHz         -20.30 dBm         Occ Bw         1.15918958 MHz           T2         1         2.40257308 GHz         -19.30 dBm         Occ Bw         1.15918958 MHz           D2         M1         1         1.2634 MHz         -0.24 dB         -0.24 dB         -0.24 dB	00 00.00									
CF 2.402 GHz         691 pts         Span 3.0 MHz           Aarker           Type Ref Trc         X - value         Function         Function Result           M1         1         2.4013575 GHz         -23.53 dBm         Function         Function Result           T1         1         2.40141389 GHz         -20.30 dBm         Occ Bw         1.15918958 MHz           T2         1         2.40257308 GHz         -19.30 dBm         Occ Bw         1.15918958 MHz           D2         M1         1         1.2634 MHz         -0.24 dB         Measuring         Measuring         26.042018	-60 dBm-									
CF 2.402 GHz         691 pts         Span 3.0 MHz           Aarker           Type Ref Trc         X - value         Function         Function Result           M1         1         2.4013575 GHz         -23.53 dBm         -20.30 dBm         -20.30 dBm         -20.20 dBm         -20.24 dB         -20.42018 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>										
Marker         Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4013575 GHz         -23.53 dBm         -20.30 dBm         Occ Bw         1.15918958 MHz           T1         1         2.40141389 GHz         -20.30 dBm         Occ Bw         1.15918958 MHz           T2         1         2.40257308 GHz         -19.30 dBm         D2         M1         1         1.2634 MHz         -0.24 dB         0.24 dB	-70 dBm									
Marker         Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4013575 GHz         -23.53 dBm         -20.30 dBm         Occ Bw         1.15918958 MHz           T1         1         2.40141389 GHz         -20.30 dBm         Occ Bw         1.15918958 MHz           T2         1         2.40257308 GHz         -19.30 dBm         D2         M1         1         1.2634 MHz         -0.24 dB         0.24 dB										
Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4013575 GHz         -23.53 dBm         -20.30 dBm         <	CF 2.402 G	Hz			691 pt	s			Spa	n 3.0 MHz
M1         1         2.4013575 GHz         -23.53 dBm           T1         1         2.40141389 GHz         -20.30 dBm         Occ Bw         1.15918958 MHz           T2         1         2.40257308 GHz         -19.30 dBm         Occ Bw         1.15918958 MHz           D2         M1         1         1.2634 MHz         -0.24 dB         Measuring         26.04.2018	Marker									
T1         1         2.40141389 GHz         -20.30 dBm         Occ Bw         1.15918958 MHz           T2         1         2.40257308 GHz         -19.30 dBm         Occ Bw         1.15918958 MHz           D2         M1         1         1.2634 MHz         -0.24 dB         Occ Bw         0.24 dB	Type Ref	f   Trc	X-value	Y-	value	Functi	ion	Fun	ction Result	1
T2         1         2.40257308         GHz         -19.30         dBm           D2         M1         1         1.2634         MHz         -0.24         dB		1	2.4013575 GH	lz -2	23.53 dBm					
D2 M1 1 1.2634 MHz -0.24 dB Measuring 26.04.2018		_				Oc	сBw		1.159:	18958 MHz
Measuring 26.04.2018		_								
	U2 M	1 1	1.2634 MF	HZ	-0.24 dB					
		Л				Meas	uring		2 <b>4/0</b>	

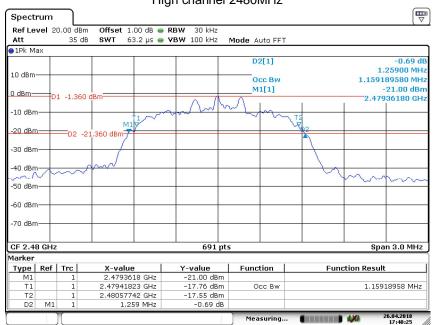
Date: 26.APR.2018 17:42:06



						_
Spectrum	ſ					
Ref Level 2	0.00 dBm	Offset 1.00 dB	RBW 30 kHz			
Att	35 dB	SWT 63.2 µs	VBW 100 kHz	Mode Auto FFT		
1Pk Max						
				D2[1]		0.02 d
						1.26340 MH
10 dBm				Occ Bw		1.163531114 MH
				M1[1]		-22.22 dBr
	1 -1.860	dBm	0 /	Δ.		2.44035750 GH
-10 dBm			- And	$\sim$		
10 dbiii		11/~	n yn ei l			
-20 dBm		M1			V702	
	D2 -2	1.860 dBm			À	
-30 dBm —						
-40 dBm	- ~!					
~ ~ ~ r	~~ ~ ~				~ (	mon
-50 dBm						
-60 dBm						
-60 asm						
-70 dBm						
, o abiii						
CF 2.441 GH	lz		691 pt	5		Span 3.0 MHz
/larker	1 1		1	· - · · · ·	_	
Type Ref		X-value	Y-value -22.22 dBm	Function	Fun	ction Result
M1 T1	1	2.4403575 GHz 2.44041389 GHz	-22.22 dBm -18.67 dBm	Occ Bw		1.163531114 MHz
T2	1	2.44041389 GHz 2.44157742 GHz	-18.13 dBm	OUC BW		1.103531114 MHZ
D2 M1		1.2634 MHz	0.02 dB			
	1					26.04.2018
				Measuring		17:41:13

Middle channel 2441MHz

Date: 26.APR.2018 17:41:13



High channel 2480MHz

Date: 26.APR.2018 17:40:25

EMC\_SZ\_FR\_21.00FCC Release 2014-03-20 Page 23 of 46



## 9.3 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	628.07
2441	633.87
2480	631.0



#### **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 MHz	Carrier Frequency Separation kHz	Result
2402	1007.2	Pass
2441	1007.2	Pass
2480	994.9	Pass

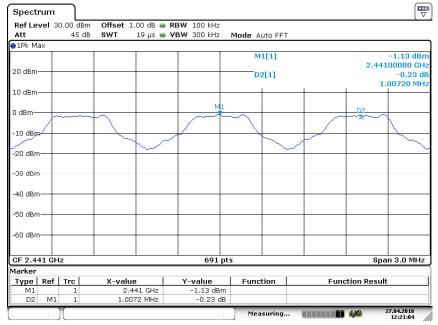
	Lo	w channel 2	2402MHz		_
Spectrum					
Ref Level 30.00 dBn Att 45 dE					
Att 45 de 1Pk Max	8 SWT 19µs 👄	<b>VBW</b> 300 kHz	Mode Auto FFT		
			M1[1]		-2.87 dBm 2.40199280 GHz
20 dBm			D2[1]		1.24 dE 1.00720 MHz
10 dBm					
0 dBm			$\sim$		
-10 dBm					
-20 dBm					
-30 dBm					
-40 dBm					
-50 dBm					
-60 dBm					
CF 2.403 GHz		691 pts	· · · ·		Span 3.0 MHz
Marker					
Type Ref Trc	X-value	Y-value	Function	Func	tion Result
M1 1 D2 M1 1	2.4019928 GHz 1.0072 MHz	-2.87 dBm 1.24 dB			
Y			Measuring		27.04.2018 12:21:33

Date: 27.APR.2018 12:21:34

#### Report Number: 68.950.18.0148.01

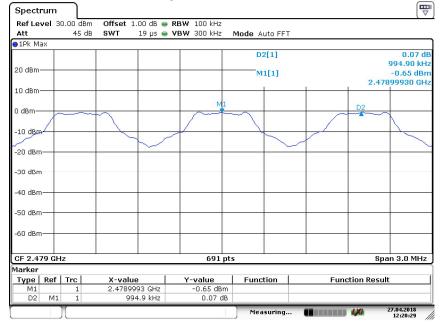


Middle channel 2441MHz



Date: 27.APR.2018 12:21:04

High channel 2480MHz



Date: 27.APR.2018 12:20:29



### 9.4 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.

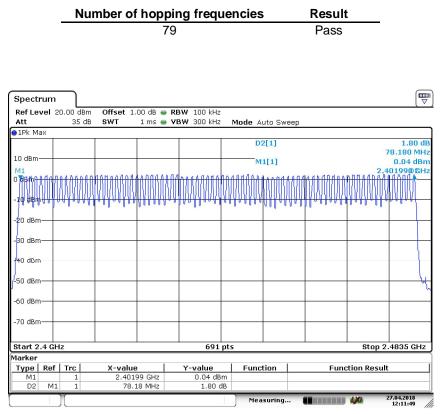
#### Limit

Limit number ≥ 15



#### 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.



Date: 27.APR.2018 12:11:49



### 9.5 Dwell Time

#### **Test Method**

- 1. 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

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.



#### **Dwell Time**

#### **Dwell time**

The maximum dwell time shall be 0.4 s.

According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

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];

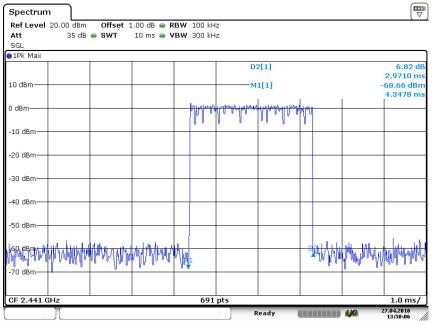
The burst width, which is directly measured, refers to the duration on one channel hop.

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

Modulation	Mode	Reading (us)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	DH5	2971	106.67	316.92	< 400	Pass
π/4-DQPSK	2DH5	2971	106.67	316.92	< 400	Pass
8-DPSK	3DH5	3000	106.67	320.01	< 400	Pass

### Test Result

#### **GFSK Modulation**



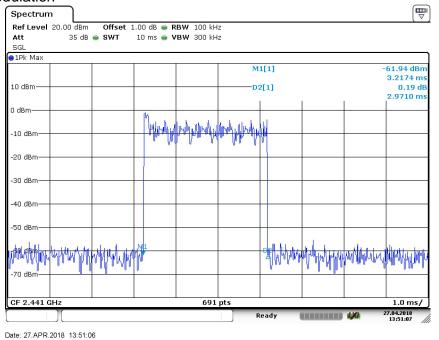
Date: 27.APR.2018 13:50:06



EMC\_SZ\_FR\_21.00FCC Release 2014-03-20

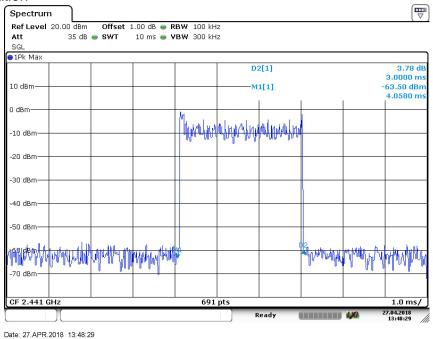


#### $\pi/4$ -DQPSK Modulation



#### 2DH5







EMC\_SZ\_FR\_21.00FCC Release 2014-03-20



### 9.6 Spurious RF conducted emissions

### **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



### **Spurious RF conducted emissions**

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

BT3.0 GFSK Modulation:

Spectrum								7
Ref Level 3	20.00 dBr	n 🛛 Offset 1.00 dB 👄	RBW 100 kHz					
Att	35 di	B SWT 9.7 ms 👄	VBW 300 kHz	Mode A	uto Swee	p		
1Pk Max								
				M	2[1]			-55.42 dB
10 dBm			_		1511			705.90 MH -55.47 dBi
				IVI	1[1]			-33.47 UBI 882.80 MF
0 dBm								002.00 mi
-10 dBm								
-20 dBm [	01 -19.88	10 dBm						
-30 dBm								
-40 dBm								
-50 dBm	1977		+ +		15. 21	M2	M1	
retreationer	admentability	were marked the more than	allower lorder	dreamphone work	ndubren	www.	upper and the	munholith
-60 dBm								
-70 dBm								
Start 30.0 M	/Hz		691 p	ots			St	op 1.0 GHz
larker								
	Trc	X-value	Y-value	Func	tion 📋	Fu	nction Resul	t
M1	1	882.8 MHz	-55.47 dBm					
M2	1	705.9 MHz	-55.42 dBn	1				

Date: 26.APR.2018 18:06:29

Ref Level	20.00 dBm	Offset 1.	00 dB 😑	<b>RBW</b> 100	kHz						1
Att	35 dB	SWT 2	40 ms 🥃	<b>VBW</b> 300	kHz N	lode A	uto Swe	ер			
1Pk Max											
						M	1[1]				0.15 dBn
10 dBm				_			0[1]				2.4070 GH: 48.83 dBn
M1						IVI	2[1]				6.6440 GH
0 dBm				_			I				
-10 dBm											
-20 dBm	D1 -19.880	) dBm									
00 JD											
-30 dBm—											
-40 dBm											
		M2									
-50 dBm	millinhe	wave			6.50 K 1		1000 100 10	and the latest		h tata anada	Mahaubur
miller	units	mound	meren	unnetize	ranno	Jone -		www	where we	Contraction of the	mun
-60 dBm				-				-			
-70 dBm					_						
Start 1.0 G	Hz				691 pts					Stop	25.0 GHz
1arker											
Type Re M1		X-value	9 D7 GHz	Y-val	ue .5 dBm	Func	tion		Functi	on Result	
M1 M2	1		44 GHz		IS dBm						

Date: 26.APR.2018 18:06:06

EMC\_SZ\_FR\_21.00FCC Release 2014-03-20



Middle channel 2441MHz

Spectrum											
Ref Level 2	0.00 dBm	Offset 1.	00 dB 🖷	RBW 1	.00 kHz						( .
Att	35 dB	<b>SWT</b> 9	.7 ms 🥃	VBW 3	IOO kHz	Mode A	uto Swi	еер			
∋1Pk Max											
						M	2[1]				-55.16 dBn
10 dBm											785.90 MH
TO UBIII						M	1[1]				-54.81 dBn
0 dBm										-	931.90 MH:
-10 dBm											
-20 dBm	1 -18.54	D dBm									_
-30 dBm				_							
-40 dBm											
-50 dBm											
-southann					See Berry		12		M2	L. L. C. D. Luchar	M1 I ling for holes
-60 dBm	mentioner	a non continue	anno corth	Carley ~~	mander	and a strange of the		Control O.			
-70 dBm											
Start 30.0 M	IHz				691 pt	s				St	op 1.0 GHz
Marker											
Type   Ref	Trc	X-value	.	Y-v	alue	Func	tion		Fund	tion Resu	lt
M1	1		9 MHz		4.81 dBm						
M2	1	785.	9 MHz	-5	5.16 dBm						
						Mea	suring.			4,70	26.04.2018 18:07:23

Date: 26.APR.2018 18:07:22

Spectr	um												
Ref Lev	<b>/el</b> 20	0.00 dBm			• RBW 100 kHz								
Att		35 dB	SWT 24	10 ms 🧉	• <b>VBW</b> 300 kHz	: Mo	de Au	uto Swi	зер				
∋1Pk Ma	яx												
							M1	1[1]					1.46 dBm
10 dBm-													2.4410 GHz
M1							M2	2[1]					49.42 dBm
0 dBm							1		1		T		6.2620 GHz
o ubm													
-10 dBm													
-10 0011													
-20 dBm		L -18.540	) dBm										
-20 ub II													
-30 dBm													
-30 UB II													
-40 dBm													
-40 00 11			M2										
-50 dB		22	-					15					
-JU UBI	Mar and	montheme	and and the most	unite	munun	hourse	madered	mandy	hardon	knowledge	whole	random	Mulymouth
-60 dBm					194 (A) 1953) A	1 1 1 1							
-oo ubiii													
-70 dBm													
-70 aBm													
Start 1.	0 GH	z			691	pts						Stop	25.0 GHz
Marker													
Type	Ref	Trc	X-value		Y-value		Funct	ion		Fi	inctio	n Result	t
M1		1		1 GHz	1.46 dB								
M2		1	6.26	2 GHz	-49.42 dB	3m							
							Mea	suring.			<b>D D</b>	7	26.04.2018 18:07:02

Date: 26.APR.2018 18:07:02

### Report Number: 68.950.18.0148.01



#### High channel 2480MHz

Spectrum											
Ref Level	20.00 dBm	Offset 1.0	10 dB 😑	RBW 100 kHz							
Att	35 dB	SWT 9.	7 ms 😑	VBW 300 kHz	M	ode A	uto Swe	еер			
●1Pk Max											
						M	2[1]				-54.26 dBn
10 dBm											769.10 MH
10 abiii						M	1[1]				-55.70 dBn
0 dBm											902.40 MH
o abiii											
-10 dBm											
10 dbiii											
-20 dBm	D1 -17.690	dBm									
20 0011											
-30 dBm											
-30 00111											
-40 dBm											
ie dem											
-50 dBm									M2		
oo abiii			La da seconda	an the well the way		4 - 1 - h - m	h Las		H AND AND AND	Althouterouters	11 Viola water h
-60 dBm	Mar and was	and a subarry	wonnown	and a manufacture	www	monday.	a marine	0000	0	00.0.0000000000000000000000000000000000	10
-70 dBm											
, o abiii											
Start 30.0	MHz			691	pts					Sto	op 1.0 GHz
Marker											
	Trc	X-value		Y-value		Func	tion		Fund	tion Result	t
M1	1	902.4		-55.70 dB							
M2	1	769.1	1 MHz	-54.26 dB	m						
						Mea	suring	1		LXI	26.04.2018 18:09:25

Date: 26.APR.2018 18:09:26

Spectrum											
Ref Level 20	0.00 dBm	Offset 1.	00 dB 🧉	RBW 10	)0 kHz						
Att	35 dB	SWT 24	40 ms 🧉	VBW 30	)0 kHz	Mode A	uto Swe	еер			
●1Pk Max											
						M	1[1]				2.31 dBm
10 dBm											2.4760 GHz
M1						M	2[1]				-45.39 dBm
0 dBm								1		1	2.6500 GHz
U UBIII											
-10 dBm											
-10 0011											
-20 dBm 0	1 -17.690	dBm									
-20 0011											
-30 dBm											
-50 0011											
-40 dBm2											
VI2											
-50 dBm .		physical									
even have	and	heren	mour	mound	mounder	grandhurden	mound	werther	norman	American	Managener
-60 dBm					_						
-70 dBm											
Start 1.0 GH	z				691 pt	s				Sto	p 25.0 GHz
Marker											
Type Ref		X-value		Y-va		Func	tion		Fur	iction Resul	t
M1 M2	1		76 GHz 55 GHz		.31 dBm .39 dBm						
1112		2.0	Jo GHZ	-45	39 UDIN	<u> </u>					
	Л					Mea	suring	- 1		l LXI	26.04.2018 18:09:09

Date: 26.APR.2018 18:09:09



### 9.7 Band edge testing

### **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:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 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 that the transmitter demonstrates compliance with the peak conducted power limits.



### GFSK mode: Hopping off

Spectrum							
Ref Level 2			RBW 100 kHz				
Att	35	dB SWT 1.1 ms	● <b>VBW</b> 300 kHz	Mode Auto Swe	эер		
∋1Pk Max				M1[1]			0.49 dBm
				MILII		2 (	0.49 dBm 402180 GHz
10 dBm				M2[1]			-55.26 dBm
				to a first			390000 CHz
0 dBm						1	
10.15							
-10 dBm							
-20 dBm-C	1 10 9	10 dBm					
-20 08111-14	1 -19.0						
-30 dBm							
-40 dBm							1 ( 4
							Ma
-50 dBm	13		7			1712	
	how	healtenerson	mental monthly and the second	Monument	manundre	antipatentillistense	house
-60 dBm							
-70 dBm							
-/0 ubiii							
CF 2.3575 C	Hz		691 pts			Spar	n 95.0 MHz
Aarker	1 - 1		1		-		
Type Ref M1	Trc 1	2.40218 GHz	<u>Y-value</u> 0,49 dBm	Function	Fu	nction Resul	τ
M2	1	2.40218 GHz 2.39 GHz	-55.26 dBm				
M3	1	2.4 GHz	-51.58 dBm				
	1			Measuring.			26.04.2018

Date: 26.APR.2018 17:53:04

Spectr	um											
Ref Lev Att	<b>/el</b> 2	0.00 dB 35 c										
Att		35 C	B SWI /	5.9 µs 😑	VBW	3UU KHZ	Mode A	uto FFI				
10 dBm-	ML							1[1] 2[1]				2.53 dBm 301760 GHz -54.26 dBm
0 dBm—	M										2.48	335000 GHz
-10 dBm	1.1	1 -17.4	70 dBm									
-20 dBm -30 dBm		1 -17.4										
-40 dBm		ha										
-50 dBm -60 dBm		v./~	Munne	mm	m	my	runn	men	m	unon	quality	whenter
-70 dBm												
Start 2.	477	GHz				691 p	ots				Sto	2.51 GHz
Marker												
	Ref		X-value		Y-1	value	Func	tion		Fund	ction Resul	t l
M1		1	2.4801			2.53 dBr						
M2 M3		1		35 GHz 2.5 GHz		54.26 dBr 54.79 dBr						
							Mea	suring			4,70	26.04.2018 17:55:53

Date: 26.APR.2018 17:55:54



### GFSK mode: Hopping on

Spectrum							
Ref Level Att	20.00 dB 35 (		RBW 100 kHz				
Att 1Pk Max	35 (	ab <b>SWI</b> 1.1 ms	🔵 <b>VBW</b> 300 kHz	Mode Auto Swi	eep		
) IPK Max		1 1					00 ID
				M1[1]		1. 2.4031	38 dBn
10 dBm —				M2[1]			87 dBn
						2.3900	
0 dBm					1	1 1	- 10
							- 601
-10 dBm							104
-20 dBm	D1 -18 6	20 dBm					
-20 aBm	01 10.0						
-30 dBm							
-50 abiii							
-40 dBm							
-50 dBm						M2	MP
howardbull	mondel	unpunpunpunpunp	alarow and more that	month where a later where the	wither and here are	multinum	Veral
-60 dBm				-			
-70 dBm						+	
CF 2.3575	GHz	1 1	691 pt	s		Span 95.	0 MHz
1arker							
Type   Ref	Trc	X-value	Y-value	Function	Fun	ction Result	
M1	1	2.40314 GH					
M2	1	2.39 GH					
MЗ	1	2.4 GH	z -54.30 dBm				

Date: 26.APR.2018 17:53:39

Spectrun	n								
Ref Level	20.00 d	Bm Offset 1	.00 dB 👄	RBW 100 kHz					1
Att	35	dB SWT 7	5.9 µs 👄	VBW 300 kHz	Mode	Auto FFT			
●1Pk Max									
10 dBm						41[1]			1.89 dBm 79790 GHz
M1					ŗ	42[1]			-55.63 dBm 35000 GHz
0 dBm <del>~~~~~</del> +10 dBm <del>~~</del>									
	D1 -18.	110 dBm							
-30 dBm									
-40 dBm—	$\uparrow$					-			
-50 dBm	Win	Me	mm	when my	Jun	manen	many	rnwould	Mila
-60 dBm									
-70 dBm									
Start 2.47	7 GHz			691	pts			Stop	2.51 GHz
/larker									
Type   Re	f Trc	X-valu	e	Y-value	Fun	ction	Fur	nction Result	t
M1	1		79 GHz	1.89 dB					
M2 M3	1		35 GHz 2.5 GHz	-55.63 dBi -55.72 dBi					
					Me	asuring		1,70	26.04.2018 17:54:35

Date: 26.APR.2018 17:54:35



### 8DPSK mode: Hopping off

Spectrum Ref Level 2		m Offset 1.00 dB (	- PRUL 400 LU-			( 🗸
Att	:0.00 ав 35 с			Mode Auto Swi	een	
1Pk Max				Hate Hate on	000	
				M1[1]		-2.70 dBn
10 dBm						2.402040 GH
				M2[1]		-55.23 dBn
) dBm						2.390000 CH
						Ι Ι Λ
-10 dBm						
20 dBm	1 -22.7	00 dBm				
30 dBm						
-40 dBm						M\$ N
						<b>J</b>
-50 dBm		undulundundu	and maller of	to a state of the	and the second second	M2
-60 dBm	- Marrison	and the second sec		and the second	asanan	a transfer and the second
oo abiii						
70 dBm						
Start 2.31 0	Hz		691 pts	5		Stop 2.405 GHz
larker						
Type Ref		X-value	Y-value	Function	Fund	ction Result
M1	1	2.40204 GHz	-2.70 dBm			
M2 M3	1	2.39 GHz 2.4 GHz	-55.23 dBm -45.59 dBm			

Date: 26.APR.2018 17:58:41

Spectr	um													
Ref Lev	el 2									_				
Att		35 c	B SWT 7	'5.9 µs 🧉	A B M	300 KH2	; n	Mode A	uto FF					
10 dBm-	M1								1[1] 2[1]				-	-0.42 dBm 98420 GHz 55.84 dBm 35000 GHz
0 dBm-			_				<u> </u>						2.48	33000 GH2
-10 dBm	7													
20 dBm		1 -20.4	20 dBm				-							
-30 dBm-		ι.												
-40 08111 1 750 dBm-		- La	Mp							M	3			
-60 dBm-		~	Verlan our	mun	www	mon	m	mennin	m	atrobas	kunner	mun	m	hanna
70 10														
-70 dBm-														
Start 2.	477	GHz		1		691	pts						Stop	2.51 GHz
Marker														
	Ref	Trc	X-valu			value		Func	tion		Fi	inction	Result	
M1		1		342 GHz		-0.42 dE								
M2 M3		1		335 GHz 2.5 GHz		55.84 dE 56.71 dE								
								Mea	suring.	. (		<b>1</b> , 1,70		26.04.2018 17:56:37 //

Date: 26.APR.2018 17:56:37



### 8DPSK mode: Hopping on

Spectrum							U ⊂
Ref Level			RBW 100 kHz				
Att	35	dB SWT 1.1 ms	🔵 <b>VBW</b> 300 kHz	Mode Auto S	weep		
∋1Pk Max							
				M1[1]			-1.22 dBm 403830 GHz
10 dBm				M2[1]			-53.87 dBm
				mz[1]			390000 GMz
0 dBm					-	-	1
							AAM .
-10 dBm							
-20 dBm	01 -21.	220 dBm					
-30 dBm							
-30 UBIII							
-40 dBm							
							M
-50 dBm						M2	
unthrough	monture	Mmahamanden	monumber	much Marcan	mehanderander	multiplice	manel
-60 dBm		~					
-70 dBm-+							
Start 2.31	GHz		691 pts	5		Stop	2.405 GHz
-larker							
Type   Ref	Trc	X-value	Y-value	Function	Fi	inction Resul	t
M1	1	2.40383 GH:					
M2	1	2.39 GH					
M3	1	2.4 GH:	-47.40 dBm				
	П			Measurin	g <b>ANNE</b>	1,70	26.04.2018 17:58:08

Date: 26.APR.2018 17:58:08

Spectrum								
Ref Level 2 Att	0.00 dBm 35 dB		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>					
■1Pk Max	35 UD	<b>3WI</b> 75.9 µS	- YOW 300 KH2	Mode A	ULU FFT			
10 dBm					1[1] 2[1]		2.48017	35 dBm
0 dBm www.h/ -10 dBm								00 0112
-20 dBm - 0	1 -20.56	) dBm						
-30 dBm								
-40 dBm	4							
-50 dBm	-thi	12 mily marmore	remarkanter	man	manone	MB marker was	mound	mertu
-60 dBm								
-70 dBm								
Start 2.477	GHz		691	pts			Stop 2.5	1 GHz
Marker				-				
Type   Ref	Trc	X-value	Y-value	Func	tion	Fun	ction Result	
M1	1	2.480176 GHz						
M2 M3	1	2.4835 GHz 2.5 GHz						
	)[]			Mea	suring		26.04. 17:5	

Date: 26.APR.2018 17:57:17



### 9.8 Spurious radiated emissions for transmitter

### **Test Method**

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

#### For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW  $\geq$  RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

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  $\geq$  RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

#### Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.



### Limit

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 MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
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



#### Spurious radiated emissions for transmitter

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:

#### BT3.0 GFSK Modulation 2402MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
Dallu	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-	677.96	27.07	Н	46	QP	18.93	-18.8	Pass
1000MHz	878.70	29.57	V	46	QP	16.43	-15.7	Pass
			Н	74	PK			Pass
1000-			Н	54	AV			Pass
25000MHz			V	74	PK			Pass
			V	54	AV			Pass

#### BT3.0 GFSK Modulation 2441MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
Danu	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-			Н	43.5	QP			Pass
1000MHz			Н	46	QP			Pass
			Н	74	PK			Pass
1000-			Н	54	AV			Pass
25000MHz			V	74	PK			Pass
			V	54	AV			Pass



#### BT3.0 GFSK Modulation 2480MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
Danu	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-			Н	43.5	QP			Pass
1000MHz			Н	46	QP			Pass
			Н	74	PK			Pass
1000-			Н	54	AV			Pass
25000MHz			V	74	PK			Pass
			V	54	AV			Pass

Remark:

- (1) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (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 10dB below the permissible limits or the field strength is too small to be measured.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss



# **10 Test Equipment List**

#### List of Test Instruments

Radiated Emission Test				
Description	Manufacturer	Model no.	Serial no.	cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-14
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-14
Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-14
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2018-7-7
Attenuator	Agilent	8491A	MY39264334	2018-7-7
3m Semi-anechoic chamber	TDK	9X6X6		2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

#### TS8997 Test System

Description	Manufacturer	Model no.	Serial no.	cal. due date
Signal Generator	Rohde & Schwarz	SMB100A	108272	2018-7-7
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-7
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2018-7-7
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2018-7-7
Power Splitter	Weinschel	1580	SC319	2018-7-7
10dB Attenuator	Weinschel	56-10	58764	2018-7-14
10dB Attenuator	R&S	DNF	DNF-001	2018-7-14
10dB Attenuator	R&S	DNF	DNF-002	2018-7-14
10dB Attenuator	R&S	DNF	DNF-003	2018-7-14
10dB Attenuator	R&S	DNF	DNF-004	2018-7-14
Test software	Rohde & Schwarz	EMC32	Version 9.26.01	N/A



## **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				
Test Items	Extended Uncertainty			
Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.98dB; Vertical: 5.06dB;			
Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.95dB; Vertical: 4.94dB;			
Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.14dB; Vertical: 5.12dB;			
Conducted RF test with TS 8997	Power level test involved: 1.05dB			